

Final

**Installation Restoration Program &
Military Munitions Response Program
Site Management Plan
Fiscal Year 2016**

**Marine Corps Installations East—Marine Corps Base Camp Lejeune
North Carolina**

Contract Task Order WE1J

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Prepared by



**3201 Highwoods Boulevard, Suite 214
Raleigh, North Carolina
NC Engineering License No. F-0699**



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Acronyms and Abbreviations

°F	degree(s) Fahrenheit
AM	Action Memorandum
AOC	area of concern
AOPC	area of potential concern
ASR	Archival Search Record
AST	aboveground storage tank
Baker	Baker Environmental, Inc.
BEQ	Bachelor Enlisted Quarters
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CA	chemical agent
CAIS	chemical agent identification set
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
CMS	Corrective Measures Study
COC	constituent of concern
COPC	constituent of potential concern
CSI	Confirmatory Site Investigation
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DCE	dichloroethene
DDT	dichlorodiphenyltrichloroethane
DGM	digital geophysical mapping
DMM	discarded military munitions
DNAPL	dense non-aqueous phase liquid
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
ERA	ecological risk assessment
ERD	enhanced reductive dechlorination
ERS	ecological risk screening
ESD	Explanation of Significant Difference
ESE	Environmental Science and Engineering, Inc.
ESI	Expanded Site Investigation
ESQD	explosives safety quantity distance
ESS	Explosives Safety Submission
EVO	emulsified vegetable oil
FFA	Federal Facilities Agreement
FS	Feasibility Study
ft ²	square foot/feet
FY	fiscal year
GIS	geographic information system
HDD	horizontal directionally drilled
HHRA	human health risk assessment
HHRS	human health risk screening

HPCA	Hadnot Point Construction Area
HPIA	Hadnot Point Industrial Area
IAS	Initial Assessment Study
IM	interim measure
IRA	Interim Remedial Action
IRACR	Interim Remedial Action Completion Report
IROD	Interim Record of Decision
IRP	Installation Restoration Program
ISCO	<i>in situ</i> chemical oxidation
JP	jet propulsion
LTM	long-term monitoring
LUC	land use control
LUCIP	Land Use Control Implementation Plan
LUST	leaking underground storage tank
MC	munitions constituent
MCAS	Marine Corps Air Station
MCIEAST-MCB CAMLEJ	Marine Corps Installations East-Marine Corps Base Camp Lejeune
MD	munitions debris
MDAS	material documented as safe
MEC	munitions and explosives of concern
mg/kg	milligram(s) per kilogram
MILCON	Military Construction
MIP	membrane interface probe
mm	millimeter(s)
MMRP	Military Munitions Response Program
MNA	monitored natural attenuation
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
NACIP	Navy Assessment and Control of Installation Pollutants
NADD	No Action Decision Document
NAE	Natural Attenuation Evaluation
NAIP	natural attenuation indication parameter
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NPL	National Priorities List
NTCRA	Non-time-critical Removal Action
O&G	oil and grease
OHM	OHM Remediation Corp.
OU	operable unit
OWS	oil-water separator
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCA	tetrachloroethane

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCP	pentachlorophenol
POL	petroleum, oil, and lubricant
PRAP	Proposed Remedial Action Plan
PRB	permeable reactive barrier
RA	remedial action
RACR	Remedial Action Completion Report
RAO	remedial action objective
RC	response complete
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RFI	Resource Conservation and Recovery Act Facility Investigation
RI	Remedial Investigation
RIP	remedy-in-place
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SC	site closeout
SDZ	surface danger zone
SEAR	surfactant enhanced aquifer remediation
Shaw	Shaw Environmental, Inc.
SI	Site Investigation
SMP	Site Management Plan
SRI	Supplemental Remedial Investigation
SSI	Supplemental Site Investigation
STP	sewage treatment plant
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TCRA	Time-critical Removal Action
TDS	total dissolved solids
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
TSS	total suspended solids
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
UXO	unexploded ordnance
VC	vinyl chloride
VIMS	vapor intrusion mitigation system
VOC	volatile organic compound
WAR	Water and Air Research, Inc.
WW II	World War II
XRF	X-ray fluorescence
yd ³	cubic yard(s)
ZVI	zero-valent iron

Introduction

This document presents the fiscal year (FY) 2016 Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP) Site Management Plan (SMP) for Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ), North Carolina. This IRP and MMRP SMP presents planned environmental activities to be conducted at MCIEAST-MCB CAMLEJ during FY 2016 and provides projections for long-term progress in accordance with the Department of the Navy (Navy) IRP and MMRP. This document has been prepared by CH2M HILL for Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division and MCIEAST-MCB CAMLEJ. The IRP and MMRP SMP is submitted to representatives of the United States Environmental Protection Agency (USEPA) Region 4, the North Carolina Department of Environment and Natural Resources (NCDENR), and members of the MCIEAST-MCB CAMLEJ Restoration Advisory Board.

1.1 IRP and MMRP SMP Purpose

The FY 2016 IRP and MMRP SMP is a forward-looking management tool and one of the primary documents identified in the Federal Facilities Agreement (FFA) (MCIEAST-MCB CAMLEJ, 1991). This IRP and MMRP SMP includes proposed deadlines for completion of deliverables, as specified in the FFA, to be submitted during FY 2016. The prioritization of activities and the conceptual schedules were developed by the MCIEAST-MCB CAMLEJ Partnering Team, which includes representatives from NAVFAC, MCIEAST-MCB CAMLEJ, USEPA, and NCDENR. The IRP and MMRP SMP is a working document that is updated yearly to maintain current documentation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process and summaries of environmental actions at MCIEAST-MCB CAMLEJ. This IRP and MMRP SMP updates and supersedes the FY 2015 IRP and MMRP SMP (CH2M HILL, 2015).

1.2 IRP and MMRP SMP Report Organization

The FY 2016 IRP and MMRP SMP is organized as follows:

- **Section 1**—Provides the IRP and MMRP SMP purpose and report organization.
- **Section 2**—Presents the description and environmental history of MCIEAST-MCB CAMLEJ and the CERCLA process for conducting site investigations and actions. Provides a Basewide summary of the IRP and MMRP. Summary figures and tables of the current site statuses are also provided.
- **Sections 3 through 10**—Provides brief IRP and MMRP site descriptions and histories, a summary of previous investigations, and planned activities for FY 2016. Each section is organized according to its corresponding phase of the CERCLA process and includes associated tables, figures, and schedules. **Section 9** includes other sites that have not been assigned IRP or MMRP site designations but are being investigated following the CERCLA process. **Section 10** includes sites that have been transferred from the IRP to the underground storage tank (UST) Program.
- **Section 11**—Provides references to other reports and documents cited in this IRP and MMRP SMP.

MCIEAST-MCB CAMLEJ Description and Environmental History

2.1 Base Description

A brief description of MCIEAST-MCB CAMLEJ (**Figure 2-1**) and setting is provided as follows.

Commissioned: 1941

Mission: Maintain combat-ready warfighters for deployment and humanitarian missions abroad. Training facilities include Camp Geiger, Camp Johnson, Stone Bay, Greater Sandy Run Training Area, and Marine Corps Air Station (MCAS) New River. Military training operations include 80 live-fire ranges, 98 maneuver areas, 26 gun positions, 4 tactical landing zones, 4 urban terrain training facilities, and amphibious operations.

Population: More than 160,000 people including active duty, dependent, retiree, and civilian employees (including over 49,000 active duty and 6,000 civilians).

Environmental and Geographical Setting: MCIEAST-MCB CAMLEJ covers more than 156,000 acres located along the Atlantic Ocean within the coastal plain of southeastern North Carolina, within Onslow County, adjacent to the City of Jacksonville. The Base consists of a diverse environmental setting with elevations ranging from sea level to 70 feet above mean sea level. Much of the topography is traversed by swales, wetlands, streams, and creeks that drain into the New River that bisects the Base and includes upland forests, wetlands, water, and urban/developed land.

Community Setting: MCIEAST-MCB CAMLEJ enjoys a close relationship with neighboring civilian communities. The Base and Onslow County work together to ensure quality living for both military and civilians throughout the area. Most of the land surrounding the facility is used for agriculture. Estuaries along the coast support commercial and recreational fishing and residential resort areas located adjacent to the Base along the Atlantic Ocean.

Weather: Short, mild winters and long, hot, and humid summers generally characterize climatic conditions. Average annual net precipitation is approximately 54 inches. Ambient air temperatures generally range from 37 to 60 degrees Fahrenheit (°F) in the winter months and 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer and north-northwesterly in the winter.

Geology/Hydrogeology: Within MCIEAST-MCB CAMLEJ, approximately 1,500 feet of a sedimentary sequence mantles the crystalline bedrock and includes seven aquifers and their associated confining units, including the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear aquifers.

Water Usage: Potable water is provided to the Base and surrounding area by water supply wells that pump groundwater from the deeper Castle Hayne aquifer. There are currently active water supply wells on Base that rely on groundwater as the supply source. The supply wells are included in the Base's annual wellhead monitoring program to ensure compliance with drinking water standards. Regionally, in southeastern North Carolina, the Castle Hayne aquifer may be used as a potable source of domestic water supply and for watering lawns or filling swimming pools.

FIGURE 2-1
Base Location Map



2.2 Environmental Restoration Program History

2.2.1 Installation Restoration Program History

Historical operations, storage, and disposal practices at MCI-EAST-MCB CAMLEJ have resulted in environmental impacts to soil and groundwater. MCI-EAST-MCB CAMLEJ has been actively engaged in environmental investigations and remediation programs since 1981, beginning with the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The Initial Assessment Study (IAS) (WAR, 1983) was the first investigation of potentially hazardous sites at the Base conducted under the NACIP program. The IAS, which was initiated in 1981, identified areas of concern (AOCs) that might cause threats to human health and the environment as a result of past storage, handling, and disposal of hazardous materials.

The Navy’s IRP was initiated in 1986, following enactment of the Superfund Amendments and Reauthorization Act (SARA) legislation. The IRP, which was implemented to follow the requirements of SARA, replaced the NACIP program. MCI-EAST-MCB CAMLEJ was placed on the CERCLA National Priorities List (NPL) on October 4, 1989 (54 *Federal Register* 41015, October 4, 1989). Following that listing, an FFA between USEPA Region 4, the North Carolina Department of Environment, Health, and Natural Resources (now NCDENR), and the Navy was signed in February 1991. The FFA was created under CERCLA Section 120 and was prepared to fulfill the following objectives:

- To ensure that potential environmental impacts associated with past and present activities at MCI-EAST-MCB CAMLEJ are thoroughly investigated and appropriate CERCLA response actions are developed and implemented as necessary to protect public health, welfare, and the environment.

- To establish a procedural framework and a schedule for developing, implementing, and monitoring appropriate response actions at MCIEAST-MCB CAMLEJ in accordance with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and relevant USEPA remediation policy.
- To encourage public participation and to facilitate cooperation and exchange of information among parties associated with the investigation and remediation process.

The annual IRP and MMRP SMP includes the sites currently under investigation following the CERCLA process and the proposed deadlines for completion of deliverables, as specified in the FFA.

Five-year Reviews were completed in 1999 (Baker, 1999), 2005 (Baker, 2005), 2010 (CH2M HILL, 2010), and 2015 (CH2M HILL, 2015). In 2015, 17 Operable Units (OUs) were identified at MCIEAST-MCB CAMLEJ for review: OUs 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 19, 20, 21, and 23. All ongoing remedial actions (RAs) were determined to be protective of human health and the environment. The recommendations from the 2015 Five-year Review are currently being implemented and the milestones and statuses are provided in **Table 2-1**. The next Five-year Review is scheduled for 2020.

As part of the requirements established under CERCLA, an Administrative Record file has been established for the IRP at MCIEAST-MCB CAMLEJ. The Administrative Record is a compilation of all documents that the Navy has used to select an RA or removal action for a site. The Administrative Record also serves as the basis for any future legal review of decisions made by the Navy concerning RA taken at a site. A copy of the MCIEAST-MCB CAMLEJ Administrative Record file is available for review at NAVFAC Mid-Atlantic in Norfolk, Virginia. The files can also be viewed online at: <http://go.usa.gov/Dy5T>. Access to the website is available at the Onslow County Library.

The fifth update to the Community Involvement Plan (CIP), which provides information on community participation, will be completed in FY 2015 (CH2M HILL, 2015) (previous versions in FY 1990, FY 1994, FY 2006, and FY 2011). The CIP will be updated again in FY 2020 or when a major change occurs in the Environmental Restoration Program.

From 2007 through 2013, MCIEAST-MCB CAMLEJ conducted a Basewide Vapor Intrusion Evaluation Study in a phased approach. The objectives of the study were to: (1) identify buildings located within 100 feet of existing monitoring wells with groundwater sample volatile organic compound (VOC) concentrations exceeding generic vapor intrusion screening values or North Carolina Groundwater Quality Standards (NCGWQS); (2) determine whether a potentially complete and/or significant vapor intrusion exposure pathway was present; (3) assess whether significant vapor intrusion impacts are occurring inside the buildings at levels that could adversely affect building occupants; and (4) provide recommendations to further investigate or to mitigate the potential vapor intrusion pathway.

The results of the study indicated that there were no significant vapor intrusion pathways of concern, except at Building 3B at Site 88; however, additional monitoring was recommended every 5 years at several buildings associated with IRP Sites 35, 73, 78, 88, 89, 93, and 96 to evaluate temporal variability, screen recent groundwater data, evaluate future plume migration, and to confirm the Basewide attenuation factor every 5 years. Vapor intrusion mitigation systems (VIMS) were installed at several buildings at IRP sites, including Buildings 3, 3B, 37, and 43 at Site 88; and Building 902 at Site 78 as a precautionary measure. The first 5-year monitoring event was completed in 2013 and recommended no further action (NFA) for vapor intrusion at Sites 35 and 73. Periodic monitoring will continue at Sites 78, 88, 89, 93, and 96 and VIMS operation and maintenance activities and monitoring are ongoing.

2.2.2 Munitions Response History

The Department of Defense (DoD) established the MMRP, which was shortened to Munitions Response Program by the Navy, under the Defense Environmental Restoration Program in September 2001. The purpose is to address military munitions and explosives of concern (MEC) (unexploded ordnance [UXO] and waste military munitions) and munitions constituents (MCs) ([chemical residues of munitions]) at locations that are not operational ranges. A requirement was established obligating the identification, characterization, and tracking of data on military munitions and military munitions responses at these locations. By September 2002, all locations

other than operational ranges requiring a military munitions response were inventoried. DoD is required by Congress to set priorities for investigating all munitions response sites (MRSs). The site prioritization is based on overall conditions at these locations and the potential risk posed to human health and the environment through evaluation of available data.

The Navy has set priorities for 29 MRSs at MCIEAST-MCB CAMLEJ. The results of this scoring will be used to sequence priorities for site remediation at MCIEAST-MCB CAMLEJ and with other Navy/Marine Corps MRSs based on relative risks and other factors, such as future land use, cultural and economic factors, and ecological impacts.

DoD and the Navy are currently establishing policy and guidance for munitions response actions under the MMRP; however, the key program drivers developed to date conclude that munitions response action will be conducted under the process outlined in NCP, as authorized by CERCLA. Therefore, the Navy and Marine Corps work with the MCIEAST-MCB CAMLEJ Partnering Team to follow the CERCLA process to address MMRP sites identified at the Base.

2.3 CERCLA Process

The objectives of the CERCLA process are to evaluate the nature and extent of contamination at a site and to identify, develop, and implement appropriate RAs to protect human health and the environment. The major elements of the CERCLA process are presented on **Figure 2-2** and discussed in further detail in the subsections below. The documents prepared for the IRP are maintained in information repositories for public review. MCIEAST-MCB CAMLEJ has developed a CIP and established a Restoration Advisory Board comprising members of the community, local environmental group members, and state and federal officials, who meet quarterly to maintain community involvement with environmental restoration activities at the Base.

2.3.1 Preliminary Assessment/Site Investigation or Site Inspection

The IRP begins with concerns about a site, area, or potential contaminant source. The Preliminary Assessment (PA)/Site Investigation (SI) phase of the CERCLA process evaluates potential sites to determine if they should be eliminated from further consideration (i.e., NFA), identified for an action to address actual or imminent threats to human health or the environment, or further evaluated through the performance of a Remedial Investigation (RI)/Feasibility Study (FS).

2.3.1.1 Preliminary Assessment

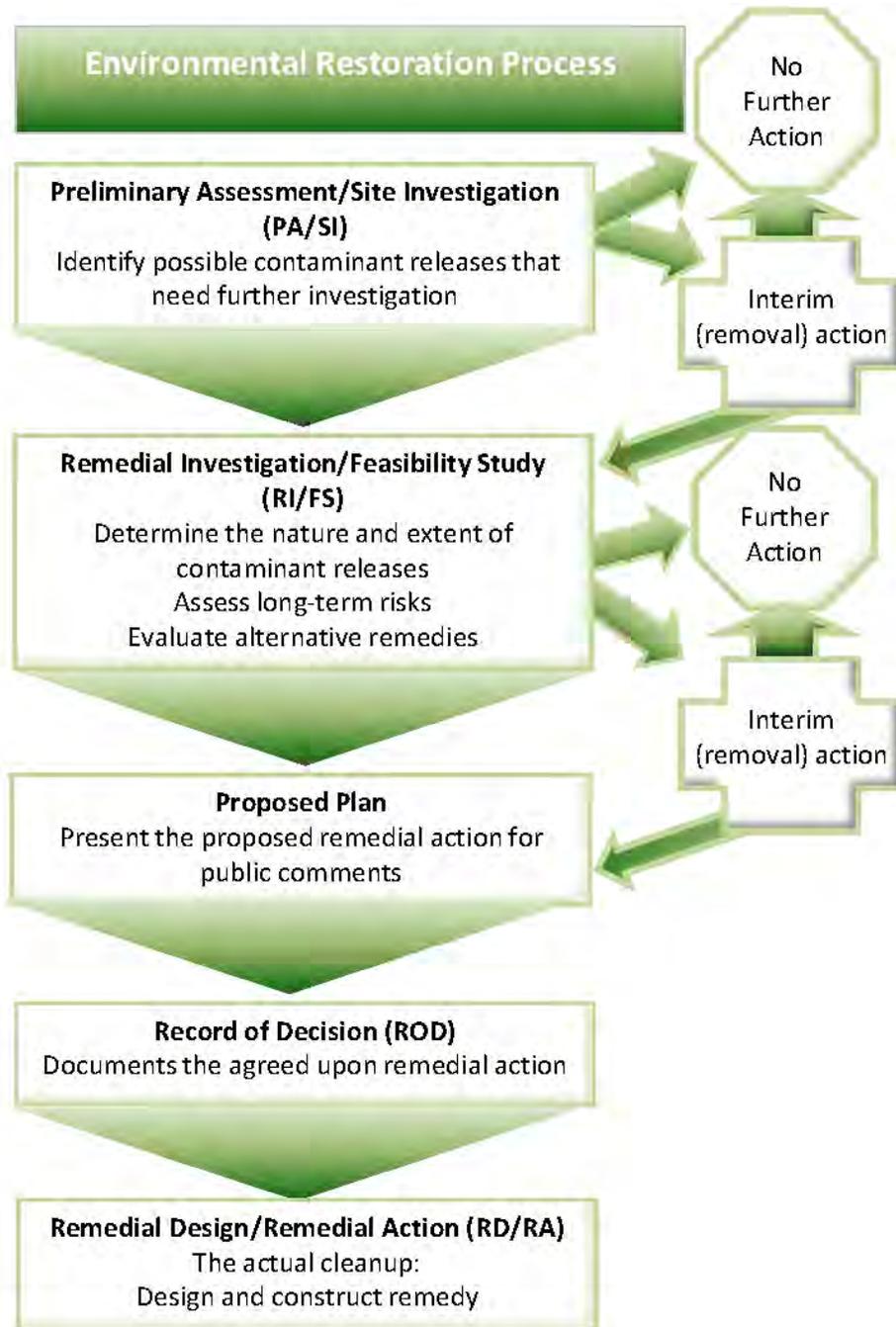
The PA is a limited-scope assessment designed to distinguish between sites that clearly pose little or no threat to human health or the environment and those that may pose a threat and require further investigation. This stage typically involves a review of historical documents and a visual site inspection. Environmental samples are rarely collected during a PA; rather, a PA is intended to be a relatively quick, low-cost compilation of existing information about a site. The PA may result in a determination of NFA; completion of an SI if there is insufficient information to reach an NFA decision; a removal action if significant threat to human health or the environment exists; or an RI/FS if remediation is deemed necessary.

2.3.1.2 Site Investigation or Site Inspection

The SI is the most common step after a PA is completed and an NFA determination cannot be made. The SI involves an onsite investigation intended to gather more information needed in determining whether there is a release or potential release, and to characterize the nature of the release and associated threats or potential threats to human health and the environment. The SI typically includes the collection of environmental samples to identify if contaminants are present at a site and a screening risk assessment to determine if they have been released at levels posing an unacceptable risk to human health or the environment. The sites that do not require further investigation or response are designated as NFA. If there is insufficient information to reach an NFA decision, a removal action or an RI/FS may be recommended.

For most sites at MCIEAST-MCB CAMLEJ, the PA and SI have been completed concurrently as a PA/SI. After completion of the PA/SI, an Expanded Site Investigation (ESI) may be conducted to confirm whether site-specific contamination or hazards are present prior to moving forward with NFA, transfer to another regulatory program, or an RI.

FIGURE 2-2
CERCLA Process



2.3.2 Remedial Investigation/Feasibility Study

The purpose of the RI/FS is to determine the nature and extent of contamination and, if sufficient need is documented by site sampling and a risk assessment, to evaluate proposed remedies. The RI and FS can be conducted concurrently; data collected in the RI influences the development of remedial alternatives in the FS, which in turn affect the data needs and scope of treatability studies and additional field investigations. This phased approach encourages the continual scoping of the site characterization, thereby minimizing the collection of unnecessary data and maximizing data quality.

2.3.2.1 Remedial Investigation

The RI is the investigative phase of the response action designed to characterize site conditions, determine the nature and extent of contamination, assess the risk to human health and the environment posed by site contamination, and provide a basis for decisions on further response actions or NFA. The RI provides information to refine the conceptual site model (CSM) and forms the basis for the development of remedial action objectives (RAOs) and remedial strategies that will comprise the FS.

2.3.2.2 Feasibility Study

The FS is the mechanism for the development, screening, and detailed evaluation of alternative RAs. The overall objectives of an FS are to develop and evaluate potential remedies that permanently and significantly reduce the threat to public health, welfare, and the environment and aid in selection of a cost-effective RA alternative that mitigates the threat(s).

2.3.3 Treatability Study

Treatability studies involve testing and evaluating a treatment technology to assess its effectiveness at a particular site or to establish site-specific design parameters. The primary objectives of treatability testing are to provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the FS and to support the remedial design (RD) of a selected alternative. Treatability studies may be conducted at any time during the CERCLA process.

The need for a treatability study generally is identified during the FS. Treatability studies may be classified as either bench-scale (laboratory study) or pilot-scale (field studies). For technologies that are well-developed and tested, bench-scale studies are often sufficient to evaluate performance. For 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.

Treatability studies may also be needed during the RD/RA phase to obtain more detailed information about the unit operations, performance, and cost for designing a full-scale treatment system. Generally, a pilot-scale system is deployed onsite to collect the required information.

2.3.4 Removal Action

A removal action is a response implemented in an expedited manner to address releases or threatened releases in order to mitigate the spread of contamination. Removal actions may be implemented at any time during the CERCLA process. Removal actions are classified as either Time-critical Removal Actions (TCRAs) or Non-time-critical Removal Actions (NCRAs).

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 TCRAs. The planning period for a TCRA is 6 months or less before field work is initiated. An Engineering Evaluation/Cost Analysis (EE/CA) is not required for a TCRA, although an Action Memorandum (AM) and Work Plan must be completed.

Removal actions that may be delayed for 6 months or more without significant additional harm to human health or the environment are classified as NCRAs. For a NCRA, an EE/CA is prepared rather than the more extensive FS. An EE/CA focuses only on the substances to be removed rather than on all contaminated substances at the site. A removal action can become the final RA if the risk assessment results indicate that NFA is required to protect human health and the environment.

A removal action can be either the final remedy or an interim action followed by a RA as the final remedy, based on the extent to which the threats are mitigated by the action. A removal action, when implemented as the final remedy, can be used for fast and significant reductions in risk and to mitigate long-term threats. In cases where the removal action is the final remedy, the removal action may lead to either response complete (RC) or site closeout (SC). If the RA was accomplished during the RI/FS phase, any final determination of RC and/or SC must be documented in the Record of Decision (ROD). If the NCP's nine criteria were not addressed as part of the EE/CA or AM, a focused FS would be needed, followed by a ROD.

2.3.5 Proposed Plan and Record of Decision

The remedy selection process involves identifying a preferred response action strategy from those alternatives evaluated in the FS. The preferred alternative is based first on each alternative's ability to satisfy the threshold criteria, and then on trade-offs among alternatives considering the primary balancing criteria. Further, results of the risk assessment need to be factored into the selection of the remedy. The remedy selection process includes a Proposed Plan and ROD.

2.3.5.1 Proposed Plan

A Proposed Plan presents the remedial alternatives developed in the FS and recommends a preferred remedial method. The public has an opportunity to comment on the Proposed Plan during an announced formal public comment period. Site information is compiled in an Administrative Record and placed in the general IRP information repositories established at local libraries for public review. A public meeting is also held to provide supporting information.

2.3.5.2 Record of Decision

At the end of the Proposed Plan public comment period, an appropriate remedial alternative is chosen to protect human health and the environment. The ROD document is then issued, describing the remedy selection process and the remedy selected. All parties directly involved in the IRP (Navy, USEPA, NCDENR, and public) must agree on the selected alternative. Any public comments received are addressed as part of the responsiveness summary in the ROD. A public notice is issued after the ROD is signed and available for public inspection. A public notice is also published for any significant post-ROD changes. Once the ROD has been signed, the RD/RA process is initiated.

2.3.6 Remedial Design and Remedial Action

Following signature of the ROD, the RD and RA phases are implemented. The technical specifications for cleanup remedies and technologies are designed in the RD phase. The RA is the actual construction or implementation phase of the cleanup process.

2.3.6.1 Remedial Design

The purpose of the RD phase is to convert the conceptual design for the selected remedy from the FS into a full-scale, detailed design for implementation. RD includes preparation of technical RD Work Plans, drawings, and specifications, and RA Work Plans.

2.3.6.2 Remedial Action

Upon completion of the RD, implementation of the RA (the remedy selected in the ROD) begins. The RA start date is defined as the date the contractor has mobilized and begun substantial and continuous physical onsite RA. The start date is important because it triggers the beginning of the Five-year Review cycle if one is required. The RA phase involves two main components, RA construction and RA operation.

Interim 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, IRAs may be implemented at any time during the process. Examples of IRAs include installing a pump-and-treat system for product recovery from groundwater or installing a fence to prevent direct contact with hazardous materials. For IRAs, a focused FS is prepared rather than the more-extensive FS. As with the removal action, an interim action may become the final RA if the results of the risk assessment indicate that NFA is required to protect human health and the environment.

2.3.7 Remedy-in-Place and Response Complete

2.3.7.1 Remedy-in-Place

For long-term remedies where it is anticipated that RAOs will be achieved over a long period, the remedy-in-place (RIP) milestone signifies the completion of the RA construction phase and that the remedy has been implemented and has been demonstrated to be functioning as designed. Once RIP is completed for a site, an Interim Remedial Action Completion Report (IRACR) is prepared to document that the remedy is constructed and operating successfully.

2.3.7.2 Response Complete

At any point during the CERCLA process, a decision can be made that no further response action is required; properly documented (necessary regulatory notification or application for concurrence has occurred), these decisions constitute RC and/or SC. RC is the point at which the remedy has achieved the required reduction in risk to human health and the environment (cleanup goals/RAOs have been met). Once RC is completed for a site under a ROD, a Remedial Action Completion Report (RACR) is prepared to demonstrate that the remedy is complete and the RAOs are met. RC is followed by individual SC.

Once all RIPs and RCs have been documented for every site at the facility and the terms of the FFA have been met, SC and NPL deletion will be requested.

2.3.7.3 Five-Year Reviews

Five-year reviews are generally required by CERCLA or program policy when hazardous substances remain on a site above levels that permit unlimited use and unrestricted exposure (UU/UE). Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy and whether it still protects human health and the environment. Generally, reviews are performed 5 years after the initiation of a CERCLA response action and are repeated every 5 years as long as future uses remain restricted. USEPA or the lead agency for a site can perform these reviews, but USEPA is responsible for assessing the protectiveness of the remedy.

2.4 Current IRP and MMRP Site Status

A total of 98 sites have been identified under the Base IRP and MMRP (**Figures 2-3 and 2-4**). Of the 68 sites identified in the IRP, 31 are considered currently active (under investigation, remediation, long-term monitoring [LTM], or have land use controls [LUCs] implemented) (**Figure 2-5**), and 37 sites have been formally closed with NFA (**Figure 2-6**). A total of 25 OUs¹ have been identified under the IRP and MMRP to group sites based on geographic location or similar disposal histories (**Table 2-2**). Of the 30 (there are two UXO-01 sites considered in this count) sites identified in the MMRP, 7 are considered currently active (**Figure 2-7**) and 23² have been closed with NFA (**Figure 2-8**). **Table 2-3** provides a Basewide summary of the IRP and MMRP sites and previous investigations. **Table 2-4** lists the current status of each site and provides a list of primary documents and anticipated submittal dates for FY 2016, 2017, and 2018.

Descriptions of each IRP and MMRP site are provided in **Sections 3 through 8** by phase in the CERCLA process (**Section 3: PA/SI, Section 4: ESI, Section 5: RI/FS, Section 6: Proposed Plan/ROD, Section 7: RD/RA, and Section 8: RIP/RC**). **Section 9** includes five additional sites that have not been assigned IRP or MMRP site designations but are being investigated following the CERCLA process (**Figure 2-9**). **Section 10** includes two sites that have been transferred from the IRP to the Base UST Program for further action (**Figure 2-10**).

¹ OU boundaries are generally defined during the PA/SI or RI phase of the CERCLA process for initial investigation. For sites with LUCs, the LUC boundaries become the site boundaries when instituted; however, OU boundaries are shown on figures, where applicable, for historical reference.

² UXO-26, the B-3 Gas Chamber, consists of three Archives Search Report (ASR) areas, ASR #2.79a, 2.79b, and 2.79c. ASR #2.79a and 2.79c have been closed with NFA and ASR #2.79b was reopened as an operational range.

TABLE 2-1

Summary of Five-Year Review Recommendations and Milestones

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

Recommendation	Site	Milestone
Collect groundwater samples for 1,4-dioxane to evaluate presence/absence	6/82	2017
	78	2017
	86	2017
Collect groundwater samples for PFCs	54	2017
Add an Industrial/Non-Industrial Use Control Boundary (VI)	6/82	2018
	35	2017
	36	2018
	73	2017
	78	2015
Remove non-industrial use LUC because post-removal confirmation samples do not exceed residential risk-based levels	2	2016
Develop Revised Proposed Plan and ROD Amendment pending the groundwater remedy evaluation to update RAOs to include VI	78	2020
Develop Revised Proposed Plan and ROD Amendment pending the groundwater remedy evaluation to update RAOs to include VI and MEC/MPPEH, and revise effluent standards for groundwater treatment system	6/82	2020
Update the OU 2 ROD to include UXO-22 and add LUCs to include an intrusive activities control for MEC	6/82	2018
Re-evaluate effluent standards for the groundwater extraction and treatment system based on current State and Federal criteria	6/82	2018
Evaluate expanding or modifying the existing treatment system at Site 82 and evaluate alternative treatment technologies at Sites 6 and 82 to remediate source areas and minimize degradation of Wallace Creek	6/82	2020
Continue groundwater remedy evaluation to determine what changes are needed and refine the CSM to evaluate extent of groundwater contamination and exposure pathways	78	2016
Complete assessment of the extent of COCs in site media (2016) and update groundwater LUCs as applicable (2018)	6/82	2016, 2018
Re-evaluate human health and ecological risks to evaluate the potential transport pathway of COCs to Wallace Creek	6/82	2017
Compare groundwater data collected from the most downgradient locations closest to Brinson Creek to 10 times the NCSWQS and use the surface water data to monitor future protectiveness of Brinson Creek	36	2016

Notes:

COCs - contaminants of concern

CSM - conceptual site model

IRP - Installation Restoration Program

LUC - land use control

MEC - munitions and explosives of concern

MMRP - Military Munitions Response Program

MPPEH - material potentially presenting an explosive hazard

NCSWQS - North Carolina Surface Water Quality Standard

OU - operable unit

PFCs - perfluorinated compounds

RAO - remedial action objective

ROD - Record of Decision

UXO - unexploded ordnance

VI - vapor intrusion

TABLE 2-2

Summary of Sites By Operable Unit

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

OU	SITE NO.	SITE DESCRIPTION	PRIMARY REASON FOR OU SELECTION
1	21	Transformer Storage Lot 140	Geographic location of sites.
	24	Industrial Area Fly Ash Dump	
	78	Hadnot Point Industrial Area	
2	6	Storage Lots 201 and 203	Geographic location of sites.
	9	Fire Fighting Training Pit at Piney Green Road	
	82	Piney Green Road VOC Area	
3	48	MCAS Mercury Dump	Similar characteristic of suspected waste (mercury).
4	41	Camp Geiger Dump near Former Trailer Park	Similar characteristic of suspected waste (chemical warfare materials).
	74	Mess Hall Grease Dump Area	
5	2	Former Nursery/Day Care Center	Similar characteristics of material handled at site
6	36	Camp Geiger Dump Area Near Sewage Treatment Plant	Similar characteristics of material disposed (POL, waste oils, solvents) and contaminants detected (metals, VOCs, O&G). Geographic location of sites.
	43	Agan Street Dump	
	44	Jones Street Dump	
	54	Crash Crew Fire Training Burn Pit	
7	1	French Creek Liquids Disposal Area	Geographic location of sites. Similar characteristics of suspected waste (O&G, POL, and metals).
	28	Hadnot Point Burn Dump	
	30	Sneads Ferry Road Fuel Tank Sludge Area	
8	16	Former Montford Point Burn Dump	Geographic location of site.
9	65	Engineer Area Dump	Geographic location of site.
10	35	Camp Geiger Fuel Farm	Accelerated cleanup necessary to abate impacts to Brinson
11	7	Tarrawa Terrace Dump	Geographic location of sites.
	80	Paradise Point Golf Course Maintenance Area	
12	3	Old Creosote Plant	Isolated site with unique waste source.
13	63	Verona Loop Dump	Isolated site with unique waste source.
14	69	Rifle Range Chemical Dump	Isolated site with unique waste source.
15	88	Base Dry Cleaners	Similar characteristic of suspected waste (dry cleaning)
16	89	Former DRMO	Geographic location of sites and adjacent surface water body. Similar characteristic of suspected waste (solvents).
	93	Building TC-942	
17	90	Building BB-9	Former UST sites with similar contamination detected in groundwater.
	91	Building BB-51	
	92	Building BB-46	
18	94	PCX Service Station	Geographic location of site, within Site 78, and similar
19	84	Building 45	Isolated site with similar waste (PCBs, POL).
20	86	Tank Area AS419-AS421 at MCAS	Site 86 was originally included under OU 6. Separate OU
21	73	Courthouse Bay Liquids Disposal Area	Similar characteristic of suspected wastes (POL, solvents).
22	96	Building 1817 UST	Transferred to IRP from RCRA based on chlorinated VOC
23	49	MCAS Suspected Minor Dump	Isolated site with chlorinated VOC plume.
24	UXO-06	Fortified Beach Assault Area (ASR #2.65)	Isolated site with potential MEC.
25	UXO-19	M-4, Rifle Grenade Range (ASR #2.104) K-22 Practice Hand Grenade Course (ASR #2.111) M115 Hand Grenade Course (ASR #2.168)	Isolated site with potential MEC.

Notes:

- DRMO - Defense Reutilization and Marketing Office
- IRP - Installation Restoration Program
- O&G - oil and grease
- OU - Operable Unit
- MCAS - Marine Corps Air Station
- MEC - munitions and explosives of concern
- MMRP - Military Munitions Response Program
- PCBs - polychlorinated biphenyls
- POL - petroleum, oil, lubricants
- RCRA - Resource Conservation and Recovery Act
- UST - underground storage tank
- VOCs - volatile organic compounds

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/RD/RA	SIGNED ROD	ROD ACTION/RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
INSTALLATION RESTORATION PROGRAM SITES																			
PA Site	--	HPIA Bldgs 1102, 1409, and 1512	--	--	--	- PA/SI (2006)	--	--	--	--	--	--	--	--	--	--	--	--	February 2006
PA Site	--	MCAS New River Bldgs SAS113, AS116, and AS119	--	--	--	- PA/SI (2006) - ESI (2010)	--	--	--	--	--	--	--	--	--	--	--	--	March 26, 2010
PA Site	--	Montford Point Bldgs M119 and M315	--	--	--	- PA/SI (2006) - ESI (2010)	--	--	--	--	--	--	--	--	--	--	--	--	March 26, 2010
1	7	Artillery units disposing liquid wastes on ground surface (1940s)	X	X	- Soil Assessment (1991) - GW Study (1993) - Project Plans (1993)	--	--	- RI (1995)	- FS (1995)	--	- RI Data Review (2013)	--	- PRAP (1995)	--	--	October 9, 1996	- LTM (1996-2001) - LUCs (2001, 2002)	RACR (2002) RACR (2015)	October 9, 1996 April 15, 2015
2	5	Bldg. 712 used for storing, handling, and dispensing pesticides (1945-1958)	X	X	- Geophysical Invest. (1992-1994) - Limited GW Sampling (1992) - Project Plans (1993)	--	--	- RI (1994)	- FS (1994)	--	--	- TCRA (1995)	- PRAP (1994)	--	--	September 15, 1994	- LTM (1995-2007) - LUCs (2001, 2002, 2008)	--	--
3	12	Creosote plant (1951-1952)	X	--	- Project Plans (1994)	--	- SI (1991)	- RI (1996)	- FS (1996)	--	--	- NTCRA (2000)	- PRAP (1996)	--	--	May 15, 1997 Amended July 28, 1999	- Soil removal & off-site disposal (2000) - LTM (1997-present) - LUCs (2001)	RACR (2001)	--
4	--	Surface disposal of construction debris including asphalt, old bricks, and cement (Unknown)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011
6	2	Lot 201 stored pesticides & transformers containing PCBs. Lot 203 served as a waste disposal area (1940s-1980s)	X	X	- Lot 203 soil gas survey (1989) - Project Plans (1992)	--	--	- RI (1993)	- FS (1993)	--	- Chlorobenzene Investigation (2010-2012) - Vapor Intrusion Evaluation (2009, 2011, and 2015) - Supplemental Investigation (2012-2015)	- TCRA (1994) - TCRA (1995/96) - TCRA (2011)	- PRAP (1993)	--	--	September 24, 1993	- Excavation & off-site disposal (1994) - LTM (1996-present) - LUCs (2001, 2002)	--	--
7	11	Tarawa Terrace dump used during construction of Base housing (Closed 1972)	X	--	- Project Plans (1994)	--	- SI (1991)	- RI (1996)	--	--	--	--	- PRAP (1996)	--	--	January 20, 1998	- NFA	--	January 20, 1998
9	2	Fire fighting training exercises using flammable liquids conducted in an unlined pit (1960s-1981), asphalt-lined pit (1981-2000), & concrete-lined pit (2002-present)	X	X	- Project Plans (1992)	--	--	- RI (1993)	- FS (1993)	--	--	- RA (2000)	- PRAP (1993)	--	--	September 24, 1993	- NFA	--	September 24, 1993
10	--	Original Base dump used for construction debris and burn dump (prior to the 1950s)	X	--	- Project Plans (1998) - GW Investigation (2001)	--	- SI (2001)	--	--	--	--	--	--	--	--	--	- NFA - LUCs implemented for conservativeness (2012)	--	April 5, 2005
12	--	Explosive ordnance disposal by burning or detonating (early 1960s)	X	--	- Project Plans (1995) - Pre-RI Screening Study (1998)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 18, 1997
13	--	Surface disposal of construction debris including clippings, branches, and asphalt (1944)	X	--	- LSA (2008)	--	--	--	--	--	--	--	--	--	--	--	--	--	November 3, 2011

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed
 IRP & MMRP Site Management Plan FY 2016
 MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/RD/RA	SIGNED ROD	ROD ACTION/RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
15	22	Burn landfill area for disposal of sewage treatment sludge, litter, metal, asphalt, sand, etc. (1948-1958)	--	--	--	- PA/SI (2011) - ESI (2012)	--	--	--	--	- SWMU 46 CSI, RFI, and IM (1997- 2007)	--	--	--	--	--	- NFA - LUCs implemented for conservativeness (2012)	--	March 26, 2012
16	8	Burn dump for trash from surrounding housing area and disposal of small amounts of waste oil (suspected 1958-1972)	X	--	- Project Plans (1994)	--	--	- RI (1996)	--	--	--	--	- PRAP (1996)	--	--	August 23, 1996 ESD (2012)	- NFA - LUCs implemented for conservativeness (2001, 2002, 2014)	--	--
18	--	Disposal of construction materials and debris (1976-1978)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	June 14, 2011
19	--	Naval Research Lab used radionuclides for metabolic studies on animals (1947-1976)	X	--	- Radiological Survey (2007)	--	- Focused SI (2008) - ESI (2010)	--	--	--	--	--	--	--	--	--	--	--	July 29, 2010
20	--	Incineration of burnable wastes associated with Naval Research Lab (1956-1960)	X	--	- Radiological Survey (2007)	--	- Focused SI (2008) - ESI (2010)	--	--	--	- Radiological Investigation (2009)	--	--	--	--	--	--	--	July 29, 2010
21	1	Pit in northern portion of site used as drainage receptor for oil from transformers (1950-1951). Pesticide mixing and wash-down area for equipment used for pesticide application (1958-1977)	X	X	- Project Plans (1993)	--	--	- RI (1994)	- FS (1994)	--	--	- RA (1995)	- PRAP (1994)	--	--	September 15, 1994 ESD (1995)	- Excavation & off-site treatment (1995) - LUCs (2001, 2002)	--	--
23	--	Storage of insecticides and herbicides (1958-1977)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011
24	1	Disposal of fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, and water treatment spiractor sludge (late 1940s-1980)	X	X	- Project Plans (1993)	--	--	- RI (1994)	- FS (1994)	--	--	--	- PRAP (1994)	--	--	September 15, 1994 ESD (1995)	- LTM (1996-1997)	--	September 15, 1994
25	--	Base incinerator burning trash and classified materials (1940-1960)	X	--	--	--	- Focused SI (2008) - ESI (2010)	--	--	--	--	--	--	--	--	--	--	--	July 29, 2010
28	7	Burn area for disposal of a variety of solid wastes (industrial waste, trash, oil-based paint, and construction debris) generated on Base and covered with soil (1946-1971)	X	X	- GW Study (1993) - Project Plans (1993)	--	--	- RI (1995)	- FS (1995)	--	- Additional Delineation (2001)	--	- PRAP (1995)	--	--	October 9, 1996	- LTM (1996-2001) - LUCs (2001, 2014)	RACR (2002)	--
30	7	Used by a private contractor as a cleaning area for emptied fuel storage tanks from other locations. Tanks stored leaded gasoline. (1970s)	X	X	- GW Study (1993) - Project Plans (1993)	--	--	- RI (1995)	--	--	--	--	- PRAP (1995)	--	--	October 9, 1996	- NFA	--	October 9, 1996

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/ Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/ RD/RA	SIGNED ROD	ROD ACTION/ RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
35	10	Camp Geiger Fuel Farm housing five 15,000-gallon ASTs, underground distribution lines, pump house, fueling pad, distribution island, & OWS (1945-1995)	X	X	- UST Site Characterization (1992) - Project Plans (1993)	--	--	- IRA RI for Soil (1994) - Comprehensive RI (1995) - Supplemental RI (2009)	- IRA FS for Soil (1994) - IRA FS for Surficial GW (1995) - FS (2009)	- Air sparge trench (1997) - Modified Fenton's/ Permanganate Pilot Study (2003-2006)	- GW Investigations (1997-2007) - NAE (1998-2003) - LTM (1999-2004) - Hot Spot Characterization (2002-2003) - Technology Evaluation (2003) - Vapor Intrusion Evaluation (2009, 2011, and 2015)	- RA (1995-1997) - NTCRA (2007)	- PRAP for Soil (1994) - PRAP for GW (1995) - Final PRAP (2009)	- September 15, 1994 (Soil) - September 22, 1995 (Surficial GW)	- Soil removal and disposal (1995-1997) - In-situ air sparging (1998)	November, 2009	- In situ air sparging (2010-2013) - LUCs (2010) - MNA (2010-present)	IRACR (2011)	--
36	6	Disposal area for mixed industrial wastes including trash, waste oils, solvents, and hydraulic fluids. Some materials burned before burial. (1940s-1950s)	X	X	- Project Plans (1994)	--	--	- RI (1996)	- FS (1998) - Revised FS (2002)	--	- Additional GW Sampling (2000)	- TCRA (1997) - NTCRA (2003)	- PRAP (2002)	--	--	July 6, 2005	- MNA (1998-present) - LUCs (2005)	IRACR (2003) IRACR (2007)	--
37	--	Surface disposal of wastes including motor parts, garbage, and wood (1950-1951)	X	--	- Confirmatory Site Assessment (2011)	- PA/SI (2014)		--	--	--	--	--	--	--	--	--	--	--	--
38	--	Surface disposal of construction debris and branches (Unknown)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011
40	--	Disposal of auto parts and metal (1969-unknown)	X	--	--	- PA/SI (2009)		--	--	--	--	--	--	--	--	--	--	--	January 27, 2009
41	4	Open burn dump containing construction debris, POL wastes, mirex, solvents, batteries, ordnance, and chemical training agents. (1946-1970)	X	X	- Project Plans (1993)	--	--	- RI/FS (1995)	--	--	--	--	- PRAP (1995)	--	--	January 16, 1996	- LTM (1997-2005) - LUCs (2001, 2002)	RACR (2006)	--
42	--	Surface disposal of debris including trees, tree stumps, and boards (1950-1960)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011
43	6	Dump receiving inert material (i.e., construction debris and trash) and sludge from a former sewage disposal facility. (Unknown)	X	--	- Project Plans (1994)	--	- SI (1991)	- RI (1996)	- FS (2002)	--	--	- IRA (1995, 2003)	- PRAP (2002)	--	--	July 6, 2005	- LUCs (2005)	IRACR (2007)	--
44	6	Active dump site receiving debris, cloth, lumber, and paint cans (1950s)	X	--	- Project Plans (December 2, 1994)	--	- SI (1991)	- RI (1996)	- FS (2002)	--	--	--	- PRAP (2002)	--	--	July 6, 2005	- LUCs (2005)	IRACR (2007)	--
46	--	Disposal of construction and demolition debris (1958-1962)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	June 14, 2011
48	3	Mercury drained from radar units and disposed in small quantities in wooded area near Bldg. AS-804 (1956-1966)	X	X	- Supplemental Characterization (1991) - Project Plans (1993)	--	--	- RI (1993)	--	--	--	--	- PRAP (1993)	--	--	September 10, 1993	- NFA	--	September 10, 1993
49	23	Disposal of paint cans (Unknown)	X	--	--	- PA/SI (2011)		- RI/FS (2012)		--	--	--	- PRAP (2013)	--	--	April 24, 2014	- LTM (2014-present) - LUCs (2014)	IRACR (2014)	--

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/RD/RA	SIGNED ROD	ROD ACTION/RD/RA	RACR	NFA DATE	
			IAS (1983)	Confirmation Study (1984-1987)																
51	--	Empty container disposal, including paint cans and hydraulic fluid (1967-1968)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	June 14, 2011	
53	--	Liquid wastes sprayed on unimproved dirt roads to control dust. Waste mixture reportedly contained crankcase waste oil, JP fuels, and paint thinners (1970-1975)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011	
54	6	Fire training burn pit using JP-fuel, stored in a nearby UST. Nearby OWS used for temporary storage and collection of spent fuel. (mid 1950s-1975).	X	X	- Project Plans (1994)	--	--	- RI (1996)	- FS (2002)	--	- Post-RI Monitoring (1998-2002)	- IRA (2000)	- PRAP (2002)	--	--	July 6, 2005	- LUCs (2005)	IRACR (2007)	--	
55	--	Disposal area for barrels, tires, trash, metal planking, and telephone poles (1950s-1960s)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011	
61	--	Disposal area for wastes generated during bivouac exercises (Unknown)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011	
62	--	Disposal area for wastes generated during bivouac exercises (Unknown)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011	
63	13	Waste disposal generated during training exercises (Unknown)	X	--	- Project Plans (1995)	--	- SI (1994)	- RI (1996)	--	--	--	--	- PRAP (1996)	--	--	May 15, 1997 ESD (2012)	- NFA - LUCs implemented for conservativeness, (2001, 2002, 2014)	--	--	
65	9	Battery acid and POL disposal, burning construction debris (1958-1972)	X	--	- Project Plans (1995)	--	- SI (1994)	- RI (1997)	--	--	- Post-RI Sampling (2001)	--	- PRAP (2001)	--	--	September 28, 2001	- NFA	--	September 28, 2001	
66	--	Vehicle maintenance area during training exercises (Unknown)	X	--	- Confirmatory Site Assessment (2011)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 11, 2011	
67	--	TNT disposal by burning in 2-3 foot deep pits (1951)	X	--	- Confirmatory Site Assessment (2010)	--	--	--	--	--	--	--	--	--	--	--	--	--	November 15, 2010	
68	--	Garbage, building debris, waste treatment sludge disposal. (1942-1972).	X	--	- Project Plans (1995) - Pre-RI Screening Study (1998)	--	--	--	--	--	--	--	--	--	--	--	--	- NFA - LUCs implemented for conservativeness, (2001, 2002)	--	May 1, 2001
69	14	Chemical waste disposal including PCBs, solvents, pesticides, calcium hypochlorite. Possible drums containing cyanide and other training agents known as CWM. (1950-1976)	X	X	- Project Plans (1993)	--	- ESI (2012)	- RI (1997)	- FS (2012)	- In-well Aeration Pilot Study (1996-1998)	- Radiological Survey (2007) - Supplemental Investigation (2011)	--	- PRAP (1998) - PRAP (2012)	June 29, 2000	- MNA (1998-2005) - LUCs (2001, 2002)	June 25, 2013	- MNA (2015-present) - LUCs (pending)	RACR (Draft, 2014)	--	

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/ Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/ RD/RA	SIGNED ROD	ROD ACTION/ RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
73	21	Waste oil disposal approximately 400,000 gallons. Waste battery acid disposal approximately 20,000 gallons. (1946-1977)	X	X	- UST Investigations (1991-1993) - Preliminary Investigation (1994) - Project Plans (1995)	--	--	- RI (1997) - Amended RI (2006) - Supplemental RI (2009)	- FS (1998) - FS (2009)	- Hydrogen Sparging (2004-2005) - Air/ozone Sparging (2007-2008)	- GW modeling (1998) - LTM (2000-2005) - NAE (2002) - Technology Evaluation (2003) - Vapor Intrusion Evaluation (2009, 2011, and 2015)	--	- PRAP (2009)	--	--	November 2009	- in situ air sparging (2010-2012) - ERD injections (2011, 2013) - MNA (2010-present) - LUCs (2010)	IRACR (2011)	--
74	4	Grease, pesticide, chemical training agents disposal (Early 1950s to early 1960s)	X	X	- Project Plans (1993)	--	--	- RI/FS (1995)	--	--	- Confirmatory Sampling (2012) - Henderson Pond/Hickory Pond Investigation Report (2013)	--	- PRAP (1995)	--	--	January 16, 1996	- LTM (1997-1998) - LUCs (2001, 2002)	RACR (2006)	--
75	--	Estimated 75-100 buried drums thought to contain tear gas. Chloroform, carbon tetrachloride, benzene, and chloropicrin may also be present. (Early 1950s)	X	--	- Project Plans (1995) - Pre-RI Screening Study (1995)	--	--	--	--	--	--	--	--	--	--	--	--	--	August 18, 1997
76	--	Approximately 25-75 buried drums likely containing tear gas, chloroform, carbon tetrachloride, benzene, and chloropicrin. (1949)	X	--	- Project Plans (1995) - Pre-RI Screening Study (1998)	--	--	--	--	--	- Additional GW Sampling (1999)	--	--	--	--	--	--	--	July 26, 2001
78	1	Petroleum and solvent related spills and leaks (Beginning in 1940s)	X	X	- GW Study at Hadnot Point Fuel Farm (1990) - Supplemental Characterization Study (1990/1991) - Project Plans (1993)	--	--	- IRA RI (1992) - RI (1994)	- IRA FS (1992) - FS (1994)	- ORC/HRC GW Pilot Study (2003-2005)	- NAE (2002) - Vapor Intrusion Evaluation (2009, 2011, and 2015) - Historical Metals Evaluation (2013) - Supplemental GW Investigation (2014)	--	- IRA PRAP (1992) - PRAP (1994)	September 23, 1992	- GW Pump & treat	September 15, 1994	- GW pump & treat (1995-present) - LTM (1995-present) - LUCs (2001, 2002, & 2015)	--	--
80	11	Golf course maintenance, pesticides (Unknown to present)	--	--	- Project plans (1994)	--	- SI (1991)	- RI (1996)	--	--	--	- TCRA (1996)	- PRAP (1997)	--	--	January 20, 1998 ESD (2012)	- NFA - LUCs implemented for conservativeness (2007, 2012)	--	January 20, 1998
82	2	Storage, disposal, and handling of potentially hazardous waste and material. (prior to late 1980s).	--	--	- Project Plans (1992)	--	- SI (1991)	- RI (1993)	- FS (1993)	- ERD Pilot Study (2007)	- Vapor Intrusion Evaluation (2009, 2011, and 2015) - Potential Source Investigation (2011) - Supplemental Investigation (2012-2015)	--	- PRAP (1993)	--	--	September 24, 1993	- Soil excavation (1994-1995) - SVE System (1996) - GW Pump & treat (1996-present) - LTM (1996-present) - LUCs (2001, 2002)	--	--
84	19	Electrical powerhouse, transformers containing PCBs (possible buried), PCB dielectric oil (Unknown) Bldg 45 maintenance facility (1965-early 1990s)	--	--	- Pre-RI Screening Study (1995) - Bldg 45 Removal (1999) - UST Removal (1999) - Project Plans (2001)	--	--	- RI (2002)	- FS (2002) - Amended FS (2008)	--	- Supplemental Investigation (2006)	- Phase I NTCRA (2002) - Phase II NTCRA (2005) - Phase III NTCRA (2007)	- PRAP (2002) - PRAP (2008)	--	--	January 31, 2009	- Soil Removal (2002-2007) - LUCs (2009)	--	--
85	--	Battery disposal (1950s)	--	--	- Project Plans (1995) - Pre-RI Screening Study (1998)	--	- PA/SI (2011)	--	--	--	- EE/CA (1999) - LTM (2001-2002) - ESI (2011)	- NTCRA (2000)	--	--	--	--	--	--	August 11, 2011

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/ Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/ RD/RA	SIGNED ROD	ROD ACTION/ RD/RA	RACR	NFA DATE	
			IAS (1983)	Confirmation Study (1984-1987)																
86	20	Petroleum products storage (1954-1988). Three 25,000 gallon AST used for No. 6 fuel/waste oil storage (1954-1979)	--	--	- Preliminary Site Investigation (1990) - AST Removal (1992) - UST Assessment (1992) - Project Plans (1994)	--	--	- RI (1996) - Amended RI (2003) - Expanded SRI (2011)	- FS (1998) - FS (2013)	- Air sparge pilot study (2005-2006) - ISCO and ERD Injections Pilot Study (2011-2013)	- LTM (1998-2005)	--	- PRAP (2014)	--	--	October 29, 2014	- LUCs (pending) - MNA (2015-present)	IRACR (Draft, 2014)	--	
87	--	Hospital waste materials including hypodermic needles and chlorine-based white powder (1986)	--	--	- Project Plans (1995) - Pre-RI Screening Study (1998)	--	--	--	--	--	--	--	--	--	--	--	--	--	June 26, 2001	
88	15	- Base Dry Cleaners (1940s-2004) - Varsol stored in USTs (1940s-1970s) - PCE stored in ASTs (1970-1980s)	--	--	- Project Plans (1997)	--	--	- Focused RI (1998) - RI (2008)	- Draft FS (2008) - Draft FS (2012)	- SEAR Pilot Study (1999) - RABITT Pilot Study (2001) - ISCO and ERD Treatability Study (2011) - ISCO and ERD Pilot Study Monitoring (2011)	- DNAPL Investigation (1998-1999) - LTM (1999-2002) - Supplemental SI (2002-2003) - MIP Investigation (2004) - Vapor Intrusion Evaluation (2009, 2011, and 2015) - Bldg HP57 Vapor Intrusion Investigation (2015)	- NTCRA (2005)	--	--	--	--	--	--	--	--
89	16	- Base Motor Pool (until 1988) - DRMO storing scrap and surplus metals, electronic equipment, vehicles, rubber tires, and fuel bladders (1988-2000)	--	--	- UST STC-868 Investigation (1994) - Project Plans (1997)	--	--	- RI (1998) - Comprehensive RI (2008) - BERA Addendum (2008)	- FS (2012)	- ERH Pilot Study (2003-2005) - Treatability Study (2008)	- LTM (1999-2003) - Supplemental Site Investigation (2001) - Vapor Intrusion Evaluation (2009, 2011, and 2015)	- TCRA (2000) - Source Area NTCRA (2007-2009) - Western Wetland NTCRA (2009)	- PRAP (2012)	--	--	December 6, 2012	- Horizontal well air sparging (2013-present) - PRB (2013) - Aerators (2014-present) - MNA (2014 - present) - LUCs (2012)	IRACR (2014)	--	
90	17	Three heating oil USTs, toluene (Unknown)	--	--	- UST Removal (1993) - Project Plans (1996)	--	--	- Focused RI (2001)	--	--	--	--	- PRAP (2001)	--	--	September 28, 2001	- NFA	--	September 28, 2001	
91	17	Two waste oil USTs (unknown-1992)	--	--	- UST Removal (1992) - Project Plans (1996)	--	--	- Focused RI (2001)	--	--	- Post-RI Monitoring (2000-2001) - Supplemental GW Report (2001)	--	- PRAP (2001)	--	--	September 28, 2001	- NFA	--	September 28, 2001	
92	17	Gasoline UST (1980-1994)	--	--	- UST Removal (1994) - Project Plans (1996)	--	--	- Focused RI (2001)	--	--	- Post-RI Monitoring (2000-2001)	--	- PRAP (2001)	--	--	September 28, 2001	- NFA	--	September 28, 2001	
93	16	Heating oil UST (unknown to 1993)	--	--	- UST Investigation (1995) - Geotechnical Investigation (1995-1996) - Project Plans (1997)	--	--	- RI (1998)	- FS (2005)	--	- NAE (2001) - Additional Plume Characterization (2002) - LTM (1999-2005) - Supplemental Site Investigation (2005) - Human Health Screening (2013) - Vapor Intrusion Evaluation (2009 and 2015)	--	- PRAP (2006)	--	--	October 2, 2006	- Permanganate injection (2006-2008) - LTM (2008-present) - LUCs (2009, 2014)	IRACR (2009)	--	
94	18	PCX Service Station containing two 10,000-gallon and two 30,000-gallon gasoline USTs (1950s-1995)	--	--	- USTs/contaminated soil removed (1995) - GW Investigation (2000-2001) - Project Plans (2004)	--	--	- RI (2005)	--	--	--	--	- PRAP (2006)	--	--	August 28, 2006	- NFA	--	August 28, 2006	

TABLE 2-3

Summary of Environmental Studies, Investigations, and Actions Completed
 IRP & MMRP Site Management Plan FY 2016
 MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/RD/RA	SIGNED ROD	ROD ACTION/RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
95	--	Livestock dipping vats (1906-1961)	--	--	- Initial Assessment (2004)	--	- SI (2007)	--	--	--	--	- NTCRA (2010)	--	--	--	--	--	--	August 24, 2010
96	--	Former 300-gallon waste oil UST	--	--	- UST removal and investigations (1997) - Confirmatory Sampling Investigation (2005)	--	--	- RFI (2005) - Amended RFI (2006)	- CMS (2007)	--	- Additional GW Delineation (2009) - Vapor Intrusion Evaluation (2009, 2011, and 2015)	--	--	--	--	--	--	--	--
MILITARY MUNITIONS RESPONSE PROGRAM SITES																			
UXO-01	--	Former Live Hand Grenade Course (1945-1946)	--	--	--	- PA/SI (2009) - ESI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	November 30, 2011
UXO-01	--	D-6 50-foot Indoor Rifle and Pistol Range (before 1954)	--	--	--	- PA/SI (2009)	--	--	--	--	--	- NTCRA (2013)	--	--	--	--	--	--	May 9, 2013
UXO-02	--	Explosive range (1973-2002)	--	--	--	- PA/SI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	May 31, 2012
UXO-03	--	Practice hand grenade course (1953-1959)	--	--	--	- Focused SI (2008) - ESI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	November 15, 2011
UXO-04	--	Bulldozer uncovered a live WWII MK-II high-explosive hand grenade during excavation (between 1974 and 1976)	--	--	--	- ESI (2009)	--	--	--	--	--	--	--	--	--	--	--	--	January 27, 2009
UXO-05	--	Miniature Anti-Tank range using .22 caliber small arms to fire at a moving target (1942-1944) Gas chamber using chemical warfare training agents (1953-1958)	--	--	- LSA (2000)	- Focused PA/SI (2007) - PA/SI (2009)	--	--	--	--	--	--	--	--	--	--	--	--	June 16, 2009
UXO-06	24	Range using small arms, 3.5-in practice rockets, rifle grenades, hand grenades (1953-1977)	--	--	--	- Focused PA/SI (2007) - Focused SIs (2006-2012) - PA/SI (2012)	- RI (2015)	--	--	--	--	--	--	--	--	--	--	--	--
UXO-07	--	Practice hand grenade course (1953)	--	--	--	- PA/SI (2011) - ESI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	December 6, 2011
UXO-08	--	Bazooka range (1970s-1990s). Gas chamber using tear gas (1953-1961).	--	--	--	- Focused PA/SI (2010) - PA/SI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	November 28, 2011
UXO-09	--	Triangulation range using service munitions and automatic rifles (~1953)	--	--	--	- PA/SI (2009)	--	--	--	--	--	--	--	--	--	--	--	--	June 23, 2009
UXO-10	--	Range using flame throwers and small arms blank ammunition (1970-1977)	--	--	--	PA/SI (2011) ESI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	March 12, 2012
UXO-11	--	Practice hand grenade course (1953)	--	--	--	- PA/SI (2011) - ESI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	December 7, 2011
UXO-12	--	Small arms range, including .33 caliber weapons (1945-1946)	--	--	--	- PA/SI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	March 10, 2011
UXO-13	--	Maneuver training area used to train troops in non-live fire operations (Unknown)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	March 24, 2004
UXO-14	--	Indoor pistol range using small caliber weapons (1950-1996), and gas chamber using tear gas (1950-1954)	--	--	--	- PA/SI (2011) - ESI (2012)	--	--	--	--	--	- NTCRA (2013)	--	--	--	--	--	--	September 4, 2013
UXO-15	--	1000-inch small arms range used for service and target practice (1945-1946)	--	--	--	- PA/SI (2010)	--	--	--	--	--	--	--	--	--	--	--	--	February 9, 2010

TABLE 2-3

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 IRP & MMRP Site Management Plan FY 2016
 MCIEAST-MCB CAMLEJ

SITE NO.	OU	HISTORIC SITE USE	PRELIM. STUDIES		PRELIMINARY INVESTIGATIONS	PA	SI	RI	FS	PILOT STUDY/TREATABILITY STUDY	ADDITIONAL INVESTIGATIONS	REMOVAL ACTIONS	PRAP/Proposed Plan	SIGNED INTERIM ROD	IROD ACTION/RD/RA	SIGNED ROD	ROD ACTION/RD/RA	RACR	NFA DATE
			IAS (1983)	Confirmation Study (1984-1987)															
UXO-16	--	Gun position training ground for 8-inch Howitzers, 4.2 inch mortars, 175 mm guns, and 120 mm mortars. (Unknown)	--	--	--	- Focused PA/SI (2009)	--	--	--	--	--	--	--	--	--	--	--	--	May 27, 2009
UXO-17	--	Firing Position used for military training (1950-1985)	--	--	--	- PA/SI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	February 16, 2012
UXO-18	--	Small arms ranges (1950-1961)	--	--	--	- PA/SI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	March 10, 2011
UXO-19	25	Grenade ranges (1950s-1970s)	--	--	--	- PA/SI (2010)	--	- RI/FS (2014)	--	--	--	--	- Proposed Plan (2015)	--	--	Draft ROD (2015)	--	--	--
UXO-20	--	1,000-inch and A-1, 50-foot .22 caliber ranges (1940s-1950s)	--	--	--	- Focused PA/SI (2011)	--	--	--	--	--	--	--	--	--	--	--	--	March 22, 2011
UXO-21	--	Gas Chamber (2nd Marine Division) (1970s)	--	--	--	- PA/SI (2011) - ESI (2012)	--	--	--	--	- MILCON Intrusive Investigation (2013)	--	--	--	--	--	--	--	July 15, 2014
UXO-22	--	Possible disposal trenches (unknown)	--	--	--	PA/SI (2013) Draft ESI (2014)	--	--	--	--	--	--	--	--	--	--	--	--	--
UXO-23	--	D-9 skeet range (1953-2011)	--	--	--	- Focused SI (2008) - Focused PA/SI (2010) - Expanded SI (2010)	--	--	--	--	- Wallace Creek Confirmation Sampling (2012)	- NTCRA (2013-2014)	--	--	--	--	--	--	--
UXO-24	--	Ammunition Burial Site (2010)	--	--	--	- PA/SI (2014)	--	--	--	--	--	--	--	--	--	--	--	--	--
UXO-25	--	Impact Area "M" range (1941 - 1945) and M-16, Outdoor Classroom range (unknown)	--	--	--	- PA/SI (2013)	--	--	--	--	--	--	--	--	--	--	--	--	February 12, 2013
UXO-26	--	B-3 Gas Chamber (1953-1958)	--	--	--	- PA/SI (2009) - ESI (2012)	--	--	--	--	--	--	--	--	--	--	--	--	September 11, 2012
UXO-27	--	Gun Position Owl	--	--	--	- PA/SI (2015)	--	--	--	--	--	--	--	--	--	--	--	--	October 18, 2015
UXO-28	--	Wallace Creek Phase I Munitions Response Site	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UXO-29	--	New River Runway Expansion Area	--	--	- Munitions Response Investigation (2014)	--	--	--	--	--	--	--	--	--	--	--	--	--	--

"--" indicates the specified report not completed for the

"X" indicates the site was included in the specified report or has achieved the specified status

AST = aboveground storage tank

BERA = baseline ecological risk assessment

Bldg = building

CSI = Confirmatory Site Investigation

CWM = chemical warfare material

DNAPL = dense non-aqueous phase liquid

DRMO = Defense Reutilization and Marketing Office

EE/CA = Engineering Evaluation/Cost Analysis

ERD = enhanced reductive dechlorination

ERH = electrical resistance heating

ESD = Explanation of Significant Difference

ESI = Expanded Site Investigation

FS = feasibility study

GW = groundwater

HPIA = Hadnot Point Industrial Area

HRC = Hydrogen Release Compound

IAS = Initial Assessment Study

IM = interim measure

IRA = Interim Remedial Action

IRACR = Interim Remedial Action Completion Report

IROD = Interim Record of Decision

ISCO = *in situ* chemical oxidation

JP = jet propulsion

LSA = Limited Site Assessment

LTM = long-term monitoring

LUCs = land use controls

MCAS = Marine Corps Air Station

MILCON = Military Construction

MIP = membrane interface probe

MNA = monitored natural attenuation

Mk = Mark

mm = millimeter

NAE = natural attenuation evaluation

NFA = No Further Action

NTCRA = Non-time-critical Removal Action

ORC = Oxygen Release Compound

OWS = oil-water separator

PA = preliminary assessment

PCB = polychlorinated biphenyl

PCE = tetrachloroethene

POL = petroleum, oil, and lubricants

PRAP = Proposed Remedial Action Plan

RA = Remedial Action

RABITT = Reductive Anaerobic Bioremediation *In Situ* Treatment Technology

RACR = Remedial Action Completion Report

RD = Remedial Design

RFI = Resource Conservation and Recovery Act Facility Investigation

RI = Remedial Investigation

ROD = Record of Decision

SEAR = surfactant enhanced aquifer remediation

SI = Site Inspection

SRI = Supplemental Remedial Investigation

SVE = soil vapor extraction

SWMU = solid waste management unit

TCRA = Time-critical Removal Action

TNT = trinitrotoluene

UST = underground storage tank

UXO = unexploded ordnance

WWII = World War II

TABLE 2-4

Sites and Status for FY 2016, FY 2017, and FY 2018

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	SITE DESCRIPTION	CURRENT SITE STATUS	FY 2016 Reports		FY 2017 Reports		FY 2018 Reports	
				Document	Anticipated Submittal Date	Document	Anticipated Submittal Date	Document	Anticipated Submittal Date
INSTALLATION RESTORATION PROGRAM SITES									
PA Site	--	HPIA Bldgs 1120 (Auto Hobby Shop), 1409 (Carpenter/Boat Repair), & 1512 (Auto Repair Shop)	NFA	--	--	--	--	--	--
PA Site	--	MCAS New River Buildings SAS113 (Auto Hobby Shop), AS116 (Vehicle Maintenance Shop), & AS119 (Vehicle Maintenance Shop)	NFA	--	--	--	--	--	--
PA Site	--	Montford Point Buildings M119 (Weapons/Auto Maintenance) & M315 (Laundry Pickup Facility)	NFA	--	--	--	--	--	--
1	7	French Creek Liquids Disposal Area	NFA	--	--	--	--	--	--
2	5	Former Nursery/Day Care Center	RIP (LUC)	--	--	--	--	--	--
3	12	Old Creosote Plant	RIP (LTM and LUC)	FY 2015 Annual LTM Report Pilot Study Report for Sites 3, 36, and 93	July 2016 August 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
4	--	Sawmill Road Construction Debris Dump	NFA	--	--	--	--	--	--
6	2	Storage Lots 201 and 203	RIP (LTM and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
7	11	Tarrawa Terrace Dump	NFA	--	--	--	--	--	--
9	2	Fire Fighting Training Pit at Piney Green Road	NFA	--	--	--	--	--	--
10	--	Original Base Dump	RIP (LUC)	--	--	--	--	--	--
12	--	Explosive Ordnance Disposal	NFA	--	--	--	--	--	--
13	--	Golf Course Construction Debris Dump	NFA	--	--	--	--	--	--
15	22	Montford Point Burn Landfill Area	RIP (LUC)	--	--	--	--	--	--
16	8	Former Montford Point Burn Dump	RIP (LUC)	--	--	--	--	--	--
18	--	Watkins Village (E) Site	NFA	--	--	--	--	--	--
19	--	Naval Research Lab Dump	NFA	--	--	--	--	--	--
20	--	Naval Research Lab Incinerator	NFA	--	--	--	--	--	--
21	1	Transformer Storage Lot 140	RIP (LUC)	--	--	--	--	--	--
23	--	Roads and Grounds Building 1105	NFA	--	--	--	--	--	--
24	1	Industrial Area Fly Ash Dump	NFA	--	--	--	--	--	--
25	--	Base Incinerator	NFA	--	--	--	--	--	--
28	7	Hadnot Point Burn Dump	RIP (LUC)	--	--	--	--	--	--
30	7	Sneads Ferry Road Fuel Tank Sludge Area	NFA	--	--	--	--	--	--
35	10	Camp Geiger Fuel Farm	RIP (MNA and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
36	6	Camp Geiger Dump Area Near Sewage Treatment Plant	RIP (MNA and LUC)	FY 2015 Annual LTM Report Pilot Study Report for Sites 3, 36, and 93	July 2016 August 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
37	--	Camp Geiger Area Surface Dump	ESI	ESI	April 2016	--	--	--	--
38	--	Camp Geiger Construction Dump	NFA	--	--	--	--	--	--
40	--	Camp Geiger Area Borrow Pit	NFA	--	--	--	--	--	--
41	4	Camp Geiger Dump near Former Trailer Park	RIP (LUC)	--	--	--	--	--	--
42	--	Building 705 BOQ Dump	NFA	--	--	--	--	--	--
43	6	Agan Street Dump	RIP (LUC)	--	--	--	--	--	--
44	6	Jones Street Dump	RIP (LUC)	--	--	--	--	--	--
46	--	MCAS Main Gate Dump	NFA	--	--	--	--	--	--
48	3	MCAS Mercury Dump	NFA	--	--	--	--	--	--
49	23	MCAS Suspected Minor Dump	RIP (MNA and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
51	--	MCAS Football Field	NFA	--	--	--	--	--	--
53	--	MCAS Warehouse Building 3525 Area	NFA	--	--	--	--	--	--
54	6	Crash Crew Fire Training Burn Pit	RIP (LUC)	--	--	--	--	--	--
55	--	Air Station East Perimeter Dump	NFA	--	--	--	--	--	--
61	--	Rhodes Point Road Dump	NFA	--	--	--	--	--	--
62	--	Race Course Area Dump	NFA	--	--	--	--	--	--
63	13	Verona Loop Dump	RIP (LUC)	--	--	--	--	--	--
65	9	Engineer Area Dump	RIP (LUC)	--	--	--	--	--	--
66	--	AMTRAC Landing Site and Storage Area	NFA	--	--	--	--	--	--
67	--	Engineer's TNT Burn Site	NFA	--	--	--	--	--	--
68	--	Rifle Range Dump	RIP (LUC)	--	--	--	--	--	--

TABLE 2-4

Sites and Status for FY 2016, FY 2017, and FY 2018

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	SITE DESCRIPTION	CURRENT SITE STATUS	FY 2016 Reports		FY 2017 Reports		FY 2018 Reports	
				Document	Anticipated Submittal Date	Document	Anticipated Submittal Date	Document	Anticipated Submittal Date
69	14	Rifle Range Chemical Dump	RD/RA	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
73	21	Courthouse Bay Liquids Disposal Area	RIP (MNA and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
74	4	Mess Hall Grease Dump Area	RIP (LUC)	--	--	--	--	--	--
75	--	MCAS Basketball Court Site	NFA	--	--	--	--	--	--
76	--	MCAS Curtis Road Site	NFA	--	--	--	--	--	--
78	1	Hadnot Point Industrial Area	RIP (Groundwater Treatment, LTM, and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
80	11	Paradise Point Golf Course Maintenance Area	RIP (LUC)	--	--	--	--	--	--
82	2	Piney Green Road VOC Area	RIP (Groundwater Treatment, LTM, and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
84	19	Building 45	RIP (LUC)	--	--	--	--	--	--
85	--	Camp Johnson Battery Dump	NFA	--	--	--	--	--	--
86	20	Tank Area AS419-AS421 at MCAS	RD/RA	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
87	--	MCAS Officers' Housing Area	NFA	--	--	--	--	--	--
88	15	Base Dry Cleaners	RI/FS	FS	September 2016	Proposed Plan ROD	February 2017 August 2017	RD	March 2018
89	16	Former DRMO	RIP (AS, PRB, Aerator, MNA, and LUC)	FY 2015 Annual LTM Report	July 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
90	17	Building BB-9	NFA	--	--	--	--	--	--
91	17	Building BB-51	NFA	--	--	--	--	--	--
92	17	Building BB-246	NFA	--	--	--	--	--	--
93	16	Building TC-942	RIP (LTM and LUC)	FY 2015 Annual LTM Report Pilot Study Report for Sites 3, 36, and 93	July 2016 August 2016	FY 2016 Annual LTM Report	July 2017	FY 2017 Annual LTM Report	July 2018
94	18	PCX Service Station	NFA	--	--	--	--	--	--
95	--	Dipping Vat Sites	NFA	--	--	--	--	--	--
96	22	Building 1817 UST	RI/FS	RI/FS	September 2016	Proposed Plan ROD	January 2017 August 2017	RD	February 2018
MILITARY MUNITIONS RESPONSE PROGRAM SITES									
UXO-01	--	Former Live Hand Grenade Course (ASR #2.23)	NFA	--	--	--	--	--	--
UXO-01	--	D-6, 50-ft Indoor Rifle and Pistol Range (ASR #2.64)	NFA	--	--	--	--	--	--
UXO-02	--	Unnamed Explosive Range (ASR #2.201)	NFA	--	--	--	--	--	--
UXO-03	--	Practice Hand Grenade Course (ASR #2.78a and 2.78b)	NFA	--	--	--	--	--	--
UXO-04	--	Knox Trailer Park	NFA	--	--	--	--	--	--
UXO-05	--	Miniature Anti-Tank Range (ASR #2.7a, 2.7b, and 2.7c)	NFA	--	--	--	--	--	--
UXO-06	24	Fortified Beach Assault Area (ASR #2.65)	RI/FS	FS Proposed Plan	October 2015 April 2016	ROD RD	October 2016 March 2017	--	--
UXO-07	--	Practice Hand Grenade Course (ASR #2.77a and 2.77b)	NFA	--	--	--	--	--	--
UXO-08	--	2.36-inch Bazooka Range, Base CS Chamber and NBC Training Trail (ASR #2.182), and D-7 Gas Chamber (ASR #2.80)	NFA	--	--	--	--	--	--
UXO-09	--	F-9, Triangulation Range (ASR #2.83)	NFA	--	--	--	--	--	--
UXO-10	--	D-11A, Flame Tank and Flame Thrower Range (ASR #2.136)	NFA	--	--	--	--	--	--
UXO-11	--	B-5, Practice Hand Grenade Course (ASR #2.81)	NFA	--	--	--	--	--	--
UXO-12	--	1,000-inch Range (ASR #2.5)	NFA	--	--	--	--	--	--
UXO-13	--	Naval Regional Medical Center	NFA	--	--	--	--	--	--
UXO-14	--	Indoor Pistol Range (ASR #2.199) and Gas Chamber (ASR #2.200)	NFA	--	--	--	--	--	--
UXO-15	--	1000-inch Range (ASR #2.19)	NFA	--	--	--	--	--	--
UXO-16	--	Former Gun Positions 41A and 41B (ASR #2.212)	NFA	--	--	--	--	--	--
UXO-17	--	Firing Position #2 (ASR #2.212)	NFA	--	--	--	--	--	--
UXO-18	--	B-6, 50-foot Small Arms Range (ASR #2.44)	NFA	--	--	--	--	--	--
UXO-19	25	M-4, Rifle Grenade Range (ASR #2.104) K-22 Practice Hand Grenade Course (ASR #2.111) M115 Hand Grenade Course (ASR #2.168)	Proposed Plan/ROD	RD	January 2016	--	--	--	--
UXO-20	--	1000-inch Range Montford Point (ASR #2.32) A-1, 50-foot .22 Caliber Range (ASR #2.87)	NFA	--	--	--	--	--	--
UXO-21	--	Gas Chamber (2nd Marine Division) (ASR #2.204)	NFA	--	--	--	--	--	--

TABLE 2-4

Sites and Status for FY 2016, FY 2017, and FY 2018

IRP & MMRP Site Management Plan FY 2016

MCIEAST-MCB CAMLEJ

SITE NO.	OU	SITE DESCRIPTION	CURRENT SITE STATUS	FY 2016 Reports		FY 2017 Reports		FY 2018 Reports	
				Document	Anticipated Submittal Date	Document	Anticipated Submittal Date	Document	Anticipated Submittal Date
UXO-22	--	Sites 6 & 82 (OU 2)	ESI	ESI ESD	November 2015 April 2016	--	--	--	--
UXO-23	--	D-9 Skeet Range (ASR #2.82)	RI/FS	--	--	RI	August 2017	FS Proposed Plan	February 2018 August 2018
UXO-24	--	Camp Geiger Area	ESI	ESI	April 2016	--	--	--	--
UXO-25	--	Verona Loop	NFA	--	--	--	--	--	--
UXO-26	--	B-3, Gas Chamber (ASR #2.79a and 2.79c)	NFA	--	--	--	--	--	--
UXO-27	--	Gun Position Owl (ASR #2.212)	NFA	--	--	--	--	--	--
UXO-28	--	Wallace Creek Phase I Munitions Response Site	PA/SI	--	--	PA/SI	November 2016	--	--
UXO-29	--	New River Runway Expansion Area (ASR #2.1, 2.167, and 2.29)	PA/SI	--	--	PA/SI	January 2017	--	--

Note: Reports and deliverable dates in bold text are final primary documents.

AMTRAC = amphibious tractor
 ASR = Archives Search Report
 BOQ = Bachelors Officers' Quarters
 CS = chemical smoke
 DRMO = Defense Reutilization and Marketing Office
 ESI = Expanded Site Investigation

FS = Feasibility Study
 ft = foot, feet
 FY = fiscal year
 HPIA = Hadnot Point Industrial Area
 LTM = long-term monitoring
 LUC = land use control

MCAS = Marine Corps Air Station
 MNA = monitored natural attenuation
 NBC = nuclear, biological, and chemical
 NFA = no further action
 NTCRA = Non-time-critical Remedial Action
 OU = operable unit

PA = Preliminary Assessment
 PRB = permeable reactive barrier
 RD = Remedial Design
 RI = Remedial Investigation
 RIP = remedy-in-place

ROD = Record of Decision
 SI = Site Investigation
 TNT = trinitrotoluene
 VOC = volatile organic compound
 UST = underground storage tank
 UXO = unexploded ordnance

SECTION 3

Descriptions of PA/SI Sites

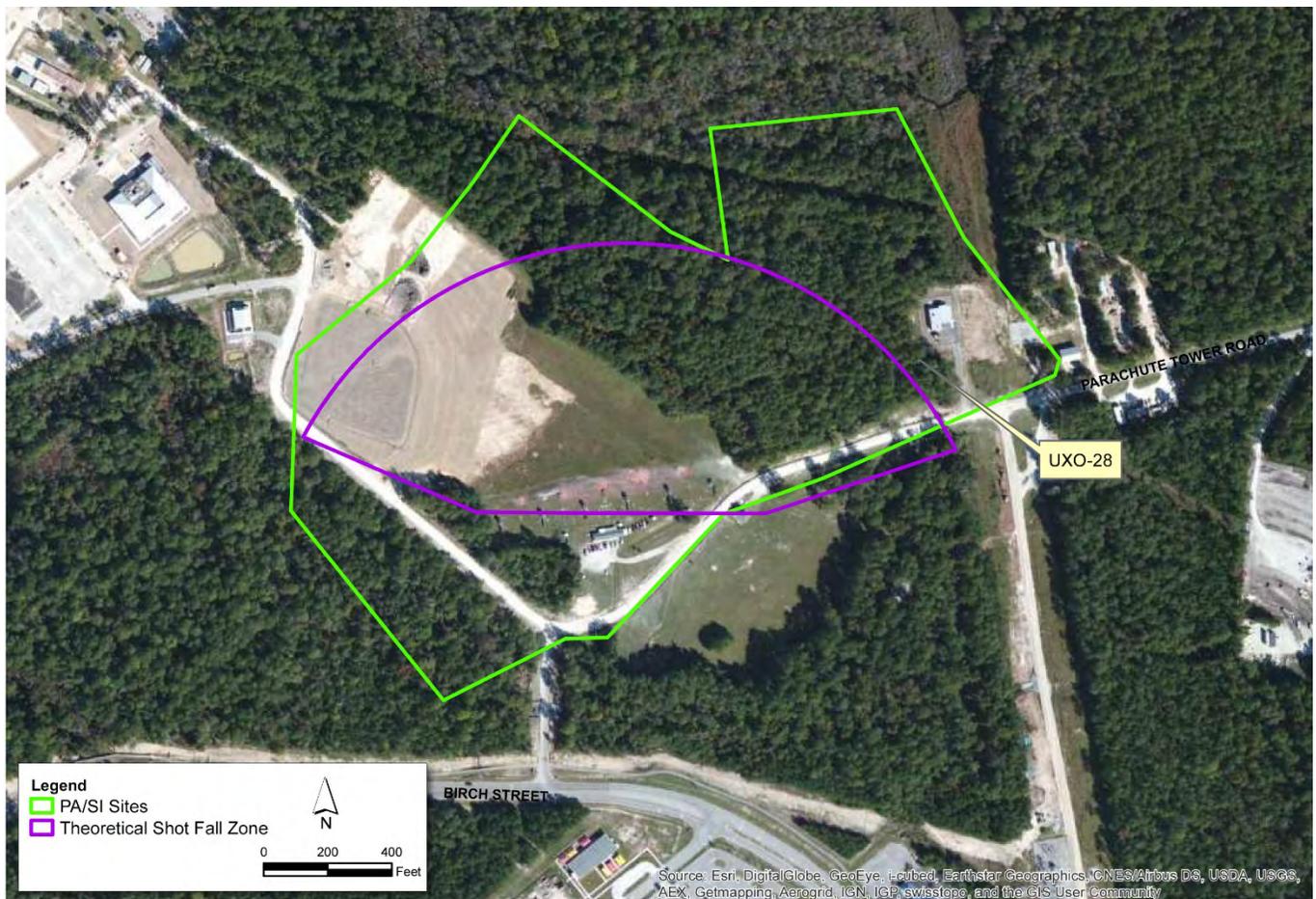
The following subsections discuss the site history, summarize previous investigations, and present future activities of the two MMRP sites that are in the PA/SI phase of the CERCLA process.

3.1 MMRP PA/SI Sites

3.1.1 UXO-28—Wallace Creek Phase I Munitions Response Site

Site UXO-28 covers approximately 58 acres, just west of the intersection of Holcomb Boulevard and Parachute Tower Road in the Mainside area of the Base (**Figure 3-1**). UXO-28 overlaps the theoretical shot fall-zone of UXO-23, the Former Base Skeet Range (**Section 5.2.2**) and was identified based on the discovery of MEC or material potentially presenting an explosive hazard (MPPEH) during the NTCRA activities in 2013.

FIGURE 3-1
MMRP Site UXO-28



3.1.1.1 Future Activities

A PA/SI will be conducted in FY 2016/2017 (**Schedule 3-1**).

**Schedule 3-1
MMRP Site UXO-28
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ**

ID	Task Name	Duration	Start	Finish	2016																		
					Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
1	PA/SI	380 days	Mon 6/8/15	Fri 11/18/16																			
2	Draft UFP-SAP	60 days	Mon 6/8/15	Fri 8/28/15																			
3	Review Period (Navy/Base)	30 days	Mon 8/31/15	Fri 10/9/15																			
4	Review Period (USEPA/NCDENR)	30 days	Mon 10/12/15	Fri 11/20/15																			
5	Final UFP-SAP	10 days	Mon 11/23/15	Fri 12/4/15																			
6	Field Activities/Data Evaluation	120 days	Mon 12/7/15	Fri 5/20/16																			
7	Draft PA/SI Report	60 days	Mon 5/23/16	Fri 8/12/16																			
8	Review Period (Navy/Base)	30 days	Mon 8/15/16	Fri 9/23/16																			
9	Review Period (USEPA/NCDENR)	30 days	Mon 9/26/16	Fri 11/4/16																			
10	Final PA/SI Report	10 days	Mon 11/7/16	Fri 11/18/16																			

3.1.2 UXO-29—New River Runway Expansion Area (ASR #2.1, #2.167, and #2.29)

Site UXO-29 covers approximately 182 acres and is located at the southern end of the runway at MCAS New River (**Figure 3-2**). The site encompasses portions of three historical terrestrial ranges. Former Infantry Weapons Demonstration Course, B17 (Archival Search Record [ASR] #2.29) was active from 1946 to 1947 and reportedly used 75 millimeters (mm), 105 mm, and 155 mm projectiles. Former Artillery Training Area (ASR #2.1) was active from 1941 to 1943 and reportedly used small arms, rockets, and projectiles. Former hand grenade range (practice demonstrator), M113 (ASR #2.167) was active from 1970 to 1977 and was reportedly used for hand grenade training. The site was identified during initial military construction (MILCON) activities for the runway expansion based on discovery of 2.36-inch practice bazooka rounds.

FIGURE 3-2
MMRP Site UXO-29, ASR #2.1, #2.167, and #2.29



Previous investigations are listed in **Table 3-1**.

TABLE 3-1
 Previous Investigations Summary, MMRP Site UXO-29, ASR #2.1, #2.167, and #2.29

Previous Investigation/Action	Date	Activities
Munitions Response Investigation (CH2M HILL, 2014)	2013-2014	In 2013, a focused munitions response investigation was conducted in the 10 acre MCAS New River Expansion area to reduce the potential for encountering MEC and MPPEH during future MILCON activities. Field activities consisted of 100 percent digital geophysical mapping (DGM) and intrusive investigations and post-detonation soil sampling. Eight MEC (including high explosive and white phosphorus rounds) and over 120 MPPEH items were identified and removed. Post-detonation soil sampling results did not indicate any unacceptable human health or ecological risks due to exposure to soil within the area of the controlled detonation. Because DGM and the intrusive investigation were conducted over 100 percent of the MRS and all identified anomalies were removed to the maximum depth of detection, the explosives safety quantity distance (ESQD) arcs were removed and MILCON was approved to proceed. The discovery of MEC and MPPEH within the footprint of Site UXO-29 indicates that additional MEC and MPPEH may exist and additional investigation was recommended.

3.1.2.1 Future Activities

Additional investigation within the MMRP site will be conducted in FY 2016 through early FY 2017 (**Schedule 3-2**).

Schedule 3-2
MMRP Site UXO-29, ASR #2.1, 2.167, and 2.29
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ

ID	Task Name	Duration	Start	Finish	2016												2017								
					Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
1	PA/SI	420 days	Mon 6/8/15	Fri 1/13/17																					
2	Draft UFP-SAP	60 days	Mon 6/8/15	Fri 8/28/15																					
3	Review Period (Navy/Base)	30 days	Mon 8/31/15	Fri 10/9/15																					
4	Review Period (USEPA/NCDENR)	30 days	Mon 10/12/15	Fri 11/20/15																					
5	Final UFP-SAP	10 days	Mon 11/23/15	Fri 12/4/15																					
6	Field Activities/Data Evaluation	160 days	Mon 12/7/15	Fri 7/15/16																					
7	Draft PA/SI Report	60 days	Mon 7/18/16	Fri 10/7/16																					
8	Review Period (Navy/Base)	30 days	Mon 10/10/16	Fri 11/18/16																					
9	Review Period (USEPA/NCDENR)	30 days	Mon 11/21/16	Fri 12/30/16																					
10	Final PA/SI Report	10 days	Mon 1/2/17	Fri 1/13/17																					

Descriptions of ESI Sites

The following sections discuss the site history, summary of previous investigations, and future activities of the one IRP site and two MMRP sites that are in the ESI phase of the CERCLA process.

4.1 IRP ESI Sites

4.1.1 Site 37—Camp Geiger Area Surface Dump

Site 37, the Camp Geiger Area Surface Dump, encompasses approximately 4 acres in the Camp Geiger area of the Base (**Figure 4-1**). Between 1950 and 1951, Site 37 was used for the surface disposal of wastes including motor parts, garbage, and wood. During investigations at Site 37, buried debris was identified. US 17 Bypass runs through the northeastern portion of the site and the rest of the site is primarily wooded. In 2010, buried munitions were discovered in the vicinity and the area was identified as UXO-24 under the MMRP (**Section 4.2.2**).

FIGURE 4-1
IRP Site 37



Previous investigations are listed in **Table 4-1**.

TABLE 4-1
Previous Investigations Summary, IRP Site 37

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 37, and no further assessment was recommended.
Confirmatory Site Assessment (Osage, 2011)	2009-2011	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Soil and groundwater samples were collected for VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls [PCBs], herbicides, and metals. Potential unacceptable risks to the environment were identified due to exposure to pesticides and herbicides in soil and an additional investigation was recommended.
UXO-24 and Site 37 Preliminary Assessment/Site Investigation (CH2M HILL, 2014)	2013 - 2014	In 2013, a PA/SI was initiated to evaluate the nature and extent of potential MEC and MPPEH at UXO-24 (described in Section 4.2.2) and to evaluate the potential risk from pesticides and herbicides identified during the Site 37 Confirmatory Site Assessment. At Site 37, field activities included soil sampling for pesticide and herbicide analysis. Pesticides were detected at concentrations exceeding the screening criteria; however, no potential human health or environmental risks were identified due to exposure to soil. During the MEC investigation activities, buried debris was identified. The PA/SI recommended an ESI to delineate the nature and extent of the waste disposal area.

4.1.1.1 Future Activities

The ESI will be conducted in FY 2015/FY 2016 (**Schedule 4-1**). Based on the findings of the ESI, the path forward for the site will be determined.

**Schedule 4-1
 IRP Site 37
 IRP & MMRP Site Management Plan FY 2016
 MCIEAST-MCB CAMLEJ**

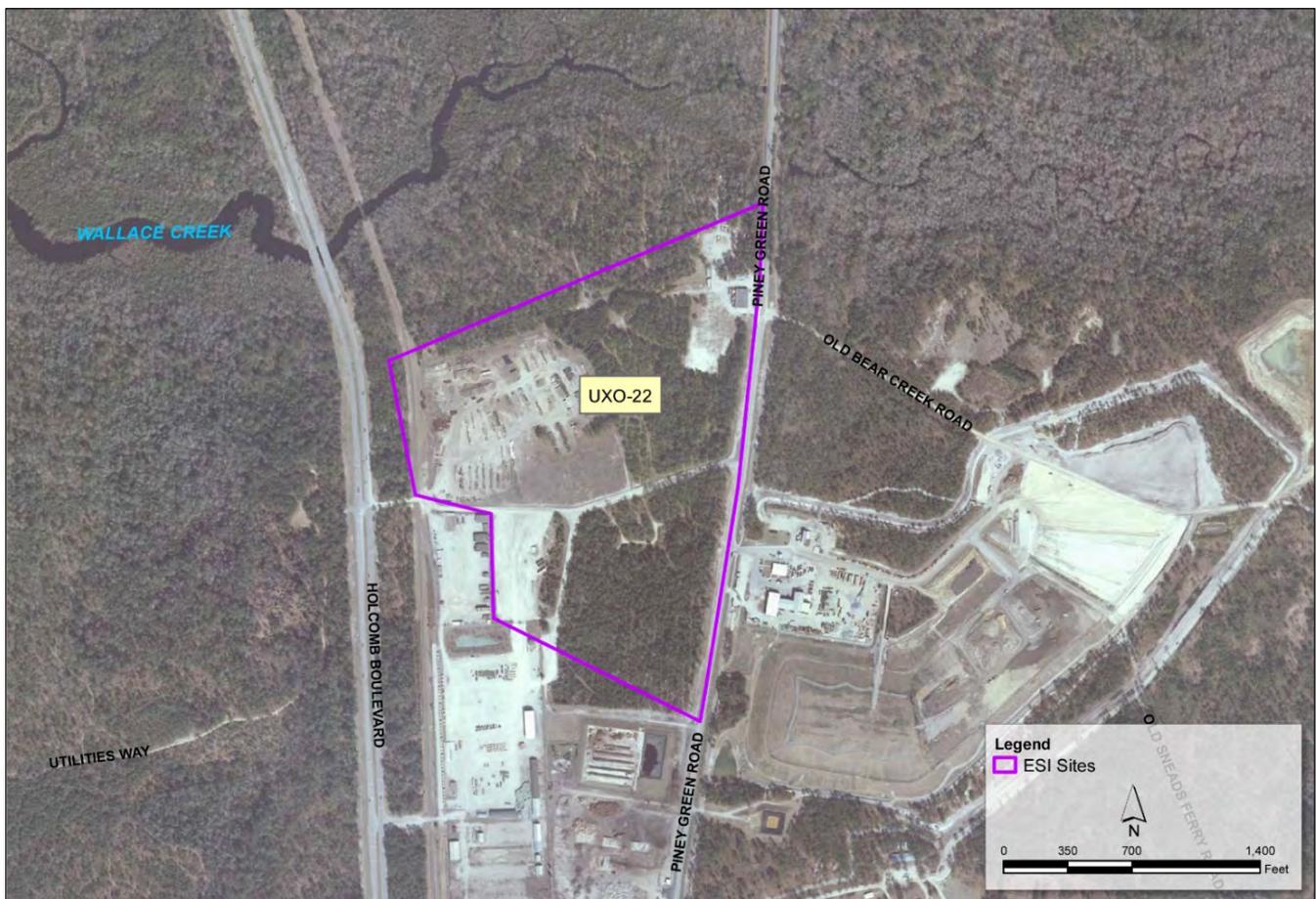
ID	Task Name	Duration	Start	Finish	2015												2016						
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	Expanded SI for UXO-24/Site 37	374 days	Fri 11/21/14	Wed 4/27/16																			
2	Draft UFP-SAP	69 days	Fri 11/21/14	Wed 2/25/15																			
3	Review Period (Navy/Base)	55 days	Thu 2/26/15	Wed 5/13/15																			
4	Review Period (USEPA/NCDENR)	30 days	Thu 5/14/15	Wed 6/24/15																			
5	Final UFP-SAP	10 days	Thu 6/25/15	Wed 7/8/15																			
6	Field Investigation/Data Evaluation	80 days	Thu 7/9/15	Wed 10/28/15																			
7	Draft Expanded SI Report	60 days	Thu 10/29/15	Wed 1/20/16																			
8	Review Period (Navy/Base)	30 days	Thu 1/21/16	Wed 3/2/16																			
9	Review Period (USEPA/NCDENR)	30 days	Thu 3/3/16	Wed 4/13/16																			
10	Final Expanded SI Report	10 days	Thu 4/14/16	Wed 4/27/16																			

4.2 MMRP ESI Sites

4.2.1 UXO-22—Sites 6 and 82 (OU 2)

Site UXO-22 covers approximately 75 acres between Holcomb Boulevard and Piney Green Road on the Mainside area of the Base (**Figure 4-2**). UXO-22 encompasses the location of the former Munitions Disposal Area and portions of IRP Sites 6 and 82 within OU 2. LUCs for intrusive activities are currently in place at Sites 6 and 82 that encompass UXO-22. Disposal trenches containing MPPEH (including expended 105-mm cartridges); communication wire; graphite battery packs; containers of petroleum, oil, and lubricant (POL); and metal 55-gallon drums were discovered and removed during the OU 2 RI (Baker, 1993), and additional MPPEH and munitions debris (MD) were identified during Supplemental Investigation activities conducted from 2009 to 2010. No former range activities are known to have occurred at the site. Current land uses at Site UXO-22 are industrial and commercial and consist of operation of the Base truck scales, equipment staging areas, parking lots, and a groundwater remediation system for Site 82.

FIGURE 4-2
MMRP Site UXO-22



Previous investigations are listed in **Table 4-2**.

TABLE 4-2
Previous Investigations Summary, MMRP Site UXO-22

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2013)	2011-2013	<p>A field investigation was conducted to evaluate the presence and nature of MC contamination. Field activities included soil and groundwater sampling for explosives residues and metals. Explosives residues and metals were detected in exceedance of screening criteria in subsurface soil, sediment, and groundwater samples.</p> <p>Potential human health and ecological risks were identified from exposure to metals in soil, including surface soil in the ephemeral drainage. The metals exceedances are likely associated with the long-term use as a historical storage and waste disposal area rather than with the presence of MPPEH and MEC. Therefore, it was recommended that metals in soil be addressed as part of IRP Sites 6 and 82.</p> <p>Potential explosive hazards were identified based on the MEC and MPPEH found onsite during previous IRP investigations. An RI was recommended to further characterize the nature and extent of MEC. Additionally, a MEC surface clearance was recommended to minimize explosive risks from unintentional detonations, especially in the wooded areas and in the former Defense Reutilization and Marketing Office (DRMO) area.</p>
Draft Expanded Site Investigation	2013-2015	<p>An ESI was conducted to further investigate the presence and nature of MEC and MPPEH and to evaluate the extent of the battery disposal area identified during the PA/SI. Field activities included DGM, an intrusive investigation, test pitting and collection of soil samples from the battery disposal area, and surface clearing and soil sifting within a portion of the former DRMO. The data is being evaluated and the ESI Report will be submitted in 2015.</p>

4.2.1.1 Future Activities

The ESI Report will be completed in 2015. An Explanation of Significant Difference (ESD) for OU 2 is planned to incorporate an intrusive activity control for potential MEC into the LUCs for OU 2 (**Schedule 4-2**).

4.2.2 UXO-24—Camp Geiger Area

Site UXO-24 covers approximately 9 acres of mostly wooded land east of G Street in the Camp Geiger area of the Base (**Figure 4-3**). Prior to the 1950s, the site was completely wooded. Between 1950 and 1951, the site was used as a surface dump for items such as wood, tires, and scrap metal (Osage, 2011). During the late 1950s, the site was partially cleared for the construction of a carpenter shop, lumber rack, and paint shop in the northern portion of the site. Buried discarded military munitions (DMM) were discovered at UXO-24 in 2010. A limited visual site inspection conducted by Base Explosive Ordnance Disposal (EOD) personnel found additional DMM and MPPEH in the area surveyed. Because Site UXO-24 also encompasses the majority of Site 37 (**Section 4.1.1**), the two sites are being investigated simultaneously.

FIGURE 4-3
MMRP Site UXO-24



Previous investigations are listed in **Table 4-3**.

TABLE 4-3
Previous Investigations Summary, MMRP UXO-24

Previous Investigation/Action	Date	Activities
UXO-24 and Site 37 Preliminary Assessment/Site Investigation (CH2M HILL, 2014)	2013-2014	In 2013, a PA/SI was initiated to evaluate the nature and extent of potential MEC and MPPEH at UXO-24 and to evaluate the potential risk from pesticides and herbicides identified during the Site 37 Confirmatory Site Assessment (described in Section 4.1.1). At UXO-24, field activities included DGM and an intrusive investigation. Approximately 1,500 anomalies were identified during DGM, and intrusive investigation of 989 of the anomalies resulted in the discovery of 14 MEC items, consisting of 2 40-mm high explosive projectiles, 1 40-mm projectile, and 11 fuzes. During the MEC investigation activities, buried waste was identified. The PA/SI recommended an ESI to delineate the nature and extent of the waste disposal area.

4.2.2.1 Future Activities

The ESI will be conducted in FY 2015/FY 2016 (**Schedule 4-3**). Based on the findings of the ESI, the path forward for the site will be determined.

Schedule 4-3
MMRP Site UXO-24
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ

ID	Task Name	Duration	Start	Finish	2015												2016						
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	Expanded SI for UXO-24/Site 37	374 days	Fri 11/21/14	Wed 4/27/16																			
2	Draft UFP-SAP	69 days	Fri 11/21/14	Wed 2/25/15																			
3	Review Period (Navy/Base)	55 days	Thu 2/26/15	Wed 5/13/15																			
4	Review Period (USEPA/NCDENR)	30 days	Thu 5/14/15	Wed 6/24/15																			
5	Final UFP-SAP	10 days	Thu 6/25/15	Wed 7/8/15																			
6	Field Investigation/Data Evaluation	80 days	Thu 7/9/15	Wed 10/28/15																			
7	Draft Expanded SI Report	60 days	Thu 10/29/15	Wed 1/20/16																			
8	Review Period (Navy/Base)	30 days	Thu 1/21/16	Wed 3/2/16																			
9	Review Period (USEPA/NCDENR)	30 days	Thu 3/3/16	Wed 4/13/16																			
10	Final Expanded SI Report	10 days	Thu 4/14/16	Wed 4/27/16																			

SECTION 5

Descriptions of RI/FS Sites

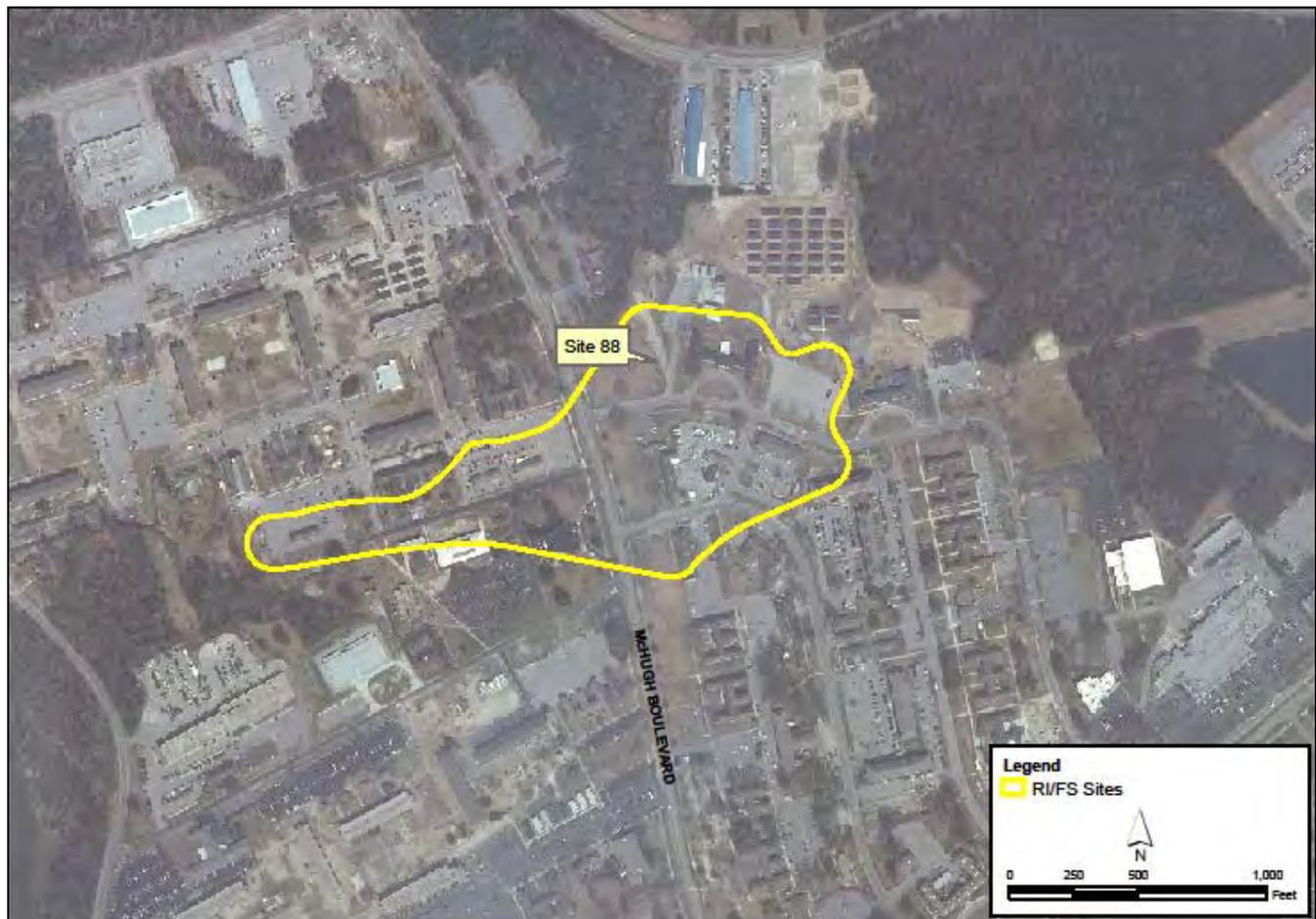
The following sections discuss the site history, summary of previous investigations, and future activities of the two IRP sites and two MMRP sites that are in the RI/FS phase of the CERCLA process. Because these sites are currently under investigation, the site boundaries encompass the current nature and extent of contamination.

5.1 IRP RI/FS Sites

5.1.1 Site 88 (OU 15)—Base Dry Cleaners

Site 88, the former Base Dry Cleaning Facility Building 25, encompasses approximately 41 acres in the Hadnot Point Industrial Area (HPIA) of MCIEAST-MCB CAMLEJ (**Figure 5-1**). Building 25 began operating as a dry cleaning facility in the 1940s. Five 750-gallon USTs were installed on the north side of the building to store dry cleaning fluids. Initially, Varsol was used in dry cleaning operations. Because of flammability concerns, Varsol’s use was discontinued in the 1970s and it was replaced with tetrachloroethene (PCE). The PCE was stored in one 150-gallon aboveground storage tank (AST) adjacent to the north wall of Building 25, in the same vicinity as the USTs. PCE was reportedly stored in the AST from the 1970s until 1995. Spent PCE was reportedly disposed of in floor drains during this time. In December 1986 and March 1995, self-contained dry cleaning machines were installed in Building 25, eliminating the need for bulk storage of PCE. The USTs and AST were removed in November 1995. The dry cleaning operations ceased in January 2004, and the building was demolished to slab in August 2004.

FIGURE 5-1
IRP Site 88, OU 15



Previous investigations are listed in **Table 5-1**.

TABLE 5-1
Previous Investigations Summary, IRP Site 88

Previous Investigation/Action	Date	Activities
Focused Remedial Investigation (Baker, 1998)	1996 - 1998	During removal of the USTs and ASTs, chlorinated volatile organic compounds (CVOCs) and metals were detected in soil samples, and CVOCs, total petroleum hydrocarbons (TPH), and naphthalene were detected in groundwater samples. As a result of these findings, a Focused RI was initiated. Field activities included soil and groundwater sampling for VOCs, and natural attenuation indication parameters (NAIPs). Subsurface soil contamination was identified under and near Building 25, and adjacent to the underground sewer line. Chlorinated solvent contamination was identified in surficial and upper Castle Hayne aquifer groundwater, and Building 25 was confirmed as the source area, suggesting the presence of a dense non-aqueous phase liquid (DNAPL).
Dense Non-aqueous Phase Liquid Recovery (Duke Engineering and Services, 1999)	1998 - 1999	Based on the results of the Focused RI, Site 88 was selected as a candidate for a surfactant enhanced aquifer remediation (SEAR) demonstration for DNAPL remediation. The presence of PCE DNAPL was confirmed, ranging from 16 to 20 feet below ground surface (bgs), directly beneath Building 25 and in an area adjacent to the north side of the building. The SEAR demonstration was conducted in the area north of Building 25 and DNAPL was extracted. Post-SEAR investigations indicated the DNAPL plume was removed from the upper, more permeable regions in the aquifer.
Long-term Monitoring	1999 - 2002	LTM at Site 88 was implemented in April 1999 and discontinued in 2002 when an Amended RI was initiated.
Reductive Anaerobic Bioremediation In Situ Treatment Technology (Battelle Memorial Institute, 2001)	2000 - 2001	Reductive Anaerobic Bioremediation In Situ Treatment Technology treatability testing was performed to the northwest of Building 25 to investigate if "microbially-catalyzed reductive dechlorination of chloroethenes could be stimulated in situ". PCE-contaminated groundwater was pumped from 88-MW051W, amended with electron donor solution (butyric acid and yeast extract), and then injected into 88-MW051W, and groundwater samples were collected and analyzed over a period of 30 weeks. The study concluded that native microbial populations were capable of sequentially reducing PCE to ethene. Also, PCE and trichloroethene (TCE) concentrations were reduced to below detectable levels in almost all pilot study wells after 14 weeks and remained depressed throughout the remainder of the demonstration.
Draft Supplemental Site Investigation (CH2M HILL, 2002)	2002	The Supplemental Site Investigation (SSI) was conducted to determine the nature and extent of contamination and to provide recommendations for completing a comprehensive RI. Groundwater samples were collected and analyzed for VOCs, metals, and NAIPs. The analytical results indicated a general northwest migration of contaminants. Further, the vertical distribution of VOCs suggested that although appreciable volumes of DNAPL are observed to have accumulated upon the shallow silt layer, this layer was not impermeable, and was evidently allowing dissolved-phase VOCs to migrate vertically to the intermediate-depth aquifer zone.
Membrane Interface Probe Investigation	2004	A membrane interface probe (MIP) investigation was conducted to refine previous source area characterization efforts and conduct vertical soil profiling in the vicinity of Building 25 and the nearby sewer systems. Information provided by the MIP investigation was used to evaluate the horizontal and vertical distribution of the DNAPL source area.
Engineering Evaluation/Cost Analysis and Non-time-critical Removal Action (CH2M HILL, 2004; AGVIQ/CH2M HILL, 2006)	2004 - 2006	An EE/CA for the source area beneath Building 25 was completed and presented at a public meeting in June 2004 and shallow soil mixing with clay/zero-valent iron (ZVI) was the recommended technology. In 2005, the removal action was completed, treating approximately 7,050 cubic yards (yd ³) of impacted soil. Within the treatment area, PCE concentrations in the soil were reduced by greater than 99 percent. Despite the significant source area reduction, residual dissolved phase groundwater contamination remained over a large portion of the surrounding and downgradient areas.
Remedial Investigation (CH2M HILL, 2008)	2005 - 2008	An RI was completed to address previous data gaps and complete the source identification and delineation of the release. Field activities included monitoring well installation and groundwater sampling. Samples were analyzed for VOCs and NAIPs. Results indicated a delineated VOC plume in groundwater that extended south of the source area. Potential human health risks were identified from VOCs in groundwater. No unacceptable ecological risks were identified.

TABLE 5-1
Previous Investigations Summary, IRP Site 88

Previous Investigation/Action	Date	Activities
Treatability Study and Technical Memorandum, Summary of ISCO, ERD, and Biobarrier Pilot Studies OU 15, Site 88 (CH2M HILL, 2011)	2010-2011	To evaluate effectiveness of remedial technologies to treat the VOC plume, a pilot study was conducted using enhanced reductive dechlorination (ERD) and in situ chemical oxidation (ISCO) for contaminant mass reduction and ERD as a biobarrier to prevent further downgradient contaminant migration. For mass reduction, ISCO was demonstrated to be most effective based on a VOC reduction of 87 percent, whereas for ERD, an appropriate dose would be cost-prohibitive. The ERD biobarrier achieved up to 97 percent PCE reduction and was effective. The results of the pilot study will be used for the development of remedial alternatives in the FS.
Draft Feasibility Study (CH2M HILL, 2012)	2011-2012	Remedial alternatives were evaluated to address VOCs in soil and groundwater in three zones. Zone 1 is defined as the location of the initial source area with high concentrations of VOC at shallow depths. Zones 2 and 3 are downgradient from Zone 1 and include constituent of concern (COC) concentrations at a wide range of depths covering a large footprint. Alternatives for Zone 1 soil included no action, LUCs, and excavation. Zone 1 groundwater alternatives included no action, vertical air sparging/soil vapor extraction (SVE), and vertical ISCO. Zone 2 alternatives for groundwater included no action, horizontal air sparging, and horizontal ISCO. Zone 3 groundwater alternatives included no action, monitored natural attenuation (MNA), and an ERD barrier. The current CSM is shown on Figure 5-2.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, CH2M HILL, 2011, and CH2M HILL, 2015)	2007 - 2015	Site 88 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Vapor intrusion was identified as a pathway of concern at 1 building and a VIMS was installed in 2012. VIMS were installed in three additional buildings in 2012 to reduce the possibility of future vapor migration and additional sampling was recommended at Building HP57 to assess temporal variability. Additional sampling was conducted at Building HP57 and Buildings 37A (identified based on exceedances of groundwater in the vicinity) in 2013. Based on the results, NFA was recommended for Building 37A and follow-up monitoring was recommended at Building HP57.
Building HP57 Additional Vapor Intrusion Investigation (CH2M HILL, 2015)	2014 - 2015	<p>An additional vapor intrusion investigation was conducted at Building HP57 based on the temporal variability of TCE concentrations and the potential for preferential transport of vapors through underground utilities. Field activities included subslab soil gas, indoor air, and outdoor air sampling. PCE, TCE, and chloroform were detected in indoor air; however, the concentrations found in the subslab were not high enough to result in vapor intrusion at levels above indoor air screening levels. Therefore, a HAPSITE investigation was conducted to identify the source of the indoor air detections.</p> <p>An uncapped sewer pipe was identified as a potential vapor entry point and the pipe was plugged. Additional indoor air samples were collected from Buildings 58, 59, and HP55, which are connected to the same sewer line. Samples were also collected, utilizing the HAPSITE, from sewer connections within Building 37, which currently has VIMS. VOCs were detected within the buildings suggesting the sewer line may act as a potential pathway for vapor to enter the buildings. The p-traps will be inspected and repaired if necessary to prevent vapors from entering spaces through the sewer line by maintaining a water barrier. Additional indoor air sampling will be conducted to evaluate PCE and TCE concentrations throughout Building HP57. A pilot study is also planned to evaluate the effectiveness of venting the sewer line.</p>

5.1.1.1 Future Activities

A Draft FS was submitted in 2012. A tracer study and additional groundwater, soil, and vapor intrusion investigation was initiated in FY 2015 to support finalizing the FS. The finalized FS, Proposed Plan, and ROD will follow (**Schedule 5-1**). If buildings are planned for construction in the vicinity of the VOC groundwater plume, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the geographic information system (GIS), and all construction projects on-Base go through environmental review.

**Schedule 5-1
IRP Site 88
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ**

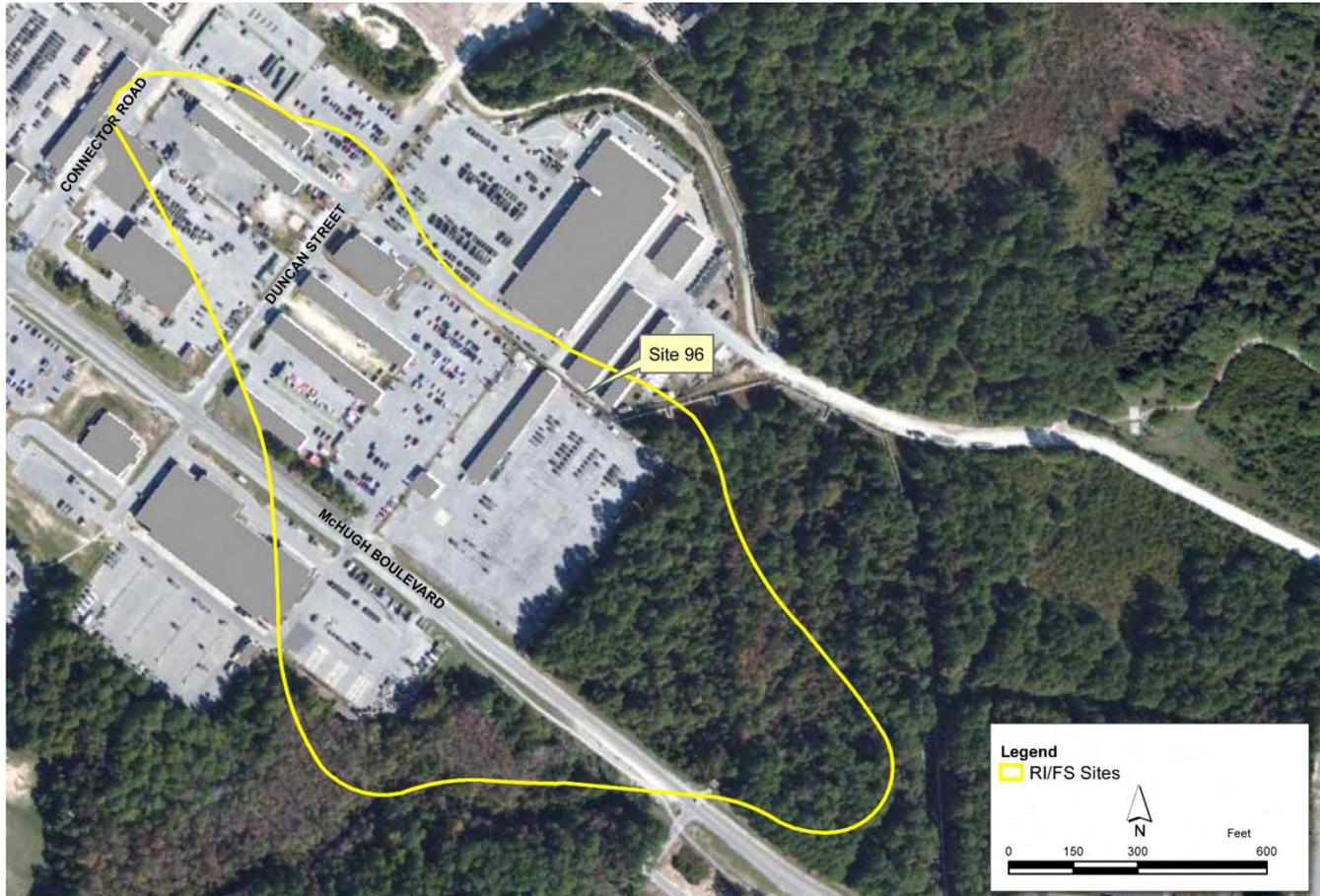
ID	Task Name	Duration	Start	Finish	2016												2017												2018											
					Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun												
1	FS	357 days	Wed 7/1/15	Thu 11/10/16	[Gantt bar from July 2015 to November 2016]																																			
2	Tracer Study	193 days	Wed 7/1/15	Fri 3/25/16	[Gantt bar from July 2015 to March 2016]																																			
3	Draft Final FS	90 days	Mon 3/28/16	Fri 7/29/16	[Gantt bar from March 2016 to July 2016]																																			
4	Review Period (Navy/Base)	30 days	Mon 8/1/16	Fri 9/9/16	[Gantt bar from August 2016 to September 2016]																																			
5	Review Period (USEPA/NCDENR)	30 days	Mon 9/12/16	Fri 10/21/16	[Gantt bar from September 2016 to October 2016]																																			
6	Final FS	14 days	Mon 10/24/16	Thu 11/10/16	[Gantt bar from October 2016 to November 2016]																																			
7	Proposed Plan	138 days	Fri 11/11/16	Tue 5/23/17	[Gantt bar from November 2016 to May 2017]																																			
8	Draft Proposed Plan	45 days	Fri 11/11/16	Thu 1/12/17	[Gantt bar from November 2016 to January 2017]																																			
9	Review Period (Navy/Base)	30 days	Fri 1/13/17	Thu 2/23/17	[Gantt bar from January 2017 to February 2017]																																			
10	Review Period (USEPA/NCDENR)	30 days	Fri 2/24/17	Thu 4/6/17	[Gantt bar from February 2017 to April 2017]																																			
11	Final Proposed Plan	10 days	Fri 4/7/17	Thu 4/20/17	[Gantt bar from April 2017 to April 2017]																																			
12	Public Meeting/Review Period	23 days	Fri 4/21/17	Tue 5/23/17	[Gantt bar from April 2017 to May 2017]																																			
13	ROD	134 days	Fri 4/7/17	Wed 10/11/17	[Gantt bar from April 2017 to October 2017]																																			
14	Draft ROD	60 days	Fri 4/7/17	Thu 6/29/17	[Gantt bar from April 2017 to June 2017]																																			
15	Review Period (Navy/Base)	30 days	Fri 6/30/17	Thu 8/10/17	[Gantt bar from June 2017 to August 2017]																																			
16	Review Period (USEPA/NCDENR)	30 days	Fri 8/11/17	Thu 9/21/17	[Gantt bar from August 2017 to September 2017]																																			
17	Final ROD	14 days	Fri 9/22/17	Wed 10/11/17	[Gantt bar from September 2017 to October 2017]																																			
18	RD	165 days	Fri 9/22/17	Thu 5/10/18	[Gantt bar from September 2017 to May 2018]																																			
19	Draft RD	75 days	Fri 9/22/17	Thu 1/4/18	[Gantt bar from September 2017 to January 2018]																																			
20	Review Period (Navy/Base)	30 days	Fri 1/5/18	Thu 2/15/18	[Gantt bar from January 2018 to February 2018]																																			
21	Review Period (USEPA/NCDENR)	30 days	Fri 2/16/18	Thu 3/29/18	[Gantt bar from February 2018 to March 2018]																																			
22	Final RD	30 days	Fri 3/30/18	Thu 5/10/18	[Gantt bar from March 2018 to May 2018]																																			

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5.1.2 Site 96 (OU 22)—Building 1817 UST

Site 96, previously Solid Waste Management Unit (SWMU) 360, encompasses approximately 14 acres in the Mainside HPIA between Connector Road and McHugh Boulevard (**Figure 5-3**). Site 96 is the site of a former 300-gallon waste-oil UST positioned near Building 1817. Building 1817 is a Hazardous Materials Consolidation Center. The former UST was located in the eastern portion of the compound, which is currently used as a temporary staging area for batteries, refrigeration units, and other used equipment prior to disposal and or reutilization.

FIGURE 5-3
IRP Site 96, OU 22



Previous investigations are listed in **Table 5-2**.

TABLE 5-2
Previous Investigations Summary, IRP Site 96

Previous Investigation/Action	Date	Activities
UST Removal and Investigations (Catlin, 1997)	1997	The 300-gallon waste oil UST was removed in July 1997, and confirmatory samples were collected under the UST Program. Additional sampling was completed in December 1997, indicating a petroleum release had occurred at the UST. A Limited Site Assessment was also conducted under the UST Program, which included installing monitoring well 1817MW01 within the former UST excavation. Upon discovery of elevated concentrations of chlorinated compounds in groundwater, the site was removed from the UST Program and included in the Confirmatory Site Investigation (CSI) under the Resource Conservation and Recovery Act (RCRA).
Confirmatory Site Investigation (Baker, 2005)	2002 - 2005	The CSI included soil and groundwater sampling for VOCs, SVOCs, pesticides, and RCRA metals analyses. The CSI identified VOCs, SVOCs, and pesticides in groundwater that exceeded screening criteria.
Resource Conservation and Recovery Act Facility Investigation (RFI) (Baker and CH2M HILL, 2005) and Amended RFI (CH2M HILL, 2006)	2005 - 2006	The RFI included soil and groundwater sampling for VOCs, pesticides, and RCRA metals analysis. A CVOC plume was identified in groundwater. Potential unacceptable human health risks to future residents were identified from exposure to PCE, TCE, and heptachlor epoxide in groundwater.
Corrective Measures Study (CH2M HILL, 2007)	2007	A Corrective Measures Study (CMS) was conducted to develop remedial goal options for the site and to evaluate management options for groundwater at SWMU 360. The corrective measures evaluated were ERD, air sparging, and ISCO.
Additional Groundwater Delineation (Osage, 2009)	2007 - 2009	The downgradient and vertical extent of the CVOC plume was not fully delineated and additional groundwater samples were collected for analysis of PCE and its daughter products. As a result, the vertical extent of contamination was delineated but the plume extends horizontally more than 1,800 feet southeast from the source area and is not fully delineated to NCGWQS. Because the contamination is not associated with the former UST, the SWMU was transferred to the IRP to complete the delineation under an RI/FS.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, CH2M HILL, 2011, and CH2M HILL, 2015)	2007 - 2015	Site 96 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Groundwater, soil gas, and air samples were collected from Building 1817 and subslab soil gas samples were collected from Buildings 1827 and 1828 which are located within the Site 96 boundary southwest of Building 1817. Although significant vapor intrusion impacts were not expected, additional sampling was recommended at Buildings 1827 and 1828 to assess temporal and spatial variability. Based on results of the phased investigations and monitoring reports, NFA was recommended for Buildings 1817 and 1827 and periodic monitoring was recommended at Building 1828 and will be conducted in FY 2018.

5.1.2.1 Future Activities

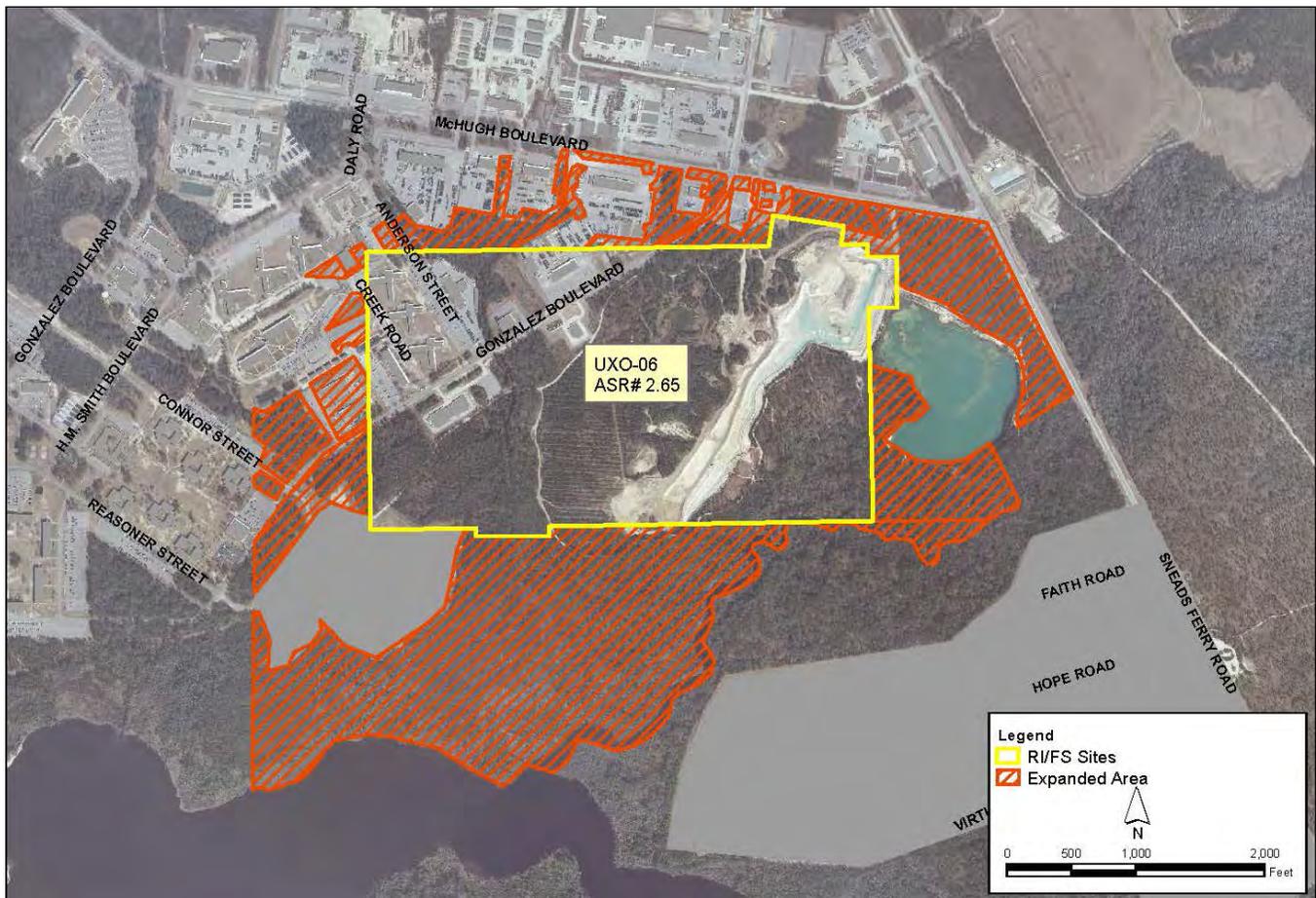
An RI/FS is planned in FY 2015/2016, followed by a Proposed Plan and ROD (**Schedule 5-2**). If buildings are planned for construction in the vicinity of the VOC groundwater plume, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS and all construction projects on-Base go through environmental review.

5.2 MMRP RI/FS Sites

5.2.1 UXO-06 (OU 24)—Fortified Beach Assault Area (ASR #2.65)

Site UXO-06, the Fortified Beach Assault Area, encompasses approximately 177 acres in the Mainside of MCIEAST-MCB CAMLEJ, south of McHugh Boulevard and west of Sneads Ferry Road (**Figure 5-4**). This range was reportedly in use from 1953 until approximately 1977. The types of munitions used onsite include blank small arms, demolitions, flame throwers, 3.5-inch practice rockets, practice rifle grenades, and smoke and white phosphorus hand grenades. In addition, solvents and solutions were used at the site to clean equipment. The east central portion of Site UXO-06 has been investigated and cleared and is being used as a borrow pit to support construction projects across the Base.

FIGURE 5-4
MMRP Site UXO-06 (OU 24), ASR #2.65



Previous investigations are listed in **Table 5-3**.

TABLE 5-3
Previous Investigations Summary, MMRP Site UXO-06 (OU 24), ASR #2.65

Previous Investigation/Action	Date	Activities
Focused Site Investigation MILCON Area (CH2M HILL, 2007)	2006 - 2007	In support of MILCON activities for an armory and extended parking area, soil and groundwater sampling, and 100 percent DGM were conducted in a 4-acre area at UXO 6. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, explosives residues, perchlorate, TPH, and metals. No unacceptable human health or ecological risks were identified in site media. The 1,368 anomalies that were identified during DGM were investigated and removed prior to MILCON activities. Several MEC items were discovered and removed including a practice rocket, colored smoke hand grenade, and hand signal flare. Because it is not possible to provide 100 percent assurance that all MEC items have been removed from the site, "3R" (Recognize, Retreat, Report) training was provided for protection of construction workers.
Focused Preliminary Assessment/Site Investigation (Arcadis, 2007)	2007	To evaluate the presence of UXO and impacted soil or groundwater within a proposed sewer line easement, the Onslow Water and Sewer Authority initiated a Focused PA/SI at UXO-06. Field activities included soil and groundwater sampling and DGM. Samples were analyzed for VOCs, SVOCs, TPH, explosives residues, perchlorate, and metals. No unacceptable risks to construction workers were identified in site media. 790 geophysical anomalies that were identified during DGM were investigated and were removed. All anomalies with the exception of two practice 3.5-inch rockets and one expended smoke rifle grenade were construction/cultural debris.
Preliminary Assessment/Site Investigation (CH2M HILL, 2012)	2008 - 2012	A sitewide field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil, groundwater, surface water, and sediment sampling; and 10 percent DGM and intrusive anomaly investigation. The samples were analyzed for VOCs, SVOCs, pesticides, explosives residues, TPH, perchlorate, and metals and no unacceptable human health or ecological risks were identified from exposure to environmental media. MPPEH was found on the ground surface and in burial pits and there is potential for MEC/MPPEH to remain in the surface and subsurface at the site. An RI was recommended to further evaluate the potential for subsurface MEC in uninvestigated and undeveloped areas within the site and along the site boundaries.
Focused Site Investigations (CH2M HILL, 2010, 2011, 2012)	2010 - 2012	A Focused SI was conducted at the UXO-06 Borrow Pit Expansion Area in a phased approach. Field activities included 100 percent DGM and intrusive investigations. A total of 10,250 geophysical anomalies were investigated, 15 MEC items were identified and destroyed through controlled detonations, and over 2,000 MPPEH items were identified. Based on the clearance activities, the borrow pit was recommended to be opened for excavation in January 2012. The intrusive investigation significantly reduced the risk of encountering subsurface MEC. However, because it is not possible to provide 100 percent assurance that all MEC items have been removed from the site, "3R" (Recognize, Retreat, and Report) training was recommended for protection of site operators. On-call support from Base EOD or a qualified UXO contractor for inspection and disposal of suspected MEC that may be unearthed was also recommended.
Remedial Investigation (CH2M HILL, 2015)	2012-2015	An RI was conducted to further evaluate the nature and extent of subsurface MEC in uninvestigated and undeveloped areas within the site and in areas adjacent to UXO-06 boundaries. Field activities included DGM, an intrusive investigation, and post-detonation soil sampling. Approximately 3,300 anomalies and 190 MPPEH items were discovered. MPPEH was demilitarized onsite and classified as material documented as safe (MDAS). Post-detonation soil sampling results did not indicate any unacceptable human health or ecological risks due to exposure to soil within the area of the controlled detonation. Human health risk assessment (HHRAs) and ecological risk assessments (ERAs) previously conducted at UXO-06 were reviewed and updated for the RI. There were no impacts to environmental media from MEC/MPPEH and no unacceptable risks to human or ecological receptors identified from exposure to MC in site media. Based on the results of the RI, NFA is recommended for the Borrow Pit Area, Cantonment Area A, and Cantonment Area C. An FS is recommended for the Cantonment Area B, Wooded, and Limited Use Areas in order to develop remedial alternatives to address potential threats from any MEC that remains at the site.

5.2.1.1 Future Activities

An FS will be completed in FY 2015/2016 followed by a Proposed Plan, ROD, and RD. (**Schedule 5-3**).

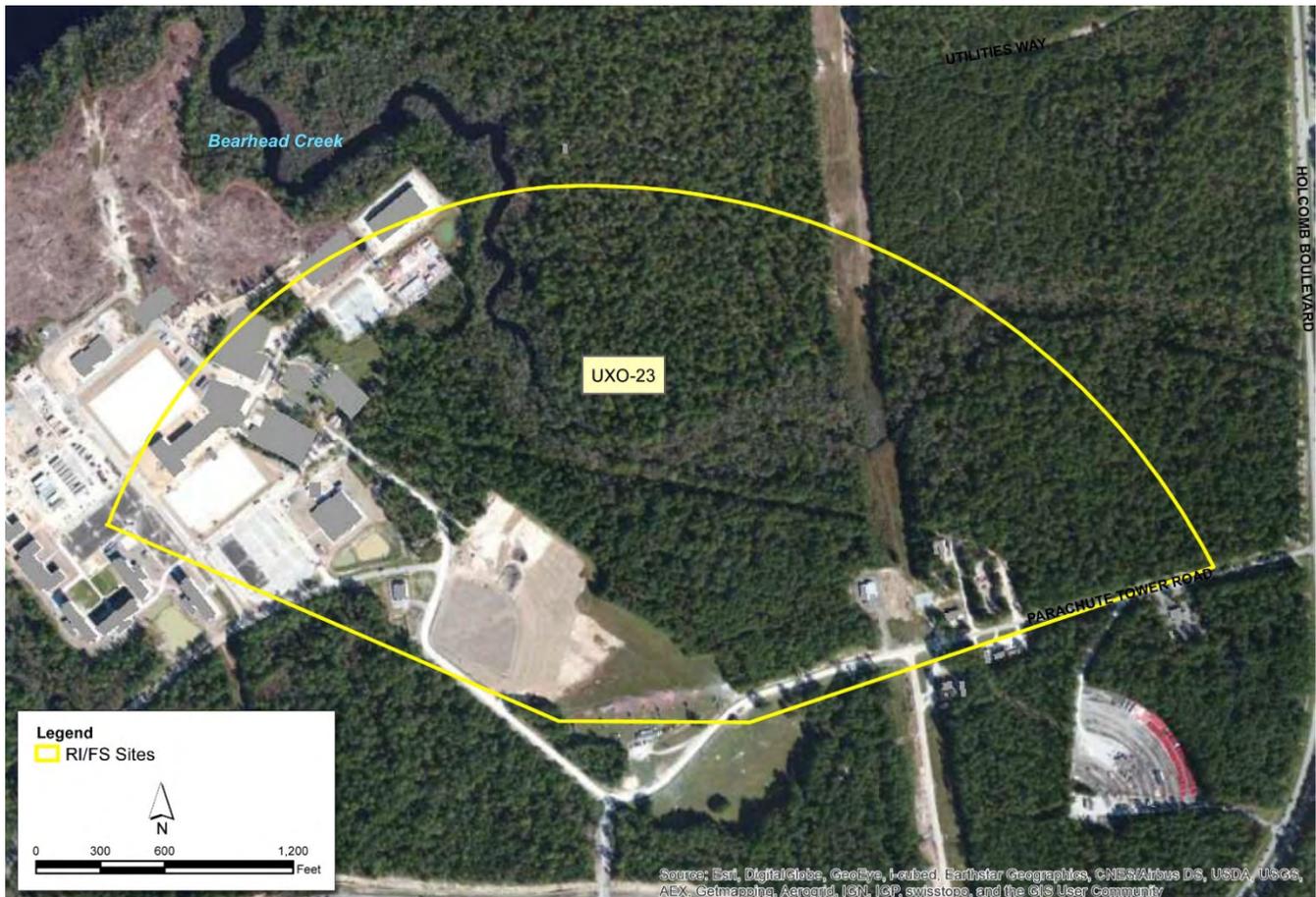
5.2.2 UXO-23—D-9 Skeet Range (ASR #2.82)

The D-9 Skeet Range is located west of Holcomb Boulevard and north of Parachute Tower Road and encompasses approximately 187 acres (**Figure 5-5**). The D-9 Skeet Range was used for recreational shooting from 1953 until it was closed in July 2011. The range was one of four live-fire ranges within a training area known as Area D. The weapons historically accommodated included 12-, 16-, 20-, 28-, and 410-gauge shotguns and sizes of lead shot used on the range included 7.5 mm, 8 mm, 8.5 mm, and 9 mm. Although the total amounts of ammunition used on the skeet ranges are not available, it is estimated that several hundred thousand rounds were fired each year.

Currently, the Wallace Creek MILCON project covers approximately 100 acres north of Hadnot Point and south of Wallace Creek and includes the theoretical shot fall-zone of the D-9 Skeet Range. Planned and ongoing construction consists of barracks support buildings (such as the mess hall and fitness center) and parking areas.

FIGURE 5-5

MMRP Site UXO-23, ASR #2.82



Previous investigations are listed in **Table 5-4**.

TABLE 5-4
Previous Investigations Summary, MMRP Site UXO-23, ASR #2.82

Previous Investigation/Action	Date	Activities
Focused Site Investigation (CH2M HILL, 2008)	2007 - 2008	A field investigation was conducted to evaluate the distribution of lead within the area south of Bearhead Creek. Surficial soil samples were field screened using X-ray fluorescence (XRF) to identify potential lead impacts. Soil and groundwater samples were also collected and analyzed for lead to confirm the XRF results. The highest concentrations of lead were generally found to correspond with the theoretical shot fall-zone for the range. Additional sampling of surface soils and groundwater and an HHRA was recommended.
Focused Preliminary Assessment/Site Investigation (CH2M HILL, 2010)	2008 - 2010	The Focused PA/SI was conducted to evaluate potential impacts to human health and the environment in the area north of Bearhead Creek. Soil, groundwater, surface water, and sediment samples were collected and were analyzed for perchlorate, polycyclic aromatic hydrocarbons (PAHs), and metals. Potential human health risks to future residents from PAHs in groundwater north of Bearhead Creek and potential ecological risks from metals and PAHs in Bearhead Creek were identified.
Wallace Creek Expanded Site Investigation (CH2M HILL, 2010)	2009 - 2010	Additional soil sampling was conducted in the theoretical shot fall-zone to delineate the horizontal and vertical extents of lead impacts and to investigate potential impacts to drainage features that convey surface water runoff from the theoretical shot fall-zone. A human health risk screening (HHRS) and an ecological risk screening (ERS) were performed on the data collected to-date. In the north area, potential risks have been identified from PAHs in groundwater, metals and PAHs in surface water and sediment within Bearhead Creek and associated wetlands and drainages. In the southern area of the Skeet Range, outside of the shot fall-zone, no unacceptable risks were identified in soil and groundwater. In the vicinity of the theoretical shot fall-zone, potential unacceptable risks to human health and the environment were identified from exposure to lead and PAHs in surface soil, and a removal action was recommended once the Skeet Range is closed.
Draft Engineering Evaluation/Cost Analysis (CH2M HILL, 2010)	2010	The EE/CA evaluated alternatives for the NTCRA to address potential unacceptable risks from lead and PAHs in the shot fall-zone. The alternatives were no action, excavation with offsite disposal, excavation with particle separation and backfill, excavation with stabilization and offsite disposal, and in situ stabilization.
Environmental Update (CH2M HILL, 2011)	2011	After submission of the Draft EE/CA, several MILCON projects were planned/initiated adjacent to the NTCRA area and additional investigation was conducted in 2011. Additional soil sampling for lead and PAH analysis was conducted in the theoretical shot fall-zone to verify and update the NTCRA removal area. Lead concentrations exceeded the cleanup level at three soil sample locations within the proposed NTCRA area. Soil samples were also screened using an XRF analyzer and three surface soil samples contained lead concentrations in exceedance of the cleanup level. The proposed NTCRA area was modified based on these results.
Engineering Evaluation/Cost Analysis (CH2M HILL, 2012)	2011 - 2012	The EE/CA evaluating alternatives for the NTCRA to address potential unacceptable risks from lead and PAHs in the theoretical shot fall-zone was updated with the modified NTCRA area based on the Environmental Update.
Action Memorandum (CH2M HILL, 2012)	2012	An AM was completed to propose in situ stabilization followed by excavation and offsite disposal as the NTCRA to address lead and PAHs in soil.
Wallace Creek Bachelor Enlisted Quarters Confirmation Sampling (CH2M HILL, 2012)	2012	In support of MILCON activities for a Bachelor Enlisted Quarters (BEQ) facility located northwest of the theoretical shot fall-zone, soil and groundwater sampling was conducted to evaluate whether environmental impacts related to historical activities could pose unacceptable risks to construction workers and future residents. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. There were no unacceptable risks for human and ecological receptors at the proposed BEQ location. Therefore, MILCON activities were recommended to proceed as planned.
Non-time-critical Removal Action Construction Completion Report (Osage, 2013)	2012-2013	The NTCRA was initiated to treat and remove lead and PAH contaminated soil in the theoretical shot fall-zone and three drainages connected to the southern portion of the shot fall-zone. Approximately 52,000 tons of contaminated soil were removed. During the NTCRA activities, nine munitions-related items, including 81-mm practice mortars, were identified. Because PAH and lead concentrations in exceedance of screening criteria were identified at greater depths than expected, the NTCRA was placed on hold until the contaminated soil could be vertically delineated. The contaminated soil was covered with a geotextile liner and 1 foot of clean fill.

TABLE 5-4
 Previous Investigations Summary, MMRP Site UXO-23, ASR #2.82

Previous Investigation/Action	Date	Activities
Non-time-critical Removal Action Technical Memorandum (CH2M HILL, 2014)	2014	In support of the remaining NTCRA area, soil samples were collected to vertically delineate PAH and lead contaminated soil. Depths to soil with concentrations below the action levels ranged from 2 to 6.5 feet bgs. Based on these results, the estimated volume of impacted soils remaining in the NTCRA area beneath the geotextile fabric was calculated to be approximately 7,000 yd ³ .

5.2.2.1 Future Activities

The removal of the remaining PAH and lead-impacted soil is projected for completion in FY 2015/2016. The RI will be completed in FY 2016/2017 followed by an FS, Proposed Plan, ROD, and RD (**Schedule 5-4**).

Schedule 5-4
MMRP Site UXO-23, ASR# 2.82
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ

ID	Task Name	Duration	Start	Finish	2016												2017												2018												2019											
					Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan								
1	NTCRA Completion	261 days	Thu 1/1/15	Thu 12/31/15	[Task bar from Oct 2015 to Dec 2015]																																															
2	RI	799 days	Mon 7/28/14	Thu 8/17/17	[Task bar from Mon 7/28/14 to Thu 8/17/17]																																															
3	Additional RI Activities	635 days	Mon 7/28/14	Fri 12/30/16	[Task bar from Mon 7/28/14 to Fri 12/30/16]																																															
4	Draft Report	90 days	Mon 1/2/17	Fri 5/5/17	[Task bar from Mon 1/2/17 to Fri 5/5/17]																																															
5	Review Period (Navy/Base)	30 days	Mon 5/8/17	Fri 6/16/17	[Task bar from Mon 5/8/17 to Fri 6/16/17]																																															
6	Review Period (USEPA/NCDENR)	30 days	Mon 6/19/17	Fri 7/28/17	[Task bar from Mon 6/19/17 to Fri 7/28/17]																																															
7	Final Report	14 days	Mon 7/31/17	Thu 8/17/17	[Task bar from Mon 7/31/17 to Thu 8/17/17]																																															
8	FS	164 days	Mon 6/19/17	Thu 2/1/18	[Task bar from Mon 6/19/17 to Thu 2/1/18]																																															
9	Draft FS	90 days	Mon 6/19/17	Fri 10/20/17	[Task bar from Mon 6/19/17 to Fri 10/20/17]																																															
10	Review Period (Navy/Base)	30 days	Mon 10/23/17	Fri 12/1/17	[Task bar from Mon 10/23/17 to Fri 12/1/17]																																															
11	Review Period (USEPA/NCDENR)	30 days	Mon 12/4/17	Fri 1/12/18	[Task bar from Mon 12/4/17 to Fri 1/12/18]																																															
12	Final FS Report	14 days	Mon 1/15/18	Thu 2/1/18	[Task bar from Mon 1/15/18 to Thu 2/1/18]																																															
13	Proposed Plan	158 days	Fri 2/2/18	Tue 9/11/18	[Task bar from Fri 2/2/18 to Tue 9/11/18]																																															
14	Draft Proposed Plan	60 days	Fri 2/2/18	Thu 4/26/18	[Task bar from Fri 2/2/18 to Thu 4/26/18]																																															
15	Review Period (Navy/Base)	30 days	Fri 4/27/18	Thu 6/7/18	[Task bar from Fri 4/27/18 to Thu 6/7/18]																																															
16	Review Period (USEPA/NCDENR)	30 days	Fri 6/8/18	Thu 7/19/18	[Task bar from Fri 6/8/18 to Thu 7/19/18]																																															
17	Final Proposed Plan	14 days	Fri 7/20/18	Wed 8/8/18	[Task bar from Fri 7/20/18 to Wed 8/8/18]																																															
18	Public Meeting/Review Period	24 days	Thu 8/9/18	Tue 9/11/18	[Task bar from Thu 8/9/18 to Tue 9/11/18]																																															
19	ROD	134 days	Fri 6/8/18	Wed 12/12/18	[Task bar from Fri 6/8/18 to Wed 12/12/18]																																															
20	Draft ROD	60 days	Fri 6/8/18	Thu 8/30/18	[Task bar from Fri 6/8/18 to Thu 8/30/18]																																															
21	Review Period (Navy/Base)	30 days	Fri 8/31/18	Thu 10/11/18	[Task bar from Fri 8/31/18 to Thu 10/11/18]																																															
22	Review Period (USEPA/NCDENR)	30 days	Fri 10/12/18	Thu 11/22/18	[Task bar from Fri 10/12/18 to Thu 11/22/18]																																															
23	Final ROD	14 days	Fri 11/23/18	Wed 12/12/18	[Task bar from Fri 11/23/18 to Wed 12/12/18]																																															

Descriptions of Proposed Plan and ROD Sites

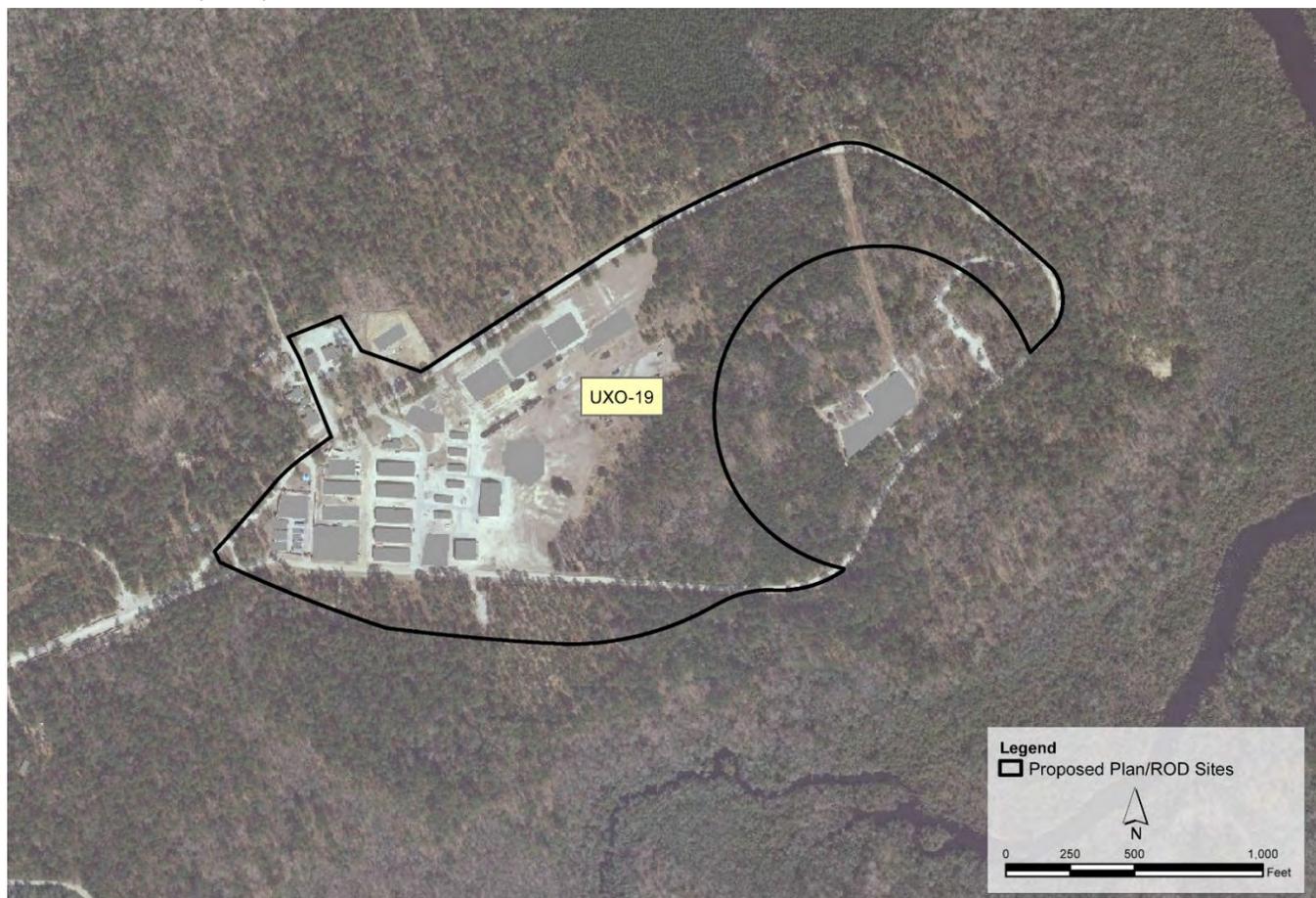
The following subsections discuss the site history, summary of previous investigations, and future activities of the one MMRP site that is in the Proposed Plan and ROD phase of the CERCLA process. Because this site is currently under investigation, the site boundaries encompass the current nature and extent of contamination.

6.1 MMRP Proposed Plan/ROD Sites

6.1.1 UXO-19 (OU 25)—M-4, Rifle Grenade Range (ASR #2.104), K-22 Practice Hand Grenade Course (ASR #2.111), and M115 Hand Grenade Course (ASR #2.168)

Site UXO-19 is located within the Camp Devil Dog training area. The site initially covered approximately 80 acres; however, a 22-acre area in the eastern portion of the initial site boundary is currently active and used as a Military Operations in Urban Terrain training facility. The current Site UXO-19 boundary, excluding the training facility, covers approximately 64 acres, as shown on **Figure 6-1**. There are eight overlapping ranges within UXO-19 boundaries, three of which were identified for closure under the MMRP. The M-4 Rifle Grenade Range (ASR #2.104) was used between 1950 and 1960. Reported munitions used were M28 and M29 rifle grenades, white phosphorus hand and rifle grenades, pyrotechnics, and demolitions. The K-22 Practice Hand Grenade Course (ASR #2.111) was used between 1950 and 1960 to practice grenade throwing techniques. Facilities included a bunker and foxhole. The M115 Hand Grenade Course (ASR #2.168) was used from 1970 to 1977 for high explosive hand grenades. The range consisted of six throwing pits, six control pits, and a barricade with two observation ports.

FIGURE 6-1
MMRP Site UXO-19 (OU 25), ASR #2.104, ASR #2.111, and ASR #2.168



Previous investigations are listed in **Table 6-1**.

TABLE 6-1
 Previous Investigations Summary, MMRP Site UXO-19 (OU 25), ASR #2.104, ASR #2.111, and ASR #2.168

Previous Investigation/Action	Date	Activities
Focused Preliminary Assessment/Site Investigation (CH2M HILL, 2010)	2010	In support of MILCON activities in the vicinity of the former grenade ranges, soil and groundwater sampling, 10 percent DGM of the former range area, 100 percent DGM of the MILCON footprint, and an intrusive MEC investigation were initiated in FY 2009. Samples were analyzed for explosives residues, metals, and perchlorate, and two subsurface soil samples were analyzed for VOCs. No unacceptable risks to human health or the environment were identified in site media. Approximately 4,465 geophysical anomalies were identified during DGM, 4,417 of which were intrusively investigated. 42 items were classified as UXO and detonated on site, and other MEC items were discovered and removed.
Remedial Investigation/ Feasibility Study (CH2M HILL, 2014)	2011-2014	<p>Field activities were conducted in support of MILCON from 2011 to 2013 and included 100 percent DGM and intrusive in the undeveloped areas of the site. Approximately 47,000 geophysical anomalies and 24 saturated responses areas were identified for intrusive investigation. Approximately 450 MEC items were identified and destroyed through controlled detonations, and over 50,000 MPPEH items were identified.</p> <p>Soil and/or groundwater samples were collected following controlled detonation and within a battery burn pit that was discovered on site. Soil results were above screening criteria in two of the detonation locations and within the burn pit. Soil investigation-derived waste was excavated from these locations; confirmation samples were collected; and no unacceptable human health risks remained.</p> <p>Based on the previous investigation activities, no unacceptable risks to human health or ecological receptors are expected from exposure to MC in site media. Potential hazards are associated with exposure to MEC present within developed areas during intrusive activities at any depth and within the undeveloped areas at depths greater than 2 feet bgs. To address these hazards, remedial alternatives evaluated include no action, LUCs, subsurface removal of MEC in undeveloped areas (via excavation, DGM, and intrusive investigation) and LUCs, and subsurface removal of MEC (via excavation and sifting) and LUCs.</p>
Proposed Plan (CH2M HILL, 2015)	2015	A Proposed Plan was issued to solicit public input on the preferred alternative (LUCs) and a public meeting was held. General comments for informational purposes were addressed during the public meeting and no written comments were received.

6.1.1.1 Future Activities

A ROD documenting the selected remedy will be completed in FY 2015 followed by a RD (**Schedule 6-1**).

Schedule 6-1
MMRP Site UXO-19 (OU 25), ASR #2.104, ASR #2.111, and ASR #2.168
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ

ID	Task Name	Duration	Start	Finish	2016											
					Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	ROD	125 days	Wed 2/18/15	Tue 8/11/15												
2	Draft ROD	51 days	Wed 2/18/15	Wed 4/29/15												
3	Review Period (Navy/Base)	30 days	Thu 4/30/15	Wed 6/10/15												
4	Review Period (USEPA/NCDENR)	30 days	Thu 6/11/15	Wed 7/22/15												
5	Final ROD	14 days	Thu 7/23/15	Tue 8/11/15												
6	RD	134 days	Thu 7/23/15	Tue 1/26/16												
7	Draft RD	60 days	Thu 7/23/15	Wed 10/14/15												
8	Review Period (Navy/Base)	30 days	Thu 10/15/15	Wed 11/25/15												
9	Review Period (USEPA/NCDENR)	30 days	Thu 11/26/15	Wed 1/6/16												
10	Final RD	14 days	Thu 1/7/16	Tue 1/26/16												

Previous investigations are listed in **Table 7-1**. A LUC summary is provided in **Table 7-2**.

TABLE 7-1
Previous Investigations Summary, IRP Site 69

Previous Investigation/Action	Date	Activities
Radiation Survey and Soil Sampling (NEESA, 1981)	1980 - 1981	Based on the reported history that Site 69 was a suspected radioactive waste disposal site, a radiation survey and soil sampling were conducted. Radioactivity was not detected at higher than average natural concentrations and soil sample results indicated naturally-occurring radioactivity.
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. A confirmation study was recommended at Site 69 based on the presence of buried hazardous or toxic wastes and the potential for migration into the aquifer.
Confirmation Study (ESE, 1990)	1984 - 1990	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Groundwater, surface water, and sediment samples were collected and analyzed for VOCs, pesticides/PCBs, select SVOCs, select metals, and residual chlorine. Analytical results identified VOCs in groundwater and surface water and pentachlorophenol (PCP) in one sediment sample.
Remedial Investigation (Baker, 1997)	1995 - 1997	Field activities were conducted to assess the nature and extent of contamination and potential human health and environmental impacts of the site. Geophysical investigations were conducted and groundwater, surface water, sediment, fish, shellfish, and benthic macro invertebrate samples were collected. Samples were analyzed for VOCs, SVOCs, metals, and pesticides/PCBs. Geophysical investigations indicated buried metallic objects near the groundwater source area. Potential human health risks were identified for future residents due to exposure of VOCs and metals in groundwater. No unacceptable ecological risks were identified and surface water and sediment analytical results indicated that the New River, Everett Creek, and the unnamed tributary north of the site were not impacted by the former disposal operations.
In-Well Aeration Pilot Study (Baker, 1998)	1996 - 1998	A pilot study was initiated to assess the effectiveness of In-well aeration for treatment of VOCs in groundwater. After 2 years of operation and testing, the method was determined to be ineffective at reducing groundwater contamination and the pilot study was discontinued.
Proposed Remedial Action Plan (Baker, 1998)	1998	The Proposed Remedial Action Plan (PRAP) identified MNA and LUCs as the preferred alternative to address potential risks from groundwater and waste. The PRAP was submitted for public review and comment. General comments for informational purposes were addressed during the public meeting and no written comments were received.
Interim Record of Decision (Baker, 2000)	2000	The interim selected remedy was LTM for MNA of VOCs in groundwater and to monitor potential migration and LUCs to prevent exposure to waste, soil, and groundwater.
Interim Remedial Action	1998 - 2005	Groundwater LTM for VOCs and NAIPIs was implemented in 1998 and continued until 2005, as the site was a part of ongoing investigations and studies in which the LTM requirements are being fulfilled or exceeded by site-specific monitoring programs. LUCs were implemented in 2001 and updated in 2002 and remain in place.
Surface Water and Sediment Sampling	2005	Due to a request by Onslow County Commissioners, NCDENR–Department of Water Quality and the Base performed split surface water and sediment sampling in surface waters adjacent to Site 69. NCDENR recommended no further sampling and no advisory to be issued.
Radiation Survey (New World Technology, Inc., 2007)	2007	A radiation survey was conducted and radioactivity was not detected at higher than average natural concentrations, which confirmed the 1980 to 1981 findings.
Supplemental Investigation (CH2M HILL, 2011)	2008 - 2011	A supplemental investigation was conducted simultaneously with the UXO-02 PA/SI to further delineate the nature and extent of contamination and move the site towards a final ROD. Field activities included a geophysical survey, monitoring well installation, and soil, groundwater, surface water, and sediment sampling. Potential human health risks were identified due to exposure to pesticides, PCBs, VOCs, and metals in groundwater. Potential ecological risks were identified due to exposure to pesticides in surface soil and sediment. An FS was recommended to identify RAOs and evaluate potential treatment alternatives. The current CSM is shown on Figure 7-2.

TABLE 7-1
Previous Investigations Summary, IRP Site 69

Previous Investigation/Action	Date	Activities
UXO-02 Expanded Site Investigation (CH2M HILL, 2012)	2011-2012	An ESI was conducted at UXO-02, including Site 69, to further investigate potential unacceptable risks identified during the UXO-02 PA/SI and Site 69 Supplemental Investigation. Field activities included an intrusive anomaly investigation, monitoring well installation, and soil, groundwater, surface water, and sediment sampling for pesticides, metals, and/or explosives residues analyses. No unacceptable human health or ecological risks were identified from potential exposure to soil, surface water, sediment, or metals in surficial aquifer groundwater. NFA was recommended for the portion of UXO-02 located outside of the Site 69 perimeter fence. The remaining environmental impacts to be further assessed were associated with potential risks from exposure to waste and the VOC groundwater plume associated with Site 69.
Feasibility Study (CH2M HILL, 2012)	2011-2012	Remedial alternatives were evaluated to address the waste disposal area and COCs in groundwater. The alternatives evaluated for the waste disposal area were no action, LUCs, capping with LUCs, and removal. The alternatives evaluated for groundwater were no action; MNA with LUCs; permeable reactive barrier (PRB) with MNA and LUCs; ERD with bioaugmentation, MNA, and LUCs; and ISCO with MNA and LUCs.
Proposed Remedial Action Plan (CH2M HILL, 2012) and Record of Decision (CH2M HILL, 2013)	2012-2013	A PRAP was issued to solicit public input on the preferred alternative (capping with LUCs for waste and MNA and LUCs for groundwater) and a public meeting was held. General comments for informational purposes were addressed during the public meeting and no written comments were received. The ROD was issued and signed on June 25, 2013.
Remedial Design (CH2M HILL, 2013) and Draft Interim Remedial Action Completion Report (TetraTech, 2015)	2013-2015	The RD presents the design of remedy as specified by the ROD, including capping, plans for MNA and LTM, and a Land Use Control Implementation Plan (LUCIP). Construction of the soil cap was completed in 2014.

TABLE 7-2
Land Use Control Summary, IRP Site 69

LUC Boundary	Estimated Area (Acres)	Final Land Use Control Implementation Plan (LUCIP)	Onslow County Registration Date
Non-Industrial Use Control Boundary	14.55	July 2002	Pending removal
Intrusive Activities Control Boundary (Groundwater)	8		Pending removal
Aquifer Use Control Boundary (1,000 feet)	127.2		February 2002
Access Control Boundary	14.6	Proposed	--
Intrusive Activities Control Boundary (Soil and Groundwater)	14.6		
Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion)	15.7		

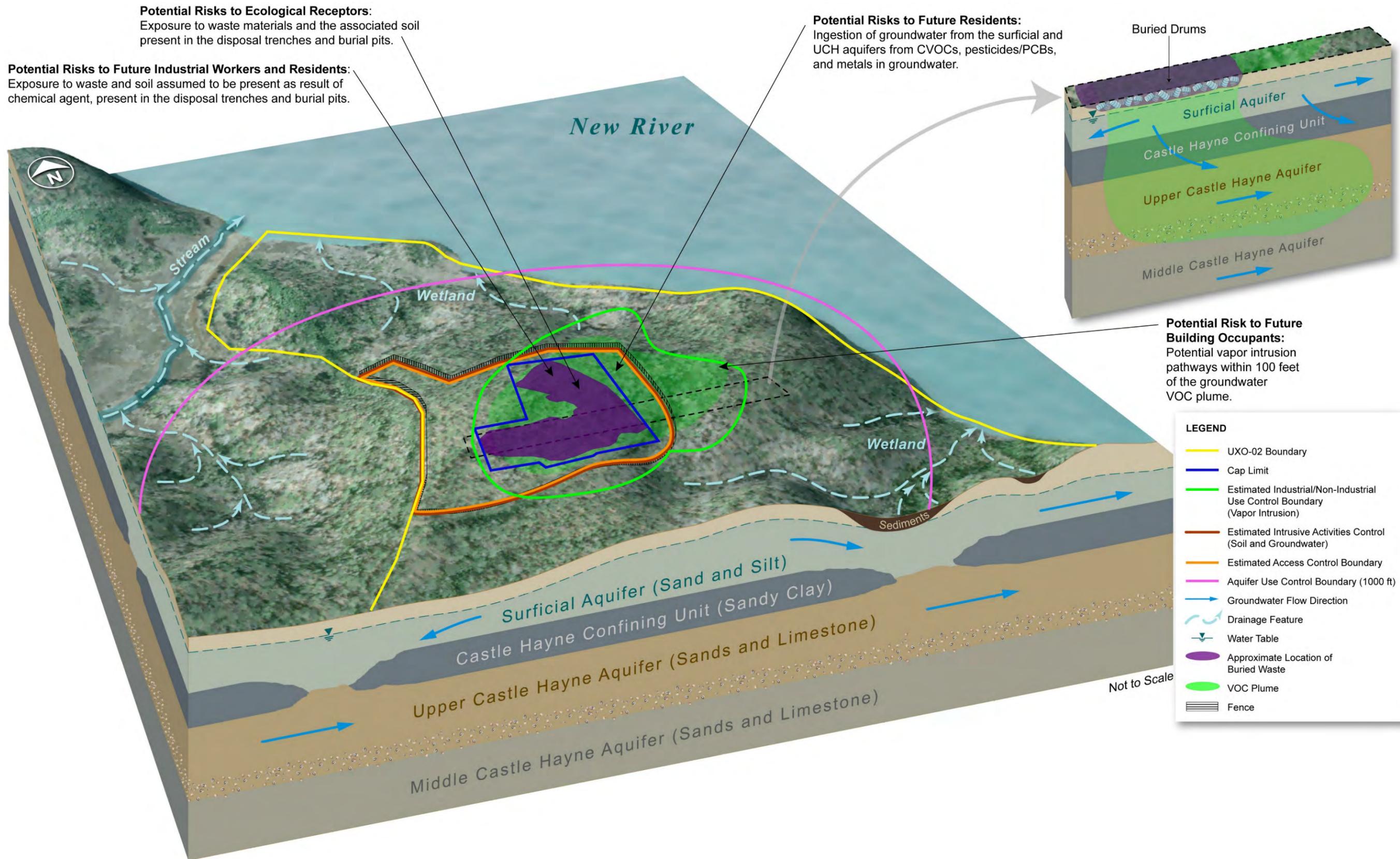
7.1.1.1 Future Activities

In FY 2015, the updated LUCs will be filed with the Onslow County Register of Deeds, LTM will begin, and the IRACR to document that the remedy is in place will be finalized (**Schedule 7-1**).

**Schedule 7-1
IRP Site 69
IRP & MMRP Site Management Plan FY 2016
MCIEAST-MCB CAMLEJ**

ID	Task Name	Duration	Start	Finish	2015											
					Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	RA	231 days	Wed 10/1/14	Wed 8/19/15												
2	Draft IRACR	157 days	Wed 10/1/14	Thu 5/7/15												
3	Review Period (Navy/Base)	30 days	Fri 5/8/15	Thu 6/18/15												
4	Review Period (USEPA/NCDENR)	30 days	Fri 6/19/15	Thu 7/30/15												
5	Final IRACR	14 days	Fri 7/31/15	Wed 8/19/15												

FIGURE 7-2
IRP Site 69 Conceptual Site Model

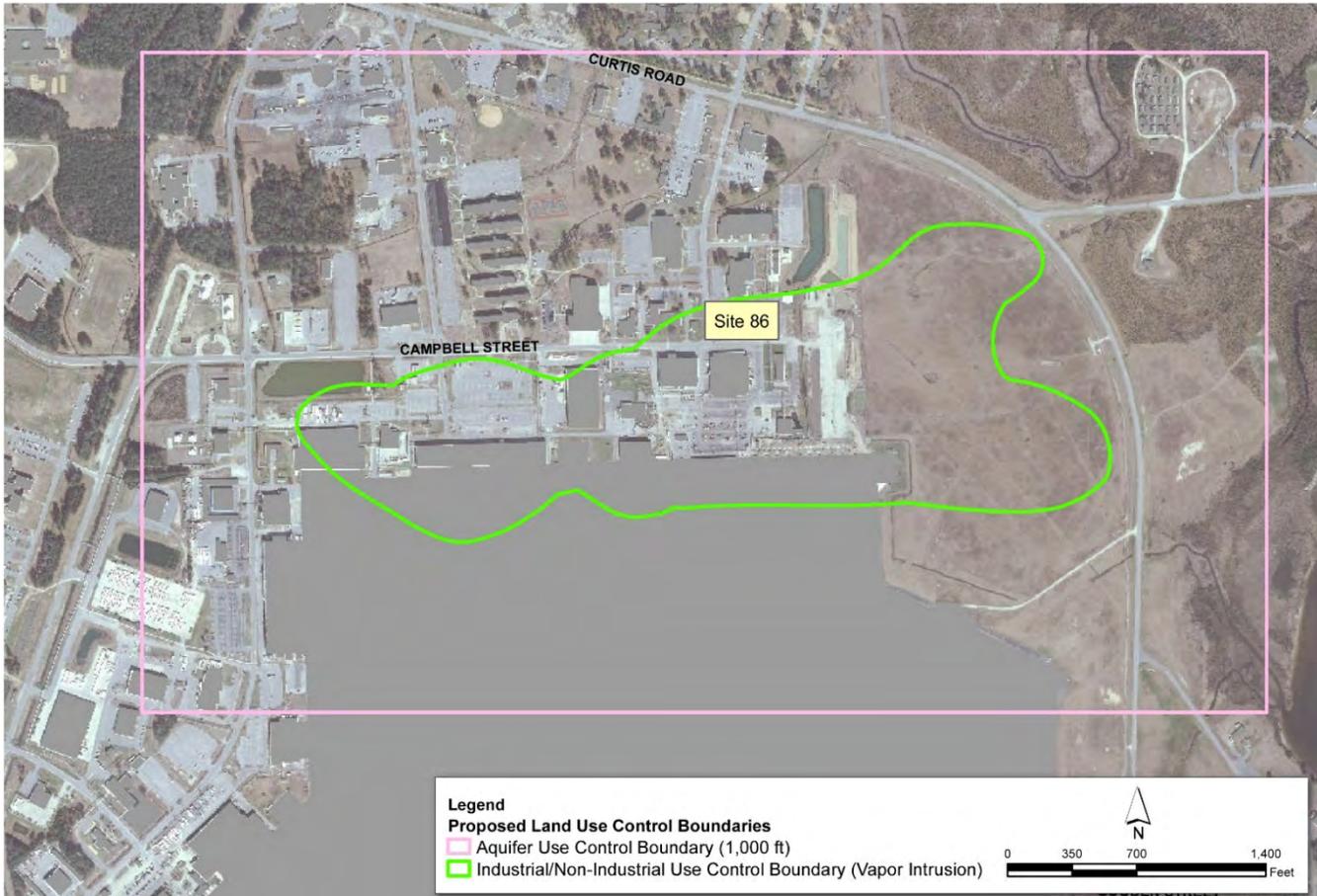


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7.1.2 Site 86 (OU 20)—Tank Area AS419-AS421 at MCAS

Site 86, Tank Area AS419-AS421, is located within the operations area of MCAS New River and covers approximately 146 acres (**Figure 7-3**). From 1954 to 1988, Site 86 served as a storage area for petroleum products. In 1954, three 25,000-gallon ASTs were installed within an earthen berm. The three tanks were reportedly used for No. 6 fuel oil storage until 1979. From 1979 to 1988, the tanks were used for temporary storage of waste oil. The three tanks were emptied in 1988 and were removed in 1992. Today, the former location of the tanks is grass-covered and only a slight depression remains. In 2006, an RFI was completed for SWMU 303/318 (located south of Site 86) and identified CVOCs in groundwater from an undetermined source. Based on these results, the IRP Partnering Team agreed that Site 86 would be expanded to include the SWMU area.

FIGURE 7-3
IRP Site 86, OU 20



Previous investigations are listed in **Table 7-3**. A LUC summary is provided in **Table 7-4**.

TABLE 7-3
Previous Investigations Summary, IRP Site 86

Previous Investigation/Action	Date	Activities
Preliminary Site Investigation (ESE, 1990)	1990	A Preliminary Site Investigation was initiated to determine the presence or absence of contamination based on the site's history. Soil samples were collected and analyzed for VOCs and TPH. The results revealed limited TPH contamination and low-level detections of VOCs, likely attributable to localized surface spills.
UST Assessment (O'Brien & Gere, 1992)	1992	Soil and groundwater sampling was conducted to determine the nature and extent of contamination as a result of three onsite ASTs used for temporary storage of waste petroleum products. Results revealed TPH contamination in soil and identified VOCs in groundwater. Due to the lack of significant petroleum-related impacts and the discovery of chlorinated solvent contamination in groundwater, UST-AS419-21 (original Site 86) was transferred from the UST Program to the IRP in April 1994. Further investigation and remediation of groundwater were recommended.
Remedial Investigation (Baker, 1996)	1995 - 1996	A soil and groundwater investigation was conducted to analyze the nature and extent of contamination. Samples were analyzed for VOCs, SVOCs, metals, and TPH. Soil results indicated localized VOC and metals contamination in samples collected within and immediately adjacent to the former AST area and wide-spread, low-level SVOC contamination (primarily PAHs). Groundwater analytical results indicated the presence of VOC contamination limited to the surficial aquifer in the central and southeastern portion of the site. Although VOCs were not present in the Castle Hayne aquifer, the VOCs appeared to have migrated vertically to the lower portion of the surficial aquifer and were migrating horizontally in the general direction of groundwater flow.
Post-Remedial Investigation Fieldwork	1997 - 2000	To delineate the vertical and horizontal extent of the VOC contamination and to collect additional data to determine the appropriate remedial alternative, post-RI field work was implemented. Soil and groundwater samples were collected for VOCs and NAIPs. A large plume was identified, extending east-northeast from Site 86, and a much smaller plume was identified to the southwest, near a former wash rack area. The plumes were not fully delineated. The results of this investigation are discussed in the Amended RI (CH2M HILL, Baker, and CDM, 2003).
Long-term Monitoring	1998 - 2005	Groundwater LTM was conducted for VOCs, NAIPs, and metals at Site 86 to assess whether contamination remained present, had migrated, or was degrading through natural processes. In 2005, the site was removed from the LTM program, as other ongoing investigations and studies were being conducted.
Amended Remedial Investigation (CH2M HILL, Baker, and CDM, 2003)	2001 - 2003	Based on the findings of post-RI monitoring, an Amended RI was conducted in order to further delineate the nature and extent of contamination. Soil and groundwater samples were collected and analyzed for VOCs. Potential human health risks were identified from VOCs in groundwater. No unacceptable ecological risks were identified.
Air/Ozone Sparging Pilot Study (AGVIQ/CH2M HILL, 2006)	2004 - 2006	The Technology Evaluation Report and Pilot Study Work Plan were completed in 2004, which recommended injection of ozone through a horizontal well. The pilot study was conducted from 2005 to 2006 for the main TCE groundwater plume at the site. The report concluded that TCE concentrations were reduced by 99 percent in groundwater.
Expanded Supplemental Remedial Investigation (CH2M HILL, 2011)	2007 - 2011	The Supplemental Remedial Investigation (SRI) was conducted to identify the potential source of VOCs, characterize the nature and extent of contamination east of the flight line, and assess potential risk to human health and the environment. Soil, groundwater, sediment, and surface water samples were collected and analyzed for VOCs, SVOCs, pesticides, and metals. Potential human health risks were identified based on future exposure to chromium in soil and VOCs and chromium in groundwater. An FS was recommended to evaluate remedial alternatives.

TABLE 7-3
Previous Investigations Summary, IRP Site 86

Previous Investigation/Action	Date	Activities
Pilot Study (CH2M HILL, 2013)	2011 – 2013	To evaluate effectiveness of technologies to treat the VOC plume, a pilot study was conducted in two separate zones at Site 86. ERD with bioaugmentation was conducted in Zone 1 and ISCO using slow-release permanganate candles was conducted in Zone 2. Follow-up monitoring indicates that in Zone 1, the TCE mass was decreased by 93 percent and the VOC mass was reduced by 81 percent. In Zone 2, initial VOC concentrations were reduced by 81 percent and subsequent monitoring results were variable. The results of the pilot study were used for the development of remedial alternatives in the FS.
Feasibility Study (CH2M HILL, 2013)	2012-2013	Remedial alternatives were developed and evaluated to address VOCs in groundwater. The five alternatives were no action, MNA and LUCs, air sparging with MNA and LUCs, ISCO with MNA and LUCs, and ERD with MNA and LUCs.
Proposed Remedial Action Plan (CH2M HILL, 2014) and Record of Decision (CH2M HILL, 2014)	2014	A PRAP was issued in January 2014 to solicit public input on the preferred alternative (MNA and LUCs) and a public meeting was held in February 2014. General comments were addressed during the public meeting and no written comments were received. The ROD was signed on October 29, 2014. The current CSM is shown on Figure 7-4.
Remedial Design (CH2M HILL, 2014) and Draft Interim Remedial Action Completion Report (CH2M HILL, 2014)	2014	The RD presents the design of remedy as specified by the ROD, including MNA and LUCs.

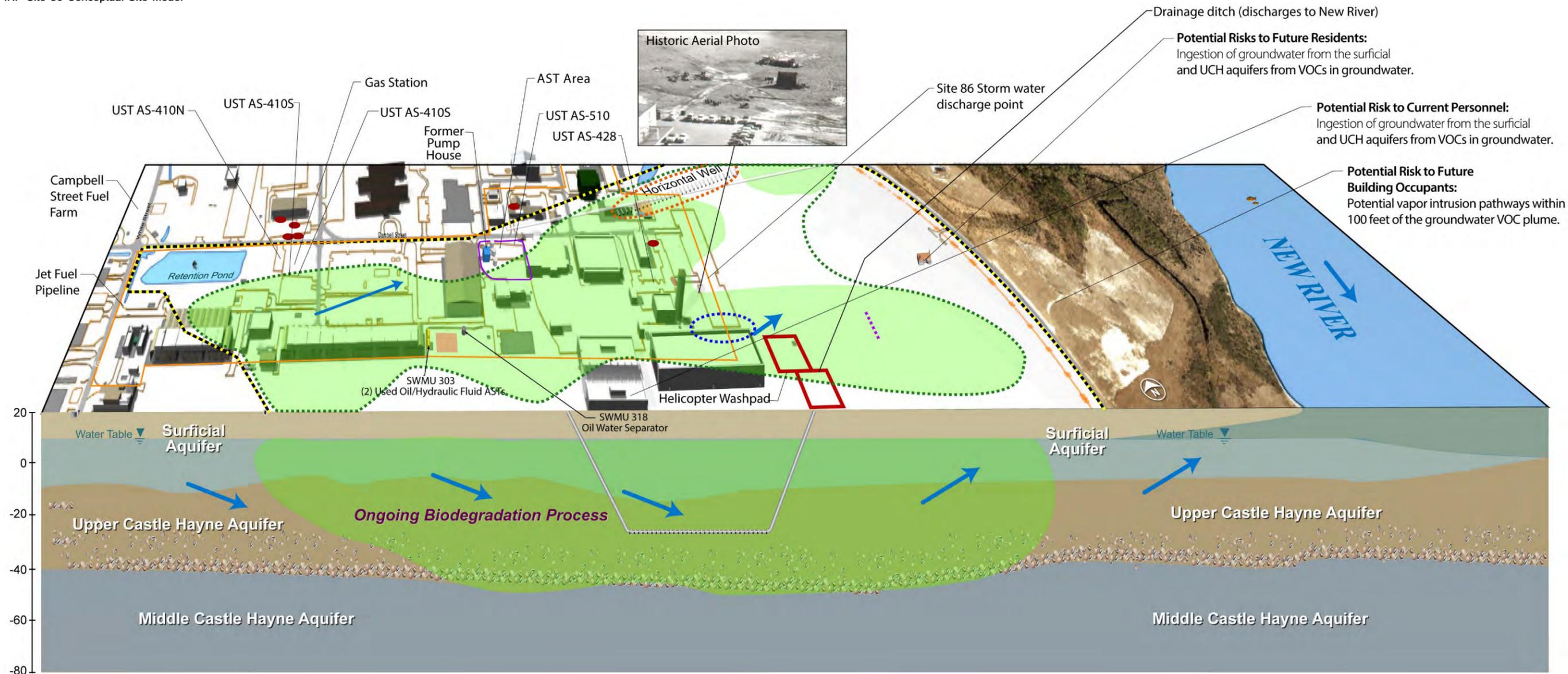
TABLE 7-4
Land Use Control Summary, IRP Site 86

LUC Boundary	Estimated Area (Acres)	Final Land Use Control Implementation Plan (LUCIP)	Onslow County Registration Date
Aquifer Use Control Boundary (1,000 feet)	501	Proposed	--
Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion)	97		

7.1.2.1 Future Activities

In FY 2015, the LUCs will be filed with the Onslow County Register of Deeds, MNA will begin, and the IRACR to document that the remedy is in place will be finalized (**Schedule 7-2**).

FIGURE 7-4
IRP Site 86 Conceptual Site Model



Legend	
	Groundwater Flow Direction
	Horizontal Well
	Drainage Area
	Underground Storage Tank
	Expanded Site 86 Boundary
	Drainage Ditch
	Surface Water Centerline
Utilities	
	Stormwater Drain
	Water Line
	Wastewater Line
	Industrial Waste Collection and Treatment Facilities
	Historic Wastewater (replaced in 1998)
	Vehicle Driveway Area
	COC Plume (Based on 2009 and 2013 data)
	Surface Water Course Area
	Buildings
	Vehicle Parking Area
Pilot Studies	
	Horizontal AS Well Pilot Study
	ERD and Bioaugmentation Pilot Study
	Slow-Release Permanganate Candles Pilot Study

Note: Not to scale.

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SECTION 8

Descriptions of RIP and RC Sites

The following sections discuss the site history for the 63 IRP sites and 23 MMRP Sites (there are two UXO-01 sites considered in this count) that are in the RIP and RC phase of the CERCLA process. Remedies are in place (such as groundwater treatment, LTM, and/or LUCs) for 26 of the IRP sites. Response is complete with NFA for 37 IRP sites and 23 MMRP sites.

8.1 IRP RIP Sites

8.1.1 Site 2 (OU 5)—Former Nursery/Daycare Center

Site 2, the Former Nursery/Daycare Center, encompasses approximately 5 acres just inside the Main Gate in the northeast portion of the Base (**Figure 8-1**). From 1945 to 1958, an onsite building was used for storing, handling, and dispensing pesticides. Chemicals known to have been used at Site 2 include chlordane, 4,4'-dichlorodiphenyltrichloroethane (DDT), diazinon, and 4,4'-dichlorodiphenyldichloroethane. Chemicals known to have been stored include dieldrin, lindane, malathion, and silvex. A preliminary soil sampling investigation conducted in 1982 indicated the presence of pesticides, resulting in the transfer of the daycare center to another location.

FIGURE 8-1
IRP Site 2, OU 5



Previous investigations are listed in **Table 8-1** and the LUC Summary is presented in **Table 8-2**.

TABLE 8-1
Previous Investigations Summary, IRP Site 2

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The potential for adverse impacts was identified from pesticides that could potentially migrate to groundwater and surface water and additional investigation was recommended.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to verify the presence of contaminants. Field activities included groundwater, surface water, soil, and sediment sampling for VOCs, pesticides, and herbicides. Analytical results indicated the presence of pesticides and VOCs in environmental media. Further characterization of groundwater and supplemental surface water and sediment investigations were recommended.
Geophysical Investigation	1991 - 1992	A surface geophysical investigation was performed to establish the source of groundwater contamination. No anomalies that could serve as sources (that is, tanks or drums) of groundwater contamination were identified. However, an atypical subsurface feature was detected. The data from this anomaly were not sufficiently conclusive to ascertain whether it was a tank, large-diameter utility line, or other buried structure. Results of this investigation are discussed in the RI (Baker, 1994).
Remedial Investigation/ Feasibility Study (Baker, 1994)	1993 - 1994	An RI was conducted to characterize potential environmental impacts and threats to human health resulting from previous site activities. A geophysical investigation and soil gas survey were conducted and soil, groundwater, surface water, and sediment samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, and metals. Unacceptable human health risks were identified due to the presence of pesticides in soil and VOCs in groundwater. Potential unacceptable risks to ecological receptors were also identified due to the presence of pesticides in sediment and soil. A TCRA was recommended for soil and remedial alternatives for groundwater were evaluated in the FS.
Time-critical Removal Action (OHM, 1995)	1994 - 1995	Based on the findings of the RI, a TCRA was recommended for removal of pesticide-contaminated soil to achieve industrial land use. The TCRA included the excavation and offsite treatment of pesticide-contaminated soil and concrete. A total of 1,049 tons of pesticide-contaminated soil was excavated and sent for offsite disposal.
Proposed Remedial Action Plan and Record of Decision (Baker, 1994)	1994	A PRAP was issued to solicit public input on the preferred alternative (LTM and LUCs) and a public meeting was held. The Final ROD was issued and signed in September 1994.
Remedy-in-Place and Long-term Monitoring Closeout Report (CH2M HILL, 2008)	1995 - 2008	Groundwater LTM was initiated in 1995 and included annual sampling of six shallow monitoring wells for VOC analysis. In 2007, groundwater concentrations fell below cleanup levels for four consecutive events, LTM was discontinued, and an SC report was submitted. LUCs were implemented in 2001 and updated in 2002 and 2008.
Update to the Operable Unit No. 5 - Site 2 Closeout Report Technical Memorandum (CH2MHILL, 2011)	2011	This Technical Memorandum provided an update to the Closeout Report for Operable Unit 5, Site 2 (CH2M HILL, 2008) to incorporate the Notice of Non-Significant Changes. The cleanup levels in groundwater were achieved, and no risk to human health and the environment from exposure to groundwater remained at Site 2. Therefore, the LUCs restricting groundwater intrusive activities and aquifer use were removed. LUCs remain in place to prohibit non-industrial use.

TABLE 8-2
Land Use Control Summary, IRP Site 2

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Updates
Non-Industrial Use Control Boundary (Soil)	3.3	September 2008	June 2009

8.1.1.1 Future Activities

Based on evaluation during the Five-year Review (CH2M HILL, 2015) that indicated post-removal confirmation samples do not exceed residential risk-based levels, the non-industrial use control boundary (soil) LUC is planned for removal in FY 2016.

8.1.2 Site 3 (OU 12)—Old Creosote Plant

Site 3, the Old Creosote Plant, encompasses approximately 5 acres on the Mainside of the Base (**Figure 8-2**). The Creosote Plant reportedly operated from 1951 to 1952 to supply treated lumber during construction of the MCIEAST-MCB CAMLEJ Railroad. An onsite sawmill, reportedly located in the northern portion of the site, supplied cut timbers for the creosote treatment.

FIGURE 8-2
IRP Site 3, OU 12



Previous investigations are listed in **Table 8-3** and the LUC summary is presented in **Table 8-4**.

TABLE 8-3
Previous Investigations Summary, IRP Site 3

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 3, and it was concluded that no further assessment was necessary. However, USEPA requested an additional investigation to determine whether hazardous waste contamination existed.
Site Investigation (1991)	1991	An SI was conducted to confirm the presence or absence of contamination at Site 3. Field activities included soil, groundwater and sediment sampling. The analytical results identified SVOCs in soil and groundwater, and an RI was proposed.
Remedial Investigation/ Feasibility Study (Baker, 1996)	1994 - 1996	An RI was conducted to characterize the nature and extent of contamination discovered during the SI. Field activities included installation of monitoring wells, and the collection of soil and groundwater samples. PAHs (primarily naphthalene) were identified in both soil and groundwater. Fuel constituents, such as ethylbenzene and xylenes, were also detected in soil and groundwater. Potential unacceptable human health risks were identified due to PAHs in soils and VOCs and PAHs in groundwater. No unacceptable ecological risks were identified. In 1996, an FS was conducted to screen remedial alternatives for addressing soil and groundwater contamination.
Proposed Remedial Action Plan (Baker, 1996) and Record of Decision (Baker, 1997; 1999)	1996 - 1999	A PRAP was issued in 1996 to solicit public input on the preferred alternative (source removal with onsite biological treatment of PAH-contaminated subsurface soils, LTM, and LUCs) and a public meeting was held. The Final ROD was issued and signed in 1997. However, a pilot scale treatability study conducted in 1998 indicated that biological treatment of soils was not effective. As a result, an Amended ROD was signed in July 1999, identifying soil excavation with offsite disposal, LTM, and LUCs as the preferred remedial alternative. The current CSM is shown on Figure 8-3.
Remedy-in-Place	1997 - present	The selected remedy for soil identified in the Amended ROD was conducted as an NTCRA in 2000, during which 3,295 tons of PAH-contaminated soil were removed to achieve industrial cleanup levels. Groundwater LTM for VOCs and SVOCs was implemented in 1997 and is ongoing. LUCs were implemented in 2001 and updated in 2002.

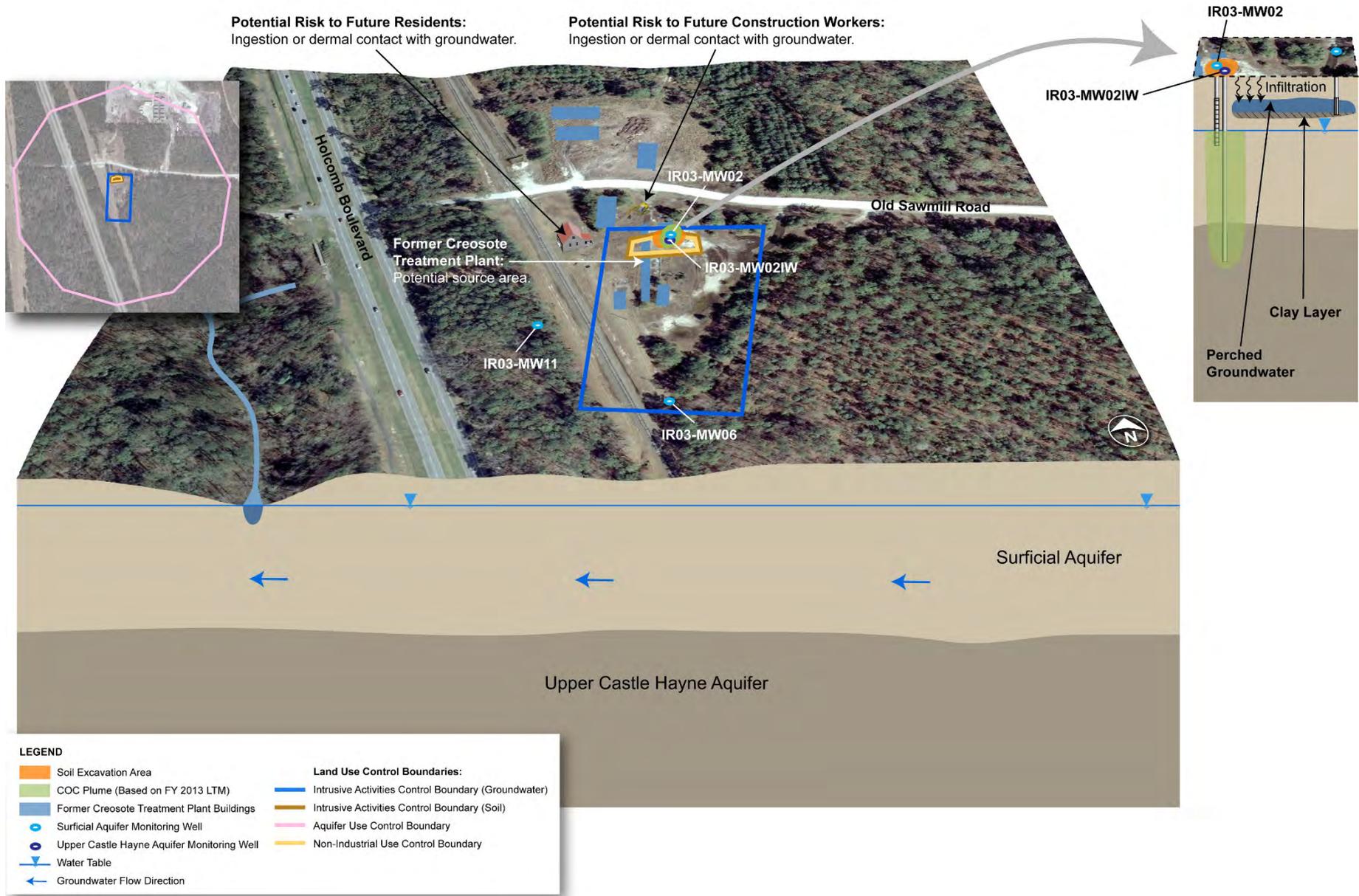
TABLE 8-4
Land Use Control Summary, IRP Site 3

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	0.14		
Intrusive Activities Control Boundary (Groundwater)	4.1	July 2002	February 2002
Aquifer Use Control Boundary (1,000 feet)	134.1		

8.1.2.1 Future Activities

LTM will continue to monitor the concentrations of SVOCs in groundwater, and LUC inspections will be conducted quarterly. A pilot study is underway to evaluate potential remedial technologies to reduce COC concentrations. The results of the pilot study will be reported in FY 2016.

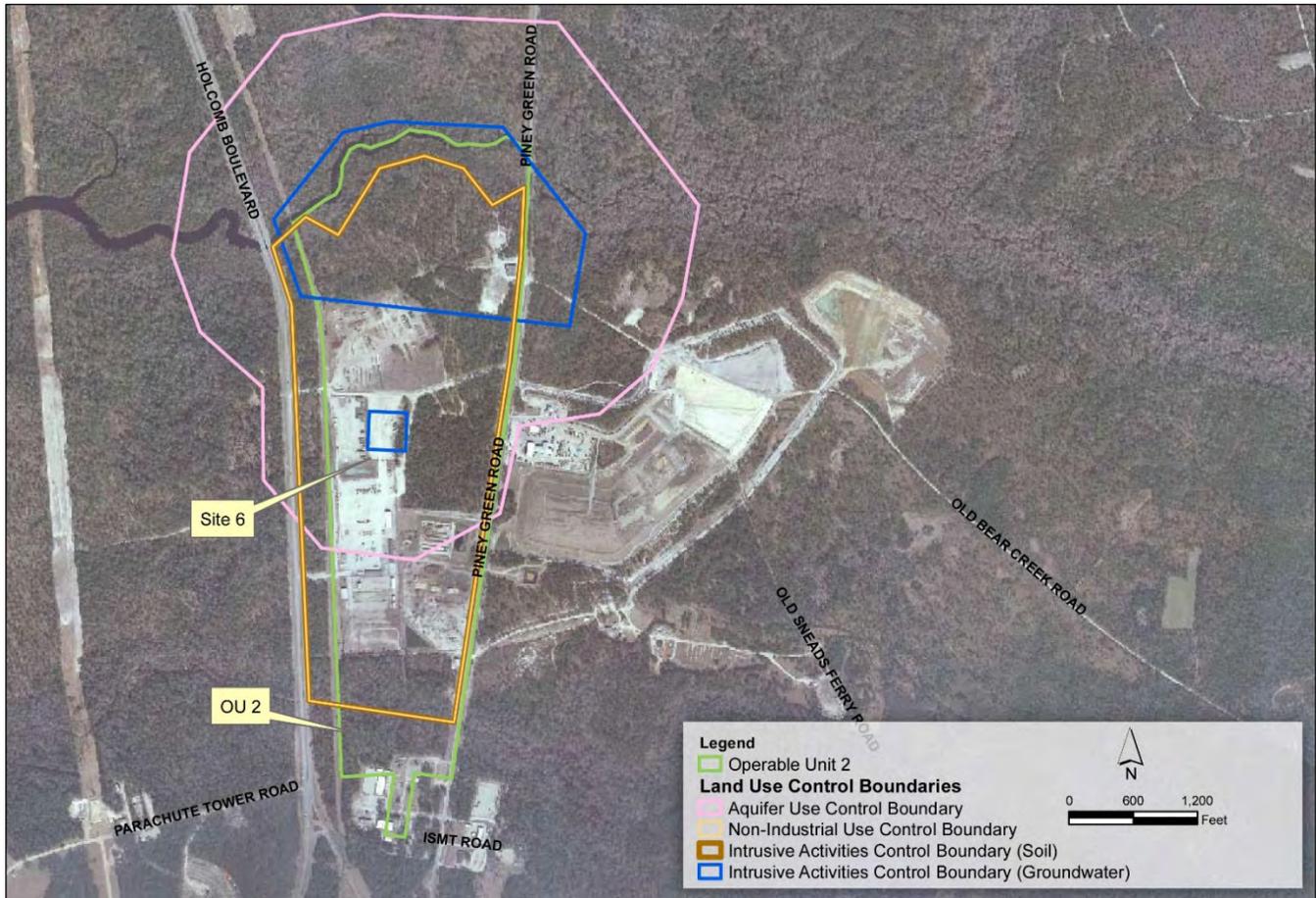
FIGURE 8-3
IRP Site 3 Conceptual Site Model



8.1.3 Site 6 (OU 2)—Lots 201 and 203

Site 6 is located within OU 2, approximately 2 miles east of the New River and 2 miles south of North Carolina Highway 24 (**Figure 8-4**). OU 2 consists of three sites (Sites 6, 9, and 82) that have been grouped together because of their proximity to one another. Site 6 covers an area of approximately 177 acres that incorporates Storage Lots 201 and 203, a wooded area between the storage lots, and a ravine. From the 1940s to the late 1980s, Site 6 was used for disposal and storage of wastes and supplies, including pesticides transformers containing PCBs, solvents, electrolytes, and waste oils. Currently, Lot 201 is used to store military equipment, vehicles, hydraulic oils, and other “non-hazardous” supplies. Most of Lot 203 remains an open field; 21 acres were temporarily used by the DRMO for metal staging operations between 2001 and 2012.

FIGURE 8-4
IRP Site 6, OU 2



Previous investigations are listed in **Table 8-5** and the LUC summary is presented in **Table 8-6**.

TABLE 8-5
Previous Investigations Summary, IRP Site 6

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Wastes present reportedly originated from dumping and storage activities and the IAS recommended that a Confirmation Study be conducted to verify the presence of contamination.
Confirmation Study (ESE, 1990)	1984 - 1990	Field activities including soil, groundwater, surface water, and sediment sampling, were conducted to verify the presence or absence of contamination. Soil samples were analyzed for pesticides, and all other media were analyzed for VOCs and pesticides. Low levels of pesticides were detected in soil samples. Groundwater samples collected from shallow monitoring wells revealed low levels of VOCs and benzene.
Soil Gas Survey (1989)	1989	A soil gas survey was conducted to identify the presence of VOCs that may potentially affect personnel working within Lot 203. No imminent hazards were identified with the results of the survey.
Remedial Investigation/ Feasibility Study (Baker, 1993)	1992 - 1993	Field activities consisted of a preliminary site survey, a geophysical survey, a soil investigation including drilling and sampling, a groundwater investigation including monitoring well installation and sampling, drum waste sampling, test pit investigation, a surface water and sediment investigation, and an aquatic and ecological survey. Pesticides/PCBs, VOCs, SVOCs, and metals were identified in soil, groundwater, surface water, and sediment across the OU. The HHRA identified potential human health risks due to exposure to soil and groundwater. Potential adverse ecological impacts were identified for Wallace Creek and Bear Head Creek. The FS developed and screened remedial alternatives for addressing groundwater and soil contamination.
Proposed Remedial Action Plan and Record of Decision (Baker, 1993)	1993	A PRAP was to solicit public input on the preferred alternative (soil removal, groundwater extraction and treatment, LTM, and LUCs) and a public meeting was held. The Final ROD was issued and signed in September 1993.
Remedy-in-Place	1994 - present	The selected remedy identified in the ROD was conducted as a TCRA in 1994, during which 20 drums containing DDT were removed and contaminated soil was excavated. A second TCRA was conducted from 1995 to 1996 to remove more than 2,655 yd ³ of drums, batteries, and communications wire. Groundwater extraction and treatment and LTM for VOCs were implemented in 1996 and are ongoing. LUCs were implemented in 2001 and updated in 2002. The current CSM is shown on Figure 8-5.
Chlorobenzene Summary Report (CH2M HILL, 2010)	2008 - 2010	To identify the potential source of chlorobenzene contamination and delineate the extent in groundwater, an SSI was conducted. During vegetation clearing activities, MD was discovered and an Explosives Safety Submission (ESS) was submitted to remove and dispose of the MD. The geophysical survey results indicated the presence of several linear features, potentially representing trenches containing metallic debris. Chlorobenzene concentrations in groundwater continue to fluctuate, the dissolved chlorobenzene is migrating downgradient, and the chlorobenzene plume has not been fully delineated vertically and horizontally. The potential source of the chlorobenzene is likely disposal trenches; test pitting, and additional groundwater delineation was recommended.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009)	2007 - 2009	A Basewide Vapor Intrusion Study was conducted to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. At OU 2, no buildings were identified within 100 feet of a monitoring well containing VOC concentrations above NCGWQS.
Chlorobenzene Test Pitting Investigation Technical Memorandum (Supplemental Investigation - Interim Results) (CH2M HILL, 2012)	2010-2012	As a follow-up to the recommendations of the Chlorobenzene Summary Report, test pitting to investigate the large geophysical anomalies and soil sampling were conducted. Twelve test pit excavations were completed and cultural debris, MD, drums, buckets, communication batteries, communication wires, and scrap metal were uncovered. At Test Pit 10, two drums were uncovered, resulting in elevated breathing zone measurements, and the soil results indicated chlorobenzene concentrations at 70,000,000 micrograms per kilogram. Additional monitoring wells were also installed and sitewide groundwater samples were collected to further investigate the extent of chlorobenzene in groundwater. Recommendations are to complete the delineation of chlorobenzene in groundwater, assess the distribution of chlorobenzene in vadose zone soil, and update LUCs, as necessary.

TABLE 8-5
Previous Investigations Summary, IRP Site 6

Previous Investigation/Action	Date	Activities
Action Memorandum and Time-critical Removal Action (CH2M HILL, 2011)	2011	An AM documented the decision for a TCRA to address the buried drums and chlorobenzene-impacted soil discovered during test pitting activities. The TCRA was conducted in May 2011. Approximately 42 yd ³ of soil and debris were removed. Confirmation samples were collected in the excavated area, and analytical results indicated that concentrations of chlorobenzene were still present in soil above industrial screening levels. The site was restored with clean backfill, and further investigation of chlorobenzene in soil via passive soil gas and soil sampling and an evaluation of the current RIP was recommended.
Lot 202 ECP for Property Real Estate DRMO Area (CH2M HILL, 2014)	2014	<p>An ECP was performed for Lot 202 to assess the lot's environmental condition in support a potential interagency transfer of the property.</p> <p>The study found that there were no known or documented instances where hazardous or petroleum substances were stored, disposed, or released on Lot 202. However, facility personnel suggested that buried debris may be present beneath Lot 202. A digital geophysical mapping survey and test pitting were conducted, and buried metallic and wooden debris was identified within the northern portion of Lot 202. Soil and groundwater samples were collected within Lot 202, and the concentrations do not pose an unacceptable human health risk. Evaluation of chlorobenzene concentrations reported in well IRO6-MW80 (adjacent to and east of Lot 202) show that exposure to the groundwater from this well would result in unacceptable human health risks. Contamination from this well has the potential to migrate beneath the northern portion of Lot 202.</p> <p>This ECP concluded that the property is suitable for transfer for the use as a controlled area storage yard, as long as the LUCs are maintained.</p>
Supplemental Investigation Report (CH2M HILL, 2015)	2012-2015	<p>In 2012 and 2013, a supplemental investigation was conducted to evaluate the potential for additional VOC source material in soil and groundwater. Field activities included hydrogeologic testing and soil, groundwater, and passive soil gas sampling for VOCs. VOCs were detected at concentrations exceeding screening criteria in soil and groundwater samples.</p> <p>Based on the results, additional horizontal and vertical delineation, groundwater modeling, and a pilot study for chlorobenzene and chlorinated ethenes in groundwater were recommended.</p>

TABLE 8-6
Land Use Control Summary, IRP Site 6

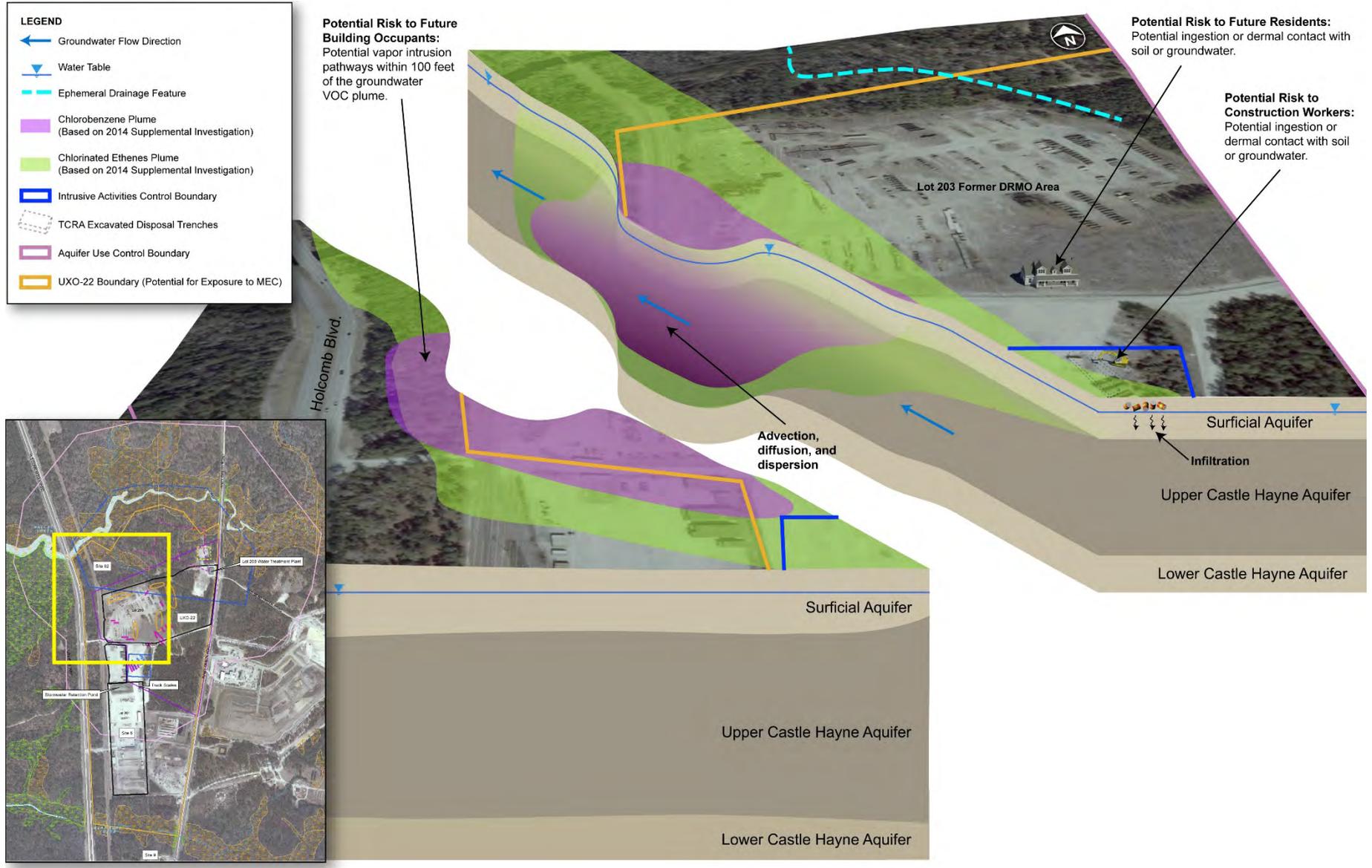
LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	206.75		
Intrusive Activities Control Boundary (Soil)	206.75		
Intrusive Activities Control Boundary (Groundwater)	99.4	July 2002	February 2002
Aquifer Use Control Boundary (1,000 feet)	404.91		

8.1.3.1 Future Activities

A supplemental remedial investigation is being conducted in FY 2015 to further delineate the current extent of groundwater contamination and design/implement pilot studies to optimize current remedies. The remedy may be updated based on the additional investigation results and to incorporate LUCs for vapor intrusion and MEC/MPPEH.

If buildings are planned for construction in the vicinity of the VOC groundwater plume prior to the implementation of the LUC for vapor intrusion, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS, and all construction projects on-Base go through environmental review.

FIGURE 8-5
IRP Site 6 Conceptual Site Model



8.1.4 Site 10 (Pre-RI)—Original Base Dump

Site 10, the Original Base Dump, is located on the Mainside of the Base (**Figure 8-6**). Site 10 was approximately 5 to 10 acres in size during full operation of the landfill and was reportedly used for construction debris and as a burn dump during construction of the Base, prior to 1950.

In 2012, the Base implemented soil LUCs for conservativeness based on the site's history as a dump. This site was moved from RC to RIP in 2013.

FIGURE 8-6
IRP Site 10



Previous investigations are listed in **Table 8-7** and the LUC summary is presented in **Table 8-8**.

TABLE 8-7
Previous Investigations Summary, IRP Site 10

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. During investigation it was determined that the site did not require further investigation. However, the site was added to the IRP in 1994 when it was reported that two Marines developed skin rashes after contacting a heavy oily material that may have been at the site.
Site Investigation (Baker, 2001)	1998 - 2001	An SI was conducted to verify the presence or absence of contamination. Field activities included a site survey and soil, groundwater, surface water, and sediment sampling. No unacceptable risks to human health were identified. The ERA identified minimal potential risks from metals in surface water. Based on the findings, the Final SI recommended NFA.
No Action Decision Document (Baker and CH2M HILL, 2005)	2005	A Final No Action Decision Document (NADD) was completed May 12, 2005.

TABLE 8-8
Land Use Control Summary, IRP Site 10

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	25.2	NA	NA

8.1.4.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.5 Site 15 (SWMU 46)—Montford Point Burn Landfill Area

Site 15, the former Montford Point Burn Landfill Area operated between 1948 and 1958 and was used for the disposal of sewage treatment sludge and other materials, including litter, metal, asphalt, and sand (**Figure 8-7**). Surface wastes in this area were investigated under the RCRA program as SWMU 46. Upon removal of surface wastes, Site 15 was transferred to the IRP on December 28, 2007. The site covers approximately 24 acres and the waste disposal area is 2 acres.

In 2012, the Base added soil LUCs for conservativeness, based on the site's history as a dump. This site was moved from RC to RIP in 2013.

FIGURE 8-7
IRP Site 15



Previous investigations are listed in **Table 8-9** and the LUC summary is presented in **Table 8-10**.

TABLE 8-9
Previous Investigations Summary, IRP Site 15

Previous Investigation/Action	Date	Activities
Confirmatory Site Investigation (Baker, 2001; 2002)	1997 - 2002	A Phase I CSI was conducted in 1997 and recommended a Phase II CSI, which was performed in 2002. Together the CSIs included soil sampling for metals and SVOCs, groundwater sampling for metals, and a geophysical survey to identify the location of the buried waste. The results indicated that an anomaly consistent with a small landfill was present in the central portion of the site.
Resource Conservation and Recovery Act Facility Investigation (Baker and CH2M HILL, 2005)	2004 - 2005	An RFI was conducted to further identify the waste locations and evaluate potential contamination. The RFI consisted of additional geophysical testing, test pit trenching, surface and subsurface soil sampling, installation of one monitoring well, and groundwater sampling. Soil samples were analyzed for VOCs, SVOCs, metals, and pesticides and groundwater was analyzed for metals. The RFI concluded that metals in surface soil and metals and pesticides in the landfill posed potential risks to human and ecological receptors. It was recommended that surface mounds and contaminated surface soil should be managed as RCRA waste and the landfill waste be managed under CERCLA as Site 15.
Site Reconnaissance and Soil Sampling (CH2M HILL, 2006)	2006	Mound and surface soil sampling for VOCs, SVOCs, pesticides/PCBs, and RCRA metals was conducted to identify the area for removal. Pesticides and metals that exceeded screening criteria were identified for interim measures (IMs) removal.
Interim Measure (Shaw, 2007)	2007	Removal of three mounds and a surface soil area to a depth of 1 foot bgs was conducted. A total of 1,039 tons of soil and debris were removed and confirmation soil sampling indicated pesticide and metal concentrations below screening criteria.
Preliminary Assessment/Site Investigation (CH2M HILL, 2010)	2009- 2010	A field investigation was completed at Site 15 in support of the potential Camp Johnson MILCON project. Field activities included soil and groundwater sampling for VOCs, SVOCs, pesticides/PCBs, and metals, and the excavation of test pits for waste delineation. Buried waste was not encountered in the test pits, with the exception of small inert pipes and metal. Potentially unacceptable human health risks were identified based on chromium in groundwater at one location. Potentially unacceptable ecological risks were identified for one surface soil and three subsurface soil areas based on pesticides, PCBs, and metals. Additional sampling and risk assessment were recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted to further assess the nature and extent of contaminants and evaluate potential risks to human health and the environment. Field activities included soil and groundwater sampling for VOCs, SVOCs, pesticides/PCBs, and metals. Exposure to surface and subsurface soil would not result in unacceptable risks to human health. Although potentially unacceptable risks were identified due to future residential exposure to SVOCs (primarily benzo(a)pyrene) in groundwater; benzo(a)pyrene was detected in only 1 of 8 samples, was not detected in the duplicate sample, and the concentration was below the maximum contaminant level. No significant ecological risks were identified from exposure to surface soil. For subsurface soil, potential risks to lower- and upper-trophic-level receptors could occur if the lead and pesticides in subsurface soil is exposed. However, given the lack of deep-dwelling earthworms, limited burrowing activity, unlikelihood for excavation in the waste disposal area, and the relatively small area exposed by occasional tree falls, exposure to subsurface soils is unlikely. Based on these conclusions, NFA was recommended.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in February 2013.

TABLE 8-10
Land Use Control Summary, IRP Site 15

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	3.3	NA	NA

8.1.5.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.6 Site 16 (OU 8)—Former Montford Point Burn Dump

Site 16, the Former Montford Point Burn Dump, encompasses approximately 4 acres in the Montford Point area of the Base (**Figure 8-8**). The Montford Point Burn dump was open from approximately 1958 to 1972, although unauthorized dumping subsequently occurred. Trash from the surrounding housing area and buildings is suspected to have been burned and then covered with soil at Site 16. Records indicate that building debris, garbage, tires, and small amounts of waste oils were disposed of at the site. Materials, including asbestos insulating material for pipes, were also dumped on the surface. The quantity of asbestos material was estimated at less than 1 yd³, and mitigation was completed. Currently, Site 16 is vacant.

FIGURE 8-8
IRP Site 16, OU 8



Previous investigations are listed in **Table 8-11** and the LUC Summary is presented in **Table 8-12**.

TABLE 8-11
Previous Investigations Summary, IRP Site 16

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Research indicated that unauthorized dumping of asbestos posed a possible health threat and recommended an investigation or removal be completed. Corrective measures were undertaken to remove the asbestos material.
Remedial Investigation/ Feasibility Study (Baker, 1996)	1994 - 1996	An RI was conducted to assess the nature and extent of contamination. Field activities included a site survey, soil, groundwater, surface water, and sediment sampling. Minimal potential human health risks were identified for future residents due to the presence of PCBs in the soil. However, the maximum detected PCB concentration (2.1 parts per million) was below the recommended cleanup level for PCBs of 10 to 25 parts per million for industrial areas. No unacceptable ecological risks were identified for terrestrial or aquatic receptors.
Proposed Remedial Action Plan and Record of Decision (Baker, 1996)	1996	A Final PRAP was issued to solicit public input on the preferred alternative (no RA) and a public meeting was held. The ROD for OU 8 was signed on September 30, 1996. Minimal risks were identified in the RI; therefore, no RAs were required in the ROD.
Remedy-in-Place	2001 - 2002	Although the ROD did not require RA, for conservativeness LUCs were implemented by the Base in 2001 and updated in 2002 due to the site's past use as a dump.
Explanation of Significant Difference (CH2M HILL, 2012)	2012	An Explanation of Significant Difference (ESD) was submitted in 2012 to document the LUCs as the remedy, including the addition of an intrusive activities control boundary for soil to prevent exposure to waste in-place.
Land Use Control Implementation Plan (CH2M HILL, 2014)	2013 - 2014	LUCs were updated in the 2014 LUCIP Update and a new Notice of Contaminated Site was filed with Onslow County real property records.

TABLE 8-12
Land Use Control Summary, IRP Site 16

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	2.1	August 2014	August 2014
Non-Industrial Use Control Boundary (Soil)	2.1		
Intrusive Activities Control Boundary (Groundwater)	0.169	July 2002	February 2007
Aquifer Use Control Boundary (1,000 feet)	60.2		

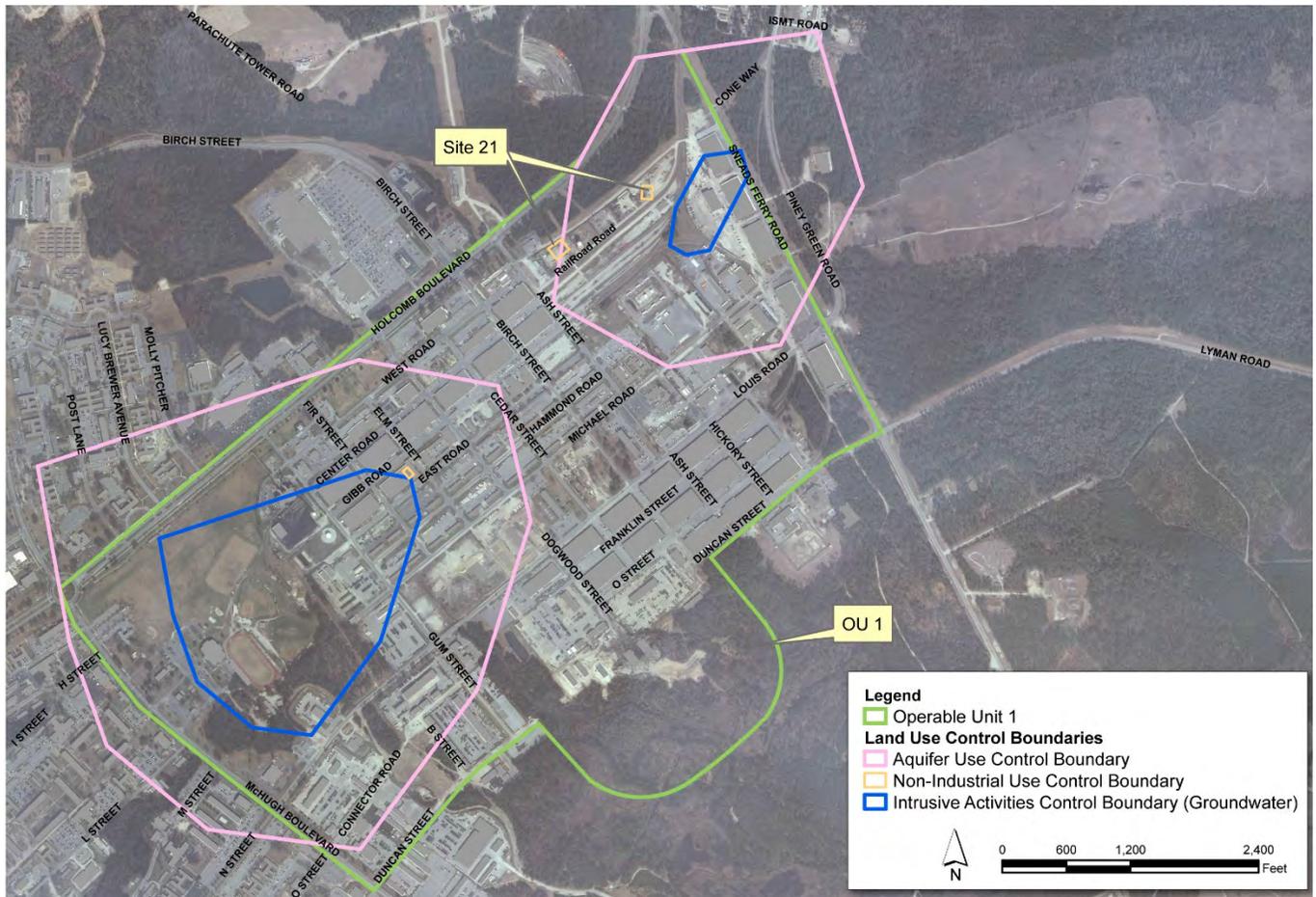
8.1.6.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.7 Site 21 (OU 1) —Transformer Storage Lot 140

Site 21, the Transformer Storage Lot 140, covers approximately 10 acres within OU 1, and is 1 mile east of the New River and 2 miles south of North Carolina Highway 24 (**Figure 8-9**). OU 1 consists of three sites (Sites 21, 24, and 78) that have been grouped together into one OU because of their proximity to one another. From 1950 to 1951, a pit located in the northern portion of Site 21 was used as a drainage receptor for oil from transformers. Surface discharge of transformer oils was also reported. The quantity of oil disposal is unknown. The pit reportedly measured 25 to 30 feet long by 6 feet wide and 8 feet deep. In 1958, a pest control shop was moved from Building 712 (Site 2) to Building 1105, located in the southern portion of Site 21. From 1958 to 1977, Building 1105 was used for pesticide mixing and as a cleaning area for pesticide application equipment. Overland discharge of wastewater generated during cleaning operations was documented. The estimated quantity of wastewater discharged was approximately 350 gallons per week in 1977.

FIGURE 8-9
IRP Site 21, OU 1



Previous investigations are listed in **Table 8-13** and the LUC summary is presented in **Table 8-14**.

TABLE 8-13
Previous Investigations Summary, IRP Site 21

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Research indicated that past site operations may have impacted soil, groundwater, and surface water and recommended an additional investigation.
Confirmation Study (ESE, 1990)	1984 - 1990	The Confirmation Study included soil and groundwater investigations. Analytical results confirmed the presence of pesticides/PCBs in soils.
Remedial Investigation/ Feasibility Study (Baker, 1994)	1994	An RI was conducted to assess the nature and extent of contamination. Field activities included groundwater, soil, sediment, and surface water sampling. No potential risks to human health were identified. Potential ecological risks were identified based on exposure to pesticides and PCBs in soil at Site 21. An FS was conducted to develop and screen remedial alternatives for addressing soil contamination at three separate areas on the site.
Proposed Remedial Action Plan and Record of Decision (Baker, 1994)	1994	A PRAP was issued to solicit public input on the preferred alternative (excavation and offsite disposal to address soil contamination) and a public meeting was held. The Final ROD was issued in September 1994.
Explanation of Significant Differences (Baker, 1995)	1995	Before implementing the soil remedy, an ESD was issued to revise the cleanup level for PCBs to the federal PCB action level for industrial sites due to the industrial nature of site activities.
Remedy-in-Place	1995 - 2002	The removal action identified in the ROD was performed in 1995, and approximately 650 tons of pesticide-contaminated soil and 161 tons of PCB-contaminated soil were excavated and disposed offsite. Because the removal action was only considered protective for industrial site use, a LUCIP was completed in 2001 that restricted development to industrial land use. LUCs were implemented as part of OU 1 in 2001 and amended in 2002.

TABLE 8-14
Land Use Control Summary, IRP Site 21

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	0.815	July 2002	February 2002

8.1.7.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.8 Site 28 (OU 7) — Hadnot Point Burn Dump

Site 28, the Hadnot Point Burn Dump, is located within OU 7 on the Mainside of the Base. OU 7 consists of three sites (Sites 1, 28, and 30) that have been grouped together into one OU because of their unique characteristics of suspected waste (POL) and geographic location (**Figure 8-10**). Site 28 operated from 1946 to 1971 as a burn area for a variety of solid wastes generated on the Base and covers approximately 17 acres. Industrial waste, trash, oil-based paint, and construction debris were reportedly burned and then covered with soil. In 1971, the burn dump ceased operations and was graded and seeded with grass. The total volume of fill within the dump is estimated to be between 185,000 and 375,000 yd³. Currently, most of Site 28 is used for recreation and physical training exercises.

FIGURE 8-10
IRP Site 28, OU 7



Previous investigations are listed in **Table 8-15** and the LUC summary is presented in **Table 8-16**.

TABLE 8-15
Previous Investigations Summary, IRP Site 28

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded potential impact to surface water due to past disposal practices and recommended an additional investigation to determine the boundaries of the disposal area and verify the presence of hazardous wastes.
Confirmation Study (ESE, 1988)	1984 - 1988	The Confirmation Study included groundwater, surface water, sediment, and fish tissue investigations. Metals detected in groundwater, surface water, and sediment were determined to be related to past site activities. Additionally, VOCs and oil and grease (O&G) were detected in groundwater samples.
Remedial Investigation/ Feasibility Study (Baker 1995)	1994 - 1995	An RI was conducted to further characterize the nature and extent of contamination. RI field activities consisted of a site survey, soil, groundwater, surface water, and sediment sampling, and an aquatic and ecological survey. Low levels of VOCs were detected in soil and metals in groundwater. Potential human health risks were identified due to the presence of metals in soil and sediment, and the presence of metals and VOC in groundwater. The concentrations of metals in soil were just above the screening criteria; therefore, the risks associated with exposure to soils were deemed low. No unacceptable ecological risks were identified. Remedial alternatives for groundwater were evaluated during preparation of the FS, submitted in July 1995.
Proposed Remedial Action Plan (Baker, 1995) and Record of Decision (Baker, 1996)	1995 - 1996	A PRAP was issued to solicit public input on the preferred alternative (LTM and LUCs) and a public meeting was held. The Final ROD was issued and signed in October 1996 followed by initiation of LTM.
Long-term Monitoring and Closeout Report (CH2M HILL, 2002)	1996 - 2002	Semi-annual groundwater, surface water, and sediment LTM was initiated in 1996 and included sampling of seven monitoring wells and three surface water and sediment locations for metals analysis. In 1998, quarterly groundwater, surface water, and sediment sampling was initiated to evaluate the seasonal fluctuations of lead. In 2001, Site 28 was recommended for removal from LTM and site closure after multiple rounds of data indicated that lead concentrations fluctuated seasonally. The seasonal fluctuations were based on naturally occurring organic matter and changes in groundwater elevation over time. Based on these results, a Closeout Report was prepared to document the completion of LTM.
Data Review	2013	Based on recommendations from the Five-year Review, existing site data were reviewed by the MCIEAST-MCB CAMLEJ Partnering Team and the consensus was reached to update the LUCIP to: <ul style="list-style-type: none"> • Remove the groundwater intrusive activities LUCs as recommended in the Five-year Review • Maintain the aquifer use LUC to prevent drinking water well installation within the extent of waste remaining in place • Maintain and extend the non-industrial use LUC to encompass the former burn dump boundaries and Orde Pond, where waste was reportedly encountered during utilities installation in 2012 • Add soil intrusive activities LUCs to prevent exposure to the waste remaining in-place as recommended in the Five-year Review
Land Use Control Implementation Plan (CH2M HILL, 2014)	2014	Based on LTM results for groundwater, cleanup levels have been achieved. A LUCIP was prepared to document the removal of LUCs restricting groundwater intrusive activities and aquifer use. Additionally, because waste remains in place, LUCs to restrict soil intrusive activities are required within the extent of waste to prevent exposure. An updated Notice of Contaminated Site was filed with Onslow County real property records in October 2014.

TABLE 8-16
Land Use Control Summary, IRP Site 28

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Waste)	25.73		
Intrusive Activities Control Boundary (Waste)	25.73	October 2014	September 30, 2014
Aquifer Use Control Boundary (1,000 feet)	79.57		

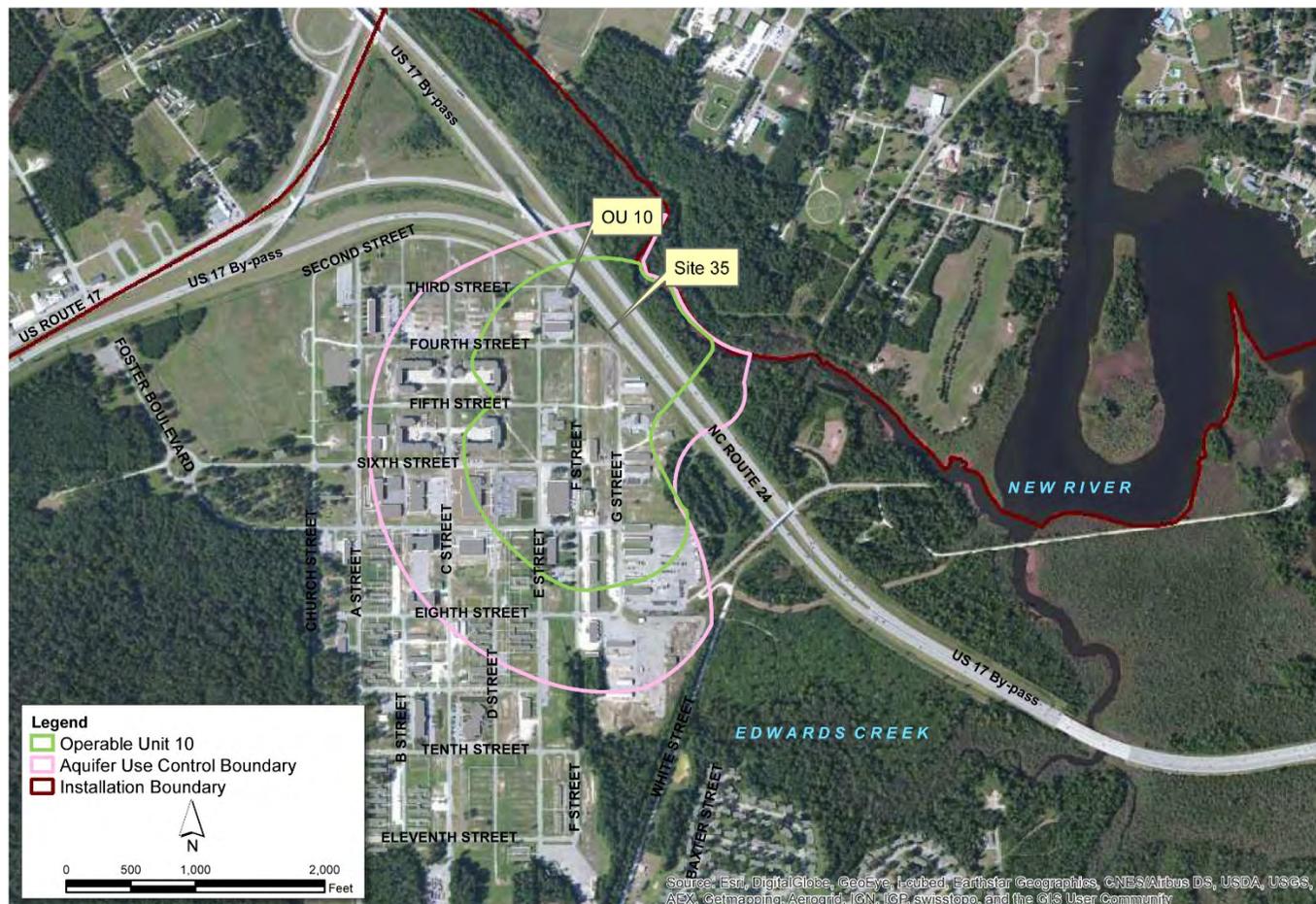
8.1.8.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.9 Site 35 (OU 10) – Camp Geiger Area Fuel Farm

Site 35, formerly the Camp Geiger Area Fuel Farm, is located within Camp Geiger, in the northwest portion of the Base and covers approximately 45 acres (**Figure 8-11**). The fuel farm was composed of five 15,000-gallon ASTs, underground fuel transmission lines, a pump house, a fuel unloading pad, an oil-water separator (OWS), and a distribution island. The ASTs were installed in 1945 as part of the original Camp Geiger construction. The fuel farm was active until it was decommissioned in the spring of 1995 to make way for the construction of the U.S. Highway 17 Bypass. During the active life of the fuel farm, several releases of fuel occurred. A vehicle maintenance garage (former Building TC474) and weapons cleaning area were also present at Site 35. Currently an armory, several warehouses, general storage buildings, and troop barracks occupy the area.

FIGURE 8-11
IRP Site 35, OU 10



Previous investigations are listed in **Table 8-17** and the LUC summary is presented in **Table 8-18**.

TABLE 8-17
Previous Investigations Summary, IRP Site 35

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Due to potential for petroleum hydrocarbon impacts from historical site activities and recorded spills, the site was recommended for further investigation.
Confirmation Study (ESE, 1990)	1985 - 1990	Soil, groundwater, sediment, and surface water samples were collected to delineate contamination. Results indicated that all media were potentially impacted by previous site activities.
Focused Feasibility Study (NUS Corporation, 1990)	1990	Soil, groundwater, surface water, and sediment samples were collected to evaluate a 1990 petroleum release. Risks to human health or the environment and IMs to remediate the area were evaluated. Although no unacceptable risks were found, remediation was recommended because petroleum hydrocarbon levels exceeded cleanup standards.
Comprehensive Site Assessment (Law, 1992)	1991 - 1992	Soil and groundwater samples were collected to identify the source, nature, and extent of petroleum hydrocarbon impacts. Petroleum hydrocarbon related contamination was found in soil (generally located at or below groundwater table) and in shallow groundwater. CVOC contamination was found in shallow and intermediate groundwater.
Interim Remedial Action Remedial Investigation/Feasibility Study (Baker, 1994)	1993 - 1994	Additional sampling and excavation of a shallow trench along Brinson Creek were conducted to support selection of an IRA to address soil contamination. Soil samples were collected for petroleum hydrocarbons. Analytical results identified three areas of petroleum hydrocarbon contamination in the soil, which corresponded to past unauthorized discharges of fuel products.
Soil Interim Record of Decision (Baker, 1994)	1994	An Interim PRAP was submitted to address soils and was followed by an Interim Record of Decision (IROD). The selected remedy was excavation and offsite disposal of contaminated soil.
Remedial Investigation (Baker, 1995)	1994 - 1995	A soil gas survey, and soil, groundwater, surface water, and sediment sampling were conducted to evaluate the nature and extent of contamination and potential risks to human health and the environment. Results revealed soil and groundwater contamination; the extent of groundwater contamination was not delineated. The HHRA concluded that the overall site risk was above the acceptable risk range and the ERA concluded that contamination had the potential to affect the integrity of ecological receptors.
Interim Feasibility Study (Baker, 1995)	1995	The Interim FS addressed groundwater impacts and identified RAs for a focused area near the fuel farm, a known source of groundwater contamination. Although the extent of groundwater contamination was not adequately defined during the RI, an Interim FS was deemed necessary because groundwater contamination in the vicinity of the Fuel Farm was a known source of ongoing contamination to Brinson Creek.
Groundwater Interim Record of Decision (Baker, 1995)	1995	An Interim PRAP was submitted to address shallow groundwater and was followed by an IROD. The IROD was issued based on the Interim FS for remediation of surficial groundwater near the fuel farm. <i>In situ</i> air sparging was the selected remedy for shallow groundwater, and the 100-foot trench was installed in 1998.
Draft Supplemental Groundwater Investigation (Baker, 1996)	1995 to 1996	Soil, groundwater, surface water, and sediment samples were collected to fill data gaps from the RI and support the air sparging pilot study. Contamination was identified in groundwater and sediment. The supplemental HHRA concluded that the overall future site risk was above the acceptable risk range.
Draft <i>In Situ</i> Air Sparging Treatability Study (Baker, 1996)	1996	A pilot study was conducted for <i>in situ</i> air sparging in the shallow aquifer. Groundwater, soil, and sediment sampling results indicated that air sparging had limited effectiveness for VOC removal, and no further investigation was recommended.
Closeout Report (OHM, 1997)	1995 - 1997	In response to the IROD, a removal action for petroleum hydrocarbon soil was initiated. From 1995 to 1997 approximately 15,700 tons of petroleum hydrocarbon contaminated soil were removed from the former fuel farm area. Confirmatory sampling was conducted and revealed concentrations below cleanup goals. The site was restored and a closeout report was completed in 1997.

TABLE 8-17
Previous Investigations Summary, IRP Site 35

Previous Investigation/Action	Date	Activities
Long-term Monitoring (CH2M HILL, 2005)	1999 - 2005	Groundwater samples were collected, quarterly in 1999 and semiannually from 2000 to 2004, to assess seasonal changes in contaminant distribution. LTM was discontinued in 2004 when an SRI was initiated.
Natural Attenuation Evaluation (CH2M HILL, Baker, and CDM, 2003)	1998 - 2003	Seasonal changes, plume stability, and presence of natural degradation were evaluated to determine if the natural attenuation process could reduce groundwater contamination to levels of compliance. Groundwater and surface water samples were collected and analyzed for VOCs, metals, and NAIPs. Results indicated natural attenuation was degrading CVOCs, but biological degradation appeared to be stalled in some locations.
Hot Spot Characterization (Baker, 2003)	2002 - 2003	Characterization was completed to delineate any continuing contaminant sources. Field activities included soil and groundwater sampling for VOCs, SVOCs, volatile petroleum hydrocarbon, extractable petroleum hydrocarbon, and total organic carbon. Based on the analytical results, one shallow hot spot was co-mingled with petroleum hydrocarbons, and a deeper, larger hot spot was identified.
Technical Evaluation (CH2M HILL, 2003)	2003	A Technical Evaluation was conducted to develop and evaluate RA alternatives for groundwater. ISCO via modified Fenton's reagent followed by potassium permanganate was recommended for TCE removal. <i>In situ</i> air sparging with vertical wells was recommended for the petroleum hydrocarbon contamination.
Pilot Study (CH2M HILL, 2006)	2003 - 2006	The pilot study evaluated the effectiveness of ISCO for the remediation of TCE-impacted groundwater. Final results revealed that TCE was reduced by 80 to 98 percent and total VOCs were reduced by 72 to 85 percent within the pilot study area.
Supplemental Remedial Investigation (CH2M HILL, 2009)	2005 - 2009	Soil, groundwater, surface water, and sediment samples were collected to delineate extent of contamination. VOCs exceeded criteria and presented unacceptable risks in groundwater.
EE/CA and Non-time-critical Removal Action (AGVIQ/CH2M HILL, 2007; 2008)	2006 - 2008	After the submittal of an EE/CA in 2007, an AM was prepared to document ERD as the preferred NTCRA to address CVOCs in groundwater. ERD via injection of emulsified vegetable oil (EVO) and lactate using direct-push technology was implemented. The results indicated minimal contaminant reduction based on limited distribution of substrate and limited microbial bioavailability.
Feasibility Study (CH2M HILL, 2009)	2009	Remedial alternatives to address CVOC-impacted groundwater were assessed including, no action, MNA, ERD with bioaugmentation, ISCO, and <i>in situ</i> air sparging.
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2009)	2009	A PRAP was issued in April 2009 to solicit public input on the preferred alternative (<i>in situ</i> air sparging using a horizontal well, LTM and MNA, and LUCs) and a public meeting was held. Questions received during the public meeting were general inquiries and no comments were received during the public comment period. The Final ROD was issued and signed in November 2009. The CSM is shown on Figure 8-12.
Remedy-in-Place and Interim Remedial Action Completion Report (Shaw, 2011)	2010 - 2011	The RD was completed for <i>in situ</i> air sparging using a horizontal well, LTM and MNA, and LUCs. The horizontal well was installed to address VOCs in groundwater; air sparging was initiated in 2010 and discontinued in 2013 based on the downward trending concentrations of VOCs in the source area wells. LUCs were also finalized to prohibit aquifer use until cleanup levels for UU/UE are achieved. Groundwater LTM and MNA for VOCs and NAIPs was initiated in 2011 to evaluate the effectiveness of the system and monitor plume migration. An IRACR was submitted in 2011.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, CH2M HILL, 2011, and CH2M HILL 2015)	2007 - 2015	Site 35 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Vapor intrusion was not identified as a significant pathway of concern for any of the buildings located in the vicinity of Site 35. However, additional sampling was recommended to further characterize temporal variability at Building G533 and based on the 2013 results, NFA was recommended.

TABLE 8-18
Land Use Control Summary, IRP Site 35

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Aquifer Use Control Boundary	178.6	May 2010	August 2010

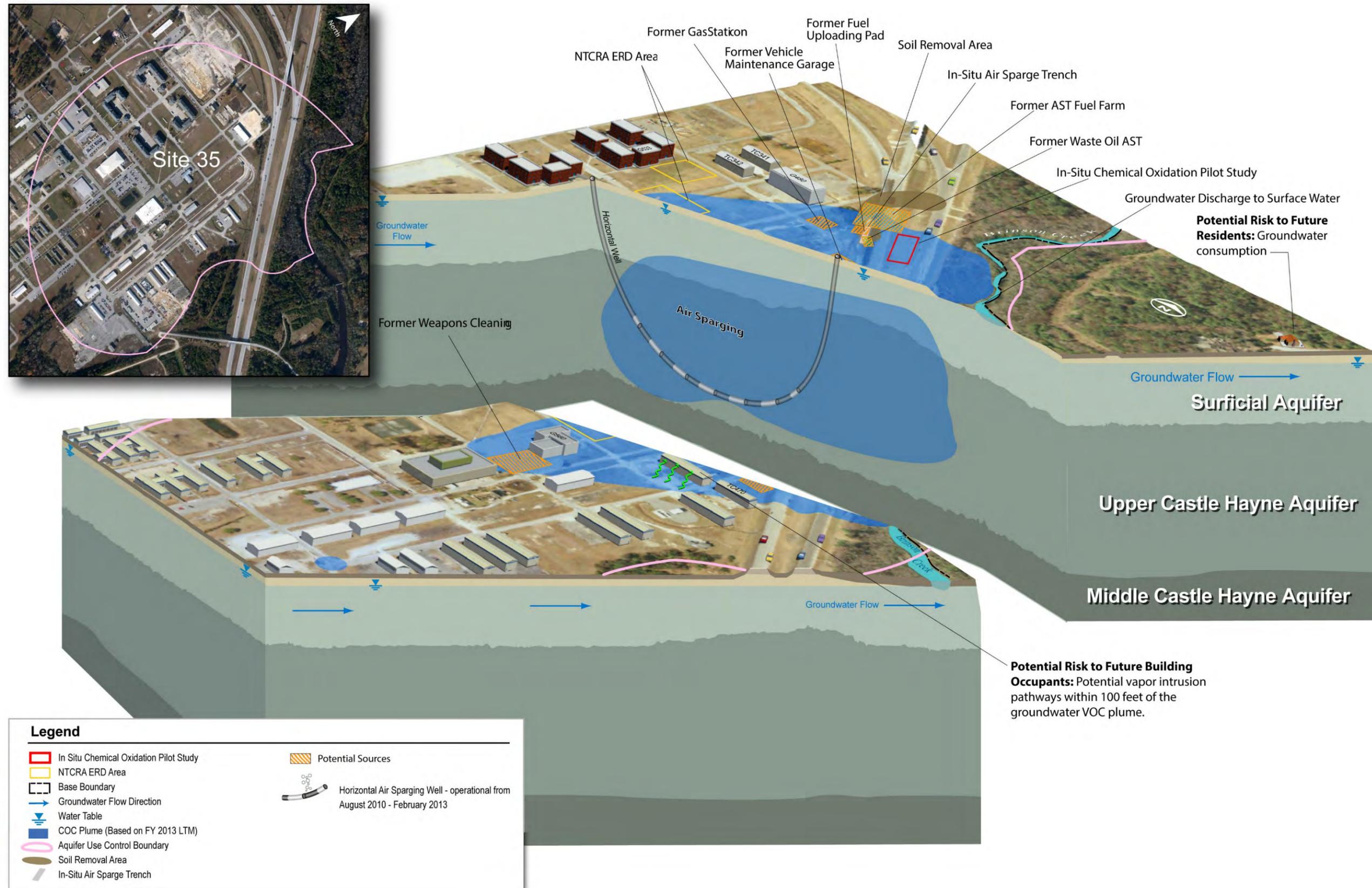
8.1.9.1 Future Activities

Groundwater MNA will continue to assess trends in VOCs and to monitor natural attenuation. LUC inspections will be conducted quarterly. An industrial/non-industrial use control boundary for vapor intrusion will be added.

If buildings are planned for construction in the vicinity of the VOC groundwater plume prior to the implementation of the vapor intrusion LUC, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS, and all construction projects on-Base go through environmental review.

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FIGURE 8-12
IRP Site 35 Conceptual Site Model

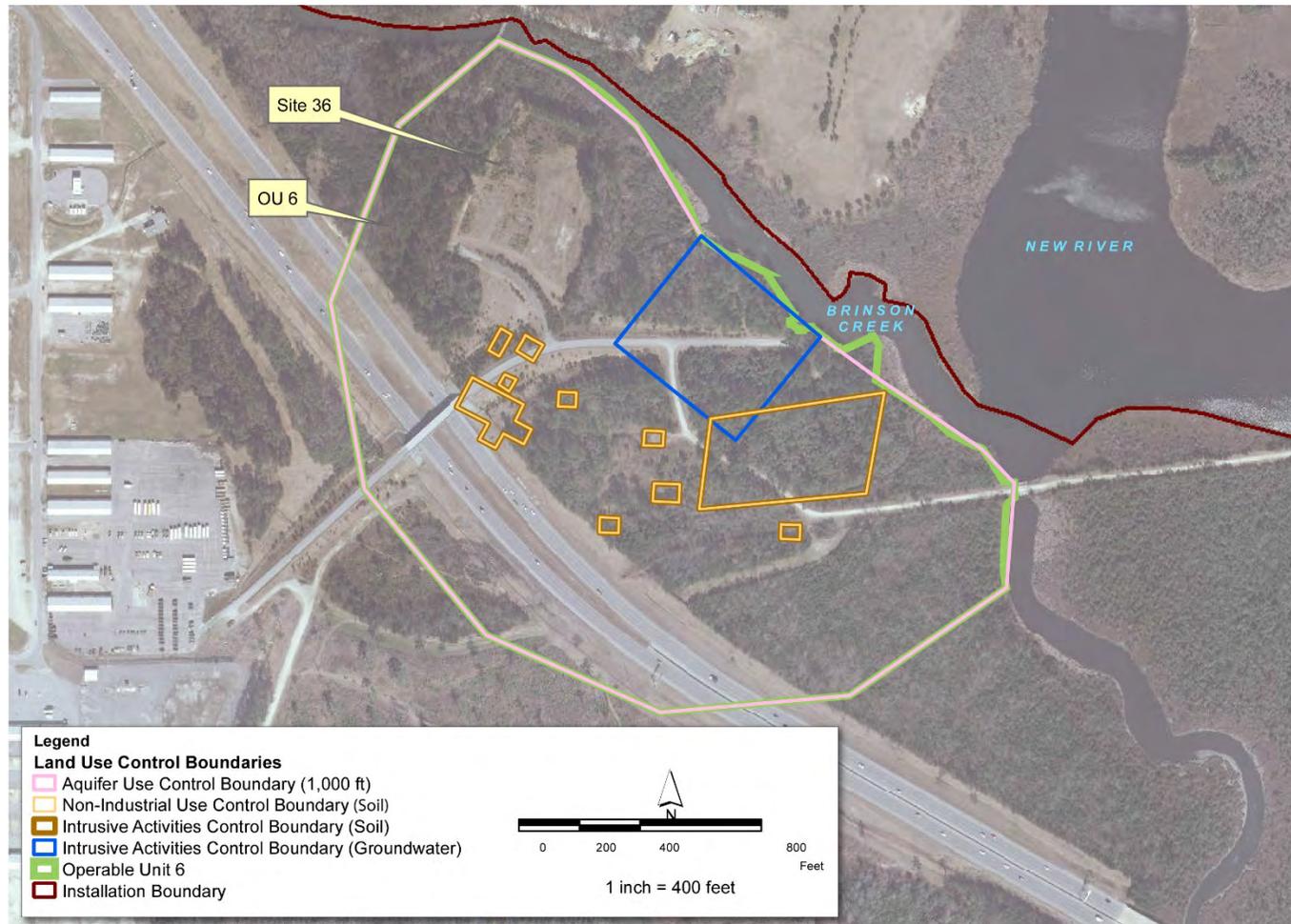


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8.1.10 Site 36 (OU 6) — Camp Geiger Dump Area Near Sewage Treatment Plant

Site 36, the Camp Geiger Dump Area, encompasses approximately 20 acres within OU 6 in the northwest portion of the Base (**Figure 8-13**). OU 6 covers approximately four sites (Sites 36, 43, 44, and 54) that have been grouped together into one OU because of the similar characteristics of material disposed and geographic location. Site 36 is reported to have been used for the disposal of municipal wastes and mixed industrial wastes, including trash, waste oils, solvents, and hydraulic fluids that were generated at MCAS New River. The dump was active from the late 1940s to the late 1950s and covers approximately 5 acres. Most of the material was burned and buried.

FIGURE 8-13
IRP Site 36, OU 6



Previous investigations are listed in **Table 8-19** and the LUC summary is presented in **Table 8-20**.

TABLE 8-19
Previous Investigations Summary, IRP Site 36

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. A Confirmation Study was recommended due to the indication that hazardous substances were disposed of.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to verify the presence of potential contaminants in groundwater, surface water, and sediment. An RI/FS was recommended to further characterize VOCs and metals in groundwater.
Remedial Investigation (Baker, 1996)	1994 - 1996	To further characterize the nature and extent of contamination, an RI was conducted. Field activities included the installation of additional monitoring wells and the collection of soil, groundwater, surface water, and sediment samples. Potential human health risks were identified due to exposure to lead, PAHs, pesticides, and PCBs in soil and VOCs in groundwater. Minimal potential ecological risks were identified for aquatic receptors at Site 36.
Time-critical Removal Action	1997	A TCRA was conducted to remove PCB-contaminated surface soil at concentrations posing an imminent threat to human health and the environment. Approximately 92 tons of regulated PCB-contaminated soils and 148 tons of non-regulated soils were excavated.
Post-Remedial Investigation Groundwater Monitoring	(1998-present)	A post-RI monitoring program consisting of quarterly groundwater and surface water sampling was initiated. Monitoring was implemented to determine if MNA could be a viable remedial alternative for VOCs in groundwater and to evaluate plume movement. Annual groundwater and semi-annual surface water sampling is currently conducted at Site 36 in accordance with the ROD, RD, and LTM optimization report.
Feasibility Study (Baker and CH2M HILL, 2002)	1998 - 2002	Based on the results of the RI, FSs were completed in 1998 and 2002 to evaluate remedial alternatives to mitigate risks from lead, PAHs, and pesticides in soil and VOCs in groundwater. The preferred alternative was excavation and offsite disposal for soil and MNA for groundwater.
Interim Remedial Action (Shaw, 2003)	2003	An EE/CA was presented at a public meeting for completing an interim response removal action. Excavation and offsite disposal of PAH and pesticide-contaminated soil was the selected NTCRA. A total of 1,630 tons of soil were removed from four areas within the south-central portion of the site. The NTCRA was completed before the Final ROD was issued.
Proposed Remedial Action Plan (Baker, 2002) and Record of Decision (CH2M HILL, Baker, and CDM, 2005)	2002 - 2005	A PRAP was issued to solicit public input on the preferred alternative (excavation and offsite disposal and LUCs for soil and MNA and LUCs for groundwater) and a public meeting was held. The Final ROD was issued and signed in July 2005.
Remedial Design (Baker and CH2M HILL, 2005) and Interim Remedial Action Completion Report (CH2M HILL, 2007)	1998 - present	LTM of groundwater and surface water for VOCs and NAPIs was initiated in 1998. An RD was completed for OU 6 in 2005 to document the LUC implementation and maintenance actions and LTM activities for MNA at Site 36. LUCs were implemented in 2005. In 2007, an IRACR was completed to document the RIP. The CSM is shown on Figure 8-14.

TABLE 8-20
Land Use Control Summary, IRP Site 36

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	4.8	September 2005	February 2007
Intrusive Activities Control Boundary (Soil)	4.8		
Intrusive Activities Control Boundary (Groundwater)	4.8		
Aquifer Use Control Boundary (1,000 feet)	64.8		

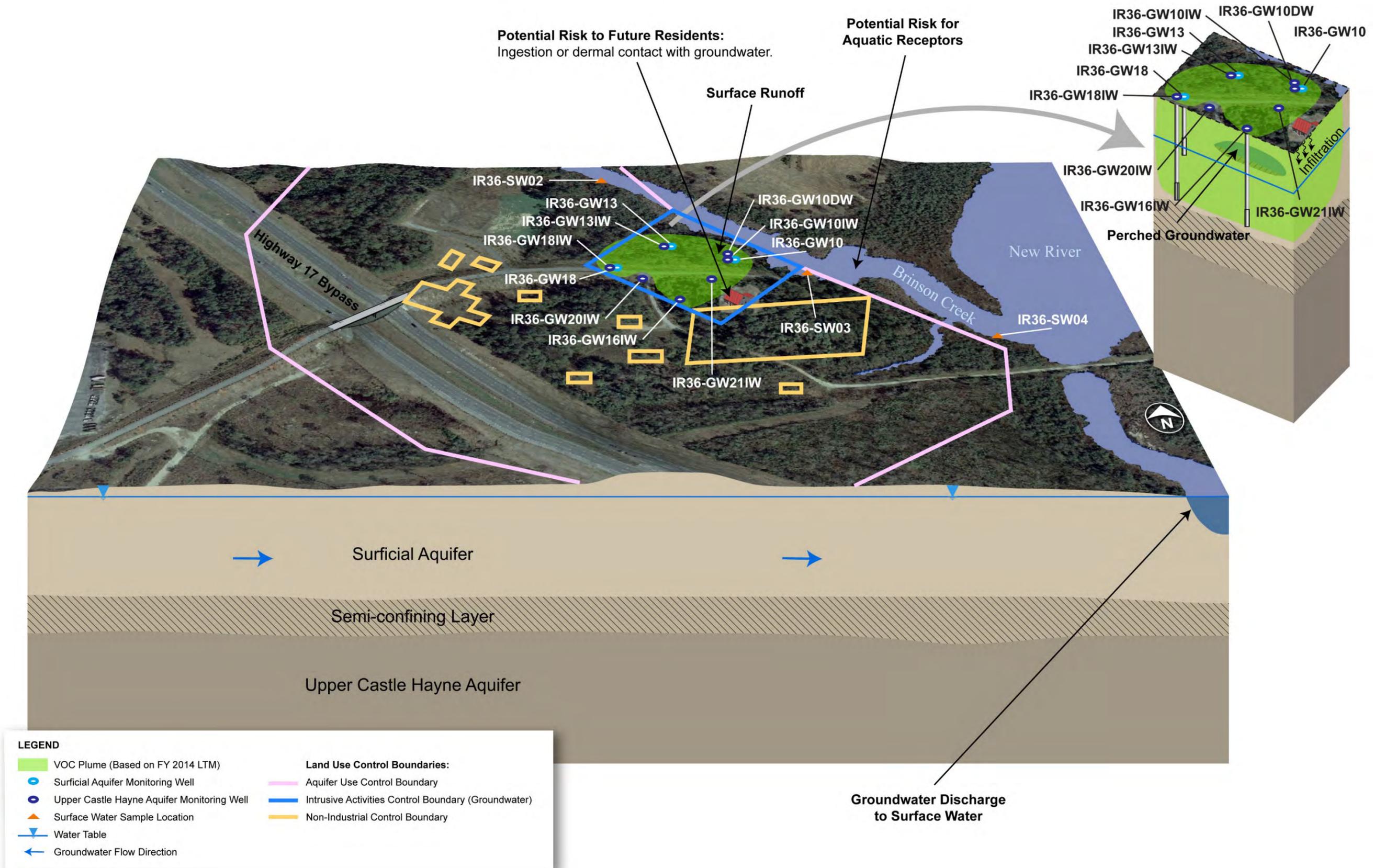
8.1.10.1 Future Activities

Groundwater and surface water MNA will continue to evaluate whether the rate of attenuation is as predicted and to evaluate reductions in contaminant concentrations through naturally occurring processes such as biodegradation, dispersion, and dilution. LUC inspections will be conducted quarterly. A pilot study is underway to evaluate potential remedial technologies to reduce COC concentrations and enhance MNA. The result of the pilot study will be reported in FY 2016.

An industrial/non-industrial use control boundary for vapor intrusion will be added. If buildings are planned for construction in the vicinity of the VOC groundwater plume prior to the implementation of the LUC, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS, and all construction projects on-Base go through environmental review.

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FIGURE 8-14
IRP Site 36 Conceptual Site Model

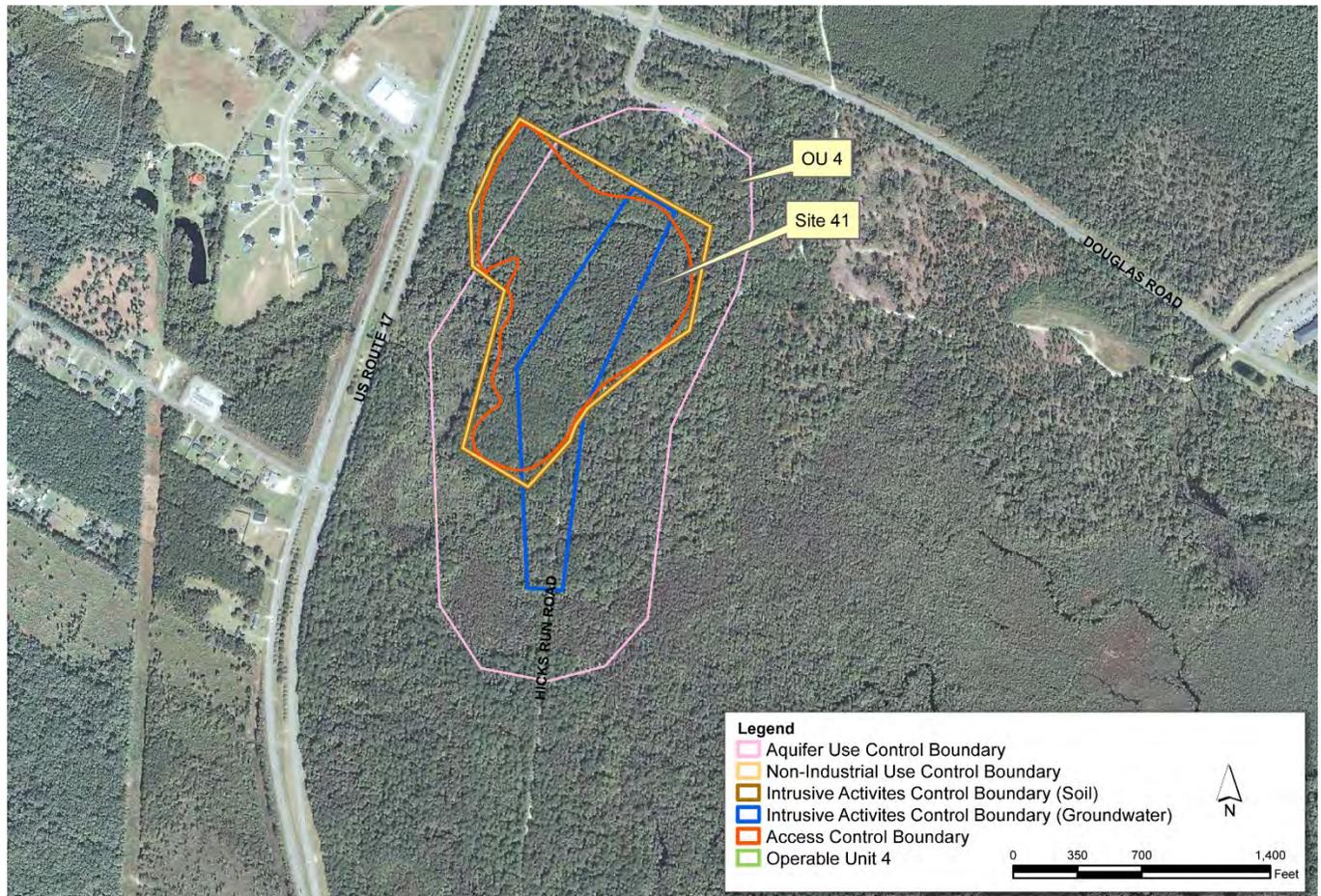


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8.1.11 Site 41 (OU 4) — Camp Geiger Dump near Former Trailer Park

Site 41, the Camp Geiger Dump near the Former Trailer Park, encompasses approximately 37 acres within OU 4 in the Camp Geiger area of the Base (**Figure 8-15**). OU 4 consists of two sites (Sites 41 and 74) that have been grouped together based on the unique characteristic of suspected waste (CAs). Construction debris, POL compounds, solvents, batteries, ordnance, chemical training agents, and, in 1964, mirex (a pesticide), was reportedly disposed at Site 41. The debris was reportedly burned and graded over with soil. The dump area contains an estimated 110,000 yd³ of waste. The amount of solvents and oil disposed was estimated to be between 10,000 and 15,000 gallons; and the quantity of mirex was estimated at several tons.

FIGURE 8-15
IRP Site 41, OU 4



Previous investigations are listed in **Table 8-21** and the LUC summary is presented in **Table 8-22**.

TABLE 8-21
Previous Investigations Summary, IRP Site 41

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that disposal of industrial wastes and pesticides could impact groundwater and recommended an additional investigation to verify the presence of hazardous wastes.
Confirmation Study (ESE, 1990)	1984 - 1990	The Confirmation Study included groundwater, surface water, and sediment investigations. O&G and phenols were detected in groundwater, surface water, and sediment samples. VOCs, metals, and one nitroaromatic were detected in groundwater samples.
Remedial Investigation/ Feasibility Study (Baker, 1995)	1993 - 1995	To further characterize the nature and extent of contamination an RI was conducted. Field activities included a geophysical investigation, soil, groundwater, surface water, and sediment sampling, and an aquatic and ecological survey. The geophysical investigation indicated that the site contained a significant amount of buried construction debris. Although there was reported history of CA disposal, no chemical surety degradation compounds were detected in soil. Potential human health risks were identified due to exposure to metals in groundwater and seep surface water. Minimal potential ecological risks were identified for aquatic receptors at Site 41. An FS was conducted to develop and screen remedial alternatives for addressing soil, groundwater, and surface water contamination.
Proposed Remedial Action Plan and Record of Decision (Baker, 1995)	1995	A PRAP was issued to solicit public input on the preferred alternative (LTM to monitor contaminant migration and LUCs) and a public meeting was held. The Final ROD was issued and signed in December 1995.
Remedy-in-Place and Remedial Action Completion Report (CH2M HILL, 2006)	1997 - 2008	LTM was initiated in 1997 and included sampling of five monitoring wells and eight surface water and sediment locations twice a year for analysis of VOCs, metals, total dissolved solids (TDS), and total suspended solids (TSS). In 2005 the groundwater cleanup levels were achieved and LTM was discontinued. LUCs were implemented in 2001 and updated in 2002. A RACR was prepared to document the completion of LTM. A fence was installed around the perimeter of the site in 2008 to restrict access.

TABLE 8-22
Land Use Control Summary, IRP Site 41

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary	36.6		
Intrusive Activities Control Boundary (Groundwater)	16.4		
Intrusive Activities Control Boundary (Soil)	36.6	July 2002	February 2002
Aquifer Use Control Boundary (500 feet)	86.4		
Access Control Boundary	30		

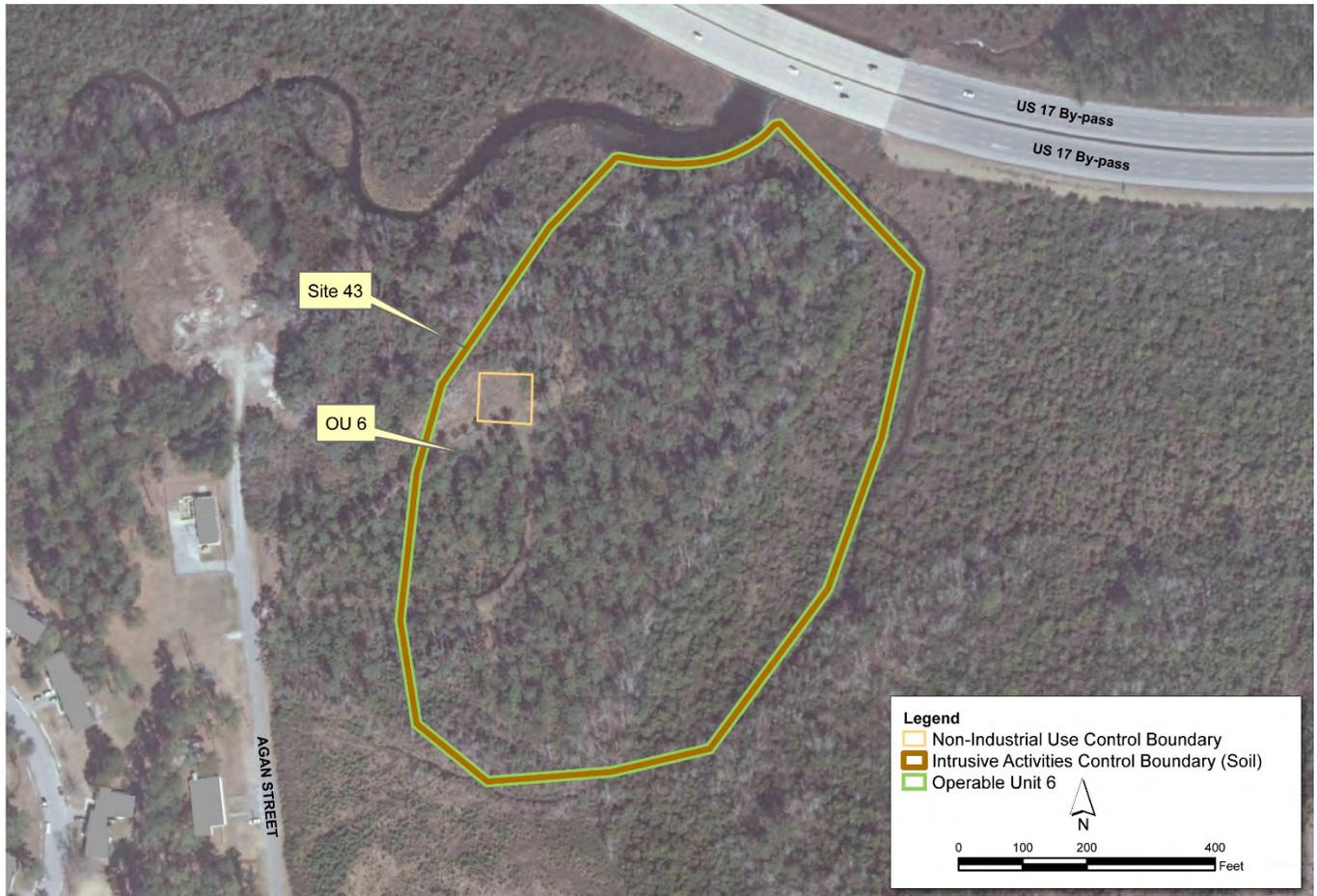
8.1.11.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.12 Site 43 (OU 6) — Agan Street Dump

Site 43, the Agan Street Dump, encompasses approximately 14 acres within OU 6 in the operations area of MCAS New River (**Figure 8-16**). OU 6 consists of four sites (Sites 36, 43, 44, and 54) that have been grouped together into one OU because of the similar characteristics of material disposed and geographic location. An abandoned sewage treatment plant (STP) is adjacent to the site. The Agan Street Dump reportedly received inert material such as construction debris and trash. Sludge from the former STP was also reportedly dumped onto the ground surface of Site 43; however, it is not clear when disposal operations took place.

FIGURE 8-16
IRP Site 43, OU 6



Previous investigations are listed in **Table 8-23** and the LUC summary is presented in **Table 8-24**.

TABLE 8-23
Previous Investigations Summary, IRP Site 43

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that waste quantities at the site, regardless of their nature, were minor; therefore, a Confirmation Study was not recommended. However, USEPA requested an additional investigation to determine whether hazardous waste contamination existed.
Site Investigation (1991)	1991	An SI was conducted to determine the presence or absence of hazardous waste contamination. Field activities included soil, groundwater, surface water, and sediment sampling. The SI identified PAHs in surface soil, carbon disulfide and metals in groundwater, benzoic acid and metals in surface water, and PAHs and pesticides in sediment. Further characterization as part of an RI/FS was recommended.
Remedial Investigation (Baker, 1996)/ Feasibility Study (Baker and CH2M HILL, 2002)	1995 - 2002	To further assess contamination at the site an RI field investigation was initiated. Field activities included a site survey and soil, groundwater, surface water, and sediment sampling. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Exploratory test pits completed as part of the soil investigation identified miscellaneous debris associated with the disposal of construction material from the nearby housing area. Potential human health risks were identified for current and future receptors due to exposure to soils. Minimal potential ecological risks were identified. Based on the findings of the RI, a removal action for PAH-contaminated soil was recommended in the revised OU 6 FS.
Interim Remedial Action (1995; 2003)	1995; 2003	IRAs were conducted at Site 43 for surficial metallic debris and PAH-contaminated soil in 1995 and 2003, respectively. Approximately 7.3 tons of metallic debris were removed for recycling and a total of 1,477 tons of soil were excavated.
Proposed Remedial Action Plan (Baker, 2002) and Record of Decision CH2M HILL, Baker, and CDM, 2005)	2002 - 2005	The preferred alternative, excavation and offsite disposal and LUCs for soil, for Site 43 was presented in the PRAP in 2002. A public notice of availability, public comment period, and public meeting were held to solicit community input on the preferred alternative. Excavation and offsite disposal for soil was completed in 2003 during the IRA. Therefore, LUCs for soil were selected as the remedy for Site 43 as documented in the ROD for OU 6, signed in July 2005.
Remedy-in-Place and Interim Remedial Action Completion Report (CH2M HILL, 2007)	2005 - 2007	Soil LUCs were implemented in 2005, and an IRACR was completed to document the RIP.

TABLE 8-24
Land Use Control Summary, IRP Site 43

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	0.14	September 2005	February 2007
Intrusive Activities Control Boundary (Soil)	13.2		

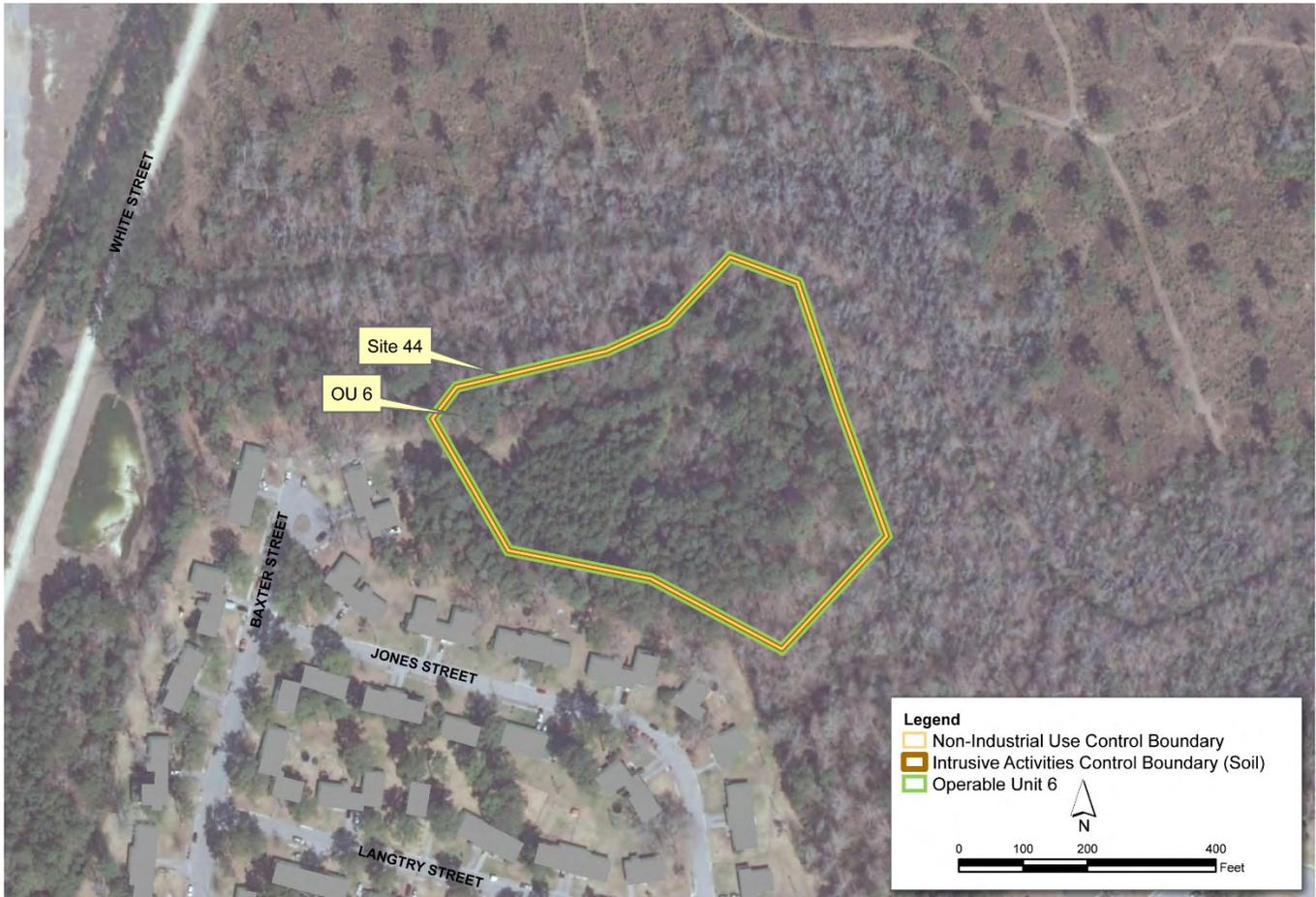
8.1.12.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.13 Site 44 (OU 6) — Jones Street Dump

Site 44, the Jones Street Dump, encompasses approximately 6 acres within OU 6 in the operations area of MCAS New River (**Figure 8-17**). OU 6 consists of four sites (Sites 36, 43, 44, and 54) that have been grouped together into one OU because of the similar characteristics of material disposed and geographic location. Site 44 was reportedly in operation during the 1950s. Although the quantity of waste is not known, debris, cloth, lumber, and paint cans were reportedly disposed of at the site.

FIGURE 8-17
IRP Site 44, OU 6



Previous investigations are listed in **Table 8-25** and the LUC summary is presented in **Table 8-26**.

TABLE 8-25
Previous Investigations Summary, IRP Site 44

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Due to the negligible quantity of inert material reportedly disposed at Site 44, a Confirmation Study was not recommended. However, the USEPA later requested an additional investigation to determine whether hazardous waste contamination existed.
Site Investigation (1991)	1991	An SI was conducted to verify the presence or absence of contamination. Field activities included soil, groundwater, surface water, and sediment sampling. The analytical results identified PAHs, pesticides, and metals in soil; VOCs, PAHs, and metals in groundwater; VOCs and metals in surface water; and pesticides and metals in sediment. Based on these results, an RI was proposed.
Remedial Investigation (Baker, 1996) and Feasibility Study (Baker, and CH2M HILL, 2002)	1995 - 2002	An RI was completed to characterize the nature and extent of contamination and potential impacts to human health and the environment. Field activities included a site survey and soil, groundwater, surface water, and sediment sampling. No unacceptable risks to human health or the environment were identified, and therefore no action was recommended in the FS.
Proposed Remedial Action Plan (Baker, 2002) and Record of Decision (CH2M HILL, Baker, and CDM, 2005)	2002 - 2005	Although no action was recommended during the FS, for conservativeness, MCIEAST-MCB CAMLEJ identified potential risks based on the OU 6 sites formerly used for waste disposal. Therefore, LUCs were the preferred alternative presented in the PRAP in 2002. A public notice of availability, public comment period, and public meeting were held to solicit community input on the preferred alternative. LUCs were selected as the remedy for Site 44 as documented in the ROD for OU 6, signed in July 2005.
Remedy-in-Place and Interim Remedial Action Completion Report (CH2M HILL, 2007)	2005 - 2007	An RD was completed for OU 6 in September 2005 to document the LUC implementation. A Final OU 6 IRACR was completed in August 2007 to document the RIP at Site 44 (LUCs).

TABLE 8-26
Land Use Control Summary, IRP Site 44

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	5.6	September 2005	February 2007
Non-Industrial Use Control Boundary	5.6		

8.1.13.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.14 Site 49 (OU 23) — MCAS Suspected Minor Dump

Site 49, the MCAS Suspected Minor Dump, encompasses approximately 1 acre and is located within MCAS New River, in the northwest portion of the Base (**Figure 8-18**). The dates of operation are unknown, but Site 49 is suspected of having been used for the disposal of paint cans. A building is located approximately 50 feet from the northeast boundary of the site and is currently used for the storage of miscellaneous industrial materials and paint supplies. A drainage pipe exits the building and ends in the northeast portion of Site 49. A drainage ditch for taxiways, runways, and miscellaneous buildings along Curtis Road and Longstaff Street bisects the site. Various types of construction-related surface debris have been observed at the site.

FIGURE 8-18
IRP Site 49, OU 23



Previous investigations are listed in **Table 8-27** and the LUC summary is presented in **Table 8-28**.

TABLE 8-27
Previous Investigations Summary, IRP Site 49

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of waste disposed of was determined to be insignificant and did not warrant further investigation.
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Soil and groundwater samples were collected in July 2009 and analyzed for SVOCs, VOCs, and metals. Based on analytical results, additional groundwater samples were collected in February 2010 and analyzed for VOCs, SVOCs, and metals were detected at concentrations exceeding screening criteria in soil. VOCs and metals were detected in groundwater at concentrations exceeding screening criteria. Potential human health and ecological risks were identified due to exposure to VOCs in groundwater. The PA/SI recommended an additional investigation to assess VOCs in groundwater.
Remedial Investigation/Feasibility Study (CH2M HILL, 2012)	2011 - 2012	Field activities were conducted to assess the nature and extent of contamination and potential human health and environmental impacts. Field activities included soil, groundwater, pore water, surface water, and sediment sampling for VOC analysis. VOC concentrations exceeded screening criteria in one soil sample, one groundwater sample, one surface water sample, and one pore water sample. Potential unacceptable human health risks were identified due to exposure to VOCs in groundwater and RAOs were developed. The remedial alternatives evaluated were no action, MNA and LUCs, enhanced <i>in situ</i> bioremediation with LUCs and LTM, and air sparging with LUCs and LTM.
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2013 and 2014)	2013 - 2014	A PRAP was issued to solicit public input on the preferred alternative (MNA and LUCs) and a public meeting was held. No written comments were received. The Final ROD was signed on April 24, 2014.
Remedial Design (CH2M HILL, 2014) and Interim Remedial Action Completion Report (CH2M HILL, 2014)	2014	The RD provides the implementation actions, monitoring framework, and site closure milestones for the selected remedy for Site 49, which includes: <ul style="list-style-type: none"> • MNA to monitor groundwater and pore water and track changes in COC concentrations • LUCs to prevent aquifer use and protect any future potential receptors from vapor intrusion MNA remedial action activities began in June 2014 and are ongoing.

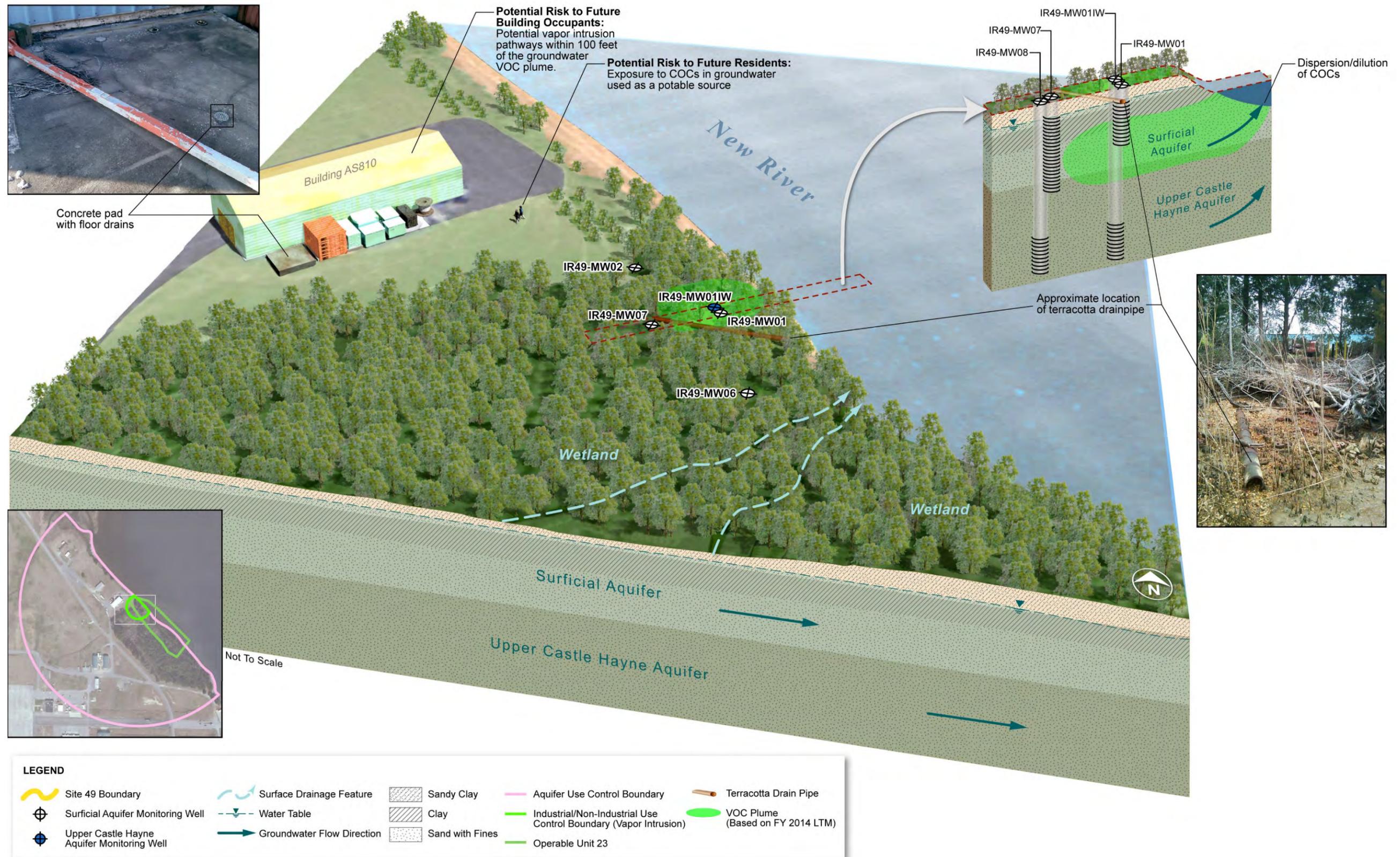
TABLE 8-28
Land Use Control Summary, IRP Site 49

LUC Boundary	Estimated Area (Acres)	Final ROD	Onslow County Registration Date
Aquifer Use Control Boundary (1,000 feet)	37.58	April 2014	September 2014
Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion)	0.46		

8.1.14.1 Future Activities

LTM will continue to monitor the concentrations of VOCs in groundwater and pore water, and LUC inspections will be conducted quarterly.

FIGURE 8-19
IRP Site 49 Conceptual Site Model

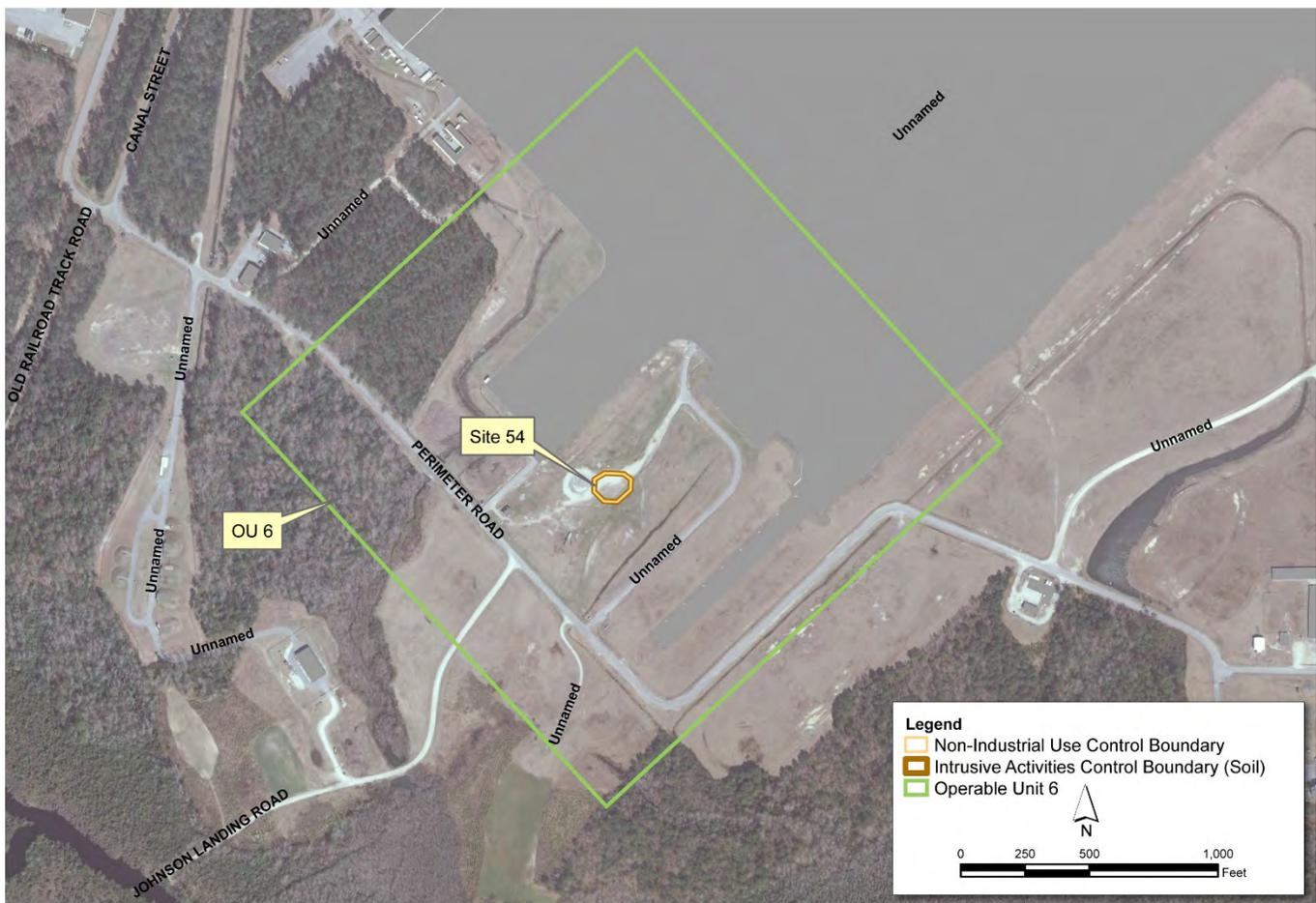


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8.1.15 Site 54 (OU 6) — Crash Crew Fire Training Burn Pit

Site 54, the Crash Crew Fire Training Burn Pit, covers approximately 1 acre near the southwest end of Runway 5-23 within the MCAS New River operations area (**Figure 8-20**). OU 6 consists of four sites (Sites 36, 43, 44, and 54) that have been grouped together into one OU because of the similar characteristics of material disposed and geographic location. The site has served as the fire training burn pit since the mid-1950s. The former Crash Crew Fire Training Burn Pit was 90 feet in diameter and situated at the center of this site. Originally, fire training was conducted on the ground surface within a bermed area using jet propulsion (JP)-type fuel, which was stored in an 8,000-gallon UST, northwest of the burn pit. An OWS, located approximately 100 feet southeast of the burn pit, was used for temporary storage and collection of the spent fuel. In 1975, a lined burn pit was constructed and was used until 1999. Beginning in August 2000, the burn pit was converted to a training area that employs clean-burning fuels with operational and engineering controls. It is estimated that nearly 500,000 gallons of POL may have been used at Site 54.

FIGURE 8-20
IRP Site 54, OU 6



Previous investigations are listed in **Table 8-29** and the LUC summary is presented in **Table 8-30**.

TABLE 8-29
Previous Investigations Summary, IRP Site 54

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. It was concluded that waste fuels, oils, and solvents may remain in the soil and recommended an additional investigation to verify the presence of hazardous wastes.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to verify the presence or absence of hazardous waste. Field activities included groundwater and sediment investigations. Due to the presence of low levels of petroleum compounds, further characterization was recommended.
Remedial Investigation (Baker, 1996)	1995	An RI was conducted to further characterize contamination at the site. Field activities included a site survey and soil and groundwater sampling. The RI identified potential risks from lead, SVOCs, and VOCs in groundwater. A Revised FS (the original FS only included Site 36) was completed for OU 6. Based on the findings of the RI, the FS recommended no action at Site 54.
Post-Remedial Investigation Monitoring	1998 - 2002	The post-RI monitoring program at Site 54 began in 1998 consisting of quarterly groundwater sampling. Based on the groundwater data collected following the IRA conducted in 2001, it was determined that lead, SVOCs and VOCs no longer posed an impact to the groundwater. Subsequently, groundwater monitoring was discontinued in 2002.
Interim Remedial Action	2001	An IRA for the UST, POL-contaminated soils, and construction debris from the former burn pit was completed at Site 54 in 2001. The removal area was 128 feet long by 96.5 feet wide and extended 9 feet bgs to the depth of groundwater. Construction activities also included a new concrete-lined fire training area and two propane tanks.
Feasibility Study (Baker and CH2M HILL, 2002)	2002	Based on the results of the IRA and post-RI groundwater monitoring, it was determined that lead, SVOCs, and VOCs no longer impacted the groundwater; therefore, no action was identified during the FS.
Proposed Remedial Action Plan (Baker, 2002) and Record of Decision (CH2M HILL, Baker, and CDM, 2005)	2002 - 2005	Although no action was recommended during the FS, for conservativeness, MCIEAST-MCB CAMLEJ identified potential risks based on the OU 6 sites formerly used for waste disposal. Therefore, LUCs was the preferred alternative presented in the PRAP in 2002. A public notice of availability, public comment period, and public meeting were held to solicit community input on the preferred alternative. LUCs were selected as the remedy for Site 54 as documented in the ROD for OU 6, signed in July 2005.
Remedy-in-Place and Interim Remedial Action Completion Report (CH2M HILL, 2007)	2005 - 2007	An RD was completed for OU 6 in 2005 to document the LUC implementation and maintenance actions at Site 54. A Final OU 6 IRACR was completed to document the RIP (LUCs).

TABLE 8-30
Land Use Control Summary, IRP Site 54

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	0.29	September 2005	February 2007
Intrusive Activities Control Boundary (Soil)	0.29		

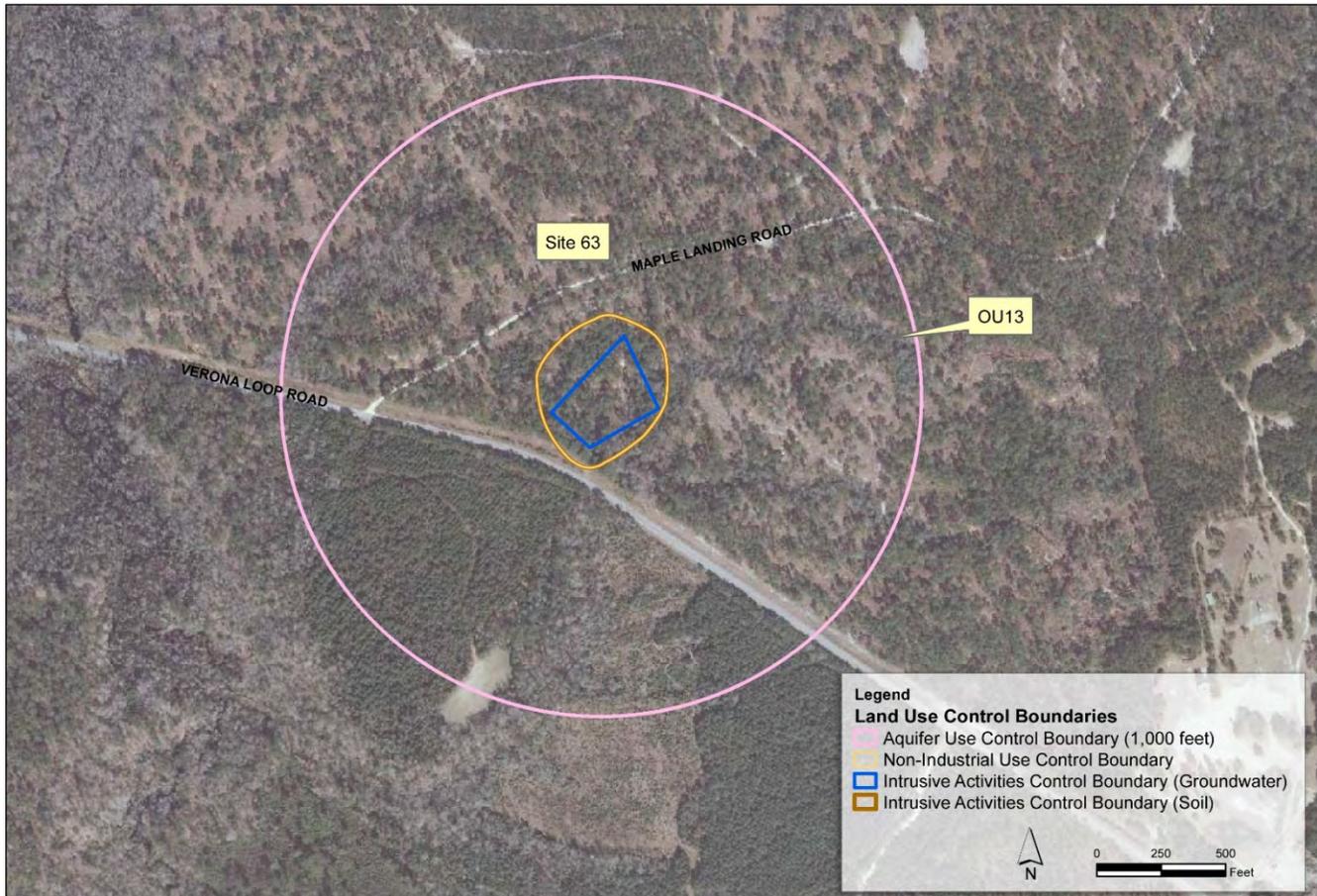
8.1.15.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.16 Site 63 (OU 13)—Verona Loop Dump

Site 63, the Verona Loop Dump, encompasses approximately 5 acres, nearly 2 miles south of the MCAS New River operations area (**Figure 8-21**). The area reportedly received bivouac wastes generated during training exercises. No hazardous wastes were reportedly disposed of at Site 63. Currently, training exercises, maneuvers, and recreational hunting frequently take place in the area.

FIGURE 8-21
IRP Site 63, OU 13



Previous investigations are listed in **Table 8-31** and the LUC summary is presented in **Table 8-32**.

TABLE 8-31
Previous Investigations Summary, IRP Site 63

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantities of waste reportedly disposed of at the site, whether hazardous or not, were insignificant and it was concluded that no further assessment was necessary. However, USEPA requested an additional investigation to determine whether hazardous waste contamination existed.
Site Investigation (Baker, 1994)	1994	An SI was conducted to determine whether hazardous waste contamination existed. Field activities included soil, groundwater, surface water, and sediment sampling for VOCs, SVOCs, pesticides/PCBs, and metals. Fill materials were encountered in soils, confirming that disposal of waste materials occurred at the site. The analytical results identified metals and organic compounds detected in soil and groundwater samples. Based on these findings, the SI recommended further evaluation.
Remedial Investigation (Baker, 1996)	1995-1996	An RI was conducted to evaluate the nature and extent of contamination and potential risks to human health and the environment. Field activities consisted of a site survey and soil, groundwater, surface water, and sediment sampling. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. No unacceptable human health or ecological risks were identified.
Proposed Remedial Action Plan and Record of Decision (Baker, 1996 and 1997)	1996 - 1997	A PRAP was issued to solicit public input on the preferred alternative (no action) and a public meeting was held. The Final ROD was issued and signed in April 1997.
Remedy-in-Place	2001 - 2002	Although the ROD did not require RA, for conservativeness the Base implemented LUCs in 2001 and updated them in 2002.
Explanation of Significant Differences (CH2M HILL, 2012)	2012	An ESD was submitted in 2012 to document the LUCs as the remedy including the addition of a non-industrial use control and an intrusive activities control boundary for soil to prevent exposure to waste in place.
Land Use Control Implementation Plan Update (CH2M HILL, 2014)	2013 -2014	LUCs were updated in the 2014 LUCIP Update and a new Notice of Contaminated Site was filed with Onslow County real property records in August 2014.

TABLE 8-32
Land Use Control Summary, IRP Site 63

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	5	August 2014	August 2014
Non-Industrial Use Control Boundary (Soil)	5		
Intrusive Activities Control Boundary (Groundwater)	2	July 2002	February 2002
Aquifer Use Control Boundary (1,000 feet)	100		

8.1.16.1 Future Activities

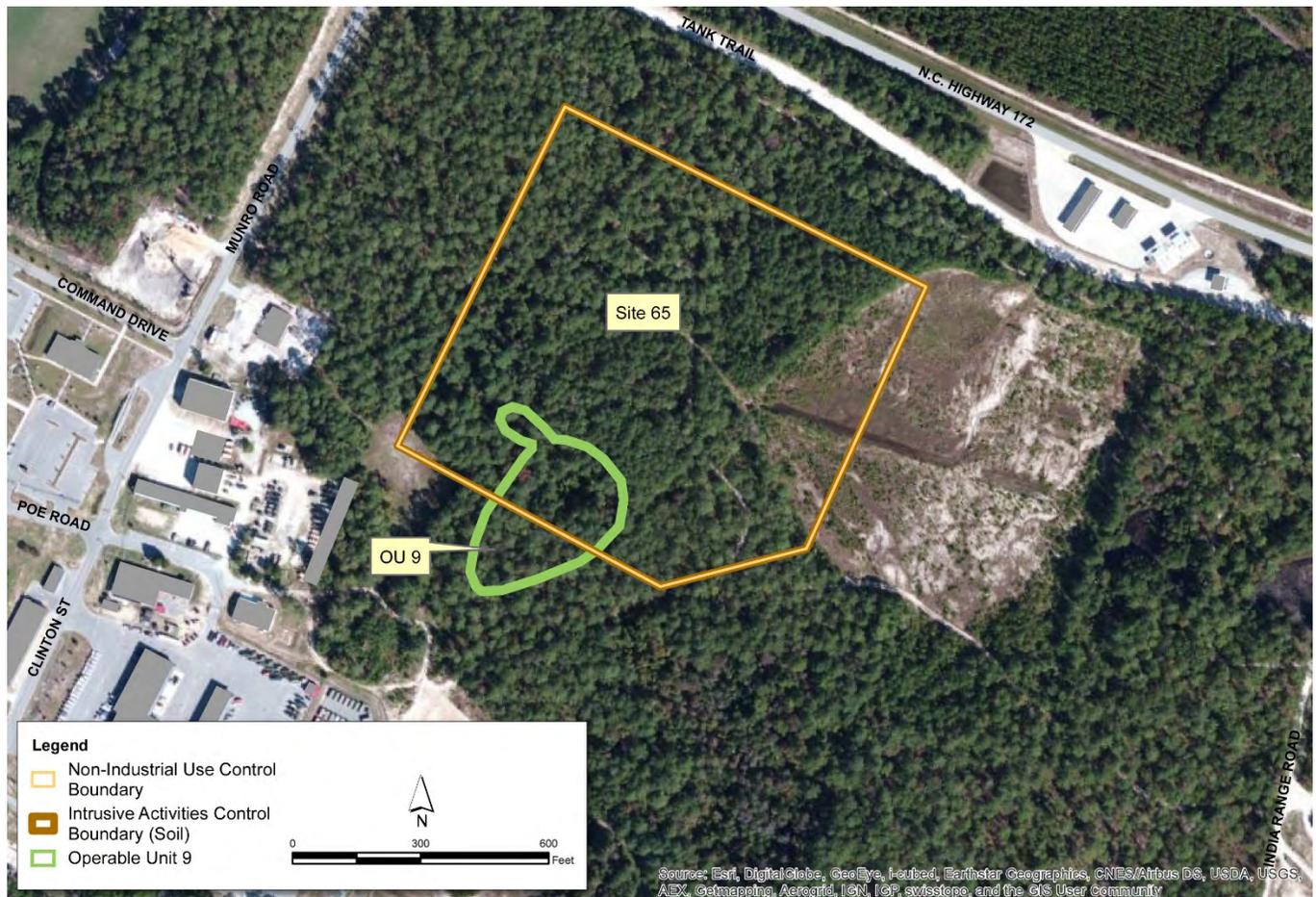
LUC inspections will be conducted quarterly.

8.1.17 Site 65 (OU 9)—Engineer Area Dump

Site 65, the Engineer Area Dump, is located in the Courthouse Bay area of MCIEAST-MCB CAMLEJ and covers approximately 2 acres (**Figure 8-22**). Two separate disposal areas have been reported at Site 65, a battery acid disposal area and a liquid disposal area. The liquids that have been disposed are reported to have been POL types. In addition, the dump was used to burn construction debris. The dump was in operation from at least 1958 until 1972. In 2013, during MILCON activities within Site 65, buried waste including asbestos containing material and oversized debris and lead impacted soil were encountered and disposed of offsite.

In 2015, the Base implemented soil LUCs for conservativeness based on the site's history as a dump. This site was moved from RC to RIP in 2015.

FIGURE 8-22
IRP Site 65, OU 9



Previous investigations are listed in **Table 8-33** and the LUC summary is presented in **Table 8-34**.

TABLE 8-33
Previous Investigations Summary, IRP Site 65

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at the site, and no further assessment was recommended. However, USEPA requested an additional investigation to determine whether hazardous waste contamination existed.
Site Investigation (Baker, 1994)	1991 - 1994	An SI was conducted to verify the presence or absence of contamination. Field activities included soil, groundwater, surface water, and sediment sampling. Fill materials were encountered in site soils, confirming that waste material was disposed of at the site. Pesticides and metals were detected in groundwater and sediment samples. Based on these findings, the SI recommended further evaluation.
Remedial Investigation (Baker, 1997)	1995 - 1997	An RI was conducted to evaluate the nature and extent of contamination and potential risks to human health and the environment. Field activities included soil, groundwater, surface water, and sediment sampling, and ecological investigations. Findings from the RI indicated that there were no releases of hazardous substances from the waste disposal areas and no unacceptable human health or ecological risks were identified.
Post-Remedial Investigation Monitoring (Baker, 2001)	2001	Several discarded containers were discovered near the site in 2001. The containers were heavily corroded and no materials were observed in the containers. Groundwater, soil, surface water, and sediment were collected to determine if surrounding media had been impacted by potential releases. Analytical results indicated there were no effects caused by the containers.
Proposed Remedial Action Plan and Record of Decision (Baker, 2001)	2001	A PRAP was issued to solicit public input on the preferred alternative (no action) and a public meeting was held. The Final ROD was issued and signed in September 2001. The ROD for Site 65 stipulated that no additional RA or monitoring was required.

TABLE 8-34
Land Use Control Summary, IRP Site 65

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	18.91	Pending	Pending
Non-Industrial Use Control Boundary (Soil)	18.91		

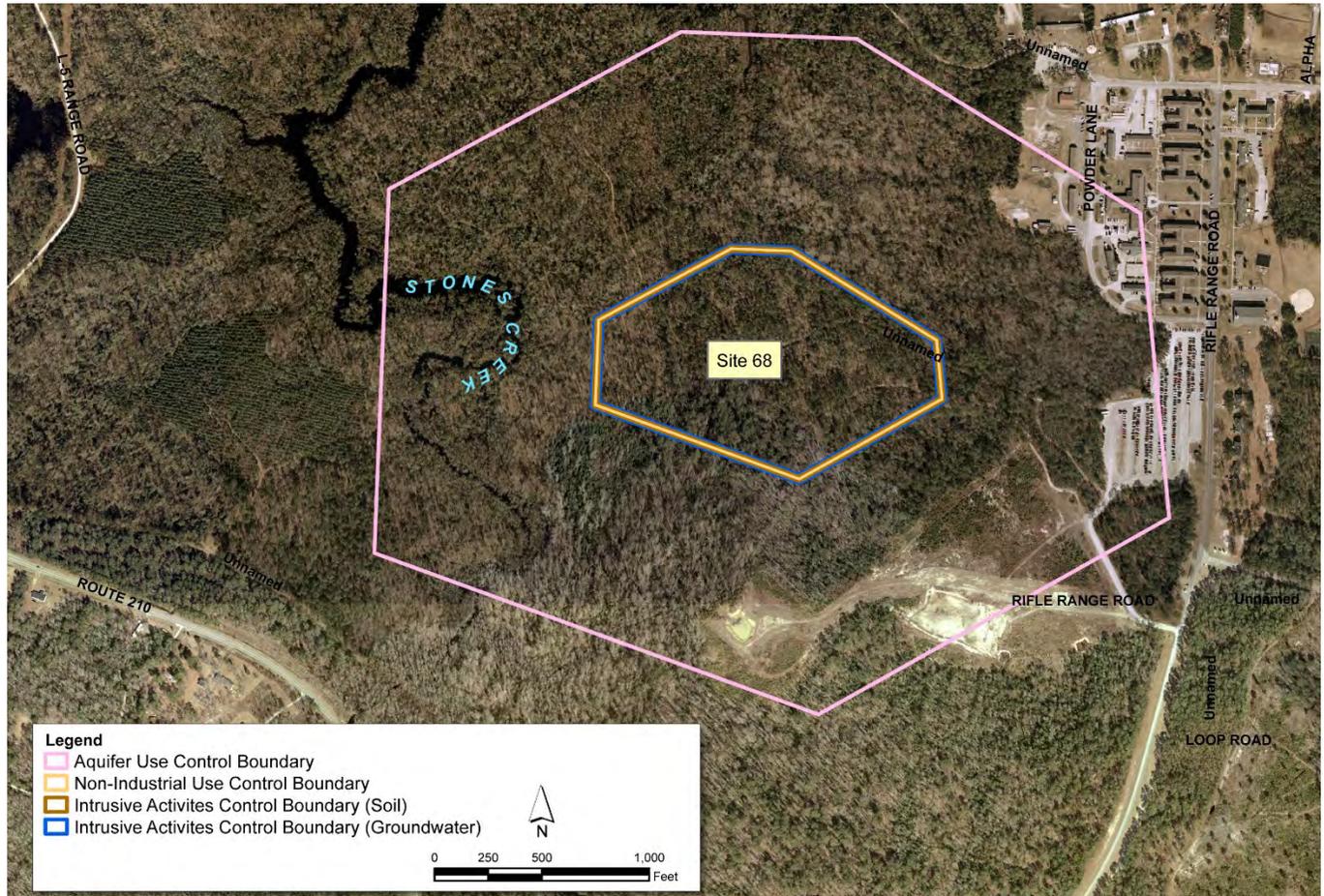
8.1.17.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.18 Site 68 (Pre-RI)—Rifle Range Dump

Site 68, the Rifle Range Dump, covers approximately 4 acres and is located in the Rifle Range Area of the Base (Figure 8-23). From 1942 to 1972, this area was used as a disposal site for various types of wastes, including garbage, building debris, waste treatment sludge, and solvents. The depth of the fill area is approximately 10 feet and the amount of material deposited has been estimated to be 100,000 yd³. The amount of solvents disposed at Site 68 was estimated to be between 1,000 and 2,000 gallons.

FIGURE 8-23
IRP Site 68



Previous investigations are listed in **Table 8-35** and the LUC summary is presented in **Table 8-36**.

TABLE 8-35
Previous Investigations Summary, IRP Site 68

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Organic compounds were identified in potable supply wells, located upgradient from the site. Even though these wells are located upgradient from the site, it was suspected that continuous pumping may have drawn contaminants to the wells. Based on these findings, the IAS recommended an additional investigation.
Site Summary Report (ESE, 1990)	1984 - 1990	Monitoring wells were installed and groundwater samples were collected for VOCs analysis from the monitoring wells and potable supply wells in 1984 and again in 1986. No constituents of potential concern (COPCs) were detected in groundwater samples collected from these wells.
Pre-Remedial Investigation Screening Study (Baker, 1998)	1995 - 1998	A Pre-RI screening study was conducted to determine whether contamination was present at the site. Field activities included soil, groundwater, surface water, and sediment sampling. Pesticide/PCBs were detected in soil samples, VOCs and metals were detected in groundwater samples, and pesticides and metals were detected in sediment. No unacceptable human health risks were identified and no further RA was recommended
No Action Decision Document (2001)	2001	The Final NADD was completed May 8, 2001, which stated that all investigations or activities for the IRP for Site 68 are complete.
Remedy-in-Place	2001 - Present	Although no RA was required, for conservativeness, the Base implemented LUCs in 2001 and updated them in 2002, due to the site's history as a dump.

TABLE 8-36
Land Use Control Summary, IRP Site 68

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	26.9		
Intrusive Activities Control Boundary (Soil)	26.9		
Intrusive Activities Control Boundary (Groundwater)	26.9	July 2002	February 2007
Aquifer Use Control Boundary (1,000 feet)	202.8		

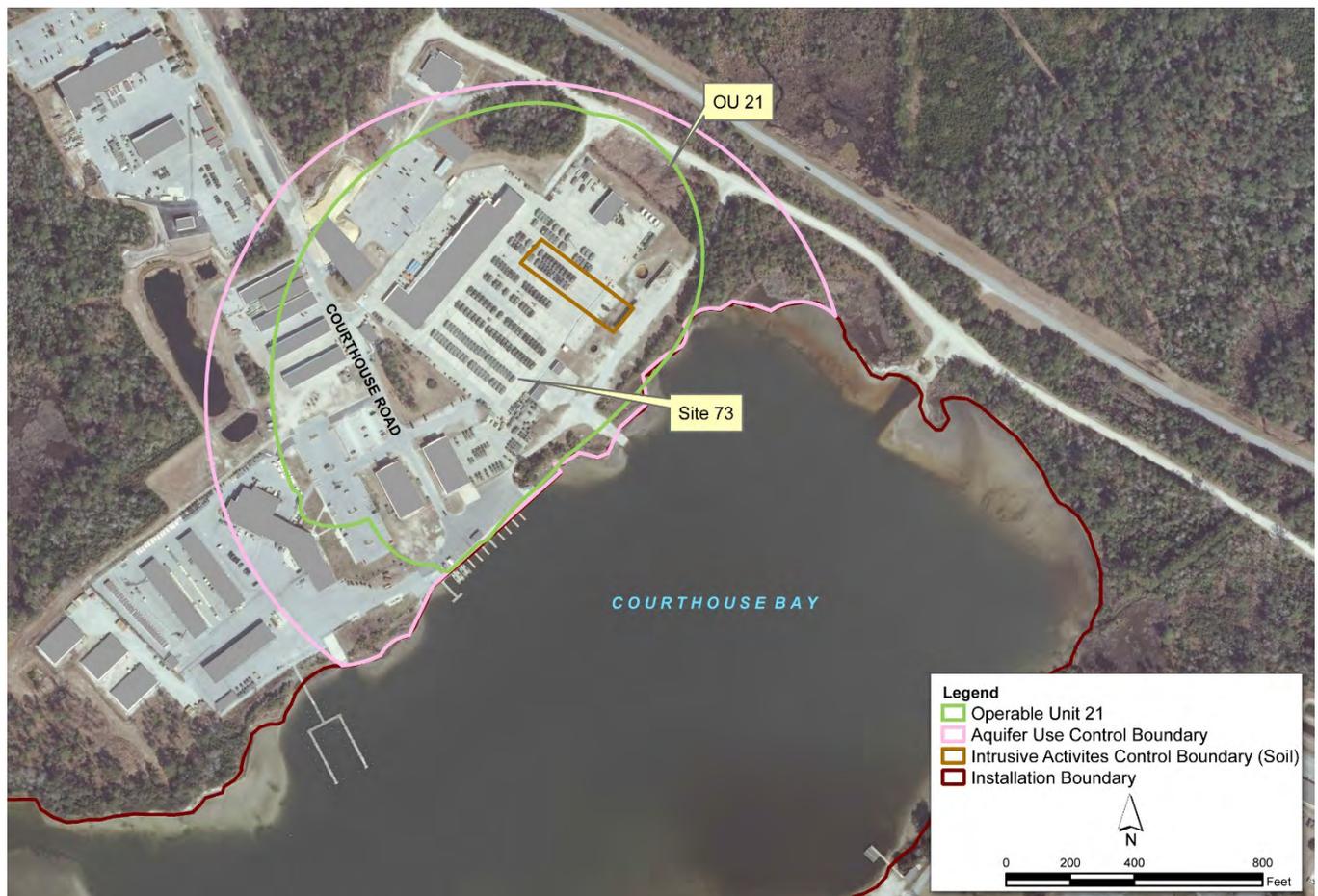
8.1.18.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.19 Site 73 (OU 21)—Courthouse Bay

Site 73, the Amphibious Vehicle Maintenance Facility covers approximately 14 acres located along the northwest shore of Courthouse Bay (**Figure 8-24**). The Amphibious Vehicle Maintenance Facility was constructed in 1946. Maintenance activities were historically conducted in the former Building A3 located southeast of the current Building A47. Used motor oil and battery acid resulting from maintenance activities were reportedly discharged directly to the ground surface northeast of former Building A3. Between 1983 and 1989, Building A3 was demolished and a new building was constructed. Based on the nature of maintenance activities conducted and CVOCs identified in groundwater, it is likely that other hazardous substances including chlorinated solvents, were also disposed of in this area. Ten USTs containing various petroleum hydrocarbon products (diesel fuel, gasoline, and/or waste oil) were formerly located at Site 73 to support the operations. All USTs except A47-1 have been removed (approximate location of A47-1 is within the footprint of the former maintenance building). UST A47-1 is currently not in use and is believed to be closed in-place. NCDENR issued NFA for five of the USTs (A47-2, A47-4, A47-5, A-2, and A-10/SA26). Investigations are currently being completed under the UST Program for four of the USTs (A47-3, UST-A47/SA21, A12-1, and A12-2). Significant development of the Courthouse Bay area surrounding Site 73 has occurred in the last 10 to 15 years and the current land use is industrial.

FIGURE 8-24
IRP Site 73, OU 21



Previous investigations are listed in **Table 8-37** and the LUC summary is presented in **Table 8-38**.

TABLE 8-37
Previous Investigations Summary, IRP Site 73

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. A review of historical records, aerial photographs, and field inspections found that an estimated 400,000 gallons of waste oil was discharged directly onto the ground surface. Approximately 20,000 gallons of waste battery acid was also reportedly disposed in the area. Therefore, Site 73 was recommended for additional study.
Confirmation Study (ESE, 1990)	1985 - 1990	To confirm the presence or absence of contamination groundwater samples were collected in areas where washing had occurred, or locations of existing or suspected former USTs. Results indicated that shallow groundwater was impacted by VOCs and metals.
UST Investigations	1991 - 1993	Between 1991 and 1993, several UST investigations were completed, which included the collection of soil and groundwater samples in the vicinity of several USTs at the site. Analytical results identified TPH and benzene, toluene, ethylbenzene, and total xylenes (BTEX) compounds in soil and groundwater.
Preliminary Investigation	1994	A soil gas survey and groundwater screening program were conducted. The analytical results identified nine AOCs at Site 73, segregated by potential sources of contamination.
Remedial Investigation (Baker, 1997)	1997	Surface soil, subsurface soil, groundwater, sediment, and surface water samples, and benthic and aquatic species were collected to evaluate the nature and extent of contamination and potential risks to human health and the environment. Several VOCs were identified as COCs in groundwater, and the HHRA identified potential risk to future receptors. The ERA identified a potential risk to terrestrial receptors due to contaminants in soil and surface water.
Feasibility Study (Baker, 1998)	1998	Groundwater sampling was conducted for further delineation. Results indicated that natural attenuation was occurring. The shallow benzene plume was stable and decreasing in concentration; and the shallow CVOC AOC had not changed in shape or size but was not fully delineated. The Supplemental Groundwater Investigation concluded that additional delineation was necessary and recommended a Natural Attenuation Evaluation (NAE). Remedial alternatives were developed and presented in an FS to mitigate the potential for direct exposure and to treat impacted groundwater.
Groundwater Modeling Report (Baker, 1998)	1998	Groundwater modeling was conducted to predict the fate and transport of CVOCs. The results indicated that natural degradation was occurring in the deep aquifer zone and that intermediate and deep groundwater was discharging to Courthouse Bay and the New River.
Long-term Monitoring Optimization Report (CH2M HILL, 2005)	2000 - 2005	LTM of CVOCs and benzene in shallow, intermediate, and deep groundwater was conducted to verify the plumes were stable and not expanding. Because of ongoing investigations at Site 73, LTM was discontinued.
Natural Attenuation Evaluation Study (Baker and CH2M HILL, 2002)	2002	A study was conducted to evaluate the extent and rate of natural attenuation. Benzene was the only fuel-related compound detected in the shallow and intermediate aquifer zones; it was degrading by natural, <i>in situ</i> processes and was not discharging to Courthouse Bay. Reduced levels of TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) and their patterns of occurrence in the shallow aquifer zone, were indicative of natural attenuation, but the potential for VC to discharge into Courthouse Bay was identified. TCE, cis-1,2-DCE, and VC were identified in the intermediate aquifer zone but were considered not likely discharging to Courthouse Bay. Additional delineation was recommended to verify the extent of impacts.
Technology Evaluation and Pilot Study Project Plans (CH2M HILL, Baker, and CDM, 2003)	2003	Potential remedial options were evaluated for treatment of intermediate groundwater with TCE concentrations above 1,000 micrograms per liter ("hot spot" area). Five treatment technologies (ISCO using permanganate, abiotic reduction using colloidal iron injection, ERD promoted by hydrogen release compound, bio-augmentation, sparging with hydrogen, cometabolic sparging with air and propane, or sparging with ozone using horizontal wells) were evaluated based on effectiveness, site constraints, depth of the contaminant mass, presence of underground utilities, land use, and cost. Hydrogen sparging delivered via an HDD well was recommended

TABLE 8-37

Previous Investigations Summary, IRP Site 73

Previous Investigation/Action	Date	Activities
Hydrogen Sparging Pilot Study (MicroPact, Baker, 2006)	2003 - 2006	A 900-foot-long horizontal well with 400 feet of screened area was installed to a depth of 85 feet bgs in the "hot spot" area. Approximately 40 hydrogen injections were completed in 2004 and 2005. The average TCE concentration decreased by approximately 35 percent, and the average total VOC concentration decreased by approximately 8 percent.
Phase 2 Pilot Study (AGVIQ/CH2M HILL, 2008)	2008	A pilot study was conducted to evaluate air and ozone sparging for removal of CVOCs present in the "hot spot" area using the existing HDD well. Results indicated that TCE concentrations in the intermediate aquifer zone decreased by 75 percent, with ERD and sparging being the primary treatment mechanisms.
Supplemental Remedial Investigation (CH2M HILL, 2009)	2006 - 2009	An SRI was completed to summarize the nature and extent of impacts and potential risks to human health and the environment. Primary COCs identified were VOCs (TCE, cis-1,2-DCE, 1,1-DCE, VC, and benzene) within the Castle Hayne aquifer. Soil samples were collected to delineate the extent of petroleum-related impacts. No significant source of free-phase petroleum was identified; however, an area of petroleum hydrocarbon-impacted soil was delineated in the area corresponding with historical waste oil discharge. The source of contamination was likely from multiple surficial spills associated with maintenance activities that occurred before the concrete-paved parking area was constructed.
Feasibility Study (CH2M HILL, 2009)	2009	Potential remedial alternatives were identified to address CVOCs in groundwater and petroleum hydrocarbon-impacted soil. Four remedial alternatives were selected for detailed comparative analysis: (1) no action, (2) MNA, (3) ERD using existing horizontal well and downgradient ERD injections, and (4) air sparging with downgradient ERD injections.
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2009)	2009	A PRAP was issued in April 2009 to solicit public input on the preferred alternative (<i>in situ</i> air sparging using the horizontal well, downgradient ERD injections, LTM for MNA, and LUCs) and a public meeting was held. Questions received during the public meeting were general inquiries and no comments were received during the public comment period. The Final ROD was issued and signed in November 2009. The CSM is shown on Figure 8-25.
Remedy-in-Place and Interim Remedial Action Completion Report and Activities Summary (Shaw, 2011 and Osage, 2014)	2009-2014	The RD was prepared for <i>in situ</i> air sparging by the horizontal well, downgradient ERD injections, LTM and MNA, and LUCs. In FY 2010, the horizontal well was initiated for air sparging to treat the highest VOC concentrations in groundwater, and LUCs were finalized to prohibit aquifer use and exposure to soil until cleanup levels for UU/UE are achieved. Quarterly groundwater LTM and MNA for analysis of VOCs and NAIPs was initiated in 2010 to evaluate the effectiveness of treatment and monitor plume migration. ERD injections were completed in 2011 and an IRACR was submitted. The air sparge system was discontinued in 2012 when RAOs within the zone of influence were met, the ERD biobarrier was in-place, and the potential for air sparging to impact vapor intrusion at adjacent buildings existed. A second round of ERD injections was completed in December 2013 and an Interim Remedial Action Activities Summary was submitted (Osage, 2014).
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, CH2M HILL, 2011, and CH2M HILL, 2015)	2007 - 2015	Site 73 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Vapor intrusion was not identified as a significant pathway of concern for any of the buildings located in the vicinity of Site 73. However, during operation of the air sparge system, subsurface soil gas concentrations increased and additional sampling was conducted to confirm that the concentrations decreased since the system was shut down in 2012. Based on the 2013 sampling results, NFA was recommended.

TABLE 8-38

Land Use Control Summary, IRP Site 73

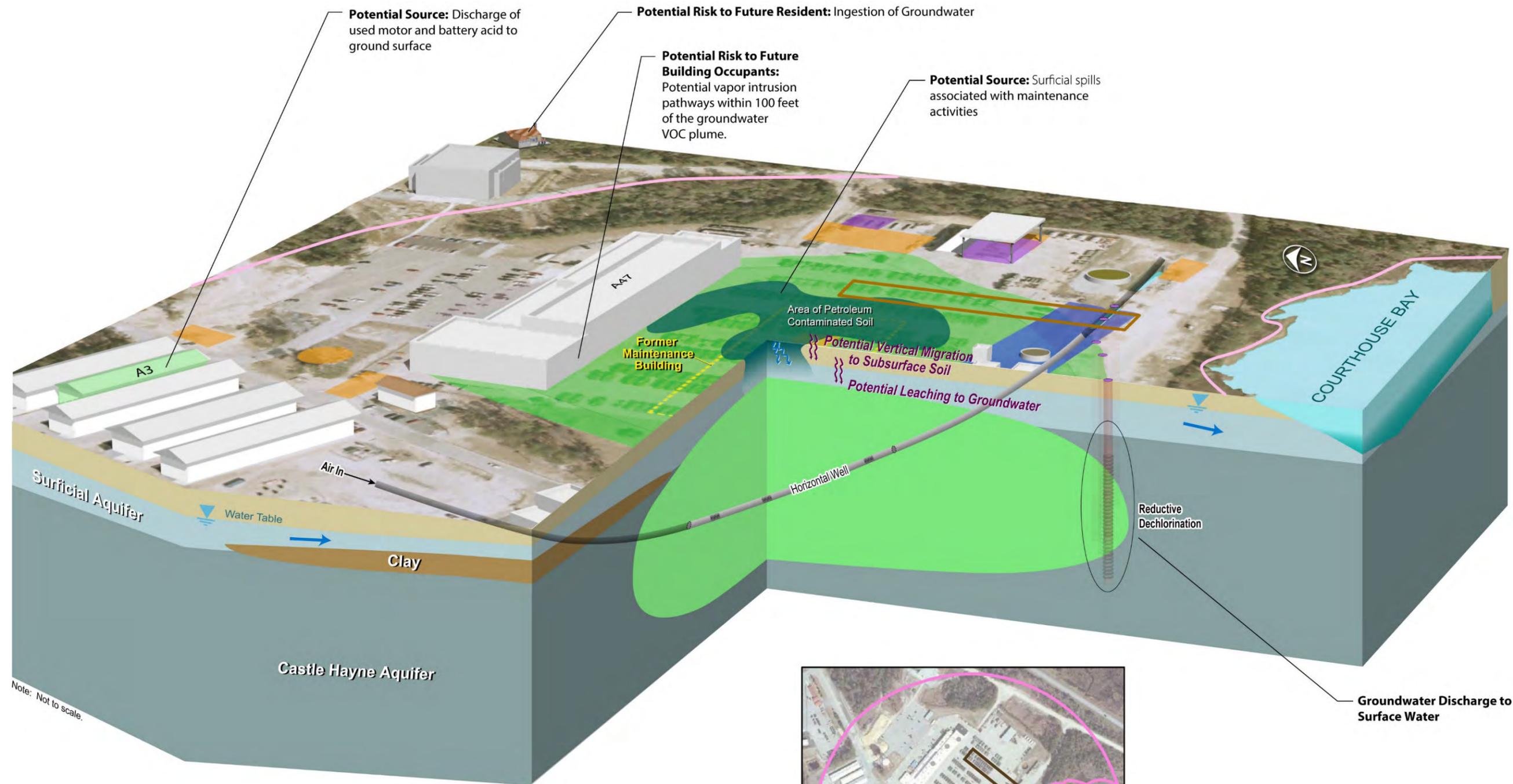
LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Intrusive Activities Control Boundary (Soil)	0.8	September 2010	August 2010
Aquifer Use Control (1,000 feet)	47.1		

8.1.19.1 Future Activities

Groundwater MNA will continue to assess trends in COCs for potential impacts to surface water, potential migration to the MCH aquifer, and to monitor for natural attenuation. LUC inspections will be conducted quarterly.

An industrial/non-industrial use control boundary for vapor intrusion will be added. If buildings are planned for construction in the vicinity of the VOC groundwater plume prior to the implementation of the LUC, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS, and all construction projects on-Base go through environmental review.

FIGURE 8-25
IRP Site 73 Conceptual Site Model



Note: Not to scale.

Legend			
	Horizontal Sparge Well - in operation from October 2010 to March 2012		ERD Biobarrier Injection Well
	Groundwater Flow Direction		Aquifer Use Control Boundary
	COC Plume (Based on FY 2013 LTM)		Intrusive Activities Control Boundary (Soil)
			Existing/Former UST
			Hazmat Storage
			Vehicle Washdown Areas

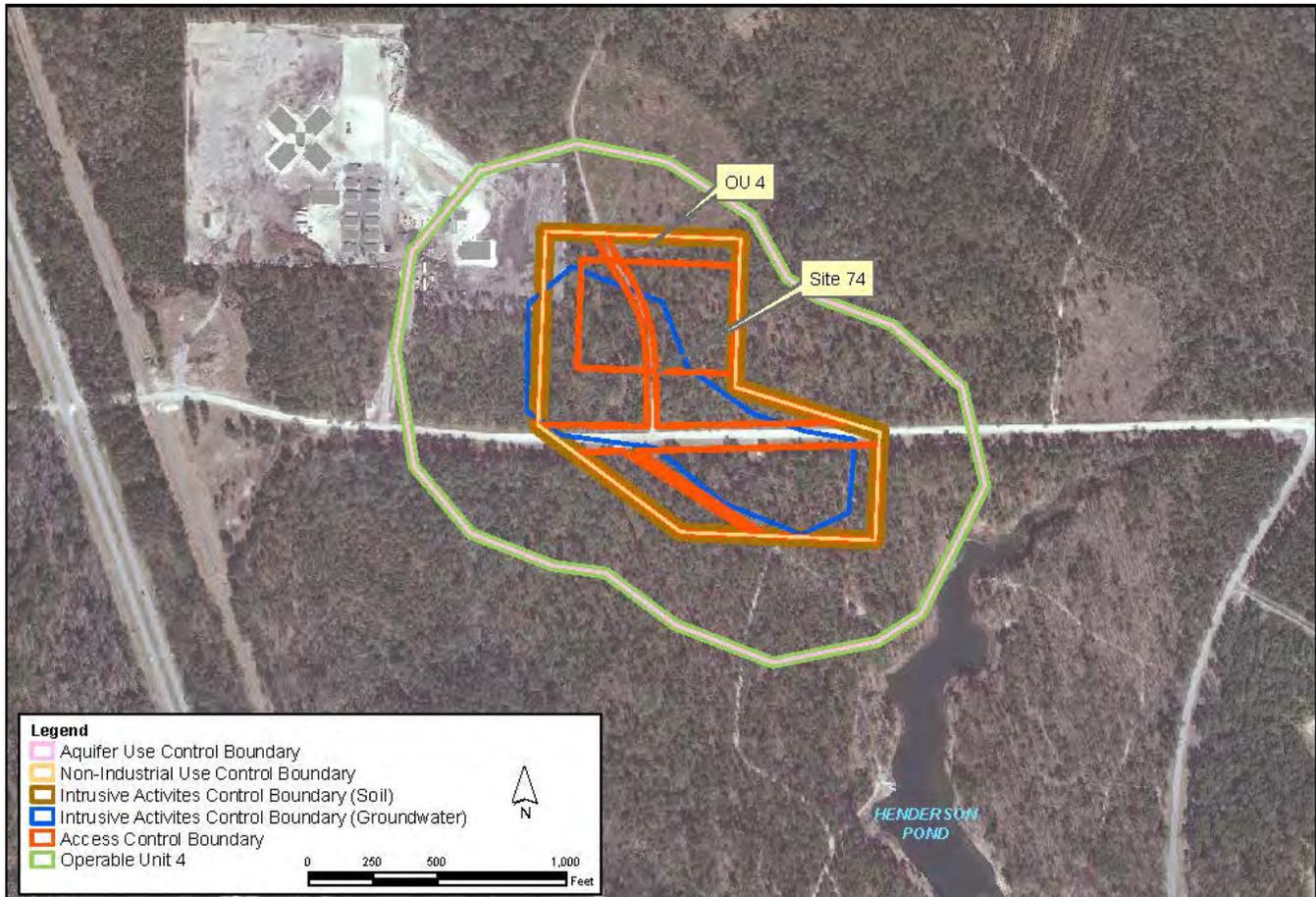


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8.1.20 Site 74 (OU 4)—Mess Hall Grease Dump Area

Site 74, the Mess Hall Grease Dump, was used from the early 1950s through the early 1960s and covers approximately 24 acres within OU 4 (**Figure 8-26**). OU 4 consists of two sites (Sites 41 and 74) that have been grouped together based on the unique characteristic of suspected waste. Grease from the mess hall at Site 74 was reportedly disposed of in trenches. It was also reported that drums containing PCBs and pesticide-soaked bags were buried near the grease pit. Estimates of quantities include 1,100 gallons of PCB oil, 50 to 500 gallons of DDT, and 2,200 gallons of drummed pesticides. One internal memorandum reports chemical training agents in the form of test kits were reportedly disposed at Site 74. A former Pest Control Area was also reportedly located in the southeastern portion of the site.

FIGURE 8-26
IRP Site 74, OU 4



Previous investigations are listed in **Table 8-39** and the LUC summary is presented in **Table 8-40**.

TABLE 8-39
Previous Investigations Summary, IRP Site 74

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that disposal of industrial wastes and pesticides could impact groundwater and recommended an additional investigation to verify the presence of hazardous wastes.
Confirmation Study (ESE, 1990)	1984 - 1990	The Confirmation Study included groundwater, surface water, and sediment investigations. O&G and phenols were detected in groundwater, surface water, and sediment samples. VOCs, metals, and one nitroaromatic were detected in groundwater samples.
Remedial Investigation/ Feasibility Study (Baker, 1995)	1993 - 1995	To further characterize the nature and extent of contamination an RI was conducted. Field activities included a geophysical investigation, soil, groundwater, surface water, and sediment sampling, and an aquatic and ecological survey. The geophysical investigation indicated that the site contained a significant amount of buried construction debris. Although there was reported history of CA disposal, no chemical surety degradation compounds were detected in soil. Potential human health risks were identified due to exposure to metals in groundwater and seep surface water. Minimal potential ecological risks were identified for aquatic receptors at Site 41. An FS was conducted to develop and screen remedial alternatives for addressing soil, groundwater, and surface water contamination.
Proposed Remedial Action Plan and Record of Decision (Baker, 1995)	1995	A PRAP was issued to solicit public input on the preferred alternative (LTM to monitor contaminant migration and LUCs) and a public meeting was held. The Final ROD was issued and signed in December 1995.
Remedy-in-Place and Remedial Action Completion Report (CH2M HILL, 2006)	1997 - 2011	LTM was initiated in 1997 and included sampling of five monitoring wells and eight surface water and sediment locations twice a year for analysis of VOCs, metals, TDS, and TSS. In 2005 the groundwater cleanup levels were achieved and LTM was discontinued. LUCs were implemented in 2001 and updated in 2002. A RACR was prepared to document the completion of LTM. A fence was installed around the perimeter of the site in 2008 to restrict access and additional fencing was installed in 2011 along both sides of the access road leading to Henderson Pond.
Confirmatory Sampling (CH2M HILL, 2012)	2012	Soil samples were collected from beneath the access road area through Site 74 leading to the proposed Henderson Pond and Hickory Pond recreational area to evaluate potential risks to human health and the environment. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. The HHRS indicated that exposure to soil by the most likely potential receptors, construction workers, was not expected to result in any unacceptable risks. Future residential (and potentially recreational) exposure to SVOCs and pesticides in soil may result in unacceptable risk to human health. Additionally, ecological exposure to pesticides/PCBs in soil may pose a potential risk. However, any exposures other than by construction workers are unlikely because the soil is beneath 0.5 to 1 foot of gravel and LUCs are in place to prevent intrusive activities and residential development.
Henderson Pond/Hickory Pond Investigation Report (CH2M HILL, 2013)	2012 - 2013	In 2012, an additional investigation was conducted based on potential risk to human and ecological receptors identified during the confirmatory sampling (Phase 1). Surface/subsurface soil, sediment, surface water, and fish tissue samples were collected and analyzed for metals, PCBs, pesticides, SVOCs, and/or VOCs. Based on risk assessments conducted using these data, direct exposure to soil within the proposed recreational improvement areas and sediment and surface water in Henderson and Hickory Ponds do not result in unacceptable risks to human health and the environment. Carcinogenic risks associated with ingestion of fish from either Henderson or Hickory Pond by adults, children, and lifetime anglers are within acceptable USEPA levels. However, ingestion of fish from Henderson or Hickory Pond, based on reasonable maximum exposure assumptions, would result in non-carcinogenic hazards above acceptable USEPA levels for adults and children. The hazard is associated with non-dioxin like PCBs for Henderson Pond and mercury for Hickory Pond. Anglers are notified of potential risk from consumption of fish, consistent with advisories already in place for North Carolina, through flyers posted at the Game Wardens Office and signage along the ponds.

TABLE 8-40
Land Use Control Summary, IRP Site 74

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	23.8		
Intrusive Activities Control Boundary (Groundwater)	13.9		
Intrusive Activities Control Boundary (Soil)	23.8	July 2002	February 2002
Aquifer Use Control Boundary (500 feet)	71.2		
Access Control Boundary	20.5		August 2011

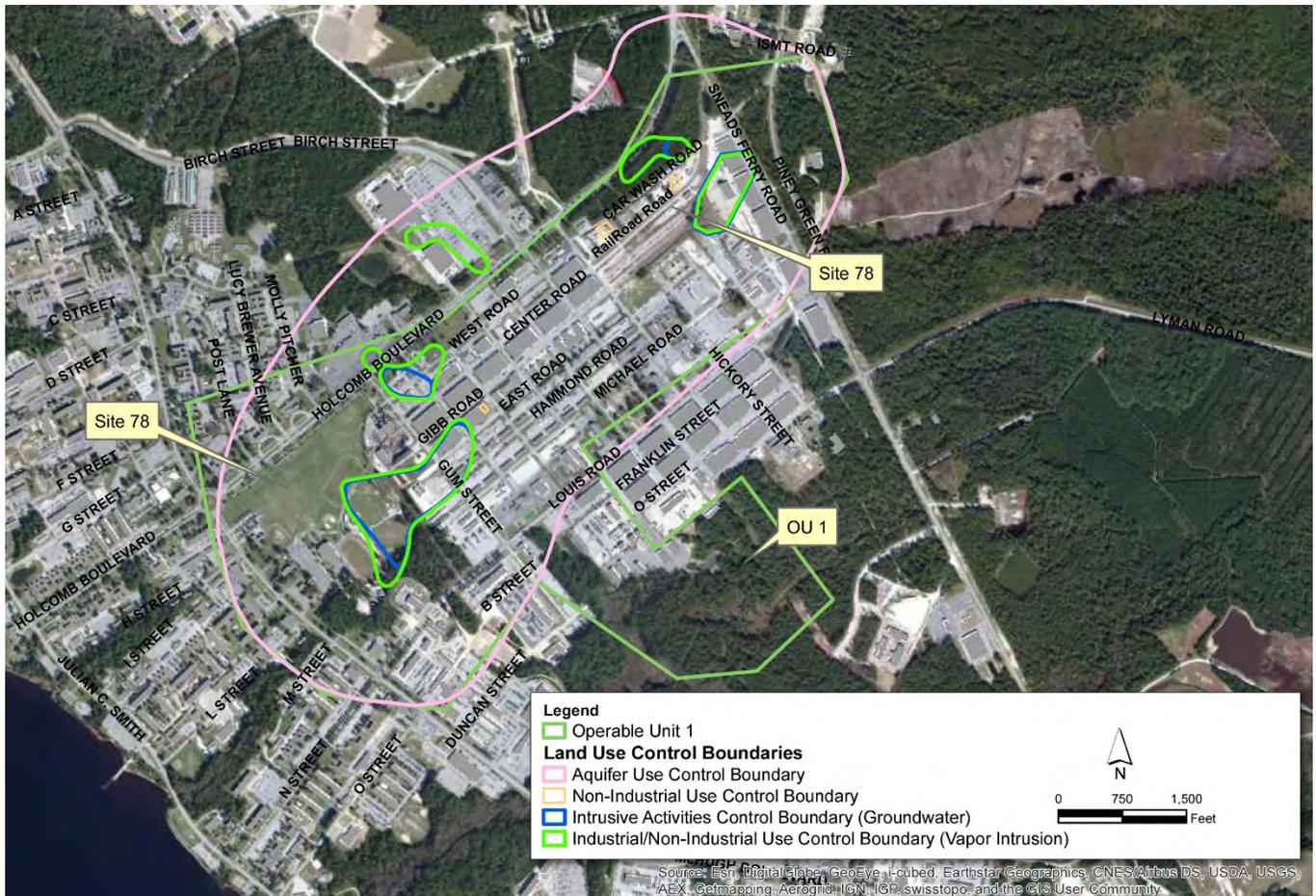
8.1.20.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.21 Site 78 (OU 1)—Hadnot Point Industrial Area

Site 78, the HPIA, covers approximately 590 acres and is located within OU 1, 1 mile east of the New River and 2 miles south of North Carolina Highway 24 (Figure 8-27). OU 1 consists of three sites (Sites 21, 24, and 78) that have been grouped together into one OU because of their proximity to one another. The HPIA, constructed in the late 1930s, was the first developed area at MCIEAST-MCB CAMLEJ. The HPIA consists of maintenance shops, warehouses, painting shops, printing shops, auto body shops, and other small industrial facilities. Due to the industrial nature of the site, many spills and leaks have occurred over the years. Most of these spills and leaks have consisted of petroleum-related products and solvents from USTs and drums.

FIGURE 8-27
IRP Site 78, OU 1



Previous investigations are listed in **Table 8-41** and the LUC summary is presented in **Table 8-42**.

TABLE 8-41
Previous Investigations Summary, IRP Site 78

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS recommended additional investigations based on historical operations in HPIA.
Interim Remedial Investigation/Interim Feasibility Study/Interim Proposed Remedial Action Plan /Interim Record of Decision for Surficial Aquifer (Baker, 1992)	1984 - 1992	Several investigations were conducted to evaluate the nature and extent of the threat to human health and the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants. Field events included a geophysical survey and groundwater and soil sampling. Elevated levels of organic compounds (primarily PCBs, pesticides, and VOCs) and inorganic compounds (metals) were identified throughout OU 1 in various media. Potential unacceptable human health risks were identified due to VOCs in groundwater. The preferred alternative for addressing the shallow groundwater VOC contamination was groundwater extraction and treatment systems to prevent migration of the VOC plumes in the shallow groundwater at Site 78 North and Site 78 South and LUCs to prevent exposure to groundwater. The IROD was signed on September 23, 1992.
Remedial Investigation/ Feasibility Study, Proposed Remedial Action Plan, Record of Decision (Baker, 1994)	1984 - 1994	Additional investigations and risk assessments were conducted to define the nature and extent of contamination in soil and groundwater. Potential ecological risks were identified based on exposure to pesticides and PCBs in soil. Potential human health risks were identified for future residents due to exposure to VOCs in groundwater at Site 78. The Final ROD for addressing soil and groundwater at OU 1 was signed September 15, 1994. The selected remedy was excavation and offsite disposal of pesticide and PCB-contaminated soil to achieve industrial cleanup levels, continuation and expansion of the groundwater extraction/treatment systems at Site 78 North and Site 78 South, LTM, and LUCs.
Explanation of Significant Differences (Baker, 1995)	1995	An ESD was issued to revise the cleanup level for PCBs to the federal PCB action level for industrial sites due to the industrial nature of site activities.
Notice of Non-significant Changes (United States Marine Corps, 1997)	1997	A Notice of Non-significant Changes was submitted that identified ROD changes including removal of heptachlor epoxide, metals, TSS, TDS, and O&G from the LTM program.
Optimization Study	2000	The optimization study recommended shutting down operation of the Site 78 South system in the short term and shutting down the Site 78 North system when mass removal from recovery wells reached asymptotic levels. The recommendations were not implemented; however, additional delineation, NAE, and pilot studies were planned.
Natural Attenuation Evaluation (CH2M HILL, Baker, and CDM, 2002)	2001 - 2002	Based on the findings of the LTM sampling, an NAE was conducted to further delineate the contaminant plume and to determine whether natural attenuation of CVOCs was occurring. Field activities included groundwater sampling for VOCs. The NAE concluded that there was evidence for natural attenuation processes occurring at the site.
Draft Oxygen Release Compound and Hydrogen Release Compound Pilot Studies/Pilot Study Report (Baker and CH2M HILL, 2005)	2003 - 2005	Two pilot studies were initiated to evaluate effectiveness of in situ technologies to remediate chlorinated compounds in groundwater. The pilot study performed at Site 78 North included injection of oxygen release compound into groundwater at locations with VC concentrations higher than 1,000 milligrams per liter. The pilot study performed at Site 78 South included the injection of hydrogen release compound, into groundwater at locations with TCE concentrations greater than 1,000 milligrams per liter. The final Pilot Study report reported that the concentration of VC in groundwater at Site 78 North was reduced by 25 to 50 percent and that the concentration of TCE in groundwater at Site 78 South was reduced by an order of magnitude at the majority of wells, but dechlorination was not complete and appeared to stall at the DCE daughter product.
Remedy-in-Place	1995 - present	The soil excavation to remove pesticide and PCB-contaminated soils was completed in 1995. The groundwater extraction and treatment systems at Site 78 North and South have been in operation since 1995. Groundwater LTM for VOCs and NAIPs was implemented in 1995 and is ongoing on a quarterly and annual basis. LUCs were implemented in June 2001 and updated in July 2002 to prohibit soil and groundwater use at Site 78. The current CSM is shown on Figure 8-28.
Hadnot Point Industrial Area Evaluation (CH2M HILL, 2010)	2009 - 2010	An extensive groundwater investigation was conducted across the HPIA to assess the current CVOC and petroleum hydrocarbon impacts and identify any data gaps. The report recommended expansion of the LTM program and LUC boundaries and treatment system optimization.

TABLE 8-41
Previous Investigations Summary, IRP Site 78

Previous Investigation/Action	Date	Activities
Plume Delineation (Rhēa, 2011)	2009 - 2011	A field screening was conducted to further delineate VOCs in groundwater. Analytical results suggested that VOC contamination was present outside of the current LUC boundaries and recovery well and LTM network. Further investigation to confirm these results was recommended.
Hadnot Point Construction Area Risk Evaluation Update (CH2M HILL, 2012)	2012	During a MILCON PA/SI for the Hadnot Point Construction Area (HPCA; CH2M HILL, 2010) located within the HPIA of Site 78, potentially unacceptable risks were identified based on future residential exposure to PAHs and metals in surface soil and ecological exposure to metals in surface water and sediment located in a drainage feature. Additional risk evaluation was recommended and an ecological site survey was conducted. The evaluation concluded that concentrations of PAHs and metals detected in surface soil appear to be ubiquitous in nature and are present across the HPCA with no identified source; the potential human health risks were based on a reasonable maximum exposure, assuming direct contact with the highest concentrations, whereas the central tendency exposure, based on more realistic exposure duration, soil ingestion rates, and average concentrations, were within USEPA's acceptable ranges. Overall, risks to ecological receptors from exposure to surface soil, sediment, and surface water at the HPCA are considered low and significant impacts to receptor populations are unlikely. Based on these conclusions, NFA was recommended in the HPCA.
Historical Metals Evaluation (CH2M HILL, 2013)	2012 - 2013	In 2012, an evaluation of metals in groundwater was conducted based on recommendations of the Five-year Review. Groundwater samples were collected from monitoring wells in the LTM program and analyzed for total metals. Ten COPCs were identified in the surficial aquifer and one COPC was identified in the Castle Hayne aquifer. The report recommended the following: (1) collect additional groundwater samples for target analyte list metals analysis every 3 years as part of the LTM program; (2) redevelop IR78-RW09 and resample using techniques that minimize turbidity; and (3) further assess fate and transport in areas where previous activities may have affected geochemical properties.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, CH2M HILL, 2011, and CH2M HILL, 2015)	2007 - 2015	Site 78 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. VIMS were installed in three additional buildings (eight were previously installed under the UST Program) within the HPIA from November 2011 to February 2012 and system startup was conducted in 2012 to reduce the possibility of vapor migration into the buildings. Although vapor intrusion was not identified as a significant pathway of concern, additional sampling was recommended at Buildings 901, 1601, and 1606 to further evaluate the vapor intrusion pathway and/or assess temporal variability. Based on the 2013 monitoring results, NFA was recommended at Buildings 901 and 1606. Periodic monitoring was recommended at Building 1601 as part of LTM.
Supplemental Groundwater Investigation (CH2M HILL, 2014)	2011-2014	In 2011, a supplemental groundwater investigation was initiated to investigate if the LTM program and LUCs remain protective in the short term and support the future evaluation of alternative treatment technologies for long-term protectiveness. The investigation included monitoring well installation, groundwater sampling, a passive soil gas survey, and an MIP investigation. The results of the investigation indicated that the groundwater COC plumes are deeper and more widespread than conditions at the time of the ROD. As a result, recommendations for changes were made for the LTM program and LUC boundaries.
Land Use Control Implementation Plan Update (CH2M HILL, 2015)	2015	Based on results of the Groundwater Delineation Report, Site 78 LUCs were updated to encompass the current extent of VOC exceedances in groundwater and to evaluate future buildings and land use for potential vapor intrusion pathways. A LUCIP was prepared to document the updated LUCs. An updated Notice of Contaminated Site will be filed with Onslow County real property records in 2015.

TABLE 8-42
Land Use Control Summary, IRP Site 78

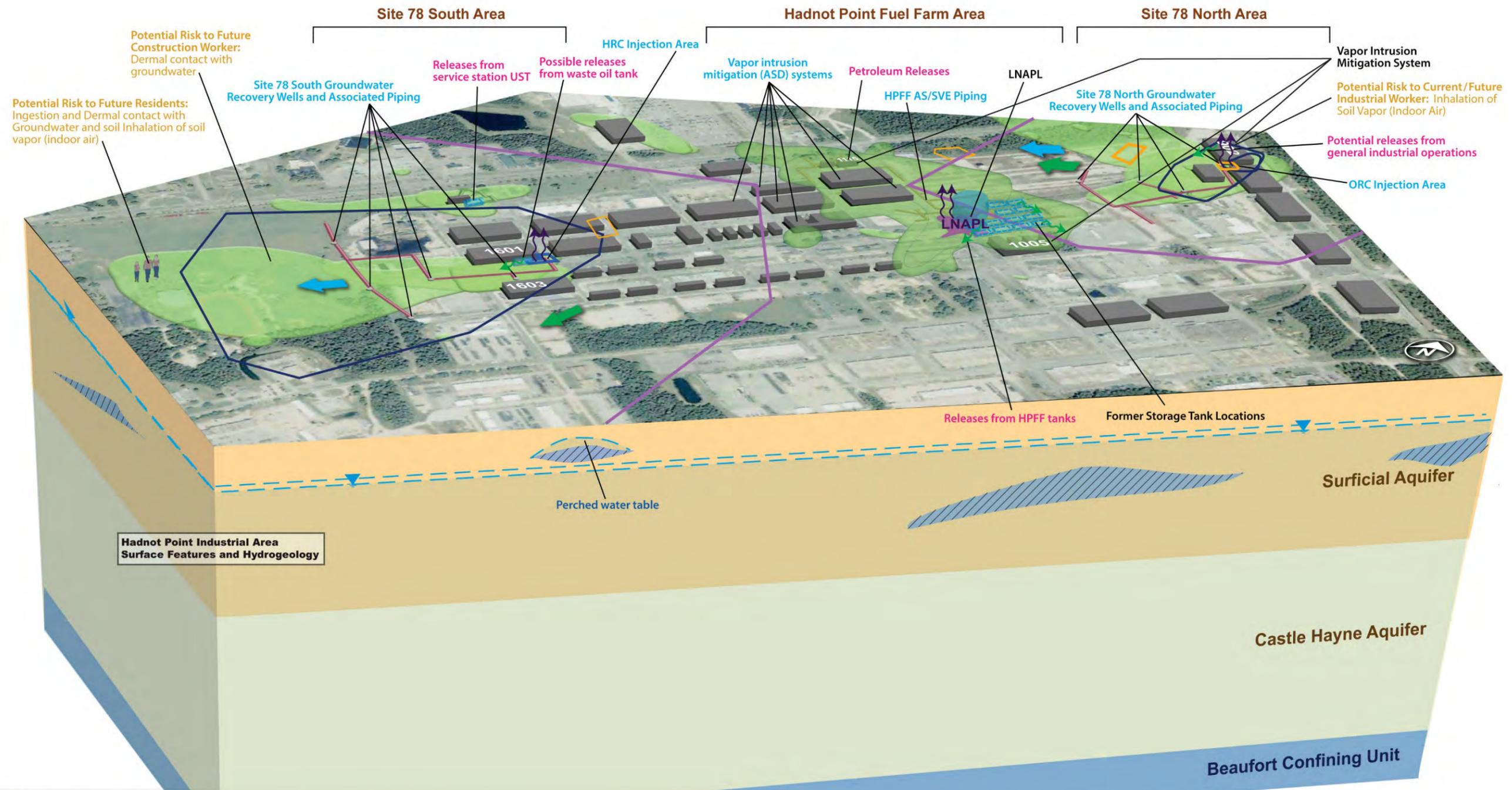
LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	0.7		
Intrusive Activities Control Boundary (Groundwater)	29		
Aquifer Use Control Boundary (1,000 feet)	720	January 2015	Pending
Industrial/Non-Industrial Use Control (Vapor Intrusion)	54		

8.1.21.1 Future Activities

A supplemental remedial investigation is being conducted to evaluate the current remedy and further refine the CSM. The remedy may be updated based on the additional investigation results and to incorporate LUCs for vapor intrusion.

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FIGURE 8-28
IRP Site 78 Conceptual Site Model



LEGEND

Water Table	VOC Plume (Based on 2013 SGI)	Remedial Actions and Treatments
Sand with Interbedded Silts and Clays	Clay	Potential Releases/Sources
Sands, Interbedded Limestone, and Partially Cemented Sand	Potential Vapor Intrusion Pathway	Potential Risks and Receptors
Groundwater Flow Direction	Aquifer Use Control Boundary	
Surficial Aquifer	Non-Industrial Use Control Boundary	
Castle Hayne Aquifer	Intrusive Activities Control Boundary	

ORC – Oxygen Release Compound
 HRC – Hydrogen Release Compound
 HPFF – Hadnot Point Fuel Farm
 AS/SVE – Air Sparge/Soil Vapor Extraction
 UST – Underground Storage Tank
 ASD – Active Sub-slab Depressurization

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8.1.22 Site 80 (OU 11)—Paradise Point Golf Course Maintenance Area

Site 80, the Paradise Point Golf Course Maintenance Area, encompasses approximately 3 acres northwest of Brewster Boulevard within OU 11 (**Figure 8-29**). OU 11 consists of two sites (Sites 7 and 80) that have been grouped together into one OU because of their similar disposal history and proximity to one another. Information regarding past maintenance procedures at Site 80 is unknown; however, the facility is currently in operation. Golf course maintenance operations which include the machine shop (a potential source of waste oils) and the routine spraying of pesticides and herbicides may have contributed to potential contamination at this site. It is unknown when the wash pad was constructed, and what the exact procedure was for cleaning the maintenance equipment prior to the construction of the wash pad. The facility is currently in operation as a maintenance facility for the Base golf course.

FIGURE 8-29
IRP Site 80, OU 11



Previous investigations are listed in **Table 8-43** and the LUC summary is presented in **Table 8-44**.

TABLE 8-43
Previous Investigations Summary, IRP Site 80

Previous Investigation/Action	Date	Activities
Site Investigation (Halliburton/NUS, 1991)	1991	An SI was conducted to determine the presence or absence of contamination at Site 80. Field activities included soil, groundwater, surface water, and sediment sampling for VOCs, SVOCs, pesticides/PCBs, herbicides, and TPH (surface water and sediment only). The analytical results identified pesticides and PCBs in soil, low level VOCs in groundwater and petroleum hydrocarbons in surface water. Based on these results, an RI was proposed.
Remedial Investigation (Baker, 1996)	1994 - 1996	An RI was completed to characterize the nature and extent of contamination and potential impacts to human health and the environment. Field activities consisted of a site survey, soil and groundwater sampling. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Pesticides were detected in soil samples. Low levels of pesticides, SVOCs, and metals were detected in groundwater. Potential unacceptable human health risks were identified due to the presence of pesticides in soil. No unacceptable ecological risks were identified.
Time-critical Removal Action (1996)	1996	Based on the potential human health risk identified in the RI, a TCRA was recommended to remove soil contaminated with pesticides to industrial levels. In July 1996, approximately 988 tons of contaminated soil was excavated and transported offsite to a disposal facility.
Proposed Remedial Action Plan and Record of Decision (Baker, 1997)	1996 - 1997	A PRAP was issued in November 1996 to solicit public input on the preferred alternative (no RAs) and a public meeting was held. The Final ROD for OU 11 (Sites 7 and 80) was issued and signed in August 1997.
Remedy-in-Place and Land Use Control Implementation Plan (CH2M HILL, 2007)	2007 - present	Although the ROD did not require RA, the soil remediation goals for the TCRA were based on industrial risk-based concentrations; to protect human health and the environment, the Base implemented LUCs in May 2007 to prohibit future exposure to surface and subsurface soil within the site boundary, including the previous soil removal action area.
Explanation of Significant Differences (CH2M HILL, 2012)	2012	An ESD was submitted in 2012 to document the LUCs as the remedy at Site 80.

TABLE 8-44
Land Use Control Summary, IRP Site 80

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	3.2	May 2007	February 2007
Intrusive Activities Control Boundary (Soil)	3.2		

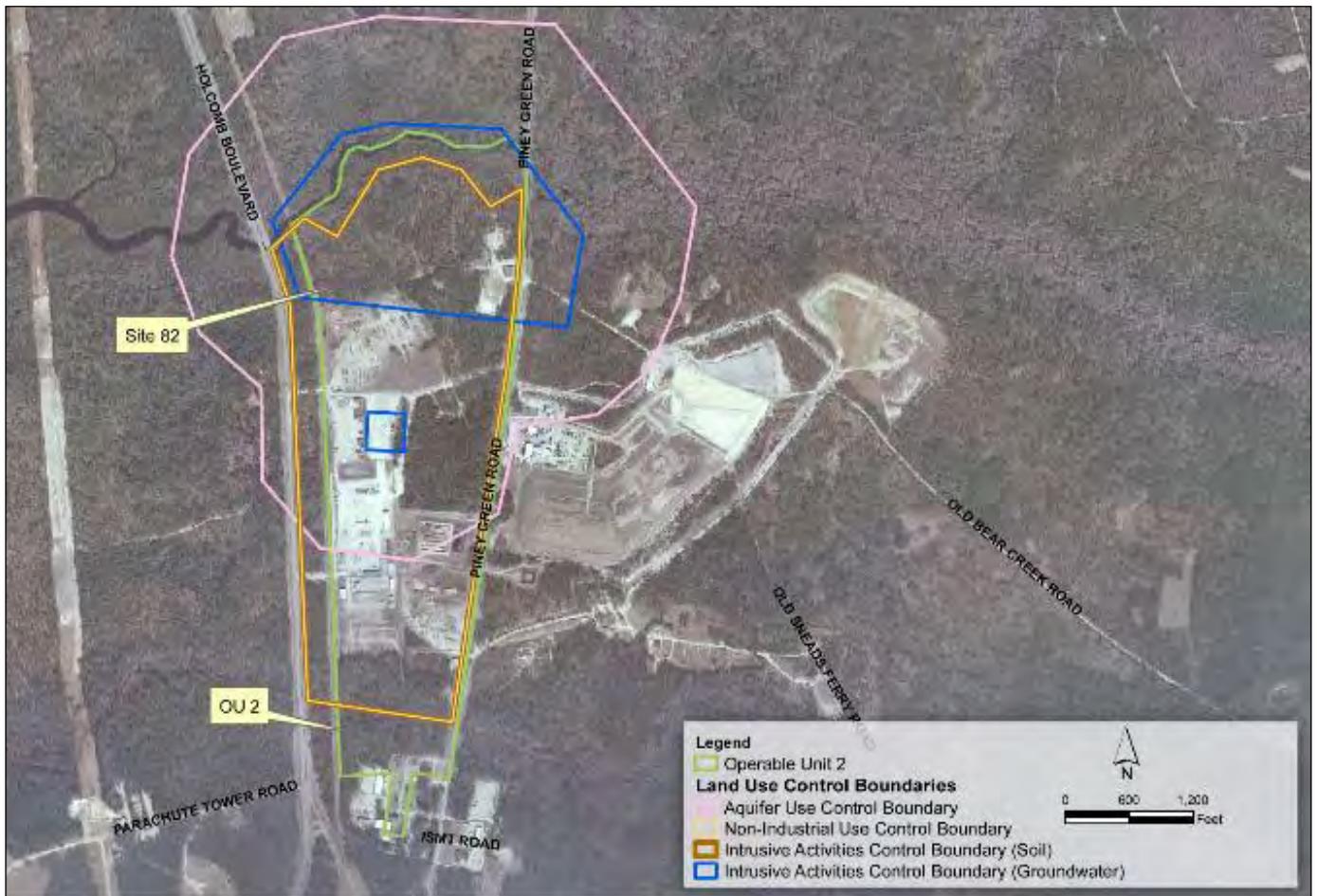
8.1.22.1 Future Activities

LUC inspections will be conducted quarterly.

8.1.23 Site 82 (OU 2)—Piney Green Road VOC Area

Site 82, the Piney Green Road VOC Area, covers approximately 30 acres and is located within OU 2 (**Figure 8-30**). OU 2 covers approximately 210 acres and consists of three sites (Sites 6, 9, and 82) that have been grouped together because of their proximity to one another. Before the late 1980s, much of the site was reportedly used for storage, disposal, and handling of potentially hazardous waste and material. Site 82 was identified during the confirmatory sampling at Site 6 in 1986, when Site 82 was randomly littered with debris including spent ammunition casings and empty or rusted drums. Some of the drums were marked as “lubrication oil” and “anti-freeze.”

FIGURE 8-30
IRP Site 82, OU 2



Previous investigations are listed in **Table 8-45** and the LUC Summary is presented in **Table 8-46**.

TABLE 8-45
Previous Investigations Summary, IRP Site 82

Previous Investigation/Action	Date	Activities
Site Investigation (Halliburton/NUS, 1991)	1991	An SI was conducted to determine the presence or absence of contamination. Field activities included soil, groundwater, surface water, and sediment sampling. VOCs were detected in surface water samples, which were considered attributable to activities conducted at Site 82.
Remedial Investigation/ Feasibility Study and Proposed Remedial Action Plan and Record of Decision (Baker, 1993)	1992 - 1993	An RI was completed to characterize the nature and extent of contamination and potential impacts to human health and the environment. Field activities included a preliminary site survey, a geophysical survey, soil, groundwater, surface water and sediment sampling. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Potential unacceptable human health risks were identified for current and future receptors due to exposure to soil and groundwater. Potential adverse ecological impacts were identified for Wallace Creek and Bearhead Creek. The FS was completed to address PCB and pesticide contaminated soil and VOC contaminated groundwater. The PRAP for OU 2 was submitted for public review and comment in August 1993. The preferred alternative was excavation and offsite disposal of pesticide and PCB contaminated soil to industrial cleanup levels, SVE to address vadose zone VOC contamination, groundwater extraction and treatment to address VOCs, LTM, and LUCs. The Final ROD for OU 2 was issued and signed in September 1993.
Remedy-in-Place	1994 - present	The soil excavation to remove pesticide- and PCB-contaminated soil was completed in 1994 and 1995. The SVE system operated for 6 months in 1996 to remediate residual VOC contamination in the vadose zone. The groundwater extraction and treatment system began full-scale operation in July 1996. Groundwater and surface water LTM began in 1997 and is ongoing. LUCs were implemented in 2001 and updated in 2002. The current CSM is shown on Figure 8-31.
Groundwater Pilot Study (CH2M HILL, 2008)	2007 - 2008	In February 2007, a groundwater pilot study was initiated at Site 82 to evaluate the performance of ERD via EVO and lactate injection and to determine whether it is a viable alternative to supplement, enhance, or replace the current groundwater extraction and treatment system. After the treatment system was turned off to implement the study, higher concentrations were identified elsewhere. Although the location of the pilot study was not optimal, the study demonstrated that ERD is a viable remedial technology for contaminant mass removal.
Potential Source Investigation (Rhēa, 2011)	2008 - 2011	The investigation was initiated to identify additional potential sources of CVOC contamination in groundwater at Site 82. During vegetation clearing activities, MD was discovered and an ESS was submitted to remove and dispose of the MD. An ESS Amendment was also submitted for OU 2. A geophysical survey, monitoring well installation, groundwater sampling, and test pitting was conducted. Soil samples collected from the test pits and groundwater samples were analyzed for VOCs. Cis-1,2-DCE, TCE, PCE, ethylbenzene, and tetrachloroethane (PCA) were detected at concentrations exceeding screening criteria.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009)	2007 - 2009	A Basewide Vapor Intrusion Study was conducted to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. At OU 2, no buildings were identified within 100 feet of a monitoring well containing VOC concentrations above NCGWQS.
Supplemental Investigation Report (CH2M HILL, 2015)	2012-2015	In 2012 and 2013, a supplemental investigation was conducted to evaluate the potential for additional VOC source material in soil and groundwater. Field activities included hydrogeologic testing and soil, groundwater, pore water and passive soil gas samples were collected and analyzed for VOCs. VOCs were detected at concentrations exceeding screening criteria in soil and groundwater samples and an area of high VOC concentrations was identified. In 2012, an evaluation of metals in groundwater was conducted based on recommendations of the Five-year Review. Groundwater samples were collected from the surficial aquifer and analyzed for target analyte list metals. Nine of the 22 detected metals exceeded the cleanup levels and background threshold values. Based on the results of these activities, additional horizontal and vertical delineation, groundwater modeling, and optimization of the existing groundwater treatment system are planned.

TABLE 8-46
Land Use Control Summary, IRP Site 82

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	206.75		
Intrusive Activities Control Boundary (Soil)	206.75		
Intrusive Activities Control Boundary (Groundwater)	99.4	July 2002	February 2002
Aquifer Use Control Boundary (1,000 feet)	404.91		

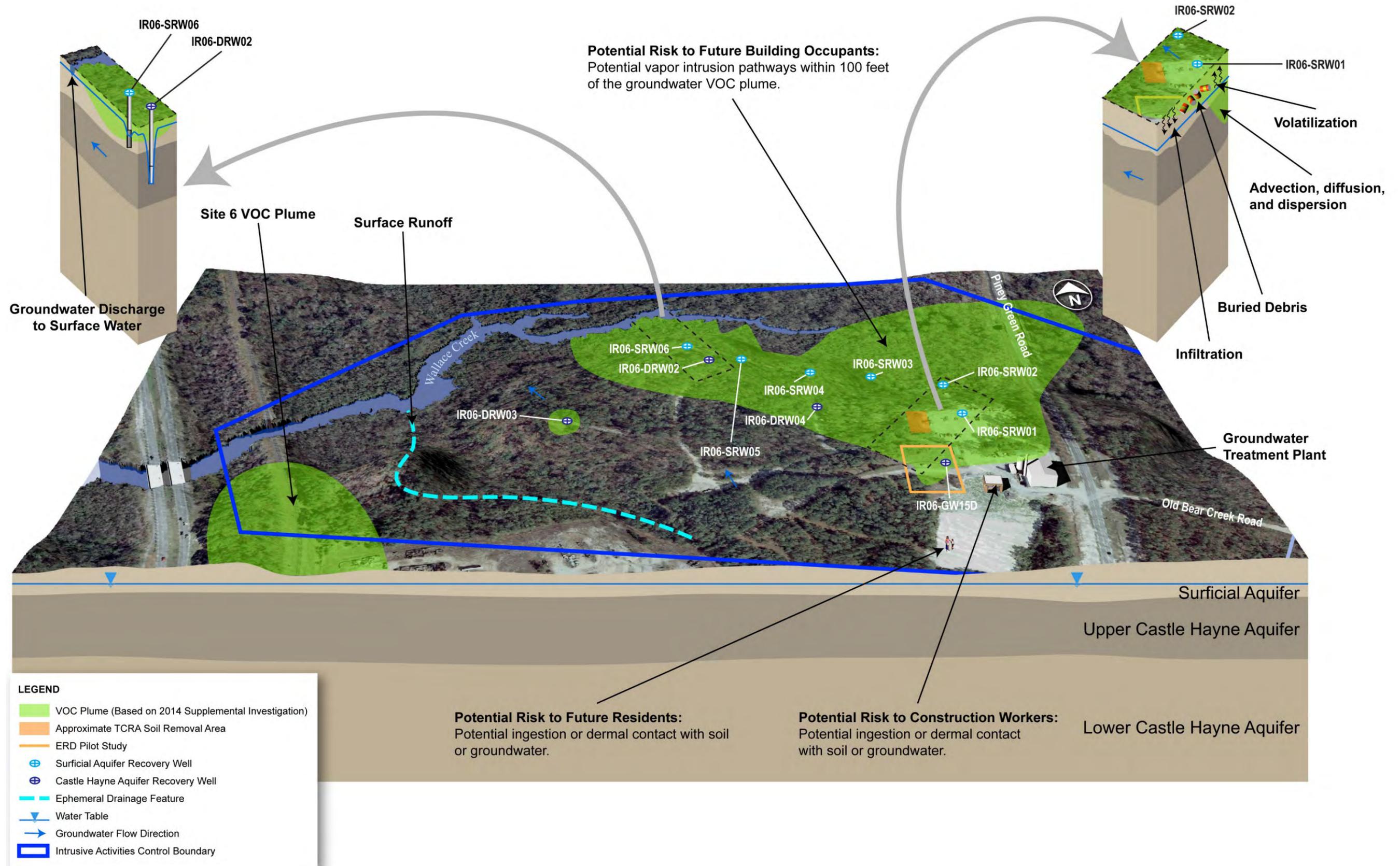
8.1.23.1 Future Activities

A supplemental remedial investigation and treatment plant evaluation is being conducted to further delineate the current extent of groundwater contamination and optimize current remedies. Human health and ecological risks will also be reevaluated during this additional investigation to evaluate the potential transport pathway of COCs to Wallace Creek. The remedy may be updated based on the additional investigation results and to incorporate LUCs for vapor intrusion and MEC/MPPEH.

If buildings are planned for construction in the vicinity of the VOC groundwater plume prior to the implementation of the vapor intrusion LUC, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed. Base Master Planning maintains current groundwater plume data in the GIS, and all construction projects on-Base go through environmental review.

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FIGURE 8-31
IRP Site 82 Conceptual Site Model

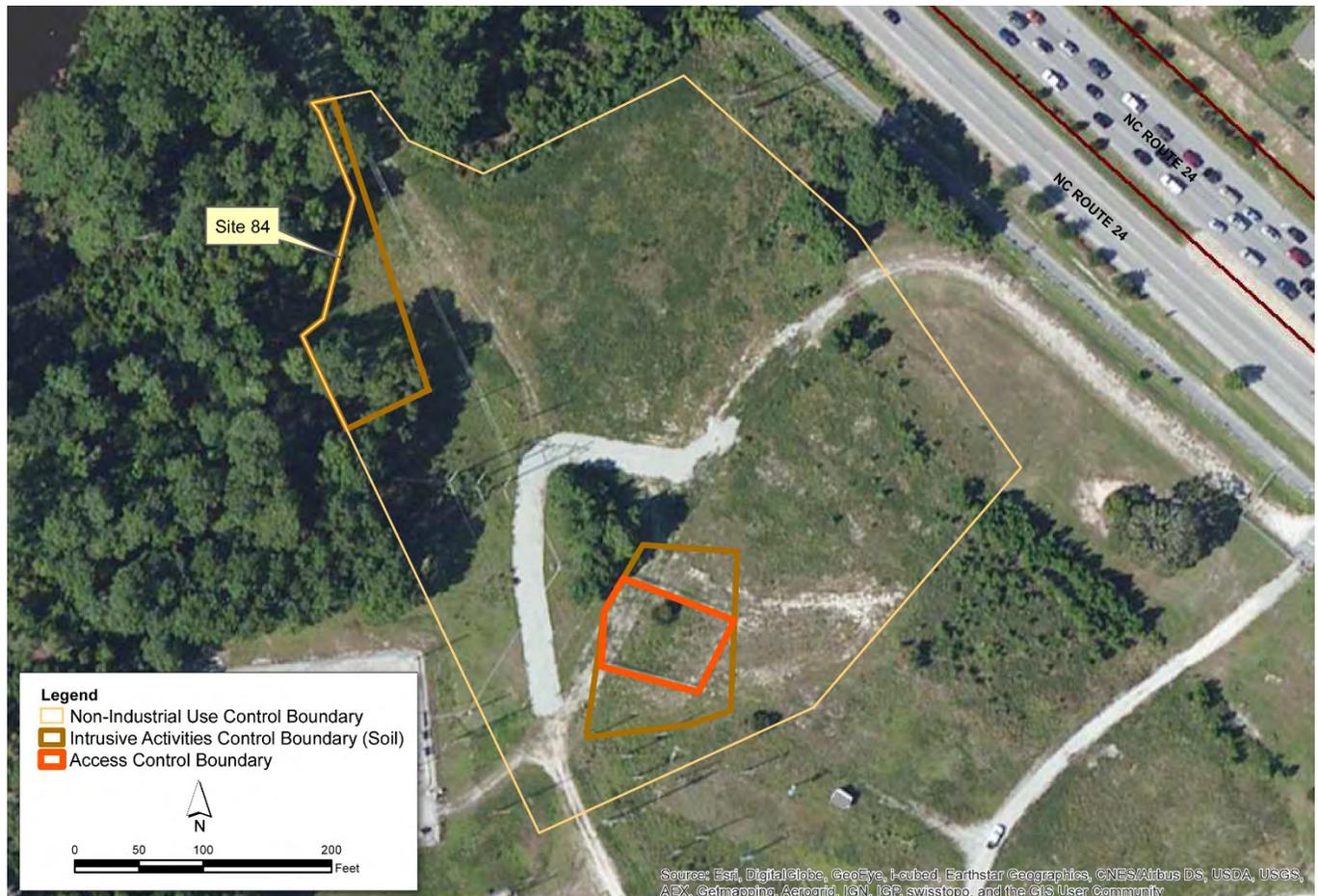


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8.1.24 Site 84 (OU 19)—Building 45

Site 84, Building 45, covers approximately 5 acres just south of North Carolina Highway 24, one mile west of the Main Gate (**Figure 8-32**). The property was purchased by the federal government in 1941 and Building 45 was a former electric substation, where transformers reportedly containing PCBs were used and possibly stored. The building was constructed by the Navy soon after purchasing the property, and leased to Tidewater Electric, who operated the building through 1965. In 1965, Building 45 was converted to a maintenance facility for large machinery. While no official operational history exists for the building and the surrounding property, former employees recalled that site activities included PCB transformer maintenance, recycling, and onsite disposal of spent transformer casings. A transformer was discovered near a wooded area and additional transformers (approximately 20), potentially containing PCB dielectric oil, were discovered near the woods of the powerhouse. Maintenance personnel at Building 45 have previously reported that additional transformers may still be buried in areas near a former lagoon; however, an excavation is reported to have been performed by Public Works Center personnel and no waste materials were discovered. In 2012, portions of the site were developed with a photovoltaic farm.

FIGURE 8-32
IRP Site 84, OU 19



Previous investigations are listed in **Table 8-47** and the LUC summary is presented in **Table 8-48**.

TABLE 8-47
Previous Investigations Summary, IRP Site 84

Previous Investigation/Action	Date	Activities
UST Investigation	1992	During a UST Investigation conducted in 1992, low levels of PCBs were detected in a soil sample collected from the area where a transformer was discovered.
Pre-Remedial Investigation Screening Study	1995 - 1998	A Pre-RI screening study was conducted to analyze the nature and extent of contamination. Field activities included soil, groundwater, surface water, and sediment sampling. Samples were analyzed for PCBs. PCBs were detected at levels above 500 parts per billion in soil collected from around the lagoon, and in surface water and sediment (above 1,000 parts per billion) collected from within the lagoon. Based on the results of the Pre-RI, a Draft EE/CA was prepared to present removal action options for the NTCRA of PCB-contaminated sediments and soil at Site 84. The EE/CA was not finalized and the removal action was delayed to allow for more complete PCB delineation at the site.
UST Removal	1999	In July 1999, a 500-gallon UST used for storing heating oil was removed in the vicinity of Building 45. Confirmatory soil samples identified petroleum hydrocarbons in the soil. The UST removal report concluded that the detected petroleum hydrocarbons might not be from the UST but rather from other unidentified source(s), based on the long industrial operation history at Building 45.
Building 45 Removal	1999	Concrete sampling and surface soil sampling was conducted at Building 45 in August 1999 in preparation for razing and offsite disposal of material from the aboveground portions of Building 45. Analytical results identified PCBs in the concrete. As a result, the aboveground portion of Building 45 was removed between August and September 1999, with the foundation left in place.
Remedial Investigation / Feasibility Study (Baker, 2002)	2001 - 2002	An RI was conducted to assess the nature and extent of contamination and potential human health and environmental impacts of the site. Field activities included soil and groundwater investigation. Potential unacceptable human health risks were identified due to the presence of PCBs and PAHs in surface soil and pesticides and metals in groundwater. Potential unacceptable ecological risks were identified due to the presence of pesticides, PCBs, and metals in soils and VOCs, SVOCs, and PCBs in sediments. The Final RI recommended completion of a NTCRA to remove surface soils surrounding Building 45, in the lagoon area, and in the midfield area, as well as removing the Building 45 foundation materials. The Final FS was completed in June 2002, which developed and screened remedial alternatives for addressing soil contamination.
Proposed Remedial Action Plan and Engineering Evaluation/Cost Analysis (2002)	2002	A PRAP was issued in 2002 to solicit public input on the preferred alternative for soil and groundwater contamination and a public meeting was held. Excavation and landfill disposal was the preferred alternative for soil recommended in the PRAP. Owing to the national debate between USEPA and DoD regarding enforcement issues of the LUCs, the Navy decided not to implement the preferred alternative from the PRAP. Accordingly an AM proposing removal actions was developed to address sediment and soil contamination.
Phase I Non-time-critical Removal Action (2002)	2002	Based on the recommendations of previous documents, an NTCRA was completed to remove the remaining building foundation at Building 45 and some surrounding PCB-contaminated soil. 4,857 tons of non-hazardous PCB-contaminated soil and 142 tons of petroleum-contaminated soil were removed from the site.
Phase II Non-time-critical Removal Action (TMS Envirocon and Baker, 2005)	2002 - 2005	Excavation and offsite disposal of contaminated soil and lagoon sediments was completed. Approximately 12,000 tons of contaminated soil/sediment was removed from the site. However remediation goals were not met because the Phase II NTCRA uncovered additional areas of contamination.
Supplemental Investigation and Recommendations Report (Rh § a, 2006)	2005 - 2006	A supplemental investigation was conducted and the geophysical investigation uncovered two underground pipes originating from the area of former Building 45. One of the pipes corresponded to the location of a concrete-encased steel pipe partially excavated during the Phase II NTCRA. PCB concentrations in soil samples collected from both pipes were less than 10 milligrams per kilogram (mg/kg) and the pipes were left in place. A confirmation groundwater sample collected during the investigation indicated no exceedances of the NCGWQS.

TABLE 8-47
Previous Investigations Summary, IRP Site 84

Previous Investigation/Action	Date	Activities
Phase III Non-time-critical Removal Action and Construction Closeout Report (Rhēa, 2007)	2006 - 2007	The Phase III NTCRA was conducted to remove additional PCB-contaminated soil to the south and west of the previous NTCRA locations. Complete excavation was deemed impractical in areas with buried, active utility and communication lines. In these areas, a 2-foot-thick vegetative soil cover was placed over the PCB-contaminated soil.
Amended Feasibility Study, Proposed Remedial Action Plan (Rhēa, 2008) and Record of Decision (Rhēa, 2009)	2008 - 2009	The Amended FS was conducted to evaluate remedial alternatives for addressing PCB soil contamination; the PRAP was completed, followed by a public meeting and public comment period to solicit community input on the preferred alternative: removal of PCB-contaminated soil and LUCs. The ROD was signed in 2009 and removal of PCB-contaminated soil and LUCs were identified as the selected remedy. Additionally, because the site is located within a utility corridor, the ROD indicated that once the utility corridor lease agreements are scheduled for renewal (2026), the affected utility companies will be notified of the contaminated area and given the option to either properly excavate and dispose of PCB contaminated soil and PCB waste soil or relocate their utilities outside of the PCB area of concern.
Remedy-in-Place and Remedial Action Completion Report (Rhēa, 2010)	2002 - 2010	Three NTCRAs were conducted from 2002 through 2006 to remove PCB-contaminated soil and a soil cover has been put in place across the site. In 2009, LUCs were implemented in the extent of PCB soil contamination greater than 10 mg/kg to restrict intrusive activities, and a fence and signs were installed to restrict access. LUCs were also implemented to prohibit non-industrial use in the extent of PCB soil contamination greater than 1 mg/kg.

TABLE 8-48
Land Use Control Summary, IRP Site 84

LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Non-Industrial Use Control Boundary (Soil)	4.6		
Access Control Boundary	0.14	May 2009	March 2010
Intrusive Activities Control Boundary (Soil)	0.55		

8.1.24.1 Future Activities

LUC inspections will be conducted quarterly. Additionally, the utility corridor lease agreements are scheduled for renewal in 2026.

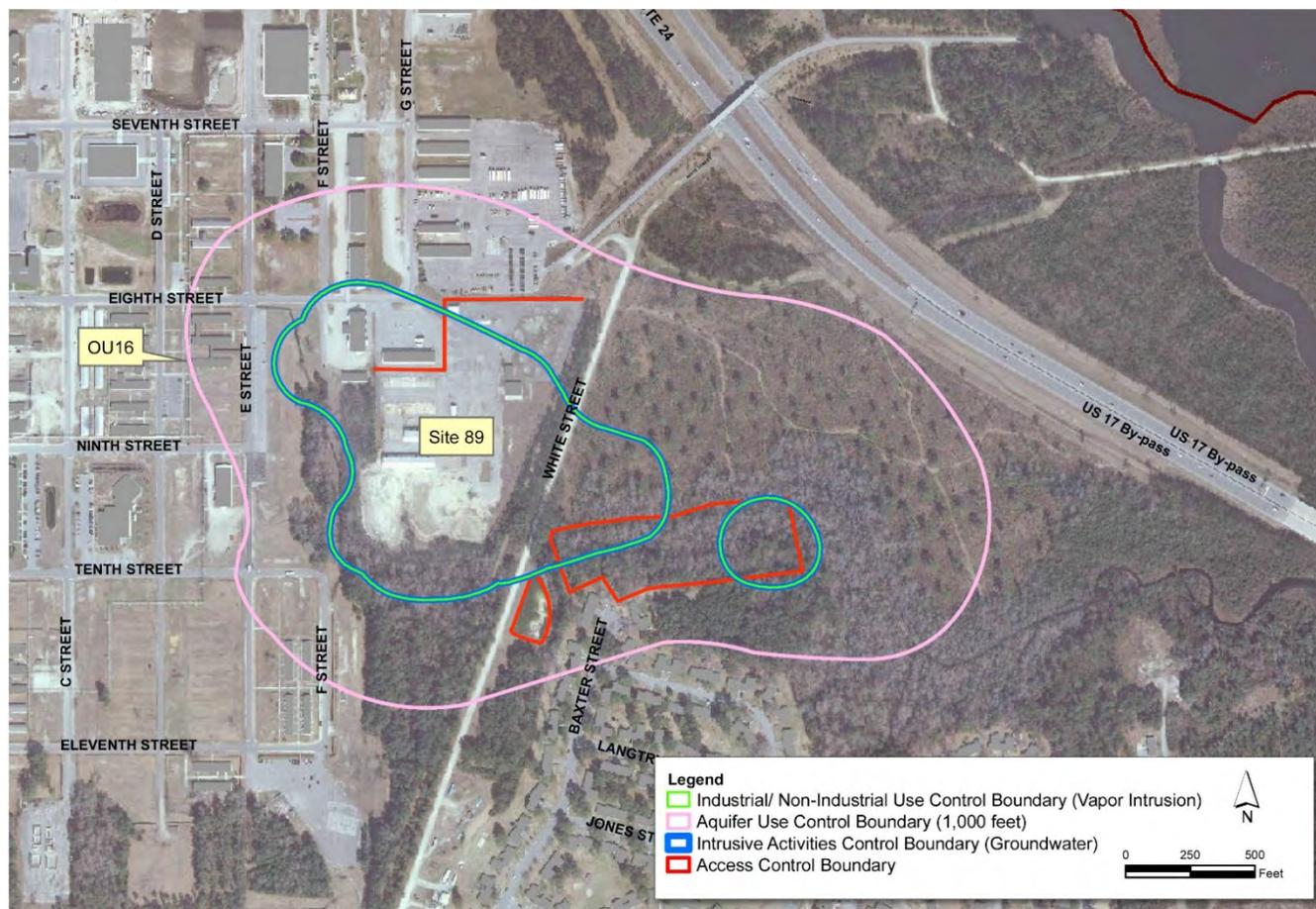
8.1.25 Site 89 (OU 16)—Former DRMO

Site 89, the former DRMO, covers approximately 50 acres within OU 16 (includes Site 89 and 93), which is located within Camp Geiger (**Figure 8-33**).

The Base motor pool operated on the site until 1988 and reportedly used solvents such as acetone, TCE, and 2-butanone (methyl-ethyl-ketone) for cleaning parts and equipment. A steel 550-gallon UST was used to store waste oil from 1983 until its removal in 1993. During removal, visible signs of contamination were observed and the contaminated soil was removed until groundwater was encountered. Other structures historically located in the former UST area include Building STC-867, which was used to store hazardous soil, and a wash rack with an associated drain and oil and water separator.

The DRMO was operated by the Defense Logistics Agency on the site until 2000. The area was used as a storage yard for items such as scrap and surplus metal, electronic equipment, vehicles, rubber tires, and fuel bladders. The former DRMO has been vacant since 2000. Currently, portions of Site 89 are used for storage and training.

FIGURE 8-33
IRP Site 89, OU 16



Previous investigations are listed in **Table 8-49** and the LUC summary is presented in **Table 8-50**.

TABLE 8-49
Previous Investigations Summary, IRP Site 89

Previous Investigation/Action	Date	Activities
UST STC-868 Investigation (R.E. Wright, 1994)	1994	A limited soil and groundwater investigation was conducted at UST STC-868 located within the Site 89 area. O&G was detected in soil and chlorinated solvents were detected in groundwater. The results were used to develop recommendations for additional assessment of Site 89 under the IRP.
Remedial Investigation (Baker, 1998)	1996 - 1998	A Focused RI was conducted to characterize the nature and extent of soil and groundwater contamination. Field activities included the collection of soil, groundwater, surface water, and sediment samples. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Results identified chlorinated solvent contamination in soil and groundwater. Potential human health and environmental risks were identified for future receptors due to exposure to CVOCs in groundwater and sediment.
Long-term Monitoring	1999 - 2003	Based on the results of the RI, LTM was implemented in order to assess plume stability. LTM was discontinued in 2003 due to the ongoing SI.
Post-Remedial Investigation	1999	A post-RI was conducted to further assess the VOC plume. Investigation activities included soil, groundwater, surface water, and sediment sampling. Samples were analyzed for VOCs. Results verified the extensive CVOCs contamination to the immediate and surrounding areas of the site. Soil sample results indicated that extremely high levels of CVOCs were affecting an extensive area within the southern portion of the site.
Low Temperature Thermal Desorption Time-critical Removal Action (2000)	2000	A TCRA was completed for the removal and treatment of vadose zone contaminants in the southern portion of the site. Low temperature thermal desorption units were used to treat the contaminated soil and roughly 32,000 tons were treated. In addition, an aeration system was installed in Edwards Creek to assist in the remediation of VOCs. The aeration system remains in place and is operational.
Supplemental Site Investigation (CH2M HILL, Baker, and CDM, 2001)	2001	An SSI was conducted in an area south of the DRMO. Soil and groundwater samples were collected for VOCs analysis. Two separate DNAPL plumes were identified.
Electrical Resistive Heating Pilot Study (Shaw, 2005)	2003 - 2005	The electrical resistance heating pilot study was conducted to treat one of the DNAPL plumes identified during the SSI. An estimated 48,000 pounds of VOCs were removed from the subsurface.
Treatability Study (CH2M HILL, 2008)	2006 - 2008	A treatability study was implemented to evaluate the performance and effectiveness of four remedial alternatives, including air sparging using an HDD well; PRB, using mulch/compost as backfill; chemical reduction via ZVI injection through pneumatic fractures; and ERD using a combination of sodium lactate and EVO, with direct-push emplacement. While air sparging and ERD reduced contaminant mass for a similar cost per volume treated, air sparging was the most practical technology for full scale implementation. The results of the studies will be used to develop a better exit strategy for the site, and to provide options for future treatment train approaches.
Comprehensive Remedial Investigation (CH2M HILL, 2008)	2006 - 2008	A Comprehensive RI was conducted to address previous data gaps. Field activities included an MIP investigation; monitoring well installation; slug testing; groundwater, soil, vapor, sediment, surface water, and pore water sampling; and a benthic community survey. TCE and 1,1,2,2-PCA and their respective degradation products were detected at elevated concentrations in soil, groundwater, and adjacent surface water and sediment from Edwards Creek. The HHRA identified potential human health risks based on hypothetical potable use of the groundwater and future residential exposure to subsurface soil, primarily from exposure to VOCs. The ERA identified potential ecological risks to benthic-dwelling organisms and amphibians from exposure to PAHs and pesticides in sediment in an adjacent wetland area. The RI recommended an FS be performed to evaluate remedial alternatives.

TABLE 8-49

Previous Investigations Summary, IRP Site 89

Previous Investigation/Action	Date	Activities
Non-time-critical Removal Action (AGVIQ/CH2M HILL, 2010)	2007 - 2010	In 2007, an EE/CA was prepared to evaluate removal action alternatives to reduce risks to human health and environment in the DNAPL source area. Five alternatives were evaluated and soil mixing with ZVI-clay addition was the selected NTCRA. A bench-scale study was conducted to optimize the amount of ZVI and clay for treatment. The area treated was 32,000 square feet (ft ²) at a depth of 25 feet, resulting in a total treated volume of 30,000 yd ³ . Follow-up monitoring has indicated significant reduction in VOC concentrations in the soil, groundwater, and adjacent creek.
Baseline Ecological Risk Assessment Addendum (CH2M HILL, 2008)	2008	Based on the results of the RI, additional sediment and surface soil samples were collected for PAHs and pesticides (dichlorodiphenyldichloroethane, dichlorodiphenyldichloroethylene, and DDT) analysis. Results confirmed an isolated area of elevated sediment contaminant concentrations posing potential ecological risks. The Final Baseline ERA Addendum was completed to document the results and the identified isolated risk.
EE/CA (CH2M HILL, 2009) and Non-time-critical Removal Action (CH2M HILL, 2010)	2009 - 2010	An EE/CA to address potential ecological risks in the adjacent western wetland area was submitted, identifying three alternatives for evaluation; no action, soil capping and LUCs, and excavation and offsite disposal. An AM was submitted documenting excavation and offsite disposal as the preferred NTCRA. The NTCRA was completed in 2009 to address the potential ecological risks in the western wetland area. After excavation, confirmation sampling was conducted and the results were below cleanup levels. Excavated soil was disposed of offsite.
Feasibility Study (CH2M HILL, 2012)	2011 - 2012	RAOs were developed to address VOC-impacted groundwater in the source and downgradient areas and surface water. The remedial alternatives evaluated for the source area were no action, ERD, ISCO, and air sparging. Downgradient groundwater alternatives were no action, MNA, and PRB with MNA. Surface water alternatives were no action, PRB, and aerators.
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2012)	2012	A PRAP was issued to solicit public input on the preferred alternative (including horizontal air sparging for source area groundwater, PRB for downgradient groundwater, and aerators for surface water). The PRAP was submitted for public review and comment. General comments for informational purposes were addressed during the public meeting and no written comments were received. The ROD was signed in December 2012.
Remedial Design (CH2M HILL, 2012) and Remedial Action Work Plans (Osage, 2013; SEPI 2013)	2012 - 2013	The RD presents the design of remedy as specified by the ROD, air sparging, PRBs, in-stream aeration, MNA, LTM, and LUCs. The current CSM is shown on Figure 8-34. The RA components for air sparging and the PRBs were initiated in FY 2013.
Interim Remedial Action Completion Report (CH2M HILL, 2014)	2013-2014	Remedial action activities began in March 2013. These activities included the installation of vertical and HDD air sparging wells in the source area, two PRBs in the downgradient area, and five in-creek aerators and baseline groundwater monitoring. The air sparging system was started in September 2013 and operation and maintenance reports are submitted monthly. LUCs were implemented and recorded with Onslow County in November 2013.
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009; CH2M HILL, 2011, and CH2M HILL 2015)	2007 - 2015	Site 89 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Vapor intrusion was not identified as a significant pathway of concern for any of the buildings located in the vicinity of Site 89. Additional sampling was recommended to further characterize temporal variability at Building TC864 and based on the 2013 results, the vapor intrusion pathway is not currently significant. However, during air sparging system operation, the subslab soil gas is sampled as part of the performance monitoring.

TABLE 8-50
LUC Summary, IRP Site 89

LUC Boundary	Estimated Area	Final ROD	Onslow County Registration Date
Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion)	29.1 acres		
Intrusive Activities Control Boundary (Groundwater)	29.1 acres	August 2012	November 2013
Aquifer Use Control Boundary (1,000 feet)	105.2 acres		
Access Control	1,600 feet of fence line		

8.1.25.1 Future Activities

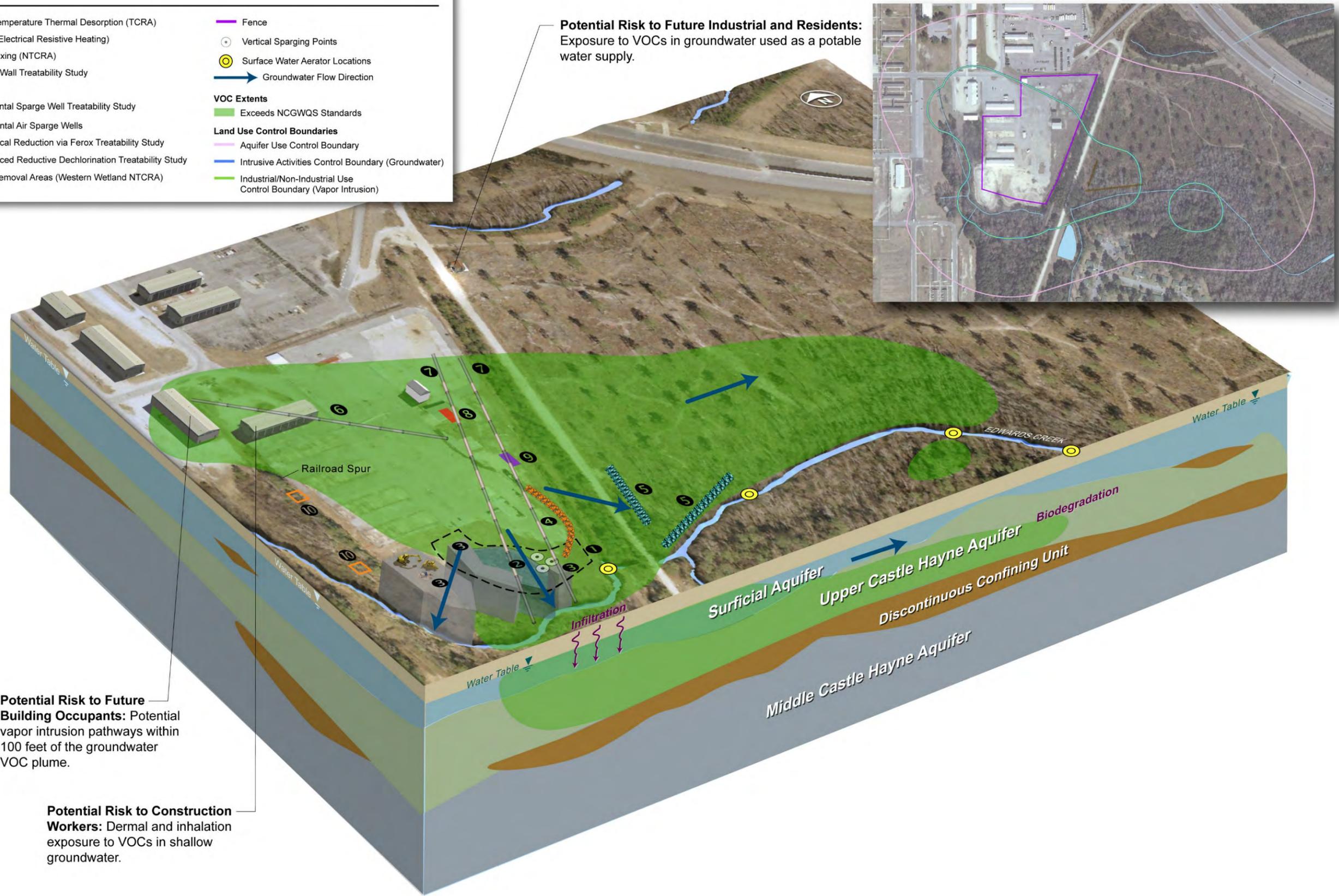
The air sparging system and in-creek aerators are in operation. Performance monitoring and MNA will continue to monitor treatment effectiveness and potential migration of COCs in groundwater and surface water as well as the potential for vapor intrusion pathways in Building TC864. LUC inspections will be conducted quarterly.

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FIGURE 8-34
IRP Site 89 Conceptual Site Model

Legend

- | | |
|--|--|
| ① Low Temperature Thermal Desorption (TCRA) | — Fence |
| ② ERH (Electrical Resistive Heating) | ○ Vertical Sparging Points |
| ③ Soil Mixing (NTCRA) | ⊙ Surface Water Aerator Locations |
| ④ Mulch Wall Treatability Study | → Groundwater Flow Direction |
| ⑤ PRB | VOC Extents |
| ⑥ Horizontal Sparge Well Treatability Study | ■ Exceeds NCGWQS Standards |
| ⑦ Horizontal Air Sparge Wells | Land Use Control Boundaries |
| ⑧ Chemical Reduction via Ferox Treatability Study | — Aquifer Use Control Boundary |
| ⑨ Enhanced Reductive Dechlorination Treatability Study | — Intrusive Activities Control Boundary (Groundwater) |
| ⑩ Soil Removal Areas (Western Wetland NTCRA) | — Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion) |



Potential Risk to Future Industrial and Residents: Exposure to VOCs in groundwater used as a potable water supply.

Potential Risk to Future Building Occupants: Potential vapor intrusion pathways within 100 feet of the groundwater VOC plume.

Potential Risk to Construction Workers: Dermal and inhalation exposure to VOCs in shallow groundwater.

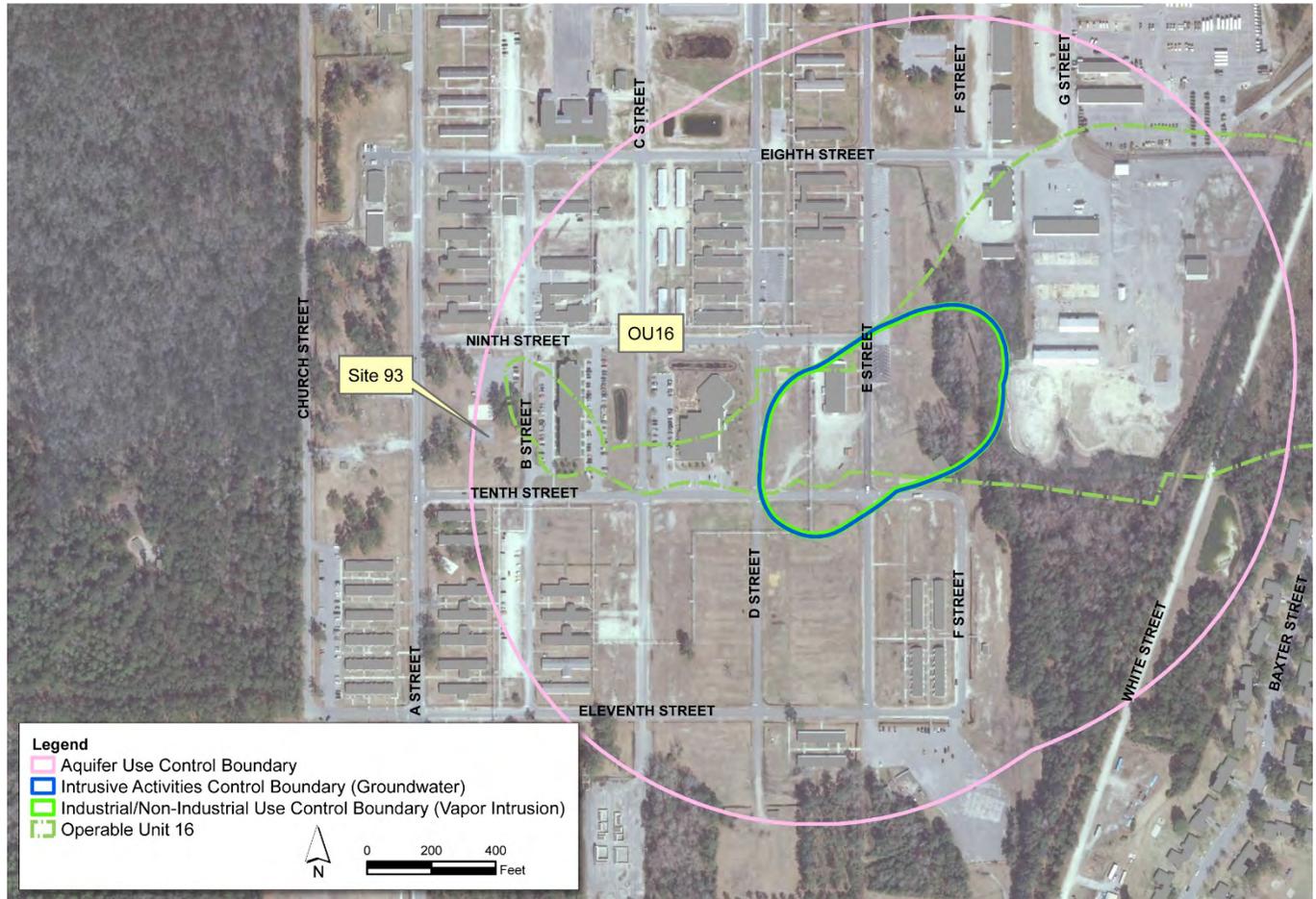
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8.1.26 Site 93 (OU 16)—Building TC-942

Site 93, Building TC-942, covers approximately 16 acres and is located at the intersection of Ninth and “E” Streets in the Camp Geiger section of MCAS New River (**Figure 8-35**). OU 16 consists of two sites (Sites 89 and 93) that have been grouped together because of their proximity to one another and unique characteristic of suspected waste (solvents). The buildings in this portion of Camp Geiger were constructed during the Korean War and currently function as classrooms, barracks, and supply rooms for the Marine Infantry School. Historical records indicate that a 550-gallon UST storing waste oil was previously located on Site 93, off the southwest corner of Building TC-942. The UST was permanently closed in December 1993.

FIGURE 8-35

IRP Site 93, OU 16



Previous investigations are listed in **Table 8-51** and the LUC summary is presented in **Table 8-52**.

TABLE 8-51
Previous Investigations Summary, IRP Site 93

Previous Investigation/Action	Date	Activities
Geotechnical Investigation (R.E. Wright, 1996)	1995 - 1996	To determine the presence or absence of contamination at the site, a geotechnical investigation and environmental screening were conducted near the barracks area. Field activities included soil and groundwater sampling. Soil samples were analyzed for O&G and halogenated solvents. Groundwater samples were analyzed for VOCs, SVOCs and metals. O&G, naphthalene, and PCE were detected in soil samples. CVOCs, SVOCs, and metals were detected in groundwater samples.
Remedial Investigation (Baker, 1998)	1996 - 1998	An RI was conducted to characterize the nature and extent of soil and groundwater contamination at OU 16. Field activities included the collection of soil and groundwater samples analyzed for VOCs. Groundwater analytical results identified CVOC contamination concentrated in the surficial aquifer within the immediate area of the former UST. Potential unacceptable human health risks were identified due to exposure to PCE and cis-1,2-DCE in groundwater. No potential unacceptable ecological risks were identified.
Natural Attenuation Evaluation	2001	In 2001, a preliminary NAE was conducted to determine whether natural site conditions would encourage the natural attenuation process of degrading CVOCs. The results indicated limited natural attenuation was occurring and the reductive dechlorination process appeared to be stalling, indicating that the reduced state of the aquifer is not enough to encourage optimal dechlorination.
Additional Plume Characterization (Baker, 2002)	2002	Additional plume characterization activities were conducted in 2002 to further delineate groundwater contamination, and provide additional data to support the selection of an active remedial system. Field activities included groundwater sampling. The primary plume appeared related to the former UST area, with smaller "hot spot" areas downgradient. The results indicated horizontal migration of groundwater contamination had been minimal since 1995; however, vertical migration was observed.
Supplemental Site Investigation (2005)	2004 - 2005	An SSI was conducted to evaluate the current conditions of groundwater contamination in the surficial aquifer, and collect additional data to support the selection of a remedial alternative. Groundwater samples were collected from boring locations at three depths, and analyzed for VOCs and NAPIs. Once the groundwater screening results were analyzed, additional permanent monitoring wells were installed to complete the horizontal and vertical delineation of the shallow groundwater contamination.
Feasibility Study (CH2M HILL, 2005)	2005	In November 2005, the Final FS was completed for Site 93, which developed and screened remedial alternatives for addressing groundwater contamination (PCE, TCE, 1,2-DCE, PCA, and VC).
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2006)	2006	A PRAP was issued to solicit public input on the preferred alternative (ISCO via permanganate injections, MNA, and LUCs) and a public meeting was held. The final Site 93 ROD was issued and signed in October 2006.
Remedy-in-Place and Interim Remedial Action Completion Report (Shaw, 2009)	2006 - present	Phased ISCO injections were conducted from 2006 through 2008. After reviewing the baseline and follow-up data, it was determined that additional ISCO injections would not be cost effective and the quarterly monitoring of the groundwater would continue to verify achievement of the 90 percent reduction in COC concentrations through natural attenuation. LUCs to prohibit aquifer use and restrict intrusive activities within the extent of groundwater VOC contamination were established in 2009. An IRACR was prepared in 2009 to document the remedy was implemented and is operational. The current CSM is shown on Figure 8-36.
Human Health Risk Screening Update	2013	MILCON was planned for utilities and soil borings in the western area of the intrusive activities (groundwater) LUC boundary at Site 93. Based on changes in CVOC concentrations over time (decreasing concentrations of PCE and TCE and increasing concentrations of breakdown products), construction worker risks were re-evaluated using the maximum CVOC concentrations detected in groundwater collected during the FY 2013 LTM. No unacceptable human health risks were identified based on construction worker exposure to groundwater. Based on these results, the Partnering Team concurred that the proposed MILCON could proceed with no environmental controls related to the IRP site, unless evidence of previously unknown contamination was discovered.

TABLE 8-51
Previous Investigations Summary, IRP Site 93

Previous Investigation/Action	Date	Activities
Land Use Control Implementation Plan (CH2M HILL, 2014)	2013 - 2014	<p>The LUCIP details how the existing LUCs established in 2009 were modified based on the recommendations from the Basewide Vapor Intrusion Evaluation and the results of the HHRS update. Based on those recommendations, the following LUC updates were registered with Onslow County in October 2014:</p> <ul style="list-style-type: none"> • Update the intrusive activities control boundary (groundwater) to be within 100 feet of the current groundwater plume • Institute a LUC to evaluate vapor intrusion pathways based on future changes in building and/or land use within 100 feet of the current groundwater plume • Update the aquifer use control boundary to be within 1,000 feet of the current groundwater CVOC plume
Basewide Vapor Intrusion Evaluation (AGVIQ/CH2M HILL, 2009, and CH2M HILL, 2015)	2007 - 2015	<p>Site 93 was included in the phased Basewide vapor intrusion evaluation, conducted from 2007-2011, to determine if complete or significant exposure pathways exist for vapor intrusion into buildings. Building TC942 was unoccupied at the time; however, the building was recently confirmed to be occupied. Therefore, subsurface soil gas sampling was conducted in 2013 and another round is recommended to evaluate temporal variability.</p>

TABLE 8-52
Land Use Control Summary, IRP Site 93

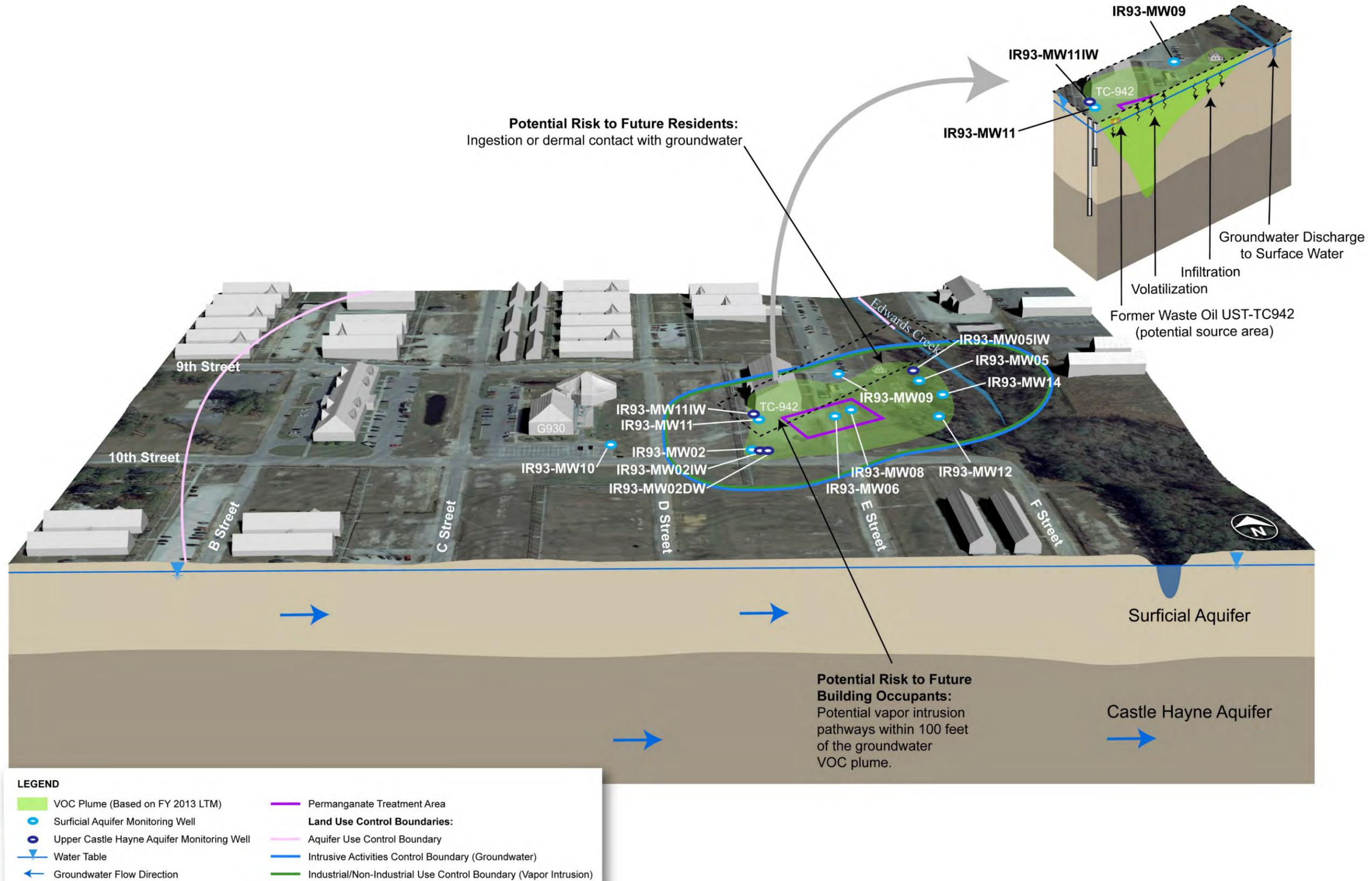
LUC Boundary	Estimated Area (Acres)	Most Current LUCIP Date	Onslow County Registration Date
Industrial/Non-Industrial Use Control Boundary (Vapor Intrusion)	8.63		
Intrusive Activities Control Boundary (Groundwater)	8.63	October 2014	October 2014
Aquifer Use Control Boundary (1,000 feet)	114.76		

8.1.26.1 Future Activities

Groundwater LTM will continue to monitor the effects of natural attenuation of the COCs in groundwater and LUC inspections will be conducted quarterly. A pilot study is underway to evaluate potential remedial technologies to reduce COC concentrations and enhance MNA. The results will be reported in FY 2016.

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FIGURE 8-36
IRP Site 93 Conceptual Site Model



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8.2 IRP RC Sites

8.2.1 Montford Point Buildings M119 and M315

The Montford Point PA site encompasses less than half an acre and includes Buildings M119 and M315, located in the Montford Point portion of the Base (**Figure 8-37**). Building M119 was constructed in 1943 as a gun shed, most likely storing howitzers. Over the years the building has been renovated, and has been used as a classroom and vehicle repair shop. Several fuel oil tanks are used for heating this building. Known chemicals/compounds that were used or stored in Building M119 include solvents, waste oils, gasoline, and vehicle repair related materials. Potential vehicle repair-related materials used or stored at this building may include paint and paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, automotive oils, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). Building M315 was thought to be a former dry cleaning facility. However, no records were located that indicated past dry cleaner operations. Rather, the building was used as a laundry pick-up facility until the 1980s.

FIGURE 8-37
Montford Point (Buildings M119 and M315)



Previous investigations are listed in **Table 8-53**.

TABLE 8-53

Previous Investigations Summary, Montford Point (Buildings M119 and M315)

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (Baker and CH2M HILL, 2006)	2002 - 2006	A PA/SI was conducted between 2002 and 2004 to identify sites that may have used, stored, or handled potentially hazardous materials and evaluate potential risks to human health and the environment. Buildings M119 and M315 at Montford Point were identified and soil and groundwater samples were collected for VOCs, SVOCs, pesticides/PCBs, and metals. The PA/SI recommended further investigation of metals in groundwater at both buildings.
Expanded Site Investigation (CH2M HILL, 2010)	2010	The ESI was conducted to confirm the results of the PA/SI and document the basis for recommendation of NFA where appropriate. Upon further review by the Partnering Team in 2009, it was concluded that the isolated detections of iron and lead in groundwater did not warrant additional investigation.
No Action Decision Document (CH2M HILL, 2010)	2010	The Final NADD was signed in December 2010.

8.2.2 MCAS New River Buildings SAS113, AS116, and AS119

The MCAS New River site encompasses less than half an acre and includes Buildings SAS113, AS116, and AS119, located in the northwest portion of the Base (**Figure 8-38**). Building SAS113 is located 100 feet west of Bancroft Road and consists of a covered four-bay open metal structure constructed on a 6-inch thick slab. Building SAS113 was constructed in 1986 as a vehicle support area when surrounding buildings were converted into automotive hobby shops. A new automotive hobby shop opened at MCAS New River in 2009, and Building SAS113 is no longer actively used. The waste disposal practices are also unknown.

MCAS New River Building AS116 is a one-story metal frame building attached to a brick building on Bancroft Street. Fencing surrounds the building, with access from Bancroft Street only. Building AS116 was constructed to replace a temporary wooden building in 1954 and to provide the MCAS New River with vehicle maintenance facilities. From 1979 to 1981, Building AS116 served as a hazardous materials and flammables storage area. In the early 1980s, a new complex was constructed for the Vehicle Maintenance Shop, and Building AS116 was converted into an automotive hobby shop along with Buildings SAS113 and AS114. A new automotive hobby shop was opened at the MCAS New River in 2009, and Building AS116 has since been used as a storage facility.

Building AS119 is a single-story metal frame building located approximately 200 feet east of White Street. Building AS119 was constructed in 1963 as an automotive vehicle maintenance facility with parts storage, service bays, and exterior service or wash rack. Records indicate that during remodeling work performed in 1988, a number of structures, including a boiler and plumbing fixtures, were removed from the building. An existing oil heater and associated piping and valves were replaced and a new fuel oil AST was installed. Currently, the building is used as a storage and vehicle maintenance facility.

FIGURE 8-38
MCAS New River Buildings SAS113, AS116, and AS119



Previous investigations are listed in **Table 8-54**.

TABLE 8-54

Previous Investigations Summary, MCAS New River Buildings SAS113, AS116, and AS119

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2006)	2001 - 2006	A PA/SI was conducted between 2002 and 2004 to identify sites that may have used, stored, or handled potentially hazardous materials and evaluate potential risks to human health and the environment. Based on the analytical results, further investigation of groundwater at Buildings SAS113, AS116, and AS119 due to the presence of metals was recommended. Although the PA/SI also recommended further investigation of soils at Building AS119 due to the presence of SVOCs, pesticides, and metals, concentrations were below background and/or regulatory screening criteria and the IRP Partnering Team concluded no further investigation of soil was necessary.
Expanded Site Investigation (CH2M HILL, 2010)	2009 - 2010	The ESI was conducted to confirm the presence or absence of elevated metals concentrations detected during the PA/SI. Although metals were detected at concentrations exceeding screening levels at two of the three buildings, no unacceptable risks to human health or the environment were identified. The ESI concluded that NFA was necessary. In 2009, the IRP Partnering Team concurred with this conclusion.
No Action Decision Document (CH2M HILL, 2010)	2010	The Final NADD was signed in December 2010.

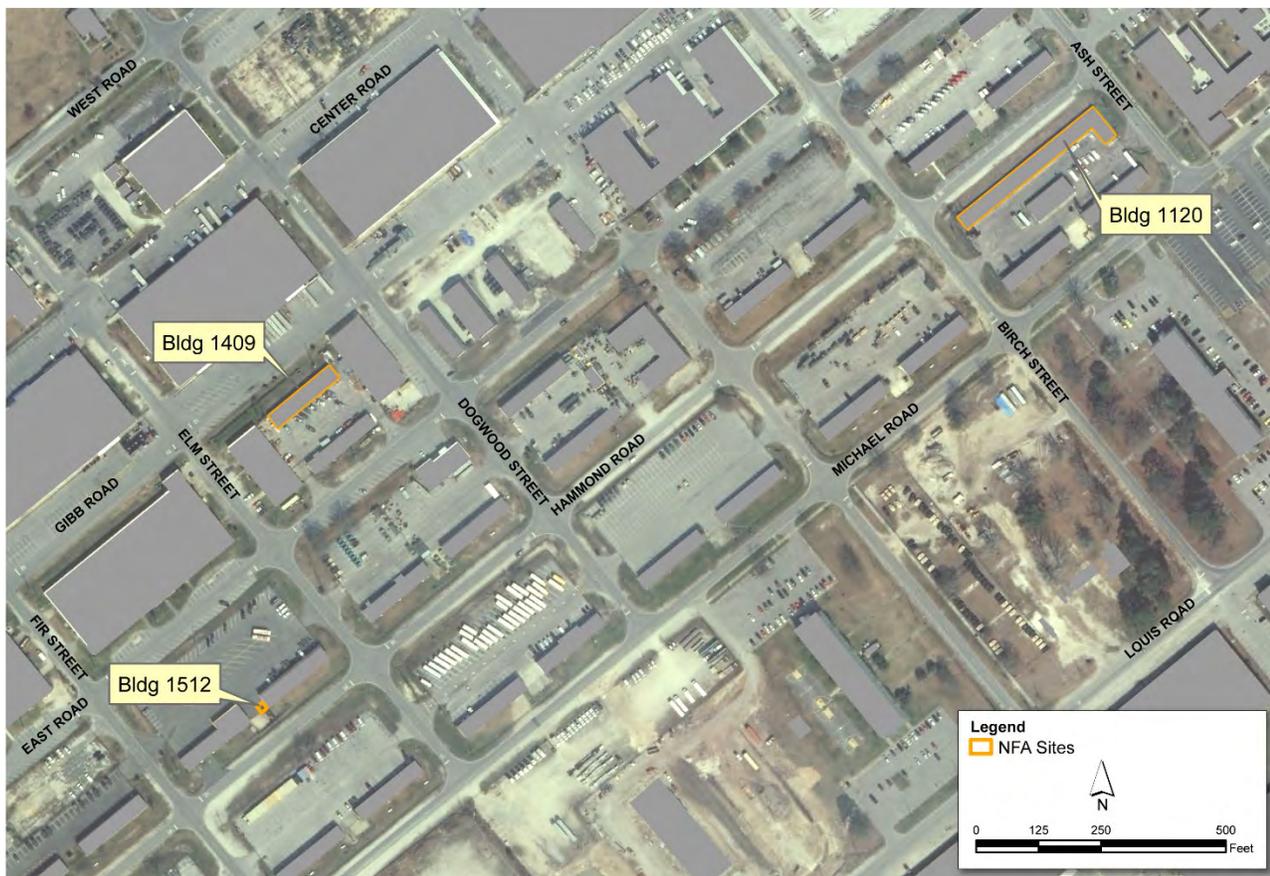
8.2.3 Hadnot Point Industrial Area Buildings 1120, 1409, and 1512

The HPIA site encompasses less than half an acre and includes Buildings 1120, 1409, and 1512, located in the HPIA. Building 1120 is located between Hammond Road, Birch Street, and Ash Street (**Figure 8-39**). It was constructed as an automobile hobby shop in 1955 with additions to the building constructed in 1964 and 1969. Building 1120 has historically been used for auto body repair and painting.

Building 1409 is located on Gibb Road. The building was constructed in 1943 and was used as the upholstery and carpenter shop in the late 1940s. Since that time, Building 1409 has been used as a classroom, Public Works storage, and a furniture repair shop.

Building 1512 was historically located between Buildings 1504 and 1503 on Hammond Road. The operational history of the building is unknown; however, it is assumed that it was used as an automotive repair support structure for the series of vehicle maintenance buildings in the surrounding area. Building 1512 is no longer present. The date of demolition is unknown.

FIGURE 8-39
Hadnot Point Industrial Area (Buildings 1120, 1409, and 1512)



Previous investigations are listed in **Table 8-55**.

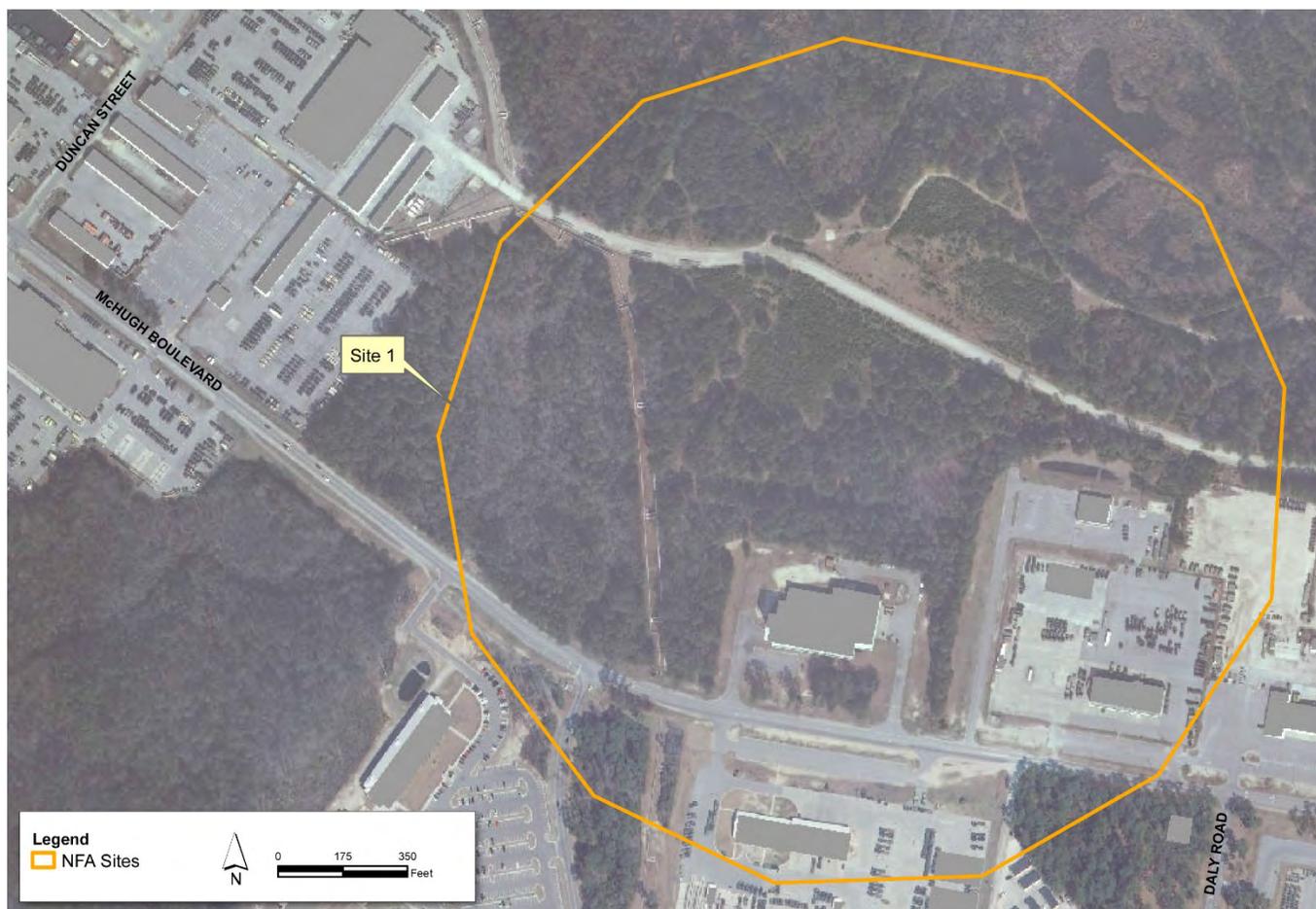
TABLE 8-55
Previous Investigations Summary, Hadnot Point Industrial Area (Buildings 1120, 1409, and 1512)

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (2006)	2001 - 2006	A PA/SI was conducted between 2002 and 2004 to identify sites that may have used, stored, or handled potentially hazardous materials and evaluate potential risks to human health and the environment. Field activities included soil and groundwater investigations. The analytical results indicated that there was no impact to the area from past site operations, and no further investigation was recommended at the buildings. In 2002, the IRP Partnering Team concurred with this conclusion (CH2M HILL, 2002).

8.2.4 Site 1 (OU 7)—French Creek Liquids Disposal Area

Site 1, the French Creek Liquids Disposal Area, covers approximately 8 acres located within OU 7 on the Mainside of the Base (Figure 8-40). OU 7 consists of three sites (Sites 1, 28, and 30) that have been grouped together into one OU because of their similar characteristics of suspected waste (POL) and geographic location. Site 1 has been used by several different mechanized, armored, and artillery units since the 1940s. Reportedly, liquid wastes generated from vehicle maintenance were routinely poured onto the ground surface. The wastes were reported to be primarily POL; however, battery acid was also reportedly disposed of. The suspected POL and battery acid disposal areas lie in the northern and southern portions of the site. The estimated quantity of POL waste disposed at the areas is between 5,000 and 20,000 gallons, and the quantity of battery acid waste is between 1,000 and 10,000 gallons. Currently, Site 1 continues to serve as a vehicle and equipment maintenance and staging area.

FIGURE 8-40
IRP Site 1, OU 7



Previous investigations are listed in **Table 8-56**.

TABLE 8-56
Previous Investigations Summary, IRP Site 1

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Results indicated that waste POL and used battery acid could potentially migrate to groundwater and surface water; and thus recommended that a Confirmation Study be conducted.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to further investigate the findings of the IAS. Field activities included groundwater, surface water, and sediment sampling for VOCs, metals, and O&G. Groundwater samples collected from the surficial aquifer identified the presence of CVOCs, metals, and O&G.
Soil Assessment (1991)	1991	A soil assessment was completed for an area in the southern portion of the site in support of a potential MILCON project. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Analytical results identified metals constituents at levels generally consistent with background concentrations.
Groundwater Study (1993)	1993	To evaluate current site conditions during scoping of the RI/FS groundwater sampling was conducted. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Analytical results identified metals constituents at concentrations generally consistent throughout the site.
Remedial Investigation/ Feasibility Study (Baker, 1995)	1994 - 1995	An RI was completed to assess the nature and extent of contamination that may have resulted from previous disposal practices. Field activities consisted of a site survey, and soil and groundwater sampling for VOCs, SVOCs, pesticides/PCBs, metals, and TPH. VOCs and metals were detected in groundwater and soil. Potential human health risks were identified for future child and adult residents due to exposure to metals in groundwater. Minimal ecological risks were identified for terrestrial receptors due to exposure from metals. COCs were evaluated during the FS and metals were eliminated as site-related COCs. The FS also evaluated remedial alternatives for VOCs in groundwater and RAOs were developed for the site.
Proposed Remedial Action Plan (Baker, 1995) and Record of Decision (Baker, 1996)	1995 - 1996	A PRAP was issued to solicit public input on the preferred alternative (LTM and LUCs) and a public meeting was held. The Final ROD was issued and signed in October 1996 followed by initiation of LTM.
Remedy-in-Place and Remedial Action Completion Report (CH2M HILL, 2002)	1996 - 2002	Groundwater LTM was initiated in 1996 and included biannual sampling of eight monitoring wells (nine monitoring wells were initially specified in the work plan; however, one well was destroyed prior to the initiation of sampling) for VOCs analysis. Upon reevaluating the LTM Program in 1998, site-wide LTM was discontinued and quarterly confirmation sampling for VOC analysis was implemented at two wells. In April 2000, the concentrations of VOCs were below the cleanup levels for at least four consecutive quarters, and discontinuation of confirmatory sampling was recommended in the October 2000 LTM Report (CH2M HILL and Baker, 2000). Following approval from USEPA and NCDENR in January 2001, a RACR was prepared to document the completion of confirmatory sampling. LUCs were implemented in 2000 and updated in 2002.
Data Review		Based on recommendations from the Five-year Review, existing site data were reviewed by the MCIEAST-MCB CAMLEJ Partnering Team and the consensus was reached to remove the LUCs and document the Response Complete in a RACR because the only unacceptable risk identified at Site 1 was related to exposure to groundwater (1995 RI) and groundwater cleanup levels were achieved during LTM.
Remedial Action Completion Report (CH2M HILL, 2015)	2015	A Notice of Record dated April 15, 2015 officially cancelled the LUCs.

8.2.5 Site 4—Sawmill Road Construction Debris Dump

Site 4, the Sawmill Road Construction Debris Dump, encompasses approximately 0.3 acre and is located on the Mainside of the Base (**Figure 8-41**). The dates of operation are unknown, but Site 4 was reportedly used for surface disposal of construction debris including asphalt, old bricks, and concrete.

FIGURE 8-41
IRP Site 4



Previous investigations are listed in **Table 8-57**.

TABLE 8-57
Previous Investigations Summary, IRP Site 4

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 4, and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009 - 2011	To verify the presence or absence of contamination, a Confirmatory Site Assessment was conducted due to the site's history as a dump. Soil and groundwater sampling for VOCs, SVOCs, and metals was completed. Based on the results, no human health or ecological risks were identified and NFA was recommended.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.6 Site 7 (OU 11)—Tarawa Terrace Dump

Site 7, the Tarawa Terrace Dump, encompasses approximately 5 acres within OU 11. OU 11 consists of two sites (Sites 7 and 80) that have been grouped together into one OU because of their similar disposal history and proximity to one another (**Figure 8-42**). Site 7 is a former dump that was used during the construction of the Base housing located in Tarawa Terrace. Precise years of operation are unknown, but it has been reported that the dump was closed in 1972. Historical records do not indicate that hazardous materials were disposed at this facility—only construction debris, water treatment plant filter media, and household trash.

FIGURE 8-42
IRP Site 7, OU 11



Previous investigations are listed in **Table 8-58**.

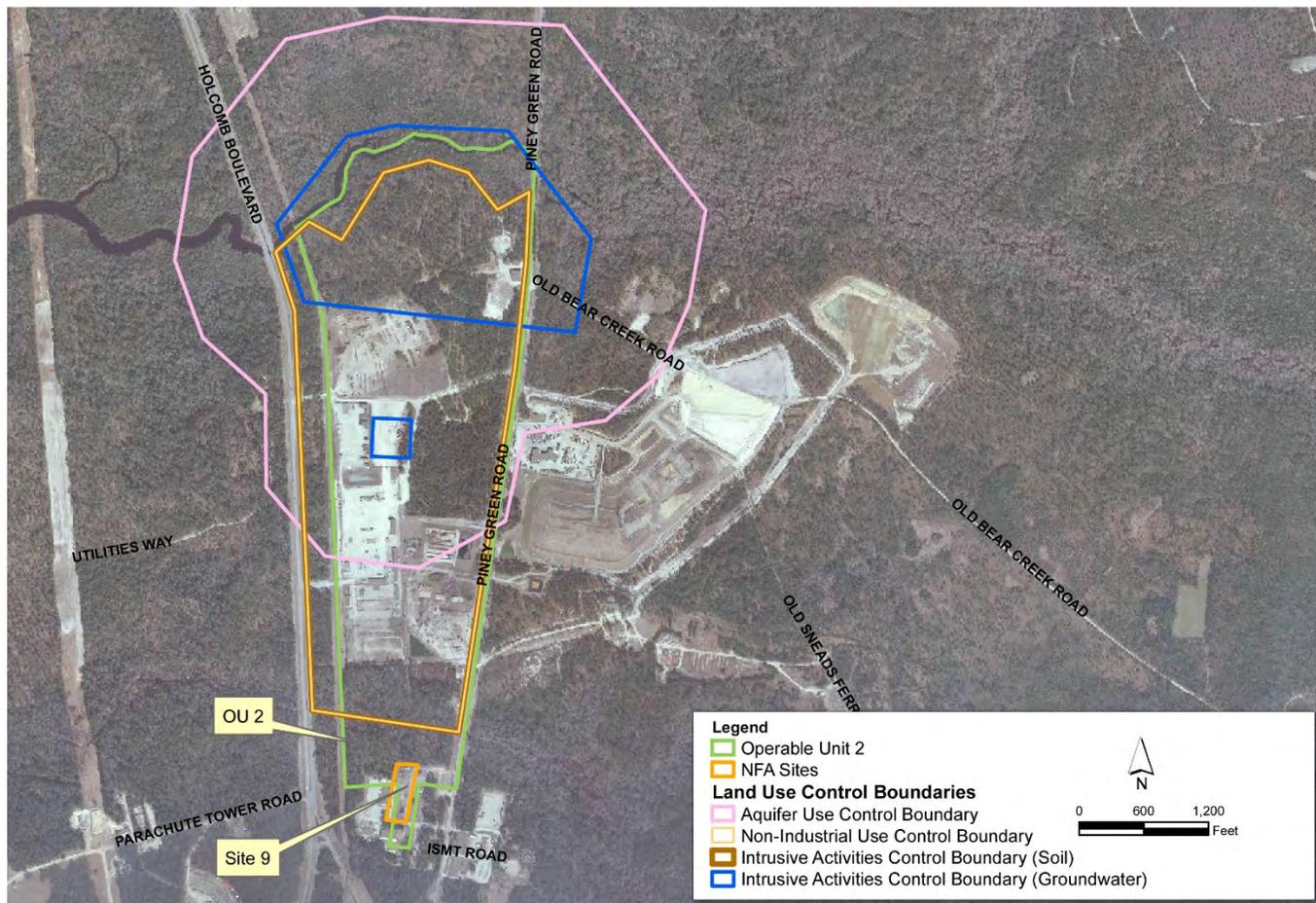
TABLE 8-58
Previous Investigations Summary, IRP Site 7

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of any waste reportedly disposed of at the site was insignificant and did not warrant further investigation.
Site Investigation (Halliburton/NUS, 1991)	1991	To determine the presence or absence of site-related contamination, an SI was conducted. Field activities included soil and groundwater investigations. Samples were analyzed for SVOCs, VOCs, pesticides/PCBs, and metals. The analytical results identified SVOCs and pesticides in soil and groundwater. Based on these results, an RI was proposed.
Remedial Investigation (Baker, 1996)	1994 - 1996	An RI was completed to characterize the nature and extent of contamination and potential impacts to human health and the environment. Field activities included a site survey, soil, groundwater, surface water, and sediment sampling, a habitat evaluation, and an earthworm bioaccumulation study. Samples were analyzed for volatile and semivolatiles organic analytes, pesticides/PCBs, and metals. No site-related contamination and no unacceptable risks to human health and the environment were identified.
Proposed Remedial Action Plan and Record of Decision (Baker, 1997)	1996 - 1997	Based on the findings of the RI, a PRAP was issued in 1996 to solicit public input on the preferred alternative (no RA) and a public meeting was held. The Final ROD was issued and signed in August 1997, and the site was closed with NFA.

8.2.7 Site 9 (OU 2)—Fire Fighting Training Pit at Piney Green Road

Site 9, the Fire Fighting Training Pit at Piney Green Road, encompasses approximately 2.6 acres in the Mainside area of the Base. From the early 1960s to 1981, training exercises were conducted in an 800-ft² unlined fire training pit, located in the southern area of the site (**Figure 8-43**). In 1981 the pit was lined with asphalt and an OWS was installed next to the pit; and in 2002 the pit was lined with concrete. Flammable liquids including solvents, used oil, and contaminated fuels were used as accelerants during the training exercises. In addition, approximately 30,000 to 40,000 gallons of JP-4 and JP-5 fuels were burned in the training pit. Four 500-gallon ASTs were located near the training area but are no longer present. The site is still currently used as a fire training facility with a concrete-lined pit.

FIGURE 8-43
IRP Site 9, OU 2



Previous investigations are listed in **Table 8-59**.

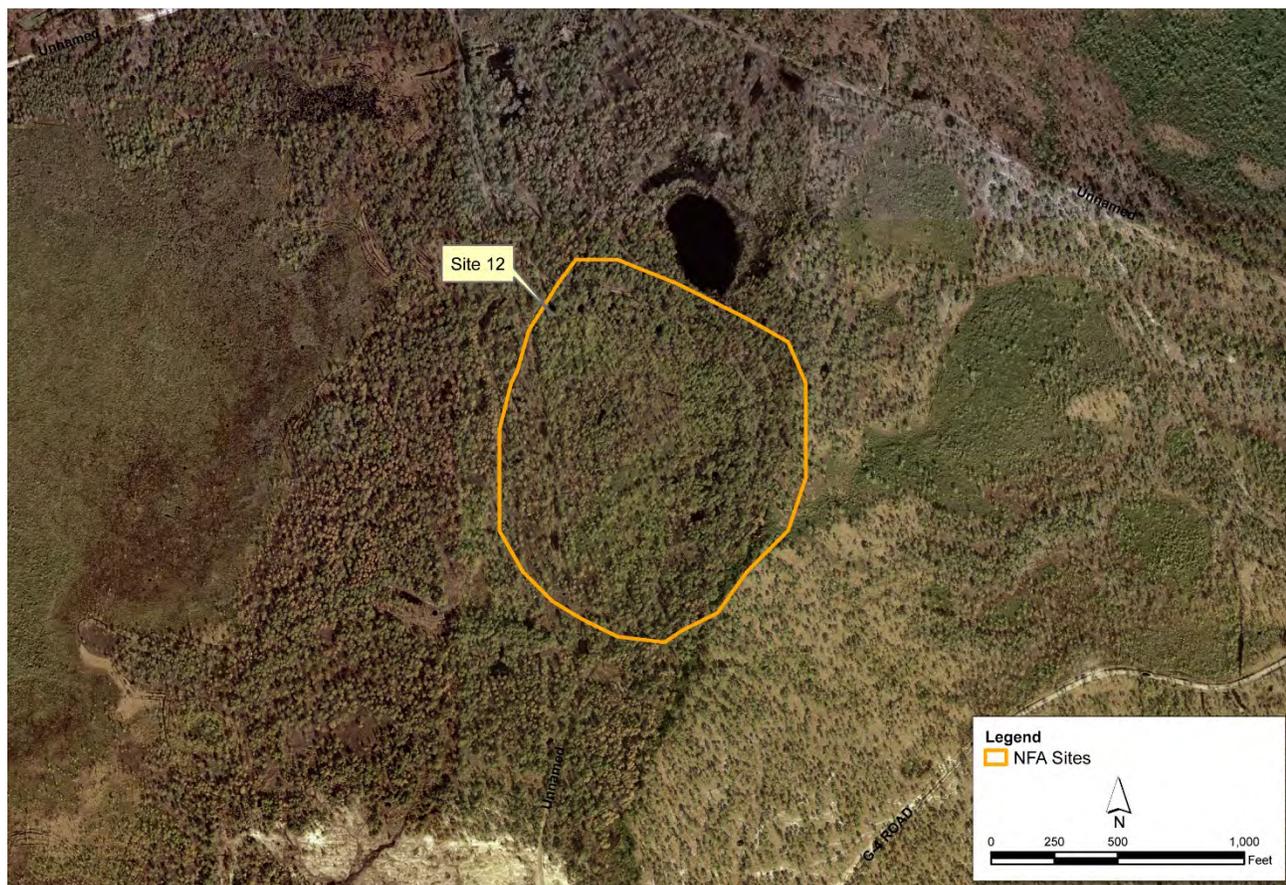
TABLE 8-59
Previous Investigations Summary, IRP Site 9

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. An estimated 30,000 gallons per year of used oil, solvents, and contaminated fuels were burned during training exercises. Based on its findings, the IAS recommended that a Confirmation Study be conducted to verify the presence of contamination and determine whether migration was occurring.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to confirm the presence of contamination discovered during the IAS. Field activities included soil, groundwater, sediment, and surface water sampling. Chromium, lead, phenols, and ethylene dibromide were detected in groundwater samples.
Remedial Investigation (Baker, 1993)	1992 - 1993	An RI was conducted to further investigate AOCs at OU 2. Field activities consisted of a preliminary site survey and soil and groundwater sampling for VOCs, SVOCs, pesticide/PCBs, and metals. Analytical results did not reveal extensive contamination. Soil and groundwater samples collected during the RI did not reveal extensive contamination at Site 9 and no potential sources of contamination were identified.
Proposed Remedial Action Plan and Record of Decision (Baker, 1993)	1993	A PRAP was issued in August 1993 to solicit public input on the preferred alternative (no RA) and a public meeting was held. The Final ROD for OU 2 was issued and signed in September 1993 and the site was closed with NFA.
Removal Action (2000)	2000	A new Fire Training Pit was completed in 2000. The new training facility employed a petroleum source for burning operations and the pit was lined with high-temperature concrete. During the installation of the new facility, POL-contaminated soil was excavated and removed from the site.

8.2.8 Site 12 (Pre-RI)—EOD Detonation Area

Site 12, the EOD Detonation Area, covers approximately 8 to 10 acres on the Mainside of the Base (Figure 8-44). Since the early 1960s, Site 12 has operated as an EOD detonation area. Ordnance is disposed by burning or detonating when it is found to be inert, unserviceable, or defective. Materials disposed at Site 12 include ordnance, colored smokes, and white phosphorus. Any undestroyed residues are typically less than 1 pound. Because Site 12 is an active range, it now falls under the Navy’s Active Range Program.

FIGURE 8-44
IRP Site 12



Previous investigations are listed in Table 8-60.

TABLE 8-60
Previous Investigations Summary, IRP Site 12

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of any waste reportedly disposed of at the site was insignificant and did not warrant further investigation. However, during a disposal exercise in 1992, an explosive crater (approximately 8 feet deep) uncovered an oily sheen and a suspected petroleum odor was noted.
Pre-Remedial Investigation Screening Study (1998)	1995 - 1998	An RI was initiated to assess the nature and extent of contamination. During the Pre-RI field investigation, EOD personnel stated that disposal of small arms ammunition was carried out by piling up the rounds, sometimes inside a crater from a past disposal, dousing the pile with diesel fuel, and exploding the pile with a small explosive. EOD personnel also stated that the range had been used for a brief time as a target range for aircraft to drop “dummy” bombs onto. Soil and groundwater samples were collected and analytical results indicated that soil and groundwater had not been impacted by site activities. As a result, the Pre-RI recommended SC.
No Action Decision Document (CH2M HILL, 2001)	2001	The Final NADD was completed May 8, 2001.

8.2.9 Site 13—Golf Course Construction Dump Site

Site 13, the Golf Course Construction Dump Site, encompasses approximately 10 acres in the Paradise Point area of the Base (**Figure 8-45**). In 1944, Site 13 was reportedly used for surface disposal of construction debris including clippings, branches, and asphalt associated with golf course construction.

FIGURE 8-45
IRP Site 13



Previous investigations are listed in **Table 8-61**.

TABLE 8-61
Previous Investigations Summary, IRP Site 13

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at the site, and the IAS concluded that NFA was necessary.
Limited Site Assessment (Osage, 2008)	2008	A Limited Site Assessment was conducted to substantiate the NFA status. Representative soil and groundwater samples were collected from across the site and analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. The soil and groundwater analytical results indicated no compounds were detected above regulatory screening levels and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.10 Site 18—Watkins Village (E) Site

Site 18, Watkins Village (E) Site, includes approximately 1 acre in the Paradise Point area of the Base (Figure 8-46). From 1976 to 1978, construction materials and debris were reportedly buried at Site 18.

FIGURE 8-46
IRP Site 18



Previous investigations are listed in **Table 8-62**.

TABLE 8-62
Previous Investigations Summary, IRP Site 18

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 18, and no further assessment was recommended.
Confirmatory Site Assessment (Osage, 2011)	2009-2011	To verify the presence or absence of contamination, a Confirmatory Site Assessment was conducted due to the site's history as a dump. Field activities included soil and groundwater sampling for VOCs, SVOCs, herbicides, pesticides/PCBs, and metals. Metals were detected in soil at concentrations exceeding regulatory screening criteria and background; however, no human health or ecological risks were identified and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.11 Site 19—Naval Research Laboratory Dump

Site 19, the Naval Research Laboratory Dump, is located within the Former Naval Research Laboratory boundary which encompasses approximately 4 acres on the Mainside of the Base. From 1947 to 1976, the Naval Research Laboratory was located in the area of the Pest Control Shop (**Figure 8-47**). Activities at the laboratory included using radionuclides (Iodine 131) for metabolic studies on small animals. From 1956 to 1960, approximately 100 dogs were disposed of. Because Iodine 131 has a half-life of only 8 days, potential for residual radiological contamination was considered to be negligible. In November 1980, strontium-90 beta buttons (self-illuminating markers containing strontium-90 used on naval vessels to light pathways and entrances) were found while grading a parking lot. The area was surveyed and contaminated items were recovered. Soil samples were obtained and the site was cleaned of radioactive substances. Five 55-gallon drums of soil and animal residues were collected, along with 499 beta buttons, and were appropriately disposed offsite.

FIGURE 8-47
IRP Site 19



Previous investigations are listed in **Table 8-63**.

TABLE 8-63

Previous Investigations Summary, IRP Site 19

Previous Investigation/Action	Date	Activities
Report of Radiological Affairs Technical Assistance Visit (NEESA, 1981)	1981	Based on the discovery of beta buttons an evaluation of former burial pits was conducted. Approximately 500 beta buttons, animal carcasses, and 160 pounds of soil contaminated with strontium-90 were removed. The contaminated material was stored in an onsite building until it was transported to the Nuclear Regulatory Commission for disposal. The former burial area was radiologically surveyed in situ for beta contamination and soil samples were collected from the burial site and sent to Naval Energy and Environmental Support Activity (NEESA) for isotope analysis. Results confirmed that the contamination was removed and that the site was available for unrestricted use.
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Based on historical documentation, Site 19 was identified as a potential hazard to human health and the environment based on past use as a dump and radiological site use. Based on the results of the 1981 radiological investigation and the small quantity of waste reportedly buried, Site 19 was not recommended for further investigation.
Focused Site Investigation (CH2M HILL, 2008)	2007 - 2008	The Focused SI was initiated to evaluate the presence or absence of chemical impacts to human health and the environment in support of future MILCON activities. Surface soil, subsurface soil, and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Metals, VOCs, SVOCs, and pesticides/PCBs were detected in soil and groundwater at levels exceeding screening criteria. An HHRA was recommended to confirm that no unacceptable risk is present.
Radiological Survey (New World Technology, Inc., 2007)	2007 - 2008	The Radiological Affairs Service Office collected surface and subsurface soil samples from the former burial pit area. Laboratory analysis for strontium-90 did not detect radioactivity above natural background levels in any of the soil samples.
Wallace Creek Expanded Site Investigation (CH2M HILL, 2010)	2009 - 2010	An HHRS and an ERS were performed on the data collected during the Focused SI in 2007, and no unacceptable risks to human health or ecological risk receptors were identified. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2011)	2011	The Final NADD was signed in November 2011.

8.2.12 Site 20—Naval Research Lab Incinerator

Site 20, the Naval Research Lab Incinerator, is located within the Former Naval Research Laboratory boundary, which encompasses approximately 4 acres on the Mainside of the Base (**Figure 8-48**). From 1947 to 1976, the Naval Research Laboratory was located in the area of the Pest Control Shop. Activities at the laboratory included using radionuclides (Iodine 131) for metabolic studies on small animals. From 1956 to 1960, Site 20 was used for the incineration of burnable wastes.

FIGURE 8-48
IRP Site 20



Previous investigations are listed in **Table 8-64**.

TABLE 8-64

Previous Investigations Summary, IRP Site 20

Previous Investigation/ Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Site 20 was identified as a potential hazard to human health and the environment based on past use as an incinerator and the potential for radiological contamination from past activities at the Laboratory. Due to the small quantity of waste reportedly burned, NFA was recommended.
Radiological Survey (New World Technology, Inc., 2007)	2007	Radiological Affairs Service Office collected samples from the concrete pad for analysis of strontium-90. No radioactivity was detected above natural background levels. No unacceptable risks were expected to future site workers.
Focused Site Investigation (CH2M HILL, 2008)	2007 - 2008	The Focused SI was initiated to evaluate the presence or absence of impacts to human health and the environment to support future MILCON activities. Surface soil, subsurface soil, and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Metals, VOCs, SVOCs, and pesticides/PCBs were detected in soil and groundwater at levels exceeding screening criteria. As a result, confirmatory sampling for TCE and an HHRA were recommended.
Radiological Investigation (Aleut World Solutions, LLC, 2009)	2008 - 2009	The Navy requested a more-detailed radiological investigation to be performed. Radiological surveying and surface and subsurface soil samples were collected within the footprint of the former incinerator for analysis of strontium-90 and Ra-226. Two soil samples were reported slightly above natural background levels for strontium-90; however, no radioactivity was detected above background for Ra-226. Based upon the results, no unacceptable risks were expected to future site workers.
Wallace Creek Expanded Site Investigation (CH2M HILL, 2010)	2009 - 2010	An HHRS and an ERS were performed on the data collected during the Focused SI in 2007, and no unacceptable risks to human health or ecological receptors were identified. Confirmatory sampling was also conducted, and TCE was not detected. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2011)	2011	The Final NADD was signed in November 2011.

8.2.13 Site 23—Roads and Grounds Building 1105

Site 23, the Roads and Grounds Building 1105, is located in the HPIA, within the boundaries of IRP Site 78, covering less than a half of an acre (**Figure 8-49**). In 1958, the Pest Control Shop moved its activities to Building 1105. From 1958 until 1977, Building 1105 was used for storage of insecticides and herbicides, while mixing of the chemicals was performed at Lot 140 (IRP Site 21). Storage and handling procedures at Building 1105 were reportedly adequate to prevent any large spills and to ensure a current safe working environment. Chemicals reportedly stored in Building 1105 included chlorinated hydrocarbons such as DDT and chlordane, as well as diazinon, malathion, lindane, mirex, 2,4-D, dalapon, and dursban.

FIGURE 8-49
IRP Site 23



Previous investigations are listed in **Table 8-65**.

TABLE 8-65

Previous Investigations Summary, IRP Site 23

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Although the site had been listed as a potential hazardous waste site, no spills or disposal of materials had been reported and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009 - 2011	To verify the presence or absence of contamination, a Confirmatory Site Assessment was conducted to determine impacts of previous pesticide and herbicide storage. Field activities included collection of soil samples for SVOCs, VOCs, pesticides, herbicides, and metals. No pesticides or herbicides were detected above screening criteria; however, VOCs were detected in groundwater and potential human health risks were identified attributable to Site 78; therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

Previous investigations are listed in **Table 8-66**.

TABLE 8-66
Previous Investigations Summary, IRP Site 24

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Research indicated that past site operations may have impacted groundwater and surface water and recommended an additional investigation.
Confirmation Study (ESE, 1990)	1984 - 1990	The Confirmation Study included groundwater, surface water, and sediment investigations. Analytical results identified the presence of metals in groundwater, surface water, and sediment. However, the detected concentrations in surface water and sediment did not exceed regulatory standards.
Remedial Investigation/ Feasibility Study (Baker, 1994)	1994	RI field activities included a site survey, groundwater, soil, sediment, and surface water sampling. Analytical results identified pesticides and metals in soil and groundwater. Potential unacceptable human health risks were identified due to pesticides in groundwater. No unacceptable ecological risks were identified. An FS was conducted to screen remedial alternatives for addressing groundwater contamination.
Proposed Remedial Action Plan and Record of Decision (Baker, 1994)	1994	The PRAP was submitted for public review and comment in July 1994. The Final ROD was signed in September 1994. The selected remedial alternative was LTM for groundwater.
Long-term Monitoring	1996 - 1997	LTM was implemented in 1996 and discontinued in 1997 after evaluating the analytical results collected over four consecutive quarters that indicated no pesticides or metals concentrations in groundwater exceeded the cleanup levels. In 2001, the LTM report documented the completion of LTM.

8.2.15 Site 25—Base Incinerator

Site 25 encompasses approximately half an acre on the Mainside of the Base. From 1940 to 1960, Site 25 operated as the Base Incinerator, burning trash and classified materials (**Figure 8-51**). Potential materials present at the site include burned trash, ashes, and melted glass.

FIGURE 8-51
IRP Site 25



Previous investigations are listed in **Table 8-67**.

TABLE 8-67
Previous Investigations Summary, IRP Site 25

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Site 25 was identified based on past use as an incinerator. However, historical records indicated that nonhazardous materials were disposed of (trash and glass) and NFA was recommended.
Focused Site Investigation (CH2M HILL, 2008)	2007 - 2008	To evaluate the presence or absence of chemical impacts to human health and the environment in order to support future MILCON activities, soil and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Arsenic was detected in surface soil samples above screening levels, and an HHRA was recommended.
Wallace Creek Expanded Site Investigation (AGVIQ/CH2M HILL, 2010)	2009 - 2010	An HHRS and an ERS were performed on the data collected during the Focused SI in 2007, and no unacceptable risks to human health or ecological receptors were identified. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2011)	2011	The Final NADD was signed in November 2011.

8.2.16 Site 30 (OU 7)—Sneads Ferry Road Fuel Tank Sludge Area

Site 30, the Sneads Ferry Road Fuel Tank Sludge Area, is located within OU 7 on the Mainside of the Base and covers approximately 1 acre (**Figure 8-52**). OU 7 consists of three sites (Sites 1, 28, and 30) that have been grouped together into one OU because of their unique characteristics of suspected waste (POL) and geographic location. Site 30 was reportedly used by a private contractor in 1970 to clean out two 12,000-gallon emptied fuel storage tanks when the contents of the tanks were converted from leaded gasoline to unleaded gasoline. Sludge and/or washout was reportedly drained from the tanks and disposed of along a tank trail that intersects Sneads Ferry Road. The composition of the waste is unknown, but it may have contained cleansing compounds and possibly diluted tetraethyl lead. An estimated minimum of 600 gallons was reportedly disposed.

FIGURE 8-52
IRP Site 30, OU 7



Previous investigations are listed in **Table 8-68**.

TABLE 8-68
Previous Investigations Summary, IRP Site 30

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that sludge deposits could potentially impact groundwater and recommended an additional investigation to determine the boundaries of the impacted area and verify the presence of hazardous wastes.
Confirmation Study (ESE, 1990)	1984 - 1990	Confirmation Study field activities included groundwater, surface water, and sediment investigations. Analytical results identified O&G in the disposal area and in stream bed sediments as well as lead in groundwater.
Remedial Investigation (Baker, 1995)	1994 - 1995	To further characterize the nature and extent of contamination an RI was conducted. Field activities consisted of a site survey and soil, groundwater, surface water, and sediment sampling. No unacceptable human health or ecological risks were identified at Site 30.
Proposed Remedial Action Plan and Record of Decision (Baker, 1995)	1995 - 1996	The PRAP was submitted for public review and comment in July 1995. The Final ROD was signed in May 1996, and due to the absence of contamination the site was closed with NFA.

8.2.17 Site 38—Camp Geiger Construction Dump

Site 38, the Camp Geiger Area Surface Dump, encompasses approximately 3 acres in the Camp Geiger area of the Base (**Figure 8-53**). The dates of operation are unknown, but Site 38 was reportedly used for surface disposal of construction debris and branches. During the IAS, evidence of dumping activities was observed.

FIGURE 8-53
IRP Site 38



Previous investigations are listed in **Table 8-69**.

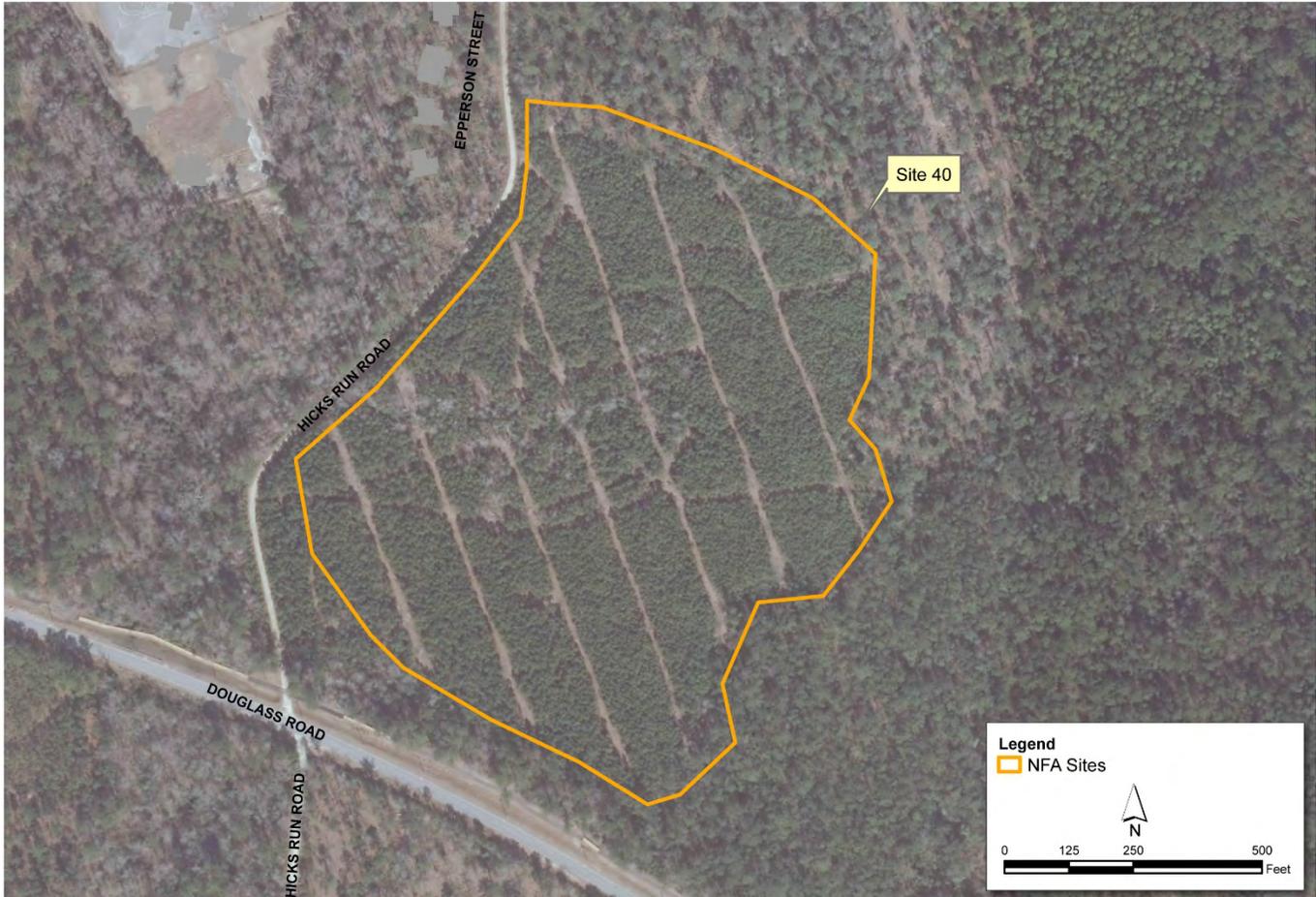
TABLE 8-69
Previous Investigations Summary, IRP Site 38

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 38, and concluded that no further assessment was necessary.
Confirmatory Sampling Report (CH2M HILL, 2011)	2010-2011	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Soil and groundwater samples were collected and analyzed for VOCs, SVOCs, and metals. No unacceptable risks to human health or the environment were identified and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.18 Site 40—Camp Geiger Area Borrow Pit

Site 40, the Camp Geiger Area Borrow Pit, encompasses approximately 22 acres (**Figure 8-54**). Starting in 1969, Site 40 was reportedly used for disposal of auto parts and metal. The former borrow pit dump was reported to have covered an area of approximately 4 to 5 acres within Site 40.

FIGURE 8-54
IRP Site 40



Previous investigations are listed in **Table 8-70**.

TABLE 8-70
Previous Investigations Summary, IRP Site 40

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCI-EAST-MCB CAMLEJ. Site 40 was identified as being a waste disposal site for automobile parts and scrap metal. Site 40 was recommended for NFA because there was insufficient evidence that hazardous substances were associated with the site.
Preliminary Assessment/Site Investigation (CH2M HILL, 2009)	2008 - 2009	A PA/SI was conducted to characterize potential contamination at Site 40 based on prospective MILCON projects in the vicinity. Field activities included soil, groundwater, surface water, and sediment sampling and test pitting to delineate the former dump area. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. No wastes were encountered and no risks to human health or the environment were identified. The site was closed with NFA.
No Action Decision Document (CH2M HILL, 2010)	2010	The Final NADD was signed in August 2010.

8.2.19 Site 42—Building 705 Bachelor Officers’ Quarters Dump

Site 42, the Building 705 Bachelor Officers’ Quarters Dump, encompasses approximately 2.8 acres in the MCAS New River portion of the Base (Figure 8-55). From 1950 to 1960, Site 42 was reportedly used for surface disposal of debris, including trees, tree stumps, and boards.

FIGURE 8-55
IRP Site 42



Previous investigations are listed in **Table 8-71**.

TABLE 8-71
Previous Investigations Summary, IRP Site 42

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 42 and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of contamination due to the site’s history as a dump, confirmatory sampling was conducted in FY 2009. Soil and groundwater samples were collected and analyzed for VOCs, SVOCs, and metals. Based on the results, no unacceptable human health or ecological risks were identified and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.20 Site 46—MCAS Main Gate Dump

Site 46, the MCAS Main Gate Dump, encompasses less than 1 acre in MCAS New River, in the northwest portion of the Base (**Figure 8-56**). From 1958 to 1962, Site 46 was reportedly used for disposal of construction and demolition debris.

FIGURE 8-56
IRP Site 46



Previous investigations are listed in **Table 8-72**.

TABLE 8-72
Previous Investigations Summary, IRP Site 46

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at Site 46 and no further assessment was recommended.
Confirmatory Site Assessment (Osage, 2011)	2009-2011	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Soil and groundwater samples were collected and analyzed for VOCs, SVOCs, herbicides, pesticides, and metals. No unacceptable risks to human health or the environment were identified and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.21 Site 48 (OU 3)—MCAS Mercury Dump

Site 48, the MCAS Mercury Dump, encompasses approximately 5 acres within MCAS New River in the northwest portion of the Base. Building AS-804 was constructed in 1955 and was used as the Administration Office and Photographic Lab from 1955 to 1990 (**Figure 8-57**). From 1956 to 1966, mercury was drained from radar units and disposed in small quantities behind the building. It was reported that approximately 1 gallon of mercury per year over a 10-year period was disposed in this manner.

FIGURE 8-57
IRP Site 48, OU 3



Previous investigations are listed in **Table 8-73**.

TABLE 8-73
Previous Investigations Summary, IRP Site 48

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. An estimated 1,000 pounds of mercury was possibly dispersed over approximately 20,000 ft ² adjacent to the New River. It was concluded that mercury disposal practices could potentially impact the New River and a Confirmation Study was recommended to verify the presence of mercury.
Confirmation Study (ESE, 1990)	1984 - 1990	A Confirmation Study was conducted to verify the presence of mercury. Field activities included soil and sediment investigations. Low levels of mercury were identified in both media, and further characterization was recommended.
Supplemental Characterization (1991)	1991	A Supplemental Characterization investigation was conducted based on results of the Confirmation Study. Field activities included surface water and sediment sampling. Mercury was not detected in any samples collected during the investigation. The risk evaluation identified several metals (not mercury) as COPCs.
Remedial Investigation (1992)	1992	To further characterize the nature and extent of contamination, an RI was conducted. Field activities included a geophysical investigation and soil, groundwater, surface water, and sediment sampling. The geophysical investigation did not identify any objects associated with mercury disposal, and analytical results did not identify mercury in any media sampled. Pesticides and metals were detected in surface soil samples. Low levels of organics and metals were detected in groundwater and surface water samples, and pesticides, PAHs, and metals were detected in sediment samples. No potential unacceptable human health or ecological risks were identified.
Proposed Remedial Action Plan and Record of Decision (Baker, 1993)	1993	A PRAP was issued to solicit public input on the preferred alternative (no action) and a public meeting was held. The Final ROD was issued and signed in September 1993. Because no RAs were required in the ROD, the site was closed with NFA.

8.2.22 Site 51—MCAS Football Field

Site 51, the MCAS Football Field, encompasses approximately 20 to 30 acres in MCAS New River in the northwest portion of the Base. Site 51 was reportedly the site of empty container disposal between approximately 1967 and 1968 (Figure 8-58). Paint cans and hydraulic fluid cans were reportedly disposed.

FIGURE 8-58
IRP Site 51



Previous investigations are listed in Table 8-74.

TABLE 8-74
Previous Investigations Summary, IRP Site 51

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of any waste reportedly disposed of at IRP Site 51 was determined to be insignificant and did not warrant further investigation.
Confirmatory Site Assessment (Osage, 2011)	2009-2011	To verify the presence or absence of waste, confirmatory sampling was conducted. Soil and groundwater samples were collected and analyzed for SVOCs, VOCs, pesticides/PCBs, and metals. No unacceptable human health or environmental risks were identified and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.23 Site 53—MCAS Warehouse Building 3525 Area

IRP Site 53, the MCAS Warehouse Building 3525 Area, encompasses approximately 3 miles of roadway in MCAS New River in the northwest portion of the Base (**Figure 8-59**). From 1970 to 1975, liquid wastes were sprayed on the unimproved dirt roads in the vicinity of IRP Site 53 to control dust. The liquid waste mixture reportedly contained crankcase waste oil, JP fuels, and paint thinners.

FIGURE 8-59
IRP Site 53



Previous investigations are listed in **Table 8-75**.

TABLE 8-75
Previous Investigations Summary, IRP Site 53

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of any waste reportedly disposed of at IRP Site 53 was determined to be insignificant and did not warrant further investigation.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of waste, confirmatory sampling was conducted. Soil and groundwater samples were collected and analyzed for SVOCs, VOCs, PCBs, and metals. Potential human health risks were identified from arsenic groundwater at one temporary well location. A permanent monitoring well was installed, a groundwater sample was collected to confirm the results, and arsenic was not detected. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.24 Site 55—Air Station East Perimeter Dump

IRP Site 55, the Air Station East Perimeter Dump, encompasses approximately 6 acres in MCAS New River in the northwest portion of the Base (**Figure 8-60**). From the 1950s to the 1960s, IRP Site 55 was reportedly used as a disposal area for barrels, tires, trash, metal planking, and telephone poles. The area is currently used as a marina and recreation area by the Air Station.

FIGURE 8-60
IRP Site 55



Previous investigations are listed in **Table 8-76**.

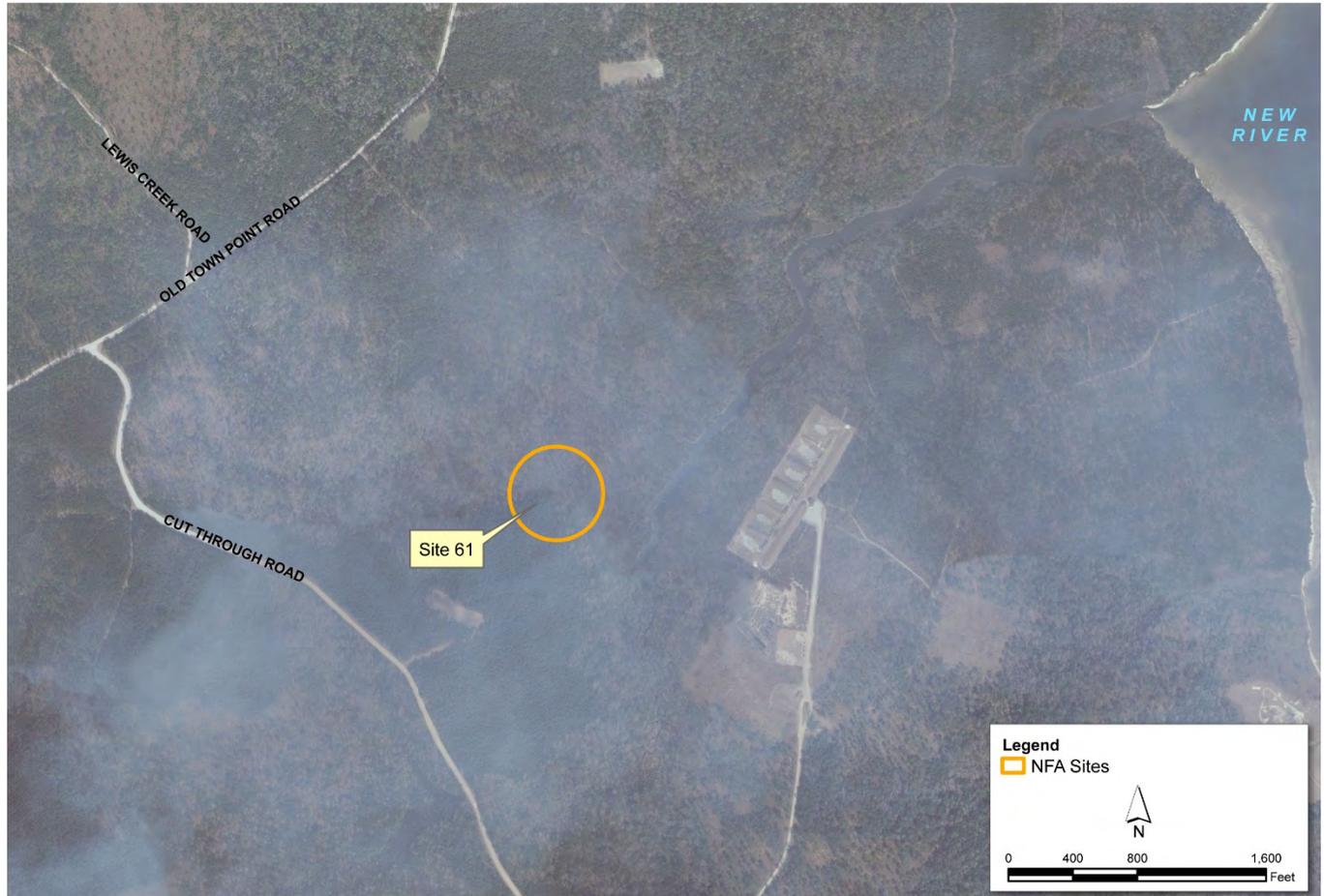
TABLE 8-76
Previous Investigations Summary, IRP Site 55

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at IRP Site 55, and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of contamination due to the site's history as a dump, confirmatory sampling was conducted. Groundwater and soil samples were collected and analyzed for SVOCs, VOCs, pesticides/PCBs, herbicides, and metals and no unacceptable risks to human health or the environment were identified. The site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.25 Site 61—Rhodes Point Road Dump

IRP Site 61, the Rhodes Point Road Dump, encompasses approximately 8 to 10 acres and is located nearly 5 miles south of the MCAS New River operations area (**Figure 8-61**). The exact dates of operation are unknown; however, it was reported that IRP Site 61 has been used as a disposal area for wastes generated during bivouac exercises. The site is currently used for training activities.

FIGURE 8-61
IRP Site 61



Previous investigations are listed in **Table 8-77**.

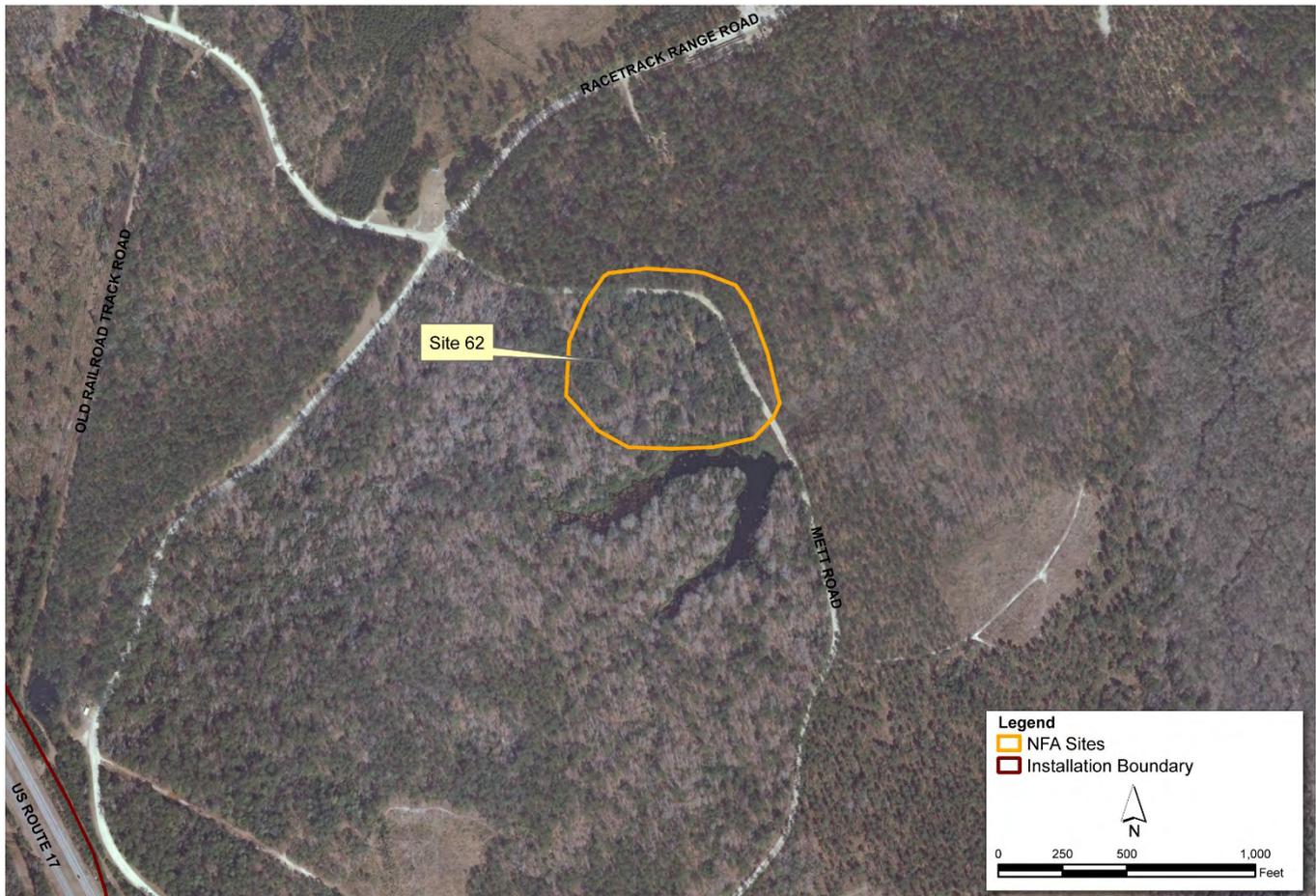
TABLE 8-77
Previous Investigations Summary, IRP Site 61

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at IRP Site 61, and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of waste, confirmatory sampling was conducted. Soil and groundwater samples were collected and analyzed for SVOCs, VOCs, PCBs, and metals. Potential human health risks were identified from arsenic groundwater at one temporary well location. A permanent monitoring well was installed, a groundwater sample was collected to confirm the results, and arsenic was detected below regulatory criteria and background. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.26 Site 62—Race Course Area Dump

IRP Site 62, the Race Course Area Dump, encompasses approximately 1 to 2 acres nearly 2 miles south of the MCAS New River operations area (**Figure 8-62**). The exact dates of operation are unknown; however, it was reported that IRP Site 62 has been used as a disposal area for wastes generated during bivouac exercises. The site is currently used for war games, so site access/use is restricted.

FIGURE 8-62
IRP Site 62



Previous investigations are listed in **Table 8-78**.

TABLE 8-78
Previous Investigations Summary, IRP Site 62

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. No hazardous wastes were reportedly disposed of at IRP Site 62, and no further assessment was recommended.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of contamination due to the site’s history as a dump, confirmatory sampling was completed. Soil and groundwater samples were analyzed for VOCs, SVOCs, and metals. No unacceptable risks to human health or the environment were identified. The site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.27 Site 66—Amphibious Tractors Landing Site and Storage Area

IRP Site 66, the Amphibious Tractors Landing Site and Storage Area, encompasses approximately 40 acres in the Courthouse Bay area of the Base (**Figure 8-63**). Beginning in the 1950s, IRP Site 66 was used for vehicle maintenance during training activities. Exact operations are unknown; however, it is likely that vehicle maintenance operations resulted in release of POL and battery acid.

FIGURE 8-63
IRP Site 66



Previous investigations are listed in **Table 8-79**.

TABLE 8-79
Previous Investigations Summary, IRP Site 66

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. Although spills of POL had likely occurred at IRP Site 66, the quantity was insignificant and did not warrant further investigation.
Confirmatory Sampling Report (CH2M HILL, 2011)	2009-2011	To verify the presence or absence of contamination, confirmatory sampling was conducted. Groundwater, soil, sediment, and surface water samples were collected and analyzed for SVOCs, VOCs, and metals. Potential ecological risks were identified from metals in surface water. Confirmation surface water sampling was conducted and the metals were not detected. Therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.28 Site 67—Engineer’s Trinitrotoluene Burn Site

IRP Site 67, Engineer’s Trinitrotoluene (TNT) Burn Site, encompasses approximately 7 acres in the Courthouse Bay area of the Base (Figure 8-64). In 1951, IRP Site 67 was reportedly used for TNT disposal. Deep pits (2 to 3 feet deep) were dug and unwanted TNT was opened and burned. Complete consumption of all TNT was reported during these procedures.

FIGURE 8-64
IRP Site 67



Previous investigations are listed in Table 8-80.

TABLE 8-80
Previous Investigations Summary, IRP Site 67

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The quantity of any waste reportedly disposed of at IRP Site 67 was insignificant and did not warrant further investigation.
Confirmatory Site Assessment (CH2M HILL, 2010)	2009-2010	To verify the presence or absence of contamination due to the site’s history, confirmatory sampling was completed in FY 2010. Soil and groundwater samples were analyzed for TNT and breakdown products. 2-Amino-4,6-dinitrotoluene was detected in groundwater at one temporary well location. The concentration was below regulatory screening criteria; therefore, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in July 2012.

8.2.29 Site 75 (Pre-RI)—MCAS Basketball Court Site

Site 75, the MCAS Basketball Court Site, encompasses approximately 1 acre in the MCAS New River operations area (Figure 8-65). Site 75 was reportedly a drum burial area that was used in the early 1950s. The excavation area was an oval-shaped pit approximately 90 feet long by 70 feet wide and was sufficiently deep to have encountered the water table. An estimated 75 to 100 55-gallon drums were placed in this pit. The drums reportedly contained a chloroacetophenone tear gas solution used for training. Additional organic chemicals, such as chloroform, carbon tetrachloride, benzene, and chloropicrin, may have been present in the solution.

FIGURE 8-65
IRP Site 75



Previous investigations are listed in **Table 8-81**.

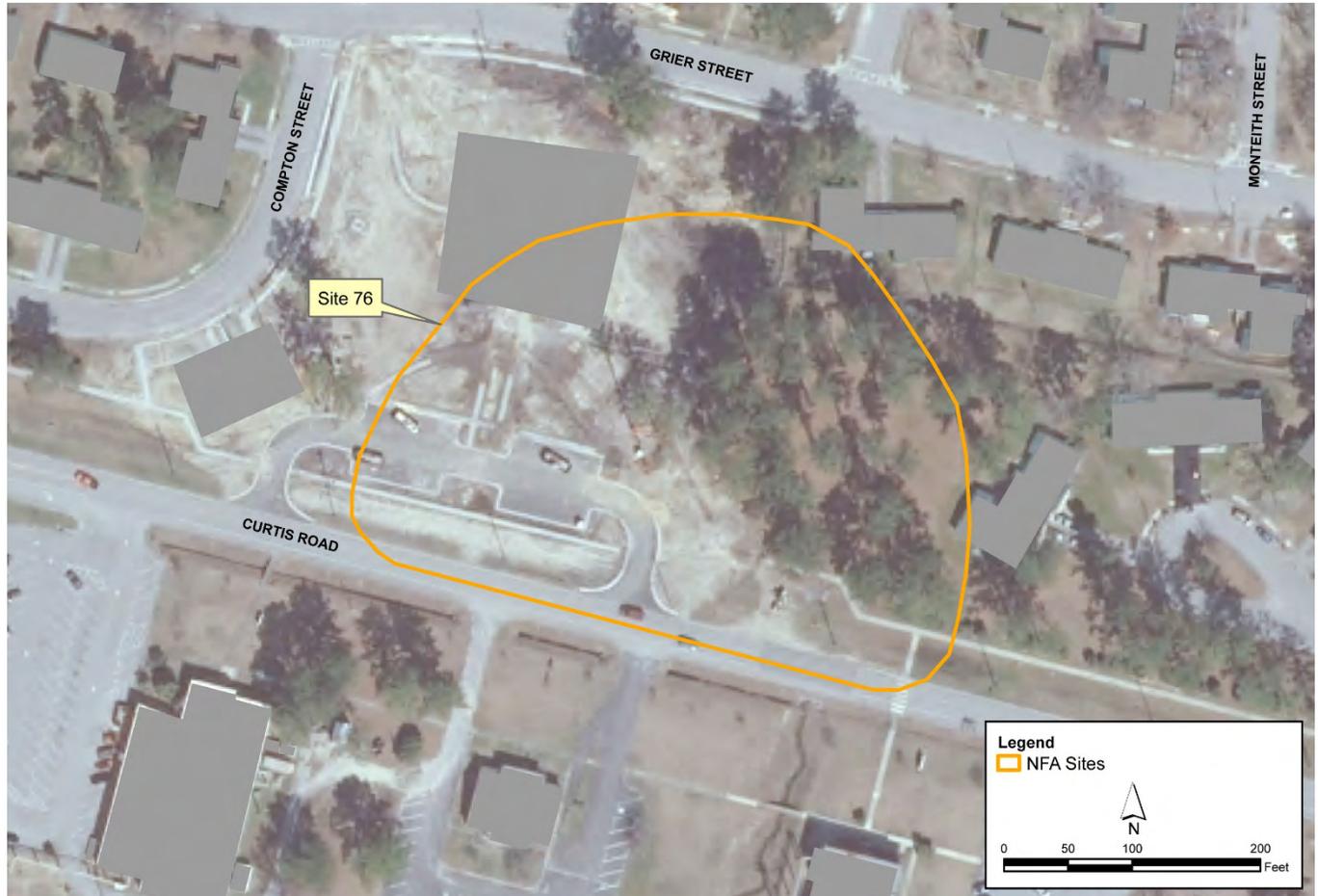
TABLE 8-81
Previous Investigations Summary, IRP Site 75

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that degradation of buried drums could result in the release of suspected materials into the groundwater, potentially impacting water supply wells within the area. Based on these findings, the IAS recommended additional investigation.
Pre-Remedial Investigation Screening Study (Baker, 1995)	1995	A Pre-RI screening study was conducted to determine whether contamination was present at the site. Field activities included a geophysical investigation and soil and groundwater sampling. The geophysical survey did not detect any major subsurface anomalies that could have been the suspected drums. SVOCs, pesticides, and metals were detected in soil samples and metals were detected in groundwater samples. No potential, unacceptable ecological risks were identified, and the Pre-RI recommended NFA.
No Action Decision Document (CH2M HILL, 2001)	2001	The Final NADD was completed May 8, 2001.

8.2.30 Site 76 (Pre-RI)—MCAS Curtis Road Site

Site 76, the MCAS Curtis Road Site, is located in the MCAS New River operations area and covers approximately 3 acres (Figure 8-66). There are several Base housing units to the immediate north of the Site 76 study area. The site was reportedly used as a drum disposal area on two occasions in 1949. The estimated area of the disposal unit is a quarter-acre, and approximately 25 to 75 55-gallon drums were allegedly disposed at this site. The drums reportedly contained a chloroacetophenone tear gas solution used for training similar to that allegedly buried at Site 75. Additional organic chemicals, such as chloroform, carbon tetrachloride, benzene, and chloropicrin, may have been present in the solution.

FIGURE 8-66
IRP Site 76



Previous investigations are listed in **Table 8-82**.

TABLE 8-82

Previous Investigations Summary, IRP Site 76

Previous Investigation/Action	Date	Activities
Initial Assessment Study (WAR, 1983)	1983	The IAS was conducted to identify potential hazardous sites at MCIEAST-MCB CAMLEJ. The IAS concluded that degradation of buried drums could potentially result in the release of suspected materials into groundwater. Based on these findings, the IAS recommended an additional investigation.
Pre-RI Screening Study (Baker, 1998)	1995 - 1998	A Pre-RI screening study was conducted to determine whether contamination was present at the site. Field activities included a geophysical investigation, soil, and groundwater sampling. The geophysical survey did not detect any major subsurface anomalies that could have been the suspected drums. VOCs, SVOCs, and pesticides were detected in soil samples. Metals were detected in groundwater samples. No unacceptable human health risks were identified due to the presence of metals in groundwater. As a result, the Pre-RI recommended NFA.
Additional Groundwater Sampling (Baker, 1999)	1999	In response to an agency comment and because metals were previously detected above screening criteria, groundwater was resampled in October 1999. Only aluminum and iron were detected above screening criteria and no unacceptable human health risks were identified.
No Action Decision Document (CH2M HILL, 2001)	2001	The Final NADD was completed May 8, 2001.

8.2.31 Site 85—Former Camp Johnson Battery Dump

Site 85 covers approximately 5 acres of heavily vegetated land (**Figure 8-67**) in the Camp Johnson area of the MCIEAST-MCB CAMLEJ. During the 1950s, Site 85 was used for battery disposal. The site was discovered in 1992 when decomposed batteries used in military communication equipment during the Korean War era were unearthed as a roadway was being widened. Discarded charcoal canisters from air purifying respirators and battery packs were also discovered throughout the site.

FIGURE 8-67
IRP Site 85



Previous investigations are listed in **Table 8-83**.

TABLE 8-83
Previous Investigations Summary, IRP Site 85

Previous Investigation/Action	Date	Activities
Pre-Remedial Investigation Screening Study (Baker, 1998)	1995 - 1998	A Pre-RI was initiated to assess the nature and extent of contamination. Field activities included a site survey, installation of temporary monitoring wells, and soil and groundwater sampling. Metals were detected in soil and groundwater samples collected near battery piles and a Baseline HHRA identified potential risks to human receptors. The Pre-RI recommended an EE/CA for the battery piles and associated soil.
Engineering Evaluation/Cost Analysis (Baker, 1999)	1999	An EE/CA was prepared to evaluate remedial alternatives for metals in soil and groundwater at Site 85. The three alternatives were institutional controls, excavation and on-Base disposal, and treatment (ex-Situ soil washing). A public notice was issued and public meeting was held in October 1998. The recommended alternative in the EE/CA included removal of soil and batteries through a NTCRA, followed by re-evaluation of groundwater.
Action Memorandum (Baker, 1999)	1999	An AM was completed to propose excavation with on-Base disposal as the NTCRA to address metals in soil and the battery piles.
Non-time-critical Removal Action (OHM, 2000)	2000	The NTCRA was conducted and 158 tons of soil and debris were removed from 16 separate battery pile locations. Confirmation soil sampling was conducted.
Long-term Monitoring (Baker, 2002)	2001-2002	Groundwater LTM was initiated in July 2001 and included sampling of five monitoring wells on a quarterly basis for metals analysis. In July 2002, the concentrations of metals were below the cleanup levels for at least four consecutive quarters, and LTM was discontinued at Site 85.
No Action Decision Document (Baker, 2005)	2005	Based on results of previous investigations at Site 85, no further RA was recommended. USEPA and NCDENR concurred with NFA status.
Preliminary Assessment/Site Inspection (CH2M HILL, 2011)	2009-2011	To characterize potential environmental impacts associated with the past use of Site 85, a PA/SI was initiated. Field activities included test pitting and collection of soil and groundwater samples for metals analysis. Four test pits were excavated from 2 to 6 feet bgs; batteries were identified at the surface of each test pit, but were not observed deeper than 2 feet bgs. A battery sample was collected for metals analysis. Lead and mercury were detected at concentrations in exceedance of USEPA maximum toxicity values. The batteries and soil were placed in separate 55-gallon drums and removed from the site. Several metals were detected in soil and groundwater at concentrations exceeding screening criteria. Potential unacceptable risks were identified in groundwater due to exposure to chromium and unacceptable risks for ecological were identified due to exposure to select metals in soil. Further assessment of soil and groundwater was recommended.
Expanded Site Investigation (CH2M HILL, 2011)	2010-2011	To assess the nature and extent of metals in soil at Site 85, an ESI was initiated. Field activities included composite surface soil, discrete surface soil, and groundwater sampling. Samples were analyzed for select metals. No unacceptable human health or ecological risks were identified during risk assessments. Based on the results of the PA/SI and ESI, the NFA decision was confirmed.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in March 2012.

8.2.32 Site 87 (Pre-RI)—MCAS Officers' Housing Area

Site 87, the MCAS Officers' Housing Area site (formerly Site A), is located on the west bank of the New River and covers less than 1 acre (**Figure 8-68**). The area was identified in 1986 when waste was identified eroding out of a cut bank along the New River near an officers' housing area. The materials were tentatively identified as hospital wastes. Various hospital waste materials were noted, including hypodermic needles and vials of white powder that were believed to contain a chlorine-based substance. No information was available regarding the volume of the waste or the mode of disposal and it is unclear how the materials got into the river bank.

FIGURE 8-68
IRP Site 87



Previous investigations are listed in **Table 8-84**.

TABLE 8-84
Previous Investigations Summary, IRP Site 87

Previous Investigation/Action	Date	Activities
Pre-Remedial Investigation Screening Study (Baker, 1998)	1995 - 1998	A Pre-RI was initiated to assess the nature and extent of contamination. Field activities included a site survey, exploratory test pits, and soil, groundwater, surface water, and sediment sampling. No potential unacceptable human health or ecological risks were identified. As a result, the Pre-RI recommended NFA.
Confirmatory Groundwater Sampling (Baker, 1999)	1999	One groundwater sample collected during the Pre-RI detected PCP above the screening criteria and the location was sampled again in 1999. No PCP was detected.
No Action Decision Document (CH2M HILL, 2001)	2001	The Final NADD was completed May 8, 2001.

8.2.33 Site 90 (OU 17)—Building BB-9

Site 90, Building BB-9, encompasses approximately 6 acres within OU 17, in the southeast portion of the Base in the Courthouse Bay Complex (**Figure 8-69**). OU 17 consists of three sites (Sites 90, 91, and 92) that have been grouped together based on the unique characteristic of suspected waste. All three sites were formerly part of the UST Program, but were transferred to the IRP because petroleum-related contamination was not identified. Site 90 is a former UST basin where three 1,000-gallon steel USTs containing heating oil were previously located between a dry cleaning distribution facility and a heating plant. The USTs were removed in March 1993. Dry-cleaning processes were performed at this location for an unknown period of time, but were subsequently discontinued. During the years that dry cleaning operations were conducted at this location, a 250-gallon AST was located onsite.

FIGURE 8-69
IRP Site 90, OU 17



Previous investigations are listed in **Table 8-85**.

TABLE 8-85
Previous Investigations Summary, IRP Site 90

Previous Investigation/Action	Date	Activities
Focused Remedial Investigation (Baker, 2001)	1997 - 2001	A Focused RI was conducted to assess the nature and extent of contamination at OU 17. Field activities included a site survey and soil and groundwater sampling. Analytical results identified the presence of toluene in soil samples and PCE and chloroform were detected in groundwater. Potential unacceptable human health risks were identified due to the presence of PCE in groundwater. Additional groundwater sampling was conducted in 1999 and 2000. Only TCE was detected above screening criteria at one location, and there is no evidence of a large-scale PCE impact of the area; NFA was recommended.
Proposed Remedial Action Plan and Record of Decision (Baker, 2001)	2001	A Final PRAP was issued in July 2001 to solicit public input on the preferred alternative (no RAs) and a public meeting was held. The Final ROD was issued and signed on September 30, 2001.

8.2.34 Site 91 (OU 17)—Building BB-51

Site 91, Building BB-51, encompasses approximately 8 acres within OU 17 in the southeast portion of the Base in the Courthouse Bay Complex (**Figure 8-70**). OU 17 consists of three sites (Sites 90, 91, and 92) that have been grouped together based on the unique characteristic of suspected waste. All three sites were formerly part of the UST Program, but were transferred to the IRP because petroleum-related contamination was not identified. Site 91 is currently used by the Marine Corps School of Engineering to train personnel. The site is a former UST basin where two 300-gallon steel USTs used to store waste oil were previously located northeast of Building BB-51. The USTs were removed in August 1992. At the time of the UST closure, TPH contamination was detected in the soil samples.

FIGURE 8-70
IRP Site 91, OU 17



Previous investigations are listed in **Table 8-86**.

TABLE 8-86

Previous Investigations Summary, IRP Site 91

Previous Investigation/Action	Date	Activities
Focused Remedial Investigation (Baker, 2001)	1997 - 2001	A Focused RI was conducted to assess the nature and extent of contamination at OU 17. Field activities included a site survey and soil and groundwater sampling. Potential risks to human health were identified from chloroform, arsenic, iron, and manganese in groundwater. Chloroform and iron were determined not to be site related.
Supplemental Groundwater Investigation (Baker, 2001)	1999 - 2001	Additional groundwater sampling was conducted in 1999 to confirm the presence of VOCs or SVOCs. Results were discussed in the 2001 Remedial Investigation. Post-RI monitoring was recommended.
Post-Remedial Investigation Groundwater Monitoring (Baker, 2001)	2000 - 2001	Post-RI groundwater monitoring was initiated in July 2000, and included quarterly groundwater sampling for VOCs, SVOCs, iron, and arsenic. The results indicated that the constituents detected were naturally occurring and not site related.
Proposed Remedial Action Plan and Record of Decision (Baker, 2001)	2001	A Final PRAP was issued in July 2001 to solicit public input on the preferred alternative (no RAs) and a public meeting was held. The Final ROD was issued and signed in September 2001.

8.2.35 Site 92 (OU 17)—Building BB-246

Site 92, formerly Building BB-246, is located within OU 17 in the southeast portion of the Base in the Courthouse Bay Complex and covers approximately 1 acre (**Figure 8-71**). OU 17 consists of three sites (Sites 90, 91, and 92) that have been grouped together based on the unique characteristic of suspected waste. All three sites were formerly part of the UST Program, but were transferred to the IRP because petroleum-related contamination was not identified. Site 92 is a former UST basin where one 1,000-gallon steel UST containing gasoline was previously located. The UST was installed in 1980, deactivated in 1989, and removed in January 1994. A subsequent SI identified the presence of chlorinated hydrocarbons in the groundwater.

FIGURE 8-71
IRP Site 92, OU 17



Previous investigations are listed in **Table 8-87**.

TABLE 8-87
Previous Investigations Summary, IRP Site 92

Previous Investigation/Action	Date	Activities
Focused Remedial Investigation (Baker, 2001)	1997 - 2001	A Focused RI was conducted to assess the nature and extent of contamination at OU 17. Field activities at Site 92 included a site survey and soil and groundwater sampling. Potential human health risks were identified from acetone, arsenic, and iron in soil and chloroform in groundwater. However, the concentrations were either comparable with background or reflective of the sample decontamination process.
Post-Remedial Investigation Groundwater Monitoring (Baker, 2001)	2000 - 2001	Based on the findings of the Focused RI, Post-RI groundwater monitoring was conducted quarterly for VOCs, SVOCs, iron, arsenic, and manganese. The results indicated that the constituents detected were naturally occurring and not site related.
Proposed Remedial Action Plan and Record of Decision (Baker, 2001)	2001	A Final PRAP was issued in July 2001 to solicit public input on the preferred alternative (no RA) and a public meeting was held. The Final ROD was issued and signed in September 2001.

8.2.36 Site 94 (OU 18)—PCX Service Station

Site 94, the PCX Service Station, covers approximately 2 acres and is located within the HPIA on the Mainside of the Base within the western portion of Site 78 (OU 1) (**Figure 8-72**). The PCX Service Station is an active facility, providing refueling services for private vehicles, and consists of a single-story brick structure flanked by three concrete pump islands on two sides. Historical records indicate that two 10,000-gallon and two 30,000-gallon USTs storing various grades of gasoline were installed during the 1950s. The USTs and associated petroleum-contaminated soil were removed in January 1995. During subsequent phases of investigation, free phase hydrocarbons and chlorinated organic contaminants were detected in groundwater. Soil and groundwater contamination resulting from the petroleum releases at the site is currently being remediated under NCDENR's UST Program.

FIGURE 8-72
IRP Site 94, OU 18



Previous investigations are listed in **Table 8-88**.

TABLE 8-88

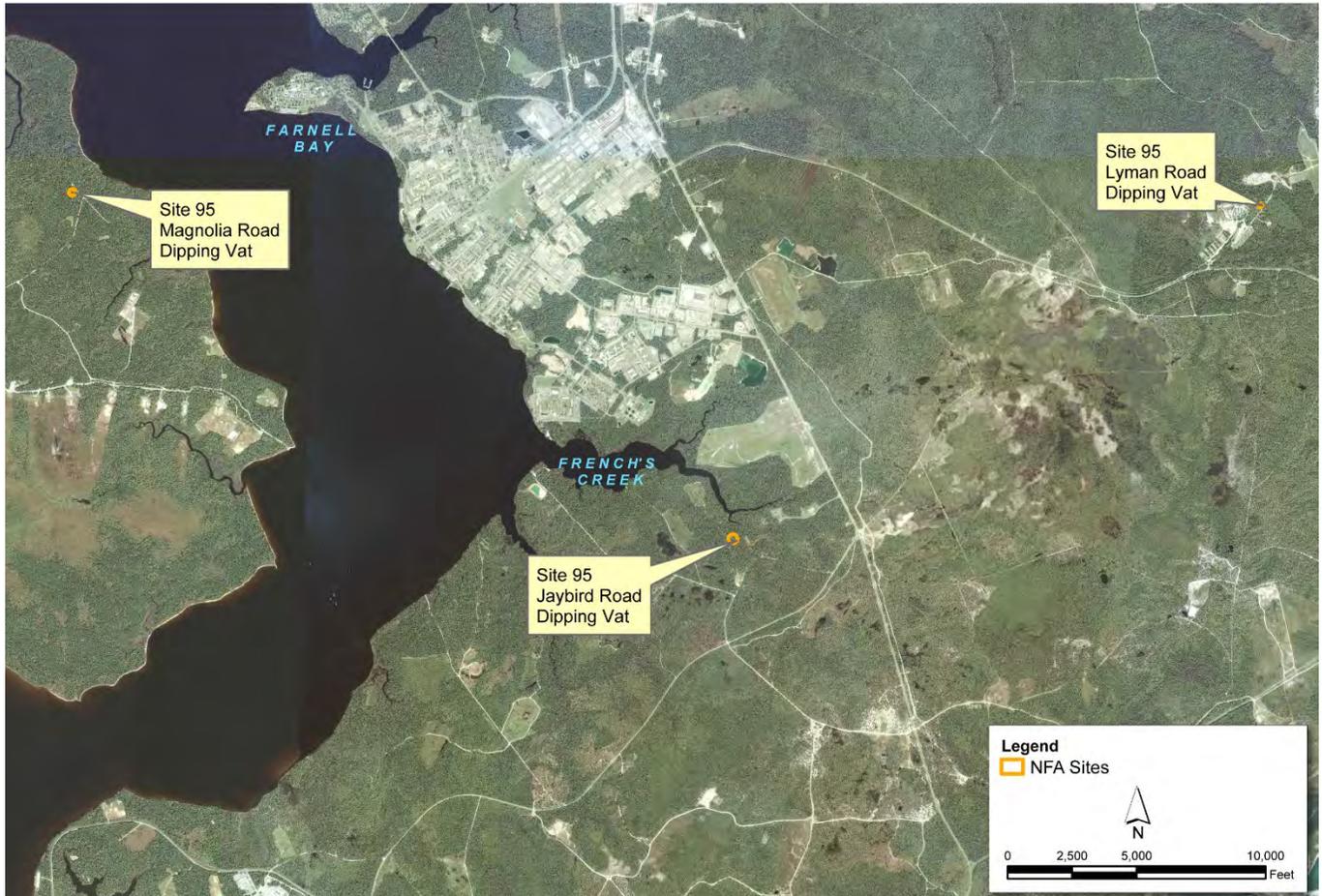
Previous Investigations Summary, IRP Site 94

Previous Investigation/Action	Date	Activities
Groundwater Investigation (OHM, 2001)	2000 - 2001	An Investigation was conducted to evaluate groundwater conditions. Analytical results identified VOCs (primarily BTEX and methyl tert-butyl ethylene) and PAHs at concentrations exceeding NCGWQS. A December 1, 2000, letter from the Base to NCDENR requested the transfer of the PCX Service Station to the IRP, which resulted in the subsequent CERCLA investigation activities.
Remedial Investigation Baseline Groundwater Sampling (2003)	2003	To obtain the most current groundwater quality data, baseline groundwater sampling was conducted. Samples were analyzed for VOCs and several VOCs exceeded screening criteria.
Remedial Investigation (CH2M HILL, 2005)	2004 - 2005	An RI was conducted to further evaluate contamination near Site 94. Field activities included soil and groundwater sampling for SVOC and VOC analysis. Potential unacceptable human health risks were identified due to VOCs in groundwater. No potential unacceptable ecological risks were identified. The Final RI concluded that groundwater contamination was from an upgradient source and will be addressed as part of Site 78.
Proposed Remedial Action Plan and Record of Decision (CH2M HILL, 2006)	2006	The PRAP was issued to solicit public input on the preferred alternative (no RA) and a public meeting was held. The ROD for OU 18 was issued for NFA and signed in August 2006.

8.2.37 Site 95—Dipping Vat Sites

IRP Site 95, the Dipping Vat sites, consists of three separate areas, which are identified by their locations (Jaybird Road, Magnolia Road, and Lyman Road), and encompass a total of approximately 4 acres (**Figure 8-73**). The IRP Site 95 dipping vats were in operation from approximately 1900 through 1960 and were used to submerge livestock in a pesticide solution consisting of arsenic and synthetic pesticides, such as DDT and toxaphene. The dipping vats were discovered during an archaeological review of MCIEAST-MCB CAMLEJ. The dipping vats were approximately 25 to 30 feet long, 4 to 5 feet deep, and 2.5 to 3.5 feet wide, each able to hold approximately 1,500 to 2,000 gallons of dipping solution. A drip pad, approximately 12 feet by 15 feet, was constructed at the exit of each vat. Holding pens, approximately 50 feet by 50 feet, were also associated with the dipping vats.

FIGURE 8-73
IRP Site 95



Previous investigations are listed in **Table 8-89**.

TABLE 8-89
Previous Investigations Summary, IRP Site 95

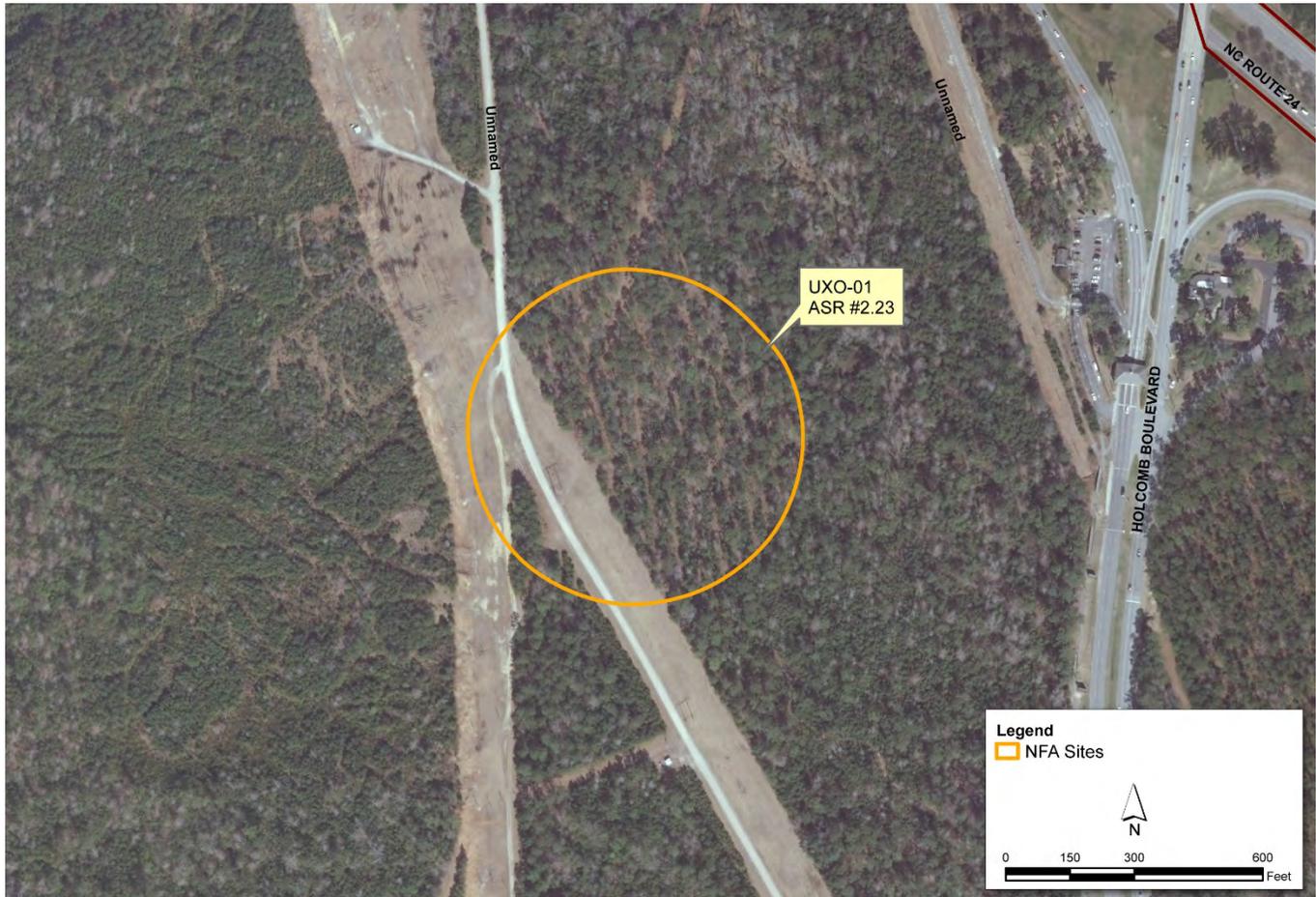
Previous Investigation/Action	Date	Activities
Initial Assessment (Baker, 2004)	2004	Vats were initially identified during an archaeological investigation of the Base. Following their discovery, an initial assessment was performed on two of the three dipping vat sites (Jaybird Road and Magnolia Road), which included soil sampling for pesticides and metals. Arsenic exceeded screening criteria, and additional assessment was recommended. The third site (Lyman Road) was identified after the initial investigation.
Site Investigation (CH2M HILL, 2007)	2006 - 2007	Based on results from the Initial Assessment, an SI field investigation was conducted. Field activities included soil and groundwater sampling for VOCs, SVOCs, pesticides/PCBs, and metals. An HHRS was completed and did not identify any unacceptable risks to human health at the Jaybird Road and Lyman Road Sites; therefore, NFA was recommended at these two locations. Potential risks to human health and the environment were identified from arsenic in soil at the Magnolia Road location and a removal action was recommended.
Engineering Evaluation/Cost Analysis (Rhēa, 2010)	2010	An EE/CA was prepared to evaluate alternatives for the NTCRA at the Magnolia Road site. The three alternatives were no action, excavation and offsite disposal, and in situ phytoremediation. A public notice was issued and public meeting was held in February 2010 to present the EE/CA. No written questions or comments were received.
Action Memorandum (CH2M HILL, 2010)	2010	An AM was completed to propose excavation with offsite disposal as the NTCRA to address the arsenic contaminated soil.
Non-time-critical Removal Action (Rhēa, 2010)	2010	The NTCRA was conducted and a second vault was identified and removed from beneath the original dipping vat at the depth of the water table. Confirmation soil sampling was conducted to confirm arsenic concentrations below the cleanup level. A permanent monitoring well was installed to conduct groundwater sampling for arsenic. Arsenic concentrations in soil and groundwater were below North Carolina standards and/or background and the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2011)	2011	The Final NADD was signed in November 2011.

8.3 MMRP RC Sites

8.3.1 UXO-01—Former Live Hand Grenade Course (ASR #2.23)

The Former Live Hand Grenade Course encompasses approximately 10 acres on the Mainside of the Base (Figure 8-74). The Live Hand Grenade Course was established under Camp Training Order Number 7-1945, dated March 19, 1945, and was disestablished in March 1946 and no longer used for firing live ammunition. During operation of the site, munitions used included fragmentation, offensive, and practice grenades.

FIGURE 8-74
MMRP Site UXO-01, ASR #2.23



Previous investigations are listed in **Table 8-90**.

TABLE 8-90

Previous Investigations Summary, MMRP Site UXO-01, ASR #2.23

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2009)	2008 - 2009	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil and groundwater sampling and 10 percent DGM. Samples were analyzed for explosives residues, metals, and perchlorate. No unacceptable risks to human health or the environment were identified in site media. 249 geophysical anomalies were identified at the site, and an intrusive investigation of subsurface anomalies was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted to further investigate the 249 geophysical anomalies identified during the PA/SI. An intrusive investigation was conducted, and no MEC or MPPEH was identified; NFA was recommended.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.
ESS Determination Request	2015	Due to low probability of encountering MEC or MPPEH, MCIEAST-MCB CAMLEJ determined an escort by UXO qualified personnel is not required to access the site. Additionally, an ESS is not required to conduct future activities. 3R training is required for all personnel accessing these locations.

8.3.2 UXO-01—D-6 50-Foot Indoor Rifle and Pistol Range (ASR #2.64)

The D-6 50-Foot Indoor Rifle and Pistol Range consists of approximately 1 acre and is identified as a former .22-caliber indoor range, which included eight manually operated targets (**Figure 8-75**). The range was in use since before 1954, but exact dates are not known. The building was demolished in 1998.

FIGURE 8-75
MMRP Site UXO-01, ASR #2.64



Previous investigations are listed in **Table 8-91**.

TABLE 8-91
Previous Investigations Summary, MMRP Site UXO-01, ASR #2.64

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (Tetra Tech, 2009)	2009	A field investigation was conducted to identify the presence or absence of contamination at the site. XRF and confirmation soil sampling was conducted to identify potential metals contamination. Three drainage soil samples were collected for metals analysis, and four groundwater samples were collected for metals and perchlorate analysis. Lead concentrations were identified as potential risk to human and ecological receptors in soil and groundwater. A removal action to address the antimony, arsenic, and lead in soil was recommended.
Engineering Evaluation/Cost Analysis (Tetra Tech, 2010) and Action Memorandum (Tetra Tech, 2011)	2010-2011	An EE/CA was prepared to identify removal action alternatives to address the antimony, arsenic, and lead in soil. Excavation and offsite disposal was the preferred alternative presented to the public in November 2010. The public comment period was held from November to December 2010 and no comments were received. The AM documented excavation and offsite disposal as the selected remedy.
Non-time-critical Removal Action Construction Completion Report (Osage, 2013)	2013	An NTCRA was initiated to address antimony, arsenic, and lead in soil. Pre-excavation soil sampling results indicated the lead concentrations would require that the soil be disposed of as hazardous waste. Therefore, soil within the excavation area was treated in place to render non-hazardous. Approximately 970 tons of soil, brush, and debris were excavated for offsite disposal. Post-excavation samples from the base of the excavation were collected and analyzed for antimony, arsenic, and lead. Antimony and lead were detected at concentrations in exceedance of the preliminary remediation goals at one location; therefore, the soil at this location was treated, excavated, and resampled; and the results were below the preliminary remediation goals. Additionally, follow-up groundwater sampling was conducted for lead analysis, and lead was not detected. Based on the results of the NTCRA and groundwater sampling, NFA was recommended.
No Action Decision Document (Osage, 2014)	2014	The Final NADD was signed in March 2014.

8.3.3 UXO-02—Unnamed Explosive Range (ASR #2.201)

Site UXO-02, the Unnamed Explosive Range, encompasses approximately 127 acres along the west bank of the New River in the Rifle Range Area of the Base (**Figure 8-76**). UXO-02 encompasses IRP Site 69 (**Section 7.1.1**). UXO-02 was used as an explosive range from 1973 to 2002; however, the types of munitions employed at this range are unknown.

FIGURE 8-76
MMRP Site UXO-02, ASR #2.201



Previous investigations are listed in **Table 8-92**.

TABLE 8-92
 Previous Investigations Summary, MMRP Site UXO-02, ASR #2.201

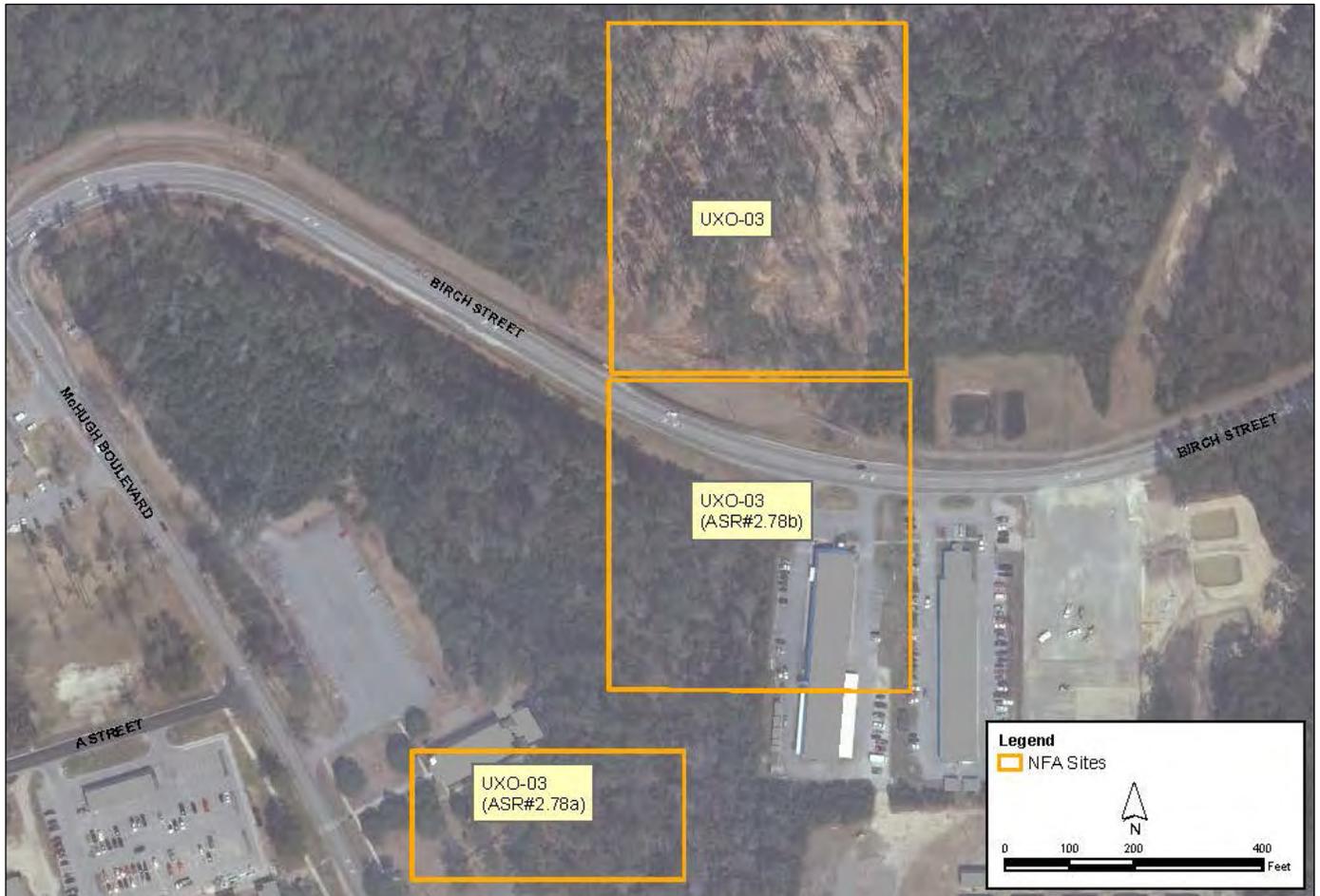
Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2012)	2009 - 2012	To identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC, field activities were conducted (concurrently with Site 69 field activities [Section 7.1.1]). Soil, groundwater, surface water, and sediment samples were collected and analyzed for explosives residues, metals, and perchlorate. Approximately 1,100 geophysical anomalies were identified during DGM, potentially representing subsurface MEC. Potential unacceptable risks to human health and the environment were identified due to exposure to metals in groundwater and pesticides in soil and sediment. Further investigation of groundwater and geophysical anomalies was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted at UXO-02, including Site 69, to further investigate potential unacceptable risks identified during the UXO-02 PA/SI and Site 69 supplemental investigation. Field activities included an intrusive anomaly investigation, monitoring well installation, and soil, groundwater, surface water, and sediment sampling for pesticides, metals, and/or explosives residues analyses. No unacceptable human health or ecological risks were identified from potential exposure to soil, surface water, sediment, or metals in the surficial aquifer groundwater. NFA was recommended for the portion of UXO-02 located outside of the Site 69 perimeter fence and a NADD was submitted in FY 2013. The remaining environmental impacts to be further assessed are associated with potential risks from exposure to waste and the VOC groundwater plume associated with Site 69.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.
ESS Determination Request	2015	Due to low probability of encountering MEC or MPPEH, MCIEAST-MCB CAMLEJ determined an escort by UXO qualified personnel is not required to access the site. Additionally, an ESS is not required to conduct future activities. 3R training is required for all personnel accessing these locations.

8.3.4 UXO-03—Practice Hand Grenade Course (ASR #2.78a and #2.78b)

Site UXO-03, the former Practice Hand Grenade Course including the northern boundary area, covers approximately 12 acres of wooded and developed land (**Figure 8-77**). The site contains two former range areas (ASR# 2.78a and ASR Area 2.78b) along Birch Street, north of the Hadnot Point area. The northern boundary area was identified to be addressed as part of UXO-03, based on the uncertainty associated with historical range boundaries and planned MILCON. Site UXO-03 was used as the practice hand grenade range between 1953 and 1959. Although the specific types of munitions used at the site are unknown, the proximity to adjacent buildings and activities would substantiate the likely use of practice munitions. It was therefore concluded to be unlikely that pyrotechnics or high-explosive munitions were used at the site.

FIGURE 8-77

MMRP Site UXO-03, ASR #2.78a and #2.78b



Previous investigations are listed in **Table 8-93**.

TABLE 8-93
Previous Investigations Summary, MMRP Site UXO-03, ASR #2.78a and #2.78b

Previous Investigation/Action	Date	Activities
Focused Site Investigation, Northern Boundary (CH2M HILL, 2008)	2008	A Focused SI was conducted within the northern boundary area to evaluate the potential for MEC and environmental impacts based on planned MILCON activities adjacent to the identified UXO-03 boundary. Soil and groundwater samples were collected and analyzed for explosives residues and metals. No exceedances of screening criteria and background were identified in soil or groundwater. A 10 percent DGM survey was also conducted and identified 189 geophysical anomalies representing potential subsurface MEC/MPPEH. A spent pyrotechnic signaling device was discovered on the ground surface during the investigation. Further investigation of the anomalies was recommended.
Expanded Site Investigation, Northern Boundary (CH2M HILL, 2011)	2009-2011	An ESI was conducted within the northern boundary area, including 100 percent DGM and intrusive anomaly investigation (except the wetland areas). 368 geophysical anomalies were identified and one MEC item and 19 MPPEH items were found during the intrusive investigation.
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2007-2011	A PA/SI was conducted to assess the potential presence and nature of site-related impacts to human health and the environment. Field activities included DGM and intrusive anomaly investigation over 11 percent of the accessible UXO-03 area; and surface and subsurface soil sampling, groundwater sampling, and surface water and sediment sampling in an unnamed drainage feature in the northern boundary area. The samples were analyzed for explosives residues and metals. There were no unacceptable risks to human health or the environment over that of background concentrations from exposure to site media based on current and potential future use. 68 geophysical anomalies were identified and three MPPEH items (a flare and small arms ammunition) were found during the intrusive investigation. Based on the results of northern boundary area investigations and the PA/SI, no munitions or MD related to high explosives residues or hand grenades were found. The only munitions or MD found within UXO-03 was a flare on the ground surface and flares have been found in other areas of the Base and are not necessarily related to the use of the site as a hand grenade range. Small arms ammunition was found, but does not pose an excessive risk to those who may come into contact with it. Therefore, NFA was recommended.
No Action Decision Document (CH2M HILL, 2012)	2012	The Final NADD was signed in August 2012.

8.3.5 UXO-04—Knox Trailer Park

Site UXO-04, Knox Trailer Park, encompasses approximately 134 acres in the northern portion of the Base (Figure 8-78). The Knox Trailer Park area began as a Civilian Conservation Corps Camp in 1941, housing workers who were responsible for eliminating the source of endemic malaria by draining all surrounding wetlands. This was accomplished by ditching, using dynamite, and spraying diesel oil on water surfaces as a larvicide. Additionally, a dog-training school was located in the southernmost area of the site from 1942 to 1946. The dogs were subjected to overhead rifle and machine gun fire and explosions of charges of dynamite and TNT to simulate battlefield conditions. It has also been reported that the research facilities at Camp Knox conducted testing on body armor during World War II (WW II) through the early 1950s. The research was likely performed indoors, and the amount of ammunition expended for testing purposes is expected to be minimal. From the early 1950s until 2006, the area has been used for residential housing. Sometime between 1974 and 1976, an EOD technician responded to the discovery of UXO in the Knox Trailer Park area. A bulldozer operator uncovered a live WW II MK-II high-explosive hand grenade while conducting excavation activities. A visual inspection of the Knox Trailer Park was conducted in November 2002 by the Base's EOD team, and no UXO was discovered.

FIGURE 8-78
MMRP Site UXO-04



Previous investigations are listed in **Table 8-94**.

TABLE 8-94

Previous Investigations Summary, MMRP Site UXO-04

Previous Investigation/Action	Date	Activities
Expanded Site Investigation (CH2M HILL, 2009)	2005 - 2009	A phased field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included a geophysical survey, intrusive investigation, soil, groundwater, sediment and surface water sampling. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, explosives residues, perchlorate, and metals. No munitions-related material that would indicate historical site use as an active range was found, and the sources of all other geophysical anomalies were found to be scrap metal. No potential unacceptable human health or ecological risks were identified. As a result, the site was recommended for NFA and removal from the MMRP. The ESI report was submitted in 2009 documenting the NFA decision.
No Action Decision Document (CH2M HILL, 2010)	2010	The Final NADD was signed in August 2010.

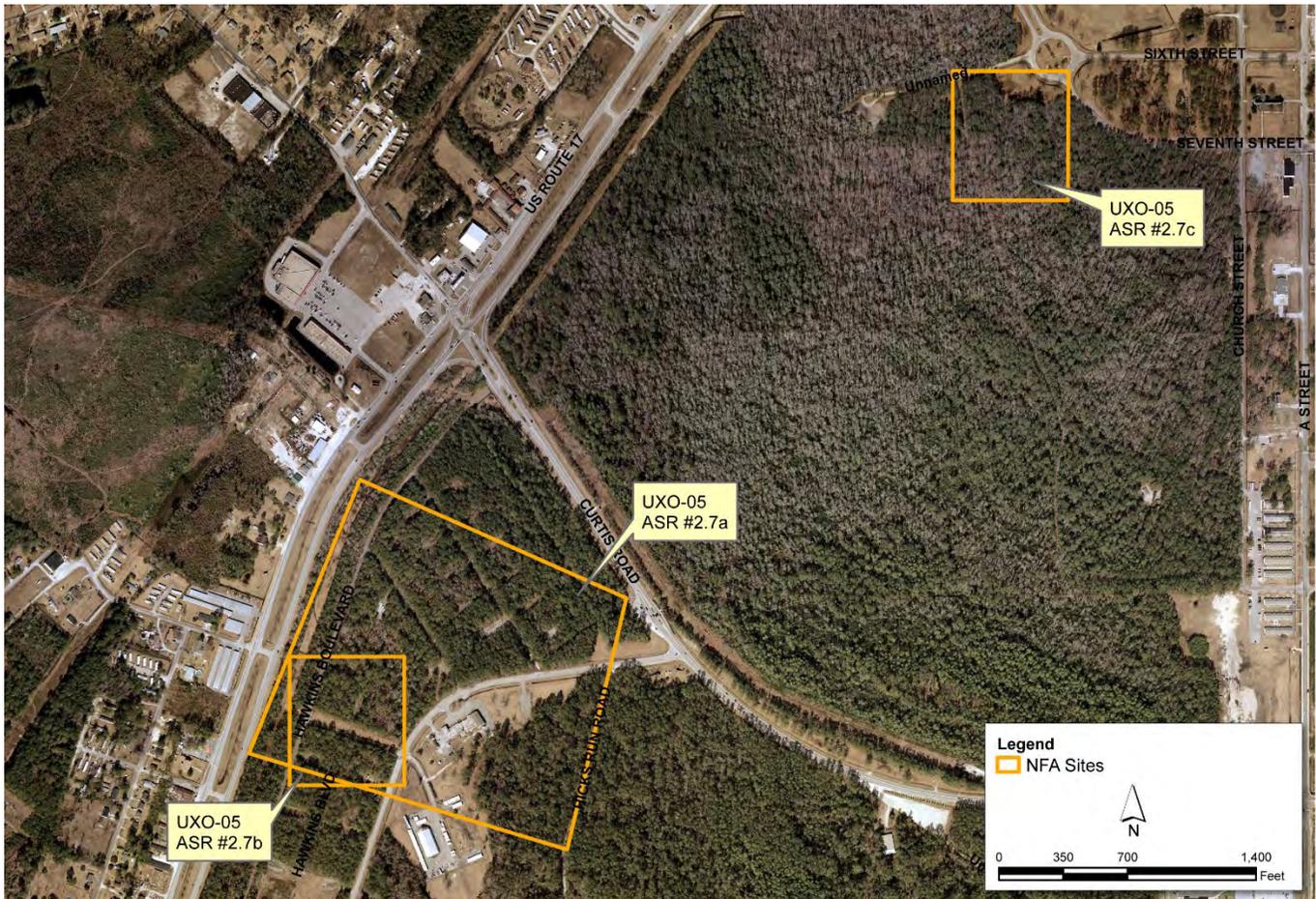
8.3.6 UXO-05—Mini Anti-Tank Range (ASR #2.7a, #2.7b, and #2.7c)

Site UXO-05 consists of three areas that cover approximately 70 acres. Two areas (ASR #2.7a and #2.7b) overlap and are located at the main entrance of the MCAS New River, just south of the intersection of Curtis Road and U.S. Highway 17 (**Figure 8-79**). The other area of Site UXO-05 (ASR #2.7c) is located north of ASR #2.7a and #2.7b in the Camp Geiger area. Site UXO-05 was used as the Miniature Anti-Tank Range between 1942 and 1944. Small arms (.22-caliber rifles) were fired at a moving target car located on a transverse track.

A 500-gallon UST was located at the former Building CG1, in the southern portion of ASR #2.7a. The tank (UST-CG1-1) was installed in 1985 and reportedly contained used oil until it was removed in February 1994.

The northern area of Site UXO-05 (ASR #2.7c) overlaps a portion of MMRP Site UXO-26 (**Section 8.3.22**), the Former B-3 Gas Chamber (ASR #2.79b), which was reopened as an operational range in 2014.

FIGURE 8-79
MMRP Site UXO-05, ASR #2.7a, #2.7b, and #2.7c



Previous investigations are listed in **Table 8-95**.

TABLE 8-95

Previous Investigations Summary, MMRP Site UXO-05

Previous Investigation/Action	Date	Activities
Limited Site Assessment Former UST CG1-1 (Law and Catlin, 2000)	2000	In February 1994, the 500-gallon used oil UST was removed from the vicinity of Building CG1. Post removal soil samples exceeded action levels for O&G; as a result, four shallow monitoring wells were installed within a 40 foot radius of the UST location and groundwater samples were collected and analyzed for volatile petroleum hydrocarbon and extractable petroleum hydrocarbon, VOCs, SVOC, chromium, and lead. Benzene, p-isopropyl toluene, and bis(2-ethylhexyl)phthalate were detected at concentrations exceeding NCGWQS but below gross contaminant levels. Soil samples collected during well installation did not exceed North Carolina Soil Screening Levels. Based on these results, the site was issued NFA status by NCDENR in July 2000.
Onslow County Water and Sewer Authority Focused Preliminary Assessment/Site Investigation (Arcadis, 2007)	2007	A focused PA/SI was conducted to evaluate the potential presence of MEC and impacted soil or groundwater within a proposed water line easement traversing ASR #2.7a of Site UXO-05. To characterize the subsurface conditions, DGM, soil sampling, and groundwater sampling was conducted. Samples were analyzed for VOCs, SVOCs, TPH-diesel-range organics, TPH-gasoline-range organics, pesticides, PCBs, metals, total organic carbon, total organic halogen, perchlorate, and explosives residues. No unacceptable risks to construction workers were identified.
Preliminary Assessment/Site Investigation (CH2M HILL, 2009)	2008 - 2009	A PA/SI was conducted at Site UXO-05 to assess the potential presence and nature of site-related impacts to human health and the environment. Field activities included surface and subsurface soil sampling, groundwater sampling, and surface water and sediment sampling. The samples were analyzed for explosives residues, perchlorate, SVOCs, and metals. No unacceptable risks to human health or the environment over that of background concentrations from exposure to site media were identified and NFA was recommended. The geophysical anomalies identified in the northern area of Site UXO-05 (ASR #2.7c) were attributed to Site UXO-26 and were addressed during the Site UXO-26 ESI.
No Action Decision Document (2009)	2009	The Final NADD was signed in October 2009.

8.3.7 UXO-07—Practice Hand Grenade Course (ASR #2.77a and #2.77b)

Site UXO-07, the Practice Hand Grenade Course, encompasses approximately 2 acres in the HPIA (**Figure 8-80**). UXO-07 was reportedly used as a range in 1953. The types of munitions employed at the site are unknown; however, based on the name of the site it is assumed that practice hand grenades were used.

FIGURE 8-80

MMRP Site UXO-07, ASR #2.77a and #2.77b



Previous investigations are listed in **Table 8-96**.

TABLE 8-96
 Previous Investigations Summary, MMRP Site UXO-07, ASR #2.77a and #2.77b

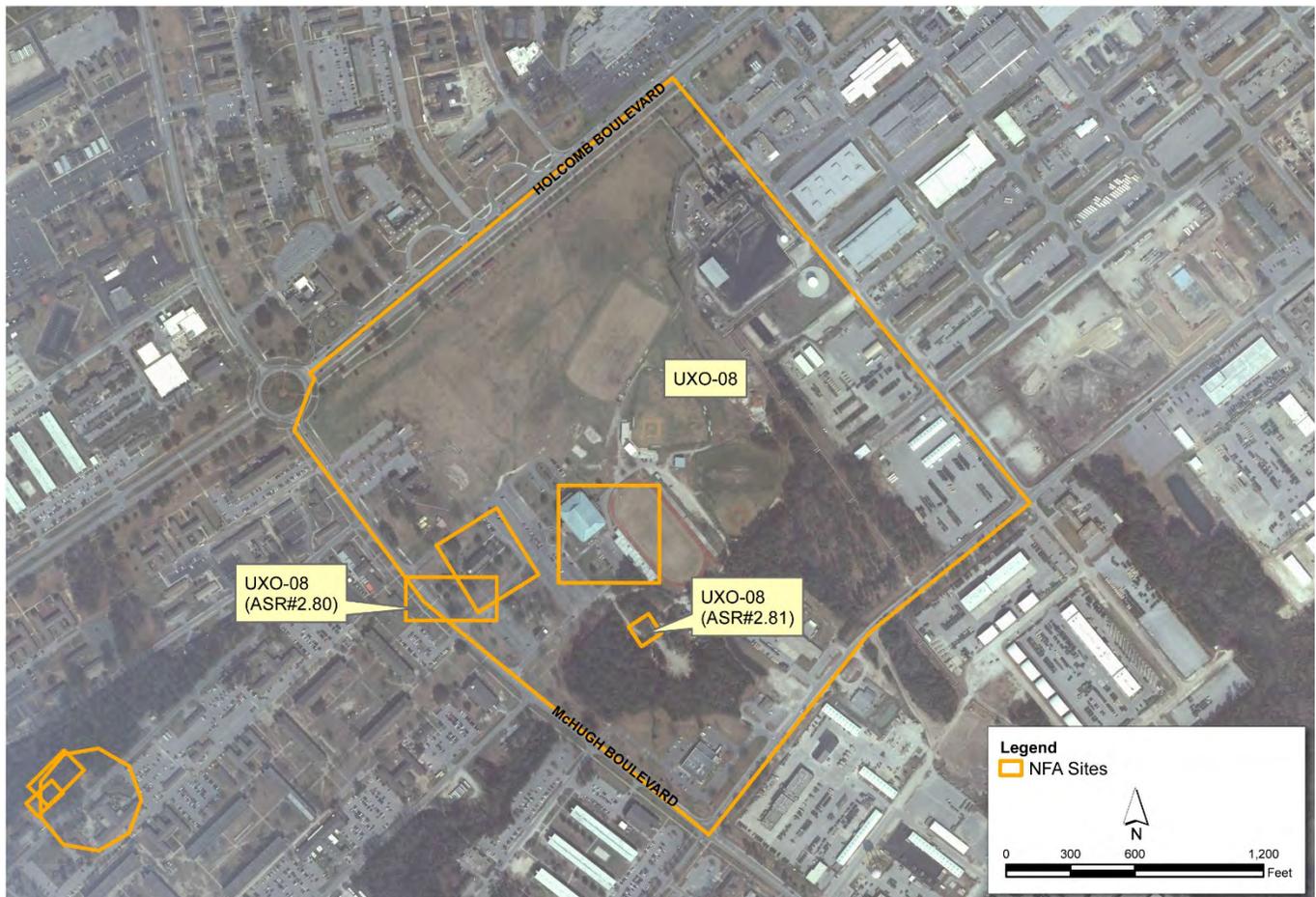
Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil, groundwater, surface water, and sediment sampling and 10 percent DGM. Samples were analyzed for SVOCs, explosives residues, metals, and perchlorate. Metals detections exceeded screening criteria in all media except surface water. Nitrobenzene and perchlorate detections also exceeded screening criteria in groundwater. No unacceptable human health or ecological risks were identified during the HHRS and ERS. 1,118 geophysical anomalies were present at the site, and an intrusive investigation was recommended.
Expanded Site Investigation (CH2M HILL, 2011)	2011	An ESI was conducted to address the PA/SI recommendations to intrusively investigate the sources of geophysical anomalies identified as representing potential subsurface MEC. No MEC items were found. The MPPEH items that were excavated were inspected, certified, and verified as MDAS. Based on the environmental and MEC investigation results, NFA was recommended at Site UXO-07.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.
ESS Determination Request	2015	Due to low probability of encountering MEC or MPPEH, MCIEAST-MCB CAMLEJ determined an escort by UXO qualified personnel is not required to access the site. Additionally, an ESS is not required to conduct future activities. 3R training is required for all personnel accessing these locations.

8.3.8 UXO-08—2.36-inch Bazooka Range, Base Chemical Smoke Chamber, and Nuclear, Biological, and Chemical Training Trail (ASR #2.182), and D-7 Gas Chamber (ASR #2.80)

Located within the boundaries of IRP Site 78, Site UXO-08 encompasses approximately 144 acres in the HPIA (Figure 8-81). Areas within UXO-08 include the 2.36-inch Bazooka Range, the D-7 Gas Chamber, and the Base Chemical Smoke Chamber and Nuclear, Biological, and Chemical Training Trail. The Range Identification and PA report (USACE, 2001) identified the D-7 Gas Chamber as being located at Building 756. The D-7 Gas Chamber is estimated to have been used from 1953 to 1961 and is thought to have primarily used tear gas. Base maps and the Range Identification and PA report indicate that the operation of the Base Chemical Smoke Chamber and Nuclear, Biological, and Chemical Training Trail took place from 1985 to 1987. The amount of chemical stimulants used during the facilities operation is unknown. Reports have indicated the presence of a suspected firing range, designated as the MCIEAST-MCB CAMLEJ Cantonment 2.36-inch Bazooka Range. Retired Base EOD personnel have reported the findings of bazooka rounds on several occasions and at various locations within Parade Grounds during the 1970s and 1990s.

FIGURE 8-81

MMRP Site UXO-08, ASR #2.182 and ASR #2.80



Previous investigations are listed in **Table 8-97**.

TABLE 8-97

Previous Investigations Summary, MMRP Site UXO-08, ASR #2.182 and ASR #2.80

Previous Investigation/Action	Date	Activities
Focused Preliminary Assessment/Site Investigation (CH2M HILL, 2010)	2009-2010	In support of MILCON activities for the HPCA, Post Office Intersection Area, and Fitness Center, soil, groundwater, surface water, and sediment sampling was conducted, along with 100 percent DGM. Samples were analyzed for VOCs, SVOCs, explosives residues, perchlorate, and metals. No unacceptable human health or ecological risks were identified in site media in the Fitness Center and Post Office Intersection Area. In the HPCA, potential unacceptable human health and ecological risks were identified from exposure to metals and PAHs in a drainage area and in soil. These risks are likely attributable to the industrial area and will be addressed as part of Site 78. Approximately 900 anomalies were identified in the MILCON areas and further investigation was recommended.
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2007 - 2011	To identify the presence and nature of MC contamination and evaluate the number and density of anomalies that could represent potential subsurface MEC, a field investigation was conducted. Field activities included soil, groundwater, surface water, and sediment sampling for explosives residues, metals, perchlorate, VOCs, SVOCs, and pesticides/PCBs, 100 percent DGM, and 10 percent intrusive investigation in MILCON areas. No unacceptable human health or ecological risks from historical munitions activities were identified. Potential ecological risks identified in surface water and sediment resulted from historical industrial activities and will be addressed as part of the FY 2015 Five-year Review for Site 78. NFA was recommended at UXO-08.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.

8.3.9 UXO-09—F-9, Triangulation Range (ASR #2.83)

Site UXO-09 encompasses approximately 3 acres in the HPIA (**Figure 8-82**). The F-9 Triangulation Range area was established in or prior to 1953. As reported in the ASR report, Base personnel stated that the range was used for M-1 rifle target practice. Base personnel also stated that the original range was most likely 100 feet wide and approximately 25 to 50 feet long, and may have contained a large dirt berm as a bullet stop. Based on interviews with Base personnel, former munitions use was reportedly limited to small arms ammunition.

FIGURE 8-82
MMRP Site UXO-09, ASR #2.83



Previous investigations are listed in **Table 8-98**.

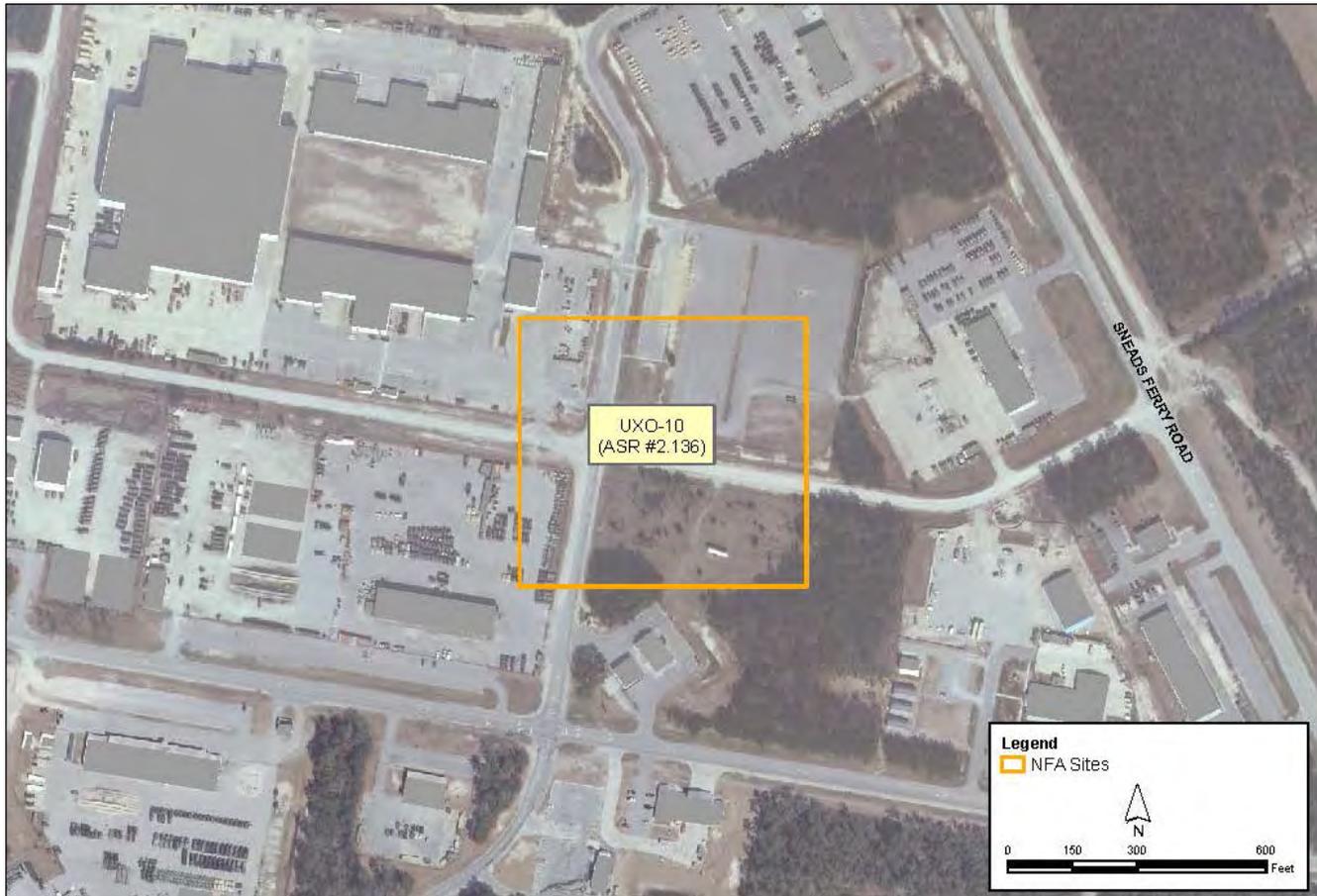
TABLE 8-98
Previous Investigations Summary, MMRP Site UXO-09

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2009)	2008 - 2009	A PA/SI was conducted to assess the potential presence and nature of site-related impacts to human health and the environment. Field activities included surface and subsurface soil sampling and groundwater sampling. The samples were analyzed for explosives residues, perchlorate, and total metals. No unacceptable risks to human health or the environment from exposure to site media were identified based on current and potential future land uses at Site UXO-09 and NFA was warranted.
No Action Decision Document (2010)	2010	The Final NADD was signed in August 2010.

8.3.10 UXO-10—D-11A, Flame Tank and Flame Thrower Range (ASR #2.136)

Site UXO-10, the Flame Tank and Flame Thrower Range, encompasses approximately 10 acres on the Mainside of the Base (**Figure 8-83**). UXO-10 was reportedly used as a range from 1970 to 1977. The types of munitions used at the range included flame throwers and small arms blank ammunition, which was reportedly used on tanks for demonstration purposes. Demolitions (C-4), white smoke grenades, white phosphorus hand grenades, flame thrower weapons, and blank ammunition for small arms were also used on the course.

FIGURE 8-83
MMRP Site UXO-10, ASR #2.136



Previous investigations are listed in **Table 8-99**.

TABLE 8-99
Previous Investigations Summary, MMRP Site UXO-10, ASR #2.136

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil and groundwater sampling and 10 percent DGM. Samples were analyzed for VOCs, SVOCs, TPH, explosives residues, metals, and perchlorate. No unacceptable human health or ecological risks were identified. 1,228 geophysical anomalies were present at the site, and an intrusive investigation was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted to further investigate geophysical anomalies identified during the PA/SI. Field activities consisted of an intrusive investigation. Two MPPEH items were identified; however, no MEC or MPPEH containing explosive material were identified, and NFA was recommended.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.
ESS Determination Request	2015	Due to low probability of encountering MEC or MPPEH, MCIEAST-MCB CAMLEJ determined an escort by UXO qualified personnel is not required to access the site. Additionally, an ESS is not required to conduct future activities. 3R training is required for all personnel accessing these locations.

8.3.11 UXO-11—B-5, Practice Hand Grenade Course (ASR #2.281)

Site UXO-11, the Practice Hand Grenade Course, encompasses approximately 2 acres in Camp Geiger in the northwest portion of the Base (**Figure 8-84**). UXO-11 was reportedly used as a range in 1953. The types of munitions employed at the site are unknown; however, it is assumed that practice hand grenades were used.

FIGURE 8-84
MMRP Site UXO-11, ASR #2.281



Previous investigations are listed in **Table 8-100**.

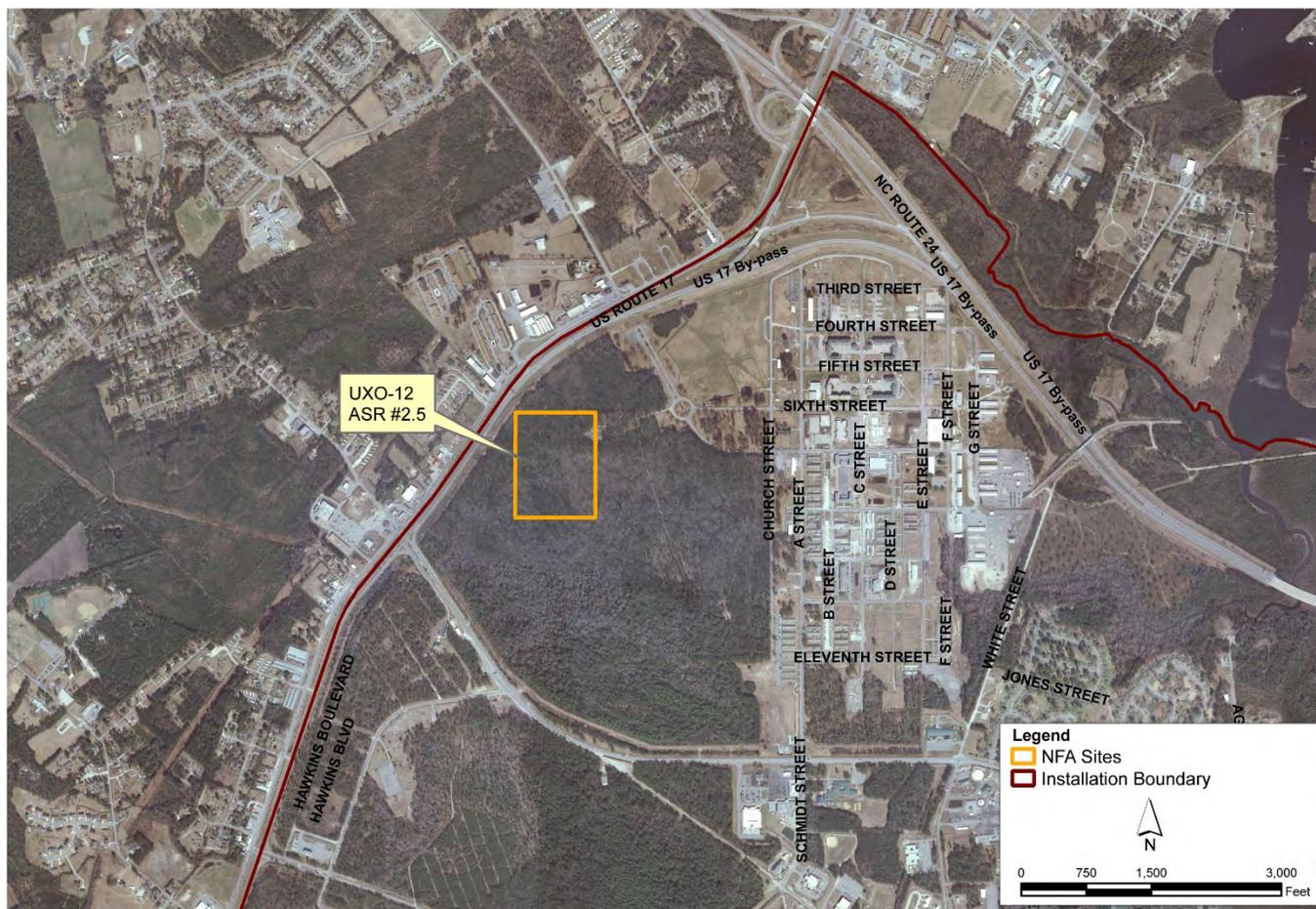
TABLE 8-100
Previous Investigations Summary, MMRP Site UXO-11, ASR #2.281

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil, groundwater, surface water, and sediment sampling and 10 percent DGM. Samples were analyzed for explosives residues, metals, and perchlorate. Explosives residues were detected in site media; however, no unacceptable human health or ecological risks were identified. 70 geophysical anomalies were present at the site, and an intrusive investigation was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted to further evaluate the geophysical anomalies identified during the PA/SI. Additional investigation was also recommended to delineate the extent of identified impacts related to MC and to delineate chromium in surface and subsurface soil. Field activities included an intrusive investigation and soil sampling for chromium and explosives residues. An HHRS and ERS were conducted to evaluate data collected during the PA/SI and the ESI. No unacceptable human health or ecological risks were identified due to exposure to site media. No MEC items were identified during the intrusive investigation and six MPPEH items (including inert training hand grenades and small arms casings) were removed from the site for disposal. These results indicate that the potential for encountering unidentified subsurface MEC at Site UXO-11 is likely to be low. NFA was recommended.
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.
ESS Determination Request	2015	Due to low probability of encountering MEC or MPPEH, MCIEAST-MCB CAMLEJ determined an escort by UXO qualified personnel is not required to access the site. Additionally, an ESS is not required to conduct future activities. 3R training is required for all personnel accessing these locations.

8.3.12 UXO-12—1,000-inch Range (ASR #2.5)

Site UXO-12, the 1,000-inch Range, encompasses approximately 30 acres and is generally located west of Camp Geiger, in the northwest portion of the Base (**Figure 8-85**). The 1,000-inch Range was established under Camp Training Order Number 7-1945, dated March 19, 1945, and was disestablished in March 1946 and no longer used for firing live ammunition. During operation of the site, munitions used included small caliber munitions (.30-caliber weapons firing). The site was investigated as part of Site UXO-18 (**Section 8.3.18**) based on its location within the boundaries of the former B-6 small arms ranges.

FIGURE 8-85
MMRP Site UXO-12, ASR #2.5



Previous investigations are listed in **Table 8-101**.

TABLE 8-101
Previous Investigations Summary, MMRP Site UXO-12, ASR #2.5

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	A field investigation was conducted to identify the presence or absence of contamination at the site. An XRF survey was conducted and surface water, sediment, and soil samples were collected and analyzed for select metals. No unacceptable human health or ecological risks were identified and the site was closed with NFA.
No Action Decision Document (2011)	2011	The Final NADD was signed in November 2011.

8.3.13 UXO-13—Naval Regional Medical Center

Site UXO-13, the Naval Regional Medical Center, encompasses approximately 176 acres on the Mainside of the Base (**Figure 8-86**). No known historical live fire activities were conducted within this area; rather it was designated as a “Maneuver Training Area” used to train troops in non-live fire operations. UXO-13 was administratively closed on March 24, 2004, due to no known historical live-fire activities on this range.

FIGURE 8-86
MMRP Site UXO-13



8.3.14 UXO-14—Indoor Pistol Range (ASR #2.199) and Gas Chamber (ASR #2.200)

Site UXO-14, the Indoor Pistol Range and Gas Chamber, encompasses less than 1 acre within the Rifle Range area of the Base (**Figure 8-87**). The Indoor Pistol Range (Building RR-53) was reportedly in use from 1950 to 1996. During operation of the range, small arms were used to fire at a fixed target. The Gas Chamber (Building RR-63) was reportedly in use from 1950 through 1954, and is thought to have primarily used tear gas.

FIGURE 8-87
MMRP Site UXO-14, ASR #2.199 and ASR #2.200



Previous investigations are listed in **Table 8-102**.

TABLE 8-102

Previous Investigations Summary, MMRP Site UXO-14, ASR #2.199 and #2.200

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil and groundwater sampling and 10 percent DGM. Samples were analyzed for metals and SVOCs. Potentially unacceptable human health risks were identified due to exposure to antimony, mercury, and lead in soil. No unacceptable ecological risks were identified. 17 geophysical anomalies were present at the site, and an intrusive investigation was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	An ESI was conducted to evaluate potentially unacceptable human health risks previously identified in soil at the former Indoor Pistol range and assess the nature of geophysical anomalies in the former Gas Chamber area. Field activities included an intrusive investigation and surface and subsurface soil sampling for antimony, lead, and mercury. Potentially unacceptable human health and ecological risks were confirmed due to exposure to lead and antimony in soil at the Indoor Pistol Range. No MEC was identified during the intrusive investigation at the former Gas Chamber. No further investigation of the Gas Chamber and an interim action and/or an RI/FS to address antimony and lead in soil at the Indoor Pistol Range was recommended.
Engineering Evaluation/Cost Analysis (CH2M HILL, 2012)	2012	The EE/CA evaluated alternatives for a NTCRA to address potential unacceptable risks from antimony and lead in soil. The alternatives were no action, excavation and offsite disposal, and in situ soil stabilization with excavation and offsite disposal.
Action Memorandum (CH2M HILL, 2013)	2013	An AM was completed to propose in situ soil stabilization with excavation and offsite disposal as the NTCRA to address antimony and lead in soil.
Non-time-critical Removal Action (Osage, 2013)	2013	An NTCRA was initiated to address antimony and lead in soil. Pre-excavation soil sampling was conducted to define the lateral extent of contamination. Soil within the excavation area was treated in place to render the soil non-hazardous for offsite disposal. Approximately 333 tons of soil was excavated for offsite disposal. Post-excavation samples were collected from the base of the excavation and the results were below the cleanup levels. Based on the results of the NTCRA, NFA was recommended in the closeout report.
No Further Action Decision Document (CH2M HILL, 2014)	2014	Based on recommendations from the ESI and completion of the NTCRA, a No Further Action Decision Document was completed to document NFA for the site and was signed in August 2014.

8.3.15 UXO-15—1,000-inch Range (ASR #2.19)

The Former 1,000-inch Range (ASR #2.19) comprises approximately 9 acres in the northern portion of the Courthouse Bay Amphibious Area where a MILCON project is proposed (**Figure 8-88**). Small arms, including M1 rifles and .30- and .45-caliber pistols, were typically fired at the 1,000-inch ranges. The 1,000-inch Range was disestablished on March 19, 1946, and is no longer used for firing live ammunition. The Courthouse Bay Amphibious Area (including the Former 1,000-inch Range) is currently used by the Amphibian Assault Battalion to evaluate track vehicle performance as part of the Joint College Training Area.

FIGURE 8-88
MMRP Site UXO-15, ASR #2.19



Previous investigations are listed in **Table 8-103**.

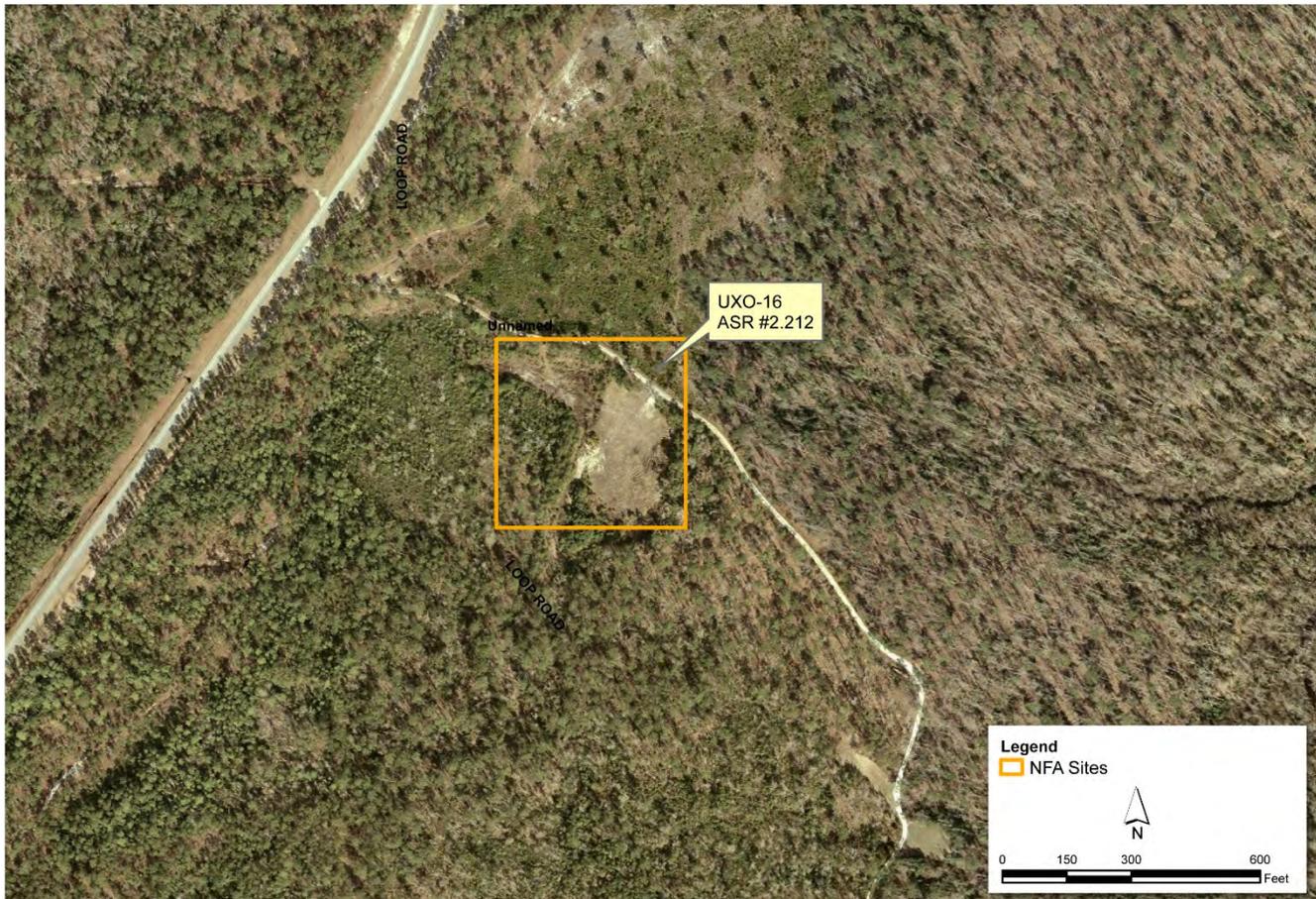
TABLE 8-103
Previous Investigations Summary, MMRP Site UXO-15, ASR #2.19

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2010)	2008 - 2010	In support of proposed MILCON activities, a field investigation was conducted to identify the presence and nature of MC contamination. Field activities included soil sampling for metals and perchlorate. Arsenic and antimony were detected at levels exceeding screening criteria; however, no MC-related contamination was identified in soil. No potential unacceptable human health or ecological risks were identified and NFA was recommended.
No Action Decision Document (2010)	2010	The Final NADD was signed in August 2010.

8.3.16 UXO-16—Former Gun Positions 41A and 41B (ASR #2.212)

Site UXO-16, also referred to as Former Gun Positions 41A and 41B, encompasses approximately 4 acres in the Stone Bay area of the Base. UXO-16 was first established during WW II as a training ground and was also used during the Korean War-era as a training ground (**Figure 8-89**). Howitzers were reportedly positioned at Site UXO-16 and fired 105-mm and 155-mm munitions into the K-2 and G-10 Impact Areas; other munitions suspected to be used at Site UXO-16 are 4.2-inch, 81-mm, 120-mm, 175-mm, 4.2-inch, and 8-inch munitions.

FIGURE 8-89
MMRP Site UXO-16, ASR #2.212



Previous investigations are listed in **Table 8-104**.

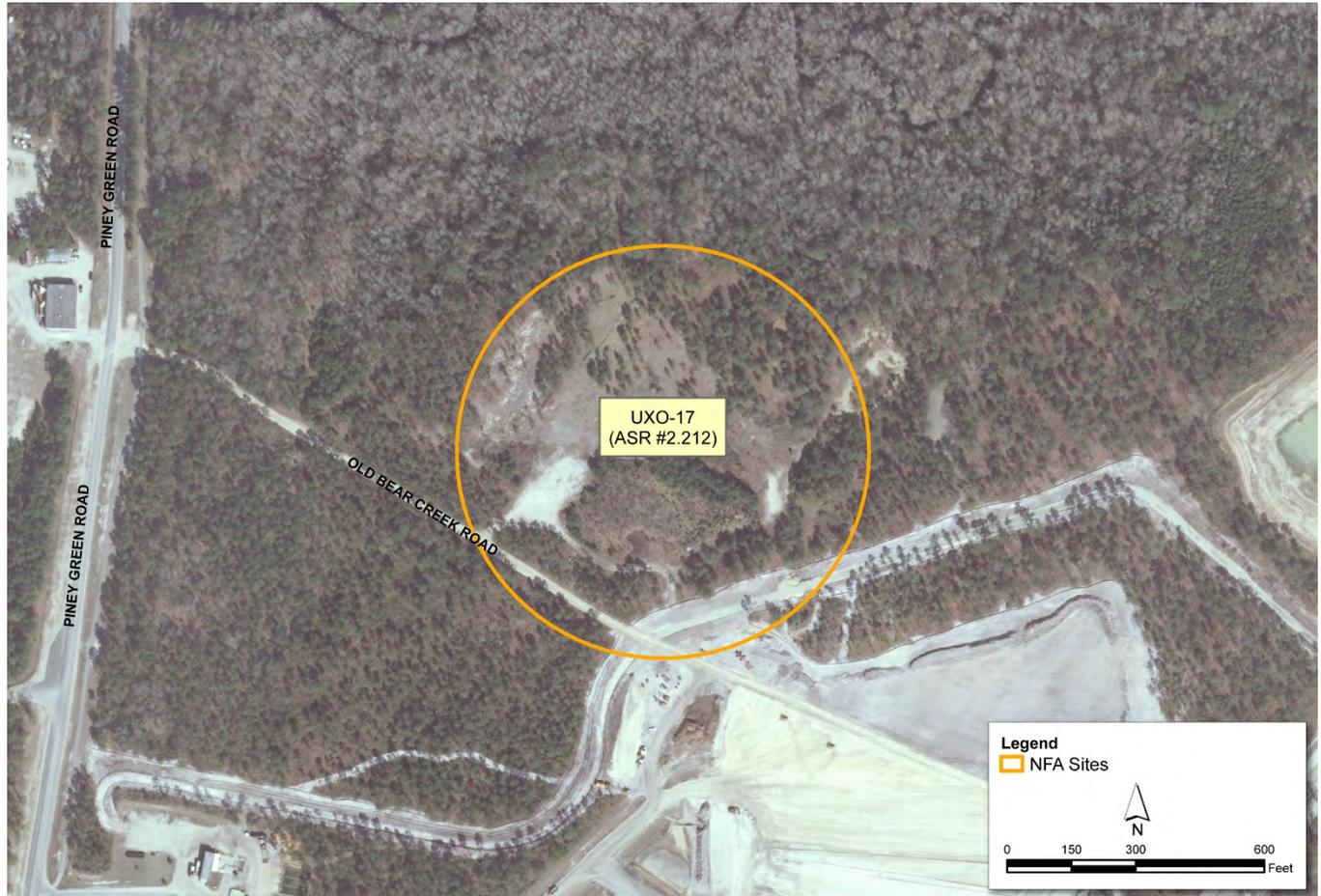
TABLE 8-104
Previous Investigations Summary, MMRP Site UXO-16, ASR #2.212

Previous Investigation/Action	Date	Activities
Focused Preliminary Assessment/Site Investigation (CH2M HILL, 2009)	2008 - 2009	In support of proposed MILCON activities, a field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included DGM and soil and groundwater sampling for explosives residues, perchlorate, and metals. A total of 895 geophysical anomalies potentially representing subsurface MEC were identified and intrusively investigated. All items were found to be MD or cultural debris. No further MEC investigations were recommended; however, because it is not possible to provide 100 percent assurance that all MEC items were removed, training and on-call support during construction activities were recommended. No MC-related contamination was identified in site media. No unacceptable risks to human health or the environment were identified. NFA was recommended.
No Action Decision Document (2010)	2010	The Final NADD was signed in August 2010.

8.3.17 UXO-17—Firing Position #2 (ASR #2.212)

Site UXO-17, Firing Position #2, encompasses approximately 16 acres in the Mainside area of the Base. UXO-17 was a gun position used for military training, which fired into the G-10 impact area (**Figure 8-90**). As a result of the type of training conducted at the site, DMM unexpected, although ammunition packaging, range residue, barbed wire, and buried garbage may be present. Firing Position #2 covers 16 acres and was reportedly used from the 1950s through at least 1985. 105-mm and 155-mm howitzer guns were used at this site.

FIGURE 8-90
MMRP Site UXO-17, ASR #2.212



Previous investigations are listed in **Table 8-105**.

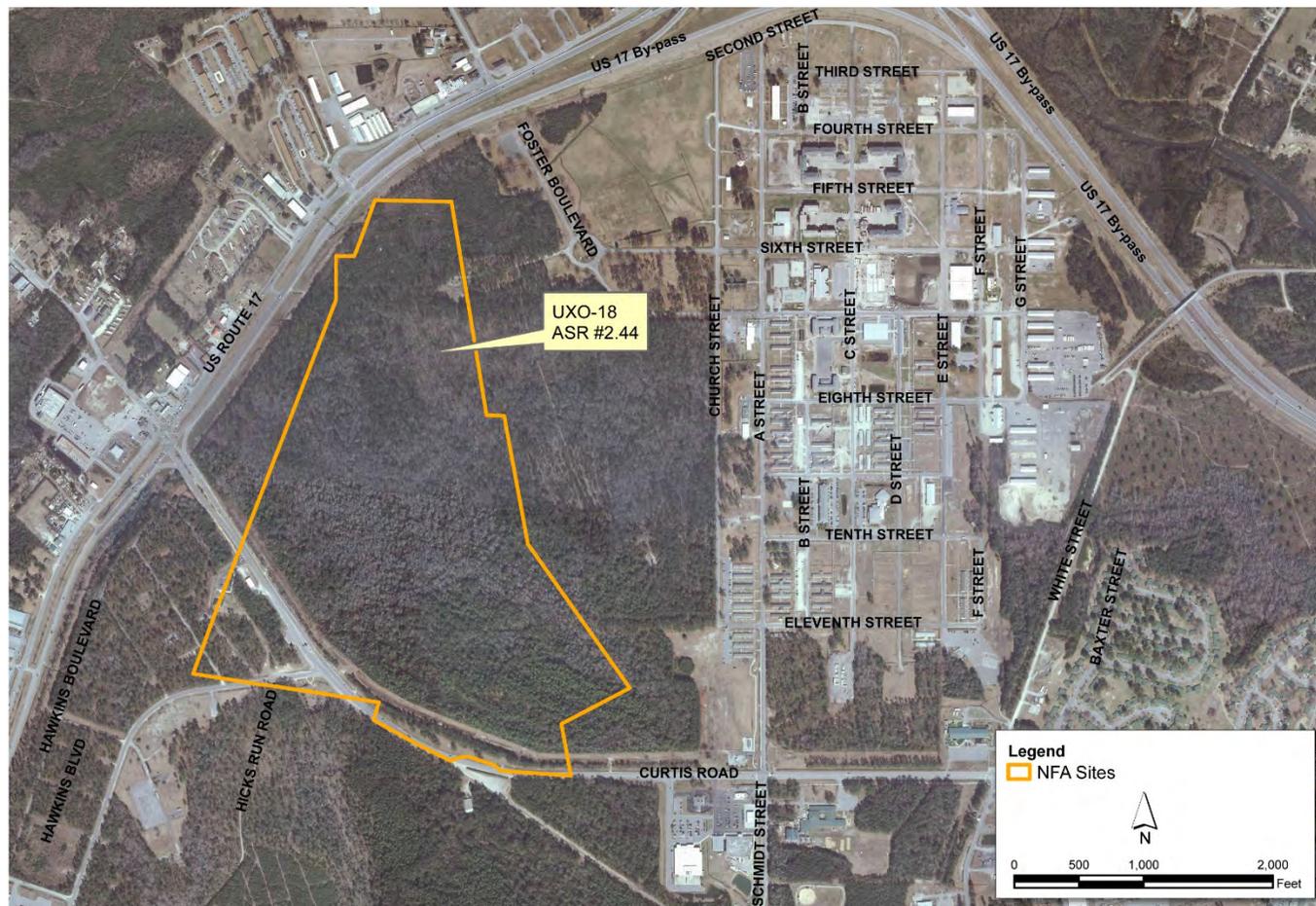
TABLE 8-105
Previous Investigations Summary, MMRP Site UXO-17, ASR #2.212

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2012)	2008 - 2012	<p>The PA/SI was completed in three phases. Phase I consisted of 100 percent DGM and intrusive investigation of a 4-acre area in the center of the site and environmental sampling of soil and groundwater. Phase II consisted of 9 percent DGM and intrusive investigation of the surrounding 12 acres and environmental sampling of soil and groundwater. Phase III consisted of groundwater sampling in the vicinity of a buried leaking drum discovered and removed during Phase I.</p> <p>Approximately 31.5 percent of Site UXO-17 was surveyed, yielding a total of 1,992 geophysical anomalies and 21 saturated response areas potentially representing subsurface MEC. Intrusive investigation resulted in the identification of 1 MEC item and 279 MPPEH items. The MEC item was determined to be DMM associated with the historical use as a firing position. Other MPPEH was consistent with the site's use for training. Other than DMM, the firing position and surrounding training area were not determined to be a source of MEC. Based on the estimated 263,500 pounds of other debris items (concrete, metal drums, and scrap metal) encountered, it is likely that portions of the site were used for disposal. The risk screening results indicated that exposure to soil, sediment, surface water, and groundwater would not result in unacceptable human health or ecological risks. Based on these results and because the site will be used as an above grade expansion area for the Base landfill, potentially covering any remaining subsurface debris, no further investigation was recommended. Prior to MILCON proceeding at the site, all site personnel conducting subsurface/intrusive activities were recommended to receive "3R" munitions awareness. On-call construction support was also recommended for inspection and disposal of suspected MEC/MPPEH that may be unearthed.</p>
No Action Decision Document (CH2M HILL, 2013)	2013	The Final NADD was signed in July 2013.

8.3.18 UXO-18—B-6, 50-foot Small Arms Range (ASR #2.44)

Site UXO-18, covers approximately 176 acres and consists of several small ranges (Figure 8-91). The B-6 ranges were used between 1950 and 1961. Twenty-five target stations were reportedly used for .22-caliber (rifle and pistol) ammunition and 10 target stations were used for .32-, .38-, and .45-caliber (pistol) ammunition. The B-6 ranges, located north of Curtis Road and Hicks Run Road, were identified for closure. Site UXO-12 (Section 8.3.12) is located within the boundaries of the former B-6 small arms ranges and was investigated as part of Site UXO-18.

FIGURE 8-91
MMRP Site UXO-18, ASR #2.44



Previous investigations are listed in **Table 8-106**.

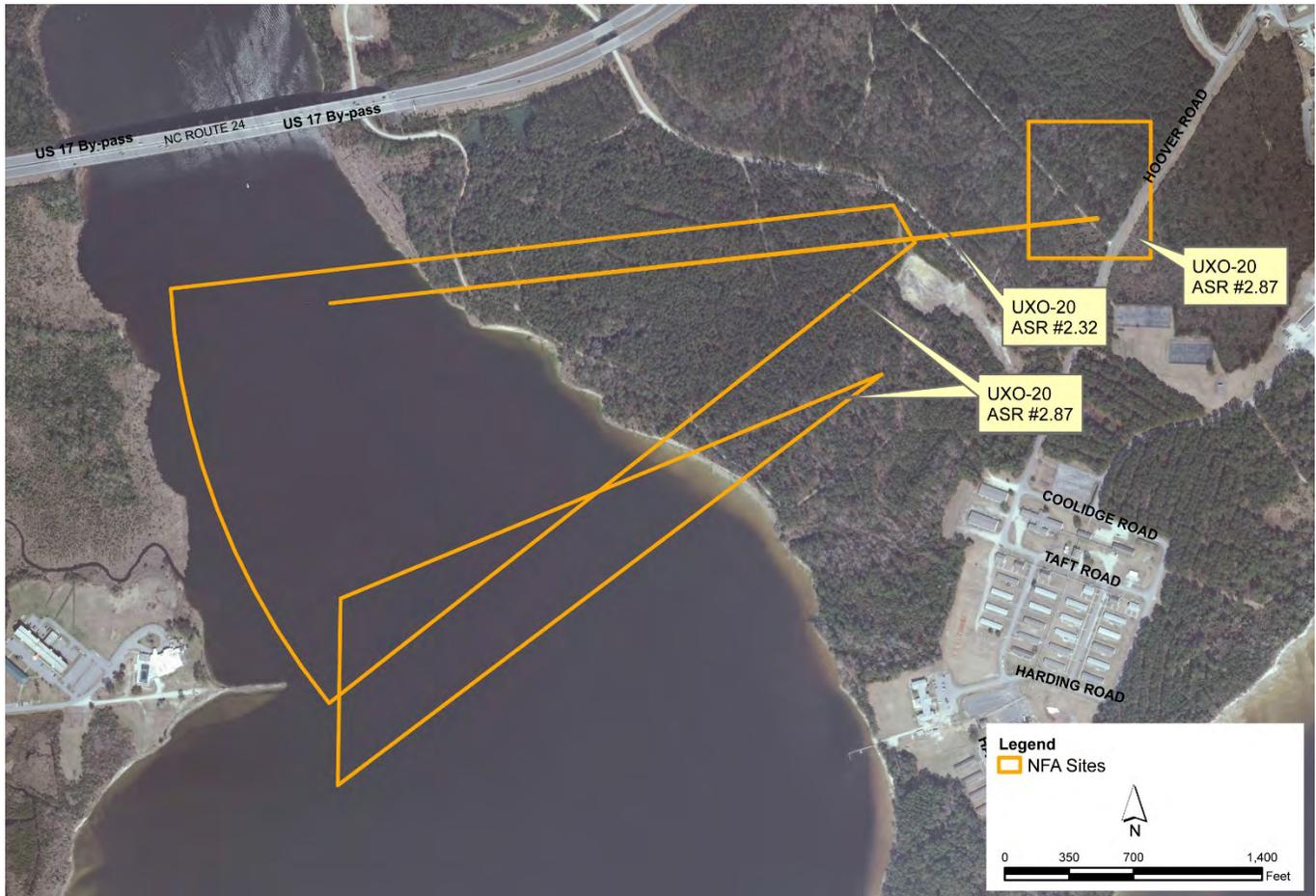
TABLE 8-106
Previous Investigations Summary, MMRP Site UXO-18, ASR #2.44

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2010 - 2011	A field investigation was conducted to identify the presence or absence of contamination at the site. An XRF survey was conducted and surface water, sediment, and soil samples were collected and analyzed for select metals. No unacceptable human health or ecological risks were identified and the site was closed with NFA.
No Action Decision Document (2010)	2010	The Final NADD was signed in November 2011.

8.3.19 UXO-20—1,000-inch Range Montford Point (ASR #2.32) A-1, 50-foot .22 Caliber Range (ASR #2.87)

Site UXO-20, includes two former small arms ranges in the Camp Johnson (Montford Point) area covering approximately 75 acres (**Figure 8-92**). The 1,000-inch Range (ASR #2.32) was used from the 1940s until the mid-1950s as a Familiarization Range for .30-caliber Browning automatic rifles. The A-1, 50-foot .22 Caliber Range (ASR #2.87) was used during the 1950s and is believed to have been inactive since 1957 and is adjacent to and overlapping the 1000-inch range delineation.

FIGURE 8-92
MMRP Site UXO-20, ASR #2.32 and #2.87



Previous investigations are listed in **Table 8-107**.

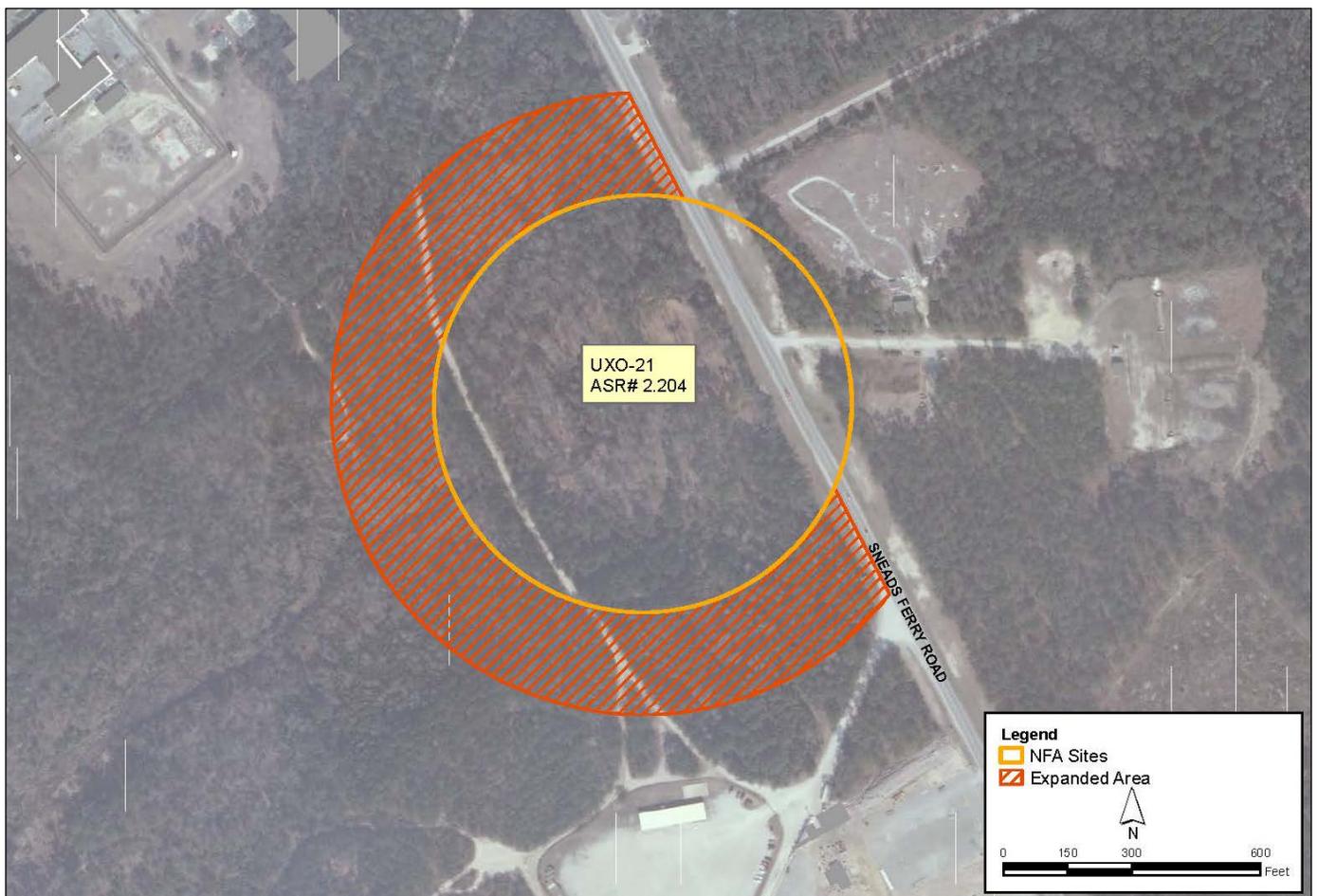
TABLE 8-107
Previous Investigations Summary, MMRP Site UXO-20, ASR #2.32 and #2.87

Previous Investigation/Action	Date	Activities
Focused Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2009 - 2011	In support of potential MILCON activities within the Camp Johnson area, a field investigation was conducted in FY 2009. Groundwater and soil samples were collected and analyzed for select metals. Although arsenic was detected above screening levels throughout the range area, no unacceptable human health or ecological risks were identified in site media. Based on the results of the PA/SI, the site was closed with NFA.
No Action Decision Document (CH2M HILL, 2011)	2011	The Final NADD was signed in November 2011.

8.3.20 UXO-21—Gas Chamber (2nd Marine Division) (ASR #2.204)

The Former Tear Gas Chamber, 2nd Marine Division site encompasses 17 acres and was used as a gas chamber in the 1970s (Figure 8-93). Based on the operational history of the site, chemical warfare training agents (tear gas) would have been used. The Preliminary Range Assessment/Archive Search Report (USACE, 2001) stated that chemical agent identification sets (CAIS) and riot-control hand grenades may have been used at the site; however, this statement was a speculation based on areas surrounding other gas chambers often being used for other chemical training. There is no documentation or other historical indications that CAIS or riot-control hand grenades were used at the former D-Area Gas Chamber, and the PA/SI, (CH2M HILL, 2011), Phase I ESI (CH2M HILL, 2012), and the Phase II ESI (CH2M HILL, 2014) found no evidence that these items are present at the site. Adjacent and overlapping ranges that may have impacted Site UXO-21 include the Impact Area located east of Sneads Ferry Road, the F-6 Live Grenade Range (ASR #2.55), the F-13 Flame Thrower Range (ASR #2.139), the F-7 Flame Thrower Range (ASR #2.128), and the F-13 Field Firing Range (ASR #2.54).

FIGURE 8-93
MMRP Site UXO-21, ASR #2.204



Previous investigations are listed in **Table 8-108**.

TABLE 8-108

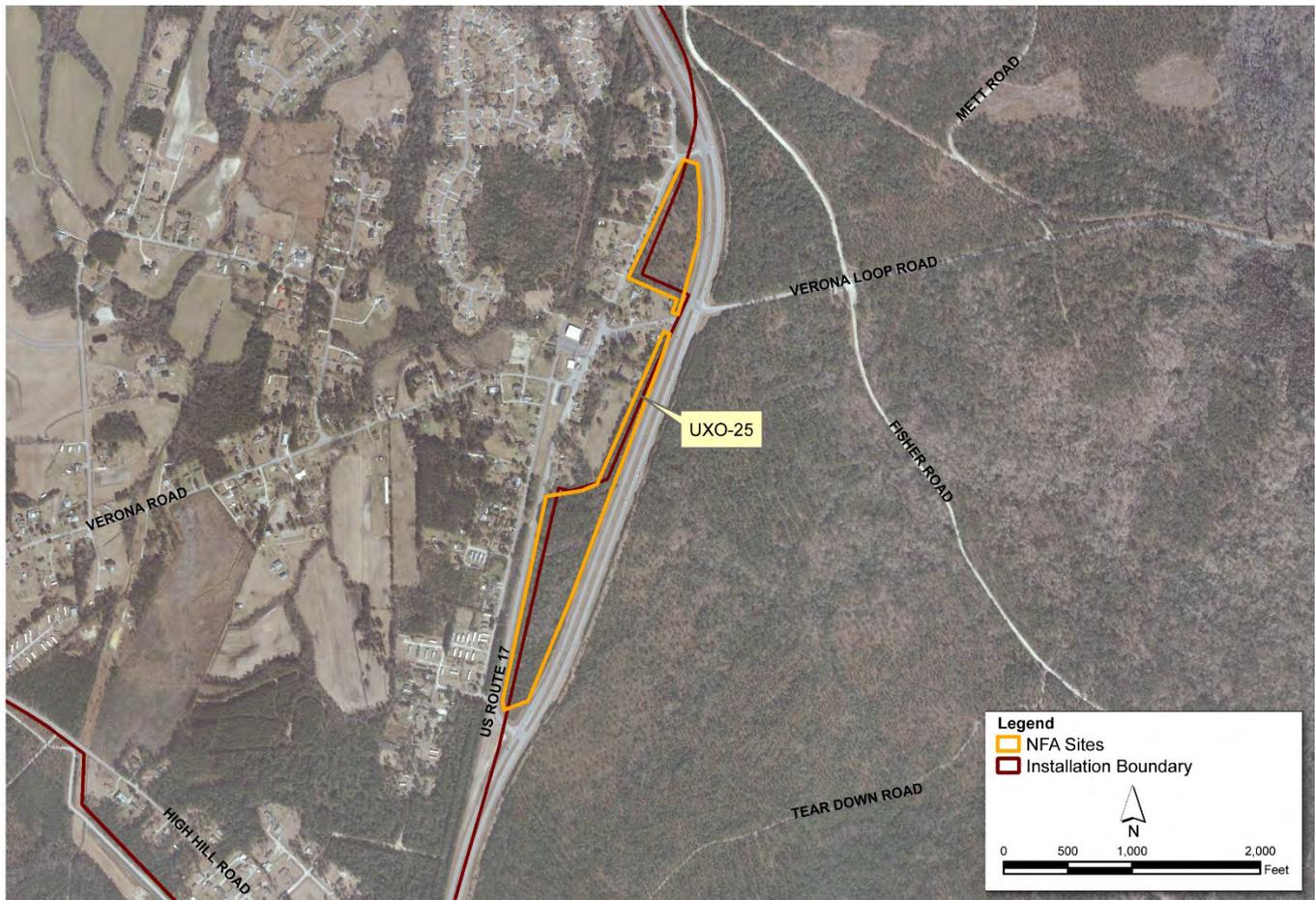
Previous Investigations Summary, MMRP Site UXO-21, ASR #2.204

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2011)	2007 - 2011	<p>In support of MILCON activities, a PA/SI was conducted in a phased approach. In the interior 5-acre area of the site, soil and groundwater sampling and DGM were conducted as part of Phase I field activities. Samples were analyzed for VOCs, SVOCs, tear gas constituents, and metals. 569 geophysical anomalies representing potential subsurface MEC were identified during Phase I DGM. An intrusive investigation was conducted, and approximately 6 percent of the anomalies were determined to be MPPEH. MPPEH was inspected, identified as MDAS, and removed for offsite disposal.</p> <p>Phase II field activities included 10 percent DGM of the surrounding 9.5 acres and soil, groundwater, surface water, and sediment sampling for VOCs, SVOCs, explosives residues, perchlorate, and metals. 738 geophysical anomalies that represented potential subsurface MEC were identified during Phase I DGM.</p> <p>No unacceptable human health or ecological risks were identified from exposure to environmental media; however, further investigation of the geophysical anomalies identified during Phase II DGM was recommended.</p>
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	<p>An ESI was conducted to further assess the nature and extent of geophysical anomalies identified during Phase II of the PA/SI. Field activities included an intrusive investigation of the 1,307 geophysical anomalies identified during the PA/SI. One MEC item was discovered and destroyed through a controlled detonation, and more than 60 MPPEH items were identified. Additional DGM and an intrusive investigation were recommended to define the extent of MEC/MPPEH beyond the boundaries of Site UXO-21.</p>
MILCON Technical Memorandum (CH2M HILL, 2013)	2012-2013	<p>An intrusive investigation was conducted to identify and remove surface and subsurface MEC and MPPEH prior to initiation of MILCON activities.</p> <p>Field work was conducted within the footprint of a planned expansion of Sneads Ferry Road including a planned utility corridor and a vehicle turn lane along Sneads Ferry Road, and within the tank trail area. Field activities consisted of an intrusive investigation and post detonation soil sampling. One MEC item and 55 MPPEH items were identified and removed. Based on these result of this investigation, the planned MILCON activities proceeded.</p>
Phase II Expanded Site Investigation (CH2M HILL, 2014)	2014	<p>Based on recommendations of the ESI, additional field activities were conducted in 2013 to define the extent of MEC/MPPEH in the MRS adjacent to UXO-21. Field activities included DGM and an intrusive investigation over approximately 7 percent of the MRS. The MEC items and MPPEH items recovered to date were inconsistent with items expected at a former gas chamber (such as expended tear gas canisters, riot control hand grenades, or war gas identification sets). The items found (e.g., pyrotechnic, screening, and marking devices) are likely a result of general military training maneuvers and exercises at overlapping and adjacent ranges. The explosive hazard analysis indicated that the probability of contact with MEC and MPPEH and the risk from explosive hazards are both low.</p> <p>Based on the environmental sampling results of the PA/SI, the intrusive investigations completed to date, and the explosives hazard analysis, NFA was recommended.</p>
No Action Decision Document	2014-2015	An NADD will be finalized in 2015 to document NFA.

8.3.21 UXO-25—Verona Loop

UXO-25 encompasses approximately 25 acres just south of MCAS New River (**Figure 8-94**) near the township of Verona, North Carolina. UXO-25 lies within portions of two former ranges, the Impact Area “M” range and the M-16, Outdoor Classroom range. The Impact Area “M” range was in use as a live fire range with maneuver exercises with the use of mortars, recoilless rifles, 2.36-inch rockets, and hand and rifle grenades from 1941 to approximately 1945. Historical information indicates that 0.30-caliber blanks may have been used, along with pyrotechnics at the M-16, Outdoor Classroom range. This area is no longer used for firing live ammunition. UXO-25 is relatively flat and heavily vegetated with trees and dense undergrowth. The area within UXO-25 is undeveloped, with a small residential area and church located adjacent to the central portion of the site where it is bisected by Verona Loop Road.

FIGURE 8-94
MMRP Site UXO-25



Previous investigations are listed in **Table 8-109**.

TABLE 8-109
Previous Investigations Summary, MMRP Site UXO-25

Previous Investigation/Action	Date	Activities
Preliminary Assessment/Site Investigation (CH2M HILL, 2013)	2012-2013	A PA/SI was conducted to evaluate the presence of potential subsurface MEC and potential impacts to soil and groundwater. Field activities included 10 percent DGM, intrusive MEC investigations and surface soil, subsurface soil, and groundwater samples were collected and analyzed for explosives residues and metals. Metals were detected at concentrations above screening criteria in soil samples. However, an HHRS and ERS were conducted and no unacceptable risks were identified. The DGM investigation identified 361 potential targets but no MEC or MPPEH were identified during the intrusive investigation. Based on these results, NFA was recommended.
No Action Decision Document (CH2M HILL, 2014)	2014	The Final NADD was signed in February 2014.

8.3.22 UXO-26—B-3 Gas Chamber (ASR #2.79a and #2.79c)

Site UXO-26, the Former B-3 Gas Chamber, is located at the main entrance of the MCAS New River. UXO-26 was entered in the MMRP as UXO-01; however, based on UXO-01 investigation results, separate MMRP site numbers (UXO-21 and UXO-26) were designated. UXO-26 encompasses approximately 14 acres (**Figure 8-95**). The B-3 Gas Chamber facility was used between 1953 and 1958. As part of operational training activities, CAs, war gas identification sets, and riot control hand grenades may have been used. Although ASR #2.79a and 2.79c were closed with NFA, ASR #2.79b was re-opened in 2014 and is currently an operational range.

FIGURE 8-95
MMRP Site UXO-26, ASR #2.79a and #2.79c



Previous investigations are listed in **Table 8-110**.

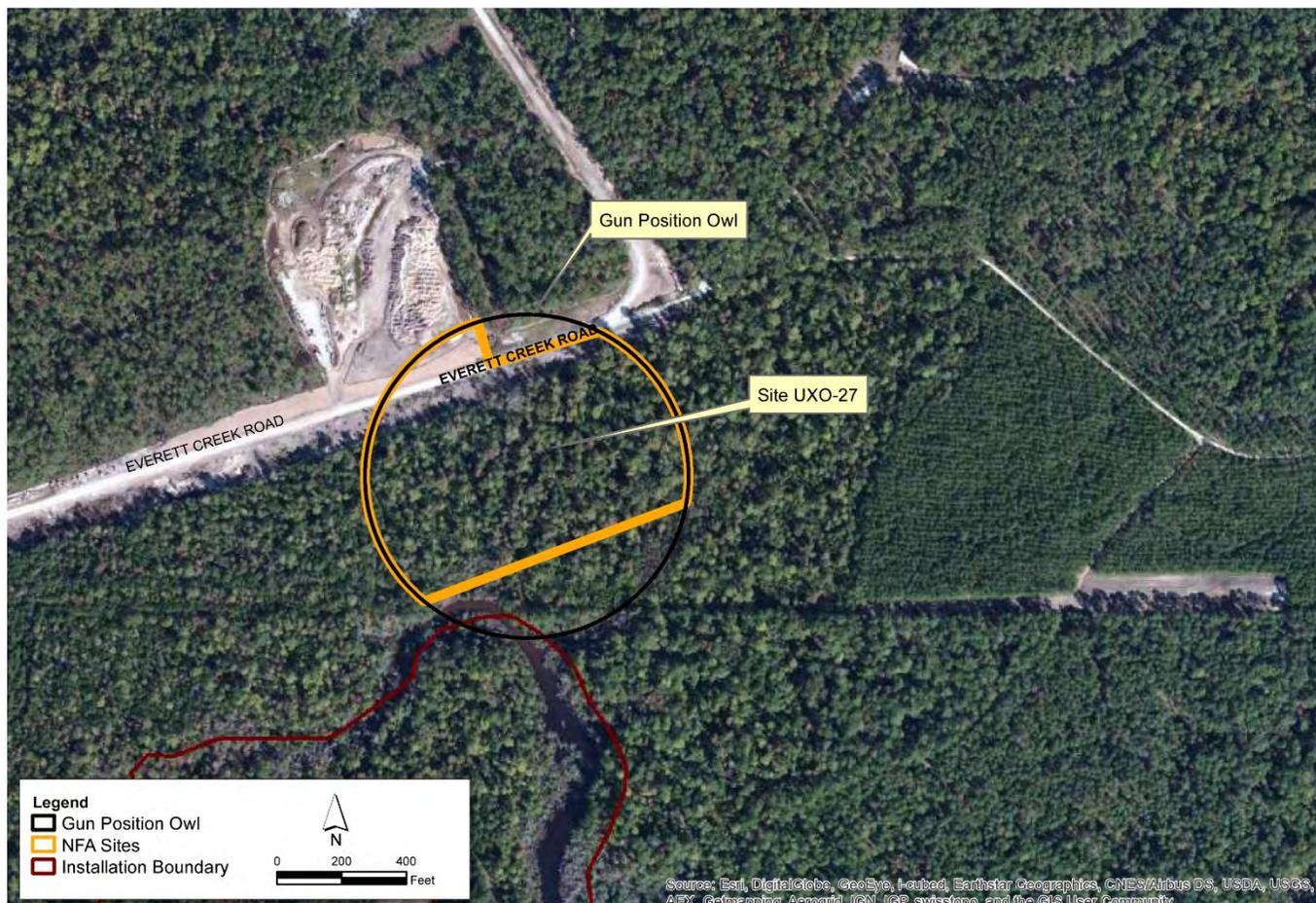
TABLE 8-110
Previous Investigations Summary, MMRP Site UXO-26, ASR #2.79a and #2.79c

Previous Investigations/Action	Date	Activities
Preliminary Assessment/Site Investigation (UXO-05 and UXO-01) (CH2M HILL, 2009)	2008 - 2009	A field investigation was conducted to identify the presence and nature of MC contamination and evaluate the number and density of anomalies that represent potential subsurface MEC. Field activities included soil, groundwater, surface water, and sediment sampling and 10 percent DGM. Samples were analyzed for SVOCs, including tear gas constituents, explosives residues, metals, and perchlorate. No unacceptable human health or ecological risks were identified in site media. 353 geophysical anomalies were present at the site, and an intrusive investigation was recommended.
Expanded Site Investigation (CH2M HILL, 2012)	2011 - 2012	The ESI field investigation was completed to assess, through intrusive investigation, the nature of the 353 geophysical anomalies identified during the PA/SI. No MPPEH was found during the intrusive investigation of areas ASR #2.79a or ASR #2.79c. In the ASR #2.79b area, M6A3 2.36-inch rockets, rocket motors, and pieces of rockets were found indicating a potential target area. However, in 2012 Base Range Control identified the area encompassing ASR #2.79b to be reopened. If the area is reopened, it will fall under the responsibility and management of Range Control, and MEC clearance activities were recommended to minimize explosive risks. If the area is not reopened, an RI is recommended under the MMRP for ASR #2.79b. Additionally, it was recommended to maintain the existing warning signs and conduct a surface sweep for MEC/MPPEH to minimize explosive risks.
Range Reopening Activities (United States Marine Corps, 2014)	2014	In March 2014, the area encompassing ASR #2.79b was reopened as an operational range for use as a School of Infantry training area. Prior to reopening, UXO clearance activities were conducted by Range Control and resulted in recovery and disposal of 15,480 pounds of munitions debris and 6,800 pounds of range-related debris, demolition and disposal of three concrete targets, and identification, demolition, and disposal of 226 MEC items.
No Further Action Decision Document (CH2M HILL, 2014)	2014	Based on recommendations from the ESI, a No Further Action Decision Document was completed to document NFA for ASR #2.79a and #2.79c.

8.3.23 UXO-27 – Gun Position Owl (ASR #2.212)

Site UXO-27 (ASR #2.212) covers approximately 14 acres in the southern portion of the Stone Bay Complex (**Figure 8-96**). The site is mostly covered by forest and Everett Creek Road runs along the northern portion of the site. Gun Position Owl may have been used for indirect firing of 105-mm and 155-mm projectiles into the K-2 impact area. No other documentation has been identified to indicate that other military munitions have been used within Gun Position Owl.

FIGURE 8-96
MMRP Site UXO-27, ASR #2.212



Previous investigations are listed in **Table 8-111**.

TABLE 8-111
Previous Investigations Summary, MMRP Site UXO-27, ASR #2.212

Previous Investigation/Action	Date	Activities
PA/SI (CH2M HILL, 2015)	2013-2015	<p>In 2013, a PA/SI was initiated to evaluate the nature and extent of potential MEC, MPPEH, and MC at UXO-27. Field activities included DGM, an intrusive anomaly investigation, and soil and groundwater sampling for MC analysis. Approximately 700 anomalies were identified during DGM and over 400 anomalies were intrusively investigated. No MEC and only MPPEH/ MDAS were identified.</p> <p>Only metals were detected above screening criteria in soil and groundwater. However, the results of the risk screening indicated that exposure would not result in unacceptable risks to human health or ecological receptors. Based on the results, no further action and closure under the MMRP was recommended for Site UXO-27.</p>

Additional Site Investigations

The following sections discuss the site history, summary of previous investigations, and future activities of the additional sites that have not been assigned IRP or MMRP site designations but are being investigated following the CERCLA/RCRA process (**Figure 2-9**).

9.1 Off-Base Surface Danger Zones

Four historical off-Base surface danger zones (SDZs) were identified based on historical range maps and documents reviewed by the Base. The former SDZs, Rocket Range Number 1 (ASR #2.33), Direct Fire Artillery Range (G-7) (ASR #2.61), G-6 Artillery Range (ASR #2.62), and Impact Area N-1 (ASR #2.207), including Bomb Target-3 and Bomb Target-5 were of various configurations from the 1940s to 2007. SDZs are safety buffers and not impact areas. The SDZs are adjacent to the southeastern boundary of MCIEAST-MCB CAMLEJ (**Figure 2-9**), and encompass approximately 1,632 acres encroaching on off-Base property consisting of private, state-administered, and state-owned parcels.

A PA/SI was initiated in 2009 to identify potential historical activities that may have impacted environmental media from MEC and/or MC, assess geophysical anomalies that represent the potential presence and density of MEC, and evaluate potential risks to human health or the environment relating to historical range activities (CH2M HILL, 2011). Community notification and involvement activities included contacting the land owners regarding the SDZs and for access approval, issuing a fact sheet, and holding a public meeting. Field activities included an aerial geophysical survey; DGM on dry land areas; soil, groundwater, sediment, and surface water/pore water sampling; and explosives residues and metals analysis. The results of the risk screenings indicate that there are no unacceptable risks to either human or ecological receptors due to site media. More than 5,000 anomalies were identified based on the geophysical surveys. An intrusive investigation was conducted on the 200 acres of Bear Island. One MEC item (aircraft flare) was found on the ground surface and several munitions-related items were found during the intrusive anomaly investigation on Bear Island.

An ESI was conducted in FY 2013 to further investigate the nature of geophysical anomalies in areas outside of Bear Island (CH2M HILL, 2014). MEC items were only found within the southwestern portion of the site, near the former Browns Island target area. Only MPPEH or cultural debris were found within the remaining areas of the off-Base SDZs. The probability of contact with MEC is low, primarily because the MEC items found were located within areas that were difficult to access due to marshy conditions.

The ESI recommended the following:

- Amend the ESS and reduce the current size of the off-Base SDZs to include only the southwestern portion of the site where MEC was found, near the former Browns Island target area.
- Prepare an EE/CA to evaluate future actions that may be used to mitigate potential munitions in the reduced area. The EE/CA would evaluate the relative effectiveness, ease of implementation, and cost of each alternative.

Based on the recommendations of the ESI, an EE/CA will be completed in FY 2015.

9.2 Base Boundary Survey

A Base boundary survey was initiated in 2009 to identify current and historical activities at the properties adjacent to MCIEAST-MCB CAMLEJ that may have resulted in environmental impacts to the Base and to evaluate potential on-Base impacts to soil and groundwater in the vicinity of identified off-Base areas of potential concern (AOPCs). After conducting a public database search and field reconnaissance, 12 AOPCs were identified. Environmental sampling was conducted at the AOPCs to evaluate the presence or absence of soil and/or groundwater contamination onto MCIEAST-MCB CAMLEJ. Based on the results, potential on-Base impacts to groundwater were identified at three of the AOPC (9, 10, and 11) (**Figure 2-9**). The *Base Boundary Report for Potential Off-Base*

Contamination Encroachment, Marine Corps Base Camp Lejeune (CH2M HILL, 2010) documents the results of the records review and field investigation. In 2010, the Base notified USEPA and NCDENR of the results. Additional delineation sampling was conducted in 2011-2012 and was documented in the *Base Boundary Report Addendum for Potential Off-Base Contamination Encroachment* (CH2M HILL, 2012). A summary of background information and future activities is provided below for each site.

9.2.1 AOPC 9—Camp Knox Road and North Carolina Highway 24

AOPC 9 is located near the intersection of North Carolina Highway 24 and Bell Fork Road. Groundwater sampling for VOCs, SVOCs, and lead was conducted and methyl tert-butyl ethylene, a gasoline additive commonly associated with petroleum releases, was detected above the NCGWQS in deep groundwater. Potential off-Base sources include the former Chico's Tires leaking underground storage tank (LUST) site, FastFare 557 UST site, and Ronnie Henderson UST site. All of these sites are located directly across the North Carolina Highway 24/Lejeune Boulevard right-of-way, approximately 100 feet north of the Base boundary. NCDENR issued NFA for the former Chico's Tires and Lejeune Exxon/Handy Mart 52 LUST sites, and there no known releases associated with the FastFare 557 or Ronnie Henderson UST sites. Due to MILCON activities, several AOPC 9 groundwater monitoring wells were abandoned or destroyed, two of which were reinstalled in FY 2015. LTM was conducted in February and March 2015 and the report will be submitted in FY 2015.

9.2.2 AOPC 10—Tarawa Boulevard and North Carolina Highway 24

AOPC 10 is located at the intersection of North Carolina Highway 24 and Tarawa Boulevard. Groundwater sampling for VOCs, SVOCs, and lead was conducted and petroleum-related compounds and CVOCs were identified in shallow and deep groundwater. Potential off-Base sources include petroleum contamination associated with the Silance Service Station LUST release and an unknown source of CVOCs. The Silance Service Station is classified as a low risk site according to the NCDENR UST Section. There are also active gasoline stations and former dry cleaning facilities located on the northern side of North Carolina Highway 24. LTM was conducted in January 2014 and analytical results indicated that COC concentrations are stable or decreasing. The report, recommending future periodic groundwater monitoring, was finalized in FY 2015 (CH2M HILL, 2014).

9.2.3 AOPC 11—Former Dogwood Variety Store

AOPC 11 is located off of Highway 172 in Hubert, North Carolina. Groundwater sampling for VOCs, SVOCs, and lead was conducted, and petroleum-related compounds have been identified in groundwater. The potential off-Base source is a petroleum release associated with the former Dogwood Variety Store LUST site that has been issued NFA by NCDENR. LTM was conducted in January 2014 and analytical results indicated that petroleum hydrocarbon concentrations are below the NCGWQS and that VOCs were not detected. The report, recommending future periodic groundwater monitoring, was finalized in FY 2015 (CH2M HILL, 2014).

9.2.4 SWMU 350—Former ASTs STT-61 through STT-66

The former AST facility, which consisted of Tanks STT-61 through STT-66, is located approximately 400 feet east of Iwo Jima Boulevard, a former entrance to the Tarawa Terrace housing development of MCIEAST-MCB CAMLEJ (**Figure 2-9**). The six ASTs (each with approximately 30,000-gallon capacity) at the facility were installed in 1942 and used for liquid propane storage until 1984. Rail cars would deliver and off-load liquid propane to the ASTs and the propane would subsequently be transferred from the tanks to delivery tanker trucks for service to MCIEAST-MCB CAMLEJ. In 1984, the AST piping system was modified and the facility was changed to waste oil storage. The six ASTs were removed in 1993, and the associated subsurface fuel lines for the tank system were left in-place.

Starting in 1990, environmental investigations conducted in the vicinity of the ASTs reported chlorinated and petroleum compounds in residual product collected from Tank STT-66, as well as in soil samples. Petroleum hydrocarbons and CVOCs were identified in groundwater located south and southwest of the SWMU. An IM soil removal was completed in 2006, consisting of the removal of fuel lines and impacted soils associated with the former AST system. Approximately 200 tons of soil were removed from the SWMU 350 trenches and disposed of as a non-hazardous waste material. In 2007, a CSI was conducted to further evaluate potentially impacted soil and groundwater at SWMU 350. Only arsenic and mercury were detected in soil at concentrations exceeding screening levels. In groundwater, benzene and naphthalene were detected at concentrations exceeding the

NCGWQS. In July 2007, groundwater sampling was conducted around Building TT-84, located downgradient from the site and there were no detections above the NCGWQS.

An RFI was initiated in 2009 to identify a potential source area for VOCs and to define the extent of groundwater impacts and was completed in 2012 (AGVIQ/CH2M HILL, 2012). The analytical data indicate the presence of two separate groundwater plumes posing potential future risks to human health if groundwater were used as a potable water supply. One plume, presumed to originate from an off-Base gasoline release, contained concentrations of BTEX, 1,2-dichloroethane, and naphthalene that exceeded the NCGWQS. The second plume contained concentrations of naphthalene that exceeded the NCGWQS. An investigation upgradient and off-Base was recommended to evaluate the nature of the AOC plume source area. The off-Base UST sites north of North Carolina Highway 24 have been referred to the NCDENR UST Section for possible future investigation. The site at 2003 Lejeune Boulevard (Former John's Mobil Service Gas Station) was accepted into the NCDENR UST State Lead Program in October 2011 as Incident Number 32724.

The IM concluded in May 2013 with a second round of injections and the biosparging treatability study and a sitewide groundwater sampling event were completed in November 2013. Based on the results, a CMS was initiated in FY 2015 to evaluate RAs. An expanded biosparging treatability study is being conducted in FY 2015 to assess the effectiveness of biosparging in a deeper aquifer than was assessed during the initial biosparging treatability study. Based on the results, the CMS will be updated in FY 2016.

Sites Transferred

This section discusses the site history for two sites that were transferred from the IRP to the UST Program (Figure 2-10).

10.1 IRP Sites Transferred

10.1.1 Site 22—Industrial Area Tank Farm

Site 22, the Hadnot Point Fuel Farm, is located within the HPIA on the Mainside of the Base (Figure 2-10). All sampling events in and around Site 22 indicated that petroleum-related products from tanks were the only apparent source of contamination. Further, the tanks at Site 22 contain only jet fuel and the site is exempt from CERCLA under the petroleum exclusion. In a letter dated April 21, 1992, the Superfund Section of NCDENR suggested that all further remediation work at Site 22 would be appropriately performed under the UST Program of the State of North Carolina. Previous investigations are listed in Table 10-1.

TABLE 10-1
Previous Investigations Summary, IRP Site 22

Previous Investigations/Actions	Date	Activities
Confirmation Study (1987)	1984 - 1987	A Confirmation Study was conducted to determine the presence or absence of contamination at the site. Field activities included groundwater sampling. The Confirmation Study confirmed the presence of VOCs related to fuels and/or solvents in groundwater and nearby water supply wells that were immediately shut down. Three groundwater plumes were identified in the shallow portion of the surficial aquifer.
Hadnot Point Fuel Farm Groundwater Study (O'Brien and Gere, 1990)	1990	A groundwater study was conducted at Site 22 as part of the MCIEAST-MCB CAMLEJ UST Program. The study concluded that fuel losses likely occurred predominantly through leaks in the transfer lines or valves. Analysis indicated that floating product had contributed significant levels of dissolved petroleum compounds including BTEX into the groundwater. Trace levels of non-petroleum VOCs, including TCE and PCE, were also detected within the fuel farm area. Based on the results of this study, a product recovery/groundwater treatment system was designed for the fuel farm and began operation in 1991.
Supplemental Characterization Study (1991)	1990 - 1991	A Supplemental Characterization Study was performed to further evaluate the extent of contamination in the shallow and deeper portions of the aquifer and to characterize the contamination within the shallow soils at suspected source locations. The study concluded that TCE was only present in soils associated with a UST, which was reportedly used to store spent solvents. The results of the shallow groundwater sampling confirmed findings from previous investigations; and the results from the intermediate and deep monitoring wells identified BTEX downgradient of the fuel farm and at other areas of the site.

10.1.2 Site 45—Campbell Street Underground Aviation Gas Storage and Adjacent JP Fuel Farm

The Campbell Street Underground Aviation Gas Storage and Adjacent JP Fuel Farm (Site 45) is located at the intersection of Campbell and White Streets aboard MCAS New River (Figure 2-10). The Campbell Street Fuel Farm is an active fuel storage facility, with four 215,000-gallon steel ASTs that hold JP-5 jet fuel, which is pumped to the tarmac helicopter refueling station via an underground delivery line. Although Site 45 was initially identified for inclusion on the NPL, petroleum-related contamination is exempt from CERCLA and remediation work at Site 45 will be appropriately performed under the UST Program of the State of North Carolina.

SECTION 11

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Response to Comments
FY 2016 Draft Site Management Plan
Marine Corps Base Camp Lejeune
North Carolina

PREPARED FOR: Dave Cleland, NAVFAC Mid-Atlantic
Charity Delaney, MCB CAMLEJ
Gena Townsend, EPA Region 4
Randy McElveen, NCDEQ
Beth Hartzell, NCDEQ

PREPARED BY: CH2M HILL

DATE: November 3, 2015

The purpose of this document is to address comments on the Fiscal Year (FY) 2016 Draft Site Management Plan (SMP), Marine Corps Base Camp Lejeune (MCB CAMLEJ), North Carolina. The United States Environmental Protection Agency (EPA) Region had no comments on the document. The North Carolina Department of Environmental Quality (NCDEQ) comments are listed below. Responses to comments are provided in bold.

NCDEQ Comments

(dated October 22, 2015)

1. Figure 2-4 and Table 2-4 shows UXO-27 Gun Position Owl as No Further Action (NFA). However, Table 2-3 does not include a NFA date. Please make appropriate correction.

Table 2-3 has been updated to include the NFA date.

2. Please update Schedule 4-2 for the Expanded SI (ESI) Report. The NCDENR was scheduled to receive and review the ESI in September-October but has not received the document.

Schedule 4-2 has been updated as recommended.

3. Please update schedule 5-1 for the Tracer Study and Draft Feasibility Study (FS). We are about 3 months behind schedule for completing the Tracer Study. This will likely affect the schedules for the other work.

Schedule 5-1 has been updated as recommended.