N00178.AR.001241
NSWC DAHLGREN
5090.3a

FINAL ENVIRONMENTAL RESTORATION SITE MANAGEMENT PLAN 2017 NSWC DAHLGREN FL

9/30/2017

NAVFAC WASHINGTON

Final
Environmental Restoration
Site Management Plan
2017

for

Naval Support Facility Dahlgren
(NSFDL)
Dahlgren, Virginia

NAVFAC Washington
1314 Harwood St SE Bldg. 212
Washington, DC 20374

September 2017

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF ACRONYMS

µg/L	micrograms per liter
3DMe™	3-Donor Microemulsion
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSS	Chemical Safety Submission
CW	Chemical Waste
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenylethane
DDESB	Department of Defense Explosive Safety Board
DDT	dichlorodiphenyltrichloroethane
DIRT	Dahlgren Installation Restoration Team
DOD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
DU	Depleted Uranium
EA	Ecological Assessment
EC	effects concentration
EE/CA	Engineering Evaluation/Cost Analysis
EEA	Explosive Experimental Area
EOD	Explosives Ordnance Disposal
EPIC	Environmental Photographic Interpretation Center
ER,N	Environmental Restoration, Navy
ESD	Explanation of Significant Differences
ESS	Explosive Safety Submission
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
FSSI	Field Support Services Inc.
ft^3	cubic feet

FY	fiscal year
GIS	Geographic Information Systems
GMP	Gas Monitoring Probe
HRA	Historical Radiological Assessment
HRC	hydrogen releasing compounds
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IC	institutional controls
IR	Installation Restoration
IRACR	Interim Remedial Action Completion Report
IRP	Installation Restoration Program
JMWA	JM Waller Associates
LEL	Lower Explosive Limit
LHA	Lifetime Health Advisory
LPV	Landfill Passive Gas Vent
LTM	Long-Term Monitoring
LUC	Land Use Controls
MCL	Maximum Contaminant Level
MEC	Munitions of Explosives Concern
mg/kg	milligram per kilogram
mm	millimeter
MPPEH	materials potentially presenting an explosive hazard
MRP	Munitions Response Program
NAVFAC	Naval Facilities Engineering Command
Navy	United States Navy
NCP	National Contingency Plan
ng/L	nanogram per liter
NORM	Navy “Normalization of Data” database
NOSSA	Naval Ordnance Safety and Security Activity
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NSASP	Naval Activity South Potomac
NSFDL	Naval Support Facility Dahlgren
NSWCDD	Naval Surface Warfare Center Dahlgren Division
O&M	Operations and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OWS	Oil/Water Separator

PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	Tetrachloroethene
PCi/g	picocuries per gram
PFCs	Perfluorinated chemicals
ppm	part per million
PRAP	Proposed Remedial Action Plan
PRG	Preliminary Remediation Goals
PVC	polyvinyl chloride
R&D	Research and Development
RACR	Remedial Action Completion Report
RAO	Remedial Action Objective
RASO	Radiological Affairs Support Office
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSIP	Regional Shore Infrastructure Plan
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SMP	Site Management Plan
SOV	Sovereign Consulting, Inc.
SSA	Site Screening Area
SSP	Site Screening Process
SVOC	Semi-volatile organic compounds
SWMU	Solid Waste Management Unit
TCA	trichloroethane
TCE	trichloroethene
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act of 1978
UFP-SAP	Uniform Federal Policy-Sampling and Analysis Plan

USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UXO	Unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
VPDES	Virginia Pollution Discharge Elimination System
VSAP	Verification Sampling and Analysis Plan
VSI	Visual Site Inspection
WWT	Wastewater Treatment
yd^3	cubic yard

DEFINITIONS

Area of Concern (AOC) - Any suspected release of a hazardous waste or hazardous waste constituent which is not associated with a Solid Waste Management Unit (SWMU).

Installation Restoration Site – Some areas of concern or solid waste management units were designated as requiring further investigation, and/or remedial action (upon investigation). These sites receive Installation Restoration site number designations, and environmental restoration activities are authorized and tracked under CERCLA.

Parties - The Navy, United States Environmental Protection Agency (USEPA), and the Commonwealth of Virginia.

Record of Decision (ROD) - A public document that selects and explains which cleanup alternatives will be implemented at Naval Support Facility (NSF) Dahlgren; includes the basis for the selection of the remedy.

Site Screening Area (SSA) - Those geographical areas listed in Appendix A of the Federal Facilities Agreement (FFA) and any additional areas agreed to by the Parties in the future. Site Screening Areas (SSA) may be either Resource Conservation and Recovery Act (RCRA) SWMUs or AOCs or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) AOCs. When the Parties agree, the SSAs may expand or contract in size as information becomes available indicating the extent of contamination and the geographical area needed to be studied.

Solid Waste Management Units (SWMUs) - Any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes. Such units include any area at a facility where solid wastes have been routinely and systematically released.

This Page Intentionally Left Blank

EXECUTIVE SUMMARY

This document presents summary information concerning the history and status of environmental restoration sites at the Naval Support Facility Dahlgren (NSFDL), Dahlgren, Virginia. This document is intended as a quick-reference guide to assist the Navy and supporting entities in the management of NSFDL environmental restoration sites. Annual updates to the Site Management Plan are required per The Comprehensive Environmental Response, Compensation, and Liability Act and the Federal Facilities Agreement. The Site Management Plan provides insight into key elements of each site at NSFDL, such as land use history, environmental impacts, cleanup goals, remedial actions, closeout strategy, and monitoring requirements.

This Page Intentionally Left Blank

1.0 INTRODUCTION

This report presents the Site Management Plan (SMP) for the Naval Support Facility Dahlgren (NSFDL) Dahlgren, Virginia. The purpose of the SMP is to document progress to date and present the planned activities to be conducted at NSFDL during fiscal years (FYs) 2017 and 2018. The SMP also provides projections for long-term progress at the installation in accordance with the Department of the Navy's Environmental Restoration (ER,N) Program and the Federal Facility Agreement (FFA) signed in September 1994 by United States Environmental Protection Agency (USEPA) Region III, Virginia Department of Environmental Quality (VDEQ) and the United States Navy (Navy). This report is updated annually in accordance with the FFA. This SMP has been prepared by the Naval Facilities Engineering Command (NAVFAC), Washington, D.C. for the NSFDL, Dahlgren, Virginia.

1.1 PURPOSE OF THE SITE MANAGEMENT PLAN

The SMP is one of the primary documents identified in the FFA. The requirements of the SMP are to document decisions made during the project planning and scheduling process for the NSFDL, and the environmental restoration activities completed for each site to date. An updated SMP is prepared each year, with the draft due before June 15 and a final due 30 days after the Navy (NAVFAC Washington) receives its annual environmental restoration fund allocation. The SMP includes proposed actions for all The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) responses, specific RCRA corrective actions, and outlines all the response activities and associated documentation, under the FFA, to be undertaken at the installation. This SMP includes proposed deadlines for completion of draft primary documents, as specified in the FFA, to be submitted during FYs 2017 and 2018 and proposed target dates for activities beyond the two-year planning period.

1.2 DESCRIPTION OF THE INSTALLATION

NSFDL is located on the western shore of the Potomac River in King George County, Virginia, approximately 25 miles east of Fredericksburg, Virginia and 40 miles south of Washington, D.C. (**Figure-1-1**). The installation was established in 1918 with the primary mission of testing all naval ordnance materials. Since then, the mission of the NSFDL has evolved to research and development (R&D) operations. NSFDL is bounded on the north by U.S. Highway 301 and on the east by the Potomac River. Upper Machodoc Creek flows in a general west-to-east direction through NSFDL, dividing it into two principal areas: the Mainside, consisting of 2,678 acres (**Figure 1-2**), and the Explosive Experimental Area (EEA), consisting of 1,614 acres (**Figure 1-3**). The EEA, located on Tetotum Flats, is commonly referred to as Pumpkin Neck.

The Naval Support Activity South Potomac (NSASP) is the NSFDL's host command. Approximately 537 structures are located within the NSFDL boundaries, including 497 buildings at Mainside and 40 at the EEA. Facilities on the Mainside include those used for administration purposes (e.g., public works, supply), R&D, housing and community support, an airfield, and a secure range area where a variety of ordnance materials are developed. Currently supported tenant commands hosted at NSFDL include the Navy Air and Missile Defense Command; Aegis Ballistic Missile Defense; Naval Surface Weapon Center Dahlgren Division (NSWCDD); the Center for Surface Combat Systems; the Aegis Training and Readiness Center; the Joint Warfare Analysis Center; the U.S. Air Force 20th Space Control Squadron, Detachment 1; and the U.S. Air Force 614th Air and Space Operations Center, Detachment 1.

The EEA is an active range area located south of the Mainside on a peninsula-like area called Tetotum Flats. The EEA is bound on the north by the Upper Machodoc Creek, separating it from Mainside, and the remainder of the EEA is enclosed by a fence with a gated, secure entrance. Access to the EEA is by request only (with proper security clearance), and is through a gated entrance located off Virginia Route 218. The EEA is presently used, and has been used since approximately 1920, for the testing of naval ordnance. It includes static detonation areas, drop test towers, static thrust stands, thermal test retaining cages, fast and slow cook-off facilities, shock test facilities, high explosive vibration facilities, and areas for the thermal treatment of explosive hazardous waste. There is no disposal of ordnance or explosive hazardous waste at the EEA; these items are disposed of at permitted facilities located outside of the NSFDL.

1.3 ENVIRONMENTAL HISTORY OF THE INSTALLATION

The history and mission at NSFDL have required and continue to require the use, handling, storage, and disposal of hazardous materials and petroleum products. Through accidental spills, leaks, and conventional waste disposal practices before the 1980s, hazardous materials came into contact with the environment and resulted in conditions that do not meet today's stricter and more comprehensive environmental standards. Today, all hazardous materials and wastes generated at NSF Dahlgren are managed in accordance with applicable state and federal regulations and are disposed of, or recycled, offsite at licensed waste disposal facilities. The present focus on cleaning up the effects caused by past waste disposal practices and controlling current practices have enabled the Navy to reduce potential threats to the public health, public welfare, or the environment. Since the late 1980s, past releases to the environment were identified and have been addressed on an ongoing basis under the Navy's comprehensive cleanup program, as described below.

Prior to the existence of the FFA, an Initial Assessment Study (IAS) was completed for the NSFDL in July 1981 (Fred C. Hart Associates, Inc., 1983). The purpose of the IAS was to identify and assess sites

posing a potential threat to human health or the environment due to contamination from past hazardous materials operations. The IAS recommendations were based on information from historical records, aerial photography, field inspections, and personnel interviews. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.

During the IAS, a list of thirty six (36) potentially contaminated sites, including sites on the Mainside and the EEA, was identified (Fred C. Hart Associates, Inc., 1983). Among these potentially contaminated sites, an initial list of seven sites requiring further investigation was identified (**Table 1-1**). The next step was a Confirmation Study involving sampling and monitoring of the sites, to identify the presence of suspected contamination, if any, and assess potential long-term impacts (O'Brien & Gere, 1986a). **Table 1-1** compares the sites recommended for further investigation in the 1983 IAS with those assessed via environmental sampling and testing performed in 1983-84 during the Confirmation Study.

Confirmation studies were completed during 1983 and 1984 at five of the seven IAS sites (O'Brien & Gere, 1986a). IAS Site 34 (Barbette/Depleted Uranium Contamination) and Site 2 (Fenced Ordnance Burial Area) were initially recommended for further investigation based on the conclusions of the IAS. However, these two sites were omitted from the Confirmation Study due to concerns of possible low-level radioactivity in wastes present at both sites. Site 2 was subsequently addressed in a Remedial Investigation. Due to special requirements for addressing radiological hazards, the Barbette platform at Site 34 was later removed in the spring of 1992 under the direction of the Navy's Radiological Affairs Support Office (RASO). A confirmation study was performed at the 1400 Area Landfill (IAS Site 17), presumably because of its suspected contribution to potential contamination at IAS Site 10. Preliminary sampling and analysis programs were conducted to attempt to confirm the presence or absence of suspected contaminants and to define any past or future migration of those contaminants. Due to the preliminary nature of the confirmation studies, only limited conclusions were possible, though the presence of contamination was indicated at all six sites.

After the completion of the Confirmation Study, the Navy concluded that eight sites should be included under the Navy's Installation Restoration Program (IRP) at the NSFDL (**Table 1-1**). IAS Site 29 was added because it was determined that this site consisted of an unlined limestone pit rather than an underground storage tank. Note that the number of IRP Sites list has been expanded to include more than the original eight, as additional sites were identified and investigated during and after the 1990s.

After the Confirmation Study, the USEPA evaluated the NSFDL using the Hazard Ranking System (HRS), which assesses the potential hazards posed by contaminated sites (USEPA, 1991). The HRS evaluated and prioritized potential risks to human health and the environment resulting from past hazardous waste management practices at the NSFDL. The HRS score for the NSFDL was higher than the 28.5 needed to

place the site on the National Priorities List (NPL). The NSFDL was proposed for the NPL on February 7, 1992, and USEPA added it to the list on October 14, 1992.

Pursuant to its Resource Conservation and Recovery Act (RCRA) Corrective Action Program, USEPA Region III conducted a visual site inspection (VSI) at NSFDL in August 1992. During the VSI, many additional areas were identified and documented for the purposes of future investigation and management under CERCLA and RCRA. As a result, 129 solid waste management units (SWMUs), 26 areas of concern (AOCs), and 5 other units were identified. The IAS sites were also assigned a SWMU or AOC number. Subsequent to the VSI, USEPA determined that six additional units required further action based on an analysis of aerial photography. From this original list USEPA and the Navy determined that 75 sites required further investigation (USEPA, 1993). The sites are divided into two categories, Appendix A sites and Appendix B sites, which are included in the Federal Facilities Agreement. Large size maps showing the locations of the units identified as AOCs, SWMUs, and other investigated sites are provided in **Attachment A** to this SMP.

In 1995, the Dahlgren Installation Restoration Team (DIRT) was formed to provide an efficient means to address cleanup at NSF Dahlgren. The Restoration Team consisted of the Navy, USEPA, and the Commonwealth of Virginia (represented by the Virginia Department of Environmental Quality [VDEQ]). The Restoration Team and environmental contractors meet every 6 to 8 weeks (“DIRT meetings”) to prioritize, discuss, and implement cleanup activities at NSF Dahlgren.

1.4 SITE MANAGEMENT PLAN FORMAT

An initial SMP was drafted and submitted to the Parties in 1994, 60 days after the FFA was signed. This initial SMP was used as a general template for subsequent annual SMP documents from 1995 to 2016. An updated SMP with a new consolidated format and interactive supporting graphics, including required contents per the FFA, was introduced in 2016. This SMP layout provides a concise and orderly presentation of site information, with Figures included at the end of each section.

The SMP is organized into eight sections, as described below:

Section 1.0 Introduction - Presents a description and history of the installation.

Section 2.0 Discusses the requirements for the Site Management Plan set forth in the FFA.

Section 3.0 Summarizes the history and IR program activities for the Appendix A Installation Restoration Sites.

Section 4.0 Summarizes the Appendix A, Priority 1 sites.

Section 5.0 Summarizes the Appendix A, Priority 2 sites.

Section 6.0 Summarizes the Appendix A, Priority 3 sites.

Section 7.0 Summarizes the Appendix A, Priority 4 sites.

Section 8.0 Gambo Creek Assessment - This section presents summaries of activities involved in the Gambo Creek Ecological Assessment.

Section 9.0 Summarizes information concerning NSFDL Munitions Response Program Sites.

Section 10.0 Describes sites that are identified in Appendix B of the FFA. The sites were screened to determine whether they belong in Appendix A.

Section 11.0 Describes sites that have records of historical use, storage, or handling of radiological isotopes or equipment.

References Includes all references consulted for the preparation of this SMP report.

Attachment A Maps of NSFDL Environmental Restoration Sites.

Attachment B Summaries of environmental restoration/history of investigation for NSFDL Appendix B sites, all closed out.

Attachment C Site Name/Number Cross Reference List - This section contains a cross-reference list for those sites that have name changes since the initial assessment.

Attachment D Navy "Normalization of Data" database (NORM) and Site Schedules

TABLE 1-1

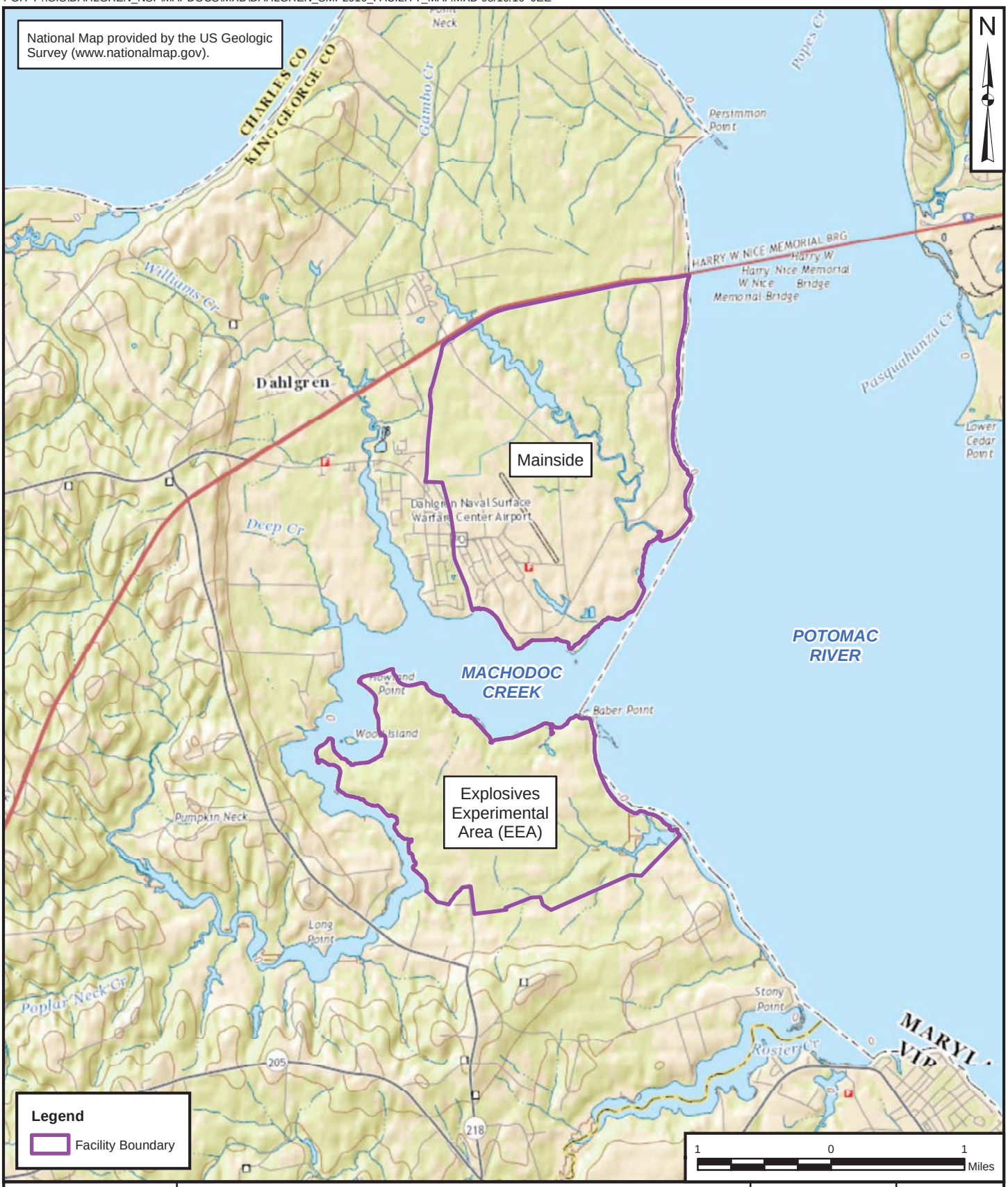
ORIGINAL SITES RECOMMENDED FOR FURTHER INVESTIGATION PER 1983 INITIAL ASSESSMENT STUDY, SITES INCLUDED IN 1984 CONFIRMATION STUDY, AND/OR INCLUDED IN INSTALLATION RESTORATION SITES AS OF 1986 (1), (2)
NSF DAHLGREN, DAHLGREN, VIRGINIA

Site Name	Fenced Ordnance Burial Area	Disposal/Burn Area	Hideaway Pond	Chemical Burn Area	1400 Area Landfill	Transformer Draining Area	Pesticide Rinse Area	Battery Service Area
SITE I.D.	**Site 2**	**Site 9**	**Site 10**	**Site 12**	**Site 17**	**Site 19**	**Site 25**	**Site 29**
IAS	✓	✓	✓	✓		✓	✓	
Confirmation Study		✓	✓	✓	✓	✓	✓	
1986 IRP Site	✓	✓	✓	✓	✓	✓	✓	✓

IAS - Initial Assessment Study
IRP - Installation Restoration Site

1. Note that Table 1 includes only sites that were slated for additional investigation as of 1986, and thus presents a partial list of NSFDL environmental restoration sites. The purpose of Table 1-1 is to show those sites which were recognized as important in the early stages of the IRP.
2. As discussed in Section 1.3, Site 34 (Barbette/Depleted Uranium Contamination) was one of the original IAS sites. However, it was omitted from the Confirmation Study due to radiological concerns, and a removal action was completed under RASO oversight in 1992 before NSFDL was listed on the NPL, so Site 34 was not included in the IR Program.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_FACILITY_MAP.MXD 08/10/16 JEE

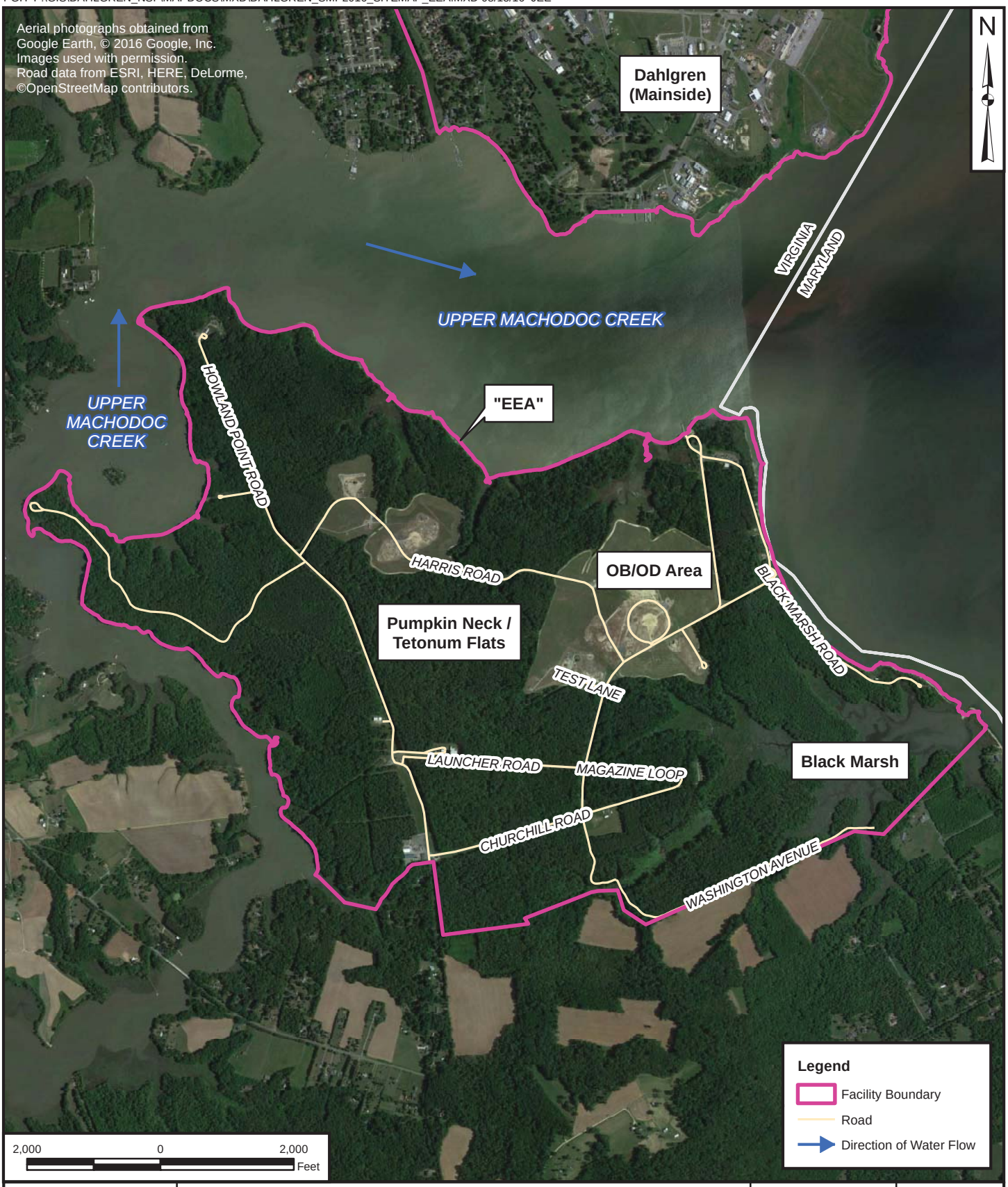


DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH		CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/10/16	INSTALLATION LOCATION MAP NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___			APPROVED BY: ___	DATE: ___
SCALE: AS NOTED				FIGURE NO.: 1-1	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_MAIN.MXD 08/10/16 JEE

DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/10/16	MAINSIDE AREA OF INSTALLATION NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 1-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_EEA.MXD 08/15/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/15/16	EXPLOSIVES EXPERIMENTAL AREA (EEA), PUMPKIN NECK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 1-3	REV: 0

2.0 FFA AND SITE PRIORITIZATION

On February 7, 1992, the USEPA proposed that the NSFDL be added to the NPL under CERCLA in 57 Federal Register 4824 through 4827. On October 14, 1992, the NSFDL was finalized on the NPL. Following listing on the NPL, negotiations for a Federal Facilities Agreement (FFA) between USEPA Region III, the Commonwealth of Virginia, and the Department of the Navy (hereafter referred to as the Parties) were initiated. The FFA was signed by the Parties on September 30, 1994. The FFA appendices (Appendix A and Appendix B) provided a comprehensive list of the sites which were identified during early studies of the facility as having possible environmental impacts or releases.

2.1 FEDERAL FACILITY AGREEMENT SITES

The FFA categorized the sites either as those that would be further characterized (Appendix A sites), or sites that required additional documentation or sampling (Appendix B sites) before a decision for no further action or additional characterization is warranted. Sites that required further characterization (Appendix A sites) are classified as site screening areas (SSAs). SSAs included the geographical areas listed in Appendix A of the FFA and any additional areas that would be agreed to by the Parties in the future. The term SSA is defined in the list of definitions following the Table of Contents. Under the terms and conditions of the FFA, SSAs are required to be investigated and, if appropriate, remediated in accordance with the National Contingency Plan (NCP); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); Superfund Amendments and Reauthorization Act (SARA); and RCRA.

Just before the FFA was drafted, personnel from the NSFDL, NAVFAC and Tetra Tech (formerly Brown & Root Environmental) conducted a site visit on July 21 through July 23, 1993 (hereafter referred to as the Navy Site Visit) to gather additional information necessary for preparing the initial SMP. The purpose of the Navy Site Visit was two-fold: to verify USEPA's descriptions and to note any changes to the sites since USEPA's August 1992 VSI. Three additional SWMUs requiring additional action were identified from the Navy Site Visit and incorporated into the FFA. These SWMUs are: the Yardcraft Oil Storage Area (SWMU 130), the Gambo Creek Compost Area (SWMU 131), and the Gun Barrel Degreasing Area Railway Spur (SWMU 132).

2.2 PRIORITIZATION OF NSFDL CERCLA UNITS (SITES)

After signing the FFA for NSFDL, the Parties developed an informal, qualitative prioritization scheme and began prioritizing the CERCLA units or sites (including SWMUs, AOCs, and RCRA units) in order to document and solidify plans for future actions. The terms SWMUs and AOCs are defined in the front of this document under definitions. Appendix A Sites are those that were prioritized in the FFA as requiring

further investigation. Appendix A sites include IRP sites, SWMUs, AOCs, and other areas. The prioritization scheme was based on the following criteria:

- Potential for groundwater contamination;
- Proximity to receptors;
- Contaminants verified as being present (including toxicity and migration potential); and
- Potential for aquatic stress.

Prioritization was not performed for the Appendix B sites since additional information had to be gathered for the Appendix B sites for the Parties to make a determination whether further investigation was required. Most of the Appendix B sites at NSFDL have been closed out with no further action status, with two sites requiring an Industrial land use restriction. Summaries of the information gathered and evaluations of the Appendix B sites is presented in Attachment B.

The Sites in the FFA Appendix A list were divided into five sub-categories (numbers 1 through 5, below) according to the informal prioritization criteria listed above. Gambo Creek was categorized in the FFA as AOC P and was added as a separate category below. In 2014, the NSFDL's first Munition Response Program (MRP) site was designated, which resulted in another sub-category below. In 2016, the Navy initiated non-CERCLA historical radiological assessment activities for sites where radioisotopes may have been used, and thus the eighth category was added for future tracking of these sites, as needed. These sub-categories, with corresponding Sections in this SMP describing the sites in each sub-category, are described below.

1. Installation restoration (IR) sites (see Section 3): At the time of the 1994 FFA, these were sites already investigated/sampled as part of the Confirmation Studies. Additional IR sites, promoted in status from the categories below after investigation confirmed remedial actions would be necessary to minimize environmental impacts, have been added since 1994.

2. Priority 1 sites (see Section 4): These sites were given the highest priority due to their likelihood for groundwater and/or surface water contamination and adverse impacts to aquatic receptors. Priority 1 sites required further assessment of possible impacts to the environment, based on the confirmed presence of chemicals in site soils, groundwater, sediment, and/or surface water.

3. Priority 2 sites (see Section 5): These sites received a high prioritization, but slightly lower than Priority 1 because more information was needed to base decisions on. Further assessment of Priority 2 sites was required and for many sites was accomplished using the Site Screening Process (SSP) investigation.

4. Priority 3 sites (see Section 6): Priority 3 sites were ranked lower due to a perceived lower likelihood for release to groundwater and adverse ecological impacts, or because the extent of impacts was considered less significant and/or unlikely to migrate.

5. Priority 4 sites (see Section 7): Priority 4 sites were primarily ordnance sites. In the early years of NSFDL's IR program (e.g., 1983 to 1995), regulations and guidance were still being developed concerning CERCLA authority and intrusive activities for ordnance sites. Therefore, these sites received the lowest prioritization to allow time for the NSFDL IR Team to develop best practices for addressing these sites.

6. Gambo Creek Ecological Assessment (see Section 8): The FFA specified that Gambo Creek (FFA "AOC P") would be investigated during characterization activities at the individual sites, and would not be investigated separately. The FFA also stipulated that within the boundaries of NSFDL, the ecological impacts to Gambo Creek would be evaluated. Thus, the Navy completed a Gambo Creek Ecological Assessment.

7. Munitions Response Program Sites (see Section 9): Sites listed under the Munitions Response Program (MRP) have been designated as such due to concerns over the presence of munitions of explosives concern (MEC) or munitions presenting a potential explosive hazard (MPPEH). These items are present due to past R&D or range testing activities. Munitions items may be inert or live, and investigation is required to assess the type and distribution of munitions, their possible impact on the environment, and response actions required to restore public safety and environmental conditions.

8. Radiological Sites (see Section 11): Some Appendix A sites also have a history of research with, or applications using radiological equipment or isotopes prior to the 1990s. Those radiological sites listed under Appendix A (and B) have been evaluated and closed out under CERCLA following elimination of operations using radioisotopes, and past removal actions. However, a Historical Radiological Assessment (HRA) is currently being performedby the Navy with guidance from Radiological Affairs Support Office (RASO). The HRA will examine and document the extent of current and former activities involving the management, use, and disposal of radioactive material at NSFDL.

The Appendix A sites are delineated in **Figures 2-1** and **2-2**, which are included in the back cover of this report. **Figure 2-1** shows the locations of the Appendix A sites at Mainside and **Figure 2-2** shows the locations of the Appendix A sites at the EEA. Likewise, the Appendix B sites at Mainside and the EEA are shown in **Figures 2-3** and **2-4**, respectively. **Table 2-1** lists the Appendix A Sites, and **Table 2-2** lists the Appendix B sites for NSFDL. The Appendix A "Site Numbers" have been changed to fit the

chronological order numbering scheme previously developed by the Navy during the Initial Assessment Study, (Fred C. Hart Associates, Inc., 1983). (See the Site Cross Reference Index in **Attachment C** to this SMP). **Table 2-1** indicates whether each Appendix A site currently has an "open" status (e.g., active monitoring, remediation, or investigation under the IR Program) as of June 30, 2017, and provides quick-links to the SMP sections where further information is provided on each site. Since 1994 the original priority designation has changed for several sites based upon potential environmental risks, site development, sampling information, and professional judgment of the Parties.

2.3 CHANGES TO SITE PRIORITIZATION

In 1994, two additional sites were identified by the Navy, the Shell House Dump (Site 57, SWMU 133; an Appendix A Priority 2 site) and the Building 1350 Landfill (Site 58, combined with IR Site 9). USEPA also identified an additional area in 1994, the Octagon Pad Dump (SWMU 135, an Appendix B site). In 1997, the Navy identified two additional sites and added them to the Appendix A Priority 3 sites list, the Gambo Creek Ash Dump (Site 61a) and Building 396 (Site 62). In 2000, the Navy identified one additional site from field surveys, the Gambo Creek Projectile Disposal Area (Site 61b).

In 2001, the Navy reopened Site 4, Case Storage Area, and Site 15, Scrap Area, due to waste visually confirmed on the sites. In 2002, the Navy (with USEPA Region III and VDEQ concurrence) transferred the investigation and potential cleanup requirements of Site 47b, Explosives Ordnance Disposal (EOD) Scrap Area, from a cleanup governed by RCRA to a cleanup governed by CERCLA and Site 47b was added to the Appendix A Priority 4 sites list. In May 2003, the Navy, USEPA Region III, and VDEQ agreed to transfer Site 61b, Gambo Creek Projectile Disposal Area, from an Appendix A to an Appendix B site based on the trenching data evaluated by DIRT during the April 30, 2003 meeting. In 2006, an additional site, Site 63 (Building 198 Neutralization Tank) was identified during remediation activities at a nearby site and added to the Appendix A Priority 3 sites list. In 2010, the Navy identified a new site, Site 64, Gum Alley Disposal Area, and added it to the list of Priority 3 sites. However, Site 64 was later determined in 2014 to be ineligible for the IR Program due to its location on an active range.

2.4 SITE SCHEDULES

The FFA requires that the SMP present project schedules for each year, with projections for activities in the following year, for all active Appendix A sites. The project schedules for the Appendix A sites include a listing of FY 2017 and FY 2018 activities (as of May 15, 2017) for each site and the associated deliverables. Funded activities are those that are scheduled in FY 2017 and budgeted for FY 2018. **Attachment D** to this document contains the Site Schedules as of June 2017.

If additional funds, beyond what was budgeted and received, are required for individual tasks, a slippage in schedule or phasing of the task may be required. At each DIRT meeting, the schedule for proposed site activities is reviewed and updated.

TABLE 2-1

APPENDIX A SITES GROUPED BY PRIORITIES
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA
PAGE 1 OF 2

Site No.	Site Name	Open Status in IRP? (as of June 30, 2017)
IR Sites		
Site 2	Fenced Ordnance Burial Area	**Yes,** LTM, FYR
Site 3	Ordnance Burn Structure	**Yes,** LTO (with Site 12)
Site 9	Disposal/Burn Area	**Yes,** LTM, FYR
Site 10	Hideaway Pond	**Yes,** LTM, FYR
Site 12	Chemical Burn Pit	**Yes,** LTO, FYR
Site 17	1400 Area Landfill	**Yes,** LTM, FYR
Site 19	Transformer Draining Area	No
Site 25	Pesticide Rinse Area	No
Site 29	Battery Service Area	No
Site 44	Rocket Motor Pit	**Yes,** LTO (with Site 12)
Site 58	Building 1350 Landfill (combined with Site 9)	**Yes,** LTM, FYR
Priority 1 Sites		
Site 6	Terminal Range Airplane Park	No
Site 21	Gun Barrel Decoppering Area	No
Site 22	Gun Barrel Degreasing Area, North Main Range	No
Site 31	Airplane Park Dump, EEA	No
Site 32	Fast Cook-Off Pit and Pond, EEA	No
Site 45	July 28, 1992 Landfill B	No
Site 46	July 28, 1992 Landfill A: Stump Dump Road	No
Site 50	Fill Areas Northeast EEA	No
Site 51	Battery Locker Acid Draining Area	No
Site 53	OWS 207 300	No
Site 55	Cooling Pond	No
Priority 2 Sites		
Site 13	Gambo Creek Truck Wash Area	No
Site 20	Former Electroplating Waste UST	**Yes,** Remedy Evaluation/LTO
Site 23	Building 480 Lot (PCB Storage)	**Yes,** Remedy Evaluation/LTO

TABLE 2-1

APPENDIX A SITES GROUPED BY PRIORITIES
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA
PAGE 2 OF 2

Site No.	Site Name	Open Status in IRP? (as of June 30, 2017)
Priority 2 Sites, continued		
Site 37	Lead Contamination Area	**Yes,** LUCs, FYR
Site 56	Gun Barrel Degreasing Area, Railway Spur	No
Site 57	Shell House Dump	No
Priority 3 Sites		
Site 4	Case Storage Area	**Yes**
Site 14	CW Evaporation Pond	**Yes**
Site 15	Scrap Area	**Yes**
Site 38	Building 1349 Pest Control Outside Area	No
Site 40	Building 120B DRMO Lot	No
Site 61a	Gambo Creek Ash Dump	**Yes**
Site 43	Higley Road Land Application Area	No
Site 62	Building 396	No
Site 63	Building 198 Neutralization Tank	No
Site 64	Gum Alley Disposal Area	No *
Priority 4 Sites		
Site 1	Old Bombing Range	No *
Site 5	Projectile Disposal Area	No *
Site 36	Depleted Uranium Mound, Pumpkin Neck, EEA	No
Site 47a	WWI Munitions Mound	No
Site 47b	EOD Scrap Area	No
Site 49	Depleted Uranium Gun Butt	No
Munitions Response Program (MRP) Sites		
UXO-01	Potomac River Range, NSFDL	**Yes**

* Sites for which assessment and/or cleanup is deferred until closure of various range areas, and thus which are removed from ER,N program funding.
FYR - Five-Year Reviews performed
LTM – Long-Term Monitoring
LTO - Long-Term Operations
LUCs – Land Use Controls maintained

TABLE 2-2

APPENDIX B SITES
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA
PAGE 1 OF 2

Site No.	Site Name	Current Status
Appendix B Sites at Mainside		
SWMU 3	Building 194 Accumulation Area (Concrete Pad)	Closed Out
SWMU 15	Building 120B Contractor Staging Area	Closed Out; Industrial Use Only
SWMU 20/Site 41	Compost Area	Closed Out
SWMU 23	Building 456 Oil Waste Drum	Closed Out
SWMU 27	Tank 280 Contractor Staging Area	Closed Out
SWMU 57/Site 60	Building 445 Star Gauge Loading Dock	Closed Out
SWMU 61	Paint Can Crusher	Closed Out
SWMU 62	Paint Can Dumpster	Closed Out
SWMU 64	Building 448 Sand Blast Area	Closed Out
SWMU 67	Building 448 Tar Tank Area (formerly Site 48)	Closed Out
SWMU 70	Building 152 TCA Accumulation Area	Closed Out; Industrial Use Only
SWMU 77	Building 1329 Wash Area	Closed Out
SWMU 78	Building 1121 Former Waste Oil UST	Closed Out
SWMU 82	Electroplating Line and WWT	Closed Out
SWMU 101	Building 155 Auto Shop Waste Oil Filter and UST	Closed Out
SWMU 115	Building 1282 Auto Hobby Outside Used Oil Storage	Closed Out
SWMU 119	Building 1282 Auto Hobby Used Oil Tank	Closed Out
SWMU 125/Site 52	OWS 107-350 (Yardcraft Area)	Closed Out
SWMU 127	OWS 1121-300, OWS 115-350, OWS 402-30,000, and OWS 486-1000	Closed Out
SWMU 128/Site 54	OWS 1121- Old	Closed Out
SWMU 130	Yardcraft Oil Storage Area	Closed Out
SWMU 131/Site 28	Gambo Creek Compost Area	Closed Out
AOC O	Building 1369 Pesticide Spill Area	Closed Out

TABLE 2-2

APPENDIX B SITES
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA
PAGE 2 OF 2

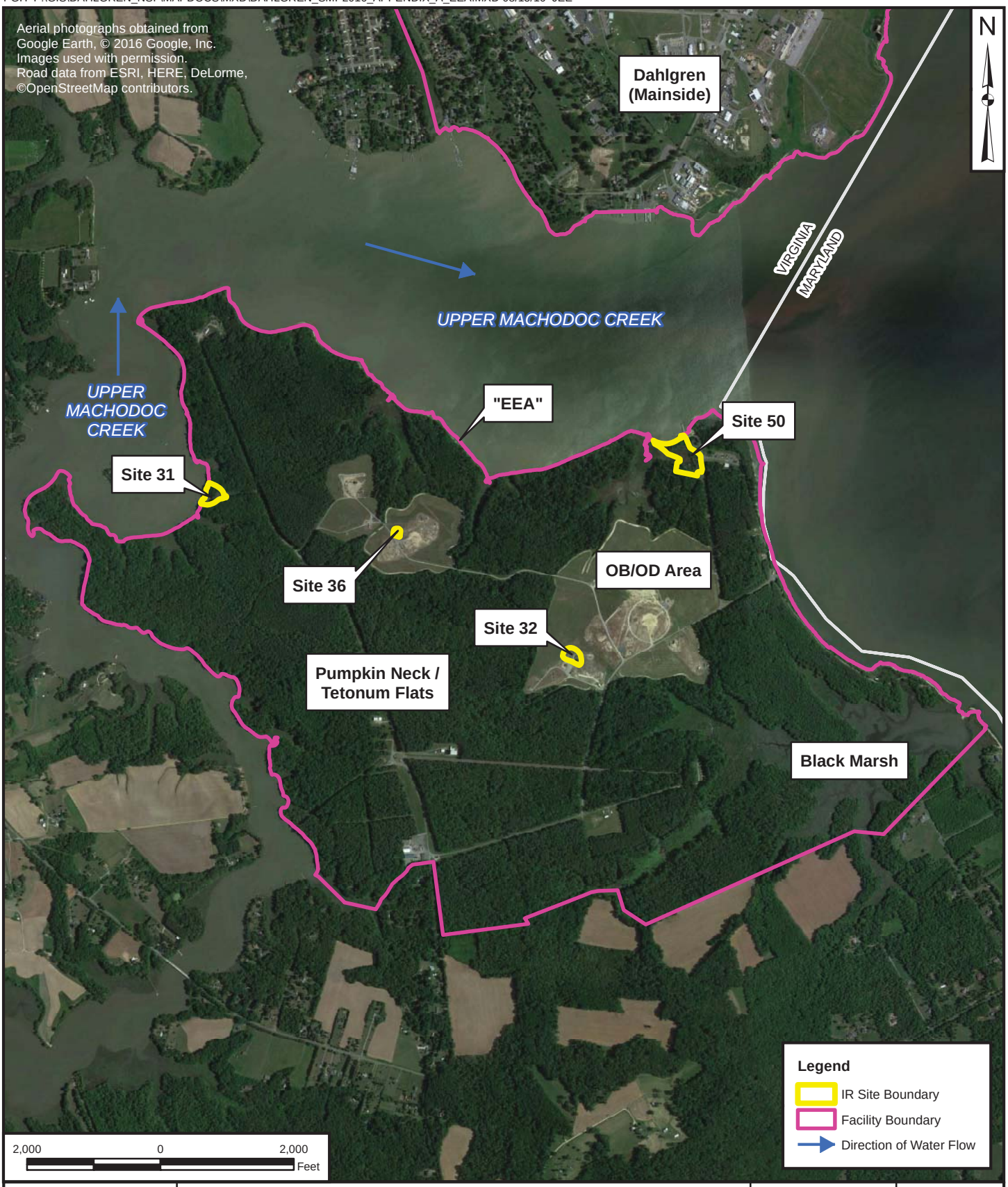
Site No.	Site Name	Current Status
(Appendix B Sites at Mainside, continued)		
AOC X	Classified Documents Incinerator Sewage Holding Tank	Closed Out
AOC X7/Site 39	Open Storage Area Main Battery	Closed Out
AOC Z	Terminal Range Building 109	Closed Out
Other Units C6	Former Radio Testing Area	Closed Out
Additional Areas X6	South Hangar Former Tank Area	Closed Out
Building 126	Former Powder Magazine	Closed Out
Site 61b	Gambo Creek Projectile Disposal Area	Closed Out
Appendix B Sites at EEA		
AOC A	Otto Fuel Spill, EEA	Closed Out
Site 59	Octagon Pad Dump, EEA	Closed Out
Appendix B Sites, Other Areas		
Other Units C3	Scar at Phalanx Test Area	Closed Out

Closed out - A close-out document is available and no further action is required for this site.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_A_MAIN_1117.MXD 08/29/16 JEE

DRAWN BY: J. ENGLISH — DATE: 08/29/16	TETRA TECH	CONTRACT NUMBER: 5663	CTO NUMBER: ____
CHECKED BY: A. McGIVNEY — DATE: 08/29/16	ALL APPENDIX A SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 2-1	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_A_EEA.MXD 08/15/16 JEE

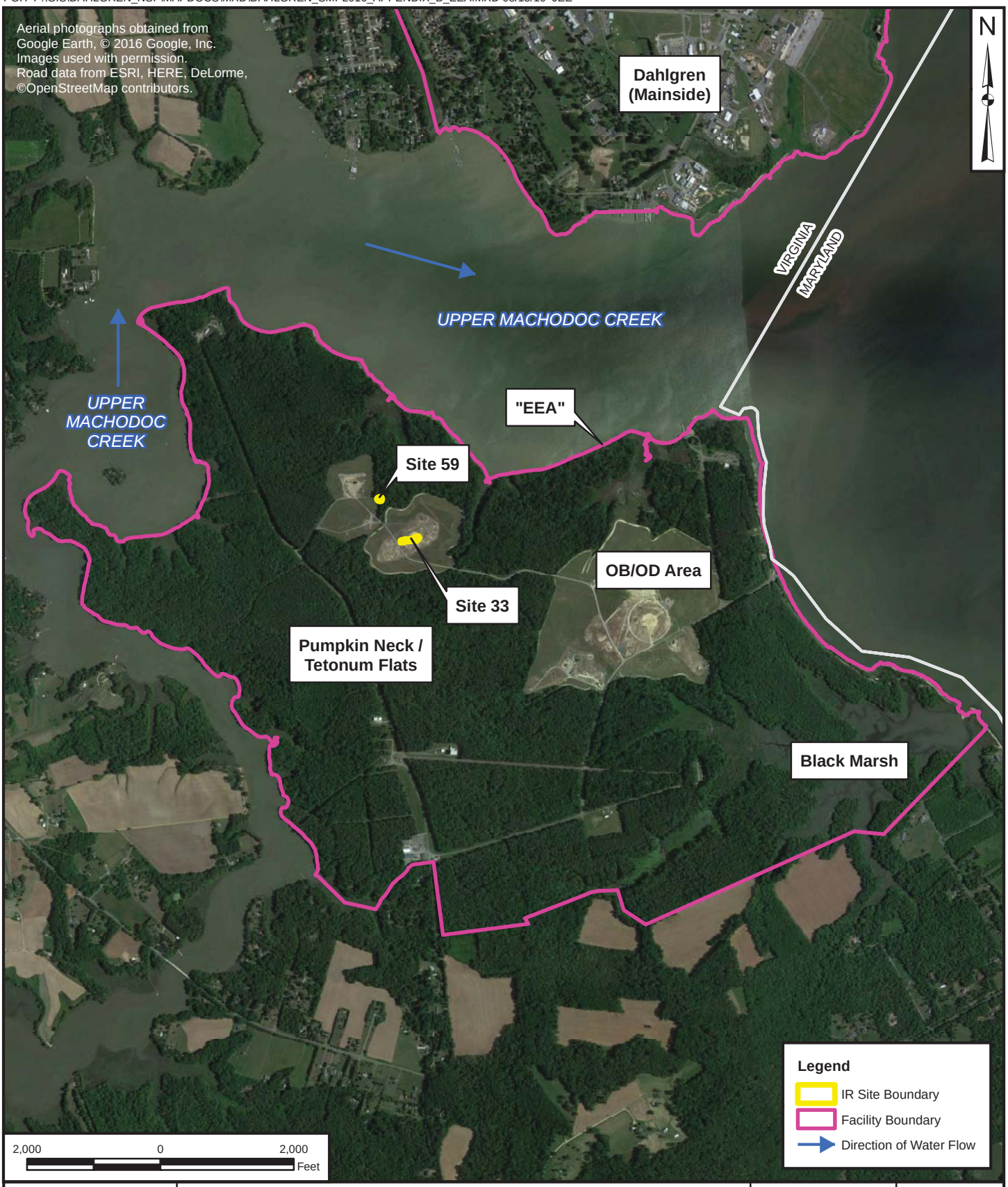


DRAWN BY: J. ENGLISH — DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/15/16	ALL APPENDIX A SITES, EEA / PUMPKIN NECK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 2-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_B_MAIN_1117.MXD 08/29/16 JEE

DRAWN BY J. ENGLISH	DATE 08/29/16	TETRA TECH	CONTRACT NUMBER 5663 / CTO NUMBER ____
CHECKED BY A. McGIVNEY	DATE 08/29/16	APPENDIX B SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. 2-3 / REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_B_EEA.MXD 08/15/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/15/16	ALL APPENDIX B SITES, EEA / PUMPKIN NECK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 2-4	REV: 0

3.0 APPENDIX A – INSTALLATION RESTORATION SITES

There are eleven sites at the NSFDL that are part of the IR Program (**Figure 3-1**). All of the IR sites are located on the Mainside Area of NSFDL. A summary table including the rationale for being listed and investigated, and the current status is provided for each IR site.

3.1 SITE 2 - FENCED ORDNANCE BURIAL AREA

IR Site 2 - Fenced Ordnance Burial Area (USEPA SWMU 46)	
Location: northern portion of the Mainside area, at intersection of Caskey Road and Gum Alley, close to the north shore of Gambo Creek. (See **Figure 3-2**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Trenches and burial pits filled with wastes - 1940s to 1970s.	Remedial Action Complete in 1998. LTM – biennial (once every two years) monitoring of groundwater; annual methane monitoring; pore water sampling for Five-Year Reviews. Next Annual Methane Monitoring: June 2017 Next Biennial Sampling: Spring 2018 Next Five-Year Review: due in December 2018.

Background: Site 2 was reported in the IAS as a landfill area originally consisting of a series of several pits and trenches used for disposing of various scrap metal including ordnance items from the 1940s to the 1970s (Fred C. Hart Associates, Inc., 1983). Later investigation found several trenches in this area contained ordnance hardware and machine parts. There were concerns that buried ordnance potentially contained explosives residues. Several trenches south of the fenced area received aircraft scrap and non-explosive missile materials. An additional trench west of the fenced area received primarily mercury-lithium and silver-cell batteries. Misch metal containing radioactive thorium was reportedly buried at this site. Misch metal, composed of thorium and rare earth metals alloyed with magnesium or nickel, was tested at the NSFDL for use in incendiary weapons. The misch metal is believed to contain approximately two percent thorium by weight and, as such, is exempt from United States Nuclear Regulatory Commission (NRC) licensing regulations.

Work Completed: The human health risk assessment completed as part of the Remedial Investigation (RI) indicated no potential health hazards were associated with Site 2 (Tetra Tech, 1997). The ecological risk assessment concluded that the concentrations of antimony in surface soils, pesticides and an

herbicide in sediments, and copper in surface water may pose unacceptable risks to ecological receptors. Potential remedial actions to address existing sediment contamination and contributions from other sources were evaluated as part of the Phase II Gambo Creek Ecological Assessment and no further actions were deemed to be necessary.

In September 1997, the Navy and USEPA signed a Record of Decision (ROD) (Tetra Tech, 1997) and VDEQ issued a concurrence letter. The selected remedial alternative for Site 2 was to remove soils exceeding remediation goals; remove western and southern trenches and debris piles; backfill with clean fill; consolidate all removed wastes onsite, dispose of recyclable materials from debris piles offsite; install a RCRA Subtitle C cap over waste and consolidated soils; and implement institutional controls within the site boundaries. Design was finalized in September 1997. Construction started in April 1998 and was completed in October 1998. During construction, additional ordnance and metal debris was found at the southwestern portion of the landfill area, thus, enlarging the cap approximately 15 percent from the original design.

Ongoing Requirements: Institutional control measures and long-term monitoring (LTM) are underway to maintain land-use restrictions and assess site groundwater/sediment/surface water impacts. Eleven rounds of groundwater monitoring have been performed at Site 2 between 2001 and 2016. The IR Team planned and documented optimization of the Site 2 LTM program from 2010 to 2012, based on decreasing chemical concentrations and lack of detections exceeding cleanup goals. The groundwater monitoring frequency was decreased from every 15 months to every two years. Surface water and sediment monitoring were discontinued, except the future requirement of one pore water sampling event to support each Five-Year Review. Optimization Measures were documented in a Memorandum to File titled “Non-Significant Changes to the Site 2 Record of Decision (ROD)” (Navy, 2014a). Methane monitoring is performed at one Site 2 passive gas vent on an annual basis. Details regarding current LTM requirements for Site 2 are provided in the Master Long-Term Monitoring Plan (Osage, 2015).

In May 2004 a Landfill Operations and Maintenance (O&M) Manual was prepared by JM Waller Associates (JMWA) for the Navy’s use (JMWA, 2004b). Maintenance requirements including mowing of vegetation and maintenance of site drainage structures, fences, and monitoring wells are presented in the O&M Manual. Routine inspections, maintenance, and minor repairs are completed primarily by NSFDL personnel. A VDEQ landfill inspection checklist is included in the manual to aid in the annual inspection performed by the State.

A detailed chronology of events for Site 2 is provided in the Five Year Review.

3.2 SITE 3 - ORDNANCE BURN STRUCTURE

IR Site 3 - Ordnance Burn Structure (USEPA SWMU 42)	
Location: in a mostly-wooded area off Caskey Road in the central part of Mainside, between Caskey Road and Gambo Creek. Site 3 is adjacent to and potentially downgradient of IR Site 12. (See **Figure 3-3**)	
Environmental Conditions at Discovery:	**Current Site Status:**
This site began operation as an ordnance burn facility and an interim RCRA site in the 1960s, and was closed in September 1994. Site 3 included a burn area/burn pan structure, and a popping furnace with attached trench located east of the burn area. During operation, soils at Site 3 were periodically cleared and tilled to remove vegetation.	Remedial Action Complete in 1998. LTO - groundwater monitoring as part of Site 12 LTO; Remedy Protectiveness addressed in Site 12 Five-Year Reviews. Next Five-Year Review: due in December 2018.

Background: Operations at Site 3 consisted of thermally treating explosive or explosive-contaminated waste in burn pans, in a steel box, in the popping furnace structure, or on the ground surface. Wastes burned at Site 3 may have included RCRA-listed hazardous wastes and characteristic reactive wastes of unknown quantities, including the following:

- Wastewater treatment sludge from the processing of explosives,
- Spent carbon from the treatment of wastewater containing explosives,
- Rocket motors,
- Explosive powder, and
- Other ordnance-related items.

Site 3 formerly consisted of a metal box and open burn pan, a popping furnace structure, and surrounding soil landscape. The burn structure was approximately 6 feet long by 6 feet wide and 4.5 feet high on a gravel base. The popping furnace structure consists of a trench with concrete block sidewalls and a gravel floor. Dimensions of the trench were approximately 35 feet long, 10 feet wide and 2 feet deep. The popping furnace was reportedly used on only one or two occasions. Soils at the site were periodically tilled during operations to clear vegetation. In 1994, the site was closed, operations were moved to the EEA, and the structures were subsequently removed.

Work Completed: Soil sampling and analysis completed in 1997 indicated inorganic concentrations above USEPA Region III Risk Based Concentration (RBC) levels included arsenic, iron, aluminum, nickel,

manganese, chromium, and vanadium. Limited organic contamination was identified, including dioxins, semi-volatile organic compounds, and explosives but no organic compounds were detected above their respective RBCs (B&R Environmental, 1998a). In June 1998 soils above RBCs in the burn area of Site 3, along with those at the adjacent Powder Burn Area/Site 44, were excavated and disposed offsite, eliminating the need for RCRA post-closure care.

Quarterly groundwater sampling was conducted at Site 3 from 2006 to 2007 to meet Virginia Hazardous Waste Management Regulations. A Remedial Investigation/Focused Feasibility Study (RI/FFS) was prepared and finalized in July 2000 (Tetra Tech, 2000a) to address residual risk following the removal action and groundwater monitoring. The FFS also provided the RCRA closure plan for groundwater at Site 3 and Site 44. This report indicated that "no further action" was warranted for soils. The human health risk assessment for exposure to groundwater indicated risks were unacceptable. However, based on the groundwater contaminants of concern (COCs) being detected at greater concentrations in upgradient, Site 12 wells (1,1,1-trichloroethane; 1,1-dichloroethene; and arsenic) it was concluded that Site 12 was the likely source of Site 3 groundwater COCs. The source area contributing to Site 3 groundwater contaminants was removed from Site 12 in 2012.

Ongoing Requirements: Future LTO at Site 12 will also monitor groundwater conditions at Site 3. Five-Year Reviews for Site 12 will evaluate the effectiveness of the source removal and groundwater remedy in reducing groundwater contaminants at Site 3.

3.3 SITE 9 - DISPOSAL/BURN AREA

IR Site 9 - Disposal/Burn Area (USEPA SWMU 19)	
Location: located off Autumn Lane in the central portion of Mainside, adjacent to the southwestern shore of Gambo Creek and north of Site 58. (See **Figure 3-4**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Extensive landfilling of waste between 1937 and 1990, primarily construction debris, in and around marsh area at bend in Gambo Creek. Seeps and drainages were observed entering Gambo Creek from the waste in historic aerials and initial site inspections.	Remedial Action Complete in 1998. LTM – biennial monitoring of groundwater; annual methane monitoring; biennial SW/SED monitoring. Next Annual Methane Monitoring: June 2017 Next Biennial Sampling: Spring 2018 Next Five-Year Review: due in December 2018.

Background: The history of Site 9 was documented primarily in the Environmental Photographic Interpretation Center (EPIC) analysis of aerial photographs (USEPA, 1992). Aerial imagery indicated

filling began in 1937 along the edge of the marsh adjacent to Gambo Creek, and expanded outward as filling operations continued through the 1980s. Evidence of waste burning at Site 9 in the 1969 image was observed as a smoke plume in the aerial imagery.

Work Completed: Based on the RI data, there were no immediate risks to human health, and the most significant ecological risk drivers are heptachlor and several metals (copper, lead, and mercury) present in surface water samples. The Feasibility Study (FS) was completed in August 1998. The selected remedial alternative included the following components:

- removal of surface debris in the marsh and placement of an engineered cap over wastes;
- excavation of Site 58 (adjacent to Site 9) contaminated soils and placement below Site 9 cap;
- upgradient slurry wall to reduce groundwater movement through the waste;
- marsh cap consisting of a woven geo textile placed over the waste disposal areas in the marsh;
- protection of Gambo Creek marsh cap shoreline against Gambo Creek erosion; and
- fill in a portion of Gambo Creek and creation of a wetland to create a buffer between the waste and Gambo Creek.

The Final Closure Report (OHM Remediation Services Corp., 2000) documents the construction process and describes the activities that were performed in executing the closure of the landfill.

Ongoing Requirements: Long-term monitoring of groundwater has been performed at Site 9 since 2002, and surface water and sediment monitoring has been performed at Site 9 on a biennial basis since 2002. Methane monitoring is performed at Site 9 on an annual basis. Groundwater monitoring frequency was decreased and required parameters reduced through optimization measures approved by the partnering Team in 2012, beginning with the 2014 event. Details regarding current LTM requirements for Site 9 are provided in the Master Long-Term Monitoring Plan (Osage, 2015). A new Remedial Action Objective (RAO) to return groundwater to beneficial use whenever practical were documented in a Memorandum to File titled “Non-Significant Changes to the Site 9 Record of Decision (ROD)” (Navy, 2017a) and signed by the Navy and regulators on February 2017.

A Landfill O&M Manual that includes Site 9 was completed in May 2004 (JMWA, 2004b) for use by the Navy. The O&M Manual addresses maintenance requirements including mowing of vegetation and maintenance of site drainage structures, fences, and monitoring wells. It also defines landfill components to inspect during routine and storm event inspections. The routine inspections are completed primarily by NSFDL personnel, who can perform minor maintenance and repairs. A VDEQ inspection checklist is included in the manual to aid in performing an annual VDEQ landfill inspection.

A detailed chronology of events for Site 9 is provided in the Five Year Review.

3.4 SITE 10 – HIDEAWAY POND

IR Site 10 – Hideaway Pond (USEPA AOC N)	
Location: a man-made pond in the northeast corner of Mainside on the NSFDL, created in a marshy drainage to Gambo Creek, approximately 1,500 feet west of the Potomac River and 2,000 feet south of U.S. Highway 301. (See **Figure 3-5**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Two small tributaries to Hideaway Pond drain a relatively small area north of the pond. One of the tributaries passes along the eastern edge of IR Site 17, a landfill north of Site 10. Site 10 investigated due to concerns over landfill discharge reaching the pond via the tributary.	Remedial Action Complete in 1998. Institutional controls are in place to prevent people from eating fish caught in the pond. (A "catch and release" policy has been enforced at Site 10 since 1983.) Fish tissue monitoring conducted every 5 years for Five-Year Reviews. Next Fish Tissue Monitoring: May 2018 Next Five-Year Review: due in December 2018.

Background: Bridge and road building activities in the immediate vicinity of Hideaway Pond began during the late 1930s and early 1940s. In 1953 a former roadway bridge across the drainage formed a dam that caused the stream to flood to the north. In 1983 flooding surmounted the northern dam and a new dam was constructed approximately 400 feet north of Bagby Road. In the meantime, IR Site 17 (1400 Area Landfill) was used for 8 years in the early 1970s as a sanitary landfill operation (Fred C. Hart Associates, Inc., 1983), and one of the tributaries feeding Hideaway Pond received drainage from the landfill.

Hideaway Pond was open to base employees for recreational fishing until 1980. At that time, it was requested that fish tissue samples be tested in to investigate an anonymous report that mercury had been disposed of in the area between the two tributaries of the pond. During the Confirmation Study (O'Brien and Gere, 1986a), mercury was not detected in water samples from the two tributary streams and the pond, but was detected in plants from the shores of these water bodies. Mercury concentrations in sediments were above detection limits and showed a pattern suggesting the upgradient landfill was a possible source. Analysis of soil and groundwater samples collected from the 1400 Area Landfill indicated that site did not appear to be a significant source of mercury in the tributary. The pond was drained in 1990, all fish were removed, and the pond was restocked.

Work Completed: After the 1995 RI and 1997 RI Addendum, an FS was prepared in July 2000 to address unacceptable human health risks associated with fish consumption and ecological risks associated with food chain effects at Site 10. The selected remedial alternative was implementation of institutional controls and mercury monitoring of fish. Monitoring (sampling and analysis) of mercury concentrations in fish tissue has been performed on a biennial basis since 2001, and institutional controls consisted of posting signs around Hideaway Pond establishing a fish catch-and-release policy. To evaluate potential risks to human health and ecological receptors, the Site 10 ROD requires sampling of specific types and sizes of fish. Fillets of largemouth bass (or equivalent) are analyzed for protection of human health from the consumption of fish, and whole fish samples of various species (including bass) were analyzed for determining ecological risks.

Following the initial three rounds of biennial monitoring, the mercury concentrations for small fish and bottom dweller fish were less than the RAO, therefore, sampling of these fish was discontinued per ROD specifications. Sampling of the predator fish (e.g., largemouth bass) was continued from Round 3 through the present. Mercury concentrations in predator fish (whole fish and fillets) have been less than RAOs for the last two rounds of monitoring. Therefore, per the ROD, if mercury concentrations are below RAOs in the next round of sampling (third consecutive round; planned for 2018), monitoring of mercury in Hideaway Pond fish may be discontinued. If mercury concentrations again exceed the RAO, fish monitoring will be performed again in five years. The institutional controls will remain in place after fish monitoring is discontinued.

Studies of the pond habitat in 2012 and 2013 suggested a deficiency in young fish possibly due to restrictive spawning habitat caused by an invasive weed, Hydrilla, combined with a decrease in food for developing fish. A pond management activity consisting of partial draining of the pond, and restocking the pond with stock size fish, was completed in May 2014 under the direction of the NSFDL Natural Resources division.

Ongoing Requirements: Fish tissue monitoring and comparison of fish tissue mercury concentrations to human health and ecological risk criteria is required for at least one more sampling event. During the next fish monitoring event (2018), only seven predator fish will be collected for mercury analysis, per the updated Master Long-Term Monitoring Plan (Osage, 2015).

A detailed chronology of events for Site 10 is provided in the Five Year Review.

3.5 SITE 12 – CHEMICAL BURN PIT

IR Site 12 – Chemical Burn Pit (USEPA SWMU 44)	
Location: in a mostly-wooded area off Caskey Road in the central part of Mainside, between Caskey Road and the east bank of Gambo Creek. Immediately north (upgradient) of the former Powder Burn Area (IR Sites 3 and 44), immediately east of Site 61a, southeast of Site 45, and northwest of the Fenced Ordnance Burial Area (Site 2). (See **Figure 3-6.**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Used for demolition-related activities as early as 1943. A chemical burn pit was created onsite between 1964 and 1967, based on historical aerial images.	Initial remedy (groundwater remediation) was completed between 1998 and 2005, but could not efficiently achieve remedial goals that were revised by EPA. Source area (pit) excavated/ removed in 2012. LTO: Groundwater sampling performed in October 2015, and future LTO is being planned. First Semi-Annual Monitoring: Spring 2018 Next Five-Year Review: due in December 2018.

Background: The chemical burn pit occupied an area approximately 40 feet by 25 feet, and was less than 10 feet deep. Burning at the site destroyed quantities of decontaminated chemical waste (CW) solution rendered safe in the laboratory (e.g., IR Site 14) by neutralization. The frequency of burning was estimated to be three to four times per year. Accumulated surface water in the pit, including possible combustion by-products and ash, was pumped onto the adjacent ground surface to prepare the site for burning. The fire department also performed a one-time pallet burning exercise in the area between Caskey Road and Chemical Burn Pit, also leaving combustion residue on the ground surface. The bare area northeast of the old chemical burn pit was reportedly used on several occasions for land farming of oil-contaminated materials during the early 1980s. The IAS did not identify the nature of the residues resulting from the burning operations (Fred C. Hart Associates, Inc., 1983). The pit was closed and filled with soil from an undocumented source in late 1986.

The primary concern associated with past activities at Site 12 is the impact from volatile organic compounds (VOCs) in the soil matrix and the shallow groundwater system. The data suggest that chlorinated solvents (primarily 1,1,1-TCA, and 1,1-DCA [dichloroethane]) were disposed at high concentrations in the Chemical Burn Pit soils and have migrated through the vadose zone and into the saturated zone. The impacts are limited to soils formerly within the pit, those below the pit, and downgradient groundwater in the shallow aquifer. An upper confining unit, consisting of a clay layer approximately 10 feet thick, is present at Site 12 around 20 to 30 feet below ground surface (bgs). Clays

were also present in the shallow soils at Site 12 and around the pit, which had an effect of adsorbing (retaining) VOCs and limiting their migration in the unsaturated and vadose zones.

Work Completed: An RI and FS were completed in July 1997. The RI found that potential ecological risks were attributed to mercury in sediment and copper in surface water; however, Site 12 could not be demonstrated as the sole source of these contaminants. In addition, groundwater to surface water contaminant transport (e.g., of VOCs) may pose unacceptable ecological risk in the future. The preferred remedy in the FS was air sparging/soil vapor extraction (AS/SVE) for groundwater and subsurface soils, and institutional controls (for groundwater and soils).

A pilot-scale AS/SVE system was installed in March 1998. A letter report was submitted documenting the pilot-scale results and recommending modification of the system to a full-scale operation (B&R Environmental, 1998b). Shortly thereafter, six additional air injection wells and five additional vapor extraction wells were installed for the full-scale operation. The system was in operation from May 2000 until November 2000. Groundwater and air samples were taken periodically to monitor the performance. The remediation goals for groundwater stated in the ROD were less conservative than maximum contaminant levels (MCLs); however based on pilot-scale operation and performance monitoring results, the USEPA requested that the remedy achieve MCLs for groundwater. The AS/SVE system was restarted in October 2001. A round of groundwater samples taken at that time indicated that the groundwater concentrations were still below the remediation goals stated in the ROD but above MCLs; however, some rebound in concentrations occurred during the year when the system was shut down. In June 2002, a draft Remedial Operation Technical Memorandum for Site 12 was completed which included a revised human health risk assessment (Tetra Tech, 2002). The revised human health risk assessment considered residential risk scenarios (not included in the original risk assessment) and the latest risk assessment guidance. New proposed remediation levels consistent with MCLs were included in this document. The AS/SVE system was not consistently achieving MCLs.

In October 2002, the Navy began to implement an enhanced groundwater remedy consisting of the Magnus™ system, in an attempt to achieve the remediation levels presented in the Remedial Operation Technical Memorandum. This technology involved the Magnus™ vendor injecting a mixture of nutrients including propane and nitrous oxide into the groundwater through existing and newly-installed air sparging wells. The nutrients enhance the growth of naturally occurring microorganisms which degrade the contaminants in situ. Magnus™ system performance monitoring completed during the first year of operation indicated a significant reduction in VOC concentrations; however, Site 12 groundwater remediation goals were still not achieved. In 2004, the vendor modified the system by adjusting airflow and connecting their system to existing air extraction wells in an attempt to enhance bioremediation in the vadose zone. The results of samples collected in November 2004 and February 2005 showed

concentrations of the parent chemical 1,1,1-TCA had decreased in the majority of the wells, but concentrations of the degradation contaminants 1,1-DCA and 1,1-DCE (dichloroethene) had either stabilized or increased. This data suggested the materials in the pit were serving as a continuing source of contaminants, and that VOCs were being mobilized from the source area. The stalling or increase in contaminant concentrations was also attributed to less than favorable geochemistry conditions, including low pH levels at Site 12.

In fall 2005, operation of the AS/SVE Magnus™ system was discontinued. Soil borings and test pits were completed to determine the limits of the former Chemical Burn Pit, in order to evaluate the feasibility of removing the Burn Pit. Alternatives for further remediation of the groundwater at Site 12 were evaluated and presented at a February 2007 NSFDL partnering meeting, and a contingency remedy, excavation of the Burn Pit and long term monitoring of the groundwater, was recommended. The results of the Site 12 field work and remedy evaluation were presented in the "Technical Memorandum for Sampling Results and Remedy Evaluation for Site 12" (Tetra Tech, 2007c). Since the above alternative differs from the selected remedy in the ROD, an Explanation of Significant Differences (ESD) was required to justify and document the differences between the two remedies. The final ESD was completed in September 2007.

Due to the former handling/disposal of neutralized CW at the Burn Pit, the partnering Team decided to sample for CW at Site 12 in preparation for pit removal. Sampling at Site 12 was completed in November 2007 and results were negative for CW analytes. In November 2008, the work plan was finalized to implement the contingency remedy (Navy 2008), and in December 2008 excavation of the pit began. On the first day of excavation, after approximately 300 cubic yards (yd^3) of soil was excavated, several canisters were uncovered and work was stopped. Additional soil was placed over the excavated area, and the stockpile area and the site was then secured. Numerous glass vials and one small glass bottle were also uncovered, which were later identified to be potential CW. The canisters were later identified as potential gas mask cartridges.

In 2009, a geophysical survey was completed over the pit, and in 2011 the Navy in conjunction with multiple agencies of the U.S. Army and the AGVIQ-CH2M HILL joint venture prepared a Work Plan for a Recovered Chemical Material Response in addition to preparing and finalizing a Chemical Safety Submission (CSS). The work plan presented a detailed approach to safely excavate, characterize and dispose of all CW to be potentially encountered during pit excavation. Final approval for site operations was provided by the U.S. Army in February 2012. The chemical burn pit contents were fully excavated between February 3, 2012 and March 26, 2012. After excavating approximately 500 yd^3 of soil and debris, verification sampling results indicated no further excavation was required at Site 12.

Ongoing Requirements: According to the ROD, long-term monitoring of groundwater and sediments was to be initiated following completion of the remedial action. An initial round of post-remedy groundwater monitoring was completed in October 2015 using existing Site 12, Site 61a, and Sites 3/44 monitoring wells. Analysis of metals and VOCs was performed in all well samples, and select samples were analyzed for explosives, perchlorate, dioxins, and pesticides. Concentrations of two VOCs exceeded MCLs (1,1-DCA and vinyl chloride), in one well only (GW12-8D). Lead also exceeded its MCL in one well with high turbidity (GW61A-03), but dissolved lead was below the MCL. A long-term monitoring plan was submitted to the Team in February 2017 with the next round of groundwater monitoring planned for the Spring of 2018. The next Five-Year Review for Site 12 will be completed and finalized in December 2018.

A detailed chronology of events for Site 12 is provided in the Five Year Review.

3.6 SITE 17 – 1400 AREA LANDFILL

IR Site 17 – 1400 Area Landfill (USEPA SWMU 30)	
Location: north of Frontage Road and south of US Highway 301, in the northeast corner of the NSFDL Mainside area. (See **Figure 3-7.)**	
Environmental Conditions at Discovery:	**Current Site Status:**
The site began as a depression left from gravel mining operations performed from the 1940s to 1960s. In the 1970s, the area served as a sanitary landfill and was filled with waste primarily originating from the base housing.	Remedial action consisted of a vegetative soil/phytoremediation landfill cap; constructed in 2000. Methane interception trench and landfill passive vents were installed in 2005 and 2012, respectively. Ongoing LTM consists of semiannual methane monitoring and biennial groundwater monitoring. Next Semi-Annual Methane Monitoring: December 2017 Next Biennial Sampling: Spring 2018 Next Five-Year Review: due in December 2018.

Background: The IAS reports that in the early 1970s, the area was used for three or four years as a sanitary landfill. Wastes, primarily municipal garbage, were deposited, compacted, and covered on a periodic basis. Other wastes may have been disposed of at this location. The Confirmation Study in 1986 suggested that mercury contamination suspected in Hideaway Pond (Site 10) may have originated from this site (O'Brien & Gere, 1986a). RI sampling results from 1996 indicated that concentrations of mercury are not significant and no source area at Site 17 was identified.

Work Completed: Results of the human health risk assessment indicate that no significant potential health hazards are associated with exposure to soils at Site 17, and no direct contact with groundwater, surface water, or sediment is anticipated at Site 17. In addition, the human health risk assessment did not identify mercury as a COC, and the ecological assessment identified it as a COC only in surface water. Elevated concentrations of other inorganic constituents were detected in groundwater and surface water collected from the eastern portion of the landfill. Low concentrations of polynuclear aromatic hydrocarbons (PAHs) also were detected in the surface soils and sediments in the northwestern portion of the landfill. The levels observed were well below RBCs. The ecological risk assessment concluded that risks were present for terrestrial receptors, over limited areas, due to organics including PAHs and Aroclor-1260 in soils, and inorganics including chromium and thallium.

The Site 17 FS was completed in August 1998 and identified the following components of the selected alternative: vegetative soil cap, offsite disposal of sediments (impacted by PAHs), wetland restoration, and phytoremediation on the cap to control groundwater levels beneath the landfill. The remedial construction began in May 2000 and was completed in December 2000. The Site 17 remedial action includes the implementation of institutional controls to enforce site and land-use restrictions, LTM, wetlands monitoring, and the performance of Five-Year Reviews. LTM included periodic groundwater, surface water, and sediment monitoring. Wetlands monitoring was conducted semi-annually between 2003 and 2010. In March 2010, the Biological Technical Assistance Group (BTAG) approved modifying the wetlands monitoring requirements from quantitative to qualitative. Wetlands monitoring continued through 2011; after that the partnering Team and BTAG agreed to discontinue it, with the requirement that monitoring and treatment for phragmites continue under the base invasive species management program.

LTM data showed mercury was not detected in surface water, and concentrations in sediments were consistently below the Environmental Protection Agency (EPA) Biological Technical Assistance Group freshwater sediment values and the historical data obtained during the RI. In June 2010, the DIRT reviewed optimization measures for the groundwater LTM at Site 17 and agreed to discontinue the analysis of total organic carbon (TOC) and TOX based on relatively consistent concentrations of these analytes over time. They also agreed to decrease groundwater monitoring frequency from every 15 months to biennial. In February 2012, the DIRT conducted further optimization of monitoring efforts and agreed to discontinue surface water and sediment monitoring at Site 17, except for collecting two co-located surface water and sediment samples to support each Five-Year Review. They also agreed to remove VOCs from the analyte list for groundwater monitoring. These optimization measures were documented in a Memorandum to File signed by the Navy and regulators and dated September 2012 (Navy, 2012b).

Methane landfill gas has been a prevalent issue at Site 17 since the 2000 capping of the landfill. In 2005, the VDEQ requested preliminary monitoring for methane, and it was discovered in monitoring well GW17-15, south of the landfill cap. Due to the proximity of Building 1400 to this location, there was a concern for people working in the basement of the building. A series of soil gas measurements was conducted in 2005 between the landfill and the parking lot of Building 1400. Methane was detected above the lower explosive limit (LEL) in locations closer to the landfill, with decreasing concentrations in the direction of Building 1400. Elevated levels of methane were detected along the southern access road of the landfill, and adjacent to the chain link fence north of Building 1400. A methane monitor was installed in the basement of Building 1400 in April 2005.

A landfill gas migration assessment report completed in 2005 concluded that an interim remedy was needed to control migration of methane towards the occupied buildings located to the south of Site 17. In December 2005, 15 gas monitoring probes (GMPs) were installed throughout the southern portion of Site 17, including nine GMPs along the southern perimeter road and six GMPs in the Building 1400 parking lot. At this time, a gas interceptor trench with seven passive trench vents was also constructed parallel to the southern landfill access road on the south side of the roadway measuring approximately 250 linear feet. Methane monitoring results since 2006 have shown a continuing concern for methane migration toward Building 1400. It appears that methane had migrated under the interim gas collection trench between the landfill and Building 1400 during a period when the groundwater elevations dropped below the trench bottom. In addition, in 2007 methane began being detected on the north side of the landfill in GW17-12. Based on the possibility of future construction activities north of Site 17, six additional GMPs (GMP17-17 through GMP17-22) were installed in July 2007 along the edge of the bordering woods, just north of the northern drainage ditch.

To document methane monitoring and mitigation activities conducted up until 2010, and to make recommendations for future methane mitigation, a Draft Methane Characterization report was submitted in June 2010 (Tetra Tech/Sovereign, 2010c). This report included the results of a soil vapor extraction (SVE) pilot study conducted in October 2009 to evaluate the feasibility of SVE to address the methane at the site. The data presented in the methane characterization study indicated that the methane concentrations at the site were decreasing, overall. After review of the Methane Characterization Report, the partnering Team decided to install seven Landfill Passive Gas Vents (LPV) at the landfill in areas of historically elevated methane concentrations. The rationale and technical approach for this action is outlined in an April 19, 2012 Technical Memorandum (AGVIQ/CH2M Hill, 2012a). In July 2012, seven LPVs, each fitted with a turbine (H-100) – passive ventilator, were installed.

Methane monitoring and the use of an automated alarm system in the basement of Building 1400 continued through May 2014. By this time, a significant decrease was observed in methane levels at LPVs and GMPs across the site, presumably due to the successful operation of the passive vents. In 2014, use of the methane alarm system in Building 1400 was discontinued, although the system was left in place in the chance it could be needed in the future.

Ongoing Requirements: In 2014, the frequency of Site 17 methane monitoring was decreased from quarterly to semiannual, and the number of monitoring points during one semiannual event decreased, as a result of optimization measures completed by the partnering Team in 2012. Groundwater monitoring is conducted on a biennial frequency, and two co-located surface water and sediment samples are collected and analyzed to support each Five-Year Review. Details regarding current LTM requirements for Site 17 are provided in the Master Long-Term Monitoring Plan (Osage, 2015).

A detailed chronology of events for Site 17 is provided in the Five Year Review.

3.7 SITE 19 - TRANSFORMER DRAINING AREA

IR Site 19 - Transformer Draining Area (USEPA AOC G)	
Location: in a paved, operational area in the south-central portion of Mainside, next to Building 120B and approximately 150 feet east of Caskey Road. (See **Figure 3-8**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
This area was the NSFDL Property Disposal Office where decommissioned equipment was turned in to be disposed or relocated. Historical records indicated transformer oil was drained onto the ground behind the Property Disposal Office when turning them in during the 1950s.	Removal action consisting of excavation of polychlorinated biphenyl (PCB)-contaminated soils and concrete completed in February 1995. A no further action necessary ROD signed by the Parties in September 1999.

Background: The amount of PCB-containing oil discharged at Site 19 in the 1950s was estimated to be 1,000 gallons. A Confirmation Study conducted by O'Brien and Gere in 1986 revealed the presence of PCBs in a number of soil samples taken from sampling points north of the concrete pad in the area where the oil was drained from the transformers. Three of these samples contained concentrations of PCBs above the 50 milligrams per kilogram (mg/kg) level established by the Toxic Substances Control Act of 1978 (TSCA). Groundwater samples were found to be free of PCBs.

Work Completed: The RI completed in March 1994 included sampling and analysis of groundwater in new and existing monitoring wells, soil, and concrete chips. The Draft RI/FS report was submitted in

September 1994. A removal action was conducted at this site to remove soil contaminated with PCBs. The excavation began in December 1994 and site activities were completed by February 1995. Approximately 282 tons of soil were removed to a level of one part per million (ppm) PCBs and disposed of at an approved permitted TSCA landfill.

In a 1999 RI/FS Addendum, soil sampling data collected during the removal action were evaluated in a revised risk assessment which indicated that remaining site risks were acceptable. Groundwater contaminants were evaluated in conjunction with an adjacent site (Site 40). Groundwater in the shallow aquifer beneath Site 19 is not a current source of drinking water. The Navy and USEPA signed a ROD in September 1999 indicating no further action was necessary at Site 19, with VDEQ issuing a concurrence letter (Navy, 1999g).

Ongoing Requirements: None.

3.8 SITE 25 - PESTICIDE RINSE AREA

IR Site 25 - Pesticide Rinse Area (USEPA SWMU 66)	
Location: in the southern portion of the Mainside at NSFDL, approximately 700 feet northwest of Upper Machodoc Creek, near Tisdale Road, Building 134, and the sewage treatment plant. (See **Figure 3-9**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
This area was used for rinsing of empty pesticide containers. Wash waters were either discharged from a wash sink to a French drain or directly to the ground surface. Evidence of possible ground staining, liquid, and erosion features, particularly in the southwest corner of the unpaved parking area, was noted in the 1960s and late 1970s.	Remedial action, consisting of excavation and offsite disposal of pesticide-contaminated soils, completed in December 2001.There is no further action required.

Background: Based on historical aerial images, the land in the vicinity of Site 25 began as an inlet to Machodoc Creek that was filled in during the late 1930s to mid-1940s to build buildings and roads. A swale in the southern portion of the site is covered in tall grass, reeds, and related marsh-type plants. Site 25 includes two areas contaminated with pesticides: a small surface soil area near Building 134 and a larger swale extending west to Upper Machodoc Creek from a former French drain that conveyed drainage from the pesticide rinse area.

Work Completed: In 1995, technologies were reviewed to provide a preliminary indication of the potential to apply bioremediation technology to the pesticide-contaminated soils at Site 25 (B&R Environmental,

1996b). A bench-scale pilot study was performed to compare various technologies including: an aerobic cycle process using indigenous bacteria; a slurry system with inoculation; an inoculated system with chemical oxidation; and the use of white rot fungus. The tests were unable to achieve anticipated treatment goals for the pesticide-contaminated soils. RI field activities included a geophysical and ground-surface radiological survey of the site. Characterization activities included sampling groundwater in new and existing monitoring wells, surface water and sediment sampling, and soil sampling. The Draft RI report was submitted in September 1995. A bioavailability study was completed to evaluate the amounts of pesticides in the soil biologically available to organisms (earthworms). These bioavailability factors were used in conjunction with food-chain modeling to develop site-specific ecologically-based PRGs (B&R Environmental, 1997).

An Addendum RI/FS was submitted in July 1999. As part of the FS, additional surface soil, subsurface soil, and groundwater sampling was performed in December 1998. The major conclusions from the 1998 sampling event were as follows: 1) no contamination exists in the French Drain Area below a depth of four feet; 2) negligible pesticide and metals were found in the groundwater; 3) while several pesticide "hot spots" were found in the surface soil throughout the site, no pesticide PRGs were exceeded at depths of two feet or greater; and 4) exceedances of dioxin/furan and metals PRGs were infrequent, random throughout the site, and typically not within the source area. For Site 25, the selected remedy consisted of excavation and offsite disposal of contaminated soils, consistent with the Navy strategy to reduce risks at the sites with minimal long-term care. In order to protect potential ecological and human receptors from soils contaminated with pesticides and inorganic constituents, contaminated soil at levels exceeding RAOs were to be excavated. The excavated areas were to be backfilled and revegetated and the wetlands restored. The Navy and USEPA signed a ROD in September 1999, with VDEQ issuing a concurrence letter (Navy, 1999h).

The Site 25 remedial action, completed in December 2001, consisted of several major components: 1) excavation of pesticide- and metal-contaminated soil; 2) offsite disposal of the contaminated soil; 3) construction of a storm water culvert to divert the Cooling Pond discharge across the restored and newly created Site 25 wetlands; 4) excavation for the purpose of wetlands expansion; and 5) planting of natural wetland vegetation (Tetra Tech, 2001d). Wetland monitoring of Site 25 began in 2003. Due to the successful establishment of wetland vegetation, the quantitative evaluation of wetlands vegetation was replaced with a qualitative evaluation starting in 2006.

Ongoing Requirements: In 2010, it was determined that the general wetland acreage and other design goals for the established wetlands at Site 25 were achieved; therefore, wetland monitoring at this site was discontinued. Monitoring and treatment for phragmites was to continue under the base invasive species management program.

3.9 SITE 29 - BATTERY SERVICE AREA

IR Site 29 - Battery Service Area (USEPA SWMU 79)	
Location: in the south-central portion of the Mainside, approximately 1,200 feet south of the airstrip, near Building 338 in a paved area with many buildings (See **Figure 3-10**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Evidence of what appears to have been a disposal pit at Site 29 was noted in historical aerial imagery from 1952 to 1977. Waste battery acids were discharged into an underground tank in this area.	The removal action consisting of excavation of a disposal pit, a 550-gallon storage tank, and contaminated soils was completed in 1998. A no further action necessary ROD signed by the Parties in September 1999.

Background: The IAS reported that waste battery acids were discharged into an underground tank at the Battery Service Area, a practice that began in the 1950s and was continued until 1985. The tank was never reported to be emptied. Approximately 10 to 15 gallons of battery acid per month were reportedly disposed of in this manner. During a site reconnaissance conducted in March 1989, the results of a dye test indicated there was in fact a covered and unlined pit present at the site rather than a tank. The pit was filled to within two feet of the ground surface with limestone, likely to neutralize the acid. The tank was filled about three times per year. Based on this, the historical application rate of acid into the limestone was estimated to be about 150 gallons per year.

Work Completed: RI field activities completed in March 1994 included sampling and analysis of soils and groundwater in new and existing monitoring wells. The Draft RI report was submitted in September 1995. An Engineering Analysis/Cost Evaluation (EE/CA) was prepared and finalized in May 1997 (Navy, 1997a). The EE/CA recommended removing the unlined neutralization pit and approximately 200 cubic yards of petroleum hydrocarbon- and metals-contaminated soils.

The removal action was performed between July and October 1997. The resulting excavation measured 21.5 feet by 38 feet by approximately 7 feet deep. This excavation was larger than anticipated because during excavation of the contaminated soils, a 550-gallon steel underground storage tank was encountered and removed. The NSFDL personnel removed the petroleum-related product remaining in the tank. The contractor shipped the product to an offsite fuel recycling facility. The tank was cleaned, decommissioned, and shipped offsite to a metal recycling facility (OHM Remediation Services Corp., 1998). Due to the low metals concentrations, the excavated soil from the entire area was classified as non-hazardous.

An RI/FS Addendum with an updated risk assessment was finalized in July 1999. Sampling data was presented to verify the removal action had achieved its objectives. The revised risk assessment for soil indicated the remaining risks are acceptable, and the RI/FS recommended that no further action be taken for soils at Site 29. Groundwater risks were acceptable. A ROD indicating no further action was necessary at Site 29 was signed by the Navy and USEPA in September 1999, with VDEQ issuing a concurrence letter (Navy, 1999g).

Ongoing Requirements: None.

3.10 SITE 44 - ROCKET MOTOR PIT

IR Site 44 - Rocket Motor Pit (USEPA SWMU 41)	
Location: in a mostly-wooded area off Caskey Road in the central part of Mainside, between Caskey Road and Gambo Creek. Site 44 is adjacent to and potentially downgradient of IR Site 12. (See **Figure 3-11.**)	
Environmental Conditions at Discovery:	**Current Site Status:**
This site was an open-burn structure used for destruction of waste rocket motors under an interim RCRA status. Site 44 is located next to the Ordnance Burn Structure (Site 3). During operation, soils at Site 44 were periodically cleared and tilled to remove vegetation.	The removal action consisting of excavation and off-site disposal of contaminated soils was completed in 1998. A no further action necessary ROD was signed by the Parties in September 2000. LTO - groundwater monitoring as part of Site 12 LTO; Remedy Protectiveness addressed in Site 12 Five-Year Reviews. Next Five-Year Review: due in December 2018.

Background: Operations at Site 44 from the 1960s to 1994 consisted of the burning of waste rocket motors while they were anchored inside a steel tube in the pit. The pit was approximately 24 feet by 36 feet, with a depth of approximately 5 feet. The sides of the unit were constructed with 0.5-inch thick steel plates and the ends are constructed of 4.5-inch thick steel plates. A steel tube with 4- to 5-inch thick steel walls, 4.5-foot interior diameter and 16 feet long, was used to confine the burning rocket motors. The bottom of the pit was not lined. During operations, a rocket motor was placed in the cylinder, ignited, and burned.

Wastes associated with Site 3 were burned at Site 44 and may have included RCRA listed hazardous wastes and characteristic reactive wastes of unknown quantities, and may have included the following (B&R Environmental, 1998a):

- Wastewater treatment sludge from the processing of explosives,
- Spent carbon from the treatment of wastewater containing explosives,
- Rocket motors,
- Explosive powder, and
- Other ordnance-related items.

Soils at the site were periodically tilled during operations to clear vegetation. In 1994, the site was closed, operations were moved to the EEA, and the structures were subsequently removed. The removal of contaminated soils along with those present at Site 3 was completed in 1998. Soils in the Powder Burn area and pit were excavated and disposed offsite, eliminating the need for RCRA post-closure care.

Work Completed: An RI/FFS was prepared in 2000 for the combined Sites 3 and 44 due to their relatively close locations and similar operations. Inorganic contamination in soils above RBCs included arsenic, iron, aluminum, nickel, manganese, chromium, and vanadium. Limited organic contamination was identified in Site 44 soils including dioxins, semi-volatile organic compounds, and explosives. No compound was detected above its respective RBC (B&R Environmental, 1998a). In Site 44 groundwater, cadmium and RDX exceeded MCLs. The Navy, USEPA Region III, and VDEQ finalized the RI/FFS in July 2000 (Tetra Tech, 2000a). The human health risk assessment indicated that “no further action” was warranted for soils, and that risks due to exposure to groundwater were unacceptable based on concentrations of 1,1,1-TCA, 1,1-DCE, and arsenic. However, Site 12 (upgradient) was thought to be the source of these contaminants. The Navy and USEPA signed a ROD in September 2000, with VDEQ issuing a concurrence letter (Navy, 2000c). The source area contributing to Site 44 groundwater contaminants was removed from Site 12 in 2012.

Ongoing Requirements: Future LTO at Site 12 will also monitor groundwater conditions at Site 44. Five-Year Reviews for Site 12 will evaluate the effectiveness of the source removal and groundwater remedy in reducing groundwater contaminants at Site 44.

3.11 SITE 58 - BUILDING 1350 LANDFILL

IR Site 58 - Building 1350 Landfill (USEPA SWMU 134)	
Location: on Mainside adjacent to IR Site 9 (Disposal Burn Area). Between Kennel Road and Gambo Creek. (See **Figure 3-12**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Surface disposal of wastes including containers of roofing tar and paint, railroad ties, roofing shingles, scrap metal and concrete	Remedial Action was completed in 1999 with the construction of the Site 9 landfill and marsh cap. Next Five-Year Review (as part of Site 9): due in December 2018.

Background: From the 1940s to 1970s, Site 58 was used as a dumping area for construction-related wastes and was an extension of the Disposal Burn Area (Site 9). Wastes disposed at this site included 55-gallon drums of roofing tar, 5-gallon and 1-gallon paint cans, railroad ties, roofing shingles, and miscellaneous steel and concrete debris. Site 58 was in use during the same period as the Disposal Burn Area, and therefore the remedial actions at Sites 9 and 58 were combined.

Work Completed: The Remedial Action to remove debris at Site 58 and transfer it to Site 9 started in March 1999 and was completed in June 1999. A Final Closure Report for Site 9 was submitted in November 2000 (OHM Remediation Services Corp., 2000). The Closure Report documents the construction process and describes the activities that were performed in executing the closure of the landfill, marsh areas, and Site 58.

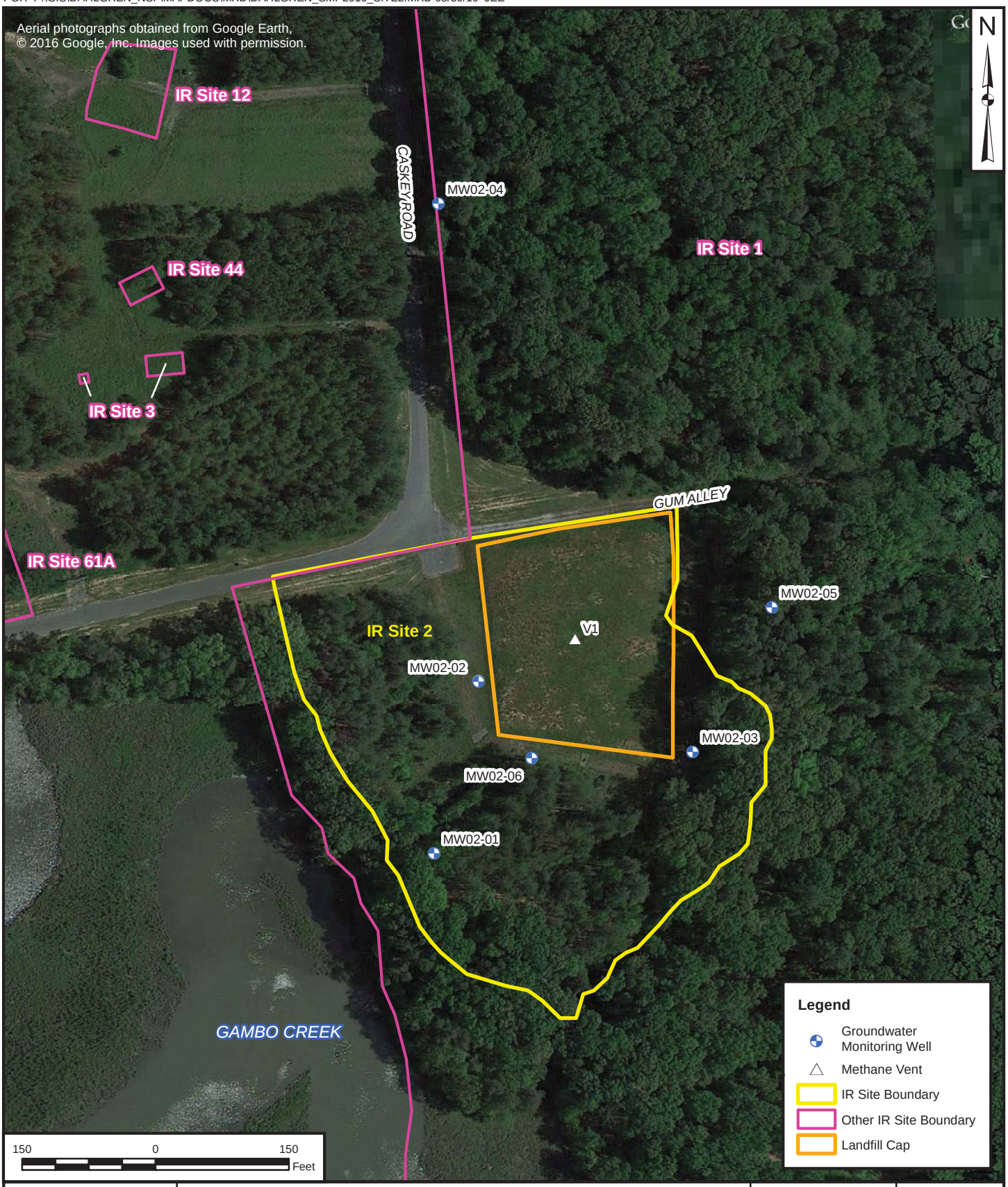
Ongoing Requirements: The long-term monitoring and O&M requirements for Site 9 also apply to Site 58, as outlined in the Master Long-Term Monitoring Plan (Osage, 2015) and the Landfill O&M Manual (JMWA, 2004b).

A detailed chronology of events for Site 9/58 is provided in the Five Year Review.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_0A.MXD 08/25/16 JEE

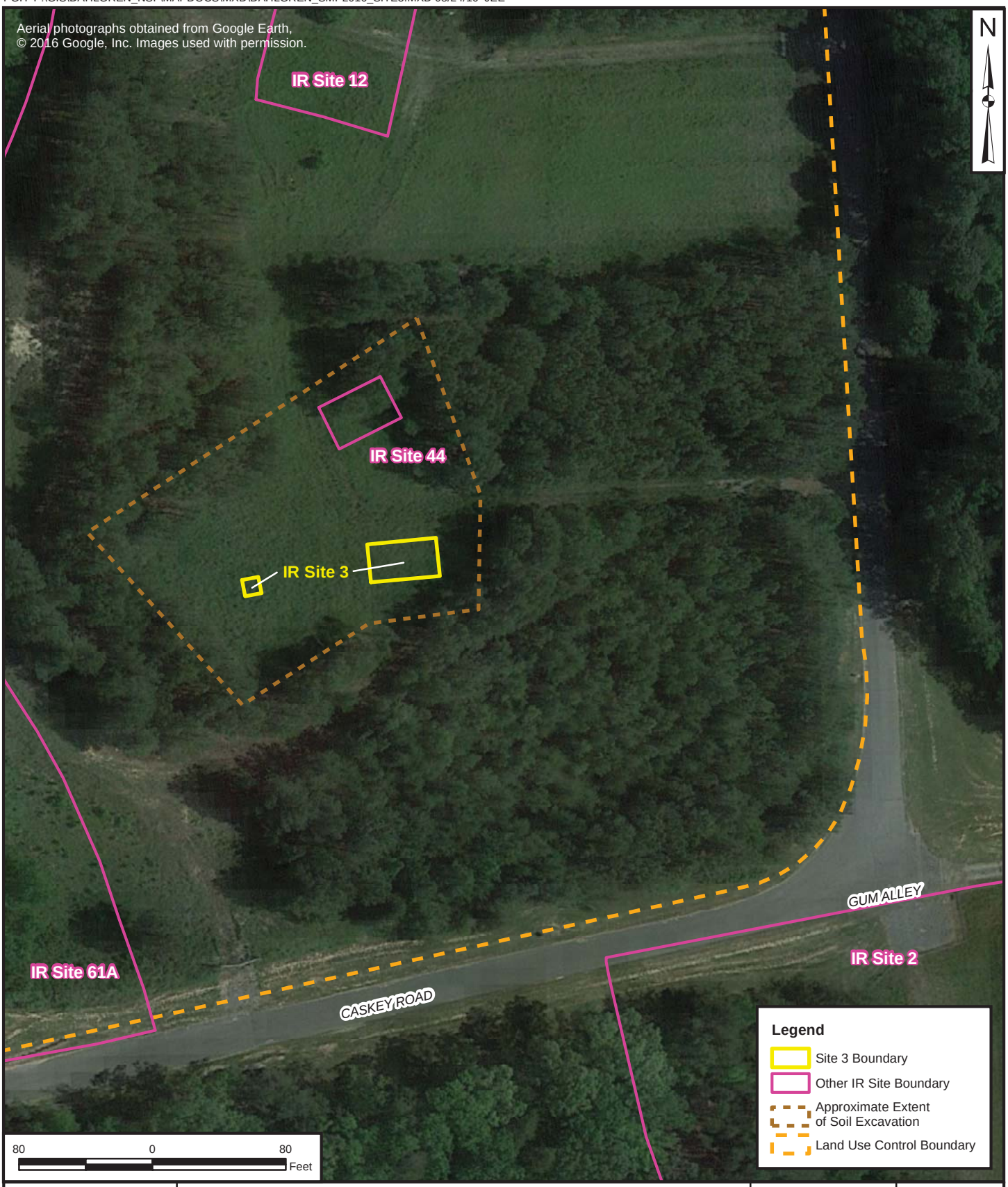
DRAWN BY: J. ENGLISH — DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	ALL IR SITES NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-1	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE2.MXD 08/30/16 JEE



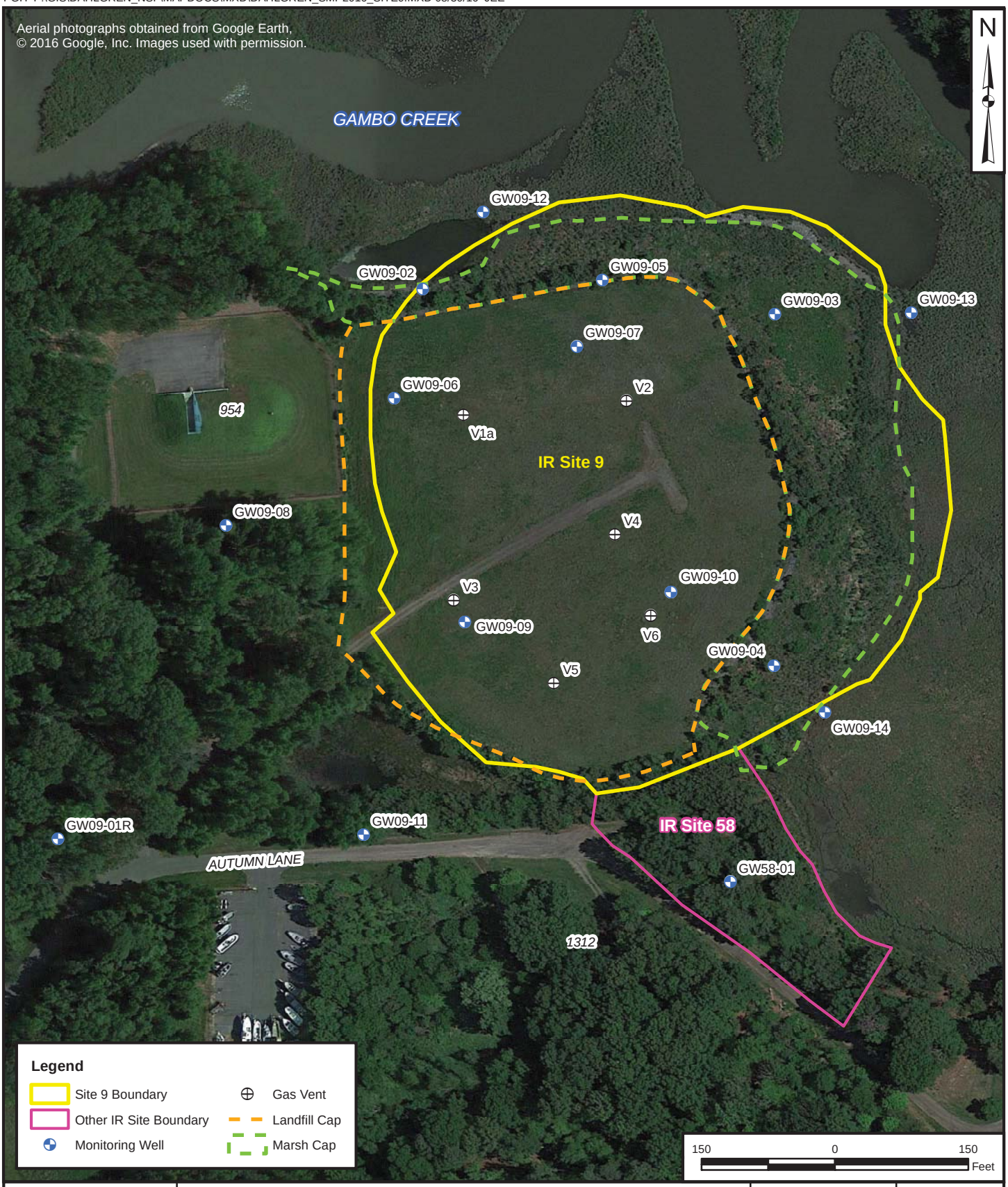
DRAWN BY: J. ENGLISH	DATE: 07/21/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/30/16	IR SITE 2 - FENCED ORDNANCE BURIAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 3-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE3.MXD 08/24/16 JEE



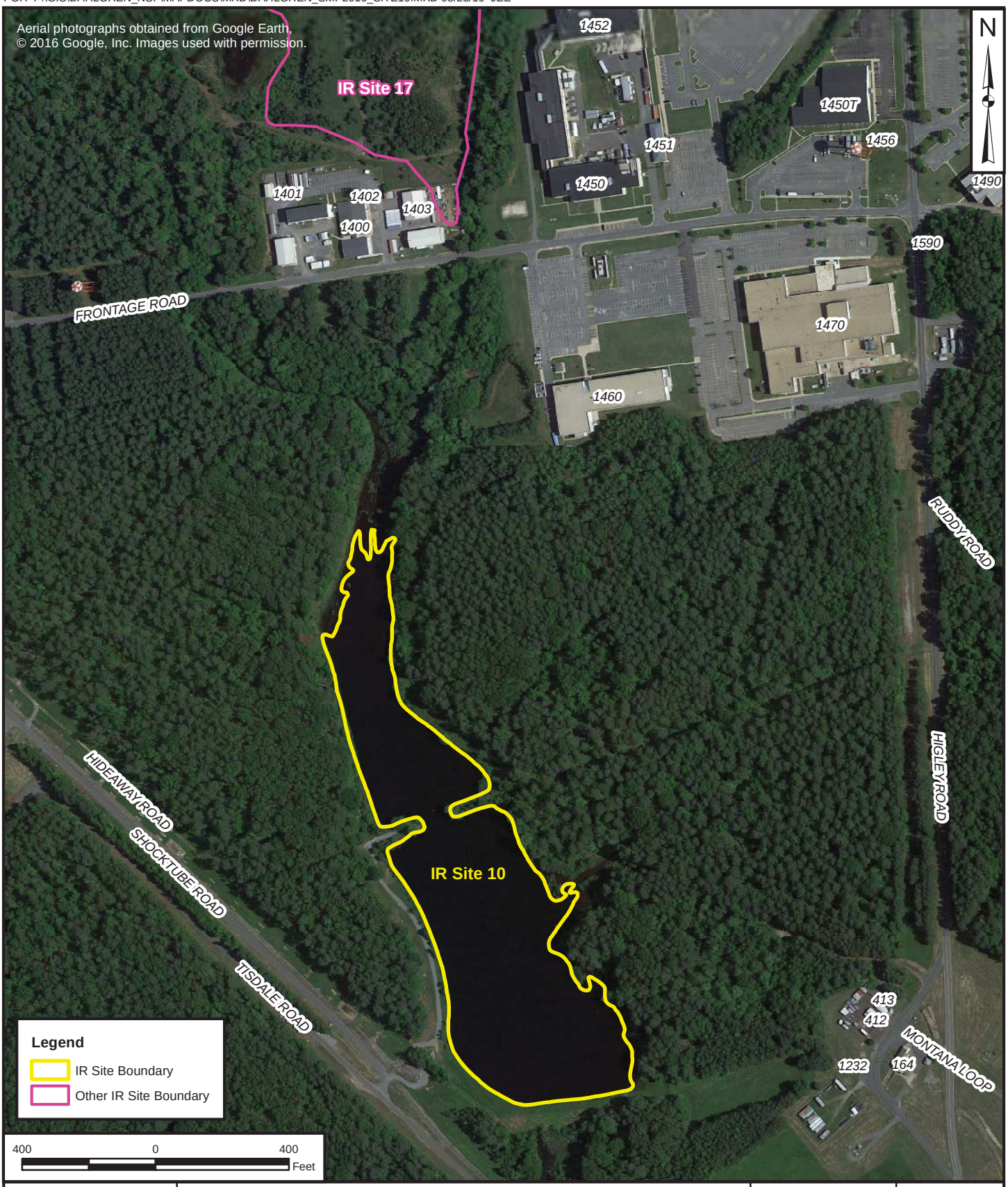
DRAWN BY: J. ENGLISH — DATE: 08/03/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/24/16	IR SITE 3 - ORDNANCE BURN STRUCTURE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-3	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE9.MXD 08/30/16 JEE



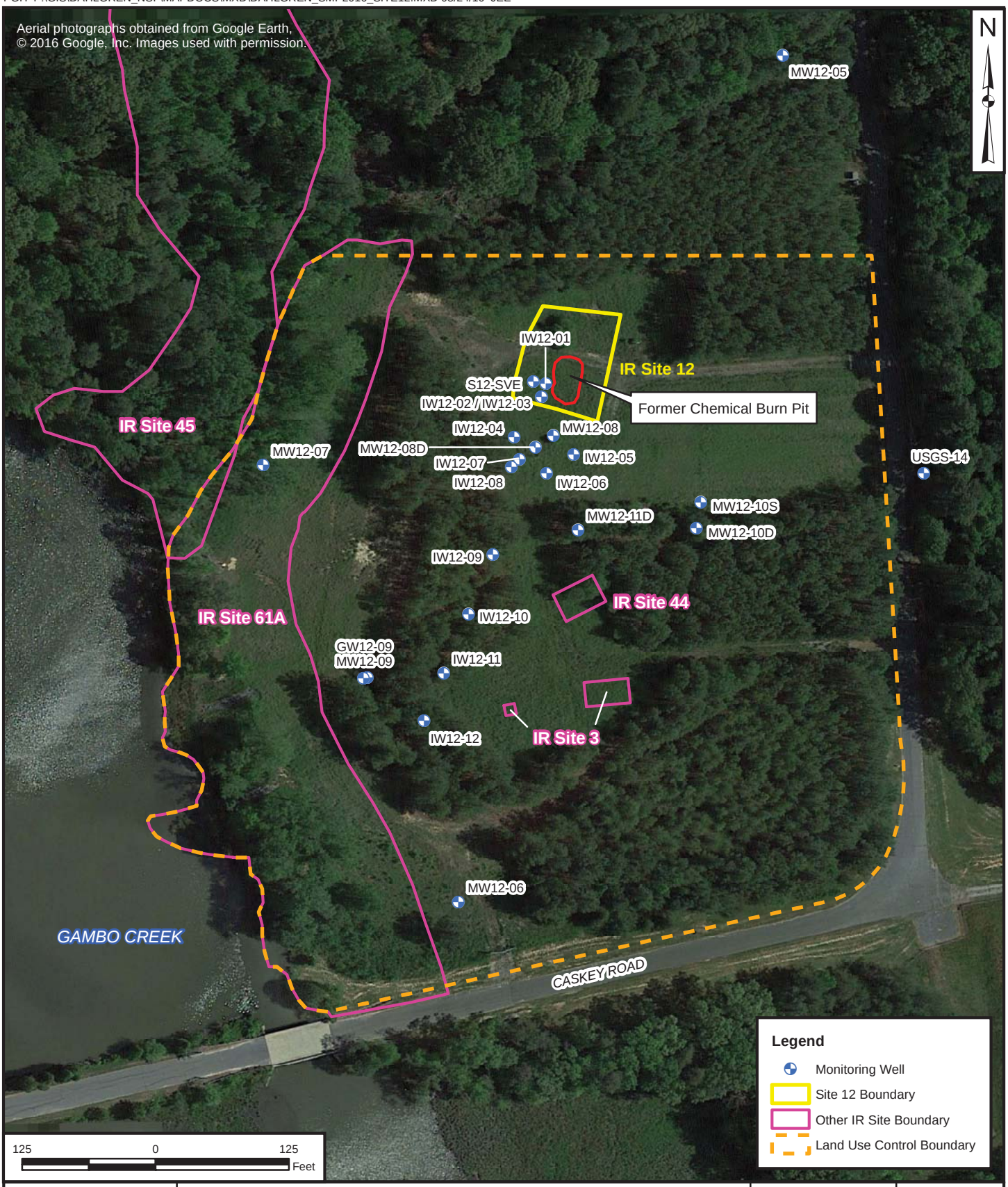
DRAWN BY: J. ENGLISH — DATE: 08/01/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/30/16	IR SITE 9 - DISPOSAL/BURN AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-4	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE10.MXD 08/23/16 JEE



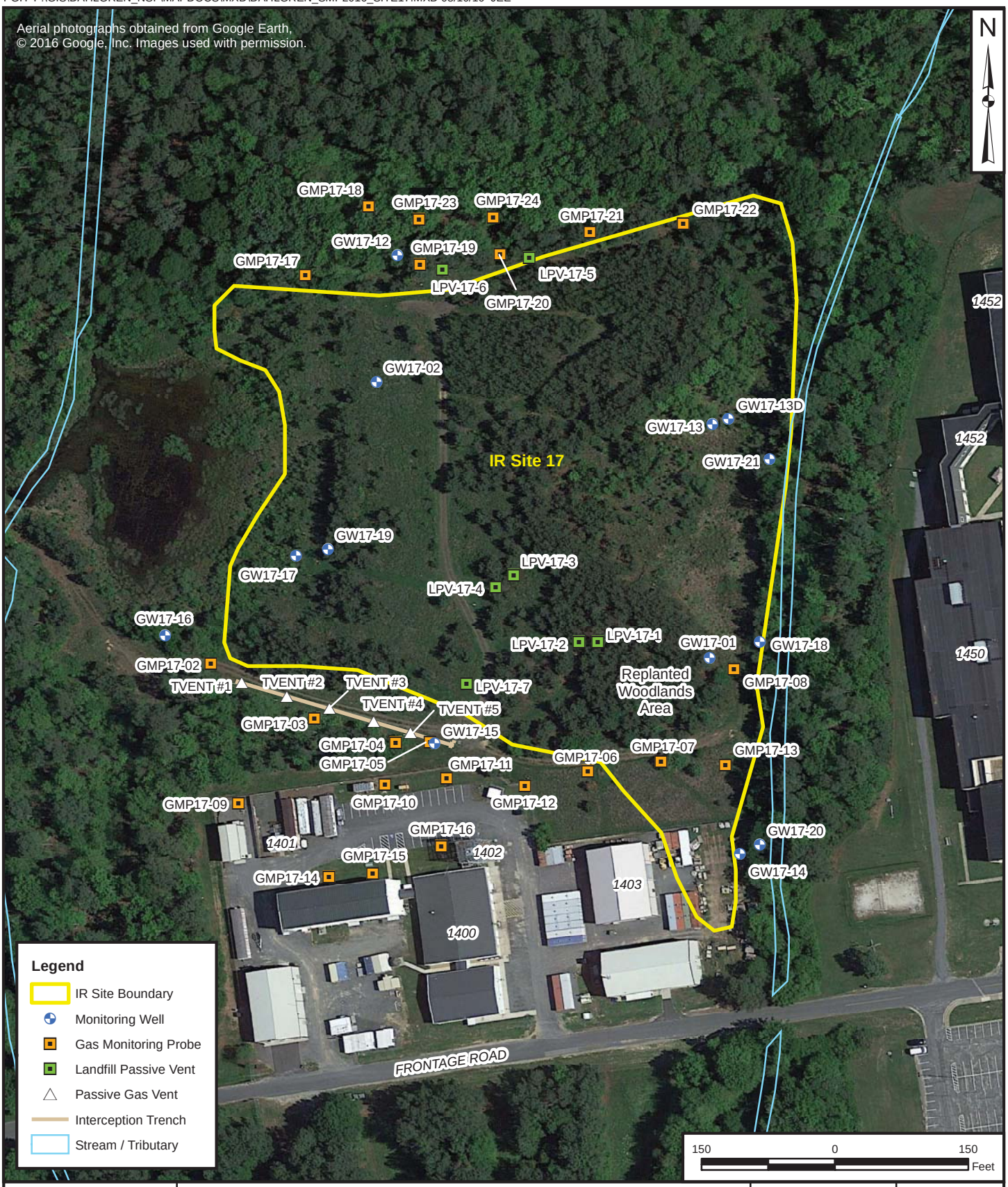
DRAWN BY: J. ENGLISH — DATE: 07/21/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/23/16	IR SITE 10 - HIDEAWAY POND NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-5	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE12.MXD 08/24/16 JEE



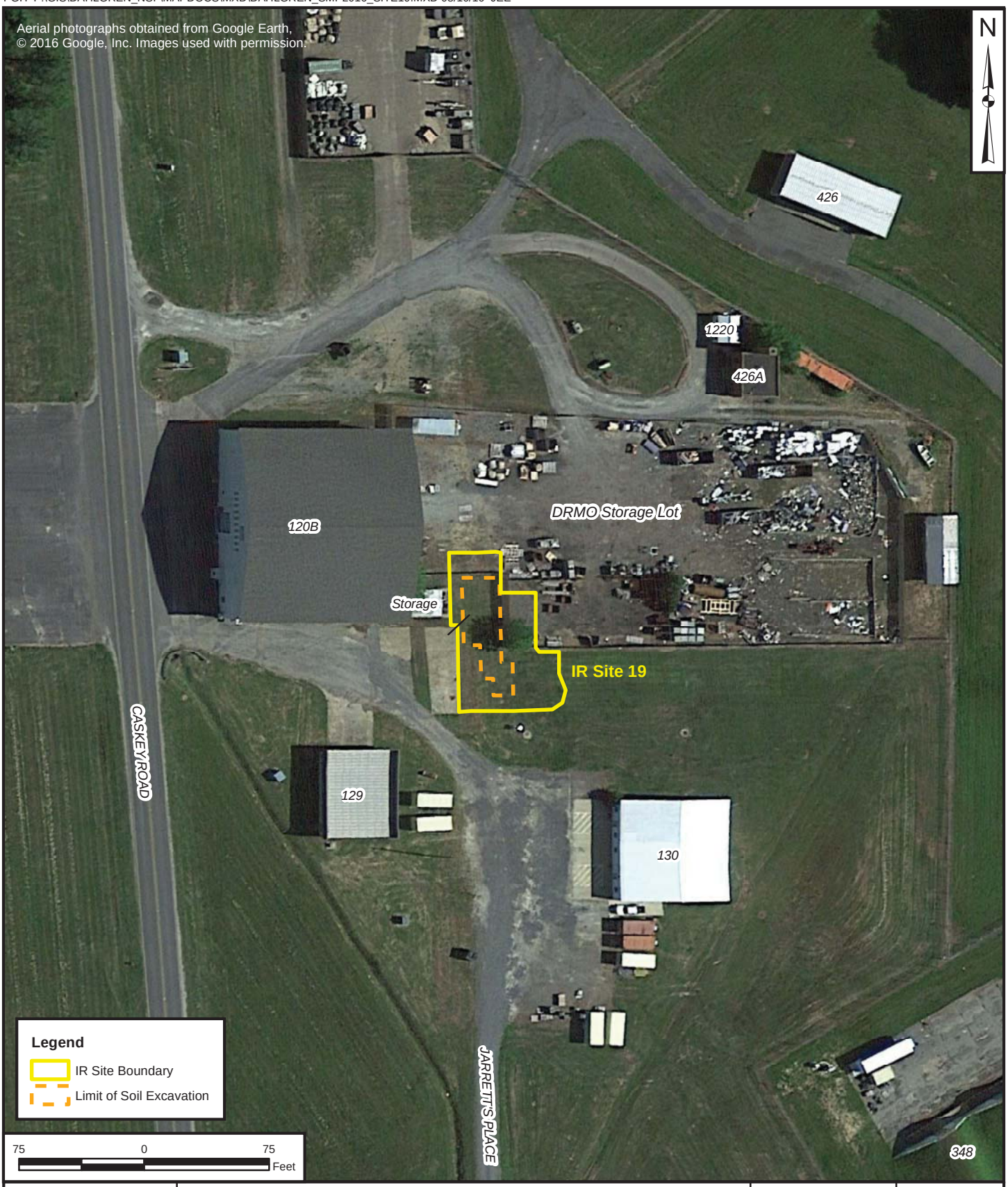
DRAWN BY: J. ENGLISH	DATE: 08/01/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/24/16	IR SITE 12 - CHEMICAL BURN PIT NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 3-6	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE17.MXD 08/10/16 JEE



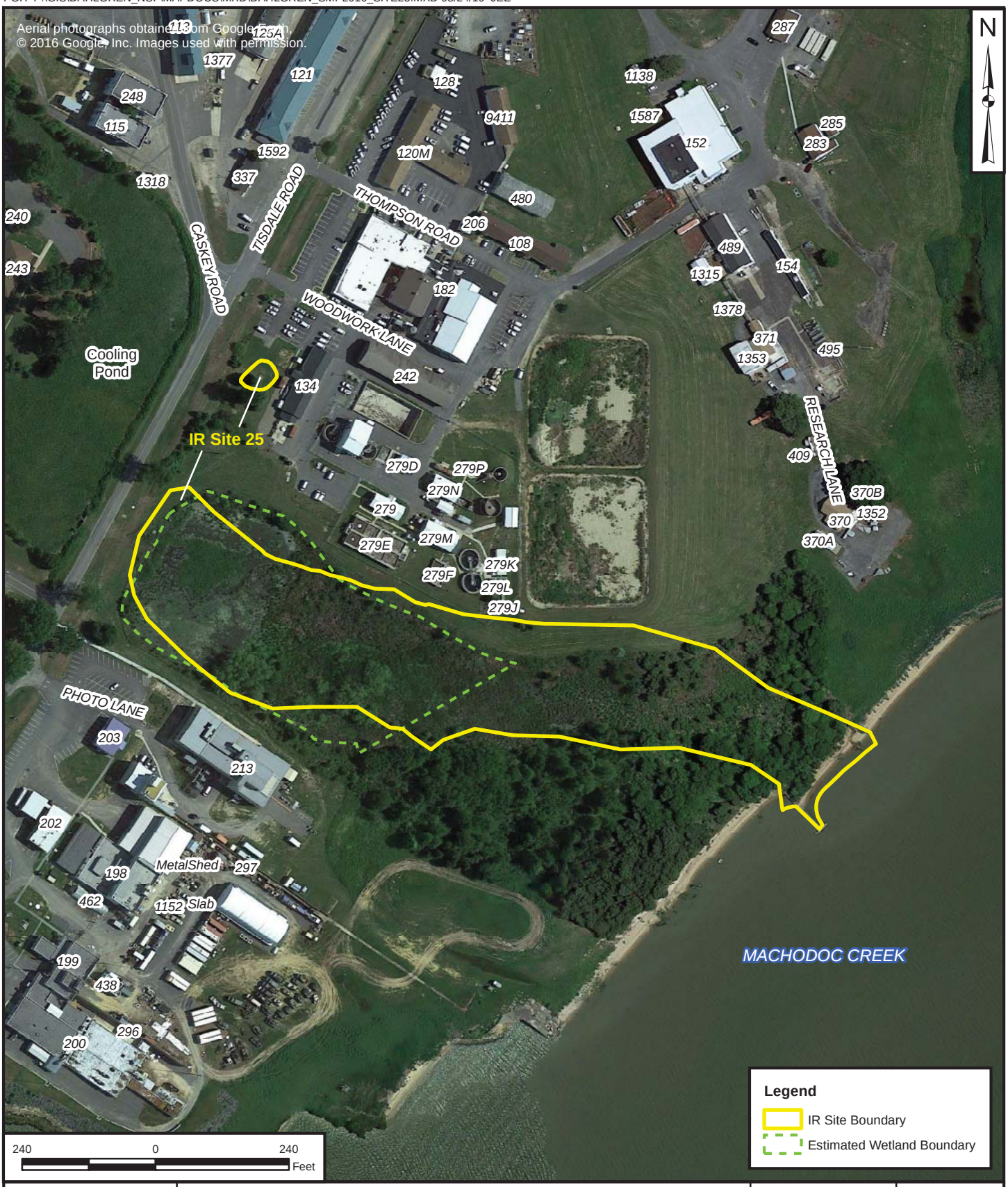
DRAWN BY: J. ENGLISH — DATE: 08/01/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 17 - 1400 AREA LANDFILL NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-7	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE19.MXD 08/10/16 JEE



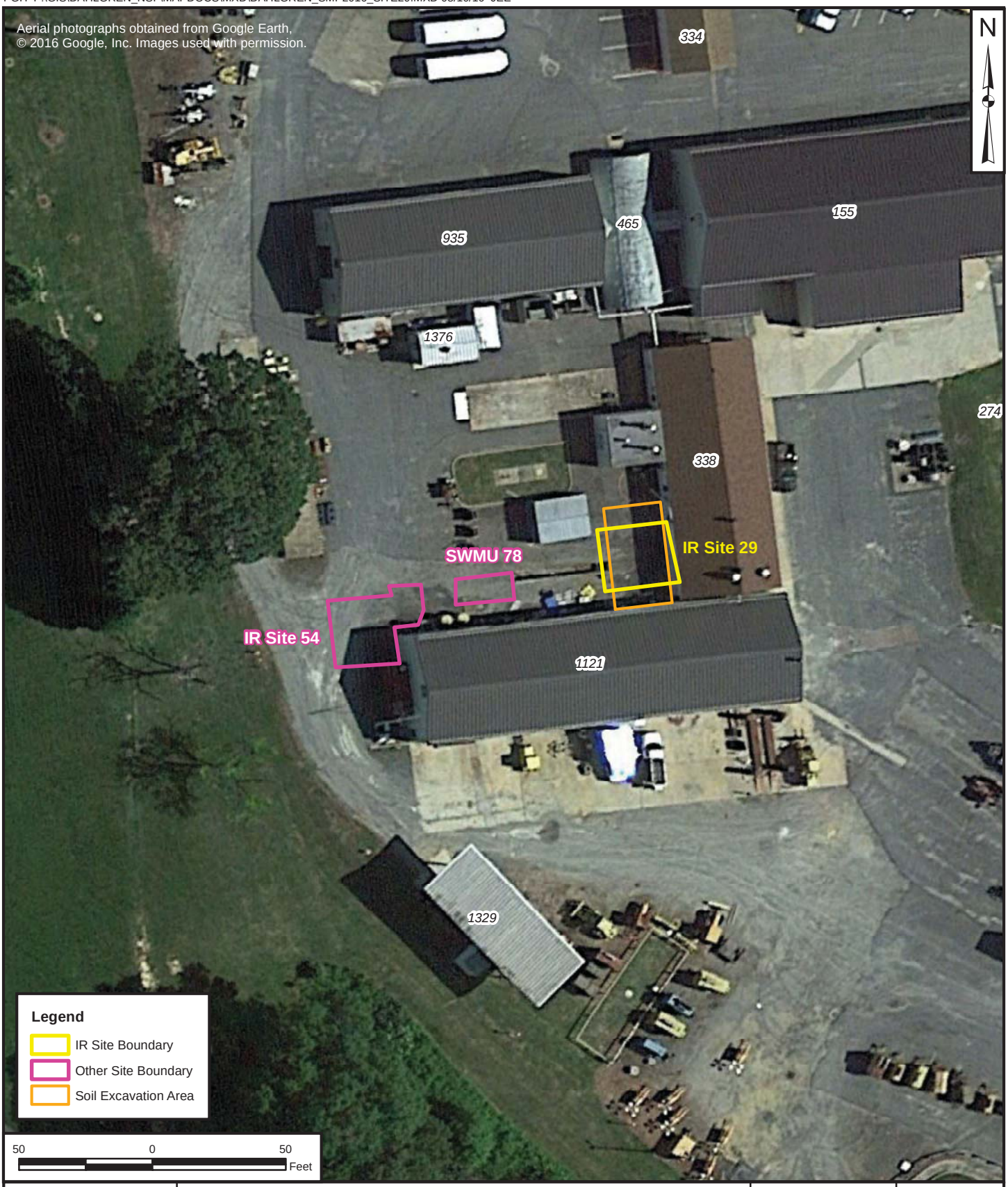
DRAWN BY: J. ENGLISH	DATE: 08/03/16	TETRA TECH	CONTRACT NUMBER: 07992 / CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/10/16	IR SITE 19 - TRANSFORMER DRAINING AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ / DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___ / DATE: ___
SCALE: AS NOTED			FIGURE NO.: 3-8 / REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE25.MXD 08/24/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/24/16	IR SITE 25 - PESTICIDE RINSE AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 3-9	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE29.MXD 08/10/16 JEE

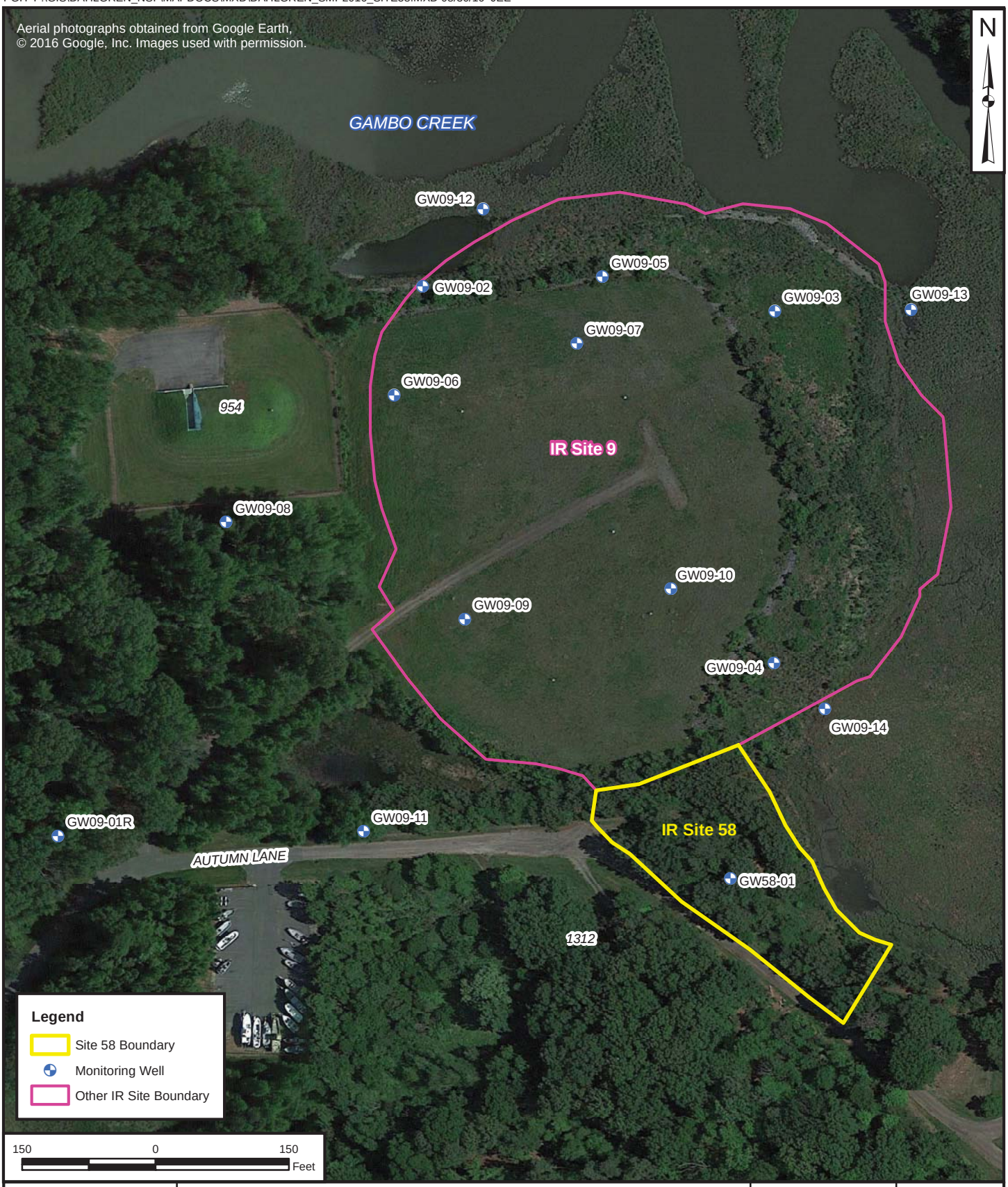


DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 29 - BATTERY SERVICE AREA AND IR SITE 54 - OWS 1121 - OLD NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-10	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE44.MXD 08/24/16 JEE

DRAWN BY: J. ENGLISH — DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/24/16	IR SITE 44 - ROCKET MOTOR PIT NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-11	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE58.MXD 08/30/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/30/16	IR SITE 58 - BUILDING 1350 LANDFILL NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 3-12	REV: 0

4.0 APPENDIX A – PRIORITY 1 SITES

There are eleven Priority 1 sites at the NSFDL. Eight Priority 1 sites are located on the Mainside Area of NSFDL (**Figure 4-1**), and three are located at the EEA (**Figure 4-2**). A summary table including the rationale for being listed and investigated and the current status is provided for each site (tables for sites on *Mainside are blue*, and for *EEA are brown*). For each site, a brief summary of the site history and IR activities follows each table.

4.1 SITE 6 - TERMINAL RANGE AIRPLANE PARK

Site 6 - Terminal Range Airplane Park (SWMU 54)	
Location: on the north side of Tisdale Road just before it crosses Gambo Creek, in the southeast quadrant of Mainside. Site 6 borders the western bank of Gambo Creek (See **Figure 4-3**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Called the Airplane Park because in the 1940s the site was used as a storage lot for inactive airplanes. Also used for staging metallic items waiting testing, supplies, etc.	Removal action completed in July 2004. Wetlands monitoring discontinued in 2011. No further action planned.

Background: Site 6 occupies a topographically high area bordered to the north by a marshy tributary of Gambo Creek, and Gambo Creek to the east. The land slopes in a semi-radial pattern toward the surrounding marsh. Groundwater and surface water at Site 6 generally flow towards the marsh north of the site. The site was used from the 1940s to 1992 to store scrap metallic items such as empty drums, inactive airplanes, and steel personnel and camera shelters; items waiting testing; drums of gun barrel preservative product; sandblasting agent product; railroad ties and telephone poles.

Work Completed: All drums were removed from Site 6 in the Fall of 1992. Sampling results of the drummed gun barrel preservative indicated that it did not contain PCBs. The Site Screening Process (SSP) report for Priority 1 Sites recommended proceeding to the RI/FS process for Site 6 (B&R Environmental, 1996a). RI sampling was completed to assess contamination in the soils, surface water, sediment, and groundwater at the site, and human health and ecological risk assessment were prepared. Chemicals detected in soils and sediment at Site 6 and requiring further delineation sampling included semivolatile organic compounds (SVOCs), pesticides, and metals. Transport of contaminants or soil particles with adsorbed contaminants was evident in the marsh. Trenching activities were conducted at Site 6 in July 2000 to determine whether waste material was present in the subsurface soils due to historical filling and regrading of the site. Additional surface soil, sediment, and surface water samples were also collected in support of an FS.

The selected remedial alternative for Site 6 was excavation with offsite disposal of buried wastes and contaminated soils/sediments and wetland restoration. Site remediation was completed in July 2004. Materials excavated and shipped off-site for disposal included 14.3 tons of sediment/ liquid from storm drain cleaning, 480 cubic yards of railroad tie timbers, 30,000 tons of non-hazardous soil and sediment, and 25 cubic yards of miscellaneous drums and debris. In addition, approximately half of a 55-gallon drum of 20 and 40 millimeter explosive rounds were recovered during excavation.

An onsite borrow area was generated to fill the excavated area, which created approximately 0.9 acres of new wetland (Tetra Tech, 2005h). Wetland monitoring was performed at Site 6 from 2004 to 2009. To increase plant species and habitat diversity at the Site 6 wetlands, a supplemental planting of 50 bald cypress trees was conducted in October 2009. Monitoring of the newly-planted trees performed in 2010 and 2011 indicated they had met their target survival rates and were functioning as planned. The 2011 wetland monitoring results suggested that the wetland hydrology and dense vegetation were functioning effectively, and that no further monitoring was required.

Ongoing Requirements: In 2011, it was determined that the general wetland acreage and other design goals for the established wetlands at Site 6 were achieved; therefore, wetland monitoring at this site was discontinued. Monitoring and treatment for phragmites was to continue under the base invasive species management program.

4.2 SITE 21 - GUN BARREL DECOPPERING AREA

Site 21 - Gun Barrel Decoppering Area (SWMU 52)	
Location: northwest of Building 235 along former railroad bed, at Mainside (See **Figure 4-4**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Small curved area along inactive railroad track bed and former loading dock, where a dip tank and wash trough were located. The trough was used from 1960s to 1970s, and the tank used from 1971 to early 1980s.	Removal Action Completed Decision Document – No Further Action

Background: Site 21 included two decoppering sites: a large tank on an inactive railroad track bed, and a smaller trough near the edge of the loading dock for the railroad tracks. The larger tank was used to decopper cases and the smaller trough was used to decopper gun barrels. Gun barrels were washed with sulfuric and chromic acid in the trough to remove built-up residues. The barrels were then lifted out of the acid bath and allowed to drain directly onto the ground and into the rail track trench. The residues

were primarily copper but also included lead, brass, and tin. It is not known where the acid used in the decoppering process was disposed.

Work Completed: A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on Site 21. The report recommended that soil in the vicinity of the railroad tracks and loading platform be identified for a removal action under CERCLA. An EE/CA was completed for this site to evaluate alternatives for a removal action. The report recommended removing the contaminated soil and debris to the target soil cleanup levels and removing any surficial contamination on the concrete platform.

A removal action was performed at the site between July and October 1997. The contractor removed railroad ties from the surface of the abandoned rail bed and excavated approximately 370 cubic yards of arsenic- and chromium-contaminated soil. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998). The September 2002 Site Decision Document recommended that no further action was required at Site 6 under a residential use scenario (Navy, 2002g).

Ongoing Requirements: None.

4.3 SITE 22 - GUN BARREL DEGREASING AREA, NORTH MAIN RANGE

Site 22 - Gun Barrel Degreasing Area, North Main Range (SWMU 53)	
Location: west of Site 21, along former railroad bed outside Building 207 at Mainside (See **Figure-4-5**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Used as a location to store and degrease 5-inch and 76-millimeter gun barrels from the 1950s to 1990s.	Removal Action completed in 1997. No Further Action Decision Document completed in 2002.

Background: In the early years of operation, gun barrels were degreased via steam cleaning over the concrete pad covering the area. The concrete pad did not have secondary containment. Beginning in the early 1980s, the aboveground site consisted of a steel degreaser tank holding approximately 1,200 gallons and measuring approximately 6 feet wide, 20 feet long, and 4 feet deep; an aboveground steel kerosene (solvent) storage tank holding approximately 2,000 gallons, with secondary containment; and two steel 55-gallon drums for storing solid wastes (e.g., rags) associated with the degreasing process. Prior to 1993, the degreaser tank was open to air, and precipitation was directed via a steel trough to an oil/water separator (OWS) 207-300 (Site 53, also removed in 1993) and then to the storm drainage system.

The tar-like preservative inside gun barrels was removed using kerosene. Used kerosene was pumped to an aboveground storage tank, and kerosene in the tank is sampled for metals prior to being pumped out of the tank and sent offsite for recycling. The degreasing process generated approximately one full-tank of used kerosene and four to five drums of solvent- and preservative-contaminated solid wastes (rags, etc.) each year. Until the mid-1980s, mineral spirits (e.g., dry-cleaning solvent) was used as a solvent as well.

Work Completed: A removal action was conducted at Site 22 between July and October 1997. The contractor used a track excavator to remove approximately 30 cubic yards of petroleum hydrocarbon-contaminated soil. The contractor placed backfill into the area once the final confirmation samples met removal action goals. A final report was submitted in October 1998 (OHM Remediation Services Corp, 1998). A Decision Document prepared in September 2002 recommended no further action under a residential use scenario (Navy, 2002g).

Ongoing Requirements: None.

4.4 SITE 31 - AIRPLANE PARK DUMP, EEA

Site 31 - Airplane Park Dump (SWMU 6), EEA	
Location: in the northwest part of the EEA adjacent to Upper Machodoc Creek, east of Wood Island (See **Figure 4-6**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
A 20 to 30 foot deep ravine that was backfilled with solid wastes such as old aircraft and aircraft parts and scrap metal from the 1940s to 1970s.	Removal action consisting of removal and offsite disposal of waste and impacted soil completed in 2001. Monitoring no longer required.

Background: Site 31 is a former landfill at the EEA, approximately two acres in size. During the 1940s to 1970s, a ravine at the site was filled with old aircraft and aircraft parts, scrap metal, waste explosive containers, electronic equipment, wood and plastic shipping containers, trash, wood railroad ties, and possibly small electrical transformers. In addition to the ravine, a trench was dug at an unknown time for the purpose of dumping scrap metal, timber, and other solid wastes. Due to the depth and slope of the ravine, solid wastes from the dump were also released into the creek. A silt fence was installed at the mouth of the ravine to slow erosion of soil from the site.

Work Completed: The 1996 SSP investigation recommended the site undergo an RI/FS to determine the potential human health risks and ecological impacts of metals detected in sites soils and groundwater. RI activities began in 1996. Various metals were found to be the primary constituents released from Site 31.

To provide data necessary for remedial design, Site 31 was included in a Draft FFS Priority 1 Sites Project Plan (March 2000). This work included soil sampling and trenching to help delineate the horizontal and vertical extent of waste. An EE/CA for Site 31, finalized in March 2001, presented results of the trenching operations and sampling effort, and presented an analysis of alternatives (Tetra Tech, 2001b). Trenching revealed construction debris, metal powder boxes, ammunition waste materials, aircraft parts, spent incendiary grenades and grenade caps, grenade containers, a torpedo part, and a small unlabeled cylinder containing a liquid. When live torpedo fuses were uncovered, the trenching had to be halted.

The selected remedial alternative for Site 31 was excavation and offsite disposal of 3,120 cubic yards of contaminated soil and waste, due to the nature of the wastes. The Removal Action took place from April to November 2001. An RI/FS was subsequently completed 2003. The RI risk assessment used data for areas not targeted by the removal but where potentially impacted soil and sediment remained at the site. The risk assessment concluded no unacceptable human health risks were present, and that ecological risks were present but were consistent with background conditions in the area. A No Further Action ROD was signed on September 29, 2003, and VDEQ concurrence was received on September 30, 2003.

Ongoing Requirements: None.

4.5 SITE 32 - FAST COOK-OFF PIT AND POND, EEA

Site 32 - Fast Cook-Off Pit and Pond (AOC F), EEA	
Location: in an active R&Darea of the Churchill Range in the central portion EEA. (See **Figure 4-7**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
This area was developed in the 1980s as a fast burn facility for testing the resilience of munitions to external explosions or burning. The pit was a shallow, concrete lined pit that was filled with kerosene or jet fuel and ignited, and the pond was for overflow.	Due to active range operations at EEA, cleanup of Site 32 to address human and ecological health risks, is on hold until the range is closed.

Background: The former pit at Site 32 was octagonal, and approximately 20 feet in diameter by 1 foot deep. It was constructed with a concrete bottom and steel walls. During testing, munitions were suspended over the pit by steel support structures, the pit was filled with water and jet fuel, and the fuel was ignited. Any runoff from this operation flowed into an associated containment pond, which had a polyvinyl chloride (PVC) liner.

Work Completed: The 1996 SSP investigation recommended the site undergo an RI/FS. RI activities began in 1996. The RI/FS was completed in 2004 and included summary of a pilot study to use bioremediation to reduce explosives concentrations. Explosives concentrations remained elevated after the 2002 study due to the ongoing explosives testing activities in the surrounding Churchill range. The human health risk assessment indicated that potential adverse health effects may be associated with hypothetical future residential exposure to RDX in groundwater. However, the RDX is not attributable to former operations at Site 32, but to ongoing range and testing activities. The ecological risk assessment indicated that potential risks exist from exposure to metals, PAHs, phthalates, and explosives in the surface soil and groundwater. The ecological risk management analysis indicated these potential risks will continue to exist as long as Churchill Range remains active.

Due to active and ongoing range activities at this site, the Parties decided that further investigation or remedial action would occur until the Churchill range is closed. A no further action ROD was signed in 2004 indicating the site would not be studied further under CERCLA until the Churchill range is closed. At the time the range is closed, cleanup of Site 32, to address human health and ecological risks, will comply with all applicable federal and state laws and regulations.

Ongoing Requirements: Further investigation deferred until range use discontinues.

4.6 SITE 45 - JULY 28, 1992 LANDFILL B

Site 45 - July 28, 1992 Landfill B (SWMU 45)	
Location: in the north-central portion of Mainside, west of Site 12, Chemical Burn Area, and east of Gambo Creek (See **Figure 4-8**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
A small, 2.5-acre unlined landfill was created at Site 45 during the 1960s and 1970s.	A general site cleanup was completed in 1997 and a Site Decision Document was issued in 2002 documenting the need for no further action at this site.

Background: Site 6 consists of a drainage area that was filled in with solid wastes such as car tires, rusted metal cans, shingles, plumbing fixtures, construction rubble, pallets, and empty powder casings. The July 28, 1992 Landfill B received its name because of the date it was discovered. During this inspection, wastes visible at the landfill surface included railroad ties, shingles, crumpled metal sheeting, a tire, porcelain plumbing appliances, and pieces of Styrofoam.

Work Completed: Site 45 was investigated during the SSP Priority 1 Sites Investigation (B&R Environmental, 1996a). Based on the findings in the report, no significant contamination concerns were detected that required further investigation. However, because solid waste remained on the site, (e.g., tires, metal cans, shingles, plumbing fixtures, construction debris, empty powder casings), a general site cleanup was performed in 1997. Ordnance was not encountered during the pre-excavation EOD reconnaissance, nor during the removal action. A Decision Document was prepared in June 2002 indicating Site 45 required no further action under a residential use scenario (Navy, 2002d).

Ongoing Requirements: None.

4.7 SITE 46 - JULY 28, 1992 LANDFILL A: STUMP DUMP ROAD

Site 46 - July 28, 1992 Landfill A: Stump Dump Road (SWMU 47)	
Location: south of Stump Dump Road, adjacent to a tributary of Gambo Creek in the central part of Mainside (See **Figure 4-9**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
A marsh area where disposal of municipal and industrial waste occurred in the 1950s and 1960s.	A removal action consisting of the excavation and offsite disposal of buried wastes and contaminated soils was completed in 2002.

Background: Based on review of historical aerial images, filling activities were suspected to have occurred sometime prior to 1958 until approximately 1969 along the edge of Gambo Creek. The waste included municipal waste, electrical components, construction debris such as shingles, railroad ties, and machine shop wastes such as metal shavings. During fall of 1992, four 55-gallon drums of tar were removed from the edge of the landfill and disposed of properly.

Work Completed: The 1996 SSP investigation found contamination in Site 6 soils, sediment, and surface water and recommended the site undergo an RI/FS. RI activities began in 1996. To address data gaps in RI data, additional characterization was performed at Site 46 during the FFS in 2000. Additional groundwater and surface water samples were collected to reevaluate human and ecological risks based on constituents detected in RI samples. The RI/FS was completed in 2001 and the selected remedial alternative was complete excavation of buried wastes and contaminated soils with offsite disposal, and wetland restoration. The Site 46 ROD was signed in 2001. In 2002, buried wastes and contaminated soils were removed and disposed of offsite.

Benthic macroinvertebrate sampling was completed from 2005 to 2009. Wetlands monitoring was performed at Site 46 from 2008 to 2011. In 2010, a supplemental planting of wetland vegetation was

recommended to increase species diversity and emergent cover. The May 2011 planting consisted of the placement of coir fiber structures along the shoreline of the pond to act as a substrate for beneficial plants and facilitate sedimentation along the shoreline. Monitoring conducted of the newly-planted areas in 2010 through 2012 indicated the supplemental planting had established successfully.

Ongoing Requirements: In 2011, it was determined that the general wetland acreage and other design goals for the established wetlands at Site 46 were achieved; therefore, wetland monitoring at this site was discontinued. Monitoring and treatment for phragmites was to continue under the base invasive species management program.

4.8 SITE 50 - FILL AREAS NORTHEAST EEA

Site 50 - Fill Areas Northeast EEA (AOC X9)	
Location: in the northeast corner of the EEA, bordering Upper Machodoc Creek. (See **Figure 4-10**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
A fill area for aircraft parts and building debris in operation from the 1940s to 1955.	Removal action consisting of removal and offsite disposal of waste completed in 2001. Monitoring no longer required.

Background: Site 50 consists of a three-acre fill area used in World War II era for the disposal of primarily building debris, and some airplanes. Filling was completed by 1952 and two temporary buildings were removed in 1958.

Work Completed: Four abandoned aircraft were removed from the site in 1994, to prepare the surface for a geophysical survey. The geophysical survey confirmed the limited depth of wastes (e.g., 10 to 15 feet).

A SSP investigation for Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. Limited COCs were identified (PAH compounds and elevated metals) primarily in surface soils and sediments. Additional sampling was recommended to delineate the magnitude and extent of PAH contamination and metals in the surface water. Additional sediment and surface water samples were collected to investigate the nature and extent of metals and PAH compounds in the marsh area, located on the western edge of the site. The final SSP Addendum Site 50 Report, issued in August 2000, included human health and ecological risk assessments.

The human health risk assessment indicated remedial action may be warranted for manganese in soils to comply with PRGs developed based on a residential scenario. A risk screening evaluation identified risks associated with groundwater at Site 50 were related to the widespread distribution of naturally occurring

elements (primarily iron and manganese). The ecological risk assessment identified potential concerns with PAHs and vanadium in sediment, and zinc in surface soils; however these were due to elevated concentrations at only one location for each. There was also potential ecological risk associated with copper in surface water. The ecological pathway of concern in each medium is direct contact with invertebrates and plants.

Chemical data from soil, surface water, sediment, and groundwater samples confirmed minimal environmental impacts from activities at Site 50. Based on contaminant distributions and relatively low risk levels, the Site 50 EE/CA recommended excavation and offsite disposal of debris (buried aircraft parts and building debris) and contaminated soil (Tetra Tech, 2000b). The Removal Action was completed between May and November 2001, at the same time as Site 31 at EEA (Tetra Tech, 2001e).

Wetlands monitoring was conducted semi-annually between 2003 and 2010. In March 2010, the BTAG approved modifying the wetlands monitoring requirements from quantitative to qualitative. Wetlands monitoring continued through 2011; after that the partnering Team and BTAG agreed to discontinue it, with the requirement that monitoring and treatment for phragmites continue under the base invasive species management program. Benthic macroinvertebrate sampling was completed from 2005 to 2009, and then was discontinued under agreement by the Parties.

Ongoing Requirements: None, except phragmites monitoring and control are to be performed annually under the base invasive species management program.

4.9 SITE 51 - BATTERY LOCKER ACID DRAINING AREA

Site 51 - Battery Locker Acid Draining Area (SWMU 98)	
Location: inside Building 338, in the south-central portion of Mainside (See **Figure 4-11**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Floor drain and limestone pit (later sealed and replaced with plastic tank) used for draining acid from batteries prior to the 1980s.	This site was dropped from further evaluation under CERCLA based on 1996 SSP investigation.

Background: The Site 51 area had been used for draining and refilling batteries for many years. Typically, less than 150 gallons a year of battery acid were drained and collected in the limestone pit or the battery acid tank.

Work Performed: The 1996 SSP investigation recommended no further action for this site. A Decision Document was not prepared.

Ongoing Requirements: None.

4.10 SITE 53 - OWS 207 300

Site 53 - OWS 207 300 (SWMU 126)	
Location: near the gun cleaning area in the Main Range at Mainside, approximately 50 feet west of Building 207 (See **Figure 4-12**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
An oil-water separator with a 300-gallon capacity used between 1986 and 1992.	Removal Action was completed in 1997. No further action required under CERCLA.

Background: The Site 53 OWS was used to separate kerosene (used as a solvent) out of the water from the gun barrel degreasing trough (IR Site 22), allowing the water to flow into the storm water drainage system.

Work Completed: In 1993, the OWS was removed. In 1996, a SSP investigation recommended the site undergo additional sampling to confirm removal activities at the site. In order to meet the RAOs, the contractor excavated a total of approximately 11 cubic yards in place volume of total petroleum hydrocarbon (TPH) contaminated soil from an area measuring approximately eight feet by six feet, and extending to a depth of approximately three feet. Excavated soil was directly loaded into waiting dump trucks. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998). Based on the removal action achieving RAOs, Site Decision Document was issued in 2002 documenting the need for no further action at this site.

Ongoing Requirements: None.

4.11 SITE 55 - COOLING POND

Site 55 - Cooling Pond (SWMU 129)	
Location: in the southern part of Mainside, at the intersection of Caskey Road and Tisdale Road (See **Figure 4-13**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Historical cooling pond receiving stormwater and process water discharge from as many as 25 industrial areas or buildings, most notably from the 1920s to 1980s.	No remedial action was found necessary. The ponds are connected to one another and now discharge into Upper Machodoc Creek via the Virginia Pollution Discharge Elimination System (VPDES) permitted outfall. Note that unidentified ferro-magnetic anomalies identified in pond sediments based on 1993 geophysics are likely still present.

Background: Site 55 includes two interconnected ponds (one small, one large) which discharge to Site 25 (Pesticide Rinse Area) by flowing over a weir. The total area of Site 55 is about 9 acres. Cooling pond use began in the 1920s, and historically, up to 25 point-source discharges were draining into the pond. These included storm water effluent, discharge from OWSs, and effluent from various buildings' floor drains. In addition, historical petroleum releases from tanks located to the north of the pond likely migrated via shallow groundwater that discharged to the pond.

Work Completed: In 1994, historical floor drains were sealed and buildings and OWSs no longer discharge to Site 55. Remedial actions not related to Site 55 were performed to address petroleum-contaminated soils and groundwater affected by storage tanks in the vicinity of the pond.

Monthly discharge monitoring was conducted in the early 1990s and identified contamination in the fish and bottom sediment by oil and grease, PCBs, pesticides (primarily DDT and associated degradation products), and metals (arsenic, lead, cadmium, and mercury). In 1993, a sampling and analysis program was conducted to investigate the presence and magnitude of previously identified contaminants (Geophex, 1993). The results from this investigation confirmed the presence of heavy metals (arsenic, chromium and lead) as well as mercury in sediments, pesticides (4,4,-DDT, 4,4'-DDD and 4,4'-DDE) in sediment and fish tissue, and PCBs (Aroclor 1260) in fish tissue. In addition, free product diesel fuel was detected below sediments along the north bank of the Cooling Pond, and twelve unidentified ferrous anomalies were found using geophysics on the bottom of the Cooling Pond.

A draft RI report was submitted in January 1999 and included human health and ecological risk assessments for this site. The draft RI recommended additional data be collected before an FS was

prepared; therefore, Site 55 was included in the FFS Priority 1 Sites Project Plans which were approved in 2000. Additional sampling was performed in July 2000 to help support the future development and evaluation of remedial alternatives. Fish sampling was conducted to evaluate the need for a catch and release fishing restriction. The resulting data were used to evaluate human health and ecological risk, and results were presented in the 2002 final RI report (Tetra Tech, 2002b). The human health risk assessment concluded that no significant potential health hazards were associated with exposure to surface water, sediment, and fish at Site 55. The results of the ecological risk assessment indicated potential ecological risks were attributed to PAHs, arsenic, cadmium, copper, and lead in sediment at Site 55. The RI recommended additional surface water and sediment sampling to determine if remedial action was warranted based on ecological risks.

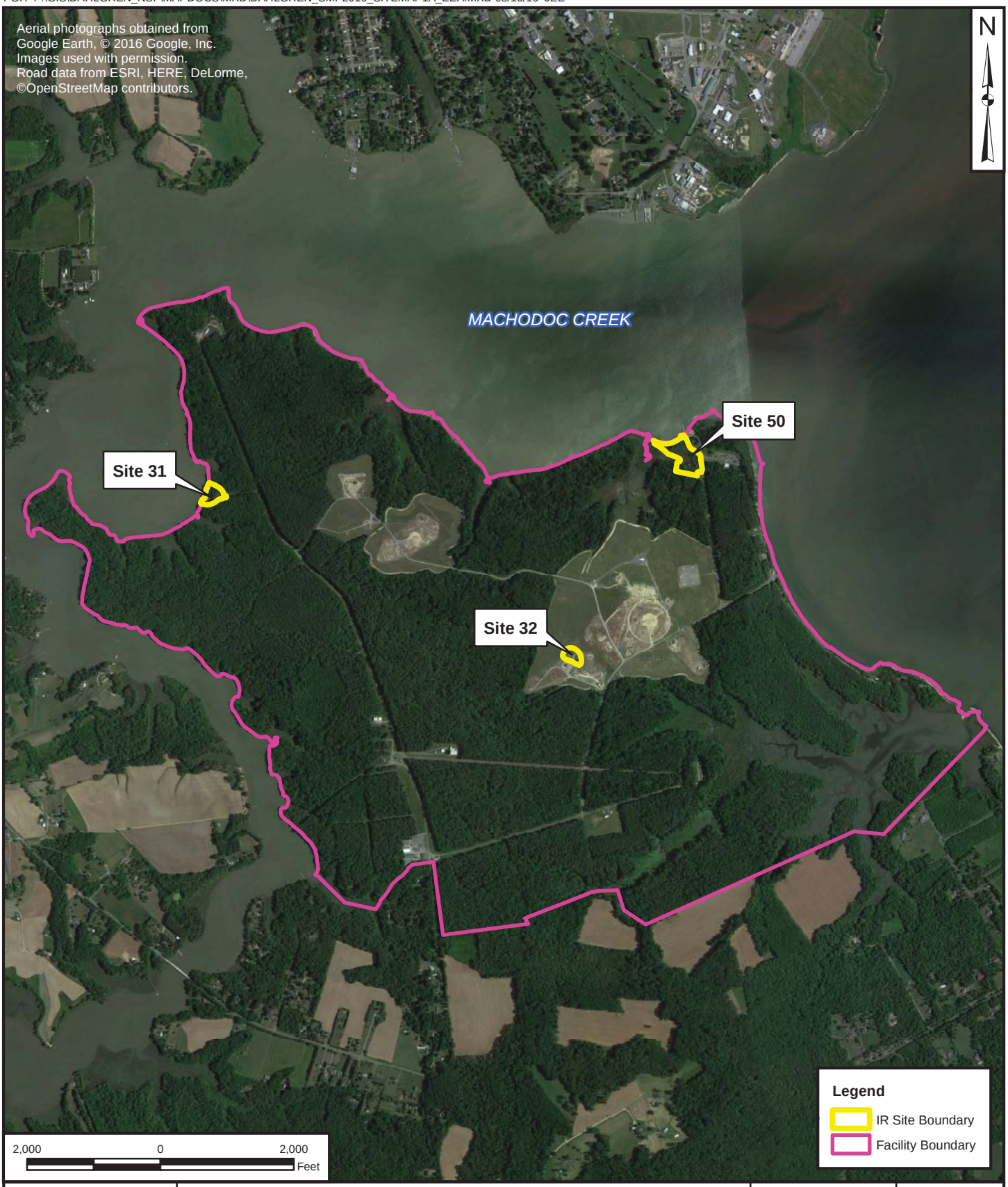
Since samples at Site 55 were collected in 1994, 1997, and 2000, additional surface water and sediment samples were collected in July 2002 to document current pond conditions. In addition, toxicity testing was performed on the shallow sediments to assess the potential risk to sediment-dwelling invertebrates. The 2002 sampling data were used to re-evaluate the ecological risks and were presented in the final FS for Site 55, issued in May 2003. The FS concluded that no unacceptable risks were present at the site and recommended no action be taken at Site 55 (Tetra Tech, 2003d). Remedial actions have been performed to address petroleum-contaminated soils and groundwater affected by storage tanks in the vicinity of the pond.

Ongoing Requirements: None, except to ensure ferro-magnetic anomalies identified in pond sediments during 1993 geophysical survey are noted in the base Geographic Information System (GIS).

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_1A_MAINSIDE.MXD 08/10/16 JEE

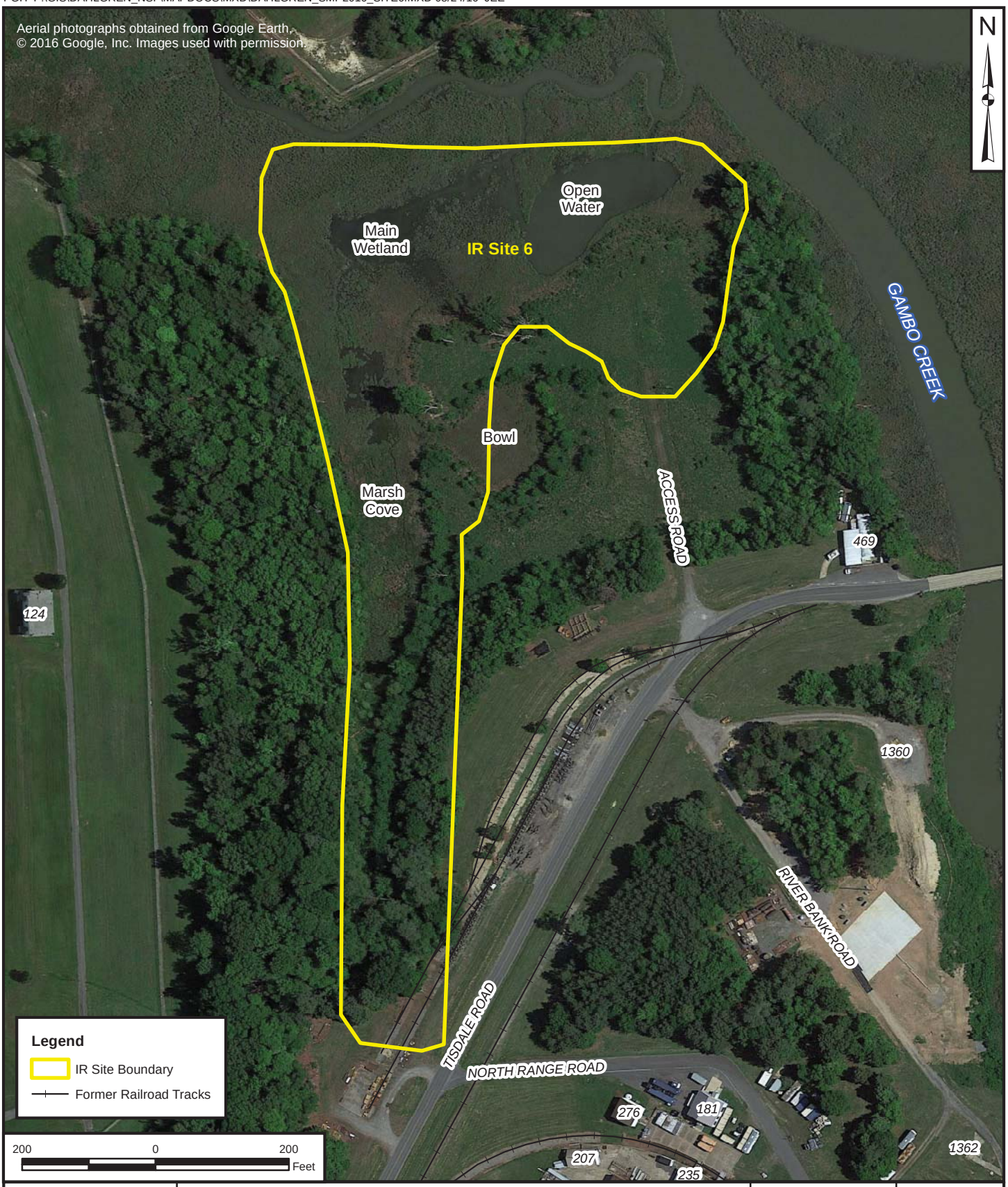
DRAWN BY J. ENGLISH	DATE 08/10/16	TETRA TECH		CONTRACT NUMBER 07992	CTO NUMBER ___
CHECKED BY A. McGIVNEY	DATE 08/10/16	ALL PRIORITY 1 SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 4-1	REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP1A_EEA.MXD 08/10/16 JEE



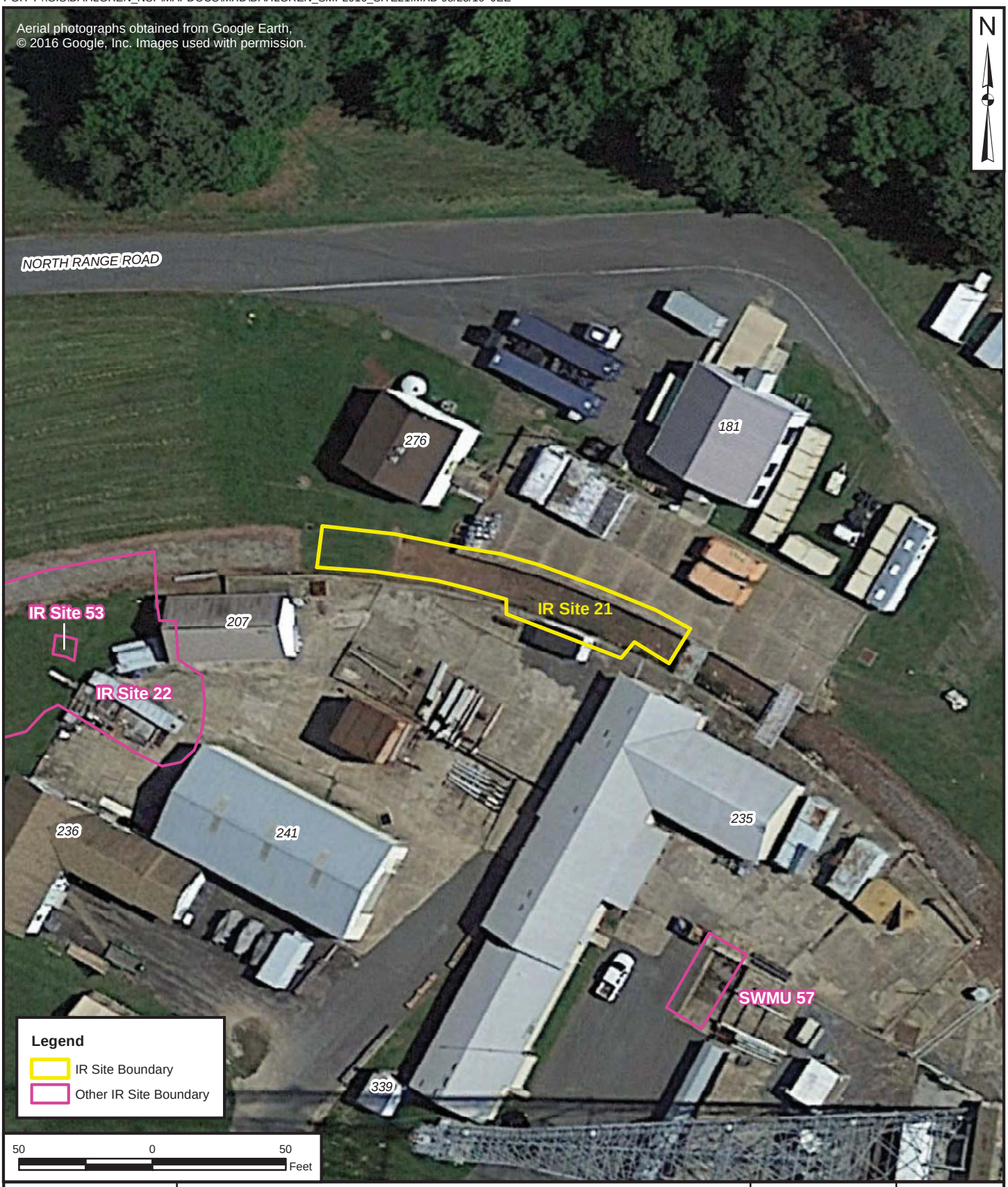
DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/10/16	ALL PRIORITY 1 SITES - EEA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 4-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE6.MXD 08/24/16 JEE



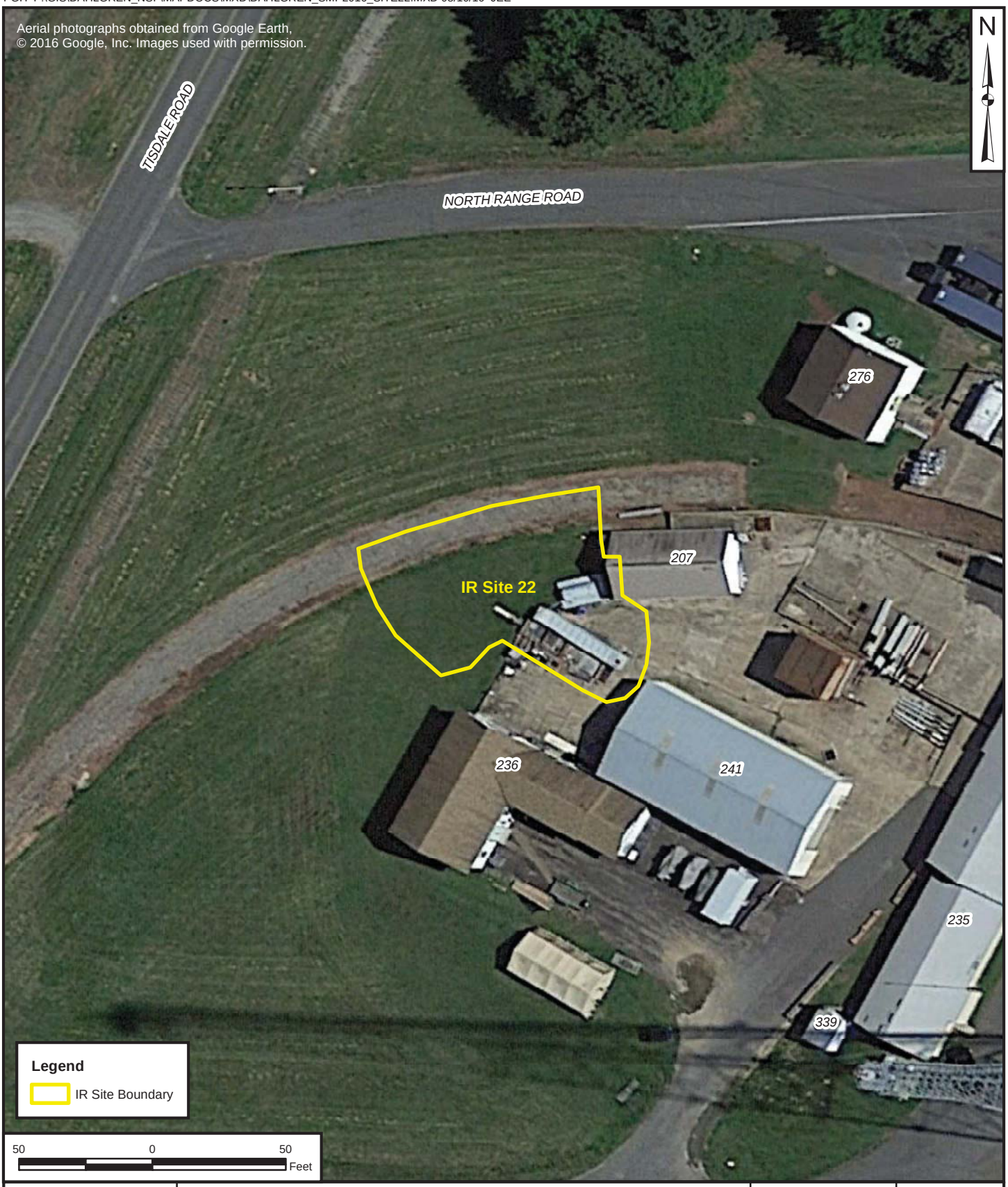
DRAWN BY J. ENGLISH	DATE 08/01/16	TETRA TECH		CONTRACT NUMBER 07992	CTO NUMBER ___
CHECKED BY A. McGIVNEY	DATE 08/24/16	IR SITE 6 - TERMINAL RANGE AIRPLANE PARK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 4-3	REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE21.MXD 08/25/16 JEE



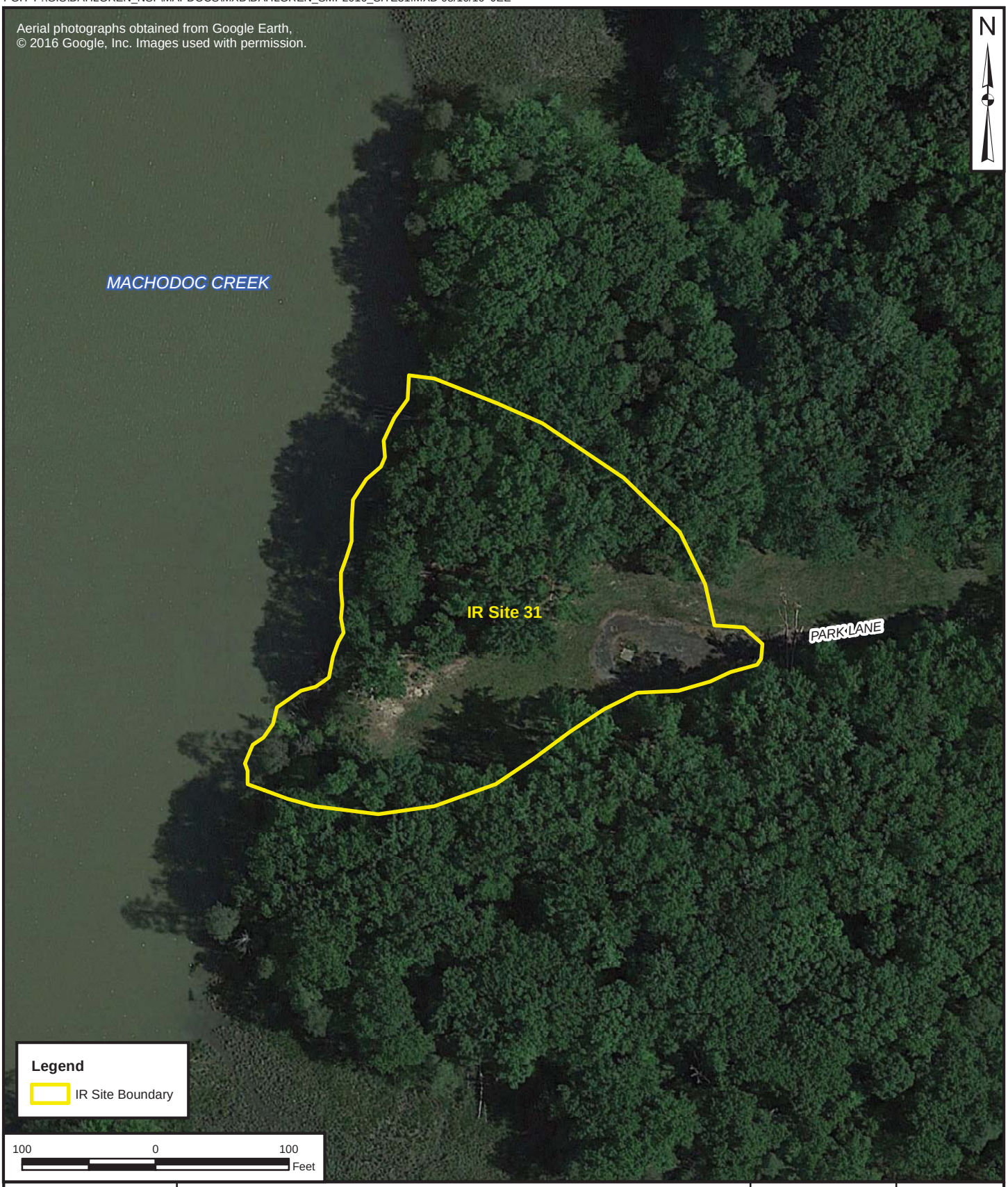
DRAWN BY J. ENGLISH	DATE 08/01/16	TETRA TECH		CONTRACT NUMBER 07992	CTO NUMBER ___
CHECKED BY A. McGIVNEY	DATE 08/25/16	IR SITE 21 - GUN BARREL DECOPPERING AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 4-4	REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE22.MXD 08/10/16 JEE



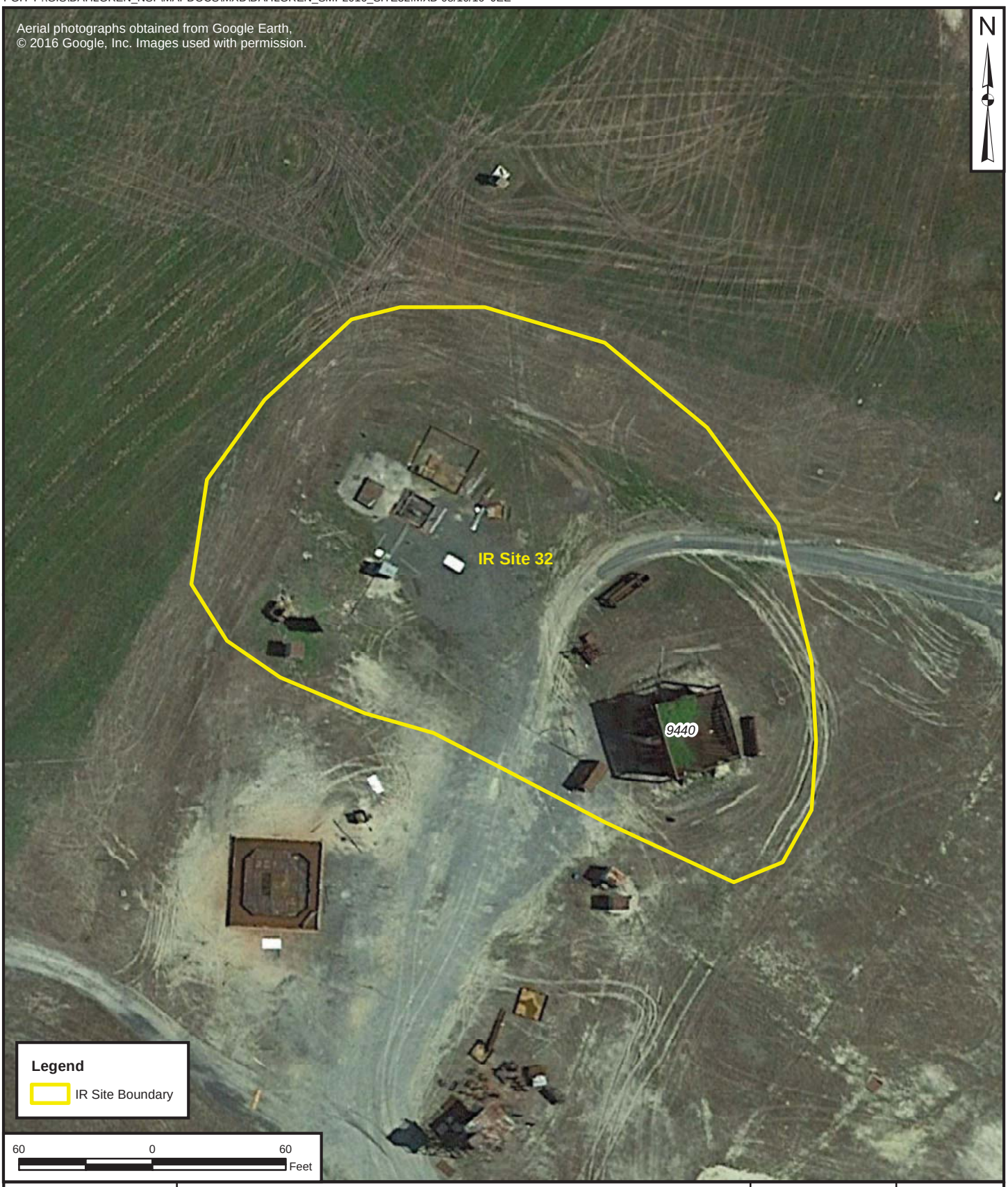
DRAWN BY: J. ENGLISH — DATE: 08/08/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 22 - GUN BARREL DEGREASING AREA, NORTH MAIN RANGE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-5	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE31.MXD 08/10/16 JEE



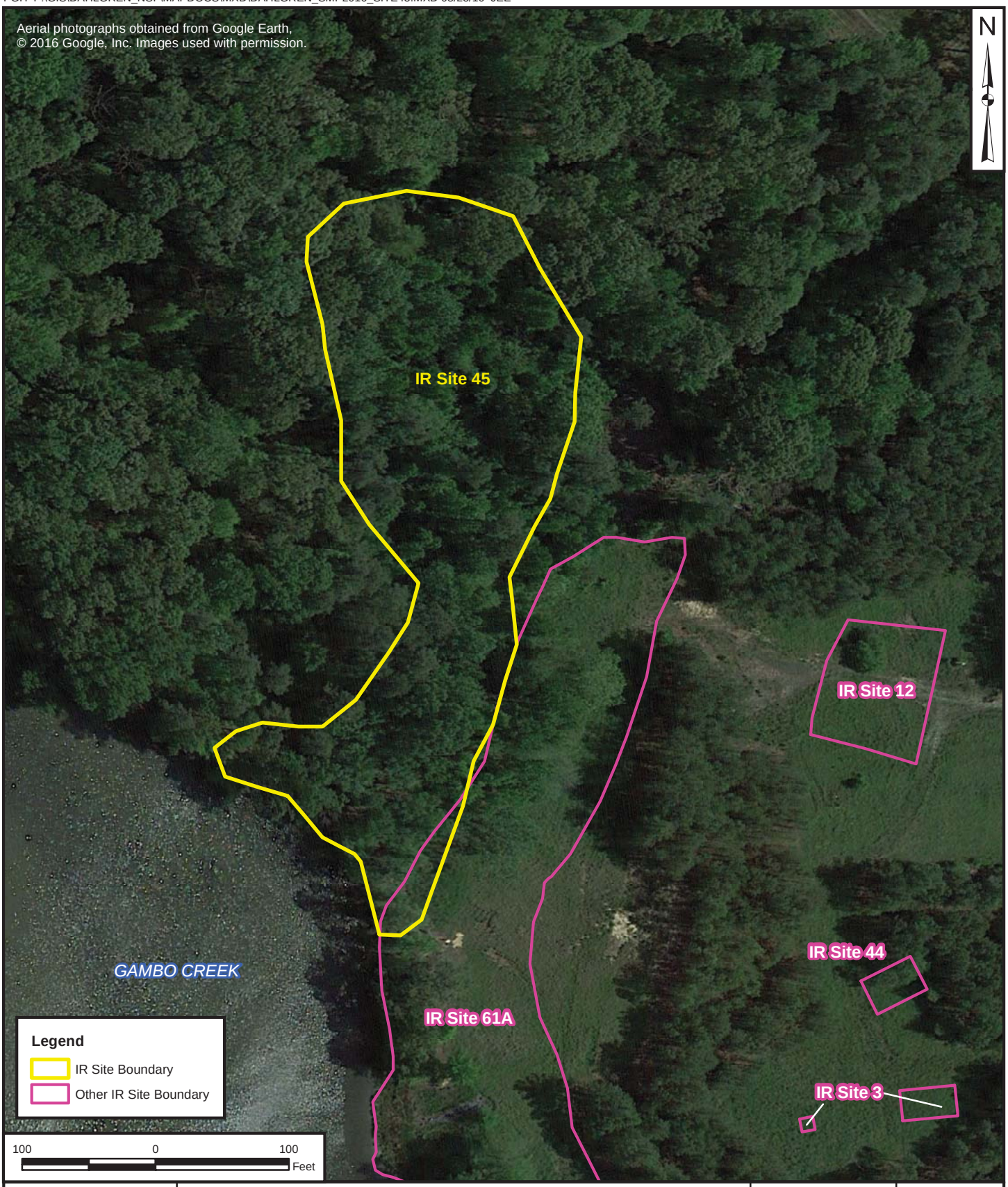
DRAWN BY: J. ENGLISH — DATE: 08/08/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 31 - AIRPLANE PARK DUMP, EXPLOSIVES EXPERIMENTAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-6	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE32.MXD 08/10/16 JEE



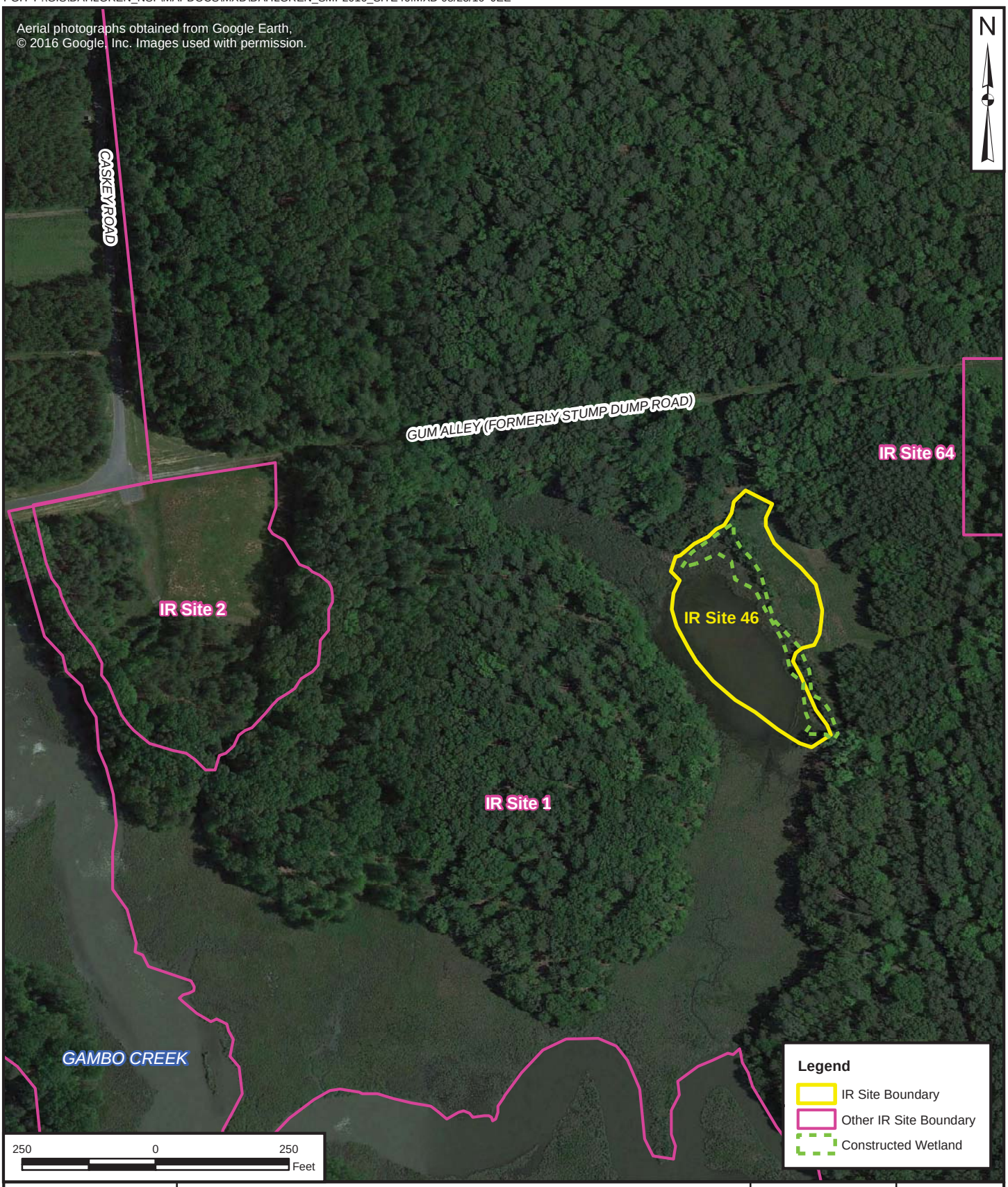
DRAWN BY: J. ENGLISH — DATE: 08/08/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 32 - FAST COOK-OFF PIT AND POND, EXPLOSIVES EXPERIMENTAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-7	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE45.MXD 08/25/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/08/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 45 - JULY 28, 1992 LANDFILL B NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-8	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE46.MXD 08/25/16 JEE

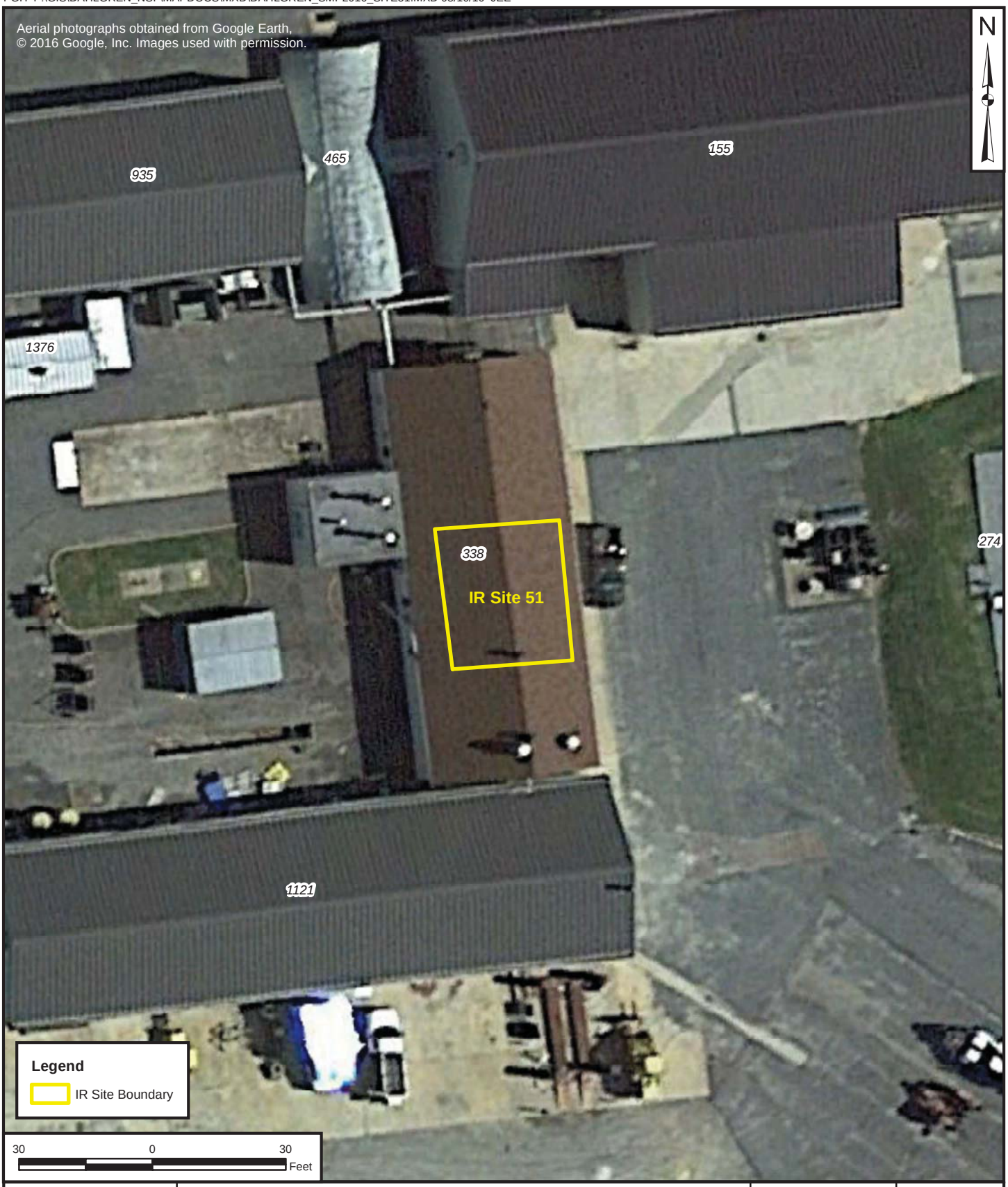


DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 46 - JULY 28, 1992 LANDFILL A: STUMP DUMP ROAD NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-9	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE50.MXD 08/10/16 JEE

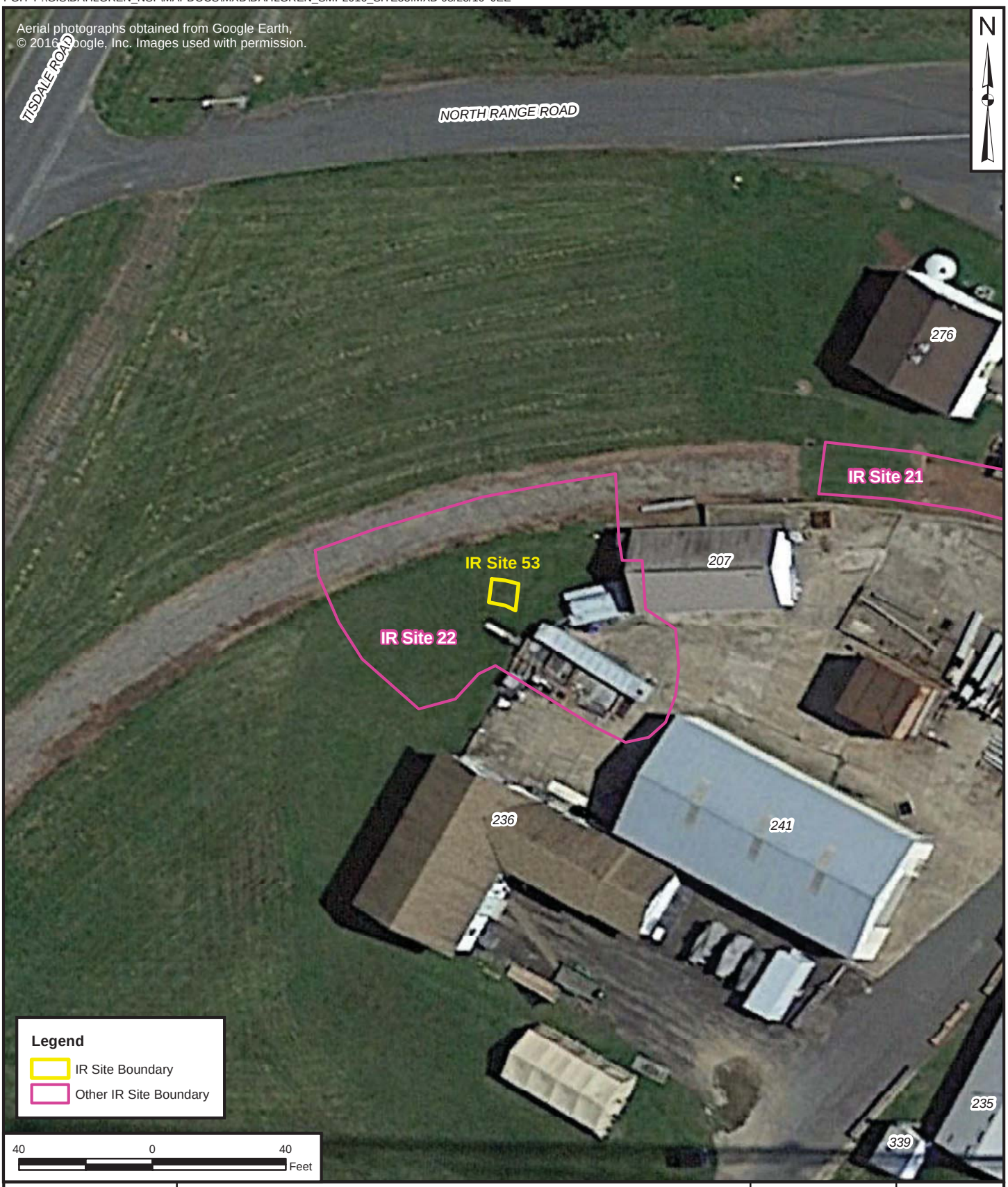
DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 50 - FILL AREAS, NORTHEAST EXPLOSIVES EXPERIMENTAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-10	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE51.MXD 08/10/16 JEE



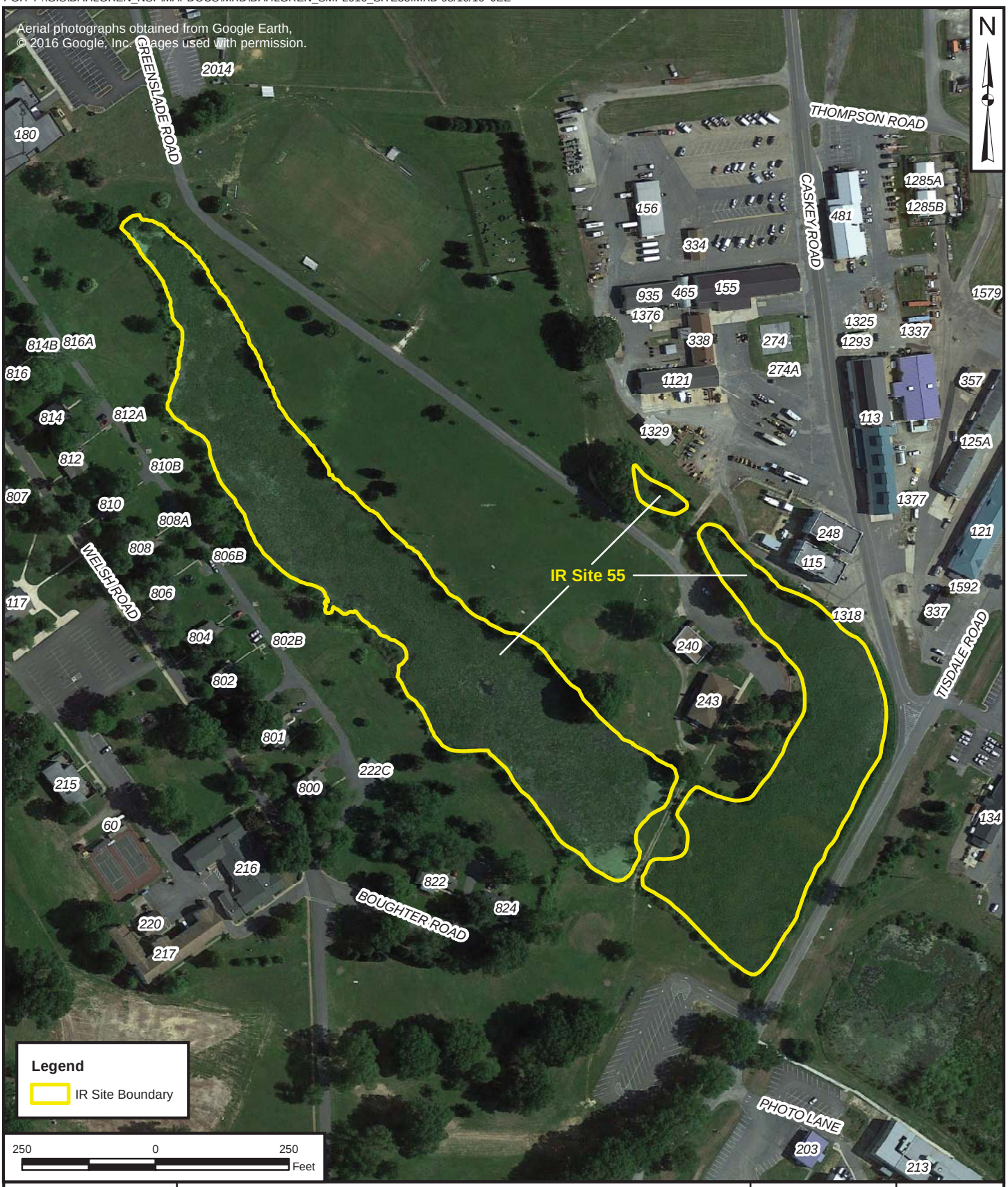
DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/10/16	IR SITE 51 - BATTERY LOCKER ACID DRAINING AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-11	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE53.MXD 08/25/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 53 - OWS 207 300 NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 4-12	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE55.MXD 08/10/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/10/16	IR SITE 55 - COOLING POND NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 4-13	REV: 0

5.0 APPENDIX A – PRIORITY 2 SITES

There are six Priority 2 sites at the NSFDL, all located on the Mainside Area (**Figure 5-1**). A summary table including the rationale for being listed and investigated, and the current status is provided for each site. For each site, a brief summary of the site history and IR activities follows each table.

5.1 SITE 13 - GAMBO CREEK TRUCK WASH AREA

Site 13 - Gambo Creek Truck Wash Area (SWMU 31)	
Location: site borders Gambo Creek north of the CW Evaporation Pond (IR Site 14), in the northwest portion of Mainside (See **Figure 5-2**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Concrete truck wash pad with drain connected to storm water discharge.	Removal Action completed in 2002. No Further Action Decision Document completed in 2003.

Background: Site 13, also known as the Inert Disposal Area, was used for vehicle washing by high-pressure water. It is approximately one half-acre in size and semi-circular in shape. The northern edge of the site borders a marshy area of Gambo Creek. A five foot high earthen berm surrounds the site. The Inert Disposal Area is adjacent to the Gambo Creek Truck Wash Area and it is included as one site. A variety of construction debris was reportedly disposed at this site including rocks, broken-up cement and asphalt, construction debris, and dredged creek sediments. The truck washing area was used from the 1980s to 1990s and is no longer active.

Work Completed: Based on the results of the Draft SSP Report (B&R Environmental, 1997), SVOCs, PCBs, and inorganic constituents were the primary concerns for Site 13. Conclusions within the SSP report included a recommendation for a removal action, since the contaminant distribution was localized and confined to surficial media.

An EE/CA completed in August 2001 included the results of three test pits excavated in 1998 to evaluate the extent and verify the type of debris, and fill (e.g., berm materials), at the site. Based on the test pits, the berm consisted primarily of soil with minimal pieces of metal, concrete, and asphalt. The debris located on the slopes north, east, and west of the berm were primarily surface debris consisting of large blocks of asphalt and concrete. No additional fill material was identified at Site 13. Human health and ecological risk assessments were included in the EE/CA. The results of the human health risk assessment suggest that remedial action may not be necessary for the soils since contaminant concentrations do not pose a human health threat. Ecological risk screening concluded that inorganic

concentrations (such as lead, mercury, and zinc) were a potential concern to ecological receptors at the site.

The Removal Action was completed from January to June 2002. Significant quantities of concrete and asphalt were removed from beneath the former truck wash area. Below the truck wash pad, petroleum contamination was encountered in soils. Therefore, post-excavation confirmatory sampling was completed and the results were presented in a Verification and Sampling Analysis Plan (VSAP) Report. A Decision Document was prepared in May 2003 indicating that no further action was required at Site 13 under a residential use scenario (Navy, 2003b).

Ongoing Requirements: None.

5.2 SITE 20 - FORMER ELECTROPLATING WASTE UST

Site 20 - Former Electroplating Waste UST (SWMU 83)	
Location: former Building 404, near the intersection of Norc Ave. and Dahlgren Rd., in the southeast portion of Mainside (See **Figure 5-3.**)	
Environmental Conditions at Discovery:	**Current Site Status:**
The former Building 404 housed an historical Electroplating shop, and the UST was used to collect and hold waste electroplating solutions until they could be transported elsewhere on base for treatment and disposal (e.g., IR Site 14).	Due to their proximity and consistent contamination, Site 20 and Site 23 (Section 4.3) were combined during investigation and remediation. Source removed occurred in 2008 and groundwater remediation was completed in 2009. LTO and remedy performance evaluation are currently underway. Next Five-Year Review due in December 2018.

Background: This UST, originally a six feet by four feet by three feet concrete-block tank with a composite liner, was used from the early 1960s until sometime before 1984 to hold electroplating wastewater from Building 404. In 1984, it was decontaminated and filled with asphalt concrete.

Work Completed: Initial and addendum SSP investigations, including the collection of soil and groundwater samples, were completed to assess the vertical and horizontal migration of contaminants in the vicinity of the UST. (B&R Environmental, 1997). Soil and groundwater samples were collected. Groundwater impacted by VOCs (PCE, TCE, and 1,1-DCE) was identified. In addition, the addendum SSP investigation at Site 20 involved a detailed evaluation of chemical, geochemical, and hydrogeologic influences on the nature and distribution of contaminants in groundwater, as well as a screening level evaluation of natural attenuation potential at the site.

The 1997 SSP investigation recommended an RI/FS and further investigation of the groundwater at the site. The RI was initiated in 2001. No further action was proposed in the RI with respect to site soils. Subsequently surface and stockpiled soils at Site 20 were removed in September 2003 and disposed offsite at a permitted facility as part of actions to restore the area following installation of new utilities. The soils contributing to potential ecological risk were removed.

A soil vapor screening was performed for Sites 20 and 23 in March 2007 to identify the potential for vapor intrusion into nearby buildings. With the exception of PCE, most detections of COCs were orders of magnitude below screening criteria. PCE was detected in soil vapor near the former UST location, at concentrations within acceptable screening levels. A draft FFS was prepared to evaluate and compare groundwater remedial alternatives for Sites 20 and 23 in March 2007 by Tetra Tech.

In 2008, contaminated soils around the former Site 20 electroplating waste UST were removed for offsite disposal. A FFS was completed in 2009 to address groundwater contamination at the site. The selected alternative included: removal of the UST concrete vault, removal of asphalt fill, concrete filled piping, and impacted subsurface soils in the area, sample remaining soil to confirm contamination removed, and fill with clean soil (already completed); enhanced bioremediation by injecting a hydrogen-releasing compound (HRC) into the contaminated groundwater to boost the natural attenuation; LTM of the sites to monitor expected reductions in contaminant concentrations, estimated to continue for approximately 25 years, and; land use controls (LUC) to restrict groundwater use at Sites 20 and 23 until levels of COCs are reduced to concentrations that allow for unlimited use and unrestricted exposure.

Groundwater remediation using in-situ chemical oxidation was completed in 2009. At Site 20, a total of 41,815 gallons of 3DMe™ emulsion was injected into 32 temporary injection points within two plume areas (Treatment zones 20A and 20B) between June 25 and July 7, 2009 (CH2M, 2011). Post-injection monitoring was performed in January 2010 (6-months post-injection monitoring), April 2010 (9-months post-injection), and July 2010 (12-months post-injection).

An Interim Remedial Action Completion Report (IRACR) for Sites 20 and 23 was finalized in May 2011 (Tetra Tech, 2011a). The first Five-Year Review (for Sites 20/23) was completed in 2015 and is currently under review.

Ongoing Requirements: LTO at Sites 20 and 23 is currently underway. Remedy performance groundwater sampling was performed in August 2016 and March 2017.Testing of groundwater for perfluorinated chemicals (PFCs)was also performed in August 2016. The results showed two well locations that exceeded the EPA's Lifetime Health Advisory (LHA). While there is no immediate risk due

to the fact that the shallow aquifer underlying the installation is not used for potable water, further evaluation is planned.

A detailed chronology of events for Sites 20 and 23 is provided in the Five Year Review.

5.3 SITE 23 - BUILDING 480 LOT (PCB STORAGE)

Site 23 - Building 480 Lot (PCB Storage) (SWMU 72)	
Location: north of Building 480, along Tisdale Road in the southeastern portion of Mainside. (See **Figure 5-4**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Site consists of a half-acre storage lot used for large metal items, such as electric transformers, since the 1960s.	Due to their proximity and consistent contamination, Site 20 and Site 23 (Section 4.3) were combined during investigation and remediation. Source removed occurred in 2008 and groundwater remediation was completed in 2009. LTO and remedy performance evaluation are currently underway. Next Five-Year Review due in December 2018.

Background: Site 23 consists of scrap yard and storage area for large metal items, surrounded by a 5-foot high chain-link fence. Items stored at the site since the 1960s included electric transformers and equipment, bricks, conduit, concrete blocks, empty new tanks, and empty 55-gallon drums. In the past, used transformers were stored in the northeast corner of the lot. Since November 1986, only new, non-PCB transformers have been stored there.

Work Completed: The SSP Investigation performed at this site in 1996 included soil and groundwater sampling (B&R Environmental, 1997). Surface and subsurface soils were collected within the fenced area and along the primary and secondary drainage swales at the site. SVOCs, PCBs, and inorganic contaminants in surface soils were the primary concerns following a risk based screening evaluation completed for the draft SSP Report. VOCs detected in groundwater were suspected to be related to an upgradient source (Site 20).

A revised SSP Report was completed in September 2003 in order to characterize the environmental condition of Site 23. This report included updated risk evaluations based on new and old analytical data, and recommended removal action should be completed for the gun barrel cutting metal debris found just west of the fenced area and in the drainage ditch. In 2004 the DIRT determined that due to their proximity and similarity in contaminants, groundwater at Site 23 should be remediated along with Site 20;

therefore all activities associated with Site 23 after 2004, including enhanced bioremediation of groundwater, are identical to those presented for Site 20, above.

In 2008, approximately 269 tons of soil were excavated from Site 23. Verification samples collected in the excavation between the concrete wall and the former railroad bed indicated elevated arsenic concentrations. This issue was discussed at the March 2008 DIRT meeting and it was determined that the excavation should be backfilled with gravel until the appropriate course of action is determined to address the arsenic. Additional soil samples were collected in March 2009. Analytical results indicated the presence of arsenic in soils in the ditch at concentrations more elevated than previously detected. It was concluded that the arsenic concentrations were not related to Site 23, but are likely attributed to the historical application of herbicide along the former railroad bed. A land-use limitation has been documented in the base GIS and Master Plan to prevent future disturbance of these soils.

Groundwater remediation using in-situ chemical oxidation was completed in 2009. At Site 20, a total of 41,815 gallons of 3DMe™ emulsion was injected into 32 temporary injection points within two plume areas (Treatment zones 20A and 20B) between June 25 and July 7, 2009 (CH2M, 2011). Post-injection monitoring was performed in January 2010 (6-months post-injection monitoring), April 2010 (9-months post-injection), and July 2010 (12-months post-injection).

An Interim Remedial Action Completion Report (IRACR) for Sites 20 and 23 was finalized in May 2011 (Tetra Tech, 2011a). The first Five-Year Review (for Sites 20/23) was completed in 2015 and is currently under review.

Ongoing Requirements: LTO at Sites 20 and 23 is currently underway. Groundwater sampling was performed in August 2016 and March 2017Testing of groundwater for perfluorinated chemicals (PFCs)was also performed in August 2016. The results showed one well location that exceeded the EPA's LHA. While there is no immediate risk due to the fact that the shallow aquifer underlying the installation is not used for potable water, further evaluation is planned.

A detailed chronology of events for Sites 20 and 23 is provided in the Five Year Review.

5.4 SITE 37 - LEAD CONTAMINATION AREA

Site 37 - Lead Contamination Area (SWMU 108)	
Location: in the "yard craft" area, on Twenty Millimeter Lane, at the southern tip of the installation at the confluence of Upper Machodoc Creek and the Potomac River (See **Figure 5-5**.)	
Environmental Conditions at Discovery:	**Current Site Status:**

Large quantities of sand containing lead residues from projectiles (as well as the projectiles themselves) fired on nearby ranges were disposed of in this area for shoreline stabilization.	Remedial Action completed in 2007. Next Five-Year Review due in December 2018.

Background: An indoor machine gun range with a sand trap was constructed at the site in the early 1940s and underwent a couple of expansions. The variety of ammunition fired at this site was reported to include 0.50-inch, 5.56-millimeter (mm), 7.62-mm, and 40-mm ammunition. Ammunition remnants were noted outside the range building in the disposal area. The site has not been used heavily since the mid-1970s. The shoreline in the vicinity of the machine gun range has also changed over time, as evidenced by aerial photography. Much of the filling conducted in this area took place between 1937 and 1943 (based on aerial photos from those years); subsequent filling was more gradual. Disposal of sand from the machine gun range has contributed some portion of fill to the evolving shoreline.

Work Completed: A SSP was performed at this site and included surface and subsurface soil, surface water, sediment, and groundwater sampling (B&R Environmental, 1997). The 1997 SSP investigation recommended an RI/FS. The RI was completed in 2003. Results indicated heavy metals (e.g., lead, iron, aluminum, copper, and nickel) and SVOCs were present in Site 37 soils. SVOC concentrations (PAHs, in particular) in surface soils at Site 37 are considered to be a potential risk to ecological receptors. SVOCs in the subsurface are likely related to deposition of dredge spoils during storm events and past shoreline filling/restoration activities.

An RI was completed in March 2003. The human health risk assessment concluded that risk levels at the site are within acceptable levels based on current and future exposure scenarios. The ecological risk assessment concluded that there are potential risks to terrestrial and aquatic receptors from SVOCs, explosives, and metals concentrations found in soil and sediment. Therefore the RI recommended that a FS be developed to evaluate potential remedial alternatives. In September 2003, Hurricane Isabel caused water levels in nearby Potomac River to reach 6 to 9 feet above normal levels. Combined high winds, storm surge and waves not only eroded away what little protection was available at the Building 200 shoreline, but uncovered previous lead contamination and eroded away existing vegetation.

The FS was completed in August 2004 and recommended excavation and off-site disposal of gun butt sands and contaminated soil in a permitted landfill. The ROD was prepared for Site 37 in Fall 2004. A ROD Amendment was completed in 2006 to modify the selected remedy to include a soil cover, rip rap shoreline stabilization and geotextile marine mattresses. Construction was completed in October 2007 (Navy, 2007c). A Remedial Action Completion Report (RACR) for Site 37 was signed by the Navy in January 2009 and approved by the EPA in April 2009 (Sovereign, 2009).

Ongoing Requirements: Monitoring of Site 37 wetlands for invasive vegetation is being conducted annually outside of the Environmental Restoration Program. VDEQ inspects the Site 37 constructed shoreline annually. Additional maintenance activities for Site 37 are conducted annually and is described in the Dahlgren Landfill O&M Manual for Sites 2, 9, 17 and 37 (Tetra Tech, 2004b). Institutional controls (IC) are in place to ensure that the soil cover is not disturbed. .

A detailed chronology of events for Site 37 is provided in the Five Year Review.

5.5 SITE 56 - GUN BARREL DEGREASING AREA, RAILWAY SPUR

Site 56 - Gun Barrel Degreasing Area, Railway Spur (SWMU 132)	
Location: along an inactive railroad track between Route 301 and Magazine #4, close to Gate B on Mainside. (See **Figure 5-6**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Used from 1961 to 1975 to store and degrease gun barrels. Small quantities of a "tarry" substance were noted on the railroad tracks and appeared to be related to the degreasing operations.	No further action planned, and Decision Document not warranted.

Background: In the 1960s and 1970s, an approximate one-mile length of inactive railroad track was used to clean as many as 6,000 3-inch and 5-inch diameter 54-caliber gun barrels at a time. Currently, the rail line is overgrown with trees and brush and the railroad tracks have been removed. Degreasing the inside of the gun barrels was accomplished with steam injection to remove cosmoline, a grease preservative containing mineral spirits that is used to prevent rust. A small amount of trichloroethene (TCE) or other solvent was used to remove any residual preservative. Good gun barrels were recoated with cosmoline and placed back in service, and gun barrels that could not be restored to specifications were sent out as scrap metal.

Work Completed: SSP and addendum SSP investigations were completed at Site 56 in 1996 and 2001, respectively. Minimal amounts of the contamination found at the site could be directly attributed to past gun barrel degreasing operations. Based on the contents of the SSP report, no further action was recommended for Site 56 under CERCLA. The contamination and associated risk appears to be consistent with that found at other railroad rights of way and does not appear to be associated with historical gun barrel degreasing operations. A Decision Document was not warranted based on consensus of the Parties.

Ongoing Requirements: None.

5.6 SITE 57 - SHELL HOUSE DUMP

Site 57 - Shell House Dump (SWMU 133)	
Location: north of Building 985 and bordering the northern edge of Buck Lane Road in the northwest portion of Mainside. (See **Figure 5-7**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Surface disposal of wastes was identified at this site and was suspected to be associated with the nearby Shell House complex.	Surface debris removed in 2011. No further remedial action is planned. Decision Document signed in 2015.

Background: This site is about one acre in size and was used from the 1960s to the late 1970s as a repository for metal objects and debris. The following items were found at the site: four inert HedgeHog bombs, old fiberglass rocket motor cases, aircraft parts, wooden pallets, ammunition crates, and one 55-gallon drum of roofing tar. The HedgeHog bombs and 55-gallon drum were removed and disposed of properly.

Work Completed: The SSP investigation was completed between 1996 and 2003. Based on the results of the contamination assessment and risk screening evaluation in the draft SSP Report (B&R Environmental, 1997), SVOCs (specifically PAHs) and metals in surface soils were the primary concerns for Site 57. Since PAHs were not detected in subsurface soils, the contamination had not migrated vertically and appeared to be localized in the shallow soils. Concentrations of cadmium, copper, lead, mercury, and zinc in the surface soil were considered potential risks to ecological receptors. The unacceptable ecological risk was confined to metals and PAHs results in one surface soil sample, SS57-7. An initial SSP Report recommended a removal action to address the localized contamination in the surface soils and to achieve risk-based cleanup goals. Specifically, the surface soil piles in the vicinity of sample locations SS57-5 and SS57-7 were to be excavated; visible surface debris was to be cleaned up; and contaminated soils were to be disposed offsite.

Addendum SSP work was performed in 2001 and 2002, including sampling in an adjacent drainage ditch, to fill data gaps identified in the draft SSP Priority 2 Sites Report. Contaminants found in sediments and surface water in the intermittent drainage ditch appeared to be primarily derived from an unknown source upstream of Site 57. The human health risk assessment found no unacceptable risks. The ecological risk assessment and risk management found potential risk from PAHs, pesticides and several metals in surface soils. An expanded surface soil/sediment sampling investigation was completed in 2009.

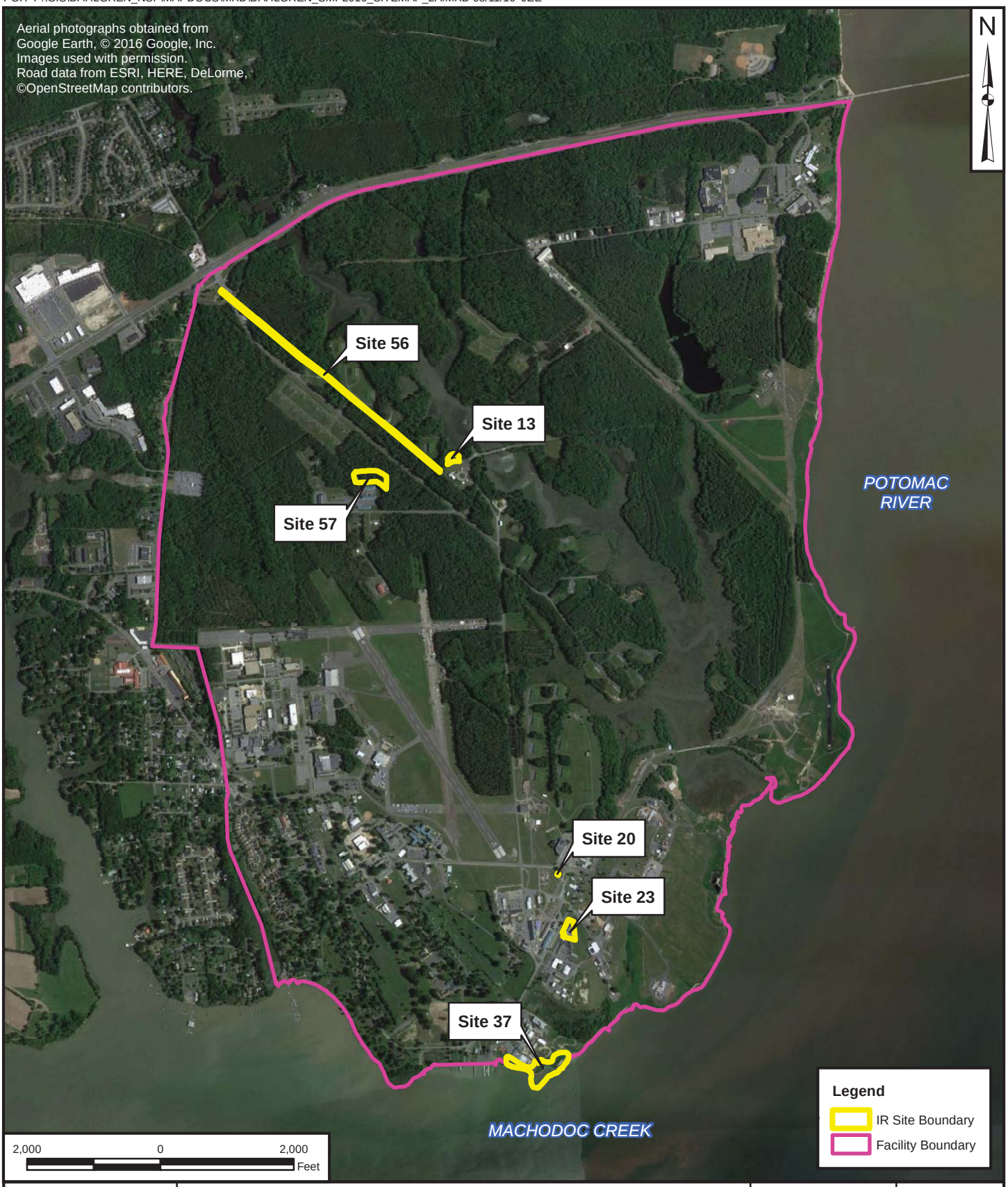
Constituents detected in surface soil and sediment samples from the ditch could not be directly attributed to Site 57.

An EE/CA (Tetra Tech, 2009) prepared in October 2009 recommended that surface debris, areas of mounded soil, or “piles”, and surface soil “hot spots” would be removed. In March 2010, the DIRT discussed Navy concerns over the interference of proposed removal activities with nearby base magazine activities, and the potential habitat destruction and impacts of related tree clearing. The DIRT decided that a limited removal of surface waste debris would be conducted, and soil piles would be removed, only if required, pending characterization sampling of the piles. In October 2010, composite soil samples were collected from three soil piles, each greater than 30 cubic yards in volume, located on the site (Tetra Tech, 2011b). At a meeting in December 2010, the DIRT Team reviewed the soil analytical data from the piles and agreed that the site soil presents no risks, but that a surface debris removal should be conducted.

Surface debris was removed from Site 57 in 2011. A total of approximately 1,000 pounds of metal waste was disposed of at the Defense Reutilization and Marketing Office (DRMO) metal recycling Hangar 120B and approximately 500 pounds of fiberglass Rocket Motor debris was disposed at the Shell House Building 985. Metal and fiberglass debris removal activities at Site 57 are complete and no further debris removal is required (AGVIQ/CH2MHill, 2012). The Site 57 “No Further Action” Decision Document was prepared and signed in 2015.

Ongoing Requirements: None.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_2A.MXD 08/11/16 JEE

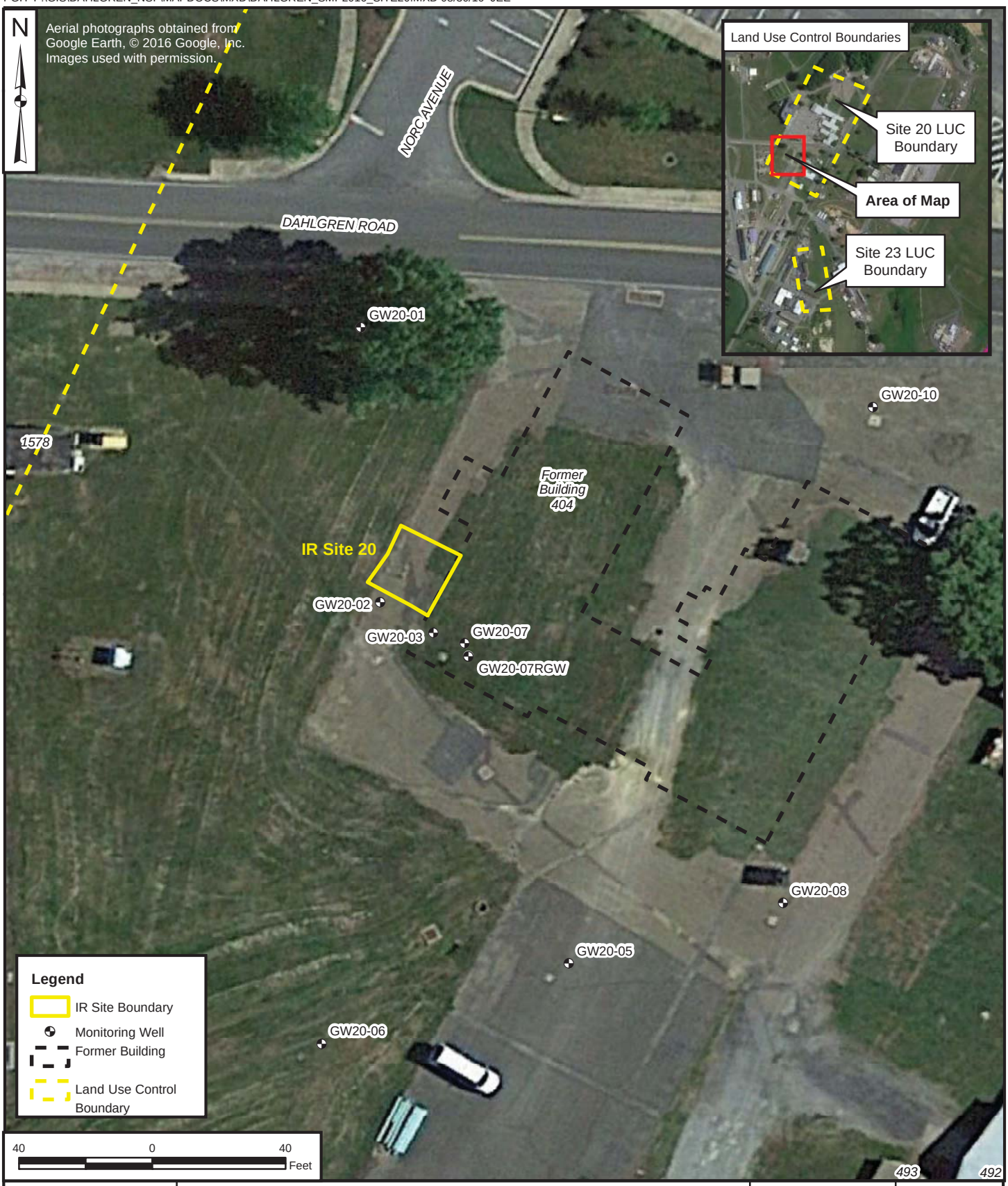


DRAWN BY: J. ENGLISH	DATE: 08/11/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/11/16	ALL PRIORITY 2 SITES NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 5-1	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE13.MXD 08/11/16 JEE

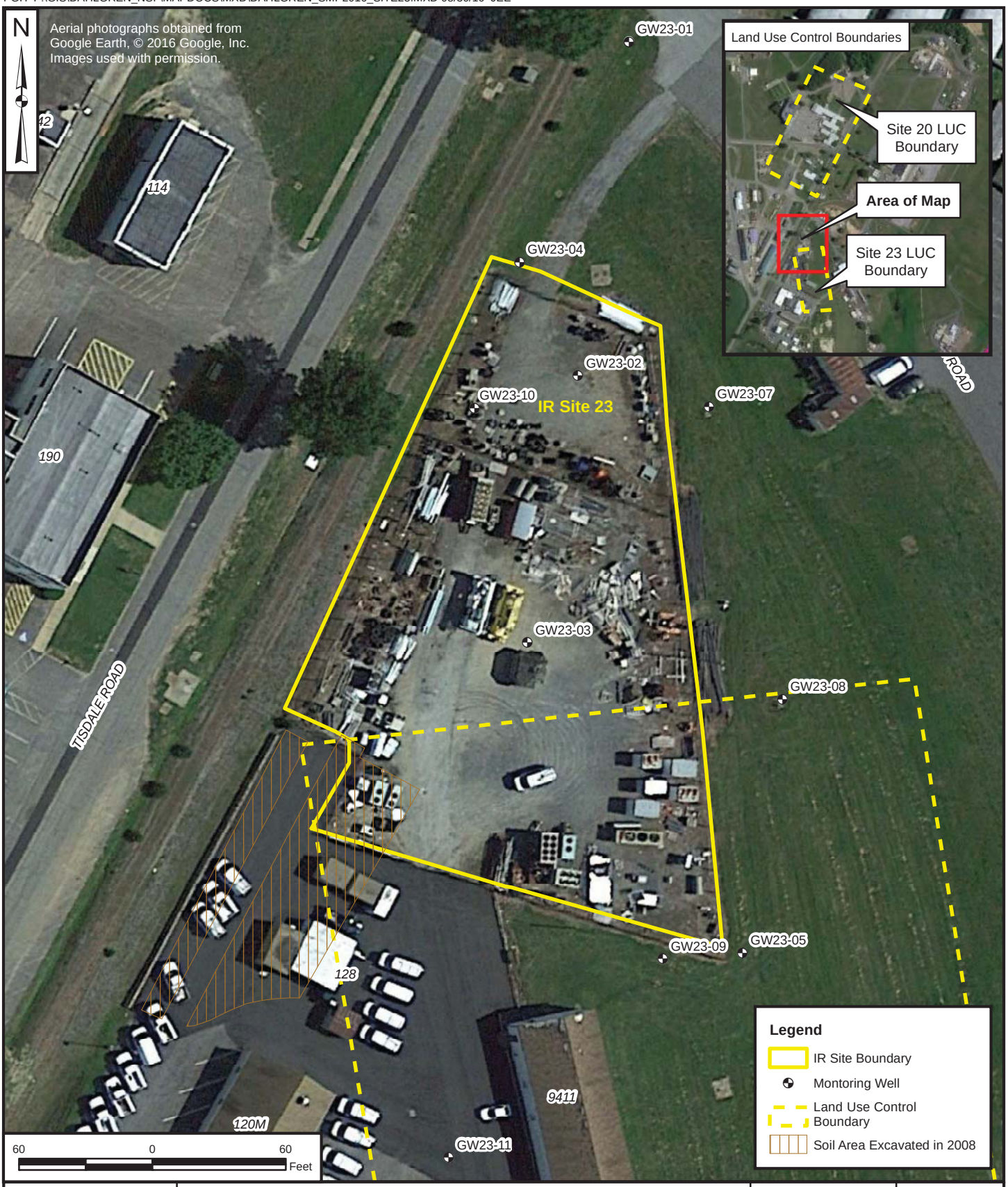
DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/11/16	IR SITE 13 - GAMBO CREEK TRUCK WASH AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 5-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE20.MXD 08/30/16 JEE



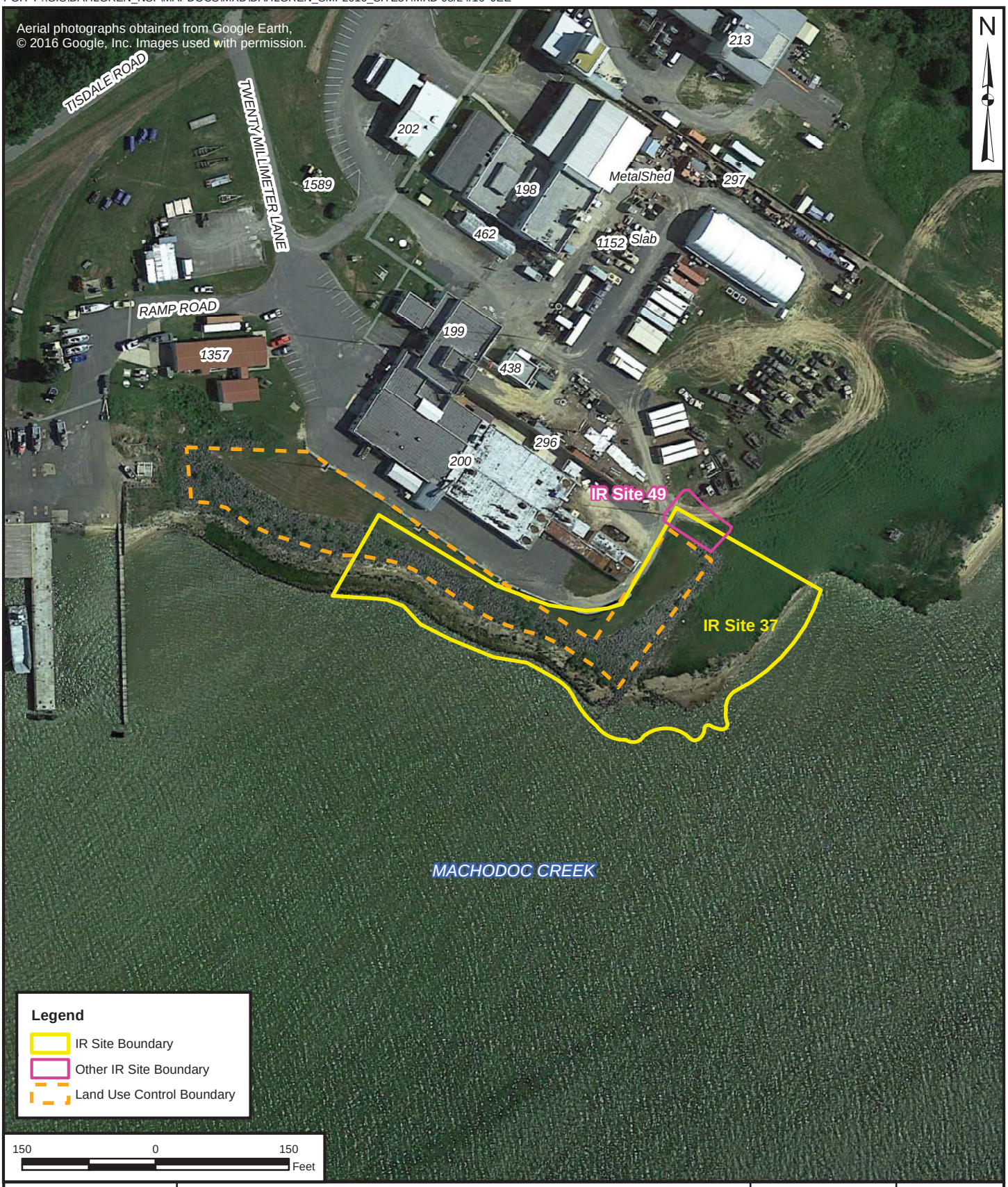
DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/30/16	IR SITE 20 - FORMER ELECTROPLATING WASTE UST NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 5-3	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE23.MXD 08/30/16 JEE



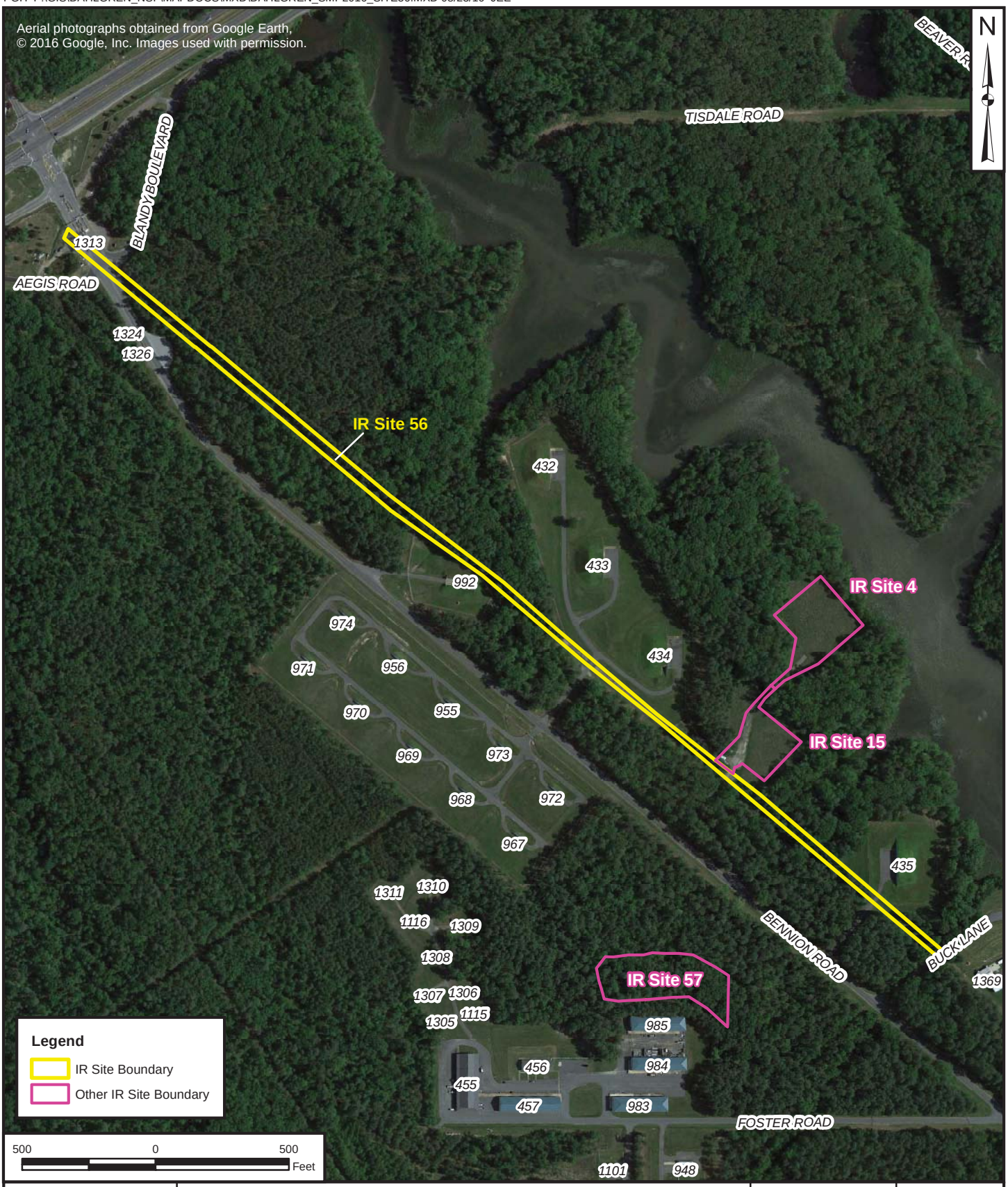
DRAWN BY: J. ENGLISH	DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/30/16	IR SITE 23 - BUILDING 480 LOT (PCB STORAGE) NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 5-4	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE37.MXD 08/24/16 JEE



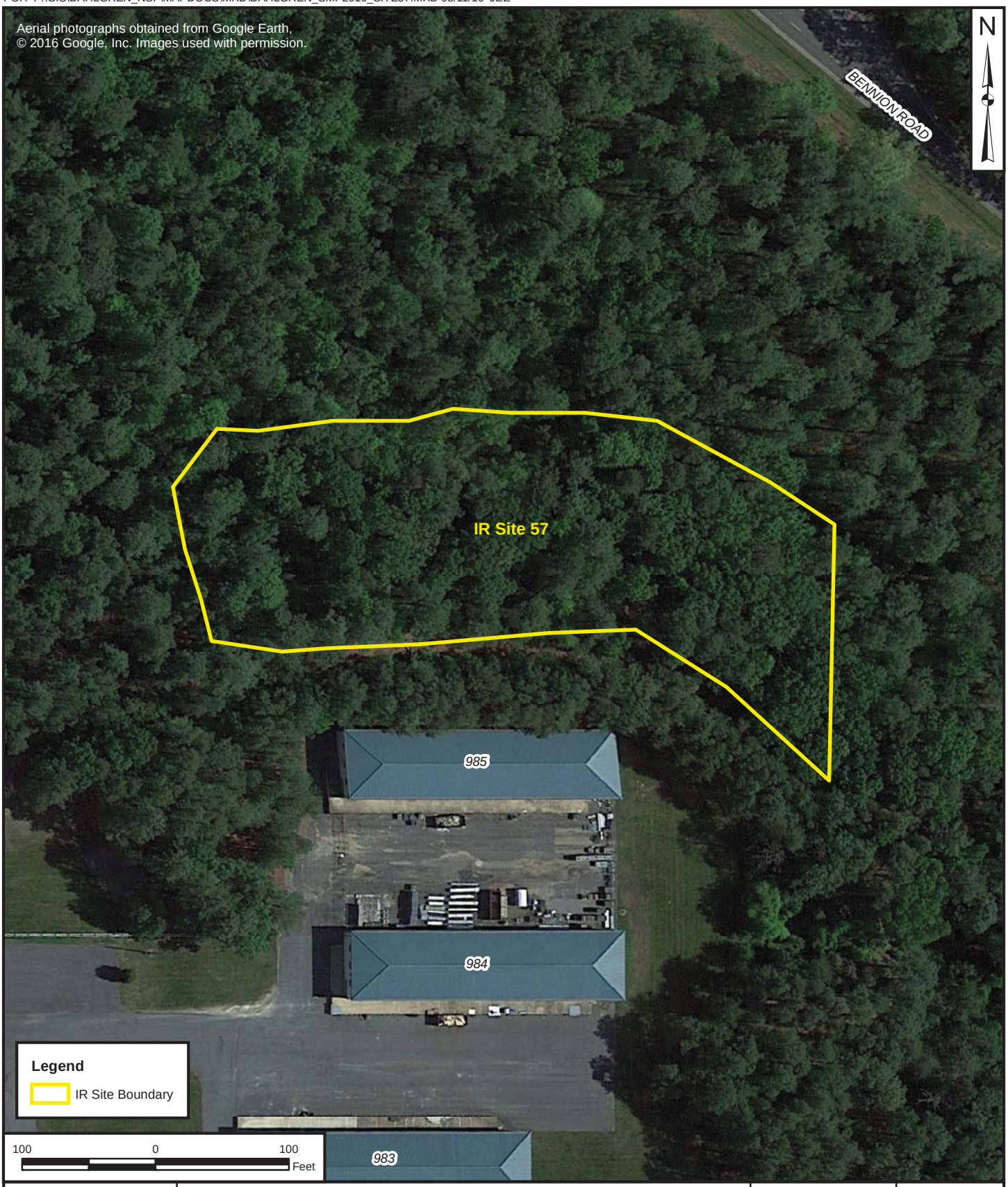
DRAWN BY: J. ENGLISH	DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992 / CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/24/16	IR SITE 37 - LEAD CONTAMINATION AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ / DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___ / DATE: ___
SCALE: AS NOTED			FIGURE NO.: 5-5 / REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE56.MXD 08/23/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/23/16	IR SITE 56 - GUN BARREL DEGREASING AREA, RAILWAY SPUR NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 5-6	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE57.MXD 08/11/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/11/16	IR SITE 57 - SHELL HOUSE DUMP NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 5-7	REV: 0

6.0 APPENDIX A – PRIORITY 3 SITES

There are ten Priority 3 sites at the NSFDL, all located on the Mainside Area (**Figure 6-1**). A summary table including the rationale for being listed and investigated, and the current status is provided for each site. For each site, a brief summary of the site history and IR activities follows each table.

6.1 SITE 4 - CASE STORAGE AREA

Site 4 - Case Storage Area	
Location: on the western bank of Gambo Creek at the end of an access road off Bennion Road, in the northwestern quadrant of Mainside. (See **Figure 6-2**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Originally used for storing ordnance items including empty projectile cases, ammunition containers, powder cases, rocket motor cases, etc. beginning in the 1940s. The site continued to be used by the DRMO until 2002 to store radar vans and systems, antennas, machine shop equipment, and surplus metal working equipment.	Removal action completed from 2005-2011. Due to their proximity and similarity of contaminants, Sites 4 and 15 were remediated concurrently. An updated risk assessment and Decision Document was in progress from 2014-2016; however the USEPA has requested additional sampling of sediments in Gambo Creek adjacent to Site 4. This work is being planned for 2018.

Background: Site 4 is approximately 1.1 acres in size, currently a grass-covered field, and surrounded on all sides by woodland. The northeastern edge of Site 4 slopes steeply to Gambo Creek. The DRMO used Site 4 primarily for storing ordnance materials for inert certification, disposal, and reutilization until Fall 2002. However, it was discovered during site investigation that fill had been placed in the area over time, and it included some munitions items such as spent shells.

Work Completed: A geophysical survey was conducted at Site 4 during a 2001 SSP investigation to help identify waste contents, depth of buried materials, and lateral extent of the waste. Wastes at Site 4 were relatively shallow, with depths up to 6 feet. The SSP report was issued in July 2003 and was finalized in September 2004 (CH2M Hill, 2005d). The SSP report summarized the results of geophysical testing, trenching, and soil, groundwater, surface water and sediment sampling activities, included a quantitative risk assessment for Site 4, and recommended a removal action based on the findings.

Due to their proximity to each other and similarity of contaminants, remedial actions at Sites 4 and 15 were completed together. A Final EE/CA (JMWA, 2004c) was submitted for Sites 4 and 15 in September 2004. The EE/CA recommended excavation of contaminated soil and debris, soil screening, reuse of soil as backfill, off-site disposal of the contaminated materials, and site restoration. Excavation activities at

Site 4 using a tracked excavator with a blast shield (required for safety in the process of recovering ordnance related items) began in April 2005. During excavation, more MPPEH was encountered than anticipated, and the excavation had to be expanded.

In 2006, the Navy determined a need to prepare a draft ESS for Sites 4 and 15. The ESS was initially prepared by CH2MHill in Fall 2006 but had to be revised due to changes in the Explosives Standard Operating Procedures. The revised ESS was approved in January 2009. A VSAP for Sites 4 and 15 was finalized and submitted in June 2008. Excavation work resumed in May 2009 and was completed in June 2011 (JMWA, 2012). Overall, approximately 4,592 cubic yards of soil was excavated and screened at Site 4. Additionally, approximately 2,909 lbs of scrap metal, and 1,952 lbs of munition-related debris was recovered from Site 4 (NSWC, 2012a). Scrap metal and munitions-related debris were visually verified inert and shipped off-site to a recycling facility. Site 4 was regraded and re-seeded in the Fall of 2010. A Removal Action Completion Report was prepared and completed in 2012 (NSWC, 2012a). Additionally, a Munitions Response After-Action Report was prepared and completed in 2012 (NSWC, 2012b).

A Decision Document to indicate no further remediation was planned and drafted for Sites 4 and 15 in 2014. At that time, the USEPA expressed concerns with metals previously detected in surface soils at Site 4 that could potentially be transported via runoff to Gambo Creek. A risk assessment update was completed by Tetra Tech/H&S Environmental in 2015 using pre-excavation data to re-evaluate risks to ecological receptors, using current risk screening guidance and criteria. The risk update, intended to be included as an attachment to a Decision Document, found risks to terrestrial plants and soil invertebrates were still in an unacceptable range given zinc concentrations, primarily at one surface soil sample location at Site 4. The risk conclusions were reviewed by the Parties, and it was decided that additional sampling of surface and subsurface soil in the elevated zinc area would be performed to support the risk assessment update, and that given the removal action at Site 4, risks using select SSP data were likely overstated.

A UFP-SAP was prepared for supplemental soil sampling and metals analysis at Sites 4 and 15 in early 2016. This plan was presented to BTAG at a June 2016 partnering meeting, and BTAG has requested that sediment sampling and analysis for metals and PCBs, at a minimum, be added to the supplemental sampling program for Site 4. This approach is currently being discussed and may proceed under a UFP-SAP update in 2017. Additional sampling at Site 4 and Site 15 are currently planned for FY18.

Ongoing Requirements: Supplemental soil and sediment sampling may be required at Sites 4 and 15 to support site closeout. This sampling is planned for 2018.

6.2 SITE 14 - CW EVAPORATION POND

Site 14 - CW Evaporation Pond (SWMU 28)	
Location: south of Building 1356, between Bennion Road and Caskey Road at Mainside. (See **Figure 6-3**)	
Environmental Conditions at Discovery:	**Current Site Status:**
An evaporation pond constructed in 1967 was used in the treatment and disposal of solutions of decontaminated CW until the late 1970s. Treated electroplating waste solutions were also placed in the evaporation pond on occasion.	Soil removal completed in 2008; piping removal and groundwater treatment completed in 2009. Remedial performance monitoring is ongoing.

Background: The site includes the former CW Evaporation Pond which was approximately 120 feet by 60 feet in size with a depth of approximately 2 feet. The pond received wastewater piped from nearby Building 1356 following the neutralization of CW waste. Neutralized solutions were allowed to evaporate, and residue was removed from the pond and burned at Site 12 or disposed elsewhere.

Work Completed: In April 1982, samples of water, sludge, and surrounding soil at the CW Evaporation Pond were collected and analyzed to see if they exhibited any characteristics of hazardous waste. Results indicated that the water, sludge, and surrounding soil are not hazardous. In the mid-1980s the CW Evaporation Pond was closed and all sludge and soils suspected of being contaminated were disposed of as a listed waste offsite at a RCRA Subtitle C landfill. Additionally, three groundwater monitoring wells were installed and the area was regraded.

An SSP investigation was completed at the site between December 2001 and March 2002, and the SSP report was finalized in September 2004 (CH2M Hill, 2005d). During the SSP field work, three additional monitoring wells were installed and sampled to characterize groundwater. In addition, seven surface soil, three subsurface soil, one surface water, and four sediment samples were collected and analyzed at Site 14. The SSP report recommended hot spot removal of surface and subsurface soils containing elevated levels of chromium and verification sampling. Updated risk assessments were recommended using newer, verification sampling data. A pre-EE/CA soil investigation was conducted by CH2M Hill from January to March 2005 to characterize chromium (total and hexavalent) concentrations in subsurface soil to identify the extent of the proposed removal action (CH2M Hill, 2006b).

Results of the 2005 sampling indicated total chromium was detected at concentrations of 5.5 mg/kg to 574 mg/kg in the 5 to 6 foot depth interval, and 1.5 to 26.2 mg/kg (some still above background level of 18.5 mg/kg) in the 9 to 10 feet bgs sample depth. The final EE/CA was prepared by CH2M Hill in

April 2006 and the recommended alternative consisted of the excavation and removal of subsurface soil from 2 to 7 feet bgs (based on a cleanup level of 42 mg/kg hexavalent chromium); application of a calcium polysulfide compound at approximately 10 feet bgs; offsite disposal of contaminated soil, and backfill with clean fill.

The “Final Action Memorandum Site 14 – Former Chemical Waste Evaporation Pond” was finalized in 2006 to document approval of the recommended non-time critical removal action at Site 14 (CH2M Hill, 2006c). A Removal Action began in January 2008 including pipeline sampling and evacuation of the previous chemical waste piping. There was no evidence of chemical waste in pipe fluid samples. Overburden soils were excavated and staged on-site for re-use. Following removal of the estimated volume of soil above action levels to 7 feet bgs, confirmation samples indicated chromium was still present above the action levels at the base of the excavation and along the south and west side walls. An additional two feet of soil was excavated from these areas until action levels were achieved. Approximately 2,750 tons of impacted soils were excavated and transported to an off-site disposal facility.

Excavation of “clean” subsurface soils was then conducted to approximately eleven feet below grade exposing the groundwater table. Following the exposure of groundwater approximately 3,100 gallons of calcium polysulfide was pumped into the excavation footprint and allowed to combine with the groundwater. The calcium polysulfide is intended to facilitate the conversion of hexavalent chromium to trivalent chromium. The excavation was then backfilled with stone, clean fill and previously staged overburden. The contaminated soil was sent for offsite treatment and subsequent disposal at a RCRA Subtitle D landfill. The removal of remaining underground piping was completed in March 2009. Although no chemical wastes were detected, the individual sections of pipeline were shipped offsite for thermal treatment as a precaution prior to disposal as non-hazardous waste in a RCRA Subtitle C (Hazardous Waste) Landfill.

Four quarterly rounds of post-remedial groundwater sampling were completed in 2009-2010. Results indicated that the excavation and groundwater treatment resulted in a significant decrease in the overall concentrations of total chromium and Cr(VI) within the groundwater at Site 14. However, GW14-05 continued to have chromium concentrations above the MCL. A combined RI/FFS was completed in 2012 to define the overall nature and extent of contamination remaining at Site 14. The remedial alternative selected in the FFS for Site 14 groundwater was Chemical Reduction Treatment using In-Situ Chemical Reduction. A draft ROD was submitted in 2013. However, the Site Remediation Goals identified in the RI/FFS were no longer accepted by USEPA based on risk criteria for hexavalent chromium being revised before the ROD could be finalized.

Since the previous groundwater sampling round was conducted in 2008, the DIRT decided to re-sample groundwater using current hexavalent chromium methodology at the site to determine the current groundwater conditions. Additionally, an up-gradient background well was installed in July 2016. Groundwater at Site 14 was also analyzed for PFCs given the historical handling of electroplating waste solutions at the former pond. Two rounds of groundwater sampling were completed in August 2016 and March 2017. The results of the PFC analysis showed zero well locations that exceeded the EPA's Lifetime Health Advisory (LHA).

Ongoing Requirements: Groundwater sampling was performed in August 2016 and March 2017, and one pore water sampling was also performed in March 2017, as part of addendum RI/FS activities to support future remedy selection and site closeout.

6.3 SITE 15 - SCRAP AREA

Site 15 - Scrap Area	
Location: off the same access road as Site 4 off Bennion Road, near Gambo Creek in the northwestern quadrant at Mainside. (See **Figure 6-4**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Used as a DRMO storage area beginning in the 1940s to stage ordnance-related items prior to inert certification. Other items began accumulating in the 1960s including scrap metal, abandoned equipment, and projectiles/shells.	Removal action completed from 2005-2011. Due to their proximity and similarity of contaminants, Sites 4 and 15 were remediated concurrently. An updated risk assessment and Decision Document was in progress from 2014-2016; however the USEPA has requested additional sampling of sediments in Gambo Creek adjacent to Site 15. This work is being planned for 2018.

Background: Site 15 is approximately 0.73 acres in size and surrounded on all sides by woodland. Drainage from Site 15 flows to Gambo Creek, which is approximately 300 feet to the east. Similar to Site 4, the Scrap Area began operations in the 1940s as a DRMO lot. The lot was used primarily for storing ordnance materials for inert certification, disposal, and reutilization until Fall 2002. The items stored here included sheet metal, old machinery, tires, electrical equipment, and railroad ties.

Work Completed: A geophysical survey was conducted at Site 15 during a 2004 SSP investigation to help identify waste contents, depth of buried materials, and lateral extent of the waste. Wastes at Site 15 were relatively shallow, with depths up to 6 feet. A SSP report was issued in July 2003 and finalized in September 2004 (CH2M Hill, 2005d). The SSP report summarized the results of geophysical testing,

trenching, and soil, groundwater, surface water and sediment sampling activities, included a quantitative risk assessment for Site 15, and recommended a removal action based on the findings.

Due to their proximity to each other and similarity of contaminants, remedial actions at Sites 4 and 15 were completed together. A Final EE/CA (JMWA, 2004c) was submitted for Sites 4 and 15 in September 2004. The EE/CA recommended excavation of contaminated soil and debris, soil screening, reuse of soil as backfill, off-site disposal of the contaminated materials, and site restoration. Excavation activities at Site 4 using a tracked excavator with a blast shield (required for safety in the process of recovering ordnance related items) began in April 2005. During excavation, MPPEH was encountered. The excavation at Site 15 removed 80 tons scrap metal, 4,389 tons of contaminated soil for off-site disposal, 1,727 pounds MPPEH, and 9.6 tons construction debris. A Removal Action Completion Report was prepared and completed in 2012 (NSWC, 2012a). Additionally, a Munitions Response After-Action Report was prepared and completed in 2012 (NSWC, 2012b).

A Decision Document to indicate no further remediation was planned was drafted for Sites 4 and 15 in 2014. At that time, the USEPA expressed concerns with metals previously detected in surface soils at Site 15 that could potentially be transported via runoff to Gambo Creek. A risk assessment update was completed by Tetra Tech/H&S Environmental in 2015 using pre-excavation data to re-evaluate risks to ecological receptors, using current risk screening guidance and criteria. The risk update, intended to be included as an attachment to a Decision Document, found risks to terrestrial plants and soil invertebrates were still in an unacceptable range given hexavalent chromium concentrations in previous Site 15 surface soils samples. The risk conclusions were reviewed by the Parties, and it was decided that additional sampling of surface and subsurface soil at Site 15 would be performed to support the risk assessment update, risks using SSP hexavalent chromium data were likely overstated given the dated analytical methodology.

A UFP-SAP was prepared for supplemental soil sampling and metals analysis at Sites 4 and 15 in early 2016. This plan was presented to BTAG at a June 2016 partnering meeting, and BTAG has requested that sediment sampling and analysis for metals and PCBs, at a minimum, be added to the supplemental sampling program for Site 15. This approach is currently being discussed and may proceed under a UFP-SAP update in 2017. Additional sampling at Site 4 and Site 15 are currently planned for FY18.

Ongoing Requirements: Supplemental soil and sediment sampling may be required at Sites 4 and 15 to support site closeout. This sampling is planned for 2018.

6.4 SITE 38 - BUILDING 1349 PEST CONTROL OUTSIDE AREA

Site 38 - Building 1349 Pest Control Outside Area (AOC I)	
Location: on the eastern side of the historical Pest Control Building (Bldg. 1349), between Frontage Road and an abandoned railroad bed in the northeast portion of Mainside. (See **Figure 6-5**)	
Environmental Conditions at Discovery:	**Current Site Status:**
A concrete pad formerly used to stage trailers that carry pest control equipment, including bulk pesticides and spray hoses, and as an area to mix pesticides.	Closed out as No Further Action under a CERCLA residential use scenario; no Decision Document prepared.

Background: Site 38 consisted of the NSFDL's outdoor pesticide mixing and transfer area prior to the 1990s. The area consists of a gravel-covered parking lot approximately 500 square feet and a concrete pad measuring approximately 15 feet by 20 feet. The gravel lot is bermed with soil on two sides. The concrete pad is sloped and has an approximately 4-inch high concrete berm on the lower sides, and a drain in the lower end. The concrete pad berm had an opening approximately one foot in length that would allow liquids on the pad to flow onto the gravel lot. Liquids that entered the drain at the lower half of the pad would flow to a lift station and then to the storm sewer. The drain was plugged in 1994.

Work Completed: An SSP investigation was completed at Site 38 between December 2001 and March 2002 (CH2M Hill, 2005d). Three monitoring wells were installed and sampled to characterize groundwater. In addition, six surface soil and three subsurface soil samples were collected at Site 38. Based on results of the final SSP Report, No Further Action under a CERCLA residential use scenario was recommended and accepted by the DIRT on May 2005 and Site 38 was closed out. A Decision Document was not prepared.

Ongoing Requirements: None.

6.5 SITE 40 - BUILDING 120B DRMO LOT

Site 40 - Building 120B DRMO Lot (SWMU 14)	
Location: a paved, DRMO storage lot located behind (east of) Building 120B, off Caskey Road in the south-central portion of Mainside. (See **Figure 6-6**.)	
Environmental Conditions at Discovery:	**Current Site Status:**
Since 1945, the lot was used for the storage of scrap metal and used batteries, as well as other equipment awaiting disposal or recycling.	Closed out as No Further Action under a CERCLA industrial use scenario; no Decision Document prepared.

Background: The DRMO lot is approximately one acre in size and surrounded by an approximately 7-foot high chain-link fence. This asphalt lot is used to store product supplies, such as metal equipment and drums of hydraulic oil, motor oil, potassium hydroxide, and cleaning/degreasing solvents. Waste lead-acid batteries and scrap metal were also stored there.

Work Completed: The results of a SSP investigation completed in 2001 indicated the presence of inorganics, VOCs, SVOCs, pesticides, and PCBs in the surface soil, subsurface soil, and the groundwater at Site 40. Industrial screening criteria were used in the human health risk assessment, and there were no Contaminants of Potential Concern (COPC) identified in surface and subsurface soil under the industrial use scenario. Two VOCs and three pesticides were retained as COPC in groundwater; however, the VOCs and beta-BHC were not detected above their respective MCLs. The ecological risk assessment indicated a potential risk to terrestrial plants and/or soil invertebrates from PAHs (primarily) and from a limited number of inorganic chemicals in the Site 40 surface soil. However, based on the low level of ecological risk indicated by Step 3A risk calculations and the low quality habitat provided by this site, no further evaluation of ecological risk was recommended for Site 40.

A Final SSP Report was submitted in October 2002 and recommended No Further Action for soil and groundwater at Site 40 (CH2M Hill, 2002). Based on results of the final SSP Report, No Further Action under a CERCLA industrial use scenario was recommended and accepted by the DIRT on May 2005 and Site 40 was closed out (CH2M Hill, 2005e). A Decision Document was not prepared.

Ongoing Requirements: None.

6.6 SITE 61A - GAMBO CREEK ASH DUMP

Site 61a - Gambo Creek Ash Dump	
Location: next to the eastern shore of Gambo Creek, north of the Caskey Road bridge crossing and west of IR Sites 3, 12, and 44. (See **Figure 6-7**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Burned ash appeared along the shore of Gambo Creek at this site between 1952 and 1961. Other munitions items and debris areas were found at Site 61a atop the bank of Gambo Creek, including gun primers and cartridges.	Removal actions completed in 2012 to address soil and near-shore sediment. Supplemental sampling completed in December 2015, and additional sampling of sediment completed in December 2016 in support of finalizing the FFS/PRAP/ROD.

Background: Site 61a was an area of ash deposited along Gambo Creek, found in 1997 during an investigation for adjacent Sites 3 and 44. Items discovered at Site 61a include gun primers, partially burned pyrotechnic flares, 20-mm projectiles and cartridge cases, small arms cartridge cases, charred wood, and steel cable. The ash and other material may have been deposited from one of the NSFDL ranges or from the No. 1 Powder Burn Area between 1952 and 1961. The burned ash appears to be contained in one area, about 20 feet by 30 feet in size, located at the high water mark of Gambo Creek. Some erosion of the ash deposit is visible in a fanned-out area located in front of the pile on the Gambo Creek shoreline.

Work Completed: An RI conducted at Site 61a between September 2001 and January 2002 included a geophysical survey; exploratory trenching; and soil, surface water, sediment and groundwater sampling. Analytical results from the RI revealed that six inorganics (chromium, iron, lead, silver, thallium, and zinc) in the surface soil exceeded both the background and ecological screening values. Eight inorganics (beryllium, chromium, iron, lead, silver, thallium vanadium, and zinc) in subsurface soil exceeded background and ecological screening values. Arochlor-1260, dieldrin, heptachlor, and gamma-BHC in sediment exceeded background and ecological screening values. Groundwater contamination with VOCs was attributed to Site 12. The RI was finalized in September 2004 (CH2M Hill, 2004c) and concluded there are ecological risks associated with soil and sediment at Site 61a, and that the waste and debris in the dump area along Gambo Creek are the primary sources of contamination.

A draft FFS was prepared and submitted in June 2004 (CH2M Hill, 2004a). The selected remedial alternative to address buried debris and metallic anomalies at Site 61a was excavation, waste removal and screening, and off-site landfill disposal. During review of the draft FFS in 2005, it was agreed that an additional investigation at Site 61a consisting of groundwater and sediment sampling was warranted to

further assess the nature and extent of contamination prior to finalization of the FFS and preparation of the PRAP and ROD.

Seventeen sediment samples were collected from Gambo Creek in February 2006, and fourteen metals (aluminum, arsenic, barium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, vanadium, and zinc) were detected in the sediment samples at concentrations that exceeded ecological screening values and/or maximum NSFDL background concentrations. Three temporary monitoring wells and one existing permanent well were sampled. Nine VOCs were detected in the groundwater samples, with TCE detected above the MCL at GW61A-01 and carbon tetrachloride was detected above the MCL at GW61A-02. Four different pesticides were detected in two wells, with 4,4'-DDD and 4,4'-DDT exceeding the tap-water RBCs in both wells. Metals concentrations were below MCLs and tap-water RBCs.

An Explosive Safety Submission (ESS) for the Site 61a Pilot Study was prepared and approved by the Naval Ordnance Safety and Security Activity (NOSSA) and the Department of Defense Explosive Safety Board (DDESB) in June 2011. The objectives of the Pilot Study include excavation of Site 61a Debris Areas and mechanical screening to separate potential MEC and MPPEH from debris. Site 61a Pilot Study operations began in May 2012. An initial activity was intrusive anomaly investigation to reaquire anomalies identified in the 2002 geophysical survey. Examples of some of the anomalies include unfired 20-mm projectiles, 20-mm empty powder cases, empty small arms cartridges, primer igniter tubes. These items were thermally treated and found to be inert.

Next, the debris areas were excavated in December 2012. Debris areas 1 and 2 were excavated and screened. The low tide area at the site was also excavated to approximately 2-feet deep, dried and screened. Verification sampling in the low tide area was reviewed by the DIRT team. The laboratory sample results indicated the presence of elevated metals. A geotextile material was placed within the excavation area and backfilled with clean soil to previous grade elevations. This area is being further evaluated in 2017 under an addendum sampling plan.

Following excavation, the debris areas were regraded and restored. A pilot-scale report and a separate verification sampling report were prepared and submitted for Navy and regulatory review in 2014. In 2014, the BTAG requested that additional sediment samples be collected at Site 61a in the fan area. The sediment samples were collected by CH2M Hill in December 2015, and a draft report was prepared in 2016. Upon review of these sample results, the BTAG requested additional sampling of sediments beyond the Site 61a sediment fan. This additional sampling was completed in December 2016.

Ongoing Requirements: Supplemental soil and sediment sampling were completed at Site 61a in December 2016 to support site closeout. The final FFS, PRAP and ROD is planned and would incorporate the results of the supplemental sampling in support of the future remedial action.

6.7 SITE 43 - HIGLEY ROAD LAND APPLICATION AREA

Site 43 - Higley Road Land Application Area (SWMU 35)	
Location: along Higley Road in the northeast corner of Mainside. (See **Figure 6-8**)	
Environmental Conditions at Discovery:	**Current Site Status:**
One-time sewage sludge land application area that included electroplating wastewater solids.	Removal action consisting of surface soil removal completed in May 2004 to achieve residential reuse criteria. No further action Decision Document prepared in 2004.

Background: Site 43 consists of the former sewer sludge land application area where sewage sludge contaminated with USEPA Hazardous Waste F006 (wastewater treatment sludge from electroplating) was applied in a one-inch thick layer in November 1989. The site is approximately 300 feet by 25 feet in size.

Work Completed: Three groundwater monitoring wells were installed and sampled in June 1991. No contamination above the regulatory limit was detected in any of the wells. Several soil samples were also analyzed; however, cadmium, in one sample, was the only constituent that exceeded a regulatory limit.

An SSP investigation was performed at Site 43 in 2001 including surface and subsurface soil sampling, and groundwater monitoring well installation and sampling. The results indicated the presence of inorganics, SVOCs, and pesticides in the surface soil, subsurface soil, and groundwater at Site 43. No constituents were retained as COPC for surface or subsurface soil as part of the human health risk screening. Arsenic and two pesticides were retained in groundwater, but none of the filtered arsenic concentrations were above the MCL. In addition, the presence of pesticides was attributed to facility-wide pesticide use rather than activities at Site 43. The report recommended that No Further Action be taken with regard to groundwater at Site 43. The ecological risk assessment indicated a potential risk from PAHs (primarily) and a limited number of inorganic chemicals in the surface soil at Site 43. The Final SSP Report recommended a removal action for Site 43 surface soil, residual slag, metal debris, and land-farmed sludge (CH2M Hill, 2002).

A removal action was completed during May 2004, which removed three to five inches of soil contaminated with F006-listed waste totaling approximately 251 tons. A VSAP Report indicated that soils left in place following the non-time-critical removal action met the residential RBCs established to protect

human health risk. Based on the results in the final SSP Report and the Site 43 Decision Document, No Further Action under a residential use scenario was recommended and accepted by the DIRT in August 2004 and Site 43 was closed out (Tetra Tech, 2004b).

Ongoing Requirements: None.

6.8 SITE 62 - BUILDING 396

Site 62 - Building 396	
Location: at Building 396 located in the Terminal Range area off Tisdale Road in the southeast portion of Mainside, near the mouth of Gambo Creek. (See **Figure 6-9**)	
Environmental Conditions at Discovery:	**Current Site Status:**
An interior wash sink in Bldg. 396 was used for oil and gun cleaning fluid associated with explosive testing activities.	Removal action completed in 2004. No further action ROD approved in 2005.

Background: This site was identified as a wash sink in Building 396 formerly discharging to a below-ground French drain. The wash sink was reportedly used to clean guns using solvents. The use of the wash sink was discontinued by 1997 and the building was demolished by 2001.

Work Completed: A Site Characterization Report was completed by Geophex (Geophex, 1997) presenting the results of samples collected to determine if soil and groundwater had been impacted by historical releases of oil and gun cleaning fluids and to provide recommendations for remedial action. Contaminants detected in the soil and groundwater (acetone, 2-butanone, and methylene chloride) are consistent with solvent releases. Lead detected in the groundwater samples exceeded the former MCL action level of 0.015 mg/L, and other metals detected were below MCLs. The source of the contaminants was most likely associated with Building 396 operations.

A field investigation to support an RI was conducted between September and October 2001. The RI/FS report was finalized in May 2005 (CH2M Hill, 2005a). The risk assessment determined that there were no unacceptable risks associated with soil, groundwater, surface water, and sediment at Site 62. However, a French drain previously connected to the Building 396 wash sink that had received various chemical wastes generated from gun cleaning activities was still in place and required further action.

An EE/CA, which was finalized in December 2004 (CH2M Hill, 2004b), focused on the French drain on the northwest side of Building 396. The EE/CA recommended removal of the French drain and surrounding soil. This non-time critical removal action was performed in December 2004. Verification

results were compared to the EE/CA PRGs, and in December 2004 the DIRT determined that this removal action addressed the source of contamination and that no unacceptable risks remained for soil and groundwater at Site 62. A No Further Action ROD was finalized in August 2005 and the DIRT recommended that this site be closed out (CH2M Hill, 2005c).

Ongoing Requirements: None.

6.9 SITE 63 - BUILDING 198 NEUTRALIZATION TANK

Site 63 - Building 198 Neutralization Tank	
Location: tank just outside Building 198 near the southern boundary of NSFDL, just north of Site 37. (See **Figure 6-10**)	
Environmental Conditions at Discovery:	**Current Site Status:**
500-gallon underground, concrete storage tank used to neutralize acid waste discharged from a physics laboratory that was housed within Building 198.	Removal of tank contents completed in 2011 and surrounding soil samples indicated no need for additional excavation. No Further Action Decision Document completed in 2013.

Background: The neutralization tank is located southwest of Building 198 and is adjacent to the southeast corner of Building 462. The neutralization tank was installed at Building 198 in 1966, with the purpose of neutralizing acid waste discharged from a physics laboratory that was housed within Building 198. The types of wastes reportedly discharged to the tank included polymers, solvents, acids, heavy metals, and potentially explosive residue. Use of the tank was discontinued in the late 1970s to early 1980s and after that it was reported that the tank contained water that may have inundated it from storm sewers or surface runoff. The tank also contained limestone chips.

Work Completed: An investigation of the tank was conducted in January 2006 that included sampling of the media inside the tank (aqueous and sludge) and two soil borings adjacent to the tank (CH2M Hill, 2007b). For the sludge sample, five SVOCs, one pesticide, and four metals were detected at concentrations exceeding residential soil RBCs. In the aqueous sample, two VOCs, three SVOCs, two pesticides, one explosive, and nine metals exceeded applicable MCLs or Region III tap water RBCs. Several constituents, including acetone, BEHP, and nitrobenzene were detected in the aqueous sample collected from inside the tank and in the adjacent soil samples, although they did not exceed screening criteria in the soils. The presence of these non-naturally occurring constituents in the tank aqueous sample as well as at least one subsurface soil proximal to the tank suggests they may have originated from the neutralization tank (CH2M Hill, 2007b).

An EE/CA providing an evaluation of the removal action objectives and engineering analysis information was completed in December 2009 (CH2M Hill, 2009). Characterization of the site groundwater was completed in April 2011. A removal action was initiated in June 2011 by removing the contents of the tank (liquid, sludge and limestone chips). During the excavation activities, it was observed that the tank walls were thicker than anticipated. In addition, approximately 12-inch thick horizontal concrete pads were located on top of the northeastern and northwestern walls of the tank. Based on these site conditions, and the close proximity to nearby buildings, the DIRT team decided to remove the contents of the tank (limestone chips, liquid and sludge) pressure wash the walls, and evaluate the conditions of the tank.

Based on the June 2011 visual inspection, the tank was intact with no cracks or structural defects that would allow the contents of the tank to leak into the surrounding soils. Therefore, because the potential source of contamination (i.e. the contents of the tank) had been removed, and no evidence of a release was identified during the removal action, the DIRT agreed to close the tank in place. Verification soil sampling was conducted, and the analytical results evaluated by the DIRT team. Based on the results of the soil samples, the DIRT team agreed that no further excavation was necessary. In July 2011, the tank was filled with gravel and the excavation backfill compacted. A Construction Completion Report was prepared and finalized in Feb. 2012 (SOV, 2012). A No Further Action Decision Document was prepared and approved in March 2013 (CH2MHill, 2013).

Ongoing Requirements: None.

6.10 SITE 64 - GUM ALLEY DISPOSAL AREA

Site 64 - Gum Alley Disposal Area	
Location: in wooded area east of Gum Alley, next to the Priority 4 Sites 1 and 5 old bombing range area, in northwest quadrant of Mainside. (See **Figure 6-11**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Household waste type debris was observed in the wooded area at Site 64.	Deferred to range cleanup program due to potential overlap of active missile test range with site disposal boundaries. Decision Document completed in 2014.

Background: This site was used as a surface disposal area and appears to contain mostly housing waste (i.e. wheels, tires, muffler pipe, metal stakes, metal cables, toys, tires, batteries, plywood structures, bricks, tiles, etc.). Debris disposal likely occurred in the mid- 1980's. The site is located at the end of an unpaved road. The access road leading to the site contains a locked gate and access is

controlled. No sampling has been done in the area, however, obvious waste disposal has occurred from the visual evidence.

Work Completed: Investigation and characterization of Site 64 was scoped in 2013. After further review, due to expanding range activities in the area of Site 64, it was determined in 2014 that the site was no longer eligible for cleanup under the ER,N Program. Due to constraints on the ER,N program, ER,N funds are not authorized for cleanup actions at operational ranges, as provided in the document titled Department of the Navy Environmental Restoration Program Manual, Section 4.2.1, Response Eligibility Criteria, pages 4 through 7. Because of this, it is anticipated that the site will be cleaned up by NSWCDD under their range maintenance program. A Decision Document for deferral of Site 64 was signed by the Navy and USEPA in September 2015 (Navy, 2015).

Any necessary cleanup of sites within operational ranges is conducted pursuant to applicable laws and regulations upon any subsequent closure or transfer of the relevant range, as provided in the document titled "Department of Defense (DOD) and EPA Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges", dated 7 March 2000. Based on this decision, potential action at Site 64 is deferred until the ranges are closed or transferred.

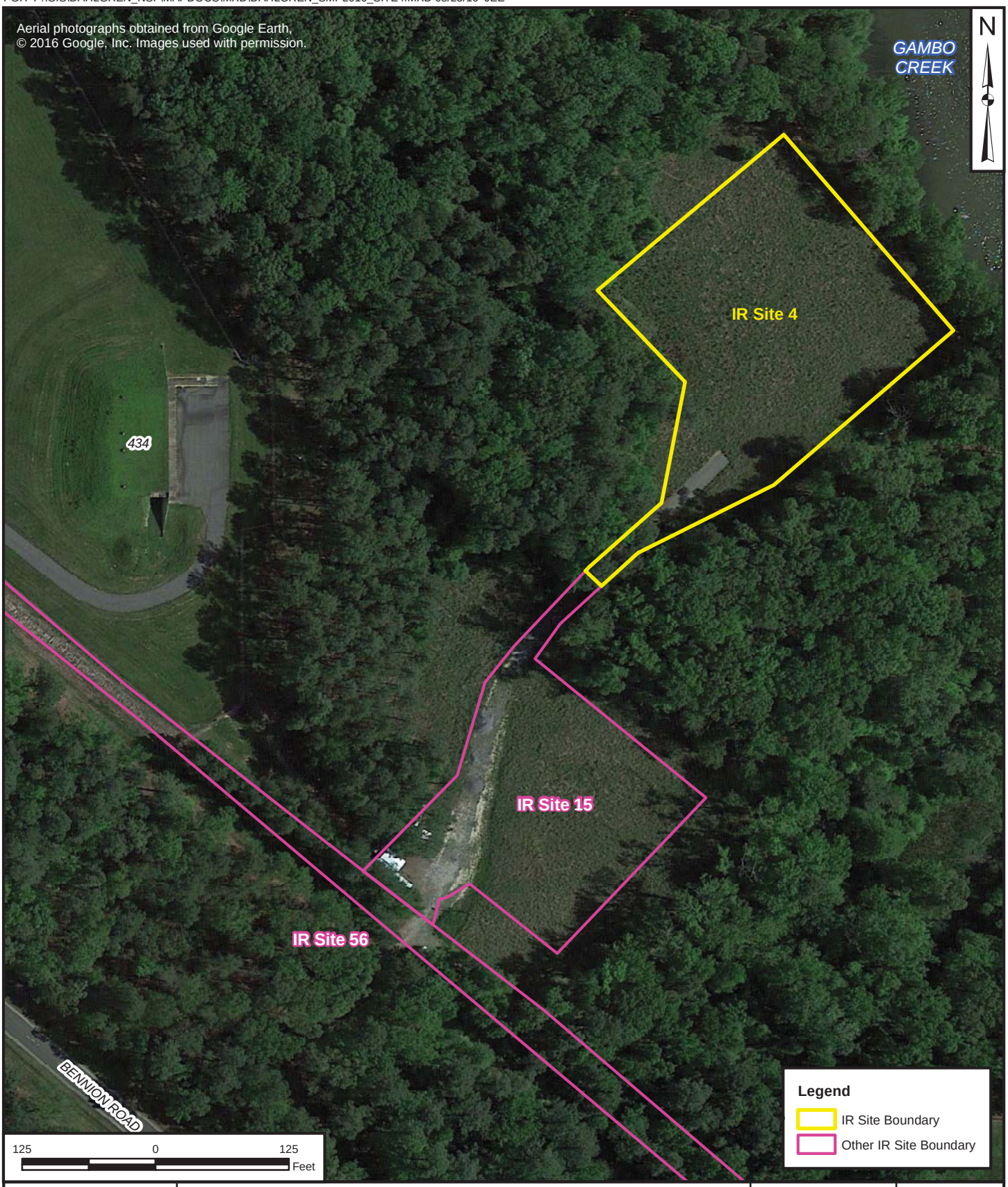
Based on the contents of the 2015 Decision Document, the location of Site 64 will remain marked on the installation's GIS in order to prevent incompatible land uses, other than range operations (Navy, 2015). Any changes in land use will be evaluated and approved for inclusion in the installation's Regional Shore Infrastructure Plan (RSIP), which documents current and anticipated land uses within the installation. The Commander in charge of the ranges has been notified of this document and concurs with its decision.

Ongoing Requirements: Further investigation deferred until range use discontinues.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_3A.MXD 08/25/16 JEE

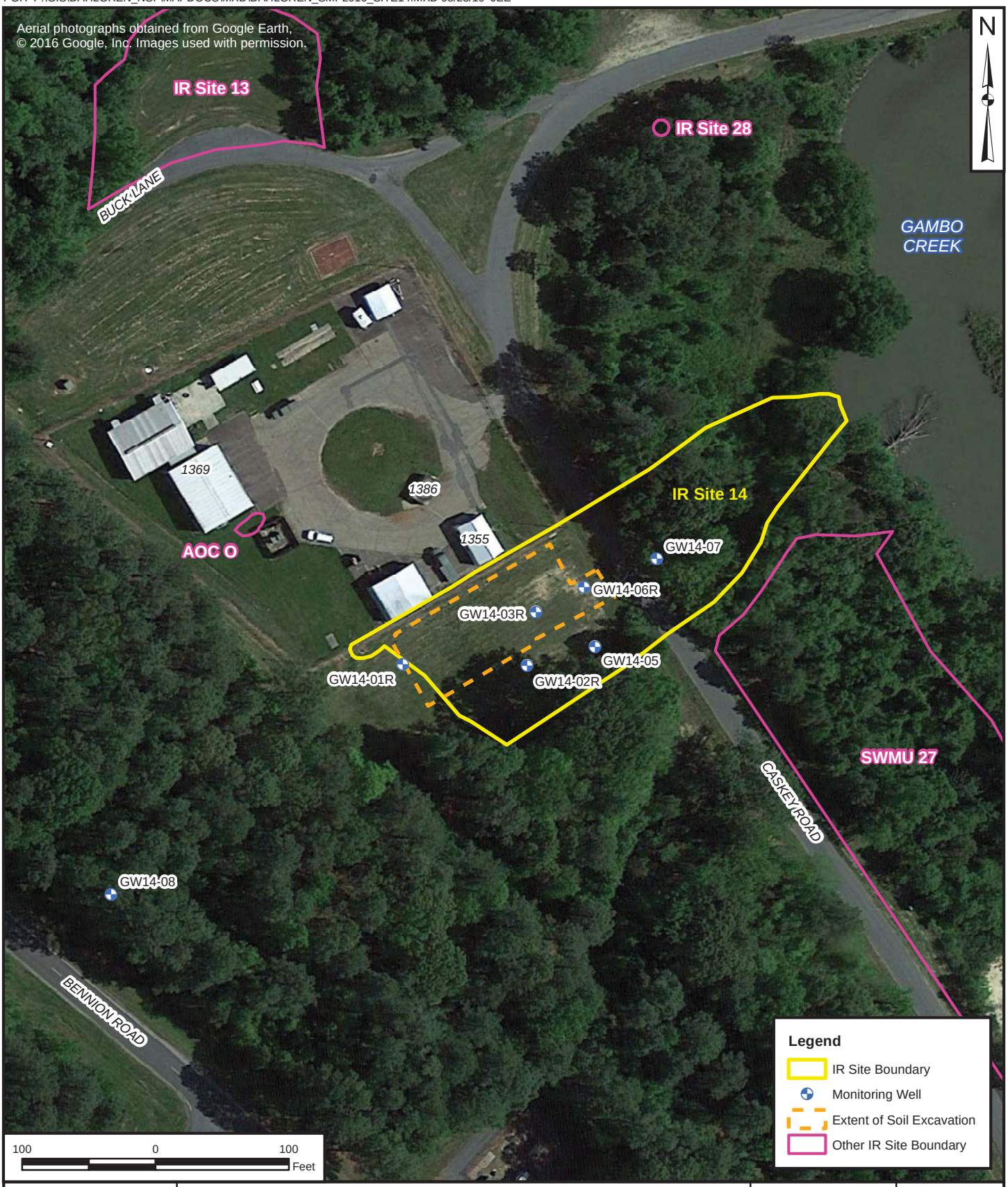
DRAWN BY J. ENGLISH	DATE 08/11/16	TETRA TECH		CONTRACT NUMBER 07992	CTO NUMBER ___
CHECKED BY A. McGIVNEY	DATE 08/25/16	ALL PRIORITY 3 SITES NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 6-1	REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE4.MXD 08/25/16 JEE



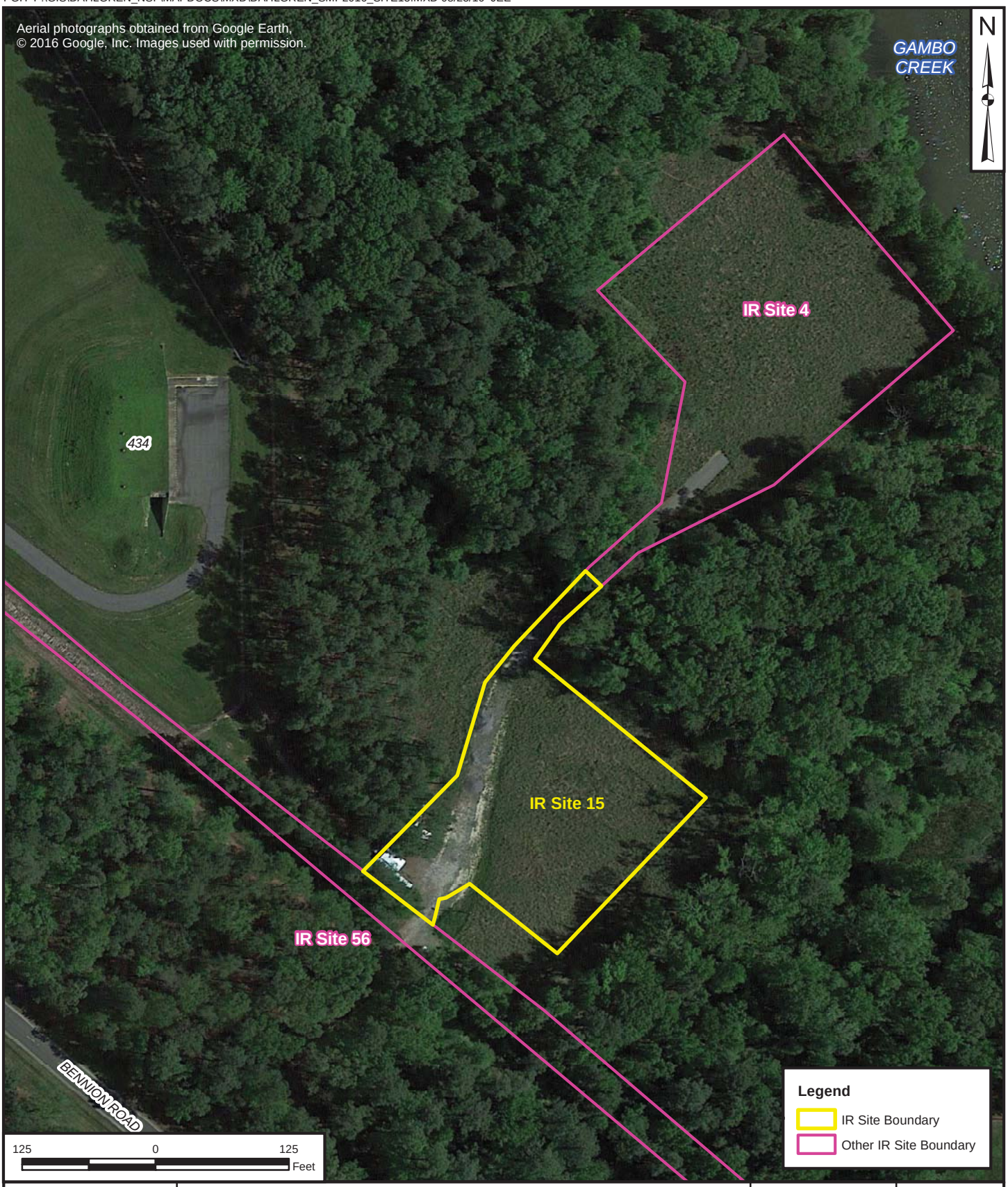
DRAWN BY: J. ENGLISH — DATE: 07/21/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 4 - CASE STORAGE AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE14.MXD 08/25/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/01/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 14 - CHEMICAL WASTE EVAPORATION POND NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-3	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE15.MXD 08/25/16 JEE

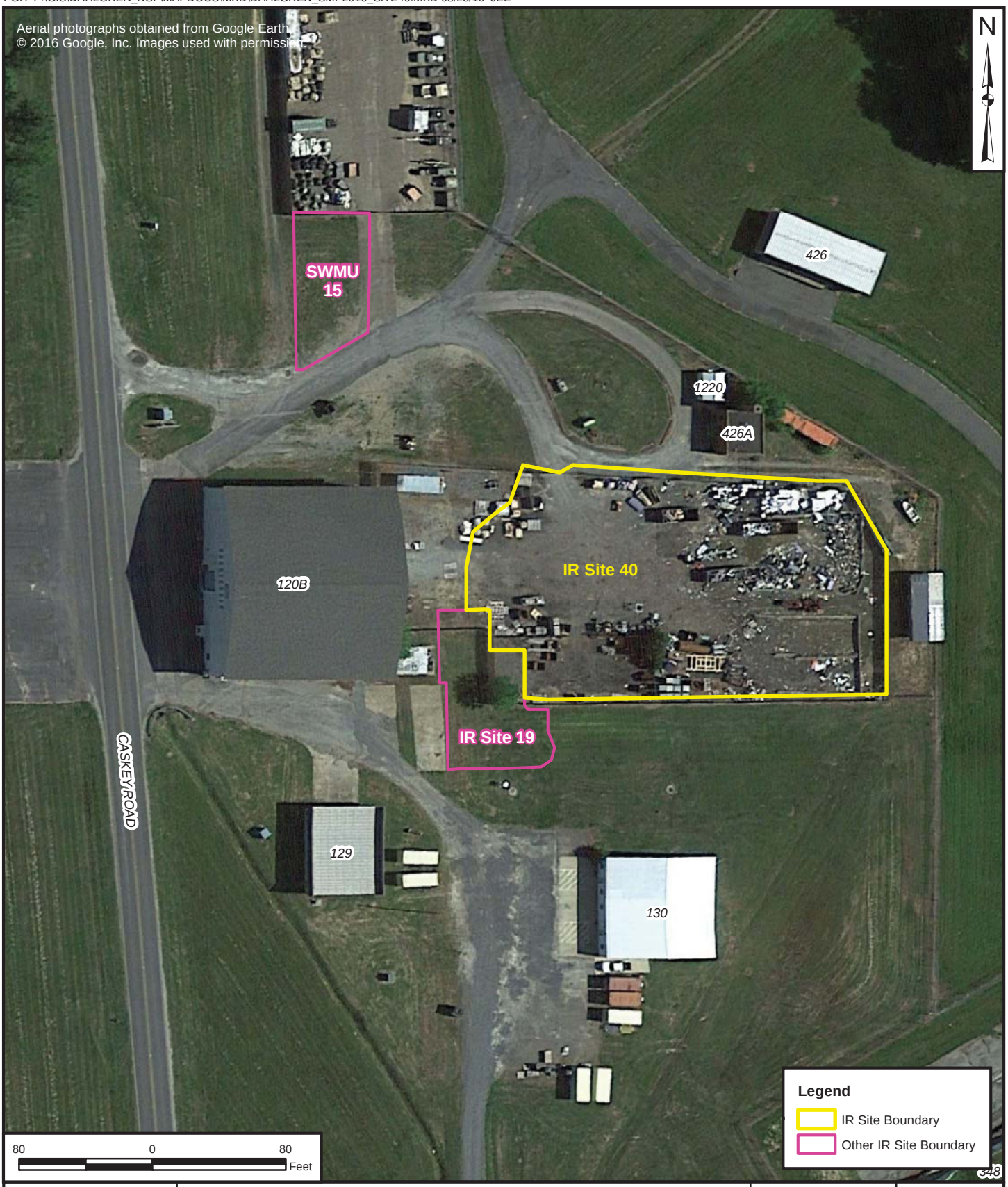


DRAWN BY: J. ENGLISH — DATE: 07/21/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 15 - SCRAP AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-4	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE38.MXD 08/25/16 JEE

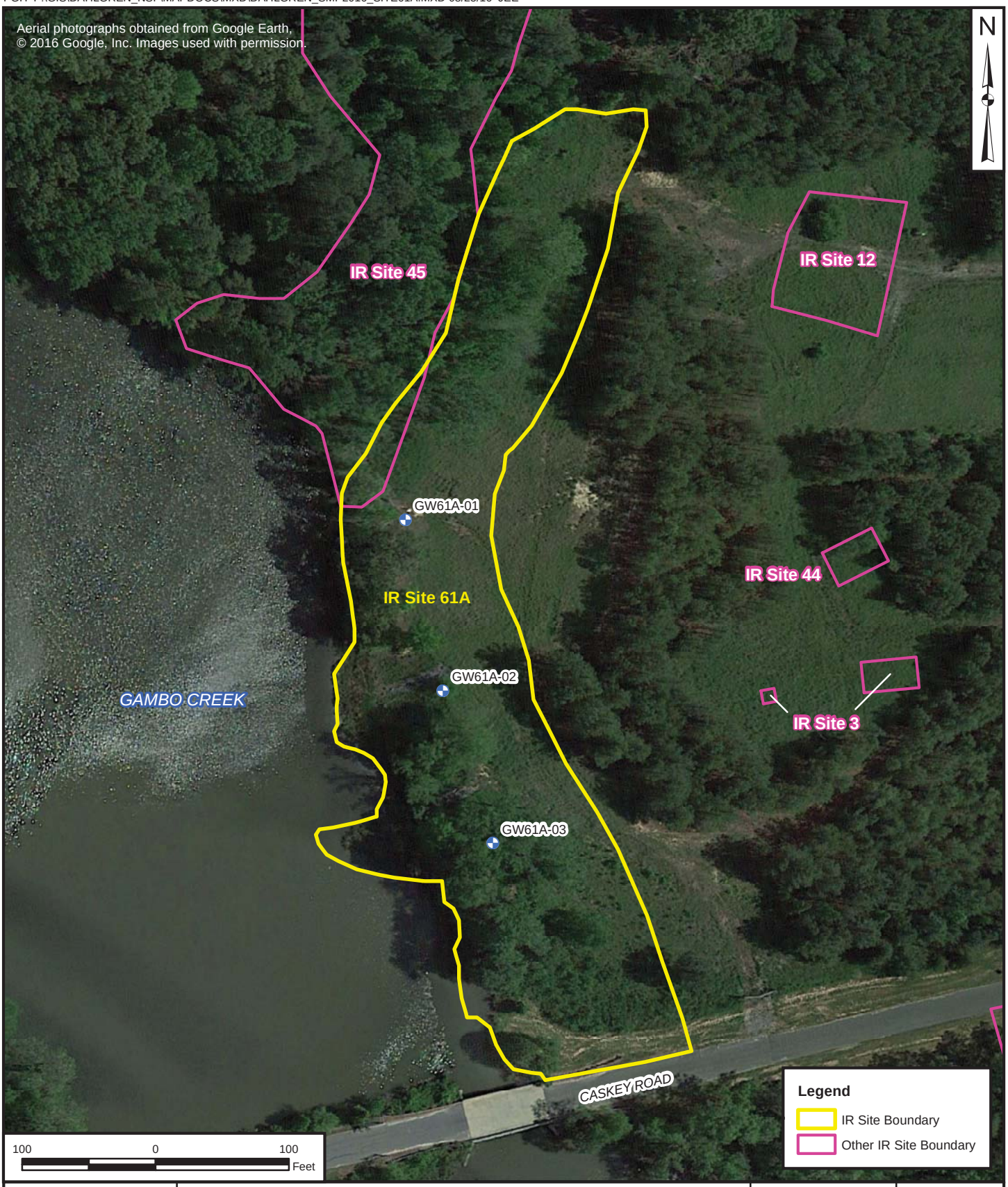
DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 38 - BUILDING 1349 PEST CONTROL OUTSIDE AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-5	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE40.MXD 08/25/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 40 - BUILDING 120B DRMO LOT NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-6	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE61A.MXD 08/25/16 JEE

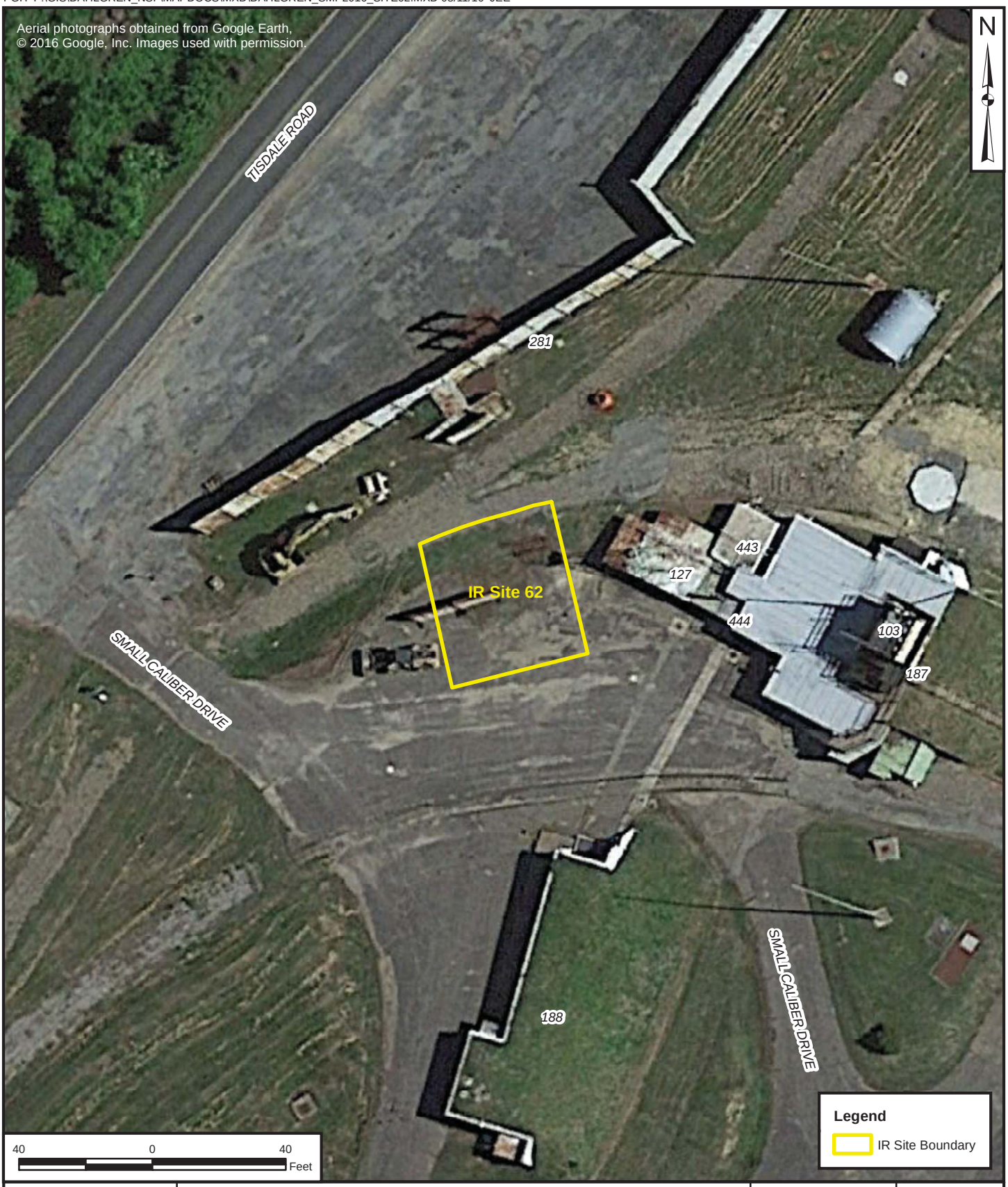


DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 61A - GAMBO CREEK ASH DUMP NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-7	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE43.MXD 08/11/16 JEE

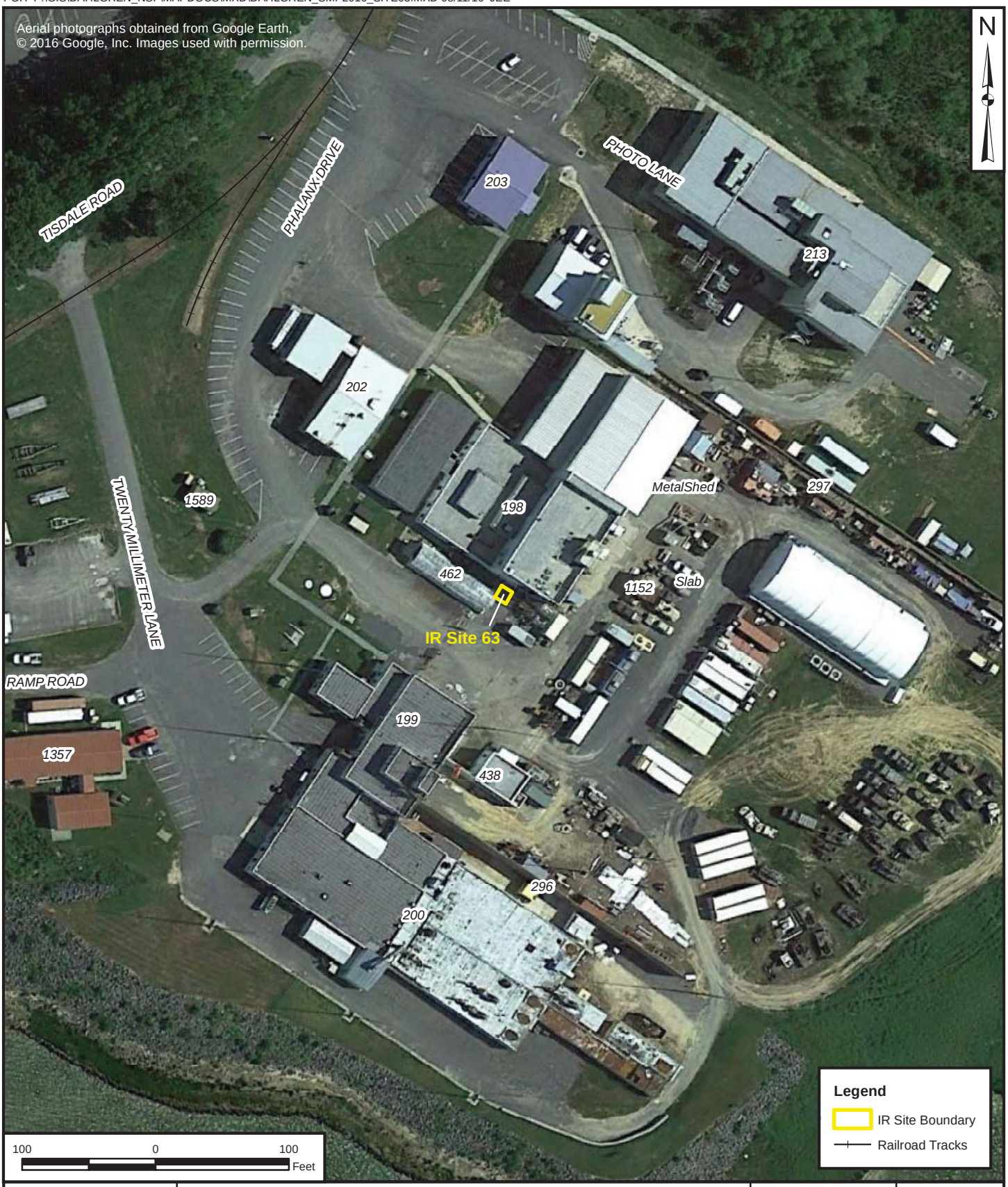
DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/11/16	IR SITE 43 - HIGLEY ROAD LAND APPLICATION AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-8	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE62.MXD 08/11/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/11/16	IR SITE 62 - BUILDING 396 NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-9	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE63.MXD 08/11/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/02/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/11/16	IR SITE 63 - BUILDING 198 NEUTRALIZATION TANK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-10	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE64.MXD 08/25/16 JEE

DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/25/16	IR SITE 64 - GUM ALLEY DISPOSAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 6-11	REV: 0

7.0 APPENDIX A – PRIORITY 4 SITES

There are six Priority 4 sites at the NSFDL, with five located on the Mainside Area of NSFDL (**Figure 7-1**), and one located at the EEA (**Figure 7-2**). A summary table including the rationale for being listed and investigated and the current status is provided for each site (tables for sites on *Mainside are blue*, and the one for *EEA is brown*). For each site, a brief summary of the site history and IR activities follows each table.

7.1 SITE 1 - OLD BOMBING RANGE

Site 1 - Old Bombing Range (AOC J)	
Location: within the boundaries of the Missile Test Range in the central part of Mainside. (See **Figure 7-3**)	
Environmental Conditions at Discovery:	**Current Site Status:**
The site was used in the early 1940s as an aerial bombing range.	Decision Document completed in 2007 that defers the cleanup of Site 1 to the range cleanup program after the range is closed.

Background: The "Old Bombing Range" is approximately 293 acres in size, and is currently wooded and vegetated. As both Sites 1 and 5 are located within the boundaries of active test ranges, it was the consensus of the Navy, the USEPA Region III, VDEQ, and members of the DIRT that these sites require no action under the NSFDL FFA. Due to constraints on the ER,N program, ER,N funds are not authorized for cleanup actions at these operational ranges, as provided in the document titled Department of the Navy Environmental Restoration Program Manual, Section 4.2.1, Response Eligibility Criteria, pages 4 through 7. Any necessary cleanup of sites within operational ranges is conducted pursuant to applicable laws and regulations upon any subsequent closure or transfer of the relevant range, as provided in the document titled "Department of Defense (DOD) and EPA Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges", dated 7 March 2000. Based on this decision, potential action at Site 1 is deferred until the ranges are closed or transferred.

Based on the contents of the September 2007 Decision Document, the location of Sites 1 and 5 will remain marked on the installation's geographical information system (GIS) in order to prevent incompatible land uses, other than range operations (Navy, 2007a). Any changes in land use will be evaluated and approved for inclusion in the installation's Regional Shore Infrastructure Plan (RSIP), which documents current and anticipated land uses within the installation. The Commander in charge of the ranges has been notified of this document and concurs with its decision.

Ongoing Requirements: Further investigation of Site 1 is deferred until range use discontinues.

7.2 SITE 5 - PROJECTILE DISPOSAL AREA

Site 5 - Projectile Disposal Area (SWMU 51)	
Location: at the southeast end of the Old Bombing Range (Site 1) at Mainside. (See **Figure 7-3**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Reported filling of wetland with debris including projectiles from the Old Bombing Range, 1930s-1940s.	Decision Document completed in 2007 that defers the cleanup of Site 5 to the range cleanup program after the range is closed.

Background: Site 5 was included in the FFA based on the verbal report of potential disposal of projectiles within a smaller area of the range. The disposal location was not identified, but was described as approximately 2.53 acres in size, and mostly vegetated with grass, except in areas previously developed or disturbed. The site is reported to have been a wetland filled in with construction rubble, projectiles, fill dirt and ordnance probably coming from others areas on the range. Disposal reportedly occurred during the late 1930s or early 1940s.

As both Sites 1 and 5 are located within the boundaries of active test ranges, it was the consensus of the Navy, the USEPA Region III, VDEQ, and members of the DIRT that these sites require no action under the NSFDL FFA. Due to constraints on the ER,N program, ER,N funds are not authorized for cleanup actions at these operational ranges, as provided in the document titled Department of the Navy Environmental Restoration Program Manual, Section 4.2.1, Response Eligibility Criteria, pages 4 through 7. Any necessary cleanup of sites within operational ranges is conducted pursuant to applicable laws and regulations upon any subsequent closure or transfer of the relevant range, as provided in the document titled “Department of Defense (DOD) and EPA Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges”, dated 7 March 2000. Based on this decision, potential action at Site 1 is deferred until the ranges are closed or transferred.

Based on the contents of the September 2007 Decision Document, the location of Sites 1 and 5 will remain marked on the installation’s geographical information system (GIS) in order to prevent incompatible land uses, other than range operations (Navy, 2007a). Any changes in land use will be evaluated and approved for inclusion in the installation’s Regional Shore Infrastructure Plan (RSIP), which documents current and anticipated land uses within the installation. The Commander in charge of the ranges has been notified of this document and concurs with its decision.

Ongoing Requirements: Further investigation of Site 5 is deferred until range use discontinues.

7.3 SITE 36 - DEPLETED URANIUM MOUND, PUMPKIN NECK, EEA

Site 36 - Depleted Uranium Mound, Pumpkin Neck EEA (AOC C1)	
Location: on the Harris Range in the northwest portion of EEA, along Harris Road. (See **Figure 7-4**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Grass-covered pile of earth where rounds of 20-millimeter depleted uranium (DU) shells were fired in the 1970s to 1980s and became embedded in the mound.	Removal action completed in 1998. No further action ROD signed in 2001. Site released for unrestricted use by the NRC.

Background: Site 36 consists of an earthen mound approximately 80 feet in diameter and 12 feet high used to test the trajectory of 20-millimeter DU penetrator shells, which became embedded in the mound. The site began operation sometime in the 1970s and was active until 1990. Site 36 was originally on the west side of Harris Test Road but was relocated to the east side in 1985.

Work Completed: A Site Characterization and an EE/CA were performed for this site (Allied Technology Group, Inc. and Geo/Resource Consultants, Inc., 1997). The risk-driver for Site 36 was DU, including U-238 and daughter decay products Th-234 and Pa-234m. Other metals and contaminants at detected concentrations were not considered to pose a significant threat to human health and the environment. The cleanup level for DU was proposed at 35 picocuries per gram (pCi/g) of U-238 activity based on Federal Register 23 October 1981, Vol. 46, No. 205, and NRC Guidelines titled “Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material”, July 1982.

The removal action was conducted in February 1998, and several M-46 grenades were found during the excavation. Due to the extreme hazard of the grenades, a pilot-scale screening study was initiated in March 1998 in order to remove the grenades from the DU soil pile. The pilot-scale proved successful and was implemented to remove all of the grenades. Once the grenades were removed, the soil was placed in piles on plastic sheeting for scanning to determine if contamination still existed in the soil and if the release criteria (i.e., 35 pCi/g, U-238) were met. A final status survey was conducted to confirm the DU contamination was removed from the site.

DU penetrators and contaminated soil were removed from the mound at Site 36 and placed in 55 gallon drums. Once confirmation samples results were received, the drums containing the DU were shipped to a permitted facility and the remaining uncontaminated soil at Site 36 was leveled to grade. Site 36 and

Site 49 were combined into one RI/FFS because removal actions were completed for both sites due to the presence of DU. A PRAP was prepared for Site 36 and Site 49 recommending no further action be taken at these sites. The Navy and USEPA signed a ROD in September 2001, with VDEQ issuing a concurrence letter (Navy, 2001d).

In January 2002, NSFDL received a letter from the NRC stating that Site 36, Depleted Uranium Mound, Pumpkin Neck, and Site 49, Depleted Uranium Gun Butt, met the criteria for unrestricted use described in 10 CFR 20.1402 (NRC, 2002).

Ongoing Requirements: May be re-investigated for possible environmental impacts as part of range closure, should range use discontinue in the future.

7.4 SITE 47A - WWI MUNITIONS MOUND

Site 47a - WWI Munitions Mound (SWMU 50)	
Location: just east of Higley Road, approximately 100 feet west of the Potomac River at Mainside. (See **Figure 7-5**)	
Environmental Conditions at Discovery:	**Current Site Status:**
Pile used from about 1917 to the late 1930s for discarded live and dud WWI munitions.	Removal action completed in 2004-2005. Site closed out under future residential use scenario, per 2006 Close Out document. No Decision Document prepared.

Background: The Site 47a mound was used from about 1917 to the late 1930s for the disposal of live and dud WWI munitions, which were piled up and covered with dirt, forming a mound approximately one acre in area and approximately 20 feet to 30 feet in height. It was not known whether the munitions were buried below grade or piled on top of the ground.

Work Completed: As part of the investigation to support an EE/CA, a geophysical study and surface and subsurface soil sampling were completed in February 2002. The geophysical study was completed to delineate areas containing munitions at Site 47a. Trenching was also performed to determine the extent of subsurface contamination.

The EE/CA for Site 47a was completed in July 2003 (Tetra Tech, 2003e). A semi-quantitative human health risk assessment was performed for potential industrial and residential receptors at Site 47a. The results of the risk analysis indicated that potential risks were within or less than USEPA acceptable levels. A qualitative ecological risk screening, performed at the site indicated a potential ecological risk to soil

invertebrates and plants associated with direct exposure to PAHs and metals in surface soil. The selected remedial action presented in the EE/CA consisted of excavation and screening; reuse and off-site disposal of contaminated soil, metal scrap, and debris; and site restoration.

The Site 47a removal action began in spring 2004 using a remote-control excavator. A screening plant with magnetic separation and a shelter/control building were also employed during the excavation due to the high density of UXO material present in the mound. The average depth of excavation was approximately 6.5 feet. Approximately 366 cubic yards of removed soil was found to be contaminated with elevated levels of several metals (i.e., arsenic, chromium and nickel) that exceeded the EPA Biological Technical Assistance Goal screening criteria. The contaminated soil was disposed of offsite in an approved disposal facility. The other debris found in the mound included 7,695 pounds scrap metal and 166 ordnance items. Following the sampling, all the remaining removed soil was returned to the excavation. The removal action was completed in December 2005.

The site Close-Out Document for Site 47a was completed in November 2006 (Navy, 2006). The conclusions of the Close-Out Document state that based upon the 2004 and 2005 verification sampling results, the DIRT determined that excavation was complete at Site 47a. Based on data presented in the site Close-Out Document, the RPMs concluded that Site 47a requires no further action under a residential use scenario under CERCLA. A Decision Document was not prepared.

Ongoing Requirements: None.

7.5 SITE 47B - EOD SCRAP AREA

Site 47b - EOD Scrap Area (AOC K)	
Location: approximately 100 feet west of the Potomac River (close to the eastern boundary of Mainside) and 470 feet east of Tisdale Road. (See **Figure 7-6**)	
Environmental Conditions at Discovery:	**Current Site Status:**
A rubble disposal area originating before the 1950s that received EOD waste including munitions.	Removal action completed in 2004-2005. Site closed out under future residential use scenario, per 2006 Close Out document. No Decision Document prepared.

Background: The EOD Scrap Area, Site 47b (known as USEPA AOC K) consists of scrap metal and debris containing various metals, wood, electrical equipment, Styrofoam, pipe conduit, glass shards, and an 8-inch shell.

Work Completed: The EE/CA for Site 47b was performed concurrently with Site 47a and was completed in July 2003 (Tetra Tech, 2003e) Sampling data indicate contaminant releases have occurred at 47a, and because the materials at Site 47b may be similar to those at Site 47a, contaminants are likely to be present at Site 47b. Both sites contain waste in place that may pose a risk to human health and the environment from the continued effects of erosion and other transport mechanisms.

The EE/CA recommended excavation, screening, reuse and off-site disposal for Site 47b. Excavation operations began in February 2005 which included seven trenching areas to identify the depth of potential ordnance related materials. Materials encountered from the excavation included 650 cubic yards of contaminated soil, 6,490 pounds scrap metal, 1,100 pounds of ordnance-related metal scrap items, and a 1,100-gallon in-tact UST with petroleum product inside. The removal of these items was completed in May 2005. Screening operations and decontamination of the mechanical screener were completed in December 2005. A Post Removal Action Report was completed in September 2006.

The Close-Out Document for Site 47b was completed in November 2006. The conclusions of the Close Out Document state that excavation was complete at the Site 47b exposure area and the UST area (which was found during excavation). The DIRT also decided that excavated soil and UST Area soil should be disposed off-site, as verification sample results indicated SVOCs and some metals concentrations greater than the screening criteria. The Turkey Trot soil stockpile (excluding the northeastern corner area) was deemed acceptable for use as excavation backfill below grade, and the Burgess Borrow Pit soil was deemed acceptable for general backfill and topsoil.

Based on data presented in the site Close-Out Document, it was the consensus of the RPMs that Site 47b requires no further action under a residential use scenario under CERCLA. A Decision Document was not prepared.

Ongoing Requirements: None.

7.6 SITE 49 - DEPLETED URANIUM GUN BUTT

Site 49 - Depleted Uranium Gun Butt (AOC C4)	
Location: east of Building 200, near IR Site 37 in the southern end of Mainside along Machodoc Creek. (See **Figure 7-7**)	
Environmental Conditions at Discovery:	**Current Site Status:**
A sand-filled steel wall used as a firing target for projectiles, including depleted uranium rounds.	Removal action completed in 1998. No further action ROD signed in 2001. Site released for unrestricted use by the NRC.

Background: The Depleted Uranium Gun Butt, Site 49 (also known as USEPA Other Units C4) was located east of Building 200. This unit was an open steel sand butt used to test DU shells. The butt was designed so that fired projectiles expended their energy in the sand. A portion of the projectile was pulverized or abraded on impact, resulting in a dust of metal and pulverized sand. This unit began operation in the 1940s. Prior to July 1991, the firing range butt was used for DU munitions tests. The butt is no longer in use. It consisted of a large steel rectangular box (24 feet wide by 51 feet deep and 15 feet high) with a vertical open face containing approximately 13,000 cubic feet (ft3) of sand and approximately 3,500 DU projectiles. The butt was constructed of steel armor plate approximately four inches thick.

Work Completed: A Site Characterization and an EE/CA were performed for this site (Allied Technology Group, Inc., and Geo/Resource Consultants, Inc., 1997). The risk-driver for Site 49 was DU, including U-238 and daughter decay products Th-234 and Pa-234. Other metals or contaminants at detected concentrations were not considered to pose a significant threat to human health and the environment. The cleanup level for DU was proposed at 35 pCi/g of U-238 activity, based on Federal Register 23 October 1981, Vol. 46, No. 205, and NRC Guidelines titled “Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material,” July 1982.

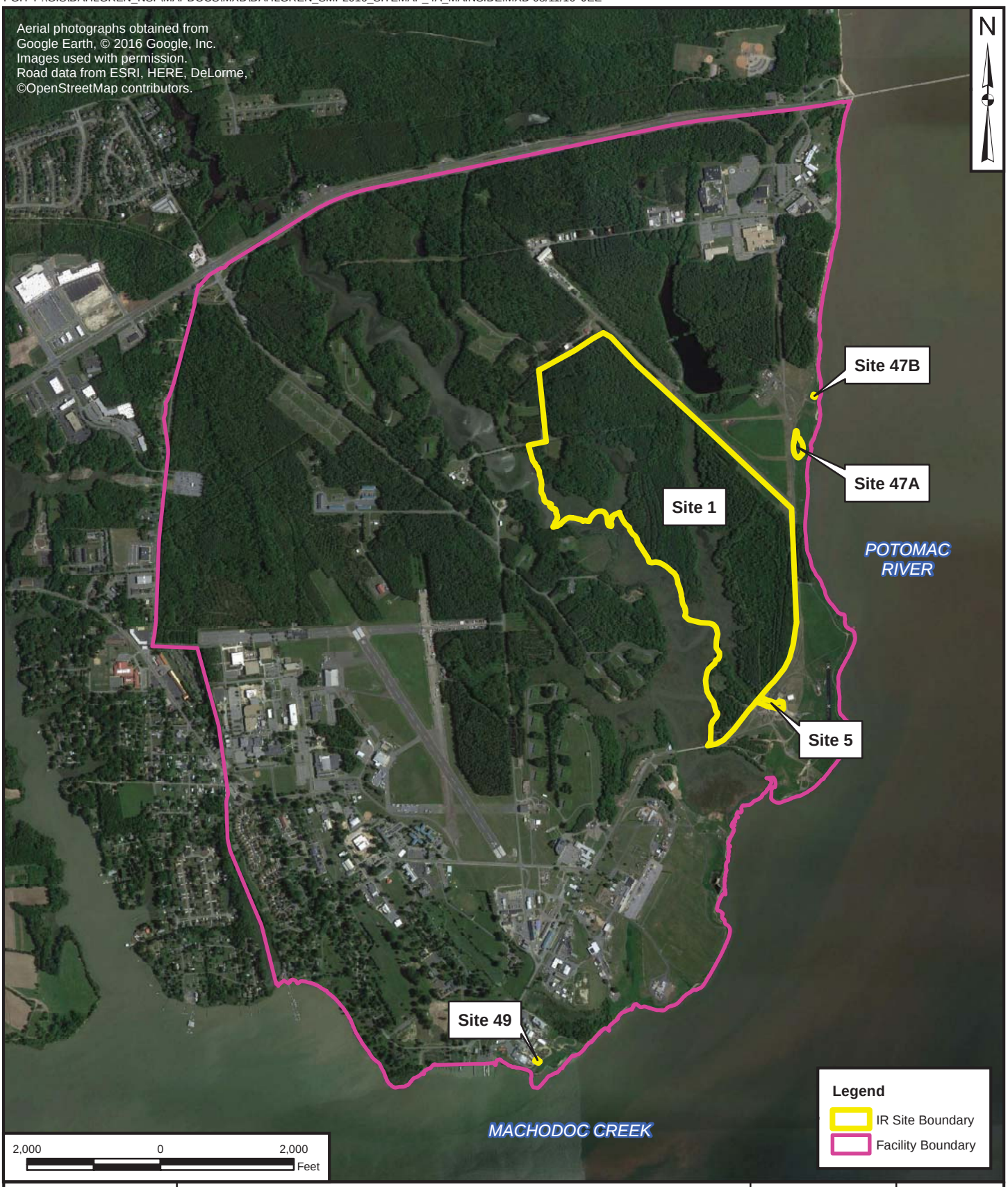
In June 1998, the DU gun butt decontamination was essentially complete. Confirmatory samples indicated that cleanup goals were achieved; however, regulatory agencies performed a final review of the site when Site 36 was complete, so that they could be reviewed together.

A combined RI/FFS for Sites 36 and 49 was submitted in July 2001. A PRAP was prepared for Site 36 and Site 49 recommending no further action be taken at these sites. The Navy and USEPA signed a ROD in September 2001, with VDEQ issuing a concurrence letter (Navy, 2001d).

In January 2002, NSFDL received a letter from the NRC stating that Site 36, Depleted Uranium Mound, Pumpkin Neck, and Site 49, Depleted Uranium Gun Butt, met the criteria for unrestricted use described in 10 CFR 20.1402 (NRC, 2002).

Ongoing Requirements: None.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_4A_MAINSIDE.MXD 08/11/16 JEE

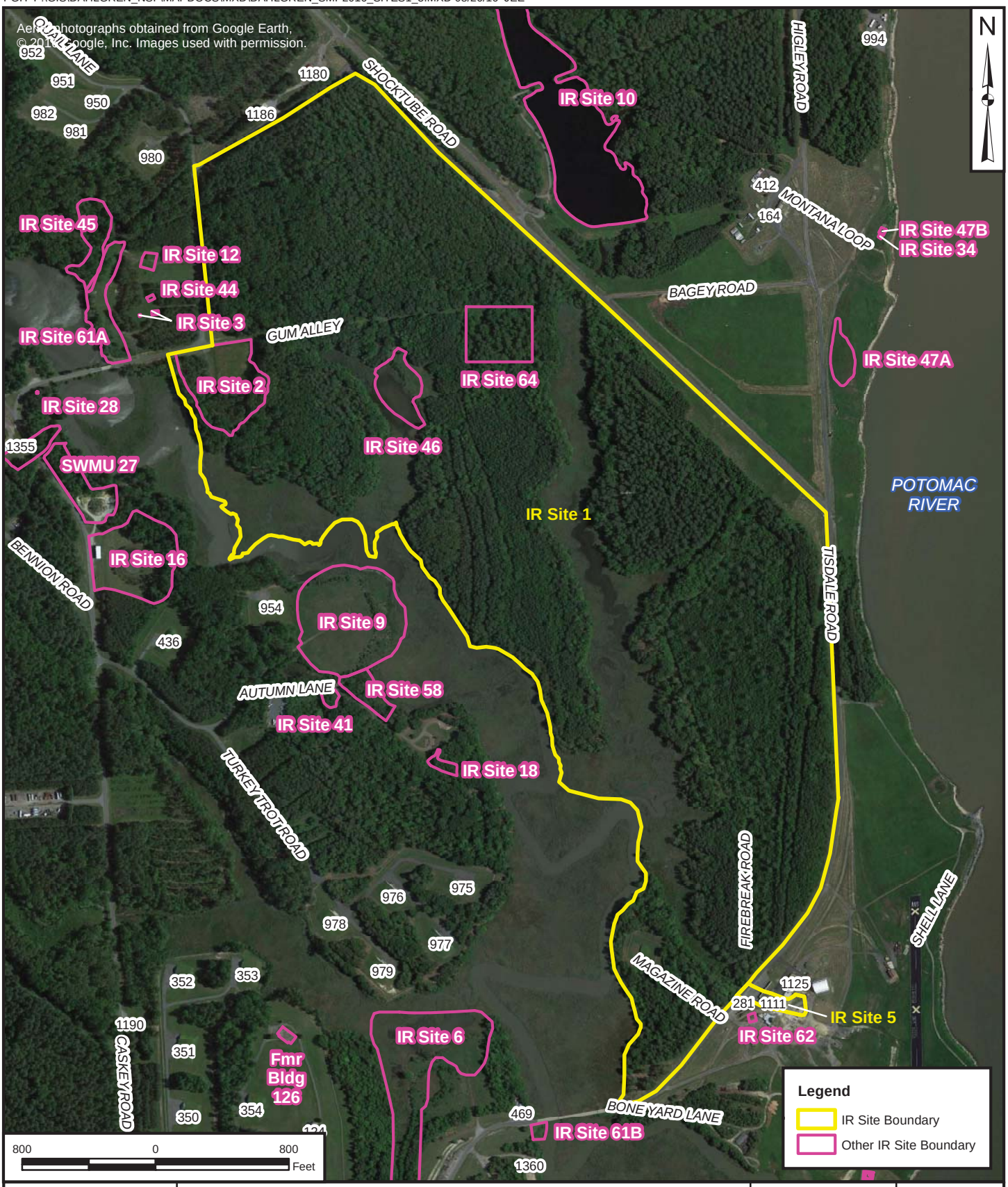


DRAWN BY: J. ENGLISH — DATE: 08/11/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/11/16	ALL PRIORITY 4 SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 7-1	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITEMAP_4A_EEA.MXD 08/11/16 JEE

DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/11/16	ALL PRIORITY 4 SITES - EEA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 7-2	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITES1_5.MXD 08/26/16 JEE



DRAWN BY: J. ENGLISH	DATE: 07/26/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/26/16	IR SITE 1 - OLD BOMBING RANGE AND IR SITE 5 - PROJECTILE DISPOSAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___	DATE: ___
SCALE: AS NOTED			FIGURE NO.: 7-3	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE36.MXD 08/24/16 JEE

DRAWN BY: J. ENGLISH — DATE: 08/08/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/24/16	IR SITE 36 - DEPLETED URANIUM MOUND PUMPKIN NECK, EXPLOSIVES EXPERIMENTAL AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 7-4	REV: 0

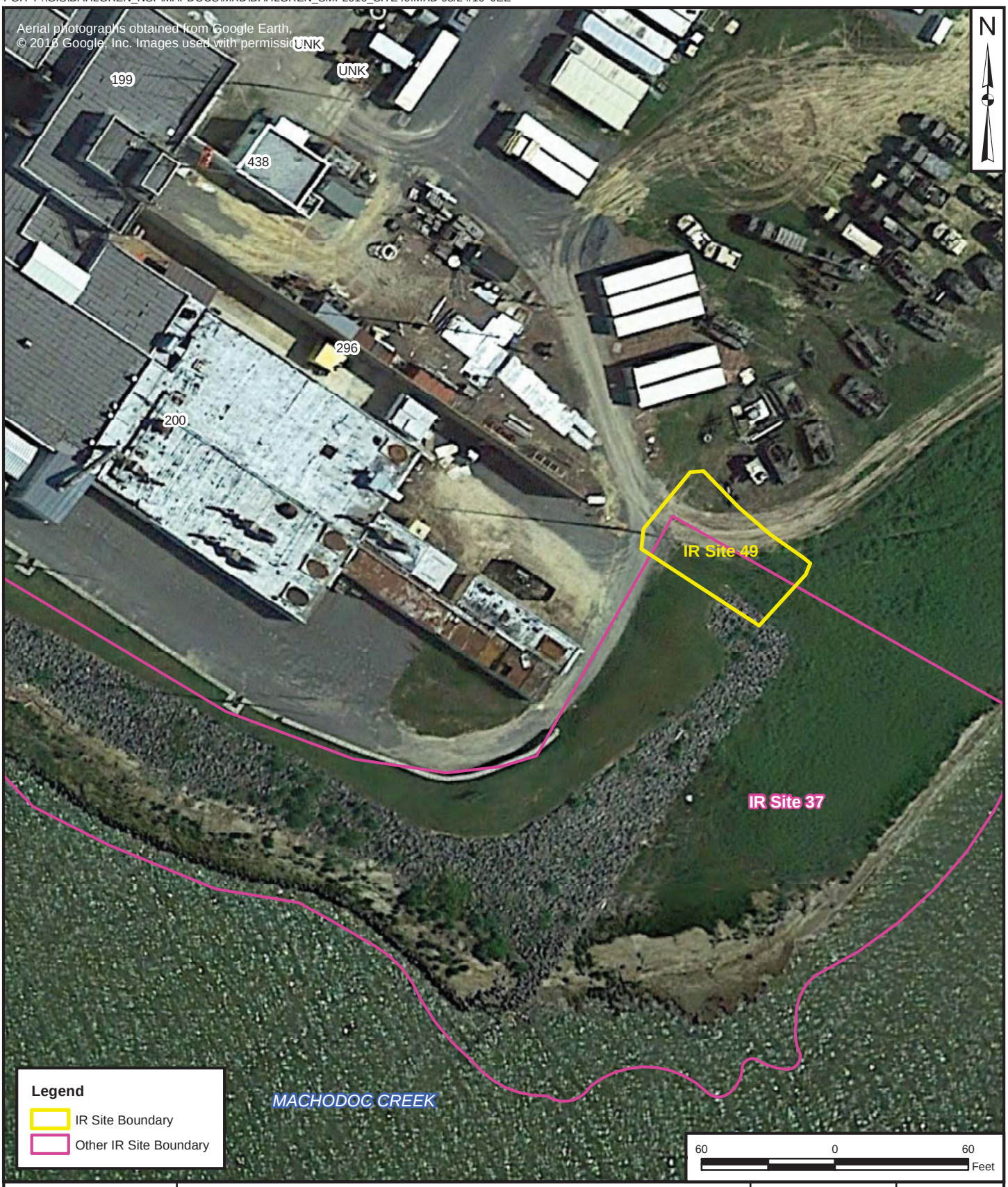
PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE47A.MXD 08/24/16 JEE

DRAWN BY: J. ENGLISH	DATE: 08/03/16	TETRA TECH	CONTRACT NUMBER: 07992 / CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/24/16	IR SITE 47A - WORLD WAR I MUNITIONS MOUND NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ / DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___ / DATE: ___
SCALE: AS NOTED			FIGURE NO.: 7-5 / REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE47B.MXD 08/24/16 JEE

DRAWN BY: J. ENGLISH — DATE: 08/04/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/24/16	IR SITE 47B - EOD SCRAP AREA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 7-6	REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_SITE49.MXD 08/24/16 JEE



DRAWN BY: J. ENGLISH — DATE: 08/09/16	TETRA TECH	CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY — DATE: 08/24/16	IR SITE 49 - DEPLETED URANIUM GUN BUTT NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ — DATE: ___	
REVISED BY: ___ — DATE: ___		APPROVED BY: ___ — DATE: ___	
SCALE: AS NOTED		FIGURE NO.: 7-7	REV: 0

8.0 GAMBO CREEK ECOLOGICAL ASSESSMENT

Sampling for the initial (Phase I) Gambo Creek Ecological Assessment (EA) was performed in the fall of 1995 for surface water, sediment, and fish tissue. The results of sediment toxicity testing and macroinvertebrate community analysis in the mainstream of Gambo Creek did not indicate obvious effects. Rather, a gradient of potential effects was seen, with some correspondence among the toxicity test results, macroinvertebrate data, and sediment chemistry. PCBs in mummichog tissue were above a conservative screening level at most Gambo Creek locations. Based on the results of the Phase I study, additional sampling of sediment and fish was recommended.

Phase II of the Gambo Creek EA was completed in September 2003. Conclusions and recommendations of the Phase II EA included:

- In areas where high contaminant concentrations were detected in sediment near Sites 6 and 46, sources should be controlled. These contaminated sediments were potentially serving as secondary sources and potentially increasing the area of risk for benthic invertebrates. Remediation of large areas of marsh should be approached with caution; the most important issue is to significantly reduce secondary source areas. Since the collection of the Gambo Creek Phase II EA data in 2000, remediation of both Sites 6 and 46 has been addressed in a ROD. Remediation of Site 46 was completed in the fall of 2002. Remediation of Site 6 was completed in 2004.

- Monuron and mercury posed negligible risk to ecological receptors and were not retained as final COCs. The following chemicals did not pose risk in the tidal portion of Gambo Creek, but remained as sediment COCs for particular sites, due primarily to areas in which the extent of contamination had not been delineated: total DDT, total PCB, barium, beryllium, cadmium, cobalt, manganese, selenium, and silver. Decisions, including potential future remedial efforts to address contamination associated with sites in the Gambo Creek system, should consider that the nine COCs listed pose relatively low risk and/or tend to co-occur where concentrations of COCs with better known toxicity are elevated.

Based on recommendations provided in the Phase II Gambo Creek EA, supplemental sediment sampling was performed in Gambo Creek in October 2006. The objective of the supplemental sediment sampling was to increase the understanding of the spatial distribution of contamination within the Gambo Creek basin. To address spatial gaps between existing sample locations, fourteen sediment samples were collected from four areas: Upper Gambo Creek, Middle Gambo Creek, Lower Gambo Creek, and the

Unnamed Tributary North of Site 62. Analyses of the sediment samples included: PAHs, SVOCs, Pesticides/PCBs and metals.

Results of the supplemental sediment sampling and analyses indicated the following:

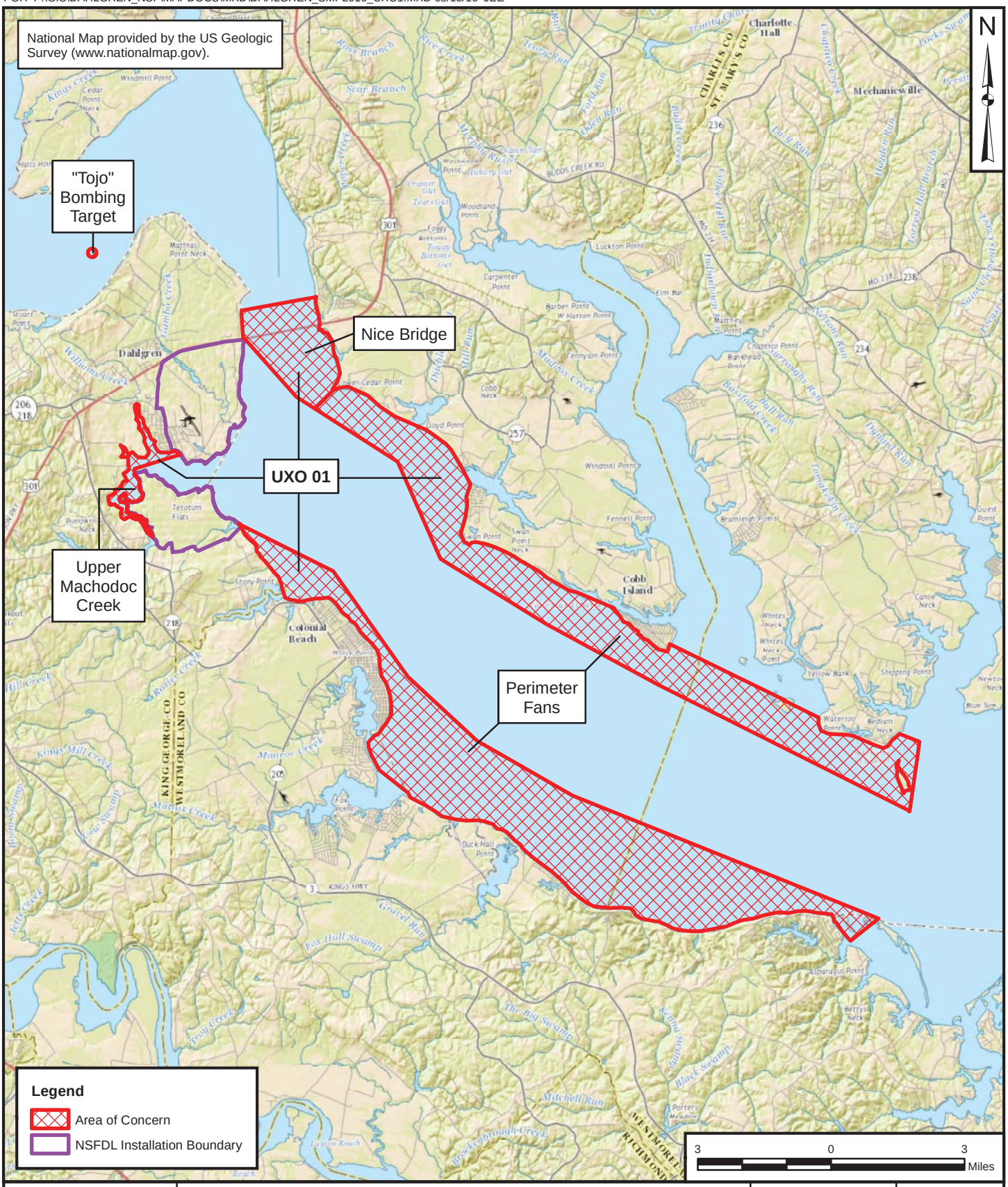
- Detected contaminant concentrations were consistent with those found in the 2003 Gambo Creek Phase II EA.
- The additional data provided a better spatial definition of previously identified areas of contamination in Gambo Creek and its tributaries.
- The data did not indicate the presence of additional sources.
- Remedial actions undertaken at IR Sites at and along Gambo Creek have been effective in mitigating contaminant migration.

Based upon these results, the objective of better characterizing sediment contamination within the Gambo Creek system has been addressed. The results of the supplemental sampling were documented in a final Technical Memorandum (Tetra Tech, 2008a). The DIRT is currently discussing how to address remaining BTAG concerns with respect to Gambo Creek, and how best to address closeout of the Gambo Creek Assessment.

9.0 MUNITIONS RESPONSE PROGRAM SITES

In 2012, the Navy prioritized its first Munitions Response Program (MRP) site at the NSFDL. This area is known as the non-active portion of the Potomac River water range, or UXO-01 (see **Figure 9-1**). UXO-01 consists of the river range perimeter fans, the “Tojo” bombing target, and the Machodoc Creek water range. A Preliminary Assessment (PA) for the NSFDL water range, including the areas later designated as UXO 01, was finalized in March 2016 (Resolution, 2016). A follow-on Site Investigation (SI) is being performed by NSWC-PCD (Panama City Division) that encompasses the Harry Nice Bridge, Tojo Target area, and an area outside the current middle danger zone between Swan Point and Cobb Island. The SI is under preparation to identifiy the potential presence of munitions items in sediments of the water range. The SI report is expected to be completed in FY18.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_UXO1.MXD 08/15/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH	CONTRACT NUMBER: 07992 / CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/15/16	UXO 1 NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ / DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___ / DATE: ___
SCALE: AS NOTED			FIGURE NO.: 9-1 / REV: 0

10.0 APPENDIX B SITES

This section discusses sites that are collectively called Appendix B sites and were listed in **Table 2-2**. All but 2 of the Appendix B sites have been closed out and designated as "no further action required" under consensus of the Parties. SWMU 15 and SWMU 70 do not require further action provided that land use remains industrial. The locations of Appendix B sites at Mainside and the EEA are shown in **Figures 10-1 and 10-2**, respectively.

The following changes were made to Appendix B site classifications under consensus of the Parties. At the February 2003 meeting, the DIRT agreed to add Building 126 to Appendix B based on potential contamination remaining at the site. As stated in Section 2.0, Site 61b was transferred from an Appendix A to an Appendix B site in May 2003. At the May 2007 meeting, the DIRT agreed to add Site 63 (the Building 198 Neutralization Tank) to Appendix B based on potential contamination remaining at the site, however, in FY 2009 is was subsequently added as an Appendix A Priority 3 Site based on further sampling and the need to perform a Removal Action at the site.

Under the FFA, the Navy agreed to provide additional site information for Appendix B Sites, which may include sampling, for review by USEPA Region III and VDEQ. Based on a desktop evaluation, the Appendix B units were proposed for "no further action" or transferred to Appendix A with the approval of the Navy, USEPA Region III, and VDEQ. The Navy prepared brief "close-out" documents for all Appendix B units requiring "no further action" or those where a removal action was completed. If a cleanup was performed at an Appendix B site, the confirmatory sampling results were documented in a close-out report that was issued to the USEPA Region III and VDEQ for approval.

Additional details concerning the nature of Appendix B sites can be found in the individual Close Out reports, and in the site summaries provided in **Attachment B** to this SMP.

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_B_MAIN_1117.MXD 08/29/16 JEE

N

BLANDY BOULEVARD
BEAVER ROAD
QUAIL LANE
TISDALE ROAD
GAMBO ROAD
FRONTAGE ROAD
WAYSIDE DRIVE
HIGLEY ROAD
SHOCKTUBE ROAD
RUDDY ROAD
BENNION ROAD
AEGIS ROAD
GUM ALLEY
TISDALE ROAD
BAGEY ROAD
FOSTER ROAD
FUZING HOUSE ROAD
CASKEY ROAD
TURKEY TROT ROAD
FIREBREAK ROAD
SHELL LANE
AVENUE D
AVENUE C
AVENUE B
AVENUE A
1ST STREET
BRONSON ROAD
MARPLE ROAD
SCHOOLHOUSE LANE
JENKINS ROAD
DAHLGREN ROAD
McVAY ROAD
MAGAZINE ROAD
HALL ROAD
COURT B
COURT D
STAR GAUGE ROAD
SAMPSON ROAD

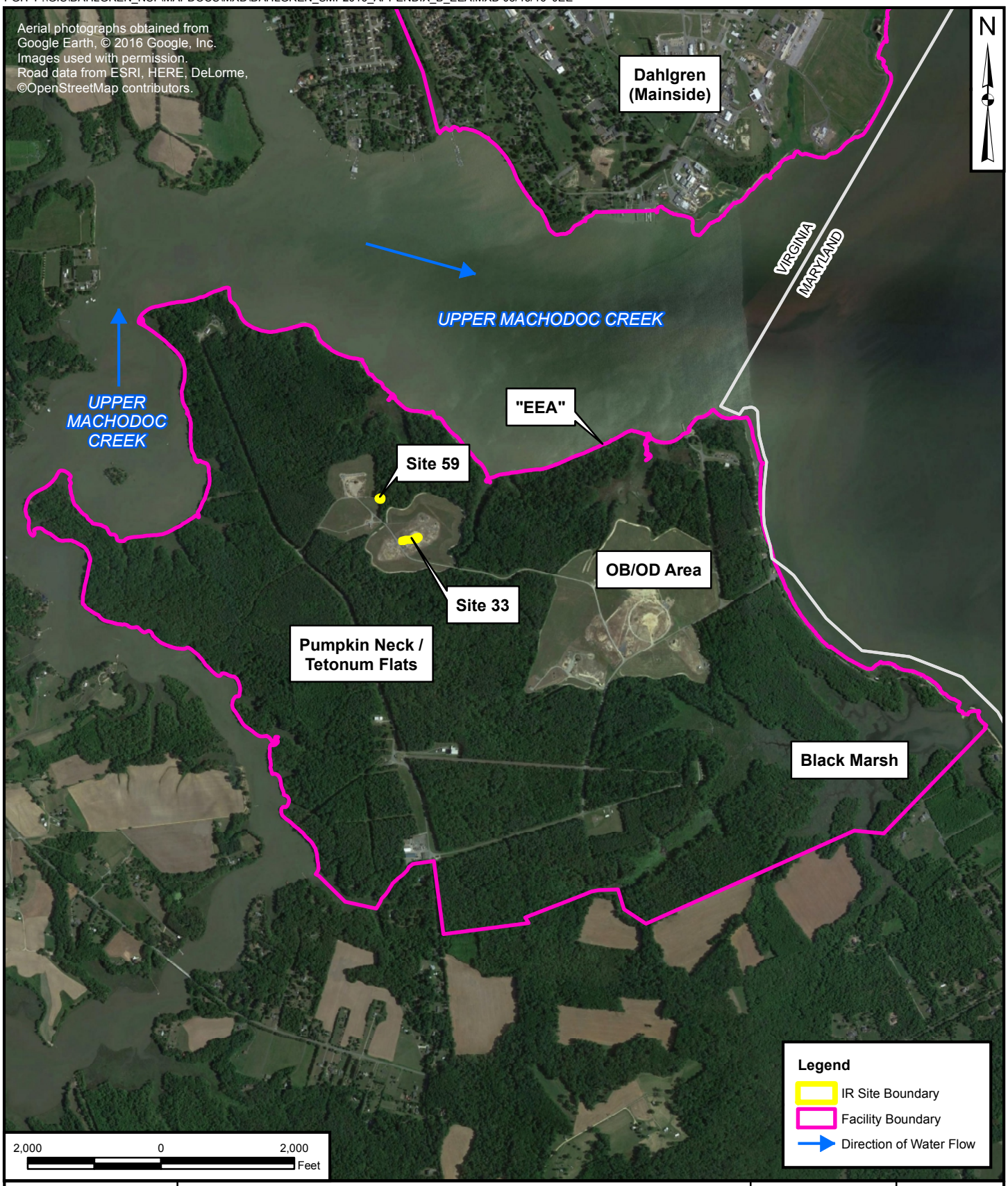
Site 28 / SWMU 131
Other Units C6
SWMU 23
AOC O
SWMU 27
Site 41 / SWMU 20
Site 18
SWMU 3
Former Bldg 126
Site 61B
Additional Area X6
SWMU 15
Site 60 / SWMU 57
AOC Z
Other Units C3
SWMU 82
AOC X7 / Site 39
SWMU 119
SWMU 78
SWMU 101
Site 54 / SWMU 128
SWMU 115
SWMU 77
SWMU 127
SWMU 70
SWMU 61
SWMU 62
Site 48 / SWMU 67
SWMU 64
Site 52 / SWMU 125
SWMU 130

1,200 0 1,200 Feet

Legend
- IR Site Boundary
- Facility Boundary

DRAWN BY: J. ENGLISH	DATE: 08/29/16	TETRA TECH	CONTRACT NUMBER: 5663 / CTO NUMBER: ____
CHECKED BY: A. McGIVNEY	DATE: 08/29/16	APPENDIX B SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY: ___ / DATE: ___
REVISED BY: ___	DATE: ___		APPROVED BY: ___ / DATE: ___
SCALE: AS NOTED			FIGURE NO.: 10-1 / REV: 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_APPENDIX_B_EEA.MXD 08/15/16 JEE



DRAWN BY: J. ENGLISH	DATE: 08/10/16	TETRA TECH		CONTRACT NUMBER: 07992	CTO NUMBER: ___
CHECKED BY: A. McGIVNEY	DATE: 08/15/16	ALL APPENDIX B SITES, EEA / PUMPKIN NECK NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA		APPROVED BY: ___	DATE: ___
REVISED BY: ___	DATE: ___			APPROVED BY: ___	DATE: ___
SCALE: AS NOTED				FIGURE NO.: 10-2	REV: 0

11.0 RADIOLOGICAL SITES

The Navy RASO is currently performing a Historic Radiological Assessment to identify candidate sites for further evaluation that have evidence of historical radiological impacts. Many of these sites were identified in the FFA, and have undergone cleanups with closeout under CERCLA (e.g., IAS Site 34, Site 36, and Site 49). The results of the radiological study are expected to be available in late 2018.

This page intentionally left blank.

REFERENCES

AGVIQ/CH2MHill, 2012. Project Completion Report – Site 57 Debris Removal, Naval Support Facility Dahlgren, Dahlgren, VA, March.

Allied Technology Group, Inc., and Geo/Resource Consultants, Inc., 1997. Final Engineering Evaluation/Cost Analysis, Naval Surface Warfare Center, Dahlgren, Virginia, February.

AGVIQ/CH2M Hill 2012a. Site 17, 1400 - Landfill Area – Methane Mitigation, Installation of Passive Landfill Gas Vents, Naval Support Facility, Dahlgren, Dahlgren, Virginia, April.

B&R Environmental (Brown & Root Environmental), 1995. Draft Final Remedial Investigation Report, Naval Surface Warfare Center, Dahlgren, Virginia, September.

B&R Environmental, 1996a. Final Site Screening Process, Priority 1 Sites, Naval Surface Warfare Center, Dahlgren, Virginia, March.

B&R Environmental, 1996b. Final Master Plans Environmental Investigations, Project Plans Remedial Investigation Phase I & II, Naval Surface Warfare Center, Virginia, April.

B&R Environmental, 1996c. Final Site Screening Process, Phase II, Priority 2 Sites, Naval Surface Warfare Center, Dahlgren, Virginia, July.

B&R Environmental, 1997. Draft Site Screening Process Report, Priority 2 Sites, Naval Surface Warfare Center, Dahlgren, Virginia, October.

B&R Environmental, 1998a. Final Engineering Evaluation/Cost Analysis, Site 3/44, Ordnance Burn Structure/Rocket Motor Pit, May.

B&R Environmental, 1998b. Phase I Air Sparging/Soil Vapor Extraction (AS/SVE) Treatability Study for Site 12 – Chemical Burn Area at Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

CH_2M Hill, 2001a. Final Work Plan for the Site Screening Process at Sites 40, 43, and 61b and Remedial Investigation at Sites 61a and 62 for Naval Surface Warfare Center, Dahlgren, Virginia, August.

CH_2M Hill, 2001b. Final Work Plan for the Site Screening Process at Sites 4, 14, 15, and 38 for Naval Surface Warfare Center, Dahlgren, Virginia, November.

CH_2M Hill, 2002. Final Site Screening Process Report, Sites 40, 43, and 61b, Naval Surface Warfare Center, Dahlgren Division, Dahlgren, Virginia, October.

CH_2M Hill, 2004a. Draft Final Focused Feasibility Study for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

CH_2M Hill, 2004b. Engineering Evaluation/Cost Analysis for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

CH_2M Hill, 2004c. Final Remedial Investigation for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

CH_2M Hill, 2005a. Final Remedial Investigation/Feasibility Study for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

CH_2M Hill, 2005b. Proposed Remedial Action Plan for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

CH_2M Hill, 2005c. Final Record of Decision for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

CH_2M Hill, 2005d. Final Site Screening Process at Sites 4, 14, 15, and 38 for Naval Support Facility Dahlgren, Dahlgren, Virginia.

CH_2M Hill, 2005e. Site Close-Out Decision Document Appendix A, Priority 3 Site 40, Naval Support Facility Dahlgren, Dahlgren, Virginia.

CH_2M Hill, 2006a. Sampling Strategy for Groundwater and Sediment at Site 61a for Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

CH_2M Hill, 2006b. Final Engineering Evaluation/Cost Analysis at Site 14, Chemical Waste Evaporation Pond for Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

CH_2M Hill, 2006c. Final Action Memorandum for Site 14, Chemical Waste Evaporation Pond for Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

CH_2M Hill, 2006d. Sampling and Analysis Report for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

CH_2M Hill, 2007a. Preconstruction Work Plan Addendum for Phase I Sampling and Fluid Evacuation Activities, Site 14 – Former Chemical Decontamination Building Discharge Pipeline, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

CH_2M Hill, 2007b. Final Sampling and Analysis Investigation Report for Building 198 Neutralization Tank, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

CH2M Hill, 2009. Final Engineering Evaluation/Cost Analysis, Site 63 – Building 198 Neutralization Tank, Naval Support Facility Dahlgren, Dahlgren, VA, December.

CH2M Hill, 2013. Groundwater Screening and Soil Confirmation Sampling Report - Site 63, Bldg. 198 Neutralization Tank, Naval Support Facility, Dahlgren, VA, February.

Department of Defense, 2007. DoD Perchlorate Handbook, Revision 1, Change 1, August.

FSSI (Field Support Services, Inc.), 2006. Final Summary Closeout Report for Marsh Cap Repairs at Site 9 Landfill Area, NSFDL, Dahlgren, VA, October.

Fred C. Hart Associates, Inc, 1983. Initial Assessment Study of Naval Surface Warfare Center Dahlgren Laboratory, Dahlgren, Virginia, Prepared for NACIP Department, May.

Geophex, 1993. Final Report, Preliminary Site Investigation of Contamination at the Cooling Pond, Naval Surface Warfare Center, Dahlgren, Virginia, September.

Geophex, 1997. Final Report, Site Characterization at Building 396, Naval Surface Warfare Center, Dahlgren, Virginia, November.

Halliburton NUS, 1993a. Work Plan for Site Screening Process at SWMUs #61, 62, 64, and 67, Naval Surface Warfare Center, Dahlgren, Virginia, July.

Halliburton NUS, 1993b. Draft Site Screening Process Report for Solid Waste Management Units #61, 62, 64, and 67, Naval Surface Warfare Center, Dahlgren, Virginia, August.

H&S Environmental, 2013. Environmental Restoration Program Community Involvement Plan for Naval Support Facility Dahlgren. Naval Support Facility Dahlgren, December.

H&S Environmental, 2016. Final Five Year Review Report Regarding Site 9, Disposal Burn Area, Site 10 Hideaway Pond, Site 12 Chemical Burn Area, Site 17 1400 Area Landfill, Site 37 Lead Contamination Area, Site 20 Former Electroplating Waste Underground Storage Tank, and Site 23 Polychlorinated Biphenyl, Outside Storage Building 480, NSFDL, Dahlgren, Virginia, November.

JMWA (JM Waller Associates), 2004a. Draft 2003 Annual Wetlands Monitoring Report, January.

JMWA, 2004b. Final Operations and Maintenance Manual for Landfill Sites 2, 9, and 17, NSFDL, Dahlgren, Virginia, May.

JMWA, 2004c. Final Engineering Evaluation/Cost Analysis for Sites 4 and 15, NSFDL, Dahlgren, Virginia, June.

JMWA, 2004d. Final Five-Year Review Report for Sites 9, 10, 12, and 17, NSFDL, Dahlgren, Virginia, December.

JMWA, 2005a. Draft 2004 Annual Wetlands Monitoring Report, NSFDL, Dahlgren, Virginia, January.

JMWA, 2005b. Final Decision Document for Site 61b, NSFDL, Dahlgren, Virginia, February.

JMWA, 2012. Verification Sampling and Analysis Report for Site 4 (Case Storage Area), and Site 15 – (Scrap Area)

Koman Government Solutions, 2017. Final Long Term Monitoring Plan for Site 12 Chemical Burn Pit NSFDL, Dahlgren, Virginia, February.

Navy (United States Navy), 1996a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 15, Building 120B Contractor Staging Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

Navy, 1996b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 70, B-152 TCA AA, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

Navy, 1996c. Federal Facility Agreement Appendix B Site Close-Out Package, AOC A, Otto Fuel Spill, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

Navy, 1996d. Federal Facility Agreement Appendix B Site Close-Out Package, AOC O, B-1369 Pesticide Spill Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

Navy, 1996e. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 23, Building 456 Oil Waste Drum, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

Navy, 1997a. Engineering Evaluation/Cost Analysis (EE/CA) for Site 29, Battery Service Area, SWMU 78, Building 1121 Former Waste Oil UST, SWMU 128, OWS 1121-Old, SWMU 77, Building 1329 Wash Area, SWMU 52, Gun Barrel Decoppering Area, SWMU 53, Gun Barrel Degreasing Area, SWMU 126,

OWS 207-300, Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

Navy, 1997b. Record of Decision, Site 12, Chemical Burn Area, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 1998a. Record of Decision, Site 9, Disposal/Burn Area, Naval surface Warfare Center Dahlgren, Dahlgren Virginia, September.

Navy, 1998b. Record of Decision, Site 17, 1400 Area Landfill, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 1999a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 3, Building 194A (Concrete Pad), for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

Navy, 1999b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 57, B-445 Star Gauge Loading Dock, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

Navy, 1999c. Federal Facility Agreement Appendix B Site Close-Out Package, AOC X7, Open Storage Area Main Battery, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

Navy, 1999d. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 62, Paint Can Crusher, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

Navy, 1999e. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 64, Building 448 Sand Blast Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

Navy, 1999f. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 130, Yardcraft Oil Storage Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, September.

Navy, 1999g. Record of Decision, Site 19 Transformer Draining Area (Soils), Site 29, Battery Service Area (Groundwater and Soils), for the Naval Surface Warfare Center, Dahlgren, Virginia, September.

Navy, 1999h. Record Decision, Site 25, Pesticide Rinse Area, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 1999i. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 78, Building 1121 Former Waste Oil Underground Storage Tank, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, November.

Navy, 2000a. Proposed Remedial Action Plan, Site 3, Ordnance Burn Structure, Site 44, Rocket Motor Pit, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

Navy, 2000b. Proposed Remedial Action Plan, Site 10, Hideaway Pond, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

Navy, 2000c. Record of Decision, Site 3, Ordnance Burn Structure, Site 44, Rocket Motor Pit, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 2000d. Record of Decision, Site 10, Hideaway Pond, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 2000e. Federal Facility Agreement Appendix B Site Close-Out Package, AOC X, Classified Incinerator Holding Area, Naval Surface Warfare Center Dahlgren, Virginia, September.

Navy, 2001a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 77, Building 1329, Wash Area, Naval Surface Warfare Center Dahlgren, Virginia, July.

Navy, 2001b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 61, Paint Can Crusher, Naval Surface Warfare Center Dahlgren, Virginia, September.

Navy, 2001c. Record of Decision, Site 46, July 28, 1992 Landfill A: Stump Dump Road, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 2001d. Record of Decision, Site 36, Depleted Uranium Mound, Pumpkin Neck and Site 49 Depleted Uranium Gun Butt, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 2002a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 67, Tar Tank Area, Naval Surface Warfare Center Dahlgren, Virginia, February.

Navy, 2002b. Federal Facility Agreement Appendix B Site Close-Out Package, Site 59, Octagon Pad Dump, Naval Surface Warfare Center Dahlgren, Virginia, April.

Navy, 2002c. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 101, Building 155 Auto Shop Waste Oil Filter and UST, Naval Surface Warfare Center Dahlgren, Virginia, April.

Navy, 2002d. Federal Facility Agreement Priority 1 Site Decision Document, Site 45, July 28 1992 Landfill B, Naval Surface Warfare Center Dahlgren, Virginia, June.

Navy, 2002e. Federal Facility Agreement Appendix B Site Close-Out Package, AOC Z, Terminal Range Building 109, Naval Surface Warfare Center Dahlgren, Virginia, September.

Navy, 2002f. Record of Decision, Site 6, Terminal Range Airplane Park, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

Navy, 2002g. Federal Facility Agreement Priority 1 Site Decision Document, Site 21 Gun Barrel Decoppering Area; Site 22, Gun Barrel Degreasing Area, North Main Range; and Site 53, OWS 207-300, Naval Surface Warfare Center Dahlgren, Virginia, September.

Navy, 2002h. Federal Facility Agreement Appendix B Site Close-Out Package, Site 41, Compost Area, Naval Surface Warfare Center Dahlgren, Virginia, October.

Navy, 2003a. Proposed Remedial Action Plan, Site 55, Cooling Pond, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, May.

Navy, 2003b. Federal Facility Agreement Priority 1 Site Decision Document, Site 13, Gambo Creek Truck Wash Area, Naval Surface Warfare Center Dahlgren, Virginia, May.

Navy, 2004. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 119, Auto Hobby Used Oil Tank, for the Naval Support Facility Dahlgren, Dahlgren, Virginia, July.

Navy, 2006. Federal Facility Agreement Appendix B Site Close-Out Package, Site 47a – World War I Munitions Mound and Site 47b – Explosive Ordnance Disposal Scrap Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Navy, 2007a. Decision Document for Site 1 – Old Bombing Range and Site 5 – Projectile Disposal Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

Navy, 2007b. ROD Sites 20 and 23, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

Navy, 2007c. Success Story at Site 37 – Lead Contamination Site (Shoreline Remediation), Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Navy, 2012b. Memorandum to File, Non-Significant Changes to the Site 17 (1400 Area Landfill) Record of Decision (ROD), NSF Dahlgren, VA September

Navy, 2014a. Memorandum to File, Non-Significant Changes to the Site 2 (Fenced Ordnance Burial Area) Record of Decision (ROD), NSF Dahlgren, VA, January.

Navy, 2014b. Site Close Out Document Addendum for Appendix B Site Area of Concern X7 (AOC X7) – Open Storage Area Main Battery. Naval Support Facility Dahlgren, Dahlgren, Virginia, July.

Navy, 2015. Decision Document for Deferral of Action, Site 64, Gum Alley Disposal Area, Naval Support Facility Dahlgren, Dahlgren, Virginia. September.

Navy, 2017. Memorandum to File, Non-Significant Changes to Site 9 (Disposal/Burn Area) Record of Decision (ROD), NSF Dahlgren, VA, February

NRC (Nuclear Regulatory Commission), 2002. Letter to Chief of Naval Operations, Department of the Navy, from Chief of Materials Licensing/Inspection Branch 2 of the Nuclear Regulatory Commission, regarding NRC Inspection Report No. 45-23645-01NA/00-06, January 8.

NSWC, 2012a. Naval Surface Warfare Center Dahlgren and DTI Associates, Inc., Removal Action Completion Report, Site 4 (Case Storage Area), and Site 15 (Scrap Yard), Naval Support Facility Dahlgren, Dahlgren, VA, January.

NSWC, 2012b. Naval Surface Warfare Center Dahlgren and DTI Associates, Inc., Munitions Response After-Action Report, Site 4 (Case Storage Area), and Site 15 (Scrap Yard), Naval Support Facility Dahlgren, Dahlgren, VA, January.

O'Brien & Gere, 1986a. NACIP Confirmation Studies at Naval Surface Warfare Center, Dahlgren, Virginia, Volume I and II, February.

O'Brien & Gere, 1986b. NACIP Groundwater Monitoring Plan for Naval Surface Warfare Center, Dahlgren, Virginia, February.

OHM Remediation Services Corp., 1998. Final Report for Sites 29, 54, SWMUs 45, 52, 53, 77, 78 & 126, October 13.

OHM Remediation Services Corp., 2000. Final Closure Report for Site 9, Dahlgren, Virginia, November.

OSAGE of Virginia (Osage), 2013a. Final Landfill Gas Monitoring for Site 2 and Site 9. Naval Support Facility Dahlgren, Dahlgren, Virginia, February

OSAGE of Virginia (Osage), 2013b. Final Surface Water and Sediment Monitoring for Site 2 – Round 6. Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

OSAGE of Virginia (Osage), 2013c. Final Surface Water and Sediment Monitoring for Site 9 – Round 6. Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

OSAGE of Virginia (Osage), 2013d. Final Surface Water and Sediment Monitoring for Site 17 – Round 6. Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

OSAGE of Virginia (Osage), 2013e. Final Periodic Groundwater Monitoring Report for Site 2 – Round 10. Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

OSAGE of Virginia (Osage), 2013f. Final Periodic Groundwater Monitoring Report for Site 9 – Round 10. Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

OSAGE of Virginia (Osage), 2013g. Final Periodic Groundwater Monitoring Report for Site 17 – Round 10. Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

OSAGE of Virginia (Osage), 2013h. Technical Memorandum for Methane Detection System Inspection and Operation and Maintenance at Building 1400. Naval Support Facility Dahlgren, Dahlgren, Virginia, July.

OSAGE of Virginia (Osage), 2013i. Final Landfill Gas Monitoring July 2013 for Site 17. Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

OSAGE of Virginia (Osage), 2014a. Final Landfill Gas Monitoring October 2013 for Site 17. Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

OSAGE of Virginia (Osage), 2014b. Final Landfill Gas Monitoring January 2014 for Site 17. Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

OSAGE of Virginia (Osage), 2014c. Final Annual Landfill Gas Monitoring April 2014 for Site 17. Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

OSAGE of Virginia (Osage), 2015. Master Work Plan for Long-Term Monitoring. NSF Dahlgren Dahlgren, Virginia, September.

OSWER, 2007. Close Out Procedures for National Priorities List Sites, Directive 9320.2-09A-P, PB98-963223, January.

Resolution Consultants, 2015. Final Preliminary Assessment of Water Ranges in the Potomac River, Naval Support Activity South Potomac, March.

RETEC, 1998. Final Report, Earthworm Bioaccumulation Study for Pesticide-Contaminated Soils, Naval Surface Warfare Center, Dahlgren, Virginia, April.

SOV (Sovereign Consulting Inc.), 2009. Remedial Action Completion Report for Site 37 – Lead Contamination Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

SOV (Sovereign Consulting Inc.), 2012. Final Construction Completion Report Site 63- Bldg. 198 Neutralization Tank, Naval Support Facility – Dahlgren, VA, February

Tetra Tech (Tetra Tech NUS, Inc.), 1997. Record of Decision for Site 2, Fenced Ordnance Burial Area, for Naval Surface Warfare Center, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 1998. Engineering Evaluation/Cost Analysis for Site 44, Rocket Motor Pit, Naval Warfare Center, Dahlgren, Virginia, November.

Tetra Tech (Tetra Tech NUS, Inc.), 1999. NSWCDL Environmental GIS Database, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2000a. Remedial Investigation/Focused Feasibility Study, Sites 3 and 44 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

Tetra Tech (Tetra Tech NUS, Inc.), 2000b. Engineering Evaluation/Cost Analysis for Site 50, Fill Area Northeast (Objects), for Naval Surface Warfare Center, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2001a. Remedial Investigation, Site 46 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2001b. Engineering Evaluation/Cost Analysis for Site 31, Airplane Park Dump, Naval Surface Warfare Center, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2001c. Site Screening Process, Priority 2 Sites, Phase II Project Plans Addendum for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, April.

Tetra Tech (Tetra Tech NUS, Inc.), 2001d. Post-Remedial Action Report for Site 25, Pesticide Rinse Area, for Naval Surface Warfare Center, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2001e. Post-Removal Action Report for Site 50, Fill Area Northeast (Objects), for Naval Surface Warfare Center, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2001f. Monitoring Report Site 10, Hideaway Pond, Year One, October 2001, Naval Surface Warfare Center, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2002a. Remedial Investigation Site 20 Volumes I, II, and III for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, February.

Tetra Tech (Tetra Tech NUS, Inc.), 2002b. Remedial Investigation Site 55 Volumes I, II, and III for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

Tetra Tech (Tetra Tech NUS, Inc.), 2003a. Biennial Surface Water and Sediment Monitoring Report for Site 2 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2003b. Biennial Surface Water and Sediment Monitoring Report for Site 9 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2003c. Biennial Surface Water and Sediment Monitoring Report for Site 17 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2003d. Feasibility Study Site 55 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, May.

Tetra Tech (Tetra Tech NUS, Inc.), 2003e. Engineering Evaluation/Cost Analysis for Sites 47a – World War I Munitions Mound, and 47b EOD Scrap Area, Naval Surface Warfare Center, Dahlgren, Virginia, July.

Tetra Tech (Tetra Tech NUS, Inc.), 2003f. Five-Year Review Report for Site 2, Naval Surface Warfare Center, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 2003g. Gambo Creek Ecological Assessment Phase II, Naval Surface Warfare Center, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 2004a. Federal Facility Agreement, Appendix B Site Close-Out Package, C6 – Former Radio Testing Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

Tetra Tech (Tetra Tech NUS, Inc.), 2004b. Site Close-Out Decision Document Appendix A, Priority 3 Site 43, - Higley Road Land Application Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

Tetra Tech (Tetra Tech NUS, Inc.), 2004c. Feasibility Study for Site 37, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

Tetra Tech (Tetra Tech NUS, Inc.), 2005a. Remedial Investigation Site 20 Volumes I, II, and III for Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

Tetra Tech (Tetra Tech NUS, Inc.), 2005b. Periodic Groundwater Monitoring Report for Site 2 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

Tetra Tech (Tetra Tech NUS, Inc.), 2005c. Periodic Groundwater Monitoring Report for Site 9 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

Tetra Tech (Tetra Tech NUS, Inc.), 2005d. Periodic Groundwater Monitoring Report for Site 17 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

Tetra Tech (Tetra Tech NUS, Inc.), 2005e. Biennial Surface Water and Sediment Monitoring Report for Site 2 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

Tetra Tech (Tetra Tech NUS, Inc.), 2005f. Biennial Surface Water and Sediment Monitoring Report for Site 9 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

Tetra Tech (Tetra Tech NUS, Inc.), 2005g. Biennial Surface Water and Sediment Monitoring Report for Site 17 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

Tetra Tech (Tetra Tech NUS, Inc.), 2005h. Gambo Creek Waste Removal and Wetlands Restoration Fact Sheet for Site 6, Terminal Range Airplane Park, Naval Support Facility Dahlgren, Dahlgren, Virginia.

Tetra Tech (Tetra Tech NUS, Inc.), 2005i. Final Proposed Remedial Action Plan for Site 37- Lead Contamination Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Tetra Tech (Tetra Tech NUS, Inc.), 2006a. Landfill Gas Monitoring for Site 17, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2006b. ROD Amendment for Site 37 – Lead Contamination Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

Tetra Tech (Tetra Tech NUS, Inc.), 2006c. Master Work Plan for Long Term Monitoring, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 2006d. Site Close-out Package for SWMU 128 – Site 54 OWS, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 2006e. Periodic Groundwater Monitoring Report for Site 2 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

Tetra Tech (Tetra Tech NUS, Inc.), 2006f. Periodic Groundwater Monitoring Report for Site 9 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

Tetra Tech (Tetra Tech NUS, Inc.), 2006g. Periodic Groundwater Monitoring Report for Site 17 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

Tetra Tech (Tetra Tech NUS, Inc.), 2007a. Draft Gambo Creek Sediment Sampling – October 2006, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

Tetra Tech (Tetra Tech NUS, Inc.), 2007b. Focused Feasibility Study, Sites 20 and 23, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

Tetra Tech (Tetra Tech NUS, Inc.), 2007c. Technical Memorandum 2006 Sampling Results and Remedy Evaluation for Site 12 Chemical Burn Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

Tetra Tech (Tetra Tech NUS, Inc.), 2007d. Periodic Groundwater Monitoring Report for Site 2-Round 7, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2007e. Landfill Gas Migration Plan, Site 17 - 1400 Area Landfill, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2008a. Technical Memorandum Gambo Creek October 2006 Sediment Sampling, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

Tetra Tech (Tetra Tech NUS, Inc.), 2008b. Draft Sampling and Analysis Plan, Site 12 Chemical Burn Pit Verification Sampling, Naval Support Facility Dahlgren, Dahlgren, Virginia. Prepared for Naval Facilities Engineering Command, Washington Navy Yard, Washington, DC, May.

Tetra Tech (Tetra Tech NUS, Inc.), 2009. Engineering Evaluation/Cost Analysis (EE/CA) for Site 57 – Shell House Dump, Naval Support Facility Dahlgren, Dahlgren, Virginia, October.

Tetra Tech (Tetra Tech NUS, Inc.), 2010. Work Plan for Soil Pile Sampling and Analysis, Site 57 – Shell House Dump, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

Tetra Tech (Tetra Tech NUS, Inc.), 2011a. Interim Remedial Action Completion Report, Sites 20 and 23, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech (Tetra Tech NUS, Inc.), 2011b. Summary of Results Soil Pile Sampling and Analysis, Site 57 - Shell House Dump, Naval Support Facility Dahlgren, Dahlgren, Virginia, October.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2008a. Five-Year Review Report for Site 2 – Fenced Ordnance Burial Area, October.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2008b. Annual Wetland Monitoring Report for Sites 6, 9/58, 17, 25, 46, and 50, for Naval Support Facility Dahlgren, located in Dahlgren, Virginia, March.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009a. Draft Work Plan, Methane Evaluation and Pre-Design Data Collection For Methane Mitigation System at Site 17 – 1400 Area Landfill for Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009b. Periodic Groundwater Monitoring Report for Site 17 – Round 8 for Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009c. Periodic Groundwater Monitoring Report for Site 9 – Round 8 for Naval Support Facility Dahlgren, Dahlgren, Virginia, October.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009d. Surface Water and Sediment Monitoring Report for Site 17 - 1400 Area Landfill, Round 4 (Year Eight) for Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009e. Surface Water and Sediment Monitoring Report for Site 2 - Fenced Ordnance Burial Area, Round 4 (Year Eight) for Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2009f. Surface Water and Sediment Monitoring Report for Site 9 - Disposal/Burn Area, Round 4 (Year Eight) for Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2010a. Five-Year Review Reports for Sites 9/58 – Disposal/Burn Area, Site 10 – Hideaway Pond, Site 12 – Chemical Burn Area, and Site 17 – 1400 Area Landfill for Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2010b. Final Annual Wetland Monitoring Report for Sites 6, 9/58, 17, 25, 46, and 50 for Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011a. Final Periodic Groundwater Monitoring Report For Site 2 – Round 9, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011b. Draft Surface Water and Sediment Montirong Report for Site 2 – Fenced Ordnance Burial Area Round 5 (Year Ten), September 2010, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011c. Draft Periodic Groundwater Monitoring Report for Site 9 – Round 9. Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011d. Draft Monitoring Report For Site 9 – Disposal/Burn Area Round 5 (Year Ten), September 2010, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011e. Draft 2010 Wetland Monitoring Technical Memorandum, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011e1. Final 2010 Wetland Monitoring Technical Memorandum, Naval Support Facility Dahlgren, Dahlgren, Virginia, April 2013.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011f. Draft Periodic Groundwater Monitoring Report For Site 17 – Round 9, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2011g. Draft Surface Water and Sediment Monitoring Report For Site 17 – 1400 Area Landfill, Round 5 (Year 10), Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2012a. Draft 2011 Wetland Monitoring Technical Memorandum, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

Tetra Tech/SOV (Tetra Tech NUS, Inc. and Sovereign Consulting, Inc.), 2012b. Final 2011 Wetland Monitoring Technical Memorandum, Naval Support Facility Dahlgren, Dahlgren, Virginia, April 2013.

USEPA (United States Environmental Protection Agency), 1991. National Priorities List (NPL), HRS Documentation for Naval Surface Warfare Center -Dahlgren, Dahlgren, Virginia, August.

USEPA, 1992. Study Area Analysis, Naval Surface Warfare Center, Dahlgren, Virginia. Prepared for the Navy by Environmental Monitoring Systems Lab, Las Vegas, Nevada, November.

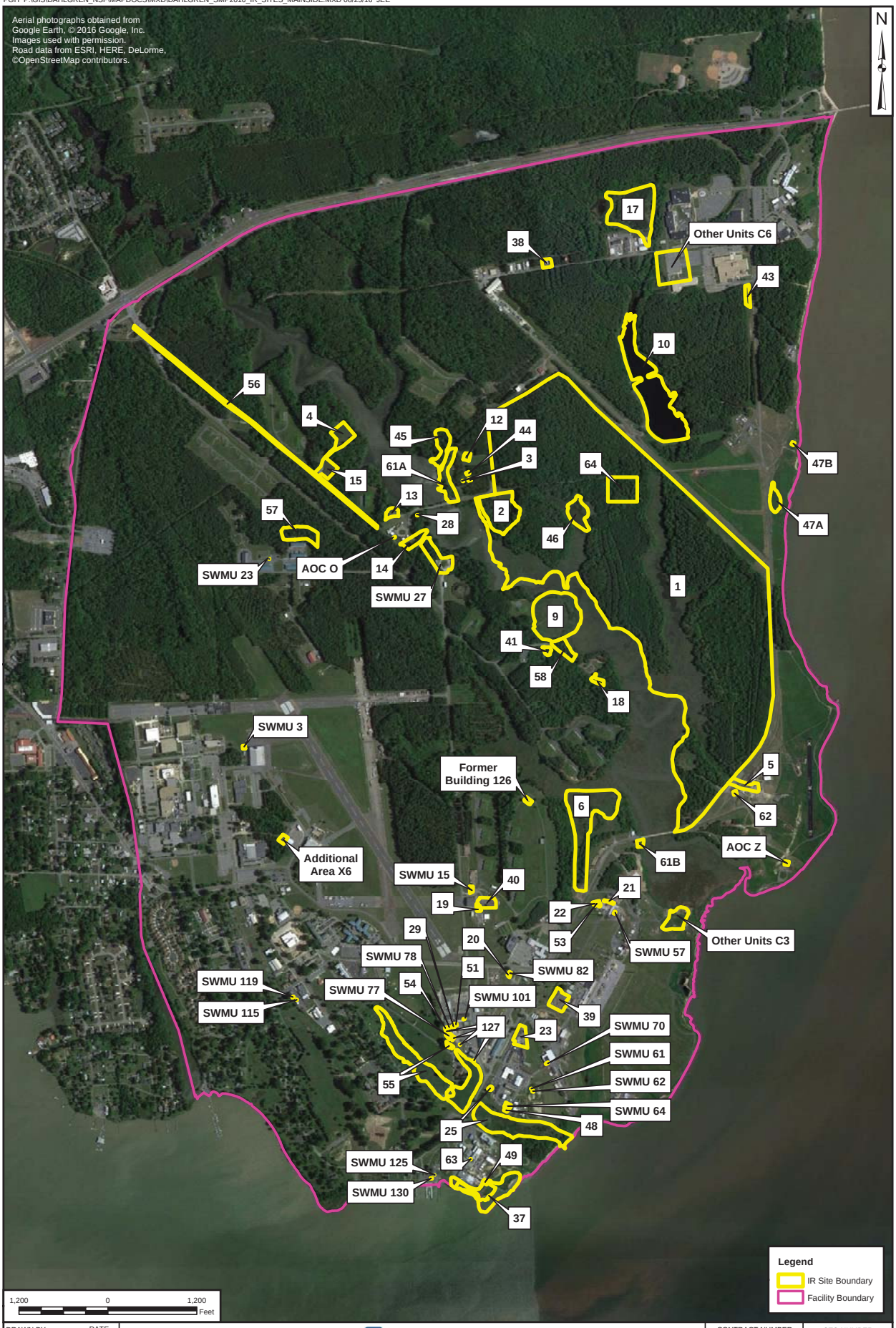
USEPA, 1993. Letter from USEPA to EFACHES, Subject: Priority Ranking of Sites at the Naval Surface Warfare Center, Dahlgren, Virginia, February 17.

This page intentionally left blank.

ATTACHMENT A

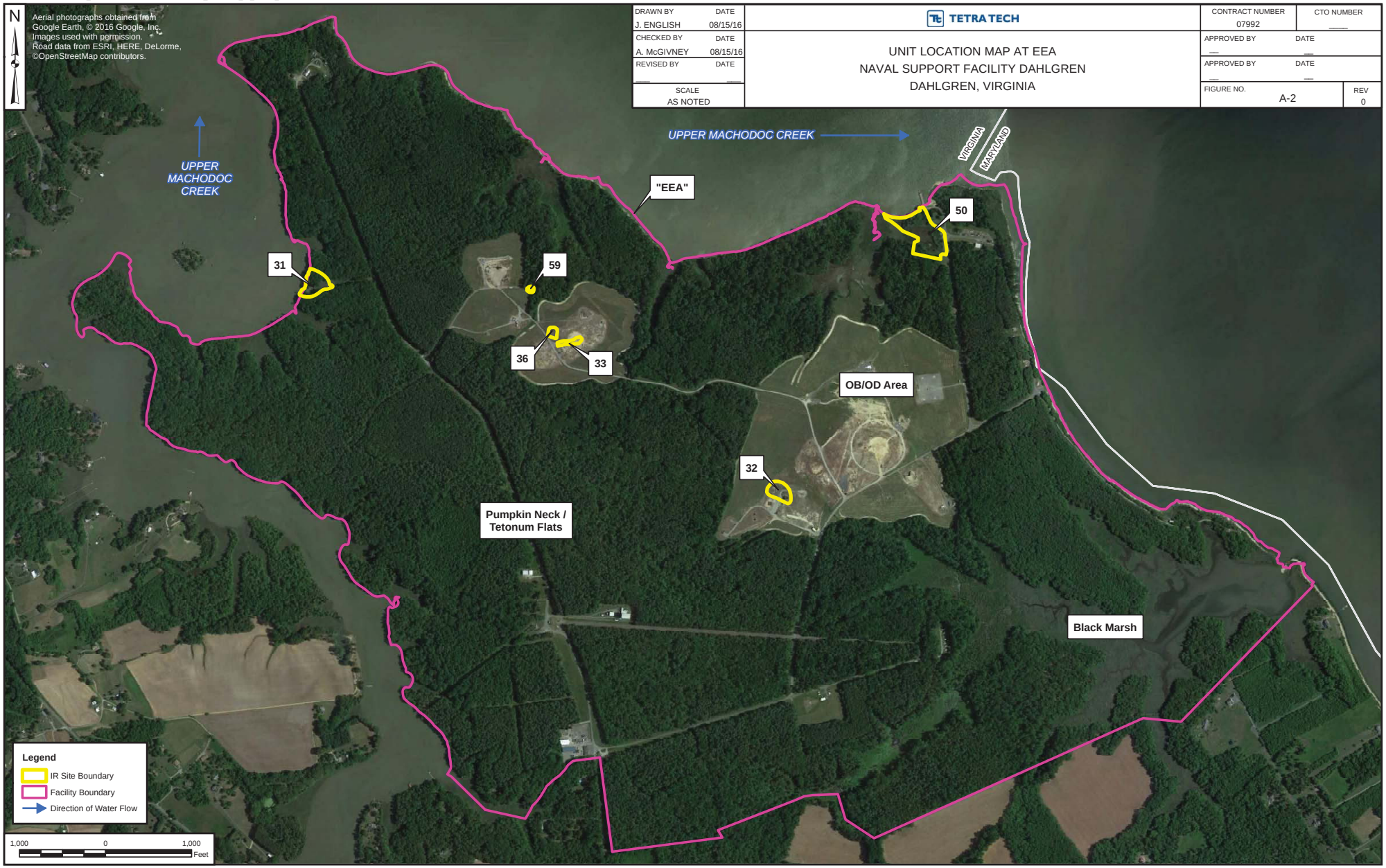
FACILITY MAPS

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_IR_SITES_MAINSIDE.MXD 08/25/16 JEE



DRAWN BY J. ENGLISH	DATE 08/15/16	TETRA TECH	CONTRACT NUMBER 07992 / CTO NUMBER ___
CHECKED BY A. McGIVNEY	DATE 08/25/16	ALL APPENDIX A SITES - MAINSIDE NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. A-1 / REV 0

PGH P:\GIS\DAHLGREN_NSF\MAPDOCS\MXD\DAHLGREN_SMP2016_IR_SITES_EEA.MXD 08/15/16 JEE



DRAWN BY J. ENGLISH	DATE 08/15/16	TETRA TECH	CONTRACT NUMBER 07992 / CTO NUMBER ____
CHECKED BY A. McGIVNEY	DATE 08/15/16	UNIT LOCATION MAP AT EEA NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. A-2 / REV 0

ATTACHMENT B

PRIORITY B SITE SUMMARIES (CD ONLY)

ATTACHMENT B

SUMMARY OF NSFDL APPENDIX B SITES (ALL CLOSED OUT)

SWMU 3 - Building 194AA (Concrete Pad)

This unit (SWMU 3) was a black drum on an eroding concrete base surrounded by grass. The unit was located on a severely deteriorated concrete pad. In addition, the unit was not equipped with curbing or a berm to provide adequate containment in case of a release. One drum of used aircraft oil was removed from the concrete pad.

Field investigation activities at the site consisted of Pre-Excavation and Post-Excavation sampling. Pre-Excavation sampling consisted of four surface soil (0 to 12 inch) samples at the perimeter of the concrete base; the samples were analyzed for total metals, PCBs, and TPH. Risk was evaluated under the residential and industrial use scenarios based upon initial soil sampling results, which included inorganics, PCBs, and TPH contamination. A cleanup was identified and performed in March 1996. During the cleanup action, when the concrete pad was removed, a slight petroleum odor was noted. The pad thickness varied from 12 to 20 inches. A 20 foot by 23 foot area surrounding the pad was excavated and removed to a depth of 14 to 24 inches. Approximately 36 tons of concrete and soil were removed from the unit and disposed of off-site at a permitted facility.

Post-Excavation sampling consisted of one surface soil sample analyzed for RCRA metals, PCBs, and TPH, and a groundwater sample analyzed for TPH and PCBs. No chemicals exceeded the RBC screening criteria. Non-detected results were obtained for TPH and PCBs in the groundwater sample.

Based upon confirmation soil and groundwater sampling, modifications to the operations of the site, and the removal of the source area, no further action is required for this unit, based on a residential use scenario under CERCLA (Navy, 1999a).

SWMU 15 - Building 120B Contractor Staging Area

Building 120B Contractor Staging Area (SWMU 15) was located north of Building 120B at Mainside. The site consisted of an office trailer and drums stored on the ground. The area encompassed approximately one acre and was used from Spring to Fall 1992. The drums included used diesel fuel, used motor oil products, scrap metal, and wood. The drums were also used while a contractor was working on a

construction project at NSFDL. The contractor removed the drums when the construction project was completed.

Field investigation activities at the site included collecting a total of five surface soil samples. These samples were analyzed for PCBs, TPH, benzene, toluene, ethyl benzene, and xylenes. Risk was evaluated under residential and industrial use scenarios.

Maximum concentrations of chemicals from soil sampling were compared to RBC tables, to screening levels for residential and industrial use, and to Soil Screening Levels (SSL) for the protection of groundwater. Arsenic, barium, PCBs, and selenium were noted as COCs. Arsenic was considered not to be significantly elevated above background levels. One soil sample for selenium was reported at an elevated detection limit above screening levels for groundwater; however, selenium was not detected in the remaining four samples and the detection limits were below the screening level. Barium was reported above the groundwater screening levels, but below background levels. PCBs were detected; however, the reported concentrations were within the industrial cleanup levels under an USEPA PCB Spill Cleanup policy. Elevated levels of TPH were detected in sampling; however, the corresponding volatile organic compounds were not detected.

The few potential COCs that were elevated slightly above RBC/SSL values are not expected to present a significant risk as long as site use remains limited to industrial activities. Based on the contents of the Site Close-Out Document, it is the consensus of the Remedial Program Managers that this site requires no further action under a continued industrial use scenario (Navy, 1996a).

SWMU 20/Site 41 - Compost Area

The Compost Area (known as USEPA SWMU 20) was located in the central section of Mainside. It consisted of four mounds over approximately a 2 acre area. Three of the mounds are approximately 30 feet in diameter and 15 feet high, and one mound is approximately 50 feet in diameter and 15 feet high. From the 1960s until the Fall of 1992, wood chips, mulch, sawdust, leaves, and similar materials were dumped on the ground in the four areas, eventually forming the four mounds of compost material. These mounds were leveled in October 1994 to discourage further use.

The Compost Area was sampled in Summer 1999 at the same time as the verification sampling for Site 9. Based on the nature and history of the compost piles, analysis of the samples collected from three of the four compost piles was limited to TAL metals plus cyanide and target compound list (TCL) Pesticides/PCBs. In addition to these analytes, Pile 3 also was sampled for TPH. Four discrete samples were collected from each of the compost piles to evaluate the contamination levels within the piles. The results of the sampling

indicated that the material could not be used based on concentrations of DDT in Pile 3. No further work was performed on the piles until 2001. At that time, the RPMs decided that Piles 1 and 2 could be used for compost and backfill at AOC Z. At the same time, the hot spot of DDT located in Pile 3 was removed and disposed off-site.

Following the removal of the hot spot in Pile 3, TtNUS re-sampled Piles 3 and 4 in 2001 following the same procedure used to sample the piles in 1999. The re-sampling was designed to confirm that pesticide concentrations met appropriate screening levels to help determine if the material could be used as topsoil at the facility. Based on the re-sampling results, the 2002 Analytical Sample Summary Report concluded that the compost was suitable for use as topsoil at the facility (but not within the buffer zone around or within wetlands as a conservative measure, based on sediment guidelines for DDT), and that no further investigation of Site 41 was necessary.

Based on the contents of the Site Close-Out Document, it was the consensus of the RPMs that this site requires no further action under a residential use scenario (Navy, 2002h).

SWMU 23 - Building 456 Oil Waste Drum

The Building 456 Oil Waste Drum (SWMU 23) was located outside the eastern side of Building 456, the Boiler House at Mainside. The 55-gallon drum was situated on the ground and did not have any secondary containment.

The drum was used in August 1992 to contain oily rags, papers, empty oil cans, and other wastes associated with UST installation. The drum and wastes were removed in August 1992. During the Navy Site Visit, an area of darkened soil approximately eight inches in diameter was noted in the area where the drum stood.

Field investigation activities at the site included collecting a total of four surface soil (0 to 12 inches) samples. These samples were analyzed for total metals, PCBs, and TPH. Risk was evaluated under residential and industrial use scenarios.

Although aluminum, arsenic, iron, and manganese were above residential screening levels, they were all within background levels of the facility. Beryllium was reported at a higher detection limit than the screening level, however, is not expected to be a constituent at the SWMU unit after calculating the risk at one half the detection limit. One of the four samples contained a slightly elevated level of PCBs; however, it does not appear that PCBs are a principal component of any releases in this small area. Consequently, existing levels do not warrant further action. One of the four samples also exhibited elevated TPH concentrations;

however, since this site was subject to an UST cleanup and the samples were at the closest edge of the building, further action does not appear to be warranted.

Based on the foregoing and considering current and planned future use, the RPMs believe the existing data is adequate to estimate risk at this site. The few potential chemicals, which are slightly above risk based concentration values, are not expected to present a significant risk for a residential use scenario.

Based on the contents of the Site Close-Out Document, it was the consensus of the RPMs that this site requires no further action under a continued industrial use or a future residential use scenario (Navy, 1996e).

SWMU 27 - Tank 280 Contractor Staging Area

The Tank 280 Contractor Staging Area (SWMU 27) was located north of Buildings 280 and 323 (the Pump House) at Mainside. It was approximately one acre in size and used from Spring to Fall 1992.

Three 55-gallon steel drums and five 4-gallon plastic drums were stored on the ground in this staging area. The drums contained waste oil, oily rags, oil product, and possibly diesel fuel that a contractor was using while working in the vicinity.

Fourteen soil samples and three sediment samples were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides/PCBs, and hexavalent chromium. There were few exceedances of screening criteria and none of them were significantly above the criteria. No further action, under a future residential use scenario, is recommended for this site.

SWMU 57/Site 60 - Building 445 Star Gauge Loading Dock

The Building 445 Star Gauge Loading Dock (SWMU 57) was located east of Building 445, at Mainside. It had been used since the 1940s for the storage and handling of paint residues and gun barrel preservative containing tar and petroleum-based solvent.

The Building 445 Star Gauge Loading Dock (SWMU 57) consisted of a U-shaped concrete loading dock with a below-grade entrance. The sides of the squared-off "U" measured approximately 30 feet and the base measured approximately 15 feet. A drain at the base of the loading dock wall, within the concrete below-grade entrance, led to the storm sewer. At the time of the Navy Site Visit, small paint and gun barrel preservative stains were visible on the concrete floors of the dock and the entrance.

Field investigation activities at the site included collecting four surface soil samples (0 to 12 inches) within the concrete loading dock basin, and analyzing the samples for total metals, TPH, and VOCs. Detected chemicals include inorganics, one VOC (1,1,1-TCA), and TPH. Risk was evaluated under the residential and industrial use scenarios, based upon the soil sampling results. A cleanup was identified and performed in March 1996. The cleanup action consisted of: removing sediment from the loading ramp, scraping loose paint and tar from the walls, and cleaning the walls and the loading ramp area with a high-pressure washer system. Since the concrete base and walls of the loading dock area were not compromised, it is unlikely that contamination would have spread beyond the loading ramp area.

Based on the source removal, new storage and handling procedures for hazardous material and professional judgment, no further action is required for this unit and no restrictions apply under CERCLA (Navy, 1999b).

SWMU 61 - Paint Can Crusher

The Paint Can Crusher (SWMU 61) was located east of Building 482 at Mainside and was used for crushing empty paint cans prior to their disposal. The unit consists of a steel hydraulic press that punctured and crushed empty paint cans and an area used to stage empty uncrushed paint cans. This unit was located on asphalt and did not have secondary containment. The empty paint cans were generated in Building 482 (Paint Shop) and were moved outside to the Paint Can Crusher (SWMU 61). The paints primarily used in the Paint Shop are oil based enamel and water based latex. No lead based paints are used in the paint shop.

The Paint Can Crusher (SWMU 61) began operation around 1986 and ceased operation at the outside location during the summer of 1993. During the Summer 1993 this unit was moved inside Building 482, and a steel drip pan was installed underneath the crusher.

The topography around Building 482 slopes gently to the east. Surface water runoff drains overland to a topographic low approximately 100 feet to the northeast.

A total of twelve soil grab samples and one field duplicate were collected from five soil borings during a field investigation conducted between in July 1993. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the 1993 SSP Work Plan (Halliburton NUS, 1993a). Twenty inorganic constituents were detected in surface and subsurface soil samples collected from the vicinity of the Paint Can Crusher (SWMU 61). With the exception of lead, all metals were below any regulatory level that would require action. Lead levels of 540 ppm and 750 ppm were found in two samples in SWMU 61. These levels are within the 500 to 1,000 ppm cleanup range for lead established by

the USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-02 for residential settings. Therefore, based on the nature and level of lead contamination, the current and proposed future land use, and the site conditions, no further action at SWMU 61 was proposed (Halliburton NUS, 1993b).

The sampling results indicate that most of the constituent levels do not exceed RBCs. Although the maximum concentration of some constituents exceeded screening criteria, the site soils have since been removed as part of sewage treatment plant improvements. Based on the contents of the September 2001 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario (Navy, 2001b).

SWMU 62 - Paint Can Dumpster

The Paint Can Dumpster (SWMU 62) was located southeast of Building 482 and is currently located east of Building 482 at Mainside. It was used for storage of crushed paint cans and related paint shop waste prior to disposal. The 10 cubic feet (ft^3) metal dumpster rests on asphalt. Paint stains mark the interior of the dumpster, and there is a drainage hole on the right side of the dumpster.

From the 1980s to July 1993 the Paint Can Dumpster (SWMU 62) was located southeast of Building 482. In July 1993 it was moved approximately 25 feet to a location east of Building 482. At this time the drain was plugged and a tarp placed on top of the unit.

Four soil grab samples and one duplicate were collected from four auger points at the previous location during a field investigation conducted in July 1993. A detailed description of the sample locations, the samples collected and the rational for their collection is provided in the SSP Work Plan (Halliburton NUS, 1993a).

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Risk was evaluated under the residential and industrial use scenarios, based upon initial soil sampling results. These results indicate that most of the contaminant levels did not exceed RBC Tables, except for arsenic, benzo(a)pyrene, barium, and chromium. Arsenic and benzo(a)pyrene slightly exceeded background levels and RBC tables. Arsenic was within overall background levels, and benzo(a)pyrene only slightly exceeded RBC levels for residential use. Barium and chromium exceeded the soils to groundwater screening criteria; however, it was determined that these constituents are not problematic given the site conditions.

Based on soil sampling results, removal of the dumpster and Building 482, and the addition of the asphalt parking lot, no further action was recommended for this unit for a residential scenario under CERCLA (Navy, 1999d).

SWMU 64 - Building 448 Sandblast Area

The Building 448 Sandblast Area (SWMU 64) was an unmarked area located south of and outside Building 448 on a paved surface at Mainside. This area was used for sandblasting paint off approximately 100 household radiators during August 1992. There is residual sandblast grit around the unit and along the edge of the paved area. The slightly undulating topography around Building 448 slopes to the south, and a wetland filter area occurs approximately 300 feet to the south.

A total of ten soil grab samples and one field duplicate were collected during a field investigation conducted in July 1993. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the SSP Work Plan (Halliburton NUS, 1993a). No contamination was detected or found to exceed ARARs at the Sandblast Area (SWMU 64).

Maximum concentrations of chemicals from soil sampling were screened against RBC tables, screening levels for industrial and residential use scenarios, and soil screening levels for the protection of groundwater. Risk was evaluated under the residential and industrial use scenarios, based upon initial soil sampling results. These results indicated that the contaminant levels did not exceed RBC tables, except for arsenic, barium, chromium, and nickel. Arsenic slightly exceeds RBC tables, however, concentrations were within overall background levels. Barium, chromium, and nickel concentrations exceeded the soil to groundwater screening criteria; however, it is not expected that these constituents are problematic since they were detected in relatively few of the nine samples obtained.

Based on soil sampling results, the removal of the sand blast area operation, addition of the asphalt parking lot, and new sewage treatment plant buildings, no further action was recommended for this unit under a residential use scenario under CERCLA (Navy, 1999e).

SWMU 67 - Building 448 Tar Tank Area

The Building 448 Tar Tank Area (formerly known as IR Site 48) was located approximately 120 feet south of Building 448 and 20 feet east of Building 946. This site consisted of two horizontally mounted tanks within a secondary containment structure. These tanks contained a heavy tar substance once used for road repair. Dark stained soils were observed beyond the secondary containment during the Navy Site

Visit. This site, which began operation in 1985, is currently inactive. The tanks and secondary containment were removed in August 1993.

During a field investigation conducted in July 1993, ten surface grab samples were collected and field-screened using an immunoassay procedure specific to petroleum hydrocarbons. The objective of the field screening was to collect samples for semi-quantitative contaminant determinations and subsequently to use this information to define the sample locations. Following the field screening analyses for petroleum hydrocarbons, surface soil samples were collected for laboratory analysis. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the SSP Report (Halliburton NUS, 1993b).

Concentrations of various PAH compounds found in the soil around the site exceeded RBCs. In October 1994, soils were excavated (approximately 100 CY) under a removal action and the area was restored to original site conditions. The excavation sidewalls and floor were sampled to confirm that contamination above RBCs had been removed.

In January 1995, the Navy Remedial Project Manager requested that a groundwater sample be obtained from SWMU 67. A groundwater sample was collected from the center of the site using direct push techniques. The sample was analyzed for TCL VOCs, SVOCs, PCBs, and TAL inorganic analytes. Sample results indicated that VOCs, SVOCs, and PCBs were not present. Some metals were present, but none exceeded background concentrations. The borehole was grouted at the completion of sampling.

The results indicate that all but one constituent, benzo(a)pyrene, are below RBCs. Benzo(a)pyrene concentrations at two locations, although they exceeded residential screening criteria based on an incremental cancer risk level of $1x10^{-6}$, are well within USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$. Average benzo(a)pyrene concentrations are below soil to groundwater screening criteria. Based on the contents of the February 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (Navy, 2002a).

SWMU 70 - Building 152 Trichloroethane Accumulation Area

The Building 152 1,1,1-trichloroethane (TCA) Accumulation Area (AA) (SWMU 70) was located adjacent to the eastern side of Building 152, on Mainside. The unit consisted of an approximately 6-foot by 8-foot concrete pad without a berm and a hazardous materials locker that measured approximately three feet wide by five feet long by five feet high. A drain to the sanitary sewer was located within the concrete pad.

The Building 152 TCA AA (SWMU 70) has been used since the 1960s for storing hazardous material products and drummed solid wastes contaminated by 1,1,1-TCA, the solvent used to wash oil from the vacuum furnace. The hazardous material stored in the locker includes TCA; approximately one drum is used every three to four months. The solid wastes stored at the unit include one 55-gallon drum each of TCA-contaminated sludge from the abrasive saw; TCA-contaminated shavings from the blast peen; and TCA-contaminated powder, also from the blast peen.

In June of 1994, operations were modified to move TCA (new and spent) indoors. New TCA is currently stored in a 5-gallon container inside Building 152, and spent TCA is piped directly from the equipment into a 5-gallon satellite AA container also within Building 152.

Field investigation activities at the site included collecting a total of four surface soil (0 to 12 inches) samples. These samples were collected just outside the concrete slab. These samples were analyzed for total metals, PCBs, and VOCs. Human Health Risk was evaluated under an industrial use scenario.

Manganese, PCBs, barium, chromium, mercury, and nickel were noted as COCs. Manganese and PCB levels were elevated slightly above the industrial and residential screening levels, respectively; however, these levels do not appear to present a significant risk, under the industrial use scenario. The remaining metals slightly exceeded soil screening levels for the protection of groundwater. However, based on the following: relatively low concentrations of these constituents, existing concrete and asphalt paved surfaces limiting potential infiltration to groundwater, comparisons to site-wide background soil concentrations and the small area of the unit, these constituents are not expected to impact groundwater quality or increase risk to groundwater.

Based on the sampling results, current and planned future use, current storage and handling procedures for hazardous material, and on professional judgment, no further action is required for this unit, under a continued industrial use scenario (Navy, 1996b).

SWMU 77 - Building 1329 Wash Area

The Building 1329 Wash Area (SWMU 77) was located north of Building 1329 at Mainside. It was a concrete pad that measured approximately 16 feet by 54 feet and was bermed on two sides. The concrete pad was covered by a roof/shelter. The unit drained to an oil/water separator which drained to the Cooling Pond (SWMU 129) on the base.

The Building 1329 Wash Area (SWMU 77) had been used since the 1960s to wash maintenance trucks. Although the washing process now involves steam-cleaning the vehicles using a non-petroleum detergent,

petroleum-based detergents may have been used in the past. According to NSFDL personnel, the concrete wash pad was rebuilt over an old oil/water separator.

An investigation began in March 1996 to delineate the extent of contamination. Contaminated soil from an area between the wash pad and the chain link fence was excavated to an average depth of two feet. Approximately 73 tons of contaminated soil were removed and transported to an approved landfill disposal facility. In April 1996 and May 1996, additional soil borings were taken to assess the release of petroleum under the concrete slab and south of the fence. After contamination was observed under the concrete slab, the investigation was terminated due to funding issues.

An EE/CA was performed for this site and finalized in May 1997. The Removal Action objective was removal of TPH contaminated soil. Upon public comment on the EE/CA, the removal action consisted of excavating approximately 922 cubic yards of TPH-contaminated soil over a 3,600 square foot area, and extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. The abandoned oil/water separator was removed and shipped offsite as construction and demolition debris in July 1997. Confirmatory sampling (26 samples) indicated that removal objectives were met. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

Based on confirmatory sampling results and considering current and planned future use, the RPMs believe the results indicate that no samples were found to exceed the cleanup level of 100 mg/kg for TPH. Based on the contents of the July 2001 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (Navy, 2001a).

SWMU 78 - Building 1121 Former Waste Oil UST

The Building 1121 Former Waste Oil UST (SWMU 78) was located at the Heavy-Duty Equipment Shop at Mainside. The site consisted of a 1,000-gallon UST outside the shop that received motor oil from a slop sink inside the shop. The site was sampled on November 1991, prior to excavation of the UST. Approximately 200 to 650 cubic yards of contaminated soil were removed from the excavation based on visually evident soil contamination. There were no historical reports of spills, and the tank appeared intact. The release was thought to be from deteriorated fittings and connections from the piping to the UST.

In December 1991, the original 1,000-gallon steel UST and contaminated soil were removed. Clean fill and a double-walled fiberglass tank with a spill alarm replaced the original UST. In 1993, subsurface soil borings were taken which revealed minor amounts of TPH soil contamination.

An EE/CA was performed for this site and finalized in May 1997 (Navy, 1997a). The RAO was to remove TPH-contaminated soil. Following public comment on the EE/CA, the removal action consisted of excavating approximately 150 cubic yards of TPH-contaminated soil from an excavation of approximately 21 feet by 26 feet extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. Post-excavation samples did not exceed the Virginia Action levels for TPH (100 mg/kg), as set forth by the Virginia Hazardous Waste Management Regulations 9VHWMR 680-13-02, Underground Storage Tank Technical Standards and Corrective Action Requirements, Action Level Guidance. Groundwater levels were also compared with Virginia Action Levels and USEPA's RBC tap water screening values, and none were exceeded. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

Based upon this sampling data, the conditions of the site, and professional judgment, no further action is required for this unit under a residential use scenario under CERCLA (Navy, 1999i).

SWMU 82 - Electroplating Line and Wastewater Treatment

The Electroplating Line and Wastewater Treatment (WWT) system (SWMU 82) were inside Building 404 at Mainside. It began operations in the early 1970s and after several inactive periods lasting several months, ceased operation permanently in early 1993.

The Electroplating Line and WWT (SWMU 82) consisted of six components: the epoxy-coated concrete flow-through in the circuit board printing and etching lines; the 2,000 gallon fiberglass holding tank; the CPU, a 200-gallon steel cylindrical device; the 500-gallon, double-shelled plastic holding tank; the four resin filters; and the final 10,000 gallon plastic tank with fiberglass and plastic fittings. The unit was used to treat electroplating waste waters. The used resin filters are considered a hazardous waste. The treated water was re-circulated and the sludge was contained in the filters.

The operating components of this unit were in good condition; however, the concrete floor of the holding tank/filter room was stained and cracked.

The underlying site soils were removed in March 2004 and a Site Close-Out Document was completed and signed. Groundwater beneath the site is being investigated in the Site 20 RI/FS. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that SWMU 82 requires no further action under a residential use scenario under CERCLA (Navy, 2001a).

SWMU 101 - Building 155 Auto Shop Waste Oil Filter and UST

The Building 155 Auto Shop Waste Oil Filter and UST (SWMU 101) was located inside Building 155 at Mainside. The building was designed to manage used automobile oil and consists of the following components: three 55-gallon drums of oil on a plastic pallet with secondary containment; a metal slop sink for transferring used oil; a 1,000-gallon double-walled fiberglass, concrete-bottomed UST to which the slop sink drains; an open-topped steel filter; and various steel and plastic buckets. The SWMU has been in use since the 1960s, although the fiberglass UST was installed in the spring of 1992 to replace a steel UST removed in December 1991. The unit is under the supervision of the VDEQ, Office of Water.

SCS Engineers (SCS) was authorized by NSFDL to prepare a Site Characterization Report in January 1992 for the former Building 155 steel UST after its removal. The report documented field activities during UST removal and subsequent site characterization efforts by SCS. The following paragraphs summarize the information provided in the SCS report (Navy, 2002c).

In January 1992, two soil samples were obtained by Atlas Resource Management from a depth of ten feet at the bottom of the UST excavation. These samples were analyzed by Technical Testing Laboratories for TPH using USEPA Method 418.1. According to the SCS report, neither sample contained TPH. Free product was not encountered during UST removal or subsequent site assessment (Navy, 2002c).

In June 1992, Steven's Drilling, Inc. advanced two soil borings with oversight by SCS. Soil samples were obtained at five-foot intervals using split-spoon samplers and screened for total organic vapors with a photo-ionization detector (PID). Organic vapor concentrations were all below three ppm. Borings B1 and B2 were completed as MW-1 and MW-2, respectively (Navy, 2002c).

SCS Analytical Laboratory submitted soil samples from the interval exhibiting the highest PID reading for TPH analysis. TPH was not detected in the sample from B-1, obtained from a depth between 14.5 and 16.0 feet (sample ID "155 B1" in the laboratory report). TPH was present at a concentration of 33 mg/kg in the sample from B-2, obtained from a depth between 4.5 and 6.0 feet (sample ID "155 B2" in the laboratory report). Concentrations were below the TPH action level of 100 mg/kg (Navy, 2002c).

Groundwater samples were obtained from the three monitoring wells by SCS in June and July 1992. The SCS Analytical Laboratory analyzed the samples for TPH in accordance with USEPA Method 418.1 and for aromatic VOCs in accordance with USEPA Method 8020. Based on the groundwater elevation contours, MW-2 is downgradient of the UST. Samples from MW-1 and MW-2, collected in June, contained TPH at concentrations of 18.1 mg/L and 0.5 mg/L, respectively. VOCs were not present in the groundwater samples.

VOCs and TPH were not present in the sample obtained from the existing monitoring well, collected in July 1992 (Navy, 2002c).

The SCS report concluded that no additional action was necessary. The UST and adjacent soils were removed, and the remaining soils contained TPH below action levels. Although the one mg/L action level for TPH in groundwater was exceeded in one monitoring well, aromatic compounds typically associated with petroleum products were not present (Navy, 2002c).

In 1996, SWMU 101 was among several Appendix B sites sampled by Martel. Martel obtained groundwater samples from what appears to be MW-2 and the monitoring well that existed prior to SCS field efforts. These samples were analyzed for metals, VOCs, TPH, pesticides, and PCBs. In addition, Martel obtained soil and water samples from a boring twelve feet south of the UST using Hydropunch techniques. Both soil samples and the water sample were analyzed for VOCs and VOCs were not present above detection limits. Sample SWMU 101 SS 2' – 4' and the water sample were also analyzed for TPH, pesticides, and PCBs. Pesticides and PCBs were not detected; TPH was present at a concentration of 150 mg/kg in the soil sample, slightly above the TPH action level of 100 mg/kg. The water sample contained TPH at a concentration of 1.1 mg/L. All samples were analyzed for metals. Soil sample results were compared to RBCs and background levels. Water sample results for metals were not considered since the sample was obtained using hydropunch techniques which typically yield highly turbid samples and false positives for elevated metals (Navy, 2002c).

Based on sampling results and considering current and planned future use, the RPMs believe the existing data is adequate to estimate risk at this site. All constituent concentrations are below background and below RBCs. All constituents detected in the groundwater obtained from the downgradient monitoring well were below Region III tap water PRGs and MCLs. Based on the contents of the April 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (Navy, 2002c).

SWMU 115 - Building 1282 Auto Hobby Outside Used Oil Storage

The Building 1282 Auto Hobby Outside Used Oil Storage (SWMU 115) is located outside the Auto Hobby Shop (Building 1282), on the eastern part of Mainside. It consists of 4 foot by 4 foot square steel pallets. The storage area was relocated inside Building 1282 in August 1992. The area outside the building, where the SWMU was located prior to August 1992, is currently vegetated with grass.

The Building 1282 Auto Hobby Outside Used Oil Storage (SWMU 115) has been used for storage of used automobile oil and antifreeze (ethylene glycol) since the mid-1980s, when a vehicle fuel filling station was

built in front of Building 1282's current location. The unit is under the supervision of the VDEQ, Office of Water.

In September 2003, a Site Close-out Document was completed and signed. All soils underlying the SWMU have been removed and the storage area was relocated inside of Building 1282. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA.

SWMU 119 - Building 1282 Auto Hobby Used Oil Tank

The Building 1282 Auto Hobby Used Oil Tank (SWMU 119) is located south of the Woodworking Shop at the eastern part of Mainside. The aboveground steel tank has approximately 1,000 gallons of capacity and has been used since 1992 to store used motor oil. The unit is equipped with secondary containment, in the form of a concrete dike. The walls of the dike are approximately three feet high and six inches wide. In August 1992, a shelter was built to prevent precipitation from entering the secondary containment basin around the tank (Navy, 2004).

Maximum concentrations of chemicals detected in the soil and groundwater samples collected form SWMU 119 and Building 1282 were compared to RBC Table screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater. Risk was evaluated under the residential and industrial use scenarios. The groundwater analytical data were compared to USEPA Region III tap water RBCs and MCLs.

The comparisons with screening criteria show that all constituents are below RBCs and/or well within USEPA's target risk range of $1x10^{-4}$ and $1x10^{-6}$. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (Navy, 2004).

SWMU 125/Site 52 - OWS 107-350 (Yardcraft Area)

The Site 52 Yardcraft Area is located at the southern edge of the Mainside, bordering Upper Machodoc Creek. Previously, the site consisted of Building 107, which was a boat engine repair and maintenance shop, an OWS, a bermed concrete pad with a roof canopy used to store new and used oil in 55-gallon drums, and an UST. Chemicals used in the engine repair shop included degreasers, oils, and various fuels. Building 107 and the associated bermed pad, the OWS and UST were demolished and removed from the site in late 2003 and early 2004.

The wash rack, located adjacent to the engine shop, consisted of a bermed concrete pad with a drain in the center. This pad was used as a discharge location for bilge water from ships and was used to store drums of oil. The drain in the wash rack was piped to the OWS for treatment prior to discharge to the facility's sanitary sewer system. The OWS was located off the northeast corner of Building 107. In addition, the steel 350-gallon approximate capacity UST, was located adjacent to the southeastern corner of Building 107 and was used to supply #2 heating oil to the building. This UST was installed in the early 1990s, replacing a similar tank. The unit has been used since the late 1980s or early 1990s to separate oil from bilge water. Water that passes through the in-ground OWS flows to a lift station, which leads to the sanitary sewer.

Approximately 550 tons of soil was removed from the excavations at Site 52 in May 2004 and transported to a RCRA Subtitle D Facility. Verification samples were taken to confirm that the area is remediated. A VSAP was submitted in August 2004 and served to close out the site. Based on the VSAP results, it is the consensus of the DIRT that the site requires no further action under a residential scenario under CERCLA and SWMU 125/Site 52 was closed out.

SWMU 127 - OWS 1121-300, OWS 115-350, OWS 402-30,000, and OWS 486-1000

These OWSs are located west of Building 1121. They received wastewater that probably contained oil and grease from vehicle wash and maintenance operations, oil storage, storage operations, and parking lot run-off. The OWSs began operation at different times and are constructed of 1-inch baffled steel.

OWS 1121-300 has 300 gallons of capacity and discharges to OWS 115-350. OWS 115-350 has 350 gallons of capacity and discharges to a lift station, which in turn discharges to the sanitary sewer. OWS 402-1000 has 30,000 gallons of capacity and discharged to the Cooling Pond (SWMU 129). OWS 486-1000 has 1,000 gallons of capacity and also discharged to the Cooling Pond.

Six subsurface soil samples and two groundwater samples were analyzed for TCL VOCs, SVOCs, TAL metals, and hexavalent chromium. There were only a few exceedances of screening criteria and none of them were significant. No further action, under a CERCLA residential use scenario, has been recommended during the May 2005 DIRT meeting and SWMU 127 was closed out.

SWMU 128/Site 54 - OWS 1121-Old

The OWS 1121-Old (known as USEPA SWMU 128) was located south of Building 1121, the Heavy Duty Shop, at the opposite corner of the building from the new OWS 1121. The OWS 1121-Old operated from the 1960s until about 1989.

It was constructed of baffled steel and concrete and had an unknown capacity. The OWS received liquids that likely contained oil and grease washed from the floors of Building 1121, where heavy machinery maintenance was done. The line to the old OWS 1121 has been plugged. Soil samples taken just west of the site did not exceed USEPA Region III Industrial Soil Screening values for volatiles, semi-volatiles, metals and TPH. Since this OWS was no longer needed, and could provide a conduit for future contamination of soils, it was targeted for removal along with the SWMU 78 contaminated soils.

An EE/CA was performed for this site and finalized in May 1997 (Navy, 1997a). The RAO included removal of potential TPH-contaminated soil and removal of the abandoned oil/water separator. Following public comment on the EE/CA, the removal action consisted of excavating approximately 150 cubic yards of TPH-contaminated soil from an approximate area of 19 by 30 feet, and extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. The abandoned oil/water separator was removed and shipped offsite as construction and demolition debris. Confirmatory sampling indicated the removal objectives were met. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

The Close-Out Document for SWMU 128 - Site 54 was completed in September 2006 (TtNUS, 2006d). The conclusions of the Close-Out Document state that while metals were detected in the subsurface soil samples taken from the site, only four metals (aluminum, arsenic, iron and vanadium) exceeded the USEPA screening criteria, however since their reference doses are based on average daily intake values and not on adverse health effects, their exceedances are not of concern. Since the arsenic result is within the USEPA's target risk range of 10^{-6} to 10^{-4}, the remaining soil does not present a concern. The maximum vanadium concentration of 21 mg/kg has an estimated residential hazard quotient (HQ) of 0.27, which is less than the acceptable HQ criteria of 1.

The groundwater comparisons show that all detected VOCs were below screening criteria. Only one metal, manganese, was detected but its concentration was less than the USEPA Region III screening criteria for tap water. TPH, while detected at concentrations above the target action level of 100 mg/kg during pre-RA sampling, was less than 100 mg/kg during post-removal sampling.

Improved operation and maintenance activities associated with OWSs, as well as monitoring of the condition of the tanks, have further minimized any potential impacts SWMU 128 might have on the environment. Therefore, it is the consensus of the RPMs that Site 54 requires no further action under a residential use scenario under CERCLA.

SWMU 130 - Yardcraft Oil Storage Area

The Yardcraft Oil Storage Area (SWMU 130) is in the Yardcraft Area behind Building 288, approximately 25 feet east of OWS 107-350 and approximately 50 feet from Upper Machodoc Creek at Mainside. The unit has been in use since the late 1980s or early 1990s.

The Yardcraft Oil Storage Area (SWMU 130) consists of a four-sided concrete pad with storage racks for up to five 55-gallon drums. The pad is approximately six feet by six feet and the berms are approximately one foot high. The pad is sloped toward a drainpipe in the berm at the side nearest Upper Machodoc Creek. The drainpipe allows liquids inside the bermed pad to drain onto the asphalt lot, and the pad is slightly uphill from Upper Machodoc Creek.

Stains were visible around the pad near the drainpipe during the Navy Site Visit, and a strong oil-like odor was noted. At that time, four 55-gallon steel drums of oil product were being stored on their sides in the storage racks on the pad.

The facility is upgrading this area in response to the National Pollutant Discharge Elimination System (NPDES) permit for industrial discharge. Stained soil was removed in response to the VPDES permit modification.

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Through comparison of maximum site concentration data to USEPA Region III screening criteria for COCs, it was determined that although arsenic exceeded the screening criteria, background comparisons indicated that it could be naturally occurring. Barium slightly exceeded the SSL for soils to groundwater, but was within base background concentrations. Nickel exceeded the SSL for soils to groundwater and the range of background, but was not considered site-related and was within residential screening criteria. Based on this information, further metals analysis was not performed for the Post-Excavation analysis.

Confirmation sampling in March 1996 consisted of two soil borings and one groundwater sample. No positive for TPH, SVOCs, or PCBs results were reported for soil and groundwater samples.

Based on sampling results and the removal of petroleum contaminated soil with the corresponding asphalt paved area, the RPMs recommended no further action under the residential use scenario under CERCLA (Navy, 1999f).

SWMU 131/Site 28 - Gambo Creek Compost Area

The Gambo Creek Compost Area (known as USEPA SWMU 131) is located west of Gambo Creek, near Building 1369 at Mainside. It consists of one mound over an approximate 2 acre area. The mound is approximately 50 feet in diameter and 12 feet high.

From the 1950s until the 1960s, wood chips, mulch, sawdust, leaves, trees, and similar materials were dumped on the ground where they eventually formed a mound. The mound is heavily vegetated.

Fourteen soil samples were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides/PCBs, and hexavalent chromium. There were few exceedances of screening criteria and none of them were significant. No further action, under a residential use scenario under CERCLA, was recommended during the May 2005 DIRT meeting and SWMU 131 was closed out.

AOC A - Otto Fuel Spill (IAS Site 33)

Otto Fuel Spill (AOC A) is located in the Harris Range in the EEA. The AOC consists of one section of bare soil where Otto fuel, a highly toxic, carcinogenic liquid propellant for torpedoes reportedly was spilled directly onto the soil in the 1970s. The one-time spill of approximately 13 gallons is roughly estimated to have covered an area of approximately 15-foot by 8-foot. File materials indicate that soil was cleaned by saturating it with petroleum products which were then ignited. In addition, facility representatives indicated that one area was covered with sand.

The area is located in an active range. Using sprayed herbicides to minimize the potential for uncontrolled fires intentionally destroys vegetation. Thus, the ground in the Otto Fuel Spill area and the surrounding area consists of soil and gravel that are free of vegetation.

No sampling for Otto fuel was performed at this site. Otto fuel consists of propylene glycol dinitrate, 2-nitrodiphenylamine and di-n-butyl sebacate.

Based on the following information: 13 gallons of Otto Fuel spilled onto the ground seventeen years ago (over time Otto fuel will degrade), EOD responded to the spill by burning the contaminated area with diesel fuel, and the resulting breakdown products of Otto fuel do not present substantial risk to human health, the RPMs believe that this AOC does not represent a human health or environmental risk, therefore, no further action is required at this AOC (Navy, 1996c).

AOC O - Building 1369 Pesticide Spill Area

The Building 1369 Pesticide Spill Area (AOC O) is located south of Building 1369. The lack of vegetation was caused by a one-time leak from a pesticide sprayer during spring 1992. This area is approximately 8 feet by 15 feet. Runoff from this area drains to an unlined drainage ditch located approximately four feet to the west.

During spring 1993, an optic line was installed for the operations in Building 1369. As part of the installation of the optic line, this area was excavated, soil removed, and the area reseeded with grass. West of the drainage ditch is a wooded area with pine trees; the general area often is covered with yellow pine pollen.

Field investigation activities at the site included collecting a total of six surface soil (0 to 12inches) samples. These samples were analyzed for total metals, TPH, PCBs, and pesticide analysis.

PCBs and pesticides were not detected at levels above the instrument detection limit. Aluminum and manganese were detected at levels above screening levels; however, they were all within background levels for the facility. Iron levels exceeded the USEPA RBC screening and background levels; however, the overall concentrations do not appear to be significantly elevated.

Arsenic levels exceeded the RBC value and were above background levels; however, the arsenic levels were not found at levels to cause unreasonable risk. The estimated risk from the potential exposure to arsenic is well within the acceptable risk range. Selenium and barium were detected at levels above the soil screening levels for protection of groundwater but these constituents do not appear to be connected to the pesticide contamination; they are more likely associated with background soil conditions. Metals concentrations do not appear to be present at levels presenting a risk to human health or the environment.

Based on sampling results, the RPMs believe the existing data is adequate to estimate risk at this site. The few COCs which are elevated slightly above screening (RBC/SSL) values are not expected to present a significant risk for a residential use scenario. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a future residential use scenario (Navy, 1996d).

AOC X - Classified Documents Incinerator Sewage Holding Tank (IAS Site 18)

The Classified Documents Incinerator Sewage Holding Tank (AOC X) is south of Building 1350. The area consisted of one 30 foot diameter by 6 foot deep holding pond, one concrete solids holding tank, one concrete pump pit, and one 100 foot by 100 foot infiltration field, approximately 70 feet to the east of the

pond and connected to it by a piping network. This system served as a sewage holding and dispersion system for the sanitary facilities at the Classified Incinerator building. The Classified Documents Incinerator Sewage Holding Tank was in operation from 1974 to 1989. The ground surface area at AOC X is generally level with the exception of the pond, which is in an approximately six-foot deep depression.

Surface soil, subsurface soil, and groundwater samples were collected during an investigation conducted at AOC X in September 1994. Based on elevated levels of mercury discovered in one sample, the tanks and the soils within the pond area were excavated and disposed of in a permitted landfill. In addition, a one-foot thick surficial layer of soil was removed from the 30-foot diameter bottom of the holding tank. Both the concrete solids holding tank and the concrete pump pit were removed along with all of the metal piping. The area was backfilled with clean soil, regraded, and reseeded. Confirmation samples were collected after the cleanup was completed. Using results from the confirmation samples, maximum concentrations of potential COCs were compared with RBC values as of April 2000. All COCs that exceeded any risk-based criteria were below background, except for arsenic and iron. Both arsenic and iron concentrations were comparable to background.

Based on the confirmation samples and the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action at this time, under a residential use scenario under CERCLA (Navy, 2000e).

AOC X7/Site 39 - Open Storage Area Main Battery (Staining)

The Open Storage Area Main Battery (known as USEPA Additional Area X7) was in the southeastern portion of Mainside. It was discovered by USEPA after an analysis of aerial photography of the NSFDL. The following description is from the USEPA VSI Report. The unit was used for open storage as early as 1953, and objects were arranged in rows and along the railroad. A stain in the southwest end of the open storage area was visible in the 1967 photograph. Additionally, a drain that directed flow to the railroad from the storage area was identified. A second stain was identified along the drain channel running along the railroad in the 1985 image. Cleaning solvents were used in this area to remove preservatives from gun barrels. Cutting and welding of metals was also performed in the open storage area.

During USEPA's August 1992 VSI, several areas of staining were identified around the west side of the open area and the drain. The open area is presently used to store three double rows of gun barrels. There were also two areas in the open storage area that contained collection drains for runoff and storm sewer control. There was one area near one of these drains where welding slag was identified.

Field investigation activities at the site included collecting a total of ten surface soil (0 to 12 inches) samples within the open storage area. These samples were analyzed for inorganics, PCBs, pesticides, herbicides, TPH, and TCL VOCs. The investigation activities did not include groundwater samples. Risk was evaluated under both residential and industrial use scenarios, based upon the soil sampling results. A cleanup was identified and performed in March 1996. The cleanup included the removal of accumulated sediments and sludge at and around each of the two storm drain catch basins. Approximately one-half ton of sediment and sludge were removed from the site and disposed at a permitted facility.

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Risk was evaluated under the residential and industrial use scenarios, based upon initial sampling results. Based upon inorganic, TPH, and one VOC exceedance, a cleanup action was identified and performed in March 1996. Accumulated sediment and sludge were removed from the area surrounding each of the two catch basins, #1 and #2. Approximately one-half ton of sediment and sludge was removed from the catch basins and the asphalt surface storage area and disposed offsite at a permitted facility.

Based upon the source removal and modifications to the operations of the site, it was decided that no further action was required for this unit under CERCLA (Navy, 1999c and Navy, 2014).

AOC Z - Terminal Range Building 109

The Terminal Range Building 109 (AOC Z) was located in the Terminal Range area at Mainside. This unit operated from approximately 1949 to 1985 as a research and development unit and a fuse chamber for testing projectile fuses. This unit was an open-topped, below-grade structure approximately 25 feet by 15 feet and 20 feet deep. The walls were constructed of two-foot thick concrete with steel armor plate (5.5 inches thick) in front for protection from projectiles. The walls originally extended from four feet above grade to 20 feet below grade. The walls formed a square that enclosed an area known as “the pit.”

The unit was removed and all the steel plates sold to a private vendor for scrap in July 1993. The bottom of the pit was in the groundwater table; therefore, during periods of high rainfall the pit had water in it. Site cleanup was completed in October 2001. Soil/slag and debris were disposed offsite in a Subtitle D landfill, and 12,000 pounds of slag and soil were disposed as hazardous waste (lead) at Perma-Fix of Michigan. Once the removal was complete, the site (i.e., the pit) was backfilled with clean fill mixed with compost from Site 41 and graded to a relatively flat area.

Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario (Navy, 2002e).

Other Units C3 - Scar at Phalanx Test Area

The Scar at Phalanx Test Area (Other Units C3) is located west and north of the Phalanx Test Area and west of the Potomac River. It is a former rocket launch area that operated from the 1960s to the 1970s, is grass-covered, and about five acres in size. The rockets launched include the 2.75 rocket and Zuni rockets. The launches were conducted on the ground after the area had been cleared of grass.

Environmental sampling of soil at the site at Phalanx Test Area occurred in July 1994. No unusual metals concentrations or distributions were observed. With respect to the other analytes, no VOCs, PCBs, herbicides, and TPH were detected above quantization limits. MCPA, chlorinated herbicide, was the one constituent that exceeded residential and industrial screening. However, it was found in only one sample out of nine and is not site-related.

This site has not been in use since the 1970s. Based on the contents of a 2003 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario.

Other Units C6 - Former Radio Testing Area

The Former Radio Testing Area (Other Units C6) is located in the north central portion of Mainside. This unit was discovered by USEPA after an analysis of aerial photography. The following description is from the USEPA VSI Report. Two trailers were located south of Frontage Road near the 1400 Area Landfill (SWMU 30). These trailers were used to test radar or microwave radio equipment. The area, as identified by aerial photography, had two drains or ditches leading from the trailers to the small tributaries leading to Hideaway Pond (AOC N).

EOD personnel performed a magnetometer sweep of the area formerly used for radio/radar testing to identify any remaining underground tanks or piping. No underground tanks or piping were found. When the site was converted into a parking lot, construction debris and two drainpipes were removed in 2002. The underlying soil was sampled for metals, cyanide, volatile organic compounds, semi-volatile organics, phenols, pesticides, and PCBs. The analytical results showed that no constituents in soil were above background or RBCs. Although lead and chromium in water exceeded some criteria, debris and the drainage lines at the site have been removed and the area is now a parking lot, which further limits exposure to any residual contaminants which may be in the soil. Based on analytical results, no further action under a CERCLA residential use scenario, was recommended to and accepted by the DIRT in May 2004 and Other Units C6 is closed (TtNUS, 2004a).

Additional Areas X6 - South Hangar Former Tank Area

The South Hangar Former Tank Area (Additional Areas X6) is located in the west-central portion of Mainside. This unit was discovered by USEPA after an analysis of aerial photography of the NSFDL. The following description is from the USEPA VSI Report. During USEPA's review of aerial photography of an area west of the South Hangar, several stained zones were detected. In a 1983 image, a horizontal tank was identified and a stain detected adjacent to it. A drainage channel was identified from the tank leading to the southwest. In 1985, the tank was gone but the drainage stain remained. This area has a new building and a new paved parking lot in the stained area.

Between 1986 and 1990, a building was constructed at the former location of the tank. In the 1990 image, a new stain was detected slightly to the east of the former stain area. In addition, several stains have been identified to the east of the hangar over the years, but most of these appear to have occurred on the concrete parking lot.

The site was subsequently closed under the September 1994 Federal Facility Agreement, per Section VI, Findings of Fact.

SITE 59 - Octagon Pad Dump, EEA

The Octagon Pad Dump (known as Site 59 or SWMU 135) was located within the Harris Test Range of the EEA at the end of a paved road adjacent to the east side of the Octagon Bombing Pad. The site was active from the 1940s until the early 1990s. Operations at the site consisted of a scrap metal AA , where used metal target and ordnance test items were collected and stored until proper disposal was arranged. Most items were located along the road shoulders, with lesser amounts located on the paved area and beyond the road into the adjacent wooded area. The site size was less than one-half acre.

In January 2001, NSFDL was tasked to conduct a cleanup of Site 59, which consisted of removing all of the scrap metal, including ordnance and target related scrap. Additional items were removed, including 27 tons of concrete debris. Several earth mounds were screened for MEC and leveled to remove any scrap or waste items. Waste items removed and disposed of through the ’s hazardous waste division included electrical wire, metal banding material, plastic film, and water piping with asbestos wrap.

In 2001, the Site 59 VSAP was approved and implemented at the site. Confirmation sampling, conducted in March 2001, indicated no further action was required at Site 59 based on risk. A stratified random sampling pattern was used for verification sampling. The site was divided into two exposure areas, each

approximately one-half acre in size and consisting of six sampling areas (SAs) approximately one-twelfth acre (0.083 acre) in size. One composite sample of six randomly selected grab sample points was collected from each SA. EA West included SAs 1, 2, 3, 5, 6, and 7, and EA East included SAs 3, 4, 7, 8, 9, and 10. SAs 3 and 7 were common to both EAs (Navy, 2002b).

In addition to the composite samples collected from the Octagon Pad Dump, two discrete samples were collected from a small drainage course located southeast of Site 59. One sample was collected upgradient (or south) of Site 59 and the other was downgradient (or northeast) of the Site. The samples were evaluated as soil samples (rather than sediment) because the watercourse is typically dry (Navy, 2002b). Laboratory analytical parameters were selected based on previous land use and were approved by the DIRT. Soils were analyzed for TAL metals and cyanide and explosives (Navy, 2002b).

Laboratory results were presented in a Verification Sampling Report prepared by TtNUS in January 2002. Because the residual soils were at or near the ground surface, verification sample results were compared to surface soil criteria. Site closure was recommended due to low contaminant concentrations (Navy, 2002b).

Based on current and planned future site use, constituent concentrations which are below residential RBCs and/or background levels, and the contents of the April 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (Navy, 2002b).

Building 126 - Former Powder Magazine

Building 126 is a former powder magazine located near Site 6 and Gambo Creek at Mainside. Lightning struck the powder magazine on July 12, 1985 and the resulting explosion threw metal powder and cardboard cans from the magazine into the area surrounding the building. Approximately 120,000 pounds of gun propellant were stored in the magazine. Aerial photographs of the building after the lightning strike showed that an area of one-quarter-mile surrounding the magazine was burned. The building was removed and visible contamination cleaned up.

Eighteen soil samples and seven sediment samples were analyzed for TAL metals, explosives, perchlorate, and asbestos. Only arsenic exceeded the screening criteria, but not significantly. Based on analytical results, no further action under a residential use scenario under CERCLA was recommended during the May 2005 DIRT meeting and Building 126 was closed out.

Site 61b - Gambo Creek Projectile Disposal Area

Site 61b is located on the southern side of the lower Gambo Creek Bridge at Mainside. The site is composed of a pile of gun projectiles of various sizes (3 to 8 inches in diameter), small pieces of scrap metal, and sand. The projectiles appear to have been fired from a gun or used for ordnance testing operations. The buried projectiles appear to be consistent with waste material from old range gun butts. The gun projectiles are located in a wooded area approximately 50 feet from the shoreline of Gambo Creek. The approximate timeframe for the placement of projectiles and potential fill operations is the late 1930s to early 1940s.

A SSP field investigation at Site 61b was conducted between September 2001 and October 2001 and included the following activities (CH_2M Hill, 2001a):

- Geophysical survey
- Surface soil and subsurface soil sampling
- Surface water and sediment sampling

The geophysical survey conducted at Site 61b used both magnetic and EM surveys to help determine the location of buried waste and the boundaries of the site. The SSP field investigation results indicated the presence of inorganics, VOCs, SVOCs, and pesticides in the surface soil, subsurface soil, surface water, and sediment at Site 61b. Of these detections, four SVOCs and five inorganics were retained as COPCs in surface soil and subsurface soil. No constituents were retained as COPCs in the surface water or sediment during the human health risk screening characterization. The ecological risk assessment indicated a potential risk from PAHs with a limited number of inorganic chemicals in the surface soil. In addition, a potential risk to mammalian soil invertebrate predators from exposure (primarily via the food web) to arsenic and copper in Site 61b surface soil was identified.

In addition to the analytical sampling performed at Site 61b, a geophysical investigation was conducted to delineate other waste debris present at the site. The Final SSP report recommended confirmatory trenching and collecting additional groundwater and soil samples from the trenches (CH_2M Hill, 2002). Confirmatory trenching was conducted in March 2003, and the results were summarized in a June 2003 Technical Memorandum. The document concluded that the goals of the investigation were met:

- With the exception of test pit (TP) TP6 where waste was not encountered, the vertical extent of waste was found to vary from approximately 2 to 4 feet bgs. Waste consisted of small amounts of nails, fragments, nose cones, and miscellaneous metal debris.

- Analytical results of the test pit soil and water samples indicated that metals are more prevalent in these media than the other groups of parameters analyzed. Detections of pesticides, PCBs, and SVOCs were infrequent. Explosives were not detected in any of the samples.

Perchlorate analysis was performed on the groundwater sample collected during the excavation conducted in 2003 at Site 61b. Using a detection limit of 1 µg/l, no perchlorate was reported for the sample.

A cleanup action was completed at Site 61b in December 2004. The items removed from the site included:

- 366 tons of contaminated soil
- 1,810 pounds scrap metal
- 1,100 pounds ordnance related scrap

Clean fill from the Turkey Trot Borrow Area was used to restore the site area to its original ground surface elevation, followed by grading and reseeding. A Close-Out document was prepared, which recommended no further action under the residential use scenario, and was signed by the DIRT in February 2005 (JMWA, 2005b).

ATTACHMENT C

SITE NAME/NUMBER CROSS REFERENCE LIST

APPENDIX C

SITE NAME/NUMBER CROSS REFERENCE LIST
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA

NAVY SITE NUMBER	EPA NUMBER	DESCRIPTION, (IAS Site Name) / (EPA Site Name)
Site 1	AOC J	Old Bombing Range
Site 2	SWMU 46	Fenced Ordnance Burial Area
Site 3	SWMU 42	Ordnance Burn Structure
Site 4		Case Storage Area
Site 5	SWMU 51	Projectile Disposal Area
Site 6	SWMU 54	Terminal Range Airplane Park
Site 7		Explosive Mat. Sure. Cont. (EEA)
Site 8		Bombing Area (EEA)
Site 9	SWMU 19	Disposal/Burn Area
Site 10	AOC N	Mercury Contamination at Hideaway Pond
Site 11		Wood/brush Disposal Area
Site 12	SWMU 44	Chemical Burn Pit
Site 13	SWMU 31	(Inert Disposal Area)/(Gambo Creek Truck Wash Area)
Site 14	SWMU 28	CW Evaporation Pond
Site 15		Scrap area
Site 16		Oil Leak (Tank #280)
Site 17	SWMU 30	(Old Sanitary Landfill)/ (1400 Area Landfill)
Site 18	AOC X	Incinerator Effluent Discharge
Site 19	AOC G	Transformer Draining Area
Site 20	SWMU 82	Former Electroplating Waste UST
Site 21	SWMU 52	Gun Barrel Decoppering Facility
Site 22	SWMU 53	Gun Barrel Degreasing Facility
Site 23	SWMU 72	(PCB Outside Storage)/(Building 480 Lot)
Site 24		Sewage Collection/Treatment
Site 25	SWMU 66	Pesticide Rinse Area
Site 26		PCB Inside Storage
Site 27		Scrap Metal
Site 28	SWMU 131	(Compost Pile)/(Gambo Creek Compost Area)
Site 29	SWMU 79	Battery Service Area
Site 30		Wide Scale Herbicide Application (EEA)
Site 31	SWMU 6	Metal Disposal Area (EEA)/(Airplane Park Dump)
Site 32	AOC F	Rapid Cook-off Area, Pit and Pond (EEA)
Site 33	AOC A	Otto Fuel Spill
Site 34		Barbette/DU Contamination
Site 35		Thorium-MG Misch Metal
Site 36	AOC C1	Depleted Uranium Mound (EEA)

SITE NAME/NUMBER CROSS REFERENCE LIST
NAVAL SUPPORT FACILITY DAHLGREN
DAHLGREN, VIRGINIA

NAVY SITE NUMBER	EPA NUMBER	DESCRIPTION, (IAS Site Name) / (EPA Site Name)
Site 37	SWMU 108	Lead Contaminated Area
Site 38	AOC I	Building 1349 Pest Control Outside Area
Site 39	AOC X7	Open Storage Area Main Battery
Site 40	SWMU 14	Building 120B DRMO Lot
Site 41	SWMU 20	Compost Area
Site 42	SWMU 31	Gambo Creek Truck Wash Area
Site 43	SWMU 35	Higley Road Land Application Area
Site 44	SWMU 41	Rocket Motor Pit
Site 45	SWMU 45	July 28, 1992 Landfill B
Site 46	SWMU 47	July 28, 1992 Landfill A, Stump Dump Rd.
Site 47a	SWMU 50	WWI Munitions Mound
Site 47b	AOC K	EOD Scrap Area
Site 48	SWMU 67	Building 448 Oil Storage Area
Site 49	AOC C4	DU Contaminated Firing Butt (Main-Side)
Site 50	AOC X9	Fill Area Northeast (EEA)
Site 51	SWMU 98	Battery Locker Acid Draining Area
Site 52	SWMU 125	OWS 107-350
Site 53	SWMU 126	OWS 207-300
Site 54	SWMU 128	OWS 1121 - OLD
Site 55	SWMU 129	Cooling Pond
Site 56	SWMU 132	Gun Barrel Degreasing Area, Railway Spur
Site 57	SWMU 133	Shell House Dump
Site 58	SWMU 134	Building 1350 Landfill
Site 59	SWMU 135	Octagon Pad Dump
Site 60	SWMU 57	Building 445 Star Gauge Loading Dock
Site 61a		Gambo Creek Ash Dump
Site 61b		Gambo Creek Projectile Disposal Area
Site 62		Building 396
Site 63		Building 198 – Neutralization Tank
Site 64		Gum Alley Disposal Area
UXO 01		Potomac River Historical Ranges

ATTACHMENT D

SITE SCHEDULES

NAVAL SUPPORT FACILITY DAHLGREN
ENVIRONMENTAL RESTORATION
Goals
FY17
Sep-2017

SITE	GOAL/MILESTONE	DUR [1]	PLANNED DATE	REVISED DATE	ACTUAL DATE	COMMENTS
All Sites						
	Update Site Management Plan FY17-18 (Draft)	90	Jun-2017	Sep-2017		
	Update Site Management Plan FY17-18 (Final)		Sep-2017	Sep-2017		
	Five-Year Review (Draft) Site 2 only	30			Nov-2013	
	Five-Year Review (Draft-Final) Site 2 only	60			Dec-2013	
	Five-Year Review (Final) Site 2 only				Sep-2016	
	Five-Year Review (Draft) Site 9, 10, 12, 17, 37	30			Feb-2015	
	Five-Year Review (Draft-Final) Site 9, 10, 12, 17, 37	60			Feb-2016	
	Five-Year Review (Final) Site 9, 10, 12, 17, 37		Dec-2016		Jan-2017	
	Five-Year Review (Draft) Site 20/23	30				
	Five-Year Review (Draft-Final) Site 20/23	60			Apr-2016	
	Five-Year Review (Final) Site 20/23		Dec-2016		Jan-2017	
	Five Year Review (installation wide)		Dec-2018			
	Update Master Project Plans (Final)		TBD			Last Update was completed in December 2015
	Update Community Involvement Plan		TBD			Last update was completed in December 2013
	Update Administrative Record CDs		TBD			
	Preliminary Closeout Report		Sep-2025			
Site 2	**Fenced Ordnance Burial Area - Landfill EPA OU-2**					Major contaminants: Metals (RC Date: 2/1/1999)
	Long-Term Monitoring					
	Methane Monitoring (annual)					
	Conduct Sampling Event	60	Jun-2017		Jun-2017	
	Methane Monitoring Report		Aug-2017		Jul-2017	
	Groundwater Monitoring (every 2 years)					
	Groundwater Sampling Event	60	Oct-2016	Nov-2016	Nov-2016	
	Draft Report (GW only)	60	Jan-2017		Apr-2017	
	Final Report (GW only)		Mar-2017	Jun-2017	Aug-2017	
	LUC Notification		Jul-2017	Sep-2017		
Site 9	**Disposal Burn Area - Landfill EPA OU-3**					Major contaminants: Metals (RC Date: 11/30/2000)
	Long-Term Monitoring					
	Methane Monitoring (annual)					
	Conduct Sampling Event		Jun-2017		Jun-2017	
	Methane Monitoring Report Only		Aug-2017		Jul-2017	
	GW/SW/SD Monitoring (every 2 years)					
	GW/SW/SD Sampling Event	60	Oct-2016	Nov-2016	Nov-2016	
	Draft Report	60	Jan-2017	Mar-2017	Apr-2017	
	Final Report		Mar-2017	Jun-2017	Aug-2017	
	LUC Notification		Jul-2017	Sep-2017		
Site 10	**Hideaway Pond EPA OU-4**					Major contaminants: Mercury in fish.(RC Date: 6/1/2000)
	Long-Term Monitoring					
	Fish Monitoring - LTM Events	60	Sep-2018			
	Draft Report	30	Dec-2018			
	Final Report		Feb-2019			
Site 12	**Chemical Burn Pit EPA OU-1**					Major contaminants: Chlorinated solvents in groundwater. (RC Date: 9/30/2022)
	Complete LTMP					
	Complete Draft LTMP	60	May-2016	Sep-2016	Sep-2016	
	Complete Final LTMP		Dec-2016		Feb-2017	
	Long-Term Monitoring					
	Complete Sampling Events	60	TBD	Mar-2018		
	Draft Monitoring Report	30	TBD			
	Final Monitoring Report		TBD			
	LUC Notification		Jul-2017	Sep-2017		
Site 14	**CW Evaporation Pond EPA OU-24**					Major contaminants: Chromium in groundwater. Groundwater treatment planned in a very limited area. (RC Date: 9/30/2023)
	Complete ROD					
	Proposed Plan and Public Notice (revisit)		TBD			
	Complete Draft Final ROD	60			Jan-2013	
	Complete Red-Lined Draft-Final	60	Oct-2017	TBD		
	Complete Final ROD	30	Jun-2018	TBD		
	Sign ROD		Aug-2018	TBD		
	Complete Groundwater Sampling					
	Award Groundwater Sampling	90			Jun-2014	
	Complete Draft UFP-SAP	60			Mar-2015	
	Complete Draft-Final UFP-SAP	30			Mar-2016	
	Complete Final UFP-SAP	60			Jun-2016	
	Complete Rd 1 of GW Sampling	180			Aug-2016	
	Complete Rd 2 of GW Sampling	60	Mar-2017		Mar-2017	
	Complete Draft GW Tech Memo	60	Jul-2017	Oct-2017		
	Complete Final GW Tech Memo	60	Sep-2017	Jan-2018		
	Complete Remedial Action					
	Award Remedial Action	90	Jul-2018	TBD		
	Complete Draft RA Work Plan	60	Dec-2018	TBD		
	Complete Final RA Work Plan	60	Feb-2019	TBD		
	Start Remediation	210	Apr-2019	TBD		
	Complete Draft Closeout Report	120	Sep-2019	TBD		
	Complete Final Closeout Report		Nov-2019	TBD		
	Complete RACR					
	Complete Final IRACR		Dec-2019	TBD		
	Complete LUC RD					
	Complete Final LUC RD		Dec-2018	TBD		
	Complete LTMP					
	Complete Final LTMP		Dec-2019	TBD		
Sites 4 and 15	**Site 4-Case Storage Area/Site 15 - Scrap Area EPA OU-26**					Major contaminants: Metals and Debris. Removal Action complete. (RC Date: 9/30/2018)
	Complete Decision Document					
	Draft Risk Screening Technical Memorandum	60			Apr-2015	
	Final Risk Screening Technical Memorandum				Sep-2015	
	Award Additional Sampling				Mar-2016	
	Draft UFP-SAP		Mar-2017		Mar-2017	
	Draft Final UFP-SAP		May-2017	Sep-2017		
	Final UFP-SAP		Jul-2017	Nov-2017		
	Field Sampling		Aug-2017	Dec-2017		
	Draft Revised Risk Screening Tech Memo		Dec-2017	Apr-2018		
	Final Revised Risk Screening Tech Memo		Mar-2018	Jul-2018		
	Draft Decision Document	90	Jun-2018	Jul-2018		
	Final Decision Document		Sep-2018			

NAVAL SUPPORT FACILITY DAHLGREN
ENVIRONMENTAL RESTORATION
Goals
FY17
Sep-2017

SITE	GOAL/MILESTONE	DUR [1]	PLANNED DATE	REVISED DATE	ACTUAL DATE	COMMENTS
Site 17	**1400 Area Landfill EPA OU-5**					Major contaminants: Metals, specifically mercury. (RC Date: 7/31/2001)
	Long-Term Monitoring					
	Methane Monitoring (Qtrly.)					
	Semi-Annual Sampling Event		Dec-2016		Dec-2016	
	Draft Report		Feb-2017		Dec-2016	
	Final Report		Mar-2017		Jan-2017	
	Annual Sampling Event		Jun-2017		Jun-2017	
	Draft Report		Aug-2017		Jul-2017	
	Final Report		Sep-2017		Jul-2017	
	Groundwater Monitoring (every 2 years)					
	Groundwater Sampling Event		Oct-2016	Nov-2016	Nov-2016	
	Draft Report (GW only)	60	Jan-2017	Mar-2017	Apr-2017	
	Final Report (GW only)		Mar-2017	May-2017	Aug-2017	
	LUC Notification		Jul-2017			
Site 20 and 23	**Site 20 Former Electroplating UST / Site 23 Bldg. 480 Lot**		**EPA OU-19**			Major contaminants: PCE, TCE and 1,1-DCE. (RC Date: 9/30/2035)
	Long-Term Monitoring					
	Complete Draft UFP-SAP	30			Mar-2015	
	Complete Draft Final UFP-SAP	60			Mar-2016	
	Complete Final UFP-SAP	60			Jun-2016	
	Complete Rd 1 of GW Sampling	60			Aug-2016	
	Complete Rd 2 of GW Sampling		Mar-2017		Mar-2017	
	Draft Report	60	Jul-2017	Oct-2017		
	Final Report		Sep-2017	Jan-2018		
	LUC Notification		Jul-2017	Sep-2017		
Site 37	**Lead Contamination Area EPA OU-10**					Major contaminants: Metals (i.e. copper, lead, silver and zinc.) (RC Date: 9/30/2007)
	LUC Notification		Jul-2017	Sep-2017		
Site 61a	**Gambo Creek Ash Dump EPA OU-17**					Major contaminants: Metals, debris and potential UXO. (RC Date: 9/30/2020)
	Complete Pilot-Scale Mechanical Screening					
	Complete Field Work				Jul-2013	
	Submit Draft Pilot-Scale Study Report				Sep-2014	
	Submit Draft Final Pilot-Scale Study Report	60			Jan-2015	
	Submit Final Pilot-Scale Study Report				Nov-2016	
	Complete FS					
	Draft Pre-FS UFP-SAP	30			Jul-2015	
	Draft-Final Pre-FS UFP-SAP	60			Sep-2015	
	Final Pre-FS UFP-SAP	30			Dec-2015	
	Complete Field Work	60			Dec-2015	
	Pre-FS Technical Memorandum				Apr-2016	
	Complete Additional Field Work	150	Jan-2017		Dec-2016	
	Draft Revised Pre-FS Technical Memorandum	90	Jun-2017	Oct-2017		
	Final Revised Pre-FS Technical Memorandum		Sep-2017	Jan-2018		
	Complete RAA (internal Navy document)		Nov-2017	Mar-2018		
	Complete Draft FS	30	Dec-2017	Apr-2018		
	Complete Draft Final FS	60	Jan-2018	May-2018		
	Complete Final FS		Mar-2018	Jul-2018		
	Complete PRAP					
	Complete Draft PRAP	60	Feb-2018	Jun-2018		
	Complete Draft Final PRAP	120	Apr-2018	Aug-2018		
	Complete Final PRAP		Aug-2018	Dec-2018		
	Complete ROD					
	Complete Draft ROD	60	Jul-2018	Nov-2018		
	Complete Draft Final ROD	120	Sep-2018	Jan-2019		
	Complete Final ROD	60	Jan-2019	May-2019		
	Sign ROD		Mar-2019	Jul-2019		
	Complete Remedial Design and Explosive Safety Sub.					
	Complete 35% RD and Explosive Safety Sub.	60	Jun-2019			
	Complete 100% RD and Explosive Safety Sub.	90	Aug-2019			
	Complete Final RD and Explosive Safety Sub.		Nov-2019			
	Complete Remedial Action					
	Award Remedial Action	90	Dec-2019			
	Complete Draft RA Work Plan	60	May-2020			
	Complete Final RA Work Plan	30	Jul-2020			
	Start Construction	180	Sep-2020			
	Complete Construction - RIP	180	Mar-2021			
	Complete Closeout Report		Sep-2021			
	Complete RACR					
	Complete Final RACR		Sep-2021			
	Complete LUC RD					
	Complete Final LUC RD		TBD			RA may result in UU/UE
	Complete LTMP					
	Complete Final LTMP		TBD			RA may result in UU/UE
UXO 001	**Potomac River Historical Ranges**					PA and historical search for historical ranges on the Potomac River. (RC Date: 6/30/2026)
	Complete Site Inspection					
	Award Site Inspection		Apr-2016		Jun-2016	
	Complete SI Fieldwork		Nov-2017			
	Complete Draft SI	60	Jul-2018			
	Complete Final SI		Sep-2018			