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FINAL REMEDIAL DESIGN OPERABLE UNIT 25 (OU 25) SITE UNEXPLODED ORDNANCE
19 (UXO 19) MCB CAMP LEJEUNE NC
3/1/2016
CH2M HILL

Final

**Remedial Design
Operable Unit 25, Site UXO-19**

**Marine Corps Base Camp Lejeune
North Carolina**

Contract Task Order WE12

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Prepared for

**Department of the Navy
Naval Facilities Engineering Command
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Prepared by



**CH2M HILL, Inc.
3120 Highwoods Blvd, Suite 214
Raleigh, North Carolina
North Carolina Engineering License #F-0699**

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Acronyms and Abbreviations

3R	recognize, retreat, report
ARAR	applicable or relevant and appropriate requirement
Army	Department of the Army
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CMC	Commandant of the Marine Corps
COM MARCORSCOM	Commander, Marine Corps Systems Command
DGM	digital geophysical mapping
EMD	Environmental Management Division
EOD	explosives ordnance disposal
ESS	Explosives Safety Submission
ESSDR	Explosives Safety Submission Determination Request
ESI	expanded site inspection
FS	Feasibility Study
GIS	geographic information system
HA	hazard assessment
LUC	land use control
MC	munitions constituents
MCB Camp Lejeune	Marine Corps Base Camp Lejeune
MCO	Marine Corps Order
MDAS	material documented as safe
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program
MOUT	Military Operations in Urban Terrain
MPPEH	material potentially presenting an explosive hazard
Navy	Department of the Navy
NCDENR	North Carolina Department of Environment and Natural Resources (now NCDEQ)
NCDEQ	North Carolina Department of Environmental Quality
NCGS	North Carolina General Statute
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OU	Operable Unit
PA	preliminary assessment
RACR	Remedial Action Completion Report
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SI	site inspection

USEPA
UXO

United States Environmental Protection Agency
unexploded ordnance

SECTION 1

Introduction

This Remedial Design (RD) provides details for implementing the Selected Remedy for controlling explosive hazards from munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH) at Operable Unit (OU) 25, Site UXO-19, located at Marine Corps Base Camp Lejeune (MCB Camp Lejeune), also referred to as the Base. This RD is consistent with the *Remedial Design/Remedial Action Handbook* (USEPA, 1995) and was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act and, to the extent applicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This RD is also consistent with the Proposed Plan (CH2M, 2015b) and Record of Decision (ROD) (CH2M, 2015c).

The objective of the RD is to provide the implementation actions for the Selected Remedy for Site UXO-19. The Selected Remedy is land use controls (LUCs) to reduce or prevent the potential for direct physical contact with MEC/MPPEH to allow current and reasonably anticipated land use (infantry training) at the site to continue. LUCs include signs, educational programs, and administrative and legal controls.

Site Background

This section presents a brief description of the Base and the site background relevant to the Selected Remedy.

2.1 Base Description

MCB Camp Lejeune is a 156,000-acre facility in Onslow County, North Carolina, adjacent to the southern side of the city of Jacksonville. The mission of MCB Camp Lejeune is to maintain combat-ready units for expeditionary deployment. The Base provides housing, training facilities, and logistical support for Fleet Marine Force Units and other assigned units.

2.2 Site Description

Camp Devil Dog is a training area in the northern portion of MCB Camp Lejeune where each year roughly 21,000 Marines receive training in land navigation, first aid, defensive combat, offensive combat, and night maneuvers. Site UXO-19 occupies an area of approximately 64 acres that encompasses the cantonment area of the Camp Devil Dog training area. Facilities within the boundary of Site UXO-19 currently consist of billeting, training classrooms, and messing.

A Military Operations in Urban Terrain (MOUT) training facility is adjacent to the eastern boundary of Site UXO-19. The MOUT is an active training area for troops to practice tactical combat maneuvers in an urban setting. The MOUT was initially investigated as part of Site UXO-19 but was removed from the site because it will continue to be an active training area.

Various ranges and training courses have been in use within and adjacent to the site since the early 1950s, resulting in the potential presence of explosive hazards at Site UXO-19. The potential sources of explosive hazards are MEC/MPPEH resulting from the use of military munitions at these historical and active ranges within and adjacent to Site UXO-19 (**Figure 2-1**).

2.2.1 Previous Investigations

Site UXO-19 was characterized through investigations conducted under the Military Munitions Response Program (MMRP) between 2009 and 2013 as summarized in **Table 2-1**. A conceptual site model was developed based on the results of previous investigations and is shown on **Figure 2-2**.

**TABLE 2-1
Summary of Previous Investigations**

Previous Investigations/ Actions	Administrative Record Number	Date	Activities and Findings
Preliminary Assessment/Site Inspection (PA/SI) (CH2M, 2010)	002885	2009	<p>The PA/SI was conducted at Site UXO-19 to evaluate the potential for contamination of site media that may have resulted from former range activities. Soil and groundwater samples were collected, and an MMRP investigation was conducted in transects that covered approximately 10 percent of the site.</p> <p>3-Nitrotoluene in groundwater and arsenic, antimony, and nitroglycerin in soil exceeded screening levels at one or more locations. A total of 4,645 geophysical anomalies were identified; 4,417 were investigated (the remaining items were inaccessible because of surface features such as packed roadways, standing water, and semi-permanent training aids). Approximately 51 percent of the anomalies investigated were identified as MEC or MPPEH.</p> <p>Human health and ecological risk screenings were conducted to assess the potential for unacceptable risks from exposure to munitions constituents (MC) in soil or groundwater. No unacceptable risks were identified to human or ecological receptors from exposure to MC in soil or groundwater based on current or potential future use. However, unacceptable risks were identified to human receptors from explosive hazards. A 100 percent MMRP intrusive investigation was recommended to reduce the overall risk.</p>

TABLE 2-1
Summary of Previous Investigations

Previous Investigations/ Actions	Administrative Record Number	Date	Activities and Findings
Remedial Investigation/ Feasibility Study (RI/FS) ¹ (CH2M, 2015a)	005876	2013	<p>In 2013, an MMRP intrusive investigation was completed at Site UXO-19 within an expanded 64-acre area of the site. The MMRP intrusive investigation was completed over 100 percent of accessible areas, including the area previously investigated during the PA/SI. The entire site including the MOUT was investigated. MEC/MPPEH was encountered from ground surface to as deep as 4 feet below ground surface (bgs).</p> <p>During both the PA/SI and ESI, 51,604 anomalies were investigated, of which 447 items were identified as MEC and 50,771 items were identified as MPPEH. The majority of MEC and MPPEH items were from 60-millimeter (mm) and 81-mm mortar projectiles.</p> <p>An explosive hazard assessment, evaluating the conditions after the MMRP intrusive investigation was completed, indicated there is a potential for explosive hazards from subsurface MEC, deeper than the investigation limits in the areas that were previously investigated (referred to as the undeveloped areas) and in areas that were inaccessible during the MMRP intrusive investigation (referred to as developed/inaccessible areas).</p> <p>Remedial alternatives were developed and evaluated to address the remaining potential explosive hazards. The following remedial alternatives were evaluated:</p> <ul style="list-style-type: none"> • 1 – No Action • 2 – LUCs • 3 – Subsurface removal of MEC/MPPEH in undeveloped areas (via excavation, digital geophysical mapping [DGM], and intrusive investigation) and LUCs • 4 – Subsurface removal of MEC/MPPEH in undeveloped areas (via excavation and sifting) and LUCs
Proposed Plan (CH2M, 2015b)	06423	2015	A Proposed Plan was issued to solicit public input on the preferred alternative (LUCs), and a public meeting was held. General comments for informational purposes were addressed during the public meeting, and no written comments were received.
ROD (CH2M, 2015c)	PENDING	2015	The ROD documenting the Selected Remedy (LUCs) was issued and signed on December 9, 2015.

2.2.2 Geology and Hydrogeology

Site-specific geological and hydrogeological characteristics were derived from soil borings and temporary monitoring wells during the PA/SI field activities. These activities were limited to a depth of roughly

¹ The RI was initially planned as an expanded site inspection (ESI); however, based on the results and potential explosive hazards remaining after the ESI, an RI was recommended. The ESI field work and results were documented in the RI and no additional field work was warranted for the RI.

25 feet bgs. The shallow soils encountered within the site consist of poorly graded sands, sands with variable amounts of silt and clay, and occasional clay lenses ranging from 3 inches to more than 9 feet thick.

The water table was encountered at depths ranging from approximately 10 to 17 feet bgs or 5 to 10 feet above mean sea level. Groundwater in the surficial aquifer generally flows toward the northeast (Figure 2-2).

2.2.3 Nature and Extent of Munitions and Explosives of Concern and Material Potentially Presenting an Explosive Hazard

During the intrusive investigations, 447 MEC and 50,771 MPPEH items were identified. A detailed description of the methods and results is provided in the RI/FS (CH2M, 2015a). The following is a summary of the MMRP intrusive investigation findings:

- MEC/MPPEH was recovered from the surface and subsurface to a maximum depth of 4 feet.
- The MEC/MPPEH items were distributed throughout the site with no discernible pattern or apparent correlation with former range areas. The distribution of items appears to be denser in the undeveloped eastern portion of the site; however, this may be because the developed/inaccessible areas were covered by roads and buildings that interfered with the intrusive investigation.
- More than 50 percent of the MEC items contained high explosive filler.
- More than 50 percent of the MEC items resulted from 60-mm or 81-mm mortar projectiles; the majority of the remaining MEC items resulted from flares (31 percent) and grenades (13 percent).
- Approximately 75 percent of the MPPEH items resulted from 60-mm or 81-mm mortar projectiles; the majority of the remaining MPPEH were from small arms ammunition (19.4 percent).
- Nine MEC items were found during military construction support in areas beneath buildings or structures that were demolished and beneath culverts.

Although the maximum detection limit for geophysical instruments is 24 inches, it is conservatively assumed that 18 inches is the maximum depth that geophysical instruments can reliably detect grenade-sized objects. DGM could not be completed in areas where buildings, permanent or semi-permanent structures, heavy vegetation or uneven ground, or other obstacles were present. Additionally, although DGM was completed as close as a geophysical instrument could physically move next to buildings and other structures, interference from the obstacles may have occurred, causing incomplete clearance of the areas around the excluded areas. Based on this, MEC/MPPEH may be present at depths greater than 18 inches bgs and in areas where buildings are currently present.

The MEC items were disposed of through explosive detonation either in place or at a consolidation point. Upon inspection and re-inspection, the MPPEH was certified as material documented as safe (MDAS). Approximately 2,800 pounds of MDAS resulted from the PA/SI, and approximately 6,516 pounds of MDAS and 434 pounds of small arms ammunition resulted from the 100 percent MMRP intrusive investigation. The demilitarized MDAS was sent offsite for witnessed destruction. The other recovered items were identified as non-munitions-related debris and were stockpiled onsite and recycled.

2.2.4 Migration of Munitions and Explosives of Concern

Migration of MEC (other than through human transport) is considered unlikely based on the regional conditions and natural mechanisms and because potential MEC remaining onsite is either beneath structures or buried deeper than 18 inches. Frost upheaval in the Coastal Plain region of North Carolina is considered unlikely because the average temperature in the coldest months is 45 degrees Fahrenheit and the average daily minimum temperature is 32 degrees Fahrenheit.

2.3 Summary of Site Risks

Potential human health and ecological risks from exposure to media and explosive hazards from MEC/MPPEH at Site UXO-19 were evaluated as part of the PA/SI and RI/FS (CH2M, 2010 and 2015a). Based on the analytical results and risk assessments completed as part of the PA/SI (CH2M, 2010), there are no unacceptable risks to human or ecological receptors from exposure to MC in surface or subsurface soil and groundwater.

An assessment was conducted of the relative risks posed to human receptors by MEC/MPPEH potentially present within the Site UXO-19 boundary. For MEC/MPPEH to result in a human injury or death, there must be the presence of MEC/MPPEH; a human receptor in contact with, or in the vicinity of, the MEC/MPPEH; and an event to cause functioning of the MEC. A MEC hazard assessment (HA) was conducted to evaluate the potential explosive hazards to receptors based on current conditions at Site UXO-19 using the interim MEC HA methodology (USEPA, 2008). Based on the MEC HA, there is an unacceptable risk from potential exposure to explosive hazards from MEC/MPPEH at Site UXO-19. Instrument limitations and site accessibility prevented complete removal of MEC/MPPEH, and potential explosive hazards exist in the area that was investigated (referred to as “undeveloped area”) and in the inaccessible or developed areas.

2.4 Remedial Action Objective

In order to protect human health and the environment and to address potential hazards identified in the explosive hazard evaluation, the remedial action objective identified for Site UXO-19 is:

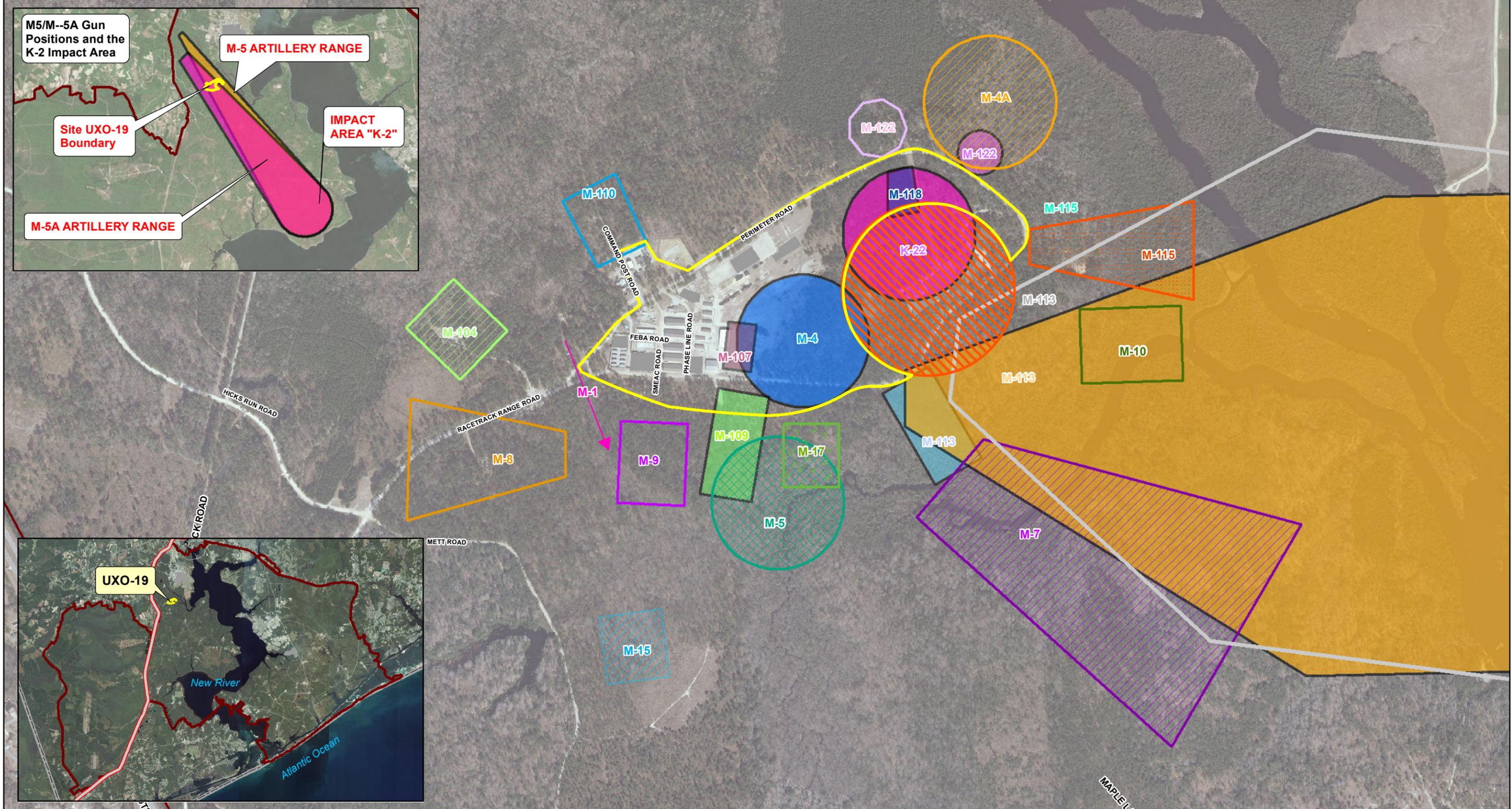
- Reduce or prevent the potential for direct physical contact with MEC/MPPEH to allow current and reasonably anticipated land use (infantry training) at the site to continue.

The applicable or relevant and appropriate requirements (ARARs) and to be considered criteria are presented in **Appendix A**.

2.5 Selected Remedy

Based on the comparative analysis using the nine United States Environmental Protection Agency (USEPA) criteria, the Selected Remedy is:

- LUCs to control exposure to MEC/MPPEH



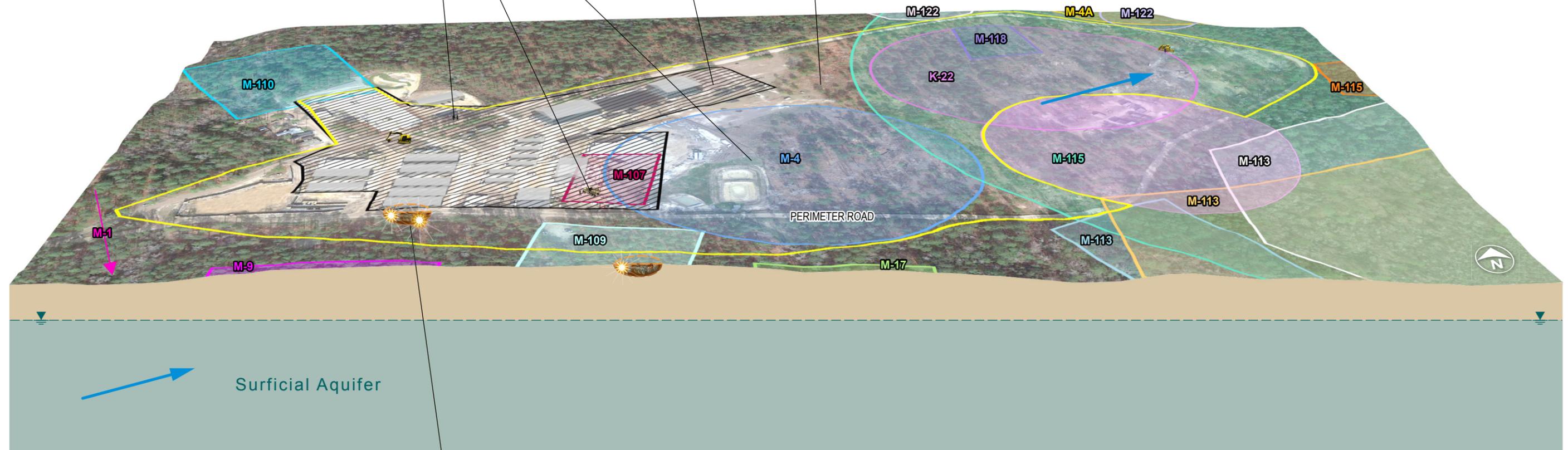
<p>Legend</p> <ul style="list-style-type: none"> M-1 Mortar Range Site UXO-19 Boundary Devil Dog MOUT Area Installation Boundary M-115 Hand Grenade Range M-110 Demolitions And Booby Trap Range K-22 Hand Grenade Course M-4 Rifle Grenade Range 	<ul style="list-style-type: none"> M-104 Demolition Range M-113 Hand Grenade Range M-15 Mine, Booby Trap Display Area M-9 Combat Village Area M-4A Practice Hand Grenade Course M-17 Practice Hand and Rifle Grenade Range M-122 Flame Thrower Range M-115 Hand Grenade Range 	<ul style="list-style-type: none"> M-113 Hand Grenade Range (Practice) Demonstrator M-10 Hand Grenade Range M-5 Practice Rifle Grenade Range M-7 Landscape Range M-8 Assault of a Fortified Position Range M-107 Hand Grenade Range M-109 Infiltration Range M-113 Battle Sites Range 	<ul style="list-style-type: none"> M-118 Individual Movement Range M-122 Flame Thrower Range 	<p>Note: Impact Area K-2 is 3.94 miles from Site UXO-19. The Devil Dog MOUT area is currently active.</p>	<p>Figure 2-1 Range Location Map Site UXO-19 Remedial Design MCB Camp Lejeune North Carolina</p>	<p>0 350 700 Feet 1 inch = 700 feet</p> <p>ch2m</p>
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Potential hazard from direct contact with MEC:

- in Developed Areas during any intrusive activity
- in Undeveloped areas during intrusive activities deeper than 18 inches

Developed Areas: Area of UXO-19 that was inaccessible or may not have been fully investigated during MEC intrusive investigations due to surface or subsurface obstructions (for example, buildings, utility lines, and fences)

Undeveloped Areas: Areas of UXO-19 located outside of the Developed Area that were investigated to 18 inches below ground surface (bgs) during the MEC intrusive investigations



Not To Scale

Potential Source: Former munitions training areas (explosive hazard).

LEGEND

- | | | |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------|
| Site UXO-19 Boundary | M-1 Mortar Range | Devil Dog MOUT |
| Developed areas | K-22 Hand Grenade Course | M-113 Battle Sites Range |
| Water table | M-4 Rifle Grenade Range | M-113 Hand Grenade Range (Practice) Demonstrator |
| Groundwater flow direction (surficial aquifer) | M-4A Practice Hand Grenade Course | M-113 Hand Grenade Range |
| Possible buried munitions and explosives of concern (MEC)/ material potentially presenting an explosive hazard (MPPEH) | M-9 Combat Village Area | M-115 Hand Grenade Range |
| | M-17 Practice Hand and Rifle Grenade Range | M-115 Hand Grenade Range |
| | M-107 Hand Grenade Range | M-118 Individual Movement Range |
| | M-109 Infiltration Range | M-122 Flame Thrower Range |
| | M-110 Demolitions And Booby Trap Range | M-122 Flame Thrower Range |

FIGURE 2-2
Conceptual Site Model
Site UXO-19 Remedial Design
MCB Camp Lejeune
North Carolina

Land Use Controls

This section describes the LUCs that the Department of the Navy (Navy) and/or MCB Camp Lejeune will implement and the continued responsibilities for monitoring, maintaining, and enforcing the LUCs at Site UXO-19. Additional requirements related to LUCs are further outlined in the LUCs Memorandum of Agreement between USEPA, the North Carolina Department of Environment and Natural Resources (NCDENR; now North Carolina Department of Environmental Quality [NCDEQ]), and the Navy for MCB Camp Lejeune (USEPA, NCDENR, and Navy, 1999).

LUCs generally include any type of legal or administrative mechanism that restricts the use of, or limits access to, contaminated real property in order to prevent or reduce risks to human health and the environment. LUCs also can include providing notice and information to governmental entities, property owners, and other interested parties about LUCs required for the property.

3.1 Land Use Control Objectives

The objectives of the LUCs to be implemented at Site UXO-19 are to:

- Restrict activities within areas possibly containing MEC/MPPEH to prevent exposure that could result in an explosion, causing injury or death.
- Maintain the integrity of any current or future remedial or monitoring system, such as the warning signs.

The Navy will not modify or terminate LUCs or LUC implementation actions, or cause or allow any land use inconsistent with the anticipated land use(s) identified in the ROD, without obtaining prior approval from USEPA and NCDEQ.

3.2 Land Use Control Implementation

To achieve the LUC objectives, the Navy will implement the following LUCs for Site UXO-19 (**Figure 3-1**):

- **Intrusive Activities Control (MEC) in Developed/Inaccessible Areas** – Require unexploded ordnance (UXO) construction support for any intrusive activities within the areas identified as developed or inaccessible within Site UXO-19. Require recognize, retreat, report (3R) munitions safety awareness training for Base personnel and subcontractors working within the Site UXO-19 boundary. This LUC encompasses an area of approximately 22 acres.
- **Intrusive Activities Control (MEC) in Undeveloped Areas** – Restrict intrusive activities within the undeveloped area with potential explosive safety hazards to less than 18 inches bgs. Require UXO construction support for all intrusive activities greater than 18 inches bgs and 3R munitions safety awareness training for all personnel working within the Site UXO-19 boundary. This LUC encompasses an area of approximately 43 acres.

The specific types of LUCs that will be implemented are:

- Installing warning signs around the perimeter of the site at key locations where trespassers or visitors may enter the site
- Requiring UXO construction support² for all intrusive activities greater than 18 inches bgs in the undeveloped area and any intrusive activity in the developed/inaccessible area

² Actual construction support requirements will be determined by the Installation's Explosives Safety Officer; Commander, Marine Corps Systems Command (COM MARCORSYSCOM); and the Department of Defense Explosives Safety Board. Construction support shall be determined by submission of an Explosives Safety Submission (ESS) and/or an ESS Determination Request (ESSDR), in accordance with appropriate Navy and Marine Corps requirements.

- Requiring 3R munitions safety awareness training for all personnel working within the site boundary
- Revising the Base Master Plan and/or geographic information system (GIS) mapping with the land use restrictions marked for this site
- Filing a Notice of Contaminated Site in Onslow County real property records in accordance with North Carolina General Statutes (NCGS) 143B-279.9 and 143B-279.10

The Navy and/or MCB Camp Lejeune is responsible for implementing, maintaining, monitoring, reporting on, and enforcing the LUCs described in this RD. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy will retain ultimate responsibility for the remedy integrity. LUCs will be maintained until the potential exposure to explosive hazards from MEC/MPPEH is at a level that allows unlimited use and unrestricted exposure at the site.

3.2.1 Warning Sign Installation

Seventeen warning signs will be installed at the site entrance and road intersections and spaced along the perimeter at approximately 200-meter intervals (Army, 2014) as shown on **Figure 3-1**. The signs will be consistent with Occupational Safety and Health Administration standard danger design specified by Code of Federal Regulations Title 29, Part 1926, Section 200b.

Each sign will contain the following text:

WARNING	white letters, red background bar, red rectangle
NO DIGGING – POSSIBLE UXO HAZARDS WITHIN THIS POSTED AREA!	
Contact MCT Bn OOD: 910-376-7555 For Information	black text
Per Base Order 5090.10	

The signs will be fabricated as follows:

- High-performance reflective vinyl bonded to 0.080 gauge aluminum
- Ultraviolet resistant
- Minimum 18-inch x 24-inch sign dimensions
- Red and black on a white background
- All letters minimum of 1 inch high, Microsoft Sans Serif

An ESSDR will be prepared to address MEC avoidance procedures that will be required during sign installation. Details regarding ESSDR requirements are described in **Section 3.2.2**.

Signs will also contain a Quick Response code linking to munitions safety awareness training as discussed in **Section 3.2.3**.

3.2.2 Unexploded Ordnance Construction Support

All projects with an intrusive component will be subject to Base Environmental Management Division (EMD) review and approval. Activities will proceed under an approved ESSDR or ESS as warranted based on the activity.

3.2.2.1 Emergency Utility Repair

Emergency utility repairs will be performed under the requirements of an ESSDR prepared for the COM MARCORSSCOM in accordance with the *Marine Corps Explosives Safety Management Program* (CMC, 2015). The following techniques will be used for emergency utility repairs:

- **Onsite construction support** – Oversight of soil excavation will be conducted in previously disturbed soil above existing underground utilities when emergency utility repairs must be conducted.
- **Anomaly avoidance** – If emergency utility pole installation is required, anomaly avoidance will be conducted to select a location with no subsurface anomalies.
- **Intrusive investigation** – If an anomaly-free location cannot be found for an emergency utility pole installation, manual excavation of soil will be conducted to expose the anomaly source to determine whether it is suspected MEC/MPPEH.

These techniques are described in detail in the ESSDR for Emergency Utility Repairs (**Appendix B**).

3.2.2.2 Other Ground-Disturbing Activities

Any ground-disturbing activity not addressed by the emergency utility repair ESSDR will require the preparation and approval of an ESSDR or an ESS as follows.

1. An ESSDR is required, but UXO construction support is not required, for ground-disturbing activities:
 - At depths of 18 inches or less, in previously investigated areas where no fill has been added after the MMRP investigation completed in 2009–2013. A detailed map was produced based on the MMRP investigated depths and thickness of fill brought onsite during post-MMRP investigation construction (**Figure 3-2**).
 - Within fill placed above the grade that existed at the time of the MMRP investigation in 2009–2013.
 - Within disturbed soils where onsite construction support or MEC clearance was conducted after the MMRP investigation in 2009–2013.
2. An ESSDR is required and anomaly avoidance must be practiced for ground-disturbing activities not exempt under Item 1, above.
3. An ESS is required and onsite UXO construction support must be provided for ground-disturbing activities not exempt under Item 1, above, if anomaly avoidance is not possible.

Detailed anomaly avoidance and/or construction support procedures will be described in the ESSDR or ESS based on project-specific requirements. The ESSDR or ESS shall be prepared in accordance with the most current version of the *Marine Corps Explosives Safety Management Program* (CMC, 2015), and will be submitted to COM MARCORSYSCOM. The ESSDR must be approved by COM MARCORSYSCOM before ground-disturbing activities may begin. The ESS must be approved by the Department of Defense Explosives Safety Board or receive Service Approval from COM MARCORSYSCOM before ground-disturbing activities may begin.

3.2.3 Munitions Safety Awareness Training

Munitions safety awareness training (3R) will be required for Base personnel and contractors working within the boundary of Site UXO-19. The Base EMD will review all construction projects requiring contractors to work within the boundary of Site UXO-19 and will provide 3R training that meets the minimum standards described herein. Site-specific training has been created and will be provided by Base EMD to personnel prior to site work.

The training will include the following information at a minimum:

- Dangers presented by UXO or MEC/MPPEH
- How to recognize items that may be UXO or MEC/MPPEH
- How to retreat safely
- How to properly mark and report possible UXO items to Base explosives ordnance disposal (EOD) personnel

Any intrusive activity that requires UXO construction support may require additional training or authorized personnel onsite.

3.2.4 Incorporating Land Use Controls into the Base Master Plan

MCB Camp Lejeune will include the LUC information for Site UXO-19 in the MCB Camp Lejeune Base Master Plan. The Master Plan identifies and sets priorities on project phasing requirements and siting considerations. It also facilitates the planning of projects and aids in obtaining necessary Base officials' approvals. Within 14 days after USEPA and NCDEQ approval of this RD, the Navy will ensure that MCB Camp Lejeune will incorporate the Site UXO-19 LUC information into the Base master planning process and GIS and will provide written notification to USEPA and NCDEQ when the LUCs have been incorporated. The Navy and/or MCB Camp Lejeune will notify USEPA and NCDEQ in advance of any internal procedural changes to the Base master planning process that would affect the LUCs.

The Navy will provide electronic coverages (maps) of the Site UXO-19 hazards and a description of the LUCs to MCB Camp Lejeune. The coverages will be included in the GIS in the Integrated Geographic Information Repository for the Base. The coverages will be used to identify land use restrictions for projects proposed within the boundaries Site UXO-19. If a change in land use is proposed for an area within the boundaries of Site UXO-19 where restrictions are applied, USEPA and NCDEQ will be notified by the Base for review, and such changes will not be implemented without the prior concurrence of both USEPA and NCDEQ.

3.2.5 Notice of Contaminated Site

Within 180 days after the date USEPA and NCDEQ approve this RD, the Navy and/or MCB Camp Lejeune must submit for USEPA concurrence and NCDEQ approval a survey plat of Site UXO-19 that will be entitled "NOTICE OF CONTAMINATED SITE" (hereafter Notice) in accordance with NCGS 143B-279.10. The survey plat will include:

- The location and dimensions of any areas of potential hazards with respect to permanently surveyed benchmarks
- The restrictions for each area type (Developed/Inaccessible and Undeveloped) as described in **Section 3.2**

The Navy will file the certified copy of the Notice in the Register of Deeds office for Onslow County within 15 days of the date on which the Navy receives approval of the Notice from USEPA and NCDEQ.

If any portion of Site UXO-19 is sold, leased, conveyed, or transferred, the deed or other instrument of transfer will contain in the description section, in type no smaller than that used in the body of the deed or instrument, a statement that the property has been used as a hazardous substance or waste disposal site and a reference by book and page to the recordation of the Notice. The deed or instrument of transfer will also include a CERCLA 120(h)(3) covenant that will contain a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and LUC objectives. The environmental restrictions are included in a section of the CERCLA 120(h)(3) covenant that the United States is required to include in the deed for any property that has had hazardous substances stored for 1 year or more, or known to have been released or disposed of on the property. The deed or instrument of transfer will also contain a reservation of access to the property for the Navy, USEPA, and NCDEQ, as well as their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Navy MMRP and the Federal Facilities Agreement. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Navy. Information on the environmental use restrictions and controls will be communicated in writing to the property owners and to appropriate state and local agencies so they can factor those conditions into their oversight and decision-making related to the property.

The Navy and/or MCB Camp Lejeune will notify USEPA and NCDEQ at least 6 months in advance of any transfer or sale of any portion of Site UXO-19 so that USEPA and NCDEQ can be involved in discussions and

ensure appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the facility to notify USEPA and NCDEQ at least 6 months in advance of any transfer or sale, then the facility will notify USEPA and NCDEQ as soon as possible, but no later than 60 days before the transfer or sale of any property subject to LUCs. In addition to the previously detailed land transfer notice and discussion provisions, the Navy further agrees to provide USEPA and NCDEQ with similar notice, within the same time frames, of federal-to-federal transfer of property. The Navy will provide a copy of the executed deed or transfer assembly to USEPA and NCDEQ.

The Notice of Contaminated Site filed pursuant to NCGS 143B-279.10 will, at the request of the owner of the land, be cancelled by the Secretary of the Navy after the hazards have been eliminated or remediated to unlimited use and unrestricted exposure standards.

3.2.6 Maintaining the Integrity of Current or Future Remedial or Monitoring Systems

The Navy and/or MCB Camp Lejeune will provide regular inspections and maintenance of current or future remedy components. Inspections will also be conducted to verify compliance with land use restrictions.

3.2.7 Monitoring Land Use Controls

Land use controls will be monitored quarterly by the Navy and/or MCB Camp Lejeune (or its contractors) consistent with the LUCs Memorandum of Agreement. The Navy will ensure that MCB Camp Lejeune will conduct quarterly visual inspections of Site UXO-19 and quarterly reviews of the applicable Base master planning process and GIS data. Any deficiencies noted will be reported to USEPA and NCDEQ within 10 days. The reports and letters will be used in preparation of the Five-Year Review to evaluate the effectiveness of the remedy.

The Base Commander will certify annually that the LUCs remain properly implemented and that deficiencies or inconsistent uses have been addressed. The monitoring reports and letters that the Navy submits to USEPA and NCDEQ will provide an evaluation of the status of the LUCs and indicate how any LUC deficiencies or inconsistent uses have been addressed. If any portion of Site UXO-19 is transferred, the evaluations will address whether the previously referenced use restrictions and LUCs were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and LUCs affecting the property, and whether use of the property has conformed to such restrictions.

3.2.8 Enforcement

The aforementioned LUCs will be maintained until the potential hazards are sufficiently removed, allowing for unlimited use and unrestricted exposure. The Navy and/or MCB Camp Lejeune will not modify or terminate LUCs or modify land use without approval from both NCDEQ and USEPA. The Navy and/or MCB Camp Lejeune will seek prior concurrence before implementing any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

The Navy and/or MCB Camp Lejeune will notify USEPA and NCDEQ at least 60 days in advance of any proposed land use changes that are inconsistent with the LUC objectives or the Selected Remedy for Site UXO-19 or of any changes to the LUCs that may be necessary to mitigate exposure to MEC. No land use change will be implemented until concurrence is obtained from USEPA and NCDEQ. Any activity that would violate or that may disrupt the effectiveness of any implemented LUCs (such as removal of warning signs) constitutes a land use change and requires prior concurrence of both USEPA and NCDEQ.

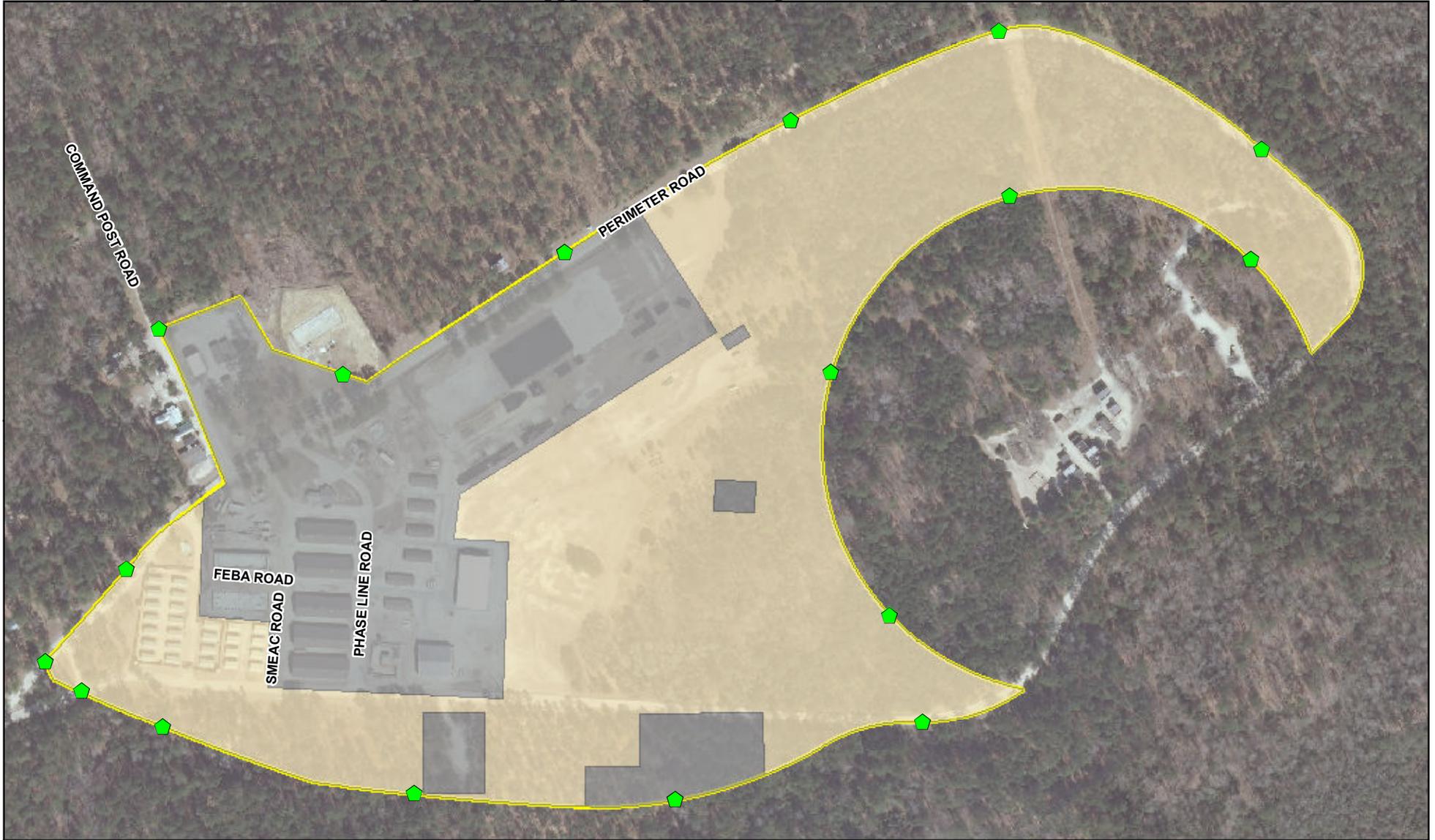
The Navy and/or MCB Camp Lejeune will notify USEPA and NCDEQ as soon as practicable but no longer than 10 days after the following:

- Discovery of any activity that is inconsistent with the LUC objectives or use restrictions or of any other action that may interfere with the effectiveness of the LUCs

- Discovery of MEC/MPPEH during activities that are consistent with the LUC objectives or use restrictions at the site, but where MEC/MPPEH is not expected (for example, items less than 18 inches bgs in the undeveloped area)
- Discovery of any new types of MEC/MPPEH

If suspected MEC/MPPEH is encountered during activities not covered under an ESS or ESSDR, MCB Camp Lejeune EOD personnel or other UXO-qualified personnel will evaluate the material to determine if it potentially poses an explosive hazard. If the material potentially poses an explosive hazard, it will be disposed of by EOD personnel. Depending on the type, depth, and location of the MEC/MPPEH, the Navy and USEPA, in consultation with NCDEQ, will determine whether an evaluation of continued protection of human health and the environment is needed.

Any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs, will be addressed by the Navy and/or MCB Camp Lejeune as soon as practicable, but in no case will the process be initiated later than 10 days after the Navy becomes aware of the breach. The Navy and/or MCB Camp Lejeune will inform USEPA and NCDEQ how the Navy and/or MCB Camp Lejeune has addressed or will address the breach within 10 days of sending USEPA and NCDEQ notification of the breach. Any LUC violations that breach federal, state, or local criminal or civil law will be reported to the appropriate civilian authorities, as required by law. Should the LUC component of the Selected Remedy fail, the Navy and/or MCB Camp Lejeune will ensure that appropriate actions are taken to reestablish its protectiveness. The Navy will exercise such rights as it retains under contracts or other relevant documents to direct that activities in violation of the LUCs or the remedy be halted. To the extent necessary, the Navy will engage the Department of Justice and may initiate legal action.



- Legend**
-  Sign Locations
 -  Developed/Inaccessible Areas
 -  Undeveloped Areas
 -  Current Site UXO-19 Boundary

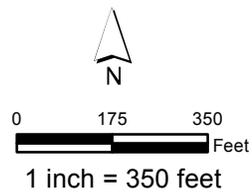
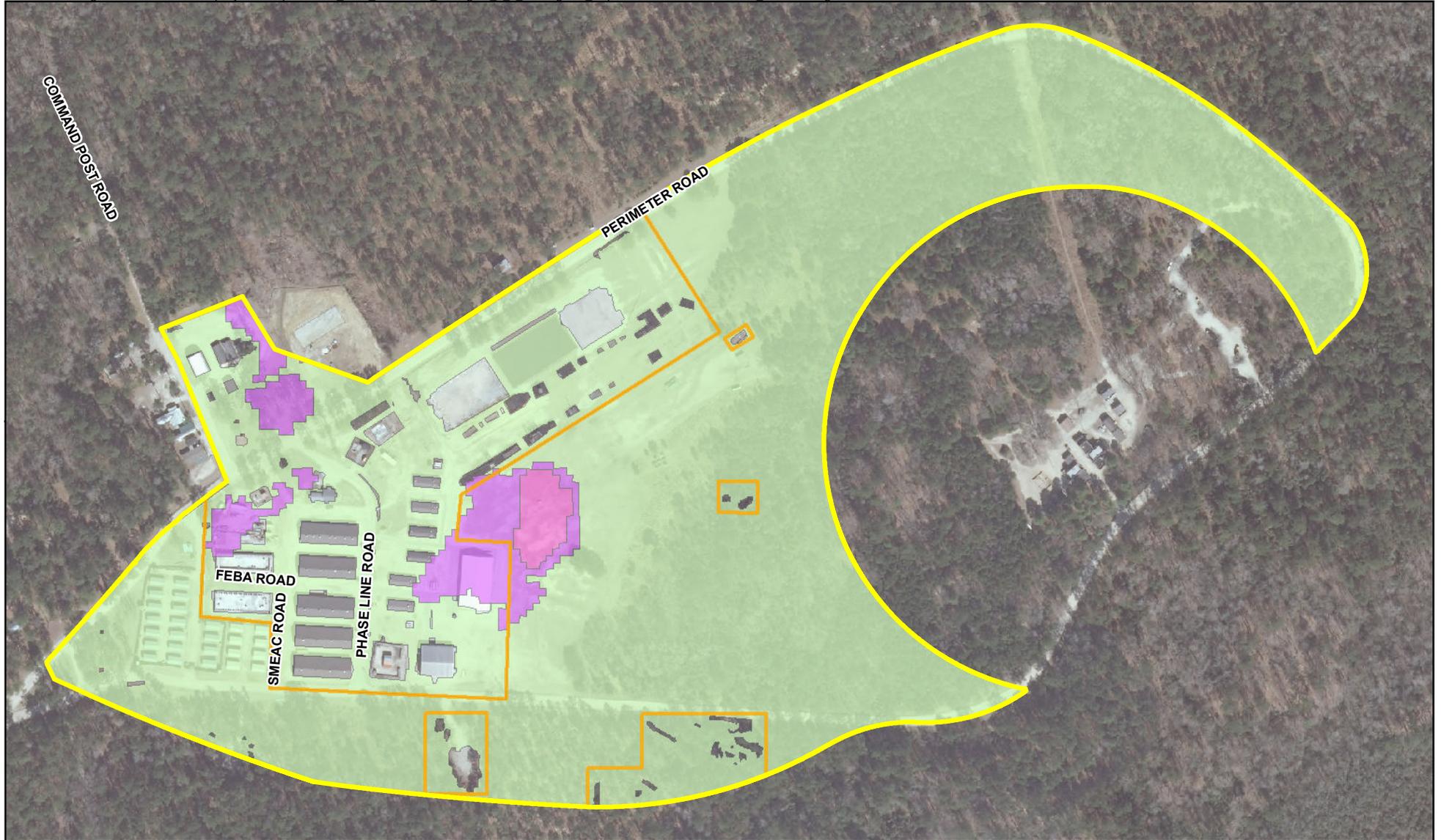


Figure 3-1
Proposed Land Use Controls
Site UXO-19 Remedial Design
MCB Camp Lejeune
North Carolina



Legend

- Current Site UXO-19 Boundary
- Developed/Inaccessible Areas
- Depth of investigation and/or fill added post-investigation**
- Up to 1.5 feet
- Up to 2.75 feet
- Up to 5.75 feet

Note: Depths are based on previous intrusive investigations to 18 inches and depths of fill brought on-site during military construction work. Intrusive work at greater depths are subject to Base approval and may require additional permission and UXO construction support. Areas that are not shaded have not been investigated to any depths.

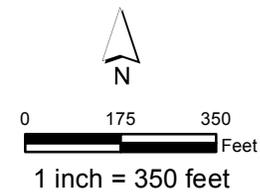


Figure 3-2
MMRP Investigated Depths
Site UXO-19 Remedial Design
MCB Camp Lejeune
North Carolina



Reporting

A Remedial Action Completion Report (RACR) and Five-Year Reviews will be completed at the frequency and duration outlined in this section.

4.1 Remedial Action Completion Report

The RACR will be prepared within 90 days once the LUCs have been put in place. The RACR will document the remedy in-place in accordance with the ROD.

4.2 Five-Year Reviews

This remedy will result in MEC/MPPEH potentially remaining onsite, preventing unlimited use and unrestricted exposure; therefore, in accordance with CERCLA Section 121(c) and the NCP at 40 CFR 300.430 (f)(4)(ii), a statutory review will be conducted by the Navy within 5 years after initiation of the remedial action. Site UXO-19 will be incorporated into the next Five-Year Review.

The Five-Year Reviews will evaluate current remedies at Site UXO-19 to ensure the remedy is, or will be, protective of human health and the environment. The protectiveness of the remedies will be evaluated through review of reports, site visits and inspections, and community involvement. In addition, the Five-Year Review will identify any issues that may be preventing a particular remedy from functioning as designed or as appropriate. If the remedy is deemed not to be protective of human health and the environment because, for example, LUCs have failed, then additional remedial actions would be evaluated by the Federal Facilities Agreement parties and the Navy may be required to undertake additional remedial action.

SECTION 5

Cost Estimate

A cost estimate has been prepared for implementing the Selected Remedy for Site UXO-19 (**Appendix C**). Costs were updated from the RI/FS to reflect updated assumptions and current discount rates.

Components of the cost estimate include surveying the LUC boundaries, sign fabrication and installation, and UXO support for MEC avoidance during onsite activities. Periodic costs include UXO construction support as needed based on ESS and ESSDR requirements for future work (assumed 80 hours per year for cost estimating purposes), LUC inspections and sign repair, and Five-Year Reviews.

Costs are summarized in **Table 5-1**.

TABLE 5-1
Cost Estimate

Components	Total Capital Cost	Total Project Cost (Net Present Value in 2015 \$)
LUCs	\$49,000	\$445,000

This rough order of magnitude cost estimate has a -30 to +50 percent range of accuracy and is based on the design and implementation assumptions described in this report.

SECTION 6

Schedule

Table 6-1 presents a proposed schedule for implementing the selected remedy for Site UXO-19.

TABLE 6-1
Schedule

Component	Anticipated Completion Date
LUC Survey	April 2016
ESSDR for Sign Installation	TBD
Sign Installation	TBD
RACR	June 2016
ESS/ESSDR and UXO Construction Support	As needed based on planned activities

SECTION 7

References

Department of the Army (Army). 2014. *Pamphlet 385-63, Range Safety*. April.

CH2M HILL, Inc. (CH2M). 2010. *Focused Preliminary Assessment/Site Inspection Report, Camp Devil Dog Construction Area and Military Munitions Response Program UXO-19, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. October.

CH2M. 2015a. *Revised Final Remedial Investigation/ Feasibility Study Report, Operable Unit 25/Site UXO-19, Camp Devil Dog, Marine Corps Installations East – Marine Corps Base Camp Lejeune, North Carolina*. January.

CH2M. 2015b. *Proposed Plan, Site UXO-19: Operable Unit 25, Marine Corps Installations East-Marine Corps Base Camp Lejeune, North Carolina*. February.

CH2M. 2015c. *Record of Decision, Operable Unit 25, Site UXO-19, Marine Corps Installations East-Marine Corps Base Camp Lejeune, North Carolina*. October.

Commandant of the Marine Corps (CMC). 2015. *Marine Corps Explosives Safety Management Program*. Marine Corps Order 8020.10. Chapter 7, Paragraph 3.d.(1). June 10.
<http://www.marines.mil/Portals/59/MCO%208020.10.pdf>.

United States Environmental Protection Agency (USEPA). 1995. *Remedial Design/Remedial Action Handbook*. EPA 540/R-95/059. June.

USEPA. 2008. Munitions and Explosives of Concern Hazard Assessment (MEC HA) Methodology Technical Work Group. http://www.epa.gov/fedfac/documents/hazard_assess_wrkgrp.htm. Accessed March 2013.

USEPA, North Carolina Department of Environment and Natural Resources (NCDENR), and United States Department of the Navy (Navy). 1999. *Land Use Controls Signing Ceremony – Memorandum of Agreement between U.S. Environmental Protection Agency, the North Carolina Department of Environment and Natural Resources, and the U.S. Department of the Navy for Marine Corps Base, Camp Lejeune*. May 24, 1999.

Appendix A
Applicable or Relevant and
Appropriate Requirements

APPENDIX A

Applicable or Relevant and Appropriate Requirements

Federal and North Carolina Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs)			
Location	Requirement	Prerequisite	Citation
Presence of migratory birds listed in 50 Code of Federal Regulations (CFR) 10.13	No person may take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such bird except as may be permitted under the terms of a valid permit issued pursuant to the provisions of this part and part 13 of this chapter, or as permitted by regulations in this part, or part 20 of this subchapter (the hunting regulations).	Action that have potential impacts on, or is likely to result in a 'take' (as defined in 50 CFR 10.12) of migratory birds – Applicable	Migratory Bird Treaty Act, 16 U.S. Code §703(a) 50 CFR 21.11
Federal and North Carolina Action-Specific ARARs and To Be Considered Criteria			
Action	Requirement	Prerequisite	Citation
Offsite Regulatory Requirements - Institutional Controls for Contamination Left in Place			
Notice of Contaminated Site	Prepare and certify by professional land surveyor a survey plat which identifies contaminated areas which shall be entitled "NOTICE OF CONTAMINATED SITE". Notice shall include a legal description of the site that would be sufficient as a description in an instrument of conveyance and meet the requirements of North Carolina General Statute (NCGS) 47-30 for maps and plans.	Contaminated site subject to current or future use restrictions included in a remedial action plan as provided in NCGS 143B-279.9(a) – To Be Considered	NCGS 143B-279.10(a)
	The Survey plat shall identify: <ul style="list-style-type: none"> the location and dimensions of any disposal areas and areas of potential environmental concern with respect to permanently surveyed benchmarks; the type, location, and quantity of contamination known to exist on the site; and any use restriction on the current or future use of the site. 	NCGS 143B-279.10(a)(1)-(3)	
	The deed or other instrument of transfer shall contain in the description section, in no smaller type than used in the body of the deed or instrument, a statement that the property is a contaminated site and reference by book and page to the recordation of the Notice.	Contaminated site subject to current or future use restrictions as provided in NCGS 143B-279.9(a) that is to be sold, leased, conveyed or transferred – To Be Considered	NCGS 143B-279.10(e)

Appendix B
ESSDR for Emergency Utility Repairs



UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005

5090.21
BEMD
NOV 10 2015

From: Commanding General, Marine Corps Installations East- Marine Corps
Base Camp Lejeune
To: Commander, Marine Corps Systems Command (Mr. Taylor Code 204),
2200 Lester Street, Quantico, Virginia 22134-6010
Subj: EXPLOSIVES SAFETY SUBMISSION DETERMINATION REQUEST FOR EMERGENCY
UTILITY REPAIRS AT MUNITIONS RESPONSE PROGRAM SITE UXO-19, MARINE
CORPS BASE CAMP LEJEUNE
Ref: (a) OPNAVINST 8020.15A/MCO 8020.13A
(b) MCO 8020.10
(c) DoD Directive 6055.9
(d) DoD 6055.9-STD
(e) OP 5 Vol. 1
(f) NAVFACINST 11010.45

Encl: (1) Explosive Safety Submission (ESS) Determination Request Form

1. In accordance with references (a) through (f) and to ensure the protection of human health and the environment, the enclosed Explosive Safety Submission (ESS) Determination Request (DR) form is submitted for your approval.

2. Land use restrictions are in place at Munitions Response Program (MRP) Site UXO-19 due to the presence of munitions items. However, underground utilities exist throughout the site. This ESSDR is to allow onsite unexploded ordnance (UXO) construction support for emergency utility repairs to occur without an Explosives Safety Submission due to the low likelihood of encountering unexploded ordnance above an existing underground utility. Base Explosive Ordnance Disposal (EOD) will be contacted should munitions potentially presenting an explosive hazard be identified.

3. This determination request only applies to emergency utility repairs. Any other planned construction project (utility or otherwise) will be required to have an ESS or ESSDR.

4. If you have questions or comments, please contact Ms. Charity Delaney, Environmental Quality Branch, Environmental Management Division, G-F, at (910)451-9385.

JOHN R. TOWNSON
By direction

Copy to:
HQMC LFL-5 (Mr. Sakai/Mr. Gamache)
MCIEAST-MCB CAMLEJ OPS (Mr. Jensen)
MCIEAST-MCB CAMLEJ PWD (Mr. A. Smith)
FILE (ODI #21859)

Explosives Safety Submission Determination Request for Emergency Utility Repairs at MMRP Site UXO-19, Marine Corps Base Camp Lejeune, North Carolina

This Explosives Safety Submission Determination Request (ESSDR) was prepared for the Commander, Marine Corps Systems Command (COMMARCORSSYSCOM) in accordance with Chapter 7, Paragraph 3.d.(1) of Marine Corps Order (MCO) 8020.10, Marine Corps Explosives Safety Management Program (10 June 2015).

(a) Site name/number

Name of Activity, City and State

Military Munitions Response Program (MMRP) Site UXO-19, Camp Devil Dog
Marine Corps Base Camp Lejeune (MCB CAMLEJ)
Jacksonville, North Carolina

(b) Date submitted

5 November 2015

(c) Project Manager and ESO

Name and contact information

MCB CAMLEJ Project Manager

Charity Delaney, P.E.
Environmental Engineer
G-F/EMD/EQB
12 Post Lane
Camp Lejeune, NC 28547

MCB CAMLEJ Explosives Safety Officer

Dave Jensen
910-451-6280
David.s.jensen1@usmc.mil

910-451-9385 (Office)
910-320-7656 (Mobile)
charity.delaney@usmc.mil

(d) Site history

Briefly describe past MEC and/or MPPEH use at the site

Site UXO-19 (**Figure 1**) encompasses portions of the following former ranges (**Figure 2**):

- K-22 Hand Grenade Course (Archive Search Report [ASR]# 2.111)
- M-4 Rifle Grenade Range (ASR# 2.104)
- M-113 Hand Grenade Range (ASR# 2.167)
- M-115 Hand Grenade Range (ASR# 2.168)
- M-110, Demolitions and Booby Trap Range (ASR# 2.166)
- M-107 Hand Grenade Range
- M-109 Infiltration Course (ASR #2.165)
- M-118 Individual Movement Day Range

Other ranges that are adjacent to the Site UXO-19 MRS include:

- M-5 Artillery Range (ASR #2.75) and M-5A Artillery Range (ASR# 2.76)
- M-9, Combat Village Area (ASR# 2.114)
- M-17, Practice Hand and Rifle Grenade Range (ASR# 2.121)
- M-4A, Practice Hand Grenade Course (ASR# 2.113)
- M-122, Flame Thrower Range (ASR#2.169)
- M-1, Mortar Range (ASR# 2.25)
- M-104 Demolition Range (ASR# 2.164)
- M-15, Mine, Booby Trap Display Area (ASR# 2.115)
- M-6, Infiltration Course (ASR# 2.106)
- M-7, Landscape Range (ASR# 2.107)

In 2013, an intrusive investigation for munitions and explosives of concern (MEC) was completed at Site UXO-19 within an expanded 64-acre area of the site. The MEC intrusive investigation was completed over 100 percent of accessible areas of the site. MEC and material potentially presenting an explosive hazard (MPPEH) were encountered from ground surface to as deep as 4 feet below ground surface.

A total of 51,604 geophysical anomalies were investigated, of which 447 items were identified as MEC and 50,771 items were identified as MPPEH. The distribution of MEC and MPPEH identified during investigations at Site UXO-19 is shown on **Figure 3** and **Figure 4**. The majority of MEC and MPPEH items were from 60-millimeter (mm) and 81-mm mortar projectiles. Upon inspection, all demilitarized MPPEH was certified as material documented as safe (MDAS).

(e) MEC and/or MPPEH known or suspected to be present

Identify quantity, type/ nomenclature, and condition

Although the MEC intrusive investigation greatly reduced the likelihood of encountering MEC/MPPEH at Site UXO-19, MEC/MPPEH may remain onsite in those areas where it could not be detected because of instrumentation limitations, where site conditions prevented 100 percent investigation, and below the depth of detection by geophysical instruments.

Based on the results of previous investigations and on the types of ordnance used on the historical ranges at and adjacent to Site UXO-19, the types of MEC and MPPEH that may be present at the site include rockets, projectiles, grenades, pyrotechnics, practice landmines, and small arms ammunition. The net explosive weights (NEW) of the ordnance that may be present at the site are shown in **Table 1**.

(f) Identify any encumbering explosives arcs and how they will be mitigated

No explosives arcs encumber Site UXO-19.

(g) Provide justification of low likelihood of encountering MEC and/or MPPEH

This ESSDR will apply only to emergency utility repairs that involve: (a) Excavation of previously-disturbed soil above existing underground utilities, and (b) installation of utility poles for above-ground utilities. Any non-emergency activity that involves ground disturbance will require the submittal of an ESS or ESS DR specific to that activity.

The likelihood of encountering MEC/MPPEH during emergency utility repairs at Site UXO-19 is low because intrusive investigations for MEC/MPPEH have already been conducted over 100% of the accessible areas at the site; excavation above existing underground utilities will be conducted in soil that

TABLE 1
Net Explosive Weights of Ordnance Potentially Present at the Site

Ordnance	NEW (lb)	Type of NEW
3.5-inch Rocket, HEAT, M28A2	1.88 ¹	Composition B
3.5-inch Rocket, Practice, M29	0.44 ¹	M7 Propellant
2.36-inch Rocket (Warhead and Motor), M6A3	0.50/0.135 ¹	Warhead-Pentolite (50/50); Motor- Ballsite
60-mm mortar,M495A5	0.79 ¹	Composition B
81-mm mortar,M43A1	1.23 ¹	TNT
105 mm M1 (Composition B filled)	5.07 ¹	Composition B
106 mm M344 (Warhead)	2.79 ¹	Composition B
Grenade, Hand, M67	0.40625 ¹	Composition B
Grenade, Hand, Smoke, HC, AN-M8	1.1875 ²	Pyrotechnic filler
Grenade, Hand, Mk II	0.125 ¹	TNT
Grenade, Rifle, M19	0.05908 ¹	Multiple Explosives
Grenade, Rifle, 40 mm, M383	0.117 ¹	Composition A-5
Grenade, Rifle, Practice, AT, M29	Inert ²	Not applicable
Grenade, Rifle, Smoke, M18/M20/M22	0.4 ²	Pyrotechnic Filler
Grenade, Rifle, Star Cluster, Green, M20A1	0.25 ⁶	Pyrotechnic Filler
Grenade, Rifle, M9	0.25 ¹	Pentolite (50/50)
Grenade, WP, M15	0.001929 ¹	Tetryl
Signal, Illumination, M125/M127/M19/M23	0.36875 ⁴	Pyrotechnic Filler
Signal, Illumination, Ground, White Star Cluster, M159	0.23 ⁶	Pyrotechnic Filler
Signal, Illumination, Ground, M22A1	0.25 ⁶	Pyrotechnic Filler
Marine Hand Signal Flare, M13 MOD-0	0.2125 ⁴	Pyrotechnic Filler
Landmine, Practice, M16A1	Inert ⁷	Not applicable
0.50- caliber Projectile	Inert	Not applicable

Notes:

1. Fragmentation Data Review Form, 21 August 2014
2. Technical Manual (TM)-43-0001-29 (Department of the Army (Army), 1994a)
3. TM-43-0001-30 (Army, 1981)
4. SWO50-AB-MMA-010 (NAVSEA, 2004b)
5. TM-43-0001-37 (Army, 1994)
6. SWO50-AB-MMA-020, (NAVSEA, 2001a)
7. TM-43-0001-36 (Army, 1994b)

Acronyms: HC = hexachloroethane

was previously excavated during utility installation, at which time MEC/MPPEH would have likely been removed if present; and anomaly avoidance will be practiced during the emergency installation of utility poles. The following techniques will be utilized under this ESSDR:

- **Onsite construction support** – Oversight of soil excavation conducted in previously-disturbed soil above existing underground utilities when emergency utility repairs must be conducted.
- **Anomaly avoidance** – If emergency utility pole installation is required, anomaly avoidance will be conducted to select a location with no subsurface anomalies.
- **Intrusive investigation** – If an anomaly-free location cannot be found for an emergency utility pole installation manual excavation of soil will be conducted to expose the anomaly source to determine whether it is suspected MEC/MPPEH.

These techniques are described in detail below. There will be no handling or disturbance of suspected MEC/MPPEH under any of the response techniques. If suspected MEC/MPPEH is found, MCB CAMLEJ EOD will be contacted to remove and dispose of the item.

All UXO-qualified personnel will be qualified and certified in accordance with Marine Corps Order (MCO) 8023.3A, *Personnel Qualification and Certification Program for Class V Ammunition and Explosives*, terms outlined by United States Department of Labor in *Employment Standards Administration Wage Hour Division for UXO Personnel*, and DDESB Technical Paper (TP)-18, *Minimum Qualifications for UXO Technicians and Personnel* (DDESB, 2015).

Onsite Construction Support

Onsite construction support will be provided for emergency repair of underground utilities when excavation is conducted in previously-disturbed soil above the underground utilities. Onsite construction support is appropriate for this activity because ground disturbance will be conducted only in soil that was previously excavated during utility installation. The probability of encountering MEC within these soils is remote because MEC would presumably have been discovered and removed during utility installation.

On-site construction support will include a least one UXO-qualified person who will be onsite continuously during ground-intrusive activities to observe excavation and other ground-disturbing activities. Ground disturbance may be conducted by non-UXO-qualified personnel using mechanical excavation methods and/or hand tools.

If the UXO-qualified person observes suspected MEC/MPPEH, MCB CAMLEJ EOD team will be notified by contacting Range Control at 910-451-3064. Suspected MEC/MPPEH will not be handled or otherwise disturbed.

Anomaly Avoidance

Emergency repairs of aboveground utilities may require the installation of new utility poles. Anomaly avoidance using a Schonstedt GA-52CX, or equivalent, will be conducted by a UXO-qualified person at the site of the borehole for the new utility pole.

If no anomaly is indicated, the boring will be advanced in 1-ft increments to the total boring depth, or a total depth of 4 ft, whichever is less, since 4 ft is the maximum expected penetration depth for ordnance used at the MRS. At the completion of each 1-ft increment, the augers will be removed and the Schonstedt GA-52CX, or equivalent, will be lowered to the bottom of the borehole. If no anomalies are indicated, the next 1-ft increment will be bored and the borehole rechecked with the Schonstedt to the lesser of 4 ft or the total boring depth.

Alternatively, anomaly avoidance may be conducted in a pilot hole installed to a depth of 3 ft. This will ensure that no anomalies are present to a depth of 4 ft., which is the maximum expected penetration depth for ordnance used at the MRS. If found to be free of anomalies, a PVC or metal pipe will be inserted into the pilot hole with at least 1 ft. remaining aboveground. The UXO Technician performing the avoidance will place a tag on the pipe indicating that a borehole centered on the pilot hole may be conducted. The UXO Technician will sign and date the tag. If the pilot hole method is used, a UXO Technician will provide onsite construction support during the installation of the full borehole.

If an anomaly is indicated during downhole avoidance, the boring will be abandoned by backfilling and a new location will be selected. If an acceptable anomaly-free location cannot be located, intrusive investigation will be conducted as provided in the Intrusive Investigation discussion below.

Soil borings may be conducted by non-UXO-qualified personnel using mechanical boring equipment and/or hand tools.

Intrusive Investigation

If a utility pole cannot be placed in an anomaly-free location, an intrusive investigation will be conducted to identify the source of any anomalies at the selected location. The UXO team performing this work will be composed of at least one UXO Technician, a Senior UXO Supervisor, and a UXO Safety Officer (UXOSO).

Excavation of anomalies will be performed by qualified UXO personnel using hand-excavation tools. Small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access potential MEC or MPPEH. Hand tools will be used for the majority of the items, which generally are expected to be found near the surface. The following basic technique will be used for anomaly excavation:

- The excavation team will investigate the anomaly location with the assistance of a Schonstedt GA-52Cx or equivalent to pinpoint the anomaly source.
- Until identified otherwise, the anomaly is assumed to be MEC. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with an appropriate geophysical instrument.
- Using progressively smaller and more delicate tools to remove the soil carefully, the excavation team will expand the sidewall to expose the metallic item for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will attempt to determine whether the item is MEC, MPPEH, or other debris without handling or disturbing the item.
 - If the item is suspected to be MEC or MPPEH, or if the item cannot be definitively identified as non-munitions-related debris, the MCB CAMLEJ EOD team will be notified by contacting Range Control at 910-451-3064.
 - If the item is other non-munitions-related debris, it will be removed and disposed of in an appropriate manner.



Legend
= Highways
□ Installation Boundary

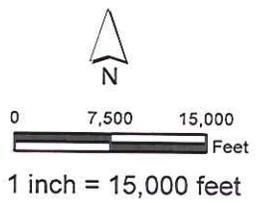
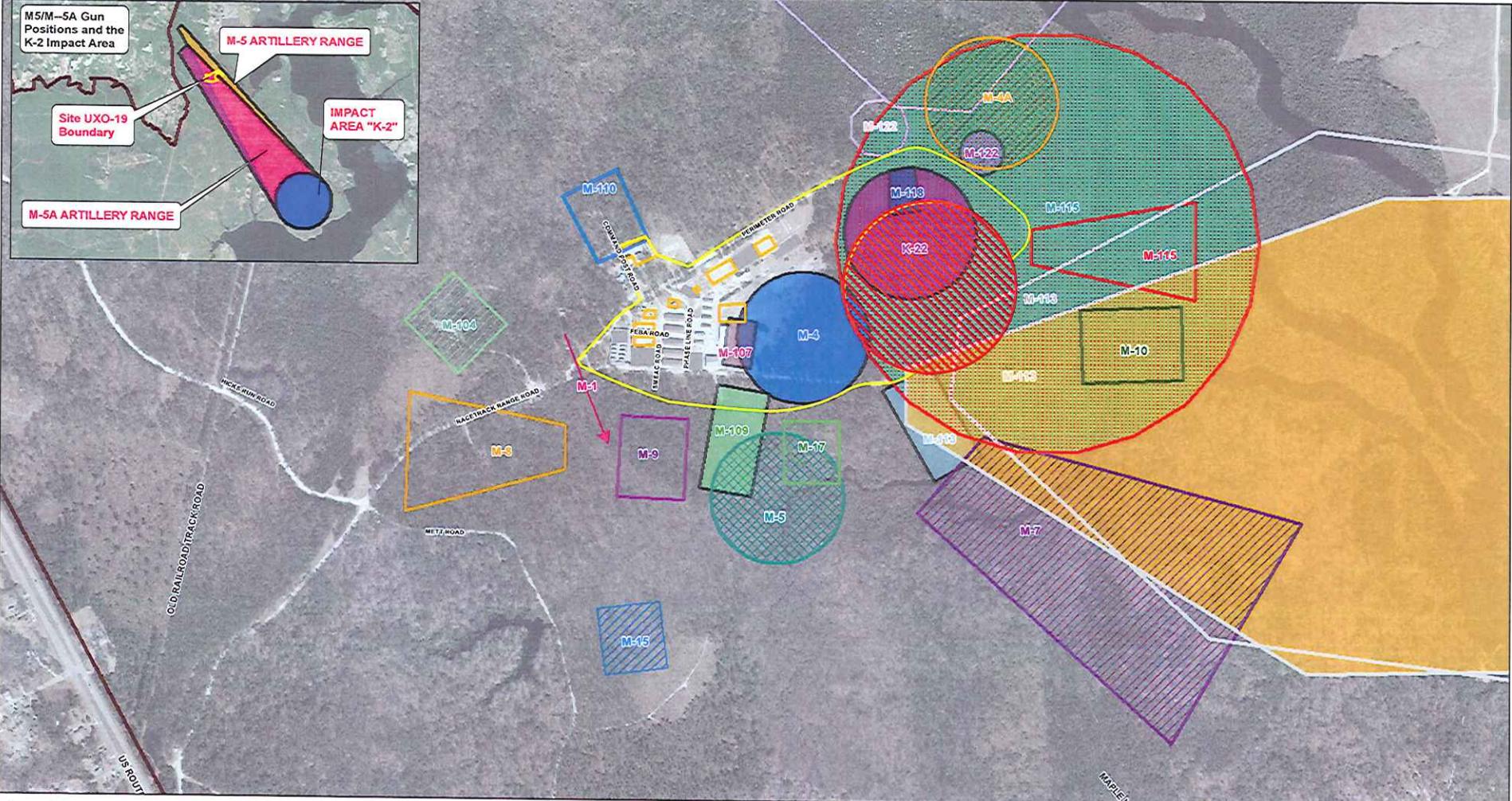


Figure 1
Site Location Map
Site UXO-19 - Emergency Utility Repairs
MCB CAMLEJ
North Carolina





Legend

<ul style="list-style-type: none"> M-1 Mortar Range Survey Limits - Approximately 886 Acres Devil Dog MOUT Area Site UXO-19 Boundary Installation Boundary MILCON Footprint M-110 Demolitions And Booby Trap Range M-104 Demolition Range 	<ul style="list-style-type: none"> M-113 Hand Grenade Range M-15 Mine, Booby Trap Display Area M-9 Combat Village Area M-4A Practice Hand Grenade Course M-17 Practice Hand and Rifle Grenade Range M-122 Flame Thrower Range M-115 Hand Grenade Range M-113 Hand Grenade Range (Practice) Demonstrator 	<ul style="list-style-type: none"> M-10 Hand Grenade Range M-5 Practice Rifle Grenade Range M-7 Landscape Range M-8 Assault of a Fortified Position Range M-107 Hand Grenade Range M-109 Infiltration Range M-113 Battle Sites Range M-118 Individual Movement Range 	<ul style="list-style-type: none"> M-122 Flame Thrower Range M-115 Hand Grenade Range K-22 Hand Grenade Course M-4 Rifle Grenade Range
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Note: Impact Area K-2 is 3.94 miles from Site UXO-19.

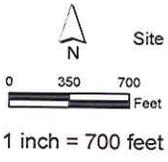
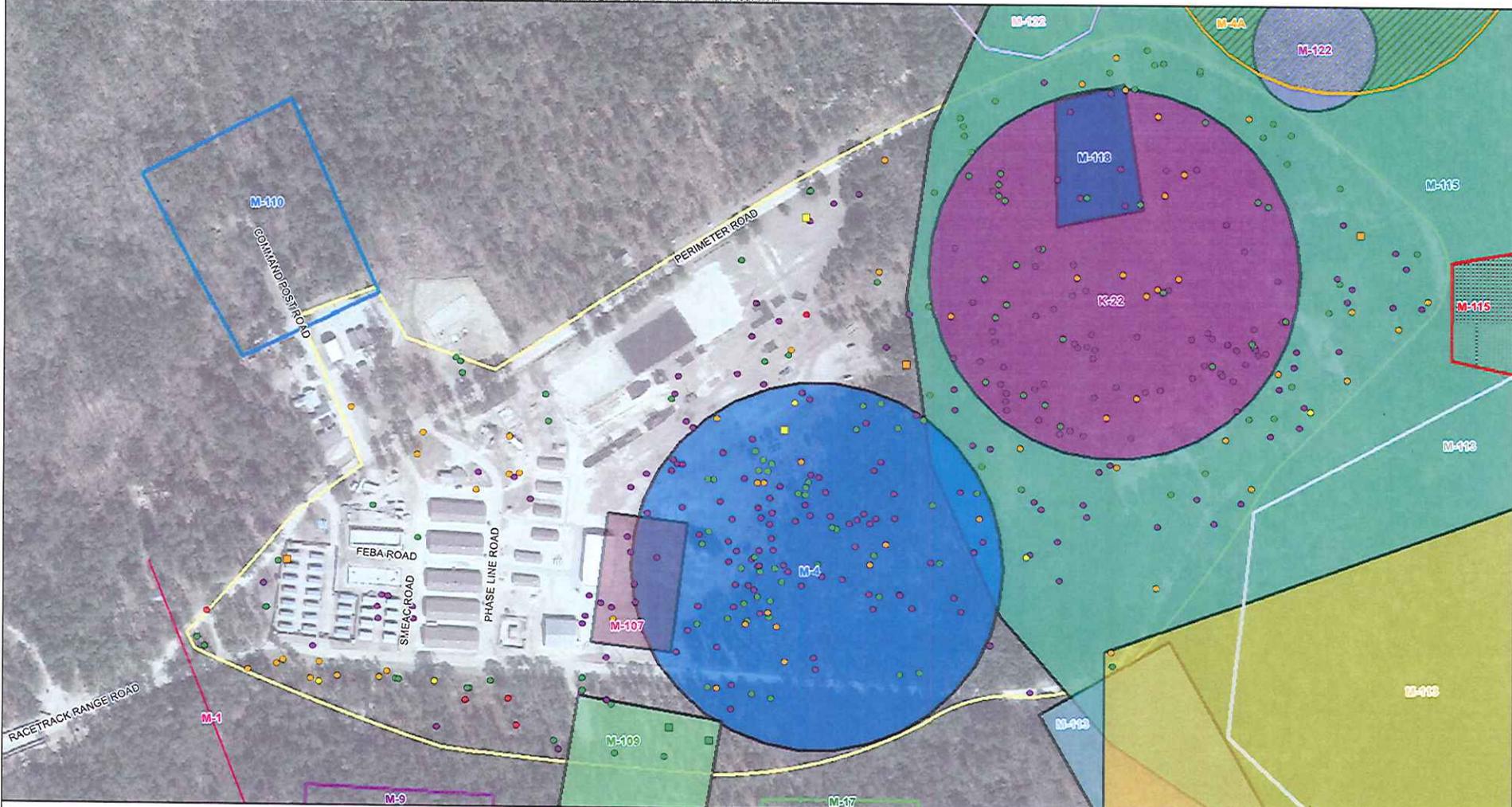


Figure 2
Range Location Map
Site UXO-19 Emergency Utility Repairs
MCB CAMLEJ
North Carolina



- Legend**
- | | | |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MEC Locations | <ul style="list-style-type: none"> ▶ M-1 Mortar Range M-9 Combat Village Area M-4A Practice Hand Grenade Course M-17 Practice Hand and Rifle Grenade Range M-122 Flame Thrower Range M-115 Hand Grenade Range M-113 Hand Grenade Range (Practice) Demonstrator M-110 Demolitions And Booby Trap Range M-113 Hand Grenade Range | <ul style="list-style-type: none"> M-107 Hand Grenade Range M-109 Infiltration Range M-113 Battle Sites Range M-118 Individual Movement Range M-122 Flame Thrower Range K-22 Hand Grenade Course M-4 Rifle Grenade Range M-115 Hand Grenade Range Site UXO-19 Boundary |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
- Flare
● Fuze
● Grenade
● Mine
● Mortar
■ Bulk Explosives
■ Projectile
■ Rocket

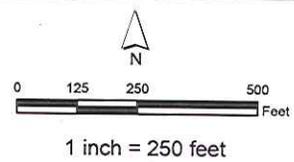


Figure 3
 Distribution of MEC Identified
 During the PA/SI and ESI
 Site UXO-19
 MCB CAMLEJ North Carolina



UNITED STATES MARINE CORPS
MARINE CORPS SYSTEMS COMMAND
2200 LESTER STREET
QUANTICO, VA 22134-6050

IN REPLY REFER TO:

8020

PMM-116/300

23 Nov 15

From: Commander
To: Commanding General, Marine Corps Installation East- Marine
Corps Base, Camp Lejeune, PSC Box 20005, Camp Lejeune, NC
28542-0005

Subj: EXPLOSIVE SAFETY SUBMISSION DETERMINATION REQUEST FOR
EMERGENCY UTILITY REPAIRS AT MUNITIONS RESPONSE PROGRAM SITE
UXO-19 MARINE CORPS BASE CAMP LEJEUNE [EES WEB PORTAL ID# 34]

Ref: (a) CG MCI EAST Camp Lejeune ESSDR of 10 Nov 15
(b) MCO 8020.10

1. As requested by reference (a), Marine Corps Systems Command (MARCORSYSCOM) reviewed the subject Explosives Safety Submission Determination Request (ESSDR) in accordance with reference (b). Based on the information provided, which documents these locations as having a low probability of encountering Munitions and Explosives of Concern (MEC) and/or Material Potentially Presenting an Explosive Hazard (MPPEH), an Explosives Safety Submission is not required to conduct emergency utility repairs. On-site UXO support is required for all utility repairs. 3R training is required for all personnel accessing these locations.

2. If MEC or MPPEH is discovered on the site, the item will be avoided and its location and description will be reported to the installation's EOD and the installation Explosive Safety Officer (ESO). Submit the appropriate EOD response sheet to COMMARCORSYSCOM (PMM-116).

3. If any MEC or MPPEH items are encountered, the following steps must be taken:

a. For expended or unexpended small arms ammunition, note their description and location, notify the responsible ESO and the project manager, and handle them in accordance with reference (c) and applicable environmental regulations.

b. For items other than small arms ammunition or those items listed in the determination request, stop all operations; notify the responsible ESO, project manager, and request an emergency response from the cognizant EOD. Operations cannot resume until COMMARCORSYSCOM (PMM-116) has been contacted and has provided guidance regarding the need for an Explosives Safety Submission.

Subj: EXPLOSIVE SAFETY SUBMISSION DETERMINATION REQUEST FOR
EMERGENCY UTILITY REPAIRS AT MUNITIONS RESPONSE PROGRAM SITE
UXO-19 MARINE CORPS BASE CAMP LEJEUNE [EES WEB PORTAL ID# 34]

4. Point of contact for this matter is Mr. James Taylor,
Environmental and Explosives Safety Team, Program Manager for
Ammunition, Marine Corps Systems Command at DSN: 378-8781, Commercial:
(703) 432-8781, email: james.t.taylor1@usmc.mil.

STEVE E. HOWELL
By direction

Appendix C

Cost Estimate

**Site UXO-19 Remedial Design
Land Use Controls (LUC)**

COST ESTIMATE SUMMARY

Site: Site UXO-19_Camp Lejeune
Location: Onslow County, North Carolina
Phase: Remedial Design
Base Year: Base Year - 2015
Date: 8/28/2015

Description: This cost estimate is for Land Use Controls (LUCs) -- the site would be designated as a "restricted use" area in the Base geographic information system (GIS). This designation would place controls on intrusive activities such as excavation. UXO technician support would be required for any intrusive activities in developed areas. In undeveloped areas, UXO technician support would be required for intrusive activities greater than 18 inches bgs. Educational support would be provided to inform and educate base personnel and subcontractors of LUCs and MEC risks at the site. Five year reviews would be completed in accordance with CERCLA.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Land Use Controls					
Site Survey	1	LS	\$ 8,500.00	\$ 8,500	BOA NavyCLEAN OY4 - Averages, 5 days and mob/demob
ESSDR Preparation	1	LS	\$ 5,000.00	\$ 5,000	
Warning Signs and Posts	17	ea	\$ 290.00	\$ 4,930	CH2M HILL Estimate, quote from Fastsigns Inc. (Nov 2014), signs every 200m (656ft)
SUBTOTAL				\$ 18,430	
Other Costs					
UXO Escort	50	HR	\$ 100.00	\$ 5,000	CH2M HILL Estimate (est. 5 days @ 10 hrs/day)
Travel - 75% per diem - first/last day	2	DAY	\$ 38.25	\$ 77	Per gsa.gov rate
Travel - per diem - full day	3	DAY	\$ 51.00	\$ 153	Per gsa.gov rate
Travel - lodging	4	DAY	\$ 97.25	\$ 389	Per gsa.gov rates plus tax for hotel (\$89 plus 9.275% tax)
Travel - vehicle (truck and fuel)	1.0	WK	\$ 441.00	\$ 441	Rental pickup truck price per recent Enterprise rate including taxes, plus fuel
SUBTOTAL				\$ 6,060	
Contingency	25%		\$ 24,489.52	\$ 6,122	10% Scope + 15% Bid, USEPA 2000, p. 5-10 & 5-11
SUBTOTAL				\$ 6,122	
Project Management	10%		\$ 30,611.90	\$ 3,061	USEPA 2000, Exhibit 5-8 on p. 5-13, <\$100K
Preparation of RACR	1	LS	\$ 15,000.00	\$ 15,000	ROM estimate based on projects similar in nature.
SUBTOTAL				\$ 18,061	
TOTAL CAPITAL COST				\$ 49,000	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
O&M LUC					
Labor (sign inspection and maintenance)	4	HR	\$ 80.00	\$ 320	CH2M HILL Estimate
Replacement Parts/Supplies	1	LS	\$ 1,000.00	\$ 1,000	CH2M HILL Allowance, includes tax
UXO Escort	80	HR	\$ 100.00	\$ 8,000	CH2M HILL Estimate (est. 1 person @ 5 days/wk @ 8 hrs/day x 2 weeks)
Travel - 75% per diem - first/last day	2	DAY	\$ 38.25	\$ 77	GSA Rates. Includes MEC Demo Team stay.
Travel - per diem - full day	6	DAY	\$ 51.00	\$ 306	GSA Rates. Includes MEC Demo Team estimated 2 night stay
Travel - per diem - weekends	2	DAY	\$ 51.00	\$ 102	GSA rates
Travel - lodging	8	DAY	\$ 97.25	\$ 778	GSA rates. Includes MEC Demo Team Stay
Travel - Airfare	1	EA	\$ 650.00	\$ 650	Airfare for MEC Demo Team, based on CTO-WE1A pricing.
Travel - vehicle (truck and fuel)	2	WK	\$ 441.00	\$ 882	Rental pickup truck price per recent Enterprise rate including taxes, plus fuel
SUBTOTAL - ALL TASKS - O & M				\$ 12,115	
Project Management	10%		\$12,114.54	\$ 1,211	USEPA 2000, Exhibit 5-8 on p. 5-13, <\$100K
SUBTOTAL				\$ 13,326	
TOTAL O&M				\$ 13,326	

Periodic Costs

DESCRIPTION	YEAR	QTY	UNIT	UNIT COST	TOTAL	NOTES
5 year Review	5	1	LS	\$15,000	\$15,000	
5 year Review	10	1	LS	\$15,000	\$15,000	
5 year Review	15	1	LS	\$15,000	\$15,000	
5 year Review	20	1	LS	\$15,000	\$15,000	
5 year Review	25	1	LS	\$15,000	\$15,000	
5 year Review	30	1	LS	\$15,000	\$15,000	
				Total	\$90,000	
TOTAL ANNUAL PERIODIC COST					\$90,000	

Effective Interest Rate= 1.4%

Source: USEPA 2000, page 4-5. This rate represents a "real" discount rate approximating interest rates adjusted for inflation. Discount rates are for 2015 (https://www.whitehouse.gov/omb/circulars_a094/a94_appx-c)

PRESENT VALUE ANALYSIS

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7.0%)	PRESENT VALUE	NOTES
CAPITAL COST	0	\$49,000	\$49,000	1.00	\$49,000	
ANNUAL O&M COST - Cap	1 to 30	\$0	\$13,326	24.36	\$324,618	
PERIODIC COST	5	\$15,000	\$15,000	0.93	\$13,993	
PERIODIC COST	10	\$15,000	\$15,000	0.87	\$13,053	
PERIODIC COST	15	\$15,000	\$15,000	0.81	\$12,176	
PERIODIC COST	20	\$15,000	\$15,000	0.76	\$11,359	
PERIODIC COST	25	\$15,000	\$15,000	0.71	\$10,596	
PERIODIC COST	30	\$15,000	\$15,000	0.66	\$9,884	
					\$444,679	
TOTAL PRESENT VALUE					\$445,000	
Present Value O&M and Periodic Costs					\$395,679	

SOURCE INFORMATION

- United States Environmental Protection Agency. July 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).
 - R.S. Means Company. 2004. Environmental Remediation Cost Data - Unit Price, 10th Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA, (Includes Labor, equipment, and materials).
 - RSMeans Facilities Construction Cost Data, 2014. 29th annual edition.
 - ECHOS (Environmental Cost Handling Options and Solutions). 2006. 12th Edition.
- Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial action alternatives.
These are order-of-magnitude cost estimates that are expected to be within -30% to +50% of the actual project costs.