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DRAFT SITE SPECIFIC FINAL REMOVAL REPORT PRELIMINARY ASSESSMENT SITE INVESTIGATION FOR THE FORCE MAINE WASTE WATER AND WATERLINE THROUGH UXO-05 ASR #2.44 AND UXO-06 MCB NEW RIVER AND CAMP LEJEUNE NC
06/01/2008
ZAPATA

DRAFT SITE SPECIFIC FINAL REMOVAL REPORT

PRELIMINARY ASSESSMENT/SITE INVESTIGATION FOR THE FORCE MAIN WASTEWATER AND WATERLINE THROUGH UXO-05, ASR #2.44 AND UXO-06

MARINE CORPS BASE
NEW RIVER AND CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

Arcadis/ONWASA/Mortec

by:

ZAPATA
TRUST • INTEGRITY • QUALITY

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June 2008

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ACRONYMS AND ABBREVIATIONS

ASR	Archive Search Report
bgs	below ground surface
CAP	Corrective Action Plan
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CWM	Chemical Warfare Materiel
DoD	Department of Defense
DGM	Digital Geophysical Mapping
ESS	Explosives Safety Submission
EZ	Exclusion Zone
EOD	Explisive Ordnance Disposal
IBD	Inhabited building distance
MCAS	Marine Corps Air Station New River
MARCORSYSCOM	Marine Corps Systems Command
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Munitions Response
MRS	Munitions Response Site
MRSs	Munitions Response Sites
PM	Project Manager
PTR	public transportation route distance
PVC	Polyvinyl Chloride
OP	Ordnance Publication
QC	Quality Control
QA	Quality Assurance
SI	Site Inspection
SHP	Safety and Health Program
SUXOS	Senior Unexploded Ordnance Supervisor
TP	Technical Paper
TSD	Team Separation Distance
TNT	Trinitrotoluene
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

1.0 INTRODUCTION

Zapata Incorporated (ZAPATA), Subcontractor to Arcadis under contract performed a Munitions and Explosives of Concern (MEC) removal. The scope of this Munitions Response (MR) included the determination and documentation of the respective types of Military Munitions (practice or live war fighting) used at Unexploded Ordnance (UXO)-05, Archive Search Report (ASR) #2.44 and UXO-06. The current MR was not a full MEC clearance project. Rather, it was designed to merely confirm the presence or absence of MEC along the proposed force main wastewater and waterline easement routes. The information gathered during the investigation will be valuable to the installation for any required future improvements in these areas. In order to accomplish this MR, ZAPATA as the UXO contractor identified target contacts i.e., those anomalies considered to be MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) investigated and removed them.

1.1 SITE LOCATION

MRS UXO-05 and MRS ASR #2.44 are located on MCAS New River, while MRS UXO-06 is located on Marine Corps Base Camp Lejeune, Jacksonville, Onslow County, North Carolina (See Figure 1).

The proposed route of the water main for delivery of water from the New River Water Treatment Plant travels through two sites designated as Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites. The locations of the two sites are show in Figure 2.

The proposed route of the force main for delivery of wastewater to the Camp Lejeune wastewater treatment plant travels through three sites designated as CERCLA sites. The location of the site is shown in Figure 3.

1.2 SITE HISTORY

1.2.1 History of MEC Use

1.2.1.1 While MRS UXO-05 is identified in the Range Identification and Preliminary Range Assessment as the Miniature Anti-Tank Range, it is also known as the Tank Battalion Tent Camp. The information concerning this range was obtained from the Range Identification and Preliminary Range Assessment. This range was used from 1942 to 1944 and involved firing 0.22 caliber weapons at a moving target on a traverse track. Explosive hazards exist only with complete rounds that would likely be found at or near the firing line. Complete small arms rounds would normally be located at the surface near the firing line, but over the years, construction and other ground disturbance may have caused the rounds to become buried to an unknown depth. No information is available on the estimated quantity of munitions used on this range or on past range clearance and dredging operations that might have occurred there. Approximately 1,500 linear feet of the proposed water line easement are within MRS UXO-05.

1.2.1.2 MRS ASR #2.44 site is identified in the Range Identification and Preliminary Range Assessment as the 50-Foot Small Arms Range B-6. The information concerning this range was obtained from the Range Identification and Preliminary Range Assessment. This range was used

from 1950 to approximately 1961 and contained 25 stations. Weapons used at this range included 0.22 caliber rifles, and 0.22, 0.32, 0.38, and 0.45 caliber pistols. Explosive hazards exist only with complete rounds that would likely be found at or near the firing line. Complete rounds of small arms would normally be located at the surface near the firing line, but over the years, construction and other ground disturbance may have caused the rounds to become buried to an unknown depth. No information is available on the estimated quantity of munitions used on this range or on past range clearance and dredging operations that might have occurred there. Approximately 1,200 linear feet of the proposed water line easement are within MRS ASR #2.44.

1.2.1.3 MRS UXO-06, identified in the Range Identification and Preliminary Range Assessment as the Fortified Beach Assault Area, is also known as D-27 or Assault of a Fortified Position. The information concerning this range was obtained from the Range Identification and Preliminary Range Assessment. Approximately 177 acres of this range was used from 1953 to approximately 1977, and ammunition approved for use at this site includes: blank small arms, demolitions, practice rockets (3.5 inch and 2.36 inch), rifle grenades (practice), smoke grenades, and pyrotechnics (flamethrowers). Although the firing of rockets and flamethrowers may have taken place in any direction; the surface danger area does not include the spectator stands, the main service road, Sneads Ferry Road, or the magazine area. Explosive hazards from small arms exist only with complete rounds that would likely be found at or near the firing line. Complete rounds of small arms would normally be located at the surface near the firing line, while the other ammunition used at the site will typically not be expected to penetrate the ground surface to a depth of more than ten inches upon impact. Construction and other ground disturbance, however, may have caused the rounds to become buried to an unknown depth. No information is available on the estimated quantity of munitions used on this range or on past range clearance and dredging operations that might have occurred there. Approximately 4,100 linear feet of the proposed force main easement are within MRS UXO-06.

1.3 TECHNICAL INSTRUCTION

ZAPATA worked in close coordination with Arcadis while developing the project scope, work plan, technical directives, and when executing the removal. ZAPATA completed the work in accordance with the SOW and the approved project work plan entitled “Preliminary Assessment / Site Investigation for the Force Main Wastewater and Waterline through UXO-05, ASR#2.44, and UXO-06.”

1.4 TECHNICAL SCOPE AND APPROACH

ZAPATA utilized a team approach consisting of in-house capabilities and subcontractors to conduct the site preparation, survey operations, geophysics and subsurface anomaly removals, and Quality Control (QC) checks within the boundaries of the project footprint.

1.4.1 Project Team Organization

1.4.1.1 Project specific personnel critical to the work site and their responsibilities while on-site are described in detail below.

1.4.1.2 The Arcadis Manager was Mr. John Maynard. All subcontractors reported to him and he was responsible for overall project quality and continuity.

1.4.1.3 The ZAPATA Project Manager was Mr. Michael Winningham. He was responsible for ensuring execution of the MEC removal in a timely and cost effective manner. He was also responsible for communicating with the Arcadis Project Manager, oversight of the performance of the project team, coordinating all contract and lower tier subcontracted work, and resolving problems. His responsibilities included monitoring adherence to the project schedule and overall management of the project budget, including assurance that subcontractor costs were within budget.

1.4.2 UXO QC Specialist/ Safety Officer

Mr. Tim Hendrix performed the duties of the Unexploded Ordnance Quality Control Specialist and Safety Officer (UXOQCS/SO). The UXOQCS/SO was responsible to the ZAPATA Project Manager for project QC and safety which included: coordinating site activities with the Project Manager and compliance with the safety provisions of the Work Plan and the Site Specific Health Plan (SSHP). Mr. Hendrix was the primary point of contact for any on-site emergency and conducted safety briefings daily.

1.4.3 UXO Technicians

During the MEC Investigation, Mr. Doug McCue (Tech III) and Mr. Robert Miller (Tech II) were UXO Technicians on-site. The UXO Technicians reported to the UXOQCS/SO. While on-site, UXO Technicians were responsible for conducting MEC services, intrusive removal operations.

1.4.4 Geographical Information System (GIS) Manager

Mr. Tim Burkett was responsible for development and maintenance of the project maps and figures in accordance with contract and SOW requirements.

1.4.5 Surveys

Arcadis was responsible for conducting surveys that established the locations and accurate dimensions of all boundaries and work areas.

1.5 PROJECT BACKGROUND

ZAPATA was tasked under contract with Arcadis to perform a MEC removal action. The purpose of this MEC removal action project was to locate, map, and remove MEC and MEC scrap from the Proposed Water Line Easement Marine Corps Air Station New River (UXO- 5 and ASR#2.44) and the Proposed Force Main Easement Marine Corps Base Camp Lejeune (UXO-6).

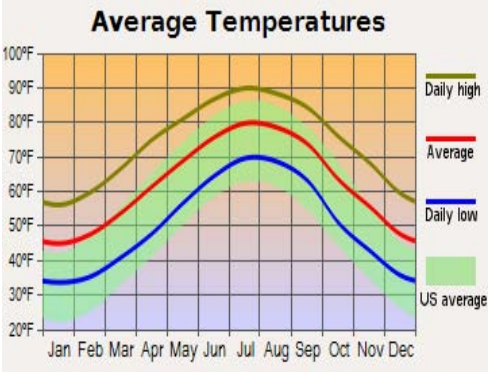
1.6 PHYSICAL SITE INFORMATION

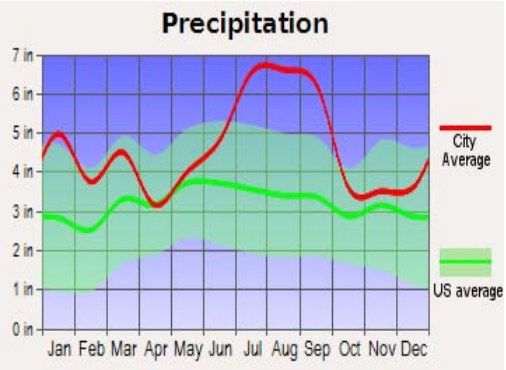
1.6.1 Topography

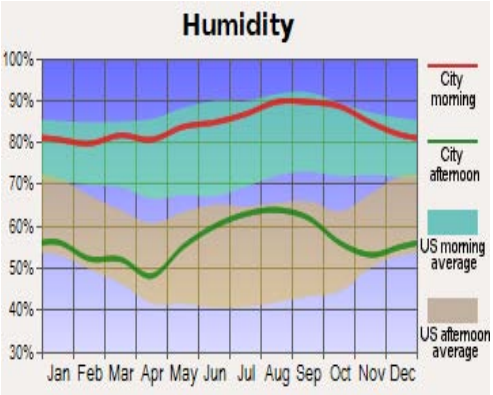
The topography of the areas is gently sloping with little elevation change. Elevations range from approximately 21 feet above mean sea level to approximately 29 feet above mean sea level.

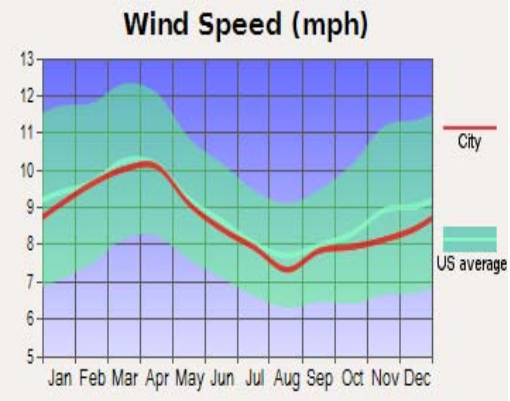
1.6.2 Climate

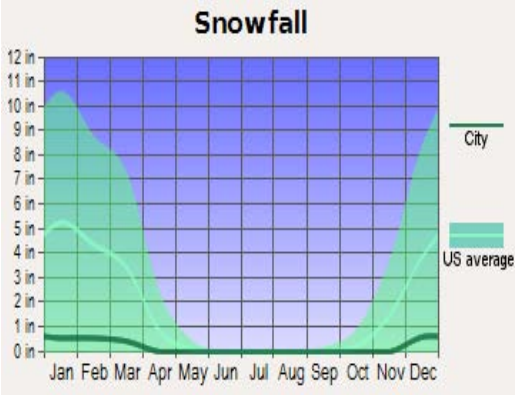
The area enjoys a temperate climate with relatively mild winters, hot and humid summers, and precipitation throughout the year. The average annual rainfall is over 50 inches, and snow, although rare, does visit the area occasionally.

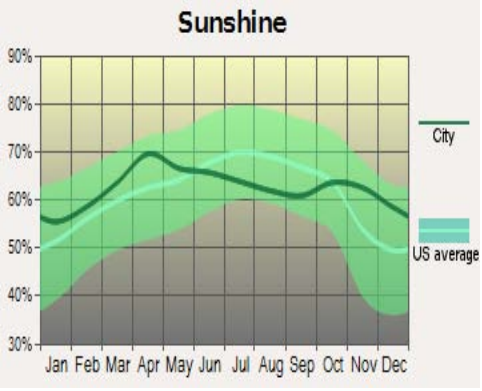


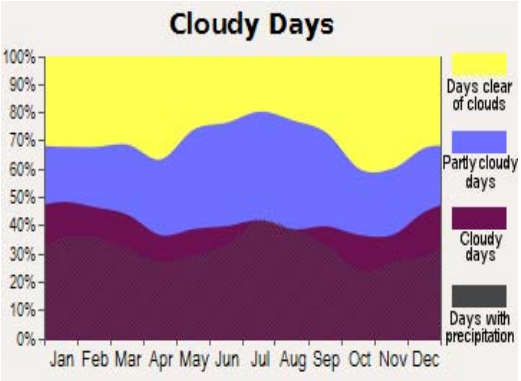












1.6.3 Overall Site Accessibility and Impediments

Site accessibility was unimpeded through the duration of the project. Marine Corps Base Camp Lejeune provided security passes for access to the Base Camp and the Marine Corps Air Station. The easements for both sites were easily accessed from primary and secondary roads.

1.6.4 Areas of Investigation

1.6.4.1 At the MCAS New River, 913 anomalies were investigated. The investigation took place in a 2700 foot section of the water line easement that started in an abandoned trailer park continued south then east on Robert L. Wilson Blvd. through the Aviation Memorial southeast on Curtis Rd. through the Pistol Range parking lot and ending at an existing water line pumping station. This area can be seen in Figure 2.

1.6.4.2 At the Marine Corps Base Camp Lejeune, 790 anomalies were investigated. This investigation took place in a 4100 foot section of the force main easement that started north of the Wastewater Treatment Plant and continued northeast along a secondary road. The investigation area veered off the road and through the woods near the construction site of the new armory and stopped in the back yard of the Fire Station. UXO-6 is shown in Figure 3.

2.0 MAJOR FIELD ACTIVITIES

The project consisted of several field activities:

- Surface Clearance / Grubbing / Tree Removal
- Geophysical Survey
- Reacquisition of anomalies
- Intrusive Investigation and removal
- QC (continued throughout the project)

2.1 SURFACE CLEARANCE / GRUBBING / TREE REMOVAL

Fieldwork started with grubbing and tree removal on 23 April, 2007. Brad Walton with Walton Logging used a Feller-Buncher Tri-wheeled Hydro-ax 321 to remove all trees and brush from both sites. Work started at the MCAS New River (UXO-5/ASR#2.44). A surface clearance was conducted by Tim Hendrix of ZAPATA in front of and as grubbing continued. Grubbing operations were completed at MCAS and moved to Camp Lejeune (UXO-6) on 25 April 2007. The same personnel, procedures, and equipment were used at UX0-6 and all grubbing was completed on 30 April, 2007.

2.2 GEOPHYSICAL SURVEY

The geophysical investigation at both sites was performed by ZAPATA, using a dual sensor EM61 MK2 Towed Array system. A geophysical prove-out (GPO) was conducted at the MCAS site on 30 April, 2007. The GPO was a single100-foot line with ordnance of concern buried at various depths and orientations. All prove-out data was processed and reviewed by the site geophysicist, the ZAPATA technical support team, and Arcadis personnel. Production mapping did not begin until all parties were satisfied with personnel, equipment, methods, and results. A UXO technician was on site throughout the duration of the survey to ensure that GEO personnel knew the location of the debris collected during the surface sweep and to identify any other munitions hazards that may be present. Geophysical mapping was completed on 11 May, 2007

2.3 ANOMALY REACQUISITION

Anomaly reacquisition started on 16 May 2008. The locations of 930 anomalies were reacquired at MCAS (UXO-5/ASR#2.44) and 790 anomalies at Camp Lejeune (UXO-6). A Trimble GEOExplorer CE GPS was used to relocate the anomalies. An orange pin flag, annotated with the anomaly number, was used to mark the location for the intrusive team. A Schonstedt® magnetometer was used to verify the presence of an anomaly in the vicinity of the pin flag. Anomaly reacquisition was completed on 27 May, 2008.

2.4 INTRUSIVE ACTIVITIES AT MCAS NEW RIVER (UXO-5/ASR#2.44)

2.4.1 The intrusive investigation began immediately following Site Specific Training on May 19, 2008. Since historical records indicate that MRS UXO-05 and MRS ASR #2.44 were used exclusively for small arms training 0.22 caliber rifles and pistols, and 0.32, 0.38, and 0.45 caliber pistols, the need for an exclusion zone was not required. This investigation was carried out to confirm the absence of MEC so that construction could take place without construction support.

2.4.2 Intrusive work started in the abandoned trailer park north of Robert L. Wilson Boulevard and continued for the next three days along Curtis Road through the Pistol Range parking lot and

ending at a waterline pumping station (see Fig. 2). The intrusive team investigated geophysical anomalies identified for excavation by the ZAPATA Senior Geophysicist and annotated the results on the Geophysical Dig Sheet and Target History form (see Appendix J1). All anomalies with the exception of anomaly number 34+80_39 (M1 practice landmine) were construction/cultural debris.

2.4.3 A meeting was held at the Aviation Memorial no 21 May, 2008 to determine an alternate route for the waterline behind the memorial. The new route for the waterline eliminated the need to investigate 25 anomalies in front of and on the east side of the memorial. Mortec and Arcadis personnel flagged in the new route along the tree line to the west and behind the memorial. Eight anomalies were investigated along the new waterline route. The excavations in the new waterline route consisted of cultural debris. The waterline easement on MCAS New River (UXO-5/ASR#2.44) was 100% complete on 21 May, 2008.

2.5 INTRUSIVE ACTIVITIES AT MARINE CORPS BASE CAMP LEJEUNE (UXO-6)

Intrusive activities started on 22 May, 2008 shortly after the morning safety briefing and site familiarization. Work started in the gravel road just north of the wastewater treatment plant. An exclusion zone of 32 feet was established using saw horses with “danger” signs attached placed in the road approximately 100 feet on either side of the intrusive team. A back-hoe was used to excavate most of the anomalies in the road however some of the smaller anomalies such as wire and nails were identified almost immediately. All anomalies with the exception of two practice 3.5” rockets and one expended smoke rifle grenade were construction/cultural debris.

2.6 DEMOLITION OPERATIONS

No live MEC was discovered during this investigation therefore demolition was not necessary.

2.7 SCRAP MANAGEMENT

Scrap management was not necessary. Three practice items and one expended smoke grenade were found. All items were taken to the home office in Charlotte, NC and added to the training/seed item stockpile.

2.8 SITE RESTORATION

All excavation holes were backfilled for safety reasons but site restoration was not necessary because construction activities are scheduled to begin soon after the Site Investigation.

2.9 QC AND SAFETY

2.9.1 ZAPATA performed QC checks on all phases and types of work done on the project. QC procedures were implemented throughout all phases of the project, including document review and control, data review/analysis, and evaluation of areas in the field.

2.9.2 ZAPATA’s QC Specialist inspected each area after removal of surface or subsurface anomalies. The inspections consisted of each excavated anomaly with a Schonstedt® magnetometer. No excavations failed QC inspections.

2.9.3 ZAPATA places the highest priority on a safe working environment. Every morning, prior to any work being done, Mr. Tim Hendrix conducted a site-specific safety briefing. During

these meetings, Mr. Hendrix addressed safety and health procedures, work practices, activity and physical hazards, and any changes that might affect on-site fieldwork. Safe work practices were monitored continuously during operations.

2.10 MEC SUMMARY

ZAPATA performed 1703 anomaly excavations. During this project three training items and one expended smoke grenade were removed from UXO-5, ASR#2.44, and UXO-6 No items were disposed of. Condensed daily SUXOS reports documenting site activities are in Appendix C. Explosives documentation is not necessary.

3.0 DOCUMENTATION

The following documentation was generated during the Removal Action at MCAS Cherry Point:

Appendix A	Scope of Work
Appendix B	Site Maps
Appendix C	SUXOS Documentation
Appendix D	QC and Safety Documentation
Appendix E	Geophysical Data
Appendix F	Site Photographs
Appendix G1	UXO-5/ASR#2.44 Dig Sheet
Appendix G2	UXO-6 Dig Sheets

4.0 SUMMARY

ZAPATA utilized a team approach consisting of in-house capabilities and a subcontractor to conduct a Preliminary Assessment/Site Investigation at the Marine Corps Air Station New River (UXO-5/ASR#2.44) and Camp Lejeune (UXO-6). The removal action included site preparation, geophysical survey, surface and subsurface investigations, and QC checks. Table 4-1 summarizes site-specific exposure data.

TABLE 4-1 EXPOSURE DATA

	TOTAL CUMULATIVE
MAN HOURS WORKED	650
NUMBER EMPLOYEES ON-SITE	5
ACCIDENTS/ILLNESS	0
LOST WORK HOURS DUE TO ACCIDENTS/ILLNESS	0
NUMBER OF VEHICLES	3
MILES DRIVEN (INCLUDES MOB AND DEMOB OF TEAM VEHICLES)	5806

5.0 CONCLUSION

5.0.1 The investigation/removal action at MCAS (UXO-5/ASR#2.44 and Camp Lejeune (UXO-6) resulted in 4 practice ordnance items being excavated from previously selected geo-physically identified anomalies. Table 5-1 shows practice items found on both sites. No MD scrap was found therefore, no procedures for inspection/certification was required. No re-vegetation or re-seeding was necessary.

TABLE 5-1 ITEMS FOUND

ITEM/SITE	QTY	ANOMALY #	DISPOSITION
M1 practice landmine/UXO-5	1	34+80_39	All items were sent to the home office in Charlotte, NC and will be used for training / seed items
M29 3.5” practice rocket/UXO-6	2	16+50_2 38+50_10	
M22 expended smoke rifle grenade/UXO-6	1	42+00_13	

6.0 REFERENCES

CH2M Hill 2006 Focused Site Inspection Report, Site UXO-06

DDESB, 2007, Methods for Predicting Primary Fragmentation Characteristics, Defense Department Explosives Safety Board (DDESB) Technical Paper (TP) 16 Current version, Alexandria, VA. (Fragmentation Database is associated with DDESB Technical Paper 16 Revision Date 2/13/07.)

DDESB, 2004, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, Defense Department Explosives Safety Board (DDESB) Technical Paper (TP) 18, 20 December 2004, Alexandria, VA.

DoD Instruction 4140.62, December 3, 2004 Department of Defense, "Management and Disposition of Material Potentially Presenting an Explosive Hazard."

Naval Facility Command Instruction.
NAVFACINST 11010.45 May 2001 Regional Planning Instruction.

NAVSEA OP 5, Vol. I, Seventh Revision change 3-1 June 2004.
Ammunition and Explosives Ashore Safety Regulations for Handling, Storage, Production, Renovation, & Shipping, Naval Sea Systems Command.

OPNAVINST 8020.14 1 Oct 1999 Department of the Navy Explosive Safety Policy.
Office of the Chief of Naval Operations.

Ordnance and Explosive Digital Geophysical Mapping Guidance Operational Procedures and Quality Control Manual (DGM QC Guidance) U.S. Army Engineering and Support Center, Huntsville AL Contract Number DACA87-00D-0012 Task order number 003 14 June 2006

U.S Army Corps of Engineers, Use of Sandbags for Mitigation of Fragment and Blast Effects Due to Intentional Detonation of Munitions HNC –ED-CS-S-98

APPENDIX A
SCOPE OF WORK

SCOPE OF WORK
Preliminary Assessment/Site Investigation (PA/SI) Activities
AOC3, D-27 Fortified Beach Assault Area
Marine Corp Base
Camp Lejeune, NC
December XX, 2006

5.1 Task 1-Prepare a Work Plan, Geophysical Prove-Out Plan and Health & Safety Plan

The Contractor shall provide a Supplemental Site Specific Work Plan (SSWP) and Health and Safety Plan (HASP) for Government review and approval prior to initiating site work. These plans will supplement the Arcadis' Work Plan and Health and Safety Plan. The contractor shall also prepare and submit a Geophysical Prove-out Plan. Once approved, the Contractor shall adhere to the Geophysical Investigation Plan, Site Specific Work Plan and Health and Safety Plan during all subsequent activities. The Contractor shall submit a "Draft" and "Final" version of the Geophysical Investigation Plan and the supplemental information to the Work Plan and HASP.

5.2 Task 2-Prepare Explosive Safety Submission (ESS)

The contractor shall prepare and submit an Explosive Safety Submission (ESS). The ESS will be prepared in accordance with the MARCORPSYSCOM and Department of Defense requirements and encompass the MEC conditions expected at each of the sites or areas.

5.3 Task 3-Site Survey

The Contractor shall survey the location of the proposed easement at 50 foot increments to submeter accuracy within the AOC. These survey points will facilitate brush clearing and digital geophysical mapping of the 24 foot easement. The points will be assigned an alpha numeric identification for later grid placement. The surveys shall be submitted in a format compatible with Camp Lejeune's Geographic Information System (GIS). The proposed survey area is approximately 2.45 acres with main extending approximately 4,450 linear feet. In the event that the surveying is not conducted by a UXO Technician, he will require UXO Escort.

5.4 Task 4-Clearing and Grubbing

Once surveying is complete, the contractor will clear the 24 foot easement of all brush and vegetation up to 6 inches in diameter. The Contractor should estimate a total of 2.45 acres will require clearing/grubbing. During the conduct of this task MEC/anomaly avoidance will be provided by qualified UXO Technician(s).

5.5 Task 5-Geophysical Prove-out and Production Digital Geophysical Mapping

The Contractor will construct a GPO Plot and conduct a Geophysical Prove-out in accordance with the GPO Plan and HASP. Upon completion of the Geophysical Prove-out, the Contractor shall submit a "Draft" and "Final" GPO Letter Report detailing the results of the GPO.

Once the GPO process has been approved, the Contractor shall perform production Digital Geophysical Mapping to identify the position of subsurface anomalies. The contractor shall perform the survey in accordance with standard industry practice. It is assumed that the GPO and production DGM activities will be concurrent (without a separate mobilization). If the activities are not concurrent, an additional mobilization will be required. Approximately 2.45 acres will be digitally geophysically mapped.

The Contractor shall review the results of the geophysical survey to identify target contacts *(i.e.,* those anomalies considered likely to be MEC) for removal. The results of the review shall be documented to include information necessary to relocate and remove the target contact. This documentation shall sufficiently justify the contractor's decision to either accept or reject an anomaly as a target contact for reacquisition and removal. All target identification will be recorded on Dig Sheets that will be utilized for target recovery by UXO technicians.

A separate mobilization and demobilization will be required between the GPO and the DGM activities.

5.6 Task 6-Primliminary Assessment/Site Investigation (PA/SI) Report

The contractor shall develop a Supplemental PA/SI to accompany Arcadis' PA/SI Report. The supplemental PA/SI will address the field activities executed by the Contractor, which include surveying, brush removal, the Geophysical Prove-out and Digital Geophysical Mapping. The Contractor shall submit a "Draft" and "Final" version of the Supplemental PA/SI.

Technical Approach
Preliminary Assessment/Site Investigation (PA/SI) Field Activities
AOC1, UXO-5, Mini Anti Tank Range and B-6 50-Foot Small Arms Range
Marine Corp Base
Camp Lejeune, NC
December XX, 2006

5.1 Task 1-Prepare a Work Plan, Geophysical Prove-Out Plan and Health & Safety Plan

ZAPATAENGINEERING will provide a supplemental Site Specific Work Plan (SSWP) and supplemental Health and Safety Plan (HASP) for Government review and approval prior to initiating site work. These plans will supplement the Arcadis' Work Plan and Health and Safety Plan. ZAPATAENGINEERING will also prepare and submit a Geophysical Prove-out Plan. Once approved, ZAPATAENGINEERING will adhere to the Geophysical Investigation Plan, Site Specific Work Plan and Health and Safety Plan during all subsequent activities. ZAPATAENGINEERING will submit a "Draft" and "Final" version of the Geophysical Investigation Plan and the supplemental information to the Work Plan and HASP.

5.2 Task 2-Prepare Explosive Safety Submission (ESS)

ZAPATAENGINEERING will prepare and submit an Explosive Safety Submission (ESS). The ESS will be prepared in accordance with the MARCORPSYSCOM and Department of Defense requirements and encompass the MEC conditions expected at each of the sites or areas.

5.3 Task 3-Site Survey

ZAPATAENGINEERING will mobilize a surveyor and UXO Technician for surveying of the AOC 1 force main. The proposed main runs through approximately 1,460 feet of AOC 1 within a 24 foot wide easement. ZAPATAENGINEERING will emplace surveying stakes at 50 foot increments along edges of the easement totaling approximately 62 points.

The points will be placed using sub-meter GPS and/or Total Station surveying equipment. Brush will be cleared for a line of sight as necessary during surveying. ZAPATAENGINEERING will establish the points using data electronically provide by ONWASA and/or Arcadis. The points will be assigned an alpha numeric identification for later grid placement. The survey data will be submitted in a format compatible with Camp Lejeune's Geographic Information System (GIS).

These survey points will facilitate brush clearing and digital geophysical mapping of the 24 foot easement. The proposed survey area is approximately 0.80 acres with main extending approximately 1,460 feet long by 24 feet wide.

It is assumed that near by existing monuments will be used for establishing control.

5.4 Task 4-Clearing and Grubbing

Once surveying is complete, ZAPATAENGINEERING will mobilize a UXO Technician for escort of the brush clearing subcontractor. The subcontractor (Clear Creek Land Clearing) will remove all brush and vegetation (within the 24 foot easement) up to 6 inches in diameter. Brush will be mulched in place. It is estimated that a total of 0.80 acres will require clearing/grubbing.

During the conduct of this task MEC/anomaly avoidance will be provided by qualified UXO Technician(s).

It is assumed the water bodies will be skirted.

If timber is harvested prior to land clearing or DGM activities, it is assumed that slashes or tree toppings will not be left in the area.

5.5 Task 5-Geophysical Prove-out and Production Digital Geophysical Mapping

ZAPATAENGINEERING will construct a GPO Plot and conduct a Geophysical Prove-out in accordance with the GPO Plan and HASP. Upon completion of the Geophysical Prove-out, ZAPATAENGINEERING will submit a "Draft" and "Final" GPO Letter Report detailing the results of the GPO.

The GPO task elements may be shared between this area (AOC 1) and another area AOC 3. If awarded, it is assumed that both areas will be executed under the same mobilization. If not conducted concurrently, additional costs maybe incurred for remapping of the GPO.

Once the GPO process has been approved, ZAPATAENGINEERING will perform production Digital Geophysical Mapping to identify the position of subsurface anomalies. ZAPATAENGINEERING will perform the survey in accordance with standard industry practice. Approximately 0.80 acres will be digitally geophysically mapped.

Digital geophysical mapping (DGM) would be done over linear easements in Area of Concerns (AOC) 1. The objective of the DGM is to identify metal objects that may be munitions and explosives of concern (MEC). These easements are 24 feet in width and cover 0.80 acres in AOC. The survey area is expected to be free of vegetation but may contain some larger trees. An electromagnetic metal detection system, the EM61, will be used to detect both ferrous and non-ferrous metal objects within the easements. EM61 DGM provides a map of the locations of identified targets, which is generally understandable on a qualitative basis by untrained personnel. The EM61 is the industry standard in the detection of potential UXO items.

ZAPATAENGINEERING proposes to use a man-pulled single EM61 system with a 0.5 meter by 1.0 meter paired transmitter/receiver coil system. Data will be colleted with the system orientated so the one-meter side of the coil is perpendicular to the direction of travel. Complete coverage of the site (100 %) would be made of those areas accessible to the towed EM61 system. Those areas inaccessible to the EM61, if any, would be investigated using hand held systems. The survey

lines will be spaced every 0.9 meters (3 feet). Positioning of the data would be done using either a centimeter level accuracy global positioning system (GPS) or a wheel distance encoder combined with survey tapes. Which method is used would depend on the degree in which the view of the sky is obstructed. It is estimated that an average of 0.6 acres per day would be surveyed requiring 6 days to complete the geophysical surveying of the site.

The data would be collected and processed using United States Army Corps of Engineers (USACOE) standards as outlined in Data Item Descriptions (DID) MR-005-05 and MR-005-05A. The DIDs require a Geophysical Prove-out (GPO) of the proposed systems prior to data collection. The GPO would involve the construction of a test plot seeded with inert and/or simulated UXO items of similar size and shape to the UXO expected to be encountered at the survey site. It is recommended that the test plot be approximately 50 feet by 50 feet in size and constructed close to the survey site so it represents similar survey conditions. The GPO would be carried out in accordance with all procedures stated in the DID MR-005-05A. This includes a development of a GPO work plan and acceptance of the GPO results by the USACOE prior to beginning the general site survey. A ZAPATAENGINEERING geophysicist and a geophysical technician will conduct the GPO surveying. A UXO Tech will be present to assist and serve as a safety oversight in the intrusive phase of the test plot construction. It is estimated that three (3) days will be required to perform the GPO. This includes:

- Identification of a suitable site for the test plot.
- Doing a pre-seed geophysical survey of the site to ensure it is relatively clean of buried metal objects.
- Burying seed items within the test plot and documenting locations.
- Geophysically survey seeded test plot using proposed geophysical systems, data collection procedures and quality control checks.

A report of GPO results would be prepared and presented to USACOE representatives for approval. USACOE may require that someone from their office be present during the GPO and may conduct additional quality control tests.

A ZAPATAENGINEERING geophysicist will process the geophysical data collected. The locations of both ferrous metal and non-ferrous metal objects will be identified in the data. It is not currently possible to consistently distinguish between non-UXO metal objects and UXO items. This requires that all EM61 anomalies above a minimum size be intrusively investigated. The depth of exploration for the EM61 system varies with the size of the metal object. The USACOE DID MR-005-05 estimates that an object is detectable to a depth of approximately 11 times its diameter. This equates to a depth of 0.97 meters (38 inches) for a 3.5-inch rocket which is the munition with the greatest fragmentation distance for AOC 3. In AOC 1, 22 caliber projectiles are the most likely item to be present, which will be detectable at or just below the surface. Generally the depth of investigation exceeds the depth of penetration for most UXO items. It is possible, however, for UXO to be located at depths below the depth of exploration for a particular geophysical system. This can occur through natural processes such as sedimentation in drainages or through human activities such as burial of the UXO or grading activities. These processes can result in the non-detection of UXO items located at depths significantly below the

item's depth of investigation for a particular geophysical system. In addition, the geophysical survey proposed would only identify potential ordnance in those areas that are not covered by buildings or other obstructions. .

The geophysical data would be evaluated to identify metal objects that may be potential UXO items. The criteria used to pick which targets are intrusively investigated will be determined from the GPO. Using this criteria target lists will be generated from the geophysical data.

The geophysical evaluation phase of the project would consist of the following tasks:

1. Develop Geophysical portion of the Work Plan for site.
2. Perform Geophysical Prove Out of the equipment, procedures and personnel over test grid near the site (3 field days).
3. Perform geophysical surveying of the approximately 3.5 acres, including processing and interpretation of the geophysical data (6 field days).
4. Generate a final report of the geophysical surveying which will be included in the overall final report for the site.

It is important to state that this investigation will not absolutely identify the location of all UXO is present at the site. For reasons discussed above it is possible that UXO items may not be detected in the surveying of the site. ZAPATAENGINEERING will attest that the site has been investigated using the best available techniques and procedures. All reasonable standards will have been met or exceeded during the survey process and the intrusive investigation. The risk of UXO on the site will have been minimized as much as possible using these techniques and standards.

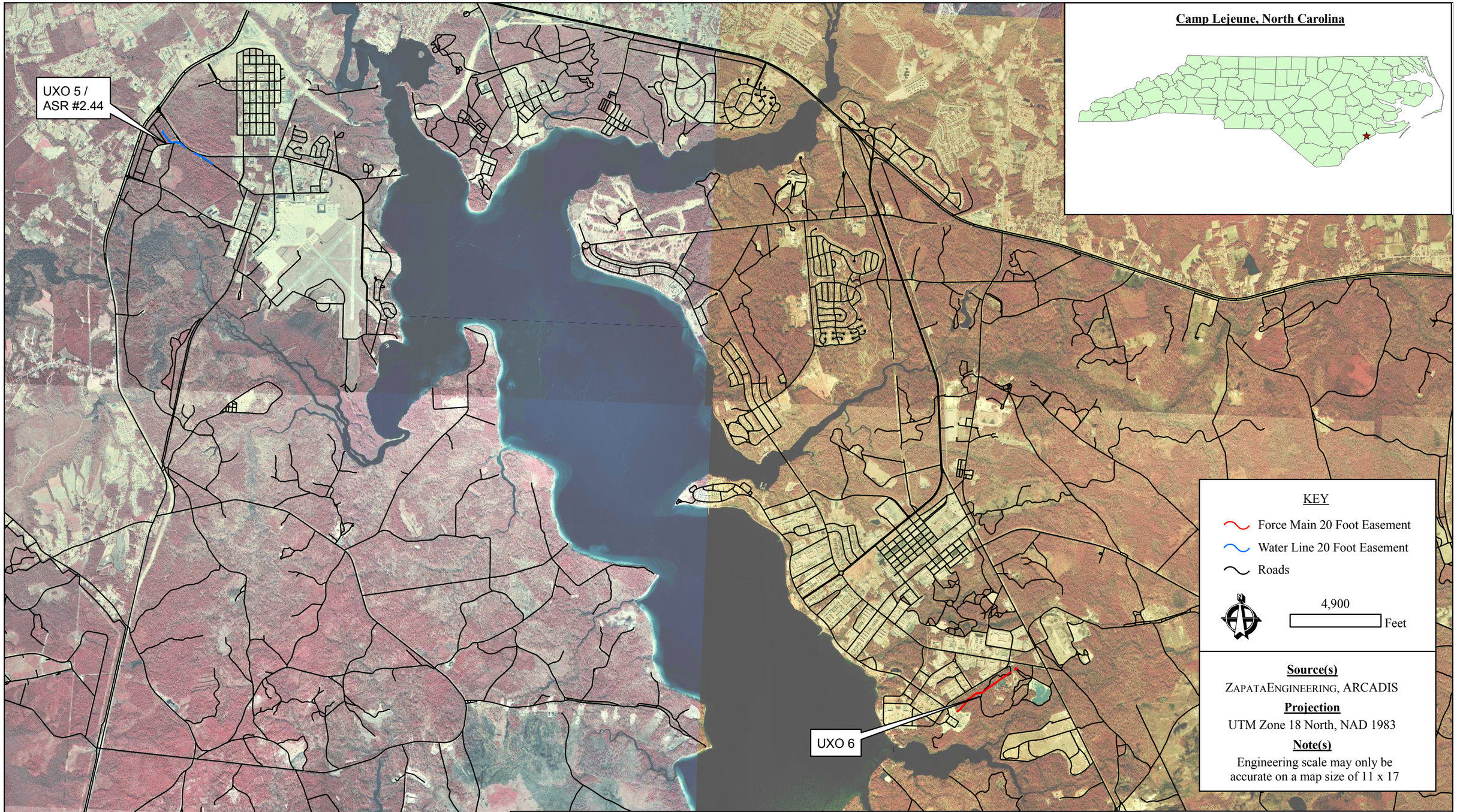
The geophysical costs were derived using the following assumptions:

1. The geophysical test grid can be located near the survey areas.
2. There will be no construction activities within or immediately adjacent to the parcel that will affect data collection.
3. Onsite training and/or issuance of security badges would require no more than 3 hours.
4. Vegetation clearance is not required and the areas are free of debris, which would impede data collection.
5. The geophysical work will be conducted on a five (5) day, ten (10) hours per day workweek.
6. A separate mobilization and demobilization will be required between the GPO and the DGM activities.

5.6 Task 6-Primliminary Assessment/Site Investigation (PA/SI) Report

ZAPATAENGINEERING will develop a Supplemental PA/SI to accompany Arcadis' PA/SI Report. The supplemental PA/SI will address the field activities, which include surveying, brush removal, the Geophysical Prove-out and Digital Geophysical Mapping. ZAPATAENGINEERING will submit a "Draft" and "Final" version of the Supplemental PA/SI.

APPENDIX B
SITE MAPS



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MARINES
THE FEW. THE PROUD.
Marine Corps Base
Jacksonville, North Carolina

Jacksonville Marine Corps Air Station New River and
Camp Lejeune , NC
Regional Map

Project No.	Drawn By	Checked By	Date	Engineering Scale	Figure
2078 / 2082	CRP	MLW	JUNE 2008	1" = 4,900'	1

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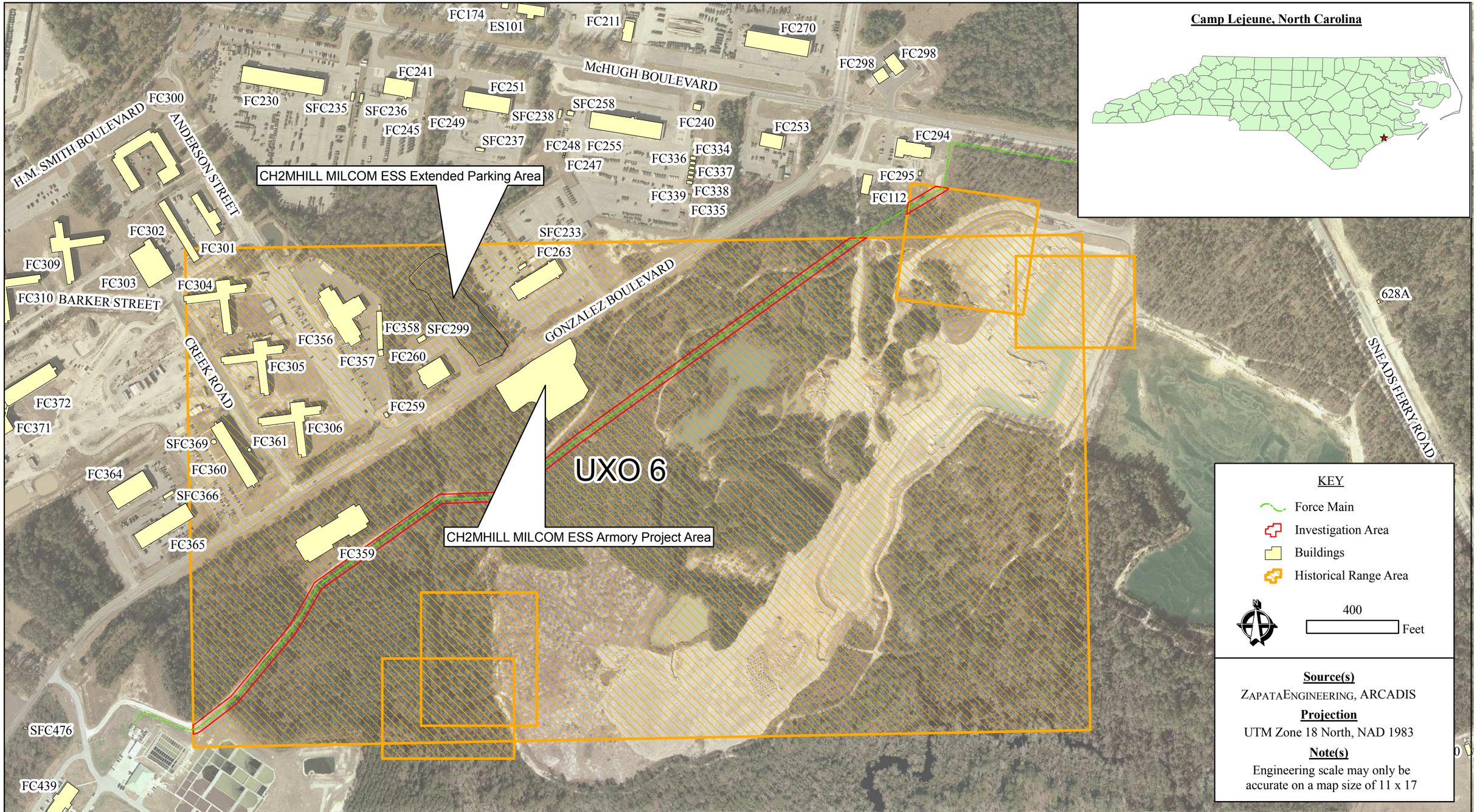
Marine Corps Base
Jacksonville, North Carolina

Jacksonville Marine Corps Air Station New River, NC
UXO 5 / ASR #2.44 - Water Line Easement

Project No.	Drawn By	Checked By	Date	Engineering Scale	Figure
2078	CRP	MLW	JUNE 2008	1" = 400'	2



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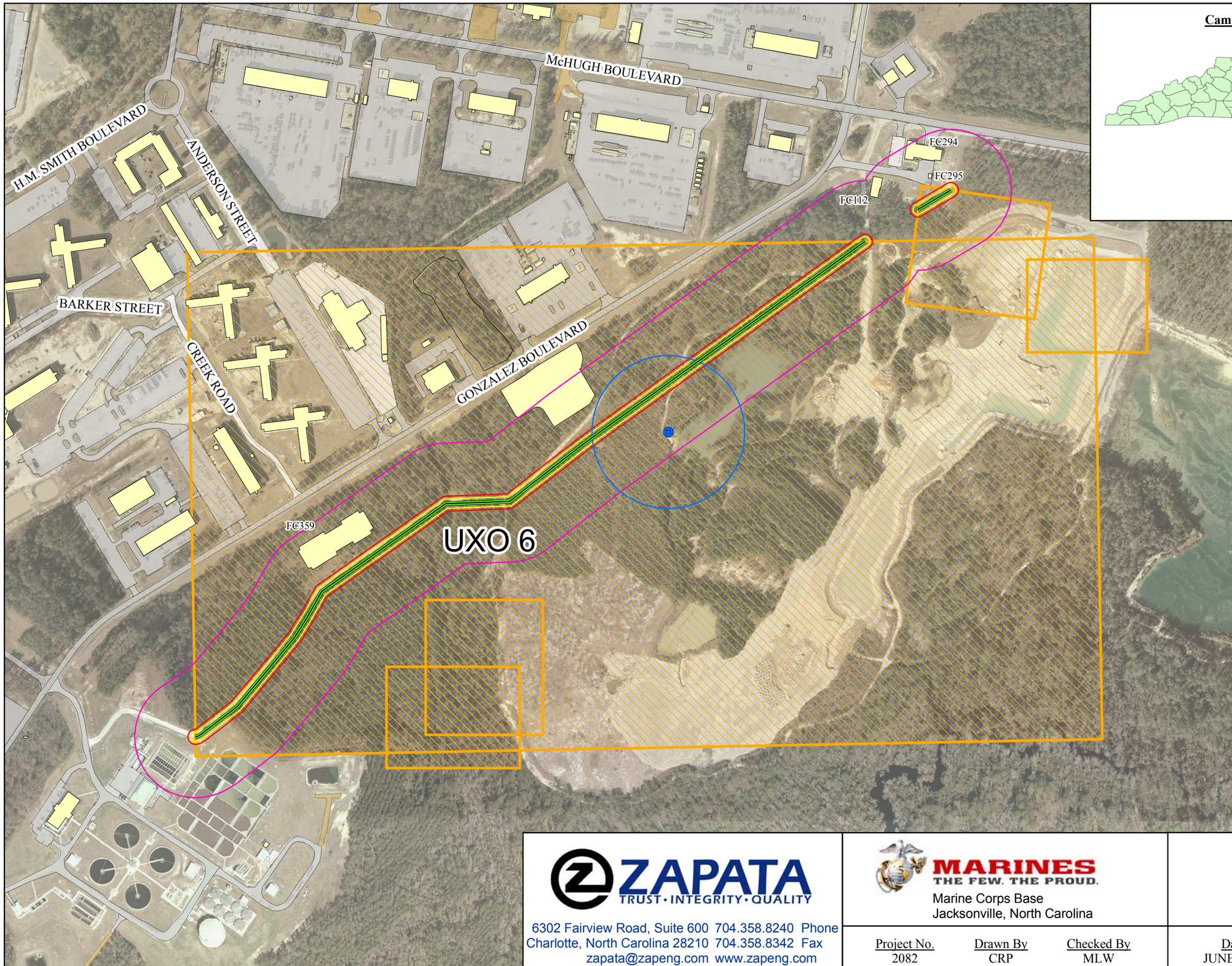
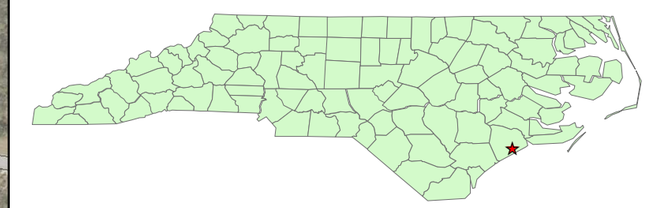
Camp Lejeune, NC
UXO 6 - Force Main Easement

Project No.	Drawn By	Checked By	Date	Engineering Scale	Figure
2082	CRP	MLW	JUNE 2008	1" = 400'	3



Camp Lejeune, North Carolina



KEY

- MPPEH Staging Location
- Munitions Response Site (Force Main)
- 328 Foot MPPEH Staging Area
- 20 Foot PTR
- 260 Foot Intentional Detonation (No Engineering Controls)
- 32Foot IBD / TSD / EZ
- Buildings
- Historical Range Area

Road / Vehicle Parking / Vehicle Driveway Areas

- Paved
- Unpaved
- Type Not Listed

N

400 Feet

Source(s)

ZapataEngineering, ARCADIS

Projection

UTM Zone 18 North, NAD 1983

Note(s)

Exclusion Zone based on 1/2 lb uncased blocks TNT

Engineering scale may only be accurate on a map size of 11 x 17

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Camp Lejeune, NC
UXO 6 - QD Arc

Project No.	Drawn By	Checked By	Date	Engineering Scale	Figure
2082	CRP	MLW	JUNE 2008	1" = 400'	4