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Explosives Safety Submission

**Munitions & Explosives of Concern
Intrusive Investigation
Site UXO-04, Knox Trailer Park
Marine Corps Base Camp Lejeune
Jacksonville, North Carolina**

**Contract No. N62470-02-D-3052
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5
Enclosure

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Acronyms and Abbreviations

CTO	Contract Task Order
DGM	Digital Geophysical Mapping
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
DDESB	Department of Defense Explosives Safety Board
EOD	Explosive Ordnance Disposal
ESI	Expanded Site Inspection
ESQD	Explosives Safety Quantity-Distance
ESS	Explosives Safety Submission
EZ	Exclusion Zone
GPO	Geophysical Prove-Out
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MRS	Munitions Response Site
MSD	Minimum Separation Distance
QA	Quality Assurance
QC	Quality Control
Q-D	Quantity-Distance
RAB	Restoration Advisory Board
SUXOS	Senior UXO Supervisor
UXO	Unexploded Ordnance

1.0 Project Summary

1.1 Purpose

This Explosives Safety Submission (ESS) was prepared to support an intrusive investigation for munitions and explosives of concern (MEC) at the Knox Trailer Park, which forms part of Munitions Response Program (MRP) Site UXO-04, located at Marine Corps Base (MCB) Camp Lejeune, Jacksonville, North Carolina. The locations and descriptions of the Knox Trailer Park Site and areas of investigation are provided later in this section.

This ESS has been prepared in accordance with Naval Ordnance Safety & Security Activity (NOSSA) Instruction 8020.15, dated 8 Mar 04, to address the MEC activities that are planned for the Knox Trailer Park site.

1.2 Location and History

1.2.1 Site Location and Description

MCB Camp Lejeune is bisected by the New River, which flows southeasterly and forms a large estuary before entering the Atlantic Ocean. The Atlantic Ocean forms the southeastern boundary of the facility. The western and northwestern boundaries are U.S. Route 17 and North Carolina State Route 24, respectively. The city of Jacksonville, North Carolina, is located immediately northwest of MCB Camp Lejeune.

A majority of the land surrounding the facility is used for agriculture. Estuaries along the coast support commercial fishing, and residential resort areas are located adjacent to MCB Camp Lejeune along the Atlantic Ocean.

A planned public-private venture (PPV) development, which consists of approximately 133 acres, is being sited in the northern portion of MCB Camp Lejeune (**Figure 2-1**). The Northeast River defines the southern boundary, Scales Creek flows near the northwestern boundary, and an unnamed tributary flows near the northeastern boundary. The planned PPV development is accessible by Florence Road from the west and Camp Knox Road from the north.

The intrusive investigation that is the subject of this ESS will be conducted in the existing Knox Trailer Park, which covers approximately 38 acres of Site UXO-04. The trailer park property is level and vegetated with grass and minimal tree cover. All residents have vacated the trailer park and the remaining mobile homes are to be removed from the site within the next several months. A network of narrow roadways covers the trailer park and all utilities, including telephone, cable, water, electricity, and sewers, are buried and are assumed to be intact.

The remaining area of Site UXO-04 consists of approximately 95 acres of woodland that surrounds the current Knox Trailer Park to the north, east, and west. Undergrowth less than

three inches in diameter was removed from the majority of the wooded area during the field investigation in support of the geophysical survey. The density of undergrowth is light to moderate in the wooded areas where geophysical surveying was not conducted. Intrusive investigation activities that are addressed in this ESS will not be conducted in this wooded area.

1.2.2 Site History

Construction of MCB Camp Lejeune began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base." Construction of the Base centered on Hadnot Point, where the major functions of the Base are located. During World War II, MCB Camp Lejeune was used as a training area to prepare Marines for combat. MCB Camp Lejeune was again used for training during the Korean and Vietnam conflicts, as well as the Gulf War. MCB Camp Lejeune hosts five Marine Corps commands and one Navy command. In addition, MCB Camp Lejeune provides support and training for the following tenet commands: Headquarters Nucleus; Second Marine Expeditionary Force; Second Marine Division; Second Marine Force Service Support Group; Second Marine Surveillance, Reconnaissance, and Intelligence Group; Sixth Marine Expeditionary Brigade; the Naval Hospital; and the Naval Dental Clinic. All of the real estate and infrastructure are owned, operated, and maintained by the host command. The mission of MCB Camp Lejeune is to maintain combat-ready units for expeditionary deployment.

The Knox Trailer Park area began as a Civilian Conservation Corps Camp in 1941. Camp personnel assisted with road work, forestry, and other phases of developing the land into a modern military post (Carraway, 1946). Another function of the Civilian Conservation Corps Camp at Camp Lejeune (in conjunction with the Malaria Control Detachment of the Marines) was to eliminate the source of endemic malaria by draining all surrounding wetlands. This was accomplished by ditching, using dynamite, and spraying diesel oil on water surfaces as a larvicide (Kimball, 2005).

A dog-training school was located in the southernmost area of Knox Trailer Park and operated from 1942 to 1946. The dogs were subjected to overhead rifle and machine gun fire and explosions of charges of dynamite and TNT to simulate battlefield conditions (Marine Devil Dogs!, 2005). The dogs and handlers were exposed to explosives typically found in a combat environment on a weekly basis. Explosives used during training included Dago bombs and quarter cans of TNT (Putney, 2001).

During WWII, there was increased research into the use of body armor to protect the troops from serious injury. Most of the testing occurred at the Naval Medical Field Research Laboratory (NMFRL), though some research facilities were located at Camp Knox (now the Knox Trailer Park area). While the specific testing at the Camp Knox research facilities has not been determined, it is known that the body armor was able to resist impact from .22 and .45 caliber automatic pistol bullets and Reising and Thompson sub-machine gun bullets at a distance of 15 ft. In addition, tests showed that the armor stopped all fragments from a detonated hand grenade (TNT-loaded) at a distance of 3 feet (Montrose, 1955). The research facilities at Camp Knox most likely fired ball-type ammunition at the vests. The firing was most likely performed inside buildings (based on historical photographs), and it is not thought that a significant amount of ammunition was expended for testing purposes (Lt. Col. L. Kimball (Ret.), personal communication, August 10, 2005). Testing and development

continued at the NMFRL throughout the Korean conflict until the cease fire was called in July 1953 (Montrose, 1955). From the early 1950s until the present time, the area has been used for residential housing.

In the 1974–1976 timeframe, an EOD technician, Mr. Don Cifelli, responded to the discovery of unexploded ordnance (UXO) in the Knox Trailer Park area. A bulldozer operator uncovered a live WWII MK-II high-explosive hand grenade while conducting excavation activities (D. Cifelli, personal communication, March 2005). The safety pin had been removed, the grenade had been thrown, and the striker had impinged the primer without causing the primer to function, thereby rendering the grenade a dud. The exact location of the grenade is not documented, but Mr. Cifelli recalls it being located off the main road leading to the trailer park (personal communications, August 15 and 18, 2005). Mr. Cifelli also recalls responding to up to three additional discoveries of practice grenades during intrusive activities in the area.

A site visit with Mr. Cifelli was conducted on June 9, 2006. Although the exact locations of the grenades were not pinpointed, Mr. Cifelli was able to confirm that the grenades had been found in the vicinity of the Knox Trailer Park.

According to base personnel, this area was never a live fire range for grenades or any other munitions (Lowder, 2005). In addition, the consulting historian for the base reported that he has not encountered any documentation that supports the Knox Trailer Park area having been an established range (Lt. Col. L. Kimball, personal communication, August 10, 2005). No previous Navy Installation Restoration Program (IRP) investigations have been conducted at the Knox Trailer Park or the surrounding area (i.e., Site UXO-04).

The discovery of previous grenades, along with interviews from EOD personnel, may contribute to the Knox Trailer Park area's inclusion as a suspected historic hand grenade range [called the Knox Trailer Park Grenade Range (Area A)] in the Draft 2002 Range Inventory Report.

The grenades used in this area were reportedly MK-II and MK-IIA1. According to the specifications, each type had a serrated cast-iron body; the MK-II grenades were equipped with an M204A1 fuse, whereas the MK-IIA1 grenades were equipped with a M10A3 fuse. Specifications state that each unit was filled with 2 oz. of flaked or granular 2,4,6-trinitrotoluene (TNT), though some older units contained E.C. Blank Smokeless Powder (U.S. Army Corp of Engineers, 2001).

A visual inspection of the Knox Trailer Park was conducted in November 2002 by the base's explosive ordnance disposal (EOD) team, and no UXO was discovered (Gunnery Sgt. G. McGurty, personal communication, July 22, 2005).

A former maneuver training area (AD Training Area) is located just north of the Knox Trailer Park. The area was in operation during the 1940s and was administratively closed by the Environmental Management Division of the Marine Corps in January 2004. No further action was determined for the AD Training Area (D. Richardson, personal communication, August 3, 2005; Department of the Navy, 2005). The area was a nonfiring area used for land navigation, patrolling, and field training, and is currently in use by the Marine Corps Combat Service Support School at Camp Johnson (D. Richardson, personal communication, August 3, 2005).

1.3 Conclusions from Previous Studies and Reports

1.3.1 Expanded Site Inspection, CH2M HILL, 2006

The intrusive investigation that is the subject of this ESS is being conducted as part of an expanded site inspection (ESI) of Site UXO-04. Digital geophysical mapping (DGM) of the site was conducted as part of the ESI data collection effort, and that data will be used to support the intrusive investigation.

A geophysical proveout (GPO) was performed at the site to validate a towed array EM61-MK2 system and a two man-portable single-coil system for DGM surveys across the site. Each system passed the project DQOs as established in the GPO Work Plan, which was presented as an appendix to the Work Plan for the ESI (CH2M HILL, October 2005).

A total of 90.9 acres were geophysically surveyed at the project site using a combination of a towed array EM61-MK2 system and two man-portable single-coil EM61-MK2 systems. The areas of the site covered by the EM61-MK2 towed array system are the objective of this intrusive investigation and are shown on **Figure 2-2**. A total of 38 acres were geophysically surveyed in the non-wooded area comprising the existing trailer park area where the MEC intrusive investigation will be conducted. The remaining 53 acres were in wooded areas of the site and will not be addressed by the MEC intrusive investigation.

The DGM results indicate a high density of anomalies due to metallic items in the current and former trailer park areas of the site. Anomalies that represent potential subsurface MEC items were identified based on their geophysical signatures. Anomalies with geophysical signatures similar to those of the target MEC item, an MK-II hand grenade, were selected from the DGM results and their coordinates recorded. Over 50,000 anomalies representing subsurface metal were selected from the data as representing potential subsurface MEC items. Within the existing trailer park area of the site, an average 600 anomalies per acre were identified as representing potential subsurface MEC.

The concentration of targeted anomalies is significantly reduced in the southwest and southeast sections of the area of inspection, outside of the area of the planned MEC intrusive investigation. Results of DGM surveys in the wooded areas to the northeast of the trailer park indicate that there may be fewer anomalies in this area as well.

1.4 Site Investigation Actions Planned

The planned MEC intrusive investigation at Knox Trailer Park includes investigation of 17 of the 166 surveyed grids (10% of the total area) that were investigated within the existing trailer park area during the DGM survey conducted in early 2006. This represents approximately four acres out of the 38-acre area surveyed.

This intrusive investigation will be conducted by reacquiring the geophysical anomalies that were identified as possibly representing subsurface MEC within the 17 randomly selected grids. These geophysical anomalies will be manually excavated to a depth no greater than two feet to determine the source of each anomaly. The DGM survey identified an average of approximately 600 anomalies per acre that will require intrusive investigation. The map showing the 17 grids is presented as **Figure 2-2** in the next section.

CH2M HILL and its subcontractors will not perform demolition on any MEC items that may be found during the course of this intrusive investigation. MCB Camp Lejeune EOD will take responsibility for demolition and disposal of all MEC items.

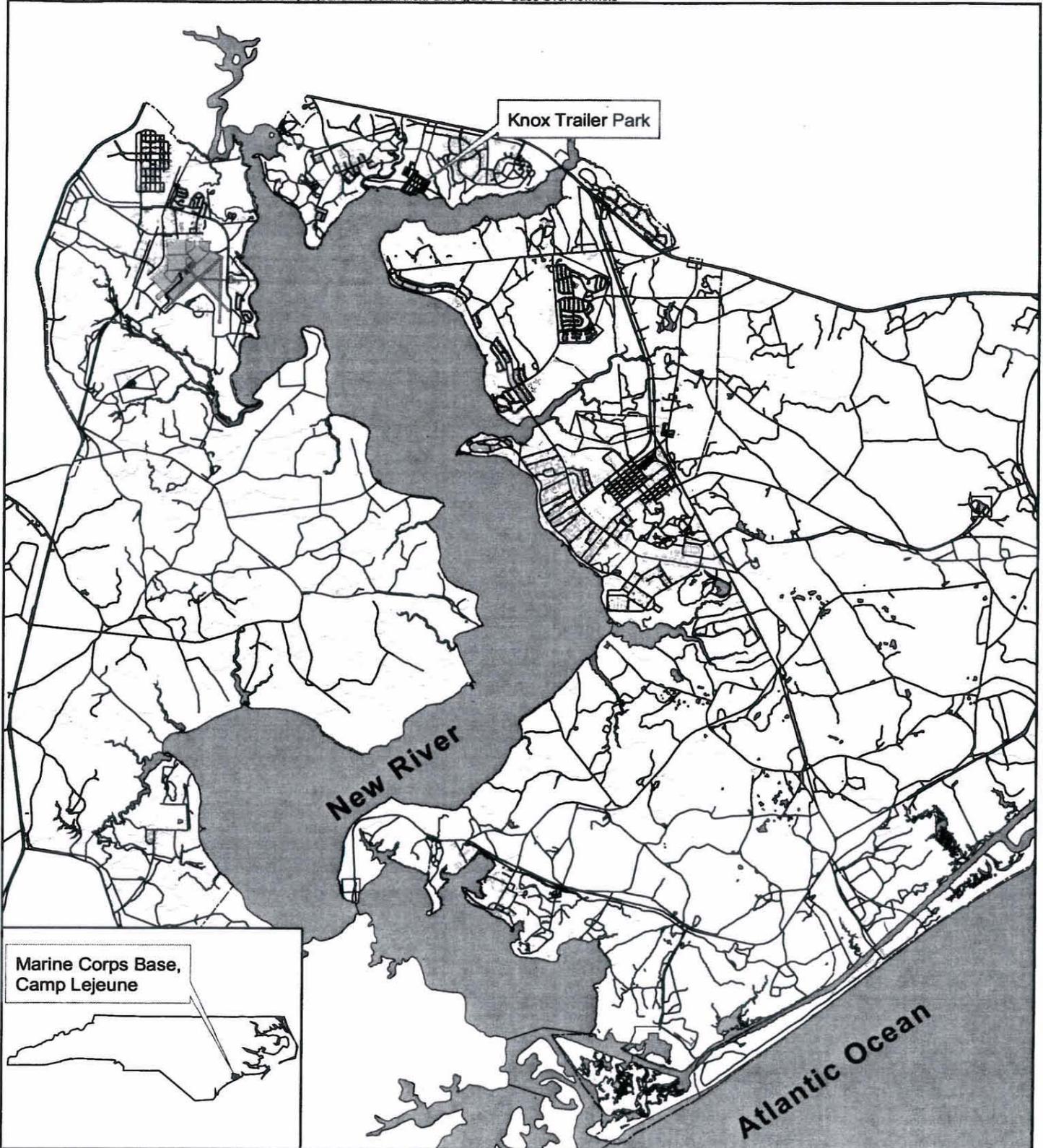
1.5 Remediation Goals

The goal of the MEC intrusive investigation is to evaluate the nature and density of MEC that may be present to a depth of two feet below ground surface at the existing Knox Trailer Park within Site UXO-04.

2.0 Maps

This section presents the following maps:

- Figure 2-1 - Base Overview
- Figure 2-2 - Explosives Safety Quantity-Distance Arcs - Example Grid
- Figure 2-3 - Exclusion Zone - Maximum Extent
- Figure 2-4 - Inhabited Building Distance (IBD) - Maximum Extent
- Figure 2-5 - Public Transportation Route (PTR) Distance - Maximum Extent



- Legend**
- Knox Trailer Park
 - Installation Area
 - Existing Structures
 - Airfield Surface Area
 - Surface Water Body Area
 - Surface Water Course Centerline
 - Road Centerline

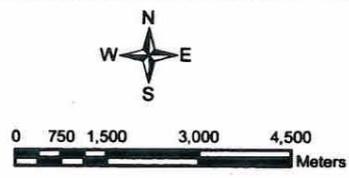
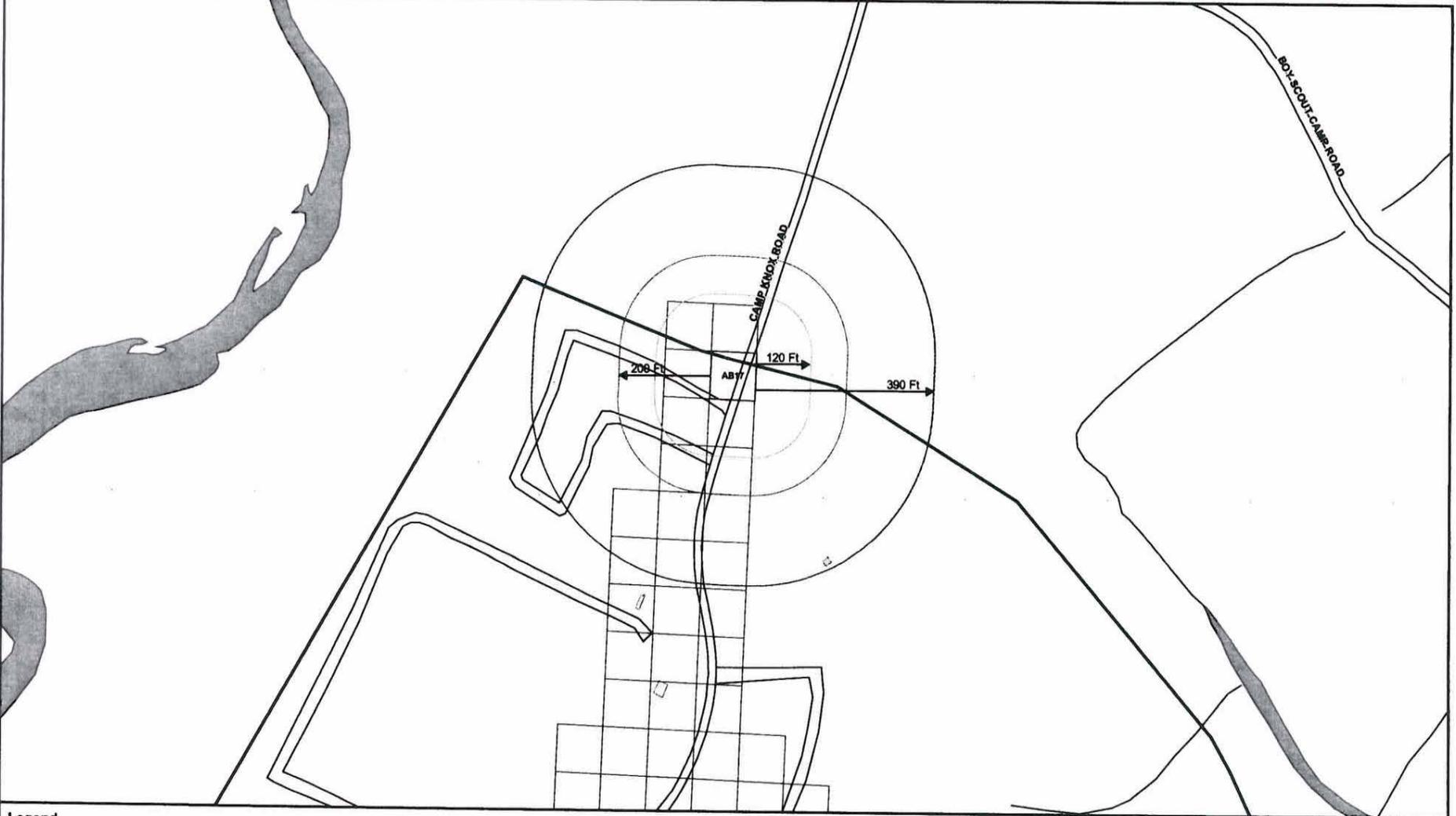


Figure 2-1
Base Overview
MCB Camp Lejeune
North Carolina





- Legend**
- | | |
|---------------------------------|--|
| Structure Area | Towed-Array Grids |
| Road Area | Intrusive Investigation Grids |
| Surface Water Course Centerline | Exclusion Zone - 390' |
| Surface Water Body Area | Inhabited Building Distance (IBD) - 200' |
| Site UXO-04 | Public Transportation Route (PTR) - 120' |

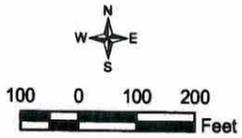
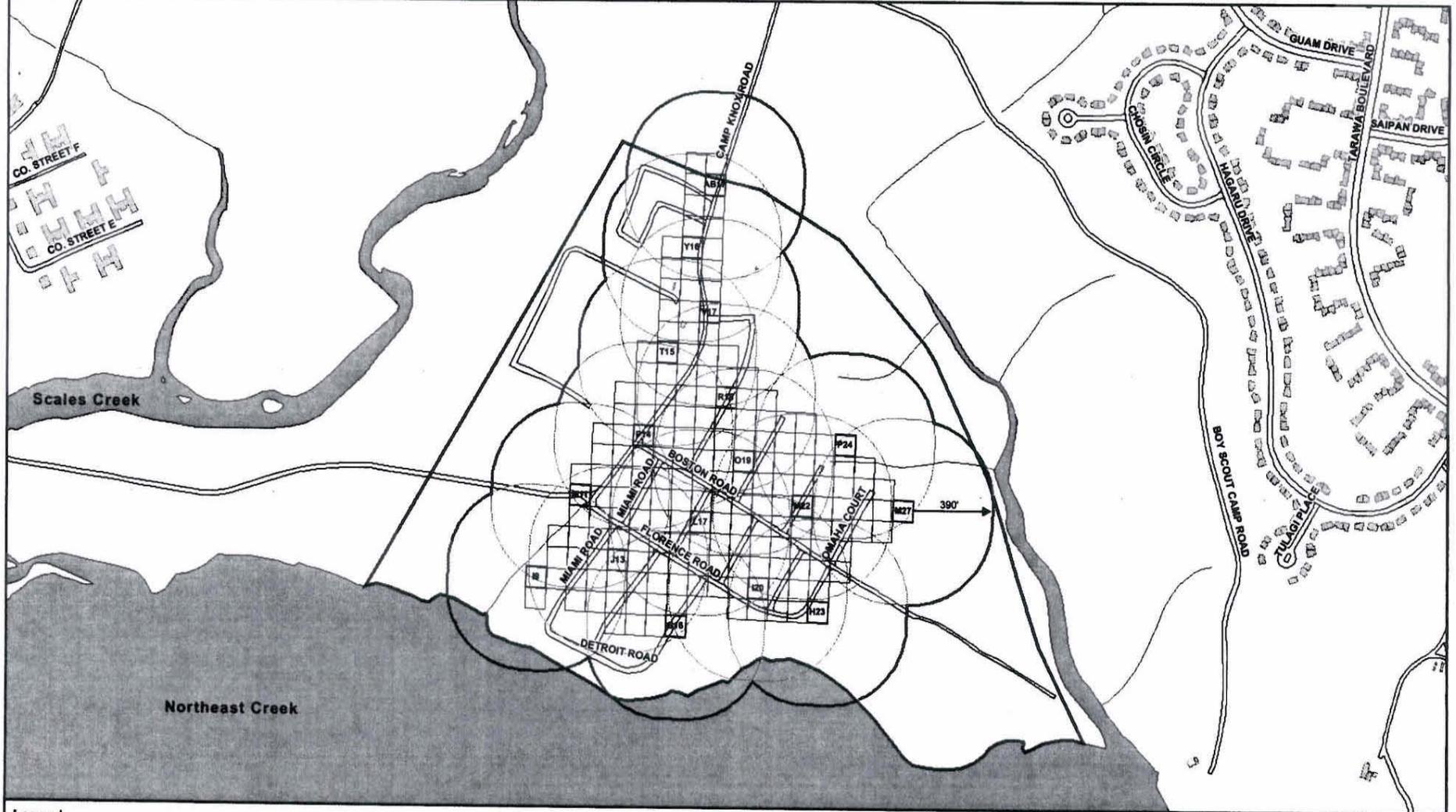


Figure 2-2
ESQD Arcs for Example Grid
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina





- Legend**
- Structure Area
 - Road Area
 - Surface Water Course Centerline
 - Surface Water Body Area
 - Site UXO-04
 - Towed-Array Grids
 - Intrusive Investigation Grids
 - Exclusion Zones
 - Exclusion Zone - Maximum Extent

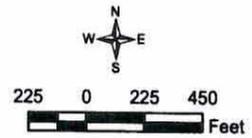
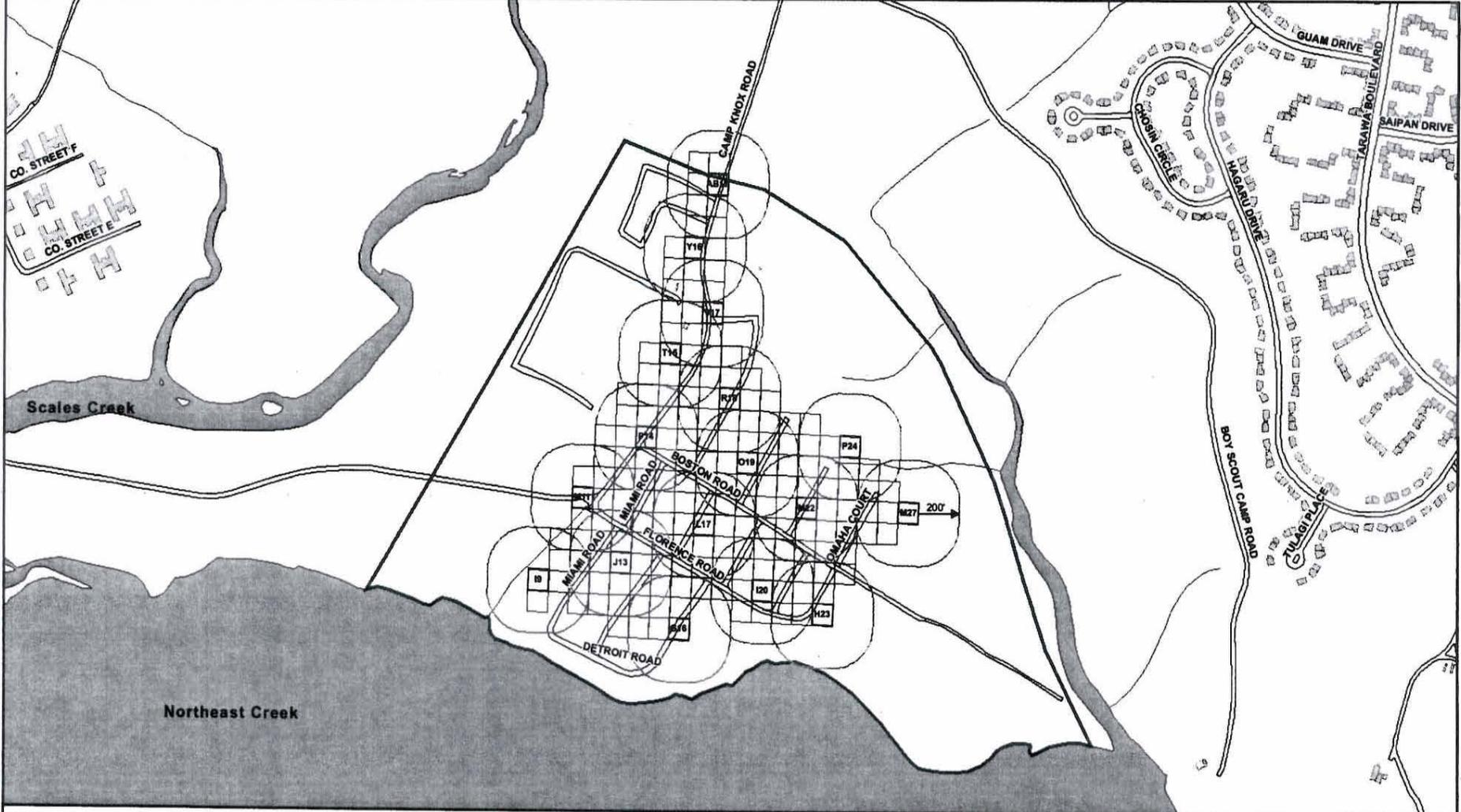


Figure 2-3
 Exclusion Zone - Maximum Extent
 Site UXO-04
 Knox Mobile Home Park
 MCB Camp Lejeune
 North Carolina





- Legend**
- Structure Area
 - Road Area
 - Surface Water Course Centerline
 - Surface Water Body Area
 - Site UXO-04
 - Towed-Array Grids
 - Intrusive Investigation Grids
 - Inhabited Building Distance (IBD) - 200'

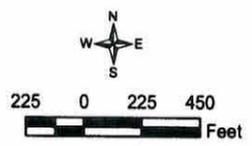
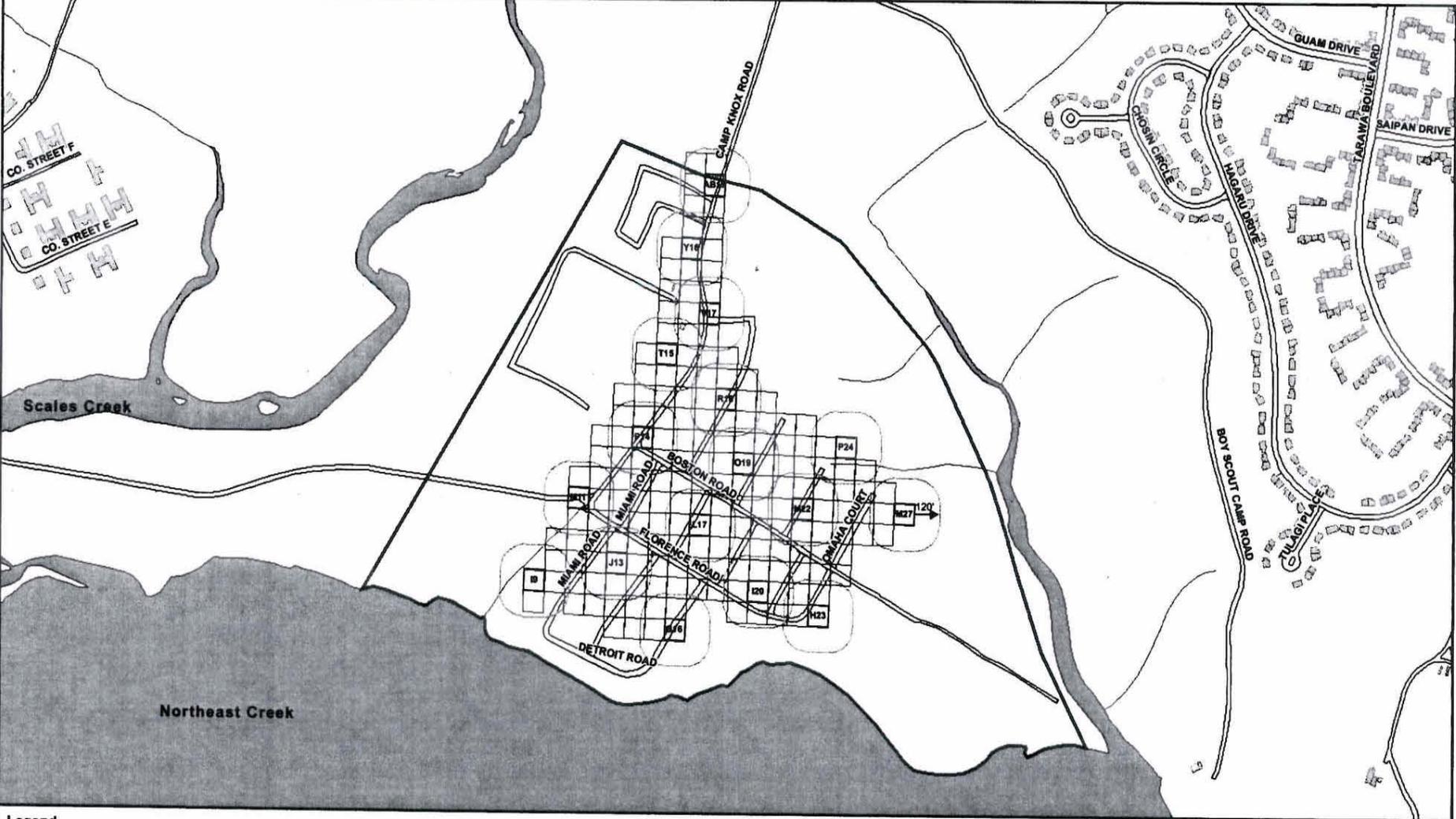


Figure 2-4
 Inhabited Building Distance - Maximum Extent
 Site UXO-04
 Knox Mobile Home Park
 MCB Camp Lejeune
 North Carolina





- Legend**
- Structure Area
 - Road Area
 - Surface Water Course Centerline
 - Surface Water Body Area
 - Site UXO-04
 - Towed-Array Grids
 - Intrusive Investigation Grids
 - Public Transportation Route (PTR) -120'

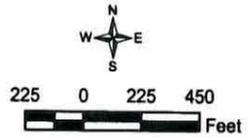


Figure 2-5
Public Transportation Route - Maximum Extent
Site UXO-04
Knox Mobile Home Park
MCB Camp Lejeune
North Carolina

