FINAL
PHASE 2 CONFIRMATORY SAMPLING
WORK PLAN
FORT STEWART
HINESVILLE, GEORGIA

AUGUST 2010

Prepared for:

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DOCUMENT 4

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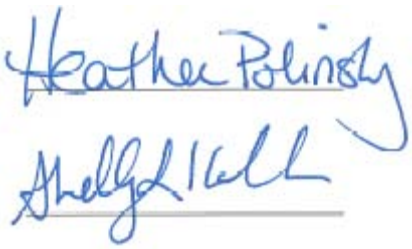
DoD Contract Number: W912DR-09-D-0016

Reviewed and Approved by:



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Malcolm Pirnie, Inc. prepared this report at the direction of the United States Army Corps of Engineers (USACE). This document should be used only with the approval of the USACE. This report is based, in part, on information provided in other documents and is subject to the limitations and qualifications presented in the referenced documents.

AUGUST 2010

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TABLE OF ACRONYMS

Acronym	Definition
cal	caliber
CMS	Corrective Measures Study
COC	Chain of Custody
CS	Confirmatory Sampling
CSM	Conceptual Site Model
CTC	Cost to Complete
CTT	Closed, Transferring, and Transferred
DI	Deionized
DoD	Department of Defense
DPW	Directorate of Public Works
DQCR	Daily Quality Control Report
DQO	Data Quality Objective
EOD	Explosive Ordnance Disposal
ERIS	Environmental Restoration Information System
FPM	Field Project Manager
FTSW	Fort Stewart
GA	Georgia
GAEPD	Georgia Environmental Protection Division
GPS	Global Positioning System
HASP	Health and Safety Plan
H&S	Health and Safety
HRR	Historical Records Review
HSD	Health and Safety Director
IDW	Investigative Derived Wastes
Malcolm Pirnie	Malcolm Pirnie, Inc.
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MIDAS	Munitions Items Disposition Action System
mm	Millimeter
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NFA	No Further Action
PA	Preliminary Assessment
PM	Project Manager
POC	Point of Contact
PWS	Performance Work Statement
QA	Quality Assurance
QAPP	Uniform Federal Policy Quality Assurance Program Plan
QC	Quality Control
RCRA	Resource Conservation Recovery Act

Acronym	Definition
RFI	RCRA Facilities Investigation
RSL	Regional Screening Levels
SI	Site Inspection
SSHP	Site Safety and Health Plan
TAL	Target Analyte List
TPP	Technical Project Planning
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
UXOSS	Unexploded Ordnance Health & Safety Supervisor

1 INTRODUCTION

Malcolm Pirnie, Inc. (Malcolm Pirnie) has prepared this Resource Conservation Recovery Act (RCRA) Confirmatory Sampling (CS) Work Plan for the Military Munitions Response Program (MMRP) eligible sites at Fort Stewart (FTSW), Georgia (GA), under United States (U.S.) Army Corps of Engineers (USACE) Contract Number W912DR-09-D-0016, Delivery Order 0004. This CS Work Plan is intended to meet the requirements of a MMRP Site Inspection (SI) Work Plan.

An installation-wide MMRP CS Report was completed at FTSW in November 2007. As part of the 2007 CS, an installation-wide MMRP Work Plan was also completed (finalized in March 2007). FTSW recently has expanded the cantonment area. To accomplish this, an approximately 4,240-acre portion of the operational footprint has been re-designated as other than operational and is no longer excluded from the MMRP. This Phase 2 MMRP Work Plan is a continuation of the initial 2007 MMRP Work Plan and is focused on evaluating the potential presence of historical munitions use on the 4,240-acre redesignated parcel. The additional MRSs include: the Anti-Tank Range 90MM – 2, Anti-Aircraft Range – 4, Grenade Launcher Range, and Small Arms Range - 2.

FTSW consists of 279,081 acres and is located north of Hinesville, GA, approximately 40 miles southwest of Savannah, GA. FTSW is the largest Army installation east of the Mississippi River, spanning portions of Bryan, Evans, Liberty, Long, and Tattnall counties. FTSW is bisected by Georgia Highway 119, which runs north to south from Pembroke to Hinesville and Georgia Highway 144, which runs east to west from Richmond Hill to Glennville. Situated south of Interstate 16 and west of Interstate 95, the installation boundaries are roughly defined by the intersection of Interstate 16 and Interstate 95 and the cities of Richmond Hill, Hinesville, Glennville, Claxton, and Pembroke.

Currently, the mission of FTSW is to sustain a quality of life and reservation support at the level necessary for divisions and non-divisional, tenant, and Reserve Component units to accomplish their training missions.

This Work Plan has been developed to provide a description of the tasks necessary to complete this project and to ensure that the project will conform with the USACE, Baltimore District project Performance Work Statement (PWS), dated 5 May 2009. In addition, this Work Plan incorporates the resolutions and ideas generated during the review and development process for this project. This Work Plan includes the following project specific information:

- Project objectives
- Project management
- Schedule
- Personnel
- Site location and history
- Field work
- Laboratory analyses
- Health and safety

The Uniform Federal Policy Quality Assurance Program Plan (QAPP) (Appendix A), Health and Safety Plan (HASP) (Appendix B), and Technical Project Planning (TPP) Meeting Minutes (Appendix C) are incorporated in this Work Plan.

This Work Plan will be used with the understanding that unanticipated conditions may dictate a change in the plan as written. Any necessary deviations from the plan will be brought to the attention of the USACE, Baltimore District Project Manager (PM) as soon as possible, and a written request for variance will be submitted to document the decision made.

1.1 PROJECT OBJECTIVES

The purpose of this project is to determine the presence or absence of munitions and explosives of concern (MEC) and munitions constituents (MC) that may remain from activities conducted by the Department of Defense (DoD) during operation of these sites and that may pose a threat to human health and/or the environment. The CS Work Plan and CS Report are intended to meet the goal of a MMRP SI Work Plan and SI Report. The primary goal of a MMRP SI and this CS is to collect information necessary to make one of the following decisions: 1) whether a RCRA Facilities Investigation (RFI)/Corrective Measures Study (CMS) is required at a MRS; 2)

whether an immediate response is needed; or 3) whether the MRS qualifies for no further action (NFA). The CS Report at FTSW will investigate the explosive safety threat posed by MEC at the MMRP eligible sites (Munitions Response Sites [MRSs or MRS]). It will also investigate human and ecological heath risks and environmental impacts associated with MC contamination at the MRSs on FTSW. The secondary goal of the CS is to collect information to complete the Cost to Complete (CTC) estimates and data to apply the MRS Prioritization Protocol for the MRSs. The data collected for this CS Report will be used to meet the secondary goal of the SI.

1.2 PROJECT MANAGEMENT

Malcolm Pirnie will provide all of the documents and will participate in all of the meetings and conference calls in accordance with the protocols stated in the USACE, Baltimore District project PWS and the Project Management Plan. The project schedule and personnel involved are outlined below.

1.2.1 Project Schedule

The project schedule has been established according to the performance of the following tasks as delineated by the USACE, Baltimore District project PWS.

- Task 1 – Stakeholder involvement
- Task 2 – Historical Records Review (HRR)
- Task 3 – TPP
- Task 4 – CS

The project schedule is provided in Attachment F.

1.2.2 Project Personnel

1.2.2.1 Malcolm Pirnie Project Personnel

Malcolm Pirnie project personnel and their responsibilities are listed in **Table 1-1**.

Table 1-1: Project Personnel

Name	Title
Heather Polinsky	Malcolm Pirnie Program Manager
Charles Myers	Malcolm Pirnie Corporate Health and Safety (H&S) Director (HSD)
Shelly Kolb	Malcolm Pirnie PM
Rosemarie Fehrman	Deputy/Field PM (FPM)
Marla Miller	Malcolm Pirnie Project Chemist
George Overby	Field personnel - MEC survey/ Unexploded Ordnance (UXO) Health and Safety Supervisor (UXOSS)
To Be Determined	Field personnel - MC sampling

Malcolm Pirnie Program Manager – Heather Polinsky

The Malcolm Pirnie Program Manager oversees the Malcolm Pirnie PM and reports directly to the USACE, Baltimore District PM. Any issues or problems the USACE, Baltimore District may experience with the Malcolm Pirnie PM may be addressed to the Malcolm Pirnie Program Manager. The Malcolm Pirnie Program Manager has full authority over the performance of the project and can direct changes in project implementation.

Malcolm Pirnie Corporate HSD – Charles Myers

The Malcolm Pirnie Corporate HSD maintains the organizational freedom and authority for ensuring full implementation of the Site Safety and Health Plan (SSHP) and Malcolm Pirnie's corporate H&S policy. The HSD can direct how the SSHP is implemented. This can include delegating authority to other personnel and directing the enforcement of the SSHP, including removing individuals from the project for non-compliance.

Malcolm Pirnie PM – Shelly Kolb

The Malcolm Pirnie PM has ultimate responsibility for all aspects of the project and reports directly to the Malcolm Pirnie Program Manager, Malcolm Pirnie Corporate HSD, and the USACE, Baltimore District PM. The Malcolm Pirnie PM is also responsible for project personnel safety and health, including correction of all identified unsafe acts or conditions and enforcement of procedures and regulations.

Malcolm Pirnie Deputy/FPM – Rosemarie Fehrman

The Malcolm Pirnie FPM is the primary contact for performance of field activities. The FPM is responsible for work with field staff for the implementation of the Work Plan, including the project quality assurance/quality control (QA/QC) requirements. The FPM will be on-site during field activities.

Malcolm Pirnie UXOSS– George Overby

The Malcolm Pirnie UXOSS reports to the Malcolm Pirnie PM for all aspects of the fieldwork and is responsible for enforcing all aspects of safety and health rules, policies, and procedures on behalf of Malcolm Pirnie.

Malcolm Pirnie Project Chemist – Marla Miller

The Project Chemist is responsible for the day to day management of the data at all stages to ensure that all project activities related to analytical data are performed to meet the project data quality objectives (DQOs).

1.2.2.2 Other Project Personnel

Table 1-2 lists the individuals and associated agencies/organizations also involved with this project. They are also included in the document distribution list.

Table 1-2: Other Project Personnel

Name	Org Code	Title	Work Phone
Army Environmental Command (AEC)			
Alan Freed	SFIM-AEC	Restoration Manager	410-436-0498
USACE, Baltimore District			
Marc Randrianarivelo	CENAB-EN-HM	PM	410-962-4869
USACE, Savannah District			
Zsolt Haverland	CESAS-EN-HM	Technical Manager	912-652-5815
FTSW			
Algeana Stevenson	FTSW/Hunter Army Airfield	PM	912-315-5144
Georgia Environmental Protection Division (GAEPD)			
A. Mohamad Ghazi	Hazardous Waste Center Management Branch	Geologist	404-656-2833
William Powell	Hazardous Waste Center Management Branch	Environmental Engineer	404-656-2833

1.2.2.3 Subcontractors

Subcontractors report to the Malcolm Pirnie FPM and UXOSS during performance of the tasks associated with their fieldwork and are responsible for complying with the project Work Plan while on-site. Katahdin Analytical Services, Department of Defense Environmental Laboratory Approval Program certifications, has been hired by Malcolm Pirnie to help complete this project. Laboratory qualifications are provided in the QAPP.

1.3 WORK PLAN ORGANIZATION

The Work Plan is organized as follows:

- **Section 1: Introduction**, the Work Plan consists of seven sections and five appendices. The remaining six sections and appendices of the Work Plan are outlined below:
- **Section 2: Project Overview** discusses the proposed activities to be conducted by Malcolm Pirnie as part of the CS.
- **Section 3: Technical Approach** outlines methods and overall QA/QC procedures.
- **Section 4: Field Activities** presents a detailed description of each MRS and site-specific field activities for the CS.
- **Section 5: Sample Management and Analysis** outlines field guidelines, including QA/QC associated with sample management. This section includes sample packaging and shipping requirements and investigative derived wastes (IDW) procedures.
- **Section 6: References**
- **Appendix A: QAPP**
- **Appendix B: HASP**
- **Appendix C: TPP Meeting Minutes**
- **Appendix D: Field Forms**
- **Appendix E: HRR Conceptual Site Model**
- **Appendix F: Project Schedule**
- **Appendix G: Ordnance Technical Data Sheets**

2 PROJECT OVERVIEW

The MMRP SI process, being conducted under RCRA correction action process for Fort Stewart, consists of five primary tasks which include the HRR, TPP, CS Work Plan, CS fieldwork, and CS Report.

HRR – consists of identifying data gaps from the U.S. Army's Phase 3 Closed, Transferring, and Transferred (CTT) Inventory and obtaining and reviewing historical records**.** The HRR is aimed at developing a draft Conceptual Site Model (CSM), focusing field work, and providing a common understanding of the MRS.

TPP – consists of planning activities conducted with the stakeholders to identify project objectives and designing data collection programs to meet objectives.

CS Work Plan – consists of preparing and submitting a site-specific Work Plan document reflecting the agreements made during the TPP session.

CS fieldwork – consists of performing investigation activities and preparing reports of findings as described in this Work Plan.

CS Report – consists of preparing and submitting a CS Report summarizing the results of the fieldwork, to include an updated CSM developed for each MRS with an appendix containing all information necessary to complete the MRS Prioritization Protocol.

2.1 HRR

A HRR for FTSW was finalized in June 2010 in support of CS. This document expanded on the information collected during the Phase 3 CTT Range Inventory and provided information pertinent to identifying, verifying, and establishing the physical limits and potential MEC and MC for each MRS. Historical records, aerial photos, existing site maps, and existing environmental restoration documents were reviewed, and interviews with installation personnel

were completed. An existing installation-specific background study, including sample analysis for metals, was reviewed. The following information is provided in the HRR:

- Project purpose/scope
- Project drivers
- Installation description/history
- Phase 3 CTT Range Inventory results
- Data collection and document review process
- MRS descriptions/HRR findings
- Draft CSM
  - MMRP site profile
    - Area and layout
    - Structures
    - Utilities
    - Boundaries
    - Security
  - Physical profile
    - Climate
    - Geology
    - Topography
    - Soil
    - Hydrogeology
    - Hydrology
    - Vegetation
  - Land use and exposure profile
    - Human receptors (current and future)
    - Zoning/land use restrictions
    - Beneficial resources
    - Demographics
  - Ecological profile
    - Habitat type
    - Degree of disturbance
    - Ecological receptors
  - Munitions/release profile
    - Munitions types and release mechanisms
    - Maximum probable penetration depth
    - MEC density
    - Munitions debris
    - Associated MC
    - Transport mechanisms/migration routes
  - Pathway analyses for MEC and MC
- Conclusions

This report documents the field activities planned for the additional MRSs not addressed during the March 2007 MMRP SI Work Plan. The focus of this Phase 2 MMRP HRR is to evaluate approximately 4,240 acres of property that have been redesignated as other than operational. In January 2009, a Preliminary Assessment (PA) of Small Arms Range – 2 was conducted. The purpose of the PA was to determine the MMRP eligibility of Small Arms Range – 2. As a result of this effort, it was determined that Small Arms Range – 2 was MMRP eligible and that further evaluation in the form of a CS investigation was warranted. During research completed as part of this HRR for the Small Arms Range – 2, three additional MRSs were identified in the newly reclassified area: the Anti-Tank Range 90MM – 2, Anti-Aircraft Range – 4, and Grenade Launcher Range.

As a result of the findings of the Phase 2 HRR, there are a total of four MMRP eligible sites (1,626 acres) at FTSW. Comments from the USACE, Baltimore District; USAEC, FTSW, and the stakeholders were incorporated into the Final HRR Report. The MRSs identified in the HRR are presented on Map 2-1. Summaries of each MRS are provided in Section 4 of this Report.

2.2 TPP PROCESS/STAKEHOLDER DATA QUALITY OBJECTIVE PROCESS

The TPP process is a comprehensive and systematic process that involves four phases of planning activities. It was developed for identifying project objectives and designing data collection programs. Use of the TPP process is consistent with the philosophy of taking a graded approach to planning that will produce the type and quality of results needed for site-specific decision-making.

A TPP session was held at FTSW on April 29, 2010. The results of the TPP session dictated the MEC and MC sampling/field activities planned for the installation. Table 2-1 provides a summary of decisions made to address MEC, and Table 2-2 provides a summary of decisions made to address MC. The Draft Meeting Minutes from the April 29, 2010 TPP session are included for review in Appendix C.

Table 2-1: Summary of MEC TPP Decisions

MRS	MEC CS Activities	
	Activity	Purpose
Anti – Aircraft Range -4	Magnetometer assisted visual survey during sampling activities of 100% of the undeveloped acres (20 acres).	Recommend RFI/CMS for MRS based on historical evidence of multiple overlapping range fans and multiple explosive ordnance disposal (EOD) responses.
Anti – Tank Range 90MM - 2	Magnetometer assisted visual survey during sampling activities of 10% of the undeveloped acres (33 acres).	Recommend RFI/CMS for MRS based on historical evidence of multiple overlapping range fans.
Grenade Launcher Range	Magnetometer assisted visual survey during sampling activities of 10% of the undeveloped acres (4 acres).	Recommend RFI/CMS for MRS based on historical evidence of multiple overlapping range fans.
Small Arms Range - 2	No MEC field activities are required because only small arms were used at the MRS.	

Table 2-2: Summary of MC TPP Decisions

MRS	MC CS Activities	
	Activity[1]	Purpose
Anti – Aircraft Range - 4	Collect 4 discrete surface soil samples. Sample locations will be randomly distributed unless biased locations are identified. Analyze for explosives and metals using United States Environmental Protection Agency (USEPA) Methods 8330B modified and 6010B	To support MC RFI/CMS recommendation based on historical and multiple EOD responses. To provide data to complete the MRSPP. To gain a greater understanding of site conditions related to MC to support the next study phase and to complete the CTC. Compare data to: • FTSW Inorganic/Metal Background Study • USEPA Regional Screening Levels (RSL) for Residential Soil • Region 4 Ecological Screening Values for surface soil

MRS	MC CS Activities	
	Activity[1]	Purpose
Anti – Tank Range 90MM - 2	Collect 4 discrete surface soil samples. A minimum of two samples will be biased and collected from the firing points of the Anti-Tank 90MM and Anti-Aircraft 40MM ranges. The remaining two contingency samples will be randomly distributed unless biased locations are identified. Analyze for explosives and metals using USEPA Methods 8330B modified and 6010B	Support CTC/Prioritization Protocol. RFI/CMS recommended for MRS based on historical evidence of multiple overlapping range fans Compare data to: • FTSW Inorganic/Metal Background Study • USEPA RSL for Residential Soil • Region 4 Ecological Screening Values for surface soil
Grenade Launcher Range	Collect 14 discrete surface soil samples. Three samples each will be collected from the location of the berms of Ranges H, B, and A. Additionally, three samples will be collected from the firing point of the 120-MM Anti-aircraft Range. The remaining two contingency samples will be randomly distributed unless biased locations are identified. Analyze sample for explosives and metals using USEPA Methods 8330B modified and 6010B.	RFI/CMS recommended for MRS based on historical evidence of multiple overlapping range fans. Support MC NFA or RFI/CMS determination. Compare data to: • FTSW Inorganic/Metal Background Study • USEPA RSL for Residential Soil • Region 4 Ecological Screening Values for surface soil
Small Arms Range - 2	Collect 10 discrete surface soil samples. Eight of the ten samples will be collected from Range N. Two samples will be collected from each of the four firing positions/berms on Range N. The remaining two samples will be randomly distributed unless biased locations are identified. Lead by USEPA Method 6010B	RFI/CMS recommended for MRS based on historical evidence of multiple overlapping range fans. Support MC NFA or RFI/CMS determination. Compare data to: • FTSW Inorganic/Metal Background Study • USEPA RSL for Residential Soil • Region 4 Ecological Screening Values for surface soil

2.3 CS FIELD ACTIVITIES

The goal of this project is to determine the presence or absence of MEC and MC that may remain from activities conducted by the DoD during operation of these sites and that may pose a threat to human health and/or the environment.

During the field sampling event, qualified team members (UXO Technicians III) will inspect the surface for MEC and provide anomaly avoidance support. Samples will be collected to analyze for metals and explosives as dictated by historical site activities. The fieldwork will take place during August 2010 and will last approximately five days.

As agreed upon during the 29 April 2010 TPP session only surface soil samples will be collected during the CS field activities. MC characterization will occur for each MRSs during the RFI investigative activities. It is anticipated that 32 surface soil samples, plus 9 additional QC samples, will be collected for analytical laboratory analysis. The analytical methods were selected on the basis of the types of munitions known to have been used at the MRS and include the standard suite of range-related analytical parameters to account for unknown items. The standard analytical methods include metals (aluminum, antimony, copper, lead and zinc) by USEPA Method 6010B and explosives by USEPA Method 8330B modified. All field and laboratory work will be of the quality to support screening against the following in the listed order:

- FTSW Inorganic/Metal Background Study (April 2000)
- USEPA RSL for Residential Soil
- Region 4 Ecological Screening Values for Surface Soil

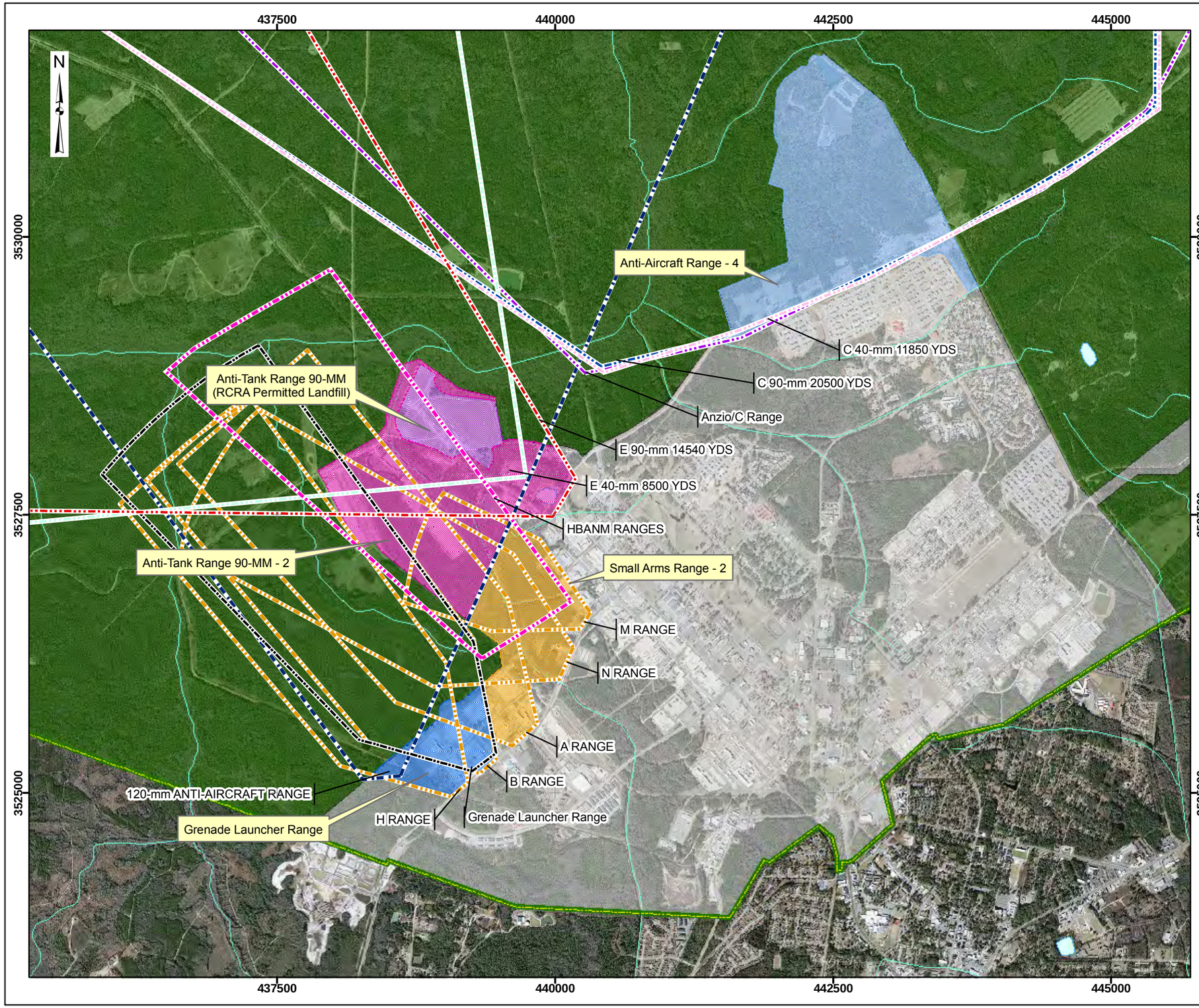
2.4 PROJECT DELIVERABLES

In addition to this Work Plan, Malcolm Pirnie will develop and submit a CS Report, which will include the:

- Final CSM;
- Analytical data; and
- Results of instrument assisted site walk.

In accordance with the PWS, all the analytical data generated during this field effort will be uploaded into the U.S. Army's Environmental Restoration Information Systems (ERIS) web-based database. The data will include the following information for each sample collected: sample identification number; preservation; date sampled; media type; site location; chemical analyses; and validation review. The format requirements for the ERIS database are in the QAPP (Appendix A). If the ERIS database format is revised during MMRP investigations, the newly established database format shall be included as an appendix to the QAPP.

Phase 2 Confirmatory Sampling Work Plan Fort Stewart, GA



Map 2-1
Phase 2 HRR MRS Overview

Legend

Installation Data
- Installation Boundary
- Other than Operational Area
- Operational Area

Phase 2 MRS (Other than Operational Area)
- Small Arms Range - 2
- Anti-Tank Range 90-MM - 2
- Anti-Aircraft Range - 4
- Grenade Launcher Range

Phase 1 MRS
- Anti-Tank Range 90-MM

Historical Fans
- Small Arms (HBANM RANGES) 1940
- Anti-Tank (E 90-mm 14540 yards) 1941
- 90-mm Anti-Aircraft (C Range) 1957,1962,1964
- 40-mm Anti-Aircraft (C 40-mm 11850 YRDS) 1941
- 90-mm Anti-Aircraft (C 90-mm 20500 YRDS) 1941
- 40-mm Anti-Aircraft (E 40-mm 8500 YRDS) 1941
- 120-mm Anti-Aircraft
- Small Arms 1944
- Grenade Launcher Range

Hydrology
- River/Stream
- Water Body

0 350 700 1,050 1,400 Meters

Data Source: Fort Stewart, GA

Coordinate System: UTM Zone 17N
Datum: NAD83
Units: Meters

Contract: DACA31-05-D-0004
Edition: Final
Date: August 2010

3 TECHNICAL APPROACH

The sampling rationale/design for the CS is to collect sufficient data to confirm the presence/absence of MEC or MC within the areas of concern. Based upon the objectives of this CS, the following items have been incorporated into the sampling program rationale/design.

3.1 MEC ACTIVITIES

This portion of the fieldwork should be such that exclusion zone impacts, engineering control requirements, clearing and grubbing efforts, and MEC disposal activities are not required. In some cases, encountering just one MEC item will be sufficient to determine that further investigation is necessary for a particular MRS. The field activities for the CS are not intended to confirm all types of MEC present, determine MEC density, or define the exact limits of the MEC impacts. The areas over which MEC activities will be conducted are discussed in detail in Section 4.

MEC that are discovered during sampling activities will not be removed, disturbed, or otherwise compromised. The sampling team will make a photographic record of the MEC item and make field notes indicating the location of the item, its conditions, and any other pertinent information. The location of the MEC item will be recorded with Global Positioning System (GPS) equipment. This information will be recorded on the MEC/Multiple Anomaly Form which is provided in Appendix D. The field crew will notify the DPW, USAEC, and USACE, Baltimore District of any MEC items encountered at the completion of field activities each day. If multiple MEC items are encountered during the field activities DPW and USACE, Baltimore District will be contacted to decide how to proceed.

3.1.1 Instrument Assisted Visual Survey

A limited instrument assisted visual survey of the suspected MEC sites (listed in Section 4) will be performed to locate and document MEC found during the site walk. Field team personnel will conduct the visual survey while being escorted by an UXO Technician III. This activity will

be limited to a surface walkover to identify materials and/or surface features that provide information on the areas and activities in question.

A Schonstedt handheld magnetometer will be used to conduct the limited survey and detect surface MEC (primarily used for MEC anomaly avoidance for safety purposes). A transect sweep approach will be used to search the identified MRS, depending on the terrain and layout. Each transect will be approximately 5 feet in width and spaced 40 feet apart, depending on the terrain, vegetation, line-of-site, and percentage of site to be covered. Site-specific details are provided in Section 4 for each MRS.

The following steps will be conducted during the site walk:

- Prior to entering an area requiring anomaly avoidance, the UXO Technician III will conduct a tailgate safety brief. This brief will cover emergency procedures, operations, types of suspected MEC that may be encountered during the site visit, and anomaly avoidance procedures.
- The UXO Technician III will enter the site first and will conduct a surface sweep of the path as the survey team follows behind in a single file. The team will identify target areas containing MEC, to include discarded military munitions, munitions debris and masses of buried materials.
- Target areas containing MEC will be marked and documented.
- Survey of firing points (where appropriate) will be documented, the GPS locations will be recorded, and the areas will be photographed.
- The survey team will observe the area for pits, craters, and unusual holes—these could indicate impact areas, demolition sites or burial pits. These areas will be documented using the MEC/Multiple Anomaly Discovery Form, the GPS locations will be recorded, and the areas will be photographed.
- If MEC are discovered, the UXO Technician III will mark the item, GPS coordinates for the item will be recorded, and the MEC item will be logged as to its description, size, color, and any other distinguishable marks. Pertinent data will be entered on an MEC/Multiple Anomaly Discovery Form. A digital photograph of the item will be taken, and the photo number and item description will be noted in the logbook. At no time will the MEC item be moved or disturbed. After collecting the necessary data, the team will proceed with its survey.
- If any live or suspected live MEC are encountered during the limited visual survey, they will be marked for positive identification, and an immediate response trigger evaluation described in Section 3.1.2 will be performed. The FTSW DPW, USAEC, and USACE, Baltimore District will be notified if any MEC item is encountered during fieldwork

The following function check procedures will be used to perform function tests on the equipment used during the visual survey:

- Hand-held metal detectors (i.e., Schonstedt,) will be swept across known selected items within an area outside of the site to demonstrate consistent effectiveness.
- Instruments and equipment used to gather and generate data will be tested with sufficient frequency and in such a manner as to ensure that accuracy and reproducibility of results are consistent with the manufactures' specifications. Instruments or equipment failing to meet the standards will be repaired, recalibrated, or replaced. Replaced instruments or equipment must meet the same specifications for accuracy and precision as the item removed from service.

In addition an all metals detector assisted visual survey will be conducted in order to locate remnants of small arms rounds that may remain. A transect sweep approach will be used to search the identified MRS. Each transect will be approximately 5 feet in width and spaced 40 feet apart, depending on terrain, vegetation, and line-of-site.

3.1.2 Triggers for Immediate Response

MEC removals will not be conducted as part of the CS. However, the field team may encounter MEC and munitions debris during site reconnaissance. An UXO Technician III will accompany the data collection team and provide MEC escort services for all data collection personnel. Any MEC and munitions debris that is encountered will be identified to help characterize the MEC and/or MC at the MRS. Under no circumstances will MEC be handled, moved, or disturbed during the visual survey. Any MEC items encountered during the CS field activities will be reported to FTSW EOD. FTSW EOD will be responsible for disposal of MEC items encountered and reported.

The CS fieldwork is not intended to include removal or disposal actions; however, if identified, an MEC or explosives hazard must be reported, and a decision must be made about its disposition, if any. The decision is based on the overall threat to human health and the environment. The level of threat is based on an overall understanding of the situation and its risk, based on site-specific data and the factors discussed in **Table 3-1**.

Table 3-1: MEC Factors for Immediate Response Actions

MEC Factor	Status Questions
Accessibility of the MEC	Is it in an area that is restricted to the public with engineering controls that preclude entry, such as fences, security guards, or posted hazards signs? Is the MEC in an area that is accessible to the public, and does this create an imminent hazard to people or the environment?
Type of MEC	What is the condition, fuzing type, net explosive weight and specific hazards of the item? Does the MEC pose an immediate threat?
Site assessment	Do the MEC and/or MC site conditions require using protective measures such as tamping, shielding, or focusing of the heat, blast, and shockwave to mitigate the explosive effects? What is the maximum fragmentation range and over-pressure distance of the MEC?
Other considerations	Can the hazard be moved? Can the area within the fragmentation and blast distance withstand a detonation, and are there critical habitats or facilities located nearby?

For the purposes of the CS, Malcolm Pirnie will immediately report the presence of MEC and the information needed to answer the questions in **Table 3-1** for determination of the appropriate action to the USACE, Baltimore PM, USAEC, and the installation point of contact (POC).

3.2 MC ACTIVITIES

The goal of the field sampling activities for MC is to determine if the MRS has been impacted by MC. Anomaly avoidance techniques will be utilized during the MC field sampling activities. Analytical results exceeding background levels and appropriate regulatory limits agreed on during the TPP session will be used for justification in moving the MRS into the RFI/CMS phase. The CS field sampling activities are not intended to determine the nature and extent of all contaminants.

All fieldwork will be of the quality needed to meet the DQOs for the project as dictated in the QAPP, the TPP Meeting Minutes, and decisions agreed upon after the TPP meeting. A decision to limit the metals analysis to primary or indicator compounds associated with the munitions history of each MRS was agreed upon after the TPP meeting. As a result of this, the metals

analysis for the FTSW MRSs will be limited to aluminum, antimony, copper, lead and zinc, which are the primary MC associated with the munitions history of these MRSs. The primary MC for the munitions items was determined utilizing the U.S. Army Technical Manuals 43-0001-28, 43-0001-29, 43-0001-30, and the MIDAS database created by the Defense Ammunition Center Technology Directorate. For MRSs where historical evidence indicates small arms use only metals analysis will be limited to lead as agreed upon during the TPP meeting. The details of the planned MEC and MC field sampling activities are provided in Section 2.

3.2.1 Surface Soil

Surface soil samples will be collected as discrete samples. Sampling rationale for each MRS is described in Section 4.

Surface soil samples will be collected with a disposable scoop or similar equipment while wearing Nitrile gloves. New scoops and gloves will be used at each sampling location. The analytical samples will be collected and placed directly into the appropriate sample containers, labeled, and placed in an ice chest chilled to a maximum temperature of 4 degrees Celsius. A portion of the sample will be set aside and used to log a description of the soil characteristics using the Unified Soil Classification System on a sample log form. After a sample is put into the ice chest, the chain of custody (COC) and Daily Quality Control Report (DQCR) forms will be filled out. The remaining soil will be disposed of on the ground surface at the locations from which they were collected. If field conditions dictate that disposable equipment cannot be used, reusable sampling equipment will be decontaminated before moving to the next sampling location. Decontamination procedures are presented in Section 3.8 of this document. If the use of reusable equipment becomes necessary, rinse blank samples will be collected as discussed in Section 3.7 of this document and as described in the QAPP. Surface sample locations will be recorded using a handheld GPS unit.

3.2.2 Chemistry Analyses

Malcolm Pirnie will meet the project-specific DQOs for sampling and analysis and the QA/QC objectives by collecting the proper quantities and types of samples, using the correct analytical methodologies, implementing field and laboratory QA/QC procedures, and using various data

validation and evaluation processes. The DQOs for each analytical method are provided in the QAPP (Appendix A). Laboratory requirements for the analytical methods being used for this project are provided below and in the QAPP. These procedures include requirements for sample preparation, sampling containers, preservation methods, and holding times.

The QAPP has been developed to support the sampling, analysis, and evaluation activities associated with this project. The QAPP consists of policies, procedures, specifications, standards, and documentation sufficient to produce data of quality adequate to meet the DQOs for the project, RCRA standards, and to minimize loss of data due to out-of-control conditions or malfunctions.

The QAPP has been prepared to ensure that this responsibility is met throughout the duration of this project. It addresses procedures to assure the precision, accuracy, representativeness, completeness, and comparability of field and laboratory data generated during the course of this project. It also provides a framework for evaluating existing data that may be used in this project. The QAPP defines the first stage of the QA requirements for sample and data acquisition, handling, and assessment.

QA procedures, such as tracking, reviewing and auditing, are implemented as necessary to ensure that all project work is performed in accordance with professional standards, USEPA and USACE regulations and guidelines, and the specific goals and requirements stated in this Work Plan.

QC of sample collection, analysis, and assessment will be performed by technical project personnel. Laboratory equipment will be maintained and calibrated, and records of these activities will be kept in accordance with established procedures. This will include laboratory oversight by Malcolm Pirnie project personnel, as well as laboratory data and document review.

Per the USEPA criteria for data quality for risk-based projects, 10% of the analytical data are required to meet a comprehensive data level of QA/QC related to sample collection, laboratory analysis, and data validation techniques. Following the processes identified in the QAPP, final

data usability will be determined by the USACE Project Chemist in coordination with the Malcolm Pirnie PM and Malcolm Pirnie Project Chemist.

Overall QA review of documentation, field sampling and laboratory QC will allow determination of the acceptability of these data for use in this project. Sample chemical analyses are discussed in greater detail in the QAPP (Appendix A).

3.3 GPS SURVEYING

Each sample location will be surveyed to document the location. The GPS unit proposed for use is a Trimble GeoExplorer CE, Geo XT handheld unit. Pathfinder Office software will be used to download and post process the data to achieve sub-meter horizontal accuracy. Field conditions, such as the number of satellites available at the reading time and density of the tree canopy, dictate the amount of time needed to acquire a reading. Coordinates will be established for each sample location to an accuracy of 1 meter.

3.4 FIELD EQUIPMENT

A variety of equipment will be used to perform the field activities for this project. Table 3-2 lists the field equipment that will be used.

Table 3-2: Field Equipment

Category	Equipment
Surface sampling	Disposable scoops (or similar), plastic sheeting, all metals detector, Schonstedt
H&S equipment	Safety boots, safety glasses, first aid kit, fire extinguisher, protective clothing, Nitrile gloves, hard hat if a danger of falling overhead objects exists.
Shipping	Packaging tape, labels, seals, COC forms, ice, zip top bags, coolers, bubble wrap, packaging material
Documentation	DQCR forms, field log book, boring logs, all applicable H&S forms
Sample containers	See Table 4-1 in the QAPP
Decontamination supplies[1]	Liquinox or Alconox detergent, potable water, deionized (DI) water, scrub brushes, decontamination tubs/buckets
GPS	Trimble GeoExplorer CE, Geo XT handheld unit

[1] If disposable equipment cannot be used, reusable sampling equipment (with decontamination supplies) will be used

3.5 LABORATORY ANALYSIS

The analytical methods are selected on the basis of the munitions items known to have been used at the MRS and include the standard suite of range-related analytical parameters to account for unknown items. As per a decision made and agreed upon after the TPP meeting the metals analysis will be limited to primary or indicator compounds associated with the munitions history of each MRS. As a result of this the metals analysis for the FTSW MRSs will be limited to aluminum, antimony, copper, lead and zinc which are the primary MC associated with the munitions history of this MRS. For MRSs where historical evidence indicates small arms use only metals analysis will be limited to lead as agreed upon during the TPP meeting. The standard analytical methods include USEPA Methods 6010B for metals (aluminum, antimony, copper, lead, and zinc) and USEPA Method 8330B modified for explosives. Screening criteria are listed in the QAPP.

3.6 QA/QC SAMPLES

QA and QC procedures are documented in the QAPP. QA and QC samples are samples analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QC samples include equipment/rinsate blanks, temperature blanks, and matrix spike/matrix spike duplicates (MS/MSD). QA samples include field duplicate samples.

3.6.1 QC Samples

Sample QC for analytical samples will be provided in the field through the use of equipment/rinsate blanks, temperature blanks, and MS/MSD. The QC samples will be handled as regular samples. In order for distinctions to be determined between study areas, the different types of samples will be submitted in separate batches for laboratory analysis. Calibrations and associated QC samples will not be mixed between sample types. Sample QC for the analytical samples will be provided in the field through the use of duplicate field samples. QC samples are used to evaluate the contract laboratory's performance. Duplicate samples are collected as a single sample, which is divided into two equal parts.

The following QC samples will be collected for analytical samples:

Matrix spikes: Samples will be collected to be split in the lab and run as MS/MSD in an amount equal to at least 5% of the study area samples for laboratory analysis.

Equipment/rinsate blanks: Equipment/rinsate blanks will not be collected because disposable sampling equipment will be used at the MRS. However, if field conditions dictate that equipment requiring decontamination be utilized sampling equipment will be decontaminated prior to and after each use, and equipment/rinsate blanks will be collected and analyzed in accordance with the QAPP (Appendix A), (i.e., one field blank per decontamination event per equipment type).

The number of QC samples to be collected is presented in **Table 3-3**.

3.6.2 Field Duplicate Samples

Sample QA for the analytical samples will be provided in the field through the use of field duplicate samples. QA samples are used to evaluate the contractor's laboratory performance. Duplicate samples are collected as a single sample, which is divided into two equal parts. As shown in Table-3-3, QA samples will be collected at a rate of at least 10% of the field samples collected. QA split samples will not be collected during the CS phase as discussed during negotiations between Malcolm Pirnie and USACE prior to contract award and per Malcolm Pirnie's general assumptions submitted with the cost estimate and accepted by USACE.

Table 3-3: Quantities of Analysis

Analysis	Media	Baseline Samples(1)				
		Field Samples	Matrix Spikes(2)	Matrix Spikes Duplicate(2)	Duplicate Field Samples(3)	Total Analyses
Metals(4,5) (aluminum, antimony, copper, lead and zinc)	Soil	32	2	2	3	39
Explosives(6)	Soil	24	1	1	3	29

(1) If equipment decontamination is necessary, then equipment blank samples must also be collected at a rate of one field blank per decontamination event per equipment type, not to exceed one per day.
(2) Two samples indicate one MS/MSD pair, collected at a rate of one pair per 20 samples.
(3) Field duplicates will be collected at a rate of one per 10 samples.
(4) As per a decision made and agreed upon after the TPP meeting the metals analysis will be limited to primary or indicator compounds associated with the munitions history of each MRS.
(5) Ten of the metals samples will be limited to lead only.
(6) Two explosives samples will be collected at the Small Arms Range -2 MRS, at each EOD response location.

3.7 SAMPLING EQUIPMENT DECONTAMINATION

In an effort to achieve the highest level of QC, one time use and disposable sampling equipment will be used whenever feasible. This type of equipment includes sampling gloves, scoops, and pre-cleaned sample jars. Applicable equipment will be decontaminated as discussed in the remainder of the section.

3.7.1 Decontamination Procedures/Sample Contaminant Sources

This section provides instructions on deciding on the appropriate decontamination scheme(s) for the project field sampling equipment in order to prevent or reduce cross-contamination of project samples. The applicability of each step in a decontamination protocol will depend upon factors such as the contaminants present on-site, the subsequent analysis to be performed, and the composition of the sampling devices. The appropriateness of a decontamination protocol is vital to the eventual validity of the analytical results and decisions made based upon those results. All sampling equipment that has come in contact with a potentially contaminated media must be cleaned prior to the subsequent use of that device. Unless field conditions dictate a change in the equipment planned for use, pre-wrapped, sterile, plastic, disposable scoops will be utilized for collecting soils samples at the installation. The scoops will be used to collect one sample and then disposed of to avoid cross-contamination between samples and locations. If field conditions dictate that other sample collection methods are required and equipment decontamination becomes necessary, all equipment will be properly decontaminated prior to and following the collection of each sample. Decontamination procedures are summarized below can be found in Section 4.7 of the QAPP (Appendix A).

3.7.2 Reagents

The detergent wash is a non-phosphate detergent solution used with brushing or circulating techniques to remove gross contamination and/or used as a mild neutralizing agent. Tap water is considered a rinse-water, preferably from a water system of known chemical composition. Acid rinses are used as the inorganic solubilizing agent or as a mild neutralizing agent. These rinses are 10:1 solution of water and acid (hydrochloric acid), respectively. The solutions are prepared from reagent grade acids and DI water. Solvent rinses are used as an organic solubilizing agent. Requirements for solvent types vary depending upon the nature of known organic contamination

requiring solubilization and any impurities present within the rinse that may potentially interfere with or contribute to the subsequent analysis. All solvent rinses used must be of pesticide grade quality. Finally, the DI water is organic-free reagent water. Analyte-free water may be used as deemed appropriate.

3.7.3 Sample Contaminant Sources and Other Potential Problems

Contaminant carryover between samples and/or from leaching of the sampling devices is very complex and requires special attention. Decisions concerning the appropriateness of the device's material composition must account for these carryover or leaching potentials and whether these contaminants are of concern on the project. Disposable equipment will be used for all sampling procedures.

3.8 HEALTH & SAFETY

The HASP (Appendix B) provides general H&S procedures applicable to sampling and analytical activities to be performed at all installations where MMRP SIs are being conducted by Malcolm Pirnie (within USACE, North and South Atlantic Divisions). The HASP sets forth health and safety protocols to be used by Malcolm Pirnie employees and its subcontractors during field activities. All work will be in conformance with the HASP unless formally modified and approved by the Malcolm Pirnie UXOSS and reviewed by the Contracting Officer via a formal record of change. The intent of the HASP is to ensure the health and safety of all site personnel, the general public, and the environment. Although it is impossible to eliminate all risks, adherence to the HASP will help minimize incidents and accidents by promoting safety while maintaining productivity. It should be noted that the HASP may include discussions that are not applicable to a specific site since it is intended to encompass all sites.

It is intended that once the HASP is finalized, it will not be modified (except for programmatic changes) and will serve as a programmatic document. Site-specific sampling information and any exceptions or proposed changes to the HASP are addressed and included in the SSHP which is included as Attachment 1 to the HASP. The SSHP is not a stand-alone document from the HASP. The HASP will provide the majority of the H&S information; the SSHP simply supplements the information in the HASP by providing for site-specific condition requirements.

4 FIELD ACTIVITIES

The field activities that will be completed at each of the MRSs at FTSW in order to identify whether MEC and/or MC are present were determined using the TPP process. The determination of whether further investigation is required or if a NFA determination is appropriate for each MRS will be made using a weight of evidence approach. Examples of evidence that will be included in the decision making process include historical information, analytical results (screened against established background levels, and agreed upon regulatory limits), and field observations. A brief site description and the agreed upon MEC/MC field activities are presented below for each of the four MRSs. Map 2-1 shows the relative location of each MRS on the installation and the historical range fans that overlap and make up each of the FTSW MRSs.

4.1 ANTI – AIRCRAFT RANGE -4 (FTSW-009-R-01)

4.1.1 Site Description

The MRS layout and location are presented on **Map 4-1**. This MRS is a 661-acre parcel located in the northern portion of the cantonment area and was used for anti-aircraft range training from 1941 to 1964. The MRS is composed of the firing points of a total of three separate/collocated ranges. The combined acreage covered by these three historical ranges is 85,325 acres, 661 acres of which are not in the operational range area and, thus, overlap the other than operational area and make up Anti-Aircraft Range – 4. The boundary of the MRS was expanded southeast beyond the firing point area to include a currently undeveloped area where an EOD response was documented. Based on historical data reviewed for this HRR, the expected munitions use associated with this MRS includes 40mm and 90mm anti-aircraft projectiles. The following EOD responses occurred at the site: “40mm” projectile (along the northern boundary of the site), “mortar round” (western central section of the site), “M67” hand grenade (along the southeast boundary) and a “2.75 rocket” (southern central section of the site). Additionally, one EOD response [labeled “EOD Response (no information)”] was reported along the southern boundary and northern central section of the site, details regarding the munitions items encountered were not available. Appendix E of this Work Plan includes the CSM developed for the Anti-Aircraft Range -4.

Map 4-1. This MRS is a 661-acre parcel located in the northern portion of the cantonment area and was used for anti-aircraft range training from 1941 to 1964. The MRS is composed of the firing points of a total of three separate/collocated ranges. The combined acreage covered by these three historical ranges is 85,325 acres, 661 acres of which are not in the operational range area and, thus, overlap the other than operational area and make up Anti-Aircraft Range – 4. The boundary of the MRS was expanded southeast beyond the firing point area to include a currently undeveloped area where an EOD response was documented. Based on historical data reviewed for this HRR, the expected munitions use associated with this MRS includes 40mm and 90mm anti-aircraft projectiles. The following EOD responses occurred at the site: "40mm" projectile (along the northern boundary of the site), "mortar round" (western central section of the site), "M67" hand grenade (along the southeast boundary) and a "2.75 rocket" (southern central section of the site). Additionally, one EOD response [labeled "EOD Response (no information)"] was reported along the southern boundary and northern central section of the site, details regarding the munitions items encountered were not available. Appendix E of this Work Plan includes the CSM developed for the Anti-Aircraft Range -4.

4.1.2 Proposed MEC/MC Activities

MEC Activities: Based on information presented in the HRR, the potential for MEC at the site exists; therefore, activities associated with MEC presence will be performed, including a magnetometer assisted visual survey during sample activities. A magnetometer assisted site walk will determine the presence of MEC on the site. Field personnel (escorted by a UXO Technician III) will traverse evenly spaced transects in order to complete the magnetometer assisted surface sweep/visual survey of 100% of the undeveloped area (approximately 20 acres). An MEC/Multiple Anomaly Discovery Sheet (Appendix D) will be completed if MEC or munitions debris are detected with the magnetometer. This site is recommended for RFI/CMS due to historical evidence of multiple overlapping range fans (Map 2-1) and multiple EOD responses.

MC Activities: Four discrete surface soil samples will be collected from randomly distributed locations unless biased locations are identified. Based on the historical layout and use of this MRS, berms or burial areas are not anticipated therefore only surface soil samples, at a depth of

0 – 6 inches, will be collected. Soil samples will be analyzed for aluminum, antimony, copper, lead, and zinc (USEPA Method 6010B) and explosives (USEPA Method 8330B modified). Data will be compared to FTSW inorganic/metal background values, USEPA Residential RSLs, and Region 4 Ecological Screening Values for Surface Soil for metals and explosives. This site is recommended for RFI/CMS based on historical evidence of multiple overlapping range fans (Map 4-1) and multiple EOD responses.

4.2 ANTI – TANK RANGE 90MM -2

4.2.1 Site Description

The MRS layout and location are presented on **Map 4-2**. This 546-acre MRS is located in the northwestern portion of the cantonment area and was used for anti-tank, anti-aircraft, grenade launcher, and small arms training during the 1940s. The MRS is composed of eight range fans. The total acreage covered by the eight historical ranges is 17,015 acres, 546 acres of which overlap the other than operational area and make up Anti-Tank Range 90MM – 2. The MRS is composed of the firing point of two separate collocated ranges (Anti-Tank Range 90MM – 2 and a 40mm anti-aircraft range) and the downrange area of six separate ranges (Ranges A, N, M, HBANM small arms range, grenade launcher range and a 120mm anti-aircraft range). The known munitions use associated with this MRS includes 40mm and 120mm anti-aircraft projectiles, 40mm grenades (practice), and 90mm anti-tank projectiles. No documentation of EOD responses was identified at this site. Appendix E of this Work Plan includes the CSM developed for the Anti-Tank Range- 90MM- 2.

4.2.2 Proposed MEC/MC Activities

MEC Activities: Based on information presented in the HRR, the potential for MEC at the site exists; therefore, activities associated with MEC presence will be performed, including a magnetometer assisted visual survey during sample activities. A magnetometer assisted site walk will determine the presence of MEC on the site. Field personnel (escorted by a UXO Technician III) will traverse evenly spaced transects in order to complete the magnetometer assisted surface sweep/visual survey of 10% of the undeveloped area (approximately 33 acres). An MEC/Multiple Anomaly Discovery Sheet (Appendix D) will be completed if MEC or

4.3 GRENADE LAUNCHER RANGE

4.3.1 Site Description

The MRS layout and location are presented on **Map 4-3**. This 132-acre MRS is located along the western perimeter of the cantonment area and was historically used as a grenade launcher range (practice), infiltration course, 120mm anti-aircraft range, and three small arms ranges during the 1940s. The total acreage covered by the six historical ranges is 10,947.6 acres, 132 acres of which overlap the other than operational range area and make up Grenade Launcher Range MRS. According to documents reviewed for the HRR, munitions used on the Grenade Launcher Range included 40mm practice grenades, small arms, and TNT. Archival documents from 1941 document the use of .30 caliber (cal) and .50 cal machine guns on FTSW. Therefore, it is assumed that .30 cal and .50 cal small arms were used on this MRS. Additionally, 120mm anti-aircraft projectile use occurred on approximately 15 acres of the MRS. No EOD responses have been reported for this MRS. Appendix E of this Work Plan includes the CSM developed for the Grenade Launcher Range.

4.3.2 Proposed MEC/MC Activities

MEC Activities: Based on information presented in the HRR, the potential for MEC at the site exists; therefore, activities associated with MEC presence will be performed, including a magnetometer assisted visual survey during sample activities. A magnetometer assisted site walk will determine the presence of MEC on the site. Field personnel (escorted by a UXO Technician III) will traverse evenly spaced transects in order to complete the magnetometer assisted surface sweep/visual survey of 10% of the undeveloped area (approximately 4 acres). An MEC/Multiple Anomaly Discovery Sheet (Appendix D) will be completed if MEC or munitions debris are detected with the magnetometer or if potential burial sites are found during the site walk. The FTSW DPW, USAEC, and USACE, Baltimore District will be notified if a MEC item is encountered during fieldwork.

MC Activities: Fourteen discrete surface soil samples will be collected at biased locations when possible or at random locations throughout the site. Based on the historical layout and use of this MRS, berms may be present. Three samples will be collected from locations of the berms from

4.3 GRENADE LAUNCHER RANGE

4.3.1 Site Description

The MRS layout and location are presented on **Map 4-3**. This 132-acre MRS is located along the western perimeter of the cantonment area and was historically used as a grenade launcher range (practice), infiltration course, 120mm anti-aircraft range, and three small arms ranges during the 1940s. The total acreage covered by the six historical ranges is 10,947.6 acres, 132 acres of which overlap the other than operational range area and make up Grenade Launcher Range MRS. According to documents reviewed for the HRR, munitions used on the Grenade Launcher Range included 40mm practice grenades, small arms, and TNT. Archival documents from 1941 document the use of .30 caliber (cal) and .50 cal machine guns on FTSW. Therefore, it is assumed that .30 cal and .50 cal small arms were used on this MRS. Additionally, 120mm anti-aircraft projectile use occurred on approximately 15 acres of the MRS. No EOD responses have been reported for this MRS. Appendix E of this Work Plan includes the CSM developed for the Grenade Launcher Range.

4.3.2 Proposed MEC/MC Activities

MEC Activities: Based on information presented in the HRR, the potential for MEC at the site exists; therefore, activities associated with MEC presence will be performed, including a magnetometer assisted visual survey during sample activities. A magnetometer assisted site walk will determine the presence of MEC on the site. Field personnel (escorted by a UXO Technician III) will traverse evenly spaced transects in order to complete the magnetometer assisted surface sweep/visual survey of 10% of the undeveloped area (approximately 4 acres). An MEC/Multiple Anomaly Discovery Sheet (Appendix D) will be completed if MEC or munitions debris are detected with the magnetometer or if potential burial sites are found during the site walk. The FTSW DPW, USAEC, and USACE, Baltimore District will be notified if a MEC item is encountered during fieldwork.

MC Activities: Fourteen discrete surface soil samples will be collected at biased locations when possible or at random locations throughout the site. Based on the historical layout and use of this MRS, berms may be present. Three samples will be collected from locations of the berms from

Ranges H, B, and A. Additionally, three samples will be collected from the firing point of the 120-MM Anti-Aircraft Range. Soil samples will be analyzed for aluminum, antimony, copper, lead, and zinc (USEPA Method 6010B) and explosives (USEPA Method 8330B modified). Data will be compared to FTSW inorganic/metal background values, USEPA Residential RSLs, and Region 4 Ecological Screening Values for Surface Soil for metals and explosives. If MC results in all of the samples fall below the applicable screening standards, the site may be recommended for NFA, depending upon the results of the MEC investigation. This site is recommended for RFI/CMS based on historical evidence of multiple overlapping range fans (Map 4-3).

4.4 SMALL ARMS RANGE - 2

4.4.1 Site Description

The MRS layout and location are presented on **Map 4-4**. This 287-acre MRS is located along the western perimeter of the cantonment area and historically was used for small arms training during the 1940s and 1950s. The combined acreage of the overlapping range fans is 2,091 acres, 287 acres of which overlap the other than operational area and make up Small Arms Range – 2. The MRS is composed of the firing points of the four small arms ranges and the downrange area of Range M and HBANM Ranges. According to documents reviewed for the June 2010 HRR, munitions used on the small arms range were .50 cal or less; however, the exact calibers are unknown. Archival documents from 1941 document the use of .30 cal and .50 cal machine guns on FTSW. Therefore, it is assumed that .30 cal and .50 cal small arms were used on this MRS. Two documented EOD responses were identified at the site. The first involved a 105mm projectile and occurred in April 2003. The second occurred in 2008; however, the munitions item encountered was not documented. Appendix E of this Work Plan includes the CSM developed for the Small Arms Range- 2.

Currently, a Supplemental Investigation and Time Critical Removal Action are on-going at the "Fire Station 5 Berm." A site investigation in October 2009 which focused on sampling for antimony, copper, and lead in surface soil and subsurface soil in the former Berm area, in surface water and sediment along the pond and ditch areas, and in groundwater near areas identified in the USACE October 2008 investigation. The investigations were conducted to ensure worker

recommended for RFI/CMS based on historical evidence of multiple overlapping range fans (Map 4-4).

As discussed earlier in Section 4.4.1, the "Fire Station 5 Berm" portion of the MRS will not be investigated for this report.

4.5 SUMMARY OF FIELD ACTIVITIES

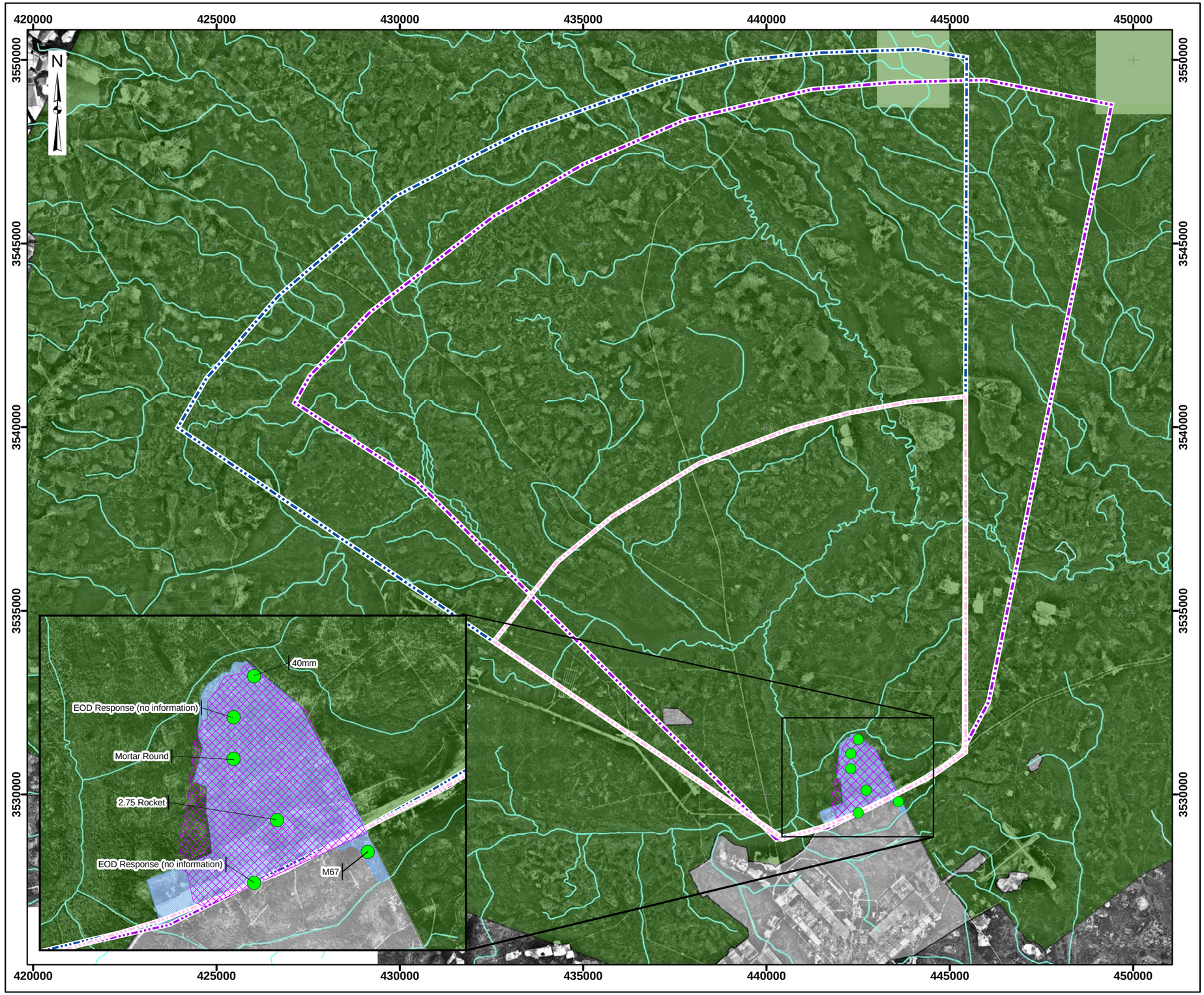
The total number of field samples that will be collected and the selected laboratory analyses are presented in **Table 4-1** below.

Table 4-1: Field Sample Summary Table

MRS	Number of Field Samples/Analysis							
	Metals (6010B)				Explosives (8330B modified)			
	Surface Soil				Surface Soil			
Sample Type	Field Sample	Duplicate Field Sample	MS	MSD	Field Sample	Duplicate Field Sample	MS	MSD
Anti – Aircraft Range – 4[1]	4	1	0	0	4	1	0	0
Anti – Tank Range 90mm – 2[1]	4	0	0	0	4	0	0	0
Grenade Launcher Range[1]	14	1	1	1	14	1	1	1
Small Arms Range – 2[2]	10	1	1	1	2	1	0	0
Total Analysis	39				29			

1 Metals analysis includes: aluminum, antimony, copper, lead, and zinc by USEPA Method 6010B.
2 Metals analysis includes: lead by USEPA Method 6010B. One explosive sample will be collected at each of the two locations of prior EOD responses.

Phase 2 Confirmatory Sampling Work Plan
Fort Stewart, GA



Map 4-1
Anti-Aircraft Range - 4

Legend

Installation Data
- Other than Operational Area
- Operational Area
- Developed Area
- EOD Response

Phase 2 MRS (Other than Operational Area)
- Anti-Aircraft Range - 4

Anti-Aircraft Range 90-MM - 2 Historical Fans
- 90-mm Anti-Aircraft (C Range) 1957,1962,1964
- 40-mm Anti-Aircraft (C 40-mm 11850 YRDS) 1941
- 90-mm Anti-Aircraft (C 90-mm 20500 YRDS) 1941

Hydrology
- River/Stream

0 2,000 4,000 Meters

Data Source: Fort Stewart, GA

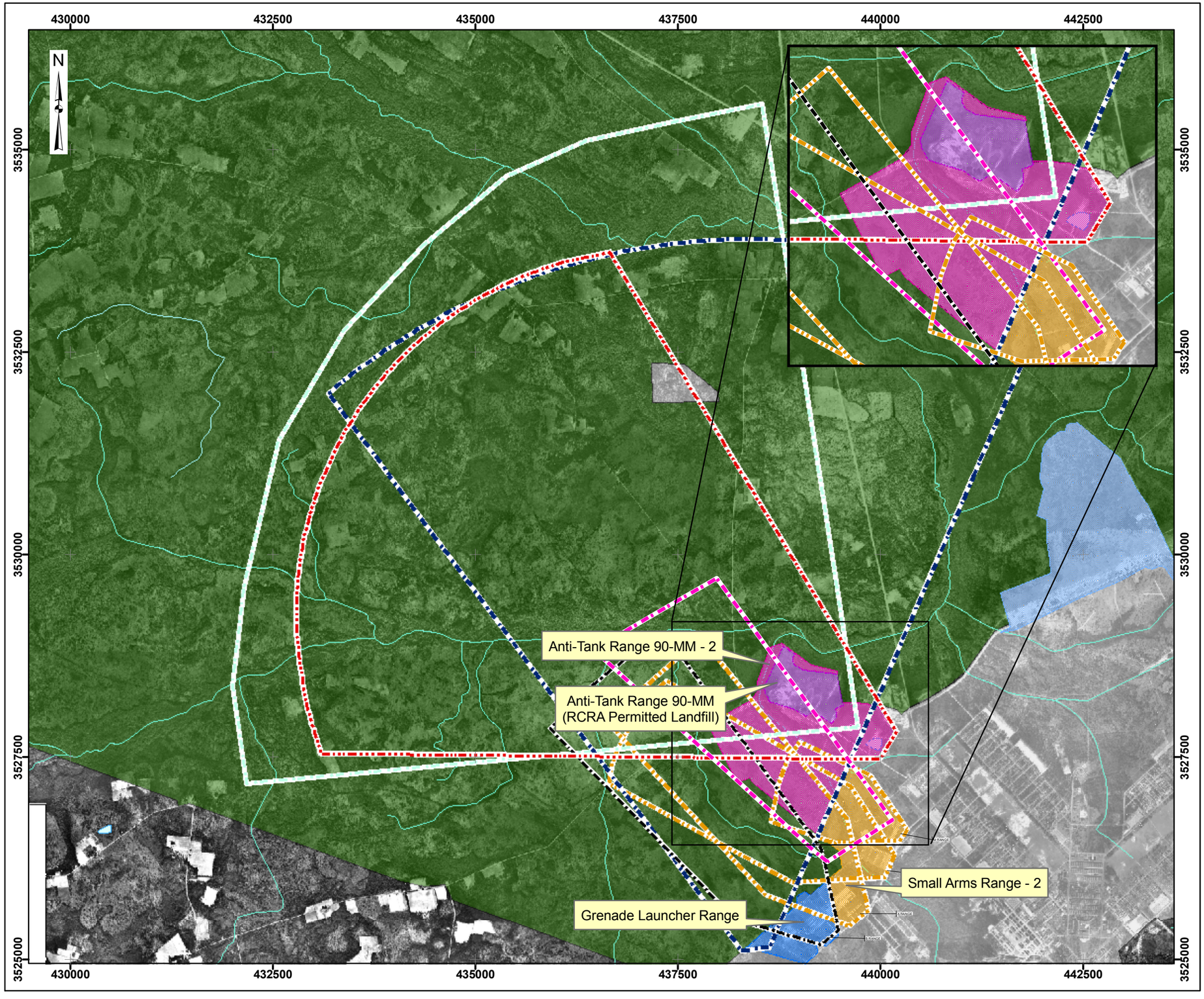
Coordinate System: UTM Zone 17N
Datum: NAD83
Units: Meters

Contract: DACA31-05-D-0043
Edition: Final
Date: August 2010

Phase 2 Confirmatory Sampling Work Plan Fort Stewart, GA

MALCOLM PIRNIE

Map 4-2
Anti-Tank Range 90-MM - 2



Legend

Installation Data
- Other than Operational Area
- Operational Area

Phase 2 MRS (Other than Operational Area)
- Small Arms Range - 2
- Anti-Tank Range 90-MM - 2
- Anti-Aircraft Range - 4
- Grenade Launcher Range

Phase 1 MRS
- Anti-Tank Range 90-mm

Anti-Tank Range 90-MM - 2 Historical Fans
- Anti-Tank (E 90-mm 14540 yards) 1941
- 40-mm Anti-Aircraft (E 40-mm 8500 YRDS) 1941
- 120-mm Anti-Aircraft

Small Arms Range - 2 Historical Range Fans
- Small Arms 1944
- Small Arms (HBANM RANGES) 1940
- Grenade Launcher Range

Hydrology
- River/Stream
- Water Body

0 1,000 2,000 Meters

Data Source: Fort Stewart, GA

Coordinate System: UTM Zone 17N
Datum: NAD83
Units: Meters

Contract: DACA31-05-D-0004
Edition: Final
Date: August 2010

436000
438000
440000
3528000
3526000
N
Anti-Tank Range - 90-MM (RCRA Permitted Landfill)
Anti-Tank Range - 90-MM - 2
Small Arms Range - 2
A Range
Grenade Launcher Range
B Range
H Range
Infiltration Course
120-mm Anti-Aircraft Range
Grenade Launcher Range

Phase 2 Confirmatory Sampling Work Plan
Fort Stewart, GA

MALCOLM PIRNIE

Map 4-3
Grenade Launcher Range

Legend

Installation Data
- Installation Boundary
- Other than Operational Area
- Operational Area
- Firing Area/Berm

Phase 2 MRS (Other than Operational Area)
- Small Arms Range - 2
- Anti-Tank Range 90-MM - 2
- Grenade Launcher Range

Phase 1 MRS
- Anti-Tank Range 90-MM

Grenade Launcher Historical Range Fans
- Small Arms 1944
- Grenade Launcher Range
- 120-mm Anti-Aircraft
- Infiltration Course

Hydrology
- River/Stream
- Water Body

0 350 700 1,050 1,400 Meters

Data Source: Fort Stewart, GA

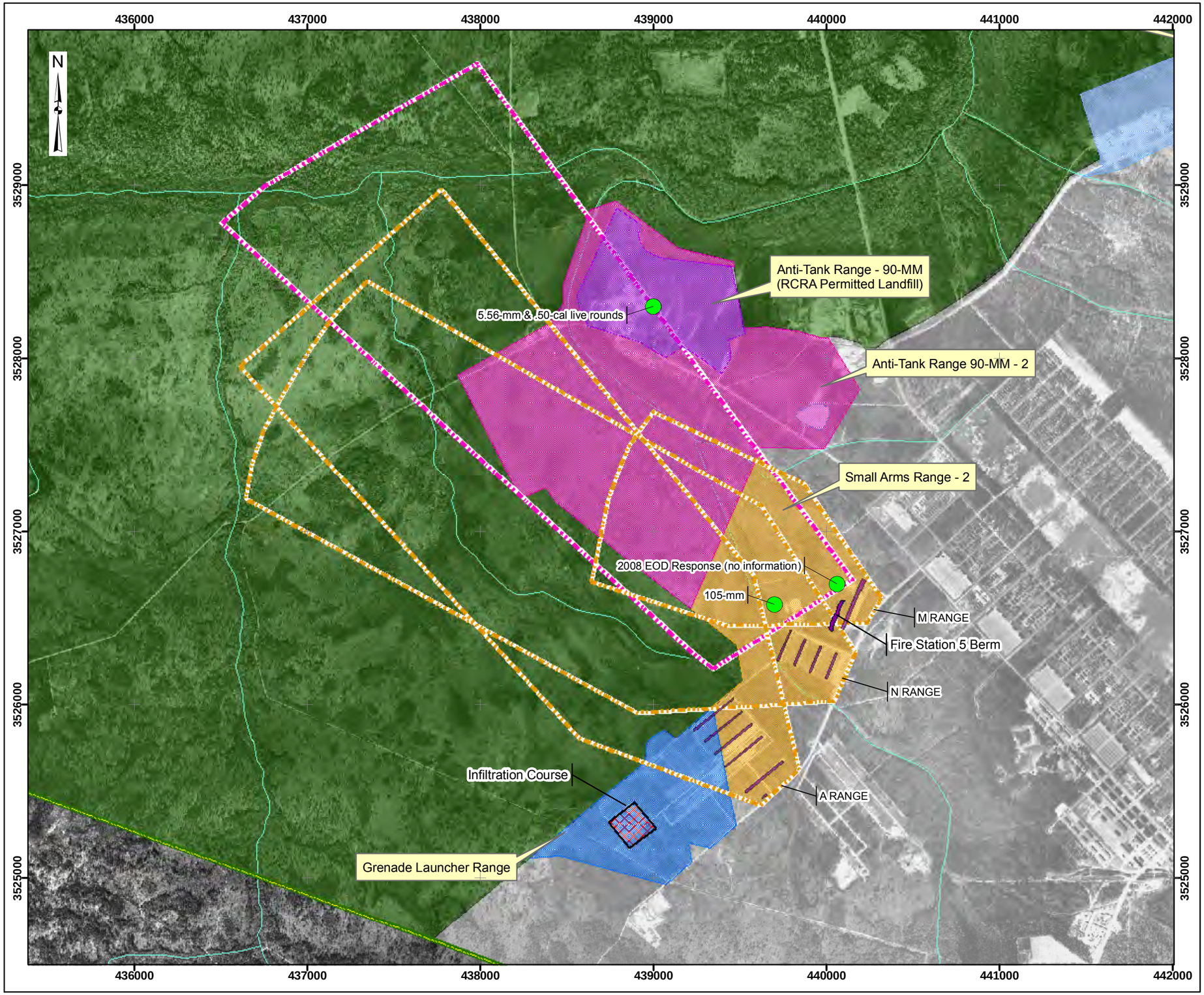
Coordinate System: UTM Zone 17N
Datum: NAD83
Units: Meters

Contract: DACA31-05-D-0004
Edition: Final
Date: August 2010

Phase 2 Confirmatory Sampling Work Plan Fort Stewart, GA

MALCOLM PIRNIE

Map 4-4
Small Arms Range - 2



Legend

Installation Data
- Installation Boundary
- Other than Operational Area
- Operational Area
- Firing Area/Berm
- EOD Response

Phase 2 MRS (Other than Operational Area)
- Small Arms Range - 2
- Anti-Tank Range 90-MM - 2
- Anti-Aircraft Range - 4
- Grenade Launcher Range

Phase 1 MRS
- Anti-Tank Range 90-MM

Small Arms Range Historical Fans
- Small Arms (HBANM RANGES) 1940
- Small Arms 1944
- Infiltration Course

Hydrology
- River/Stream
- Water Body

0 250 500 750 Meters

Data Source: Fort Stewart, GA

Coordinate System: UTM Zone 17N
Datum: NAD83
Units: Meters

Contract: DACA31-05-D-0043
Edition: Final
Date: August 2010

5 SAMPLE MANAGEMENT AND ANALYSIS

5.1 FIELD OPERATIONS DOCUMENTATION

Field documentation of the samples taken is of the utmost importance in assuring QC. Field documentation will include DQCRs, field notebooks, sample labels, and COC forms. All field documentation will be completed in indelible ink. Corrections will be made by drawing a single line through the text and legibly writing the correction.

5.2 DQCR

As described in the QAPP, the DQCR will be prepared by the FPM each day that fieldwork is performed, commencing with the first day work is performed on-site. All workdays will be documented in this report throughout the duration of the fieldwork. Malcolm Pirnie will provide DQCRs to the USACE, Baltimore District PM in the CS Report. A sample DQCR form is included in Field Forms in Appendix D.

5.3 FIELD NOTEBOOKS

Field notes regarding all sampling and field activities will be kept in a bound notebook with pre-numbered pages. Indelible ink will be used for all entries. The field notes will be filled out while the fieldwork is taking place and will include all of the information that is reported on the DQCR forms.

5.4 SAMPLE NUMBERING SCHEME

All samples taken will employ the USACE Laboratory numbering system. This system assures that QC checks originating from the field are blind to the laboratory and that a uniform and consistent numbering system is employed in the field.

All samples collected as part of this CS Report will utilize the following standard designation format:

FTSW- [Sample media] - [Location designation] - [sample date (month) (day) (year)]

SS will be used to designate a surface soil sample (e.g., FTSW-SS-22-080104).

All duplicate samples collected will utilize the following standard designation format:
FTSW - [Sample media] - [Location designation/DUP] - [sample date (month)(day)(year)]
(e.g., FTSW-S-22/DUP-080104)

All MS/MSD samples collected will utilize the following standard designation format:
FTSW - [Sample media] - [Location designation/MSD] - [sample date (month)(day)(year)]
(e.g., FTSW-SS-22/MSD-080104)

All equipment blank samples collected will utilize the following standard labeling format:
FTSW - [Sample media] - [Location designation/EB] - [sample date (month)(day)(year)]
(e.g., FTSW-SS-22/EB-080104)

5.5 SAMPLE LABELS

Correct sample labeling and the corresponding notation of the sample identification numbers in the field notebook, DQCR, and on the COC forms will be utilized to prevent misidentification of samples and their eventual results. All sample labels will be completed legibly with indelible ink. The labels will be affixed to the sample bottle and covered with clear tape.

At a minimum, the sample labels will include the following:

a. Project name
b. Company name
c. Name/initials of the collector
d. Date and time of collection
e. Sample location and depth
f. Analysis required
g. Preservatives added
h. Matrix

5.6 COC

The COC procedures will be in accordance with USACE Sample Handling Protocol and USEPA procedures. COC procedures are used to document and track samples from collection through reporting of analytical results and to serve as permanent records of sample handling and shipment. Strict COC protocol will be maintained for all samples collected during this project. The COC forms will be filled out with indelible ink by the FPM, and any mistakes made will be crossed out with a single line and initialed and dated. The information on the COC form will include the following:

a. Sample identification numbers
b. Date and time of sample collection
c. Project name and number
d. Number of sample containers
e. Analyses required including method number
f. Turn-around time required
g. Preservatives used
h. Signatures of all parties who had possession of the samples
i. Matrix

COC forms will be completed for every cooler and will be sealed in a resealable bag and taped to the inside of the lid of the cooler. The FPM will keep one copy of the COC form. The laboratory will then sign the COC form upon accepting the samples for analysis. Copies of the COC forms will be included in the CS Report as an appendix and given to the USACE, Baltimore District PM upon completion of the field sampling effort.

5.7 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Custody of samples must be maintained throughout the shipment of samples to the selected laboratory. The following procedures will be used to send samples to be analyzed for explosives and metals to the laboratory:

- Use waterproof high strength plastic ice chests or coolers only.
- After filling out the pertinent information on the sample label and tag, put the sample in the container and screw on the lid. Secure the bottle lid with strapping tape.

- Tape cooler drain shut.
- Place about 3 inches of inert cushioning material, such as vermiculite or Styrofoam "popcorn", in the bottom of the cooler.
- Enclose the containers in clear plastic bags through which sample labels are visible, and seal the bag. Place containers upright in the cooler in such a way that they do not touch and will not touch during shipment.
- Put in additional inert packing material to partially cover sample containers (more than halfway). Place bags of ice or ice gel packs around, among, and on top of the sample containers.
- Fill the remaining space in the cooler with cushioning material.
- If sending the samples by common carrier, sign the COC form under "Relinquished by," enter the carrier name and air bill number, retain a copy for field records, put the COC record in a waterproof plastic zip top bag and tape it with masking tape to the inside lid of the cooler.
- If sending the samples by courier or field team shipper, follow the above procedures, but also have the receiving carrier sign under "Received by."
- Apply custody seals to the front and back of the cooler, across the lid.
- Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- Attach completed shipping label to top of the cooler. The shipping label will have a return address.
- Ship the cooler by overnight express or courier to the respective laboratory.

The primary laboratory address and POC are noted below:

Katahdin Analytical Services
600 Technology Way
Scarborough, ME 04074
ATTN: Kate Zaleski/Sample Custodian
Phone: (207) 874-2700 x17
Fax: (207) 775-4029

A secondary laboratory (i.e., back-up) has been selected for the MMRP investigations, which can meet the analytical requirements of this program. The secondary laboratory, which is noted below, will analyze samples ONLY in instances when Katahdin Analytical Services cannot.

Analytical Laboratory Services, Inc.
34 Dogwood Lane
Middletown, PA 17057
ATTN: Tonya Hironimus/Sample Custodian
Phone: (717) 944-5541
Fax: (717) 944-1430

5.8 INVESTIGATIVE DERIVED WASTE (IDW)

IDW will not require containerizing or special disposal procedures. Soil cuttings and excess sample material will be returned to the sample hole or boring for backfill purposes immediately after completion of sampling.

Decontamination fluids are not expected since dedicated/disposable field sampling equipment will be used. Used gloves, core liners, and any other disposable sampling equipment or personal protective equipment will be double bagged and disposed of off-site as non-hazardous waste.

6 REFERENCES

Malcolm Pirnie, Inc. Quality Assurance Program Plan, MMRP SI. July 2004.

Malcolm Pirnie, Inc. Final Phase 2 Historical Records Review, Fort Stewart, Georgia. June 2010.

U.S. Environmental Protection Agency. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. USEPA-540-R-03-001. Technical Review Workgroup for Lead, Washington, D.C. January 2003.

U.S. Environmental Protection Agency. EPA Regional Screening Levels Table, May 2010.

U.S. Environmental Protection Agency. Region 4 Ecological Screening Values for surface soil: http.//www.epa.gov/regional4/waste/ots/epatab4.pdf

Appendix A: Quality Assurance Program Plan

Appendix B: Health and Safety Plan

The following Appendices are provided on the enclosed CD:

Appendix C: Technical Project Planning Session Meeting Minutes

Appendix D: Field Forms

Appendix E: HRR Conceptual Site Models

Appendix F: Project Schedule

Appendix G: Ordnance Technical Data Sheets

Appendix H: Standard Operating Procedures

Appendix I: Laboratory DoD Qualifications