FINAL REVISED
MMRP RCRA FACILITY INVESTIGATION WORK PLAN
FOR
ANTI-AIRCRAFT RANGE 90-mm – 2 MRS (FTSW-002-R-01) and
HERO ROAD TRENCH AREA MRS (FTSW-008-R-01)
FORT STEWART
HINESVILLE, GEORGIA

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Prepared for:

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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the Earth Resources Technology, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of USACE regulatory constraints under the current project, within which this work has been completed.

05/22/12

Michael Dorman — Date
Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included a review of assumptions; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

7/14/2011

Barry Millman — Date
Independent Technical Reviewer

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AF	soil-to skin adherence factor
AHA	Activity Hazard Analysis
ALSI	Analytical Laboratory Services, Inc.
APP	Accident Prevention Plan
AR	Administrative Record
ASCII	American Standard Code for Information Interchange
ASP	Ammunition Supply Point
AT	averaging time
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BGS	below ground surface
BIP	blow in place
BLRA	Baseline Risk Assessment
BW	body weight
CAIS	Chemical Agent Identification Sets
CENAB	US Army Corps of Engineers, Baltimore District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAS	US Army Corps of Engineers, Savannah District
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CIP	Community Involvement Plan
cm	centimeter
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
COR	Contracting Officer's Representative
CS	Confirmatory Sampling
CSM	Conceptual Site Model
CTT	Closed, Transferring and Transferred
DA	Department of the Army
DAF	dermal absorption fraction
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DID	Data Item Description
DMM	discarded military munitions
DoD	Department of Defense
DOT	Department of Transportation
DPW	Directorate of Public Works
DQCR	daily quality control report
DQO	data quality objective
ECPP	Environmental and Cultural Protection Plan
ED	exposure duration
EF	exposure frequency
EM	Engineer Manual

Acronym	Definition
EOD	Explosive Ordnance Disposal
EP	Engineer Pamphlet
EPC	exposure point concentration
ERAGS	Ecological Risk Assessment Guidance for Superfund
ERT	Earth Resources Technology, Inc.
ESP	Explosives Siting Plan
EZ	exclusion zone
FGDC	Federal Geographic Data Committee
FI	fraction ingested
FTSW	Fort Stewart
GAEPD	Georgia Environmental Protection Division
GIS	geographic information system
GPS	global positioning system
GSV	geophysical system verification
HA	hazard assessment
HE	high explosives
HHRA	Human Health Risk Assessment
HI	hazard index
HRR	Historical Records Review
HQ	hazard quotient
IDW	investigation derived waste
IR	ingestion rate
ISO	Industry Standard Objects
ITR	Independent Technical Review
IVS	instrument verification strip
LUC	land use controls
MC	munitions constituents
MCGI	Meridian Consultant Group, Inc.
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MGFD	munition with the greatest fragmentation distance
MI	multi-incremental
MIS	multi-incremental sampling
mm	millimeter
MMDC	Military Munitions Design Center
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MSD	minimum separation distance
NCP	National Contingency Plan

Acronym	Definition
NCR	nonconformance reports
OAF	oral absorption factor
OB/OD	open burn/open detonation
OESS	Ordnance and Explosives Safety Specialist
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PDF	portable document format
PDT	Project Delivery Team
PEF	particulate emission factor
PM	Project Manager
PMP	Project Management Plan
POC	point of contact
PPE	personal protective equipment
PRE	preliminary risk evaluation
PSHM	Project Safety and Health Manager
PWS	Performance Work Statement
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QCM	Quality Control Manager
QCP	Quality Control Plan
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RfC	reference concentration
RfD	reference dose
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
RSL	Regional Screening Level
RTS	Robotic Total Station
SA	surface area
SLERA	Screening-Level Ecological Risk Assessment
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSL	soil screening level
STR	Senior Technical Review
SUXOS	Senior UXO Supervisor
SWMU	Solid Waste Management Units
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TM	Technical Manual
TNT	trinitrotoluene
TP	Technical Paper

Acronym	Definition
TPP	Technical Project Planning
TRV	toxicity reference value
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	US Army Corps of Engineers
USAEC	US Army Environmental Command
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQC	UXO Quality Control Officer
UXOSO	UXO Safety Officer
VSP	Virtual Sampling Plan

GLOSSARY OF TERMS

Cultural Debris – Debris found on operational ranges or munitions response sites, which may be removed to facilitate a range clearance or munitions response, that is not related to munitions or range operations. Such debris includes, but is not limited to, rebar, household items (refrigerators, washing machines, etc.), automobile parts and automobiles that were not associated with range targets, fence posts, and fence wire. Cultural debris does not refer to items of cultural or historical significance.

Defense Site – All locations that are or were owned by, leased to, or otherwise possessed or used by the DoD. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions.

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2)).

Explosive Hazard – A condition where danger exists because explosives are present that may react (e.g., detonate, deflagrate) in a mishap with potential unacceptable effects (e.g., death, injury, damage) to people, property, operational capability, or the environment.

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration.

Explosive Ordnance Disposal (EOD) Unit – A military organization constituted by proper authority, manned with EOD personnel, outfitted with equipment required to perform EOD functions, and assigned an EOD mission.

Explosives Safety – A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks of potential mishaps involving military munitions.

Material Potentially Presenting an Explosive Hazard (MPPEH) – Material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; range-related debris); or material potentially containing a high enough concentration of explosives such that the materia1 presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means (A) UXO,

as defined in 10 U.S.C. 101(e)(5); (B) DMM, as defined in 10 U.S.C. 2710(e)(2); or (C) munitions constituents (MC) (e.g., Trinitrotoluene [TNT], Cyclotrimethylenetrinitramine [RDX]), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) – Any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710(e)(3)) .

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions Response – Response actions, including investigation, removal actions and remedial actions to address the explosives safety, human health, or environmental risks presented by UXO, DMM, or MC, or to support a determination that no removal or remedial action is required.

Munitions Response Area – Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. An MRA is composed of one or more munitions response sites.

Munitions Response Site (MRS) – A discrete location within an MRA that is known to require a munitions response.

Operational Range – A range that is under the jurisdiction, custody, or control of the Secretary of Defense and that is used for range activities or, although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. (10 U.S.C. 101(e)(3)(A) and (B)). Also includes "military range," "active range," and "inactive range" as those terms are defined in 40 Code of Federal Regulations §266.201.

Other than Operational Range – Encompasses closed, transferred, and transferring ranges or areas within an installation that are not used for operations, such as leased land areas, schools, etc.

Range – A designated land or water area that is set aside, managed, and used for range activities of the DoD. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 U.S.C. l0l (e)(l)(A) and (B)).

Unexploded Ordnance (UXO) – Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)(A) through (C)).

Unexploded Ordnance (UXO)-Qualified Personnel – Personnel who have performed successfully in military EOD positions or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO

Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

Unexploded Ordnance (UXO) Technicians – Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

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1.0 INTRODUCTION

1.1 Project Authorization

Earth Resources Technology, Inc., (ERT) will conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the United States Army Corps of Engineers (USACE), Baltimore District (CENAB), at two (2) Military Munitions Response Program (MMRP) sites at Fort Stewart (FTSW) in Hinesville, Georgia. The work is being performed as a performance-based task order under the Multiple Award Military Munitions Services Contract (W912DR-09-D-0012, Delivery Order 0004). The two Munitions Response Sites (MRS) identified are the Anti-Aircraft Range 90-mm - 2 (FTSW-002-R-01) and the Hero Road Trench Area (FTSW-008-R-01).

The Department of Defense (DoD) established the MMRP under the Defense Environmental Restoration Program to address unexploded ordnance (UXO), munitions and explosives of concern (MEC), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations. MEC are a safety hazard and may constitute an imminent and substantial endangerment to field personnel and the public. Applicable provisions of Chapter 29 of the Code of Federal Regulations (CFR) 1910.120 apply. ERT will perform work in accordance with the Georgia Environmental Protection Division (GAEPD) issued RCRA Part B Permit, Section III, Corrective Action, with regulatory coordination, as appropriate, with the GAEPD and the United States Environmental Protection Agency (USEPA) Region IV. Every activity involving work in areas potentially containing MEC hazards will be conducted in full compliance with USACE, Department of the Army (DA), and DoD safety regulations. All MEC encountered during this munitions response will be destroyed on-site and appropriately disposed of per the Explosives Siting Plan (ESP) and DoD Instruction 4140.62.

This Work Plan applies to RFI activities within the two MRSs and describes in detail the procedures, methods, organization, and resources that ERT will use to achieve the project objectives described in the Performance Work Statement (PWS) dated 09 April 2010 (Appendix A).

1.2 Purpose and Scope

FTSW is an active installation that currently occupies approximately 280,000 acres. FTSW has been utilized since 1940 for training and as a deployment platform. Training activities have included tank, field artillery, helicopter gunnery, small arms, and various infantry training. The overall purpose of the RFI is to determine whether the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) and the Hero Road Trench Area (FTWS-008-R-01) MRSs warrant further response actions pursuant to RCRA and the MMRP process. The objectives of the RFI are to: determine the nature and extent of potential MC contamination or MEC hazards; determine the potential risks posed to human health and the environment from MC; and to collect or develop additional data for a Corrective Action Plan, as appropriate, to determine corrective measures, including no further action. The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is being investigated for both MEC and MC, while the Hero Road Trench Area MRS (FTWS-008-R-01) is only being investigated for MC contamination.

Both MRSs are considered areas of concern (AOC) and are covered by the FTSW Hazardous Waste Facility Permit #HW-045(S) (Appendix J), which requires FTSW to properly manage the storage of hazardous wastes and to investigate and conduct corrective action at solid waste management units (SWMU) and AOC. ERT will follow all guidelines listed in the permit, including: analyzing samples using the most appropriate methods as listed in 40 CFR Part 261 Appendix I; recording and reporting monitoring information related to sample collection and analysis; preparing a RFI Work Plan, and incorporating all permit required elements in the RFI Report.

The scope of the project includes the preparation and/or undertaking of the following work elements required to achieve the project objectives:

- Project Management Plan and Schedule
- Technical Project Planning (TPP)
- Geographic Information System (GIS)
- RFI Work Plan and Quality Assurance Project Plan (QAPP)
- RFI Field Work
- RFI Report
- Administrative Record (AR)

1.3 Work Plan Organization

This Work Plan, prepared in accordance with Data Item Description (DID) MR-001, Engineer Manual (EM) 1110-1-4009, and EM 385-1-1, covers the RFI and each associated preparatory activity necessary to characterize the nature and extent of potential MC contamination or MEC hazards within each MRS. The Work Plan is organized to address each of the components of the PWS in accordance with a MR-001 Type I Work Plan and comprises several sub-plans or chapters, each discussing a different aspect of the investigation. The Work Plan is intended to be an all-inclusive document tailored to address every foreseeable potential investigation action at the currently identified MRSs at FTSW. This document will be updated and amended as necessary.

1.3.1 Integration of UFP-QAPP into the Work Plan

This Work Plan contains a QAPP prepared in accordance with the US Environmental Protection Agency (USEPA)/DoD/US Department of Energy Uniform Federal Policy (UFP) for QAPPs (USEPA, 2005). The UFP-QAPP for the FTSW RFI is provided as Appendix E. A UFP-QAPP is designed to be a more comprehensive document that addresses each elements of the project scope related to MC environmental media sampling in worksheet format, duplicating much of the information typically presented in USACE Type I Work Plan sub-plans. The UFP-QAPP does not include information regarding MEC investigation activities.

To avoid duplication to the extent practical, this Work Plan makes reference to the more detailed information presented in the UFP-QAPP worksheets when it is more appropriately contained there, and the UFP-QAPP worksheets reference this Work Plan sub-plan discussions, when that is more appropriate. In general, FTSW and MRS background information, and project

administration and organization is presented in the Work Plan, while the more detailed technical information addressing sampling and chemical data requirements, is presented in the UFP-QAPP worksheets. The UFP-QAPP has not yet been formally adapted to address MEC; therefore, MEC details are contained in the Work Plan. Worksheet 2 of the UFP-QAPP (Appendix E) presents a crosswalk between this Work Plan and the UFP-QAPP worksheets.

1.3.2 Type I Work Plan Sub-plans

The organization of this Work Plan into sub-plans or subsections is summarized below:

- Section 1: Introduction - details the overall scope and objective of this RFI, presents the organization of the Work Plan document, and presents an overview and the history of FTSW.
- Section 2: Technical Management Plan - details the organizational structure, roles, and responsibilities of the project team, the lines of authority among team members, and project communication and reporting activities.
- Section 3: Field Investigation Plan - describes the field methods and procedures planned for each MRS, and the approach to risk characterization and assessment.
- Section 4: Quality Control (QC) Plan (QCP) - describes procedures for controlling and measuring the quality of work performed, including the organization, responsibilities, and policies.
- Section 5: Explosives Management Plan - describes details for management of explosives used to destroy MEC items recovered during the project, including acquisition, receipt, storage, transportation, and inventory.
- Section 6: ESP – prepared and provided by USACE as a standalone document, it discusses the criteria for planning and siting explosives demolition events that may be required during this RFI. It is included in the main portion of the Work Plan by reference only; the full document can be found in Appendix G.
- Section 7: Environmental and Cultural Protection Plan (ECPP) – describes the procedures and methods to be implemented to minimize pollution, protect and conserve natural and cultural resources, and control noise, while completing RFI activities.
- Section 8: Property Management Plan - provides detailed information on the types, quantities, and sources of equipment and materials that will be required to perform field and office operations for this RFI.
- Section 9: References - includes a list of references used in the preparation of this Work Plan.

Additional information and plans attached to this Work Plan as appendices include:

- Appendix A: Performance Work Statement.
- Appendix B: Figures. Every map and figure is contained in Appendix B, whether introduced in the Work Plan subsections or the UFP-QAPP worksheets. The exception is for figures required in the Accident Prevention Plan (APP) and Site Safety and Health

Plan (SSHP) (Appendix D), such as hospital location and site access maps. The intent is for those documents to be self-contained with critical maps easily available.

- Appendix C: Points of Contact.
- Appendix D: APP – contains the SSHP (Attachment 1) and the Activity Hazard Analyses (AHAs) (Attachment 2). This appendix describes the health and safety procedures, personal protection standards, and environmental health hazards applicable to this project.
- Appendix E: UFP-QAPP - outlines the objectives of the planned sampling activities, the specific Quality Assurance/Quality Control (QA/QC) procedures, and the measurement and data acquisition goals for the project.
- Appendix F: Contractor Forms - relevant forms for collecting and recording data.
- Appendix G: ESP –as provided by USACE.
- Appendix H: MC Sampling Rationale Memo – details the MC expected based on the known munitions utilized within the MRSs.
- Appendix I: Technical Project Planning (TPP) - the minutes generated through the TPP process are presented.
- Appendix J: FTWS RCRA Part B Permit.

1.4 Project Location

FTSW is located approximately 40 miles southwest of Savannah, Georgia and just north of Hinesville, Georgia. The cities of Pembroke and Richmond Hill are 1.5 to 2.2 miles north of FTSW, respectively. Situated south of Interstate 16 and west of Interstate 95, FTSW boundaries are roughly defined by the intersection of Interstate 16 and Interstate 95 and the cities of Richmond Hill, Hinesville, Glennville, Claxton, and Pembroke (Figure 1, Appendix B) (Malcolm Pirnie, 2006).

1.5 MRS Description

1.5.1 MRS Locations

The FTSW overall map is included as Figure 2 in Appendix B. The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is a 77 acre area (Figure 3, Appendix B) located within a former 90-mm anti aircraft range fan; five other former anti-aircraft and tank ranges also overlap this MRS (Figure 4, Appendix B). This MRS is approximately 2.8 miles northwest of the cantonment area. An ammunition supply point (ASP) is located within this MRS, and as such is subject to additional security with a secured, gated fence surrounding most of the MRS. This MRS is relatively flat and covered with maintained grass and buildings.

The Hero Road Trench Area MRS (FTSW-008-R-01) is approximately 34.5 acres in size and lies within the cantonment area (Figure 5, Appendix B). This MRS consists of dense young forest and substantial undergrowth. There is anecdotal evidence that dilute agent Chemical Agent Identification Sets (CAIS) kits may have been disposed of in burial trenches within this MRS. Historical photos show areas of ground scarring that may be associated with these burial areas;

an example of one of these photos is included as Figure 6 in Appendix B. Based on guidance included in the Army Memorandum: Interim Guidance for Chemical Warfare Materiel Responses (DA, 2007), dilute agent CAIS kits and associated chemicals are to be treated as hazardous waste. Additionally, based on the Probability Assessment the probability of encountering CWM during any subsequent actions or operations at FTSW is Unlikely (USACE, 2010b).

1.5.2 Environmental Setting

FTSW, comprising about 280,000 acres, is bordered to the north and south by agriculture and wetlands, to the east by the Ogeechee River, and to the west by agricultural lands. The nearest cities are: Hinesville, next to the southern boundary and cantonment area; Richmond Hill, one mile to the east of the eastern boundary; Pembroke, two miles to the north of the northern boundary; Glennville, on the western boundary; and Savannah, about 41 miles to the northeast. FTSW is in the Coastal Marine Flatlands region of the Atlantic Coastal Plain physiographic province, which is characterized by flat land areas with an average slope of less than 3 percent. The Coastal Marine Flatlands region's land surface consists of rolling terraces gently rising east to west. These terraces are separated by broad, low-lying areas with poor drainage. Elevations at FTSW average 33 feet above sea level east of the Canoochee River with a peak elevation of 183 feet above sea level near the western boundary (Malcolm Pirnie, 2006).

FTSW is a large, mostly undeveloped installation with more than 87% (243,000 acres) comprised of upland forest or forested wetlands and the remaining 13% (37,000 acres) comprised of open areas, including the cantonment area, ranges, and impact areas. The cantonment area is the "living and working" portion of FTSW (US Army, 2010).

The bedrock in the area surrounding FTSW is composed primarily of rock formations ranging in age from the Precambrian (greater than 570 million years old) to Triassic (205 to 240 million years old) ages. This local bedrock is overlain with thick wedges of unconsolidated and partially consolidated sediments (US Army, 2010).

Most of the soil at FTSW is classified as sandy and infertile. Soils in low-lying, poorly drained areas are high in organic matter and can remain saturated with water for eight months or more every year (US Army, 2010). On a very broad scale, there are four types of ecosystems on FTSW: sandhills, pine flatwoods, upland forests, and wetlands (Malcolm Pirnie, 2006). Wetlands are mainly of the bottomland hardwood variety, with mixed types of vegetation and only occasional flooding. Isolated cypress ponds also occur.

Four watersheds occur within FTSW's boundaries: the Altamaha, Canoochee, Lower Ogeechee, and Ogeechee Coastal watersheds. Most of FTSW is in the Canoochee River Watershed. FTSW has about 265 miles of freshwater rivers and streams and an additional 12 miles of brackish water streams (US Army, 2010).

Deeper groundwater wells are used as drinking water sources for FTSW. There are 31 groundwater wells located on FTSW; five of these are used to supply water through the distribution system to the cantonment area. The cantonment area wells range in depth from 500 to 800 feet and are cased to depths of 400 to 470 feet. The potable water capacity from the five active wells is approximately 10.4 million gallons per day (Malcolm Pirnie, 2006).

1.6 FTSW History

Construction of the reservation that was to become FTSW began on September 10, 1940, on what was formerly the Camp Savannah Anti-Aircraft Firing Center. On November 18, 1940, the reservation's name was changed from Camp Savannah to Camp Stewart in honor of the Revolutionary War Brigadier General Daniel Stewart. The reservation was established as an anti-aircraft center with facilities to prepare artillery troops for overseas deployment. The reservation's mission of training anti-aircraft units ended on November 20, 1944, and all training terminated in December 1944. Army ground forces units were to have departed by April 30, 1945. A prisoner-of-war camp that was operated at the reservation was also closed. The reservation's mission was reestablished as a separation center for redeployed troops from August 6, 1945 until September 2, 1945. On September 30, 1945, Camp Stewart was inactivated, and the reservation became a training location for the Georgia National Guard (Malcolm Pirnie, 2006).

With the outbreak of hostilities in Korea in June 1950, Camp Stewart was reactivated on August 9, 1950 and was designated the 3rd Army Anti-Aircraft Artillery Training Center. In 1953, armor and tank training was added to the mission of the reservation. On March 21, 1956 Camp Stewart was re-designated as Fort Stewart and was designated a permanent Army installation. In 1959, FTSW became an armor and artillery firing center. Troop training at FTSW peaked in 1961 and 1962 in response to the Berlin and Cuban crises, respectively. The 1st Armored Division was relocated to the reservation during the Cuban crisis (Malcolm Pirnie, 2007).

In response to a need for more helicopter and light fixed wing aircraft in support of the Vietnam conflict, an element of the U.S. Army Aviation School at Fort Rucker, Alabama, was transferred to FTSW in 1966. Helicopter pilot training and helicopter gunnery courses became the new mission for FTSW. In 1967, the main mission for FTSW was to train Army aviators. The reservation was also used to maintain readiness for other active duty, Reserve, and National Guard personnel. In 1970, Vietnamese helicopter pilots began training at FTSW. Aviation training at FTSW was phased out in 1973, when all aviation training was consolidated at Fort Rucker. By 1974, FTSW had become a training and maneuver area, providing tank, field artillery, helicopter gunnery, and small arms training for regular Army and National Guard units. FTSW supported training by providing facilities, conducting training opportunities, and assisting in the mobilization and deployment troops (Malcolm Pirnie, 2006).

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.

1.7 MRS History

The use of the Anti-Aircraft 90-mm – 2 range began in 1941 and ceased in 1944 (Malcolm Pirnie, 2006). The six historical anti-aircraft and tank ranges (Figure 4, Appendix B) that overlap this MRS were used from 1941 through 1964 (Malcolm Pirnie, 2006). These include two 90-mm anti-aircraft ranges, two 40-mm anti-aircraft ranges, a 90-mm tank range, and tank range where the munitions used are unknown. The Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) is positioned downrange of these ranges and does not overlap impact/target

areas or firing points (Malcolm Pirnie, 2006). The ASP has been active within this MRS since the early 1980s (USACE, 1981 and 1983).

The Hero Road Trench Area MRS (FTSW-008-R-01) was identified in January 2003 when a former Directorate of Public Works (DPW) staff member reported to the DPW Environmental Office that materials (i.e., mustard gas) had been buried in the DPW Family Housing Maintenance parking lot located on Hero Road. Initially, the MRS was identified to be a 10-acre parcel located within the cantonment area (Malcolm Pirnie, 2006). The Confirmatory Sampling (CS) Report increased the MRS from 10 to 34.5 acres (Malcolm Pirnie, 2007). An Interim Remedial Action, which fenced in 32 acres of the site and included the placement of twenty-one warning signs along the fence, was completed in 2005 (STEP, 2005). A Time Critical Removal Action was conducted in 2008 to fence in an additional 2.243 acres and add additional warning signs around the fence (SpecPro, 2009).

1.8 Current and Projected Land Use

It is expected that both of these MRSs will continue with their present land use for the foreseeable future. The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is located within the operations range portion of FTWS and consists of an ASP within a fenced area that covers a majority of the MRS acreage; a cleared buffer area surrounding the fence is also included in this MRS. The ASP is a gated, secured area; entry to this area is controlled and monitored. This MRS is expected to continue as an ASP for the foreseeable future. The entire MRS is relatively flat and covered with maintained grass; buildings, gravel and paved roads and parking areas, and the munition storage bunkers are all located within the fenced area. No activities occur in the buffer area surrounding the fence line.

The Hero Road Trench Area MRS (FTSW-008-R-01) lies within the cantonment area and is surrounded by a gated, locked fence. The MRS is kept secured at all times; no activities occur within this MRS. The MRS consists of dense young forest and substantial undergrowth and is presently not slated for any new development in the foreseeable future. The land area around the MRS within the cantonment area includes a wastewater treatment plant, a school, roads, and forested areas.

1.9 Previous Investigations

Previous investigations specific to the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) and Hero Road Trench Area (FTSW-008-R-01) MRSs include:

1.9.1 Final Closed, Transferred, and Transferring (CTT) Inventory Report, Malcolm Pirnie, Inc., October 2003

This report presented the results of the Phase 3 CTT range inventory. In addition to identifying the two MRSs that are being investigated under this task, it also noted that FTSW occupies 279,081 acres of which 274,988 are classified as operational range area and 4,093 acres are non-range areas. The Phase 3 inventory identified seven closed ranges totaling 483 acres within FTSW boundaries. No transferred or transferring ranges were identified.

1.9.2 Historical Records Review (HRR), Malcolm Pirnie, Inc., September 2006

Munitions documented at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) include 40- and 90-mm anti-aircraft projectiles and unknown tank munitions. Additionally, 37-mm rounds are documented to have been issued to FTSW. The HRR identified specific secondary explosives and munitions removed from the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01)through explosive ordnance disposal (EOD) call responses including C-4 plastic explosives, an M-222 Dragon anti-tank missile, M-7 grenades, and MK-2 grenades.

The HRR presents the history of the Hero Road Trench Area MRS (FTSW-008-R-01) including a review of documented dilute agent CAIS kits at FTSW, the presence of a nearby former gas chamber and the wastewater treatment plant, and historical aerial photos documenting ground disturbance in the MRS between the years of 1941 and 1957. Specific potential constituents associated with the dilute agent CAIS kits include mustard agent (5% solution), lewisite (5% solution), chloropicrin (50% solution), and pure phosgene agent. According to the HRR, every dilute agent CAIS kit issued to FTSW was collected and accounted for during disposal activities in 1978. However, individual vials of agent were considered expendable.

The HRR also developed a preliminary conceptual site model (CSM) for each of the MRSs.

1.9.3 Confirmatory Sampling (CS) Report, Malcolm Pirnie, Inc., November 2007

A limited magnetometer assisted visual survey was performed as part of the CS in the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01). No MEC or MD was identified during this survey. A single composite soil sample was collected and analyzed for aluminum, copper, zinc, lead, antimony, and explosives. Only zinc was found to be above FTSW background levels, though it was below USEPA Region 4 screening values.

A limited magnetometer assisted visual survey was performed over the Hero Road Trench Area MRS (FTSW-008-R-01). No MEC or munitions debris (MD) was identified during the survey. A single composite soil sample was collected and analyzed for aluminum, copper, zinc, lead, antimony, and explosives. Samples were not analyzed for any dilute agent CAIS kit degradation byproducts. Lead was found at levels above FTSW background levels. Visual observations made during the CS found undulating ground surface in the southernmost parts of the area, which was believed to be related to possible suspected burial activities. The MRS was enlarged based on these observations from 10 acres to approximately 34.5 acres. Prior to completion of the CS, 32 acres of this MRS were enclosed by chain link fence in 2005, followed by the fencing of an additional 2.243 acres in 2007.

1.10 Initial Summary of Risk from Munitions and Explosives of Concern

Due to findings during previous investigations within the two MRSs, small amounts of MEC are anticipated to be present in the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01). Currently there are land use controls (LUCs) in the forms of signs and public education being utilized around FTSW. Explosive warning signs are attached to the fence surrounding the Hero Road Trench Area MRS (FTSW-008-R-01). In general, MEC, where present, may constitute an

imminent and substantial endangerment to the public and the environment. Access to these items and removal by unauthorized personnel is also a concern.

Table 1-1 lists MEC and MD that have been found within the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) during previous investigations as detailed in the HRR and CS. The dates and exact number of occurrences of EOD calls to this area is unknown and no EOD reports are available to determine the location of these items. Figure 4 shows the historical range fans associated with this MRS. Many of the items were identified as practice, inert, or empty. The table represents some, but not all of the MEC items that could be encountered at FTSW. Appendix H details the known munitions that were used on ranges whose fans overlap this MRS. The risks and viable mitigation measures vary and will be addressed for each MRS. Field personnel will be given UXO recognition training on the type of ordnance suspected of being present prior to commencing any field activities. In addition, in the event MEC is encountered, field personnel will be instructed to proceed in accordance with the procedures described in Section 3 of this Work Plan. MEC and MD are not expected to be present within the Hero Road Trench Area MRS (FTSW-008-R-01); field activities in this MRS are related to possible MC contamination from the dilute agent CAIS kits.

Table 1-1. MEC and MD from Previous Anti-Aircraft Range 90-mm - 2 MRS Investigations

Projectiles	37mm high explosive (HE), 40mm HE dual purpose, 90mm HE, 75mm, 76mm, 105mm, 152mm, 155mm
Grenades	40mm, M7 Riot, fragmentation grenade
Rockets	Dragon II high explosive anti-tank guided missile, 3.25-inch target rocket
Small Arms	.45 caliber, .50 ball, .30 caliber, .50 caliber, 7.62mm

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2.0 TECHNICAL MANAGEMENT PLAN

2.1 Project Objectives

The project objectives are to conduct an RFI to adequately characterize the nature and extent of MEC hazards and any potential MC contamination, to determine the potential risks posed to human health and the environment by MEC and MC, and to collect or develop additional data for the Corrective Action Plan, as appropriate, to determine corrective measures for mitigation, including no action.

2.2 Project Organization

Several organizations are directly involved in the FTSW RFI. The technical team is shown in the Organization Chart (Figure 2-1). The roles of these team members are described below.

2.2.1 US Army Corps of Engineers

The USACE Savannah District (CESAS) is the overall project manager for this MMRP Project. Ana del R. Vergara is the District Project Manager (PM). The District is responsible for leading and facilitating the project delivery team (PDT) towards effective project development and execution. CENAB is responsible for overall project administration and technical management services including contracting and procurement, submittals management, cost and schedule management, and technical oversight. Travis McCoun is the CENAB Military Munitions Design Center (MMDC) Technical Lead.

2.2.2 Contractor

ERT is the architectural/engineering contractor, providing overall project management and coordination during field operations, including sampling, coordination of analytical samples, geophysical anomaly reacquisition and clearance, coordination of subcontractors, documentation of field activities, and preparation of the RFI Report. ERT's Program Manager is Mike Dorman. The Project Manager (PM) is Jennifer Harlan. She is supported by key personnel who are responsible for completing each of the required elements related to their respective technical areas. The PM will also rely on staff resources that are available to the project team. Key personnel include TJ Fanning (Senior UXO Supervisor (SUXOS)), Steve Burhans (UXO Quality Control/Safety Officer (UXOQC/SO)), Amy Rosenstein (Risk Assessment), and Ji Ma (Senior Geophysicist). Additional technical staff includes project scientists, geophysicists, UXO Technicians, and ERT subcontractors.

2.2.3 Subcontractors

ERT subcontractors will provide the following services, as necessary:

- Laboratory – Analytical Laboratory Services, Inc. (ALSI)
- Data Validation – Meridian Consultant Group, Inc. (MCGI)
- Well Driller, if necessary – to be determined (TBD)
- Civil Surveyor – Brewer Land Surveying

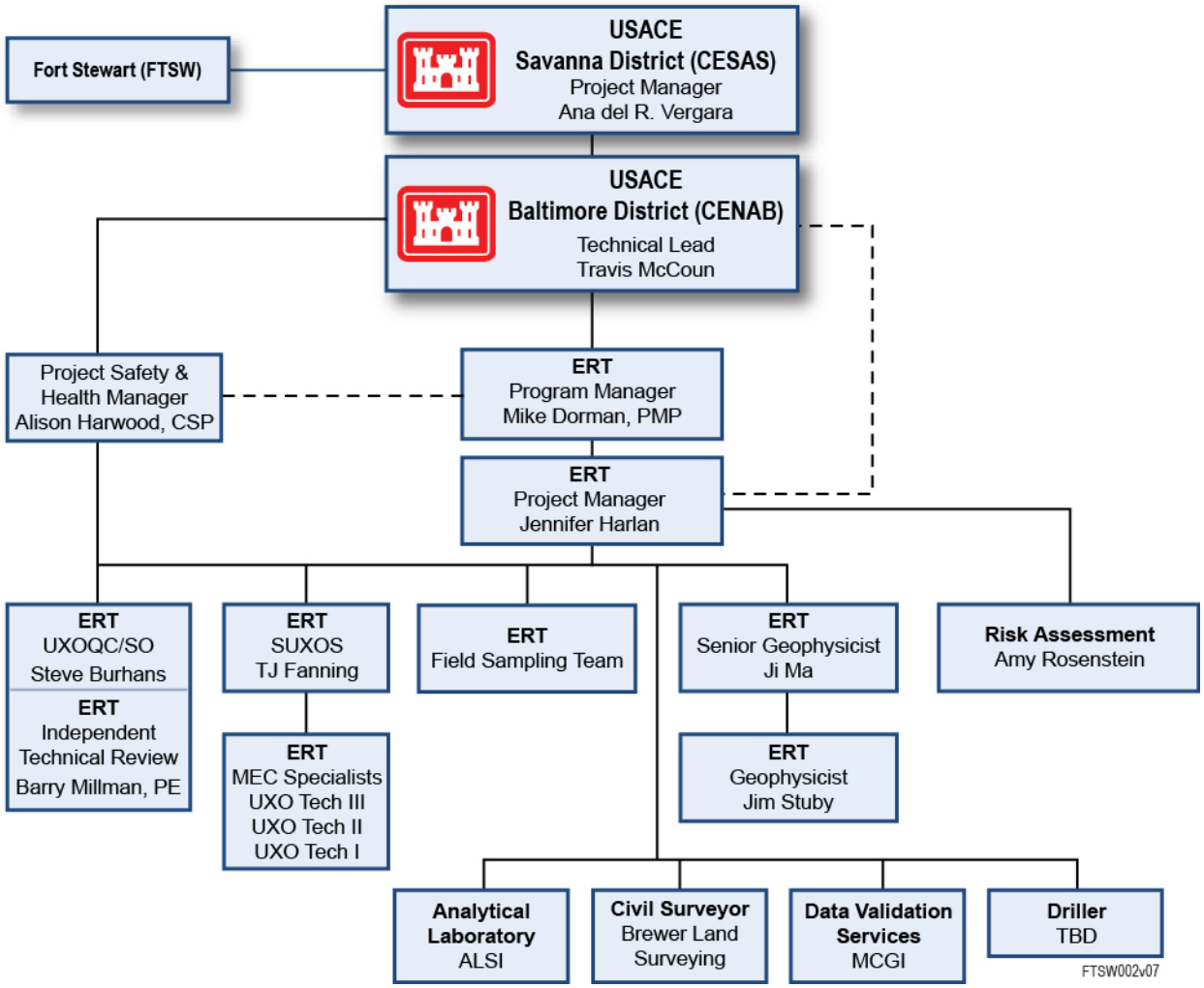

Figure 2-1. Organization Chart

2.3 ERT Project Personnel

2.3.1 Project Team

ERT is employing a highly experienced team to support this project. Key ERT project personnel, as identified in the Project Management Plan, have served in their proposed capacity on numerous other Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), RCRA, and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) related projects involving MEC and MC.

2.3.2 Project Manager

ERT's PM, Jennifer Harlan, will be the direct point-of-contact (POC) for USACE. She is responsible for managing each requirement of the project, overseeing the performance of each individual on the project team, coordinating contract work, and overseeing specific task identification and resolutions. The PM will also schedule field efforts, identify field personnel to accomplish the specific project tasks as defined in this Work Plan, implement project QC and safety procedures, and direct personnel to achieve successful and timely completion of the project tasks. The PM will promptly implement approved and authorized changes to ongoing work orders, as necessary. The ERT PM will be assisted by the following key personnel.

2.3.3 Project Safety and Health Manager

The Project Safety and Health Manager (PSHM) for this project is Alison Harwood Certified Safety Professional (CSP). She will ensure that procedures developed in the Work Plan and APP/SSHP are safe and that all safety processes and procedures are implemented in the field. The PSHM will be responsible for safety audits. The UXOSO will report to the PSHM concerning non-MEC related safety issues.

2.3.4 Technical Directors

ERT conducts senior technical reviews of all documents. Mike Dorman will be the Technical Director responsible for providing these reviews. In addition, each draft submittal will also have an independent technical review by a qualified person. Barry Millman, PE, Independent Technical Reviewer, will conduct this final review of draft documents to be submitted to USACE.

2.3.5 Senior Geophysicist

Ji Ma is the Senior Geophysicist responsible for the design, implementation, and management of geophysical investigations required for the work effort. He has an advanced degree in geophysics and more than 20 years of directly related experience.

2.3.6 Project Geophysicist

The Project Geophysicist responsible for the day-to-day operations of the field geophysical investigations is Jim Stuby, PG. He has an advanced degree in geophysics and more than 16 years of directly relevant experience.

2.3.7 Project QC Specialist

The Project QC Specialist is Mike Gearheart who is the primary author of the UFP-QAPP, ensuring it is prepared in accordance with relevant USACE guidance. He will provide analytical laboratory oversight, technical support to the field sampling teams, and review analytical results.

2.3.8 UXO Personnel

UXO teams will consist of qualified personnel per Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18. The field teams will consist of qualified UXO personnel and UXO Technicians, including the SUXOS, UXOQC/SO, and UXO Technicians IIIs, IIs, and Is. UXO Technicians I may be used to excavate and handle potential MEC under the direct supervision of UXO-qualified personnel per DDESB TP 18. UXO personnel fall under the direct supervision of the SUXOS. For this project, the Site Safety and Health Officer (SSHO) position is the same as the UXOSO. The SSHO is qualified per EM 385-1-1 criteria. The positions of the UXOSO and UXOQC will be dual-hatted per USACE Engineering Pamphlet (EP) 1110-1-18 and for purposes of this document this position will be referred to as the SSHO/UXOSO-QC. Mr. Steve Burhans will be the SSHO/UXOSO-QC.

2.4 Federal, State, and Local Agencies

The lead regulatory agency involved in the RFI is the GAEPD, who will provide review and technical input on this Work Plan and the RFI Report.

2.5 Stakeholders

In addition to USACE, and the GAEPD, numerous other Army stakeholders are involved in the RFI activities for FTSW, including:

- FTSW Staff
- Installation Management Command
- US Army Environmental Command (USAEC)

2.6 Project Communication and Reporting

2.6.1 Record Keeping

The administration of the contract must be substantiated by permanent records, such as written correspondence, notes, and photographs. It is essential to summarize important non-written communications with notes covering conferences, telephone calls, and discussions, giving the date, location, parties involved, and important issues/topics discussed. Written correspondence is the most deliberate, as well as the most important, of the three general types of contractual communication (i.e., person to person, telephone calls, and written correspondence).

External communications with local, state, and federal agencies, other groups associated with FTSW, and the general public, will be initiated by USACE and/or FTSW personnel.

2.6.2 Project Meetings

Several types of project meetings will be coordinated to discuss planning activities, including a kick-off meeting and TPP meetings. The objective of these meetings is to reach consensus among the PDT members on key project decisions, present field data findings, and discuss project deliverables. The PDT includes personnel from: CESAS, CENAB, FTSW, GAEPD, USAEC, ERT, and ERT subcontractors. Meeting attendees will vary based on the agenda items for discussion. ERT will coordinate and document these meetings unless otherwise instructed by CENAB.

2.6.3 TPP Meetings

ERT has implemented USACE's four-phase TPP process to identify the project, determine data needs, develop data collection options, and finalize the data collection program in order to support project objectives. One of the primary outcomes of TPP is the development of Data Quality Objectives (DQOs) for the level of data acceptable. ERT is conducting the TPP in accordance with USACE EM 200-1-2 and EM CX Interim Guidance Document 01-02. TPP includes the following:

- Identifying stakeholders.
- Conducting a thorough review of historical MRS operations. All available MRS specific data will be used to prepare background/presentation materials for the TPP.
- Organizing and coordinating meetings with stakeholders to be conducted at FTSW.
- Preparing quality presentations for each TPP meeting:
  - Meeting #1 occurred on October 13, 2010. The objective was to summarize previous relevant previous findings, present the current preliminary CSM from the CS, and discuss the conceptual approach to proposed digital geophysical mapping (DGM) and field sampling activities, including identification of analytical parameters. The meeting summary is included in Appendix I.
  - Meeting #2 occurred on February 15, 2012. The final technical approach outlined in the Work Plan was reviewed; the Work Plan will be finalized shortly after this meeting.
  - During meeting #3, the data summary tables will be presented, preliminary conclusions based on findings will be developed, and concurrence that data gaps have been filled will be achieved.
- Preparing TPP minutes for each meeting.

2.6.4 Project Reporting

Project status reports will include a summary of the work performed during the reporting period as well as work planned for the upcoming period. These reports will summarize results of meetings that occurred during the reporting period. A request for payment invoice will be provided showing verification of achievement of payment milestones.

2.6.5 Field Communications and Reporting

The following actions or communications associated with field operations will be documented as discussed in Section 4 of this Work Plan in a written or electronic log maintained by the ERT SUXOS or ERT PM designated person:

- Each occasion that MEC is encountered;
- When and why work is stopped for safety reasons;
- Health and safety violations;
- Personnel changes and reason for changes; and
- Any deviations from the approved Work Plan or APP/SSHP that occur in the field (e.g., number of samples, analysis, or problems encountered).

A Daily Progress Report (example shown in Appendix F) will be completed by the ERT SUXOS or ERT PM designated person. The report will include the following:

- Discussion of work progress;
- Individuals contacted or interviewed;
- Problems encountered; and
- Discussion of work completed versus project schedule.

Additionally, during sampling activities, Daily Quality Control Reports (DQCRs) will be prepared and submitted with the Daily Progress Report. The DQCR will include, at a minimum, weather information at the time of sampling, field instrument measurements, calibrations, identification of field and control samples collected, deviations from the UFP-QAPP, any problems encountered, and any USACE Contracting Officer's Representative (COR) directives.

2.7 Project Deliverables

The project deliverables required in the PWS and their estimated submittal schedules are listed in Table 2-1. For some documents, specific submittal dates will be a function of consensus through the TPP process.

Table 2-1. Project Deliverables

Name	Estimated Submittal Date
Project Management Plan (PMP)	September 15, 2010
Final TPP Memorandum	60 days after each TPP meeting
Final Work Plan	TBD
Daily QC Report for Sampling	Daily during sampling activities
Analytical Data for QA Evaluation	75 days after completion of fieldwork
Electronic Lab Data Submittal	90 days after completion of fieldwork
Final RFI Report	TBD (no later than 31 May 2013)
Final GIS Files (on CD/DVD)	TBD (no later than 31 May 2013)

Various reviewers, including regulatory agencies, and other identified stakeholders, will have the opportunity to review final submittals. ERT will review every comment received through the

USACE Project Manager and will issue a formal, annotated response to each. ERT will not non-concur with a comment without discussing with the USACE.

Documents will be submitted in draft, draft final, and final versions, unless otherwise specified.

2.8 Project Schedule

A detailed Microsoft Project schedule has been prepared for this project. The activity based schedule is logically sequenced and outlines activities and milestones necessary to support and manage completion of the task order. This schedule will be updated periodically (typically, in each Project Status Report) as it is subject to change and presented to USACE (Appendix E, Worksheet #16).

The field operations schedule is dependent upon the Work Plan schedule, which is a function of several activities: the time required for ERT to prepare the draft documents; the anticipated USACE review time of the draft product; ERT's response to comments and preparation of the draft-final for stakeholder review; the anticipated time for the stakeholder review; response to stakeholder comments; and finally, ERT's preparation of the Final Work Plan.

ERT field activity durations are based on experience at many projects performing similar work tasks. ERT will coordinate activities to ensure that the project schedule does not conflict with other contractor activities on-site or interrupt FTSW activities.

2.9 Periodic Reporting

Section 2.6.4 discusses the Project Status Reports to be completed as part of the task order.

2.10 Costing and Billing

This project is a Performance Based Contract. Payment milestones are detailed in the PMP. The milestone payment plan provides discrete and measurable elements and activities associated with project progress. ERT will invoice USACE based on these milestones, as approved by the COR. In addition to all contract-required documentation, the ERT PM will submit summary level information that supports each invoice submitted to the USACE for review. This summary level information will be presented on ENG FORM 93-1.

2.11 Project Community Relations Support

FTSW will take the lead on communications with the public on this RFI. ERT will provide the necessary support to initiate, schedule, and address each public participation aspect of the project (i.e., preparing briefings, presentations, fact sheets, and public notices to news media). FTSW has a Community Involvement Plan (CIP) that was published in 2007. ERT will update that CIP for the MMRP RFI, if necessary.

2.12 Subcontractor Management

2.12.1 Analytical Laboratory

ERT has subcontracted with ALSI for laboratory analysis of soil, sediment, and groundwater samples. ALSI is accredited in accordance with the *National Environmental Laboratory Accreditation Conference*, and certified to perform the specified methods by the National

Environmental Laboratory Accreditation Program and DoD *Environmental Laboratory Accreditation Conference*, in compliance with the DoD Quality System Manual. ALSI will furnish all labor, tools, equipment, supplies, material, and licenses, and perform all technical, professional, supervisory, QC, and other services necessary to complete the analytical services. Invoices will be submitted to ERT once the required analytical work is complete and data have been satisfactorily validated. ERT's Project QC Specialist will be the single POC with the laboratory.

2.12.2 Other Subcontractors

ERT has also subcontracted data validation services with MCGI. The Project QC Specialist will be the single POC with MCGI. ERT will subcontract a Georgia-licensed civil surveyor to install benchmarks and base stations, as needed. Additional services may be subcontracted as required. For example, if the PDT determines groundwater wells are needed once the geophysical investigation results are discussed, a local driller with experience at FTSW or in the surrounding area will be subcontracted for these services.

2.13 Management of Field Operations

2.13.1 Summary of Field Operations

ERT personnel, under the direction of the ERT PM, will manage the successful execution of all field activities. Section 3 presents the detail of the major elements of the field operations, including:

- Mobilization and demobilization;
- Field support logistics;
- DGM;
- Intrusive investigation of geophysical anomalies;
- Environmental sampling; and,
- Processing of MEC/MD and Investigation Derived Waste (IDW).

Mobilization and demobilization to and from FTSW will be coordinated by ERT PM designated personnel. DGM will be coordinated by the Senior Geophysicist and performed by the field geophysicists.

Intrusive investigations will be performed based on analysis of the DGM results. Under the supervision of the SUXOS, the UXO team personnel will be responsible for disposition of MEC or MD items as detailed in Section 3.7.9.

Soil and groundwater (if required) sampling will be performed by the ERT field team, under the guidance of the ERT PM. Due to the nature of MEC at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), UXO avoidance support will be required when conducting field sampling.

3.0 FIELD INVESTIGATION PLAN

3.1 Overall Approach to Munitions Response Activities

3.1.1 MRS Characterization Goals

The MRS characterization goal of this RFI is to assess the nature and extent of MEC and MC contamination caused by the past military activities at FTSW and to recommend whether further RCRA actions are warranted. Risks to human health and the environment will be quantified in a Human Health and Ecological Risk Assessment. MEC hazards will be assessed using USEPA's MEC Hazard Assessment (HA) methodology. Additionally, the MRSs will be evaluated for sequencing using DoD's Munitions Response Site Prioritization Protocol (MRSPP).

3.1.2 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality and level of data required to support the decision-making processes for a project. The *Data Quality Objectives Process for Hazardous Waste Site Investigations (QA/G-4HW)* (USEPA, 2000a) provides general, non-mandatory guidance on developing DQOs for environmental data collection operations in support of hazardous waste site investigations. USACE's TPP process (EM 200-1-2) closely mirrors EPA's 7-step DQO process, and DQOs for FTSW have been refined through TPP meetings, for which the minutes are presented in Appendix I. The DQOs are based on the overall objective of the current executable phase of the project (the RFI), which is to determine whether or not the MRSs warrant further corrective action pursuant to RCRA based on a characterization of the nature and extent of MEC and MC contamination and a determination of the potential risks to human health and the environment from MEC and MC.

Tables 3-1 and 3-2 present the overall DQOs for the DGM and intrusive investigation, the primary means of identifying the nature and extent of MEC contamination. Tables 3-3 and 3-4 present the DQOs for soil sampling activities, which are the primary means for identifying the nature and extent of MC contamination. In addition, secondary performance criteria associated with DGM data collection and reacquisition of anomalies are discussed in Section 3.5.14. Project Quality Objectives and laboratory analytical DQOs for environmental sampling are presented in Worksheet #11 of the UFP-QAPP (Appendix E). Worksheet 11 of the UFP-QAPP also outlines the 7-step DQO process, from statement of the problem to optimization of the design, which culminates in the DQOs.

Table 3-1. DQO – DGM/Intrusive Investigation Anti-Aircraft Range 90-mm - 2 MRS	
Data Quality Objective Element	**Site-Specific DQO Statement**
Project Objective(s) Satisfied	To characterize the nature and extent of MEC.
Data User Perspective(s)	To obtain data that satisfy compliance, risk, and if needed, corrective action requirements.
Contaminant or Characteristic of Interest	To determine the distribution and density of MEC.
Media of Interest	MEC in Soil
Required Sampling Locations or Areas and Depths	A. Perform DGM survey of MRS using EM61-MK2 integrated with robotic total station (RTS) or equivalent accuracy RTK global positioning system (GPS). B. DGM survey coverage will be 5.56 acres via grid survey, determined through Virtual Sample Plan (VSP) and UXO Estimator to be sufficient to determine 95% confidence that MEC density is less than or equal to 0.5 MEC item/acre. C. Hand excavation will be performed for each target identified above the target threshold. D. The results will be recorded via GPS and dig sheets.
Number of Samples Required	Each geophysical target identified above the target threshold will be intrusively investigated.
Reference Concentration of Interest or Other Performance Criteria	Determine density of MEC within the MRS.
Sampling Method	A. DGM survey of 9.78 percent of the MRS, approximately 5.56 acres, using grids randomly placed by VSP. B. Additional biased transects placed between bunkers, including approximately 13,630 linear feet of transects, based on request of GAEPD at TPP #1.
Analytical Method	EM61-MK2

Table 3-2. DQO - DGM/Intrusive Investigation for the Hero Road Trench Area MRS

Data Quality Objective Element	Site-Specific DQO Statement
Project Objective(s) Satisfied	To characterize the nature and extent of possible dilute agent CAIS kit burial/disposal pits.
Data User Perspective(s)	To obtain data that satisfy compliance, risk, and if needed, corrective action requirements.
Contaminant or Characteristic of Interest	To characterize the nature and extent of dilute agent CAIS kits and their degradation products within the MRS.
Media of Interest	Dilute agent CAIS kit burial/disposal pits in soil.
Required Sampling Locations or Areas and Depths	A. DGM survey of the MRS using the EM31 with RTS or Line & Fiducial navigation. B. Survey to be close to 100 percent coverage, with 15-foot lane spacing over the entire MRS. Based on discussions from TPP #2, the parking area on the southeastern boundary of the MRS will not be surveyed.
Number of Samples Required	A. Intrusively investigate potential burial sites with test pits/trenches based on historical photographs and DGM results. B. Determination of test pits/trenches location and number will be based on a discussion of the Test Pit Recommendation Memo (developed based on DGM results) with the PDT.
Reference Concentration of Interest or Other Performance Criteria	Determine presence/absence of any burial pits potentially containing dilute agent CAIS kits or related degradation products.
Sampling Method	Excavation of potential burial/disposal pit locations, each approximately 30 square feet in surface area.
Analytical Method	EM31

Table 3-3. DQO – Soil Sampling for the Anti-Aircraft Range 90-mm - 2 MRS	
Data Quality Objective Element	**Site-Specific DQO Statement**
Project Objective(s) Satisfied	To characterize the nature and extent of MC contamination.
Data User Perspective(s)	To obtain data that satisfy compliance, risk, and if needed, corrective action requirements.
Contaminant or Characteristic of Interest	Analyze for metals (Al, Cu, Pb, and Zn) as identified in the MC Memo (Appendix H) and explosives.
Media of Interest	Soil
Required Sampling Locations or Areas and Depths	A. Up to 10 biased soil samples will be collected in areas where there is visible evidence of energetic material, e.g., munitions items which are breeched. Biased soil samples will also be collected in areas of significant MD, where at least 50% of the munition could be identified by UXO Technicians, such that an assumption of MC in the vicinity could be tested by taking a sample. B. The depth for the biased soil samples will be just below the depth of the associated munition, or in the case of samples collected where there is visible evidence of energetic material in the top few inches of soil. C. Randomly placed discrete surface (0-12 inches) and subsurface (12-24 inches) soil samples will be taken at locations determined by VSP. Although the expectation is that no surface MEC or debris will found at this MRS, past studies have shown levels of some metals (e.g., lead) at FTSW elevated above background levels; therefore, the surface soil must be investigated to support the risk assessment. D. Background surface soil samples collected from FTSW Solid Waste Management Units (SWMUs) used for development of existing background dataset. Availability of these SWMUs for sampling will be coordinated with FTSW personnel.
Number of Samples Required	A. Up to 10 biased samples based on (A. above). B. 10 random discrete surface samples (VSP determined). C. 10 random discrete subsurface samples (VSP determined). D. 10 background surface samples.
Reference Concentration of Interest or Other Performance Criteria	USEPA Regional Screening Levels (RSLs), FTSW SWMUs background dataset (for Pb values), and USEPA Ecological Benchmarks (See QAPP Worksheet #15 for more information).
Sampling Method	A. Obtain discrete biased and background soil samples using hand trowels. B. Obtain discrete random surface or subsurface soils using a hand auger or hand trowel, depending on depth.
Analytical Method	Metals analysis (exclusively Al, Cu, Pb, and Zn) by SW-846 Method

Table 3-3. DQO – Soil Sampling for the Anti-Aircraft Range 90-mm - 2 MRS	
Data Quality Objective Element	**Site-Specific DQO Statement**
	6020A/7471A and explosives analysis by SW-846 Method 8330B. For background dataset, Al, Cu, and Zn analysis by SW-846 Method 6020A/7471A as these are not part of the existing SWMU dataset (Pb is covered by the FTSW SMWU background dataset).

Table 3-4. DQO - Soil Sampling for the Hero Road Trench Area MRS	
Data Quality Objective Element	**Site-Specific DQO Statement**
Project Objective(s) Satisfied	To characterize the nature and extent of dilute agent CAIS kit degradation products.
Data User Perspective(s)	To obtain data that satisfy compliance, risk, and if needed, corrective action requirements.
Contaminant or Characteristic of Interest	Analyze for arsenic, oxithiane, dithiane, and thiodiglycol (degradation products from the dilute agent CAIS kits).
Media of Interest	Soil
Required Sampling Locations or Areas and Depths	A. Collect two biased soil samples from the side wall of each test pit/trench, one 0 to 12 inches bgs and a second sample from 1 foot to the bottom of the pit/trench. B. Biased subsurface soil samples will be collected from the soil horizon immediately above groundwater, and will be placed based on the distribution of DGM ground conductivity results and historical aerial photography. C. Randomly placed surface (0-12 inches) and subsurface (12-24 inches) soil samples will be taken at locations determined by VSP.
Number of Samples Required	A. Two biased soil samples collected from each test pit/trench, up to a total of 8 biased samples in test pits/trenches. B. 16 biased surface and subsurface soil samples placed based on distribution of DGM ground conductivity results and historical aerial photography. C. 10 random discrete surface samples (VSP determined). D. 10 random discrete subsurface samples (VSP determined)
Reference Concentration of Interest or Other Performance Criteria	USEPA Regional Screening Levels (RSLs), FTSW SWMUs background dataset, and USEPA Ecological Benchmarks (See QAPP Worksheet #15 for more information).
Sampling Method	A. Obtain discrete surface and subsurface soil samples from excavation trenches/pits using hand trowels. B. Obtain discrete biased and random surface and subsurface samples using a hand auger.
Analytical Method	Metals analysis (exclusively arsenic) by SW-846 Method 6020A/7471A and organosulfur residues (1,4-dithiane, 1,4-oxathiane, and thiodiglycol) by SW-846 Method 8270D/8321.

3.1.3 Data Incorporation into RFI Report

Raw data from field measurements (including geophysical, intrusive, and environmental sampling data collection activities) will be recorded and noted in the field notebooks. Data review will be performed on both the geophysical surveys and the intrusive investigations. Geophysical data will be validated by reviewing the field notes, geophysical data, reacquisition results, intrusive results, and QC test results to confirm that they meet the applicable DQOs. Analytical data validation will be conducted in accordance with UFP-QAPP Worksheets #34 through #37 (Appendix E). If requested, unprocessed geophysical data can be provided to USACE in a reasonable time after collection (typically within 36 hours after completion of the day's work).

3.1.4 MEC Exposure Analysis

Each encountered MEC and MD item will be removed as the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is characterized. MEC and MD are not anticipated to be encountered at the Hero Road Trench Area MRS (FTSW-008-R-01). No MEC or MD will remain in anomalies or excavations investigated as part of this effort. The AHA, Attachment 2 of Appendix D, identifies control measures used to mitigate worker exposure during field activities.

3.1.5 Use of Interim Measures

The procedures outlined in this Work Plan are for a RFI. In the event that circumstances develop during any investigation activities that justify the need for interim measures, such as a significant possibility of explosive hazards resulting in injury or loss of life, work will stop and USACE will determine whether interim measures are warranted while the long-term, comprehensive corrective action strategy is being developed.

3.1.6 Follow-on Activities

ERT will prepare the RFI, which will guide any follow-on actions in accordance with RCRA and Army guidance.

3.2 MRS Constraints and Limiting Factors

The FTSW map is provided in Figure 2 in Appendix B. Figures 3 and 5 in Appendix B show the Anti-Aircraft Range 90-mm - 2 (FTSW-002-R-01) and Hero Road Trench Area (FTSW-008-R-01) MRSs, respectively.

Special consideration is given to the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), because it is currently utilized as an ASP. A gated fence surrounds the majority of the MRS; the ASP is guarded and access is restricted to approved personnel only. Access to this MRS will require advance communications and scheduling with FTSW personnel and associated groups. Access will be secured at least two weeks prior to mobilization. The Hero Road Trench Area MRS (FTSW-008-R-01) is located within the cantonment area, mostly within an area secured by a chain link fence. ERT will obtain keys to the MRS gate, and will ensure the gates are kept locked at all times during operations at the site.

3.3 Field Mobilization/Demobilization and Field Preparation

3.3.1 Objective

The objective of this subsection is to describe the logistics of mobilizing personnel, equipment, and facilities to begin the project, as well as demobilizing personnel, equipment, and facilities upon completion of the project.

3.3.2 Overview

Prior to mobilization to FTSW, the ERT project team will receive site-specific health and safety training. The field team will reduce schedule risk by ensuring that each piece of equipment and material needed for project completion is on hand, tested, configured, and setup prior to deployment. Their responsibilities, as delegated by the ERT PM, will include:

- Performing functional and operation checks of equipment;
- Confirming that all personnel have the proper training records and are under medical surveillance;
- Coordinating the installation of roll-off bins for non-hazardous items disposal;
- Coordinating the delivery and staging of temporary storage units (CONEX or equivalent);
- Preliminary coordination of explosives delivery and scrap metal removal;
- Coordinating the installation of Exclusion Zones (EZs);
- Coordinating project details with FTSW, CENAB, and CESAS personnel; and
- Simulating data transfer to identify and fix any potential problems prior to subsequent geophysical activities.

3.3.3 Utility Protection Service

The ERT SUXOS will coordinate with Georgia811 (http://www.georgia811), the utility protection service for the area, as detailed in the FTSW contractor standard operating procedure (SOP) prior to any intrusive work.

3.3.4 MRS Security

The ERT SSHO will be responsible for security of the Hero Road Trench Area MRS (FTSW-008-R-01) during active operations. Security of the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is coordinated by the FTSW ASP. The ERT SUXOS and ERT PM will coordinate any FTSW MRS security issues with CESAS, CENAB, and/or FTSW directly.

3.3.5 Demobilization

Each piece of equipment brought to FTSW will be removed from the property at demobilization. This will occur in phases, as particular field activities are completed and associated equipment is no longer needed on-site.

3.4 Field Preparation

3.4.1 Introduction

This section details each of the initial activities that must be performed prior to DGM data collection in each of the two MRSs.

3.4.2 Civil Survey and Transect/Grid Establishment

Each MRS will be mapped by a civil surveyor licensed in the state of Georgia. Every man-made surface feature will be mapped to 3 centimeters (cm) of accuracy, including buildings, paved surfaces, fences, sign posts, utilities, etc. The results of this survey will be incorporated on the site maps used for data presentation. The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) will be DGM surveyed using a combination of grids and transects. The Hero Road Trench Area MRS (FTSW-008-R-01) will be DGM surveyed using transects. For more information on the placement of grids and transects, see Section 3.5.12.2. Transect end-points and midpoints (placed every 300 feet), and grid corners will be marked with wooden stakes or nonmetallic pin flags. All work performed in the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) will be performed under the escort of a UXO Technician II. Each transect or grid point staked will be evaluated using anomaly avoidance procedures and a Schoenstedt GA-52CX magnetometer.

3.4.3 Brush Removal

Brush removal will not be required in the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) as the entire MRS is maintained with grass cutting equipment. The Hero Road Trench Area MRS (FTSW-008-R-01) is expected to require extensive brush removal, performed using the surveyor marked transect end- and mid-points as guidance. The EM-31 is carried by hand, and does not use a wheeled cart and therefore is capable of passing through areas with moderate brush. However, the RTS navigational system requires line-of-sight between the base station and prism (mounted on the EM31 system). Brush removal will be performed with this in mind, using hand tools and/or a brush hog while cutting a minimum amount of underbrush. No brush larger than 3 inches in diameter at chest height will be cut. The equipment used for cutting will cut/chip the brush in place; no accumulated piles of cut material will be left within the MRS. It is anticipated that after brush removal some areas will still be difficult to survey using the RTS system. ERT will use the Line & Fiducial method when RTS is not practical.

3.4.4 MEC Surface Clearance

No MEC surface clearance is anticipated to be required in either MRS. The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) has been maintained as grassy fields for over 30 years; therefore, no surface MEC or debris is known to exist at the surface of the MRS. The Hero Road Trench Area MRS (FTSW-008-R-01) is not a MEC MRS, and any constituents at the MRS are expected to be located in subsurface burial pits.

3.5 Geophysical Investigation Plan

3.5.1 Purpose and Scope

The purpose of the DGM survey is to acquire data that will aid in the characterization of the nature and extent of subsurface MEC contamination in the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) and the distribution of possible subsurface burial pits in the Hero Road Trench Area MRS (FTSW-008-R-01).

3.5.2 Site Description

Site description is provided in Section 1.5.

3.5.3 Geophysical Data Quality Objectives

In general, the purpose of DGM is to determine the locations of anomalies possibly caused by MEC-related materials or determine areas of disturbed earth that may be potential subsurface burial pits. Section 3.1.2 provides project DQOs while detailed secondary DQOs are provided in Section 3.5.14.

3.5.4 Specific Area to Be Investigated

The specific areas to be investigated at FTSW are described in Section 1.5. A DGM transect and grid map for the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is provided as Figure 8 in Appendix B.

3.5.5 Past, Current, and Future Use

Past, current, and future use is described in Sections 1.6 and 1.7.

3.5.6 Anticipated Anomaly Source Type, Composition and Quantity

Numerous MEC and MD have been found at FTSW over the years. Table 1-1 provides a summary of items found in the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01); no information on the location of these items is available. This list includes both ferrous and non-ferrous metallic MEC items and components. This list is not inclusive of every munition type that may have been used at FTSW or that may be found in the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01). It is estimated that there may be approximately 0.5 MEC items per acre in this MRS, for a total of less than 50 items.

Anomaly sources in the Hero Road Trench Area MRS (FTSW-008-R-01) are related to possible burial/disposal pits where dilute agent CAIS kits and/or debris may be buried. Debris may be composed of various metals, cultural, and/or industrial waste. The dilute agent CAIS kits are anticipated to include glassware possibly stored in metal canisters. It is estimated that there are less than four potential burial pit locations, based on historical photography and past investigations.

3.5.7 Anticipated Depth

Munitions records for items found in the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) do not include information on depth of discovery. As the MRS is not an impact area, and

ASP as-built records indicate minimal ground disturbance during construction, it is anticipated that MEC is located in the shallow subsurface between 6 inches and 2 feet.

The depth of potential burial pits in the Hero Road Trench Area MRS (FTSW-008-R-01) is unknown; however, the depth is anticipated to be above groundwater, which ranges from 2 to 10 feet below the surface in the area of this MRS.

3.5.8 Geologic Conditions

Geologic conditions are described in Section 1.5.2.

3.5.8.1 Soil Conditions

Soil conditions are described in Section 1.5.2.

3.5.8.2 Shallow Groundwater

Groundwater conditions are described in Section 1.5.2.

3.5.8.3 Geophysical Conditions

The geophysical conditions at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) are challenging due to the current use of the MRS and cultural influences. Cultural features such as gravel and paved roads, vehicles, fences, landscaped areas, utilities, munitions storage bunkers, and buildings create localized differences in background responses for electromagnetic and magnetic techniques. Aside from the perimeter fence, it is anticipated that there are few cultural influences on geophysics at the Hero Road Trench Area MRS (FTSW-008-R-01).

Static electromagnetic noise levels are typically within a range of 3 millivolts, but can increase significantly in the vicinity of power lines or utilities. Other cultural items, such as metallic debris and road bed material containing magnetic rocks cause anomalous responses that are difficult to distinguish from anomalies that could represent MEC. These conditions result in difficulties meeting the required signal response reductions when resolving anomaly excavations.

3.5.9 MRS Utilities

It is not anticipated that utilities either buried or overhead will be encountered during the Hero Road Trench Area MRS (FTSW-008-R-01) investigation. Utilities likely do exist at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01). ERT will coordinate with FTSW DPW and Georgia811 per Section 3.3.3.

Each visible surface feature will be located and identified during geophysical surveys. The locations of utilities will be considered during the selection of anomalies for intrusive investigation and the anomaly resolution process.

3.5.10 Dynamic Events Affecting Field Operations

Dynamic events such as rain, lightning, and solar flares may affect geophysical data collection. Procedures for geophysical survey operations when these events occur are described below.

Rain: The effect of rain on geophysical operations is primarily dependent on the instrument being used and the physical field conditions (terrain and vegetation).

Instruments: Most instruments commercially available are relatively water resistant. Additional measures will be taken by the DGM survey teams (such as covering connections with plastic sheeting) to reduce the possibility of moisture impacting the instrument's electronics. When possible, DGM survey teams will only operate the instruments in the rain under very light rain conditions (drizzling). If the rain persists and the field geophysicist determines that there is a potential for an impact to the data quality, or that moisture could be getting into the instrument, field operations will cease and the Project Geophysicist will be notified. Operations will continue after the rain has ceased or has reduced to a drizzle.

Field Conditions: In areas where footing for the operators becomes difficult because of wet terrain or vegetation, operations will cease until the area is deemed safe by the SSHO/UXOSO-QC. The determination to stop work will be made by the SSHO/UXOSO-QC, and the field project team will be immediately notified.

Lightning: Any observed lightning in the area will be considered a safety hazard and field activities will be stopped until all lightning activity has ceased. If any field personnel observe lightning, they will stop work immediately and notify the SSHO/UXOSO-QC, who will instruct all other field personnel to stop work and take equipment to a safe area. Work will not resume until the SSHO/UXOSO-QC has given notice that it is safe to do so.

Solar Flares: Solar flares are sun-generated phenomena that may temporarily generate high-magnitude magnetic noise sufficient to make magnetometers, often gradiometers, and occasionally electromagnetic sensors unusable for the duration of the event. Solar flares are typically readily observable by the instrument operators (throughout the area) as rapidly fluctuating signal readings with no apparent cultural or survey source. The Project Geophysicist will be alert to solar flares and will temporarily cease data collection until static testing shows a cessation of the solar activity. The Project Geophysicist will log the time intervals when solar flare activity is observed to help determine whether any data (for digital geophysics) have been affected. The National Oceanic and Atmospheric Administration maintains a website at http://www.swpc.noaa.gov/rt_plots/mag_3d.html, which will be monitored during the fieldwork.

3.5.10.1 Overall MRS Accessibility

Each MRS will be accessed by vehicle, with parking at the perimeter of the MRS. Both MRSs are secured by fences. ERT will obtain keys to the Hero Road Trench Area MRS (FTSW-008-R-01) gates. Access to the Anti-Aircraft Range 90-mm - 2 (FTSW-002-R-01) is controlled by FTSW. ERT will coordinate FTSW security to gain access at least 2 weeks prior to mobilization. ERT will strictly comply with all ASP access rules and regulations.

3.5.10.2 Potential Worker Hazards

Potential worker hazards and corresponding safety measures and procedures are summarized in the APP/SSHP and AHAs (Appendix D).

3.5.11 Geophysical System Verification Plan

Geophysical System Verification (GSV) will be utilized to monitor and test geophysical data quality for UXO DGM surveys at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01). The Geonics EM-61 MK2A total metal detector (EM61) is planned for use during the geophysical

mapping, anomaly reacquisition, and resolution tasks (detailed proposed geophysical equipment is presented in the Section 3.5.12.3) at this MRS. GSV is composed of daily surveys of an Instrument Verification Strip (IVS) and the use of a blind seed program, where metallic pipes ("seeds") are placed in the subsurface along transects or within grids in the survey area, at locations unknown to the geophysical data collectors. The following sections describe the procedures associated with the GSV to be completed at the Anti-Aircraft Range 90mm – 2 MRS only.

As the Hero Road Trench Area MRS is not a MEC site, and the instrument planned for use (EM31) is not compatible with GSV, alternative QC tests will be performed during DGM surveys there. These tests and frequency of tests are identified in Table 3-7 (tests 1-5 and 8). EM31 calibration as described in Section 3.5.14.1 will also be performed.

3.5.11.1 Seed Items

Seed items are inert Industry Standard Objects (ISO) that have been well characterized geophysically and are obtained easily. Table 3-5 presents the detail of the IVS items. Table 3-6 presents details on placement of these items in the IVS. ISOs will be obtained and buried by UXO Technicians at various depths, orientations, and locations (Figure 7 in Appendix B). The location of seed items (IVS and blind seeds) will be surveyed at the time of burial to document their horizontal and vertical positions as well as depth below ground surface (bgs). The locations will be provided to USACE.

Table 3-5. IVS Contents

Item	Nominal Pipe Size	Outside Diameter	Length	ASTM Specification*
Small ISO	1"	1.315" (33 mm)	4" (102 mm)	A53/A773
Medium ISO	2"	2.375" (60 mm)	8" (204 mm)	A53/A773
Large ISO	4"	4.500" (115 mm)	12" (306 mm)	A53/A773

**Source: ESTCP's Final GSV: A Physics-Based Alternative to Geophysical Prove-Outs for Munitions Response, Page 27.*

3.5.11.2 Instrument Verification Strip Objective

The objective of the IVS is to confirm the geophysical survey instrument selection, verify that the targets of interest will be detectable to the depth of interest at this site, validate predetermined anomaly selection methods, and provide a daily verification of proper operation of the geophysical sensor system (sensor plus location system plus data recording approach).

3.5.11.3 Instrument Verification Strip Preparation

Ideally the IVS location will be representative of the terrain, geology, and vegetation that will be encountered in the MRSs, and will have similar geophysical characteristics such as background and noise levels. The test items will be buried as specified in Table 3-6 and as shown in Figure 7. The actual locations of the test items will be recorded by civil surveyors as described below.

Table 3-6. IVS Design Summary

MRS	Surrogate Item	Distance from start point (feet)	Depth bgs (inches)	Orientation	Simulation
Anti-Aircraft 90-mm Range - 2	Small ISO	10	6	Vertical	Small items (grenades, 20mm rounds, etc.)
	Small ISO	20	9	Horizontal, perpendicular to traverse	
	Medium ISO	30	18	Vertical	Medium items (40mm rounds, mortars, etc)
	Medium ISO	40	18	Horizontal, parallel to traverse	
	Large ISO	50	24	Vertical	Large items (105mm rounds, Livens projectiles, etc)

The proposed IVS location for the Anti-Aircraft Range 90mm - 2 MRS (FTSW-002-R-01) is near the southeast corner of the ASP (location is subject to approval by FTSW) (Figure 3). The space required for the IVS is approximately 20.5 feet wide by 70 feet long, although spatial constraints may force the IVS to be smaller (fewer than the proposed number of seed items).

Table 3-6 lists each surrogate item to be buried in the IVS including orientation and depth. Small, medium, and large ISOs simulate potential MEC to be found at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01). It is anticipated that no surface vegetation or debris removal will be required for IVS construction. Anomaly avoidance techniques will be implemented to ensure that areas chosen for the placement of seed items and corner markers are clear of metallic anomalies.

Seed items will be placed by UXO Technicians using shovels to dig holes and place the seed items in the ground. A Georgia state licensed civil surveyor will survey the location of the seed items. The center and ends of seed items will be surveyed for elevation. Surface elevation will be measured after seed item burial, to accurately determine depth bgs.

3.5.11.4 Initial IVS Survey

The initial survey of the IVS is designed to confirm both the operation of the survey system and the ability of the chosen sensor to detect the items of interest at the depth of interest in the noise environment particular to the survey area. Initial data collection over the IVS is more extensive than future passes over the IVS area.

At the Anti-Aircraft Range 90mm - 2 MRS (FTSW-002-R-01), the first pass is made with the EM61 sensor 2.5 ft offset from the seed line. The next pass is directly over the test items. The third pass will be made with an offset of 1.25 feet (one half of the planned line spacing—the maximum offset of any target from the center of a survey line) and a fourth at an offset of 2.5 feet. The final pass is 6 feet offset from the line of targets to make a measurement of survey noise at this location. In addition, a conventional 6-line test will be performed on the seed line in order to quantify possible instrument lag.

3.5.11.5 Quality Control

ERT will follow QC procedures in accordance with ESTCP's GSV Guidance document and DID MR-005-05.01 and attachments. As discussed in the following sections, QC will be performed and documented at the beginning and end of each day and reviewed by the Project Geophysicist on a daily basis.

3.5.11.6 QC Steps/Tests

The required equipment tests and frequency of testing are summarized in Table 3-7.

Table 3-7. QC Test Frequency

Test No.	Test Description	Power On	First Day	Beginning and end of Day		One Line per Grid or 100 ft per Linear Mile
				EM61	EM31	
1	Equipment Warm up	X				
2	Personnel Test			X	X	
3	Static Background Test			X	X	
4	Vibration Test			X	X	
5	Static Spike Test			X	X	
6	IVS Test			X		
7	6-line Test		X			
8	Repeat Data					X

3.5.11.7 IVS Test

In addition to the QC tests detailed in Table 3-7, the survey crew will collect data at the IVS at the beginning and end of each day during DGM of the Anti-Aircraft Range 90mm - 2 MRS (FTSW-002-R-01). This survey will be simplified from the initial IVS survey. One pass will be made over the line of ISOs to confirm sensor operation and one pass will be made to confirm that the survey noise has not changed. If the sensor performance and system noise are within specifications before and after each day of surveying, it is reasonable to expect that the system was performing within acceptable bounds throughout the day. If the sensor performance is

within performance criteria in the morning and not in the evening, the data must be examined to determine if any are usable. The results of these twice-daily performance confirmation surveys will be reported in a continually updated set of plots showing the down-track position error and amplitude variation for each target. As with the first day's measurements, any deviations outside the data objectives will require a detailed root cause analysis before survey operations can be resumed.

3.5.11.8 6-line Test

The six-line test involves collecting data along a line six times. The purpose of the test is to evaluate heading effects or lag and latency. For the first two line paths (1 and 2), data are collected along the line in opposite directions at a normal walking pace with no test item present. The piece of rebar used in the Static Standard Response Test is then placed in a known location on the path, and data are collected along the line in equivalent manner to the first two lines (3 and 4). For the last two line paths, data are collected in one direction at a slow pace and in the opposite direction at a faster pace (5 and 6).

3.5.11.9 Repeat Data

To determine positional and data repeatability, one line 100 feet long per mile of transect or one line per grid will be repeated after a survey. The repeat line will be walked in the same direction of travel as the original line. Errors in position repeatability outside acceptable tolerances indicate a problem in navigation by the operator or in the navigation equipment. Errors in amplitude repeatability outside acceptable tolerances indicate detector system problems or operator errors. Acceptance criteria for data repeatability include ±20% for response amplitude and ±20 cm for positional accuracy.

3.5.11.10 Blind Seeding Program

As one part of the QC plan for the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01), a blind seed program will be implemented in the production survey areas. The blind seeds will be used to verify that the DQOs concerning geolocation, sensor performance, anomaly selection, and anomaly resolution requirements are being met. Due to the limits of the EM31 ability to detect small items, no blind seeds will be placed in the Hero Road Trench Area MRS (FTSW-008-R-01).

Following the initial survey of the IVS, blind seed items will be placed by a UXO Tech II at the time of civil survey and transect layout. One blind seed item will be placed in each survey grid and one every 10,000 linear feet of transect. This ensures that at least one blind seed item is encountered on each day of DGM survey activities. These items will be small, medium, or large ISOs. The location, depth, orientation, and inclination of each seeded item will be recorded by the civil surveyor and documented with a digital photograph. ISO's will be tagged with non-biodegradable labels identifying the items as inert and providing a contract reference, a point of contact address and telephone number, and a target identifier. The CENAB Geophysicist, Ordnance and Explosives Safety Specialist (OESS), or approved alternate may choose bury blind seed items as an alternate to an ERT UXO Tech II.

The surveyed locations of these items will be provided directly to the CENAB Geophysicist or approved alternate. DGM activities will then commence. Seed items should be detected by the DGM team and locations should match picked targets on dig sheets to within +/-20 cm, and amplitudes should fall within a predictable range based on depth of burial. The data will be submitted to the USACE geophysicist for review.

3.5.12 Geophysical Investigation

3.5.12.1 Survey Design

The objective of DGM surveys at the Hero Road Trench Area MRS (FTSW-008-R-01) is to identify any potential burial/disposal pits. In order to accomplish this, a 100 percent DGM coverage (less the parking area on the southeastern boundary) survey using the EM31 with 15-foot spacing will be conducted.

The EM31 was selected at the Hero Road Trench Area MRS (FTSW-008-R-01) because it is assumed that backfilled pits and trenches will have a different ground conductivity than surrounding undisturbed ground, in addition to fact that the EM31 can detect metals. The EM61-MK2 was not selected because, even with total coverage of the MRS, the chances of finding dilute agent CAIS kits would be low. The EM61-MK2 is limited in detection depth and unable to detect non-metallic subsurface features, such as burial pits/disturbed soils and glassware. Due to the EM61's configuration (1 meter wide and wheel-mounted) and narrow survey footprint, it is also poorly suited for use in heavily vegetated areas such as the Hero Road Trench Area MRS (FTSW-008-R-01). The EM31 is a narrow, hand-carried instrument with a wide footprint, requiring minimal brush removal and fewer survey transects, and is thus better suited for this MRS.

Results of the EM31 investigation will be reported in a memorandum to the PDT, including contour maps of quadrature and in-phase of anomalies as well as recommended test pit/trench targets. The number and location of the test pit/trenches will be agreed upon by the PDT prior to intrusive activity.

The objective of DGM at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is to determine the vertical and lateral extent of MEC contamination in the subsurface, and identify the MEC density.

The EM61-MK2 was selected for use at the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) because it is a well-established instrument for detection of isolated MEC and MD items. The EM61-MK2 is capable of resolving small metal induced anomalies and potentially characterizing the nature of the anomalies. It is ideal for use with geo-statistical DGM sampling and has been proven effective for the purposes of the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01). Due to its large geophysical footprint, the EM31 is not able to resolve anomalies caused by individual MEC or MD items.

Based on the current CSM the Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) does not contain firing points, target zones, or impact areas. Records indicate soils were largely left undisturbed during construction of the ASP aside from along roads and structures (USACE, 2006a). Therefore, it is assumed the soils are homogeneous relative to MEC distribution. Using an MRS size of 56.84 acres with buildings and paved surfaces removed from the total MRS

acreage (based on agreement at the TPP #1 meeting), ERT calculated the survey acreage necessary to determine with a 95 percent confidence that there are 0.5 UXO items or less present per acre. It was determined using UXO Estimator (software) that 5.56 acres should be investigated through DGM.

VSP software, developed by Pacific Northwest National Laboratory, was then used to randomly place survey grids of various sizes (in order to investigate narrow areas between the bunkers, road, and fence) in order to meet the UXO Estimator determined coverage in the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01). These grids are shown in Figure 8.

Due to the presence of the fence within the actual MRS boundary and numerous closely spaced bunkers in the MRS, additional DGM survey transects will be placed as shown in Figure 8, for a total length of approximately 13,630 feet. These biased transects will determine MEC distribution and density in these areas, should they differ from the rest of the MRS.

No DGM investigation is planned for the surface of the munitions storage bunkers for the following reasons:

- Installation security and safety regulations do not allow access to the top of the bunkers, particularly intrusive investigations on the bunkers;
- Construction records indicate the soils used for bunker construction came from a clean fill borrow area outside of the MRS, suggesting no subsurface MEC exists in the soils on the bunkers; and
- Significant interference from metals used in the construction of the bunkers will prevent the DGM equipment from being able to resolve individual targets that may represent subsurface MEC.

3.5.12.2 Survey Control and Survey Types

Initial activity includes the establishment of navigational base stations by a Georgia State Licensed Civil Surveyor, survey grid corners, and survey transect end points and midpoints (spaced every 300 linear feet) in each MRS. The surveyor will place at a minimum, Class 1, Third Order survey benchmarks for the navigational system base stations.

3.5.12.3 Equipment

The Schonstedt GA-52Cx Magnetic Locator is a hand-held gradiometer that detects the magnetic field of a ferromagnetic object. Instrument controls consist of an on/off sensitivity switch with four sensitivity settings and a volume control. It responds to the difference in the magnetic field between two sensors spaced about 0.51 meters apart. The response is a change in the frequency of the signal emitted by the piezoelectric speaker. The instrument provides audio detection signals that peak in frequency when the locator's tip is held directly over the target. The locator can be oriented in any direction without producing a significant change in the frequency of the tone from its idling frequency. The Schonstedt GA-52Cx will be used by qualified UXO personnel for anomaly avoidance and for intrusive clearance.

The Geonics EM61-MK2A is a time-domain electromagnetic device consisting of a computer, data logger (Juniper Systems Allegro CX), and cart assembly that carries an upper and lower copper coil towed on wheels. This instrument measures the response of the immediate area to a

primary pulsed electromagnetic field, generated in the lower copper coil. The EM61 is able to discriminate between surface and subsurface conductive materials (metals) more efficiently than most other metal detection devices. The device will be integrated with the Topcon HiPerGa RTK GPS, described below. If tree canopy makes the GPS signal unusable, line and fiducial navigation will be used.

The Geonics EM31 is a frequency-domain electromagnetic device used to measure ground conductivity. It can also be used as a total metals detector. It consists of a data logger (Juniper Systems Allegro CX), and a transmitter and receiver coils that are carried by the operator. The EM31 uses a method of induction to induce an electromagnetic field in the subsurface materials, and then measures the response. The instrument effectively measures ground conductivity to depths up to 6 meters (~20 feet). The instrument collects data continuously along each transect and both ground conductivity (Quadrature) and metal detection (In-phase) data are acquired.

The Topcon HiPerGa or Hiper+ RTK GPS (or equivalent model) is the selected positioning system for the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01). It consists of a base station and rover antenna. The base station is placed over established MRS monuments with known coordinates. The rover will be mounted on a tripod over the center of the EM61 coils. The system features an integrated 13-channel, dual-frequency GPS receiver with integrated radio modem. The Leica RTS (or equivalent model) is the selected positioning system for the EM31 survey at the Hero Road Trench Area MRS (FTSW-008-R-01). It consists of a robotic base station with laser rangefinder that automatically tracks a rover prism. The base station is placed over established MRS monuments with known coordinates. The rover prism will be mounted on the back of the EM31 operator.

There may be some areas within the Hero Road Trench Area MRS (FTSW-008-R-01) which are not practical for survey with the RTS due to thick brush, even after brush removal is performed. The Line & Fiducial method will be used under these circumstances. Any areas requiring Line & Fiducial survey will have non-metallic pin flags placed as fiducial markers every 60 feet, using 300 foot fiberglass measuring tapes and the Georgia Licensed Surveyor placed survey stakes as guidance. Line & Fiducial data will be collected in 'Auto' mode on the Allegro field PC, and the operator will hit the 'mark' button as they pass over each pin flag. Upon download, data is distance normalized between fiducial markers to generate positionally referenced data.

3.5.12.4 Geophysical Personnel

Senior project personnel are described in Section 2.3. A field geophysicist and a field technician will be utilized during DGM surveys.

3.5.12.5 DGM Procedures

The DGM team will consist of two geophysicists. One will operate the EM31 or EM61-MK2, and the other will take field notes, carry supplies, and generally assist the operator. A UXO escort will be required during all activities being conducted within the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01); as there is no MEC hazard associated with the Hero Road Trench Area MRS (FTSW-008-R-01), a UXO escort will not be needed for work within this MRS.

Survey line spacing during grid survey with the EM61-MK2 will be maintained by following a pre-established grid. Line spacing within the area of investigation will be 2.5 feet, ensuring overlap between transects.

Transect DGM will be performed with both the EM31 and EM61-MK2, following the pre-marked transect end points and midpoints. If line of sight is not clear from midpoint to midpoint, additional flagging tape will be used to mark the transects prior to survey.

The daily DGM tasks include:

- Upon arrival at the MRS, meet with every other project personnel and receive site safety briefing;
- Verifying each MRS boundary and benchmarks;
- Performing geophysical surveys of the Anti-Aircraft Range 90-mm - 2 (FTSW-002-R-01) and Hero Road Trench Area (FTSW-008-R-01) MRSs;
- Performing QC before, during, and after geophysical surveys; and
- Downloading data.

The following information will be recorded during data acquisition in field log books:

- Team members;
- Weather;
- Start time and date;
- File names;
- Base stations used;
- Equipment serial numbers;
- Equipment settings;
- Battery voltage;
- MRS and transect or grid locations;
- Transect or grid conditions;
- Field conditions (terrain, vegetation, etc) and a hand-sketch; and
- Cultural features encountered.

3.5.13 Data Processing and Anomaly Selection

3.5.13.1 Data Processing

EM61-MK2 and EM31 data will be transferred from the data loggers via data card. Data will be reviewed and converted from R61/R31 format to M61/M31 format using Dat61 and Dat31 software, respectively. Data will be integrated with the positioning data and converted to Geosoft .xyz format and transferred to the Senior Geophysicist for QC review, data analysis, and target selection.

Data will be downloaded and reviewed for completeness and accuracy at the end of each survey day by the Site Geophysicist, then electronically transferred to the Senior Geophysicist for additional review and processing utilizing Geosoft Oasis Montaj with UX Detect, as follows:

- Latency corrections are performed based on instrument latency;
- Data are reviewed for precision, accuracy, response, completeness, and sensitivity as defined in Table 3-7. Line paths are plotted to evaluate across-track sampling in grids. A velocity map is generated to locate any areas where collection speed is above 3 miles per hour;
- EM61-MK2 and EM31 data are gridded using the minimum curvature algorithm with a cell size of 0.5 and 3.75 feet, respectively.
- A series of color maps are produced from the gridded data; and
- Line paths are posted over the mapped data, and reviewed for coverage completeness.

At the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), individual targets will be selected for subsequent intrusive investigation. Based on IVS results, anticipated target peak response, and measured signal-to-noise ratio, a target threshold will be determined for optimum target detectability. Every anomaly exceeding this threshold will be isolated for analysis using the Blakely peak picking algorithm in the Oasis Montaj UX-Detect extension.

Each automatically selected target will be manually reviewed. Any targets displaying abnormal decay or association with cultural features will be deselected, but will be maintained in the target database.

Every other target will be identified on a dig sheet along with characteristics of the target to be used during re-acquisition and intrusive investigation. One hundred percent of target anomalies will be intrusively investigated.

A contour map of the geophysical responses will be generated, and recommendations will be made for the test pit/trench locations at the Hero Road Trench Area MRS (FTSW-008-R-01).

For quality control and interim reporting of the DGM data, DID MMRP-04-009 will be followed, and the following file formats will be provided to USACE for each transect group and each grid:

- .xyz
- .gdb
- .target-gdb
- .map
- .grd

3.5.13.2 Dig Sheet

A final target dig list will be generated for the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), in which the following information will be included, following DID MMRP-04-009:

- MRS number

- Unique target ID
- Easting and Northing positions
- Channel 1 Response
- Channel 2 Response
- Channel 3 Response
- Channel 4 Response
- Stacked Channel Response
- Time Stamp

The target dig sheet is the basis of data input into VSP for geostatistical mapping of anomaly density (cluster analysis). In VSP, only anomaly locations are used. The intensity (instrument response) is not evaluated.

3.5.14 Quality Control

Each member of the field team will have the opportunity to comment on the data and procedures used to collect the data. If it appears that a particular geophysical method or instrument is not generating meaningful results, the use of that instrument will be suspended and the situation will be reviewed by the Project Geophysicist, the ERT PM, and the CENAB Geophysicist. A decision will then be made as to whether the instrument or method will continue to be used to complete the survey.

Geophysical data collected in the field will be reviewed at several stages. The first quality check will be during data collection. The field crews will be able to check the data logger to monitor instrument response and to ensure that data are being collected. The field team will also examine the data when the information is downloaded to the hard drive of a portable computer, ensuring that the data are intact and backed up. Another quality check will occur when the data are preprocessed and formatted for use in the form of post maps (allowing a check of positional accuracy when plotted on an air photo) and preliminary contour maps. Cultural features, geological features, and other relevant information will be noted on the field data forms. Another quality check will be performed when the data are loaded into Oasis Montaj for full processing and target picking.

The Project Geophysicist will review the field notes, geophysical data, QC test results, reacquisition results, and excavation results to ensure that the project DQOs are met. Tables 3-8 and 3-9 list the criteria that are applicable to field preparation, visual surveying, geophysical data collection, anomaly resolution, and target reacquisition. The Senior Geophysicist will be notified if any of the datum fail to meet the performance goals.

When a condition adverse to quality is noted, the cause of the condition will be determined and immediate corrective actions will be implemented. Quality improvement measures will also be taken to preclude repetition. All project personnel have the responsibility, as part of their work duties, to promptly identify, solicit approved corrections, and report conditions adverse to quality.

3.5.14.1 EM31 Calibration

The EM31 will be tested daily using the cable shake test and the IVS. Standard calibration will also occur as part of QC for the EM31 according to the manufacturer instructions outlined below:

Battery Check

1. Set the MODE switch to OPER position and rotate the RANGE switch to the BA TT position.
2. If the meter reads above ±4.4 then the batteries are in good condition; a lower reading indicates the batteries should be replaced before continuing.

Initial Set-up/Instrument Nulling

1. Attach the transmitter coil tube.
2. Set the MODE switch to OPER and cheek the zero reading. Set the RANGE switch to the least sensitive position (1,000 mS/m).
3. The instrument should read ±1 mS/s. To adjust the reading use the DC ZERO CONTROL, located under the front panel.
4. Turn the instrument off and attach the receiver coil tube.

Equipment Functional Checks

1. Set the RANGE switch to 100 mS/m. (if reading on the meter is off-scale, i.e. >100 mS/m, set switch to 1000 mS/m).
2. Set the MODE switch to OPER position and adjust the inphase meter reading to zero using the COARSE and FINE COMPENSATION controls. Tolerance is +0.1 ppt.
3. To check the phase of the instrument, set the MODE switch to PHASE position. Note meter reading and rotate the COARSE control one step clockwise. If the conductivity meter reading remained the same (tolerance ±0.2), the phase is already correct. Return COARSE control to its original position.
4. If there is a difference in the readings, with the COARSE control in its original position, adjust the PHASE potentiometer about ¼ turn clockwise. Repeat the phase test. If the difference in readings has decreased, repeat procedure or if the difference has increased, the PHASE potentiometer should be rotated counter-clockwise.
5. Always remember to set the COARSE control back to its original position. This can be confirmed by checking that the inphase meter reads zero with the MODE switch set to OPER.
6. To check the sensitivity of the instrument, set MODE switch to COMP position and rotate COARSE control clockwise one step. The conductivity reading should change between 22 to 26 mS/m.

3.5.15 Records Management

Paper and digital field records (field data forms, field note copies) will be maintained on-site until the RFI field work is complete. Every record will be filed such that they can be found using the date they were created and the team who created them. Pertinent information will be input into the FTSW GIS database. Copies of all data will be provided to USACE for inclusion into the AR.

3.5.16 Interim Reporting

Reporting will be done in accordance with DID MMRP-09-004. ERT will furnish initial and processed data as they become available. All data will be processed into ASCII file format. Each space-separated ASCII file of processed data will contain a header or separate file describing the type of data, area covered in the file, date collected, location, and data column descriptions.

3.5.17 Final Reports and Maps

The results of the DGM conducted at the MRSs will be presented in the form of color maps and anomaly dig sheets for both MRSs. The maps will include the following basic map features:

- Map scales will be in even multiples of the base units presented in the map;
- Map sizes will be designed to fit standard printer or plotter sizes. Preferred paper sizes for small maps are letter (8.5” x 11”) and tabloid (11” x 17”). For larger maps, the preferred sizes are C1 (24” x 36”) or smaller;
- An attempt will be made to use a standard color bar for presentation of geophysical data (magnetic gradient on transects and EM grid data); and
- Maps will be presented in UTM Zone 17N, meters.

Table 3-8. Geophysical Data QC Testing and Acceptance Criteria				
Criterion	**Objective**	**Instrument Tested**	**Frequency**	**Measurement Method**
Instrument Warm-Up	Allow instrument to stabilize before use.	Every Instrument	Daily prior to data collection	Allow instrument to warm up for at least 5 minutes after turning on.
Vibration Test	Verify that cables and connections are intact and not a source of noise.	Every Instrument	Daily before and after data collection	Shake cables for 1 minute while recording and observing data. Data collected during the vibration test should show no spikes or major variations. Performed concurrently with Personnel Test.
Personnel Test	Verify that the instrument operator is not wearing objects that could increase the noise level or produce false positives during data collection.	EM61-MK2 and EM31	Daily before and after data collection	Collect data for 1 minute while the instrument operator moves close to the sensor. Monitor the response of the instrument to confirm that the movement does not induce significant response increases (i.e., 2.5 mV on channel 1 for EM61-MK2). Performed concurrently with Vibration Test.
Instrument Verification Strip (IVS)	Determine vertical and horizontal target detection capability of the instrument. Verify that limits set by the initial IVS are met daily.	EM61-MK2	Daily before and after data collection	Meet or exceed vertical and horizontal detection limits set by the initial USACE approved IVS. Performed prior to and after data collection each day.
Background Noise	Verify that geophysical sensor noise levels are consistent with established baseline.	EM61-MK2 and EM31	Daily before and after data collection	Determine a criterion for the maximum acceptable standard deviation over a three minute static test based on project startup tests. The Site Geophysicist will review subsequent static background tests to verify that the noise levels are within the acceptable range.

Table 3-8. Geophysical Data QC Testing and Acceptance Criteria				
Criterion	**Objective**	**Instrument Tested**	**Frequency**	**Measurement Method**
Instrument Latency	Apply appropriate latency corrections to geophysical data to compensate for delays in data recording.	EM61-MK2	Each Dataset	Visual examination of anomaly shape for zig-zag or chevron appearances (in grid areas only).
Blind Seed Detection	Measure capability to detect blind seeded items similar in depth, shape and composition to expected buried MEC.	EM61-MK2 and Navigational System	Each Dataset	Data collected during the DGM will detect the blind seed items, which will be graphically presented in maps and the raw data provided to CENAB.
Field Notes	Every line is listed on field notes with gaps where data were not collected clearly and accurately explained.	Every Instrument	Daily	Field notes will be reviewed to ensure every data acquisition line is listed and notes are clear and understandable.
Repeat Lines	Repeat data should reasonably duplicate the initial data collected over the same profile.	EM61-MK2 and Navigational Systems	Each Dataset	The Site Geophysicist will review anomaly peaks over the target threshold on repeat data collected over the same line to confirm that the peaks are located within 2 feet of each other and the response magnitudes are within 20%.
Anomaly Selection	Select each anomaly meeting the anomaly selection criteria that are not caused by a known source such as cultural objects.	Every Instrument	Each Dataset	An anomaly selection metric will be developed based on the results of the initial IVS.

Table 3-9. Anomaly Resolution QC Testing and Acceptance Criteria for the Anti-Aircraft Range 90-mm – 2 MRS				
Criterion	**Objective**	**Instrument Tested**	**Frequency**	**Measurement Method**
Instrument Warm-Up	Allow instrument to stabilize before use.	Every Instrument	Daily prior to data collection	Allow instrument to warm up for at least 5 minutes after turning on.
Vibration test	Verify that cables and connections are intact and not a source of noise.	Every Instrument	Daily before and after data collection	Shake cables at the beginning of the day while recording and observing data. Data collected during the vibration test should show no spikes or major variations.
Background Noise	Verify that geophysical sensor noise levels are consistent with established baseline.	EM61-MK2 and EM31	Daily prior to data collection	Determine a criterion for the maximum acceptable standard deviation over a three minute static test based on project startup tests. The Site Geophysicist will review subsequent static background tests to verify that the noise levels are within the acceptable range.
Resolution Performance	Verify to 70% confidence that <10% of anomalies are unresolved (Assuming MEC are found in MRS).	EM61-MK2 and navigational system	Per dig target	Accept resolution on zero reading, signal too small to represent UXO, signal associated with surface material or other known non-UXO cause.

3.5.18 Geophysical Investigation Performance Goals

3.5.18.1 Geophysical Data Acquisition

The geophysical investigation performance goals are in accordance with USACE EM 1110-1-4009 as described in this discussion. The primary objective of the geophysical investigation is to accurately locate and record locations of geophysical metallic or ground conductivity anomalies that represent MEC, including but not limited to those listed in Table 1-1, or potential dilute agent CAIS kit burial pits. The geophysical investigation areas and identified anomalies will be mapped for subsequent evaluation.

A false positive occurs when an anomaly is detected at a given location, posted on an anomaly dig sheet, and no basis for the anomaly is found upon excavation. The false positive rate will be minimized by accurately documenting the data collection effort in field notes, setting and following appropriate geophysical data collection procedures, and evaluating the results of quality control tests. Specific criteria designed to minimize false positives are described in Table 3-9. The performance goal for the FTSW RFI is to have zero instances of false positive anomalies with large signal to noise ratios from the original survey dataset.

3.5.18.2 Anomaly Reacquisition

The objectives of anomaly reacquisition are to refine and mark the location of the anomaly peaks and measure the peak and background response values. The criteria listed in Table 3-9 are designed to verify that the geophysical equipment is functioning properly and the reacquisition procedures are implemented correctly. The anomaly reacquisition performance goal will be to meet these criteria.

3.5.18.3 Anomaly Resolution

The objective of anomaly resolution is to ensure that the cause of the anomaly has been located. The criteria listed in Table 3-9 are designed to verify that the geophysical equipment is functioning properly, that the source of each anomaly is removed or identified, and the anomaly resolution process is implemented correctly. The anomaly resolution performance goal will be to meet these criteria.

3.5.19 Anomaly Resolution Procedures

Before data collection and reacquisition the rover will be used to check the position of a known location (verified or placed by licensed surveyor), verifying accuracy within 0.1 foot. Once the correct system setup has been confirmed work will begin. At the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), anomaly reacquisition will initially be performed using the same navigational system utilized in production DGM (either RTS or RTK GPS). A nonmetallic pin flag will be placed in the ground at the location of each anomaly with a "fixed" GPS position. RTS positional accuracy does not vary. After locations have been initially flagged a geophysicist using the EM61-MK2 will adjust the flag position to match the nearest EM peak within a 3-foot radius of the originally marked position.

The UXO team will dig each anomaly location at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) manually and remove every piece of metal found within a 3-foot radius of the

flagged position. Once the metals have been removed the area will be swept with a Schonstedt GA-52Cx magnetometer at the highest (most sensitive) setting to ensure no metals remain. The results of the investigation will be recorded on the dig sheet. See Section 3.7 for more details on intrusive investigation and MEC sorting, cataloguing, and disposal.

After excavation and removal of the target item, the instrument used for the initial survey and reacquisition will be used to check the target location. If the signal recorded during reacquisition drops by 90 percent or more the target is considered resolved and no further work is needed at the target.

If the anomaly is not resolved, the CENAB Project Geophysicist will be notified. The ERT Project Geophysicist and SUXOS will discuss recommendations for further excavation investigation and potential reasons for lack of resolution for a given anomaly. If the Project Geophysicist and SUXOS determine that further excavation is not feasible, then it will be documented as such.

The SUXOS will inform the ERT Project Geophysicist of any cultural or geologic features that are considered to be the source of an anomaly, but that cannot be removed (e.g., immobile metal objects, foundations, manhole covers, hot rock, etc). In this event, the ERT Project Geophysicist will develop a way to resolve the anomaly and propose it to the CENAB Project Geophysicist for concurrence. Details of the feature will be collected as necessary, and further concurrence will be requested from the CENAB Project Geophysicist for a No Further Action decision.

At the Hero Road Trench Area MRS (FTSW-008-R-01) proposed test pit/trench locations will be marked using the RTS only, as reacquisition with the EM31 is unnecessary due to the large footprint of the instrument relative to the precision of the RTS. Excavation pits will be dug manually and materials removed from the pit will be checked for metals and glassware. Upon completion of the excavation the base of the pit will be evaluated using a Schonstedt GA-52Cx magnetometer to ensure that the anomaly has been resolved. Should hand excavation at this MRS be unsuccessful, ERT will switch to mechanical excavation. If mechanical excavation is required a small backhoe or equivalent piece of equipment will be utilized.

3.6 Geospatial Information and Electronic Submittals

The purpose of this section is to describe the procedures and data formats pertaining to the use of geospatial information and the production of electronic submittals for geophysical and intrusive investigation at the MRSs. Accuracy and methods of location surveys and mapping is also addressed. ERT will perform every activity related to gathering and maintaining geospatial information in accordance with DID MMRP-09-007 and Appendix C of the PWS.

Geospatial information will be recorded in UTM WGS84 (Zone 17N). The geospatial data layers created by ERT will conform to the GIS created for FTSW and will conform to the Federal Geographic Data Committee (FGDC)'s National Standard for Spatial Data Accuracy. Metadata will be prepared for the core geospatial data layers in accordance with FGDC's Content Standard for Digital Geospatial Metadata standards, and metadata will include horizontal accuracy results. The geodatabase will be compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment.

3.6.1 Location Survey and Mapping

As described above, civil surveying (including blind seed items) will be performed by a Georgia State licensed civil surveyor to a horizontal accuracy of 3 cm and a vertical accuracy of 5 cm. The center and ends of blind seed items will be surveyed and placed by the surveyor with UXO technician support. Initial field activities include the establishment of survey base stations, grid corners, and mapping of selected surface features by the civil surveyor. Data will be provided in UTM Zone 17N, meters. Relevant data, including previous FTSW investigation data, MRS features and topography, cultural and environmental resources, and historical information will be incorporated into the GIS. Archaeological site location(s) will not be released to the public without written permission from USACE.

Geophysical survey transects and grids will be defined using VSP and incorporated into GIS prior to field work. GPS data will be collected for the transects, for intrusive investigation locations including anomalies, and for every environmental sampling location. GIS layers will also include every MEC, MD, and MPPEH found during the investigation.

GIS data created by ERT, including points identified in the field, will be tested in accordance with the NSSDA for horizontal accuracy, and will be provided in UTM Zone 17N, meters.

Pre- and post-RFI geospatial data analyses will be performed to consolidate every available existing datum applicable to the project into the geodatabase and to relay pertinent information to the PDT. These data analyses will support each conclusion of the CSM.

3.6.2 Geospatial Information Formats

Vector data incorporated into the GIS will be stored in ESRI shapefile or geodatabase formats. These files will be delivered upon completion of the project. Examples of vector datasets include physical, cultural, biological, and MEC-related items. Raster GIS data will be used in either JPEG, TIF or Mr. Sid-compliant formats with accompanying world files (.tfw or .sdw). Image files will be delivered upon completion of the project with associated world file (.tfw). Examples of raster datasets are aerial photography and scanned topographic maps (DRGs). Tabular data will be stored in either Microsoft Excel or Microsoft Access formats during the course of the project. These file types as well as comma delimited (.csv) text files will be delivered where feasible, upon completion of the project. ArcGIS map files (.mxd) for plates, figures and drawings used in the RFI Report will be included in the electronic deliverable.

Laboratory data will also be provided electronically. In addition, laboratory data will be uploaded to the AEC's Environmental Restoration Information System.

The geodatabase will be maintained as a living repository and will be refined throughout the duration of the project. Geophysical data will be provided in Geosoft .xyz, .map, .grd, .gdb, and .target.gdb formats to CENAB geophysicists. Data submittals will be made available via the ERT file transfer protocol site.

3.6.3 Metadata

Metadata will be created in accordance with FGDC standards and will describe the key information about each geospatial dataset. The metadata will contain information about the data source, its location, where it originated, its structure, key attributes, and other miscellaneous

items of interest to the project team. Metadata as a portable document format (PDF) file for all Geosoft functions shall also be included with geophysical data submittal.

3.6.4 Electronic Submittals

Two GIS deliverables will be produced. The first deliverable will consist of existing GIS data used for the purpose of developing this Work Plan. The second deliverable will contain all RFI data. Final document files will be submitted to USACE in MS Office and Adobe PDF. Geospatial datasets will be delivered to USACE in native ESRI shapefile or geodatabase format. Metadata will be delivered with the files. Data will be submitted on CD or DVD.

3.7 Intrusive Investigation Plan

3.7.1 General Methodology

Intrusive investigations will be coordinated with CENAB and FTSW, and will be performed in accordance with procedures outlined in USACE EM 385-1-97 with Errata Sheets 1 through 5, and the *Military Munitions Response Program, Munitions Response, Remedial Investigation/Feasibility Study Guidance*. Strict adherence to the APP/SSHP contained in Appendix D will be maintained at all times.

3.7.1.1 Equipment Needs

Typical equipment needs for the intrusive anomaly investigation are presented in Table 3-10.

Table 3-10. Equipment Needs (Typical)

Task	Equipment
Intrusive Anomaly Investigation	General purpose vehicles GPS units Schonstedt GA-52Cx flux-gate magnetometer Shovels Hand trowels Radios Personal protective equipment (PPE)

3.7.1.2 Team

Typical intrusive investigation team requirements for each operation are summarized below. A single UXO team is anticipated to be required for this effort.

The following ERT staff will be present during land based field operations:

- SUXOS (1);
- Dual-Hat SSHO/UXOSO-QC (1);
- UXO Technician III Team Leader (1); and

- UXO Technicians I and II Team Members (6).

3.7.1.3 Intrusive Investigation Daily Operations

Daily operations include:

1. Workers and support staff arrive on-site.
2. All personnel receive a daily safety briefing from the SSHO/UXOSO-QC.
3. All personnel receive a daily operations schedule.
4. Team departs/arrives at work site.
5. Team establishes and sets up equipment in the EZ at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), in accordance with the approved ESP. No EZ will be required in the Hero Road Trench Area MRS (FTSW-008-R-01) as it is not a MEC MRS.
6. The SSHO/UXOSO-QC ensures each piece of equipment is operational. The SSHO/UXOSO-QC will maintain the file of completed pre-operations checklists.
7. As directed by the SUXOS, work will commence in accordance with this Work Plan and the APP/SSHP.

3.7.2 Accountability and Records Management for MEC, MD and MPPEH

Individual anomaly investigation grid sheets will be maintained and will account for every material encountered during the surface investigations including MEC, MD, and MPPEH. These grid sheet entries will indicate amount, identification, condition, depth, and disposition.

An account of every recovered MEC/MPPEH/MD item will be maintained in the project database. Each piece of recovered intact ordnance will be given a unique database ID number, and the item will be tracked from discovery to final disposition. The date of demolition or disposal from the MRSs will be recorded. The SUXOS is responsible for the tracking and maintenance of each piece of ordnance recovered during the project.

3.7.3 Personnel Qualifications

UXO teams will consist of qualified personnel, in accordance with DDESB TP 18, and as accepted by the USACE COR. Non-UXO qualified personnel will not perform any excavation nor handle potential MEC. Non-UXO-qualified personnel may perform field activities, such as sampling, under the direct supervision of UXO-qualified personnel. All project personnel will complete the Occupational Safety and Health Administration (OSHA) 40-hour training course for hazardous waste site workers as required by the specific task. Additional site-specific training, in accordance with 29 CFR 1910.120, EM 385-1-1 (*USACE Safety and Health Requirements Manual*), ER 385-1-92 (*Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste and Ordnance and Explosive Waste Activities*), and ER 385-1-95 (*Safety and Health Requirements for Ordnance and Explosives Operations*) will be provided to all personnel upon their initial mobilization.

A medical surveillance program will be in place for each member of the field personnel, with the most recent exam for each member having occurred within the last 12 months. Personnel qualifications and requirements are presented in more detail in the APP/SSHP (Appendix D).

3.7.4 Intrusive Investigation Procedures

3.7.4.1 General

After approval of the dig locations as discussed in Section 3.5.11.1, a separate test pit/trench log sheet will be provided for each proposed test pit/trench in the Hero Road Trench Area MRS (FTSW-008-R-01) identifying the perimeters of each exploration pit, geophysical characteristics, information from historical aerial photographs, and any other pertinent information. Should any evidence of possible dilute agent intact CAIS kits be found, the ERT field personnel will immediately stop all work and secure the area by establishing an exclusion zone based on the downwind hazard of 40 millimeters of the industrial compound phosgene. ERT will begin conducting real-time monitoring to confirm any low-level near real-time detections; upon confirmation of monitoring results PPE levels will be adjusted, if necessary. ERT will coordinate any finds with CENAB to determine if additional USACE support is required.

Should unexpected materials, such as landfill material, construction waste, etc., be found during excavation of the pits/trenches at the Hero Road Trench Area MRS (FTSW-0108-R-01), ERT will visually characterize the materials, note the location and coordinate with CENAB for additional guidance as HTRW contamination is not covered under the current PWS.

The following sections describe the intrusive investigation procedures to be used to investigate designated subsurface anomalies. For the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) a dig sheet will be provided for a particular grid or transect along with information regarding the relative location of the anomaly or anomalies to be investigated. Following anomaly reacquisition, the SUXOS will establish an EZ per the DDESB-approved ESP and munition with the greatest fragmentation distance (MGFD) designated for the MRS. All non-essential personnel will be evacuated from the MRS to outside of the EZ prior to beginning intrusive work. Essential personnel working within the MRS, (e.g. UXO Teams, Geophysical Teams, or Sampling Teams) will maintain the Team Separation Distance identified in the ESP, typically the K40 distance (50 ft) of the MGFD for the MRS.

Copies of the geophysical maps for the area to be investigated will be furnished to the intrusive investigation team. The dig sheet will provide anomaly amplitude information to the intrusive team to assist them in determining the potential size of the anomaly source.

3.7.4.2 Procedures for Investigating Anomalies

The excavations required for the intrusive investigations of anomalies at the Hero Road Trench Area MRS (FTSW-008-R-01) are planned to be conducted by hand. Excavation materials will be removed by spade or hand trowel. This MRS is not a MEC MRS; however, UXO technicians will be utilized for intrusive investigation of the test pits to ensure any possible hazardous MEC related materials found are identified. The base of the pit will be advanced six inches at a time, after which the base of the pit will be investigated by a UXO Technician using a Schonstedt GA-52Cx magnetometer. If subsurface metals are detected, the pit will be advanced another six inches, the process will be repeated until no subsurface metals are detected in the base of the pit. Excavation soils will be temporarily stored on heavy plastic sheeting until completion of the pit, and then placed back into the test pit.

Excavations will not exceed 30 square feet in surface area, with a maximum expected depth for hand excavation of 4 feet or the water table. Should Schonstedt anomalies be found below 4 feet depth, the use of mechanical excavation (by backhoe or similar equipment) will be required. For mechanical excavations, the maximum depth will be 10 feet or the water table, and either shoring or benching will be used so that personnel may safely enter the excavation, as detailed in the APP/SSHP/AHA. Any excavated materials identified and confirmed to be non-hazardous waste will be placed in appropriate bins for recycling or disposal. Everything removed from the pit will be recorded on an exploration log sheet and photographed.

Soil samples will be collected from the excavation pit for characterization; the UPF-QAPP contains the details regarding the sampling.

Field restoration will be performed to return conditions to the original status, at a minimum.

Excavation of individual targets in the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) will be conducted by hand digging, and will be monitored by a UXO Technician III or higher at all times. Soils will be placed adjacent to each excavation and returned to the hole upon completion. Results of the excavation will be recorded on the grid sheet including a detailed description of any debris found. Should MEC or MD be found, the item will be inspected by the UXO Team Leader and handled appropriately (see Section 5.0)

The following information will be collected during the intrusive investigation to assist in ensuring that each anomaly has been adequately resolved:

- The item(s) removed from each excavation will be photographed;
- Written descriptions of the item(s) removed from each excavation will be recorded in the field logbook and on the dig sheet including item type [where known], approximate size, and material;
- The physical dimensions of each excavation will be recorded;
- Coordinates of anomalies will be recorded to assist in comparing the location with the original and reacquisition geophysical data; and
- Where considered appropriate by the field team, soil stratigraphy will be recorded using standardized nomenclature (e.g., Wentworth grain size scale, Munsell color table).

Upon completion of the excavation, anomaly resolution will be performed as described in Section 3.5.19. MEC/MD disposal procedures are detailed in Section 3.7.9.

3.7.5 MC Sampling Approach

Various types of samples will be collected during RFI activities at FTSW. The following media are proposed for environmental sampling for munitions constituents: surface and sub-surface soil, sediment, and possibly groundwater and surface water. Worksheet #12 of the MC QAPP (Appendix E) contains additional detail about the analytical parameters and procedures for the RFI sampling. In addition, ERT SOPs addressing these sampling activities are contained as Attachments to the MC QAPP.

Appendix H contains the MC Sampling Rationale Memo, which details munitions found or expected to be at each MRS and the associated MC. Based on this information, the Anti-Aircraft

Range 90-mm – 2 MRS (FTSW-002-R-01) will be sampled for aluminum, copper, lead, zinc, and explosives. The Hero Road Trench Area MRS (FTSW-008-R-01) will be sampled for the degradation products associated with the dilute agent CAIS kits, to include arsenic, oxithiane, dithiane, and thiodiglycol.

3.7.5.1 Soil Sampling

The soil sampling approach is based on previous investigation findings as well as discussions with USACE and GAEPD personnel. Soil sampling will be a mixture of random and biased discrete surface and subsurface samples at the potential locations listed below, based on the rationale provided in Worksheets 14 and 17 of the MC QAPP (Appendix E):

- From the side wall of the test pits/trenches at 0-12 inches bgs and 1-10 feet bgs (or the bottom of the trench) at the Hero Road Trench Area MRS (FTSW-008-R-01);
- Up to 10 biased samples within the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01);
- Sixteen biased locations within the Hero Road Trench Area MRS (FTSW-008-R-01) based on DGM ground conductivity results;
- VSP determined random locations at both MRSs;
- 10 background surface soil samples located within the FTSW SWMUs used for previous background sampling; and
- Where blow in place (BIP) activities take place.

Locations of random samples for each MRS are shown on Figures 9 and 10. Biased soil samples at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) will only be collected in areas where there is visible evidence of energetic material, e.g., munitions items which are breeched. Biased soil samples will also be collected in areas of significant MD, where at least 50% of the munition could be identified by UXO Techs, such that an assumption of MC in the vicinity could be tested by taking a sample. The depth for the biased soil samples will be just below the depth of the associated munition. Each biased soil sample will be a discrete sample. Surface samples will be collected from 0-12 inches bgs. Subsurface samples will be collected from 1 – 2 feet bgs.

For the Hero Road Trench Area MRS (FTSW-008-R-01), biased subsurface samples will be collected in areas where the DGM ground conductivity results show there may be disturbed soil; these will be in locations that are not selected for the test pits/trenches. These subsurface samples will be collected from the soil horizon immediately above the groundwater, or at a depth suggested by the DGM ground conductivity results.

As the existing FTSW SWMU background dataset does not include data for Al, Cu and Zn, ERT will collect 10 background soil samples within a subset of the same SWMUs sampled during the development of the background dataset. Determination of the location of the samples will be made through coordination with FTSW personnel while ERT is conducting the field investigations to ensure access to selected sampling areas is available.

The analytical parameters will include explosives by USEPA SW-846 Method 8330B, and select metals, as detailed in Section 3.7.5, by USEPA SW-846 Method 6020A.

In addition, pre- and post-detonation BIP samples will be collected by multi-incremental® (MI®) sampling (MIS), and analyzed for explosives by USEPA SW-846 Method 8330B. Details on MIS sampling for BIP are located in QAPP Worksheet #17 and Figure 11.

3.7.5.2 Groundwater Sampling

Determination of whether to install temporary monitoring wells and their locations will be made by the PDT after review of the soil sampling results. If the PDT determines wells are necessary, the number and location of the wells will be determined by the PDT. The analytical parameters will include explosives by USEPA SW-846 Method 8330B and same metals as sampled in the soil by USEPA SW-846 Method 6020A.

3.7.5.3 Sediment and Surface Water Sampling

Per GAEPD request, one sediment sample will be collected from the drainage ditch at the north end of Anti-Aircraft Range 90-mm – 2 MRS (FTWS-002-R-01), proximal to where the ditch exits the fence.

The depth for the biased sediment sample will be a discrete sample collected from 0-12 inches bgs. The analytical parameters will include explosives by USEPA SW-846 Method 8330B, and select metals, as detailed in Section 3.7.5, by USEPA SW-846 Method 6020A.

If surface water is present in the drainage ditch where the sediment sample is being collected, ERT will also collect a surface water sample for analysis. The analytical parameters will include explosives by USEPA SW-846 Method 8330B, and select metals, as detailed in Section 3.7.5, by USEPA SW-846 Method 6020A.

3.7.6 Munition with the Greatest Fragmentation Distance

The MGFD is selected based on the ordnance item with the greatest fragmentation distance that can reasonably be expected to be found within the MRS. The DDESB approved ESP will identify the MGFD for the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) to be investigated with associated MSD. This will be prepared by USACE as a stand-alone document. The ESP (Appendix G) will contain the MGFD and the MSD calculations for each MRS to be investigated and will be provided by USACE. The Hero Road Trench Area MRS (FTSW-008-R-01) is not a MEC MRS; therefore, no MGFD will be calculated for it.

3.7.7 Minimum Separation Distances

The MSD is the minimum distance at which personnel in the open must be from an intentional or unintentional detonation. The MSDs associated with the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) are contained in the ESP (Appendix G).

3.7.8 MEC/MPPEH/MD Identification

If an item is suspected to be MEC/MPPEH, the UXO team will assess the suspect item in accordance with the established MEC SOPs provided as Attachment 1 of the UFP-QAPP (Appendix E).

3.7.9 MEC/MPPEH Disposal

3.7.9.1 General Procedure

If HE are determined to be present during the MEC/MPPEH assessment, the item will be removed/demilitarized in accordance with the Technical Manual (TM) 60 Series EOD Disposal Procedures, on the same day found. If necessary, MEC/MPPEH items may be moved to a disposal location within FTSW, as long as the provisions of Errata Sheet 5 of EM 385-1-97 are met. The SUXOS and the SSHO/UXOSO-QC must agree the item is acceptable-to-move per Table I.2.1 of that Errata Sheet.

One hundred percent of the observed MPPEH will be inspected by at least a UXO Technician II and then 100 percent of the observed MPPEH will be re-inspected by at least a UXO Technician III, and certified by the SUXOS as either material deemed as safe (MDAS) or material deemed as an explosive hazard (MDEH). Verification of the process may be done by the CENAB OESS. If a USACE OESS is not on-site, the verification process may be delegated to the SSHO/UXOSO-QC, or a similarly qualified individual, per Errata Sheet 2, USACE EM 1110-1-4009.

The certification/verification process will be documented on form DD 1348-1A. Every DD Form 1348-1A must clearly show the typed or printed names of the ERT SUXOS and the person verifying the debris as MDAS or free of explosives, including telephone numbers. The DD1348-1A will contain the following statement, *"This certifies and verifies the material listed has been 100% inspected and to the best of our knowledge and belief, are inert, and/or free, of explosives or related materials."*

It is intended that all MDEH, or material containing explosives, recovered during this RFI will be demilitarized to the level that it can be certified and verified as being free of explosives.

3.8 Investigation Derived Waste Plan

This IDW Plan has been developed for the management of IDW by ERT during the RFI. It is not anticipated that much IDW will be generated during this RFI. However, this section presents the disposal procedures for any waste streams requiring disposal, potentially including MD scrap, soil cuttings, well development/purge water, decontamination water, PPE, and miscellaneous solid waste. Additional details about IDW are found in Appendix E, Worksheet #17.

3.8.1 Scrap and MD

ERT will arrange for maintaining the chain of custody and final disposition of the certified and verified material. Certified and verified material, as detailed in Section 3.7.9.1, per Form DD 1348-1A will only be released to an organization that will:

- Upon receipt of the unopened labeled containers (each with its unique identification number and unbroken seal to ensure continued chain of custody), review and concur with the provided supporting documentation.
- Sign for receiving the sealed containers and verify that the sealed containers contain no explosive hazard when received.

- Provide the above concurrence, signature, and verification in writing on company letterhead.
- Also provide in writing on company letterhead a statement that the contents of the sealed containers will not be sold, traded, or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

Copies of the final notification and supporting documents, from the receiving agency, will be incorporated into the final project report.

3.8.2 Well Development and Decontamination Water and PPE

3.8.2.1 General

Soil cuttings and monitoring well purge water will be generated when installing and sampling the temporary monitoring wells, if determination is made by the PDT that they are necessary. Decontamination water will be generated from the decontamination of equipment and scrap (as necessary). The SSHP specifies PPE requirements.

3.8.2.2 IDW Sampling

Sampling of the containerized soil cuttings and development/purge water or decontamination water will be performed for total characteristic leaching procedure (TCLP) disposal characterization as discussed in detail in Worksheets #14 and #17 of the MC QAPP; this sampling is a requirement of the facility receiving the IDW.

Used PPE (tyvek) will be considered non-hazardous trash and will not be decontaminated or sampled; PPE will be disposed of in trash bags with other non-hazardous trash.

The relatively small number of IDW drums accumulated will be staged next to the fence line within each MRS at locations deemed appropriate by the Installation. Any necessary IDW sampling will be performed from the drums at these locations.

3.8.2.3 Containers

DOT Type H metal drums will be used to separately containerize the development/purge water, decontamination water, and soil cuttings, if temporary wells are installed. Containers will be stored on pallets covered with plastic sheeting.

3.8.2.4 Disposal

Disposal decisions will be based on TCLP analytical sampling results. However, items are expected to be non-hazardous and able to be disposed at a Subtitle D permitted solid waste landfill. Non-metallic scrap and trash, including used tyveks (PPE) will be landfilled in this manner. ERT will be responsible for removing the IDW from FTSW.

3.9 MEC Risk Characterization and Analysis

Risk characterization and analysis for MEC will be performed for the FTSW RFI for the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) only as MEC is not anticipated at the Hero Road Trench Area MRS (FTSW-008-R-01). Should MEC be unexpectedly found in the Hero

Road Trench Area MRS (FTSW-008-R-01), a MEC risk characterization will also be completed for this MRS. The guidance for MEC risk is contained in EM 1110-1-4009 and Interim Guidance Document 01-01, "OE Risk Impact Analysis for OE EE/CA Evaluations".

3.9.1 Introduction

This subsection describes risk characterization for MMRP and is limited to risk from MEC. A risk assessment is used to describe and estimate the likelihood of adverse outcomes from an encounter with MEC. An explosives safety hazard is the probability that MEC might detonate and potentially cause harm as a result of human activities. An explosives safety hazard exists if a person can come near to or into contact with MEC and then energy of some sort is applied to it to cause it to detonate. The energy could be applied by the person, by external forces not associated with the person's contact, or an internal mechanism within the MEC item itself. MEC risk assessments will concentrate on the explosive hazards associated with MEC. However, risk is also associated with the presence of MC. This is addressed in accordance with USEPA RAGS.

3.9.2 MEC CSM

The CSM is used to communicate and describe the current state of knowledge and assumptions about risks at a project area. The CSM presents the exposure pathway analysis by integrating information on the MEC and MC source, receptors, and receptor/MEC interaction. Figures 12 and 13 in Appendix B present the current preliminary CSM for both MEC and MC for each MRS, showing complete and incomplete exposure pathways based on MRS history and current field conditions.

3.9.3 MEC Risk Pathway

The potential for an explosives safety hazard depends upon the presence of three critical elements to complete the risk pathway. If any one of these three elements is missing, there is no complete pathway and, therefore, no resulting MEC risk:

(1) A source of MEC (or the presence of MEC).

(2) A receptor or person.

(3) The potential for interaction between the source and the receptor.

3.9.3.1 Source

The factors affecting risk associated with the MEC source are the quantity or density of the MEC. The more MEC present at a project property, the greater the likelihood for an interaction between a receptor and MEC. If there is no MEC present, there is no completed pathway and, consequently, no explosives safety hazard.

The primary release mechanisms resulting in the occurrence of MEC are related to the type of military munition activity, or result from the improper functioning of the military munition. For example, when a HE military munition is fired it will do one of three things:

(a) It will detonate completely (a high order detonation).

(b) It will undergo incomplete detonation (a low order detonation).

(c) It will fail to function (results in UXO).

Military munitions may be lost, abandoned, or buried, resulting in unfired munitions that could be fuzed or unfuzed. In addition, there are military munitions that will have a delayed function and may be hidden by design resulting in a deployed, armed, and fuzed munition. Demilitarization through open burn or open detonation (OB/OD) was often used to destroy excess, obsolete, or unserviceable munitions by combustion or by detonation. An OD operation can result in a high order detonation or a low order detonation. In addition, the munitions may possibly be spread beyond the immediate vicinity by the detonation ("kickouts"). Incomplete combustion or low/high order detonation failure can leave uncombusted explosives.

As the MEC CSM indicates, the source of MEC at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) was primarily the result of firing activities at the Installation. While there is no detailed information for the target/firing points for the specific FTSW historical ranges that overlap this MRS, historical documents related to anti-aircraft ranges note that there are no impact areas within an anti-aircraft range (USACE, 2006a). Targets at these ranges were either balloons towed behind planes, rockets, or some other target in the air; therefore, there would be random impact locations throughout the range, rather than centralized to one area (USACE, 2006a). For type I, II, and IV tank ranges, moving tank targets were used; therefore, the impact locations are random. For type III and V tank ranges, each target was stationary (USACE, 2006b). Historical documents related to the tank range layouts note that buffer zones are included on the sides of the tank range (USACE, 2006b); the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) is located within these buffer zones for the historical tank ranges that overlap this MRS. Based on our knowledge of the MRS history and the location of the MRS, this MRS does not contain firing or impact points.

3.9.3.2 Receptors

Per the MEC HA guidance (USEPA, 2008b), the only receptors for a MEC HA are people that have the potential to contact MEC. The factors affecting risk associated with the receptor include the number of people that may traverse or otherwise use the area containing MEC and the accessibility of the property containing MEC. The more receptors that use the location and the easier it is to access the property, the greater the potential for MEC contact. The converse is also true: the fewer the number of people that are present and the harder it is to access the property due to man-made or natural barriers, the lower the potential for MEC contact.

Due to the controlled access to most of the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), the stability of the terrain (flat and has been maintained for the past 30 years), and the limited activities (dispersal of munitions and grass maintenance), the potential for MEC contact is low. As shown in the preliminary human health CSM (Figure 12), the receptors include outdoor workers, and construction workers.

3.9.3.3 Interaction

The factors affecting risk that are associated with the interaction with the MEC include: MEC contact potential; energy application; and MEC sensitivity and potential severity.

The MEC contact potential is affected by: the depth of the MEC; site stability (erosion); and the depth and type of receptor activity.

The energy application factor affects the likelihood that a receptor will apply enough energy to a MEC item causing it to function. Examples include an item that is picked up, hit with a hammer, thrown in a fire, etc. However, there may also be the case where the type of MEC requires no force be applied to it by the receptor in order to function.

The greater the sensitivity, the greater the likelihood for a MEC item to function. The type of MEC affects the likelihood and severity of injury if a MEC functions. The hazard from MEC typically results from a single interaction between a receptor and a MEC source and may have one of three outcomes: no effect, injury, or death.

At the MRS, interaction is a function of accessibility. MEC in surface soil is accessible to most receptors, while MEC in the subsurface will only be accessible to intrusive receptors.

3.9.4 MEC Risk Management Principles

Should risk from MEC be determined through the RFI, a Corrective Action Plan will provide risk management by evaluating corrective measures. Corrective Action Plans are typically considered as a two-part response, those munitions response actions that remove the hazard such as physical removals and those munitions response actions that manage the residual hazards such as LUCs. Physical removal involves reducing the quantity of MEC at the property, which directly lowers the risk. However, there frequently is residual risk since it is technically and financially impracticable to provide 100 percent removal of all items. LUCs can be used to effectively manage the residual risk. LUCs may consist of educational awareness programs, legal restrictions on land use, and physical access controls.

In general, if there is potential for a completed MEC pathway the following risk management principles can be applied to mitigate the risk:

(1) Reducing the quantity of MEC on-site lowers the risk.

(2) Reducing the number of potential receptors on-site lowers the risk.

(3) Reducing the potential for interaction between receptors and MEC lowers the risk.

(4) Modifying or controlling the behavior of the receptors lowers the risk.

3.9.5 MEC Risk Characterization Methods

MEC risk characterizations are site-specific evaluations and may vary in both detail and extent to which qualitative and quantitative inputs are used. The risk characterizations depend on the complexity and particular circumstances of the MRSs and consider the potential risks associated with current land use and activities, as well as reasonably anticipated future land use. Existing site conditions provide a baseline risk in the absence of any actions to control or mitigate that risk.

The MEC Hazard Assessment (MEC HA) methodology for assessing potential explosive hazards to human receptors at MRSs will be used for this RFI. MEC HA is the 'explosive hazard' component of a Human Health Risk Assessment, allowing a project team to evaluate the potential explosive hazard associated with an MRS, given current conditions and under various cleanup scenarios, land use activities, and land use control alternatives. The *MEC Hazard Assessment Methodology, Interim October 2008,* provides the methodology for assessing

explosive hazards to human receptors at MRSs. It was developed by the Technical Working Group for Hazard Assessment which consists of representatives from the DoD, Department of the Interior, State program managers from the Association of State and Territorial Solid Waste Management Officials and the Tribal Association for Solid Waste and Emergency Response, and the USEPA.

The results of the MEC HA will be used to evaluate potential munitions response alternatives. The risk characterization is used to communicate the magnitude of the risk at the location and the primary causes of that risk, and to aid in the development, evaluation, and selection of appropriate response alternatives.

3.10 Baseline Risk Assessment

This section describes the approach to be used for the Baseline Risk Assessment (BLRA) for this RFI. The BLRA is being conducted under RCRA Part B Permit, with regulatory coordination with the GAEPD and the USEPA Region IV. The BLRA will include a human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA). The BLRA focuses on MC only, and not on the potential explosive or other hazards associated with MEC, which are addressed in Section 3.9.

As listed below, the HHRA and SLERA will be prepared in accordance with GAEPD guidance. USEPA guidance will also be used when specified by GAEPD or when necessary to complete the BLRA. In addition, applicable USACE policy and guidance with respect to site investigation and risk assessment for MRSs will be complied with.

GAEPD:

- Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units (GAEPD, 1996).

USEPA:

- RCRA Facility Investigation (RFI) Guidance, Volumes I through IV, Interim Final, EPA/530-SW- 89-031 (USEPA, 1989a).
- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Part A) (USEPA, 1989b).
- RAGS, Volume I, Human Health Evaluation Manual. Part E, Supplemental Guidance for Dermal Risk Assessment, Final (USEPA, 2004a).
- RAGS, Volume I: Human Health Evaluation Manual. Part F, Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009a).
- Guidance for Data Usability in Risk Assessment (Part A) (USEPA, 1992a).
- Supplemental Guidance to RAGS: Calculating the Concentration Term (USEPA, 1992b).
- Guidance for Risk Characterization (USEPA, 1995b).
- Soil Screening Guidance (USEPA, 1996a).
- Exposure Factors Handbook (USEPA, 2011b); and Child-Specific Exposure Factors Handbook (USEPA, 2008b).

- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002a).
- Amended Guidance of Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders. USEPA Region 4, 4WD-OTS memorandum June 23, 2000 (USEPA, 2004b).
- Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments; EPA 540-R-97-006 (USEPA, 1997a).
- EPA Region IV Eco Screening Values (USEPA, 1999a).

US Army:

- Tri-Service Procedural Guidelines for Ecological Risk Assessments (Wentsel, et al., 1996).
- Risk Assessment Handbook, Volume I: Human Health Evaluation (EM 200-1-4) (USACE, 1999).
- Risk Assessment Handbook, Volume II: Environmental Evaluation (EM 200-1-4) (USACE, 2010a).

3.10.1 Conceptual Site Model

A CSM has been developed for each MRS to identify contaminant sources and transport mechanisms, potential human and ecological receptors, and exposure scenarios for a MRS. A CSM is an effective tool in the planning phases of a RFI to define the goals of the investigation, streamline the risk evaluation, and to develop appropriate response actions. It identifies complete exposure pathways for the media affected by site-related contamination. Understanding site conditions and land uses helps to accurately identify potential receptors under current and likely future scenarios, as well as the most appropriate corrective action.

CSMs are dynamic tools that can be updated as necessary. If changes in site conditions occur, or additional site characterization information is collected, the CSM can be revised to more accurately reflect the most current information. Additionally, the CSM can be revised during the risk assessment planning process to include input from stakeholders.

Preliminary CSMs for current and future human and ecological receptor exposure scenarios at the two MRSs have been developed to aid in understanding and describing the MRSs, and to present assumptions regarding:

- Suspected sources and types of constituents present, constituent release and transport mechanisms, and affected media
- Potential exposure routes
- Potential human and ecological receptors

The preliminary human health CSMs for the two MRSs are shown in Figures 12 and 14.

3.10.1.1 Constituents Present, Constituent Release and Transport Mechanisms, and Affected Media

Based on past MRS uses, MEC, MD and possible MC have been found or are suspected to be present. Appendix H details the MEC items and associated MC that have been found or are suspected in each MRS.

Affected media and constituent release and transport mechanisms must be considered to delineate potential exposure routes. Previous investigations at the MRSs have determined that potentially impacted media at the MRSs include surface soil (0-1 feet bgs) and subsurface soil (greater than 1 feet bgs). Therefore, soil is the focus of this investigation. Although the expectation is that no surface MEC or debris will found at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), past studies have shown levels of some metals (e.g., lead) at FTSW elevated above background levels; therefore, the surface soil at both MRSs must be investigated to support the risk assessment.

The specific constituents/analytes which will be investigated for the Anti-Aircraft Range 90 mm - 2 MRS (FTSW-002-R-01) are select metals (Al, Cu, Pb, and Zn) and explosives; the rationale for these selected metals is outlined in Appendix H (MC Sampling Rationale Memo). The Hero Road Trench Area MRS (FTSW-008-R-01) investigations are related exclusively to potential MC contamination from dilute agent CAIS kits, which anecdotal evidence suggests may have been disposed in burial trenches in the MRS. For the Hero Road Trench MRS (FTSW-008-R-01), the specific constituents that will be investigated are arsenic, 1,4-oxithiane, 1,4-dithiane, and thiodiglycol.

Based on a review of the hydrogeological data (SAIC, 1999), it appears unlikely that MC in shallow groundwater would migrate to the deeper aquifers that are used as a water supply for Fort Stewart. The Principal Artesian aquifer is isolated from the surface aquifer by a confining unit (SAIC, 1999). The surface aquifer is composed of a relatively thin layer of sands, gravels and clays. It is recharged directly from rainfall percolating through sediments. Therefore, a shallow groundwater investigation will only be conducted if the soil sampling results warrant additional investigations. This decision will be based on a screening of the soil sampling results against "Protection of Ground Water" Soil Screening Levels (SSLs) established by the USEPA (USEPA, 2012b). These SSLs are conservative soil screening levels designed to evaluate the leaching potential of constituents from soils to groundwater. If these screening levels are exceeded, then groundwater sampling will be considered.

3.10.1.2 Potential Receptors and Exposure Routes

A potential receptor evaluation should consider criteria such as:

- Current and future land use on and near the MRS;
- Zoning status and/or deed restrictions of the MRS and adjacent properties;
- Current and future access to the MRS and to the affected media;
- Existing and/or planned exposure controls (e.g., engineered containment structures);
- Present and planned MRS activities;
- Extent that the MRS is developed and vegetated; and

- Potential for soils to be disturbed (e.g., soil-invasive activities).

Human Receptors

The Anti-Aircraft Range 90-mm - 2 MRS (FTSW-002-R-01) is a located within the operations range portion of FTSW and is an ammunition supply point. As such, there are activities related to ammunitions constantly ongoing at the site, and the area is gated and secured with controlled, monitored entry. Surrounding the fence is a cleared buffer area in which no activities occur. No change in site use is expected in the future.

Because of the secure nature of the MRSs in this RFI, current and future potential human receptors for surface and/or subsurface soil will likely be limited to authorized site workers, which could include outdoor workers and construction workers. Although trespassers are not likely based on the secure nature of these areas, this is a potential current receptor, and will be included in the HHRA. In the future, because the Hero Road Trench Area MRS (FTSW-008-R-01) is surrounded by a waste water treatment plant, a school, roads, and forested areas, residential use could be a potentially foreseeable use in this MRS. The residential receptor will also be evaluated for the Anti-Aircraft Range 90mm – 2 MRS (FTSW-002-R-01), although the future use of the site is expected to remain the same as the current use. Potential human receptors that may occur outside of the boundaries of FTSW will not be considered in the HHRA.

Surface soil exposure could occur currently or in the future for outdoor workers, construction workers, or trespassers. Although there is no expectation of surface MEC or debris at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), past studies have shown levels of some metals (e.g., lead) at FTSW elevated above background levels; therefore, the surface soil for both MRSs must be investigated to support the HHRA. Exposure to combined surface/subsurface soil could occur currently or in the future for construction workers or for future residents if intrusive activities occur, resulting in subsurface soil constituents becoming available for contact. Potential human exposure routes for surface/subsurface soil could include incidental ingestion, dermal contact, and inhalation of particulates. Since MC are not typically volatile, volatile compounds are not being investigated in this RFI and inhalation of volatile compounds will not be considered in the BLRA.

Currently, the surface aquifer, or shallow groundwater, is used as a source for domestic secondary water in some other areas of the region, as stated in the HRR (Malcolm Pirnie, 2006). However, this domestic use of shallow groundwater does not currently occur at FTSW. Based on the hydrogeological information detailed in SAIC, 1999, MC in shallow groundwater is not likely to migrate to the deeper aquifer that is used as a water supply for FTSW; therefore, potential exposures via deeper groundwater are not considered as part of the BLRA. A shallow groundwater investigation will only be conducted if the soil sampling results warrant additional investigations, based on screening against appropriate SSLs. If it is determined that a shallow groundwater investigation will be conducted, a HHRA addendum outlining receptors and pathways for groundwater will be prepared. For example, if the shallow groundwater on the base is utilized for grounds keeping, a potential receptor would be outdoor workers. Similarly, if construction or excavation occurs in the future, exposures to shallow groundwater could occur for construction or excavation workers.

Ecological Receptors

Most of the Anti-Aircraft Range 90 mm - 2 MRS (FTSW-002-R-01) is enclosed by a fence, relatively flat, and covered with maintained grass and buildings.

In the Hero Road Trench MRS (FTSW-008-R-01, the size of the potential burial/disposal pit locations is unknown. The constituents at the MRS are expected to be located in the subsurface burial pits 2 to 10 feet below the surface. The MRS lies within the cantonment area and is surrounded by a fence. The MRS consists of dense young forest and substantial undergrowth.

For ecological receptors, surface soil (0 ft bgs to 1 ft bgs) exposures will be evaluated in the SLERA. Subsurface soil will not be evaluated.

Table 3-11 summarizes the potentially exposed receptors and the exposure pathways that will be considered in the HHRA. These pathways are also shown in the preliminary human health CSMs for both sites in Figures 12 and 14, and for ecological receptors in Figures 13 and 15.

Table 3-11. Summary of Potential Receptors and Exposure Routes

MRS	Media	MC	Potentially Exposed Receptors	Potential Exposure Routes
Anti-Aircraft Range 90-mm - 2	Surface Soil	Select metals (Al, Cu, Pb, Zn) and explosives	Outdoor workers, construction workers, trespassers Biota (e.g., birds, mammals, soil invertebrates, reptiles)	Incidental ingestion, dermal contact, and inhalation of particulates Ingestion, dermal contact
	Surface/ Subsurface Soil	Select metals (Al, Cu, Pb, Zn) and explosives	Future outdoor workers, construction workers, and residents	Incidental ingestion, dermal contact, inhalation of particulates
Hero Road Trench Area	Surface Soil	Arsenic and organosulfur residues (1,4-dithiane; 1,4-oxathiane; and thiodiglycol)	Outdoor workers, construction workers, trespassers Biota (e.g., birds, mammals, soil invertebrates, reptiles)	Incidental ingestion, dermal contact, and inhalation of particulates Ingestion, dermal contact
	Surface/ Subsurface Soil	Arsenic and organosulfur residues (1,4-dithiane; 1,4-oxathiane; and thiodiglycol)	Future outdoor workers, construction workers, and residents	Incidental ingestion, dermal contact, inhalation of particulates

3.10.2 Human Health Risk Assessment Approach

The HHRA for the MRSs will include the following four key steps:

1. Screening to identify chemicals of potential concern (COPC). FTSW-wide soil and groundwater background data and statistics that were developed as part of a 16 SWMU RFI (SAIC, 1999) will be used. Additional background soil samples will be collected and analyzed for Al, Cu, and Zn. Lead has already been analyzed in the SWMU background database; this historic lead background data will be used in the HHRA.
2. Exposure assessment, including characterizing the site setting and identifying current and potential future human receptors and exposure pathways (as was done in the development of the CSM), along with calculating exposure point concentrations, and estimating the potential intake of COPCs.
3. Identify toxicity information for each COPC.
4. Characterize site-specific risks.

3.10.2.1 Screening to Identify Chemicals of Potential Concern

Site-specific COPCs are the chemicals detected during the field investigation that warrant evaluation in the quantitative HHRA. The screening process presented relies on comparison of site-related chemicals to conservative health-based screening criteria and to site-wide soil background data (SAIC, 1999). Health-based screening criteria are tabulated in the USEPA Regional Screening Level (RSL table) (USEPA, 2012b, or the most recent version at the time the HHRA is started) for both industrial and residential exposure scenarios. The screening process is as follows:

1. The maximum detected concentration of a chemical in soil will be compared to the USEPA RSL that is protective to a cancer risk level of 1×10^{-6} (for carcinogens) or a non-cancer hazard quotient level of 0.1. Residential RSLs will be used for screening at the Anti-Aircraft Range. At the Hero Road Trench Area, the HHRA will assume potential future residential use; therefore, maximum detected concentrations will be screened against the residential RSLs. This screening of COPCs approach is consistent with the GAEPD risk assessment guidance (Section III.1.b, GAEPD, 1996). The generic RSLs are based on potential exposures via the dermal, ingestion, and inhalation routes. Only chemicals that exceed the RSLs will be retained as COPCs.
2. When a RSL is not available for a compound, it will be determined if alternate screening values have been established. Otherwise, the compound will be carried through the HHRA.
3. In addition to the RSL comparison, the maximum detected concentration of a chemical in soil will be compared to the background as previously established (SAIC, 1999). Inorganic constituents in soil will be eliminated as COPCs for human exposures if the maximum detected concentration is less than two times the average site-specific background concentration (Supplemental Guidance to RAGS: R4 HHRA Bulletin No. 1),.

4. Finally, chemicals detected in soil will be compared to the USEPA "Protection of Groundwater" SSLs (USEPA, 2012b), specifically developed by USEPA for the protection of groundwater. These are conservative screening-level concentrations to assess the movement of contaminants from soil to groundwater. The RFI Report will include a review of all input parameters upon which the SSL calculations are based and provide justification to show that these values are acceptable for use at FTSW.

Tables summarizing detected chemicals in surface soil and in subsurface soil will present the process by which a chemical has been selected or eliminated as a COPC, along with the frequency of detection, detection limits, maximum and average of detected concentrations, and the risk-based screening criteria. The selected COPCs will be carried through a quantitative HHRA.

3.10.2.2 Exposure Assessment

Current human receptors for the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) and the Hero Road Trench Area (FTSW-008-R-01) MRSs include outdoor workers, construction workers, and trespassers.

Future land use is expected to remain the same as current land use, although construction or excavation could take place on-site, potentially exposing construction or excavation workers to subsurface soil. As discussed in Section 3.10.1.2, the future resident receptor will be evaluated for both MRSs in the HHRA.

Reasonable maximum exposure (RME) and risk estimates will be calculated in the HHRA. The RME scenario is defined as the maximum exposure that is reasonably expected to occur (USEPA, 1989b), and exposure parameters are chosen with the understanding that the combination of variables for a given pathway would result in an estimate of the RME for that pathway. Average or central tendency exposure scenarios will not be evaluated in the HHRA.

Exposure Routes and Exposure Assumptions

The potentially exposed receptors and exposure routes for the two MRSs are outlined below. The exposure factors that will be used to estimate exposures are summarized in Tables 3-12 through 3-16.

Surface Soil: Under current and future land use, outdoor workers, construction workers, and trespassers may be exposed to surface soil. Outdoor workers are the workers likely to be the most exposed to surface soil during gardening or other outdoor activities, such as maintenance of grass, gravel areas, fence, and buildings. Relevant exposure pathways to surface soil for outdoor workers, construction workers, and trespassers include incidental ingestion, dermal contact, and inhalation of particulates, although current vegetative cover is likely to reduce dust emissions to very low levels.

Surface and Subsurface Soil: Under future land use, construction workers could be exposed to soil both on the surface and soil that is currently at depth when digging foundations or servicing utilities. Future residents could also be exposed to surface and subsurface soil that has been mixed following construction. Relevant exposure pathways include incidental ingestion, dermal contact, and inhalation of particulates.

USEPA (1996b and 2002a) guidance does not recommend estimating intakes (i.e., mg/kg-day) for the air inhalation pathway. Rather, risks and hazards are determined by comparing estimated particulate air concentrations (calculated as described in the next subsection), adjusted for exposure frequencies/durations/time, with inhalation toxicity values. Chronic inhalation toxicity factors developed by USEPA assume continuous (i.e., daily, 24-hour exposure) long-term exposure. Therefore, it is necessary to adjust for the fraction of time breathing contaminated air for daily exposures less than 24 hours, using the Exposure Time (ET) factor; it is assumed that site workers and trespassers could be exposed for 8 of 24 hours per day, while residents could be exposed 24 hours/day.

Tables 3-12 through 3-16 summarize the exposure factors that will be used in the HHRA.

Table 3-12. Exposure Factors for Outdoor Worker (Surface Soil)

Exposure Factor	Scenario [a/]	Rationale	Reference
BW = Body Weight 70 kg [b/]	RME	Standard reference weight for adult males.	USEPA, 1997a
EF = Exposure Frequency 250 days/yr	RME	Assumes year-round weekday exposure.	USEPA, 1991a
ED = Exposure Duration 25 years	RME	Upper bound time at one place of employment.	USEPA, 1997a
SA = Surface Area 3,300 cm^2 [d/]	RME	Default exposed skin surface area.	USEPA, 2004a
AT = Averaging Time 25,500 days (carcinogens) ED x 365 days/year (noncarcinogens)	RME	Conventional human lifespan. Intakes for carcinogens are averaged over the duration of exposure. Equal to the exposure duration (in days).	USEPA, 1989b
FI = Fraction Ingested (unitless) 1.0	RME	RME conservatively assumes 100 percent of daily soil incidental ingestion occurs on-site.	Professional judgment
DAF = Dermal Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
OAF = Oral Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
IR = Incidental Soil Ingestion Rate 330 mg/day [e/]	RME	Default soil incidental ingestion rate for workers.	USEPA, 2002a
AF = Soil-to-Skin Adherence Factor 0.2 mg/cm^2-day [f/]	RME	Activity and body part-specific weighted based on exposed body parts.	USEPA, 2011b
ET = Fraction of EF breathing contaminated outdoor air (unitless) 33%	RME	Based on 8/24 hours per day (33 percent) of day spent outdoors at contaminated site.	Professional judgment

Notes:
a/ RME = Reasonable Maximum Exposure
b/ kg = kilogram
c/ days/yr = days per year
d/ cm^2 = square centimeters
e/ mg/day = milligrams per day
f/ mg/cm^2-day = milligrams per square centimeter-day

Table 3-13. Exposure Factors for Trespasser (Surface Soil)

Exposure Factor	Scenario [a/]	Rationale	Reference
BW = Body Weight 45 kg [b/]	RME	Typical trespasser is represented by an adolescent aged 7-16 years old. .	GAEPD guidance
EF = Exposure Frequency 100 days/yr [c/]	RME	GAEPD guidance.	GAEPD guidance
ED = Exposure Duration 10 years	RME	Time in adolescent age group.	USEPA, 1997a
SA = Surface Area 3,300 cm^2 [d/]	RME	Default exposed skin surface area.	USEPA, 2004a
AT = Averaging Time 25,500 days (carcinogens)	RME	Conventional human lifespan. Intakes for carcinogens are averaged over the duration of exposure.	USEPA, 1989b
FI = Fraction Ingested (unitless**)** 1.0	RME	RME conservatively assumes 100 percent of daily soil incidental ingestion occurs on-site.	Professional judgment
DAF = Dermal Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
OAF = Oral Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
IR = Incidental Soil Ingestion Rate 100 mg/day [e/]	RME	Default soil incidental ingestion rate for adult residents.	USEPA, 1997a
AF = Soil-to-Skin Adherence Factor 0.07 mg/cm^2-day [f/]	RME	Activity and body part-specific weighted based on exposed body parts.	USEPA, 2004a
ET = Fraction of EF breathing contaminated outdoor air (unitless) 33%	RME	Based on 8/24 hours per day (33 percent) of day spent outdoors at contaminated site.	Professional judgment

Notes:
a/ RME = Reasonable Maximum Exposure
b/ kg = kilogram
c/ days/yr = days per year
d/ cm^2 = square centimeters
e/ mg/day = milligrams per day
f/ mg/cm^2-day = milligrams per square centimeter-day

Table 3-14. Exposure Factors for Construction/Excavation Worker (Surface/Subsurface Soil)

Exposure Factor	Scenario [a/]	Rationale	Reference
BW = Body Weight 70 kg [b/]	RME	Standard reference weight for adult males.	USEPA, 1997a, Section 7.3
EF = Exposure Frequency 250 days/yr [c/]	RME	Assumes year-round weekday exposure.	USEPA, 1991a, Section 2.1
ED = Exposure Duration 2 years	RME	Assumption for upper bound length of time of construction.	Professional judgment
SA = Surface Area 3,300 cm^2 [d/]	RME	Standard default skin surface area.	USEPA, 2004a
AT = Averaging Time 25,500 days (carcinogens)	RME	Conventional human lifespan. Intakes for carcinogens are averaged over the duration of exposure.	USEPA, 1989b
FI = Fraction Ingested (unitless) 1.0	RME	RME conservatively assumes 100 percent of daily soil incidental ingestion occurs on-site.	Professional judgment
DAF = Dermal Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
OAF = Oral Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
IR = Incidental Soil Ingestion Rate 330 mg/day [e/]	RME	Default soil incidental ingestion rate for workers.	USEPA, 2002a
AF = Soil-to-Skin Adherence Factor 0.3 mg/cm^2-day [f/]	RME	Activity and body part-specific weighted based on exposed body parts.	USEPA, 2011b
ET = Fraction of EF breathing contaminated outdoor air (unitless) 33%	RME	Based on 8/24 hours per day (33 percent) of day spent outdoors at contaminated site.	Professional judgment

Notes:
a/ RME = Reasonable Maximum Exposure
b/ kg = kilogram
c/ days/yr = days per year
d/ cm^2 = square centimeters
e/ mg/day = milligrams per day
f/ mg/cm^2-day = milligrams per square centimeter-day

Table 3-15. Exposure Factors for Hypothetical Future Adult Resident (Surface/Subsurface Soil)

Exposure Factor	Scenario [a/]	Rationale	Reference
BW = Body Weight 70 kg [b/]	RME	Standard reference weight for adult males.	USEPA, 1997a
EF = Exposure Frequency 350 days/yr [c/]	RME	Assumes year-round exposure with one 2-week vacation.	Professional judgment
ED = Exposure Duration 30 years	RME	Upper bound time living in one location.	USEPA, 1997a
SA = Surface Area 3,300 cm^2 [d/]	RME	Default exposed skin surface area.	USEPA, 2004a
AT = Averaging Time 25,500 days (carcinogens)	RME	Conventional human lifespan. Intakes for carcinogens are averaged over the duration of exposure.	USEPA, 1989b
FI = Fraction Ingested (unitless**)** 1.0	RME	RME conservatively assumes 100 percent of daily soil incidental ingestion occurs on-site.	Professional judgment
DAF = Dermal Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
OAF = Oral Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
IR = Incidental Soil Ingestion Rate 100 mg/day [e/]	RME	Default soil incidental ingestion rate for adult residents.	USEPA, 1997a
AF = Soil-to-Skin Adherence Factor 0.07 mg/cm^2-day [f/]	RME	Activity and body part-specific weighted based on exposed body parts.	USEPA, 2004a
ET = Fraction of EF breathing contaminated outdoor air (unitless) 100%	RME	Based on 24 hours per day (100 percent) of day exposed to dust from site.	Professional judgment

Notes:
a/ RME = Reasonable Maximum Exposure
b/ kg = kilogram
c/ days/yr = days per year
d/ cm^2 = square centimeters
e/ mg/day = milligrams per day
f/ mg/cm^2-day = milligrams per square centimeter-day

Table 3-16. Exposure Factors for Hypothetical Future Child Resident (Surface/ Subsurface Soil)

Exposure Variable	Scenario [a/]	Rationale	Reference
BW = Body Weight 15 kg [b/]	RME	Average body weight for children (1 to 6 years).	USEPA, 2008
EF = Exposure Frequency 350 days/yr [c/]	RME	Assumes year-round exposure with one 2-week vacation.	Professional judgment
ED = Exposure Duration 6 years	RME	Time for ages 0 to 6 at one residence.	USEPA, 1997
SA = Surface Area 4,070 cm^2 [d/]	RME	Assumed contact with head, arms, hands, legs, and feet.	USEPA, 2011b
AT = Averaging Time 25,500 days (carcinogens) ED x 365 days/year (noncarcinogens)	RME RME	Conventional human lifespan. Intakes for carcinogens are averaged over the duration of exposure. Equal to the exposure duration (in days).	USEPA, 1989a USEPA, 1989a
FI = Fraction Ingested 1.0 (unitless**)**	RME	Conservatively assume 100 percent of daily soil incidental ingestion occurs on-site.	Professional judgment
DAF = Dermal Absorption Fraction Chemical-specific	RME	Chemical-specific.	USEPA, 2004a
IR = Incidental Soil Ingestion Rate 200 mg/day	RME	Default EPA soil ingestion rates for children.	USEPA, 2011b
AF = Soil-to-Skin Adherence Factor 0.054 mg/cm^2 [f/]	RME	Mean adherence factor for arms, hands, legs, and feet for daycare children, playing both indoors and outdoors.	USEPA, 2011b .
ET = Exposure Time 8 hours/day	RME	Assumed 8 hours/day outdoors.	Assumed

a/ RME = Reasonable Maximum Exposure
b/ kg = kilogram
c/ days/yr = days per year
d/ cm^2 = square centimeters
e/ mg/day = milligrams per day
f/ mg/cm^2 = milligrams per square centimeter

Quantification of Exposure

The exposure point concentration (EPC) is a conservative estimate of the average concentration of a COPC, calculated from the analytical results of every sample for a particular environmental medium to which a receptor may be exposed. An EPC may be based on media concentrations that have been directly measured or it may be derived based on environmental medium-to-medium transport modeling.

Both the mean and the upper confidence limit (UCL) on the mean will be estimated for each COPC in each medium. USEPA ProUCL statistical software (USEPA, 2011a) will be used to

calculate 95% UCLs of the mean of datasets with non-detects, and perform other statistical analyses on every dataset (including those with non-detects). The UCL or maximum detected concentration, whichever is smaller, will be selected as the exposure point concentration. If a dataset consists of fewer than five data points, the maximum detected concentration will be used.

Per USEPA (1996a and 2002a), exposure point concentrations for COPCs in airborne fugitive dust should be based on soil exposure point concentrations and will be estimated using the following equation:

$$C_{air} = \frac{C_{soil}}{PEF}$$

Where:

C_{air} = COPC concentration in air at the exposure point (mg/m^3)

C_{soil} = COPC exposure-point concentration soil (mg/kg)

PEF = Particulate emission factor (m^3/kg)

The PEF relates the concentration of the soil COPC to the concentration of dust particles in the air. This calculation addresses dust generated from open sources, which is termed "fugitive" because it is not discharged into the atmosphere in a confined flow. The USEPA's default PEF of 4.63E+09 m^3/kg will be used for the determination of the COPC concentration in air, and revise accordingly.

3.10.2.3 Toxicity Assessment

Reference doses, reference concentrations, and cancer slope factors will be obtained from the following hierarchy of primary sources, as specified by USEPA guidance:

- USEPA's IRIS (on-line) (USEPA, 2012a);
- USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs);
- Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Levels (MRLs); and
- Other sources, as necessary.

Dermal reference doses and cancer slope factors will be estimated from oral values (USEPA, 2004a). Specifically, oral slope factors will be converted to dermal slope factors by dividing by the oral absorption efficiency. Oral reference doses will be converted to dermal reference doses by multiplying by the oral absorption efficiency (USEPA, 2004a).

For the inhalation of particulates pathway for future construction or excavation workers, the inhalation chronic toxicity factors derived by USEPA (2000b) (i.e., inhalation unit risks [IURs] and reference concentrations [RfCs]) are expressed as air concentrations. USEPA (1996a) recommends direct comparison of measured or modeled air concentrations to inhalation toxicity factors rather than using daily inhalation rates to convert to internal doses (i.e., mg/kg-day).

3.10.2.4 Risk Characterization

The risk characterization step will integrate the toxicity and exposure assessment outputs into quantitative estimates of risk. The carcinogenic risk and non-carcinogenic hazard (as represented by the Hazard Quotient [HQ]) posed by a chemical to a receptor will be calculated using the following equations:

$$\textbf{Risk} = (CDI)(SF)$$

Where:

Risk is the carcinogenic risk posed by the chemical through the pathway

CDI is the chronic daily intake of the chemical through the pathway

SF is the cancer slope factor for the chemical by that pathway

$$\textbf{HQ} = CDI/RfD$$

Where:

HQ is the non-cancer hazard quotient posed by the chemical through the pathway

CDI is the intake of the chemical through the pathway

RfD is the reference dose for the chemical by that pathway

AT is the averaging time

The total pathway-specific cancer risk or non-cancer hazard quotients for the receptor will be derived by summing all the risks or hazards for all the chemicals in that pathway. The total carcinogenic risk or hazard for a receptor across all media and pathways will be derived by adding all the pathway-specific risks or hazards. The sum of HQs is referred to as a hazard index (HI). The estimated total risks and hazards will be compared to established risk management criteria, as follows:

- The incremental cancer risk range of $1x10^{-6}$ will be used when discussing total cancer risks[1]

[1] It is understood that 10^{-6} is a trigger point for RCRA site cleanups in Georgia. Per the GAEPD guidance for Selection Media Remediation Levels at RCRA Solid Waste Management Units (November 1996, pg 7), the 1 x 10-^{6} cumulative risk level and the HI of 1 are used as the remediation "triggers." The carcinogen "trigger" represents the summed risks to a receptor of all COPC's for all pathways per land use scenario. The HI represents the total of the HQs of all COPCs for all pathways per land use scenario (If the HI exceeds 1.0, then the more specific HIs should be developed by summing HQs of COPCs with RfDs based on toxic effects on the same target organs. This specific target-organ based HI should form the basis of COC selection.). Additionally, the facility reviews the results of the baseline risk assessment and proposes a remediation level for protection of human health for each COC in each affected medium. These proposed remediation levels and justification for their selection are presented in the RFI Report. EPD's preference for calculating proposed remediation levels is at a risk level of 1 x 10^{-6} for carcinogens and a hazard quotient of 1 for non-carcinogens. In no event shall a facility propose a remediation level that exceeds a risk level of 1 x 10-4 for carcinogens or a hazard quotient of 3 for non-carcinogens."

- An HI of 1 will be used when evaluating total non-carcinogenic hazards for each receptor.
- If the target HI of 1 is exceeded, the target organ toxicity approach will be applied. Groups of toxicants that affect the same target organ will be separated; for each target organ-specific effect, individual HIs will be calculated and compared to a hazard index of 1.
- If inhalation risks are included in the HHRA, the risks will be characterized as per USEPA guidance (USEPA, 2009a).
- The GALM and IEUBK models (USEPA, 2002b) will be used to evaluate lead exposure if the maximum detected lead concentration in soil exceeds the USEPA Residential RSL of 400 mg/kg.

3.10.2.5 Uncertainty Assessment

The HHRA will include a qualitative discussion of the uncertainties associated with the estimation of human health risks using the methods proposed in this Work Plan. These uncertainties include, but are not limited to, analytical results, toxicity evaluations, and exposure assumptions.

3.10.3 Screening Level Ecological Risk Assessment

Most of the Anti-Aircraft Range – 90 mm MRS (FTSW-002-R-01) is enclosed by a fence, relatively flat, and covered with maintained grass and buildings. The specific constituents/analytes that will be investigated in soil for the Anti-Aircraft Range – 90 mm MRS (FTSW-002-R-01) are the select metals (Al, Cu, Pb, and Zn) and explosives; the rationale for these selected metals is outlined in Appendix H (MC Sampling Rationale Memo). Although the MRS is not a maintained ecological habitat, a screening-level ecological risk assessment (SLERA), in which constituents in surface soil will be screened against appropriate ecological benchmarks, will be conducted. Subsurface soil will not be considered for ecological receptors. If constituents exceed screening levels, a qualitative discussion of the potential ecological effects will be presented, because of the low ecological value of the MRS.

The Hero Road Trench MRS (FTSW-008-R-01) lies within the cantonment area and is surrounded by a fence. The MRS consists of dense young forest and substantial undergrowth. The Hero Road Trench Area MRS (FTSW-008-R-01) investigations are related exclusively to potential MC contamination from dilute agent CAIS kits, which anecdotal evidence suggests may have been disposed in burial trenches in the MRS. The specific constituents that will be investigated are arsenic, 1,4-oxithiane, 1,4-dithiane, and thiodiglycol. A screening-level ecological risk assessment, as described in the sections below, will be conducted for surface soil in this MRS. If constituents exceed screening levels, further quantitative risk characterization will be conducted.

In performing a SLERA for the MRSs, the GAEPD 1996 guidance will be applied, generally following the steps outlined in that guidance as a Preliminary Risk Evaluation (PRE). In general, the GAEPD guidance follows the 8-step ecological risk assessment process outlined by U.S.

EPA in the *Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997b).

The GAEPD PRE is the initial ecological risk screening assessment at a RCRA facility. The primary purpose of the PRE is to compare concentrations of site-related constituents to ecological screening values and to conduct a preliminary risk characterization. Based on the extent of potential ecological harm, a more detailed ecological exposure assessment and risk characterization may be recommended as a possible next step for one or more ecological receptors.

3.10.3.1 Comparison to Ecological Screening Values and Background

For ecological receptors, surface soil (0 ft bgs to 1 ft bgs) exposures will be evaluated in the SLERA. Subsurface soil will not be evaluated. Chemicals of potential ecological concern (COPECs) will be selected based on a comparison to USEPA Region 4 ecological screening values (USEPA, 1999a), which can be obtained from the tables in Bulletin 2 (Ecological Screening Values) of the Ecological Risk Assessment Bulletins - Supplement to RAGS (USEPA, 2001c). For naturally occurring inorganic metals, the on-site maximum concentration will be compared to 2 times the average site-specific background concentration.

For chemicals that lack USEPA Region 4 screening values, supplemental screening values from other sources will be proposed, and will be based on ecotoxicological information from other regulatory programs, scientific literature, or computer databases.

3.10.3.2 Problem Formulation

The problem formulation step will provide an ecological site description, discussion of potential receptors and critical habitats, and a discussion of potential ecological exposure pathways.

Environmental Setting and Ecological Site Description: An overview of each MRS and its ecological characteristics, such as forested areas, disturbed or developed areas, and water bodies, will be presented. This section will include:

- Descriptions of the disturbed and undisturbed natural and developed areas;
- The past, current, and future land-uses (i.e., industrial, residential, undeveloped);
- Facilities that exist or existed at the MRS;
- The environmental characteristics/ecological types (wetlands, forests, grasslands, water-bodies, human-made/disturbed areas);
- Areas that are potentially, or known to be, at risk from chemical contamination; and
- Discussion of whether the contamination may have moved off-site to impact other areas.

Potential Receptors and Critical Habitats: Potential ecological receptors and critical habitats (if any) will be described. For terrestrial communities, the major groups include terrestrial invertebrates, mammals, and birds. For aquatic and/or wetland communities, the major groups are vertebrates (waterfowl and fish), aquatic invertebrates, and wetland/terrestrial mammals. Any ecological receptors that are listed as rare, threatened, or endangered will be described.

Potential Ecological Exposure Pathways: The potential ecological exposure pathways will be outlined in the problem formulation step. Ecological exposure pathways can include direct contact, such as ingestion of soil by terrestrial receptors, or indirect contact, such as bioaccumulation of contaminants through the food chain.

3.10.3.3 Preliminary Ecological Effects Evaluation

Preliminary evaluation of ecological effects will include a general discussion of the potential toxicity of the COPECs that exceed screening criteria for the ecological receptors at the sites. Based on a review of scientific literature, this section will present an overview of the levels of COPECs that could cause adverse effects in the plants and animals that may come in contact with the constituents present at the sites.

3.10.3.4 Preliminary Exposure Assessment

The preliminary exposure assessment will estimate the nature, extent, and magnitude of potential exposure of receptors to COPECs that are present at or migrating from each MRS. Exposure and chemical uptake will be discussed in general terms, but will take into account the spatial and temporal distribution of the ecological receptors and the COPECs. The preliminary exposure assessment will also discuss the bioavailability of the COPECs and the means by which potential ecological receptors may be exposed (exposure pathways) for soil. Sediment and surface water are not potential exposure media for ecological receptors at these MRSs, because there are no water bodies at these locations.

3.10.3.5 Preliminary Risk Characterization

The last step of the PRE for the two MRSs will be a preliminary risk characterization. For the Anti-Aircraft Range 90 mm -2 MRS (FTSW-002-R-01), the preliminary risk characterization will consist of a qualitative discussion of potential ecological risks, because of the low ecological value of the maintained and fenced lawn within the MRS. For the Hero Road Trench MRS (FTSW-008-R-01), if any constituents in surface soil exceed screening values, a quantitative assessment of hazard based on a hazard quotient (HQ) calculation will be done. The HQ calculation will compare the estimated exposure level or daily dose for each COPEC to available literature Toxicity Reference Values (TRVs), in order to determine the potential for adverse effects for ecological receptors exposed to soil at the MRS. TRVs usually are based on no observed adverse effect levels and lowest observed adverse effect levels, with safety factors applied. Appropriate documents that summarize the available ecotoxicological information and benchmark values will be consulted. The level of effort will be limited to these secondary sources and will not include review of the primary toxicological literature (i.e., details of toxicity test conditions to determine validity of the tests performed will not be reviewed). If the HQs estimated using TRVs exceed 1, a refined evaluation will be conducted using receptor-specific exposure parameters to estimate more site-specific HQs.

A more detailed ecological exposure assessment and risk characterization may be recommended as a next step for one or more ecological receptors, if warranted based on the results of this SLERA.

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4.0 QUALITY CONTROL PLAN

4.1 General

The purpose of the Quality Control Plan (QCP) is to provide the approach, methods, and operational procedures used to ensure quality throughout the execution of the tasks required by the PWS. The QCP provides organization, responsibilities, policies, and procedures for maintaining the highest possible standards. The QCP applies to all work performed by ERT and its subcontractors.

4.2 Introduction

This QCP describes the QC organization, program, and objectives for this RFI.

The objectives of this QCP are to anticipate the specific operating requirements of the project, and to establish procedures to ensure that the quality of the work performed meets specifications and conforms to the requirements of the PWS. Specifically, this plan:

- Identifies the project QC organization and defines each individual's respective authority, responsibilities, and qualifications;
- Defines project communication, documentation, and recordkeeping procedures; and
- Establishes QC procedures, including the necessary supervision and tests to ensure that work meets applicable specifications.

4.3 QC Personnel Organization and Responsibilities

ERT utilizes an established Corporate Quality Control Program (based on International Organization for Standardization principles) on every contract and project. The basic concepts include designation of an experienced ERT Senior Manager or Principal as the QC Manager for the project. Michael Dorman has been assigned as QC Project Manager (QCM) for this project. The QCM reports directly to ERT's President, and therefore has the appropriate level of authority to ensure that project deliverables are subject to the major elements of the QC process.

ERT maintains an organizational structure based on the project management matrix system. A PM is responsible for bringing many different functions and activities together in order to successfully complete the project. QC is the function that provides independent review and assessment. The QCM works with the PM and other project personnel to ensure that the project QCP is implemented, to identify areas where the project could benefit from improvement, and to assist with the implementation of improvements. For MMRP projects, an SSHO/UXOSO-QC is required who is capable of implementing the three-phase control process: conducting surveillance activity, performing acceptance sampling inspections when required, and meeting specific contract requirements for this position. See Section 4.14 for additional information regarding personnel qualifications and training.

4.3.1 Document and Data Control

The PM will ensure that a project central file is established and maintained and that project documents are retained and controlled appropriately.

4.4 Instrument and Equipment Testing

Instruments and equipment used to gather and generate environmental data will be tested with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Instruments and equipment required for this RFI will include DGM instruments, analog instruments, digital cameras, and cell phones. The QC procedures for the reconnaissance data collection, the survey data collection associated with sampling, and the GIS procedures are discussed below.

Testing, calibration, repair, and replacement records will be filed and maintained by the ERT Project Geophysicist and the SSHO/UXOSO-QC. Testing records of the field instrumentation will be filed with the ERT PM after completion of the project.

4.4.1 Instrument Standardization

Geophysical equipment standardization will be performed in accordance with the detailed description in Section 3.5.

4.4.2 Analog Instrument Quality Control

An inventory and inspection of the equipment will be performed (for example, batteries including backups, end probe, sensitivity adjustment device, etc.) upon arrival at the MRS. The analog instrument, such as the Schonstedt, will be checked at the start and end of each day by operating the instrument over a test plot seeded with metallic test items. At the start of each day, each operator will also be checked for interfering metallic items by scanning with the instrument. The battery will be checked and the instrument will be shaken to check for loose parts and bad electrical connections. The performance of these tests will be documented in the field books.

4.4.3 Digital Camera Quality Control

The digital cameras will be checked each day prior to use during the project. The battery level will be checked and, as needed, the batteries recharged, or replaced, as appropriate. Before work begins each morning, the team leader will verify that each camera function is working properly and the available memory space on the camera is sufficient for a complete day of field photography.

4.4.4 Cell Phone Quality Control

Each field team will keep a minimum of one cell phone with them at all times for emergency use. The cell phone(s) will be checked each day prior to use during the project. The battery level will be checked and, as needed, the batteries recharged or replaced. In addition, the team will verify that cell phone coverage is adequate at the MRS. If at any time during the project it is determined that communication by cell phone is not available at any portion of the MRS, Motorola walkie-talkies will be utilized.

4.4.5 GIS Quality Control Procedures

The accuracy of the geographic analysis is equivalent to the accuracy of the underlying data being analyzed. Certain guidelines are necessary to ensure data quality after it has been entered

into the system. The QC guidelines presented in this chapter pertain to GIS data loaded into the GIS system.

Potential data problems include source data errors, data entry, and data editing errors that can be corrected, data corruption errors that can be prevented, and user errors that can be anticipated.

Geometric Accuracy: After the coordinate information for reconnaissance waypoints are verified, the geometric accuracy of the geographic features will be checked. When this is detected, the source data will be examined and the correct locations and place points will be determined in the GIS dataset to represent identifiable elements of the feature such as corners or intersections. Original files will be backed up prior to making edits to prevent errors from occurring during the editing process.

Geographic Accuracy: The strength of GIS is the accuracy with which geographic phenomena can be mapped. However, if the overall spatial accuracy of the data is not clearly indicated, this becomes a significant weakness. A statement of the accuracy of the spatial data will be included with documentation of the graphic files. The GIS coverage will be evaluated to determine if the geographic features are graphically correct. If they are not in accordance with the data dictionary, they will be corrected.

Data Loss and File Corruption: There are several programs that manipulate the various files used by the GIS and relational database. Due to hard disk limitations, Random Access Memory limitations, or human error these programs occasionally crash, and the files being manipulated by these programs can become corrupted. To prevent data loss, these files will be backed up on a regular basis, and stored in a separate physical location from the primary storage device.

Schema Quality Control: The database values are the other part of the data structure that requires quality control. The database is generally treated as a single file with unique properties. QC procedures will be developed by the GIS operator to ensure that the data contained therein are accurate and usable. Before editing any database tables, the tables will be unloaded for backing up the schema. Another safeguard is to use a reference file of how data entry is performed.

The GIS operator will develop and use a checklist of standard QC steps. For example, another approach to correcting errors is to run a program that edits the ASCII data export file.

4.5 Instrument/Equipment Maintenance

Instruments, equipment, and other items requiring preventive maintenance will be serviced in accordance with the manufacturers' specified recommendations and written procedures developed by the operators. The exception is DGM equipment which, by manufacturer's design, is calibrated at the time of manufacture and should not require field calibration or maintenance. Pre-operational and post-operational checks will be performed to ensure that the equipment is fully capable and will be performed in accordance with the manufacturer's specifications; any equipment that is found unsuitable will be immediately removed from service. These checks will provide QC data indicating the proper functionality of the instruments.

4.5.1 Maintenance Procedures

Measurement equipment utilized on-site, i.e., DGM, analog, monitors, etc., will be checked daily for operational reliability. Equipment such as vehicles and boats will have before-, during-, and after-operation maintenance performed in accordance with the equipment operating manual. It will be the operator's responsibility to adhere to these maintenance schedules and to arrange any necessary and prompt service, as required. At a minimum, equipment used daily will be cleaned at the end of each workday and kept in good operating condition. Qualified personnel will perform service to the equipment and instruments, as required. In the absence of any manufacturers' recommended maintenance criteria, the operator will develop a maintenance procedure based on experience and previous use of the equipment.

The SSHO/UXOSO-QC is specifically responsible for inspecting the equipment and maintenance records. Records of these checks are maintained in the SSHO/UXOSO-QC log book. If equipment field checks indicate that any piece of equipment is not operating correctly and field repair cannot be made, the equipment will be tagged and removed from service. ERT's PM will be notified and a request for replacement equipment placed immediately. Replacement equipment must meet the same specifications for accuracy and precision as the equipment removed from service.

4.6 Instrument/Equipment Troubleshooting

Troubleshooting for the equipment will consist of reviewing the guidelines provided in the operator's manual for the analog geophysical equipment, and ensuring batteries are charged and memory sticks have sufficient storage capability remaining prior to beginning field work each day. An inventory of spare parts or units for every piece of equipment will be maintained for the project. This inventory will include a minimum of at least one extra battery for the geophysical mapping equipment, one analog instrument, digital camera, digital camera memory stick, and one set of applicable rechargeable batteries (and charger, if necessary) for each item. A back-up geophysical instrument will not be kept on-site; however, arrangements will be made with an equipment vendor so replacement equipment or any needed spare parts can be delivered to FTSW the next day.

4.7 Data Management

4.7.1 Data Reduction

Geophysical data collected in the field will be processed and managed by the ERT Senior Geophysicist. Processing procedures vary depending on the technology and/or instrument selected for use. Any raw data from field measurements will be appropriately recorded in field notebooks or computers. Records (field data forms and field note copies) will be maintained onsite in a portable file. Every record will be stored such that they can be found using the date they were created, the team who created them, and a MRS identification number. If the data are to be used in the project reports, they will be reduced and summarized, and the reduction method will be documented in the report.

Reduction of analytical laboratory data from the environmental sampling is provided in Worksheets #34 through #37 of the UFP-QAPP (Appendix E).

4.7.2 Field Data Storage

Data collected in the field will be stored electronically in notebook computers and emailed to the Senior Geophysicist daily. The files associated with this RFI will be backed up onto ERT's servers weekly.

4.7.3 Data Validation

Validation of analytical laboratory data from the environmental sampling is provided in Worksheets #34 through #37 of the UFP-QAPP (Appendix E).

4.8 Field Operations Documentation

4.8.1 Daily Field Activity Records

ERT field personnel will use bound logbooks with consecutively numbered pages. The field logbooks will record the daily activities of field teams, weather, provide sketch maps and locations of cultural debris, MEC/MD, and other pertinent items, and note any observations that might affect the quality of data. The field logbooks and field records will be used to record the following:

- Field Log Books: The Team Leader will maintain field logbooks to record MRS activities and field data. These logbooks will be maintained in a neat and legible manner and provide a historical record of MRS activities. Field Logbooks will be scanned electronically and backed up on ERT servers.
- SUXOS Daily Log Book: The SUXOS will maintain a daily journal. This provides a summary of each MEC operation conducted, to include information on weather conditions, problem areas, Work Plan modifications, injuries, start/stop times, tailgate safety briefs, equipment discrepancies, MEC/MD located, training conducted, visitors, and any additional items deemed appropriate.
- Anomaly Excavation Records: These records will be maintained by the SUXOS or designate and consist of two series of sheets used to record data on the excavation of anomalies and to record data on MEC/MD items encountered. These data are forwarded to the SSHO/UXOSO-QC and GIS managers, who enter the data into the GIS and update the project database.
- Safety Logbook: The SSHO/UXOSO-QC will maintain this information. It will record every safety matter associated with the specific project, such as safety briefings/meetings (including items covered and attendees), safety training, safety audits, near-misses/accidents/incidents with cause and corrective action taken, weather conditions, and any other matters relating to safety.
- Training Records: The SSHO/UXOSO-QC maintains training records for all field personnel. These records contain training certificates, licenses, and other qualifying data for an individual's duty position.
- Quality Control Log: The SSHO/UXOSO-QC maintains this log to record the performance and results of QC checks and audits. As part of their QC responsibilities,

the SSHO/UXOSO-QC will conduct and document daily safety and occupational health inspections in their daily QC logs.

- Visitor's Log: The SSHO/UXOSO-QC maintains this log. Each person who is not directly involved in the project field activities are identified in this log by name, company, date, time in/out, and a contact phone number. Safety briefings and training for visiting personnel are also recorded in this log.
- Photographic Log: The SSHO/UXOSO-QC maintains a photographic log to record each video recording and photographs taken to document work and/or field conditions. Photographic records will be used to supplement information recorded in the daily log and field data collection forms, including photographs of equipment prior to use, typical ordnance items, and the condition of sites prior, during, and after any activity. Each digital photograph will be identified using a file name that accurately describes the MRS, subject of the photograph, and the date the photograph was taken.
- Correspondence Log: The ERT PM maintains a log of each official incoming and outgoing project correspondence.
- Project Maps: The SUXOS and GIS specialist (through the PM) maintain current working maps of the operating areas throughout execution of the field operations.

The SSHO/UXOSO-QC will inspect logs, records, and reports on a weekly basis. These inspections focus on the completeness, accuracy, and legibility of the entries and records. Results of these inspections will be forwarded to the ERT PM.

4.9 Nonconforming Items Or Activities And Corrective Actions

4.9.1 Identification

Circumstances that prevent a work process from conforming to the contract requirements will be promptly identified, documented, investigated, and corrected appropriately. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality. The status of nonconformance reports (NCR) will be maintained in a log, and progress of their resolutions will be documented and reviewed monthly to ensure prompt attention to their conclusion.

4.9.2 Resolution, Corrective Action, and Verification

The ERT PM is responsible for evaluating the cause of a NCR and will recommend solutions for correcting the deficiency identified. Actions and technical justifications for an action proposed to resolve the corrective action will be reviewed and approved by personnel responsible for the technical aspect of the work. The QCM will be responsible for verifying implementation of corrective action, monitoring the effectiveness of preventive action, and reporting any findings to the ERT PM.

4.9.3 Material and Item Nonconformance

The QCM ensures that the following requirements are implemented:

- Items that do not conform to prescribed technical and/or quality requirements are tagged or otherwise identified, documented, and reported as nonconforming. The documentation will include the following information:
  - Identification of the nonconforming activity, material, or item;
  - Identification of the technical and quality requirement(s) with which the activity, material, or item is not in compliance;
  - Identification of the current status of the activity, material or item (i.e., whether the item is on hold or whether its use is conditional);
  - Names and dates of the individuals identifying the nonconformance;
  - Identification of the individual(s) or organization(s) responsible for resolution;
  - Indication of the severity of the nonconformance(s); and
  - Indication regarding the continuance or stoppage of work associated with each nonconforming activity, material, or item.
- Nonconforming materials and items are segregated, when possible, from conforming materials and/or items to the extent necessary to preclude their inadvertent use.
- The status of nonconforming activities, materials, and items and the progress of their resolution are documented and routinely reviewed to ensure prompt attention to conclusion.

4.9.4 Review and Disposition of Nonconformance

The review is conducted by the PM, QCM, and SSHO/UXOSO-QC (if applicable) to ensure that:

- The responsibility for review and disposition of nonconformance is defined;
- Nonconforming materials and items are reviewed in accordance with procedures. Nonconformance can be evaluated according to four criteria:
  - Reworked to meet the original requirements;
  - Accepted with or without repair;
  - Re-graded for alternative applications; and
  - Rejected or scrapped.
- Repaired or reworked materials items are re-inspected; and
- Each document used to identify and correct nonconforming conditions allows for the evaluation and approval of proposed actions by the appropriate authority.

4.9.5 Trend and Root Cause Analysis

The trend analysis of QC audits, subcontractor/supplier surveillance reports, and nonconformance will include the following information:

- Total number of audit findings and observations, surveillance reports, and NCRs for each area of the QCP;

- A summary of the root causes for the nonconformance consolidated for each area of the QCP; and
- Trends that are developing or that have developed.

The PM will perform the trend analysis and the QCM will verify the implementation of any preventive actions resulting from the trend analysis.

The QCM is responsible for evaluating on a semiannual basis (or as appropriate) every NCR affecting quality and will recommend solutions, as well as steps for verifying their implementation.

4.9.6 Lessons Learned

Lessons learned from the project will be communicated by the ERT PM to CENAB by means of electronic mail or during phone calls.

4.10 Audits and Surveillances

4.10.1 Audit Planning

The QCM will perform periodic audits of the project activities and, as required, audits of subcontractors/suppliers as noted below:

- Every area where activities are being performed (where audits are not planned for certain areas, the audit schedule will include appropriate justification for the course of action); and
- The audit schedule will identify the subcontractors to be audited.

The QCM will prepare the audit plan. The audit plan will include the following information:

- Identification of the organization and work areas to be audited;
- Identification of location, times, and dates of duration of the audit;
- Identification of the documents that specify the criteria against which the work will be measured;
- Checklists prepared as a guide during the audit;
- Identification of auditing personnel; and
- Signatures and dates approving the audit.

4.10.2 Audit Reporting

The audit results approved by the lead auditor will include the following information:

- Reference to audit plan;
- Identification of and justification for any differences that occurred between the audit plan and the actual conduct of the audit;
- Synopsis of the audit results;
- Description of nonconformity (identified as findings and observations); and

- Completed audit checklist and documentation (objective evidence) supporting the discovery of the nonconformity.

Conditions determined to be in nonconformance with the contract, procedures, or other specified requirements are identified as findings. Conditions not in nonconformance when first identified, but could lead to nonconformance if left uncorrected, are identified as observations. Formal responses are required for findings only. Corrective action is required for both findings and observations.

For internal audits, the QCM will issue the audit report to the ERT PM and the ERT President. For audits of suppliers or subcontractors, the QCM will issue the report to the ERT PM, who will issue the audit report to the audited subcontractors and suppliers.

4.10.3 Review, Approval, and Verification of Recommended Action Response

The recommended corrective action proposed by the management of the organization audited in response to the nonconformity will be reviewed and approved by the QCM. Justification for rejection of the response will be documented by the QCM and transmitted to the organization providing the response.

Management of the organization being audited will report the implementation of corrective action to close out the audit nonconformity. The QCM will verify a closeout action at the time of the next scheduled audit.

4.11 Quality Control Reports

During the project, the QCM will prepare at least one QC report to discuss significant quality assurance problems and corrective actions taken.

In addition, the ERT PM will receive periodic updates concerning QC associated with the field activities, the GIS process, the laboratory analysis, and the data processing.

4.12 Documents and Submittals

ERT's project deliverables are subject to the following major elements of the QC process:

4.12.1 Phase I – Initial QC Planning

Initial QC Planning. The PM is responsible for ensuring a complete review of the initial quality requirements presented in each task order and any associated project documents to identify and plan for completion of a successful project that has been documented correctly and thoroughly. Initial QC planning includes:

- Identification of a designated peer reviewer;
- Establishment of quality-related planning schedules for development of technical documentation;
- Assessment of specific impact on manpower, equipment, software, and hardware; and
- Establishment of a corrective action process to ensure deficiencies are promptly resolved.

Project Coordination and Task Review. The Program Manager will provide the following levels of project coordination and review, at a minimum, to ensure the delivery of a quality product consistent with QC requirements:

- Initial Task Review - The Program Manager will confer with the client representative when new work (i.e., new task order, modification to existing task order) is requested and verify that there is a mutual understanding of the requirements.
- Development of Proposal/Estimate – The Program Manager will review each proposal/estimate, usually developed by the PM, to ensure that budgeting, scheduling, and staffing will meet the needs of the project, including necessary budgeting and scheduling for the required QC procedures.
- In-progress Task Reviews - The Program Manager will confer with staff members on a regular basis to review progress and quality of the work. The frequency of in-progress reviews will be based on the projected complexity of the project.

4.12.2 Phase II – Independent Peer Review Process

The purpose of the Independent Peer Review is to provide a detailed, technical review of each deliverable. Peer reviews are conducted by staff members who have expertise in the contract/project subject area, but have not significantly contributed to the project documentation or work products. A qualified peer reviewer will be dedicated in writing to each project deliverable, and will be identified by the PM, with approval of the Program Manager. Comments from the peer reviewer will be addressed by the document author, and additional peer review of the updated document will be done to ensure every required change has been made correctly.

4.12.3 Phase III – Editorial Review

The purpose of the Editorial Review is to ensure that each written deliverable is grammatically correct and properly formatted. Each document will be reviewed for correct grammar and punctuation in addition to appropriate style, format, and overall readability, continuity, and consistency.

4.12.4 Phase IV – Final QC Review and Approval for Release

The PM will perform initial review of documents while the deliverable is still in the working stages. Each deliverable will be reviewed by the PM to ensure:

- Adherence to the PWS; and
- Activities proposed meet the overall project technical objectives, budgetary constraints, and are within the established project limitations.

Formal Senior Technical Reviews (STRs) of individual documents will be provided by one senior technical reviewer. Mr. Michael Dorman will be responsible for STR for this RFI.

STRs will be performed on the completed document. The comments from the STRs will be forwarded to and discussed with the PM who will administer the implementation of any necessary changes. A revised version of the deliverable will be re-reviewed by the STR to

ensure the comments have been addressed. After completion of this review, the document will be forwarded to the independent technical reviewer.

Draft submittals will have an independent review prior to final submittal to USACE. Qualified persons who have not been involved in the preparation and who are under a separate supervision from those involved in the preparation of the submittals will conduct the Independent Technical Reviews (ITRs). Mr. Barry Millman will provide overall ITR of draft submittals for the FTSW RFI.

4.13 Personnel Selection

Project personnel, in addition to the key personnel discussed in Section 2.3.1, will be designated by the PM. Those requiring licenses, certification, or other forms of qualifications necessary to perform their work will be selected and evaluated periodically or on each change of task assignment by program management to ensure that their credentials are current to perform the pre-established job description.

Project personnel performing functions that affect quality will receive, prior to assuming duty, indoctrination and training. The job description, indoctrination, training, and certification will be maintained in the project files. To ensure quality and consistency throughout the duration of the FTSW project, ERT will maintain a dedicated group of qualified, trained project personnel to conduct the various tasks associated with this project.

4.14 Personnel Qualifications and Training

Project staff members will be qualified to perform their assigned jobs in accordance with the applicable sections of this Work Plan. The SSHO/UXOSO-QC will verify personnel assigned to the project, the required qualifications, and training for the assigned position.

4.14.1 Documentation of Qualification and Training

The review and verification of personnel qualifications will be documented on the Preparatory Inspection Checklist and/or Surveillance Report. The SSHO/UXOSO-QC will maintain records documenting the required qualifications and training for each field worker.

The SSHO/UXOSO-QC will monitor expiration dates to provide advance warning to the PM when employees require refresher training or other requirements. The SSHO/UXOSO-QC will maintain records of site-specific and routine training for personnel and visitors, as required by this Work Plan. These records will be maintained in the project files.

4.14.2 Health and Safety Training

Health and safety training requirements for on-site project personnel have been established in accordance with OSHA requirements for hazardous site workers (29 CFR 1910.120) and ERT policies and procedures. These training requirements are specified in the SSHP and will be met before project personnel can begin field work.

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5.0 EXPLOSIVES MANAGEMENT PLAN

5.1 Introduction

5.1.1 General

This plan has been prepared in accordance with DID MMRP-09-002, basic contract, local, state, and federal laws and regulations, Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) P 5400.7(6/90), DoD, and DOT regulations.

5.1.2 Licenses/ Permits

Licenses and permits will be obtained in accordance with CERCLA, Section 104, and in substantial compliance with the NCP, Sections 300.120(d) and 300.400(e).

Licenses or permits issued under this section or a copy of a license or permit will be posted and available for inspection on each project location where explosives materials are purchased, stored, transported, or used.

5.2 Acquisition

5.2.1 Description and Estimated Quantities

When required, the ERT SUXOS will order the minimum amount of commercial counter charges and initiating explosives required for disposal and demilitarization operations. The explosives will be ordered on a daily (or as frequently needed) basis to ensure no unsecured explosives/MEC items remain exposed on the site overnight. A day box will be used, as needed, to secure explosives upon initial delivery until consumed.

5.2.2 Acquisition Source

When required, the ERT SUXOS will purchase explosives from Dyno-Nobel, a local licensed explosives distributor, who will deliver the demolition material to FTSW. The SUXOS will be authorized to request and receive explosives from the explosives distributors. ERT has previously used the vendor, Dyno-Nobel, on many projects.

5.3 Initial Receipt

Shipments of on-call explosives will be by commercial carrier from the explosives supplier. The explosives supplier is responsible for all permits and documentation required by federal, state, and local regulations.

5.3.1 Procedures for Receipt of Explosives

The USACE PM will be provided written and verbal notice of the need for and delivery of on-call explosives. The ERT PM will notify the FTSW Installation Manager of their need, and when they will arrive on-site. On receipt of any explosives the type, quantity, and lot number of each explosive item will be checked against the manifest. The original receipt documents and Explosives Usage Record form shown in Figure 5-1 (and contained in Appendix F) will be maintained on file by the SUXOS.

5.3.2 Procedures for Reconciling Receipt Documents

The SUXOS will reconcile the delivery shipping documentation with the requested amounts ordered and received. Any shortages or overages will be reported to the UXO subcontractor PM, who will contact the explosives distributor and reconcile any differences. In addition, the SUXOS will notify the ERT PM and CENAB OESS of any discrepancies.

5.4 Storage

5.4.1 Storage Day Box

An explosive storage magazine, which would be used to store MEC items prior to detonation, will not be required for the FTSW RFI investigation.

5.4.2 Physical Security of Day Box

5.4.2.1 Locks

The day box will be equipped with two padlocks fastened in separate hasps and staples. Padlocks must have at least five tumblers or five blades, and a case-hardened shackle of at least 3/8-inch diameter. Padlocks will be protected with ¼-inch or larger steel hoods that will not cause sawing or lever action on the locks, hasps, and staples. The doors will be equipped with the following locks:

- Padlock, Key Operated, High Security 5 – Pin;
- Padlock, Key Operated, High Security 5 – Blade; or
- HI SHEAR LK1200, High Security Padlock.

5.4.2.2 Fire Protection

Smoking, matches, open flames, spark-producing devices, and firearms will not be permitted inside of or within 50 feet of the day box. Two fire extinguishers, rated at 20 ABC, will be placed in close proximity to the day box.

5.4.3 Certification

The SUXOS and the UXO Technician III team leader performing demolition will sign and date the Explosives Usage Record form certifying that the explosives were used for their intended purpose.

5.5 Receipt Procedures

The SUXOS will strictly control access to all explosives. All receipts, issues, turn-ins, and inventories of explosives will be properly documented and verified, through physical count, by the SUXOS and the SSHO/UXOSO-QC.

Explosives Usage Record *Contract Number:*

Team Number: Date: Project Name:

Team Leader: Work Areas & Grid Numbers:

Explosives Issued Signature Of Team Leader:

Item	Quantity	Lot Number	Checkers Initials

Explosives Expended Signature Of Team Leader

Item	Quantity	Lot Number	Checkers Initials

Explosives Returned Signature Of SUXOS:

Item	Quantity	Lot Number	Checkers Initials

The signatures in each section of this document indicate that the items listed in that section were in fact issued, expended, or returned to storage and that the quantities listed were verified through a physical count.

Figure 5-1. Explosives Usage Record

5.5.1 Records Management and Accountability

Original records of on-call explosives will be forwarded to ERT's head office for archiving in accordance with ATF regulations and requirements. Additionally, copies of on-call explosives records will be maintained onsite by the SUXOS and will be available for inspection by authorized agencies. Explosives items will be tracked by their respective lot number until the item is expended, transferred to Government control and accountability, or returned to the distributor.

The SUXOS will be responsible for the initial receipt, control, and issue of all explosives stored on-site. The SUXOS will verify that all explosives were destroyed and consumed. The Explosives Usage Record form will be completed by the SUXOS and included in the Weekly Reports.

5.5.2 Authorized Individuals

5.6 Inventory Procedures

ERT is required to provide explosives distributors with documentation of individuals authorized to request and receive explosives. The individuals authorized to receive and issue explosives are the SUXOS, the SSHO/UXOSO-QC, or the UXO Technician III (demolition supervisor). The SUXOS will designate in writing the individual(s) who is/are authorized to transport and use explosives. ERT's Federal Explosives License/Permit (8-MD-027-33-2H-00254) covers ERT for any work done as a Federal contractor in Georgia on Federal property.

On-call explosives will be inventoried by the SUXOS after receipt on-site. Complete inventories will also be conducted after any issues/turn-ins of demolition material.

5.6.1 Physical Inventory Procedures

The SUXOS will strictly control access to all explosives. Any issues and turn-ins of explosives will be properly documented and verified, through physical count, by a joint inventory by the SUXOS and SSHO/UXOSO-QC.

The SUXOS will review every request for on-call explosives and only sufficient types and quantities for the day's operations will be requested and delivered. Issues of explosives will be recorded on the Explosives Usage Record form, and annotated in the daily log. This procedure will ensure that the issued explosives are accounted for while they are in the possession of individual users. The end user of explosives will certify on the Explosives Usage Record that the explosives were used for their intended purpose. Entries made on the Explosives Usage Records will be verified through physical count by the UXO Technician III when drawing or turning-in the explosives and verified by the SUXOS.

At the end of each on-call detonation operation, the SSHO/UXOSO-QC and the demolition team UXO Technician III will reconcile the entries on the Explosives Usage Record and turn this record over to the SUXOS. The record of ordnance items destroyed with the explosives consumed will be kept in the SUXOS daily log.

Entries made on the Explosives Usage Record will be verified through physical count by the demolition team UXO Technician III when drawing or turning in the explosives, and the SSHO/UXOSO-QC will verify the record.

5.6.2 Procedures for Reconciling Inventory Discrepancies

In the event that a discrepancy is discovered between the inventory and the quantity on hand, the Explosives Usage Record will be reviewed to ensure that there is no error in the data entry. If the records review does not reconcile the discrepancy, then it will be reported immediately to the ERT PM, CENAB OESS, and the USACE PM for investigation. In the event the discrepancy cannot be rectified, it must be reported to ATF.

5.7 Reporting Loss or Theft of Explosive Materials

Loss or theft of explosives will be reported as required in 27 CFR Part 55, Sub part C Paragraph 55.30. ATF Form 5400.5 will be completed, within 24 hours and forwarded to the ATF, with a copy to the contracting officer. The following persons will be notified immediately upon discovery of theft of explosives:

- ERT PM and CENAB OESS;
- CESAS PM, CENAB Technical Lead, and the USACE Contracting Officer;
- ATF at 1-800-800-3855; and
- Dyno-Nobel (supplier of explosives).

5.8 Procedures for Return to Storage of Explosives Not Expended

For on-call UXO demolition, the UXO Technician III will return any unused explosives to the on-call explosives distributor, and record the returned items on the Explosives Usage Record.

5.9 Disposal of Remaining Explosives

As described in Section 5.8, any unused explosives will be returned to the on-call explosives distributor. Returned items will be recorded on the Explosives Usage Record.

5.10 Economic Analysis for Different Alternatives

The type and quantity of explosives are not known at this time. In accordance with the applicable DID, this subsection is not required for Firm Fixed Price tasks.

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6.0 EXPLOSIVES SITING PLAN

6.1 Introduction

The DDESB-approved ESP was prepared by CENAB as a standalone document and is included as Appendix G.

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7.0 ENVIRONMENTAL AND CULTURAL RESOURCES PROTECTION PLAN

7.1 Introduction

This ECPP has been prepared for the FTSW RFI field activities in accordance with DID OT-005-12. The purpose of the ECPP is to establish procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources near the MRSs during field activities. This section describes the resources that may be found within the MRSs (bulleted below) and describes procedures and methods to protect and/or mitigate them:

- Threatened and endangered species;
- Trees and shrubs that may be impacted; and
- Cultural and archaeological resources.

7.2 Field Activities

Field activities at FTSW include DGM surveys along transects and grids, and intrusive investigations. Individual and clusters of anomalies identified by geophysical means will be intrusively investigated within pits/trenches by hand-digging at the Anti-Aircraft Range 90-mm – 2 (FTSW-002-R-01) and either hand or mechanical digging at the Hero Road Trench Area (FTSW-008-R-01) MRSs, respectively. Temporary groundwater monitoring wells may also be installed depending on the decisions made by the PDT after the soil analytical data are reviewed. Environmental sampling will be conducted at MEC-related anomaly locations and other areas where historical usage could have caused MC contamination, in addition to randomly determined sampling locations. These investigation activities will tentatively begin in late spring 2012 and continue into summer.

Based on the size of the investigation area and time of year the field activities are planned, the scope of the intrusive investigation should have minimal, if any, impact on recreational activities or ecological habitats in and around FTSW. Mitigation procedures to ensure this are detailed in Section 7.4. There are no recreational activities conducted near the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) and the area has a low ecological value as it is maintained grass. At the Hero Road Trench Area MRS (FTSW-008-R-01), brush cutting of the undergrowth will be conducted, but no substantial trees or shrubs will be removed during this effort; thereby minimizing any ecological impacts.

7.3 Environmental and Cultural Background

7.3.1 Flora and Fauna

The vegetation at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) includes maintained grasslands habitats. The vegetation at the Hero Road Trench Area MRS (FTSW-008-R-01) consists of a mature forest with significant amounts of undergrowth. Numerous species of birds, mammals, and reptiles are found throughout FTSW.

7.3.2 Endangered, Threatened, or Special Concern Species

Protected species are defined as those listed by the US Fish and Wildlife Service (USFWS) as endangered or threatened under the Endangered Species Act; listed by Georgia as rare, unusual, endangered, or threatened; designated as a special species of concern by the Georgia Natural Heritage Program; or proposed for listing by Georgia or USFWS. FTSW has designated habitat management units as detailed in the Integrated National Resources Management Plan to protect sensitive species. No designated habitat management units are within the MRSs being investigated. The six Federal and one state of Georgia faunal species listed or proposed for listing by the Endangered Species Act found at FTSW are:

- Red-cockaded woodpecker;
- Eastern indigo snake;
- Frosted flatwoods salamander;
- Wood stork;
- Bald eagle;
- Shortnose sturgeon; and
- Gopher tortoise (state listed) (US Army, 2010).

7.3.3 Cultural and Archaeological Resources

There is a low probability, given geological history and MRS use, of the recovery of prehistoric artifacts within the MRSs being investigated; however, the identification of small sites or isolated finds is possible. Significant cultural resource investigations/surveys have been undertaken at FTSW; the data provided by this survey program allow for estimates of the likelihood for archaeological remains to be found at a particular location (US Army, 2001). Both MRS locations are in areas where surveys have been completed or were in process as of August 2001 (US Army, 2001) and no information released on these MRSs indicates that these are culturally significant areas within FTSW. Upon discovery prehistoric artifacts, the ERT SUXOS or SSHO will contact the ERT PM, who will then contact the USACE PM and MMDC Technical Lead and the FTSW DPW personnel by email and phone to notify them of the find and determine the next steps.

7.4 Mitigation Procedures

Investigation activities at the MRSs have been designed to avoid impacts to sensitive resources. For this reason, extensive mitigation is not anticipated. However, the following general mitigation procedures and engineering controls will be used during field activities.

7.4.1 Tree, Shrub and Landscape Protection and Restoration

No brush will be removed at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01). For the Hero Road Trench Area MRS (FTSW-008-R-01) to the extent possible, disturbance to vegetation will be avoided during field activities by cutting only those plants necessary to implement this Work Plan. Environmental impacts will be minimized by limiting the width and spacing of geophysical transects and the extent of vegetation cutting within transects. Only

vegetation between 6 inches and 6 feet above ground surface will be cut, and trees larger than 3 inches at chest height will be preserved. Transects will not exceed three feet in width. Transect and grid location for the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) are included for review in Figure 8 of this Work Plan.

7.4.2 Access Routes

Existing roads, multi-use paths, trails, and other access points will be used to the maximum extent possible at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01); due to the maintained grass areas and gravel roads, no impact to vegetation is expected.

Access routes for geophysical surveys and environmental sampling within the Hero Road Trench Area MRS (FTSW-008-R-01) will be established in a manner that will minimize vegetation impacts and prevent erosion and run-off. Impacts will be prevented by walking along openings through vegetation, minimizing the amount of vegetation cut and then utilizing these cut areas for access as much as possible, and ensuring any excavated soil is covered during precipitation events.

7.4.3 Control of Water Run-on and Run-off

Project activities will be performed in a manner that will prevent the discharge of pollutants into adjacent surface water and groundwater within and outside of the investigation area. Excavated soil will be placed on plastic sheeting until the excavation is complete when the soil will be placed back into the excavated area. If precipitation occurs during an excavation, the excavated material will be covered with plastic sheeting. The use of controls such as berms, dikes, enclosures, and barriers to minimize water run-on/run-off and sediment, or siltation migration, will be based on heavy precipitation events (usually more than 1 inch of rain in a 24-hour period) and observed conditions, such as areas of visual erosion and sediment trails that are associated with project investigation activities.

7.4.4 Erosion and Sediment Control

Because the intrusive investigations will be relatively small (each pit/trench at the Hero Road Trench Area MRS (FTSW-008-R-01) will be less than 30 square feet in surface area and only individual anomalies at the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01) will be dug), the need for erosion and sediment control measures is not anticipated during field activities. If it is determined that additional erosion and sediment control measures are needed based on field conditions such as visual sediment trails from the excavation areas, the ERT SUXOS will direct the construction of adequate controls to minimize any environmental impacts, such as fabric silt fencing or hay placed along the downslope boundary of the intrusive investigation sites to control erosion and minimize surface water run-off damage.

7.4.5 Spill Control and Prevention

Small amounts of liquid IDW will be stored in metal drums. Small quantities of fuel will be stored in OHSA approved safety containers. IDW containers will be stored on pallets covered with plastic sheeting and the fuel will also be stored on plastic sheeting. These containers will be checked daily to ensure their integrity. If a leak of fuel or other fluids (i.e., over 2 gallons of

liquid), such as hydraulic or transmission fluid, occurs in the field from equipment or vehicles, the following procedures will be implemented:

- Promptly berm the area with dirt to prevent the fuel or fluid from spreading along the ground surface.
- Apply oil-absorbing material such as sawdust or kitty litter to the spill. A supply of this material adequate to address the puncture of a full, 25-gallon fuel tank will be always available on-site as part of the team's "possibilities" kit.
- Report the spill to the SUXOS and follow instructions for cleanup. It is anticipated that this will involve digging up and drumming contaminated soil followed by its disposal.

7.4.6 Anomaly Excavation Backfill Procedures

Minor intrusive excavation of individual anomalies will be conducted without any engineering controls. Intrusive excavation of the pits/trenches will also be conducted without any engineering controls as the depth of the pits/trenches are currently expected to be less than 5 feet; details on intrusive investigation procedures are detailed in Section 3.7.4.2. The excavated soil will be backfilled as soon as possible following completion of the excavation or any BIP activities. MD, MEC, and MPPEH will be removed, sorted and disposed of properly per Section 3.8.1. However, scrap metal sticking out from the sidewall of the pits/trenches may not be removed from the pit/trench; this determination will be made in the field after consultation with USACE personnel. Site restoration will be performed to return conditions to the original status, at a minimum.

7.4.7 IDW Disposal

IDW disposal is described in Section 3.8.

7.4.8 Storage Areas

Storage will be required for IDW and gasoline, if needed, for this project. ERT will use OSHA approved safety cans for gasoline and DOT Type H drums for IDW. The storage area will have spill kits close at hand and will be located within the fence line of each MRS at areas determined to be acceptable through coordination with Installation personnel. For the Hero Road Trench Area MRS (FTSW-008-R-01), the storage area will be located next to the staging area near the parking lot. Due to the increased security within the Anti-Aircraft Range 90-mm – 2 MRS (FTSW-002-R-01), determination of the storage area will be made by the Installation staff. Every IDW drum will be stored on pallets covered with plastic sheeting. Gasoline, if needed for the project, will be stored per appropriate regulations, which include EM 385-1-1, OSHA 1910.106, and Georgia Standard Fire Code, and will not be stored near any sources of heat, spark, open flame, or other ignition sources.

7.4.9 Burning Activities

Open fires will not be permitted during the performance of this project. Smoking will be restricted to designated smoking areas, which will be coordinated with FTSW personnel prior to field mobilization. Smoking regulations are detailed in the APP/SSHP.

7.5 Procedures for Post-Activity Clean-Up

Each piece of field equipment brought to FTSW and all drummed IDW will be removed upon completion of field activities. Detailed handling, storage, and disposal procedures for IDW are included in Section 3.8.

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8.0 PROPERTY MANAGEMENT PLAN

8.1 Description

While this Property Management Plan was prepared in general accordance with DID MR-005-09, that DID is not intended for Firm Fixed Price task orders such as the FTSW RFI. DID MMRP-09-008 provides requirements for a Property Management Plan and is intended for Firm Fixed Price tasks; it has been followed to the extent practicable. The field schedule for the project will be relatively short term and ERT does not anticipate that there will be any Government Furnished Property or Government Furnished Equipment. Therefore, many of the specific elements of the DID do not apply.

This Property Management Plan provides detailed information on the types, quantities, and sources of equipment and materials that will be required to perform field and office operations at FTSW. Field operations include every activity to be performed to complete the fieldwork. Office operations include every task performed in support of project management requirements to implement the field work consistent with the requirements of the PWS.

The types of equipment recommended, selected, and proposed to complete the FTSW RFI are those that have been tested and proven in the industry and are reliable to use in performing the various activities associated with this project. The quantities proposed are those needed to perform the work in an efficient and cost effective manner while maintaining the project schedule. ERT's Property Manager for the FTSW RFI is Steve Burhans.

8.1.1 Field Equipment

8.1.1.1 Geophysical Equipment

Section 3, Sections 3.5 and 3.6 of this Work Plan describe in detail the geophysical equipment to be used for the RFI field work.

8.1.1.2 Transportation and Excavation Equipment

Various types of transportation equipment will be required during field operations. Vehicles required for on-road service during the project may include standard automobiles, four-wheel drive vehicles, and vans.

8.1.1.3 Safety Gear

Depending on job assignment and field task, the appropriate levels of PPE as described in detail in the Appendix D SSHP will be used. Personnel assigned to activities outside the EZ will conduct their operations in Level D PPE consisting of standard work clothes with long pants, steel-toed safety boots, and hard hats (if overhead hazard is present). Personnel working away from active field investigations will not be required to wear hard hats.

8.1.1.4 Equipment for Handling and Disposal of Scrap

To enable proper handling of MEC scrap encountered or recovered during the intrusive fieldwork, special equipment and materials are required. Drums and containers may be used for

temporary storage of MEC/MD scrap and other metallic debris, as well as for off-site transportation and disposal.

8.1.1.5 Communication Equipment

Communications equipment to be used includes hand held two-way radios and cellular phones.

8.1.2 Office Equipment

The majority of the office equipment to be used on this project is located in the ERT headquarters office in Laurel, Maryland. Most of the equipment (for example, Computer Aided Design and Drafting or GIS workstations, computers, printers, plotters, etc.) is owned by ERT and the charges to the project will be as proposed for the task order.

8.1.3 Consumable Supplies

The consumable supplies to be used on this project have been defined in ERT's proposal and the types and quantities will be as proposed for the task order. Consumable supplies include, but are not limited to: field notebooks, spray paint, pin flags, flagging tape, and soil sampling supplies.

8.2 Vendors and Associated Costs

ERT owns much of the field equipment to be used to perform the field work. However, some equipment will be obtained from vendors with proven records of furnishing well-maintained, reliable, and updated equipment that can be used to successfully complete the field and office operations. General estimates on the types, quantities, and sources of equipment proposed for the FTSW RFI are summarized in Table 8-1.

8.3 Procurement Procedures

Equipment will be procured or purchased for each aspect of project activities during this field effort. An evaluation will be performed whether to rent or purchase needed equipment. When possible, ERT will price equipment through three different commercial vendors and select the most economical option. It may be the case that renting equipment and supplies is more economical than purchasing equipment. In certain cases involving special maintenance and calibration requirements for an instrument, a sole-source vendor may be used.

8.4 Leased or Rented Vehicles

The rented vehicles will be selected from Enterprise Rent-A-Car facilities as they have numerous facilities readily available and their rates are competitive with other vendors. The number of vehicles will be determined by the specific work task and distances between work crews. During DGM investigations, there will be one vehicle for approximately two employees working on-site. During UXO operations, there will be separate vehicles for the SUXOS, the SSHO/UXOSO-QC, and each team of UXO technicians. The type of vehicles used on-site will be determined by the MRSs' physical conditions, such as terrain, weather conditions, and distances between the temporary storage unit and the field work areas.

Table 8-1. List of Equipment				
Office/Field Operations	**Equipment Type (or equivalent)**	**No. of Units**	**Anticipated Source**	**Status**
Communication during fieldwork	Motorola HT-1000 radios	5	Vendor	Rent
Communication during fieldwork	Cellular phone	5	ERT	Own
Processing and interpretation of field data	Field computer	2	ERT	Own
Anomaly Excavation/Site Set-up	Hand Tools	8	ERT	Own
Geophysical Instrument	Schonstedt magnetic locator (GA-52Cx)	8	ERT	Own
Geophysical Instrument	Geonics EM31	1	ERT	Own
Geophysical Instrument	Geonics EM61-MK2	1	ERT	Own
Navigation Equipment	Leica Robotic Total Station	1	ERT	Own
Navigation Equipment	Topcon HiperGA + RTK GPS	1	ERT	Own
Brush cutting equipment	Echo brush cutter SRM 410U-1	4	Vendor	Rent
Transportation of personnel and field equipment	SUVs or equivalent	6	Enterprise	Rent
Transportation of personnel and field equipment	Vehicle – passenger car or van	2	Enterprise	Rent
Equipment storage	Temporary storage unit	1	Vendor	Rent
Sanitation	Portable toilets	2	Vendor	Rent
Geophysical survey supplies	Engineers tapes, traffic cones	4 sets	ERT	Own
PPE	Hard hats, tyvek, gloves, eye protection	10 sets	Vendor	Purchase
MEC destruction	Donor explosives	On call, as needed	Dyno-Nobel	Purchase
Office processing of data and development of maps	GIS workstation	1	ERT	Own
Photo documentation of fieldwork	Cameras	1	ERT	Own
Documentation of fieldwork	Field notebooks	5	Vendor	Purchase

8.5 Consumable Supplies and Personal Property

Consumables and personal property include home office supplies and equipment such as letterhead, pen/pencils, standard personal computers, office furnishings, etc. Field office supplies are direct charged to the project.

8.6 Property Storage Plan

A temporary storage unit (such as a POD or Conex box) to store equipment for the FTSW RFI project will be provided by ERT and stored as close to the MRS being investigated as possible, based on coordination with FTSW personnel. Although none is anticipated for this project, any Government Furnished Property or Equipment will be stored here until needed at the MRS. These items will be secured and protected appropriately in accordance with any special requirements for health and safety or security considerations.

8.7 Property Tracking

Although this is a firm fixed price contract, an inventory list will be maintained by ERT for the non-consumable items purchased for the FTSW project. When applicable, the serial number, model or manufacturer, date purchased, present location of item, cost, current status (functional, need of repair, needs batteries, etc.), and a description of the item will be included on the inventory list.

Inventories will be conducted by the Project Property Manager on a monthly basis to verify the status of Government Furnished Equipment (if any).

8.8 Loss Notification

For any Government Furnished Equipment items on the inventory for the FTSW RFI project, ERT's Property Manager will notify CENAB if the item is lost or stolen.

9.0 REFERENCES

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