FINAL SITE SPECIFIC WORK PLAN
FOR

REMEDIAL INVESTIGATION / FEASBILITY STUDY
AT THE CULEBRA ISLAND SITE
PUERTO RICO

CONTRACT NO. W912DY-04-D-0009

TASK ORDER NO. 0013

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Prepared For:

U.S. Army Engineering & Support Center
CEHNC-CT
4820 University Square
Huntsville, Alabama 35816-1822

Geographical District

U.S. Army Engineering District, Jacksonville

Prepared By:

Explosive Ordnance Technologies, Inc. (EOTI)
105 W. Tennessee Ave.
Oak Ridge, Tennessee 37830

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

March 24, 2010

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Wayne Evans
Quality Manager

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^{O}F	Degrees Fahrenheit
AP	Armor piercing
ASR	Archives Search Report
BATF	Bureau of Alcohol, Tobacco, and Firearms
BIP	Blow-in-Place
CAR	Corrective Action Report
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	Corps of Engineers, Jacksonville District
CWM	Chemical Warfare Material
DGM	Digital Geophysical Mapping
DID	Data Item Description
DMM	Discarded Military Munitions
DoD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
EE/CA	Engineering Evaluation / Cost Analysis
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESE	Environmental Science and Engineering, Inc.
ESRI	Environmental Systems Research Institute
FAR	Federal Acquisition Regulations
FDE	findings and determination of eligibility
FLEX	fleet landing exercises
FSP	Field Sampling Plan
FUDS	Formerly Used Defense Site
FWS	United States Fish and Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
GSA	General Services Administration
HE	high-explosives
HEI	high-explosive incendiary
HFD	Hazardous fragment distance
INPR	Inventory project report
M	Meter
MC	Munitions Constituents
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
mm	Millimeter
MPH	Miles Per Hour
MPM	Most Probable Munition
MPPEH	Material Potentially Presenting and Explosive Hazard

MQL	Method Quantitation Limit
MRS	Munitions Response Site
MSD	Minimum Separation Distance
NEW	Net Explosives Weight
NOAA	National Oceanic and Atmospheric Administration
OESS	Ordnance and Explosive Safety Specialist
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
PREQB	Puerto Rico Environmental Quality Board
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
RA	Removal Action
RAC	Risk Assessment Code
RAGS	Risk Assessment Guidance
RCWM	Recovered Chemical Warfare Material
RI/FS	Remedial Investigation / Feasibility Study
RSL	Regional Screening Level
SDTS	Spatial Data Transfer Standard
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Statement of Work
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TMP	Technical Management Plan
USACE	United States Army Corps of Engineers
USACE-RI	United States Army Corps of Engineers, New England District
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UXO	Unexploded Ordnance

1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

1.1.1 Explosive Ordnance Technologies, Inc. (EOTI) was awarded Task Order 0013 under Contract No. W912DY-04-D-0009 on 27 June 2008 to obtain government acceptance of a Decision Document including conducting a Remedial Investigation (RI) / Feasibility Study (FS) on Munitions Response Site (MRS) 02, 04, 05, and 07 and all necessary activities required to accomplish this objective.

1.1.2 The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the United States (U.S.) Army Corps of Engineers (USACE) is conducting environmental response activities at FUDS for the Army, DoD's executive agent for the FUDS program. The Culebra Island site falls under the boundary of the USACE Jacksonville District (CESAJ).

1.1.3 This Work Plan describes the goals, methods, procedures, and personnel to perform a field investigation, to consolidate previous site data into a RI Report and FS Report, and to prepare a Decision Document for stakeholder concurrence.

1.2 PURPOSE AND SCOPE

1.2.1 This Work Plan is to serve as a comprehensive plan for the completion of field investigation, RI Report, FS Report, and Decision Document for MRS 02, 04, 05, and 07 on Culebra Island. This task involves compiling data and information from previous investigations conducted as well as collecting new information. Details about the execution of field activities and the secured disposition of any MEC or munitions debris encountered are included in this Work Plan. This Work Plan provides a basis for consistent project objectives and uniformity of methods, procedures, and quality objectives throughout the RI/FS process.

1.2.2 The contents of this Work Plan are generally based upon the requirements of applicable U.S. Army Corps of Engineers (USACE) Data Item Descriptions (DIDs). This Work Plan covers work to be completed in accordance with the performance work statement (PWS) dated 27 May 2008. The PWS is provided in Appendix A. The Work Plan is written in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Activities involving work in areas potentially containing MEC hazards will be conducted in accordance with the USACE - Huntsville Center (CEHNC), Department of the Army, and Department of Defense (DoD) requirements regarding personnel, equipment, and procedures.

1.3 SITE DESCRIPTION

1.3.1 Location

1.3.1.1 Culebra Island, Puerto Rico is located 17 miles east of the Island of Puerto Rico at approximately latitude 18°33′ N, longitude 65°33′ W. Figure B-1 (see Appendix B) shows the site and surrounding areas. Adjacent to Culebra Island are about 24 cays, mostly owned by the United States Fish and Wildlife Service (FWS). The total land area is approximately 7,300 acres, of which approximately 1,500 acres are owned by FWS. The Commonwealth of Puerto Rico owns the remainder, of which approximately 1,200 acres are primarily in the custody of the Puerto Rico Department of Natural and Environmental Resources (DNER) and approximately 4,600 acres are owned by private citizens and the Municipality of Culebra. DNER ownership extends from the high-tide mark to 9 nautical miles out.

1.3.1.2 Culebra Island is separated from Puerto Rico by about 17 miles of Vieques Sound. The Caribbean Sea lies to the south, and the Atlantic Ocean lies to the north. The warm, clear waters provide a home for a wide variety of sea life that attracts scuba divers from all over the world.

1.3.2 Topography

1.3.2.1 Culebra Island is underlain by both intrusive and extrusive volcanic rock of the Upper Cretaceous Age. The volcanic rock exhibits little or no porosity due to compaction and filling of the pores with quartz and calcite. The volcanic rocks exhibit strong magnetic properties that can affect magnetometer readings.

1.3.2.2 Culebra Island (598 acres) has sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep hills, and narrow valleys. Ninety percent of the island is hilly, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate. Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate.

1.3.2.3 Fresh water is scarce on the island, and it is high in chloride and saline. Most residents get their water from a desalination plant installed by the Navy at the lower camp and a water line from the Island of Puerto Rico. Surface water is scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and collect and drain runoff water only during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons.

1.3.2.4 The National Oceanic and Atmospheric Administration (NOAA) estimates that water depths average approximately 70 to 90 feet in the areas surrounding Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local maritime charts show "Caution unexploded ordnance (UXO)" in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

1.3.3 Climate

1.3.3.1 Culebra Island has a tropical marine climate, with a year-round average daily temperature of 80 degrees Fahrenheit (°F). The average rainfall is 36 inches, and the average humidity is approximately 73 percent, with a daytime average of approximately 65 percent and a nighttime average of approximately 80 percent. The most humid months are August through January, although the humidity in the remaining months is only slightly lower. Prevailing winds are from the east-northeast for November through January and from the east for the rest of the year. Average wind speed is 8 knots. The hurricane season is from June through November, with most storms occurring July through September. Severe hurricanes occur through this area every 15 to 33 years.

1.3.4 Geology

1.3.4.1 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, which is locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

1.3.4.2 Culebra and the adjacent cays are underlain by volcanic and intrusive rocks of Upper Cretaceous Age. Andesite lava and andesite tuff are clearly dominant. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995).

1.3.4.3 The bedrock beneath most of Culebra is andesite lava and lava breccia. This material is generally overlain by a thin (generally 2 to 3 feet thick) layer of disturbed saprolite (USACE-RI 1995). In the area of the project sites, the ground surface may have been impacted by the detonation of ordnance as part of DoD activities, which may have locally fractured some of the rock.

1.3.5 Hydrogeology

1.3.5.1 About a dozen natural springs and seeps exist on Culebra Island, but they are charged only after particularly wet seasons. Some wells 10 to 20 feet deep exist in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. As a result, most Culebra citizens get their fresh water from the desalinization plant installed by the Navy at the lower camp or from a potable-water pipeline that connects Culebra with the main island of Puerto Rico (USACE-RI 1995).

1.3.5.2 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as a potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the adjacent cays.

1.4 SITE HISTORY

1.4.1 Ships with heavy armaments and carriers of the United States Navy and the North Atlantic Treaty Organization used the former Culebra Island naval facility on Culebra Island, Puerto Rico, for training. Facilities constructed by the Navy included a desalination plant, an airfield, barracks, helicopter pads, range instrumentation facilities,

gun sites (for the defense of the islands), observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval ordnance.

1.4.2 Culebra Island and adjacent cays were used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The Marines used Culebra Island as a training facility from 1903 until 1941, during which time a rifle range was constructed at the airfield site. The United States Caribbean fleet used Culebra Island and the adjacent cays for naval exercises throughout its history. A large fleet exercise was conducted from December 1923 through February 1924. Approximately 3,300 Marines participated in the maneuvers armed with 155-millimeter (mm) guns, 75 mm guns, and machine guns. The exercise involved the 5th Marine Corps Regiment, which included a "gas platoon." This is the only indication of the possible presence of chemical warfare materiel (CWM). Another fleet exercise was conducted from January through April 1935.

1.4.3 The Navy abandoned the lower camp area in 1920. This area was re-activated in 1942 before its reduction to caretaker status in 1944. Culebra Island was used as a bombing and gunnery range from 1935 through 1975. Naval records indicate bombardment of Flamenco Peninsula in 1936 and again in 1949.

1.4.4 The Navy also conducted submarine warfare maneuvers. Fourteen live torpedoes were fired at Cayos Geniqui in November 1959, and records indicate that submarines also fired torpedoes at Marcs Point on Isla Culebrita. The firing of torpedoes within the area of Culebra and the adjacent cays ceased prior to 1969.

1.4.5 Until the early 1960s, Flamenco Peninsula, Los Gemelos, and Alcarraza were the only aircraft targets in the complex. To support increased training needs during Vietnam operations, the Navy acquired additional training areas on cays east and west of Culebra Island for use as aircraft ranges. Navy records indicate that Flamenco Peninsula was the target area for naval gunfire support training. Ships fired from ranges of 2,000 to 12,000 yards. In 1969, ships fired live 40 mm, 3-inch, 5-inch, 6-inch, and 8-inch rounds. It is likely that 81 mm illuminating rounds were also fired. Ships from Great Britain, Canada, Germany, Netherlands, France, Brazil, Columbia, and Venezuela also used Flamenco Peninsula target facilities.

1.4.6 In 1964, the target range was expanded to the eastern and western cays. Aerial mining operations were also conducted in these outlying areas. Live ordnance operations reached their peak in 1969, when the fleet was training pilots for Vietnam. Aircraft bombing and strafing of Flamenco Peninsula ended in 1970, and the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted until ordnance use was terminated on September 30, 1975.

1.4.7 In 1975, the Navy issued a report of excess for the land associated with the Navy's original 1900 holdings. In 1980, the General Services Administration (GSA) transferred 776 acres to the USFWS to establish the Culebra National Wildlife Refuge. The remaining 936 acres were accepted in a quitclaim deed from the Secretary of the Interior by the Governor of Puerto Rico in 1982.

1.4.8 As part of this quitclaim deed, the governor agreed to the provisions of Section 204 of Public Law 93-166 stating that Northwest Peninsula was accepted in its present condition, having been used as a bombardment area by the Navy. It also stated that the

grantor will hold no responsibility for decontamination nor any claims of damage or loss of property or persons associated with use or presence on the property. In accordance with Public Law 93-166, SI data were not collected on Northwest Peninsula.

1.4.9 Currently, the DNER manages the southern half of Northwest Peninsula and the USFWS manages the northern half of Northwest Peninsula and cays associated with MRS 02.

1.4.10 Munitions Response Site-Specific Descriptions/Operations (This RI/FS covers MRSs 02, 04, 05, and 07 within the Culebra Island Site.)

1.4.10.1 MRS 02 – Culebra and Cays[1]

1.4.10.1.1 For this investigation, this MRS includes Cerro Balcon, Cayo Ballena, Cayo Lobo (a.k.a. Cross Cay), Cayo Lobito, Cayo Del Agua (a.k.a. Water Key), Cayo Yerba, Cayo Raton, Los Gemelos (a.k.a. Twin Rock), Cayos Geniqui (a.k.a. Palada Cay), and Cayo Sombrerito. Cerro Balcon is a 30 acre mortar range. The adjacent Cayos consist of approzimately 39.5 acres. Figure B-2 in Appendix B depicts the investigation areas. The Navy conducted fleet maneuvers and fleet landing exercises (FLEX) on MRS 02 between 1923 and 1941. During these exercises, the surrounding cays were heavily bombarded with high-explosive (HE) bombs, projectiles, and rockets, as well as illumination and practice rounds. Training continued through the 1950s and 1960s, and in the early 1960s aerial bombardment was expanded from Northwest Peninsula, Los Gemelos, and Alcarazza to most of the cays on the east and west side of Culebra. Training continued until 1975. Cerro Balcon, in the center of Culebra, was used as a mortar range target. Records show that the property near Cerro Balcon was leased beginning in 1924 to some time around 1939.

1.4.10.2 MRS 04 – Flamingo Lagoon Maneuver Area

1.4.10.2.1 The 550-acre MRS 04 includes Flamingo Lagoon and the hillside east of the lagoon. Records show that Combat Range #2, located on the south side of Flamingo Beach, was used for direct and indirect fire of small arms and 81mm mortars from firing positions on the hillside within MRS 04 during FLEX #4 in 1938. Firing positions for 75mm projectiles used during FLEX #5 in 1939 were also located in MRS 04. There are no records for lease or excess of this property; it is currently under private ownership.

1.4.10.3 MRS 05 – Mortar and Combat Range Area

1.4.10.3.1 MRS 05, the largest MRS on Culebra Island, includes most of the landmass between Resaca Beach and Carenero Point, totaling approximately 2,842 acres. Historical training records indicate that many of the hills in this area may have been used for direct fire. Cerro Balcon Mortar Range, which is part of MRS 02, is surrounded by MRS 05. Unexploded ordnance (UXO) has been identified near Cerro Balcon on portions of the MRS 05 property. MRS 05 includes two 1936 combat training areas leased for combat,

[1] Work at Northwest Peninsula is specifically excluded from any action under the present work plan. Section 9 of the quitclaim deed from the United States to the Commonwealth states: "In accordance with the provisions of Section 204 of Public Law 93-166, that portion of the subject property which has heretofore been used as a bombardment area by the United States Navy is hereby accepted by Grantee in its present condition and further agrees that the United States shall not in any manner be responsible for decontamination of such area, nor for the costs thereof, but the same is and shall be solely (sic) the responsibility of the Grantee." Additionally, USACE, FWS, DNER, EQB and NMFS, have agreed that the following cays will not be part of the cleanup project as they are inaccessible. The cays are: Cayo Tiburón, Whale Rock, El Mono, Cayo Mono, Alcarazza/Fungi Bowl, The Washer.

target, and sweep-of-fire range training. Small arms and 81mm mortars may have been used at Combat Range #1 in 1937 during FLEX #4. A 1924 standing barrage training area is also included in the MRS. Historical records indicate that land within MRS 05 were leased in 1924 from Mr. A. Lugo for gun emplacements and other possible camp sites. The property was returned to Mr. A Lugo in November 1939. Most of MRS 05 is privately owned; however, USFWS manages a large portion of the property surrounding Mount Resaca and DNER manages the property along the beaches on the northeastern side of the site.

1.4.10.4 MRS 07 – Culebrita Artillery Impact Area

1.4.10.4.1 MRS 07 includes the northern portion of Culebrita as well as Cayo Botella (a.ka. Ladrone Cay). The Marines used this 375-acre area as an artillery impact area between 1936 and the late 1940s. The United States and the United Kingdom used Cayo Botella for an aircraft bombing/rocket target in 1969. Munitions included 20mm projectiles, Mk 44 and Mk 45 flares, live and practice bombs up to 500 pounds, and 2.75-inch rockets as well as British bombs and rockets. Culebrita beaches are used recreationally, and many boats visit the island each year. Culebrita was part of the land designated for use by the Department of the Navy in 1900; it was reported excess in 1972. This MRS is managed by the USFWS.

1.5 CURRENT AND FUTURE LAND USE

1.5.1 There are two main commercial areas on Culebra: the town of Dewey, located on the west side of Great Harbor, and the area surrounding the airport. Most of the residential development is on the northwest end of Great Harbor; however, residents are scattered throughout the island. Two houses are present on Cerro Balcon and land has been cleared for development on the southeast side of Cerro Balcon; therefore, future residential development is expected in this area. Lower Town, Flamenco Point, Mount Resaca, Northwest Peninsula, and all of the beaches are managed by the USFWS or DNER for wildlife conservation and recreational use. It is anticipated that the land use will remain the same and that development for similar purposes will likely continue on site.

1.6 PREVIOUS INVESTIGATIONS OF THE SITES

1.6.1 1991 Inventory Project Report

1.6.1.1 An Inventory Project Report (INPR) was signed on 24 December 1991, establishing the Culebra Island site as a FUDS, defining a site boundary, and assigning FUDS Project No. I02PR006800 (USACE, 1991). The Findings and Determination of Eligibility (FDE) concluded that "the site, except for 87.5 acres still under control of the Navy, has been determined to be formerly used by the Department of Defense. It is therefore eligible for the Defense Environmental Restoration Program (DERP)."

1.6.2 1995 Archives Search Report

1.6.2.1 The Archives Search Report (ASR) was completed by the USACE Rock Island District in February 1995 (USACE, 1995) after reviewing available records, photographs, and

reports that documented the history of the site. As part of the ASR, a site visit was conducted in October 1994, during which the team identified munitions debris (MD) on Cayo Botella, Cayos Geniqui, and Cayo del Agua. In addition, MD was identified on Flamenco Beach, Flamenco Peninsula, and the hillside near Cerro Balcon. The ASR listed several ordnance items verified on site by either explosive ordnance disposal (EOD) personnel or the ASR field team. The confirmed munitions listed in the ASR are shown on the CSM in Appendix J.

1.6.3 1995 Interim Remedial Action

1.6.3.1 In 1995 MTA, Inc. completed an interim remedial action on 3.66 acres of the Flamenco Bay Campground (MRS 02) near Flamenco Beach to dispose of UXO within 2 feet of the ground surface at the campground (MTA, 1995). Work was conducted on the site between 12 May and 26 May 1995. MTA found 11 items of MEC and munitions debris.

1.6.4 1997 Final Engineering Evaluation / Cost Analysis

1.6.4.1 In April 1997, Environmental Science and Engineering, Inc. (ESE) submitted the final engineering evaluation and cost analysis (EE/CA) for the Former Culebra Island Naval Facility, Culebra Island, Puerto Rico (ESE, 1997). The EE/CA investigation included surface and subsurface sample grids on Flamenco Peninsula, Isla Culebrita, Cayo Botella, Cayo del Agua, Cayo Lobo, and Cerro Balcon. MEC were found in all areas except Cayo Lobo and Cerro Balcon, where only muntions debris was identified.

1.6.5 2004 UXO Construction Support

1.6.5.1 In June 2004, Ellis Environmental Group, LC (Ellis) submitted the Site-Specific Final Report, UXO Construction Support, Culebra Island Wildlife Refuge, Culebra Island, Puerto Rico (Ellis, 2004a). The report documented clearance efforts conducted by Ellis on Northwest Peninsula. Ellis performed four phases of clearance from January 2001 to February 2004. Phase I consisted of construction support by clearing roadways, a wind generator foundation, a desalination plant foundation, and re-grading the site. Phase II of the construction support was not exercised due to a stop in funding for the construction project. Phase III included surface clearance of 70 acres of bird nesting area and 4-foot-depth subsurface clearance of roadways, firebreaks, and an observation post. Phase IV consisted of demilitarization of muntions debris, construction of a fence and information kiosk, and development of public awareness information. The public awareness information included a video, safety posters and brochures.

1.6.6 2004 Archives Search Report Supplement

1.6.6.1 The ASR Supplement was completed by the USACE Rock Island District as an addition to the 1995 ASR (USACE, 2004a). This report provides detail of aerial training conducted by the Navy between 1935 and 1975 and identifies the following range areas:

- Mortar Range: This area is also called Cerro Balcon and is part of MRS 02. The following munitions may have been used in this area: Mk1 3-inch HE mortar and M329A1 4.2-inch HE mortar.
- Airfield Rifle Range: This small arms range in MRS 14 is seen on historic maps in the vicinity of the airport. Suspect munitions include general small arms.

- Aerial Mining Range: Practice mines were dropped in the water-covered portion of this area and then cleared by divers or minesweepers.
- Aerial Mining Range: Practice mines were dropped in the water-covered portion of this area and then cleared by divers or minesweepers.
- Water Mine Field: The water area is suspected to have been used for mine training.
- Water West: Part of this area is included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Water Center: This area is included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Water South: This water area includes the small bay north of Soldado Point (part of MRS 09). A local diver reported underwater ordnance in this area. Suspect ordnance includes Mk II 6-inch HE; however, other ordnance types are suspected due to use as 1936 aerial target and 1938 mortar boat firing exercises.
- Shark Rock: Part of MRS 02, also known as Cayo Tiburon, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Palada Cay: Part of MRS 02, also known as Cayos Geniqui, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Ladrone Cay: Part of MRS 02, also known as Cayo Botella, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Culebrita Strafing Range: This strafing range target was on the north side of Culebrita and is part of MRS 07. Suspected munitions include general small arms, .50-caliber small arms, and MKI 20mm HEI.
- Culebrita Torpedo Range: Firing at this range from the water north of Culebrita targeted the sheer cliffs of Cayos Geniqui, part of MRS 02. Suspected munitions include the Navy's general torpedo.
- Naval Gunfire Target Area: This range was a naval gunfire and air-to-ground range with its target located on Northwest Peninsula, MRS 02. Munitions included general small arms, .50-caliber small arms, Mk80s series general purpose bombs, M1 105mm HE, Mk21 8-inch armor piercing (AP), Mk5 16-inch AP, 2.75-inch rockets, and the 11.75-inch Tiny Tim rocket.
- Twin Rocks: This area, also known as Los Gemelos, is part of MRS 02. These cays were used as targets for aerial bombs and rockets. Munitions included Mk80s series general purpose bombs, 5-inch Zuni rockets, and Mk8 5-inch practice rockets.
- Fungy Bowl: This area, also known as Alcarazza, is part of MRS 02. This large rock was used as a target for aerial bombs and rockets. Suspected munitions include Mk80s series general purpose bombs and 5-inch Zuni rockets.
- Cross Cay: This area, also known as Cayo Lobo, is part of MRS 02 and was used as a strafing and bombing target. Munitions included general small arms,

.50-caliber small arms, Mk80s series general purpose bombs, and Mk I 20mm HEI.

- Agua Cay: This area, also known as Water Key, is part of MRS 02 and was used as a target for bombing and rocket fire. Munitions include Mk80s series general purpose bombs and 2.75-inch rockets.
- Air-to-Ground North: This target, at the northern tip of Northwest Peninsula, is part of MRS 02. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Air-to-Ground South: This target was located at the northern tip of Northwest Peninsula and is part of MRS 02. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Rifle Range South: This small arms range is believed to be located on undeveloped land near the southern tip of the island in MRS 09. This range has not been confirmed; however, munitions used at this range would have included only general small arms.

1.6.7 2005 Revised Inventory Project Report

1.6.7.1 A Revised INPR was completed in June 2005 (USACE, 2005b). The Revised INPR further clarified the military use of the Island of Culebra and divided the original site, Property No I02PR0068, into 14 separate MRSs. One hazardous and toxic waste (HTW) project was identified and assigned the number 00, and 13 MMRP project areas were identified and assigned Risk Assessment Code (RAC) scores. MRS 01 was not defined.

1.6.8 2005 Supplemental Archives Search Report

1.6.8.1 The Supplemental ASR was completed by the USACE St. Louis District in 2005 as an addition to the 1995 ASR (USACE, 2005c). The Supplemental ASR is the source of most of the historical information pertaining to site operations and identifies the key areas of focus for the SI. This document provided a detailed summary of military activities conducted on Culebra Island and the surrounding cays. The document summarizes planned and/or executed maneuvers and training conducted at the site, including specific time periods, locations, and munitions used. Figure 2.5 shows range and maneuver areas as determined by USACE using historical maps and documents reviewed as part of the Supplemental ASR.

1.6.9 2006 Non Time-Critical Removal Action

1.6.9.1 Ellis Environmental Group, LC (EEG), under contract to the United States Army Engineering and Support Center, Huntsville (CEHNC), is providing non-time-critical removal operations on Culebra Island and adjacent islands, or cays, in Puerto Rico. The areas included in this surface clearance included Cerro Balcon, Culebrita, and the adjacent cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza.

1.6.10 2007 Site Inspection

1.6.10.1 Parsons conducted a site inspection (SI) to determine whether the Culebra Island formerly used defense site (FUDS) warrants further investigation under the Military

Munitions Response Program (MMRP). Due to the presence of MEC and MD observed during previous investigations and during the SI field visit, 12 of the 13 MRSs at the Culebra Island FUDS were recommended to proceed to RI/FS. During the SI, further evaluation of MC was recommended for all of the MRSs (02, 04, 05 and 07) covered under this RI/FS.

1.6.11 2008 Non Time-Critical Removal Removal Action

1.6.11.1 USA Environmental is currently conducting a non time-critical removal action at Flamenco Beach. Under contract to the CEHNC the scope included to perform Digital Geophysical Mapping (DGM) and a removal action (RA) to remove and dispose of all explosive hazards within the selected beach areas at Isla Culebrita and Culebra, Puerto Rico in accordance with the signed Action Memorandum.

1.7 INITIAL SUMMARY OF RISK FROM MEC

Table 1.1 list the munitions with the greatest fragmentation distance for each munition response site (MRS) within the project site. This list was compiled utilizing historical data.

TABLE 1.1 MINIMUM SEPARATION DISTANCES (MSD)

Area	MEC	MSD (ft)				
		For Unintentional Detonations		For Intentional Detonations		
		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)	Without Engineering Controls	Using Sandbag Mitigation	Using Water Mitigation Carboys/ Pool
MRS 02						
Cerro Balcon	3-inch Stokes	39	125	1,346	200	200[a]
Cayo del Agua	76 mm HE	48	234	1,742	200	200[a]
Cayo Genequi	Mk 82 500-lb bomb	265	688	3,177	N/A	N/A
Cayo Lobito	Mk 76 25-lb practice bomb with Mk4 spotting charge	18	200	200	200	200
Cayo Lobo	Mk 76 25-lb practice bomb with Mk4 spotting charge	18	200	200	200	200
Cayo Raton	76 mm HE	48	234	1,742	200	200[a]
Cayo Sambrerito	20 mm HEI	20	114	318	200	200
Cayo Yarba	76 mm HE	48	234	1,742	200	200[a]
Isla Culebrita	20 mm HEI	20	114	318	200	200
Los Gemelos	Mk 83 1,000-lb bomb	30	150	3,288	N/A	N/A
MRS 04						
Flamenco Lagoon Maneuver Area	81mm HE	58	234	1,233	200	264
MRS 05						
Mortar and Combat Range Area	81mm HE	58	234	1,233	200	264
MRS 07						
Culebrita Artillery Impact Area	Mk 82 500-lb bomb	265	688	3,177	N/A	N/A
Cayo Botella	6-inch naval projectile	16	90	2,510	220	275[a]

[a] = Requires the use of 1,100-gallon tank for water mitigation for this munition
1. See Appendix G for calculation sheets and documentation of MSD

2.0 TECHNICAL MANAGEMENT PLAN

The Technical Management Plan (TMP) describes the investigation at Culebra Island in detail including the approach, methods and procedures to be implemented by EOTI.

2.1 PROJECT OBJECTIVES

The objective of the project is to complete a RI/FS for Culebra Island. The purpose of the RI/FS project is to characterize the nature and extent of contamination within MRSs 02, 04, 05, and 07 for the purpose of developing and evaluating effective remedial alternatives, including the assessment of risks to human health, safety, and the environment.

2.2 PROJECT ORGANIZATION

The project management organization consists of the CEHNC Project Manager, CESAJ Project Manager and the EOTI project management team. Figure 2-1 depicts the project management organization.

2.2.1 EOTI's Project Manager will be the primary point of contact with the CEHNC Project Manager and will have overall responsibility for ensuring that work is completed in accordance with the Work Plan. The Project Manager will prepare submittals and reports in accordance with the PWS. The Senior Unexploded Ordnance Supervisor (SUXOS) will be the primary point of contact in the field. The SUXOS will plan and supervise work and ensure compliance with the Work Plan and other applicable requirements. The SUXOS will directly coordinate with the CEHNC onsite safety representative, property owners and other site personnel as necessary to minimize conflicts and schedule activities. The SUXOS will prepare and submit daily reports through the EOTI Project Manager. The SUXOS will be responsible to ensure that work is completed safely and to standard and will evaluate work daily and report any safety or quality concern to the EOTI Project Manager and / or Corporate Safety Manager. The UXOSO will work closely with the USAESCH onsite Safety Representative to immediately address any issues or concerns. The UXOSO always has a direct line of communication with the EOTI Corporate Safety Manager and UXOQCS always has a direct line of communication with the EOTI Corporate Quality Manager. The UXOSO and UXOQCS are matrixed to the SUXOS. The lines of communication and supervision are shown in Figure 2.1 below. A complete description of the UXOSO and UXOQCS job functions are located in Section 2.3.5 and 2.3.6 subsequently. All Unexploded Ordnance (UXO) Technicians and team members will meet, or exceed the requirements in EP 1110-1-18 for the positions they hold. The organizational chart below shows the key project positions and personnel and the relationships between them and other team members.

2.3 PROJECT PERSONNEL

The following paragraphs describe the specific responsibilities associated with the EOTI project management personnel shown on the project organizational chart, Figure 2-1. All personnel assigned to this project will meet USACE training and experience requirements for their assigned position. The key personnel will be supported by technical resources throughout the USACE and EOTI on an as-needed basis.

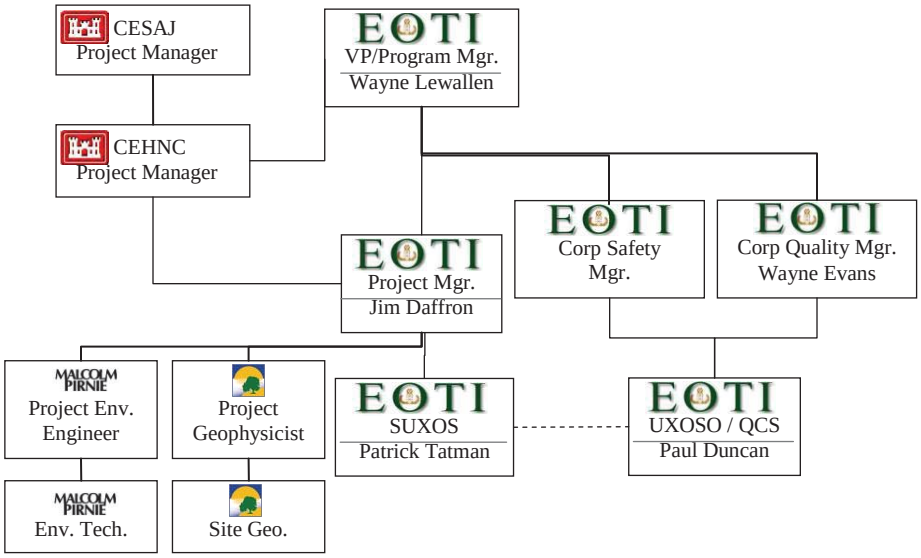


Figure 2.1 EOTI Project Organization

2.3.1 EOTI Project Manager (PM)

The EOTI PM for this project is James Daffron, PE. The PM is responsible for the overall execution of work assigned under this Work Plan. The PM is responsible for the management of all EOTI team resources needed for the successful implementation of site operations. All support personnel will report to the PM. The PM is the single Point of Contact (POC) with the CEHNC and is responsible for overall project performance, quality, schedule, and cost performance.

2.3.2 Environmental Lead (Project Environmental Engineer)

The environmental lead for this project is George Overby. The environmental lead is responsible for the preparation of the RI/FS once the field activities have been completed. The environmental lead will report to the PM with questions and concerns during the reporting phase of the project.

2.3.3 Project Geophysicist

The Project Geophysicist for this project is Brian Brunette. The Project Geophysicist will supervise the Site Geophysicist and be responsible for processing, and dig-list picks, ensuring the completion

of all applicable forms. The Site Geophysicist will notify the Project Geophysicist of site-specific activities, survey progress, problems, and results on a daily basis.

2.3.4 **Senior Unexploded Ordnance Supervisor (SUXOS)**

2.3.4.1 The SUXOS has more than 10 years of military/civilian EOD/UXO experience. The SUXOS will manage the intrusive investigation. The SUXOS will keep the Project Manager informed of activities requiring his notification. The SUXOS is responsible for all daily work activities. He will brief the Project Manager daily on all project activities to include production, quality of work, safety, equipment status and personnel status. The SUXOS will directly coordinate any evacuation requirements with the CEHNC onsite safety representative. The responsibilities of the SUXOS include:

- Identification of personnel and equipment requirements;
- Supervision of all daily field team activities;
- Early detection and identification of potential problem areas and institution of corrective measures;
- Assisting with the preparation of all project reports;
- Preparation of a daily report, which will include man-hours expended, areas cleared, explosives expended, and any other information required by the Project Manager;
- Providing on-the-job training for selected UXO Supervisor(s) who may be called upon to temporarily perform SUXOS duties during his absence from the site;
- Supervision of UXO Technicians; and
- Scheduling and executing a daily safety meeting, scheduling and coordinating subcontractor field team activities, and oversight of all field activities.

2.3.5 **UXO Safety Officer (UXOSO)**

2.3.5.1 The UXOSO has more than 8 years of military/civilian EOD/UXO experience. He is responsible for implementing all Site Specific Health Plan (SSHP) requirements, onsite training requirements and recommending changes to level of personal protection equipment (PPE) to the SUXOS as site conditions warrant. The UXOSO has Stop Work Authority for safety conditions. He will report all safety work stoppages immediately to the Ordnance and Explosive Safety Specialist (OESS). The UXOSO evaluates and analyzes any potential safety problems, implements safety-related corrective actions, and maintains a Daily Safety Log. The UXOSO will also perform daily inspections of all project operations, including explosives inventories and other documentation, and will inspect and approve each completed area prior to turnover to the CEHNC onsite safety representative. The UXOSO reports to the Safety Manager. The UXOSO will:

- Perform on-the-job training for selected UXO Technicians who may be called upon to temporarily perform the duties of UXOSO during his absence from the site, upon approval of the OESS; and
- Maintain daily liaison with the OESS.

2.3.6 UXO Quality Control Specialist (UXOQCS)

2.3.6.1 The UXOQCS has more than 8 years of military/civilian EOD/UXO experience. He is responsible for implementing all site Quality Control requirements, reviewing on-site training requirements and recommending procedural changes to insure quality objectives are met as site conditions warrant. He will report all quality concerns immediately to the SUXOS. The UXOQCS evaluates and analyzes any potential quality problems, recommend related corrective actions, and maintains a Daily QC Log. The UXOQCS reports to the Quality Manager. The UXOQCS will:

- Perform quality inspections/review all project operations, including explosives inventories, daily reports, time sheets and other documentation;
- Maintain daily liaison with the USACE Safety Specialist; and
- Inspect and approve at least 10% of each completed grid/area prior to be turned over to the OE Safety Specialist.
-

2.4 PROJECT COMMUNICATION AND REPORTING

2.4.1 Project communications will be facilitated by the EOTI PM. The PM will be the main contact to CEHNC. The majority of this communication will be in the form of phone calls and emails, but will also be formalized in the project status reports that will be completed throughout the duration of the project. Daily reports will be submitted to the PM from the EOTI Senior Manager onsite, and at the completion of the field activities, a RI Report and FS Report will be prepared.

2.4.2 During field operations, hand-held radios will be utilized for internal communications between teams and key personnel. This radio networks will allow the quick processing of working information, within site, between teams, and between the UXOSO and the UXOQCS. It allows the SUXOS to communicate with team leaders and facilities contact between team leaders.

2.4.3 After field, GPS, and Geographic Information System (GIS) data has been analyzed in the field, the data reporting process will begin. The reports to be prepared will include the RI, FS, Proposed Plan, and Decision Document. Detailed descriptions of these reports are outlined in Section 2.5 of this Work Plan. Once completed, reports will be submitted to CEHNC as Draft, Draft Final, and Final versions. After each stage, comments from CEHNC will be responded to and the document will be revised accordingly. Final documents will be supplied in hard copy and used as the basis for the next stage of the project. Appendix C contains a complete list of individuals and phone numbers of the on-site and off-site contacts for this Task Order.

2.5 PROJECT DELIVERABLES

2.5.1 Upon completion of field activities, EOTI will prepare a RI Report and FS Report. The reports will be prepared under the direction of the EOTI PM and will incorporate data quality objectives (DQOs), making them part of the project QC requirements for inspection.

2.5.2 Information gathered in the field related to MEC and MC will be posted to a secure, password-protected website for information sharing purposes. GIS information will also be available on this website, which will allow 24/7 access to the GIS maps and geo-referenced data files related to the site. This website will be the first line of communication from the field to the project team and CEHNC to address site specific issues.

2.5.3 A comprehensive RI Report will be prepared following United States Environmental Protection Agency (USEPA) CERCLA guidance and conform, as appropriate, with the Military Munitions Center of Expertise Technical Update dated April 2005 for Standard Format for Remedial Investigation Reports for the Military Munitions Response Program. The RI Report will document the investigation; include appropriate MEC data from the previous investigations. As part of the RI, a MEC risk assessment will be carried out following guidance for a Munitions and Explosive of Concern Hazard Assessment Methodology (MEC HA).

2.5.4 The MEC HA provides a method of risk assessment that allows the project team to evaluate the potential explosive hazard associated with an MRS, given current conditions and under various cleanup, land use activities, and land use control alternatives. The MEC HA is intended to fit into military munitions response program (MMRP) activities and the regulatory structure of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It addresses the National Contingency Plan (NCP) direction to conduct site-specific risk assessments for threats to human health and the environment. The MEC HA addresses human health and safety concerns associated with potential exposure to MEC at MRS.

2.5.5 A FS Report will be prepared following USEPA CERCLA guidance and conform, as appropriate, with the Military Munitions Center of Expertise Technical Update dated April 2005 for Standard Format for Feasibility Study Reports for the Military Munitions Response Program. The FS Report will document the remedial options that are available to address MEC that was discovered and not removed as part of the previous site work. The FS Report will include documentation of the evaluation of the alternatives listed in paragraph 4-4.3.7 of ER 200-3-1. Following CERCLA guidance, the FS Report will not select a preferred remedy but instead will present the advantages and disadvantages of each alternative evaluated against the nine USEPA Superfund evaluation criteria. In accordance with the PWS, the FS Report will include potential risk reductions and cost estimates for alternatives.

2.5.6 A Proposed Plan document will be prepared outlining the response action alternatives preferred for this site as a result of the RI/FS process. The Proposed Plan will be prepared in accordance with ER 200-3-1 FUDS Program Policy and USEPA Policy and will undergo a required 30-day public review. The Proposed Plan will summarize the

alternatives studied in the FS and will specify the preferred alternative. The Plan will be written in clear, non-technical language so that the public can easily understand the reasons for the choice of the preferred alternative.

2.5.7 Upon completion of the review period for the Proposed Plan, a Decision Document will be prepared in accordance with ER 200-3-1 FUDS Program Policy and USEPA policy. A Decision Document is similar to a Record of Decision in a CERCLA project. This document will contain information similar to that in the Proposed Plan, but will contain greater technical detail as it becomes the basis for future actions, if any. The Decision Document will include the responses to any comments that were offered during the Proposed Plan public review process.

2.6 PROJECT SCHEDULE

A complete anticipated project schedule is provided with this document as Figure 2-2. This schedule is for the entire project and will be adjusted as the project progresses. EOTI's tentative work schedule for field operations will be five, 10-hour workdays per week (Monday through Friday). Updates to the schedule will be made in the project status reports and clearly outlined to the CEHNC by EOTI.

2.7 PERIODIC REPORTING

Project status reports will be prepared by EOTI and submitted to CEHNC. These status reports will outline the current status and schedule of tasks, upcoming work, and any anticipated problems. These project status reports will be the formal line of communication between EOTI and CEHNC.

2.8 COSTING AND BILLING

Invoicing will be submitted throughout the project as milestones are successfully completed. Project status reports will be prepared and submitted to the CEHNC during each month of this project and weekly during field activities. The reports will contain the status, on a percentage basis, of the total amount of work completed.

2.9 PROJECT PUBLIC RELATIONS SUPPORT

EOTI team members will participate in three public meetings on Culebra Island. The time and place of the meetings will be determined by CEHNC. EOTI will prepare and assist in presentation of the materials that outline/explain the activities and the process associated with the RI/FS. Materials for the meetings may include a PowerPoint presentation and graphics for a more informal "Open House" meeting format. When approached by a third party, EOTI will inform CEHNC of the request and as applicable, respond with relevant information that has been authorized by CEHNC.

2.10 SUBCONTRACTOR MANAGEMENT

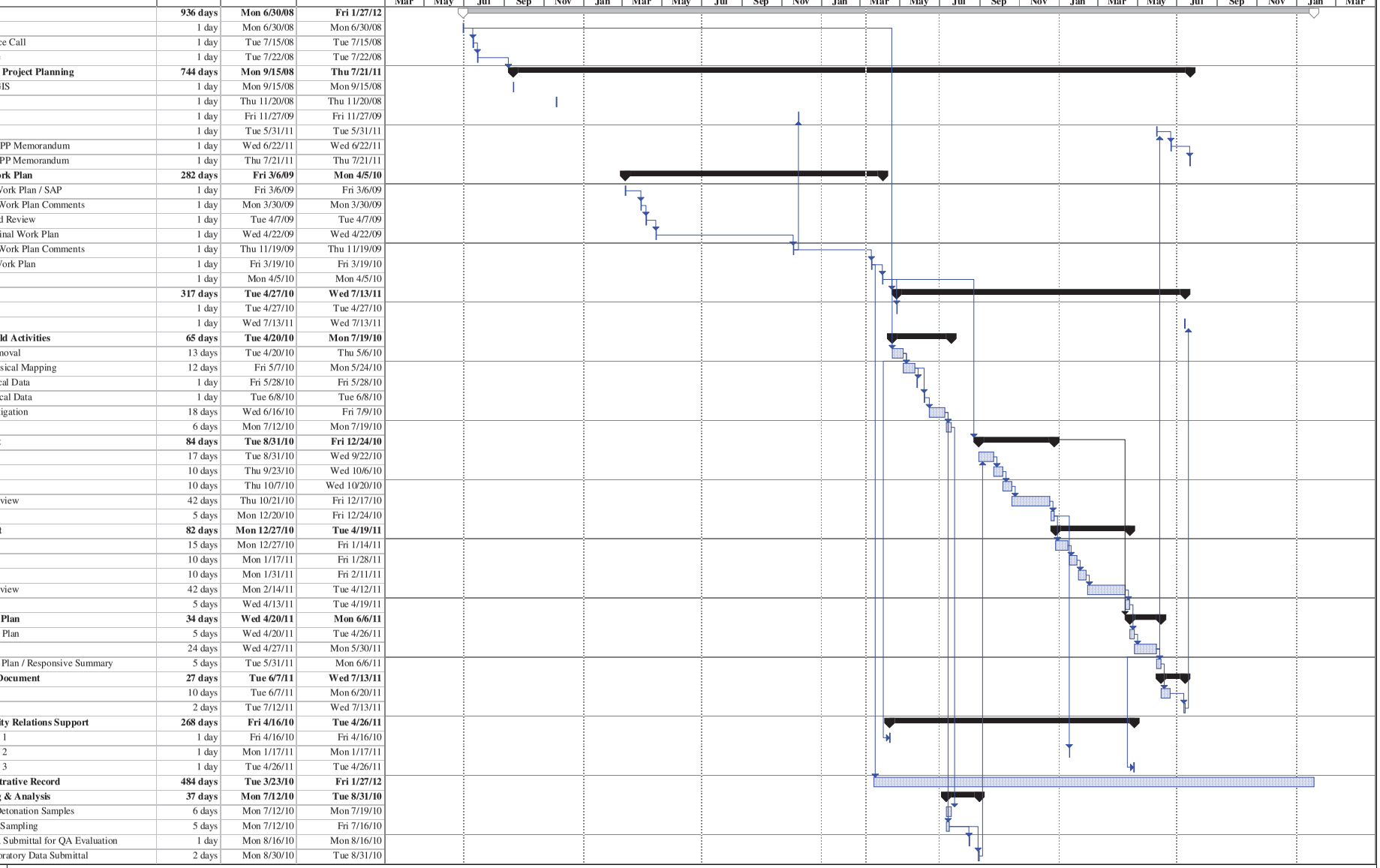
Subcontractors will be managed throughout the RI/FS process to support field work and document preparation. Qualified subcontractors have gone through a rigorous review process for ability to supply resources and meet the project schedule prior to award. Malcolm Pirnie will provide report preparation and MC sampling. ARM Group will provide digital geophysical mapping (DGM). A local vendor will provide surveying services. A review process will be implemented to monitor task completion and schedule. The subcontractor environmental lead and geophysical manager will report directly to the EOTI PM on a weekly basis with issues and concerns. Due to the overlapping capabilities of our teaming partners, additional resource requirements and staffing needs can be easily addressed throughout the period of performance.

2.11 MANAGEMENT OF FIELD OPERATIONS

Field operations will be managed corporately by the EOTI PM. The Site Management (SUXOS, Site Geophysicist, and Environmental Technical Lead) will direct day-to-day operations in the field and report to the PM with issues and concerns. The site management will direct the field team to each day's activities and participate in the investigation. When issues arise in the field, the field team will report to the appropriate Site Manager and if necessary the PM will be consulted.

Remedial Investigation / Feasibility Study
Culebra Island Site, Puerto Rico

ID	Task Name	Duration	Start	Finish
1	**RI/FS**	**936 days**	**Mon 6/30/08**	**Fri 1/27/12**
2	Award	1 day	Mon 6/30/08	Mon 6/30/08
3	Kick-off Conference Call	1 day	Tue 7/15/08	Tue 7/15/08
4	Proposed Schedule	1 day	Tue 7/22/08	Tue 7/22/08
5	**Task 1. Technical Project Planning**	**744 days**	**Mon 9/15/08**	**Thu 7/21/11**
6	Submit CSM/GIS	1 day	Mon 9/15/08	Mon 9/15/08
7	TPP Meeting 1	1 day	Thu 11/20/08	Thu 11/20/08
8	TPP Meeting 2	1 day	Fri 11/27/09	Fri 11/27/09
9	TPP Meeting 3	1 day	Tue 5/31/11	Tue 5/31/11
10	Submit Draft TPP Memorandum	1 day	Wed 6/22/11	Wed 6/22/11
11	Submit Final TPP Memorandum	1 day	Thu 7/21/11	Thu 7/21/11
12	**Task 2. RI/FS Work Plan**	**282 days**	**Fri 3/6/09**	**Mon 4/5/10**
13	Submit Draft Work Plan / SAP	1 day	Fri 3/6/09	Fri 3/6/09
14	Receive Draft Work Plan Comments	1 day	Mon 3/30/09	Mon 3/30/09
15	Attend Onboard Review	1 day	Tue 4/7/09	Tue 4/7/09
16	Submit Draft Final Work Plan	1 day	Wed 4/22/09	Wed 4/22/09
17	Receive Draft Work Plan Comments	1 day	Thu 11/19/09	Thu 11/19/09
18	Submit Final Work Plan	1 day	Fri 3/19/10	Fri 3/19/10
19		1 day	Mon 4/5/10	Mon 4/5/10
20	**Task 3. GIS**	**317 days**	**Tue 4/27/10**	**Wed 7/13/11**
21	GIS Data	1 day	Tue 4/27/10	Tue 4/27/10
22	Final GIS Files	1 day	Wed 7/13/11	Wed 7/13/11
23	**Task 4. RI/FS Field Activities**	**65 days**	**Tue 4/20/10**	**Mon 7/19/10**
24	Vegetation Removal	13 days	Tue 4/20/10	Thu 5/6/10
25	Digital Geophysical Mapping	12 days	Fri 5/7/10	Mon 5/24/10
26	Raw Geophysical Data	1 day	Fri 5/28/10	Fri 5/28/10
27	Final Geophysical Data	1 day	Tue 6/8/10	Tue 6/8/10
28	Intrusive Investigation	18 days	Wed 6/16/10	Fri 7/9/10
29	Demolition	6 days	Mon 7/12/10	Mon 7/19/10
30	**Task 5. RI Report**	**84 days**	**Tue 8/31/10**	**Fri 12/24/10**
31	Draft RI	17 days	Tue 8/31/10	Wed 9/22/10
32	COE Review	10 days	Thu 9/23/10	Wed 10/6/10
33	Draft Final	10 days	Thu 10/7/10	Wed 10/20/10
34	Stakeholder Review	42 days	Thu 10/21/10	Fri 12/17/10
35	Final	5 days	Mon 12/20/10	Fri 12/24/10
36	**Task 6. FS Report**	**82 days**	**Mon 12/27/10**	**Tue 4/19/11**
37	Draft FS	15 days	Mon 12/27/10	Fri 1/14/11
38	COE Review	10 days	Mon 1/17/11	Fri 1/28/11
39	Draft Final	10 days	Mon 1/31/11	Fri 2/11/11
40	Stakeholder Review	42 days	Mon 2/14/11	Tue 4/12/11
41	Final	5 days	Wed 4/13/11	Tue 4/19/11
42	**Task 7. Proposed Plan**	**34 days**	**Wed 4/20/11**	**Mon 6/6/11**
43	Draft Proposed Plan	5 days	Wed 4/20/11	Tue 4/26/11
44	Public Review	24 days	Wed 4/27/11	Mon 5/30/11
45	Final Proposed Plan / Responsive Summary	5 days	Tue 5/31/11	Mon 6/6/11
46	**Task 8. Decision Document**	**27 days**	**Tue 6/7/11**	**Wed 7/13/11**
47	Draft DD	10 days	Tue 6/7/11	Mon 6/20/11
48	Final DD	2 days	Tue 7/12/11	Wed 7/13/11
49	**Task 9. Community Relations Support**	**268 days**	**Fri 4/16/10**	**Tue 4/26/11**
50	Public Meeting 1	1 day	Fri 4/16/10	Fri 4/16/10
51	Public Meeting 2	1 day	Mon 1/17/11	Mon 1/17/11
52	Public Meeting 3	1 day	Tue 4/26/11	Tue 4/26/11
53	**Task 11. Administrative Record**	**484 days**	**Tue 3/23/10**	**Fri 1/27/12**
54	**Task 12 Sampling & Analysis**	**37 days**	**Mon 7/12/10**	**Tue 8/31/10**
55	Pre- and Post Detonation Samples	6 days	Mon 7/12/10	Mon 7/19/10
56	Environmental Sampling	5 days	Mon 7/12/10	Fri 7/16/10
57	Analytical Data Submittal for QA Evaluation	1 day	Mon 8/16/10	Mon 8/16/10
58	Electronic Laboratory Data Submittal	2 days	Mon 8/30/10	Tue 8/31/10



Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

3.0 FIELD INVESTIGATION PLAN

3.1 OVERALL APPROACH TO MUNITIONS RESPONSE ACTIVITIES – MEC CHARACTERIZATION

3.1.1 MEC Site Characterization Goals

The primary goal of the RI/FS MEC investigation at Culebra Island is to characterize the nature and extent of MEC and munitions debris. MEC has previously been recovered from several areas on the former military property and may remain on the site as a result of activities conducted by the DoD during operations at Culebra Island and may pose a threat to human health. An intrinsic geophysical investigation and MEC sampling will be conducted to determine the presence and characteristics of MEC. This will be combined with previous MEC investigation and removal data to complete an RI and FS for Culebra Island.

3.1.2 Data Quality Objectives for MEC Investigation

Data Quality Objectives (DQO) are established for this project to incorporate the data needs of the RI Report and FS Report. The RI Report will be a stand alone document providing results of the MEC characterization investigations. The RI Report will be prepared after the conclusion of field activities. The document will include a logical conclusion to the status of MEC at the site based on information gathered in the field. The RI Report will contain maps showing the search grids and records of MEC, and munitions debris found at the site by grid number, type, and quantity.

3.1.2.1 The use of DQOs is a systematic approach for establishing the quality and quantity of data needed to support project decisions. To establish DQOs, the intended use of the data, possible consequences of incorrect decisions attributed to inadequate or invalid data, and an acceptable level of uncertainty must be considered. Guidelines followed in the preparation of DQOs are set out in EM 1110-1-4009, Engineering and Design - Military Munitions Response Actions, and the Guidance for the Data Quality Objectives Process U.S. Environmental Protection Agency (EPA) QA/G-4, Final Guidance (USEPA, 2000).

3.1.2.2 ***State the Problem***

- Information regarding the potential distribution of MEC at a site is limited or unavailable.
- The MEC site boundaries are unknown relative to the presence of MEC at a site.
- The extent and location of field sampling for the identification of the quantity and distribution of MEC is unknown.

3.1.2.3 ***Identify the Decision***

- Obtain data regarding the presence of MEC at the site.
- Define the site boundaries.
- Define the locations and the area to be covered during field sampling.

3.1.2.4 ***Identify Inputs to the Decision***

- Historical information (e.g., ASR, field notes, aerial photos, maps) regarding potential MEC.

- Observations:
  - Visual field MEC confirmation
    - Type(s) of MEC
    - Location(s) of MEC items
  - Proximity to inhabited locations and structures (public roads, recreation paths, homes, etc.)
  - Accessibility of the site
- The Conceptual Site Model (i.e. historical information {ASR, field notes, aerial photographs, maps}, anticipated MEC type(s), anticipated MEC distribution, terrain and vegetation, current/proposed land use, and natural and cultural boundaries.)
- Statistically calculated MEC densities based on historical use of area, previous MEC investigation and removals, and current field sampling data.
- Present and/or future land use considerations (i.e., site coverage needs).
- Statistical analysis tools.

3.1.2.5 ***Define Boundaries of Study***

- Established MRS's will be utilized to subdivide investigation areas.
- Limited to the ground surface and near surface.
- Exclusive of inaccessible areas (due to vegetation / terrain).
- Time frame for collection (including ecological factors).
- Spatial boundary based on geophysical equipment capabilities for particular MEC types and site conditions.
- Rights of Entry

3.1.2.6 ***Develop a Decision Rule***

- Sampling should be in an amount optimal to characterize the site.
  - MRS 02 – As described in Section 1.4.10.1.1 the investigation of MRS 02 includes the area of Cerro Balcon and all nine of the cayos believed to be accessible by boat. Cayos that cannot be safely accessed by boat are excluded from the investigation. Data will be collected along meandering transects using one of two methods, depending on terrain, vegetation, and other factors.
    - Qualitative Reconnaissance - meandering transects divided into 200' segments that are investigated with analog geophysical techniques. The team will count "hits" and keep a log of the "hits" per segment. Detected anomalies will be investigated by UXO technicians as they are detected. Once the segment is characterized by a MPPEH item or three or more indicators of MEC, no additional intrusive investigation will be conducted on the segment. The investigation will be conducted as a typical "mag and dig" on the meandering transect segments (See Section 3.9.4.3.1).
    - Digital geophysical mapping along meandering transects with 250 feet separation with no more than 25 feet or 10% deviation from course (for heavy vegetation or lack of ROE).

  - Based on results from the investigation along meandering transects, targeted grids may be placed in an MRS in order to further define the nature of MEC contamination in the area. The size and placement of these grids will be recommended by the project engineer and approved by the USACE. EOTI will investigate 100% of the area within the grid using either analog (mag and dig) or digital geophysical methods.

- MRS 04 – As described in Section 1.4.10.2.1, this 550-acre MRS includes Flamingo Lagoon and the hillside east of the lagoon.
  - East to west, 3ft wide meandering transects, 250 feet separation, with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects using either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).
- MRS 05 – As described in Section 1.4.10.3.1, this 2,842-acre MRS includes most of the landmass between Resaca Beach and Carenero Point.
  - Qualitative Reconnaissance to fill in the gaps from the SI.
  - Meandering transects, 250 feet apart, with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects using either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).
- MRS 07 - This MRS includes the northern portion of Culebrita as well as Cayo Botella (a.k.a. Ladrone Cay).
  - Meandering transects, perpendicular to range fan, 150 feet apart (as shown in Figure B-5); with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).

Table 3.1 Proposed Investigation[2]				
Area	Transect (Acres)	Grids (25 x 25) Acres	Spacing	Anomalies[3]
MRS 02	0.20 (Cerra Balcon)	1 (outlying islands)	250	30 Cerro Balcon 40 Cayos
MRS 04	3	1	250	200
MRS 05	14	3	250	850
MRS 07	2	1	150 to 250	150

- If a transect sector/grid contains MPPEH, then the sector/grid has been defined.
- When a transect sector provides three indicators of MEC use or proximity to MEC use, the SUXOS will consult with the Project Manager and Environmental Engineer for a recommendation regarding additional field sampling for further characterization of MEC quantities and distribution.
- If historical information and field sampling indicate no evidence of MEC in an area, then the boundary of the MRS may be redefined to contain only areas exhibiting evidence of MEC. If MRSs are redefined to better represent areas with similar potential risks, the CSM will be revised and included in the RI report.
- If a sampling methodology will provide for sampling of a statistically representative portion of the site, then it will be implemented to define the locations and the area to be covered during field sampling.
- If a sampling methodology does not provide for sampling of a statistically representative portion of the site, it will be revised to do so by sampling design modification, or it will not be implemented.

3.1.2.7 ***Specify Tolerable Limits of Decision Error***

- If all the inputs to the decision rule were performed to the standard of Quality Control/Quality Assurance (QC/QA) procedures as specified in the QAPP and the Work Plan, then the error is within tolerable limits.

3.1.2.8 ***Optimize the Design for Obtaining Data***

- Each MRS will be prioritized systematically based on the recommended minimum survey requirement and statistical probability tools. Meandering transects will be utilized to establish a contamination boundary and possibly reduce the area of interest (See Section 3.13).

[2] Subject to change as determined necessary by the Project Engineer and approved by the USACE Project Manager.

[3] Anomalies indicated in the table are estimated based on an anomaly density of 50 anomalies per acre. It is believed that 50 anomalies per acre will generally be sufficient to characterize a segment or grid.

3.2 OVERALL APPROACH TO MUNITIONS RESPONSE ACTIVITIES - MC INVESTIGATION

3.2.1 MC Site Characterization Goals

The primary goal of the RI/FS MC investigation at the Culebra Island Sites is to characterize the nature and extent of MC in surface soil and sediment at the site. Limited environmental sampling was conducted at MRS 04, 05, and 07 as part of the 2007 Site Inspection activities. Following the MEC investigation, samples will be collected from various locations to obtain data to delineate the nature and extent of potential MC in the surface soil, sediment, and groundwater at the various MRS. The objectives of the Culebra Island Sites MC field investigation are:

- Evaluate the conceptual site model
- Collect surface soil composite samples to assess the presence of MC at the sites
- Collect sediment samples to assess the presence of MC at the sites
- Determine the nature and extent of MC at the site

3.2.2 Data Quality Objectives for MC Investigation

As previously described in Section 3.1.2, DQOs are established for this project to incorporate the data needs of the RI Report and FS Report. The RI Report will include a logical conclusion to the extent of MC at the site based on information gathered in the field. The RI Report shall contain maps showing MC detections within the various MRS boundaries. DQOs for MC sampling and analysis were developed following the same guidelines previously described for the MEC investigation and are summarized in the following sections.

3.2.2.1 *State the Problem*

- Determine whether MC associated with munitions used during training activities is present in surface soil and/or sediment at the Culebra Island Sites
    - Assess concentrations of MC of concern
    - Assess potential exposure of receptors to impacted surface soil
    - Assess potential exposure of receptors to impacted sediment
    - Assess other media (dependent on results of surface soil sampling)

3.2.2.2 *Identify the Decision*

- Determine the types of MC potentially released to the surface soil as a result of Culebra Island activities
- Determine the types of MC potentially released to the sediment as a result of Culebra Island activities
- Determine the site specific background concentrations for metals within the various MRSs.
- Determine the range of MC concentrations in surface soil samples across the sites
- Determine the range of MC concentrations in sediment samples across the sites
- Estimate the spatial extent of MC in surface soil

3.2.2.3 *Identify Inputs to the Decision*

- Historical information from previous uses of the site
- Location of MEC and munitions debris identified in previous investigations at the Culebra Island Sites

- Location of MEC, munitions debris, range structures, and other evidence of munitions based on MEC characterization/geophysical investigations to be completed in the field under this Work Plan
- Compare soil metals detections in background samples to site-specific background concentrations
- Compare soil and sediment metal and explosive detections to United States Environmental Protection Agency (USEPA) residential Regional Screening Levels (RSL) (if required)
- Screening-level ecological risk assessment (if required)

3.2.2.4 ***Define the Boundaries of the Study***

- Overall Culebra Island boundary; MRS boundaries
- Sampling locations based on documentation of previous use and previous investigations/removals
    - MC is expected to be found in the known impact areas (especially areas with visible ground scarring or impact craters)
    - MC may be present in areas of previous removal actions and potentially areas outside the impact areas due to migration
- Sampling locations based on the intrinsic geophysical MEC investigation in fixed range locations
    - MC is expected to be found in front of and behind the firing lines, in target areas, and in other identified impact areas
    - Surface soil from areas within the fixed ranges with identified MEC will also be sampled for MC

3.2.2.5 ***Develop a Decision Rule***

- Compare biased metals results to site-specific background concentrations
- If soil and sediment samples results exceed site-specific background concentrations, results will be compared to USEPA residential RSLs and ecological assessment levels.
- If there are exceedances of the assessment levels, additional samples will be collected to delineate the soil to the appropriate assessment levels
- If vertical delineation is necessary, a more extensive subsurface investigation will be conducted

3.2.2.6 ***Specify Tolerable Limits on Decision Errors***

- Two possible decision errors for this project:
    - Concluding that the suspect medium (surface soil) within the boundaries of the study is contaminated when it is really not (Type I error)
    - Concluding that the soil within the boundaries of the study is not contaminated when it really is (Type II error).
- Type I error is more tolerable; minimize Type II errors

3.2.2.7 ***Optimize the Design for Obtaining Data***

- Employ judgmental sampling – focus sampling locations at areas most likely to contain residual MC (firing points, target areas, impact areas)

- Analyze at method quantitation limits (MQLs) that are equal to or lower than screening levels to minimize Type II errors

3.3 DATA INCORPORATED INTO RI AND FS REPORTS

Historical data as well as previous investigation data concerning the presence of MEC will be incorporated into the RI Report as both site history and RI data. Multiple investigations and clearance activities have been conducted at the Culebra Island Sites. This information will be useful for MEC characterization activities for the overall site. Historical and previous investigation data will also be incorporated into the RI Report to describe the rational for MC sampling locations.

Data from the geophysical investigations with intrusive anomaly investigations will be incorporated in the RI Report as supplied by the field team. Any MEC found at the site will be documented in field logs/dig sheets and locations will be logged using GPS. This information will be brought together in GIS and displayed on maps that summarize the results of the field activities. Information recorded on field logs and dig sheets will be written into text summarizing the location, size, and description of any MEC at the site. Additional information will be added by the Daily SUXOS reports that include any valid information about site conditions. Information from the existing MEC reports will be used for the other three areas of concern.

Data collected as part of the MC surface soil and sediment sampling investigation will be incorporated into the RI Report as supplied by the laboratory following a data quality review. Site-specific background metal concentrations in soil will be assessed by collecting surface soil samples within each MRS. Detections will be summarized and exceedances will be mapped using GIS. Samples will be collected throughout the impacted areas to be analyzed to determine whether MC of concern have been released to the surface soil as a result of historical military activities at the Culebra Island. Metals detections will be compared to site-specific background concentrations. Metals that exceed the site-specific background values and all detected explosives will be compared to USEPA residential RSL's and ecological assessment levels. Analytical data will be used to summarize path forward recommendations for the Culebra Island Sites. If there are exceedances of USEPA residential RSLs and/or ecological assessment, a recommendation will be made in the RI requesting the collection of additional samples to delineate the soil to the appropriate screening standard.

Data collected as part of the RI field activities will be used to produce a FS for the Culebra Island Sites. The FS will evaluate options for the site including no further action and various clearance activities with institutional controls.

3.4 USE OF TIME-CRITICAL REMOVAL ACTIONS DURING THE RI/FS PROCESS

Time-Critical Removal Actions (TCRAs) are removal actions intended to address the imminent safety hazard posed by the presence of MEC/MC, where cleanup or stabilization actions must be initiated within 6 months to reduce the risk to public health or the environment. Once the imminent threat at a site is addressed through the TCRA, additional work that is necessary is completed through the non-TCRA process. During the course of the RI/FS process, if an area is discovered that

poses an imminent danger, CESAJ and CEHNC will be notified for the purpose of reevaluating the area for a TCRA.

If an evaluation of the hazards warrants a TCRA, a Action Memorandum will be prepared and submitted. This document will contain a location and description of the site, a description of existing MEC/MC hazards, current land use activities, and previous actions that have taken place to address the MEC/MC hazard. The Decision Document will also include an endangerment determination with the following statement: "There is a significant possibility that an individual may encounter MEC/MC hazards at this site, and that these hazards may cause injury or death to individuals who encounter the hazards if not addressed through the response action described in the Decision Document."

3.5 FOLLOW-ON ACTIVITIES

Upon completion of the RI/FS and associated reports, follow-on activities may include:
- Implementation of Risk Management processes
- Implementation of Remedial Actions
- Implementation of the recurring review processes

3.6 IDENTIFICATION OF AREAS OF CONCERN

The placement of the data collection transects is intended to permit probability statements to be made regarding MEC characteristics across the site. As the exact areas available for RoE access and sensitive habitat are currently unknown, the transects will be adjusted in the field to accommodate these issues. The initial planning of transects are set up in accordance with Figures B-3 through B-5.

During selection of areas to be investigated, several measures have been and will be implemented to mitigate, eliminate, and avoid disturbance and impacts to threatened and endangered species habitat. Field briefings for personnel training will include identification of threatened and endangered species and habitat.

3.7 GEOPHYSICAL PROVE OUT PLAN AND REPORT

3.7.1 Objective

3.7.1.1 EOTI will perform digital geophysical mapping (DGM), utilizing the Geonics EM61 MK2 time domain electromagnetic (TDEM) system at Culebra Island. The overall objective of this Delivery Order is for EOTI to obtain government acceptance of a Decision Document including conducting a RI/FS on Munitions Response Site (MRS) 02, 04, 05, and 07 and all necessary activities required to accomplish this objective..

3.7.1.2 The project requires a site-specific Geophysical Prove Out (GPO) test for the purpose of evaluating geophysical instruments and developing the standard response for the selected

instrument(s), instrument configuration, and techniques. Mobilization to begin DGM surveying will not occur until the Government accepts the results and recommendations stemming from this GPO.

3.7.1.3 Since analog data will be collected as well as DGM, White's metal detectors will be tested prior to beginning work each morning and when site conditions change. The White's will be checked on a test strip located near the area being investigated. Daily checks will be conducted by each instrument operator using his assigned instrument on the test plot. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The Team leader and UXOQC will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test plot. If the operator displays improper techniques or is unable to accurately and consistently locate seed item, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test plot before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation.

3.7.1.3.1 <u>The test strip will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. The test strip will be constructed by emplacing inert ordnance items (or item of similar size and mass) at selected intervals. EOTI will bury 20 mm projectiles (or surrogates) just below the surface and at 8.5 inches depth. The test strip will also include an 81mm (or surrogates) buried to a depth of 36 inches below the ground surface.</u>

3.7.1.4 The specific Data Quality Objectives (DQOs) for the GPO will be to:

1. Demonstrate that the geophysical investigation system/equipment is operating properly.
2. Provide a set of isolated objects (e.g., single inert target items or target surrogates). The sensor signatures from these items will be used to determine the equipment limitations in this geologic setting.
3. Assess the operators performance and update related procedures
4. Establish a baseline of performance capabilities for the selected instruments.
5. Establish decision parameters for target selection by the site geophysicists.
6. Evaluate navigational/position systems for positional accuracy
7. Instrument latency will be corrected using an appropriate correction routine that accounts for instrument latency time and sensor velocity. Corrections will be specific for all segments of data with equal sensor velocities. No "zig-zag" or "chevron" effects are visible in the data maps when plotted at the scales used to detect the smallest amplitude signal for any given UXO item expected at this site.

3.7.2 Personnel Qualifications

EOTI will utilize ARM Geophysics to support the GPO, DGM and reacquisition tasks. The geophysical investigation will be managed and performed by qualified geophysicists. It is anticipated that Brian Brunette, a Senior Geophysicist with EOTI team member ARM Geophysics, will be the Project Geophysicist. The Site Geophysicist is anticipated to be Ian Wilson, also of ARM Geophysics.

3.7.3 GPO Test Plot Design

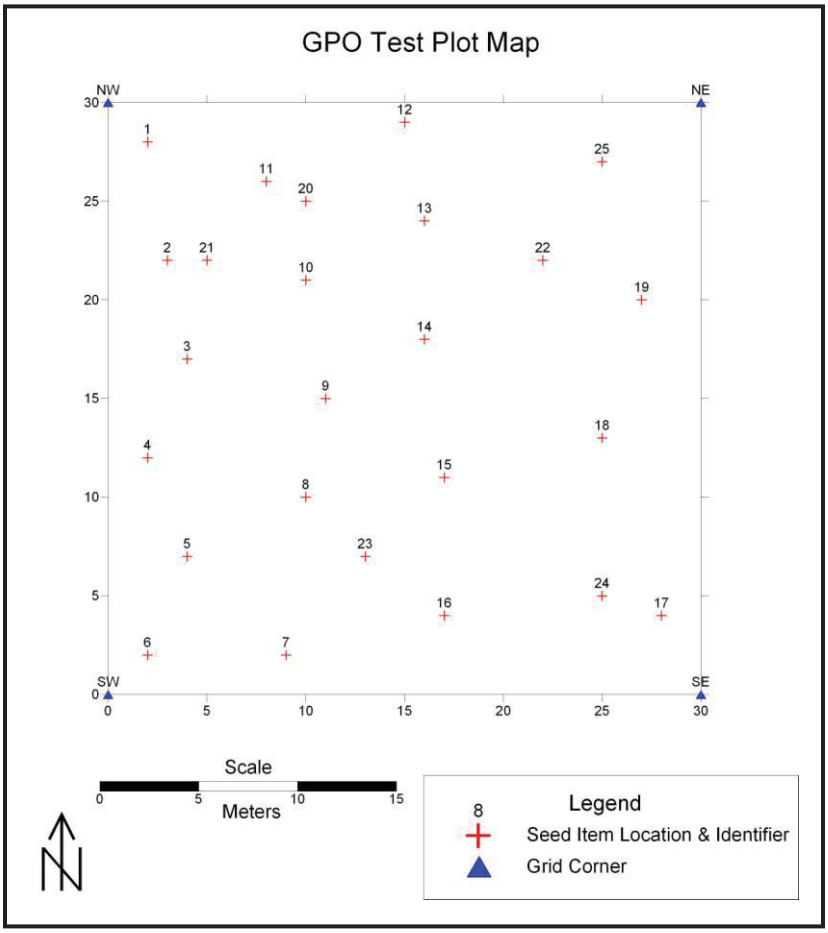
EOTI will construct a test plot for evaluation of proposed analog and geophysical technologies to be used on the site. The size for the test plot is approximately 30 meters x 30 meters in size. A suitable test plot location will be selected by EOTI and the USACE on-site representative.

3.7.4 Planned Seeded Items

The test plot will be seeded as part of the GPO. Twenty-five (25) inert target items will be seeded in the test plot at varying depths and orientations. Table 3.2 presents the planned seeded item locations and type.

Table 3.2 Seed Items and Placement Parameters						
ID	**Item**	**Orientation**	**Bearing**	**Depth (Meters)**	**Easting (Meters)**	**Northing (Meters)**
1	37-mm projectile	vertical	N	0.4	2	28
2	57mm projectile	horizontal	SW	0.6	3	22
3	60 mm mortar	vertical	N	0.6	4	17
4	75 mm projectile	horizontal	SE	0.8	2	12
5	81 mm mortar	vertical	N	0.8	4	7
6	2.75” rocket	horizontal	N	0.76	2	2
7	90 mm projectile	vertical	SW	1.0	9	2
8	105 mm projectile	horizontal	SE	1.1	10	10
9	155 mm projectile	vertical	N	1.7	11	15
10	37-mm projectile	45 degree	N	1.16	10	21
11	57mm projectile	45 degree	SE	0.3	8	26
12	60 mm projectile	45 degree	N	0.3	15	29
13	75 mm projectile	45 degree	N	0.4	16	24
14	81 mm projectile	45 degree	N	0.3	16	18
15	2.75” rocket	45 degree	SW	0.38	17	11
16	90 mm projectile	45 degree	N	0.5	17	4
17	105 mm projectile	45 degree	SE	0.5	28	4
18	155 mm projectile	45 degree	N	0.6	25	13
19	37 mm projectile	45 degree	N	0.1	27	20
20	60 mm mortar	horizontal	N	0.3	10	25
21	20 mm projectile	vertical	SW	0.22	5	22
22	20 mm projectile	horizontal	N	0.11	22	22
23	MK2 Grenade	vertical	N	0.33	13	7
24	MK2 Grenade	horizontal	N	0.66	25	5
25	Steel Pin	Vertical	N/A	N/A	25	27
NW	Northwest corner	N/A	N/A	N/A	0	30
NE	Northeast corner	N/A	N/A	N/A	15	30
SW	Southwest corner	N/A	N/A	N/A	0	0
SE	Southeast corner	N/A	N/A	N/A	15	0

Figure 3.1 Planned Test Plot Map



USACE may select to bury additional seed items in the GPO plot. If inert items cannot be obtained, surrogate items will be substituted with USACE approval.

3.7.5 Site Preparation

Vegetation removal to a height of 6 inches or other site preparation will be performed by EOTI if required. For areas requiring wheel fiducials (e.g. canopied areas), the quality of vegetation removal will have to be such that reliable and smooth wheel fiducials can be collected.

3.7.6 Location Surveying

All coordinates will be in UTM meters, NAD 1983 coordinates. Surveying of seed item locations will be performed by EOTI using survey grade GPS. Pre-seeding geophysical

surveys will be performed by EOTI using a man-portable EM61 MK2. The data will be used by EOTI for incorporation into the overall GPO evaluation.

3.7.7 Quality Control Procedures

3.7.7.1 QC of the instrument will be achieved by field testing and checking the sensor and navigation system daily against a known target, to ensure that it is operating properly. The Site Geophysicist will observe this activity. The standardization check described in section 3.7.8 will be implemented to achieve QC objectives. Operational and test procedures will conform to the manufacturer's standard instructions.

3.7.7.2 All geophysical instruments and equipment used to gather and generate field data are calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Calibration, repair, or replacement records will be filed and maintained by the Site Geophysicist and may be subject to audit by the QA Manager. Testing records of the field instrumentation will be filed with the USACE PM after the fieldwork is completed.

3.7.7.3 Data processing QC is required to assure data quality. Potential data problems include source data errors, data entry errors, data editing errors, data corruption errors, and user errors. EOTI's data review is implemented to identify and correct any of these errors should they occur. Files will be backed up daily in order to ensure that data loss and file corruption does not occur. The Site Geophysicist will inspect to insure the accuracy of the data and that the backup has occurred.

3.7.8 Instrument Standardization

All instrument standardization will be performed per the requirements described in ARM's Standard Operating Procedure (SOP) Quality Control and Project Management Procedures for Munitions Response RI/FS Digital Geophysical Mapping (see Appendix K) follows the new requirement outlined in document CEHNC RI/FS DGM provided December 2008.

EOTI will perform QC Tests in accordance with the required equipment tests and frequency of testing. They are summarized in Table 3.3. The following tests will be conducted**:**

3.7.8.1 Equipment/Electronics Warm-up

The purpose of Equipment/Electronics Warm-up is to minimize sensor drift due to thermal stabilization. Most instruments require a few minutes to warm up before data collection begins. Follow the manufacturer's instructions or, if none are given, observe the data readings until they stabilize. Acceptance criteria are equipment-specific (typically 5 minutes).

Table 3.3 Proposed Quality Control Measures and Associated Frequencies

Test #	Test Description	Specific detector	Power on	Beginning of Day	Beginning and End of Day	1st Day of Project	Per Grid or Dataset
1	Equipment Warm-up		X				
2	Personnel Test			X			
3	Vibration Test (Cable Shake)			X			
4	Static Background and Static Spike				X		
5	6 Line Test					X	
6	2 Line Test			X			
7	Dynamic Repeatability						X
8	Positioning Device Check			X			

3.7.8.2 Personnel Test

The purpose of personnel testing is to ensure survey personnel have removed all potential interference sources from about their person Common interference sources include steel-toed boots, boots with metal shanks or large metallic belt buckles, which can produce data anomalies similar to MEC targets. All personnel who will be coming within close proximity of the sensor during survey operations must approach the sensor and have a second person monitor and record the results.. Acceptance criteria for the EM61 is +/- 2.5mV.

3.7.8.3 Record Relative Sensor Positions

The purpose of the record relative sensor positions test is to document relative navigation and sensor offsets, detector separation, and detector heights above the ground surface. This will ensure that detector offset corrections can be done correctly and that the surveys are repeatable. The acceptance criteria is +/- one inch (2.54 cm). Typically, the GPS antenna will be in the centre of the coil, thus only coil height above ground surface needs to be verified (16 inches when using regular wheels).

3.7.8.4 Vibration Test (Cable Shake)

The purpose is to identify and replace any shorting cables and broken pin-outs on connectors. With the instrument held in a static position and collecting data, an assistant will carefully shake all cables to test for shorts and broken pin-outs. Observe readings for any changes (spikes) in instrument response. If shorts are found, the cable should be immediately repaired or replaced. After repair, cables need to be rigorously tested before use. The acceptance criteria is a data profile that does not exhibit data spike responses +/- 2.5mV.

3.7.8.5 Static Background and Static Standard Response (Spike) Test

The purpose of this test is to quantify instrument background readings, locate potential interference spikes in the time domain, and repeatability of the instrument to a standard test item (test jig). Improper instrument function and the presence of local sources of ambient noise (such as EM transmissions from high-voltage electric lines or electrical storms) are

potential causes of inconsistent, non-repeatable readings. A minimum of 3 minutes static background collection after instrument warm-up, followed by a 1-minute standard (spike) test followed by a 1-minute static background data will be performed. The acceptance criteria are as follows: Static Background Test: EM61 +/- 2.5 mV, Spike Test: EM61 +/- 10% of standard item response, after background correction.

3.7.8.6 Six Line Test

The purpose of this test is to document latency and repeatability of response amplitude, and that instrument latency is not variable across usual survey speeds at project start. The test will be completed one time at the start of the project, as indicated within Table 3.3. This test will be performed in an area relatively clear of anomalous response, ensuring that the area surrounding the half-way point, in particular is anomaly-free. The test line will be well marked to facilitate data collection over the exact same line each time the test is performed. The following procedure will be followed:

1. Lay out a 50-foot non-metallic tape in an N-S or E-W direction (this directionality should be observed so as to facilitate processing). Run a survey along the 50-foot line going one direction.
2. Run a survey along the 50-foot line in reverse direction.
3. Place target (test jig) at the midpoint (25 feet).
4. Run a survey along the 50-foot line in first direction.
5. Run a survey along the 50-foot line in opposite direction.
6. Run a survey along the 50-foot line in first direction, moving faster than normal.
7. Run a survey along the 50-foot line in opposite direction, moving slower than normal.

3.7.8.7 Two Line Test

The purpose is to daily test and document latency and repeatability of response on a daily basis for the project duration, as indicated within Table 3.3. This test will be performed in an area relatively clear of anomalous response. The following procedure will be followed:

1. Lay out a 50-foot non-metallic tape in an N-S or E-W direction (this directionality should be observed so as to facilitate processing).
2. Place target (test jig – ensure that it is placed in same orientation each time the test is performed) on clean area of the line at an inline distance of 25 feet.
3. Run a survey along the 50-foot line in one direction.
4. Run a survey along the 50-foot line in opposite direction.

3.7.8.8 Dynamic Repeatability Test

A standard test item shall be placed within the grid (i.e. a small pipe or flat plate with a small area response. The item will be placed flush with the surface at a standard orientation). The standard response to this test item will be defined prior to the start of production field activities. Response repeatability to this standard test item in the mapping data will indicate data quality is consistent and sufficient for detection of the MEC items of interest. The dynamic repeatability test is a replacement for the predecessor repeat lines test.

Test item anomaly characteristics (peak response and size) shall be repeatable with an allowable variation of +/-25%. This test shall be preformed once per grid or dataset and a dataset will most likely be grouped into morning and afternoon sessions.

3.7.8.9 Data Position Check

At the beginning of each day, a known local survey point, emplaced by EOTI, will have its position recorded and compared to the known position to ensure it is within the tolerance of the navigation system

Acceptance Criteria: 4 inches or 10.12cm.

3.7.9 Data Collection Variables

3.7.9.1 Sensors

The EOTI team will evaluate the Geonics EM61 MK2 TDEM system in man-portable configuration for the completion of the test plot.

3.7.9.2 Positioning Systems

EOTI will utilize a Leica 500, 1200 or comparable RTK Differential Global Positioning System (DGPS) to integrate location data with the EM data. The GPS system employed will have centimeter accuracy and will utilize a base station established at a known monument/control point. EOTI will also evaluate man-portable EM61 with fiducial positioning if transects and/or grids in canopied areas are needed.

3.7.9.3 Sampling Rate

Sampling rates of the EM61 will be approximately 10-12 Hz for DGPS and once every 10cm for wheel mode fiducials. For DGPS, downline sample separation will be 0.2m or less, 95% of the time. Sampling rates on the GPS will once per second.

3.7.9.4 Across Line Sampling

Grid data will be collected in lanes 0.6m apart based on the known presence of 25 mm projectiles at the Culebra Island Site.

3.7.9.5 Production Rates

EOTI anticipates 3 10-hour days for completion of GPO DGM field activities for the proposed instruments and crew: One day for background survey and one day for post seeding DGPS and fiducial surveys. In between the two separate DGM activities (pre and post seeding GPO surveys) EOTI will construct the GPO.

3.7.10 Data Analysis And Interpretation

3.7.10.1 Procedures

EOTI will utilize Geonics DAT61 to integrate and position the EM data and Geosoft's Oasis Montaj running the UX-process and UX-Detect Modules to process the data. EOTI will perform daily QC and processing of all data sets.

3.7.10.2 Initial Field Processing

EOTI will perform data file review and correction of the following:

- Grid name and location;

- Line numbers, survey direction, start and end points

DAT61 will be used to convert raw EM data and to position with respect to integrated GPS data or fiducial marker information.

3.7.10.3 Standard Data Processing

EOTI will utilize Geosoft's Oasis Montaj running the UX-process and UX-Detect Modules to perform the following corrections where appropriate:

- Positional offset correction
- Background leveling
- Sensor drift removal
- Lag/Latency correction
- Noise / spike filtering
- Gross overlap removal

3.7.10.4 Quantitative Interpretation and Dig Sheet Development

3.7.10.4.1 EOTI will determine the optimum gridding method, search criteria, and contour level selection with background shading and target selection criteria analysis based on the data collected. EOTI will discuss these parameters with USACE prior to beginning DGM production.

3.7.10.4.2 Colored maps will be constructed in accordance with Attachment D, DID MR-005-05.01, Geophysical Map Deliverable Format. Dig sheets will be constructed in accordance with Attachment C, DID MR-005-05.01. Colored contour maps and profile data will be evaluated to make appropriate picks of seeded UXO targets. EOTI will compare the selected location with the known item location.

3.7.10.4.3 Items seeded by USACE will remain unknown to the contractor. EOTI team geophysicists will make a professional determination regarding the identification of target anomalies in the datasets.

3.7.10.5 Reacquisition

Targets on the test plot will be reacquired using a RTK DGPS . The distance from the reacquired target and the targets actual location will be measured and recorded to evaluate the effectiveness of the reacquisition process.

3.7.10.6 Records Management

3.7.10.6.1 Field data sheets shall be maintained in accordance with Attachment A of DID MR-005-05.01. Project documentation will be collected and managed on-site during the field portion of the geophysical investigation for inspection by client personnel. Geophysical data are recorded digitally and downloaded daily to a field computer for processing or transfer to the processing center. In addition to the copy of data placed on the field computer's hard drive, a copy of the data will be written to CD, DVD or an external harddrive, for backup before the data are erased from the equipment.

3.7.10.6.2 As an additional means of ensuring data availability, all data will be transferred to the geophysical data processing center on a daily basis. This off-site storage of data will

further reduce the likelihood that data will be lost. Transfer may be accomplished by e-mail attachment, file transfer protocol (FTP), or overnight delivery of CD or DVD. If possible, copies of field data collection forms and appropriate field logbooks should be scanned or faxed.

3.7.10.6.3 The Project Geophysicist will review the uploaded geophysical data to verify that the transfer system is functioning on a daily basis. This review will also serve to double-check the field data review for QA/QC purposes. The review will verify that the data are valid and useable for the intended purpose.

3.7.10.6.4 All digital data stored at the geophysical data processing center will be backed up on a regular basis. All data, reports, memorandums, spreadsheets, etc., should be maintained in a designated client/site subdirectory and transferred to the central GIS/database system.

3.7.11 Data Evaluation

3.7.11.1 EOTI will evaluate and score the different geophysical approaches. Scoring criteria will be:

- Percent of seeded items detected (by class/size, and overall)
- Number of unknown targets
- Production rate
- Equipment durability
- Safety

3.7.11.2 On completion of the GPO data processing, EOTI will provide to the Government a listing of each target, which will include a complete description of detection characteristics to include, at a minimum, the following information:

- Seed item ID, if provided by the Government; or else anomaly ID
- Seed item description, if provided by the Government
- Seed item burial characteristics, if provided by the Government
- UTM Meter coordinates of peak response
- Anomaly peak response amplitude
- The distance and bearing from actual center of seeded item locations to interpreted center of seed item locations, if provided by the Government

Based upon the above, EOTI will determine which approach is likely to be most efficient and effective for the site.

3.7.12 GPO Letter Report

After the GPO field work has been completed, EOTI will prepare a GPO Letter Report including the following:

1. As-built drawing of the GPO plot;
2. Seed Item location spreadsheet and all control points (Microsoft Excel format);
3. All raw and processed geophysics data;
4. Summary of the GPO results;
5. Proposed geophysical equipment, techniques, and methodologies; and
6. Sufficient supporting information to justify the project team's recommendations.

3.8 SURFACE PREPARATION

3.8.1.1 Brush cutting will be required to ensure effective surface clearance in portions of the designated areas. Clearance of plants, trees and brush will be coordinated with FWS and DNER because of endangered plant species. The biologist will be classified as essential personnel in order to accompany the field crew to identify endangered species.

3.8.1.2 EOTI plans to trim and prune only the minimum amount of vegetation in order to allow effective DGM and surface / subsurface removal of MPPEH required in the PWS. Underbrush and trees may be pruned to a height of 12 inches from the ground surface or less to allow full instrument coverage underneath the trees.

3.8.1.3 To the extent possible, native trees greater than 2 inches in diameter must be left in place; however, they may be lightly pruned as required to allow full coverage of the ground with the geophysical sensors. In cases where MEC is found embedded in a native tree, FWS and DNER will be notified prior to removal. Invasive plants such as mesquite can be removed. All protected native trees which should not be pruned or removed as part the removal action will be flagged.

3.8.1.4 Shrubs, trees, and limbs will not be cut without prior approval from the project biologist. Cut brush will be removed from the area of interest, if necessary to prevent interference with site operations. EOTI's brush cutting team will use a variety of clearing techniques depending on the ground conditions (portions are expected to be soft and wet) and type of vegetation. Much of the brush removal may be accomplished by simply dragging the brush outside of the areas. Various hand and mechanical methods will be applied to complete this task. EOTI anticipates the use of mechanical brush cutting equipment, such as chainsaws and heavy-duty steel bladed weed eaters. Chain saws and chippers may also be used to cut and reduce brush and low hanging limbs that would interfere with detection and removal operations.

3.8.1.5 No sea grapes or other larger plants will be cut within designated critical habitat boundaries; however, these plants may be lightly pruned as necessary to gain access to characterize the site.

3.8.1.6 The brush clearance team(s) will be structured to safely and efficiently clear each of the designated areas. The SUXOS will designate team personnel and equipment, based on the size of the area, type of brush, terrain, MPPEH, etc. Brush cutting teams will consist of no less than two personnel and will include a minimum of one UXO qualified personnel (UXO Tech II or above).

3.8.1.7 Surface metal removal entails the visual inspection of each transect for metal ordnance-related items. This activity helps ensure that only subsurface anomalies are investigated during subsequent geophysical survey operations. The same crew performing the geophysical investigation will also perform the surface metal removal. If possible, large surface items that cannot be moved will be avoided, and the transect survey lines moved away from/directed around the items. Any MEC or MD will be logged as a surface item on the dig sheet and, if possible, coordinate recorded.

3.8.1.8 EOTI will conduct minimal activities on beaches. Prior to the initiation of field activities, field crews will be briefed as to the endangered status of sea turtles, potential penalties associated with violation of ESA crawl and nest identification, and sea turtle biology. The team members will receive site specific training to include standard operating procedures for endangered species conservation and all relevant documents in Appendix J.

3.9 GEOPHYSICAL INVESTIGATION PLAN

3.9.1 The Geophysical Investigation Plan (GIP) is delineated into the following six subject categories, based on guidelines from USACE provided within DID MR-005-05.01:

1. UXO Safety;
2. Personnel Qualifications;
3. Geophysical Investigation Plan Outline;
4. Geophysical Investigation Performance Goals;
5. Geophysical Mapping Data; and
6. Geophysical Investigation Plan Summary and Conclusions.

3.9.2 Unexploded Ordnance (UXO) Safety

Areas of new DGM will be surface-cleared by EOTI prior to DGM activities.

3.9.3 Personnel Qualifications

3.9.3.1 The geophysical investigation will be managed and performed by qualified geophysicists meeting the qualification requirements. Qualifications overviews of selected key personnel are provided below.

3.9.3.2 The anticipated Project Geophysicist, Brian Brunette, has over eight years of experience as a geophysicist, including five years of continuous on-site UXO geophysics project experience. He has trained, educated, and managed a diversified staff of geophysicists and UXO technicians in data collection, processing, interpretation, and reacquisition procedures. As a geophysicist, he has successfully completed projects for USAESCH, Department of Energy, U.S. Navy, and U.S. Air Force customers. Lastly, Mr. Brunette has provided geophysics support for EE/CA and removal actions for CONUS/OCONUS Army projects.

3.9.3.3 The anticipated Site Geophysicist, Ian Wilson, has five years of experience performing geophysical surveys on UXO projects in both the United States and Australia. he has collected and processed geophysical data with a wide range of geophysical tools, which include: TM-5 EMU (Dual and Single), TM-4 and TM-6 Magnetometers, EM61 MK2, Trimble, Ashtech and Leica GPS systems, and Leica Robotic Total Stations.

3.9.4 Geophysical Investigation Plan (GIP) Outline

3.9.4.1 The GIP Outline is delineated into the following 11 subject categories, based on guidelines from USACE provided within the DID MR-005-05.01:

- Site Description;
- Geophysical Investigation;
- Instrument Standardization;

- Data Processing, Corrections, and Analysis;
- Dig Sheet Development;
- Feed-Back Process;
- Quality Control;
- Corrective Measures;
- Records Management;
- Interim Reporting; and
- Map Format.

3.9.4.1.1 Accordingly, the current specifications pertaining to performing GIP-related activities after the mobilization is completed to Culebra Island will be discussed in order of appearance as listed above.

3.9.4.2 Site Description

The Site Description portion of the GIP is delineated into the following 16 subject categories, based on guidelines from USACE provided within DID MR-005-05.01: (a) geophysical data quality objectives; (b) specific areas to be investigated; (c) past, current, and future use; (d) anticipated UXO type, composition, and quantity; (e) depth anticipated; (f) digital topographic maps; (g) vegetation; (h) geologic conditions; (i) soil conditions; (j) shallow groundwater conditions; (k) geophysical conditions; (l) site utilities; (m) man-made features potentially effecting geophysical investigations; (n) site specific dynamic events; (o) overall site accessibility and impediments; and (p) potential worker hazards. Accordingly, the current specifications pertaining to performing site-specific related activities after the mobilization is completed to Culebra Island will be discussed in order of appearance as listed above.

3.9.4.2.1 Geophysical Data Quality Objectives

3.9.4.2.1.1 Following USEPA QA/G-4, ,Guidance on Systematic Planning Using the Data Quality Objective (DQO) Process DQOs are normally defined by a seven-step process which includes the following standard procedures:

- Identify the nature of the problem;
- Develop a conceptual model of the hazards;
- Identify the decisions to be made;
- Identify the type of data needed;
- Identify the analytic approach that defines how the data will be used;
- Define acceptable quantitative criteria on the quality; and
- Develop data collection design that will meet the quantitative criteria.

3.9.4.2.1.2 The DGM task has a DQO of the Government finding no ferrous metal items within the subsurface of the designated clearance areas to item depths of 11 times the item diameter (or width) up to the specified clearance depth. The DQOs will be validated at the GPO.

3.9.4.2.2 Anticipated MEC, Composition and Quantity

3.9.4.2.2.1 As stated previously, Culebra Island and the surrounding cays were used by the military from 1903 to 1975. Extensive munitions training has left debris in many areas of the

site, and it is likely that MEC still remains in some areas. Of the 13 MRSs, three have confirmed MEC and eight have confirmed MD.

3.9.4.2.2.2 The types of ordnance-related material expected on site include, but are not limited to a variety of small arms, 20 mm projectiles, 76 mm HE projectiles, 81-mm HE projectiles, mortars, and grenades.

3.9.4.2.3 Depth Anticipated

Based on the ordnance items, the depths anticipated are expected to be less than three feet with the majority of the items found within the first one to two feet.

3.9.4.2.4 Topography

Culebra Island and the surrounding cays have irregular, rugged coastlines with sandy beaches, lagoons, coastal wetlands, and mountainous terrain. The highest point on Culebra is Mount Resaca at approximately 630 feet.

3.9.4.2.5 Vegetation

Vegetation is moderately to extremely dense on undeveloped portions of Culebra, Luis Pena Cay, Northeast Cay, and Culebrita; however, vegetation is sparse or absent on many of the smaller cays as most are rocky with very little soil. Hazardous vegetation include the Mesquite acacia or thorny brush, which may be present on Culebra and all of the surrounding cays, and the poisonous Manchineel tree (also called Manzanillo Tree on Culebra), which is known to be present on Northwest peninsula and near Flamenco Lagoon.

3.9.4.2.6 Geologic Conditions

Culebra Island and the surrounding cays are part of the Culebra Archipelago. The rocks are predominantly intrusive or extrusive volcanic rocks consisting of andesite lava and tuff. The rocks in the north-central portion of Culebra and on the east side of Cayo Luis Pena contain diorite porphyry inclusions and have little to no porosity due to compaction and quartz and calcite growth in the pore space.

3.9.4.2.7 Soil Conditions

Soils are generally shallow and rocky and consist mostly of silts and clays. Loamy organic-rich soils are found in areas of dense vegetation and grasses, while sandy soils are found on tidal flats or areas near the beach. Many of the beaches on Culebra and the surrounding cays have clean white to tan sand, while other beaches are rocky with a mix of cobbles and pieces of dead coral reef.

3.9.4.2.8 Shallow Groundwater Conditions

The Island of Culebra and the surrounding cays are made up of volcanic and intrusive rocks consisting of predominantly andesite lava, lava breccia, and tuffs. Groundwater on Culebra is scarce and only known to occur in alluvial deposits and in fractures in volcanic and plutonic rocks. Average annual rainfall is 30 to 50 inches, and all aquifer recharge comes from direct rainfall. The public water supply on Culebra comes from a desalination plant located near Lower Town. In some households, municipal water is supplemented with rooftop cisterns or groundwater for non-drinking water uses.

3.9.4.2.8.1 There are no permanently flowing surface water streams on Culebra. Three large ephemeral streams drain the hills north of Great Harbor to the south, and one large ephemeral stream has developed along an old, washed-out jeep road on the north side of the island toward Brava Beach. These ephemeral streams generally only carry water after heavy precipitation. There are many small ephemeral gullies and ditches throughout the island, and several lagoons are present on Culebra as well as Culebrita, Cayo Norte, and Cayo Luis Pena.

3.9.4.2.9 Geophysical Conditions

As far as site-specific conditions that may affect geophysical surveys, the igneous rock may lead to false positives in the DGM data caused by ferrous rich rock ("Hot Rock").

3.9.4.2.10 Sensitive Environments

The main island of Puerto Rico and its associated islands support 75 federally listed threatened and endangered species consisting of 26 animals and 49 plants. Among this diverse group of fauna and flora are multiple species that are known to exist, potentially exist, or temporarily use areas within the Culebra Island, such as migratory birds. Of the 75 federally listed species, nine are known or are suspected to occupy Culebra Island and/or the associated cays. In addition to the federally listed species, 13 state-listed species are known to occupy Culebra Island and/or the associated cays. The federally and state-listed species includes both terrestrial and marine life. The federally listed species of most concern for the wildlife refuge are the Culebra Island giant anole, Virgin Islands tree boa, roseate tern, brown pelican, green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, Leptocereus grantianus (cactus), and Wheeler's peperomia. Due to declining populations, the elkhorn and staghorn corals in the surrounding waters are proposed to be federally listed threatened and endangered species.

3.9.4.2.11 Man-made Features Potentially Affecting Geophysical Investigations

The Culebra Island site is home to the Municipality of Culebra, with just under 2,000 residents and many visitors throughout the year. The island has schools, residential areas, a clinic, an airport, restaurants, hotels, shops, and a few industrial companies. Water is provided by a desalination plant, built by the Navy, located on DNER land near the USFWS and DNER offices. The surrounding cays have no structures except Cayo Norte, which has a few full-time residents, and Culebrita, where the oldest operating lighthouse in the Caribbean is still maintained. Only Culebra and Cayo Norte have full-time residents.

3.9.4.2.11.1 If a man-made feature is noticed during DGM investigations, the team will pause DGM operations and note the feature on the DID MR-005-05.01, Attachment C, Dig Sheet, or within their logbook.

3.9.4.2.12 Site-specific Dynamic Events

Site-specific dynamic events are possible at the work site, but none are assumed to effect the equipment, personnel, or the corresponding DGM productivity / quality above and beyond effects that were noticed during the previous DGM data collection activities. Possible site-specific dynamic events include high winds and/or thunderstorms. In the event of inclement

weather, electrical storms, hurricanes, or extremely hot weather, it may be necessary to cease operations and evacuate the site. Appendix D, Section 12.14, contains a contingency plan for severe weather.

3.9.4.2.13 Potential Worker Hazards

Potential worker hazards include the standard slips, trips, and falls related to surface conditions, changes in weather, vegetation, and terrain. Field personnel will wear safety glasses and non-metallic ankle-high boots during daily operations. Leg-chaps will be worn when working around chain saws and weed-whackers. Safety gloves shall be worn when moving brush or during similar activities. Other hazards may include electrical hazards, heavy lifting, and vehicle safety. Trucks will be driven at safe speeds at all times, passengers will wear seatbelts while the vehicles are moving and drivers shall not use cell phones while operating the vehicle. Heavy lifting will be accomplished by two personnel for objects in excess of 50 pounds, especially those of awkward dimensions and is encouraged for all lifting. Biological hazards such as insects, snakes and prickly or poisonous plants may be present at the site and should be avoided when possible. Personnel with known allergies shall carry their EpiPen kit or similar, about their person at all times. EOTI will monitor the occurrence of storms and lightning and temporarily stand-down work crews if lightning is present for a period of 30mins after last occurrence of lightning within 5 miles.

3.9.4.3 Geophysical Investigation

The Geophysical Investigation portion of the GIP is delineated into the following six subject categories, based on guidelines from USACE provided within the DID MR-005-05.01: (a) survey type; (b) equipment; (c) procedures; (d) personnel; (e) production rates; and (f) data spatial density.

3.9.4.3.1 Survey Type

3.9.4.3.1.1 EOTI will perform surveys in areas determined during the Technical Project Planning (TPP) process. Survey types expected to be man-portable transects and small grids located over areas of interest identified during the transect collection.

3.9.4.3.1.2 Analog methods (qualitative reconnaissance) and techniques will be implemented as required to meet DQOs when canopy, vegetation, potential environmental impacts, or terrain prevent the use of digital methods. This analog method will utilize meandering transects divided into segments. The team will count “hits” and keep a log of the “hits” per segment. Anomalies detected along the meandering transect will be investigated to determine their source. All detected anomalies will be investigated by UXO technicians, until the segment is characterized by the discovery of an MPPEH item or three MEC indicators.

3.9.4.3.1.3 The UXO Team will mobilize to conduct the qualitative reconnaissance in advance of the DGM team. During the qualitative reconnaissance, the on-site management will scout for areas appropriate for DGM. Information to consider includes canopy, vegetation, potential environmental impacts, and terrain. Another consideration will be to avoid any vegetation removal that could potentially create access to areas containing a risk. The DGM team will mobilize with a clear understanding of the location and amount of DGM to be conducted.

3.9.4.3.1.4 Due to the potential for encountering sensitive species and habitat, vegetation clearance will be minimized. Heavy vegetation can significantly limit the effectiveness of digital geophysical mapping. When necessary due to potential environmental impacts dues to vegetation removal, the team will implement quantitative reconnaissance (analog) following meandering transects using White Eagle Spectrum XLT or other equivalent metal detector proven effective in locating potential MEC on site.

3.9.4.3.1.5 The below list describes the anticipated type of geophysical investigation agreed upon during the initial TPP meeting. The methods and techniques implemented will be determined on site as required to meet the DQOs.

- MRS 02 – As described in Section 1.4.10.1.1 the investigation of MRS 02 includes the area of Cerro Balcon and all nine of the cayos believed to be accessible by boat. Cayos that cannot be safely accessed by boat are excluded from the investigation.
- Data will be collected along meandering transects using one of two methods, depending on terrain, vegetation, and other factors.
  - Qualitative Reconnaissance - meandering transects divided into 200’ segments that are investigated with analog geophysical techniques. The team will count “hits” and keep a log of the “hits” per segment. Detected anomalies will be investigated by UXO technicians as they are detected. Once the segment is characterized by a MPPEH item or three or more indicators of MEC, no additional intrusive investigation will be conducted on the segment. The investigation will be conducted as a typical “mag and dig” on the meandering transect segments (See Section 3.9.4.3.1).
  - Digital geophysical mapping along meandering transects with 250 feet separation with no more than 25 feet or 10% deviation from course (for heavy vegetation or lack of ROE).
  - Based on results from the investigation along meandering transects, targeted grids may be placed in an MRS in order to further define the nature of MEC contamination in the area. The size and placement of these grids will be recommended by the project engineer and approved by the USACE. EOTI will investigate 100% of the area within the grid using either analog (mag and dig) or digital geophysical methods.
- MRS 04 – As described in Section 1.4.10.2.1, this 550-acre MRS includes Flamingo Lagoon and the hillside east of the lagoon.

  - East to west, 3ft wide meandering transects, 250 feet separation, with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects using either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).
- MRS 05 – As described in Section 1.4.10.3.1, this 2,842-acre MRS includes most of the landmass between Resaca Beach and Carenero Point.
  - Qualitative Reconnaissance to fill in the gaps from the SI.
  - Meandering transects, 250 feet apart, with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects using either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).
- MRS 07 - This MRS includes the northern portion of Culebrita as well as Cayo Botella (a.ka. Ladrone Cay).
  - Meandering transects, perpendicular to range fan, 150 feet apart (as shown in Figure B-5); with no more than 25 feet or 10% deviation from course. Data will be collected along meandering transects using either by digital geophysical mapping followed by anomaly investigation or by analog (mag and dig) operations. The most effective method will be determined by the site management, based on terrain, vegetation, and other factors affecting the quality of data collection.
  - After vegetation removal, 25ft by 25ft Grids may be placed based on areas of high anomaly count (as determined by the Project Engineer and approved by the USACE Project Manager).

3.9.4.3.1.6 Transects will be tracked using GPS whenever possible. If satellite service is not available due to canopy, the team will maintain a heading using a compass, with no more than 25 feet or 10% deviation from course (for heavy vegetation or lack of ROE) until satellite service is restored. Each transect will be divided into 200’ segments. Each segment will be named with a unique identifier. The team will maintain a log with an estimated anomaly count for each segment. Segments with high anomaly counts or indicators of MEC (as determined by the Project Engineer and approved by the USACE Project Manager).will be recommended for intrusive investigation in

targeted grids. In the event that vegetation is very heavy and DGPS technology rendered ineffective, analog methods and/or the EM61 deployed in wheel fiducial mode will be used.

3.9.4.3.1.7 The reconnaissance team will include three personnel, at least two will be UXO Tech IIs or higher. One team member will be primarily responsible for navigation and record keeping. One will be primarily responsible for operating the geophysical instrument and detecting anomalies. The third member will provide support, to potential include minor brush clearing and intrusive investigations along the transects. A UXO Tech III will supervise the work of two reconnaissance teams (six personnel total). The reconnaissance teams will be supported by a SUXOS, UXOQCS, UXOSO and a Biologist. The biologist will brief teams on potential sensitive species and habitat in the areas where the teams are working and will be available to answer questions as they arise.

3.9.4.3.1.8 As anomalies are detected along transects they will be investigated and documented in accordance with intrusive procedures described in Section 3.11 of this work plan. Areas with transect segments that have high anomaly counts and indication of potential MEC will be recommended for further intrusive investigations using sample grids. In areas identified with high anomalies, the project team may elect to investigate only the number of anomalies required to characterize the nature and extent of the MEC contamination in accordance with the DQOs. As described in section 3.1.2.6, a transect sector or grid is considered defined if it contains MPPEH or three indicators of MEC use.

3.9.4.3.1.9 When a transect sector provides three indicators of MEC use or proximity to MEC use, the SUXOS will consult with the Project Manager and Environmental Engineer for a recommendation regarding additional field sampling for further characterization of MEC quantities and distribution. This may involve additional sampling within the sector or around the sector to define a boundary.

3.9.4.3.2 Equipment

The geophysical survey equipment utilized will be the same for all DGM tasks. The survey platform consists of a man-portable EM61 MK2 system (0.5m x 1.0m coil), preferably in wheeled configuration. For areas requiring fiducial positioning (e.g. canopied areas), wheel mode must be employed due to the inaccuracies involved with utilizing time fiducials. As such, terrain over which data can be collected shall be restricted to that which can be safely traversed by a two person team (one with the pack, pushing the EM61 and one pulling the EM61 by means of rope or harness). Platform height off the ground surface will be maintained at the standard 16 inches due to the use of standard Geonics wheels. Regular DGM is anticipated to utilize EM61 MK2 sensors in conjunction with a DGPS positioning unit. Tasks involving DGPS will set the collection rates at once per second for the DGPS and at 10-12 times per second for the EM61. For wheel fiducials, sample separation shall be set to one sample every 0.1m.

For the DGM tasks, the processing system will utilize computers installed with Geonics DAT61, Geosoft Oasis Montaj base package with UX-Detect extension module, and a mixture of other (off-the-shelf and proprietary) programs in order to process the data.

3.9.4.3.3 Procedures

Field procedures will begin and end each day with the QC tests discussed in section 3.7. In between the QC tests, all of the production activities such as DGM activities with their associated procedures will be completed. DGM will involve a three-person team collecting DGPS integrated and / or wheel fiducial EM61 data in transects and grid patterns. Digital data will be recorded to the field PC (Allegro) and manual data, such as grid maps and pertinent QC information, will be recorded on sheets similar to Attachment A (see Appendix F) for each set of transects or grid(s) surveyed. More details are provided in the QC, Reacquire, and DGM sections to follow.

3.9.4.3.4 Personnel

Key personnel and their roles were provided previously in Section 2.3.

3.9.4.3.5 Production Rates

Transect collection rates are highly dependant on a number of factors, including terrain and surface conditions and length and separation of transects, however, EOTI anticipates in the order of 3 to 5 miles per day. Transect collection rates in areas requiring wheel fiducials are anticipated to be significantly lower due to the extra time required for laying out measurement constraints (fiducial markers) along the transect segments.

As grids (25’ x 25’, but up to 200’ x 200’) will be emplaced and surveyed after processing of the transect data on the basis of anomaly density, production rates cannot be estimated due to the unknown number and separation of grids. Where feasible, however, grids should be placed contiguously to better facilitate collection.

For larger grids (up to 1 acre in area), EOTI would estimate a collection rate of up to 1 to 1.5 acres per day for DGPS and up to 0.75 to 1 acres per day, wheel fiducial, dependant on terrain and vegetation density. For smaller (25’ x 25’) grids, EOTI would estimate somewhere in the order of 8 individual grids per day depending on separation.

3.9.4.3.6 Data Spatial Density

Data spatial density for grids is to be in the order of 0.6 meters across-track for 90% or greater coverage and 1.5% less than or equal to 0.2 meters along-track for grids where DGM mapping is used to detect anomalies. Down line data density is restricted by the fiducial separation for wheel fiducial data.

3.9.4.4 Instrument Standardization

The following QC measures are to be implemented prior to conducting and/or during daily field operations (see Table 3.3). Each of the QC tests is outlined in detail within Attachment B of DID MR-005-05.01, however, the measures were reviewed briefly regarding their project-specific implementation, metrics, and frequency in the GPO Plan (section 3.7).

3.9.4.4.1 Dynamic Repeatability for DGM

A standard test item shall be placed within the grid (i.e. a small pipe or flat plate with a small area response. The item will be placed flush with the surface at a standard orientation). The standard response to this test item will be defined prior to the start of production field activities. Response repeatability to this standard test item in the mapping data will indicate data quality is consistent and sufficient for detection of the MEC items of interest. The dynamic repeatability test is a replacement for the predecessor repeat lines test.

Test item anomaly characteristics (peak response and size) shall be repeatable with an allowable variation of +/-25%. This test shall be preformed once per grid or dataset and a dataset will most likely be grouped into morning and afternoon sessions.

3.9.4.4.2 Blind Detection QC Seed Item Recovery

Based on the maximum consistent detection depths for 20 mm projectiles, 37 mm projectiles, MK2 grenades, and 60 mm mortars from the GPO EOTI will develop a blind seed program for QC of grids where analog or DGM methods will be used. All blind seed items will be buried between 95% and 100% of the depths established from the GPO. Blind seed items will be placed approximately one per acre for DGM/analog QC.

3.9.4.4.3 Full-DGM of GPO

The full DGM of GPO is the standard start of project test area whereby the DGM system is tested and validated for use on the project site. As with the production data, the grid is reviewed for general equipment operation quality and interpreted for peak anomaly locations in order to document the responses for future project use. The DGM of the GPO is described in Section 3.7. The field teams will only be required to make additional validation passes through the GPO if changes in the DGM platform or technology are deemed significant enough to merit an additional pass (e.g. replacement of coil), or if personnel change.

3.9.4.5 Data Processing, Corrections and Analysis

EOTI will utilize Geosoft's Oasis Montaj running the UX-process and UXO Detect Modules to process the data. EOTI will perform daily QC and data processing of all data sets.

3.9.4.5.1 Initial Field Processing

EOTI will perform data file QC review and correction of the following:

2. Grid name and location
3. Line numbers, survey direction, start and end points
4. Removal of data drop-outs, spikes and physical feature interference sources.

3.9.4.5.2 Standard Data Analysis

EOTI will perform the following corrections where appropriate:

5. Positional offset correction
6. Sensor bias, background leveling and/or standardization adjustment
7. Sensor drift correction
8. Latency correction

3.9.4.5.3 Advanced Data Processing, Digital Filtering and Enhancement

During DGM tasks, advanced processing steps and analyses steps will be implemented based on which are deemed most effective for the local area using information gathered during the intrusive investigation and feed-back processes. At this time, EOTI infers that one or two of the techniques will be deemed most effective for finding the most probable munitions in the local area, as verified by intrusive results.

3.9.4.5.4 Anomaly Selection and Decision Criteria

3.9.4.5.4.1 EOTI will determine the optimum gridding method, search criteria, and contour level selection with background shading target selection criteria and ranking based on the data collected from the GPO. EOTI will discuss these parameters with USACE prior to beginning production of the draft report figures.

3.9.4.5.4.2 Colored maps will be constructed in accordance with Attachment D, DID MR-005-05.01, Geophysical Map Deliverable Format.

3.9.4.6 Dig Sheet Development

Dig sheets will be constructed in accordance with Attachment C, DID MR-005-05.01.

3.9.4.7 Reacquisition

EOTI will reacquire geophysical target anomalies identified as priority targets on the dig sheets for excavation and utilize a precision surveying method to identify the location. EOTI will also utilize an EM61 MK2 during reacquisition activities. EOTI will mark the location of each identified anomaly shown on the dig sheet with a non-metallic pin flag to within 3 inches of the calculated location and then confirm presence of anomaly with the EM61. EOTI has assumed a reacquire rate of 50 targets per day.

EOTI shall reacquire anomalies along transects in wooded areas using distances from stakes (e.g. 4.5 meters from stake B1 towards stake B2). Each reacquired anomaly location will be marked using a non-metallic pin flag, with anomaly sequence number marked on the flag in indelible ink.

In areas were EM61 grid data is collected using wheel fiducial mode, targets will be reacquired using distances from corner stakes (e.g. 5.75 meters from the south west corner stake in the ‘x’ direction and 10 meters from the south west corner in the ‘y’ direction). Each reacquired anomaly location will be marked using a non-metallic pin flag, with anomaly sequence number marked on the flag in indelible ink.

The reacquisition surveys will be performed in accordance with DID MR-005-05.01 and the Geophysical Investigations for Buried Munitions Operational Procedures and Quality Control Manual. Reacquisition and dig results will be entered on the dig sheets as required in DID MR-005-05.01 Attachment C

3.9.4.8 Feed-Back Process

Geophysical oversight will be provided during the intrusive investigation processes in order to evaluate the dig results compared to the original DGM responses, as tabulated on the dig

sheets. The review will not only determine whether the metallic items detected were likely removed ("intrusive investigation results agree with DGM results") but will also determine if there are any noticeable patterns of obvious successes ("ordnance finds have these parameters in common") or failures ("no finds have this parameter in common"). Such observations will be documented so that future operations can benefit through a feed-back process. Lastly, any observations that are deemed to be due to intrusive investigation field procedure errors will be communicated directly to the teams in order to improve current operations.

3.9.4.9 Quality Control

3.9.4.9.1 EOTI will utilize the Geosoft USACE Oasis Montaj UXO Quality Control and Quality Assurance System Software to QC geophysical data where applicable. The instrument standardization tests related to QC procedures are described by their methods, frequency, and task-specific applications in section 3.7.8.

3.9.4.9.2 If an instrument does not meet the standard set in section 3.7.8, it will be re-calibrated, repaired or replaced. Operational and test procedures will conform to manufacturer's standard instructions. All geophysical instruments and equipment used to gather and generate field data are calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

3.9.4.9.3 All raw data from field measurements (including both the required Intrusive Investigation Dig Sheets and optional DGM DID MR-005-05.01, Attachment A field forms) will be appropriately recorded during each day and scanned digitally each night. During the subsequent days, the information will be transcribed digitally to the files by an administrative assistant with the Site Geophysicist / SUXOS reviewing the final product prior to delivering to USACE. Data reduction and analysis methodologies will be dependent upon those geophysical methods selected.

3.9.4.10 Corrective Measures

Problems noticed during daily QC test monitoring, intrusive investigation, or intrusive verification activities such as equipment or human operation errors that are noticed during subsequent cause-effect data review will be documented with a root-cause analysis to follow. Once the analysis is complete, a solution will also be documented and implemented as a corrective measure in order to solve the problem. Examples may include changing out faulty equipment or possibly changing field procedures in order more effectively complete tasks.

3.9.4.11 Records Management

Project documentation will be collected and managed by EOTI and will be kept on site during the field portion of the subsurface investigation for inspection by the USACE on-site manager. Additionally, data will be managed and posted on EOTI's file transfer protocol (FTP) site. In general, all data management will be consistent with Huntsville District's Draft Life Cycle Data Management (LCDM) guidelines. Copies of data will made on a daily basis and maintained at an off-site storage location. This off-site storage of data will further

reduce the likelihood that data will be lost. Transfer may be accomplished by e-mail attachment, FTP, or overnight delivery of CDs.

3.9.4.12 Interim Reporting

EOTI will provide Weekly and Monthly Status Reports to the USACE PM. EOTI will post the raw geophysical data in digital format to the web-based data management system no later then 48 hours after collection. USACE can view and download data for evaluation. All finalized data will be provided to USACE on a weekly basis.

3.9.4.13 Map Format

EOTI will generate a map format that will follow the guidelines of DID MR-005-05.01, Attachment D using Geosoft Oasis Montaj software. For the required intrusive investigation tasks, EOTI will tabulate the data and then provide/display the data using a combination of Microsoft Excel, Microsoft Access, and Environmental Systems Research Institute (ESRI) software packages.

3.9.5 Geophysical Investigation Performance Goals

3.9.5.1 The Geophysical Investigation Performance Goals are delineated into the following three subject categories, based on guidelines from USACE provided within the DID MR-005-05.01:

1. Detection of MEC or other munitions;
2. Horizontal Accuracy; and
3. False Positives.

3.9.5.2 Accordingly, the current specifications pertaining to performing GIP-related activities after the mobilization is completed to Culebra Island, will be discussed in order of appearance as listed above.

3.9.5.3 Detection of Munitions and Explosives of Concern (MEC)

Successful performance will be measured by detection of ordnance-related items of interest down to depths of 11 times the ordnance item diameter (or width) within the designated investigation areas. The performance standard will also be limited to ordnance-related items with geophysical responses that are greater than or equal to 20mm, as initially established at the maximum detected seeded depth within the GPO. The smallest detected ordnance-related item of interest may change based on the GPO results, and therefore the performance standard may change as well. Ultimately, the performance standard is based on the GPO.

3.9.5.4 Horizontal Accuracy

Horizontal accuracy requirements have been established and are required to be met during the lifetime of the project. First, 95 percent of all reacquired anomaly locations must lie within a 1-meter radius of their original surface location as marked on the dig sheet. Second, 95 percent of all excavated items must lie within a 35-centimeter radius of their mapped surface location as marked in the field after reacquisition. The first metric requires that all significant peak anomaly positions that are marked during the reacquire interrogation sweep

process must lie within one meter, or roughly to the nearest line of data, of the starting-point (centroid) reacquire location. The second metric requires that all significant post-peak-adjusted end-point reacquire locations must have metal pieces found within a roughly 1/3 meter (35 centimeter) of the end-point reacquire locations. If a pattern of offsets are noticed while evaluating the results of either the first metric (DGM to reacquire difference) or the second metric (reacquire to intrusive difference), corrective measures will be discussed and provided to USACE by EOTI.

3.9.5.5 False Positives

If there are more than 15 percent "false positives," a re-evaluation of the data, detection methods being utilized and overall project QC shall be performed. False positives are defined as anomalies reacquired that result in no detectable metallic material recovered during excavations, calculated as a running average for the sector.

3.9.6 Geophysical Mapping Data

3.9.6.1 The Geophysical Mapping Data is delineated into the following three (3) subject categories, based on guidelines from USACE provided within DID MR-005-05.01:

- Sensor and Navigational Data Correlation;
- Geophysical Data Analysis and Reporting;
- Anomaly Excavation and Reporting.

3.9.6.2 Accordingly, the current specifications pertaining to DGM related activities on Culebra Island, will be discussed in the order listed above. The discussion to follow will be a review to aid tie-in of previously introduced topics on field data collection, processing, and deliverables preparation techniques found in sections 3.9.4.3, 3.9.4.4, and 3.9.4.5.

3.9.6.3 Sensor and Navigational Data Correlation

3.9.6.3.1 The man-portable sensor and navigational equipment for DGM activities is the Geonics EM61 MK2 in man-portable wheeled mode in conjunction with RTK DGPS and / or wheel fiducials. The EM61 MK2 will be sampled at least 10 times per second while the DGPS will be updated once per second. Wheel fiducial data will have a sample rate set at one reading every 0.1m.

3.9.6.3.2 DGM sensor data shall be pre-processed for sensor lag, drift, and additional corrections as needed. All pre-processing and advanced processing steps (detailed in section 3.9.4.5) will be completed and digital deliverables of raw, processed, final, and interpretation results for individual grids in the standard Geosoft XYZ ascii format. EOTI will utilize Geonics DAT61, Geosoft Oasis Montaj with UX-Detect module, and other proprietary software packages to complete all processing, visual display, and deliverables preparation activities.

3.9.6.4 Geophysical Data Analysis, Field Reacquisition, and Reporting

As an overview, EOTI will primarily utilize Geosoft Oasis Montaj for all data analysis techniques that may include (but are not limited to) the following: amplitude analysis,

depth/size estimations, threshold area estimations, and decay curve analyses. The final data analysis and subsequent anomaly prioritizations for future DGM data collection are highly dependent on the feedback process during the upcoming intrusive operations. At this time, EOTI expects some techniques to be more effective at the site than others. Thus, not necessarily all of the previously outlined analysis methods may be implemented. The reporting of anomaly prioritizations for intrusive investigation will occur either within individual Attachment C style dig sheets or database equivalent as stated in the DID. Additional details for processing and related data analysis steps are discussed in section 3.9.4.5.

3.9.6.5 Anomaly Excavation Reporting

As required by the DID, EOTI will excavate all anomalies marked in the field with unique identified PVC pin-flags. The intrusive information, recorded on the dig sheet, will include details such as depth, orientation, size, offset, and additional required reporting information as listed in DID MR-005-05.01, Attachment C. The Site Geophysicist will review the intrusive records to qualitatively verify that the metal removed was enough to generate the response characteristics calculated during processing of DGM data. Any noticeable patterns in ordnance, non-ordnance, clutter or no-finds that are specifically related to reported data analysis patterns (timegate, area, depth, etc.) that were utilized during the original prioritization decision-making process will be documented. The documented patterns will be used in a feed-back process in order to improve future DGM, reacquisition, and intrusive operations.

3.9.7 Geophysical Investigation Plan (GIP) Summary and Conclusion

Since the GIP (Section 3.9) have been discussed according to their subject categories provided within the DID, this portion of the work plan is complete.

3.10 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

3.10.1 General

3.10.1.1 The foundation of the GIS will be derived from existing data developed during previous site efforts at Culebra Island. Mr. Matthew S. Norris (EOTI's GIS Manager) has acquired the existing GIS provided by the Government, and will expand it to meet the needs of the project. The GIS will be maintained through the project's life cycle and accumulate all associated geospatial data along with base map layer and analysis data.

3.10.1.2 Accuracy

3.10.1.2.1 GIS data developed for the field activities for this project is subject to accuracy restraints dictated by the DGPS accuracy used to reacquire the Geophysical anomalies. During surface activities, results will be collected using a handheld data collection (HDC) system developed by EOTI. The system will utilize the Trimble GeoXT GPS unit. The accuracy of this GPS model is sub-foot during data collection; furthermore, the unit will utilize the Federal Aviation Administration (FAA) and the Department of Transportation (DOT) Wide Area Augmentation System (WAAS). WAAS corrects for GPS signal errors caused

by ionosphere disturbances, timing, and satellite orbit errors. This eliminates need for GPS base station, in turn reducing cost and vital field time during the duration of field activities.

3.10.1.3 Geographic Information Systems (GIS) Incorporation

3.10.1.3.1 The foundation of the GIS will be derived from base layers collected from State and or local Government agencies such as local fire departments, local engineering department, state GIS clearinghouses, and previous MEC related investigations conducted at the project site. All data will be converted or digitized into ArcGIS shapefile and or Geodatabase formats to streamline data and avoid multiple data formats.

3.10.1.3.2 All data collected during field activities will be submitted to the GIS Manager daily through EOTI's secure FTP site. The GIS Manager will perform QC measures on all Geophysical and MEC field data to elevate formatting or incorporation issues. Collected data will be incorporated into the GIS and conform to the Universal Transverse Mercator (UTM) projection, a datum of GCS North America 1983 (NAD83), and with linear unit of measure in Meters. All Geospatial data delivered to USAESCH will conform to Universal Transverse Mercator projection, and a datum of GCS North America 1983 (NAD83) with linear units of measure in Meters, as specified in the PWS.

3.10.1.3.3 Mr. Norris will maintain GIS quality control data for the project. QC procedures will be performed periodically on the GIS datasets for inaccuracies that may jeopardize the stability of the GIS and spatial data it contains. Any inaccuracies that arise will be reviewed to determine if the error rests on the GIS incorporation methods or if the actual field data is inaccurate. After the error assessment has been completed, the EOTI Project Manager (PM) will be made aware of the inaccuracies and a formal error assessment report will be submitted by the GIS Manager. The GIS Manager will take proper action to resolve the error and retain stability over the GIS database.

3.10.1.3.4 Additional data entered or modifications to the existing GIS will be noted with revision dates. This will also be captured in the geospatial dataset's Federal Geographic Data Committee (FGDC) metadata.

3.10.1.3.5 All Spatial data incorporated into the project specific GIS will conform to the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) standards to give all spatial datasets more compatibility with other government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for spatial layers that have been created by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigation, imagery, etc., will contain previously developed metadata created by the originator. All GIS data will be developed and incorporated in to ESRI's Shapefile or Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the final report. All Spatial Imagery during the life of the project will transferred in to LizardTech MrSID format to help in reducing image file size. The client will have the option to receive the imagery in MrSID format of Tiff (Tagged Image File Format) with submission of the final report. All GIS and Geophysical data will be available throughout the project's life on EOTI's Secure Project collaboration website (http://www.eoti.net/). Access to the website

will be limited to EOTI and the CEHNC project management. If the CEHNC PM elects to add additional personnel or additional subcontractors related to the project then the CEHNC PM must submit in writing the person's name, title, company working for, contact information, and relation to the project.

3.10.1.4 Plotting

3.10.1.4.1 EOTI anticipates hard copy printouts will be utilized of the project. Hard copy map graphic scales will be based on standard mapping scales. Maps will be developed showing progress results of clearance activities. Maps will be available in hard copy of digital PDF format to CEHNC.

3.10.1.5 Mapping

3.10.1.5.1 All survey points related to designated work areas will be incorporated into the project specific GIS. Each area will be identified by alpha-numeric designator and boundary coordinates on all hard copy and digital PDF maps. Maps will include true north and magnetic north arrows with the difference between them on degree and minutes shown. Tic marks at standard interval with UTM coordinate designators for the specified area that the map covers will be shown on the edge of the map. A map legend with standard mapping symbols and map index showing area covered on map in relationship to project boundary will be displayed on the map.

3.10.2 Computer Files & Digital data Sets

3.10.2.1 EOTI utilizes ESRI's ArcGIS version 9.x in development of comprehensive and accurate geospatial data. EOTI proposes to submit the most current GIS as part of any report submitted to the CEHNC. This will include ArcGIS project files and metadata for the geospatial data that is referenced in the project files.

3.10.2.2 The GIS will be updated on a daily basis throughout the projects life cycle. Updating on a routine basis will facilitate EOTI planning efforts and Government progress tracking of clearance and or investigation efforts. The Government and other stakeholders will have the ability to view progress and project data in a map-based environment and to view the tabular data associated with the GIS vector data.

3.10.2.3 EOTI's GIS staff will produce updated maps on a weekly basis, which will be provided to the Government in the weekly report. The maps will document the work efforts that were conducted from the prior week. Digital PDF copies of the maps will be uploaded to the project collaboration website and made available to the Government. All GIS data and ArcGIS projects will be developed and incorporated in to the ESRI's Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the final report. All spatial imagery during the life of the project will be transferred into LizardTech MrSID format to help in reducing image file size unless stated otherwise by the Government.

3.10.2.4 All MEC items that are discovered during the investigation and are determined or suspected of containing energetic material will be documented within the GIS. Coordinates for the individual items will be collected using handheld data collection (HDC) system developed by EOTI in coordination with the Trimble GeoXT GPS unit prior to blow in place, consolidation, or removal operations beginning.

3.10.2.5 External tabular data that is not integrated within the Geodatabase will be provided to the Government in ANSI SQL format as well as Microsoft Access at the completion of the project. All supporting databases will be complete and single entities, with no relations or joined connections to others.

3.10.2.6 All geospatial data developed by EOTI will be incorporated into the project specific GIS and will conform to the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) standards and the USAESCH and CEHNC data standards to give all spatial datasets more compatibility with other Government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for core MEC-GIS data layers. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigations, etc., will contain previously developed metadata created by the originator.

3.10.2.7 EOTI will deliver the project specific Geodatabase on DVD media. The Geodatabase that will accompany the weekly reports submitted to the CEHNC will either be delivered by e-mail, or if file sizes are to immense for e-mail, then the Geodatabase will be either uploaded to the project collaboration site hosted by EOTI or will be uploaded to a password protected FTP site for download.

3.10.2.8 GIS data will be available throughout the projects life on EOTI's Secure Project collaboration website. Access to the website will be limited to the EOTI Team, CEHNC project personnel, and others authorized by CEHNC. Spatial data created for the project will be developed and managed in ESRI-compliant formats (Shapefiles or Geodatabases) throughout the life of the project. All project data and project related documents will be incorporated into the project specific GIS and will be available on-line to the government and invested parties through EOTI's secure project specific collaboration / Web-GIS throughout the projects life cycle.

3.11 INTRUSIVE INVESTIGATIONS

3.11.1 General Methodology

3.11.1.1 Subsurface investigations will be performed on all anomalies selected by the Site Geophysicist. Intrusive investigation teams, consisting of at least two UXO-qualified individuals and equipped with Whites, Global Positioning System (GPS), field computer and hand digging implements will conduct excavations. A visual and electronic search of the excavation will be made until the anomaly is located. If the subsurface target is unable to be located, the data for undiscovered anomalies will be reviewed by the project geophysicist and the MEC team supervisor(s).

3.11.1.2 Upon excavation, the intrusive investigation team will record the location, identification, and attributes of the excavated item (either manually on a dig sheet or electronically in a field computer). In all cases where occupied structures may be within the pre-established exclusion zone (EZ) distance, an engineering control, such as a Miniature Open Front Barricade (MOFB) aka "Bud Light" or other equally protective control measure will be used to preclude having to unnecessarily evacuate occupied structures. The EZ is based on the minimum safe distances found of Table 1.1. This procedure will be followed whenever an inhabited building is within the pre-established EZ distance for the munitions with the greatest fragmentation distance (MGFD). In the event an ordnance item other than those listed in Appendix G is encountered, the USACE OE Safety Specialist and the UXOSO will make the determination as to what procedures need to be taken (to include evacuation).

3.11.1.3 MEC located during the subsurface search will be reported to the SUXOS. A description of all MEC, munitions debris, and non-munitions debris recovered will be recorded and incorporated into the project database. Recorded data will include, where possible, size, estimated weight, orientation, depth bgs, and description of the item excavated. If acceptable to move, suspected or known MEC will be consolidated for destruction.

3.11.1.4 Munitions debris will be inspected, certified as free of reactive constituents, and reclassified as Material Document as Safe (MDAS) prior to being placed in a lockable storage container. After confirming that the item causing the anomaly was removed, excavations will be back filled and tamped. The excavation site will be returned as nearly as feasible to an undisturbed condition.

3.11.2 Accountability and MEC Records Management

3.11.2.1 A detailed accounting will be made of all MEC items encountered during the RI activities. This accounting will include the nomenclature (if applicable) type, approximate weight, depth, orientation, condition, and location of the item indicated. The UXO Tech III (team leader) will record specific details regarding the material found, including (but not limited to), the following: specific nomenclature, type of fusing, condition, and external markings. The X, Y, and Z coordinates and disposition of the item also will be recorded.

3.11.2.2 Each suspected MEC item encountered will be entered on the MEC Accountability Log. The SUXOS will prepare and submit the MEC Accountability Log using the Daily

Report and/or disposal record. The SUXOS will provide copies of the MEC Log to the EOTI PM. The intrusive investigation data will be compiled on a weekly basis and sent to EOTI PM for review. Excavated anomaly attributes will also be added to the project GIS database.

3.11.2.3 The inventory count of MEC items will be conducted by the SUXOS and UXOQC/SO on a weekly basis and any discrepancies with the project database will be reported immediately to the CEHNC OE Safety Specialist and EOTI PM.

3.11.3 UXO Personnel Qualifications

Each intrusive investigation team will be comprised of a Technician III and up to six UXO Tech II/I. It is anticipated that two intrusive investigation teams will be utilized during the RI. In addition, a SUXOS and UXOQC/SO be on the project site during all intrusive investigations. The qualifications for these personnel are included in Chapter 2, Technical Management Plan.

3.11.4 MEC Sampling Locations

UXO personnel will excavate subsurface geophysical targets identified, as a result of the geophysical mapping and data evaluation effort, and picked for excavation using the RI/FS DQO methodology and model. Therefore, MEC sampling locations will be along the same path that the geophysical investigation teams used to collect the subsurface data. The routes for geophysics and MEC sampling will be conceptual in nature and are subject to change slightly in accordance with site topography, vegetation and avoidance of sensitive species habitat. During the field activities, revised field maps will be generated that illustrate the actual paths taken with anomaly points selected for MEC sampling for use by field crews and QC personnel.

3.11.5 MEC Sampling Procedures

3.11.5.1 Subsurface MEC Investigation

The equipment requirements for this activity include:

- Geophysical Instrumentation to identify the geophysical target and assess proximity to subsurface metallic anomalies and/or MEC during progress of excavation.
- Miscellaneous common hand tools (e.g., screwdrivers, digging implements)
- Field computers, forms and logbooks to record activities

3.11.5.1.1 Anomaly locations identified by EOTI will be recovered using the EM61 in conjunction with GPS equipment to navigate to the coordinates of each predicted geophysical target identified during DGM data processing and interpretation. The anomaly reacquisition team will refine the anomaly location and methods that were demonstrated and approved at the GPO.

3.11.5.1.2 A geophysical reacquisition team will use an GPS system to determine the location of the anomaly based on the UTM coordinates reported on the field computer dig sheet. Reacquisition teams will search a 3-foot radius to delineate the exact location of the

anomaly's peak. If the anomaly is found, a pin flag will be placed at the actual anomaly location. The signal response, offset distance, and direction from the re-acquired location will be noted in the field computer. If the anomaly is not found a probable source for the reacquisition failure will be examined.

3.11.5.2 Near-Surface Anomalies

Near-surface anomaly sources are those that are partially exposed or suspected to be within 1 ft of the surface and that can be excavated using hand tools. These anomalies will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Technicians will use White's metal detectors to check and verify the proximity of the anomaly source.

3.11.5.3 Subsurface Anomalies

Subsurface anomalies are those caused by sources that are more deeply buried > 1 ft bgs. Mechanical methods may be used to excavate all subsurface anomalies to within one foot of the anomaly source. Mechanical excavation will be done in lifts. After each lift, the anomaly location will be redefined with the White. This process will continue until the source of the anomaly has been uncovered and identified.

3.11.6 Munition with the Greatest Fragmentation Distance / Minimum Separation Distances

3.11.6.1.1 See Table 1.1 for a complete list of munition with the greatest fragmentation distance (MGFD) and minimum separation distances (MSD) for each area of concern.

3.11.7 MEC Identification

3.11.7.1 All MPPEH recovered during this project will be handled and processed in accordance with Chapter 14, Corps of Engineers Contractors MPPEH Inspection, Certification, and Final Disposition Procedures of EM 1110-1-4009, dated 15 June 2007.

3.11.7.2 EOTI will comply with the following procedures for processing MPPEH for final disposition. The objective of these procedures is to ensure that an inspection procedure of the exterior and interior surfaces of all recovered MPPEH is in place to ensure these items do not present an explosive hazard.

3.11.7.2.1 Unexploded Ordnance (UXO) Tech I can tentatively identify a located item as MPPEH, followed by a required confirmation by a UXO Tech II or III

3.11.7.2.2 UXO Technician II will:

3.11.7.2.2.1 Perform a 100% inspection of each item as it is recovered and determine the following:

- Is the item a MEC, a DMM, munitions debris, or range related debris?
- Does the item contain explosives hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization (demil) or venting to expose dangerous fillers?

• Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic or radiological waste (HTRW) materials?

3.11.7.2.2.2 Segregate items requiring demil or venting procedures from those items ready for certification.

3.11.7.2.2.3 Items found to contain explosives hazards or other dangerous fillers will be processed in accordance with applicable procedures.

3.11.7.2.3 UXO Technician III will:

3.11.7.2.3.1 Perform a 100% re-inspection of all recovered items to determine if free of explosives hazards or other dangerous fillers and engine fluids, illuminating dials and other visible liquid HTRW materials?

3.11.7.2.3.2 Supervise detonation of items found to contain explosive hazards or other dangerous fillers and venting/demil procedures.

3.11.7.2.3.3 Supervise the consolidation of MDAS and Range-related Debris for containerization and sealing. MDAS and Range-related Debris will be segregated.

3.11.7.2.4 UXO Quality Control (QC) Specialist will:

3.11.7.2.4.1 Conduct daily audits of the procedures used by UXO teams and individuals for processing MPPEH.

3.11.7.2.4.2 Perform and document random sampling (by pieces, volume or area) of all MPPEH collected from the various teams to ensure no items with explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials are identified as munitions debris or range-related debris as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.

3.11.7.2.5 UXO Site Safety Officer (UXOSO) will:

3.11.7.2.5.1 Ensure the specific procedures and responsibilities for processing MPPEH for certification as MDAS or range-related debris specified in the work plan are being followed.

3.11.7.2.5.2 All procedures for processing MPPEH are being performed safely and consistent with applicable regulations.

3.11.7.2.6 Senior UXO Supervisor will:

3.11.7.2.6.1 Be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH for final disposition as MDAS or range-related debris.

3.11.7.2.6.2 Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all MDAS and range-related debris to be transferred for final disposition.

3.11.7.2.6.3 Perform random checks to satisfy that the MDAS and range -related debris is free from explosive hazards necessary to complete the Form, DD 1348-1A.

3.11.7.2.6.4 Certify all MDAS and range-related debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials.

3.11.7.2.6.5 Be responsible for ensuring that inspected debris is secured in a closed, labeled and sealed container and documented as follows;

• The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification that will start with USACE/Installation Name/EOTI /0001/Seal's unique identification and continue sequentially.

• The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.

• A documented description of the container will be provide by EOTI with the following information for each container; contents, weight of container; location where munitions or range-related debris was obtained; EOTI, names of certifying and verifying individuals; unique container identification; and seal identification, if required. EOTI will, in a separate section of the final report also provide these documents.

3.11.8 MEC Removal

3.11.8.1 MPPEH Certification and Verification

3.11.8.1.1 EOTI will ensure that MPPEH is properly inspected in accordance with the procedures in Section 3.11.7. Only personnel who are qualified UXO personnel will perform these inspections. The Senior UXO Supervisor will certify and the USACE OE Safety Specialist will verify that the debris is free of explosive hazards. If the USACE OE Safety Specialist is not on-site, the UXOQCS, or a similarly trained individual can be delegated to verify the debris as free of explosive hazards (Paragraph I.11.B.01, EM 385-1-97).

3.11.8.1.2 DD form 1348-1A will be used as certification/verification documentation. All DD1348-1A must clearly show the typed or printed names of the Senior UXO Supervisor and the USACE OE Safety Specialist, organization, signature, and EOTI MEC Operations office and field office phone number(s) of the persons certifying and verifying the debris as free of explosive hazards.

3.11.8.1.2.1 Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplementation to these procedures.

3.11.8.1.2.2 In addition to the data elements required and any locally agreed to directives, the DD 1348-1A must clearly indicate the following for MDAS:

- Basic material content (Type of metal; e.g., steel or mixed)
- Estimated weight
- Unique identification of each of the containers and seals stated as being turned over.
- Location where MDAS or range-related debris was obtained.
- Seal identification, if different from the unique identification of the sealed container.

3.11.8.1.2.3 The following certification/verification will be entered on each DD 1348-1A for turn over of MDAS or range-related debris and will be signed by the Senior UXO Supervisor and the USACE OE Safety Specialist. If the USACE OE Safety Specialist is not on-site, the UXOQCS, or a similarly trained individual can be delegated to verify the debris as free of explosive hazards (Paragraph I.11.B.01, EM 385-1-97). This statement will be used on any ranges where Range Related Debris is being processed along with MDAS: "This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials."

3.11.8.1.2.4 The following certification/verification will be entered on each 1348-1A for turn over of MDAS and will be signed by the Senior UXO Supervisor on properties where only MDAS is being processed: "This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."

3.11.8.2 Maintaining The Chain Of Custody And Final Disposition

3.11.8.2.1 EOTI, in coordination with the Corps of Engineers, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will only be released to an organization that will:

3.11.8.2.1.1 Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. This will be signed on company letterhead and stating that the contents of these 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.

3.11.8.2.1.2 Send notification and supporting documentation to EOTI's documenting that the sealed containers have been smelted and are now only identifiable by their basic content.

3.11.8.2.1.3 This document will be incorporated EOTI's final report as documentation for supporting the final disposition of MDAS and range-related debris.

3.11.8.2.1.4 If the chain of custody is broken, the affected debris must undergo a second 100 percent inspection, a second 100 percent re-inspection, and be documented to verify its explosives safety status (identified as either MDAS or range related debris).

3.11.8.2.2 Material that has been documented as safe is no longer considered MPPEH as long as the chain of custody remains intact. A legible copy of inspection, re-inspection, and documentation must accompany the material through final disposition and be maintained for a period of 3 years thereafter.

3.11.8.2.3 Material that is still MPPEH after inspection may be released only to a qualified receiver.

3.11.8.2.3.1 The following must be accomplished prior to release of the property:

3.11.8.2.3.1.1 Ensure that MPPEH that has been documented as hazardous is only transferred or released to those entities that:

- Have the licenses and permits required to receive, manage, or process the materials.
- Have technical expertise about the known or suspected explosive hazards associated with the MPPEH.
- Are qualified to receive, manage, and process MPPEH in accordance with DoD Instruction 4140.62.
- Have personnel who are:
    - Experienced in the management and processing of hazardous materials equivalent to the MPPEH.
    - Trained and experienced in the identification and safe handling of used and unused military and/or any potential explosive hazards that may be associated with the specific MPPEH.

3.11.8.2.3.1.2 The receiver must be advised of all of the potential hazards associated with the MPPEH and agree to receive and process the material IAW with DoD Instruction 4141.62.

3.11.8.2.3.1.3 All MPPEH shipments over public transportation routes must comply with DoD guidance that implements hazardous material transportation regulations.

3.11.8.2.3.1.4 Ensure that chain of custody and accountability records are maintained through final disposition of MPPEH. A legible copy of inspection, re-inspection, and documentation must accompany MPPEH through final disposition and be maintained for a period of 3 years thereafter.

3.11.8.3 Managing MEC

3.11.8.3.1 At least two UXO qualified personnel (Tech II or above) must be in agreement on the condition of a live or suspected live MEC item before any removal action is attempted. All available data sources will be consulted prior to this determination.

3.11.8.3.2 As MEC items are located they will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all live/suspected MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification (ID) Number (a unique number)
- Location;
- Nomenclature;
- Fuse Description;
- Fuse Condition; and
- Additional comments, if required.

3.11.8.3.3 Each suspect MEC item encountered will be identified using a unique numerical identifier, such as 3-C-6–0001 (for first live/suspect item (0001) encountered in Site 3, Grid 3-C-6).

3.11.8.4 Record Keeping

3.11.8.4.1 Any MEC item found will be carefully uncovered, so that it can be examined to determine the item and its condition. Each item will be identified in the logbook and on the dig sheet. A detailed accounting of all live MEC items encountered during the investigation / removal activities will be maintained. The Team Leader will provide validated data to the SUXOS at the close of each working day.

3.11.9 MEC Storage

3.11.9.1 Off-Site Transportation

EOTI does not anticipate transporting any MEC / MPPEH items off-site for disposal.

3.11.9.2 Safe Holding Areas

Please see the Explosive Siting Plan for Culebra Island.

3.11.9.3 Each type of live or suspect MEC item encountered will be identified using a unique numerical identifier. Photographs of live or suspect MEC items will be taken for documentation purposes. A ruler or some similar item, to show scale, should be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the SSFR; thus, a focused, well thought out photograph, paying particular attention to lighting and shadows, is necessary.

3.11.10 MEC Reporting And Disposition

3.11.10.1 Personnel Responsibilities

3.11.10.1.1 SUXOS – The SUXOS has overall responsibility for reporting and disposition of MEC. He will:

- Coordinate all disposal/demolition operations with the demolition team;
- Ensure a MEC Accountability Log is maintained.
- Ensure the accuracy of field data and providing verified data for posting to website.
- Assure that MDAS generated from any demolition operations is inspected prior to removal from the site.
- Inspect all recovered munitions and range-related debris.
- Collect and review the raw field data for accuracy; and
- Provide the verified data to the Oak Ridge office for posting to EOTI's project collaboration website.
- The data will provide the information for the Final Report.
- For documentation purposes, photographs will be taken of encountered live MEC and MDAS stockpiles. The photograph will be taken to show detail and will be annotated with the location or area discovered.
- Photographic records will be used to supplement information recorded as needed.

3.11.10.1.2 UXOSO/QCS – The UXOSO/QCS is responsible for insuring all MEC operations meet safety and quality requirements. He will:

- Verify processes by which munitions and range-related debris is inspected and certified to be free of explosives; and
- Insure compliance with all requirements of the QC Plan.
- Insure dig sheets are properly filled out with the accuracy and completeness required.
- Verify the identification of MEC items;
- Assure the area is clear prior to capping in by the demolition team; and
- Insure compliance with all requirements of the SSHP.

3.11.10.1.3 UXO Tech III – The UXO Tech III is responsible for the supervision of the UXO team.

3.11.10.1.4 UXO Tech III – The UXO Tech III is responsible for the supervision of the MEC disposal operation. He will:

- Confirm the identification of MEC items;
- Post individuals at entry points (if required);
- Construct appropriate engineering controls in accordance with "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions," HNC-ED-CS-S-98-7, August 1998 if required;
- Assign team members to specific demolition duties;
- Assure the area is clear prior to capping in for demolition operations; and
- Check the area following each shot or series of shots.

3.11.10.1.5 UXO Tech II – The UXO Tech II will:

- Provide identification of MEC items; and
- Perform duties as assigned.

3.11.10.1.6 UXO Tech I – The UXO Tech I will perform demolition duties as assigned.

3.11.10.2 Safety Precautions

Detailed specific safety procedures are described in the SSHP (Appendix D.) The following general safety precautions will be followed during the execution of this project:

- Only UXO qualified personnel (Tech II or above) will perform MEC procedures.
- A minimum of three personnel will be present during all MEC operations; two UXO-qualified personnel to conduct the MEC operation and one additional personnel to act as a safety observer.
- During all MEC operations, only the minimum number of personnel required to safely perform the task will be allowed on-site.
- Authorized visitors will be considered essential personnel and their presents will not effect site operations.
- Non-essential personnel will not be allowed on-site during UXO operations. EOTI personnel may escort essential non-UXO qualified personnel (Tech II or above) as required and to the extent that they are not exposed to unnecessary risk. Visitors must coordinate with the SUXOS and will receive a safety briefing prior to entering the exclusion zone.
- Non-essential personnel will be briefed on-site hazards prior to entering the project area.
- UXO operations will cease within EZ distance of non-essential personnel who are onsite.
- UXO personnel required for this project will include qualified UXO supervisors and technicians, all of whom possess the relevant U.S. military EOD or other approved qualifications and experience. Personnel for this project have been selected from a pool of available qualified UXO technicians.
- All UXO personnel assigned to this project will meet the personnel training and experience requirements set forth in the PWS and EP-1110-1-18, Engineering and Design, OE Response.
- Excavations will conform to EOTI's Corporate Safety and Health Program so that confined space hazards are not created.

- EOTI personnel will not attempt to remove any fuze(s) from the MEC and will not dismantle or strip components from any MEC.
- EOTI personnel are not authorized to inert any MEC items found on-site.
- MEC/UXO items will not be taken from the site as souvenirs.

3.11.10.3 MEC will be guarded, if necessary (e.g. accessible to the public), until disposal is accomplished. If possible, demolition operations will occur weekly on the last business day of the week.

3.11.11 MEC Disposal and Unidentifiable MEC

3.11.11.1 All MEC disposal operations will be conducted in accordance with the DOD 6055.9-STD, EP 385-1-95a, HNC-ED-CS-S-98-7, and the Puerto Rico Explosives Act. If unidentifiable MEC is found, the default separation distance specified in DDESB TP 16 will be used to establish the exclusion zone. Unidentified MEC will not be disposed of until the munitions filler can be determined. EP 385-1-95a and EP 75-1-3 provides guidance in helping to determine unknown explosive fillers.

3.11.11.2 EOTI will conduct demolition operations, as necessary to ensure that investigated items are free of explosive hazards prior to disposal. If an item is acceptable to move it may be consolidated for demolition operations [see Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 (Terminology Update April 2000)]. Munitions and range-related debris created or recovered during the operation will be collected in secure containers for disposal. This munitions and range-related debris will be disposed of through a local scrap dealer and will not be released to the public until it has been processed through a smelter or shredded.

3.11.11.3 If a MEC item is unacceptable-to-move (fuzed and fired) and the fragmentation zone does not include inhabited areas, it will be blown in place (BIP). If the fragmentation zone is in the vicinity of inhabited areas, then EOTI will utilize engineering controls to limit the fragment displacement distance thus reducing the fragmentation zone.

3.11.11.4 Access to the areas where disposal operations are conducted will be restricted and will be coordinated through USACE. Personnel deemed as non-essential to the demolition operation will be evacuated or assigned duties outside of the fragmentation zone.

3.11.11.5 The UXOSO is responsible for ensuring all personnel are accounted for during disposal operations and that the demolition operation is conducted in strict compliance with required procedures. The EOTI SUXOS and/or UXOSO will visually inspect the demolition site and announce all clear upon completion of demolition operations.

3.11.11.6 Site Controls

3.11.11.6.1 The ordnance items with the greatest fragmentation distance (MGFD) for each MRS/cayo is listed in Table 1.1. The required minimum separation distance (MSD) is for intentional detonations and unintentional detonations are also listed.

3.11.11.6.2 Controlling access to the site, closing roads, signs and barricades are all means of keeping the general public from accidentally wandering into the site during site operations. If unauthorized personnel are observed in the EZ, all MEC operations will cease until the area is cleared of unauthorized personnel.

3.11.11.7 Engineering Controls

3.11.11.7.1 Intentional Detonations. When the quantity-distance (Q-D) or MSD cannot be met, a sandbag enclosure may be used to meet the requirements for items up to 155mm in diameter. The sandbag enclosure shall be constructed in accordance with HNC-ED-CS-S-98-7, Paragraph 3.2 (a copy will be maintained on-site). The walls and sides will have a thickness equal to those listed in the MSD calculation sheets in Appendix G. If items other than those identified in Appendix G are destroyed by intentional detonation, distances and enclosure thickness will be determined, if possible, using Department of Defense Explosive Safety Board (DDESB) Technical Paper 16 and the associated fragmentation database. For items larger than 155mm in diameter, tamping in accordance with Chapter 6, A Method For Determining The Fragment Hazards Due To Detonation Of A Buried Munition, of DDESB TP16 - Methodologies For Calculating Primary Fragment Characteristics, will be used.

3.11.11.7.2 If necessary, a sandbag barricade will be constructed to ensure that species or habitats are protected. The barricade will be of sufficient height (2 to 4 feet tall) to protect the main part of the vegetation from fragmentation. Before and after photographs will be taken to show the extent of impact to the area after the detonation has occurred. To reduce noise and fragmentation during detonations, MEC up to 155 millimeters (mm) will be tamped with sandbags per United States Army Corps of Engineers (USACE) guidance documents. Items greater than 155 mm will be tamped using loose soil in accordance with the buried explosion module (BEM). Vegetation surrounding detonation points will be wetted to prevent fires. Water mitigation of fragmentation may be used in lieu of sandbags.

3.11.11.7.3 Unintentional Detonation

3.11.11.7.3.1 MSD applies from MEC areas to non-project personnel for ongoing surface or intrusive activities. Project personnel are defined as those contractor and Department of Defense employees who are onsite to conduct the removal action, plus any authorized visitors. All other personnel are considered non-project personnel. The MSD is the fragmentation distance for the MGFD for the area. EOTI will take appropriate measures to eliminate/reduce risk for exposures within the exclusion zone. Such measures (including the use of protective works, engineering controls, evacuation of inhabited buildings and traffic control) will be maintained on-site for the duration of the project. Any actions that require interaction with the public will be facilitated through the appropriate local Authorities.

3.11.11.8 Demolition and Post Demolition Operations

Upon completion of explosive demolition operations or explosive venting operations by the demolition team, the EOTI intrusive investigation team will return to the demolition site(s) and verify that the demolition site and surrounding area is free of explosive hazards. An instrument-assisted search will be done to recover fragments or other Munitions Debris resulting from the demolition operation and to ensure complete destruction of energetic material.

Demolition activities will be in compliance with:

- USAESCH Basic Safety Concepts and Considerations for OE Operations;
- DOD 6055.9 Std., DOD Ammunition and Explosive Safety Standards;

- Technical Manual (TM) 60A 1-1-31, Explosive Ordnance Disposal Procedures; and
- Electric Firing Procedures.

3.11.11.9 General Demolition Practices

Personnel will adhere to the following standard safe practices and procedures when conducting demolition operations:

- Review electro-magnetic radiation (EMR) hazards and precautions and electrical grounding procedures;
- Carry blasting caps in approved containers and keep them out of the direct rays of the sun;
- Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons will retire to a place of safety;
- Do not use explosives or accessory equipment that are obviously deteriorated or damaged. They may detonate prematurely or fail completely;
- Do not abandon any explosives. Fatal or serious accidents can result from such careless practice;
- Do not use unexploded dud ordnance items for demolition purposes. They may be in an extremely sensitive and hazardous condition;
- Disposal operations will not be initiated until at least one-half hour after sunrise and will be concluded by at least one-half hour prior to sunset;
- Restrict and control access to the disposal site to a minimum of authorized personnel necessary for safe conduct of the disposal operations;
- Do not carry fire- or spark-producing devices into a disposal site except as specifically authorized;
- Do not smoke except in areas specifically designated. After smoking, assure that all burning tobacco is extinguished; and
- Avoid inhaling, and skin contact with explosives, the smoke, fumes, vapors of explosives, and related hazardous materials.

3.11.11.10 Handling Demolition Materials

When handling demolition materials, EOTI UXO Technicians will observe the following rules and safe practices:

- Do not strike, tamper with, or attempt to remove or investigate the contents of a blasting cap (electric or non-electric), detonator, or other explosive initiating device. A detonation may occur.
- Do not pull on the electrical lead wires of electric blasting caps, detonators or other electro-explosive devices. A detonation may occur.
- Do not attempt to remove an unfired or misfired primer or blasting cap from a coupling base. There is a high risk of an explosion.
- Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling. This will minimize injury should the item explode.
- Shaped charges - be certain there is no obstruction in the conical cavity or between the charge and the target, as any obstruction will materially reduce the penetration effect.

3.11.11.11 Preparation for Firing

When preparing firing systems, EOTI will:

- Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.
- Use electric blasting caps of the same manufacture, whenever possible, for each demolition shot involving more than one cap.
- Keep blasting caps in approved containers, located at least 7.62 meters (25 feet) from other explosives, until needed for priming.
- Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

3.11.11.12 Electric Priming

EOTI will prepare electric priming systems using the following techniques and procedures:

- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.
- Unroll the lead wires so that the cap is as far as possible from the operator and pointing away from him/her. Place the blasting cap under a sandbag or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.
- Use only the battery recommended by the manufacturer in the testing galvanometer. Other types of dry cells may produce sufficient voltage to detonate blasting caps.
- Do not connect the power source to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charges.
- Do not hold the blasting cap directly in the hand when uncoiling the leads. Hold the wires approximately 152 mm (6 inches) from the cap. This will minimize injury should the cap explode. The lead wires will be straightened by hand and not thrown, waved, or snapped to loosen the coils.
- Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts will ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the circuit firing unless the power ends of the circuit firing leads are shorted.
- Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- The UXO person in-charge will order the final priming of the shot.

3.11.11.13 Firing Demolition Charges

3.11.11.13.1 General Procedures

3.11.11.13.1.1 Keep the power end of the firing wire shunted until ready to connect the power source.

3.11.11.13.1.2 The signal for detonation will be given by the UXO person in-charge only after all personnel in the area have reached cover or a safe distance from the charge.

3.11.11.13.1.3 Prior to making connections to the power source, test the firing circuit for electrical continuity.

3.11.11.13.1.4 The UXO person in-charge will order the firing wires to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.

3.11.11.13.1.5 When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.

3.11.11.13.1.6 Do not complete the circuit at the power source (panel) or give the signal for detonation until directed to do so by the UXO person in-charge.

3.11.11.13.1.7 Do not attempt to fire a single electric blasting cap or a combination of electric blasting caps in a circuit with less than the minimum current required by the total circuit. Misfires can be expected where this occurs.

3.11.11.13.1.8 The UXO person in charge and a safety observer will check the shot following the detonation.

3.11.11.13.1.9 The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting "blow-in-place" operations. Always check the "blow-hole" for secondary items and remove all munitions and range-related debris and fragmentation.

3.11.11.13.2 Electro-Magnetic Radiation (EMR) Hazards. Prior to the application of detonation-in-place procedures, an EMR survey shall be conducted to determine if there are any transmitting antennas of radio, radar, or other electro-magnetic-generating devices located in the vicinity.

3.11.11.13.3 Radio Frequency (RF) EMR. RF EMR consists of waves of electrical energy. These waves are radiated in a line-of-site from the antennas of electronic devices that transmit radio, radar, television, or other communication, to include cellular telephones, or other communication or navigation RF signals. Table 3.4 states the minimum safe distance from electro-explosive devices (EEDs) and the transmitting antenna of all RF emitters. Table 3.5 states the minimum safe distances, which will be maintained between Mobile RF transmitters and electric blasting operations. The factors to be considered when evaluating the degree of hazard that the EMR (RF) energy represents are:

- The strength of the field (its power);
- The frequencies transmitted;
- The distance from the transmitter antenna to the ordnance; and
- The amount or type of protection available.

Table 3.4 Minimum Safe Distance from Electro-explosive Devices (EEDs) and RF Transmitter Antenna Emitters

AVERAGE OR PEAK TRANSMITTER POWER IN WATTS	MINIMUM DISTANCE TO TRANSMITTER IN METERS/FEET
0 – 30	30 / 98.4
31 – 50	50 / 164.1
51 – 100	110 / 360
101 – 250	160 / 525
251 – 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3.002
20,001 - 50,000	1,530 / 5,020
50,001 – 100,000	3.050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,000 - 6,400,000	24,400 / 80,056

* When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

Table 3.5 Minimum Safe Distances in Feet Between Mobile RF Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	MF to 3.4 MHz Industrial	HF 28 to 29.7 MHz Amateur	VHF 35 to 36 MHz 42 to 44 MHz 50 to 64 MHz	VHF 144 to 148 MHz 150.8 to 161.6 MHz	UHF 450 to 460 MHz Cellular Car Phones above 800 MHz
5[1]	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40
100	120	320	260	100	60
180[2]	170	430	350	130	80

[1] Citizens band radio (walkie-talkie) [26.96 to 27.41 megahertz (MHz)] - minimum safe distance -five feet. Double sideband - 4 watts maximum transmitter power - hand-held, 5 feet; vehicle mounted, 65 feet. Single sideband - 12 watts peak envelope power - handheld, 20 feet; vehicle mounted, 110 feet.

[2] Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).
[3] MF – Modulated Frequency; HF – High Frequency; VHF – Very High Frequency; UHF – Ultra High Frequency

3.11.11.13.4 Lightning, Electric Power Lines, and Static Electricity. Lightning is a hazard to both electric and non-electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap and other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during electrical storms and when one is impending. All blasting activities will be suspended when lightning-thunder storms are within ten miles of the project site.

3.11.11.13.5 Electrical firing will not be performed within 510 feet of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 510 feet to electric power lines, non-electric firing systems will be used or the power lines de-energized.

3.11.11.13.6 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by a great variety of causes; among them, dust storms, which have caused a large number of detonations; snow storms, less dangerous, but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.

3.11.11.14 Preparation of Demolition Shots

3.11.11.14.1 After determining and locating a safe location away from the charges, lay out the firing wire and prepare and place all explosive charges.

3.11.11.15 Test Firing Wire

3.11.11.15.1 If using the blasting galvanometer/M51 test set - check the galvanometer by holding a piece of metal across its terminals. If the battery is good, there should be a wide deflection of the needle. Check the M51 test set by holding a piece of wire across its terminals and depress handle - lamp should glow.

3.11.11.15.2 When using a Model "D" Blaster's Ohmmeter with the Lawrence Silver Chloride Dry Cell, a full needle indication is required. Frequently cells, which have been stored for long periods of time, will require re-activation. To obtain full-scale deflection of the meter needle, the meter contact posts should be shorted with a metal instrument such as a screwdriver or knife blade. Place the metal blade in full contact with both terminals simultaneously for a period of twenty seconds to one minute. This should activate the cell to full-scale deflection. If it does not, do not use the ohmmeter.

3.11.11.15.3 Separate firing wire connectors at both ends, and touch those at one end to galvanometer/test set posts. The needle should not move nor lamp glow. If either occurs, the firing wire has a short circuit.

3.11.11.15.4 Twist wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections. Note: Firing wire can be tested on the reel, but unnoticed broken wires could produce false readings. Firing wire must be tested after unreeling. Caution: Do not drag a firing cable over sand or other insulated surfaces as this can generate a static charge that will electrically fire blasting caps.

3.11.11.15.5 Twist free ends of firing wire together to prevent an electric charge from building up in the firing wire.

3.11.11.16 Test Blasting Caps

Complete the following steps in order to test the blasting caps:

- Test galvanometer/M51 test set as outlined above.
- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit.
- Place the cap under a sandbag or other protective device in the event that the cap accidentally functions.
- Individual conducting this test will ground himself prior to removing the shunt.
- Remove short circuit shunt.
- Touch one cap lead wire to one post and the other cap lead wire to the other post. If the galvanometer's needle deflects slightly less than it did when instrument was tested, or the lamp glows, the blasting cap is satisfactory; if not the cap is defective. Destroy it on the detonation. Note: If the battery is fresh, the galvanometer should read at least half scale when the instrument is tested and when a good blasting cap is tested.

3.11.11.17 Connecting the circuit.

Complete the following steps when connecting an electrical firing circuit:

- At the firing position, keep the free ends of the firing wire twisted together until ready to connect the blasting machine.
- Individual will ground himself prior to performing next step.
- Splice free cap lead wires to firing wire.
- Insert cap into charge.

3.11.11.18 Firing Procedures

Complete the following steps in order when firing the shot:

- Test the entire circuit. Move to the firing position and test the entire firing circuit with the galvanometer or test set as outlined above. If the firing circuit is defective, shunt wires; go down-range and recheck circuit. If the splice is found defective, re-splice wires. If cap is found defective, replace it.
- Twist free ends of firing wire together.
- Exercise the blasting machine. Test blasting machine by actuating it several times with nothing attached to the terminals.
- Connect blasting machine.
- Sound a warning (siren, horn, etc.) and loudly call out "Fire in the hole"! three times. Two Pairs of Wires
  (While performing demolition operations,
  specific procedures for warnings and notifications will conform to the requirement of the installation.)
- Activate blasting machine.

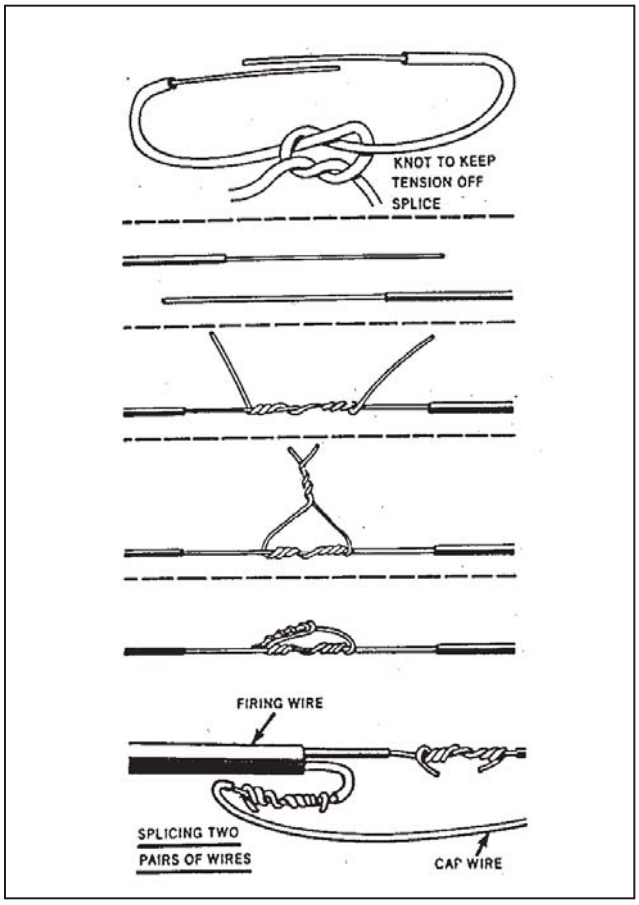


Figure 3.2 Splicing

3.11.11.19 Electric Misfire

3.11.11.19.1 Prevention of electric misfires. In order to prevent misfires, insure that:

- All blasting caps are included in the firing circuit;
- All connections between blasting cap wires, connecting wires, and firing wires are properly made;
- Short circuits are avoided;
- Grounds are avoided; and
- Number of blasting caps in any circuit does not exceed rated capacity of power source on hand.

3.11.11.19.2 Causes of electric misfires. Common specific causes of electric misfires include:

- Inoperative or weak blasting machines or power source;
- Improperly operated blasting machine or power source;
- Defective and damaged connections, causing either a short circuit, a break in the circuit, or high resistance with resulting low current;
- Faulty blasting caps;

- The use in the same circuit of blasting caps made by different manufacturers or different design; and
- The use of more blasting caps than power source rating permits.

3.11.11.19.3 Clearing electric misfires. If charge is primed electrically, proceed as follows:

- Make several successive attempts to fire;
- Check firing wire connections to blasting machine terminals to be sure those contacts are good;
- Make 2 or 3 more attempts to fire charge;
- If available, try again with another blasting machine or power source;
- Make 2 or 3 more attempts to fire charge;
- Disconnect blasting machine, or other power source, and shunt firing wire;
- Allow a minimum of 30 minutes to elapse from the last attempt to fire, before starting to investigate;
- Test firing circuit with circuit tester for breaks and short circuits, and correct any defects noted;
- Remove and disconnect old blasting caps and shunt wires; Note: do not strike or dig into a buried misfired charge;
- Uncover only enough to position a fresh charge immediately adjacent to the misfired charge;
- Connect wires of new blasting cap(s) to firing circuit and re-prime charge; and
- Connect firing wire ends to blasting machine and fire charge.

3.12 INVESTIGATIVE DERIVED WASTE PLAN

IDW generated as part of the MC field investigation will be properly collected, labeled, profiled, manifested, transported, and disposed of, if necessary, at a facility licensed to handle these materials. IDW will include used sterile soil/sediment sampling scoops and personal protective equipment (PPE). The details concerning containerizing, sampling, and disposal are further discussed in the FSP.

3.13 RISK CHARACTERIZATION AND ANALYSIS

A detailed risk characterization and analysis following the Munitions and Explosives of Concern Hazard Assessment (MEC HA) methodology will be completed as part of the RI/FS. This risk assessment requires information about the presence of MEC at the Culebra Island Sites for completion. MEC has been found and removed from various areas across the site. Further MEC investigation activities (geophysical study) will be conducted as part of this RI which will involve anomaly identification and investigation. Pertinent information that will be gathered about MEC during the geophysical investigation are discussed in Section 3.9. Information regarding site characteristics, site accessibility, site stability, human factors, site activities, and population will also be gathered during the MEC and MC investigations to ensure a complete risk assessment. It should be noted that the risk assessment activity may not be necessary for areas where there is no evidence

of MEC presence. However, the exception to this would be the presence of MC in the surface soil in an area suspected to have been impacted by training activities.

Human health and ecological risk due to potential exposure to MC will be evaluated using the methodology outlined in by the USEPA Risk Assessment Guidance (RAGS) and USACE guidance EM 200-1-4, Volumes l and II. The primary methodology for evaluating human health risk will be comparison of environmental sampling analytical data to the appropriate screening levels. A Screening-Level Ecological Risk Assessment (SLERA) may also be required as MRS 05 and 07 contain wildlife refuge areas. The human health and SLERA will be developed in accordance with USACE guidance EM 200-1-4, EM 1110-1-1200, as appropriate, USEPA Risk Assessment Guidance for Superfund. The results will be provided in the RI Report and will factor into potential removal/remediation measures during the FS phase.

3.14 ANALYSIS OF INSTITUTIONAL CONTROLS

Institutional controls will be an integral part of the RI/FS report and will be discussed once the presence of MEC at areas to be assessed as part of the geophysical investigation has been confirmed or refuted and the nature and extent of MC across the site has assessed. It should be noted that the analysis of institutional controls may not be necessary across the site depending on whether MEC presence is confirmed, MEC characterization and removal, and MEC density. It should also be noted that the analysis of institutional controls for surface soil may not be necessary across the site depending on the nature and extent of MC.

3.15 RECURRING REVIEW PLAN

A Recurring Review Plan will not be part of the RI/FS project phase, but will be considered in the development and evaluation of remedial alternatives.

4.0 QUALITY CONTROL PLAN

This Quality Control Plan (QCP) will dictate the methods and procedures that will be used during the project addressing Quality Control (QC) inspection, audits, and reporting.

4.1 INTRODUCTION

4.1.1 QC Objectives

4.1.1.1 This Chapter of the Work Plan presents the project Quality Control Plan as required by the PWS. The QC procedures described in this chapter will be used for all work performed during the RI/FS activities at Culebra Island. This site-specific QC plan is designed to manage, control, and document performance of work efforts and to ensure quality throughout the execution of all tasks. This QC Plan will achieve the following objectives.

- Identify QC procedures and responsibilities for MEC removal actions.
- Ensure CEHNC notifications as required by the CEHNC PWS.
- Document the quality of work efforts via audits and independent staff reviews of deliverables.
- Ensure data integrity through implementation of data management QC procedures.
- Ensure the development of an appropriate ordnance accountability ledger and appropriate MEC chain of custody and disposal.

4.1.2 Quality Policies

4.1.2.1 All services provided will be consistent with and will meet the requirements of all applicable laws and regulations. EOTI is solely responsible for the control of product quality. Only those products/services that conform to contractual requirements will be offered to the Government for acceptance. Emphasis will be placed on preventive actions that minimize quality failures or defects.

4.1.2.2 Quality Management will be applied throughout all phases of the project - from the time of the task order award, until the Final Report is accepted.

4.1.2.3 EOTI will staff all project sites with the best qualified, trained, available personnel, based upon their knowledge and prior experience with the type of operations and hazards expected to be encountered. The minimum qualifications will meet or exceed the customer's requirements. All EOTI employees and team members are empowered to identify and evaluate potential quality problem areas and are encouraged to recommend solutions or corrective actions.

4.1.2.4 All EOTI personnel will be provided with all of the information necessary to accomplish their assigned tasks in a safe, responsible, cost-efficient manner and they will be held accountable for the quality of their work.

4.1.2.5 The project team will be provided with a copy of the final approved Work/Safety and Health Plan prior to the performance of any MEC-related activities on a project site.

4.1.2.6 EOTI will take corrective actions on any complaint, quality defect, or negative result from an audit of operations.

4.1.3 Definitions

- Removal Standard - a specified size of MEC to a specified depth.
- Customer/Client - refer to the term "Purchaser" for Government contracts.
- Government Representative - an on-site Government employee with specified responsibilities and authority.
- Nonconformance:
  - A minor nonconformance is not likely to materially reduce the usability of the services. It is generally a departure from the approved procedures that have little bearing on the end product.
  - A major nonconformance is likely to result in failure of the services or to materially reduce the usability of the end product.
  - A critical nonconformance is likely to result in hazardous or unsafe conditions for individuals using or depending upon the services.
- Purchaser: When used in the Quality Systems definitions of U. S. Government contracts, the term purchaser will refer to the body of the Government Agency administering the particular contract involved, or the authorized representative of that Government body.
- Quality Conformance Inspections: Normal inspections/audits conducted by authorized EOTI personnel during the accomplishment of the organization's mission to determine conformance to contract requirements.
- Quality Control: The process by which EOTI manages, controls, and documents its activities in the accomplishment of the mission.
- Quality Defect: A nonconformance issue with published policy and/or a contractual requirement that requires corrective action(s).
- Quality Management: All those control and assurance activities instituted to safely and effectively accomplish the assigned mission.
- Root Cause: The basic reason for an undesirable condition or problem if eliminated or corrected, would have prevented it from existing or occurring.
- Stop-Work-Authority: The right and obligation to stop all work when serious quality or safety concerns arise.
- Subsurface Removal: Locating and removing UXO that are not visible or not partially visible on the surface, requiring the use of geophysical detection equipment, to the removal standard.
- Surface Removal: Locating and removing UXO that are visible on the surface, or partially visible. This includes items that are partially exposed, which will require only minimal hand excavation to determine identification.
- See Federal Acquisition Regulations (FAR) Part 2.1 for additional definitions.

4.1.4 Quality Management

4.1.4.1 The Project Manager has the responsibility of ensuring that QC procedures are implemented in accordance with the PWS.

4.1.4.2 The QA/QC Manager will provide the Quality Management oversight for the project. The QA/QC Manager is a part of the project team, but is authorized to elevate any quality problems that cannot be resolved by the project team. The QA/QC Manager interacts with the Project Manager, SUXOS, UXOQCS, and subcontractor QC staff as appropriate to prevent and/or correct problem situations, as necessary. Vendors and subcontractors will be monitored to assure that they supply items and services, which meet quality requirements. Periodic audits will be performed to verify that the quality system and the UXOQCS are performing as required. He also ensures that:

- Required site training is conducted prior to the start of field activities.
- The UXOQC Specialist is qualified and trained.
- Quality controls are built into the Project Work Plan to support the MEC removal action.
- The requirements of the Quality Control Plan are adhered to.

4.1.4.3 Effective day-to-day field QC management is delegated to the on-site EOTI UXOQCS. He will interact daily with the project team to ensure that all QC procedures presented in the Project Work Plan are followed in the accomplishment of all project tasks. The UXOQCS reports directly to the QA/QC Manager. Scheduled activities are coordinated with the Project Manager, SUXOS, UXO Safety Manager, and all other project team members as needed. He has the authority to:

- Initiate action to prevent the occurrence of nonconformance's relating to the provided services.
- Identify and record any problems relating to the services.
- Initiate, recommend or provide solutions through the on-site management channel.
- Verify the implementation of solutions.
- Control further actions of any nonconforming services until the unsatisfactory conditions have been corrected.
- Elevate Quality concerns, which cannot be resolved on-site to the Quality Manager.

4.1.4.4 All project team members are responsible for and will be held accountable for the quality of their work. Every team member has Stop-Work-Authority when an immediate safety situation is observed which could cause personal injury or damage to property and equipment. All project team members are encouraged to identify potential quality problems and are encouraged to suggest solutions or corrective actions to ensure all work conforms to the approved Work Plan and Quality Assurance requirements. During site-specific training, personnel will be briefed by the QA/QC Manager or the UXOQCS, on the importance of quality work and the above stated requirements. This briefing is aimed at insuring that all site personnel understand EOTI's dedication to quality.

4.2 PROJECT SPECIFIC QUALITY CONTROL REQUIREMENTS

4.2.1 This Section describes project specific tasks and related quality considerations and standards.

4.2.2 Contract Submittals

4.2.2.1 All contract submittals will be prepared by qualified personnel in accordance with the PWS and contract requirements. All documents undergo a peer review in which they will be reviewed by an equally qualified person familiar with the project and submittal requirements.

4.2.2.2 The Project Manager is responsible to ensure that all documents are prepared in accordance with contract requirements and applicable standards. He will assign subject matter experts to prepare draft documents or sections of draft documents. Each document will undergo a peer review and then a final check by the EOTI QC Manager prior to submitting then to the client. Submittals will be made in accordance with the PWS.

4.2.2.3 Specific documents that will be prepared and submitted under this Task Order include: a Site-Specific Work Plan, a Public Involvement Plan, and a Site-Specific Final Report. GIS data will also be submitted as described in Section 3.10 of this Work Plan.

4.2.3 Site-Specific Work Plan

4.2.3.1 EOTI will prepare a Site-specific Work Plan in accordance with the PWS and DID MR-005-01. Each required sub-plan, chapter, and appendix will be prepared in accordance with the appropriate DID and other appropriate guidance documentation. Three drafts of the Work Plan will be prepared and submitted in accordance with the requirements of the PWS. The Project Manager will assign competent personnel to prepare each section of the document and will ensure that the schedule for submittal is met. Each section of the WP will undergo a peer review and the document will undergo a technical edit and final QC review before it is submitted to the Client. The Accident Prevention Plan will be signed by a qualified safety professional and the Work Plan will be signed by the Corporate Quality Manager. Each hard copy as well as each electronic copy of each draft will be inspected before it is shipped.

4.2.3.2 The Draft WP will be reviewed by USAESCH subject-matter experts. EOTI will address all comments received on the Draft WP and publish a Draft-Final version of the WP that will be reviewed by the client and potentially by regulators and other stakeholders. Any additional comments received will be addressed and a Final Work Plan will be prepared and submitted. EOTI will attend an On-board Review at the USAESCH office, if necessary before submitting the Draft-Final Work Plan. During this review, responses to comments and proposed changes to the documents will be discussed.

4.2.4 Surface Removal

4.2.4.1 EOTI will conduct a MEC surface clearance as described in Section 3.8. This work will be conducted in accordance with the Work Plan which complies with the PWS and Action Memorandums.

4.2.4.2 The Team Leader assigned to clear a specific area is responsible to ensure that his team conducts all aspects of the assigned work in accordance with the Work Plan and instructions provided by the SUXOS. The UXOQCS will observe a portion of all phases of the work to ensure compliance with the work plan and approved procedures. Any non-conformance will be noted and discussed with the team leader. Major nonconformance issues and safety-related nonconformance will result in work stoppage, immediate corrective action, and / or retraining.

4.2.4.3 White's metal detectors used to assist with the surface clearance will be tested prior to beginning work each morning and after each break and when site conditions changes. The team leader will carry a surrogate and each team member will check his instrument against the surrogate on the ground surface. If the instrument is not operating properly it will be replaced.

4.3 CORRECTIVE / PREVENTATIVE ACTION

4.3.1 QC/QA Failure

4.3.1.1 Every area designated for investigation will undergo a Search Effectiveness QC Inspection (SE QCI) involving approximately 10% of the square footage. The exact location of this square footage is at the discretion of the UXOQCS. The quality failure criteria will be no MEC item equal to or smaller than the (audible or digital) response of a 20mm projectile, as established within the guidelines of the GPO process at the project start. The Team Leader will notify the SUXOS and / or UXOQCS as soon as the grid or transect segment is completed. The SUXOS will immediately notify the USAESCH on-site representative so that QC and QA checks can be scheduled and completed as soon as possible.

4.3.2 QC/QA Nonconformance

4.3.2.1 Nonconformance will be documented on a Quality Conformance Inspection Record (QCIR). The QCIR will document the reason for the nonconformance and describe the corrective actions taken to resolve the problem and the actions taken to prevent reoccurrence. QCI are generally intended to be preventative, rather than corrective in nature. Through preventative QCI, continuous improvement of site operations will occur.

4.3.2.2 The QCIR may be legibly hand completed, in ink, but the preferred method is via computer (Word) on the site. A QCIR will be completed for tasks when they do not conform to the Work Plan. Nonconformance QCIRs will be forwarded by facsimile or email to the Project Manager and the QA/QC Manager. A QCIR may also be completed for tasks when they are in conformance with the Work Plan. QCIRs for conforming tasks will not generally be distributed off the project site.

4.3.2.3 A QCIR will be completed for re-inspection of nonconformance. If the re-inspection indicates that the nonconformance has been corrected, both QCIRs will be filed in the Inactive Sub-file and a copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager. If the re-inspection indicates the nonconformance has NOT been corrected, both QCIRs will be filed in the Active Sub-file. A copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager.

4.3.2.4 Nonconformance will be evaluated and corrective action implemented by on-site management whenever possible. The Project Manager and QA/QC Manager will track all nonconformance's to assure that they have been resolved, actions to prevent re-occurrence have been implemented and that lessons learned are communicated effectively. A root cause analysis will be conducted on major or critical non-conformance issues as described in Section 4.3.4.

4.3.3 Customer Complaints

4.3.3.1 Customer complaints will be addressed immediately. The complaint may come in the form of a verbal comment or written correspondence. Whatever the vehicle, the Project Manager will conduct an investigation to analyze the complaint and assure corrective action has been initiated. The corrective action will address not only the root cause but also the application of controls to assure its effectiveness.

4.3.3.2 The Project Manager will document the complaint or nonconformance and the investigation. He will look for the root cause. Lessons Learned will be documented on the CAR and communicated to Project personnel and the QA/QC Manager.

4.3.3.3 The action on the CAR is not complete until the UXOQCS and/or SUXOS have completed follow-up. The corrective / preventative actions have to be adequate to prevent reoccurrence and the customer must be satisfied with these actions. The issue addressed in the CAR will be an item for a future QCI to ensure that the corrective / preventive actions have in fact addressed the issue and the solution was effective.

4.3.4 Root Cause Analysis

4.3.4.1 EOTI will conduct a Root Cause Analysis for all QC/QA failures. The project manager is the person primarily responsible for conducting this analysis with assistance from the QA/QC manager, SUXOS, and UXOQCS.

4.3.4.2 Prior to conducting the analysis the EOTI Project Manager will gather all available documentation and information related to the quality issue. He will then conduct interviews and /or request additional information necessary to determine the root cause of the issue. In conducting the analysis, the Project Manager will rely primarily on objective facts but may consider opinion or assumptions, if necessary due to the lack of facts and data. The objective of the analysis is to identify basic cause for the undesirable condition or outcome and to determine corrective measures.

4.3.4.3 Once the likely cause is determined, it will be documented along with corrective actions designed to prevent the recurrence of the issue. Re-training will be conducted, as required, to ensure that the team is aware of changes in techniques and procedures. The results of changes will be evaluated to determine their effectiveness and documented as lessons learned.

4.4 QC PLAN PROCESSES

4.4.1 This section documents the quality processes applicable to this project. These are essential steps to ensure a quality product is delivered to the Government. Described below are the specific procedure that will be used to assure quality in this PWS regarding; Audits, Corrective/Preventive Action, Data Management, Field Operations, Equipment Calibration and Maintenance, and Personnel Protective Equipment.

4.4.2 Quality Audits

4.4.2.1 Periodic audits will be performed by the QA/QC Manager to ensure that the requirements of this Quality Plan are being followed. This may include on-site visits as well as frequent document review activities. Training records, periodic reports, and adherence to all aspects of this QC Plan will be monitored to assure compliance.

4.4.2.2 All instruments, vehicles/machinery, and equipment will be checked prior to the start of each workday, batteries will be replaced as needed, and instruments requiring calibration will be checked against a known source. Detection capabilities will be checked at the beginning and end of each work day.

4.4.2.3 The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made. The UXOQCS performs random, unscheduled Quality Conformance Inspections (QCI) to ensure that personnel accomplish all work specified in the Project Work Plan. The QCI Schedule will adhere to the following table. The UXOQCS has the latitude to modify this schedule based on the quality of work being performed and the frequency of noted activities.

Table 4.1 Frequency of QC/QA Inspections and Checks

TASK	100%	DAILY	WEEKLY	BI-WEEKLY	AS NEEDED
Personnel Qualifications	✓				
Accident/Incident Reporting	✓				
Search Effectiveness					✓
Turn-in of Recovered MDAS	✓				
Preventive Maintenance		✓			
Communications Equipment		✓			
Safety Inspections		✓	✓		
Medical Support		✓			
Communications Effectiveness		✓			
Explosives Accountability		✓			
Explosives – MEC Transportation			✓		

TASK	100%	DAILY	WEEKLY	BI-WEEKLY	AS NEEDED
Brush – Vegetation Removal			✓		
MEC Final Disposal					✓
MEC Accountability		✓			
Fire Protection – Prevention			✓		
Project Administration			✓		
Safety and Health Programs				✓	
Visitor Briefing					✓
Site – Specific Training					✓
Hazard Assessment – Risk Analysis					✓

4.4.3 Project Documentation

4.4.3.1 QC Files

4.4.3.1.1 The following two files will be established and maintained by the UXOQCS.

- QCI Record File
- Corrective Action Request (CAR) File

4.4.3.1.2 The QCI Record File will be a two-part file, containing Active and Inactive Sub-files. The Inactive Sub-file will contain those QCIR for tasks that were found to be in compliance with the Work Plan and those that were not in compliance, but have been re-inspected and are subsequently corrected. The Active Sub-file will contain those QCIR for tasks that were found to be not in compliance with the Work Plan and have not yet been corrected.

4.4.3.1.3 The CAR File will be a two-part file containing an Active Sub-file and an Inactive Sub-file. A CAR will be maintained in the Active File until follow-up has been conducted and deemed satisfactory. Once the follow-up is completed, the CAR will be placed in the Inactive File.

4.4.3.2 Document Control and Data Management

4.4.3.2.1 Rigid control must be maintained over the production of QC documents. The following guidelines will apply to all documentation generated by QC staff.

4.4.3.2.2 Document Completion - All sections of forms will be completed. Any unused spaces will be marked N/A. In long columns of empty lines, N/A may be written in the first and last lines of that column with a single line connecting the entries. Large areas of unused spaces may be designated N/A by drawing a single line through the unused areas with the letters N and A on either side of that line.

4.4.3.2.3 To eliminate misunderstanding, the following time and date formats will be used on all official reports and correspondence:

- Time: 24-hour (Examples: 0730H, 1930H)
- Date: MM/DD/YY (Examples: 04/05/06, 11/15/06)

4.4.3.2.4 All report work will be accomplished by word processor or with a BLACK ink pen. No pencils or colored-ink pens may be used.

4.4.3.2.5 All signatures will be accompanied by the date the signature was made, either in a date block or with the date written following the signature.

4.4.3.2.6 White opaque correction fluids/tape may not be applied to records to correct mistakes. Incorrect entries will be drawn through with a single line with the initials of the author and the date of the correction immediately adjacent. Corrected entries will be placed above or immediately following the line through or otherwise entered on the document in a legible, understandable means.

4.4.3.2.7 Any entries or corrections to a document, other than in document control blocks, made after its date of inception, will be considered a "late entry". Late entries will be clearly designated with the capital letters "LE", the initials of the person making the late entry, and the date the late entry is made.

4.4.3.2.8 Official original documents will be distinctly marked, as such.

4.4.3.3 Data Management

4.4.3.3.1 Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically and data will not be stored only on one single media. Floppy disks, Zip disks, CDs or other means of storage will be used in addition to standard computer hard drives to assure data is not lost by the failure of any one device. Since conventional Document Control Practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records.

4.4.3.3.2 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and will appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that documents registration number.

4.4.3.3.3 Changes, additions, late entries and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

4.4.3.3.4 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

4.4.3.3.5 Any document that is revised after any required distribution either off-site or to any electronic or hard copy file will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

4.4.3.3.6 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words "signature on file" will be entered on the electronic copy, in the signature space, of all documents requiring signatures. The signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed and filed.

4.4.3.3.7 Logs maintained electronically may be updated as required for daily activities without going through the above revision process. Each day's log, however; will be saved electronically with the date included in the file name. Previous day's logs will not be deleted from the database and will serve as additional back up should the current days log be damaged or lost.

4.4.3.4 Photographic Records

4.4.3.4.1 Photographs will be generated to document significant site activities and MEC Photographic records may be used to supplement information recorded in the daily logs, to include photographs of equipment prior to use, and the condition of the site prior to any activity. Photographs will clearly show the task being accomplished and provide for a visual record of the operations. Operations will not be staged. Selected representative photographs will be included in the Final Report.

4.4.3.5 Logs

4.4.3.5.1 Field activity logbooks will be maintained in ink. All personnel will use bound and numbered field logbooks with consecutively numbered pages. These logbooks are QA records and will be completed in accordance with this section of this QC Plan. These activity logbooks will become part of the Final Report; thus, it is imperative that they be completed clearly and legibly. Appropriate documentation will be maintained regarding the location and disposition of all MEC and munitions debris. Locations will be documented on a site map and entered in the Ordnance Accountability Log. Daily and Weekly Summary Reports will be prepared by the UXOQCS and forwarded via facsimile or email to the Project Manager on a timely basis.

4.4.3.5.2 Daily Activity Log

4.4.3.5.2.1 Daily Activity Logs will be maintained and will include the following:

- Date and recorder of field information.
- Start and end time of work activities including lunch and down time.
- Visitors.
- Weather conditions.
- Important telephone calls.
- Any deviations form planned activities
- Equipment checks and calibrations.
- Equipment monitoring results, if applicable.
- QCI Performed
- Nonconforming conditions
- Lessons Learned
- Signatures of the SUXOS and UXOQCS indicating concurrence.
- Safety/Quality Control Log
- The Safety / Quality control Log will include the following:
- Date and recorder of log.
- Significant site events relating to safety or quality.
- Accidents or nonconformance issues.
- Stop Work due to safety concerns or major nonconformance issues.
- Lessons Learned.
- Results of Safety / Quality Audits.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.4.3.5.3 Training Log

4.4.3.5.3.1 Training will be documented in the Training Log as follows:

- Date and recorder of log.
- Nature of training
- Tailgate safety briefings (including time conducted, person conducting the briefing and attendees).
- Visitor Training (including names of visitors, description of training, and person performing training).
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.4.3.6 MEC Identification and Reporting

4.4.3.6.1 At least two UXO qualified personnel (UXO Tech II or above) must be in agreement on the condition of a live or suspected live MEC item before any removal action is attempted. All available data sources will be consulted prior to this determination.

4.4.3.6.2 As MEC is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all live/suspected MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #).
- Location.
- Classification (UXO, DMM or MC with an explosive hazard).
- Nomenclature.
- Fuse Description.
- Fuse Condition.
- Depth
- Additional comments, if required.

4.4.3.6.3 Each suspect MEC item encountered will be identified using a unique numerical identifier, such as C-6–0001 (for first live/suspect item (0001) encountered in Grid C-6).

4.4.3.6.4 Photographs of live or suspect MEC items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the final report; thus, a focused, well thought out photograph is necessary.

4.4.3.6.5 MEC identification data will be entered into an electronic MEC Accountability Log, daily. Terminology and definitions used when completing the MEC Accountability Log will be consistent with those given in the 21 April 2005 Memorandum from the Office of the assistant Secretary, Installation and Environment; Subject: Munitions Response Terminology. The UXOQCS will review this data to ensure accuracy and consistency in reporting. This review will include a comparison of photographs with recorded data. Any conflict or discrepancy will be discussed and resolved with the Team Leader. Signatures of the SUXOS and UXOQCS on the MEC Accountability Log indicate concurrence of the reported data.

4.4.3.7 Lessons Learned

4.4.3.7.1 Lessons learned from day to day activities are an important part of the continuous improvement process. They can prove vital to prevent similar problems from occurring at other sites. Lessons learned from daily activities and from the occurrence of nonconforming conditions will be documented by the UXOQCS / UXOSO, as appropriate. Lessons learned as a result of nonconforming conditions are captured and documented on the QCIR as a result of its investigation and disposition. Other Lessons learned, from both positive and negative events will be documented in the Daily Activity Log and/or Safety Log. These items will be included in the Final Report. The QA/QC Manager will maintain a database of Lessons learned for communication to other sites and for incorporation into Training Requirements.

4.4.3.8 Training

4.4.3.8.1 The Project Manager will verify that all project personnel have completed the following training prior to their assignment:

- US Naval Explosive Ordnance Disposal, Indian Head, Maryland / Eglin AFB, FL or EOD Assistant's Course, Redstone Arsenal, AL / Eglin AFB, FL or other Equivalent Course certified IAW DDESB TP-18.
- OSHA 40 Hour HAZWOPER in accordance with 29CFR1910.120 and 8 hour refreshers as need.
- Site Specific Training on this Work Plan and additional training, as needed, will be performed and documented on a QCIR, which will be forwarded to the Project Manager for review.
- Safety Meetings will also be documented. The UXOQCS will ensure that all personnel using geophysical detection equipment are properly trained to use that piece of equipment. This may include verification of past experience as well as on-site training on using specific equipment in site-specific conditions, which will be documented on a QCIR and forwarded to the Project Manager.

4.4.3.8.2 The UXOQCS will conduct, as necessary, site-specific training and/or review of known MEC to ensure that all site personnel are thoroughly familiar with the hazards and the general safety precautions and procedures required. Contractor personnel and site visitors will also receive site-specific training and safety briefings, as required, to ensure safety on the project. Visitors must be briefed on all of the known or anticipated hazards of the site, required PPE to be worn while on the site, and site emergency procedures. Visitors will be escorted by a UXO qualified person (Tech II or above) whenever they enter the exclusion zone and all UXO operations will cease whenever a visitor is within the exclusion zone.

4.4.3.9 Chemical Quality Data Management (CQDM)

4.4.3.9.1 No Hazardous, Toxic and Radiological Waste (HTRW) or Chemical Warfare Materials (CWM) is expected at this site per the PWS. CQDM related to Sampling and Analysis is included in Section 3 of the FSP included as Appendix E of the Work Plan.

4.4.3.10 QC Record Retention

4.4.3.10.1 All original QC Records and documentation will be maintained on-site and made available for government inspection upon request.

4.5 MUNITIONS CONSTITUENTS SAMPLING

See Appendix E, Field Sampling Plan (FSP).

4.6 DIGITAL GEOPHYSICAL MAPPING

4.6.1 Quality Control Procedures

4.6.1.1 QC of the instrument will be achieved by field testing and checking the sensor and navigation system daily against a known target, to ensure that it is operating properly. The standardization checks described in previous sections will be implemented to achieve QC objectives. Operational and test procedures will conform to the manufacturer's standard instructions.

4.6.1.2 All geophysical instruments and equipment used to gather and generate field data are calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Calibration, repair, or replacement records will be filed and maintained by the Site Geophysicist and may be subject to audit by the QA Manager. Testing records of the field instrumentation will be filed with the USACE PM after the fieldwork is completed.

4.6.1.3 Data processing QC is required to assure data quality. Potential data problems include source data errors, data entry errors, data editing errors, data corruption errors, and user errors. EOTI's data review is implemented to identify and correct any of these errors should they occur. Files will be backed up daily in order to ensure that data loss and file corruption does not occur.

4.6.2 Instrument Standardization

4.6.2.1 All instrument standardization will be performed per the requirements described in Section 3.7.8 and outlined below.

4.6.2.2 EOTI will perform QC Steps/Tests in accordance with the required equipment tests and frequency of testing. They are summarized in Table 4.1. The tests described in Table 3.2 will be conducted.

4.6.2.3 Equipment/Electronics Warm-up

The purpose of Equipment/Electronics Warm-up is to minimize sensor drift due to thermal stabilization. Most instruments require a few minutes to warm up before data collection begins. Follow the manufacturer's instructions or, if none are given, observe the data readings until they stabilize. Acceptance criteria is equipment-specific (typically 5 minutes).

4.6.2.4 Personnel Test

The purpose of personnel testing is to ensure survey personnel have removed all potential interference sources from about their person Common interference sources include steel-toed boots, boots with metal shanks or large metallic belt buckles, which can produce data anomalies similar to MEC targets. All personnel who will be coming within close proximity of the sensor during survey operations must approach the sensor and have a second person monitor and record the results.. Acceptance criteria for the EM61 is +/- 2.5mV.

4.6.2.5 Record Relative Sensor Positions

The purpose of the record relative sensor positions test is to document relative navigation and sensor offsets, detector separation, and detector heights above the ground surface. This will ensure that detector offset corrections can be done correctly and that the surveys are repeatable. The acceptance criteria is +/- one inch (2.54 cm). Typically, the GPS antenna will be in the centre of the coil, thus only coil height above ground surface needs to be verified (16 inches when using regular wheels).

4.6.2.6 Vibration Test (Cable Shake)

The purpose is to identify and replace any shorting cables and broken pin-outs on connectors. With the instrument held in a static position and collecting data, an assistant will carefully shake all cables to test for shorts and broken pin-outs. Observe readings for any changes (spikes) in instrument response. If shorts are found, the cable should be immediately repaired or replaced. After repair, cables need to be rigorously tested before use. The acceptance criteria is a data profile that does not exhibit data spike responses +/- 2.5mV.

4.6.2.7 Static Background and Static Standard Response (Spike) Test

The purpose it to quantify instrument background readings, locate potential interference spikes in the time domain, and repeatability of the instrument to a standard test item (test jig). Improper instrument function and the presence of local sources of ambient noise (such as EM transmissions from high-voltage electric lines or electrical storms) are potential causes of inconsistent, non-repeatable readings. A minimum of 3 minutes static background collection after instrument warm-up, followed by a 1-minute standard (spike) test followed by a 1-minute static background data will be performed. The acceptance criteria are as follows: Static Background Test: EM61 +/- 2.5 mV, Spike Test: EM61 +/- 10% of standard item response, after background correction.

4.6.2.8 Six Line Test

The purpose of this test is to document latency and repeatability of response amplitude, and that instrument latency is not variable across usual survey speeds at project start. This test will be performed in an area relatively clear of anomalous response, ensuring that the area surrounding the half-way point, in particular is anomaly-free. The test line will be well marked to facilitate data collection over the exact same line each time the test is performed. The following procedure will be followed:

- Lay out a 50-foot non-metallic tape in an N-S or E-W direction (this directionality should be observed so as to facilitate processing). Run a survey along the 50-foot line going one direction.
- Run a survey along the 50-foot line in reverse direction.
- Place target (test jig) at the midpoint (25 feet).
- Run a survey along the 50-foot line in first direction.
- Run a survey along the 50-foot line in opposite direction.
- Run a survey along the 50-foot line in first direction, moving faster than normal.
- Run a survey along the 50-foot line in opposite direction, moving slower than normal.

4.6.2.9 Two Line Test

The purpose is to daily test and document latency and repeatability of response,. This test will be performed in an area relatively clear of anomalous response. The following procedure will be followed:

- Lay out a 50-foot non-metallic tape in an N-S or E-W direction (this directionality should be observed so as to facilitate processing).
- Place target (test jig – ensure that it is placed in same orientation each time the test is performed) on clean area of the line at an inline distance of 25 feet.
- Run a survey along the 50-foot line in one direction.
- Run a survey along the 50-foot line in opposite direction.

4.6.2.10 Repeat DataDynamic Repeatability Test

A standard test item shall be placed within the grid (i.e. a small pipe or flat plate with a small area response. The item will be placed flush with the surface at a standard orientation). The standard response to this test item will be defined prior to the start of production field activities. Response repeatability to this standard test item in the mapping data will indicate data quality is consistent and sufficient for detection of the MEC items of interest. The dynamic repeatability test is a replacement for the predecessor repeat lines test.

Test item anomaly characteristics (peak response and size) shall be repeatable with an allowable variation of +/-25%. This test shall be preformed once per grid or dataset and a dataset will most likely be grouped into morning and afternoon sessions.

4.6.2.11 Data Position Check

At the beginning of each day, a known local survey point, emplaced by EOTI, will have its position recorded and compared to the known position to ensure it is within the tolerance of the navigation system

Acceptance Criteria: 4 inches or 10.12cm.

5.0 EXPLOSIVES MANAGEMENT PLAN

5.1 GENERAL

5.1.1 This plan details the management of explosives that may be required for the destruction or venting of live, suspected live, or inert MPPEH items at Culebra Island. Explosives used in the performance of this Task Order will be obtained by EOTI from commercial sources. These materials will be obtained and used for the specific purpose of disposal of live or suspect MEC and explosive venting of inert MPPEH items, if required, located during the Field Activities associated with the RI/FS at Culebra Island. An electrical firing system will be used. Quantities of explosive materials required to conduct the day's operations will be retrieved as needed from a magazine sited to store donor explosives on site.

5.2 LICENSES/PERMITS

5.2.1 EOTI will maintain on site and, upon request, make available to any local, state, or federal authority a copy of all licenses/permits required to authorize EOTI to purchase, transport, store, or use explosives. If no other licenses or permits are required by the state, EOTI will maintain a copy of its Federal ATF license on-site.

5.3 DESCRIPTION AND QUANTITIES

5.3.1 Explosive materials used during the performance of the work at Culebra Island site will be obtained from commercial sources. These explosive materials will be for the specific purpose of disposal of live or suspect MEC and explosive venting of inert MPPEH items, if required, located during the removal action. An electrical firing system will be utilized. Quantities of explosive materials required to conduct the day's operation will be stored in an ATF-approved Type II magazine sited and installed at the magazine compound. Explosives will be transferred, as required, within the Culebra Island site using EOTI vehicles. MEC will be marked and guarded, if necessary (e.g. accessible to the public), until disposal is accomplished. EOTI estimates 2 ea. electric blasting caps (1.4B); and 2 ea. 23 gram perforators (1.1D) and/or 2 ea ¾ pound cast booster (1.1D) will be used during disposal or venting operations for a single item and Detonation Cord (1.1D) will be used to link perforators and /or boosters.

5.4 ACQUISITION SOURCE

5.4.1 EOTI has obtained agreements with donor explosives vendor, Slurry Corporation, Jet Research Center, and Atlantic Explosives who agreed to supply and deliver the necessary quantities of demolition explosives.

5.5 LIST OF EXPLOSIVE MATERIALS

- As stated above, explosives that will be used are:
- Electric Blasting Caps (1.4B)
- Shaped Charge perforators, 32 gram (1.1.D)
- Detonation Cord, (1.1D)
- Cast Booster ¾ lb. (1.1D)

5.6 INITIAL RECEIPT PROCEDURES

5.6.1 Receipt of explosives other than perforators will be from Orica USA of Tulsa, OK (Phone number 918-720-6718). Shaped charge perforators will be supplied by Jet Research Center. Upon receipt of donor materials, an inventory will be conducted to ascertain:

- correct type
- serviceable condition
- correct quantity

5.6.2 A copy of the invoice(s) for the incoming donor materials will be kept in the on-site donor materials accountability file.

5.6.3 Upon receipt, a separate EOTI Memorandum will be prepared, with the following information, and retained on-site:

- Date of acquisition
- Name or brand name of manufacturer
- Manufacturer's marks of identification
- Quantity
- Description
- Name, address, and license number of the persons from whom the explosive materials are received

5.6.4 A set of duplicate EOTI Magazine Data Cards (see Appendix F) will also be prepared in accordance with the instructions on the reverse of the card.

5.7 PROCEDURES FOR VARIANCES BETWEEN QUANTITIES SHIPPED AND QUANTITIES RECEIVED

5.7.1 If any discrepancies of any kind should be found during the initial receipt inventory and inspection, the following procedures will be followed:

- If during the initial receipt inventory a discrepancy is found between the quantity listed on the invoice and the quantity being delivered, the quantity received will be annotated on the invoice and on the memorandum.
- The SUXOS will notify the supplier of the discrepancy before the explosives are accepted from the supplier's representative.
- The Project Manager will be notified telephonically, with a copy of the memorandum and a copy of the invoice being faxed as soon as possible**.**

5.8 ESTABLISHMENT OF EXPLOSIVE STORAGE FACILITY

5.8.1 EOTI will establish a storage facility for donor explosives sited at the magazine compound. If available, EOTI may use an existing storage facility at the site. The existing magazine is sited in accordance with the approved ESS and was properly grounded by a licensed electrician. Any new or additional magazine will be sited in accordance with the ESS and will be properly grounded by a qualified electrician.

5.8.2 MPPEH will not be stored. When discovered it will be inspected to determine if it is acceptable to move. If possible it will be consolidate for onsite detonation. If it is determined unacceptable to move, it will be blown in place. MPPEH will be guarded, as necessary to ensure the protection of the public (e.g. accessible to the public), until demolition operations are completed.

5.8.3 Lightning protection system (LPS); each magazine will be provided lightning protection in accordance with DA Pam 385-64. The provisions of the National Fire Protection Association (NFPA) 780, which is consistent with Army guidance, may be used to supplement Army guidance where necessary.

5.8.3.1 Prior to storing explosives in any magazine with an installed LPS, the system will be inspected and tested to ensure it is functional.

5.8.3.2 If more than one portable magazine is used, they will be separated by a minimum of 2 meters (6.5 feet) if they are grounded separately, or they will be bonded to a common grounding system if the 2 meters (6.5 feet) criteria cannot be met. Fences installed around magazines will be at least 2 meters (6.5 feet) from the magazine or bonded into the grounding system.

5.9 PHYSICAL SECURITY OF EXPLOSIVE STORAGE FACILITY

5.9.1 EOTI plans to establish an explosives storage facility for this project. Explosives for disposal of MEC will be provided and delivered by a local vendor and stored in an ATF-approved Type II explosives magazine with an attached cap box. While donor explosives are on site, EOTI will comply with all regulations and requirements applicable to the USACE facility, ATF regulations, the Puerto Rico Explosives Act and USAESCH requirements for security of explosives.

5.10 TRANSPORTATION

5.10.1 On-site transportation of explosives from the magazines to the demolition location(s) will be by designated vehicle, following the requirements set forth in 49 CFR and DoD 6055.9 STD. Only UXO-qualified personnel may transport explosives. These individuals must have a valid driver's license and will be instructed on transporting explosives, inspecting and operating vehicles, and emergency response.

5.10.2 Vehicles used to transport explosives will have substantially constructed bodies, with no sparking metal exposed in the cargo space, and be equipped with suitable sides and tailgates. Explosives will not be piled to extend over the sides or the end of the vehicle.

5.10.3 Vehicles containing explosives will be maintained in good condition and operated at a safe speed and in accordance with all safe operating practices. Vehicles containing explosives will be posted with proper warning signs.

5.10.4 Materials or supplies will not be placed on or in the vehicle cargo space containing explosives, detonating cord, or detonators, except for safety fuse and properly secured nonsparking equipment used expressly in the handling of such explosives or detonating cord. Explosives and blasting caps will be transported in separate vehicles. Explosives and blasting caps will be promptly transported without delays in transit. EOTI will use day boxes for the transport of explosives. Explosives and blasting caps will be transported at times and over routes that limit exposure to a minimum number of people.

5.10.5 Only the necessary attendants will ride on or in vehicles containing explosives or blasting caps. When a vehicle containing explosives or detonators is parked, the brakes will be set, the motor will be shut off, and the vehicle will be blocked securely against rolling. After the vehicle is secured, the blasting cap box and the containers with the explosives will be removed from the cargo area of the vehicle and placed on the ground before any explosives or blasting caps are removed from the containers.

5.10.6 The motor vehicle used for transporting explosives will have the following minimum safety equipment:

- Fire extinguishers (two 10A:60B:C dry chemical extinguishers)
- Flame-retardant cover, or metal containers such as Institute of Makers of Explosives (IME) boxes or other suitable metal containers with latching lids and appropriate padding
- Non-metallic bed-liner such as sand bags, dunnage, or wooden box

5.10.7 When transporting donor explosives to the disposal site or transporting MPPEH items to the disposal location:

- Vehicles used for transportation of explosive materials will not be loaded beyond their rated capacity and the explosive materials will be secured to prevent shifting of load or dislodgment from the vehicle; when explosive materials are transported by a vehicle with an open body, a magazine or closed container will be securely mounted on the bed to contain the cargo.
- All vehicles transporting explosive materials will display all placards, lettering, and/or numbering required by DOT and will have two each 10BC fire extinguishers on board.
- Explosive materials and blasting supplies will not be transported with other materials or cargos. Blasting caps (including electric) will not be transported in the vehicle or conveyance with other explosives unless the conditions of 49 CFR 177.835(g) are met (i.e., an IME-22 Container is used to transport the blasting caps).
- All vehicles used for transportation of explosive materials will be in the charge of and operated by a person who is physically fit, careful, reliable, able to read and understand safety instructions, and not under the influence of intoxicants or narcotics.
- Only the authorized driver and his or her helper will be permitted to ride on any conveyance transporting explosive materials or detonators.
- Explosives will not be exposed to sparking metal during transportation of materials and all electric wiring will be completely protected and securely fastened to prevent short circuits. A written record of such inspection will be kept on file.

- Vehicles transporting explosive materials will be operated with extreme care; full stops will be made at approaches to all railroad crossings and main highways and the vehicles will not proceed until it is known that the way is clear.
- No vehicle will be refueled while explosive materials are on the motor vehicle except in an emergency.
- Persons employed in the transportation, handling, or other use of explosive materials will not smoke or carry on their persons or in the vehicle, matches, firearms, ammunition, or flame-producing devices.
- Vehicles transporting explosive materials will not be left unattended.

5.11 REQUIREMENTS FOR VEHICLES TRANSPORTING EXPLOSIVES TO THE REMOVAL SITE

5.11.1 All applicable requirements of Section 5.10 will apply to transportation of explosives on the removal site.

5.12 RECEIPT PROCEDURES

5.12.1 Accountability

5.12.1.1 Upon receipt from the vendor, accountability will be established for each type of explosive material in accordance with Paragraph 5.6 above. Copies of vendor invoices will be kept with the receipt memoranda in the donor materials accountability file in the on-site project office.

5.12.1.2 Daily transactions, which include receipt, issue, and/or turn-in of donor materials, will be annotated on both copies of the EOTI Magazine Data Card Form (instructions for completing the form are on the back of the form). Daily transactions will be conducted by two persons, at least one of whom will be a UXO Tech III or higher. Balances on both copies of the EOTI Magazine Data Card forms will be compared against each other and the physical balance on hand. Inventories will be conducted at least weekly in accordance with Section 5.13. Discrepancies will be resolved immediately. If it is determined that a theft or loss has occurred, the procedures in Section 5.14 will be followed.

5.12.1.3 When the balance for an item reaches "zero", both copies of the EOTI Magazine Data Card will be maintained in an "Inactive" Donor Materials Accountability file in the on-site project office

5.12.1.4 All documents associated with receipt, transfer, issue, or turn –in of donor explosives will be maintained in the Donor Materials Accountability file in the on-site project office.

5.12.2 Designated Individuals

5.12.2.1 The following individuals are authorized to order and receive explosives from the supplier:

- Senior UXO Supervisor
- Site Safety and Health Officer

5.12.2.2 The following individuals are authorized to transport and use donor explosives:

- Senior UXO Supervisor
- Site Safety and Health Officer
- UXO Tech III
- UXO Tech II

5.12.3 Explosive Use Certification

5.12.3.1 At the conclusion of the intrusive investigation activities at Culebra Island Site, the SUXOS will complete an EOTI Memorandum stating all donor explosives expended during MEC removal operations were used for their intended purpose. Any explosives remaining after a disposal operation will be disposed of in accordance with Section 5.16.

5.13 INVENTORY

5.13.1 Physical Inventories

Physical inventories will be conducted to verify the accuracy of the amounts indicated on the

EOTI Magazine Data Cards. Upon removing explosives from the inventory or returning explosives to the inventory, the quantities will be recorded on both copies (the magazine copy and the file copy) of the EOTI Magazine Data Cards and the inventory balance will be adjusted on both cards. Before leaving the magazine, the balance on both cards will be compared against each other and the physical balance on hand.

5.13.2 Weekly Inventories

Inventories of explosives in stock will be conducted at least weekly. Results will be recorded on both copies of the EOTI Magazine Data Card. The same individual will not conduct consecutive inventories. Each inventory will be verified by a second person.

5.14 PROCEDURES UPON DISCOVERY OF LOST, STOLEN, OR UNAUTHORIZED USE OF EXPLOSIVES

5.14.1 Lost, stolen or unauthorized use of explosive materials will be reported as follows:

- The SUXOS will give an immediate telephonic notification to the Contracting Officer, followed up by a written report within 24 hours
- Notify the Bureau of Alcohol, Tobacco, and Firearms (ATF) at 800-800-3855, within 24 hours of discovery (complete ATF Form 5400.5, Report of Theft or Loss - Explosive Materials and mail to nearest ATF office. Instructions for completion of the form are on the reverse side.);
- Notify the local law enforcement agency.

5.15 RETURNING EXPLOSIVES TO THE EXPLOSIVE STORAGE AREA

5.15.1 If, for any reason, explosives are removed from the magazine and then not used, they will be returned to the magazine the same day. Documentation will be accomplished in accordance with paragraph 5.12.

5.16 DISPOSAL OF UNUSED EXPLOSIVE MATERIALS

5.16.1 All unused explosive materials remaining at the end of disposal activities at the site will be returned to the vendor. A signed receipt will be obtained from the recipient. If any explosives cannot be returned to the vendor, they will be destroyed on site. Documentation will be accomplished in accordance with paragraph 5.12.

6.0 EXPLOSIVES SITING PLAN

In accordance with Interim Guidance Document (IGD) 08-01, the government will prepare an Explosives Siting Plan (ESP) in coordination with the Contractor as a stand alone document to be inserted into the WP after ESP acceptance.

7.0 ENVIRONMENTAL PROTECTION PLAN

7.1 IDENTIFICATION OF ENVIRONMENTAL CONCERNS

7.1.1 This chapter of the Work Plan describes environmental concerns and describes methods used during site activities designed to minimize pollution, protect and preserve natural resources, restore damage, and control noise and dust within reasonable limits. Appendix J includes the *Standard Operating Procedures For Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802, Culebra, Puerto Rico.* This document contains a series of standard operating procedures (SOPs) to avoid or minimize impacts to threatened and endangered species listed pursuant to the Endangered Species Act (ESA) during work on Culebra and adjacent cays and in the surrounding waters.

7.1.2 Appendix J also contains other documents relevant to the ecology of the site including:

- Interim Guidelines for UXO Investigation, Identification, and Removal Activity Taking Place at Culebra National Wildlife Refuge
- Protected Species and Habitat Protocols
- Vessel Strike Avoidance Measures and Reporting for Mariners
- FWS Letter Regarding Fish and Wildlife Coordination Act
- Floral & Faunal Survey of Cerro Balcon Project Site
- Floral & Faunal Survey of Cayo Lobo DERP-FUDS Clean Up
- Acropora ESA 4(d) Rule

7.1.3 Prior to the initiation of field activities, team members will receive site specific training to include all relevant documents in Appendix J.

7.2 ENDANGERED / THREATENED SPECIES WITHIN THE PROJECT SITE

7.2.1 Endangered and threatened plant and animal species inhabit specific areas of the Culebra. It is essential that site personnel maintain close coordination with the responsible environmental resources agencies to avoid disturbing any of these species.

7.2.2 In the event that a threatened or endangered species is harmed as a result of clearance activities, EOTI will notify the contracting officer.

7.2.3 Access to the cays will be conducted in accordance with the SOPs and coordinated with the responsible environmental resources agencies.

7.2.4 Species include the endangered hawksbill (Eretmochelys imbricata) and leatherback (Dermochelys coriacea) sea turtles, the threatened green sea turtle (Chelonia mydas) and its designated critical habitat 3 nautical miles around Culebra and its surrounding islands and cays, the threatened elkhorn (Acropora palmata) and staghorn corals (Acropora cervicornis), the West Indian manatee (Trichechus manatus), and avian species. The following table lists the known endangered and threatened species that may be located in the area.

Table 7.1 Known Endangered and Threatened Species

Classification	English Common Name	Spanish Common Name	Latin Names	FWS ESA Status	Puerto Rico Status
Marine Mammals	Sperm whale		Physter catodoc	E	NL
	Humpback whale	Ballena jorbada	Megaptera novaeangliae	NL	V
	Finback whale		Balaenoptera physalis	E	NL
	West Indian (Antillean) manatee	Manati antillano	Trichechs manatus	E	E
	Caribbean monk seal		Monachus Tropicalis	E	E
Birds	Brown pelican	Pelícano pardo	Pelicanus occidentalis occidentalis	E	E
	Peregrine falcon	Falcón peregrino	Falco peregrinus tundrius	NL	CE
	Roseate tern	Palometa	Sterna dougalli	T	V
	Masked duck	Pato dominico	Oxyura dominica	NL	E
	Ruddy duck	Pato chorizo	Oxyura jamaicensis	NL	V
	Caribbean coot	Gallinazo caribeño	Fulica caribaea	NL	V
	Least grebe	Tigua	Tachybaptus dominicus	NL	DD
	West Indian whistling duck	Chiriria antillano	Dendrocygna arborea	NL	CE
	White cheeked pintail	Pato quijada colorada	Anas bahamensis	NL	V
	Least tern	Gaviota chica	Sterna antillarum	NL	DD
	White crowned pigeon	Paloma cabeciblanca	Columba leucocephala	NL	DD
	Bridled quail dove	Paloma perdiz de Martinica	Geotrygon mystacea	NL	DD
	Piping plover	Chorlo melódico	Charadrius melodus	T	CE
Reptiles	Hawksbill sea turtle	Carey de concha	Eretmochelys imbricata	E	E
	Leatherback sea turtle	Tinglar	Dermochelys coriacea	E	E
	Green sea turtle	Peje blanco	Clelonia mydas	T	E
	Loggerhead sea turtle	Cabezón	Caretta caretta	T	NL
	Virgin Islands tree boa	Boa de Islas Vírgenes	Epicrates monensis granti	E	CE
	Puerto Rican boa	Boa puertorriqueña	Epicrates inornatus	E	V
	Slipperyback skink	Lucía	Mabuya mabouya sloanei	NL	V
	Culebra giant anole	Lagartijo gigante de Culebra	Anolis roosveltii	E	CE
	Puerto Rican slyder	Jicotea	Trachemys stejnegeri	NL	DD
Plants	Wheeler's peperomia		Peperomia wheeleri	E	E
	Square stem cactus		Leptocereus grantianus	E	NL

*Caribbean monk seal is presumed extinct
Key: CE = Critically endangered; DD = Deficient data; E = Endangered; NL = Not listed; T = Threatened; V = Vulnerable
Sources: DNER 2004 (Regulation No. 6766); FWS 2005 (Puerto Rico species lists at URL http://ecos.fws.gov/tess_public/servlet/gov.doi. tess_public. servlets. RegionLists?lead_region=4#PR); ESEW.org 2005 (http://www.esew.org/warning_lists/usa_teritory/ puertorico/ puertorico.htm)

7.2.4.1 The cays surrounding Culebra are known nesting areas for shorebirds, seabirds, and sea turtles. Although seabirds may be present on the cays year round, the majority of shorebird and seabird nesting occurs during the spring and summer months. Critical times that MEC should not be detonated because of seabird activity are April through September; this would also be protective of most sea turtle nesting. All work schedules will be coordinated with the responsible natural resource agencies to avoid or mitigate possible disturbance of sensitive species during nesting seasons.

7.2.4.1 The volcanic rocks and cays of northeastern Puerto Rico provide a suitable habitat for the nesting of marine birds. These rocks and cays are unstable and subject to erosion despite their dense vegetative cover. Fourteen species of marine birds nest in the Culebra archipelago. On the Island of Culebra sooty terns select nest sites that have tall vegetation and more cover over the nest and that were farther from open areas.

7.2.4.2 All on-site project personnel will be instructed during site orientation training of the potential threatened and endangered species in the area and of the need to avoid harming these plants and animals. On-site personnel will be instructed that civil and criminal penalties exist for harming, harassing, or killing birds, manatees, sea turtles, dolphins, or whales, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act (ESA) of 1973, and Puerto Rico DNER Regulation Number 6766 for the preservation of vulnerable species and species in danger of extinction (February 11, 2004).

7.2.4.3 Roseate tern (palometa), a threatened species, arrives at the end of April and begins nesting in the middle of May. Nesting areas may be moved from year to year. If reproduction is successful, juveniles and adults leave Culebra at the end of July or early August. Nesting pairs of roseate tern have continually declined from 300 in 1988 to 15 to 25 in the 1990s. Population estimates in 2000 and 2004 indicated no more than 15 pairs (Saliva 2005). Roseate terns usually hide their nests under some sort of protective cover such as rocks, vegetation, or washed-up debris (Spendelow 1995). Caribbean birds use a variety of substrates, including open sand and coral rubble, rocky cliffs, and low islands. Nesting sites may be densely vegetated or bare. Varying amounts of debris and vegetation may be present in the nesting area.

7.2.4.4 The Atlantic Coast piping plover (Charadrius melodus) population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina). The piping plover's winter range extends along the Atlantic and Gulf coasts from North Carolina to Mexico and into the Bahamas and West Indies (FWS 1996). Plovers appear to prefer sandflats adjacent to inlets or passes, sandy mudflats along prograding spits, and overwash areas as foraging habitats (FWS 1996, 50 CFR 17).

7.2.4.5 NMFS (FR Vol. 63, No.170, September 2, 1997) designated critical habitat pursuant to the Endangered Species Act of 1973 (ESA) for the threatened green turtle (Chelonia mydas) to include waters extending seaward 3 nautical miles (5.6 kilometers) from the mean high water line of Culebra Island. These waters include Culebra's outlying cays, including Cayo Norte, Cayo Ballena, Cayos Geniqui, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Pena, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. The extensive seagrass beds of the Culebra archipelago support a large juvenile population of green turtles.

7.2.4.6 On November 10, 1993, FWS designated Culebra seagrass beds as Resource Category 1, recognizing these seagrasses as critical foraging habitat for juvenile green turtles. Resource Category 1 designation recognizes the habitat as unique and irreplaceable on a national or ecoregional level and states that loss of the habitat is not acceptable. The seagrass beds of Culebra consist primarily of turtle grass (Thalassia testudinum). In the Caribbean, turtle grass beds consist primarily of turtle grass but may include other species of seagrass such as manatee grass (Syringodium filiforme), shoal grass (Halodule wrightii), and sea vine (Halophila decipiens), as well as several species of algae including green algae of the genera Halimeda, Caulerpa, and Udotea.

7.2.4.7 Nesting hawksbill sea turtles prefer low-energy sandy beaches with woody vegetation such as sea grape or saltshrub located within a few meters of the water line. Suitable nesting habitat can be extremely variable and ranges from high-energy ocean beaches to tiny pocket beaches only a few meters in width. Nests are typically placed under vegetation. The nesting season varies with locality, but in most locations nesting occurs some time between April and November. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. On Isla Culebrita, all beachfront areas on the southwest-facing shore, east-facing shore, and northwest-facing shore of the island from mean high tide inland to a point 150 meters from shore have been designated critical habitat for hawksbill sea turtles (50 CFR 17.95).

7.2.4.8 The largest concentration of nesting leatherback sea turtles in the United States Caribbean has been documented at Sandy Point National Wildlife Refuge, St. Croix, and Playa Brava and Playa Resaca on Culebra Island. Nesting females prefer high-energy beaches with deep and unobstructed access. The Island of Culebra and St. Croix beaches have the greatest density of leatherback nests within United States waters. In the wider Caribbean, major nesting commences in April (a few nests may be laid from December to February) and continues into July. On Culebra, the nesting season begins in February and continues through July. Hatching may begin as early as April and continues through September. Leatherbacks nest in sand near the vegetation line on the beach (http://www.coralations.org/turtles/index.htm). Atlantic leatherbacks nest an average of six times from April to July, with approximately 10 days between the nesting episodes. Often turtles will lay their nests in areas that are under water during high tide.

7.2.4.9 In the Atlantic, leatherbacks nest from November to April (http://www.glf.dfo-mpo.gc.ca/os/beach-rivage/turtle-tortue-e.php). In St. Croix, the nesting period extends from February 9 to August 11, with each turtle laying an average of 5.26 nests per season with an inter-nesting interval of 9.6 days (Boulon et al. 1996).

7.2.4.10 On Culebra and the surrounding cays, the slipperyback skink (Mabuya mabouya) is listed as vulnerable in DNER Regulation No. 6766 and in the Draft Puerto Rico's Comprehensive Wildlife Conservation Strategy. This skink is found in dry tropical forests in leaves, rocks, and trunks. Slipperyback skink was restricted to dry scrub woodland and littoral forest in the Dominican Republic (citation Ricklefs and Lovette 1999).

7.3 BENTHIC HABITATS

7.3.1 NMFS has proposed that elkhorn (Acropora palmata) and staghorn (A. cervicornis) corals be listed as threatened under the ESA (FR Vol. 70, No. 88:24359, May 9, 2005). Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over two meters in length and height. It occurs in back reef and fore reef environments from 0 to 30 meters depth. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Although A. cervicornis colonies are sometimes found interspersed among colonies of A. palmata, they are generally in more protected, deeper water or seaward of the A. palmata zone and hence protected from waves (Acropora BRT 2005). Fore reef zones at intermediate depths (5 to 25 meters) were formerly dominated by extensive single species stands of staghorn coral until the mid-1980s. Elkhorn coral is a large branching coral with exceptionally thick and sturdy antler-like branches forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Colonies prefer exposed reef crest and fore reef environments in depths of less than 6 meters, although isolated corals may occur to 20 meters. The preferred habitat of A. palmata is the seaward face of a reef (turbulent shallow water), including the reef crest, and shallow spur and groove zone (Acropora BRT 2005).

7.3.2 Both elkhorn and staghorn corals underwent precipitous declines in abundance in the early 1980s throughout their range, and this decline has continued. The major threats to the existence of these corals are disease, elevated temperature, and hurricanes. Disease was identified as the single largest cause of both elkhorn and staghorn coral mortality and decline. Hurricanes appear to be the main factor for the large-scale decimation of elkhorn coral (A. palmata) biotopes in Puerto Rican reefs, Less severe stressors include anchoring and subsequent breakage of corals. Their branching morphology makes them particularly susceptible to breakage. The creation of fragments through breakage is a natural means of asexual reproduction for these species; however, the fragments must encounter suitable habitat to be able to reattach and create a new colony (FR Vol. 70, No. 88:24359, May 9, 2005).

7.3.3 Brief descriptions of some acroporid reefs in Puerto Rico were described by the Acropora Biological Review Team (2005) and are excerpted verbatim in the following paragraphs.

7.3.4 In Puerto Rico, well-developed and dense thickets of A. cervicornis were present through the late 1970s at many reefs surrounding the main island, and also the offshore islands of Mona, Vieques and Culebra (Almy and Carrión-Torres 1963, McKenzie and Benton 1972, Rogers 1977, Goenaga and Cintrón 1979, Boulon 1980). Later, in 1978-79 during an island-wide survey, A. cervicornis was found on only 20% of those reefs (Bruckner 2002). Unfortunately, quantitative trend data sufficient for a case study to depict trend in A. cervicornis abundance or distribution are not available from Puerto Rico. A recent description of the status of A. cervicornis in Puerto Rico can be found in Bruckner (2002); a few other studies are summarized below:

7.3.4.1 Along the shelf-edge reef south of Puerto Rico, A. cervicornis was the dominant coral prior to Hurricane David in 1979. Twenty random 0.6 m2 photoquadrats were selected from each of ten 40-m long transects parallel to the depth contours across the reef (16.7 to 19.2 m depth). Based on analysis of point count data, A. cervicornis had a mean of 31.1%

total cover (range of 9.9 to 56.9%) prior to the storm; after the storm, total cover of A. cervicornis dropped to a mean of 0.90% (range of 0.02 to 2.7%) (Boulon unpubl. data).

7.3.4.2 With the exception of a few reefs in the southwest and isolated offshore locations, the dense, high profile, monospecific thickets of both species (A. cervicornis and A. palmata) have disappeared from Puerto Rico coral reefs (Weil et al. unpublished data).

7.3.4.3 In the summer of 2004, there was an epidemic outbreak of white pox disease at Los Corchos coral reef in Culebra, Puerto Rico. Coral cover on the reef reaches values of 80%; a total of 80 to 90% of the A. cervicornis colonies at a permanent monitoring site were already dead or dying three weeks after Tropical Storm Jeanne (Rogers, pers. comm.).

7.3.4.4 On November 21, 2008 the 4(d) Rule established "take" prohibitions for threatened corals. The term "take" means to hurt, hunt, shoot, capture, trap, kill, collect, bother, harm, or purse an ESA-listed species, or attempt any of these activities. A complete copy of the final 4(d) Rule may be found in Appendix J.

7.4 WATER RESOURCES

7.4.1 Although scarce, ground water in Isla de Culebra is known to occur in alluvial deposits and in the volcanic and plutonic rocks. Alluvial deposits are located along major stream valleys that reach the coast. The alluvium is mostly composed of silt and clay with limited quantities of sand and gravel. Fractures and joints within the volcanic and plutonic rock formations store water in small quantities. Most of these fractures and joints diminish in number and size with depth and pinch out at about 300 feet below land surface. Water-table conditions prevail in the bedrock aquifer. By comparing changes in water levels with records of pumpage and estimates of recharge, the specific yield for the bedrock aquifer was estimated as less than one percent.

7.4.2 The only source of recharge for the aquifers of Isla de Culebra is direct rainfall. Annual rainfall on Isla de Culebra averaged approximately 32 inches from 1961 to 1970 (Jordan and Gilbert, 1976). However, recharge from rainfall only occurs during storms that last two to four days. Such storms take place only two to three times a year. About one percent of the rainfall infiltrates to the aquifer during these events. Annual recharge ranges from 0 to 6.8 percent of annual rainfall (Jordan and Gilbert, 1976). A relation between water levels and rainfall events exists; after rainstorms, water levels rise for several months. This is caused by a thick layer of soil or fine grained alluvium that acts as a reservoir and that releases water at a slow rate. This reservoir system occurs in the alluvium and underlying saprolite of the high valley that lies at the eastern end of the dioritic rocks in north-central Isla de Culebra. The yield of bedrock wells in the valley is due to the reservoir system. Water-table conditions prevail in the bedrock aquifer. Each stream drainage basin constitutes a separate aquifer with a ground-water divide impeding movement between basins. The depth to the water table beneath the hills may be 100 feet or more, but in the lower part of the valleys may be less than 10 feet. The water flows towards the sea, but little water is discharged to the sea because it mostly evaporates from the water table. In coastal embayments, the water table usually is 1 to 2 feet above mean

sea level. Because of the low heads and the proximity to the sea, salt water encroachment is common.

7.4.3 The fractured rock aquifer of Isla de Culebra is considered a set of independent aquifers: the aquifer in each drainage basin is separated from the aquifer in adjacent basins by a ground-water divide. Although ground-water resource is scarce, existing or potential pollution of an aquifer, therefore, will usually affect a single basin. The ground water on Isla de Culebra is rich in mineral concentrations, which, in most cases, exceed USEPA standards for drinking water. Dissolvedsolids concentration range from 500 to 1,000 mg/L. This condition is a result of airborne particulates that fall in the land surface and infiltrate the aquifer during periods of recharge, evapotranspiration in the soil zone, and the limited amount of recharge. The most serious potential threat to ground water on Isla de Culebra are effluents from septic tanks. The effluents can quickly infiltrate through the thin soil and saprolite zone and enter the fractured bedrock aquifer in a nearly unfiltered, unaltered state. The greater the concentration of septic tanks in an area, the greater the potential threat to the aquifer.

7.4.4 A small cattle watering pond is in the Cerro Balcon area. Drainage features only intermittently contain water. No streams are located on Culebra.

7.4.5 Lagoons are located on the northwest portion of Isla Culebrita within the strafing range project area. Saline ponds and lagoons are particularly important to migratory waterfowl such as blue-winged teal, as well as the resident white-cheeked pintail and several waders. The usual fringe of mangroves surrounding these saltwater ponds provides habitat for nesting populations of herons, pigeons, and many songbirds (EEG 2006).

7.4.6 Groundwater is not commonly encountered on Culebra Island or the surrounding cays due to the limited thickness of soil and the shallow igneous rock; therefore, groundwater resources will not be adversely affected by site operations.

7.5 WETLANDS WITHIN THE PROJECT SITE

7.5.1 Several lagoons are present on Culebra and Culebrita. The proposed work will not be conducted in submerged wetlands areas. EOTI personnel will perform required tasks in a manner that will minimize the possibility of surface runoff that may affect the wetlands. If any areas are adjacent to wetlands or other bodies of water, sandbags or other barrier devices will be used to reduce the spread of potentially contaminated soil or water. EOTI field supervisors will monitor work sites for situations that could cause wetlands impact and will alert the appropriate agency.

7.5.2 Laguna del Flamenco is located within MRS 04 on the south side of Flamenco Beach. Flamenco Lagoon is fed by groundwater, surface water, and runoff from MRS 04. Small ephemeral gullies in MRS 04 drain storm water to Flamenco Lagoon.

7.5.3 MRS 07 contains two shallow lagoons or tidal flats flood during rain events and may receive sea water from storm surges. Laguna de Molino (western tidal flat occurs on the western tip of Culebrita and covers approximately 5.5 acres. The other lagoon is located on the southwest edge of Culebrita toward the Canal De Culebrita. This wetland is smaller, covering only 0.9 acres.

7.6 CULTURAL, ARCHAEOLOGICAL, AND WATER RESOURCES WITHIN THE PROJECT SITE

7.6.1 There are no known cultural, archaeological, or water resources that will be negatively impacted by planned activities. According to the National Register Information System (NRIS), National Historic Landmarks (NHL) list, National Heritage Areas (NHA) list, and National Park Service (NPS), there is only one registered cultural resource within the boundaries of the Culebra Island site. On the Isla Culebrita is an historic lighthouse called Faro Isla de Culebritas. The lighthouse is not open to the public due to building deterioration. According to the Puerto Rico State Historic Preservation Office (SHPO), there are no known architectural resources within the boundaries of the Culebra Island site; however, an architectural survey has not yet been conducted for Culebra. An archeological survey performed at Lower Camp in 1992 found evidence of prehistoric and historic inhabitants distributed over a half-acre area within the Lower Camp site.

7.7 COASTAL ZONES

7.7.1.1 This investigation will include accessing via beaches in and around Isla Culebrita and the other cays. Operations on Isla Culebrita and other cays will require transport of work crews and equipment via boat. Landing and transport will be handled in accordance with the SOP located in Appendix J.

7.7.1.2 To reduce fragmentation distance and potential for fire, detonations of munitions up to 155 mm will be tamped with biodegradable sandbags or water bags. If MEC is deemed acceptable to be moved, it will be moved toward the site interior at a distance greater than 200 feet from the shoreline for detonation. If MEC is deemed unacceptable to be moved and occurs less than 200 feet from the shoreline, it is possible that sandbag remnants could be blown into the water. Sandbag remnants landing in the water would cause minimal adverse impacts and would not reduce the quality or quantity of essential fish

habitat, would cause no cumulative impacts, and would not adversely effect populations of species listed in Caribbean Fishery Management Council management plans.

7.7.1.3 Water containment may be used rather than sandbags. Water to fill the containment system would be pumped from nearshore environment. Water would be obtained from the site's adjacent waters utilizing a centrifugal trash pump. These pumps typically have pumping rates of 200 to 400 gallons per minute with a 2-inch to 4-inch intake port. Water containment could require up to 1,100 gallons of water. Small invertebrates, zooplankton, ichthyoplankton, and juvenile or small fish could potentially be entrained in the intake water. Given the small volumes of water needed (approximately 1,000 gallons) and the short duration of pumping (approximately five to ten minutes) the wetting operations would produce a minimal adverse and short-term impact. To further reduce the entrainment potential of juvenile and small fish, the end of the intake hose may be covered with a screen. The potential minimal and short-term entrainment of organisms would not reduce the quality or quantity of essential fish habitat and would not adversely affect populations of managed species.

7.7.1.4 The worst-case scenario would involve the detonation of 500-to-1,000-pound bombs, if those are discovered. Those larger ordnance items cannot be tamped with sandbags or water. The detonation of those items would produce fragments that will be blown into the water. The maximum fragment weights for the 500- and 1,000-pound bombs are 0.89 and 0.9 pound, respectively. Maximum fragmentation distances are 3,177 feet for the 500-pound bomb and 3,288 feet for the 1,000-pound bomb. The ranges for no more than one hazardous fragment per 600 square feet are 688 feet for the 500-pound bomb and 813 feet for the 1,000-pound bomb (see MSD calculation sheets in Appendix G). The descent of fragments will be slowed by the water as they settle to the bottom.

7.8 TREES AND SHRUBS

7.8.1.1 In accordance with the SOP included in Appendix J, a standard 70 meter setback (from mean high water) is usually designated to avoid impacts to hawksbill sea turtle nesting habitat during nesting season. Based on the characteristics of the nesting habitat in Culebra and the surrounding cays, an appropriate setback will have to be established for beaches that are part of the cleanup project. For instance, hawksbill sea turtle nesting habitat might be designated from the line of woody vegetation instead of from the high water line. Measuring and flagging the setback on project beaches might be easier if measured landward from the edge of the existing woody vegetation since the high water line may change daily.

7.8.1.2 Brush cutting will be required to ensure effective surface removal in portions of the designated areas. Clearance of plants, trees and brush will be coordinated with FWS and DNER because of endangered plant species. The biologist will be classified as essential personnel in order to accompany the field crew to identify endangered species.

7.8.1.3 EOTI plans to trim and prune only the minimum amount of vegetation in order to allow effective DGM and surface / subsurface removal of MPPEH required in the PWS. If necessary, EOTI may trim grasses to no less than 6 inches in height. Underbrush and

trees may be pruned to a height of 12 inches from the ground surface or less to allow full instrument coverage underneath the trees.

7.8.1.4 To the extent possible, native trees greater than 2 inches in diameter must be left in place; however, they may be lightly pruned as required to allow full coverage of the ground with the geophysical sensors. In cases where MEC is found embedded in a native tree, FWS and DNER will be notified prior to removal. Invasive plants such as mesquite can be removed. All protected native trees which should not be pruned or removed as part the removal action will be flagged. Shrubs, trees, and limbs will not be cut without prior approval from the project biologist. Cut brush will be removed from the area of interest, if necessary to prevent interference with site operations.

7.9 MANIFESTING, TRANSPORTATION, AND DISPOSAL OF WASTE

7.9.1 EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and MDAS will be certified free of explosive hazard and turned over for recycling. Non-hazardous, municipal wasted generated during this project will be transported to a municipal landfill for disposal.

7.10 BURNING ACTIVITIES

7.10.1 EOTI will not conduct burning activities during the performance of work required in the PWS.

7.11 DUST AND EMISSION CONTROL

7.11.1 There is potential for dust generation during the performance of the work required in the PWS. The environmental conditions of the site contribute to soil moisture content. This will help to minimize dust emissions. The SUXOS, UXOSO/QC, and Team Leaders will closely monitor dust emissions resulting from soil excavation operation. Dust masks will be available to workers in areas of high dust concentrations.

7.11.2 Other emissions will primarily result from operation of engines associated with transportation equipment. These emissions will be limited by limiting the time that equipment idles when not in use. Team leaders will ensure that equipment is turned off when not in use. If excessive emissions are generated due to engine maintenance, equipment will be shut down until inspected by a mechanic.

7.12 SPILL CONTROL AND PREVENTION

7.12.1 EOTI will inspect vehicles and equipment before, during and after operation to identify any leaks of petroleum, oil and lubricants (POL). If leaks are detected, the equipment will not be used until the leak is controlled. Drip pans will be used to catch dripping POL.

7.12.2 POL will be stored on-site in approved containers, in approved areas with required containment. If a spill occurs it will be reported immediately and steps will be taken to contain the spill and limit contamination. Contaminated soil will be excavated and packaged for treatment or disposal.

7.13 STORAGE AREAS AND TEMPORARY FACILITIES

7.13.1 EOTI may place chemical toilets on the site. These toilets will be delivered, setup and serviced by a subcontractor.

7.14 ACCESS ROUTES

7.14.1 EOTI will primarily use existing roads and trails to access the work areas. These routes will allow access by foot or light vehicle to areas requiring investigation. Any additional temporary access routes required to access portion of the investigation areas will be cleared of MEC / MPPEH, but will otherwise be unimproved.

7.15 DECONTAMINATION AND DISPOSAL OF EQUIPMENT

7.15.1 Soil will be thoroughly cleaned from equipment and tools at the end of the project. Tools and equipment will be cleaned by brushing, sweeping and/or wiping dirt from them. Equipment may be further cleaned at established wash facilities.

7.16 MINIMIZING AREAS OF DISTURBANCE

7.16.1 EOTI will minimize the areas of disturbance by working only in the areas designated in the PWS and this Work Plan. EOTI will limit vegetation removal and excavation to what is necessary to complete the work.

7.17 POST-ACTIVITY CLEAN-UP

7.17.1 After completing the project, EOTI will remove all equipment tools, and cultural debris from the site. The SUXOS will inspect the area to ensure that area is clean prior to demobilization.

7.18 AIR-MONITORING PLAN

7.18.1 There is no Recovered Chemical Warfare Material (RCWM) expected at this site and no anticipated, significant exposure to other chemicals, and therefore no air monitoring will be conducted.

8.0 PROPERTY MANAGEMENT PLAN

Not required for this Task Order.

9.0 INTERIM HOLDING FACILITY

Not required for this Task Order.

10.0 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

Not required for this Task Order.

11.0 REFERENCES

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