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Work Plan to Conduct Phase I RCRA Facility Investigation Piñeros and Cabeza de Perro Islands Naval Activity Puerto Rico

Contract Task Order 0113

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AM	Activity Manager
AOC	Area of Concern
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CADD	computer-aided drafting and design
cal	caliber
CAP	corrective action plan
CAR	Corrective Action Request
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	characteristic leaching procedure
COC	chain-of-custody
CSM	conceptual site model
CTO	contract task order
DENR	Department of Environment and Natural Resources
DFOW	definable feature of work
DGM	digital geophysical mapping
DGPS	differential global positioning system
DNER	(Puerto Rico) Department of Natural and Environmental
DP	direct push
DQO	data quality objective
EA	Environmental Assessment
E&E	Ecology & Environment, Inc.
EIS	Environmental Information Specialist
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
EQB	(Puerto Rico) Environmental Quality Board
ESRI	Environmental Systems Research Institute, Inc.
ESS	explosives safety submission
FTL	Field Team Leader
GC	gas chromatography
GIP	Geophysical Investigation Plan
GIS	geographical information system
HSM	Health and Safety Manager
HSP	Health and Safety Plan

HTW	hazardous or toxic waste
IDW	investigation-derived waste
IRP	Installation Restoration Program
MC	munitions constituents
MD	Munitions Debris
MDL	method detection limit
MEC	munitions and explosives of concern
M	meter
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRP	Munitions Response Program
MRSIMS	Munitions Response Site Information Management System
MS	mass spectroscopy
msl	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl tertiary butyl ether
NAPR	Naval Activity Puerto Rico
NAVEODTECHDIV	Naval Explosive Ordnance Disposal Technology Division
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act
NOSSA	Naval Ordnance Safety & Security Activity
PARCC	precision, accuracy, representativeness, comparability, and completeness
PC	project chemist
PCB	polychlorinated biphenyls
PDF	Portable Document Format
PM	Project Manager
PQCP	Project Quality Control Plan
PQL	practical quantification limit
QA	quality assurance
QACM	Quality Assurance Control Manager
QA/QC	quality assurance/quality control
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RI	remedial investigation
RPD	relative percent difference
RTK	real-time kinematic
SAP	Sampling and Analysis Plan
SOP	standard operating procedure

SPECWAR	Special Warfare Group Two, Unit Four
SSC	Site Safety Coordinator
HSP	Site Specific Safety and Health Plan
SU	standard unit
SUXOS	Senior UXO Supervisor
SVOC	Semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TOC	total organic carbon
TOX	total organic halogens
TRPH	total recoverable hydrocarbons
USA	USA Environmental, Inc.
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance
VOC	volatile organic compound

SECTION 1

Introduction

CH2M HILL is conducting a Phase I Resource Conservation and Recovery Act I (RCRA) Facility Investigation (RFI) at Piñeros and Cabeza de Perro Islands, Puerto Rico. The Phase I RFI is being conducted for the Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Atlantic Division, under the Comprehensive Long-Term Environmental Action Navy (CLEAN) III Program. This work is being performed under Contract Task Order 113 (CTO 0113) of Contract No. N62470-02-D-3052.

1.1 Background and Project Objectives

Piñeros and Cabeza de Perro Islands, located off the coast of Puerto Rico, were part of the former Roosevelt Roads Naval Station. The islands were used for various military training exercises from the late 1950s until the closing of Roosevelt Roads in 2004, and are now overseen by Naval Activity Puerto Rico (NAPR).

The Department of the Navy anticipates transferring control of the Islands to an agency of the Commonwealth of Puerto Rico. Due to the past military operations, munitions and explosives of concern (MEC) are potentially present on these islands. A draft RCRA 7003 Order is currently being developed for the NAPR facility. The RCRA 7003 Order is expected to include requirements for addressing Pineros and Cabeza de Perro Islands as "areas of concern" (AOCs) to be addressed pursuant to RCRA corrective action requirements. As a first step in the RCRA corrective action process, and to facilitate transfer of the islands, a Phase I RFI is being conducted to accomplish the following objectives:

- Identify areas that are potentially accessible to the public under a land use scenario that allows limited access to the islands for recreational purposes.
- Evaluate the potential for MEC to be present in these areas through a visual assessment and by evaluating the density of geophysical anomalies.
- Evaluate the presence or absence of munitions constituents (MC) in these areas through the collection and analysis of surface soil samples.
- Evaluate the potential for MEC to be present at four suspected underwater demolition areas geophysical assessments of these areas.

This Phase I RFI is not intended as a full-scale study of the nature and extent of contamination or explosives hazards. Its purpose is to generate field data to determine if further response action or remedial investigation is appropriate. The purpose of performing the Phase I RFI is to efficiently gather data necessary to make this determination.

1.2 Work Plan Scope and Organization

This Phase I RFI work plan provides background information needed to understand the project tasks, describes conditions at the site, and presents the technical approach to be used for implementation of the work activities. The following primary Phase I RFI activities will be performed to accomplish the objectives described in Section 1.1:

- Conduct an archival records search to determine the types of military activities that were conducted, identify the types of MEC that were used, and determine the locations where military activities were carried out.
- Develop a land use plan that would allow limited public access for recreational purposes.
- Conduct a field investigation for MC contamination by collecting and analyzing surface soil samples in potential public access areas.
- Conduct a visual and geophysical evaluation of the potential for MEC to be present in potential public access areas.
- Conduct a geophysical evaluation of the potential for MEC to be present in four suspected underwater demolition areas.
- Prepare a Phase I RFI Report.

This work plan is divided into sections providing information on the detailed approach, including procedures to be employed during the execution of the project. Appendixes to the work plan provide supporting documentation that details specific procedures for the execution of the project.

This work plan is organized as follows:

- **Section 1, Introduction,** provides general information about this work plan, describes the Piñeros and Cabeza de Perro Islands, summarizes the military history of the islands, and presents the project scope and objectives.
- **Section 2, Technical Management Plan,** identifies the technical approach, methods, and operational procedures that will be used to execute the Phase I RFI project.
- **Section 3, Field Investigation Plan,** identifies the technical approach, methods, and operational procedures that will be used to execute the field investigation activities, including mobilization and demobilization, vegetation clearing, soil sampling, visual MD evaluations, and geophysical investigations.
- **Section 4, Quality Control Plan (QCP),** provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the Phase I RFI.

- **Section 5, Environmental Protection Plan,** describes the approach, methods, and operational procedures to be employed to protect the natural environment during the performance of all field tasks.
- **Section 6, References,** lists the references cited in the preceding sections.
- **Appendix A, Archival Records Search,** presents the results of the records search and personnel interviews that were conducted to identify historical activities that may have resulted in environmental contamination of the project area with MEC or MC. Appendix A also includes historical photographs obtained for this project.
- **Appendix B, Health and Safety Plan** (HSP), provides the health and safety procedures that will be followed by field personnel during site operations. The HSP also includes the MEC avoidance procedures that will be used to ensure that onsite personnel are protected from MEC that may be present at the site
- **Appendix C, Geophysical Investigation Plan** (GIP), details the approach, methods, and operational procedures that will be used in performing geophysical investigations at the site.
- **Appendix D, MEC Conceptual Site Model**, describes sources of MEC and MC; actual, potentially complete, or incomplete exposure pathways; current or reasonable anticipated land uses; and potential receptors.
- **Appendix E, Standard Operating Procedures** (SOPs), provides detailed instructions for the collection of environmental samples for laboratory analyses.

Additionally, an explosives safety submission (ESS) waiver request was submitted to NAVFAC Atlantic and was approved by the Naval Ordnance Safety and Security Activity.

1.3 Site Location and Description

Piñeros and Cabeza de Perro Islands are located in the Caribbean Sea, approximately 0.5 mile east of the former Roosevelt Roads Naval Station on the eastern coast of Puerto Rico, as shown on Figure 1-1. Piñeros, shown on Figure 1-2, is approximately 1 mile by 0.5 mile in size with an approximate area of 310 acres. Cabeza de Perro, also shown on Figure 1.2, is located immediately east of Piñeros and is approximately 0.25 mile in diameter with an approximate area of 30 acres.

1.3.1 Topography

The following description of topography is excerpted from Ecology & Environment, Inc. *(E&E) 1992.*

The topography of Piñeros Island is characterized by a series of smooth, round hills and low-lying swampy areas. A topographic map of both islands is shown on Figure 1-2, and an aerial photo of the islands is provided as Figure 1-3. The hills range in elevation from less than 70 feet in the northwest to a hill of 250 feet above mean sea level (msl) in the south-central portion of the island. The hills run generally in a southeast to northwest direction. These hills are generally very steep, with slopes of greater than 25 percent found on 45.3 percent (140.5 acres) and slopes of 15 to 25 percent on 13.6 percent (42.2 acres) of the

island. Only approximately 12.6 percent (39 acres) of the surface area on Piñeros consists of upland with slopes less than 15 percent. The remaining 28.5 percent (88.2 acres) of Piñeros is composed of low-lying mangrove swamp or brackish lagoon. The most significant area of swamp is located on the southwestern portion of the island, and two others are located in the northeastern portion of the island. Piñeros Island is surrounded by mostly narrow (less than 10-foot-wide) sandy beaches, except where steep rock cliffs abut the ocean. Coral reefs border the north and east coastlines.

Cabeza de Perro Island is a smoothly rounded cay with a maximum elevation of 100 feet above msl. The shoreline of Cabeza de Perro consists of rocky beaches and sea cliffs.

1.3.2 Climate

The following description of climate is adapted from E&E 1992.

The climate of Piñeros and Cabeza de Perro Islands is tropical marine, with minimal fluctuations in temperature, relatively moderate humidity, and frequent rain showers. The islands are directly in the path of the easterly trade winds, which moderate temperature extremes. The nearest weather station to Piñeros Island is located on NAVSTA Roosevelt Roads, approximately 0.5 mile west of Piñeros Island. Climatic data at the station are recorded by the Navy Weather Service and compiled by the Naval Oceanography Command Detachment, Asheville, North Carolina.

The mean annual temperature at the former Roosevelt Roads Naval Station, located approximately 0.5 mile west of Piñeros Island, averages 79.9 degrees Fahrenheit (°F) based on data compiled from 1957 through 1982. Similar historical data show July and August as the warmest month, at 82.4°F, and February as the coldest month, at 76.8°F. The relative humidity averages 65 to 78 percent.

Rainfall on the island generally consists of brief showers throughout the year. The average annual rainfall on Piñeros Island is approximately 50 inches, based on data compiled by the weather station that was located at the former Roosevelt Roads. This rainfall estimate may be somewhat high; the Draft Ecological Assessment (E&E, 1992) noted that during the field surveys for the ecological assessment, rain clouds approaching the former Roosevelt Roads Naval Station from the east tended to move in a path that took them north of Piñeros. The majority of the moisture contained in these rain clouds did not precipitate until the clouds reached the Puerto Rico mainland. As a result, the Draft Ecological Assessment suggested that Piñeros Island likely receives less precipitation than does the weather station at the former Roosevelt Roads Naval Station. The rainy season in this region is typically defined as May through November.

Winds in the vicinity of the former Roosevelt Roads Naval Station are typically from the east or northeast at an average speed of approximately 6 knots. Tropical storms and hurricanes are most likely to occur during the summer and early fall.

1.3.3 Geology and Soils

The following description of geology and soils is excerpted from E&E 1992.

Piñeros and Cabeza de Perro Islands are both of volcanic origin. The geology of Piñeros and Cabeza de Perro Islands consists of lava, lava breccia, tuff, and tuffaceous breccia of lower

Cretaceous age (Briggs, 1964). These volcanic rocks were formed directly from molten rock that cooled quickly in a marine environment. Vesicular structure is prominent in some areas and represents rock formation near the gaseous top of a lava flow. Dense, fine-grained fragments of volcanic rock and ash that exhibit a rough, gritty texture are also present. Thin-bedded sandstone and siltstone are also present in some areas. The total thickness of these rock formations may exceed 30,000 feet. Rock on the two islands is extensively weathered.

Swamp and marsh deposits overlie the igneous rocks on the southwest portion of Piñeros Island. Moderately saline swamps containing organic muck, peat, silt, and sand occur in this area (Briggs, 1964).

Piñeros Island is underlain by two types of soil: Descalabrado clay loam and tidal swamp soils (Boccheciamp, 1977). Tidal swamp soils are found on 28 percent of the island in the salinas and mangrove areas on the southwest quarter of the island and around lagoons in its northeastern section. The remainder of Piñeros and all of Cabeza de Perro are underlain by Descalabrado clay loam. These soil types are described below.

Tidal swamp soils are inundated with brackish to saline water for most of the year and typically, as is the case on Piñeros, support a thick growth of mangrove trees. They are either sandy or clayey, light colored, saline, nearly level, and contain organic material from decaying mangroves. The tidal swamp soils on Piñeros are more clayey than sandy. Tidal swamp soils are underlain by coral, shell, and marl at varying depths and serve as a feeding and breeding place for birds, oysters, and crabs (Boccheciamp, 1977).

Tidal swamp soils have no value for farming and possess very severe limitations for non-farm uses. Because they are poorly drained and subject to frequent flooding, these soils are very poorly suited for roads, paths, and trails. They are also poor sources of road fill and topsoil (Boccheciamp, 1977).

The Descalabrado clay loam soil type consists of fine-textured, shallow, eroded soils underlain and derived from volcanic rock. This soil is found on hillsides and ridgetops with slopes of 20 percent to 40 percent in semiarid volcanic uplands. The surface layer is neutral clay loam about 6 inches thick. Subsurface layers are friable clay loam interspersed with small volcanic rock fragments. The underlying material is olive-brown loam saprolite that extends to a depth of about 19 inches, where weathered volcanic rock is found (Boccheciamp, 1977).

Descalabrado soils are severely limited in their use for farming because of steep slopes, shallowness to bedrock, rapid runoff, low rainfall (30-35 inches annually), and the hazard of erosion. Descalabrado soils are best suited for pasture grazing and wildlife food and cover. The steep slope and shallowness of this soil severely limit its use for paved roads and moderately limit its usefulness for paths and trails where the slope is less than 25 percent. It is also a poor source of road fill and topsoil due to its shallowness (Boccheciamp, 1977). Presently, exposed soils occur along small-arms trails and where targets have been constructed.

1.4 Site History

The Navy acquired Piñeros and Cabeza de Perro Islands in the early 1940s as part of its general acquisition of land in the Ensenada Honda area for the former Roosevelt Roads Naval Station. Specifically, the two islands were acquired from the Fajardo Sugar Growers Association on January 31, 1942, under court settlement No. 2435. Prior to this, a small area on the northwest coast of Piñeros Island was cultivated, probably for sugarcane.

Shortly after the Navy acquired Piñeros and Cabeza de Perro Islands, the British built a network of roads, gun emplacements, and bunkers on Piñeros Island for use during World War II, as shown on Figure 1-4. These facilities were abandoned after the war. Beginning in the late 1950s, Piñeros and Cabeza de Perro Islands were utilized by Special Warfare Group Two, Unit Four (SPECWAR) personnel for various training activities. Exercises included beach landings combined with sea-to-land gunfire and underwater demolition on offshore coral reefs, and small-arms training.

Prior to 1987, training activities took place on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro Islands. Approximately 300 men, in groups of 50, were trained each year. Underwater demolitions teams utilized two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater and land explosives. Training in setting up explosives without detonation also occurred at the south shore beach, which had an emplacement of 12 to 15 obstacles in the water just off the beach.

Trails used for small-arms training led from the aforementioned beaches toward the center of the island. Units also utilized the large mangrove swamp on the southwest corner of the island to train for overland maneuvers and the location of objectives by compass at night.

In 1987, the Navy and the U.S. Fish and Wildlife Service (USFWS) signed an agreement that set restrictions on military training operations on Piñeros Island until Endangered Species Act Section 7 consultation was completed for the use of islands. Restrictions included off-limits areas in mangrove swamps, the concentration of small-arms firing along an upland area running generally northwest-to-southeast, and the limitation of underwater demolitions to one beach on each of the northern and southern shores (see Figure 1-4).

After the agreement was signed with USFWS, training on Piñeros and Cabeza de Perro Islands consisted of groups of 20 men for 2-week sessions six times per year. The first week consists of instruction-based sessions at the main camp on the northern shore. The second week consisted of practical missions where small arms, beach approaches, and overland maneuvers were practiced.

Other training activities at Piñeros and Cabeza de Perro Islands have included survival techniques, land navigation, underwater and small-unit demolition, small boat operation, diving, small-arms training (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .50 cal) , pyrotechnics (smoke grenades, pop flares, grenade simulators, etc.), and standard military demolitions (claymore mines, plastic explosives, etc.).

Following the 1987 agreement between the Navy and USFWS, a draft Environmental Assessment (EA) was prepared in accordance with the Council on Environmental Quality (CBO) Regulations pursuant to the National Environmental Policy Act (NEPA) and the Navy's Environmental and Natural Resources Protection Manual. The draft EA evaluated

the potential environmental impacts of maximizing the operational training opportunities on Piñeros and Cabeza de Perro Islands, as well as the environmental impacts of alternatives to this proposed action. Quarterly field surveys were conducted during 1989 to obtain additional information with which to assess the potential impacts of training activities on endangered species. A Draft Environmental Assessment Report was issued in June 1992 (E&E, 1992).

The former Naval Station Roosevelt Roads ceased operations on March 31, 2004, and NAPR was created to provide oversight during the final disposal of the property. Current NAPR operations are those necessary to maintain the property and provide utilities to personnel and agencies still present at NAPR. Because Piñeros and Cabeza de Perro Islands were part of the former Naval Station Roosevelt Roads, military operations on those islands ceased with the closing of NAVSTA Roosevelt Roads, and the islands are now the responsibility of NAPR.

The Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV) conducted an unexploded ordnance (UXO) surface survey of Piñeros and Cabeza de Perro Islands in late 2004 (NAVEODTECHDIV, 2004). The site survey found evidence of training activities having been conducted on Piñeros Island. Evidence included small arms remnants over about one-third of the island, breeching activities conducted in and around the bunkers, booby traps, 40mm practice grenade clutter, and assorted expended demolition material. One item dud-fired percussion grenade was also found. The visual inspection identified the following MEC-related items on Piñeros Island; however, this list is not a complete inventory of items that were used or that may possibly exist on the island:

- Dud and expended 40mm flares
- Hand grenades
- 40mm practice grenades
- 40mm cartridge cases
- 40mm smoke grenades
- Mk84 timer
- Missile cases
- Dud fired grenade
- Booby traps
- Detonation Cord
- M60 fuze lighters
- Explosive fasteners
- Shape charge remnants
- Expended cartridge cases and other small arms

Geophysical equipment was transported to Piñeros Island for the NAVEODTECHDIV survey, but was never used. The foliage was so thick and terrain so inhospitable that too much time would have been spent clearing an area to survey. It was decided that time would be better spent by covering a wider area with visual inspection.

A limited offshore underwater survey was performed with mask and snorkel. No sign of any ordnance was observed. A surface walk was conducted on Cabeza de Perro Island, which was inconclusive for UXO. Most of the island was covered tall grass, which obscured a visual and geophysical survey of the island without burn-off of the vegetation.

NAVEODTECHDIV concluded that a thorough survey of Piñeros and Cabeza de Perro Islands would require land-clearing techniques that may not be appropriate for the ecological well being of the islands.

NAVFAC issued a task order to CH2M HILL in 2005 for the performance of a Phase I RFI to evaluate the potential presence of MEC and MC at Piñeros and Cabeza de Perro Islands. Under this task order, a site visit was conducted in November 2005 with representatives of NAVFAC, NAPR, USFWS, Puerto Rico Department of Natural and Environmental Resources (DNER), and Puerto Rico Environmental Quality Board (EQB). This site visit included a visual reconnaissance of the trail leading from the south beach of Piñeros Island to the bunker in the center of the island, a visual reconnaissance of a portion of the trail from the north beach of Piñeros Island, and an offshore observation of the coastlines of both Piñeros and Cabeza de Perro Islands.

At the time of the 2005 site visit, the trails on Piñeros Island were heavily overgrown and difficult to traverse. Evidence of past military activities was consistent with that reported during the NAVEODTECHDIV survey.

1.5 Future Land Use Evaluation

Piñeros and Cabeza de Perro Islands are heavily vegetated. A complete investigation for, or removal of, MEC from the islands would require the removal of extensive areas of vegetation. Vegetation removal would result extensive removal of canopy and subcanopy vegetation. Arboreal species and other species that occur in forested habitat on Piñeros Island would be negatively impacted by the loss of habitat until such time as the forest regenerated. Additionally, vegetation clearing provides an opportunity for aggressive, weedy species to become established that may exclude the native forest vegetation and slow the recovery from vegetation clearing.

Due to site conditions, and because access to the interior of the islands and to the most of the shoreline is difficult, making public access to most island areas unlikely, NAVFAC Atlantic, in consultation with USFWS, DNER, and EQB, has decided on an approach that will allow public access to limited areas of Piñeros Island while protecting the ecology of the islands by disturbing only a small portion of the vegetation on Piñeros Island. This approach was developed by identifying areas that are currently being accessed by the public, and by evaluating areas that could potentially be used for limited public access. This evaluation resulted in the selection of the following potential public access areas that will be investigated under this Phase I RFI:

- Beach Access
- Bunker Trail
- Land Crabbing
- Offshore Anchorages

These areas are shown on Figure 1-5 and are discussed in detail below.

1.5.1 Beach Access

Piñeros and Cabeza de Perro Islands are currently off-limits to public access, and signs to this effect are in place along portions of the Piñeros Island shoreline. However, public use of accessible Piñeros Island beaches has been reported.

Four beach areas on Piñeros Island were identified as being potentially accessible to the public. These beaches are identified on Figure 1-5. The remaining shoreline of Piñeros Island, and the entire shoreline of Cabeza de Perro Island, presents difficult and dangerous landing conditions and it is recommended that all shore areas other than the four beaches identified here remain off-limits to public access.

Visual reconnaissance and digital geophysical mapping (DGM) will be conducted on these four beaches to assess the potential presence of MEC. The beaches shown on Figure 1-5 total approximately 3,700 feet in length; however, the lengths of the areas to be investigated are only estimated and may be longer or shorter than shown based on site conditions at the time of the investigation.

1.5.2 Bunker Trail

Heavy vegetation currently limits public access to most interior areas of Piñeros Island. However, local stakeholders expressed interest in allowing limited access to the island interior for those interested in the island's history and ecological resources.

To allow access to the interior of Piñeros Island, a trail has been proposed that would connect the north side of the island with the south side of the island and would lead through a World War II era bunker. As shown on Figure 1-5, the trail would begin on the easternmost beach on the north side of Piñeros Island, and then follow the base of the hill below the former helicopter landing pad before turning west and going uphill to join the former combat trail that leads to the hilltop bunker. After entering the south entrance to the bunker, the trail would pass by a former gun mount north of the bunker, and then lead northeast until entering a small valley and traveling south to the beach on the southern side of the island.

The length of the proposed bunker trail is approximately 2,800 feet. This length was estimated based on the proposed location shown on Figure 1-5; the actual length may vary based on site characteristics that may cause slight changes in the final trail location.

1.5.3 Land Crabbing

As stated above, Piñeros and Cabeza de Perro Islands are currently off-limits to public access, and signs to this effect are in place along portions of the Piñeros Island shoreline. However, it has been reported that local residents access interiors areas on the western end of Piñeros Island for the purpose of collecting land crabs. During the November 2005 site visit, crab traps were found near the proposed trail leading from the northern beach, confirming that illegal trapping does occur on the island.

In order to assess the potential presence of MEC in this land crabbing area, a visual reconnaissance and digital geophysical mapping (DGM) will be conducted along the transects identified on Figure 1-5. Section 3 of this Phase I RFI Work Plan presents the procedures that will employed for the investigation of this area.

The total length of the transects shown on Figure 1-5 is approximately 1,600 feet. The actual length may vary based on site characteristics that may cause slight changes in the final transect locations.

1.5.4 Offshore Anchorages

There is a potential for boats to anchor offshore anywhere around Piñeros and Cabeza de Perro Islands. During the November 2005 site visit, a small craft was observed to be anchored off the northern shore of Piñeros Island while the occupants snorkeled.

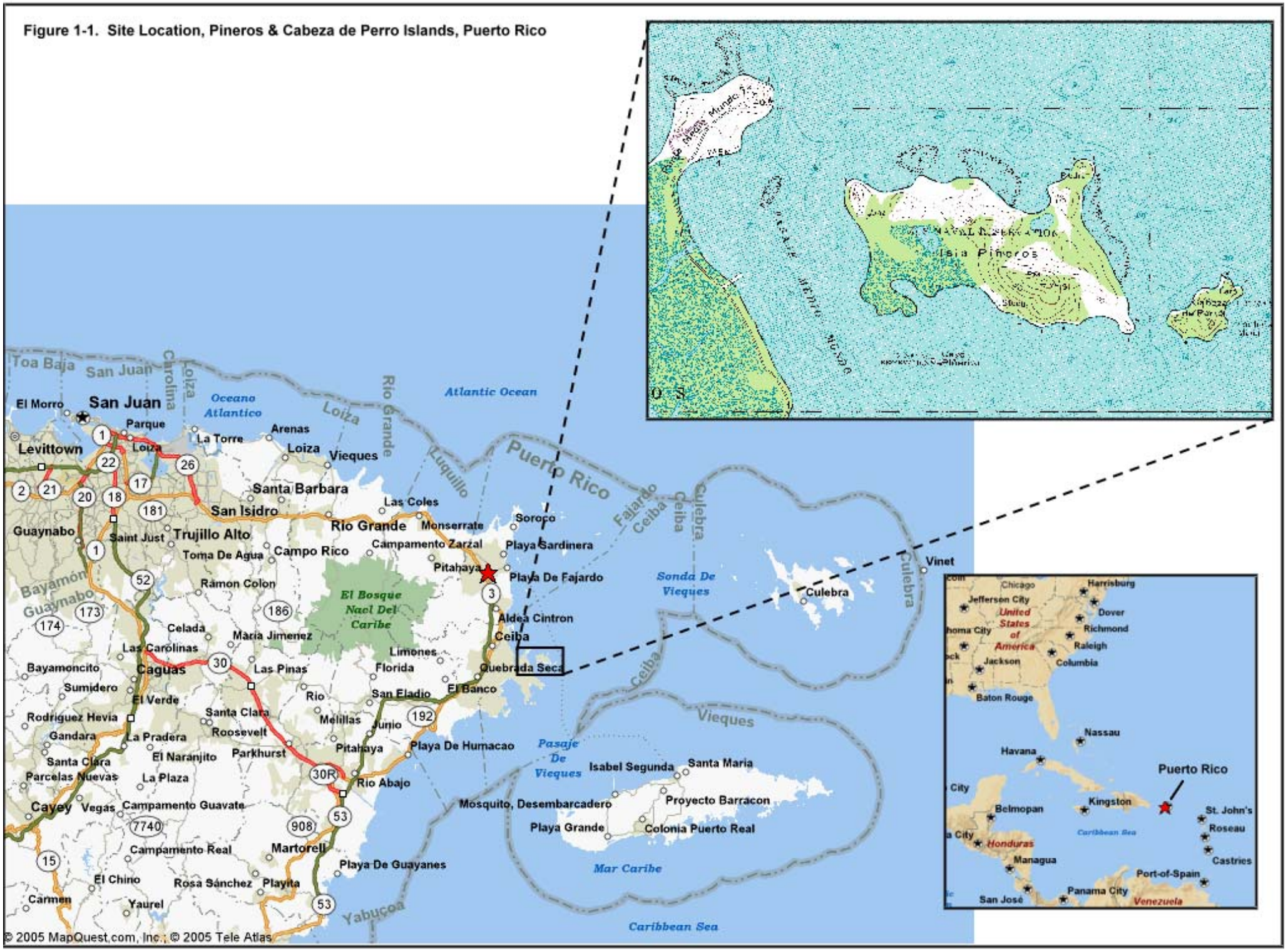
Because of the potential for snorkeling and SCUBA diving offshore of the islands, an assessment of the potential presence of MEC will be conducted at the four suspected underwater demolition areas shown on Figure 1-5. This assessment will be conducted by performing digital geophysical mapping at these four locations, which total approximately 16 acres in area.

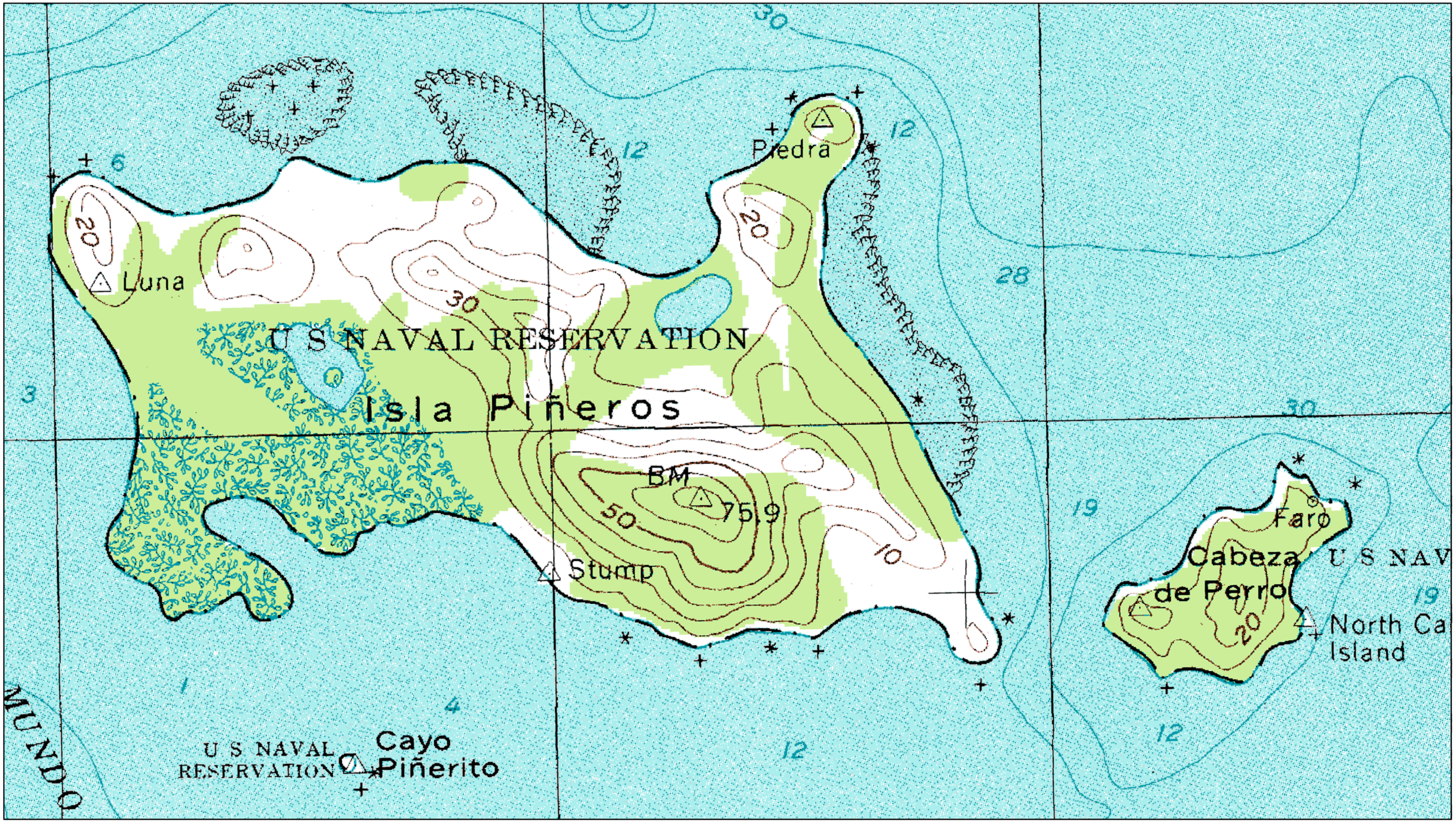
1.5.5 Other Areas

The archival records search (Appendix A) included interviews with former military personnel familiar with historical activities on Pineros and Cabeza de Perro Islands. Additional personnel who trained on Pineros Island have been identified and interviews are ongoing.

If the interviews with personnel who trained on Piñeros Island reveal information indicating potential hazards in specific areas other than those identified above, those additional areas may be inspected in an effort to evaluate the potential hazards. The need for inspection of additional areas will be determined on a case-by-case basis after consideration of the information provided by interviewees. The need for inspection will be based on the specificity of information provided, the potential hazard severity, and the probability of mishap occurring as a result of the potential hazard.

Figure 1-1. Site Location, Pineros & Cabeza de Perro Islands, Puerto Rico





Punta Puerca, P.R USGS Topo Map - Photorevised 1982

N

500 250 0 500 Feet

1 inch equals 600 feet

Figure 1-2
Topographic Map
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

CH2MHILL

File Path: G:\projects2\PinerosIsland\MXDs\Figures\Figure2_topo.mxd, Date: December 30, 2005, User: DABERCRO

N

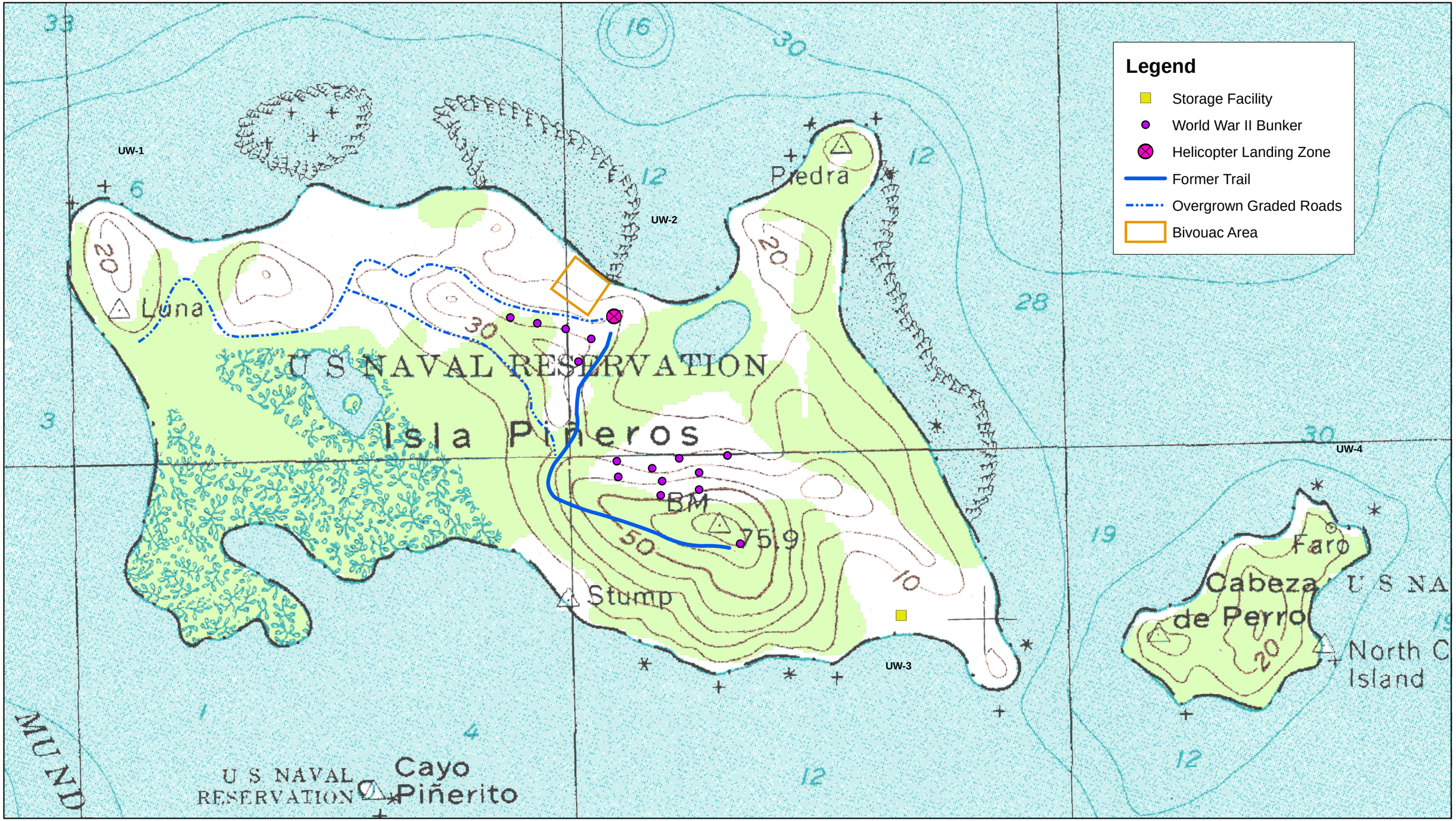
500 250 0 500 Feet

1 inch equals 600 feet

Figure 1-3
Aerial Photography Map
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

CH2MHILL

File Path: G:\projects2\PinerosIsland\MXDs\Figures\Figure3_aerial.mxd, Date: December 30, 2005, User: DABERCRO



Punta Puerca, P.R USGS Topo Map - Photorevised 1982

N

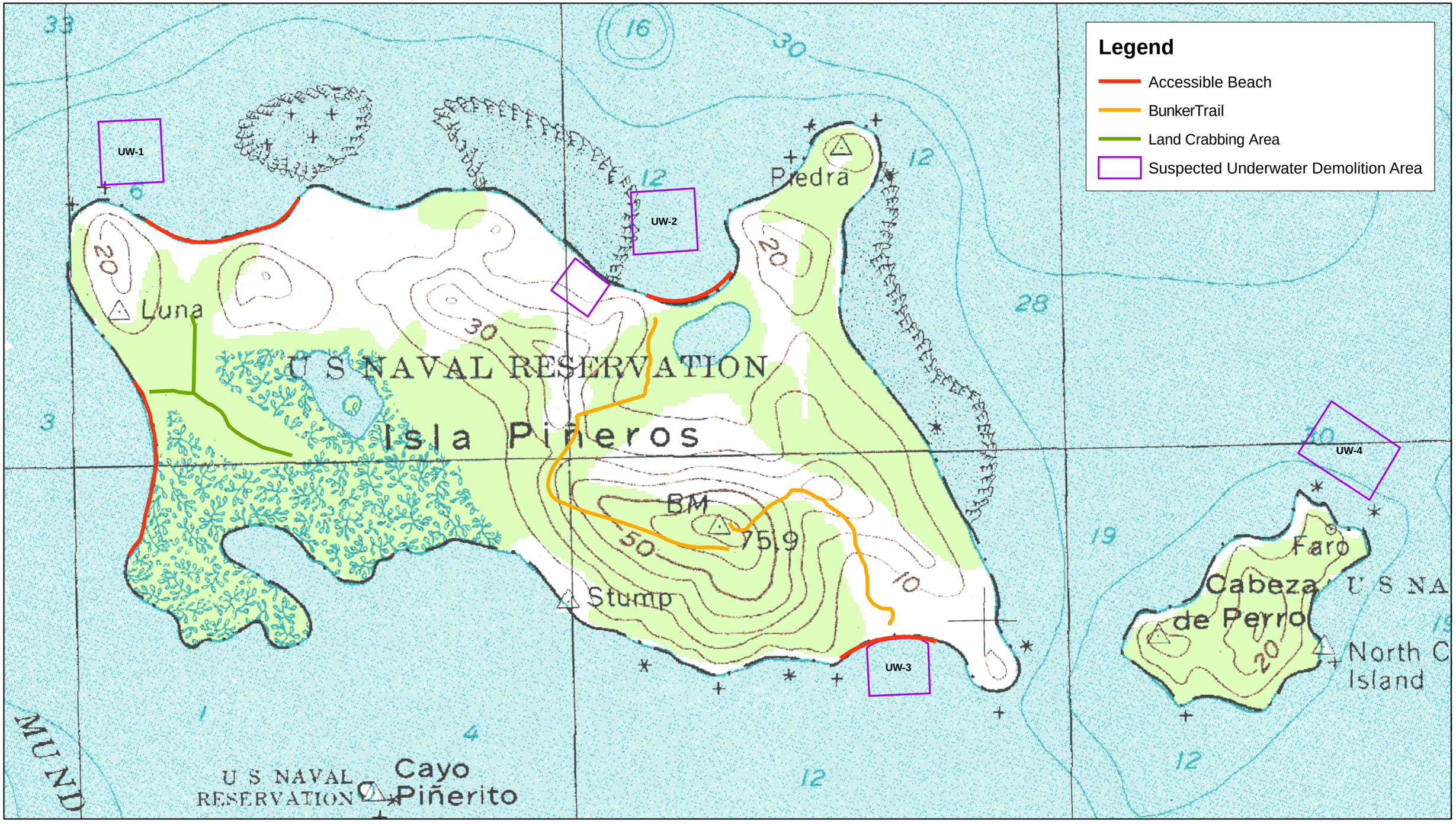
500 250 0 500 Feet

1 inch equals 600 feet

Figure 1-4
Historical Features
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

CH2MHILL

File Path: G:\projects2\PinerosIsland\MXDs\Figures\Figure4_HistoricalFeatures.mxd, Date: December 30, 2005, User: DABERCRO



Punta Puerca, P.R USGS Topo Map - Photorevised 1982

N

500 250 0 500 Feet

1 inch equals 600 feet

Figure 1-5

Proposed Investigation Areas

Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

CH2MHILL

File Path: G:\projects2\PinerosIsland\MXDs\Figures\Figure5_ProposedInvestigationAreas.mxd, Date: December 30, 2005, User: DABERCRO

SECTION 2

Technical Management Plan

2.1 Project Personnel, Organization, Reporting, and Schedule

2.1.1 Project Organization

The key organizations involved in this project are NAVFAC Atlantic, USFWS, NAPR, DNER, EQB, and CH2M HILL, Inc. Project execution will be conducted by CH2M HILL and its subcontractors. CH2M HILL will issue subcontracts for MEC support, DGM, vegetation clearing, laboratory analytical services, and data validation services.

CH2M HILL—Prime Contractor

As the prime contractor, CH2M HILL is the primary point of contact with NAVFAC Atlantic. CH2M HILL will manage the overall project, providing day-to-day oversight and related program management support to execute the project successfully. Project duties controlled by CH2M HILL include the following:

- Project planning, implementation, and reporting
- Subcontractor selection, management, and control
- Program- and project-level QC
- Program- and project-level health and safety
- Site management
- Technical direction for geophysical operations, geographical information system (GIS), and database management
- Performance of field sampling activities
- Analysis of data and preparation of the Phase I RFI report
- Project closeout

USA Environmental—Subcontractor

USA Environmental (referred to herein as USA) will provide UXO-trained personnel for escort and MEC avoidance during field operations. Specific project duties will include the following:

- Train field personnel in appropriate MEC safety procedures prior to initiation of field activities and provide MEC safety briefings during daily health and safety tailgate meetings.
- Escort site personnel in areas that have not been cleared of MEC.
- Engage in surface MEC avoidance for vegetation removal and DGM operations.
- Engage in subsurface MEC avoidance for soil sampling activities.

USA will provide the labor, equipment, and tools required for the work described above.

Geophysical Services Subcontractor

The geophysical services subcontractor will provide trained personnel for geophysical investigation services. Specific project duties assigned to the geophysical services subcontractor are to perform DGM services according to the GIP (refer to Appendix C), including the DGM survey, data processing and interpretation, and preparation of geophysical anomaly maps.

The geophysical services subcontractor will provide the labor, equipment, and tools required for the work described above.

2.1.2 Project Personnel

The reporting relationships between key project personnel are illustrated in the organization chart provided as Figure 2-1. Table 2-1 provides contact information for project team members. The roles and responsibilities of the key personnel are discussed below.

- Program Manager—Doug Dronfield will provide program management support of this CTO and will ensure that all contract requirements are met during execution of this project.
- Senior Consultant—Ben Redmond will serve as senior technical consultant and will provide quality assurance reviews on all submittals.
- Project Delivery Lead—JoLee Gardner will provide senior review of project delivery performance and ensure that project delivery requirements are met.
- Project Manager (PM)—Thomas M. Roth, P.E., will have overall CH2M HILL responsibility for technical support and oversight, budget and schedule review and tracking, invoice review, personnel resources planning and allocation, and project coordination. Mr. Roth will also coordinate field activities with project field personnel and act as CH2M HILL's primary point of contact with NAVFAC Atlantic and NAPR personnel during implementation of this CTO.
- Corporate Munitions Response (MR) Safety and QC Officer—Dan Young, CSP, will oversee the field team leader (FTL)'s implementation of the HSP (refer to Appendix B) and QC Plan (refer to Section 4) to ensure that they meet the specific needs of the project and that appropriate health and safety and QC requirements are defined and properly executed.
- Program Health and Safety Manager—Michael Goldman, C.I.H., will support the implementation of the HSP (refer to Appendix B) to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are executed.
- Field Team Leader (FTL) – Ted Dingle will be CH2M HILL's onsite representative to coordinate and oversee the activities of field support personnel and subcontractor personnel. The FTL is also responsible for implementation of and compliance with HSP and QC requirements during the field effort.

- Program Geophysicist—Tamir Klaff will be responsible for ensuring that the QC procedures and objectives for the geophysical investigations are implemented and met. Mr. Klaff will work closely with the geophysical services subcontractor during the execution of this CTO and will provide oversight of the geophysical services subcontractor and will be responsible for the acceptance of their geophysical data

2.1.3 Project Schedule

Modification 2 to CTO-113, which authorizes CH2M HILL to perform the Phase I RFI at Piñeros and Cabeza de Perro islands and provides full funding for the Phase I RFI, was issued by NAVFAC on October 4, 2005. The schedule for performing the Phase I RFI is provided as Figure 2-2. This schedule will be revised as the project progresses.

2.2 Technical Approach

The work under this CTO has been divided into the following tasks, which are described in the remainder of this subsection:

- Task 1 – Contract Startup (CS)
  - CTO 0113 Startup (CS.01.13)
- Task 2 – Project Planning (PP)
  - Project Management (PP.PM)
  - Meetings and Project Coordination (PP.MG)
  - Accident Prevention Plan (PP.HS)
  - Project Quality Control Plan (PP.QC)
  - Other Relevant Planning Documents (PP.WP)
- Task 3 – Site Inspection (SI)
  - Preliminary Site Visit (SI.PA)
  - Conceptual Site Model (SI.SM)
  - Site Preparation (SI.SP)
  - Detector Aided, Non-Intrusive Survey (SI.GI)
  - Underwater Reconnaissance (SI.UW)
- Task 4 – Ordnance (XO)
  - Explosives Safety Submission Waiver (XO.XS)
  - MEC Management and Contingency Plan (XO.XO)
- Task 5 – Munitions Constituents Activities (MC)
  - Sampling and Analysis Plan (MC.SP)
  - Sample Collection & Handling (MC.SC)
  - Data Validation & Reporting (MC.DV)
- Task 6 – Geographical Information System (GI)
  - Geographic Information System (GI.GI)
- Task 7 – Reporting (RP)
  - Phase I RFI Report (RP.FR)

2.2.1 Task 1 — Contract Startup

This task, which is now complete, included the activities necessary for initiating this CTO. The primary activities included a project scoping meeting, preparation of a proposed scope of work and preliminary cost estimate, preparation of the Implementation Plan and Fee Proposal, and project setup in the CH2M HILL accounting system.

2.2.2 Task 2 — Project Planning

This task includes Project Management (PP.PM), Meetings and Project Coordination (PP.MG), Accident Prevention Plan (PP.HS), Project Quality Control Plan (PP.QC), and Other Relevant Planning Documents (PP.WP).

Project management includes all work necessary for controlling the project budget and schedule. This includes monthly status reports and invoicing, as well as all other administrative tasks needed for project performance.

Two meetings are planned for this project. These meetings will be held to discuss the proposed field activities as presented in the Phase I RFI Work Plan and to discuss the investigation findings. It is assumed that the PM and Project Geophysicist will attend both meetings, and the Senior Consultant will attend one meeting. One meeting is planned to be held in Washington, DC, or Norfolk, VA, and one meeting is planned to be held in Puerto Rico.

A Site Specific Safety and Health Plan (HSP) will be prepared as an appendix to Phase I RFI Work Plan. The HSP safe working procedures for all onsite activities. An MEC Avoidance Plan included as part of the HSP.

A Project Quality Control Plan (PQCP) will be prepared as part of the Phase I RFI Work Plan. The PQCP will present the quality control methods to be used for project activities.

This task also includes the preparation of all planning components not specifically addressed above, and includes compiling all components into this Phase I RFI Work Plan.

Three versions of this Work Plan will be prepared: 1) Draft Work Plan for NAVFAC Atlantic review, 2) Draft-Final Work Plan for regulatory review that incorporates NAVFAC comments, and 3) Final Work Plan that addresses regulatory comments.

Under this task, CH2M HILL has also conducted a detailed historical archive also attempted to identify and interview former military personnel and obtain their accounts of activities that may have impacted the project area. The information collected has been used in planning the site inspection and has been summarized in the Appendix A to this Work Plan.

2.2.3 Task 3 — Site Inspection

This task includes Preliminary Site Visit (SI.PA), Conceptual Site Model (SI.SM), Site Preparation (SI.SP), Detector Aided, Non-Intrusive Survey (SI.GI), and Underwater Reconnaissance (SI.UW). All field investigation activities will be performed under this task. The scope of the field investigation and the technical approach is presented in Section 3.

The preliminary site visit was conducted on November 9 and 10, 2005.

A conceptual site model (CSM) was prepared and is presented as Appendix D to this Work Plan. The CSM identifies past munitions-related activities; determines expected MEC contaminants; determines the most likely primary and secondary release mechanisms; determines potential migration pathways; and identifies exposure pathways for current and reasonably anticipated future land uses.

Site preparation will consist of three specific activities: 1) subcontracting, 2) mobilization and demobilization, and 3) vegetation clearing. Anticipated subcontractor services include MEC support, vegetation clearing, digital geophysical mapping, laboratory analysis, and data validation. Mobilization and demobilization includes those activities necessary to secure all equipment, materials, and personnel that are needed for the site inspection, and to transport them to and from the project site. Vegetation will be removed from selected areas to allow the geophysical investigation team to collect geophysical survey data from areas of interest as identified in Section 3 of this Work Plan.

CH2M HILL will conduct DGM of the project area to identify the number and density of geophysical anomalies that could potentially represent subsurface MEC along trails and in areas of concern. Section 3 of this Work Plan provides detailed information on the performance of the DGM effort.

CH2M HILL will also conduct underwater DGM at four near-shore locations of approximately four acres each. The purpose of the underwater DGM is to identify possible MEC-related items that could pose a potential hazard and that may need to be investigated during a later phase of the project. Section 3 of this Work Plan provides detailed information on the performance of the underwater DGM effort.

2.2.4 Task 4 — Ordnance

An explosives safety submission (ESS) will not be required because no intrusive MEC investigations are planned, and CH2M HILL will implement MEC avoidance procedures during all onsite activities. An ESS Waiver Request and an Operational Risk/Hazard Assessment was prepared in accordance with Naval Ordnance Safety & Security Activity (NOSSA) INSTRUCTION 8020-15, "Military Munitions Response Program Oversight" and was approved by NOSSA (Figure 2-3).

MPPEH, including MEC and munitions debris (MD) will not be handled during the course of the Phase I RFI field effort. If MPPEH is encountered in the proposed geophysical survey paths, the paths will be rerouted to avoid the MPPEH.

If suspected surface MEC is encountered, a UXO technician will take the following action:

- Record the GPS coordinates
- Make a preliminary identification of the item without handling it,
- Record all physical characteristics (i.e., length, weight, color, markings, shape, whether it's partially buried, etc.)
- Take a digital photo of the item, including a reference scale
- Place flagging tape with a reference number at a point on the geophysical trail that is perpendicular to the MEC location to assist in relocating the item.

The Project Manager will submit this information, including digital photo, to the NAVFAC Project Manager, who will report the possible MEC item to Navy EOD. Navy EOD will make a determination as to whether a response is needed and will be responsible for conducting such a response, if one is necessary.

2.2.5 Task 5 — Munitions Constituents Activities

This task includes Sampling and Analysis Plan (MC.SP), Sample Collection & Handling (MC.SC), and Data Validation & Reporting (MC.DV)

A Sampling and Analysis Plan (SAP) for MC was prepared and is included as part of this Work Plan. The SAP addresses the collection, handling, and analysis of samples for MC.

Surface soil samples will be collected at Piñeros Island for MC analysis. Samples will be collected in accordance with the SAP and will be analyzed by a subcontracted analytical laboratory. This task also includes management of environmental sample data from the time the samples are collected until the validated data is received and incorporated into the project reports. This includes sample tracking from field collection through the receipt of validated data, coordination and communications with the laboratory and data validator, and preparation and delivery of the site data sets.

Data validation will be conducted by a subcontracted data validation service, and will begin when the validator from the analytical laboratory receives the "raw" laboratory data. A validation report will be expected within three weeks of the validator's receipt of Level IV laboratory data packages. Level IV data will be validated per the U.S. Environmental protection Agency (EPA)'s Contract Laboratory Program (CLP) National Functional Guidelines criteria (EPA, 1999, 2004).

2.2.6 Task 6 — Geographical Information System

All data will be collected in preparation for the creation of a GIS tailored for the specific MEC investigative needs of the site. All digital data will be created using a software platform that will allow data to be loaded directly into the MEC GIS system. The main purpose of the GIS is to assemble all the data required to associate the non-intrusive subsurface geophysics investigative data to its correct geographical location, the relational database, mapping, and remote sensing data. The GIS tools are used to manage the project, assemble data for the administrative record, and help determine areas requiring further investigation.

2.2.7 Task 7 — Reporting

A Draft Phase I RFI Report will be prepared to document the findings of the field investigation. Table 2-2 presents a general outline of the Phase I RFI Report, which will include the following primary sections:

- Introduction – This section will present the project background and objectives and will describe the site location, conditions, and history.
- Field Investigation Procedures – This section will describe the field investigation activities that were conducted during the Phase I RFI, including the MD visual survey, the terrestrial and underwater geophysical surveys, and MC sampling and analysis.

- Site Characterization – This section will present the results of the Phase I RFI field investigation and will characterize the site in terms of surface MD, terrestrial and underwater geophysical results, and MC analytical data. This section will also include a report of the current ecological conditions, including information gathered regarding species of concern that are identified during the species survey, and information on any sea turtles or sea turtles that may be encountered during the field investigation.
- Risk Evaluation – This section will provide a qualitative evaluation of MC hazards and will also include a screening-level assessment of risks to human health and the environment posed by MC. This screening-level risk assessment will be conducted by comparing contaminant concentrations detected in site media to regulatory and/or risk-based criteria.
- Recommendations – This section will provide recommendations for any further actions that may need to be taken at the site.
- Appendices – Appendices will be included, as appropriate, to present detailed reports of data collected during the Phase I RFI field effort. Depending on the volume of data, some of the appendices may be submitted on CD-ROM only.

Based on the comments that are received from the NAVFAC review of the document, a response to comments letter will be prepared and submitted. Once the comments are resolved, a Draft-Final Phase I RFI Report will be submitted for regulatory review. After comments are received from the regulatory agencies, a Final Phase I RFI Report will be prepared.

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TABLE 2-1
Project Personnel Contact Information
Work Plan to Conduct Phase I RFI
Piñeros and Cabeza de Perro Islands, Naval Activity Puerto Rico

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Doug Dronfield Program Manager CH2M HILL	13921 Park Center Road Suite 600 Herndon, VA 20171-3241	703-471-1441 (office) 703-471-1508 Doug.Dronfield@ch2m.com
Ben Redmond Senior Consultant CH2M HILL	151 Lafayette Dr. Suite 110 Oak Ridge, TN 37830	865-483-9032 x535 (office) 865-384-5511 (cell) 865-481-5511 (fax) Ben.Redmond@ch2m.com
JoLee Gardner Project Delivery Lead CH2M HILL	9428 Baymeadows Road Suite 200 Jacksonville, FL 32256	904-733-8150 x61 (office) 904-733-9570 (fax) JoLee.Gardner@ch2m.com
Thomas M. Roth, P.E. Project Manager CH2M HILL	2607 LaVista Road Decatur, GA 30033-1725	770-474-7640 (office) 404-259-6674 (cell) 770-604-9183 (fax) Tom.Roth@ch2m.com
Michael Goldman, C.I.H. Program H&S Manager CH2M HILL	115 Perimeter Center Place NE Suite 700 Atlanta, GA 30346-1278	770-604-9095 (office) 770-604-9183 (fax) Michael.Goldman@ch2m.com
Dan Young, CSP, CSRP Corporate MR Safety & QC Officer CH2M HILL	10687 Aloe Lane Lillian, AL 36549	251-962-2963 (home office) 256-527-5662 (cell) Dan.Young@ch2m.com
Tamir Klaff Program Geophysicist CH2M HILL	13921 Park Center Road Suite 600 Herndon, VA 20171-3241	703-471-1441 (office) 202-415-9472 (cell) 703-471-1508 (fax) Tamir.Klaff@ch2m.com

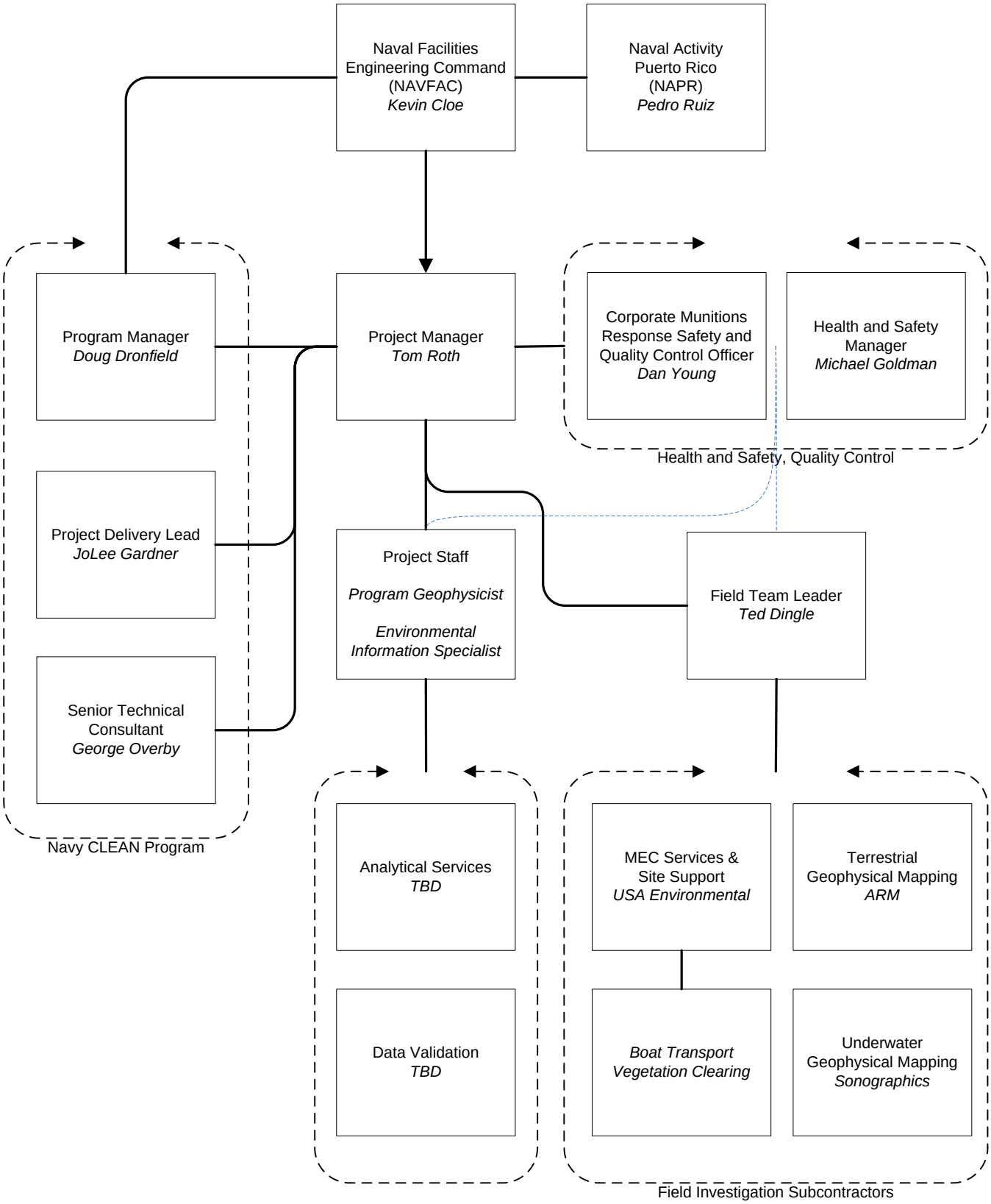


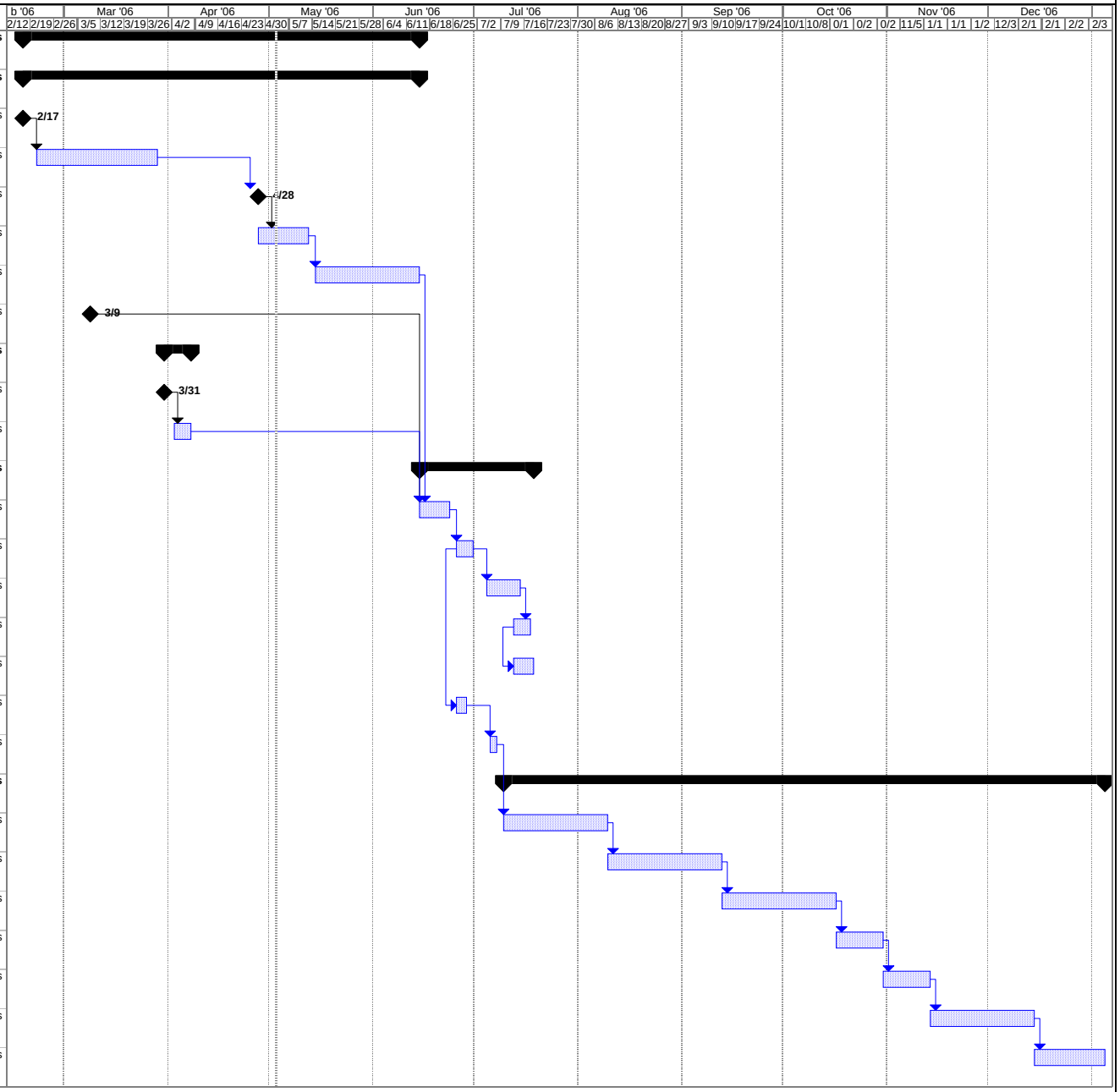
Figure 2-1
Project Team Organizational Structure
Phase I RCRA Facility Investigation
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

CH2MHILL

Figure 2-2. Project Schedule

Phase I RCRA Facility Investigation
Pineros & Cabeeza de Perro Islands
Naval Activity Puerto Rico

ID	Task Name	Start	Finish	Duration
1	**Project Planning**	**Fri 2/17/06**	**Wed 6/14/06**	**81 days**
2	**Work Plan**	**Fri 2/17/06**	**Wed 6/14/06**	**81 days**
3	Submit Draft Work Plan	Fri 2/17/06	Fri 2/17/06	0 days
4	Regulatory Review	Tue 2/21/06	Tue 3/28/06	26 days
5	Review Meeting	Fri 4/28/06	Fri 4/28/06	0 days
6	Submit Final Work Plan	Fri 4/28/06	Fri 5/12/06	11 days
7	Regulatory Review & Approval	Mon 5/15/06	Wed 6/14/06	20 days
8	ESS Waiver Approved	Thu 3/9/06	Thu 3/9/06	0 days
9	**Biological Assessment**	**Fri 3/31/06**	**Fri 4/7/06**	**6 days**
10	Submit BA to USFWS	Fri 3/31/06	Fri 3/31/06	0 days
11	USFWS Review & Concurrence	Mon 4/3/06	Fri 4/7/06	5 days
12	**Field Investigation**	**Thu 6/15/06**	**Tue 7/18/06**	**22 days**
13	Mobilization	Thu 6/15/06	Fri 6/23/06	7 days
14	Species Identification	Mon 6/26/06	Fri 6/30/06	5 days
15	Vegetation Clearing	Wed 7/5/06	Fri 7/14/06	8 days
16	Terrestrial Geophysical Investigation	Thu 7/13/06	Mon 7/17/06	3 days
17	Underwater Geophysical Investigation	Thu 7/13/06	Tue 7/18/06	4 days
18	Munitions Debris Visual Survey	Mon 6/26/06	Wed 6/28/06	3 days
19	Environmental Sampling	Thu 7/6/06	Fri 7/7/06	2 days
20	**PA/SI Report**	**Mon 7/10/06**	**Thu 1/4/07**	**129 days**
21	Laboratory Analysis	Mon 7/10/06	Wed 8/9/06	23 days
22	Data Validation	Thu 8/10/06	Tue 9/12/06	24 days
23	Interal Draft PA/SI Report Preparation	Wed 9/13/06	Mon 10/16/06	24 days
24	NAVFAC/NAPR Review	Tue 10/17/06	Mon 10/30/06	10 days
25	Draft PA/SI Report Preparation	Tue 10/31/06	Mon 11/13/06	10 days
26	Regulatory Review	Tue 11/14/06	Thu 12/14/06	23 days
27	Final PA/SI Report Preparation	Fri 12/15/06	Thu 1/4/07	15 days



Project: Schedule (2006-05-03)
Date: Wed 5/3/06

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

Figure 2-3 ESS Waiver Approval

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE SAFETY & SECURITY ACTIVITY
FARRAGUT HALL BLDG D-323
23 STRAUSS AVENUE
INDIAN HEAD MD 20640-5555

8020
Ser N537/390
9 Mar 06

From: Commanding Officer, Naval Ordnance Safety and Security Activity
To: Commanding Officer, Naval Facilities Engineering Command Atlantic (OPCEV5)

Subj: EXPLOSIVES SAFETY SUBMISSION (ESS) WAIVER REQUEST FOR PINEROS AND CABEZA DE PERRO ISLANDS, NAVAL ACTIVITY PUERTO RICO

Ref: (a) NAVFAC Atlantic ltr of 15 Feb 06; Explosive Safety Submission (ESS) Waiver Request for Munitions and Explosives of Concern (MEC) Avoidance at Pineros and Cabeza de Perro Islands, Naval Activity Puerto Rico
(b) NOSSAINST 8020.15, Military Munitions Response Program Oversight dtd 8 Mar 04
(c) NAVSEA OP 5, Volume 1, Revision 7, Change 3 of 27 Jul 04

1. As requested by reference (a), the Naval Ordnance Safety and Security Activity (NOSSA) reviewed the subject Explosives Safety Submission (ESS) waiver request in accordance with references (b) and (c).

2. Based on the information you presented in reference (a) and on the ESS criteria in Section 7 of reference (b), NOSSA waives the requirement for submission of an ESS at this time. However, should any removal or destruction of live munitions during the work effort become necessary, you must stop and submit an ESS.

3. The NOSSA point of contact for this ESS waiver is Mr. Rick Urbanski, who can be contacted at DSN 354-4450 or commercial 301-744-4450.

Pamela G. Clements

PAMELA G. CLEMENTS
By direction

Copy to:
CNO (N411; N45C)
COMNAVENGCOM HQ (EN.RM, EN.MD)
NOSSA ESSOLANT (N7L)

SECTION 3

Field Investigation Plan

3.1 Overall Approach

Piñeros and Cabeza de Perro Islands were used for military training activities associated with the former Roosevelt Roads Naval Station, Puerto Rico. The objectives for this field investigation are to:

- Identify areas that are potentially accessible to the public under a land use scenario that allows limited access to the islands for recreational purposes.
- Evaluate the potential for MEC to be present in these areas through a visual assessment and by evaluating the density of geophysical anomalies.
- Evaluate the presence or absence of MC in these areas through the collection and analysis of surface soil samples.
- Evaluate the potential for MEC to be present at four suspected underwater demolition areas through geophysical assessments.

The field investigation will accomplish the above objectives through the following activities, which will be conducted in accordance with CH2M HILL SOPs provided in Appendix E:

- Collect surface soil samples from selected areas proposed for public access.
- Perform DGM in the following areas of Piñeros Island as shown on Figure 1-5:
  - Along a trail from the northern shore to the southern shore, passing through the bunker in the center of the island
  - Along transects in an area used by local residents for illegal land crabbing in the western portion of the island
  - On four beach areas that are potentially accessible to the public by boat
- Perform offshore geophysical mapping of four suspected underwater demolition areas, shown on Figure 1-5.

The field investigation activities are detailed below.

3.2 Site Preparation and Restoration

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment, preparation for intrusive environmental investigation activities, and preparation for DGM.

3.2.1 Mobilization

A mobilization period will include identifying, briefing, and mobilizing staff, as well as securing and deploying equipment. Mobilization activities include general activities and a kickoff and safety meeting.

General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical detection equipment, hand tools and supplies, and vegetation clearance equipment.
- Coordinate with Federal, Commonwealth, and local agencies, including EPA, USFWS, DNER, and EQB.
- Coordinate communications and other logistical support.
- Finalize operating schedules.
- Test and inspect equipment.
- Conduct site-specific training on the work plan, accident prevention plan, HSP, and MEC procedures and hazards.
- Verify that all forms and project documentation are in order and project team members understand their responsibilities regarding completing project-reporting requirements.

Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this work plan and a review and acknowledgment of the health and safety plan by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

3.2.2 Vegetation Removal and Munitions Debris Survey

To facilitate the use of DGM, limited brush clearing will be conducted along the trail and in the land crabbing area. A biologist will walk the trail and land crabbing area transects prior to the clearance of vegetation to identify any threatened or endangered species that may be encountered during vegetation clearance. Any threatened or endangered species will be identified and left in place in accordance with the Environmental Protection Plan (refer to Section 5). If species of concern are identified during the species survey, the proposed path location will be moved as necessary to avoid such species. The biologist conducting this effort will be knowledgeable of the flora and fauna in environments similar to those on Piñeros Island and will coordinate with EPA, USFWS, DNER, and EQB in the performance of this work.

A qualified UXO technician will provide MEC escort and avoidance services to the species survey personnel as required by the HSP, presented as Appendix B to this Work Plan. While escorting the species survey personnel, escort personnel will inspect for MPPEH across the entire four-foot width of the paths. The paths that are traveled by the species survey team will be clearly marked with survey tape for the benefit of the brush clearing personnel. If

MPPEH is identified within a path, the path location will be moved as necessary to avoid the MPPEH. If MPPEH is identified close to the path, the area surrounding such MPPEH will be clearly marked with a different color survey tape to ensure that the brush clearing crews do not enter that area.

While escorting the species survey personnel, escort personnel will employ the MRP Enterprise system to record the locations and types of MD that is found on and adjacent to the paths. The MRP Enterprise System is a data management system designed to track and easily query data for MR projects. The MRP Enterprise System uses handheld digital devices to capture, track, and create automated reports. Field operations data is captured using GPS-enabled handheld devices running mobile GIS/Forms based software. The data is transferred to and then validated within a centralized relational database and then made available for queries.

Data to be collected during the MD survey will included the locations, types, and quantities of MD that can be identified, and descriptions of suspected MD that cannot be readily identified. Representative photographs of MD will also be collected during the MD survey.

Following completion of the biological and MD surveys, vegetation less than 4 inches in diameter will be removed from a 4-foot wide lane along the trail leading from the bunker to the north and south beaches. Vegetation less than 4 inches in diameter will be also be removed from a 4-foot wide lane along the transects in the land crabbing area. The total area of vegetation removal will be approximately 0.4 acre.

Vegetation removal will be accomplished by manual methods using hand tools (such as machetes) and power tools (such as chain saws). The cut vegetation will be left in place or moved to areas adjacent to the cleared areas. Trees greater than 4 inches in diameter will not be removed. In accordance with the Environmental Protection Plan, presented as Section 5 of this Work Plan, vegetation within 50 feet of the water line and within 10 meters (m) (33 feet) of any lagoons will not be cut. A minimum of 10 feet of vegetation will be left uncut at the trailheads on the north and south beaches so that the trails are not visible from the beaches.

3.2.3 Site Restoration and Demobilization

Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance and quality control (QA/QC) checks have been performed. Personnel who are no longer needed during the course of field operations may be demobilized prior to the final project completion date. The following will occur prior to demobilization:

- All areas to be geophysically mapped will be verified as completed.
- Chain-of-custody (COC) records will be reviewed to ensure that all samples were collected as planned and were submitted for appropriate analyses.
- All equipment will be inspected, packaged, and shipped to the appropriate location.

3.3 Geophysical Investigation Plan

The GIP (refer to Appendix C) provides details of the equipment, approach, methods, operational procedures and quality control to be used in performing the geophysical investigations at Piñeros Island.

3.4 Geospatial Information and Electronic Submittals

This subsection describes the methods, equipment, and accuracy requirements for conducting DGM at Piñeros Island. This plan also identifies the requirements for the electronic submittal of documents and survey, mapping, and GIS data.

All geospatial data will conform to the Computer-Aided Drafting and Design (CADD)/GIS Technology Center Spatial Data Standards for Facilities Infrastructure and Environment and will be provided in metric units.

3.4.1 Surveying

Geophysical surveying and surveying of environmental sampling locations will be conducted by the geophysical subcontractor using a real-time kinematic (RTK) digital geophysical positioning system (DGPS).

3.4.2 Geographic Information System Incorporation

The final submittal in electronic format will contain all required project (ArcGIS.mxd) files and layout files for all drawings that are presented in the final report.

Environmental Systems Research Institute, Inc. (ESRI)–compliant formats (shapefiles, coverages, or geodatabases) will be used to present GIS data during the project, with supporting tabular data provided in Microsoft Excel format, Microsoft Access format, or both, as needed.

3.4.3 Plotting

All of the control points recovered and/or established at the site will be plotted at the appropriate coordinate points on reproducible electronic media for production of planimetric or topographic maps at scales appropriate for the parcel size being described.

3.4.4 Mapping

The location, identification, coordinates, and elevations of all control points that are recovered and/or established at the site will be plotted on one or more site maps. Each control point will be identified on the map by its name and number and the final adjusted coordinates.

Each map will include a legend showing the standard symbols used for the mapping, a north arrow, and a title block.

3.4.5 Digital Data

Location information will be collected as part of the DGM survey and will be sufficient to approximate the position of geophysical anomalies in the field and to approximate the position of each anomaly in the GIS.

3.4.6 Computer Files and Digital Data Sets

All final document files, including reports, figures, and tables, will be submitted in electronic format. These files will be compatible with Microsoft Office 97 or later formats and in Portable Document Format (PDF) on CD-ROM.

CDs containing PDF files will also include the Adobe Acrobat Reader so that the user can use the CD either to install the programs and documents on a machine or to view the document files in stand-alone mode.

All final GIS data generated will be submitted in ESRI's shape file, coverage, or geodatabase format. All data will conform to Spatial Data Standards for Facilities Infrastructure and Environment.

3.5 Field Sampling Plan

3.5.1 Soil Sampling Program

In order to evaluate the potential presence of MC contamination resulting from past military training activities on Piñeros Island, surface soil samples will be collected from locations where MEC or munitions debris is found. Soil samples will be collected in accordance with the sampling SOPs that are provided as Appendix E to this Work Plan. MEC anomaly avoidance procedures will be used as described in the HSP (refer to Section 3.6).

Up to 20 surface soil samples, including one background sample, will be analyzed by a fixed-base laboratory for explosives residues by SW-846 Method 8330 (also refer to Tables 3-1 and 3-2). These sampling locations will be selected in areas where MD is located as identified through the MD survey (see Section 3.2.2). Immediately following completion of the MD survey, the results will be evaluated and the locations selected in consultation with NAVFAC. An attempt will be made to target areas with the greatest concentration of MD and to also sample areas containing different types of MD. Sample locations will be distributed across the site to provide data representative of a variety of area on Pineros Island.

Nine additional samples, including one background sample, will also be analyzed for VOCs, SVOCs, Pesticides/PCBs, and RCRA Metals. These samples will be collected at the following locations shown on Figure 1-4:

- Former storage facility (2 samples),
- Former bivouac area (2 samples),
- Former helicopter landing pad (2 samples),
- In the area where several crab traps were found near the northern trailhead during the November 2005 site visit (1 sample),
- On the western end of the island if there is any evidence of crab traps (1 sample), and

- Background location on or adjacent to one of the geophysical transects in an area where no MD is located and where there are no subsurface geophysical anomalies (1 sample).

Samples will be collected, handled, and analyzed as described in the remainder of Section 3.5, below. All samples will be Level IV validated by a third-party validator, as described in Section 4, and laboratory data reports will be certified by a chemist licensed in Puerto Rico.

3.5.2 Analytical Requirements and Sample Handling

Sample Collection

Discrete soil samples for VOC analyses will be collected with single-use EnCore samplers as described in Appendix E, SOP A-3. Samples for VOC analyses will be collected at or near the center of the sampling location.

Surface soil samples for all other analyses will be collected following the "TR-02-1" approach, which is summarized below and described in US Army Corps of Engineers Technical Report ERDC/CRREL TR-02-1, "Guide for Characterization of Sites Contaminated with Energetic Materials" (Thiboutot, et.al., 2002).

Each sampling location will be defined as an area up to 1m x 1m in size. In locations where samples are collected due to the presence of MD, the sampling location should encompass only the area of MD and may be less than 1m x 1m in size. Coordinates of the sampling location will be based on the center of the sampling area. Sampling personnel will record the dimensions of each sampling location in the field logbook.

Multi-increment composite soil samples for all other analyses will be collected by compositing a minimum of ten sample increments from random locations within each 1m x 1m (maximum) sampling location. The sample increments will be approximately equal in the amount of soil, which will be collected from depths of 0-2 inches. The sample increments at each location will be composited into a single sample following the procedures in Appendix E, SOP A-4, *Homogenization of Soil and Sediment Samples*, prior to being transferred to the appropriate sample containers.

Additional instructions on sample collection are provided in the SOPs found in Appendix E.

Sample Preservation and Handling

Sample preservation occurs in the field immediately after collection. The containers supplied by the laboratory will contain applicable preservative. This will protect field personnel from transporting, handling, and measuring concentrated acids and bases. QA/QC samples, with the exception of trip blanks, will be collected in the same containers with preservatives as the field samples. The preservative and holding time for analysis is shown in Table 3-1.

Quality Assurance and Quality Control

QA/QC requirements for environmental sampling, handling, and management are detailed in Section 4. Field QC samples (including trip blanks, field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples) will be collected during the investigation and submitted for laboratory analysis. Required QA/QC samples and the required frequency of collection are listed in Table 3-2. Table 3-3 presents the anticipated number of field samples and their associated QA/QC samples.

Sample Identification System

The following is a general guide for sample identification; an electronic sample–tracking program will be used to manage the flow of information from the field sampling team to the laboratory and to internal and external data users. The tracking program is used to produce sample labels and COC forms and to manage the entry of sampling-related data, such as station locations and field measurements. The method of sample identification used depends on the type of sample collected and the sample container.

The field analysis data are recorded in field logbooks, along with sample identity information, while in the custody of the sampling team.

Labels for samples sent to a laboratory for analysis will be produced electronically. If the labels cannot be produced electronically, they must be written in indelible ink. The following information typically is included on the sample label:

- Site name or identifier
- Sample identification number
- Date and time of sample collection
- Sample matrix or matrix identifier
- Type of analyses to be conducted

Each analytical sample will be assigned a unique number of the following format:

[CTO#]-[Media/Station# or QA/QC]-[Depth Interval]

An explanation of each of these identifiers is given below.

[CTO#]: This investigation is being conducted under NAVFAC Contract Task Order 113. Therefore, the prefix "CTO113" will be used.

[Media]: GW = Groundwater
SW = Surface water
SS = Surface or subsurface soil
SD = Sediment

[Station#]: Soil sample locations will be numbered consecutively from 01 through 20.

[QA/QC]: D = Duplicate sample (following sample type/number)
FB = Field blank
ER = Equipment rinsate
TB = Trip blank

All MS/MSD samples will be entered in the same line as the field sample on the COC. The total number of sample containers submitted will be entered on the COC and "MS/MSD" will be indicated in the comments section.

[Depth Interval]: Depth indicators will be used for soil samples. The number will reference the depth interval of the sample in inches:

0–2 = 0 to 2 inches below ground surface (bgs)

Under this sample designation format, "CTO113-SS01-0-2" would mean the following:

CTO113-SS01-0-2	CTO 113
CTO113-SS01-0-2	First soil sample collected
CTO113-SS01-0-2	Sampled collected from 0 to 2 inches bgs

This sample designation format will be followed throughout the project. Required deviations to this format in response to field conditions will be documented.

Sample Packaging and Shipping

Samples will be tightly packed in a cooler with bubble wrap packaging material and ice as a preservative. Ice will be securely packaged to prevent leakage, and absorbent material will be placed in the cooler to absorb condensation that may form on the outside of the ice packages.

The samples will be shipped to the laboratory via overnight courier. The Animal and Plant Health Inspection Service of the U. S. Department of Agriculture (APHIS-USDA) regulates the importation of soil into the United States from foreign sources, including Puerto Rico. In accordance with APHIS-USDA regulations, the receiving laboratory will be permitted as a soil laboratory and will provide a written statement that they will take responsibility for the shipments of soil samples. A copy of the receiving laboratory's permit will be affixed to the exterior of each shipping cooler.

The field team leader is responsible for completion of the following forms:

- Sample labels and COC seals
- COC forms
- Appropriate labels and forms required for shipment

Custody of the samples will be maintained and documented at all times. Chain-of-custody will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory.

3.5.3 IDW Management

IDW includes solid waste generated during sampling activities. All solid waste will be containerized in trash bags and transported off of Piñeros Island for disposal as municipal and solid waste. Sampling equipment will be decontaminated prior to shipment to the project site, so no decontamination fluids will be generated onsite.

3.6 Health and Safety Plan (HSP)

The project specific HSP is provided as Appendix B.

Due to the potential presence of MEC at this site, MEC avoidance techniques will be employed throughout the field investigation to ensure the safety of all onsite personnel. Procedures for conducting MEC avoidance are provided in the HSP in Appendix B.

3.7 Data Documentation and Processing Procedures

During the Phase I RFI, three types of data will be generated: field, laboratory, and investigation interpretive. This subsection presents documentation and processing procedures for the data.

3.7.1 Field Data

The field team will document all field activities, including any visits to the site by regulatory personnel or their contractors, in a bound field logbook. The logbook will also be used to document, explain, and justify all deviations from the approved work plan, which will also be recorded on a Field Change Form, as discussed in Section 4 of this Work Plan. Its pages will have water-resistant sizing and will be consecutively numbered. Waterproof ink, preferably black, will be used to record entries in the field logbook. Each page will be dated and signed by the individual making the entry. The field logbook should provide a summary of the field activities.

The sampling team will record in the field logbook sampling information, physical and geological information, and any field measurements (for example, pH and temperature) taken during sampling. The sample identification system in Section 3.5.2 will be used to identify each sample. An identification label will be affixed on each sample container sent to the laboratory.

A copy of all field logbook entries and COC records will be made available upon request.

3.7.2 Laboratory Data

Upon receipt at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, and any mislabeling will be identified, investigated, and corrected prior to the samples into the laboratory. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.

Raw data will be entered by the analysts in bound laboratory notebooks. A separate book will be maintained for each analytical procedure. All calculations will be entered into designated laboratory notebooks with a sufficient amount of data to compute without reference to other documents. A tracking form will be used to show that at least 10 percent of all calculations have been checked by the analyst and the laboratory QA supervisor from the raw data to the final value stages prior to reporting the results of a group of samples. This tracking form, as well as all logs and calculations, will be made available for any QA audit conducted during the investigation.

Instrument calibration logs and internal quality control procedures will be documented in accordance with the analytical method in use. All proposed analytical methods have been documented in detail in the Master Plans and in Section 3.5. Documentation of these activities will be made available during QA audits.

The reporting requirements will be in accordance with the CLP Statement of Work OLM04.3 for organics analysis and ILM04.3 for inorganics analysis, or other specified analytical method.

Copies of all the analytical data reports, including the QC data, will be maintained by CH2M HILL in the project files.

3.7.3 Investigation Results

The results of the Phase I RFI will be presented in tabular and graphical formats, as well as by descriptive and interpretive text. The detailed geophysical data and raw analytical data will be included in appendices to the Phase I RFI report. Depending on the volume of such data, these appendices may be presented only in electronic format on CD-ROM.

The following data will be presented in tables:

- Sampling location coordinates
- Analytical data results
- Types and quantities of MEC and MD that were identified

Graphs or figures will be used to depict the following:

- Layout and topography
- Sampling locations
- Horizontal extent of contamination, as practicable
- Areas of visual MD surveys
- Locations of found MEC or munitions debris
- Geophysical anomalies (terrestrial and underwater)
- Extent of vegetation removal.

3.8 Project File Requirements

This project will require the administration of a central project file. The data and records management protocols will provide adequate controls and retention of all materials related to the project. Record control will include receipt from external sources, transmittals, transfer to storage and indication of record status. Record retention will include receipt at storage areas, indexing, filing, storage, maintenance, and retrieval.

3.8.1 Record Control

All incoming materials related to the project, including sketches, correspondence, authorizations, and logs, shall be forwarded to the PM or designated assistant. These documents will be placed in the project file. Project personnel will work from a copy of the necessary documents. All records shall be legible and easily identifiable.

Examples of the types of records that will be maintained in the project file are:

- Field documents
- Correspondences
- Photographs
- Laboratory data
- Reports
- Procurement agreements

Outgoing project correspondence and reports will be reviewed and signed by the PM.

3.8.2 Record Status

To prevent the inadvertent use of obsolete or superseded project-related procedures, the project team members will be responsible for reporting changes in protocol to the CH2M HILL PM. The PM will then inform other members of the Project Team and the Project Quality Assurance Officer of these changes.

Revisions to procedures shall be subject to the same level of review and approval as the original document. The revised document will be distributed to all holders of the original document and discussed with project personnel. Outdated procedures will be marked "void." One copy of a document marked "void," along with the reason(s) for marking the document "void" will be maintained in the project file. In addition, the date a document is marked "void" will be recorded.

3.8.3 Record Storage

All project related information will be maintained by CH2M HILL for the duration specified by contract N62470-02-D-3052. Designated personnel will assure that incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages: storage during and immediately following the project, and permanent storage of records directly related to the project.

CH2M HILL will use storage facilities providing a suitable environment, one that will minimize deterioration or damage and prevent loss. Records will be secured in steel file cabinets labeled with the appropriate project identification. CH2M HILL will use Microsoft Excel for data storage. Data will be maintained on CD-ROM and backed up each time a file is edited. Upon presentation of data to NAVFAC and NAPR, a backup of that version will be permanently stored in the central filing location.

At the completion of the project, the PM or the appointed document custodian will be responsible for the project file inventory. All material from the project file, including drawings, project related QA documents, and electronic project documentation and verification records will be maintained by CH2M HILL for the duration specified by contract N62470-02-D-3052.

TABLE 3-1
Analyses, Bottleware, Preservation, and Holding Time Requirements
Work Plan to Conduct Phase I RFI

Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Media	Analysis	Method	Container	Preservation/ Storage	Holding Times
Soil	Explosives Residues	SW-846 8330	1x8-oz bottle, Teflon cap	4ºC	7 days to extraction, 40 days from extraction to analysis
Soil	Volatiles	CLP OLM04.3	3 EnCore Samplers	4ºC	48 hours to preservation at the lab; (7 days if frozen)
Soil	Semivolatiles	CLP OLM04.3	Two 4-oz. glass bottles with Teflon-lined caps	4ºC	14 days
Soil	Pesticides/PCBs	CLP OLM04.3	Two 4-oz. glass bottles with Teflon-lined caps	4ºC	14 days
Soil	RCRA Metals	CLP ILM04.3	One 4-oz. glass bottles with Teflon-lined caps	4ºC	6 months
Water	Explosives Residues	SW-846 8330	2x1-L amber jar	4ºC	7 days to extraction, 40 days from extraction to analysis
Water	Volatiles	CLP OLM04.3	Three 40-ml glass vial with Teflon-lined cap	HCl to pH<2; 4ºC	14 days
Water	Semivolatiles	CLP OLM04.3	Two 1-liter amber bottles with Teflon-lined caps	4ºC	7 days to extraction, 40 days to analysis
Water	Pesticides/PCBs	CLP OLM04.3	Two 1-liter amber bottles with Teflon-lined caps	4ºC	7 days to extraction, 40 days to analysis
Water	8 RCRA Metals	CLP ILM04.3	One 1-liter polyethylene botter per analysis	HNO to pH<2; 4ºC	6 months

Notes

L = liter
oz = ounce

TABLE 3-2
QA/QC Samples and Frequency of Collection Requirements
Work Plan to Conduct Phase I RFI
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect possible contamination from ambient conditions. A field blank is analyte-free water collected directly in the sample bottle at the site during the sampling event. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from each sampling event, where a sampling event is defined as 1 day. Field blanks are collected more frequently during dusty or windy conditions.	All laboratory analyses requested for the environmental samples collected at the site for that week
Equipment Blank	Designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to the laboratory for analysis.	One per each day of sampling	All laboratory analyses requested for environmental samples collected at the site on that day
Field Duplicate	Designed to check precision of data in the laboratory. A field duplicate is a sample collected in addition to the native sample at the same sampling location during the same sampling event.	10%	Same parameters as parent sample
MS/MSD	Designed to evaluate potential matrix interferences, accuracy, and precision. Three aliquots of a single sample—one native and two spiked with the same concentration of matrix spike compounds—are analyzed.	5%	Same parameters as parent sample

TABLE 3-3
Sample Collection Frequencies

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs	Trip Blanks
Surface Soil Samples							
Explosives Residues (SW-846 8330)	Solid	29	3	3	3	2	NA
Volatiles (CLP OLM04.3)	Solid	9	1	3	3	1	3
Semivolatiles (CLP OLM04.3)	Solid	9	1	3	3	1	NA
Pesticide/PCBs (CLP OLM04.3)	Solid	9	1	3	3	1	NA
8 RCRA Metals (CLP ILM04.3)	Solid	9	1	3	3	1	NA

Notes
MS/MSD = Matrix Spike and Matrix Spike Duplicate pair

Field duplicates are collected at the rate of 1 for every 10 environmental samples.

Equipment rinsate blanks are typically collected at the rate of 1 per day per media. If disposable equipment is used, one equipment blank near the start of the sampling event is collected to test the cleanliness of the disposable equipment.

Field blanks are typically collected at the rate of 1 per week during sampling.

One trip blank is supplied in each cooler submitted to an offsite lab containing VOCs and is analyzed only for VOCs. MS/MSDs are collected at the rate of 1 for every 20 samples.

The QA/QC sample quantities shown here may be adjusted if the number of field samples is significantly altered, if the sample collection effort takes longer than expected, or if field conditions warrant otherwise.

SECTION 4

Quality Control Plan

4.1 Introduction

This QCP describes the QC approach and procedures for the Phase I RFI at Piñeros and Cabeza de Perro Islands, Puerto Rico. The QCP is divided into three parts: Section 4.2 describes the project organization and responsibility of the project team members. Section 4.3 addresses the environmental investigation activities. Section 4.4 addresses the MEC avoidance and DGM activities.

The requirements and systems established in this QCP are relevant and applicable to project work performed by CH2M HILL and its subcontractors.

4.2 Project Organization and Responsibilities

This section identifies key project team members and lists the QA/QC responsibilities associated with each position and describes communication procedures that will be followed throughout the project.

4.2.1 Project Team Members

The organizational structure and responsibilities of the project team (refer to Figure 2-1) are designed to provide project QA/QC for the Phase I RFI at Piñeros and Cabeza de Perro Islands. Selected positions are described in the following paragraphs.

Project Manager

The PM for this project is Thomas M. Roth, P.E. The PM is responsible for overall project activities, including cost control, schedule control, and technical quality. In addition, the PM develops the work plan and monitors task order activities to ensure compliance with project objectives and scope. The PM communicates with NAVFAC, NAPR, and other designated parties regarding project progress.

The PM has ultimate responsibility within the project team for producing deliverables that are technically adequate, satisfactory to the client, and cost-effective. To accomplish this, the PM develops an internal project review schedule, provides written instructions and frequent guidance to the project team, and monitors budgets and schedules. The PM will work with the project team to select an internal QA/QC review team, to coordinate review efforts, to address review comments, and to adjudicate technical issues.

Senior Consultant

The senior consultant for this project is Ben Redmond. The Senior Consultant is a company-wide resource with significant experience in the various technical aspects

involved in a complex project. The Senior Consultant coordinates all internal QA/QC review for technical validity and adherence to CH2M HILL policy. The Senior Consultant is responsible for evaluating the technical merit of the work planning documents before field activities begin, and reviewing all deliverables before submittal to NAVFAC and NAPR. The Senior Consultant assists the PM in selecting an internal QA/QC review team, coordinating review efforts, addressing review comments, and resolving technical issues.

Environmental Information Specialist (EIS)

The environmental information specialist (EIS) for this project is Felicia Arroyo. The EIS is responsible for the structure, organization, format, implementation, and operation of the project database as described in the work plan. She provides a point of communication between the laboratory and the project team, supervises the analytical data quality evaluation, and participates in preparing deliverables to the client. The EIS is also responsible for monitoring project-specific laboratory activities, including checking laboratory invoices and reports. She also supervises the data management team and provides direction to the database manager.

Corporate Munitions Response Safety and Quality Control Officer

The Corporate MR Safety & QC Officerfor this project is Dan Young. The MR Safety & QC Officer's responsibilities include, but are not limited to, the following:

- Review and approve the qualifications of proposed UXO staff and UXO subcontractors.
- Ensure that the requisite MEC safety records are generated and retained as prescribed in this QCP.
- Perform MEC safety and QC audits and surveillance as needed.
- Ensure that the responsibilities specific to MR operations are performed by the UXO Technicians.

The MR Safety & QC Officer will coordinate with the PM and the FTL and has authority to enforce the MEC procedures defined in this QCP. The MR Safety & QC Officer has the authority to stop work to ensure project activities comply with MEC-related specifications of this QCP, the Contract, and the project. This authority applies equally to all project activities, whether performed by CH2M HILL or its subcontractors.

Health and Safety Manager (HSM)

The health and safety manager (HSM) for this project is Mike Goldman. The HSM reviews and approves the project-specific HSP as well as subcontractor HSPs. The HSM serves as the point of contact for the FTL for any health- or safety-related issues, and may conduct project audits. The HSM is also responsible for investigating accidents should any occur during the course of the project.

Field Team Leader (FTL) and Site Safety Coordinator (SSC)

The field team leader (FTL) for this project is Ted Dingle. The FTL reports to the PM and is responsible for coordinating field efforts; providing and maintaining sampling equipment and materials; providing shipping and packing materials; and accurately completing the

field logbook. The FTL will supervise the completion of all COC records and the proper handling and shipping of samples. As the lead field representative, the FTL is also responsible for ensuring the consistent implementation of project QA/QC measures at the site and for ensuring that field activities are performed in accordance with approved work plans, policies, and field procedures.

The FTL for this project will also serve as the SSC. The SSC implements the project-specific HSP (refer to Appendix B) in the field. The SSC will assist in conducting site briefings and ensure that all final safety checks are performed. The SSC is responsible for stopping any investigation-related operation that threatens the health and safety of the field team or surrounding populace.

Subcontractors

The following services will be provided by subcontractors:

- Vegetation removal
- MEC avoidance
- Digital geophysical mapping
- Laboratory analyses
- Data validation

Procurement of subcontractors will be performed in accordance with the Navy CLEAN Contract Procurement Manual.

4.2.2 Project Communication

One of the most critical elements in performing any type of project is to establish and maintain lines of communication among all project personnel. At the beginning of the project or at major milestones, the PM will prepare written project instructions that will be distributed to all team members. These instructions will document project and task instructions, and each team member's responsibility in meeting the objectives, as well as a budget and schedule for successfully executing the work.

Before field activity begins, a project team meeting will be held to review the concept, assumptions, objectives of the field approach, and project objectives. Periodic meetings will be held to review data validity, technical evaluations, major decisions, and overall progress toward completing the project. Additionally, a team kickoff meeting will be held before work on each task is started. Senior personnel, including the FTL, will participate in the meetings to help focus the project approach and to define specific issues.

During the field investigation phase of projects, the field teams will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled or the FTL will meet individually with field personnel or the subcontractors to resolve problems. During the field effort, the FTL will prepare a weekly report detailing project progress.

During the field effort, the FTL will be in regular telephone or face-to-face contact with the project team. When significant problems or decisions requiring additional authority occur, the FTL can immediately contact the PM for assistance. The EIS, in consultation with the PM

and the project chemist (PC), will coordinate communication with the laboratory during sample collection, sample analysis, and data quality evaluation.

Daily and weekly reports, QA reports, and other project information will be shared by the members of the project team as needed. All communications with NAVFAC and NAPR will be channeled through the CH2M HILL PM, who will be informed on a daily basis of field activities being conducted.

4.3 Environmental Investigation Quality Assurance Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required from field and laboratory data collection activities to support decisions concerning risk and remediation. DQOs are established prior to data collection and describe what data are needed, why the data are needed, and how the data will be used to address the problems being investigated. DQOs help to ensure that all data collected are legally and scientifically defensible.

The environmental QC forms (Forms 4-1a and 4-2a) referenced in this section are provided at the end of the section.

4.3.1 Background

The purpose of this Phase I RFI is to evaluate the presence of MEC and MC in selected areas of Piñeros and Cabeza de Perro Islands. The specific objectives are to:

- Identify areas that are potentially accessible to the public under a land use scenario that allows limited access to the islands for recreational purposes.
- Evaluate the potential for MEC to be present in these areas through a visual assessment and by evaluating the density of geophysical anomalies.
- Evaluate the presence or absence of MC in these areas through the collection and analysis of surface soil samples.
- Evaluate the potential for MEC to be present at four suspected underwater demolition areas through visual and/or geophysical assessments.

4.3.2 Levels of Data Quality

Three categories of data are typically collected as part of a field effort, and each category has a different level of supporting QA/QC documentation. Level 1, which will not be used on this project, includes field monitoring activities, such as pH, conductivity, temperature, and turbidity. Level 2 includes the analyses associated with the characterization of IDW samples, which will not be required on this project. All other samples will be submitted to the laboratory for Level 4 analyses. For each QC level, the measures and methods to be used, as well as the applicable data package deliverables, are outlined below.

Level 1—Field Surveys

Level 1 encompasses field monitoring or screening activities and does not require formal data package deliverables. Level 1 activities are focused on easily measured characteristics

of a sample such as pH, conductivity, and temperature. The data generated from field surveys are used to make decisions about the execution of the investigation or to provide general sample screening before laboratory analysis.

Monitoring results, as well as pertinent data concerning the sampling event, will be documented in the field logbook. Level 1 documentation will consist of the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and field measurements
- Field measurement results

The logbooks will be reviewed daily by the FTL for completeness and correctness. No additional documentation or data quality evaluation is required.

Level 2—IDW Analyses

Level 2 includes the samples submitted to the laboratories for IDW characterization. Samples submitted for analysis under Level 2 will require the delivery of an analytical data package. Level 2 documentation will consist of the following:

- Case narrative
- Sample results
- Selected QC information such as surrogate recovery
- Associated blank results
- Completed COC form and sample receipt information

Level 3—Laboratory Analyses

The purposes of Level 4 data include determining the presence or absence of MC contamination at and the presence of MEC and geophysical anomalies at areas being investigated.

Samples will be analyzed for the analyses presented in Tables 3-1 through 3-2. EPA-approved methods from the current edition of publication SW-846, *Test Methods for Evaluating Solid Waste,*[1] will be used to analyze samples. Data package deliverables are summarized below.

Level 4 Data Package Deliverables (Standard Deliverable Package)
All Analytical Fractions
Case Narrative
Sample ID Cross Reference Sheet (Lab IDs and Client IDs)
Completed COC form and any sample receipt information
Any analytical/procedural changes (copies of “Confirmation of Communication”)
Copies of non-conformance memos and corrective actions
All CLP Forms – (for non-CLP methods, CLP-like forms will be provided
All raw data from bench logs, instrument printouts

[1] Available at http://www.epa.gov/epaoswer/hazwaste/test/main.htm#table.

4.3.3 Quality Assurance Objectives for Chemical Data Management

Analytical performance requirements are expressed in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC). Brief definitions for each parameter are presented below.

Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the relative percent difference (RPD).

Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy is defined as percent recovery.

Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness will be assessed by reviewing the presence/absence of contaminants in method blanks, trip blanks, and equipment blanks; sample condition/integrity upon receipt and storage at the laboratory; and laboratory adherence to sample holding times. In addition, the effects of sample matrix interferences, if any, will be evaluated to determine possible data impact.

Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known.

Completeness

Completeness is defined as the percentage of valid measurements compared to the total number of measurements made for a specific sample matrix and analysis. The completeness goal for analytical data is 90 percent. All validated data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, corrective action will be initiated by the PM.

4.3.4 Sampling Procedures

Sampling locations and procedures are discussed in Section 3.

and equipment blanks; sample condition/integrity upon receipt and storage at the laboratory; and laboratory adherence to sample holding times. In addition, the effects of sample matrix interferences, if any, will be evaluated to determine possible data impact.

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4.3.4 Sampling Procedures

Sampling locations and procedures are discussed in Section 3.

4.3.5 Sample Custody

A sample is physical evidence collected from a hazardous waste site, the immediate environment, or another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in enforcement proceedings.

COC procedures are used to maintain and document sample possession for enforcement purposes. The principal documents used to identify samples and to document possession are the following:

- Packing lists
- COC records
- Air bills (such as Federal Express, UPS)
- Field logbooks
- Color photographs of the field activities

Sample custody and COC records will be maintained by the field team until delivered to the laboratory. Sample shipping information from each day will be maintained by the FTL and relayed to the laboratory as soon as possible after sample pickup. These documents could be introduced as evidence should a site inspection result in legal action. To document sample possession, COC procedures are followed.

Definition of Custody

A sample is under the field team's custody if one or more of the following criteria are met:

- It is in the field team's possession.
- It is in the field team's view after being in the field team's possession.
- It was in the field team's possession and then the field team locked it up to prevent tampering.
- It is in a designated secure area.

Field Custody

In collecting samples, the amount collected should be only enough to provide a good representation of the media being sampled. To the extent possible, the quantity and types of samples and sample locations are determined before the actual field work begins.

The following procedures will be used to document, establish, and maintain custody of field samples:

- Labels will be completed for each sample with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container
- All sample-related information will be recorded in the site logbook
- The field sampler will retain custody of the samples until they are transferred or properly dispatched
- To simplify the COC record and minimize potential problems, as few people as possible will handle the samples or physical evidence. One individual from the field sampling team will be designated as the responsible individual for all sample transfer activities. This field investigator will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
- All samples will be accompanied by a COC record, which documents the transfer of custody of samples from the field investigator to another person, the laboratory, or other organizational elements. Each change of possession must be accompanied by a signature for relinquishment and receipt of the samples.
- Completed COC forms will be placed in a plastic cover, which is then placed inside the shipping container used for sample transport from the field to the laboratory.
- When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form or in the site logbook.
- Custody seals will be used on the shipping containers when samples are shipped to the laboratory to inhibit sample tampering during transportation.

Sample Labels

The sampling location identification and sample labeling, handling, and shipping must be performed using standardized and well-documented procedures so that a sample can be

tracked to its point of origination. Tracking will be performed from the time of sampling until the analytical data are released from the laboratory. The effectiveness of the tracking process will determine the integrity of the samples. Therefore, a sample-numbering system with a tracking mechanism that allows the retrieval of sample information including sampling locations, date, time, and analytical parameters must be used. Procedures for this system are provided in Section 3.5.2. The method of sample identification to be used depends on the type of sample collected and container used, as follows:

- Samples collected for in situ field analysis are those collected for specific field analyses or measurements for which the data are recorded directly in the field logbooks or recorded on field data sheets, along with sample identity information, while in the custody of the sampling team. Examples are samples for measurement of field pH, specific conductance, and temperature.
- Samples other than those collected for in situ field measurements or analyses are to be identified on a sample label affixed to the sample container by the FTL. The following information must be included on the label:
  - Laboratory
  - Project name (and number where appropriate)
  - Sample ID
  - Station ID
  - Date (for key to sampling round)
  - Preservation
  - Analysis
  - Sampler's initials, date, and military time

Chain-of-Custody Record

Samples are accompanied by a COC record, which will contain the information described in the next section.

Transfer-of-Custody and Shipment

When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the COC record. This record documents custody transfer from the sampler to the analyst at the laboratory.

Samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate COC record accompanying each shipping container. Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier name(s), and other pertinent information, will be entered in the '"Received By" section of the COC record.

When samples are split with a facility owner or agency, this information will be noted in the "Sample Remarks" section of the COC record and will be signed by both the sampler and the recipient. If the split is refused, the refusal will be noted and signed by both parties. The "Sample Remarks" section will also indicate if a representative is unavailable or refuses to sign. When appropriate, as in the case of the representative being unavailable, the COC record should contain a statement that the samples were delivered to the designated location at the designated time.

All shipments will be accompanied by the COC record identifying their contents. The original record and yellow copy will accompany the shipment to the laboratory, and the pink copy will be retained by the FTL.

If sent by mail, the package will be registered with return requested. If sent by common carrier, a bill of lading will be used. Freight bills, postal service receipts, and bills of lading will be retained as part of the permanent documentation.

Laboratory Chain-of-Custody Procedures

When samples are shipped to the laboratory, they will be placed in containers that are sealed on each side with at least one custody seal. A designated sample custodian will accept custody of the shipped samples following the procedure outlined below.

When sample analyses and necessary QA checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying stickers, data sheets, and laboratory records will be retained as part of the documentation. Sample containers and remaining samples will be disposed in compliance with all federal, state, and local regulatory requirements.

Sample Receipt. A designated sample custodian will accept custody of the shipped samples and verify that the packing list sample numbers match those on the COC record. The custodian will enter pertinent information as to shipment, pickup, and courier in the "Sample Remarks" section of the COC record and enter the sample numbers into a field logbook, which is arranged by project code and station number. Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the COC and record the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample. Cooler temperature (temperature vial) will be checked and recorded.

Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the FTL as part of the corrective action process (refer to Section 4.3.12). A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.

Sample Storage. The laboratory custodian will use the sample identification number and assign a unique laboratory number to each sample, and is responsible for seeing that all samples are transferred to the proper analyst or stored in the appropriate secure area. The laboratory will send a sample acknowledgement letter to the PM or FTL as a record of the shipment's arrival and the condition of the containers. Any discrepancy will be identified by the laboratory custodian, and corrective actions taken. The PC may need to provide guidance concerning additional actions. A copy of the sample acknowledgement letter will be retained with the COC by the PM.

Data Recording. The custodian will distribute samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they

are received until the sample is exhausted or returned to the custodian. The data from sample analyses are recorded on the laboratory report form.

Documentation Procedures

Field documentation will consist of one or more site-specific field logbooks and any necessary field forms as described in Section 3.7. Each logbook will be identified uniquely by project task and consecutively numbered. For extended field activities, logbooks will be maintained onsite until complete, then stored in the project files.

Photographs will be taken during key field activities.

Sample Identification. Sample identification procedures are identified in Section 3.5.2. The sample designation format will be followed throughout the project. Required deviations from this format in response to field conditions will be documented.

Field Logs. Field logs will consist of all associated field logbooks and any necessary field forms.

Site Logbook. The site logbook chronicles field investigation activities, but does not have the same level of detail as the field logbook. The site logbook delineates conditions and activities that occur on a given day and references the appropriate field logbooks and forms for specific information. The site logbook also is used to record field changes, along with supporting rationale (refer to Form 4-1, at the end of this section).

The person responsible for the field effort will complete the site logbook. Pages will not be removed from the document. Partially used pages will be lined out, dated, and initialed to prevent data entry at a later date.

The front cover or first page of the site logbook must list the project name, the project number, and dates of use. The following items are to be included, as appropriate to the work scope, in the site logbook:

- Date
- Weather conditions
- List of CH2M HILL personnel, subcontractor personnel, and site visitors by name, title, organization, and purpose, who entered the project area during the day
- Brief descriptions of activities conducted
- Field changes or variances with references to the appropriate documentation of these changes
- Specific comments related to peculiar problems that occurred during the day, if any, and their resolution

Field Logbook. Information required on the cover of the site logbook also must be provided on the cover of each field logbook. Entries in the field logbook must be continuous through the day. Pages, as well as the logbooks themselves, are numbered consecutively. The following information should be included in the field logbook:

- Date, time of specific activities, and physical location
- Weather conditions
- Names, titles, and organization of personnel onsite, names and titles of visitors, and times of visits
- Field observations, including specific details on sampling activities (including type of sampling, time of sampling, and sample numbers), a description of any field tests and their results, and references to any field forms used and type of document generated
- A detailed description of samples collected and any splits, duplicates, matrix spikes, or blanks that were prepared. A list of sample identification numbers, packaging numbers, and COC record numbers pertinent to each sample or referenced to the appropriate documentation should be noted
- Specific problems, including equipment malfunctions and their resolutions
- A list of times, equipment types, and variations of decontamination procedures followed or a reference to the appropriate documentation
- Photograph records

Additional information may be recorded at the discretion of the logbook user. Information to be recorded may include the following:

- Date and time of sample collection
- Types of sample containers and sample identification numbers
- Preservatives used
- Laboratory analyses requested
- Field analysis data and methods
- Sample distribution and transporter
- MEC or MD in the vicinity of the sample collection location

Corrections to Documentation. All original handwritten data recorded in field logbooks, sample identification tags, COC records, and receipts-for-sample forms will be written in black, waterproof ink. Corrections must be marked with a single line, dated, and initialed. No accountable control documents (such as site, field, and calibration logbooks) are to be destroyed or discarded, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one team member, the FTL may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

Final Evidence File Documentation. Documentation, including voided entries, must be maintained within project files.

4.3.6 Calibration Procedures

Field and laboratory equipment must operate satisfactorily within specified operating limits before it can be expected to produce reliable and usable data for a project. Documentation concerning the calibration laboratory equipment should include instrument type, calibration frequency, reference standards used, calibration acceptance criteria, and calibration documentation procedures. Calibration applies to field and laboratory instruments, including balances, refrigerators, and ovens.

Instrument testing is primarily achieved by following the manufacturer's instructions with regard to proper voltages, carrier gas flow rates, temperatures, mass or retention time windows, and certified calibration standards. Practically all instruments come with manufacturer's instructions for initial setup, routine checks, corrective actions, and preventive maintenance.

Field Instruments

Field instruments will be calibrated at the beginning of each day using the method described by the manufacturer's instructions and then checked periodically during the day and at the end of the measurement period. All instrument calibration activities are documented in the field logbooks.

All field instruments will be set up and operated in strict accordance with the manufacturer's instructions. When the operation of these instruments needs modification because of specific site or sample conditions, such modification will be documented in the instrument logs and field logbooks.

Laboratory Equipment

Laboratory instruments will be calibrated in accordance with the manufacturer's directions and applicable method specifications. Laboratory instrument calibration procedures will be summarized in the laboratory's quality assurance plan, which will be reviewed and approved by the PC or designee before samples are submitted for analysis.

4.3.7 Analytical Procedures

The parameters to be analyzed and the specific analytical methods to be used are discussed in Section 3.

4.3.8 Data Reduction, Validation, and Reporting

The data quality evaluation process is used to assess the effect of the overall analytical process on the usability of the data.

Level 1—Field Survey Data

Field instruments used to collect field survey data (or bulk measurements, such as pH or conductivity) are direct readings, thus making field calculations and subsequent data

reduction unnecessary. Field data will be recorded in the site logbooks by appropriately trained field personnel. Field data will include the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and sample measurement
- Sample results
- Supporting information if appropriate

Data will be reviewed by the FTL, who is responsible for the collection and verification of all field data while in the field. Data initially will be accepted or rejected by the FTL before leaving the sampling site. Extreme readings (readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings verified by re-testing.

Field documentation, sample data, instrument calibrations, and QC data will be reviewed by the PM (or a designee) before being included in the project files.

Level 2—Screening Analyses

Level 2 data includes the samples submitted to the laboratories for physical parameter testing and IDW characterization. Samples submitted for Level 2 analysis will require the delivery of a limited data package, which includes:

- Case narrative
- Sample results
- Selected QC information, such as surrogate recovery
- Associated blank results
- Completed COC forms and sample receipt information

The PC or designee will review the supporting information and will provide a summary report to the PM at the end of the field effort.

Laboratory Analyses

Data validation will be performed by a third-party data validation subcontractor and all laboratory data reports will be certified by a chemist licensed in Puerto Rico.

The data quality evaluation process is used to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and identifies whether the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of the matrix interferences is more subtle and involves analysis of several results including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

Before the analytical results are released by the laboratory, both the sample and QC data will be reviewed carefully to verify sample identify, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data will be reduced and spike recoveries will be included in control charts, and the resulting data will be reviewed to ascertain whether they

are within the laboratory-defined limits for accuracy and precision. Any non-conforming data will be discussed in the data package cover letter and case narrative. The laboratory will retain all of the analytical and QC documentation associated with each data package.

The data package will be reviewed by the PC or designee using the process outlined by the EPA (1999, 2004).

For non-CLP methods, the validation will be performed in a process analogous to the National Function Guidelines, but will use QC criteria established by the method.

The data review and validation process is independent of the laboratory's checks; it focuses on the usability of the data to support the project data interpretation and decision-making process. Areas of review include data package completeness, holding time compliance, initial and continuing calibration, spiked sample results, method blank results, and duplicate sample results. A data review worksheet will be completed for each data package. Acceptance criteria for each area of review are specified in the analytical method.

Sample results that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one- or two-letter abbreviation that indicates a possible problem with the data. Flags used in the text may include the following:

- U—Undetected. Samples were analyzed for this analyte, but it was not detected above the method detection limit (MDL) or instrument detection limit
- UJ—Detection limit estimated. Samples were analyzed for this analyte, but the results were qualified as not detected. The results are estimated
- J—Estimated. The analyte was present, but the reported value may not be accurate or precise
- R—Rejected. The data are unusable (analyte/compound may or may not be present)

It is important to note that laboratory qualifying flags are included on the data summary forms that are submitted by the laboratory. However, during the data review and validation process, the laboratory qualifying flags are evaluated and replaced with the project-specific validation flags.

Once each of the data packages has been reviewed, and the data review worksheets completed, then the entire data set will be evaluated for overall trends in data quality and usability. Information summarized as part of the data quality evaluation may include chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set will also be evaluated to identify potential data limitations or uncertainties in the laboratory. Additional areas of review are listed below.

Field and Laboratory Blank Contamination. The appearance and concentration of target compounds in field and laboratory blanks as well as environmental samples will be reviewed. Common field sampling and laboratory contaminants detected in blanks include acetone, methylene chloride, and phthalates. Acetone and methylene chloride are used to extract samples in the laboratory, and hence, are common laboratory contaminants.

Phthalates (such as bis(2-ethylhexyl)phthalate) are used as plasticizers and are often introduced during sample handling.

If these compounds are encountered in a method blank at a concentration greater than the practical quantification limit (PQL), corrective actions will be taken in an attempt to eliminate these compounds. These compounds may also be detected in field blanks above the PQL. In either case, all analytical data above the PQL associated with these compounds will be flagged to indicate possible cross-contamination.

Surrogate Spike Recoveries. Surrogate spike compounds are added to each sample for the organic analytical methods. Surrogate spike compounds are structurally similar (but not identical) to target compounds and should behave in a similar manner during analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because these blanks represent an ideal sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences.

When surrogate spike recoveries for field samples fall outside the method target acceptance windows, the samples are re-extracted if appropriate, then re-analyzed. If the surrogate spike recovery is still outside the acceptance window for the re-analyzed sample, then the sample results are qualified as affected by matrix interferences.

Matrix Spike Recoveries. For this QC measure, three aliquots of a single sample are analyzed—one normal and two spiked with the same concentration of matrix spike compounds. Unlike the surrogate spike compounds, matrix spike compounds are found on the method target compound list. Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. The duplicate spike results are compared to evaluate precision.

Laboratory Control Samples. An aliquot of American Society for Testing and Materials Type II water or "Ottawa sand" for organic analyses is spiked with target analytes or compounds at concentrations in the middle of the linear calibration range, and then prepared and analyzed with a batch of samples. The laboratory control sample is used to ensure quality control for each preparation batch.

Duplicate Sample Results. Duplicate samples will be collected and submitted for laboratory analysis. Both the native and duplicate samples will be analyzed for the same parameters. Target compounds that are detected in both the native and duplicate samples will be compared and the precision estimated for the sample results calculated.

Laboratory Data Reporting. Laboratory data will be reported in Level 3 QC and validated for risk assessment. Level 3 reporting includes all QC and calibration summaries for a project-specific batch of samples. Matrix-specific QC is performed relative to project sample delivery groups.

4.3.9 Internal Quality Control

Field Measures

Field sampling QC procedures will include collecting trip blanks, field blanks, equipment blanks, field duplicates, and MS/MSD samples, as discussed in Section 3.5.2. These QC samples will be submitted blind to the laboratory. Field measurement QC procedures will include the calibration requirements discussed in Section 4.3.5.

Samples will be collected by personnel wearing Level D personal protection equipment.

Routine Analytical Services

Laboratory QC procedures will include the following:

- Analytical methodology according to the specific methods identified
- Instrument calibrations and standards as defined in the specific methods
- Laboratory blank measurements at a minimum frequency of 5 percent or one-per-batch
- Accuracy and precision measurements at a minimum frequency of 5 percent or one-per-set
- Data reduction and reporting according to the specific methods and the specifications outlined in Section 4.3.7
- Laboratory documentation according to the specifications outlined in Section 4.3.7

4.3.10 Performance and System Audits

Performance and systems will be audited to verify documentation and implementation of the project-specific QCP, to identify nonconformance, and to verify correction of identified deficiencies.

Assessment activities may include surveillance, inspections, peer review, management system review, readiness review, technical systems audit, performance evaluation, and data quality assessment. The Quality Assurance Control Manager (QACM) will be responsible for initiating audits, selecting the audit team, and overseeing audit implementation.

The QACM, or designee, in consultation with the PM, will evaluate the need for an independent audit. The client may also perform independent project audits. Performance audits are used to quantitatively assess the accuracy of analytical data through the use of performance evaluation and blind check samples. Laboratory performance will be audited by the QACM or designee

Project Systems Audit

A systems surveillance of operations may be required by the project-specific work plan and would be used to review the total data generation process. This will include onsite review of the field operational system, physical facilities for sampling, and equipment calibrations. Informal document control surveillance will consist of checking each document for completeness, including such items as signatures, dates, and project numbers.

An audit report summarizing the results and corrections will be prepared and entered in the project files.

Technical Performance Audits

The FTL or a designated representative will conduct an informal surveillance of the field activities. Surveillance for completeness will include the following items:

- Sample labels
- COC records
- Field logbooks
- Sampling operations

The first three items above will be checked for completeness. Sampling operations will be reviewed to determine if they are being performed as stated in Section 3 or as directed by the FTL. A performance surveillance may be conducted by the PM and the FTL during the first week of sampling if it is deemed necessary by the PM, FTL, or client. The surveillance may focus on verifying that proper procedures are followed so that subsequent sample data will be valid. Before the surveillance, a checklist will be prepared by the PM and the FTL to serve as a guide for the performance surveillance. The surveillance may verify the following:

- Collection of samples follows the available written procedures
- COC procedures are followed for traceability of sample origin
- Appropriate QC checks are being made in the field and documented in the field logbook
- Specified equipment is available, calibrated, and in proper working order
- Sampling crews are adequately trained
- Record-keeping procedures are being followed and appropriate documentation is maintained
- Corrective action procedures are followed

An audit report summarizing the results and corrections will be prepared and entered in the project files.

Field Audits

Field audits are not currently anticipated during this investigation, but will be performed if necessary.

Laboratory Audits

The analytical laboratory will conduct both internal and external QC checks. External QC checks include participation in EPA's certification and performance evaluation programs. The results of quarterly performance evaluation samples will be made available to the PM upon request. Internal QC checks (duplicates, blanks, and spiked samples) will be performed in accordance with the approved methods.

Laboratory systems are audited annually and as required by specific projects. The laboratories are required to submit a laboratory quality assurance plan and relevant SOPs

before the field effort begins. During data evaluation and data use, if any problems are noted, specific corrective actions will be implemented on a case-by-case basis. An additional systems audit may be requested if warranted.

The laboratory will be required to perform the following:

- Monthly project review of 10 percent of all projects done by the QA department
- Audits by the laboratory QA manager at a frequency greater than specified in the laboratory quality assurance plan
- Special audits by the QACM or corporate management when a problem is suspected
- Yearly audits by the corporate QACM

4.3.11 Preventive Maintenance

Field Equipment

The field personnel operating the field equipment and appropriate offsite laboratory chemists are responsible for the maintenance of their respective instruments. Preventive maintenance will be provided on a scheduled basis to minimize down time and the potential interruption of analytical work. All instruments will be maintained in accordance with the manufacturer's recommendations and normal approved laboratory practice.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of using properly functioning equipment. If a project team member suspects an equipment malfunction, the device will be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration can be performed or a substitute piece of equipment can be obtained.

Laboratory Equipment

Designated laboratory personnel will be trained in routine maintenance procedures for all major instrumentation. When necessary, repairs will be made by either trained staff or trained service engineers/technicians employed by the instrument manufacturer. The laboratory will have multiple instruments that will serve as backup to minimize the potential for downtime.

Preventive maintenance will be performed according to the procedures delineated in the manufacturer's instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance. Procedures should be listed in greater detail in the laboratory's quality assurance plan.

Chromatographic carrier gas purification traps, injector liners, and injector septa will be cleaned or replaced on a regular basis. Precision and accuracy data will be examined for trends and excursions beyond control limits to identify evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade, as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or more of the QC criteria.

Instrument downtime will be minimized by keeping adequate supplies of all expendable items (that is, an expected lifetime of less than 1 year). Selected items include gas tanks,

gasoline filters, syringes, septa, gas chromatography (GC) columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, open-split interfaces, and mass spectroscopy (MS) filaments.

Instrument Maintenance Logbooks

All maintenance will be documented in permanent logs that will be available for review by auditing personnel. Both scheduled and unscheduled maintenance required by operational failures will be recorded. The designated laboratory operations coordinator will review maintenance records regularly to ensure that required maintenance is occurring.

Instrument maintenance logbooks are maintained in laboratories at all times. The logbooks, in general, contain a schedule of maintenance, as well as a complete history of past routine and non-routine maintenance. Laboratories will be audited by the PC prior to the start of analyses.

4.3.12 Specific Procedures Used to Assess Data

The final activity of the data quality evaluation is an assessment of whether the data meet the DQOs. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and that the resulting analytical data can be used to support the project decision making process.

Data assessment will follow the data review and validation described in Section 4.3.7. An assessment report will be prepared at the end of the project. The report will summarize the findings of the data review/validation as relevant to project usage. Data accuracy, precision, and completeness values will be summarized in the assessment report. The following subsections describe the quantitative definition of accuracy, precision, and completeness.

Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the RPD and is calculated as follows:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \times 100 = \left\{ \frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right\} \times 100$$

where:

X_1 = native sample
X_2 = duplicate sample

Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred

technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy, defined as percent recovery (P), is calculated as follows:

$$P = \left[\frac{(SSR - SR)}{SA} \right] x\ 100$$

where:

SSR=spiked sample result
SR=sample result (native)
SA=the spike concentration added to the spiked sample

Completeness

Completeness is defined as the percentage of measurements judged to be valid compared to the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the following formula:

$$\text{Completeness} = \frac{\text{Valid Measurements}}{\text{Total Measurements}} \times 100$$

Experience on similar projects has shown that laboratories typically achieve about 90 percent completeness. All validated data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, corrective action will be initiated by the PM.

4.3.13 Corrective Actions

Field Activities

The PM is responsible for initiating corrective actions, which include problem identification, investigation responsibility assignment, investigation, action to eliminate the problem, increased monitoring of the effectiveness of the corrective action, and verification that the problem has been eliminated.

Documentation of the problem is important to the overall management of the study. A corrective action request form for problems associated with sample collection is completed by the person discovering the QA problem (refer to Form 4-2 at the end of this section). This form identifies the problem, establishes possible causes, and designates the person responsible for action. The responsible person will be either the PM or the FTL.

The corrective action request form includes a description of the corrective action planned and has space for follow-up. The PM verifies that the initial action has been taken and appears to be effective, and at an appropriate later date, checks to see if the problem has been resolved fully. The PM receives a copy of all corrective action request forms and enters them into the corrective action log. This permanent record aids the PM in follow-up and assists in resolving the QA problems.

Examples of corrective action include, but are not limited to, correcting COC forms, analysis reruns (if holding time criteria permit), recalibration with fresh standards, replacement of

sources of blank contamination, or additional training in sampling and analysis. Additional approaches may include the following:

- Resampling and reanalyzing
- Evaluating and amending sampling and analytical procedures
- Accepting the data and acknowledging the level of uncertainty or inaccuracy by flagging the validated data and providing an explanation for the qualification

Laboratory Activities

The laboratory department supervisors review the data generated to verify that all QC samples have been run as specified in the protocol. Laboratory personnel will be alerted that corrective actions may be necessary if the following should occur:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory QAP for any target compound.
- Undesirable trends are detected in matrix spike recoveries or RPD between matrix spike duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by the laboratory QA Director during internal or external audits, or from the results of performance evaluation samples.

If non-conformances including, but not limited to, analytical methodologies or QC sample results are identified by the bench analyst, corrective actions will be implemented immediately. Corrective action procedures will be handled initially at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors and check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst will immediately notify his/her supervisor of the problem and the investigation being made. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor and QA/QC Officer for further investigation. Once resolved, full documentation of the corrective action procedure will be filed with the laboratory supervisor, and the QA/QC Officer will be provided a corrective action memorandum for inclusion in the project file if data are affected. Corrective actions may include, but are not limited to, the following:

- Re-analyzing suspect samples
- Re-sampling and analyzing new samples
- Evaluating and amending sampling and/or analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Recalibrating analytical instruments
- Qualifying or rejecting the data

Following the implementation of the required corrective action measures, data that are deemed unacceptable may not be accepted by the PM, and follow-up corrective actions may

be explored. Details of laboratory corrective actions are provided in the laboratory's quality assurance plan. Corrective action requests will be documented with Form 4-2 (refer to the end of this section).

4.3.14 Quality Assurance Reports

The purpose of QA reports is to document implementation of the QCP. These reports include periodic assessments of measurement data accuracy, precision, and completeness of the results of performance audits, the results of system audits, and the identification of significant QA problems and recommended solutions.

The analytical laboratory will be responsible for submitting monthly progress reports to the PM. The PM is responsible for submitting these reports to the client, as required.

The final QA report can be attached as an appendix to the ESI report and may include the following:

- Data quality assessment in terms of PARCC, and the method detection limits
- Degree to which DQOs were met
- Limitations of the measurement data and usability of the data
- Applicability of the data to site conditions
- Laboratory QC activities, including a summary of planned versus actual laboratory QC activities, explanations for deviations, and an evaluation of data quality for each analysis for each medium
- Field QC activities, including a summary of planned versus actual field QC activities, explanations for deviations, and evaluations of the data quality of field QC samples/activities and estimated effect on sample data
- Data presentation and evaluation, including an assessment of sampling and analysis techniques, data quality for each analysis and each medium, and data usability

A final report will be submitted to the client after comments from the client and regulatory agencies have been incorporated.

4.4 MEC-Related Quality Assurance Objectives

The MEC-related QC forms (Forms 4-1b through 4-9b) referenced throughout this section are included at the end of the section. As discussed in Section 4.3.1, the purpose of this Phase I RFI is to evaluate the presence of MEC and MC in selected areas of Piñeros and Cabeza de Perro Islands. The specific objectives include the following:

- Identify areas that are potentially accessible to the public under a land use scenario that allows limited access to the islands for recreational purposes.
- Evaluate the potential for MEC to be present in these areas through a visual assessment and by evaluating the density of geophysical anomalies.

- Evaluate the presence or absence of MC in these areas through the collection and analysis of surface soil samples.
- Evaluate the potential for MEC to be present at four suspected underwater demolition areas DGM.

4.4.1 Definable Features of Work and the Three-Phase Control Process

MEC-related QC will be monitored through the definable features of work (DFOW) using a three-phase control process. The DFOWs and the three-phase control process are discussed in the following subsections.

Definable Features of Work

The DFOW for this project are divided into activities related to planning, field operations, and final project reports and closeout:

1. **Planning**
   - Pre-Mobilization Activities: System setup for GIS, document management and control, data management and subcontracting
   - Preparing work plan
   - Preparing an ESS Waiver: Preparing and obtaining approval from appropriate EOD personnel

2. **Field Operations**
   - Site Preparation: mobilization, vegetation removal
   - Visual ground surface MEC survey
   - Land-based DGM survey
   - Underwater DGM survey
   - Demobilization

3. **Final Project Reports and Closeout**
   - Preparing GIS maps
   - Phase I RFI Draft and Final Reports: preparing and obtaining approval
   - Data archiving and project closeout

Three Phases of Control

The Corporate MR Safety & QC Officer is responsible for ensuring that the three-phase control process, including the Preparatory Phase, Initial Phase, and Follow-up Phase, is implemented for each DFOW listed in this QCP.

Each control phase is important for obtaining a quality product and meeting the project objectives; however, the preparatory and initial audits are particularly valuable in preventing problems. Production work is not to be performed on a DFOW until successful Preparatory and Initial Phases have been completed.

Preparatory Phase. The Preparatory Phase culminates with the planning and design process leading up to actual field activities. Successful completion of the Preparatory Phase verifies

that the project delivery, QC, and safety plans have been completed. The following actions will be performed as applicable for each DFOW:

1. Confirm that the appropriate technical procedures are incorporated into the project work plan and review procedures.
2. Confirm that adequate testing is called for to ensure quality delivery.
3. Confirm definition of preliminary work required at the work site and examine the work area to confirm required preliminary work has been properly completed.
4. Confirm availability of required materials and equipment. Examine materials and equipment to confirm compliance with approved submittals and procedures. Ensure equipment testing procedures are in place, with control limits and frequency, for each piece of equipment.
5. Confirm qualifications/training of personnel and verify roles/responsibilities are well-defined and communicated.
6. Confirm with the HSM that the site HSP adequately address the work operations and that applicable safety requirements have been incorporated into the plan.
7. Discuss methods to be employed during the field activities.
8. Confirm any required permits and other regulatory requirements are met.
9. Verify that lessons learned during previous similar work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems.

Project staff must correct or resolve discrepancies between existing conditions and the approved plans/procedures identified by the PM, Corporate MR Safety & QC Officer, and the team during the Preparatory Phase. The PM or designee must verify that unsatisfactory and nonconforming conditions have been corrected prior to granting approval to begin work.

Results of the activity are to be documented in the Preparatory Inspection Checklist (Form 4-1b) specific for the DFOW and summarized in the Weekly QC Report.

Initial Phase. The Initial Phase occurs at the startup of field activities associated with a specific DFOW. The Initial Phase confirms that this QCP, other applicable work plan sections, and procedures are being effectively implemented and the desired results are being achieved.

During the Initial Phase, the initial segment of the DFOW is observed and inspected to ensure that the work complies with contract and work plan requirements. The Initial Phase should be repeated if acceptable levels of specified quality are not met. The following shall be performed for each DFOW:

1. The FTL will ensure that the field teams are aware of expectations associated with the field methods established under the Preparatory Phase by observing the initial work activities and interacting with the PM and responsible subcontractors' supervisors.
2. Resolve conflicts. The Senior Technical Consultant will guide the PM and responsible supervisor(s) in resolving conflicts. Should conflicts arise in establishing the baseline

quality for the DFOW, the responsibility to resolve the conflict falls to the PM. Should the conflict not be resolved in a manner that satisfies the project requirements, the Senior Technical Consultant must elevate the conflict to the program level (that is, the Program QC Manager) and issue a non-conformance report. The Senior Technical Consultant may direct a cessation of work activity with the concurrence of the Program QC Manager should the issue jeopardize the results of the DFOW or put the project at risk of non-conformance.

3. Verify with the HSM that the site HSP was developed to ensure that the identified hazards adequately address field conditions. Confirm that applicable safety requirements are being implemented during field activities.

Upon completion of Initial Phase activities, the results are to be documented in the Initial Phase Inspection Checklist (Form 4-2b) and the QC logbook and summarized in the Weekly QC Report. Should results be unsatisfactory, the Initial Phase will be rescheduled and performed again.

Follow-up Phase. Completion of the Initial Phase of QC activity leads directly into the Follow-up Phase, which addresses the routine day-to-day activities at the site. Inspection and audit activities associated with each DFOW are addressed in Section 4.4.2. Specific concerns associated with the Follow-up Phase include:

1. Inspection of the work activity to ensure work complies with the Contract and work plans
2. Evaluation and confirmation that the quality of work is being maintained at least at the level established during the Initial Phase
3. Evaluation and confirmation that required testing is being performed in accordance with the procedures in this Work Plan
4. Confirmation that nonconforming work is being corrected promptly and in accordance with the direction provided by the PM, FTL, Senior Technical Consultant, or Corporate MR Safety & QC Officer.

To conduct and document these inspections, the FTL is to generate the Follow-up Phase Inspection Checklist (Form 4-3b). The Follow-up Phase inspections will be performed daily or as otherwise identified in this QCP until the completion of each DFOW.

The FTL is responsible for onsite monitoring of the practices and operations taking place and verifying continued compliance with the specifications and requirements of the Contract, project, and approved project plans and procedures. The FTL is also responsible for verifying that a daily health and safety inspection is performed and documented as prescribed in the HSP (refer to Appendix B, Attachment B). Discrepancies between site practices and approved plans and procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the FTL or a designee prior to granting approval to continue work. Follow-up Phase inspection results are to be documented in the QC logbook and summarized in the Weekly QC Report.

Additional Audits. Additional audits performed on the same DFOW may be required at the discretion of the Program QC Officer, Senior Technical Consultant, Corporate MR Safety & QC Officer, HSM, or the PM. Additional preparatory and initial audits are generally

warranted under any of the following conditions: unsatisfactory work, changes in key personnel, resumption of work after a substantial period of inactivity (for example, two weeks or more), or changes to the project scope of work/specifications.

Final Acceptance Audit. Upon conclusion of the DFOW and prior to closeout, the Final Acceptance Inspection must be performed to verify that project requirements relevant to the work are satisfied. Outstanding and nonconforming items are to be documented on the Final Inspection Checklist (Form 4-4b). Resolution of each item must be noted on the checklist. Contractor acceptance and closeout of each definable work feature is a prerequisite to project closeout.

4.4.2 Audit Procedures

The Corporate MR Safety & QC Officer is responsible for verifying compliance with this QCP through audits and surveillance. The PM or a designee is to inspect/audit the quality of work being performed for the definable feature of work. The PM or a designee is to verify that procedures conform to applicable specifications stated in this work plan or other applicable guidance. Identified deficiencies are to be communicated to the responsible individual and documented in the QC logbook and Weekly QC Report. Corrective actions are to be verified by the Corporate MR Safety & QC Officer and recorded in the Weekly QC Report.

The specific QC audit procedures for the DFOWs, including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to take if failure occurs, are presented in Table 4-1.

Detailed QC procedures for DGM activities are outlined in the GIP (Appendix C). The QC performed for the DGM activities will be tracked in the MRP Enterprise system (refer to Section 4.4.4) and will be audited by the Project Geophysicist or his designee on a daily basis.

The Inspection Schedule and Tracking Form (Form 4-5b) is to be used by the Corporate MR Safety & QC Officer for planning, scheduling and tracking the progress of audits for this project. The information on the form is to be kept up to date and reviewed by the Corporate MR Safety & QC Officer for planning purposes. Audit activities and corrective actions are to be documented by the Corporate MR Safety & QC Officer in accordance with this chapter. Audit records are to be maintained as part of the project QC file.

4.4.3 Corrective/Preventive Action Procedures

The corrective and preventive action procedures are designed to prevent quality problems and to facilitate process improvements, as well as identify, document, and track deficiencies until corrective action has been verified.

TABLE 4-1
Definable Features of Work Auditing Procedures
Work Plan to Conduct Phase I RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure[2]	QC Phase[3]	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Planning						
Geographical Information System (GIS) Setup (Pre-mobilization Activities)	Project GIS Manager	Verify GIS system has been set up and is ready for site data.	PP	O	GIS system has been set up and is ready for site data.	Do not proceed with field activities until criterion is passed.
Document management and control (Pre-mobilization Activities)	Project Manager	Verify appropriate measures are in place to manage and control project documents.	PP	O	Appropriate measures are in place to manage and control project documents.	Do not proceed with field activities until criterion is passed.
Data Management (Pre-mobilization Activities)	Project Manager, Project Geophysicist	Verify appropriate measures are in place to manage and control project data.	PP	O	Appropriate measures are in place to manage and control project data.	Do not proceed with field activities until criterion is passed.
Subcontracting (Pre-mobilization Activities)	Project Manager, Site Manager	Verify subcontractor qualifications, training, and licenses.	PP/IP	O	Subcontractors' qualifications, training, and licenses are up to date and acceptable.	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor.
Technical and Operational approach (Technical Project Planning)	Project Manager	Verify technical and operational approaches have been agreed on by the project team.	PP/IP	O	Technical and operational approaches have been agreed on by project team and incorporated into the Work Plans.	Do not proceed with field activities until criterion is passed
Work Plan and Explosives Safety Submission (ESS) Waiver preparation and approval	Project Manager	Verify Work Plan and ESS Waiver have been prepared and approved.	PP/IP	O	Work Plan and ESS Waiver has been approved	Do not proceed with field activities (excluding site mobilization) until criterion is passed.
Field Operations						
Site preparation (Mobilization)	Project Manager	Verify local agencies are coordinated.	PP/IP	O	Local agencies are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify equipment has been inspected and tested.	PP/IP	E	Equipment passes inspection and testing.	Proceed only with activities for which equipment has passed inspection and testing.
Site preparation (Mobilization)	Project Manager	Verify communications and other logistical support are coordinated.	PP/IP	O	Communications and other logistical support are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager	Verify emergency services have been coordinated.	PP/IP	O	Emergency services are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MR Safety & QC Officer, Project Manager	Verify site-specific training is performed and acknowledged.	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	MR Safety & QC Officer, Project Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site Preparation (Vegetation Removal)	FTL	Verify personnel qualifications and training.	PP/IP	O	Personnel qualifications and training are appropriate.	Ensure subcontractor provides appropriately trained and qualified personnel or replace with properly trained personnel.
Site Preparation (Vegetation Removal)	FTL	Verify environmental controls are correct and functional.	IP/FP	O	Environmental controls are correct and functional.	Ensure that appropriate environmental controls are in place prior to proceeding with vegetation removal.
Site Preparation (Vegetation Removal)	FTL	Verify vegetation removal is conducted IAW Section 3 of the Work Plan.	FP	D	Vegetation removal is conducted IAW Section 3 of the Work Plan.	Stop vegetation removal activities until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
Site Preparation (Surface MEC identification)	FTL	Verify equipment testing is performed per Section C.24 of the Geophysical Investigation Plan (Work Plan Appendix C).	IP/FP	O/D	Equipment passes daily function test in equipment check area.	Repair or replace instrument.
Site Preparation (Surface MEC identification)	FTL	Verify area/boundary.	PP/IP	O	Area/boundary is marked.	Stop activities until area/boundary can be verified.

TABLE 4-1
Definable Features of Work Auditing Procedures
Work Plan to Conduct Phase I RFI
Piñeros and Cabeza de Perro Islands
Naval Activity Puerto Rico

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure[2]	QC Phase[3]	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Site preparation (Surface MEC identification)	FTL, MR Safety & QC Officer, Project Geophysicist	Verify work methods are conducted IAW the Geophysical Investigation Plan (Work Plan Appendix C) and Health and Safety Plan (Work Plan Appendix B). Survey/Sweeps MEC Surface Sweeps Scrap Inspection Operations	IP/FP	D	Work methods are being performed IAW the Work Plan and SOPs.	Stop activities until Work Plan and SOPs are being followed and any activities not performed within compliance are re-evaluated and re-performed if necessary.
DGM Survey	Project Geophysicist	Verify DGM Survey conducted IAW Geophysical Investigation Plan (Chapter 3.3) and DGM SOPs: EM-61-MK2 Metal Detection Surveys Geophysical Surveying with EM-61-MK2 .	IP/FP	O/D	DGM Survey conducted IAW Geophysical Investigation Plan (Chapter 3) and DGM SOPs.	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
DGM Survey	Project Geophysicist	Check results of QC tests performed as specified in QCP and DGM SOPs..	FP	E	QC tests must pass IAW standards and referenced SOPs.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	Confirm that DGM survey DQOs are being met.	FP	E	DGM survey DQOs are being met.	If the DQOs are not being met, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Data Processing	Project Geophysicist	Verify data checks specified in QCP and SOPs: EM-61-MK2 Data Processing and Database Management Uploading and Downloading Data to the FTP Site .	FP	E	Data checks must pass in accordance with standards established in the Work Plan.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
Demobilization	Project Manager	Verify facilities-support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition.	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout						
Final Report	Project Manager	Verify Final Report has been approved.	IP	O	Final Report has been approved.	Take appropriate actions to ensure Report gets approved
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
IAW = in accordance with

QC Phase	Frequency
PP = Preparatory Phase	O = Once
IP = Initial Phase	D = Daily
FP = Follow-up Phase	W = Weekly
	E = Each occurrence

[1] The responsible person (if other than the MR Safety & QC Officer) is the individual with whom the MR Safety & QC Officerwill coordinate with to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.
[2] Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.
[3] Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan.

Preventive Measures

While the entire QC program is directed toward problem prevention, certain elements of the program have greater potential to be proactive. The primary tools for problem prevention on this project are discussed in Three Phases of Control (Section 4.4.1), Submittal Management (Section 4.4.5), and Personnel Qualification and Training (Section 4.4.6). Should these preventive measures fail, tracking and communicating deficiencies provide a mechanism for preventing their recurrence.

Continual Improvement

Project staff at all levels are encouraged to provide recommendations for improvements in established work processes and techniques. The intent is to identify activities that are compliant but can be performed in a more efficient or cost-effective manner. Typical quality improvement recommendations include identifying an existing practice that should be improved and/or recommending an alternate practice that provides a benefit without compromising prescribed standards of quality. Project staff members are to bring their recommendations to the attention of project management or the QC staff through verbal or written means. However, deviations from established protocols are not to be implemented without prior written approval by the PM and concurrence of the Senior UXO Consultant. Where a staff-initiated recommendation results in a tangible benefit to the project, public acknowledgment is to be given by the PM.

Deficiency Identification and Resolution

While deficiency identification and resolution occurs primarily at the operational level, QC audits provide a backup mechanism to address problems that either are not identified or cannot be resolved at the operational level. Through implementation of the audit program prescribed in this QCP, the QC staff is responsible for verifying that deficiencies are identified, documented as prescribed herein, and corrected in a timely manner. Deficiencies identified by the QC staff are to be corrected by the operational staff and documented by the QC staff.

Corrective Action Request

A Corrective Action Request (CAR) (Form 4-6b) can be issued by any member of the project staff, including CH2M HILL and subcontractor employees. If the individual issuing the CAR is also responsible for correcting the problem, then that individual should do so and document the results on Part B of the CAR (Form 4-6b). Otherwise, the CAR should be forwarded to the PM, who is then responsible for evaluating the validity of the request, formulating a resolution and prevention strategy, assigning personnel and resources, and specifying and enforcing a schedule for corrective actions. Once a corrective action has been completed, the CAR and supporting information are to be forwarded to the Corporate MR Safety & QC Officer for closure. Sufficient information is to be provided to allow the QC reviewer to verify the effectiveness of the corrective actions.

In addition to observing actual work operations, CARs are to be reviewed during follow-up QC audits. The purposes of this review are as follows: to ensure that established protocols are implemented properly; to verify that corrective action commitments are met; to ensure that corrective actions are effective in resolving problems; to identify trends within and among similar work units; and to facilitate system root cause analysis of larger problems.

Particular attention is to be given by the QC staff to work units that generate either an unusually large or unusually small number of CARs.

The PM will determine whether a written Corrective Action Plan (CAP) (Form 4-7b) is necessary, based on whether or not any of the following are met: the CAR priority is high; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent recurrence. The CAP is developed by a PM designee and approved and signed by the PM. The CAP is to indicate whether it is submitted for informational purposes or for review and approval. In either event, the operational staff members are encouraged to discuss the corrective action strategy with the QC staff throughout the process. The CAP form is included at the end of this chapter.

Deficiency and Corrective Action Tracking

Each CAR must be given a unique identification number and tracked until corrective actions have been taken and documented in Part B of the form and the CAR is submitted to the PM or a designee for verification and closure.

Lessons Learned and Other Documentation

The lessons learned through the deficiency management process are documented on CARs and CAPs. To share the lessons learned, these documents can be submitted to the Client through a Weekly QC Report summarizing the week's QC activities and including a grouping of the Daily QC Reports (Form 4-8b) and all other pertinent reports created during the week.

CARs should be cited in the Weekly QC Report. Minor deficiencies identified during a QC audit that are readily correctable and can be verified in the field are to be documented in the QC logbook and Weekly QC Report without initiating a CAR. Deficiencies that cannot be readily corrected are to be documented by the QC staff on a CAR and in the Weekly QC Report. Copies of CARs are to be referenced in and attached to the Weekly QC Report. CAPs will also be attached to Weekly QC Reports to document the final outcome of the deficiency. Similar or related deficiencies may be addressed on a single CAP.

4.4.4 Records Generated

Onsite Project File

The FTL will establish and maintain an onsite project file in accordance with the CH2M HILL corporate quality manual for document control. The onsite files will be maintained in the project field office or designated field vehicle. The purpose of these files is to maintain a complete set of all documents, reports, certifications, and other records that provide information on project plans, contractual agreements, and project activities.

The CH2M HILL MRP Enterprise system, which consists of a mobile field data collection device used to collect form-based information of MEC and DGM operations and a centralized desktop interface and database, will be the repository for most of the information collected by the field team (e.g., daily reports). This database will contain information that can be easily presented and delivered through automated report production, which reduces the amount of actual paper in the files. The database will be

backed-up daily and stored in an offsite location as well as in the project trailer. The files (in either paper or digital format) will include copies of the following:

- Qualifications and training records of all site personnel
- Submittals
- Schedule and progress reports
- Survey records
- Conversation logs
- Meeting minutes and agenda
- Audit logs and schedules
- Photo documentation
- Site maps
- Equipment check records
- Nonconformance and corrective action reports
- Daily work activity summary reports, which may include:
  - Weekly QC Report
  - Daily Health and Safety Report
  - Daily Report (including activity log)
  - Daily MEC Team Logs
  - Daily DGM Team Logs
  - Reports on any emergency response actions (EOD will handle emergencies on this project)
  - Equipment check records
  - COC records
  - Incident reports
  - Truck load tickets and shipping papers (if applicable)

As the project activities progress, the FTL will monitor the usefulness of the project filing system for information retrieval. If additional file sections are needed, the FTL will expand the initial filing structure to include additional sections.

Weekly QC Report

The FTL is responsible for preparing and submitting the Weekly QC Report to the Program QC Officer for the project file and providing concurrent courtesy copies to the PM. The Weekly QC Report with attachments is to be submitted to the Program QC Officer on the first workday following the dates covered by the report.

The Weekly QC Report is to provide an overview of QC activities performed each day, including those performed by subcontractors. The QC reports must present an accurate and complete picture of QC activities by reporting both conforming and deficient conditions, and the reports should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports, are to be attached.

A field QC log is to be maintained by the FTL to document details of field activities during QC monitoring activities. At the end of each day, copies of the log entries are to be attached to the Weekly QC Report. The information in the field QC log provides backup information and is intended to serve as a phone log and memory aid in the preparation of the Weekly QC Report and for addressing follow-up questions.

QC and health and safety staff input for the Weekly QC Report is to be provided in writing to the FTL at a previously agreed upon time and place, generally no later than 1 hour before normal close of business. For the sake of simplicity and completeness, the format for QC staff input should follow the same format as the Weekly QC Report with only the relevant sections completed.

Copies of Weekly QC Reports with attachments and field QC logs no longer in use are to be maintained in the project QC file. Upon project closeout, all QC logs are to be included in the project QC file.

4.4.5 Submittal Management

The PM is responsible for overall management and control of project submittals. The PM is also responsible for submittal scheduling and tracking.

The PM is responsible for ensuring, through detailed review, that submittals as well as the materials and the work they represent, are in full compliance with applicable contractual specifications and the project plans. The PM is also responsible for ensuring that a project file is established and maintained and that project documents are retained and controlled appropriately.

Review of Plans and Specifications

During the Preparatory Phase of a DFOW, the PM is responsible for reviewing the plans and, when necessary, requesting clarification from the project team. The primary purpose of this review is to identify and resolve potential conflicts prior to initiating work operations.

Review and Approval of Submittals

The Senior Technical Consultant and the PM must review submittals prepared by CH2M HILL and subcontractors for completeness and compliance with the specifications of the project and Contract. Non-compliant submittals are to be returned to the originator for corrective action and re-submittal to the PM or his designee.

Prior to submittal to the Senior Technical Consultant for certification, technical documents (e.g., reports and plans) are to be reviewed by qualified staff. Although part of the QC process, technical reviewers may include, but are not limited to, the QC staff.

For each project document that is submitted for technical review, a Document Review and Release Form (Form 4-9b) is to be initiated by the author, submitted with the document to be reviewed, and used to document and track the review process. A copy of the completed Document Review and Release Form is to be submitted to the PM together with the corrected document for his review and certification. Each document is to provide a signature block for PM and Senior Technical Consultant certification. Original Document Review and Release Forms, reviewer comments, and annotated versions are to be retained with the deliverable in the project file and reviewed by the QC staff during project audits.

4.4.6 Personnel Qualifications and Training

All project staff members will be qualified to perform their assigned jobs in accordance with the terms outlined in the Contract and by the project plans. Specific qualifications and

training required for UXO-qualified personnel are stated in the following subsections. Qualifications for DGM operations-related personnel are covered in the GIP in Section 3.4.

Documentation of Qualification and Training for UXO-qualified Personnel

The Field Team Leader will maintain records documenting the required qualifications, training, and certifications for each site worker. The FTL will monitor expiration dates to provide advance warning to the PM of when employees will require refresher training or other renewals. The Corporate MR Safety & QC Officer will maintain records of site-specific and routine training for personnel and visitors, as required by these project plans. These records will be maintained onsite for audit purposes.

All UXO Personnel

All MEC personnel will comply with the training requirements specified by the Program QC Manager. UXO personnel assigned to the position of UXO Technician I, UXO Technician II, or Corporate MR Safety & QC Officer will be graduates of one of the following schools or courses:

- U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland
- U.S. Naval EOD School, Indian Head, Maryland
- U.S. Naval EOD School, Eglin Air Force Base, Florida
- U.S. Department of Defense-certified equivalent course (UXO Technician I only)

EOD experience in National Guard or Reserve Units will be based on the actual documented time spent on active duty, not on the total time of service.

UXO Sweep Personnel

UXO sweep personnel assist UXO technicians and UXO-qualified personnel in the performance of UXO-related operations. UXO sweep personnel do not have to be UXO technicians; however, they must be provided job and site-specific training. At a minimum, training will include: explosives safety; recognition of MEC, particularly UXO; and the proper use of personal protective equipment. UXO sweep personnel are not involved in the execution of explosives operations and will not have intentional physical contact with MEC. With direction and supervision of UXO-qualified personnel, UXO sweep personnel may:

- Conduct visual and/or detector-aided MEC field search activities.
- Locate subsurface MEC by operating geophysical detection instruments and related equipment.
- Perform field maintenance and tests on geophysical detection instruments and related equipment.
- Remove nonhazardous munitions debris and range-related debris, only after such items have been inspected by a UXO technician or UXO-qualified personnel and determined to be safe for handling.
- Perform site and area security functions.

UXO Technician I

In addition to being able to perform all functions of the UXO sweep personnel listed in this section, for this project, UXO Technician I personnel may, with the direction and supervision from UXO-qualified personnel:

- Reconnoiter and classify MEC.
- Identify all types of military munitions, including possible fuzes and their condition, armed or unarmed; examples are the following:
  - Bombs
  - Guided missiles
  - Projectiles
  - Rockets
  - Land mines and associated components
  - Pyrotechnic items
  - Military explosives and demolition materials
  - Grenades
  - Submunitions
- Operate personnel decontamination stations

UXO Technician II

In addition to being able to perform all functions of the UXO sweep personnel and UXO Technician I listed in this chapter, for this project, UXO Technician II personnel may:

- Determine precise location in field environment using a variety of techniques such as global positioning equipment or basic land navigation using topographical map and compass.
- Perform field-expedient identification procedures to identify contaminated soil.
- Perform limited technical supervision of UXO sweep personnel.
- Escort personnel who are not directly involved in UXO-related operations (e.g., personnel performing environmental monitoring), but who have activities to perform within exclusion zones.
- Inspect material potentially presenting an explosive hazard (MPPEH) for the presence of explosive safety hazards.

Corporate MR Safety & QC Officer

The Corporate MR Safety & QC Officer may:

- Develop and implement the MEC-specific sections of the QCP for all MEC-related operations.
- Identify and verify completion of all corrective actions to ensure all MEC operations comply with requirements.

UXO Team Composition and Roles

For all MEC-related operations, each UXO team will have a minimum of two UXO-qualified personnel, one of which will be the UXO Technician II. A UXO Technician II will supervise all MEC operations and all teams operating within an exclusion zone.

Health and Safety Training

Health and safety training requirements for onsite project personnel have been established in accordance with Occupational Safety and Health Act/Occupational Safety and Health Administration requirements for hazardous site workers (29 CFR 1910.120) and are specified in the HSP (Appendix B). These training requirements must be met before project personnel can begin site work.

4.4.7 Testing and Maintenance

Testing and maintenance of equipment such as geophysical instruments, radios, cell phones, vehicles and machinery will be performed per the manufacturer's specifications, this work plan, and all applicable SOPs. Geophysical detection equipment will be tested daily, as specified in the GIP.

Test results must be documented by the individual performing the test. Testing and maintenance records associated with the measuring and testing of equipment must be generated by the individual performing the activity. Documentation for testing and maintenance of equipment is to be made available to the client upon request.

The FTL is responsible for ensuring that the tests are performed and that the results are summarized and provided with the weekly QC report. To track each failing test for future retesting, the failing test must be noted on the deficiency log. Resolution of the failing test is complete when retesting is performed and the corrective action is verified on the deficiency log.

4.4.8 DGM Systems Quality Control

An extensive QC program will be applied to the DGM operations at the site. The QC requirements for geophysical investigations are provided in the Geophysical Investigation Plan included as Appendix C to this Work Plan.

Form 4-1a: Field Change Documentation

Date: _____

Page _____ **of** _____

Project:

Project No.:

Applicable Document:

Change Description:

Reason for change:

Recommended disposition:

Impact on present and completed work:

Final disposition

Request by:

CH2M HILL Field Team Leader: _____ Date:_____

Approvals:

CH2M HILL Project Manager: _____ Date:_____

Form 4-2a: Corrective Action Request Form

Originator: _____ Date: _____

Person responsible for replying: _____

Description of problem and when identified: _____

_____

Sequence of Corrective Action (CA): (Note, if no responsible person is identified, submit this form directly to the PM)

State date, person, and action planned:

_____

_____

_____

_____

_____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approval by: _____ Date: _____

Information copies to:

Responsible person:_____

Field Team Leader:_____

Project Manager: _____

FORM 4-1b

Preparatory Inspection Checklist
(Part I)

Contract No.:

Date: _____

TITLE AND NO. OF TECHNICAL SECTION: _____

_____

_____

_____

A. Planned Attendees:

	Name	Position	Company
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			

B. Submittals required to begin work:

	Item	Submittal No.	Action Code
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			

I hereby certify, that to the best of my knowledge and belief, that the above required materials delivered to the job site are the same as those submitted and approved.

_____

Contractor Quality Control Systems Manager

FORM 4-1b (Continued)

Preparatory Inspection Checklist
(Part I)

Contract No.:

Date: _____

C. Equipment to be used in executing work:

1) _____
2) _____
3) _____
4) _____
5) _____

D. Work areas examined to ascertain that all preliminary work has been completed:

_____
_____

E. Methods and procedures for performing Quality Control, including specific testing requirements:

_____
_____

The above methods and procedures have been identified from the project plans and will be performed as specified for the Definable Feature of Work.

_____
Contractor Quality Control Systems Manager

FORM 4-1b (Continued)

Preparatory Inspection Checklist
(Part II)

A. Persons in attendance: See Meeting Attendance Sheet (attached)

B. Because of mutual understanding developed during review of preparatory outline and Contract Requirements: (Contract items not specifically covered during the preparatory inspection conference are assumed to be in strict conformance with the contract requirements.)

The items noted above constitute a memorandum of mutual understanding and will be performed as planned and specified.

Corporate MR Safety & QC Officer

Technical Representative

FORM 4-2b

Initial Phase Check List

Contract No.:

Date: _____

Title and No. of Technical Section: _____

_____

_____

Description and Location of Work Inspected: _____

A. Key Personnel Present:

Name	Position	Company

B. Materials being used are in strict compliance with the contract plans and specifications: Yes ___ No ____

If not, explain: _____

_____

_____

_____

C. Procedures and/or work methods witnessed are in strict compliance with the contract specifications: Yes No ___

If not, explain: _____

_____

_____

_____

D. Workmanship is acceptable: Yes ____ No ____

State where improvement is needed: _____

_____

_____

_____

E. Workmanship is free of safety violations: Yes ____ No ____

If no, corrective action taken:

_____

_____

_____

_____

_____

CORPORATE MR SAFETY & QC OFFICER

FORM 4-3b

FOLLOW-UP CHECKLIST

Date:
Contractor:
Contract No:

Y=YES; N=NO; SEE REMARKS BLANK=NOT APPLICABLE	
WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE	

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION, AND LIST PERSONNEL PRESENT

TESTING PERFORMED & WHO PERFORMED TEST (Include number of samples and/or tests taken)

QA Representative_____ **Date** _____

Corporate MR Safety & QC Officer_____ **Date** _____

FORM 4-4b

Final Inspection Checklist
(Part I)

DATE: _____

CONTRACT NO.:_____

Project / Area of Inspection: _____

_____

_____

A. DEFINABLE FEATURES OF WORK: Status of Inspection:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

I hereby certify, that to the best of my knowledge and belief, that the work inspected is complete and all materials and equipment used and work performed were completed in accordance with plans submitted and approved.

_____

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER

B. Final Acceptance is Approved, Subject to the Correction of the Punchlist Items Below:

_____

_____

_____

_____

_____

FORM 4-4b (Continued)

Final Inspection Checklist
(Part I)

DATE:_____

CONTRACT NO.:

A. Persons in Attendance: See Meeting Attendance Sheet (attached)

B. Resolution of Punchlist Items:

The items noted above constitute a memorandum of mutual understanding and work has been performed as planned and specified.

CORPORATE MR SAFETY & QC OFFICER

TECHNICAL REPRESENTATIVE

FORM 4-4b (Continued)

Final Inspection Checklist
(Part II)

MEETING ATTENDANCE LIST

Meeting:		Date:
Name	**Organization**	**Phone Number**

FORM 4-5b

INSPECTION SCHEDULE AND TRACKING FORM

Project:	**Project Manager:**	**MR Safety & QC:**

Reference Number	Definable Feature of Work	**Preparatory**		**Initial**		**Follow-Up**		**Completion**		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

FORM 4-6b

CORRECTIVE ACTION REQUEST

(2)CAR #:	(3)PRIORITY: ☐HIGH ☐NORMAL	(4)DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

(5)PROJECT:	
(6)PROJECT MANAGER:	(7)MR Safety & QC Officer:
(8)WORK UNIT:	(9)WORK UNIT MANAGER:
(10)ISSUED TO (INDIVIDUAL & ORGANIZATION):	
(11)REQUIREMENT & REFERENCE:	
(12)PROBLEM DESCRIPTION & LOCATION: (4)CAP REQUIRED? ☐YES ☐NO (14)RESPONSE DUE:	
(15)ISSUED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:	(16)MANAGEMENT CONCURRENCE:

Forrm4-6B (continued)
CORRECTIVE ACTION REQUEST

PART B: CORRECTIVE ACTION

(17)PROPOSED CORRECTIVE ACTION/ACTION TAKEN: NOTE: SUPPORTING DOCUMENTATION MUST BE LISTED ON THE BACK OF THIS FORM AND ATTACHED.	
(18)PART B COMPLETED BY (NAME & TITLE): SIGNATURE: DATE:	(19)QC CONCURRENCE:

PART C: CORRECTIVE ACTION VERIFICATION

(20)CAR VERIFICATION AND CLOSE-OUT: (CHECK ONLY ONE & EXPLAIN STIPULATIONS, IF ANY)

- ☐APPROVED FOR CLOSURE WITHOUT STIPULATIONS
- ☐APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS

COMMENTS/STIPULATIONS:

(21)CLOSED BY (PRINTED NAME & TITLE):

SIGNATURE: DATE:

Forrm4-6B (continued)
CORRECTIVE ACTION REQUEST

CORRECTIVE ACTION REQUEST (CAR) INSTRUCTION SHEET

(1) **MR Safety & QC Officer**: Verify that the total number of pages includes all attachments.

(2) **MR Safety & QC Officer**: Fill in CAR number from CAR log.

(3) **MR Safety & QC Officer**: Fill in appropriate priority category. **High** priority indicates resolution of deficiency requires expediting corrective action plan and correction of deficient conditions noted in the CAR and extraordinary resources may be required due to the deficiency's impact on continuing operations. **Normal** priority indicates that the deficiency resolution process may be accomplished without further impacting continuing operations.

(4) **CAR Requestor**: Fill in date CAR is initiated.

(5) **CAR Requestor**: Identify project name, number, CTO, and WAD.

(6) **CAR Requestor**: Identify Project Manager

(7) **CAR Requestor**: Identify CQC System Manager.

(8) **CAR Requestor**: Identify project organization, group, or discrete work environment where deficiency was first discovered.

(9) **CAR Requestor**: Identify line manager responsible for work unit where deficiency was discovered.

(10) **MR Safety & QC Officer**: Identify responsible manager designated to resolve deficiency (this may not be work unit manager).

(11) **CAR Requestor**: Identify source of requirement violated in contract, work planning document, procedure, instruction, etc; use exact reference to page and, when applicable, paragraph.

(12) **CAR Requestor**: Identify problem as it relates to requirement previously stated. Identify location of work activities impacted by deficiency.

(4) **MR Safety & QC Officer**: Identify if Corrective Action Plan (CAP) is required. CAP is typically required where one or more of the following conditions apply: CAR priority is **High**; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent future recurrence.

(14) **MR Safety & QC Officer**: Identify date by which proposed corrective action is due to QC for concurrence.

Forrm4-6B (continued)
CORRECTIVE ACTION REQUEST

(15) **MR Safety & QC Officer**: Sign and date CAR and forward to responsible manager identified in (10) above.

(16) **Responsible Manager**: Initial to acknowledge receipt of CAR.

(17) **Responsible Manager**: Complete corrective action plan and identify date of correction. Typical corrective action response will include statement regarding how the condition occurred, what the extent of the problem is (if not readily apparent by the problem description statement in [12]), methods to be used to correct the condition, and actions to be taken to prevent the condition from recurring. If a CAP is required, refer to CAP only in this section.

(18) **Responsible Manager**: Sign and date corrective action response.

(19) **MR Safety & QC Officer**: Initial to identify concurrence with corrective action response from responsible manager.

(20) **MR Safety & QC Officer**: Check appropriate block to identify if corrective action process is complete so that CAR may be closed. Add close-out comments relevant to block checked.

(21) **MR Safety & QC Officer**: Indicate document closeout by signing and dating.

FORM 4-7b

CORRECTIVE ACTION PLAN

Attach clarifications and additional information as needed. Identify attached material in appropriate section of this form.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT:		
(2)PROJECT MANAGER:	(3) MR Safety & QC Officer:	
(4)CAR NO(S) AND DATE(S) ISSUED:		
(5)DEFICIENCY DESCRIPTION AND LOCATION:		
(6)PLANNED ACTIONS	(7)ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE
(9)PROJECT MANAGER SIGNATURE:		DATE:

PART B: TO BE COMPLETED BY MR SAFETY & QC OFFICER OR DESIGNEE

(10)CAP REVIEWED BY:	DATE:
(11)REVIEWER COMMENTS:	
(12)CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY) ☐ APPROVED WITHOUT STIPULATIONS ☐ APPROVED WITH STIPULATIONS ☐ APPROVAL DELAYED, FURTHER PLANNING REQUIRED COMMENTS:	
(4) MR SAFETY & QC OFFICER SIGNATURE:	DATE:

FORM 4-8b

DAILY QUALITY CONTROL REPORT

Contract No.: _____

Date: _____Task Order No.:_____Report No:_____

LOCATION OF WORK: _____
DESCRIPTION: _____ _____
WEATHER: (CLEAR) (FOG) (P.CLOUDY) (RAIN) (WINDY)
TEMPERATURE: MIN °F MAX °F

1. Work performed today:

_____

_____

2. Work performed today by CH2MHILL subcontractor(s):

_____

_____

3. Preparatory Phase Inspections performed today (include personnel present, specification section, drawings, plans, and submittals required for definable feature of work):

_____

_____

4. Initial phase Inspections performed today (include personnel present, workmanship standard established, material certifications/test are completed, plans and drawings are reviewed):

_____

_____

5. Follow-up Phase Inspections performed today (include locations, feature of work and level of compliance with plans and procedures):

_____

_____

_____

6. List tests performed, samples collected, and results received:

_____

_____

_____

7. Verbal instructions received (instructions given by Government representative and actions taken):

_____

_____

_____

8. Non-conformances/deficiencies reported:

_____

_____

_____

9. Site safety monitoring activities performed today:

_____

_____

10. Remarks:

_____

_____

_____

_____

CERTIFICATION: *I certify that the above report is complete and correct and that I, or my representative, have inspected all work identified on this report performed by CH2M HILL and our subcontractor(s) and have determined to the best of my knowledge and belief that noted work activities are in compliance with the plans and specifications, except as may be noted above.*

MR Safety & QC Officer (or designee) Signature: _____

Form 4-9b

Document Release and Review

Client:	Author:	Submittal Register Item No.:	Date:
Document Title:		Revision: D.O.#	WAD#

Reviewer (*print*)	Reviewer initial & date	Technical	Project Manager	CQC System Mgr.	Health & Safety	Editorial	Chemistry	Construction	Reviewer Comments Resolved (*Signature & Date)*
Same as Technical Reviewer Above		X	Topic outline with objectives for each section submitted prior to Rev. A						

Program Reviewer's Acceptance for Document Submittal	Signature	Yes	No
1) A 4025 (as applicable) prepared and submitted with document?			
2) Technical Conclusions adequately supported by text and data?			
3) Tables and Figures are in the proper format and checked and approved?			
4) The Table of Contents consistent with text information?			
5) Technical Reviewers are qualified and accepted by Technical Manager?			
6) A document Distribution List been prepared and submitted with document?			

Approval: _____
Project Manager

Approval: _____
MR Safety & QC Officer

Recommended
4025 Code _____

SECTION 5

Environmental Protection Plan

5.1 Endangered/Threatened Species within the Project Site

5.1.1 Terrestrial Species

Terrestrial Vegetation

Vegetation surveys were conducted on Piñeros and Cabeza de Perro Islands as part of a draft Environmental Assessment (E&E, 1992) to document the occurrence and distribution of rare plant species. Three plant species that are categorized as species of special concern by the Puerto Rico Natural Heritage Program were listed as occurring on Piñeros Island: *Maytenus cymosa*, *Malphigia linearis* (Stingingbush) and *Ziziphus rignonii*.

Maytenus cymosa is widely distributed on Piñeros Island within the upland forest, dry coastal forest, and in the Leucana-mixed woodland. It is especially abundant on the east-facing slope of the highest hill on Piñeros Island and in forested areas of the northwest portion of Piñeros Island.

The area to be cleared will be surveyed by a qualified biologist to determine whether any Maytenus cymosa occur in the proposed work area. Any plants found will be clearly indicated with conspicuous flagging and avoided during the clearing activities.

Ziziphus rignonii and *Malphigia linearis* were not located on either Piñeros or Cabeza de Perro Islands during the quarterly field surveys conducted as part of the Environmental Assessment. However, if these species are identified during the species survey, they will be clearly indicated with conspicuous flagging and avoided during the clearing activities.

A 4-foot wide path will be cleared along approximately 4,400 linear feet of proposed trails on Piñeros Island. Cut vegetation will be left in place or placed along the edge of the cleared area. Cut vegetation will be placed to avoid creating a barrier to water flow. Trees greater than four inches in diameter will not be removed. A qualified biologist will walk all areas proposed for vegetation clearing to identify any protected species that may be encountered during the vegetation clearing. If the identified species can be avoided with a minor adjustment to the proposed route of the path, that adjustment will be made. Otherwise, any listed plant species will be identified with flagging and left in place.

Terrestrial Wildlife

Table 5-1 lists the threatened and endangered wildlife species either found or identified as having the potential to occur on Piñeros and Cabeza de Perro Islands based on the 1992 draft EA (E&E 1992). However, discussions with the USFWS on January 9, 2006, confirmed that no federally protected terrestrial species currently occur on these islands. The West Indian Whistling Duck is protected in the Commonwealth of Puerto Rico and is known to occur on Piñeros Island.

TABLE 5-1
Rare, Threatened, and Endangered Terrestrial Animal Species Potentially Occurring on Piñeros & Cabeza de Perro Islands
Work Plan to Conduct Phase I RFI
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Species	Status	Notes
Birds		
Brown Pelican	Federal Endangered	Observed Feeding and Roosting on both islands
West Indian Whistlling Duck	Locally Protected	Observed in lagoon on Piñeros island
Roseate Tern	Federally Threatened	Observed feeding at Piñeros Island
Yellow-Shouldered Blackbird	Federally Endangered	May occur, not confirmed
Reptiles		
Puerto Rican Boa	Federally Endangered	May occur on Piñeros Island, not confirmed
Virgin Islands Tree Boa	Federally Endangered	May occur on Cabeza de Perro, not confirmed

Additionally, most bird species that occur on Piñeros and Cabeza de Perro Islands are protected under the Migratory Bird Treaty Act, even if not listed as threatened or endangered. This is true of all wading birds, shorebirds, raptors, and sea birds that occur on the islands, and many of the ducks and passerine birds.

Work near wetlands associated with lagoons will occur in proximity to habitats used or potentially used by most of the protected birds. The West Indian Whistling Duck typically uses the lagoons but would not be impacted because the wetland vegetation would screen these birds from the areas where clearing would occur and no clearing is proposed adjacent to lagoons.

The proposed vegetation clearing would have only minimal impacts on birds using the wetlands and adjacent upland areas. The clearing activity would result in temporary displacement of transient migrants, such as the roseate tern, and resident birds from these areas, but the birds would be expected to return once work was complete.

5.1.2 Marine Species

The presence of threatened or endangered marine species was evaluated during the Environmental Assessment (E&E, 1992). The Environmental Assessment reported that threatened or endangered marine species whose ranges extend around Piñeros and Cabeza de Perro Islands included the West Indian manatee (*Trichechus manatus*) and the green, hawksbill, loggerhead, and leatherback sea turtles. There were no direct observations of threatened or endangered marine wildlife species on Piñeros during the marine surveys, but a green turtle (*Chelonia mydas*) was observed approximately 0.5 mile from Piñeros Island. The Environmental Assessment reported that evidence of herbivory was found within the seagrass beds along the southern coast of Piñeros Island, but the species of herbivore that had grazed there could not be identified.

The sea turtle species identified above have the potential to utilize the marine environment near the beach area and also the shoreline during nesting. Evidence of sea turtle foraging

has been found off the northwestern coats of Piñeros Island. Sea turtle nesting may occur from March through November. Two beaches on northern side of Piñeros Island have been determined to be suitable for sea turtle nesting and work is planned for one of these beaches (in the northwestern corner of the island).

Discussions with the USFWS identified the hawksbill sea turtle (*Eretmochelys imbricata*) as the only federally protected species that could occur on Piñeros Island. This species nests in dense vegetation landward of the beach, with the peak of the nesting season from June through December.

MEC Investigations on Beaches

Any MEC investigations on beaches prior to May 31 may proceed following a daily visual inspection of the beaches for sea turtle tracks. If no turtle tracks are found on the beach, work may proceed. If sea turtle tracks are observed on the beach, no activity would occur until the nest area is identified.

Prior to implementing work on beaches after May 31, a qualified biologist will check the beach for signs of turtle nesting activity. This check will be made each day prior to beginning work. If any nesting activity is found, all nest areas will be staked and flagged as off limits. All project personnel will be instructed to avoid sea turtles or sea turtle nests that are encountered. Any sea turtle nests that are located will be marked by flagging during the duration of the project to prevent potential impacts. This flagging will be removed at the close of the project.

If no turtles are on the beach, work may proceed. If sea turtles are observed on the beach, no activity would occur until the turtle or turtles had returned to the sea.

MEC Investigations on Bunker Trail and in Land Crabbing Areas

Vegetation clearing more than 50 meters landward from the high tide line will not have the potential to impact sea turtles. Any vegetation clearing within 50 meters of the high tide line that would be implemented from June 1 through December 31 would not impact hawksbill sea turtles. Prior to implementing vegetation clearing within 50 meters of the high tide line between June 1 and December 31, a qualified biologist will survey the route for signs of turtle nesting activity. This check will be made each day prior to beginning work. If any nesting activity is found, all nest areas will be staked and flagged as off limits. Vegetation clearing and subsequent MEC investigation would be delayed until after the eggs have hatched and the young moved to the sea. All project personnel will be instructed to avoid sea turtles or sea turtle nests that are encountered. Any sea turtle nests that are located will be marked by flagging during the duration of the project to prevent potential impacts. This flagging will be removed at the close of the project.

Any nest areas along the path that could not be cleared or routed around would be located using sub-meter accuracy global positioning system receivers to allow future relocation of these sites for investigation or cleanup.

MEC Investigations in Potential Underwater Demolition Areas

The MEC investigation activities will be kept off the coral reef and would not result in damage to the reef.

Potential underwater demolition site UW-4 is not near a beach or coral reef and would not be used by hawksbill sea turtles. MEC investigations at this site may be conducted at any time.

The remaining three potential underwater demolition areas (UW-1, UW-2, and UW-3) are near beaches and have the potential for hawksbill sea turtle activity. Typically, this activity would be transient swimming and the sea turtles would be expected avoid the area where the investigation was active if geophysical equipment was in use. However, potential underwater demolition area UW-2 is adjacent to a coral reef and it is possible that the MEC investigation activity at this site would temporarily displace hawksbills from potential foraging areas.

MEC investigations of potential underwater demolition areas UW-1 and UW-3 conducted between January 1 and May 31 may proceed without implementing additional measures to protect hawksbill sea turtles.

MEC investigations of potential underwater demolition area UW-2 conducted between January 1 and May 31 may proceed after a visual survey of UW-2 and the adjacent coral reef. If Hawksbill sea turtles are foraging on the reef, MEC investigations must wait until sea turtles have left the area, and then may be conducted without additional protective measures.

MEC investigations in potential underwater demolition areas UW-1, UW-2, and UW-3 during the period June 1 through December 31 may disrupt the return of sea turtles to a nesting beach and it is possible that the disturbance could be sufficient to make a turtle abandon a beach. If circumstances make it necessary to conduct MEC investigations in these areas past between June 1 and December 31, a qualified biologist will investigate the potential underwater demolition area and the surrounding area for sea turtles prior to implementation of MEC investigation. If turtles are active in the investigation area or the immediately surrounding ocean, the MEC investigation would be delayed until this activity has passed.

No MEC investigations in UW-1, UW-2, and UW-3 will be conducted during the 48-hour period following the emergence of Hawksbill hatchlings on the associated beach.

5.2 Wetlands within the Project Site

Each of the three wetland areas on Piñeros Island is associated with one of the three lagoons on the island. None of the planned work would occur within wetlands. However, vegetation clearing, and possibly surface soil sampling, will be done in proximity to wetlands associated with two of the lagoons. No vegetation clearing will be conducted within 10 meters (33 feet) of the lagoons. Work is not expected to impact either of the wetland areas. Care will be taken to assure that cleared vegetation does not form obstructions that could result in altered water flow patterns.

5.3 Cultural and Archaeological Resources within the Project Site

A limited archaeological reconnaissance survey was conducted for selected areas of Piñeros Island during the Environmental Assessment (E&E, 1992). A complete walkover reconnaissance survey, as well as limited subsurface testing, was conducted on Cabeza de Perro. The surveys were designed to test hypotheses developed in a sensitivity assessment of Piñeros and Cabeza de Perro Islands. Although the sensitivity assessment suggested that the northeastern portion of Piñeros would be most likely to yield unrecorded prehistoric rites, none were identified there.

Three types of cultural resources were reported to have been located and identified during the survey of selected area of Piñeros Island: 1) a prehistoric flake find spot that was tentatively designated as cultural; 2) a sparse, culturally unidentifiable shell midden; and 3) the historic ruins of the extensive World War II military complex. Only one type of cultural resource was reported to have been located and identified during the survey on Cabeza de Perro Island: the remains of three military structures.

The Environmental Assessment concluded that any remains of extant cultural resources, particularly prehistoric ones, were likely obliterated as a result of large-scale excavations, grading, and filling associated with the construction of the military complex, and from military activities performed during contemporary training maneuvers. The Environmental Assessment reported that no surveyed portion of the island appeared to be undisturbed.

Based on available data, the probability that significant cultural or archaeological resources are located within the project area is low. Furthermore, none of the planned investigation activities would result in the disturbance of cultural or archeological resources. If any new cultural or archaeological materials or resources are discovered within the project area during field investigations, a qualified archaeologist will be notified to provide guidance on performing further work in the area.

5.4 Trees and Shrubs to be Removed within the Project Site

Site vegetation will be removed in 4-foot wide lanes along approximately 4,400 linear feet of DGM area. The total area of vegetation removal is approximately 0.4 acre.

In order to hide trailheads until MEC clearance is performed, vegetation will not be removed within 10 feet of the beach/vegetation line. If vegetation cutting is conducted between June 1 and December 31, a qualified biologist will survey areas to be cleared within 50 meters of the high tide line for signs of turtle nesting. Additional procedures for the protection of sea turtles are provided above.

Cut vegetation will be left in place or placed along the edge of the cleared area. Cut vegetation will be placed to avoid creating a barrier to water flow. Trees greater than 4 inches in diameter will not be removed unless absolutely necessary. A qualified biologist will walk all areas proposed for vegetation clearing to identify any species of concern that may be encountered during the vegetation clearing. If the identified species can be avoided

with a minor adjustment to the proposed route of the path, that adjustment will be made. Otherwise, any listed plant species will be identified with flagging and left in place.

5.5 Compliance with Applicable or Relevant and Appropriate Requirements (ARARS)

CH2M HILL will follow all applicable regulations concerning environmental protection, pollution control, and abatement for the proposed project work. No permits have been determined to be required for the proposed work. Table 5-2 lists the potential ARARs for environmental protection.

TABLE 5-2
Potential Applicable or Relevant and Appropriate Requirements for Environmental Protection
Work Plan to Conduct Phase I RFI
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Reference	Title
40 CFR Part 261	Identification and Listing of Hazardous Waste
40 CFR Part 266, Subpart M	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities – Military Munitions
33 USC 1251, et seq.	Clean Water Act
33 USC 403	Rivers and Harbors Act of 1899
16 USC 1531 et seq., per 50 CFR 402	Endangered Species Act
16 USC 703, et seq.	Migratory Bird Treaty Act
16 USC 470	National Historic Preservation Act of 1966
16 USC 469, et seq., and 36 CFR 65	National Archaeological and Historic Preservation Act

5.6 Detailed Procedures and Methods to Protect and/or Mitigate the Resources/Sites Identified

Prior to initiation of the proposed work, a general survey of the project areas will be conducted by a qualified biologist to identify any obvious environmental concerns. The biologist, in conjunction with the PM, will provide instructions to field personnel regarding the protection of onsite environmental resources. Such protective measures will include, but are not limited to, the following:

- Avoid disturbance of any protected plant that is found within the project area. Flag specimens within the project area for easy relocation and verification.
- Avoid wetlands identified on the islands during project implementation. Wetlands outside project area will be clearly identified on project maps and avoided.

- Avoid placing cleared vegetation in a manner that would obstruct or alter natural water flow paths.
- If any cultural or archaeological material or resource is discovered within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area.
- The PM will seek the guidance of the qualified biologist to determine appropriate mitigation measures in the event that the performed work activities impact any environmental resource.

SECTION 6

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Appendix A
Archival Search Report

Archival Records Search Report in support of the Phase I RCRA Facility Investigation

Piñeros and Cabeza de Perro Islands
Naval Activity, Puerto Rico

Contract Task Order 113
May 2006

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Herndon, Virginia

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Attachments

1 Resource Review Summary

Acronyms and Abbreviations

°F	degrees Fahrenheit
asl	above sea level
CCC	Civilian Conservation Corps
CTO	Contract Task Order
DMM	Discarded Military Munitions
EOD	Explosive Ordnance Disposal
HTW	hazardous and toxic wastes
LANTDIV	Atlantic Division
MC	munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
NARA	National Archives and Records Administration
NAVFAC	Naval Facilities Engineering Command
NMFRL	Naval Medical Field Research Laboratory
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
TNT	2,4,6-trinitrotoluene
UXO	unexploded ordnance
WWII	World War II

SECTION 1

Introduction, Purpose, and Scope

This archival records search is being conducted in support of a Phase I RCRA Facility Investigation (RFI). The archival records search report is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment, specifically with munitions of explosive concern (MEC). The scope of the report includes:

- A review of existing information about the site (including maps, drawings, and reports, and interviews with former Naval Station Roosevelt Roads personnel).
- A site and environs reconnaissance.
- Collection of additional information about the site.

A complete listing of resources identified and investigated for this report is provided in Attachment 1. The majority of information provided in this report has been collected from a Draft Environmental Assessment (EA) that was completed in 1992. Per discussions with NAPR personnel the EA was never finalized because the project was cancelled upon closure of the Naval Station Roosevelt Roads. Attachment 1 also includes details concerning the reviews of the historical information from the Marine Corp Library, National Archives and Records Administration (NARA) map and text files, and former Naval Station Roosevelt Roads base files. Attachment 2 contains photographs obtained during the research activities.

SECTION 2

Background Information

2.1 Facility Information

Piñeros and Cabeza de Perro islands are located in the Caribbean Sea approximately one-half mile east of the former Naval Station Roosevelt Roads, Puerto Rico. Piñeros Island is approximately one mile by ½ mile in size (310 acres). Cabeza de Perro Island is approximately ¼ mile in diameter (30 acres) and is located ¼ mile east of Piñeros. The U.S. Navy acquired Piñeros and Cabeza de Perro islands in the early 1940's as part of its general acquisition for the former Naval Station Roosevelt Roads. Shortly after the Navy acquired Piñeros and Cabeza de Perro Islands, the British built a network of roads, gun emplacements, and bunkers on Piñeros Island for use during World War II. These facilities were abandoned after the war. Since the late 1950's, Piñeros and Cabeza de Perro islands have been utilized by Special Warfare Group 2, Unit Four (SPECWAR), personnel for various training activities. Training exercises included beach landings combined with sea-to-land gunfire and underwater demolitions on offshore coral reefs, and small arms training. Prior to 1987, training activities took place on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro islands. In 1987, the Navy and the United States Fish and Wildlife Service (USFWS) signed an agreement which set restrictions on military training operations on Piñeros Island.

2.1.1 Site Conditions

A site survey for the identification of munitions of explosive concern (MEC) was completed in 2004 at Piñeros and Cabeza de Perro Islands. Evidence of training activities at Piñeros Island included the presence of small arms remnants over approximately one third of the island; breeching activities conducted in and around the bunkers, booby traps, 40mm practice grenade clutter, and assorted expended demolition material. Only one item was found to be dud fired and it was described as a percussion grenade. The foliage was so thick and the terrain so inhospitable that geophysical equipment could not be used for the survey. A limited underwater survey was conducted and no ordnance was observed. A surface walk was completed at Cabeza de Perro Island, which was inconclusive for MEC. Most of the island was described as tall grass which obscured a visual or geophysical survey (Ecology and Environment, June 1992).

2.1.2 Climate and Meteorology

The climate of Piñeros and Cabeza de Perro islands is tropical-marine, with minimal fluctuations in temperature, relatively moderate humidity, and frequent rain showers (Ecology and Environment, June 1992). The mean annual temperature averages 79.9 °F. Historical data show July and August to be the warmest months, at 82.4 °F, and February is the coldest month at 76.8 °F.

Rainfall generally consists of brief showers throughout the year. The average annual rainfall reported from the nearest weather station located at the Naval Station Roosevelt Roads is approximately 50 inches. The typical rainy season is reported as May through November.

Winds in the vicinity of Naval Station Roosevelt Roads are typically from the east or northeast at an average speed of approximately 6 knots. Tropical storms and hurricanes are most likely to occur in the summer and early fall.

2.1.3 Topography, Geology and Hydrology

Piñeros Island is heavily vegetated and consists of 2/3 coastal scrub forest and 1/3 mangroves. The topography is characterized by a series of smooth, round hills and low lying swampy areas. The hills range in elevation from less than 70 feet above mean sea level (msl) in the northwest to a hill of 250 feet above msl in the south-central portion of the island. The hills run generally in a southeast to northwest direction and are generally very steep. Approximately 183 acres of Piñeros Island consists of hills with slopes ranging from 15% to 25%, approximately 39 acres consists of uplands with less than a 25% slope, and the remaining 88 acres is composed of low-lying mangrove swamp or brackish lagoon. The most significant area of swamp is located on the southwestern portion of the island. The shoreline of Piñeros Island consists of narrow sandy beaches. Cabeza de Perro Island is a smoothly rounded cay with a maximum elevation of 100 feet above msl. The shoreline of the island consists of rocky beaches and sea cliffs.

Piñeros and Cabeza de Perro islands are both of volcanic origin. The geology of Piñeros and Cabeza de Perro islands consists of lava, lava breccia, tuff, and tuffaceous breccia of lower Cretaceous age (Ecology and Environment, June 1992). The volcanic rock was formed directly from molten rock that cooled quickly in a marine environment. Vesicular structure is prominent in some areas and represents rock formation near the gaseous top of a lava flow. Dense, fine-grained fragments of volcanic rock and ash that exhibit a rough, gritty texture are also present. Thin-bedded sandstone and siltstone are also present in some areas. The total thickness of these rock formations may exceed 30,000 feet. Rock on the two islands is extensively weathered. Swamp and marsh deposits overlie the igneous rocks on the southwest portion of Piñeros Island. Moderately saline swamps containing organic muck, peat, silt, and sand occur in this area (Briggs 1964). Piñeros Island is underlain by two types of soil: Descalabrado clay loam and tidal swamp soils (Boccheciamp 1977). Tidal swamp soils are found on 28% of the island in the salinas and mangrove areas on the southwest quarter of the island and around lagoons in its northeastern section. The remainder of Piñeros and all of Cabeza de Perro are underlain by Descalabrado clay loam. These soil types are described below.

Tidal swamp soils are inundated with brackish to saline water for most of the year and typically, as is the case on Piñeros, support a thick growth of mangrove trees. They are either sandy or clayey, light colored, saline, nearly level, and contain organic material from decaying mangroves. The tidal swamp soils on Piñeros are more clayey than sandy. Tidal swamp soils are underlain by coral, shell, and marl at varying depths and serve as a feeding and breeding place for birds, oysters , and crabs (Ecology and Environment, Inc. 1992).

Tidal swamp soils have no value for farming and possess very severe limitations for non-farm uses. Because they are poorly drained and subject to frequent flooding, these soils are

very poorly suited for roads, paths, and trails. They are also poor sources of road fill and topsoil (Ecology and Environment, Inc. 1992).

The Descalabrado clay loam soil type consists of fine-textured, shallow, eroded soils underlain and derived from volcanic rock. This soil is found on hillsides and ridgetops with slopes of 20% to 40% in semiarid volcanic uplands. The surface layer is clay loam about six inches thick. Subsurface layers are friable clay loam interspersed with small volcanic rock fragments. The underlying material is olive-brown loam saprolite that extends to a depth of about 19 inches, where weathered volcanic rock is found (Ecology and Environment, Inc. 1992).

2.2 Ownership and Operational History

2.2.1 Ownership History

The U.S. Navy acquired Piñeros and Cabeza de Perro islands in the early 1940's as part of the general acquisition for the former Naval Station Roosevelt Roads.

2.2.2 Operational History

Prior to 1987, training activities took place on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro islands. Approximately 300 men, in groups of 50, were trained each year. Underwater demolitions teams utilized two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater and land explosives. Training in setting up explosives without detonation also occurred at the south shore beach, which had an emplacement of 12 to 15 obstacles in the water just off the beach.

Trails used for small-arms training lead from the afore-mentioned beaches toward the center of the island. Units also utilized the large mangrove swamp on the southwest corner of the island to train for overland maneuvers and the location of objectives by compass at night.

In 1987, the Navy and USFWS signed an agreement which set restrictions on military training operations on Piñeros Island until Endangered Species Act Section 7 consultation was completed for the use of Piñeros and Cabeza de Perro islands. Restrictions included off-limits areas in mangrove swamps, the concentration of small-arms firing along an upland area running generally northwest-to-southeast, and the limitation of underwater demolitions to one beach on each of the northern and southern shores. Training on Piñeros and Cabeza de Perro islands consisted of groups of 20 men for two-week sessions six times per year. The first week consisted of instruction-based sessions at the main camp on the northern shore. The second week consisted of practical missions where small arms, beach approaches, and overland maneuvers were practiced.

Piñeros and Cabeza de Perro islands were the primary training areas for SPECWAR. The commanding officer of NAVSTA Roosevelt Roads assigned SPECWAR operational control and exclusive use of Piñeros and Cabeza de Perro islands. SPECWAR training activities on Piñeros and Cabeza de Perro islands emphasized small-unit tactics in a tropical maritime environment. The training, which was unique to Piñeros and Cabeza de Perro islands, was a combination of maritime drop-off and pick-up capabilities and small unit live fire and maneuver drills. Other training activities included survival techniques, land navigation,

underwater and small unit demolition, small boat operation, diving, small arms training (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .5 cal) , pyrotechnics (smoke grenades, pop flares, grenade simulators, etc.), and standard military demolitions (claymore mines, plastic explosives, etc.).

Following the 1987 agreement between the Navy and USFWS, an environmental assessment (EA) was prepared in accordance with the Council on Environmental Quality (CBO) Regulations pursuant to the National Environmental Policy Act (NEPA) and the Navy's Environmental and Natural Resources Protection Manual. The EA evaluated the potential environmental impacts of maximizing the operational training opportunities on Piñeros and Cabeza de Perro islands, as well as the environmental impacts of alternatives to this proposed action. Quarterly field surveys were conducted during 1989 to obtain additional information with which to assess the potential impacts of training activities on endangered species. A Draft Environmental Assessment Report was issued in June 1992 (E&E 1992).

The former Naval Station Roosevelt Roads ceased operations in March 2004, and Naval Activity Puerto Rico (NAPR) was created to provide oversight during the final disposal of the property. Current NAPR operations are those necessary to maintain the property and provide utilities to personnel and agencies still present at NAPR. Because Piñeros and Cabeza de Perro islands were part of the former Naval Station Roosevelt Roads, military operations on those islands ceased with the closing of NAVSTA Roosevelt Roads, and the islands are now the responsibility of NAPR.

The Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV) conducted a UXO surface survey of Piñeros and Cabeza de Perro islands in late 2004 (NAVEODTECHDIV 2004). The site survey found evidence of training activities being conducted on Piñeros Island. Evidence included small arms remnants over about one third of the island, breeching activities conducted in and around the bunkers, booby traps, 40mm practice grenade clutter, and assorted expended demolition material. One item dud-fired percussion grenade was also found.

Geophysical equipment was transported to Piñeros Island for the NAVEODTECHDIV survey but was never used. The foliage was so thick and terrain so inhospitable that too much time would have been spent clearing an area to survey. It was decided that time would be better spent by covering a wider area with visual inspection.

A limited offshore underwater survey was performed with mask and snorkel. No sign of any ordnance was observed. A surface walk was conducted on Cabeza de Perro Island, which was inconclusive for UXO. Most of the island was covered with tall grass, which obscured a visual and geophysical survey of the island without burn-off of the vegetation. NAVEODTECHDIV concluded that a thorough survey of Piñeros and Cabeza de Perro islands would require land-clearing techniques that may not be appropriate for the ecological well being of the islands.

2.3 Current Operational Information

As stated above, the former Naval Station Roosevelt Roads ceased operations in March 2004, and NAPR was created to provide oversight during the final disposal of the property. Because Piñeros and Cabeza de Perro islands were part of the former Naval Station

Roosevelt Roads, military operations on those islands ceased with the closing of NAVSTA Roosevelt Roads, and the islands are now the responsibility of NAPR.

NAVFAC issued a task order to CH2M HILL in 2005 for the performance of a Phase I RFI to evaluate the potential presence of muntions and explosives of concern (MEC) and munitions constituents (MC) at Piñeros and Cabeza de Perro islands. Under this task order, a site visit was conducted in November 2005 with representatives of NAVFAC, Naval Activity Puerto Rico (NAPR), USFWS, Puerto Rico Department of Natural and Environmental Resources (DNER), and Puerto Rico Environmental Quality Board (EQB). This site visit included a visual reconnaissance of the trail leading from the south beach of Piñeros Island to the bunker in the center of the island, a visual reconnaissance of a portion of the trail from the north beach of Piñeros Island, and an offshore observation of the coastlines of both Piñeros and Cabeza de Perro Islands.

At the time of the 2005 site visit, the trails on Piñeros Island were heavily overgrown and difficult to traverse. Evidence of past military activities was consistent with that reported during the NAVEODTECHDIV survey.

SECTION 3

Findings

Based on the research activities, prior to 1987, military training exercises were conducted on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro islands. After 1987, military training exercises were conducted on a more limited schedule and localized areas. Based on a phone interview with Pedro Ruiz, the exact date that military exercises ceased is not known, however, for practical purposes the assumed date for ceasing military exercises has been March 21, 2004. Evidence of MEC on the ground surface was found during the 2004 EOD investigation and during the 2005 site visit.

SECTION 4

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Ecology and Environment, Inc., *Environmental Assessment of Training Activities on Piñeros and Cabeza de Perro Islands, U.S. Naval Station Roosevelt Roads,* June 1992.

Global Security Website, November 9, 2005.
http://www.globalsecurity.org/military/facility/roosevelt-roads.htm

Attachment 1
Resource Review Summary

ATTACHMENT 1

A. Resource Review Summary

The following table provides a summary of the specific references identified for review, interview, or contact for the archival report.

Resource	Actions Completed
Washington Navy Yard, Marine Corp Library Historical Aerial Photos	Reviewed all available file folders related to Piñeros and Cabeza de Perro Islands.
US National Archives (WDC) Historical Files	Reviewed text and drawing files from Text Division and Cartographic Division.
Naval Station Roosevelt Roads Personnel	
Pedro Ruiz, Naval Activities Puerto Rico	Contacted and interviewed.
Jose Montalvo, Naval Activities Puerto Rico	Contacted and interviewed. Files gathered are included in section A.3.
Other Contacts	
Lt. Jeff Klinker/ (EOD at Mayport Naval Station) /historical consultant	Contacted and interviewed.
Chief Petty Officer Mike Solis (EOD Detachment Mayport)	No return calls.
Chief Petty Officer James Marlow (EOD Detachment Mayport)	Contacted and interviewed.
Dewey Thedford/ Pika International, former EOD at Naval Station Roosevelt Roads	Contacted and interviewed.
Mr. Harry Coleman/ Pika International	Contacted and interviewed.
Tom Freeman/USACE	No return calls.
Mr. Thomas M. Ligon/former member of UDT-21 and SEAL Team TWO out of Little Creek, VA	Contacted and interviewed.
Mr. Henry (Bud) S. Thrift, Jr./former member of UDT-21	Contacted and interviewed.

Site Visit, November 10, 2005.

Mr. Tom Roth, CH2M HILL, participated in a site vist to ascertain the current condition of Piñeros and Cabeza de Perro Islands.

Lietenant Jeff Klinker, EOD Detachment Mayport (904) 270-5412

Lt. Klinker was contacted on November 21, 2005, for general information about the two facilities. Lt. Klinker has never been to either of the two islands but did provide contact names for two EOD technicians in Mayport that have visited the islands (Chief Petty Officer Mike Solis and Chief Petty Officer James Marlow).

Chief Petty Officer James Marlow, EOD Detachment Mayport (904) 270-5412

Chief Petty Officer James Marlow was contacted on November 22, 2005. Chief Marlow explained that he has only visited Piñeros Island once in January 2005 in order to provide clearance for a site visit. He escorted a team of individuals to Piñeros but they did not access Cabeza de Perro. On Piñeros he recalled observation of flairs (spent and unspent), smoke grenades, and M16 blanks. He also observed numerous crab traps along the beaches of Piñeros and indicated that locals often go to the beaches to trap crabs.

Mr. Pedro Ruiz, Naval Activity Puerto Rico (NAPR), (787) 865-4429 ext. 459

Mr. Ruiz was contacted on November 15, 2005. Mr. Ruiz provided the contact name of Jose Montalvo as the contact for any inquiries regarding Piñeros Island and Cabeza de Perro Island.

Mr. Jose Montalvo, Naval Activity Puerto Rico (NAPR), (787) 865-4152 ext. 469

Mr. Jose Montalvo was contacted on November 21, 2005. Mr. Montalvo e-mailed the files that he had with respect to historical operations at Piñeros and Cabeza de Perro Islands.

Mr. Thomas M. Ligon

Mr. Ligon was interviewed in April 2006. Mr. Ligon's comments are summarized as follows:

As a member of UDT-21 and SEAL Team TWO out of Little Creek, VA, Mr. Ligon participated in approximately four or more separate periods of training, each approximately 6 to 8 weeks in length, at Piñeros Island. Transport to the island was on a daily basis, while being bivouacked at Naval Station Roosevelt Roads. Hourly training schedules varied widely from day to day. His first training period attended was in October 1963 as a BUDs (Basic Underwater Demolition) trainee with a rate as BMSN (Boatswain's Mate Seaman) and training team member. The subsequent training periods occurred between this session and his final trip, which occurred in October, 1968 (as a BM1-Boatswains Mate First Class, with a team assignment as squad leader). All training sessions involved many exercises requiring large demolition shots, some as large as 800-1000 pounds net explosive weight (NEW). These were mainly C-4 charges used to demolish man-made concrete barriers and buildings. He recalls during one session the firing of 40mm HE (high explosive) projectiles, with the possibility of 3 or more duds during one event. Probable location of impromptu range is indicated on the map as one of the east side beaches.

Mr. Henry (Bud) S. Thrift, Jr.

Mr. Thrift was interviewed in April 2006. Mr. Ligon's comments are summarized as follows:

As a member of UDT-21, Mr. Thrift also attended the same type of training sessions as reported by Mr. Ligon (see above) and at approximately the same time frames, first as a BUDs graduate in 1963, and later as a squad leader in 1968. He participated in this training later in 1971, acting as ordnance officer with the rank of Warrant Officer TWO. In addition

to the usual heavy demolition/breaching charges, illumination flares were used during this session in support of squad infiltration exercises. Both individuals recall that Special Forces of the Republic of Vietnam (LDNN) were also given similar training during the period of the late 1960's, early 1970's. Transport of the explosives occurred on a daily basis, using a variety of 36-foot hull craft. Policing of explosives (with the exception of the above 40mm's) was thorough, with all remaining charges either detonated or returned to magazines maintained at Naval Station Roosevelt Roads.

An additional source that Mr. Thrift indicated for future interview is retired Master Chief Tom Keith. Both interviewees contributed to a rough outline map, indicating areas of activity inasmuch as memory could recall. Both also strongly recommended Mr. Keith as an exceptional source for a further MEC historical data and to provide a personally guided tour, if such could be arranged.

A.1 National Archives and Records Administration Review

Text Division

Contact: Mr. Barry Zirby, 301-713-7250 x285
Site visit on November 10, 2005

No information was obtained from the Text Division

Cartographic Division

The cartographic division did not contain any relevant information pertaining to historical ordnance use on Piñeros Island or Cabeza de Perros. Information for Roosevelt Roads is located under Record Group (RG) 71-Bureau of Yards and Docks. The index for locating cartographic materials is then grouped by subject codes. The only available drawing for Roosevelt Roads was for Subject Area 10- Seawalls. Subject Area 44 is Rifle ranges, machine gun ranges, sighting ranges, bombing targets; however, no materials were located under this Subject Area. Only one microfilm roll was identified for Roosevelt Roads (RG 71, Reel 75, Series I). The reel was primarily dedicated to Guantanomo Bay Cuba, and Vieques, PR. The only information related to the subject islands are a few maps that show Piñeros Island as a neighboring island to Ensenada Honda. There was no information related to ordnance use.

List of Documents Obtained from National Archives

None available for Piñeros or Cabeza de Perro Islands.

A.2 Washington Navy Yard Library (WNY) and Historical Center

CH2M HILL reviewed following documents from the WNY Library:

- On-line Catalogue under Roosevelt Roads, Piñeros Islands, and Cabeza de Perros Islands; no information was available.

- US Government Printing Office, *Federal Owned Real Estate Under Control of Navy Department*, Washington, DC, 1937.
- US Government Printing Office, *Building the Navy's Bases in WWII: History of the Bureau of Yards and Docks and the Civil Engineering Corp, 1940-1946*, Vol. 1 and II, 1947.
- El Navegante, "*Naval Station Bids Farewell to An Old Friend*", by Capt. Robert D. Wilson, Jr. Naval Station Roosevelt Roads, Commanding Officer, Nov. 21, 2003, Vol. 27, No. 21.
- Paolo E. Coletta, Editor, *US Navy and Marine Corp Bases Overseas*, Greenwood Press, Westport, CT, 1985.

CH2M HILL reviewed following documents from the WNY Historical Center, Operational Archives Branch:

- US Naval Station Roosevelt Roads, Command History File 1943-1973 (except 1967 and 1972); topics covered mission, chronology of significant events, background, general operations, and special operations.
- Department of the Navy, Index to Administrative Histories: The Navy in WWII and Miscellaneous Materials, July 3, 1953.
- Department of the Navy, Administrative Histories: The Navy in WWII, Appendices, July 3, 1953.
- Department of the Navy, Records of the Field Liason and Records Section Checklist, Base Maintenance Division, 1930-1965.
- Department of the Navy, Post 1974 Command File Shore Establishment, Roosevelt Roads, Naval Legal Service, Office Detachment.

List of Documents Obtained from NAVFAC

Environmental Assessment of Training Activities on Piñeros and Cabeza de Perro Islands, prepared by Ecology and Environment, Inc., June 1992

CH2M HILL has reviewed the EA for the islands.

UXO Site Analysis Roosevelt Roads, Puerto Rico, Piñeros & Cabeza de Perro Islands, December 2004

Naval Explosive Ordnance disposal Technology Division, Indian Head, MD

A.3 Files from Naval Activity Puerto Rico

Draft Attorney Work Product, Piñeros, LCDR Lindy Young, June 22, 2000

Correspondence Letter from Navy to US Fish and Wildlife Service (USFS), Subject: biological/environmental assessment at Piñeros and Cabeza de Perro Islands, July 25, 1990

Correspondence Letter from Navy to USFS regarding training activities on Piñeros and Cabeza de Perro Islands, November 18, 1992

Correspondence Memorandum from Naval Station Roosevelt Roads to LANTDIV, subject: Environmental Assessment of impact of training activities on Pinero and Cabeza de Perro Islands, May 16, 1991

Department of Navy memorandum, Environmental Assessment – Piñeros and Cabeza de Perro Islands, October 22, 1992

Meeting minutes, Environmental Assessment, Piñeros Island and Cabeza de Perro Island, May 3, 1989

Correspondence Letter from Navy to USFS, Environmental Assessment, December 13, 1990

Navy Comment Letter on the Environmental Assessment of the Impact of Training Activities on Piñeros and Cabeza de Perro Islands, date is illegible

Potential Operational Criteria, NSWU-4 Training Ops, May 4, 1989

Correspondence from Navy NSWU-4 to Navy Atlantic Division, response to information request regarding the Environmental Assessment of Piñeros and Cabeza de Perro Islands, May 10, 1989

Correspondence from United States Department of Commerce National Oceanic and Atmospheric Administration to Public Works Department U.S. Naval Station FPO Miami, Review of Environmental Assessment, January 2, 1991

Correspondence from USFS to Public Works Department U.S. Naval Station FPO Miami, Review of Environmental Assessment, January 8, 1991

Correspondence from Navy FPO Miami to Navy Atlantic Division, comments on the Environmental Assessment Report for Piñeros and Cabeza de Perro Islands, May 16, 1991

Correspondence from Navy FPO Miami to Navy Atlantic Division, comments on the Environmental Assessment for Piñeros and Cabeza de Perro Islands, March 7, 1991

Correspondence from Director, Environmental Engineering Division, Public Works Department to USFS, confirmation of verbal agreement to continue limited military training, August 19, 1987

Conversation Record, Susan Silander, USFS and Winston Martinez, December 21, 1992

Conversation Record, Ronald Dudley, LANTDIV and Carmen V, January 7, 1991

Conversation Record, Ronald Dudley, LANTDIV and Carmen V, December 4, 1990

Conversation Record, Susan Silander, USFS and Carmen V, December 4, 1990

Correspondence from Ecology and Environment to USFS, modified field survey program for Environmental Assessment activities, February 22, 1988

Correspondence from Navy to Ecology and Environment, Contract scope discussion, April 21, 1989

Correspondence from Navy NSWU-4 to Navy Atlantic Division, Information request in support of the Environmental Assessment of Piñeros and Cabeza de Perro Islands, February 8, 1989

Correspondence from Mangrove Systems, Environmental Consultants, to Roosevelt Roads Naval Station, acknowledgement of NSWU-4 cooperation during subcontractor effort, February 9, 1989

A.4 Aerial Photographs

Aerial photographs were reviewed for the following years; 1958, 1961, 1964, 1976, 1985, 1995, 1998.

A.4 On-line Searches

http://www.globalsecurity.org/military/facility/roosevelt-roads.htm

Appendix B
Health and Safety Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 332320

CLIENT: Navy

PROJECT/SITE NAME: CLEAN III CTO-113 / Piñeros and Cabeza de Perro Islands, Puerto Rico

SITE ADDRESS: Naval Activity Puerto Rico

CH2M HILL PROJECT MANAGER: Tom Roth/ATL (INC)

CH2M HILL OFFICE: Atlanta

DATE HEALTH AND SAFETY PLAN PREPARED: 12/29/2005; Revised 04/06/2006

DATE(S) OF SITE WORK: May 2006 through June 2006

SITE ACCESS: Refer to attached Figure B-1. Access to all sites is physically unrestricted. Signs are posted along some shoreline access points on Piñeros Island warning visitors that the site is off-limits to non-military personnel. Access to Cabeza de Perro is difficult do to physical conditions of the shoreline.

SITE SIZE: Piñeros Island is approximately 310 acres in area and Cabeza de Perro Island is approximately 30 acres in size.

SITE TOPOGRAPHY: The topography of Piñeros Island is characterized by a series of smooth, round hills and low-lying swampy areas. The hills range in elevation from less than 70 feet in the northwest to a hill of 250 feet above mean sea level (MSL) in the south-central portion of the island. Approximately two-thirds of the island is covered in dense jungle vegetation that makes inland access difficult without the use of machetes. Narrow beaches line parts of the island. The remainder of the island consists of lagoons and mangrove swamps.

Cabeza de Perro Island is a smoothly rounded cay with a maximum elevation of 100 feet above MSL. The shoreline of Cabeza de Perro consists of rocky beaches and sea cliffs. Most of this island is covered in tall grasses.

PREVAILING WEATHER: The climate of Piñeros and Cabeza de Perro islands is tropical marine, with minimal fluctuations in temperature, relatively moderate humidity, and frequent rain showers. The islands are directly in the path of the easterly trade winds, which moderate temperature extremes.

The mean annual temperature at the former Roosevelt Roads Naval Station, located approximately 0.5 mile west of Piñeros Island, averages 79.9 degrees Fahrenheit (°F) based on data compiled from 1957 through 1982. Similar historical data show July and August as the warmest month, at 82.4°F, and February as the coldest month, at 76.8°F. The relative humidity averages 65 to 78%.

Rainfall on the island generally consists of brief showers throughout the year. The average annual rainfall on Piñeros Island is approximately 50 inches. The rainy season in this region is typically defined as May through November.

Winds in the vicinity of the former Roosevelt Roads Naval Station are typically from the east or northeast at an average speed of approximately 6 knots. Tropical storms and hurricanes are most likely to occur during the summer and early fall.

SITE DESCRIPTION AND HISTORY: Piñeros and Cabeza de Perro Islands are located in the Caribbean Sea, approximately one-half mile east of the former Roosevelt Roads Naval Station on the eastern coast of Puerto Rico, as shown on Figure B-1.

The Navy acquired Piñeros and Cabeza de Perro islands in the early 1940s as part of its general acquisition of land for the former Roosevelt Roads Naval Station. Shortly after the Navy acquired Piñeros and Cabeza de Perro islands, the British built a network of roads, gun emplacements, and bunkers on Piñeros Island for use during World War II. These facilities were abandoned after the war. Beginning in the late 1950s, Piñeros and Cabeza de Perro islands were utilized by special forces personnel for various training activities. Exercises included beach landings combined with sea-to-land gunfire and underwater demolition on offshore coral reefs, and small-arms training.

Training activities have taken place on all parts of Piñeros Island and in offshore waters around Piñeros and Cabeza de Perro islands. Prior to 1987, approximately 300 men, in groups of 50, were trained each year. Underwater demolitions teams utilized two beaches on the northern coast of Piñeros to practice detonating up to 500 pounds of underwater and land explosives. Training in setting up explosives without detonation also occurred at the south shore beach, which had an emplacement of 12 to 15 obstacles in the water jut off the beach. Trails used for small-arms training led from the aforementioned beaches toward the center of the island. Units also utilized the large mangrove swamp on the southwest corner of the island to train for overland maneuvers and the location of objectives by compass at night.

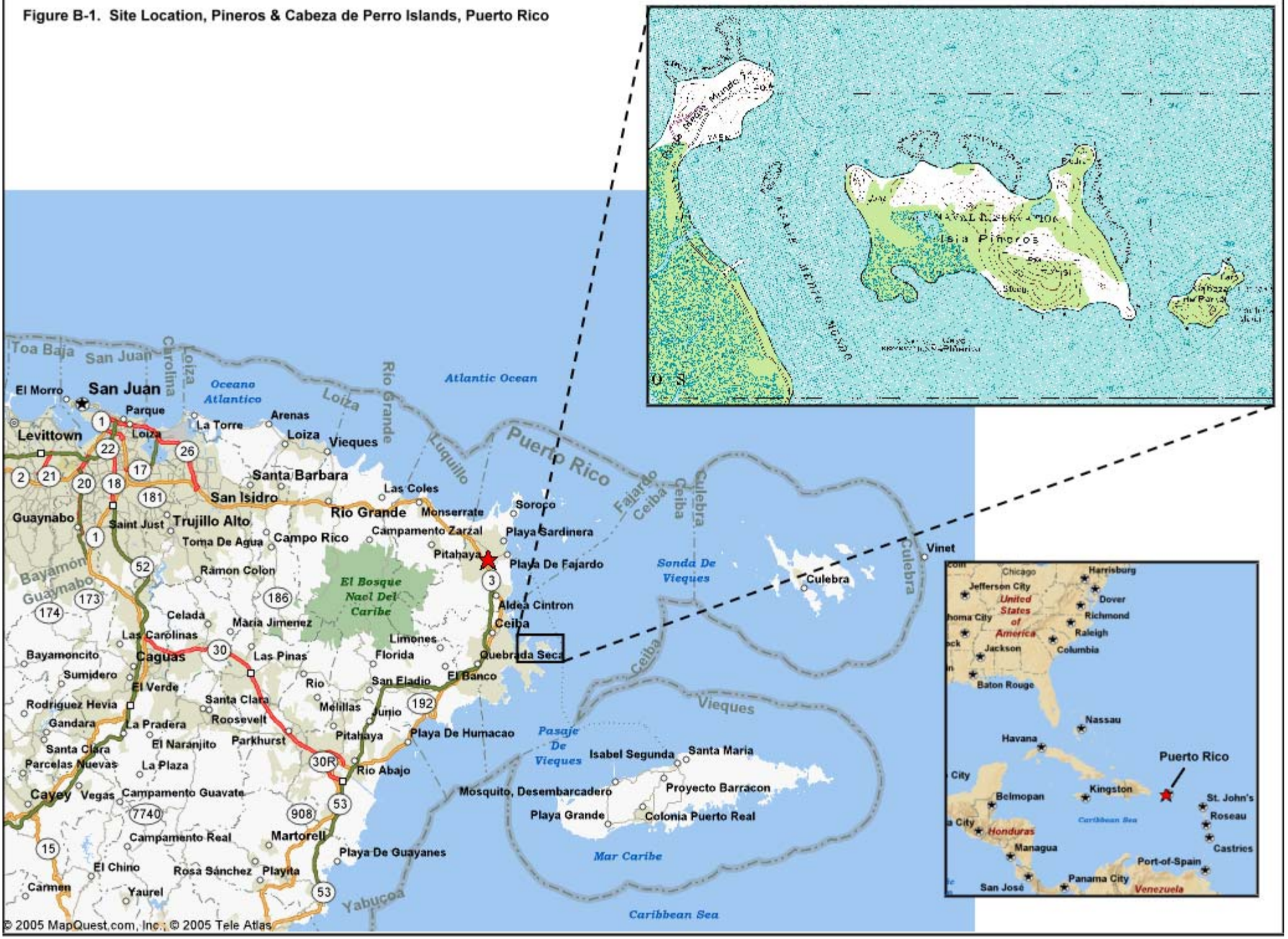
Other training activities at Piñeros and Cabeza de Perro islands have included survival techniques, land navigation, underwater and small-unit demolition, small boat operation, diving, small-arms training (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .50 cal) , pyrotechnics (smoke grenades, pop flares, grenade simulators, etc.) , and standard military demolitions (claymore mines, plastic explosives, etc.).

The former Naval Station Roosevelt Roads ceased operations in March 2004, and Naval Activity Puerto Rico (NAPR) was created to provide oversight during the final disposal of the property. Current NAPR operations are those necessary to maintain the property and provide utilities to personnel and agencies still present at NAPR. Because Piñeros and Cabeza de Perro islands were part of the former Naval Station Roosevelt Roads, military operations on those islands ceased with the closing of NAVSTA Roosevelt Roads, and the islands are now the responsibility of NAPR.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

- Vegetation clearing in three-foot wide paths along a distance of approximately 4,400 feet throughout Piñeros Island;
- Visual reconnaissance and digital geophysical mapping (DGM) along the approximately 4,400 feet of cleared pathways and along approximately 37,000 square feet of beaches;
- Underwater DGM of four offshore demolition areas totaling approximately 16 acres in size; and
- Collection of surface soil samples for explosives analysis from 20 locations where MEC or munitions debris if found.

Figure B-1. Site Location, Pineros & Cabeza de Perro Islands, Puerto Rico



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1 Tasks to be performed under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1.1 HAZWOPER-Regulated Tasks

- Vegetation Removal
- Soil sampling

1.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-HAZWOPER-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS							
	Vegetation Removal	**Surface Soil Sampling**						
Flying debris/objects	X	X						
Noise > 85dBA	X							
Electrical								
Suspended loads								
Buried utilities, drums, tanks		X						
Slip, trip, fall	X	X						
Back injury	X	X						
Confined space entry								
Trenches / excavations								
Visible lightning	X	X						
Vehicle traffic								
Elevated work areas/falls								
Fires								
Poisonous plants and insects	X	X						
Entanglement	X							
Drilling								
Heavy equipment								
Working near water	X	X						
Working from boat								

1.3 Activity Hazard Analysis for Munitions and Explosives of Concern

Principal Steps	Potential Hazards	Recommended Controls
Surveying and establishing boundaries.	Accidental detonation of MEC	Personnel involved will attend site-specific health and safety training and daily safety briefings that will include procedures for MEC avoidance. UXO personnel will escort non-UXO personnel in areas that have not been marked as free of surface MPPEH. Mark and avoid MPPEH. Check location with magnetometer prior to driving stakes.
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools.	Refer to the Activity Hazard Analysis section of this SSHP.
Clearing and grubbing	Accidental detonation of explosives	Personnel involved will attend site-specific health and safety training and daily safety briefings that will include procedures for MEC avoidance. Be alert and mark all MPPEH located. Only clear and grub to within 4 inches of the ground surface. UXO personnel will escort non-UXO personnel in areas that have not been marked as free of surface MPPEH. Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential MEC.
Fire extinguishers First aid kits Manual hand tools Geophysical instrumentation Global Positioning System instrumentation PPE Communications equipment	Daily preventive maintenance and operational checks. First aid kits. Calibration of geophysical instrumentation.	40-hour qualification per 29 CFR 1910.120 8-hour refresher OE/MEC personnel EOD trained Tailgate safety meetings Site-specific orientation Lead awareness training

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

2.1 Project-Specific Hazards

2.1.1 Heat Stress

(Reference CH2M HILL SOP HS-211 *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

2.1.2 Vegetation Clearing Safety

- Maintain a safe distance from tree and brush clearing operations.
- Before trimming a tree, inspect the area to identify possible hazards (e.g., presence of power lines, broken or cracked limbs after a severe storm) and take appropriate actions to prevent injuries or accidents. Assume any power lines are energized or "live".
- Mark off area around tree and prevent bystander access. Always work with another person who stays on the ground.
- Learn to recognize trees weakened by disease and types of trees prone to cracking. Inspect tree limbs for strength before climbing.
- Check for cavities in the tree, rotten or dead branches, splits and cracks in the trunk or where branches are attached, broken branches hanging in the tree, etc.

- Inspect the fall protection equipment and lines before each time they are used.
- Tag and remove any damaged or defective equipment from service until it can be repaired or replaced and disposed of properly, according the manufacturer's recommendations..
- If a ladder is used, tie it off on a secure branch.
- Use approved and appropriate fall protection gear when working above ground including when working from a ladder or platform.
- Break small dead branches off by hand as you climb.
- Remove larger branches with proper tools.
- Place hands and feet on separate limbs and move only one hand or foot at a time.
- Raise or lower tools by attaching hand lines to the end of tools. Tools attached at the center might catch on branches. Smaller tools may be raised and lowered in a bucket attached to a hand line.
- Use non-conductive tools and personal protective equipment if working near electrical power lines.
- Do not use dead branches for support.
- Do not climb trees during wet or icy weather or under high wind conditions.
- Do not leave partially sawn limbs on trees.
- Do not carry saws, pruners and other tools while climbing.
- Do not use axes or hatchets. Contact the power utility company before working on trees near power lines to arrange for ways to protect the employees (e.g., cutting off the power to the lines and grounding them or using insulating blankets on the power lines).
- Maintain a minimum working distance of 20 feet from "live" power lines for the voltage they are conducting.
- Use proper ropes with appropriate carriers and hooks for raising and lowering equipment.
- Use a pull rope to prevent branches from falling toward power lines.
- Use non-conducting tools and equipment.
- Wear rubber gloves when using a pole pruner.
- Ensure that the pole pruner's cutting head is connected to the lever at the lower end of the pole with a polypropylene rope. Do not use a wire or chain.
- Apply and maintain a coating of non-conductive, wood preservative to help keep wooden pruner handles dry.
- Use approved safety belts, lifelines, and leather gauntlet gloves.
- Wear head and eye protection and footwear protection with slip-resistant soles.
- Choose close-fitting, long-sleeved clothing.

2.1.3 Working Near Water

When working near water, and there is a risk of drowning or falling in:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jacket, provided for each employee will be worn.
- PFDs will be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment will be used according to the manufacturer’s instructions.
- A minimum of one life-saving skiff will be provided for emergency rescue.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue.

2.1.4 Working on Water

- Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling.
- The boat/barge must be equipped with adequate railing.
- Employees should be instructed on safe use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- The engine should be shut off before refueling; do not smoke while refueling.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Provide employees with required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods)*

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-208 *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-206 *Electrical*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.
  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Stairways and Ladders

(Reference CH2M HILL SOP HS-214, *Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day’s use. Defective ladders must be tagged and removed from service.

- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials
- Straight and extension ladders must be tied off to prevent displacement
- Ladders that may be displaced by work activities or traffic must be secured or barricaded
- Portable ladders must extend at least 3 feet above landing surface
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder
- Stepladders are to be used in the fully opened and locked position
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

2.2.8 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying	Use mild drying lotions and powders,	Remove to cooler area. Rest lying	Remove to cooler area. Rest lying down, with head in low	Cool rapidly by soaking in cool–

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	down. Increase fluid intake. Recovery usually is prompt and complete.	and keep skin clean for drying skin and preventing infection.	down. Increase fluid intake.	position. Administer fluids by mouth. Seek medical attention.	but not cold–water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.2.9 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

The project site is in a tropical location; therefore, cold stress requirements do not apply.

2.2.10 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.11 Procedures for Locating Buried Utilities

The project site is located on an uninhabited island with no utilities; therefore, buried utility requirements do not apply.

2.2.12 Confined Space Entry

(Reference CH2M HILL SOP HS-203, *Confined Space Entry*)

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.
When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

2.2.13 Working Near Water

When working near water, and there is a risk of drowning, the following precautions should be taken:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jackets, provided for each employee shall be worn.
- PFDs shall be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment shall be used according to the manufacturer's instructions.
- A minimum of one life-saving skiff shall be provided for emergency rescue.
- A minimum of one ring buoy with 90 ft of 3/8-inch solid-braid polypropylene (or equal) rope shall be provided for emergency rescue.

2.3 Biological Hazards and Controls

2.3.1 Snakes

No poisonous snakes are indigenous to Puerto Rico.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac are not present in tropical locations, including Piñeros and Cabeza de Perro Islands.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. Keep bees away by wearing light-colored clothing; avoiding scented soaps and perfumes; and containerizing all food, drinks, and garbage containers.

If stung, and a stinger is present, it should be removed by scraping the stinger away in a side-to-side motion with a fingernail, stiff paper, or credit card.. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops. Ice or a cold compress and pain-relieving creams or oral medications may used if needed.

2.3.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.3.6 Mosquito Bites

West Nile Virus activity has been detected in Puerto Rico; therefore, it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3-15 days.

If you have any questions or to report any suspicious symptoms, contact the project Health and Safety Manager.

2.3.7 Fire Ant Bites

Fire ants are present in Puerto Rico, although their presence on Piñeros and Cabeza de Perro Islands is unknown. These insects typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

2.3.8 Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the site. If additional concerns are identified, they will be added to this Site Safety Health Plan.

Hazardous Flora. Incidence of contact by individuals to poisonous and thorny plants is high; therefore, bare skin should be covered (i.e., long pants and shirt, steel-toed boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area in the direct path of known poisonous flora; a secondary route should be selected. Care should also be taken when walking in such areas because uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete and gas-powered weed cutter. Therefore, care should be taken when using such devices. (Note: Hearing protection, steel-toed boots, gloves, and safety glasses are required when using weed cutters.) All rashes and other injuries will be reported to the UXOSO as soon as they are known.

Five plants potentially present on Piñeros Island that are known to be irritating/allergins are Christmas-bush (*Comocladia dodonaea*), White maran (*Croton discolor*), Cowitch (*Stizolobium pruriens*), Manchineel (*Hippomae mancinella*), and Castor bean (*Ricinus communis*):

- Christmas-bush - *Comocladia dodonaea* - is a fairly small shrub that has waxy looking leaves that have a small spine at the end of each of them. The leaves can vary in color from green to yellow to red. The sap and residue on the leaves contain a chemical similar to those found in poison ivy but in a higher concentration.
- White maran - *Croton discolor* - is a fairly large bush (up to 7 ft. tall) that looks like it is drying out and doesn't have long to live. There are two species on the island, but both look very similar and have very hairy leafs. The leaves have a tendency to stick to your clothing because of the hairs of the leaves.
- Cowitch - *Stizolobium pruriens* - is commonly known as Pica-Pica as well as Cowitch. It is a vine that, if cut or disturbed, will release hairs that can cause skin irritations.
- Manchineel - *Hippomae mancinella* - is an evergreen tree found in coastal forest or thickets and can be more toxic than poison ivy or poison sumac. Its sap produces lesions similar to chemical burns.
- Castor bean - *Ricinus communis* - has sap that can cause skin lesions and is found in previously disturbed coastal areas.

Hazardous Fauna. Mosquitoes and sand flies may pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoid the use of perfumes and scented deodorants, and don light-colored clothing. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

The potential exists to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the UXOSO.

Mongooses, rats, and mice have been documented to potentially carry rabies. There is some evidence that mongooses can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongooses and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Working in wet or swampy areas unprotected shall not be allowed because of the presence of a variety of etiologic (disease-causing agents). Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol. Symptoms of infection are fever, diarrhea, itchy skin, and central nervous system (CNS) damage. Schistosomiasis is hard to treat; once established in its host, it may remain for several years.

Before beginning site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and other Illnesses. According to the Centers for Disease Control (CDC), Dengue Fever is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3 to 4 days after the onset of fever. Because there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, travelers should wear clothes that cover most of the body. Travelers should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N,N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellent to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely, toxic reactions or other problems have developed after contact with DEET. For greater protection, clothing can be soaked in or sprayed with permethrin, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

Traveler's Diarrhea is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites that are found universally throughout the region. Transmission is most often through contaminated food or water. Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack.

Hepatitis A is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy supportive care is available, only supportive care. The virus is inactivated by boiling or cooking to 85ºC for 1 minute. Therefore, eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual*, and *Corporate Health and Safety Program, Radiation Protection Program Manual*, for standards of practice in contaminated areas.

Hazards	Controls
None Known	None Required

2.5 UXO/MEC

MEC Avoidance Procedures. MEC avoidance operations will be required during vegetation removal, and sampling operations. Avoidance operations will consist of a team composed of two UXO Technicians, one of which shall be a UXO Technician II. The UXO Team will not destroy any MEC encountered. All MEC contacts and suspected MEC anomalies will be reported to the site manager who will in turn notify in accordance with contractual requirements.

Access routes to sampling locations. Prior to sampling or well drilling crews on site, the UXO Technicians will conduct a reconnaissance of the sampling area. The reconnaissance will include locating the designated sampling or drilling location(s) and insuring that they are free of anomalies. If anomalies are detected the point will be relocated as directed. Once the designed point has been cleared, an access route for the sampling crew's vehicles and equipment will be cleared. The access route, at a minimum will be twice the width of the widest vehicle and the boundaries will be clearly marked to prevent personnel from straying into non cleared areas. If surface MEC is encountered, the UXO Team will mark and report the item and divert the approach path around the MEC. A magnetometer will be used to ensure there are no subsurface MEC with the approach path. If a subsurface magnetic anomaly is encountered, it will be assumed to be a possible MEC and the path diverted to avoid it.

Vegetation removal will be performed under the direction of UXO Technicians; all activities will be conducted after a visual and/or electronic (magnetic) sweep of the area by the UXO Technicians. Mechanical and manual vegetation removal teams will include one or more UXO Technicians using appropriate geophysical instruments and observations to avoid MEC.

Soil Sampling Sites. The UXO Technicians will clear a work site for soil samples and clearly mark the boundaries. The area will be large enough to provide a work area for the crews. If a pre-selected area indicates magnetic anomalies, a new sampling site will be chosen.

Removal of MEC-related scrap & non-MEC related scrap. No scrap handling will be conducted during this phase of the project.

MPPEH Certification and Verification

MPPEH certification and verification will not be conducted during this phase of the project.

CONTACT WITH MEC IS PROHIBITED

Chemical hazards associated with MEC include toxicity. Toxicity may occur following inhalation of chemical vapors that could potentially be released from soil and ingestion or direct contact with soil and/or ground water that could potentially contain hazardous substances. Therefore, ensure basic sanitation (washing of hands), eating, smoking, etc., are prohibited in the Area.

Explosive residues such as 2,4,6-trinitrotoluene (TNT) 1,3-dinitrobenzene (DNB) and 1,3,5-trinitrobenzene (TNB) are synthetic substances used in explosives. They dissolve in certain liquids. They have no odor or taste. Could affect the nervous system and liver if swallowed or gets on the skin. Exposure to residues can occur through eating, drinking, touching, or inhaling contaminated soil, water, food or air. Therefore ensure proper PPE use, and basic sanitation (washing of hands), eating and smoking are prohibited n the Area.

2.6 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
2,4,6-trinitrotoluene (TNT) and	GW: NA SB: NA SS: Unknown	1.5 mg/m^3	500 mg/m^3	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough, sore throat; peripheral neuropathy, muscle pain; kidney damage; cataract; sensitization dermatitis; leukocytosis (increased blood leukocytes); anemia; cardiac irregularities	UK
1,3-dinitrobenzene (DNB)	GW: NA SB: NA SS: Unknown	1 mg/m^3	50 mg/m^3	Anoxia, cyanosis; visual disturbance, central scotomas; bad taste, burning mouth, dry throat, thirst; yellowing hair, eyes, skin; anemia; liver damage	UK

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.7 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-113, *Medical Surveillance,* and HS-02, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
			Level ___ SSC; FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact
Kevin Cloe, P.E.
NAVFAC Atlantic
Code: OPCEV5
6506 Hampton Blvd
Norfolk, Virginia 23508-1278
757-322-4736
757-322-4805 fax
kevin.cloe@navy.mil

Facility Contact
Pedro Ruiz
Naval Activity Puerto Rico
Public Works Department
Building 31, 2nd Floor
Ceiba, PR 00735
787-865-4152 x459

ruizp@napr.navy.mil

3.2.2 CH2M HILL

Project Manager: Thomas M. Roth, P.E.
Health and Safety Manager: Michael Goldman/ATL for General and Dan Young/NVR for MEC
Field Team Leader: Ted Dingle
Site Safety Coordinator: Ted Dingle
UXO Safety Officer: Ted Dingle

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

UXO TECHNICIAN II

The UXO Technician II for this project will report directly to the Project Manager on issues pertaining to the operations at the project site. The UXO Technician II will have the following safety and health related responsibilities:

- Reports directly to the CH2M HILL Project Manager;
- Managing the funding, manpower and equipment necessary to safely conduct site operations;
- Reviewing and becoming familiar with the site Work Plan (WP) and SSHP;
- Provide copies of the WP and SSHP to site and subcontract personnel;
- Review the scope of work (SOW) and ensure that the required safety and health elements are addressed in the SSHP and/or WP;
- Coordinating the assignment of personnel and ensuring that the personnel and equipment provided meet the requirements of the WP and SSHP;
- Ensuring implementation of project quality, safety and health procedures;
- Early detection and identification of potential problem areas, including safety & health matters, and instituting corrective measures;
- Directly interfacing with the Project manager and advising him of safety and health matters related to conduct of the site operations.
- Acts as the On-Scene-Incident-Commander (OSIC) in the event of an MEC emergency, notifying and coordinating with off site emergency and medical response agencies.

UXO SITE SAFETY AND HEALTH OFFICER

The UXO Site Safety Officer (UXOSO) for this project reports directly to the Project Manager and oversees all UXO safety and heath aspects for this site. For this project the UXO Technician II will assume the duties of the UXOSO. He/she will coordinate all daily activities with the Project Manager. The UXOSO will have the following responsibilities;

- Has STOP WORK authority for UXO safety and heath reasons;
- Implement and enforce the SSHP, and report safety violations to the Project Manager and other appropriate personnel;
- Establishing work zones and controlling access to these zones;
- Conduct daily UXO Safety Briefings;
- Implement and document the Site Specific Hazard Information Training Program;
- Consulting with the SUXOS as necessary;
- Assisting in the continued development of this Avoidance Plan, and the SSHP and other safety and health procedures, as applicable;
- Investigate and report accidents/incidents and ‘near misses;”
- Conduct visitor orientation;
- Enforce the “buddy” system;
- Restrict site personnel from site activities if they exhibit systems of alcohol or drug use or illness, and continually monitor site personnel for signs of environmental exposure or physical stress;
- Maintain the site safety and monitoring logs;

- Maintains an alternate line of communication with the Project Manager.

UXO TECHNICIANS

All UXO Technicians are required to comply with the provisions of this Avoidance Plan, the SSHP, the WP and all applicable Federal, State and local regulations. They will report to the UXO Technician II.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

Subcontractor: USA Environmental, Inc.
Subcontractor Contact Name: Rick Hanoski
Telephone: 813-343-6382

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment*, HS-121, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
General site entry Surveying	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Surface soil sampling	Modified D	Work clothes or cotton coveralls **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SSC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207 - *Exposure Assessment for Airborne Chemical Hazards)*

5.1 Air Monitoring Specifications

Air monitoring is not required for the activities covered by this HSP.

5.2 Calibration Specifications

Air monitoring is not required for the activities covered by this HSP.

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

None anticipated.

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Michael Goldman/ATL
Other: Dan Young/NVR

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- Dispose of PPE in municipal trash, or contain for disposal
- Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- Contain solvent waste for offsite disposal

Heavy Equipment

- Power wash
- Steam clean
- Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure B-2 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.

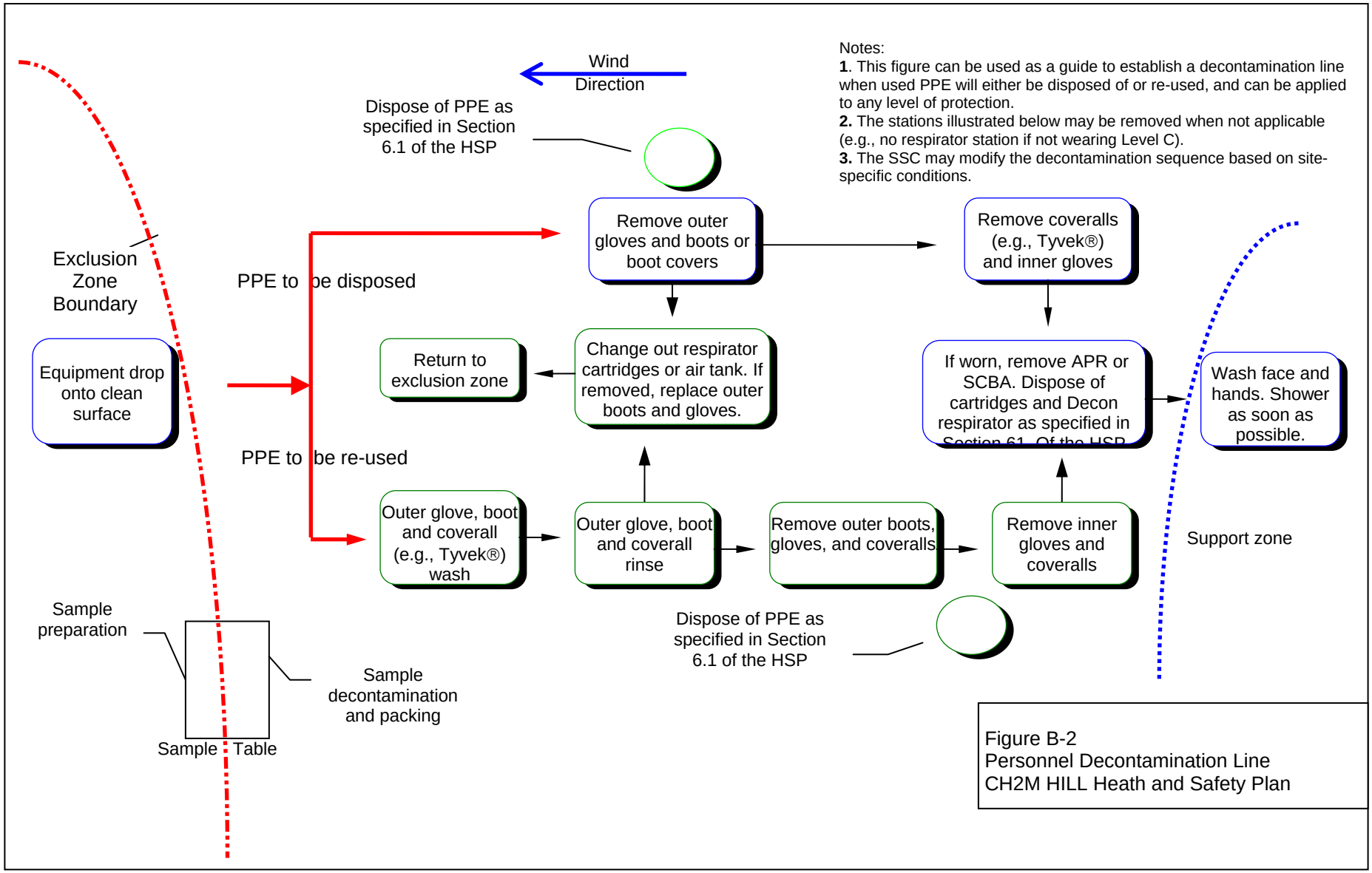

Figure B-2
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control)*

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 UXO Site Control

The UXO Technician II coordinates access control and security on site. Due to the hazardous nature of MEC work, only authorized personnel will be allowed in the exclusion zone (EZ). The EZ is the work site encompassing an area large enough to prevent personnel injuries from fragmentation and overpressure resulting from either an unintentional or intentional detonation of MEC.

During all intrusive operations the EZ will be a radius of 400 feet minimum (MK II Grenade) (distance from DDESP TP-16, Chapter 4). During UXO operations, only UXO trained or authorized essential personnel are allowed in the EZ. Authorized personnel are those that have completed the required training, meet medical requirements and are essential to the ongoing operation.

During all operations on site, the site UXO Technician II will cease operations if non-essential personnel are observed within the operating area (EZ). During duty hours, personnel will provide security at the site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

- Eating, drinking and smoking are prohibited except in designated areas;
- MEC operations will cease if non-UXO trained or non-essential personnel are present;
- The UXO Technician II will escort all authorized visitors to the site;
- The UXO Technician II will maintain the site entry control log to ensure accurate accountability of personnel;
- The UXO Technician II will brief this UXO Avoidance Plan to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the briefing log;
- In case of an emergency, personnel will exit the site and move to the designated safe area. The safe area will be located upwind of the site and outside of the fragmentation (400 feet) area. The UXO Technician II will assist in determining the severity of the emergency. If the emergency warrants evacuation, the UXO Technician II will notify the Project Manager.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans)*

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-106, *Emergency Response*)

9.1 Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy’s wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: **Thomas M. Roth/ATL** **Date: January 11, 2006**
Dan Young/NVR

Approved By: Michael Goldman **Date: January 16, 2006**

10.2 Revisions

Revisions Made By: Thomas M. Roth **Date: April 11, 2006**

Revisions to Plan: 2.3.4, 2.3.8

Revisions Approved By: Michael Goldman **Date: April 14, 2006**

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11 Attachments

Attachment 1: Employee Signoff Form – Field Safety Instructions
Attachment 2: Project-Specific Chemical Product Hazard Communication Form
Attachment 3: Chemical-Specific Training Form
Attachment 4: Emergency Contacts
Attachment 5: Project H&S Forms/Permits
Attachment 6: Project Activity Self-Assessment Checklists
Attachment 7: Applicable Material Safety Data Sheets

ATTACHMENT 1

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: CLEAN III CTO-113 / Pineros Island, PR **Project Number:** 332320

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

ATTACHMENT 2

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: CLEAN III CTO-113 / Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Project Number: 332320

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
None					

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

ATTACHMENT 3

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #:
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

ATTACHMENT 4 - EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification MUST be made within 24 hours of the injury.

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911 or Hospital #: (787) 863-0505 Ambulance #: 911 LEPC (Poison Control)#: (800) 222-1222	**CH2M HILL Medical Consultant** Dr. Peter Greaney GMG WorkCare, Orange, CA 800/455-6155 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency – Not Available Onsite	**Local Occupational Physician**
Coast Guard Search & Rescue Rescue Coordination Center, San Juan Sub-Center 911 or 787-289-2042	
Security & Police – Not Available Onsite	**Corporate Director Health and Safety** Name: Mollie Netherland/SEA Phone: 206/453-5005 **24-hour emergency beeper: 888-444-1226**
Utilities Emergency - NA Water: Gas: Electric:	**Health and Safety Manager (HSM)** Name: Michael Goldman/ATL Phone: (770) 604-9182 x 396
Designated Safety Coordinator (DSC) Name: TBD Phone:	**Regional Human Resources Department** Name: Mary Jo Jordan/GNV Phone: 352/355-2867
Project Manager Name: Tom Roth Phone: 404-259-6674 (cell)	**Corporate Human Resources Department** Name: John Monark/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation and Auto Claims** Sterling Administration Services Phone: 800/420-8926 After hours: 800/497-4566 Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD	**Evacuation Assembly Area(s):** TBD by the SC-HW; will probably be the local hotel where the field team is staying

Facility/Site Evacuation Route(s): Go to the beach landing area for the work zone you are at (north beach, south beach, or west beach) and wait for boat transport to arrive onshore.

Route to Hospital:

The hospital route directions are from Puerto del Rey Marina.

For non-life-threatening emergencies, injured personnel should be transported to Puerto del Rey Marina on the subcontracted boat.

If the injury is critical, an ambulance should be contacted (call 911) and asked to meet the boat at Puerto del Rey Marina.

For life-threatening injuries or if the injured party cannot be safely moved, Coast Guard response should be requested (call 911).

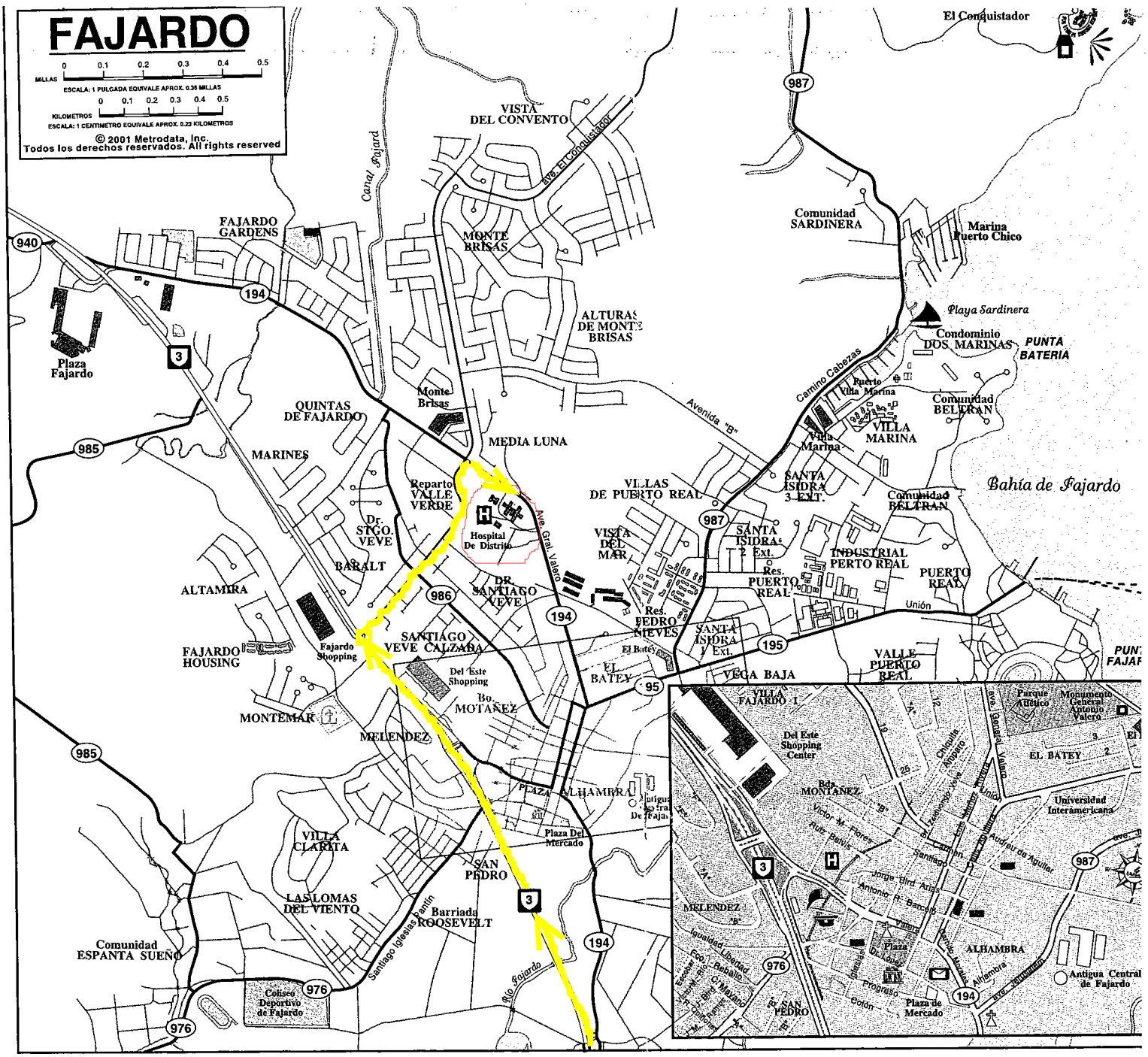
- **Exit Puerto del Rey Marina and drive North on Route 3 toward Fajardo.**
- **After entering town, go past the Del Este Shopping Center on the right.**
- **Turn right onto Avenida El Conquistador.**
- **Proceed approximately ½ mile and turn right onto Avenida General Valero (Route 194).**
- **The hospital will be on your right.**

Local hospital: Hospital San Pablo del Este
Avenida General Valero, 404, Fajardo PR 00738

Tel: (787) 863-0505
Fax (787) 860-8514

..

Local ambulance service: 911
.



Exit Puerto del Rey Marina and drive North on Route 3 toward Fajardo.
After entering town, go past the Del Este Shopping Center on the right.
Turn right onto Avenida El Conquistador.
Proceed approximately 1/2 mile and turn right onto Avenida General Valero (Route 194).
Hospital San Pablo del Este will be on your right.

Figure B-2
Route to Hospital

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists
(Not Applicable to Activities on this Project)

CH2MHILL

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable Material Safety Data Sheets
(Not Applicable to Activities on this Project)

Appendix C
Geophysical Investigation Plan

APPENDIX C

Geophysical Investigation Plan

This GIP provides details of the equipment, approach, methods, operational procedures and quality control (QC) to be used in performing the geophysical investigations for the Phase I RCRA Facility Investigation (RFI) at Piñeros and Cabeza de Perro Islands, Puerto Rico. The following topics are covered in the GIP subsections: safety issues; geophysical data quality objectives (DQOs); description of the site; anticipated Munitions and Explosives of Concern (MEC) types, quantities, compositions, and depths; site physical conditions (e.g., geology and topography); adverse geophysical conditions; site utilities and manmade features that may affect the geophysical operation; data acquisition and reporting; and geophysical program QC requirements.

C.1 Geophysical Operations Overview

Geophysical instruments will be used during digital geophysical mapping (DGM) survey operations. DGM operations use instruments that record instrument response digitally, allowing for the subsequent download and interpretation of the data. DGM instruments will be operated by the DGM subcontractors. Geophysical instruments used during operations such as clearance of locations for emplacement of survey stakes will be analog, meaning these instruments will be used to detect metallic items in the subsurface on a real-time basis and the instrument response will not be recorded. Generally analog instruments indicate the presence of metallic anomalies through sound or visual display. The analog instruments will be operated by unexploded ordnance (UXO) technicians.

C.2 Safety Issues

Because MEC and MPPEH items may be present in the survey area, DGM survey personnel are prohibited from touching, handling, moving, or investigating any item that resembles MEC or MPPEH. Upon encountering such an item, survey personnel will immediately inform the Senior UXO Supervisor (SUXOS) or a UXO technician. In the event that such an item is discovered, either inside or outside the controlled project boundaries, and no UXO-qualified personnel are present, survey personnel will conspicuously mark and secure a perimeter around the item and immediately contact the SUXOS. DGM survey personnel should not remain within 200 feet of any suspected MEC or MPPEH item.

DGM survey personnel will not access any terrestrial areas that have not been previously surface cleared by a UXO technician. Personnel will also be required to adhere to the project Health and Safety Plan (refer to Appendix B of this WP).

C.3 DGM Personnel Qualifications

Land-based DGM operations will be conducted by personnel experienced in MEC geophysical operations and led by a qualified geophysicist who has experience on MEC

projects. Underwater DGM will be performed by a subcontractor specializing in underwater geophysics and oversight will be provided by the CH2M HILL Project Geophysicist (who meets all of the qualifications outlined below.) Throughout DGM operations, DGM support personnel will strictly adhere to the general practices given in this WP and specifically in the project Health and Safety Plan (refer to Appendix B of this WP).

The following are additional specific qualifications for land-based DGM personnel that will be met:

- **Project Geophysicist:** will have a degree in geophysics, geology, geological engineering, or a closely related field, and have a minimum of 7 years of directly related geophysical experience. This individual will be capable of managing a geophysical data collection and processing project/program including several task orders/sites.
- **Site Geophysicist:** will have a degree in geophysics, geology, geological engineering, or a closely related field, and have a minimum of 5 years of directly related geophysical experience. This individual will be capable of competently managing personnel, equipment and data on projects requiring multiple (three or more) geophysical field teams and geophysical data processors.
- **Geophysical Data Processor:** will have a degree in geophysics, geology, geological engineering, or a closely related field, and will have at least 6 months experience in processing geophysical data related to MEC projects.
- **Field Geophysicist:** will have a degree in geophysics, geology, geological engineering, or a closely related field, and will have a minimum of 2 years of directly related geophysical experience related to MEC projects.
- **Geophysical Technician:** will have at least 6 months of experience in geophysical data collection on MEC related projects.

C.4 Areas to be Investigated

The areas to be investigated are shown in Figure 1.5 of the Work Plan and consist of the following:

1. Transects in the land-crabbing area on the western side of the island (approximately 1,600 feet of transects proposed);
2. The trail connecting the north beach and the south beach by way of the WWII bunker (approximately 2,800 feet in length);
3. Four beach areas (approximately 3,700 feet in length by 10 feet in width, or 0.85 acre); and
4. Four underwater demo areas (approximate total of 16 acres).

C.5 Past, Current, and Future Site Uses

See Sections 1.4 and 1.5 of Work Plan.

C.6 Anticipated MEC Types, Composition, and Quantities

Possible MEC at the site, based on the ASR and visual inspection of the island (1992 Draft Environmental Assessment and the December 2004 UXO Site Analysis) includes:

40mm flares	Percussion grenades
Hand grenades	Booby traps
40mm practice grenades	40mm smoke grenades
Mk84 timers	Detonation Cord
M60 fuze lighters	Shape charge remnants
Pop Flares	Grenade simulators
Claymore mines	Plastic explosives

Although not considered MEC, small-arms (5.56mm, 7.62mm, 9mm, .45 caliber [cal], .38 cal, and .50 cal) may also be found.

C.7 Anticipated Depth of MEC Items

The anticipated depth of potential MEC items is near-surface based on the types of MEC documented to have been used at the site and CH2M HILL personnel experience at other military installations.

C.8 Vegetation and Topography

See Section 1.3.1 of Work Plan.

C.9 Geologic Conditions

See Section 1.3.3 of Work Plan.

C.10 Shallow Groundwater Conditions

Groundwater is anticipated to be relatively shallow, within approximately 10 feet below ground surface.

C.11 Adverse Geophysical Conditions

The geology of the site consists partially of volcanic rocks that may have enough ferrous mineral content to severely impact the ability of magnetometers to detect metal in the subsurface. (Electromagnetic techniques will be used for the terrestrial surveys to deal with the potential for this condition as they are less susceptible to ferrous minerals.) Volcanic substrate near the surface has been reported to cause interference on the island of Culebra. Sub-bottom surveys located areas with sediment overburden that served as a buffer and permitted magnetometer data to be taken. This condition may exist at Piñeros and Cabeza in the designated areas.

C.12 Site Utilities

There are no known utilities in the areas to be surveyed.

C.13 Manmade Features Potentially Affecting Geophysical Operations

Manmade features potentially affecting the land-based geophysical operations include primarily concrete and metal structures such as the WWII bunker and a gun mount along the bunker trail. The beach and underwater areas do not contain any known manmade features.

C.14 Site-Specific Dynamic Events

No site-specific dynamic events (e.g., unusually strong winds, harsh weather conditions) that might affect the DGM survey operations at the site are anticipated. Although it is possible that weather conditions may impede operations at some time during the project, no significant delays or effects on geophysical instruments resulting from weather are expected.

C.15 Overall Site Accessibility and Impediments

The site will be accessed from the mainland of Puerto Rico by boat. Vegetation along the bunker trail will be removed prior to the land-based DGM surveys so as not to adversely impact site access. Personnel and geophysical equipment for the terrestrial DGM survey will have to be transferred from a larger transport vessel into a smaller landing craft due to shallow water near Piñeros Island. Piñeros Island has no docking facilities and boats must make beach landings, offering the possibility that personnel and equipment may get wet when exiting the landing craft on the beach.

C.16 Potential Worker Hazards

No potential worker hazards are apparent at the site other than those associated with conducting project fieldwork, which are addressed in the project Health and Safety Plan (refer to Work Plan Appendix B).

C.17 DGM Data Quality Objectives

The primary objective of the DGM activities at the site is to identify metallic anomalies that may be MEC or MPPEH. DQOs specific to the DGM surveys at the site are summarized in Attachment 1 to this GIP.

C.18 Geophysical Instrumentation

C.18.1 Analog Geophysical Instruments

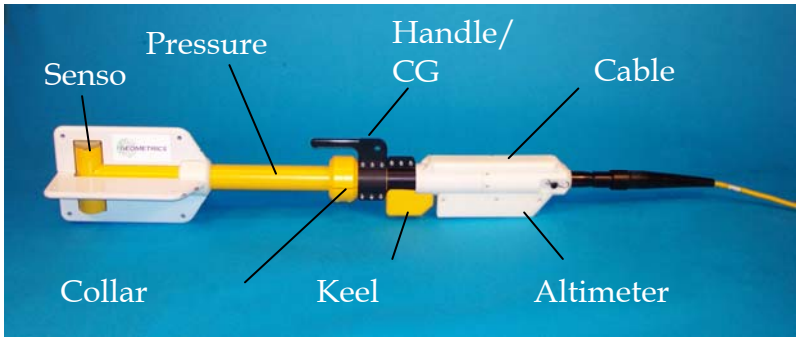
The analog geophysical instrument to be used during non-DGM operation where a geophysical instrument is needed to detect metallic items will be an all-metals detector, such as a White's metal detector or comparable.

C.18.2 DGM Instruments

The instrumentation to be used for the land-based DGM operations at the site will be the EM61-MK2. The EM61-MK2 utilizes the electromagnetic induction technique. This technique uses an active sensor that induces currents in conductive objects near the instrument that are measured by a receiving coil to detect both ferrous and non-ferrous items. The instrument will be operated either in one of the "modes" shown below:

Potential modes of operation for EM61-MK2

The instrumentation to be used for the underwater DGM operations will be the Geometrics G882 (shown below) equipped with a depth sensor and altimeter. The G882 is a cesium vapor magnetometer with a published sensitivity of <0.004 nT/ pHz rms. Typically 0.02 nT P-P at a 0.1 second sample rate or 0.002 nT at 1 second sample rate up to 10 samples per second. The magnetometer signal level will be monitored to ensure optimum sensor alignment and external interference is minimized or eliminated.



Geometrics G882

C.19 Data Positioning

It is anticipated that two type of positioning will be used for the ground-based DGM data. The first (and preferred) method is the Global Positioning System (GPS). In areas where there is a clear view of the sky (no overhead canopy of vegetation), the DGM subcontractor will use sub-meter (or better) GPS to position the DGM data to within at least 1 ft of the collected data point.

In areas where there is overhead vegetation, data will be collected and positioned using the "fiducial" method. With this method there are two points of known position at the end-points of segment of a transect and the operator(s) either use a wheel odometer or a constant pace system to determine the location of data points collected between the points. This method is far less accurate than using GPS; however, the goal of the project is to determine whether there are metallic anomalies in the subsurface along the transects and the approximate density. The locations of anomalies do not need to be reacquired at a later date.

Data positioning for the underwater DGM surveys will be either differential or WAAS GPS. The towfish will be positioned by entering the cable layback from the GPS antenna into a cable layback algorithm in the Hypack Program. The depth and altitude data will be recorded with the intensity readings and towfish position. The sampling rate will be at 10 samples per second.

The survey will be conducted as a grid of parallel lines at each site with a spacing of 10 feet. The height of the sensor above the bottom will be maintained between 5 and 10 feet. A crude bathymetric survey will be conducted first to show any hazards. An optimal survey grid direction will be derived from the combination of area boundaries, bathymetry and geological interference.

C.20 Data Acquisition, Processing and Reporting

C.20.1 Field Data Sheets

Field data sheets (paper or digitally recorded) will include, at a minimum, the following:

- Site ID
- Grid ID (or other identifier of surveyed area)
- Field team leader name
- Field team members' names
- Date of data collection
- Instrument used
- Positioning method used
- Instrument serial numbers
- File names in data recorders
- Data collection sampling rate
- Line numbers, survey direction, fiducial locations, start and end points
- Weather conditions
- Grid conditions
- Terrain conditions
- Cultural conditions
- Survey area sketch
- Associated QC data file names
- Field notes (other)

C.20.2 Data Processing

Instrument-specific software will be used for initial data processing and the output will be imported into Geosoft Oasis Montaj™ for additional processing, graphical display, anomaly

selections and QA/QC. Types of processing will be system specific, but the general processing steps that may be performed on the data include the following:

- Positional offset correction
- Sensor bias, background leveling and/or standardization adjustment
- Sensor drift removal
- Latency correction
- Geophysical noise identification and removal (spatial, temporal, motional, terrain induced)
- Contour level selection with background shading
- Digital filtering and enhancement (low pass, high pass, band pass, convolution, correlation, non-linear, etc.)

C.20.3 Interpretation/Anomaly Selection

MEC-experienced data processing geophysicists will use the following criteria for selecting and locating anomalies:

- Maximum amplitude of the response with respect to local background conditions
- Lateral extent (plan size) of the area of response
- Three-dimensional shape of the response
- Potential distortions in the response due to interference from nearby cultural features

C.20.4 Dig Sheets

The target analysis process culminates in the creation of dig sheets, which contain target information location, amplitude, and other distinguishing characteristics (e.g., depth and weight estimates) when possible. At a minimum, the following information will be provided on the dig sheets:

- Project site
- DGM contractor
- Responsible geophysicist
- Grid identification
- Unique anomaly identification numbers
- Predicted location NAD83 UTM Coordinates in Easting (meters) and Northing (meters)
- Instrument peak value (where applicable) at each anomaly location

C.20.5 Grid Maps

With each dig sheet, the DGM subcontractor will also provide a grid map, which contains the following:

- Client
- Project

- Contractor
- Map creator
- Map approver
- Date map was created
- Map file name (full path and file extension)
- Scale
- Grid identification
- Contoured data
- Anomaly locations with unique identification numbers
- North arrow, legend, title block, etc.

C.20.6 Records Management

All files will be made available for QC verification during the project to verify that the field and data processing procedures are properly implemented. All raw data files, final processed data files, hard copies, and field notes will be maintained for the duration of the project.

C.20.7 Final Reports, Maps, and Geophysical Mapping Data

No later than 3 work days after collection, the DGM subcontractor will provide each day's data for QC inspection via the Internet using a File Transfer Protocol (FTP) site, electronic mail (email) attachments for small files under 5 megabytes, or digital compact disk (CD). Such data are considered to be in raw form. These data will be corrected for sensor offsets, diurnal variations, latency, heading error, and drift. Also provided will be a digital planimetric map, in Environmental Systems Research Institute (ESRI) ArcView and Geosoft format and coincident with the location of the geophysical survey, so that each day's geophysical data set can be registered within the original mission plan survey map.

All geophysical field data will be provided to CH2M HILL in delineated fields as x, y, z, v1, v2, and so on, where x and y are North American Datum 83 (NAD83) Universal Transverse Mercator (UTM) Coordinates in Easting (meters) and Northing (meters) directions, z (elevation is an optional field in feet), and v1, v2, v3, and so on are the instrument readings. The last data field will be a time stamp. Each data field will be separated by a comma or tab. No individual file may be more than 100 megabytes in size and no more than 600,000 lines long. Each grid of data will be logically and sequentially named so that the file name can be easily correlated with the grid name used by other project personnel.

Within 5 working days of data collection, the processed geophysical field data, all final maps, and supporting geophysical interpretations will be provided to CH2M HILL. All geophysical data will be accompanied by a Microsoft®Word 6.0 or higher file documenting the field activities associated with the data and the processing performed. Required information is summarized in Table C-1.

TABLE C-1
Processing Documentation Requirements

Information Type	"Raw" Data Delivery	Final Data Delivery	Must be in File Headers
Site ID	X	X	X
Geophysical instrument type used	X	X	X
Positioning method used	X	X	X
Instrument serial numbers (geophysical and positioning)	X	X	
Coordinate system and unit of measure	X	X	X
Grid ID (or other identifier of surveyed area)	X	X	X
Date of data collection	X	X	X
Raw data file names associated with delivery	X	X	X
Processed data file names associated with delivery	X	X	X
Name of Project Geophysicist	X	X	
Name of Site Geophysicist	X	X	
Name of data processor	X	X	X
Data processing software used	X	X	
Despiking method and details	X	X	
Sensor drift removal and details	X	X	
Latency correction and details	X	X	
Sensor bias, background leveling and/or standardization adjustment method and details	X	X	
Geophysical noise identification and removal (spatial, temporal, motional, terrain induced) and details		X	
Other filtering/processing performed and details		X	
Gridding method		X	
Anomaly selection and decision criteria details		X	
Other processing comments		X	
Date data processing is completed	X	X	
Data delivery date	X	X	
Scanned copy of field notes and field mobile data collection device notes (if applicable)	X		

C.21 DGM Systems Quality Control

An extensive QC program will be applied to the DGM operations at the site. Figure C-1 shows an overall chart of the QC steps, and details for those steps are provided in the following subsections.

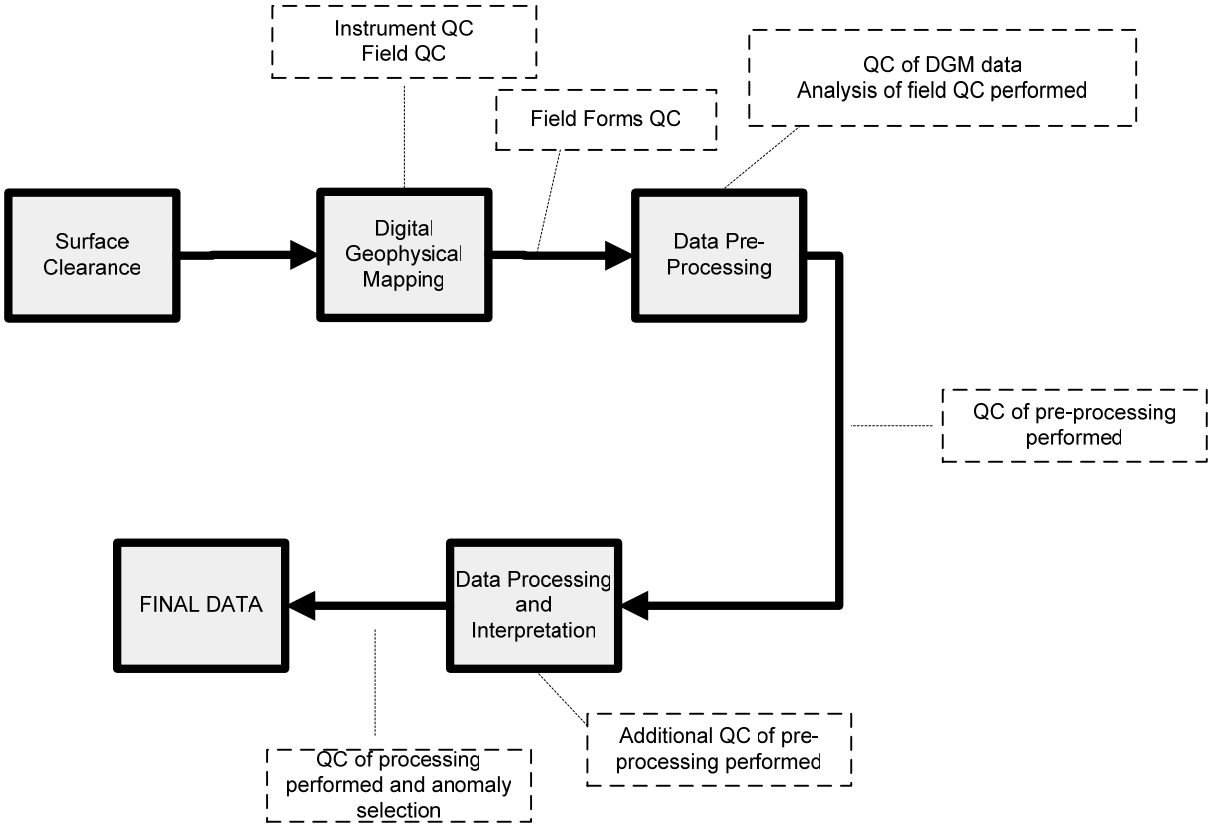


FIGURE C-1
Overview of DGM Process QC

C.22 DGM Instruments Quality Control

Each of the geophysical systems will be field tested to confirm proper operating conditions. Several basic QC tests will be performed in addition to instrument-specific tests. A description of each basic QC test, its acceptance criteria, and its frequency is provided below and summarized in Table C-2.

1. **Equipment Warm-up**. This is an instrument-specific activity, although standard warm-up time is 5 minutes. Some geophysical systems require more warm-up time than others. Each system-specific SOP defines the equipment-specific warm-up time. Equipment warm-up will be performed the first time an instrument is turned on for the day or has been turned off for a sufficient amount of time for the specific instrument to cool down.

2. **Record Sensor Positions**. Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each work day. *This test will not be performed if a benchmark location cannot be located in the project area.*

3. **Personnel Test.** This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each work day. The personnel test will be conducted at the beginning of the survey operation for each work day (except for towed systems where the personnel are in the tow platform as opposed to near the geophysical instrument[s]).

4. **Vibration Test (Cable Shake).** This test checks the response of instruments to vibration. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response will be observed in the field for immediate corrective action and transmitted back to the processor and analyzed and checked for spikes in the data that can possibly create false anomalies. The vibration test will be conducted at the beginning of the survey operation for each work day.

5. **Static Background and Static Spike**. Static tests will be performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic contacts and collecting data for (minimally) a 1-minute period. During this time, the instrument will be held in a fixed position without a spike (known standard) and then with a spike. The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist. The static background and static spike test will be conducted at the beginning and end of each survey operation.

6. **Six Line Test.** The Six Line Test is a standard response test consisting of a predetermined route (survey line) established on or near the site in an area free of metallic contacts. The beginning, midpoint, and end of the line will be marked; data will be collected along the line. The line will be traversed a total of six times as follows: 1) *normal* data collection speed *without* a spike at the centerpoint; 2) *normal* data collection speed *without* a spike at the centerpoint; 3) *normal* data collection speed *with* a spike at the centerpoint; 4) *normal* data collection speed *with* a spike at the centerpoint; 5) *fast* data collection speed *with* a spike at the centerpoint; 6) *slow* data collection speed *with* a spike at the centerpoint. The Six Line Test will be conducted the first time a system is used at the site. (This test will not be conducted for the underwater DGM system.)

7. **Repeat Data.** This test is performed to verify repeatability of the data and will be performed after the initial survey over an area. At least 2% of the survey lines will be repeated.

TABLE C-2
DGM Instruments Standardization Tests and Acceptance Criteria

Test	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	First Time Instr. Used	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (typically 5 min)	X				
2[A]	Record Sensor Positions	± 1 ft		X			
3[B]	Personnel Test	Based on instrument used. Personnel, clothing, etc. should have no effect on instrument response		X			
4	Vibration Test (Cable Shake)	Data profile does not exhibit data spikes		X			
5	Static Background & Static Spike	± 20% of standard item response, after background correction			X		
6[C]	Six Line Test	Repeatability of response amplitude ± 20%, Positional Accuracy ± 20 cm				X	
7	Repeat Data	Repeatability of response amplitude ± 20%, Positional Accuracy ± 20 cm					X

[A] *This test will not be performed if a benchmark location cannot be located in the project area.*
[B] *This test will not be performed for towed systems where the personnel are in the tow platform as opposed to near the geophysical instrument[s]*
[C] *This test will not be conducted for the underwater DGM system.*

C.23 Quality Control of DGM Data and Deliverables

Both the DGM subcontractor and CH2M HILL will perform QC of geophysical data and data deliverables at each step of the processing path. Figure C-2 shows the processing path and the QC steps performed. Data will not move to the next stage until they have passed the QC check.

The following items are among the QC checks performed on the field forms:

- Appropriate fields have been completed
- Field entries are appropriate for work performed
- Data required for geophysical data processors have been entered
- General editorial review (spelling, dates, etc.)

The following items are among the QC checks performed (as applicable to the particular data set) on the "Pre-processed Data":

- Data have been translated from local coordinates into the State Plane system
- Coordinates are correct (grids fall in correct locations when loaded into GIS)
- Line gaps have been accounted for
- Background geophysical noise is acceptable
- Crosstrack distances between lines are acceptable
- Downline data density is acceptable
- Appropriate file headers have been attached
- Files contain appropriate grids

The following items are among the QC checks performed (as applicable to the particular data set) on the "Processed Data":

- Lag correction is appropriate
- Despiking is appropriate
- Leveling is appropriate
- Filtering performed is appropriate
- Line breaking is appropriate
- Anomaly selections are appropriate

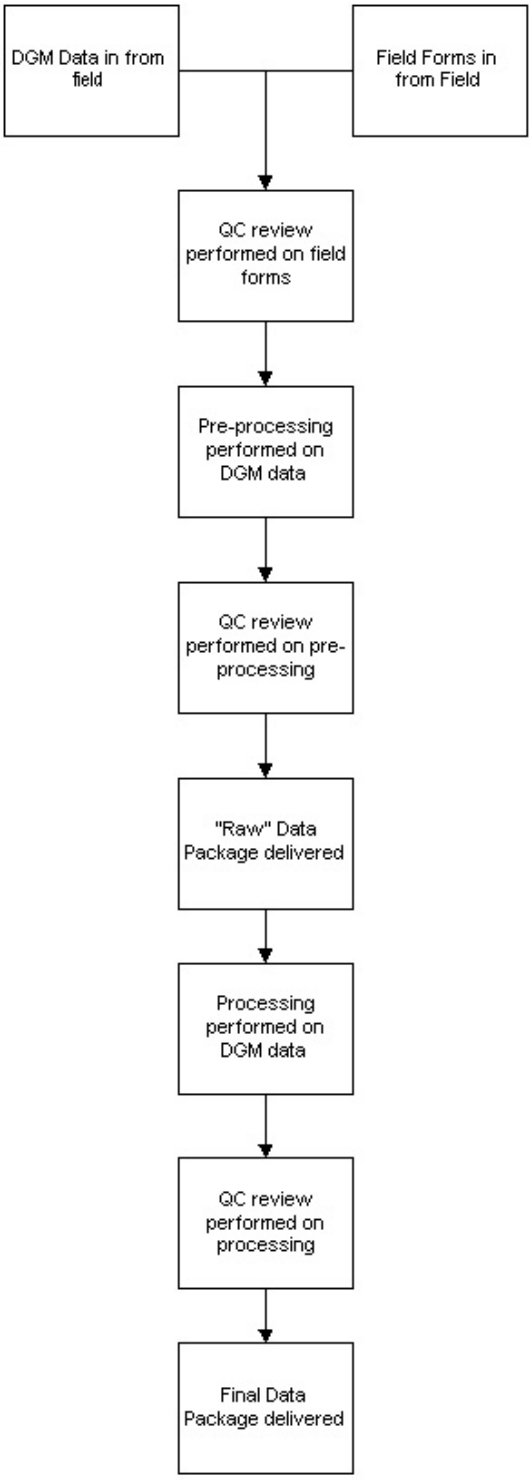


FIGURE C-2
QC of DGM Data – Process Flowpath

C.24 Analog Geophysical Systems Quality Control

QC over the analog geophysical instruments will be accomplished through daily checks that the instruments are functioning prior to using them for field activities. Each instrument will be operated over a small metallic item. If the instrument is not able to detect the item, it will be taken out of use until it is repaired.

Attachment 1

Data Quality Objectives

Project Data Quality Objectives

The project DQOs, measurement performance criteria, and test method to be used are discussed in the following sub-sections and summarized in Table 1.

General Geophysical Systems Functioning

DGM Systems Positioning

The DQO for DGM systems positioning is that the coordinates being obtained from the positioning systems are at a sufficient enough accuracy to allow for appropriate placement on a map for characterization purposes. The measurement performance criterion for this is that the positional error at known monuments will not exceed ±1ft when GPS is used and 10 ft when fiducial methods are used. The GPS positioning will be evaluated if a benchmark is available by ensuring that, on a daily basis, the positioning system in use passes QC Test #2 (Record Sensor Positions), as outlined on Table c-2 of the Phase I RFI Work Plan.

DGM Systems Data Repeatability

The DQO for DGM systems data repeatability is that the systems respond consistently from the beginning to the end of an operation. The measurement performance criterion for this is that the response to a standardized item will not vary more than ±20%. This will be evaluated by ensuring that, on a daily basis, the geophysical system being used passes QC Test # 5 (Static Background and Static Spike) and QC Test #7 (Repeat Data), as outlined on Table C-2 of the Phase I RFI Work Plan.

TABLE 1
Project Data Quality Objectives

Data Quality Objective	Measurement Performance Criteria
General System Functioning	
Accurate coordinates are being obtained from DGM positioning systems.	Positional error at known monuments will not exceed ±1 ft.
Repeatable data are being obtained from DGM system.	Response to standardized item will not vary more than ±20%.
DGM Surveys	
Downline data density is sufficient to detect MEC items.	Data is collected at a maximum separation distance of 0.5 ft along each transect
Coverage over non-transect survey areas is sufficient to detect MEC items.	Search transect spacing to vary no more than ±20% of spacing specified in sampling design.
Data Handling	
All data must be delivered in a timely manner and in a useable format.	“Raw” Data packages are completed and delivered to the CH2M HILL Project Geophysicist within 3 working days of data collection and “Final” within 5 working days of data collection.

DGM Surveys

Downline Data Density

The DQO for downline (along the survey transect) data density is to have sufficient data collected along each transect to detect MEC items. The measurement performance criterion for this is data is collected at a maximum separation distance of 0.5 ft along each transect. This will be evaluated by verifying that all the DGM data collected meets this standard.

Survey Coverage (Lane Spacing)

The DQO for lane spacing is to maintain appropriate lane spacing to provide 100 percent coverage of the non-transect survey areas. The measurement performance criterion for this is that the lane spacing varies no more than ±20 percent of spacing specified in the sampling design. This will be evaluated by verifying that all of the DGM data collected and used for anomaly selection meets this standard.

Data Handling

The DQO for data handling is that all data must be delivered in a timely manner and in a useable format. During production surveys, the measurement performance criterion for data handling will require that "draft" (raw) data packages be completed and delivered to the CH2M HILL Project Geophysicist within 3 working days of data collection and the final data packages within 5 working days of data collection.

Appendix D
MEC Conceptual Site Model

APPENDIX D

Conceptual Site Model

CH2M HILL is conducting a Phase I RCRA Facility Investigation (RFI) at Piñeros and Cabeza de Perro Islands, Puerto Rico. The Phase I RFI is being conducted for the Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Atlantic Division (LANTDIV), under the LANTDIV Comprehensive Long-Term Environmental Action Navy (CLEAN) III Program. This Munitions and Explosives of Concern (MEC) Conceptual Site Model (CSM) was developed to support the Phase I RFI Work Plan.

D.1 Introduction

This MEC CSM describes sources of MEC and munitions constituents (MC); actual, potentially complete, or incomplete exposure pathways; current or reasonable anticipated land uses; and potential receptors. The purpose of the CSM is to serve as a planning instrument, a modeling and data interpretation aid, and a communication device among the project team members (USACE, 2003).

Information in this CSM is based on available documentation of historical activities and current site conditions, including the following:

- *Draft Environmental Assessment of Training Activities on Piñeros and Cabeza de Perro Islands, U.S. Naval Station Roosevelt Roads* (Ecology & Environment, 1992).
- *UXO Analysis, Roosevelt Roads, Puerto Rico, Piñeros & Cabeza de Perro Islands* (NAVEODTECHDIV, 2004).
- *Archival Records Search Report in support of the Preliminary Assessment/Site Investigation, Piñeros and Cabeza de Perro Islands, Naval Activity, Puerto Rico* (Appendix A to the accompanying Phase I RFI Work Plan).

This CSM was prepared in accordance with U.S. Army Corps of Engineers Engineering Manual (EM) 1110-1-1200, *Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects* (USACE, 2003).

Piñeros and Cabeza de Perro Islands are heavily vegetated. A complete investigation for, or removal of, MEC from the islands would require the removal of extensive areas of vegetation, which would have negative impacts on island wildlife. In addition, access to the interior of the islands, and to the most of the shoreline, is difficult, making public access to most island areas unlikely.

Due to site conditions, NAVFAC, in consultation with USFWS, DNER, and EQB, has decided on an approach that will allow public access to limited areas of Piñeros Island while protecting the ecology of the islands by disturbing only a small portion of the vegetation on Piñeros Island. This approach was developed by identifying areas that are currently being accessed by the public, and by evaluating areas that could potentially be used for limited

public access. This evaluation resulted in the selection of the following potential public access areas on Piñeros Island that will be investigated under this Phase I RFI:

- Beach Access
- Bunker Trail
- Land Crabbing
- Offshore Anchorages

These areas are shown on Figure D-1. Cabeza de Perro Island will remain off-limits to public access as access to the island from the shoreline is difficult.

D.2 Profiles

Known or suspected conditions about sources and potential receptors, and the interactions between them, may be categorized into five "profile types" that address specific yet overlapping types of information (USACE, 2003). These profile types are Facility Profile, Physical Profile, Release Profile, Land Use and Exposure Profile, and Ecological Profile.

D.2.1 Facility Profile

The Facility Profile describes man-made features and potential sources at or near the site. Typical profile information include structures, physical boundaries and administrative controls, ordnance activity areas, and historical features such as ground scars and impact craters that may indicate potential source areas.

The British built a network of roads, gun emplacements, and bunkers, as shown on Figure D-2 on Piñeros Island for use during World War II. These facilities were abandoned after the war, but remnants of these structures still remain. In particular, the bunker and a nearby gun emplacement at the top of the hill in the southeastern portion of the island are mostly intact.

Beginning in the late 1950s, Piñeros and Cabeza de Perro islands were utilized by Special Warfare Group Two, Unit Four (SPECWAR), personnel for various training activities. Exercises included beach landings combined with sea-to-land gunfire, underwater demolition on offshore coral reefs, and small-arms training. Historical data indicate that all of Piñeros Island was potentially used for these military training exercises and most areas could currently contain MEC or MEC-related debris.

There are no physical barriers to limit access to either island, other than the natural barriers discussed in the Physical Profile. Signs on two Piñeros Island beaches warn visitors that the island if off-limits to public access.

D.2.2 Physical Profile

The Physical Profile describes factors that may affect release, fate and transport, and access. Typical profile information includes topographic and vegetative features, surface water features, geology and soil type, meteorological data, and other physical features of the site that may impact site activities.

Natural physical barriers currently limit access to the islands. Offshore reefs surrounding Piñeros Island make access by large boats difficult; however, there are limited beach areas suitable for landing by small craft, and deep water is close enough to shore to allow access by swimmers and snorkelers. Piñeros Island is heavily vegetated, hindering access to the interior of the island. The shoreline of Cabeza de Perro Island offers no areas suitable for landing watercraft. The Cabeza de Perro Island shore is steep and rocky, making access to the island interior difficult from the water.

The islands are in a tropical climate, so movement of MEC by frost heave is not a concern. Rainfall is plentiful, but heavy vegetation on both islands limits the amount of erosion.

Lagoons located on Piñeros Island, along with an extensive mangrove swamp, collect surface water runoff from portions of the island. Surface water from much of Piñeros Island, and all of Cabeza de Perro Island, that does not infiltrate the ground surface runs off into the ocean. The potential presence of groundwater resources on the islands has not been evaluated, but there are no potential groundwater uses on either island.

D.2.3 Release Profile

The Release Profile describes the movement and extent of contaminants in the environment. Typical profile information includes contaminants and media of potential concern and migration routes and mechanism for MC.

Movement of MEC is expected to be negligible. Frost heave is not a factor in the site's tropical environment, and erosion is expected to be minimal due to the heavy vegetation across the islands. Contact with MEC would have to occur at current MEC locations.

There is a potential for MC to migrate from source locations. Migration of MC would most likely occur during periods of precipitation by surface water runoff and infiltration into the subsurface environment.

D.2.4 Land Use and Exposure Profile

The Land Use and Exposure Profile provides information used to identify and evaluate the applicable exposure scenarios, receptors, and receptor locations. Typical profile information includes receptors associated with current and reasonable future land use, types of current or future activities at the site, beneficial resources, resource use locations, and demographics of the site and surrounding area.

D.2.4.1 Land Use

Piñeros and Cabeza de Perro Islands are currently owned by the Department of the Navy, which anticipates turning ownership over to the Commonwealth of Puerto Rico in the near future. There are no known plans for private ownership or development of either island.

Both islands are off-limits to the public, but nearby residents are known to collect land crabs on the western end of the Piñeros Island and snorkelers have been seen offshore. Beaches on Piñeros Island have also been reported to be visited occasionally by passengers on boats sailing in the area.

Cabeza de Perro Island is occasionally accessed by members of the U.S. Coast Guard for the purpose of performing maintenance on a light tower that is located on the island.

D.2.4.2 Potential Receptors

Potential human receptors on Piñeros Island are unauthorized visitors who collect land crabs on the western end of the island and visit the beaches on the island. Snorkelers may also be considered potential receptors if they snorkel to the sea floor in the suspected underwater demolition areas.

Potential human receptors on Cabeza de Perro Island are the U.S. Coast Guard employees who visit the island to perform maintenance on the light tower located there.

Potential environmental receptors on both islands include any wildlife that may contact MEC or MC. Sea turtles nesting on the Piñeros Island shoreline are also potential receptors of any MEC that may be located there.

D.2.4.3 Demographics

Piñeros and Cabeza de Perro Islands are uninhabited and there are no plans for development of either island.

D.2.5 Ecological Profile

The Ecological Profile describes the natural habitats of the site and ecological receptors in those areas. Typical profile information includes habitat types, degree of disturbance of the site, identification of ecological receptors, and relations of any releases to potential habitat areas.

D.2.5.1 Biological Resources

Eight vegetation cover types are found on Piñeros Island: upland forest, dry coastal forest, Leucana woodland, Leucana thicket, mangrove forest (includes salina), vine thicket, beach strand, and cocopalm plantation (E&E,1992).

Upland forest, found on approximately 95 acres (31%), is the most common vegetation type on Piñeros Island. It is most common in the central portion of the island, especially on relatively steep (greater than 15%) slopes where historical disturbances to vegetation were minimal.

Coastal dry forest is found on approximately 29 acres, or 9%, of Piñeros Island. It is found along the windswept eastern coast of the island to an elevation of approximately 60 feet above MSL.

Leucana woodland and Leucana thicket are found on approximately 48 acres (15%) and 5 acres (2%), respectively. These vegetation types are found in areas that have been disturbed by clearing activities, primarily in the north-central and southeast portions of Piñeros Island. Leucana woodlands are found in the areas that were cleared in the early 1940s.

Mangroves cover 83 acres (28%) of Piñeros Island. The greatest expanse of mangrove is located in the southwest quarter of Piñeros Island. Additional areas of mangrove are located around the two brackish lagoons in the northeast section of the island.

The vine-thicket vegetation type consists of previously disturbed areas where saplings and woody vines predominate, contributing to a dense jungle community. Vine-thicket type

vegetation is found on approximately 12 acres (4%) of Piñeros Island, primarily in the southeastern portion of the island.

Beach strand and beach scrub vegetation covers approximately 16 acres (5%) of Piñeros Island. This vegetation type is found, to varying extents, wherever a sand beach fringe exists around the island. It is not found on the southeast coast, where red mangroves face the sea, or at various points around Piñeros where rocky headlands meet the sea.

Cocopalm (Cocos nucifera) plantation covers approximately 0.95 acre (<1%) of Piñeros and is located entirely in a single pocket along the western portion of the north coast. Cocopalm dominates the shrub, sapling, and overstory layers. The canopy is dense and ruches a height of 30 to 40 feet. The understory is moderately open. This area was likely planted with cocopalms by humans at some time during its history to serve as a food source and has since perpetuated through natural reproduction.

Only three vegetation types are found on Cabeza de Perro Island: prairie, open woodland, and beach strand. Prairie is found on approximately 23 acres (78%); vegetation is comprised of dense grasses to a height of 1.5 meters. Beach strand is found on approximately 2 acres (6%); it is much less extensive on Cabeza de Perro than on Piñeros, however, because much of Cabeza de Perro is surrounded by rocky shores and headlands. Open woodland is found on approximately 3 acres (8%); its distribution is limited to the leeward-facing slopes on the west side of the island.

D.2.5.2 Threatened and Endangered Species

Terrestrial Species

Terrestrial Vegetation

Vegetation surveys were conducted on Piñeros and Cabeza de Perro islands as part of a draft Environmental Assessment (E&E 1992) to document the occurrence and distribution of rare plant species. Three plant species that are categorized as species of special concern by the Puerto Rico Natural Heritage Program were listed as occurring on Piñeros Island: *Maytenus cymosa*, *Malphigia linearis* (Stingingbush) and *Ziziphus rignonii*.

Maytenus cymosa is widely distributed on Piñeros Island within the upland forest, dry coastal forest, and in the Leucana-mixed woodland. It is especially abundant on the east-facing slope of the highest hill on Piñeros Island and in forested areas of the northwest portion of Piñeros Island.

The area to be cleared will be surveyed by a qualified botanist to determine whether any Maytenus cymosa occur in the proposed work area. Any plants found will be clearly indicated with conspicuous flagging and avoided during the clearing activities.

Ziziphus rignonii and *Malphigia linearis* were not located on either Piñeros or Cabeza de Perro islands during the quarterly field surveys conducted as part of the draft Environmental Assessment.

Terrestrial Wildlife

Table D-1 lists the threatened and endangered wildlife species either found or identified as having the potential to occur on Piñeros and Cabeza de Perro Islands based on the 1992 EA (E&E 1992). However, discussions with the U.S. Fish and Wildlife Service on January 9, 2006, confirmed that no federally protected terrestrial species currently occur on these

islands. The West Indian Whistling Duck is protected in the Commonwealth of Puerto Rico and is known to occur on Piñeros Island.

TABLE D-1
Rare, Threatened, and Endangered Terrestrial Animal Species Potentially Occurring on Piñeros & Cabeza de Perro Islands
Work Plan for the Preliminary Assessment/Site Investigation
Piñeros & Cabeza de Perro Islands, Naval Activity Puerto Rico

Species	Status	Notes
Birds		
Brown Pelican	Federal Endangered	Observed Feeding and Roosting on both islands
West Indian Whistlling Duck	Locally Protected	Observed in lagoon on Piñeros island
Roseate Tern	Federally Threatened	Observed feeding at Piñeros Island
Yellow-Shouldered Blackbird	Federally Endangered	May occur, not confirmed
Reptiles		
Puerto Rican Boa	Federally Endangered	May occur on Piñeros Island, not confirmed
Virgin Islands Tree Boa	Federally Endangered	May occur on Cabeza de Perro, not confirmed

Additionally, most bird species that occur on Piñeros and Cabeza de Perro Islands are protected under the Migratory Bird Treaty Act, even if not listed as threatened or endangered. This is true of all wading birds, shorebirds, raptors, and sea birds that occur on the islands, and many of the ducks and passerine birds.

Marine Species

The presence of threatened or endangered marine species was evaluated during the draft Environmental Assessment (E&E 1992). The draft Environmental Assessment reported that threatened or endangered marine species whose ranges extend around Piñeros and Cabeza de Perro islands included the West Indian manatee (*Trichechus manatus*) and the green, hawksbill, loggerhead, and leatherback sea turtles. There were no direct observations of threatened or endangered marine wildlife species on Piñeros during the marine surveys, but a green turtle (*Chelonia mydas*) was observed approximately 0.5 mile from Piñeros Island. The draft Environmental Assessment report that evidence of herbivory was found within the seagrass beds along the southern coast of Piñeros Island, but the species of herbivore that had grazed there could not be identified.

The sea turtle species identified above have the potential to utilize the marine environment near the beach area and also the shoreline during nesting. Evidence of sea turtle foraging has been found off the northwestern coats of Piñeros Island. Sea turtle nesting may occur from March through November. Two beaches on northern side of Piñeros Island have been determined to be suitable for sea turtle nesting and work is planned for one of these beaches (in the northwestern corner of the island).

Discussions with the U.S. Fish and Wildlife Service identified the hawksbill sea turtle (*Eretmochelys imbricata*) as the only federally protected species that could occur on Piñeros

Island. This species nests in dense vegetation landward of the beach, with the peak of the nesting season from June through December.

The National Oceanographic and Atmospheric Agency (NOAA) Fisheries Service registered elkhorn (Acropora palmata) and staghorn corals (Acropora cervicornis) as threatened on May 9, 2006, with official listing effective 30 days after. The draft Environmental Assessment reported both species as present on the reefs offshore of Pineros Island.

D.2.5.3 Cultural Resources

A limited cultural resources survey was conducted as part of the draft Environmental Assessment (E&E, 1992); the results of that survey are summarized in this section.

The cultural resources survey located and identified three types of cultural resources on Piñeros Island: a sparse shell ridden, a prehistoric flake find, and the remains of a historic World War II military complex. Only one type of cultural resource was located and identified during the survey on Cabeza de Perro Island: the remains of three military structures.

It is highly likely that the large-scale excavations, grading, and filling associated with the construction of the military complex and contemporary training maneuvers subsequent to its abandonment have obliterated the remains of extant cultural resources, particularly prehistoric ones. No surveyed portion of the island appeared to be undisturbed.

D.3 Pathway Analysis

Information from the profiles in Section D.2 is used to identify actual, potentially complete, or incomplete source–receptor interactions for the site for both current and reasonably anticipated future land use. An exposure pathway is the course a chemical or physical agent takes from a source to a receptor. For MEC, each pathway must include a source, access, activity, and a receptor. For MC, each pathway must include a source, an exposure medium, an exposure route, and a receptor. Sources are those areas where MEC or MC has entered, or may enter, the physical system. Interaction describes ways that receptors come into contact with a source. Typically, movement of OE is not significant, and interaction will occur only at the source area, limited by access and activity. A receptor is a human or ecological organism that contacts a chemical or physical agent. The pathway evaluation considers both current and reasonably anticipated future land use.

D.3.1 Source Media

Due to the widespread extent of military training activities on Piñeros and Cabeza de Perro Islands, nearly all of both islands can be considered potential source areas for MEC. Potential source areas for MC may include surface soils in all areas on both islands, as well as surface water and sediment in the lagoons on Piñeros Island.

D.3.2 Receptors

As previously discussed, any current interaction with either island is unauthorized, but unauthorized access has occurred and future land use may allow limited public access to certain parts of Piñeros Island. Potential human receptors under current and reasonably

anticipated future land use may include land crabbers, inland visitors, beach visitors, and nearshore snorkelers and divers.

Land crabbers

Trespassers have been reported to illegally access Piñeros Island to collect land crabs. Evidence of illegal land crabbing has been reported on the western portion of Piñeros Island, and crab traps have been found near the eastern beach on the northern side of Piñeros Island.

Inland Visitors

Under current use conditions, inland visitors (with the exception of land crabbers discussed above) are expected to be rare because dense vegetation and the lack of trails through the jungle are expected deter access any areas beyond the beaches of Piñeros Island. Trespassers on Piñeros Island would likely visit the interior of the island only because they have knowledge of the WWII-era bunker; trespassers would be attempting to access the bunker and would be unlikely to be randomly exploring other areas of the island.

Heavy vegetation and rocky outcrops are likely deterrents to any type of access to Cabeza de Perro Island.

Under future use conditions, inland visitors would include visitors hiking on the proposed bunker trail connecting the north and south sides of Piñeros Island. Hikers leaving the established trail are expected to be a rare occurrence due to the dense vegetation on Piñeros Island.

Beach Visitors

Although access to Piñeros and Cabeza de Perro Islands is currently prohibited, occasional use of the beaches on Piñeros Island has been reported. Under future land use conditions, access is expected to continue. Such access is likely to remain low under either scenario because the reefs surrounding Piñeros Island limit access to small boats with shallow drafts.

Cabeza de Perro is surrounded by rocky outcrops and does not offer beaches that would present a likely destination to boaters in the area.

Snorkelers/Divers

Snorkelers and divers have been reported to visit the reefs near Piñeros Island. There are no physical barriers to snorkelers and divers, but the number of visitors is likely to remain low due to the limited extent of these reefs.

D.3.3 Routes of Exposure

Receptors at the site may come into contact with the source materials (MEC) through direct contact (e.g., picking up an item, inadvertently kicking an item). Currently this interaction would result from unauthorized access to the island; however, future land use may include interaction by recreational users if limited access is allowed on beaches and trails on Piñeros Island.

There are currently no man-made physical barriers to restrict site access. Signs warning that the site is off-limits to the public are in place on two Piñeros Island beaches, and dense

jungle vegetation acts as a natural deterrent to those who would try to access the interior of Piñeros Island. The steep, rocky shoreline of Cabeza de Perro limits the likelihood of public access to that island.

Movement of MEC is typically not significant. Movement through natural processes, such as erosion, is expected to be minimal or non-existent. Movement from human activity is possible if unauthorized visitors were to pick up MEC and move it to a different location. However, as stated above, the islands are off-limits to the public, and natural barriers (heavy vegetation on Piñeros Island and a steep, rocky shoreline on Cabeza de Perro Island) act as deterrents to those who would try to access the interior of either island where MEC is more abundant.

This section evaluates routes of exposure through which the potential receptors identified above may come into contact with the potential source media. The exposure routes are discussed in terms of each potential receptor.

Land crabbers

Land crabbers could potentially come into contact with MEC that may be present on the land surface at Piñeros Island.

Land crabbers could potentially come into contact with MC through dermal contact with contaminated surface soil. Dermal exposure to surface water and sediment is not anticipated as the land crabbers are unlikely to wade into the lagoons or mangrove swamps. Ingestion is not an anticipated exposure route for any media.

Inland Visitors

Inland visitors could potentially come into contact with MEC that may be present on the land surface at Piñeros Island.

Inland visitors could potentially come into contact with MC through dermal contact with contaminated surface soil. As discussed above, current trespassers would most likely be accessing the interior of the island only to find the WWII-era bunker. Exposure to contaminated surface water and sediment is not likely to occur on Piñeros Island because the lagoons are not near the former or proposed trails to the bunker, and visitors who may find the lagoons would not be expected to wade into them. Ingestion is not an anticipated exposure route for any media.

Beach Visitors

Visitors to the Piñeros Island beaches could potentially come into contact with surface MEC that may be present in the beach areas. Beach visitors could potentially come into contact with subsurface MEC if they dig into the sand.

Beach visitors could potentially come into contact with MC if the beach sand has been contaminated through historic activities. Dermal contact by adults and dermal contact and ingestion by children are possible MC exposure routes for beach visitors.

Snorkelers/Divers

Snorkelers and divers on the reefs near Piñeros and Cabeza de Perro Islands could potentially come into contact with MEC that may be present on the sea floor or on the reef structures.

No MC exposure routes have been identified for snorkelers and divers because MC in the ocean waters around the islands is not considered to be a source media, and dermal contact with sediments on the ocean floor is not likely.

D.4 References

Ecology & Environment, Inc. (E&E). 1992. Draft Environmental Assessment of Training Activities on Piñeros and Cabeza de Perro Islands, U.S. Naval Station Roosevelt Roads. Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia.

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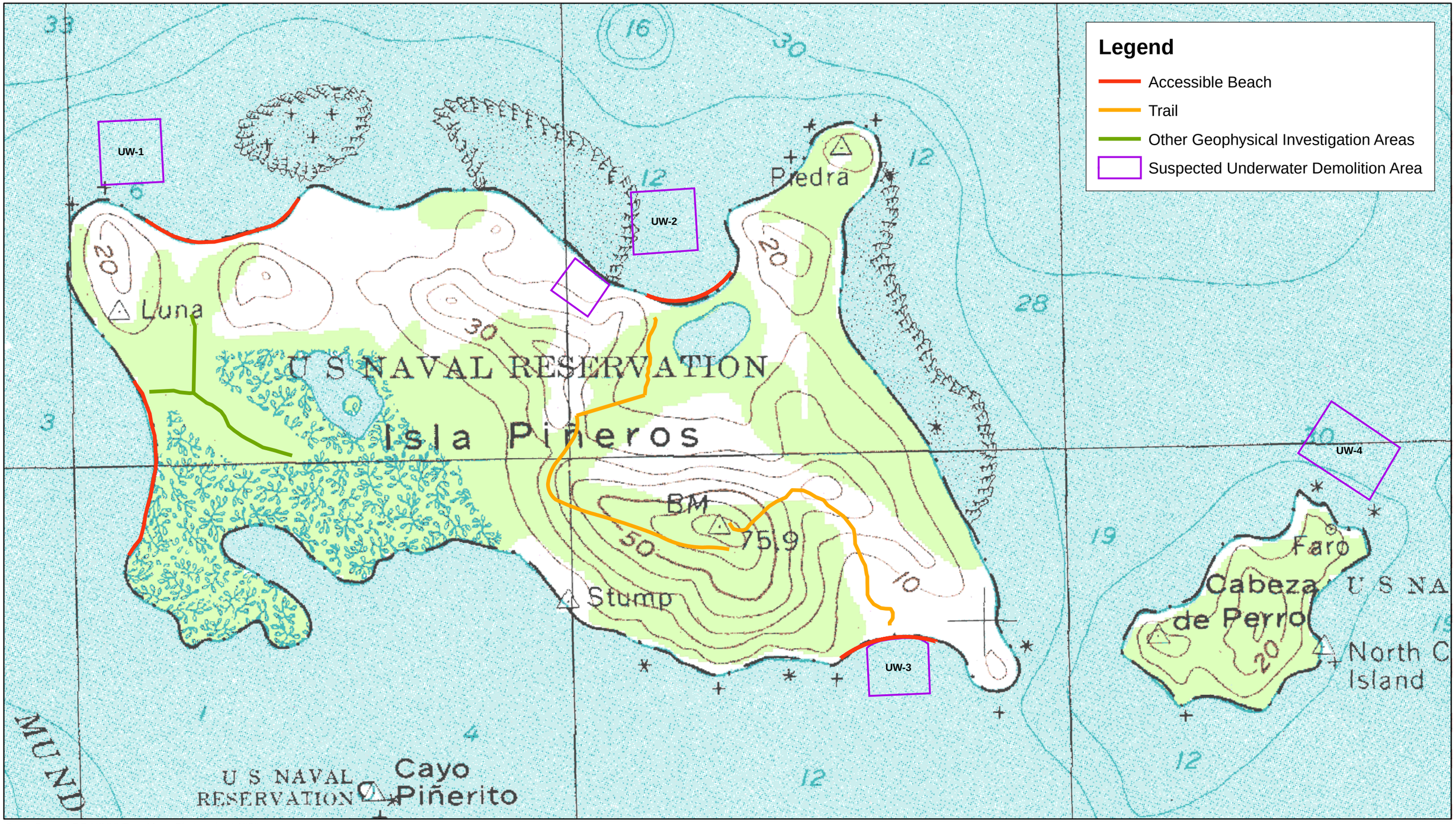
USACE, 2003. Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects; EM 1110-1-1200. Department of the Army, U.S. Army Corps of Engineers, Washington, DC. February 3, 2003.



Punta Puerca, P.R USGS Topo Map - Photorevised 1982

N

500 250 0 500 Feet

1 inch equals 600 feet

Figure D-1

Proposed Investigation Areas

Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

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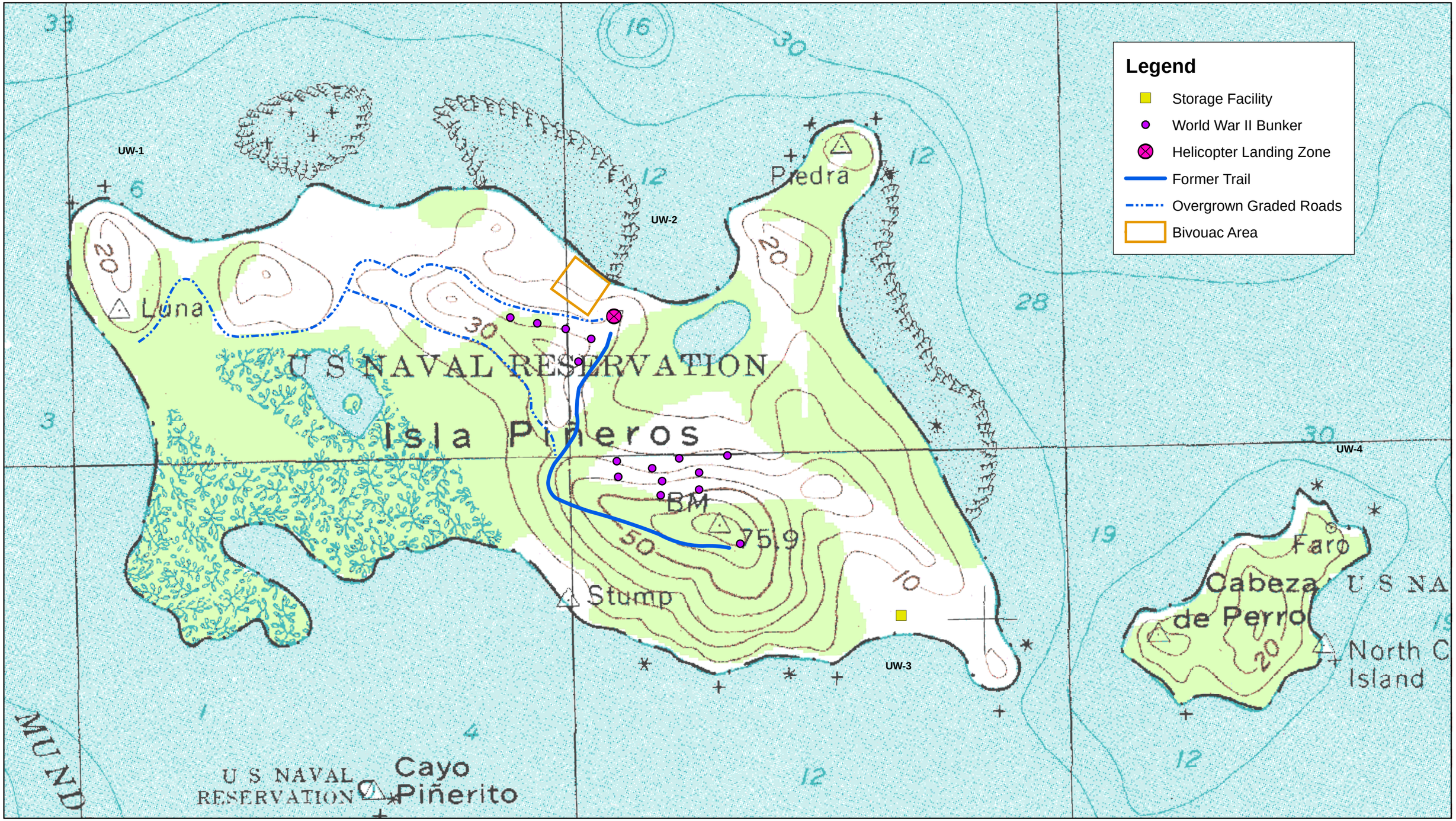

Punta Puerca, P.R USGS Topo Map - Photorevised 1982

N

500 250 0 500 Feet

1 inch equals 600 feet

Figure D-2
Historical Features
Pineros & Cabeza de Perro Islands, Naval Activity Puerto Rico

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Appendix E
Standard Operating Procedures

STANDARD OPERATING PROCEDURE A-1

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Fiberglass measuring tape (at least 200 feet in length)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

   b. Proceed to sample the points on the grid line.

c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of roofs, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Supervisor (FTS). If the FTS concurs, the sampling point will be deleted from the program. The FTS will contact the CH2M HILL project manager (PM) immediately. The PM and Navy Technical Representative (NTR) will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the NTR in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging

down to a depth of about 6 inches, or the depth specified in the workplan.

b. Subsurface soil: Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take a photoionizaton detector (PID) reading of the sampled soil and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP *Decontamination of Drilling Rigs and Equipment*.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with soil removed from the borehole. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Use phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

STANDARD OPERATING PROCEDURE A-2

Surface Soil Sampling

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for obtaining samples of surface soils for laboratory analysis. Soil samples for VOC analysis using the EnCore® sampler should be collected using the procedures in SOP A-3.

II. Equipment and Materials

All or some of the following items will be required, depending on the types of soil samples being collected and the methods being used. Refer to Paragraph III, below.

- Stainless-steel trowel, shovel, scoopula, coring device, trier, hand auger, or other appropriate hand tool
- Stainless-steel, split-spoon samplers
- Thin-walled sampling tubes
- Drilling rig or soil-coring rig
- Stainless-steel pan or bowl
- Sample bottles

III. Procedures and Guidelines

Before sampling begins, equipment will be decontaminated using the procedures described in the appropriate SOP for equipment decontamination, unless pre-cleaned equipment is being used (i.e., single use disposable sampling accessories). The sampling point is located and recorded in the field logbook. Debris should be cleared from the sampling location.

A. Surface and Shallow Subsurface Sampling

A shovel, post-hole digger, or other tool can be used to remove soil to a point just above the interval to be sampled. A decontaminated sampling tool will be used to collect the sample when the desired sampling depth has been reached. Soil for semivolatile organic and inorganic analyses is placed in the bowl and mixed. Soil for volatile organic analysis is not mixed or composited but is placed directly into the appropriate sample bottles. (NOTE: If EnCore® samplers are being used, refer to SOP A-3, *Soil Sampling for VOCs Using the Encore Sampler*.) A stainless-steel or dedicated wooden tongue depressor is used to transfer the sample from the bowl to the container.

The soils removed from the borehole should be visually described in the field log book, including approximated depths.

When sampling is completed, photo-ionization device (PID) readings should be taken directly above the hole, and the hole is then backfilled.

More details are provided in the SOP *Shallow Soil Sampling.*

B. Split-Spoon Sampling

Using a drilling rig, a hole is advanced to the desired depth. For split-spoon sampling, the samples are then collected following the ASTM D 1586 standard (attached). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight (``hammer'') dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. To collect the sample, the surface of the sample should be removed with a clean tool and disposed of. Samples collected for volatiles analysis should be placed directly into the sample containers from the desired depth in the split spoon. Material for samples for all other parameters should be removed to a decontaminated stainless steel tray. The sample for semivolatile organic and inorganic analyses should be homogenized in the field by breaking the sample into small pieces and removing gravel. The homogenized sample should be placed in the sample containers. If sample volume requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from below the sample and compositing the sample for non-volatile parameters only.

Split-spoon samples also will be collected using a tripod rig. When using a tripod rig the soil samples are collected using an assembly similar to that used by the drilling rig.

C. Thin-Walled Tube Sampling

Undisturbed samples may be collected for analysis for geotechnical parameters such as vertical hydraulic conductivity. These samples will be collected using thin-walled sampling tubes (sometimes called Shelby tubes) according to ASTM D 1587 (attached). Tubes will be 24- to 36 inches long and 3- to 4-inches in diameter, depending upon the quantity of sample required. Undisturbed samples will be obtained by smoothly pressing the sampling tube through the interval to be sampled using the weight of the drilling rig. Jerking the sample should be avoided. Once the sample is brought to the surface, the ends will be sealed with bees wax and then sealed with end caps and heavy tape. The

sample designation, data and time of sampling, and the up direction will be noted on the sampling tube. The tube shall be kept upright as much as possible and will be protected from freezing, which could disrupt the undisturbed nature of the sample. Samples for analysis normally are not collected from thin-walled tube samples.

IV. Attachments

ASTM D 1586 *Standard Penetration Test Method for Penetration Test and Split-Barrel Sampling of Soils*

ASTM D 1587 *Standard Practice for Thin-Walled Tube Sampling of Soils*

V. Key Checks and Preventative Maintenance

- Check that decontamination of equipment is thorough.
- Check that sample collection is swift to avoid loss of volatile organics during sampling.

STANDARD OPERATING PROCEDURE A-3

Soil Sampling for VOCs Using the EnCore® Sampler

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for obtaining samples of surface and subsurface soils using the EnCore® Sampler.

II. Equipment and Materials

- The EnCore® Sampler 5g or 25g versions
- Reusable T-handle with a plunger
- 40 mL VOA vial
- 2 oz wide mouth jar

III. Procedures and Guidelines

The sampling point is located and recorded in the field logbook. Debris should be cleared from the sampling location. The EnCore® sampler is being used to collect, store and deliver soil in a sealed, headspace-free state.

A. Surface and Shallow Subsurface Sampling

A shovel, post-hole digger, or other tool can be used to remove soil to a point just above the interval to be sampled. Remove EnCore® sampler from package and attach handle. Quickly collect a 5 or 25 gram sample using the EnCore® sampler. Attach the cap. Fill out a label and attach to sampler.

Ship one EnCore® Sampler per sample location. If low-level analyses are needed, two additional EnCore® samplers will be required. T**he EnCore® sampler has to reach the lab for preservation within 48 hours.** Please refer to the SOP *Packaging and Shipping Procedures* for guidance on shipping.

The soils removed from the borehole should be visually described in the field log book, including approximated depths.

When sampling is completed, photo-ionization device (PID) readings should be taken directly above the hole, and the hole is then backfilled.

B. Split-Spoon Sampling

Using a drilling rig, a hole is advanced to the desired depth. For split-spoon

sampling, the samples are then collected following the ASTM D 1586 standard (see SOPs for *Soil Boring Drilling and Abandonment* or *Logging of Aoil Borings* for this ASTM). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight (``hammer'') dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. To collect the sample, the surface of the sample should be removed with an empty EnCore® Sampler. Samples collected for volatiles analysis should be placed directly into the sample containers from the desired depth in the split spoon.

Split-spoon samples also will be collected using a tripod rig. When using a tripod rig the soil samples are collected using an assembly similar to that used by the drilling rig.

IV. Attachments

None

V. Key Checks and Preventative Maintenance

Check that sample collection is swift to avoid loss of volatile organics during sampling.

STANDARD OPERATING PROCEDURE A-4

Homogenization of Soil and Sediment Samples

I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for VOCs or field GC screening; samples for these analyses should NOT be homogenized.

III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for explosives residues, semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

If samples for VOCs are collected, they should be taken immediately upon opening the spoon and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in the appropriate SOP prior to homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

V. Attachments

None.

VI. Key Checks and Items

- Take VOC samples immediately and do not homogenize the soil.
- Homogenize soil for analyses other than VOCs in a clean, stainless steel bowl.

STANDARD OPERATING PROCEDURE A-5

Sample Shipping

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for shipping samples to the analytical laboratory.

II. Equipment and Materials

- Coolers
- Bubble wrap
- Re-sealable plastic bags
- Ice
- Strapping tape
- Custody seals
- Clear adhesive tape

III. Procedures and Guidelines

Samples collected during field activities will be shipped via an overnight courier to the analytical laboratory or will be hand-delivered daily to the mobile or fixed-base laboratory. A cooler of suitable strength for packaging and shipping of samples will be used and will be manifested to meet U.S. Department of Transportation (DOT) regulations (dangerous goods, etc.). The bottom and sides of each cooler will be lined with bubble wrap or other cushioning material. Each sample jar or bottle will also be individually wrapped in bubble wrap to prevent breakage. All samples will be kept upright in the cooler. Once the samples are in the cooler, any voids will be filled with additional packaging material. Ice will be double-bagged in re-sealable bags and placed in the cooler with the samples. A sufficient amount of ice will be added to the coolers to ensure they arrive at the laboratory at a temperature of 4°C. The chain-of-custody (COC) record will be placed in a watertight plastic bag and taped to the inside lid of the cooler. The cooler will be secured with strapping tape and custody seals will be affixed to the front and back of the cooler. The custody seals will be covered with wide, clear adhesive tape.

IV. Attachments

None

V. Key Checks and Preventative Maintenance

Check that all bags are sealed, that sufficient ice is used, and that the contents match the chain of custody forms.