FINAL
WORK PLAN

Environmental Baseline Survey Culebra Water Ranges – Flamenco Bay Water Area (MRS 03) and Luis Peña Channel (MRS 12)

Culebra, Puerto Rico

November 16, 2012

Prepared under:

Contract Task Order 0003
Contract No. W912DY-10-D-0015

Prepared for:

U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, FL 33207
&
U.S. Army Engineering and Support Center, Huntsville
4820 University Square
Huntsville, AL 35816-1822

Prepared by:

TETRA TECH EC, INC.
1050 NE Hostmark Street, Suite 202
Poulsbo, Washington 98370

Review Signature: M. W. Dollar Date: Nov. 16, 2012

Mark Dollar, Tetra Tech EC, Inc.
Quality Management Representative

This page intentionally left blank.

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS

(Continued)

TABLE OF CONTENTS
(Continued)

TABLES

TABLE OF CONTENTS
(Continued)

FIGURES

APPENDICES

This page intentionally left blank.

ABBREVIATIONS AND ACRONYMS

AP	armor piercing
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
ARPA	Archaeological Resources Protection Act
ASR	Archives Search Report
BIP	blow-in-place
BTM	Benthic Terrain Modeler
CADD	computer-aided design and drafting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CESAJ	Corps of Engineers Jacksonville District
CFR	Code of Federal Regulations
CHIRP	Compressed High Intensity Radar Pulse
CSM	conceptual site model
CTD	conductivity, temperature and depth
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DID	Data Item Description
DNER	Department of Natural and Environmental Resources
DoD	Department of Defense
DR	Daily Report
DTM	digital terrain model
EBS	environmental baseline survey
EE/CA	Engineering Evaluation and Cost Analysis
EEG	Ellis Environmental Group, Inc.
EFH	essential fish habitat
EM	Engineer Manual
EOD	explosive ordnance disposal
EPP	Environmental Protection Plan
ESA	Endangered Species Act
FAR	Federal Acquisitions Regulations
FOL	field operations lead
FTP	file transfer protocol
FUDS	Formerly Used Defense Site
GAMS	GPS azimuth measurement subsystem
GeoTIFF	geo-referenced Tagged Image File Format
GIS	geographic information system

ABBREVIATIONS AND ACRONYMS
(Continued)

GPS	global positioning system
HE	high explosives
HIPS	Hydrograph Information Processing System
Hz	hertz
IHO	International Hydrographic Organization
IMU	inertial motion unit
INPR	Inventory Project Report
kHz	kilohertz
MBE	multibeam echosounder
MC	munitions constituent
MD	munitions debris
MEC	munitions and explosives of concern
MGA	Marine Gradiometer Array
MLLW	mean lower low water
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	Munitions Response Site
NAD83	North American Datum 1983
Navy	Department of the Navy
NHA	National Heritage Area
NHL	National Historic Landmarks Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries Service
NRIS	National Register Information System
OPUS	Online Positioning User Service
PESM	Program Environmental Safety Manager
PHINS	Photonic Inertial Navigation System
PjM	Project Manager (TtEC)
PM	Project Manager (USACE)
PPE	personal protective equipment
PREQB	Puerto Rico Environmental Quality Board
PWS	Performance Work Statement

ABBREVIATIONS AND ACRONYMS
(Continued)

QA	quality assurance
QC	quality control
QCM	quality control manager
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROV	remotely operated vehicle
RTK	real-time kinematic
SHPO	State Historic Preservation Office
SIPS	Sidescan Image Processing System
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
SSS	sidescan sonar
SUXOS	Senior Unexploded Ordnance Supervisor
SVP	sound velocity profile
T&E	threatened and endangered
T&M	time and materials
TBC	To Be Considered
TMP	Technical Management Plan
TPP	Technical Project Planning
TtEC	Tetra Tech EC, Inc.
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
UTC	Coordinated Universal Time
UXO	unexploded ordnance
VCF	vessel configuration file
VHF	very high frequency

This page intentionally left blank.

1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

1.1.01 Tetra Tech EC, Inc. (TtEC) is the prime contractor to the U.S. Army Engineering and Support Center, Huntsville (USAESCH) under Contract W912DY-10-D-0015, Task Order 0003. This Task Order was established to perform a munitions and explosives of concern (MEC) Remedial Investigation/Feasibility Study (RI/FS) of the Culebra Water Ranges, located in Culebra, Puerto Rico. A copy of the Performance Work Statement (PWS) is included as Appendix A.

1.1.02 This project falls under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). The work conducted for this project will be performed in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121; Executive Order 12580; and the National Oil and Hazardous Substances Pollution Contingency Plan. All activities involving work in areas potentially containing material potentially presenting an explosive hazard (MPPEH) will be conducted in full compliance with USAESCH, Department of Defense (DoD), Department of Army, U.S. Army Corps of Engineers (USACE), and local requirements regarding personnel, equipment, and procedures. Activities under this PWS fall under the applicable provisions of 29 Code of Federal Regulations (CFR) 1910.120.

1.2 PROJECT PURPOSE AND SCOPE

1.2.01 The purpose of this phase of the project is to conduct an environmental baseline survey (EBS) for two underwater Munitions Response Sites (MRSs). MRS 03 and MRS 12 are located offshore east and west-southwest, respectively, of the Northwest Peninsula of Culebra, Puerto Rico. MRS 03, also known as the Flamenco Bay Water Area (FUDS Project No. I02PR006803M01), and MRS 12, also known as the Luis Peña Channel Water Area (FUDS Project No. I02PR006812M01), will be referred to herein as Flamenco Bay and the Luis Peña Channel, for consistency. The primary field activities performed during the EBS will include multibeam echosounder (MBE) bathymetry, sidescan sonar (SSS), and underwater video surveys to conduct a benthic terrain and habitat assessment prior to the RI/FS. This work plan addresses activities that will be performed for the EBS, the first phase of the RI. Additional work plans will be developed for subsequent phases of the RI.

1.3 WORK PLAN ORGANIZATION

1.3.01 This work plan has been developed for the EBS and has been prepared in accordance with Data Item Description (DID) WERS-001.01 (Work Plans) and Engineer Manual (EM) 1110-1-4009 Chapter 4 – Work Plans. Additional work plans will be developed for subsequent phases of the RI. The sections that comprise the EBS Work Plan are discussed below.

- Section 1, Introduction, of this Work Plan details the overall scope and objective of the project, presents the organization of the work plan, and presents an overview of the site and its history.

- Section 2, Technical Management Plan, details the organizational structure, lines of authority, and communication of the project team.
- Section 3, Field Investigation Plan, describes the approaches to be taken for the procedures that will be implemented to complete the required field work.
- Section 4, Quality Control (QC) Plan, describes TtEC's procedures for controlling and measuring the quality of work performed, including the organization, responsibilities, and policies to be implemented.
- Section 5, Explosives Management Plan, describes details for management of explosives used to destroy MEC recovered during the project, including acquisition receipt, storage, transportation, and inventory. This plan is not included in this Work Plan for the EBS but will serve as a placeholder section.
- Section 6 describes the Environmental Protection Plan (EPP), which provides general information and lists applicable requirements.
- Section 7, Property Management Plan, describes how property management will be performed.
- Section 8, Interim Holding Facility Siting Plan for Recovered Chemical Warfare Materiel (RCWM) Projects, is not applicable to this project and will serve as a placeholder section only.
- Section 9, Physical Security Plan for RCWM Project Sites, is not applicable to the project and will serve as a placeholder section only.
- Section 10, References, includes a list of references used in the preparation of this Work Plan.

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

- Task Order Scope of Work: The PWS is included as Appendix A.
- Standard Operating Procedures (SOPs): The SOPs were prepared by USACE and are included as Appendix B.
- Points of Contact: Various points of contact are listed in Appendix C to this Work Plan.
- Accident Prevention Plan (APP): The APP is attached as Appendix D of this Work Plan. The APP describes the health and safety procedures, personal protection standards, and environmental health hazards applicable to this project.
- Snorkeling Safety Plan: A Snorkeling Safety Plan is included in Appendix E.

- Contractor Forms: Relevant forms and templates are provided in Appendix F.
- Contractor Personnel Qualifications Certifications Letter: Qualification certifications of key personnel are included in Appendix G.
- Technical Project Planning (TPP) Work Sheets and Documentation: Appendix H contains the TPP Work Sheets, conceptual site models (CSMs) for MEC and MC, and minutes from the TPP meetings.

1.4 PROJECT PROPERTY DESCRIPTION

1.4.01 Culebra Island is located approximately 17 miles east of the island of Puerto Rico and is approximately 9 miles from the Island of Vieques (Figure 1-1).

Figure 1-1. Location Map of Culebra

1.5 PROJECT HISTORY

1.5.01 The Culebra Island Archipelago (including the Northwest Peninsula of Culebra and these two water range MRSs) was used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The southern portion of the Northwest Peninsula of Culebra lies between the two water range MRSs. This peninsula was used as a target for aerial bombing, aerial rockets, strafing, and naval gunfire from roughly 1941 until

1975. Most of the gunfire was indicated to have been fired from ships in the water east of the peninsula and directed at targets on its eastern beach and ridges and plateaus. The upland targets included white painted drums, Sherman tanks, trucks, panels, and circular targets painted on the ground. A movable cable target system was constructed in this area and used for a short time.

1.5.02 The areas between the ridges on the peninsula were used as impact areas for conventional and napalm-laden bombs. Landing practice operations also took place on the beach areas of Flamenco Bay. Some of these exercises were accompanied by the firing of illuminating flares and white phosphorus rounds. Floating target structures may also have been towed off-shore into Flamenco Bay or the waters of Luis Peña Channel and used for training. Most of the munitions discovered to date on the Northwest Peninsula appear to have resulted from naval gunfire, illumination flares, and practice bombs. Since relatively flat trajectory projectiles were typically fired from the ships, it appears unlikely that many rounds fired from the northeast would have impacted on the western slope of the peninsula ridge. However, there may have been overshoots resulting in the potential for MEC in the Luis Peña Channel.

1.5.03 No confirming evidence has been discovered that upland targets were ever placed on the steep western slopes of the peninsula or shoreline areas to the south. The steepness and inaccessibility of these slopes would have made the placement and maintenance of upland targets very difficult. It is also not known with certainty whether floating targets were ever used on the western side of the Northwest Peninsula in the Luis Peña Channel. Naval firing from the west is believed to have been less likely because of the relatively shallow water in many areas and restrictive reefs and small cays. In consideration of these factors, prior MEC investigations in the upland areas of the Northwest Peninsula have focused primarily on its eastern side and northern portion (including the beach and shoreline areas of Flamenco Bay) where evidence of upland targets has been found. The Archives Search Report stated that the TtEC biological dive team observed munitions at Flamenco Beach. This was the only report of MEC or munitions debris (MD) in the water of Flamenco Bay. The Archives Search Report also documented a local scuba dive instructor who said he spotted many underwater ordnance items around Culebra, with the highest concentration in the Luis Peña Channel and water west of Flamenco Peninsula. It was not indicated whether these items were MEC or MD.

1.6 CURRENT AND PROJECTED LAND USE

1.6.01 In 1901, Culebra's public land was placed under Department of the Navy (Navy) control. The Island and adjacent cays were used as impact areas and firing ranges for aerial bombs and rockets, missiles, mortars, small arms, artillery rounds, and naval projectiles by the Navy and U.S. Marine Corps from 1903 until 1975. In 1978, part of the public land was transferred to the Commonwealth of Puerto Rico and the rest to the U.S. Fish and Wildlife Service (USFWS). Lands were transferred to the Commonwealth through a Quitclaim Deed and a Cooperative

Management Agreement signed by the Government of Puerto Rico and the Department of the Interior in 1982.

1.6.02 The Finding and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the DERP-FUDS. However, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS except the Northwest Peninsula, which is not eligible under the 1982 Quitclaim Deed and Public Law 93-166, and the tract that was controlled by the Navy after 1986. The revised area covered by the DERP-FUDS projects for Culebra Island and adjacent cays consists of approximately 8,430 acres. Figure 1-2 shows the DERP-FUDS project for Culebra.

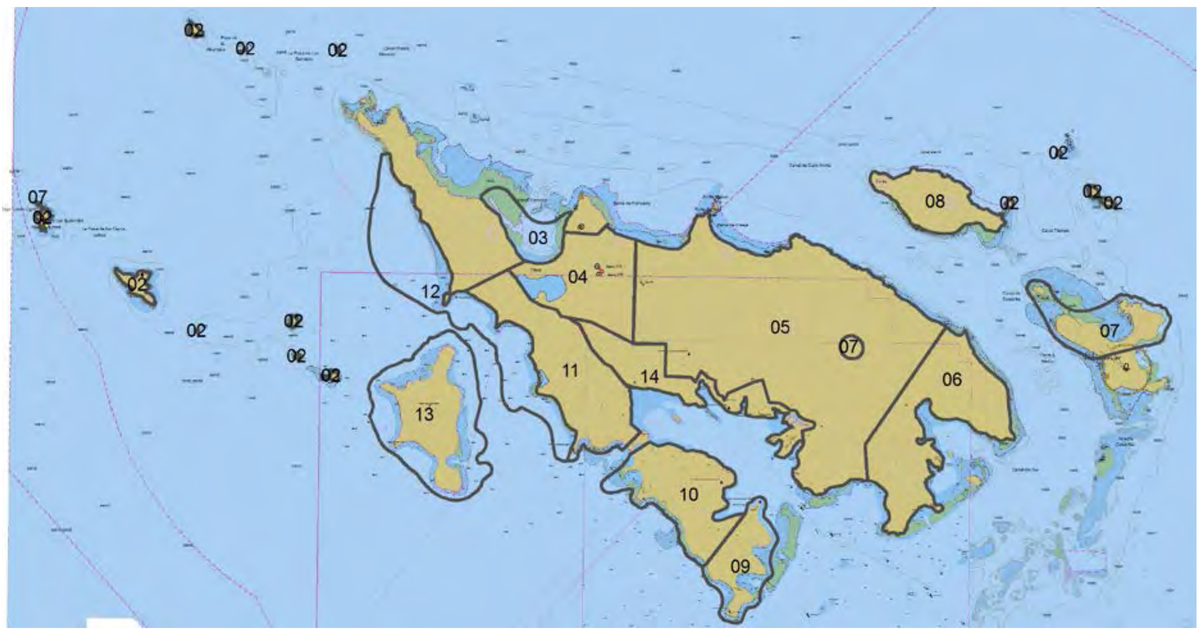


Figure 1-2. DERP-FUDS Projects for Culebra

1.6.03 The objective of DERP-FUDS projects are to reduce risk to human health and the environment and reduce the hazards to public safety presented by military munitions through implementation of effective, legally compliant, and cost-effective response actions. The TPP Team, comprising federal and Commonwealth of Puerto Rico agencies, agreed to conduct underwater water investigations in an effort to gather information that would help to determine the nature and extent of munitions constituent (MC) or MEC contamination on Culebra Island. Tetra Tech will conduct underwater investigations in MRS 03 and MRS 12 to: a) characterize and map benthic habitats within investigation areas; b) determine, identify, and map endangered or threatened species, in particular coral colonies; c) gather the necessary information to determine potential effects (e.g., location of species versus location of suspected MEC) on endangered or threatened species during remedial investigations and cleanup activities; d) determine presence or absence of MC and MEC; e) characterize the nature and extent of MC and

MEC presence; and f) determine if the MC or MEC pose an unacceptable risk to human health and the environment, which would require further considerations or a response action. The first phase, the EBS (the subject of this Work Plan), will address "a" and "b" above. Subsequent work plans will be developed for the following phases to address the additional objections upon completion of the EBS.

1.7 PREVIOUS INVESTIGATIONS

1.7.01 This section summarizes previous investigations conducted at Culebra. The following sections are taken from the Final Site Inspection Report (Parsons 2007) and information provided by the USAESCH.

1.7.1 1991 Inventory Project Report

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

1.7.2 1995 Archives Search Report

1.7.2.01 The Archives Search Report (ASR) was completed by the USACE Rock Island District in February 1995 (USACE 1995) after reviewing available records, photographs, and reports that documented the history of the site. As part of the ASR, a site visit was conducted in October 1994, during which the team identified MD on Cayo Botella, Cayos Geniqui, and Cayo del Agua. In addition, MD was identified on Flamenco Beach, Flamenco Peninsula, and the hillside near Cerro Balcon. The ASR listed several ordnance items verified on site by either explosive ordnance disposal (EOD) personnel or the ASR field team.

1.7.3 1995 Interim Remedial Action

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

1.7.4 1997 Final Engineering Evaluation/Cost Analysis

1.7.4.01 In March 1997, Environmental Science and Engineering, Inc. submitted the *Final Engineering Evaluation and Cost Analysis (EE/CA) for the Former Culebra Island Naval Facility, Culebra Island, Puerto Rico* (ESE 1997). The EE/CA investigation included surface and subsurface sample grids on Flamenco Peninsula, Isla Culebrita, Cayo Botella, Cayo del Agua, Cayo Lobo, and Cerro Balco, where only ordnance-related scrap was identified. Items found included 20 millimeter (mm) high explosive (HE) incendiary devices, Mk76 practice bombs, Mk50s, 37-mm projectiles, 5-inch rockets, 76-mm projectiles, 3- to 6-inch naval projectiles, 81-mm mortars, and a grenade.

1.7.5 2004 UXO Construction Support

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

1.7.5.02 During UXO Construction Support project, Ellis excavated 6,121 holes and recovered 15,479 pounds of scrap metal and 249 UXO items. Fifteen (15) of the 249 UXO items were found within the boundary of the southern portion of the Northwest Peninsula principal area of interest.

1.7.6 2004 Archives Search Report Supplement

1.7.6.01 The ASR Supplement was completed by the USACE Rock Island District as an addition to the 1995 ASR (USACE 2004). This report provides details of aerial training conducted by the Navy between 1935 and 1975 and identifies range/sub-range areas. Of the identified areas, boundaries of the following sub-ranges encompass areas within or adjacent to MRSs 03 and 12:

- Water West: Part of this area in included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Water Center: This area is included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Naval Gunfire Target Area: This range was a naval gunfire and air-to-ground range with its target located on Northwest Peninsula. Munitions included general small arms, .50-caliber small arms ammunition, Mk80s series general purpose bombs, M1 105mm HE, Mk21 8-inch armor piercing (AP), Mk5 16-inch AP, 2.75-inch rockets, and the 11.75-inch Tiny Tim rocket.

- Agua Cay: This area, also known as Water Key, is part of MRS 02 and was used as a target for bombing and rocket fire. Munitions include Mk80 series general purpose bombs and 2.75-inch rockets.
- Air-to Ground North: This target was located at the northern tip of Northwest Peninsula. Munitions used include general small arms, .50-caliber small arms ammunition, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Air-to Ground South: This target was located at the northern tip of Northwest Peninsula. Munitions used include general small arms, .50-caliber small arms ammunition, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.

1.7.6.02 No site visit was conducted in support of the ASR Supplement.

1.7.7 2005 Revised Inventory Project Report

1.7.7.01 A Revised INPR was completed in June 2005 (USACE 2005a). The Revised INPR further clarified the military use of the Island of Culebra and divided the original site, Property No. I02PR0068, into 14 separate MRSs. One hazardous and toxic waste project was identified and assigned the number 00, and 13 MMRP project areas were identified and assigned Risk Assessment Code scores. MRSs 03 and 12 were each assigned as Risk Assessment Code 1.

1.7.8 2005 Supplemental Archives Search Report

1.7.8.01 The Supplemental ASR was completed by the USACE St. Louis District in 2005 as an addition to the 1995 ASR (USACE 2005b). The Supplemental ASR is the source of most of the historical information pertaining to site operations and identified the key areas of focus for the 2007 site inspection. This document provided a detailed summary of military activities conducted on Culebra Island and the surrounding cays. The document summarizes planned and/or executed maneuvers and training conducted at the site, including specific time periods, locations, and munitions used.

1.7.9 Cultural and Archeological Resources

1.7.9.01 The following is taken from the Final Site Inspection Report (Parsons 2007):

> "According to the National Register Information System (NRIS), National Historic landmarks (NHL) list, national Heritage Areas (NHA) list, and national park Service (NPS), there is only one registered cultural resource within the boundaries of the Culebra Island site. On the Isla Culebrita is an historic lighthouse called Faro Isla de Culebritas. The lighthouse is not open to the public due to building deterioration. According to the Puerto Rica State Historic Preservation Office (SHPO), there are no known architectural resources within the boundaries of the Culebra Island site; however, an architectural survey has not yet been conducted for Culebra. An archeological survey performed at

Lower Camp in 1992 found evidence of prehistoric and historic inhabitants distributed over a half-acre area within the Lower Camp site."

1.7.10 2006 and 2007 Underwater Investigations

1.7.10.01 Between 2006 and 2007, several underwater investigations and surveys were performed around Culebra. In 2006, the USACE performed a feasibility study of geophysical methods for offshore military munitions response surveys in the vicinity of Culebra Island. In addition, preliminary underwater video surveys were conducted by USA Environmental in support of their ongoing RI/FS task order to investigate the water areas around MRS 09 (Soldado Point) and MRS 13 (Luis Pena). USA Environmental has teamed with Parsons, another contractor, to perform the underwater investigation around Culebrita (MRS 07) and adjacent cayos (MRS 02). In 2007, Science Applications International Corporation (or SAIC) performed a marine towed array survey, running a series of transect surveys of various bays on the southwest side of Culebra and on all sides of the much smaller island Cayo de Louis Peña.

1.8 INITIAL SUMMARY OF MEC RISK

1.8.01 MEC is a safety hazard and, as such, may constitute an imminent and substantial endangerment to the general public, on-site personnel, and the environment. Numerous MEC and MD items have previously been recovered from Culebra (see Section 1.6), and there is potential for additional items to be present. Members of the public have access to Flamenco Bay and Luis Peña Channel; consequently, there is potential for public access to MEC if present.

1.8.02 Potential MEC at the Flamenco Bay and Luis Peña Channel sites consists of both munitions known or suspected to have been used and the types of MEC and MD that have previously been recovered or observed. Types of munitions anticipated based on the ASR and EE/CA findings include:

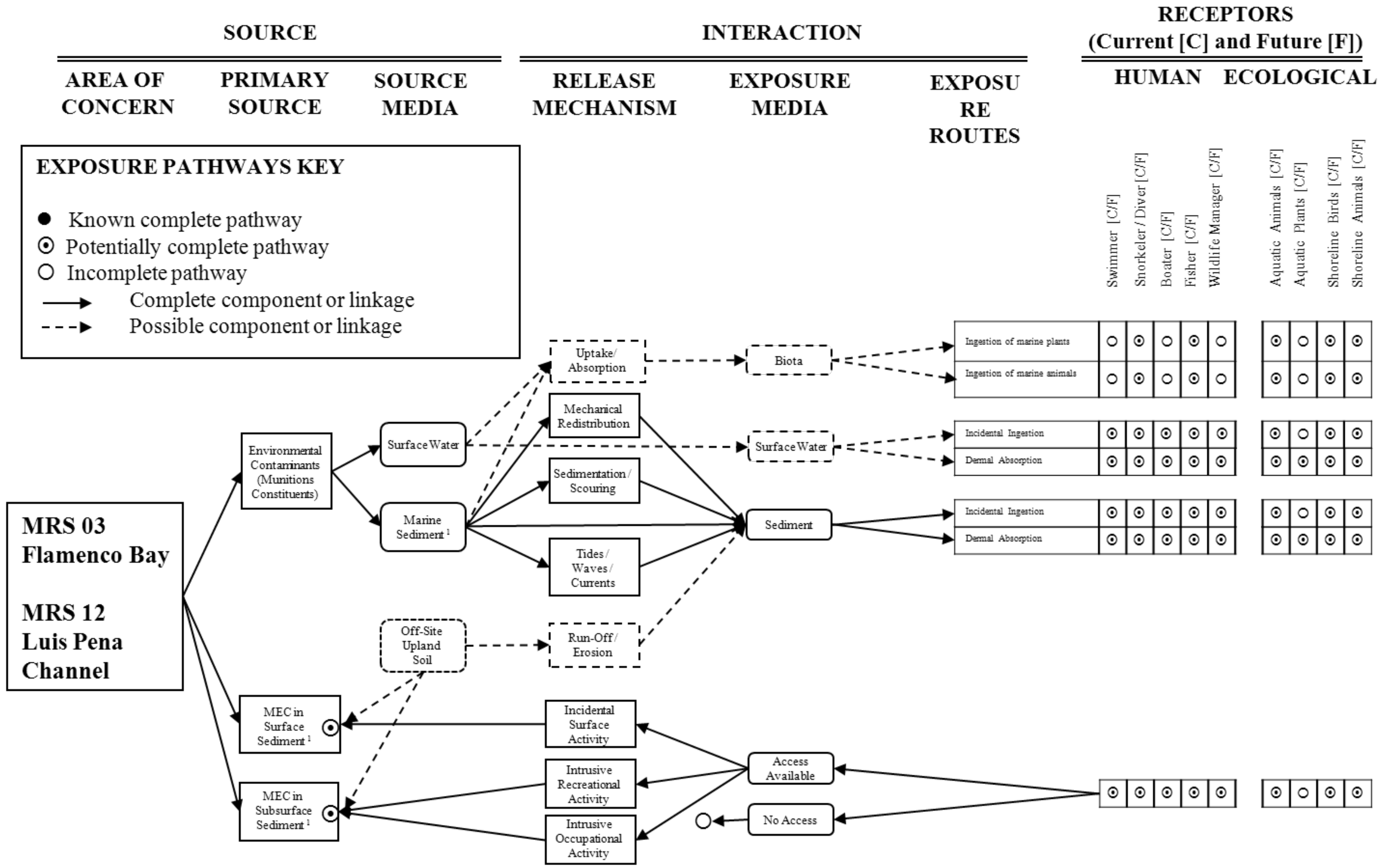
- Small arms ammunition;
- Rockets;
- Grenades;
- Projectiles;
- Artillery;
- Mortars;
- Mines; and
- Various fuzes associated with the above munitions.

1.8.03 All field personnel will be given recognition training on the types of munitions known or suspected to be present prior to commencing any field activities. The EBS includes no intrusive activities, but in the event MEC is encountered, all personnel will be instructed to avoid any physical contact with the item or surrounding terrain, to record its location and associated sensor or imagery data, and provide this information in the report. There is a possibility MC may also be present at the site, although there are currently no data available to make this determination. In certain concentrations and site conditions MC may pose risks to human health or the environment.

1.9 INITIAL CONCEPTUAL SITE MODEL

1.9.01 A CSM is a description of a site and its environment that can be used to summarize potential contamination and the possible human and environmental receptors, and also to focus the investigation. The CSM is a 'living document' based on existing knowledge and updated throughout the course of the project as more data become available.

1.9.02 For the purposes of this RI/FS, initial CSMs have been developed for MEC and MC in accordance with EM 1110-1-1200. Each of these CSMs is presented as a flow chart and shows the potential MEC and MC contamination as well as the receptors that may come into contact with any potential contamination via various media and migration pathways. A CSM summary table has also been prepared to summarize the key information for each MRS, including acreage, potential munitions present and depths, land use, and findings of historical photograph analyses. The CSM summary table and CSMs will be revised based on investigation results and USAESCH, Corps of Engineers Jacksonville District (CESAJ), and stakeholder feedback. As more data are gathered, revised versions will be submitted in subsequent submittals such as the RI and FS reports. The preliminary CSM flow chart and summary table are presented in Figure 1-3 and Table 1-1, respectively, and are included with the TPP documentation in Appendix H of this Work Plan. The CSMs will be presented to the stakeholders during the TPP meetings in support of the RI/FS project.



NOTES:

1 Release mechanisms for MEC include firing (direct hits, overshoots, and undershoots), aerial dropping, or loss/mishandling during beach landing training.

Figure 1-3. Preliminary CSM for Potential Exposure to MEC and MC at the Culebra Water Ranges MRS 03 and MRS 12

Table 1-1. CSM Summary Table

Site	Acres	Site Type	Past DoD Activities	OE-related Items Found Since Closure	Post-DoD Land Use and Current Land Use	PRP Involvement	TPP Recommendations: Geophysical Investigations	TPP Recommendations: MEC
MRS 3 – Flamenco Bay	195	OE	Marine amphibious and other training exercises area. Located immediately adjacent to a former Navy gunfire and bombardment area in use from 1934-1975. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure. Sources include interviews with local residents, camping ground employees, and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Camping Ground and Public Beach.		
MRS 12 – Luis Peña Channel	835	OE	Located immediately adjacent to the Northwest Peninsula bombardment and impact area. Also Marines fired mortars from higher grounds to the beach. Portions of the site were also used as an impact area for barrage mortar firing from boats. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure, specifically in the ocean floor. Sources include interviews with local residents and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Natural Marine Reserve.		

Notes:
DNER – Department of Natural and Environmental Resources
DoD – Department of Defense
MEC – munitions and explosives of concern
OE – ordnance and explosives
TPP – Technical Project Planning
UXO – unexploded ordnance

2.0 TECHNICAL MANAGEMENT PLAN

2.1 INTRODUCTION

2.1.01 The purpose of the Technical Management Plan (TMP) is to provide the approach and procedures that will be used to execute the tasks required to meet the project objectives. This Work Plan has been developed for the EBS phase of the overall project. Field procedures for this phase of the project include non-invasive marine geophysical surveys. The TMP focuses on project objectives, organization, personnel, communication and reporting, deliverables, schedule, billing, public relations, duties and responsibilities, as well as the functional relationship between the different organizations. For this phase of the project, the applicable elements of the TMP will be presented and discussed. Additional and remaining elements of the TMP will be addressed in subsequent work plans for the follow on phases of work.

2.2 OBJECTIVES

2.2.01 The purpose of the EBS is to provide information to help characterize the nature and extent of sensitive marine habitats and species within the boundaries of MRS 03 Flamenco Bay and MRS 12 Luis Peña Channel. The objective of the EBS is to identify areas of sensitive habitat and to determine where towed operations and sampling can be safely conducted. Underwater investigation activities to be conducted as part of the EBS consist of visual observations, boating and snorkeling operations, and remote sensing surveys. No intrusive investigation will be conducted during the EBS phase of the project. This work plan has been developed to describe these underwater EBS activities. The TPP Team will develop and coordinate further investigations based on the EBS results.

2.3 EBS ORGANIZATION

2.3.01 The EBS project organization consists of representatives from TtEC as depicted in Figure 2-1. Appendix C lists the key points of contact for the Task Order under the EBS phase of work. The roles of each of the Project Delivery Team members are described below.

2.4 TETRA TECH EC PERSONNEL

2.4.01 The EBS will be conducted by the personnel outlined below.

2.4.1 Program Management

2.4.1.01 TtEC program management is provided by following individuals:

- The program manager is Kent Weingardt. The program manager is responsible for ensuring contract requirements are met during the performance of the Task Order.
- The program safety manager is Roger Margotto.
- The munitions response program and diving safety manager is Steve Neill.
- The program QC manager is Mark Dollar.
- The lead hydrographer/geophysicist QC manager is Burr Bridge.

2.4.2 Project Manager

2.4.2.01 The Project Manager (PjM), Scot Wilson, is responsible for the strategic and tactical leadership, management, and administration of the Task Order and is supported at the corporate level with health and safety, project controls, quality, finance, procurement, engineering, and environmental and regulatory compliance. The PjM is responsible for the day-to-day management of project activities, monitoring the project budget, updating the status the project schedule, and ensuring project compliance.

2.4.3 Field Investigation Coordinator

2.4.3.01 Fernando Pagés will serve as the Field Investigation Coordinator for the EBS. Fernando is based in Puerto Rico with knowledge of the personnel and resources for effective implementation of the project. The Field Investigation Coordinator is responsible for coordinating EBS resources on-site to support the project field investigation.

2.4.4 Underwater Lead

2.4.4.01 The underwater lead, Robert Feldpausch, will oversee the technical management of the field program. The underwater lead ensures timely resolution of project-related technical, quality, and safety questions associated with in-water survey operations; coordinates and oversees in-water hydrographic and geophysical work performed by TtEC field and office technical staff, including data collection and interpretation; and coordinates preparation and review of hydrographic and geophysical deliverables.

2.4.5 Field Operations Lead / Quality Control Manager

2.4.5.01 The field operations lead (FOL), Richard Funk, is responsible for implementation of the field program. In addition to Richard Funk, the FOL role may alternatively be fulfilled by Cory Graves or Brent Johnston. The FOL oversees day-to-day field operations for hydrographic studies and in-water geophysical mapping and ensures that proper staffing and resources are available on-site, that personnel have reviewed and understand their responsibilities, and that data collection activities are conducted in accordance with the approved plan and cited standards. For the EBS, the FOL will also serve as the field QC manager (QCM) and is responsible for all aspects of data quality. This individual must ensure that data collection procedures and data processing and interpretation procedures are observed and that the resulting data meet the performance specifications in the approved plan.

2.4.6 Hydrographers and Geophysicists

2.4.6.01 The lead hydrographer and geophysicist for this project is Burr Bridge, who will primarily perform quality control and data review offsite. Onsite hydrographer/geophysics duties will be performed by Erin Campbell or Mike Reed under the supervision of the FOL/QCM. Alternate personnel who may perform field hydrography and geophysics tasks include Cory Graves, Brent Johnston, Joanna Hobson, Brian Donahue, and/or Kyle Enright.

Hydrographers and geophysicists are responsible for reviewing and understanding their responsibilities as assigned and for general safety at the project site. They will carry out the daily field activities, which include deployment and operation of survey equipment and acquisition of high-quality survey data under the supervision of the FOL.

2.4.7 Biologists

2.4.7.01 Each team performing underwater investigation work will be accompanied on the boat, but not necessarily in the water, by qualified, trained, and experienced personnel (e.g., biologist, marine biologist, environmental scientist, among others) in order to identify the presence or absence of threatened or endangered species. The primary TtEC field biologist will be Edwin Hernandez-Delgado, Ph.D, with support from Edwin Rodriguez-Class, Ph.D. Both individuals have extensive experience and academic qualifications for observing sea turtles, other marine mammals, and coral and seagrass habitat; they also meet the National Marine Fisheries Service (NMFS) and USFWS requirements for observers and are qualified to provide the endangered species briefings to project personnel. In addition, TtEC has identified a qualified environmental scientist with experience in marine mammal observation, Ms. Maylene Pérez Robles. Training and briefing of project personnel by the project biologist will be completed prior to performing any in-water work.

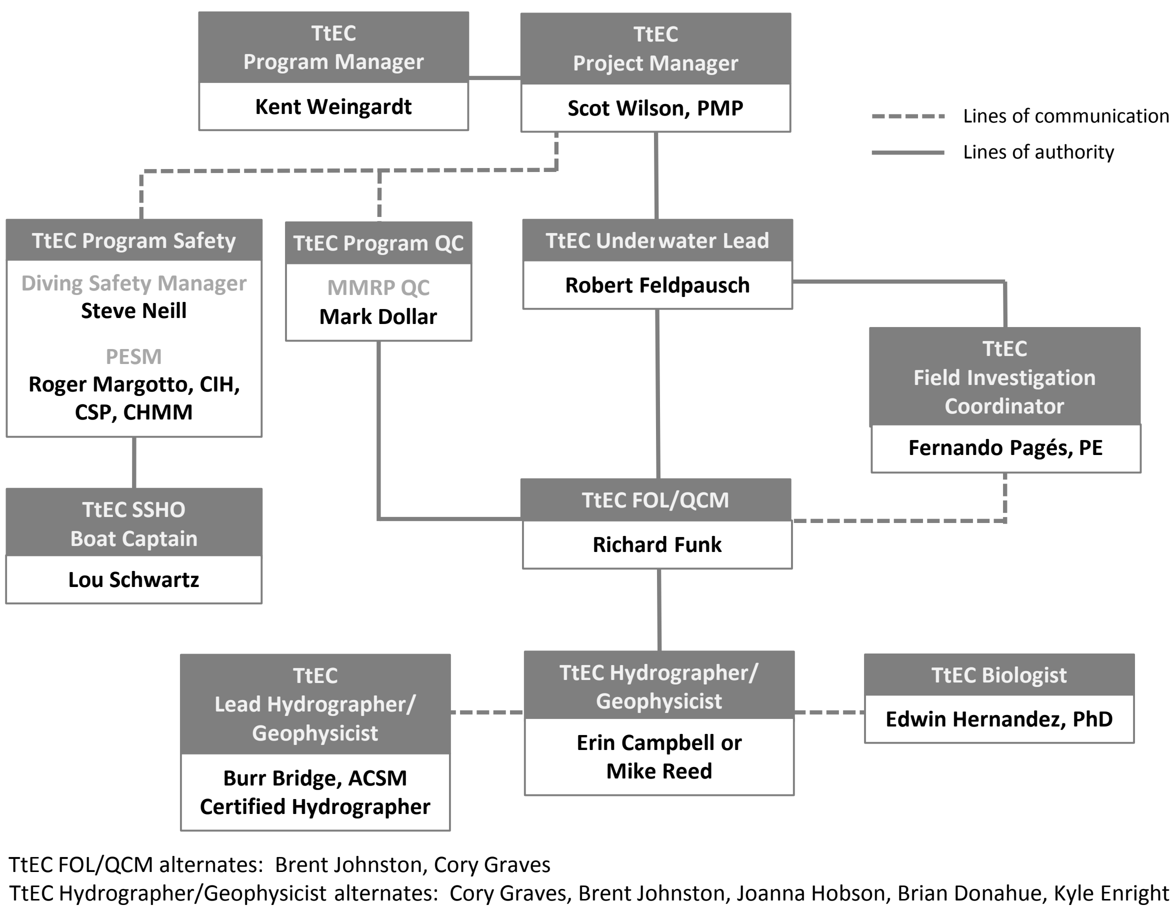


Figure 2-1. Environmental Baseline Survey Organization

2.5 COMMUNICATION AND REPORTING

2.5.1 Recordkeeping

2.5.1.01 All aspects of administering the Task Order must be substantiated by permanent records, such as written correspondence, notes, and photographs. It is essential to summarize important non-written communications with notes covering conferences, telephone calls, and discussions, giving the date, location, parties involved, and important topics discussed. Written correspondence is the most deliberate, as well as the most important, of the three general types of contractual communication (i.e., person to person, telephone calls, and written correspondence). Office Communications and Reporting

2.5.1.02 The TtEC Project Manager is responsible for issuing the following documents throughout the duration of the Task Order:

- Meeting minutes (due 5 business days after a meeting);
- Record of telephone conversations (due with the Project Status Report); and
- Project Status Reports (in accordance with DID WERS-016).

2.5.2 Field Communications and Reporting

2.5.2.01 The following communications will be documented in a chronological communications log maintained by the on-site FOL:

- Each and every occasion MEC is encountered;
- When and why work is stopped for safety reasons;
- Health and safety violations;
- Personnel changes and reason for changes; and
- Any deviations from the approved Work Plan that occur in the field (for example, equipment changes, analysis, or problems encountered).

2.5.2.02 During field work, Daily Reports (DRs) will be completed to detail the personnel on-site, production, equipment, lessons learned, and summaries of safety and QC tasks. During the EBS, the DR will include, at a minimum, weather information at the time of survey, field instrument measurements and calibrations (if applicable), any problems encountered, and any Government personnel directives.

2.6 DELIVERABLES

2.6.01 Project deliverables will meet the schedule requirements of the project and will be prepared in accordance with the applicable DID format referenced in the PWS. Deliverables will undergo internal TtEC technical and QC reviews prior to submittal to other organizations. The primary deliverables for associated with the EBS are:

- Work Plan
- Snorkel Plan
- Environmental Baseline Survey Report

2.6.02 The EBS Report will include items presented in Table 2-1 and summarized in the sections below.

Table 2-1. Summary of Data Deliverables

Version	Product	Format
Draft	Report	Electronic (.pdf)
Draft Final	Report	Electronic (.pdf)
Final	Report	Electronic (.pdf) Paper
	Bathymetry	ArcASCII Grid Fledermaus (.scene)
	Bathymetric Imagery	GeoTIFF
	Benthic Terrain Model Results	GeoTIFF
	Sidescan Sonar	GeoTIFF mosaics, 0.25m (.tif)
	Underwater Video	MPEG (1 copy on DVD[s] or hard drive[s])
	Target List	Shapefile

2.6.1 Environmental Baseline Survey Report

2.6.1.01 TtEC will provide a baseline survey report describing the methods, procedures, and quality checks used to perform the bathymetric, digital video, and habitat assessment portions of the survey. The report will be developed and delivered in advance of conducting the subsequent digital geophysical mapping (DGM). The DGM will be performed with a towfish, except for in very shallow water areas (i.e., depths of less than approximately 4 feet) and in areas where coral heads project within 4 feet of the surface. In many instances, the towfish will be used at the surface of the water. TtEC will evaluate environmental factors such as location, tides, water turbulence, and wave action as well as depth for making the determination for entry by vessel and transect coverage/towfish use to prevent damage to coral reefs or sensitive habitats and to prevent accidental groundings. The report will include the bathymetric survey results, including multibeam imagery, a digital elevation model of Flamenco Bay and the Luis Peña Channel, a Benthic Terrain Modeler (BTM; as described in Section 3.5), and a general description of the bottom and habitat types present in the area. The report text will be provided in Portable Document Format (.pdf) format, data products in the form of maps, and digital data in standard geographic information system formats.

2.6.2 MBE Deliverables

2.6.2.01 A combination of CARIS, Fledermaus Pro, ArcGIS, and TtEC-developed software will be used to generate final data products and to downsample the high-resolution multibeam data into a digital terrain model (DTM), which will be based on a 1-meter grid (or less). The minimum number of points required per grid will be one, ensuring that all data collected would be represented. Any grid cell without a sounding will be shown as a hole, or "holiday," in the data set (unless interpolation is requested). Charts displaying the site bathymetry and mapped features will be generated in the project datum at a scale that will be pertinent for site evaluation.

2.6.2.02 In addition to delivering the final bathymetry chart as described above, the bathymetry data will also be provided as a Fledermaus scene electronic file, with a viewer that allows the data to be viewed interactively in three dimensions.

2.6.2.03 The MBE bathymetry and imagery will be analyzed using ArcGIS BTM tools and other software to determine the boundaries of various bottom types within the survey area, and to help locate any discrete features, such as reefs or coral heads and seagrass beds that may represent protected habitat or listed species. The results of these analyses will be delivered in ArcGIS compatible formats (e.g., geo-referenced Tagged Image File Format [GeoTIFF]).

2.6.3 Sidescan Sonar Deliverables

2.6.3.01 Images acquired on adjacent transects will be merged to produce a geo-referenced mosaic.

2.6.3.02 The SSS data will be produced on a series of maps and as a composite image of the sediment surface (mosaic) in GeoTIFF.

2.6.3.03 All survey documentation will be included with the final delivery of the report.

2.6.4 Underwater Video Deliverables

2.6.4.01 To assist regulatory agencies anxious to review the video collected during the underwater video survey, a password-protected file transfer protocol (FTP) or SharePoint site to which to upload the video files will be established by TtEC as part of data processing and QC. If the USAESCH and USACE Jacksonville determine that providing the regulatory agencies access to the video files (prior to submittal of the baseline survey report) will ultimately benefit the task order, TtEC will create usernames and passwords for the specified regulatory agency representatives to view as authorized visitors to the FTP/SharePoint site and post video to the site as Internet connectivity allows.

2.6.4.02 Underwater video footage will be used to refine and ground-truth the bottom type map developed during analysis of the bathymetry and imagery data. In areas of interest, where for example features are present that could be sensitive habitat, the video will be reviewed and still images will be extracted and inserted into the baseline survey report. Additional video collection, using a remotely operated vehicle (ROV), towed camera sled, and/or a diver using snorkeling equipment, as described in Section 3.3.3, may be necessary to verify bottom type interpretation or feature identification following analysis of the bathymetry and imagery.

2.6.5 Targets

2.6.5.01 While the EBS is not intended to detect munitions, targets of possible MEC identified during acquisition or routine processing of the baseline MBE and SSS data will be compiled into a shapefile with associated images, if appropriate. If a possible MEC target is identified in the video during investigation of sensitive habitat, it will be added to the target shapefile; however, the video will not be reviewed specifically for that purpose.

2.7 SCHEDULE

2.7.01 A project schedule for this phase of the project and associated tasks has been prepared for work planning purposes (Figure 2-2, placed at end of this section for convenience). This schedule will be updated, when necessary, and submitted to USAESCH with the associated progress report. The included schedule is based on the current Draft Work Plan and the anticipated time needed for stakeholder review, TtEC's response to comments and Draft Final and Final Work Plan preparation. Revisions to the project schedule will be included with the project status reports.

2.8 PERIODIC REPORTING

2.8.01 Over the course of the project, periodic reports such as weekly/monthly project status reports and DRs will be required to document project activities. TtEC will prepare these reports in accordance with the PWS, the applicable DIDs, and the project schedule. Specific reports associated with this EBS phase are discussed in Section 2.6 of this Work Plan.

2.9 COSTING AND BILLING

2.9.01 This Task Order was awarded to TtEC as a combination of firm fixed price tasks, fixed unit price tasks, and cost plus fixed fee tasks. The firm fixed price/fixed unit price tasks are billed based on work completed in accordance with the negotiated milestones or accepted unit rates. The cost plus fixed fee tasks are billed based on monthly progress. Milestones will be considered met or completed when the required QC documentation has been submitted, quality assurance (QA) completed, and the submittal is accepted. A milestone payment schedule has been established for this Task Order.

2.10 PROJECT PUBLIC RELATIONS SUPPORT

2.10.01 Site personnel will not disclose any data generated or reviewed during this and each phase of the Task Order and will refer all requests for information concerning site conditions to the CESAJ Project Manager (Tom Freeman) with copy furnished to USAESCH (Roland Belew and Teresa Carpenter). Information gathered by this project is the property of the DoD and distribution to any other source is prohibited.

2.11 FIELD OPERATION MANAGEMENT PROCEDURES

2.11.01 This subsection lists the major field operation components of the EBS. Detailed descriptions and field procedures to be followed during each of these steps are presented in the subsequent chapters and appendices of this Work Plan. Field operations for the EBS are separated into the following primary steps:

- Mobilization
- Equipment setup and instrument validation
- Environmental Baseline Survey
- Demobilization

2.11.02 TtEC will manage and be responsible for all aspects of the field work during the EBS phase of the project. All work will be performed in accordance with the approved EBS Work Plan and project SOPs, adhering to the appropriate level of care and limitations based upon site-specific conditions and work locations (e.g., presence of endangered species, shallow depths, coral and seagrass habitat, beach activities, and turtle nesting activity) to ensure vessel use and entry, use of the towfish array, entry into areas by snorkelers, and staging of equipment on beaches do no harm to these species and resources. The on-site FOL will be responsible for the on-site operations, ensuring project goals are met in a safe and effective as well as environmentally protective manner. As required in this plan and the SOPs, TtEC will coordinate with USACE project management and natural resource agency personnel with NMFS/National Oceanic Atmospheric Administration (NOAA), Puerto Rico Environmental Quality Board (PREQB), USFWS, and Department of Natural and Environmental Resources (DNER) to schedule the work within the MRSs and sensitive habitats areas. TtEC will also coordinate with the USACE contractor USA Environmental who will be performing work in adjacent water areas and MRSs, to ensure there are no conflicts. The field investigation coordinator and the site geophysicist along with the QC manager will be responsible for the management of onsite field data as it is generated.

2.11.1 General Approach

2.11.1.01 The EBS will be conducted within the boundaries of MRS 03 and 12. Upon completion of the EBS and subsequent report, the project team will evaluate the results for use in developing additional project work plans for DGM and intrusive investigation activities. The intrusive investigation will characterize the nature and define the extent of MEC contamination. The results of these investigations will be used to focus the collection of media samples for the MC analysis.

2.11.2 Mobilization

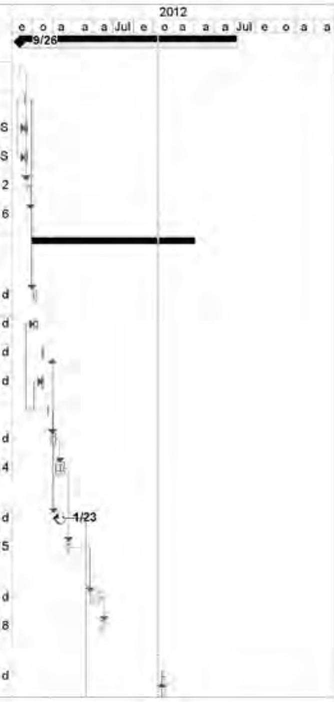
2.11.2.01 Preparation for mobilization will commence prior to receipt of the notice-to-proceed. Upon receipt of the notice to proceed, the field team will be notified, travel and lodging arrangements will be made, and the requisite copies of the applicable project and reference documents will be assembled.

2.11.2.02 Mobilization of the field team and equipment will be conducted based on the sequence of the field tasks. All field personnel will attend site-specific training upon mobilization. The survey team and support personnel will mobilize to the site and establish the field office and support facilities, receive equipment deliveries, and prepare equipment for use. Site preparation activities include establishing support facilities and establishing docking and marine access arrangements, and establishing survey coordinates and parameters. The field crew will complete the installation of survey equipment on the vessels and perform required equipment installations and test prior to the survey.

2.11.3 Environmental Baseline Survey

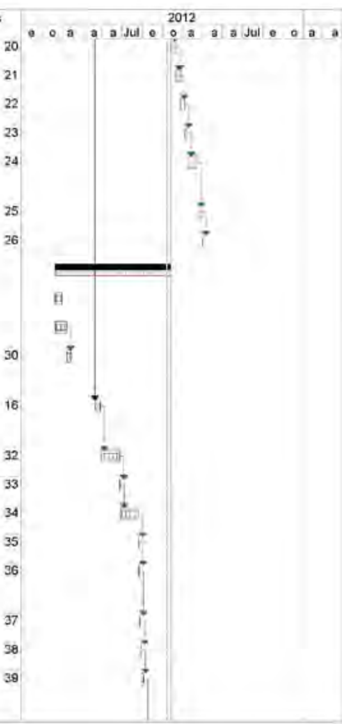
2.11.3.01 Non-invasive marine geophysical surveys will be conducted in Flamenco Bay and Luis Peña Channel extending from 4 feet mean lower low water (MLLW) to the offshore boundary of each site. The EBS will be conducted to evaluate the characteristics of the marine environment and identify endangered species and sensitive areas such as coral reefs that may not be adequately defined. The EBS will be conducted using surface vessel–mounted and/or near surface towed sensor systems and scientific snorkelers to delimit and ensure the preservation of sensitive marine habitats and flora/fauna prior to the use of towed sensors in the water column. A qualified marine biologist under the supervision of the project biologist will be used during the baseline survey to investigate shallow or sensitive habitat areas by swimming with mask, fins, and snorkel to observe and digitally record conditions with a video camera. The baseline survey will also use hull-mounted and towed sensors and video equipment to investigate and document deeper areas of interest. The marine geophysical surveys will include the following remote sensing systems: high-resolution MBE, SSS, and underwater video.

ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
1	**RI/FS Culebra Underwater Ranges**	**467 d**	**Mon 9/26/11**	**Tue 7/9/13**	**54%**	
2	Contract Award	1 d	Mon 9/26/11	Mon 9/26/11	100%	
3	Kickoff Phone Conference	1 d	Tue 10/11/11	Tue 10/11/11	100%	
4	Proposed Schedule	7 d	Tue 10/11/11	Mon 10/17/11	100%	3SS
5	Kickoff Meeting Minutes	7 d	Tue 10/11/11	Mon 10/17/11	100%	3SS
6	Army Contractor Manpower Reporting 1	1 d	Sat 10/15/11	Sat 10/15/11	100%	2
7	Army Contractor Manpower Reporting 2	1 d	Sun 10/16/11	Sun 10/16/11	0%	6
8	**Task 1a, Technical Project Planning (TPP) Phase 1 (EBS Survey)**	**490 d**	**Tue 11/1/11**	**Mon 3/4/13**	**66%**	
9	Organize & Coordinate TPP Meeting	15 d	Tue 11/1/11	Tue 11/15/11	100%	3FS+20 d
10	Pre-TPP Meeting Materials	10 d	Mon 11/7/11	Wed 11/16/11	100%	13SS-14 d
11	AAPP	2 d	Fri 12/2/11	Mon 12/5/11	100%	13FS-14 d
12	Conceptual Site Model	5 d	Thu 12/1/11	Wed 12/7/11	90%	13SS-14 d
13	****Conduct 1st TPP Meeting***	2 d	Mon 12/19/11	Tue 12/20/11	100%	
14	Prepare & Submit for Review Draft TPP Memorandum	14 d	Tue 12/27/11	Wed 1/11/12	100%	13FS+1 d
15	USACE and CX Review & Comment on Draft TPP Memorandum	27 d	Thu 1/12/12	Tue 2/7/12	85%	14
16	****Government Development of Fieldwork SOPs***	56 d	Mon 1/23/12	Mon 4/9/12	100%	13FS+22 d
17	Incorporate Comments, Prepare & Submit for Review Draft TPP Memorandum	10 d	Mon 2/13/12	Wed 2/22/12	100%	15
18	Regulator Review of Draft TPP Memorandum	23 d	Tue 4/24/12	Thu 5/24/12	0%	17FS+2 d
19	Incorporate Comments, Prepare and Submit Final Phase 1 TPP Memorandum	10 d	Fri 5/25/12	Thu 6/7/12	0%	18
20	Conduct 2nd TPP Phase 1 Meeting (EBS Plan)	1 d	Tue 11/27/12	Tue 11/27/12	0%	42FS+15 d



Task Critical Milestone Summary Task Critical

ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
21	Prepare Draft TPP Phase I Addendum	10 d	Wed 11/28/12	Tue 12/11/12	0%	20
22	USACE Review of Draft TPP Phase I Addendum	10 d	Wed 12/12/12	Tue 12/25/12	0%	21
23	Response to USACE review comments	10 d	Wed 12/26/12	Tue 1/8/13	0%	22
24	Project Delivery Team back check	5 d	Wed 1/9/13	Tue 1/15/13	0%	23
25	Regulator Review and Comment on Draft Final TPP Phase I Addendum	23 d	Wed 1/16/13	Fri 2/15/13	0%	24
26	Prepare Final TPP Phase I Addendum	10 d	Mon 2/18/13	Fri 3/1/13	0%	25
27	Acceptance of Final TPP Phase 1 Memorandum	1 d	Mon 3/4/13	Mon 3/4/13	0%	26
28	****Task 2.0 Baseline Survey Workplan***	**250 d**	**Tue 12/13/11**	**Mon 11/26/12**	**98%**	
29	Prepare Baseline Suvey Accident Prevention Plan	15 d	Tue 12/13/11	Mon 1/2/12	100%	
30	Prepare and Submit Draft Baseline Survey Workplan	25 d	Tue 12/13/11	Mon 1/16/12	100%	
31	USACE Review and Comment of Draft Baseline Survey Workplan	10 d	Tue 1/17/12	Mon 1/30/12	100%	30
32	(SOP Delay) Incorporate USACEComments and SOPs, prepare and submit Draft Baseline Survey Workplan	12 d	Thu 4/12/12	Fri 4/27/12	100%	16
33	Project Delivery Team Backcheck	41 d	Mon 4/30/12	Mon 6/25/12	100%	32
34	USACE PM sends to CX for review	1 d	Tue 6/26/12	Tue 6/26/12	100%	33
35	CX Review	40 d	Wed 6/27/12	Tue 8/21/12	100%	34
36	USACE PM Sends CX comments to Contractor	1 d	Wed 8/22/12	Wed 8/22/12	100%	35
37	Contractor addresses CX comments and sends back to USACE	1 d	Thu 8/23/12	Thu 8/23/12	100%	36
38	Project Delivery Team concurence with comments	2 d	Fri 8/24/12	Mon 8/27/12	100%	37
39	Contractor prepares Draft Final Work Plans	3 d	Tue 8/28/12	Thu 8/30/12	100%	38
40	Project Delivery Team Back Check of Draft Final Work Plans	5 d	Fri 8/31/12	Thu 9/6/12	100%	39



Task Critical Milestone Summary Task Critical

Figure 2-2. Proposed EBS Schedule

ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
41	USACE PM sends Draft Final Work Plans to Regulators for review	1 d	Fri 9/7/12	Fri 9/7/12	100%	40
42	Regulator Review and Comment on Baseline Survey Workplan	41 d	Mon 9/10/12	Mon 11/5/12	100%	41
43	Address regulator comments from review and TPP meeting 2	5 d	Wed 11/7/12	Tue 11/13/12	100%	42FS+1 d
44	Prepare Final EBS Work Plan	2 d	Wed 11/14/12	Thu 11/15/12	100%	43
45	Project Delivery Team Backcheck of Final EBS Work Plan	3 d	Fri 11/16/12	Tue 11/20/12	0%	44
46	Approval of Final Baseline Survey Workplan and NTP	1 d	Mon 11/26/12	Mon 11/26/12	0%	45FS+3 d
47	**Task 4, RI/FS Field Activities**	**26 d**	**Fri 11/30/12**	**Tue 12/25/12**	**0%**	
48	Initial Mobilization (Logistics and Site Setup)	4 d	Fri 11/30/12	Mon 12/3/12	0%	46FS+3 d
49	***Task 4a MRS 3 Phase 1 Baseline Survey***	**6 d**	**Tue 12/4/12**	**Tue 12/11/12**	**0%**	48
50	Optional Task 4a1, Bathymetry	4 d	Tue 12/4/12	Fri 12/7/12	0%	48
51	Optional Task 4a2, Side Scan Sonar	2 d	Mon 12/10/12	Tue 12/11/12	0%	50
52	Task 4a3, ROV/AUV	4 d	Tue 12/4/12	Fri 12/7/12	0%	48
53	***Task 4b MRS 12 Phase 1 Baseline Survey***	**11 d**	**Tue 12/11/12**	**Tue 12/25/12**	**0%**	52FS+1 d
54	Optional Task 4b1, Bathymetry	8 d	Tue 12/11/12	Thu 12/20/12	0%	
55	Optional Task 4b2, Side Scan Sonar	3 d	Tue 12/11/12	Thu 12/13/12	0%	
56	Optional Task 4b3, ROV/AUV	8 d	Fri 12/14/12	Tue 12/25/12	0%	55
57	**Task 12, Environmental Sampling and Analysis**	**15 d**	**Mon 12/10/12**	**Fri 12/28/12**	**0%**	48
58	**Task 12c1 Phase I Beach Monitoring*	15 d	Mon 12/10/12	Fri 12/28/12	0%	50
59	**Task 14, Baseline Survey Report**	**140 d**	**Wed 12/26/12**	**Tue 7/9/13**	**0%**	
60	Prepare Draft EBS Report	25 d	Wed 12/26/12	Sat 1/19/13	0%	56

ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
61	USACE Review and Comment of Draft EBSSurvey Report	10 d	Mon 1/21/13	Fri 2/1/13	0%	60
62	Incorporate USACE Comments on Draft Baseline EBS Report	10 d	Mon 2/4/13	Fri 2/15/13	0%	61
63	Project Delivery Team Backcheck	5 d	Mon 2/18/13	Fri 2/22/13	0%	62
64	USACE PM sends to CX for review	1 d	Mon 2/25/13	Mon 2/25/13	0%	63
65	CX Review	10 d	Tue 2/26/13	Mon 3/11/13	0%	64
66	USACE PM Sends CX comments to Contractor	1 d	Tue 3/12/13	Tue 3/12/13	0%	65
67	Contractor addresses CX comments and sends back to USACE	10 d	Wed 3/13/13	Tue 3/26/13	0%	66
68	Project Delivery Team concurence with comments	5 d	Wed 3/27/13	Tue 4/2/13	0%	67
69	Contractor prepares Draft Final EBS Report	10 d	Wed 4/3/13	Tue 4/16/13	0%	68
70	Project Delivery Team Back Check of Draft EBS Report	5 d	Wed 4/17/13	Tue 4/23/13	0%	69
71	USACE PM sends Draft Final EBS Report to Regulators for review	1 d	Wed 4/24/13	Wed 4/24/13	0%	70
72	Regulator Review and Comment on EBS Report	23 d	Thu 4/25/13	Mon 5/27/13	0%	71
73	Address regulator comments from review and TPP meeting 3	10 d	Tue 5/28/13	Mon 6/10/13	0%	72
74	Prepare Final EBS Survey Report	10 d	Tue 6/11/13	Mon 6/24/13	0%	73
75	Project Delivery Team Backcheck of Final EBS Report	10 d	Tue 6/25/13	Mon 7/8/13	0%	74
76	Approval of Final EBS Report	1 d	Tue 7/9/13	Tue 7/9/13	0%	75

Figure 2-2. Proposed EBS Schedule (continued)

This page intentionally left blank.

3.0 FIELD INVESTIGATION PLAN

3.0.01 This section describes tasks that will be performed during the EBS. These tasks will be completed prior to performing the geophysical surveys, which require the use of towed sensors and sediment sampling. The objectives of these tasks are to identify areas of sensitive habitat and to determine where towed operations and sampling can be safely conducted.

3.0.02 The collection of high-resolution bathymetry data in both MRS areas is critical to the success of the subsequent DGM effort that will be conducted as part of the RI/FS. Magnetometer/gradiometer and electromagnetic sensors inherently have very short detection ranges for anything but the largest MEC items. In a marine environment, with a sensor that must be flown on or very close to the bottom to provide useful data, it is absolutely imperative to have a very accurate three-dimensional model of the bottom to avoid damage to the equipment and sensitive marine life, such as corals, during survey operations. Currently, high-resolution multibeam bathymetry is the best available technology that will provide the necessary accuracy and resolution to build this model.

3.0.03 The field investigation will be conducted in three phases: Phase 1, the EBS, to develop basemaps to guide the following phases; Phase 2, the DGM, to provide an assessment of the distribution and density of metallic items and debris fields that may be MEC; and Phase 3, which will be an intrusive investigation. This document describes the plan of work for Phase 1 EBS activities.

3.1 OVERALL APPROACH TO EBS ACTIVITIES

3.1.1 Site Characterization Processes

3.1.1.01 The EBS will be conducted prior to the DGM and intrusive investigations to identify areas of endangered corals/sensitive habitat and to determine where the magnetometer/electromagnetic system can be safely deployed. The EBS will include the following components:

- Bathymetric and bottom type mapping, including acquisition and interpretation of high-resolution MBE bathymetry and imagery.
- SSS data collected to provide high-quality imagery and to augment the MBE and underwater video imagery for bottom type characterization and target identification.
- Underwater video collected concurrently with the MBE and SSS data will aid project geologists, biologists, and MEC specialists with bottom type classification, identification of sensitive habitat, and potential identification of MEC.
- Benthic terrain modeling conducted on the MBE bathymetry using the National Oceanic and Atmospheric Administration's (NOAA's) BTM.

- If necessary, following analysis of the MBE bathymetry and imagery, additional video or visual inspection may be conducted using an ROV, towed video sled, drop camera deployment, and/or diver equipped with snorkeling gear and handheld camera.
- No environmental sampling will be conducted as part of Phase 1.

3.1.2 Measurement Quality Objectives

3.1.2.01 Application of measurement quality objectives developed as part of Phase 1 will ensure high-quality data will be obtained. Table 3-1 provides the measurement quality metrics that will be achieved to ensure project objectives are met.

Table 3-1. Measurement Quality Metrics

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Hydrographic Survey – Multibeam	Precision/ Repeatability	Cross line data	Data points common to both main survey lines and QC cross lines will have x,y,z coordinates that are repeatable within specified USACE Hydrographic Survey standards (refer to Appendix B of the standard, Table 1 [USACE 2002]). Hydrographic Survey data shall meet or exceed Special Order standards.	Minimum 4% of total line plan
	Completeness	Visual evaluation of data real-time for verification that intended coverage goals are met	Real-time coverage plots (i.e., matrix fill) will be utilized to monitor coverage completeness. Along-track coverage, which is a function of vessel speed and ping rate, will be evaluated by calculating the percentage of data obtained at less than 6 knots (i.e., 95% of MBE data were obtained at < 6 kts).	Continuous visual monitoring during data collection
	Sensitivity	Real-time monitoring and use of gains and gate filters, software quality flags	Data collection depth range is optimized to reduce anomalous reflections and provide optimum data, gains are set to provide appropriate bottom tracking. The data acquisition software is used conduct internal testing to check the validity of each ping based on colinearity and brightness and ensure each ping is tagged with a quality flag of 0-3 based on the these tests. During processing, the pings are filtered based on the quality flags to eliminate all but the data with a quality of 3 unless conditions warrant accepting lower quality pings (e.g., where there are topography discontinuities such as wrecks or piles).	Continuous visual monitoring during data collection, sonar system quality flags

Table 3-1. Measurement Quality Metrics (continued)

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Geodetic Equipment	Functionality/ Accuracy	1. GPS Positioning – Survey crew will check selected terrestrial control points with RTK GPS rover. 2. Water level check – Use RTK GPS rover or temporary bench mark at vessel dock to check water surface elevation. Compare to survey system navigation reported tide level. 3. Bar check and/or lead line check vs. water surface relative depth from sonar.	1. RTK GPS measurements will match published position to within 0.1 meters x, y and z. 2. RTK GPS water level and survey system tide level will match to within 0.1 meters. 3. Nadir bathymetry depths relative to surface, corrected for draft and attitude matches to within 0.06 meters.	1. Daily 2. Daily 3. At the start of survey
Sidescan Sonar Survey	Completeness	Visual evaluation of data real-time for verification that intended coverage goals are met.	Real-time coverage plots will be used to monitor coverage completeness.	Continuous visual monitoring during data collection
Sidescan Sonar Positioning	Accuracy	Visual evaluation following collection of first lines.	A feature detected in adjacent lines run in opposite directions will be compared to each other and to the location of the feature in the MBE data to determine towfish positioning accuracy.	At start of survey

Table 3-1. Measurement Quality Metrics (continued)

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Sidescan Sonar Survey	Data Quality/Safety	Maximize data quality while monitoring safety of environment.	To minimize the risk of physical contact with, or potential damage to sensitive habitats, the SSS system will be mounted on the bow of the vessel or towed near the surface just aft of the survey vessel. Existing bathymetry and imagery in the area will be assessed prior to deployment of the SSS system. In deeper water where the towfish will be towed at depth, towfish flight altitude and water depth will be continuously monitored during survey operation. To the extent possible, the towfish will be flown at a constant altitude approximately 10-20 percent of range, unless a risk to habitat or equipment, such as irregular or steep terrain, has been determined. To the extent possible, sonar range will be kept constant at 50 meters.	Continuous
Underwater Video Camera	Functionality	Visual Inspection	Test the camera prior to deployment to ensure that the unit is working correctly.	Daily

Notes:
MBE – multibeam echosounder
QC – quality control
RTK GPS – real-time kinematic global positioning system
USACE – U.S. Army Corps of Engineers

3.2 IDENTIFICATION OF AREAS OF CONCERN

3.2.01 The areas to be surveyed include Flamenco Bay (MRS 03) and the Luis Peña Channel (MRS 12) (Figure 3-1). The TtEC team, which includes local scientists and biologists, have consulted high-resolution aerial imagery and local knowledge sources to delineate known ordnance items and areas of sensitive habitat to minimize risk of impact from survey operations. The maps in Figures 3-2 and 3-3 have been marked with the anticipated survey tracts that will be performed, and project biologists with local knowledge of the MRSs have marked the locations of sensitive habitats, including areas where coral reefs are known to exist.

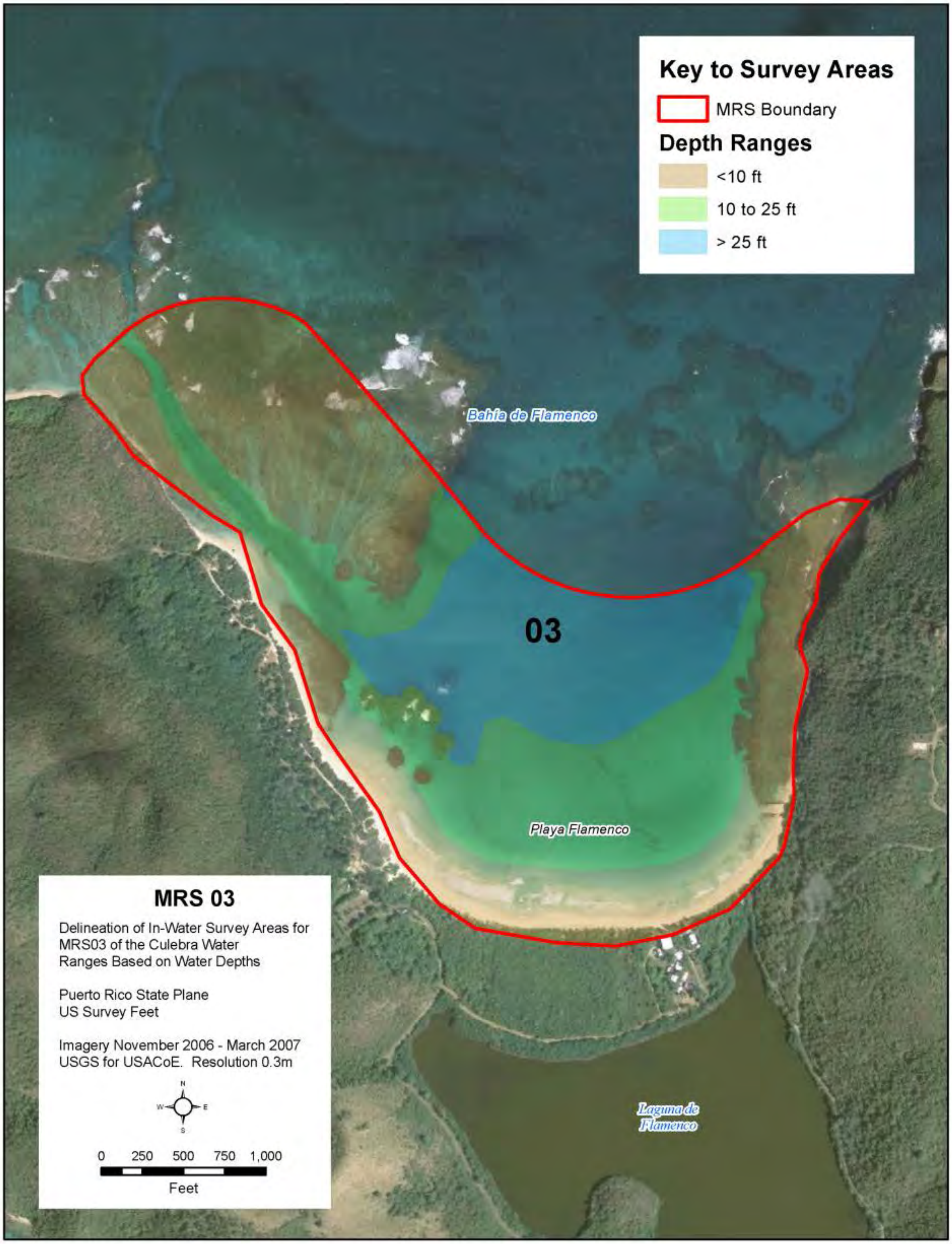


Figure 3-1a. Flamenco Bay Survey Area

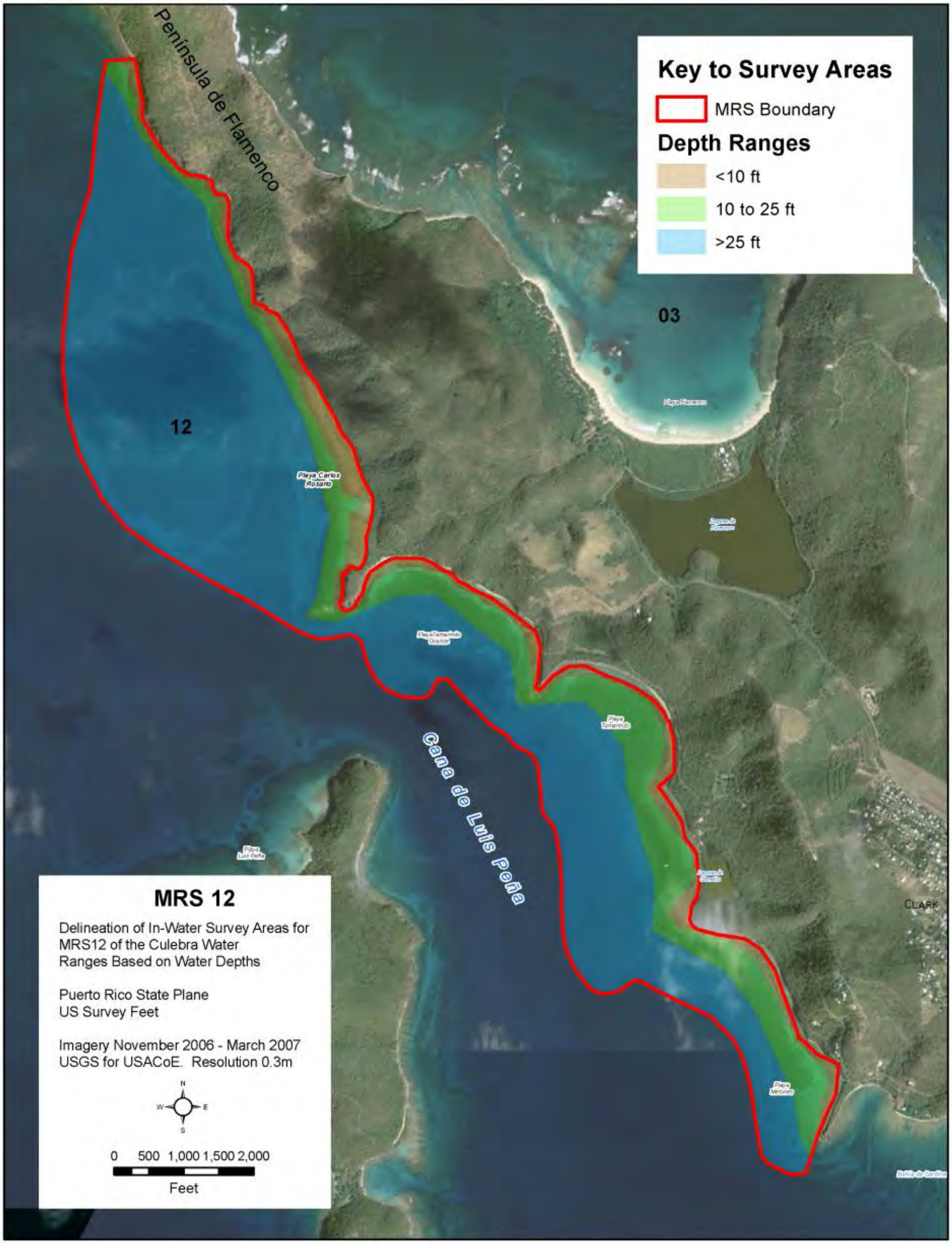


Figure 3-1b. Luis Peña Channel Survey Area

3.2.02 The TtEC team will then perform non-invasive marine geophysical surveys from approximately the 4-foot (~1.2 meter) shallow water limit for vessel operations stated in the SOPs in Appendix B and this Work Plan to the offshore boundary of each site, taking extra care to avoid high-risk areas determined during the existing data review and delineate areas that should be marked for avoidance during the follow-on RI investigations.

3.3 LOCATION SURVEYS AND MAPPING PLAN

3.3.1 Bathymetry Survey

3.3.1.01 The primary objective of the MBE survey is to provide high-resolution bathymetry for the EBS and to guide planning for Phase 2 and 3 operations. High-resolution bathymetric mapping will be conducted to:

- Provide an accurate topographic model to support all subsequent survey and sediment sampling efforts (ensuring review of proposed sample locations by the project biologist so that no coral critical habitat areas are proposed for sampling during the RI);
- Locate potential hazards to the marine towed sensors and survey/sampling vessels;
- Map or delineate features of interest, such as areas of potential sensitive habitat or listed corals, possible debris, areas of sand ripples, and rocky outcrops; and
- Provide detailed bathymetric and depth information to support dive planning.

3.3.1.02 Bathymetry systems will be mounted on surface vessels, minimizing the risk of physical contact with, or potential damage to, sensitive habitats. MBE imagery data will be collected to assist with classification of bottom types and items of interest. Bottom type classification methods from MBE imagery are discussed further in Section 3.6.10.

3.3.1.03 Specific calibrations for the MBE and data collection systems are detailed in Section 4 of this Work Plan and in the quality assurance project plan. Performance standards and acceptance criteria for the calibrations and tests are consistent with the USACE Hydrographic Survey manual (EM 1110-2-1003; USACE 2002) and industry standards will be implemented.

3.3.1.04 Since there have been no previous high-resolution bathymetric surveys of these areas, operational procedures will be employed to ensure that the survey vessel(s) do not run aground and damage sensitive habitats. The bottom of the boat (and its draft), as well as any towfish array or other equipment projecting below the bottom of the boat, will stay a minimum of 4 feet from the top of the coral and the bottom of the channel or bay.

- When approaching shallow waters, the vessel crew will make use of the wide swath of the multibeam sonar to help identify and avoid potential grounding sites by surveying from deeper to shallower areas, and keeping the boat within areas that have adequate depths for safe passage.

- When operating in shallow areas, one of the crew will act as a bow watch, visually checking for shoal areas and communicating with the vessel captain to avoid grounding or hitting coral.

3.3.2 Sidescan Sonar Survey

3.3.2.01 High-quality seabed imagery will be collected concurrently with the MBE and video imagery within the survey areas to aid in bottom type characterization and identification of bottom features of interest detected in the bathymetric and underwater video data.

3.3.2.02 In shallower areas, the SSS system will be pole-mounted or towed near/at the surface to minimize risk to coral heads or sensitive habitats. The decision on depth of deployment of this system will also be based on site-specific MRS characteristics such as tide cycles, high wave action, low visibility, or known proximity to sensitive habitats. In deeper areas and areas that do not have projecting coral reefs, the towfish will be actively flown in the water column to get better quality imagery, but the tow altitude will be kept well above the bottom and/or tops of coral heads (more than 4 feet [~1.2 meters]) as defined by available existing bathymetry data for the area or biologist direction based on observations. The sidescan data, which provide information on towfish altitude, will also be monitored to minimize the risk of physical contact with, or potential damage to, sensitive habitats. To the extent possible, the range setting will be maintained at 50 meters and target altitude will be kept approximately 20 percent of the range.

3.3.2.03 Sidescan range settings will be selected to provide overlap of adjacent track lines to provide full coverage of the survey area. Survey lines were planned based on a range setting of 50 meters; the range will be kept constant to the extent possible.

3.3.3 Underwater Video Survey

3.3.3.01 TtEC will conduct underwater video acquisition as part of the EBS. A video camera system will be mounted on the survey vessel and will collect video of the seabed concurrently with the MBE/SSS. Once the MBE bathymetry and MBE/SSS imagery have been processed, the vessel-mounted underwater video imagery will be used to ground-truth and support bathymetry and imagery derived and developed bottom type classification, and will be used by project biologists to identify specific species of interest within the survey area. If necessary, additional underwater video acquisition or observation/investigation by diver using a mask, snorkel, and handheld camera may be performed to support bottom type classification. Video imagery may be required in areas of deeper water where video imagery may be unclear or where specific features identified in the MBE data need to be further explored. Additional video may be acquired using a camera mounted on the vessel's hull, ROV, a towed camera sled, or by a diver using snorkeling equipment with a hand-held underwater video or digital still camera. Digital video will be used to refine classification derived from the bathymetry terrain, multibeam sonar imagery, and/or aerial photography.

3.3.3.02 The digital video will be geo-referenced using the vessel and/or subsurface navigation systems. Geo-referencing will be achieved using time synchronization with global positioning system (GPS) and/or overlay of GPS data on the video image.

3.3.4 Data Spatial Density

3.3.4.01 Full bottom coverage with the MBE and SSS will be acquired in accessible areas to sufficiently show surface sediment structures and bedforms as well as detect and provide detailed information on the size and shape of significant features such as coral reefs, rock outcrops, debris, or wrecks that may be present. MBE and SSS data will be collected at the site to the shallow water limit of the equipment and survey vessel or to a minimum of 4 feet below the MBE.

3.3.4.02 The site will be surveyed with the MBE and SSS using a line plan that is dependent on water depth and other site constraints. The line spacing will be designed to provide full bottom coverage with both MBE and SSS except in areas not accessible with the survey vessel or equipment; the SSS range will be set to optimize resolution while providing complete coverage, and changes to the sonar settings will be minimized to the extent possible. SSS coverage may be limited by factors such as shallow water or obstructions that are determined to pose a risk to the towed system or environment.

3.3.4.03 While it is anticipated that video data will be collected simultaneously with MBE survey lines, the spacing of these lines will vary with water depth and other site constraints (e.g., presence of coral heads at or near surface, identification of listed coral species). Therefore, the precise density of video data cannot be specified. However, transect spacing for the underwater video survey, if not obtained during the MBE survey, will be adjusted to be not less than approximately 100 feet, water depths and site conditions permitting.

3.3.5 Survey Data Collection Areas and Line Plans

The MRS 3 and 12 survey areas contain zones too shallow and/or dangerous to survey due to the presence of shoals and/or coral. The anticipated areas excluded from vessel operations were determined by both water depth (Figures 3-1a and 3-1b), and by the presence of coral colonies as determined by TtEC field biologist Edwin Hernandez-Delgado, Ph.D., (Figure 3-2).

These anticipated exclusion areas are shown in Figure 3-3 along with a simplified example line plan for the areas. The actual line plan will be developed based on field conditions and the results of the survey as it progresses. Survey operations will generally progress from deeper water into shallower water. The MBE and SSS both provide wide coverage swaths both directly under the survey vessel and to port and starboard (MBE approximately 3 times water depth) and as a result, the survey team is able to plan subsequent survey lines in shallower water to avoid exclusion areas (those areas with water depths too shallow or coral too close to the surface) using data acquired in preceding lines.

0 1,000 2,000 4,000 Feet

Legend
- MRS Boundary
- Reef habitats where Acroporid corals are known to occur through range
- Hard grounds where Staghorn coral (Acropora cervicornis) is likely to occur
- Staghorn coral and Elkhorn coral farms and reef restoration sites

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)
CULEBRA WATER RANGES, CULEBRA, PUERTO RICO
EXPLOSIVES SAFETY SUBMISSION

FIGURE 3-2: MRS 3 AND 12 PRELIMINARY CORAL DELINEATIONS

TETRA TECH

SOURCE: USDA NRCS 1-foot Aerial Imagery (highres1-1_n_s_pr049_2007.sid)

PROJECT NUMBER 44070003

FILE NAME:
Z:\Gdrive\Projects_2012\Culebra\maps\Corals.mxd

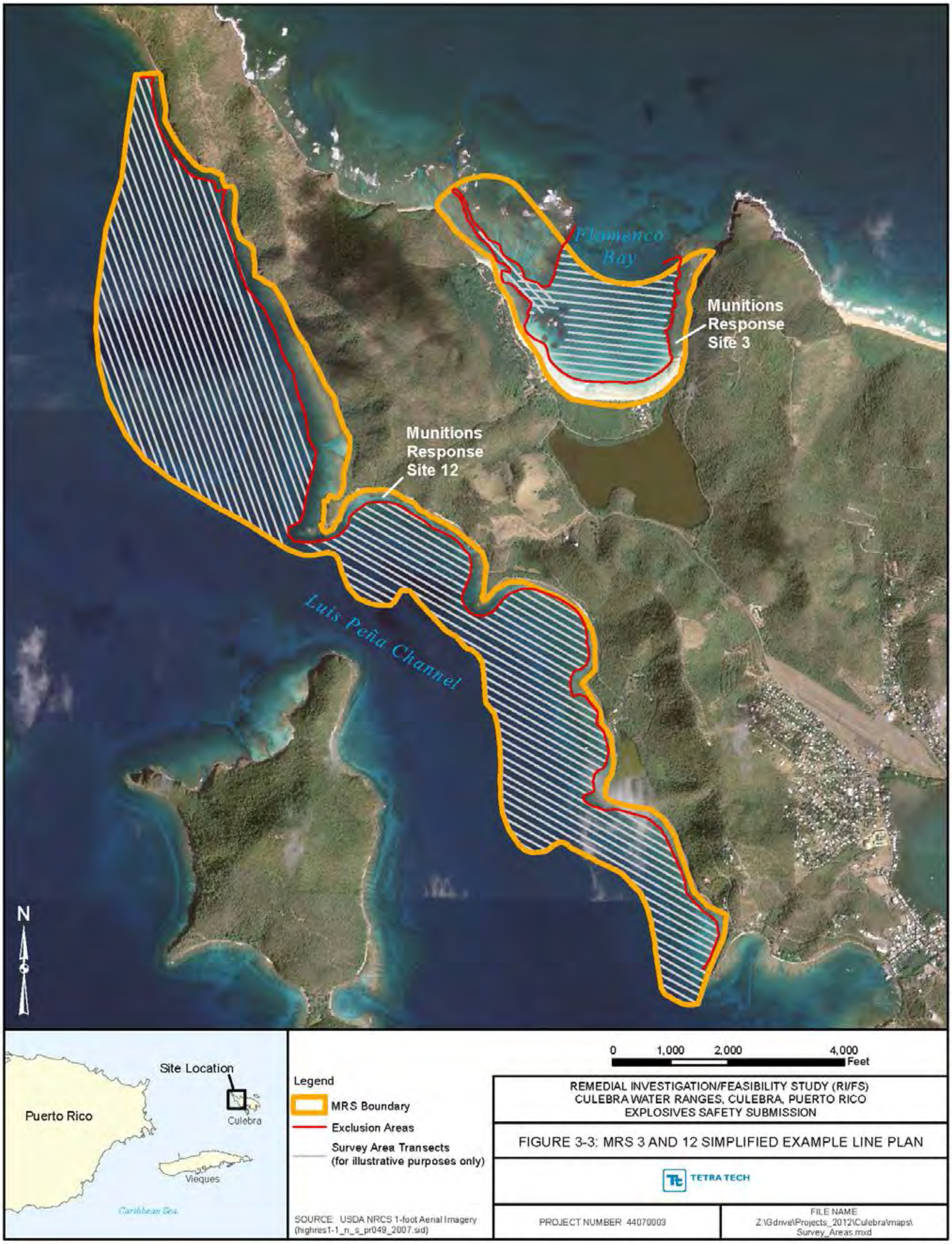


FIGURE 3-3: MRS 3 AND 12 SIMPLIFIED EXAMPLE LINE PLAN

The example and simplified transects shown are based on SSS with a range of 50 meters. The spacing of the simplified transects is 40 meters. This allows for the coverage of the nadir region of adjacent lines.

3.3.6 Equipment Specifications

3.3.5.01 A high-resolution MBE, SSS, and an underwater video system or ROV will be deployed during the EBS to develop a detailed terrain and imagery derived map to guide the subsequent RI efforts, to aid in bottom type classification, and to identify areas of potentially sensitive habitat.

3.3.5.02 Table 3-2 contains a summary of the various systems that will be used and the purpose or value of their use. The systems are described in detail in the following sections.

Table 3-2. Summary of Technologies

Technology	Purpose/Value
MBE (multibeam echosounder)	Map site bathymetry in high resolution. Identify debris fields and items and features of interest as well as items or shoals that may damage the magnetometer/electromagnetic sensors or survey vessel during subsequent investigations.
SSS (sidescan sonar)	Provide photo-like imagery of seabed. Uses low grazing angle beams which create shadows used to better identify smaller items and better define larger items on or proud of the bottom. Increases the quality of the bottom image.
Underwater Video	Underwater video cameras will be used during MBE operations to aid in classification of the seabed and to potentially help identify areas of sensitive habitat.
Positioning Equipment	Used to track the instrument locations and the vessel motion, and geo-reference features identified in the sonar and video data.

3.3.6.1 Multibeam Echosounder

3.3.5.1.01 The RESON SeaBat 7125 MBE, one of the highest resolution MBE systems commercially available, will be augmented with real-time kinematic global positioning system (RTK GPS) and an inertial motion sensor with RTK corrections capable of achieving 0.01 degree roll and pitch accuracy. Multibeam sonars transmit acoustic pulses (sound waves) in a fan-shaped pattern. These pulses reflect back from the seafloor and/or items on the seafloor and the returns are measured from different angles across the swath with a large number of narrow receiver beams. The signal strength (amplitude), angles, and travel time of the pulses in each beam can be used to determine the size/shape of features/objects on the seafloor and the distance to those features/objects. When the sonar beams are very narrow and the ping rate high relative to the speed of motion of the survey vessel, the MBE data can be used to generate a very detailed, full coverage, bathymetry map of the seafloor and objects on the bottom. Figure 3-4 shows an example of the type of terrain model and feature detail that can be created using data from a high-resolution MBE system.

3.3.5.1.02 The MBE will provide a total angular coverage of approximately 130 degrees across track. The RESON sonar system specified utilizes 256 or 512 (user selectable), focused 0.5 x 1.0 degree beams at 400 kilohertz (kHz). The MBE system will be operated to collect sample points at up to the maximum rate of 50 hertz (Hz). This corresponds to 50 pulses per second in very shallow water; however, the pulse rate decreases with depth as the pulses require longer increments of time to reach the seafloor and return. The system incorporates an Applanix POS MV roll, pitch, heave, heading, and position sensor (or equivalent), a Sea-Bird SBE-19 or YSI Castaway conductivity, temperature and depth profiler (CTD), and a Sea-Bird 37 MicroCat CTD (or equivalent) sound speed sensor. Data from these systems are used to convert the sonar data from sensor relative to geo-referenced soundings on the earth, corrected for vessel attitude, heading and position, and to correct for the effects of changing sound speeds at the sonar head and through the water column.

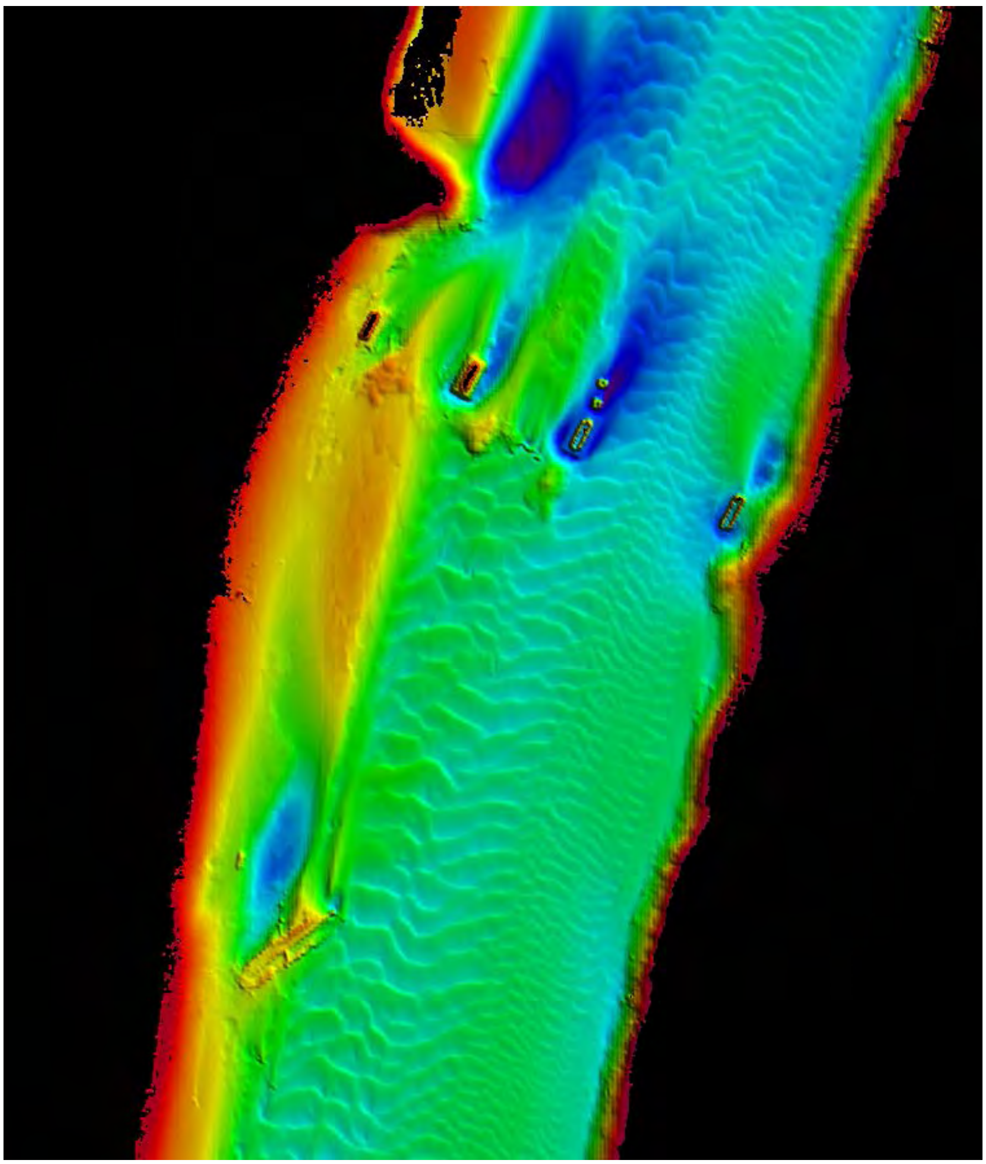


Figure 3-4. Example MBE Terrain Model

3.3.5.1.03 Reflected signal strength is a function of the physical properties of the seafloor and can therefore also provide data to characterize physical/geological features of the study area. Materials such as metals, boulders, gravel, or recently extruded volcanic rock are very efficient at reflecting acoustic pulses. Finer sediments like clay and silt do not reflect sound as well. Strong reflectors create strong echoes, while weak reflectors create weaker echoes. The project team will use this information to develop a better understanding of the site and to evaluate the physical and geologic properties of the seafloor and the objects present on it.

3.3.5.1.04 The MBE is mounted on a rigid pole attached directly to the hull of the survey vessel and thus is subject to the same physical influences as the vessel itself. The MBE will be combined with inertial navigation and a vessel heading and attitude sensor to compensate for these influences. Position (x, y) and water height (z) data will be provided using a RTK GPS with corrections from either a base station provided and set up by TtEC or a local RTK network, if available.

3.3.5.1.05 Using the RTK GPS for vessel elevation, together with appropriate data quality checks, will provide positional accuracy (x, y, and z) of approximately 0.1 meter and will be used to:

- Provide highly accurate vessel position,
- Correct for changing tide levels,
- Eliminate the vertical uncertainties inherent with modeling vessel settlement and squat as a function of speed through the water, and
- Automatically compensate for changes in the vessel draft due to crew and material loading.

3.3.5.1.06 Heading will be obtained from a gyrocompass and/or an integrated inertial system (Applanix POS MV, IXSEA PHINS, or equivalent). This high performance system will also measure vessel pitch, roll, and heave, which will be used by the acquisition and processing software (HYPACK / HYSWEEP and CARIS) to compensate the bathymetry data for vessel motion induced by wave action and other vessel dynamics.

3.3.5.1.07 A water column profiler, such as a Sea-Bird SBE-19 or YSI Castaway, and a sound speed sensor, such as a SBE 37 MicroCat mounted adjacent to the multibeam sonar array, will be used to measure changes in conductivity and temperature with depth and provide information to the sonar to aid in accurate beam forming. Differentials in these parameters along the water column influence the path and speed of the pulses created by the MBE. Data from the CTD profiler will be input to HYSWEEP and CARIS software to model the refraction and path length effects of any changes in the water column properties with depth and to apply the appropriate corrections in calculating the positions of the soundings on the seafloor. The frequency and location of the CTD casts to be used in processing the data will be determined by the local water conditions at the survey site.

3.3.6.2 Sidescan Sonar

3.3.5.2.01 To provide high-quality imagery, SSS data will be collected with a CHIRP sidescan system with an operating frequency of 600 kHz, or equivalent. Range settings on the SSS will be set at the beginning of the survey to optimize resolution and to a range longer than the spacing between adjacent track lines to provide full coverage. The range setting will be reduced in shallower areas where the track line spacing is narrower. Changes to the settings will be minimized to the extent possible, to minimize variability in the imagery due to settings changes.

3.3.5.2.02 Sidescan sonars transmit a narrow fan-shaped acoustic pulse (ping) perpendicular to the direction of travel. As the pulse travels outward from the sonar unit, the seafloor and other objects will reflect some of the sound energy back in the direction of the unit (backscatter). The signal strength (amplitude) and travel time are analyzed to provide data on the form and nature of the seafloor. One advantage of the SSS is the low grazing angle of the transmitted beam(s) over the seafloor. This results in distinctive shadows being cast behind objects on the seafloor making smaller objects more visible and providing greater detail on larger objects.

3.3.5.2.03 While SSS imagery does not measure the depths of features it can provide a reasonable size estimate and can often provide a sufficiently high resolution image to enable identification of many features (Figure 3-5). These characteristics make it a very good complement to MBEs and magnetometers, helping discriminate features of interest from background clutter.

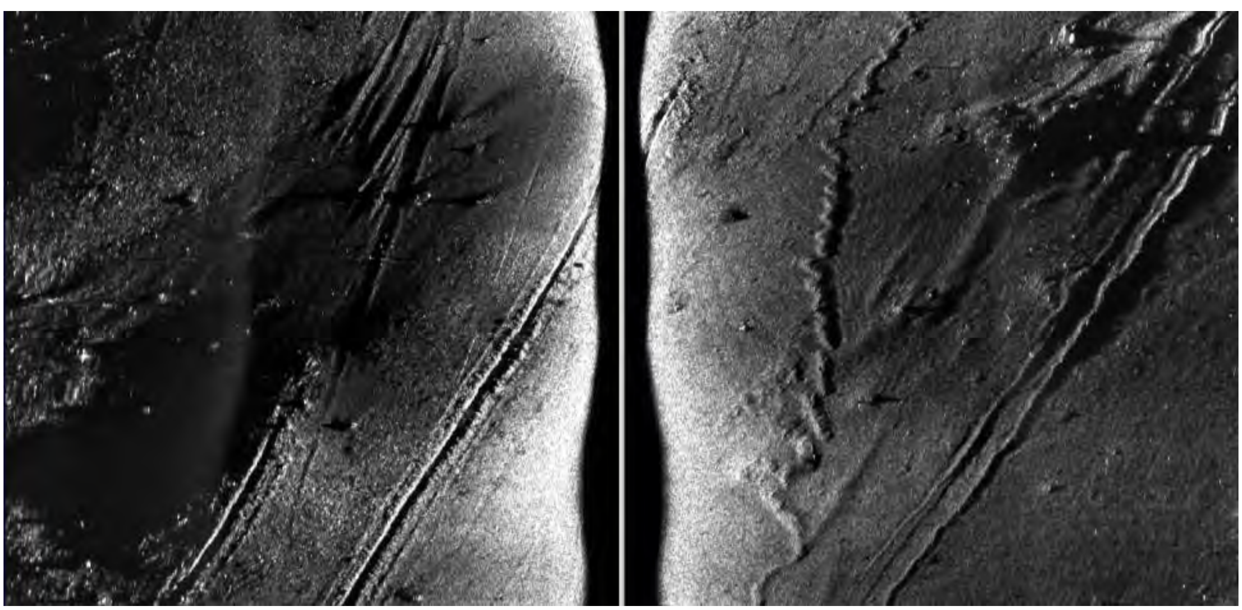


Figure 3-5. Example 600-kHz Sidescan Imagery for Feature Detection and Location

3.3.6.3 Underwater Video

3.3.5.3.01 An underwater video camera system mounted on the vessel will be used for the shallower portions of the survey. In areas where additional video coverage is needed, for example in areas of deeper water or to further investigate features of interest, the camera system will be mounted on an ROV, a towfish, or be deployed as a drop camera. Alternatively, video and photo coverage may be acquired using a diver equipped with snorkeling equipment. The digital images/video from these systems will be geo-referenced using the vessel and/or subsurface navigation systems and time correlation with a common clock, typically GPS Coordinated Universal Time (UTC) time, or in the case of snorkeling operations, locations will be estimated based on surrounding features. A video overlay showing GPS position and time will be recorded on the video. Video cameras, such as Deep Sea Power & Lights's Wide-i SeaCam, provide high-quality imagery in low light conditions. Imagery will be reviewed in real time, allowing operators to identify targets that may require further investigation and to provide supplemental information for bottom type classification during post-processing and analysis of bathymetry terrain and imagery data. Additionally, this information will be reviewed, as needed, prior to and throughout the RI/FS process.

3.3.5.3.02 Snorkelers will only enter areas to survey where they (or their equipment) will not make contact with the coral. Generally, snorkelers will maintain a distance of at least 3 feet from the channel or bay bottom or the top of coral heads. Depth of consideration for entry by snorkelers will also include evaluation of the tides, wave action, and turbidity that may impact visibility. Snorkelers will wear positive buoyancy personal flotation devices, make sure their equipment is secure, practice good finning and body control to avoid accidental contact with coral or stirring up of the sediment, and follow other measures as noted in Section 4.5.5 of the SOP.

3.3.7 Survey Vessel

3.3.6.01 A TtEC-owned vessel, a vessel from the University of Puerto Rico, or a similar vessel will be mobilized to perform the EBS activities. These vessels are equipped for coastal shallow water surveys with all required U.S. Coast Guard equipment, positioning instrumentation, equipment racks with operator stations, equipment mounts, a hydraulic A-Frame and winch for deploying towed equipment. The TtEC 29.5-foot aluminum survey vessel has a variable draft of 24 to 43 inches, depending on out-drive position (Figure 3-6). To obtain bathymetry and/or video in areas where depth to sensitive habitat is approaching the 4-foot specified minimum water depth below the vessel and/or survey equipment, snorkelers may be deployed to collect survey data, video, or photos at the surface. TtEC will not bring the survey vessel or equipment into areas where the minimum water depth or depth to coral heads below the vessel and equipment (4 feet minimum) cannot be maintained to avoid potential damage to sensitive habitat or listed species. The bottom of the boat (its overall draft including propeller and other equipment as configured) and the towfish array will stay at a minimum of 4 feet from the top of coral or channel or bay bottom depth. TtEC also will consider other factors such as changing tides and wave action or ground swell in making vessel or towfish operational restrictions as these factors may cause potential depth fluctuations that could bring the vessel and its equipment closer than 4 feet. Depth will be adjusted conservatively based on site conditions to minimize the potential for accidental groundings or coming too close to coral heads.

<u>**Vessel Specifications**</u>
Hull Construction: Welded Aluminum
Overall Length: 29.5 ft. **Beam:** 9.5 ft.
Draft: Hull 13”, Outdrive 24 to 43”. **Gross Tons:** ~5
Propulsion: VolvoPenta KAD44 Turbo charged Diesel with duo prop outdrive
Electrical Generation: Honda 6500/3000 Watt
Safety Equipment: All required U.S. Coast Guard equipment
Bridge Equipment: DGPS, POS MV, RTK GPS, Ross Hypack Control, Radar, VHF
Survey Facilities: Equipment rack with operator stations and 2 to 6 LCD monitors
Transducer Mounts: RESON 8101/8125/7125/7101/NS 420/Benthos C3D/R2 Sonics 2024/Ross 825B/Innerspace 448, IXSEA GAPS USBL, customizable as needed
Hull Mounted Transducers: As required
A-Frame and Winches: Pullmaster PL-3 support by hydraulic A-frame

Figure 3-6. TtEC’s 29.5-foot Aluminum Survey Vessel and Specifications

3.3.8 Survey Systems Schematic

3.3.7.01 Figure 3-7 provides an example graphic of the various sensor systems, with the exception of the Marine Gradiometer Array (MGA) magnetometer that will be used for the EBS, and Figure 3-8 shows an example configuration of the instrumentation (schematic).

It should be noted that various types of positioning systems may be utilized based upon site-specific conditions, and that other ancillary equipment may be added to enhance data quality and completeness. In addition, systems may not be configured as shown; for example, towed components may be hull- or pole-mounted to the survey vessel in the shallower portions of the survey area.

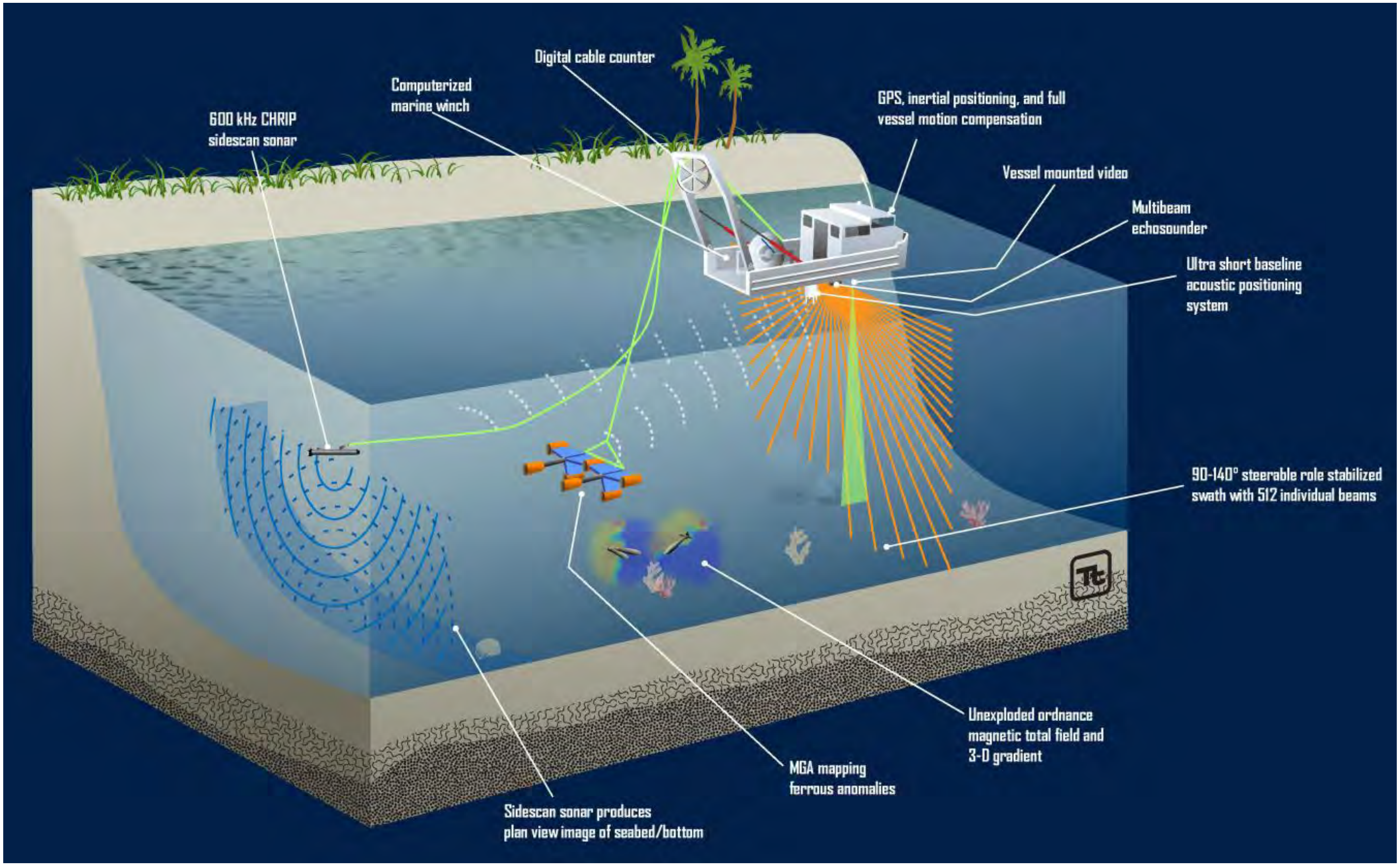


Figure 3-7. TtEC EBS and DGM Survey Systems

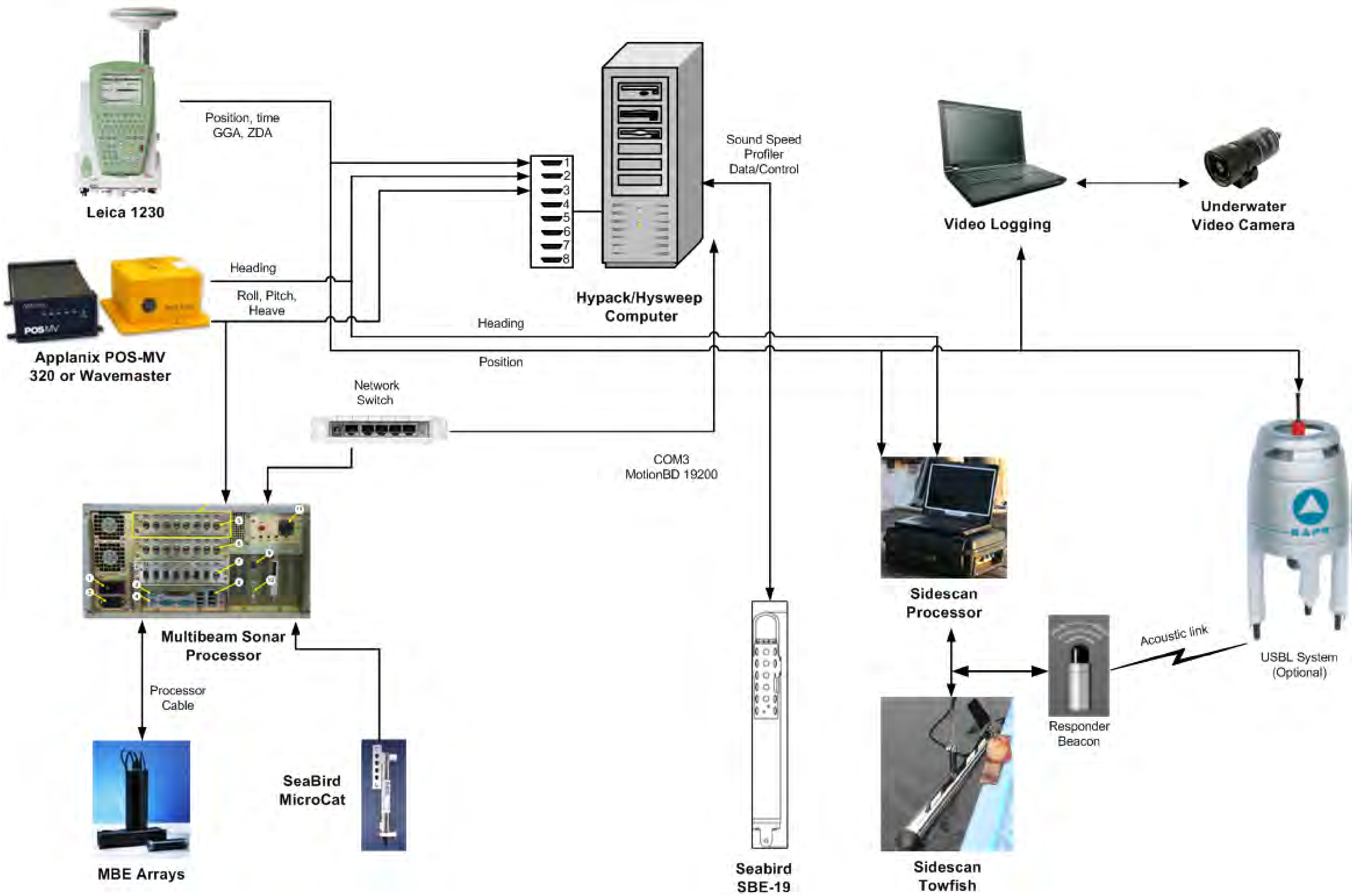


Figure 3-8. Environmental Baseline Survey System Configuration

3.4 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

3.4.01 This section presents the methods, equipment, and accuracy required for conducting location surveys and mapping, and managing geospatial information in support of the EBS. The section was prepared following EM 1110-1-4009 and provides details of the methods and equipment to be used to achieve accuracy requirements in performing location surveying and mapping.

3.4.1 Coordinates

3.4.1.01 All surveying will be performed using the North American Datum 1983 (NAD83) Puerto Rico 5200 State Plane coordinate system in units of meters. The vertical datum will be Puerto Rico Vertical Datum of 2002 (PRVD 02).

3.4.2 Control Points

3.4.2.01 The control points to be used for the surveys will be provided by the USACE prior to the commencement of field operations. If not provided by USACE, project control will be established by TtEC using conventional survey methods or the Online Positioning User Service (OPUS) network. Control will be verified by a professional land surveyor.

3.4.3 Accuracy

3.4.3.01 Each data type will be documented for associated position accuracies. The accuracy assessment will include the type and accuracy of the position sensor(s) used for the data and any other factors that could affect the data location accuracy. For example, the accuracy of the bathymetry sounding data from the MBE system is a function of the accuracies of the GPS used for vessel position; the sonar; the attitude sensor used to measure roll, pitch, and heave of the vessel; the sound speed profiler used to measure sound speed vs. depth in the water column; and the offset measurements of the sensors.

3.4.4 Map Requirements

3.4.4.01 The project maps shall be prepared in accordance with EM 1110-1-4009 and DID WERS-007.01 to accurately depict the marine habitat and to identify and delineate areas where corals are present, including listed species in MRS 03 and MRS 12. The maps will contain as much detail as can be ascertained from the information collected within the scope of the survey, survey method, and techniques. Means of coral identification may be ascertained by biologists from review of underwater video or photos, SSS or MBE survey data, identification and logging by scientific snorkelers, or known information based on prior studies of the MRSs. There may be limitations that preclude the ability of the team to identify species of coral, such as if visibility is poor or no video is recorded for an area, or in areas where snorkelers cannot make entry.

3.4.5 Monument Description

3.4.5.01 The monument descriptions for the control points to be used for the survey, or links to them, will be provided by the USACE prior to the commencement of field operations. If not provided by USACE, TtEC will describe monuments that will be used for project survey control.

3.4.6 Digital Format for Geographic Information System Data

3.4.6.01 A geographic information system (GIS) has been developed for the project to aid in the development of the CSM and maintain and manage all project and geospatial data. The GIS was developed in accordance with DID WERS-007.01, EM 200-1-2, EM 1110-1-4009, and applicable interim guidance documents.

3.4.6.02 The geospatial data for the EBS will include the following:

- A comprehensive CSM.
- All available existing applicable to the project will be consolidated into the geodatabase and analyzed to relay pertinent information to the Project Delivery Team. If an existing GIS database is available, it will be provided by the government.
- The analysis of data from the GIS will support all conclusions of the CSM.
- The pre-RI analysis will encompass social, environmental, and/or economic entities that will be or may be impacted by response-action activities.
- The post-RI and FS analysis will detail entities impacted by RI/FS activities and impacts of future response action activities (if applicable). The pre- and post-RI and FS analysis may detail the fieldwork strategies, areas of concern, survey requirements, environmental concerns, milestones, and/or other factors that affect product delivery and future action planning.
- Entities that may be affected by response actions include, but are not limited to, landowners, homeowners, rental tenants, schools, utilities, roads, businesses, recreational areas, air traffic, water bodies, and/or industries.
- The geodatabase will be a living repository that is refined throughout the life of the EBS and the entire project.
- Layers that overlay on maps of the site that identify physical features and areas of possible debris found during the EBS will be incorporated. Examples include streets, anomalies, MEC positively identified, identifiable MD, sampling location, cultural resources, and environmental, biological, and socio-economic variables.
- Archaeological site location(s) will not be released to the public without written permission from USACE.
- Locations for MEC items will not be released to the public or placed in documents without written permission from USACE.

- Civil surveys will be performed in accordance with EM 1110-1-4009 and DID WERS-007.01.
- Property owner privacy will be preserved. Property owner names will not be disseminated in any documents.

3.4.6.1 Sources and Standard

3.4.6.1.01 The project geospatial data will include all information from the Microsoft Access project database (EM 1110-1-4009). All digital GIS data will be created in an ArcView compatible format. All data will conform to the Spatial Data Transfer Standard (SDTS) and be ESRI-compliant (geodatabases). The standards are designed for computer assisted mapping methods that must interface with other surveying firms, government contractors and customers. Bathymetry derived digital elevation model (DEM) data will be provided as ArcGIS raster coverage and/or Arc ASCII grids, as required. Other raster data (geophysical color-contoured data, orthophotography, remote sensing imagery, etc.) will be provided in GeoTIFF. Supporting tabular data will be provided in ANSI SQL language compatible format, such as Microsoft Access. The GIS point, polyline and area vector data will be provided in ArcGIS format including geodatabases and .shp files and will include all appropriate metadata. The final electronic submittal will also include layout files for all plates, figures, and drawings conveyed in the report.

3.4.6.2 File Backup

3.4.6.2.01 The GIS data will be backed up daily and data processing progress will be documented on a data tracking spreadsheet.

3.4.7 Quality Control

3.4.7.01 QC checks will be completed periodically to confirm accurate data storage and backup. This process will be accomplished by reviewing survey logs and data processing logs. The FOL/QC manager will verify the performance of these QC activities.

3.5 DATA COLLECTION AND PROCESSING PROCEDURES

3.5.1 General Requirements and Procedures

3.5.1.01 The requirements in this section are applicable to all field activities including boating activities, marine bathymetric and geophysical mapping and data verification. Historical review, administrative activities, or training conducted off-site are not subject to the requirements in this section. SOPs for the activities have been provided by the USACE and are presented in Appendix B of this document.

3.5.1.1 Daily Briefings/Verification

3.5.1.1.01 At the beginning of each working day, the project FOL or designee will hold a daily briefing. At a minimum, the daily briefings will include:

1. Review of safety practices and emergency procedures

2. Review and testing of communications
3. Review of any site-specific or applicable task-specific hazards

3.5.1.1.02 Other topics that will be discussed, as necessary, include QC, changes to the work schedule, equipment maintenance, and any other issues that may affect the activities being performed that day or in the near future.

3.5.1.1.03 During the daily briefing, the FOL will also discuss selected work sites and/or tasks for the day. Each field team member will receive the instructions necessary to perform the assigned work. Attendance at the daily briefing will be documented in the FOL's field logbook and/or on daily briefing forms.

3.5.1.2 Tailgate Briefing

3.5.1.2.01 If the field team is divided into groups working in separate areas of the site or on separate tasks, a tailgate briefing may be required during which the team lead for that activity discusses specific safety hazards or mitigation measures specific to the assigned task or work area. The daily briefing at the site will fulfill the requirement for a tailgate briefing if all relevant information is presented regarding the hazards associated with all assigned work.

3.5.1.3 Equipment Testing and Maintenance

3.5.1.3.01 All equipment used by the field team will be verified to be working properly prior to use each day. The functionality of marine mapping instrumentation will be ensured by using the calibration and QC testing discussed in Sections 4.5 and 5.

3.5.1.3.02 All mapping equipment testing will be verified and documented in the field log book or on appropriate field forms by the FOL or designee. If any equipment requires repair or new equipment is brought on-site, it must be inspected and confirmed to be operational by the FOL or designee prior to use. The FOL or designee will also inspect any other equipment, including marine vessels and safety equipment, to be used each day to ensure that the equipment is in proper working order. Inspections will be documented in the filed log book or on appropriate forms.

3.5.2 Positioning

3.5.2.01 All positioning data for the survey will be based on RTK GPS or OmniSTAR-HP differential global satellite navigation system to provide sub-meter position accuracies both horizontally and vertically.

3.5.2.02 The vessels conducting MBE operations will be set up with the Applanix POS MV or IXSEA PHINS system (or equivalent), which provides position, heading, and vessel roll, pitch, and heave information to the MBE data collection systems. This positioning system includes two RTK GPS receivers that are used to discipline the inertial motion unit (IMU) and aid in the determination of heading. RTK corrections will be provided from a base station via radio modem.

3.5.2.03 Towfish positioning will be provided using an ultra-short baseline acoustic positioning system. This GPS-aided inertial platform measures position, heading, roll, pitch, and heave so that it can independently determine its position and attitude. A cable counter will also be installed as backup. If a survey area is not of sufficient depth to utilize the acoustic tracking, the layback calculation may be used as the primary method for positioning the SSS towfish.

3.5.3 Site Control Network

3.5.3.01 Geodetic control at the site will be established for the hydrographic and underwater video surveys. Control point locations will facilitate GPS base station control for bathymetric mapping (areas with a sufficient view of the sky that are accessible for base station setup). All survey data and control will be referenced to the following, unless otherwise specified:

Horizontal Datum:	State Plane NAD83 Puerto Rico 5200 Meters
Vertical Datum:	Puerto Rico Vertical Datum of 2002 (PRVD 02) Meters

3.5.4 Multibeam Echosounder Survey

3.5.4.01 The MBE bathymetric survey will be conducted in general accordance with the most recent USACE Hydrographic Surveying Engineering Manual (USACE 2002) for an echosounder survey.

3.5.4.02 Accuracy standards for various types of survey are tabulated in Appendix B, Table 1 of USACE (2002) and Table 1 of the International Hydrographic Organization (IHO) Special Publication No. 44 (IHO 1998). Data from both of these publications are consolidated in Table 3-3 below. USACE and IHO special survey requirements will be fulfilled, with the acknowledgement that conforming to the full bottom coverage requirement in the identified survey area will be contingent upon unlimited access to areas with sufficient water depth and maneuvering, and that the survey will be conducted with a 400-kHz multibeam system. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas. RTK GPS or OmniSTAR-HP positioning will be utilized, resulting in horizontal positioning accuracy of approximately 0.1 meter.

Table 3-3. Multibeam Echosounder Accuracy Standards

Order	**Special**	**1**	**2**	**3**
Examples of Typical Areas	Harbors, berthing areas, and associated critical channels with minimum under-keel clearances	Harbors, harbor approach channels, recommended tracks, and some coastal areas with depths up to 100m	Areas not described in Special Order and Order 1, or areas up to 200m water depth	Offshore areas not described in Special Order, and Orders 1 and 2
Horizontal Accuracy (95% Confidence Level)	2m	5m + 5% of depth	20m + 5% of depth	150m + 5% of depth
Depth Accuracy for Reduced Depths (95% Confidence Level) [1/,2a/]	a = 0.25m b = 0.0075	a = 0.5m b = 0.013	a = 1.0m b = 0.023	Same as Order 2
100% Bottom Search [3/]	Compulsory [2b/]	Required in selected areas [2b/]	May be required in selected areas	Not applicable
System Detection Capability	Cubic features > 1m	Cubic features > 2m in depths up to 40m; 10% of depth beyond 40m [3/]	Same as Order 1	Not applicable
Maximum Line Spacing [4/]	Not applicable, as 100% search compulsory	3 x average depth or 25m, whichever is greater	3 to 4 x average depth or 200m, whichever is greater	4 x average depth

Notes:
1/ To calculate the error limits for depth accuracy, the corresponding values of a and b listed in this table are introduced into the formula

$$\pm\sqrt{a^2 + (b*d)^2}$$

where,
a is the constant depth error, i.e., the sum of all constant errors,
b*d is the depth dependent error, i.e., the sum of all depth-dependent errors,
b is the factor of depth-dependent error and
d is depth.
2a/ The confidence level percentage is the probability that an error will not exceed the specified maximum value.
2b/ For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for Special Order and Order 1 surveys.
3/ A method of exploring the seabed which attempts to provide complete coverage of an area for the purpose of detection of all features addressed in this publication. The value of 40m has been chosen considering the maximum expected draught of vessels.
4/ The line spacing can be expanded if procedures for ensuring adequate sounding density are used.
Sources: USACE 2002; IHO 1998

3.5.5 Multibeam Echosounder Data Processing

3.5.5.01 The collected MBE sounding data will be processed using HYPACK and CARIS Hydrographic Information Processing System (HIPS) software, respectively, to generate the XYZ soundings in the survey coordinate system and units.

3.5.5.02 The MBE data cleaning will be performed in CARIS HIPS two-dimensional and three-dimensional editing software. A subsequent area-based cleaning, using the merged data from all the survey lines, will then be conducted on the MBE data using the CARIS HIPS subset editing tool. XYZ files of the individual soundings will then be exported out of the CARIS environment. Following initial post-processing the data will be imported and gridded in Fledermaus for further processing and format conversion. Sounding data collected in shallow water will be interpolated to fill data gaps. Final data presentation materials will be generated using a combination of Fledermaus, HYPACK, and ArcGIS software.

3.5.6 Quality Assurance/Quality Control for Multibeam Echosounder Data

3.5.6.01 TtEC's data quality is established at the time of data collection through proper setup and operation of the survey systems, and cannot be enhanced during processing, other than to remove obviously invalid data. Survey, data processing, and QA procedures will comply with the applicable guidelines provided by the USACE.

3.5.6.02 Data quality can be assessed explicitly: a single data element is compared directly to a standard or known control. Alternatively, quality can be assessed implicitly: combinations of data elements are compared to members of their own set for internal consistency. Additionally, quality can be measured quantitatively (numerically) or qualitatively, requiring interpretation on the part of an operator.

3.5.6.03 For each step of the setup and operation of the survey system, a series of checks is run on the equipment and data collection software configuration. These checks will be documented in the survey collection logs and a dedicated QC electronic log and the results will be included in the EBS report. Where possible, a quantitative measurement of data quality is identified for each data type acquired. Procedures are constructed to measure this quantity as near as practicable to the point of acquisition. These measurements of quality are continually assessed throughout the acquisition and processing phases of the project. Where a quantitative measure of data quality cannot be developed, an interpretive or qualitative method is contrived to estimate data quality.

3.5.6.04 Data that fail to meet minimum quality standards will be discarded. A number of individual data elements are required to calculate a sounding. These include sounder data, vessel attitude, sound velocity profile (SVP), tide, draft, and position.

3.5.6.05 Field methods used for measuring data quality begin with position accuracy. Throughout the survey the echosounder operator reviews the positions of identifiable features in the online HYPACK/HYSWEEP coverage plots. This software allows the user to compare the results of the measured positions for consistency within the lines and against external references. Positions of well-defined features, mapped on overlapping lines, should agree to within a few decimeters.

3.5.6.06 Motion data are also scrutinized in HYSWEEP. These data are more difficult than vessel position to QC because there is only one system and it cannot be checked against itself. Consequently, the heave component of the motion data set is merged with the soundings from the vertical beam. A timing error in either of these systems will result in a residual oscillation in the measured depth. Amplitude errors in the heave record will have a similar effect.

3.5.6.07 Sounding data from the MBE are subject to interpretive and quantitative measurements of data quality. During acquisition, sonar operators monitor data quality on the MBE monitor and HYPACK/HYSWEEP acquisition screens. The general noise level of the soundings and useable swath width are visible on the echosounder's monitor. Custom screens in HYPACK and HYSWEEP allow the operator to view a DTM of average depths, waterfall displays, and individual profiles. These displays require interpretation and are used as the first quality check on multibeam data.

3.5.6.08 The data will be viewed again as they are cleaned (flagged for exclusion from the final data set) and edited. In HYPACK and CARIS HIPS, lines can be examined for obvious errors. By this time, however, the data are bundled with all their ancillary data elements: SVP, tide, static draft, squat and settlement, heave, pitch, and roll.

3.5.6.09 The final quality assessment for the data set is conducted with Fledermaus Pro software. Production line data are compared to a DTM created from a cross line. Differences between the soundings and the surface are tabulated for each beam and evaluated with respect to an accuracy standard, in this case, an IHO specification. Compliance with the specification must exceed 95 percent.

3.5.6.010 The visualization tools available in the processing software provide clear indications of any problems in the motion sensor data or in the time correlation of the echosounder and motion data. Any errors in these areas will result in identifiable data artifacts. Conducting at least preliminary processing of the bathymetry data on the vessel will allow any problems to be caught and corrected quickly, and will ensure that a full, high-quality data set is collected.

3.5.7 Sidescan Sonar Survey

3.5.7.01 Acoustic images of the seafloor in the survey area will be acquired with SSS. These data will be used to provide qualitative information on the nature of the bottom type. This characterization includes identifying zones of hard or soft bottom (rock or coral outcrops and fine- to coarse-grained sediment) and the presence of debris proud of the bottom.

3.5.7.02 During SSS operations, images will be displayed in real-time on a computer monitor that will be interfaced with the navigation system to provide geo-referencing for the data. The data will be digitally recorded.

3.5.7.03 The SSS towfish will be tracked with an acoustic tracking system; a cable counter will be employed as backup to calculate layback. In shallow areas, the SSS may be mounted off the bow with a fixed offset applied.

3.5.8 Sidescan Sonar Data Processing

3.5.8.01 SSS will be processed using Chesapeake Technology's SonarWiz.MAP software (or similar). Each data file will be bottom-tracked to remove the water column from the data to allow proper slant range and beam angle corrections to be applied.

3.5.8.02 Targets detected in the SSS data can be picked in real time or in post-processing and can be exported in a target report in shapefile and/or Microsoft Excel format directly from SonarWiz.MAP.

3.5.8.03 Sidescan data will be exported as a mosaic in GeoTIFF format to be used for delineation of habitat areas.

3.5.8.04 Final data presentation materials will be generated using a combination of SonarWiz.MAP and ArcGIS.

3.5.9 Quality Assurance/Quality Control for Sidescan Sonar Data

3.5.9.01 The SSS is factory calibrated and cannot be field calibrated or adjusted. QA/QC of the SSS data will be performed in real time by observing the quality of the data on the computer monitor used with the digital acquisition system. The digital data, along with the navigation, will be reviewed at the end of each survey day to verify the data quality and ensure that the requirements for coverage have been met.

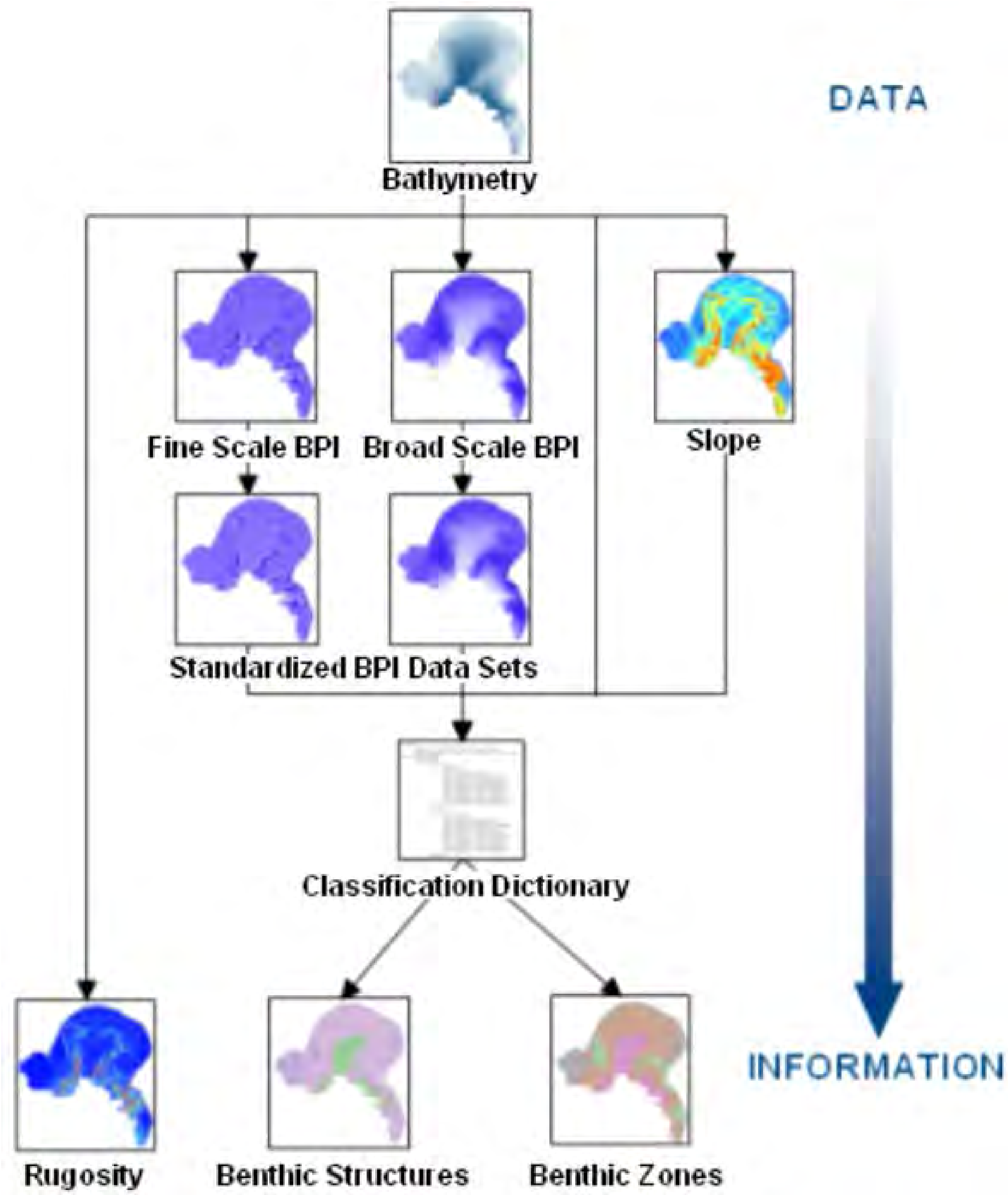
3.5.9.02 A navigation check will be conducted on the SSS data by measuring the position offset of a target observed on two adjacent lines run in opposite directions. This check will be conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing.

3.5.10 Benthic Characterization and Habitat Assessment

3.5.10.01 The survey area bottom type characterization will build upon the results of the MBE, SSS, and video surveys. MBE and SSS imagery data will be processed using Quester Tangent Swathview™ software, the Geocoder module implementation in the CARIS HIPS/ Sidescan Image Processing System (SIPS) software package, Fledermaus Pro, or an equivalent Geocoder implementation. Geocoder, originally developed by Dr. Luciano Fonseca, contains algorithms for radiometric and geometric backscatter corrections, as well as angular response analysis capabilities, to produce reliable mosaics of acoustic backscatter that can aid in the mapping of surficial seafloor features and facies and aid in seafloor characterization.

3.5.10.02 The BTM will be used to analyze the MBE bathymetry to further evaluate and define bottom types. The BTM is a set of ArcGIS-based tools for benthic analysis developed by the Department of Geosciences at Oregon State University and National Oceanic and Atmospheric Administration Coastal Services Center. The BTM will be used to characterize the seabed bathymetry and classify the benthic terrain within the survey area by comparing positions of grid points in the bathymetry DTM to adjacent points, to determine areas of different terrain structures (Figure 3-9).

3.5.10.03 These bottom type and classification methods will be used along with readily available aerial photographs to develop a detailed preliminary assessment of the bottom topography and structure, including delineation of areas of different bottom type. This preliminary bottom type classification will be evaluated and revised by both a TtEC geologist and a biologist experienced with classification of bottom and habitat types because all bottom-type classification software is still in developmentr and no commercial off-the-shelf software that produces reliable classification without human interaction is available. The geologist and biologist will review the results of the MBE bathymetry and imagery analyses to identify areas of potential sensitive habitat. The video from these target areas will then be reviewed and assessed as to whether additional video surveys are needed to support bottom-type characterization and identification of features detected in the MBE data and to help define the locations and types of habitat-based ecosystems.



Source: OSU and NOAA

Figure 3-9. Graphical Depiction of the BTM Process

4.0 QUALITY CONTROL PLAN

4.0.01 TtEC will use a range of operator data displays, processing tools, and procedures to ensure all survey equipment are functioning correctly and accurately prior to the start of the survey, at the start of survey day, during the course of data collection, and by performing at least preliminary processing of survey data prior to terminating field operations. These checks will include daily GPS water level checks, sonar bar checks, real-time monitoring of incoming data by trained operators, and quality checks such as the collection of cross lines (lines set at approximately 45 to 90 degrees to the survey lines). The bathymetry data obtained at the intersection of the survey lines and cross lines will be post-processed in CARIS HIPS or Fledermaus Pro to provide a statistical analysis of the correlation between the data from two perpendicular survey lines. The SSS navigation check will be performed daily by surveying two adjacent lines in opposing directions and evaluating the alignment of features. Table 4-1 summarizes the measurement performance criteria for each survey system and the frequency at which the check will be performed. Appendix F contains the SOP and QC forms that will be used for this EBS.

4.1 POSITION VALIDATION

4.1.01 Prior to start of survey operations, the survey crew will verify the positional (X and Y) accuracy of the GPS by comparing it with selected terrestrial control points. RTK GPS measurements will match the published positions to within 0.1 meter x, y, and z. This check will also be conducted at the end of survey operations and documented in the survey log.

4.2 VESSEL SURVEY AND VERIFICATION

4.2.01 Spatial offsets are precisely measured for the multibeam sonar, attitude sensor, and GPS antennas, so that the HYPACK/HYSWEEP acquisition software can accurately combine and convert the sonar and support sensor data into real-world coordinates in real time. These offsets are also used in the CARIS software vessel configuration file (VCF) for data processing. The VCF serves the purpose of spatially integrating sonar and ancillary sensor data and in doing so, converts the raw sonar data into real world coordinates as defined by the project coordinate system. After installation of the MBE equipment on the hull of the survey vessel, the appropriate equipment locations will be measured using a combination of a Leica Disto A8 laser range measurement device (or similar), tape measures and/or total station. All equipment installed will be measured relative to the location and orientation of the IMU. Verification will be performed by having different crew members take independent measurements and comparing the results. The offsets will also be verified through use of the POS MV’s GPS azimuth measurement subsystem (GAMS) calibration and documented in the survey log (refer to Section 4.3).

4.3 GAMS CALIBRATION

4.3.01 Prior to performing a multibeam system installation calibration test (a "patch test") and whenever necessary, as automatically determined by the Applanix software (POSView), an alignment calibration of the Applanix motion and heading sensor will be performed. This procedure, which Applanix refers to as a GAMS calibration, utilizes software integrated into the motion sensors. The GAMS calibration procedure is initiated while the survey vessel maneuvers in a figure eight pattern. This calibration procedure allows the POSView software to calculate offsets between the motion sensor's two GPS antennas and align the measured heading with the vessel, resulting in achievement of the POS MV specified heading accuracies, which range from 0.02 to 0.06 degree.

4.4 MBE PATCH TEST

4.4.01 A standard patch test also known as an installation calibration test will be carried out prior to the MBE survey to calculate the angular offsets between the multibeam echosounder and the motion sensor IMU. The installation calibration process is used to derive the roll, pitch, and yaw angular offsets between the multibeam sonar and the local reference frame defined by the IMU. The patch test is also used to determine latency in the positioning equipment. The sonar and acquisition computers are time synchronized by the motion sensor's GPS; as a result, there should be no latency detected between sensors.

4.4.02 The patch test is generally conducted over an area where multiple distinct features with significant changes in depth occur over short distances along track. Pitch, roll, and yaw are measured using areas with the following characteristics and documented in the survey log:

- Roll—reciprocal lines surveyed over a flat bottom
- Pitch—reciprocal lines surveyed over a sloping bottom, or a distinct linear feature
- Yaw—offset lines surveyed over a sloping bottom, or a distinct linear feature

4.5 BAR CHECKS

4.5.01 Bar checks are conducted daily during sonar operations to ensure sonar equipment and processing software are functioning properly. The bar check is a consistency check. An aluminum plate on a calibrated line is manually lowered to a known depth below the sonar head. The depth of the plate below the water surface is recorded and compared to the value reported by the HYSWEEP Bar Check Utility and documented in the survey log.

4.6 WATER SURFACE CHECKS

4.6.01 The water level check compares the water level reported by the HYPACK acquisition software to the value measured at the same time by a field technician using a Leica 1230 RTK GPS rover identical to the model installed on the survey boat. This test verifies proper installation offsets on the vessel and that the GPS is configured properly and receiving accurate real-time corrections and documented in the survey log.

4.7 CROSS LINE TESTS

4.7.01 The cross line test is both a measure of the system function and a data quality check. This test is performed by collecting data (hydrographic or geophysical) along lines intersecting and roughly orthogonal to the primary data collection lines. Data points coincident to both data sets are then statistically compared using Fledermaus Pro (or equivalent) to ensure that the data are consistent. Results of this comparison can be output in a graphical or tabular report. Failures in this test are indicative of malfunction, improper installation or calibration, invalid sound speed corrections, or improper operation of the instrumentation.

4.8 SIDESCAN SONAR NAVIGATION CHECK

4.8.01 A system navigation check will be conducted on the SSS data by measuring the position offset of a target observed on two adjacent lines run in opposite directions against each other and compared to the location of this feature in the MBE data. This check will be conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing and documented in the survey log.

Table 4-1. Measurement Performance Criteria Table

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Hydrographic Surveys	Precision	Cross line data	Data points common to both survey lines and cross lines will have x, y, z coordinates that are repeatable within SOP 01 specified USACE Hydrographic survey standards (refer to Table 3.3). Hydrographic Survey data shall meet or exceed Special Order Standards. Special Order Standards include the following: Horizontal Accuracy (95% confidence Level) is 2 meters. Depth Accuracy for Reduced Depths (95% Confidence Level) is calculated using the following equation $DARD = +/- [a^2 + (b * d)^2]^{1/2}$ where: a (0.25 meter) is a constant depth error, i.e., the sum of all constant errors, (b = 0.0075)*d is the depth dependent. The near full bottom search is compulsory and system detection capability is measured as cubic features >1 meter.	Minimum one cross line per 20 transects	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Visual evaluation of real-time data for verification that intended coverage goals are met	Real-time coverage plots (matrix fills) will be utilized to monitor MBE coverage. 90% of the matrix will be filled in areas that are accessible for survey (i.e., sufficient water depth, lack of obstacles, safe for navigation) and do not fall into shadow areas due to objects proud (slightly above) of the bottom, or due to depressions. Coverage will be confirmed during post processing. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas	Continuous visual monitoring during data collection	Data gaps will be identified and additional data will be collected to fill in the area.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Hydrographic Surveys cont'd	Sensitivity	Real-time monitoring and use of gains and gate filters, software quality flags.	MBE data collection depth range is optimized to reduce anomalous reflections and provide optimum data, gains are set to provide appropriate bottom tracking. The MBE conducts internal testing to check the validity of each ping based on colinearity and brightness and each ping is tagged with a quality flag of 0-3 based on the these tests. During processing, the pings are filtered based on the quality flags to eliminate all but the data with a quality of 3 unless conditions warrant accepting lower quality pings (such as shorelines or vertical structures).	Continuous visual monitoring during data collection, sonar system quality flags.	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Accuracy	GPS survey crew will check on selected control points with rover GPS. Water level check – Use GPS rover to check water surface elevation. Compare to survey system navigation reported tide level. Bar check and/or lead line check vs. water surface relative depth from sonar.	GPS measurements will match published position to within 0.1 meter x, y and z. GPS water level and survey system tide level will match to within 0.1 meter. Nadir bathymetry depths relative to surface, corrected for draft and attitude match to within 0.1 meter.	Daily Once at the start and once at the end of survey operations. Once at the Start of MBE Survey Operations	Root cause analysis will be performed. Source of failure will be identified and corrected.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Sidescan Sonar	Navigation Precision	Reciprocal Survey lines or adjacent survey lines with overlapping coverage collected in opposite directions	Bottom features will align within 2 meters. Conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing. This criterion may be relaxed if the magnetic heading sensor in the sidescan towfish is adversely affected by the magnetic rock present within the survey areas, or if course made good headings are not sufficient.	Minimum of one check per day	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Visual evaluation of real-time data for verification that intended coverage goals are achieved	Post-processed will have no along track coverage gaps. Nadir regions will be covered by adjacent survey lines to achieve full coverage in areas that are accessible for survey (i.e., sufficient water depth, lack of obstacles, safe for navigation) and do not fall into shadow areas due to objects proud (slightly above) of the bottom, or due to depressions. Coverage will be confirmed during post processing. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas.	Daily	Data gaps will be identified and additional data will be collected to fill in the area.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Underwater Video	Quality	Recorded Video	A minimum of 1 minute of recorded and video will be played back at the start of each day to ensure the equipment is functioning properly and providing adequate imagery.	Daily	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Tracklines, Data files	Video will be recorded concurrently with MBE and SSS surveys if possible and at transects of no less than 100ft apart if not. Data acquisition coverage plots along with file size monitoring will be used to verify that video has been recorded.	Continuously	Data gaps will be identified and additional data will be collected to fill in the area.

5.0 EXPLOSIVES MANAGEMENT PLAN

5.0.01 Section 5 is not applicable to the project and will serve as a placeholder section only.

This page intentionally left blank.

6.0 ENVIRONMENTAL PROTECTION PLAN

6.1 INTRODUCTION

6.1.01 This EPP was prepared in accordance with Data Item Description MR-005-12, the Performance Work Statement, and the SOPs developed by the USACE (Appendix B). The purpose of this EPP is to establish general procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during field activities and comply with applicable or relevant and appropriate requirements (ARARs). This EPP describes sensitive natural resources specifically within the MRSs Flamenco Bay (MRS 03) and the Luis Peña Channel (MRS 12) and sets forth methods to protect and conserve those resources during the EBS field activities. The intent of the EBS is to photograph and collect video and to perform bathymetry surveys documenting benthic site conditions, define and delineate benthic and coral reef habitats, sensitive or critical habitat areas, and document features of the underwater environment in these two MRSs. This information is being used to help protect these areas and the species that inhabit them from harm during the more intrusive RI activities.

6.1.02 Flamenco Bay is a shallow bay comprising approximately 195 acres that extends up the east side of the Northwest Peninsula and the west side of Flamenco Point in Puerto Rico. Flamenco Bay is currently used for recreational swimming, diving, and snorkeling activities. The Luis Peña Channel is made up of waters that comprise the Luis Peña Channel Marine Reserve, approximately 835 acres of water along the west coast of Culebra from the Northwest Peninsula to Scorpion Point. The Luis Peña Channel Marine Reserve is managed by the DNER, which has identified 41 types of uses (Valdez-Pizzini et al. 2008), including recreational swimming, boating snorkeling, and diving. Fishing is another use documented in the area (Hernández-Delgado 2003a; Pagán-Villegas et al. 1999), although since 2004 its practice is illegal inside the Reserve (Valdez-Pizzini et al. 2008; DNER 2010a).

6.1.03 This EPP outlines potential measures that can be implemented to mitigate potential impacts to sensitive biological resources. These mitigation measures were developed based upon a site-specific analysis that addresses unique concerns for work within and along the beaches of the Culebra Water Ranges and incorporates best management practices and guidelines that have been implemented for intensive field programs previously performed by other Military Munitions Response Program (MMRP) contractors on Culebra. Several SOPs for conservation of endangered species and their critical habitat during underwater investigations were developed by USACE and comprise:

- An April 2012 Final SOP for Endangered Species Conservation and their Critical Habitat during Underwater Investigations (most up-to-date information is contained in this document related to corals) including two appendices as follows:
  - A July 2008 Final SOP for Endangered Species Conservation and their Habitat; and

- An April 2011 Addendum to the 2008 SOP (contains mainly terrestrial based species information).

6.1.04 These SOPs are referenced throughout the EPP and are included in this Work Plan as Appendix B. As stated in Section 4.6 of the 2012 SOP, the July 2008 SOP and its 2011 Addendum remain in effect. The 2012 SOP is meant to supplement, not replace, previous SOPs; it provides the most up-to-date information regarding listed corals.

6.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

6.2.01 This project is being performed as part of a FUDS Program. Through a site inspection (Parsons 2007), it was determined that MRSs 03 and 12 warrant further investigation under the MMRP. FUDS response activities are conducted in accordance with the DERP statute (10 U.S. Code [USC] Section 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; 42 USC Section 9601 et seq.), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Regulations Part 300). An RI/FS will be performed by TtEC for the two MRSs that comprise the Culebra Water Ranges. Prior to the RI fieldwork, an EBS will be performed. The EBS is the subject of this EPP. A separate EPP will be prepared for the RI fieldwork based, in part, on findings of the EBS.

6.2.02 The identification of ARARs and To Be Considered (TBCs) is an iterative process that must be considered throughout the CERCLA process. As such, the list of identified requirements and their relevance may change as more information is obtained following completion of the EBS and during the RI/FS process. The EBS and RI are used to ascertain site conditions and types and extents of contamination. Site remedies are not evaluated until the FS. During the investigation stage of the RI, limited ARARs that potentially directly relate to site activities may be determined. Federal and Puerto Rico-specific potential ARARs and TBCs are presented in paragraphs 6.2.05 through 6.2.07. This Environmental Protection Plan, including associated SOPs help define the requirements that will be followed during the EBS to comply with these ARARs and TBCs. In addition, coordination with Commonwealth of Puerto Rico agencies such as DNER and the PREQB as well as coordinating officials with NMFS/NOAA, USFWS, and Refuge Managers within their jurisdiction is also appropriate to ensure the project is protective of the environment and of listed species and critical habitat.

6.2.03 Federal and state requirements must be considered for identification of site-specific ARARs. Federal and state requirements include ARARs that are:

- Chemical-specific (governing the level or extent of site remediation relative to a specific constituent);
- Location-specific (pertaining to existing site features and location); and
- Action-specific (pertaining to proposed site remedies and implementation of the selected site remedy).

6.2.04 Chemical-specific ARARs are not addressed in this EPP because these will come into play following the RI if MC are found during sediment sampling and are compared to data quality objectives that the project team determines for the FS evaluation. A limited amount of location- and action-specific ARARs and TBCs are listed for the EBS and RI, which may undergo further revision during the FS process as more information is known about these MRSs and remedial alternatives are proposed for comparative analysis. Paragraphs 6.2.06 through 6.2.08 contain the tentatively identified ARARs and TBCs.

6.2.05 Following are some notes regarding the ARARs for the EBS identified below:

- Chapter 4 of the EPA guidance document entitled *CERCLA Compliance with Other Laws Manual, Part II* (EPA 1989) states that "While EPA interprets CERCLA §121(e) to exempt lead agencies from obtaining Federal, State, or local permits (or documents similar to permits) or from complying with the administrative requirements for on-site remedial activities, it is strongly recommended that lead agencies, nevertheless, consult as specified with administering agencies for on-site actions. The administering agencies have the expertise to determine the impacts of a remedial action on particular aspects of the environment and what steps should be taken to avoid and mitigate adverse impacts." For instance, with respect to Archaeological and Historic Preservation Act and Archaeological Resources Protection Act (ARPA) consultation requirements, the guidance states that "Although administrative and procedural requirements are not ARARs for onsite activities, adherence to these steps is strongly recommended for cleanup actions that take place entirely onsite because of the effectiveness of these procedures in identifying cultural resources and the expertise of the SHPO and Advisory Council on Historic Preservation in these matters." As such, while the administrative aspects of consultation do not need to be strictly followed, active input and involvement with resource experts does ensure cultural, historic, and archaeological or other eligible resources are properly documented and preserved.
- The potential ARARs cited in this document specifically prepared for the EBS Survey are not intended to apply to cleanup actions because the EBS is being undertaken for purposes of site characterization only. The RI Work Plan, which will be prepared separately, will identify potential ARARs that apply to the work to be undertaken during the RI which is more intrusive in nature, and will incorporate results of the EBS survey as necessary (e.g., if cultural items are discovered during the EBS). ARARs for the remedial alternatives analysis will be finalized during the CERCLA remedial alternatives evaluation.
- Because the EBS survey is not anticipated to generate hazardous waste (non-intrusive), the potential ARARs list does not include an evaluation of federal hazardous waste regulations as ARARs. The substantive requirements of these regulations will be included in the Environmental Protection Plan within the RI Work Plan.

- EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for removal actions (EPA 1988). In essence, the CERCLA/NCP requirements at 40 CFR § 300.515 for removal actions provide that the lead federal agency request that the state identify chemical-, location-, and action-specific state ARARs upon completion of site characterization. At the present time, Puerto Rico–specific ARARs are not identified because site characterization has not been completed. The purpose of the EBS is for further site characterization.

6.2.06 Federal

1. Presence of endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226, Endangered Species Act (ESA) of 1973, as amended and 16 USC 1531 et seq. (50 CFR 402). On-site activities must be conducted in a manner that does not result in a take of these species and actions must not destroy critical habitat. No takes are authorized and penalties may be issued to personnel whose actions result in a "take." Personnel on this project will be trained to recognize these species and their critical habitat as well as the actions that minimize potential for a take to occur and prevent destruction of critical habitat; they will also be informed that penalties may be imposed on persons whose action results in a take.

2. Presence of essential fish habitat (EFH) under the Magnuson-Stevens Fishery, Conservation and Management Act, 50 CFR 600.920(e)(3) and 16 USC 1801. The Act defines EFH as the waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. An adverse impact as defined in the EFH rules is "any impact which reduces quality and/or quantity of EFH. . . . [and] may include direct, indirect, site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions." U.S. coral reef ecosystems in Puerto Rico were designated as EFH by the Caribbean Fisheries Management Council pursuant to the Magnuson-Stevens Fishery, Conservation, and Management Act. The 2004 *Essential Fish Habitat Consultation Guidance* (NMFS 2004), pursuant to Section 104-279(b)(2) of the Act, states that when an agency determines that its activities may have an adverse effect on EFH, consultation with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) is required. Although administrative requirements such as consultation need not be complied with for CERCLA actions and are not ARARs, if it is determined, for instance, during the EBS that in situ MEC disposal (blow in place) is required because an item is deemed unstable and posing immediate potential for harm and that this detonation could have an adverse impact on coral reefs, consultation with NOAA Fisheries (as well as consultation regarding ESA species and their critical habitat, which could result in an incidental take of listed species) may be warranted so that appropriate mitigation strategies can be identified.

3. **Archaeological Resources Protection Act (ARPA) of 1979.** Substantive provisions at 16 USC § 470ee(a) state that no person may excavate, remove, damage, or otherwise alter or deface, or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public or Indian lands unless such activity is pursuant to a permit or is exempted. In addition, no person may sell, purchase, exchange, transport, or receive any archaeological resource if resource was excavated or removed in violation of this regulation. Should suspected archaeological, cultural, or historical items be discovered during the course of the investigation, the item(s) will not be disturbed. Any such findings will be reported to the USACE representative so that notification of the SHPO and Advisory Council can be made. Identification of resources during the EBS and consultation will help ensure that these items are not adversely impacted during the RI or remedial action that follows.

4. **Archaeological and Historic Preservation Act, 16 USC § 469–469c-1.** Substantive provisions of this Act require the preservation of historical and archaeological data that might otherwise be lost as a result of an activity. If an activity in connection with any federally approved project may cause irreparable loss to significant scientific, prehistorical, or archaeological data, the Act requires the agency undertaking the project to preserve the data or request the Department of the Interior to do so. Should suspected archaeological, cultural, or historical items be discovered during the course of the investigation, the items will not be disturbed. Any such findings will be reported to the USACE representative so that notification of the SHPO and Advisory Council can be made. Identification of resources during the EBS and consultation will help ensure that these items are not adversely impacted during the RI or remedial action that follows.

5. Criteria for evaluating effects to waters of the U.S., including wetlands. Clean Water Act; 40 CFR 320.1 et seq.; 401, 404 et seq. Project activities will consider ways to lessen impact to estuarine or marine wetlands using methods that involve least disturbance of the benthic environment, least impact to threatened or endangered species, sensitive habitats, and least potential for suspension of sediment.

6. Coastal Zone Management Act; 16 USC 1451-1464; 15 CFR 921-933. Federal agency actions affecting the coastal zone must be consistent with the enforceable policies of the approved Puerto Rico coastal zone management program.

7. The Migratory Bird Treaty Act; 16 USC 701-712. This Act makes it unlawful to (or attempt to) pursue, hunt, take, capture, or kill any migratory bird, part, nest, egg, or product. All but a few bird species naturally occurring in the U.S. are protected under this Act. On-site activities must be conducted in a manner that does not result in a take of these species.

8. Marine Mammal Protection Act of 1972 (MMPA); 16 USC 1361, 50 CFR 12. It is unlawful for any person or federal agency to take (harass or kill any marine mammal) on the high seas, in U.S. waters, or on land under the jurisdiction of this Act. On-site activities must be conducted in a manner that does not result in a take of these species.

6.2.07 Worker and Public Safety:

1. DoD Ammunition and Explosives Safety Standards DoD 6055.9-STD. Establishes uniform safety standards applicable to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal.
2. Ammunition and Explosives Safety Standards DA PAM 385–64. This pamphlet provides force protection guidance for commanders with an ammunition or explosives mission. It sets forth procedures for use when transporting ammunition or explosives over the public highway. Provides guidance for the remediation of active and FUDS contaminated with ammunition and explosives.

6.2.08 Puerto Rico:

1. Regulation Number 6766 – Regulation to designate Threatened and Endangered Species of the Commonwealth of Puerto Rico, Puerto Rico DNER. On-site activities must comply with the requirements of Law Number 241 (Puerto Rico Wildlife and Critical Habitats Law).
2. Law 112 Protection Law for the Terrestrial Archeological Patrimony of the Commonwealth of Puerto Rico.
3. Regulation for the Control of Hazardous Solid Waste of the PREQB.
4. Regulation for the Control of Non-Hazardous Solid Waste of the PREQB.
5. Regulation for Water Quality Standards of the PREQB.
6. Law 416 – Puerto Rico Environmental Policy Act.

6.2.09 The following are some of the sources that were consulted for identifying biological and cultural resources known to exist or potentially existing at the Culebra Water Ranges site:

- 2012 SOPs (including sub-appendices A and B) (Appendix B);
- Ecological Services in the Caribbean (website) (USFWS 2011a)
- Draft Stock Assessment: West Indian Manatee (*Trichechus manatus*) Puerto Rico Stock (Antillean subspecies, *Trichechus manatus manatus*) (USFWS 2009)
- Draft Site Inspection Report, Northwest Peninsula of Culebra (Parsons 2011)

- Culebra National Wildlife Refuge (website) (USFWS 2008)
- DNER website (http://www.drna.gobierno.pr/)
- Draft Puerto Rico Coastal and Estuarine Land Conservation Plan (DNER 2010b)
- Elkhorn Coral (website) (NOAA Fisheries 2011a)
- Sea Turtles (website) (NOAA Fisheries 2011b)
- Resource Category 1 Designation: The Seagrass Beds of Culebra Island, Puerto Rico (USFWS 1992)
- Environmental Protection Plan, Non-Time Critical Removal Action, Municipality of Culebra, Puerto Rico Final Work Plan (EEG 2006)
- National Wetlands Inventory website (http://107.20.228.18/Wetlands/WetlandsMapper.html)
- National Register Information System (NRIS), National Register of Historic Places
- List of National Historic Landmarks – National Historic Landmarks Program (NHL)
- List of National Heritage Areas (NHA), National Heritage Areas Program
- Coastal Zone Management Program (NOAA)
- National Marine Fisheries Service (NMFS) (NOAA)
- National Marine Sanctuaries and Marine Protected Areas (NOAA)

6.3 ENDANGERED AND THREATENED SPECIES

6.3.01 According to the USFWS, in Puerto Rico and the U.S. Virgin Islands there are 78 protected species including 29 animals. According to the Caribbean and U.S. Virgin Islands threatened and endangered (T&E) species database for the Culebra Archipelago, there are seven endangered species (three with critical habitat); three threatened species (one with critical habitat); and one species that has been delisted, but is subject to a monitoring plan (USFWS 2011a). In addition, two threatened coral species, listed by NMFS, may also be present in the Culebra Water Ranges (NOAA Fisheries 2011c). On October 20, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of corals as T&E and to designate critical habitat for these corals. Seven of the 82 coral species have the potential to occur in waters around Culebra and listing of these corals may be warranted. Several endangered whales may be present during certain times of the year around Culebra though they are not likely present in the shallower waters of these MRSs. There are two listed endangered species of plant and two listed reptiles that are not likely to be found in areas of work for the Culebra Water Ranges due to location and project tasks to be performed.

6.3.02 Other than roseate tern and brown pelican, the T&E species listed and/or proposed for listing in Table 6-1 are described in Section 3.0 of the 2012 SOP and in Appendix B of the 2012

SOP, along with photographs typical of the species and identification of breeding/nesting behaviors and critical habitat designations. Reptile and plant (terrestrial) species are addressed in Appendix B to the 2012 SOP in Appendix B. All project personnel will be fully briefed by a qualified staff member (e.g., project biologist) on this EPP and the 2012 SOP (including Appendices A and B) requirements prior to beginning the EBS in order to raise awareness and protect T&E species and sensitive or critical habitats, including sea turtles, sea turtle critical habitat, and other marine mammals. An emphasis will be made as to the potential for civil and criminal penalties to be issued to individuals who harm, harass, or kill T&E species (referred to as a “take”). These documents, including this EPP, will be available to all field teams during the EBS.

6.3.03 Threatened and/or endangered species that may be present in the Culebra Water Ranges, including corals that may be subject to listing, are included in Table 6-1. Logs will be maintained during the project detailing endangered or threatened species sightings in both terrestrial and marine habitats as required in Section 4.1.6 of the 2012 SOP and its appendices.

Table 6-1. Listed or Proposed Threatened or Endangered Species

Common Name	Scientific Name	Group	Status[1/]	Distribution
Loggerhead Sea Turtle	*Caretta caretta*	Reptile	T	Coastal Zones
Green Sea Turtle	*Chelonia mydas*	Reptile	T, CH	Coastal Zones
Leatherback Sea Turtle	*Dermochelys coriacea*	Reptile	E, CH	Coastal Zones
Hawksbill Sea Turtle	*Eretmochelys imbricate*	Reptile	E, CH	Coastal Zones
Brown Pelican	*Pelecanus occidentalis*	Bird	D, MP	Coastal Zones, No Nesting
Roseate Tern	*Sterna dougallii*	Bird	T	Coastal Areas and Offshore Cays, Nesting
Culebra Giant Anole	*Anolis roosevelti*	Reptile	E, CH	Arboreal forest
Virgin Islands Tree Boa	*Epicrates monensis granti*	Reptile	E	Forest and Shrublands
Wheeler’s peperomia	*Peperomia sheeleri*	Tree	E	Mesic, Semi-Evergreen Forest
[No Common Name]	*Leptocereus grantianus*	Cactus	E	Subtropical Dry Forest, Rock Substrate
Antillean Manatee	*Trichechus manatus manatus*	Mammal	E	Coastal Zones
Elkhorn Coral	*Acropora palmata*	Invertebrate	T, CH	Coral Reefs
Staghorn Coral	*Acropora cervicornis*	Invertebrate	T, CH	Coral Reefs
Lamarck’s Sheet Coral	*Agaricia lamarcki*	Invertebrate	Proposed	Coral Reefs
Boulder Star Coral	*Montastraea annularis*	Invertebrate	Proposed	Coral Reefs
Mountainous Star Coral	*Montastrae faveolata, Montastrae franksi*	Invertebrate	Proposed	Coral Reefs
Pillar Coral	*Dentrogyra cylindrus*	Invertebrate	Proposed	Coral Reefs
Elliptical Star Coral or Pineapple Coral	*Dichocoenia stokesii*	Invertebrate	Proposed	Coral Reefs
Rough Cactus Coral	*Mycetophyllia ferox*	Invertebrate	Proposed	Coral Reefs

Table 6-1. Listed or Proposed Threatened or Endangered Species (continued)

Common Name	Scientific Name	Group	Status[1/]	Distribution
Blue Whale	*Balaenoptera musculus*	Mammal	E	Oceans
Sperm Whale	*Physeter macrocephalus*	Mammal	E	Oceans
Sei Whale	*Balaenoptera borealis*	Mammal	E	Oceans
Fin or Finback Whale	*Balaenoptera physaluis*	Mammal	E,	Oceans
Humpback Whale	*Megaptera novaeangliae*	Mammal	E, De	Oceans

1/ E=Endangered; T=Threatened; CH=Critical Habitat; De=Delisted due to Recovery; MP= Monitoring Plan; Proposed = May be subject to listing as endangered or threatened, but not listed at the present time; De – depleted
Sources:
NOAA Fisheries 2011a, b, c; USFWS 2011b; SOPs (see Appendix B)

6.3.04 Chapter 9 of the ESA prohibits the taking of listed species without special exemption. There is no authorized take of any listed species during this project and no exemptions will be granted. Individuals whose action results in a take may be subject to penalties under the ESA. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. If any take does occur, work will stop immediately and the take will be reported. Under terms of sections 7(b)(4) and 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided such taking is in compliance with an incidental take statement.

6.4 CRITICAL HABITAT DESIGNATIONS

6.4.01 On Culebra, critical habitat designations for several listed species have been made as follows (USFWS 2011b; NMFS 2008).

6.4.02 Hawksbill Sea Turtle: On Culebra, critical habitat designation has been made for areas of beachfront on the north shore of the island from mean high tide inland to a point 150 meters from shore Playa Resaca, Playa Brava, and Playa Larga. These critical habitat areas are not within the survey areas of Flamenco Bay or the Luis Peña Channel though these turtles may be present.

6.4.03 Elkhorn and Staghorn Coral: The NMFS has designated critical habitat for Elkhorn and Staghorn corals in Puerto Rico that encompasses the entire Island and associated cays of Culebra. Coral is discussed further in Section 6.6.1.

6.4.04 Green Sea Turtle: On Culebra, critical habitat designation has been made in the waters surrounding the island of Culebra from the mean high water line seaward to 3 nautical miles (5.6 km). The surrounding islands and cays are also critical habitat for green sea turtles. Seagrass beds such as those in the Luis Peña Channel provide shelter and food for green sea turtles. Seagrass beds are discussed further in Section 6.6.2.

6.4.05 Culebra Giant Anole: On Culebra, critical habitat designation has been made under the ESA for most of the remaining forests on Culebra Island, comprising Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava.

Methods to Avoid or Minimize Impacts to T&E Species

6.4.06 Site personnel will coordinate closely with the USACE representative as well as federal and Commonwealth of Puerto Rico environmental agencies as required in the SOPs included as Appendix B to this Work Plan, to avoid and minimize potential impacts to listed species and their habitat. There is no authorized "take" of any of these species during the EBS fieldwork. These SOPs were developed to avoid or minimize impacts take to T&E species listed, pursuant to the ESA, proposed species of coral, and their critical habitats (where identified) during underwater investigations on Culebra Island and the adjacent cays. If take occurs, work must stop immediately and the take must be reported.

6.4.07 Site personnel will follow the requirements included in these SOPs to avoid and/or minimize possible impacts to T&E species and their habitats. Measures to avoid or minimize possible impacts that TtEC will follow during this work are included in Section 4.0 of the 2012 SOP as well as in both Appendices A and B of the 2012 SOP.

6.4.08 Section 4.1.6 of the 2012 SOP will be followed. TtEC will maintain a log detailing endangered or threatened species sightings in terrestrial and marine habitats. The log will include, but not be limited to, the following information: date and time; location coordinates using a GPS unit; species; one or more photographs, if possible; and any actions taken (e.g., species identification and distance from working area, reasons to cease operation, reasons to determine that operation may be resumed, among others) during the work period. All data shall be provided to USACE.

6.4.09 Descriptions of and specific measures to be taken for protection of various species are identified in the following sections of this EPP as follows:

- Marine mammals, including manatees, dolphins, whales, and sea turtles (Section 6.5)
- Coral reefs and seagrass beds (Sections 6.6.1 and 6.6.2)
- Nesting birds (Section 6.6.3)
- Terrestrial endangered plants (Section 6.11)
- Terrestrial endangered reptiles (Section 6.6.4)

6.4.010 The Puerto Rico DNER has jurisdiction on every resource in Puerto Rico (marine and terrestrial). Project activities will be coordinated with the DNER Endangered Species Division, Mr. Carlos Diez. In addition, other agencies also have jurisdiction regarding endangered species and must be coordinated with/consulted as appropriate, if not coordinated through Mr. Diez. The coordinating official on T&E species on Culebra is the Chief of the USFWS, Caribbean Field Office in Boquerón for species under their jurisdiction (sea turtles inland, manatees, birds, and terrestrial species). For aquatic species (sea turtles in water, corals, and marine mammals), Dr. Lisamarie Carrubba, Coordinating Official for NOAA Fisheries, has jurisdiction. For activities being conducted adjacent or within the Culebra National Wildlife Refuge, the Refuge Manager also has jurisdiction.

6.4.011 In the event that a T&E species is harmed or incidentally taken during the EBS activities, work will stop, and the TtEC PjM will notify the USACE Project Manager (PM) and the DNER coordinating official, and others will be notified as required (e.g., Refuge Manager, NOAA Coordinating Official, USFWS). Following this EPP and the 2012 SOP and its two appendices for work in Flamenco Bay or the Luis Peña Channel will help minimize potential impacts to threatened or endangered species and minimize harm to sensitive or critical habitat areas.

6.5 MARINE MAMMALS AND SEA TURTLES

6.5.01 Several species of marine mammals (whales, dolphins, and manatee) and sea turtles could be present in the offshore or potentially nearshore areas around Culebra.

6.5.02 The MMPA protects all marine mammals and prohibits the take of marine mammals in U.S. waters and by U.S. citizens on the high seas. Additionally, six species (sperm, sei, fin, blue, and humpback whales, and the West Indian manatee) are listed as endangered under the ESA (see Table 6-1). All of these species are managed by NOAA Fisheries, with the exception of West Indian manatee (*Trichechus manatus*), which is managed by the USFWS. A sub-species of the West Indian manatee, the Antillean manatee (*Trichechus manatus manatus*), occurs in Puerto Rico and is endangered. The following describes these species and the sections of the SOPs that contain further information.

6.5.03 Whale species listed in Table 6-1 (T&E species) as well as other species that are not endangered or threatened but are protected under the MMPA may be present at times, though their presence around Culebra, especially in the two water ranges, is not likely and work activities are not likely to impact the species. Whales are addressed in Sections 3.6 through 3.10 of the 2012 SOP. There are procedures to follow to minimize potential impacts to marine mammals from project activities which are included in the SOPs.

6.5.04 Manatees have been reported irregularly in Culebra Island through the years, the individuals usually staying only for a couple of weeks. Although Culebra Island has available habitat, it lacks fresh water, which may hinder a longer stay by manatees (USFWS 2009). Manatees are described in Section 3.5 of the 2012 SOP.

6.5.05 Several species of T&E sea turtles—the loggerhead sea turtle (described in Section 3.1 of the 2012 SOP), green sea turtle (described in Section 3.2 of the 2012 SOP), leatherback sea turtle (Section 3.3 of the 2012 SOP), and the hawksbill sea turtle (described in Section 3.4 of 2012 SOP)—may be present in the waters around Culebra. Seagrass beds (see Section 6.6.2 below) and coral reefs (see Section 6.6.1 below) are an important habitat for sea turtles for foraging and feeding. Seagrass beds are designated as critical habitat for the green sea turtle, as is the area surrounding Culebra to 3 nautical miles offshore, including surrounding islands and cays. Damage to seagrass beds and coral reefs must be avoided during field activities and extra vigilance is required when operating boats near these habitats as potential contact with sea turtles is more likely. In addition, during breeding season, turtles make nests and lay eggs on beaches on Culebra Island and the adjacent cays, making them susceptible to boating activities being performed in shallow water or on beaches during particular times of the year.

Measures to Mitigate Potential Impacts to Marine Mammals and Sea Turtles

6.5.06 One major threat to sea turtles includes destruction and alteration of nesting and foraging habitats. Turtles are also vulnerable in their pelagic stages as juveniles and adults, when they may be caught in fishing nets, struck by boats, or caught in debris.

6.5.07 All of the general and specific conservation measures in Section 4.0 of the 2012 SOP will be followed during the EBS. Specific conservation measures are identified in Section 4.2 (Staging Area Sea Turtle Nesting Monitoring), Section 4.4 (Marine Mammals and Sea Turtles Avoidance Measures), and Section 4.3 (Coral and Seagrass Avoidance Measures). In addition, Section 4.5 (Diving Operations and Equipment) will also be followed during the EBS activities in order to avoid harming of sea turtles and marine mammals and habitat during these activities. Some site activities performed in the Luis Peña Channel may require coordination and scheduling around dates of high green sea turtle activity if the seagrass beds are within the work area. More procedures are included in Appendix A to the 2012 SOP. Where information is provided in more than one location in these SOPs, the most stringent is to be applied.

6.5.08 Beach surveys are an important component of sea turtle protection if staging areas are required in beach areas. In order to select staging areas on beaches and minimize potential impacts to sea turtles and their nests from, on, or near shore survey activities, TtEC will coordinate with the DNER Endangered Species Division (Mr. Carlos Diez). Nest monitoring will be performed in accordance with Section 4.2 of the 2012 SOP and Beach Monitoring and Designation of Beach Zones sections in Appendix A to the 2012 SOP (as applicable) based on activities being performed, though the EBS does not include UXO clearance or vegetation clearance activities. The standard beach monitoring protocol will include having the Project Biologist perform daily morning beach patrols to identify the potential presence of new nests prior to and during the nesting season. The priorities for the beach monitoring protocol are to identify and record nesting behavior (tracks), site selection (sand, vegetation, and borderline), and threats to hatch success (predators, poachers, seawater, and desiccation). As part of the protocol, if sea turtle nests are found, the Project Biologist, their supervisor, and/or monitoring personnel will communicate daily with the USFWS Boquerón Endangered Species Specialist and the Culebra Islands National Wildlife Refuge Manager (if within the Refuge) as well as the DNER Endangered Species Division. Communications will help ascertain whether new nests have been located and their locations within the work area.

6.5.09 When it is not nesting season, the Project Biologist or appropriately trained personnel will conduct morning beach surveys prior to crews commencing daily activities to determine whether sea turtle nesting has occurred. The same priorities for the protocol inside a nesting season, and described above, will be followed.

6.5.010 Any collisions or sighting of injured or incapacitated marine mammals or sea turtles will be reported immediately to the USACE, USFWS, NMFS/NOAA, and DNER as required in Section 4.4.12 of the 2012 SOP.

6.6 SENSITIVE ENVIRONMENTS AND HABITATS

6.6.01 The Culebra National Wildlife Refuge comprises about 1,480 acres, includes 23 islands and rocks in addition to the four tracts on the main island of Culebra and associated cays, including Luis Peña. The refuge is well known as a nesting site for a variety of seabirds and preserves important habitat for endangered sea turtles.

6.6.02 Conservation priority areas for Culebra include all of the lagoons and beaches on Culebra, the Flamenco Peninsula, all cayos and cays around Culebra, and the Canal Luis Peña Natural Preserve. Flamenco Point and the Northwest Peninsula, and all beaches are managed by the USFWS or DNER for wildlife conservation and recreational use.

6.6.03 Flamenco Bay includes the tourist areas most visited in Culebra and endangered turtle nesting areas. The Luis Peña Channel is located in the Marine Natural Reserve and has coral reef barriers and endangered turtle nesting areas.

6.6.04 The following sections address the varieties of sensitive environments that may be found in the Culebra Water Ranges.

6.6.1 Coral Reefs

6.6.1.01 The DNER, through the Bureau of Fisheries and Wildlife Program, is responsible for conservation and management of coral reefs in Puerto Rico under Law 147, July 15, 1999 (Law for the Protection, Conservation, and Management of Coral Reefs in Puerto Rico). At the national level this coral reef program is part of the Coral Reef Initiative under Executive Order 13809 (Coral Reef Protection), which seeks to "preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment." The NOAA Fisheries Southeast Region's coral reef ecosystem conservation activities in Puerto Rico are managed by the Southeast Fisheries Science Center and the Southeast Regional Office, including the Caribbean Field Office. The activities are also executed pursuant to the Coral Reef Conservation Act, which provides funding for NOAA's Coral Reef Conservation Program. Coral reef ecosystem conservation activities also support and strengthen efforts related to the implementation of NOAA mandates under the Magnuson-Stevens Fishery Conservation and Management Act and the ESA. Hurricanes, namely Hurricane Hugo, caused widespread damage to coral reefs in Puerto Rico; in addition, other factors, such as pollution and damage from commercial and recreational activities, are causing continued decline. Coral reef restoration efforts continue to be made in Puerto Rico, with limited success.

6.6.1.02 Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) are both coral species in the genus Acropora. The NMFS designated critical habitat in Puerto Rico for both elkhorn and staghorn corals in November 2008 and in May 2006, NMFS listed both species as threatened. Staghorn and elkhorn coral are two of the three most important Caribbean corals in terms of their contribution to reef growth and fish habitat. Other corals also may be present and, though not currently listed, provide essential habitat for fish and reef structure that is protective of inner lagoons and cays. An additional seven species of coral have been proposed for listing.

6.6.1.03 Coral reefs in the Luis Peña Channel are documented since 1927 (Valdez-Pizzini et al. 2008) where most are patch reefs (Pagán-Villegas et al. 1999) and fringing reefs (Vicente 1995) and are described to maintain an extensive development of coral communities healthier than the vast majority of reef communities around Puerto Rico (Hernández-Delgado 2000; Hernández-Delgado and Sabat 2000).

6.6.1.04 Since 1980, populations have collapsed throughout their range from disease outbreaks with losses compounded locally by hurricanes, increased predation, bleaching, elevated temperatures, and other factors. This species is also particularly susceptible to damage from sedimentation.

6.6.1.05 Threats to coral reefs include:

- disease, such as white band disease
- hurricanes
- predation
- bleaching
- algae overgrowth
- sedimentation
- temperature and salinity variation
- low genetic diversity

6.6.1.06 Descriptions, including photographs, of elkhorn and staghorn corals are included in Sections 3.11 and 3.12 of the 2012 SOP. Descriptions including photographs of the other seven species of coral proposed for listing are included in Section 3.13 of the 2012 SOP.

6.6.2 Seagrass Beds

6.6.2.01 The Culebra seagrass beds have been proposed by the USFWS for designation as Resource Category 1 because these areas are unique and irreplaceable on a national or eco-regional level. Seagrass beds are considered a habitat area of particular concern as a subset of EFH in the U.S. Caribbean under the Magnuson-Stevens Fishery Conservation and Management Act because they provide important ecological functions and/or are especially vulnerable to degradation. Consultation with NOAA Fisheries is required for federal projects that may have adverse impacts upon EFH. Seagrass beds are extensive in the Luis Peña Channel (Hernández-Delgado 2003a) comprising the most abundant marine habitat in the Luis Peña Channel (Hernández-Delgado et al. 2002). These beds provide important habitat for a variety of species, including the endangered green sea turtle. Projects undertaken must not decrease the integrity of this habitat. The EBS performed prior to the RI will ascertain the location and extents of these seagrass beds so that intrusive activities performed during the RI can minimize damage to these beds.

6.6.2.02 The following information is excerpted from Resource Category 1 Designation: The Seagrass Beds of Culebra Island (USFWS 1992).

> "There are about 49 species of plants that have become fully adapted to marine environments. These species are called seagrasses because of their external morphological similarity to terrestrial grasses. These marine flowering plants have undergone very little speciation since and represent less than l % of the 250,000 flowering plants known worldwide. Although little speciation has occurred, seagrasses have developed a necessary adaptation called hydrophilic pollination. There is no equivalent of insect pollinators in aquatic plants.
> The association of seagrasses with other tropical or subtropical, shallow marine systems (mangroves and coral reefs) has been known to exist since Cretacean times. However, recent seagrass bed systems developed as the continental and insular shelves became flooded during the Holocene transgression following the Wisconsian Glaciation. Seagrass beds have therefore accumulated and trapped huge amounts of sediments, created and modified shorelines, and probably sustained large turtle, manatee, and fish populations within the West Indian tropics for long periods of time. Seagrass beds continue to keep pace with rising sea levels and fulfill physical and biological functions which ensure the ecological integrity of our coastlines.
>
> There are 4 species of seagrasses within the Culebra archipelago: turtle grass (*Thalassia testudinum*), manatee grass, shoal grass (*Halodule wrightii*), and sea vine (*Halophilia decipiens*). Turtle and manatee grasses are usually found growing together in shallow, protected environments with unconsolidated

> substrates. Manatee grass occurs as monotypic stands in wave-exposed sandy bottoms. *H. decipiens* is usually found in deeper water but may occur in shallow, turbid water. Shoal grass, with or without manatee grass, is usually found colonizing blowouts or other barren exposed bottoms. *Ruppia maritimea* (widgeon grass) is found only in very shallow semi-enclosed lagoons where salinities of 25 parts per trillion or less may be found because low salinities are required for Ruppia to reproduce sexually. On the other hand, extremely high salinities exclude seagrasses from Flamenco Lagoon, the largest lagoon in Culebra."

6.6.2.03 The seagrass beds of the Culebra archipelago support a large juvenile population of green turtles and are identified as critical habitat for this species.

Measures to Mitigate Potential Impacts to Coral Reefs and Seagrass Beds

6.6.2.04 Coral and seagrass avoidance measures are included in Section 4.3 (Coral and Seagrass Avoidance Measures) of the 2012 SOP. These measures will be followed at all times during the EBS activities. Notifications to the NMFS Boquerón Office and DNER will be made in accordance with Section 4.3.9 of the 2012 SOP should any coral be damaged or injured. Any activities causing the damage will be ceased and the coral will be left in place. If any boat runs aground, the boat operator will follow the procedures in Section 4.3.10 of the 2012 SOP. Diving operation procedures are included in Section 4.5 of the 2012 SOP.

6.6.3 Nesting Areas for Birds

6.6.3.01 The cays and coastal areas of Culebra are known nesting areas for shorebirds and seabirds with abundant suitable habitat amongst the rocky shores and cliffs and associated coastal vegetation. The largest seabird nesting colony occurs at Peninsula Flamenco, where 50,000 sooty terns nest. Most of the nesting for birds occurs in the spring and summer months (April through September) though birds may reside year-round. Migratory birds also frequent Culebra along routes of migration and the Culebra National Wildlife Refuge areas provide a haven for these species.

6.6.3.02 Several species of marine birds nest on the island of Culebra and surrounding cays as follows, one of which is listed as threatened species (EEG 2006):

- Brown noddy
- Laughing gull
- Red-billed tropicbird
- White-tailed tropicbird
- Audubon's shearwater
- Bridled tern

- Roseate tern (threatened)
- Cayenne tern
- Sooty tern
- Royal tern
- Sandwich tern

6.6.3.03 It is not anticipated that activities performed during the RI will have adverse impact on nesting seabirds or shorebirds as the nesting areas will not be directly disturbed and disposal of munitions are not likely to be performed during the EBS. Boating operations may be performed near shore where nesting birds are present, which could cause disturbance to nesting birds if present. TtEC will coordinate site activities in consultation through the USACE with USFWS and DNER personnel as required to minimize potential impacts to nesting birds and will attempt to coordinate work schedules so that impacts are lessened for nesting birds.

6.6.4 Terrestrial Reptiles

6.6.4.01 Two endangered and/or threatened species of reptile are present on Culebra and its adjacent cays. Species include the Culebra giant anole (*Anolis roosevelti*) and the Virgin Islands tree boa (*Epicrates monensis granti*). Sections 2.1 and 2.2 of Appendix B to the 2012 SOP contain information and photographs of these species. Critical habitat has been designated for the Culebra giant anole at Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava. No critical habitat has been designated for the Virgin Island tree boa on Culebra. Impacts to these species are not likely during the EBS because this work will be performed on water, though during travel to and from the sites, these species could be encountered. Sections 3.0, 3.2, and 3.3 of Appendix B to the 2012 SOP will be followed to avoid impacts to these species during the work. The project biologist will brief employees at project start so that these species can be recognized and avoided. All sightings of these species will be recorded on a daily log and reported to the USACE. If the Culebra giant anole is sighted during any field activities, the USACE and USFWS must be notified immediately as specified in Appendix B to the 2012 SOP as these are extremely rare.

6.7 WETLANDS

6.7.01 There are no freshwater wetlands in Culebra. Estuarine and marine wetlands, including conservation priority area lagoons, are the wetland types that could potentially be impacted by work during the RI. Marine wetlands represent 27 percent of the total wetland resources in Puerto Rico. Seagrass beds are included in this category of wetland and are described in Section 6.6.2 above. Long stretches of beach and shore habitats, along with associated buffer areas, are becoming increasingly rare due to agriculture and recreational or commercial activities and development. The principal habitats of concern in Puerto Rico’s coastal and estuarine environment are: shoreline, wetland, and adjacent coastal upland areas. Each of these habitats provides a key contribution to the ecological integrity of the overall coastal environment and "ecological significance" is determined by the quality of existing natural habitats, the diversity of species present, and the existence of threatened or endangered species (DNER 2010a).

6.7.02 The USFWS Wetlands Online Mapper was used to identify wetlands within the Culebra Water Ranges. There are several marine and estuarine wetland areas identified in small bays along the Luis Peña Channel of the main island of Culebra and there are extensive seagrass beds in the Luis Peña Channel (Hernández-Delgado 2002; Valdez-Pizzini et al. 2008). Extensive areas of Flamenco Bay are identified as estuarine or marine wetlands. These sensitive areas were delineated as part of the EBS performed by TtEC so that they can be protected during work activities.

6.7.03 It is anticipated that impacts to wetlands will not occur during the EBS as intrusive investigations will not be performed and conservation measures will be followed for performing work near seagrass beds.

6.8 CULTURAL AND ARCHAEOLOGICAL RESOURCES

6.8.01 The NRIS, NHL list, NHA list, and the National Park Service list one registered property, Faro Isla de Culebritas, which is part of the Lighthouse System of Puerto Rico. This lighthouse is not within the areas that will be worked in during the EBS or RI. There are known prehistoric sites on Culebra Island (USFWS n.d.); however, these are documented to be on land and not in the areas where the EBS will be conducted. A literature assessment by Valdés Pizzini et al. (2008) showed that there is not extensive information about cultural and archaeological resources for the Luis Peña Channel Reserve.

6.8.02 During the EBS, snorkeler personnel will visually observe work areas for cultural and archaeological artifacts during the course of site activities. If the snorkelers or data from geophysical or bathymetry surveys identify potential cultural or archaeological items or structures, the USAESCH PM will be notified. If any known or suspected cultural or archaeological items are found, the location will be marked, a photo will be taken (if possible), and the USAESCH PM will be notified of the finding. Work in the immediate area of an artifact will be halted until a qualified person, typically the State Historic Preservation Officer, can inspect the item.

6.9 WATER RESOURCES

6.9.01 Groundwater on Culebra is scarce and only known to occur in alluvial deposits and in fractures in volcanic and plutonic rocks. Average annual rainfall is 30 to 50 inches, and all aquifer recharge comes from direct rainfall. The public water supply on Culebra comes from a desalination plant located near Lower Town. In some households, municipal water is supplemented with rooftop cisterns or groundwater for non-drinking water uses. There are no permanently flowing surface water streams on Culebra (Parsons 2011).

6.9.02 Groundwater and freshwater resources will not be adversely impacted by project activities and are not the focus of the EBS. Care will be exercised to minimize adverse impacts to estuarine or marine wetlands and to preserve sensitive habitats and ecologically and economically important marine and estuarine water resources.

6.10 COASTAL ZONES

6.10.01 The management of the coastal zone was adopted on July 12, 1978, as the Coastal Land Use Plan of Puerto Rico. The lead agency for coastal zone management in Puerto Rico is the DNER, whose primary responsibility is to protect the natural resources of Puerto Rico. The Planning Board is the government agency responsible for administering the certification process with the Federal Support Program. The NMFS also has jurisdiction in coastal zones. The Coastal Zone of Culebra as described in the Puerto Rico Coastal Zone Management Program (DNER 2008) as "a strip of land one thousand linear meters inland, measured from the coastline, as well as the additional distance necessary to incorporate key natural systems of the coastal environment. In addition, it includes the territorial waters of Puerto Rico and the corresponding submerged lands (three marine leagues, 9 nautical miles or 10.35 land miles), the islands of Vieques, Culebra, Mona, Monito, Desecheo, Caja de Muertos and all keys and small islands within them." All project activities taking place for the Culebra Water Ranges are considered within the Coastal Zone.

6.10.02 In order to access the MRSs, work crews and equipment must be transported by boat. In addition, sonar and marine geophysical detection equipment and snorkeling operations will be used during the EBS. Any anchorage areas will be carefully examined following procedures in the 2012 SOP and its appendices to protect coral reefs and seagrass beds. Information from bathymetric surveys, snorkel surveys, and remotely operated vehicle photo-documentation collected during the EBS will be used to further delineate sensitive habitats and procedures to avoid damage to these resources. Information contained in the 2012 SOP and its appendices will be amended as necessary with supplementary information and followed to ensure that anchorage of boats or grounding of boats on sensitive coral reefs does not occur during the follow-on RI. The EBS is being performed prior to the RI to help characterize the benthic environment and delineate sensitive habitats and coral reef areas so that provisions to avoid adverse impacts can be planned for during the RI.

6.10.03 TtEC will utilize public or private docks for launching boats. TtEC will not be landing boats onto beaches and will avoid damaging coral reefs, turtle and bird nesting areas, and seagrass beds during this work as outlined in Sections 6.4 through 6.6 of this EPP and the referenced SOPs. No anchoring will take place in areas other than unvegetated sandy bottoms, and the use of existing mooring buoys rather than anchoring is preferred whenever possible. Consultation with agencies such as the PREQB, NMFS/NOAA, the USFWS, and the Refuge Manager on this project, as well as meeting regulations or other requirements of these agencies during the EBS, will ensure this project adheres to coastal zone management objectives and protects marine and estuarine water resources.

6.11 TREES AND SHRUBS

6.11.01 There will be no removal of trees or shrubs on this project because this work is being performed wholly within marine areas using existing dock facilities. Beach surveys will not disturb or harm trees and access to work sites will utilize existing docks, roads, trails, and paths whenever possible.

6.11.02 Appendix B to the 2012 SOP, Section 2.3, contains information on Wheeler's peperomia (*Peperomia wheeleri*) and *Leptocereus grantianus*, an unnamed species of spineless cactus, both of which are considered endangered. Information contained in these sections as well as the mitigation measures in Sections 3.0 and 3.4 of this appendix will be communicated to project personnel by the project biologist so that these species can be avoided if there is potential for impact through vegetation disturbance in areasr where these species may be present. In addition, association of other canopy species may be an indicator of the potential presence of the Wheeler's peperomia, and particular attention will also be paid to these types of forest canopies. If any of these species are present where work will be conducted or along an intended travel route, the route will be adjusted so that these species are not contacted. Reporting of any finds of these species in work areas or paths will be logged and reported to the USACE as required in Appendix B to the 2012 SOP.

6.12 EXISTING WASTE DISPOSAL SITES

6.12.01 There are no known munitions waste disposal sites within the Culebra Water Ranges of Flamenco Bay or the Luis Peña Channel. MEC was used during training exercises and is considered UXO. Discarded military munitions, which are military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal, are not known to be present in these MRSs.

6.13 PROJECT WASTE MANAGEMENT

6.13.01 The following sections describe wastes that may be generated during the EBS and the disposition of these wastes. Wastes will be managed, transported, and disposed of in accordance with federal and Commonwealth of Puerto Rico regulations and requirements.

6.13.1 Unexploded Ordnance

6.13.1.01 It is anticipated that UXO, if discovered during the EBS, will be identified, photographed, and left in place and position documented.

6.13.1.02 If the underwater investigation team identifies an item that is UXO and it is determined that disposal activities for the UXO are warranted (explosive hazard poses a high risk to site receptors), the related work and its conservation measures plan will be closely developed and coordinated with the TPP Team. Alternatives to munitions detonation exist, which may be performed in particularly sensitive environments that otherwise may cause damage to these areas, in particular coral reefs. One alternative involves placement of a pre-cast concrete coffin over the munitions that are not considered safe to move. This alternative also functions as a small-scale artificial reef structure, providing potential habitat for fish and invertebrate species substrate.

6.13.2 Common Trash

6.13.2.01 Common trash such as food wastes, food containers, and office-related trash will be collected off boats on a daily basis and disposed of in the office trash dumpster. This dumpster will be regularly picked up and disposed of in a local sanitary waste facility as arranged with the Municipality of Culebra.

6.13.3 Vehicle and Boat Maintenance Fluids

6.13.3.01 Project vehicle and boat maintenance (e.g., oil changes), if required during the project, will be performed by a vendor on Culebra who will perform disposal and/or recycling of waste materials.

6.13.4 Sanitary Wastes

6.13.4.01 Sanitary wastes from boats equipped with U.S. Coast Guard–approved marine sanitation devices and grey water from hand washing will be regularly pumped out at/by an approved facility at public or private dock.

6.14 WASTE TRANSPORTATION AND DISPOSAL

6.14.01 Waste profile sheets are not anticipated to be required based on the anticipated wastes that will be generated during the EBS because no special waste or hazardous waste will be generated.

6.14.02 If required (e.g., if unanticipated contaminated wastes require special waste disposal), profile sheets will be coordinated with the intended facility based on their waste acceptance criteria. Waste profile sheets will be submitted for review and signature by the USACE representative. If the disposal facility issues permits for receiving waste, the permit will accompany the waste to the disposal facility when shipped.

6.14.03 Likewise, based on anticipated wastes that will be generated during the EBS, manifests are not required, though straight bills of lading may be used to track shipments or for payment purposes.

6.14.04 Munitions are regulated for transportation on public roads though there will be no transportation of UXO items from their in situ location to any land-based disposal area during the EBS. No other wastes listed above are regulated for transport on public roadways by the U.S. Department of Transportation, Hazardous Material Regulations. As such, these wastes may either be self-transported to the disposal/recycling facility or a local solid waste vendor affiliated by contract for disposal to the intended facility by contract.

6.14.05 All waste generated during field activities will be properly containerized and disposed of in accordance with all applicable federal and Puerto Rico regulations and through approved channels.

6.14.06 Solid waste facilities will be chosen based on their waste handling permit and waste acceptance criteria. Wastes will only be sent to facilities that are operating in compliance with their permits and applicable federal and Puerto Rico regulatory requirements.

6.15 CONTINGENCY FOR UNANTICIPATED WASTE

6.15.01 If unanticipated wastes are generated during project activities, TtEC will notify the PjM and Program Environmental Safety Manager (PESM), as well as the USACE PM to determine the proper and safe course of action to properly characterize, containerize, transport, and dispose of the waste. The PESM will ensure hazardous waste trained personnel are identified, and will initiate and identify appropriate sampling and analysis, containerization requirements, waste storage requirements, proper shipping descriptions per the U.S. Department of Transportation, Hazardous Material Regulations, initiate waste profile sheets and manifests for the appropriate RCRA licensed and permitted facilities, and ensure that the paperwork is completed from point of generation to disposal in accordance with federal and Puerto Rico regulations.

6.15.02 If a waste is discovered during the EBS and the waste is not related to project activities, TtEC will notify the PjM, PESM, and the USACE PM. The USACE PM will determine proper federal and local agency notifications to make (e.g., if the waste is not the result of project activities). TtEC will not handle the waste if it is not generated as part of the project.

6.15.03 Depending on the USACE generator status (large, small, or conditionally exempt small quantity generator), hazardous waste disposal must occur within the required timeframes specified under the regulations (e.g., large quantity generators have 90 days and small quantity generators have 180 days from accumulation start date).

6.15.04 TtEC will also notify the client representative, the Contracting Officer as the Generator of Record, to ensure provisions are made for signature of the waste profile sheet, land disposal restriction, and uniform hazardous waste manifest, and to determine the generator category and disposal timeframe requirements. TtEC personnel cannot sign any of these Generator of Record documents as TtEC or as Agents of the Government unless designated specifically in the contract agreement.

6.16 IMPACT MINIMIZATION MEASURES

6.16.01 Impact minimization procedures, in addition to those discussed throughout this EPP, will include briefing all on-site personnel on applicable health and safety issues as well as the need for minimizing impacts on sensitive biological resources as outlined in this EPP. Methods for recognizing, avoiding, and minimizing potential impacts on the plant and animal species and habitats of concern will be stressed during the on-site training.

6.16.02 Close coordination with environmental resource agencies before and during the project will help ensure impacts to sensitive environments; critical habitats, endangered/threatened species, as well as impacts to recreational activities are minimized throughout this project.

6.16.03 Areas disturbed during the EBS activities will be kept to the minimum required to accomplish the project tasks.

6.17 BURNING

6.17.01 Burning of materials within or around the Culebra Water Ranges will not be performed during the EBS.

6.18 DUST AND AIR POLLUTION CONTROL

6.18.01 Widespread dust control is not anticipated on this project because much of the project takes place on the water. However, control of fugitive dust on the project may include best management practices such as keeping speeds down on dirt or gravel roads to minimize generation of dusts and housekeeping efforts to prevent buildup of dirt or mud on boat decks, equipment, docks, and ramps to prevent the dirt or mud from drying out and causing dust in work areas.

6.18.02 Other emissions sources include vehicles and boats used to transport personnel. All vehicles and equipment will be in good working order, inspected, and will meet applicable vehicle emissions requirements. Vehicles will not be left idling for extended periods of time.

6.19 SPILL CONTROL PLAN

6.19.01 Reporting of spills to federal and Commonwealth of Puerto Rico agencies will occur after immediate notification has been made to the TtEC PjM and USAESCH PM. Spills on the water are immediately reportable to the National Response Center without delay. All spills that occur on this project from vessels or on land will be reported to the National Response Center. The Response Center notifies all trustees automatically of the reported spill.

6.19.02 For oil or chemical spill notification, call the National Response Center at **800-424-8802.**

6.19.1 Spill Potential

6.19.1.01 Due to the nature of the operations, a spill of pollutants to the environment could occur. The most likely spill is a spill of fuel to water which could occur during operation of boats, primarily during refueling operations. Refueling operations, however, will not be done on the water, other than at the dock. Refueling will be performed following best management practices, including slowing down when filling fuel tanks; knowing the size of the tank, and avoiding topping off the tank. Fuel collars, absorbent pads, and fuel/air separators are tools that can be used to help avoid spills or to contain excess fuel that has accidentally spilled. A fuel collar is a doughnut of absorbent material that fits around the fueling nozzle and catches splashes or drips during refueling. Absorbent pads can be used to wipe up excess fuel or to capture fuel from leaks. A fuel/air separator can prevent the escape of fuel from the air vent during filling.

6.19.1.02 In addition, boats will be maintained in proper working order and subject to a preventative maintenance schedule. Boat operators will also conduct a pre-launch boat inspection every day.

6.19.1.03 In the event of a spill, the largest quantity of pollutant (gasoline) that can reasonably be lost at any one time during refueling is 10 gallons of gasoline. If a leak of fuel or other fluids, such as hydraulic or transmission fluid, occurs on a boat, field personnel will promptly attempt to plug the hole and/or turn off pumps if safe to do so.

6.19.1.04 If the spill occurs on the ground, the material spilled will be bermed with dirt so that the fluid does not spread along the ground surface. Any spills originating from small containers (e.g., gasoline cans) will be contained by the use of absorbent materials. Any spill cleanup materials will be contained and managed for disposal according to federal and Puerto Rico regulations.

6.19.2 Other Preventive Spill Control Measures

6.19.2.01 Containers of liquids containing petroleum products (gas or diesel) or other chemicals with potentially hazardous constituents (paints, lubricants, etc.) will be kept closed when not in use, maintained in original containers with labels affixed, and will be kept in appropriate storage areas (e.g., flammable storage cabinets).

6.19.2.02 TtEC plans to conduct all fueling, maintenance, and repair of vehicles and boats off-site. This practice will decrease the amount of pollutants that need to be stored on the site. Those liquids of a hazardous nature that are absolutely necessary to conduct field operations will be stored in the minimum required quantities.

6.19.2.03 Any spills originating from small containers (e.g., gasoline cans) will be contained by the use of absorbent materials.

6.19.3 Emergency Spill Response and Notification

6.19.3.01 The procedures described below will be followed in the event of a spill on-site.

6.19.3.02 All spills, leaks, and fires involving oil or hazardous substances must be reported to the PjM and the PESM as well as the client representative and the National Response Center. The person reporting the leak or spill is required to provide the following information:

- His/her name
- Location of spill and facility number, if known
- Number of injured personnel and nature of injuries, if known
- Substance spilled
- Estimated amount spilled
- Extent of spill
- Estimated rate at which the substance is currently being released
- Estimated time the spill occurred
- Any other pertinent information

6.19.3.03 Minor and major spill procedures are outlined below.

6.19.3.1 Minor Spill Procedure

6.19.3.1.01 A minor spill would involve no immediate threat to human health or the environment (e.g., not cause sheen or discoloration on the water), cause minimal property damage, be readily cleaned up by TtEC crewmembers, be a known substance, and not exceed the reportable quantity for that material. In the event of a minor spill, the appropriate response action is for the responsible person to notify the client and the PjM as well as the National Response Center and supply the responders with as much information as possible. In the case of a spill of contaminated or hazardous materials, the following procedures will be followed:

- Stop the source of the spill if safe to do so (e.g., upright a container, shut off valve, etc.).
- Notify a supervisor (FOL, Site Safety and Health Officer [SSHO]).
- SSHO or FOL notifies the PjM and the PESM.
- Identify protective clothing or equipment required to respond.
- Contain the spill.
- Neutralize and/or solidify any product.
- Transfer material into appropriate waste containers as directed by the FOL or PjM. Transfer the waste to the appropriate storage area for management and disposal at the direction of the FOL or PjM.
- Document the incident.

6.19.3.2 Major Spill Procedure

6.19.3.2.01 In the event of a major spill where human health and/or the environment is at risk (e.g., spill is to a surface water, persons are injured, there is a risk of fire or explosion from the materials, material spilled is not known, the spilled material is more than can be reasonably handled with on hand resources in a few minutes time, or spills that have or are likely to enter a storm drain or other conveyance), the following procedures shall be followed.

- A spill to surface water may not constitute an immediate hazard to workers; however any spill to surface water is agency reportable and is to be treated as an emergency.
- Isolate the spill area, shut down equipment if safe to do so, and evacuate upwind.
- Keep others from entry into the area.
- If anyone is injured, at risk, or there is a fire or explosion, call 911.
- Notify the FOL and/or SSHO.
- SSHO or FOL will immediately notify the PjM, PESM, and client and relay pertinent information. Notify the National Response Center.
- If source of spill is not unknown and other hazards are not likely to exist (e.g., fires, exposures, or explosions), assess extent of spill and identify potential pathways of dispersion. Cover or isolate these pathways in advance of the spill, if feasible, but only if exposures can be avoided.
- Note type, amount, and location of material released. Provide Material Safety Data Sheets for response personnel.

6.20 STORAGE AREAS AND TEMPORARY FACILITIES

6.20.01 A temporary office facility and equipment storage space will be located for use (location is to be determined).

6.21 ACCESS ROUTES

6.21.01 Existing roads will be used to access and transport personnel to dock facilities.

6.22 CONTROL OF WATER RUN-ON AND RUN-OFF

6.22.01 This investigation involves work within marine waters and not land-based activities. There will not be any drainage patterns that are altered by site activities and therefore mitigation procedures will not be required to control water run-on or run-off. Furthermore, TtEC will not conduct any activities that discharge pollutants into waterways or waterbodies. Spill prevention practices and response procedures will be in place to minimize the chances for spills and releases. Waste management and disposal will comply with federal and Puerto Rico regulations.

6.23 DECONTAMINATION OF EQUIPMENT

6.23.01 There is no anticipated decontamination required on this project.

6.24 MINIMIZING AREAS OF DISTURBANCE

6.24.01 Boating activities will be performed to the extent required to map and survey the benthic environment while minimizing harm through direct contact with coral reefs, seagrass beds, and marine mammals or sea turtles. Work areas will be planned in advance so that appropriate resource agencies can review them and scheduled activities will cause minimal potential for impact to the environment. Maps, charts, and aerial photos will help ensure that the areas worked in are minimally disturbed and sensitive areas (coral reefs and seagrass beds) can be avoided. Equipment checks will be performed daily before and during work to ensure data collection is completed with minimal amount of potential rework. Boat trips to and from the launch will be minimized to the extent possible through proper pre-trip planning to minimize boat traffic overall and the most direct routes with the least potential for impacts to coral reefs and seagrass beds will be used to access the work areas.

6.25 POST-ACTIVITY CLEANUP

6.25.01 Following completion of both daily work and the project, all boats and equipment will be properly secured and stowed. Periods of potential severe weather will require paying particular attention to securing and stowing of gear as required to minimize the potential for damage or materials to be dispersed by wind or rain. Cleaning of boats will only be done in a designated onshore location and laydown area. Trash and sanitary waste will be removed and placed in designated waste receptacles. All waste will be properly disposed of prior to demobilization from the project.

7.0 PROPERTY MANAGEMENT PLAN

7.0.01 This Property Management Plan has been prepared in accordance with DID MR-005-09 and Federal Acquisition Regulations (FAR), Part 45.5 and it supplements to provide detailed information on the types, quantities, and sources of equipment and materials that will be required to perform field and office operations on this Task Order. Field operations include all activities to be performed to complete the fieldwork. Office operations include all tasks performed in support of project management and the implementation of project work in the field through completion consistent with the requirements of the scope of work (Appendix A). The types of equipment recommended, selected, and proposed for this work are those that have been tested and proven in the industry and, therefore, are reliable to use in performing the various activities associated with this project. The quantities proposed are needed to help perform the work in a timely and cost-effective manner as dictated by the project schedule.

7.1 FIELD EQUIPMENT

7.1.1 Survey Equipment

7.1.1.01 Survey vessel and equipment that will be used during the EBS phase are described in detail in Section 3, Field Investigation Plan.

7.1.2 Transportation Equipment

7.1.2.01 Various types of transportation equipment will be required during field operations. Vehicles required during the project may include standard automobiles and pickup trucks with vessel trailers.

7.1.3 Safety Gear

7.1.3.01 The EBS is non-invasive and no contact with potential MEC is expected. Appropriate personal protective equipment (PPE) for vessel operations will be worn and may include, but is not limited to, boots, leather work gloves, latex or nitrile gloves, hardhats, and safety glasses. Personnel will typically conduct their operations in Level D PPE consisting of standard work clothes with long pants, safety boots (as needed), hard hats (when overhead hazard is present), safety glasses or face shields (as needed), and hearing protection (as needed). Personnel working away from active field investigations will not be required to wear safety boots or hard hats.

7.1.4 Communication Equipment

7.1.4.01 Communications equipment to be used includes handheld two-way radios, VHF radios, and cellular telephones.

7.1.5 Office Equipment

7.1.5.01 The majority of the survey equipment to be used on this project, including the vessel, will be brought to the site from the TtEC office in Bothell, Washington, with support

7.0 PROPERTY MANAGEMENT PLAN

7.0.01 This Property Management Plan has been prepared in accordance with DID MR-005-09 and Federal Acquisition Regulations (FAR), Part 45.5 and it supplements to provide detailed information on the types, quantities, and sources of equipment and materials that will be required to perform field and office operations on this Task Order. Field operations include all activities to be performed to complete the fieldwork. Office operations include all tasks performed in support of project management and the implementation of project work in the field through completion consistent with the requirements of the scope of work (Appendix A). The types of equipment recommended, selected, and proposed for this work are those that have been tested and proven in the industry and, therefore, are reliable to use in performing the various activities associated with this project. The quantities proposed are needed to help perform the work in a timely and cost-effective manner as dictated by the project schedule.

7.1 FIELD EQUIPMENT

7.1.1 Survey Equipment

7.1.1.01 Survey vessel and equipment that will be used during the EBS phase are described in detail in Section 3, Field Investigation Plan.

7.1.2 Transportation Equipment

7.1.2.01 Various types of transportation equipment will be required during field operations. Vehicles required during the project may include standard automobiles and pickup trucks with vessel trailers.

7.1.3 Safety Gear

7.1.3.01 The EBS is non-invasive and no contact with potential MEC is expected. Appropriate personal protective equipment (PPE) for vessel operations will be worn and may include, but is not limited to, boots, leather work gloves, latex or nitrile gloves, hardhats, and safety glasses. Personnel will typically conduct their operations in Level D PPE consisting of standard work clothes with long pants, safety boots (as needed), hard hats (when overhead hazard is present), safety glasses or face shields (as needed), and hearing protection (as needed). Personnel working away from active field investigations will not be required to wear safety boots or hard hats.

7.1.4 Communication Equipment

7.1.4.01 Communications equipment to be used includes handheld two-way radios, VHF radios, and cellular telephones.

7.1.5 Office Equipment

7.1.5.01 The majority of the survey equipment to be used on this project, including the vessel, will be brought to the site from the TtEC office in Bothell, Washington, with support from the office in TtEC office in Carolina, Puerto Rico. Most of the equipment (for example, vessel, MBE, SSS, underwater video, GPS equipment, radios, CADD or GIS workstations, computers, printers, plotters, etc.) is owned by TtEC, and the charges to the project will be as proposed for this Task Order. However, some items may need to be rented or purchased for fieldwork.

7.1.6 Consumable Supplies

7.1.6.01 Consumable supplies planned for the purchase in support of the EBS include but are not limited to:

- Fuel for vessels, vehicles and equipment;
- Disposable gloves and leather work gloves;
- Potable water;
- Eye wash;
- First aid kits;
- Fire extinguishers;
- Log books; and
- Ink cartridges for printers and copy paper.

7.1.7 Vendors and Associated Costs

7.1.7.01 TtEC will provide the majority of the field and office equipment; however, certain types of equipment and materials will be rented, leased, or purchased from vendors with proven records of furnishing well-maintained, reliable, and updated equipment that can be used to successfully complete the field and office operations. General cost estimates on the types, quantities, and sources of equipment proposed for the EBS are summarized in Table 7-1. The majority of consumable supplies will be provided by local vendors; however, some consumables may be purchased from specialty vendors.

Table 7-1. List of Equipment

Office/Field Operations	Equipment Type (or equivalent)	Number of Units	Anticipated Source	Status
Communication during fieldwork	Motorola handheld radios and cellular telephones	8	TtEC	Own*
Interpretation of field data and information processing	Field laptop computers, printer, scanner	3	TtEC and local vendor	Own* and purchase
Survey Operations	MBE, SSS, underwater video, positioning	8	TtEC	Own*
Survey Operations	Vessel	2	TtEC	Own*
Transportation of personnel and equipment	Pickup truck, vessel trailer	2	Local Vendor	Lease
Field Office	Portable Trailer	1	Local Vendor	Lease

Table 7-1. List of Equipment (continued)

Office/Field Operations	Equipment Type (or equivalent)	Number of Units	Anticipated Source	Status
Sanitation	Portable toilets	3	Local Vendor	Rent
Remote office processing of data and development of maps/graphics	Desktop computers, laptop computers, GIS workstation, printers/copiers/plotters	4	TtEC	Own*
Photodocumentation of fieldwork	Digital cameras	2	TtEC	Own*
Field Safety	AED	1	TtEC	Own*

* Equipment is owned and maintained by TtEC and will be rented to the project at the contract rates.

7.1.8 Procurement Procedures

7.1.8.01 Equipment will be leased or rented, and consumables and supplies will be purchased in a procurement process in strict conformance with the FAR and Defense Federal Acquisition Regulations. There are no known instances where purchase of equipment on behalf of the government will be required on this project. TtEC will follow standard procurement procedures for all purchases. TtEC will acquire at least three quotes for each item and a comparison of rental versus purchase of each item will be performed in accordance with FAR thresholds.

7.1.9 Leased and Rented Vehicles

7.1.9.01 The leased vehicles will be selected using the comparison of rate quotes from at least three commercial vendors. The number of vehicles will be determined by one vehicle for approximately four personnel working on-site. The type of vehicles used will be determined by the site's physical conditions, such as terrain, weather conditions, and distances between lodging, the site office, and the fieldwork area. Any exceptions will be justified by TtEC and approved by the Contracting Officer.

7.1.10 Consumable Supplies and Personal Property

7.1.10.01 TtEC's disclosed accounting practices prescribe that all materials and supplies required for the performance of the contract and Task Order will be direct charged to that order, and such materials and supplies are not included in the basis for overhead computation. The only exception is limited to home office supplies and equipment such as letterhead, pens, pencils, standard personal computers, office furnishings, etc. Field office supplies are typically direct charged to the project and not included in the overhead computation.

7.1.11 Property Storage Plan

7.1.11.01 The site office will be used to store purchased items for the EBS. If needed, an off-site storage unit will be rented. TtEC-owned property will be segregated from government property.

7.1.12 Ultimate Disposal Plan

7.1.12.01 Non-consumable items purchased on time and material (T&M) tasks will be reassigned to other government projects at the end of the project. TtEC will provide an inventory to USAESCH and request further direction for transfer/disposal details.

7.1.13 Property Tracking Plan

7.1.13.01 An inventory list will be maintained by TtEC for the non-consumable items purchased on T&M tasks for the EBS. When applicable, the serial number, model or manufacturer, date purchased, present location of item, cost, current status (functional, need of repair, needs batteries, etc.), and a description of the item are recorded on the inventory list. A property tracking log report will be submitted to USAESCH that will list all TtEC-acquired property that is directly charged to the Task Order on T&M tasks. The property tracking log report will be submitted at the conclusion of the field investigation.

7.1.14 Loss Notification

7.1.14.01 For all non-consumable items purchased on the inventory for the EBS, TtEC will notify the Contracting Officer if the item is lost, damaged, stolen, or destroyed.

This page intentionally left blank.

8.0 INTERIM HOLDING FACILITY SITING PLAN FOR RECOVERED CHEMICAL WARFARE MATERIEL (RCWM) PROJECTS

8.0.01 Section 8 is not applicable to this project and will serve as a placeholder section only.

This page intentionally left blank.

9.0 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

9.0.01 Section 9 is not applicable to the project and will serve as a placeholder section only.

10.0 REFERENCES

10.0.01 DNER (Department of Natural and Environmental Resources Puerto Rico). 2008. Puerto Rico Coastal Zone Management Program. Available online at: http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/costasreservasrefugios/pmzc/publicaciones/Executive%20Summary.pdf

10.0.02 DNER. 2010a. Reglamento de Pesca de Puerto Rico (Puerto Rico Fishing Regulations). Estado Libre Asociado de Puerto Rico. 104 pp.

10.0.03 DNER. 2010b. Draft Puerto Rico Coastal and Estuarine Land Conservation Plan. Prepared by Ernesto Diaz and Craig G. Lilyestrom, Ph.D. March. Available online at: http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/costasreservasrefugios/pmzc/humedales-1/Final%20draft%20PR%20CELCP%20Plan%2010%20Mar10.pdf

10.0.04 DNER. 2010c. Puerto DRNA, navego por el ambient [Internet]. Available online at http://www.drna.gobierno.pr/

10.0.05 EEG (Ellis Environmental Group). 2004. Site-Specific Final Report, UXO Construction Support, Culebra Island Wildlife Refuge, Culebra Island, Puerto Rico.

10.0.06 EEG. 2006. Environmental Protection Plan, Non-Time Critical Removal Action, Municipality of Culebra, Puerto Rico Final Work Plan.

10.0.07 EPA (U.S. Environmental Protection Agency). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01, -02. EPA/540/G-89/004. October.

10.0.08 EPA. 1989. CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements. OSWER Directive 9234.1-02. August.

10.0.09 ESE (Environmental Science and Engineering, Inc.). 1997. Final Engineering Evaluation and Cost Analysis (EE/CA) for the Former Culebra Island Naval Facility, Culebra Island, Puerto Rico.

10.0.010 Hernández-Delgado, E.A. 2000. Effects of Anthropogenic Stress Gradients in the Structure of Coral Reef Fish and Epibenthic Communities. Ph.D. Dissertation, Dept. Biology, University of Puerto Rico, San Juan, Puerto Rico. 330 pp.

10.0.011 Hernández-Delgado, E.A. 2002. 1997-2002. Long-term Coral Reef Ecological Change Monitoring Program of the Luis Peña Channel Marine Fishery Reserve, Culebra Island, Puerto Rico: I. Status of the coral reef epibenthic communities.

10.0.012 Hernández-Delgado, E.A. 2003a. Coral Reef Ecological Change Long-Term Monitoring Program of the Luis Peña Channel No-Take Natural Reserve, Culebra Island, Puerto Rico: I. Status of the Coral Reef Epibenthic Communities (1997-2003). Tech. rep. submitted to the USCRI, DNER, San Juan, PR. 163 pp.

10.0.013 Hernández-Delgado, E.A. 2003b. Suplemento técnico al Plan de Manejo de la Reserva Natural del Canal Luis Peña, Culebra, Puerto Rico. I. Caracterización de habitáculos. Informe sometido al Departamento de Recursos Naturales y Ambientales (Technical Supplement to the Natural Reserve Luis Peña Channel Management Plan. I. Characterization of habitats. Report submitted to the Department of Natural and Environmental Resources). San Juan, PR. 30 de agosto de 2003. 109 pp.

10.0.014 Hernández-Delgado, E.A., and A.M. Sabat. 2000. Ecological Status of Essential Fish Habitats Through an Anthropogenic Environmental Stress Gradient in Puerto Rican Coral Reefs. Proc. *Gulf Caribb. Fish. Inst.* 51:457–470.

10.0.015 Hernández-Delgado, E.A., M.A. Lucking, J. Márquez, K. García, C. Martínez-Rubio, D. Martinó, J. Lassus, C. López, and E. Acosta. 2002. Status of the Shallow-Water Seagrass Communities and Conch Populations within the Luis Peña Channel No Take Natural Reserve, Culebra Island, Puerto Rico. Technical Report submitted to the U.S. Department of Commerce Caribbean Fishery Management Council San Juan, Puerto Rico. October 11, 2002. Special contribution No. 01-2002 of the Coral Reef Research Group.

10.0.016 Hernández-Delgado, E.A., M.T. Vázquez, A. Díaz, X. Rentas, J.C. López, K. Cortés, A.F. Rainford, D. Colón, A. López, A. Rodríguez , G. Hernández, I. Navarro, J. Gómez, M. González, and S. Hernández. 2003. Suplemento técnico al Plan de Manejo de la Reserva Natural del Canal Luis Peña, Culebra, Puerto Rico. III. Usos históricos, actuales y valor arqueológico del Canal Luis Peña. Informe sometido al Departamento de Recursos Naturales y Ambientales (Technical Suplemment to the Natural Reserve Luis Peña Channel Management Plan. III. Historic and Present uses and Archeological Value of the Luis Peña Channel. Report submitted to the Department of Natural and Environmental Resources). San Juan, PR. 30 de agosto de 2003. 45 pp.

10.0.017 IHO (International Hydrographic Organization). 1998. International Hydrographic Organization Special Publication No. 44, 4th Edition.

10.0.018 MTA, Inc. 1995. Final Removal Reports. Interim Remedial Action, Culebra Island NWR, P.R. Remediation of Sites in the U.S. Virgin Islands and Puerto Rico. Contract No. DACA 87-92-92-D-0147, Delivery Order 0002. Prepared by MTA, Inc., Huntsville, Alabama, November 15.

10.0.019 NMFS (National Marine Fisheries Service). 2004. Essential Fish Habitat Consultation Guidance, Version 1.1. National Marine Fisheries Service, Office of Habitat Conservation. April 2004.

10.0.020 NMFS. 2008. Elkhorn and Staghorn Coral Critical Habitat [Internet]. December. Available online at http://www.nmfs.noaa.gov/pr/pdfs/criticalhabitat/corals_elkhorn_staghorn.pdf

10.0.021 NOAA Fisheries (National Oceanic and Atmospheric Administration Fisheries Service). 2011a. Elkhorn Coral [Internet]. Available online at: http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

10.0.022 NOAA Fisheries. 2011b. Sea Turtles [Internet]. Available online at: www.nmfs.noaa.gov/pr/species/turtles

10.0.023 NOAA Fisheries. 2011c. Marine Invertebrates and Plants [Internet]. Available online at: http://www.nmfs.noaa.gov/pr/species/invertebrates/

10.0.024 OSU (Oregon State University) and NOAA (National Oceanic and Atmospheric Administration). Benthic Terrain Modeler Tutorial [Internet]. NOAA Coastal Services Center. Available online at: http://www.csc.noaa.gov/digitalcoast/tools/btm/index.html

10.0.025 Pagán-Villegas, I.M.; Hernández-Delgado, E.A. and V.P. Vicente. 1999. Documento De Designación Reserva Natural Del Canal De Luis Peña Culebra, Puerto Rico (Designation Document of the Natural Reserve Luis Peña Channel). Versión Re-Editada Por Edwin A. Hernández-Delgado. Febrero De 2003. Departamento De Recursos Naturales Y Ambientales Programa De Manejo De La Zona Costanera De Puerto Rico San Juan, Puerto Rico

10.0.026 Parsons. 2007. Final Site Inspection Report, Culebra Island Site. September.

10.0.027 Parsons. 2011. Draft Site Inspection Report, Northwest Peninsula of Culebra. July 6.

10.0.028 USACE (U.S. Army Corps of Engineers). 1991. Inventory Project Report.

10.0.029 USACE. 1995. Archives Search Report—Findings for Culebra Island National Wildlife Refuge. Culebra, Puerto Rico. Property Number I02PR0068. Defense Environmental Restoration Program for Formerly Used Defense Sites Ordnance and Explosive Waste. USACE Rock Island District. February.

10.0.030 USACE. 2002. Engineering and Design – Hydrographic Surveying. EM 1110-2-1003.

10.0.031 USACE. 2004. Archives Search Report Supplement. USACE Rock Island District.

10.0.32 USACE. 2005a. Revised Inventory Project Report.

10.0.33 USACE. 2005b. Supplemental Archives Search Report. Culebra, Puerto Rico. Property Number I02PR0068. Defense Environmental Restoration Program for Formerly Used Defense Sites Military Munitions Response Program. Prepared by USACE St. Louis District. September.

10.0.034 USFWS (U.S. Fish and Wildlife Service). 1992. Resource Category 1 Designation: The Seagrass Beds of Culebra Island, Puerto Rico. September.

10.0.035 USFWS. 2008. Culebra National Wildlife Refuge [Internet]. Available online at www.fws.gov/caribbean/refuges/culebra/

10.0.036 USFWS. 2009. Draft Stock Assessment: West Indian Manatee (*Trichechus manatus*) Puerto Rico Stock (Antillean subspecies, *Trichechus manatus manatus*). Available online at: http://www.fws.gov/caribbean/es/pdf/Draft_Antillean_Manatee_SAR_PR.pdf

10.0.037 USFWS. 2011a. Ecological Services in the Caribbean [Internet]. Available online at: http://www.fws.gov/caribbean/

10.0.038 USFWS. 2011b. Caribbean Endangered Species Map (Mapa de Especies Caribeñas en Peligro de Extinctión). Available online at: http://www.fws.gov/caribbean/es/PDF/Map.pdf (last updated June 15, 2011).

10.0.039 USFWS. National Wetlands Inventory [Internet]. Available online at: http://107.20.228.18/Wetlands/WetlandsMapper.html

10.0.040 USFWS. No date. Archeology at Lower Camp. Culebra Island National Wildlife Refuge, Puerto Rico. Prepared by Jose R. Oliver, PhD, Garrow and Associates. Available online at: http://www.nps.gov/seac/lower_camp/lc-index.htm (accessed April 2012).

10.0.041 Valdés-Pizzini, M., T. Rivera, D. Beltrán, M. Fernández, M. Muñoz, R. Vélez, and C.J. Carrero. 2008. Plan de Manejo de la Reserva Natural Canal de Luis Peña (Management Plan of the Natural Reserve Luis Peña Channel). Centro Interdisciplinario de Estudios del Litoral. Departamento de Recursos Naturales y Ambientales de Puerto Rico. 187 pp.

10.0.042 Vicente, V.P. 1995. Reserva Marina Flamenco/Luis Peña, Isla de Culebra (Marine Reserve Flamenco/Luis Peña, Culebra Island). Informe sometido a la Oficina del Alcalde, Administración Municipal de Culebra, Culebra, P.R., 19 de abril de 1995. 18 pp.

APPENDIX A

PERFORMANCE WORK STATEMENT

Performance Work Statement
Remedial Investigation / Feasibility Study
Culebra Water Ranges
Culebra Puerto Rico
I02PR0068
~~15 August 2011~~
~~30 Aug 2011~~
Revision: 4
Revision Date: 2 Sep 2011
The purpose of this revision is to edit wording in Para 3.2, 3.4.2

1.0 OBJECTIVE: The objective of this task order is to achieve acceptance of Decision Document(s) in compliance with CERCLA and Department of Defense, Army, and USACE Regulations and Guidance to include Interim Guidance and Data Item Descriptions (DID) at the referenced underwater Munitions Response Sites MRS 3 (195 acres) and MRS 12 835 acres). There are no land investigations in this PWS.

2.0 BACKGROUND

2.1 Work under this Performance Work Statement (PWS) falls within the Military Muntions Response Program (MMRP) for Flamingo Bay (MRS 3) and Luis Peña Channel Area (MRS 12) of Culebra, PR, a Formerly Used Defense Site (FUDS). The Contractor shall perform all work in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. All activities involving work in areas potentially containing explosive hazards shall be conducted in full compliance with Department of Defense (DOD), Army, and United States Army Corps of Engineers (USACE) Regulations and Guidance to include Interim Guidance and Data Item Descriptions (DID).

2.2 Available Site Specific information will be provided with the request for proposal for contractor review and use via either a designated Internet site or delivery of recorded data on CD/DVD. This information may include but is not limited to general site history, previous investigations, and other documentation.

3.0 General Requirements:

3.0.1 Contractor Methods: This is a performance based task order. The task order objectives and performance standards included herein are the basis of the task order requirements. The technical approach and level of effort expended to achieve task order objectives and performance standards are solely up to the contractor to select and adjust as necessary through the life of the task order. Government recognizes the contractor's right to change the technical approach and level of effort from that proposed with the understanding that the contractor shall still meet all task order objectives and gain government Quality Assurance acceptance in order to receive payment.
If performance standards are changed due to the technical project planning and adjustment in the quantities or field investigation methodologies is required, the government, at its discretion may choose to modify the contract with the price adjustment based upon the negotiated unit prices. Once these price adjustments are complete the contractor shall be obligated to deliver the required performance standards, making adjustments in the field strategy as may be necessary.

3.0.2 Quality monitoring and measurement: The contractor will be evaluated periodically during performance of this task order to ensure compliance with the work plans, regulations, guidance, and DIDs; and to document that acceptance criteria (AC), delivery schedule, and the overall completion dates are being met. This evaluation will be performed according to a Quality Assurance Surveillance Plan (QASP). A programmatic QASP will be provided by the government as a starting point for the contractor prepared Draft QASP per Task 2. The government will finalize the contractor's Draft QASP. This final QASP will be supplied to the contractor and used by the government to evaluate the contractor's performance. Failure to adequately complete any service or submittal at the stated minimum acceptance criteria (quality) will result in repeat of the work until the minimum AC is met. Tasks that cannot be repeated such as public meetings may result in a poor performance evaluation.

3.0.3 Performance Requirements. Performance standards are addressed in each task and summarized in the Performance Requirements Summary (PRS) Table provided in Attachment A. Performance metrics are provided in Attachment B. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics.

3.0.4 Task pricing: A pricing schedule is provided in Attachment D which will be used as a basis for negotiation of price increase or decrease due to government changes in the specified performance objectives.

3.1 Task 1, Technical Project Planning (TPP): This is a Firm Fixed Price/Unit Price task.
Objective: Implement the four-phase TPP process in accordance with EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents.

Performance Standard: Achieve the objectives of each TPP phase as listed in EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents. Facilitate meetings in a professional and organized manner.

AC: Acceptance of TPP documents (meeting presentations, agenda, handouts, CSM and memorandums) with up to one (1) revision. Meetings held are organized; accomplish requirements of the TPP process; and professional in nature. Zero letters of reprimand, grievances, or formal complaints

Measurement / Monitoring: TPP checklist for each phase as provided in the guidance will be used to measure and document successful progress; guidance cited will be used to evaluate content of documents for acceptance / non-acceptance. Government will attend and evaluate organization and facilitation of the meetings, and professional nature of the meetings.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The contractor shall utilize the TPP process to obtain consensus on specific Data Quality Objectives that the contractor intends to achieve in pursuit of the established RI performance requirement that were proposed and accepted as the basis for the RI task. The Contractor shall plan for meetings to occur as follows: first meeting, pre-Work Plan with resulting DQOs and conceptual site model (CSM), and TPP Memorandum; second meeting, to finalize Work Plan with resulting TPP addendum; third meeting, verify all data gaps have been filled and finalize Remedial Investigation Report with resulting TPP addendum. The contractor shall organize and coordinate all meetings; identify and involve all stakeholders, upon approval by the Government; and be responsible for the logistics of these meetings to include, but not limited to, providing a facilitator, obtaining meeting location, and sending invitation letters (pending government review and acceptance). The Contractor shall prepare, submit for review and gain acceptance of a TPP memorandum or addendum for each meeting. If a site visit is planned prior to acceptance of a Work Plan, the Contractor shall prepare and submit for acceptance an Abbreviated Accident Prevention Plan (AAPP). The Contractor shall utilize statistical methods to support the decision making processes used to characterize both UXO/DMM (such as Visual Sample Plan (VSP) software) and MC. The Contractor shall prepare a preliminary Munitions Response Prioritization Protocol for each Munitions Response Site covered under this task order.

3.2 Task 2, Optional RIFS Work Plan (WP), Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) and QASP: This is a Firm Fixed Price task.
Objective: Prepare, submit and gain acceptance of a WP, munitions constituent (MC) UFP-QAPP and QASP that are detailed and comprehensive plans covering all aspects of site characterization, risk assessment and methodology, and project execution as applicable. UFP-QAPP applies only to environmental sampling.

Performance Standard: Prepare the WP in accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1, EM 385-1-97 as appropriate. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and **Intergovernmental Data Quality Task Force UFP-QAPP Manual**, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.

AC: Acceptance of WP and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.

Measurement / Monitoring: Review of WP, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: Incorporate all decisions pursuant to the TPP process. The sampling and analysis plan (SAP) shall include the Contractor's phased approach and address contaminants of interest and sample media (soil/groundwater/sediment/surface water).

3.2.1 Optional, Task 2a, Explosive Siting Plan: This is a Firm Fixed Price task. If this optional task is not awarded, an Explosive Siting Plan will be provided by the government for inclusion in the WP.

Objective: Prepare, submit and gain acceptance of an Explosives Siting Plan.

Performance Standard: Prepare required submission in accordance with DoD 6055.09-m, EM 385-1-97, Errata Sheet #3,and DID WERS-003 as a stand alone document for inclusion after acceptance into the WP.

AC: Acceptance of submission with two revisions.

Measurement / Monitoring: Review by Government using guidance cited to determine acceptability.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: Allow eight (8) weeks in the schedule for DDESB approval after submission of final document to the CEHNC-CX.

3.2.2 Optional, Task 2b, Dive Plan: This is a Firm Fixed Price task.
Objective: Prepare, submit and gain acceptance of a Dive Plan.

Performance Standard: Prepare, submit and gain acceptance of a Dive Plan that is a detailed and comprehensive plan covering <u>all</u> aspects of dive operations in accordance with EM 385-1-1 and 385-1-86.

AC: Acceptance of submission with two revisions.

Measurement / Monitoring: Review by Government using guidance cited to determine acceptability.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: None.

3.3 Task 3, GeoSpatial Data: This is a Firm Fixed Price/Unit Price task.
Objective: Utilize GIS in the development of the Conceptual Site Model (CSM) and maintain and manage all project and geospatial data.

Performance Standard: Manage and maintain project data, and develop CSM in GIS IAW DID WERS-007.01, EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents.

AC: Acceptance of CSM and GeoSpatial Data submissions meets quality and formatting requirements.

Measurement / Monitoring: Review by Government using guidance cited to determine acceptability.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The GeoSpatial Data shall include:
- A comprehensive CSM
- A pre and post-project response action geospatial data analysis will be performed using a GIS.

- All available existing data that is applicable to the project will be consolidated into the GeoDatabase and analyzed to relay pertinent information to the PDT. If an existing GIS database is available, it will be provide by the government.
- The analysis of data from the GIS shall support all conclusions of the CSM.
- The information attained through the pre-RI analysis will be documented in the work plan.
- The information attained in the post-RI and FS analysis will be documented in the RI and FS reports.
- The pre-RI analysis will encompass social, environmental and/or economic entities that will be or may be impacted by response-action activities.
- The post-RI and FS analysis will detail entities impacted by RI/FS activities and impacts of future response action activities (if applicable).
- The pre and post-RI and FS analysis may detail the fieldwork strategies, areas of concern, survey requirements, environmental concerns, milestones and/or other factors that affect product delivery and future action planning.
- Entities that may be affected by response actions include but are not limited to: landowners, homeowners, rental tenants, schools, utilities, roads, businesses, recreational areas, air traffic, water bodies and/or industries.
- The GeoDatabase shall be a living repository that is refined throughout the life of the project.
- Incorporate layers that overlay on maps of the site that identify physical features, and MPPEH/MD and Range-Related Debris found during the investigation. Examples include: streets, anomalies, MEC positively identified, identifiable MD, sampling location, cultural resources, environmental, biological, and socio-economic variables.
- Archeological site location(s) will not be released to the public without written permission from USACE.
- Perform civil surveys IAW EM 1110-1-4009 and DID WERS-007.01
- Property owner privacy will be preserved. Property owner names shall not be disseminated in any documents.

3.4 Task 4, RI/FS Field Activities: This is a Cost Plus Fixed Fee Price task.
Objective: Conduct a remedial investigation in accordance with CERCLA, characterizing the nature and extent of MEC contamination at the required munitions response sites (MRS) meeting the project DQOs as defined during the TPP process. This task shall include all field activities necessary to execute this task except MC sampling. MC sampling requirements are covered under Task 12, Environmental Sampling & Analysis.

3.4.1 Task 4a, MRS 03 Flamingo Bay Water Area (195 acres), FUDS Project No. I02PR006803M01. Refer to historical project documentation of site location, historical information, and boundaries.

3.4.1.1 Optional Task 4a1, Bathymetry. This task is Cost Plus Fixed Fee (CPFF).

3.4.1.2 Optional Task 4a2, Side Scan Sonar. This task is Cost Plus Fixed Fee (CPFF).

3.4.1.3 Task 4.a3, ROV/AUV Underwater Video. This task is Cost Plus Fixed Fee (CPFF).

3.4.1.4 Optional Task 4.a4, Magnetometer/ EM Survey. This task is Cost Plus Fixed Fee (CPFF).

3.4.1.5 Optional Task 4.a5, Intrusive Investigation. This task is Cost Plus Fixed Fee (CPFF).

3.4.2 Optional Task 4b, MRS 12 Luis Pena Channel Water Areas (835 acres), FUDS Project No. I02PR006812M01. Refer to historical project documentation of site location, historical information, and boundaries

3.4.2.1 Optional Task 4b1, Bathymetry. This task is Cost Plus Fixed Fee (CPFF).

3.4.2.2 Optional Task 4b2, Side Scan Sonar. This task is Cost Plus Fixed Fee (CPFF).

3.4.2.3 Optional Task 4.b3, Remote Operated Vehicle. This task is Cost Plus Fixed Fee (CPFF).

3.4.2.4 Optional Task 4.b4, Magnetometer Survey. This task is Cost Plus Fixed Fee (CPFF).

3.4.2.5 Optional Task 4.b5, Intrusive Investigation. This task is Cost Plus Fixed Fee (CPFF).

3.4.3 The following applies to all MRSs:

Performance Standard: Field work, data quantity and quality, and analysis of said data (does not include area where Rights-of-entry were not obtained) provides the following results in the RI report:
- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance documents;

- Demonstrate that areas with elevated anomaly density or with potential to contain MEC are traversed and that there is at least 90% chance of detecting these areas.
- Demonstrate that the boundaries of all identified MEC contaminated areas have been delineated to an accuracy of at least +/- half the transect spacing, maximum 250 feet.
- Demonstrate that data inputs from the RI into the FS will enable remediation cost estimates with an accuracy of +50%/-30%. The work and reporting shall address the surface and sub-surface metallic anomaly density distribution (anomaly/acre) across identified MEC contaminated areas and other remediation cost drivers such as vegetation type and density, terrain conditions, soil type, exclusion zone evacuation costs, etc each to a level of accuracy within the range specified herein.
Additionally:
- Perform the RI field activities in accordance with the accepted Work Plan, QASP and UFP-QAPP.
- Proper processing and disposition of UXO, DMM and MC encountered in accordance with approved plan(s).
- All Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs as defined by the TPP process.
- All geophysics shall be IAW geophysics DID or as agreed to by the PDT Marine field work QC shall be recommended by the Contractor in the QCP. Government QA is expected to be limited to visual observation of the Contractors field work and QC operations due to the dynamics of this high energy environment. The government recognizes that submerged metallic items have the potential to move great distances due to the local current and surf conditions and that prolonged seeding of test items may not be feasible. The government requests that the Contractor submit a modified QC Requirements table for government acceptance for the marine and beach portions of the project to meet the needs of the project and still insure acceptable data quality to meet the project objectives. For this task order 1 acre of transects equals 14,520 lf (2.75 miles) of transects 3 feet wide. One acre’s worth of grids equals seventeen (17) 2500 sf grids or four (4) 10,000 sf grids.

AC: Conduct the RI in accordance with the accepted/approved WP, UFP-QAPP, and ESP. QC data submitted meets requirement described in the most recent geophysics and chemistry DIDs or QCP that has been accepted by the PDT.
- No more than 3-4 CARs/948s for non-critical violations and/or 1 CAR/948 for critical violation. No unresolved corrective action requests.
- All final data and QC tests/documentation submitted. Government QA acceptance of QC tests/documentation gained.
- No Class “A” Safety accidents, contractor at fault; <1 non-explosive Class C accidents; and <2 non-explosive related Class D accidents, IAW AR 385-40.
- Major safety violations, no more than 1 non-explosive related safety violation.
- Minor safety violations, no more than 2 safety violations.
- Zero letters of reprimand, grievances, or formal complaints.

Measurement / Monitoring: Period inspection/review of field work. Verify compliance with accepted WP, UFP-QAPP and Dive Plans as applicable. Quality control tests/documentation submitted per the QASP for government review. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software, UXO Estimator or other approved statistical method. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/uncontaminated areas in question. Anomaly density profile and other remediation cost driver precision will be verified by QA of methods used.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor’s expense.

Specific Task Requirements:
- Restore all areas to their original condition; all access/excavation/detonation holes shall be backfilled.
- Maintain a detailed accounting of all UXO, DMM, MD and range-related debris encountered per DID WERS-004.01. This accounting shall include: amounts of UXO, DMM and MD; nomenclature; location and depth of UXO/DMM; location of MD; and final disposition. The accounting system shall also account for all demolition materials utilized on site. Digital photographs of UXO and DMM and examples of MD found during the investigation are to be taken.
- All UXO, DMM and MC encountered during this munitions response shall be processed in accordance with the approved work and safety plans.
- To the maximum extent practicable, the permanent record shall include sensor data that is digitally-recorded and geo-referenced. Exceptions to the collection of sensor data that is digitally-recorded and geo-referenced should be limited primarily to cases where impracticable.
-Perform visual survey of surface MEC

-Perform biological survey of all species of coral and other threatened and endangered plant species.

3.5 Task 5, Optional Remedial Investigation (RI) Report: This task is a Firm Fixed Price task.
Objective: Prepare, submit and gain acceptance of a RI report in accordance with EM CX Interim Guidance 06-04 and EPA Guidance.

Performance Standard: The RI report shall document the result of the RI and be in accordance with EP 1110-1-18, EM CX Interim Guidance 06-04 and EPA guidance.

AC: Acceptance of RI with two revisions.

Measurement / Monitoring: Review of RI against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:
- Prepare, submit and gain acceptance of a RI report in accordance with EP 1110-1-18 EM-CX Interim Guidance 06-04, and EPA guidance.
- Use EPA MEC Hazard Assessment, not Ordnance and Explosives Risk Impact Assessment.
- Incorporate all RI data and data from previous investigations, historical documents, PA/SI into this RI.
- Recommend changes in realignment of MRS dependent on RI finding.
- Prepare, as an appendix to this report, a new or update Munitions Response Site Prioritization Protocol (MRSPP) for each MRS dependent upon RI findings using the MRSPP worksheets, http://www.lab-data.com/MRSPP/ .

3.6 Task 6, Optional Feasibility Study (FS) and Report: This task is a Firm Fixed Price task.

Objective: Conduct a feasibility study and prepare, submit and gain acceptance of a FS report in accordance with EM CX Interim Guidance 06-04.

Performance Standard: The FS report shall document the result of the feasibility study and be in accordance with EP 1110-1-18, EM CX Interim Guidance 06-04 and EPA guidance.

AC: Acceptance of FS with two revisions.

Measurement / Monitoring: Review of FS against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: None.

3.7 Task 7, Optional Proposed Plan: This task is a Firm Fixed Price task.

Objective: Prepare, submit and gain acceptance of a Proposed Plan (PP).

Performance Standard: Prepare the PP in accordance with CERCLA, ER 200-3-1, EP 1110-1-18, EM-CX Interim Guidance 06-04, and EPA 540-R-98-031.

AC: Acceptance of PP with two revisions.

Measurement / Monitoring: Review of PP against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: After government & regulator review, the revised draft-final version of the Proposed Plan will be subject to a minimum 30-day public review. A public meeting shall be held to present the Proposed Plan to the public. This public meeting falls under Task 9, Community Relations Support.

3.8 Task 8, Optional Decision Document: This task is a Firm Fixed Price task.

Objective: Prepare, submit and gain acceptance of a Decision Document (DD) for each MRS identified.

Performance Standard: Prepare the DD in accordance with CERCLA, ER 200-3-1, EP 11101-1-18, Appendix C, and EPA 540-R-98-031.

AQL: Acceptance of DDs with two revisions.

Measurement / Monitoring: Review of DD against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: PWS Appendix C provides new formatting requirements for the Decision Document. For formatting of Decision Documents, Attachment C supersedes MM CX Interim Guidance 06-04.

3.9 Task 9, Optional Community Relations Support: This task is a Firm Fixed Price task.
Objective: Successfully complete public meetings and support the CESAJ District with community relations.

Performance Standard: Contractor attends and participates in meetings. Meeting transcripts PP meeting are accurate. Meeting materials are accepted by the government as required.

AC: Acceptance of meeting materials with two revisions, acceptance of PP meeting transcripts in one revision. Meetings held are organized; and professional in nature. Personnel are thoroughly familiar with the project. Zero letters of reprimand, grievances, or formal complaints

Measurement / Monitoring: Review of required materials for meetings. Government will attend and evaluate contractor's attendance, participation and professional demeanor.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating.

Specific Task Requirements: The Contractor shall attend and participate in Three (3) public meeting(s). These meetings are different and in addition to TPP meetings. These meetings will be held on the Island of Culebra, Puerto Rico. The support shall include, but is not limited to: preparation and delivery of briefings, graphics, maps, posters, and support of question and answer sessions. The Contractor shall also obtain the meeting site, perform public notification and prepare any correspondence necessary to meeting the objectives of this task. The government shall approve all correspondence, public notices and all other materials prior to being presented/distributed to the public. These actions are independent of the field activities that involve interaction with the community. The meeting for the Proposed Plan shall be covered under this task. Transcripts of the public meeting for the Proposed Plan shall be prepared and submitted with the Final Proposed Plan.

3.10 Task 10, Optional Public Involvement Plan (PIP): This task is a Firm Fixed Price task.
Objective: Update, submit and gain acceptance of a PIP in accordance with EP 1110-3-8, ER 200-3-1, EM-CX Interim Guidance 06-04, guidance provided in the FUDS Public Involvement Toolkit and DENIX website.

Performance Standard: Prepare the PIP in accordance with EP 1110-3-8, ER 200-3-1, EM-CX Interim Guidance 06-04, guidance provided in the FUDS Public Involvement Toolkit and DENIX website.

AQL: Acceptance of PIP with two revisions.

Measurement / Monitoring: Review of PIP against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: This effort shall include, but is not limited to: preparation and delivery of stakeholder surveys, review and presentation of survey findings, completion of stakeholder interviews. The government shall approve all correspondence, survey content, and all other materials prior to being presented/distributed to the public. These actions are independent of the field activities that involve interaction with the community.

3.11 Task 11, Optional Administrative Record: This task is a Firm Fixed Price task.
Objective: Maintain the Administrative Record for each MRS throughout the period of performance of this Task Order.

Performance Standard**:** Prepare in accordance with the guidance in EP 1110-3-8, Chapter 4 (Establishing and Maintaining Administrative Records) and Standard Operating Procedure for Formerly Used Defense Sites (FUDS) Records Management, Revision 5, dated January 2008 (or most recent version).

AC: Administrative record will be evaluated against guidance for compliance with requirements, accuracy and completeness of the record, with up to one uncorrected deficiencies remaining during the period of performance.

Measurement / Monitoring: The government will visit, at least once, the administrative record's location and check for completeness and compliance with referenced EP; electronic submissions will be evaluated randomly upon receipt as data is entered into the record.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: Secure a location such as a public library for a place to house the Administrative Record in the local city or community of each MRS. This task requires close coordination with the Jacksonville District (CESAJ) and USAESCH to secure all required documents to support the Administrative Record. Provide copies of all final documents posted to the Administrative Record on CD/DVD to USAESCH and CESAJ, 2 copies each. These files shall be suitable for placement on the PIRS web site.

3.12 Optional Task 12, Environmental Sampling & Analysis: This task is a Firm Fixed Price/Unit Price task.
Objective: Collect data that meets the project DQOs as defined during the TPP process, of known quality and quantity, to determine the nature and extent of munitions constituents (MC) and perform a human health and ecological risk assessment.

3.12.1 Task 12a, Optional Flamingo Bay Water Area, FUDS Project No. I02PR006803M01. This task is FFP. Refer to historical project documentation of site location, historical information, and boundaries.

3.12.2 Task 12b, Optional Luis Pena Channel Water Area, FUDS Project No. I02PR006812M01. This task is FFP**.** Refer to historical project documentation of site location, historical information, and boundaries.

3.12.3, Task 12c, Optional Beach Monitoring. This task is Fixed Unit Price.
The Contractor shall provide a qualified Project Biologist for daily beach monitoring prior to intrusive ordnance activities as described in the Standard Operation Procedure for Endangered Species Conservation, USACE, and Jacksonville District. Project Biologist qualifications shall reflect 2-4 years experience in related work, working independently under general supervision (equivalent to industry Biologist II).

Performance Standard: Perform field activities in accordance with the Work Plan and UFP-QAPP. MC analyses shall be performed in accordance with the requirements of the Department of Defense (DoD) Quality Assurance Manual (QAM), WERS-009.01 Munitions Constituents Chemical Data Quality Deliverables, and the approved project specific UFP-QAPP. The ecological and human health risk assessment shall be performed in accordance with the EPA Risk Assessment Guidance (RAGS) and USACE EM 200-1-4, Volumes I and II.

AC: Sampling field work and data meets established criteria within the accepted Uniform Federal UFP-QAPP, SAP, and Work Plan.

Measurement / Monitoring: Period inspection/review of field work, and data. Compliance with accepted WP, UFP-QAPP and ESP. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software or other approved statistical method. Quality control tests/documentation submitted per the QASP for government review.

Incentive/Disincentive: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Task Specific Requirements: The contractor shall propose on the sampling rationale, and methods that will be utilized to ensure that data generated are of an acceptable quality for its intended use. The contractor shall also propose on the quantity, quality and the methods used to verify adherence to the PARCCS parameters for sample collection, handling, laboratory analysis, verification and validation. The contractor shall propose processes that will be utilized to address the corrective actions when established criteria are not being met. Any deviations from the accepted SAP shall be documented in the Daily Quality Control Reports (DQCR) and conveyed to USAESCH personnel immediately.

3.12.3, Optional Beach Monitoring Fixed Unit Price
The Contractor shall provide a qualified Project Biologist for daily beach monitoring prior to intrusive ordnance activities as described in the Standard Operation Procedure for Endangered Species Conservation, USACE, Jacksonville District. Project Biologist qualifications shall reflect 2-4 years experience in related work, working independently under general supervision (equivalent to industry Biologist II).

3.13 Optional Task 13, Optional Implement Innovative Technology: This task is a Firm Fixed Price task.
Objective: Propose, utilize and evaluate effectiveness of innovative technology selected by the contractor.

Performance Standard: Perform field activities using innovative technology while meeting the established criteria in tasks 4 and 12. Evaluation is supported by data and documented in a letter report that obtains Government QA acceptance with two revisions.

AC: Applicable field work and data meets established criteria within the accepted Uniform Federal UFP-QAPP, SAP, and Work Plan.

Measurement / Monitoring: Period inspection/review of field work, and data. Compliance with accepted WP, UFP-QAPP and ESP. Quality control tests/documentation submitted per the QASP for government review.

Incentive/Disincentive: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The contractor shall select an innovative technology to demonstrate during the implementation of tasks 4 and/or 12. The contractor shall provide in its proposal how the technology will be used, how it will evaluate the technology, and how it will document the effectiveness of the technology. This task shall cover the full cost of implementing, evaluating and documenting effectiveness of the technology.

3.14 Task 14, **Optional Baseline Survey Report** This task is a Firm Fixed Price Task.
Objective: Contractor shall prepare, submit and gain approval of a Baseline Survey Report documenting the results from the bathymetry, side scan sonar, and magnetometer/EM and ROV/AUV investigation, as appropriate to include map(s) indicating location of surface MEC, coral species and other threatened and endangered plant species.

Performance Standard:

AC:

Measurement/Monitoring:

Incentive/Disincentive: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Task Specific Requirements: The contractor shall provide map(s) indicating the location of MEC and the location and identification of coral species and threatened and endangered plant species.

4.0 Submittals.

Even though draft and draft final submittals are requested, the term "draft" shall not reflect upon the quality of the submittal being provided by the Contractor. Submittals shall include all supporting materials including supporting data whether electronic or hardcopy. Submittals not meeting the requirements of referenced guidance or Data Item Descriptions or missing supporting data may be rejected and revised by the contractor at the contractor's own expense.

4.1 The Contractor shall deliver the specified number of copies shown in Table 4.2 of each report listed in Table 4-1 to the following addressees (addresses to be verified by Contractor):

US Army Engineering & Support Center, Huntsville
Attn: CEHNC-CT-E (Lydia Tadesse)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

US Army Engineering & Support Center, Huntsville
Attn: CEHNC-OE-DC (Roland Belew) (PM and COR)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

Commander
U.S. Army of Corps of Engineers, Jacksonville District
Attn: CESAJ (Tom Freeman) (PM)
701 San Marco Blvd
Jacksonville, FL 32207-0000

Contractor to obtain and/or verify addresses.

4.2 Submittals and Due Dates.
The Contractor shall submit 1 copy of the entire submittal on a CD with each hard copy of a submittal (Reports, Plans, etc) in accordance with DID WERS-007.01. Hardcopies shall be printed on both sides of the paper whenever possible.

Table 4-1 List of Submittals

Submittal	**Due Date (Calendar Days)**
Meeting minutes for Kickoff phone conference	7 days after Kickoff phone conference
Proposed Schedule	7 days after kickoff conference call
Pre-TPP Meeting Materials	14 Days prior to TPP meetings
Conceptual Site Model (CSM)	With Pre-TPP materials
AAPP	7 days prior to site visit
Draft TPP Memorandum	14 days after first TPP meeting
Final TPP Memorandum	7 days after acceptance of comment responses
Draft TPP Memorandum Addendum	7 days after second TPP meeting
Final TPP Memorandum Addendum	7 days after acceptance of comment responses
Draft TPP Memorandum Addendum	7 days after third TPP meeting
Final TPP Memorandum Addendum	7 days after acceptance of comment responses
Draft Public Involvement Plan	TBD
Draft-Final Public Involvement Plan	14 days after acceptance of comment responses
Final Public Involvement Plan	7 days after acceptance of comment responses

Pre-Public Meeting Materials	14 Days prior to public meetings
Final Public Meeting Materials	no later than day of Meeting
Draft Work Plan/Dive Plan/ESP and Draft QASP	21 days after acceptance of TPP memorandum
Draft Final Work Plan/Dive Plan/ESP	14 days after acceptance of comment responses
Final Work Plan/Dive Plan/ESP/CSP	14 days after acceptance of comment responses and TPP meeting
Quality Control Documents	**As required by Regulation, guidance, DIDs, QCP, QASP, or agreed to in project schedule, to include the following**:
Daily QC Report for Environmental Sampling	Daily during Sampling Activities
Analytical Data Submittal for QA Evaluation	30-45 days after completion of fieldwork
Electronic Laboratory Data Submittal	45-60 days after completion of fieldwork
Draft Baseline Survey Report	90 days after completion of underwater visual survey
Draft Final Baseline Survey Report	21 days after acceptance of comment responses
Final Baseline Survey Report	14 days after acceptance of comment responses
Draft RI Report	60-81 days after completion of field work
Draft Final RI Report	21 days after acceptance of comment responses
Final RI Report	14 days after acceptance of comment responses and TPP meeting
Draft FS Report	21 days after acceptance of the RI Report
Draft Final FS Report	14 days after acceptance of comment responses
Final FS Report	14 days after on board Review
Draft Proposed Plan	14 days after acceptance of the FS Report
Draft Final Proposed Plan	14 days after acceptance of comment responses
Final Proposed Plan	14 days after PP public meeting
PP Meeting Transcripts	with final Proposed Plan
Responsiveness Summary	with Decision Document Submittals
Draft Decision Document	14 days after acceptance of Proposed Plan
Draft Final Decision Document	7 days after acceptance of comment responses
Final Decision Document	7 days after acceptance of comment responses
Final Administrative Record (On CD/DVD)	Upon completion of the Record
Final GIS Files on CD	End of Project

4.3 Submittal Quantities

Provide the number of submittals shown in Table 4-2 to the addressees given in Section 4.2. No draft documents shall be released to the regulatory community until reviewed by the government.

Table 4-2 Submittal Guidance

	Draft Documents	Draft Final/Final Documents
KO/COR	1 each	1 each
USAESCH	3	3
CESAJ	3	3

4.4 Period of Performance: The Completion Date for this Task Order is March 15, 2013.

5.0 Milestone Payments for firm fixed price tasks: Milestones will be considered met or completed when the required QC documentation has been submitted, QA completed and the submittal and/or product is accepted. Any payment vouchers submitted that do not coincide with the final accepted milestones or do not have the appropriate QC documentation will be rejected. All payments will be made utilizing an agreed upon Payment Milestone Schedule. The Contractor shall provide suggested milestones for payment. Milestones for payment shall be shown on the project schedule.

5.1 The following is a list of potential milestones for payment:

- Final Submittals: upon government acceptance, for example: Final WP
- Field Work: for defined units and activities completed and QA review and acceptance, for example: Final QC density data package.

- Meetings: after completion of meetings with government acceptance of meeting minutes, for example: Final PP meeting minutes.

6.0 REFERENCES:

6.1 Refer to "Base Contract."

6.2 Data Items Descriptions at the following website:
http://www.hnd.usace.army.mil/engr/WERS.aspx .

7.0 GENERAL CONDITIONS: See the Base Contract Section C, Section 10 General Conditions and the following addendums:

7.1 This is a performance based task order. The inclusion of unit prices in the proposal shall in no way be construed to mean that the Government is procuring a specified number of units of any given service.

7.2 Government acceptance of the proposed technical approach and/or price does not relieve the Contractor from full responsibility for the viability, productivity, and efficiency of the approach used to meet the performance requirements of the PWS at the price proposed. The task order is for the provision of services that ultimately meet the performance requirements of this task. If the contractor must adjust its technical approach or perform more field work than anticipated in order to achieve the proposed performance goal then the contractor will do so with no change in task order price.

7.3 If the Government at its sole discretion chooses to modify the performance standard the parties to this task order will assess the impact on the estimated amount of field work required to achieve the new performance standards and will negotiate a price adjustment based upon the unit prices providing as price proposal supporting documentation (See Attachment D).

7.4 The Contractor attests that it applied due diligence in the research and development of its proposal has priced reasonable estimates of the site conditions and the associated risks into the price. The Contractor accepts full and sole responsibility for identifying and considering all factors that may affect the cost to execute the work. The act of signing this task order signifies that the Contractor has been given ample opportunity to assess the conditions under which the work will be performed and the Contractor either fully understands those conditions or has factored the risk into the price.

7.5 The Government provided the Contractor with historical documents and documents from previous site activities. The Contractor attests it interpreted the data utilizing an experienced understanding of how the data of this type is collected, analyzed, interpreted, and presented.

8.0 ARMY CONTRACTOR MANPOWER REPORTING

8.1 Implementation.

8.1.1 The Office of the Assistant Secretary of the Army (Manpower & Reserve Affairs) operates and maintains a secure Army data collection site where the contractor will report contractor manpower information (including subcontractor manpower information) required for performance of this contract. The contractor shall submit all the information required in the format specified at the following web address: **https://cmra.army.mil/default.aspx**

8.1.2 The Contractors shall fill in the required information on the website, fields are shown below:

- Contract Number
- Delivery Order Number (if applicable)
- Task Order Number (if applicable)
- Requiring Activity Unit Identification Code (UIC)
- Command
- Contractor Contact Information
- Federal Service Code (FSC)
- Direct Labor Hours
- Direct Labor Dollars
- Location Information (where contractor and subcontractors (if applicable) performed the services

8.1.3 Reporting period will be the period of performance not to exceed 12 months ending September 30 of each government fiscal year and must be reported by 15 October of each calendar year.

8.1.4 If your particular contract crosses fiscal years, 2 entries must be made to capture the data for the contract period; for example if the contract start date is 1 January 2007 and ends 31 December 2007, the data for the period from 1 January 2007 through 30 September 2007 shall be entered not later than 15 October 2007 and the period 1 October 2007 through 31 December 2007 shall be entered not later than 15 January 2008.

Attachment A

Performance Requirements Summary:

A.1 The Contractor shall meet the following performance requirements. Performance requirements are addressed in each task and summarized in the following Performance Requirements Summary. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics.

Table A-1 Performance Requirements Summary

Task Application	Objective	Performance Standard	Minimum Acceptable Criteria	Measurement / Monitoring	Incentive/ Disincentive
1	Implement the four-phase TPP process in accordance with EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents.	Achieve the objectives of each TPP phase as listed in EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents. Facilitate meetings in a professional and organized manner.	Acceptance of TPP documents (meeting presentations, agenda, handouts, CSM and memorandums) with up to one (1) revision. Meetings held are organized; accomplish requirements of the TPP process; and professional in nature. Zero letters of reprimand, grievances, or formal complaints.	TPP checklist for each phase as provided in the guidance will be used to measure and document successful progress; guidance cited will be used to evaluate content of documents for acceptance / non-acceptance. Government will attend and evaluate organization and facilitation of the meetings, and professional nature of the meetings.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
2	Prepare, submit and gain acceptance of a WP, munitions constituent (MC) UFP-QAPP and QASP that are detailed and comprehensive plans covering all aspects of site characterization, risk assessment and methodology, and project execution as applicable. UFP-QAPP applies only to environmental	Prepare the WP in accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1, EM 385-1-97 as appropriate. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and UFP-QAPP, as appropriate. Prepare a risk assessment work plan incorporating implementation of the risk assessment and methodologies per EPA Risk Assessment	Acceptance of WP and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.	Review of WP, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

	sampling.	Guidance (RAGS) and USACE EM 200-1-4, Volumes I and II, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.			
2a	Prepare, submit and gain acceptance of an Explosives Siting Plan.	Prepare required submission in accordance with DoD 6055.09-m, EM 385-1-97, Errata Sheet #3,and DID WERS-003 as a stand alone document for inclusion after acceptance into the WP.	Acceptance of submission with two revisions.	Review by Government using guidance cited to determine acceptability.	Allow eight (8) weeks in the schedule for DDESB approval after submission of final document to the CEHNC-CX.
2b	Prepare, submit and gain acceptance of a Dive Plan.	Prepare, submit and gain acceptance of a Dive Plan that is a detailed and comprehensive plan covering all aspects of dive operations in accordance with EM 385-1-1 and 385-1-86.	Acceptance of submission with two revisions.	Review by Government using guidance cited to determine acceptability.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
3	Utilize GIS in the development of the Conceptual Site Model (CSM) and maintain and manage all project and geospatial data.	Manage and maintain project data, and develop CSM in GIS IAW DID WERS-007.01, EM 200-1-2, EM 1110-1-4009 and applicable Interim Guidance Documents.	Acceptance of CSM and GeoSpatial Data submissions meets quality and formatting requirements.	Review by Government using guidance cited to determine acceptability.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
4	Conduct a remedial investigation in accordance	Field work, data quantity and quality, and analysis of said data (does not	Conduct the RI in accordance with the accepted/approved WP, UFP-QAPP, and	Period inspection/review of field work. Verify compliance	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-

	with CERCLA, characterizing the nature and extent of MEC contamination at the required munitions response sites (MRS) meeting the project DQOs as defined during the TPP process. This task shall include all field activities necessary to execute this task except MC sampling. MC sampling requirements are covered under Task 12, Environmental Sampling & Analysis.	include area where Rights-of-entry were not obtained) provides the following results in the RI report: - Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance documents; - Demonstrate that all areas with the potential to have greater than or equal to .1 (when significant intrusive activities occur), .5 (when use is moderate) and 1 (when little or no intrusive activities occur) UXO per acre are classified as MEC-contaminated. - Demonstrate that the boundaries of all identified MEC contaminated areas have been delineated to an accuracy of at least +/- half the transect spacing, maximum 250 feet. - Demonstrate that data inputs from the RI into the FS will enable remediation cost estimates with an accuracy of +50%/-30%. The work and reporting shall address the surface and sub-surface metallic anomaly density distribution (anomaly/acre) across identified MEC contaminated areas and other remediation cost drivers such as vegetation type and density, terrain conditions, soil type,	ESP. QC data submitted meets requirement described in the most recent geophysics and chemistry DIDs or QCP that has been accepted by the PDT. - No more than 3-4 CARs/948s for non-critical violations and/or 1 CAR/948 for critical violation. No unresolved corrective action requests. - All final data and QC tests/documentation submitted. Government QA acceptance of QC tests/documentation gained. - No Class "A" Safety accidents, contractor at fault; <1 non-explosive Class C accidents; and <2 non-explosive related Class D accidents, IAW AR 385-40. - Major safety violations, no more than 1 non-explosive related safety violation. - Minor safety violations, no more than 2 safety violations. - Zero letters of reprimand, grievances, or formal complaints.	with accepted WP, UFP-QAPP and Dive Plans as applicable. Quality control tests/documentation submitted per the QASP for government review. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software, UXO Estimator or other approved statistical method. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/uncontaminated areas in question. Anomaly density profile and other remediation cost driver precision will be verified by QA of methods used.	performance of work at contractor's expense.

		exclusion zone evacuation costs, etc each to a level of accuracy within the range specified herein. Additionally: - Perform the RI field activities in accordance with the accepted Work Plan, QASP and UFP-QAPP. - Proper processing and disposition of UXO, DMM and MC encountered in accordance with approved plan(s). - All Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2. - Meet the project DQOs as defined by the TPP process. - All geophysics shall be IAW geophysics DID or as agreed to by the PDT Marine field work QC shall be recommended by the Contractor in the QCP. Government QA is expected to be limited to visual observation of the Contractors field work and QC operations due to the dynamics of this high energy environment. The government recognizes that submerged metallic items have the potential to move great distances due to the local current and surf conditions and that prolonged			

		seeding of test items may not be feasible. The government requests that the Contractor submit a modified QC Requirements table for government acceptance for the marine and beach portions of the project to meet the needs of the project and still insure acceptable data quality to meet the project objectives. For this task order 1 acre of transects equals 14,520 lf (2.75 miles) of transects 3 feet wide. One acre's worth of grids equals seventeen (17) 2500 sf grids or four (4) 10,000 sf grids.			
5	Prepare, submit and gain acceptance of a RI report in accordance with EM CX Interim Guidance 06-04 and EPA Guidance.	The RI report shall document the result of the RI and be in accordance with EP 1110-1-18, EM CX Interim Guidance 06-04 and EPA guidance.	Acceptance of RI with two revisions.	Review of RI against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
6	Conduct a feasibility study and prepare, submit and gain acceptance of a FS report in accordance with EM CX Interim Guidance 06-04.	The FS report shall document the result of the feasibility study and be in accordance with EP 1110-1-18, EM CX Interim Guidance 06-04 and EPA guidance.	Acceptance of FS with two revisions.	Review of FS against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
7	Prepare, submit and gain acceptance of a Proposed Plan (PP).	Prepare the PP in accordance with CERCLA, ER 200-3-1, EP 1110-1-18, EM-CX Interim Guidance 06-04, and	Acceptance of PP with two revisions.	Review of PP against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at

		EPA 540-R-98-031.			contractor's expense.
8	Prepare, submit and gain acceptance of a Decision Document (DD) for each MRS identified.	Prepare the DD in accordance with CERCLA, ER 200-3-1, EP 11101-1-18, Appendix C, and EPA 540-R-98-031.	Acceptance of DDs with two revisions.	Review of DD against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
9	Successfully complete public meetings and support the CESAJ District with community relations.	Contractor attends and participates in meetings. Meeting transcripts PP meeting are accurate. Meeting materials are accepted by the government as required.	Acceptance of meeting materials with two revisions, acceptance of PP meeting transcripts in one revision. Meetings held are organized; and professional in nature. Personnel are thoroughly familiar with the project. Zero letters of reprimand, grievances, or formal complaints	Review of required materials for meetings. Government will attend and evaluate contractor's attendance, participation and professional demeanor.	Satisfactory or greater CPARS rating/poor CPARS rating.
10	Update, submit and gain acceptance of a PIP in accordance with EP 1110-3-8, ER 200-3-1, EM-CX Interim Guidance 06-04, guidance provided in the FUDS Public Involvement Toolkit and DENIX website.	Prepare the PIP in accordance with EP 1110-3-8, ER 200-3-1, EM-CX Interim Guidance 06-04, guidance provided in the FUDS Public Involvement Toolkit and DENIX website.	Acceptance of PIP with two revisions.	Review of PIP against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
11	Maintain the Administrative Record for each MRS throughout the period of performance of this Task Order.	Prepare in accordance with the guidance in EP 1110-3-8, Chapter 4 (Establishing and Maintaining Administrative Records) and Standard Operating Procedure for Formerly Used	Administrative record will be evaluated against guidance for compliance with requirements, accuracy and completeness of the record, with up to one uncorrected deficiencies remaining during the	The government will visit, at least once, the administrative record's location and check for completeness and compliance with referenced EP; electronic submissions will	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

		Defense Sites (FUDS) Records Management, Revision 5, dated January 2008 (or most recent version).	period of performance.	be evaluated randomly upon receipt as data is entered into the record.	
12	Collect data that meets the project DQOs as defined during the TPP process, of known quality and quantity, to determine the nature and extent of munitions constituents (MC) and perform a human health and ecological risk assessment.	Perform field activities in accordance with the Work Plan and UFP-QAPP. MC analyses shall be performed in accordance with the requirements of the Department of Defense (DoD) Quality Assurance Manual (QAM), WERS-009.01 Munitions Constituents Chemical Data Quality Deliverables, and the approved project specific UFP-QAPP. The ecological and human health risk assessment shall be performed in accordance with the EPA Risk Assessment Guidance (RAGS) and USACE EM 200-1-4, Volumes I and II.	Sampling field work and data meets established criteria within the accepted Uniform Federal UFP-QAPP, SAP, and Work Plan.	Period inspection/review of field work, and data. Compliance with accepted WP, UFP-QAPP and ESP. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software or other approved statistical method. Quality control tests/documentation submitted per the QASP for government review.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
13	Propose, utilize and evaluate effectiveness of innovative technology selected by the contractor.	Perform field activities using innovative technology while meeting the established criteria in tasks 4 and 12. Evaluation is supported by data and documented in a letter report that obtains Government QA acceptance with two revisions.	Applicable field work and data meets established criteria within the accepted Uniform Federal UFP-QAPP, SAP, and Work Plan.	Period inspection/review of field work, and data. Compliance with accepted WP, UFP-QAPP and ESP. Quality control tests/documentation submitted per the QASP for government review.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
14	Contractor shall prepare, submit and gain approval				Satisfactory or greater CPARS rating/poor CPARS rating and/or re-

	of a Baseline Survey Report documenting the results from the bathymetry, side scan sonar, and magnetometer/ EM and ROV/AUV investigation, as appropriate to include map(s) indicating location of surface MEC, coral species and other threatened and endangered plant species.				performance of work at contractor's expense.

Attachment B
PERFORMANCE METRICS

B.1 Performance Metrics for Performance Assessment Record (PAR)

	Exceptional	**Very Good**	**Satisfactory**	**Marginal**	**Unsatisfactory**
PAR Category: Quality of Product or Service					
Performance indicator: Document reviews					
Draft Plans, Reports, and documents [Plans, documents and reports are considered draft until accepted as final by the Government]	All contract-milestone documents accepted as submitted	No substantive comments (i.e. limited to grammar, spelling, terminology) to any of the documents, but a few exceptions were noted and corrected	Contractor met Acceptance Criteria	One or more documents required revisions to be resubmitted for approval prior to proceeding. Two backchecks were required on one or more documents before original comments were resolved satisfactorily.	One or more documents did not comply with contract requirements, or one or more documents required more than two backchecks before original comments were resolved satisfactorily, or more than one document was rejected.
Performance indicator: Project Execution					
Process Compliance	Zero Corrective Action Requests (CAR) or 948s	{1-2} CARs/948s for non-critical violations to WP requirements	Contractor met Acceptance Criteria	{5-6} CARs/948s for non-critical violations and/or {2} CARs/948 for critical violations	{>6} CARS for non-critical violations and/or {>2} CARs/948s for critical violations, or any unresolved CARs
Project Execution	Zero letters of reprimand, grievances, or formal complaints AND one or more unsolicited letters of commendation		Contractor met Acceptance Criteria	{One} letter of reprimand, grievance or formal complaint that was resolved through negotiation	More than {one} letter of reprimand, grievance or formal complaint that were resolved through negotiation
Task Completion			Contractor met Acceptance Criteria		Final data and QC documentation submitted but not accepted
PAR Category: Schedule					
Performance indicator: Timely completion of tasks					
Final Plans and Reports, project milestones, T.O. invoices	All document submittals and task order milestones and	Project closed out/final invoice accepted ahead	Project closed out/final invoice accepted on	Project closed out/final invoice accepted within 30 calendar days	Project closed out/final invoice accepted more

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
	invoices complete and accepted by T.O date, project closed out/final invoice approved ahead of schedule	of schedule	T.O. date	after T.O. date.	than 30 calendar days after T.O. date.
Project status reports accurate			Yes		No
Performance indicator: Impacts to schedule					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/ PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Cost Control (Not Applicable for Firm Fixed Price)					
Performance indicator: No unauthorized cost overruns					
Unauthorized cost overruns			No		Yes
Total Project Costs	Total contract invoices less than 98% of T.O. authorized amount	Total contract invoices greater than 98% but less than 99.99%of T.O. authorized amount	Total contract invoices between 99.99% and 100% of T.O. authorized amount	Total contract invoices greater than 100% but less than 105% of T.O. authorized amount	Total contract invoices greater than or equal to 105% of T.O. authorized amount
Performance indicator: Monthly cost report					
Monthly cost reports accurate			Yes		No
Performance indicator: Impacts to cost					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Business Relations					
Performance indicator: Met contractual obligations					
Corrective Actions taken were timely and effective (Refer to CARs issued to Contractor)			Yes		No
Performance indicator: Professional and Ethical Conduct					
Meetings and	Zero letters of		Contractor met	One letter of	More than one

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
correspondences with Public, project delivery team and other stakeholders	reprimand, grievances, or formal complaints AND one or more unsolicited letters of commendation		Acceptance Criteria	reprimand, grievance or formal complaint that was resolved through negotiation	letter of reprimand, grievance or formal complaint that were resolved through negotiation OR removal of one or more project personnel as a results of a letter of reprimand, grievance or formal complaint.
Performance indicator: Customer has overall satisfaction with work performed					
Customer survey results for rating period	4.0-5.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0
Performance indicator: Personnel responsive and cooperative					
Key personnel responsive, and cooperative	Always		Most Times		Almost Never
PAR Category: Management of Key Personnel and Resources					
Performance indicator: Personnel knowledgeable and effective in their areas of responsibility					
Personnel assigned to tasks	All personnel proposed by Contractor were assigned to project, some personnel were substituted by higher qualified individuals.		All personnel proposed by Contractor were assigned to project, some personnel were substituted by equally qualified individuals.	All personnel proposed by Contractor were assigned to project, some personnel were substituted by equally qualified individuals, Letter of reprimand received for personnel conduct from HNC.	All personnel proposed by Contractor were assigned to project, some personnel were substituted by lesser qualified individuals or HNC requested, in writing, removal of assigned personnel for poor performance.
Performance indicator: Personnel able to manage resources efficiently					
Instances when resource management had negative impact on project execution	0	1-2	3-4	5-6	>6
PAR Category: Safety					
Performance indicator: Accidents and Violations					
*No Class A Accidents, Contractor at fault	0 No class A accidents IAW AR 385-10	No class A accidents IAW AR 385-10	Contractor met Acceptance Criteria	{<2} non-explosive related Class C accidents, or {1}	{1} Any Class A accident IAW AR-385-10, or

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
				non-explosive Class B accident, IAW AR 385-10	Any explosive related accident.
*Major safety violations	0 accidents/injuri es No safety violations	0 accidents/injuri es No safety violations		{2} non-explosive safety violations.	{>1} any violation of procedures for handling, storage, transportation, or use of explosives IAW the WP, and all Federal, State and local laws/ordinances .
*Minor safety violations	No safety violations	1 safety violation		{3} safety violations	{>3} safety violations

Classes of Accidents:

- **Class A:** Fatality or permanent total disability (Government Civilian, Military Personnel, and/or Contractor), or >$2,000,000 property damage.

- **Class B:** Permanent partial disability or impatient hospitalization of 3 or more persons (Government Civilian, Military Personnel, and/or Contractor), $500,000< $2,000,000 property damage.

- **Class C:** Lost Workday (Contractor) or Lost Time (Government Civilians), $50,000< $500,000 property damage.

- **Class D:** $2000 < $50,000 property damage.

* From Section C of Solicitation Number W912DY-08-R-0016, Amendment 0007 (may be included but are not limited to these).

The following guidelines are provided for issuing ratings that are subjective in nature, these ratings will be supported by the weight of evidence documented during the government's surveillance efforts:

Exceptional: Performance *meets* contractual requirements and *exceeds many* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *few minor problems* for which corrective actions taken by the Contractor were *highly effective*.

Very Good: Performance *meets* contractual requirements and *exceeds some* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *some minor problems* for which corrective actions taken by the Contractor were *effective*.

Satisfactory: Performance *meets* contractual requirements. The contractual performance of the element or sub-element contains *some minor problems* for which corrective actions taken by the Contractor *appear or were satisfactory*.

Marginal: Performance *does not meet all* contractual requirements. The contractual performance of the element or sub-element being assessed reflects a *serious problem* for which the Contractor has *not yet identified corrective actions*. The Contractor's proposed actions appear only *marginally effective or were not fully implemented*.

Unsatisfactory: Performance *does not meet most* contractual requirements and *recovery is not likely* in a timely manner. The contractual performance of the element or sub-element contains *serious problems* for which the Contractor's corrective actions *appear or were ineffective*

Attachment C

1. REQUIREMENTS AND PROCEDURES:

a. This interim guidance provides specific requirements for MMRP Decision Documents.

b. Format and content of ALL MMRP decision documents and action memoranda, regardless of signature authority shall be in accordance with Section 2. Each document will contain:

(1) A title page,

(2) A table of contents,

(3) List of acronyms,

(4) Page numbers on each page indicating page number and total number of pages in the document, e.g., “1 of 25”.

(5) Header in the upper right-hand corner of each page including; document type (“Decision Document”, “Time Critical Removal Actions (TCRA) Action Memorandum”, or “Non-time Critical Removal Action (TCRA) Action Memorandum”), project name (“Sitka Naval Operating Base”), project location (“Sitka, Alaska”), and project number to include MRS number.

c. All decision documents or action memoranda, regardless of level of signature authority, will be accompanied by an Executive Summary that for Headquarters (HQ). USACE will forward to ACSIM-ISE and DASA (ESOH). The Executive Summary shall be kept to a single page, whenever possible, and will include:

(1) Title, including project name and project number, date DD (or AM) was signed and by whom,

(2) Brief description of the Munitions Response Sites (MRS), covered by the decision,

(3) Brief description of selected response action and its relationship to other cleanup actions,

(4) Degree of risk reduction,

(5) Present worth cost of selected response action, and the contribution to the cost-to-complete of all remedies for the FUDS Property,

(6) Amounts and fiscal year(s) that funds are required for remedial/removal action design and construction,

(7) Duration of any remedial action-operation (RA-O), removal action construction (RmA-C) and/or Long Term Monitoring (LTM) actions,

(8) Land use controls (LUC) required and means of maintaining them,

(9) Other potential response actions considered, and

(10) Expected result of the action.

2.0 CONTENT

Remedial Action Decision Document
Table of Contents

Remedial Action Decision Document Outline

PART 1: THE DECLARATION

The Declaration functions as the abstract and formal authorizing signature page for the DD.

1. PROJECT NAME AND LOCATION.
2. STATEMENT OF BASIS AND PURPOSE.

   Certify the factual and legal basis for the Selected Remedy.

3. ASSESSMENT OF PROJECT MRS.

   Certify that the MRS poses a threat to public health, welfare, or the environment.

4. DESCRIPTION OF SELECTED REMEDY.

   a. Describe the major components of the Selected Remedy in a bullet fashion.

   b. Describe the scope and role of this MRS.

   c. Describe how this remedial action addresses principal threats and other contamination at the MRS (i.e., what is being treated, what is being contained, and what is the rationale for each).

5. STATUTORY DETERMINATIONS.

   a. Describe how the Selected Remedy satisfies the statutory requirements of CERCLA §121 and discuss the applicability of the 5-year review requirements.

6. DATA CERTIFICATION CHECKLIST.

   The Declaration should certify that the following information is included in the DD (or provide a brief explanation for why this information is not included):

   a. Munitions and Explosives of Concern (MEC) and munitions constituents (MC) and their respective concentrations.

   b. Baseline risk represented by the MEC/MCs.

   c. Cleanup levels established for MEC/MCs and the basis for these levels.

   d. How MEC and MC will be addressed.

   e. Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and DD.

   f. Potential land and groundwater use that will be available at the MRS as a result of the Selected Remedy.

   g. Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.

   h. Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

7. AUTHORIZING SIGNATURE.

   The following general paragraph and signature block. (*Note: Signature block may not appear alone on a page – it must be on the same page with the preceding paragraph*):

   "This Decision Document presents the selected response action at [place]. The U.S. Army Corps of Engineers is the lead agency under the Defense Environmental Restoration Program (DERP) at the [FUDS property name] Formerly Used Defense Site, and has developed this Decision Document consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and

Hazardous Substances Pollution Contingency Plan (NCP). This decision document will be incorporated into the larger Administrative Record file for [FUDS property name], which is available for public view at [address]. This document, presenting a selected remedy with a present worth cost estimate of [$$], is approved by the undersigned, pursuant to Memorandum, DAIM-ZA, September 9, 2003, subject: Policies for Staffing and Approving Decision Documents (DDs), and to Engineer Regulation 200-3-1, Formerly Used Defense Sites (FUDS) Program Policy."

APPROVED:

(insert individual's signature block here) Date_________________________

For present worth cost estimate of $2M or less:
District Commander" Signature Block

For present worth cost estimate of more than $2M and less than or equal to $10M:
HQUSACE signature block for:
Chief, Department of Defense
Support Team
Directorate of Military Programs

For present worth cost estimate of more than $10M:
Signature block for ACSIM or DASA(ESOH) or both

PART 2: THE DECISION SUMMARY

The Decision Summary identifies the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

1. PROJECT NAME, LOCATION, AND BRIEF DESCRIPTION.
   a. Name and location.

   b. FUDS Project Number.

   c. Lead and support agencies (e.g., DoD, State, Tribes).

   d. Source of cleanup monies (e.g., ER-FUDS, ER-Army, ER-BRAC).

   e. Brief MRS description.

2. PROJECT HISTORY AND ENFORCEMENT ACTIVITIES.
   a. History of MRS activities that led to the current problems.

   b. History of federal, state, and local MRS investigations and removal and remedial actions conducted under CERCLA or other authorities.

   c. History of CERCLA enforcement activities at the MRS (e.g., results of PRP searches, issuances of special notices to PRPs).

3. COMMUNITY PARTICIPATION.
   a. Describe how the public participation requirements in CERCLA and the NCP were met in the remedy selection process (e.g., community relations plans, fact sheets, public notices, public meetings, public Restoration Advisory Board).

   b. Describe other community outreach and involvement efforts.

c. Describe efforts to solicit views on the reasonably anticipated future land uses and potential future land uses.

4. SCOPE AND ROLE OF RESPONSE ACTION.
   a. The planned sequence of actions.

   b. The scope of problems those actions will address.

   c. The authorities under which each action will be/has been implemented (e.g., removal, remedial).

5. <u>PROJECT MRS CHARACTERISTICS</u>: (Include maps, a site plan, or other graphical presentations, as appropriate.)

   a. Describe the conceptual site model (CSM) on which the risk assessment and response action are based.

   b. Provide an overview of the MRS, including the following:

      (1) Size of MRS (e.g., acres).

      (2) Geographical and topographical information (e.g., surface waters, flood plains, wetlands).

      (3) Surface and subsurface features (e.g., number and volume of tanks, lagoons, structures, and drums on-site).

      (4) Areas of archaeological or historical importance.

   c. Describe the sampling strategy (e.g., which media were investigated, what sampling approach was used, over what area, when was the sampling performed).

   d. Describe known or suspected sources of contamination.

   e. Describe types of contamination and the affected media, including the following:

      (1) Types and characteristics of MEC/MCs (e.g., toxic, mobile, carcinogenic, non-carcinogenic).

      (2) Quantity/volume of MEC/MC that needs to be addressed.

      (3) Concentrations of MEC/MCs in each medium.

      (4) RCRA hazardous wastes and affected media.

   f. Describe location of contamination and known or potential routes of migration, including the following:

      (1) Lateral and vertical extent of contamination.

      (2) Current and potential future surface and subsurface routes of human or environmental exposure.

      (3) Likelihood for migration of MEC/MCs from current location or to other media.

      (4) Human and ecological populations that could be affected.

   g. For MRSs with groundwater contamination, describe the following:

      (1) Aquifer(s) affected or threatened by site contamination, types of geologic materials, approximate depths, whether aquifer is confined or unconfined.

      (2) Groundwater flow directions within each aquifer and between aquifers and groundwater discharge locations (e.g., surface waters, wetlands, other aquifers).

(3) Interconnection between surface contamination (e.g., soils, sediments/surface water) and groundwater contamination.

(4) Confirmed or suspected presence and location of non-aqueous phase liquids.

(5) If groundwater models were used to define the fate and transport of MEC/MC, identify the model used and major model assumptions.

h. Note other site-specific factors that may affect response actions at the MRS.

6. CURRENT AND POTENTIAL FUTURE LAND AND WATER USES.

a. Land Uses.

(1) Current on-site land uses.

(2) Current adjacent/surrounding land uses.

(3) Reasonably Anticipated Future Land Uses and Basis for Future Use Assumptions (e.g., zoning maps, nearby development, 20-year development plans, dialogue with local land use planning officials and citizens, reuse assessment).

b. Groundwater and Surface Water Uses.

(1) Current groundwater and surface water uses.

(2) Potential beneficial groundwater and surface water uses (e.g. potential drinking water, irrigation) and basis for future use assumptions (e.g., Comprehensive State Groundwater Protection Plan, promulgated state classification guidelines).

(3) If beneficial use is potential drinking water source, identify the approximate time frame of projected future drinking water use (e.g., groundwater aquifer not currently used as a drinking water source but expected to be utilized in 30 to 50 years).

(4) Location of anticipated use in relation to location and anticipated migration of contamination.

7. SUMMARY OF PROJECT MRS RISKS.

a. Human Health Risks.

(1) Identify the concentrations of MEC/MC in each medium.

(2) Summarize the results of the exposure assessment.

(3) Summarize the results of the toxicity assessment for the MEC/MC.

(4) Summarize the risk characterization for both current and potential future land use scenarios and identify major assumptions and sources of uncertainty.

b. Ecological Risks.

(1) Identify the concentrations of MEC/MC in each medium.

(2) Summarize the results of the exposure assessment.

(3) Summarize the results of the ecological effects assessment.

(4) Summarize the results of the ecological risk characterization and identify major assumptions and sources of uncertainty.

c. Basis for Response Action.

(1) Clearly Present the Basis for Taking the Response Action at the Conclusion of this Section.

8. REMEDIAL ACTION OBJECTIVES.

a. Present a clear statement of the specific RAOs for the MRS (e.g., treatment of contaminated soils above health-based action levels, restoration of groundwater plume to drinking water levels, and containment of DNAPL source areas) and reference a list or table of the individual performance standards.

b. Discuss the basis and rationale for RAOs (e.g., current and reasonably anticipated future land use and potential beneficial groundwater use).

c. Explain how the RAOs address risks identified in the risk assessment (e.g., how will the risks driving the need for action be addressed by the response action?).

9. DESCRIPTION OF ALTERNATIVES: The objective of this section is to provide a brief understanding of the remedial alternatives developed for the MRS.

a. Remedy Components. Provide a bulleted list of the major components of each alternative, including but not limited to:

(1) Treatment technologies and the materials they will be used to address (e.g., principal threats).
(2) Containment components of remedy (e.g., engineering controls, cap, hydraulic barriers) and the materials they will be used to address (e.g., low concentration source materials, treatment residuals).

(3) Land use controls (and entity responsible for implementing and maintaining them).

(4) Operations and maintenance (O&M) activities required to maintain the integrity of the remedy (e.g., cap maintenance).

(5) Monitoring requirements.

b. Common Elements and Distinguishing Features of Each Alternative. Describe common elements and distinguishing features unique to each response option. Examples of these elements include:

(1) Key ARARs (or ARAR waivers) associated with each alternative (e.g., action- and/or location-specific groundwater treatment units, manifesting of hazardous waste, and regulating solid waste landfills).

(2) Long-term reliability of remedy (potential for remedy failure/replacement costs).

(3) Quantity of untreated MEC/MC to be disposed off-site or managed on-site in a containment system and degree of residual contamination remaining in such waste.

(4) Estimated time required for design and construction (i.e., implementation time frame).

(5) Estimated time to reach cleanup levels (i.e., time of operation, period of performance).

(6) Estimated capital, annual O&M, and total present worth costs, discount rate, and the number of years over which the remedy cost estimate is projected.

(7) Describe uses of presumptive remedies and/or innovative technologies.

c. Expected Outcomes of Each Alternative.

(1) Available land uses upon achieving performance standards. Note time frame to achieve performance standards (e.g., commercial or light industrial use available in 3 years when cleanup levels are achieved).

(2) Available groundwater uses upon achieving performance standards. Note time frame to achieve performance standards (e.g., restricted use for industrial purposes in technical impracticability [TI] waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50 to 70 years).

(3) Other impacts or benefits associated with each alternative.

10. COMPARATIVE ANALYSIS OF ALTERNATIVES. Compare the relative performance of each alternative against the others with respect to the nine evaluation criteria (summarize in a table if appropriate).

11. PRINICIPAL MEC/MC ISSUES. Identify the MEC/MC issues at the MRS and discuss how the alternatives will address them.

Note: The *Statutory Determinations* section of the DD should explain whether or not the Selected Remedy satisfies the statutory preference for remedies employing treatment that reduces toxicity, mobility, or volume as a principal element. By indicating whether the principal threats will be addressed by the alternatives, this section of the *Decision Summary* should provide the basis for that statutory determination.

12. SELECTED REMEDY.

a. Summary of the Rationale for the Selected Remedy.

(1) Provide a concise discussion of the key factors for remedy selection.

b. Detailed Description of the Selected Remedy.

(1) Expand on the Description of the Selected Remedy from that which was provided in the Description of Alternatives section and provide a brief overview of the RAOs and performance standards.

c. Cost Estimate for the Selected Remedy.

(1) Present a detailed, activity-based breakdown of the estimated costs associated with implementing and maintaining the remedy (include estimated capital, annual O&M, and total present worth costs discount rate and the number of years over which the remedy cost estimate is projected).

d. Estimated Outcomes of Selected Remedy.

(1) Available land use(s) upon achieving cleanup levels. Note time frame to achieve available use (e.g., commercial or light industrial use available in 3 years when cleanup levels are achieved).

(2) Available groundwater use(s) upon achieving cleanup levels. Note time frame to achieve available use (e.g., restricted use for industrial purposes in TI waiver zone, drinking water use in non-TI zone upon achieving cleanup levels in 50 to 70 years).

(3) Final cleanup levels for each medium (i.e., contaminant-specific cleanup levels), basis for cleanup levels, and risk at cleanup levels (if appropriate).

(4) Anticipated socioeconomic and community revitalization impacts (e.g., increased property values, reduced water supply costs, jobs created, increased tax revenues due to redevelopment, environmental justice concerns addressed, enhanced human uses of ecological resources).

(5) Anticipated environmental and ecological benefits (e.g., restoration of sensitive ecosystems, protection of endangered species, protection of wildlife populations, wetlands restoration).

13. STATUTORY DETERMINATIONS.

a. Explain how the remedy satisfies the requirements of §121 of CERCLA to:

(1) Protect human health and the environment.

(2) Comply with ARARs, or justify a waiver.

(3) Be cost-effective.

(4) Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable (i.e., explain why the Selected Remedy represents the best option).

(5) Satisfy the preference for treatment as a principal element, or justify the selection of an alternative remedy.

b. Explain 5-year review requirements for the Selected Remedy.

14. DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN. If there are significant changes in the Selected Remedy from the Preferred Alternative:

a. Discuss the Preferred Alternative originally presented in the Proposed Plan.

b. Describe the significant changes in the Selected Remedy.

c. Explain the rationale for the changes and how they could have been reasonably anticipated based on information presented in the Proposed Plan or the Administrative Record file.

PART 3: THE RESPONSIVENESS SUMMARY

The Responsiveness Summary serves the dual purposes of: (1) presenting stakeholder concerns about the MRS and preferences regarding the remedial alternatives; and (2) explaining how those concerns were addressed and the preferences were factored into the remedy selection process. This discussion should cross-reference sections of the Decision Summary that demonstrate how issues raised by the community have been addressed.

1. STAKEHOLDER ISSUES AND LEAD AGENCY RESPONSES: Summarize and respond concisely to issues raised by stakeholders.

2. TECHNICAL AND LEGAL ISSUES: Expand on technical and legal issues, if necessary

Attachment D

Price Spreadsheet

Culebra Water Ranges				
Task, Title, Type	Qty	Unit	Price	Total
1, Technical Project Planning, FFP/UP	1.0	LS		
1a, Additional meeting, FUP	1.0	Ea		
2,Optional RI/FS Work Plan, FFP	1.0	LS		
2a, Optional, Explosive Siting Plan, FFP	1.0	LS		
2b, Optional, Dive Plan, FFP	1.0	LS		
3, GIS, FFP/UP	1.0	LS		
3a, Additional GIS per month, FUP	1.0	EA		
4, RI/FS Field Activities, CPFF/FUP				
4a, Flamingo Bay Water Area,				
4a1, Optional Bathymetry, CPFF	1.0	LS		
4a2, Optional Side Scan Sonar, CPFF	1.0	LS		
4.a3, ROV/AUV Underwater Video, CPFF	1.0	LS		
4.a4, Optional Magnetometer/EM Survey, CPFF	1.0	LS		
4.a5, Optional, Intrusive Investigation, CPFF	1.0	LS		
4b, Optional Luis Pena Channel Water Areas, CPFF/FUP				
4b1, Optional Bathymetry, CPFF	1.0	LS		
4b2, Optional Side Scan Sonar, CPFF	1.0	LS		
4.b3, Optional ROV/AUV Underwater Video, CPFF	1.0	LS		
4.b4, Optional Magnetometer/EM Survey, CPFF	1.0	LS		
4.b5, Optional Intrusive Investigation, CPFF	1.0	LS		
Civil Survey, per acre, FUP	1.0	Ea		
DGM Transect geophysics per acre, FUP	1.0	Ea		
Analog Transect geophysics per acre, FUP	1.0	Ea		
DGM Grids geophysics per acre, FUP	1.0	Ea		
Analog Grids geophysics per acre, FUP	1.0	Ea		
Underwater DGM Transects per acre, FUP	1.0	Ea		
Underwater Mag & Dig Transects per acre, FUP	1.0	Ea		
Side Scan Sonar per mile, FUP	1.0	Ea		
Bathymetry per mile, FUP	1.0	Ea		
ROV/AUV Underwater Video per mile, FUP	1.0	Ea		
Mob/Demob Density Transect Team, FUP	1.0	Ea		
Mob/Demob, DGM Team, FUP	1.0	Ea		
Mob/Demob, MEC Investigation Team, FUP	1.0	Ea		
Mob/Demob Side Scan Sonar Team , FUP	1.0	Ea		
Mob/Demob Underwater Geo Team, FUP	1.0	Ea		
Mob/Demob Underwater MEC Investigation Team, FUP	1.0	Ea		
Mob/Demob Underwater Mag & Dig Team, FUP	1.0	Ea		
Underwater Investigation – On-shore support per day, FUP	1.0	Ea		
Underwater Investigation – On-shore support per week, FUP	1.0	Ea		
Underwater Investigation – Off-shore support per day, FUP	1.0	Ea		
Underwater Investigation – Off-shore support per week, FUP	1.0	Ea		

Culebra Water Ranges				
Task, Title, Type	Qty	Unit	Price	Total
Each Demolition Shot, FUP	1.0	Ea		
Each Underwater Demolition Shot, FUP	1.0	Ea		
Intrusive Investigation – Land, per day, FUP	1.0	Ea	NA	NA
Intrusive Investigation - Land, per week, FUP	1.0	Ea	NA	NA
Coral Replacement, ¼ Acre, FUP	1	Ea		
Sea Grass Replacement, ¼ Acre, FUP	1.0	Ea		
Intrusive Investigation – Underwater, per day, FUP	1.0	Ea		
Intrusive Investigation - Underwater, per week, FUP	1.0	Ea		
Program/Project Management, per week, in office, FUP	1.0	Ea		
Program/Project Management, per week, in field, FUP	1.0	Ea		
Site Management (SUXOS, UXOQC, UXOSO), per week, FUP	1.0	Ea		
Contractor can add relevant fixed unit pricing for review and acceptance by the Government.				
5, Optional Remedial Investigation Report Initial, FFP	1.0	LS		
6, Optional Feasibility Study Report Initial MRS, FFP	1.0	LS		
7, Optional Proposed Plan Initial MRS, FFP	1.0	LS		
8, Optional Decision Document Initial MRS, FFP	1.0	LS		
9, Optional Community Relations Support, FFP	1.0	LS		
10, Optional Public Involvement Plan, FFP	1.0	LS		
11, Optional Administrative Record, FFP	1.0	LS		
12, Optional Environmental Sampling & Analysis, FFP/FUP				
12a, Optional Flamingo Bay Water Area, FFP	1.0	LS		
12b, Optional Luis Pena Channel Water Areas, FFP	1.0	LS		
12c, Optional Beach Monitoring, FFP	1.0	LS		
Sampling and analysis, Soil, ten plus QC/QA, MS/MSD, FUP	1.0	Ea		
Sampling and analysis, Water, ten plus QC/QA, MS/MSD, FUP	1.0	Ea		
Sampling and analysis, Sediment, ten plus QC/QA, MS/MSD, FUP	1.0	Ea		
Incremental Sampling Unit(DU) (100'x100'), FUP	1.0	Ea		
Pre & Post Detonation per set, FUP	1.0	Ea		
Subsurface Sampling, per 2' - 4' boring, FUP	1.0	Ea		
Contractor can add relevant fixed unit pricing for review and acceptance by the Government.	1.0	Ea		
13, Optional Innovative Technology, FFP	1.0	LS		
14, Optional Baseline Survey Report, FFP	1.0	LS		
			Total	

- Note: Use RSMeans, most recent version, for applicable unit pricing using applicable location factors.

This page intentionally left blank.

APPENDIX B

STANDARD OPERATING PROCEDURES

FINAL

Standard Operating Procedures for Endangered Species Conservation and their Critical Habitat during Underwater Investigations

DERP-FUDS Property No. I02PR0068
Culebra, Puerto Rico

US Army Corps of Engineers
Jacksonville District

April 2012

US Army Corps
of Engineers
Jacksonville District

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix A. SOPs for Endangered Species Conservation and their Habitat (July 2008)

Appendix B. Addendum to the 2008 SOPs (April 2011)

LIST OF FIGURES

LIST OF ACRONYMS

DERP	Defense Environmental Restoration Program
DNER	Department of Natural and Environmental Resources
EBS	Environmental Baseline Survey
EQB	Environmental Quality Board
ESA	Endangered Species Act
FUDS	Formerly Used Defense Sites
FWS	U.S. Fish and Wildlife Service
MC	Munitions Constituent
MEC	Munitions and Explosive of Concern
MRS	Munitions Response Sites
Navy	Department of Navy
NMFS	National Marine Fisheries Service
SOPs	Standard Operating Procedures
TPP	Technical Project Planning
UIT	Underwater Investigation Team
USACE	U.S. Army Corps of Engineers

STANDARD OPERATING PROCEDURES FOR ENDANGERED SPECIES CONSERVATION AND THEIR CRITICAL HABITAT DURING UNDERWATER INVESTIGATIONS AT DERP-FUDS PROPERTY No. I02PR0068, CULEBRA ISLAND, PUERTO RICO

1.0 INTRODUCTION

Culebra Island is located approximately 17 miles east of the island of Puerto Rico and is approximately 9 miles from the Island of Vieques (**Figure 1**).

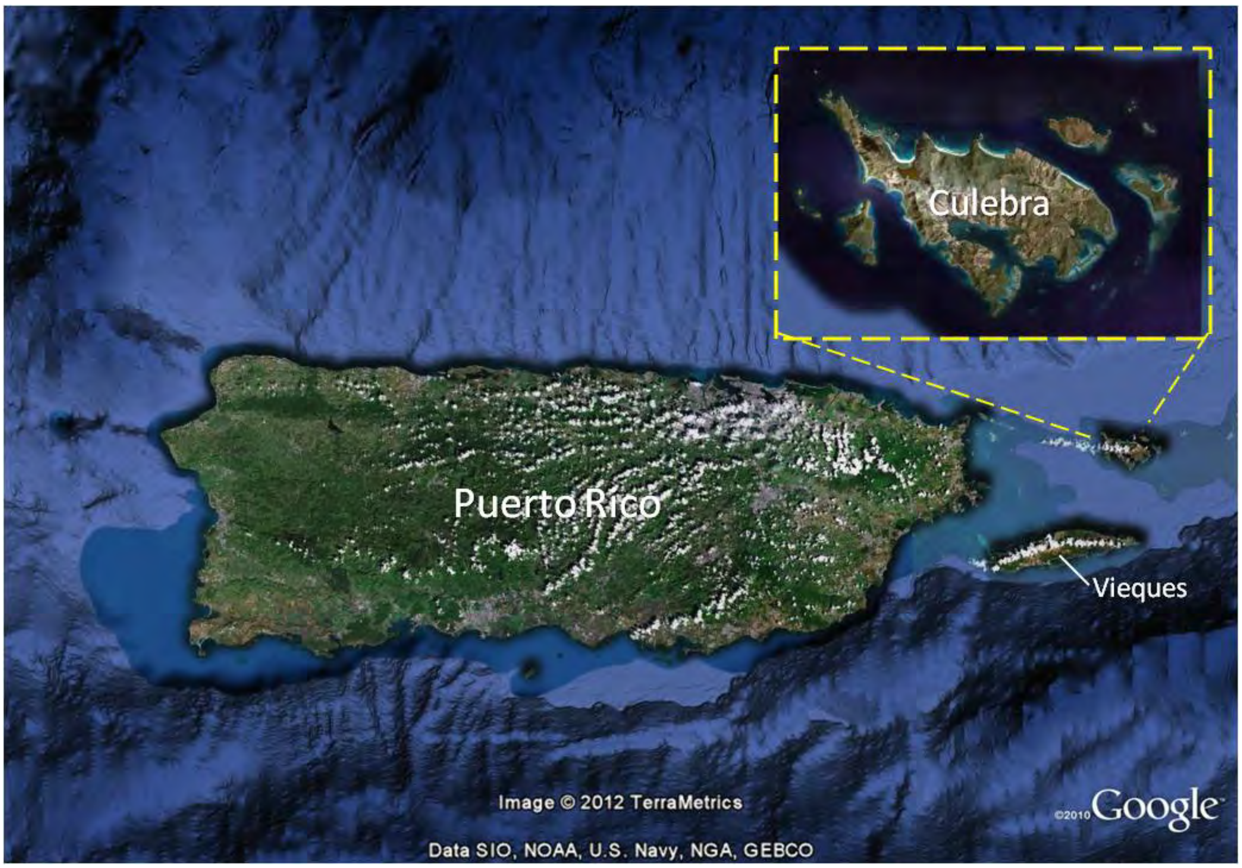


Figure 1. Location Map of Culebra.

In 1901, Culebra's public land was placed under the Department of Navy (Navy) control. The Island and adjacent cays were used as impact areas and firing ranges for aerial bombs and rockets, missiles, mortars, small arms, artillery rounds, and naval projectiles by the Navy and U.S. Marine Corps from 1903 until 1975. In 1978, part of the public land was transferred to the Commonwealth of Puerto Rico and the rest to the U.S. Fish and Wildlife Service (FWS).

Lands were transferred to the Commonwealth through a Quitclaim Deed and a Cooperative Management Agreement signed by the Government of Puerto Rico and the Department of the Interior in 1982.

The Finding and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). However, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS, except the Northwest Peninsula which is not eligible under the 1982 Quitclaim Deed and Public Law 93-166, and the tract that was controlled by the Navy after 1986. The revised area covered by the DERP-FUDS projects for Culebra Island and adjacent cays consists of approximately 8,430 acres. **Figure 2** shows the DERP-FUDS project for Culebra.

Figure 2. DERP-FUDS Projects for Culebra.

The objectives of all the DERP-FUDS projects are to reduce risk to human health and the environment and reduce the hazards to public safety presented by military munitions through implementation of effective, legally compliant, and cost-effective response actions. In order to gather additional information that would help to determine the nature and extent of munitions constituent (MC) or munitions and explosive of concern (MEC) contamination on Culebra Island Munitions Response Sites (MRS), it was agreed by the Technical Project Planning Team (TPP Team) comprised of Federal and Commonwealth of Puerto Rico agencies to conduct underwater investigations and to prepare an Environmental Baseline Survey (EBS). The main objectives of the underwater investigations are: a) characterize and map benthic habitats within investigation areas, b) determine, identify and map endangered or threatened species, in particular coral colonies, c) gather the necessary information to determine potential effects (e.g. location of species versus location of suspected MEC) on endangered or threatened species during remedial investigations and cleanup activities, d) determine presence or absence of MC and MEC, e) characterize the nature and extend of MC and MEC presence, and f) determine if the MC or MEC pose an unacceptable risk to human health and the environment, which would require further considerations or a response action.

2.0 PURPOSE AND NEED

The purpose of this document is to develop a series of Standard Operating Procedures (SOPs) to avoid or minimize impacts to threatened and endangered species listed, pursuant to the Endangered Species Act (ESA), and their critical habitats during the DERP-FUDS underwater investigations on Culebra Island and adjacent cays. Also, serve as a guide for the underwater investigation team (UIT) providing them a general description of the listed species known to be found in the waters around Culebra and for which the surrounding waters and marine substrate were designated as critical habitat.

For the purpose of this document underwater investigation activities consist of visual observations, boating and diving operations, and remote sensing surveys. No intrusive investigation will be conducted. Based on the EBS results, additional SOPs or other measures would be developed and coordinated with the TPP for further investigation phases.

The information used to describe the listed species and their habitat was obtained from state/federal agencies fact sheets, recovery and management plans, petitions, the Federal Register and internet search, among other sources.

3.0 LISTED THREATENED OR ENDANGERED SPECIES

The purpose of this section is to provide a general description of threatened and endangered species that are known to occur or have the potential to occur in the waters around Culebra Island and adjacent cays. Species include the Loggerhead (*Caretta caretta*), Green (*Chelonia* *mydas*), Leatherback (*Dermochelys coriacea*) and Hawksbill (*Eretmochelys imbricata*) sea turtles, West Indian manatee (*Trichechus manatus manatus*), Humpback (*Megaptera novaeangliae*), Finback (*Balaenoptera physalus*), Sei (*Balaenoptera borealis*), Sperm (*Physeter macrocephalus*) and Blue (*Balaenoptera musculus*) whales and Elkhorn (*Acropora palmata*) and Staghorn (*Acropora cervicornis*) corals.

3.1 Loggerhead Sea Turtle (*Caretta caretta*)

Description: The loggerhead is characterized by a large head with blunt jaws. The carapace and flippers are a reddish-brown color; the plastron is yellow. The carapace has five pairs of costal scutes with the first touching the nuchal scute. There are three large inframarginal scutes on each of the bridges between the plastron and carapace. Adults grow to an average weight of about 200 pounds (**Figure 3**). This species was listed as threatened on July 28, 1978.

Figure 3. Loggerhead Sea Turtle
Source: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm

Nesting Season and Development: Nesting season extends from about May through August with nesting occurring primarily at night and it is infrequent in Puerto Rico. Loggerheads are known to nest from one to seven times within a nesting season (mean is about 4.1 nests per season) at intervals of approximately 14 days. Mean clutch size varies from about 100 to 126 along the southeastern U.S. coast. Incubation ranges from about 45 to 95 days, depending on incubation temperatures, but averages 55 to 60 days for most clutches in Florida. Hatchlings generally emerge at night. Remigration intervals of 2 to 3 years are most common in nesting loggerheads, but remigration can vary from 1 to 7 years. Age at sexual maturity is believed to be about 20 to 30 years. The species feeds on mollusks, crustaceans, fish, and other marine animals.

Distribution/Habitat: The loggerhead sea turtle can be found throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. Loggerheads nest on ocean beaches and occasionally on estuarine shorelines with suitable sand. Nests are typically made between the high tide line and the dune front. Most loggerhead hatchlings originating from U.S. beaches are believed to lead a pelagic existence in the North Atlantic gyre for an extended period of time, perhaps as long as 10 to 12 years, and are best known from the eastern Atlantic near the Azores and Madeira. Post-hatchlings have been found floating at sea in association with *Sargassum* rafts. Once they reach a certain size, these juvenile loggerheads begin recruiting to coastal areas in the western Atlantic where they become benthic feeders in lagoons, estuaries, bays, river mouths, and shallow coastal waters. These juveniles occupy coastal feeding grounds for a decade or more before maturing and making their first reproductive migration, the females returning to their natal beach to nest.

3.2 Green Sea Turtle (*Chelonia mydas*)

Figure 4. Green Sea Turtle
Photo: Andy Bruckner, NOAA
Source: http://www.nmfs.noaa.gov/pr/species/turtles/green.htm

Description: The green sea turtle grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of costal scutes, none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes (**Figure 4**). This species was listed under the ESA on July 28, 1978. The breeding populations in Florida and the Pacific coast of Mexico are listed as endangered; elsewhere the species is listed as threatened.

Nesting Season and Development: The nesting season varies with the locality. In Puerto Rico, it is roughly June through October. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years. A female may lay as a many as nine clutches within a nesting season (overall average is about 3.3 nests per season) at about 13-day intervals. Clutch size varies from 75 to 200 eggs, with an average clutch size of 136 eggs reported for Florida. Incubation ranges from about 45 to 75 days, depending on incubation temperatures. Hatchlings generally emerge at night. Age at sexual maturity is believed to be 20 to 50 years.

Distribution/Habitat: The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° North and 30° South. In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore (reefs and seagrass beds) waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico.

Critical habitat was designated in 1998 for green turtles in coastal waters around Culebra (**Figure 5**).

Figure 5. Green Sea Turtle Critical Habitat.

3.3 Leatherback Sea Turtle (*Dermochelys coriacea*)

Figure 6. Leatherback Sea Turtle
Source: http://en.wikipedia.org/wiki/Leatherback_sea_turtle

Description: The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles. The adult leatherback can reach 4 to 8 feet in length and 500 to 2000 pounds in weight. Its shell is composed of a mosaic of small bones covered by firm, rubbery skin with seven longitudinal ridges or keels. The skin is predominantly black with varying degrees of pale spotting; including a notable pink spot on the dorsal surface of the head in adults. A toothlike cusp is located on each side of the gray upper jaw; the lower jaw is hooked anteriorly. The paddle-like clawless limbs are black with white margins and pale spotting (**Figure 6**). Hatchlings are predominantly black with white flipper margins and keels on the carapace. Jellyfish are the main staple of its diet, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed. The leatherback turtle was listed under the ESA as endangered in 1970.

Breeding Season and Development: On Culebra nesting occurs from about February to August with the peak occurring around April to May. Female leatherbacks nest an average of 5 to 7 times within a nesting season, with an observed maximum of 11 nests. The average interesting interval is about 9 to 10 days. The nests are constructed at night in clutches of about 70 to 80 yolked eggs. The white spherical eggs are approximately 2 inches in diameter. Typically incubation takes from 55 to 75 days, and emergence of the hatchlings occurs at night. Most leatherbacks return to their nesting beaches at 2 to 3-year intervals. Leatherbacks are believed to reach sexual maturity in 6 to 10 years.

In the U.S., small nesting populations occur on the Florida east coast (35 females/year), Sandy Point, U.S. Virgin Islands (50 to 100 females/year), and Puerto Rico (30 to 90 females/year). The leatherback is the most pelagic of the sea turtles. Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the crawl to dry sand is not too far. The preferred beaches have proximity to deep water and generally rough seas. Culebra beaches most used by the species are Flamenco, Brava, Resaca and Soni Beach.

Distribution/Habitat: The leatherback turtle is distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. It is also found in small numbers as far north as British Columbia, Newfoundland, and the British Isles, and as far south as Australia, Cape of Good Hope, and Argentina.

3.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Description: The Hawksbill Turtle (*Eretmochelys imbricate*) is small to medium-sized compared to other sea turtle species. Adults weigh 100 to 150 lbs (45 to 68 kg) on average, but can grow as large as 200 lbs (91 kg). Hatchlings weigh about 0.5 oz (14 g). The carapace (top shell) of an adult ranges from 25 to 35 inches (63 to 90 cm) in length and has a "tortoiseshell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The shells of hatchlings are 1-2 inches (about 42 mm) long and are mostly brown and somewhat heart-shaped. The plastron (bottom shell) is clear yellow. The rear edge of the carapace is almost always serrated, except in older adults, and has overlapping "scutes". The hawksbill turtle's head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. Hawksbill turtles are unique among sea turtles in that they have two pairs of prefrontal scales on the top of the head and each of the flippers usually has two claws (**Figure 7**). This species was listed under the ESA as endangered in 1970.

Figure 7. Hawksbill Sea Turtle
Photo: Caroline Rogers, USGS
Source: http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm

Nesting Season and Development: The nesting season varies with locality, nesting occurs all year long. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest. They nest under the vegetation on the high beach and nests have been observed having the last eggs of the clutch as close as 3 inches from the sand’s surface. Remigration intervals of 2 to 3 years predominate. The incubation period averages 60 days. Hawksbills recruit into the reef environment at about 35 cm in length and are believed to begin breeding about 30 years later. However, the time required to reach 35 cm in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is not known.

Distribution/Habitat: Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and at night. Hawksbills are known to inhabit the same resting spot night after night. Hawksbills are also found around rocky outcrops and high energy shoals. These areas are optimum sites for sponge growth, which certain species are the preferred food of hawksbills. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent.

3.5 Antillean Manatee (*Trichechus manatus manatus*)

Description: Manatees are marine mammals found in marine, estuarine, and freshwater environments. The West Indian manatee, *Trichechus manatus*, includes two distinct subspecies, the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). While morphologically distinctive, both subspecies have many common features. Manatees have large, seal-shaped bodies with paired flippers and a round, paddle-shaped tail. They are typically grey in color (color can range from black to light brown) and occasionally spotted with barnacles or colored by patches of green or red algae. The muzzle is heavily whiskered and coarse, single hairs are sparsely distributed throughout the body. Adult manatees, on average, are about nine feet long (3 meters) and weigh about 1,000 pounds (200 kilograms). At birth, calves are between three and four feet long (1 meter) and weigh between 40 and 60 pounds (30 kilograms) (**Figure 8**). This species was listed under the ESA as endangered in 1967.

Figure 8. Antillean Manatee
Source: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A007

Behavior, Development and Diet: The manatee maneuvers through the water moving its paddle-like tail up and down and steering with its flippers. It often rests suspended just below the water's surface with only the snout above water. It feeds underwater, but must surface periodically to breathe. Although the manatee can remain underwater for as long as 12 minutes, the average time is 4-1/2 minutes.

Manatees reach breeding maturity between 3 and 10 years of age. The gestation period is approximately 13 months. Calves may be born at any time during the year. Usually a single calf is born, but twins do occur. An adult manatee will usually give birth to a calf every 2 to 5 years. The low reproductive rate makes the species less capable of rebounding from threats to its survival. They nurse underwater for about three minutes at a time from a nipple located behind their mother's forelimb. Born with teeth, calves begin eating plants within a few weeks but remain with their mother for up to 2 years. Manatees may live for several decades.

Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation. Common forage plants include and are not limited to: cord grass, alga, turtle grass, shoal grass, manatee grass, eel grass, and other plant types. Manatees also require sources of freshwater, obtained from both natural and anthropogenic sources.

Distribution/Habitat: All of the studies suggest that manatees in Puerto Rico are more commonly observed in coastal areas from San Juan, eastward to the east coast, (and including Culebra and Vieques Islands) and then south and west, past Jobos Bay, to the west coast, and then about as far to the northwest as Rincon. Manatees are concentrated in several "hot spots" including Ceiba, Vieques Island, Jobos Bay and Boquerón Bay, and are less abundant along the north coast, between Rincón and Dorado.

3.6 Humpback Whale (*Megaptera novaeangliae*)

Description: Humpback whales are well known for their long "pectoral" fins, which can be up to 15 feet (4.6 m) in length. Their scientific name, *Megaptera novaeangliae,* means "big-winged New Englander" as the New England population was the one best known to Europeans. These long fins give them increased maneuverability; they can be used to slow down or even go backwards.

Figure 9. Humpback Whale
Source: http://www.nmfs.noaa.gov/pr/images/cetaceans/humpbackwhale_noaa_large.jpg

Similar to all baleen whales, adult females are larger than adult males, reaching lengths of up to 60 feet (18 m). Their body coloration is primarily dark grey, but individuals have a variable amount of white on their pectoral fins and belly. This variation is so distinctive that the pigmentation pattern on the undersides of their "flukes" is used to identify individual whales, similar to a humans fingerprint (**Figure 9**).

In June 1970, humpback whales were designated as "endangered" under the Endangered Species Conservation Act (ESCA). In 1973, the ESA replaced the ESCA, and continued to list humpbacks as endangered.

Behavior, Development and Diet: Humpback whales travel great distances during their seasonal migration, the farthest migration of any mammal. The longest recorded migration was 5,160 miles (8,300 km). This trek from Costa Rica to Antarctica was completed by seven animals, including a calf. One of the more closely studied routes is between Alaska and Hawaii, where humpbacks have been observed making the 3,000 mile (4,830 km) trip in as few as 36 days.

During the summer months, humpbacks spend the majority of their time feeding and building up fat stores (blubber) that they will live off of during the winter. Humpbacks filter feed on tiny crustaceans (mostly krill), plankton, and small fish and can consume up to 3,000 pounds (1360 kg) of food per day. Several hunting methods involve using air bubbles to herd, corral, or disorient fish. One highly complex variant, called "bubble netting," is unique to humpbacks. This technique is often performed in groups with defined roles for distracting, scaring, and herding before whales lunge at prey corralled near the surface.

In their wintering grounds, humpback whales congregate and engage in mating activities. Humpbacks are generally "polygynous" with males exhibiting competitive behavior on wintering grounds. Aggressive and antagonistic behaviors include chasing, vocal and bubble displays, horizontal tail thrashing, and rear body thrashing. Males within these groups also make physical contact; striking or surfacing on top of one another. These bouts can cause injuries ranging from bloody scrapes to, in one recorded instance, death. Also on wintering grounds, males sing complex songs that can last up to 20 minutes and be heard 20 miles (30 km) away. A male may sing for hours, repeating the song several times. All males in a population sing the same song, but that song continually evolves over time.

Gestation lasts for about 11 months. Newborns are 13 to 16 ft (4 to 5 m) long and grow quickly from the highly nutritious milk of their mothers. Weaning occurs between 6 and 10 months after birth. Mothers are protective and affectionate towards their calves, swimming close and frequently touching them with their flippers. Males do not provide parental support for calves. Breeding usually occurs once every two years, but sometimes occurs twice in three years.

Distribution/Habitat: Humpback whales live in all major oceans from the equator to sub-polar latitudes. In the western North Atlantic ocean, humpback whales feed during spring, summer, and fall over a range that encompasses the eastern coast of the U.S. (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland. In winter, whales from the Gulf of Maine mate and calve primarily in the West Indies. Not all whales migrate to the West Indies every winter, and significant numbers of animals are found in mid- and high-latitude regions at this time.

During migration, humpbacks stay near the surface of the ocean. While feeding and calving, humpbacks prefer shallow waters. During calving, humpbacks are usually found in the warmest waters available at that latitude. Calving grounds are commonly near offshore reef systems, islands, or continental shores. Humpback feeding grounds are in cold, productive coastal waters (**Figure 14**).

3.7 Fin or Finback Whale (*Balaenoptera physalus*)

Description: Fin or finback whales are the second-largest species of whale, with a maximum length of about 75 ft (22 m) in the Northern Hemisphere, and 85 ft (26 m) in the Southern Hemisphere. Fin whales show mild sexual "dimorphism", with females measuring longer than males by 5-10%. Adults can weigh between 80,000-160,000 lbs (40-80 tons).

Figure 10. Fin or Finback Whale
Source: http://www.cetaceanalliance.org/cetaceans/Bp_home.htm
Photos © Tethys Research Institute.

Fin whales have a sleek, streamlined body with a V-shaped head. They have a tall, "falcate" dorsal fin, located about two-thirds of the way back on the body, that rises at a shallow angle from the animal's back. The species has a distinctive coloration pattern: the back and sides of the body are black or dark brownish-gray, and the ventral surface is white. The unique, asymmetrical head color is dark on the left side of the lower jaw, and white on the right side. Many individuals have several light-gray, V-shaped "chevrons" behind their head, and the underside of the tail flukes is white with a gray border (**Figure 10**).

Within the U.S., the fin whale is listed as endangered throughout its range under the ESA and is listed as "depleted" throughout its range under the Marine Mammal Protection Act of 1972.

Behavior, Development and Diet: Fin whales can be found in social groups of 2-7 whales and in the North Atlantic are often seen feeding in large groups that include humpback whales, minke whales, and Atlantic white-sided dolphins. Fin whales are large, fast swimmers and the killer whale (*Orcinus orca*) is their only non-human predator.

During the summer, fin whales feed on krill, small schooling fish (e.g., herring, capelin, and sand lance), and squid by lunging into schools of prey with their mouth open, using their 50-100 accordion-like throat pleats to gulp large amounts of food and water. They then filter the food particles from the water using the 260-480 "baleen" plates on each side of the mouth. Fin whales fast in the winter while they migrate to warmer waters.

Little is known about the social and mating systems of fin whales. Similar to other baleen whales, long-term bonds between individuals are rare. Males become sexually mature at 6-10 years of age; females at 7-12 years of age. Physical maturity is attained at approximately 25 years for both sexes. After 11-12 months of gestation, females give birth to a single calf in tropical and subtropical areas during midwinter. Newborn calves are approximately 18 ft (6 m) long, and weigh 4,000-6,000 lb (2 tons). Fin whales can live 80-90 years.

Distribution/Habitat: Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally (**Figure 14**).

3.8 Sei Whale (*Balaenoptera borealis*)

Description: Sei whales are members of the baleen whale family and are considered one of the "great whales" or rorquals. Two subspecies of sei whales are recognized, *B. b. borealis* in the Northern Hemisphere and *B. B. schlegellii* in the Southern Hemisphere.

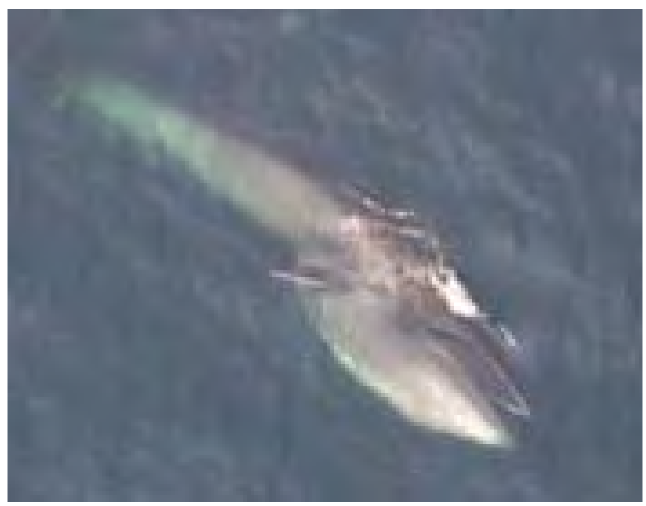


Figure 11. Sei Whale
Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/seiwhale.htm#more

These large animals can reach lengths of about 40-60 ft (12-18 m) and weigh 100,000 lbs (45,000 kg). Females may be slightly longer than males. Sei whales have a long, sleek body that is dark bluish-gray to black in color and pale underneath. The body is often covered in oval-shaped scars (probably caused from cookie-cutter shark and lamprey bites) and sometimes has subtle "mottling". This species has an erect "falcate", "dorsal" fin located far down (about two-thirds) the animals back. They often look similar in appearance to Bryde's whales, but can be distinguished by the presence of a single ridge located on the animal's "rostrum". Bryde's whales, unlike other rorquals, have three distinct prominent longitudinal ridges on their rostrum. They have 219-410 baleen plates that are dark in color with gray/white fine inner fringes in their enormous mouths. They also have 30-65 relatively short ventral pleats that extend from below the mouth to the naval area. The number of throat grooves and baleen plates may differ depending on geographic population (**Figure 11**).

When at the water's surface, sei whales can be sighted by a columnar or bushy blow that is about 10-13 feet (3-4 m) in height. The dorsal fin usually appears at the same time as the blowhole, when the animal surfaces to breathe. This species usually does not arch its back or raise its flukes when diving.

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: They are usually observed singly or in small groups of 2-5 animals, but are occasionally found in larger (30-50) loose aggregations. Sei whales are capable of diving 5-20 minutes to opportunistically feed on plankton (e.g., copepods and krill), small schooling fish, and cephalopods (e.g., squid) by both gulping and skimming. They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey. Sometimes seabirds are associated with the feeding frenzies of these and other large whales.

Sei whales become sexually mature at 6-12 years of age when they reach about 45 ft (13 m) in length, and generally mate and give birth during the winter in lower latitudes. Females breed every 2-3 years, with a gestation period of 11-13 months. Females give birth to a single calf that is about 15 ft (4.6 m) long and weighs about 1,500 lbs (680 kg). Calves are usually nursed for 6-9 months before being weaned on the preferred feeding grounds. Sei whales have an estimated lifespan of 50-70 years.

Distribution/Habitat: Sei whales have a cosmopolitan distribution and occur in subtropical, temperate, and subpolar waters around the world. They prefer temperate waters in the mid-latitudes, and can be found in the Atlantic, Indian, and Pacific Oceans. During the summer, they are commonly found in the Gulf of Maine, and on Georges Bank and Stellwagen Bank in the western North Atlantic. The entire distribution and movement patterns of this species is not well known. This species may unpredictably and randomly occur in a specific area, sometimes in large numbers. These events may occur suddenly and then not occur again for long periods of time. Populations of sei whales, like other rorquals, may seasonally migrate toward the lower latitudes during the winter and higher latitudes during the summer. They prefer subtropical to subpolar waters on the continental shelf edge and slope worldwide and they are usually observed in deeper waters of oceanic areas far from the coastline (**Figure 14**).

3.9 Sperm Whale (*Physeter macrocephalus*)

Description: Sperm whales are the largest of the odontocetes (toothed whales) and the most sexually dimorphic cetaceans, with males considerably larger than females. Adult females may grow to lengths of 36 feet (11 m) and weigh 15 tons (13607 kg). Adult males, however, reach about 52 feet (16 m) and may weigh as much as 45 tons (40823 kg). It is distinguished by its extremely large head, which takes up to 25 to 35% of its total body length. It is the only living cetacean that has a single blowhole asymmetrically situated on the left side of the head near the tip. Sperm whales have the largest brain of any animal (on average 17 pounds (7.8 kg) in mature males), however, compared to their large body size, the brain is not exceptional in size.

Figure 12. Sperm Whale

Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm

There are between 20-26 large conical teeth in each side of the lower jaw. The teeth in the upper jaw rarely erupt and are often considered to be vestigial. It appears that teeth may not be necessary for feeding, since they do not break through the gums until puberty, if at all, and healthy sperm whales have been caught that have no teeth.

Sperm whales are mostly dark gray, but oftentimes the interior of the mouth is bright white, and some whales have white patches on the belly. Their flippers are paddle-shaped and small compared to the size of the body, and their flukes are very triangular in shape. They have small dorsal fins that are low, thick, and usually rounded (**Figure 12**).

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: Because sperm whales spend most of their time in deep waters, their diet consists of many larger organisms that also occupy deep waters of the ocean. Their principle prey are large squid weighing between 3.5 ounces and 22 pounds (0.1 kg and 10 kg), but they will also eat large demersal and mesopelagic sharks, skates, and fishes. The average dive lasts about 35 minutes and is usually down 1,312 feet (400 m), however dives may last over an hour and reach depths over 3280 feet (1000 m).

Female sperm whales reach sexual maturity around 9 years of age when they are roughly 29 feet (9 m) long. At this point, growth slows and they produce a calf approximately once every five years. After a 14-16 month gestation period, a single calf about 13 feet (4 m) long is born. Although calves will eat solid food before one year of age, they continue to suckle for several years. Females are physically mature around 30 years and 35 feet (10.6 m) long, at which time they stop growing. For about the first 10 years of life, males are only slightly larger than females, but males continue to exhibit substantial growth until they are well into their 30s. Males reach physical maturity around 50 years and when they are 52 feet (16 m) long. Unlike females, puberty in males is prolonged, and may last between ages 10 to 20 years old. Even though males are sexually mature at this time, they often do not actively participate in breeding until their late twenties.

Most females will form lasting bonds with other females of their family, and on average 12 females and their young will form a family unit. While females generally stay with the same unit all their lives in and around tropical waters, young males will leave when they are between 4 and 21 years old and can be found in "bachelor schools", comprising of other males that are about the same age and size. As males get older and larger, they begin to migrate to higher latitudes (toward the poles) and slowly bachelor schools become smaller, until the largest males end up alone. Large, sexually mature males that are in their late 20s or older, will occasionally return to the tropical breeding areas to mate.

Distribution/Habitat: They inhabit all oceans of the world. They can be seen close to the edge of pack ice in both hemispheres and are also common along the equator, especially in the Pacific. Sperm whales are found throughout the world's oceans in deep waters between about 60° N and 60° S latitudes. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. It migrations are not as predictable or well understood as migrations of most baleen whales. In some mid-latitudes, there seems to be a general trend to migrate north and south depending on the seasons (whales move poleward in the summer). However, in tropical and temperate areas, there appears to be no obvious seasonal migration.

Sperm whales tend to inhabit areas with a water depth of 1968 feet (600 m) or more, and are uncommon in waters less than 984 feet (300 m) deep. Female sperm whales are generally found in deep waters (at least 3280 feet, or 1000 m) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). These conditions generally correspond to sea surface temperatures greater than 15°C, and while female sperm whales are sometimes seen near oceanic islands, they are typically far from land (**Figure 14**).

Immature males will stay with female sperm whales in tropical and subtropical waters until they begin to slowly migrate towards the poles, anywhere between ages 4 and 21 years old. Older, larger males are generally found near the edge of pack ice in both hemispheres. On occasion, however, these males will return to the warm water breeding area. No critical habitat has been designated for this species.

3.10 Blue Whale (*Balaenoptera musculus*)

Description: The blue whale is a cosmopolitan species of baleen whale. In the Northern Hemisphere, they are generally smaller than those in the Southern Ocean. Maximum body length in the North Atlantic was about 88.5 feet (27 m) and the largest blue whale reported from the North Pacific was about 88 feet (26.8 m). Adults in the Antarctic can reach a maximum body length of about 108 feet (33 m) and can weigh more than 330,000 pounds (150,000 kg). As is true of other baleen whale species, female blue whales are somewhat larger than males. Blue whales are identified by the following characteristics: a long-body and comparatively slender shape; a broad, flat "rostrum" when viewed from above; a proportionately smaller dorsal fin than other baleen whales; and a mottled gray color pattern that appears light blue when seen through the water (**Figure 13**).

Figure 13. Blue Whale
Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/bluewhale.htm

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: Scientists have yet to discern many details regarding the life history of the blue whale. The best available science suggests the gestation period is approximately 10-12 months and that blue whale calves are nursed for about 6-7 months. Most reproductive activity, including births and mating, takes place during the winter. Weaning probably occurs on, or en route to, summer feeding areas. The average calving interval is probably two to three years. The age of sexual maturity is thought to be 5-15 years. There are no known differences in the reproductive biology of blue whales in the North Pacific and North Atlantic oceans.

The primary and preferred diet of blue whales is krill (euphausiids). In the North Atlantic, blue whales feed on two main euphausiid species: *Thysanoëssa inermis*and and *Meganyctiphanes norvegica*. In addition, *T. raschii*and and *M. norvegica* have been recorded as important food sources of blue whales in the Gulf of St. Lawrence. In the North Pacific, blue whales prey mainly on *Euphausia pacifica*and secondarily on *T. spinifera*. While other prey species, including fish and copepods, have been mentioned in the scientific literature, these are not likely to contribute significantly to the diet of blue whales.

Distribution/Habitat: They are found in oceans worldwide and are separated into populations by ocean basin in the North Atlantic, North Pacific, and Southern Hemisphere. They follow a seasonal migration pattern between summering and wintering areas, but some evidence suggests that individuals remain in certain areas year-round. The extent of knowledge concerning distribution and movement varies with area and migratory routes are not well known but, in general, distribution is driven largely by food requirements.

Blue whales inhabit sub-polar to sub-tropical latitudes. Poleward movements in spring allow the whales to take advantage of high zooplankton production in summer. Movement towards the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in reproductive activities in warmer waters of lower latitudes. Although the species is often found in coastal waters, blue whales are thought to occur generally more offshore than humpback whales, for example (**Figure 14**).

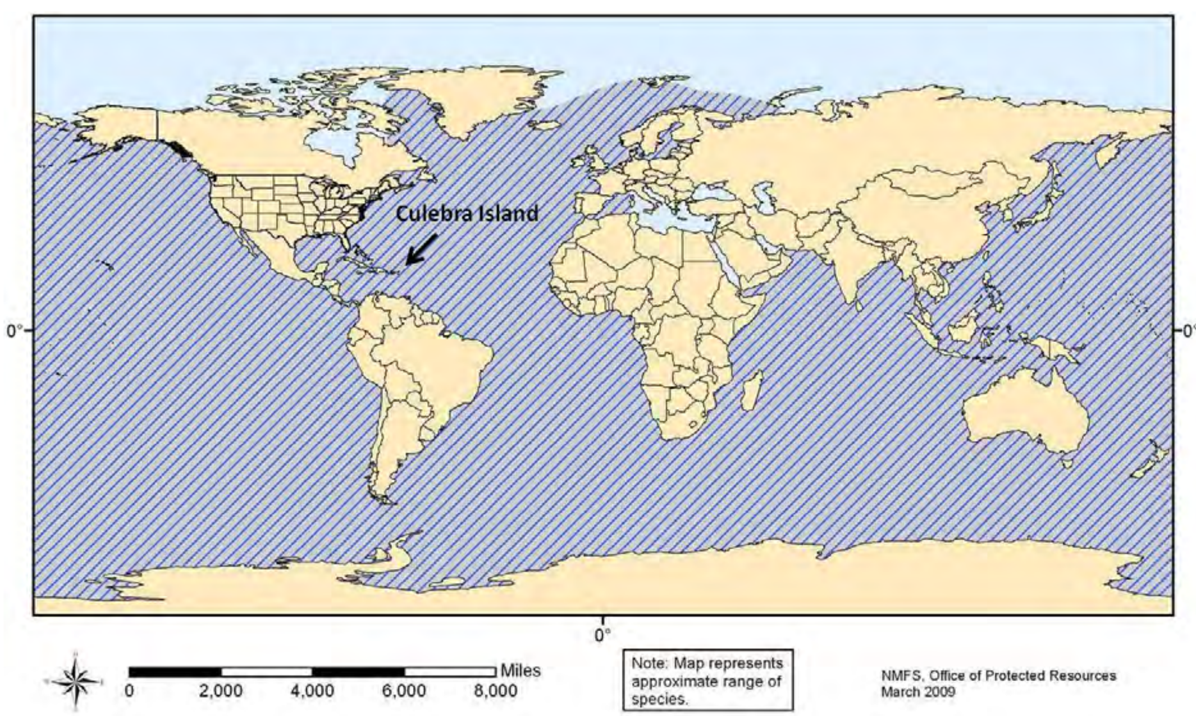


Figure 14. Approximate range map for Humpback, Sei, Sperm and Blue whales.

3.11 Elkhorn coral (*Acropora palmata*)

Figure 15. Elkhorn Coral
Source: http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

Description: It is a large, branching coral with thick and sturdy antler-like branches (**Figure 15**) and is found in shallow reefs, typically in water depths from 0-35 feet, as these corals prefer areas where wave action causes constant water movement. Colonies are fast growing: branches increase in length by 2-4 inches (5-10 cm) per year, with colonies reaching their maximum size in approximately 10-12 years. Over the last 10,000 years, elkhorn coral has been one of the three most important Caribbean corals contributing to reef growth and development and providing essential fish habitat. This species was listed under the ESA as endangered on May 4, 2006.

Color: Living colonies are yellow, brown or golden with light rims.

Habitat: Elkhorn coral was formerly the dominant species in shallow water (3 ft-16 ft [1-5 m] deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (6 m), although isolated corals may occur to 65 feet (20 m).

Distribution/Reproduction: Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean.

The dominant mode of reproduction for elkhorn coral is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will typically release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity may be very low in the remnant populations.

3.12 Staghorn coral (*Acropora cervicornis*)

Figure 16. Staghorn Coral
Source: http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

Description: It is a branching coral with cylindrical branches ranging from a few centimeters to over 6.5 feet (2 m) in length (**Figure 16**). This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 4-8 inches (10-20 cm) per year. This species was listed under the ESA as endangered on May 4, 2006.

Color: Living colonies are light, grayish to yellowish-brown.

Habitat: Staghorn coral occur in back reef and fore reef environments from 0-100 feet (0 to 30 m) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths of 15-80 feet (5-25 m) were formerly dominated by extensive single species stands of staghorn coral until the mid 1980s.

Distribution/Reproduction: Staghorn coral is found in the Atlantic Ocean, Caribbean Sea, and western Gulf of Mexico. Specifically, staghorn coral is found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. The northern limit of staghorn coral is around Boca Raton, FL.

The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity is very low in the remnant populations

The NMFS has designated critical habitat for elkhorn and staghorn corals in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix. **Figure 17** shows the designated areas for Puerto Rico. In addition, a 4(d) rule (50 CFR Part 223) establishing “take” prohibitions for elkhorn and staghorn corals went into effect on November 28, 2008. Take includes collect, bother, harm, harassment, damage to, death, or other actions that affect health and survival of listed species.

Figure 17. Elkhorn and Staghorn Corals Critical Habitat.

3.13 Species of Corals Proposed for Listing under the ESA

On 20 October 2009, the National Marine Fisheries Service (NMFS) received a petition from the Center for Biological Diversity to list 83 species of corals as threatened or endangered under the Endangered Species Act (ESA) and to designate critical habitat for these corals. NMFS reviewed the petition and determined that the requested listing actions may be warranted for 82 of the 83 coral species. All of the Atlantic coral species have the potential to be found in waters around Culebra. These species are: Lamarck's Sheet Coral (*Agaricia lamarcki*), Boulder Star Coral (*Montastraea annularis*), Mountainous Star Coral (*Montastrae faveolata*), *Montastraea franksi*, Pillar Coral (*Dendrogyra cylindrus*), Elliptical Star Coral or Pineapple Coral (*Dichocoenia stokesii*) and Rough Cactus Coral (*Mycetophyllia ferox*). As of the day of this document, no final decision on whether to list these species has been made by NMFS. **Figure 18** shows a range map for the seven species of coral proposed for listing under ESA.

Figure 18. Range map for the seven species of coral proposed for listing under ESA.

3.13.1 Lamarck's Sheet Coral (*Agaricia lamarcki*)

Description: Colonies form large, mostly thick plates, broad, rounded or acute, often overlapping each other. The upper surface bears concentric rows of ridges with relatively wide, straight or reticulate, valleys. The white, star-like, polyps are in the valleys' center. The septa alternate in height and thickness. Generally, the taller and thicker primary septa extend close to the columella before dropping sharply into the corallite pit, while the thinner secondary septa appear shorter, because they slope

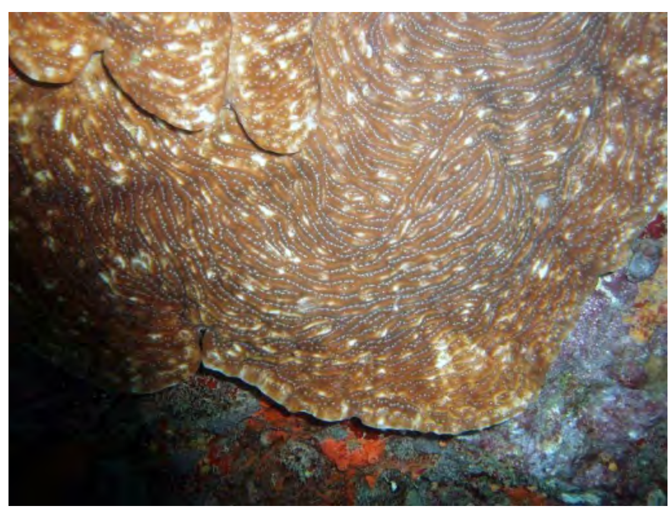


Figure 19. Lamarck's Sheet Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/agaricia_lamarcki.html

gradually into the corallite pit. The underside of the colony is smooth, without polyps (**Figure 19**).

Color: Yellow-brown to golden-brown to brown, sometimes with bluish or grayish tints, with contrasting white polyps (**Figure 19**).

Habitat: On sloping reefs and along walls, between 16-165 feet (5-50 m), but most common between 65-115 feet (20 and 35 m).

Distribution: Occasional in Florida and the Bahamas, common in the Caribbean (**Figure 18**).

3.13.2 *Montastraea* Complex

3.13.2.1 Boulder Star Coral (*Montastraea annularis*)

Description: The colonies grow in several morphotypes that were originally described as separate species. The species occurs as long, thick columns with enlarged, dome-like tops; large, massive mounds; sheets with skirt-like edges; irregularly bumpy mounds and plates or as smooth plates. Colonies up to 10 feet (3 m) in diameter. The surface is covered with distinctive, often somewhat raised, corallites (**Figure 20**).

Figure 20. Boulder Star Coral
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20annularis01.JPG

Color: Shades of green to brown, yellow-brown and gray.

Habitat: Inhabit most reef environments and the species is often the predominant coral between 22-82 feet (7-25 m). The flattened plates are most common at deeper reefs, down to 165 feet (50 m).

Distribution: Common to abundant Florida, Bahamas and Caribbean (**Figure 18**).

3.13.2.2 Mountainous Star Coral (*Montastraea faveolata*)

Description: This species has been called the "dominant reef-building coral of the Atlantic". *Montastraea faveolata* buds extratentacularly to form head or sheet colonies with corallites that are uniformly distributed and closely packed, but sometimes unevenly exsert. Septa are highly exsert, with septocostae arranged in a variably conspicuous fan system, and the skeleton is generally far less dense than those of its sibling species. Active growth is typically found at the edges of colonies, forming a smooth outline with many small polyps (**Figure 21**).

Figure 21. Mountainous Star Coral
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20faveolata01.JPG

Color: It is usually pale brown but may be bright, fluorescent green over the dark brown.

Habitat: *M. faveolata* is found from 3-100 feet (1-30 m) in backreef and fore-reef habitats, and is often the most abundant coral between 30-65 feet (10-20 m) in fore-reef environments.

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. May also be present in Bermuda, but this requires confirmation (**Figure 18**).

3.13.2.3 *Montastraea franksi*

Description: This species builds massive, encrusting plate or subcolumnar colonies via extratentacular budding. The characteristically bumpy appearance of this species is caused by relatively large, unevenly exsert, and irregularly distributed corallites. *M. franksi* is distinguished from its sibling *Montastraea* species by this irregular or bumpy appearance; a relatively dense, heavy, and hard skeleton (corallum); thicker septo-costae with a conspicuous septocostal midline row of lacerate teeth; and a greater degree of interspecies aggression (**Figure 22**).

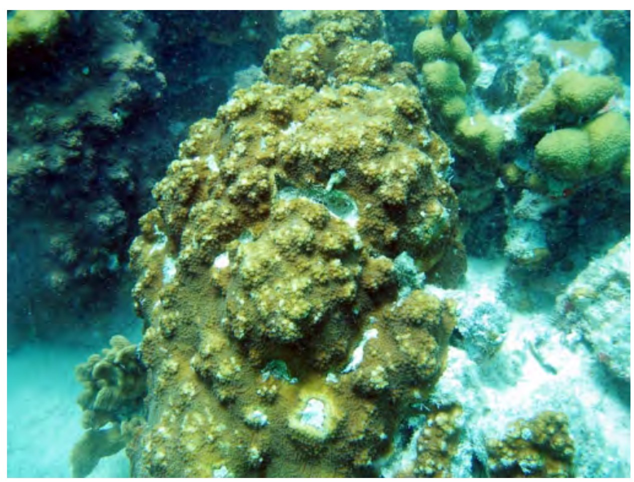


Figure 22. *Monstastraea franki*
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20franksi01.JPG

Color: It is basically orange-brown with many pale patches on the lumpy surface, but may be grey or greenish-brown (**Figure 22**).

Habitat: This species mostly grows in the open like other species of this genus but smaller, encrusting colonies are common in shaded overhangs. It is uncommon in very shallow water, but becomes common deeper.

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas (**Figure 18**).

3.13.3 Pillar Coral (*Dendrogyra cylindrus*)

Description: Colonies form numerous, heavy, cylindrical spires, that grow upwards from an encrusting base mass. The colonies can attain a height of 10 feet (3 m), with a pillar diameter of more than 4 inches (10 cm). Polyps are normally extended during the day, giving the colony a fuzzy appearance and obscuring the long, meandroid, corallite series (**Figure 23**).

Figure 23. Pillar Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/dendrogyra_cylindrus.html

Color: Light tan to golden brown and chocolate brown.

Habitat: Colonies are typically found on flat gently sloping back reef and fore reef environment in depths of 3-82 feet (1-25 m). The species does not occur in extremely exposed locations.

Distribution: This species occurs in the Caribbean, the southern Gulf of Mexico, Florida, and the Bahamas (**Figure 18)**.

3.13.4 Elliptical Star Coral or Pineapple Coral (*Dichocoenia stokesii*)

Description: Colonies form rounded heads, domes or flattened plates. The distinctive character of this species is the oval corallites which protrude conspicuously above the surface between the corallites (coenesteum). Corallites are markedly oval and become elongated, almost meandroid, before dividing. Corallites are well separated from each other, and the surface between them is granular (**Figure 24**).

Color: Though sometimes green, they are usually orange-brown with white septo-costae.

Habitat: It is uncommon but has been found in most reef environments within its range, including both back and fore reef environments, rocky reefs, lagoons, spur and groove formations, channels, and occasionally at the base of reefs. This species occurs in depths from 6-236 feet (2-72 m); when found in exposed reefs at depths less than 65 feet (20 m), its hemispherical heads are more abundant than usual.

Figure 24. Elliptical/Pineapple Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/dichocoenia_stokesii.html

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida (including the Florida Middle Grounds), the Bahamas, and Bermuda (**Figure 18**).

3.13.5 Rough Cactus Coral (*Mycetophyllia ferox*)

Description: Colonies consist of flat plates with radiating valleys. It is a widely recognized valid species with colonies comprised of thin, weakly attached plates with interconnecting, slightly sinuous, narrow valleys. Tentacles are generally absent and corallite centers tend to form single rows. The walls of the valleys commonly join to form closed valleys, a feature not seen in other members of *Mycetophyllia*. The ridges are usually small and square, with a groove on top. The ridges, or walls between valleys, are commonly quite thin, and are irregular, and valleys are narrower (**Figure 25**).

Figure 25. Rough Cactus Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/mycetophyllia_ferox.html

Color: Valleys and walls are contrasting shades of grays and browns.

Habitat: This species is most common in fore reef environments from 5-30 meters (but is more abundant from 10-20 meters), but also occurs at low abundance in certain deeper back reef habitats and deep lagoons.

Distribution: This species occurs in the Caribbean, southern Gulf of Mexico, Florida, and the Bahamas (**Figure 18**).

4.0 MEASURES TO AVOID OR MINIMIZE POSSIBLE IMPACTS

The following measures will be implemented to avoid or minimize impacts to threatened or endangered species and their habitat during underwater investigation activities. Because the proposed action consists of data collection, no intrusive work will be performed and munitions disposal are not considered. Adverse impacts to protected species or their habitats are not expected.

The Contractor will be required to implement these SOPs, as well as the previously developed SOPs included in the attached Appendices A and B as part of any underwater work.

4.1 General Conservation Measures

4.1.1 Date of Commencement: The Contractor will provide to the U.S. Army Corps of Engineers (USACE) with a written notification of the date of commencement of underwater investigation work and a detailed description of the work to be implemented based on the Work Plan (WP) that will be coordinated and reviewed by TPP Team. USACE will provide the date of commencement to the TPP Team at least 10 days prior to initiating fieldwork.

4.1.2 Training/Briefing: Prior to initiating work all personnel shall receive training or briefings regarding the importance of endangered species, their characteristics, how they can be identified, potential and critical habitats, types of material in which they may hide, actions to take if are sighted, and avoidance measures to be followed as detailed in these SOPs. This training or briefing shall be prepared and offered by qualified personnel (e.g. biologist, marine biologist, environmental scientist, among others). The Contractor shall submit their qualifications to the USACE for review and approval. The training or briefing will also include safety and emergency procedures.

4.1.3 Civil and Criminal Penalties: The Contractor shall instruct all personnel associated with the project of the potential presence of threatened or endangered species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing, killing or otherwise altering the natural behavior or condition of threatened or endangered species protected under the ESA, the Puerto Rico Wildlife Law, and the Regulation to Govern the Endangered and Threatened Species of the Commonwealth of Puerto Rico. ESA gives both the FWS and NMFS responsibility for enforcing its provisions. The Commonwealth regulations to protect endangered and threatened species are enforced by the Puerto Rico Department of Natural and Environmental Resources (DNER).

4.1.4 Qualified Personnel: Each team performing underwater investigation work shall be accompanied on the boat, but not necessarily in the water, by qualified and experienced personnel (e.g. biologist, marine biologist, environmental scientist, among others) in order to identify the presence or absence of threatened or endangered species. The Contractor shall submit their qualifications to the USACE. The divers can request to the designated and qualified personnel on the boat to enter in the water to identify and determine if a suspected threatened or endangered species is present in the study area.

4.1.5 Coordination: All related work will be coordinated with the TPP Team prior to initiation as described in Part 4.1.1. The Contractor will provide a preliminary schedule and the areas (including the proposed transects and grids) where investigation will be performed and all the equipment to be used. Changes to the schedule and working areas will be provided to the TPP Team. The Contractor will make any required project notifications to the appropriate USACE personnel, who will in turn notify the regulators and resource agencies.

4.1.6 Reports: The Contractor shall maintain a log detailing endangered or threatened species sightings in terrestrial and marine habitats. The log shall include, but not limited to, the following information: date and time, location coordinates using a Global Positioning System (GPS) unit, species, one or more photographs, if possible, and any actions taken (e.g. species identification and distance from working area, reasons to cease operation, reasons to determine that operation may be resumed, among others) during the work period. All data shall be provided to USACE to be shared with the TPP.

4.1.7 Detonation Activities: Because the proposed action consists of data collection and characterization of benthic habitats, intrusive investigation or munitions detonations will not be conducted under this phase. If MECs are indentified during underwater work, they will be left in place and GPS coordinates of the MEC's location will be obtained for further investigations. MEC location will be shared with the TPP as "Privilege and Confidential." Due to public safety concerns, the MEC location shall not be released to the public. Based on the EBS results, additional SOPs or other conservation measures will be closely developed and coordinated with the TPP for further investigation phases and disposal activities.

4.1.8 If the UIT determines that weather conditions are unsafe (e.g. heavy rain, strong wind and rough seas), underwater investigation will not be conducted in order to minimize the potential for accidental groundings.

4.1.9 Underwater investigation activities will be conducted during day time hours (7:00am-5:00pm) only.

4.1.10 If during underwater activities the Contractor observes items that may have historic or archeological value, the Contractor will obtain GPS coordinates of the items' locations and notify the USACE of the observation. In consultation with the State Historic Preservation Officer, the USACE will use this information to assess the significance of the items in compliance with the National Historic Preservation Act.

4.2 Staging Area and Sea Turtle Nesting Monitoring

4.2.1 Contractor shall identify any onshore staging areas needed for execution of these investigations so that sea turtle nest monitoring can be conducted prior to initiating mobilization to ensure no impacts occur to this species.

4.2.2 The sea turtle nests monitoring will be limited to the areas used by the Contractor personnel. The beach monitoring efforts will consist of nests sighting and identification. The Contractor will avoid any sea turtle nests that are encountered. Any nest encountered shall be clearly marked (e.g. using flagging). The Contractor personnel shall stay at least 26 feet (8 meters) away from the marked area to avoid impacts to the nest(s). All nest sightings and actions taken shall be documented as described in Part 4.1.6. Additional conservation measures are provided in Appendices A and B.

4.2.3 Staging areas shall not require any removal of coastal vegetation. These areas shall consist of temporary tents or similar structures that can be easily removed.

4.2.4 Any areas proposed for use as staging area that form part of the Culebra National Wildlife Refuge shall be closely coordinated with the refuge manager. Points of contact are provided in Part 5.0.

4.2.5 The smaller offshore cays should not be used as staging areas; only cays that can be safely accessed by boats should be identified for use. Temporary mooring buoys should be employed to access staging areas to avoid repeated anchoring and impacts to marine bottom as per previous SOPs (refer to Parts 4.3 - 4.4 and Appendix A for more information).

4.2.6 Monitoring shall be conducted daily by qualified personnel (e.g. biologist, marine biologist, environmental scientist, among others) to identify the potential presence of new nests or sea turtle tracks during the activity period (refer to Appendix A for detailed information).

4.2.7 If sea turtle nests are found, the Contractor personnel will notify USACE, who will notify the FWS Boquerón Endangered Species Specialist, NMFS Boquerón Office and DNER

POC. If agreed the nest locations will be clearly marked and the staging area will be relocated. This information shall be documented as described in Part 4.1.6.

4.3 Coral and Seagrass Avoidance Measures

4.3.1 Prior to initiation of field activities the UIT shall receive a boating safety briefing and information regarding location and identification of coral reefs, colonized hardbottom and seagrass (refer to Part 4.1.2 for more information). Also, the information contained in these SOPs and its Appendices, and the types of actions that constitute a violation to the 4(d) rule (50 CFR Part 223) shall be discussed.

4.3.2 Vessel operator shall carry and consult appropriate NOAA nautical charts, NOAA benthic habitat maps and aerial photographs to locate potential coral reefs, colonized hardbottom and seagrass areas. Combining information from aerial photographs with hydrographic data will help to ensure that nautical charts are accurate.

4.3.3 Real-time data (e.g. GPS with nautical chart and depth finder on boat) will be continuously observed to verify water depths and vessel location. For additional information, please refer to Parts 4.3.5 and 4.4.3.

4.3.4 Vessel operator and UIT shall maintain a vigilant watch for coral reefs, colonized hardbottom and seagrass areas to avoid running aground or striking protected species. As part of the WP for conducting the underwater investigations and EBS, the Contractor shall provide and specify the type of equipment to be used and their recommended safety depths to avoid impacts to endangered and threatened species.

4.3.5 From the water's surface, some coral areas appear golden-brown. These areas should be avoided to keep from running aground. The operator shall stay at a minimum of 4 feet from the bottom of the vessel to the top of coral areas.

4.3.6 If no moorings are available, the vessel will be anchor in unvegetated sandy areas away from corals and seagrasses, so the anchor, chain and line do not contact or damage coral or seagrass areas.

4.3.7 Vessels shall be maintained away from areas with corals and seagrasses (see Part 4.3.5). Operations shall be conducted in such manner that bottom scour or prop dredging will be avoided when corals or seagrasses are present.

4.3.8 The following actions are prohibited:

a. Walk on, sit on or stand on coral
b. Collect coral (dead or alive)
c. Anchoring on coral/seagrass
d. Touch coral with hands or equipment
e. Discharge any pollutant or contaminant
f. Dump trash

4.3.9 If during the underwater investigation work any coral is injured, whatever activity causing the damage will be stopped, the injured coral will be left in place and the U.S. Coast Guard (USCG), NMFS Boquerón Office and DNER should be immediately notified. If listed corals are injured, the Contractor shall also contract the NOAA Office of Law Enforcement at 1-800-853-1964. The following information must be provided:

a. The time, date, and location (latitude/longitude) of the incident.
b. The name and type of the vessel involved.
c. The vessel's speed during the incident.
d. A description of the incident.
e. Water depth.
f. Environmental conditions (e.g. wind speed and direction, sea state, cloud cover, and visibility).
g. The type of coral or description, if possible.
h. A description of the damage caused to any coral, if possible.

4.3.10 If the vessel runs aground, the operator shall perform the following:

a. Turn of the engine.
b. Do not try to use the engine to power off the reef, hardbottom or seagrass.
c. Raise the propeller, and allow the boat to drift free.
d. Radio the Coast Guard, Marine Patrol or VHF Channel 16 for assistance.
e. If any coral or seagrass is injured the Contractor shall follow the procedures described in Part 4.3.9.

4.4 Marine Mammals and Sea Turtles Avoidance Measures

4.4.1 Vessel strike avoidance measures were also provided in Appendix A, page 12, items 1-6. These measures have been updated and for the purpose of underwater investigation activities, the Contractor shall follow and implement the avoidance measures provided under this section.

4.4.2 The Contractor shall instruct all personnel associated with the underwater investigation work of the potential presence of marine mammals (e.g. manatees and whales) and sea turtles and the need to avoid collisions with these species. The Contractor shall be held responsible for any marine mammal and sea turtle harmed, harassed, or killed as a result of underwater activities (including vessel operations supporting these activities) and general boating activities needed to go to and from the study areas. All appropriate precautions shall be followed and the operator will avoid excessive speed as described in Parts 4.4.7 and 4.4.8.

4.4.3 All vessels associated with the underwater investigations shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits.

4.4.4 Mooring bumpers shall be placed on all vessels wherever and whenever there is a potential for marine mammal or sea turtle to be crushed between two moored vessels. The bumpers shall provide a minimum stand-off distance of four feet.

4.4.5 Vessel operator and UIT should maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

4.4.6 If a marine mammal or sea turtle is sighted within 300 feet (100 yards) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of these species. These precautions shall include the operation of all moving equipment no closer than 150 feet (50 yards) of a marine mammal or sea turtle. If a marine mammal or sea turtle is closer than 150 feet (50 yards) to moving equipment or the study area, the equipment shall be shut down and all activities shall cease to ensure protection of the species. Underwater activities shall not resume until the marine mammal(s) or sea turtle(s) have left the study area naturally. Animals must not be herded away or harassed into leaving.

4.4.7 When marine mammals or sea turtles are sighted while a vessels is underway, the operator will remain parallel to the animal's course. Vessel operator will avoid excessive speed or abrupt changes in direction until the animal has left the area.

4.4.8 Vessel operator will reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of marine mammals are observed near an underway vessel, when safety permits. A single marine mammal at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures will be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 300 feet whenever possible.

4.4.9 Marine mammals and sea turtles may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, the vessel operator will reduce speed and shift the engine to neutral. Vessel operator will not engage the engines until the animals are clear of the area.

4.4.10 Monitoring: The UIT shall monitor for the presence of marine mammals and sea turtles.

4.4.11 All sightings and actions taken shall be reported as described in Part 4.1.6.

4.4.12 Injured or Dead Protected Species Reporting: Any collisions or sighting of any injured or incapacitated marine mammals or sea turtles shall be reported immediately to the USACE, FWS, NMFS, and DNER and information listed in Part 4.3.9 must be provided. For additional contact information, please refer to Section 5.0.

- Report stranded marine mammals to Southeast U.S. Stranding Hotline: (305) 862-2850
- Report stranded sea turtles to the NMFS Southeast Regional Office: (727) 824-5312
- NMFS Boquerón Office: (787) 851-3700
- FWS Boquerón Office: (787) 851-7297
- FWS Culebra NWR Office: (787) 742-0115
- DNER: (787) 645-5593

4.5 Diving Operations and Equipment

4.5.1 All underwater investigation work will be conducted by qualified and trained divers and will be planned in a manner that avoids direct impacts to threatened or endangered species and sensitive habitats within the project area. Anchoring practices described in Part 4.3 shall be implemented.

4.5.2 Prior to initiation of daily operations the UIT will check the weather conditions, inspect the vessel and verify that all the required equipment is available, in good condition, working correctly, and calibrated. The Contractor will maintain a log detailing equipment inspections.

4.5.3 The UIT will make sure that underwater conditions (e.g. visibility, current speeds) and weather are suitable for diving to ensure safety for divers and for sensitive underwater habitats.

4.5.4 Based on dive site conditions, the amount of divers in the water will be determined by the Contractor.

4.5.5 The following general "best diving practices" will be followed:

a. The point of entry and exit will be carefully selected to avoid coral or underwater sensitive areas.
b. Divers will make sure that all equipment is well secured before entering in the water.
c. Divers will make sure that they are neutrally buoyant at all times.
d. Safe distance from coral areas to be provided in the WP shall be maintained.
e. Good finning practice and body control will be followed to avoid accidental contact with coral or stirring up the sediment.
f. Divers will stay off the bottom and will never stand or rest on corals or other sessile benthic invertebrates.

4.5.6 To support or supplement the underwater investigation activities the following equipment, but not limited to, will be used: remotely operated vehicle (ROV), side scan sonar towfish, underwater metal detectors, benthic/diver sleds, towing cables and lifting lines, underwater cameras, marking buoys and floats, and GPS. The Contractor shall provide and specify the type of equipment to be used and their recommended safety depths to avoid impacts to endangered and threatened species (see Parts 4.1.1 and 4.1.5).

4.5.7 All equipment will be used in a manner to avoid physical contact or harassment of any protected species and it shall not interfere with diving operations. Hand-held equipment that would be carried by divers shall not contact corals or disturb the bottom or seagrasses in the area.

4.5.8 Site conditions, marine structures present, real-time information and existing water depth will be constantly monitored by trained operators to determine the appropriate use of equipment needed to minimize the risk of physical contact with protected species and sensitive habitats.

4.5.9 Any unintentional injury to protected species during diving operations will be reported immediately as described in Parts 4.3.9 and 4.4.12.

4.6 Supplemental Information

The July 2008 SOPs developed for Culebra DERP-FUDS and its April 2011 Addendum remain in effect. Copies of these documents are included in the attached Appendices A and B. The SOPs in the current document are meant to supplement, not replace, previous SOPs and are directed toward underwater investigation activities. The SOPs in the current document also provide the most up-to-date information regarding listed corals.

5.0 POINTS OF CONTACT FOR SOPs COORDINATION AND REPORTING

Name	Organization	Telephone/Email
Tom Freeman Project Manager	USACE, Jacksonville	Desk: 904-232-1040 Thomas.R.Freeman.III@usace.army.mil
José Méndez Forward Project Manager	USACE, Antilles Office	Desk: 787-729-6877 Jose.M.Mendez@usace.army.mil
Iván Acosta Chief, Special Projects Section	USACE, Jacksonville	Desk: 904-232-2050 Ivan.Acosta@usace.army.mil
Wilberto Cubero Environmental Scientist	USACE, Jacksonville	Desk: 904-232-2050 Wilberto.Cubero-delToro@usace.army.mil
David McCullough Archaeologist	USACE, Jacksonville	Desk: 904-232-3685 David.L.McCullough@usace.army.mil
Roland Belew Project Manager	USACE, Huntsville	Desk: 256-895-9525 Roland.G.Belew@usace.army.mil
Teresa Carpenter Technical Manager	USACE, Huntsville	Desk: 256-895-1659 Teresa.M.Carpenter@usace.army.mil
Kelly Enriquez Geophysicist	USACE, Huntsville	Desk: 254-895-1373 Kelly.D.Enriquez@usace.army.mil
Edwin Muñiz Field Supervisor	FWS	Desk: 787-851-7297 Edwin_Muñiz@fws.gov

Name	Organization	Telephone/Email
Susan Silander Project Leader Caribbean Islands National Wildlife Refuges Complex	FWS	Desk: 787-504-5938 Susan_Silander@fws.gov
Ana Roman Deputy Project Leader and Culebra NWR Manager	FWS	Desk: 787-742-0115 / 787-306-1389 Ana_Roman@fws.gov
Lisamarie Carrubba Director, Caribbean Field Office	NMFS	Desk: 787-851-3700 Lisamarie.Carrubba@noaa.gov
José Rivera Habitat Conservation Division	NMFS	Desk: 787-405-3605 Jose.A.Rivera@noaa.gov
Julio F. Vazquez Remedial Project Manager	EPA Region II	Desk: 212-657-4323 Vazquez.Julio@epa.gov
Damaris Delgado Bureau of Coast, Reserves and Refuges	DNER	Desk: 787-999-2200 ext. 2107 ddelgado@drna.gobierno.pr
Wilmarie Rivera Program Manager	EQB	Desk: 787-767-8181 ext. 6129 WilmarieRivera@jca.gobierno.pr

LIST OF APPENDICES

APPENDIX A

SOPs for Endangered Species Conservation and their Habitat (July 2008)

Standard Operating Procedures For Endangered Species Conservation And their Habitat on DERP-FUDS Project No. I02PR006802. Culebra, Puerto Rico

US Army Corps of Engineers
Jacksonville District

Standard Operating Procedures For Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802. Culebra, Puerto Rico

PURPOSE

The intent of this document is to develop a series of standard operating procedures (SOPs) to avoid or minimize impacts to threatened and endangered species listed pursuant to the Endangered Species Act (ESA) during the DERP-FUDS work at locations designated for cleanup on Culebra and adjacent cays and in surrounding waters that serve as habitat for these species. Species include the endangered hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) sea turtles, the threatened green sea turtle (*Chelonia mydas*) and its designated critical habitat 3 nautical miles around Culebra and its surrounding islands and cays, the threatened elkhorn (*Acropora palmata*) and staghorn corals (*Acropora cervicornis*), the West Indian manatee (*Trichechus manatus*), and avian species. These SOPs are in accordance with on-going communication with staff from the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS) and the Puerto Rico Department of Natural and Environmental Resources (DNER), as well as pursuant to the Interim Guidelines provided by FWS to work on lands of Culebra National Wildlife Refuge, with the U.S. Army Corps of Engineers (USACE) Regulations and Environmental Operating Principles. These SOPs were prepared to supplement existing and future USACE contracts for work on Culebra and surrounding islands and cays under the DERP/FUDS Program and to satisfy the substantive requirements of Section 7 of the Endangered Species Act. These SOPs do not address requirements related to access approvals from FWS on lands that are within the Culebra National Wildlife Refuge.

SEA TURTLES

Culebra has some of the most important sea turtle nesting beaches in the US Caribbean. Three species of sea turtles utilize these beaches throughout the year. The endangered leatherback and hawksbill sea turtles are the most common nesters, and the threatened green sea turtle also nests on beaches in the project area. The beaches on Culebrita, Cayo Norte, and Playa Larga, Brava and Resaca on Culebra were designated as critical habitat under the Endangered Species Act by FWS in recognition of their vital importance to the future of these species (50 CFR 17.95). Similarly, waters surrounding the island of Culebra (50 CFR 226.208) from the mean high water line seaward to 3 nautical miles (5.6 km) are designated as critical habitat for the green sea turtle. These waters include Culebra's outlying Keys including Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla

Culebrita, Arrecife Culebrita, Cayo de Luis Peña, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven where cleanup efforts are anticipated. Sea grass beds within these waters are foraging habitat for the species. In addition, the benthic habitat, including seagrass beds, coral reefs, and colonized hardbottom, around Culebra and its surrounding islands and cays provides foraging and refuge habitat for sea turtles.

Nesting Seasons

The following nesting season information was obtained from the USFWS sea turtle fact sheets and local agencies.

Green Sea Turtle: The nesting season varies with the locality. In Puerto Rico, it is roughly June through October. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years. A female may lay as a many as nine clutches within a nesting season (overall average is about 3.3 nests per season) at about 13-day intervals. Clutch size varies from 75 to 200 eggs, with an average clutch size of 136 eggs reported for Florida. Incubation ranges from about 45 to 75 days, depending on incubation temperatures. Hatchlings generally emerge at night. Age at sexual maturity is believed to be 20 to 50 years. Nesting data for Puerto Rico, specifically for Culebra beaches shall be obtained from the FWS. However, the DNER indicated that nesting of green turtles in Culebra beaches is infrequent and not as common as the other species.

Green Sea Turtle

Hawksbill Turtle: The nesting season varies with locality, in Culebra, as per DNER, nesting occurs all year long with the peak between August to November. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest. They nest under the vegetation on the high beach and nests have been observed having the last eggs of the clutch as close as 3 inches from the sand’s surface. Remigration intervals of 2 to 3 years predominate. The incubation period averages 60 days. Hawksbills recruit into the reef environment at about 35 cm in length and are believed to begin breeding about 30 years later. However, the time required to reach 35 cm in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is not known.

Hawksbill Sea Turtle

Leatherback Turtle: On Culebra nesting occurs from about February to August with the peak occurring around April to May. Female leatherbacks nest an average of 5 to 7 times within a nesting season, with an observed maximum of 11 nests. The average internesting interval is about 9 to 10 days. The nests are constructed at night in clutches of about 70 to 80 yolked eggs. The white spherical eggs are approximately 2 inches in diameter. Typically incubation takes from 55 to 75 days, and emergence of the hatchlings occurs at night. Most leatherbacks return to their nesting beaches at 2 to 3-year intervals. Leatherbacks are believed to reach sexual maturity in 6 to 10 years. Culebra beaches most used by the species are Flamenco, Brava and Resaca.

Leatherback Sea Turtle

Acroporid Corals

Since the preparation of some of the Culebra Project work plans, two coral species have been listed as threatened by the National Marine Fisheries Service effective May 8, 2006. Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) belong to the most abundant group of corals in the world and once represented the most dominant reef building species throughout Florida and the Caribbean. Elkhorn corals are found in shallow reefs, typically in water depths from 0-35 feet, as these corals prefer areas where wave action causes constant water movement. Staghorn corals are found in water depths ranging from 1-160 feet, although they are most common in depths from 10-60 feet. In addition to growing on reefs, staghorn corals often form colonies on bare sand. Acroporid corals have relatively high growth rates (5-6 inches per year) for corals and exhibit branching morphologies that provide important habitat for other reef organisms. The abundance of these corals has been declining for several decades due in part to hurricane damage and disease.

Acropora cervicornis

Acropora palmata

<u>Measures to Avoid or Minimize Possible Impacts Resulting from Munitions Clearance and Detonation Activities</u>

Vegetation Removal:

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

Beach Monitoring

To the maximum extent practicable detonation activities shall be realized when it is not sea turtle nesting season and when hatchlings are not present on beaches. To the maximum extent practicable, ground intrusive activities, including detonation, will not occur during the peak nesting seasons from March to November.

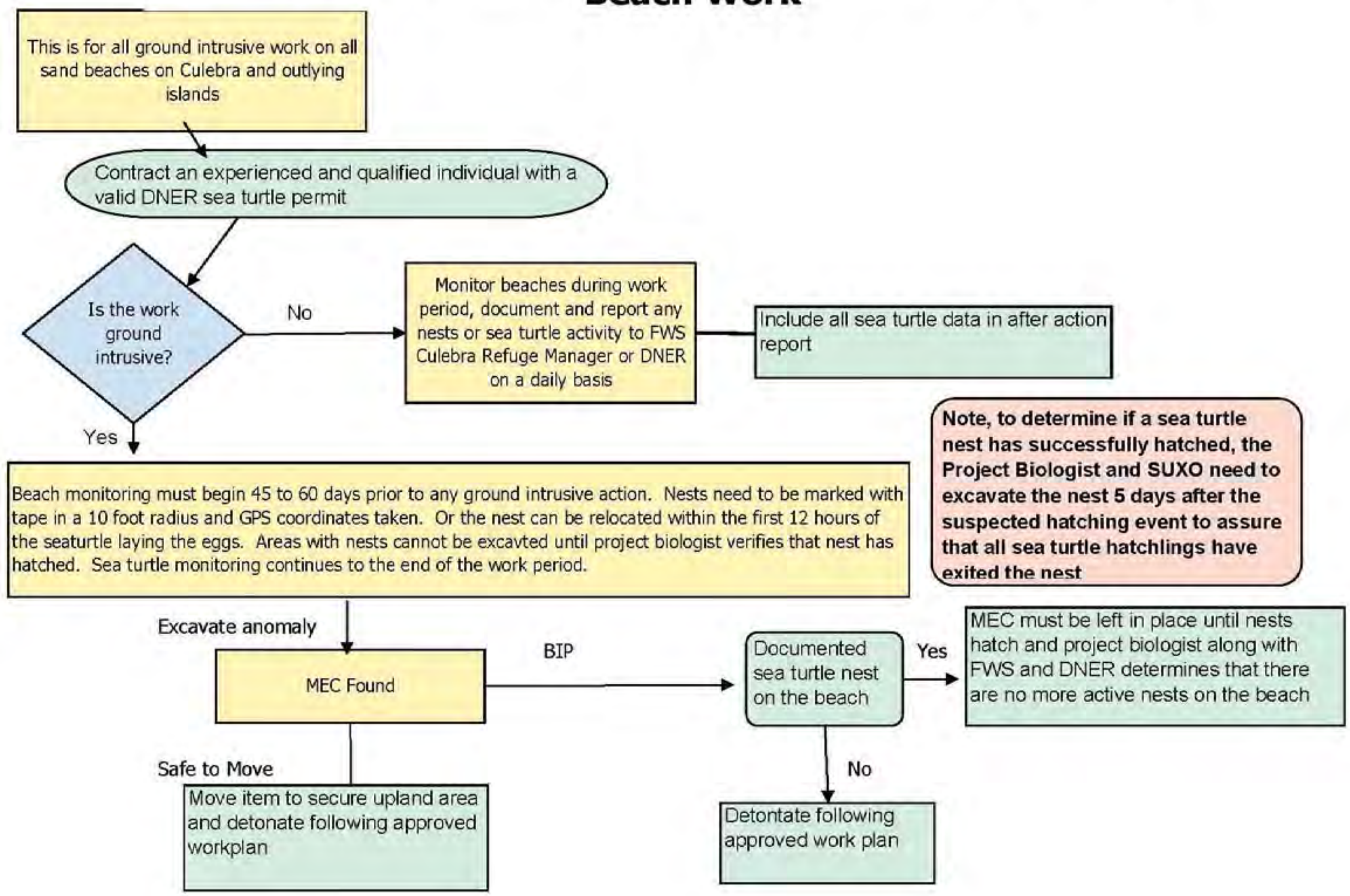
Prior to commencement of clearance activities, including vegetation removal and removal of unexploded ordnance, on Culebra, Culebrita, Cayo Norte and Cayo Luis Peña the contractor shall appoint a Project Biologist whose qualifications shall be submitted for the approval of the contracting officer and the FWS. All beach clearance activities, including vegetation removal and removal of unexploded ordnance, will be closely coordinated with FWS. In lieu of an independent Project Biologist, a USACE biologist could assist the contractor in this effort provided the USACE biologist has the appropriate training for conducting beach surveys. The Project Biologist shall perform morning beach patrols to identify the potential presence of new nests prior to and during the nesting season. When it is not nesting season, the Project Biologist or appropriately trained personnel shall conduct morning beach surveys prior to crews commencing daily activities to determine whether sea turtle nesting has occurred and to ensure that activities may be accommodated in a window of time when no nests are present.

If sea turtle nests are found on beaches being cleared of unexploded ordnance, the Project Biologist, the UXO supervisor, and/or monitoring personnel will communicate daily with the FWS Boqueron Endangered Species Specialist and the Culebra Islands NWR Refuge Manager as to whether new nests have been located, and their locations within the work area. If agreed upon by FWS, nest locations will be clearly marked to ensure clearance personnel avoid nests and no clearance activities will take place in the area until the hatchlings emerge and vacate the nest. Otherwise, nests will be relocated to a safe beach within 6-12 hours following nesting. The relocation program will be carried out by the Project Biologist and experienced personnel with the required DNER endangered species permits. This approach has been utilized by DNER personnel on Vieques from 1990-2000 to protect sea turtle nests from military operations with a hatching success of relocated nests of over 80%.

The Project Biologist shall also be responsible for training beach clearance crews prior to the initiation of clearance activities regarding the importance of endangered species, in particular the status of sea turtles at this location; the potential penalties associated with violations of the ESA; measures for crawl and nest identification; and sea turtle biology.

As an additional tool for sea turtle conservation, the following decision tree was prepared by the FWS to provide guidance on the sequence of events during ground-intrusive beach work. Project biologist shall work closely with UXO personnel to ensure these steps are followed.

Sea Turtle Conservation Measures for Ground Intrusive Beach Work



Designation of Beach Zones for Vegetation Removal and Munitions Detonation:

The information contained in this section was provided by the USFWS based on zones established during clearing activities for a Navy-led project in Vieques. The designation of zones based on number of nests, restrictions within the zones, etc. must be developed in coordination with the FWS to be specific to Culebra. The Corps shall require UXO contractors through the Project Biologist, to establish three work zones, based on sea turtle nesting data, and site inspections to ensure sea turtle nest protection during vegetation removal and munitions detonation activities. It shall be the Project Biologists responsibility to obtain specific nesting data for the beach area where the contractors will be working. This data can be obtained from the FWS Ecological Services Office in Cabo Rojo or the DNER office on Culebra or Fajardo.

The work zones proposed are:

Zone 1. No restrictions because sea turtle nesting is not expected within the area (rocky shore, no sand, etc).

Zone 2. Minor restrictions because of low historical sea turtle nesting events (fewer that 4 nests per year have occurred within the zone). Zone 2, beaches will be surveyed twice a week, 75 days prior to the activity by experienced and qualified personnel. Surveys should cover both the open sand and the area below the vegetation. No driving on the beach will occur. If no nests are found, cutting of trees smaller than 3 inches in diameter may occur. Manual cutting using machetes is the preferred alternative to allow for re-growth. If power tools such as chain saws are required, the FWS recommended pruning low branches instead of removing the trees (except for mesquite trees). Both techniques would allow for re-growth of suitable habitat. Mechanized removal of vegetation using mowers of vehicles should not be used near beach areas. When nests are found, a protection or exclusion zone of 8m should be designated around the nest and marked with flagging tape. Vegetation removal outside of the exclusion zone may occur if conducted manually. Vegetation removal within the nest area should be postponed until 5 days after hatching is documented, unless UXO is found in the vicinity of the nest.

Vegetation removal within the hawksbill sea turtle nesting habitat should not occur from June to mid December (peak of the nesting season). Hawksbill sea turtle nesting habitat varies from 10 m to 25m from the edge of the woody vegetation.

Zone 3. Major restrictions because 4 or more historical sea turtle nesting events have occurred within the zone. Zone 3, beaches will be surveyed every morning by a qualified biologist utilizing pedestrian surveys beginning 75 days prior to the scheduled start date of the project and until ordnance or vegetation removal actions are completed. Minimizing the amount of woody vegetation such as sea grape cleared would help minimize impacts to nesting hawksbill sea turtles. The rest of the conditions are the same as Zone 2.

When no nests are found on Zone 3 beaches, vegetation cutting may be conducted outside of the peak nesting season of the hawksbill sea turtle. A protection zone of 10 meters (measured landward from the edge of the woody vegetation) should be established to protect leatherback and green sea turtle nesting habitat. If leatherback and/or green sea turtle nests are left in situ (in place), vegetation removal activities should not occur within 10 meters of the landward edge of the nest track. The preferred alternative for cutting the vegetation, if nests are in situ, is hand cutting using machetes or power tools.

Vehicular Traffic

It should be noted that driving on sand beaches as a means of site access should be regarded as a measure of last resort after all other site access options have been explored. A designated entrance and an exit at the beach area, and monitoring of nesting events by qualified and experienced personnel is needed for vehicular beach access. If vehicular access is needed, we recommend the vehicular access be limited to the intertidal zone (below mean high water). Driving above the intertidal zone should not be allowed. All known nests should be marked by stake and survey tape or string in an area at least 20 feet (6 meters) in any direction from the center of the nest. No activities should enter in this area. Other alternative routes should be explored to avoid driving on sea turtle nesting beaches.

Vessel Traffic

For beach access from the ocean, should landing a vessel on the beach be necessary, the landing site shall be coordinated with the FWS Culebra National Wildlife Refuge personnel and the DNER. The route of the vessel shall be coordinated with NMFS to ensure that impacts to designated critical habitat and listed coral species are avoided. However, landing vessels on beaches should be regarded as a measure of last resort.

Beach activities on Culebrita, need to be coordinated with NMFS and FWS, the following vessel access SOPs will be implemented to minimize impacts to sea turtle refuge and foraging habitat, designated critical habitat, and listed coral species:

1. Culebrita will be accessed by entering Bahia Tortuga, the bay north of Beach E (as identified in the Engineering Evaluation/Cost Analysis for the cleanup of beaches on Culebrita and Flamenco Beach on Culebra). Contractors will tie boats to existing mooring buoys or, if the draft of vessels is shallow, anchor in the unvegetated, sandy zone between the seagrass beds and the beach.

2. No additional access points to beaches A, B, C, or D will be established as the contractor will bring all equipment and supplies to Beach E for offloading and transport overland or will offload personnel and equipment from an unanchored vessel into a inflatable craft that will then transit to access point previously established in coordination with NMFS and FWS. These access points do not currently exist and would have to be agreed upon.

In meetings with USACE, FWS, DNER, EQB and NMFS, it was agreed that the following cays will not be part of the cleanup project as they are inaccessible. The cays are:

1. Cayo Tiburón
2. Whale Rock
3. El Mono
4. Cayo Mono
5. Alcarazza/Fungi Bowl
6. The Washer

It was further agreed that access to the some of the cays that will be part of the cleanup project will be as follows:

1. Cayo Botella – contractors will use the Culebrita Island access in the bay northwest of the largest beach (Beach E) or anchor boats in the sandy bottom area south of the cay and use a inflatable craft, kayak, or swim to access the cay from the southeast where there is a small sand channel between areas of coral reefs.

2. Cayo Norte – boats will anchor in sand bottom in the small bay off the beach on the southeast of the island.

3. Pajarito Cay – from anchorage or mooring in Culebrita or Cayo Norte, access will be by inflatable craft entering the south side of the cay.

4. Cross Cay/Cayo Lobo – boats can anchor in unvegetated sandy bottom in the bay on the southeast side of the cay and anchors will not be dropped in areas containing coral colonies or seagrass beds.

The Corps, in coordination with the FWS, NMFS and DNER personnel have agreed that, in order to avoid impacts to listed coral species and designated critical habitat, the installation of mooring buoys to access Palada Cay/Cayo Geniqui, Cayo de Agua, Cayo Yerba and Cayo Ratón (also called Los Gemelos/Twin Rocks) will be completed if the clean-up activities will take place on these cays for more than two weeks. Prior to installation of mooring buoys at any given location in Culebra waters, the proposed locations shall be assessed for presence/absence of unexploded ordnance and to select final locations in unvegetated, sandy bottom. If the mooring buoys are not installed, the contractor will use a transit vessel to transport personnel to a site near each cay. The transit vessel will not weigh anchor and personnel will access the cays via an inflatable craft.

The following areas were identified using aerial photography, nautical charts and area maps and are proposed for installation of mooring buoys:

1. Cayo Geniquí/Palada Cay: Mooring buoy in 20-30 feet of water in the hardbottom area south of the cay to moor the transport boat. Access to the cay will be via inflatable craft.

2. Cayo del Agua: Mooring buoy in 20-30 feet of water on the south side of the cay to moor the transport boat. Access to the cay will be via inflatable craft.

3. Los Gemelos/Twin Rocks (Cayos Ratón and Yerba): Transit vessel will moor to the buoy serving Cayo del Agua and a inflatable craft will be used to access the cays.

These mooring buoy locations shall be coordinated with the United States Coast Guard.

In addition to establishment of access points, the following protocols shall be followed to minimize impacts to sea turtle refuge and foraging habitat, designated critical habitat, and listed coral species:

1. Access to the cays that have not been determined to be inaccessible and therefore form part of cleanup efforts will be dependent on wind, wave, and current conditions. During periods of rough seas, cays will not be accessed in order to minimize the potential for accidental groundings.

2. The transport boat utilized to provide access to the smaller cays will remain offshore and will not weigh anchor

Clearance crews and equipment will be ferried to the cays with an inflatable-type craft and the landing point for this craft will be determined in coordination with NMFS and FWS.

<u>NMFS Protected Species Vessel Strike Avoidance Measures and Reporting</u>

Background

The National Marine Fisheries Service (NMFS) has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures should be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species to discountable levels. NMFS should be contacted to identify any additional conservation and recovery issues of concern, and to assist in the development of measures that may be necessary.

Protected Species Identification Training

Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify protected species that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean Sea, and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

Vessel Strike Avoidance

In order to avoid causing injury or death to marine mammals and sea turtles the following measures should be taken when consistent with safe navigation:

1. Vessel operators and crews should maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.

3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.

4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Additional Requirements for the North Atlantic Right Whale

The NMFS guidance includes additional requirements for the North Atlantic right whale, but these do not apply for the Culebra activities.

Injured or Dead Protected Species Reporting

Vessel crews should report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.
Report marine mammals to the Southeast U.S. Stranding Hotline: 877-433-8299
Report sea turtles to the NMFS Southeast Regional Office: 727-824-5312
If the injury or death of a marine mammal was caused by a collision with your vessel, responsible parties should remain available to assist the respective salvage and stranding network as needed. NMFS' Southeast Regional Office should be immediately notified of the strike by email (takereport.nmfsser@noaa.gov) using the attached vessel strike reporting form.

For additional information, please contact the Protected Resources Division at:
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
Tel: (727) 824-5312
Or visit their website at: http://sero.nmfs.noaa.gov

Considerations for Other Species

The Corps and its contractors shall avoid contact with any bird or reptile found injured or otherwise in the way of the cleanup activities, until adequate coordination is done with the resource agencies. Detonation of UXO on cays should be conducted outside of the seabird nesting season. Some seabirds nest year round, in the event an item needs to be detonated near nests, the birds should be captured and held prior to the blow in place. This should be coordinated with the Project Biologist, FWS and DNER. In the event of manatee sighting in the vicinity of a work area, the work will stop until the animal(s) are at a safe distance.

Point of Contact for SOP Coordination

José Méndez, Project Manager
Jose.Mendez2@usace.army.mil
787-729-6893

Iván Acosta, Environmental Engineer
Ivan.Acosta@usace.army.mil
904-232-1693

Nelson Colón, Biologist
Nelson.R.Colon@usace.army.mil
904-232-2442

APPENDIX B

Addendum to the 2008 SOPs (April 2011)

FINAL

Addendum to the Standard Operating Procedures for Endangered Species Conservation and their Habitat

DERP-FUDS Project No. I02PR006802
Culebra, Puerto Rico

US Army Corps of Engineers
Jacksonville District

April 2011

TABLE OF CONTENTS

LIST OF FIGURES

Final Addendum to the Standard Operation Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802, Culebra, Puerto Rico

1.0 INTRODUCTION

In 2008, the U.S. Army Corps of Engineers (USACE) in coordination with the National Marine Fisheries Services (NMFS) Protected Resources Division and the U.S. Fish and Wildlife Services (FWS) developed a series of standard operating procedures (SOPs) to avoid or minimize impacts to listed species and their critical habitats pursuant to the Endangered Species Act (ESA) during Formerly Used Defense Site (FUDS) work at locations designated for investigation and cleanup on Culebra Island, its adjacent cays and in surrounding waters that serves as habitat for these species.

In recent communications, the FWS recommended to the USACE to modify the existing SOPs in order to include terrestrial listed species that have the potential to occur in the project areas and were not covered under the July 2008 SOPs. Based on FWS recommendations and on-going communications with their staff this addendum has been prepared.

The intent of this document is to 1) supplement the 2008 SOPs 2) serve as guidance for the USACE and its contractors in order to avoid or minimize impacts to terrestrial listed species and their designated critical habitat, and 3) satisfy the substantive requirements of the ESA.

2.0 TERRESTRIAL LISTED THREATENED OR ENDANGERED SPECIES

The purpose of this section is to provide a detailed description of the threatened and endangered terrestrial species and their habitat to be found in Culebra Island and its adjacent cays. Species include the Culebra giant Anole (*Anolis roosevelti*), Virgin Islands tree boa (*Epicrates monensis granti*), Wheeler's perperomia (*Peperomia wheeleri*) and *Leptocereus grantianus* (no common name).

The information used to describe the listed species and their habitat was obtained from state/federal agencies fact sheets, recovery and management plans, the Federal Register and internet search, among other sources.

2.1 Culebra Giant Anole (*Anolis roosevelti*)

2.1.1 General Description: The Culebra Island Giant Anole (*Anolis roosevelti*) is an extremely rare or possibly extinct lizard of the *Anolis* genus. It is native to Culebra Island, Puerto Rico. It is a rather large lizard reaching a length of approximately 160 mm snout-vent length. The color in life is brownish-grey with two lines on each side. One line begins around

Figures 1 and 2. Culebra Giant Anole. Source: http://eolspecies.lifedesks.org/node/1797

the ear and extends posteriorly to the groin; the other begins in the shoulder region and extends posteriorly into the groin. There is a distinct light spot on the temple, and the eyelids are yellow. The throat fan is grey except for the lower rear quarter which is light yellow. The tail is yellowish-brown and the underside of the belly is whitish. The tail is deeply scalloped and supports a large fin along most of its length. This fin is high: the third from the distal most ray is twice as long as the depth of the tail, and the fourth proximal ray is as long as the depth of the tail (**Figure 1 and 2**). The edge of the tail fin is scalloped between rays in *A. roosevelti*, as opposed to straight in *A. cuvieri*. *Anolis roosevelti* is additionally distinguished from *Anolis cuvieri* by being grey, not green or brown; by lacking postanal scales in males (present in *A. cuvieri*); by smooth scales under the base of the tail (keeled in *A. cuvieri*), and by its large size **Figure 3** shows *A. cuvieri* for comparison purposes.

2.1.2 Breeding Season and Behavior: Reproduction behavior is unknown. The only information available on its food and foraging behavior is that the species was sighted feeding on the fruits of Ficus trees. There are no information on population number and trends. There have been no confirmed observations of the species since 1932.

Figure 3. *Anolis cuvieri*. Source: http://www.drna.gobierno.pr/biblioteca/banco-de-fotos/Slide9.JPG/view fotos/Slide9.JPG/view

2.1.3 Habitat and Distribution: This lizard is presumably arboreal and restricted to the large Ficus and gumbo-limbo trees. There is no other information on its ecology on the island. In 1977, FWS determined that the *Anolis roosevelti* is an endangered species under the provisions of the ESA and declared most of the remaining forest in Culebra Island as critical habitat. The critical habitat area comprises Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava. **Figure 4** shows the designated critical habitat areas for the Culebra Island Giant Anole.

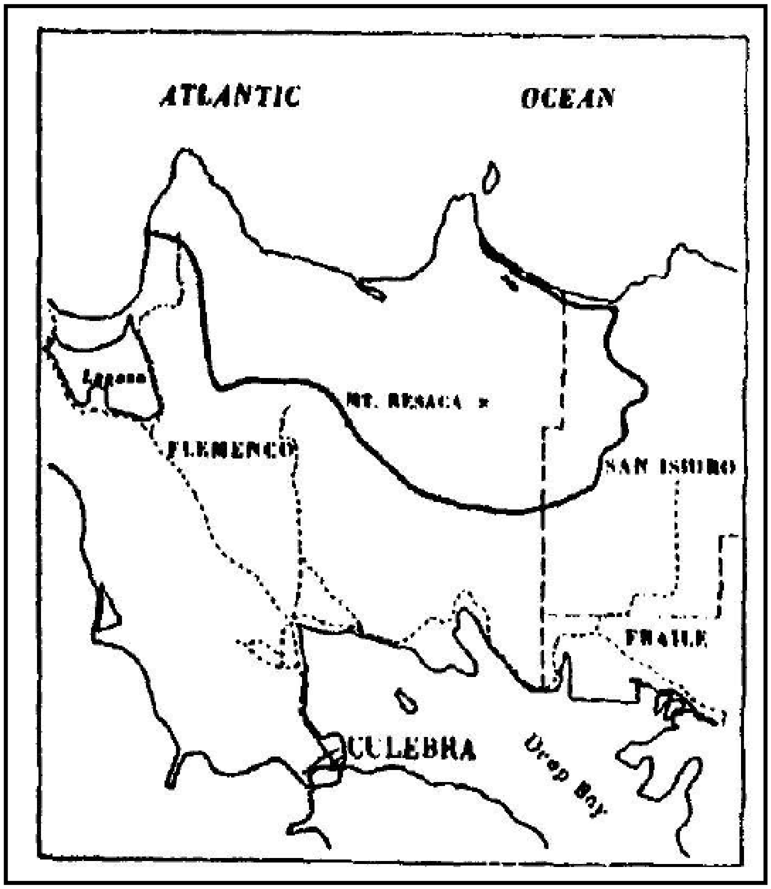


Figure 4. Boundaries of the critical habitat designated for the Culebra Island Giant Anole. Source: Critical Habitat Designations for PR and USVI (FWS 2007).

2.2 Virgin Islands Tree Boa (*Epicrates monensis granti*)

2.2.1 General Description: The adult body color is light plumbeous brown with darker blotches partially edged with black. The ventral surface is greyish-brown speckled with darker spots. This snake grows to slightly less than a meter snout-vent length (**Figure 5**). The Virgin Island (VI) boa was listed as an endangered species in 1979. Critical habitat has not been designated for this species.

2.2.2 Behavior: The VI boa is considered a nocturnal or crepuscular (active at twilight or sunrise) species, but can be active during daylight hours. Little is know of their food habits.

Figure 5. Virgin Island Tree Boa. Source: http://www.flickr.com/photos/deep-blue/2588456233/

2.2.3 Habitat and Distribution: The VI boa is considered endemic to Puerto Rico and the VI. The historical distribution of the VI boa suggests that this species was widely distributed throughout Puerto Rico and the VI, including the northeastern side of Puerto Rico, the offshore cay of Cayo Diablo, Culebra Island, and St. Thomas in USVI; Tortola, and Virgin Gorda in British Virgin Islands (BVI). Although the number of individuals at Culebra Island has not been determined, individuals have been sighted.

The VI boa's habitat has been described from two forest associations: subtropical dry forest and subtropical moist forest. The subtropical dry forest zone is the driest life zone found in VI, Vieques, southwestern Puerto Rico, plus all of Mona Island, Culebra Island and Desecheo. The dry forest habitat is characterized by small (<5m/ 15 ft) deciduous trees with small, coriaceous or succulent leaves and thorns, spines, and secondary defensive compounds, with high density of inter-digitating branches and vines greater than 1 cm (0.4 in) in diameter connecting adjacent tree canopies, and with a rainfall less than 750 mm (30 in) per year.

The species has also been sighted in mangrove forests including Button wood *(Conocarpus erectus)* and red mangrove, *(Rhizophora mangle)* on Culebra Island and Cayo Ratones. It was also found the VI boa in disturbed lower vegetation and artificial structures. Foraging boas are not restricted to trees, as they also use salt-tolerant shrub lands just above the high tide line.

2.3 Wheeler's Peperomia (*Peperomia wheeleri*)

2.3.1 General Description: *Peperomia wheeleri* is an evergreen, glabrous, erect herb which may reach 1 meter in height. The stems root only at the base and may be up to 1 centimeter in diameter. The opposite leaves are entire, fleshy, elliptic to elliptic-obovate, with 3 or 5 main veins ascending from the base. The lower side of the leaf is inconspicuosly black punctate. Inflorescenses are spikes, 10 to 16 centimeters long and 5 millimeters in diameter, which are borne solitary and opposite the leaves or at the leaf axils. Flowers are minute, approximately 0.5 millimeter in diameter (**Figure 6**).

2.3.2 Habitat and Distribution: The species is known to occur in Culebra Island and has been documented in the municipalities of Isabela and Quebradillas.

Culebra Island has an irregular topography and occurs on volcanic and intrusive rocks. The vegetation of this island is classified as belonging to subtropical dry forests. *P. wheeleri* is found in a more mesic environment, the semi-evergreen seasonal forest that consists of two strata, a tree canopy and herbaceous layer. The canopy reaches approximately 16 feet in height. Mature trees are approximately 7 to 15 feet apart (3 to 5 meters), separate by large granodiorite boulders. Roots form an entangled mass. *P. wheeleri* is a component of the understory of this semi-evergreen seasonal forest. This small herb grows on the humus which accumulates on these granodiorite boulders. Removal of the forest canopy alters the microclimatic conditions within this forest, resulting in the elimination of the humus substrate necessary for the survival of the species.

Figure 6. Wheeler's Peperonia. Source: http://www.fws.gov/caribbean/es/Images/Endangered/Peperomia_wheeleri.JPG

P. wheeleri is associated with the following canopy species: *Clusea rosea*, *Bursera simaruba* and *Ficus citrifolia*. It is also associated with other species growing in the herbaceous strata: several species of *Tillandsia*, *Anthurium acaule*, *Whittmackia lingulata* and *Epidendrum cochleatum*.

2.4 *Leptocereus grantianus* (No Common Name)

2.4.1 General Description: *Leptocereus grantianus* is a sprawling or suberect, nearly spineless cactus, which may reach up to 2 meters in height and 3 to 5 centimeters in diameter. The elongated stems have 3 to 5 prominent ribs with broadly scalloped edges. Ribs of young joints are thin, and the small areoles or spine-bearing areas may bear from one to three minute, nearly black spines which disappear as the joints grow older and the ribs become thicker. The flowers are solitary at terminal areoles, from 3 to 6 centimeters long, and nocturnal. The ovary and flower tube bear distinct areoles. The outer perianth segments are linear, green, and tipped by an areole like those of the tube and ovary. The inner perianth segments are numerous, cream-colored, oblong-obvate, obtuse, and about 8 millimeters long. Stamens are many and have yellow anthers. The stigma lobes are several and short. The fruit is subglobose to ellipsoid and about 4 centimeters in diameter (**Figure 7**).

This species is similar to another endemic species, *L. quadricostatus*, known from southern and southwestern Puerto Rico. These species differ primarily in flower morphology and in the characteristic areoles.

2.4.2 Habitat and Distribution: It is endemic to Culebra Island, and island located just off the northeastern corner of Puerto Rico. The species is found in the subtropical dry forest life zone in dry thickets which grow on a crumbling rock substrate on a steep bank just above the shoreline. Associated species include the sea grape (*Coccoloba uvifera*) and almacigo (*Bursera simaruba*). This species is currently known to occur in Punta Melones, Villas de Mi Terruño at Sardineras Ward, and Punta Soldado. In addition, the species has been introduced in a private property located at Fraile Ward, and at the Observation Point located within the Culebra National Wildlife Refuge in Punta Flamenco.

Figure 7. *Leptocereus grantianus*. Source: http://www.fws.gov/caribbean/ES/Images/Leptocereus_grantianus.jpg

L. grantianus was determined to be an endangered species in 1993 pursuant to ESA. Critical habitat has not been designated for this species.

3.0 MEASURES TO AVOID OR MINIMIZE POSSIBLE IMPACTS

The following measures will be implemented to avoid or minimize impacts to terrestrial threatened or endangered species and their habitat during investigation and cleanup work on Culebra Island and its adjacent cays.

3.1 General Procedures

3.1.1 Protected Species Identification Training/Briefing: Prior to initiate work all personnel shall receive training or briefings regarding the importance of endangered species, their characteristics, how they can be identified, potential habitats, types of material in which their may hide, actions to take if are sighted and avoidance measures to be followed. This training or briefing shall be prepared and offered by qualified personnel (e.g. biologist, environmental scientist, botanist, among others).

3.1.2 Civil and Criminal Penalties: The Contractor shall instruct all personnel associated with the project of the potential presence of threatened or endangered species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing or killing threatened or endangered species protected under the ESA and Commonwealth of Puerto Rico Endangered Species Regulation.

3.1.3 Qualified Personnel: Each team performing vegetation clearance/removal (e.g. pruning, trimming, and cutting) shall be accompanied by qualified and experienced personnel in order to identify the presence or absence of threatened or endangered species. The Contractor shall submit their qualifications to the USACE and the FWS.

3.1.4 Coordination: All related work will be coordinated with the resource agencies (FWS, DNER and NMFS) prior initiation. The Contractor will provide a preliminary schedule and the areas (including the proposed transects and grids) where investigation or cleanup activities will be performed. Changes to the schedule and working areas will be provided to the resource agencies. Any access and work on the adjacent cays will be closely coordinated with FWS and DNER. Seabirds breeding season (May-August) shall be considered during the cays access coordination.

3.1.5 Reports: The Contractor shall maintain a log detailing sightings. The log shall include, but not limited to, the following information: date and time, location, species, and any actions taken during the work period. All data shall be forwarded to USACE Environmental Branch.

3.1.6 Detonation Activities: If determined that detonation activities are required, the related work and its conservation measures will be closely coordinated with the resource agencies.

3.2 Culebra Giant Anole Avoidance and Monitoring

3.2.1 In order to avoid impacts to this species transects/grids monitoring surveys will be conducted by qualified personnel to determine its presence or absence. The areas where the vegetation will be cleared shall be inspected prior to proceed with vegetation clearance.

3.2.2 According to the obtained information, this species is presumably active in daytime. For that reason, if it is sighted the vegetation clearance work shall cease to ensure the protection of the species. The activities will not be resumed until the animal has moved, at least, 100 feet outside the transect/grid limits or is at a safe distance.

3.2.3 The vegetation where the species was sighted shall not be cleared, until coordination with FWS has been completed.

3.2.4 The capture or collection of this species is prohibited. This species is protected under ESA.

3.2.5 It should be noted that this species has not been sighted since 1932. If this species is identified during investigation or cleanup work, the USACE Environmental Branch and FWS personnel must be notified immediately. It location shall be documented and provide it to FWS in order to facilitate additional field investigations. The USACE and FWS points-of-contact (POC) are included in Section 4.0.

3.3 Virgin Islands Tree Boa

3.3.1 Boa Monitoring: Boas have the potential to occur within the work area limits, in trees or bushes, under stored materials or inactive equipment stored in shady locations. Qualified personnel shall conduct the boa monitoring. Boas are active mostly during the night. Therefore, a daily search around and in machinery shall be completed at the beginning of each working day, prior to start-up of engines of quarry machinery, bulldozers, trucks, etc. Particular attention should be paid to motors and other warm areas that may be entered at night by the animals in an attempt to warm themselves.

3.3.2 If search of machinery does not discover any specimens, areas that are about to be cleared of vegetation shall be inspected next, especially piles of brush, leaf litter and rotting vegetation. These areas may be prodded gently with a blunt stick.

3.3.3 Relocation Actions: If a boa is discovered, all work shall stop within a 50 foot radius of the boa's location. One person shall keep watch on the boa while another contacts the designated boa monitor. If it is sighted within the transect limits, the boa shall be allowed to leave the site naturally. If the boa does not show any intention of leaving the area naturally, it will be relocated off the transect limits to an area with similar characteristic (e.g. vegetation cover) in order to resume the activities. If relocation is required 1) the boa monitor shall contact the USACE, FWS, and DNER POCs 2) shall provide the proposed relocation site location and its description, and 3) then will perform the capture, and relocation of the boa. The FWS and/or DNER POCs shall agree with the relocation site prior its relocation. The captured animal must be maintained in a cool, shady place (not inside a parked car) until relocation is completed.

3.3.4 The areas where boas have been relocated shall be clearly marked, documented, and provided to the USACE, FWS and DNER POCs.

3.3.5 Capture and Relocation Supplies and Equipment: At least three items should be provided by the contractor to the boa monitor, and maintained available on-site to handle and carry snakes if they are spotted: These are: a blunt snake hook, netting or burlap bags with closing ties, and a 6 x 6 or 8 x 8 foot tarpaulin.

3.4 Listed Vegetation Avoidance Measures

3.4.1 <u>Cutting or pruning of any of these species (*Peperomia wheeleri* and *Leptocereus grantianus*) is prohibited. These species are listed as endangered and are protected under ESA.</u>

3.4.2 Prior to the beginning of any vegetation clearance, the Contractor's qualified personnel shall identify if any of the listed species described in Section 2 are present or absence within the work area. The Contractor shall contact the FWS in order to obtain additional information (e.g. GIS shapefiles, location maps, etc.) on the locations and populations of these species. This information will be used to determine the transects/grids dimensions and their final locations. During the investigation activities qualified personnel shall conduct visual surveys to ensure the presence or absence of these species and to avoid or minimize possible impacts.

3.4.3 Vegetation clearance in areas where specimens of Wheeler's Peperomia are found shall be closely coordinated with FWS and DNER. Removal of the forest canopy could alter the microclimatic conditions within the forest, resulting in the elimination of humus substrate necessary for the survival of the species. This species is associated with the following canopy species: *Clusea rosea*, *Bursera simaruba* and *Ficus citrifolia*. It is also associated with other species growing in the herbaceous strata: several species of *Tillandsia*, *Anthurium acaule*, *Whittmackia lingulata* and *Epidendrum cochleatum*. Particular attention should be paid to these areas.

3.4.4 Cutting or pruning vegetation within Wheeler' Peperomia habitat, including forested areas with boulders that are densely covered by bromeliads, orchids or anthuriums, shall be avoided to the maximum extend possible in order to maintain the microclimate conditions that contribute to the suitability of this endangered species.

3.4.5 Cutting or pruning of any species of cacti shall be avoided in order to prevent impacts to *Leptocereus grantinanus* species.

3.4.6 If any of these species (*Peperomia wheeleri* and *Leptocereus grantianus*) is found within the proposed transect/grid, the route will be realigned. The species shall be clearly marked in order to ensure its protection.

4.0 POINT OF CONTACT FOR SOP COORDINATION

U.S. Army Corps of Engineers, Jacksonville District:

Thomas R. Freeman, Project Manager
Thomas.R.Freeman.III@usace.army.mil
Telephone: (314) 331-8785

José Méndez, Project Manager
Jose.M.Mendez@usace.army.mil
Telephone: (787) 729-6877

Iván Acosta, Chief Special Projects Section
Ivan.Acosta@usace.army.mil
Telephone: (904) 232-2050

Wilberto Cubero, Environmental Scientist
Wilberto.Cubero-delToro@usace.army.mil
Telephone: (904) 232-2050

U.S. Fish and Wildlife Services:

Edwin Muñiz, Field Supervisor
Edwin_Muniz@fws.gov
Telephone: (787) 851-7297

Ana Roman, Refuge Manager
Ana.Roman@fws.gov
Telephone: (787) 742-0115 or (787) 306-1389

National Marine Fisheries Service:

Lisamarie Carrubba, Director Caribbean Field Office
Lisamarie.Carrubba@noaa.gov
Telephone: (787) 851-3700

P.R. Department of Natural and Environmental Resources:

Roberto Matos, Refuges and Reserves
rmatos@drna.gobierno.pr
Telephone: (787) 999-2200 x.2718

Damaris Delgado López
ddelgado@drna.gobierno.pr
Telephone: (787) 999-2200

P.R. Environmental Quality Board:

Wilmarie Rivera, Federal Facilities Coordinator
WilmarieRivera@jca.gobierno.pr
Telephone: (787) 767-8181 x.6129

This page intentionally left blank

APPENDIX C

POINTS OF CONTACT

Points of Contact

Organization	*Name*	*Telephone*
U.S. Army Corps of Engineers Formerly Used Defense Site Program Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Thomas R. Freeman III, PE Project Manager Email: Thomas.R.Freman.III@usace.army.mil	Desk (904) 232-1040 Cell (314) 625-8256
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Roland Belew, PMP, Project Manager Email: Roland.G.Belew@usace.army.mil Cell (256) 213-8209	 Desk (256) 895-9525 Cell (256) 503-0661
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Kelly D. Enriquez, Geophysicist Email: Kelly.D.Enriquez@usace.army.mil	 (256) 895-1373
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Teresa M. Carpenter, Technical Manager Email: Teresa.M.Carpenter@usace.army.mil	(256) 895-1659
U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Jose Mendez, Project Manager Email: Jose.M.Mendez@usace.army.mil	(256) 895-6893/6895 Extension 3099
U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Wilberto Cubero, Environmental Scientist Email: Wilberto.Cubero-Deltoro@usace.army.mil	(904) 232-2050
PRDNER-Carr.8838 Sector El Cinco Rio Piedras, SJ, PR 00936	Damaris Delgado, President Bureau of Coasts, Reserves, and Refuges, DNER Email: d.delgado@drna.goberierno.pr	(757) 999-2200 Extension 2107
* Puerto Rico EQB P.O. Box 11488 1375 Ponce de Leon Avenue San Juan, PR 00910	Pedro Nieves Miranda, Director PREQB/JCA Email: not provided	(787) 767-8056
Puerto Rico EQB PO Box 11488 1375 Ponce de Leon Avenue San Juan, PR 00910	Ms. Wilmarie Rivera, Program Manager Email: wilmarierivera@jca.gobiernao.pr	(727) 365-8573

Organization	Name	Telephone
US Fish and Wildlife Service Culebra National Wildlife Refuge PO Box 190 Culebra, PR 00622	Ms. Ana Román, Refuge Manager Email: Ana_roman@fws.gov	Desk (787) 742-0115 Cell (787) 396-7711
*USEPA Centro Europa Building Suite 4171492 Ponce de Leon Avenue San Juan, PR 00907-4127	Karl Soderberg, Regional Administrator Email: not provided	(787) 977-5870
NOAA National Marine Fisheries Service PO Box 1310 Boqueron, PR 00622	Dr. Lisamarie Carrubba Email: lisamarie.Carrubba@noaa.gov	(787) 851-3700
USFWS P.O. Box 491 Boqueron, PR 00622	Felix Lopez, Ecologist Email: felix.lopez@fws.gov	(787) 510-5208
USEPA Region II 290 Broadway New York, NY 10007- 186	Julio F. Vasquez, RPM Email: Vasquez.julio@epa.gov	(212) 657-4323
UXO Pro 811 Duke Street Alexandria, VA 22314	Jim Pastorick Email: jim@uxopro.com	(703) 548-5300
USFWS 2890 Woodbridge Avenue Edison, NJ 08833	Richard Henry Email: Richard_henry@fws.gov	(732) 906-6987
USFWS P.O. Box 510 Boqueron, PR 00622	Susan Silander Email: Susan_Silander@fws.gov	(787) 504-5938
NOAA/NOS 74 Magruder Road Highlands, NJ 07732	Diane Wehner Email: diane.wehner@noaa.gov	(240) 338-3411
USEPA P.O. Box 1537 Vieques, PR 00765	Daniel Rodriguez Email: rodruiguez.daniel@epa.gov	(787) 741-5201
NOAA 400 Fernandez Juncos Avenue San Juan, PR 00901	José A. Rivera Email: jose.a.rivera@noaa.gov	(787) 405-3605

Organization	***Name***	***Telephone***
Tetra Tech EC 1050 NE Hostmark Street, Suite 202 Poulsbo, WA 98370	Scot Wilson, PMP, Project Manager Email: scot.wilson@tetratech.com	Direct (360) 598-8111 Fax (360) 598-8195 Cell (360) 626-3193
Tetra Tech, Inc. PO Box 79192 Carolina, PR 00979	Fernando Pagés Rangel, Director Tetra Tech PR Ops Email: Fernando.pages@tetratech.com	Direct (626) 688-1017 Fax (787) 791-0803
Tetra Tech EC 19803 North Creek Parkway Bothell, WA 98011	Robert Feldpausch Principal Scientist/Hydrographer Email: robert.feldpausch@tetratech.com	Direct (425) 482-7862 Fax (425) 482-7652 Cell (425) 503-2468
Tetra Tech EC 160 Federal Street, 3rd Floor Boston, MA 02110	Ronald Marnicio, PhD, PE National Discipline Lead, Risk Assessment Email: ronald.marnicio@tetratech.com	Direct (617) 443-7551
Tetra Tech EC 19803 North Creek Parkway Bothell, WA 98011	Richard Funk, Senior Geophysicist Email: richard.funk@tetratech.com	Direct (425) 482-7629 Cell (973) 216-9295

APPENDIX D

ACCIDENT PREVENTION PLAN

FINAL

ACCIDENT PREVENTION PLAN

Environmental Baseline Survey

Culebra Water Ranges

Culebra, Puerto Rico

Contract Task Order 0003
Contract No. W912DY-10-D-0015

November 16, 2012

Prepared for:

U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, FL 33207
&
U.S. Army Engineering and Support Center, Huntsville
4820 University Square

Huntsville, AL 35816-1822

Prepared by:

TETRA TECH EC, INC
1050 NE Hostmark Street, Suite 202
Poulsbo, Washington 98370

TABLE OF CONTENTS

TABLES

FIGURES

EXHIBITS

ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
CSP	Certified Safety Professional
DART	Days Away/Restricted or Transfer
DID	Data Item Description
DMM	discarded military munitions
EBS	Environmental Baseline Survey
EC	Emergency Coordinator
EHS	Environmental Health and Safety
EM	Engineer Manual
EMR	experience modification rating
FIC	Field Investigation Coordinator
FOL	Field Operations Lead
FS	feasibility study
MBE	multibeam echosounder
MC	munitions constituent
MEC	munitions and explosives of concern
MRS	munitions response site
MSDS	Material Safety Data Sheet
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer
PESM	Project Environmental Safety Manager
PFD	personal flotation device
PjM	Project Manager

PPE	personal protection equipment
RI	remedial investigation
ROV	remotely operated vehicle
SBE	single beam echosounder
SSHO	Site Safety and Health Officer
SSP	Snorkeling Safety Plan
SSS	sidescan sonar
TtEC	Tetra Tech EC, Inc.
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
UXO	unexploded ordnance
WERS	Worldwide Environmental Remediation Services

1.0 INTRODUCTION

1.01 This Accident Prevention Plan (APP) refers to written procedures that are a part of Tetra Tech EC, Inc.'s (TtEC's) Environmental, Safety, and Quality Programs. The plan specifies the written corporate procedure by number. The cover page to this document has the signatures of the Certified Industrial Hygienist (CIH) and the Program Manager.

1.02 This APP was prepared for the U.S. Army Engineering and Support Center, Huntsville (USAESCH) in accordance with Worldwide Environmental Remediation Services (WERS) Data Item Description (DID) WERS-005.01 under Contract Number W912DY-10-D-0015. The APP assigns responsibilities, establishes standard operating procedures, and sets forth contingencies that may arise while operations are being performed and establishes policies and procedures to protect workers and the public (if applicable) from the potential hazards posed by site work. The elements of this plan comply with the informational requirements of Occupational Safety and Health Administration (OSHA) (29 Code of Federal Regulations [CFR] 1910.120. [b][1] and 29 CFR 1926.65[b][4][ii]), Section 28B in the U.S. Army Corps of Engineers [USACE] Safety and Health Requirements Manual, Engineer Manual [EM] 385-1-1), and TtEC's Environmental, Health, and Safety programs.

1.1 SIGNATURE SHEET

Prepared by: Jennifer Peters
Senior Safety and Health Specialist (360) 598-8108

Approved by: Kent Weingardt, PE, PMP
Program Manager (619) 471-3532

Concurrence: Roger Margotto, CIH, CSP, CHMM
Project Environmental Safety Manager
(619) 471-3503

1.2 BACKGROUND INFORMATION

a. Contractor: Tetra Tech EC, Inc.

b. Contract Number: W912DY-10-D-0015 (Task Order 0003)

c. Project Name: Environmental Baseline Survey at Culebra Water Ranges, Culebra, Puerto Rico

d. The overall project being performed under this contract, Task Order 0003 is performance of a Remedial Investigation (RI)/Feasibility Study (FS) [RI/FS] at the Culebra Water Ranges, which comprise two munitions response sites (MRSs), Flamenco Bay (MRS 03) and the Luis Peña Channel (MRS 12) in Culebra, Puerto Rico (Figures 1-1 and 1-2). This phase of the project, the Environmental Baseline Survey (EBS), is being performed prior to the RI/FS and is the sole activity covered by this APP. A separate APP is being prepared for the RI fieldwork activities. The major field activities associated with the EBS include performance of a non-intrusive biological survey using scientific snorkelers in shallow water areas and use of geo-referenced remotely operated vehicles (ROVs) in deeper water areas. The purpose of the survey is to photograph and collect video to document benthic site conditions, define and delineate benthic and coral reef habitats, including sensitive (e.g., coral reef, seagrass beds) or critical habitat areas, and document features of the underwater environment. In addition, hydrographic mapping and seabed characterization will be performed as part of a bathymetric survey in areas of Flamenco Bay and the Luis Peña Channel using high resolution multi-beam echosounder (MBE) equipment, single-beam echosounder (SBE), and sidescan sonar (SSS) imagery equipment. This task will provide an accurate topographic model to support subsequent survey and remediation investigation and design efforts in the RI/FS, will help locate potential hazards to the marine towed sensors, map debris fields or features of interest, and provide detailed bathymetric and depth information.

   The survey area characterization done during the EBS will be built upon during the RI by magnetometer surveys conducted as part of the marine geophysical survey. The remote sensing surveys of the EBS and RI geophysical survey will be used to develop a benthic terrain model that will yield a detailed assessment of the bottom topography and structure, including delineation of areas of different bottom type and to aid in dive planning during the RI. These data, together with the geo-referenced underwater video, will help define the locations and types of habitat-based ecosystems. This information, together with the locations of possible unexploded ordnance (UXO) items derived from the geophysical survey and identified in the underwater video and/or intrusive sampling, will be used to determine the general locations and extents of contaminated areas requiring remediation that will be evaluated during the RI.

e. Exposure data are calculated on a monthly basis by the Project Environmental Safety Manager (PESM). Man-hours worked are obtained from hours charged to a project for payroll purposes. TtEC also collects the number of man-hours worked by subcontractors on project sites by reviewing daily production reports and recording the hours on those reports. TtEC has an experience modification rating (EMR) of 0.74. OSHA 300A forms are available for inspection. TtEC has had an OSHA recordable rate that has been in the range of 0.46 case per 200,000 man-hours. Construction industry averages are usually in the 4.7 to 7.1 range.

f. Phases of work requiring Activity Hazard Analysis (AHAs) (some tasks are part of a single AHA) are:

   - Mobilization and Site Setup, Boating, and Scientific Snorkeling
   - Mobilization and Site Setup, Boating, and ROV Underwater Video Surveys
   - Boating and Bathymetry Surveys

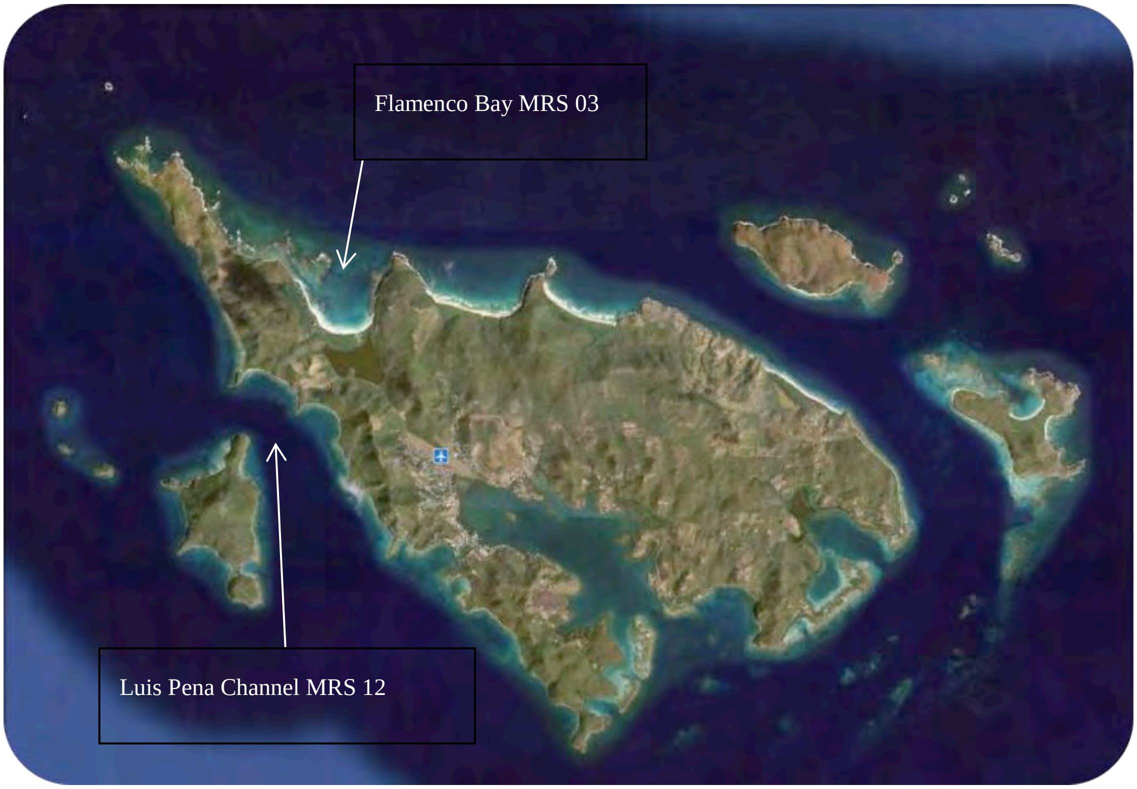


Figure 1-1. Regional Location Map

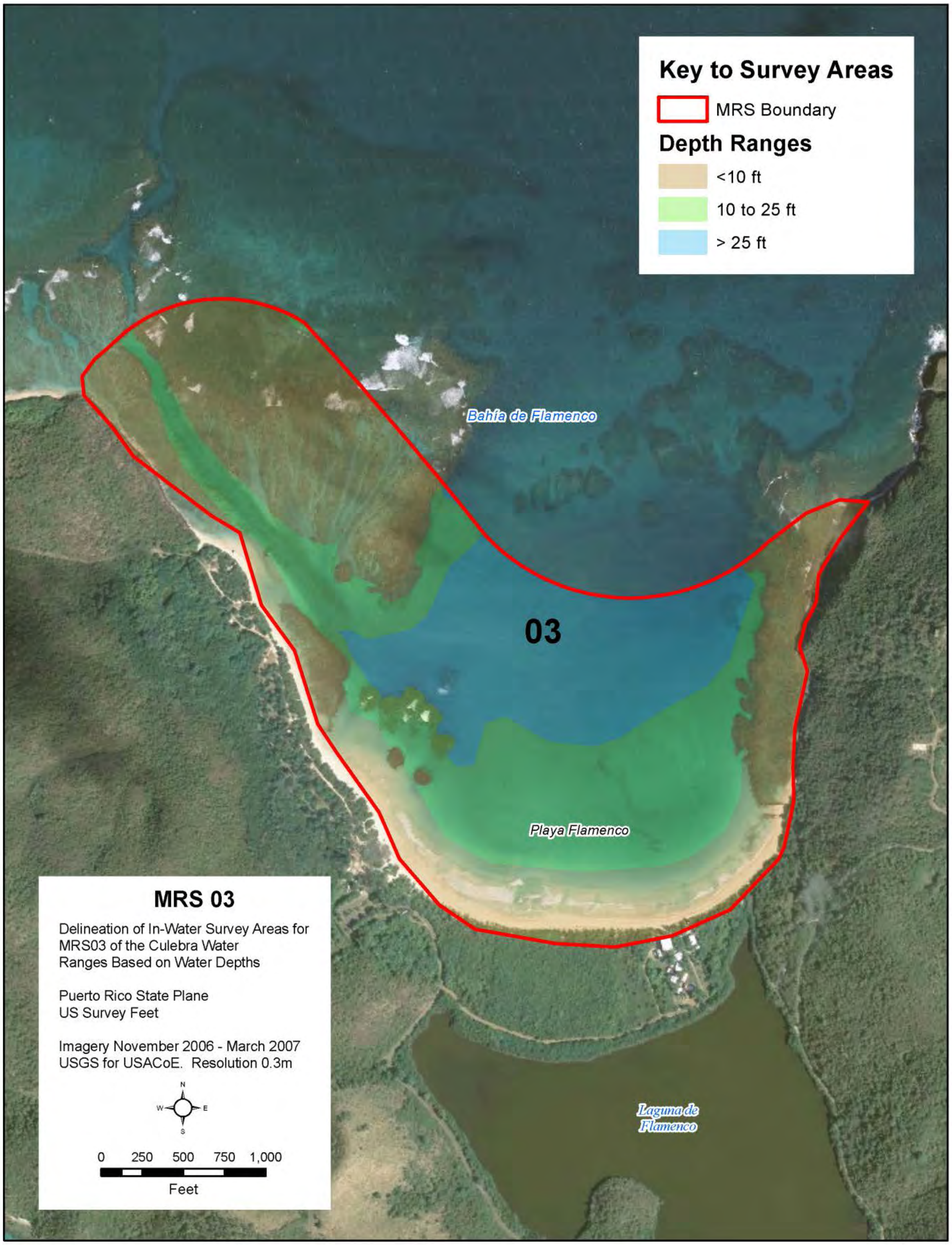


Figure 1-2a. Site Location Map MRS 03

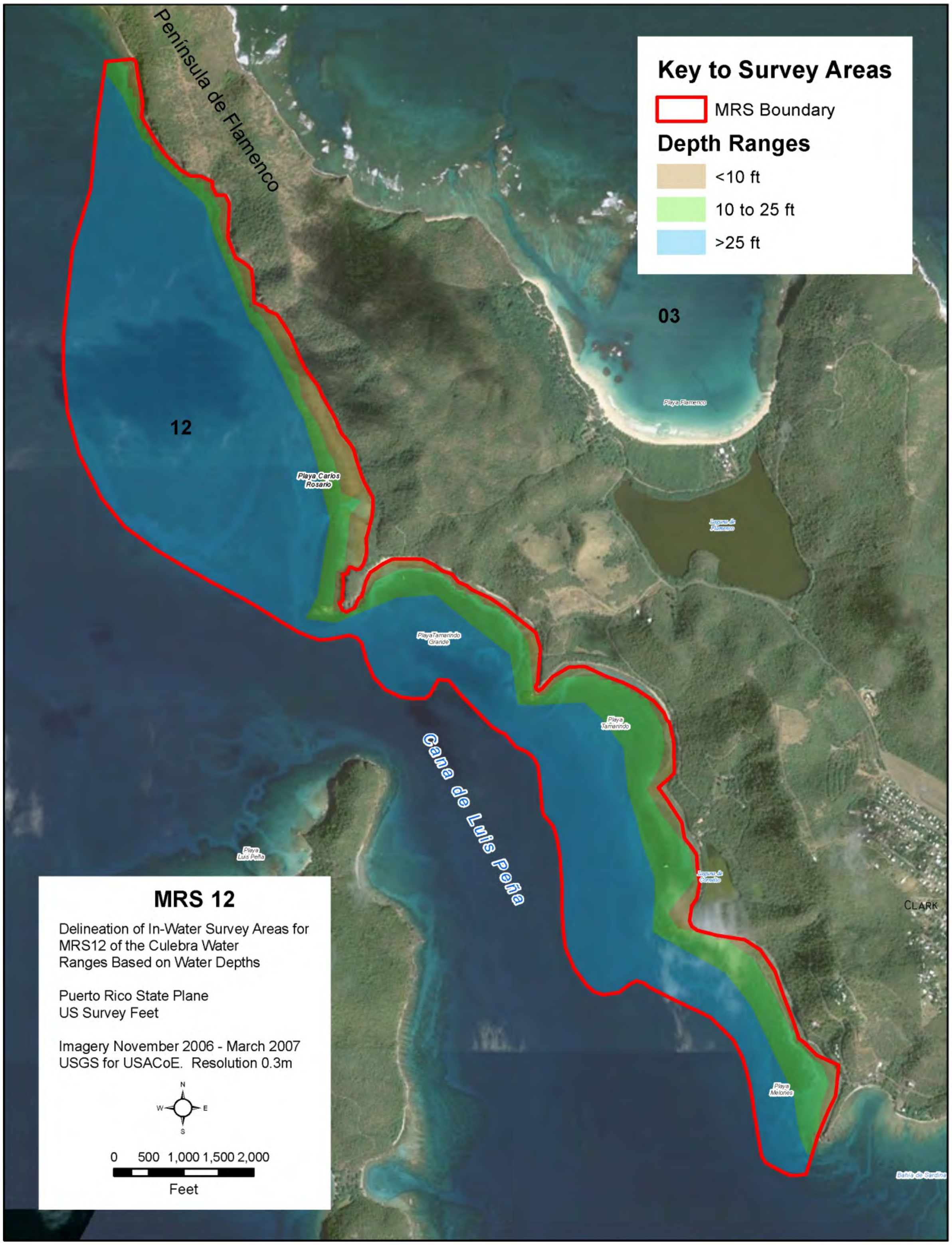


Figure 1-2b. Site Location Map MRS 12

2.0 STATEMENT OF HEALTH AND SAFETY POLICY

2.01 TtEC's goal is to maintain a safe and healthy work environment during the performance of the project activities. The work being conducted for the EBS is not considered hazardous, toxic, or radioactive waste work as per EM 385-1-1 (USACE 2008); thus, a Site Safety and Health Plan is not specifically required. This APP has been developed to fulfill the goal of maintaining a safe and healthy work environment during the EBS and achieve the following objectives:

- Instruct TtEC employees and contractors on procedures to minimize the potential for injury or exposure to hazardous conditions.
- Train TtEC employees and contractors on the proper action to be taken if a hazardous condition cannot be avoided by use of engineering controls.
- Provide guidelines for emergency response for known hazards and hazardous situations.
- Specify actions required to comply with applicable U.S. Department of Labor, OSHA, and other local regulations or other requirements.

2.02 This APP is intended as a guideline that allows the Site Safety and Health Officer (SSHO) to respond to changing conditions and make professional judgments regarding the interpretation of monitoring data and related control measures. This APP also delineates health and safety responsibilities and assigns those responsibilities to project and office personnel. This APP and attachments must be on the project site at all times. All personnel on-site must receive training on this plan prior to performing any work on the project site. The TtEC Corporate Health and Safety Programs have a strong philosophy and policy regarding health and safety. Refer to the following exhibits (at the back of this APP):

Exhibit 1 – Environmental Safety and Quality Policy

Exhibit 2 – Corporate Health and Safety Program Procedures List

Exhibit 3 – Zero Incident Performance®

Exhibit 4 – Zero Incident Performance Pledge

3.0 RESPONSIBILITIES AND LINES OF AUTHORITY

3.01 This section identifies the roles and responsibilities of TtEC personnel and contractors conducting field activities at the site. Personnel will be drawn from the company to ensure that managers and field representatives have the qualifications, training, and experience to safely conduct their respective tasks while also providing a safe work environment for contractors.

3.1 PROJECT ENVIRONMENTAL SAFETY MANAGER

3.1.01 The PESM will review and approve this APP and any amendments prior to their adoption. The PESM will assist with implementation of the APP and provide project support on health and safety issues. The PESM will consult with the Project Manager (PjM) if revision of this APP is required. The PESM will verify field personnel training, medical surveillance, and other requirements. The PESM will advise the PjM regarding industrial hygiene concerns, interpretation and evaluation of analytical exposure data, and other safety related issues, as needed. Contractor health and safety plans will be reviewed by the PESM.

3.1.0.2 The PESM for the Environmental Baseline Survey at Culebra Water Ranges, Culebra, Puerto Rico, is:

Roger Margotto, CIH, CSP, CHMM
TtEC Program Health and Safety Manager
1230 Columbia Street, Suite 750
San Diego, California 92101
(619) 471-3503 office
(619) 988-0520 mobile
roger.margotto@tetratech.com

3.2 PROGRAM DIVE SAFETY MANAGER

3.2.01 The Program Dive Safety Manager will review this APP for snorkeling and boating-related safety in accordance with TtEC's program requirements. The Dive Safety Manager will assist the PjM and PESM with implementation of the APP related to snorkeling and boating operations and provide project support on health and safety issues. The Dive Safety Manager will consult with the PESM and PjM if revision of this APP is required and will verify field personnel training, medical surveillance, and other requirements related to snorkeling or boating operations and, along with the PESM will advise the PjM regarding other safety-related issues, as needed.

3.2.0.2 The Dive Safety Manager for the EBS at Culebra Water Ranges, Culebra, Puerto Rico, is:

Steve Neill
UXO/Diver Safety Manager
(804) 642-0202 office
(770) 330-7068 cell
steve.neill@tetratech.com

3.3 PROJECT MANAGER

3.3.01 The PjM is responsible for ensuring that the APP are prepared, reviewed, approved, and implemented. The PjM will not initiate field activities until the APP has been approved by the PESM and assigned personnel have received the required level of project-specific health and safety instruction. The PjM will review and evaluate field and laboratory data as they become available during the course of the project and consult with the PESM and SSHO if revisions to the APP are required. The PjM is responsible for the overall health and safety performance and compliance with applicable regulations and is the senior contact in the event of a site emergency. In addition, the PjM will ensure that health and safety activities are conducted according to APP requirements and according to other, relevant company policies and procedures. On-site injuries, illnesses, and accidents will be reported to the client by the PjM, SSHO, or the PESM.

3.3.0.2 The PjM for the EBS at Culebra Water Ranges, Culebra, Puerto Rico, is:

Scot Wilson P.M.P.
Project Manager
1050 NE Hostmark Street, Suite 202
Poulsbo, WA 98370
(360) 598-8111 office
(360) 626-3193 mobile
scot.wilson@tetratech.com

3.4 FIELD OPERATIONS LEAD

3.4.01 The Field Operations Lead (FOL) is responsible for coordination of the EBS activities on-site. The FOL is responsible for ensuring that all work is performed in accordance with the contract requirements in a safe and healthful manner. As a line manager, the FOL has the same responsibilities for health and safety program implementation as the PjM. The FOL will:

- Ensure that work crews have adequate resources to effectively conduct field activities.
- In conjunction with the SSHO, ensure that proper protective equipment is being used by all personnel.
- Ensure that appropriate disciplinary actions are taken when health and safety requirements are not being followed or when unsafe practices occur.

- Oversee work practices to verify that they are in accordance with this APP.
- Understand and be familiar with the APP.
- Participate in the daily tailgate safety meetings.
- Observe project personnel for signs of chemical or physical trauma or fatigue.
- Immediately notify the SSHO and the PESM of any illness, accident, injury, or near-miss incident.
- Correct any hazards disclosed by project workers or the SSHO.
- Act as the alternate Emergency Coordinator (EC).

3.4.0.2 The FOL has the authority to suspend field activities if the health and safety of personnel are in danger.

3.4.0.3 The FOL for the EBS at Culebra Water Ranges, Culebra, Puerto Rico, is:

Richard Funk, PG
FOL/Quality Control Manager
(973) 216-9295
richard.funk@tetratech.com

3.5 SITE SAFETY AND HEALTH OFFICER

3.5.01 The SSHO for the EBS will be present on-site during the conduct of field operations and is responsible for all health and safety activities and the delegation of duties to the health and safety staff in the field. The SSHO is also the boat captain on this project. The SSHO is responsible for implementing the APP, ensuring that appropriate personal protective equipment (PPE) is used relative to the hazard that may be encountered, verifying that communication systems are in place, monitoring conformance with safety and emergency response procedures, giving safety briefings, seeing that safety equipment is maintained, and conducting safety drills and exercises. The SSHO has stop work authorization, which will be executed upon determination of an imminent safety hazard or potentially dangerous situation. Work cannot restart until clearance has been authorized by the SSHO. The SSHO is responsible for maintaining the site health and safety logbooks.

3.5.02 The SSHO possesses the knowledge and experience necessary to ensure that all elements of the APP are implemented and enforced on-site. The TtEC SSHO has a minimum of 5 years of experience and has completed a minimum of the OSHA 30-hour Construction Safety course and at least 24 hours of formal safety and health related coursework every four years. Every SSHO is certified as having completed training in first aid and cardiopulmonary resuscitation (CPR) by a recognized organization (such as the American Red Cross Association).

TtEC Environmental Health and Safety (EHS) Procedure 1-2 (EHS 1-2; see Attachment B for copies of EHS procedures) states that the SSHO is responsible for:

- Ensuring that TtEC employees understand the requirements of TtEC EHS programs and procedures through training and communication.
- Developing or assisting with the development of EHS plans in conjunction with project personnel.
- Assisting management with EHS plan implementation.
- Performing specific tasks in accordance with EHS plans.
- Fulfilling the specific responsibilities for project EHS personnel that are identified within each EHS procedure.

3.5.03 Additional responsibilities of the SSHO, as described in the TtEC EHS program, include but are not limited to:

- Investigating accidents, injuries, illnesses, near-misses, and other incidents.
- Ensuring that employees are trained on the hazards of hazardous substances used on any project, maintaining Material Safety Data Sheet (MSDS) files to provide easy access to all employees, and performing inspections to ensure that all containers are labeled.
- Ensuring that the APP is read, understood, and signed by all field personnel including subcontractors. (The APP will be maintained and updated as needed, and one copy will be placed on or near the site safety bulletin board and postings.)
- Ensuring that tailgate safety meetings are conducted on days that work is performed. Ensuring that all meetings and any other additional training are documented.
- Assessing employee exposure through specified monitoring protocols and ascertaining that protective measures are appropriate.
- Verifying that project safety equipment is inspected, as required by the EHS program.
- Reporting to the Client within 24 hours all incidents required to be reported by EM 385-1-1 (USACE 2008); and reporting immediately to the client if any fatal injury occurs, one or more persons are admitted to a hospital, or if damage to government property occurs.
- Informing the PjM of any site personnel with medical restrictions.
- Determining and posting emergency phone numbers and routes to medical facilities and arranging for emergency transportation to the medical facilities.
- Serving as the Project Hazard Communication Coordinator.
- Serving as the Primary EC.

3.5.04 The SSHO for the EBS at Culebra Water Ranges, Culebra, Puerto Rico, is:

Lou Schwartz
(425) 877-3589
lou.schwartz@tetratech.com

3.6 WORK PARTY

3.6.01 Members of the work party, defined as personnel and contractors working on the project, are required to comply with the health and safety requirements presented in this APP and, if appropriate, in their corresponding company health and safety manuals. This project is supported by others as described in the Work Plan such as project geophysicists, a project biologist, and a Field Investigation Coordinator (FIC). Both the project biologist and the FIC live and work in Puerto Rico and have a wealth of local knowledge that will enhance the health and safety of the project team. The responsibilities of the work party members include, but are not limited to, the following:

- Read and understand this APP, including referenced procedures or plans.
- Participate in daily tailgate meetings and any project-specific training.
- Implement safe work practices and good personal hygiene for hazardous waste operations.
- When unsafe conditions or work practices are observed at the site, stop the work and notify a supervisor.
- Maintain and use PPE in good working condition.
- Respond to site emergencies, if necessary, and direct evacuation or summon emergency assistance.

3.7 COMPETENT PERSONS

3.7.01 The competent person designated by the PjM for the project is the SSHO (Lou Schwartz). The SSHO or a designated competent person is on-site at all times when work is being performed. Qualified personnel will be used for boating as overseen by Lou Schwartz, the SSHO and boat captain, and snorkeling operations as identified in the AHAs and the Snorkeling Safety Plan (SSP, which in included as Appendix F of the Work Plan). Qualifications of personnel will be verified and documented.

3.8 LINES OF AUTHORITY

3.8.01 Figure 3-1 shows an organization chart depicting the lines of authority.

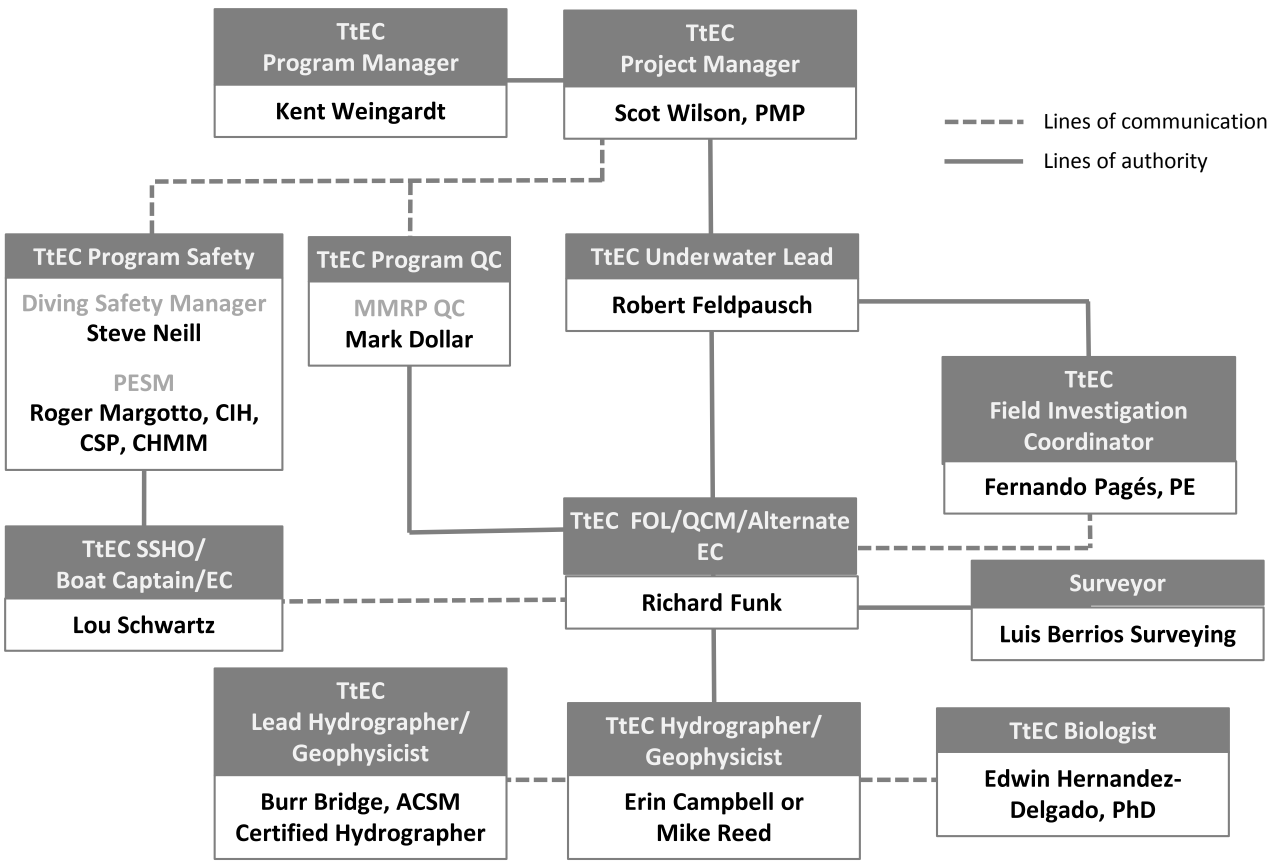


Figure 3-1. Organization Chart, Environmental Baseline Survey

3.9 SAFETY PROGRAM GOALS

3.9.01 TtEC believes that all incidents are preventable through careful planning, tasking, and error-free execution of the work. Company management personnel also believe that everyone is accountable for working safely and for identifying and controlling workplace hazards. This is the foundation of the TtEC Zero Incident Performance® (ZIP) philosophy. TtEC has adopted ZIP as a central goal and promotes it vigorously in all operations, because to accept a goal of anything more than zero is to assume and accept that some of our coworkers will get hurt. This is an unacceptable concession.

3.9.02 In pursuing this goal, TtEC anticipates zero recordable injury cases for the current and all subsequent years, no property loss events > $500, no first aid cases, or serious environmental releases (> reportable quantity). In achieving this goal, TtEC further anticipates a steady drop in recordable injury rates, Days Away/Restricted or Transfer (DART) incident rates and DART severity rates to well below industry averages. TtEC also expects EMR rates to remain less than 1.0 with a gradual lowering of the rate over time.

3.10 SAFETY INCENTIVES

3.10.01 Safety incentive programs are developed for large projects or programs. The incentive programs are site- and contract-specific. An incentive program has not been developed for this project; however, the PM has the option of nominating employees who perform exemplar work for a Star of the Month award. This award program recognizes achievements in all fields including safety. Employees selected for the award receive a certificate and cash award.

3.11 PRE-TASK SAFETY AND HEALTH ANALYSIS

3.11.01 This plan requires the preparation of an AHA for each task. Three AHAs have been prepared and are included in Attachment A. This plan also requires that these task analyses are reviewed with all workers and that workers acknowledge their review of safety and health requirements for each task. Where subcontractors are used to perform certain work activities, the SSHO will ask the subcontractor to provide an AHA for review or the SSHO will work with the subcontractor in the preparation of the AHA for review. The AHA must be reviewed by the PESM. As new activities are identified or the work environment of the task changes, new or revised AHAs are prepared by TtEC. These revisions or new AHAs will be submitted to the PESM and the client representative for review.

3.11.02 Each worker performing tasks described in an AHA must receive training in the AHA and be allowed to make comments and suggestions regarding the AHA to ensure that all hazards are properly identified and that control measures are in place to mitigate these hazards.

3.12 Policies Regarding Noncompliance

3.12.01 TtEC has a discipline program that is discussed in all new employee orientations and is also written in the TtEC Project Orientation, Rules and Safety Guidelines Handbook (TtEC 2009), a booklet that is given to every company employee. Briefly, the rules implement a progressive disciplinary program. However, if at any time there is a significant compromise of safety procedures, immediate termination of an employee is allowed by the procedure. The SSHO will immediately report to the PjM and PESM observations of noncompliance in the performance of the subcontractor or workers.

3.13 Manager and Supervisor Accountability for Safety

3.13.01 TtEC EHS 1-1 of the Corporate Safety Program requires that:

> "Line Management, the Project Manager, and supervisors, ensure that all company activities are executed in accordance with TtEC EHS programs, procedures, and applicable regulations. Line managers have primary EHS responsibility and have EHS personnel support to help them fulfill this responsibility."

3.14 RECORDKEEPING

3.14.01 The following is a summary of required health and safety logs, reports, and recordkeeping.

3.14.1 Site Health and Safety Plan Changes

3.14.1.01 An FCR form will be completed and submitted for all changes to the APP. PESM approval is required of all FCRs that affect the site safety programs.

3.14.2 Medical and Training Records

3.14.2.01 Full medical and training records are normally kept by the employer. Proof of the most recent training and medical qualification must be provided to the SSHO by the employee. The SSHO will maintain a file containing appropriate training and medical qualifications for all site workers including subcontractors. Medical records will be maintained in accordance with 29 CFR 1910.20. The examining physician retains custody of the complete medical record. Employee records include only the physician statement of medical qualification for duty and the employee's fitness to wear a respirator.

3.14.3 On-Site Log

3.14.3.01 A log of personnel (including job title, level of protection, and work location) will be kept on-site each day by the SSHO or designee. Originals will be kept in the project file.

3.14.4 Exposure Records

3.14.4.01 Personal monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.20. For TtEC employees, the originals will be sent to the records coordinator. For subcontractor employees, the originals will be sent to the subcontractor employer and a copy will be kept in the project file.

3.14.5 Accident/Incident Reports

3.14.5.01 A TtEC accident/incident report must be completed following any event involving emergency first aid, lost time, or property damage. The originals will be sent to the TtEC records coordinator for maintenance and distribution by TtEC. Copies will be distributed to the PESM, Project Superintendent, and subcontractor employees, if appropriate. A copy of the completed forms will be kept in the project file.

3.14.6 OSHA Form 300

3.14.6.01 An OSHA Form 300 (Log of Occupational Injuries and Illnesses) will be kept at the project site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the TtEC records coordinator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA Form 300. The TtEC accident/incident report meets the requirements of the OSHA Form 301 (Supplemental Record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses.

3.14.7 Health and Safety Field Logbooks

3.14.7.01 The SSHO will maintain the daily logbook at the site. Logbooks will be used to document important events as they occur. Some general procedures will pertain to the use of all logbooks. The following information will be recorded on each page of all logbooks:

- Initials of persons making entry
- Date
- Time of each entry (military time)
- Location

3.14.7.02 The logbook will be signed at the end of each day or work shift. All entries will be made in black ink. No pages will be removed from the logbook and each page will be numbered. Corrections will be made with a single line through the entry, and initialed.

3.14.7.03 The logbook will be used to record daily site conditions and activities within the exclusion zones. The logbook will contain the following items:

- Names and job titles of personnel in the work group
- Level of protection
- Health and safety monitoring equipment used
- Weather conditions
- Work/rest schedule (if appropriate)
- A description of the activities as they are occurring
- Any pertinent health and safety observations
- Sample number (if appropriate)

3.14.7.04 Copies of the logbooks will be submitted to the Project Superintendent as necessary. The original logbooks will become part of the exposure records file and will be maintained by the TtEC records coordinator.

3.14.8 Material Safety Data Sheets

3.14.8.01 The SSHO will maintain an MSDS on file at the project site for each hazardous chemical that is on-site. An MSDS for each contaminant also will be maintained on file.

3.14.9 Closeout Safety Report

3.14.9.01 A final closeout safety report will be provided to the PESM summarizing the safety performance achieved during the site work. Specific elements of the report will include the following:

- A description of significant events, exposures, accidents, illnesses, and actions taken to prevent their occurrence.
- A summary of monitoring results including air, noise, radiation, and heat stress samples.
- A description of any state or federal inspections involving the health and safety of site workers.

3.14.10 Training Records

3.14.10.01 Training records will be maintained in accordance with EHS 1-9, Recordkeeping.

4.0 SUBCONTRACTORS AND SUPPLIERS

4.1 IDENTIFICATION OF SUBCONTRACTORS AND SUPPLIERS

4.1.01 The principal subcontractor for the EBS at Culebra Water Ranges, Culebra, Puerto Rico, is:

- Surveying – Luis Berrios Surveying

4.1.02 Subcontractors and suppliers anticipated during the course of the project include:

- Equipment and Boat Rental – Out to bid
- Lodging/Office Space Rental – Out to bid

4.2 MEANS FOR CONTROLLING AND COORDINATING SUBCONTRACTORS

4.2.01 TtEC directs the subcontractor's supervisor regarding the tasks to be performed and the manner in which the tasks are performed. Subcontractors are responsible for assigning specific tasks to their employees; ensuring that their employees are properly trained and are in compliance with applicable regulations; and allocating sufficient time, materials, and equipment to safely complete activities in accordance with this APP and their individual health and safety plans.

4.3 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS AND SUPPLIERS

4.3.01 This APP recognizes that projects such as this require that subcontractors and suppliers become involved during the course of the project. All subcontractors are responsible for compliance with this APP and other applicable regulations. Subcontractor personnel must receive a briefing from the SSHO prior to unescorted access to the project site. They must fulfill the requirements established by this plan. They must acknowledge receipt of the plan and the hazard communication briefing. On-site subcontractors are responsible for providing their personnel with appropriate PPE as specified by the plan. Subcontractor and third-party personnel have the authority to request a work area hazard assessment by the SSHO prior to the commencement or continuation of work. Any member of the work party observing an imminent safety hazard or potentially dangerous situation will immediately suspend field activities.

4.3.02 Most subcontractors have their own health and safety plans and/or company policies that are specific to their specialty services. TtEC management is responsible for making sure that subcontractor employees follow the policies and procedures of TtEC and the APP. If subcontractor safety plans are more restrictive, the subcontractor supervisors must ensure that their safety plans are also followed.

4.3.03 Hazards not listed in this APP but known by the subcontractor, or known to be associated with a subcontractor's specialty, must be identified by and addressed in the subcontractor's health and safety plan and during the daily tailgate meeting prior to beginning work. The subcontractor will inform the SSHO and the PjM. The subcontractors will also develop AHAs for review by the SSHO and the PESM or they will coordinate the completion of AHAs with the SSHO for subsequent review by the PESM.

5.0 TRAINING

5.01 The EBS portion of this project covered by this APP is not subject to the rules and regulations of 29 CFR 1910.120 (hazardous waste operations and emergency response). Although personnel on the project may have this training, and it will be applicable for tasks performed during the RI, it is not required or addressed in this APP. All new TtEC employees receive new employee training as required by corporate Human Resources and as specified in the Project Orientation, Rules and Safety Guidelines Handbook. Other training required on this project includes the following. Table 5-1 presents a summary of the required training.

Table 5-1. Training Summary

Personnel	Requirements
All General Site Workers	Site-specific orientation training.
Project FOL	First aid/CPR training in addition to General Site Worker training.
Site Safety and Health Officer	First aid/CPR training and General Site Worker training plus OSHA's 30-hour Construction Safety course.
Snorkelers	Nationally recognized open water diving certification (e.g., PADI, NAUI, etc.) or skin diver/snorkeler certification. First aid/CPR training.
Boat Operator	Boating safety course meeting the criteria of the U.S. Coast Guard Auxiliary, National Association of Safe Boating Law Administrators or equivalent, and motorboat handling training, based on the type of boats they will operate.
Boat Occupants	Safety briefing on boat operations and boat safety and emergency equipment, man overboard and abandon ship procedures.
Two workers, in addition to SSHO and Project Supervisors	First aid/CPR and Bloodborne Pathogens.
Users of portable fire extinguishers	OSHA-compliant fire extinguisher education [29 CFR 1910.157(g)].
Users of personal hearing protection and those enrolled in hearing conservation program	OSHA hearing conservation program and hearing protector use training [29 CFR 1910.95(i),(k)].

5.1 UNEXPLODED ORDNANCE AWARENESS TRAINING

5.1.01 There is no intrusive work and there is no handling or identification of munitions and explosives of concern (MEC), including UXO allowed during the EBS. The MRSs that are the subject of this EBS and subsequent RI/FS may contain MEC items. Personnel working on this EBS in the field will have UXO awareness training as part of the site orientation training with review of this APP.

5.1.02 The term MEC, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, includes UXO, as defined in 10 United States Code (USC) 101(e)(5); discarded military munitions (DMM), as defined in 10 USC 2710(e)(2); or munitions constituents (MC) (e.g., trinitrotoluene, Royal Demolition Explosive), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard. UXO are military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard; and remain unexploded whether by malfunction or design.

5.1.03 Munitions have the potential to kill or cause serious injury if improperly handled. UXO is the most dangerous form of MEC, as these items have been fired and did not detonate as planned, therefore, poses a higher risk of detonation. UXO is the form of MEC that is anticipated to be found at the Culebra Water Ranges based on prior use history.

5.1.04 Do not touch or attempt to identify any items during the survey. There is no intrusive activity allowed during the EBS. The RI will include intrusive activities using trained and qualified UXO technicians and established procedures for the identification and handling of MEC.

5.1.1 MEC History at Culebra

5.1.1.01 The Culebra Island Archipelago (including the Northwest Peninsula of Culebra and the two water range MRSs) was used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The southern portion of the Northwest Peninsula of Culebra lies between the two water range MRSs. This peninsula was used as a target for aerial bombing, aerial rockets, strafing, and naval gunfire from roughly 1941 until 1975. Most of the gunfire was indicated to have been fired from ships in the water east of the peninsula and directed at targets on its eastern beach and ridges and plateaus. The planned targets included white painted drums, Sherman tanks, trucks, panels, and circular targets painted on the ground. A movable cable target system also was constructed in this area and used for a short time.

5.1.1.02 The areas between the ridges on the peninsula were used as impact areas for conventional and napalm-laden bombs. Landing practice operations also took place on the beach areas of Flamenco Bay. Some of these exercises were accompanied by the firing of illuminating flares and white phosphorus rounds. Floating target structures may also have been towed off-shore into Flamenco Bay or the waters of Luis Peña Channel and used for training. Most of the munitions discovered to date on the Northwest Peninsula appear to have resulted from naval gunfire, illumination flares, and practice bombs. Since relatively flat trajectory projectiles were typically fired from the ships, it appears unlikely that many rounds fired from the northeast would have impacted on the western slope of the peninsula ridge. However, there may have been overshoots resulting in MEC landing in the Luis Peña Channel.

5.2 SNORKELER TRAINING AND CERTIFICATION

5.2.01 All snorkelers, including snorkeling observers and assistants, will be certified as skin divers (snorkelers) or will be open water certified divers, trained and certified by a nationally-recognized organization.

5.2.02 In addition, all snorkelers will be determined to be medically fit by a licensed physician on an annual basis and the certification records shall be on-site. All snorkeling team members are certified in CPR and first aid.

5.3 BOAT OPERATOR TRAINING AND CERTIFICATION

5.3.01 Boats used for the EBS will be operated by experienced crewmembers who have successfully completed a boating safety course meeting the criteria of the U.S. Coast Guard Auxiliary, National Association of Safe Boating Law Administrators or equivalent, and motorboat handling training, based on the type of boats they will operate, provided by qualified instructors. Boat operations will comply with TtEC's Boating Safety Procedure, EHS 6-6, and U.S. Coast Guard regulations.

5.4 SITE-SPECIFIC TRAINING

5.4.01 Prior to commencement of field activities, the SSHO will provide site-specific training to all personnel assigned to the site; this training will address the activities, procedures, monitoring, and equipment for the site operations. Training will include site and base layout, hazards, emergency response actions including: evacuation route(s), emergency services at the site, the hazard communication program, and will highlight all provisions contained within this APP. Boater safety training will be given to all persons riding in boats used on this project. This training will also allow field-workers to clarify anything they do not understand and will reinforce each individual's responsibilities regarding safety and health for their particular activity. If additional training is required for completion of field tasks during site work, the PESM or SSHO will either conduct the training or manage site personnel to ensure that tasks are conducted by appropriately trained personnel.

5.5 ON-SITE SAFETY BRIEFINGS

5.5.01 Project personnel and visitors will participate in daily on-site health and safety briefings conducted by the SSHO, or designee, to assist site personnel in safely conducting their work activities. Safety briefings will be conducted at the start of new work activities using AHAs, which are provided in Attachment A. The briefings will include information on new operations, changes in work practices, or changes in the site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements, and identify performance deficiencies related to safety during daily activities or as a result of safety inspections, and review any events (such as near misses, injuries, or material release). Work will be stopped and a safety briefing will be conducted following any event that could compromise the safety of personnel or the environment.

5.6 FIRST AID AND CPR

5.6.01 The SSHO will identify those individuals who have completed current first aid and CPR training. At a minimum, two persons including the SSHO will be current in CPR/first aid and all snorkelers and their attendants will be first aid/CPR trained. The names of all CPR/first aid qualified workers will be posted on the site bulletin board and will be added to this APP when the project starts.

5.6.02 A first aid kit meeting the requirements of EM 385-1-1, Section 03.B.01 (USACE 2008), will be readily available at each work site by having the kit out and ready for use. The location of each first aid kit must be clearly marked, and kits will be protected from the weather and maintained clean. The kit must contain all the items listed in Table 3-1 of the EM 385-1-1 manual and include one pocket mouthpiece or CPR barrier and latex gloves. The kit will be inspected weekly, and items will be replaced as they are used. Personnel trained in first aid and CPR will also have training in bloodborne pathogens and the protective measures to be used when providing CPR and first aid.

5.6.03 MSDSs will be maintained on file in field office for each chemical product used on the project. These MSDSs will be made available to each employee on request. The content of the MSDS will be discussed with the employee before they begin work. Workers who may be exposed to hazardous chemicals will be trained to recognize chemical contact hazards in the workplace, the physical properties and health hazards of hazardous chemicals, and the personal protective measures that will be taken to control exposures.

6.0 SAFETY AND HEALTH INSPECTIONS

6.01 EHS 3-3, EHS Inspections, describes various inspection programs within TtEC. The procedure employs the use of checklists and requires daily, weekly, monthly, and quarterly inspections. Weekly inspections and the monthly inspection are documented on a form that is part of EHS 3-3. Equipment will be inspected prior to use to ensure that it is in proper working order.

6.02 Daily inspections and any deficiencies are noted on a deficiencies log as required by EM 385-1-1, Section 01.A.12d. The weekly inspection is conducted by the FOL or SSHO and the monthly inspection is performed by the PjM. The inspections are tracked for follow-up action on each of the respective forms. The monthly inspection is submitted to the PESM (a CIH) for review and follow-up. The PESM may conduct unannounced inspections at any time and will conduct the quarterly inspections. The PESM submits the quarterly inspection report to the SSHO, PjM, Program Manager, and the TtEC Vice President, Environmental Safety and Quality Programs.

6.1 BOAT/VESSEL INSPECTIONS

6.1.01 A small boat inspection checklist for use by boat crews is provided in Attachment C. Vessel inspections will be conducted by the SSHO initially for each boat brought to the jobsite and periodically thereafter throughout the duration of the project though the boat operator is responsible for pre-launch checks to ensure the boat is equipped with all required safety equipment and is in condition for launch.

6.2 RECEIPT INSPECTION FOR HEAVY EQUIPMENT

6.2.01 Construction equipment, if used during the EBS, will be subject to a receipt inspection by a TtEC person experienced in heavy equipment operations prior to acceptance at the project site. The inspections and tests will be in accordance with the manufacturer’s recommendations. Most vendors provide a form for notation of any existing damage to the equipment to be filled out on receipt. The equipment should be inspected carefully to determine its condition, including any damage, missing or nonfunctional equipment. Pictures of any damage shall be taken and saved in the equipment file.

6.2.02 The agreement should be used as a basis to determine that everything contracted for (e.g., the equipment, its condition, manuals, spares, documentation of inspections, and certifications) has been delivered. All discrepancies should be noted on the form. A pre-inspection of the equipment prior to transport to the project site will be conducted. Particular attention should be given to the following items:

- All safety equipment and its condition.
- Operator certification on the equipment, when provided.
- Posted operating and safety instructions are present.

- All pollution control devices and their condition.
- All safety locking mechanisms and back up alarms.
- Safe entry and egress, with steps, ladders, handholds, and platforms provided as required, including safe access to perform routine checks, maintenance, and refueling operations.
- Leaking fluids, such as hydraulic oil, engine oil, transmission fluid, and coolant.
- Deteriorated or cracked hydraulic and coolant hoses which could result in leaks or spills.
- Presence of the manufacturer operation and maintenance manual.

6.2.03 Equipment with deficient conditions relating to safety or protection of the environment will not be placed into service until the deficiencies have been corrected and documented.

6.3 DAILY HEAVY EQUIPMENT INSPECTIONS

6.3.01 All heavy equipment will be subject to a daily (when in use) inspection for safety and operability, including manufacturers recommend daily inspections by the FOL. The SSHO will be notified of any deficiency immediately. The daily equipment inspection will be conducted at the start of the shift and provided to the SSHO.

6.4 VEHICLE INSPECTIONS

6.4.01 Site vehicles will be subjected to a daily inspection for safety and operability. The inspection will include all safety related items such as windshield wipers, seat belts, tires, steering and brakes.

6.5 COMMUNICATION EQUIPMENT

6.5.01 Cellular telephones and field radios will be tested each morning to ensure that batteries are properly charged and these units are functioning. It will be essential to verify that communication lines across the site and with emergency service providers is available at all times.

6.6 SNORKEL EQUIPMENT

6.6.01 Snorkel equipment such as mask, fins, snorkel, harness, and tether lines will be inspected before use each day. A snorkeling equipment inspection checklist is included in Attachment C of the SSP (Appendix F of the Work Plan).

6.7 TOOLS

6.7.01 Power and hand tools will be inspected before use by the user. Any worn or damaged tools will be taken out of service for repair or replacement.

7.0 ACCIDENT REPORTING

7.01 7.02 EHS 1-7, Event Reporting and Investigation, details the procedures and the forms used by TtEC for investigations and reports. All personnel working on site are expected to participate in the event reporting and notification process and to notify their supervisor of all incidents, including near misses. When an incident occurs, the site FOL will verbally notify the PjM immediately. The PjM must notify the Program Manager. The SSHO will notify the PESM.

7.03 After the verbal report, the FOL or SSHO must complete a written TtEC event report form within 24 hours. This form can be either prepared manually using the form found in the company procedure or the form can be completed electronically using a corporate TtEC database. Within 72 hours, a completed investigation report must be submitted. The investigation report is part of the initial written report form. These forms can be completed by persons involved in the incident, except that the investigation must be completed by a supervisor and/or the SSHO. All reports are reviewed by the PjM and the PESM upon submission. Within the reporting system, corrective actions and persons responsible for those corrective actions are identified. Corrective actions will be implemented as soon as reasonably practical. The system requires follow-up to ensure completion of corrective actions.

7.04 In accordance with DID WERS-005.01, the USAESCH Contracting Officer will be notified as soon as possible via telephone of any serious mishaps that occur at a given jobsite and a follow-up ENG Form 3394 Incident Report (see Attachment C) being sent to their office within 5 days of the event. A serious mishap is considered an accidents/incident which results in a fatality, injury of employees, lost workdays, and/or property damage assessed at a cost of $2,000 or more. The contracting officer must also be notified immediately if any incident could bring adverse attention or publicity to the U.S. Army Corps of Engineers.

7.05 For all reportable injuries (fatality or one or more employee hospitalizations), OSHA will be notified by the PESM within 8 hours of the incident.

7.06 All recordable injuries, near miss incidents, high loss potential incidents, property damage incidents costing more than $500, first aid cases, and environmental spills (greater than reportable quantity) will be noted on TtEC's Program Incident Database. This database summarizes the accident/incident history of the program from the start of the contract and on a year-to-date basis.

8.0 PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL (AS APPLICABLE)

8.01 TtEC has established written corporate requirements for compliance with regulations and implementing TtEC policy to prevent accidents and injuries. This section describes how some of these programs are implemented specifically for this project.

8.1 LAYOUT PLANS

8.1.01 This project will utilize a temporary office facility during fieldwork. Equipment storage and parking for site vehicles will be provided at the office location. Boats will be launched from a public or privately secured launch and dock facility.

8.1.02 It is not anticipated that any rights of entry or access agreements be secured for work on this project.

8.2 EMERGENCY RESPONSE PLANS

8.2.01 Emergency response has been planned for potential injuries or medical emergencies, explosions and fires, severe weather, man overboard or abandon ship situations, earthquakes, and spills. The Emergency Response Plan for this project is contained within this section of the APP. Emergency response procedures specific to scientific snorkeling activities are included in the SSP. Both emergency plans will be available and reviewed during snorkeling activities because the APP Emergency Response Plan includes additional requirements.

8.2.1 Procedures and Tests

8.2.1.01 On this project, the SSHO is the primary Emergency Coordinator (EC) and the boat operator is the alternate EC. In the event of an emergency situation such as fire or explosion, the SSHO or boat operator will activate an air horn for approximately 15 seconds indicating the initiation of evacuation procedures. All personnel will assemble in a safe area identified by the SSHO. For the EBS, the immediate assembly area will be one of two boats involved in the survey tasks, depending on whether or not the boat is involved in the fire or explosion. The location of the assembly area should be upwind of the fire or explosion. The assembly area will be used to account for all personnel and assess if anyone is missing. As soon as possible, and while the safety of all personnel is confirmed, emergency agency notification will commence. Following assembly, the boats will proceed to the dock and assemble in the evacuation area. The evacuation area(s) and routes from the evacuation area for each of the two MRSs are shown in Figures 8-1 and 8-2.

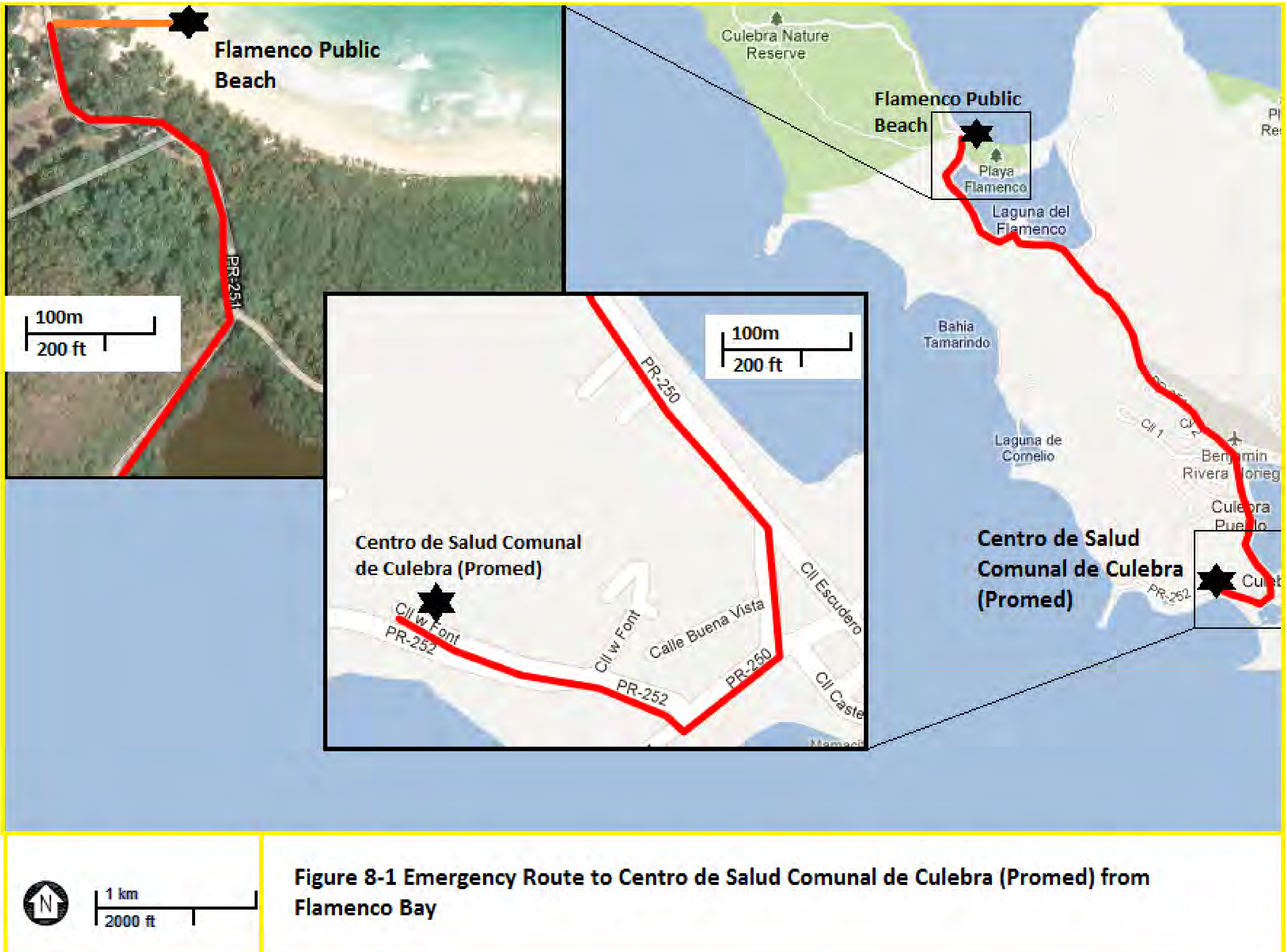


Figure 8-1 Emergency Route to Centro de Salud Comunal de Culebra (Promed) from Flamenco Bay

Figure 8-2 Emergency Route to Centro de Salud Comunal de Culebra (Promed) from Luis Pena Channel

8.2.1.02 For efficient and safe site evacuation and assessment of the emergency situation, the FOL or SSHO will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSHO must ensure that access is provided for emergency equipment and that equipment that may cause combustion has been shut down once the alarm has been sounded.

8.2.1.03 Before starting work, the SSHO will establish safe egress routes from the work location at each site to the site evacuation area. From this point, the map showing the route to the nearest clinic and hospitals (Figures 8-1 and 8-2) will be used if medical services are required.

8.2.1.04 An evacuation exercise will be practiced within 1 week of the start of the project and randomly during the course of the project. After the practice drill or after any actual evacuation, all involved site personnel will attend a briefing to evaluate the evacuation. The employees will discuss the evacuation and anything that could be done to improve or change future evacuations. The results of this briefing will be documented on a safety meeting attendance form. A copy of the evaluation report will be sent to the PESM.

8.2.2 Spill Plans

8.2.2.1 Spill Prevention

8.2.2.1.01 The project should not involve the handling of large containers of hazardous materials, however gasoline and oil are used on the boats and a spill or leak could occur. In addition to training, the following procedures will be implemented to prevent and minimize releases of hazardous materials:

- Do not conduct hazardous materials operations when the weather could cause significant risk to the surrounding area if a spill should occur.
- Pre-launch checks will be done before the boat is backed into the water and includes checking the engine oil and/or fuel mixtures in the tanks.
- Any mixing of fuel and oil will be done in a separate UL approved flammable liquid storage container prior to filling the vessel tanks. This will ensure the gas/oil mixture is correct.
- Whenever possible, perform fuel mixing and transfer in an environmentally safe area where spills can be easily cleaned.
- Transfer all materials in or over a bermed or “protected” area. A protected area is one that is covered with an impermeable material, such as polyethylene.
- Perform preventative maintenance on construction equipment and boats to minimize chances for hose and other equipment failure.

- Follow good housekeeping operations and store hazardous materials in authorized storage areas.
- Use only UL-listed, OSHA-approved metal cans for portable gasoline storage containers.
- Keep hazardous material containers closed when not in use.

8.2.2.1.02 Maintain a supply of basic spill response materials and protective equipment on-site to include:

- Absorbent sheets, pillows, booms, or absorbent material
- Open-top 55-gallon drums or other appropriate containers with lids
- Brooms, shovels, and other tools, such as squeegees

8.2.2.2 Spill Response

8.2.2.2.01 All spills, leaks, and fires involving oil or hazardous substances must be reported to the PjM and the PESM as well as the USAESCH Project Manager. The person reporting the leak or spill is required to provide the following information:

- His/her name
- Location of spill and facility number, if known
- Number of injured personnel and nature of injuries, if known
- Substance spilled
- Estimated amount spilled
- Extent of spill
- Estimated rate at which the substance is currently being released
- Estimated time the spill occurred
- Any other pertinent information

8.2.2.2.02 The USAESCH Project Manager, in coordination with the PjM, will manage notifications to regulatory agencies. In addition, all spills will be reported to the PESM. Project personnel will not report spills directly to any agency unless specifically requested by the client representative or the Contracting Officer. Minor and major spill procedures are outlined below.

8.2.2.23 Minor Spill Procedure

8.2.2.2.04 A minor spill would involve no immediate threat to human health or the environment (e.g., not cause sheen or discoloration on the water), cause minimal property damage, and not exceed the reportable quantity for that material. In the event of a minor spill, the appropriate response action is for the responsible person to notify the client and the PjM and supply the responders with as much information as possible. In the case of a spill of contaminated or hazardous materials, the following procedures will be followed:

- Notify the FOL, the PjM, and the PESM.
- Identify protective clothing or equipment required to respond.
- Contain the spill.
- Neutralize and/or solidify any product.
- Transfer material into appropriate waste containers as directed by the FOL or PjM. Transfer the waste to the appropriate storage area for management and disposal at the direction of the FOL or PjM.
- Document the incident.

8.2.2.25 Major Spill Procedure

8.2.2.2.06 In the event of a major spill where human health and/or the environment is at risk (e.g., spill is to a surface water, persons are injured, there is a risk of fire or explosion from the materials, material spilled is not known, the spilled material is more than can be reasonably handled with on hand resources in a few minutes time, or spills that have or are likely to enter a storm drain or other conveyance), the following procedures shall be followed.

- A spill to surface water may not constitute an emergency; however any spill to surface water is reportable and is to be treated as an emergency.
- Isolate the spill area, shut down equipment if safe to do so, and evacuate upwind.
- Keep others from entry into the area.
- If anyone is injured, at risk, or there is a fire or explosion, call 911.
- Notify the FOL and SSHO.
- SSHO or FOL will immediately notify the PjM, PESM, and client and relay pertinent information.
- If source of spill is not unknown and other hazards are not likely to exist (e.g., fires, exposures, or explosions), assess extent of spill and identify potential pathways of dispersion. Cover or isolate these pathways in advance of the spill, if feasible, but only if exposures can be avoided.
- Note type, amount, and location of material released. Provide MSDSs for response personnel.

8.2.3 Firefighting Plan

8.2.3.01 Motor boats or skiffs over 26 feet will have a minimum of two 1-A:10BC fire extinguisher available. Larger craft will have additional requirements. Each fire extinguisher shall be inspected by the SSHO at least once every week to ensure that it is sufficiently charged and that the nozzles are free and clear. Discharged fire extinguishers shall be replaced or recharged immediately. The number and sizes of extinguishers required will depend on the vessel size and applicable regulations.

8.2.3.02 Workers will not fight any fires other than incipient stage fires and personnel will be trained in the use and limitations of fire extinguishers. The fire extinguishers are intended to fight only fires that have recently occurred and can reasonably be extinguished immediately. In no case will workers attempt to fight any fire that cannot reasonably be extinguished within 30 seconds to 1 minute (the fire extinguishers have only enough agent for small fires).

8.2.3.03 Prior to fighting any fire or during the course of fighting a fire, the Municipality of Culebra Fire Department will be called. Always summon help immediately if a fire on board a boat occurs. Fire prevention planning is addressed in Section 8.17 of this APP.

The following describe procedures for fighting small and large fires.

8.2.3.1 Small Fire Procedure

8.2.3.1.01 In the event of a small fire (one that can be extinguished with the available portable fire extinguisher (20 pound), the following will occur:

- Evacuate nonessential personnel upwind of the fire (on open deck), designate a person to contact 911 to get fire services enroute;
- If onboard a boat during a fire, designate a person to signal the support boat so it can come alongside or nearby to retrieve personnel if the abandon ship order (Section 8.2.5) is given;
- Ensure person with extinguisher has an escape route in the event the fire does not extinguish;
- Extinguish the fire by aiming the extinguisher nozzle at the base of the fire, pull the pin, depress the handle, and sweep the nozzle side to side in a fluid motion at the base of the fire;
- Remain at the location, contact SSHO and PjM, and meet emergency services to ensure the fire is out.

8.2.3.2 Large Fire Procedure

8.2.3.2.01 In the event of a large fire (one that cannot be extinguished with the available portable fire extinguisher (20 pound), the following will occur:

- Evacuate nonessential personnel upwind of the fire (on open deck) and designate a person to contact 911 to get fire services enroute – with large fires on a boat, it may be prudent to make the call to abandon ship as the immediate action and have the support boat call for emergency services;

- If onboard a boat during a fire, designate a person to signal the support boat so it can come alongside or nearby to retrieve personnel if the abandon ship (Section 8.2.5) order is given;
- Get personnel to a safe location upwind. If on a boat, evacuate to at least 200 feet away from the boat involved in the fire and upwind;
- Advise the fire department as required; and
- Notify SSHO and PjM.

8.2.3.3 Explosion Procedure

8.2.3.3.01 In the event of an explosion, immediately evacuate the area to an upwind location and call emergency services (911). If the explosion occurs on a boat, the boat operator may make an abandon ship call. The support boat should be deployed to a safe distance (200 feet minimum) from the boat involved in the explosion and if any persons are in the water, prepare to rescue persons in the water. If persons are injured, attempt to assist them out of the area to a safe location before rendering first aid if you can safely do so. If the explosion occurs on a boat, follow the direction of the boat operator for abandoning ship (see Section 8.2.5).

8.2.4 Posting of Emergency Telephone Numbers

8.2.4.01 Table 8-1 shows emergency contact numbers. This table is placed on clipboards, which are then placed on the dashboard of every vehicle used by the workers and on every boat. Also on this clipboard will be a map (see Figures 8-1 and 8-2) showing egress routes from the work site area to the evacuation area and routes to the local medical facility.

8.2.5 Man Overboard/Abandon Ship

8.2.5.01 Prior to the start of field activities, the boat operator and SSHO will give a detailed health and safety briefing on the location and use of all vessel safety equipment and the procedures for addressing on-board emergencies (i.e., fire or explosion onboard, mechanical failure, man overboard situation, abandon ship, etc.) and a man overboard/abandon ship drill will be rehearsed. The buddy system is to be used onboard boats so that man overboard retrieval can be performed expediently in the event a person goes into the water.

8.2.5.02 All boats will meet U.S. Coast Guard license and registration requirements and be equipped to safely support maximum rated crew and passenger sizes. Information on the types and configuration of boats used on this project is included in the Work Plan. The maximum number of passengers and weight shall be conspicuously posted on each vessel. The number of passengers shall not exceed the number of personal flotation devices (PFDs). Each boat shall have sufficient room, freeboard, and stability to safely carry cargo and the number of persons allowed with consideration given to the weather and water conditions in which it will be operated. Boats shall be equipped with kill switches and shall meet 33 CFR 183, which requires level flotation after flooding or swamping.

Table 8-1. Emergency Contact Information

Contact	Firm or Agency	Telephone Number
Culebra Police Department	Municipality of Culebra Police	**Emergency 911** (787) 742-3501/0106
Culebra Fire Department	Municipality of Culebra Fire Department	**Emergency 911** (787) 742-3530
Local Emergency Hospital and Ambulance Services	Promed Medical Center, Culebra, Puerto Rico	**Emergency 911** (787) 742-3511
Advanced Care Emergency Hospital	San Pablo del Este Hospital Fajardo, Puerto Rico	**(787) 740-0333 (emergency)** (787) 863-0505 (main)
Coast Guard	Duty Officer	(787) 729-2301
Coast Guard 24-hour Emergency Number	Rescue Coordination Center, San Juan, Puerto Rico	(787) 289-2042
Puerto Rico Department of Natural Resources Conservation Rangers	Cuerpo de Vigilantes	(787) 742-0720
USACE Project Manager , Thomas Freeman III	CESAJ	(904) 232-1040 (main) (314) 625-8256 (cell)
USACE Project Manager, Roland Belew	USAESCH	(256) 895-9525 (main) (256) 503-0661 (cell)
USACE Designated Dive Coordinator, John Houvener	USACE, Baltimore District	USACE Designated Dive Coordinator, John Houvener
WorkCare	Occupational Medicine Contact	1-800-455-6155
Program Manager, Kent Weingardt	TtEC	(619) 471-3532
Project Manager, Scot Wilson	TtEC	(360) 598-8111 (360) 626-3193 (cell)
Geophysics Lead, Robert Feldpausch	TtEC	(425) 482-7862 (main) (425) 503-2468 (cell)
CIH/PESM, Roger Margotto	TtEC	(619) 988-0520 (cell)
Diving Safety Manager, Steve Neill	TtEC	(804) 642-0202 (770) 330-7068 (cell)
Field Operations Lead/Alternate Emergency Coordinator, Richard Funk, PG	TtEC	(425) 482-7629 (main) (973) 216-9296 (cell)
Field Investigation Coordinator Fernando Pagés Rangel	TtEC	(626) 688-1017 (main) (787) 791-0803 (alternate)
SSHO/Primary Emergency Coordinator and Boat Operator, Lou Schwartz	TtEC	(425) 877-3589 (cell) Marine Radio Channel 16
Project Biologist, Edwin Hernandez-Delgado, PhD	TtEC	TBD
National Poison Control Center	National Poison Control Center	(800) 222-1222
CHEMTREC	CHEMTREC	(800) 424-9300
National Response Center	National Response Center	(800) 424-8802

8.2.5.03 Personnel working from small boats or skiffs, on structures or equipment extending over or next to the water (except where guard rails or personal fall protection systems are provided), or whenever there is a drowning hazard, will wear an inherently buoyant Type II or higher (capable of turning its wearer in a vertical or slightly backward position in the water). Automatic inflating PFDs can be used providing that they are approved in the APP, an AHA addresses its use, the PFD is not used by persons less than 90 pounds, and it is inspected, maintained, and stored in accordance with the manufacturer's instruction. In addition, each boat (those less than and up to 26 feet and those over 26 feet and less than 65 feet in length), in accordance with EM 385 1-1 Section 05.J.06 and TtEC Boating Procedure EHS 6-6, shall be equipped with at least one Type IV PFD, ring buoy, 24 inches in diameter with 90 feet of buoyant line attached, designed to be thrown to a person in the water and grasped and held by the user until rescued. A buoyant boat cushion equipped with straps or float rings are two common examples of additional types of life rings that can qualify as a Type IV PFD and help in a rescue.

8.2.5.04 PFDs will be of an international orange (or orange/red) or ANSI 107 yellow-green color. PFDs shall have an attached whistle and emergency light or other suitable device in the event of a man overboard. During evening operations (not currently planned), the PFDs will be equipped with flashing beacons.

8.2.5.05 In addition, each boat will have at least one sound signaling device (air horn), U.S. Coast Guard compliant navigation lights, visual distress signals (pyrotechnic and non-pyrotechnic), and at least one vessel-mounted or hand-held radio to communicate with shore-based support facilities and other vessels operating nearby. Each boat less than 26 feet in length will have at least one 1-A:10-B:C fire extinguisher and each boat 26 feet in length or longer will have at least two1-A:10-B:C fire extinguishers. The boat operator will also look for and avoid other vessels operating in the area at all times. Boating operations will be suspended during severe weather or rough seas.

8.2.5.06 Other equipment required to be onboard boats on this project includes:

- A tool kit sufficient for the boat operator to troubleshoot common mechanical problems;
- Appropriate spare parts such as a propeller, spark plugs, shear pins, patch kits, air pumps, etc.);
- A backboard or Stokes litter equipped with flotation to assist an injured or unconscious person out of the water or evacuate an injured person in areas where there are no roads or vehicle accessibility (e.g., snorkeling team performing in-water work or emergency where man overboard situation occurs);
- A survival kit containing some additional first aid equipment, high energy food, drinking water, blankets, heat source, signaling devices, waterproof matches, and other items necessary to ensure survival for a minimum of 24 hours for the entire crew; and
- TtEC personnel shall utilize the “one-third rule” in boating fuel management. Use one-third of the fuel to get to the destination, one-third to return, and keep one-third in reserve.

8.2.5.1 Man Overboard Procedure

8.2.5.1.01 In the event of a man overboard, the following will occur:

- The person who observes the man overboard shall shout out "man overboard" and what side of the boat (port or starboard);
- The person who goes overboard should shout out to those on the boat if it is not noticed that they are in the water or use the whistle on the PFD if present;
- Throw a life ring over the side as near as possible to the person in the water;
- Notify the boat operator as quickly as possible and make sure to keep track of the person in the water so they are not lost;
- Direct the boat operator to the direction of the person so that recovery can be made.

8.2.5.2 Abandon Ship Procedure

8.2.5.2.01 In the event an abandon ship order is issued, the following will occur:

- Follow the direction of the boat operator; who will direct personnel to the appropriate station onboard the vessel.
- Ensure PFD is securely fastened.
- Note the location of and distance to the nearest land and stay with your group until instructed to abandon ship.
- Deploy rescue raft (if equipped) on windward side of the boat and await orders to board.
- Boat operator or designated person will activate the ships emergency communication devices (marine distress call via radio, air horn, marine flares, etc.) as capable based on the nature of the emergency and will grab survival kit as applicable.
- Enter the water by the safest means. If ladder is present, use ladder to get into the water before jumping overboard.
- If the boat is on fire or there is risk of explosion, stay at least 200 yards from the boat.
- If raft is equipped, stay in raft and try to flag down a rescue boat and paddle toward shore. If the current tries to take you away from shore, try to paddle perpendicular to the current, toward areas where more land is visible or more boaters may be present.
- As a group, or if personnel are separated and in the water, remain calm. To conserve energy and reduce risk of hypothermia, float on your back with your knees bent toward your chest. If together as a group, huddle together.

8.2.6 Medical Support

8.2.6.01 The following contains information on procedures to follow for onsite and offsite medical support, including first aid and non-emergency and emergency care, location of medical support facilities and arrangements with medical care providers. Table 8-1 contains emergency contact information with names, addresses, and phone numbers. Figures 8-1 and 8-2 show emergency routes from each MRS to the local hospital on Culebra.

8.2.6.1 Medical Surveillance and Fitness for Duty

8.2.6.1.01 For the EBS, exposure to potentially hazardous substances is not expected to occur and participation in a 29 CFR 1910.120 compliant medical surveillance program is not required. Corporate Medical Surveillance Program requirements for new hires include a complete pre-employment physical and drug screen and employees on this project who will perform snorkeling activities will have evidence of annual medical clearance by a licensed physician and have a copy of their medical clearance on file at the site before they are allowed to participate in these activities.

8.2.6.1.02 Physician services for TtEC are provided by Work Care, 300 South Harbor Boulevard, Suite 600, Anaheim, CA 92805, (Phone: 1-800-455-6155). Actual employee medical exams are conducted by Work Care-affiliated clinics.

8.2.6.1.03 Employees will be given a medical data sheet to fill out during the site orientation training. The filled out sheets will be given to the SSHO. This sheet is voluntary; however, it is important, as it identifies each employee’s allergies, medications they are taking, and medical conditions that may be important in the event of an emergency where they are unable to communicate to medical providers. These sheets are kept confidential and are used in the event of an emergency situation, should it occur on the project.

8.2.6.1.04 In order to prepare for potential injuries during the field activities, the site staff shall familiarize themselves with the TtEC Zip Bulletin 108 titled “Improving Injured Worker Case Management.” This will be completed at the daily safety brief on the first day of activities prior to work or during a pre-job meeting.

8.2.6.2 First Aid

8.2.6.2.01 Only qualified personnel will provide first aid and stabilize an individual needing assistance. Life support techniques such as CPR and treatment of life-threatening problems such as airway obstruction and shock will be given top priority. At least two persons, including the FOL and SSHO, and all snorkelers/attendants will be certified in first aid techniques and CPR. EHS 4-1, Bloodborne Pathogens, will be followed when first aid/CPR are administered (information on bloodborne pathogens is included in Section 10. Professional medical assistance will be obtained at the earliest possible opportunity, even in first aid cases. Ensure that WorkCare® has been contacted at (800) 455-6155.

8.2.6.2.02 An industrial first aid kit will be available at the field office and on each boat. The kit must be filled as required by EM 385-1-1, Table 3-1 (USACE 2008). The kit will include a bloodborne pathogen kit.

8.2.6.3 On-Site Medical Support

8.2.6.3.01 In the event of an injury requiring first aid (non-emergency):

- Administer first aid if qualified; if not qualified, immediately seek out a person qualified to administer first aid.
- Notify the SSHO of the name of the individual involved, their location, and the nature of injury.
- Medical follow up and care with a clinic may be required for first aid incidents on a non-emergency basis. This will be determined through consultation with WorkCare by calling 1-800-455-6155. Non-emergency medical care, if needed, will be provided by the Promed Medical Center (Telephone: 787-742-3511).
- Notify the USAESCH PM, TtEC PM, and PESM, if not already notified.
- Complete the TtEC Incident Report and Investigation form and ENG Form 3394 as appropriate.

8.2.6.3.02 In the event of an emergency where first aid is being rendered, always notify 911 promptly.

8.2.6.4 Off-Site Medical Support

8.2.6.4.01 In the event of serious personal injury (fatality, patient unconscious, possibility of broken bones, severe bleeding that will not stop, severe burns, blood loss, shock, trauma, chest pain, difficulty breathing, seizure, electrocution, disorientation, suspected poisoning), the first responder shall immediately:

- Call 911 and give the appropriate patient information and their location.
- Administer first aid if qualified; if not qualified, immediately seek out a person qualified to administer first aid.
- Notify the SSHO of the name of the individual involved, their location, and the nature of injury.

8.2.6.4.02 Upon notification of a serious personal injury, the SSHO shall immediately:

- Notify Culebra Emergency Services at Promed Medical Center (911) if not done already and give the appropriate patient information and their location (depending on nature of injury, Promed Medical Center Emergency Services may call for Air Ambulance transport to an acute care facility;
- Assist the injured party as deemed appropriate;

- Provide a copy of the injured party’s medical data sheet to responding medical personnel;
- Designate someone to accompany the injured party to the hospital;
- Call WorkCare, (800) 455-6155;
- Notify the USAESCH PM, TtEC PM, and PESM, if not already notified; and
- Complete the TtEC Incident Report and Investigation form and ENG Form 3394 as appropriate.

8.2.6.4.03 Serious injuries occurring at the jobsite will be treated at or with coordination from the Culebra Promed Medical Center (Telephone: 787-742-3511). Serious trauma or medical emergencies may require the Promed Medical Center to arrange for airlift to the Fajardo or San Juan, Puerto Rico medical facilities or other specialized facilities as noted below. Route maps with directions to the Promed Medical Center from the project sites are provided in Figures 8-1 and 8-2.

8.2.6.4.04 Local ambulance service will be used to transport the injured worker to the hospital by calling 911. While worker is being transported to hospital, WorkCare will be contacted.

8.2.6.5 On-site – Culebra Community Medical Center

8.2.6.5.01 The Promed Medical Center (Telephone: 787-742-3511) is located at Calle William Font Final, Culebra, PR 00775. Figures 8-1 and 8-2 show emergency routes from each MRS to this hospital.

8.2.6.6 Off-site – Fajardo San Pablo del Este Hospital

8.2.6.6.01 The Fajardo medical facility, San Pablo del Este Hospital (Telephone: 787-863-0505) is located at General Valero Avenue # 404 in Fajardo, Puerto Rico.

8.3 PLAN FOR PREVENTION OF ALCOHOL AND DRUG ABUSE

8.3.01 TtEC has a Drug Free Workplace Program. All contractors and subcontractors on this project are subject to drug and alcohol testing at any time. Supervisors, managers, and the SSHO are to determine the fitness of their workers including whether their workers may be under the influence of any drugs or alcohol. This includes over-the-counter medications and prescription medications. At the beginning of the project, during the initial site orientation and training, all workers are reminded of the program and policies. The policy is also described in the Work Rules. Workers are encouraged to confidentially list their medications on a medical information form that is provided to them and retained by the SSHO. If a worker is involved in an accident or is injured, the worker(s) involved may be asked to be tested. If supervisors observe any worker who appears to be under the influence of drugs or alcohol, the supervisor may request testing of the worker.

8.4 SITE SANITATION PLAN

8.4.01 It is anticipated that the field office used for this project will have plumbing with working sinks and toilets as well as showering facilities. The main boat used for surveys will have an approved marine sanitation device that complies with U.S. Coast Guard requirements. This device will be pumped as necessary at an approved pump station and has a facility for washing hands. Workers will discard all food debris and other trash in a designated container onboard the boat. This container will be emptied at the end of each day in the trash bin at the TtEC field office.

8.5 ACCESS AND HAUL ROAD PLAN

8.5.01 No haul roads will be built for this project. The launching and operation of boats to access the work areas presents potential for injury to personnel. To minimize these hazards, the PjM and FOL will designate routes for access to and from launch areas and boat ramps and the boat operator will be responsible for establishing specific traffic patterns as required when on the water to minimize potential accidents involving other boats. Trucks and boat trailers will have spotters for backing maneuvers. Only qualified personnel will operate boats or back boat trailers.

8.5.02 If construction equipment is used, personnel needing to approach heavy equipment while it is operating will observe the following protocols:

- Make eye contact with the operator (and spotter);
- Signal the operator to cease heavy equipment activity and wait for operator to signal the okay to enter the area;
- Approach the equipment and inform the operator of intentions

8.5.03 TtEC personnel will follow all local traffic rules. Company vehicles will yield to bikes and pedestrians. Personnel working in areas subject to vehicular traffic (streets, parking lots, etc.) will wear high-visibility safety vests. Flashing lights or reflectorized barricades will be used for roads that are blocked due to equipment. Coordinate traffic management issues with the client.

8.6 RESPIRATORY PROTECTION PLAN

8.6.01 Use of respirators is not currently required for the EBS because there are no contaminants of concern and no inhalation exposure routes.

8.6.02 Potential dust generation will be controlled in part by practicing good housekeeping on boats and launch areas. Boat and boat ramps and docks will be kept reasonably free of accumulated soil if tracked onboard. At the end of shift, other areas where equipment on the boat deck will be washed down to the extent that gross material accumulations on equipment are not allowed to dry on the equipment.

8.7 HEALTH HAZARD CONTROL PROGRAM

8.7.01 Hazards on this project include physical and environmental hazards related to working on and in the water related to boating and snorkeling operations such as potential drowning or near drowning hazards, hypothermia and heat stress related illnesses, and severe weather. Other physical hazards include slips, trips, and falls, noise exposure, and struck by or pinch points related to equipment operation. Biological hazards include potential for contact with poisonous or dangerous marine life, stinging or biting insects or poisonous plants, and potential bloodborne pathogens if CPR or first aid is rendered. Chemical hazards include those presented by use of and refueling of boats with gasoline and engine oil. Chemical hazards are addressed through the project hazard communication program addressed in Sections 5.0 and 8.8.

8.7.02 This APP address mitigation and control of the site specific hazards anticipated on this project, which may be physical, chemical, environmental, and biological in nature. Those hazards not addressed specifically by EM 385 1-1, Appendix A – Plans, Section 8.0 are included in Section 10 of this APP and are incorporated into the AHAs and include:

- Physical Hazards **–** Slips, trips, and falls; noise; head and back injuries, electrical hazards; and illumination.
- Biological Hazards **–** Poisonous or dangerous animals and plants and bloodborne pathogens.

8.8 HAZARD COMMUNICATION PROGRAM

8.8.01 At the time of the preparation of this APP, the specific hazardous materials or chemicals that will be brought onto the project site are not fully known but are anticipated to be minimal, consisting mainly of gasoline and engine oil or lubricants used for boat operations and maintenance. When any material or chemical is brought onto the site, MSDSs will be provided to the SSHO. Materials that may be brought on-site include fuels and lubricants for equipment.

8.8.02 The SSHO will file the MSDSs in a notebook that will be available in the field office. The SSHO will review the MSDSs with the workers, and this training will be documented on the daily safety meeting form. All workers will have general hazard communication training that specifically requires that workers notify the SSHO when any new material is brought onto the site and how the program is managed on the site. The corporate program is used as a reference (EHS 4-2).

8.8.03 All containers will be labeled as to content and hazards of the material in the container.

8.9 PROCESS SAFETY MANAGEMENT PLAN

8.9.01 Not applicable.

8.10 LEAD ABATEMENT PLAN

8.10.01 Not applicable.

8.11 ASBESTOS ABATEMENT PLAN

8.11.01 Not applicable.

8.12 RADIATION SAFETY PROGRAM

8.12.01 Not applicable.

8.13 ABRASIVE BLASTING

8.13.01 Not applicable.

8.14 HEAT/COLD STRESS MONITORING PLAN

8.14.01 With the possible combination of ambient factors such as high air temperature, high humidity, low air movement, high radiant heat, and protective clothing (e.g., snorkel ensemble), the potential for heat stress is a concern. The potential exists for:

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

8.14.02 EHS 4-6 describes the heat stress management and prevention program. At 70 degrees Fahrenheit (°F) ambient temperature, the supervisor on-site will initiate the procedures in the program.

8.14.03 This information is discussed during a safety "tailgate" meeting before each workday where heat stress may be a factor. Workers are encouraged to increase consumption of water and electrolyte containing beverages such as Gatorade® during warm weather. Water and electrolyte containing beverages will be provided on-site and will be available for consumption during work breaks.

8.14.04 At a minimum, workers will break every 2 hours for 10- to 15-minute rest periods. In addition, workers are encouraged to take rests whenever they feel any adverse effects, especially those effects that may be heat related. The frequency of breaks may need to be increased upon worker recommendation or decision of the SSHO and a supervisor.

8.14.05 Heat stress monitoring is used to estimate workloads and establish work/rest times based on 1) Wet Bulb Globe Temperature (WBGT) instrumentation and calculations, 2) monitoring physiological conditions and adjusting work/rest periods, or 3) using personnel heat stress monitors.

8.14.06 Workers need to protect themselves from sunburn. Workers should wear clothing that protects them from the sun or otherwise wear a sunscreen lotion with a skin protection factor of 15 or greater. TtEC will provide sunscreen lotion to all workers. Use of a sunscreen lotion that is resistant to perspiration is preferred. Hats are also a good preventative measure for sun exposure to the head.

8.14.07 The EHS procedure also describes a cold stress prevention program. At certain times of the year, workers may be exposed to the hazards of working in colder environments and work in the water, even if ambient temperatures in the air are high, potential for cold stress is possible. Potential hazards that could occur on this project include hypothermia as well as hazards related to slippery surfaces, brittle equipment, and cold effects that lead to poor judgment and taking short cuts on the job. The effects of wind chill upon the body even in weather that is not considered extremely cold, can cause cold stress, particularly when coupled with wet weather. TtEC will implement cold stress prevention program elements contained in EHS 4-6 when there is a potential for cold related injuries. Workers should be protected from exposure to cold so the core body temperature does not fall below the Threshold Limit Value of 96.8ºF (36ºC).

8.15 CRYSTALLINE SILICA MONITORING PLAN (ASSESSMENT)

8.15.01 Not applicable.

8.16 NIGHT OPERATIONS LIGHTING PLAN

8.16.01 Not applicable. Work will be performed during daylight hours.

8.17 FIRE PREVENTION PLAN

8.17.01 Fire prevention and protection measures require preplanning. Each boat used by TtEC personnel less than 26 feet shall carry at least one 1-A:10:BC fire extinguisher (for use in gasoline, oil and grease fires) approved by Underwriters Laboratories (UL). Motor boats or skiffs over 26 feet will have a minimum of two 1-A:10BC fire extinguisher available. Each fire extinguisher shall be inspected by the SSHO at least once every week to ensure that it is sufficiently charged and that the nozzles are free and clear. Discharged fire extinguishers shall be replaced or recharged immediately.

8.17.02 All gasoline engines, except outboard motors, installed in a boat must have an approved flame arrestor (backfire preventer) fitted to the carburetor.

8.17.03 A mounted fire extinguisher is required in every vehicle including heavy equipment. Extinguishers mounted on heavy equipment will be a minimum 5-pound ABC dry chemical type. Fire extinguishers inside the cab of pickup trucks will be 2 ½-pound dry chemical ABC. Fire extinguishers in the cabs of all vehicles must be mounted or secured. Fire extinguishers in the beds of all pickup trucks must be mounted or secured.

8.17.04 Employees will follow safe work practices to include proper storage of flammable and combustible liquids. Smoking is permitted only in those areas designated specifically by the PjM or SSHO and posted as smoking areas.

8.17.05 Personnel will follow hot work procedures to ensure that work is performed in a safe environment. Additional fire prevention measures are given in the AHAs developed for this project.

8.17.06 In the event of a fire or explosion, the Municipality of Culebra Fire Department will be summoned immediately, a head count will be taken, and fire or explosion responses and evacuation procedures will be implemented as described in Section 8.2.3 of this APP.

8.18 WILD LAND FIRE MANAGEMENT PLAN

8.18.01 Not applicable.

8.19 HAZARDOUS ENERGY CONTROL PLAN

8.19.01 Control of hazardous energy during installation, start-up, and maintenance will follow TtEC EHS 6-4 and OSHA 1910.147. EHS 6-4, Lockout/Tagout, establishes the TtEC Control of Hazardous Energy Program. This program applies to all TtEC operations, except as follows:

- Work on cord- and plug-connected electrical equipment where the plug is under the control of the employee performing the work
- Hot tap operations
- Work involving minor changes and adjustments to equipment during routine operations (such as small tooling adjustments)

8.19.02 Refer to details of this program in EHS 6-4. Details of methods used to control hazardous energy for a defined task must be documented in the AHA for that task.

8.20 CRITICAL LIFT PROCEDURES

8.20.01 Not applicable.

8.21 CONTINGENCY PLAN FOR SEVERE WEATHER

8.21.01 The SSHO will monitor weather forecasts each morning, evening, and periodically throughout the day. The hurricane season for Puerto Rico is June 1 through November 30. Hurricanes, tropical storms, and lesser storms that may occur during daily cycles in the tropics, can bring winds, rain, and thunder/lightning. With adverse weather, the seas respond accordingly and hazardous surface water conditions can develop. The local National Oceanic and Atmospheric Administration (NOAA) broadcast local forecasts on the Weather Radio Station WNJ-693 on a frequency of 162.450 megahertz. This as well as other forecasts on the internet can be monitored to obtain severe weather advisories and warnings. These include the NOAA National Hurricane Center at www.nhc.noaa.gov and the NOAA National Weather Forecast Office in San Juan, Puerto Rico at www.srh.noaa.gov/sju and the Caribbean Hurricane Network at http://stormcarib.com.

8.21.02 In the event of adverse weather conditions, the SSHO will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Extreme temperatures (> 100 ºF or < 0 ºF)
- Treacherous weather-related working conditions (extreme rain, high winds [> 30 miles per hour])
- Visible lightning within 10 miles
- Limited visibility (fog)
- Weather forecasts where severe weather hazards are likely to occur (e.g., tropical storms, hurricanes)
- Other factors as appropriate that are identified in conjunction with lesser weather related hazards (e.g., pronounced ground swell or rip currents).

8.21.03 Prior to beginning work, the SSHO will review the weather forecast for the day to screen for anticipated severe weather conditions, warn the field crews accordingly, heighten awareness, and ensure proper planning. In the event that work is suspended, the SSHO will notify personnel or field teams by cellular telephones, marine or project radios or in person as applicable.

8.22 FLOAT PLAN

8.22.01 TtEC will follow EHS 6-6 Boating Procedures on this project. This procedure requires TtEC to file a float plan for all boating trips using the US Coast Guard example Float Plan. The USCG example Float Plan is included in Attachment C. The SSHO or FIC shall be aware of the location of all project boats and personnel using them at all times. If several boats and crews are involved or are traveling to remote areas, each designated boat operator shall file a written float plan with the SSHO or FIC. The float plan shall include the following:

- The names of the boat operator and passengers;
- A description and registration numbers of the boat;
- Radio call sign or cellular telephone number if boat is so equipped;
- A trip itinerary with expected time and location of return;
- Steps the SSHO or FIC will take to initiate a search response if the expected time of return is exceeded; and
- A Float Plan shall be prepared by each designated boat operator and approved by the PjM, and SSHO and/or qualified person prior to the activity.

8.23 SITE-SPECIFIC FALL PROTECTION AND PREVENTION PLAN

8.23.01 Not applicable.

8.24 DEMOLITION PLAN

8.24.01 Not applicable.

8.25 EXCAVATION/TRENCHING PLAN

8.25.01 Not applicable.

8.26 EMERGENCY RESCUE (TUNNELING)

8.26.01 Not applicable.

8.27 UNDERGROUND CONSTRUCTION FIRE PREVENTION AND PROTECTION PLAN

8.27.01 Not applicable.

8.28 COMPRESSED AIR PLAN

8.28.01 Not applicable.

8.29 FORMWORK AND SHORING ERECTION AND REMOVAL PLANS

8.29.01 Not applicable.

8.30 PRECAST CONCRETE PLAN

8.30.01 Not applicable.

8.31 LIFT SLAB PLANS

8.31.01 Not applicable.

8.32 STEEL ERECTION PLAN

8.32.01 Not applicable.

8.33 SITE SAFETY AND HEALTH PLAN FOR HTRW WORK

8.33.01 Not applicable.

8.34 BLASTING SAFETY PLAN

8.34.01 Not applicable.

8.35 DIVING PLAN

8.35.01 Although there will be no self-contained underwater breathing apparatus (SCUBA) or surface supplied air diving performed during this EBS, snorkel surveys will be performed and the hazards associated with snorkeling include some of the hazards that diving operations pose including: drowning, hypothermia, being carried away by surface currents or into hazardous areas, and being struck by surface vessels. An SSP has been prepared for the scientific snorkeling tasks and is included as Appendix F of the Work Plan. The SSP includes the requirements of EM 385-1-1, Section 30.G and the Tetra Tech Dive Safety Manual for scientific snorkeling.

8.36 CONFINED SPACE PLAN

8.36.01 Not applicable.

9.0 RISK MANAGEMENT PROCESSES

9.01 AHAs for the planned activities are included in Attachment A of this APP; AHA #1 of the attachment has also been duplicated in the SSP. If any new tasks are identified or if planned activities vary from the written AHAs, the SSHO will develop or alter the existing AHAs with the assistance of the workers and subcontractors to address the specific activities. All AHAs will be reviewed by the PESM and the USAESCH Project Manager.

Because the RI will begin during the latter part of this EBS, no AHA for demobilization has been prepared for this plan. AHAs for the RI work are included in a separate APP.

AHA	Activity
1	Mobilization and Site Setup, Boating, and Scientific Snorkeling
2	Mobilization and Site Setup, ROV Underwater Video Surveys
3	Boating and Bathymetry Surveys

10.0 OTHER PROJECT HAZARDS

10.1 NOISE

10.1.01 On projects where noise levels may exceed a time-weighted average of 84 decibels, A scale (dBA), hearing protection will be made available to all exposed employees. Additionally, sound-level monitoring using a sound level meter may be conducted on-site if the SSHO determines that equipment noise is louder than normally encountered with the equipment. Annual audiograms are required for personnel who are exposed to 85 dBA time-weighted average or greater for 8 or more hours per day. Personnel with a standard threshold shift will be restricted from high noise exposure or will be required to wear hearing protection at all times. EHS 4-4 is a hearing conservation program complying with OSHA regulations (29 CFR 1910.95).

10.2 SLIPS, TRIPS, AND FALLS

10.2.01 Working in and around the site, both on land and on boats or dive platforms, may pose slip, trip, and fall hazards due to slippery and wet surfaces. The terrain at boat launch areas and access points may be steep or uneven and vegetation may pose hidden trip or fall hazards to workers. Waves, ground swell, or boat maneuvering on the water may cause personnel to lose balance or items to shift on board the boat posing slip, trip, and fall hazards. Portable ladders, if used, will be of the proper rating and configuration and will be tied off. Workers will use three points of contact when climbing or descending any ladder.

10.2.02 Slips, trips, and falls are a leading cause of injuries in field-related work settings. Potential adverse health effects include falling to the ground and becoming injured or twisting an ankle or more severe injuries to the back, head, or neck. Falling or stepping onto a sharp object is also a hazard and can lead to cuts, lacerations, or puncture wounds.

10.2.03 Site personnel will be instructed to look for these potential safety hazards and immediately inform the SSHO about any new hazards as well as taking actions to correct the hazard upon discovery. If the hazard cannot be immediately removed, action must be taken to warn site workers about the hazard and appropriate precautions must be taken. Proper housekeeping such as keeping work areas reasonably free of trash and debris and maintaining tools and equipment neatly in designated storage areas must be maintained. Small holes and pits along high foot traffic areas should be covered or barricaded to prevent injury.

10.2.04 Supervisors will remind personnel and subcontractors daily to maintain sure footing on all surfaces. Prior to first time entry, the supervisor and the SSHO will inspect all work areas prior to the start of work to look for hazards. Hazards in the work area will be identified with high-visibility spray paint, traffic cones, or barricade tape. The work areas must be illuminated to at least 30 foot-candles (EM 385-1-1, Table 7-1).

10.2.05 Where engineering controls such as guardrails cannot be installed or used, personnel working 6 feet above any surface (including man lifts), are required to wear safety harnesses and safety lanyards attached to an anchorage that can support 5,000 pounds. The SSHO will inspect these before use. Fall protection is not anticipated on this project. If this changes, a Fall Protection Plan must be developed and implemented.

10.3 HEAD AND BACK INJURIES

10.3.01 At a minimum, workers will don hard hats (when overhead or struck-by hazards exist), safety boots, and safety glasses prior to performing any site activities. This will prevent minor injuries caused by bumping one’s head while working around and under equipment.

10.3.02 Personnel are instructed in proper lifting techniques and will not lift heavy items without assistance per EHS 3-1. Each worker will not lift more than 50 pounds. Objects heavier than 50 pounds require assistance from another person. Supervisors will use mechanical lifting equipment whenever possible to minimize worker exposure to lifting hazards.

10.4 FALLING OBJECTS

10.4.01 No personnel will work under suspended equipment at any time. The SSHO will ensure that an adequate area is clear of personnel while the equipment is in operation.

10.5 ELECTRICAL HAZARDS

10.5.01 To prevent accidents caused by electric shock, the project SSHO will inspect electrical connections on a daily basis. The SSHO will shut down and lock out any equipment that is found to have frayed or loose connections until a qualified electrician is contacted and repairs are made. The equipment will be de energized and tested before any electrical work is done. Equipment will be properly grounded prior to and during work. For outdoor use, ground fault circuit interrupters (GFCIs) will be installed for each circuit between the power source and tool. In the event that generators are used to supply power, these generators will contain GFCIs.

10.5.02 Requirements for electrical safety include:

- Electrical wiring and equipment will be listed by a nationally recognized testing laboratory (Underwriters Laboratories, Canadian Standards Association, and others).
- Live parts of wiring and equipment will be guarded to protect persons or objects from harm. Uninsulated live wires must be placed at various heights and distances from the ground and from buildings depending on the voltage carried by those lines.
- Transformer banks and high-voltage equipment will be protected from unauthorized access.
- A qualified electrician will perform all work on electrical power supplies and lines.
- Flexible cords (extension cords) will contain the number of conductors required for service plus a ground wire. Cords will be rated for hard usage (S, SE, SEO, SO, SOO,

ST, STO, STOO). This rating is not required to be listed on the cord itself; check the wrapping or label that comes with the cord to ensure that the cord meets this requirement. Flexible cords are not allowed to pass through doors, windows, or be placed on the ground where they are subject to being run over by vehicles. If flexible cords must pass through walls, the cords will be protected by bushings or fittings.

- Flexible cords must be inspected on each day of use. No splices or fraying is allowed.
- Flexible cords will not be secured with staples, hung from nails, or suspended by bare wire. Plastic tie straps, commonly used today, are acceptable.
- Bulbs in portable lamps must be protected by a substantial guard attached to the lamp holder handle.
- Circuit breaker panels, electrical transformers, and supply equipment must be labeled as to the voltage contained therein.
- Circuit breaker panels must be labeled as to what each breaker controls.
- Breaker panels and electrical panels must have a cover protecting any live exposed wires.
- At least a 30-inch clearance must be maintained on three sides of circuit breaker boxes, transformers, and electrical supply equipment so as to provide ready access to the equipment in the event of an emergency. A 36-inch clearance is required for higher voltages; to assure that adequate clearance is provided, TtEC requires a 36-inch clearance of all breaker boxes, etc.
- Circuit breaker boxes that are locked or kept in locked rooms must have a key readily available in the event of an emergency.

10.5.1 Portable Generators

10.5.1.01 Portable generators are used on many work sites. Portable generators must meet the requirements for grounding as specified in the National Electrical Code (NEC) National Fire Protection Association 70. NEC 250-6 has certain exemptions for the grounding of portable and vehicle-mounted generators. Refer to EM 385-1-1, Section 11.D.01 (USACE 2008) for additional details. Portable generators and any other gasoline or diesel fired equipment will be operated in open air only where there is sufficient ventilation to prevent accumulation of exhaust gases including carbon monoxide.

10.5.2 Temporary Wiring

10.5.2.01 A qualified electrician will design temporary wiring. A qualified engineer will approve the design. The system will be tested as required by EM 385-1-1, Section 11.E. Temporary lighting will be protected by guards and will not be suspended by the wire. Exposed empty light sockets and broken bulbs are not permitted. Temporary lighting circuits will be separate from electrical tool circuits. Circuits will be labeled as “LIGHTS ONLY” or “TOOLS ONLY.”

10.6 ANIMALS, INSECTS, AND PLANTS

10.6.01 Wild animals on land and marine animals pose hazards to workers who come into contact with them. Problematic stinging or biting insects may be present at all times of the year and likely may present problems to workers. Insects may carry a variety of diseases. Poisonous plants such as the Manzanillo tree or thorny plants such as acacia thorns may also be present on land or adjacent to the beaches.

10.6.02 The following biological hazards may be present at the site. The SSHO will instruct the field crew in the recognition and procedures for encountering biological hazards at the site. In addition, a project biologist will be on staff for this project when work is being performed. The project biologist will assist the SSHO and brief employees on hazardous marine life and terrestrial plants and wildlife that could pose a danger to employees performing their required tasks (e.g., snorkeling), including recognition and avoidance of the species.

10.6.1 Stinging Insect Hazard Identification and Mitigation

10.6.1.01 Insects, including bees, wasps, hornets, centipedes, and scorpions are known to be present in Culebra, Puerto Rico, making the chance of a bite or sting possible. Some individuals may have severe allergic reactions to an insect sting that can result in a life threatening condition.

10.6.1.02 Several species of scorpions inhabit the islands of Puerto Rico, namely the West Indian species. Local centipedes and scorpion stings are painful, but none are known to be fatal.

10.6.1.03 The SSHO will instruct the field crew in the recognition and procedures for encountering stinging insects at the site noting that these insects may be present or have nests/shelter in the ground, in shrubs or trees, debris piles, and other structures. Additionally, any individuals who have been bitten or stung by an insect will notify the SSHO. The following is a list of preventive measures:

- Wear proper protective clothing (work boots, socks, and pants). Tuck pant legs into socks when possible.
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.

10.6.1.04 Field personnel who may have insect allergies will provide this information to the SSHO prior to commencing work, and shall have their prescription allergy medication on site. In addition, workers are encouraged to have over the counter Benadryl (diphenhydramine) available for use should they not have a prescription for known severe allergies.

10.6.1.05 Mild insect stings should be treated by applying a baking soda paste or ice wrapped in a wet cloth. Bee stingers should be gently scraped off the skin, working from the side of the stinger. If insect bites become red or inflamed or symptoms such as nausea, dizziness, shortness of breath, etc., appear, medical care will be sought. Immediate care is needed if a person is allergic to insect stings. If an allergic person receives an insect sting, seek immediate medical attention, keep the victim calm, and check vital signs frequently. Rescue breathing should be given if necessary to supply oxygen to the victim.

10.6.2 Biting Insect Hazard Identification and Mitigation

10.6.2.01 Spiders such as the black widow or brown recluse are known to be present on Culebra. If a person is bitten, these bites pose adverse health effects that require prompt professional medical attention. For most, these spider bites do not pose life-threatening conditions; however, severe tissue damage and skin lesions and other effects can occur that cause permanent damage if medical attention is delayed.

10.6.2.02 The black widow bite is characterized by a pinprick sensation and burning around the bite area. After 15 minutes to an hour after the bite, intense pain may be felt in the bite area, which spreads. Bite victims may exhibit profuse sweating, muscle pain and spasms, breathing difficulty, difficulty speaking, poor coordination, and generalized swelling of the extremities.

10.6.2.03 The brown recluse bite is characterized by blistering at the bite location, followed by burning sensation 30 to 60 minutes after the bite. A large red swollen, often pulsating lesion with a characteristic bulls-eye may appear. The bite victim will exhibit a generalized rash, have joint pain, chills, fever, nausea, and vomiting and onset of severe pain. Necrosis of tissue may occur around the bite area, which can spread.

10.6.2.04 Mosquitoes, biting flies, fleas, and ticks are known to be present and may pose a bite hazard to workers. Mosquitoes can carry disease such as dengue, which can be fatal in some instances.

10.6.2.05 According to the Centers for Disease Control, dengue is endemic to Puerto Rico and is a leading cause of illness and death in the tropics and subtropics. As many as 100 million people are infected yearly. Dengue is caused by any one of four related viruses transmitted by mosquitoes. The most effective protective measures are those that avoid mosquito bites. When infected, early recognition and prompt supportive treatment can substantially lower the risk of developing severe disease.

10.6.2.06 The principal symptoms of dengue are high fever and at least two of the following:

- Severe headache
- Severe eye pain (behind eyes)
- Joint pain
- Muscle and/or bone pain
- Rash
- Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
- Low white cell count

10.6.2.07 Watch for warning signs as temperature declines 3 to 7 days after symptoms began.

10.6.2.08 Go IMMEDIATELY to an emergency room or the closest health care provider if any of the following warning signs appear:

- Severe abdominal pain or persistent vomiting
- Red spots or patches on the skin
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools (feces, excrement)
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

10.6.2.09 Lyme disease is caused by bites from infected ticks that are common in and near wooded areas, tall grass, and brush. Ticks are small, ranging from the size of a comma up to about one-quarter inch. When embedded into the skin, they may resemble a small freckle. Tick season extends from spring through summer, but may extend year-round in areas without significant cold weather.

10.6.2.010 Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream, which could lead to the worker contracting Lyme disease. Lyme disease may cause a variety of medical conditions including arthritis, which can be treated successfully if the symptoms are recognized early and medical attention is received. Treatment with antibodies has been successful in preventing more serious symptoms from developing. If left untreated, Lyme disease can cause serious nerve or heart problems as well as a disabling type of arthritis.

10.6.2.011 Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. This flu-like illness is out of season, commonly happening between May and October when ticks are most active. A large expanding skin rash usually develops around the area of the bite. More than one rash may occur. The rash may feel hot to the touch and may be painful. Rashes vary in size, shape, and color, but often look like a red ring with a clear center. The outer edges expand in size. It is easy to miss the rash and the connection between the rash and a tick bite. The rash develops from three days to as long as a month after the tick bite. Almost one-third of those with Lyme disease never get the rash. Joint or muscle pain may be an early sign of Lyme disease. These aches and pains may be easy to confuse with the pain that comes with other types of arthritis. However, unlike many other types of arthritis, this pain seems to move or travel from joint to joint.

10.6.2.012 Lyme disease can affect the nervous system. Symptoms include stiff neck, severe headache, and fatigue usually linked to meningitis. Symptoms may also include pain and drooping of the muscles on the face, called Bell’s Palsy. Lyme disease may also mimic symptoms of multiple sclerosis or other types of paralysis. Lyme disease can also cause serious but reversible heart problems, such as irregular heartbeat. Finally, Lyme disease can result in a disabling, chronic type of arthritis that most often affects the knees. Treatment is more difficult and less successful in later stages. Often, the effects of Lyme disease may be confused with other medical problems.

10.6.2.013 It is recommended that personnel check themselves when in areas that could harbor ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the SSHO will be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe. The employee will be offered the option for medical treatment by a physician, which typically involves prophylactic antibiotics. If personnel feel sick or have signs similar to those above, they will notify the SSHO immediately. Try to save the tick and bring it with the affected employee for positive identification.

10.6.2.014 To help minimize bites from insects, apply insect repellent prior to fieldwork and as often as needed throughout the work shift. Apply DEET (vapor-active repellent) to any exposed skin surface (except eyes and lips), and apply the permethrin repellent spray to field clothing. Note: Allow the permethrin to dry before using the treated clothing.

10.6.2.015 In addition:

- Wear proper protective clothing (work boots, socks, and pants). Tuck pant legs into socks when possible.
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.
- Inspect yourself in the mirror at the end of the day for ticks and/or evidence of bites such as swollen or reddened areas, areas tender or warm to the touch. Report instances of suspected bites to the SSHO. Prompt discovery and reporting, observation for signs and symptoms, and follow-up medical care are crucial.

10.6.3 Wild Animal Hazard Identification and Mitigation

10.6.3.01 Wild animals such as stray dogs or cats, mice, or other mammals may be encountered. These animals may bite and can carry rabies and should be avoided. In addition, hantavirus is also a concern when coming in contact with rats, mice, and bats. Hantavirus is a disease spread primarily from infected rodent droppings.

10.6.3.02 Hantavirus is an airborne virus that is spread through the urine and feces of infected rodents. Hantavirus is not transferred from person to person. The overwhelming evidence is that the virus is spread from rodent to humans through contact with infected rodent secretions or airborne transmission by infected dust particles.

10.6.3.03 Workers shall use discretion and avoid all contact with wild animals and shall not feed wild animals or improperly discard food waste or lunchroom trash. Trash shall be disposed of in proper receptacles with covers. If these animals present a problem or significant rodent populations are encountered, the PESM will be notified and will develop a plan to alleviate the problem.

10.6.4 Sharks and Other Hazardous Marine Life

10.6.4.01 The sites that are the focus of the EBS are part of the marine nearshore environment. A variety of different shark species may be present ranging from small reef sharks to larger and more rarely seen sharks such as ocean whitetip sharks. Sharks may be attracted to certain activities or scents in the water and on occasion, an unprovoked shark attack may occur, though rarely. A prevalence of sharks in the area or ocean whitetip shark sightings in the area may warrant caution or hazard evaluation during snorkeling operations.

10.6.4.02 Another type of marine life that can injure divers or people, who otherwise come into contact with them, is the cnidarian, commonly called the jellyfish. More than 100 species of jellyfish are toxic to humans. Cnidarians have tentacles that have stinging cells called nematocysts, which are coiled like springs and, when contact is made, send a stinger into the skin with a toxin. Contact with jellyfish (including some species of corals) can cause skin rashes, and in more severe cases or contact with more toxic species, can cause cardiovascular and respiratory system collapse. There are three classes of jellyfish in the Caribbean (all except the box jellyfish, which is the most toxic): true jellyfish, which are the most common variety; sea anemones and corals; and the most dangerous in the Caribbean, the Portuguese man-of-war, though contact with the Portuguese man-of-war in Puerto Rico is reportedly rare.

10.6.4.03 Most jellyfish stings can be treated by first removing any remaining tentacles using a towel or gloved hand, followed by rinsing the area with hot water (not scalding hot); if hot water is not available, use salt water rather than fresh water, as fresh water may cause more pain. Soaking the affected area in hot water and over-the-counter medications such as acetaminophen or ibuprofen may help with the pain. Always seek medical attention if signs and symptoms of anaphylaxis are observed with any sting, and always seek medical attention if stung by a Portuguese man-of-war, as these stings often lead to more severe reactions and, in some instances, death.

10.6.4.04 The red lionfish, a tropical native of the Indian and Pacific oceans, has undergone an invasive population explosion in the waters of the Caribbean, including Puerto Rico. Lionfish have distinctive brown or maroon and white stripes or bands covering the head and body. They have fleshy tentacles above their eyes and below the mouth and fan-like pectoral fins with long separated dorsal spines. An adult lionfish can grow as large as 18 inches, while juveniles may be as small as 1 inch or less. Lionfish can be found in nearly all marine habitat types found in warm marine waters of the tropics, and have been found in water depths from 1 to 1000 feet on hard bottom, mangrove, seagrass, coral, and artificial reefs.

10.6.4.05 Lionfish spines deliver a venomous sting that can last for days and cause extreme pain, sweating, respiratory distress, and even paralysis. Their venom glands are located within two grooves of the spine and the venom is a combination of protein, a neuromuscular toxin, and a neurotransmitter called acetylcholine. After the spine punctures the skin, the venom enters the wound when exposed to the venom glands within the grooves of the spine. If you are stung by a lionfish, seek medical attention immediately. Snorkelers should be aware of lionfish hazards and avoid contact with this fish and be extra vigilant around coral reefs and shallow water areas. In addition, as the lionfish is an invasive species, reporting of lionfish sightings to local fish and wildlife agencies may be warranted.

10.6.5 Poisonous Plant Hazard Identification and Mitigation

10.6.5.01 The potential for contact with poisonous plants exists when in undeveloped and wooded areas. In Puerto Rico, the Manchineel (often referred to as Manzanillo) tree is one such poisonous plant. The Manchineel tree grows to a height of 40 to 50 feet, predominantly along sandy seashores. It has green leaves that are shiny in appearance. The tree and its parts contain strong toxins, some of which are unidentified. It has a milky white sap that contains Phorbol and other skin irritants, producing strong allergic dermatitis. Standing beneath the tree during rain will cause blistering of the skin from mere contact with this liquid; even a small drop of rain with the milky substance in it will cause the skin to blister. Burning the tree may cause blindness if the smoke reaches the eyes. The fruit can also be fatal if eaten.

10.6.5.02 A person experiencing symptoms of poisoning will likely exhibit blistering at the site of contact, usually within 12 to 48 hours. Reddening, swelling, burning, and itching at the contact site may also occur, often painful. Other reactions may include respiratory effects such as asthma or anaphylaxis in highly sensitive individuals. Employees will be trained in the identification of these species and will be advised to wear protective clothing such as gloves and long sleeve shirts when working conditions permit. Employees should also consider applying barrier lotions to the skin that has potential to contact these species.

10.7 BLOODBORNE PATHOGENS

10.7.01 Bloodborne pathogens enter the human body and blood circulation system through punctures, cuts, or abrasions of the skin or mucous membranes. They are not transmitted through ingestion (swallowing), through the lungs (breathing), or by contact with whole, healthy skin. However, under the principle of universal precautions, all blood should be considered infectious, and all skin and mucous membranes should be considered to have possible points of entry for pathogens.

10.7.02 Potential bloodborne pathogen exposures include:

- Contact with contaminated medical equipment or medical waste or sharps;
- Medical emergency response operations such as administering first aid or CPR; and
- Two primary bloodborne pathogens include hepatitis B and human immunodeficiency virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS).

10.7.03 To reduce the risk of contracting a bloodborne pathogen, take the following precautions:

- Avoid contact with blood and other bodily fluids;
- Use protective equipment when giving first aid/CPR, such as disposable gloves and breathing barriers; and
- Thoroughly wash your hands with soap and water immediately after giving care.

10.7.04 When cleaning up blood or other bodily fluids:

- Clean up the spill immediately or soon as possible after the spill occurs.
- Use disposable gloves and other PPE when cleaning spills.
- Wipe up the spill with paper towels or other absorbent materials.
- After the area has been wiped up, flood the area with a solution of ¼ cup of liquid chlorine bleach to 1 gallon of fresh water and allow it to stand for at least 20 minutes.
- Dispose of the contaminated material used to clean up the spill in a labeled biohazard container.

10.7.05 A vaccine exists for hepatitis B. Should employees desire the vaccine, their employer will arrange to have the employee receive the series of inoculations. The hepatitis B vaccine also is effective, though less efficient, when administered after exposure to blood containing the hepatitis B virus. The SSHO should be notified of any potential contact with blood or bodily fluids resulting from first aid or CPR administered on the job. Site personnel will be given bloodborne pathogens training.

10.8 ACCIDENTAL GROUNDINGS

10.8.01 While it is possible for vessels to accidentally become grounded, many precautions are in place to minimize the potential for this. If it is determined that weather conditions are unsafe (e.g., heavy rain, strong wind, and rough seas), boating operations in specific areas, or altogether as conditions dictate, will not be conducted in order to minimize the potential for accidental groundings.

10.8.02 If the vessel runs aground, the operator shall perform the following:

1. Turn off the engine.
2. Avoid using the engine to power off the reef, hardbottom, or seagrass.
3. Raise the propeller, and allow the boat to drift free.
4. Radio the Coast Guard, Marine Patrol, or VHF Channel 16 for assistance.
5. Report any coral and seagrass bed damage from the grounded vessel according to procedures provided in the SOP in Appendix B of the Work Plan.

11.0 REFERENCES

TtEC (Tetra Tech EC, Inc.). 2012. Environmental Baseline Survey Work Plan. January.

——————. 2009. Project Orientation, Rules and Safety Guidelines Handbook. July.

USACE (U.S. Army Corps of Engineers). 2008. Safety and Health Requirements Manual. Engineering Manual (EM) 385-1-1. September 15.

U.S. Department of Labor. Part 1910. Occupational Safety and Health Administration, Occupational Safety and Health Standards. 29 *Code of Federal Regulations* (CFR).

EXHIBITS

ESQ

ENVIRONMENTAL SAFETY AND QUALITY

POLICY

Tetra Tech EC, Inc. (TtEC) is committed to ensuring the health, safety, and well being of our employees and the communities in which we work, enhancing and protecting the environment, and providing quality services to our clients. Our Environmental, Safety and Quality (ESQ) Policy provides the framework and underlying principles for our Environmental Management System and is an integral part of how we conduct business.

All TtEC associates have the right to work in a safe and healthful workplace as well as the responsibility to help create and work in a safe and environmentally protective manner:

- We will complete our work successfully, with a great deal of attention to health and safety by:
  - Incorporating pollution prevention and loss prevention principles into our work process.
  - Employing well-trained personnel who understand and have the knowledge to fulfill their ESQ responsibilities.
- We will fully comply with all laws and regulations pertaining to our business, including company policies and procedures and the requirements of ISO 14001.
- We will commit ourselves to complying with the terms of our contracts and to meeting the four project objectives—knowing scope, budget, schedule, and level of quality.
- We will provide the level of quality our internal and external clients expect and pay for and use its attainment as our measure of success.
- We will safely and properly plan our work and work our plan.
- We will communicate and document the execution of our work.
- We will gather data and make decisions inclusively and involve employees and others affected by ESQ decisions inclusively.
- We will dedicate ourselves to continuous improvement by:
  - Establishing and periodically updating ESQ improvement objectives and targets.
  - Recognizing outstanding employee and project ESQ performance.

These commitments are defined in, and are fundamental to, our **Client Service Quality®**, **Do It Right®**, and **Shared Vision®**, **Zero Incident Performance®** operating philosophies.

Don Rogers
President and CEO

TETRA TECH EC, INC.

TETRA TECH EC, INC. CORPORATE HEALTH AND SAFETY PROGRAM PROCEDURES LIST

EHS 1-1	Responsibilities for Program Implementation
EHS 1-2	Awareness and Recoginition Program
EHS 1-3	Employee Participation Program
EHS 1-4	Subcontractor Selection and Management
EHS 1-5	Visitor Safety
EHS 1-7	Event Reporting and Investigation
EHS 1-9	Recordkeeping
EHS 1-10	External Regulatory Inspections and Notifications
EHS 1-11	Training
EHS 2-1	Emergency Preparedness
EHS 3-1	Ergonomics
EHS 3-2	Procedures – Environmental Health and Safety Plan(s)
EHS 3-3	EHS Inspections
EHS 3-4	Site and Contamination Control
EHS 3-5	Activity Hazard Analysis
EHS 3-6	Work Rules
EHS 3-7	Hazardous Material Storage and Transportation
EHS 3-8	Fall Protection
EHS 3-9	Hoisting and Rigging
EHS 3-10	Electrical Safety
EHS 3-11	Hand and Portable Power Tools
EHS 3-12	Scaffolding
EHS 3-13	Motorized Vehicles and Equipment
EHS 3-14	Fire Prevention
EHS 3-15	Underground Utilities
EHS 4-1	Bloodborne Pathogens
EHS 4-2	Hazard Communication
EHS 4-3	Radioactive and Mixed Waste Programs
EHS 4-4	Hearing Conservation
EHS 4-5	Medical Screening and Surveillance
EHS 4-6	Temperature Extremes

TETRA TECH EC, INC. CORPORATE HEALTH AND SAFETY PROGRAM PROCEDURES LIST

EHS 5-1	Personal Protective Equipment
EHS 5-2	Respiratory Protection
EHS 6-1	Confined Space Entry
EHS 6-2	Drill Rigs
EHS 6-3	Excavation and Trenching
EHS 6-4	Lockout/Tagout
EHS 6-5	Welding/Hot Work
EHS 6-6	Boating
EHS 6-7	Drum and Container Handling
EHS 6-8	Demolition
EHS 6-9	Line Breaking
EHS 7-1	UXO Initial Site Assessment
EHS 7-2	UXO Drilling Operations
EHS 7-3	UXO Quality Control
EHS 7-4	UXO Safety Concepts
EHS 7-5	UXO Demolition Safety Precautions
EHS 8-1	Asbestos Control

ZIP

Zero Incident Performance®

We value the safety and well being of all associates. We work on the premise that all accidents are preventable. Our goal of **Zero Incident Performance®** is supported by the integration of safety concepts, principles and practices into each work effort and project phase.

Zero Incident Performance

Zip

Do it safe... Do it right

TETRA TECH EC, INC.

Zero Incident Performance® Pledge

As a member of the Tetra Tech EC, Inc. Team,
I am dedicated to the goal of Zero Incident Performance:

- I believe that all incidents are preventable.
- I believe that Zero Incident Performance is achievable through proper planning, tasking, and execution of plans and procedures as written.
- I believe that the investigation of "near misses" provides an opportunity for improvement before a loss occurs.
- I will make every effort to understand how to properly perform each task that I am assigned.
- I will perform each task in a safe and environmentally protective manner with the appropriate level of quality.
- I will help to fix things that are wrong.
- I will immediately report all incidents including "near misses" to my supervisor.

SYSTEM CERTIFICATION ISO14001 SGS

TETRA TECH EC, INC.

ATTACHMENT A

ACTIVITY HAZARD ANALYSES

Activity Hazard Analysis (AHA)

Job/Task: Mobilization, Site Set Up, Boating and Scientific Snorkeling	**Overall Risk Assessment Code (RAC) (Use highest code)**	**H**

Project Location: Culebra Water Ranges, Culebra, Puerto Rico

Contract Number: W912DY-10-D-0015

Date Prepared: November 17, 2011

Prepared by (Name/Title): Jennifer Peters, Sr. EHS Specialist

Reviewed by (Name/Title): Roger Margotto, CIH, CSP, CHMM, Tetra Tech EC EHS Manager

Notes: (Field Notes, Review Comments, etc.)
In addition to the information listed in this AHA, all field personnel must review and be familiar with all provisions of the approved safety plan. TtEC Corporate Safety Programs will also be available on site for review of specific materials and mitigation measures.

Risk Assessment Code (RAC) Matrix

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

	RAC Chart
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk** **H = High Risk**
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling

Job Steps	**Hazards**	**Controls**	**RAC**
1. Set up shore-based work areas	Workers could be exposed to chemical hazards during fueling.	Delineate the refueling zone, and use PPE as required by the type of material being used. The tasks performed, ambient air monitoring, temperature, and visual observation will be used to verify the selection of PPE. Identify all chemical hazards and receive training regarding the safe handling of chemicals (refer to MSDSs). The SSHO will maintain copies of all MSDSs at the site.	L
	Noise from the site setup could cause hearing loss to workers.	Hearing protection is required when sound levels exceed 84 dBA continuously. This rule applies to personnel working near heavy equipment, generator use, or operating engines.	L
	Slip, trip, and fall hazards could be present.	Visually inspect work areas; eliminate slip, trip, and fall hazards if feasible, otherwise barricade/ isolate the hazards. Keep work areas neat and orderly. Always place supplies, hoses, cords and other equipment in areas away from normal foot traffic, and equipment and tools in a safe location that does not present a trip hazard to work areas. Maintain proper illumination in all work areas. Work is authorized during daylight hours only.	L

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
1. Set up shore-based work areas (cont'd)	Sharp objects could cause puncture.	Wear cut-resistant work gloves when handling sharp edges and items with pinch points, such as barricades, EZ-up shade structures, folding chairs, etc. Whenever possible, blunt sharp edges and double over wire ends (fencing, material bundles, etc.). Workers should not stand or walk on either equipment or supplies.	L
	Musculo-skeletal strains from lifting and moving materials/ equipment manually.	Use mechanical lifting equipment and hand-trucks whenever possible. Otherwise, use proper lifting techniques, such as keeping the back and neck straight, lifting with the legs without twisting, and getting help when moving bulky/heavy materials and equipment. Employees will not lift more than 50 pounds alone. Encourage a steady, sustainable work pace.	M
	Worker exposure to extreme temperatures.	Monitor for heat stress and follow safety plans.	L
	Eye injury.	Safety glasses (clear or tinted) are the minimum required eye protection for all work areas during setup and shut down.	L
	Lack of communication in widely dispersed areas could lead to a delayed response in an emergency.	Ensure that each work team has a phone, or access to a phone, for emergency communication. Verify emergency numbers and functions of telephones and radios. Use the buddy system. Verify routes to local hospital.	L
	Contact with wild animals, biting or stinging insects, and poisonous plants could cause injury upon contact	Workers will apply DEET to work clothing following manufacturer's instructions as a preventative measure for biting insects. Workers will exercise caution when working in brushy or grassy areas, wood or debris piles, and recessed areas. Site orientation will include briefing on local hazardous flora and fauna, signs and symptoms of exposure and precautions to take. Workers with allergies will let the SSHO know using the medical data sheet and will carry their own prescription medication as applicable. First aid and medical attention as required.	L
2. Backing of boats on boat trailers	Failure of proper backing can cause struck by and pinch point injuries or property damage	Use spotters for all backing operations. Ensure spotter stands in line of sight of the person backing the vehicle. All personnel who back a trailer are trained and qualified to do so and are designated by the PjM for such activities. Use boat checklist in APP prior to launching boat. Verify understanding of hand signals used for backing, going forward, stopping, and turning left or right. Use parking brake and ensure operator is not moving vehicle before unhitching boat from trailer. Follow EHS 6-6, Boating Procedure.	M
3. Use boat to bring personnel to designated area(s)	Failure to meet EM 385-1-1 Section 19 in general and specifically 19F requirements for use of boats could cause injury or death.	Follow the requirements of EM 385-1-1 and EHS 6-6, Boating Procedure, using the inspection checklist provided in the APP. All boat operators are qualified and trained in boat use and procedures. Ensure boat passengers have been briefed on the location, use, and inspection of emergency equipment onboard and the procedures to follow in the event of a shipboard emergency. Practice drills will be done prior to or during first deployment for situations such as man overboard, fires and explosions, and abandon ship.	H

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
3. Use boat to bring personnel to designated area(s) (cont'd)	Fueling of boat- potential for fire, environmental release. Run out of fuel when operating.	No smoking or other sources of ignition when fueling. Engine must be off. There must be a fire extinguisher available. Refuel in a manner to prevent any spills, especially spills into the water. (If there is any sheen in the water the spill must be reported). Check for fuel leaks in the boat, if fuel lines are located in the boat.). Ensure there is enough fuel supply for the trip and the return to dock plus 1/3 in reserve.	M
	Boat could malfunction and drift into open water if engine does not work.	Ensure communications are working on boat. Have anchor and enough line to deploy in the event of motor/engine malfunction. Ensure that a Float Plan is filed in accordance with the APP using the example Coast Guard Float Plan in the APP. File this plan daily with the PjM or designee before leaving the dock and notify them of your return.	M
	Personnel can slip or trip while on the dock and when getting on or off the boat,	Personnel should use appropriate footwear to ensure that there is enough tread on the soles to minimize slipping. Look out for trip hazards. Those hazards that cannot be removed must be marked. When climbing up or down always ensure three points of contact.	L
	Sunburn for observers in boat.	Use a broad spectrum sunscreen SPF 15 or greater as necessary.	L
	Severe weather can cause dangerous seas and hazardous boating conditions	Monitor the local and national weather service broadcasts prior to mobilization by boat and during the day. Pay attention to weather advisories and storm warnings, namely hurricanes. Monitor actual water conditions for dangerous wave or ground swell action. Follow provisions in the APP for severe weather.	M
	Grounding	Use caution in the shallow areas. Use depth meter and spotting to avoid striking the bottom or grounding.	L
	Heat or cold stress may be experienced	Boat occupants will be monitored for signs and symptoms of heat stress and cold stress (in colder weather, wet weather, or if wind chill is a factor) in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for boat occupants. Boat occupants will be prepared with raingear and a change of clothing in the event they get wet and chilled. Boat survival kit, if used, will be restocked with necessary equipment. Adequate drinking water and electrolyte fluids will be available for boaters. Boat cabin shall have air conditioning or at a minimum, shade for employees to rest in.	M
	Boat could be struck by other boats in area	Boat operator is in charge of situational awareness while on the water. Boat operator will not be doing other tasks. Monitor Channel 16 and U.S. Coast Guard rules for lighting and other vessel operations. Use air horn in the event of a boat coming close.	M
4. Snorkeling	Failure to meet EM 385-1-1 Section 30 for Scientific Snorkeling requirements could lead to injury or death.	Follow the requirements of the EM 385-1-1 Section 30.G using the inspection checklist in the APP. Follow the requirements identified in the Snorkeling Safety Plan.	H

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
	Contact with dangerous marine life can cause injury to snorkelers	Brief personnel on the hazards of contact with marine life as per Section 11 of the APP. Ensure first aid kits are accessible and stocked as per EM 385 1-1. Ensure emergency numbers are posted and communications equipment is available for use.	L
	Snorkelers could be struck by other boats in area	Snorkelers will be no more than 50 feet from the support boat or observer/assistant. Cordon off the work zone with buoys or lines as needed to restrict boating traffic in the survey area. Locate the boat between the divers and any potential boating traffic and have air horn to get attention of any boats that come near work zone. Utilize radio channel 16	M
	UXO may be present in the sediments of Flamenco Bay or the Luis Pena Channel.	Snorkelers will not touch any items on the seafloor during the survey. MEC awareness training is provided in the site orientation training.	M
	Heat or cold stress may be experienced	Snorkelers will be monitored for signs and symptoms of heat stress and cold stress in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for snorkelers.	M
	Snorkelers could fall while boarding onto or deploying from boat	Boat will be equipped with a ladder and handrail assembly to facilitate safe entry and egress from boat and water and platform to step onto. A sling, ladder or sked-type stretcher will be available in the event a snorkeler is injured and needs assistance into the boat.	M

AHA Mobilization, Site Set Up, Boating, Scientific Snorkeling		
Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
Site Vehicles	Drivers must have current State or Puerto Rico-issued driver's license.	Daily vehicle inspection by drivers.
Boats	Qualified Operators will have U.S. Coast Guard approved boater safety qualifications identified in the APP and experience in use of the boats on the project.	Inspect daily, and before use. Use the boating checklist form. Follow procedures in EHS 6-6, Boating Procedure.
PPE and snorkeling equipment	Training as required by EM 385-1-1, Section 30 G. Snorkelers will be certified as skin divers (snorkelers) or open water divers by a nationally recognized organization	Daily inspection by users using attached checklist. Follow Snorkeling Safety Plan. Inspect tethering rope prior to each day of use.
Type II or better PFD to be worn and snorkeler's PFD	User will inspect each day before use	An experienced operator will use. SSHO will instruct in proper use.
Fire Extinguishers	Fire Extinguisher Training including use/limitations.	At least monthly by SSHO or designee.
First aid kits and other emergency equipment	Use of emergency equipment/first aid kits must be done by personnel familiar with this plan; use and inspection criteria of the equipment, and what the equipment is used for, by or under direction of the SSHO.	Initially and at least weekly thereafter or after use for restocking. (29 CFR 1926.50(d)(2))

Acronyms:

AHA – Activity Hazard Analysis
APP – Accident Prevention Plan
CFR – Code of Federal Regulations
dBA – decibels, A-scale
DEET – N,N-diethyl-meta-toluamide
EHS – Environmental, Health, and Safety
EM – Engineer Manual
MEC – munitions and explosives of concern
MSDS – Material Safety Data Sheet
PPE – personal protective equipment
RAC – Risk Assessment Code
SSHO – Site Safety and Health Officer
UXO – unexploded ordnance

Activity Hazard Analysis (AHA)

Job/Task: Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use	**Overall Risk Assessment Code (RAC) (Use highest code)**					**H**
Project Location: Culebra Water Ranges, Culebra, Puerto Rico	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W912DY-10-D-0015	**Severity**	**Probability**				
Date Prepared: November 17, 2011		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Jennifer Peters, Sr. EHS Specialist	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Roger Margotto, CIH, CSP, CHMM, Tetra Tech EC EHS Manager	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**
Notes: (Field Notes, Review Comments, etc.) In addition to the information listed in this AHA, all field personnel must review and be familiar with all provisions of the approved safety plan. TtEC Corporate Safety Programs will also be available on site for review of specific materials and mitigation measures.	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				**RAC Chart**	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				**E = Extremely High Risk** **H = High Risk**	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				**M = Moderate Risk** **L = Low Risk**	

AHA – 2 Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use

Job Steps	Hazards	Controls	RAC
1. Set up shore-based work areas	Workers could be exposed to chemical hazards during fueling.	Delineate the refueling zone, and use PPE as required by the type of material being used. The tasks performed, ambient air monitoring, temperature, and visual observation will be used to verify the selection of PPE. Identify all chemical hazards and receive training regarding the safe handling of chemicals (refer to MSDSs). The SSHO will maintain copies of all MSDSs at the site.	L
	Noise from the site setup could cause hearing loss to workers.	Hearing protection is required when sound levels exceed 84 dBA continuously. This rule applies to personnel working near heavy equipment, generator use, or operating engines.	L
	Slip, trip, and fall hazards could be present.	Visually inspect work areas; eliminate slip, trip, and fall hazards if feasible, otherwise barricade/ isolate the hazards. Keep work areas neat and orderly. Always place supplies, hoses, cords and other equipment in areas away from normal foot traffic, and equipment and tools in a safe location that does not present a trip hazard to work areas. Maintain proper illumination in all work areas. Work is authorized during daylight hours only.	L

AHA – 2 Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use			
Job Steps	**Hazards**	**Controls**	**RAC**
1. Set up shore-based work areas (cont'd)	Sharp objects could cause puncture.	Wear cut-resistant work gloves when handling sharp edges and items with pinch points, such as barricades, EZ-up shade structures, folding chairs, etc. Whenever possible, blunt sharp edges and double over wire ends (fencing, material bundles, etc.). Workers should not stand or walk on either equipment or supplies.	L
	Musculo-skeletal strains from lifting and moving materials/ equipment manually.	Use mechanical lifting equipment and hand-trucks whenever possible. Otherwise, use proper lifting techniques, such as keeping the back and neck straight, lifting with the legs without twisting, and getting help when moving bulky/heavy materials and equipment. Employees will not lift more than 50 pounds alone. Encourage a steady, sustainable work pace.	M
	Worker exposure to extreme temperatures.	Monitor for heat stress and follow safety plans.	L
	Eye injury.	Safety glasses (clear or tinted) are the minimum required eye protection for all work areas during setup and shut down.	L
	Lack of communication in widely dispersed areas could lead to a delayed response in an emergency.	Ensure that each work team has a phone, or access to a phone, for emergency communication. Verify emergency numbers and functions of telephones and radios. Use the buddy system. Verify routes to local hospital.	L
	Contact with wild animals, biting or stinging insects, and poisonous plants could cause injury upon contact	Workers will apply DEET to work clothing following manufacturer's instructions as a preventative measure for biting insects. Workers will exercise caution when working in brushy or grassy areas, wood or debris piles, and recessed areas. Site orientation will include briefing on local hazardous flora and fauna, signs and symptoms of exposure and precautions to take. Workers with allergies will let the SSHO know using the medical data sheet and will carry their own prescription medication as applicable. First aid and medical attention as required.	L
2. Backing of boats on boat trailers	Failure of proper backing can cause struck by and pinch point injuries or property damage	Use spotters for all backing operations. Ensure spotter stands in line of sight of the person backing the vehicle. All personnel who back a trailer are trained and qualified to do so and are designated by the PjM for such activities. Use boat checklist in APP prior to launching boat. Verify understanding of hand signals used for backing, going forward, stopping, and turning left or right. Use parking brake and ensure operator is not moving vehicle before unhitching boat from trailer. Follow EHS 6-6, Boating Procedure.	M
3. Use boat to bring personnel to designated area(s)	Failure to meet EM 385-1-1 Section 19 in general and specifically 19F. requirements for use of boats could cause injury or death.	Follow the requirements of EM 385-1-1 and EHS 6-6, Boating Procedure, using the inspection checklist provided in the APP. All boat operators are qualified and trained in boat use and procedures. Ensure boat passengers have been briefed on the location, use, and inspection of emergency equipment onboard and the procedures to follow in the event of a shipboard emergency. Practice drills will be done prior to or during first deployment for situations such as man overboard, fires and explosions, and abandon ship.	H

AHA – 2 Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use			
Job Steps	**Hazards**	**Controls**	**RAC**
3. Use boat to bring personnel to designated area(s) (cont'd)	Fueling of boat- potential for fire, environmental release. Run out of fuel when operating.	No smoking or other sources of ignition when fueling. Engine must be off. There must be a fire extinguisher available. Refuel in a manner to prevent any spills, especially spills into the water. (If there is any sheen in the water the spill must be reported). Check for fuel leaks in the boat, if fuel lines are located in the boat.). Ensure there is enough fuel supply for the trip and the return to dock plus 1/3 in reserve.	M
	Boat could malfunction and drift into open water if engine does not work.	Ensure communications are working on boat. Have anchor and enough line to deploy in the event of motor/engine malfunction. Ensure that a Float Plan is filed in accordance with the APP using the example Coast Guard Float Plan in the APP. File this plan daily with the PjM or designee before leaving the dock and notify them of your return.	M
	Grounding	Use caution in the shallow areas. Use depth meter and spotting to avoid striking the bottom or grounding.	L
	Personnel can slip or trip while on the dock and when getting on or off the boat,	Personnel should use appropriate footwear to ensure that there is enough tread on the soles to minimize slipping. Look out for trip hazards. Those hazards that cannot be removed must be marked. When climbing up or down always ensure three points of contact.	L
	Sunburn for personnel in boat.	Use a broad spectrum sunscreen SPF 15 or greater as necessary.	L
	Severe weather can cause dangerous seas and hazardous boating conditions	Monitor the local and national weather service broadcasts prior to mobilization by boat and during the day. Pay attention to weather advisories and storm warnings, namely hurricanes. Monitor actual water conditions for dangerous wave or ground swell action. Follow provisions in the APP for severe weather.	M
	Heat or cold stress may be experienced	Boat occupants will be monitored for signs and symptoms of heat stress and cold stress (in colder weather, wet weather, or if wind chill is a factor) in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for boat occupants. Boat occupants will be prepared with raingear and a change of clothing in the event they get wet and chilled. Boat survival kit, if used, will be restocked with necessary equipment. Adequate drinking water and electrolyte fluids will be available for boaters. Boat cabin shall have air conditioning or at a minimum, shade for employees to rest in.	M
	Boat could be struck by other boats in area	Boat operator is in charge of situational awareness while on the water. Boat operator will not be doing other tasks. Monitor Channel 16 and U.S. Coast Guard rules for lighting and other vessel operations. Use air horn in the event of a boat coming close.	M
4. Setup of RTK GPS base and ROV setup	Injury or accidents such as pinch points, struck by, caught between hazards with equipment especially when on a boat	Training of personnel using this equipment will include familiarity with the hazards due to weight distribution, lines and other equipment used to secure the equipment on boat deck, procedures for safe setup of equipment prior to deployment. Familiarization will include manufacturer's guidelines and instructions and site specific procedures included in the Work Plan. Equipment will be inspected before use, each day by the user.	M

AHA – 2 Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use			
Job Steps	**Hazards**	**Controls**	**RAC**
5. Deployment and operation of ROV	Back injury and strains could occur and loads could shift on boat	Site personnel will be instructed on proper lifting techniques (keep back straight, lift with legs, limit twisting, etc.). Mechanical devices should be used to reduce manual handling of materials and tag lines for stabilization shall be used as necessary rather than direct hand contact. Team lifting should be utilized if mechanical devices are not available. An individual will not lift loads greater than 50 pounds. Have boat operator position boat to minimize effect of ground swell or wave/wind action when deploying ROV into the water from the boat deck. Do not deploy equipment if weather or dangerous sea state conditions exist.	M
	Struck by or caught between, object dropped on feet	Wear steel or safety toed boots. Keep fingers and hands and feet (and entire body as required) out of pinch points and lines. Ensure one person is in charge of lifts and deployment and that others are aware of intentions and signals used. Wear hard hat if overhead hazards exist or worker head could be struck.	M
	Noise	Hearing protection with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs) will be worn as necessary in accordance with the level of noise produced by vessel engines, power tools, lifts and other motor driven equipment.	L
	Ropes and lines can cause burns to hands by friction and pinch points.	Workers will wear gloves when handling lines and deploying equipment. Do not get hands on or in lines that are being controlled by mechanical winch. Lock out and tagout procedures, if required per manufacture guidelines for working on equipment will be followed.	L
6. Retrieval of ROV	Struck by or caught between, object dropped on feet	Wear steel- or safety-toed boots. Keep fingers and hands and feet (and entire body as required) out of pinch points and lines. Ensure one person is in charge of lifts and deployment and that others are aware of intentions and signals used. Wear hard hat if overhead hazards exist or worker head could be struck.	M
	Ropes and lines can cause burns to hands by friction and pinch points.	Workers will wear gloves when handling lines and retrieving equipment. Do not get hands on or in lines that are being controlled by mechanical winch. Lock out and tagout procedures, if required per manufacture guidelines for working on equipment, will be followed.	L
	Back injury and strains could occur and loads could shift on boat	Site personnel will be instructed on proper lifting techniques (keep back straight, lift with legs, limit twisting, etc.).	M

AHA 2 - Mobilization, Site Setup, Boating and Remotely Operated Vehicle Use		
Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
Site Vehicles	Drivers must have current State or Puerto Rico-issued driver's license.	Daily vehicle inspection by drivers.
Boats	Qualified Operators will have U.S. Coast Guard approved boater safety qualifications identified in the APP and experience in use of the boats on the project.	Inspect daily, and before use. Use the boating checklist form. Follow procedures in EHS 6-6, Boating Procedure.
Fire Extinguishers	Fire Extinguisher Training including use/limitations.	At least monthly by SSHO or designee.
First aid kits and other emergency equipment	Use of emergency equipment/first aid kits must be done by personnel familiar with this plan; use and inspection criteria of the equipment, and what the equipment is used for, by or under direction of the SSHO.	Initially and at least weekly thereafter or after use for restocking. (29 CFR 1926.50(d)(2))
RTK GPS unit	Hydrographer to check each day prior to operations.	An experienced operator will use.
Type II or better PFD to be worn	User will inspect each day before use.	An experienced operator will use. SSHO will instruct in proper use.

Acronyms:

AHA – Activity Hazard Analysis
APP – Accident Prevention Plan
CFR – Code of Federal Regulations
dBA – decibels, A-scale
DEET – N,N-diethyl-meta-toluamide
EHS – Environmental, Health, and Safety
EM – Engineer Manual
GPS – global positioning system
MEC – munitions and explosives of concern
MSDS – Material Safety Data Sheet
PFD – personal flotation device
PPE – personal protective equipment
RAC – Risk Assessment Code
ROV – remotely operated vehicle
RTK – real time kinematic
SSHO – Site Safety and Health Officer
UXO – unexploded ordnance

Activity Hazard Analysis (AHA)

Job/Task: Boating and Bathymetry Surveys	Overall Risk Assessment Code (RAC) (Use highest code)					H
Project Location: Culebra Water Ranges, Culebra, Puerto Rico	Risk Assessment Code (RAC) Matrix					
Contract Number: W912DY-10-D-0015	Severity	Probability				
Date Prepared: November 17, 2011		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Jennifer Peters, Sr. EHS Specialist	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by (Name/Title): Roger Margotto, CIH, CSP, CHMM, Tetra Tech EC EHS Manager	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Notes:	RAC guidance	RAC Chart
Notes: (Field Notes, Review Comments, etc.) In addition to the information listed in this AHA, all field personnel must review and be familiar with all provisions of the approved safety plan. TtEC Corporate Safety Programs will also be available on site for review of specific materials and mitigation measures.	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)	
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	**RAC Chart**
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk**
		H = High Risk
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk**
		L = Low Risk

AHA – 3 Boating and Bathymetry Surveys

Job Steps	Hazards	Controls	RAC
1. Set up shore-based work areas	Workers could be exposed to chemical hazards during fueling.	Delineate the refueling zone, and use PPE as required by the type of material being used. The tasks performed, ambient air monitoring, temperature, and visual observation will be used to verify the selection of PPE. Identify all chemical hazards and receive training regarding the safe handling of chemicals (refer to MSDSs). The SSHO will maintain copies of all MSDSs at the site.	L
	Noise from the site setup could cause hearing loss to workers.	Hearing protection is required when sound levels exceed 84 dBA continuously. This rule applies to personnel working near heavy equipment, generator use, or operating engines.	L
	Slip, trip, and fall hazards could be present.	Visually inspect work areas; eliminate slip, trip, and fall hazards if feasible, otherwise barricade/ isolate the hazards. Keep work areas neat and orderly. Always place supplies, hoses, cords and other equipment in areas away from normal foot traffic, and equipment and tools in a safe location that does not present a trip hazard to work areas. Maintain proper illumination in all work areas. Work is authorized during daylight hours only.	L

AHA – 3 Boating and Bathymetry Surveys			
Job Steps	**Hazards**	**Controls**	**RAC**
1. Set up shore-based work areas (cont'd)	Sharp objects could cause puncture.	Wear cut-resistant work gloves when handling sharp edges and items with pinch points, such as barricades, EZ-up shade structures, folding chairs, etc. Whenever possible, blunt sharp edges and double over wire ends (fencing, material bundles, etc.). Workers should not stand or walk on either equipment or supplies.	L
	Musculo-skeletal strains from lifting and moving materials/ equipment manually.	Use mechanical lifting equipment and hand-trucks whenever possible. Otherwise, use proper lifting techniques, such as keeping the back and neck straight, lifting with the legs without twisting, and getting help when moving bulky/heavy materials and equipment. Employees will not lift more than 50 pounds alone. Encourage a steady, sustainable work pace.	M
	Worker exposure to extreme temperatures.	Monitor for Heat Stress and follow safety plans.	L
	Eye injury.	Safety glasses (clear or tinted) are the minimum required eye protection for all work areas during setup and shut down.	L
	Lack of communication in widely dispersed areas could lead to a delayed response in an emergency.	Ensure that each work team has a phone, or access to a phone, for emergency communication. Verify emergency numbers and functions of telephones and radios. Use the buddy system. Verify routes to local hospital.	L
	Contact with wild animals, biting or stinging insects, and poisonous plants could cause injury upon contact	Workers will apply DEET to work clothing following manufacturer's instructions as a preventative measure for biting insects. Workers will exercise caution when working in brushy or grassy areas, wood or debris piles, and recessed areas. Site orientation will include briefing on local hazardous flora and fauna, signs and symptoms of exposure and precautions to take. Workers with allergies will let the SSHO know using the medical data sheet and will carry their own prescription medication as applicable. First aid and medical attention as required.	L
2. Backing of boats on boat trailers	Failure of proper backing can cause struck by and pinch point injuries or property damage	Use spotters for all backing operations. Ensure spotter stands in line of sight of the person backing the vehicle. All personnel who back a trailer are trained and qualified to do so and are designated by the PjM for such activities. Use boat checklist in APP prior to launching boat. Verify understanding of hand signals used for backing, going forward, stopping, and turning left or right. Use parking brake and ensure operator is not moving vehicle before unhitching boat from trailer. Follow EHS 6-6, Boating Procedure.	M
3. Use boat to bring personnel to designated area(s)	Failure to meet EM 385-1-1 Section 19 in general and specifically 19F requirements for use of boats could cause injury or death.	Follow the requirements of EM 385-1-1 and EHS 6-6, Boating Procedure, using the inspection checklist provided in the APP. All boat operators are qualified and trained in boat use and procedures. Ensure boat passengers have been briefed on the location, use, and inspection of emergency equipment onboard and the procedures to follow in the event of a shipboard emergency. Practice drills will be done prior to or during first deployment for situations such as man overboard, fires and explosions, and abandon ship.	H

AHA – 3 Boating and Bathymetry Surveys			
Job Steps	**Hazards**	**Controls**	**RAC**
3. Use boat to bring personnel to designated area(s)	Fueling of boat- potential for fire, environmental release. Run out of fuel when operating.	No smoking or other sources of ignition when fueling. Engine must be off. There must be a fire extinguisher available. Refuel in a manner to prevent any spills, especially spills into the water. (If there is any sheen in the water the spill must be reported). Check for fuel leaks in the boat, if fuel lines are located in the boat.). Ensure there is enough fuel supply for the trip and the return to dock plus 1/3 in reserve.	M
	Boat could malfunction and drift into open water if engine does not work.	Ensure communications are working on boat. Have anchor and enough line to deploy in the event of motor/engine malfunction. Ensure that a Float Plan is filed in accordance with the APP using the example Coast Guard Float Plan in the APP. File this plan daily with the PjM or designee before leaving the dock and notify them of your return.	M
	Grounding	Use caution in the shallow areas. Use depth meter and spotting to avoid striking the bottom or grounding.	L
	Personnel can slip or trip while on the dock and when getting on or off the boat,	Personnel should use appropriate footwear to ensure that there is enough tread on the soles to minimize slipping. Look out for trip hazards. Those hazards that cannot be removed must be marked. When climbing up or down always ensure three points of contact.	L
	Sunburn for personnel in boat.	Use broad spectrum sunscreen SPF 15 or greater as necessary.	L
	Severe weather can cause dangerous seas and hazardous boating conditions	Monitor the local and national weather service broadcasts prior to mobilization by boat and during the day. Pay attention to weather advisories and storm warnings, namely hurricanes. Monitor actual water conditions for dangerous wave or ground swell action. Follow provisions in the APP for severe weather.	M
	Heat or cold stress may be experienced	Boat occupants will be monitored for signs and symptoms of heat stress and cold stress (in colder weather, wet weather, or if wind chill is a factor) in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for boat occupants. Boat occupants will be prepared with raingear and a change of clothing in the event they get wet and chilled. Boat survival kit, if used, will be restocked with necessary equipment. Adequate drinking water and electrolyte fluids will be available for boaters. Boat cabin shall have air conditioning or at a minimum, shade for employees to rest in.	M
	Boat could be struck by other boats in area	Boat operator is in charge of situational awareness while on the water. Boat operator will not be doing other tasks. Monitor Channel 16 and U.S. Coast Guard rules for lighting and other vessel operations. Use air horn in the event of a boat coming close.	M

AHA – 3 Boating and Bathymetry Surveys			
Job Steps	**Hazards**	**Controls**	**RAC**
4. Setup of RTK GPS base and setup for Bathymetric Survey	Injury or accidents such as pinch points, struck by, caught between hazards with equipment especially when on a boat	Training of personnel using this equipment will include familiarity with the hazards due to weight distribution, lines and other equipment used to secure the equipment on boat deck, procedures for safe setup of equipment prior to deployment. Familiarization will include manufacturer's guidelines and instructions and site specific procedures included in the Work Plan. Equipment will be inspected before use, each day by the user. Safety equipment onboard will include an industrial first aid kit and required USCG safety equipment. Personnel will be informed of its' location and use and emergency procedures. A minimum of 2 persons will be first aid/CPR trained.	M
5. Deployment and operation of Bathymetric Survey equipment	Back injury and strains could occur and loads could shift on boat	Site personnel will be instructed on proper lifting techniques (keep back straight, lift with legs, limit twisting, etc.). Mechanical devices should be used to reduce manual handling of materials and tag lines for stabilization shall be used as necessary rather than direct hand contact. Team lifting should be utilized if mechanical devices are not available. An individual will not lift loads greater than 50 pounds. Have boat operator position boat to minimize effect of ground swell or wave/wind action when deploying ROV into the water from the boat deck. Do not deploy equipment if weather or dangerous sea state conditions exist. Monitor the weather forecasts.	M
	Struck by or caught between, object dropped on feet	Wear steel or safety toed boots. Keep fingers and hands and feet (and entire body as required) out of pinch points and lines. Ensure one person is in charge of lifts and deployment and that others are aware of intentions and signals used. Wear hard hat if overhead hazards exist or worker head could be struck.	M
	Noise	Hearing protection with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs) will be worn as necessary in accordance with the level of noise produced by vessel engines, power tools, lifts and other motor driven equipment.	L
	Ropes and lines can cause burns to hands by friction and pinch points.	Workers will wear gloves when handling lines and deploying equipment. Do not get hands on or in lines that are being controlled by mechanical winch. Lock out and tagout procedures, if required per manufacture guidelines for working on equipment, will be followed.	L
6. Retrieval of Bathymetric Equipment	Struck by or caught between, object dropped on feet	Wear steel- or safety-toed boots. Keep fingers and hands and feet (and entire body as required) out of pinch points and lines. Ensure one person is in charge of lifts and deployment and that others are aware of intentions and signals used. Wear hard hat if overhead hazards exist or worker head could be struck.	M
	Ropes and lines can cause burns to hands by friction and pinch points.	Workers will wear gloves when handling lines and retrieving equipment. Do not get hands on or in lines that are being controlled by mechanical winch. Lock out and tagout procedures, if required per manufacture guidelines for working on equipment will be followed.	L

AHA – 3 Boating and Bathymetry Surveys			
Job Steps	**Hazards**	**Controls**	**RAC**
	Back injury and strains could occur and loads could shift on boat	Site personnel will be instructed on proper lifting techniques (keep back straight, lift with legs, limit twisting, etc.).	M

AHA 3 – Boating and Bathymetric Surveys		
Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
Site Vehicles	Drivers must have current State or Puerto Rico-issued driver's license.	Daily vehicle inspection by drivers.
Boats	Qualified Operators will have U.S. Coast Guard approved boater safety qualifications identified in the APP and experience in use of the boats on the project.	Inspect daily, and before use. Use the boating checklist form. Follow procedures in EHS 6-6, Boating Procedure.
Fire Extinguishers	Fire Extinguisher Training including use/limitations.	At least monthly by SSHO or designee.
First aid kits and other emergency equipment	Use of emergency equipment/first aid kits must be done by personnel familiar with this plan; use and inspection criteria of the equipment, and what the equipment is used for, by or under direction of the SSHO.	Initially and at least weekly thereafter or after use for restocking. (29 CFR 1926.50(d)(2))
RTK GPS unit, intertial measurement unit, side scan sonar, single and multibeam echosounders	Hydrographer to check each day prior to operations.	An experienced operator will use.
Type II or better PFD to be worn	User will inspect each day before use.	An experienced operator will use. SSHO will instruct in proper use.

Acronyms:

AHA – Activity Hazard Analysis
APP – Accident Prevention Plan
dBA – decibels, A-scale
CFR – Code of Federal Regulations
DEET – N,N-diethyl-meta-toluamide
EHS – Environmental, Health, and Safety
EM – Engineer Manual
GPS – global positioning system
MSDS – Material Safety Data Sheet
PFD – personal flotation device
PPE – personal protective equipment
RAC – Risk Assessment Code
ROV – remotely operated vehicle
RTK – real-time kinematic
SSHO – Site Safety and Health Officer
USCG – U.S. Coast Guard

ATTACHMENT B

SELECT ENVIRONMENTAL HEALTH AND SAFETY PROCEDURES (ON CD ONLY)

ATTACHMENT C

INSPECTION AND REPORTING FORMS

SMALL BOAT INSPECTION CHECKLIST			Date of Inspection:
Contractor			Contract No.
Inspected by (Signature)			
Safety and Health Requirement to Reference EM 385-1-1**.** Section 19.F	Yes	No	N/A
Is each operator properly licensed?			
Is hull in satisfactory condition? (Any obvious leaks?)			
Are the lights properly maintained, assuring that they can be seen between sunset and sunrise?			
Is condition of fuel supply hose satisfactory?			
Is boat equipped with a white stern light, having a 0.2-mile visibility?			
Is the maximum number of passengers that can be safely transported posted on all launched, motorboats and skiff?			
Does horsepower of engine meet hull specifications?			
Is signal device provided on the vessel to give signals required by applicable navigation rules?			
Are visual distress signal devices (day and night) present and up to date?			
Is type and size of anchor and attached line suitable for size of boat?			
Are paddles and/or oars onboard and in good condition?			
Is bilge pump and discharge (if so equipped) properly located and in good operating condition?			
Is fully stocked First Aid kid of proper size onboard?			
Are navigation lights working properly?			
Has a Type III / Type V or better USCG personal floatation device (PFD) been provided to all boat passengers and properly worn?			
Are PFD's inspected for defects which would alter their buoyancy before and after each use?			
Are defective PFD's or PFD's with less than 13 pounds buoyancy removed from service?			
Are PFD's equipped with retro-reflective tape meeting EM385-1-1.			
Is each boat equipped with at least one USCG-approved life ring or ring buoy with at least 90 feet 3/8" solid braid polypropylene line or equivalent attached?			
Is the motor boat equipped with a kill switch?			
Are boat seats securely bolted to the boat desk?			
Are launches and motorboats equipped with fire extinguishers of at least the size and ratings specified?			

SNORKLING INSPECTION CHECKLIST EM 385-1-1 Section 30 G			Date of Inspection:
Contractor			Contract No.
Inspected by (Signature)			

***Safety and Health Requirement to Reference EM 385-1-, Section 30 G*.**	Yes	No	N/A
Snorkeling team will not be less than 2 persons. (snorkeler and observer/assistant)			
Snorkeling will be done only on the surface of the water.			
Untethered scientific snorkeling is not allowed in waters deeper than 5 feet.			
The snorkeler is tethered with a harness and a maximum of 40 feet of floating line..			
The tether is constantly tethered from the shore or boat.			
The snorkeler is wearing a device providing a minimum of 15.5 lbs. positive buoyancy.			
There are no potential entanglement hazards in the snorkeling area (overhanging branches or objects, surface stumps, rocks, etc.			
Snorkelers and observer/ assistants are certified as skin divers (snorkelers or open water divers by a nationally recognized organization.			
An observer/assistant will accompany each untethered snorkeler either along the shore or in about and will be within 50-feet of the snorkeler at all times.			
Non snorkeling observer/assistants must wear a PFD and be equipped with a ring buoy with at least 70 feet of line. Must be capable of performing a rescue on the specific snorkelers in an emergency			
Areas of extreme water velocity and turbulence are avoided.			
Snorkelers have appropriate thermal protection.			
The employees are medically fit to perform snorkeling activities.			
All snorkeling team members are certified in CPR and First Aid.			
There is First Aid kit is available in the boat.			
The AHA is modified for the specific snorkeling session			
Records for snorkeling are maintained.			
Snorkelers are wearing apparel that provides appropriate environmental protection. The apparel includes fins or other appropriate foot protection.			

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY (CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPIT-ALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#	TYPE	#
SECONDARY	#	SOURCE	#
f. NATURE OF ILLNESS/INJURY	(CODE) #		

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐ PICKUP/VAN ☐ AUTOMOBILE	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END	(1) FRONT SEAT			
☐ TRUCK ☐ OTHER *(Specify)*	☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)

	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*

	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL
CORPS ____ CONTRACTOR ____			

16. MANAGEMENT REVIEW *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10. ACCIDENT DESCRIPTION *(Continuation)*

13a. DIRECT CAUSE *(Continuation)*

13b. INDIRECT CAUSES *(Continuation)*

14. ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

GENERAL. Complete a separate report for each person who was *injured, caused,* or *contributed* to the accident (excluding uninjured personnal and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the descretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16. and 17.

INSTRUCTIONS FOR SECTION 1 — ACCIDENT CLASSIFICATION. *(Mark All Boxes That Are Applicable.)*

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY—Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury). CA-2 (illness), or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

($2,000 or more) (2) PROPERTY DAMAGE—Mark the appropriate box if accident resulted in any damage of $2000 or more to government property (including motor vehicles). also see ER385-1-99 for new classes of accidents.

(3) VEHICLE INVOLVED—Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY—Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY—Mark if accident resulted in any contractor lost-time injury/illness or fatality.

($2,000 or more) (2) PROPERTY DAMAGE—Mark the appropriate box if accident resulted in any damage of $2000 or more to contractor property (including motor vehicles). Also see ER385-1-99 for classes of accidents

(3) VEHICLE INVOLVED—Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY—Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY—Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

(2) VOID SPACE—Make no entry.

(3) VEHICLE INVOLVED—Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE—Make no entry.

INSTRUCTIONS FOR SECTION 2—PERSONAL DATA

a. NAME—(MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. AGE—Enter age.

c. SEX—Mark appropriate box.

d. SOCIAL SECURITY NUMBER—(FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. GRADE—(FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: O-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE—For *government civilian employees* enter the pay plan, full series number, and job title, e.g. GS-0810/Civil Engineer. For *military personnel* enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For *contractor employees* enter the job title assigned to the injured person, e.g. carpenter, laborer, surveyor, etc.,

g. DUTY STATUS—Mark the appropriate box.

(1) ON DUTY—Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident

h. EMPLOYMENT STATUS—(FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3—GENERAL INFORMATION

a. DATE OF ACCIDENT—Enter the month, day, and year of accident.

b. TIME OF ACCIDENT—Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. EXACT LOCATION OF ACCIDENT—Enter facts needed to locate the accident scene. (installation/project name, building number, street, direction and distance from closest landmark, etc.,).

d. CONTRACTOR NAME

(1) PRIME—Enter the exact name (title of firm) of the prime contractor.

(2) SUBCONTRACTOR—Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER—Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT—Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW)—Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4—CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY—Select the *most appropriate* construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION	14. ELECTRICAL
2. SITE PREPARATION	15. SCAFFOLDING/ACCESS
3. EXCAVATION/TRENCHING	16. MECHANICAL
4. GRADING (EARTHWORK)	17. PAINTING
5. PIPING/UTILITIES	18. EQUIPMENT/MAINTENANCE
6. FOUNDATION	19. TUNNELING
7. FORMING	20. WAREHOUSING/STORAGE
8. CONCRETE PLACEMENT	21. PAVING
9. STEEL ERECTION	22. FENCING
10. ROOFING	23. SIGNING
11. FRAMING	24. LANDSCAPING/IRRIGATION
12. MASONRY	25. INSULATION
13. CARPENTRY	26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT—Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5—INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY / ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI NO INJURY
FAT FATALITY
PTL PERMANENT TOTAL DISABILITY
PPR PERMANENT PARTIAL DISABILITY
LWD LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA RECORDABLE FIRST AID CASE
NRI NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST—Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED—Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY—Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED—Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE; DISC)
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury / illness from the list below. This nature of injury / illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury / illness name on the line and place the corresponding CODE letters in the box provided.

* The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN.
	TC	CONTUSION; BRUISE; ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER; STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY — OTHER (EXCEPT DISEASE, ILLNESS)

**A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which doses not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC — OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface)

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/ oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle..
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY

CODE	SOURCE OF INJURY NAME
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED: SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL—CORROSIVE
0712	DRY CHEMICAL—TOXIC
0713	DRY CHEMICAL—EXPLOSIVE
0714	DRY CHEMICAL—FLAMMABLE
0721	LIQUID CHEMICAL—CORROSIVE
0722	LIQUID CHEMICAL—TOXIC
0723	LIQUID CHEMICAL—EXPLOSIVE
0724	LIQUID CHEMICAL—FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INANIMATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE)
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)

CODE	SOURCE OF INJURY NAME
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 — PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT—Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the *most* appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating—powered
3. Boating—unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving, scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.)
24. Sports/winter (skiing, sledding, snowmobiling etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED—If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7—MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE—Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION—Mark appropriate box.

c. SEAT BELT—Mark appropriate box.

INSTRUCTIONS FOR SECTION 8—PROPERTY/ MATERIAL INVOLVED

a. NAME OF ITEM—Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP—Enter ownership for each item listed. (Enter one of the following: *USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)*

c. $ AMOUNT OF DAMAGE—Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9—VESSEL/ FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT—Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel/ floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP—Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEPT DOWN ON DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10—ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT—Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11—CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN—Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE—Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION—Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES—Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES—Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS—Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS—Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS—Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by-products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) OFFICE FACTORS—Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) SUPPORT FACTORS—Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc?

(11) PERSONAL PROTECTIVE EQUIPMENT—Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) DRUGS/ALCOHOL—Is there any reason to believe the person's mental or physical capabilities, judgement, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. WRITTEN JOB/ACTIVITY HAZARD ANALYSIS—Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. *If one was performed, attach a copy of the analysis to the report.*

INSTRUCTIONS FOR SECTION 12—TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?—For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

b. TYPE OF TRAINING—Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

c. DATE OF MOST RECENT TRAINING—Enter the month, day, and year of the last *formal* training completed that covered the activity-task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13—CAUSES

a. DIRECT CAUSES—The direct cause is that single factor which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES—Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (note USACE vehicle was in proper/safe working condition).
Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: Failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14—ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION—Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15—DATES FOR ACTION

a. BEGIN DATE—Enter the date when the corrective action(s) identified in Section 14 will begin.

b. COMPLETE DATE—Enter the date when the corrective action(s) identified in Section 14 will be completed.

c. TITLE AND SIGNATURE—Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE Supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in Section 16.

d. DATE SIGNED—Enter the month, day, and year that the report was signed by the responsible supervisor.

e. ORGANIZATION NAME—For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. OFFICE SYMBOL—Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16—MANAGEMENT REVIEW (1st)

1ST REVIEW—Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17—MANAGEMENT REVIEW (2nd)

2ND REVIEW—The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18—SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW—The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc, are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19—COMMAND APPROVAL

4TH REVIEW—The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

FLOAT PLAN

INSTRUCTIONS: Complete this plan before you go boating and leave it with a reliable person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return or check-in as scheduled. If you have a ***change of plans*** after leaving, be sure to notify the person holding your Float Plan.

Do <u>NOT</u> file this plan with the Coast Guard.

www.cgaux.org

www.uscgboating.org

VESSEL

IDENTIFICATION:

Name & Home Port ____________

Doc. / Registration No. ____________

Year & Make ____________

Length ______ Type PWR Draft ____ (Inch/CM) Hull Mat. Fiber

Hull Color(s) ____________

Prominent Feature(s) ____________

PROPULSION:

Primary - Type Gas IO No. Eng __ Fuel Capacity ____

Auxiliary - Type none No. Eng __ Fuel Capacity ____

TELECOMMUNICATIONS:

Radio Call Sign ____________

DSC MMSI Number ____________

Radio-1: Type VHF-FM Ch / Freq. Monitored ______

Radio-2: Type ______ Ch / Freq. Monitored ______

Cell Phone ____________

Pager ____________

NAVIGATION: (Check all on board)

☐ Maps ☐ Charts ☐ Compass ☐ GPS / DGPS

☐ Radar ☐ Loran C ☐ Sounder ☐ ______

SAFETY & SURVIVAL

VISUAL DISTRESS SIGNALS:

☐ Day Only type

☐ Night Only type

☐ Day & Night type

PFDs: (Do not count Type IV devices)

___ Quantity on board

AUDIBLE DISTRESS SIGNALS:

☐ Horn / Whistle

☐ Bell

☐ ______

GROUND TACKLE:

☐ Anchor - line length _____ ft.

OTHER GEAR / SUPPLIES:

☐ Lifeboat / Life Raft ☐ Flashlight / Searchlight

☐ Dinghy / Skiff ☐ Signal Mirror

☐ Food / Water ☐ Drogue / Sea Anchor

☐ EPIRB none ☐ ______

☐ Foul Weather Gear ☐ ______

PERSONS ON BOARD

OPERATOR: Age M/F Notes (Special medical condition, Can't swim, etc.)

Name ____________ ___ ___ ____________

Address ____________ Experience: w/Boat ☐ w/Area ☐

City ____________ State ____ Zip code ______ Home Phone ____________

Vehicle (Year, Make & Model) ____________ Vehicle License No. ____________

Where will trailer be parked? ____________ Trailer License No. ____________

PASSENGERS: Name & Home Phone Age M/F Notes (Special medical condition, Can't swim, etc.)

1. ____________ ___ ___ ____________
2. ____________ ___ ___ ____________
3. ____________ ___ ___ ____________
4. ____________ ___ ___ ____________
5. ____________ ___ ___ ____________

Attach Supplemental Passenger List if additional passengers on board.

ITINERARY

	DATE	TIME	LOCATION	MODE OF TRAVEL	REASON FOR STOP	CHECK-IN TIME
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						

Attach Supplemental Itinerary if additional space required.

Contact 1 ____________ Phone Number ____________

Contact 2 ____________ Phone Number ____________

If you have a genuine concern for the safety or welfare of any persons on board this vessel, who have not returned or checked-in within a reasonable amount of time, then follow the step-by-step instructions on the **Boating Emergency Guide** included with this plan, or on the World Wide Web at:

http://www.uscgaux.org/~floatplan/BoatingEmergencyGuide.htm

ME2(b) Rev(1.29.05)

BOATING EMERGENCY GUIDE

You will need the following items before you begin: 1) The **Float Plan**, if one was given to you; 2) **Pen** or **Pencil**; 3) Clean sheet of **paper** or **writing tablet**; and 4) **Telephone Directory**.

Step 1

Is there a genuine concern for the safety or welfare of any persons on board the vessel, who have not returned or checked-in within a reasonable amount of time?

If YES, continue with **Step 2**. If NO, then **Stop**. No further action is required at this time.

Step 2

Were you given a prepared Float Plan by anyone onboard the vessel?

If YES, continue with **Step 3**. If NO, then go to **Step 5**.

Step 3

On the Float Plan, locate the two contact lines, below the "Itinerary" at the bottom of the Float Plan. Call the telephone number of Contact-1.

<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>A person answered the phone...</td><td>Take notes during your conversation.
1. Let the person know that you are responding to a late return or check-in by the individuals designated on the Float Plan.
2. Determine if the person you are talking to, or anyone else at that location, has recently had contact with anyone on the vessel, and when and where that contact occurred.
3. Are you still concerned about the safety or welfare of any persons on board the vessel?
<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>Yes</td><td>Continue with Step 4.</td></tr>
<tr><td>No</td><td>Stop. No further action is necessary at this time.</td></tr>
</table></td></tr>
<tr><td>Otherwise...</td><td>Continue with Step 4.</td></tr>
</table>

Step 4

Call the telephone number for Contact-2.

<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>A person answered the phone...</td><td>Take notes during your conversation.
1. Let the person know that you are responding to a late return or check-in by the individuals designated on the Float Plan.
2. Determine if the person you are talking to, or anyone else at that location, has recently had contact with anyone on the vessel, and when and where that contact occurred.
3. Are you still concerned about the safety or welfare of any persons on board?
<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>Yes</td><td>Continue with Step 6.</td></tr>
<tr><td>No</td><td>Stop. No further action is necessary at this time.</td></tr>
</table></td></tr>
<tr><td>Otherwise...</td><td>Continue with Step 6.</td></tr>
</table>

ME2(b) Rev(1.29.05)

Step 5

Take a moment to jot down the facts you know about each item in the checklist below:

Do not speculate! Speculation of a fact may mislead search and rescue personnel and add to the overall search and rescue time, adversely affecting the outcome.

- ❑ Period of time the vessel has been overdue.
- ❑ Purpose of the trip or voyage.
- ❑ Description of vessel (color, size, shape, etc.)
- ❑ Vessel's departure point and destination.
- ❑ Places the vessel planned to stop during transit.
- ❑ Navigation equipment on board (such as GPS, Compass, Maps, Charts, LORAN C, etc.)
- ❑ Survival equipment on board (life jackets, EPIRB, flares, etc.)
- ❑ Number of people on board the vessel, as well as personal habits e.g. dependability, reliability, etc.
- ❑ Was the vessel already moored, or did a vehicle tow it to the location?
- ❑ License plate number and description of the vehicle of the towing and/or crew transport vehicle.
- ❑ Communications equipment on board including radio frequencies monitored, cellular telephone numbers of people aboard.
- ❑ Additional points of contact in the area.
- ❑ Were there any pending commitments (work, appointments, etc.)?

Continue with **Step 6**.

Step 6

1. Contact your local Law Enforcement agency.
2. Let the dispatcher know that you are responding to a late return or check-in by the persons on board.
   a. The dispatcher will guide you from there. The dispatcher will provide you with the necessary contact or agency connection (if one was not given on the Float Plan) to get a Search And Rescue (SAR) mission started. This is usually handled this way because it puts you closest to the agency conducting the rescue mission, eliminating an unnecessary middleman.
   b. The dispatcher will let you know if they would like a follow-up call from you on the outcome.
3. The dispatcher will instruct you from there.

Continue with **Step 7**.

Step 7

Be patient... you've done everything you can possibly do for now. Stay off of the phone, so emergency personnel can contact you with additional information and/or questions concerning the Search And Rescue (SAR) effort.

End of Guide

http://www.uscgaux.org/~floatplan/

This page intentionally left blank.

APPENDIX E

SNORKELING SAFETY PLAN

FINAL
Snorkeling Safety Plan

Environmental Baseline Survey
Culebra Water Ranges

Culebra, Puerto Rico

Prepared by:

TETRA TECH EC, INC.

November 16, 2012

APPROVALS

By their signature, the undersigned hereby certify that this Snorkeling Safety Plan has been reviewed and approved for use during the Environmental Baseline Survey at the Culebra Water Ranges in Culebra, Puerto Rico.

TtEC Project Manager: Scot Wilson, PMP

______________________________ Date: ______________

TtEC Diving Safety Manager: Steve Neill

SW Neill Date: 6/27/12

USACE Dive Safety Officer: John Houvener

______________________________ Date: ______________

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

AHA	activity hazard analysis
APP	Accident Prevention Plan
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
EBS	Environmental Baseline Survey
EC	Emergency Coordinator
EM	Engineer Manual
FOL	Field Operations Lead
MRS	Munitions Response Sites
PESM	Project Environmental Safety Manager
PFD	personal flotation device
PjM	Project Manager
RI/FS	remedial investigation/feasibility study
SCUBA	self-contained underwater breathing apparatus
SSHO	Site Safety and Health Officer
SSP	Snorkeling Safety Plan
TtEC	Tetra Tech EC, Inc.

1.0 INTRODUCTION

1.0.01 This Snorkeling Safety Plan (SSP) addresses the health and safety practices and controls that will be implemented by all Tetra Tech EC, Inc. (TtEC) employees and subcontractors participating in the scientific snorkeling operations to perform baseline benthic characterization surveys during the Environmental Baseline Survey (EBS) at the Culebra Water Ranges in Culebra, Puerto Rico.

1.0.02 Field operations are tentatively scheduled to commence in September 2012. Activities to be performed under this SSP comply with applicable sections of Occupational Safety and Health Administration Standard 29 Code of Federal Regulations (CFR) 1910.120, the American Academy of Underwater Sciences Standards, Engineer Manual (EM) 385 1-1 Section 30.G (USACE 2008), and TtEC's Dive Safe Practice Manual (included as Attachment A to this Plan).

1.0.02 This SSP is not meant to be a stand-alone document. This SSP will be implemented in conjunction with the Accident Prevention Plan (APP), which is the overarching safety plan for the EBS portion of the project. Sections of the APP are referenced (or duplicated) in this SSP to the appropriate section of the APP where appropriate. Both documents will be available and accessible to personnel during scientific snorkeling activities. Snorkeling personnel will be familiarized with both the APP and this SSP prior to beginning fieldwork.

2.0 DESCRIPTION OF PROJECT

2.0.01 The EBS will be performed at underwater Munitions Response Sites (MRSs) 03 and 12, both located offshore east and west-southwest of the Northwest Peninsula of Culebra, Puerto Rico (See Figures 1-2a and b in the APP) [the Culebra Water Ranges]. The EBS tasks include performance of a multibeam echosounder bathymetry survey, a sidescan sonar survey, and an underwater video survey to conduct a benthic terrain and habitat assessment prior to the remedial investigation/feasibility study (RI/FS). The benthic terrain and habitat assessment task will be supplemented, as required, by use of scientific snorkelers with sufficient biological habitat expertise who observe or verify and document habitat conditions to the extent possible from the surface of the water, including collection of photographs or video. Information collected during the EBS will be used to better define the underwater environment and sensitive habitats such as coral reefs and seagrass beds for the RI/FS which includes intrusive investigation activities. A separate APP/Site-Specific Safety and Health Plan and Dive Plan will be prepared for the RI fieldwork.

2.0.02 The EBS activities in this SSP only relate to scientific snorkeling activities which are wholly performed on the surface of the water. No self-contained underwater breathing apparatus

(SCUBA) or airline diving will be performed during the EBS. The scope of work for this site includes:

- Mobilization
- Benthic surveys
- Scientific snorkeling
- Demobilization

2.0.03 Activity hazard analyses (AHAs) have been prepared and are included as Attachment A of the APP. The benthic surveys and scientific snorkeling tasks will be performed primarily by boat though some shallow water snorkeling may be performed from a beach entry point. Boating hazards as well as physical, environmental, and biological hazards are included in the AHA for the scientific snorkeling activities as AHA #1, which is included (duplicated from the APP) in Attachment B of this SSP. A snorkeling inspection checklist is included as Attachment C of this SSP; additionally, a small boat inspection checklist is included as a form in Attachment C of the APP.

2.0.04 Upon field task completion, TtEC will ensure demobilization of equipment and supplies from site.

3.0 ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

3.0.01 TtEC is the prime contractor for this project. TtEC staff will be conducting the boating and scientific snorkeling tasks performed during the EBS. No subcontractors will be performing snorkeling activities. The snorkeling team will be made up of no less than three (3) persons: the snorkeler, the snorkeler observer/assistant, and snorkeling team supervisor. For this project, TtEC will have one snorkeler in the water, while the snorkeling supervisor and observer/attendant will be in the boat. The snorkeling team supervisor will also be the boat operator. The Mark V (or equivalent) inflatable boat used for conducting the snorkeling operations. The support boat (either the 29.5-foot or the 34-foot scientific research boat) that is in the vicinity and in communication with the snorkeling team boat will have all applicable up-to-date boat safety and emergency equipment and the boat operator(s) will have the required qualification and training as specified in the APP.

3.0.02 The organizational structure and responsibilities of the Project Manager (PjM), SSHO, and Field Operations Lead (FOL) are included in Section 3 of the APP. The Dive Safety Manager (Steve Neill) is the person to whom the SSHO reports for all boating and/or scientific snorkeling-related matters, including near misses or event reporting.

3.0.03 Should this approved SSP require modification or should any of the snorkeling procedures or activities change, any changes must be approved by the Dive Safety Manager and the USACE Designated Dive Coordinator.

4.0 SCIENTIFIC SNORKELING

4.1 SCIENTIFIC SNORKELING HAZARDS

4.1.01 The primary hazards associated with snorkeling include drowning, hypothermia or heat stress, being carried away by strong surface currents or into hazardous areas, encountering dangerous marine life, severe weather or currents, and being struck by surface vessels. These hazards, as well as boating related hazards are described in detail in Sections 8 and 10 of the APP. In addition, the hazards and mitigation strategies to follow to minimize potential injuries during scientific snorkeling are also addressed in the AHA #1, which is included as Attachment B to this SSP.

4.1.02 Other hazardous conditions, though not as likely to occur as the above during the EBS activities, include:

- Electrical Shock – Electrical shock is rare under or in the water but may occur when using power equipment underwater or topside. A ground fault interrupter must be used with electrical equipment employed on the boat, both on the surface and in the water.
- Sonar – Additional precautions may be required when snorkeling in the vicinity of vessels that employ active sonar. Ships use low frequency sonar for object location and depth finding. It is a dense, high-energy pulse of sound that can cause damage to a snorkeler's ears. Avoid snorkeling in the vicinity of low frequency sonar and approach no closer than 600 yards. The optimal separation distance is 3,000 yards. Additionally, the U.S. Navy Diving Manual has a worksheet to compute actual time and distance restrictions for various types of sonar. This worksheet takes into account such variables as depth, time, diving apparatus, and wetsuit hoods. High frequency (greater than 100 kilohertz), short duration sonar, such as used with sidescan and hand-held sonar, poses little danger to the snorkeler. The snorkeler will abort the dive if active low frequency sonar is energized while he is in the water.
- Snorkelers could encounter dangerous or unpleasant forms of pollution that can cause potential health problems, such as: effluent from a sewer or industrial outfall, oil leaking from a damaged fuel tank, toxic materials or volatile fuels leaking from barges or tanks, and ordnance. The snorkeling team shall not conduct the snorkeling until the hazard is no longer present and shall notify the FOL, PjM, and Project Environmental Safety Manager (PESM). The PjM will notify the U.S. Army Corps of Engineers. If contamination gets onto the snorkeler, the PESM will be notified, and the process for decontamination and follow up established.

4.2 SITE CONDITIONS

Surface & Underwater Conditions	Visibility	Water Temp	Thermal Protection	Currents
Culebra: Calm to choppy seas. Coral/Seagrass habitat	15-100 feet	70-80°F	Dive Skin or coveralls	Weak to strong

4.3 SCIENTIFIC SNORKELER QUALIFICATIONS AND TRAINING

4.3.01 All members of the scientific snorkeling team meet the certification and training requirements in EM 385-1-1, Section 30.G.06. TtEC scientific snorkelers performing the EBS are open water divers certified by a nationally recognized organization (e.g., Professional Association of Diving Instructors, National Association of Underwater Instructors, etc.). The observer/assistant snorkeler team members will rotate during each snorkeling event. As necessary, team members may switch in the role they fill (i.e., supervisor/boat operator, snorkeler, and observer/assistant) as long as the Dive Safety Manager qualifies the individual in the role of supervisor and the person who will be designated as supervisor/boat operator clearly understands and is able to demonstrate their ability to perform responsibilities in this role and has the appropriate experience, qualifications, and certifications. The TtEC SSHO, under the direction of the Dive Safety Manager, who reviews and approves all snorkelers and divers used on TtEC projects, will verify that all snorkelers have proper certification and training as well as the required medical clearance for performing snorkeling activities during this project. The TtEC SSHO will also verify that all parties involved in these activities have reviewed and are familiar with the APP as well as this SSP by signature. Snorkeler certifications will be maintained on-site.

4.3.02 In addition, all snorkelers will be determined to be medically fit by a licensed physician on an annual basis and the certification records shall be on-site. All snorkeling team members are certified in cardiopulmonary resuscitation (CPR) and first aid. A copy of each snorkeler's certifications, medical clearance, and first aid/CPR credentials will be sent to the Dive Safety Manager and copies will be submitted to the USACE representative.

4.4 SNORKELING EQUIPMENT

4.4.01 All snorkelers must wear a type III personal flotation device (PFD) or fully inflated snorkeling vest providing a minimum of 15.5 pounds of positive buoyancy.

4.4.02 Snorkelers will wear appropriate thermal protection consisting of dive skins or coveralls as conditions dictate, which will also help to minimize potential for sunburn as well as minimize potential skin contact with marine life such as jellyfish or fire corals.

4.4.03 A professional-grade diving mask and snorkel, as well as fins or other appropriate foot protection will also be provided and worn during snorkeling activities.

4.4.04 Appropriate tether lines and surface buoys will be used as described below.

4.4.05 All snorkel equipment and safety gear will be inspected before use on a daily basis. Damaged equipment will be taken out of service and repaired or replaced. After use, equipment will be cleaned (with light soapy water and rinse according to manufacturer instructions) and will be stored in a dry location when not in use.

4.5 PRE-SNORKELING ACTIVITIES

4.5.01 Pre-snorkeling activities are as follows:

- The SSHO will verify all snorkelers/observers and supervisor/boat operator (snorkeling team) have attended site-specific APP and Snorkeler Safety Plan training and have reviewed the AHA in Attachment B, and that copies of all certifications are on-site.
- The SSHO and snorkeling team will hold a briefing each day to discuss personnel assignments, techniques, and equipment to be used, and to review the AHA and emergency procedures.
- The snorkeling inspection checklist in Attachment C of this SSP will be filled out on a daily basis by the snorkel team supervisor prior to commencing snorkeling activities. Daily before snorkeling and during snorkeling, the snorkeling supervisor will evaluate conditions as necessary such as temperature (water and air), tide (high and low), current speed/direction, wind speed/direction; landmarks, sunrise and sunset times, and wave action (height and direction). The boat operator will monitor the weather forecast or be in communication with the survey vessel boat operator, who will monitor the weather forecast.
- A small boat inspection checklist in Attachment C of the APP, will be filled out by the boat operator on a daily basis.
- Verify working means of communication (cell phone [waterproof phones] and marine radio channel 16) before starting the project and daily to ensure communications work in the area and that communications are working between the survey boat(s) and the snorkeling boat.
- Review emergency signals, including air horn signals, hand signals and line tug/ping signals. In the event that the snorkelers need to be recalled to the boat for an emergency, the boat horn (or air horn) will be given a single blast. If the snorkelers fail to hear the surface alarm, the observer will signal the snorkelers using four hits to a metal pipe (ping) with a hammer to signal to surface or four tugs on the tether line.
- Inspect and verify the required snorkeler's safety and emergency equipment is present and in good condition including PFDs, mask, fins, snorkel, wetsuit, surface buoy and tethers for observation of snorkelers by boat side personnel.
- Check snorkeler's physical condition.

- Ensure a Stokes litter or backboard with flotation is available for emergency retrieval of an injured or unconscious snorkeler onto boat or, if snorkeling is done from land entry, is immediately available onshore.
- Review emergency procedures, contacts, and numbers, and ensure a vehicle is available at the boat launch site for transportation to the hospital if required. Ensure the team knows the location of the emergency numbers, the hospital, and route to the hospital, which are included on Figures 5-1 and 5-2 (see Section 5).

4.6 SNORKELING PROCEDURES

4.6.01 The snorkeling procedures are as follows:

- When the team arrives at the snorkeling site, the boat captain will position the boat between the snorkeling work zone and potential other boat traffic and place the motor in neutral or hold position as required. The snorkelers will suit up and don required safety equipment.
- Prior to entry into the water, the snorkeling supervisor will ensure the boat operator has the boat motor in neutral and that personnel are entering the water so that the propeller is not engaged. The snorkeling supervisor will notify the boat operator when snorkelers and tender line are not in proximity to the propeller and when it is safe to engage the propeller.
- Snorkeling will only be permitted on the surface of the water. No diving of any kind is permitted.
- All snorkelers in water deeper than 5 feet, waters that a snorkeler cannot wade across, or anywhere a pressure differential may exist will be tethered with a harness and a maximum of 40 feet of floating line that is constantly tethered from the shore or boat.
- The Type II PFD or fully inflated snorkeling vest must be worn.
- There must be no potential tether entanglement hazards in the snorkeling area.
- Snorkeling will be discontinued if sudden squalls, electric storms, heavy seas, unusual tide, or any other condition exists that, in the opinion of the snorkeling supervisor, jeopardizes the safety of the team. At no time will snorkeling be conducted in poor weather conditions, currents exceeding 1 knot or in marginal visibility conditions.
- If untethered snorkeling is performed in areas that are less than 5 feet deep, waters that a snorkeler cannot wade across, or where a pressure differential may exist, the observer will accompany each untethered snorkeler either along the shore or in a boat and be within 50 feet of the snorkeler at all times. Two untethered snorkelers in the same body of water may act as observer/assistant for each other if they remain within 50 feet of each other. Non-snorkeling observer/assistants will wear a PFD and be equipped with a throw bag and/or ring buoy with at least 70 feet of line and must be capable of performing rescue on the snorkeler in the event of an emergency.

- Areas of extreme water velocity or turbulence (e.g., rip currents, wave break on shore or reefs) will be avoided.
- The boat will be located between the snorkelers and any potential boat traffic to minimize potential for vessel strikes.
- A ladder extending below the surface of the water and handrails three feet minimum above the diving platform will be provided to assist the snorkeler on entry and exit from the water (inflatable boats are exempt from this requirement).
- The propeller of the vessel will be stopped before the snorkeler enters or exits the water.

4.7 POST-SNORKELING PROCEDURES

4.7.01 The snorkeling team supervisor will check the physical conditions of the snorkelers between rotations and/or at the end of shift. Any adverse health problems, however minor they may seem (including any rashes, itching, etc.), must be reported to the SSHO as soon as the snorkeler has knowledge of the condition. Additionally, all snorkelers will report sightings of lionfish, abundant jellyfish populations in the area, or other potentially dangerous marine life observed that could present a potential hazard to the snorkeler so appropriate measures can be taken to remove or minimize the potential for exposure.

4.7.02 Clean and stage equipment for next day's snorkeling event.

5.0 EMERGENCY MANAGEMENT PLAN

5.0.01 The following Emergency Management Plan includes the required elements of EM 385-1-1 Section 30.A.19 for scientific snorkeling activities. Additional general and site-specific emergency procedures (fires and explosions, medical emergencies, spills, injuries, severe weather, man overboard, and abandon ship) are contained in detail in the APP (which will also be present in the snorkel team boat) as follows:

- Emergency Response Plans (Section 8.2)
- Procedures and Tests (Section 8.2.1)
- Emergency Evacuation Routes (Figures 5-1 and 5-2 in this plan, and 8-1 and 8-2 in the APP)
- Spill Plans and Response (Section 8.2.2)
- Firefighting Plan and Explosion Procedure (Section 8.2.3)
- Emergency Telephone Numbers (Table 5-1 in the SSP and Table 8-1 in the APP)
- Man Overboard/Abandon Ship (Section 8.2.5)
- Medical Support (Section 8.2.6)
- Contingency Plan for Severe Weather (Section 8.21)

5.0.02 Because this project does not involve any diving operations, recompression chamber locations and Dive Alert Network information are not provided in this plan.

5.1 EMERGENCY HOSPITAL AND COAST GUARD INFORMATION

5.1.01 The nearest Emergency Services provider on Culebra is the Promed Medical Center located at Calle William Font Final, Culebra, PR 00775. Their telephone number is **787-742-3511**. **For emergencies, dial 911**. For Advanced Care Emergency Services, if the medical emergency or injury requires it, the Promed Medical Center will call for Air Ambulance transport to an acute care facility in Fajardo, Puerto Rico (information below). Figures 5-1 and 5-2 show emergency routes from each munitions response site to the Promed Medical Center via vehicle.

5.1.02 Local ambulance service, dispatched from the Promed Medical Center, will be used to transport the injured worker to the hospital by calling 911. Should the emergency situation warrant rescue operations at sea, the U.S. Coast Guard will be notified via marine radio channel 16. The Commander of the U.S. Coast Guard Sector San Juan, Puerto Rico (24-hour regional contact for emergencies) is the Rescue Coordination Center, which can be reached at **(787) 289-2042**.

5.1.03 The Fajardo medical facility, San Pablo del Este Hospital (Telephone: **787-863-0505**), is located at General Valero Avenue # 404 in Fajardo, Puerto Rico.

5.2 EMERGENCY NONTIFICATION AND TRANSPORT PLAN

5.2.01 During snorkeling events, the snorkel team supervisor is considered the emergency coordinator. The Emergency Coordinator (EC) will be responsible for initiating any evacuation activities, coordination of snorkeling emergency procedures, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units. The EC shall conduct an inspection of emergency response equipment on a daily basis.

5.2.02 In the event of serious personal injury (fatality, patient unconscious, possibility of broken bones, severe bleeding that will not stop, severe burns, blood loss, drowning, shock, trauma, chest pain, difficulty breathing, seizure, electrocution, disorientation, suspected poisoning), the first responder shall immediately take the following steps:

- The EC will establish the safety and location of all personnel (in water personnel first) and direct the administration of first aid.
- The victim will be brought on board the dive boat (if emergency occurs in the water) by project team personnel using the sling, ladder, or stokes-type stretcher with flotation as necessary. The snorkeler observer/assistant may be required to enter the water to assist in rescue and securing the victim in the sling or stretcher; however, bringing the injured party onto the boat will likely require assistance of personnel on the support boat unless the observer/assistant reboards the boat.
- Stabilization of the victim will be performed in the boat, on deck.

Figure 5-1 Emergency Route to Centro de Salud Comunal de Culebra (Promed) from Flamenco Bay

Figure 5-2 Emergency Route to Centro de Salud Comunal de Culebra (Promed) from Luis Pena Channel

5.2.03 The boat captain/snorkel team supervisor will immediately notify the support boat to come to aid and for transport to shore if required. First aid and CPR will be initiated, as required, by first aid/CPR qualified persons (all snorkel team members are first aid/CPR qualified).

- The boat captain/snorkel team supervisor (or designee) will use the cellular telephone to **call 911** to report the emergency, giving details such as the nature of the emergency, location of the emergency, victim information and vitals, boat identification number, what dock facility or location the victim will be taken to, and any other requested information. Stay on the line with the 911 dispatcher.
- In the event the cellular telephone is not functioning or another cellular telephone is unavailable (e.g., on the support boat), the marine radio (Channel 16) will be used to call the U.S. Coast Guard for emergency assistance. If the emergency requires rescue services, the U.S. Coast Guard Rescue Center, San Juan, Puerto Rico will be contacted at **(787) 289-2042** or via marine radio channel 16.
- Keep the victim in the stretcher/litter if already in the stretcher, if possible (depending upon on the nature of the emergency, which may dictate removal from the stretcher if it inhibits the administration of first aid or CPR) to minimize the amount of movement during transport.
- If the victim is on the snorkel boat (e.g., smaller Mark V inflatable) and if safe to do so and as necessary (depending on location and distance from shore), transfer the victim (in the stretcher/litter) to the support boat for transport to shore and secure the victim from movement to the extent possible.
- Transport the victim to the nearest accessible public dock or shore with road access (field decision) and ensure emergency dispatch is informed of the intended location. The main dock that will be used for emergencies is immediately adjacent to the Culebra Ferry Terminal on Calle Pedro Marquez (see Figures 5-1 and 5-2); however, situations may arise that may dictate alternate egress routes that would be more expedient for the medical care of the victim (e.g., shallow snorkeling near shore in Flamenco Bay).
- Assist the emergency responders as necessary to facilitate movement of the victim to the ambulance.
- If not notified already, notify the SSHO.
- Provide a copy of the injured party's medical data sheet to responding medical personnel.
- Designate someone to accompany the injured party to the hospital.
- Call WorkCare at (800) 455-6155.
- Notify the USAESCH PM, TtEC PM, and PESM, if not already notified.
- Follow up on the victim and complete the TtEC Incident Report and Investigation form and ENG Form 3394 as appropriate.

5.3 EMERGENCY EQUIPMENT

5.3.01 A means of routine and emergency communication (waterproof cellular telephone) for contacting emergency services will be immediately available onboard the snorkeling team boat and on each scientific study boat. Boats will have a marine radio with Channel 16. In addition, a cellular telephone (protected with waterproof casing or waterproof phone) will be available and used for emergency communication. Working radio and cellular telephone communications will be verified in the field at the start of the project and on a daily basis.

- A copy of the APP and this SSP will be immediately available on the boat during snorkeling activities. Emergency numbers in Table 5-1 below will be posted and the location known to all team members.
- A first aid kit meeting the requirements of ANSI Z308.1 and any appropriate optional fill contents based on the hazard assessment, will be available in snorkeling locations (e.g., on the boat).
- If snorkeling is done in areas that are not accessible by boat or vehicle, a flotation litter or stretcher will be available to transport an injured person.
- A throw bag and/or life ring buoy with at least 70 feet of line.
- A buoy will be attached to the snorkel set for observation by boat side personnel
- A sling, ladder, or stokes-type stretcher will be provided to assist an injured snorkeler from the water.
- A device will be used which minimizes the possibility of entanglement of the snorkeler's tether in the propeller of the vessel.
- All required safety equipment for the boat as required by the U.S. Coast Guard and EM 385-1-1 as outlined in the APP. Small boat inspection checklist will be followed for performing the daily boat inspection. A Float Plan will be prepared as required in Section 8.22 of the APP.

5.4 PERSONNEL EMERGENCY CONTACT INFORMATION

5.4.01 Table 5-1 is duplicated from the APP.

Table 5-1. Emergency Contact Information

Contact	Firm or Agency	Telephone Number
Culebra Police Department	Municipality of Culebra Police	**Emergency 911** (787) 742-3501/0106
Culebra Fire Department	Municipality of Culebra Fire Department	**Emergency 911** (787) 742-3530
Local Emergency Hospital and Ambulance Services	Promed Medical Center, Culebra, Puerto Rico	**Emergency 911** (787) 742-3511
Advanced Care Emergency Hospital	San Pablo del Este Hospital Fajardo, Puerto Rico	(787) 740-0333 (emergency) (787) 863-0505 (main)
Coast Guard	Duty Officer	(787) 729-2301

Table 5-1. Emergency Contact Information (continued)

Contact	Firm or Agency	Telephone Number
Coast Guard 24-hour Emergency Number	Rescue Coordination Center, San Juan, Puerto Rico	(787) 289-2042
Puerto Rico Department of Natural Resources Conservation Rangers	Cuerpo de Vigilantes	(787) 742-0720
USACE Project Manager , Thomas Freeman III	CESAJ	(904) 232-1040 (main) (314) 625-8256 (cell)
USACE Project Manager, Roland Belew	USAESCH	(256) 895-9525 (main) (256) 503-0661 (cell)
USACE Designated Dive Coordinator, John Houvener	USACE, Baltimore District	USACE Designated Dive Coordinator, John Houvener
WorkCare	Occupational Medicine Contact	1-800-455-6155
Program Manager, Art Holcomb	TtEC	(256) 430-3701
Project Manager, Scot Wilson	TtEC	(360) 598-8111 (360) 626-3193 (cell)
Geophysics Lead, Robert Feldpausch	TtEC	(425) 482-7862 (main) (425) 503-2468 (cell)
CIH/PESM, Roger Margotto	TtEC	(619) 988-0520 (cell)
Diving Safety Manager, Steve Neill	TtEC	(804) 642-0202 (770) 330-7068 (cell)
Field Operations Lead/ Alternate Emergency Coordinator, Richard Funk, PG	TtEC	(425) 482-7629 (main) (973) 216-9296 (cell)
Field Investigation Coordinator Fernando Pagés Rangel	TtEC	(626) 688-1017 (main) (787) 791-0803 (alternate)
SSHO/Primary Emergency Coordinator and Boat Operator, Lou Schwartz	TtEC	(425) 877-3589 (cell) Marine Radio Channel 16
Project Biologist, TBD	TtEC	TBD
National Poison Control Center	National Poison Control Center	(800) 222-1222
CHEMTREC	CHEMTREC	(800) 424-9300
National Response Center	National Response Center	(800) 424-8802

6.0 FIELD PERSONNEL REVIEW

6.0.01 This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the SSP. It is maintained on-site by the SSHO as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site. In addition, the APP will be reviewed and signed by all team members prior to beginning work.

6.0.02 I have read, or have been informed of, and understand the information contained in this Snorkeling Safety Plan for the Environmental Baseline Survey activities to be conducted at the Culebra Water Ranges Project in Culebra, Puerto Rico. I will comply with the provisions contained herein.

Name (Print and Sign)	Date
____	____________________
____	____________________
____	____________________
____	____________________
____	____________________

ATTACHMENT A

EHS 2-2, DIVE SAFE PRACTICE MANUAL

EHS 2-2 : Corporate Dive Safe Practice Manual

Last Revision By: Andrew Hopper on 02/13/2012
Created By: Dawn Stuart on 09/10/2009

Purpose:	This document establishes the Tetra Tech EC, Inc. (TtEC) Diving Safe Practices Manual (DSPM) as required in 29 CFR, Subpart "T". This document provides guidance and procedures to conduct safe diving operations by all employees of TtEC Inc. or under the auspices of TtEC. This DSPM is based on those rules and recommendations as offered by the following agencies, the Occupational Safety and Health Administration (OSHA), the American Academy of Underwater Sciences (AAUS), U.S. Army Corps of Engineers (ACOE) and the U.S. Navy.		
Version Date:	10/10/2009 - Revised	**Original Issue Date:**	12/28/2007
Category:	Company Procedures	**Sections:**	ESQ - Environmental Health & Safety Programs
Sub Category:	Departmental/Discipline	**Document Type:**	Procedure Manual
Keyword Index:		**Document Owner:**	Skip Parry
Approved By:			

Table of Contents

1.0 PURPOSE

This document establishes the Tetra Tech EC, Inc. (TtEC) Diving Safe Practices Manual (DSPM) as required in 29 CFR, Subpart "T". This document provides guidance and procedures to conduct safe diving operations by all employees of TtEC Inc. or under the auspices of TtEC. This DSPM is based on those rules and recommendations as offered by the following agencies, the Occupational Safety and Health Administration (OSHA), the American Academy of Underwater Sciences (AAUS), U.S. Army Corps of Engineers (ACOE) and the U.S. Navy.

2.0 SCOPE

This document contains procedures applicable to all TtEC, Inc. projects conducting underwater operations that employ the use of divers or snorkeler's to perform work or scientific research. The procedures in this document are a combination of the requirements in 29 CFR 1910 Subpart T – Commercial Diving Operations and The American Academy of Underwater Sciences, Standards for Scientific Diving. Specific or special requirements for scientific diving that are not specifically included in this Dive Safe Practices Manual will be included in the Project Specific Health and Safety Dive Plan (HASDP). When contracted to dive for a client like the ACOE, additional equipment, procedures, and review requirements will be addressed in the Project Specific HASDP. The specific ACOE requirements are identified in Section 30 of EM 385-1-1, 15 SEP 2008, Safety and Health Requirements Manual. If there are any conflicts between this manual, OSHA regulations, AAUS and State OSHA regulations, the most stringent regulations take precedence provided safety is not compromised. All conflicts will be detailed and procedures provided in the Site Specific Health and Safety Diving Plan.

3.0 MINIMUM REQUIREMENTS

3.1 General

It is the policy of TtEC to consistently provide safe diving operations to meet the client's required level of work, that are in compliance with applicable laws and/or regulations, and that are consistent with the project-defined scope, schedule, budget and level of quality. To accomplish this objective TtEC will provide the appropriate qualified personnel, resources and guidance to operating units where diving is required. Such resources may include specialized diver expertise that may be located in another office, corporate affiliate or subcontracted to the appropriate company.

This Diving Safe Practices Manual addresses procedures for the safe utilization of Self Contained Underwater Breathing Apparatus (SCUBA) and surface supplied diving operations. Mixed gas diving is not authorized for employees covered under these procedures. All dives will be planned to adhere to standard air and no decompression tables set forth in the US Navy Diving Manual.

The individual state requirements will be reviewed and incorporated into the project specific HASDP. As of this revision date of the manual those States are California, Michigan, Oregon, and Washington. This review will be prior to commencing any diving operations within the affected State. Prior to diving, the project specific Dive Safety Plans must be approved by the Chairman of the TtEC Diving Review Board (DRB) for construction diving or the Scientific Diving Safety Officer for scientific diving, with the approved copy forwarded to the TtEC Chairman of the Diving Review Board.

3.1.1 Scientific Diving Standards

The TtEC Diving Safety Practice Manual (DSPM) provides for the development and implementation of policies and procedures that will enable TtEC scientific divers to safely manage local diving conditions and comply with the AAUS scientific diving standards. For the purposes of these standards the auspices of TtEC as an AAUS Organizational Member is for the purposes of scientific diving in which TtEC is connected because of ownership of equipment, locations, or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of TtEC, where such employees are acting within the scope of the employment, and the operations of other persons who are engaged in scientific diving with TtEC, or are diving as members of an organization recognized by TtEC.

TtEC's DSPM shall adhere to and/or include the following:

a. AAUS standards may be used as a set of minimal guidelines for the development of an organizational member's Dive Safe Practice Manual which will include both construction and scientific divers. AAUS Standards Volume 1, Sections 1.00 through 6.00 and its appendices are required for all dive manuals. AAUS Standards Volume 2, Section 7.00 is applicable only when TtEC engages in those activities. This dive manual meets the requirements of AAUS Standards for scientific diving and OSHA Subpart T, and ACOE Diving Operations (EM 385-1-1 [15 Sept 08]) for construction diving, and includes compliance with each section applicable to TtEC diving policies. Sections of the AAUS Standards which are not included in this dive manual are not allowed under TtEC safe dive practices.
b. Emergency evacuation and medical treatment procedures.
c. Criteria for diver training and certification.
d. Standards written or adopted by reference for each

diving mode utilized which include the following:

- Safety procedures for the diving operation.
- Responsibilities of the dive team members.
- Equipment use and maintenance procedures.
- Emergency procedures.

3.1.2 Scientific Diving Definition

Scientific diving is defined as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks (29 CFR 1910.402).

3.1.3 Scientific Diving Exemption

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29 CFR 1910 Subpart T):

a. The Scientific Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
b. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
c. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
d. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists of scientists-in-training.
e. In addition, the scientific diving program shall contain at least the following elements (29 CFR 1910.401):
    - Diving safety manual which includes at a minimum: procedures covering all diving operations specific to the program, including procedures for emergency care, recompression and evacuation, and the criteria for diver training and certification.
    - Scientific Diving Control Board, with the majority of its members being active scientific divers, which shall at a minimum have the authority to:

approve and monitor diving projects, review and revise this diving safety manual, assure compliance with the manual, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

3.1.4 Consequences of Violation of Regulation by TtEC Scientific Divers

Failure to comply with the regulations of TtEC's diving safety manual may be cause for the revocation or restriction of the diver's scientific diving certification by action of the DSO and Diving Review Board.

3.1.5 Consequences of Violation of Regulations by AAUS Organizational Members

Failure to comply with the regulations of the AAUS Standards may be cause for the revocation or restriction of TtEC's recognition as an Organizational Member of AAUS.

3.2 Responsibilities

The UXO/Diving Safety Manager, under the Environmental Health and Safety (EHS) Department, is designated the Chairman of the Diving Review Board and is responsible for updating this procedure. The Chairman of the Diving Review Board will maintain the qualification records of those personnel approved for diving and approve all other divers and subcontractors involved in diving on TtEC projects.

This procedure will be reviewed by the Vice President of UXO Operations for technical content involving UXO diving, the EHS representative for environmental, health and safety and the Scientific Diving Safety Officer for the Science Divers. They will ensure diving operations are conducted in a safe and efficient manner throughout he company.

The Administration/Compliance Department will review for compliance with appropriate laws and regulations.

Approval authority rests with the TtEC Chief Executive Officer, with review by the Director, EHS Services Department.

Suggestions for revision will be submitted to the Chairman, Diving Review Board through the Director, EHS Services. The Chairman, Diving Review Board is responsible for all required corporate record keeping in accordance with this manual and maintenance of all identified references.

manual and maintenance of all identified references.

For UXO diving, the Vice President for UXO operations will review and approve all TtEC employees and subcontractor personnel involved in UXO diving.

For scientific diving the Scientific Diving Safety Officer along with the Scientific Diving Control Board will review and approve the qualifications and authorized diving depth for science divers yearly.

No Diving Safe Practice Manual (DSPM) will ever exist that can substitute for prior planning, sound judgment and a continuing concern for maximum safety. Safety is not a rulebook; it is a state of mind. However, not all circumstances or situations can be explained and detailed in this DSPM, and in light of that fact, TtEC recommends that deviation from these guidelines should be undertaken only when, in the opinion of the Diving Supervisor/Lead Diver, an emergency situation exists where the health and safety of personnel are in immediate danger. The Diving Supervisor/Lead Diver will have final authority as to safe conditions on the dive site. A written event report will be submitted to the Chairman of the Diving Review Board within 48 hours of the deviation from the DSPM to document possible changes to this manual and conform to OSHA requirements.

Definitions used in this manual:

- Chairman Diving Review Board - ESQ Department member which manages and oversees the Diving Review Board
- Diving Review Board - Has the overall responsibility to review and manage all diving operations within TtEC
- Diving Safety Officer - For the scientific divers, manages the TtEC science diving program and represents the science divers on the Diving Review Board
- Diving Control Board - The group of scientific divers overseeing the AASU certified diving program within TtEC

3.2.1 UXO/Diving Safety Manager/Chairman, Diving Review Board

The UXO/Diving Safety Manager, under the Director, EHS Services is the Chairman of the TtEC Diving Review Board. The Diving Review Board is made up of a qualified diver from the UXO Group and the Sciences Diving Safety Officer as assigned by the appropriate manager. The Chairman, Diving Review Board is responsible for managing the TtEC Diving Program in conjunction with the assigned board members and he/she will maintain the diving logs and references as required by OSHA 29 CFR Subpart "T" and the American Academy of Underwater Sciences, Standards for Scientific Diving. The Chairman of the Diving Review Board will maintain qualifications and physical records for all TtEC divers. He will review and approve divers, including subcontractors who are assigned to individual projects.

3.2.2 Vice President of UXO Operations

The TtEC Vice President of UXO Operations as a permanent Diving Review Board member is responsible for the safe conduct of UXO and construction diving operations. He is responsible for the appropriate diver training and qualifications for UXO operations. He will submit to the Diving Review Board names of qualified UXO divers to be certified by TtEC to work on the company projects. He will maintain a recent copy of the US Navy Diving Manual. All applicable governing legislation (OSHA, USCG, ANSI, and applicable local regulations), and the Association of Diving Contractors International Consensus and Technical standards. He will make these manuals available to the Diving Supervisors as required.

The Vice President of UXO Operations identifies Diving Supervisors and designates them in writing after review board concurrence.

3.2.3 Science Group Diving Review Board Member

The Science Diving Safety Officer will be a permanent member of the TtEC Diving Review Board and will monitor and advise on all TtEC scientific diving projects. Coordinate approval of authorized divers and submittal of individual diving records and dive logs to the Chairman of the Diving Review Board. Review and approve the EHS 2-2 Safe Diving Practice Procedures and science project-specific Dive Safety Plans. Ensure that an approved Diving Supervisor/Lead Diver is assigned and that they meet the requirements of paragraph 3.2.6 below. Coordinate project operations with the assigned Diving Supervisor/Lead Diver to assign the diving team members and develop the Diving Plan to meet the requirements of the project and this procedure.

3.2.4 Scientific Diving Safety Officer

The TtEC Scientific Diving Safety Officer (DSO) serves as a member of the Diving Review Board member and the Scientific Diving Control Board. This person should have a broad technical and scientific expertise in research related diving.

a. Qualifications

- Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the Scientific Diving Control Board.
- Shall be trained as a scientific diver.
- Shall be a full member as defined by AAUS.
- Shall be an active underwater instructor from an internationally recognized certifying agency.
- Shall be qualified as a TtEC Environmental Safety Supervisor (ESS)

b. Duties and Responsibilities

- Shall be responsible, through the Scientific Diving Control Board, to the responsible administrative officer or designee, for the conduct of TtEC's scientific diving program. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant policies of TtEC, rests with the DSO.
- Will forward all approved dive plans when approved and before diving commences and diving records at the completion of each weeks diving to the Chairman of the Diving Review Board as the Corporate POC for diving.
- May permit portions of this program to be carried out by a qualified delegate, although the DSO may not delegate responsibility for the safe conduct of the local diving program.
- Shall be guided in the performance of the required duties by the advice of the Scientific Diving Control Board, but operational responsibility for the conduct of the local diving program will be retained by the DSO.
- Shall suspend diving operations considered to be unsafe or unwise.

3.2.5 Senior UXO Supervisor

A Senior UXO Supervisor (SUXO) will be assigned and designated in writing by the Vice President of UXO Operations for projects that have an UXO removal/investigation requirement as well as a diving requirement. The SUXO will coordinate all ordnance response requirements and establish safe procedures for the removal of the UXO hazard. On larger joint diving/UXO operations the Diving Supervisor/Lead Diver will normally supervise the diving evolution and the SUXO will oversee supervise the diving evolution and the SUXO will oversee the UXO response. The SUXO and Diving Supervisor/Lead Diver can be the same person if that person has both qualifications on smaller projects. The SUXO will be a qualified TtEC ESS person.

3.2.6 Diving Supervisor/Lead Diver

A qualified person will be designated in writing, to be in charge of each diving operation. This person will be designated based on knowledge, experience, and level of training.

The Diving Supervisor/Lead Diver is in charge of the overall diving operation, and is responsible for the planning and execution of the dive, as well as the safety and health of the dive team. The Diving Supervisor/Lead Diver will be a qualified TtEC ESS person. In carrying out these duties his responsibilities will include, but will not be limited to ensuring that:

- All dive team members who are exposed to, or control the exposure of others to, hyperbaric conditions will be trained in diving-related physics and physiology.
- Each dive team member will be assigned tasks in accordance with the employee's experience or training. Limited additional tasks may be assigned to an employee undergoing training, provided that these tasks are performed under the direct supervision of an experienced dive team member.
- A dive team member will not be required to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.
- A dive team member will not be permitted to dive or otherwise be exposed to hyperbaric conditions for the duration of any physical impairment or condition which is known and is likely to adversely affect the safety or health of a dive team member.
- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility.
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness.
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 10 days of the incident of decompression sickness.
- Being fully aware of all relevant governmental

- Being fully aware of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed.
- Be in immediate control and available to implement emergency procedures during diving operations. The Dive Supervisor is not permitted to dive unless another qualified dive supervisor is present and has been appointed and designated to assume this responsibility.
- Ensuring, prior to diving, that all additional parties are informed that diving operations are about to be undertaken. These parties include but are not limited to, craft masters, boat pilots, harbor masters, managers of pipelines, and managers for civil engineering sites and inland waterways.
- Ensuring that diving operations are conducted from a suitable and safe location on the surface. Refer to Section 3.3 for additional diving procedures.
- Establishing a project-specific Dive Safety and Health Plan, ensuring that sufficient air supply, supplies and proper equipment are available for the safe and timely completion of the job task. This must be approved by the Scientific Diving Safety Officer prior to conducting any diving evolution.
- Briefing the dive team as to the plan of attack and soliciting suggestions per Attachment 1. During the briefing the supervisor will make team assignments, designate required equipment, review diving signals, establish a positive diver recall method, and cover emergency procedures.
- Use Attachments 2 and 3 for pre-dive and post-dive checklists.
- Ensuring all members of the diving team are familiar with the emergency procedures contained in Attachment 4.
- Being aware of the procedures to follow and the routes to take to obtain medical support in the event of an accident, either diving or non-diving related.
- Ensuring that a two-way communication system is available and tested.
- Ensuring that the Emergency Phone Numbers Checklist, Attachment 5, is completed and posted at the dive site.
- Determining the qualifications and proficiency of all personnel and permitting no dives to be made by any person who is not qualified.
- Verifying that all equipment required is on scene and in working order.
- Ensuring that all-relevant operating instructions, manuals, decompression schedules, treatment tables and regulatory publications are available on the dive site.

- Maintaining a dive profile log for each diver to include depth bottom time and residual nitrogen time per Attachment 6.
- Terminating diving operations at any time when, in his opinion, safe diving procedures are not being followed or conditions prevent safeguarding the divers. The Diving Supervisor/Lead Diver will not resume diving operations until the unsafe conditions have been removed or corrected.
- Ensuring that after every dive the post-dive checklist, Attachment 3, is used.
- Ensuring after any treatment or unplanned dive conducted outside the no-decompression limits that the diver is instructed to stay awake and remain in the vicinity of the chamber for at least one hour.
- Reporting all accidents or incidents involving personnel as required by TtEC procedures and relevant governmental regulations.
- Ensuring all reports and paperwork are completed and submitted at the end of the diving day.
- Maintain certification in cardiopulmonary resuscitation (CPR), First Aid (American Red Cross or equivalent) and automated external defibrillator (AED), and O_2 administration.

3.2.7 Diver(s)/Snorkel(s)

A diver will be at least 18 years old, be medically certified "fit to dive", and have a knowledge of diving theory, diving related physics and physiology. He will provide the Chairman of the Diving Review Board copies of his certifications before being allowed to dive. On diving projects involving UXO operations the minimum age of the diver is 21 years, per the Bureau of Alcohol, Tobacco and Firearms (ATF) regulations concerning the handling of explosives. This individual will also have a full understanding of the diving equipment in use, and of the tasks assigned. The diver is assigned by the Diving Supervisor/Lead Diver to perform specific tasks underwater and topside. He must be qualified for the diving technique, particular equipment selected, and the task assigned. In addition, each diver will maintain certification in cardiopulmonary resuscitation (CPR) (American Red Cross or equivalent), First Aid, AED and O_2 administration.

Each diver in the accomplishment of his duties will:

- Know the use of tools, equipment and systems relevant to assigned tasks.
- Techniques of the assigned diving mode.
- For scientific research operations, the use of snorkeling equipment is authorized by a qualified diver in place of scuba tanks for shallow water

observations with no encumbered obstacles in the vicinity of the snorkeler. See ACOE 385-1-1 for additional requirements.

- Accomplish all tasks assigned by the Diving Supervisor/Lead Diver. In the event that he is assigned a task for which he does not consider himself qualified either by training and/or experience, he will immediately inform the Diving Supervisor/Lead Diver.
- Read, understand and comply with all TtEC policies and with applicable governmental regulations as they relate to his qualifications or performance while engaged in diving.
- Maintain a high level of physical fitness.
- Immediately obey all commands or instructions from the Diving Supervisor/Lead Diver to return to the surface, or first decompression stop as appropriate.
- Keep topside personnel advised of conditions on the bottom.
- Be responsible for the diving gear worn and ensure that it is complete, in good repair, and ready for use at any time in accordance with regulations or instructions concerning its use, maintenance, repair and testing.
- Report to the Diving Supervisor/Lead Diver any defect or malfunction of the diving equipment provided for the diving operation.
- Ensure the deepest depth of his dive has been established before his ascent.
- Report to the Diving Supervisor/Lead Diver any recent medical treatment or illness so that the proper determination can be made concerning the divers fitness to dive.
- Immediately report all symptoms or suspected symptoms of decompression sickness as early and accurately as possible.
- Follow safe diving practices at all times during the diving operation whether topside or in the water. The diver will bring to the attention of the Diving Supervisor/Lead Diver any questionable items and will be alert for the safety of all.
- Remain awake and in the vicinity of the decompression chamber for at least one hour following treatment or a hyperbaric exposure beyond no decompression limits.
- Know and observe the rules for ascending to altitude, including flying after diving.
- Ensure that his diving equipment has been properly maintained, prepared and tested before each dive. This requirement should never be delegated to others.

others.

- Maintain a divers' logbook, which details all dives, medical examinations, courses taken, and personal equipment maintenance.
- Ensure their medical certificates are up to date and recorded in their diving logbooks. Divers will present their logbooks to the Diving Supervisor/Lead Diver at every job.
- A diver will not be exposed to hyperbaric conditions against his will, except when necessary to complete decompression or treatment procedures.
- Maintain certification in CPR, First Aid, AED and O_2.
- A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive since the ultimate responsibility for safety rests with the diver. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the regulations in this manual.

3.2.8 Standby Diver

The standby diver is a fully qualified diver, assigned for back up to provide emergency assistance, and is ready to enter the water when conducting diving operations with a single tended diver. When assigned during buddy diving, where two divers are conducting the dive together, he will be ready to enter the water prior to commencing the dive and then may remove tank, mask and fins, at the Diving Supervisor/Lead Diver's discretion. Under no circumstances will he leave the dive site. The standby diver receives the same briefings and instructions as the working diver/s, wears the same diving equipment, monitors the progress of the dive and is fully prepared to respond if called upon for assistance.

While acting as a standby diver, in addition to the requirements of a regular diver, he will:

- Be rested and fully capable of performing emergency rescue assistance.
- Be sufficiently free of residual nitrogen to allow for sufficient bottom time for the prescribed task at the working depth without exceeding the no-decompression limits for that depth.
- Be dressed appropriately to allow prompt entry into the water as directed by the Diving Supervisor/Lead Diver.
- Remain at his station throughout the entire dive.
- Not be assigned any tasks that might interfere with his duties as a standby diver while there is a diver

in the water.

- Maintain certification in CPR, First Aid AED and O_2.

3.2.9 Diver Tender

The tender is the surface member of the diving team who works most closely with the diver on the bottom. Though it is preferred that the tender be a qualified diver it is not mandatory. If the tender is not a qualified diver he must be familiar with line pull signals and emergency procedures. The tender is assigned by the Diving Supervisor/Lead Diver to continuously tend (monitor) the diver. He will devote his full attention to tending the diver he is assigned to, from preparation of the dive through its completion. He will not be assigned any other task while the diver is in the water.

The tender should further:

- Assist the diver in dressing and undressing and confirm that the diver's equipment is functioning properly.
- Tend the diver's safety line and be aware of the diver's depth and location at all times.
- Set up and operate all equipment as directed by the Dive Supervisor/Lead Diver.
- Immediately inform the Diving Supervisor/Lead Diver in the event that he is assigned a task for which he does not consider himself qualified either by training and/or experience. Be alert and immediately report any conditions that may be hazardous or unsafe.
- Assist in topside work as required or directed.
- Maintain certification in CPR, First Aid AED and O_2.

3.2.10 Reciprocity and Visiting Scientific Diver

- Two or more AAUS Organizational Members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating Diving Review (Control) Boards to govern the joint dive report.
- A Scientific Diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational member by submitting to the DSO of the host Organizational Member a document containing all information described in AAUS Standards Appendix 6 - AAUS Request for Diving Reciprocity Form Verification of Diver Training and Experience. This form shall be signed by the DSO or Chairman of the Scientific Diving Control Board.
- A visiting Scientific Diver may be asked to

demonstrate their knowledge and skills for the planned dive.

- If a host Organizational Member denies a visiting Scientific Diver permission to dive, the host Scientific Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

3.2.11 Waiver of Requirements

The Diving Review Board may grant a waiver for specific requirements of training, examinations, and minimum activity to maintain certification.

3.3 General Requirements for Diving or Snorkeling

3.3.1 The requirements presented in this section will be used in conjunction with procedures and requirements for individual dive techniques presented in following sections of the dive manual.

• All dives will be executed in accordance with 29 CFR 1910 Subpart “T”, for commercial diving. The 29 CFR 1910 Subpart “T” will accompany this DSPM on the diving location. Scientific diving has an exemption in OSHA 29 CFR 1920 Subpart "T" for strictly scientific diving purposes. Scientific diving will be in accordance with this manual and the American Academy of Underwater Sciences Standards for Scientific Diving. The Association of Diving Contractors (ADC) Consensus and Technical Standards provides an accepted interpretation of these regulations. All ascents, descent and decompression procedures will be in accordance with the US Navy Dive Manual. A link to the U.S. Navy Diving Unlimited/No-Decompression limits is located in Section 5 References.

• The qualifications of personnel and equipment requirements for snorkeling are the same as diving with the exception of the required air supply for diving.
• A ladder extending below the surface of the water and handrails three feet minimum above the diving platform will be provided to assist the diver on entry and exit from the water (inflatable boats are exempt from this requirement).
• A means will be provided to assist an injured diver from the water.

• When diving from vessels, the international code alpha and recreational dive flag with a minimum dimension of 23 inches will be displayed whenever diving operations are being conducted and will not be removed until diving operations have been completed and all divers are safely out of the water. TtEC divers will comply with all site-specific local, state, federal and international regulations specific local, state, federal and international regulations regarding marking of diving activities.

- For enclosed areas, i.e. intracoastal waterway or marinas, individual buoys with recreational diver flags will mark the outline of the diving area and the divers may have a "follow me" buoy with the recreational dive flag to determine their exact location. A rigid replica of the International Code Alpha flag at least one meter in height shall be displayed at the dive location visible all-round.

- A diver will be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.
- Positive communications to the recompression facility, the designated medical facility and any required transportation to these facilities (medivac, ambulance, etc.) will be checked daily. This communication will include cellular telephone or radio communications with a constantly manned location with telephone access at the dive site. Diving operations will not be conducted without established communications.
- The Diving Supervisor/Lead Diver is not permitted to dive unless another qualified supervisor is present and has assumed the Dive Supervisor responsibility.

3.3.2 Employees engaged in SCUBA diving will comply with the general requirements for diving and the following additional requirements, unless otherwise specified:

- Audio communications are preferred in all diving situations. However, this type of communication is not required for a diver who is accompanied by another diver (buddy), or who can communicate with the tender on the surface via a safety line using line pull signals.
- The planned time of such a diving operation will not exceed the no decompression limits according to the US Navy Dive Manual, or the air supply duration of the cylinders in use exclusive of the reserve supply. The cylinder pressure will be determined immediately before each dive.
- Each diver will be equipped with a knife, a diving wristwatch, a depth gauge or dive computer, a facemask, a submersible cylinder pressure gauge, and a life jacket or buoyancy compensator.
- A weight belt or integrated weight system with a quick release that is appropriate for the suit and the depth of the dive will be worn.
- A cylinder harness with a quick release will be worn to secure the SCUBA cylinders to the diver.
- The weight belt and cylinder harness, will be independently attached to permit release of either one without interference by the other.

- A personal flotation or buoyancy compensation device will be worn. An exception will be considered during approval of the Dive Plan for diving in enclosed spaces or under the ice.
- SCUBA diving will not be conducted at depths deeper than 130 feet. For depths from 100 feet to 130 feet, a recompression chamber must be within 5 minutes of reaching the surface.
- During all SCUBA dives, a standby diver will be available while a diver is in the water.
- A SCUBA diver will be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations. If the SCUBA diver is tended, he will wear a harness (ACOE requirement).
- A diver-carried reserve breathing gas supply will be provided for each diver consisting of:
  - A manual reserve (J valve); or
  - An independent reserve cylinder that either has a separate regulator or is connected to the underwater breathing apparatus. If connected to the underwater breathing apparatus the valve will be closed until required. For ACOE diving a 30 CuFt reserve cylinder is required with separate regulator.
  - The air pressure of the reserve breathing gas supply will be gauged and the valve left in the closed position prior to the dive.

3.3.3 Employees engaged in Surface Supplied diving will comply with the general requirements for diving and the following additional requirements, unless otherwise specified.

- The approximate depth of each dive will be determined prior to the start of operations.
- A weight belt appropriate for the suit and depth of the dive will be worn, except when conditions dictate otherwise for the safety of the diver.
- A 5-point safety harness, with a positive buckling device, shall be worn, under all other types of equipment (except in heavy gear). This harness will have an attachment point for the umbilical to distribute the weight of the diver's body and prevent any strain from being placed on the divers mask or helmet if/when the umbilical is pulled on. The safety harness will also have a lifting point to distribute the pull force of the line over the diver’s body. The safety harness may be equipped with a backpack for a bailout bottle.
- Surface supplied dives will not exceed 190 FSW, and will

not enter into exceptional exposure dives as set forth in the U. S. Navy standard air decompression tables.

- A decompression chamber will be ready for use on site for any dive outside the no-decompression limits or deeper than 100 FSW.
- A diving bell will be used for all dives requiring an in-water decompression time greater than 120 minutes.
- Each diver will be continuously tended by another dive team member while in the water.
- A diver will be stationed at the underwater entry point when diving is conducted in enclosed or physically confining spaces.
- A standby diver will be available while a diver is in the water.

- Each dive will have a primary air supply capable of supplying the diver(s) with the specified air volume, pressure and flow rate IAW manufacturer's specifications of the diving apparatus worn, throughout the planned depth of the dive, including decompression.
- Each dive location will have a reserve breathing air supply, in line, capable of supporting the dive operation.
- A diver carried reserve breathing gas supply will be provided for each diver on dives deeper than 60 FSW or outside no-decompression limits, or when the diver does not have direct access to the surface (on all ACOE surface supplied dives). This does not apply to heavy gear.
- On all dives deeper than 100 FSW or outside the no-decompression limits, an extra breathing gas hose capable of supplying gas to the diver in the water will be available to the stand by diver.
- On all dives deeper than 100 FSW or outside the no-decompression limits, an in water stage will be provided.

3.4 Diver Training and Qualifications

The following section describes the minimum requirements for TtEC divers. Additional training may be needed for site specific conditions or required under state, federal or local regulations.

- The level of experience or training required by the standard depends upon the job the employees are required to do. All dive-team members must have either experience or training in the use of tools, equipment, systems, techniques, operations, operational procedures and emergency procedures that are pertinent to, and necessary for, the assigned tasks for the diving mode. It is essential that those dive-team members who are exposed to hyperbaric conditions, or those members who control the exposure of others have knowledge of the physiological effects of diving and the related effects of pressure effects of diving and the related effects of pressure. Accordingly, this standard also requires that employees be trained in diving-related physics and physiology. Employee qualifications achieved through field experience and classroom training may be used to meet the requirements of the standard.

- Federal service qualification certificates, (such as from the Army Corps of Engineers, NOAA, or Military Diving School.

- Civilian diving school certificates of completion for the appropriate training level issued by schools associated with the Association of Diving Contractors International.

- Each dive-team member must be trained in CPR (American Red Cross or equivalent), First Aid, AED and O_{2t} treatment. Employees completing this training are issued a card certifying that they have successfully completed the course.

- Each member of the TtEC diving team will be qualified to conduct the work assigned by completion of training and/or experience. This qualification will be documented by completion of a certified course of instruction, either a certified commercial course (ASSOCIATION OF COMMERCIAL DIVING EDUCATORS (A.C.D.E.) accredited), civilian certification with experience for the profile of the dive or documented military diver training and experience are acceptable.

- All divers will maintain a personal dive log that will document all hyperbaric exposures. The following minimum information should be included in the log. Additionally, dates of diving physicals and a record of relevant training will accompany the log.
    - Location of Exposure
    - Maximum depth
    - Time left surface, total bottom time and time reached surface
    - Type of breathing apparatus and mixture used
    - Task performed
    - Decompression table and schedule used
    - Any Decompression sickness symptoms or injury
    - Signed by the Diving Supervisor/Lead Diver
    - Comments

3.4.1 Entry Level Training

All TtEC non-divers who have the required skills and training to participate in diving related activities shall be certified by an internationally recognized agency.

3.4.2 SCUBA Training

All TtEC divers shall provide a copy of their diver certification to the Chairman of the Diving Review Board, and to the DSO for scientific divers that represent successful completion of a swimming evaluation, practical diver training, written examination and open water evaluation. The certificate from the training activity will be used to document the location and date of training. The dive log will document the depth and number of diving qualification dives.

3.4.3 Scientific Diver Training

TtEC divers engaged in scientific diving shall comply with the policies and guidelines set forth in this manual; as well as demonstrated proficiency in diving and in meeting the project objectives and goals. Only a person diving under the auspices of TtEC that subscribes to the practices of AAUS is eligible for scientific diver certification. The diving log will be used to document the number of dives and depth qualifications of scientific divers.

3.4.4 Surface Supplied Diver Training

The training certificate will be provided to document previous training and dive log to document number of dives and depth of diving qualifications. The conduct of training dives will be required to ensure all divers are current in the type of equipment and the depth expected of the diving project.

3.4.5 Requirements for Scientific Diver Certification

TtEC divers participating in scientific diving must be approved by the DSO or designee and the Diving Control Board. Any applicant who does not possess the necessary skills and training may be denied Organizational Member scientific diving privileges.

3.4.6 Theoretical and Practical Training

A TtEC professional considered for scientific diving must complete theoretical aspects and practical training for a minimum cumulative time of 100 hours.

- Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study, and shall include the following:

scientific study, and shall include the following:

- Diving Emergency Care Training
- Dive Rescue
- Dive Physics
- Dive Physiology
- Dive Environments
- Decompression Theory and Application
- Scientific Diving Regulations and History
- Scientific Method
- Data Gathering Techniques (specific to the area of study)
- Common Biota
- Site Selection, Location, and Re-Location
- Specialized Equipment for Data Gathering

- Practical training must include a checkout dive, with evaluation of open water skills with the DSO or qualified delegate followed by at least 5 ocean or open water dives in a variety of dive sites and conditions for a cumulative bottom line of 3 hours. This qualifies the person to the initial qualification depth of 30 feet.
- An additional 12 dives under supervision from 31 feet to 60 feet for a dive time of 4 hours will certify the diver to the 60 foot depth. This method will continue to advance the dive depth to deeper certification levels as outlined in paragraph 5.40 in the AAUS manual.

3.4.7 Continuation of Certificate and Re-Certification

During any 12-month period, each certified scientific diver must log a minimum of 12 dives. At least one dive must be logged near the maximum depth of the divers certification during each 6 month period. A diving certificate may be revoked or restricted for cause by the DSO or Diving Review Board. A TtEC diver may be re-certified upon review of the diver's skills by the DSO and Diving Review Board.

3.5 Personnel Requirements

3.5.1 Self Contained Underwater Breathing Apparatus (SCUBA)

a. Option one, Tended Diver – 1, Stand-by Diver – 1, Diving Supervisor/Lead Diver – 1

b. Option two, Divers – 2, Stand-by Diver – 1, Diving Supervisor/Lead Diver – 1

c. Option two modified, (Science diving only in shallow waters), Divers – 2, Diving Supervisor/Lead Diver/Standby – 1

Note: "Scientific diving is defined (29CFR 1910.401) as diving

Note: Scientific diving is defined (29CFR 1910.401) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks."

3.5.2 Surface Supplied Diving (0-100 FSW with no decompression diving)

a. Tended Diver – 1

b. Diver Tender – 1 (Can be the Stand-by Diver)

c. Stand-by Diver – 1 (May not be required for all dives)

d. Air supply Operator – 1 (Can be a non-diver)

e. Diving Supervisor/Lead Diver – 1

Note: In establishing the number of dive-team members required for a dive, proper consideration must be given to 29CFR1910.421 (d) Planning and assessment, 29CFR1910.421 (e) Hazardous activities. This latter provision required employers to provide a means to assist an injured diver from the water, such as a small boat or stokes basket, this may necessitate additional dive-team members.

3.5.3 Surface Supplied Diving (Deeper than 100 FSW or decompression diving)

a. Tended Diver – 1

b. Stand-by Diver – 1

c. Diver Tender – 2

d. Air supply Operator – 1 (Can be a non-diver)

e. Diving Supervisor/Lead Diver – 1

3.5.4 An additional dive crew member may be required when any diving operations which has an increased likelihood of diver entrapment or potential for rendering the diver unconscious or incapacitated from chemical, physical, electrical or topside hazards. These operations include but are not limited to:

- Diving on ordnance and/or explosives.
- Diving from a small boat.
- Diving in remote areas where assistance from non-diving crew personnel is not **immediately** available, i.e. within communication range.
- Penetration diving, both horizontal and vertical.

- Any crane operations associated with the diving program.
- Diving in any situation where the diver utilizes surface tended equipment.
- Diving from a platform greater than 8' above the water surface.

3.6 Medical Requirements

3.6.1 Physical Examination

Each diver will receive a diving physical examination initially when assigned diving duties and yearly there after. In addition, a medical examination will be conducted whenever a diver has been hospitalized for more than 24 hours due to an injury or illness. A determination as to his fitness to continue to dive will be prepared by the examining physician. The physician will prepare a written report containing the following statement: a physician based on the following certifies the diver as "Fit to Dive":

- Medical requirements of this standard and a summary of the nature and extent of hyperbaric exposure to which the diver will be exposed, including diving modes and types of work to be assigned. TtEC will provide the dive information.

- The divers medical history, Attachment 7 will be filled out completely and will be provided to the examining physician.

- A basic diving physical examination will be conducted initially and annually for all TtEC divers which will include Chest X-ray, vision testing, audiogram, Pulmonary Function Test (PFT), blood chemistry panel, CBC with differential, urinalysis and Micro (US) and any additional tests required by the examining physician. An electrocardiogram (EKG) will occur during the first annual physical and every three years after. An exercise stress test may be indicated based on risk factor assessment by the doctor.

- The results of the medical examination.

- The examining physician's opinion of the employee's fitness to be exposed to hyperbaric conditions, including any recommendations or limitations to such exposure. TtEC will provide the employee with a copy of the physician's written report.

Determination of the employee's fitness to dive will be based on the physician's written report and review by the Diving Review Board. If the physician has recommended a restriction or limitation on the employees' exposure to hyperbaric conditions, and the employee does not agree with the physician's findings, then the employee has the right to obtain his own diving certified physician to perform a diving physical. If the second physician does not agree with the findings of the first physician, then a third physician will be consulted for resolution.

3.7 Equipment Considerations

The Diving Supervisor/Lead Diver in conjunction with the Diving Review Board will establish the equipment requirements for individual projects. This list will be included in the approved Dive Plan and will include required dive gear, boat equipment and any required task-specific equipment. This list should be submitted to the Project Manager when the Dive Plan has been approved.

Each equipment modification, repair, test, calibration or maintenance service that is required will be recorded by means of a tagging or logging system. This system will include the date, serial number of the item and nature of the work performed and the initials of the person who conducted the work.

3.7.1 Regulators

TtEC divers will be responsible for inspecting and scheduling maintenance on their regulators prior to first use and every 12 months thereafter. Documentation of the inspections and maintenance will be maintained in the TtEC diving files.

3.7.2 Air Supply Requirements

Diver air will be procured from a facility where the compressors meet the requirements established by the Compressed Gas Association (CGA pamphlet G-7.1) or more stringent standards. The tanks will be filled with compressed air from a source which complies with, at a minimum, 29 CFR, Subpart T, section 1910.430 (equipment). The breathable air supplied to the diver will be tested every 6 months and will not contain:

- A level of carbon monoxide (CO) greater than 10 parts per million (ppm).
- A level of carbon dioxide (CO_2) greater than 1,000 ppm.
- A level of oil mist greater than 5 milligrams per cubic meter.
- A level of hydrocarbons other than methane greater than 25 ppm.
- No noxious or pronounced odor.

A copy of the latest air test results will be reviewed and/or obtained and filed with the dive plan. When using local established vendors providing divers air, a check of current certification is required every 6 months. If air test results certification is required every 6 months. If air test results are not available TtEC will draw an air sample from the compressor for appropriate analyses.

3.7.3 Compressed Air Cylinders

Compressed breathing air cylinders will:

- Be constructed with seamless steel or aluminum, which meet DOT 3AA and DOT 3AL specifications.
- Have identification symbols stamped into the shoulder of the cylinder.
- Be inspected internally and externally for corrosion and pitting on an annual basis. If a defect is found that may impair the safety of the pressure vessel, then a hydrostatic test must be performed.
- Be hydrostatically tested every 5th year in accordance with DOT regulations. The test dates will be stamped into the shoulder of each cylinder.

- Documentation of each cylinder inspection will be maintained in the TtEC diving files.

- Be stored in a ventilated area and protected from excessive heat.
- Be secured from falling.
- Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or when installed with a manifold, or when used for SCUBA diving.

3.7.4 Air Compressor Systems

Air Compressors used to supply air to the diver will:

- Be equipped with a volume tank that has a check valve on the inlet side, a pressure gauge, a relief valve and a drain valve.

- Have intakes located away from areas where exhaust fumes or other air contaminates may be present.

- Be tested every six months by means of samples taken at the connection to the distribution system to ensure that the air supplied meets all applicable standards (See Section 3.7.1, above). Non-oil lubricated compressors do not have to be tested for oil mist.

- Be equipped with a moisture separator and filtration system

- A log shall be maintained showing all tests, repairs, maintenance and run time on all air compressors systems.

3.7.5 Divers Air Supply

The diver's surface supplied air supply may originate from an air compressor, a bank of high-pressure air flasks, or a combination of both. Regardless of the source, the air must:

• Meet the purity standards stated above.

• Be supplied in an adequate volume for breathing.

• Have a rate of flow that properly ventilates the helmet or mask.

• Be provided at sufficient pressure to overcome the bottom water pressure and the pressure losses due to flow through the diving hose, fittings, and valves.

The air supply requirements depend upon specific factors for each dive such as depth, duration, level of work, number of divers being supported, and type of diving system being used.

The capacity of the primary air supply must meet the consumption rate for the designated number of divers for the full duration of the dive (bottom time plus decompression time). The maximum depth of the dive, the number of divers, and the equipment to be used must be taken into account when sizing the supply.

The secondary air supply must be sized to support recovery of all divers using the equipment and dive profile of the primary supply, if the primary supply malfunctions or fails at the worst-case time (i.e., immediately prior to completion of planned bottom time of maximum dive depth, when decompression obligation is greatest).

3.7.6 Breathing Gas Supply Hoses (High Pressure)

Breathing gas supply hoses will:
• Have a working pressure at least equal to the pressure of the total breathing gas system.
• Have a rated bursting pressure at least 4 times the working pressure.
• Be tested annually (at a minimum) to 1.5 times their working pressure.
• Have their ends taped, capped or plugged when not in use.
• Have connections made of corrosion resistant material, and be resistant to accidental disengagement.
• Have connectors with a working pressure at least equal to the hose they are attached to.

3.7.7 Divers Air Supply Hoses (Umbilical)

Umbilical's will:
- Be marked (starting from the divers end) at 10' increments for the first 100; and 50' increments thereafter.
- Be made of kink resistant material
- Have a working pressure greater than the pressure equivalent of the maximum depth of the dive plus 100-psi.

3.7.8 Gauges and Time Keeping Devices

- Each depth gauge will be deadweight tested or calibrated against a master reference gauge every six months, and when there is a discrepancy greater than two percent of full scale between any two equivalent gauges.
- A cylinder pressure gauge that is capable of being monitored by the diver during the dive will be worn by each SCUBA diver and surface supplied diver when equipped with a bailout bottle.
- Each SCUBA diver will wear a diving watch capable of displaying elapsed time.
- A timekeeping device will be available at each dive location.

- Dive computers are approved for use after their review and approval of the Diving Review/Control Board. See paragraph 3.7.12 below.

3.7.9 Buoyancy Control

- A dry suit or buoyancy compensator not directly connected to the helmet or mask will be equipped with an exhaust valve. For more information on dry suits and cold-water equipment considerations see Appendix 14.

- Helmets or masks directly connected to a dry suit or other buoyancy-changing device will be equipped with an exhaust valve.

- When used for SCUBA diving, a buoyancy compensator will have an inflation source separate from the breathing gas supply and a manual inflator hose.

- An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manual activated inflation source independent of the breathing gas supply, an oral inflation device, and an exhaust valve is required for SCUBA diving, except when diving in enclosed spaces or under the ice.

3.7.10 Masks and Helmets

- Surface-supplied masks/helmets will have a non-return

• Surface-supplied masks/helmets will have a non-return valve at the attachment point between helmet or mask and hose, which will close readily and positively. Masks/helmets will also have an exhaust valve.
• Surface-supplied air masks and helmets will have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated, or they will have the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

3.7.11 Hand-held Power Tools

Hand-held power tools are not normally used during SCUBA diving operations, but if used they will be used in accordance with the following safeguards:

• Hand-held power tools and equipment will be de-energized before being placed into or out of the water.

• Hand-held power tools will not be supplied with power from the dive location until requested from the diver.

• 2-way Voice communications between divers and topside must be used.

3.7.12 Dive Computers

Diver carried computers that calculate decompression time based on time and depth must be checked for accuracy prior to use. AAUS recommendations on dive computers are located in the AAUS Standards, Appendix 8.

3.7.13 Dive Tables

Dive tables must be made available to divers at all diving locations.

3.7.14 Backpacks

Backpacks worn during diving operations without integrated flotation devices and weight systems need to be equipped with a quick release device.

3.7.15 Welding/Cutting/Burning

These procedures are not addressed in this manual. When a diving project requires welding, cutting or burning operations, those specific procedures will be addressed in the Project Specific Dive Plan (PSDP) for that project.

3.7.16 First Aid/CPR/AED/Oxygen

A first aid kit, appropriate for diving operations and approved by a physician will be available at the dive site. This kit will contain an American Red Cross standard first aid handbook or equivalent, a bag-type resuscitator with transparent mask and tubing, and a stokes litter or backboard w/flotation. Additionally, a portable source of oxygen will be available at the dive site for transport of a diving related casualty to the hyperbaric treatment facility. One additional first aid kit will be the Automatic External Defibrillator (AED). It has been proved that in the case of cardiac arrest, the AED if used within the first 3 minutes would save an additional 74% of patients.

3.8 Record Keeping Requirements

The following records are required by 29 CFR 1910, Subpart T, and AAUS Standards for Scientific Diving and will be maintained as indicated. The TtEC Chairman, Diving Review Board will maintain all historical records. Records and documents are as required by 29 CFR 1910, Subpart T, and will be provided upon request to employees, designated representatives, and other as determined by TtEC. The Scientific Diving Safety Officer or designee shall maintain permanent records for each Scientific Diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, reports of disciplinary actions by the organizational member Diving Control Board, and other pertinent information deemed necessary.

3.8.1 Dive Profile Log (Depth-Time Profile)

Attachment 6 will be forwarded to the Chairman, Diving Review Board and maintained for 1 year. If there has been a diving related illness or injury on the project, the records will be maintained for a period of 5 years. After the 5 year time limit, the records will be forwarded to the National Institute for Occupational Safety and Health (NIOSH). The Scientific Diving Safety Officer will also maintain copies for all scientific divers.

3.8.2 Diving Related Injury Records

Any diving related injury or illness, which requires any dive team member to be transported to a hospital for treatment of any diving incident will be reported to the Project Environmental Safety Manager (PESM) and documented by specifying the circumstances of the incident and extent of the injuries in the section provided in the Dive Profile Log, Attachment 6. The PESM will subsequently report this accident/incident to the TtEC organization in accordance with Event Reporting EHS 1-7 and to OSHA/AAUS as required. The Dive Profile Log and written accident/incident report will then be forwarded to the PESM, who will forward it to the Chairman, Diving Review Board who will include the Dive Profile Log sheet into the TtEC Dive Log.

3.8.3 Recording of Dive

As stated above a Dive Profile Log sheet will be completed for each dive, and upon completion of the dive will be forwarded to the Chairman, Diving Review Board. The Chairman, Diving Review Board will include the Dive Profile Log into the TtEC Dive Log, which will document all dives conducted by TtEC personnel. Ensure that Attachment 7, Divers History & Supplemental Questionnaire is completed for each diver before they commence diving.

3.8.4 Decompression Procedure Assessment Evaluation

In the event of a diving related incident, which requires treatment by recompression, the section of the Dive Profile Log for Decompression Procedure Assessment Evaluation will be completed and forwarded to the Chairman, Diving Review Board who will include the log into the TtEC Dive Log. The Dive Log will be maintained for a period of 5 years. The Chairman, Diving Review Board or designee will conduct the accident investigation.

3.8.5 Equipment Inspections and Testing Records

Maintain current log entry or tag for required equipment until equipment is removed from service.

3.8.6 Records of Hospitalization

Ensure all medical records generated by a hospitalization are forwarded to the TtEC Medical Provider.

3.8.7 Diver Medical Records

Maintain diver qualification medical records that are signed by the TtEC Medical Provider on site for the project duration or 5 years, which ever is longer.

3.8.8 Dive Safe Practices Manual

Only the current document is required to be maintained.

3.8.9 Forwarding of Records

After the expiration of the retention period of any record required to be kept for five (5) years, the Chairman, Diving Review Board will forward such records to the National Institute for Occupational Safety and Health (NIOSH). See OSHA Subpart T for address.

3.8.10 Termination of Diving Operations

In the event that TtEC ceases to do business the successor employer will receive and retain all dive and employee medical records required by 29 CFR 1910, Subpart T. If there is not a successor employer then all dive and employee medical records will be sent to the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare.

3.8.11 Training Records

Copies of each diver's successful completion of Navy Dive School or civilian certification and any other certificates of any specialized training (relevant to the job) will be forwarded to the Chairman, Diving Review Board and kept on the project site. Additionally, any training conducted in preparation for the job will be documented and retained on site and copies forwarded to the Chairman, Diving Review Board.

3.9 Operations Planning

This section provides guidance on effective dive planning for any size operation. The success of any diving operation is a direct outcome of careful, thorough planning. The site-specific circumstances of each operation determine the scope of the planning effort, but certain considerations apply to every operation. The “Dive Plan” provides a basic outline of minimum required information to successfully plan the diving operation. A project-specific Dive Safety Plan will be developed and implemented by the designated TtEC Diving Supervisor/Lead Diver for each separate diving project.

3.9.1 Termination of Dive Operations

The working interval of a dive will be terminated when:

- The activities are completed as planned

- A diver requests termination.
- A diver fails to respond correctly to communications.
- Communications are lost and cannot be quickly re-established between the diver and a dive team member at the dive location, or between the designated person-in-charge and the person controlling the vessel in live boating operations.
- A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.
- When the Diving Supervisor/Lead Diver determines that any unsafe condition exists.

3.9.2 Hazardous Environmental Conditions

Effective dive planning must provide for extremes in environmental conditions. Diving will be discontinued if sudden squalls, electric storms, heavy seas, unusual tide, or any other condition exists that, in the opinion of the Diving Supervisor/Lead Diver, jeopardizes the safety of the divers.

3.9.3 Communications

Adequate communications for the dive site will be provided as follows:

Diver to diver – Wireless electronic communications is preferred for SCUBA operations, but diver-to-diver hand signals or line pull signals, in accordance with the U.S. Navy Diving Manual are acceptable, Attachment 8. Surface supplied diving requires an operating two-way audio communication system between the diver and topside.

Surface to Diver/Diver to Surface – Wireless electronic communications is preferred for SCUBA operations, but line pull signals in accordance with the U.S. Navy Diving Manual are acceptable, Attachment 8 Surface supplied diving requires an operating two-way audio communication system between the diver and topside.

Emergency Assistance – Telephone communications will be maintained on site via landline, cell phone or two-way radio communications with a constantly manned location to activate emergency services if required.

3.9.4 Cold Water Diving

Cold water diving is defined as diving in water at or below a temperature of 37 degrees Fahrenheit. Cold water diving requires the use of special equipment and techniques. All dives conducted in cold water will be in accordance with Attachment 9. Hypothermia demands immediate treatment and prompt evacuation to a medical facility. The Diving Supervisor/Lead Diver will also take into consideration hypothermia for the surface support personnel. The local/responding medical facility must be notified of the possibility of hypothermia PRIOR to the commencement of diving operations. Emergency re-warming and evacuation plans should be established with their (the medical facility's) recommendations. See Attachment 9 for Cold Water Considerations and Safety Precautions. Diving under the ice requires extremely specialized training and equipment and will not be performed by TtEC employees.

3.9.5 Diving at Altitude

Diving operations may be required in bodies of water at higher altitudes. Because of the reduced atmospheric pressure, dives conducted at altitude require more decompression than identical dives conducted at sea level. Standard air decompression tables, therefore, cannot be used as written. Planning must address the effects of the atmospheric pressures that may be lower than those at sea level. No correction is required for dives conducted at altitudes between sea level and 300 ft. The additional risk associated with these dives is minimal. At altitudes between 300 and 1000 feet, correction is required for dives deeper than 145 FSW (actual depth). At altitudes above 1000 ft., correction is required for all dives. High altitude diving requires special equipment and techniques and will be conducted in accordance with the provisions of the U.S. Navy Diving Manual. Additionally, standard operating procedures addressing the special requirements and support will be developed prior to commencing any high altitude diving and included in the project specific, Health and Safety Diving Plan.

3.9.6 Diving on UXO

Diving in the vicinity of explosive ordnance combines the inherent risk of diving and the explosive hazards of ordnance. Diving to investigate, recover or dispose of explosive ordnance found underwater, regardless of the type or fuzing, will only be accomplished by qualified UXO divers.

Generally, it is safer for divers to work in pairs rather than singly. However, when diving on explosive ordnance the use of two divers doubles the exposure to the ordnance and the amount of bottom time expended, and increases the risk to life from an unplanned detonation. Consequently, the Diving Supervisor/SUXOS should employ a single tended or marked diver when any manipulation of the ordnance is anticipated. Use of two divers for ordnance search operations is authorized and preferred. The development and use of standard operating procedures to address the hazards associated with the explosive ordnance is required when conducting UXO Diving.

3.9.7 Diving in Contaminated Water

Divers may encounter dangerous or unpleasant forms of pollution that can cause severe problems, such as: effluent from a sewer or industrial outfall, oil leaking from a wellhead or damaged fuel tank, toxic materials or volatile fuels leaking from barges or tanks, and ordnance or chemical warfare material. The dive team should not conduct the dive until the contaminate has been identified, the safety factors evaluated, and the process for the safety factors evaluated, and the process for decontamination set up. When diving in a known or suspected radiological environment, proper radiological procedures must be followed. When diving in contaminated waters the appropriate dress should be a fully contained dry suit with gloves and hood, with a positive pressure full-face mask or the new "Dirty Harry" SSDS. Technical advice for contaminated water diving is available from the National Oceanic and Atmospheric Administration (NOAA), HAZMAT Department, (206) 526-6317.

3.9.8 Diving Hazards

In addition to environmental hazards, and the hazards directly attributable to diving, a diver may occasionally be exposed to operational hazards that are not unique to the diving environment.

- **Underwater Obstacles** – Various underwater hazards such as: broken pilings, rocks, wrecks, dumping grounds, and discarded munitions offer serious hazards to diving.

- **Electrical Shock –** Electrical shock is rare underwater but may occur when using power equipment underwater or topside. A ground fault interrupter (GFI) must be used with electrical equipment employed on the dive site, both on the surface and underwater.
- **Explosions** – Explosions may occur during demolition tasks or during ordnance clearance operations, intentionally or accidentally. When using explosives, or as identified during UXO diving, separate standard operating procedures and work plans will be developed to cover all aspects of the use or possibility of encountering explosives/ordnance underwater. All divers will be out of the water prior to any planned detonation of explosives or ordnance.

- **Explosives** – All diving related explosives use will be pre-approved by the Manager of UXO Operations. The procedures for explosives handling, use, storage and underwater procedures will be detailed in the specific Dive Plan for the project.

- **Sonar** – Additional precautions are required when diving in the vicinity of vessels, which employ active sonar. Ships use low frequency sonar for object location and depth finding. It is a dense, high-energy pulse of sound that can cause damage to divers' ears. Avoid diving in the vicinity of low frequency sonar and approach no closer than 600 yards. The optimal separation distance is 3,000 yards. Additionally, the US Navy Diving Manual has a worksheet to compute actual time and distance restrictions for various compute actual time and distance restrictions for various types of Sonar. This worksheet takes into account such variables as depth, time, diving apparatus and wetsuit hoods. High frequency (greater than 100 kHz), short duration sonar, such as used with side scan and hand-held sonar, poses little danger to the diver. The diver will abort the dive if active low frequency sonar is energized while he is in the water.

• **Marine Life** – Certain marine life, because of its aggressive or venomous nature, may be dangerous to man. Some species of marine life are extremely dangerous while some are merely an uncomfortable annoyance. Most marine life poses little threat, as they tend to leave man alone. The diver's best defense against injury is knowledge. All divers should be able to identify the dangerous species which are likely to be found in the area of operations, and should be able to deal with each appropriately. The U.S. Navy Diving Manual provides specific information about dangerous marine life.

• **Ascent to Altitude including Flying after Diving -** Leaving the dive site may require temporary ascent to a higher altitude. For example, divers may drive over a mountain pass at higher altitude or leave the dive site by air. Ascent to altitude after diving increases the risk of decompression sickness because of the additional reduction in atmospheric pressure. The higher the altitude, the greater the risk. The cabin pressure in commercial aircraft is maintained at a constant value regardless of the actual altitude of the flight. Though cabin pressure varies somewhat with aircraft type, the nominal value is 8,000 feet. For all diving projects divers will wait at least 12 hours before flying after any dive, or 24 hours following multiple days of repetitive dives. The ascent to altitude table located in the Navy Diving Manual gives the surface interval (hours; minutes) required before making a further ascent to altitude. The surface interval depends on the planned increase in altitude and the highest repetitive group designator obtained in the previous 24-hour period. Enter the table with the highest repetitive group designator obtained in the previous 24-hour period and read the required surface interval from the column for the planned change in altitude. Diving at altitude considerations will be outlined in the Safety and Health Dive Plan and approved by the Chairman of the Diving Review Board or the Diving Safety Officer for scientific diving.

3.9.9 Boating

All boating activities will be conducted according to applicable State, Coast Guard and TtEC regulations, including Boating EHS 6-6.

• Diving Operations involving live boating will not be conducted unless using surface-supplied air at depths that are restricted for TtEC to no deeper than 100 FSW, in rough seas, which significantly impede diver mobility or work function; or, in non-daylight hours.

• The propeller of the vessel will be stopped before the diver enters or exits the water.

• A device will be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

• Two-way voice communication between the designated person-in-charge (Dive Supervisor) and the person controlling the vessel will be available while the diver is in the water.

• Each diver engaged in live boating operations will carry a diver-carried reserve breathing gas supply.

3.9.10 Other Hazards

• Noise – Some operations may require the use of generators, pumps, compressors, engines, and other equipment that can generate high levels of noise. Short term exposure to extremely loud noise and/or long exposure to low level noise can cause hearing loss. Personnel assigned to a high noise area shall wear proper hearing protection and be enrolled in a hearing conservation program.

• Lifting Hazards – During some operations, there may be several instances when personnel would be called on to lift and/or carry a heavy load, sometime over rough or unstable terrain. When doing so, personnel should be instructed to observe the following rules.

- Test the load to ensure it can be moved safely

- Plan the move to ensure the travel path is clear

- Keep the back in its normal arched position while lifting, bend at the knees to lift

- Lift with the legs and stand up in one smooth motion

- Move the feet to change direction, do not twist at the waist

4.0 GUIDELINES

4.1 Definitions

Arterial Gas Embolism (AGE) – AGE is caused by entry of gas bubbles into the arterial circulation system then act as blood vessel obstructions called emboli.

ASME Code or Equivalent – American Society of Mechanical Engineers – Boiler and Pressure Vessel Code. Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA – Atmosphere absolute - Total pressure exerted on an object, by a gas or mixture of gases at a specific depth or elevation, including normal atmospheric pressure.

Bottom Time - The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) they begin their ascent from the bottom or from the deepest depth attained. This time is measured in minutes.

Breath-Holding Diving - A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply

Buddy Breathing - Sharing of a single air source between divers

Buddy Diver - Second member of the dive team

Buddy System - Two comparably equipped scuba divers in the water in constant communications

Buoyant Ascent - An ascent made using some form of positive buoyancy

Bursting Pressure - The pressure under which a pressure containment device would fail structurally.

Certified Diver - A diver who holds a recognized valid certification from an organizational member, internationally recognized certifying agency, or through military training.

Controlled Ascent - Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

Cylinder - A pressure vessel for the storage of gases.

Decompression Chamber - A pressure vessel for human occupancy. Also called a hyperbaric chamber.

Decompression Schedule - A specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table. It is normally indicated as feet/minutes.

Decompression Sickness – A condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction.

Decompression Table – A profile or set of profiles of depth-time relationship for ascent rates and breathing mixtures to be followed by divers after a specific depth-time exposure or exposures.

Decompression Time – Elapsed time from when the divers leave the bottom to the time when they reach the surface.

Descent Time – Descent time is the total elapsed time from when the divers leave the surface to the time they reach the bottom. Descent time is rounded up to the next whole minute

Dive Computer - A microprocessor based device which computes a diver's theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.

Dive Location - A surface of vessel from which a diving operations is conducted. The surface location from which diving operations are conducted such as a vessel, barge, wharf, pier, riverbank or offshore rig.

Dive Location Reserve Breathing Gas - A supply system of air at the dive location which is independent of the primary system and sufficient to support divers during the planned decompression.

Dive Team - Divers and support employees involved in a diving operation, including the Diving Supervisor/Lead Diver

Diver – An employee working in water using underwater apparatus, including snorkel, that supplies breathing gas at the ambient pressure.

Diver Carried Reserve Breathing Gas - A diver carried independent supply of air sufficient under standard operating conditions to allow the diver to reach the surface.

operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another driver.

Diving Control Board (DCB) - The Diving Control Board shall consist of a majority of active scientific divers. Voting members shall include the Scientific Diving Safety Officer, the responsible administrative officer, or designee, and should include other representative of the diving program such as qualified divers and members selected by procedures established by each organizational member. A chair person and a secretary may be chosen from the membership of the board according to local procedure.

Diving Mode – A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Diving Review Board (DRB) – The TtEC Review Board has oversight for all diving operations within the company. Board members will review the diving procedures and qualification of divers before authorization is given to conduct diving operations. The board is made up of qualified divers from the UXO Group, the Science Department and the ESQ Department.

Equivalent Single Dive Time - The time, in minutes, for which the schedule of a single repetitive dive is selected.

FSW - Feet of Sea Water

Heavy Gear – Diver worn deep sea dress including helmet, breast plate, dry suit, and weighted shoes. Advances in diving equipment and technology have lead to heavy gear that does not include a breastplate. Surface-supplied diving gear, including helmet, dry suit, and weighted shoes (i.e. with the helmet directly connected to the dry suit, forming a self-contained pressure envelope for the diver) constitutes heavy gear as well.

Hyperbaric Conditions – Pressure conditions in excess of surface pressure.

Lead Diver - Certified scientific diver with experience and training to conduct the diving operations.

Live Boating - The practice of supporting a surface-supplied air diver from a vessel which is underway

Mixed-Gas-Diving - A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No Decompression (No "D") Limits – The maximum time that can be spent at a given depth that safe ascent can be made directly to the surface at a prescribed travel rate with no decompression stops.

Organizational Member - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.

Penetration Diving – Passing through a barrier where the divers lifeline/umbilical requires tending by another diver or swimmer.

PESM – Project Environmental Safety Manager, Responsible for all safety aspects of the diving evolution. The on site ESS qualified person reports to the PESM on all safety related matters.

Pressure Related Injury - An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include: decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardum.

PSI (g) – Pounds per square inch (gauge).

Pulmonary Over Inflation Syndromes – Disorders that are caused by gas expanding in the lungs, and include arterial gas embolism, pneumothorax, mediastinal and subcutaneous emphysema.

Recompression/Decompression Chamber – A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Repetitive Dive - Any dives conducted within 12 hours of a previous dive.

Repetitive Group Designation - A letter, which is used to relate directly to the amount of residual nitrogen remaining in a diver's body.

Residual Nitrogen - Nitrogen gas that is still dissolved in a diver's tissues after surfacing.

Residual Nitrogen Time - Time, in minutes, which must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive.

Scientific Diving - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific research or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as but not limited to: placing or removing heavy objects underwater; inspection of pipelines and similar objects, construction; demolition; cutting or welding; or the use of explosives.

Scientific Diving Safety Officer (DSO) - The Scientific Diving Safety Officer serves as a member of the Diving Control Board (DCB) and is responsible through the DCB for the conduct of the scientific diving program of the membership organization. A permanent member of the TtEC Diving Review Board.

SCUBA Diving - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Single Dive - Any dives conducted more than 12 hours after a previous dive.

Standby Diver – A diver at the dive location properly equipped and available to assist a diver in the water.

Surface Interval - The time a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as he starts his next descent.

Surface-Supplied Diving - Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full face mask. The diver may rely on the tender at the surface to keep up with the diver's depth, time and diving profile.

Tended/Marked Diver - When a diver has a buoy line to the surface or is tended by another diver located in the diving boat or on the surface platform.

Treatment Table – A depth-time and breathing gas profile designed to treat decompression sickness or pulmonary over-inflation syndromes.

Umbilical – The composite hose bundle between a dive location and the diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions. This includes a safety line between the diver and the dive location or dive bell.

Volume Tank – A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working Pressure – The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

5.0 REFERENCES

Please Describe your Reference Here	**Place your Link in this Column**
1. U.S. Navy Diving Manual	http://www.supsalv.org/pdf/DiveMan rev6.pdf
2. 29 CFR 1910, Subpart "T" – Commercial Diving Operations	http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=3449
3. WAC 296-37 – Standards for Commercial Diving Operations	http://apps.leg.wa.gov/WAC/default.aspx?cite=296-37
4. U.S. Army Corps of Engineers, Safety & Health Requirements Manual, EM 385-1-1	http://140.194.76.129/publications/eng-manuals/em385-1-1/2008 English/toc.html
5. The American	http://www.aaus.org/mc/page.do?sitePageId=29798&origId=aaus

Academy of Underwater Sciences, Standards for Scientific Diving	
6.	
7.	

6.0 ATTACHMENTS

Please Provide a Description of the Attachment	Place your Attachments Here
1. Dive Supervisor Dive Plan Briefs	EHS 2-2, Attachment 1, Supervisor Dive Plan.doc
2. Diving Supervisor Pre-Dive Check List	EHS 2-2, Attachment 2, Supervisor Pre-dive Checklist.doc
3. Diving Supervisor Post-Dive Check List	EHS 2-2, Attachment 3, Supervisor Post-dive Checklist.doc
4. Emergency Procedures	EHS 2-2, Attachment 4, Emergency Procedures.doc
5. Emergency Phone Number Check List	EHS 2-2, Attachment 5, Emergency Phone Numbers.doc
6. Dive Profile Log	EHS 2-2, Attachment 6, Dive Profile Log.doc
7. Divers Medical History & Supplemental Diving Questionnaire	EHS 2-2, Attachment 7, Divers History & Supplemental Questionaire.doc
8. U.S. Navy	

8. U.S. Navy Standard Pull Line Signals	EHS 2-2, Attachment 8, Line Pull Signals.doc
9. Cold Water Considerations & Safety Precautions	EHS 2-2, Attachment 9, Cold Water Safety.doc
10a. Navy No Decompression Table	EHS 2-2, Attachment 10a, Navy No Decompression Table Rev.1.pdf
10b. Navy Residual Nitrogen Table	EHS 2-2, Attachment 10b, Navy Residual Nitrogen TableRev1.pdf
10c. Navy Shallow No Decompression Table	EHS 2-2, Attachment 10c, Navy Shallow No Decompression Table.Rev1pdf.pdf

ATTACHMENT 1
DIVE SUPERVISOR DIVE PLAN BIEF

PROJECT NAME/NUMBER: ____

1. **NOTIFICATIONS -** The following list of notifications is not to be considered all-inclusive and should be modified to fit the intended task. Place a “X” in the box of those called, include the phone number

   a. Harbor Master: ☐_____
   b. Pipeline Manager: ☐_____
   c. Boat Pilots: ☐____
   d. Port Services: ☐_____
   e. Cognizant Authority: ☐_____
   f. Ambulance/Air Evac: ☐_____
   g. Recompression Chamber: ☐_____
   h. Medical Facility: ☐☐____
   i. Coast Guard: ☐_____
   j. Army COE Representative: ☐____
   k. Navy Representative: ☐____
   l. Support Personnel: ☐_____

2. **PERSONNEL ASSIGNMENTS**

   a. Diving Supervisor: ____________
   b. Standby Diver: _______________
   c. Diver: ______________________
   d. Diver: ______________________
   e. Senior UXO Sup: ______________________
   f. Boat Operator: __________________________
   g. Assistance: ____________________________
   h. Tenders: ______________________________

	YES	NO
• Has any diver dove in the last 12 hours?	____	____
• Is any diver taking any type of medication?	____	____
• Does any diver have any aches or pains?	____	____
• Can divers clear on the surface?	____	____
• Does any diver have a hangover?	____	____
• Is any diver wearing contact lenses?	____	____
• Do divers feel well or have any problem making the dive?	____	____
• Do divers know the emergency procedures for the diving mode?	____	____
• Do all divers have current dive physicals (1 year)?	____	____

3. **ENVIRONMENTAL DATA**:

   a. Temperature: Water: ____________Air: ________________

   b. Tide: High: _______/_______ Low: ________/_______

   c. Visibility expected: _____________ Bottom type: _____________

   d. Current speed/direction: ________________________

   e. Wind Direction/Speed: ____________/_____________

   f. Landmarks:_______________________________________

   g. Sunrise/Sunset: ______________/______________

   h. Wave action: Height_____________ Direction: ___________

   i. Dive platform: _______________________________________

ATTACHMENT 1
DIVE SUPERVISOR DIVE PLAN BRIEF

PROJECT NAME/NUMBER: ____

4. **OBJECTIVES:**

   a. Purpose of the dive (TASK): ____________________________________

   b. Location: ____

   c. General comments: ____

   d. Dive schedule: ______/______ Depth:________ Max depth:________

   e. Dive mode to be used____

5. **ANTICIPATED HAZARDS**:

   a. Boating: ______________________________

   b. Ensure the “Code ALPHA” flag is flying from the vessel, or a 1-meter rigid “Code ALPHA” flag is prominently displayed from the non-vessel dive platform (pier, shore, etc.).

   c. Ensure the “Divers down” flag is also displayed.

   d. If you hear boat engines overhead and still within NO "D” limits, remain on the bottom.

   e. If remaining on bottom will put you into SUR "D" come up on buoy line, Chase boat will clear the area of other boats.

   f. Climate: _________________________________

   g. Sea Life: _________________________________

   h. Expected Ordnance: __________________________

   i. Current: __________________________________

   j. Pollution: _________________________________

   k. Other: ___________________________________

6. **EQUIPMENT REQUIREMENTS**:

   a. Diving Mode:____

   b. Search Equipment:____

   c. Recovery Equipment:____

   d. Explosive Disposal Equipment:___________________________________

   e. Special Task Equipment:_______________________________________

PROJECT NAME/NUMBER: ____

7. **GENERAL DIVING SAFETY PRECAUTIONS**

- Ensure divers are physically and mentally ready to perform the assigned dive task.
- Determine the exact depth of the dive site through use of lead line or Fathometer.
- Gauge diving and emergency air cylinders prior to diving.
- All dives will be no-decompression dives.
- Ensure the dive platform is in a position for rapid and safe recovery of the divers.
- Each diver is responsible for the condition of his/her own diving equipment.
- Ensure the standby diver is well briefed and ready to enter the water.
- The buddy system will be used whenever possible. If the buddy system is not used or inappropriate for the Dive, the diver will be tended.
- Ensure the international code “alpha” is and “divers down” prominently displayed. If diving is not conducted from a vessel then a 1-meter square rigid replica of the “alpha” flag will be displayed.
- Ensure divers are briefed and protected against local harmful marine life.
- The Diving Supervisor must be aware of local ship and small boat traffic in the vicinity of the diving operation.
- Ensure the appropriate diving mode and dress; have been selected for the task at hand.
- All dives conducted where there is not free access to the surface must be tended dives.
- Do not inflate life jacket or BCD where ascent to the surface is restricted.
- The Diving Supervisor will use the Pre-dive and Post-dive check-off sheets, Attachment 6 and 7 respectively.
- Devise and use a method of diver recall.
- The dive will be aborted in the event of any equipment malfunction.
- Inflate your life vest if surfacing with injuries or excessive fatigue.
- Do not force the dive.
- Use the proper ascent and descent rates of 75 feet per minute for descent and 30 feet per minute for ascent.
- Divers will not position themselves between any objects (camels, pier, boat, etc.).
- Brief task specific safety precautions (UXO diving, Altitude diving, ordnance/explosive safety, etc.).
- Brief special line-pull signals Attachment 8.
- Brief appropriate ordnance safety precautions.
- For cold water see Attachment 9.

8. **COMMUNICATIONS:**

a. Radio frequency: ___________________________________

b. Radio call signs:

i Primary: ___________________________________

ii Secondary: __________________________________

c. Telephone location: _________________________________

d. Site cell phone number: ______________________________

e. Other cell phones: ___________________________________

ATTACHMENT 1
DIVE SUPERVISOR DIVE PLAN BRIEF

PROJECT NAME/NUMBER: ____

9. **SPECIAL CONSIDERATIONS**:

Meals: ___________ Water: ___________ Heat source: _______________

Clothing change: ____________________

10. . **EMERGENCY PROCEDURES**: See Attachment 4

ATTACHMENT 2

DIVING SUPERVISORS PRE-DIVE CHECKLISTS

PROJECT NAME/NUMBER:____

1. **DIVING SUPERVISORS PRE-DIVE CHECKLIST FOR SCUBA DIVING**
   Note: Ensure divers are not sick or recently treated for an injury or illness

   a. **All divers shall have the following minimum equipment**:

_______SCUBA w/regulator

_______Life Jacket/Buoyancy Compensator (BC)

_______Submersible cylinder pressure gauge

_______Weight belt

_______Mask

_______Knife

_______Depth Gauge

_______Diving Watch or Diving Computer

_______Fins

_______Safety Harness (mandatory for COE projects if tended)

______Cylinder pressure is adequate for both the emergency air and SCUBA

_______All quick-release buckles and fastenings can be reached by either hand and are properly rigged for quick release.

______Weight belt is outside of all other belts, straps and equipment, and is not likely to become pinched under the bottom edge of the cylinders.

______Life preserver/BC is not constrained, is free to expand, CO2 carts are installed and all air has been evacuated.

______Check position of the knife to ensure that it will remain with the diver no matter what equipment he may jettison.

______Conduct time check and synchronize watches.

______Cylinder valve open and then back off 1/4 to 1/2 turn.

______Have diver breathe for 30 seconds. While doing this, he should be alert for any impurities in the air or for any unusual physiological reactions.

______Have divers check their reserve air/mechanisms and ensure it is left in the closed/up position.

______Conduct final review of the dive plan.

ATTACHMENT 2

DIVING SUPERVISORS PRE-DIVE CHECKLISTS

PROJECT NAME/NUMBER:____

______Brief the divers on the following reasons for terminating the dive:

- The diver requests termination.
- The diver fails to respond correctly to communications or signals.
- Communications are lost and cannot be quickly reestablished.
- The diver begins to use his/her reserve breathing air.
- Puncture/tear of a dry suit.

______Divers physically and mentally ready to enter the water.

______Ladder is in place to retrieve divers from water

______Divers know the maximum depth and bottom time.

______Review proper/special line pull signals.

______Code Alpha and Divers Down flags are displayed.

______Standby diver has tending line with bowline tied around waist.

______Ensure standby diver knows searching signals

______Verify that personnel and equipment are ready to give proper visual, sound or radio signals to warn off other vessels.

______The diver or divers are now ready to enter the water.

b. Pre-Descent Surface Check

______Conduct a breathing check of the SCUBA. Breathing should be easy, without resistance, and with no evidence of water leaks.

______Visually check dive partner's equipment for leaks, especially at all connection points (cylinder valves hoses at regulator and mouthpiece).

______Check face mask seal.

______Check partner for loose or entangled straps.

______Check buoyancy. SCUBA divers should strive for neutral buoyancy.

______If wearing a dry suit, check for leaks.

______Orient yourself with your surroundings, note any obstructions that you may encounter upon surfacing.

NOTE: SURFACE TIME SHOULD BE KEPT TO A MINIMUM DURING COLD WEATHER DIVING. PRECAUTIONS SHOULD BE TAKEN DURING COLD WEATHER DIVING TO AVOID HYPOTHERMIA DURING SURFACE INTERVALS. CONSIDERATION SHOULD ALSO BE TAKEN FOR THE SURFACE SUPPORT PERSONNEL.

ATTACHMENT 2

DIVING SUPERVISORS PRE-DIVE CHECKLISTS

PROJECT NAME/NUMBER:____

2. DIVING SUPERVISOR'S PRE-DIVE CHECKLIST FOR SURFACE-SUPPLIED DIVING

CAUTION - This checklist is an overview intended for use with the detailed Operating Procedures (OP's) from the appropriate equipment O&M technical manual.

a. Basic Preparation:

___Verify that a recompression chamber is present on the diving station for dives deeper than 100 FSW or dives requiring decompression.

___ Verify that proper signals indicating underwater operations being conducted are displayed correctly.

___ Ensure that all personnel concerned, or in the vicinity, are informed of diving operations.

___ Determine that all valves, switches, controls, and equipment components affecting diving operations are tagged-out to prevent accidental shut-down or activation.

b. Equipment Protection:

___ Assemble all members of the diving team and support personnel (winch operators, boat crew, etc.) for a pre-dive briefing.

___ Assemble and lay out all dive equipment, both primary equipment and standby spares for diver (or standby diver), including all accessory equipment and tools.

___ Check all equipment for superficial wear, tears, dents, distortion, or other discrepancies.

___ Check all masks, helmets, view ports, faceplates, seals, and visors for damage.

___ Check all harnesses, laces, strain relief, and lanyards for wear; replace as needed.

c. Helmets and Masks:

___ Ensure that all Set up and Operating Procedures have been completed in accordance with the appropriate Technical Manual and Operating Procedures.

d. General Equipment:

___ Check that all accessory equipment – tools, lights, special systems, spares, etc., are on site and in working order. In testing lights, tests should be conducted with lights submerged in water and extinguished before removal, to prevent overheating and failure.

___ Erect diving stage or attach diving ladder. In the case of the stage, ensure that the screw pin shackle connecting the stage line is securely fastened with the shackle pin seized with wire or a safety shackle is used to help prevent opening.

___ Ensure first aid kits, portable O2 and AED's are available and working.

PROJECT NAME/NUMBER:____

e. Preparing the Diving System:

___ Check that a primary and suitable back-up air supply is available with a capacity in terms of purity, volume, and supply pressure to completely service all divers and standby diver, including decompression, recompressions and accessory equipment throughout all phases of the planned operation.

___ Verify that all diving system operating procedures have been conducted to properly align the dive system.

___ Ensure that qualified personnel are available to operate and stand watch on the dive system.

f. Compressors:

___ Determine that sufficient fuel, coolant, lubricants, and antifreeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated, and serviced (with all spillage cleaned up completely).

___ Check maintenance and repair logs to ensure the suitability of the compressor (both primary and back-up) to support the operation.

___ Verify that all compressor controls are properly marked and any remote valving is tagged with "**Divers Air Supply - Do Not Touch"** signs.

___ Ensure that the compressor is secure in the diving craft and will not be subject to operating angles, caused by roll or pitch that will exceed 15 degrees from the horizontal.

___ Verify that oil in the compressor is an approved type. Check that the compressor oil does not overflow the FULL mark; contamination of air supply could result from fumes or oil mist.

___ Check that compressor exhaust is vented away from work areas and, specifically, does not foul the compressor intake.

___ Check that compressor intake is obtaining a free and pure suction without contamination. Use pipe to lead intake to a clear suction location if necessary.

___ Check all filters, cleaners and oil separators for cleanliness.

___ Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs, and that all petcocks are closed.

___ Check that all belt-guards are properly in place on drive units.

___ Check all pressure-release valves, check valves and automatic unloaders.

___ Verify that all supply hoses running to and from compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends, and are not exposed in such a way that they could be rolled over, damaged, or severed by machinery or other means.

ATTACHMENT 2

DIVING SUPERVISORS PRE-DIVE CHECKLISTS

PROJECT NAME/NUMBER:____

___ Verify that all pressure supply hoses have safety lines and strain relief's properly attached.

g. Activate the Air Supply in accordance with approved OPs.

a. Compressors:

___ Ensure that all warm-up procedures are completely followed.

___ Check all petcocks, filler valves, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind.

___ Verify that there is a properly functioning pressure gauge on the air receiver and that the compressor is meeting its delivery requirements.

b. Cylinders:

___ Gauge all cylinders for proper pressure.

___ Verify availability and suitability of reserve cylinders.

___ Check all manifolds and valves for operation.

___ Activate and check delivery.

For all supply systems, double check "Do Not Touch" tags (tag out).

h. Diving Hoses:

___ Ensure all hoses have a clear lead and are protected from excessive heating and damage.

___ Ensure that the hose (or any length) has not been used in a burst test program. No hose length involved in such a program will be part of an operational diving hose.

___ Check that hoses are free of moisture, packing material, or chalk.

___ Soap test hose connections after connection to air supply and pressurization.

___Ensure umbilical boots are in good condition.

i. Test Equipment with Activated Air Supply:

___ Hook up all air hoses to helmets, masks and chamber; make connections between back-up supply and primary supply manifold.

___ Verify flow to helmets and masks from primary and secondary air supply.

___ Check all exhaust and non-return valves.

___ Hook up and test all communications.

PROJECT NAME/NUMBER:____

___ Check air flow from both primary and back-up supplies to chamber.

j. Recompression Chamber Checkout (Pre-dive only):

___ Check that chamber is completely free and clear of all combustible materials.

___ Check primary and back-up air supply to chamber and all pressure gauges.

___ Check that chamber is free of all odors or other "contaminants."

___ Hook up and test all communications.

___ Check air flow from both primary and back-up supplies to chamber.

k. Final Preparations:

___ Verify that all necessary records, logs, and timesheets are on the diving station.

___ Check that appropriate decompression tables are readily at hand.

___ Place the dressing bench in position, reasonably close to the diving ladder or stage, to minimize diver travel.

ATTACHMENT 3

DIVING SUPERVISOR POST-DIVE CHECKLIST

PROJECT NAME/NUMBER:____

______Check the physical condition of the diver.

______Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness.

______Advise the diver of the location of the closest recompression chamber that is ready for use.

______Alert the diver to the potential hazards of ascending to altitude, including flying after diving (SEE DSPM Paragraph 3.9.5)

______Assemble diving equipment and return to site support facility (trailer).

______Have divers shower and consume warm liquids, avoid beverages with caffeine.

______Observe the divers on the surface for symptoms of diving disorders for a minimum of 10 minutes before allowing the divers to leave the dive site.

______Wash all diving equipment in fresh water and hang to dry.

______Reorder/replace equipment as necessary.

______Complete dive profile log for all divers and submit the log to the Chairman Diving Review Board for input into TtEC's master dive log.

ATTACHMENT 4

EMERGENCY PROCEDURES

1. **Decompression Sickness or Gas Embolism**:
   a. Recall all divers.
   b. Begin transport to chamber on oxygen.
   c. Administer first aid/CPR and O2 as required.
   d. Notify Recompression Chamber.
2. **Fire in Equipment**:
   a. Evaluate effect of fire on diver AND topside crew.
   b. Terminate dive if necessary.
   c. Inform crew and diver of action planned.
   d. Activate plan.
3. **Explosive detonation with divers in the water**:
   a. Try to establish communications with the divers using standard line pull signals. If contact is established with the divers, recall, recover, and administer first aid as required. Transport to medical assistance as required.
   b. If communications cannot be established, activate the standby diver and recover the divers via the tending line, and administer first aid as required. Request medical assistance and remember that unconscious divers should be treated for possible A.G.E.
   c. Discontinue diving operations until the cause of the explosion is determined.
4. **Boat Breakdown:**

   This situation is considered to constitute an emergency due to the loss of control of the divers.

   a. Recall and recover the divers.
   b. Discontinue diving operations.
   c. Deploy the anchor
   d. Request assistance via radio, phone, or signals.
5. **Variations in ascent rate**.
   a. Always ascend at a rate of 30 fpm (20 seconds per 10 FSW). Minor variations in the rate of travel between 20 and 40 FSW/minute are acceptable. Any variation in the rate of ascent must be corrected in accordance with the following procedures however; a delay of up to one minute in reaching the first decompression stop can be ignored.
   b. **Travel Rate Exceeded.** On a Standard Air Dive, if the rate of ascent is greater than 30 feet per minute (fpm), STOP THE ASCENT, allow the watches to catch up, and then continue ascent. If the decompression stop is arrived at early, start the stop time after the watches catch up.
   c. **Delay greater than 1 minute, deeper than 50 FSW**. Add the total delay time (rounded up to the next whole minute) to the bottom time, re-compute a new decompression schedule, and decompress accordingly.
   d. **Delay greater than 1 minute, shallower than 50 FSW**. If the rate of ascent is less than 30 fpm, add the delay time to the diver's first decompression stop. If the delay is between stops, disregard the delay. The delay time is rounded up to the next whole minute.

6. Unplanned Ascent (Blowup)

a. **Ascent from 20 Feet or Shallower with No Decompression Stops Required.** No recompression is required if the diver surfaces from 20 feet or shallower but was within no-decompression limits. The diver should be observed on the surface for 1 hour. Consider administering O2.

b. **Ascent from 20 Feet or Shallower (Willow Surfacing) with Decompression Stops Required.** If decompression is required and the diver surfaces from 20 FSW or shallower (missed the 20 and/or 10 ft stop) and feels well, the diver is returned to that decompression stop.

   1) If the time from the surface back to the stop was less that 1 minute, add 1 minute to the stop.

   2) If the time from the surface back to the stop was more that 1-minute and the diver remains asymptomatic, multiply the 20 and/or 10 ft stops by 1.5.

   3) Observe diver for 1 hour. Consider administering O2.

c. **Ascent from Deeper than 20 Feet (Uncontrolled Ascent).** Any unexpected surfacing of the diver from depths in excess of 20 feet is considered an uncontrolled ascent. If the diver is within no-decompression limits and asymptomatic, he should be observed for at least 1 hour on the surface. Recompression is not necessary unless symptoms develop. Consider administering O2.

d. **Asymptomatic Uncontrolled Ascent.** Asymptomatic divers who experience an uncontrolled ascent and who have missed decompression stops are treated by recompression based on the amount of decompression missed as follows:

e. **Oxygen Availabl**e. Immediately compress the diver to 60 feet in the recompression chamber. If less than 30 minutes of decompression (total ascent time from the tables) were missed, decompress from 60 feet on Treatment Table 5. If more than 30 minutes of decompression were missed, decompress from 60 feet on Treatment Table 6.

f. **Oxygen Not Availabl**e. Compress the diver to 100 feet in the recompression chamber and treat on Table 1A if less than 30 minutes of decompression were missed; compress to 165 feet and treat on Table 2A if more than 30 minutes were missed.

g. **Symptomatic Uncontrolled Ascent.** If a diver has had an uncontrolled ascent and has any symptoms, he should be recompressed immediately in a recompression chamber to 60 FWS.

   1) If the diver surfaced from 60 FWS or shallower, compress to 60 FSW and begin Treatment Table 6.

   2) If the diver surfaced from a greater depth, compress to 60 FSW or depth where the symptoms are significantly improved, not to exceed 165 FSW, and begin Treatment Table 6A.

7. Emergency Evacuation

   a. Notify diver and dive team of emergency and abort dive.

   b. Evacuate all unnecessary personnel.

   c. Decompress the diver (if required) and recover. If decompression is not possible, follow omitted decompression procedures.

ATTACHMENT 4

EMERGENCY PROCEDURES

SCUBA EMERGENCY PROCEDURES

1. **Buddy Separation** – Make a 360-degree check, above and below, if your buddy is not found, surface immediately. Check the surface for bubbles and notify the Diving Supervisor immediately.

2. **Lost Diver** – The first stage of a lost diver is when communications have been lost and emergency recall has failed.

    a. Initiate diver recall.

    b. Wait 1 minute for response.

    c. Deploy lost diver buoy.

    d. Deploy standby diver (Dive Supervisor's discretion) chase bubbles or conduct expanding circle line search from last known position.

    e. Notify ships/boats in the area to look out for lost diver and request assistance from the Coast Guard Rescue Center, if necessary.

3. **Loss of Air/Equipment Malfunction (SCUBA)**

    a. Signal buddy/surface and abort dive.

    b. Buddy breath/activate reserve/breath from emergency air supply.

    c. Exhale to the surface.

4. **Mechanical Injury:**

    a. Signal buddy/surface and abort dive.

    b. Inform Dive Supervisor.

    c. Rule out possible decompression sickness.

    d. If immediate treatment required, recall all divers & transport to hospital.

5. **Fouled/Trapped Diver**:

    a. Don't panic, stop and think!

    b. Notify your buddy diver or topside, if possible (2-2-2 fouled and need assistance, or 3-3-3 fouled and can clear myself).

    c. Carefully and calmly try to work yourself free of the entanglement.

    d. If required, ditch your equipment and make a buoyant ascent to the surface.

    e. If the diver is trapped, the buddy diver should mark the position of the trapped diver with a circle line, his tending line or any available method of marking the trapped diver's position, and then surface and report to the Diving Supervisor.

    f. The Diving Supervisor will formulate a rescue plan, while the diver delivers additional air to the trapped diver.

    g. Dive supervisor will then brief the rescue plan to the dive team and execute the rescue.

After rescue, observe the divers on the surface for signs of A.G.E., asphyxia, physical injury, omitted decompression, and hypothermia.

ATTACHMENT 4

EMERGENCY PROCEDURES

SURFACE SUPPLIED EMERGENCY PROCEDURES

1. Loss of Breathing Media

a. Re-establish breathing media supply by:

1) Activate topside secondary breathing media supply, or

2) Diver go on bailout bottle, or

3) Put breathing media to diver's pneumofathometer hose and have the diver insert the hose into his helmet or mask.

b. Alert stand by diver

c. Have stricken diver go to bell, stage or ladder.

d. If required, send stand by diver to assist.

e. Terminate dive

2. Loss of Communications

a. Attempt to establish communications with line pull signals.

b. Put constant air to the divers pneumofathometer.

c. Alert stand by diver

d. If communications are established using line pull signals, abort dive and decompress if required.

e. If communications are not established, send stand by diver to divers assistance, abort dive and decompress if required.

3. Fouled or Trapped diver

a. Avoid panic and ensure diver does NOT ditch equipment.

b. Diver informs topside – give a good report.

c. Alert stand by diver.

d. Diver determines the extent of entrapment.

e. Diver attempts to free himself.

f. If required, deploy stand by for assistance.

g. Abort dive and decompress if required

4. Injury in the Water

a. Diver informs topside of injury and extent, give detailed report.

b. Alert stand by diver

c. If required, deploy stand by diver to assist stricken diver.

d. Abort dive and follow decompression protocol, unless injury indicates a greater risk than omitted decompression. Check surface decompression tables for alternate protocol.

e. Request required medical assistance.

5. Severance of Divers Air Supply

a. Put constant air to diver's pneumofathometer.

b. Diver goes on emergency air or inserts pneumofathometer into mask or helmet.

c. Alert stand by diver.

d. Abort dive and decompress.

e. Deploy stand by diver with more air and/or to assist stricken diver if required.

6. Severance of Complete Umbilical

a. Diver goes on emergency air.

b. Topside alert stand by diver

c. Deploy stand by diver down stage line, divers umbilical (if visible), or descent line with additional air supply (his pneumofathometer if necessary) to assist stricken diver and inform topside of conditions.

d. Abort dive and decompress. Check surface decompression tables for shorter water time.

ATTACHMENT 5

EMERGENCY PHONE NUMBERS CHECKLIST

PROJECT NAME/NUMBER:____

RECOMPRESSION CHAMBER:

ADDRESS/LAT-LONG_________________

PHONE NUMBER: ___________________

POC: ______________________________

RESPONSE TIME: ___________________

HOSPITAL:

ADDRESS/LAT-LONG______________

PHONE NUMBER: ________________

POC: ___________________________

RESPONSE TIME:_________________

AIR TRANSPORTATION:

ADDRESS/LAT-LONG________________

PHONE NUMBER: ___________________

POC: ______________________________

RESPONSE TIME: ___________________

SEA TRANSPORTATION:

ADDRESS/LAT-LONG______________

PHONE NUMBER:_________________

POC: ___________________________

RESPONSE TIME: ________________

AMBULANCE:

ADDRESS/LAT-LONG________________

PHONE NUMBER: ___________________

POC: ______________________________

RESPONSE TIME: ___________________

PHYSICIAN:

ADDRESS/LAT-LONG_____________

PHONE NUMBER: ________________

POC:___________________________

RESPONSE TIME: ________________

COMMUNICATIONS:

ADDRESS/LAT-LONG________________

PHONE NUMBER: ___________________

POC: ______________________________

RESPONSE TIME: ___________________

USCG RESCUE COORD. CENTER:

ADDRESS/LAT-LONG______________

PHONE NUMBER: ________________

POC: ___________________________

RESPONSE TIME:_________________

NOTE – THIS CHECKLIST WILL BE PROMINENTLY POSTED AT THE DIVE SITE AND BE PLACED IN ALL BOATS AND RESPONSE VEHICLES.

ATTACHMENT 6

TETRA TECH EC DIVE PROFILE LOG

PROJECT NAME/NUMBER:____

1. Date of Dive:__________________________ 2. Time of Dive: ________________________

3. Location of Dive (Address or Lat/Long):_______________________

4. Dive Team:
   Dive Supervisor: _________________________________
   Standby Diver: __________________________________
   Diver: ____
   Diver: ____
   Tender: ____
   Tender: ____

5. Environmental Data:
   Current: ____
   Visibility: _______________________________________
   Water/Air Temperature: __________/_______________

6. Diving Mode used:______________________________

7. Brief Statement of Work
   Performed:____
   ____
   ____

8. Diving Related Injury/Illness (describe circumstances of injury/illness, extent of the injury/illness, and actions taken, if hospitalized, attach hospital report, include name and address of attending physician):
   ____
   ____
   ____
   ____
   ____
   ____
   ____

9. Decompression Procedure Assessment Evaluation (to be completed if treatment by recompression was required as a result of this Dive, provide details on, depth and time of on-set of symptoms, treatment table selected and results of treatment):
   ____
   ____
   ____
   ____
   ____
   ____
   ____
   ____

_____________________ _______________________

Diving Supervisor Date

ATTACHMENT 6

TETRA TECH EC DIVE PROFILE LOG

PROJECT NAME/NUMBER:____

1. All Tetra Tech ECI dives will be recorded on this attachment.

2. Upon completion of the project or weekly, all Dive Logs will be collected by the Dive Supervisor/Field Lead forwarded to the Chairman Diving Review Board and for science divers a copy to the Science DSO. The Chairman Diving Review Board will retain this log for 1 year, except 5 years where there has been an injury or incident of decompression sickness.

3. Definitions:

a. Old Group - Repetitive group designation from previous dive. Leave blank if this is the first dive.

b. Surface Interval - The time, which a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as he starts his next descent. Not required for first dive.

c. RNT - RESIDUAL NITROGEN TIME - Time, in minutes, which must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive.

d. Depth - Depth of current dive.

a. Bottom Time - The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) they begin their ascent from the bottom.

f. Decompression time – Decompression Schedule/Decompression time

f. Equivalent Single Dive Time - RNT plus actual bottom time.

g. New Group - REPETITIVE GROUP DESIGNATION - A letter, which is used to relate directly to the Amount of residual nitrogen remaining in a diver's body.

4. RNT Exception Rule - If performing a repetitive dive to the same depth or deeper, and the RNT is greater than the bottom time of the previous dive, use the bottom time of the previous dive as the RNT.
5. See Attachment 10a, 10b, and 10C for the Navy Diving Tables.

ATTACHMENT 6
TETRA TECH DIVE PROFILE LOG (Page 3)

PROJECT NAME/NUMBER:

DATE	DIVERS NAME DIVE SET DAY/JOB	OLD GROUP	SURFACE INTERVAL	RNT	DEPTH	BOTTOM TIME (min)	DECOMPRES-SION SCHEDULE/ TIME	EQUIVALENT SINGLE DIVE TIME	NEW GROUP
	Total Bottom Time								

Attachment 7
Supplemental Diving Questionnaire
(Updated Yearly and forwarded to the Chairman
Diving Review Board and Science
Diving Safety Officer)

Name ___________________________________ Employee Number ____________

Social Security Number ____________________ Date ______________________

1. **How long have you been diving? ____________________________________**
   Max. Depth: Air ____
   Mixed Gases ____
   Longest Bottom Time: Air ______________________________________
   Mixed Gases ________________________________
   Have you made any saturation dives? ( )YES ( ) NO
   Gas Mix: Heliox ( ) Trimix ( ) Nitrox ( )
   Max Depth __________ Total Duration (days) _________

2. **Diving Experience (Numbers of years Experience)**
   Air __________ Mixed Gases ____________ Saturation _______
   Have you passed an Oxygen Tolerance Test? ___________________________
   Name of Company/School ______________________________________

3. **Number of Decompressions Incidents**
   Decompression sickness: Pain only _________ Neurological _______________
   Serious Symptoms: Chokes ___________ Inner Ear _____________
   List any residuals: ____

4. **In Diving have you had a history of (Provide details of dates and severty)**

   Gas Embollsm_______________________ Deafness ________________________
   Oxygen Toxicty _____________________ Ear Drum Rupture _______________
   Lung Squeeze ______________________ Lung Squeeze ___________________
   CO2 Toxicty _______________________ Near Drowning __________________
   CO Toxicty ________________________ Asphydation ____________________
   Ear/Sinus Squeeze __________________ Vertigo (Dizziness) _______________

5. **Have you ever been involved in a diving accident? ________**
   Details: ____
   ____
   ____
   Date of Last Physical: ____
   For what company were you working for: ___________________________
   Name and address of physician who provided care: ___________________
   ____

6. **Have you had any of the following and if so, provide dates:**
   ( ) Chest X-Ray ______________________ ( ) Pulmonary Function Studies_______
   ( ) EEG ___________________________ ( ) Treadmill EKG ________________
   ( ) EMG ___________________________ ( ) EKG _________________________
   ( ) Nerve condition Studies ______________ ( ) Exercise EKG _________________
   ( ) Audiogram ______________________

7. I have not been recently hospitalized for more than 24 hours to an injury or illness.

   Signed ________________________

Attachment 8
Line Pull Signals

From Tender to Diver

1 Pull	"Are you all right?" When diver is descending, one pull means "Stop."
2 Pulls	"Going Down." During ascent, two pulls mean "You have come up too far; go back down until we stop you."
3 Pulls	"Stand by to come up."
4 Pulls	"Come up."
2-1 Pulls	"I understand" or "Talk to me."
3-2 Pulls	"Ventilate."
4-3 Pulls	"Circulate."

Searching Signals (Without Circling Line)

7 Pulls	"Go on (or off) searching signals."
1 Pull	"Stop and search where you are."
2 Pulls	"Move directly away from the tender if given slack; move toward the tender if strain is taken on the life line."
3 Pulls	"Face your umbilical, take a strain, move right."
4 Pulls	"Face your umbilical, take a strain, move left."

From Diver to Tender

1 Pull	"I am all right." When descending, one pull means "Stop" or "I am on the bottom."
2 Pulls	"Lower" or "Give me slack."
3 Pulls	"Take up my slack."
4 Pulls	"Haul me up."
2-1 Pulls	"I understand" or "Talk to me."
3-2 Pulls	"More air."
4-3 Pulls	"Less air."

Searching Signals (With Circling Line)

7 Pulls	"Go on (or off) searching signals.
1 Pull	"Stop and search where you are."
2 Pulls	"Move away from the weight."
3 Pulls	"Face the weight and go right."
4 Pulls	"Face the weight and go left."

Special Signals From the Diver

1-2-3 Pulls	"Send me a square mark."
5 Pulls	"Send me a line."
2-1-2 Pulls	"Send me a slate."

Emergency Signals From the Diver

2-2-2 Pulls	"I am fouled and need the assistance of another diver."
3-3-3 Pulls	"I am fouled but can clear myself."
4-4-4 Pulls	"Haul me up immediately."

ALL EMERGENCY SIGNALS SHALL BE ANSWERED AS GIVEN EXCEPT 4-4-4

A special group of searching signals is used by the tender to direct a diver in moving along the bottom. These signals are duplicates of standard line-pull signals, but their use is indicated by an initial seven-pull signal to the diver that instructs the diver to interpret succeeding signals as searching signals. When the tender wants to revert to standard signals, another seven-pull signal is sent to the diver which means searching signals are no longer in use. Only the tender uses searching signals; all signals initiated by the diver are standard signals. To be properly oriented for using searching signals, the diver must face the line (either the lifeline or the descent line, if a circling line is being employed).

ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

1. UNDER ICE DIVING

Diving under the ice requires extremely specialized training and equipment and will not be performed by Tetra Tech ECI employees unless approved by the Diving Review Board.

2. COLD WATER DIVING

In addition to decompression, thermal problems arising from exposure to cold water pose the major consideration when planning operational dives and selecting equipment. The working diver commonly experiences heat loss during immersion and often expects to be uncomfortably chilled at the end of a dive. Bottom time limits may be determined by the diver's cold tolerance rather than by decompression considerations.

An individual thoroughly conditioned physically can be transported from warm climates into cold climates and immediately begin diving without harmful effects. However, individuals differ in how well suited they are for cold weather operations. At least half of the diving team should have previous experience in ice or cold water diving operations and should be well qualified to train the less experienced.

Personnel scheduled to go to Polar Regions should be instructed in cold weather physiology and the prevention of cold injuries. To prevent injury, any techniques that aid heat balance, protection, and basic metabolism should be used.

Cold water immersion may also cause excessive urination, severely dehydrating the diver. This in turn reduces performance and may increase the risk of developing decompression sickness. A diver who is dehydrated may appear normal in the water. However, exiting the water combined with warming of the skin may cause pooling of the blood in the extremities leading to fainting. This means that divers who have been in cold water for any period of time and who appear cold should be assisted from the water and sit or lie down and take fluids until they are sure they can stand without problems.

Vertigo is caused by cold water stimulating the balance mechanism of the inner ear.

In repetitive diving with cold exposure, the operation should be planned so that the diver is re-warmed to the point of sweating before diving again. If cold water exposures are severe and if more than a 30 -minute duration, then consideration should be given to requiring an overnight rest between exposures. The diver must also have sufficient non-caffeine beverages to replace the excessive body fluid loss from cold water induced urination.

The support equipment required for ice and cold water diving must be carefully evaluated for effectiveness and suitability

Maintaining proper body temperature is particularly difficult for a diver working underwater. The principal temperature control problem encountered by divers involves keeping the body warm. The high thermal conductivity of water, coupled with the normally cool-to-cold waters in which divers operate, can result in rapid and excessive heat loss. At extremely low temperatures or with prolonged immersion, body heat loss will reach a point at which death will occur. Appropriate dress can greatly reduce the effects of heat loss, and a diver with proper dress can work in very cold water for reasonable periods of time

In very cold water, the wet suit is only a marginally effective thermal protective measure and its use exposes the diver to hypothermia and restricts available bottom time. The use of alternative thermal protective equipment should be considered in these circumstances

ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

The variable volume dry suit and hot water suit are effective means of thermal protection for cold water diving. Wet suits made of incompressible material are now available. Such suits offer more protection at depth than standard wet suits of the same thickness. Prior to the use of variable volume dry suits and hot water suits in cold and ice-covered waters, divers must be trained in their use and be thoroughly familiar with the operation of these suits.

More weight must be used with a variable volume dry suit than with a wet suit due to the great positive buoyancy of a dry suit. Manufacturer's recommendations should be followed to select starting weight. The additional weight makes use of a weight vest or harness desirable. A shoulder harness is one method of preventing the heavy, awkward belts from slipping down during a dive. A few heavy hip hugger weights are better than several smaller weights.

Both single- and double-hose regulators are used for ice and cold water diving. The single-hose regulator is preferred for buddy breathing, is less bulky, and is easier to maintain than the double-hose; however, it is more subject to freeze-up than the double-hose regulator. Due to the serious nature of the freeze-up problems in single-hose regulators, they should not be allowed to free-flow or be purged for over five seconds at a time. Only regulators having a cold water conversion will be used for ice/cold water diving.

The single-hose regulator should be kept in a warm place before diving. It is important that the divers test the regulator in a warm place, then refrain from breathing it until submerging. When returning to the surface, the regulator should remain submerged and the diver should refrain from breathing from the regulator until re-submerging. The diver's time on the surface should be kept to a minimum. Once under the water, chances of a freeze-up are reduced. However, if a regulator is allowed to free-flow at depth for as little as five seconds, freeze-up may occur. The diver should therefore avoid purging the second stage of the regulator when diving in cold water. If water needs to be purged from the mouthpiece, the diver should do so by exhaling into it.

Where water temperature is at or below 37'F, a redundant SCUBA system (twin SCUBA bottles, each having a "K" valve and an approved cold water regulator) or twin SCUBA bottles with one common manifold and an approved cold water regulator (with octopus) may be used. When selecting the redundant SCUBA system, maximum depth and bottom time is greatly reduced because the extra SCUBA will be used for emergencies only.

Using surface supplied diving in cold water requires detailed operations planning and extensive logistical support. This includes thermal protection for an elaborate dive station and recompression chamber and hot water heating equipment. In addition, dive equipment may require cold climate modification. Because of logistical considerations, scuba is used in most ice diving situations. However, surface supplied diving may be required because of prolonged bottom times, depth requirements, and complex communications between topside and diver. When diving in cold water that is not ice covered, logistic and equipment support requirements are reduced; however, very cold water poses many of the same dangers to the surface-supplied diver as ice diving.

The diver's mask may show an increased tendency to fog in cold water. An anti-fog solution should be used to prevent this from occurring. Saliva will not prevent this fogging.

3. **Hypothermia**. When diving in cold water, hypothermia may predispose the diver to decompression sickness. Hypothermia is easily diagnosed. The hypothermic diver loses muscle strength, the ability to concentrate, and may become irrational or confused. The victim may shiver violently, or, with severe hypothermia, shivering may be replaced by muscle rigidity. Profound hypothermia may so depress the heartbeat and respiration that the victim appears dead. However, a diver should not be considered dead until the diver has been re-warmed and all resuscitation attempts have been proven to be unsuccessful.

ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

Hypothermia demands immediate treatment and prompt evacuation to a medical facility. A hypothermic diver must not be allowed to walk; i.e., the diver should be transported in a horizontal position. Improper handling of the diver can cause dangerous rhythms of the heart and a drop in the body core temperature, known as after drop. The local/responding medical facility must be notified of the possibility of hypothermia PRIOR to the commencement of diving operations. Emergency re-warming and evacuation plans should be established with their recommendations.

Some of the signs and symptoms of hypothermia are shivering, mental confusion, loss of memory, speech/sensory impairment, and hallucinations. At app. 88 degrees F, all shivering stops, the victim will not recognize familiar people, followed by muscle rigidity and loss of consciousness.

Table 9-7. *No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.*

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595	
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	60	7	12	17	22	28	33	39	45	51	57	60					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	30	4	7	11	14	17	21	24	28	30							
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	10	2	4	6	9	10											
140	10	2	4	6	8	10											
150	5	2	3	5													
160	5		3	5													
170	5			4	5												
180	5			4	5												
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

Table 9-8. *Residual Nitrogen Time Table for Repetitive Air Dives.*

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

Group	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																:10 2:20 *
B															:10 1:16	1:17 3:36 *
C														:10 :55	:56 2:11	2:12 4:31 *
D													:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *
E												:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *
F											:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *
G										:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *
H									:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *
I								:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *
J							:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 7:00	7:01 8:16	8:17 10:36 *
K						:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *
L					:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:44	8:45 10:01	10:02 12:21 *
M				:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *
N			:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *
O		:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

Table 2A-1. *No-Decompression Limits and Repetitive Group Designators for Shallow Water Air No-Decompression Dives.*

Depth (fsw)	No-Stop Limit (min)	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
31	334	16	26	37	48	60	73	87	102	119	138	158	182	209	242	282	334
32	304	15	25	35	46	58	70	83	98	114	131	150	172	197	226	261	304
33	281	15	24	34	45	56	67	80	94	109	125	143	163	186	212	243	281
34	256	14	23	33	43	54	65	77	90	104	120	137	155	176	200	228	256
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
36	212	14	22	31	40	50	61	72	84	97	110	125	142	160	180	204	212
37	197	13	21	30	39	49	59	69	81	93	106	120	136	153	172	193	197
38	184	13	21	29	38	47	57	67	78	90	102	116	131	147	164	184	
39	173	12	20	28	37	46	55	65	76	87	99	112	126	141	157	173	
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
41	155	12	19	27	35	43	52	61	71	81	92	104	117	130	145	155	
42	147	11	19	26	34	42	50	59	69	79	89	101	113	126	140	147	
43	140	11	18	25	33	41	49	58	67	76	87	98	109	122	135	140	
44	134	11	18	25	32	40	48	56	65	74	84	95	106	118	130	134	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
46	116	10	17	23	30	38	45	53	61	70	79	89	99	110	116		
47	109	10	16	23	30	37	44	52	60	68	77	87	97	107	109		
48	102	10	16	22	29	36	43	51	58	67	75	84	94	102			
49	97	10	16	22	28	35	42	49	57	65	73	82	91	97			
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			

Table 2A-2. *Residual Nitrogen Time Table for Repetitive Shallow Water Air Dives.*

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																:10 2:20 *
B															:10 1:16	1:17 3:36 *
C														:10 :55	:56 2:11	2:12 4:31 *
D													:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *
E												:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *
F											:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *
G										:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *
H									:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *
I								:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *
J							:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 7:00	7:01 8:16	8:17 10:36 *
K						:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *
L					:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:44	8:45 10:01	10:02 12:21 *
M				:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *
N			:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *
O		:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
31	334	282	243	210	183	159	139	120	103	88	74	61	49	38	27	17
32	305	262	227	198	173	151	132	115	99	85	71	59	47	36	26	17
33	282	244	213	187	164	144	126	110	95	81	69	57	46	35	25	16
34	262	229	201	177	156	138	121	105	91	78	66	55	44	34	25	16
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
36	231	204	181	161	143	126	111	98	85	73	62	51	41	32	23	15
37	218	194	173	154	137	122	107	94	82	70	60	50	40	31	23	14
38	207	185	165	148	132	117	103	91	79	68	58	48	39	30	22	14
39	197	177	158	142	127	113	100	88	77	66	56	47	38	29	21	14
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
41	180	163	146	132	118	105	93	82	72	62	53	44	36	28	20	13
42	173	156	141	127	114	102	91	80	70	61	52	43	35	27	20	13
43	166	150	136	123	110	99	88	78	68	59	50	42	34	26	19	12
44	160	145	131	119	107	96	85	75	66	57	49	41	33	26	19	12
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
46	149	136	123	111	101	90	81	71	63	54	46	39	32	25	18	12
47	144	131	119	108	98	88	78	70	61	53	45	38	31	24	18	11
48	139	127	116	105	95	85	76	68	60	52	44	37	30	24	17	11
49	135	123	112	102	92	83	74	66	58	51	43	36	30	23	17	11
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11

Residual Nitrogen Times (Minutes)

ATTACHMENT B

ACTIVITY HAZARD ANALYSIS #1

Activity Hazard Analysis (AHA) #1

Job/Task: Mobilization, Site Set Up, Boating and Scientific Snorkeling	**Overall Risk Assessment Code (RAC) (Use highest code)**					**H**
Project Location: Culebra Water Ranges, Culebra, Puerto Rico	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W912DY-10-D-0015	**Severity**	**Probability**				
Date Prepared: November 17, 2011		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Jennifer Peters, Sr. EHS Specialist	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Roger Margotto, CIH, CSP, CHMM, Tetra Tech EC EHS Manager	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**
Notes: (Field Notes, Review Comments, etc.) In addition to the information listed in this AHA, all field personnel must review and be familiar with all provisions of the approved safety plan. TtEC Corporate Safety Programs will also be available on site for review of specific materials and mitigation measures.	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.	**RAC Chart**				
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk**				
		H = High Risk				
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk**				
		L = Low Risk				

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling

Job Steps	Hazards	Controls	RAC
1. Set up shore-based work areas	Workers could be exposed to chemical hazards during fueling.	Delineate the refueling zone, and use PPE as required by the type of material being used. The tasks performed, ambient air monitoring, temperature, and visual observation will be used to verify the selection of PPE. Identify all chemical hazards and receive training regarding the safe handling of chemicals (refer to MSDSs). The SSHO will maintain copies of all MSDSs at the site.	L
	Noise from the site setup could cause hearing loss to workers.	Hearing protection is required when sound levels exceed 84 dBA continuously. This rule applies to personnel working near heavy equipment, generator use, or operating engines.	L
	Slip, trip, and fall hazards could be present.	Visually inspect work areas; eliminate slip, trip, and fall hazards if feasible, otherwise barricade/ isolate the hazards. Keep work areas neat and orderly. Always place supplies, hoses, cords and other equipment in areas away from normal foot traffic, and equipment and tools in a safe location that does not present a trip hazard to work areas. Maintain proper illumination in all work areas. Work is authorized during daylight hours only.	L

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
1. Set up shore-based work areas (cont'd)	Sharp objects could cause puncture.	Wear cut-resistant work gloves when handling sharp edges and items with pinch points, such as barricades, EZ-up shade structures, folding chairs, etc. Whenever possible, blunt sharp edges and double over wire ends (fencing, material bundles, etc.). Workers should not stand or walk on either equipment or supplies.	L
	Musculo-skeletal strains from lifting and moving materials/ equipment manually.	Use mechanical lifting equipment and hand-trucks whenever possible. Otherwise, use proper lifting techniques, such as keeping the back and neck straight, lifting with the legs without twisting, and getting help when moving bulky/heavy materials and equipment. Employees will not lift more than 50 pounds alone. Encourage a steady, sustainable work pace.	M
	Worker exposure to extreme temperatures.	Monitor for heat stress and follow safety plans.	L
	Eye injury.	Safety glasses (clear or tinted) are the minimum required eye protection for all work areas during setup and shut down.	L
	Lack of communication in widely dispersed areas could lead to a delayed response in an emergency.	Ensure that each work team has a phone, or access to a phone, for emergency communication. Verify emergency numbers and functions of telephones and radios. Use the buddy system. Verify routes to local hospital.	L
	Contact with wild animals, biting or stinging insects, and poisonous plants could cause injury upon contact	Workers will apply DEET to work clothing and skin area following manufacturer's instructions as a preventative measure for biting insects. Workers will exercise caution when working in brushy or grassy areas, wood or debris piles, and recessed areas. Site orientation will include briefing on local hazardous flora and fauna, signs and symptoms of exposure and precautions to take. Workers with allergies will let the SSHO know using the medical data sheet and will carry their own prescription medication as applicable. First aid and medical attention as required. Report any bites, stings, or rashes to the SSHO.	L
2. Backing of boats on boat trailers	Failure of proper backing can cause struck by and pinch point injuries or property damage	Use spotters for all backing operations. Ensure spotter stands in line of sight of the person backing the vehicle. All personnel who back a trailer are trained and qualified to do so and are designated by the PjM for such activities. Use boat checklist in APP prior to launching boat. Verify understanding of hand signals used for backing, going forward, stopping, and turning left or right. Use parking brake and ensure operator is not moving vehicle before unhitching boat from trailer.	M
3. Use boat to bring personnel to designated area(s)	Failure to meet EM 385-1-1 Section 19 in general and specifically 19F requirements for use of boats could cause injury or death.	Follow the requirements of EM 385-1-1 using the inspection checklist provided in the APP. All boat operators are qualified and trained in boat use and procedures. Ensure boat passengers have been briefed on the location, use, and inspection of emergency equipment onboard and the procedures to follow in the event of a shipboard emergency. Practice drills will be done prior to or during first deployment for situations such as man overboard, fires and explosions, and abandon ship.	H

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
3. Use boat to bring personnel to designated area(s) (cont'd)	Fueling of boat- potential for fire, environmental release. Run out of fuel when operating.	No smoking or other sources of ignition when fueling. Engine must be off. There must be a fire extinguisher available. Refuel in a manner to prevent any spills, especially spills into the water. (If there is any sheen in the water the spill must be reported). Check for fuel leaks in the boat, if fuel lines are located in the boat.). Ensure there is enough fuel supply for the trip and the return to dock plus 1/3 in reserve.	M
	Boat could malfunction and drift into open water if engine does not work.	Ensure communications are working on boat. Have anchor and enough line to deploy in the event of motor/engine malfunction. Ensure that a Float Plan is filed in accordance with the APP using the example Coast Guard Float Plan in the APP. File this plan daily with the PjM or designee before leaving the dock and notify them of your return.	M
	Personnel can slip or trip while on the dock and when getting on or off the boat,	Personnel should use appropriate footwear to ensure that there is enough tread on the soles to minimize slipping. Look out for trip hazards. Those hazards that cannot be removed must be marked. When climbing up or down always ensure three points of contact.	L
	Sunburn for observers in boat.	Use a broad spectrum sunscreen SPF 15 or greater as necessary.	L
	Severe weather can cause dangerous seas and hazardous boating conditions	Monitor the local and national weather service broadcasts prior to mobilization by boat and during the day. Pay attention to weather advisories and storm warnings, namely hurricanes. Monitor actual water conditions for dangerous wave or ground swell action. Follow provisions in the APP for severe weather.	M
	Grounding	Use caution in the shallow areas. Use depth meter and spotting to avoid striking the bottom or grounding.	L
	Heat or cold stress may be experienced	Boat occupants will be monitored for signs and symptoms of heat stress and cold stress (in colder weather, wet weather, or if wind chill is a factor) in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for boat occupants. Boat occupants will be prepared with raingear and a change of clothing in the event they get wet and chilled. Boat survival kit, if used, will be restocked with necessary equipment. Adequate drinking water and electrolyte fluids will be available for boaters. Boat cabin shall have air conditioning or at a minimum, shade for employees to rest in.	M
	Boat could be struck by other boats in area	Boat operator is in charge of situational awareness while on the water. Boat operator will not be doing other tasks. Monitor Channel 16 and U.S. Coast Guard rules for lighting and other vessel operations. Use air horn in the event of a boat coming close.	M

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
4. Walking in to areas and exiting areas for shore approach to snorkel surveys	Hazardous plant and/or animal contact	Brief personnel on recognition of species and the hazards of contact with dangerous plants and animals as per Section 11 of the APP. Ensure first aid kits are accessible and stocked as per EM 385 1-1. Ensure emergency numbers are posted and communications equipment is available for use. Use the buddy system. Ensure a litter or stretcher is available in the event a snorkeler is injured or unconscious.	M
	Slips, trips, and falls	Use established pathways, roads, and trails to the extent possible. Wear sturdy shoes. Pay attention to the surroundings and footing. Do not carry heavy or awkward objects down steep embankments.	L
	Heat or cold stress may be experienced	Personnel will be monitored for signs and symptoms of heat stress and cold stress (in colder weather, wet weather, or if wind chill is a factor) in accordance with the APP. Hydration and work/rest regimens will be followed. Team members will be prepared with raingear and a change of clothing in the event they get wet and chilled. Boat survival kit, if used, will be restocked with necessary equipment and blankets. Adequate drinking water and electrolyte fluids will be available onshore. Rest areas will have shade for employees to rest in.	M
5. Snorkeling	Failure to meet EM 385-1-1 Section 30 for Scientific Snorkeling requirements could lead to injury or death.	Follow the requirements of the EM 385-1-1 Section 30 using the inspection checklist in the APP. Follow the requirements identified in the Snorkeling Safety Plan for snorkeling operations. All members of the snorkeling team are first aid/CPR trained.	H
	Dangerous currents, squalls, storms, or tides could catch snorkelers and boat and cause hazardous conditions.	Follow the Snorkeling Safety Plan. Daily before snorkeling and during snorkeling, the Snorkeling Supervisor will evaluate conditions. Snorkeling will be discontinued if sudden squalls, electric storms, heavy seas, unusual tide, or any other condition exists that, in the opinion of the Snorkeling Supervisor/Lead Snorkeler, jeopardizes the safety of the team. Snorkeling will not be performed against currents that exceed one knot.	M
	Potential contaminants in the water could present health risk to snorkelers	Snorkelers may encounter dangerous or unpleasant forms of pollution that can cause severe problems, such as: effluent from a sewer or industrial outfall, oil leaking from a wellhead or damaged fuel tank, toxic materials or volatile fuels leaking from barges or tanks. The snorkeling team should not conduct in-water work until the contaminant has been identified, the safety factors evaluated, and the process for decontamination established.	L
	Contact with dangerous marine life can cause injury to snorkelers	Brief personnel on recognition of species and the hazards of contact with marine life as per Section 11 of the APP. Ensure first aid kits are accessible and stocked as per EM 385 1-1. Ensure emergency numbers are posted and communications equipment is available for use.	L
	Snorkelers could be struck by other boats in area	Snorkelers will be no more than 50 feet from the support boat or observer/assistant. Cordon off the work zone with buoys or lines as needed to restrict boating traffic in the survey area. Locate the boat between the divers and any potential boating traffic and have air horn to get attention of any boats that come near work zone. Utilize radio channel 16.	M

AHA – 1 Mobilization, Site Setup, Boating, Scientific Snorkeling			
Job Steps	**Hazards**	**Controls**	**RAC**
5. Snorkeling (cont'd)	UXO may be present in the sediments of Flamenco Bay or the Luis Pena Channel.	Snorkelers will not touch any items on the seafloor during the survey. MEC awareness training is provided in the site orientation training.	M
	Heat or cold stress may be experienced by snorkelers	Snorkelers will be monitored for signs and symptoms of heat stress and cold stress in accordance with the APP. Hydration and work/rest regimens will be followed. Survival kits on the boat will include blankets in the event of hypothermia for snorkelers.	M
	Snorkelers could fall while boarding onto or deploying from boat	Boat will be equipped with a ladder and handrail assembly to facilitate safe entry and egress from boat and water and platform to step onto.	M

AHA – 1 Mobilization, Site Set Up, Boating, Scientific Snorkeling		
Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
Site Vehicles	Drivers must have current State or Puerto Rico-issued driver's license.	Daily vehicle inspection by drivers.
Boats	Qualified Operators will have U.S. Coast Guard approved boater safety qualifications identified in the APP and experience in use of the boats on the project.	Inspect daily, and before use. Use the boating checklist form.
PPE and snorkeling equipment	Training as required by EM 385-1-1, Section 30 G. Snorkelers will be certified as skin divers (snorkelers) or open water divers by a nationally recognized organization	Daily inspection by users using attached checklist. Inspect tethering rope prior to each day of use.
Type II or better PFD to be worn and snorkeler's PFD	User will inspect each day before use	An experienced operator will use. SSHO will instruct in proper use.
Fire Extinguishers	Fire Extinguisher Training including use/limitations.	At least monthly by SSHO or designee.
First aid kits and other emergency equipment	Use of emergency equipment/first aid kits must be done by personnel familiar with this plan; use and inspection criteria of the equipment, and what the equipment is used for, by or under direction of the SSHO.	Initially and at least weekly thereafter or after use for restocking. (29 CFR 1926.50(d)(2))

Acronyms:
AHA – Activity Hazard Analysis
CFR – Code of Federal Regulations
dBA – decibels, A-scale
MEC – munitions and explosives of concern
MSDS – Material Safety Data Sheet
PPE – personal protective equipment
RAC – Risk Assessment Code
SSHO – Site Safety and Health Officer
UXO – unexploded ordnance

ATTACHMENT C

SMALL BOAT INSPECTION CHECKLIST

SNORKLING INSPECTION CHECKLIST EM 385-1-1 Section 30 G			Date of Inspection:
Contractor			Contract No.
Inspected by (Signature)			
Safety and Health Requirement to Reference EM 385-1-, Section 30 G.	Yes	No	N/A
Snorkeling team will not be less than 3 persons (snorkeler and observer/assistant and snorkeling team supervisor/boat operator).			
Snorkeling will be done only on the surface of the water.			
Untethered scientific snorkeling is not allowed in waters deeper than 5 feet.			
The snorkeler is tethered with a harness and a maximum of 40 feet of floating line.			
The tether is constantly tethered from the shore or boat.			
The snorkeler is wearing a device providing a minimum of 15.5 lbs. positive buoyancy.			
There are no potential entanglement hazards in the snorkeling area (overhanging branches or objects, surface stumps, rocks, etc.			
Snorkelers and observer/ assistants are certified as skin divers (snorkelers or open water divers by a nationally recognized organization.			
An observer/assistant will accompany each untethered snorkeler either along the shore and will be within 50-feet of the snorkeler at all times.			
Non snorkeling observer/assistants must wear a PFD and be equipped with a ring buoy with at least 70 feet of line. Must be capable of performing a rescue on the specific snorkelers in an emergency			
Areas of extreme water velocity and turbulence are avoided.			
Snorkelers have appropriate thermal protection.			
The employees are medically fit to perform snorkeling activities.			
All snorkeling team members are certified in CPR and First Aid.			
There is First Aid kit is available in the boat.			
The AHA is modified for the specific snorkeling session			
Records for snorkeling are maintained.			
Snorkelers are wearing apparel that provides appropriate environmental protection. The apparel includes fins or other appropriate foot protection.			

APPENDIX F

CONTRACTOR FORMS

TETRA TECH

Tetra Tech EC, Inc. Survey Log Sheet

Date: | Julian Date: ##### | Reach / Area: | To: | Survey Name: #N/A

Survey Vessel: | Surveyor(s): | Time Zone: UTC

Survey Type: Multibeam | Captain: | Job Name Modifier:

Client:

Device Information

	POS MV 320	Leica	Leica RTK GPS	Trimble AG 132
Starboard:	0.00	1.90	-0.20	0.01
Forward:	0.00	-7.40	14.11	0.14
Vertical:	0.00	-9.60	-5.86	-8.30
Yaw:				
Pitch:				
Roll:				
Latency:				

SVP File:

Patch Test Date:

Start Time	Stop Time	Raw File Name	Line Type	Survey Direction	Survey Speed	Comments

CONTRACTOR PRODUCTION REPORT

TETRA TECH

Contract No. W912DY-10-D-0015	Title & Location:						Date: / Report No. 0
Rental Equipment	**Vendor**	**PO/MOA#**	**Charge #**	**Start Date**	**Rate**	**Daily Hrs**	**P.O.P. Expires**
Materials	**Vendor**	**PO #**	**Charge #**	**QTY REC'D**	**ACCUM QTY**	**P O QTY**	**P.O.P. Expires**

Contractor Field Operations Lead ____________________ Date ____________

Environmental Baseline Survey Culebra Water Ranges.

Daily QC Checklist

Tetra Tech Marine Mapping Group

2012

QC Checklist

GPS

☐ Survey monument verification with rover GPS

Multibeam Sonar

☐ Bar Check
☐ Water Level Check
☐ Cross Lines
☐ Patch Test

See the Multibeam Sonar SOP and the Measurement Performance Criteria Table for additional information

Side Scan Sonar

☐ Reciprocal survey lines over distinct feature

See the Side Scan Sonar SOP and the Measurement Performance Criteria Table for additional information

Underwater Video

☐ Video acquisition verification

See the Underwater Video SOP and the Measurement Performance Criteria Table for additional information

Problems experienced? ☐Yes ☐No

Comments:

TETRA TECH

FIELD CHANGE REQUEST (FCR)

TASK ORDER # ____________ FCR # ____________ DATE ____________

LOCATION: ____________ Client Representative ____________

1. Document to be changed. Identify revision, date, section, drawing, etc.

2. Description of existing requirement and proposed change (Attach sheet if necessary)

3. Reason for Change (Attach sheet if necessary)

4. Originator: (print name and sign)		Title	Date
Reviewed by: (print name and sign)		Title	Date
Field Operations Lead (Print name and sign)	Date	Task Order Manager (Print name and sign)	Date
TtEC Program QC Manager (Print Name and Sign)	Date	Client Acknowledgement (Print name and sign)	Date

GPS Base Station and Rover QC Log

						Published Coordinates			Observed			Difference			
Date	Time	Location	File Name	Obs. Type	Ant. Ht	Easting	Northing	Elev.	Easting	Northing	Elev.	Easting	Northing	Elev.	Notes
3/6/2012	12:00	TBM1		Base	4.1437	1182855.44	219403.90	14.69							
3/6/2012	12:38	JP-23	QC-JP23-030612	Rover	NA	1182264.38	218962.82	26.42	1182264.28	218962.79	26.48	0.09	0.04	-0.06	
3/6/2012	1306	JP-21	QC-JP21-030612	Rover	NA	1181851.98	218524.15	48.75	1181851.97	218524.10	48.95	0.01	0.05	-0.20	

TETRA TECH

Daily Water Level Check

Project Avg.	0.050
Project Stdv	0.071
Project Min	0.000
Project Max	0.100

Date	Time	Reach	Leica Rover Waterline Ht.(w/geoid)	HYPACK Tide corr	Port Draft	Stbd Draft	Avg Draft	Corr. Tide	Diff	ABS(Diff)	Notes
mm/dd/yyyyy	hh:mm		10.000	-9.400	0.6	0.8	0.70	10.10	-0.10	0.100	EXAMPLE
			10.000	-9.300	0.6	0.8	0.70	10.00	0.00	0.000	EXAMPLE

TETRA TECH

Personnel on Board

☐	☐	☐	☐
☐	☐	☐	☐

Reson SeaBat 7125

Start-up

☐ Energize the system. (Press the On / Reset switch UP towards the On position)
☐ Start the sonar by clicking the 7K Control Center icon on the 7-P operator desktop
☐ If using dual sonar verify that port sonar is the master and starboard sonar is the slave
☐ Select the operating frequency and number of beams
☐ Click *Start* to launch the user interface

Master/Slave Connection (Dual Sonar Only)

☐ Open the Configuration menu on the master sonar and select Dual Head
☐ Enter the IP address of the slave processor and click connect

PPS, Sound speed, Attitude Connections

☐ Confirm PPS is and ZDA is being received. Look for any alarms.
Confirm Sound Velocity data is being received and is a reasonable value: ~1500 m/s
Confirm Attitude data is being received. Turn on role stabilization.

Ocean Menu Tab

☐ Verify Absorption value is set correctly for the environment.
☐ Verify Spreading value is set correctly for the environment.

Applanix MRU (POSView software)

☐ Click the connect button
☐ Select Ethernet Real-time Output Control from the Logging menu
☐ Set output rate to 50 Hz
☐ Select POSpac and groups
☐ Select Ethernet Logging from the Logging menu
☐ Set output rate to 25 through 100 Hz (50Hz recommended)
☐ Select POSpac
☐ Browse to correct file path and set file name (ex: CU_mmddyy_MB)
☐ Select a file size control of 64 MB
☐ START LOGGING: Enter times here
hh:mm GMT START TIME
hh:mm GMT END TIME
☐ Record the Status Indicators and Accuracy LEDs
POS MODE:Nav: Full, IMU STATUS:OK, NAV STATUS:FIXED RTK, GAMS:Online
Full or initial setup would require checking equipment and GAMS offsets and I/O port settings

Hypack

☐ Create new project (Project_mmddyy_Type_Boat#) Ex: CU_MMDDYY_MB_#
☐ Verify Hypack and Hysweep hardware settings and enter in log sheet
☐ Verify Geodesy settings
☐ Verify measurement units
☐ Enable all desired layers (targets, lines, backgrounds, matrix, etc.)

- ☐ Start Hypack Survey and Hysweep Survey
- ☐ Check for audible and visual alarms
- ☐ Verify POS timing is PPS in POS device window

Quality Control

- ☐ Set the Bar Check at a fixed depth below the sonar. Use the bar check utility in Hysweep to record multiple measurements.
- ☐ Average the bar check measurements and record in the Bar Check QC Sheet
- ☐ If using RTK GPS for water level determination, measure the WL with a GPS rover. Record this value and the vessel water level reading in the Water Level QC sheet.
- ☐ Apply Patch Test values in HyPack

Problems experienced? ☐Yes ☐No
Comments:

Personnel on Board

☐	☐	☐	☐
☐	☐	☐	☐

Edgetech 4125

Start-up

- ☐ Power on the towfish and acquisition laptop
- ☐ Connect to the Sonar
- ☐ Launch the towfish
- ☐ Start Edgetech Discover software
- ☐ Select the pulse type
- ☐ Confirm sound speed is set correctly
- ☐ Set the sonar range
- ☐ Turn on the sonar
- ☐ Set the record file path

GAPS USBL Tracking

- ☐ Power on the GAPS
- ☐ Launch the MMI and start tracking
- ☐ Start the “MMI to GGA” python script

GPS input

- ☐ Confirm GGA message from the GAPS is being received in Discover

Bottom Tracking and Alarms

- ☐ Adjust the automatic bottom tracking and set an audible minimum altitude alarm.

Hypack Navigation Software

- ☐ Configure and display the towfish location using both the USBL and layback for verification.
- ☐ Use the coverage driver to monitor sonar coverage during acquisition.

Quality Control

☐ Collect data on adjacent lines in opposite directions with overlapping data. Data must image a distinct target that can be used for navigation precision verification.

Problems experienced? ☐Yes ☐No
Comments:

Personnel on Board

☐	☐	☐	☐
☐	☐	☐	☐

Underwater Camera

Start-up

- ☐ Power on the camera
- ☐ Start the video acquisition software
- ☐ Set the data file path and name
- ☐ Examine video for acceptable image quality
- ☐ Start Recording

GAPS USBL Tracking (if video camera is towed)

- ☐ Power on the GAPS
- ☐ Start the MMI software and start tracking
- ☐ Start the “MMI to GGA” python script

GPS overlay

- ☐ Confirm position and time stamp overlay is being written
- ☐ If the camera is towed, confirm the overlay position is that of the camera.

Hypack Navigation Software

- ☐ Configure and display the towfish location using both the USBL and layback for verification.
- ☐ Use the coverage driver to monitor video coverage during acquisition.

Quality Control

☐ Collect and review a minimum of one minute of data to ensure the equipment is functioning properly and providing adequate imagery.

Problems experienced? ☐Yes ☐No
Comments:

This page intentionally left blank.

APPENDIX G

RESUMES

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Program Manager Kent Weingardt	▪ Over 23 years' experience - 17 years with TtEC - in program management, project management, environmental design, and construction and remediation work – has managed HTRW projects on more than 25 different DoD sites including active installations and BRAC sites ▪ Program manager for NAVFAC SW EMAC and USAESCH WERS, with responsibility for overall management of these multi-award remediation contracts – recently completed Program Management for $28M FFP HTRW projects under MATOC program for U.S. Navy; currently managing one MMRP removal project at a BRAC site (Concord) and closing out a successful MMRP removal project at an active military installation (Fallbrook).
Project Manager/Technical Lead - CONUS Brian Maidrand	▪ Extensive technical and management experience with over 11 years as a project manager of fixed-price and cost-plus projects involving munitions and HTRW investigations supporting site assessment, remediation, and closure. Has experience on more than 30 projects located on various DoD sites. Additionally, ▪ Enlisted as a private in the 2nd Ranger Battalion and retired as an infantry captain; served four years in the Ranger Battalion and then entered the California Army National Guard. Attended SDSU ROTC and earned an officer commission. ▪ (Note a couple of specific projects here)
Assistant Project Manager/Data Manager - OCONUS Anthony Joiner USAESCH ID #1495	▪ More than nine years of MMRP project experience in management, data management, and as UXO tech and geophysical field lead. Has performed geophysical mapping using Digital Geophysical Mapping (DGM) vehicle towed array and anomaly reacquisition, trained team members on geophysical equipment, and managed anomaly databases. ▪ (note some specific project support roles here focused on data collection and management)
MMRP Quality Assurance/Quality Control Manager Mark Dollar, PMP USAESCH ID#0720	▪ Munitions response project manager and quality assurance/control manager with over 19 years' combined experience in US Navy Explosive Ordnance Disposal (EOD) and the commercial munitions response (MR)/hazardous, toxic, and radioactive waste (HTRW) industry. ▪ Member of the Interstate Technical and Regulatory Council UXO Team assisting in the preparation of technical guidance documents.
SUXOS Dave Bennett USAESCH ID#0713	▪ 23 years of combined military EOD and civilian UXO experience serving as SUXOS or UXOSO/UXOQCS on numerous sites; Team Leader for Al Kharj, Saudi Arabia. Worked with site manager to safely recover 7 military fighting vehicles and 2,000 pounds of DU.
UXOQC/UXOSO Anthony Crino USAESCH ID#0513	▪ Combined military and civilian EOD/ munitions and explosives of concern (MEC) experience for more than 20 years; versed in locating, identifying, safe-rendering, and disposing of conventional, nuclear, and chemical weapons, and improvised explosive devices.

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Project Chemist Lynn Arabia	▪ Over 20 years of chemistry-related experience with RI/FS and site investigations for HTRW and MMRP for DoD, EPA, and private clients. Experienced with preparation of FSP/UFP-QAPP and CSM documents, performance of data usability assessments, and contamination nature/extent and fate/transport. ▪ Served as SI, RI, or Enforcement Lead/Project Chemist for the Davids Island Environmental Restoration Project for USACE New York, USACE Kansas City and EPA Region 2 for the Crown Cleaners of Watertown Superfund Site, for the Air Force Plant 39,fir USACE Louisville District, and for USACE Kansas City and EPA Region 2 for the CPS/Madison Industries Superfund Site.
Senior Geophysicist Mike McGuire	▪ More than 28 years' experience as a geophysicist including data collection, processing, interpretation, and mapping of seismic reflection and refraction data, time and frequency domain electromagnetic (EMI) data, magnetic data, ground penetrating radar (GPR) data, resistivity data, and borehole geophysics.
GIS Analyst Jared MacLachlan	▪ Performs data preparation, editing, analysis, and cartographic tasks with current ESRI ArcGIS products; expertise includes raster data, Spatial Analyst, and hydrological applications; and ERDAS Imagine 2010 for multi-spectral, hyperspectral, and panchromatic image preparation, enhancement, and analysis tasks
Human Health Risk Assessor Ron Marnicio, PhD, PE	▪ Has worked for more than 26 years in the environmental consulting field; national lead for the technical discipline of risk assessment responsible for ensuring technical quality in the company's human health, ecological, and other risk-related work products ▪ Has worked on multiple SIs for other sites under CERCLA and other State/Program guidelines.
Ecological Risk Assessor John Schaffer, CHMM	▪ A certified ecologist with over 20 years of experience as an ecological risk assessor and ecologist supporting EPA and DoD projects. Served as ecological risk assessor for Massachusetts Military Reservation (MMR), Mississippi Munitions Complex – Stennis Space Center, Naval Station Weymouth – Nomans Land Island Former Naval Bombing Range. ▪ Prepared baseline ecological risk assessments for multiple small arms and artillery ranges following a combined process involving USEPA Ecological Risk Assessment Guidance for Superfund and U.S. Army risk assessment guidance.
Corporate H&S Officer Steve Neill USAESCH ID#0756	▪ Serves as the TtEC Corporate Munitions Response H&S Manager responsible for the health and safety of personnel at munitions response projects throughout the US and overseas. Conducts health and safety inspections and develops activity hazard analyses, work plans, accident prevention plans, and site-specific accident prevention plans.

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Corporate CIH Roger Margotto, CIH, CSP, CHMM	▪ Over 24 years of experience developing and implementing safety and health programs at hazardous waste sites, with extensive knowledge of state and federal occupational safety and health regulations and statutes, including 17+ years of experience with EM 385-1-1 and OSHA.
Corporate Quality Manager Paul White, CQM	▪ Over 37 years of experience including QC and QA of investigation, remediation, construction, HTRW and munitions response projects as an ASQC Certified Quality Auditor (CQA), US, Number 16066 and an ISO 9001 2008 Certified Lead Auditor.
	▪
Project Manager, UXO Diving Technical Lead Scot Wilson, PMP	▪ BS in Oceanography from University of Washington and MS Information Systems and Operations, Naval Postgraduate School. ▪ Over 20 years of experience in diving and munitions response projects. ▪ Former Navy EOD and Diving Officer and Navy Diving Supervisor. ▪ Project Manager for U.S. Navy at Jackson Park Housing Complex in WA. Work included conducting a 35-acre surface sweep for DMM and diving operations to investigate and recover DMM at over 800 magnetic anomaly sites at the bottom of Ostrich Bay. All field tasks were completed ahead of schedule and under budget while maintaining a perfect safety record.
Technical Advisor and Project Biologist Edwin Hernandez-Delgado, PhD	▪ PhD, Tropical Biology from the University of Puerto Rico. ▪ 22 years of experience with coral reef ecology, ecosystem investigation, rehabilitation, and restoration. ▪ Completed numerous aquatic, fish, and marine research projects and studies, including sea turtles and marine mammals.
Technical Advisor and Project Biologist Omar Rodriguez-Class, PhD	▪ PhD, Marine Biology from Bircham International University. ▪ 16 years of experience as a biologist, conducting research development and implementation, monitoring, and other published field studies in a variety of marine and terrestrial habitats. ▪ Studied the physical, geological, and biological processes that regulate the form and development of the terrestrial landscape in the coastal systems of Puerto Rico. ▪ 2,600 hours of marine mammals monitoring and 250 hours of sea turtles/nesting sites monitoring.

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Underwater Geophysical Lead Bob Feldpausch	▪ BS, Environmental Studies and Policy from Michigan State University and AS in Geographic Resources and Environmental Technology from Lansing Community College. ▪ Specializes in managing and performing single and multibeam hydrographic surveys in accordance with USACE Hydrographic Surveying Manual and International Hydrographic Organization Standards; mapping and detection of munitions in marine and freshwater environments; and manages Tetra Tech's Marine Mapping Group. Experienced in terrestrial DGM data collection and interpretation. ▪ Served as the Co-Principal Investigator for an Environmental Security Technology Certification Program (ESTCP) Wide Area Assessment (WAA) for Marine Munitions in Seattle, WA to demonstrate a practical approach to detecting and locating MEC and munitions debris in lakes, rivers, and oceans at depths ranging from one to 110 feet. Project included multibeam bathymetry (including back-scatter), SSS, subbottom profiling, and magnetometry with Tetra Tech's MGA. ▪ Served as the Project Manager for a U.S. Navy Underwater MPPEH Detection System Demonstration Program at Ostrich Bay, WA. Performed a marine gradiometer survey of a geophysical test bed selected and created by the U.S. Department of Navy, Naval Facilities Engineering Command Northwest (NAVFAC NW).
ACSM Certified Hydrographer Burr Bridge	▪ More than 16 years of experience performing and supporting hydrographic and geophysical field survey programs and more than 26 years in software development for data analysis and support of various types of operations. ▪ American Congress on Surveying & Mapping (ACSM) Certified Hydrographer (certification number 256). ▪ Expertise with multithreaded, real-time applications, hardware control/ instrumentation programming, ArcGIS, HYPACK/HYSWEEP, Fledermaus Pro, Caris and a broad range of marine and geophysical hardware and software. ▪ Responsible for planning, oversight and QC of hydrographic and geophysical surveys and processing.
Lead DGM Geophysicist, Field Operations Lead, and Quality Control Manager Richard Funk, PG	▪ MS, Geological Sciences from University of California. ▪ Over 13 years of experience in geophysical (terrestrial & marine) data collection, processing, and interpretation. ▪ Designed/managed integrated geophysical programs using electromagnetic, seismic, resistivity, gravity, and borehole geophysical methods to investigate and assess ordnance end explosives.

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Field Operations Lead/ Quality Control Manager Brent Johnston (alternate)	▪ More than 22 years of experience in the environmental monitoring, mapping, and remote sensing and construction fields. ▪ Experience with data collection and analysis, including hydrographic survey, sediment sampling, water quality monitoring and sampling, aerial photography, photogrammetry, map production, software development, GPS survey, and construction oversight. ▪ Well-versed in sonar systems, water quality equipment and has expertise with HYPACK/HYSWEEP, Fledermaus, CARIS, AutoCAD, PolyWorks and ArcMap data acquisition, processing and presentation and visualization software.
Field Operations Lead/ Quality Control Manager Cory Graves (alternate)	▪ BS, Geography, emphasis in Cartography, GIS and Remote Sensing, University of Oregon, School of Geography. ▪ More than 9 years of experience in the mapping and hydrographic survey fields. ▪ World wide experience in East Africa, the Middle East, Papua New Guinea, Australia, Japan, India, Latin America, and Asia with hydrographic data collection and analysis, including land and hydrographic survey, sediment sampling and map production.
Field Investigation Coordinator Fernando Pagés, PE	▪ ME, Civil/Coastal Engineers from Texas A&M University. ▪ PE with over 22 years of experience with numerous RI/FS for the DoD. ▪ Currently responsible for Tetra Tech's operations in Puerto Rico, along with all local technical and field logistics coordination.
Ecological Risk Assessor John Schaffer, CHMM	▪ BS, Biology and MA, Biology both from William Patterson College of New Jersey. ▪ Based out of the TtEC Morris Plains, New Jersey office. ▪ Over 17 years of experience as an ecologist with specialization in ecological risk assessment, marine and freshwater fisheries, and aquatic impact evaluation. ▪ Serves as the Ecological Risk Assessor for the Former Camp Swift RI/FS. ▪ Served as the Ecological Risk Assessor for Massachusetts Military Reservation (MMR) and prepared baseline ecological risk assessments (BERAs) for multiple small arms and artillery ranges following a combined process involving USEPA ERAGS, MassDEP MCP, and U.S. Army risk assessment guidance.
GIS Analyst Dominic Oppedisano	▪ BS in Geography (GIS) from the University at Oneonta. ▪ Over six years of experience in GIS, including UXO mapping, and mapping for environmental applications such as RIs. ▪ Proficient in operation and setup of Garmin and Trimble GPS navigation devices.

TtEC's Proposed Project Team

Position and Name	Relevant Experience
Community Relations Specialist/Marine Mammal Observer Maylene Pérez Robles, MSEM	▪ Community Relations Specialist for several projects in Culebra. Excellent relationship with the Culebra Conservation and Development Authority (ACDEC, for its Spanish acronym). ▪ Founded Organization for Sustainable Environment (NGO) and was the president and the Blue Flag National Coordinator for 7 years. ▪ Environmental Consultant specializing flora and fauna, jurisdictional determination (wetland delineations) and environmental impact statements for environmentally sensitive marine projects. ▪ Experience monitoring and witnessing turtle nesting. ▪ Experience giving workshops in environmental themes including turtle nesting and ESA. ▪ Aguirre Offshore LNG Facility, PR – Environmental scientist providing support in FERC filing, NEPA documents, local PR environmental documents and public participation plans.
Luis Berrios Surveying	▪ Licensed Puerto Rican surveyor responsible for all surveying tasks

This page intentionally left blank.

APPENDIX H

TECHNICAL PROJECT PLANNING (TPP) WORK SHEETS AND DOCUMENTATION

Draft Final
TECHNICAL PROJECT PLANNING MEMORANDUM

Culebra Water Ranges
Culebra, Puerto Rico
FUDS Project Number: I02PR0068

Prepared For:

U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, FL 32207

and

U.S. Army Engineering and Support Center, Huntsville
4820 University Square
Huntsville, AL 35816-1822

Worldwide Environmental Remediation Services (WERS)
Contract Number: W912DY-10-D-0015
Delivery Order 003

Prepared By:
Tetra Tech EC, Inc.
101 Quality Circle, Suite 140
Huntsville, AL 35906

February 2012

Technical Project Planning Memorandum

Subject: Documentation of Technical Project Planning (TPP) Meeting No. 1 for the Remedial Investigation and Feasibility Study, Culebra Water Ranges, Culebra, Puerto Rico

Site: Water Ranges Munitions Response Site (MRS) 3 and MRS 12, Culebra, Puerto Rico

Contract: Contract Number W912DY-10-D-0015, Delivery Order 003

This document provides a record of the TPP meeting for the Culebra Water Ranges, Culebra, Puerto Rico, held on December 20, 2011, at the U.S. Army Engineer District, Patio Conference Room, Antilles Office, San Juan, Puerto Rico. During the meeting, the TPP team members listed below were provided an opportunity to comment on the plans presented there for conducting the Remedial Investigation (RI). The TPP worksheets are enclosed at the end of the memorandum. The meeting began at 1:00 P.M. and concluded at approximately 5:00 P.M.

Attendees:

The meeting was attended by persons representing the U.S. Army Corps of Engineers (USACE) – Huntsville District (USAESCH) and Jacksonville District (CESAJ); Puerto Rico Environmental Quality Board (PREQB); Puerto Rico Department of Natural and Environmental Resources (PRDNER); U.S. Environmental Protection Agency (USEPA) Region 2; U.S. Fish and Wildlife Service (USFWS); National Oceanic and Atmospheric Administration (NOAA); and Tetra Tech EC (TtEC). A list of attendees is provided at the end of this memorandum.

Presentation:

Following introductions of the Agency representatives, Mr. Freeman (USACE) introduced Mr. Roland Belew (USACE). Mr. Belew then introduced the project manager for TtEC, Mr. Wilson. Mr. Wilson introduced his Tt colleges and provided a brief summary of his background and experience with underwater unexploded ordnance (UXO) sites. TtEC then presented a PowerPoint briefing that included a summary of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, Formerly Used Defense Site (FUDS) program, and site history, as well as the preliminary conceptual site model for the Culebra Water Ranges. The presentation then presented the project goals and objectives and the proposed technical approach. TtEC also presented a PowerPoint slide show that demonstrated examples of previous marine surveys and descriptions of the marine sensors that were proposed for use during the Culebra Water Ranges investigation. Following the PowerPoint presentations, Mr. Wilson (TtEC) led the group through the proposed Data Quality Objectives (DQOs). During the presentations and briefings, questions and concerns of the Agency representatives were discussed and addressed. The section below summarizes these discussions.

Discussions:

- Mr. Rodriguez (USEPA) initiated a discussion on the gap in Luis Peña Channel between MRS 12 and MRS 13. The boundaries are based on range fans from previous activities and the delineation of the MRS boundaries can be adjusted based on the data collected during the remedial investigation. If munitions and explosives of concern (MEC) are discovered outside the MRS boundaries during the investigation, there are step-out procedures that can be used to address the items.

- Ms. Wehner (NOAA) commented that the investigation seemed to be focused on the substrate surface and asked if the investigation would also include subsurface detection. Mr. Wilson (TtEC) explained that the sensors that will be used during the investigation will be able to detect metallic items below the surface. The depth of detection is based on the mass of the item, its orientation, the type of sensor that is used, and the height of the sensor above the bottom.

- Dr. Carrubba (NOAA National Marine Fisheries Service [NMFS]) asked if the baseline survey would include mapping the benthic habitat, including the distribution of coral species. Mr. Wilson (TtEC) answered that the baseline survey would include that type of data and that Dr. Edwin Hernandez would be assisting the survey team with the baseline survey and coral identification using recent 2010/2011 aerial photos.

- Dr. Carrubba (NOAA NMFS) explained that all marine areas surrounding Culebra out to a distance of 3 miles are designated as critical habitat and that the baseline survey would need to identify all habitats within the MRSs, not just coral.

- Dr. Carrubba (NOAA NMFS) asked if the baseline survey will include bathymetry and if the map of the bottom will be cross referenced to habitat. Mr. Wilson (TtEC) answered yes to both questions and Mr. Feldpausch (TtEC) described the process of starting the baseline survey in the deeper water using hull-mounted sensors to map the bathymetry. This approach would allow information to be collected in the shallower areas before any attempt is made to take the boat into the shallower areas. The geometry of the multi-beam echosounders will allow the survey team to map the shallow areas from the side, reducing the risk of contact with corals. In shallow areas, single-beam echosounders on floating platforms will be used.

- Dr. Carrubba (NOAA NMFS) asked if it will be possible to visually identify items during the baseline survey. Mr. Wilson (TtEC) explained that the baseline survey will include hull-mounted video, and drop cameras will be used, if needed, to capture additional footage of areas of interest.

- Mr. Pastorick (UXOPro) asked if the bathymetry, sidescan sonar, and magnetometer electromagnetic induction (Mag/EM) surveys would be three separate events or would be combined. Mr. Feldpausch (TtEC) and Mr. Funk (TtEC) described the preferred method to conduct the surveys. TtEC would like to combine the multi-beam echosounder and sidescan sonar in the baseline survey and conduct the Mag/EM survey as a separate event, but that EM and Mag surveys cannot be performed concurrently. Dr. Carrubba (NOAA NMFS) said she did not have objections to the sidescan data being acquired during the baseline survey if standard operating procedures (SOPs) are followed to protect the habitat. This led to additional discussions on the technical aspects and differences between the Mag/EM sensors.

- Mr. Rivera (NOAA) asked a series of technical questions on the capabilities of the sidescan sonar sensor. These questions included the possible degree of resolution, the proposed frequencies, and the effects of water and tow depths on the extent of coverage and resolution. Mr. Funk (TtEC) explained that the sidescan sonar was capable of 4 centimeter (cm) resolution at nadir (the point directly beneath the sonar projector/transducer). Mr. Funk (TtEC) also provided the frequency ranges and discussed the relationship between depth, resolution, and area of coverage. Mr. Funk (TtEC) said that the sidescan sonar would be adjusted to maximize resolution (~ 4 cm/600 kilohertz [kHz]) by limiting the sonar's operational range and adjustments would be minimized to the extent possible. It should be noted that the manufacturer's published cross track resolution is 1.5 cm rather than ~ 4 cm as stated during the meeting.

- Mr. Pastorick (UXOPro) asked a series of questions on the proposed transect spacing for both MRS 3 and MRS 12 and if VSP software was appropriate to use for this underwater application. Dr. Marnicio (TtEC) explained that the rationale of the transect spacing was based on the conceptual site model (CSM) and the human exposure zones identified as Zones A, B, and C in the CSM. He also indicated that adjustments to the inputs had been made to reflect some key differences between terrestrial and underwater fragmentation dispersal. The transect spacing was selected to achieve 90 percent confidence (value specified in the project work statement) of locating MEC above an estimated background threshold. The 90 percent confidence is achieved in the lowest human exposure zone (C). The confidence percentage is higher than 90 percent in the higher human exposure Zones A and B, which is why the transect spacing is closer together in those zones. This led to a general discussion on the percentage of coverage for each zone. The baseline survey will achieve 100 percent multibeam and sidescan sonar coverage of all areas that can be surveyed. The Mag/EM survey will achieve 50 percent coverage of Zone A, 9 percent of Zone B, and 4 percent of Zone C. It is possible to adjust the transect spacing between zones to provide a greater percent of coverage in Zones B or C by reducing the percent of coverage in Zone A; however, the Zone C coverage would not then meet the specifications of the contract. Specification of a particular risk assessment tool was tabled until a later date.

- Dr. Carrubba (NOAA NMFS) commented on the selection of activities in the zones of the CSM. She suggested that snorkeling should also be included in Zone B because snorkelers routinely exceed depths of 10 feet. She also explained that fishing and anchoring were not authorized activities in the MRSs. Based on Dr. Carrubba's (NOAA NMFS) comments, the CSM was revised to include snorkeling in Zone B, notes were added to indicate that fishing and anchoring were not permitted in the MRSs (although may still occur from ignorance or disregard of the regulations), surfing was added as an activity in MRS 3, and a separate CSM was developed for each MRS to better reflect the unique activities that occur in each MRS. In addition, a written explanation of the CSM zones has been prepared to better articulate the human exposure–based rationale for selecting the depth intervals of the three zones.

- Dr. Carrubba (NOAA NMFS) expressed a strong desire to have the baseline survey completed with the results available prior to discussing the details of the technical approach for the RI. She believed that this would allow a more complete understanding of the habitat delineation within the MRSs before any intrusive work is performed. It was agreed that the baseline survey results will be available before the RI work plans are finalized.

- Mr. Pastorick (UXOPro) inquired about the positional accuracy of the Mag/EM sensors and the divers during the RI. Mr. Funk (TtEC) explained that the position of the sensors was known to a positional accuracy of 1 meter based on input from the real-time kinematic global positioning system (RTK GPS), the cable counter, and the slant range of the ultra-short baseline acoustic positioning system (USBL). Mr. Wilson (TtEC) explained that the divers also have 1-meter positional accuracy when reacquiring anomalies or when investigating grids. Mr. Pastorick expressed reservations about the diver's ability to reacquire anomalies in the open ocean with 1-meter accuracy. Mr. Wilson offered examples of TtEC experience during MEC remedial investigations at the Navy's Operable Unit 3– Marine site at Jackson Park Housing Complex in Washington state and other sites that demonstrated that reacquisition of anomalies was routinely achievable in this environment (this method is also used by Navy explosive ordnance disposal [EOD] divers to reacquire mine-like contacts in the open ocean).

- Mr. Rivera (NOAA) asked if using both the Mag and EM sensors during the RI would produce different results. Mr. Funk (TtEC) and Mr. Feldpausch (TtEC) provided explanations of why it would be necessary to use both sensors based on site-specific conditions. The EM sensor will be the preferred sensor but needs to be kept close to the bottom in open areas. The EM sensor detects all metals and is less affected by geologic formations (e.g., rocks with high iron content or magnetic resonance). The Mag sensor detects ferrous metal and does not need to be as close to the item to detect it. Since the items of interest for the RI will all contain ferrous metal, both sensors will be able to detect the anomalies and provide useful, high quality information.

- During the DQO presentation, there were additional discussions on the boundaries of MRS 12 within the Luis Peña Channel and TtEC's ability to detect the edge of the boundary/edge of the contamination. Mr. Feldpausch (TtEC) explained that MRS boundaries will be programmed into the survey vessel navigation system and survey data will be processed to the edge of the MRS boundary. Mr. Belew (USACE) explained that the contract specified the survey coverage was to the boundary of the MRS. If MEC is discovered outside the MRS boundaries during the investigation, there are step-out procedures that can be used to address the items.

- Dr. Carrubba (NOAA NMFS) initiated additional discussions during the DQO briefing on the importance of delineating the benthic community during the baseline survey, including both the listed corals and the additional corals under review. She also reiterated the need to have approved SOPs before survey operations could occur within the MRSs. The USACE will collaborate with the Agencies to develop SOPs for the fieldwork conducted under the RI. The timeline for SOP development and approval was not discussed. The DQOs will be revised to include sidescan sonar as a component of the baseline survey.

- Mr. Pastorick commented during the discussion of the diver DQOs that if sample plots are investigated by the divers, they would not need to be concerned with 1-meter accuracy re-acquiring anomalies. This led to additional discussions on how the diving would be performed. The location of the divers to within 1-meter using the USBL will be known. The methods used to investigate anomalies will be determined by the site conditions of the sub-areas within the MRS. In areas with a flat sandy bottom, divers can follow current terrestrial-based methodologies to investigate 100 percent of anomalies in designated circular sample plots. In areas with complex bottom types or at locations that cannot be excavated (coral or hard substrate), it will be more efficient (i.e., require less bottom time) for divers and less impact on the environment to reacquire and investigate individual anomalies randomly selected from the anomaly population using an appropriate statistical design. The DQOs will be modified to include each methodology that may be used for diver investigation.

- Ms. Wehner (NOAA) commented during the DQO session that the munitions constituent (MC) sampling methods may need to include sampling sediment below the MEC at locations that meet the sampling criteria. The MC sampling methods will include sampling from the side and beneath a MEC item, if it is safe to do so. A few particular sources of MC screening criteria for explosives in sediment were identified.

List of Attendees

Organization	Name	Telephone
U.S. Army Corps of Engineers Formerly Used Defense Site Program Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Thomas R. Freeman III, PE Project Manager Email: Thomas.R.Freman.III@usace.army.mil	Desk (904) 232-1040 Cell (314) 625-8256
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Roland Belew, PMP, Project Manager Email: Roland.G.Belew@usace.army.mil	Desk (256) 895-9525 Cell (256) 503-0661 Cell (256) 213-8209
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Kelly D. Enriquez, Geophysicist Email: Kelly.D.Enriquez@usace.army.mil	(256) 895-1373
U.S. Army Corps of Engineers Ordnance and Explosives Design Center P.O. Box 1600 Huntsville, AL 35807-4301	Teresa M. Carpenter, Technical Manager Email: Teresa.M.Carpenter@usace.army.mil	(256) 895-1659

Organization	Name	Telephone
U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Jose Mendez, Project Manager Email: Jose.M.Mendez@usace.army.mil	(256) 895-6893/6895 Extension 3099
U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207-0019	Wilberto Cubero, Environmental Scientist Email: Wilberto.Cubero-Deltoro@usace.army.mil	(904) 232-2050
PRDNER-Carr.8838 Sector El Cinco Rio Piedras, SJ, PR 00936	Damaris Delgado, President Bureau of Coasts, Reserves, and Refuges, DNER Email: d.delgado@drna.goberierno.pr	(757) 999-2200 Extension 2107
* Puerto Rico EQB P.O. Box 11488 1375 Ponce de Leon Avenue San Juan, PR 00910	Pedro Nieves Miranda, Director PREQB/JCA Email: not provided	(787) 767-8056
Puerto Rico EQB PO Box 11488 1375 Ponce de Leon Avenue San Juan, PR 00910	Ms. Wilmarie Rivera, Program Manager Email: wilmarierivera@jca.gobiernao.pr	(727) 365-8573
US Fish and Wildlife Service Culebra National Wildlife Refuge PO Box 190 Culebra, PR 00622	Ms. Ana Román, Refuge Manager Email: Ana_roman@fws.gov	(787) 742-0115
*USEPA Centro Europa Building Suite 4171492 Ponce de Leon Avenue San Juan, PR 00907-4127	Karl Soderberg, Regional Administrator Email: not provided	(787) 977-5870
NOAA National Marine Fisheries Service PO Box 1310 Boqueron, PR 00622	Dr. Lisamarie Carrubba Email: lisamarie.Carrubba@noaa.gov	(787) 851-3700
USFWS P.O. Box 491 Boqueron, PR 00622	Felix Lopez, Ecologist Email: felix.lopez@fws.gov	(787) 510-5208
USEPA Region II 290 Broadway New York, NY 10007- 186	Julio F. Vasquez, RPM Email: Vasquez.julio@epa.gov	(212) 657-4323
UXO Pro 811 Duke Street Alexandria, VA 22314	Jim Pastorick Email: jim@uxopro.com	(703) 548-5300
USFWS 2890 Woodbridge Avenue Edison, NJ 08833	Richard Henry Email: Richard_henry@fws.gov	(732) 906-6987
USFWS P.O. Box 510 Boqueron, PR 00622	Susan Silander Email: Susan_Silander@fws.gov	(787) 504-5938

Organization	Name	Telephone
NOAA/NOS 74 Magruder Road Highlands, NJ 07732	Diane Wehner Email: diane.wehner@noaa.gov	(240) 338-3411
USEPA P.O. Box 1537 Vieques, PR 00765	Daniel Rodriguez Email: rodruiguez.daniel@epa.gov	(787) 741-5201
NOAA 400 Fernandez Juncos Avenue San Juan, PR 00901	José A. Rivera Email: jose.a.rivera@noaa.gov	(787) 405-3605
Tetra Tech EC 1050 NE Hostmark Street, Suite 202 Poulsbo, WA 98370	Scot Wilson, PMP, Project Manager Email: scot.wilson@tetratech.com	Direct (360) 598-8111 Fax (360) 598-8195 Cell (360) 626-3193
Tetra Tech, Inc. PO Box 79192 Carolina, PR 00979	Fernando Pagés Rangel, Director Tetra Tech PR Ops Email: Fernando.pages@tetratech.com	Direct (626) 688-1017 Fax (787) 791-0803
Tetra Tech EC 19803 North Creek Parkway Bothell, WA 98011	Robert Feldpausch Principal Scientist/Hydrographer Email: robert.feldpausch@tetratech.com	Direct (425) 482-7862 Fax (425) 482-7652 Cell (425) 503-2468
Tetra Tech EC 160 Federal Street, 3rd Floor Boston, MA 02110	Ronald Marnicio, PhD, PE National Discipline Lead, Risk Assessment Email: ronald.marnicio@tetratech.com	Direct (617) 443-7551
Tetra Tech EC 19803 North Creek Parkway Bothell, WA 98011	Richard Funk, Senior Geophysicist Email: richard.funk@tetratech.com	Direct (425) 482-7629 Cell (973) 216-9295

* Person did not attend meeting, but was represented.

Enclosure 1
TPP Worksheets

Technical Project Planning
Phase I MFR Worksheet

Author(s): | **Reviewer: Scot Wilson**
Latest Revision Date: | **Review Date: 12 Dec 2011**

Location: Culebra, Puerto Rico
Site(s): Culebra Water Ranges (MRS 3 – Flamenco Bay and MRS 12 – Luis Peña Channel)
Project: Remedial Investigation/Feasibility Study

(Attach Phase I MFR to PMP)

TPP Team		**EM 200-1-2, Paragraph 1.1.1**
Decision Maker	USACE	
Costumer	Huntsville District	
Project Manager	Roland Belew (CEHNC – PM and COR) Tom Freeman (CESAJ –PM)	
Regulators	Puerto Rico Environmental Quality Board (PREQB) Environmental Protection Agency Region II	
Stakeholders	Department of Natural and Environment Resources (DNER) Fish & Wildlife Services (FWS) National Oceanic and Atmospheric Administration (NOAA) – National Marine Fisheries (NMF) Culebra Municipality	
Data Types	**Data User**	**Data Gatherer**
Compliance/Regulatory (CR)	CEHNC, CESAJ, and Regulators	Tetra Tech
Demographic/Land Use (LU)	CEHNC, CESAJ	Tetra Tech
Site Conditions (SC)	CEHNC, CESAJ	Tetra Tech
MEC/UXO (UXO)	CEHNC, CESAJ	Tetra Tech
MC	CEHNC, CESAJ	Tetra Tech
CUSTOMER'S GOALS		**EM-200-1-1, Paragraph 1.1.2**
Land Use(s)	**Issues and Regulatory Compliance Status**	**Site-Specific Closeout Goal (if applicable)**
MRS 3- Flamenco Bay Current Land Use: Recreational	Former Water Ranges	Determine current threat based on current use and recommend a response action.
MRS 12- Luis Peña Channel Current Land Use: Recreational/ Natural Reserve	Former Water Ranges	Determine current threat based on current use and recommend a response action.
Site Closeout Statement		
Water safe for intended use after performing proposed remedial actions**.**		
Customer's Schedule Requirement		
RI/FS Investigation and Reporting Finalized by 31-MAR-14		
Customer's Site Budget		
RI/FS Investigation and Reporting: $1.5M		

IDENTIFY CURRENT PROJECT		
SITE CONSTRAINTS AND DEPENDENCIES		**EM 200-1-2, Paragraph 1.3.1**
Administrative Constraints and Dependencies		
Funding		
Public Involvement and RAB Notifications		
Technical Constraints and Dependencies		
Endangered Species (Corals, Turtle Nesting Season, Migratory Birds)		
Tourist & Beach Seasons		
Coral Reef Areas		
Legal and Regulatory Milestones and Requirements		
Consistent with CERCLA and NCP		
Public, stakeholder and Regulatory Involvement and review of key documents		
CURRENT EXECUTABLE STAGE		**EM 200-1-2, Paragraph 1.3.3**
Remedial Investigation / Feasibility Study		
See attached worksheets		
Basic (For Current Projects)	**Optimum (For Future Projects)**	**Excessive (Objectives that do not lead to site closeout)**
Varies by Project – See Objectives Worksheet attached	Varies by Project – See Objectives Worksheet attached	Varies by Project – See Objectives Worksheet attached
IDENTIFY SITE APPROACH		
EXISTING SITE INFORMATION & DATA		**EM 200-1-2, Paragraphs 1.1.3 & 1.2.1**
Attachment(s) to Phase 1 MFR	**Site Information Repository(ies)**	**Preliminary Conceptual Site Model**
Archive Search Report Conclusions & Recommendations	USACE, PREQB	No
Supplemental Archive Search Report (Final) September 2005	USACE, PREQB	Yes
POTENTIAL POINTS OF COMPLIANCE		**EM 200-1-2, Paragraph 1.2.1.3**
Explosives or Explosives Residuals in Marine Floor Sediments		
MEC / Explosive Safety Munitions		
MEDIA OF POTENTIAL CONCERN		**EM 200-1-2, Paragraph 1.2.1.4**
Off-Site Upland Soil	Subsurface Sediment	
Surface Water	Marine Sediment	
SITE OBJECTIVES		**EM 200-1-2 Paragraph 1.2.2**
Site Closeout		
See attached worksheets		
REGULATOR AND STAKEHOLDER PERSPECTIVES		**EM 200-1-1 Paragraph 1.2.3**
Regulators	**Community Interests**	**Other**
Potential Receptors	Land Use	
Safety Concerns – Recreational Users	Tourism – not to impact tourist areas	
Endangered species and coral reefs impact	Endangered species and coral reefs impact	

PROBABLE REMEDIES	EM 200-1-2, Paragraph 1.2.4
Detonation of Suspect UXO as found during investigation phase	
Risk Management	
EXECUTABLE STAGES TO SITE CLOSEOUT	**EM 200-1-2, Paragraph 1.2.5**
Remedial Investigation	
Feasibility Study	
Proposed Plan	
Decision Document	
Removal Actions (as needed)	

NOTES

CEHNC =	Corps of Engineers Huntsville Center
CERCLA =	Comprehensive Environmental Response, Compensation and Liability Act
CESAJ =	Corps of Engineers Jacksonville Center
DNER =	Department of Natural and Environmental Resources
EM =	Engineering Manual
FWS =	Fish and Wildlife Services
M=	Millions
MFR =	Memorandum for Record
MRS =	Munitions Response Site
NCP =	National Oil and Hazardous Substances Pollution Contingency Policy
NMF =	National Marine Fisheries
NOAA =	National Oceanic and Atmospheric Administration
PMP =	Project Management Plan
PREQB =	Puerto Rico Environmental Quality Board
RAB =	Restoration Advisory Board
TPP =	Technical Project Planning
USACE =	US Army Corps of Engineers

PROJECT OBJECTIVES WORKSHEET

SITE: MRS 3 – Flamenco Bay
PROJECT: RI/FS

Site Objective				Data Collection Method	Project Objective Classification
	Executable Stage				
Number	Current	Future	Description		
1	Yes		Delineate critical habitat areas	Hull-mounted multi-beam echosounder, video by pole-mounted camera, ROV and biologist	Basic
2	Yes		Determine nature and extent of MEC contamination	Sidescan sonar, EM survey, intrusive investigation	Basic
3	Yes		Determine nature and extent of MC contamination	Sediment and surface water samples	Basic
4	Yes		Evaluate remedial alternatives	RI analysis	Basic
5	Yes		Select RA	FS	Basic
6	Yes		Document RA selection	Proposed Plan	Basic

SITE: MRS 12 – Luis Peña Channel
PROJECT: RI/FS

Site Objective				Data Collection Method	Project Objective Classification
	Executable Stage				
Number	Current	Future	Description		
1	Yes		Delineate critical habitat areas	Hull-mounted multi-beam echosounder, video by pole-mounted camera, ROV and biologist	Basic
2	Yes		Determine nature and extent of MEC contamination	Sidescan sonar, EM survey, intrusive investigation	Basic
3	Yes		Determine nature and extent of MC contamination	Sediment and surface water samples	Basic
4	Yes		Evaluate remedial alternatives	RI analysis	Basic
5	Yes		Select RA	FS	Basic
6	Yes		Document RA selection	Proposed Plan	Basic

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 3 – Flamenco Bay
PROJECT: RI/FS
DQO Statement Number: 01

Intended Data Use:	Delineation of sensitive habitat and identification of bottom features to support follow on EM survey and anomaly investigation.

Is data: basic, optimal, or excessive need?	Basic

How much data is enough?	100% bottom coverage of the MRS area

How will this data be collected?	Hull-mounted multi-beam echosounder, single-beam echosounder, video camera, biologist

Was DQO attained?	

Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 3 – Flamenco Bay
PROJECT: RI/FS
DQO Statement Number: 02

Intended Data Use:	Mapping and selection of metallic anomalies to be intrusively investigated during the RI

Is data: basic, optimal, or excessive need?	Basic

How much data is enough?	Enough survey coverage to ensure a 90% CI for detecting areas of MEC contamination and delineation of MEC contaminated boundaries are identified to an accuracy of plus or minus half the transect line spacing or a maximum of 250 feet

How will this data be collected?	Sidescan sonar and Mag/EM sensor surveys

Was DQO attained?	

Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 3 – Flamenco Bay
PROJECT: RI/FS
DQO Statement Number: 03

Intended Data Use:	Determination of the nature and extent of MEC contamination for the FS
Is data: basic, optimal, or excessive need?	Basic
How much data is enough?	Achievement of a 90% CI that MEC will be detected if present. Sample size based on VSP software tool.
How will this data be collected?	Diver intrusive investigations
Was DQO attained?	
Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 3 – Flamenco Bay
PROJECT: RI/FS
DQO Statement Number: 04

Intended Data Use:	Determination of the nature and extent of MC contamination for the FS
Is data: basic, optimal, or excessive need?	Basic
How much data is enough?	Phased approach based on results of intrusive investigations and triggering conditions of breached MEC or clusters of MEC
How will this data be collected?	Sediment and surface water samples near the MEC
Was DQO attained?	
Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 12 – Luis Peña Channel
PROJECT: RI/FS
DQO Statement Number: 01

Intended Data Use:	Delineation of sensitive habitat and identification of bottom features to support follow-on EM survey and anomaly investigation.

Is data basic, optimal, or excessive need?	Basic

How much data is enough?	100% bottom coverage of the MRS area

How will this data be collected:	Hull-mounted multi-beam echosounder, single-beam echosounder, video camera, biologist

Was DQO attained?	

Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 12 – Luis Peña Channel
PROJECT: RI/FS
DQO Statement Number: 02

Intended Data Use:	Mapping and selection of metallic anomalies to be intrusively investigated during the RI
Is data: basic, optimal, or excessive need?	Basic
How much data is enough?	Enough survey coverage to ensure a 90% CI for detecting areas of MEC contamination and delineation of MEC contaminated boundaries are identified to an accuracy of plus or minus half the transect line spacing or a maximum of 250 feet
How will this data be collected?	Sidescan sonar and Mag/EM sensor surveys
Was DQO attained?	
Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 12 – Luis Peña Channel
PROJECT: RI/FS
DQO Statement Number: 03

Intended Data Use:	Determination of the nature and extent of MEC contamination for the FS
Is data: basic, optimal, or excessive need?	Basic
How much data is enough?	Enough to achieve a 90% CI that MEC will be detected if present. Sample size based on VSP software tool.
How will this data be collected?	Diver intrusive investigations
Was DQO attained?	
Where is supporting data maintained?	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

DATA QUALITY OBJECTIVES WORKSHEET

SITE: MRS 12 – Luis Peña Channel
PROJECT: RI/FS
DQO Statement Number: 04

Intended Data Use:	Determination of the nature and extent of MC contamination for the FS

Is data: basic, optimal, or excessive need?	Basic

How much data is enough?	Phased approach based on results of intrusive investigations and triggering conditions of breached MEC or clusters of MEC

How will this data be collected?	Sediment and surface water samples near the MEC

Was DQO attained?	

Where is supporting data maintained:	

** Additional TPP meetings will be required before the final DQO's can be established for investigation and intrusive operations.

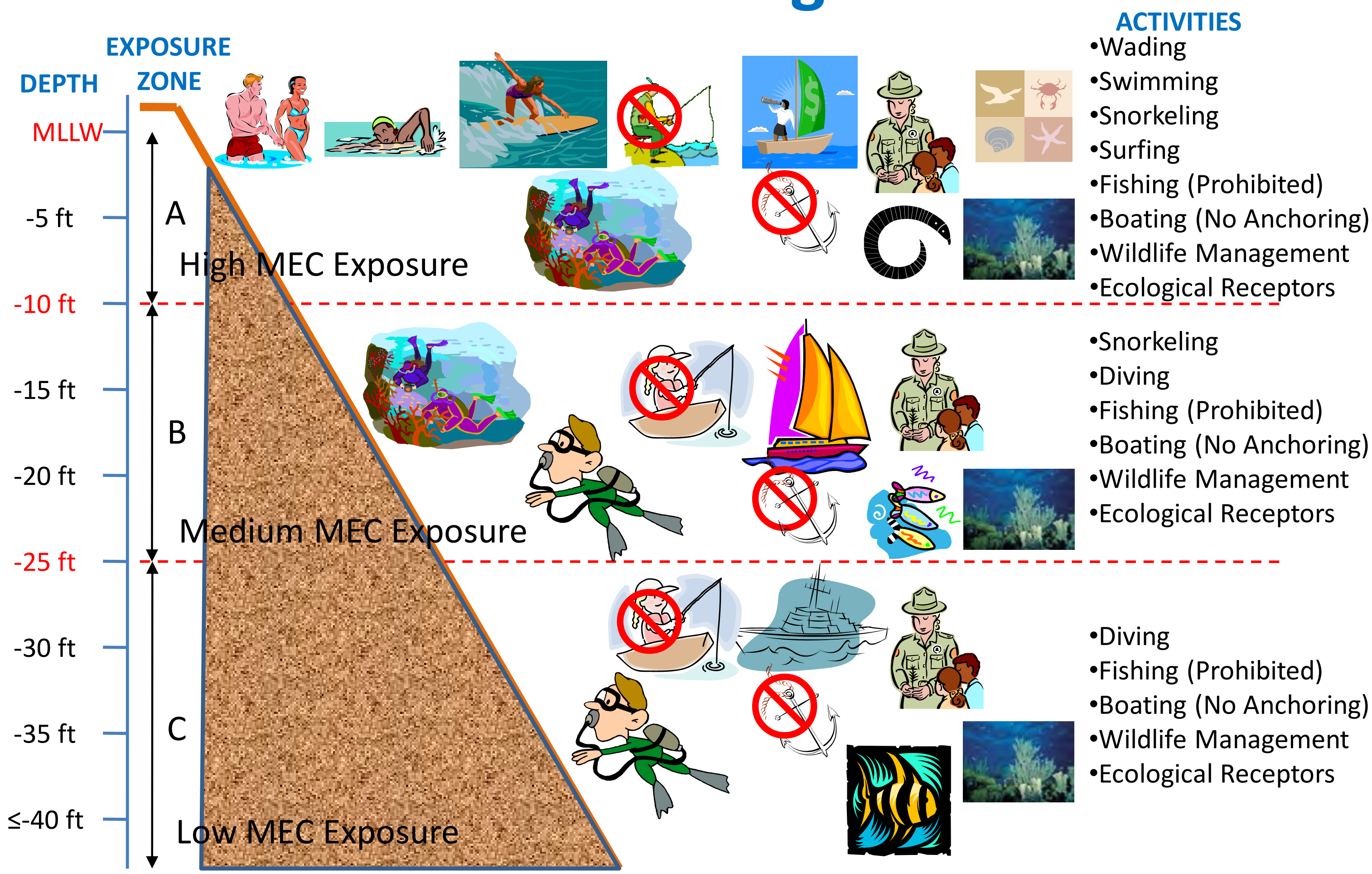
TECHNICAL PROJECT PLANNING
CULEBRA WATER RANGES, CULEBRA, PUERTO RICO
Written Conceptual Site Model

SITE	ACREAGE	SITE TYPE	PAST DoD ACTIVITIES	OE RELATED ITEMS FOUND SINCE CLOSURE	POST-DoD LAND USE AND CURRENT LAND USE	PRP INVOLVEMENT	TPP RECOMMENDATIONS	
							Geophysical Investigations	MEC
MRS 3 – Flamenco Bay	195	OE	Marine amphibious and other training exercises area. Located immediately adjacent to a former Navy gunfire and bombardment area in use from 1934-1975. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure. Sources include interviews with local residents, camping ground employees, and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Camping Ground and Public Beach.		
MRS 12 – Luis Peña Channel	835	OE	Located immediately adjacent to the Northwest Peninsula bombardment and impact area. Also Marines fired mortars from higher grounds to the beach. Portions of the site were also used as an impact area for barrage mortar firing from boats. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure, specifically in the ocean floor. Sources include interviews with local residents and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Natural Marine Reserve.		

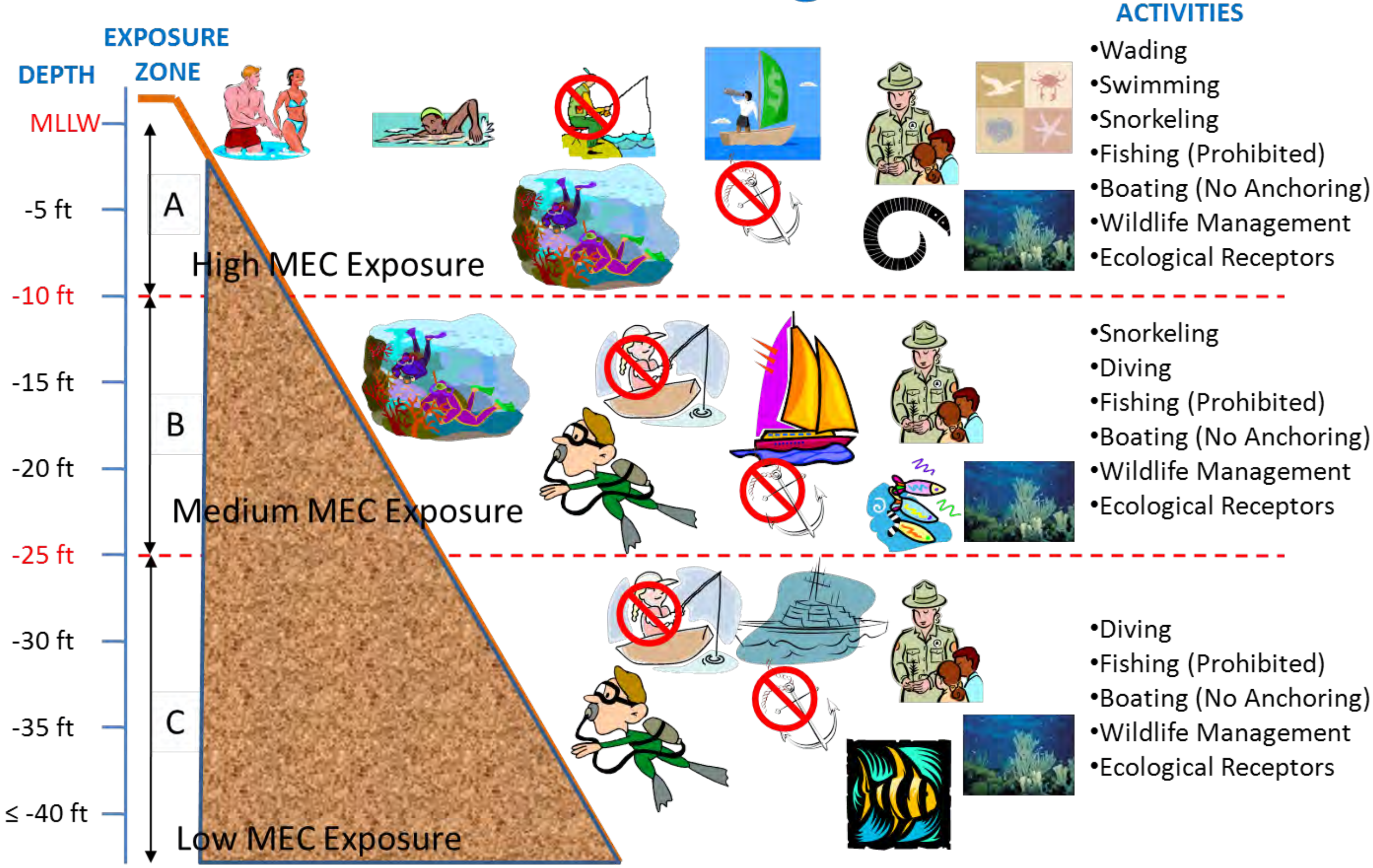
NOTES:
DNER = Department of Natural and Environmental Resources
DoD = Department of Defense
MEC = munitions and explosives of concern
OE = ordnance and explosives
TPP = Technical Project Planning
UXO = unexploded ordnance

Enclosure 2
Conceptual Site Model Figures for MRS 3 and MRS 12

Potential Human and Ecological Receptors
Culebra Water Ranges – MRS 03



Potential Human and Ecological Receptors
Culebra Water Ranges – MRS 12



Enclosure 3
Conceptual Site Model Narrative

WORKING PAPER

DRAFT CULEBRA MRS 3 AND 12 CONCEPTUAL SITE MODEL DISCUSSION

Background: Currently there is not an approved munitions and explosives of concern hazard analysis (MEC HA) process for underwater munitions response sites (MRS). Without an approved standardized process, a hazard model must be developed for each site based on all available information and professional judgment. Two factors for determining the hazard for human exposure to MEC are the number of people exposed and the duration of exposure. For MRSs 3 and 12, we have developed a conceptual site model (CSM) that includes levels of potential human exposure to MEC based on each site's current and anticipated future use.

Discussion: The base assumptions for the CSM are that the hazard level increases with shallower water depths and higher, longer use of the area (which are themselves related). For this CSM, three zones were identified. The first zone, which has the greatest hazard level, is the area with depths 10 feet or less that receives the greatest typical use (people may wade, swim, or surf for hours in this area). Additionally, the consequences of an unintentional detonation at that depth range are more severe in shallow water because of less tamping and the potential for fragmentation to breach the surface. This zone is designated as Zone A and has the highest potential for human exposure to MEC.

There are fewer people in the 10- to 25-foot-deep water and they occupy this region for shorter periods of time. Additionally, the deeper water depth provides enough tamp that fragmentation from 5-inch projectiles is not likely to breach the surface, resulting in less hazard for people doing activities on the surface. This zone is designated as Zone B and is assessed as having a medium potential for human exposure to MEC.

The deepest zone is below 25 feet and is used by the fewest number of people for the shortest periods of time. Although an unintentional detonation would be catastrophic for anyone near the point of detonation, the hazard is less because there are far fewer people exposed and the duration of exposure is for the shortest period of time. This zone is designated as Zone C and has been assessed to have the lowest potential for human exposure to MEC.

Conclusion: Although the selection of the depth range for each zone may appear arbitrary, these zones reasonably delineate the activities that occur within the zones and differentiate the different levels of human exposure to MEC that may occur within the MRSs. This allows a logically designed investigation that gathers the appropriate amount of data based on the potential MEC hazard to humans.

This page intentionally left blank.