8 AUGUST 2014

FINAL

REMEDIAL INVESTIGATION REPORT

TISBURY GREAT POND INVESTIGATION AREA
MARTHA'S VINEYARD, MASSACHUSETTS

FUDS Project No. D01MA0453
Contract No. W912DY-04-D-0019
Task Order No. 0006

Prepared for:
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

Prepared by:
UXB International, Inc.

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS

µ	micro(s)
ADR	Automated Data Review
AirMag	airborne magnetometry
AMEC	AMEC Environment & Infrastructure, Inc.
Aqua Survey	Aqua Survey, Inc.
ARAR	applicable or relevant and appropriate requirements
AUF	area use factor
B	the concentration of the COPEC in the food of the receptor
bgs	below ground surface
CENAE	United States Army Corps of Engineers, New England District
CERCLA	Comprehensive Environment Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHE	Chemical Hazard Evaluation
CHF	Contaminant Hazard Factor
cm	centimeter(s)
COC	chain of custody
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
C_s	soil concentration of the COPEC
CSM	conceptual site model
CWM	chemical warfare materiel
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DNT	dinitrotoluene
DoD	United States Department of Defense
DQO	Data Quality Objective
EcoSSL	Ecological Soil Screening Level
EHE	Explosive Hazard Evaluation
EM	electromagnetic
EOD	explosives, ordnance, and disposal
EPC	exposure point concentration
ERA	ecological risk assessment
ESP	Explosives Siting Plan
ESTCP	Environmental Security Technology Certification Program
EZ	exclusion zone
°F	degree(s) Fahrenheit
FDE	Findings and Determination of Eligibility
FDEM	Frequency Domain Electromagnetic
FIR	food ingestion rate
FS	Feasibility Study
ft	foot or feet
FUDS	Formerly Used Defense Site
GIS	Geographic Information System

GPO	geophysical prove-out
GPS	global positioning system
GSV	geophysical system verification
HA	hazard assessment
HE	high explosives
HFD	hazardous fragment distance
HHE	Health Hazard Evaluation
HHRA	Human Health Risk Assessment
HMX	1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient
IDW	investigation derived waste
in.	inch(es)
INPR	Inventory Project Report
IS	incremental sample
ISO	industry standard object
IVS	instrument verification strip
kg	kilogram(s)
kg dw/kg-day	kg dry weight of food per kg body weight per day
K_H	Henry's Law Constant
K_{OC}	organic carbon partition coefficient
L/kg	liters per kilogram
m	meter(s)
MADCR	Massachusetts Department of Conservation and Recreation
MADEP	Massachusetts Department of Environmental Protection
MC	munitions constituent
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MD	munitions debris
MDF-H	maximum fragmentation distance, horizontal
MEC	munitions and explosives of concern
MGA	magnetic gradiometer array
mg/kg	milligrams per kilogram
mg/kg-day	mg per kg body weight per day
mg/L	milligrams per liter
MGFD	munitions with the greatest fragmentation distance
MK	Mark
MMRP	Military Munitions Response Program
MPF	migration pathway factor
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSD	minimum separation distance
msl	mean sea level
mV	millivolts
NAEVA	NAEVA Geophysics, Inc.
NC	nitrocellulose

NG	nitroglycerin
NOAEL	no observed adverse effort level
P	ingestion rate of soil as a proportion of food ingestion rate
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RAGS	Risk Assessment Guide for Superfund
RDX	1,3,5-trinitro-1,3,5-triazine
RF	receptor factor
RI	Remedial Investigation
RL	reporting limit
RSL	Regional Screening Level
RTK	real time kinematic
SDDW	small diameter driven well
SUF	seasonal use factor
SUXOS	Senior Unexploded Ordnance Supervisor
TBC	to be considered
TCRA	Time Critical Removal Action
TestAmerica	TestAmerica, Inc.
TNT	2,4,6-trinitrotoluene
TPP	Technical Project Planning
TSERAWG	Tri-Services Environmental Risk Assessment Work Group
TtEC	Tetra Tech EC, Inc.
TTOR	The Trustees of Reservations
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USAESCH	United States Army Engineering Support Center, Huntsville
USDA-SCS	United States Department of Agriculture – Soil Conservation Service
USEPA	United States Environmental Protection Agency
UXB	UXB International, Inc.
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
VOC	volatile organic compound
VRH	VRHabilis, LLC
TRV	toxicity reference value
WAA	Wide Area Assessment
WAAS	Wide Area Augmentation System
ww	wet weigh

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GLOSSARY

Anomaly – An anomaly is any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and nonferrous material at a site (pipes, power lines, etc.).

Anomaly Avoidance – This is a technique employed on property known or suspected to contain unexploded ordnance (UXO), other munitions that may have experienced abnormal environments [e.g., discarded military munitions (DMM)], munitions constituents (MC) in high enough concentrations to pose an explosive hazard, or chemical agents, regardless of configuration, to avoid contact with potential surface or subsurface explosive or chemical agent hazards, to allow entry to the area for the performance of required operations.

Archives Search Report (ASR) – An ASR is a detailed investigation report on past munitions activities conducted on an installation. The principal purpose of the archives search is to assemble historical records and available field data, assess potential ordnance presence, and recommend follow-up actions at a Defense Environmental Restoration Program (DERP) Formerly Used Defense Site (FUDS). There are four general steps in an archives search: records search phase, Site Safety and Health Plan, site survey, and ASR, including risk assessment. The ASR has since been replaced in the Military Munitions Response Program (MMRP) process by the Historical Records Review.

Blind Seeding –Part of the geophysical system verification process, "seeds" [inert items similar in size/shape to munitions and explosives of concern (MEC) items of concern] are buried at locations unknown to the geophysical or intrusive contractor as a quality control check of their equipment and processes.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – CERCLA authorizes federal action to respond to the release or threatened release of hazardous substances into the environment or a release or threat of release of a pollutant or contaminant into the environment that may present an imminent or substantial danger to public health or welfare.

Data Quality Objective (DQO) – DQOs are project-specific statements that clarify the study objective, define the most appropriate type of data to collect, determine the most appropriate conditions from which to collect the data, and specify tolerable limits on decision errors (used in establishing the quantity and quality of data needed).

Decision Document (DD) – DDs serve to provide the reasoning for the choice of or changes to a Superfund site cleanup plan. DDs include Proposed Plans (PPs), Records of Decision (RODs), ROD Amendments, and Explanations of Significant Differences, along with other associated memoranda and files. DDs are required by Section 117 of CERCLA, as amended by SARA, for remedial actions taken pursuant to Sections 104, 106, 120, and 122. Sections 300.430(f)(2), 300.430(f)(4), and 300.435(c)(2) of the National Contingency Plan (NCP) establish the regulatory requirements for these DDs.

Defense Environmental Restoration Program (DERP) – Established in 1984, DERP promotes and coordinates efforts for the evaluation and cleanup of contamination at DoD installations.

Dig Sheet – A list of selected targets with the target location given in the referenced coordinate system, represented amplitude of response based on selection criteria, and any comments or details regarding target properties.

Discrete – A sample that represents a single location or short time interval. A discrete sample can be composed of more than one aliquot. The term has the same meaning as "individual sample."

Downline Width – The distance between readings recorded by the sensor.

Explosive Ordnance Disposal (EOD) personnel – Military personnel who have graduated from the naval School, Explosive Ordnance Disposal; are assigned to a military unit with a service defined EOD mission; and meet service and assigned unit requirements to perform EOD duties. EOD personnel have received specialized training to address explosive and certain chemical agent hazards during both peacetime and wartime. EOD personnel are trained and equipped to perform render safe procedures on nuclear, biological, chemical, and conventional munitions and on improvised explosive devices.

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

Feasibility Study (FS) – The FS follows the remedial investigation. During the FS, the remedial investigation data are analyzed and remedial alternatives are identified and evaluated. The FS serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

Formerly Used Defense Site (FUDS) – FUDS include those properties previously owned, leased, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense, or manufacturing facilities for which real property accountability rested with the DoD but were operated by contractors (government owned, contractor operated) and that were later legally disposed of. FUDS is a subprogram of the DERP.

Hot rock – "Hot rock" is a term used to describe a rock with enough magnetism to be detected by geophysical instrumentation as an anomaly.

Incremental Sampling (IS) – IS is a structured composite sampling and processing protocol that improves the reliability and defensibility of sampling data by reducing data variability and provides a reasonable estimate of a chemical's mean concentration for the volume of soil being sampled. The three key components of IS are systematic planning, field sample collection, and laboratory processing and analysis. Typically, 30 to 100 increments (1 to 5 kilograms) of uniform size are collected from surface soils across a grid formation that represents a specific area entire sample unit. In the lab, the entire sample is spread into a grid formation and the sub-sample is generated using similar techniques employed in the field, only on a much smaller scale. This entire sub-sample is used for analysis and multi-incremental sample replicates are usually normally distributed with very few outliers. Thus, the goal of limiting discrete sample variability is achieved.

Inert – An inert substance is one that is not generally reactive. This is a synonym for "inactive."

Magnetometer Survey and Intrusive Investigation (Mag and Dig) – A mag & dig survey consists of using analog instrumentation for surface and subsurface anomaly detection with real-time follow-on intrusive investigation to confirm the source and nature of detected anomalies.

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

Military Munitions – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy (DoE), and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. The term does not include wholly inert items; improvised explosive devices; and nuclear weapons, nuclear devices, and nuclear components, other than nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the DoE after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed (10 USC 101(e)(4)(A) through (C)).

Military Munitions Response Program (MMRP) – The United States Congress established the MMRP under the DERP to address UXO, DMM, and MC located on current and former defense sites. MMRP eligible sites include other than operational ranges where UXO, DMM, or MC are known or suspected. Properties classified as operational military ranges, permitted munitions disposal facilities, or operating munitions storage facilities are not eligible for the MMRP.

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means UXO, as defined in 10 USC 101(e)(5)(A) through (C); DMM, as defined in 10 USC 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

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

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

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

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

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

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – Revised in 1990, the NCP provides the regulatory framework for responses under CERCLA. The NCP designates the DoD as the removal response authority for explosive hazards associated with military munitions.

Ordnance – Explosives, chemicals, pyrotechnics, and similar stores. Examples of ordnance are bombs, guns and ammunition, flares, smoke, or napalm.

Peak Response – The highest value recorded over an item or highest value of the gridded data.

Remedial Action – An action consistent with the permanent remedy taken in the event of a release or a threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health, welfare, or the environment.

Remedial Investigation (RI) – An RI is performed to to collect data to characterize site conditions and assess risk/hazard to human health and the environment. The RI process includes scoping and site characterization. Data collected in the RI influence the development of remedial alternatives in the Feasibility Study.

Seed items – Seed items are known magnetic sources, such as inert munitions or other metallic items that are used in a quality control program to verify that geophysical instrumentation used for anomaly detection is working properly and accurately.

Static Test – Test to determine whether a particular geophysical instrument is collecting stable readings. Improper instrument function, the presence of local sources of ambient noise, and instability in the earth's magnetic field are all potential causes of inconsistent, non-repeatable readings.. This test involved collecting background data in a static (i.e., stationary) mode for one minute, collecting data with a test item for one minute, and removing the test item and collecting background data for one additional minute.

Transects – Lines for ecological measurements; a strip of ground along which ecological measurements are made at regular intervals.

Unexploded Ordnance (UXO) – Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in a manner that constitutes a hazard to operations, installation, personnel, or material; and remain unexploded either by malfunction, design, or any other cause. (10 USC 101(e)(5)(A) through (C) and 40 CFR 266.201)

UXO-Qualified Personnel – UXO-qualified personnel have performed successfully in military EOD positions or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, and contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

UXO Technicians – UXO Technicians are qualified for filling Department of Labor, Service Contract Act, Directory of Occupations, and contractor positions: UXO Technician I, UXO Technician II, and UXO Technician III.

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1.0 EXECUTIVE SUMMARY

1.0.1 Between 14 December 2010 and 2 November 2011, UXB International, Inc. (UXB) and its subcontractors conducted a Remedial Investigation (RI) at Tisbury Great Pond Investigation Area, referred to hereinafter as the Investigation Area. UXB prepared this document under contract to the U.S. Army Engineering Support Center, Huntsville (USAESCH), Contract No. W912DY-04-D-0019, Task Order No. 006. Field activities conducted during this RI were in accordance with the RI Work Plan (UXB, 2011). An RI was recommended at the conclusion of a Site Inspection, which identified the historic use of practice bombs at Tisbury Great Pond (Alion, 2008).

1.0.2 The purpose of this RI was to collect data necessary to determine the nature and extent of potential munitions and explosives of concern (MEC) and munitions constituents (MCs) resulting from historical military activities conducted within the Investigation Area. In order to fully develop the Investigation Area conceptual site model (CSM), the RI Report includes data collected during the current investigation and results from previous investigations, and unexploded ordnance (UXO) emergency responses. The data presented is used to support fate and transport analysis, evaluate the potential risks to human health and the environment, and will be used to support the development of a Feasibility Study (FS) to evaluate future response actions at the Investigation Area, if necessary. This RI Report documents the methods and procedures employed during field activities and presents the results of the Investigation Area site characterization.

1.0.3 Between August 1943 and July 1947, the Investigation Area was used as a practice dive bombing and strafing range. Strafing and masthead targets were constructed at the Investigation Area in support of the U.S. Navy's fighter training program. Military practice ordnance potentially used at the Investigation Area include 0.30 and 0.50 caliber ammunition; practice bomb series AN-Mark (MK)5, MK15, MK21, AN-MK23, and AN-MK43. Additionally, spotting charges may have been used in the practice bombs to permit pilots to observe bombing accuracy. Since the end of military operations in 1947, numerous reports identifying practice bombs within the Investigation Area have been made by local residents, wildlife refuge officials, and U.S. Army Corps of Engineers (USACE) personnel (Alion, 2008). The practice bombs that remain at the Investigation Area present a potential explosive safety hazard.

1.0.4 To achieve the goals established for this RI, various field investigative activities were conducted including: geophysical surveying, intrusive investigations, and environmental sampling for analysis of MCs. The Investigation Area was subdivided into four sub-area types according to sub-area geomorphology which included land, beach, inland water, and ocean areas. The investigations were designed such that the type of geophysical methods and instrumentation proposed were appropriately matched to the unique character of each sub-area.

1.0.5 A wide area assessment (WAA) was initially performed to help identify high density areas of geophysical anomalies that might be indicative of an area previously used as a military target, aid in determining the extent of potential MEC contamination, and focus subsequent detailed intrusive investigations. The WAA consisted of:

- Analog density transects in the upland areas using hand-held analog instruments to minimize the amount of brush clearing;
- Digital Geophysical Mapping (DGM) transects on the beach and dune areas where no vegetation clearing was required;
- Underwater DGM in the inland water areas; and,
- Analog magnetometer suvey and intrusive investigation (Mag and Dig) ocean transects.

1.0.6 This work was supplemented with an airborne magnetometry (AirMag) survey performed using a magnometer array mounted to a helicopter. The AirMag was flown over portions of the land, beach and shallow inland water/surf zone at 3 to 10 feet (ft) above the surface.

1.0.7 Data collected during the WAA was subsequently used to site grids for additional DGM surveying and intrusive investigation within the inland water, land, and beach areas. Based upon the results of the WAA, anomalies were identified, mapped using ESRI ArcGIS, and analyzed to identify high density anomaly areas. The grids were sited in areas of high, medium, and low anomaly densities to refine the extent, and establish the nature of MEC contamination through subsequent intrusive investigations. High density anomaly areas were then used to determine the size and location of grids over which additional DGM data would be collected. Fifty-two DGM land/beach grids and 18 DGM inland water grids were located within the Investigation Area. Geophysical data were collected in the grids by towing the electromagnetic (EM) sensor system by hand across the surface within each grid for land/beach grids, and towing an underwater EM sensor system with a boat/amphibious vehicle in the inland water areas. DGM data collected within the grids were evaluated and a list of anomalies to be intrusively investigated was generated.

1.0.8 The intrusive investigation was conducted by reacquiring the anomaly locations selected for intrusive investigation and excavating the locations to identify the source of the anomaly. Excavation of land/beach locations were conducted by UXO technicians and excavation of inland water locations were conducted by UXO divers. Due to the dynamic nature of the ocean surf zone, a "Mag and Dig" technique was used for ocean transects. Divers identified anomalies on transects using an underwater hand-held analog instrument, and subsequently excavated each anomaly as it was found. This methodology provided both WAA and intrusive investigation to provide nature and extent data. Once identified, debris was classified as non-MD, cultural artifacts, MD, or MEC. During the intrusive investigation, 6

MEC and 31 MD items were recovered from land, beach, inland water, and ocean areas. MEC items included AN-MK23 3-lb practice bombs with intact spotting charges, and MD items included expended AN-MK23 3-lb practice bombs and remnants of 100-lb practice bombs including an inert spotting charge. MEC and MD items discovered during the intrusive investigation were removed, demilitarized, and properly disposed.

1.0.9 Based upon data collected during these two phases of work, it was determined that additional investigation of the areas along the dunes east of the "cut" was warranted as large anomalous images were detected by AirMag and MD items continued to be identified within the dune/beach area after each cut was made. Since the cuts have moved from west to east, the area east of the cut was the most likely potential source of MEC/MD.

1.0.10 Between 13 October and 2 November 2011, environmental sampling for MCs was conducted at the Investigation Area, which included the collection of discrete, biased surface and subsurface soil samples and groundwater samples. Samples were analyzed for MCs, including antimony, copper, lead, nickel, and zinc, and explosive compounds, including pentacrythrite tetranitrate (PETN) and nitroglycerin (NG), previously identified as components of munitions identified within the Investigation Area. Analytical results indicated that lead is present at concentrations exceeding ecological screening criterion at three soil sample locations, but below the human health screening criterion. All other detections of metals in soil and groundwater were below human health and ecological screening criterion. No explosives were detected in soil samples collected within the Investigation Area. In groundwater, no explosives were detected. In sediment, lead and nickel were detected at concentrations exceeding ecological screening criterion at four locations, but below human health screening criterion. Based upon the Technical Justification Memorandum issued to the project team following Technical Project Planning (TPP) Meeting #3 (See Section 3.5.1), sediment and surface water background samples were required to finalize MC characterization at the Investigation Area.

1.0.11 Background sediment and surface water samples were collected from the northern fingers of the Tisbury Great Pond on 8 August, 2013. The background samples were analyzed for lead and nickel, since both were detected at concentrations exceeding the ecological screening criteria in sediment. The discrete biased sediment samples found lead and nickel at concentrations of 34 mg/kg and 21 mg/kg, respectively. The background sediment concentrations (lead and nickel at 32 mg/kg and 16 mg/kg, respectively) are similar to the biased discrete sediment samples collected from Tisbury Great Pond.

1.0.12 Using the data obtained through this RI and information collected during previous investigations and removal actions, a qualitative MEC Hazard Assessment (HA) was conducted for the land and beach portions of the Investigation Area. Under current conditions, the

Investigation Area received a hazard level category of 1, indicating the highest potential explosive hazard conditions are present.

1.0.13 A Human Health Risk Assessment (HHRA) was conducted for the Investigation Area to provide a comprehensive assessment of potential risks to individuals that may be exposed to hazardous constituents at the Investigation Area. The HHRA concluded that there is no unacceptable risk to human health from MC at the Investigation Area.

1.0.14 A Screening-Level Ecological Risk Assessment (SLERA) was performed to evaluate risks posed to ecological receptors (plants, invertebrates, herbivores, predators, and marine receptors) due to exposures to residual MCs. Based on the low concentrations of MCs within soil and groundwater samples, and the results of this assessment, it was concluded that none of the MCs evaluated pose a potential for risk to ecological receptors.

1.0.15 Based upon RI results, it is recommended that no change be made to the MRA boundary established during the Site Inspection (Alion, 2008). The boundary includes the extent of MEC determined through previous investigations, geophysical and intrusive investigation data. It is also recommended that Tisbury Great Pond MRA should be subdivided into two MRSs, comprising the Tisbury Great Pond MRS and the Remaining Land/Water MRS (Figure 8-1). Based upon the information gathered from historical records, previous investigations, and RI results, a FS is recommended to evaluate future response action alternatives with regard to MEC hazards at the two MRSs. No further evaluation of MC is warranted.

2.0 INTRODUCTION

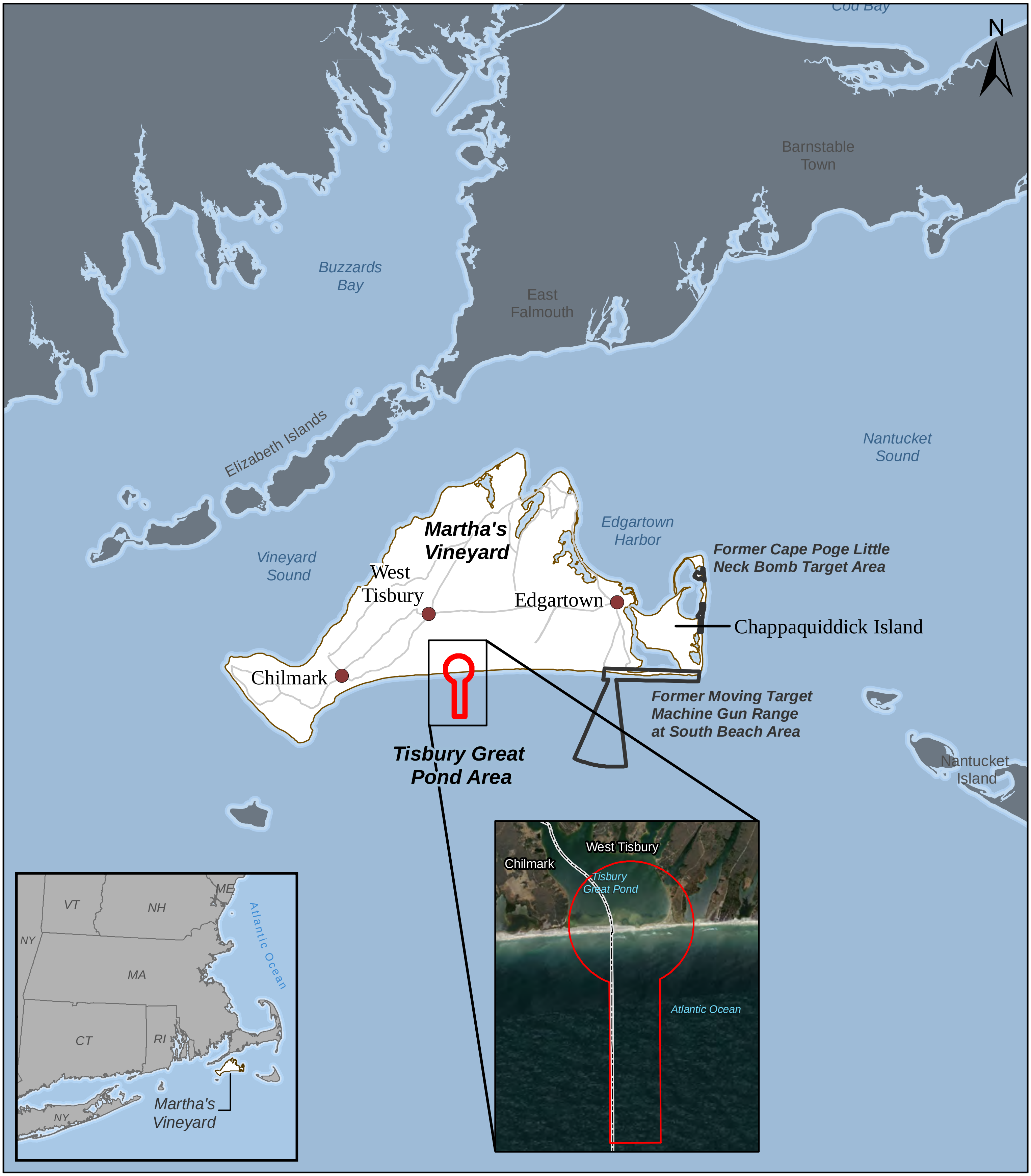
2.0.1 This RI Report was prepared by UXB on behalf of the United States Army Corps of Engineers, New England District (CENAE) for the Tisbury Great Pond Investigation Area, located in Martha's Vineyard, Massachusetts, referred to hereinafter as the Investigation Area (Figure 2-1). The Formerly Used Defense Site (FUDS) boundary (Figure 2-2) for the Tisbury Great Pond Target Area (D01MA0453) consists of 497 acres covering the historic target location. The Investigation Area boundary (Figure 2-2) was delineated based upon the historic target location and areas where MD and suspected MEC items had been identified. The Investigation Area boundary (768 acres) encompasses and extends beyond the FUDS boundary with the exception of the rectangular ocean area extending seaward from the former range.

2.0.2 UXB has prepared this document under contract to the USAESCH, Contract No. W912DY-04-D-0019, Task Order No. 006. This report was prepared in accordance with USACE Engineering Manual (EM) 1110-1-1200 (USACE, 2003), Interim Guidance 06-04, Draft Engineering Pamphlet (EP) 1110-1-18 (USACE, 2006), and the Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environment Response, Compensation, and Liability Act (CERCLA), (USEPA], 1988). Field activities were conducted in accordance CERCLA 1980, as amended by Superfund Amendments and Reauthorization Act of 1986; the National Oil and Hazardous Substances Pollution Contingency Plan; and the RI Work Plan (UXB, 2011).

2.1 Purpose

2.1.0.1 The purpose of this RI Report is to document the methods employed during field activities and present the results of the Investigation Area site characterization. The RI was conducted to collect data necessary to:

- Determine the nature and extent of MEC and MCs;
- Support MC fate and transport analysis;
- Evaluate the potential risks to human health and the environment;
- Develop a MEC Hazard Assessment (HA); and,
- Support the development of a Feasibility Study (FS) to evaluate future response actions, if necessary.



US Army Corps of Engineers®

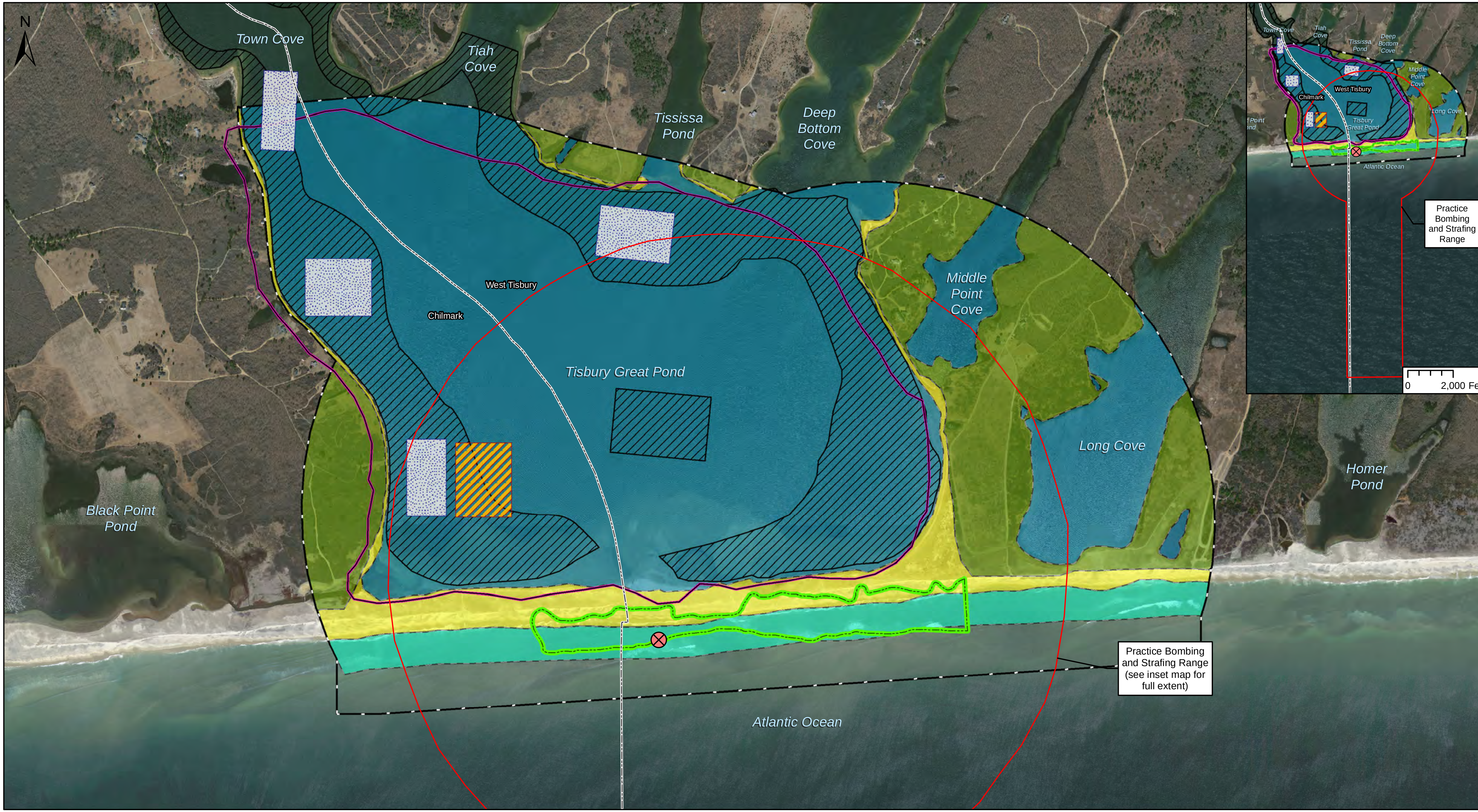
FIGURE 2-1
Site Location - Martha's Vineyard, MA

0 2.5 5 10 15 Miles
0 5 10 15 20 25 Kilometers

UXB amec

NOTES:
Base map data source: ESRI

03/05/2014	Rev:	Tisbury_MV_Island_Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000



Former Bombing Target
Town Boundary
Tisbury Great Pond Area of Investigation
Tisbury Great Pond FUDS Boundary

Tisbury Great Pond Investigation Areas Subdivisions

Beach - 62 acres
Inland Water - 508 acres
Land - 146 acres
Ocean - 52 acres

Oyster Grow Out Equipment
Shell Reef
Oyster Growth
Former Bigelow Property

US Army Corps of Engineers

FIGURE 2-2

Site Map - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 100 200 400 600 Meters
0 500 1,000 1,500 2,000 Feet

UXB amec

NOTES: 2009 Aerial Data Source: MassGIS	12/24/2013	Rev:	Tisbury_Site_Loc_Remedial_Inv_Rpt.mxd
	Drawn: JBO	Chk: DMS	PROJ: 562910000

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2.2 Property Description and Problem Identification

2.2.0.1 The following subsections describe potential safety hazards, physical characteristics, and potential receptors within the Investigation Area.

2.2.1 Explosives Safety Hazards

2.2.1.0.1 Tisbury Great Pond was used as a practice dive-bombing and practice strafing range in support of the U.S. Navy's fighter training program. Ordnance potentially used at the site include 0.30 and 0.50 caliber machine gun rounds as well as practice bombs types (AN-MK5, MK15, MK21, AN-MK23, and AN-MK43).

2.2.1.0.2 Practice bombs were used with signals (also called spotting charges) that would permit pilots to observe bombing accuracy. The signals contained expelling charges and marker charges composed of pyrotechnic mixtures. Upon impact with water or land, the signal would detonate, producing a flash and a large puff of smoke.

2.2.1.0.3 The area surrounding the historic target location, which includes land, beaches, inland water, and ocean, is utilized by residents, tourists, and on-site workers. Current land use has resulted in exposure of the public, residents, and community workers to potential MEC. Therefore, there is a potential explosive safety hazard for persons that may come into contact with practice bombs that remain at the site.

2.2.2 Physical Characteristics

2.2.2.1 Site Description

2.2.2.1.0.1 As shown on Figure 2-1, the Investigation Area is located within the towns of Chilmark and West Tisbury, in the southwest portion of Martha's Vineyard, Massachusetts. The Investigation Area encompasses an area of approximately 768 acres, divided into approximately 146 acres of land, 62 acres of beach, 508 acres of inland water, and 52 acres of ocean (Figure 2-2).

2.2.2.1.0.2 The site is comprised of the Tisbury Great Pond, small areas along the shoreline and surrounding areas (mostly residential), a small strip of beach along the southern edge of the pond, and a small portion of the Atlantic Ocean. The U.S. Navy constructed temporary range strafing and masthead targets within the Investigation Area, which were removed once military activities ceased. There are numerous single-family residential homes located within and adjacent to the site.

2.2.2.2 Current and Future Land Use

2.2.2.2.0.1 Currently, the site is owned by The Trustees of Reservations (TTOR), the Commonwealth of Massachusetts (inland and coastal waters), and private landowners (Figure 2-3). The land is part of the Massachusetts Coastal Zone and Long Point Wildlife Refuge. When military use of the property ended, Tisbury Great Pond was developed into a shellfish harvest area. Today the site is a designated shellfish fisheries area and is actively harvested for oysters, clams, and fish. Private landowners own small portions of the property for residential use. The majority of the barrier beach at the southern end of the pond is privately owned. It is anticipated that the future land use will remain the same.

2.2.2.3 Topography

2.2.2.3.0.1 The topography of the Investigation Area is relatively flat with sand dunes, which ran in height from approximately 5 to 10 ft. Elevations within the Investigation Area range from sea level to approximately 3 ft above mean sea level (msl) near the southern coastline to approximately 15 ft above msl in the northern portion of the site (Figure 2-4). There is a barrier beach that separates Tisbury Great Pond from the Atlantic Ocean. The Tisbury and Chilmark Shellfish Departments breach the beach several times a year to hydraulically connect the pond to the ocean to allow the pond to discharge freshwater to the Atlantic Ocean and allow saltwater enter the pond. The breach locations started on the western edge of the pond and move eastward with each successive breach east of the previous one. The most recent breaches (included in this RI) have cut through the dune on the eastern edge of the pond.

2.2.2.4 Habitat and Vegetation

2.2.2.4.0.1 The current Investigation Area includes four habitat types: 1) upland habitat; 2) inland water, 3) beach; and 4) ocean (Figure 2-2). These areas provide habitat to a variety of terrestrial plants, invertebrates, and wildlife as well as freshwater, estuarine, and marine organisms. The eastern portion of the Investigation Area includes the TTOR Long Point Reservation, an openspace area designated for conservation. The upland portions of the Investigation Area are part of the sandplains habitat of Martha's Vineyard that originally supported a grassland or open woodland vegetation dominated by little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), and other species of grasses, sedges, and forbs. Dominant trees of this habitat included scrub oak (*Quercus ilicifolia*) and pitch pine (*Pinus rigida*) (USFWS, 1991). Various human disturbances, including agricultural and residential development, have modified or removed this natural vegetation type over some of the Investigation Area. Poison ivy (*Toxicodendron radicans*), beach plum (*Prunus maritima*), and bayberry (*Myrica pensylvanica*) are common throughout the area. Most of the

US Army Corps of Engineers ®

NOTES:
2009 Aerial Data Source: MassGIS

UXB amec

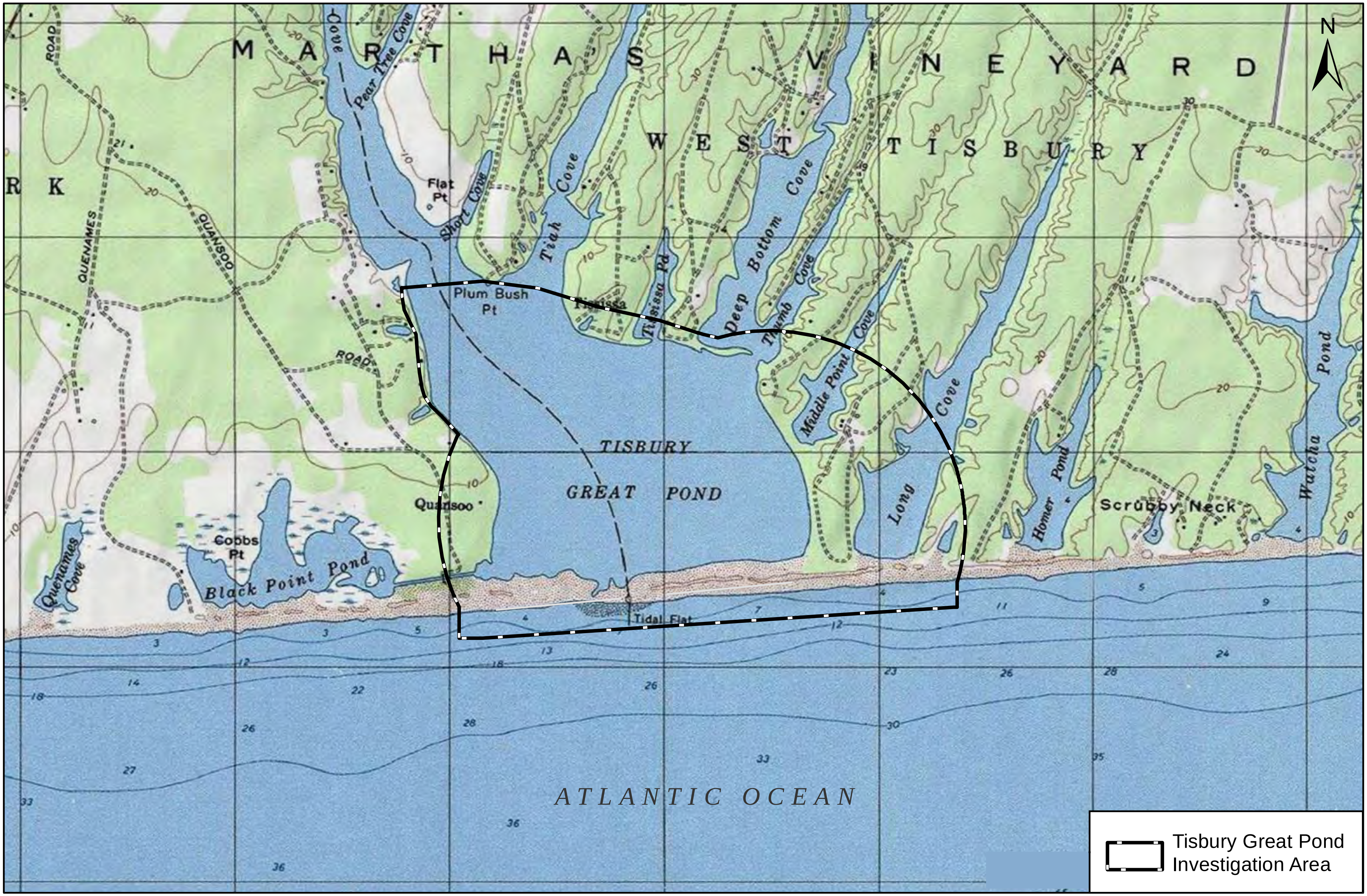
FIGURE 2-3

Current Land Use - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 550 1,100 1,650 2,200 2,750 Feet

0 100 200 300 400 500 Meters

02/07/2014	Rev:	Drawn: JBO	Chk: DMS	Tisbury_Private_Public_Land_Remedial_Inv_Rpt1.mxd	PROJ: 562910000



US Army Corps of Engineers	NOTES: Base Map Data Source: USGS; obtained through ESRI online services.	UXB amec	**FIGURE 2-4** Topographic Map - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 1,000 2,000 3,000 4,000 5,000 Feet
0 200 400 600 800 Meters

02/07/2014	Rev:	Drawn: JBO	Chk: DMS	Tisbury_USGS_Topo_Remedial_Inv_Rpt.mxd	PROJ: 562910000

upland area surrounding Tisbury Great Pond has been designated as Core Habitat and Critical Natural Habitat under BioMap2 (MDFW, 2012). The beach habitat includes large areas of unvegetated beach face backed by dunes supported by American beach grass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*), and other species adapted to coastal sand environments. Tisbury Great Pond is designated as suitable habitat for shellfish, including both American oyster and bay scallop (MassGIS, 2012). This designation, however, is based solely on observation of these species since the mid-1970's and does not imply current occurrence or significant abundance of either species within the demarked areas.

2.2.2.4.0.2 The investigation area is mapped as "Core Habitat" and "Critical Natural Landscape" by the MA NHESP BioMap2 town report for Edgartown (MA NHESP, 2012). Core habitat identifies areas that are critical to long-term persistence of rare species in Massachusetts. Critical Natural Landscape encompasses habitat used by wide ranging species (e.g. tern), large areas of contiguous habitat, and buffer habitat. The Investigation Area is within Core Habitat area 102 and Critical Natural Landscape area 45.

2.2.2.5 Climate

2.2.2.5.0.1 Martha's Vineyard has a temperate marine climate. Although Martha's Vineyard's weather is typically moderate, there are occasions where the island experiences extreme weather conditions such as nor'easters and hurricanes. Martha's Vineyard's generally experiences a delayed spring season, being surrounded by an ocean that is still cold from the winter; however, it is also known for an exceptionally mild fall season, due to the ocean remaining warm from the summer. The highest temperature ever recorded on Martha's Vineyard was 99 degrees Fahrenheit (°F) in 1948, and the lowest temperature ever was -9°F in 1961 (USACE, 2009a).

2.2.2.5.0.2 Precipitation on Martha's Vineyard and the islands of Cape Cod and Nantucket is the lowest in the New England region, averaging slightly less than 40 inches (in.) per year. This is due to storm systems that move across western areas, building up in mountainous regions, and dissipating before reaching the coast (USACE, 2009a).

2.2.2.6 Soils

2.2.2.6.0.1 The soils at Investigation Area consist of beaches, Udipsamments, Carver loamy coarse sand, Riverhead sandy loam, and Eastchop loamy sand; and the low lying soils Barryland loamy sand and Pompton sandy loam (USDA-SCS, 1986). Descriptions of the soils located at various locations within the MRS are provided below.

2.2.2.6.0.2 Soils at the barrier beach consist of beach areas and Udipsamments soils, which are found near the coast. Both soils consist of deep sand of various texture that have rapid to very rapid permeability. Due to the continuous washing and rewashing by waves, beach areas typically do not have plant cover. Most areas of Udipsamments will have a cover of grasses and shrubs. The beaches nearest the ocean are inundated twice daily by tides. The entire beach is generally flooded by spring tides and storm tides (USDA-SCS, 1986).

2.2.2.6.0.3 Soils located adjacent to Tisbury Great Pond primarily consist of Carver loamy coarse sand and Riverhead sandy loam, with a smaller area of Eastchop loamy sand located on the western shore of the pond. These soils are very deep and range from well to excessively drained. All three soils are found on outwash plains and consist of sandy loam, loamy sand, or loamy coarse sand over coarse sand. Permeability of these soils ranges from rapid to very rapid. The depth to seasonal high water table is greater than 6 ft below ground surface (bgs) (USDA-SCS, 1986).

2.2.2.6.0.4 Two smaller soil units, based on aerial extent, located within the Investigation Area are the Barryland loamy sand and Pompton sandy loam. These soils are located along Thumb Cove and Tisbury Great Pond. These soils are very deep and are generally poorly drained. Both soils are found closed depressions, at the base of swales, in low areas that border ponds and swamps, and in drainageways. The Barryland and Pompton soils consist of sand and loamy sand, respectively. These soils have moderate to rapid permeability. The Barryland soil (located along Thumb Cove) has a seasonal high water table at or near ground surface in the fall, winter, and spring. Water is ponded in the surface in some areas. The Pompton soil (located along the Tisbury Great Pond) has a seasonal high water table at a depth of 1 to 2 ft bgs (USDA-SCS, 1986).

2.2.2.7 Geology

2.2.2.7.0.1 The Investigation Area and the island of Martha's Vineyard are relicts of the last ice age and the warming trends that followed. Repeated glaciations scraped soil and rock from the mainland of New England. Eighteen-thousand years ago, the glaciers reached their southernmost extent and began to melt and retreat, depositing the rock and soil, once trapped within the ice, as terminal moraines. These terminal moraines can be found on Martha's Vineyard (USACE, 2009a).

2.2.2.7.0.2 The geological deposits that make up the site consist of recent beach and marsh sediments, glacial deposits, interglacial deposits, and glacially deformed ancient coastal plain sediments. The island consists mostly of deposits from the last glacial stage, but in places consists of glacial or interglacial deposits as much as 300,000 years old. These deposits overlie solid bedrock and ranges from 500 ft thick on the north shore of Martha's Vineyard to 900 ft thick on the south shore (USACE, 1999). The bedrock consists of metamorphic rocks, such as schist and gneiss, and igneous rocks (Alion, 2008; USACE, 2009a).

2.2.2.8 Surface Water Hydrology

2.2.2.8.0.1 Tisbury Great Pond is a salt-water pond that fills with fresh water runoff from adjacent lands. Several times a year, a channel is cut hydraulically connecting the pond to the Atlantic Ocean, recharging the salinity and lowering the pond water level. In addition to the planned openings, natural breaches occur as a result of storm events. Regardless of whether the breach is man-made or natural, it closes naturally after several days to several weeks. The man-made cuts progress west to east, and each cut is moved sequentially to the east. This action allows 3 to 4 ft of water to drain back to the ocean. The channel is then opened on an "as needed" basis (USACE, 1999).

2.2.2.9 Groundwater Hydrology

2.2.2.9.0.1 Groundwater at the Investigation Area occurs predominately in the unconsolidated and moderately consolidated glacial till material, which derive their water from local precipitation. Bedrock is much less permeable than the overlying sediments, commonly contains seawater, and is not considered to be part of the aquifers of Martha's Vineyard (USACE, 2009a).

2.2.2.9.0.2 In the northern portion of the site, groundwater is typically encountered at a depth ranging from approximately 5 to 15 ft bgs. In the southern portion of the site, groundwater is encountered at a depth ranging from 1 to 2 ft bgs. The water table generally mimics topography and is weakly influenced by tidal fluctuations. Groundwater quality studies indicate that salt water intrusion occurs along the coastline and to a lesser degree throughout the interior of the island. The shallow freshwater aquifer is underlain by brackish groundwater that is unsuitable for human consumption (USACE, 2009a). Groundwater flow direction within the Tisbury Great Pond watershed generally trends to the south or toward the pond (Alion, 2008). Groundwater in Martha's Vineyard is primarily discharged directly to the ocean and surrounding bays (USACE, 2009a).

2.2.2.9.0.3 In general, supplies of water for homes, cooling, and small businesses can be developed in most areas of outwash from wells that are 1.5 to 2 in. in diameter with 3 ft of screen set about 10 ft below the water table. According to the Massachusetts Department of Environmental Protection (MassDEP) Public Water Supply and Wellhead Protection Areas database, there are approximately 12 public water supply wells within 4 miles of Tisbury Great Pond (Alion, 2008).

2.2.3 Potential Human and Ecological Receptors

2.2.3.1 Demographics

2.2.3.1.0.1 The Investigation Area is located near the towns of Chilmark and West Tisbury, in the southwest portion of Martha's Vineyard, Massachusetts. According to the 2010 Census,

census track 2004 has a population density of 33.6 people per square miles and there are 1,239 housing units within two miles of the investigation area.

2.2.3.2 Potential Receptors

2.2.3.2.0.1 Based upon the historical use and physical characteristics of the Investigation Area, potential media of concern include surface soil, subsurface soil, sediment, and groundwater. Potential receptors include residents, visitors/trespassers, on-site workers, and biota (mammals, fish, soil invertebrates, shellfish, birds, reptiles, insects, and plants). A detailed discussion of potential human and ecological receptors is discussed in Sections 7.3 and 7.4, respectively.

2.2.3.2.0.2 Because access to the Investigation Area is not restricted, impacted soils could present a risk to residents, visitors/trespassers, and biota via direct contact, accidental ingestion, and ingestion of plants that uptake constituents from the soil/sediment. Impacted surface water could present a risk to residents, visitors/trespassers, and biota via direct contact and accidental ingestion. Impacted groundwater could present a risk to residents, site workers, and biota via direct contact and ingestion.

2.2.3.3 Threatened, Endangered, or Special Concern Species

2.2.3.3.0.1 The investigation area has been designated as a Priority Habitat of Rare Species and Estimated Habitats of Rare Wildlife in the Massachussetts Natural Heritage Atlas 13th Edition (effective October 1, 2008). Habitat alteration within areas mapped as Priority Habitats (PH) may result in a take of a state-listed species, and is subject to regulatory review by the Natural Heritage & Endangered Species Program. Priority habitat maps are based on known occurrence of rare species and habitat considerations. The Investigation Area is mapped as PH 15. Based upon coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Massachusetts Natural Heritage and Endangered Species Program; there are approximately 37 federal/state threatened, endangered, and/or special concern species that could be present on Martha's Vineyard (Table 2-1). Table 2-1 is specific to Martha's Vineyard.

Table 2-1. Endangered, Threatened, and Special Concern Species Observed on Martha's Vineyard

Common Name	Scientific Name	State Status	Federal Status
Birds			
Common Tern	*Sterna hirundo*	Special Concern	--
Roseate Tern	*Sterna dougallii*	Endangered	Endangered
Least Tern	*Sterna antillarum*	Special Concern	--
Northern Harrier	*Circus syneus*	Threatened	--
Piping Plover	*Charadrius melodus*	Threatened	Threatened
Reptiles			
Green Sea Turtle	*Chelonia mydas*	Threatened	Threatened
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened
Kemp's ridley Sea Turtle	*Lepidochelys kempi*	Endangered	Endangered
Insects			
Chain dot Geometer	*Cingulia cateraria*	Special Concern	--
Coastal Heathland Cutworm	*Abagrotis nefascia*	Special Concern	--
Gerhard's Underwing Moth	*Catocala Herodias gerhardi*	Special Concern	--
Faded Grey Geometer	*Stenoporpia Polygrammaaria*	Threatened	--
Pine Barrens Zale	*Zale sp 1 nr. lunifera*	Special Concern	--
Pink Sallow Moth	*Psectraglea carnosa*	Special Concern	--
Sandplain Euchaena	*Euchlaena madusaria*	Special Concern	--
Barrens Buckmoth	*Hemileuca maia*	Special Concern	--
Melsheimer's Sack Bearer	*Cicinus Melsheimeri*	Threatened	--
Pine Barrens Lycia	*Lycia ypsilon*	Threatened	--
Coastal Swamp Metarranthis Moth	*Metarranthis pilosaria*	Special Concern	--
Slender Clearwig Sphinx Moth	*Henaris pilosaria*	Special Concern	--
Spartina Borer Moth	*Spartiniphagia inops*	Special Concern	--
Imperial Moth	*Eacles imperialis*	Threatened	--
Barrens Metarranthis Moth	*Metarranthis apiciaria*	Endangered	--
Comet Darner	*Anax longippes*	Special Concern	--
Purple Tiger Beetle	*Cicindela purpurea*	Endangered	--
Northeastern Tiger Beetle	*Cicindela dorsalis*	Endangered	Threatened
Three-Lined Angle Moth	*Digrammia eremiata*	Threatened	--
Plants			
Sandplain gerardia	*Agalinus acuta*	Endangered	Endangered
Bristly Foxtail	*Setaria parviflora*	Special Concern	--
Bushy Rockrose	*Crocanthemum dumosum*	Special Concern	--
Purple Needlegrass	*Aristida purpurascens*	Threatened	--
Sandplain Flax	*Linum intercursum*	Special Concern	--
Saltpond Pennywort	*Hydrocotyle verticellata*	Threatened	--
Pygmyweed	*Tillacea aquatica*	Threatened	--
Sandplain Blue-eyed grass	*Sisinchium fuseatum*	Special Concern	--
Nantucket Shadbush	*Amelanchier nantuckensis*	Special Concern	--
Sea-Breach Knotweed	*Polygonum glaucum*	Special Concern	--

2.2.3.3.0.2 Table 2-2 summarizes the observed species found within the Investigation Area. These include piping plover (Charadrius melodus) a federally threatened species which may utilize beach and nearby upland habitat, and the federally endangered roseate tern (Sterna dougallii) and four federally listed sea turtle species which may utilize nearshore ocean habitat. Sea turtles occur seasonally off the coast of Martha's Vineyard from June through early November of any year. While they may occur near shore off Tisbury Great Pond, they are likely to occur in the offshore MRS only briefly as transients. State listed species include many insect and plant species which may utilize upland coastal sandplain or beach habitat.

Table 2-2. Observed Species within Tisbury Great Pond Investigation Area

Species	Federal Threatened/ Endangered Species?	Massachusetts Threatened/ Endangered Species?	Found Within FUDS MRS?	Found On Martha's Vineyard?	Comment	Reference
Piping plover (Charadrius melodus)	Yes	Yes	Yes	Yes	Two piping plovers were observed by Biodiversity Works during RI fieldwork	Correspondence, Biodiversity Works, April 2011
Roseate Tern (Sterna dougallii)	Yes	Yes	Yes	Yes	MANHESP has recorded nesting of protected tern species along the Tisbury Great Pond barrier beach to the west of Long Point to the western end on the private properties controlled by the Quansoo Beach Association	Personal communication, Tim Simmons, MANHESP 5 (November 2010)
Common Tern (Sterna hirundo)	No	Yes	Yes	Yes	In 2010 a tern colony, Common and Least, were recorded nesting along the beach/dunes of Tisbury Great Pond barrier beach.	Chapter 7.0 Environmental Protection Plan, Final RI Work Plan (November 2010)
Least Tern (Sterna antillarum)	No	Yes	Yes	Yes		
Northeastern beach tiger beetle (Cicindela dorsalis)	Yes	Yes	Yes	Yes	The Northeastern Beach Tiger Beetle (NEBTB) occurs on the sandy beaches, washover areas and blowouts of the Tisbury Great Pond MRS.	Chapter 7.0 Environmental Protection Plan, Final RI Work Plan (November 2010)
Gerardia Sandplain (Agalinus acuta)	Yes	Yes	Yes	Yes	Sandplain gerardia has been located only at the Tisbury Great Pond MRS, east of Long Cove Pond.	USFWS Response Letter, September 27, 2010

2.2.3.3.0.3 The RI field work schedule was developed to avoid nesting seasons/fledgling seasons (spring/summer) as much as possible. From April 4 to April 20, 2011, Biodiversity Works provided monitoring to ensure the RI work was not interfering or encroaching on the protected birds species. Two piping plovers were observed during that time, however, there was no courtship or nesting activity at that time. No other threatened or endangered species were observed within the investigation area.

2.3 Historical Information

2.3.0.1 Between August 1943 and July 1947, the Investigation Area was used as a practice dive bombing and strafing range (Figure 2-2). The site was utilized to support the U.S. Navy's fighter training program at Quonset Point Naval Air Station, Rhode Island and the Naval Auxiliary Air Station, Martha's Vineyard, Massachusetts. During the initial operational period of the range, strafing and masthead targets were constructed to allow student pilots to develop their gunnery and bombing skills. It is believed that military activities ceased at the site by the end of World War II. On 27 March 1947, the site was reinstated for practice bombing use by the carrier fleet based at Newport, Rhode Island. A masthead target was constructed on the barrier beach south of the pond (UXB, 2011). On 29 July 1947, the commander of the 1st Naval District reported that the Tisbury Great Pond Area was excess to the needs of the U.S. Navy and the area was closed, the targets were removed, and the area was decontaminated (Alion, 2008).

2.3.0.2 Military practice ordnance potentially used at Investigation Area include:

- 0.30 and 0.50 caliber ammunition;
- Miniature practice bombs, AN-MK5, MK15, MK21, AN-MK23, and AN-MK43; and,
- Practice 300-lb general purpose bombs(USACE, 1999).

2.3.0.3 Records do not indicate that the property was ever used to store, transport, treat, or dispose of associated munitions used on the property. Following site closure and land transfer, Tisbury Great Pond was developed into a shellfish harvest area (Alion, 2008).

2.4 Previous Investigations

2.4.0.1 Investigations conducted at the Investigation Area prior to the 2011 RI include the following, each of which is detailed below:

- Inventory Project Report (INPR), USACE, 1996;
- Archives Search Report (ASR), USACE, 1997;
- ASR Supplement, USACE, 2004;
- Site Inspection Report, Alion Science and Technolgy (Alion), 2008; and,
- Emergency Response, VRHabilis, LLC (VRH), 2009 to 2011.

2.4.1 Inventory Project Report

2.4.1.0.1 In 1996, the USACE issued an INPR for the Tisbury Great Pond Target Area. The INPR concluded that the property was used as a practice bombing and strafing range. The report stated that only practice bombs were known to be used at the site; including, practice bombs AN-MK23, AN-MK43, MK15, and MK21, and the spotting charge AN-MK4 may have been used with each of these practice munitions. Additionally, small arms including 0.50 caliber wing-mounted munitions were used at the site. Based on the possibility that ordnance may still be present, the property was determined to be eligible for cleanup under the FUDS program. The Findings and Determination of Eligibility for the site established the eligibility of 514 acres as a FUDS. A Military Munitions Response Program (MMRP) project was proposed and the INPR identified a MEC category hazard potential. The INPR assigned a Risk Assessment Code of 2 for the site and recommended further action by USAESH (UXB, 2011).

2.4.2 Archives Search Report

2.4.2.0.1 In 1997, the USACE prepared an ASR that documented a historical records search and site inspection for ordnance and explosives (OE) presence located at Tisbury Great Pond, Martha's Vineyard, Massachusetts. The purpose of this investigation was to characterize the site for potential OE presence to include conventional ammunition and chemical warfare material. The investigation was conducted through the evaluation of historical records, interviews, and on-site visual inspections (USACE, 1999).

2.4.2.0.2 Interviews conducted indicate that no explosions were heard during practice bombings, the flight lines were north to south (Tisbury Great Pond to ocean), and multiple residents found various types of practice bombs in and along Tisbury Great Pond. One of the original landowners, Deloris Bissell Bigelow, requested a cleanup from the Navy of the metal debris on her 11.1 acre property after it was returned (Figure 2-2). A site inspection and historical photographs confirmed the presence of ordnance on 24 acres of land located around the practice bombing and strafing target area. The site inspection team discovered what appeared to be an MK15 series 100-lb sand or water-filled bomb. Additionally, Shellfish Wardens provided a 1992 photograph of items discovered and removed from the pond-side shoreline in this area. Items present in the photographs are AN-MK5 and MK23, 3-lb practice bombs and broken 300-lb general purpose bomb bodies (USACE, 1999). The ASR determined that there was no evidence of chemical warfare storage, usage, or disposal (USACE, 1999).

2.4.3 Archives Search Report Supplement

2.4.3.0.1 In 2004, the USACE prepared an ASR Supplement to combine with the information regarding specific munitions presented in the ASR to generate a list of military munitions types and composition for Tisbury Great Pond. USACE technical documents, manuals, and other resources were used to identify a list of MCs associated with each munitions type. The report indicated that associated MCs includes nitroglycerin (NG), dinitrotoluene (DNT) and breakdown products (2,4-DNT; 2,6-DNT; 2-amino-4,6-DNT; 2-nitrotoluene; 3-nitrotoluene; and 4-nitrotoluene), antimony, copper, iron, lead, nickel, strontium, and zinc (Alion, 2008).

2.4.3.0.2 The ASR Supplement also assigned a Risk Assessment Code (RAC) score to the site. RAC score indicates the level of MEC risk associated with a site, with a score of 1 indicated a site with the highest risk and a score of 5 indicating a site with the lowest risk. Tisbury Great Pond received a score of 2 (Alion, 2008).

2.4.4 Site Inspection Report

2.4.4.0.1 In September 2008, a Site Inspection Report was prepared by Alion to document the site inspection findings at the Tisbury Great Pond. The site inspection was conducted to determine whether further response was necessary at the site. The scope of the investigation was restricted to the evaluation of the presence of MEC or MC related historical use of the property. Activities associated with this investigation included a records review, qualitative site reconnaissance, and environmental sampling (Alion, 2008).

2.4.4.0.2 A qualitative site reconnaissance was conducted on January 29, 2008 on approximately 4.49 acres of land and water. During the reconnaissance, analog geophysics was conducted and visual observations were made. The field sampling approach included magnetometer-assisted reconnaissance following a meandering path in and around sampling locations to confirm the location of the practice bombing and strafing targets and identify whether MEC, MD, or other areas of interest were present. During the reconnaissance, one underwater anomaly was observed in the eastern portion of the pond and one subsurface anomaly was detected. These anomalies were not investigated since they were not visible from the surface (Alion, 2008).

2.4.4.0.3 A qualitative MEC SLERA was also conducted for the Tisbury Great Pond. This assessment was based on results and findings from the site inspection qualitative reconnaissance, the INPR, ASR, and the ASR Supplement. The potential risk posed by MEC was based on three factors, including the presence of a MEC source, accessibility or pathway presence, and potential receptors. Based on the available information, the site was given a low-to-moderate risk (Alion, 2008).

2.4.4.0.4 Finally, MC sampling and risk screening was conducted for the site. MC sampling included six discrete surface soil sample locations, two background surface soil sample locations, one discrete subsurface soil sample location, five sediment sample locations, and two background sediment sample locations. These samples were located on the beach near Long Cove Point, in the vicinity of the practice ranges, and along the shoreline of the pond. The samples were analyzed for associated explosives and metals. The human health screening did not identify any Chemicals of Potential Concern (COPCs) for the environmental media sampled.

Based upon the SLERA, antimony and lead in surface soil and strontium in surface water were identified as Chemicals of Potential Ecological Concern (COPECs). Only antimony and lead in surface soil were determined to be present at potentially unacceptable risks to ecological receptors. The Site Inspection established a MRS boundary and recommended an RI/FS (Alion, 2008).

2.4.5 Emergency Response

2.4.5.0.1 Between 19 August 2009 and 13 July 2011, VRH/Navy EOD responded to emergency calls associated with potential ordnance. The details of the emergency responses and number of items found are presented in Table 2-2.

Table 2-3. Tisbury Great Pond Investigation Area Emergency Response Activities

Date	Location	Quantity	Ordnance Description	Response Action
19-08-2009	Long Point	1	Ordnance item at the West Tisbury Great Pond "cut." Nose fuse was visible, but the rest of the item was indiscernable. Determined to be potentially hazardous.	Navy EOD destroyed the item by counter charging. Navy EOD reported that item was a high explosive round.*
20-08-2009	Long Point	1	Ordnance item at the West Tisbury Great Pond "cut."	Due to high tide and strong currents, debris was left in place.
23-02-2011	Tisbury Great Pond	3	Metal debris found in the vicinity of the cut. Determined to be munitions debris with no explosive hazard.	Removed and placed in a secure container in Edgartown.
24-02-2011	Tisbury Great Pond	3	Metal debris found in the vicinity of the cut. Determined to be munitions debris with no explosive hazard.	Removed and placed in a secure container in Edgartown.
26-02-2011	Tisbury Great Pond	2	Metal debris found in the vicinity of the cut. Determined to be munitions debris with no explosive hazard.	Removed and placed in a secure container in Edgartown.
13-7-2011	Long Point	6	Metal debris found on the beach. Two of the items were clearly ordnance debris. No explosive hazard related to the items.	The debris was removed and disposed.

Notes:
EOD – Explosives Ordnance Disposal
* Due to the mission of the EOD to render items safe by detonation (as opposed to perforating the items to first determine whether the items contain explosives) coupled with the large amount of explosives used by the EOD team, USACE has concluded that is highly unlikely and extremely difficult to determine if an item was MD or MEC after detonation.

3.0 PROJECT REMEDIAL RESPONSE OBJECTIVES

3.0.1 This section discusses the results of the TPP Process, used to identify project objectives, assist in the data collection design, and guide the project ensuring effective and efficient progress. The TPP Process is a systematic process that involves four phases of planning activities designed to accelerate progress to site closeout within all project constraints. Phase I activities bring together a TPP team to identify the current project and to document both short-and long-term project objectives through completion of all work at a site (site closeout). Phase II efforts involve an evaluation to determine if additional data are needed to satisfy the project objectives. The data need requirements for the additional data are then identified during the balance of Phase II efforts. Phase III activities involve identifying the appropriate sampling and analysis methods for the data needed. During Phase IV, the TPP team finalizes a data collection program that best meets the short- and long-term project needs. The following TPP meetings were held at the Edgartown Town Hall:

- TPP Meeting #1 (24 March 2010);
- TPP Meeting #2 (14 October 2010);
- TPP Meeting #3 (16 June 2011); and,
- TPP Meeting #4 (5 September 2012).

3.0.2 During the TPP process, stakeholders provided input which resulted in the development of a CSM, preliminary remediation goals, the identification of potential applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) information, development of an Institutional Analysis, and determination of data needs and data quality objectives (DQOs) of the investigation. The TPP team consisted of:

- USAESCH;
- CENAE;
- UXB;
- AMEC Environment & Infrastructure, Inc. (AMEC) (subcontractor);
- VRH (subcontractor);
- Aqua Survey, Inc. (subcontractor);
- MassDEP;
- Massachusetts Department of Conservation and Recreation (MADCR);
- U.S. Environmental Protection Agency (USEPA);
- TTOR; and,
- Town of Edgartown.

3.1 Conceptual Site Model and Project Approach

3.1.0.1 Evaluation of the site history, potential contaminant sources, environmental setting, and current and future land use have led to the development of a CSM, the major components of which have been summarized in Table 3-1. A discussion of the sources, release mechanisms, fate and transport processes as well as the pathway exposure analysis are discussed below.

3.1.1 Sources

<u>MEC</u>

3.1.1.0.1 Items containing explosives/pyrotechnics potentially used at the Investigation Area include the spotting charges MK4 (used in the AN-MK5, AN-MK23, and AN-MK43 practice bombs) and MK7 (used in the MK15 practice bombs). The MK4 spotting charge contained smokeless powder/red phosphorus, while the MK7 contained 1 lb of black powder. Aircraft flares were used to provide illumination and contained black powder and a pyrotechnics mixture to create the illuminating flare. Due to the construction of the pyrotechnic signals in the practice bombs (cardboard and thin metal), the pyrotechnic constituents are expected to have already been released and no longer present in the environment at detectable levels (USACE, 2009a). However, during the TPP Process, it was determined that explosives would be analyzed in all samples to identify the presence or absence of explosives constituents in environmental media.

<u>MCs</u>

3.1.1.0.2 MCs associated with ordnance potentially used at the Investigation Area include metals used to construct ammunition casings, bullets, and bomb casings as well as explosives compounds that were utilized to make spotting charges. The practice bomb casings were comprised of varying materials ranging from zinc alloy (AN-MK5), sheet steel (AN-MK15 and AN-MK21), cast iron (AN-MK23) and lead-antimony alloy (AN-MK43). The MK4 (used in the AN-MK5, AN-MK23, and AN-MK43 practice bombs) and MK6 (used in the MK15 practice bombs) spotting charges were composed of explosives/pyrotechnic mixtures. The MK4 spotting charge contained smokeless powder/red phosphorus, while the MK6 contained 2 lbs of black powder. However, according to the Site Inspection Report, constituents of black powder are not expected to persist in the environment above background concentrations for a significant period of time after the initial release.

3.1.1.0.3 Generally, 0.30 and 0.50 caliber ammunition consists of a brass casing (70 percent copper and 30 percent zinc) that contains the primer and propellant and holds in place a bullet/projectile composed of a lead-antimony alloy. The cartridges are loaded with varying amounts of propellant, which are either single-base or double-base propellants. Single base propellants within these munitions are primarily composed of nitrocellulose (NC) and 2,4-DNT, while double-base propellants are composed primarily of NC and NG.

Table 3-1. Evaluating Existing Data
Preliminary Conceptual Site Model Summary

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Facility Description: • Approximately 768 acres. [1] • Located in the southwest portion of Martha's Vineyard, Massachusetts, which is bound to the south by the Atlantic Ocean and to the north, east, and west by privately and publicly owned land. • No permanent structures were constructed by the U.S. Navy at the site. [2] **Site History:** • Between August 1943 and July 1947, the site served as a practice dive bombing and strafing range in support of the fighter training program [2]. • Records do not indicate that the property was ever used to store, transport, treat, or dispose of the associated munitions used on property [2]. **Munitions Potentially Used:** • 0.30 and 0.50 caliber ammunition; • Miniture practice bombs, AN-MK 5, 15, 21, 23, and 43; • Spotting charges may have been used with the practice bombs (AN-MK 4, 6 or 7).	**Site Characteristics:** • Approximately 146acres of land • Approximately 62 acres of beach • Approximately 508 acres of inland water • Approximately 52 acres of ocean [1] **Topography:** • Relatively flat with sand dunes. • Elevations within beach area ranges from approximately 0 to 22 ft above msl. • Elevations within land areas range from approximately 1 to 21 ft above msl. **Vegetation:** • Predominately low grass vegetation and areas of barren beaches. The northern portion of the site is covered with trees and shrubs [2]. **Surface Water:** • Tisbury Great Pond is a salt-water pond that fills during the winter storms. Each spring a natural channel, located on the western end of the sand spit, which divides the pond from the Atlantic Ocean, is reopened. This action allows 3 to 4 feet of water to drain back to the ocean. **Soils:** • Predominately medium to fine grained sand with trace quantities of silt and have high permeability. Soils adjacent to the Tisbury Great Pond contain larger amounts of fine sediments and high organic material content and have low er permeability [2]. • The thickness of the soil ranges from 0 to greater than 10 ft [2]. **Geology:** • Glacial deposits consisting of recent beach and marsh sediments, glacial deposits, interglacial deposits, and glacially deformed ancient coastal plain sediments [2]. • Bedrock is encountered at approximately 500 ft bgs and is comprised of metamorphic and igneous rocks [2]. **Hydrogeology:** • In the northern portion of the site, groundwater is encountered at approximately 5 to 15 ft bgs. Goundwater at other portions of the site is encountered at approximately 1 to 2 ft bgs [2]. • The shallow freshwater aquifer is underlain by brackish groundwater that is unsuitable for human consumption [2]. • Groundwater empties into Tisbury Great Pond [2]. **Meteorology:** • Average Annual Rainfall = 46 inches per year. [2]	**Contaminants of Potential Concern:** • Antimony, copper, lead, nickel, zinc, and explosives. • Munitions and explosives of concern (MEC) is a concern due to spotting charges within the practice bombs used at the Investigation Area. **Media of Potential Concern:** • Surface soil, subsurface soil, sediment, and groundwater. **Confirmed Munitions Debris Locations:** • Since military use of the Investigation Area ceased, numerous reports of practice bombs (MK5, MK-15, MK21, MK23, and MK43) have been reported by local residents, wildlife refuge officials, and USACE personnel. **MC Sampling:** • During the 2008 SI, environmental samples were collected and analyzed for explosives and metals. Positive results summarized below. Soil: – All six metals (antimony, copper, lead, nickel, strontium, and zinc) detected above background but below residential and industrial screening levels. – Antimony and lead exceeded eco-SSLs in four of six soil samples. Sediment: – All six metals detected above background but below screening values. Surface Water: – Nickel and strontium detected in all three samples, but below human health screening values. – Strontium exceeded eco-SSLs in all three samples [2]. **Potential Pathways:** • Ordnances located within the Tisbury Great Pond may be subject to transport when the barrier sand dune is breached to allow salt water to enter the pond. • MEC items are transported by various physical factors/transport processes that include: ocean currents; natural erosion of soil by wind and water exposing buried MEC items; and, relocation or removal by the public. • Munitions constituents from items dropped on upland soils at the site would most likely leach through the soil into groundwater. • Munitions constituents from items dropped in marshes would most likely be adsorbed to the organic matter that is characteristic of soils in these areas. However, more soluble constituents could migrate within surface water into adjacent surface water bodies. • Munitions constituents within the pond could adsorb to sediment at the bottom of the pond or dissolve into solution.	**Current Landowners:** • The Trustees of Reservations (TTOR), the Commonwealth of Massachusetts (inland and coastal waters), and private landowners [2]. **Current Land Use:** • After military use of the property ended, Tisbury Great Pond was developed into a shellfish harvest area [2]. • The Great Pond is a designated Commonwealth of Massachusetts shellfish fisheries area and is actively harvested for oysters, clams, and fish [2]. • A portion of the site encompasses the Long Pond Wildlife Refuge [2]. • Private landowners own small portions of the property for residential use [2]. **Future Land Use:** • The land use is not expected to change in the future [2]. **Resource Identification:** • There are approximately 12 public water supply wells within four miles of the Tisbury Great Pond [2]. • Estuarine marine wetlands including marine intertidal regularly flooded wetlands, irregularly flooded wetlands, and emergent wetlands are present at the site [2]. • The site is located within the Massachusetts Coastal Zone and the Long Point Wildlife Refuge [2]. **Potential Receptors:** • Residents, recreation users, on-site workers, and biota[2].	**Property Description:** • The impact area of the site consists of inland water, adjacent marshes, a small strip of beach, and the Atlantic Ocean. • Present land use includes recreational use with moderate to high disturbance due to the breaching of the barrier sand dune. **Potential Ecological Receptors:** • Inland and marine plant species, fish, birds, insects, soil invertebrates, and mammals that inhabit or migrate through the site. Associated threatened and endangered species are included. **Threatened and Endangered Species:** • There are approximately 37 federal/state threatened, endangered, and/or special concern species that could be present at the site. [1] **Relationship of MEC/MD to Habitat:** • MEC/MD items may be located within and/or adjacent to habitat areas.

Notes:
[1] UXB International, Inc., 2011. *Final Revision 1, Remedial Investigation Work Plan, Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts*. January.
[2] Alion Science and Technology, 2008. *Final Site Inspection Report for Tisbury Great Pond*. September.

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3.1.2 Release Mechanisms

3.1.2.0.1 Practice bombs used at the site have been identified within the Investigation Area. From these locations, ordnance would be exposed to weathering/corrosion processes, which could lead to the release of MCs into the environment.

3.1.3 Fate and Transport Processes

<u>MEC and MD</u>

3.1.3.0.1 The ultimate fate of MEC and MD items at the site is governed by various physical factors/transport processes. Natural erosion over time of soil by wind or by water can result in the exposure of buried MEC or MD by the removal of the overlying soil.

3.1.3.0.2 Historically, the target area was located at the land/beach interface. At this location, items containing MEC or MD are subject to ocean currents that likely facilitated the movement of these items out to sea or horizontally along the beach. As discussed in Section 2.2.2.7, every spring a channel is reopened on the beach south of Tisbury Great Pond. This channel allows water from the pond and the Atlantic Ocean to mix. The reopening of the channel results in erosion of the beach around the cut and movement of sediment at the bottom of the pond, which in turn results in the uncovering and/or movement of potential MEC items.

3.1.3.0.3 In addition, because the area surrounding Tisbury Great Pond is used by residents and recreational users, movement of practice ordnance by the public is a concern.

<u>MCs</u>

3.1.3.0.4 MCs were evaluated in the RI and are discussed in Section 6.0.

3.1.4 Exposure Pathway Analysis

<u>MEC</u>

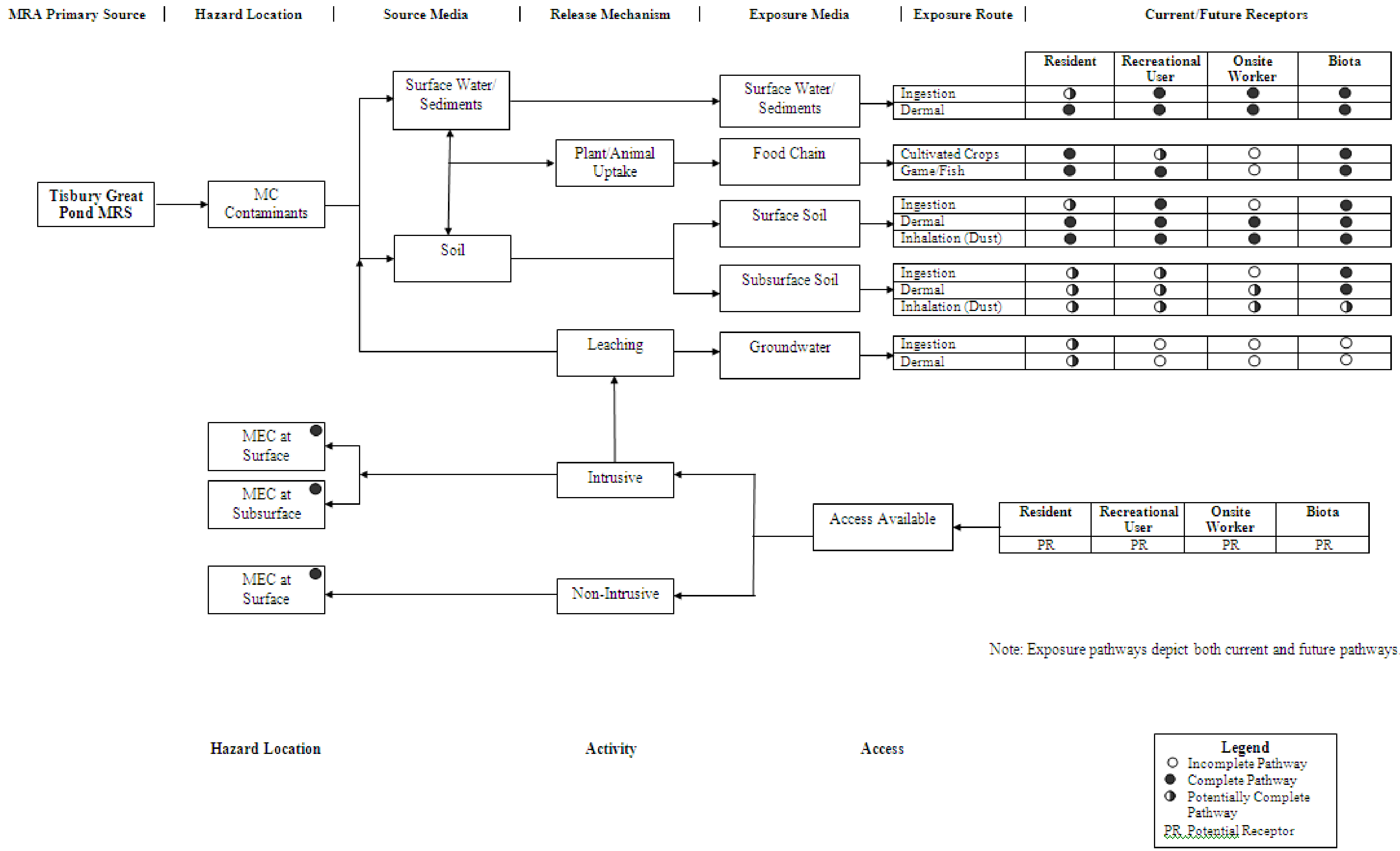
3.1.4.0.1 Exposure to MEC via surface and subsurface soil were evaluated and summarized on Figure 3-1. Based upon the exposure analysis, potential receptors for MEC include residents, recreational users, on-site workers, and biota.

<u>MCs</u>

3.1.4.0.2 Exposure to MCs via surface soil, subsurface soil, sediment, surface water, groundwater, and the food chain were evaluated and the results are summarized on Figure 3-1.

3.1.4.0.3 The surface soil exposure pathway was evaluated for potential receptors through the ingestion, dermal contact, and inhalation exposure routes. Exposure of MCs through ingestion of surface soil is considered complete for recreational users and biota, potentially complete for residents, and incomplete for on-site workers. Exposure through dermal contact and inhalation is considered complete for all receptors.

Figure 3-1. Conceptual Site Model Summary



3.1.4.0.4 The subsurface soil exposure pathway was evaluated for potential receptors through the ingestion, dermal contact, and inhalation exposure routes. Exposure of MCs through ingestion of subsurface soil is considered complete for biota, potentially complete for residents and recreational users, and incomplete for on-site workers. Exposure through dermal contact is considered complete for biota and potentially complete for residents, recreational users, and on-site workers. Exposure through inhalation is considered potentially complete for all receptors.

3.1.4.0.5 The surface water/sediment exposure pathway was evaluated for potential receptors through the ingestion and dermal contact exposure routes. Exposure of MCs through ingestion of sediment/surface water is considered complete for recreational users, on-site workers, and biota; and considered potentially complete for residents. Exposure through dermal contact is considered complete for all receptors.

3.1.4.0.6 The groundwater exposure pathway was evaluated for potential receptors through the ingestion and dermal contact exposure pathway. Exposure of MCs through these pathways was considered potentially complete for residents and incomplete for all other receptors.

3.1.4.0.7 The food chain exposure pathway was evaluated for potential receptors through the consumption of cultivated crops and game/fish exposure routes. Exposure of MCs through consumption of cultivated crops is considered complete for residents and biota, potentially complete for recreational users, and incomplete for on-site workers. Exposure through consumption of game/fish is considered complete for residents, recreational users, and biota; and considered incomplete for on-site workers.

3.2 Preliminary Remediation Goals

3.2.0.1 Preliminary Remediation Goals were developed for MEC, materials potentially presenting an explosive hazard (MPPEH), and associated MCs. For MEC and MPPEH, the Preliminary Remediation Goals include characterizing the nature and extent of these items and reducing the associated risks. To meet these Preliminary Remediation Goals, a geophysical survey and visual inspection were conducted to identify MEC, MPPEH, and MD items as well as subsurface anomalies. Once anomalies were identified, an intrusive investigation was conducted on all anomalies that met or exceeded selection criteria for MEC. To confirm/mitigate the risk associated with MEC, the MPPEH items were vented and perforated.

3.2.0.2 The Preliminary Remediation Goals for MCs are the screening criterion identified during the TPP process to be protective of human health and ecological receptors. If environmental media containing MCs above the screening criterion are identified, a risk assessment shall be conducted to determine if additional action is necessary to mitigate risks to human health and the environment. To evaluate relevant MCs, environmental media (soil, groundwater, and sediment) were sampled and analyzed for MCs potentially released at the site.

Additionally, a HHRA and SLERA were conducted to determine if any MCs required additional assessment. Constituents exceeding the applicable regulatory criterion, were further evaluated in a baseline HHRA following the USEPA risk assessment guidance (USEPA, 1989) and an SLERA in accordance with current guidance including the 2001 USEPA Supplemental Guidance to Risk Assessment Guide for Superfund (RAGS), Ecological RAGS (USEPA, 1997), and the Massachusetts Method 3 Risk Characterization methodology under the Massachusetts Contingency Plan (MCP) (MADEP, 1996). Applicable screening criteria are provided in Table 3-2.

Table 3-2. Human Health and Ecological Screening Criterion, TGP Investigation Area

Media of Concern	Screening Criterion	
	Human Health	Ecological
Soil	Criteria for human health were identified as the lower of: 1. USEPA Residential Risk Screening Level 2. MADEP Method 1 Soil Standard (S1 value selected as most stringent)	Criteria for ecological were identified as the USEPA EcoSSL[1] (lowest of avian, mammalian, plant, or invertebrate)
Sediment	not available	Criteria for ecological endpoints identified as lower of: 1. Region 5 Ecological Screening Level 2. Region 3 Freshwater Screening benchmark 3. MADEP Freshwater Sediment Screening benchmarks 4. Region 6 Toxicity Reference Values 5. Los Alamos National Laboratory ECORISK Database 2.5 6. 1,3-nitrobenzene (surrogate for 1,2-isomer Region 4 ESV[2])
Ground-water	Criteria for human health were identified as the lower of: 1. USEPA Maximum Contaminant Level 2. USEPA Regional Screening Level 3. MADEP Method 1 Groundwater Standards	not available

Notes: [1]EcoSSL - Ecological Soil Screening Level [2]ESV – Ecological Screening Value

3.3 Identification of Potential ARARs

3.3.0.1 A list of potential ARARs [in accordance with 40 Code of Federal Regulations (CFR) §300.415(j)] and TBC information were identified.

3.3.0.2 The following five criteria that must be met for a standard, requirement, criteria, or limitation to be considered an ARAR:

1. The requirement must be promulgated;
2. The requirement must be related to a Federal/State environmental law or state siting law;
3. The requirement must be substantive;
4. The requirement must be a cleanup standard, standard of control, or requirement that specifically addresses a CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location; and,
5. The requirement must be applicable or relevant and appropriate.

3.3.0.3 Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may; however, be useful and are TBC. TBC requirements (40 CFR §300.400[g][3]) complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

3.3.0.4 A list of the potential federal and state ARARs for activities at the Investigation Area are provided in Table 3-3.

Table 3-3. List of Potential ARARs, Tisbury Great Pond Investigation Area

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Federal Requirements			
Federal Endangered Species Regulations	16 U.S.C. §1538(a)(1)	With respect to any endangered species of fish or wildlife listed pursuant to Section 1533 of Title 16, it is unlawful for any person subject to the jurisdiction of the U.S. to take any such species within the U.S. or the territorial sea of the U.S.	Appropriate for any future response actions that may impact listed species
Resource Conservation and Recovery Act, Miscellaneous Units	40 CFR 264.601, 264.602, 264.603	Establishes requirements under RCRA 40 CFR 264 subpart X applicable to operators of open burning/open detonation of explosive waste, including military munitions/explosive wastes. Specifically, 40 CFR 264.601, 264.602, and 264.603 require that miscellaneous units be located, designed, constructed, operated, maintained, monitored and closed in a manner that will ensure protection of human health and the environment. Only substantive portions are appropriate.	Appropriate for any future remedial alternatives that address MEC disposal using technologies or disposal means classified as "miscellaneous units" under Subpart X, including consolidated detonation areas.

Notes: RCRA – Resource Conservation and Recovery Act CFR – Code of Federal Regulation U.S.C – United Stated Code

3.4 Summary of Institutional Analysis

3.4.0.1 The objective of this analysis is to gather background information and document which stakeholders have jurisdiction over the subject property and to assess the capability and willingness of these entities to assert institutional controls protecting the public from potential explosive hazards present at the site. An Institutional Analysis Report will be developed and presented in the FS.

3.5 Data Needs and Data Quality Objectives

3.5.0.1 The following sections discuss the data needs previously identified for the Investigation Area and the DQOs developed to ensure that these data needs were met. The data needs and project objectives for this RI were discussed and agreed upon by the TPP Team.

3.5.1 Data Needs

3.5.1.0.1 An evaluation of existing data was conducted to determine the data needs and the methods required to fulfill those needs. The evaluation results are presented in Section 3.1, *Conceptual Site Model and Project Approach,* which confirms the use and presence of military ordnance at the site. Data needs identified during the TPP process included:

- Characterizing potential release points for MCs present within environmental media;
- Identifying MCs within environmental media;
- Characterizing the nature and extent of MEC and MCs; and,
- Collecting adequate data to define the potential risks associated with MEC and MCs present.

3.5.1.0.2 During the TPP process, the TPP team agreed to the following investigation requirements necessary to fill the identified data gaps at Tisbury Great Pond.

<u>TPP Meeting #1</u>

- The following areas were identified to be investigated at each site.
  - Land
    - Analog transects (magnetometer/all-metals detector), DGM grids
    - Anomaly Investigation
    - MC Sampling (soil)
  - Beach
    - DGM transects (EM61 Towed array) and DGM grids
    - Anomaly investigation
  - Inland Water
    - DGM transects (underwater EM61) and DGM grids
    - Underwater Anomaly Investigation
    - MC Sampling (Sediment and Surface Water)
  - Ocean
    - Analog transects (magnetometer) and analog grids
    - Underwater anomaly investigation
- Collect biased, discrete samples for surface and subsurface soil.
- Analyze explosives and a limited list of inorganics associated with munitions used.
- Compare analytical results to USEPA Regional Screening Levels (RSLs) (USEPA, December, 2009) or MADEP delineation criteria, whichever is more stringent.

<u>TPP Meeting #2</u>

- Conduct aerial geophysics for the Investigation Area.
- Conduct blind seeding on grids only. Conduct blind seeding on all water except ocean.

<u>TPP Meeting #3</u>

- Collect a discrete surface/subsurface soil sample where one MK23 was found on land.
- Collect sediment samples in areas where MEC/MD have been identified.

Follow-up Conference Call to TPP Meeting #3

- Implement a phased approach to groundwater sampling. Initially, four grab samples will be collected using Small Diameter Driven Well (SDDW) technology approved by MADEP. Background samples will be collected if results indicate groundwater concentrations exceed human health screening criterion. A total of 3 samples will be collected. They will be filtered in the field using a 0.45 micron filter and analyzed for explosives and inorganics related to the MCs used at the site. One sample will be collected in the vicinity of the MEC item identified during the geophysical and intrusive investigation, and the remainder will be collected in the vicinity two residential wells.
- Sediment samples will be collected within the biologically active zone (0 to 6 in.) using a grab (e.g., ponar) dredge and/or vibracore. A total of seven samples will be collected within this area:
  - Four samples evenly spaced along the southern portion of Tisbury Great Pond nearest to the historic target (spaced approximately 800 to 1,000 ft apart);
  - Two samples in areas of identified MEC and MD (Northern Portion and Southeast portion of Tisbury Great Pond); and
  - One sample along the western portion near shellfish beds.
- Background sediment samples will be collected in the northern fingers of Tisbury Great Pond will be collected if sediment samples exceed ecological screening criteria.
- Shellfish sampling mayl be conducted if ecological screening criteria listed are exceeded.
- Background samples will be collected if soil sample concentrations exceed the human health screening criteria listed on Worksheet # 15 of the UFP-QAPP (UXB, 2011).

3.5.2 Data Quality Objectives

3.5.2.0.1 DQOs are outputs derived from the seven-step DQO process that are used to guide environmental data collection activities (USEPA, 2000). This process provides a systematic approach for defining the criteria that a data collection design should satisfy. DQOs are qualitative and quantitative statements that define the purpose of the investigation, what the data collected should represent to satisfy the objectives of the investigation, and specify the quality of data required to support decisions made during the investigation. The overall project objectives with respect to data quality are to obtain data that are technically sound and legally defensible. This is accomplished through the proper implementation of field sampling and surveying procedures, field logs and chain of custody (CoC) documentation, controlled laboratory analysis, and validation of the reported data prior to their use. A discussion of the DQOs for each investigation element performed during this RI is provided in the following subsections.

3.5.2.1 Geophysical Investigation

3.5.2.1.0.1 The overall objective of the geophysical investigation is to define the nature and extent of MEC. To ensure that the activities conducted during the geophysical investigation satisfy this objective, the following geophysical DQOs were developed.

3.5.2.1.0.2 **DQO 1 – The MEC footprint will be defined such that a representative boundary of MEC contamination is discerned.**

3.5.2.1.0.3 The extent of MEC at the Investigation Area was defined through the collection of geophysical data (analog and digital) within land, beach, inland water, and ocean areas.

3.5.2.1.0.4 **DQO 2 – The total geophysical acreage surveyed should be a minimum of 0.75 percent of the total MRS, or Investigation Area, acreage for a statistically valid survey to result.**

3.5.2.1.0.5 The total acreage surveyed on land, beach, inland water and ocean is 14.82 acres, or 1.9 percent of the total acreage (768 acres) of the Investigation Area. The total area surveyed with the Airborne Magnetic Vertical Gradiometer system was~ 590 acres.

3.5.2.1.0.6 **DQO 3 – The coordinates obtained from the positioning system will be of sufficient accuracy to allow for appropriate relocation of MEC items for intrusive investigation.**

3.5.2.1.0.7 This DQO was achieved by collecting data with the real time kinematic (RTK) global positioning system (GPS) system over a known point. All collected data was within the required 4 in. [10 centimeters (cm)] tolerance.

3.5.2.1.0.8 **DQO 4 – Have sufficient data collected along each line to detect munitions items.**

3.5.2.1.0.9 This DQO was achieved by calculating the percentage of sequential data points separated by more than 25 cm to ensure that the number of readings that fell outside did not exceed 25 cm.

3.5.2.1.0.10 **DQO 5 – Maintain appropriate lane spacing to provide greater than 90 percent coverage at project line spacing (2.5 ft).**

3.5.2.1.0.11 This DQO was achieved by evaluating the collected data through the generation of footprint coverage maps.

3.5.2.1.0.12 **DQO 6 – Anomaly characteristics (peak response and downline width) will be repeatable to greater than or equal to 65 percent of expected minimum value.**

3.5.2.1.0.13 This DQO was achieved by comparing the test item coordinates and response in the instrument verification strip (IVS) against the initial day's results.

3.5.2.1.0.14 **DQO 7 – Anomaly characteristics (peak response and downline width) will be repeatable within 0.73 meters (m) of original location for data positioned with GPS and 0.88 m of the original location.**

3.5.2.1.0.15 This DQO was achieved by comparing the DGM selected target location to the intrusive dig location.

3.5.2.1.0.16 **DQO 8 – The DGM system will respond consistently from the beginning to the end of an operation.**

3.5.2.1.0.17 This DQO was achieved by evaluating the static test results to ensure that the static response did not exceed +/-10 percent after background correction.

3.5.2.2 Munitions and Explosives of Concern Intrusive Investigation

3.5.2.2.0.1 The DQOs for MEC intrusive investigation activities performed and a summary of how each of these DQOs were accomplished are provided below.

3.5.2.2.0.2 **DQO 1 – MEC will be uniquely identified as to type, condition, orientation, etc.**

3.5.2.2.0.3 This DQO was achieved by conducting Mag and Dig operations with the ocean and intrusive investigations within 45 grids, resulting in the identification and recovery of 6 MEC items.

3.5.2.3 Munitions Constituents Investigation

3.5.2.3.0.1 The DQOs for MC field investigation activities performed and a summary of how each of these DQOs were accomplished are provided below.

3.5.2.3.0.2 **DQO 1 – Field and Analytical performance/acceptance criteria per method as detailed in the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 and defined on Worksheet #12 in the approved RI Work Plan (UXB, 2011).**

3.5.2.3.0.3 All data was collected and analyzed in accordance with the procedures, methods, and performance/acceptance criteria detailed in the DoD Quality Systems Manual (QSM) Version 4.2 and defined in Worksheet #12 of the UFP-QAPP in the approved RI Work Plan (UXB, 2011).

3.5.2.3.0.4 **DQO 2 – The quantity and location of samples is acceptable when nature and extent is determined using the Decision Rules identified in Worksheet #12, Step 5, in the approved RI Work Plan (UXB, 2011).**

3.5.2.3.0.5 This objective was achieved by conducting incremental and discrete soil sampling as well as groundwater sampling within the Investigation Area in accordance with the approved RI Work Plan (UXB, 2011). These samples were analyzed by the contracted laboratory by

Method 8321B for the target explosives including NG, DNT and breakdown products (2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, and 4-nitrotoluene), and select metals (antimony, copper, iron, lead, nickel, and zinc) using Method 6020A. Based upon the results of initial soil and groundwater sampling, decision rules contained within Step 5 were satisfied.

3.5.2.3.0.6 **DQO 3 – SW 846 Methods will provide an acceptable detection limit and accuracy for use in decisions related to attaining cleanup goals.**

3.5.2.3.0.7 Analytical data were analyzed using analytical methods listed in the UFP-QAPP, provided in the RI Work Plan (UXB, 2011).

3.5.2.3.0.8 **DQO 4 – The laboratory will review and apply usability qualifiers to the analytical data.**

3.5.2.3.0.9 The scope of work defined for the contracted laboratory includes data review and the use of usability qualifiers for all analytical results, where applicable.

3.5.2.3.0.10 **DQO 5 – All data will be verified using the Automated Data Review (ADR) software tool.**

3.5.2.3.0.11 All analytical data was verified using ADR software by USAESCH.

3.5.2.3.0.12 **DQO 6 – A data validation will be conducted on 100 percent of the analytical data by an experienced chemist to assess the data usability. The data usability will then be evaluated by the appropriate agencies for final approval.**

3.5.2.3.0.13 Data validation was performed on 100 percent of the analytical data by a qualified chemist.

4.0 CHARACTERIZATION OF MEC AND MCs

4.0.1 The objective of this RI was to collect data necessary to determine the nature and extent of MEC and MCs; evaluate the potential risks to human health and the environment; and support the development of a FS to evaluate future response actions, if necessary. To achieve these objectives, various field investigative activities were conducted; including, geophysical surveying of land, beach, and ocean waters; intrusive investigations of anomalies; and environmental sampling of soil and groundwater for analysis of MCs. This section presents a summary of the field activities conducted during this RI.

4.1 Site Preparation

4.1.0.1 Prior to MEC and MC characterization activities, several preparation activities were conducted including a utility clearance and vegetation/brush clearing. A utility clearance was conducted at proposed drilling locations to ensure no impacts to underground utilities would result from drilling activities. Initially, vegetation was cleared as necessary to allow access for personnel and equipment during the geophysical investigation. While performing brush clearing activities, sensitive ecosystems and endangered/protected plant species were avoided in accordance with the Environmental Protection Plan (EPP) (UXB, 2011).

4.1.0.2 Before field activities began, field personnel were briefed on health and safety issues and the need for avoiding sensitive biological and cultural resources based on the EPP (UXB, 2011). An EPP field manual, providing a brief description/picture of protected animal and plant species, was prepared in collaboration with the CENAE Environmental Specialist and personnel were trained on its use as part of site-specific training. The EPP field manual was provided to all field personnel and consulted as needed. It should be noted that no rare species or cultural resources were encountered during the field effort.

4.2 MEC Characterization

4.2.0.1 This section details the approach, methods, and operational procedures used during MEC characterization activities. The overall goal of MEC characterization activities was to delineate the nature and extent of MEC within the Investigation Area. To accomplish this goal, characterization activities were conducted in a phased approach that included:

- Collection of geophysical data via instrument-aided reconnaissance and DGM;
- Data processing and interpretation;
- Dig sheet development; and,
- Intrusive investigation.

4.2.0.2 A project sequence overview is presented in Figure 4-1 to understand the chronology of activities conducted at the Investigation Area.

4.2.0.3 Field activities were managed from a rented house in Edgartown, Massachusetts, which was used as the field office and the central command post during investigation activities. The field office was used as a location to store equipment and supplies, health and safety records, material safety data sheets, site maps, and project documents as well as park vehicles necessary to complete the field investigation.

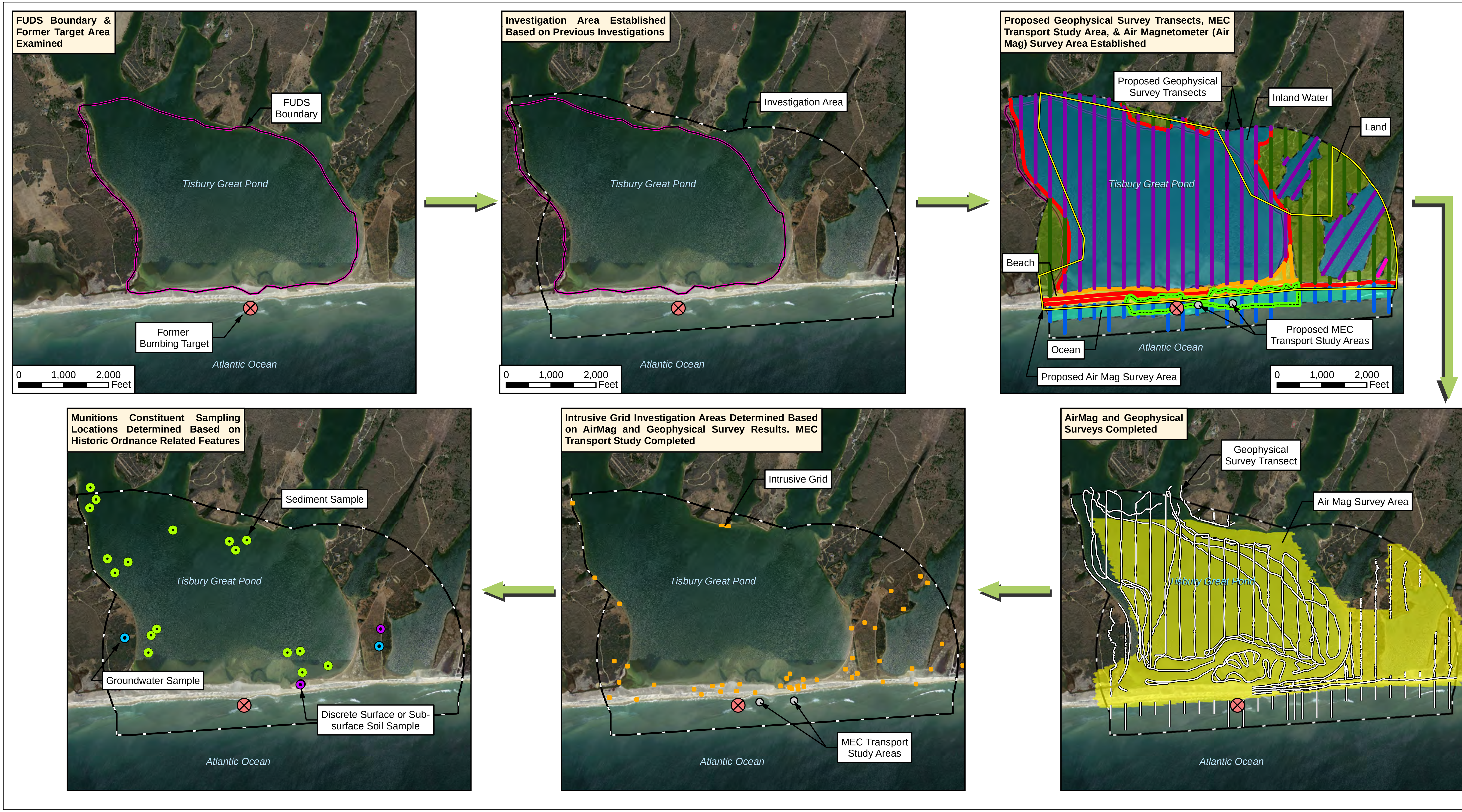
4.2.1 Geophysical Investigation

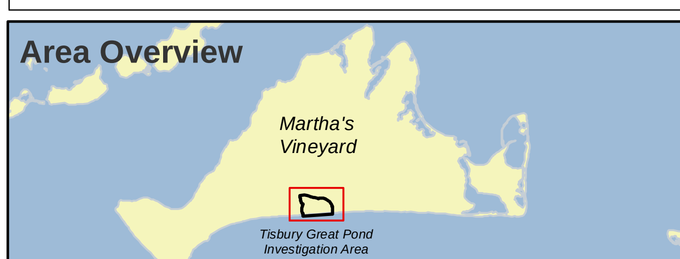
4.2.1.1 A geophysical investigation was conducted to delineate the nature and extent of surface and subsurface metal debris by measuring variations (anomalies) in both local magnetic and electromagnetic fields. Geophysical surveying was conducted during two phases of work. During the first phase, geophysical data was collected along linear, reconnaissance transects located throughout the Investigation Area, and supplemented with an AirMag survey. During the second phase, the nature of the anomaly source was investigated by either DGM over selected grids and intrusively investigating all anomalies that met or exceeded selection criteria for MEC within the grids, or reacquiring and intrusively investigating anomalies located along transects investigated during the first phase. Based upon data collected during these two phases of work, it was determined that additional investigation of the areas along the dunes east of the "cut" was warranted as large anomalies were detected by AirMag and MD items continued to be identified within the dune/beach area after each cut was made. Since the cuts have moved from west to east, the area east of the cut was the most likely potential source of MEC/MD.

4.2.1.2 Prior to conducting the geophysical survey, the Investigation Area was subdivided into three sub-area types according to sub-area geomorphology, which are listed and defined below.

- Beach – the land immediately adjacent to either marine or fresh water;
- Land – all land excluding beaches and dunes;
- Inland Water – protected marine or fresh water environments, such as coves or ponds; and,
- Ocean – those waters directly associated with the Atlantic Ocean, Vineyard Sound or Nantucket Sound.

4.2.1.3 The geophysical investigation was designed such that the type of geophysical methods and instrumentation proposed were appropriately matched to the unique character of the sub-area. Analog magnetometry transects were completed in land and ocean areas, and beach areas were investigated using digital EM methods and instrumentation as summarized in Table 4-1.





US Army Corps of Engineers

FIGURE 4-1

Project Sequence Overview -
Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

N

- SCALE AS SHOWN -

UXB amec

NOTES: 2009 Aerial Data Source: Mass GIS

02/07/2014	Rev:	CPoge_Dec_Logic_Flowcht_Remedial_Inv_Rpt.mxd
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Table 4-1. Analog, DGM Transect, and Grid Coverage
Tisbury Great Pond Investigation Area

Area	Transects (miles)	Transects (acres)	Grids (acres)
Land	7.9	0.97	0.92
Beach	3.45	0.42	1.66
Inland water	19.12	7.08	3.27
Ocean	1.36	0.50	0.0

4.2.1.1 Wide Area Assessment

4.2.1.1.0.1 During geophysical surveying, a WAA was initially performed to help identify large areas of geophysical anomalies that might be indicative of an area previously used as a military target, aid in determining the extent of potential MEC contamination, and focus subsequent detailed intrusive investigation. The WAA consisted of:

- Analog density transects in the upland areas using hand-held analog instruments to minimize the amount of brush clearing; and,
- DGM transects on the beach area where no vegetation clearing was required using a cart-mounted EM61 coil.
- DGM transects in the inland water area using an underwater towed EM61 coil.

4.2.1.1.0.2 This work was supplemented with an AirMag survey performed using an AirMag array mounted to a helicopter and flown over the land and beach at 3 to 10 ft above the surface.

<u>Airborne Magnetometry</u>

4.2.1.1.0.3 Between 6 February and 18 February 2011, a low-altitude airborne vertical magnetic gradient geophysical survey was conducted by Battelle Oak Ridge Operations using Battelle's VG-22 airborne vertical gradient magnetometry system over approximately 590 acres within the Investigation Area. AirMag was utilized as a WAA tool to provide reconnaissance level magnetometry data over a large percentage of the Investigation Area to detect spatially large areas of elevated anomalies which may be indicative of the presence of a historical aerial bombing target. The objective of the survey was to collect high resolution AirMag data to detect groupings and clusters of MEC and MD items.

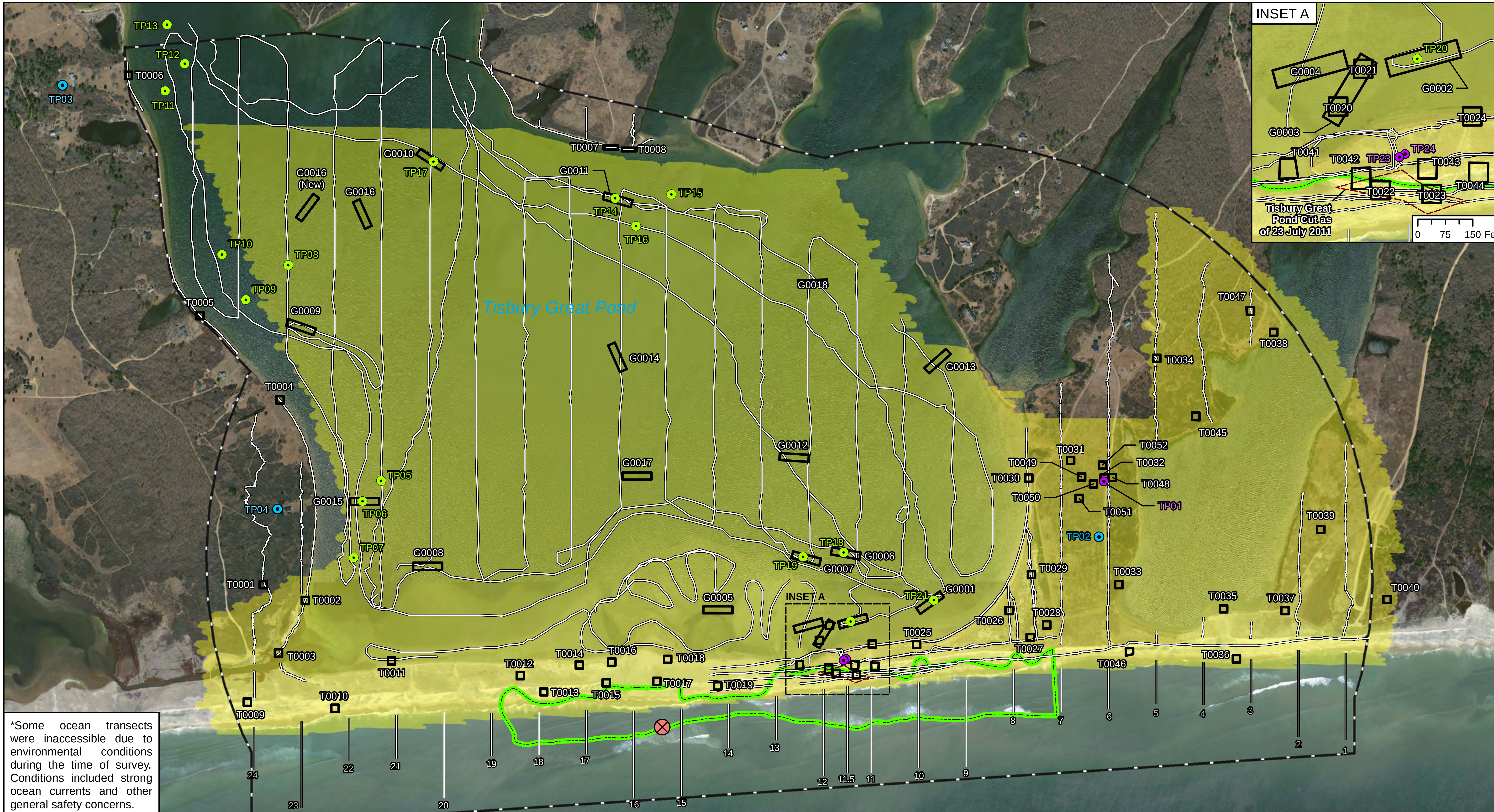
4.2.1.1.0.4 Preliminary modeling suggested that the height of the airborne system above the ground would limit the resolution of detection such that a single AN-MK23 practice bomb may not be detected; however, concentrated contamination with AN-MK23 and MD would likely prove detectable. To test the data limits of AirMag at the Investigation Area, test flights were performed over a specially installed instrument verification strip (IVS) at the Martha's Vineyard Airport. The results of the test flights suggested that the AirMag survey could successfully identify a highly contaminated aerial bombing target if one were present but would not likely identify a single AN-MK23 practice bomb. The results of the test flights are presented in Appendix A.

4.2.1.1.0.5 An IVS of ten representative target items was established at Martha's Vineyard airport and used to verify positioning and system operation. The target items were laid on the surface and the line was flown at 1 to 2 m altitude during each day of project operations. Data were also acquired at a suite of altitudes ranging from 1 to 5 m for sensitivity assessment.

Analog Frequency-Domain Electromagnetic Detectors

4.2.1.1.0.6 Analog transect surveys were conducted on land within the Investigation Area by UXB using a MineLab brand model F3 Frequency-Domain Electromagnetic (FDEM) induction "all-metal" detectors. This model was chosen for use at the Investigation Area because of the historical use of the AN-MK5 practice bomb, which is composed of a zinc alloy that is non-ferromagnetic and thus not detectable using strictly magnetic-based sensors. The "all-metal" detector can detect the nearby presence of metallic objects (including, but not limited to ferromagnetic objects) by producing a "known" local EM field that induces a secondary EM field in the nearby metal object. This secondary field perturbs the known transmitted EM field, thus producing an EM "anomaly" in the return signal. FDEM instruments generate the known EM field via a transmitting antenna, sometimes referred to as a transmitter coil, and detect the secondarily induced perturbations via an EM receiver antenna or Receiver coil.

4.2.1.1.0.7 The objective of the transect surveys was to locate areas of elevated concentrations of geophysical anomalies that might represent potential historical military target areas or areas impacted with MEC or MD. Between 14 December 2010 and 16 December 2010, analog "Bin Lines" were collected along 9 reconnaissance transects spaced approximately 100 m apart and crossed the Investigation Area at 100 m spacing. A "Bin Line" is a geophysical transect surveyed using an analog instrument where surface and subsurface anomalies are counted and recorded in a hand-held data logger. The data recorded includes different types of items observed on the surface and a sum count of subsurface anomalies within the "bin". Transect spacing was determined using the software application Visual Sample Plan. The design was developed such that if remains of an aerial bombing target were to be present, there would be a statistical probability of greater than 95 percent that the target would be traversed and detected by the geophysical surveyors. The input target type was an aerial bombing target for an AN-MK23 practice bomb and the design anticipated traversing a target of this type on at least 7 of the installed transects. The acreages of analog transects and DGM grids surveyed within the Investigation Area are shown in Table 4-1 and the actual transect locations are shown on Figure 4-2. During the analog reconnaissance, transects were surveyed using Trimble GeoXT Wide Area Augmentation System (WAAS) enabled GPS units that provided sub-meter accuracy.



Groundwater Sample
Sediment Sample Location
Discrete Surface or Subsurface Soil Sample
Former Bombing Target
Geophysical Survey Transect
Ocean Transect Inaccessible*
Intrusive Grid
Air Mag Survey Area
Tisbury Great Pond Cut
Former Bigelow Property
MRS Boundary
S0001 Intrusive Grid ID

US Army Corps of Engineers

FIGURE 4-2

Geophysical Survey Transect, Intrusive Grid, & MC Sampling Locations

Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 100 200 300 400 500 600 700 Meters

0 600 1,200 1,800 2,400 Feet

UXB amec

NOTES:
2009 Aerial Data Source: MassGIS

02/07/2014	Rev:	Tisbury_All_Activities_Loc_Remedial_Inv_Rpt.mxd
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Digital Geophysical Mapping

4.2.1.1.0.8 DGM included the collection of data along transects and within grids located throughout the Investigation Area. A discussion of DGM within grids can be found in Section 4.2.1.2. Land and beach DGM transects were surveyed by NAEVA Geophysics, Inc. (NAEVA). Underwater DGM was conducted by Aqua Survey, Inc. (Aqua Survey) at Tisbury Great Pond.

4.2.1.1.0.9 Between 14 December and 15 December 2010, NAEVA performed DGM transects (land-based) at the Investigation Area. DGM was performed using the Geonics® EM61-MK2 time-domain metal detector integrated with a Trimble 5700 RTK GPS system. The EM61-MK2 is a high-resolution time-domain EM instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. The EM61-MK2 system consists of two air-cored coils, a digital data recorder, batteries and processing electronics. The EM61-MK2's transmitter generates a pulsed primary magnetic field, which then induces eddy currents in nearby metallic objects producing a secondary magnetic field. Each of the two spatially separated receiver coils measures these secondary fields. The EM61-MK2 offers the ability to measure the secondary fields at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded. Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils by the secondary magnetic field are measured in millivolts (mV). Target resolution of approximately 0.5 m is expected with the system. EM61-MK2 data were initially stored in a hand-held data logger or field personal computer. Following the completion of each data file, data were transferred to a laptop computer for preliminary evaluation and editing.

4.2.1.1.0.10 Digital geophysical data were acquired at a walking pace in a person portable fashion (EM61 MK2 integrated with RTK GPS). Bottom coil height was maintained at the standard height of 40 cm above the ground by mounting the system on manufacturer supplied wheels. A Trimble TSC2 survey controller connected to the integrated RTK GPS system was used to follow the intended path of each transect. Navigation with GPS was accomplished with a single GPS sensor mounted over the center of the coil to provide real-time positional tracking capabilities. The instrument was operated in 4-Channel mode, recording secondary voltages in the bottom coil at four time gates. If vegetation or site conditions precluded collection along the intended path, the operator veered around the obstacle and continued back on path. For transects intended for beach areas that are currently underwater due to beach erosion, data collection was done at low tide as close to the water line as possible.

4.2.1.1.0.11 During land-based geophysical data collection, NAEVA installed an on-site IVS for quality control (QC) and validation of the EM61-MK2 system. Transect data were collected, processed, and reviewed. Raw data, processed data, final data, associated reports, and target lists were delivered to UXB in the specified formats.

Inland Water DGM

4.2.1.1.0.12 Work at Tisbury Great Pond began on 13 January 2011. The first task was the establishment and QC check of the initial RTK-differential global positioning system (DGPS) base station location. This system consists of a Trimble 5700 base station with Trimmark 3 radio modem at the base station and a Trimble MS750 rover with Teledyne radio modem. NGS benchmark Hancock 1887 was used to transfer control and QC points to the boat ramp to be used during the project. Between 17 and 20 January 2011 a bathymetric and side scan sonar survey was conducted in the area of concern at Tisbury Great Pond. Delays in the survey were caused by partial ice coverage of the survey area. The bathymetric survey was conducted using an Innerspace 455 survey grade fathometer with narrow beam 200 kilohertzk (kHz) transducer. The side scan sonar survey was conducted using an Edgetech 4125 dual frequency sonar operating at 400 kHz and 900 kHz. Data was collected along parallel survey lines spaced 25 ft apart. Data was processed and a side scan sonar mosaic and bathymetric contours were created to assist with the planning of EM transects.

4.2.1.1.0.13 The EM survey at Tisbury Great Pond began 16 February 2011 with the preliminary EM survey conducted over the proposed underwater IVS location. On 20 February 2011, the IVS was installed and locations of the objects were recorded with RTK-DGPS from the surface. On 21 February 2011, the EM transect survey at Tisbury Great Pond began. EM transect data was collected using a Geonics EM61-Mk2 HP console and underwater coil through most of the survey area on 21 and 22 February using a boat towed cart system. As the cut was open and water level was too shallow at the southern end of the pond to survey using the boat, the cart was pulled behind an Argo Avenger amphibious vehicle to collect data in this area on 1 March 2011. On 1 March additional RTK control and QC points were installed near the land IVS which was used for that days data collection. The rolling cart was used to collect all EM data in Tisbury Great Pond. A total of 26,271 m of transect data was collected.

4.2.1.2 Grid Selection and Mapping

4.2.1.2.0.1 Data collected during the WAA was subsequently used to site grids for additional DGM surveying and intrusive investigation within land and beach areas. Based upon the results of the WAA, anomalies were identified, mapped using ESRI ArcGIS, and analyzed for areas of elevated concentrations of anomalies. Anomalies from available data sets were evaluated, including AirMag, analog land transects, and DGM transects. The grids were sited in areas of high, medium, and low anomaly densities to refine the extent, and establish the nature of MEC contamination through subsequent intrusive investigation. Areas of elevated anomaly densities were then used to determine the size and location of grids over which additional DGM data would be collected. Proposed grid sizes and locations were presented to the USACE for concurrence prior to final placement. A weekly conference call conducted between the

USAESCH, CENAE, and UXB, for which minutes were prepared, was typically held to discuss decisions related to proposed grid locations and anomaly selections.

4.2.1.2.0.2 Between 23 February and 30 March 2011, NAEVA returned to the Investigation Areato map land-based grids based off analog and DGM transects as well as AirMag data. The objective of the DGM grid surveys was to characterize geophysical anomalies within localized areas as suggested by the results of the WAA.

4.2.1.2.0.3 The DGM survey was conducted within grids using appropriate EM61 coil, and location of each anomaly recorded using an integrated RTK GPS unit. Initially, 52, 50-ft by 50-ft land DGM grids were selected within the Investigation Area. However, several grids were not investigated due to not obtaining ROEs and several grids were relocated resulting in total of 45 grids being intrusively investigated. Geophysical data were collected in the grids by towing the EM sensor system by hand. For 50-ft by 50-ft grid setup, measuring tapes were stretched along the grid to be surveyed and ropes were laid out at 25-ft intervals across the direction of travel. Each rope had marks painted every 2.5 ft, which allowed the operator to walk straight lines of overlapping coverage. Data coverage was monitored in the field using Geomar's Nav61MK2 data collection program. DGM data collection within grids used an EM61-MK2.

4.2.1.2.0.4 Between 25 March and 15 April 2011, grids at Tisbury Great Pond were surveyed. Initially grids were attempted on 25 and 29 March using divers to methodically survey using the cart. This was found to be inefficient and starting on 30 March, grid data was collected towing the cart behind the boat. A total of 17, 60-m by 13-m grids were surveyed. Grid data was collected using the same EM system and cart as was used during the transect survey. Data was logged both within the designated grids and in the turn arounds resulting in additional coverage and anomalies for investigation.

4.2.1.3 Supplemental Dune Survey

4.2.1.3.0.1 Based upon limitations of the AirMag survey and the continuing appearance of MD from the area near the cut, additional investigation of the dune was necessary to fully characterize the nature and extent of MEC within the Dune. Direct observations of MD items eroding from the dune have occurred, confirming the presence of MD items in this area. In addition, magnetic anomalies were identified during the AirMag study. However, the effects of extreme topographic changes in the immediate vicinity of the MD finds significantly impacted the data usability of the AirMag results. The steep local terrain limited the AirMag helicopter's lateral access to the dune face, preventing low-altitude surveying of the scarp face magnetic anomalies. Specifically, only those sensors on the outermost edge of the sensor-boom would achieve low-altitude approach. This topographic fact limited the overall accuracy of AirMag anomaly shape and character in these areas. Similarly, the sharp terrain constrained the use of ground-based DGM in these areas as industry-standard DGM protocols typically limit surveys to surfaces with slopes not exceeding 30 degrees.

4.2.1.3.0.2 Additional investigation was conducted on 12.9 acres on the dune immediately east of the cut. The area was investigated by a two person team using a Geonics EM61-MK2 electromagnetic metal detector and a Geometrics 858 cesium vapor magnetometer (G-858), which is a ground-based Total Field Magnetometry (GroundMag) – both of which are continuations of previous surveys; EM61 surveys of the grids, and the AirMag, respectively. GroundMag methodology was used to obtain the deepest depth penetration, and in conjunction with EM61, further differentiation of the depth of anomalies is possible (i.e. EM61 does not have as deep a penetration as the GroundMag, so any anomalies detected by both GroundMag and EM61 will be "shallow", while those anomalies detected only by Ground-Mag will be deep). Data were collected in lines spaced 2.5 feet apart. The top of the dune area was 100 percent investigated with the sides being investigated as much as possible. The EM61 and G-858 was operated at a walking pace by one or two people. Both instruments will be operated in auto mode and positioned with a Trimble 5700/R7/R8 RTK-GPS.

4.2.1.4 Magnetite Study

4.2.1.4.0.1 As the result of storm events, the top of the dune was washed away lowering the dune height by approximately 10 ft. Areas along the edge of the eroded areas showed distinct "black sand" immediately below the root mas of the dune vegetation indicative of magnetite, a naturally occurring mineral with a ferrous signal. Field tests were conducted using a simple magnet which attracted the black sand, confirming its ferrous properties. As a result of the significant layer of magnetite immediately below the root layer in the dune, additional investigation/prove-out was conducted in an attempt to delineate magnetite response from that of suspect MEC items as areas of magnetic streaking were evident in the AirMag data as noted above. As part of the intrusive investigation, several anomalous responses suspected to be magnetite deposits were "picked" for intrusive investigation. These were confirmed as magnetite, and not MEC/MD items, and the information was used for subsequent data analysis/dig sheet development.

4.2.1.5 Geophysical Data Processing

4.2.1.5.0.1 Prior to intrusive investigation, DGM data collected within the grids were evaluated and "picks" were made of anomalies to be intrusively investigated. Geosoft Oasis Montaj and ESRI ArcMap were used for analog transects. Geosoft Oasis Montaj for DGM data post processing, in conjunction with ArcMap. The following subsections discuss the data analysis process followed to identify intrusive investigation areas.

4.2.1.5.1 Data Storage and Initial Editing

4.2.1.5.1.0.1 EM61-MK2 data were stored in an Allegro CX data logger using Geomar's Nav61MK2 software and then downloaded into a laptop computer for further on-site processing using Geomar's TrackMaker 61MK2 software.

4.2.1.5.1.0.2 Daily logs, QC, and grid field information forms were input digitally into handheld personal digital assistant and synchronized to the project database. Initial data processing was performed by the field team, which included reviewing the data for integrity and completeness, and creating positioned XYZ files for each data file and QC test for use in further processing of the geophysical data. Data point positions in the raw XYZ files were in Universal Transverse Mercator coordinates in the WGS84 reference frame.

4.2.1.5.2 Preprocessing

4.2.1.5.2.0.1 Converted raw data files were imported into Geosoft's Oasis Montaj to perform the following:

- Review and finalize all QC tests (IVS lines, static, cable shake, personnel) prior to processing daily DGM data;
- Evaluate GPS positional accuracy;
- Evaluate data density;
- Apply auto leveling and instrument drift corrections;
- Apply initial lag correction;
- Use minimum curvature gridding to produce a regular data grid of Channel 2; and,
- Generate preliminary contour map(s) from gridded data.

4.2.1.5.3 Final Processing

4.2.1.5.3.0.1 After completion of preprocessing, the data were further evaluated and processed to generate final processed data files. Final processing steps included:

- Evaluation/refinement of auto leveling and instrument drift corrections for all channels;
- Evaluation and refinement of lag correction;
- Additional digital filtering and enhancement, as necessary;
- Targeting of data;
- Generation of formatted American Standard Code for Information Interchange files containing processed data by dataset;
- Generation of final maps for each grid showing contoured gridded data, target locations, and culture;
- Generation of final target lists for each grid;
- Generation of processing report; and,
- Creation of dig sheets for each grid.

4.2.1.5.3.0.2 The QC data for each survey were evaluated for compliance with requirements specified in the Work Plan and are provided in Appendix D. The results of the latency test were evaluated to determine the instrument latency correction necessary for transect data or evaluated gridded anomalies to determine the correction necessary for grids. This corrected for delays that occur in the electronics of the EM61-MK2 and in the processing of the data on the data recording computer. The latency correction was computed by determining the latency value that corrects the position to overlap the anomaly due to the latency test item when the sensor travels over it in different directions. Typically, this value was between 0.2 and 0.4 seconds.

4.2.1.5.3.0.3 Once the latency correction value had been determined, the value was applied to the whole data set and the geophysicist gridded the total channel data using Geosoft. The gridded channel 2 data were then displayed on a map with a color ramp to represent changing response values. The displayed values were evaluated to determine if they were consistent with the known site conditions and whether the data meet expected data quality standards.

4.2.1.5.4 Digital Geophysical Anomaly Selection

4.2.1.5.4.0.1 The anomaly selection process was established using data gathered with input from the USAESCH project geophysicist. The UX-Detect module within Oasis Montaj was used to identify peak amplitude responses above 3 mV in Channel 2 believed to be associated with nearby metallic sources. Initial target selections were made based on the gridded data. Data profiles corresponding to the anomalies selected by Geosoft were then analyzed by trained geophysicists, with the targets evaluated as to their validity and position, as single-source anomalies may generate multiple target designations depending on shape and orientation. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent a potential MEC target, were manually selected. All target selection was performed on final processed data from Channel 2 of the bottom coil of the EM61-MK2. The criteria for selecting and locating anomalies included the following:

- The maximum amplitude of the response with respect to local background conditions;
- The lateral extent (width) of the response;
- The location of the response with respect to the edge of the survey area, unsurveyable areas, land features, or cultural features within or adjacent to the survey area; and,
- The shape and amplitude of the response with respect to the response of known targets buried in the IVS.

4.2.1.5.4.0.2 Consistent response decay across the other three channels to flag potential noise targets (i.e., non-noise targets should exhibit channel amplitudes such that Ch1>Ch2>Ch3>Ch4.) Additional advanced processing techniques were used to calculate the decay constant and size of the anomalies. The decay constant may be used in conjunction with other advanced processing parameters to aid in selecting anomalies most likely to be produced by MEC.

4.2.1.5.4.0.3 Anomaly selections were merged so that closely spaced anomaly selections (peaks that appear to be caused by the same source item) were consolidated to a single pick. Anomalies which were known to be caused by visible metal objects (e.g., fences) were removed from the target list. The anomaly selections and the data were then evaluated by the geophysical processor to ensure that the remaining anomaly selections were reasonable. The processor added or deleted any anomaly selections as necessary.

4.2.1.5.5 Dig Sheet Development

4.2.1.5.5.0.1 Geophysical anomalies were identified in the EM61-MK2 data collected in the grids at the various locations during the RI field work. The project geophysicist used the anomaly selection process described previously and the prioritization process to develop dig sheets that specified the anomalies to be intrusively investigated (Appendix E). The information maintained on these dig sheet included:

- A unique anomaly identification number; northing and easting coordinates for each anomaly;
- The geophysical instrument response value from the original survey;
- The geophysical instrument response from the reacquisition;
- The reacquisition and intrusive investigation dates; The depth of the recovered item(s);
- A description of the source of the anomaly; and,
- Other pertinent comments.

4.2.2 Intrusive Investigation

4.2.2.0.1 An intrusive investigation was conducted to resolve the source of any geophysical anomalies identified during the WAA and DGM mapping within grids. The investigation was conducted by reacquiring anomaly locations that were selected for intrusive investigation and excavating the locations to identify the source of the anomaly.

4.2.2.0.2 Intrusive investigation activities were conducted by teams consisting of either a three-man team consisting of one UXO Technician III (team leader), one UXO Technician II, and one UXO Technician I; or a five-man team of one UXO Technician IIIs, two UXO Technician II's, and two UXO Technician I's. Teams reacquired anomaly locations using a RTK GPS or sub-meter accuracy Trimble GeoXH WAAS GPS units. Once anomaly locations were identified, the team excavated the area to identify the source of metal debris. Excavation of land/beach locations were conducted by UXO technicians. Once identified, debris was classified as non-MD, cultural artifacts, MD, or MEC. All MEC and MD discovered during the intrusive investigation were removed and properly disposed.

4.2.2.0.3 Due to the dynamic nature of the ocean surf zone, a "Mag and Dig" technique was used for ocean transects. While the ocean transects were initially planned on extending just 300 feet seaward in compliance with FUDS Guidance, a waiver was granted mid-project enabling ocean transects to extend beyond the initial 300 ft limit, with ocean transects starting at the water's edge and extending perpendicular to the shoreline a distance of up to 600 ft seaward, which is the practical length of the diver umbilical. The justification for extending the transects is included in Table 4-2. In all 24 transects were planned.

Table 4-2. Rationale for Extension of Transects

TRANSECT ID	SELECTION RATIONALE FOR 600-FOOT LENGTH
11	Dual-purpose: 1) Possible Receptor Location for MEC leaving TGP cut 2) Long-shore down-stream of eastern-most TGP MEC transport grid
12	Dual-purpose: 1) Possible Background/up-stream location for MEC leaving TGP cut, or 2) Possible Receptor Location for MEC leaving estimated historical aerial bombing target position
15	Possible Receptor Location for MEC leaving estimated historical aerial bombing target position
16	Possible Background/up-stream location for estimated historical aerial bombing target position
20	Long-shore down-stream of southwestern corner of TGP barrier beach airmag anomalies and ROE-restricted parcels
23	Dual-purpose: 1) Background/up-stream location for entire TGP ocean frontage 2) Long-shore down-stream of western-most TGP MEC transport grid

Notes:
MEC – munitions and explosives of concern
TGP – Tisbury Great Pond

4.2.2.0.4 Between 21 October 2011 and 25 November 2011, VRH performed Mag and Dig operations in the surfzone ocean areas along the barrier beach adjacent to Tisbury Great Pond. Analog surveying was conducted on 17 ocean transects. The dive team consisted of a dive team supervisor, a primary diver, a stand-by diver, and two dive tenders. Divers identified anomalies along transects using an underwater hand-held analog instrument, and subsequently excavated each anomaly as it was found. This methodology provided both WAA and intrusive investigation to provide nature and extent data, with tape and azimuth coordinates obtained for each offshore anomaly investigated.

4.2.2.1 Anomaly Reacquisition

4.2.2.1.0.1 Reacquired anomalies were intrusively investigated usually on the same day that reacquisition took place. The selected geophysical anomalies were located using Trimble GeoXH sub-meter GPS units with an external antenna. Anomaly locations were marked with pin flags labeled with the appropriate anomaly identification number. Pertinent information recorded during the reacquisition included the reacquisition time, date, and the grid number.

4.2.2.2 Excavation Methods

4.2.2.2.0.1 During intrusive investigations, the appropriate minimum separation distances were established per the approved Explosives Siting Plan (ESP) (USAESCH, 2010). Due to the location of the investigation sites at the Investigation Area, there were no nonessential personnel or occupied structures within the minimum separation distances.

4.2.2.2.0.2 Intrusive operations at each anomaly location were initiated by hand. The intrusive team excavated at the location of the pin flag within the search radius until the source of the anomaly was found or a no-contact was determined. If no single point within the search radius was determined to be an anomaly location (i.e., all readings remained constant), the center point of the radius was dug until the source of the anomaly was found or a no-contact was determined. A location was considered a no-contact when no specific metallic items were encountered after excavating 2 ft in depth, and no definite anomalous signal remained in the excavation. If present, the signal was pursued until a metallic item was found or until a depth of 4 ft bgs was reached.

4.2.2.2.0.3 Excavation procedures at each anomaly location were conducted in accordance with the RI Work Plan (UXB, 2011). The excavation methods included first excavating and setting aside any root mass, followed by excavating to depth to interrogate the anomaly. Once the anomaly was recovered and the excavation confirmed "safe", the excavated material was replaced in reverse order, with the root mass placed last. No additional site restoration was necessary after excavation activities as the work plan (UXB, 2011) prescribed natural re-colonization of vegetation.

4.2.2.2.0.4 Intrusive operations at anomaly locations as part of the supplemental dune investigation were also completed in this fashion, with the exception of the investigation of a large ferrous anomaly at depth. This anomaly required a large pit to be excavated, and modular aluminum shoring was used in conjunction with active dewatering using a local trash pump to provide worker safety during the investigation, as well as not interfere with analog magnetometers used to guide the investigation. A track backhoe was used to strip overburden and set the shoring, with the intimate investigation performed by hand excavation as described above.

4.2.2.3 Munitions with the Greatest Fragmentation Distance

4.2.2.3.0.1 The munitions with the greatest fragmentation distance (MGFD) for an area is the munitions that have the greatest fragmentation distance of any or all MEC items that are reasonably expected to be found within that area, based on research or site characterization. As presented in the DoD Explosives Safety Board (DDESB)-approved ESP, Correction 1 (USAESCH, 2010), the MGFDs for this RI was the 100-lb practice bomb, MK15 Mod 3 with MK7 spotting signal. The specific MGFDs for the Investigation Area were presented in the ESP (USAESCH, 2010) and the RI Work Plan (UXB, 2011).

4.2.2.4 Minimum Separation Distance

4.2.2.4.0.1 The MSD is the protective distance based on the characteristics of the selected MGFD (see above). The specific MSDs for this RI were presented in the DDESB-approved ESP, Correction 1 (USAESCH, 2010) and the RI Work Plan (UXB, 2011). Minimum separation distances for unintentional detonations were established for nonessential personnel based on the hazardous fragment distance (HFD) for the appropriate MGFD. MSDs for intentional detonations were also established for disposal operations and these were based on the maximum fragmentation distance, horizontal (MDF-H) for the appropriate MGFD, though these distances could be reduced if engineering controls were used.

4.2.2.5 Exclusion Zones

4.2.2.5.0.1 Exclusion zones (EZs) were established during the RI to protect the public and non-essential personnel from both intentional and unintentional detonations. The primary protective distance used was the minimum separation distance for unintentional detonations, which was based on the HFD for the appropriate MGFD (see above), and these EZ distances were enforced throughout the intrusive operations at the Investigation Area. The appropriate EZ distance for intentional detonations, which was based on the MDF-H for the appropriate MGFD modified as necessary using engineering controls (see above), was enforced during all MEC disposal operations conducted during the RI.

4.2.3 Ocean Transport Study

4.2.3.0.1 Since the end of military operations in 1947, MPPEH items have periodically appeared at the barrier beach immediately south of Tisbury Great Pond presenting a potential risk to land owners and the public. To better understand the movement of MD items in the surf zone and support the characterization of nature and extent of MEC, if present, at the Investigation Area, an ocean transport study was conducted. The study was conducted during several mobilizations, including a MEC transport acoustic transponder (pinger) survey conducted from 12 December 2010 through 04 November 2011, and a numerical modeling study of the currents produced during of one of the "cuts" with field work completed 11 November, 2011. The objectives of the study were to:

1. Determine whether MPPEH can be transported by ocean waves;

2. Determine the area within the coastal surf zone where wave-driven MPPEH transport is most likely to occur; and,
3. Determine whether prevailing wave-induced erosion is likely to continue exposing and transporting MPPEH if any remain buried under the existing beach; if so, determine the sections of beach that might be most vulnerable.
4. Determine the theoretical distance MEC/MD items could be carried seaward from the cut to ensure transect lengths bounded this limit.

4.2.3.0.2 UXB originally planned to also monitor the migration of ordnance items currently in the environment by completing baseline and post-storm event analog magnetometry anomaly density surveys within the bounds of two "MEC Transport Grids" located in the near-shore environment. However, severe marine weather conditions during the field season prevented completion of MEC Transport Grid surveys. A summary of the activities conducted during the ocean transport study are presented below the complete transport study report is included as Appendix A.

4.2.3.1 Transport Acoustic Pinger Survey

4.2.3.1.0.1 The Transport Acoustic Pinger Survey was conducted to determine the area within the coastal surf zone where wave-driven MPPEH transport is most likely to occur. Eight acoustic target transponders (pingers) were placed within two grids – one to the west of the last cut between Transects 14/15, and the other east of the last cut between Transects 11/12 (Figure 4-2). Each grid was seeded with two 100-lb bomb simulants and two spotting charge simulants. Each seed was fitted with a pinger for tracking purposes. At the conclusion of the field operations, the seeds were interrogated.

4.2.3.2 Numerical Modeling Study

4.2.3.2.0.1 The movement of munitions in underwater conditions can be greatly enhanced through the application of numerical modeling methods. UXB contracted the Woods Hole Group to complete numerical hydrologic circulation modeling in the vicinity of the cut at Tisbury Great Pond in an effort to understand how the opening, closing, and migration of the man-made cut might influence munitions migration. To support this modeling, Woods Hole Group completed a review of all historical water level information available for Tisbury Great Pond, assessed what additional water level or water flow information was needed to support the numerical modeling, and mobilized to the field to collect any missing data.

4.2.3.2.0.2 The numerical modeling study is intended to help address concerns of potential UXO exposure and/or transport by currents in the pond and immediately adjacent portion of the Atlantic Ocean resulting from breaches or intentional periodic cutting of a channel through the barrier beach. Channel cutting is performed when the pond level exceeds approximately 4.3 ft

NAVD88 to drain the pond to reduce flooding upland potential, and to allow tidal exchange to improve water quality. Channel cuttings are typically required 3 to 4 times per year depending on the weather. The resulting erosion and high current velocities immediately following a channel cutting event (typically lasting two tidal cycles) introduce a potential pathway for exposure and/or transport of UXO. The hydrodynamic model was designed to simulate water levels and current velocities immediately following a channel cutting event as a result of drainage from the pond and subsequent tidal currents.

4.2.4 Quality Control

4.2.4.0.1 To establish confidence in the data reliability, QC tests were conducted throughout the project. Tests were conducted prior to, during, and after all data collection sessions. QC tests for the EM61-MK2 were conducted after a minimum 15-minute warm-up period for the electronics.

4.2.4.1 Geophysical System Verification Plan

4.2.4.1.0.1 The geophysical system verification (GSV) plan is an alternative to traditional geophysical prove-outs (GPOs). The protocol is based on extensive physics-based modeling of instrument response to industry standard objects (ISOs) at different orientations and depths. At the Investigation Area, three small ISOs (1 in. by 4 in. steel pipes) and two medium ISOs (2 in. by 8 in. steel pipes) were seeded at detectable depths bgs to create an IVS.

4.2.4.1.1 Instrument Verification Strip

4.2.4.1.1.0.1 As an alternative to establishing a GPO, NAEVA built an IVS at the Investigation Area. It was installed in accordance with the standard operating procedure which was integrated in the RI Work Plan (UXB, 2011). The IVS is a seeded strip used to demonstrate the detection sensor functionality, evaluate the geologic response and geophysical data collection. Before starting field work and at any time a change is made in equipment or operator, the IVS was run to validate the overall process. All three IVSs were seeded at various depths that produced a consistent and predictable detection instrument response. The IVS locations were selected in an area that represent the terrain, vegetation, and underlying rock and/or soils that naturally exist at the site. A single line over the IVS was collected daily to ensure data quality and equipment functionality.

4.2.4.1.1.0.2 The IVS is an integral component of the GSV process. The purpose of surveying the IVS is to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of fieldwork and to document the site-specific capabilities of a DGM system. Serial number identifications were recorded in the database for all instrumentation (i.e. data logger, EM61-MK2 electronics, coils), and the IVS was mapped using the same personnel, equipment, and methodologies employed for the DGM survey.

4.2.4.1.1.0.3 A suitable area within or near the Investigation Area yet containing similar geologic and vegetative conditions, free of interference and anomalous response, was chosen for the locations of each IVS. Prior to finalizing the IVS location, the DGM team thoroughly checked the area using the EM61-MK2 in an analog mode. Any pre-existing anomalies were marked and avoided during IVS construction. Once a suitable location was found, a background survey was performed to establish the locations of any existing anomalies, of which there were none. Following this, five items were buried according to Table 4-3. After the seeding was completed, the start and end points of the IVS line and the locations of the ISOs were recorded using a Trimble RTK GPS.

Table 4-3. IVS Design
Tisbury Great Pond Investigation Area

Item	Easting (m)	Northing (m)	Depth (to center of mass)	Item Size	Orientation
1	362777.668	4578852.901	9 cm	Small ISO	Vertical
2	362776.737	4578857.737	18 cm	Medium ISO	Vertical
3	362775.716	4578862.764	19 cm	Small ISO	Vertical
4	362774.73	4578867.721	36 cm	Medium ISO	Vertical
5	362773.829	4578872.618	10 cm	Small ISO	Vertical

Notes:
cm – centimeters
ISO - industry standard object
m - meter(s)

4.2.4.1.1.0.4 The IVS was initially mapped with five lines of data consisting of a line directly over the ISOs, a line on either side at the standard line spacing (2.5 ft), a line on one side at half line spacing (1.25 ft), and a background/noise line offset about 10 ft from the ISOs. The IVS data were used to document the repeatable responses of known objects at known depths. Daily peak responses were compared to the ideal response as documented during the initial 5-line IVS. Subsequent runs of the IVS recorded data directly over the ISOs and along the background line.

4.2.4.1.2 Blind Seeding

4.2.4.1.2.0.1 The blind seeding portion of the GSV was conducted and evaluated by UXB. Seed items were emplaced at varying depths throughout the gridded area of collection, so that at least one seed item would be surveyed each day. The locations of these items were not provided to NAEVA. The UXB Geophysicist evaluated the data delivered by NAEVA and did not report a failure to detect or target any of the blind seeds. Table 4-4 summarizes the blind seeding activities.

Table 4-4. Summary of Blind Seeding Activities
Tisbury Great Pond Investigation Area

Grid ID	Seed ID	Easting	Northing	Recovered	DGM Target ID	EM61Signal CH1_Final	EM61Signal CH2_Final	EM61Signal CH3_Final	EM61Signal CH4_Final
T0004	9	361164.3	4579236.9	Y	0003	240.0426636	180.221405	112.0343552	60.02360152
T0005	27	360982	4579420.5	Y	0001	417.7797146	307.3827344	198.6094329	111.9655439
T0006	11	360833.3	4579930.99	Y	0001	128.6683702	95.23800629	59.28714508	31.07647347
T0007	14	361862.4	4579773	Y	0002	62.47885129	43.67486952	26.02985762	12.66685867
T0008	12	361887.1	4579769.91	Y	0002	84.98192463	61.03002241	36.50909041	17.78008782
T0028r	1	362771.0	4578766.07	Y	0001	270.3312951	186.0120775	107.336986	50.66010739

4.2.4.2 Instrument/Equipment Testing

4.2.4.2.0.1 The following QC procedures were performed and documented during the data collection process and reviewed by a qualified geophysicist on a daily basis.

4.2.4.2.1 Geonics® EM61-MK2

4.2.4.2.1.0.1 Each day of data collection, the instrument was powered-on for a warm-up period of at least 15 minutes to stabilize readings and minimize instrument drift. After warm-up, a series of 60-second static QC tests were performed with the instrument immobilized over an area of minimal background response in order to document proper instrument function. These tests were also performed at the end of each day. While checking instrument performance, the static background test also documents local site noise levels. The instrument operator monitored the response during the tests for abnormal behavior. During data processing, the tests were further analyzed quantitatively.

4.2.4.2.1.0.2 Digital geophysical data was collected at a rate high enough (≥10 readings/second) to achieve the DQO that 98 percent of the along-track readings did not exceed 25 centimeters (cm). For grids, at least 90 percent of the across-track sampling was equal to the proposed 2.5 ft line spacing. QC procedures were performed and documented during the data collection process and reviewed by a qualified geophysicist on a daily basis. The standard of performance adhered to the most recent USACE performance requirements for RI/FS using DGM methods. Static and dynamic repeatability for both detection and positioning systems, geodetic accuracy, coverage, target selections, and anomaly resolution was consistently monitored at appropriate frequencies to ensure that all requirements and DQOs were achieved.

<u>Personnel Test</u>

4.2.4.2.1.0.3 While logging the data, the operator looked for changes in response associated with personnel in proximity to the instrument coil. Support personnel not actively operating the instrument generally do not approach the coil during production surveys. This test is designed to confirm that the instrument operator, who is closest to the coil during logging, does not interfere with the data. Common sources of operator interference include metal items in pockets and steel-toed boots.

Cable Shake Test

4.2.4.2.1.0.4 In the cable shake test, all system cables are shaken while logging and monitoring for data spikes. This test functions to detect problems associated with damaged or loose connectors, damaged cables, and other defects. Replacing the offending component usually resolves problems in this test.

Background/Spike Test

4.2.4.2.1.0.5 Performed at the beginning and end of each day, the background/spike test consists of three 60-second lines of data: background, ISO/spike, and background. Background lines are monitored for data spikes and noise level while the spike line is examined for consistent response. Monitoring background noise enables the Geophysical Data Processor to calibrate data leveling during processing. For the spike test, a small ISO is approximately centered above the EM61-MK2 coil. During the DGM survey, an item height of 50 cm was initially used, but was later changed to 43 cm. Daily spike response values were plotted against the small ISO response curve at the given depth. The acceptance criterion for the spike response was ±20 percent of the expected response according to the response curve (13.35 mV and 22.4 mV in Channel 2); static tests were also plotted on a scale of ±2 mV so that any abnormally high data spikes could be observed.

Repeat Data

4.2.4.2.1.0.6 After completion of each dataset, approximately 2 percent of the data were recollected in a separate file to demonstrate instrument consistency and data integrity throughout the course of the survey. Repeat data also serves to evaluate and validate the particular collection and positioning methods. Evaluation of repeat data was conducted qualitatively against original data profiles.

4.2.4.2.2 Trimble 5700 RTK GPS System

4.2.4.2.2.0.1 At the beginning of the day, and after setting up the base station and before collecting any data, the GPS antenna was mounded on a survey pole and placed at a known point to check the accuracy. The reported position was compared to the known position to check for proper base station and rover operation. The locations were stored in Trimble Survey Controller and input into the PDA for inclusion in the project database. Positional discrepancies within 10 cm were considered acceptable.

4.2.4.3 Data Processing and Database Quality Control

4.2.4.3.0.1 New field data (XML files) were imported into the database and were checked to make sure that all the field notes were formatted and filled in correctly. Dataset identification and grid identification were verified as unique with no duplicated information. Line paths plotted to be sure that all the grids associated with a dataset were present in the database and that any missing grid identifications were updated. The actual acreage of data collection was calculated and was updated in the database.

4.2.4.3.0.2 Raw field reports were printed and checked to confirm they contained all the proper information, including grid identification, sketch maps and field notes. At the end of processing a dataset, processing reports were generated from the project database, which list down-line data density statistics, GPS quality, leveling, lag, and gridding parameters used in processing each dataset, as well as a list of all associated file names and supporting QC test results. Suspected culture or noise targets were identified in the comments field of the target lists. Processors examined all data prior to NAEVA demobilizing from the site.

4.2.4.3.0.3 The hand held analog instruments used for instrument-aided reconnaissance and anomaly avoidance were checked at the start and end of each day by operati ng the instrument over a test plot seeded with metallic test items. The instruments were considered functional if the items could be detected. The instrument was also shaken to check for loose parts and bad electrical connections. The instrument checks were recorded in the field log book. No deficiencies in the operation of the Minelab F3 and/or Schonstedt magnetometers were noted.

4.2.4.4 Intrusive Investigation Quality Control

4.2.4.4.0.1 Each anomaly was intrusively investigated and characterized by the intrusive team. For location data, the daily GPS QC Check was documented in the team's logbook (see Appendix F). The intrusive team leader documented the source of the anomaly, and verified that the anomaly had been adequately characterized. A final reading was taken with the EM61-MK2 at the anomaly location to confirm that the area had been cleared. Any remaining response at an anomaly location was investigated unless the source of the response could be attributed to an anomaly greater than 3 ft from the original peak. In addition to the post-intrusive checks by the dig teams, the site geophysicist reviewed the dig results and compared what was found by the intrusive teams with the geophysical anomalies selected from the DGM data.

4.2.5 Munitions Management

4.2.5.1 MEC Storage

4.2.5.1.0.1 In accordance with the ESP (USAESCH, 2010), a collection point was established within the work area for the storage of MEC items for same-day consolidated shots if items were acceptable to move; any items not deemed acceptable to move were demolished using blow-in-place (BIP) procedures. MEC items were demolished the day they were found; in the event demolition was not practical due to items found late in the day, weather, etc., a guard was posted until demolition took place the next day. MD items recovered during the project were stored in a locked container, with access controlled by the Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO).

4.2.5.2 MEC Disposal

4.2.5.2.0.1 An account of recovered MPPEH, MEC, or MD items, including photographs, was maintained during the RI. Each piece of recovered MEC or MPPEH was given a unique database identification number, and the item was tracked from discovery to final disposition. MEC items discovered during this project were disposed of either through BIP or consolidated shots they day they were discovered, and the date of demolition was recorded. Any MEC/MPPEH not disposed of on the day of discovery was guarded until it was able to be disposed of the next day. The SUXOS was responsible for the tracking and maintenance of all ordnance recovered during the project.

4.2.5.3 Inspection of Material Potentially Presenting an Explosive Hazard

4.2.5.3.0.1 MPPEH Items confirmed or suspected to be MEC were determined to be acceptable-to-move and with the concurrence of both the UXOSO and the USACE Safety Specialist, the item(s) were consolidated with other MEC items for demolition. Once demolition operations were complete, the SUXOS certified the explosively vented items and any remaining MPPEH were free of explosive hazards. This condition was verified by the UXOSO or Unexploded Ordnance Quality Control Specialist (UXOQCS). Once the MPPEH was determined to be free of explosive hazards, the SUXOS certified and signed, and the UXOSO/UXOQCS verified and signed the DD Form 1348-1A (Appendix H) to certify the material as MD. A summary of daily activities is document in the daily reports included in Appendix E. After inspection and certification, the recovered MD items were placed in the locked storage container at the secure storage area until appropriate disposition was arranged at the conclusion of field operations.

4.3 MC Characterization

4.3.0.1 The following subsections provide a description of the environmental sampling activities performed at the site in order to characterize MCs. This includes all field activities, duration and procedures for collecting samples and data, and variations from the work plan.

4.3.1 Field Activities and Methodologies

4.3.1.0.1 Between 13 October and 2 November 2011, environmental sampling for MCs was conducted at the Investigation Area. Subsequent background sampling was conducted 8 August 2013. Field activities were documented in a field log, included in Appendix E. A photograph log of MC sampling activities is included in Appendix I. The procedures and methodologies for field investigation activities followed those outlined in the RI Work Plan (UXB, 2011). Any deviations from these plans and sampling rationale are discussed in Section 4.3.2.

4.3.1.0.2 Table 4-5 provides a summary of the MCs that were potentially released at the site. Samples collected during this investigation (soil, sediment, and groundwater) were analyzed for these MCs.

Table 4-5. Summary of Munitions Constituents
Tisbury Great Pond Investigation Area

Constituent	CAS Number*	Synonym/ Abbreviation	Description*
Metals			
Antimony	7440-36-0	--	Alloy used as a hardening agent
Copper	7440-50-8	--	Bomb casing alloy metal
Lead	7439-92-1	--	Bomb casing alloy metal
Nickel	7440-02-0	--	Bomb casing alloy metal
Zinc	7440-66-6	--	Bomb casing alloy metal
Explosives Compounds			
1,3,5-Dinitrotoluene	99-35-4	1,3,5-DNT	TNT co-contaminant and breakdown product
1,3-Dinitrotoluene	99-65-0	1,3-DNT	DNT breakdown product and TNT co-contaminant
2,4,6-Trinitrotoluene	118-96-7	2,4,6-TNT	Nitroaromatic explosive.
2,4-Dinitrotoluene	121-14-2	2,4-DNT	Nitroaromatic explosive/ propellant; also TNT co-contaminant
2,6-Dinitrotoluene	606-20-2	2,6-DNT	Nitroaromatic explosive/ propellant; also TNT co-contaminant
2-Amino-4,6-Dinitrotoluene	355-72-78-2	--	TNT breakdown product
2-Nitrotoluene	88-72-2	--	DNT co-contaminant
3-Nitrotoluene	99-08-1	--	DNT co-contaminant
4-Amino-2,6-Dinitrotoluene	1946-51-0	--	TNT breakdown product
4-Nitrotoluene	99-99-0	--	DNT co-contaminant
Nitrobenzene	98-95-3	--	DNT co-contaminant
Nitroglycerin	55-63-0	NG	Nitrate ester explosive/propellant
Pentaerythritol tetranitrate	78-11-5	PETN	Nitrate ester explosive
Methyl-2,4,6-trinitrophenylnitramine	479-45-8	Tetryl	Nitramine explosive

*Information gathered from ATSDR Toxicological Profiles (located at http://www.atsdr.cdc.gov/toxprofiles/) and the Hazardous Substances Data Bank (located at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB).

4.3.1.1 Soil Investigation

4.3.1.1.0.1 Between October 19 and November 2, 2011, 2 discrete surface soil (0 to 6 in. and 6 to 12 in. bgs), and 3 discrete subsurface soil (12 to 18 in., 12 to 24 in., and 72 to 84 in. bgs) samples were collected at the site. Quality control samples were collected at 10 percent of discrete soil sample locations resulting in 1 duplicate surface soil sample. Soil sample locations were biased toward areas where MEC and MD items were identified during geophysical/

intrusive investigation. Due to the identification of MD items in the sand dunes, two subsurface soil sample locations (TP23 and TP24) were added to the sampling plan.

4.3.1.1.0.2 Soil samples were collected in accordance with the MC Sampling and Analysis Plan (UXB, 2011). Soil sample locations are shown on Figure 4-2. A sample collection log documenting surface soil sample collection is included as Appendix E. Table 4-6 provides a summary of the soil samples collected at the site.

Table 4-6. Soil Sample Summary
Tisbury Great Pond Investigation Area

Station ID	Sample ID	Sample Date	Sample Type	Matrix	Depth (inches)	Rationale
TP01	SB128	10/19/11	Discrete	Surface Soil	0-6	Sample collected near identified MEC item.
TP01	SB129	10/19/11	Discrete Duplicate	Surface Soil	0-6	Duplicate sample for QC.
TP01	SB130	10/19/11	Discrete	Surface Soil	6-12	Sample collected near identified MEC item.
TP01	SB131	10/19/11	Discrete	Subsurface Soil	12-18	Sample collected near identified MEC item.
TP23	SB132	11/2/11	Discrete	Subsurface Soil	12-24	Sample collected near identified MD item.
TP24	SB133	11/2/11	Discrete	Subsurface Soil	72-84	Sample collected near identified MD item.

Notes:
IS – incremental sample
%RSD – percent relative standard deviation

4.3.1.2 Sediment Investigation

4.3.1.2.0.1 On October 19, 2011, 17 discrete sediment samples (0 to 6 in.) were collected at the site. Quality control samples were collected at 10 percent of discrete sediment sample locations resulting in 2 duplicate sediment soil samples. Sediment samples were collected as discrete samples biased toward areas where the intrusive investigation identified high concentrations of MEC and MD. Samples were collected using a petite ponar dredge sampler. Sediment sample locations are shown on Figure 4-2. A sample collection log documenting sediment sample collection is included as Appendix E. Table 4-7 provides a summary of the sediment samples collected at the site.

Table 4-7. Sediment Sample Summary
Tisbury Great Pond Investigation Area

Station ID	Sample ID	Sample Date	Sample Type	Matrix	Depth (inches)	Location
TP05	SD018	10/19/11	Discrete	Sediment	0-6	Sample collected from biologically active zone within intrusive grid.
TP06	SD019	10/19/11	Discrete	Sediment	0-6	Sample collected from biologically active zone within intrusive grid.
TP07	SD020	10/19/11	Discrete	Sediment	0-6	Sample collected from biologically active zone within intrusive grid.
TP08	SD021	10/19/11	Discrete	Sediment	0-6	Sample collected from biologically active zone within intrusive grid.
TP09	SD022	10/19/11	Discrete	Sediment	0-6	Sample collected from biologically active zone within intrusive grid.
TP10	SD023	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP11	SD024	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP12	SD025	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP13	SD026	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP14	SD027	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP14	SD028	10/19/11	Discrete Duplicate	Sediment	0-6	Duplicate sample for QC.
TP15	SD029	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP16	SD030	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP17	SD031	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP18	SD032	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP19	SD033	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP20	SD034	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP21	SD035	10/19/11	Discrete	Sediment	0-6	Sample collected in biologically active zone in area of known shellfish reefs.
TP21	SD036	10/19/11	Discrete Duplicate	Sediment	0-6	Duplicate sample for QC

4.3.1.3 Groundwater Investigation

4.3.1.3.0.1 On 2 November 2011, three groundwater samples and one duplicate sample were collected at the site (Figure 4-2). Tidewater, Inc. provided drilling services using a remote controlled Geoprobe® drill rig using the small diameter driven well sample collection method (MADEP, 1999). Groundwater samples were collected to characterize the groundwater within the Investigation Area and to determine whether historical military activities have affected groundwater quality. No monitoring wells were installed during this RI.

4.3.1.3.0.2 Groundwater samples were collected using a peristaltic pump and low flow sampling techniques. A sample was collected after stabilization of field measurements; including, temperature, specific conductance, dissolved oxygen, oxidation reduction potential, salinity, and turbidity. The laboratory provided sample containers were filled directly through an inline 0.45 micrometer filter connected to tubing. Groundwater sample locations are shown on Figure 4-2. A sample collection log documenting groundwater sample collection is included as Appendix E. Table 4-8 provides a summary of the groundwater samples collected at the site.

Table 4-8. Groundwater Sample Summary
Tisbury Great Pond Investigation Area

Station ID	Sample ID	Sample Date	Sample Type	Matrix	Depth (ft)	Location
TP02	GW011	11/2/11	Discrete	Groundwater	8-12	Grab sample collected near identified MEC item.
TP03	GW012	11/2/11	Discrete	Groundwater	16-20	Grab sample collected near residence.
TP04	GW013	11/2/11	Discrete	Groundwater	8-12	Grab sample collected near residence.
TP04	GW014	11/2/11	Discrete Duplicate	Groundwater	8-12	Duplicate sample for QC.

4.3.1.4 Background Investigation

4.3.1.4.0.1 Background samples were collected from surface water and sediment within Tisbury Great Pond in accordance with the RI WP (UXB, 2011a) and associated Technical Justification for Martha's Vineyard Sampling Approach (UXB, 2011b). Discrete samples were collected from the northern fingers of the Tisbury Great Pond to establish inorganic background concentrations. Sediment samples were collected between 5 and 11 feet below the water surface, within the top 6 inches of the pond floor. Surface water samples were collected approximately 1 foot above the bottom of the pond. The sediment samples were analyzed for lead and nickel using EPA Method 6020A. Two surface water samples were collected from each location, one of which was filtered with a 0.45 micrometer filter. The filtered and unfiltered samples were analyzed for dissolved phase and total lead and nickel concentratrions, respectively, using EPA Method 6020A. Sediment and suface water background sample locations are shown on Figure 4-3 and Table 4-9 provides a summary of the background samples collected. A sample collection logs documenting sample collection are included as Appendix E.

Table 4-9. Sediment and Surface Wwater Background Sample Summary
Tisbury Great Pond Investigation Area

Station ID	Sample ID	Sample Date	Sample Type	Matrix	Depth (ft)
BG-01	SD037	08/08/13	Discrete	Sediment	8
BG-02	SD038	08/08/13	Discrete	Sediment	9
BG-03	SD039	08/08/13	Discrete	Sediment	7
BG-04	SD040	08/08/13	Discrete	Sediment	6
BG-05	SD041	08/08/13	Discrete	Sediment	6
BG-05	SD042	08/08/13	Discrete Duplicate	Sediment	6
BG-06	SD043	08/08/13	Discrete	Sediment	8
BG-07	SD044	08/08/13	Discrete	Sediment	9
BG-08	SD045	08/08/13	Discrete	Sediment	5
BG-09	SD046	08/08/13	Discrete	Sediment	8
BG-10	SD047	08/08/13	Discrete	Sediment	11
BG-01	SW001	08/08/13	Discrete	Surface Water	7
BG-02	SW002	08/08/13	Discrete	Surface Water	8
BG-02	SW003	08/08/13	Discrete Duplicate	Surface Water	8
BG-03	SW004	08/08/13	Discrete	Surface Water	6
BG-04	SW005	08/08/13	Discrete	Surface Water	5
BG-05	SW006	08/08/13	Discrete	Surface Water	5
BG-06	SW007	08/08/13	Discrete	Surface Water	7
BG-07	SW008	08/08/13	Discrete	Surface Water	8
BG-08	SW009	08/08/13	Discrete	Surface Water	4
BG-09	SW010	08/08/13	Discrete	Surface Water	7
BG-10	SW011	08/08/13	Discrete	Surface Water	10

4.3.2 Variations from the Work Plan

4.3.2.0.1 The sampling procedures and analytical protocols presented in the RI Work Plan (UXB, 2011) were followed; however, due to MD items found in the sand dunes adjacent to the barrier beach, two soil sample locations (TP23 and TP24) were added to the sampling plan.

4.3.3 Sample Procedures and Analysis

4.3.3.0.1 Chemical analysis of environmental samples collected at the Investigation Area were conducted by TestAmerica, Inc. (TestAmerica) located in Arvada, Colorado, a DoD Environmental Laboratory Accreditation Program certified lab. COCs for samples sent to TestAmerica are included in Appendix E. Analytical procedures followed Method 3050/6020A for discrete soil metals analysis, Method 8321B for discrete soil explosives analysis, Method 3050/6020A for metals analysis of groundwater, and Method 3535A/8321B for explosives analysis of groundwater.

4.3.4 Data Validation

4.3.4.0.1 One-hundred percent of the MC data was validated according to the DoD QSM Version 4.2 and verified by the USAESCH using ADR software. Data quality was evaluated against the DQOs established in the RI Work Plan (UXB, 2011).

4.3.4.0.2 A presentation of various field and laboratory quality assurance (QA)/QC criteria used to evaluate data quality and results of the data quality evaluation process are included in the Data Validation Report (Appendix D). Based on the Data Quality Indicators (precision, accuracy, representativeness, comparability, and completeness), the data for the site was evaluated and determined to be usable for the evaluation of the nature and extent of contamination and for use in evaluating potential effects of existing site conditions on human health. Qualified data are usable with the limitations described. Results of data quality evaluation are summarized as follows:

- Accuracy and Precision goals were met;
- Project Representativeness goals were achieved;
- Samples collected during the RI generated a Level IV data package, which allows for adequate comparability to past and future investigations; and,
- Laboratory completeness was 100 percent, and field completeness was 95 percent.

4.3.5 Investigation Derived Waste

4.3.5.0.1 Less than 10 gallons of investigation derived waste (IDW) was generated during equipment decontamination activities and low flow groundwater purging. A waste characterization sample (MV01 IDW01) was collected on 3 November 2011 and analyzed at TestAmerica Denver. The IDW was transported to and disposed at the Edgartown Wastewater Treatment Facility.

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Background Sediment and Surface Water Sample Location

Sediment Sample Location

Former Rocket Target

Oyster Grow Out Equipment

Shell Reef

Oyster Growth Area

Tisbury Great Pond Area of Investigation

US Army Corps of Engineers

N

0 500 1,000 2,000 Feet

UXB amec

FIGURE 4-3

Background Sediment and Surface Water Sample Locations - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

NOTES:	02/07/2014	Rev:	Tisbury_BG_Sediment_Samp_Remedial_Inv_Rpt.mxd
	Drawn: JBO	Chk: DMS	PROJ: 562910000

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5.0 REVISED CONCEPTUAL SITE MODEL AND RI RESULTS

5.0.1 Results from the MEC and MC investigations have been evaluated and used to update the pre-investigation CSM discussed in Section 3.1.

5.1 MEC Investigation Results

5.1.1 AirMag Results

5.1.1.0.1 Within the Investigation Area, 3,608 anomalies were identified above the threshold value presented in Figure 5-1. A full description of the Battelle VG-22 system, field operations, and findings of the AirMag survey are presented in Appendix A and summarized in Table 5-1.

Table 5-1. AirMag Summary Table, Tisbury Great Pond Investigation Area

Coverage	Mean Altitude	Total Number of Anomalies	Number of Anomalies Picked	Collection Dates	Number of Reflights Lines
590 acres	1.96 meters	3,608	Priority 1 = 1,386 Priority 2 = 722 Priority 3 = 1,500	2/09/11, 2/10/11, 2/14/11	1

5.1.1.0.2 Geologic features appear to be scattered throughout this area, with several relatively long linear geologic anomalies in the central region. Other linear features on the beach (southeastern area of the map) indicate possible man-made structures. A few anomalies that may be related to lobster/crab traps or oyster growth trays also appear to be present in the survey area.

5.1.2 Analog Results (Land)

5.1.2.0.1 The objective of the analog transect surveys to locate areas of elevated concentrations of geophysical anomalies that could represent potential historical military target areas or areas impacted with MEC or MD was achieved as shown in Figure 5-2. No high density anomaly clusters were located during the analog surveys.

5.1.3 Digital Geophysical Mapping Results

5.1.3.0.1 DGM data were collected within transects and grids over 13.35 acres of land, beach, and inland water areas of the Investigation Area.

Transects:

5.1.3.0.2 The objective was to locate elevated areas of geophysical anomalies that could represent MEC or MD. DGM data were collected along transects covering 7.5 acres at the Investigation Area resulting in a total of 50 anomalies identified above the targeting threshold of 3 mV in Channel 2. This data was used to located grids for intrusive investigation as discussed in Section 5.1.3.3 and as indicated in Figure 5-3.

Grids:

5.1.3.0.3 The placement of grids was decided by the density of anomalies found along the analog transects as well as targets of interest located on beach transects and AirMag data. Grids were placed in areas of high, medium, and low density anomalies. A total of 45, 50-ft by 50-ft grids covering 2.58 acres were mapped resulting in 226 targets.

5.1.3.0.4 The grids located in the Investigation Area were much like the grids along South Beach in that they did not contain very many anomalies. Many grids along the western side of Tisbury Great Pond contained no anomalies. Along the south eastern area of the Investigation Area, centered on grids T0037 and T0039, the density of anomalies increased as well as the number of high response anomalies. Divots in the ground resembling impact craters were observed during collection. The other area of higher anomaly density was around grids T0027 and T0028. It was observed that both of these grids contained metallic non-MD debris, and this could relate to the number of targets.

5.1.4 Supplemental Dune Investigation

5.1.4.0.1 Results of the supplemental dune investigation were included in the results for the intrusive investigation and can be found in the below section.

5.1.5 Intrusive Investigation Results

5.1.5.0.1 During intrusive investigation activities, 6 MEC and 31 MD items were recovered from land, beach, and inland water areas. These items included intact AN-MK23 3-lb practice bombs, and the remnants of a 100-lb practice bomb. Tables 5-2 through 5-4 present the location, description, quantity, and final disposition of MEC and MD items recovered for each of the areas investigated. MD items were transferred to the secure MD storage area, and transported to the RM Packer Company for recycling. The disposal documentation for MEC investigation activities performed at the Investigation Area during this RI is included in Appendix H.

<u>Land and Beach</u>

5.1.5.0.2 During intrusive investigation activities within land and beach areas, 1 MEC item and no items of MD were recovered. The MEC item was recovered within grid T-32 and identified as AN-MK23 3-lb bomb with spotting charges intact. No MD items were recovered in any of the grids. Table 5-2 presents the location, description, quantity, and final disposition of MEC items recovered. All other anomalies investigated were identified as non-MD (172 items of wire, nails, anchors, fence posts, lengths of pipe) found in all but 6 of the grids. The UXB Site Manager's daily reports and photographs taken during the investigation are included in Appendices E and I, respectively. The results of the intrusive investigations are presented in Figure 5-3.

Former Bombing Target

Tisbury Great Pond Area of Investigation

Vertical Gradient (nT/m)*

-4.7 -3.7 -2.2 -1.2 0.0 1.4 2.4 3.5 4.5

*The scale of the vertical gradient is -5 to 5 nanoTesla/meter (nT/m)

US Army Corps of Engineers

FIGURE 5-1

Air Magnetometer Results Tisbury Great Pond Investigation Area

Martha's Vineyard, MA

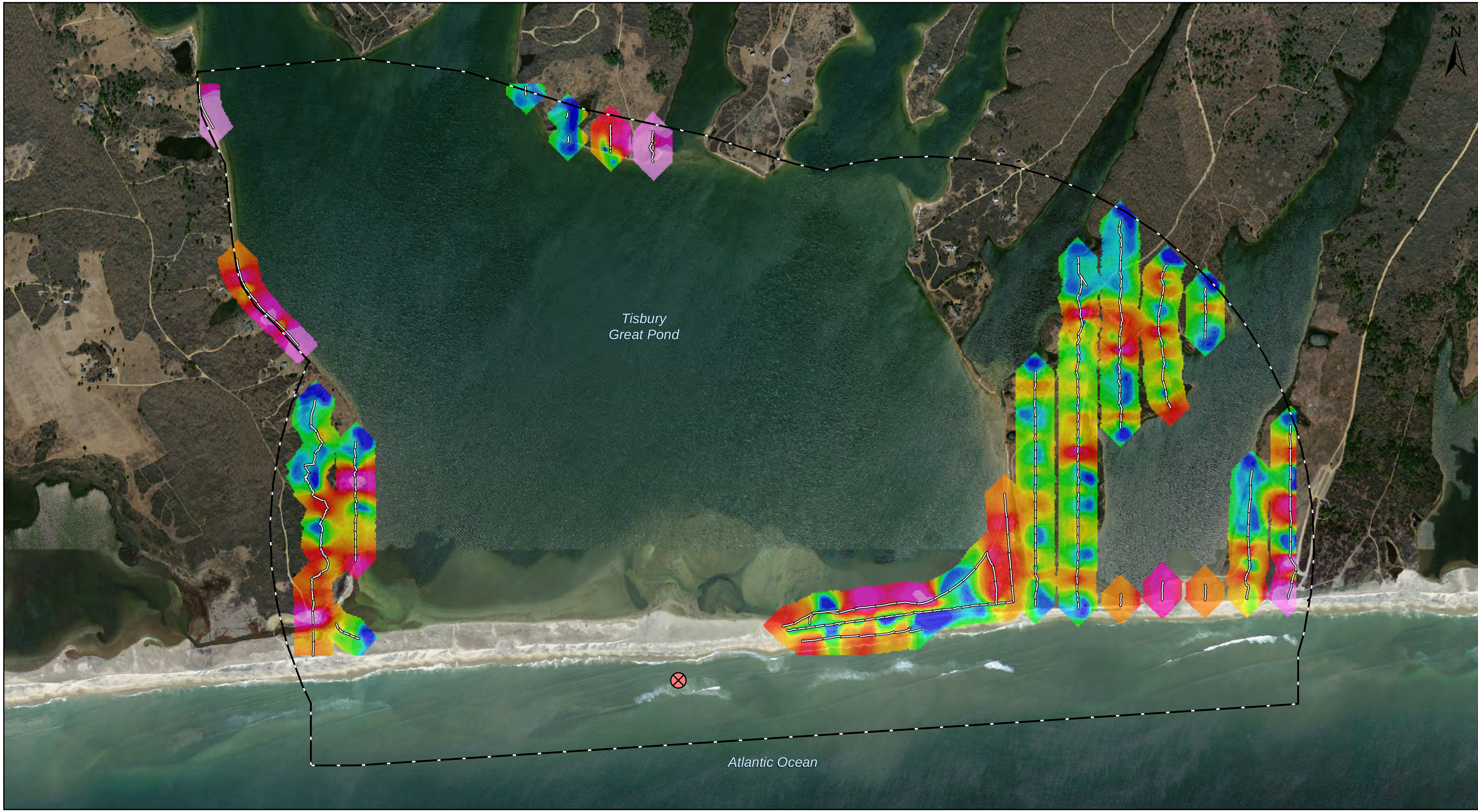
0 75 150 300 450 600 Meters

0 250 500 1,000 1,500 2,000 Feet

UXB amec

NOTES:
2009 Aerial Data Source: MassGIS

09/20/2012	Rev:	Tisbury_Air_Mag_Results_Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000



Former Bombing Target

Analog Geophysical SurveyTransect*

Tisbury Great Pond Area of Investigation

Anomaly Density**
Anomalies per bin

6.74
4.74
2.77
1.98
0.86
0.31
.01
0.0

*Each segement of the Geophysical Survey Transect line equals one 50 foot survey transect bin.
**Anomaly density values are estimated based on counts per geophysical survey transect bin.

US Army Corps of Engineers

FIGURE 5-2

Land Analog Transect Results - Tisbury Great Pond Investigation Area
Martha's Vineyard, MA

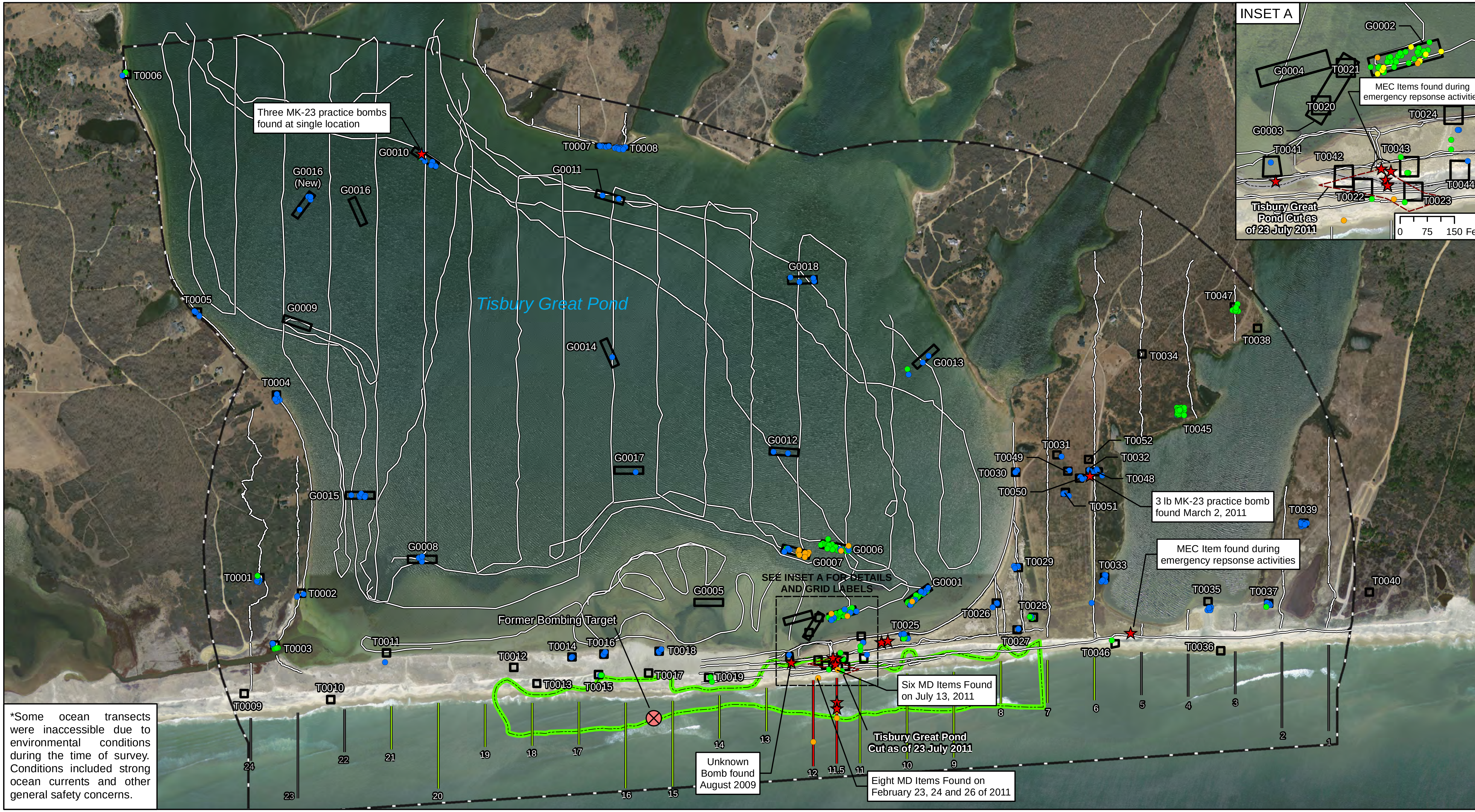
0 200 400 600 800 Meters

0 700 1,400 2,100 Feet

UXB amec

NOTES:
2009 Aerial Data Source: MassGIS

02/07/2014	Rev:	Tisbury_Land_Results_ Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000



Anomaly Type

- MEC
- MD
- Non-MD
- Cultural Artifact
- No Find
- Former Bombing Target
- Geophysical Survey Transect
- Ocean Transect Inaccessible*
- Ocean Transect with MEC or MD
- Ocean Transect with no MEC, MPPEH, or MD
- Intrusive Grid
- Tisbury Great Pond Cut
- Former Bigelow Property
- Tisbury Great Pond Investigation Area
- T0001 Intrusive Grid ID

US Army Corps of Engineers

FIGURE 5-3

Geophysical Survey Transect and Intrusive Grid Results

Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 100 200 300 400 500 600 700 Meters

0 600 1,200 1,800 2,400 Feet

UXB amec

NOTES:
2009 Aerial Data Source: MassGIS

06/13/2014	Rev:	Tisbury_All_Activities_Results_Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000

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**Table 5-2. Summary of MEC and MD Recovered (Land and Beach)
Tisbury Great Pond Investigation Area**

	Dig Descriptions						
Grid	MEC	MPPEH	MD	Non-MD	CA	Cleared	Comments
T1	N/A	N/A	N/A	6	N/A	1-Mar	Harrier habitat
T2	N/A	N/A	N/A	3	N/A	7-Mar	
T3	N/A	N/A	N/A	4	N/A	10-Mar	Completed while Tim Simmons onsite/4 items located in water.
T4	N/A	N/A	N/A	8	N/A	7-Mar	
T5	N/A	N/A	N/A	6	N/A	3-Mar	
T6	N/A	N/A	N/A	2	N/A	3-Mar	
T7	N/A	N/A	N/A	9	N/A	3-Mar	
T8	N/A	N/A	N/A	16	N/A	3-Mar	
T9	---	---	---	---	---	---	No ROE as of 2/23/2011
T10	N/A	N/A	N/A	N/A	N/A	4-Apr	0 anomalies
T11	N/A	N/A	N/A	1	N/A	4-Apr	
T12	---	---	---	---	---	---	No ROE as of 2/23/2011
T13	N/A	N/A	N/A	N/A	N/A	31-Mar	0 anomalies
T14	N/A	N/A	N/A	3	N/A	4-Apr	
T15	N/A	N/A	N/A	1	N/A	6-Apr	
T16	N/A	N/A	N/A	3	N/A	6-Apr	
T17	N/A	N/A	N/A	N/A	N/A	31-Mar	0 anomalies
T18	N/A	N/A	N/A	3	N/A	6-Apr	
T19	N/A	N/A	N/A	N/A	N/A	16-Mar	2 No finds
T20	---	---	---	---	---	---	Relocated
T21	---	---	---	---	---	---	Relocated
T22	N/A	N/A	N/A	N/A	N/A	16-Mar	1 No find
T23	N/A	N/A	N/A	N/A	N/A	16-Mar	1 No find
T24	N/A	N/A	N/A	2	N/A	18-Mar	
T25	N/A	N/A	N/A	11	N/A	9-Mar	
T26	N/A	N/A	N/A	4	N/A	7-Mar	
T27	N/A	N/A	N/A	2	N/A	4-Apr	Naeva reacquired
T28	N/A	N/A	N/A	5	N/A	4-Apr	Naeva reacquired
T29	N/A	N/A	N/A	4	N/A	7-Mar	
T30	N/A	N/A	N/A	2	N/A	2-Mar	
T31	N/A	N/A	N/A	1	N/A	2-Mar	
T32	1	N/A	N/A	6	N/A	3-Mar	MK23 with spotting charge
T33	N/A	N/A	N/A	6	N/A	9-Mar	
T34	---	---	---	---	---	---	Relocated
T35	N/A	N/A	N/A	7	N/A	2-Mar	
T36	---	---	---	---	---	---	Relocated
T37	N/A	N/A	N/A	7	N/A	7-Mar	
T38	---	---	---	---	---	---	Relocated
T39	N/A	N/A	N/A	34	N/A	7-Mar	
T40	N/A	N/A	N/A	1	N/A	9-Mar	
T41	N/A	N/A	N/A	1	N/A	18-Mar	Replaced T0020
T42	N/A	N/A	N/A	N/A	N/A	18-Mar	Replaced T0021/0 anomalies

Table 5-2. Summary of MEC and MD Recovered (Land and Beach)
Tisbury Great Pond Investigation Area (continued)

Grid	Dig Descriptions					Cleared	Comments
	MEC	MPPEH	MD	Non-MD	CA		
T43	N/A	N/A	N/A	N/A	N/A	18-Mar	Replaced T0022/2 No finds (depth exceeded 3-ft)
T44	N/A	N/A	N/A	1	N/A	18-Mar	Replaced T0023
T45	N/A	N/A	N/A	2	N/A	21-Mar	Replaced T0034
T46	N/A	N/A	N/A	N/A	N/A	18-Mar	Replaced T0036/1 No find
T47	N/A	N/A	N/A	N/A	N/A	21-Mar	Replaced T0038/7 No finds
T48	N/A	N/A	N/A	3	N/A	4-Apr	Reserve Grid
T49	N/A	N/A	N/A	1	N/A	4-Apr	Reserve Grid
T50	N/A	N/A	N/A	2	N/A	4-Apr	Reserve Grid
T51	N/A	N/A	N/A	5	N/A	4-Apr	Reserve Grid
T52	N/A	N/A	N/A	N/A	N/A	4-Apr	Reserve Grid/0 anomalies
Totals	**1**	**0**	**0**	**172**	**0**		

Notes:
ft – foot or feet
N/A – not applicable
MK – mark
MEC – munitions and explosives of concern
MPPEH - material potentially presenting an explosive hazard
MD – munitions debris
CA – cultural artifact
ROE – right of entry

Inland Water

5.1.5.0.3 Based on geophysical surveys, 18 inland water grids (Grids 1-18) were selected for intrusive investigation. The grids were located within Tisbury Great Pond, and each measured approximately 60-m by 13-m. During the investigation, 3 MEC items, 13 MD items, and 82 non-MD items were identified and recovered by the UXO dive team. The MEC items were all recovered in a single grid (Grid 10) and consisted of 3 MK23s co-located in one hole. This fact coupled with the distance from the historic target and other MK23 finds, indicates it is likely they were secondarily transported via human activity. Table 5-3 presents the location, description, quantity, and final disposition of MEC and MD items recovered. The MD items were recovered in 5 Grids, one of which is located in the northern section of the pond, with the other 4 located near the last cut in the southern section of the pond. There were 12 grids without any MEC or MD recovered and one grid (Grid 3) which could not be investigated due to currents/shoaling from the cut (Figure 5-3).

Table 5-3. Summary of MEC and MD Recovered (Inland Water)
Tisbury Great Pond Investigation Area

Grid	Dig Descriptions					Cleared	Comments
	MEC	MPPEH	MD	Non-MD	CA		
Grid 1	N/A	N/A	1	14	N/A	18-Apr	2.25-in. rocket motor
Grid 2	N/A	N/A	2	17	N/A	27-Apr	5-in. rocket motor/pieces of MK23
Grid 3	---	---	---	---	---	---	Could not access due to location of the cut and associated currents.
Grid 4	N/A	N/A	N/A	N/A	N/A	12-Apr	No anomalies in grid
Grid 5	N/A	N/A	N/A	N/A	N/A	13-Apr	No anomalies in grid
Grid 6	N/A	N/A	2	21	N/A	25-Apr	2-Expended MK23s
Grid 7	N/A	N/A	8	5	N/A	4-May	8-Expended MK23s
Grid 8	N/A	N/A	N/A	3	N/A	5-May	
Grid 9	N/A	N/A	N/A	N/A	N/A	13-Apr	No anomalies in grid
Grid 10	3	N/A	N/A	4	N/A	17-May	3-MK23s with intact spotting charges (were destroyed on 5/6).
Grid 11	N/A	N/A	N/A	2	N/A	13-May	100 lb spotting charge determined to be inert.
Grid 12	N/A	N/A	N/A	2	N/A	16-May	
Grid 13	N/A	N/A	N/A	3	N/A	16-May	
Grid 14	N/A	N/A	N/A	N/A	N/A	17-May	
Grid 15	N/A	N/A	N/A	2	N/A	19-May	
Grid 16	N/A	N/A	N/A	4	N/A	17-May	
Grid 17	N/A	N/A	N/A	1	N/A	16-May	
Grid 18	N/A	N/A	N/A	4	N/A	13-May	
Totals	**3**	**0**	**13**	**82**	**0**		

Notes:
in. – inch(es)
N/A – not applicable
MK – mark
MEC – munitions and explosives of concern
MPPEH - material potentially presenting an explosive hazard
MD – munitions debris
CA – cultural artifact
lb – pound(s)

<u>Ocean</u>

5.1.5.0.4 Mag and Dig operations were conducted along 17 ocean transects in the surfzone along the barrier beach immediately adjacent to Tisbury Great Pond. During the investigation, 2 MEC items and 18 MD items were identified and recovered by the UXO dive team (Table 5-4). Initially 24 transects were planned; however, ROE issues prevented investigation of transects 1 through 5, and transects 22 through 24 were dropped as there were no finds in the previous 9 transects. An additional transect (11.5) was added there was a find in Transect 12, which was east of the cut, and further delineation between the cut and transect 12 was deemed necessary.

Table 5-4. Ocean Transect MEC and MD Recovered
Tisbury Great Pond Investigation Area

	Dig Descriptions						
Transect	**MEC**	**MPPEH**	**MD**	**Non-MD**	**CA**	**Cleared**	**Comments**
1							Not Completed
2							Not Completed
3							Not Completed
4							Not Completed
5							Not Completed
6	N/A	N/A	N/A	N/A	N/A	10-Nov	No Finds
7	N/A	N/A	N/A	N/A	N/A	9-Nov	No Finds
8	N/A	N/A	N/A	N/A	N/A	9-Nov	No Finds
9	N/A	N/A	N/A	N/A	N/A	9-Nov	No Finds
10	N/A	N/A	N/A	N/A	N/A	21-Nov	No Finds
11	N/A	N/A	N/A	N/A	N/A	25-Oct	No Finds
11.5	2	N/A	17	N/A	N/A	31-Oct	5 - MD (Expended MK23s at 206 ft, 210 ft, 228 ft, 232 ft, and 270 ft); 12 - Pieces of 100-lb bomb; 2 - MEC (MK23s at 167 ft and 211 ft).
12	N/A	N/A	1	N/A	N/A	25-Oct	1 - MD (Expended MK23 at 430 ft).
13	N/A	N/A	N/A	N/A	N/A	25-Oct	No Finds
14	N/A	N/A	N/A	N/A	N/A	24-Oct	No Finds
15	N/A	N/A	N/A	N/A	N/A	24-Oct	No Finds
16	N/A	N/A	N/A	N/A	N/A	24-Oct	No Finds
17	N/A	N/A	N/A	N/A	N/A	24-Oct	No Finds
18	N/A	N/A	N/A	N/A	N/A	19-Oct	No Finds
19	N/A	N/A	N/A	N/A	N/A	19-Oct	No Finds
20	N/A	N/A	N/A	N/A	N/A	18-Oct	No Finds
21	N/A	N/A	N/A	N/A	N/A	18-Oct	No Finds
22							Not Completed
23							Not Completed
24							Not Completed
Totals	**2**	**0**	**18**	**0**	**0**		

Notes:
* 2 seed items located in the vicinity of Ocean Transect 11.5 and one that exceeded the maximum allowable distance of the divers support lines.
N/A – not applicable
ft – foot or feet
MK – Mark
MEC – munitions and explosives of concern
MPPEH - material potentially presenting an explosive hazard
MD – munitions debris
CA – cultural artifact MEC – munitions and explosives of concern

5.1.6 Ocean Transport Study

5.1.6.0.1 The results of the ocean transport study summarized below are presented in detail in Appendix A.

5.1.6.1 Transport Acoustic Pinger Survey

5.1.6.1.0.1 The Transport Acoustic Transponder (Pinger) Survey: Interrogation of the eight pingers was attempted during completion of the ocean transects November 2011. The pingers in the grid west of the previous cut were interrogated, but no return signal was identified. It is unknown if this was due to battery failure, or proximity, as the divers were not able to get close to the grid site due to umbilical length limitation/right of entry (ROE) issues.

5.1.6.1.0.2 Of the 4 pingers in the east grid, two responded (one 100-lb bomb simulant and one spotting charge simulant), but only the 100-lb bomb simulant was recovered. The spotting charge simulant migrated laterally beyond umbilical length and was not able to be recovered. The second 100-lb bomb simulant was located during mag/dig transect investigation and the pinger batteries were expired. Both 100-lb bomb simulants were found in the location they were placed, but both had become buried about 8 inches below the surface of the sand.

5.1.6.2 Numerical Modeling Study Results

5.1.6.2.0.1 There is a potential to transport UXO either seaward or into the pond based on the tide cycle. The current velocity field during the time of maximum ebb/draining currents in the cut occurs approximately 6 hours after the excavation of the cut was finished with a maximum ebb discharge of 1,250 cubic feet per second (cfs) and maximum current velocity of 13 feet per second (ft/s) (8 knots) in the cut channel. At this time current velocities greater than 5 ft/s (3 knots) extend approximately 400 ft offshore within a relatively narrow jet. Any UXO transported during this time would likely move in a seaward direction. The current velocity field during the time of maximum flood current occurs on the first reversing tide after the channel is cut. At this time the modeled flow rate into the pond is approximately 3,500 cfs, the depth averaged velocity is nearly 8 ft/s (5 knots) in the cut channel, and velocities greater than 5 ft/s (3 knots) extend approximately 300 ft into the pond. Any UXO transported during this time would likely move toward the pond. Transects 11 and 12 in the vicinity of, and east of the cut were extended to 600 ft as noted previously. The potential transport distance seaward is bounded by the transects as completed, with a strong west to east current along the face of the beach in the surf zone. This is confirmed with the transect finds on Transect 11, 11.5, and 12 with all MEC/MD items found within 430 ft of beach; and a large accumulation of MEC/MD items in Tisbury Great Pond inland water grids 1,2,6, and 7, all within approximately 300 ft of the cut.

5.2 MC Investigation Results

5.2.1 Soil

5.2.1.0.1 Soil samples were collected to determine the presence or absence of MCs. Based on the results of the intrusive investigation, two discrete surface soil (0 to 12 in. bgs) samples and 3 discrete subsurface soil (>12 in. bgs) samples were collected at the site.

5.2.1.0.2 Analytical results from surface and subsurface soil sampling are presented in Tables 5-5 and 5-7, respectively. A statistical summary of surface and subsurface soil data collected at the site are presented in Tables 5-6 and 5-8, respectively. Analytical Laboratory Reports are included in Appendix D. A summary of the results is presented below.

<u>Metals</u>

5.2.1.0.3 Metals (antimony, copper, lead, nickel, and zinc) were analyzed in surface soil samples, which were collected at two discrete sample locations. Antimony was detected at one sample location (TP01 0 to 6 in. bgs) and the remaining metals were detected at both surface soil sample locations (TP01 0 to 6 in. bgs and 6 to 12 in bgs). Lead was detected at concentrations exceeding ecological screening criterion at both sample locations. None of the metals were detected in surface soil at concentrations exceeding human health screening criterion.

5.2.1.0.4 Metals were also analyzed at three discrete subsurface soil sample locations. Antimony was detected at two subsurface sample locations (TP23 and TP24) and the remaining metals were detected at each sample locations. Lead was detected at concentrations exceeding ecological screening criterion at two sample locations, TP01 and TP23. No metals were detected in subsurface soil at concentrations exceeding human health screening criterion.

<u>Explosives</u>

5.2.1.0.5 Explosives were analyzed in surface and subsurface soil samples. No explosives compounds were detected in surface or subsurface soil samples.

Table 5-5. Surface Soil Sample Results Summary
Tisbury Great Pond Investigation Area

Station ID	Sample ID	Sample Date	Sample Type	Sample Depth Interval (inches)	Metals by 6020A									
					Antimony		Copper		Lead		Nickel		Zinc	
Human Health Screening Criterion[1]					20		3100		300		20		2500	
Ecological Screening Criterion[2]					0.27		28		11		38		46	
Results are presented in milligrams per kilogram (mg/kg)														
TP01	SB128	10/19/2011	Regular	0-6	0.21	U	**1.8**	**J**	**32**		**2.3**		**8.3**	
TP01	SB129	10/19/2011	FD	0-6	**0.018**	**J**	**1.8**	**J**	**32**		**2.1**		**7.6**	
TP01	SB130	10/19/2011	Regular	6-12	0.2	U	**1.4**	**J**	**44**		**3.9**		**8.4**	

Notes:
[1] Criteria for human health were identified as the lower of 1) U.S. Environmental Protection Agency Risk Screening Level (residential selected as the most stringent) 2) Massachusetts Department of Environmental Protection Method 1 Soil Standard (SI value selected for the greatest stringency).

[2] Criteria for ecological were identified using the U.S. Environmental Protection Agency Ecological Soil Screening Level (lowest of avian, mammalian, plant or invertebrate).

Acronyms

FD - field duplicate **J** - quantitation estimated

FT - field triplicate **U** - not detected

Detected concentration is greater than ecological screening criterion.

Table 5-6. Surface Soil Data Statistical Summary
Tisbury Great Pond Investigation Area

Constituent	HHSC[1] (mg/kg)	ECOSC[2] (mg/kg)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Maximum Detection Location
Antimony	20	0.27	3	1	33	0	0	0	0.018	0.018	TP01 SB129
Copper	3100	28	3	3	100	0	0	0	1.4	1.8	TP01 SB128, TP01 SB129
Lead	300	11	3	3	100	0	3	100	32	44	TP01 SB130
Nickel	20	38	3	3	100	0	0	0	2.1	3.9	TP01 SB130
Zinc	2500	46	3	3	100	0	3	100	7.6	8.4	TP01 SB130
1,3,5-Trinitrobenzene	2200	0.376	3	0	0	0	0	0	n/a	n/a	n/a
1,3-Dinitrobenzene	6.1	0.073	3	0	0	0	0	0	n/a	n/a	n/a
2,4,6-Trinitrotoluene	19	6.4	3	0	0	0	0	0	n/a	n/a	n/a
2,4-Dinitrotoluene	0.7	1.28	3	0	0	0	0	0	n/a	n/a	n/a
2,6-Dinitrotoluene	61	0.0328	3	0	0	0	0	0	n/a	n/a	n/a
2-Amino-4,6-dinitrotoluene	150	10	3	0	0	0	0	0	n/a	n/a	n/a
2-Nitrotoluene	2.9	9.9	3	0	0	0	0	0	n/a	n/a	n/a
3-Nitrotoluene	2.9	12	3	0	0	0	0	0	n/a	n/a	n/a
4-Amino-2,6-dinitrotoluene	150	3.6	3	0	0	0	0	0	n/a	n/a	n/a
4-Nitrotoluene	30	22	3	0	0	0	0	0	n/a	n/a	n/a

Notes:
(1) Criteria for human health were identified as the lower of 1) U.S. Environmental Protection Agency Regional Screening Level (residential selected as the most stringent) 2) Massachusetts Department of Environmental Protection Method 1 Soil Standard (SI value selected for the greatest stringency).
(2) Criteria for ecological were identified using the U.S. Environmental Protection Agency Ecological Soil Screening Level (lowest of avian, mammalian, plant or invertebrate).

ECOSC - Ecological Screening Criterion

n/a – not applicable

HHSC - Human Health Screening Criterion

mg/kg - milligrams per kilogram

Table 5-7. Subsurface Soil Sample Results Summary
Tisbury Great Pond Investigation Area

Location ID	Sample ID	Sample Date	Sample Type	Sample Depth Interval (inches)	Metals by 6020A				
					Antimony	Copper	Lead	Nickel	Zinc
Human Health Screening Criterion[1]					20	3100	300	20	2500
Ecological Screening Criterion[2]					0.27	28	11	38	46
Results are presented in milligrams per kilogram (mg/kg)									
TP01	SB131	10/19/2011	Regular	12-18	0.19 U	**1.3 J**	**39**	**3.7**	**7.9**
TP23	SB132	11/2/2011	Regular	12-24	**0.068 J**	**1.4 J**	**15**	**3.7**	**21**
TP24	SB133	11/2/2011	Regular	72-84	**0.038 J**	**0.86 J**	**6.9**	**1.8**	**9.6**

Notes:
[1] Criteria for human health were identified as the lower of 1) U.S. Environmental Protection Agency Risk Screening Level (residential selected as the most stringent) 2) Massachusetts Department of Environmental Protection Method 1 Soil Standard (SI value selected for the greatest stringency).
[2] Criteria for ecological were identified using the U.S. Environmental Protection Agency Ecological Soil Screening Level (lowest of avian, mammalian, plant or invertebrate).

Detected concentration is greater than ecological screening criterion. (shaded cells)

Acronyms

FD - field duplicate
U - not detected
J - quantitation estimated
UJ - not detected, quantitation estimated

Table 5-8. Subsurface Soil Data Statistical Summary
Tisbury Great Pond Investigation Area

Constituent	HHSC[(1)] (mg/kg)	ECOSC[(2)] (mg/kg)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Maximum Detection Location
Antimony	20	0.27	3	2	67	0	0	0	0.038	0.68	TP23 SB132
Copper	3100	28	3	3	100	0	0	0	0.86	1.4	TP23 SB132
Lead	300	11	3	3	100	0	2	100	6.9	39	TP01 SB131
Nickel	20	38	3	3	100	0	0	0	1.8	3.7	TP23 SB132, TP24 SB133
Zinc	2500	46	3	3	100	0	3	100	7.9	21	TP23 SB132
1,3,5-Trinitrobenzene	2200	0.376	3	0	0	0	0	0	n/a	n/a	n/a
1,3-Dinitrobenzene	6.1	0.073	3	0	0	0	0	0	n/a	n/a	n/a
2,4,6-Trinitrotoluene	19	6.4	3	0	0	0	0	0	n/a	n/a	n/a
2,4-Dinitrotoluene	0.7	1.28	3	0	0	0	0	0	n/a	n/a	n/a
2,6-Dinitrotoluene	61	0.0328	3	0	0	0	0	0	n/a	n/a	n/a
2-Amino-4,6-dinitrotoluene	150	10	3	0	0	0	0	0	n/a	n/a	n/a
2-Nitrotoluene	2.9	9.9	3	0	0	0	0	0	n/a	n/a	n/a
3-Nitrotoluene	2.9	12	3	0	0	0	0	0	n/a	n/a	n/a
4-Amino-2,6-dinitrotoluene	150	3.6	3	0	0	0	0	0	n/a	n/a	n/a
4-Nitrotoluene	30	22	3	0	0	0	0	0	n/a	n/a	n/a
HMX	1	27	3	0	0	0	0	0	n/a	n/a	n/a
Nitrobenzene	4.8	1.31	3	0	0	0	0	0	n/a	n/a	n/a
Nitroglycerin	6.1	71	3	0	0	0	0	0	n/a	n/a	n/a
PETN	120	100	3	0	0	0	0	0	n/a	n/a	n/a
RDX	1	7.5	3	0	0	0	0	0	n/a	n/a	n/a
Tetryl	240	0.99	3	0	0	0	0	0	n/a	n/a	n/a

Notes:
(1) Criteria for human health were identified as the lower of 1) U.S. Environmental Protection Agency Regional Screening Level (residential selected as the most stringent) 2) Massachusetts Department of Environmental Protection Method 1 Soil Standard (SI value selected for the greatest stringency).
(2) Criteria for ecological were identified using the U.S. Environmental Protection Agency Ecological Soil Screening Level (lowest of avian, mammalian, plant or invertebrate).
ECOSC - Ecological Screening Criterion
n/a – not applicable
HHSC - Human Health Screening Criterion

5.2.2 Sediment

5.2.2.0.1 During the RI, 17 sediment sample locations were identified and samples were collected from a depth interval of 0 to 6 in. bgs. Analytical results from sediment sampling are presented in Table 5-9. A statistical summary of sediment data collected at the site is presented in Table 5-10. Sediment sample locations and results are presented on Figure 5-4. Analytical Laboratory Reports are included in Appendix D. A summary of the results is presented below.

Metals

5.2.2.0.2 Metals were analyzed in sediment samples collected at the Investigation Area. Antimony was detected at seven sample locations (TP05, TP06, TP08, TP09, TP10, TP20, and TP21) and the remaining metals were detected at each sediment sample locations. Lead was detected at concentrations exceeding ecological screening criterion at two locations (TP08 and TP12). Nickle was detected at concentrations exceeding ecological screening criterion at four locations (TP08, TP09, TP10, and TP12). No samples exceeded the human health screening criterion.

5.2.2.0.3 Based upon the Technical Justification Memorandum issued to the project team following Technical Project Planning (TPP) Meeting #3 (See Section 3.5.1), sediment and surface water background samples were collected and analyzed for nickel and lead in follow-on sampling effort conducted in October 2013.

Explosives

5.2.2.0.3 Explosives were analyzed in sediment samples; however, no explosives compounds were detected in sediments.

5.2.3 Groundwater

5.2.3.0.1 Groundwater samples were collected from three sample locations at the Investigation Area. Analytical results from groundwater sampling are presented in Table 5-11. A statistical summary of groundwater data collected at the site is presented in Table 5-12. Groundwater sample locations are presented on Figure 4-2. Analytical Laboratory Reports are included in Appendix D. A summary of the results is presented below.

Metals

5.2.3.0.2 Metals were analyzed in all groundwater samples. Antimony was detected at one location (TP04), copper and lead were not detected at any location, and nickel and zinc were detected at all three sample locations. None of the metals were detected at concentrations exceeding human health groundwater screening criterion.

Explosives

5.2.3.0.3 Explosives were analyzed in each groundwater sample; however, no explosives compounds were detected in groundwater.

5.2.4 Background Sampling

5.2.4.0.1 Background sediment and surface water samples were collected from the northern fingers of the Tisbury Great Pond on 8 August, 2013. The background samples were analyzed for lead and nickel, since both were detected at concentrations exceeding the ecological screening criteria in sediment (Table 5-9). The discrete biased sediment samples found lead and nickel at concentrations of 34 mg/kg and 21 mg/kg, respectively. The background sediment concentrations (lead and nickel at 32 mg/kg and 16 mg/kg, respectively) are similar to the biased discrete sediment samples collected from Tisbury Great Pond. The following sections detail the results of the background sampling.

5.2.4.1 Sediment

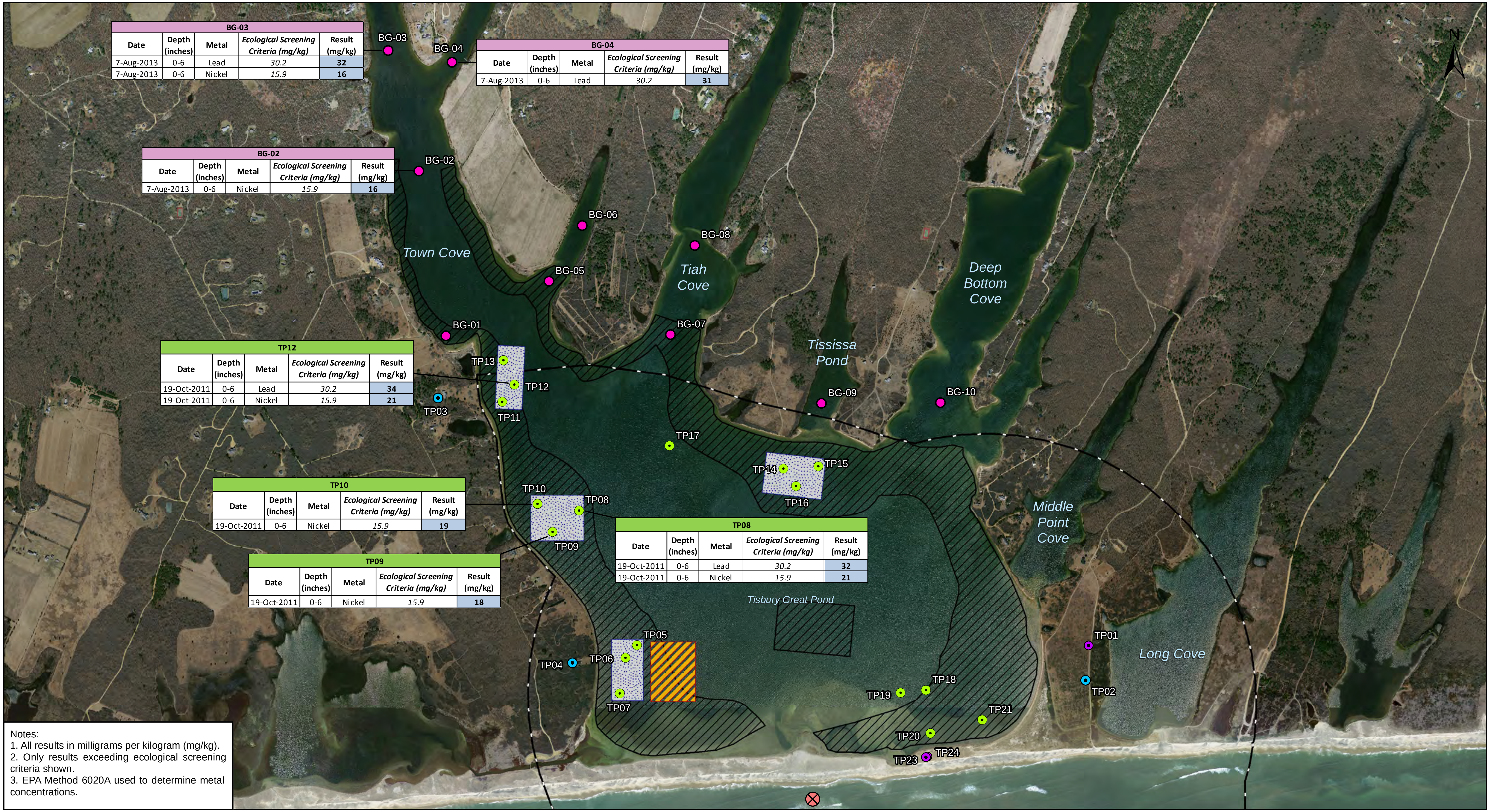
5.2.4.1.0.1 Ten background sampling locations were identified and sediment samples were collected from a depth interval of 0 to 6 in. bgs. Analytical results from sediment sampling are presented in Table 5-13. A statistical summary of sediment data collected at the site is presented in Table 5-14. Sediment sample locations and results exceeding the screening criteria are presented on Figure 5-4. Analytical Laboratory Reports are included in Appendix D.

5.2.4.1.0.2 Lead and nickel were analyzed in sediment samples collected at the Investigation Area, and both metals were detected in each of the ten sediment samples. Lead was detected at concentrations exceeding ecological screening criterion at one location (BG03). Nickel was detected at concentrations exceeding ecological screening criterion at two locations (BG02 and BG03).

5.2.4.2 Surface Water

5.2.4.2.0.1 Ten background sampling locations were identified and surface water samples were collected approviemately one foot above the bottom of the pond, colocated with the sediment samples. Analytical results from surface water sampling are presented in Table 5-15. A statistical summary of surface water data collected at the site is presented in Table 5-16. Analytical Laboratory Reports are included in Appendix D.

5.2.4.2.0.2 Lead and nickel were analyzed in surface water samples collected at the Investigation Area. Total and dissolved nickel was detected in all ten surface water samples. Lead (total) was detected in three samples (BG-4, BG-9 and BG-10). Lead (dissolved) was detected in one sample, BG-09. Neither metal was identified at concentrations exceeding the ecological screening concentrations obtained from the 2008 National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQuiRT) for Inorganics in Marine Water – Chronic Levels.



BG-03				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
7-Aug-2013	0-6	Lead	30.2	32
7-Aug-2013	0-6	Nickel	15.9	16

BG-04				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
7-Aug-2013	0-6	Lead	30.2	31

BG-02				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
7-Aug-2013	0-6	Nickel	15.9	16

TP12				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
19-Oct-2011	0-6	Lead	30.2	34
19-Oct-2011	0-6	Nickel	15.9	21

TP10				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
19-Oct-2011	0-6	Nickel	15.9	19

TP08				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
19-Oct-2011	0-6	Lead	30.2	32
19-Oct-2011	0-6	Nickel	15.9	21

TP09				
Date	Depth (inches)	Metal	Ecological Screening Criteria (mg/kg)	Result (mg/kg)
19-Oct-2011	0-6	Nickel	15.9	18

Notes:
1. All results in milligrams per kilogram (mg/kg).
2. Only results exceeding ecological screening criteria shown.
3. EPA Method 6020A used to determine metal concentrations.

Background Sediment Sample Location
Discrete Surface or Subsurface Soil Sample
Groundwater Sample
Sediment Sample Location
Former Bombing Target
Oyster Grow Out Equipment
Shell Reef
Oyster Growth Area

US Army Corps of Engineers

FIGURE 5-4

MC Sampling Results Exceeding Ecological Screening Criteria - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 100 200 400 600 800 Meters

0 500 1,000 1,500 2,000 2,500 Feet

UXB amec

NOTES:
2009 Aerial Data
Source: MassGIS

02/07/2014	Rev:	Tisbury_MC_Samp_Results_Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000

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Table 5-9. Sediment Sample Results Summary, Tisbury Great Pond Investigation Area

Location ID	Sample ID	Sample Date	Sample Type	Sample Depth Interval (inches)	Metals by 6020A									
					Antimony		Copper		Lead		Nickel		Zinc	
Human Health Screening Criterion[1]					NA		NA		NA		NA		NA	
Ecological Screening Criterion[2]					2		16		30.2		15.9		121	
Results are presented in milligrams per kilogram (mg/kg)														
TP05	SD018	10/19/2011	Regular	0-6	**0.027**	**J**	**5.2**	**J**	**11**	**J**	**7.4**	**J**	**34**	
TP06	SD019	10/19/2011	Regular	0-6	**0.019**	**J**	**3.8**		**7.8**		**5.2**		**25**	
TP07	SD020	10/19/2011	Regular	0-6	0.25	U	**2.2**	**J**	**5.2**		**3.1**		**15**	
TP08	SD021	10/19/2011	Regular	0-6	**0.034**	**J**	**15**		**32**		**21**		**93**	
TP09	SD022	10/19/2011	Regular	0-6	**0.037**	**J**	**13**		**28**		**18**		**88**	
TP10	SD023	10/19/2011	Regular	0-6	**0.033**	**J**	**14**		**30**		**19**		**92**	
TP11	SD024	10/19/2011	Regular	0-6	0.24	U	**4.6**		**5.8**		**3**		**16**	
TP12	SD025	10/19/2011	Regular	0-6	0.47	U	**16**		**34**		**21**		**100**	
TP13	SD026	10/19/2011	Regular	0-6	0.43	U	**12**		**26**		**15**		**85**	
TP14	SD028	10/19/2011	FD	0-6	0.23	U	**1.2**	**J**	**2.9**		**1.7**		**8.7**	
TP14	SD027	10/19/2011	Regular	0-6	0.24	U	**1.5**	**J**	**3.3**		**2**		**10**	
TP15	SD029	10/19/2011	Regular	0-6	0.27	U	**1**	**J**	**2.6**		**1.5**		**7.1**	
TP16	SD030	10/19/2011	Regular	0-6	0.21	U	**1.4**	**J**	**3.1**		**2**		**9.9**	
TP17	SD031	10/19/2011	Regular	0-6	0.26	U	**2.3**	**J**	**5.1**		**3.3**		**16**	
TP18	SD032	10/19/2011	Regular	0-6	0.28	U	**3.3**	**J**	**5.6**		**4.7**		**19**	
TP19	SD033	10/19/2011	Regular	0-6	0.3	U	**6.4**		**9.8**		**9.4**		**36**	
TP20	SD034	10/19/2011	Regular	0-6	**0.023**	**J**	**0.51**	**J**	**2.8**		**1**		**5.1**	
TP21	SD036	10/19/2011	FD	0-6	**0.033**	**J**	**0.63**	**J**	**4.4**		**1.3**		**7.3**	
TP21	SD035	10/19/2011	Regular	0-6	**0.037**	**J**	**0.58**	**J**	**4.8**		**1.4**		**7.8**	

Notes:
[1] Sediment Criteria are generally for protection of ecological resources. Soil criteria can be used as conservative human health screening levels.
[2] Criteria for ecological endpoints were identified as the lowest of 1) Region 5 Ecological Screening Level 2) Region 3 Freshwater Screening Benchmark 3) Massachusetts Department of Environmental Protection Freshwater Sediment Screening Benchmarks 4) Region 6 Toxicity Reference Values 5) Los Alamos National Laboratory ECORISK Database Release 2.5 (October, 2010) 5) Region 4 Ecological Screening Value.

Acronyms **FD** - field duplicate **NA** - not available **J** - quantitation estimated **U** - not detected **UJ** - not detected, value estimated

Table 5-10. Sediment Data Statistical Summary
Tisbury Great Pond Investigation Area

Constituent	HHSC[1] (mg/kg)	ECOSC[2] (mg/kg)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Maximum Detection Location
Antimony	NA	2	19	8	42	0	0	0	0.019	0.037	TP09 SD022, TP21 SD035
Copper	NA	16	19	19	100	0	0	0	0.51	16	TP12 SD025
Lead	NA	30.2	19	19	100	0	2	11	2.6	34	TP12 SD025
Nickel	NA	15.9	19	19	100	0	4	21	1	21	TP08 SD021, TP12 SD025
Zinc	NA	121	19	19	100	0	0	0	5.1	100	TP12 SD025
1,3,5-Trinitrobenzene	NA	0.24	19	0	0	0	0	0	n/a	n/a	n/a
1,3-Dinitrobenzene	NA	0.00861	19	0	0	0	0	0	n/a	n/a	n/a
2,4,6-Trinitrotoluene	NA	9.2	19	0	0	0	0	0	n/a	n/a	n/a
2,4-Dinitrotoluene	NA	0.0144	19	0	0	0	0	0	n/a	n/a	n/a
2,6-Dinitrotoluene	NA	0.0398	19	0	0	0	0	0	n/a	n/a	n/a
2-Amino-4,6-dinitrotoluene	NA	34	19	0	0	0	0	0	n/a	n/a	n/a
2-Nitrotoluene	NA	28	19	0	0	0	0	0	n/a	n/a	n/a
3-Nitrotoluene	NA	24	19	0	0	0	0	0	n/a	n/a	n/a
4-Amino-2,6-dinitrotoluene	NA	9.5	19	0	0	0	0	0	n/a	n/a	n/a
4-Nitrotoluene	NA	4.06	19	0	0	0	0	0	n/a	n/a	n/a
HMX	NA	0.47	19	0	0	0	0	0	n/a	n/a	n/a
Nitrobenzene	NA	0.145	19	0	0	0	0	0	n/a	n/a	n/a
Nitroglycerin	NA	1700	19	0	0	0	0	0	n/a	n/a	n/a
PETN	NA	1400	19	0	0	0	0	0	n/a	n/a	n/a
RDX	NA	0.013	19	0	0	0	0	0	n/a	n/a	n/a
Tetryl	NA	100	19	0	0	0	0	0	n/a	n/a	n/a

Notes:
(1) Sediment Criteria are generally for protection of ecological resources. Soil criteria can be used as conservative human health screening levels.
(2) Criteria for ecological endpoints were identified as the lowest of 1) Region 5 Ecological Screening Level 2) Region 3 Freshwater Screening Benchmark 3) Massachusetts Department of Environmental Protection Freshwater Sediment Screening Benchmarks 4) Region 6 Toxicity Reference Values 5) Los Alamos National Laboratory ECORISK Database Release 2.5 (October, 2010) 5) Region 4 Ecological Screening Value.
ECOSC - Ecological Screening Criterion　**HHSC** - Human Health Screening Criterion　**mg/kg** - milligrams per kilogram　**n/a** – not applicable or not available
HMX - 1,3,5,7-tetranitro-1,3,5,7-tetrazocine　**RDX** - 1,3,5-trinitro-1,3,5-triazine　**PETN** - pentaerythrite tetranitrate

Table 5-11. Groundwater Sampling Results Summary
Tisbury Great Pond Investigation Area

Location ID	Sample ID	Sample Date	Sample Type	Sample Depth Interval (inches)	Metals by 6020A				
					Antimony	Copper	Lead	Nickel	Zinc
Human Health Screening Criterion[1]					6	1300	10	100	11000
Ecological Screening Criterion[2]					NA	NA	NA	NA	NA
Results are presented in micrograms per liter (µg/L)									
TP02	TP02 GW011	11/2/2011	Regular	8-12	6 U	2 U	3 U	**6.5**	**12 J**
TP03	TP03 GW012	11/2/2011	Regular	16-20	6 U	2 U	3 U	**4.5**	**5.7 J**
TP04	TP04 GW013	11/2/2011	Regular	8-12	**0.074 J**	2 U	3 U	**13**	**4 J**
TP04	TP04 GW014	11/2/2011	FD	8-12	**0.073 J**	2 U	3 U	**12**	**4.2 J**

Notes:
[1] Criteria for human health were identified as the lower of 1) U.S. Environmental Protection Agency Maximum Contaminant Level, 2) U.S. Environmental Protection Agency Regional Screening Level, 3) Massachusetts Department of Environmental Protection Method 1 Groundwater Standards (GW1 value selected for the greatest stringency).
[2] U.S. Environmental Protection Agency ecological criteria for groundwater were not identified. Massachusetts Department of Environmental Protection GW-3 standards are intended to protect surface water, so selecting the lowest groundwater standard is protective of surface water.

Acronyms

FD - field duplicate

NA - not available

J - quantitation estimated

U - not detected

Table 5-12. Groundwater Data Statistical Summary
Former Moving Target Machine Gun Range Investigation Area

Constituent	HHSC(1) (µg/L)	ECOSC(2) (µg/L)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Maximum Detection Location
Antimony	6	NA	4	2	50	0	0	0	0.073	0.074	TP04 GW013
Copper	1300	NA	4	0	0	0	0	0	n/a	n/a	n/a
Lead	10	NA	4	0	0	0	0	0	n/a	n/a	n/a
Nickel	100	NA	4	4	100	0	0	0	4.5	13	TP04 GW013
Zinc	11000	NA	4	4	100	0	0	0	4	12	TP02 GW011
1,3,5-Trinitrobenzene	1100	NA	4	0	0	0	0	0	n/a	n/a	n/a
1,3-Dinitrobenzene	3.7	NA	4	0	0	0	0	0	n/a	n/a	n/a
2,4,6-Trinitrotoluene	2.2	NA	4	0	0	0	0	0	n/a	n/a	n/a
2,4-Dinitrotoluene	0.22	NA	4	0	0	0	0	0	n/a	n/a	n/a
2,6-Dinitrotoluene	37	NA	4	0	0	0	0	0	n/a	n/a	n/a
2-Amino-4,6-dinitrotoluene	73	NA	4	0	0	0	0	0	n/a	n/a	n/a
2-Nitrotoluene	0.31	NA	4	0	0	0	0	0	n/a	n/a	n/a
3-Nitrotoluene	3.7	NA	4	0	0	0	0	0	n/a	n/a	n/a
4-Amino-2,6-dinitrotoluene	73	NA	4	0	0	0	0	0	n/a	n/a	n/a
4-Nitrotoluene	4.2	NA	4	0	0	0	0	0	n/a	n/a	n/a
HMX	200	NA	4	0	0	0	0	0	n/a	n/a	n/a
Nitrobenzene	0.12	NA	4	0	0	0	0	0	n/a	n/a	n/a
Nitroglycerin	3.7	NA	4	0	0	0	0	0	n/a	n/a	n/a
PETN	17	NA	4	0	0	0	0	0	n/a	n/a	n/a
RDX	0.61	NA	4	0	0	0	0	0	n/a	n/a	n/a
Tetryl	150	NA	4	0	0	0	0	0	n/a	n/a	n/a

Notes:
(1) Criteria for human health were identified as the lower of 1) USEPA MCLs, 2) USEPA RSL, 3) MADEP Method 1 Groundwater Standards (GW1 value selected for the greatest stringency).
(2) USEPA ecological criteria for groundwater were not identified. MADEP GW-3 standards are intended to protect surface water; so selecting the lowest groundwater standard is protective of surface water.

ECOSC - Ecological Screening Criterion
HHSC - Human Health Screening Criterion
µg/L - micrograms per kilogram
n/a – not applicable
HMX - 1,3,5,7-tetranitro-1,3,5,7-tetrazocine
RDX - 1,3,5-trinitro-1,3,5-triazine
PETN - pentaerythrite

Table 5-13. Background Sediment Sample Results Summary

Location ID	Sample ID	Sample Date	Sample Type	Sample Depth Interval (ft below sediment surface)	Metals by 6020A (mg/kg)	
					Lead	Nickel
Human Health Screening Criterion[1]					NA	NA
Ecological Screening Criterion[2]					30.2	15.9
BG01	SD037	8/8/2013	Regular	0-0.5	**28**	**15**
BG02	SD038	8/8/2013	Regular	0-0.5	**29**	**16**
BG03	SD039	8/8/2013	Regular	0-0.5	**32**	**16**
BG04	SD040	8/8/2013	Regular	0-0.5	**31**	**15**
BG05	SD041	8/8/2013	Regular	0-0.5	**18**	**9.2**
BG05	SD042	8/8/2013	FD	0-0.5	**15**	**7.8**
BG06	SD043	8/8/2013	Regular	0-0.5	**9.4**	**4.1**
BG07	SD044	8/8/2013	Regular	0-0.5	**22**	**13**
BG08	SD045	8/8/2013	Regular	0-0.5	**1.4 J**	**0.66 J**
BG09	SD046	8/8/2013	Regular	0-0.5	**19**	**8.3**
BG10	SD047	8/8/2013	Regular	0-0.5	**22**	**11**

Notes: [1] Sediment Criteria are generally for protection of ecological resources. Soil criteria can be used as conservative human health screening levels.
[2] Criteria for ecological endpoints were identified as the lowest of 1) Region 5 Ecological Screening Level 2) Region 3 Freshwater Screening Benchmark 3) Massachusetts Department of Environmental Protection Freshwater Sediment Screening Benchmarks 4) Region 6 Toxicity Reference Values 5) Los Alamos National Laboratory ECORISK Database Release 2.5 (October, 2010) 6) Region 4 Ecological Screening Value.
Bold results indicate a detection. **Acronyms:** NA – Not applicable FD – Field Duplicate J - quantitation estimated

Table 5-14. Background Sediment Data Statistical Summary

Constituent	HHSC[1] (mg/kg)	ECOSC[2] (mg/kg)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Maximum Detection Location
Lead	NA	30.2	11	11	100	0	1	9	1.4	32	BG03 SD039
Nickel	NA	15.9	11	11	100	0	2	18	0.66	16	BG02 SD038 BG03 SD039

Notes:[1] Sediment Criteria are generally for protection of ecological resources. Soil criteria can be used as conservative human health screening levels.
[2] Criteria for ecological endpoints were identified as the lowest of 1) Region 5 Ecological Screening Level 2) Region 3 Freshwater Screening Benchmark 3) Massachusetts Department of Environmental Protection Freshwater Sediment Screening Benchmarks 4) Region 6 Toxicity Reference Values 5) Los Alamos National Laboratory ECORISK Database Release 2.5 (October, 2010) 5) Region 4 Ecological Screening Value.
ECOSC - Ecological Screening Criterion **HHSC** - Human Health Screening Criterion **mg/kg** - milligrams per kilogram **n/a** – not applicable or not available

Table 5-15. Background Surface Water Sample Results Summary

Location ID	Sample ID	Sample Date	Sample Type	Metals by 6020A (total)				Metals by 6020A (dissolved)			
				Lead		Nickel		Lead		Nickel	
Human Health Screening Criterion[1]				NA		NA		NA		NA	
Ecological Screening Criterion[2]				8.1		8.2		8.1		8.2	
Results are presented in micrograms per liter (ug/L)											
BG01	SW001	8/8/2013	Regular	0.50	U	**0.51**	**J**	0.50	U	**1.1**	**J**
BG02	SW002	8/8/2013	Regular	0.50	U	**0.48**	**J**	0.50	U	**0.85**	**J**
BG02	SW003	8/8/2013	FD	0.50	U	**0.42**	**J**	0.50	U	**0.69**	**J**
BG03	SW004	8/8/2013	Regular	0.50	U	**0.35**	**J**	0.50	U	**0.95**	**J**
BG04	SW005	8/8/2013	Regular	**0.36**	**J**	**0.35**	**J**	0.50	UJ	**0.97**	**J**
BG05	SW006	8/8/2013	Regular	0.50	U	**0.34**	**J**	0.50	U	**0.71**	**J**
BG06	SW007	8/8/2013	Regular	0.50	U	**0.40**	**J**	0.50	U	**1.0**	**J**
BG07	SW008	8/8/2013	Regular	0.50	U	**0.46**	**J**	0.50	U	**1.0**	**J**
BG08	SW009	8/8/2013	Regular	0.50	U	**0.47**	**J**	0.50	U	**1.1**	**J**
BG09	SW010	8/8/2013	Regular	**0.18**	**J**	**0.46**	**J**	**0.40**	**J**	**1.2**	**J**
BG10	SW011	8/8/2013	Regular	**0.41**	**J**	**0.47**	**J**	0.50	U	**0.97**	**J**

Notes: [1] Surface water screening criteria are generally for protection of ecological resources.
[2] Ecological screening concentrations were obtained from the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQuiRT) for Inorganics in Marine Water – Chronic Levels.
Bold results indicate a detection.
Acronyms: NA – not applicable FD – Field Duplicate J - quantitation estimated U - undetected

Table 5-16. Background Surface Water Data Statistical Summary

Constituent	HHSC(1) (µg/L)	ECOSC(2) (µg/L)	Analyzed	Detected	Percent of Detection	Exceeded HHSC	Exceeded ECOSC	Percent Exceeded ECOSC	Minimum Detection (µg/L)	Maximum Detection (µg/L)	Maximum Detection Location
Lead (total)	NA	8.1	11	3	27	0	0	0	0.18 J	0.41 J	BG10 SW011
Lead (dissolved)	NA	8.1	11	11	100	0	0	0	0.34 J	0.51 J	BG01 SW001
Nickel (total)	NA	8.2	11	1	9	0	0	0	0.40 J	0.40 J	BG09 SW010
Nickel (dissolved)	NA	8.2	11	11	100	0	0	0	0.69 J	1.2 J	BG09 SW010

Notes:[1] Surface water screening criteria are generally for protection of ecological resources.
[2] Ecological screening concentrations were obtained from the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQuiRT) for Inorganics in Marine Water – Chronic Levels.
ECOSC - Ecological Screening Criterion HHSC - Human Health Screening Criterion mg/kg - milligrams per kilogram n/a – not applicable or not available

5.3 Revised Conceptual Site Model

5.3.0.1 The preliminary CSM presented in Section 3.1 was reviewed and revised based upon the results of MEC and MC characterization activities. The key findings of the investigations conducted at the Investigation Area include:

- The beach, inland water, and ocean near the "Cut" contained the highest concentration of MEC and MD items.
- Two MEC items (MK23s) were identified in the ocean south of the "Cut."
- Three MEC items (MK23s) were identified in the northwest portion of Tisbury Great Pond.
- The land area east of Tisbury Great Pond contained one MEC item (MK23) and no MD items. Considering the distance from the historic bombing target and that no other MEC or MD items were observed in the adjacent areas, it is unlikely that other MEC items are located in this area. Therefore, this MEC item is considered an outlier.
- The residential area on the western shore of Tisbury Great Pond did not contain MEC or MD.
- An unknown bomb was identified in an emergency response by EOD in August 2009 west of the current "Cut."
- One ordnance item was identified during an emergency response at the West Tisbury Great Pond "cut" on 20 August 2009. Due to high tide and strong current, the item was left in place.
- MD items were identified during an emergency response in four instances on the beach near the "Cut," three on 23 February, three on 24 February, two on 26 February, and six on 13 July 2011.
- During the Transport Acoustic Transponder (Pinger) Survey a spotting charge simulant was transported laterally/parallel to the beach in near shore currents and 100-lb bomb simulants were identified at the location where they were placed but were buried under 8 inches of sand.
- MC sampling indicated that human health screening criterion were not exceeded in any media.
- Lead was identified at concentrations exceeding ecological screening criterion in surface and subsurface soil.
- Lead and nickel were identified at concentrations exceeding ecological screening criterion in sediment in both investigation and background samples.

5.3.0.2 These findings build upon data gathered from historical records, previous investigation, removal actions, and interviews with long-term residents and former military personnel. Table 5-13 summarizes the revised CSM including facility, physical, release, land use and exposure, and ecological profiles for MEC and MCs.

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Table 5-17. Revised Conceptual Site Model Summary, Tisbury Great Pond Investigation Area

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Facility Description: • Approximately 768 acres. [1] • Located in the southwest portion of Martha's Vineyard, Massachusetts, which is bound to the south by the Atlantic Ocean and to the north, east, and west by privately and publicly owned land. • No permanent structures were constructed by the U.S. Navy at the site. [2] **Site History:** • Between August 1943 and July 1947, the site served as a practice dive bombing and strafing range in support of the fighter training program [1]. • Records do not indicate that the property was ever used to store, transport, treat, or dispose of the associated munitions used on property [2]. **Munitions Potentially Used:** • 0.30 and 0.50 caliber ammunition; • Miniture practice bombs, AN-MK 5, 15, 21, 23, and 43; • 2.25 and 5" rocket motors • Spotting charges may have been used with the practice bombs (AN-MK 4, 6 or 7).	**Site Characteristics:** • Approximately 146 acres of land • Approximately 62 acres of beach • Approximately 508 acres of inland water • Approximately 52 acres of ocean [1] **Topography:** • Relatively flat with sand dunes. • Elevations within beach area ranges from approximately 0 to 22 ft above msl. • Elevations within land areas range from approximately 1 to 21 ft above msl. **Vegetation:** • Predominately low grass vegetation and areas of barren beaches. The northern portion of the site is covered with trees and shrubs [1]. **Surface Water:** • Tisbury Great Pond is a salt-water pond that fills during the winter storms. Each spring a natural channel, located on the western end of the sand spit, which divides the pond from the Atlantic Ocean, is reopened. This action allows 3 to 4 feet of water to drain back to the ocean. **Soils:** • Predominately medium to fine grained sand with trace quantities of silt and have high permeability. Soils adjacent to the Tisbury Great Pond contain larger amounts of fine sediments and high organic material content and have low permeability [2]. • The thickness of the soil ranges from 0 to greater than 10 ft [2]. **Geology:** • Glacial deposits consisting of recent beach and marsh sediments, glacial deposits, interglacial deposits, and glacially deformed ancient coastal plain sediments [2]. • Bedrock is encountered at approximately 500 ft bgs and is comprised of metamorphic and igneous rocks [2]. **Hydrogeology:** • In the northern portion of the site, groundwater is encountered at approximately 5 to 15 ft bgs, while groundwater at other portions of the site is encountered at approximately 1 to 2 ft bgs [2]. • The shallow freshwater aquifer is underlain by brackish groundwater that is unsuitable for human consumption [2]. • Groundwater empties into Tisbury Great Pond [2]. **Meteorology:** • Average Annual Rainfall = 46 inches per year. [2]	**Contaminants of Potential Concern:** • Lead in soil • Lead and nickel in sediment • Suspected HE bomb (MEC) found in August 2009. **Media of Potential Concern:** • Surface soil, subsurface soil, and sediment **Confirmed MEC:** • MEC was identified during intrusive investigations at the following locations: – One MK23 on land east of Tisbury Great Pond; – Three MK23s with intact spotting charges found in the northwest portion of Tisbury Great Pond; and, – Two MK23s in the ocean south of the "Cut." • An unknown bomb was discovered by the public in August 2009 on the beach west of the "Cut." There is no supporting evidence through historical research or the RI that the bomb was part of historical military operations conducted and will be considered an isolated find. **Confirmed MD:** • During the 2010-2011 Remedial Investigation, 31 MD items were identified within inland water (13 MD items) and ocean (18 MD items) adjacent to the "Cut." **MC Sampling:** • During the 2008 SI, environmental samples were collected and analyzed for explosives and metals. Soil: – All six metals (antimony, copper, lead, nickel, strontium, and zinc) detected above background but below residential and industrial screening levels. – Antimony and lead exceeded eco-SSLs in four of six soil samples. Sediment: – All six metals detected above background but below screening values. Surface Water: – From the SI, nickel and strontium detected in all three samples, but below human health screening values. – Strontium exceeded eco-SSLs in all three samples [2]. • During the 2010-2011 RI, surface, subsurface, sediment, and groundwater samples were collected. Sample results indicate that MC concentrations do not exceed human health screening criteria. Lead was detected in soil at concentration exceeding ecological screening criterion. Lead and nickel were detected in sediment at concentrations exceeding ecological screening criterion in both investigationa and background samples. **Identified Pathways:** • Lead and nickel detected in soil and/or sediment at concentrations above ecological screening criterion. Results indicate that adsorption of MCs to soil/sediment particles have been the primary mechanism influencing the extent of MCs in the environment. No significant risk was identified in the Baseline Human Health Risk Assessment. • MD items are transported by washing up on the beach or are exposed from beach erosion. • MEC items are transported by various physical factors/transport processes that include: ocean currents; natural erosion of soil by wind and water exposing buried MEC items; and, relocation or removal by the public.	**Current Landowners:** • The Trustees of Reservations (TTOR), the Commonwealth of Massachusetts (inland and coastal waters), and private landowners [2]. **Current Land Use:** • After military use of the property ended, Tisbury Great Pond was developed into a shellfish harvest area [2]. • The Great Pond is a designated Commonwealth of Massachusetts shellfish fisheries area and is actively harvested for oysters, clams, and fish [2]. • A portion of the site encompasses the Long Pond Wildlife Refuge [2]. • Private landowners own small portions of the property for residential use [2]. **Future Land Use:** • The land use is not expected to change in the future [2]. **Resource Identification:** • There are approximately 12 public water supply wells within four miles of the Tisbury Great Pond [2]. • Estuarine marine wetlands including marine intertidal regularly flooded wetlands, irregularly flooded wetlands, and emergent wetlands are present at the site [2]. • The site is located within the Massachusetts Coastal Zone and the Long Point Wildlife Refuge [2]. **Potential Receptors:** • Residents, recreation users, on-site workers, and biota[2].	**Property Description:** • The impact area of the site consists of inland water, adjacent marshes, a small strip of beach, and the Atlantic Ocean. • Present land use includes recreational use with moderate to high disturbance due to the breaching of the barrier sand dune. **Potential Ecological Receptors:** • Inland and marine plant species, fish, birds, insects, soil invertebrates, and mammals that inhabit or migrate through the site. Associated threatened and endangered species are included. **Threatened and Endangered Species:** • There are approximately 37 federal/state threatened, endangered, and/or special concern species that could be present at the site. [1] **Relationship of MEC/MD to Habitat:** • MEC/MD items may be located within and/or adjacent to habitat areas.

Notes:
[1] UXB International, Inc., 2011. *Final Revision 1, Remedial Investigation Work Plan, Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts*. January.
[2] Alion Science and Technology, 2008. *Final Site Inspection Report for Tisbury Great Pond*. September.

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6.0 CONTAMINANT FATE AND TRANSPORT

6.0.1 The source of MEC and MCs are evaluated in relation to historic and current site activities and processes, lateral and vertical distribution, and the physical and chemical properties that act to concentrate or degrade the mass and concentration of the chemicals in the environment. Constituent fate and transport are also affected by the physical and chemical properties of MEC and MCs, the nature and extent of the release, as well as physical and chemical properties of the medium in which MEC and MCs are present. For example, MEC may be found on the surface or buried in the subsurface; however, it is possible for natural processes to result in the movement, relocation, or unearthing of MEC, increasing the chance of subsequent exposure to receptors.

6.1 Fate and Transport Processes for MEC

6.1.0.1 As presented in Section 3.1.3, the ultimate fate of MEC items within the Investigation Area is governed by various physical factors/transport processes that include:

- Transport by ocean currents;
- Natural erosion of soil by wind and water exposing buried MEC items; and,
- Transport via removal or relocation of MEC by the public.

6.1.0.2 The results of the geophysical and intrusive investigations conducted as part of this RI and historical investigations indicate that both MEC and MD were discovered within the investigation area as part of this investigatation, as well as in emergency UXO responses.

6.2 Fate and Transport Processes for MCs

6.2.0.1 As discussed in Section 3.1.3, the fate and transport of metals in the environment is governed by a number of interrelated processes, including oxidation/reduction conditions, the degree of inorganic and organic complexation, and pH conditions of the soil and groundwater. Adsorption of metal cations has been correlated with such soil properties as pH, redox potential, clay and/or soil organic matter content, iron and manganese oxides, and calcium carbonate content. Typically, as these soil properties increase, the adsorption capacity of cationic metals will also increase.

6.2.0.2 MC sampling results indicate that lead exceeded the ecological screening criterion in soil and lead and nickel exceeded ecological screening criterion in sediment. Based upon the fate and transport processes of cationic metals as well as the distribution and concentration of the evaluated metals, it appears that these metals have adsorbed to soil and/or sediment particles and are bound to soil and/or sediment particles.

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7.0 MEC HAZARD ASSESSMENT AND MC BASELINE RISK ASSESSMENT

7.1 MEC Hazard Assessment

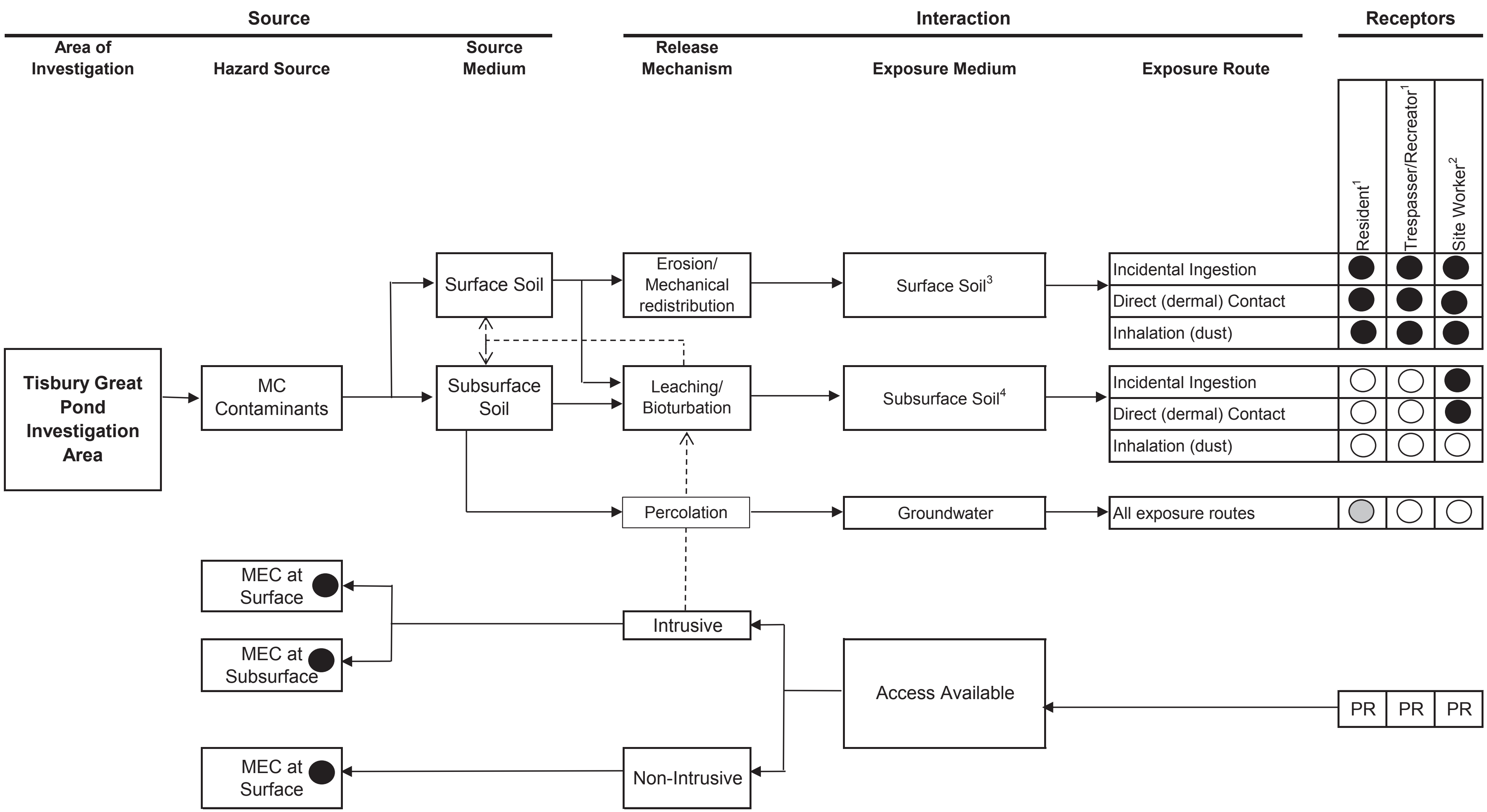
7.1.0.1 In the RI phase of the CERCLA process, the MEC Hazard Assessment (HA) is developed to support the hazard management decision making process by analyzing site-specific information to assess existing explosives hazards. The MEC HA addresses human health and safety concerns associated with potential exposure to MEC at a site. It does not directly address environmental or ecological concerns that might be associated with MEC, including the risks associated with exposure to MCs as environmental contaminants.

7.1.0.2 An explosive hazard exists at a site if there is a potentially complete MEC exposure pathway. A potentially complete MEC exposure pathway is present any time a receptor can come near or into contact with MEC and interact with it in a manner that might result in its detonation. The three elements of a potentially complete MEC exposure pathway, which include a source of MEC, a receptor, and the potential for interaction between the MEC source and the receptor, but all three elements must be present for a potentially complete MEC exposure pathway to exist. Because MEC has been identified in surface and subsurface media and there are potential receptors that may come into contact with MEC within the Investigation Area, the pathway for surface and subsurface media is considered complete (Figure 7-1).

7.1.0.3 The qualitative HA technique presented in this report follows the MEC HA method, which provides an assessment of the acute explosive hazards associated with remaining MEC at a site by analyzing site-specific conditions and human issues that affect the likelihood that a MEC accident will occur. The MEC HA method focuses on hazards to human receptors and does not directly address environmental or ecological concerns that might be associated with MEC. The process for conducting the MEC HA is described in the MEC HA interim guidance document (USEPA, 2008) and uses input data based on historical documentation, field observations made during this RI and previous studies and removal actions, and on the results of the intrusive investigations conducted as part of this. The MEC HA interim guidance was developed by the Technical Working Group for Hazard Assessment, which included representatives from the DoD, the U.S. Department of the Interior, the USEPA, and various states and tribes (USEPA, 2008). The DoD has encouraged the use of this method on a trial basis (DoD, 2009).

7.1.0.4 The MEC HA method reflects the basic difference between assessing acute hazards from exposure to MEC and assessing chronic environmental risks from exposure to potential contaminants, such as MCs. An explosive hazard can result in immediate injury or death and; therefore, risks from explosive hazards are evaluated either as being present or not present. If the potential for an encounter with MEC exists, then the potential that the encounter may result in

Figure 7-1. CSM for Human Exposures



Legend	
●	Complete Pathway
◍	Potential Complete Pathway
○	Incomplete Pathway (not evaluated)
PR	Potential Receptor
NA	Pathway not applicable to the receptor

Notes:

1. Includes anglers and clammers.
2. Employee of Trust or other authorized entrant for inspection or observational purposes; no physical/intrusive activities or contact with the aquatic zone assumed.
3. Surface soil represented by soil samples collected from 0 - 2 inches and 2 - 12 inches below ground surface (bgs).
4. Subsurface soil represented by soil samples collected between 12 and 18 inches bgs.
5. Includes shellfish consumed by humans and those serving as food sources in the food chain.

injury or death also exists. Conversely, if the potential presence of MEC at a site can be ruled out as a result of RI activities, then no explosive hazards are present and no MEC HA is necessary.

7.1.0.5 The MEC HA presented in this RI Report was conducted to characterize the baseline conditions for the Investigation Area with regard to explosive hazards. This baseline characterization may be referenced in the subsequent FS where they may be used to provide the basis for the evaluation and implementation of effective management response alternatives.

7.1.1 Defining the Areas to be Assessed

7.1.1.0.1 The MEC HA is typically focused on each MRS at a site. Based upon the identification of MD and MEC items during previous investigations and by the public, the Tisbury Great Pond FUDS boundary was expanded to encompass the current boundaries of the Investigation Area.

7.1.1.0.2 The MEC HA does not address underwater areas (i.e., inland water and ocean areas) or areas in which no MEC was identified. Therefore the MEC HA will address the land/beach areas of the Tisbury Great Pond Investigation Area only (208 acres).

7.1.2 Overview of MEC Hazard Assessment Input Factors

7.1.2.0.1 Under the MEC HA method, the potential hazards posed by MEC are characterized by evaluating three primary factors:

- *Severity*: the potential consequences of the effect on a human receptor should a MEC item detonate;
- *Accessibility*: the likelihood that a human receptor will be able to come into contact with a MEC item; and,
- *Sensitivity*: the likelihood that a MEC item will detonate if a human receptor interacts with it.

7.1.2.0.2 To complete the baseline MEC HA, various input factors are reviewed and suitable categories are selected based on historical documentation and field observations made during the RI and previous studies. These input factors include such details as "energetic material type," "site accessibility," "potential receptor contact hours," "amount of MEC," "MEC classification," and "MEC size," each of which has two or more possible categories. Each category for each of the MEC HA input factors has an assigned score that relates to the relative contributions of the different input factors to the overall MEC hazard. Scores for the categories are in multiples of five, with a total maximum possible score for all factors of 1,000 and a minimum possible score of 125. The various input factors for the MEC HA method are explained in detail in the MEC HA interim guidance document (USEPA, 2008) and are summarized in Appendix J of this report.

7.1.3 Overview of MEC Hazard Assessment Output Factors

7.1.3.0.1 Once the categories and scores for all input factors have been determined for the assessment area, the related scores for each category are totaled to calculate an overall MEC HA score. The total maximum possible MEC HA score for a site is 1,000 while the minimum possible score is 125. The MEC HA method describes associated "hazard levels" for these scores, which range from 1 (highest) to 4 (lowest). The basis for these hazard levels is provided in the MEC HA interim guidance document (USEPA, 2008). The output factors for the MEC HA are summarized in Appendix J.

7.1.4 Summary of Baseline MEC Hazard Assessment Characterizations

7.1.4.0.1 Tisbury Great Pond barrier beach/upland areas, where a suspect HE bomb was discovered through emergency UXO response, and an intact AN-MK-23 3-lb bomb during this investigation, was characterized using the MEC HA method based on the results obtained through this RI and information collected during previous investigations and removal actions, a qualitative MEC Hazard Assessment (HA) was conducted for the land/beach area. A MEC HA was not conducted for the remainder of the Investigation Area since The MEC HA is not applicable for underwater areas. The results of the MEC HA for the area are summarized in Table 7-1. Under current conditions, the land/beach received a hazard level category of 1, indicating the highest potential explosive hazard conditions are present. This information will provide the baseline for any assessment of response alternatives to be conducted. Note that these total MEC HA scores and the associated hazard levels are *qualitative references only* and should not be interpreted as quantitative measures of explosive hazard.

Table 7-1. MEC HA Scoring Summary, Tisbury Great Pond Investigation Area

Scoring Summary		
Site ID: FUDS No. D01MA0453 – Land/Beach Areas	a. Scoring Summary for Current Use Activities	
Date: 8/01/2013	Response Action Cleanup: No Response Action	
Input Factor	**Input Factor Category**	**Score**
Energetic Material Type	High explosive and low explosive filler in fragmenting rounds	100
Location of Additional Human Receptors	Inside the Munitions Response Site or inside the Explosives Safety Quantity Distance arc	30
Site Accessibility	Full Accessibility	80
Potential Contact Hours	≥1,000,000 receptor hours per year	120
Amount of MEC	Target Area	180
Minimum MEC Depth Relative to Maximum Intrusive Depth	Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC	240
Migration Potential	Possible	30
MEC Classification	Unexploded Ordnance	110
MEC Size	Small	40
	Total Score	**930**
	Hazard Level Category	**1**

7.2 Munitions Response Site Prioritization Protocol

7.2.0.1 The Munitions Response Site Prioritization Protocol will be presented as a separate document.

7.3 MC Baseline Human Health Risk Assessment

7.3.0.1 This HHRA has been performed in accordance with CERCLA guidelines and the RI WP (UXB, 2011), reviewed and approved by the MADEP and the USACE. The HHRA process is intended to provide a comprehensive assessment of potential risks to identified receptors that may be exposed to hazardous constituents at or from the Investigation Area.

7.3.0.2 This HHRA was conducted consistent with appropriate portions of the guidance provided by USEPA (RAGS, Volume 1: Human Health Evaluation Manual, Parts A, D, E, and F). USEPA's risk assessment guidance describes a four-step protocol:

- Hazard Identification;
- Toxicity Assessment;
- Exposure Assessment; and,
- Risk Characterization.

7.3.0.3 This HHRA consists of a semi-quantitative assessment that identifies the receptors, potential exposure pathways, and compares the data to risk-based screening levels to identify chemicals of potential concern (COPCs) at the Site. No COPCs were identified in the screening process; therefore a full quantitative HHRA was not required nor performed.

7.3.1 Hazard Identification

7.3.1.0.1 The Hazard Identification step of the HHRA is used to identify the COPCs in each environmental medium to which human receptors may be exposed. The analytical data collected for the Investigation Area includes metals and explosives analytical results for the following samples:

- Surface soil samples collected from between 2 to 12 inches below ground surface (bgs);
- Subsurface soil samples collected from between 12 to 84 inches bgs;
- Sediment samples collected from between 0 to 6 inches bgs;
- Groundwater samples;

7.3.2 Conceptual Site Model

7.3.2.0.1 Section 3.1 presents a preliminary CSM based on the identified receptors described in Section 2.2.3. The updated CSM based on the results of the RI appears in Section 5.3. Metals were detected in one or more samples for all media sampled (surface soil, subsurface soil, sediment, and groundwater). As indicated above, samples were analyzed for metals and explosives. Explosives were not detected in any media. All detected metals concentrations are less than the applicable USEPA human health screening levels. In addition, with the exception of nickel in sediment, all detected concentrations are less than the applicable MassDEP MCP standards. The maximum nickel concentration in sediment of 21 mg/kg marginally exceeds the current S-1/GW-1 standard, which is based on background. The maximum nickel concentration in sediment does not exceed the MassDEP proposed S-1/GW-1 standard of 600 mg/kg. Metals constituents could have reached soil, sediment, and/or groundwater via the following processes: metals from items located on the sand dunes could leach through the soil into the groundwater and discharge to surface water via sediment; metals could also adsorb to soil particles and be transported to the pond via storm events.

7.3.2.0.2 Figure 7-1 summarizes the CSM for human exposure to media potentially impacted by the Investigation Area. The potential exposure pathways and receptors are described further below.

7.3.3 Receptors and Pathways

7.3.3.0.1 Environmental media at the Investigation Area that present a potential for human exposure are surface and subsurface soil, sediment, and groundwater.

7.3.3.0.2 The Investigation Area is owned by The Trustees of Reservations (TTOR), the Commonwealth of Massachusetts (inland and coastal waters), and private landowners. The land is part of the Massachusetts Coastal Zone and Long Point Wildlife Refuge. When military use of the property ended, Tisbury Great Pond was developed into a shellfish harvest area. Today the site is a designated shellfish fisheries area and is actively harvested for oysters, clams, and fish. Private landowners own small portions of the property for residential use. The barrier beach at the southern end of the pond is privately owned. It is anticipated that the future land use will remain the same.

7.3.3.0.3 The following exposure pathways apply for humans:

<u>Direct Contact with Surface and Subsurface Soil</u>

7.3.3.0.4 Surface soils include samples collected generally from the 0 to 1 ft depth interval. Subsurface soil includes samples collected generally from the 1 to 10 ft depth interval. The sampling intervals, per sample, are shown in Table 4-6 for surface and subsurface soils. As intrusive activities are possible due to residential and recreational use of the Investigation Area, it is possible that residents, visitors/trespassers, and site workers may come into contact with surface soil (0 to 1 ft) and to the upper portion (1 to 2 ft zone) of the subsurface soil interval. Pathways of exposure include incidental ingestion, dermal contact, and inhalation of dust. These pathways are assumed to be complete pathways for both current and future Site use. Exposure to soil greater than 2 ft. is considered incomplete as as the existing receptors are not expected to engage in intrusive activities deeper than 2 feet below ground surface, and no future construction is planned. Volatilization-related inhalation exposures are also incomplete as no volatile organic compounds (VOCs) have been identified associated with munitions releases.

7.3.3.0.5 Future use of the Investigation Area is expected to remain consistent with current land use.

Direct Contact with Sediment

7.3.3.0.6 The site is a designated shellfish fisheries area and is actively harvested for oysters, clams, and fish. Fishermen that dig or dredge sediments during harvesting, may contact sediments. Pathways of exposure are incidental ingestion and dermal contact with sediment. No inhalation pathways are complete because wet sediments do not generate dust and there are no VOCs. While sediment ingestion would be limited to areas where sediment is exposed or covered by shallow water; it was assumed that fishermen had the potential to contact all sediment within the Investigation Area.

Ingestion of Fish and Shellfish

7.3.3.0.7 Local residents, and recreational users are assumed to eat clams, oysters, or fish harvested from Tisbury Great Pond. Fish and shellfish can accumulate contaminants from sediment.

Use of Groundwater

7.3.3.0.8 There are approximately 12 public water supply wells within four miles of the Tisbury Great Pond. Additionally, groundwater within the Investigation Area meets the criteria of a potential drinking water source area under the MCP (it is designated as a sole source aquifer). Therefore, exposures to contaminants in groundwater used as a potable water supply would be intentional ingestion and dermal contact. Inhalation is not a pathway of concern due to the absence of VOCs.

7.3.4 Data Screening

Selection of Screening Criteria

7.3.4.0.1 Because residents are potential receptors and groundwater underneath the Investigation Area may be used for potable use, the most stringent screening levels for soil and groundwater are assumed applicable. Additionally, sediment was screened against the soil screening values as well; sediments are not actually soil and present a lower contact potential than soils. However, the soil values are typically used in risk screening process in the absence of published sediment screening levels for the protection of human health. These values have been identified for soil and sediment as the USEPA Residential Regional Screening Levels (RSLs)[1] and for groundwater the lowest of the USEPA Maximum Contaminant Levels (MCLs) and the

[1] http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

USEPA tapwater RSLs. While not typically used for screening under CERCLA, the MassDEP Method 1 S-1/GW-1 Standards and published MassDEP background values were used for comparison purposes in the process, per the Work Plan (UXB, 2011). A few notes regarding this process are presented below.

7.3.4.0.2 The Method 1 Standards are not actually screening levels, but are promulgated health-based standards in Massachusetts. The excess lifetime cancer risk-based target of one in a million (10^{-6}) used in the Method 1 standard derivation (along with consideration of background) is equivalent to the target cancer risk used in the RSLs. The target hazard of 0.2 is actually more stringent that the target of 1 used in the RSLs. In addition, per the Massachusetts Contingency Plan (MCP) [310 Code of Massachusetts Regulations (CMR) 40], in a Method 1 Risk Characterization an exposure point concentration less than the applicable S-1 standard must be met to achieve site closure in the absence of an Activity and Use Limitation that formally limits future site use. The Method 1 GW-1 standards would also be applicable to this site, as it meets the criteria for a potential drinking water source area. Therefore, the Method 1 S-1/GW-1 and GW-1 standards are considered appropriate for use in screening the Investigation Area data. The S-1/GW-1 soil standards are intended to be protective of direct contact soil exposures as well as leaching of compounds in soil to potable use groundwater. For the groundwater data, the Method 1 GW-1 standards were used for comparison purposes as well.

7.3.4.0.3 Background comparisons are not typically included in the COPC screening process for a CERCLA project. However, MassDEP published background concentrations were included in the screening tables for comparison purposes. All detected concentrations in soil are below published background concentrations.

7.3.4.0.4 COPC selection consists of determining if any analytes were detected above the lowest of the USEPA Residential RSLs and MassDEP Method 1 S-1/GW-1 Standards for soil, and the USEPA MCLs, USEPA tapwater RSLs, and MassDEP Method 1 GW-1 standards for groundwater. Additionally, maximum detected concentrations were compared to published background concentrations. The findings of this screening are presented in the sections below.

Results of Screening Evaluation

7.3.4.0.5 Four metals (copper, lead, nickel, and zinc) were detected in one or more surface soil samples. Maximum detected concentrations were below the Residential RSLs, the Method 1 S-1/GW-1 Standards, and published background concentrations. No COPCs were identified in surface soil. Refer to Table 7-2 for a tabular depiction of the screening process for soil.

7.3.4.0.6 Five metals (antimony, copper, lead, nickel, and zinc) were detected in one or more subsurface soil samples. Maximum detected concentrations were below the Residential RSLs, the Method 1 S-1/GW-1 Standards, and published background concentrations. No COPCs were identified in subsurface soil. Refer to Table 7-3 for a tabular depiction of the screening process for subsurface soil.

7.3.4.0.7 Five metals (antimony, copper, lead, nickel, and zinc) were detected in one or more sediment samples. Maximum detected concentrations for all analytes with the exception of nickel were below the Residential RSLs, the Method 1 S-1/GW-1 Standards, and published background concentrations. Nickel was detected at concentrations above the current MassDEP S-1/GW-1 criteria for nickel, but below the USEPA residential RSLs and the proposed revised MassDEP S-1/GW-1 criteria. Therefore no COPCs were identified in subsurface soil. Refer to Table 7-4 for a tabular depiction of the screening process for sediment.

7.3.4.0.8 As described above, detected sediment concentrations were found to be below human health screening levels and background concentrations for all metals but nickel, which just slightly exceeded the soil background concentration of 20 mg/kg at 21 mg/kg. These values were conservatively used to screen sediment; however, they are not intended to address consumption of fish tissue or predict bioaccumulation up the food chain. The metals detected in the Investigation Area sediments do not behave as bioaccumulators. The USEPA has identified substances considered Persistent, Bioaccumulative and Toxic (PBTs[2]) and mercury is the only metal identified as PBT. Similarly, the Food and Drug Administration (FDA) National Shellfish Sanitation Program[3] only has established benchmarks in shellfish for selected lipophilic organic compounds and methyl mercury. Lipophilic chemicals have the ability to dissolve in fats, oils, and other non-polar solvents, which allows them to bioaccumulate. Other metals, such as the five detected at the Investigation Area, do not exhibit the lipophilic properties that contribute to bioaccumulation and therefore are not likely to pose a risk to human consumers of edible fish or shellfish.

7.3.4.0.9 Three metals (antimony, nickel, and zinc) were detected in one or more groundwater samples. The maximum detected concentrations for all analytes were below the USEPA MCLs and the USEPA Tapwater RSLs. No COPCs were identified in groundwater. Refer to Table 7-5 for a tabular depiction of the screening process for groundwater.

7.3.4.0.10 Because no COPCs have been identified in media at the Investigation Area, no further risk evaluation is required. There is no unacceptable risk to human health.

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[2] USEPA 2011, Fact Sheet: Multimedia Strategy for Priority Persistent, Bioaccumulative, and Toxic (PBT) Chemicals. <http://www.epa.gov/pbt/pubs/fact.htm>

[3] FDA, 2009. NSSP Guide for the Control of Molluscan Shellfish. Action Levels, Tolerances and Guidance levels for Poisonous or Deleterious Substances in Seafood.

Table 7-2. Summary of COPC Screening for Surface Soils
Tisbury Great Pond Investigation Area

Analyte	CAS #	USEPA Residential RSL (mg/kg)	MADEP S1/GW-1 Standard (mg/kg)	Human Health Screening Level[(1)] (mg/kg)	MADEP Background[(2)] (mg/kg)	N[(3)]	FOD	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum
Antimony	7440-36-0	31	20	20	1	2	0%	--	--	--
Copper	7440-50-8	3100	--	3100	40	2	100%	1.4 J	1.8 J	TP01 SB128
Lead	7439-92-1	400	300	300	100	2	100%	32	44	TP01 SB130
Nickel	7440-02-0	1500	20	20	20	2	100%	2.3	3.9	TP01 SB130
Zinc	7440-66-6	23000	2500	2500	100	2	100%	8.3	8.4	TP01 SB130
1,3,5-Trinitrobenzene	99-35-4	2200	--	2200	--	2	0%	--	--	--
1,3-Dinitrobenzene	99-65-0	6.1	--	6.1	--	2	0%	--	--	--
2,4,6-Trinitrotoluene	118-96-7	19	--	19	--	2	0%	--	--	--
2,4-Dinitrotoluene	121-14-2	1.6	0.7	0.7	--	2	0%	--	--	--
2,6-Dinitrotoluene	606-20-2	61	--	61	--	2	0%	--	--	--
2-Amino-4,6-dinitrotoluene	35572-78-2	150	--	150	--	2	0%	--	--	--
2-Nitrotoluene	88-72-2	2.9	--	2.9	--	2	0%	--	--	--
3-Nitrotoluene	99-08-1	6.1	--	6.1	--	2	0%	--	--	--
4-Amino-2,6-dinitrotoluene	19406-51-0	150	--	150	--	2	0%	--	--	--
4-Nitrotoluene	99-99-0	30	--	30	--	2	0%	--	--	--
HMX	2691-41-0	3800	2	2	--	2	0%	--	--	--
Nitrobenzene	98-95-3	4.8	--	4.8	--	2	0%	--	--	--
Nitroglycerin	55-63-0	6.1	--	6.1	--	2	0%	--	--	--
PETN	78-11-5	120	--	120	--	2	0%	--	--	--
RDX	121-82-4	5.6	1	1	--	2	0%	--	--	--
Tetryl	479-45-8	240	--	240	--	2	0%	--	--	--

Notes:
(1) Criteria for human health were identified as the lower of 1) USEPA Risk Screening Level (RSL; residential selected as the most stringent) 2) MADEP Method 1 S-1/GW-1 Standard.
(2) Background concentrations obtained from the Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. MADEP, 2002.
(3) This table includes all samples collected from between 0 and 1.5 ft bgs, including QA/QC samples

mg/kg - milligrams per kilogram
N - number of samples
FOD - frequency of detection
% - percent
COPC - contaminant of potential concern
-- Value not published or not applicable

Table 7-3. Summary of COPC Screening for Subsurface Soils
Tisbury Great Pond Investigation Area

Analyte	CAS #	USEPA Residential RSL (mg/kg)	MADEP S1/GW-1 Standard (mg/kg)	Human Health Screening Level[1] (mg/kg)	MADEP Background[2] (mg/kg)	N[3]	FOD	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum
Antimony	7440-36-0	31	20	20	1	3	67%	0.04	0.068	TP23 SB132
Copper	7440-50-8	3100	--	3100	40	3	100%	0.86	1.4	TP23 SB132
Lead	7439-92-1	400	300	300	100	3	100%	6.9	39	TP01 SB131
Nickel	7440-02-0	1500	20	20	20	3	100%	1.8	3.7	TP01 SB131/SB132
Zinc	7440-66-6	23000	2500	2500	100	3	100%	7.9	21	TP23 SB132
1,3,5-Trinitrobenzene	99-35-4	2200	--	2200	--	3	0%	--	--	--
1,3-Dinitrobenzene	99-65-0	6.1	--	6.1	--	3	0%	--	--	--
2,4,6-Trinitrotoluene	118-96-7	19	--	19	--	3	0%	--	--	--
2,4-Dinitrotoluene	121-14-2	1.6	0.7	0.7	--	3	0%	--	--	--
2,6-Dinitrotoluene	606-20-2	61	--	61	--	3	0%	--	--	--
2-Amino-4,6-dinitrotoluene	35572-78-2	150	--	150	--	3	0%	--	--	--
2-Nitrotoluene	88-72-2	2.9	--	2.9	--	3	0%	--	--	--
3-Nitrotoluene	99-08-1	6.1	--	6.1	--	3	0%	--	--	--
4-Amino-2,6-dinitrotoluene	19406-51-0	150	--	150	--	3	0%	--	--	--
4-Nitrotoluene	99-99-0	30	--	30	--	3	0%	--	--	--
HMX	2691-41-0	3800	2	2	--	3	0%	--	--	--
Nitrobenzene	98-95-3	4.8	--	4.8	--	3	0%	--	--	--
Nitroglycerin	55-63-0	6.1	--	6.1	--	3	0%	--	--	--
PETN	78-11-5	120	--	120	--	3	0%	--	--	--
RDX	121-82-4	5.6	1	1	--	3	0%	--	--	--
Tetryl	479-45-8	240	--	240	--	3	0%	--	--	--

Notes:

(1) Criteria for human health were identified as the lower of 1) USEPA Risk Screening Level (RSL; residential selected as the most stringent) 2) MADEP Method 1 S-1/GW-1 Standard.

(2) Background concentrations obtained from the Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. MADEP, 2002.

(3) This table includes all samples collected from between 0 and 1.5 ft bgs, including QA/QC samples

mg/kg - milligrams per kilogram
N - number of samples
FOD - frequency of detection
% - percent
COPC - contaminant of potential concern
-- Value not published or not applicable

Table 7-4. Summary of COPC Screening for Sediments
Tisbury Great Pond Investigation Area

Analyte	CAS #	USEPA Residential RSL (mg/kg)	MADEP S1/GW-1 Standard (mg/kg)	Human Health Screening Level[1] (mg/kg)	MADEP Background[2] (mg/kg)	N[3]	FOD	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum
Antimony	7440-36-0	31	20	20	1	17	41%	0.019	0.037	TP09 SD022 & TP21 SD035
Copper	7440-50-8	3100	--	3100	40	17	100%	0.51	16	TP12 SD025
Lead	7439-92-1	400	300	300	100	17	100%	2.6	34	TP12 SD025
Nickel	7440-02-0	1500	20	20	20	17	100%	1	**21**	TP08 SD021 & TP12 SD025
Zinc	7440-66-6	2300	2500	2300	100	17	100%	5.1	100	TP12 SD025
1,3,5-Trinitrobenzene	99-35-4	2200	--	2200	--	17	0%	--	--	--
1,3-Dinitrobenzene	99-65-0	6.1	--	6.1	--	17	0%	--	--	--
2,4,6-Trinitrotoluene	118-96-7	19	--	19	--	17	0%	--	--	--
2,4-Dinitrotoluene	121-14-2	1.6	0.7	0.7	--	17	0%	--	--	--
2,6-Dinitrotoluene	606-20-2	61	--	61	--	17	0%	--	--	--
2-Amino-4,6-dinitrotoluene	35572-78-2	150	--	150	--	17	0%	--	--	--
2-Nitrotoluene	88-72-2	2.9	--	2.9	--	17	0%	--	--	--
3-Nitrotoluene	99-08-1	6.1	--	6.1	--	17	0%	--	--	--
4-Amino-2,6-dinitrotoluene	19406-51-0	150	--	150	--	17	0%	--	--	--
4-Nitrotoluene	99-99-0	30	--	30	--	17	0%	--	--	--
HMX	2691-41-0	3800	2	2	--	17	0%	--	--	--
Nitrobenzene	98-95-3	4.8	--	4.8	--	17	0%	--	--	--
Nitroglycerin	55-63-0	6.1	--	6.1	--	17	0%	--	--	--
PETN	78-11-5	120	--	120	--	17	0%	--	--	--
RDX	121-82-4	5.6	1	1	--	17	0%	--	--	--
Tetryl	479-45-8	240	--	240	--	17	0%	--	--	--

Notes:
(1) Criteria for human health were identified as the lower of 1) USEPA Risk Screening Level (RSL; residential selected as the most stringent) 2) MADEP Method 1 S-1/GW-1 Standard.
(2) Background concentrations obtained from the Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. MADEP, 2002.
(3) This table includes all samples collected from between 0 and 1.5 ft bgs, including QA/QC samples

mg/kg - milligrams per kilogram
N - number of samples
FOD - frequency of detection
% - percent
COPC - contaminant of potential concern
-- Value not published or not applicable

Table 7-5. Summary of COPC Screening for Groundwater
Tisbury Great Pond Investigation Area

Analyte	CAS #	USEPA MCL (ug/L)	USEPA Tapwater RSL (ug/L)	MADEP GW-1 Standard (ug/L)	Human Health Screening Level (1) (ug/L)	N(2)	FOD	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Location of Maximum
Antimony	7440-36-0	6	6	6	6	3	33%	0.074 J	0.074 J	TP04 GW013
Copper	7440-50-8	1300	620	--	620	3	0%	--	--	--
Lead	7439-92-1	15	NA	15	15	3	0%	--	--	--
Nickel	7440-02-0	--	300	100	100	3	100%	4.5	13	TP04 GW013
Zinc	7440-66-6	--	4700	5000	4700	3	100%	4 J	12 J	TP02 GW011
1,3,5-Trinitrobenzene	99-35-4	--	460	--	460	3	0%	--	--	--
1,3-Dinitrobenzene	99-65-0	--	1.5	--	1.5	3	0%	--	--	--
2,4,6-Trinitrotoluene	118-96-7	--	2.2	--	2.2	3	0%	--	--	--
2,4-Dinitrotoluene	121-14-2	--	0.2	30	0.2	3	0%	--	--	--
2,6-Dinitrotoluene	606-20-2	--	15	--	15	3	0%	--	--	--
2-Amino-4,6-dinitrotoluene	35572-78-2	--	30	--	30	3	0%	--	--	--
2-Nitrotoluene	88-72-2	--	0.27	--	0.27	3	0%	--	--	--
3-Nitrotoluene	99-08-1	--	1.3	--	1.3	3	0%	--	--	--
4-Amino-2,6-dinitrotoluene	19406-51-0	--	30	--	30	3	0%	--	--	--
4-Nitrotoluene	99-99-0	--	3.7	--	3.7	3	0%	--	--	--
HMX	2691-41-0	--	780	200	200	3	0%	--	--	--
Nitrobenzene	98-95-3	--	0.12	--	0.12	3	0%	--	--	--
Nitroglycerin	55-63-0	--	1.5	--	1.5	3	0%	--	--	--
PETN	78-11-5	--	16	--	16	3	0%	--	--	--
RDX	121-82-4	--	0.61	1	0.61	3	0%	--	--	--
Tetryl	479-45-8	--	61	--	61	3	0%	--	--	--

Notes:
(1) Criteria for human health were identified as the lower of 1) USEPA Maximum Contaminant Levels (MCLs), 2) USEPA Risk Screening Level (RSL), 3) MADEP Method 1 GW-1 standard.
(2) This table includes all samples collected including QA/QC samples.

-- Value not published or not applicable
N - number of samples
µg/L - micrograms per liter
FOD - frequency of detection
% - percent

7.4 MC Environmental Evaluation

7.4.0.1 The purpose of this SLERA is to determine whether potentially unacceptable risks are posed to ecological receptors due to exposures to residual MCs at the Investigation Area and to identify the specific chemicals contributing to that risk. As per the *Final United States Army Military Munitions Response Program RI/FS Guidance* (USACE, 2009b), ERAs for MMRP sites are to be performed based on USEPA guidance for conducting ERAs at CERCLA-regulated sites, principally *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Draft* (USEPA, 1997, as implemented by USEPA, 1999), and supplemental guidance was from the Tri-Services Environmental Risk Assessment Work Group (TSERAWG) document *A Guide to Screening Level Ecological Risk Assessment* (TSERAWG, 2008). Because this site is located within the State of Massachusetts, the approach used in evaluating potential ecological risk is also consistent with a Method 3 Risk Characterization as specified by the MADEP (MADEP, 1996) under the MCP.

7.4.0.2 The ERA process under CERCLA is separable into two general phases: the screening level ERA and the Baseline ERA. The purpose of the screening level ERA is to (1) evaluate the conditions of the site to determine whether complete exposure pathways may exist between constituents of potential concern and ecological receptors, (2) identify specific ecological receptors or resources of concern and the media through which they may be exposed to site constituents, and (3) conservatively evaluate the existing data for these media to determine whether any of these constituents occur at levels that could pose an unacceptable risk to ecological receptors or resources. Constituents found to be at such levels are identified as chemicals of potential ecological concern (COPECs) for the site and a scientific/management decision is made as to whether or not these constituents warrant further investigation under the Baseline ERA), or whether a risk management or remedial action should be implemented in lieu of the Baseline ERA.

7.4.0.3 Site constituents found in the screening level ERA to pose a negligible potential for ecological risk, either by lack of a complete exposure pathway or by lack of a sufficient concentration in ecologically-relevant media to pose a potential risk, are eliminated from further consideration in the ERA process. If all site constituents are found in the screening level ERA to pose no significant risk, the ERA process is concluded with a finding of no risk and no further action based on ecological risk is required.

7.4.0.4 Because screening level ERAs are designed to be highly conservative in nature, they are likely to significantly overestimate the level of risk for some receptors. For this reason, the highly conservative initial screening of the data (as per USEPA guidance) is followed by a more realistic (i.e., less conservative) refinement of the evaluation of potential risk for constituents that do not pass the initial risk screening. The purpose of this step is to reduce the possibility that one or more COPECs are carried into the Baseline ERA when sufficient information currently exists to support a conclusion that they do not pose significant risk.

7.4.0.5 The MADEP process is similar in structure to the USEPA CERCLA process. In the Stage I screening characterization, the potential for complete exposure pathways is evaluated. Contaminant concentrations in media associated with complete pathways are then compared to published effects-based benchmarks. If the concentrations exceed the benchmarks, the process proceeds to a Stage II environmental risk characterization which can vary in scope but generally follows the USEPA guidance for a Baseline ERA. If concentrations do not exceed screening levels, no further evaluation is required and a condition of "No Significant Risk to the Environment" is concluded. Key differences between the federal and Massachusetts processes are that the MCP allows consideration of background in eliminating media from further concern, and that the Stage I process considers screening benchmarks only and does not evaluate dose as the screening level ERA may.

7.4.0.6 Due to the historical use of the Investigation Area as a target range, the constituents of potential concern for this evaluation are limited to MC, including selected metals (antimony, copper, lead, nickel, and zinc) and explosives and their by-products. This assessment assumes that all of these constituents have potentially toxic characteristics to ecological receptors if certain threshold levels in the environment are exceeded. Although the sampling of environmental media at the Investigation Area for MC included soil, sediment, and groundwater, only the soil samples collected between 0 to 24 inches below ground surface (bgs) and sediment samples (all collected from 0-6 inch depth interval) were considered ecologically relevant and were included in the screening level ERA.

7.4.0.7 The presentation of this screening level ERA is structured in accordance with the three-step paradigm for ERAs (USEPA, 1998). These are:

1. Preliminary Problem Formulation;
2. Analysis; and,
3. Risk Characterization.

7.4.0.8 The following sections describe the purpose and goal of each of these steps and present the results as are applicable and relevant to the assessment of ecological risk at the Investigation Area.

7.4.1 Preliminary Problem Formulation

7.4.1.0.1 In the Preliminary Problem Formulation, the potentially affected environment is described and a CSM is developed to identify fate and transport mechanisms that could lead to potentially complete exposure pathways to ecological receptors at the site. Key ecological resources are identified and assessment and measurement endpoints are developed for the protection of those resources. The elements of the Problem Formulation for the Investigation Area are described in the following sections.

7.4.1.1 Site Description and Ecological Resources

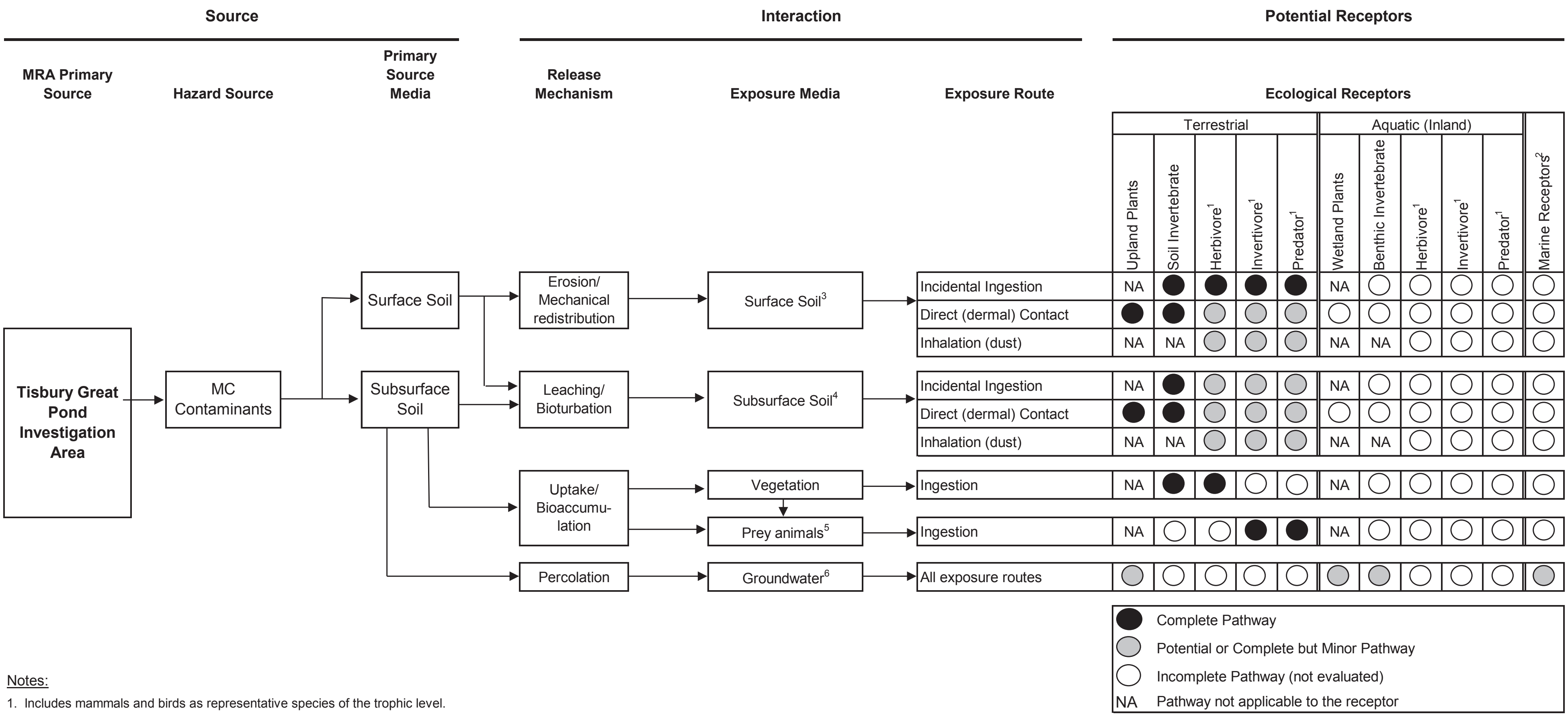
7.4.1.1.0.1 The Tisbury Great Pond MRS is located within the towns of Chilmark and West Tisbury, Martha's Vineyard, Massachusetts. The site encompasses approximately 768 acres comprising 146 acres of upland habitat, 62 acres of beach, 508 acres of inland water, and 52 acres of ocean. The majority of the site is owned by the Commonwealth of Massachusetts, TTOR, and private landowners (USACE 2008 Site Inspection Report for Tisbury Great Pond). Tisbury Great Pond has elevations that range from sea level to approximately 15 feet above mean sea level. Although the majority of the upland area is flat, sand dunes, some of which are approximately 5 to 10 feet high occur near the coastline. A large dune separates Tisbury Great Pond from the Atlantic Ocean which at times (at least once per year) is breached to allow saltwater to enter the pond (USACE 2008 Site Inspection Report for Tisbury Great Pond).

7.4.1.1.0.2 The vegetation surrounding Tisbury Great Pond consists of predominantly low grasses and areas of barren beaches. Common plant species found throughout the site include poison ivy (*Toxicodendron radicans*), beach plum (*Prunus maritima*), and bayberry (*Myrica* spp.). Tree species, which are more typically found in the northern portion of the site, include maple (*Acer* spp.), various pine tree species (*Pinus* spp.), oak (*Quercus* spp.), and beech (*Fagus* spp). As detailed in Section 2.2.2.4 and Table 2-1, the Investigation Area contains significant ecological resources and is potential habitat for threatened, endangered, or other sensitive or protected species. Most of the site is designated by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) as Core Habitat and Critical Natural Habitat under BioMap2 (MDFW, 2012). It contains Priority Habitats of Rare Species and provides critical habitat for tern foraging. Tisbury Great Pond is also suitable habitat for shellfish (American oyster and soft-shelled clam) (MassGIS, 2012).

7.4.1.2 Conceptual Site Model

7.4.1.2.0.1 A detailed CSM for ecological exposures at the Investigation Area is presented in Figure 7-2. The media of primary ecological concern at this site are surface (0 to 12 in.) and subsurface (12 to 24 in.) soil of the upland and beach habitats, and surface sediment (0 to 6 in.) of the inland water habitat. For plants and soil/benthic invertebrates within these habitats, primary exposures to MC are through direct contact with the soil or sediment. For wildlife receptors, the primary complete exposure pathways are the incidental ingestion of contaminated soil/sediment and transfers through the foodweb.

Figure 7-2. Ecological Conceptual Site Model



Notes:

1. Includes mammals and birds as representative species of the trophic level.
2. No significant exposure pathways to marine receptors are identified for this site.
3. Surface soil represented by soil samples collected from 0 - 2 inches and 2 - 12 inches below ground surface (bgs).
4. Subsurface soil represented by soil samples collected between 12 and 18 inches bgs.
5. Prey animals include soil invertebrates for the invertivores and herbivorous mammals for the predators.
6. Significant migration of MC to groundwater at this site is not anticipated.
7. Significant release of MC to surface water at this site is not anticipated.
8. No significant risk was identified at the site.

7.4.1.3 Data Summary and Initial Screening

7.4.1.3.0.1 The MC sampling strategy for the Investigation Area was based on the results of geophysical surveys and subsequent intrusive investigations of the site. The sampling points for the soil and sediment samples are shown in Figure 4-2. At the upland soil sampling location (TP01), discrete samples were collected from three intervals—0-6 in., 6-12 in., and 12-18 in. bgs. At the beach location, a single soil sample (TP23), was collected from the 12-24 inch depth interval. Although a soil sample was collected from the nearby TP24 location, its depth (72-84 in. bgs) was considered to be beyond the range of potential exposure by ecological receptors and was therefore not used in this screening level ERA. All sediment samples were collected from the 0-6 inch depth interval within the Tisbury Great Pond. The depth of water overlying these samples ranged from 1.4 to 9.6 feet.

7.4.1.3.0.2 The soil samples were analyzed for metals (USEPA Method 6020A) and high explosives and their by-products (USEPA Method 8321B). The metals analyses were limited to five analytes: antimony, copper, lead, nickel, and zinc. Data from duplicate discrete samples (collected for QA purposes) were combined as a single point based on the following rules:

- If both values were detects, the arithmetic mean of the two was used;
- If both values were non-detects, the lower of the two reporting limit (RL) values was used (divided by 2 if used in summary calculations); and
- If one value was detected and the other was a non-detect, the final result was calculated as the arithmetic mean of the detected value and ½ the RL of the nondetect. However, if ½ the RL of the non-detect was greater than the detect, only the detected concentration was used.

7.4.1.3.0.3 The data evaluated in this SLERA are summarized in Tables 7-6 through 7-8. An initial screening of these data was conducted to eliminate any analytes that did not warrant further investigation based on three criteria: frequency of detection, comparison to background, and comparison to ecological screening levels. First, analytes that were not detected in any samples of a particular medium (soil or sediment) were eliminated from further consideration in the risk assessment provided that the RLs were less than their corresponding ecological screening level. Second, analytes that showed no concentrations exceeding an accepted background screening level for a specific medium were also eliminated. Finally, analytes that showed no concentrations exceeding its ecological screening level (for the specific medium) were eliminated from further consideration in the ERA. The remaining set of analytes were identified as COPECs and retained for further risk evaluation.

7.4.1.3.0.4 As shown in Tables 7-6 and 7-7, four of the five metals (copper, lead, nickel, and zinc) were detected in all soil and sediment samples from this site. Detections of antimony were sporadic, but included the surface soil in the upland habitat, the subsurface soil sample in the

Table 7-6. Summary of Metals Analysis Results for Soils of the Upland and Beach Habitats Tisbury Great Pond Investigation Area

Analyte	CAS #	Massachusetts Soil Background[1] (mg/kg)		USEPA EcoSSL[2] (mg/kg)	n	FOD	RL Range (mg/kg)		Range of Detections (mg/kg)		Location of Maximum Detection
		90th %'tile	50th %'tile				Min	Max	Min	Max[3]	
Upland Habitat: Surface Soil (0-12 inches)											
Antimony	7440-36-0	1	0.34	0.27	2	50%	0.2	0.2	0.018 J	0.018 J	TP01 (0-6 in.)
Copper	7440-50-8	40	7.3	28	2	100%	NA	NA	1.4 J	1.8 J	TP01 (0-6 in.)
Lead	7439-92-1	100	19.1	11[4]	2	100%	NA	NA	32	**44**	TP01 (6-12 in.)
Nickel	7440-02-0	20	5.1	38	2	100%	NA	NA	2.2	3.9	TP01 (6-12 in.)
Zinc	7440-66-6	100	27.7	46	2	100%	NA	NA	8.0	8.4	TP01 (6-12 in.)
Upland Habitat: Subsurface Soil (12-18 inches)											
Antimony	7440-36-0	1	0.34	0.27	1	0%	0.19	0.19	NA	NA	TP01
Copper	7440-50-8	40	7.3	28	1	100%	NA	NA	1.3 J	1.3 J	TP01
Lead	7439-92-1	100	19.1	11[4]	1	100%	NA	NA	39	**39**	TP01
Nickel	7440-02-0	20	5.1	38	1	100%	NA	NA	3.7	3.7	TP01
Zinc	7440-66-6	100	27.7	46	1	100%	NA	NA	7.9	7.9	TP01
Beach Habitat: Subsurface Soil (12-24 inches)											
Antimony	7440-36-0	1	0.34	0.27	1	100%	NA	NA	0.068 J	0.068 J	TP23
Copper	7440-50-8	40	7.3	28	1	100%	NA	NA	1.4 J	1.4 J	TP23
Lead	7439-92-1	100	19.1	11[4]	1	100%	NA	NA	15	**15**	TP23
Nickel	7440-02-0	20	5.1	38	1	100%	NA	NA	3.7	3.7	TP23
Zinc	7440-66-6	100	27.7	46	1	100%	NA	NA	21	21	TP23

Notes:

[1]Background for natural soils as established by Massachusetts Department of Environmental Protection (2002)

[2]From U.S. Environmental Protection Agency (USEPA) (2005a, b; 2007a, b, c)

[3]Values in **BOLD** exceed the USEPA Eco-SSL

[4]Based on exposure in insectivorous birds. The next higher Eco-SSL for lead was 46 mg/kg based on exposure in herbivorous birds.

Acronyms and Abbreviations:

Eco-SSL = ecological soil screening level
FOD = frequency of detection
J = estimated value
n = number of samples
NA = not applicable
RL = reporting limit
% = percent
%'tile = percentile
mg/kg – milligrams per kilogram

Table 7-7. Summary of Metals Analysis Results for Sediments of the Inland Water Habitat
Tisbury Great Pond Investigation Area

Analyte	CAS #	Ecological Screening Level[1] (mg/kg)	n	FOD	RL Range (mg/kg)		Range of Detections[2] (mg/kg)		Location of Maximum Detection
					Min	Max	Min	Max	
Surface Sediment (0-6 inches)									
Antimony	7440-36-0	2	17	41.2%	0.21	0.47	0.019 J	0.037 J	TP09
Copper	7440-50-8	18.7	17	100%	NA	NA	0.51 J	16	TP12
Lead	7439-92-1	30.2	17	100%	NA	NA	2.6	**34**	TP12
Nickel	7440-02-0	15.9	17	100%	NA	NA	1.0	**21**	TP08 & TP12
Zinc	7440-66-6	121	17	100%	NA	NA	5.1	100	TP12

Notes:

[1]From U.S. Environmental Protection Agency Region 3 (2012); Minimum of freshwater and marine sediment screening level

[2]Values in **BOLD** exceed the ecological screening level.

Acronyms and Abbreviations:

FOD = frequency of detection
J = estimated value
n = number of samples
NA = not applicable
RL = reporting limit
% = percent
mg/kg = milligrams per kilogram

beach habitat, and approximately 40% of the sediment samples from Tisbury Great Pond. Therefore, none of the five metals was eliminated from further consideration as a COPEC based on low frequency of detection.

7.4.1.3.0.5 In contrast to the metals, the analyses of the explosive compounds (Table 7-8) showed no detections for any of the 16 analytes in either soil or sediment. However, in a few cases (1,3-dinitrobenzene in soil, 2,4-dinitrotoluene in sediment, and 2,6-dinitrotoluene in both soil and sediment) the RLs were found to be greater than their corresponding ecological screening levels for these media, presenting the possibility that the actual concentrations of these compounds could exceed the screening levels and potentially pose a risk to ecological receptors. This was considered unlikely, however, due to the facts that the screening levels are relatively close to or exceed one half of the RLs, which is considered the nominal concentration of non-detects, and that the actual limit of detection (i.e., the method detection limit) for these analytes will be less than the RL and likely less than the screening values, indicating that the true concentration of the analyte will also be less than the screening level. For these reasons, none of the 16 explosive compounds was considered to be a COPEC for this site and all were eliminated from further evaluation.

7.4.1.3.0.6 As previously indicated, the MCP allows consideration of natural background levels in the elimination of analytes from further concern in the risk process. To this end, the maximum detected concentrations of the five metals were compared against the MADEP accepted state-wide background concentrations for natural soils (MADEP, 2002). As seen in Table 7-6, none of these maximum exceeded the corresponding MADEP accepted background concentration as based on the 90th percentile of natural background. Further, with the exception of lead in the upland soil (all depths), none of the metals even exceeded the 50th percentile of natural background levels for the State. Therefore, the measured levels of metals in the upland and beach soils are consistent with a condition of No Significant Risk based on the MCP Method I Standards. However, because the maximum concentration of lead in the soil (44 mg/kg) was found to exceed the Ecological Soil Screening Level (Eco-SSL) for this metal, lead was retained for further evaluation as a COPEC in soil.

7.4.1.3.0.7 The maximum concentrations of metals in the site sediments were compared to ecological screening levels for this medium. USEPA Region 3 (2012) sediment screening levels (minimum between freshwater and marine) were used as the sediment screening criteria. As shown in Table 7-7, the maximum concentrations of both lead and nickel (34 and 21 mg/kg, respectively) exceeded their corresponding screening levels (30.2 and 15.9 mg/kg, respectively). Although site-specific background levels of metals in sediment were determined based on ten sediment samples collected from coves and ponds surrounding Tisbury Great Pond, it was found that although the maximum background concentrations for lead and nickel (32 and 16 mg/kg, respectively) slightly exceeded the corresponding screening values, both were less than the maximum site concentrations. For this reason, both lead and nickel were retained as COPECs for sediment.

**Table 7-8. Summary of Explosives Analysis Results for Soils and Sediment
Tisbury Great Pond Investigation Area**

Analyte	CAS #	ESL-soil[1] (mg/kg)	Surface Soil (0-12 inches)				Subsurface Soil[2] (12-24 inches)			ESL-sediment[1] (mg/kg)	Sediment (0-6 inches)			
			n	FOD	RL-min[3] (mg/kg)	RL-max (mg/kg)	n	FOD	RL (mg/kg)		n	FOD	RL-min (mg/kg)	RL-max[3] (mg/kg)
1,3,5-Trinitrobenzene	99-35-4	0.376 (B)	2	0%	0.095	0.097	2	0%	0.096	0.24 (C)	17	0%	0.091	0.099
1,3-Dinitrobenzene	99-65-0	0.073 (A)	2	0%	0.095	0.097	2	0%	0.096	0.67 (C)	17	0%	0.091	0.099
Nitrobenzene	98-95-3	1.31 (B)	2	0%	0.095	0.097	2	0%	0.096	0.145 (B)	17	0%	0.091	0.099
2,4,6-Trinitrotoluene	118-96-7	6.4 (A)	2	0%	0.095	0.097	2	0%	0.096	9.2 (C)	17	0%	0.091	0.099
2-Amino-4,6-dinitrotoluene	35572-78-2	10 (A)	2	0%	0.095	0.097	2	0%	0.096	34 (A)	17	0%	0.091	0.099
4-Amino-2,6-dinitrotoluene	19406-51-0	3.6 (A)	2	0%	0.095	0.097	2	0%	0.096	9.5 (A)	17	0%	0.091	0.099
2,4-Dinitrotoluene	121-14-2	1.28 (B)	2	0%	0.095	0.097	2	0%	0.096	0.014 (B)	17	0%	0.091	0.099
2,6-Dinitrotoluene	606-20-2	0.0328 (B)	2	0%	0.095	0.097	2	0%	0.096	0.040 (B)	17	0%	0.091	0.099
2-Nitrotoluene	88-72-2	9.9 (A)	2	0%	0.095	0.097	2	0%	0.096	28 (A)	17	0%	0.091	0.099
3-Nitrotoluene	99-08-1	12 (A)	2	0%	0.095	0.097	2	0%	0.096	24 (A)	17	0%	0.091	0.099
4-Nitrotoluene	99-99-0	22 (A)	2	0%	0.095	0.097	2	0%	0.096	52 (A)	17	0%	0.091	0.099
Nitroglycerin	55-63-0	71 (A)	2	0%	0.095	0.097	2	0%	0.096	1,700 (A)	17	0%	0.091	0.099
HMX	2691-41-0	27 (A)	2	0%	0.095	0.097	2	0%	0.096	0.47 (C)	17	0%	0.091	0.099
PETN	78-11-5	100 (A)	2	0%	0.095	0.097	2	0%	0.096	1,400 (A)	17	0%	0.091	0.099
RDX	121-82-4	7.5 (A)	2	0%	0.095	0.097	2	0%	0.096	1.3 (C)	17	0%	0.091	0.099
Tetryl	479-45-8	0.99 (A)	2	0%	0.095	0.097	2	0%	0.096	100 (A)	17	0%	0.091	0.099

Notes:
[1]Ecological screening values from (A) LANL 2011; (B) USEPA Region 5 2003; and (C) Talmage et al. 1999. Shaded cells indicate ESL < Min RL.
[2]Subsurface soils include both upland and beach habitats. Both had the same RL for all analytes.
[3]Duplicate samples included as the minimum of the two RLs.

Acronyms and Abbreviations:
ESL = ecological screening level
FOD = frequency of detection
mg/kg – milligrams per kilogram
n = number of samples
RL = reporting limit
RL-max = maximum reporting limit
RL-min = minimum reporting limit

7.4.1.4 Assessment and Measurement Endpoints

7.4.1.4.0.1 Assessment endpoints represent explicit expressions of the actual environmental values to be protected at the site. Measurement endpoints represent quantifiable ecological characteristics that can be measured, interpreted, and related to the valued ecological component(s) chosen as the assessment endpoints. The assessment and measurement endpoints for the inland water habitat are presented in Table 7-9 along with the key ecological receptor(s) associated with these endpoints. For the inland water habitat (which is the only habitat type with identified COPECs), benthic invertebrates (particularly shellfish) were identified as the key receptors, although sediment screening levels are typically based on a broad range of potential receptors.

Table 7-9. Assessment and Measurement Endpoints, SLERA
Tisbury Great Pond Investigation Area

Habitat Type	Assessment Endpoint	Measurement Endpoint	Key Ecological Receptor
Inland Water Habitat	Protection of benthic invertebrate populations from exposures to MC residues in sediments that could adversely affect growth, reproduction, or survival.	Comparison of MC concentrations in soil to established or estimated sediment quality criteria.	Freshwater/estuarine benthic invertebrates (generic)

7.4.2 Analysis

7.4.2.0.1 The Analysis phase of the screening level ERA involves two steps: estimation of potential exposures (Exposure Assessment) and identification of thresholds of effects, such as toxicologically based benchmarks or established ecological screening values (Effects Evaluation), which are described in the following sections.

7.4.2.1 Exposure Assessment

7.4.2.1.0.1 The Exposure Assessment is the process of estimating the magnitude of potential exposures of the selected ecological receptors to COPECs present at the site. This includes the identification of the exposure point concentration (EPC) in each relevant medium that reasonably represents the expected level of exposure that would be experienced by an individual of the receptor species using the site. For the initial data screening, the potential exposure level was conservatively estimated as the maximum measured concentration for each medium. A more realistic estimate of the EPC within the Investigation Area (i.e., representing exposure in a typical individual within the exposed population) would be the mean of these samples, which can be conservatively estimated by its 95% upper confidence limit (UCL). To this end, the USEPA Pro-UCL Version 4.1.01 software package (USEPA, 2011) was used to calculate the 95% UCLs for lead and nickel in sediment (Table 7-10). These 95% UCLs were used as the EPCs for the risk characterizations in this screening level ERA.

Table 7-10. Calculation of 95 Percent UCLs for Metals in Sediments of the Inland Water Habitat, Tisbury Great Pond Investigation Area

Analyte	CAS #	ESL[1] (mg/kg)	Approximate Distribution[2]	Arithmetic Mean[2] (mg/kg)	95% UCL of the Mean[3] (mg/kg)	Basis of 95% UCL[3]
Lead	7439-92-1	30.2	None	12.7	25.2	Chebyshev 95% (approx.)
Nickel	7440-02-0	15.9	Gamma	8.1	12.7	Approx. gamma

Notes:
[1] USEPA Region 3 (2012).
[2] As per USEPA Pro-UCL version 4.1.01 (USEPA, 2011).
[3] Based on 95% UCL estimate recommended by USEPA Pro-UCL version 4.1.01 (USEPA, 2011).

Acronyms and Abbreviations:
ESL = ecological screening level
mg/kg – milligrams per kilogram
UCL = upper confidence limit

7.4.2.1.0.2 For soil, insufficient data are available to calculate a 95% UCL. Further, as explained in Section 7.4.2.2, the potential for risk to upland receptors from lead exposure is limited to insectivorous birds. Because insectivorous birds forage on the ground surface, possibly probing into the soil the length of their bill, they will have limited contact with subsurface soils. Therefore, the EPC for soil was estimated to be 38 mg/kg, which is the mean of the 0-6 and 6-12 inch upland soil intervals. Neither the subsurface upland soil (12-18 inches bgs) nor the beach habitat subsurface soil (12- 24 inches bgs) were considered relevant to this receptor.

7.4.2.2 Effects Evaluation

7.4.2.2.0.1 The Effects Evaluation establishes the toxicity benchmarks against which the EPCs are compared to screen for the potential risk to specific receptors. For lead in soil, the minimum USEPA Eco-SSL for lead (11 mg/kg [USEPA, 2005b]) was used as the screening benchmark. This Eco-SSL is based on exposure in an insectivorous birds (specifically, the American woodcock [*Scolopax minor*]. It should be noted that the next higher Eco-SSL for lead is 46 mg/kg (based on exposure in an herbivorous bird), which exceeds the maximum lead concentration measured in the soils of the site. For the sediments of the Tisbury Great Pond, the sediment screening benchmarks from USEPA Region 3 (2012) were used to determine potential risk. These values include both freshwater and marine sediment benchmarks. Because Tisbury Great Pond represents of mix of freshwater and marine environments (due to the periodic breaching of the barrier dune) the minimum of these two benchmarks was used for screening. For the two COPECs identified for this habitat (lead and nickel), these benchmarks are 30.2 and 15.9 mg/kg, respectively.

7.4.3 Risk Characterization

7.4.3.0.1 This section describes the initial evaluation of potential ecological risk from the COPECs identified in Section 7.4.1.3. Specifically, these COPECs are lead and nickel in sediment.

7.4.3.1 Risk Screening

7.4.3.1.0.1 Based on the evaluation of the sediment data from the Investigation Area, only lead and nickel were identified as a COPECs requiring further evaluation for potential ecological risk. The risk characterization of these metals was based on the calculation of hazard quotients of the form:

$$HQ = \frac{EPC}{ESL}$$

Where:
HQ = Hazard quotient (unitless)
EPC = Exposure point concentration (mg/kg)
ESL = Ecological screening level (mg/kg)

7.4.3.1.0.2 A HQ less than or equal to 1 indicates that the EPC is less than or equal to the ecological screening level and therefore, the conclusion can be drawn that potential for significant risk is negligible for that COPEC in that medium and the COPEC can be eliminated from further consideration. If, however, the calculated HQ is greater than 1, then a conclusion of negligible risk cannot be drawn and the COPEC is retained for further evaluation. Note that it is not concluded that the COPEC poses a risk when the HQ exceeds 1 since this could be the result of multiple conservatisms built into both the EPC and the screening level. Such conservatisms are evaluated in the refined risk screening for those COPECs showing HQs greater than 1 and discussed in the uncertainty analysis.

7.4.3.1.0.3 For the two COPECs identified at the Investigation Area (lead and nickel), the calculated screening-level HQs are as follows:

Lead (surface soil): $HQ_{initial} = \frac{38\ mg/kg}{11\ mg/kg} = 3.5$

Lead (surface sediment): $HQ_{initial} = \frac{25.2\ mg/kg}{30.2\ mg/kg} = 0.83$

Nickel (surface sediment): $HQ_{initial} = \frac{12.7\ mg/kg}{15.9\ mg/kg} = 0.80$

7.4.3.1.0.4 Based on these results, both of these COPECs can be eliminated from further consideration in sediment since the EPCs for both lead and nickel (as represented by their 95% UCL concentrations) were less that their corresponding screening levels Although the HQ for lead in surface soil was low, a further refinement of the risk screening was conducted to further evaluate the potential for risk in this medium.

7.4.3.2 Refined Risk Screening

7.4.3.2.0.1 In the refinement of the initial risk screening, the HQs are recalculated based on a less conservative estimate of the threshold of adverse effects (i.e., the Eco-SSL) for lead. To this end, it should again be noted that the Eco-SSL for lead (11 mg/kg) is based on exposure in the American woodcock. The next smallest Eco-SSL derived by USEPA (2005b) for lead is 46 mg/kg (for an herbivorous bird), which is greater than the maximum measured concentration of lead in the soil at the Investigation Area. Therefore, this refinement of risk estimation for lead is focused on the conservative assumptions used to derive the Eco-SSL for the woodcock.

7.4.3.2.0.2 The EcoSSLs for wildlife receptors are based on the solution of the following equation under the condition that HQ=1 (USEPA, 2005b):

$$HQ = FIR \cdot (C_s \cdot P + B)/TRV$$

Where:

HQ= the hazard quotient (set at 1)

FIR=food ingestion rate of the receptor (in kg dry weight of food per kg body weight per day [kg dw/kg-day])

C_s= the soil concentration of the COPEC (in mg/kg)

P= the ingestion rate of soil as a proportion of FIR (unitless)

B=the concentration of the COPEC in the food of the receptor (i.e., earthworms) (in mg/kg dw)

TRV=the toxicity reference value for the receptor based on chronic oral exposure to the COPEC (in mg per kg body weight per day [mg/kg-day])

7.4.3.2.0.3 The concentration of lead in earthworm tissue (B) is estimated by the relationship (USEPA, 2005b):

$$\ln(B) = 0.807 \cdot \ln(C_s) - 0.218$$

Where:

B= the concentration of the COPEC in the earthworm tissues (in mg/kg dw)

C_s= the soil concentration of the COPEC (in mg/kg)

ln(X) = the natural logarithm of X

7.4.3.2.0.4 The Eco-SSL is defined as the value of C_s that results in a HQ of 1 in the first equation. The TRV for oral lead exposure in birds was derived by USEPA (2005b) to be

1.63 mg/kg-day, which is based on no observed adverse effect level (NOAEL) for chronic exposure. This TRV was not changed in the refined assessment of risk.

7.4.3.2.0.5 Both the FIR and P values used in the derivation of Eco-SSL are based on conservative estimates of these two exposure factors. The value used as FIR is based on the maximum food ingestion rate of the American woodcock of 1.43 kg wet weight (ww) per kg body weight per day (kg ww/kg-day) as reported in the USEPA Wildlife Exposure Factors Handbook (USEPA, 1993). When converted to a dry weight basis (assuming a water content in earthworms of 85% [USEPA, 1993]), the FIR used in the Eco-SSL (0.214 kg dw/kg-day) is obtained. The mean food ingestion rate for the woodcock, however, is 0.77 kg ww/kg-day (USEPA, 1993), which converts to a dry weight FIR of 0.116 kg dw/kg-day. In the case of P, 16.4% is used in the derivation of the Eco-SSL to estimate incidental soil ingestion by the woodcock. USEPA (1993), however, presents a lesser value of 10.4% for this species. Substituting these two less conservative exposure factors (i.e., FIR = 0.116 kg dw/kg-day and P = 10.4%) into the equations above and solving for C_s under the condition that HQ =1, a refined SSL of 26.4 mg/kg is obtained. This results in the following changes to the HQs for lead in the surface soil:

Lead (surface soil): $HQ_{refined} = \frac{38\ mg/kg}{26.4\ mg/kg} = 1.4$

7.4.3.2.0.6 Thus, these two modifications in the exposure factors used to derive the EcoSSL for lead in the American woodcock are sufficient to reduce the predicted level of potential risk to a level that can be considered negligible. As discussed in the following section, other conservative exposure assumptions remain that are likely to further reduce the prediction of potential risk at this site.

7.4.3.3 Uncertainty Analysis

7.4.3.3.0.1 Throughout the risk assessment process, there are many uncertainties stemming from imperfect knowledge and data gaps that necessitate the implementation of assumptions that allows the process to proceed. Each of these assumptions has the capacity to influence the resulting prediction of potential risk to different degrees and in different direction from the "true" level of risk posed by the site. Thus, these assumptions may lead to either an overestimation of actual site risk, thereby favoring a greater degree of caution and protection of environmental resources (often referred to as "conservatism"), or to an underestimation of actual site risk, which could ultimately lead to an inadequate response.

7.4.3.3.0.2 The ERA process is designed to proceed in an iterative approach from highly conservative estimates of potential risk to estimates that can be accepted as more accurate yet still conservative predictions of actual site risk. In the following sections, some areas of uncertainty and assumptions used to address them in this risk assessment are described as well as their potential effect on the resulting risk prediction.

7.4.3.3.0.3 **Bioavailability.** Because the risk evaluations for metals were all based on total concentrations in soil, an unstated assumption is that each of the metals within those media are in a bioavailable form (i.e., 100 percent of the measured metal is in a form that can be taken up by plants or absorbed or assimilated through dermal contact, inhalation, or ingestion by animals). Typically, however, metals in soils and sediments occur in forms that are not bioavailable (e.g., as a solid metallic fragment, an insoluble mineral, or bound to other minerals or organic matter) and only a fraction of the total measured metal concentration is likely to be in a bioavailable form. Therefore, the assumption of 100 percent bioavailability is conservative and is likely to lead to an overestimation of the actual potential for risk.

7.4.3.3.0.4 **Exposure Point Concentrations.** Based upon the results of geophysical surveys and intrusive investigations, sampling of soil and sediment at the Investigation Area was biased toward areas that were most likely to have been affected by its historical use. However, the soil and sediment EPCs used in this ERA are assumed to represent the entire area of its corresponding habitat within the Investigation Area and therefore represent the expected exposure of an average individual of the exposed population rather than that of the maximally exposed individual. Because the data upon which EPCs are based represent only a small fraction of the entire Investigation Area and are biased toward the areas of highest expected concentration, they are likely to overestimate potential exposures in most receptors relative to the site-wide average. For this reason, it is highly likely that estimates of potential for risk represented by these EPCs also overestimate actual potential for risk from the Investigation Area as a whole.

7.4.3.3.0.5 EPCs for lead and nickel in sediment were represented by 95% UCLs of the mean. These provide a conservative estimate of the true mean concentrations in the sediment than the arithmetic mean (i.e., the simple average). Therefore, the EPCs result in conservative estimates of potential risk.

7.4.4 Conclusions

7.4.4.0.1 Based on this screening level ERA for the Investigation Area, the following conclusions can be drawn:

- No high explosive compounds or by-products occur in the soil or sediment at detectable levels; therefore, none of these compounds pose a potential risk to ecological receptors resources at this site.
- None of the key metals (antimony, copper, lead, nickel, and zinc) occur in soil at levels that exceed MADEP-specified background concentrations; therefore, all are consistent with a condition of No Significant Risk based on the MCP Method I Standards.

- Lead levels in surface soil exceeded the Eco-SSL for insectivorous birds; however, further evaluation of conservative assumptions associated with that Eco-SSL and the EPC indicated that the potential for risk from this metal is negligible.
- Although the concentrations of lead and nickel in surface sediment from Tisbury Great Pond exceeded the USEPA Region 3 ecological screening levels for those metals, their potential for risk was found to be negligible based on the 95% UCL concentrations. In addition, background sediment concentrations also exceeded the USEPA Region 3 ecological screening levels for lead and nickel.

7.4.4.0.2 Therefore, it can be concluded that none of the MCs evaluated at the Investigation Area pose a potential for risk to ecological receptors.

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8.0 CONCLUSIONS AND RECOMMENDATIONS

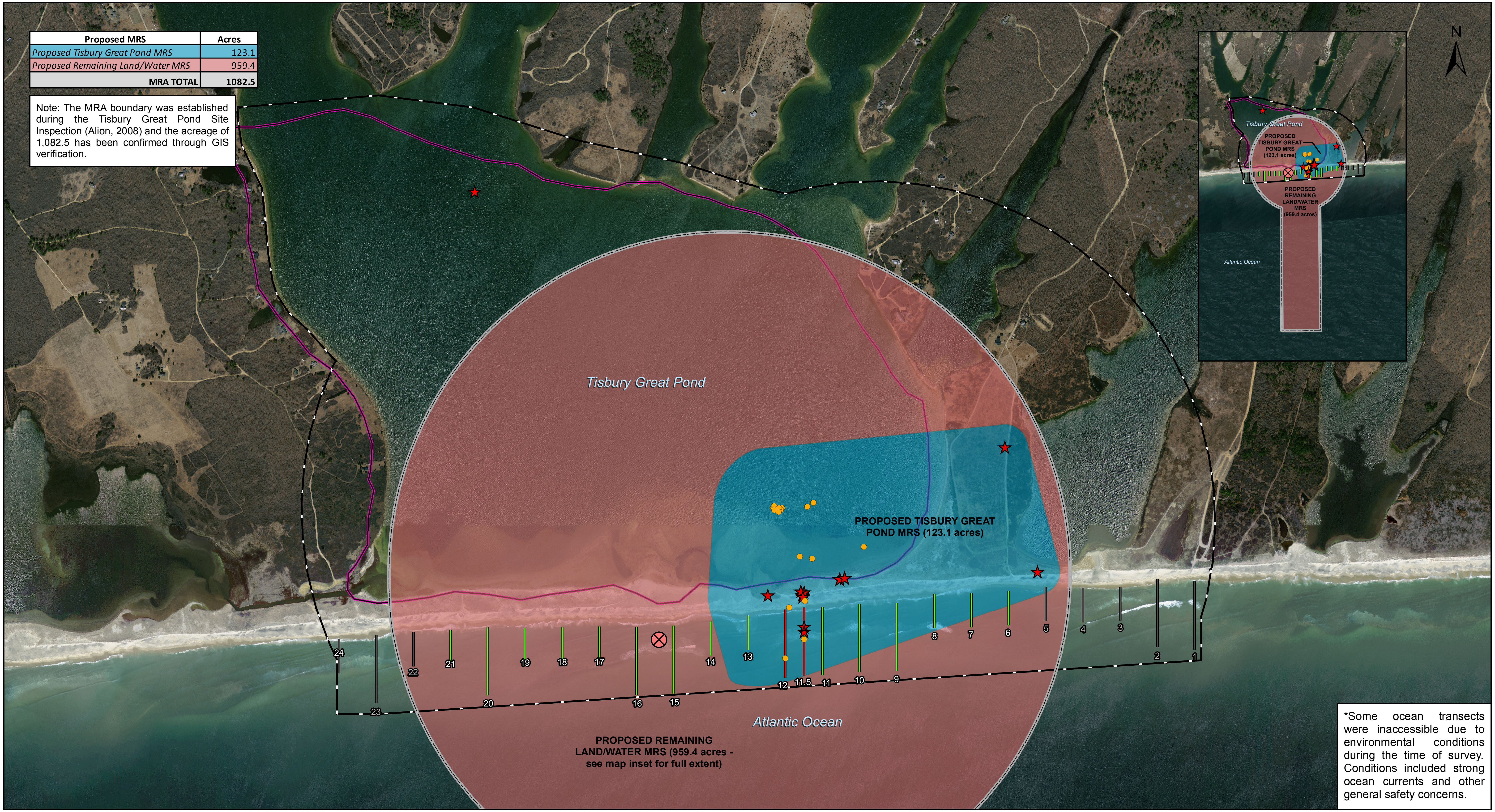
8.0.1 An RI was conducted as recommended at the conclusion of the Site Inspection, which identified the historic use of practice bombs at Tisbury Great Pond (Alion, 2008). The objective of the RI, to delineate the nature and extent of MEC and MCs impacted from historic training activities conducted at the Investigation Area, has been achieved. RI activities including geophysical surveying, intrusive investigations, and environmental sampling for analysis of MCs was conducted within land, beach, and ocean Investigation Area sub-areas.

8.0.2 Key findings of the RI include:

- During the RI, 6 MEC items (practice bombs with spotting charges), 31 MD items and 254 non-MD items were identified.
    - The beach, inland water, and ocean near the "Cut" contained the highest concentration of MEC and MD items.
    - Three MEC items were identified within the northwest portion of Tisbury Great Pond. The MEC items were all recovered in a single grid and consisted of 3 MK23s co-located in one hole. This fact coupled with the distance from the historic target and other MK23 finds indicates it is likely they were secondarily transported via human activity.
    - The land area east of Tisbury Great Pond contained one MEC item and no MD items. Considering the distance from the historic bombing target and that no other MEC or MD items were observed in the adjacent areas, it is unlikely that other MEC items are located in this area. Therefore, this MEC item is considered an outlier.
    - The residential area on the western shore of Tisbury Great Pond did not contain MEC or MD.
- Emergency Responses
    - MD items were identified in four instances on the beach near the "Cut," three on 23 February, three on 24 February, two on 26 February, and six on 13 July 2011.
    - An unknown bomb determined to be filled with high explosives by EOD was identified in August 2009 west of the current "Cut." Due to the mission of the EOD to render items safe by detonation (as opposed to perforating the items to first determine whether the items contain explosives) coupled with the large amount of explosives used by the EOD team. USACE has concluded that is highly unlikely and extremely difficult to determine if an item was MD or MEC after detonation.
    - One ordnance item was identified during an emergency response at the West Tisbury Great Pond "cut" on 20 August 2009. Due to high tide and strong current, the item was left in place.

- During the Transport Acoustic Transponder (Pinger) Survey a spotting charge simulant was transported laterally/parallel to the beach in near shore currents and 100-lb bomb simulants were identified at the location where they were placed but were buried under 8-in. of sand.
- MC Sampling
  - MC sampling indicated that human health screening criterion were not exceeded in any media.
  - Lead was identified at concentrations exceeding ecological screening criterion in surface and subsurface soil.
  - Lead and nickel were identified at concentrations exceeding ecological screening criterion in sediment in both investigation and background samples.
  - No high explosive compounds or their by-products were detected in soil; therefore, none of these compounds pose a potential risk to ecological receptors resources at this site.
  - None of the key metals (antimony, copper, lead, nickel, and zinc) occur in soil at levels that exceed MADEP-specified background concentrations; therefore, all are consistent with a condition of No Significant Risk based on the MCP Method I Standards.
  - Lead levels in surface soil exceeded the Eco-SSL for insectivorous birds; however, further evaluation of conservative assumptions associated with that Eco-SSL and the EPC indicated that the potential for risk from this metal is negligible.
  - Although the concentrations of lead and nickel in surface sediment from Tisbury Great Pond exceeded the USEPA Region 3 ecological screening levels for those metals, their potential for risk was found to be insignificant based on the 95% UCL concentrations. In addition, background sediment concentrations also exceeded the USEPA Region 3 ecological screening levels for lead and nickel.
- Under current conditions, the land/beach received a hazard level category of 1, indicating the highest potential explosive hazard conditions are present. This assessment was based upon the pre-RI discovery of an unknown HE bomb west of the current "Cut" location.

8.0.3 Based upon RI results, it is recommended that no change be made to the MRA boundary established during the Site Inspection (Alion, 2008). The boundary includes the extent of MEC determined through previous investigations, geophysical and intrusive investigation data. It is also recommended that Tisbury Great Pond MRA should be subdivided into two MRSs, comprising the Tisbury Great Pond MRS and the Remaining Land/Water MRS (Figure 8-1). Based upon the information gathered from historical records, previous investigations, and RI results, a FS is recommended to evaluate future response action alternatives with regard to MEC hazards at the two MRSs. No further evaluation of MC is warranted.



Proposed MRS	Acres
Proposed Tisbury Great Pond MRS	123.1
Proposed Remaining Land/Water MRS	959.4
MRA TOTAL	1082.5

Anomaly Type

- MEC
- MD
- Former Bombing Target
- Ocean Transect Inaccessible*
- Ocean Transect with MEC or MD
- Ocean Transect with no MEC, MPPEH, or MD
- Proposed Tisbury Great Pond MRA
- Tisbury Great Pond FUDS Boundary
- Tisbury Great Pond Investigation Area

US Army Corps of Engineers®

FIGURE 8-1

Proposed Revised MRA Boundary - Tisbury Great Pond Investigation Area, Martha's Vineyard, MA

0 100 200 400 600 Meters

0 500 1,000 1,500 2,000 Feet

UXB amec

NOTES:
2009 Aerial Data Source: MassGIS

03/12/2014	Rev:	Tisbury_Site_Loc_Remedial_Inv_Rpt.mxd
Drawn: JBO	Chk: DMS	PROJ: 562910000

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APPENDIX A
SUPPLEMENTAL STUDIES

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TECHNICAL MEMORANDUM

Date: June 09, 2014
To: Mr. Mike Warminsky PE
From: Nate Dill, David Walsh, and Bob Hamilton, Woods Hole Group, Inc.
Re: Tisbury Great Pond Hydrodynamic Modeling

1.0 INTRODUCTION

This technical memorandum describes a numerical modeling effort performed by Woods Hole Group, Inc. to assist UXB International, Inc. and the United States Army Corps of Engineers in their Remedial Investigation and Feasibility study at the Tisbury Great Pond Investigation Area, Martha's Vineyard, Massachusetts. This work is intended to help address concerns of potential Unexploded Ordinance (UXO) exposure and/or transport by currents in the pond and immediately adjacent portion of the Atlantic Ocean resulting from breaches or intentional periodic cutting of a channel through the barrier beach. Channel cutting is performed when the pond level exceeds approximately 4.3 feet NAVD88 to drain the pond to reduce flooding upland potential, and to allow tidal exchange to improve water quality. Channel cuttings are typically required 3-4 times per year depending on the weather. The resulting erosion and high current velocities immediately following a channel cutting event (typically lasting two tidal cycles) introduce a potential pathway for exposure and/or transport of UXO.

The hydrodynamic model presented here was designed to simulate water levels and current velocities immediately following a channel cutting event as a result of drainage from the pond and subsequent tidal currents. The model described in this memo was developed to simulate a specific channel cutting made on November 11th, 2011, and the modeling effort was supported by field data collection during the same time period. The field data collection and analysis is described in another technical memorandum provided to UXB (WHG, 2012). This memorandum describes the model development including: the modeling approach; model configuration; and model calibration and verification. Results estimate the area of potential UXO exposure, and present model results for the current velocity field that UXB can compare to threshold velocity levels related to UXO transport.

2.0 MODEL DEVELOPMENT

MODELING APPROACH

The Environmental Fluid Dynamics Code (EFDC)

The Tisbury Great Pond hydrodynamic model was developed using the Environmental Fluid Dynamics Code (Hamrick, 1996). The EFDC is a Fortran program which solves the three-dimensional, vertically hydrostatic, free surface, turbulent-averaged equations of motions for a variable-density fluid using the finite difference method on a structured curvilinear-orthogonal grid. The model includes dynamically coupled transport equations for turbulent kinetic energy, turbulent length scale, salinity and temperature. In addition, the EFDC model may be configured to simulate cohesive and non-cohesive sediment transport, eutrophication processes, both near field and far field dilution of discharges, and the transport and fate of toxic contaminants. The model is capable of simulating multiple size classes of cohesive and non-cohesive sediments along with the associated deposition and resuspension processes and bed geomechanics. The model allows for the wetting and drying of shallow areas using a mass conservative scheme. For this effort EFDC was configured to simulate hydrodynamics using a single vertical layer (i.e. two-dimensional depth averaged) and a constant density fluid (i.e. no vertical stratification).

Sequential Simulations with Varying Bathymetry

Cutting of the barrier beach at Tisbury Great Pond is initially followed by highly dynamic erosion of the cut channel and an increase in conveyance between the pond and ocean as the pond drains. As the water level in the pond drops below high tide in the ocean, reversing tidal currents occur with varying amounts of erosion and deposition in the channel as the current velocity varies from ebb to slack to flood to slack and so on. In order to simulate the varying bathymetry, the model was setup to run as a sequence of individual simulations, each with the model grid modified to account for the varying bathymetry of the cut channel. In this way, a suite of 144 sequential simulations were required to simulate 2 days. With exception of the first simulation in the sequence, the built-in restart capabilities of EFDC were utilized to ensure each subsequent simulation began with initial conditions (i.e. water surface elevation and current velocity) identical to final conditions of the previous simulation.

Cut channel cross-sections used in the model were derived from the Sontek RiverSurveyor M9 bottom tracking data (WHG, 2012). These data were used to define a time varying sequence of straight prismatic channels connecting the pond and the ocean. The channel cross-sections were interpolated in time at 20 minute intervals to generate a different bathymetry for each simulation in the suite. However, qualitative observations of the evolution of the cut channel, the lack of cross-section data for the entire simulation period (particularly during flood and slack tides), as well as preliminary simulations using the bathymetry defined in this way, suggest that use of a sequence of single cross-sections to define the cut channel bathymetry is not sufficient to realistically describe the evolving cut channel. Therefore, lacking additional bathymetric data for the cut channel, the method for determining equilibrium scour depths at tidal inlets introduced by Hughes (1999) was utilized to further adjust the bathymetry prior to each simulation. This methodology is based on the assumption that, given sufficient time, a tidal inlet will scour to a live-bed equilibrium condition where the bottom shear stress is no longer sufficient to initiate sediment movement. The equilibrium scour depth may be determined via the equation:

$$h_e = \frac{0.234(q)^{(8/9)}}{\left(g(s-1)\right)^{(4/9)} d_{50}^{(1/3)}}$$

Where h_e is the equilibrium scour depth, q is the discharge per unit width, g is acceleration due to gravity, s is the specific gravity of sediment, and d_{50} is the median sediment grain size. A nominal d_{50} value of 0.2 millimeters was applied based on visual observation of sand at the Tisbury Great Pond beach site, and a specific gravity of 2.65 for quartz sand was used. Discharge per unit width was determined as the product of depth and current speed at each model grid cell. It is important to note that this methodology does not consider the effects of wave action and longshore currents on inlet scour and is generally only applicable to tidal inlets dominated by tidal currents. As such, it is reasonable to apply this methodology to the Tisbury Great Pond cut channel only during the pond draining phase when channel is enlarging. Also, since this methodology does not consider the effects of wave action on the bottom boundary layer velocity profile, the model results have greater uncertainty where wave action affects bottom shear stresses (i.e. on the Atlantic Ocean side of the barrier beach).

The procedure for varying the model bathymetry through a suite of sequential simulations was as follows:

1. Run the initial 20 minute EFDC simulation starting with zero current velocity and the water surface elevation at the initial pond water level (4.3 ft-NAVD88).
2. Define a new model bathymetry using a straight prismatic channel based on River Surveyor cross-section data.
3. Read water level and current velocity data from the last output of the previous simulation.
4. Compute equilibrium scour depths for each cell in the model grid using water levels and currents from step 3.
5. Adjust bathymetry for cells where the depth from step 2 is less than the equilibrium scour depth from step 4.
6. Simulate the next 20 minutes of water levels in currents using the bathymetry from step 5.
7. Repeat steps 2 thru 6 until the entire 48 hour simulation sequence is complete.

MODEL CONFIGURATION

Model configuration involves the development of a model grid specific to the area of interest, assignment of appropriate boundary conditions, and the selection of various parameters which control the model's operation.

Model Grid

A curvilinear-orthogonal grid was generated using the method of nearly-orthogonal grid generation with aspect ratio control (Akcelik, 2001). The domain boundaries were set to approximate the shoreline of Tisbury Great Pond and to include a portion of the Atlantic Ocean large enough to eliminate unwanted boundary effects in the area of interest. Grid resolution was set to less than 2 meters in the vicinity of the cut channel. Figure 1 presents the model grid. Multiple sources of elevation data were used to define the model bathymetry. These include:

- 2010 bathymetric survey conducted by UXB,
- USACE 2007 National Coastal Mapping Program Lidar data,
- 1992 bathymetric survey by Fugro-McClelland, Inc.
- Hydrographic survey data from the National Oceanic and Atmospheric Administration's National Ocean Service survey H-8847.

All bathymetric data were converted to the NAVD88 vertical datum and Massachusetts State Plane (mainland) horizontal coordinates and combined to produce a consistent bathymetric dataset for interpolation to the model grid. In areas where multiple datasets overlap, priority was given to the more recent dataset. Figure 2 presents the model bathymetry after interpolation to the model grid.

Figure 1. Tisbury Great Pond hydrodynamic model grid

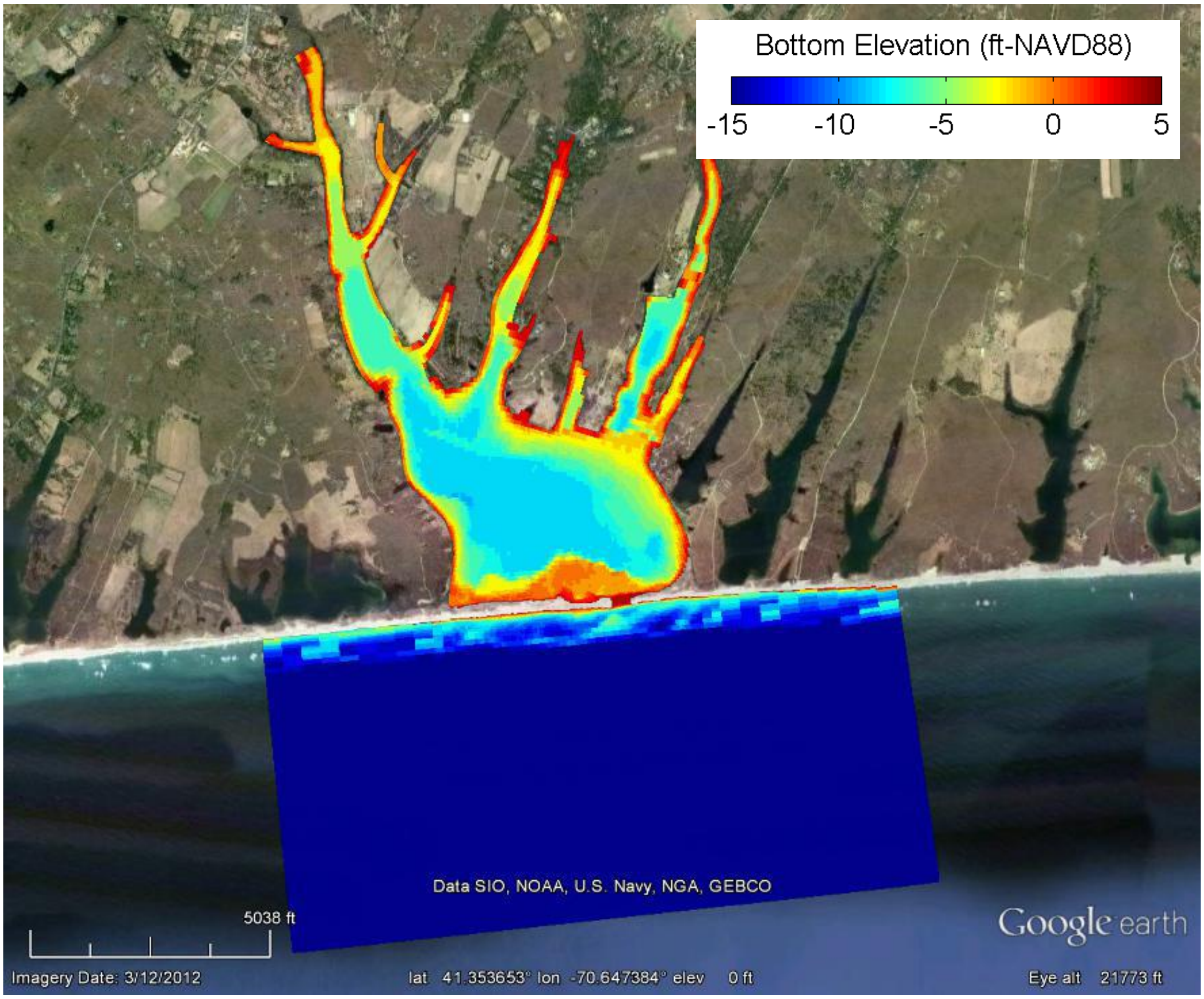

Figure 2. Tisbury Great Pond hydrodynamic model Bathymetry

Boundary Conditions

Assignment of boundary conditions is required for the EFDC to compute a unique solution for water levels and current velocities throughout the model domain. Three types of boundary conditions were utilized for the Tisbury Great Pond model.

- Land boundary (i.e. zero normal flow) along the Atlantic and Tisbury Great Pond shorelines.
- A Specified constant inflow of 22.5 cfs at the head of Town Cove. This inflow volume was added to account for the combined average freshwater input into the pond including stream flow, ground water, and direct precipitation (Healy, 2009)
- Tidal water surface elevation was specified on the Atlantic Ocean boundary. The water surface elevation time series was derived from pressure measurements at Martha's Vineyard Coastal Observatory (MVCO) underwater node located approximately 1 mile southeast of Tisbury Great Pond. The conversion from pressure to water surface elevation in NAVD88 is described in the field work technical memo (WHG, 2012)

MODEL CALIBRATION

In practice, hydrodynamic models require input of some physical parameters that are unknown or only known within a reasonable range. The model calibration process involves systematically adjusting these parameters through a reasonable range of values to ensure that model accurately reproduces observations. Bottom friction parameters, because they must account for a combination of various frictional processes that are not fully described in the model formulation, are often used as calibration parameters. EFDC uses a log-law roughness length to parameterize bottom drag forces. The Tisbury Great Pond model was calibrated by running a series of simulation suites with different roughness lengths until modeled water levels in the pond closely matched observed water levels. Ultimately, a roughness length of 2.5 millimeters was found to accurately reproduce observations during the initial draining phase of the simulation period. On subsequent tides, however, a larger value of 31.2 millimeters was found to most accurately reproduce observed water levels. The need for a lower roughness value during the initial draining phase suggest that frictional forces are lower during this period when the channel is eroding and the bottom is in motion. After the initial draining phase, the channel bottom has achieved a relatively stable cross-section and appropriate roughness length values are more characteristic of the size of bedforms on the channel bottom.

Figure 3 shows a comparison of the observed and modeled water surface elevation time series in the pond immediately following the channel cutting event on November 10th 2011. The solid red line represents the modeled water surface elevation while the blue dots represent the observed water level. Qualitatively, this figure exhibits good agreement between the modeled and observed water level during the 48 hours immediately following the channel cutting. Figure 4 provides a scatter plot comparison of the modeled and observed water surface elevation. On the scatter plot individual modeled values are plotted against the corresponding observed values. If the model has perfect agreement with the observed data, the points would lie on a line with slope of 1 passing through the origin (red line). The vertical distance between a point on the scatter plot and the line of perfect agreement represents the model error for that particular observation. As such, the scatter plot provides a visual representation of the quantified model error. Model error for a given observation time series is further quantified by computing the Bias Error and Root Mean Square Error (*RMSE*). The *Bias* and *RMSE* are calculated as:

$$Bias = \frac{\sum_{1}^{n}\left(p_{\mathrm{mod}} - P_{obs}\right)}{n} \tag{1}$$

$$RMSE = \sqrt{\frac{\sum_{1}^{n}\left(p_{\mathrm{mod}} - p_{obs}\right)^2}{n}} \tag{2}$$

Where p_{mod} and p_{obs} are the modeled and observed values respectively and n is the number of discrete measurements in the time series. The bias provides a measure of how close on average the modeled results are to the observed data. A positive value indicates that the model is over-predicting the observation, while a negative value indicates that the model is under-predicting the observations; a bias of zero indicates that the on average the model reproduces the observations. The RMSE is an average of the magnitude of the error. *RMSE* is always positive with smaller values indicating better model performance. The computed bias and *RMSE* for the Tisbury Great Pond water surface elevation are 0.02 and 0.11 feet, respectively, indicating excellent agreement between the modeled and observed water levels. In terms of relative error, both the *Bias* and *RMSE* are less than 4% of the observed water level range in the pond.

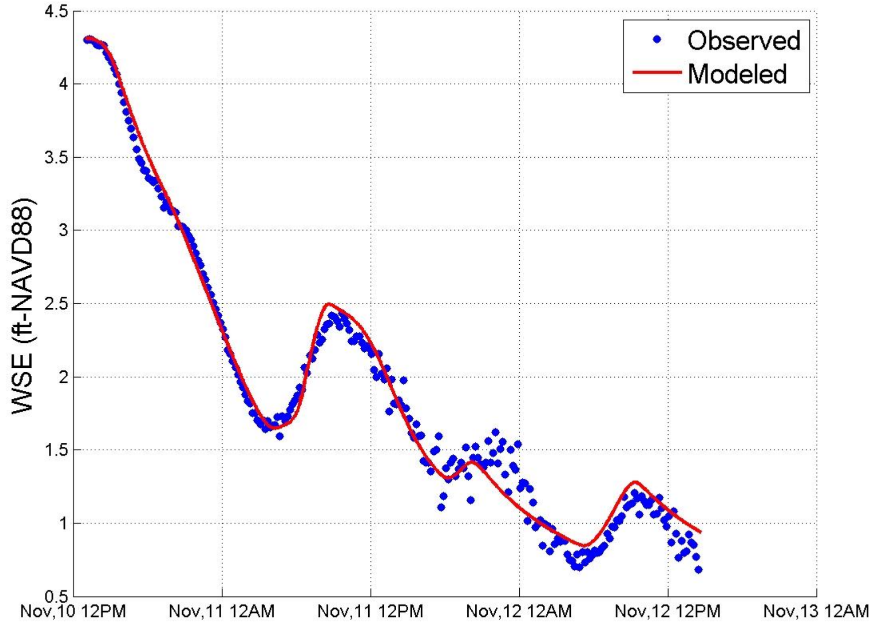

Figure 3. Comparsion of observed and modeled water surface elevation time series in Tisbury Great Pond.

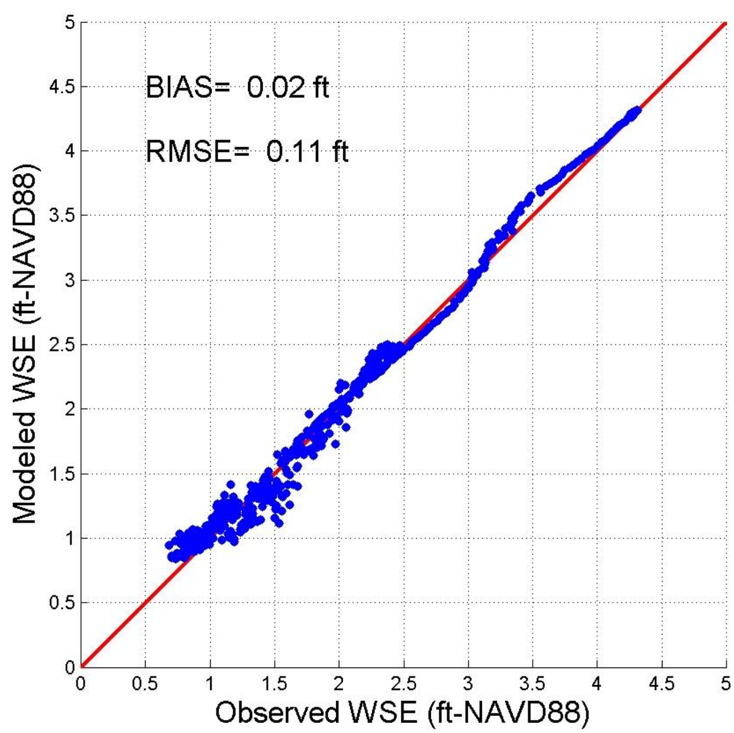

Figure 4. Scatter plot for Tisbury Great Pond water surface elevation time series.

MODEL VERIFICATION

The model results were verified by comparing model computed flow rates with observed flow rates through the barrier beach cut. The observed flow rates were computed from the RiverSurveyor cross-sectional profiles as described in the field work memo (WHG, 2012). The results are presented as a time series comparison as well as a scatter plot in figures 5 and 6, respectively. Overall the model computed flow rates show reasonable agreement with observed values. The *Bias* and *RMSE* errors were determined to be 154 cfs and 260 cfs, respectively. The positive bias indicates that the model somewhat over-predicts the flow rate through the cut channel suggesting that the model results are conservative with respect to potential exposure and/or transport of UXO due to high currents through the cut channel.

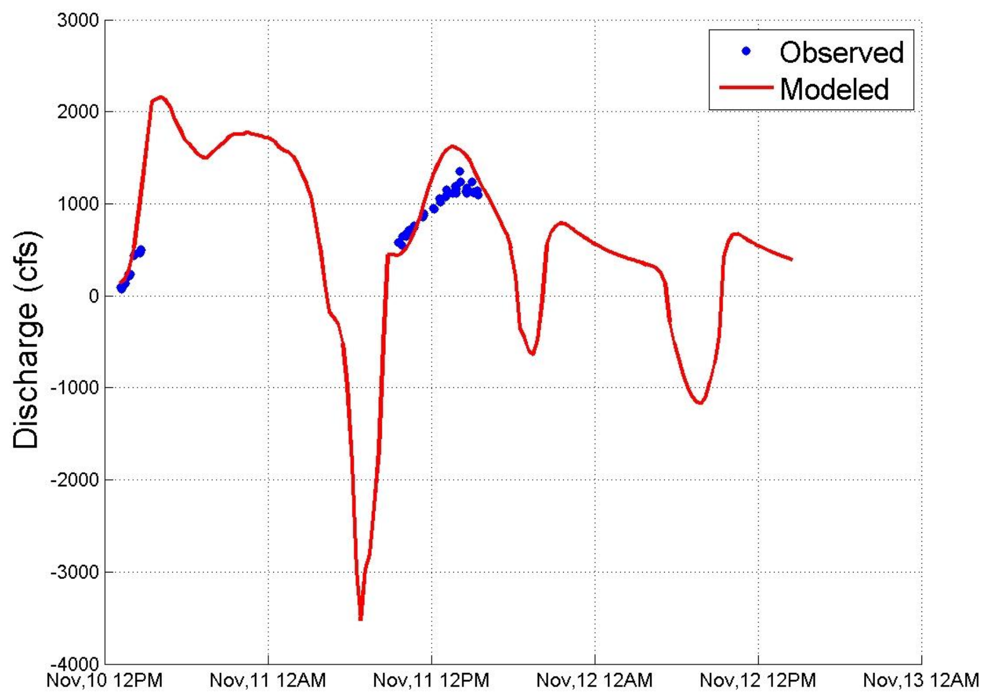

Figure 5. Comparsion of observed and modeled flowrate in the cut channel.

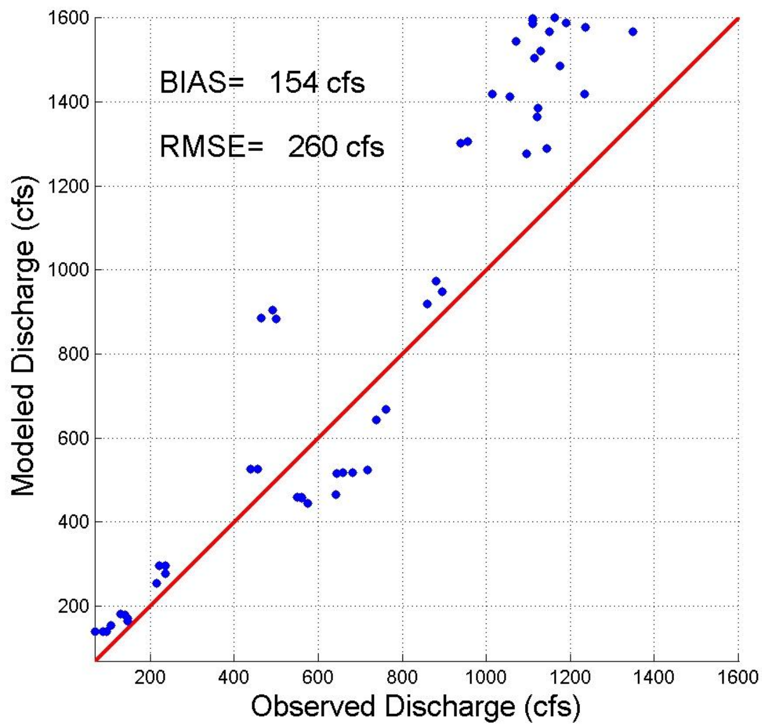

Figure 6. Scatter plot for flow rate time series.

3.0 MODEL RESULTS AND DISCUSSION

The conceptual model for UXO transport includes exposure and transport pathways related to tidal currents and scour, wave-induced currents and scour, gravity-driven UXO transport along the seabed, natural erosion/retreat/breaching of the barrier beach, and direct movement by human activities. The modeling herein focuses on the impact of currents induced by the intentional cutting of a channel in the barrier beach. Estimates are provided related to the area within which UXO may be exposed by inlet currents, and velocities are provided so UXB can estimate areas within which specific types of UXO may be transported.

The area of potential exposure of UXO can be estimated based on the equilibrium scour depth results from the sequence of model runs. Figure 7 illustrates the area within which, at any time during the sequence, the equilibrium scour depth exceeded the actual measured depth. Where the calculated equilibrium scour depth exceeds the actual measured depth, there is likelihood for additional scour, resulting in channel deepening and potential exposure of buried UXO. Within this area the model results indicate sediment removal is possible during some portion of the simulated time period. Model results indicate this area extends approximately 800 feet into the Atlantic Ocean and 800 feet into the Tisbury Great Pond. Outside this area (i.e., more than 800 feet seaward or 800 feet pond-ward from the barrier beach) exposure of UXO as a result of tidal inlet currents is unlikely. Since the barrier beach and inlet location evolves over time, there is potential for exposure of UXO at similar distances offshore and onshore from past and future inlet locations.

Determining full areas for potential transport of UXO is complex and would require a comprehensive understanding of the fluid dynamics and associated lift, and drag forces acting on specific types and shapes of UXO. This would require detailed knowledge of the actual size and shape and weight of the UXO, and other transport mechanisms related to waves and gravity beyond the scope of this study. To assist UXB in determining areas of potential UXO transport, modeled current velocities are provided as a proxy. We understand UXB has prior knowledge of threshold velocities that cause transport of specific UXO; therefore, it is anticipated that information related to current velocities provided herein can be used by UXB to determine areas where UXO transport may occur. Figure 8 shows a snapshot of the current velocity field during the time of maximum ebb/draining currents. This occurs approximately 6 hours after the excavation of the cut was finished with a maximum ebb discharge of 1250 cfs and maximum current velocity of 13 ft/s (8 knots) in the cut channel. At this time current velocities greater than 5 ft/s (3 knots) extend approximately 400 feet offshore within a relatively narrow jet. Any UXO transported during this time would likely move in a seaward direction. Figure 9 shows a snapshot of the current velocity field during the time of maximum flood current, which occurs on the first reversing tide after the channel is cut. At this time the modeled flow rate into the pond is approximately 3500 cfs, the depth averaged velocity is nearly 8 ft/s (5 knots) in the cut channel, and velocities greater than 5 ft/s (3 knots) extend approximately 300 feet into the pond. Any UXO transported during this time would likely move toward the pond.

Areas of potential exposure and/or transport of UXO are deduced from the model results by considering the physical processes that may result in movement of UXO. Sediment removal may result from a number of processes including but not limited to: Aeolian transport (i.e., wind-blown); anthropogenic activities (e.g., excavation); wave processes (e.g., wave induced suspension and transport); and processes associated with ephemeral tidal inlets (e.g., longshore inlet migration and storm-induced breaching). Once exposed, movement of UXO can result from a combination of forces including gravitational forces, and lift and drag forces imposed by fluid motion due to wave- and tidal-induced currents. The model results presented herein consider physical processes related to tidal inlet currents after intentional inlet creation (initiated by excavation). The results herein focus on this potential pathway for exposure and transport of UXO. UXO exposed as the inlet scours and deepens after the cut may be subsequently buried deeper as the inlet shoals, or UXO may be transported farther offshore or into Tisbury Great Pond, possibly remaining exposed or transported and/or buried by gravity, waves, or other forcings not included in the current modeling. Uncertainty in areas where wave processes are more significant (e.g., on the Atlantic Ocean side of the barrier beach, during storm events) could be constrained by including wave processes into the model. UXO may also reside in areas outside the influence of the current beach/inlet configuration since the beach has retreated at an average rate of 6 ft/yr according to MACZM, and the inlet also has migrated over time. UXO may also reside in areas within the historic test firing region independent from oceanographic transport processes.

Figure 7. Area where equilibrium scour depth exceeds actual depth at any point in time during the simulation sequence.

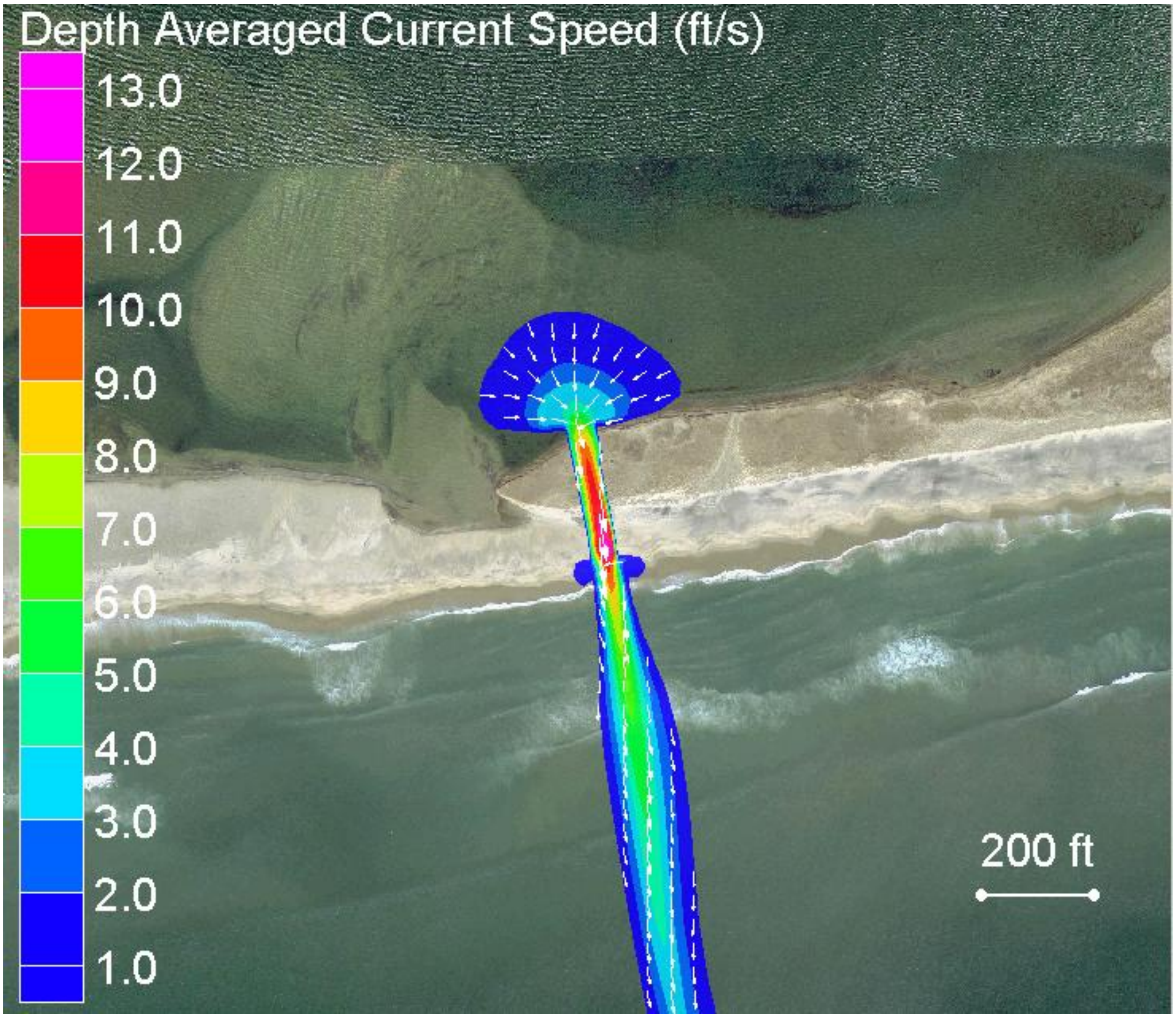

Figure 8. Maximum depth-averaged current velocity during ebb tide / draining.

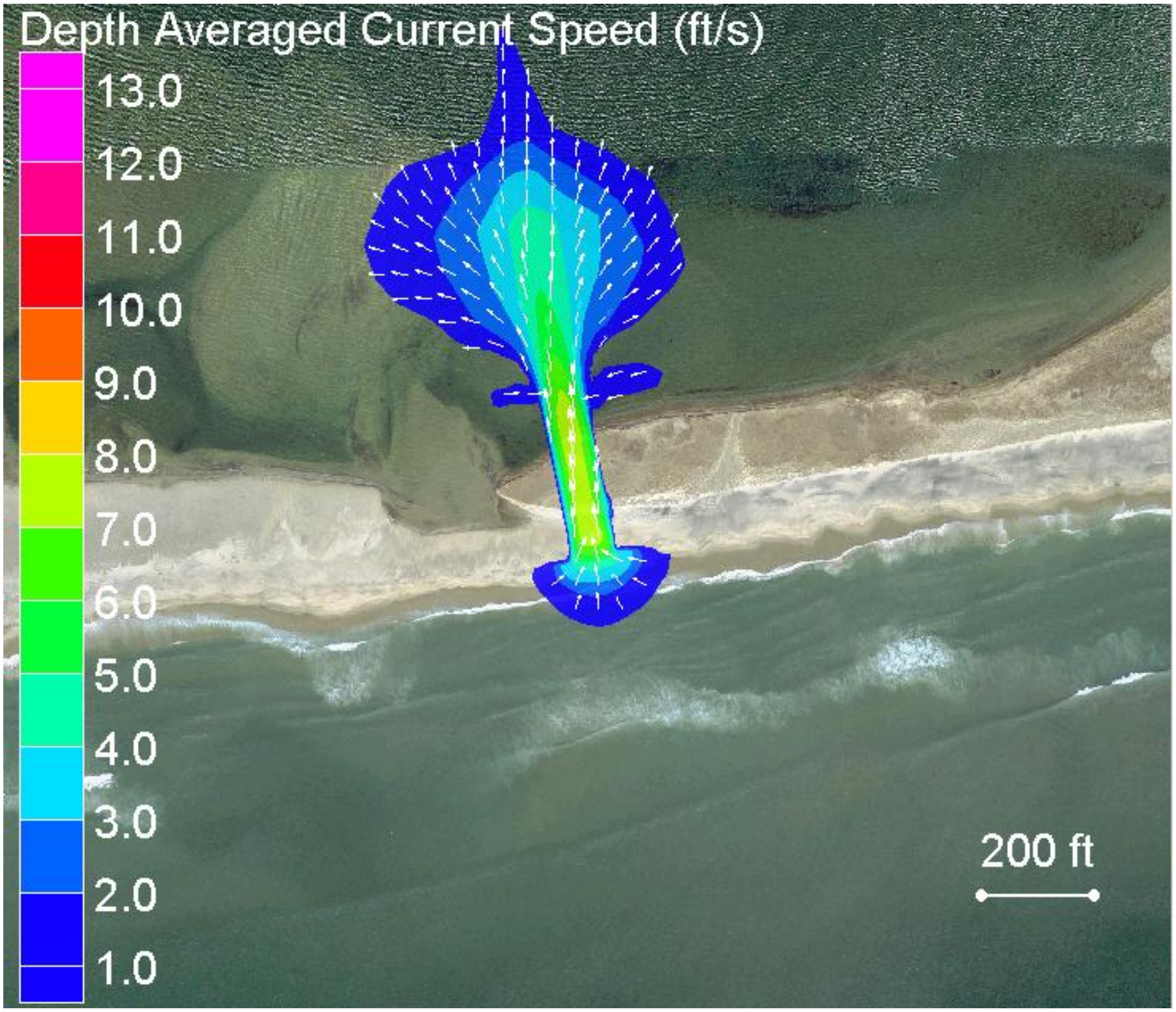

Figure 9. Maximum depth-averaged current velocity during flood tide.

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Final Report
on
Airborne Geophysical Survey
at

Martha's Vineyard, MA

February, 2011

Prepared for

UXB International Inc.

Prepared by

Battelle Oak Ridge Operations

Executive Summary

Between February 6th and 18th 2011, a low-altitude airborne vertical magnetic gradient geophysical survey was conducted over 1301 acres distributed into three separate areas on Martha's Vineyard Island, Massachusetts. The objective of the survey was to collect high-resolution airborne magnetometer data to detect groupings and clusters of MEC and MD items. The project involved the application of Battelle's VG-22 airborne vertical gradient system,

This system consists of 11 vertical magnetic gradiometers, each consisting of a pair of cesium magnetometers, vertically offset by 0.5 meters. Lateral separation is 1m between seven gradiometers that compose the forward array and 1.7m between gradiometers in the side arrays.

A geophysical prove-out (GPO) line of ten representative target items was established at Martha's Vineyard airport and used to verify positioning and system operation. The target items were laid on the surface and the line was flown at 1-2m altitude during each day of project operations. Data were also acquired at a suite of altitudes ranging from 1-5 meters for sensitivity assessment.

The survey was comprised of 590 acres of Tisbury Great Pond, 364 acres of South Beach, and 347 acres of Cape Poge. Mean sensor altitude for the three sites ranged from 2.0 to 2.5m. The magnetic data were processed and picked for target locations using a dipole inversion method. The RMS noise value for the survey was 0.1nT. The picking threshold was then set at 0.5nT, 5 times the RMS value. A complete listing of the analytic signal anomalies equal to or above the threshold of 0.5nT is presented for each area. Cape Poge contains 2,447 anomalies above the threshold, Tisbury Great Pond contains 3,608 anomalies, and South Beach contains 4,349 anomalies.

Several QC parameters, including survey speed, GPS quality, data noise, data drops, and flight altitudes were monitored throughout the survey and are summarized in Appendix A. Final data deliverables include geophysical maps and databases. Final deliverables will also include anomaly pick lists for each of the three areas.

Area	Total Area Surveyed	Total Potential MEC	Group 1 Priority	Group 2 Priority	Group 3 Priority
Tisbury Great Pond	590 acres	3608	1386	722	1500
Cape Poge	347 acres	2447	782	550	1115
South Beach	364 acres	4349	2254	776	1319

Table of Contents

List of Acronyms

AGL	Above Ground Level
ASCII	American Standard Code for Information Interchange
DGM	Digital Geophysical Mapping
EM	Electromagnetic
GIS	Geographic Information System
GPO	Geophysical prove-out
GPS, DGPS	(Differential) Global Positioning System
HAE	Height above ellipsoid
HDOP	Horizontal Dilution of Precision
IMU	Inertial Measurement Unit
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MRP	Munitions Response Program
NAD83	North American Datum 1983
OE	Ordnance and ExplosivesQA/QC Quality Assurance/Quality Control
SI	Site Investigation
TEM	Transient Electromagnetic
TIF, GeoTIF	(Geographically referenced) Tagged Information FileUTM Universal Transverse Mercator
UXO	Unexploded Ordnance
VG-22	Battelle'sVertical magnetic Gradient airborne system with 22 total sensors
WGS84	World Geographic System 1984

List of Figures

List of Tables

1. Introduction

1.1 Background

This report describes the methodology and results of a low-altitude vertical magnetic gradient helicopter geophysical survey carried out by Battelle for the purpose of detecting and mapping surface and buried munitions and explosives of concern (MEC) and munitions debris (MD) located over 1301 acres on Martha's Vineyard Island, MA. The survey used the state-of-the-art Battelle airborne high-resolution vertical magnetic gradient system (VG-22). This airborne system has previously been deployed at several sites in the U.S., including Twentynine Palms in California, Former Kirtland Precision Bombing Range in New Mexico, El Centro Naval air Facility in California, and Fort Wingate Army Depot in New Mexico. The Martha's Vineyard data will be used to guide ordnance remediation decisions for the site.

The objective of the airborne geophysical survey was to acquire vertical magnetic gradient data to provide an indication of the level of UXO contamination and to localize potential sources with sufficient positional accuracy (a few 10s of cm) to permit ground-based reacquisition of targets. It is important for potential users of these data to recognize that the airborne data should not be used to declare an area free of ordnance contamination. A lack of anomalies may indicate ordnance that is too small or deep to be detected or data that are insensitive to larger ordnance due to high survey altitudes.

1.2 Project Site Description

The survey site was composed of three areas: 1) Tisbury Great Pond, a 590-acre area where 100-lb M-38 ordnance occur at depths of 0-12 ft; 2) Poge Sound, a 347-acre area where 3-lb are found at up to 20 ft depth, and 3) a 364-acre portion of the South Beach and surf zone with mixed ordnance types. The locations of survey areas are shown in Figure 1.

Figure 1-1: Map of Martha's Vineyard

1.3 Site Geology

Martha’s Vineyard Island’s geologic origin dates back to the last ice age. This island is composed of deposited materials that were carried by the glaciers. Martha’s shares its history with Cape Cod, Nantucket, Long Island, and Staten Island. They are all part of a large terminal moraine, unconsolidated material, which formed around 10,000 years ago at the end of the last ice age. As the glaciers melted at the end of the ice age the sea levels rose and only the areas of thickest sediments were left. The sea continues to erode and rework these islands giving them their distinct shapes.

1.4 Weather, Topography and Vegetation

The climate of Martha’s Vineyard features generally milder winters and cooler weather in the summer compared to mainland cities such as New Bedford, Duxbury, and Boston. Average temperatures in the summer are in the 70s with the hottest month being July. Average temperatures in the winter are in the 40s, January being the coolest month of the year. The airborne survey took place during February when the temperature was relatively cold. The temperature fluctuated from the 20s and low 30s at night to the high 40s and 50s during the day.

The terrain of Martha’s Vineyard is relatively flat. Each of the three survey areas, particularly Tisbury Great Pond and Cape Poge, had portions which were over water. As a safety measure, a rescue boat was mobilized and ready at these sites whenever data were being acquired. However, no incidents occurred which required activation of the boat.

1.5 Airborne Vertical Magnetic Gradient System

The airborne magnetic data at Martha's Vineyard were acquired with the VG-22 system, developed and operated by Battelle. This system, shown in Figure 1.2, consists of 11 vertical magnetic gradiometers, each consisting of a pair of cesium magnetometers, vertically offset by 0.5 meters. This arrangement provides a substantial increase in detection capability compared to total field airborne systems because the gradient arrangement serves to reject much of the magnetic noise caused by large or deep geologic features and the moving magnetized components of the helicopter. In addition, the sensors mounted in the forward boom of the VG-22 are more closely spaced (laterally) than in the Battelle VG-16 system, (1.0 m vs. 1.7 m horizontal separation), thus providing greater sensitivity to smaller ordnance and greater positional accuracy for detected items.

Figure 1-2: Battelle VG-22 vertical magnetic gradiometer system.

Fourteen magnetometers are located in the seven gradiometer pods with 1.0 meter lateral spacing on the forward boom (Figure 1-2) and four magnetometers are located in each of the lateral booms (two gradient pods on either side) at 1.7m lateral spacing. The VG-22 system is mounted on a Bell 206 Long Ranger helicopter and flown as low to the earth's surface as safety permits, typically 1-2 meters above ground level, in pre-programmed traverses over the survey areas. Survey speeds averaged 13m/s. Data are processed at 120 Hz sample rate.

Flight lines were spaced 10m apart in all three areas. The flight line spacing is greater than the width of the front array, and smaller than the width of the full (forward plus lateral) array, leading to a cost-effective hybrid approach. This approach was designed to provide high density data over about 70% of each swath (1.0m line spacing) to improve sensitivity to small ordnance items. The remaining 30% of each swath was covered by the lateral magnetometers at slightly greater altitude and less regular spacing. In this outer portion of each swath, outboard magnetometers from adjacent swaths overlap to provide line density of less than 1.7m, but varying along the flight path; depending on how precisely the pilot was able to fly the pre-programmed course. Airborne magnetic data are acquired during daylight hours only.

The data positioning and system orientation (pitch, roll, and yaw) is based on an integrated Global Positioning System (GPS) / Inertial Measurement Unit (IMU), The GPS antenna is mounted in the center of the forward array, and the IMU is mounted inside the aircraft near the center of gravity. A laser altimeter is mounted beneath the helicopter to monitor sensor height above the ground. Data are recorded digitally on a console inside the helicopter in a binary format. The magnetometers are sampled at a 1200 Hz sample rate and desampled to 120Hz before processing.

Figure 1-3: Rack-mount components inside the helicopter for the VG-22 system. These include the recording console, an extendable flat screen monitor, extendable keyboard and mouse shelf for navigation system, and the navigation system with CRT display and the GPS positioning console.

2. Survey Parameters and Procedures

2.1 Survey Parameters and Procedures

The airborne survey was completed during the 13 day period (on-site) between February 6, 2011 and February 18, 2011 with flight activity from February 8-17. A comprehensive Operational Emergency Response Plan was developed and issued previously to address issues related to flight operations, safety, and emergency response. This plan was incorporated into an overall Mission Plan that was developed and used to manage field survey operations.

The geophysical survey crew included William Doll (Project Manager), Jeffrey Gamey (Project Geophysicist) and Jeannie Norton (Project Geophysicist) from Battelle. The flight crew consisted of Doug Christie (pilot), Marcus Watson (system operator), and Darcy McPhee (engineer) from National Helicopters.

Operations were based out of Martha's Vineyard Airport. Equipment was installed there and the aircraft was parked there overnight. A local GPS base station was established at a known monument, MVY B, at the airport (NAD83 70° 36' 19.45872" West, 41° 23' 49.23710" North, NAVD 88 17.24m above ellipsoid) and was used throughout the survey. All computer operations and data processing were conducted at the hotel.

2.2 Magnetic Data Acquisition

Upon arrival in Martha's Vineyard, Battelle personnel set up a geophysical prove-out (GPO) line at the airport for quality control and calibration. The GPO line contained a 105 mm mortar round, an M38 practice bomb, two 81 mortars, a rocket venturi, two 3lb practice bombs, a 2.25 rocket, two 3-inch" rockets, a 2.75-inch rocket, and a 105 projectile (**Error! Reference source not found.**). These targets were considered representative of the types of MEC expected on site. Prior to placement of the calibration targets, the area was swept with a man-portable magnetometer to determine the presence of pre-existing subsurface anomalies. A post-seed ground-based magnetometer survey was conducted for comparison to the airborne data.

The helicopter arrived on-site on February 6th and equipment installation was conducted on February 7th. The GPO preseed survey, seed emplacement, and postseed survey were performed on February 8th, with airborne data acquisition starting on February 9th. The VG-22 data were desampled from 1200Hz to a 120 Hz recording rate. All other raw data were interpolated to a 120 Hz rate. This results in a down-line sample density of approximately 10cm at average survey speeds. Data were converted to an ASCII format and imported into a Geosoft format database for processing. With the exception of the differential GPS post-processing and the calculation of compensation coefficients, all data processing was conducted using the Geosoft Oasis Montaj software suite.

A variety of Quality Control checks were performed throughout the survey. The test line was flown at the beginning or end of each survey day. A "bed of nails" test was also run periodically, where a plywood sheet with a grid of roofing nails was pulled underneath each magnetometer to check noise levels, anomaly response, etc.

2.3 Positioning

The pilot was guided during flight by an onboard navigation system. This provided sufficient accuracy for data collection (approximately 1m), but was inadequate for final data positioning. To increase the accuracy of the final data positioning, a GPS base station was established at a monument, MVY B, located at the airport (NAD83 70° 36’ 19.45872” West, 41° 23’ 49.23710” North, NAVD 88 17.24m above ellipsoid). Raw GPS data were collected in the aircraft and on the ground for differential corrections. These were applied in post-processing to provide better accuracy in the antenna positioning. The final latitude/longitude data were projected onto an orthogonal grid using the North American Datum 1983, UTM Zone 19N, meters.

The locations of each magnetometer sensor and the GPS antenna have been precisely measured relative to the helicopter tow hook by a civil surveyor. In-flight locations are determined by using the GPS antenna location and the aircraft orientation, as measured by an inertial navigation unit that samples at a 100Hz rate. This system outputs pitch, roll and azimuth. These data are combined with the physical geometry of the array to calculate the position and relative height of each magnetometer sensor.

Height above ground was monitored by a laser altimeter with an accuracy of about 2cm.

3. Magnetic Data Processing

The magnetic data were processed in several stages. This included correction for time lags, removal of sensor spikes and dropouts, compensation for dynamic helicopter effects, correction for sensor heading error, array balancing, and removal of helicopter rotor noise. The vertical magnetic gradient was calculated by subtracting readings from pairs of total field magnetometers. The magnetic analytic signal (total gradient) was derived from the vertical gradient through an FFT integral algorithm.

3.1 Quality Control

The data were examined in the field to ensure sufficient data quality for final processing, as discussed in Appendix A. Each of the processing steps listed above were evaluated and tested. The adequacy of the compensation data, heading corrections, time lags, orientation calibration, overall performance and noise levels, and data format compatibility were all confirmed during data processing. During survey operations, flight line locations were plotted to verify full coverage of the area. Missing lines or areas where data were not captured were rejected and reacquired. Data were also examined for high noise levels and data drop-outs. Lines deemed to be unacceptable were re-flown. Occasional lines deviated from a straight flight path due to local vegetation, infrastructure, or topography. In instances where the pilot intentionally slid sideways down the hill in order to maintain uniform sensor clearance, the sensor altitude was given priority over uniform coverage.

3.2 Time Lag Correction

There is a lag between the time the sensor makes a measurement and when it is time-stamped and recorded. This applies to both the magnetometer and the GPS data. Accurate positioning requires a correction for this lag. Time lags between the magnetometers, fluxgate and GPS signals were measured by a proprietary utility. This utility sends a single EM pulse that is visible in the data streams of all three instruments. In order to save space in the database, the lag correction is applied to the timestamp data rather than all of the geophysical responses. All positioning data are referenced to this timestamp when they are imported into the database. No additional lag correction is required.

3.3 Sensor Drop-outs

Cesium vapor magnetometers have a preferred orientation to the Earth's magnetic field. As a result of the motion of the aircraft, the sensor dead zones will occasionally align with the Earth's field. In this event, the readings drop out, usually from a local average of over 50,000 nT to 0 nT. This usually occurs only during turns between lines, and rarely during on-line surveying (<1sec of data loss per day). All dropouts were removed manually during processing.

3.4 Aircraft Compensation

The close proximity of the helicopter to the sensors causes considerable deviation in the readings, which requires compensation. The orientation of the aircraft with respect to the sensors and the motion of the aircraft through the earth's magnetic field are contributing factors. A calibration flight is flown to record the information necessary to remove these effects. The maneuver consists of flying a square-shaped flight path at high altitude to gain information in each of the cardinal directions. During this procedure, the pitch, roll and yaw of the aircraft are varied. This provides a complete picture of the effects of the aircraft at all headings in all orientations. The entire maneuver was conducted twice for comparison. The information was used to calculate coefficients for a 19-term polynomial for each sensor. The fluxgate data were used as the baseline reference channel for orientation. The polynomial is applied post flight to the raw data, and the results are referred to as the compensated data.

3.5 Rotor Noise

The aircraft rotor spins at a constant rate of about 400rpm. This introduces noise to the magnetic readings at a frequency of approximately 6.6 Hz. Harmonics at multiples of this base are also observable, but have much smaller amplitudes. This frequency is usually higher than the spatial frequency created by near-surface metallic objects and is removed with a frequency filter.

3.6 Heading Corrections

Cesium vapor magnetometers are susceptible to heading errors. The result is that one sensor will give different readings when rotated about a stationary point. This error is usually less than 0.2 nT. Heading corrections are applied to adjust readings for this effect.

3.7 Vertical Magnetic Gradient

The vertical magnetic gradient is measured as the difference between measured values in each gradiometer pod (bottom magnetometer minus top). This is a distinction from total magnetic field surveys in which vertical magnetic gradient is calculated, rather than measured. In addition to reducing the effects of aircraft and rotor noise, this technique removes the necessity of monitoring and subtracting diurnal variations in the Earth's field. These data were gridded using a 0.5m interval.

3.8 Analytic Signal

The analytic signal is calculated from the gridded vertical magnetic gradient data as the square root of the sum of the squares of three orthogonal magnetic gradients. It represents the maximum rate of change of the magnetic field in three-dimensional space – a measure of how much the magnetic field would change by moving a small amount in the direction of maximum change.

There are several advantages to using the analytic signal. It is generally easier to interpret than total field or vertical gradient data for small object detection because it has a simple positive response above a zero background. The amplitude of the analytic signal response depends on the strength of the magnetic anomaly. In contrast, total field and vertical gradient maps typically display a dipolar response to small, compact sources (having both a positive and negative deviation from the background). The actual source location is at a point between the two peaks that is dependent upon the magnetic latitude of the site and the properties of the source itself. Analytic signal is essentially symmetric about the target, is always a positive value and is less dependent on magnetic latitude. More generally, the analytic signal highlights the corners of source objects, but for small targets at the latitude of this survey, these corners converge into a single peak almost directly over the target.

The dominant noise source in analytic signal is residual line-to-line inconsistencies in the gridded data which impact the horizontal gradients. These may be caused by residual heading error, altitude variation or uncompensated aircraft effects. The minimum anomaly threshold was set above the analytic signal noise floor at 0.2nT/m for single peaks. This represents the 10:1 signal-noise ratio based on a measured noise floor of 0.02nT/m.

3.9 Inversion

An automated dipole inversion routine was applied to the data to calculate the location, moment, dipole inclination/declination and RMS fit error. The angle between the Earth's field and the dipole vector was also calculated, as was the final forward model and residual after removal of the forward model. The inversion results of the GPO were sorted by each of the inversion parameters, but no single parameter showed a positive correlation with the ground truth at the GPO as well as the analytic signal. Where the inversion failed to resolve a target, the original analytic signal peak location was used. Anomalies were then examined manually to adjust their priority based on the appearance of the gridded data. The peakedness picking of the GPO resulted in a mean locational accuracy of 0.74m and a standard deviation of 0.38m. Locational accuracy, based on dipole inversion of anomalies for the VG-22 system at 1.5m altitude, had a mean of 0.3m and a standard deviation of 0.2m, proving that the inversion greatly improved the accuracy of the target locations.

3.10 Altitude Effect on Sensitivity

As mentioned previously, magnetometer system sensitivity is strongly limited by survey altitude and burial depth. The magnetic response amplitude from a single UXO target drops with $1/r^3$, where r is the distance between the sensor and target. This is illustrated in Figure 3-1 which shows the size of target (moment) required to generate a minimum magnetic response (1.5nT) at a range of altitudes.

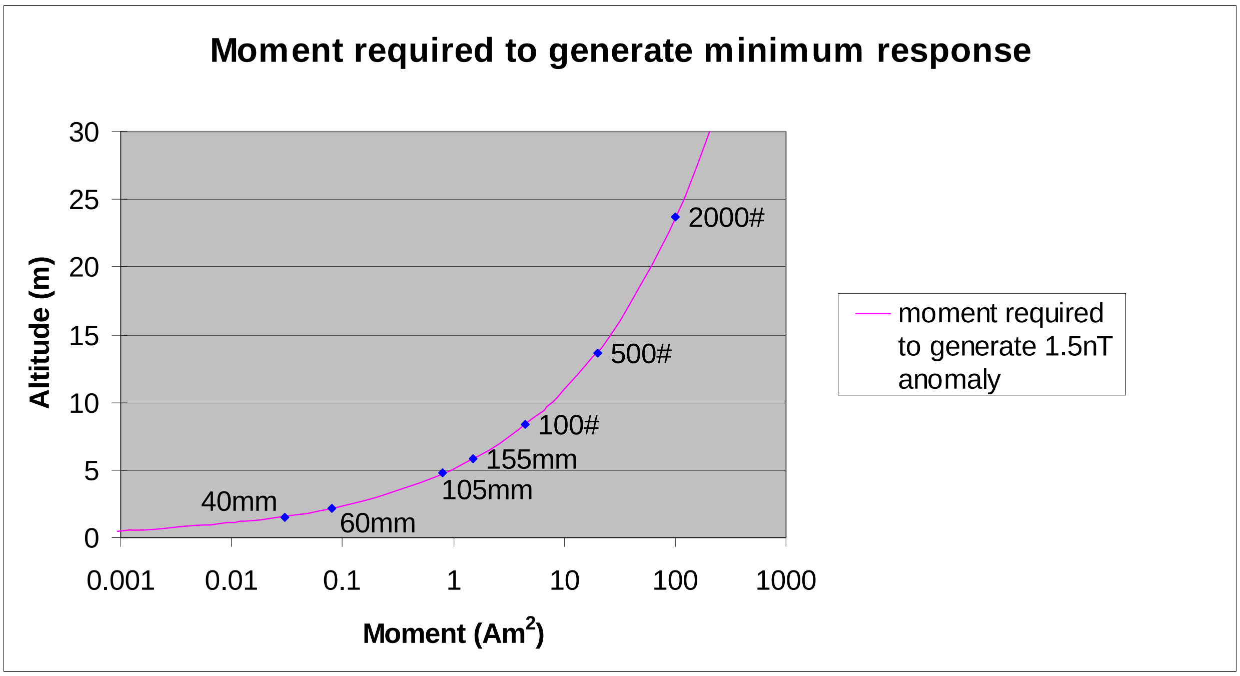

Figure 3-1: Magnetic moment required to generate a 1.5nT response at a range of altitudes. Moments shown here represent an average for each ordnance type and will vary with orientation. 40mm projectiles represent the smallest targets that have been detected by airborne systems. However, combinations of items in close proximity can create a cumulative anomaly, so that concentrations of small ordnance can be detected at greater altitudes than individual anomalies.

4. Calibration and Verification

4.1 Geophysical Prove Out Line

A calibration site was used to support QC of field operations and to verify target response against the local geologic background. The site consisted of 12 ordnance items in a line running approximately N-S. A pre-seed ground survey was conducted at the test line site to check for any preexisting anomalies. Several anomalies were present on the test line as seen in the vertical gradient map, Figure 4-1. The items (**Error! Reference source not found.**) were placed in areas where pre-existing anomalies were not present, approximately 10m apart on the surface as shown in **Error! Reference source not found.**. Figure 4-2 shows the vertical gradient data from the February 11th flight over the test line once the items were in place; this flight was flown at 1m altitude. Figure 4-3 shows the analytic signal of this same flight. This map shows the target positions collected from five different flights with flight altitudes of 1-2m. QC flights were flown over the calibration line throughout the survey, see Appendix A.

The percent of detection measured from the GPO low altitude test data are shown in **Error! Reference source not found.**. Lower detection rates are expected in the data from survey sites where flight heights were usually greater, and ordnance were buried at a range of depths, and are deformed and/or fragmented. Initial anomaly picks were based on the Geosoft peakedness utility, and final picks were based on dipole inversion. The peakedness picking resulted in a mean location accuracy of 0.74m and a standard deviation of 0.38m. Locational accuracy, based on dipole inversion of anomalies for the VG-22 system at 1.5m altitude, had a mean of 0.3m and a standard deviation of 0.2m.

Table 4-1: Geophysical Prove-Out Line detection probabilities for each emplaced target. A target was detected based up a 1m radial offset.

Description of item (North to South)	**Detection probability from low altitude test data**
5” projectile	100%
105 projectile	100%
3lb practice bomb	62.5%
3” rocket	87.5%
2.75” rocket	75%
81 mortar	100%
3” rocket	100%
2.25” rocket	75%
3lb practice bomb	87.5%
81 mortar	87.5%
VENT	87.5%
M38	75%

Table 4-2: Geophysical Prove-Out Line Table of radial offsets for each target for each survey day. Radial offsets are based upon inversion results and are reported in meters.

Target	2/8/2011 Radial offset in meters	2/9/2011 Radial offset in meters	2/10/2011 Radial offset in meters	2/11/2011 Radial offset in meters	2/12/2011 Radial offset in meters	2/13/2011 Radial offset in meters	2/14/2011 Radial offset in meters	2/17/2011 Radial offset in meters
5” projectile	0.237	0.112	0.134	0.166	0.274	0.104	0.834	0.137
105 projectile	0.213	0.787	0.787	0.301	0.703	0.06	0.707	0.787
3lb practice bomb	0.708	1.054	0.708	0.708	x	1.49	1.435	0.652
3” rocket	0.143	0.116	x	0.196	0.572	0.168	0.158	0.519
2.75” rocket	0.122	0.424	0.066	0.037	1.397	0.038	0.618	1.011
81 mortar	0.442	0.086	0.236	0.201	0.831	0.204	0.319	0.747
3” rocket	0.081	0.081	0.139	0.049	1.336	0.182	0.518	0.962
2.25” rocket	0.255	0.315	0.066	0.093	1.096	0.303	0.523	1.189
3lb practice bomb	0.646	0.311	0.418	0.384	0.646	0.485	0.646	1.006
81 mortar	0.246	0.231	0.154	0.332	0.405	0.105	0.125	1.347
Venturi	0.177	0.177	0.177	0.177	0.177	0.177	0.177	1.114
M38	0.359	1.333	0.199	0.33	0.429	0.2	0.429	1.059

Table 4-3: Geophysical Prove-Out Line Table of the analytic signal for each target for each survey day.

Target	2/8/2011 Analytic Signal (nT/m)	2/9/2011 Analytic Signal (nT/m)	2/10/2011 Analytic Signal (nT/m)	2/11/2011 Analytic Signal (nT/m)	2/12/2011 Analytic Signal (nT/m)	2/13/2011 Analytic Signal (nT/m)	2/14/2011 Analytic Signal (nT/m)	2/14/2011 Analytic Signal (nT/m)
5” projectile	40.1	49.84	191.78	62.38	36.26	102.77	82.37	146.89
105 projectile	962.92	2964.92	4544.32	2191.14	1658.16	1133.12	993.77	2262.55
3lb practice bomb	1.81	0.56	0.29	0.66	x	1.03	1.18	0.55
3” rocket	11.1	21.26	x	13.31	31.01	37.46	41.93	30.91
2.75” rocket	166.02	162.39	63.79	160.2	447.07	154.62	301.25	292.06
81 mortar	6.41	31.99	27.68	24.29	12.25	35.04	10.34	18.77
3” rocket	58.36	44.15	118.88	151.01	230.9	233.55	83.4	81.48
2.25” rocket	43.65	26.94	60.23	84.39	90.34	142.97	58.39	43.77
3lb practice bomb	0.68	2.88	2.45	2.95	4.26	2.67	2.34	4.06
81 mortar	94.78	22.72	15.41	76.47	51.92	77.67	72.13	12.56
Venturi	0.56	0.72	1.52	0.74	1.35	1.35	0.55	0.92
M38	282.32	52.19	2.86	135.94	107.81	137.02	258.97	35.48

The Geophysical Prove Out line was flown on February 11th at 5 different altitudes; 1m, 2m, 3m, 5m, and 7m heights (Figure 4-4, Figure 4-5, and Figure 4-6). Using a picking threshold of 0.5nT, Table 4-2 shows the analytic signal for each target that was detected at each of the heights. A picking radius of 1.5m was used for the target detections for the 5 separate flight altitudes.

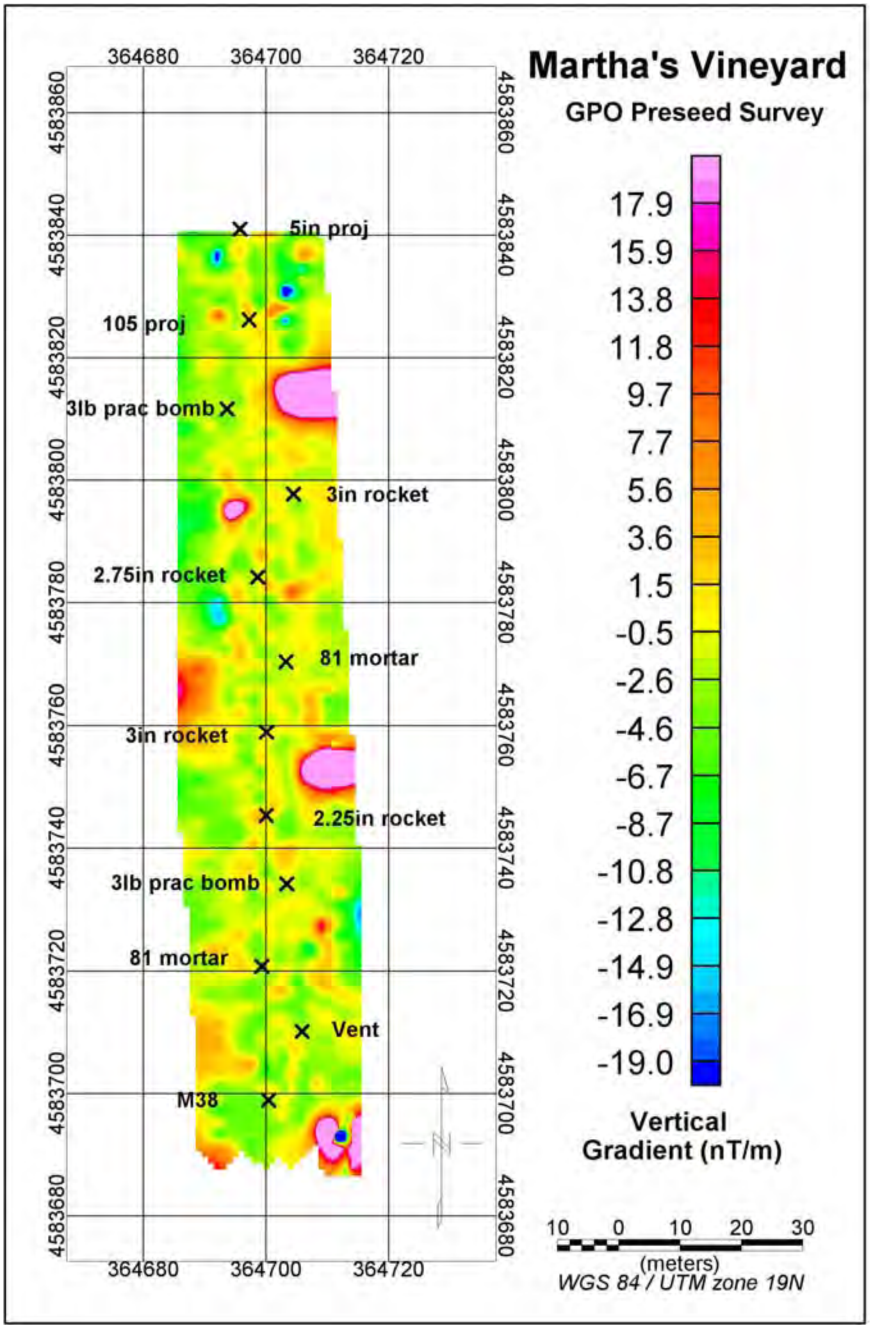

Figure 4-1: Vertical Gradient of the Geophysical Prove Out area before any items were emplaced. The scale used is -20 to 20 nanoTesla/meter. A large anomaly is present about halfway down the line.

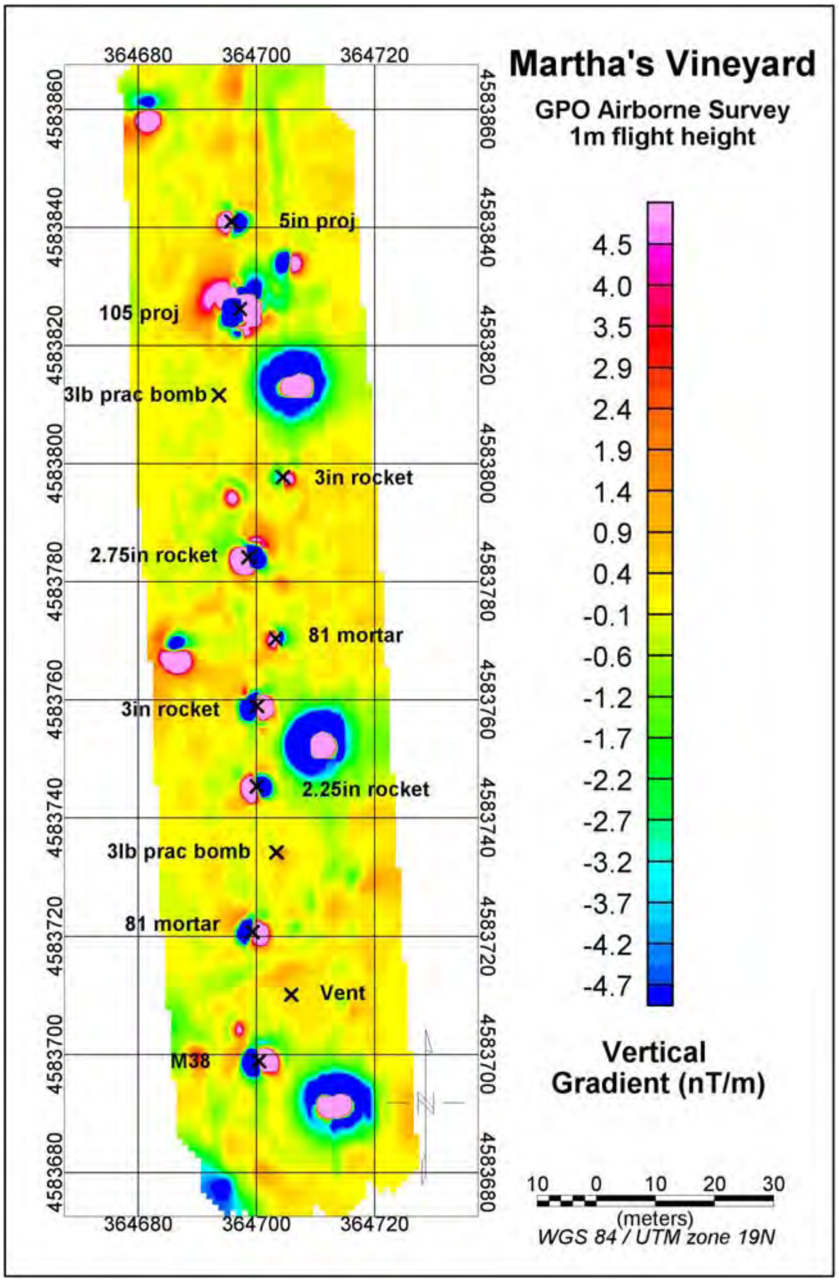

Figure 4-2: Vertical Gradient of Ground Prove Out line with target labels and locations. The scale of the vertical gradient is -5 to 5 nanoTesla/meter.

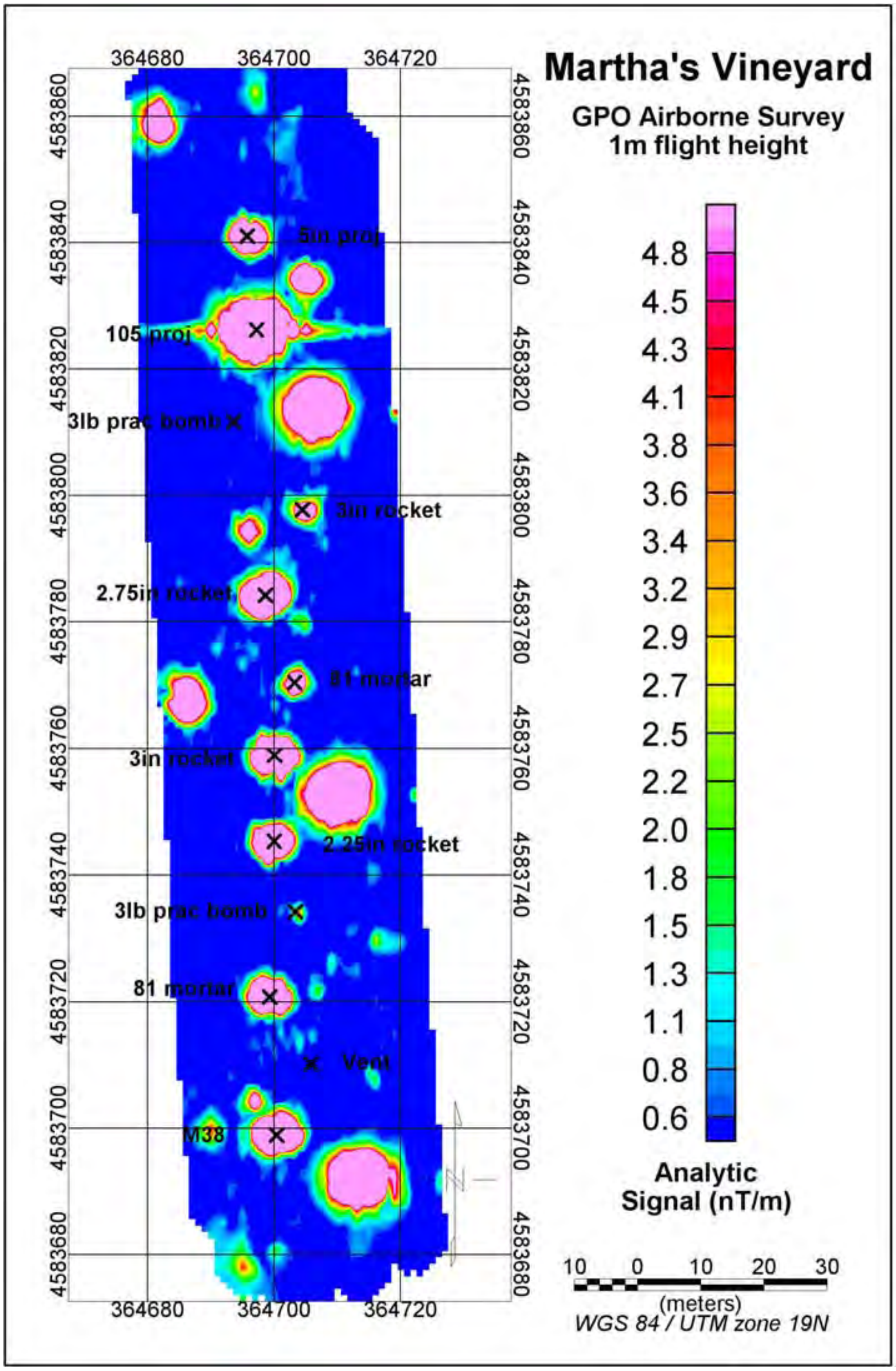

Figure 4-3: Analytic signal of Geophysical Prove Out line for 1m flight height. The scale of the analytical signal map is 0.5 to 5 nanoTesla/meter.

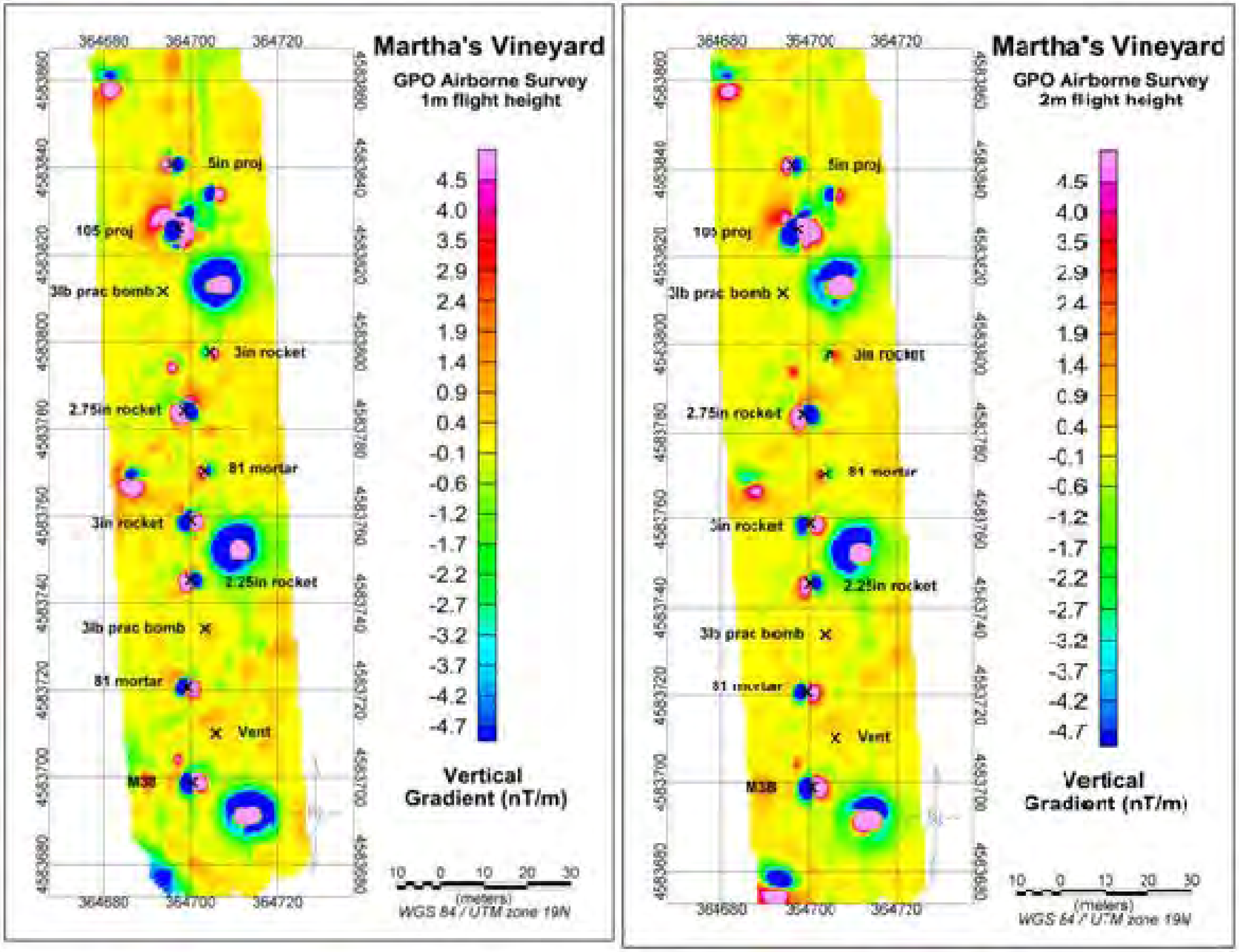

Figure 4-4: Vertical Gradient of Geophysical Prove Out line for 1m and 2m flight height. The scale of the vertical gradient maps is -5 to 5 nanoTesla/meter.

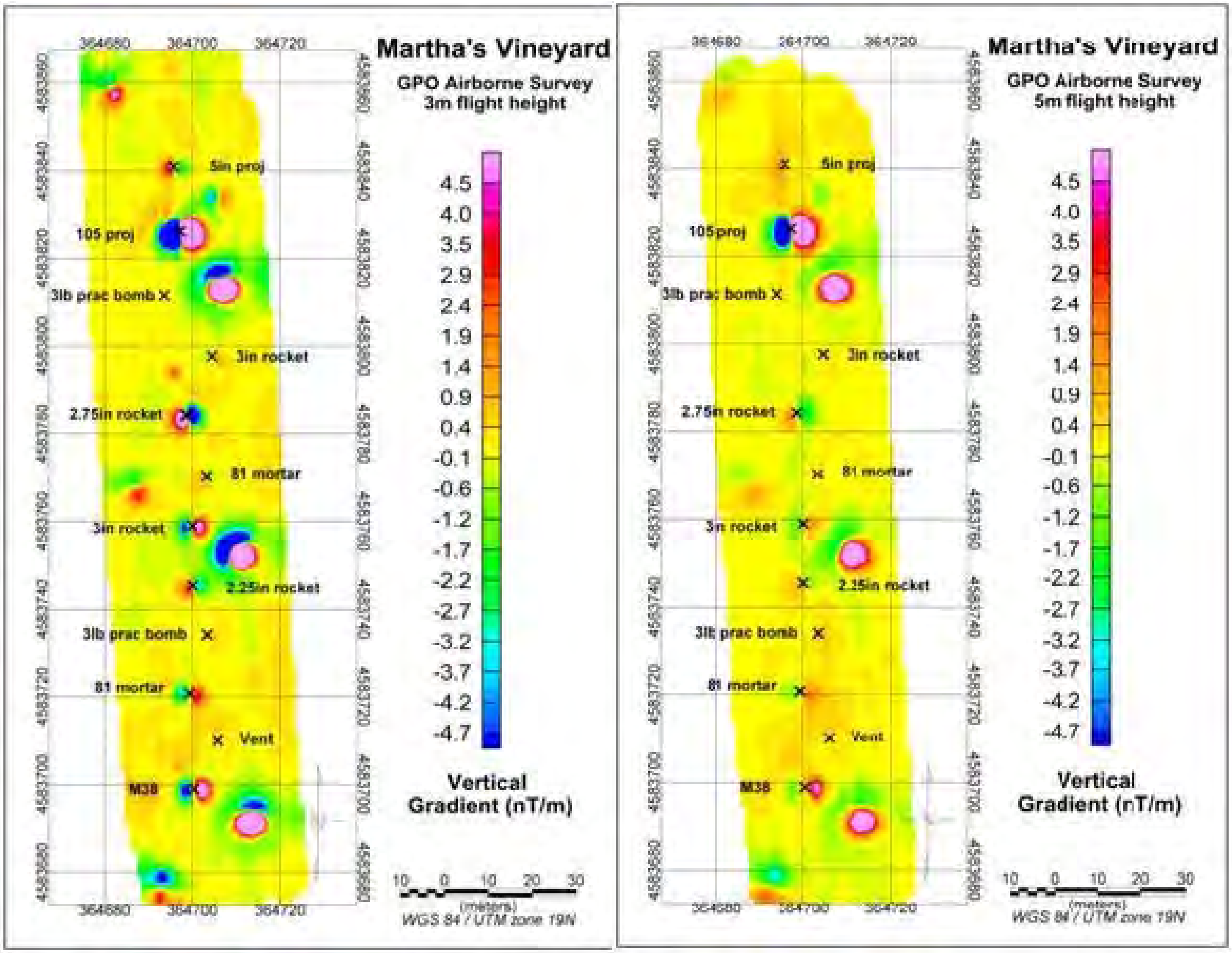

Figure 4-5: Vertical Gradient of Geophysical Prove Out line for 3m and 4m flight height. The scale of the vertical gradient maps is -5 to 5 nanoTesla/meter.

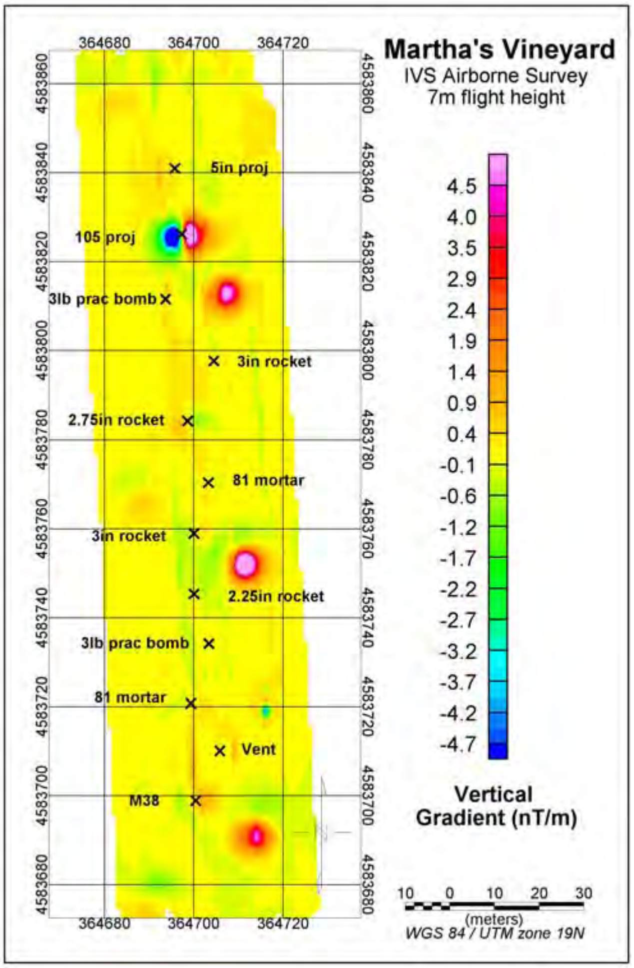

Figure 4-6: Vertical Gradient of Geophysical Prove Out line for 7m flight height. The scale of the vertical gradient map is -5 to 5 nanoTesla/meter.

Table 4-4: Geophysical Test Line results for five separate flight altitudes; 1m, 2m, 3m, 4m, and 5m. Table documents the amplitude of the analytic signal for each of the twelve targets.

	1m height (analytic signal)	2m height (analytic signal)	3m height (analytic signal)	5m height (analytic signal)	7m height (analytic signal)
5” projectile	40.1	33.14	7.28	1.04	x
105 projectile	962.89	589.34	129.19	23.99	7.27
3lb practice bomb	2.59	x	x	x	x
3” rocket	11.1	x	x	x	x
2.75” rocket	166.01	74.92	14.31	2.44	0.64
81 mortar	6.41	5.84	1.14	x	x
3” rocket	62.55	33.51	10.18	1.45	x
2.25” rocket	43.65	15.32	5.54	0.88	x
3lb practice bomb	0.68	1.25	x	x	x
81 mortar	94.78	29.35	4.13	x	x
Venturi	0.56	x	x	x	x
M38	282.31	54.97	8.02	x	x

5. Data Interpretation

5.1 Great Tisbury Pond Vertical Gradient, Analytic Signal, and Altitude Maps

Error! Reference source not found. shows a map of the vertical magnetic gradient anomalies at Tisbury Great Pond. **Error! Reference source not found.** shows a map of the analytical signal computed from the vertical magnetic gradient data. An altitude map is shown in **Error! Reference source not found.**. The average laser altimeter altitude over the area was 1.96 m. A vertical gradient map with the anomaly picks is shown in Figure 5.1-4. This map shows the location of the 3,608 picks for Tisbury Great Pond. The data for this area were collected over February 9, 10, and 14 with reflights on February 17th. Geologic features appear to be scattered throughout this area, with some long linear geologic anomalies in the central region of the map. Other linear features on the beach (southeastern are of the map) indicate possible manmade structures. A few anomalies that may be related to crab traps also appear to be present in the survey area. These anomalies appear similar to plus signs or like the 5 dots on one side of dice and are approximately 35m x 35m.

A total of 3,608 anomalies were selected and divided into three priority groups as shown in Table 5-1. Priority 1 group included 1386 anomalies. These had analytic signal amplitudes greater or equal to 2 nT. The Priority 2 group included 722 anomalies. These had analytic signal amplitudes less than 2 nT and greater than 1 nT. The Priority 3 group included 1500 anomalies. These anomalies had analytic signal amplitudes less than or equal to 1 nT and greater than or equal to 0.5 nT. The prioritization scheme was chosen based upon the GPO results.

Table 5-1: Geophysical Test Line results for five separate flight altitudes; 1m, 2m, 3m, 4m, and 5m.

Great Tisbury Pond - 3608 total anomalies		
Priority 1 group	Priority 2 group	Priority 3 group
1386	722	1500

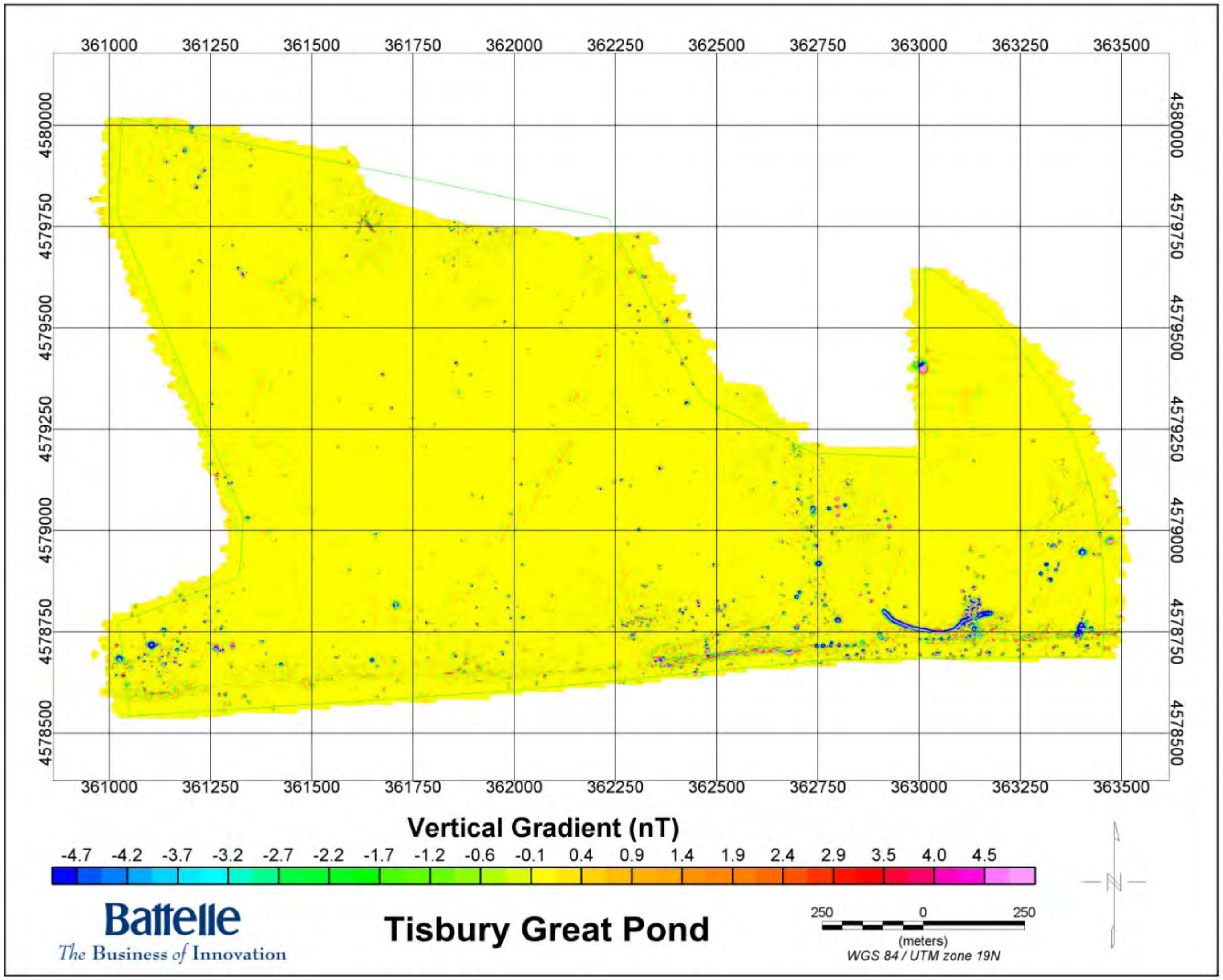

Figure 5-1: Vertical gradient map of the Tisbury Great Pond. The scale of the vertical gradient is -5 to 5 nanoTesla/meter.

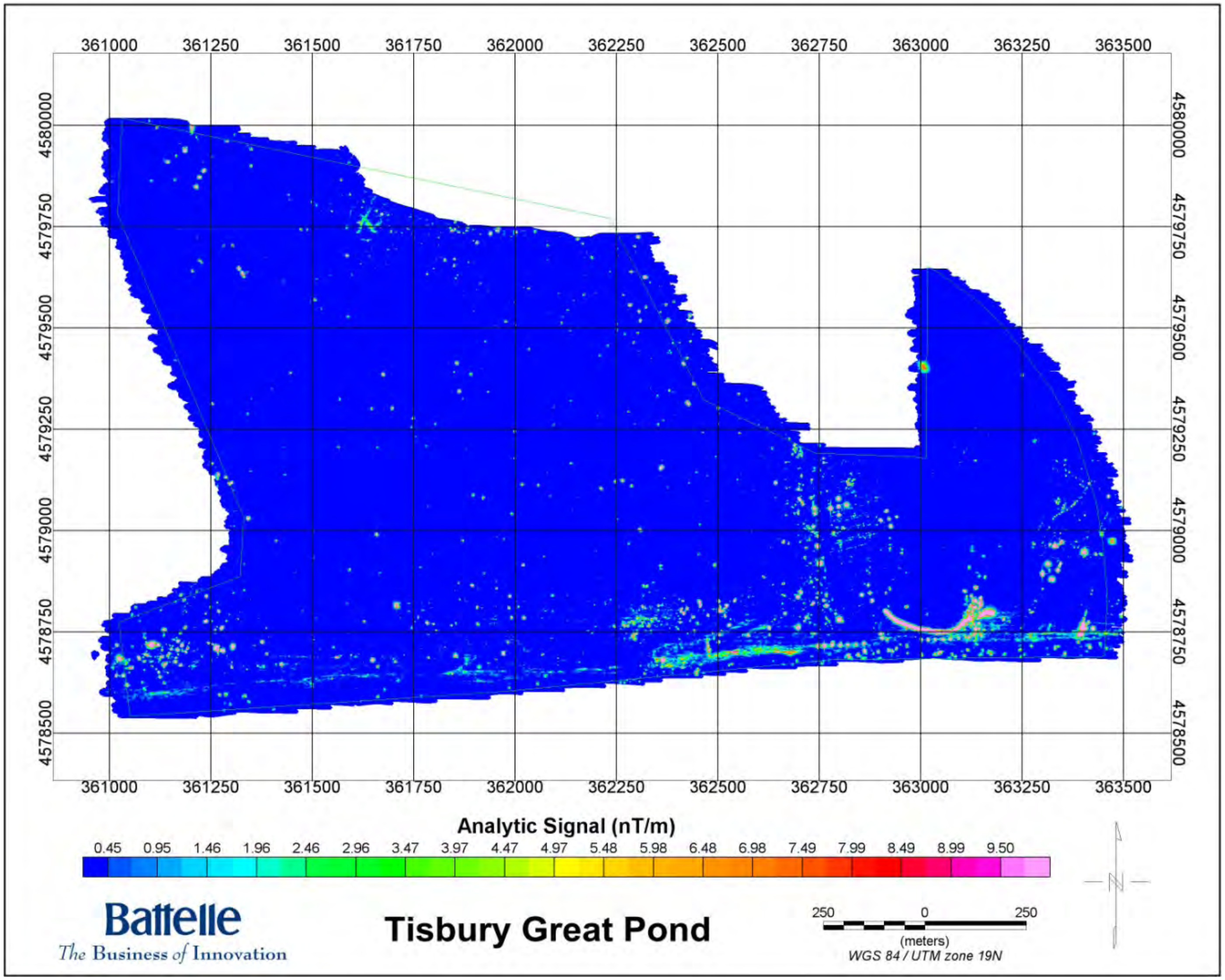

Figure 5-2: Analytic Signal map of the Tisbury Great Pond. The scale of the analytic signal is 0.5 to 10 nanoTesla/meter.

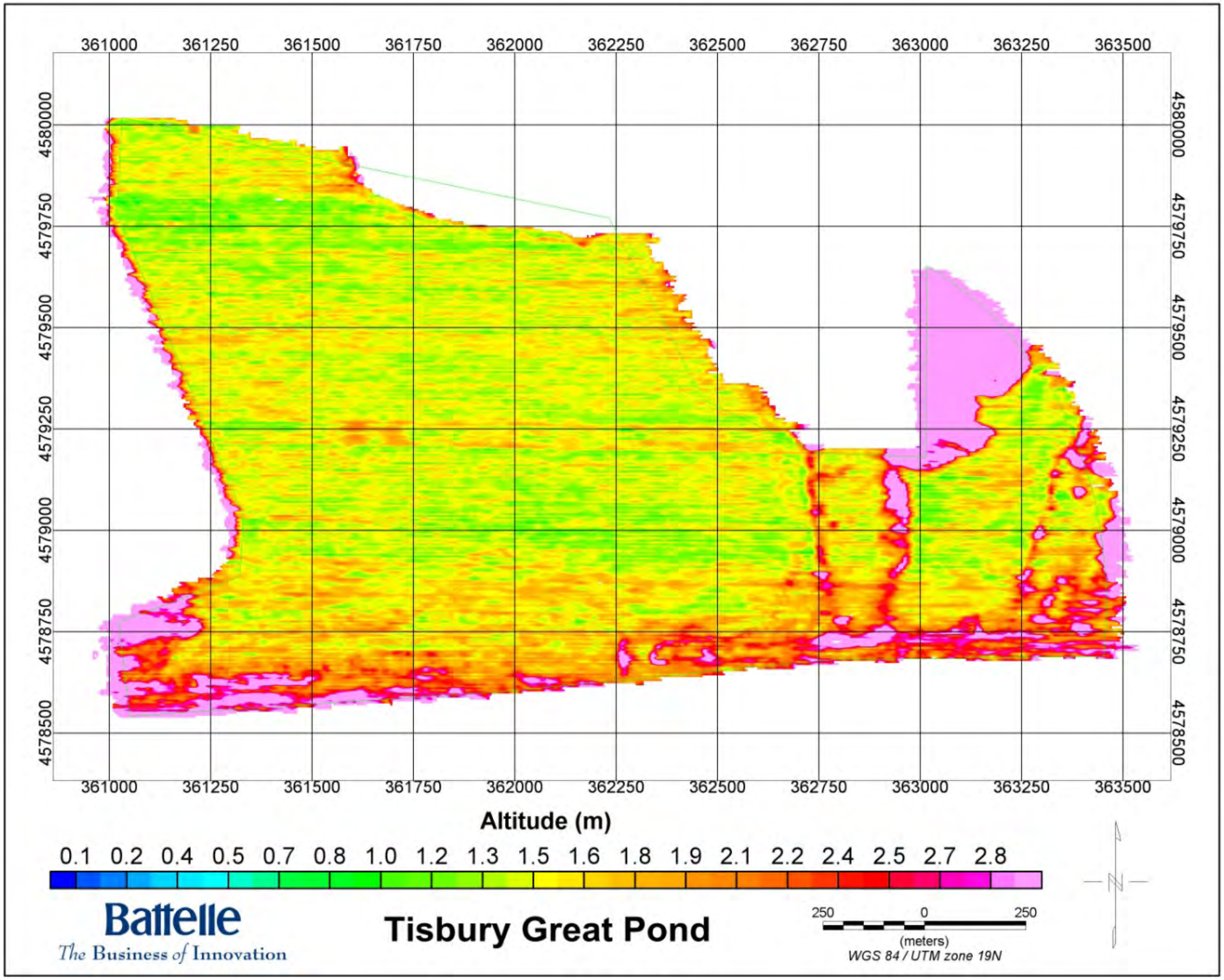

Figure 5-3: Altitude map for the Tisbury Great Pond.

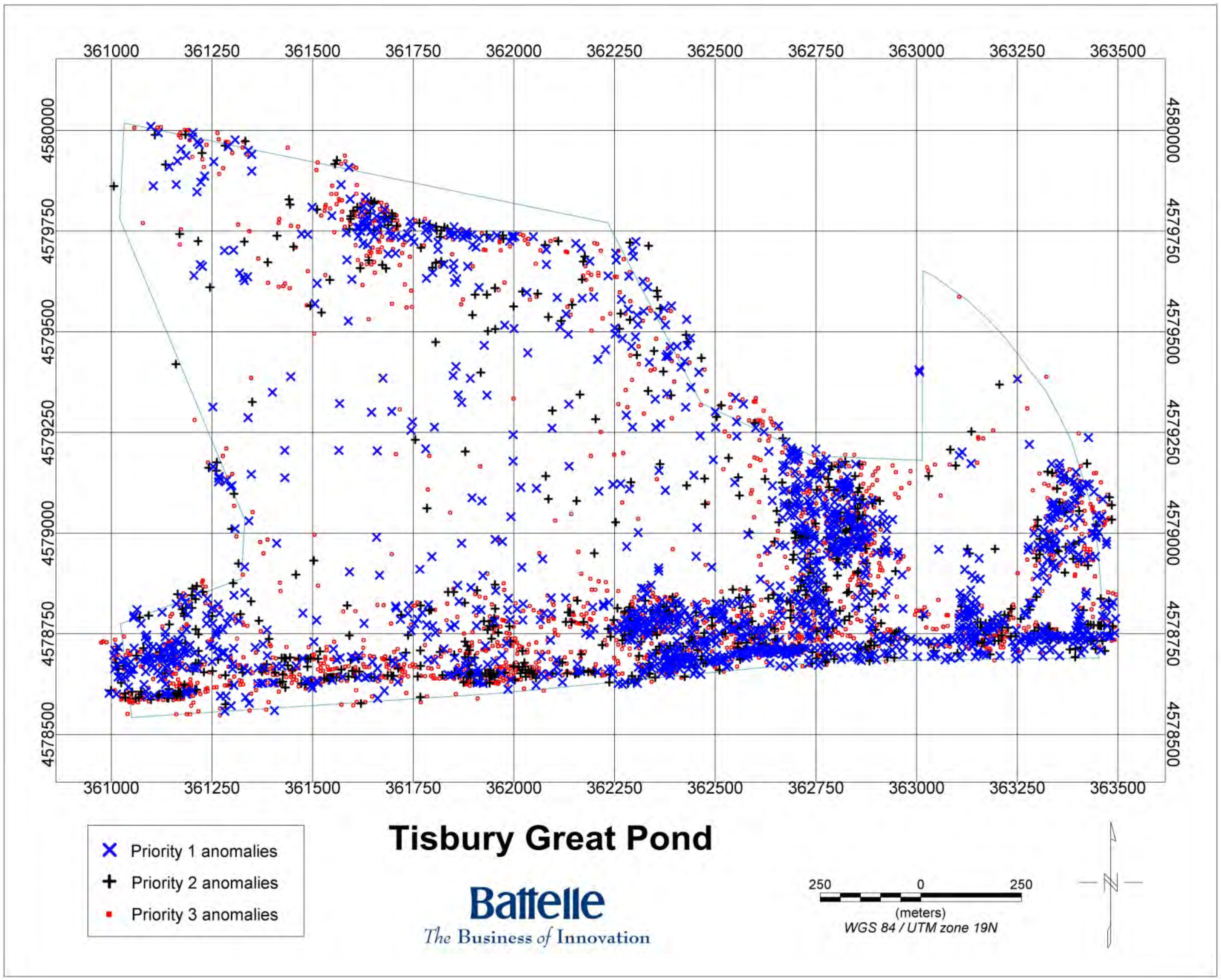

Figure 5-4: Anomaly map for the Tisbury Great Pond

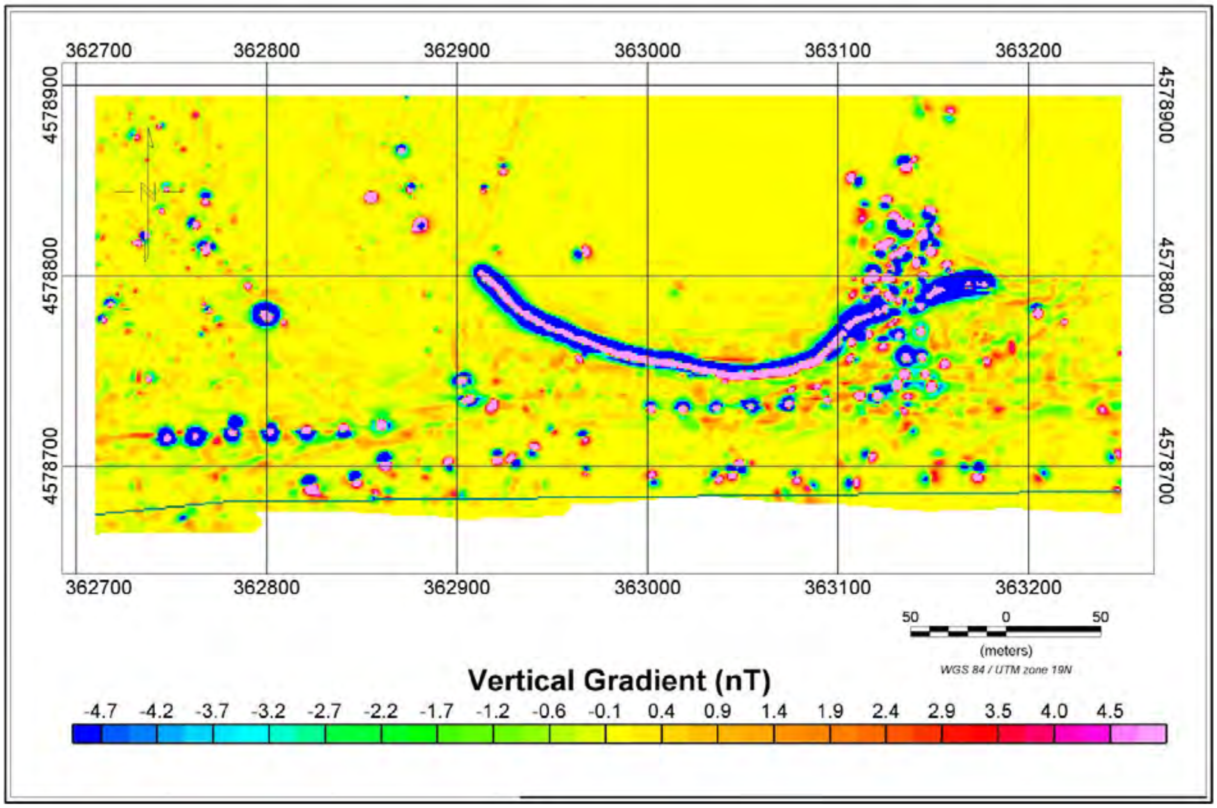

Figure 5-5: Manmade structures on the beach found in the southern portion of the Tisbury Great Pond survey area.

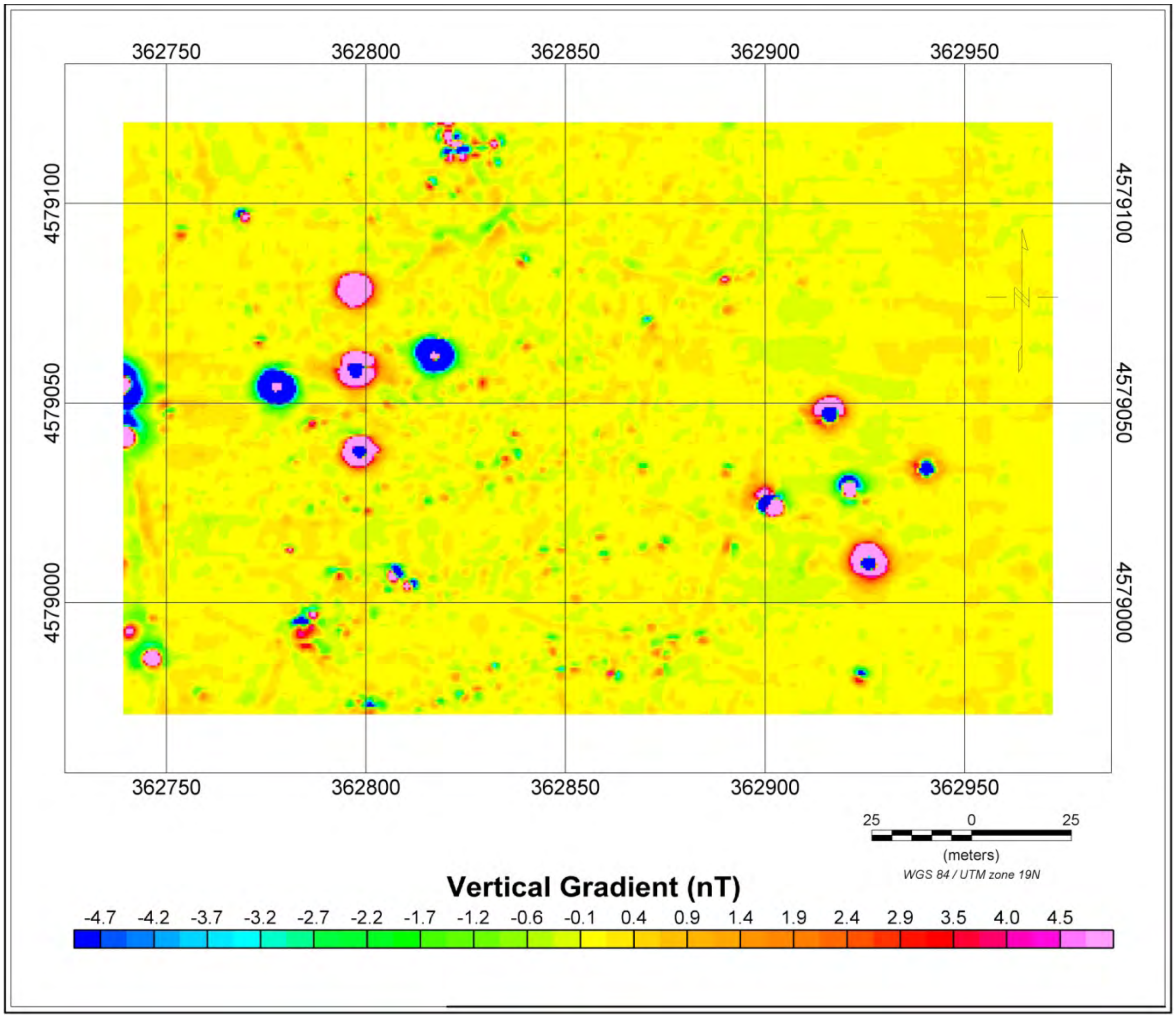

Figure 5-6: Interesting anomalies of possible crab traps.

5.2 Cape Poge Vertical Gradient, Analytic Signal, and Altitude Maps

Error! Reference source not found. shows a map of the vertical magnetic gradient anomalies at the Cape Poge survey area. **Error! Reference source not found.** shows a map of the analytical signal computed from the vertical magnetic gradient data. **Error! Reference source not found.** shows an altitude map of the Cape Poge survey area. The average laser altimeter altitude over the area was 2.5 m. A vertical gradient map with the anomaly picks is shown in Figure 5.1-10. This anomaly maps shows the location of the 2,447 picks for Cape Poge. Data for Cape Poge were collected on February 11th, 16th, and 17th. Three lines for Cape Poge were flown on the 11th. The Cape Poge site was completely reflown on February 17th. There were no required reflights for the area Figure 5.1-11 shows an example of the geology present at the Cape Poge site.

A total of 2,447 anomalies were selected and divided into three priority groups as shown in Table 5-2. Priority 1 group included 782 anomalies. These had analytic signal amplitudes greater or equal to 2 nT. The Priority 2 group included 550 anomalies. These had analytic signal amplitudes less than 2 nT and greater than 1 nT. The Priority 3 group included 1115 anomalies. These anomalies had analytic signal amplitudes less than or equal to 1 nT and greater than or equal to 0.5 nT. The prioritization scheme was chosen based upon the GPO results.

Table 5-2: Geophysical Test Line results for five separate flight altitudes; 1m, 2m, 3m, 4m, and 5m.

Cape Poge -2447 total anomalies		
Priority 1 group	Priority 2 group	Priority 3 group
782	550	1115

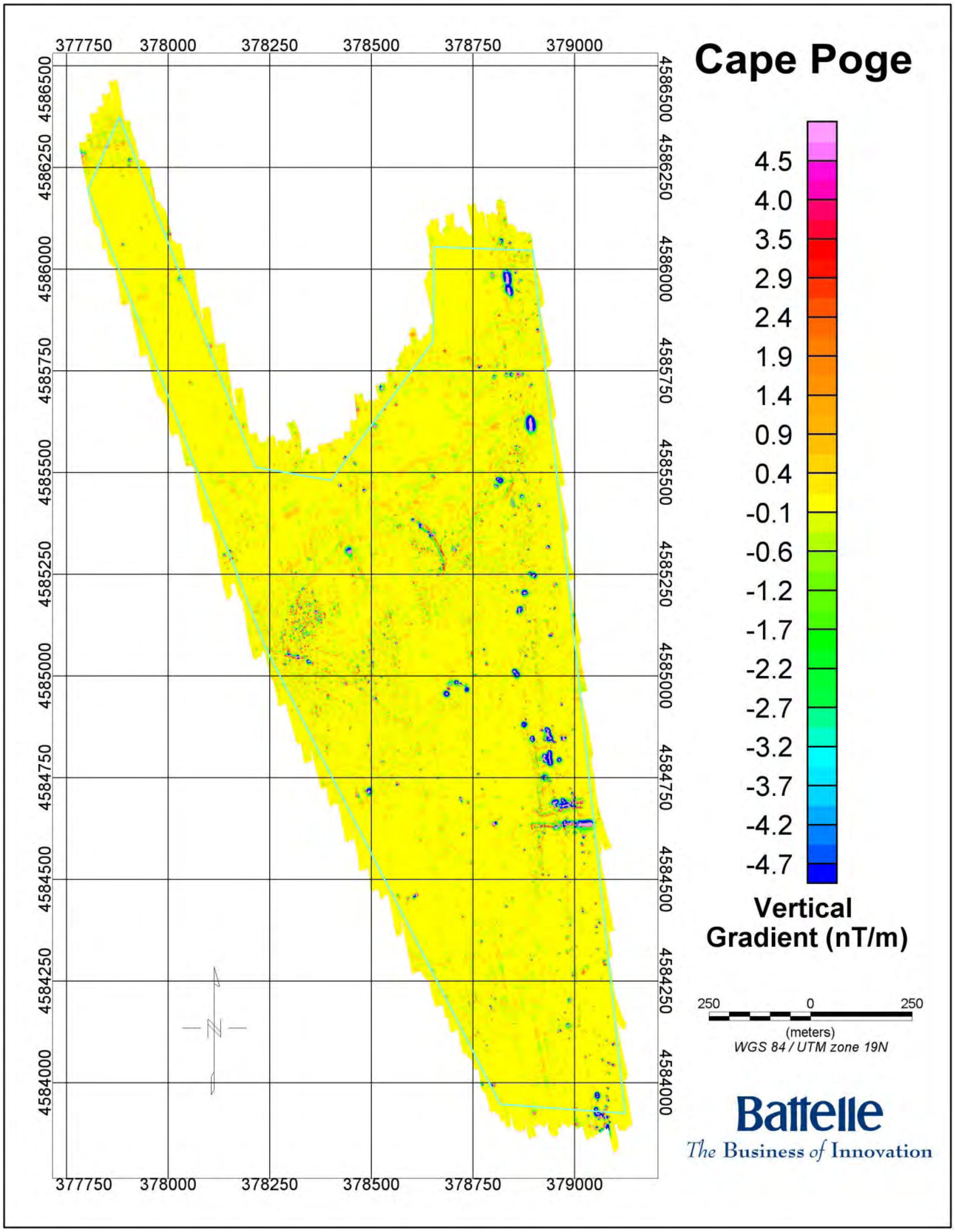

Figure 5-7: Vertical gradient map of Cape Poge. The scale of the vertical gradient is -5 to 5 nanoTesla/meter.

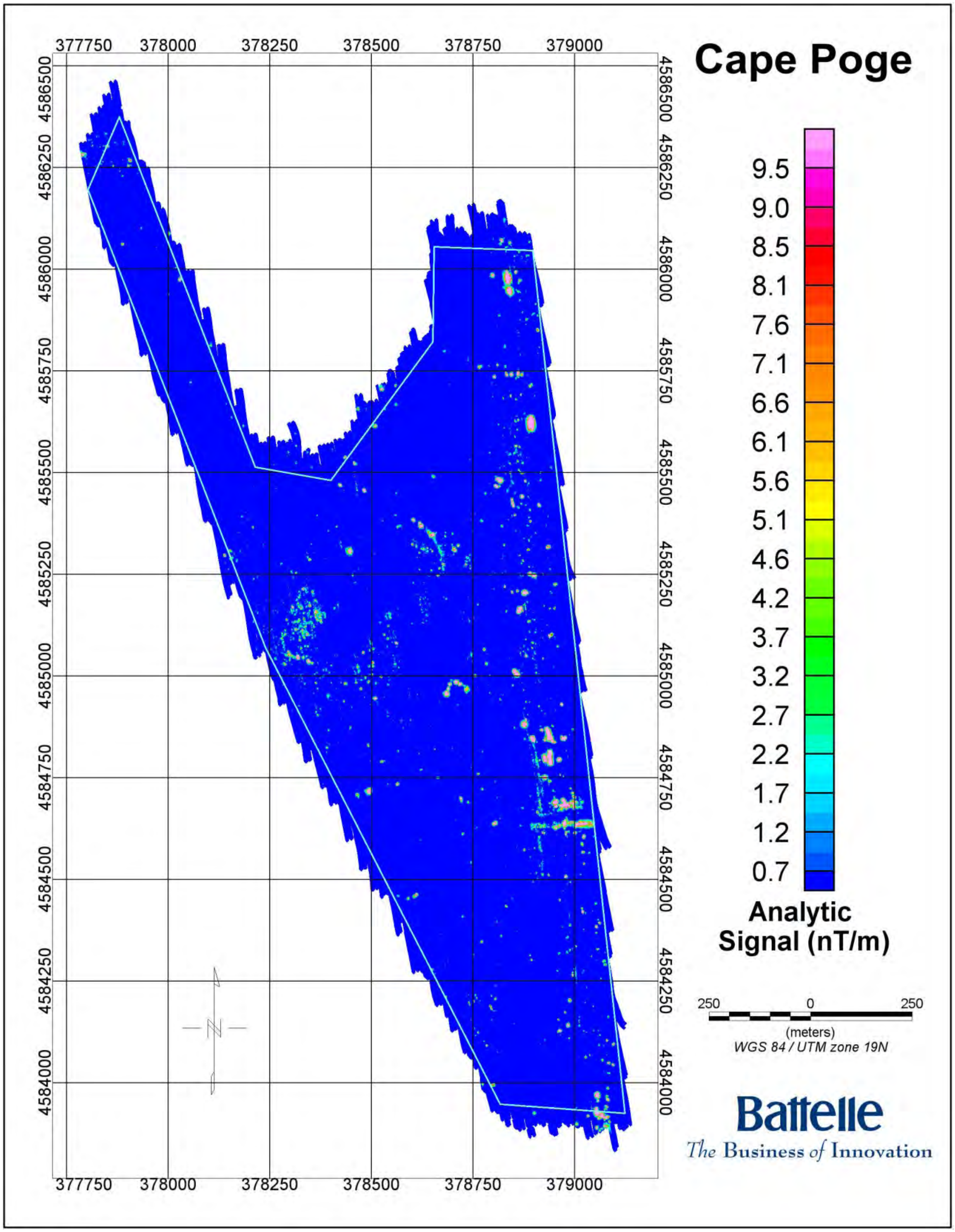

Figure 5-8: Analytic Signal map of the Cape Poge. The scale of the analytic signal is 0.5 to 10 nanoTesla/meter.

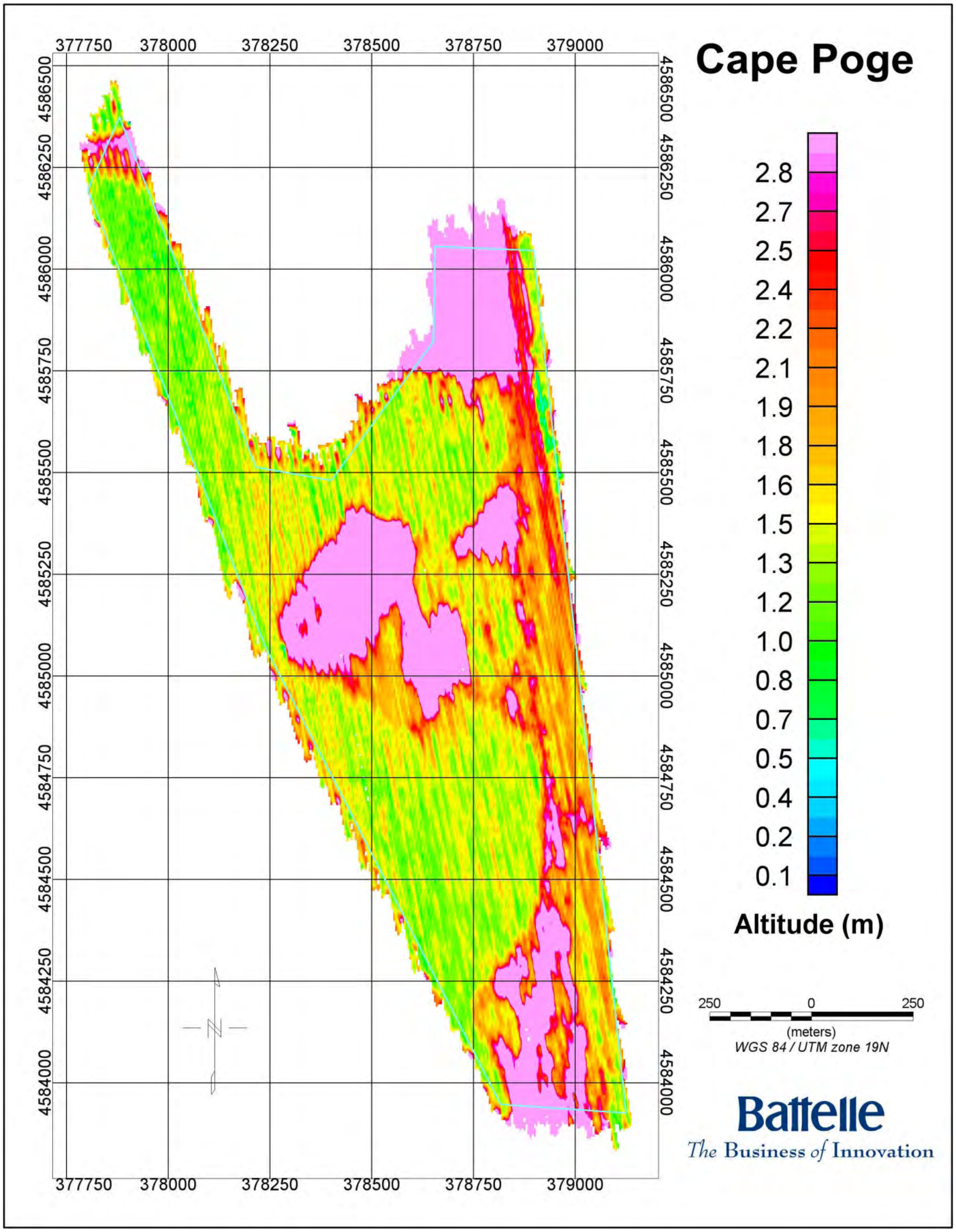

Figure 5-9: Altitude map for the Cape Poge.

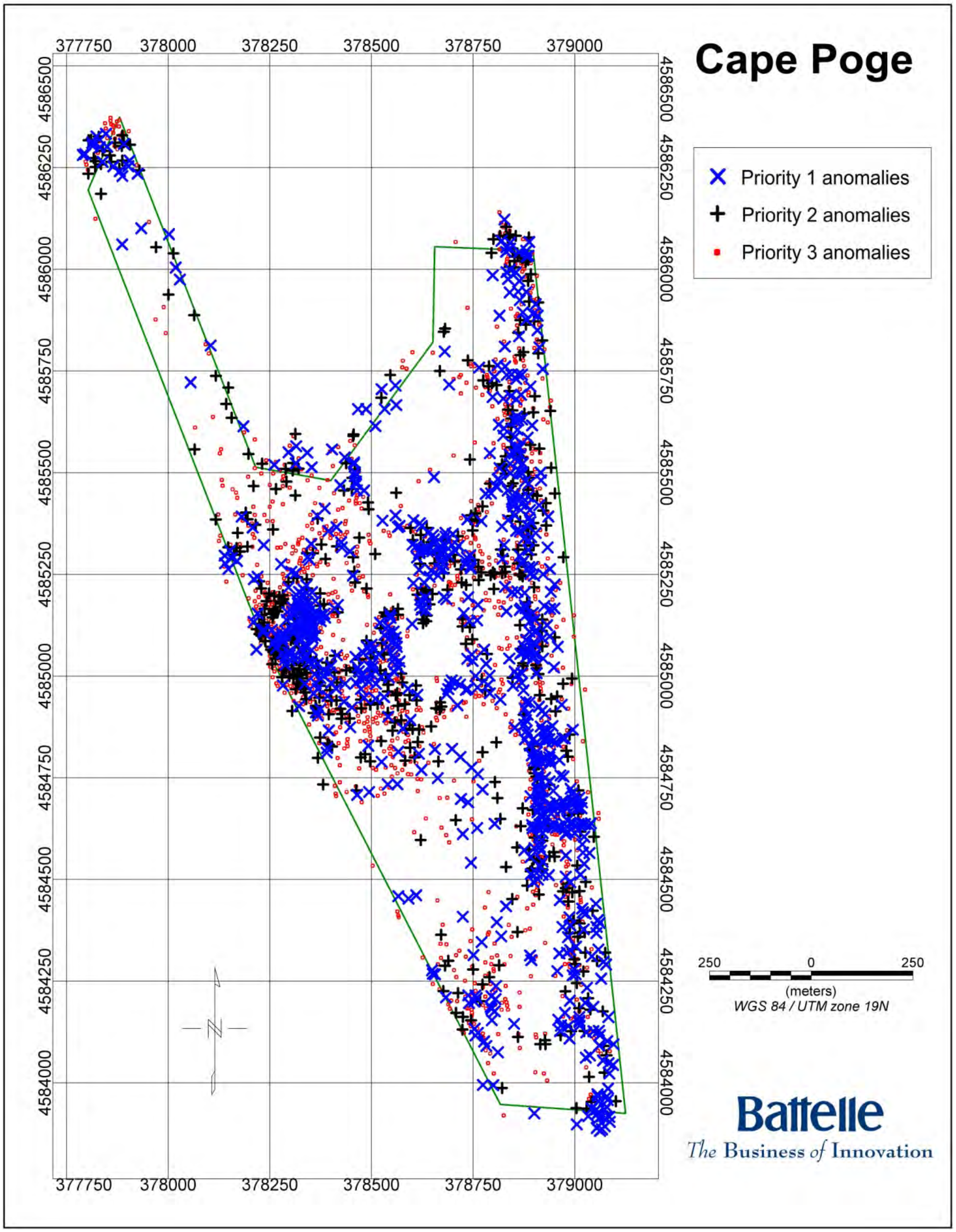

Figure 5-10: Anomaly map for the Cape Poge.

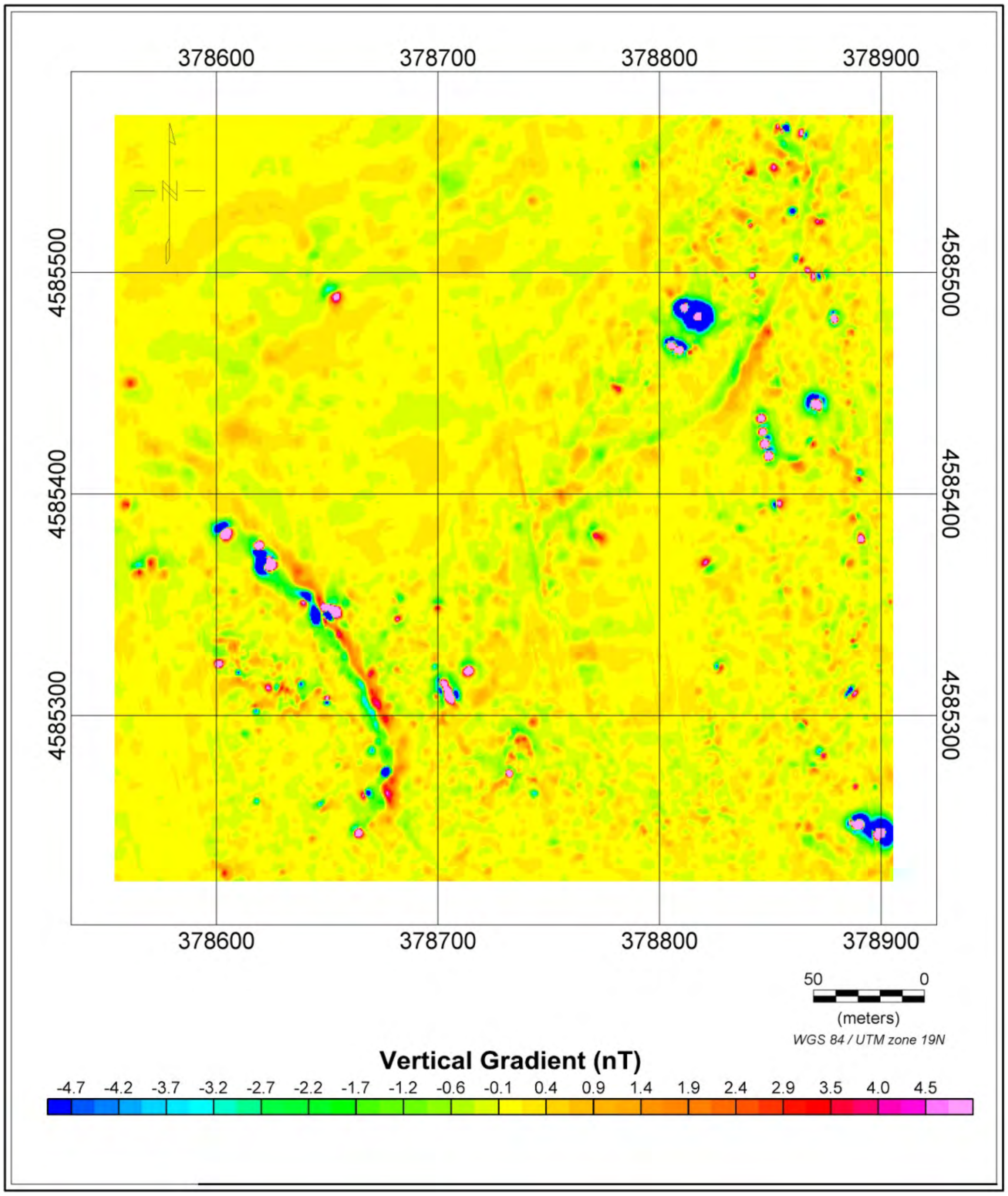

Figure 5-11: Example of geologic anomalies intermingled with others that are presumably associated with man-made items in Cape Poge vertical gradient map.

5.3 South Beach Vertical Gradient, Analytic Signal, and Altitude Maps

Error! Reference source not found. shows a map of the vertical magnetic gradient anomalies at the South Beach site. **Error! Reference source not found.** shows a map of the analytical signal computed from the vertical magnetic gradient data. An altitude map is shown in **Error! Reference source not found.**; the average laser altimeter altitude over the area was 2.34 m. A vertical gradient map with the anomaly picks is shown in Figure 5.1-14. This anomaly maps shows the location of the 4,349 picks for South Beach. Data for the South Beach survey were collected over February 10th and 11th with the a few reflights due to data gaps on February17th.

A total of 4,349 anomalies were selected and divided into three priority groups as shown in Table 5-3 . Priority 1 group included 2254 anomalies. These had analytic signal amplitudes greater or equal to 2 nT. The Priority 2 group included 776 anomalies. These had analytic signal amplitudes less than 2 nT and greater than 1 nT. The Priority 3 group included 1319 anomalies. These anomalies had analytic signal amplitudes less than or equal to 1 nT and greater than or equal to 0.5 nT. The prioritization scheme was chosen based upon the GPO results.

Table 5-3: Geophysical Test Line results for five separate flight altitudes; 1m, 2m, 3m, 4m, and 5m.

South Beach - 4349 total anomalies		
Priority 1 group	Priority 2 group	Priority 3 group
2254	776	4349

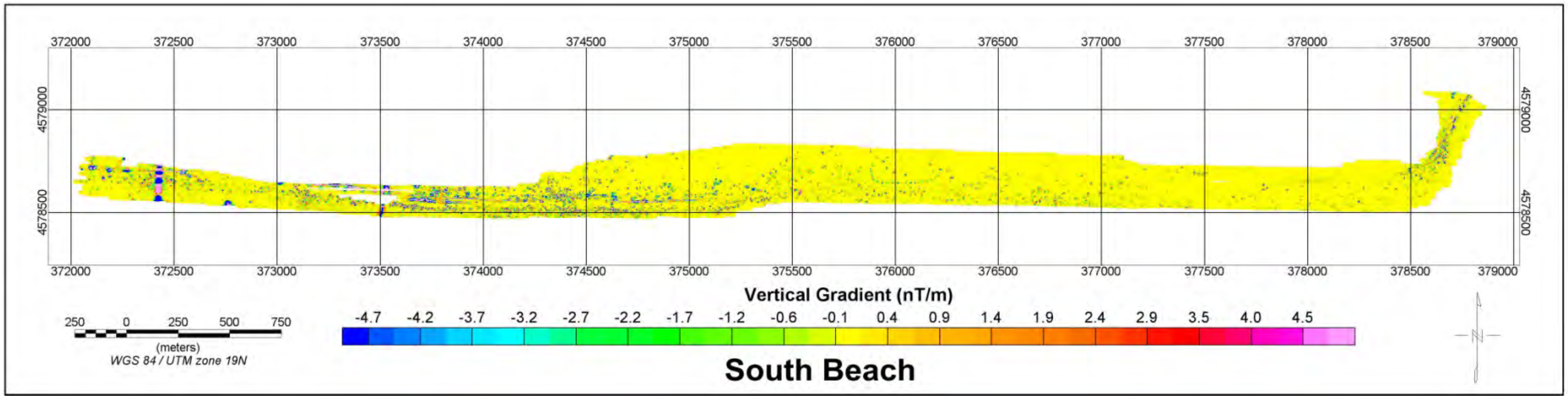

Figure 5-12: Vertical magnetic gradient map of South Beach. The scale of the vertical gradient is -3 to 3 nanoTesla/meter.

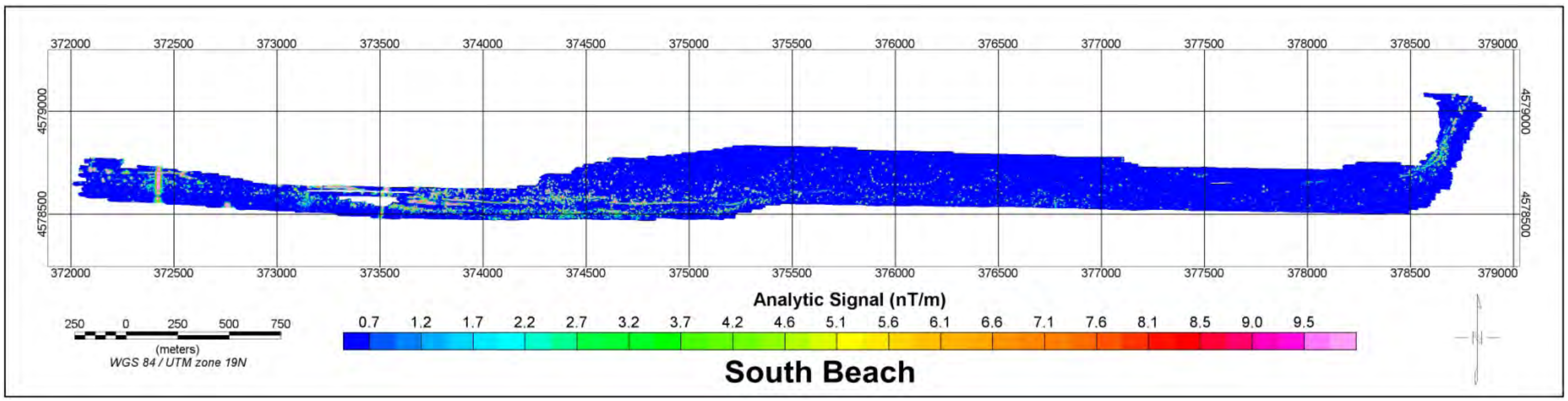

Figure 5-13: Analytic Signal map of South Beach. The scale of the analytic signal is 0.5 to 5 nanoTesla/meter.

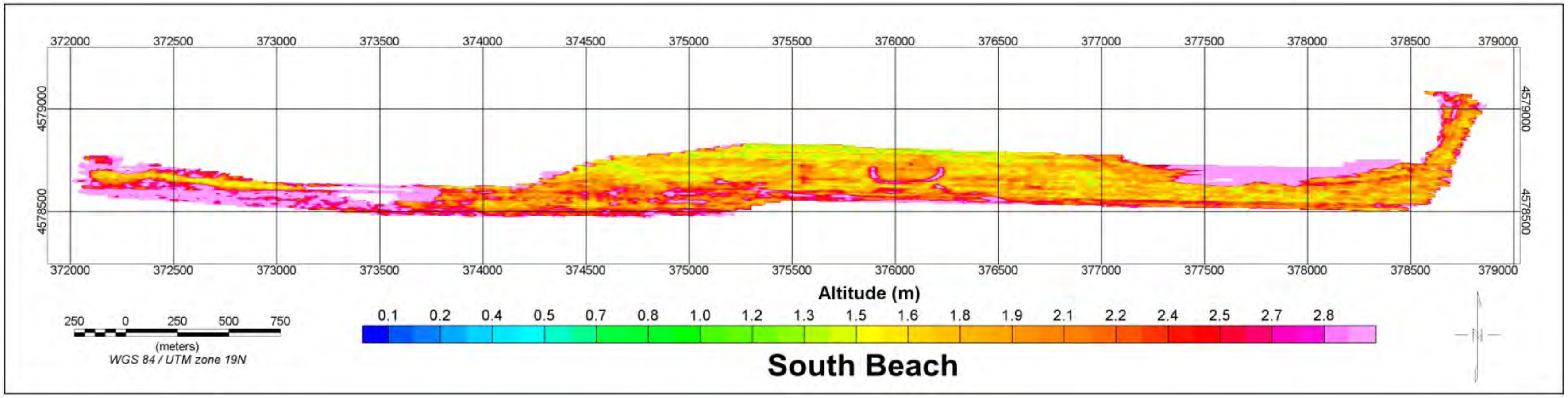

Figure 5-14: Altitude map of South Beach.

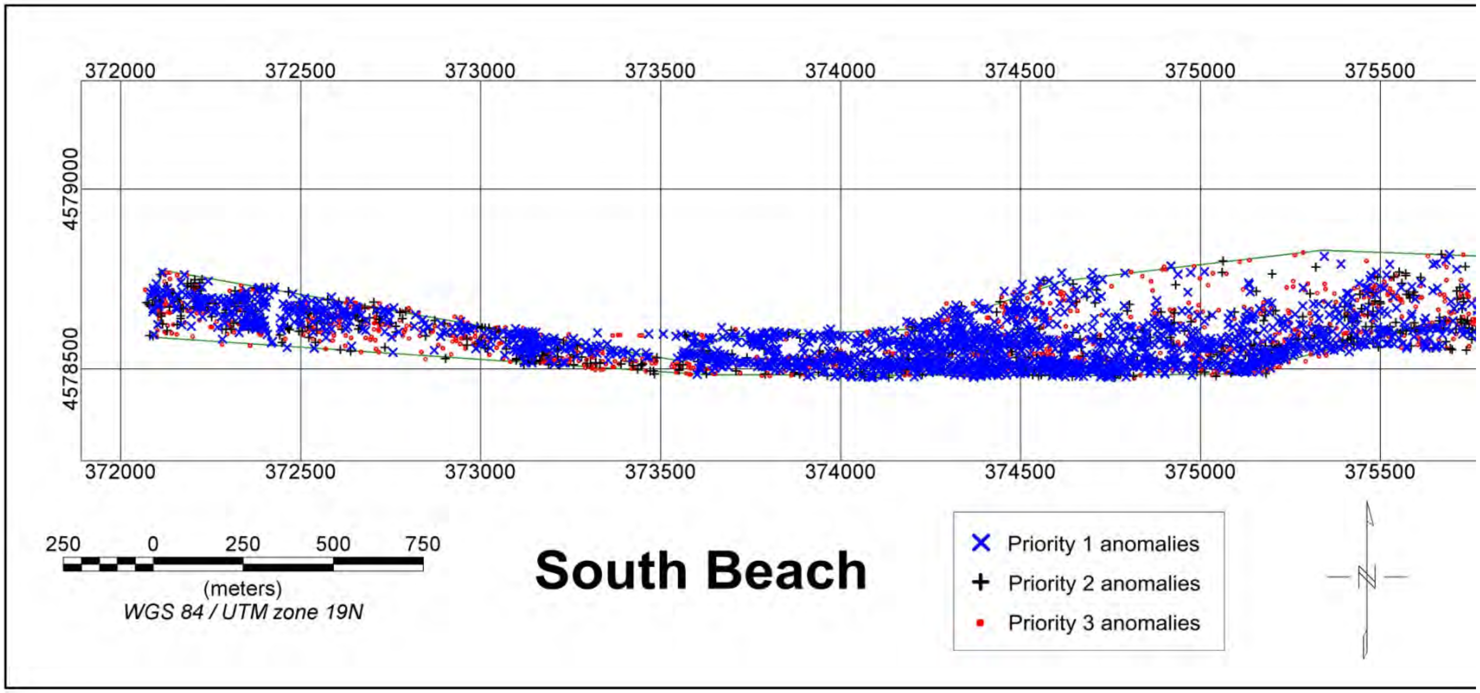

Figure 5-15: Anomaly map for the eastern portion of South Beach.

5.4

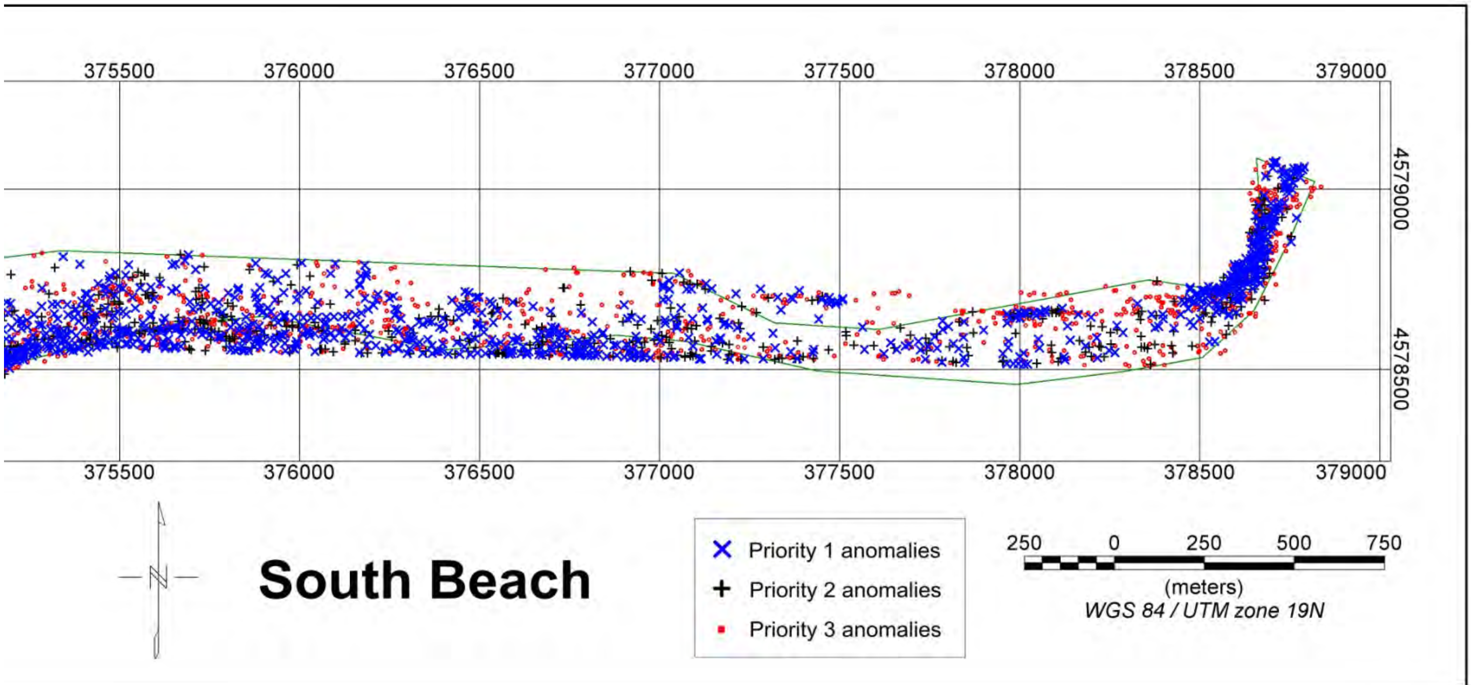

Figure 5-16: Anomaly map for the western portion of South Beach.

5.5 Anomaly Lists

Anomalies are picked from the peaks in the analytic signal map. An inversion was then run on the pick lists for each of the areas. The actual target location is usually within 75cm, of this peak/inversion location. The inversion results of the GPO test line were analyzed and sorted using different inversion results; amplitude, orientation, RMS fit, etc. Sorting with the analytic signal provided the most effective prioritization. The targets were then broken up into three separate groupings; Priority 1, Priority 2, and Priority 3. The thresholds used to select the thresholds between the different groups were based up the GPO results. Priority 1 group had analytic signal amplitudes greater or equal to 2 nT. The Priority 2 group included anomalies with analytic signal amplitudes less than 2 nT and greater than 1 nT. The Priority 3 group anomalies had analytic signal amplitudes less than or equal to 1 nT and greater than or equal to 0.5 nT. The prioritization scheme was chosen based upon the GPO results. For the Priority 1 Group the threshold of 2 nT encompassed the analytic signal results for the majority of the target items on the test grid. The 3lb practice bomb and the Venturi had analytic signals below the 2nT threshold of Group 1, however both of these two targets gave responses higher than 1nT for most of the GPO flights. Geology was present at all three of the Martha's Vineyard sites and the associated anomalies generally fell into the Priority 3 Group.

Table 5-4: Summary table for the anomaly picks for all three areas.

Area	Total Area Surveyed	Total Potential MEC	Group 1 Priority	Group 2 Priority	Group 3 Priority
Tisbury Great Pond	590 acres	3608	1386	722	1500
Cape Poge	347 acres	2447	782	550	1115
South Beach	364 acres	4349	2254	776	1319

6. Data and Image Archive

Geosoft gridded data files were provided to UXB International upon completion of the field component of the project. Although these were preliminary files, they were considered to be sufficiently similar to the anticipated final products that UXB and USAESCH would be able to use them for preliminary assessment of ordnance density in the three areas so that follow-on activities could be planned.

Several files in final form accompany this report. Original Geosoft format files are provided as the principal digital format. This includes database files with georeferenced point data (GDB), and interpolated grid files (GRD). A free data viewer is included with the digital data or is available online at www.geosoft.com (Oasis Montaj Viewer). Map data are provided as image files in GeoTiff format in addition to the smaller reproductions included in this report. These maps are provided with a digital resolution of 300 dpi. GeoTiff format files of the geophysical data alone are provided for quick inclusion into other GIS platforms, but the resolution is not as high as the original Geosoft GRD files. Image files are named as follows;

MV_*area* vg.tif	Vertical gradient map
MV _*area* vg.grd	Vertical gradient grid (Geosoft format)
MV _*area* vg only.tif	Vertical gradient map with data only (for GIS import)
MV _*area* as.tif	Analytic signal map
MV _*area* as.grd	Analytic signal grid (Geosoft format)
MV _*area* as only.tif	Analytic signal map with data only (for GIS import)
MV _*area* alt.grd	Flight altitude grid (Geosoft format)
MV _*area* alt.tif	Flight altitude map
MV _IVS as.tif	Calibration line analytic signal with item locations
MV _IVSvg.tif	Calibration line vertical gradient with item locations

The Geosoft databases (GDB) are the primary data source. They represent the highest data resolution, but have no visual component. Lines in the vertical gradient survey database represent the trace of a single sensor as it travels down the line. Lines are numbered "L####.S", where #### is the survey line number and S is the sensor number (1-7 from left to right across the VG-22 front array). Data columns or channels in the vertical gradient databases are bulleted below.

- Xm Easting coordinate in UTM Zone 19N meters.
- Ym Northing coordinate in UTM Zone 19N meters.
- HAE Height above ellipsoid.
- alt Sensor altitude above ground level in meters.
- vg Total field magnetic values in nanoTesla per meter.
- line Flight line number

The final data type provided is the anomaly list file (also known as a dig list or pick file) in XYZ format. This file is named picks "MV_*area* picklist.XYZ" and contains the following four columns:

- ID number of the specific analytic signal anomaly
- x x coordinate in meters (UTM zone 19N)
- y y coordinate in meters (UTM zone 19N)
- AS magnitude of analytic signal anomaly

7. Conclusions

7.1 Summary

Airborne vertical magnetic data were acquired over 1301 acres at Martha's Vineyard Island. The sizes of the areas flown are as follows; 590 acres of Tisbury Great Pond, 364 acres of South Beach, and 347 acres of Cape Poge. The purpose of the survey was to use geophysical information derived from a low-flying helicopter system to precisely locate metallic items and ordnance. To this end, the VG-22 high-resolution vertical magnetic gradient system developed by Battelle was used. Table 7-1 summarizes the results of the survey.

Table 7-1: Summary Table

Site	Size	Mean altitude	Total number of anomalies	Number of anomalies picked	Collection Dates	Number of reflights lines
Tisbury Great Pond	590 acres	2.03m	3608	Priority 1 = 1386 Priority 2 = 722 Priority 3 = 1500	2/9/11, 2/10/11, 2/14/11, 2/17/11	3 reflight lines
Cape Poge	347 acres	2.49m	2447	Priority 1 = 782 Priority 2 = 550 Priority 3 = 1115	2/11/11, 2/16/11, 2/17/11	0 reflight lines
South Beach	364 acres	2.42m	4349	Priority 1 = 2254 Priority 2 = 776 Priority 3 = 1319	2/10/11, 2/11/11	6 reflight lines

7.2 Performance Evaluation

The results from the Geophysical Prove-Out (GPO) line demonstrate that the system performed well. These targets were considered representative of the range of the UXO expected on site. Prior to placement of the calibration targets, the area was swept with a man-portable magnetometer to determine the presence of pre-existing subsurface anomalies. The 5” projectile, 105 projectile, one of 81 mortars, and one of the 3” rockets were detected 100% of the time on the GPO line. The second 81 mortar the 3” rocket, the 3lb practice bomb, and the venturi were detected 87.5% of the time. The 2.75” rocket, 2.25” rocket, and the M38 were all detected 75% of the time while the second 3lb practice bomb was detected 62.5% of the flights over the GPO line (refer to Table 4.1). This gives an overall target detection of 86%. The location accuracy was calculated from the difference between item locations as recorded by post-processed GPS readings and airborne locations based on the analytic signal maps and inversion results, as determined by automated picking algorithms. Figure A-8 shows the distribution of airborne anomalies against the ground anomalies. The standard deviation of the radial offset is 38cm showing the consistency of the airborne data.

Appendix A **Battelle Quality Control Report**

A-1 **Introduction**

These tables, together with daily maps of various Quality Control (QC) parameters, constitute the final QC Report for the Martha's Vineyard Airborne Geophysical Survey Project. Each level of QC test corresponds to a different frequency of trigger event. Some tests are conducted only once per survey (Level A), while others are conducted on a point-by-point basis throughout the entire dataset (Level D). A description of the various parameters is provided in the QC Work Plan (see Appendix). Individual specifications may be modified by the Mission Plan or by special exception with the concurrence of the client.

Text notes and graphic examples are included for many of the QC items. Parameters which fail the QC test are flagged in red within the table. A note explaining either the exceptional circumstances or the resolution methods taken accompany each QC failure.

A-2 **Level A (Installation)**

These tests are conducted only once at the start of each survey, usually immediately after equipment installation on the helicopter. Some tests were repeated if the magnetometer sensors were altered or replaced during the course of the survey. All results for the following six Level A tests are recorded in Table A-3.

a) Rotor susceptibility

- Trigger: Prior to mob or on new equipment installation.
- Description: The rotor head is the source of 6.5Hz magnetic noise in the data. Its parts should be measured with a Gaussmeter prior to mobilization if possible. This allows the helicopter company to de-Gauss the head if necessary. If the aircraft has not been tested within the last 6 months this test must be done prior to mobilization. If the aircraft has been in continuous use, or if it has been tested within the last six months then it will be tested prior to each installation. If the specs approach failure limits at any time, then plans should be made to de-Gauss at a convenient maintenance break.
- Pass criteria: <20 if in the field, <10 if in the hangar prior to mob (if >6mo since last test).
- Failure resolution: Remove rotor mast and send for de-Gaussing until it passes.

b) GPS base station

- Trigger: New GPS base station setup.
- Description: The GPS base station should be located at a known survey benchmark (minimum 3rd order to meet DID, preferably 1st order or better). These coordinates are available on-line at http://www.ngs.noaa.gov/cgi-bin/ds_radius.prl. Errors in identifying the monument or typing in the coordinates to the post-processing software will result in an offset to the survey data. The location of a second monument should be measured with a hand-held GPS and differentially corrected. The location error between the measured and published monument positions should be minimal.

- Pass criteria: Maximum location error 20cm.
- Failure resolution: Determine source of error (identification, typo etc) and resolve. This may involved acquiring data from third party GPS stations and recalculating the base station location. Any data collected during this period should be reprocessed after the correct location is determined. Failure of this criteria is not necessarily sufficient reason to fail survey data QC since it can be recovered with additional post-processing.

c) Impulse test for lag

- Trigger: On installation or change of system configuration file in firmware.
- Description: The Battelle airborne system incorporates a small EM coil between the cesium magnetometer and the fluxgate magnetometer. It is triggered manually by the operator and synchronized to the next GPS pulse-per-second. The response from this coil can be seen in the magnetometers and is used to determine the electronic latency or lag between the GPS time and the magnetometers. This number is used in subsequent processing routines. It has no pass/fail criteria but is critical to data positioning.
- Pass criteria: N/A
- Failure resolution: N/A

d) Static noise with heli off

- Trigger: On installation or change of magnetometer.
- Description: A brief data file is collected with the helicopter turned off. The 4th difference noise parameter is automatically output, and the standard deviation is calculated. This test may require relocating the helicopter to a lower noise environment away from the concrete runway.
- Pass criteria: Standard deviation of 4th difference channel over 1s <0.2 nT/m/(sample)^4.
- Failure resolution: Replace sensor and retest until pass.

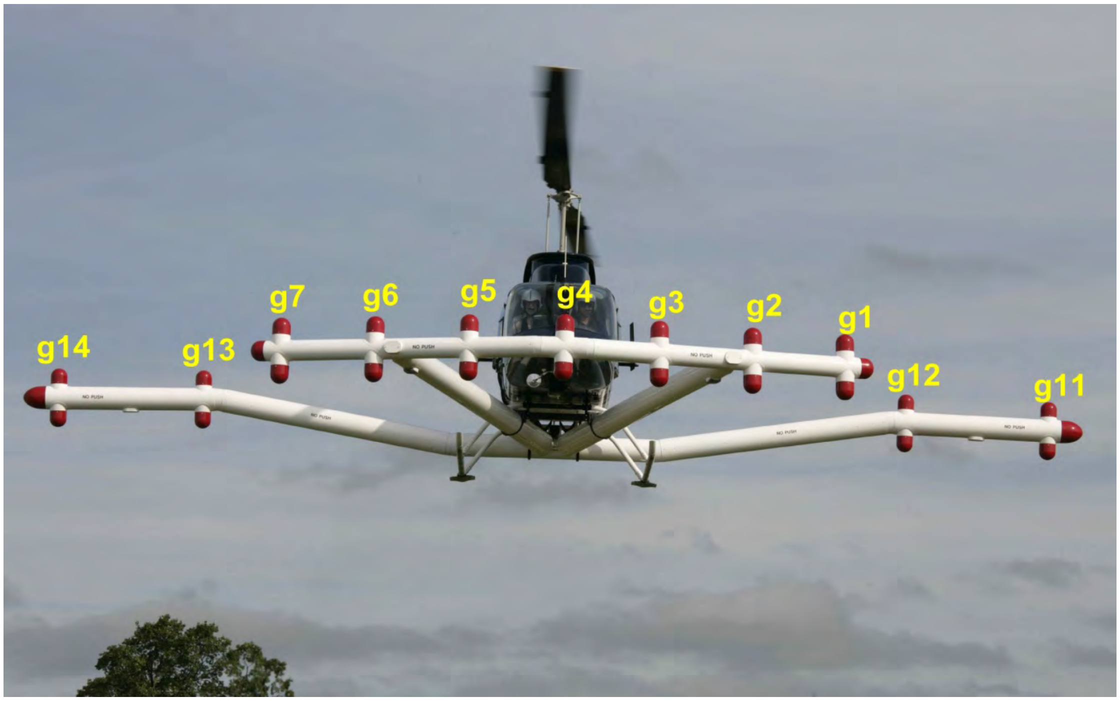

Figure A-1: Diagram showing the locations of each of the 11 gradients. Gradients 1-7 are located in the front array, while gradients 11-14 are located in the back lateral array.

Table A-1: Table of gradient calculations. Gradients equal the lower magnetometer minus the upper magnetometer divided by the magnetometer's separation distance (0.5 meters). Lm stands for Lateral magnetometers (see Figure A-1).

Gradient	Gradient Calculation
grad1	(mag1 -mag2) / 0.5m
grad2	(mag3 -mag4) / 0.5m
grad3	(mag5 -mag6) / 0.5m
grad4	(mag7 -mag8) / 0.5m
grad5	(mag9 -mag10) / 0.5m
grad6	(mag11 -mag12) / 0.5m
grad7	(mag13 -mag14) / 0.5m
grad11	(Lm1 -Lm2) / 0.5m
grad12	(Lm3 -Lm4) / 0.5m
grad13	(Lm5 -Lm6) / 0.5m
grad14	(Lm7 -Lm8) / 0.5m

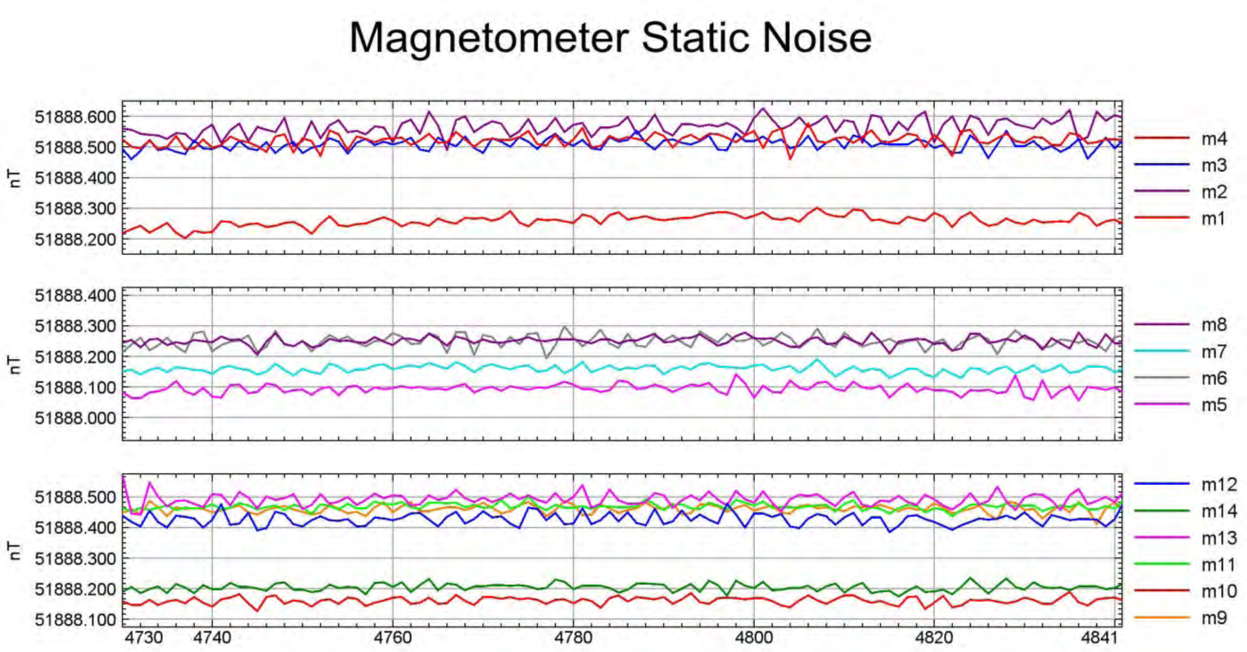

Figure A-2: Profiles show the front 14 magnetometers (for gradients 1-7) static noise levels while the helicopter is shut off.

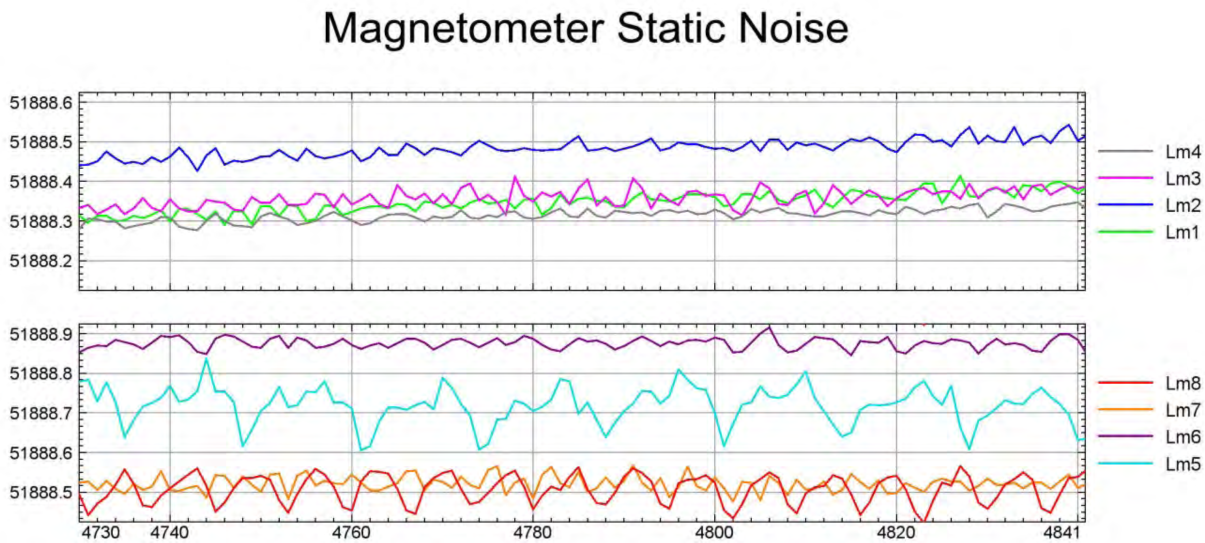

Figure A-3: Profiles show the lateral 8 magnetometers (for gradients 11-14) static noise levels while the helicopter is shut off.

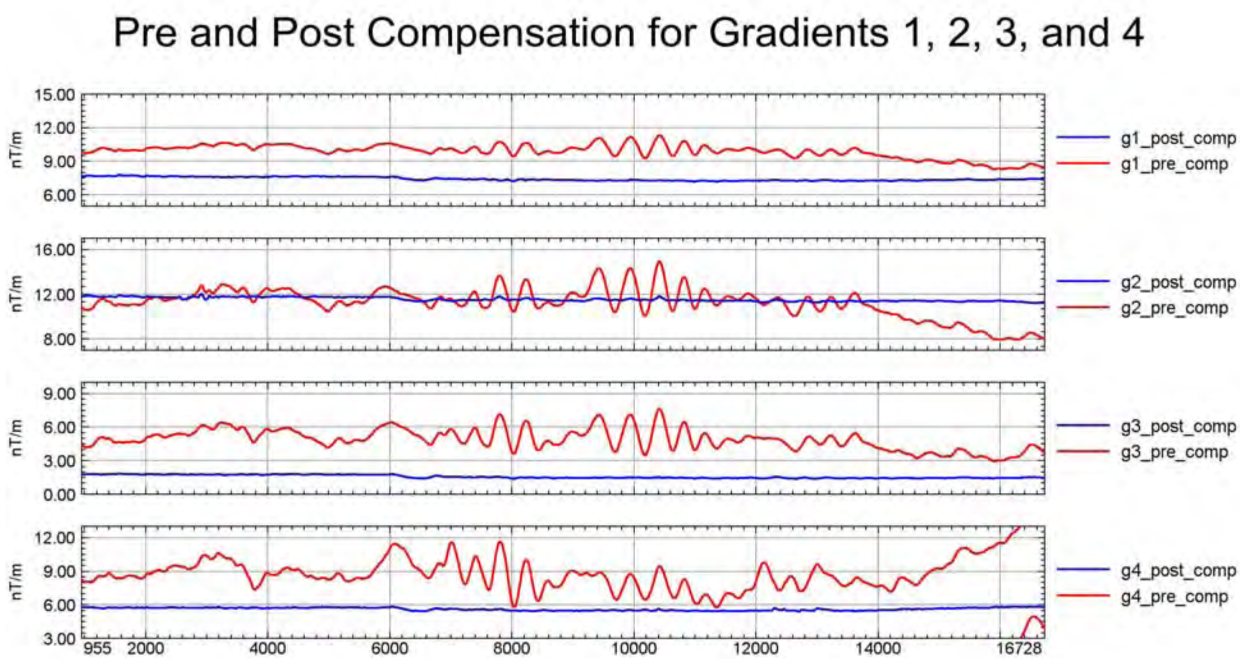

Figure A-4: Profiles show gradiometers 1-4 static noise levels while the helicopter is shut off. The pre comp values represent the static noise levels before compensation was applied, post comp values represent the static noise levels once compensation has been applied.

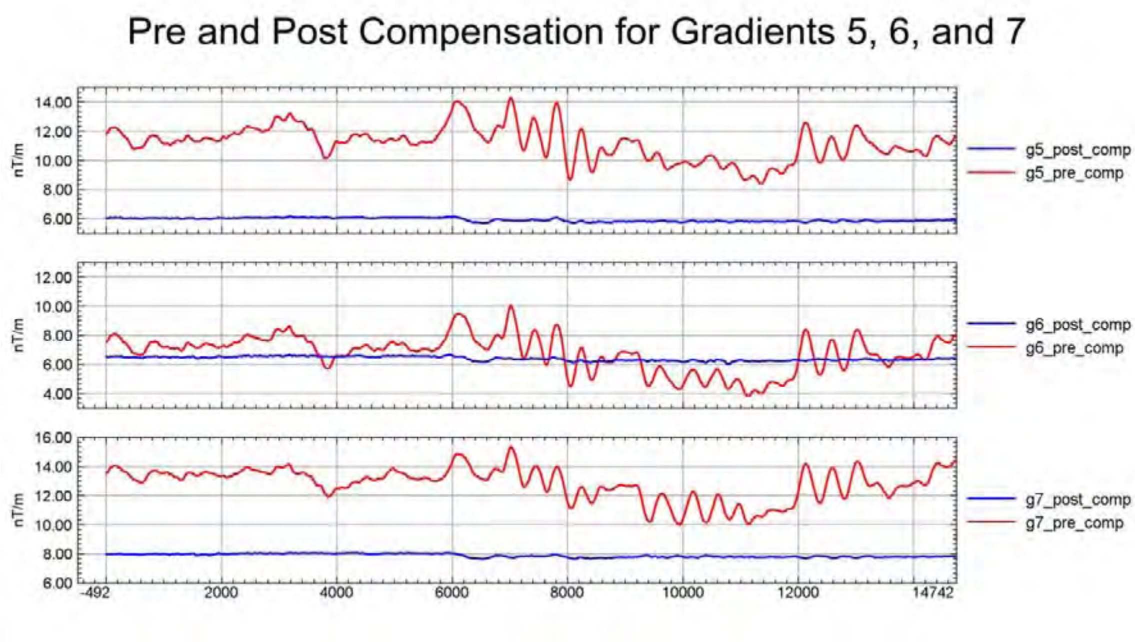

Figure A-5: Profiles show gradiometers 5-7 static noise levels while the helicopter is shut off. The pre comp values represent the static noise levels before compensation was applied, post comp values represent the static noise levels once compensation has been applied.

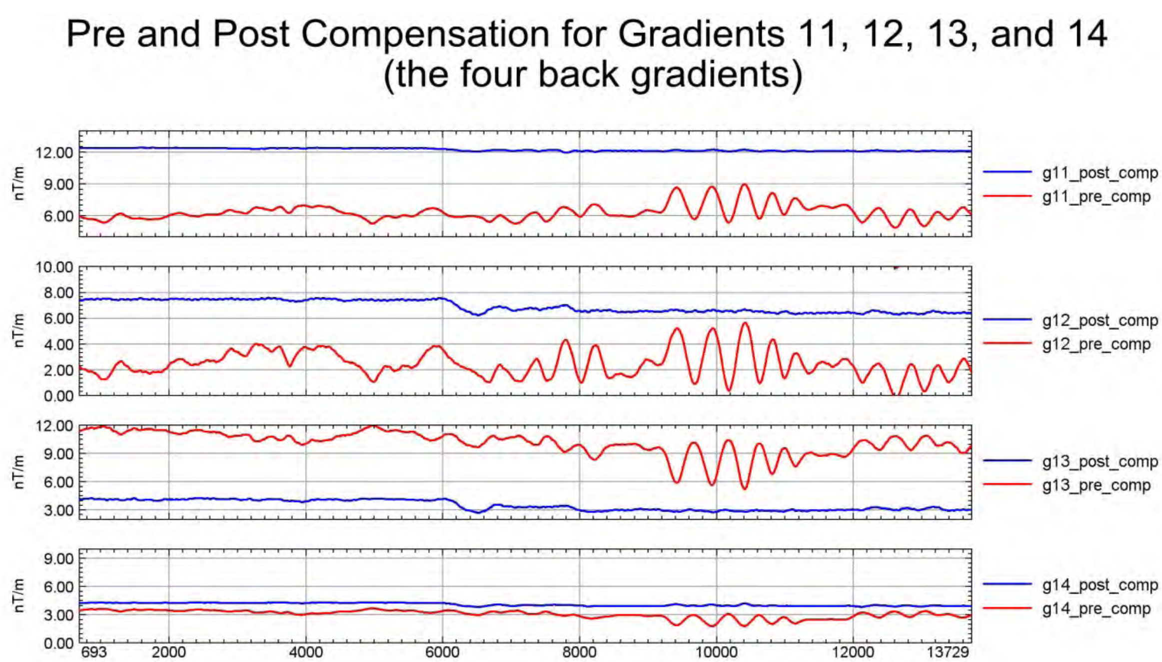

Figure A-6: Profiles show gradiometers 1-4 static noise levels while the helicopter is shut off. The pre comp values represent the static noise levels before compensation was applied, post comp values represent the static noise levels once compensation has been applied.

e) Standard target response

- Trigger: Equipment installation or mag sensor replacement
- Description: A single target will be dragged on the ground beneath the sensor pods without the helicopter running, and the response amplitude will be compared for consistency across the array.
- Pass criteria: Maximum +/-20% of average gradient amplitude.
- Failure resolution: Replace faulty sensor and repeat until pass. Faulty sensors will be returned to the manufacturer for servicing.

Table A-2 shows the target responses for each of the survey days. The responses on February 14th and 17th were lost due to a noise source which masked the data. The helicopter was more than likely parked over or near a significant noise for these two days. Gradient 13 and Gradient 14 were inconsistent and this may also be due to where the helicopter was parked during the testing. If the helicopter was not positioned in the exact same position as the day before, where the previous test was performed, then the responses will vary.

Table A-2: Standard target response table showing the vertical gradient responses for each gradient.

	Gradient 1	Gradient 2	Gradient 3	Gradient 4	Gradient 5	Gradient 6	Gradient 7	Gradient 11	Gradient 12	Gradient 13	Gradient 14
Vertical Gradient on 2/9/2011	*	64.4	64.1	65.3	67.8	71.5	73.0	33.7	36.6	26.2	36.3
Vertical Gradient on 2/11/2011	66.3	64.3	64.7	61.5	62.7	64.6	66.8	40.9	34.0	28.1	33.7
Vertical Gradient on 2/12/2011	56.9	61.4	66.6	65.3	73.8	82.8	92.0	35.1	27.8	69.9	81.7
Vertical Gradient on 2/13/2011	54.7	59.0	60.4	59.3	69.6	79.2	90.0	32.9	30.0	59.8	76.8

f) Aeromagnetic compensation FOM/IR

- Trigger: Equipment installation or mag sensor replacement.
- Description: The Figure of Merit (FOM) and Improvement Ratio (IR) is a measure of the absolute and relative effectiveness of the compensation coefficients. The FOM is measured as the sum of the average peak-peak deflection which remains in the calibration flight data after compensation. The calibration flight consists of twelve distinct movements in a continuous data stream. These movements include pitch, roll and yaw in each of the four cardinal directions (N,S,E,W). After application of the compensation correction, the average peak-peak residual is measured for each movement and the sum is the FOM. With perfect compensation, the FOM will equal 12x the noise floor. The IR is defined as the ratio of the standard deviation of the calibration flight data before and after compensation correction.
- Pass criteria: FOM 10nT/m, IR 10:1
- Failure resolution: Recalculate the coefficients based on a different subset of the original data, or refly the calibration flight until it passes.

g) Summary of Level A Tests

Table A-3: Level A Test Results (Installation)

Test	Pass/Fail	Measurement	made by
rotor susceptibility	Max 1 nT	Max 0.25 nT	J. Gamey
GPS base accuracy	Max 20cm	11cm	J. Norton
response latency	N/A	33pts	J.Norton
sensor noise (heli off)	Max 0.5nT/m/s^4	Average 0.01nT/m/s^4	J.Norton
target response -1 (gradient 1)	Max ±20%	8 %	J. Norton
target response -2 (gradient 2)	Max ±20%	3 %	J. Norton
target response -3 (gradient 3)	Max ±20%	3 %	J. Norton
target response -4 (gradient 4)	Max ±20%	4 %	J. Norton
target response -5 (gradient 5)	Max ±20%	5 %	J. Norton
target response -6 (gradient 6)	Max ±20%	9 %	J. Norton
target response -7 (gradient 7)	Max ±20%	1 %	J. Norton
target response -8 (gradient 11)	Max ±20%	7 %	J. Norton
target response -9 (gradient 12)	Max ±20%	10 %	J. Norton
target response -10 (gradient 13)	Max ±20%	25.9 %	J. Norton
target response -11 (gradient 14)	Max ±20%	21.5 %	J. Norton
compensation FOM	Max 10nT	1.46 nT	J. Norton
compensation IR	Min 10x	10.35x	J. Norton

A-3 **Level B (GPO)**

Depending on the project and local availability, the Geophysical Prove-out (GPO) grid may be an extant site, a custom airborne site, or a few target items laid out on the surface. For the GPO at the Martha's Vineyard Airport, 12 items of interest were laid out near one of the airport runways. This GPO was flown at the beginning and end of each day and also in each direction, north and south. The GPO was also flown at five different flight altitudes; 1m, 2m, 3m 5m , and 7m. See Table A-4 for the Level B test results. Figure A-7 is a vertical gradient map of a low altitude flight over the GPO. Items are labeled and the x's indicate the items position of the daily low altitude flights (1-2m). This figure visually shows the picked target locations and offsets.

a) In-flight lag

- Trigger: Over GPO grid
- Description: The GPO will be flown twice in opposite directions. Each direction will be gridded separately. Peak target locations from opposite directions will be used to verify that the latency calculated in the impulse test is accurate.
- Pass criteria: Average location differences not to exceed 50cm.
- Failure resolution: Adjust lag setting until pass. If no single lag is sufficient, double check positioning system accuracy. Repeat until pass.

b) Target detection

- Trigger: Over GPO grid
- Description: Targets of interest and the probability of detection will vary between sites and will be specified in the Work Plan. Anomalies will be selected by an automated picking procedure. Processing and picking parameters will be adjusted until the required detection probabilities are met. The corresponding false positive ratio will then be determined and reported. It is assumed that the false positive ratio is not part of the pass criteria, but is a qualifying parameter.
- Pass criteria: Detection of targets of interest will exceed specifications.
- Failure resolution: Repeat or reprocess until pass.

c) Target location

- Trigger: Over GPO grid
- Description: Having detected a target, this tests how accurately its position is known and represented in the gridded data.
- Pass criteria: Average location differences not to exceed 1m.
- Failure resolution:

d) Summary of Level B Tests

Table A- 4: Level B Test Results (GPO)

Test	Pass/Fail	Measurement	made by
positional lag	max50cm	33cm	J.Norton
target detection	80%	86%	J.Norton

probability			
target position error	max50cm	38cm radius	J.Norton

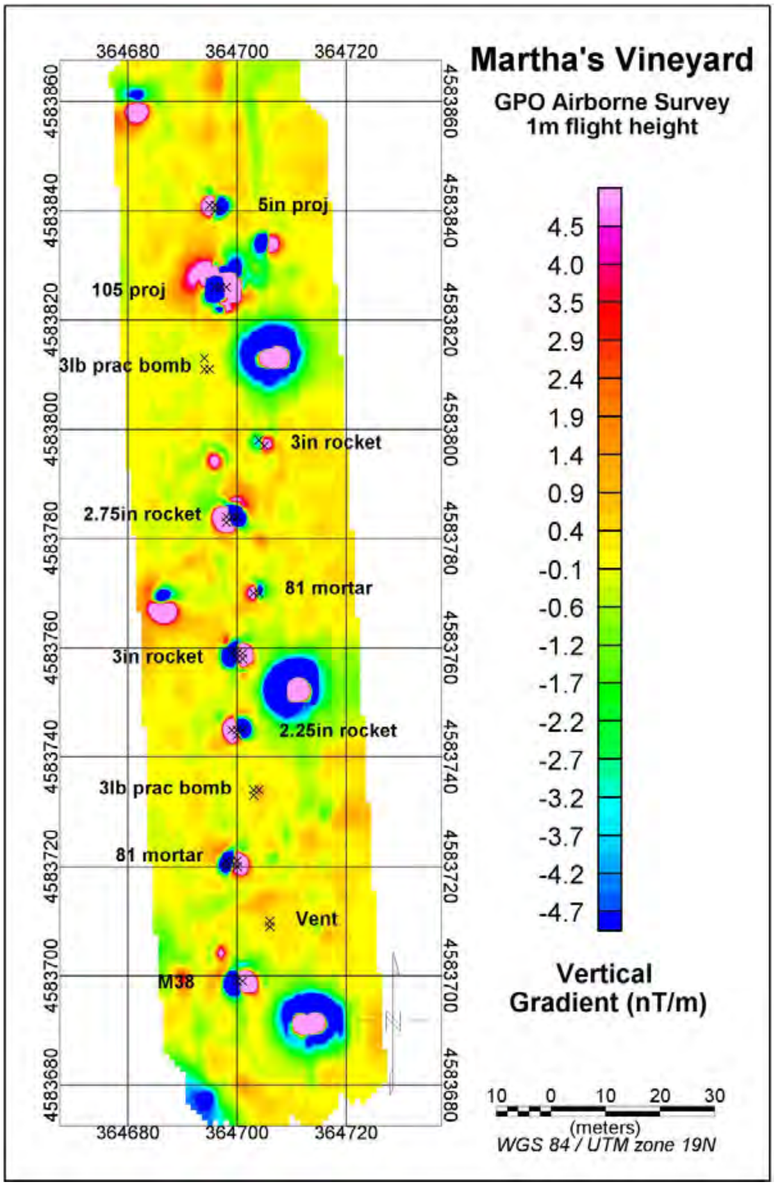

Figure A-7: Vertical Gradient map for GPO test line. Items are labeled and the x's indicate the items position of the daily low altitude flights (1-2m).

- Detection probability was measured from the GPO low altitude test data. All targets were considered detected when seen with automated anomaly picking procedures, see Table A-5. Detection Accuracy was calculated from the difference between item locations as recorded by post-processed GPS readings and airborne locations based on the analytic signal maps as determined by automated picking algorithms. Figure A-8 shows the distribution of airborne anomalies against the ground anomalies. The standard deviation of the radial offset is 38cm showing the consistency of the airborne data.

Table A-5: GPO items detection rates.

Description of item (North to South)	**Detection probability from low altitude test data**
5” projectile	100%
105 projectile	100%
3lb practice bomb	62.5%
3” rocket	87.5%
2.75” rocket	75%
81 mortar	100%
3” rocket	100%
2.25” rocket	75%
3lb practice bomb	87.5%
81 mortar	87.5%
VENT	87.5%
M38	75%

Table A-6: Mean offsets for the GPO test line.

	Mean Offsets
x_off mean	0.15
y_off mean	-0.07
rad_off mean	0.38

Table A-7: Standard deviation of the radial offset for the GPO test line target locations.

	Standard Deviation Offsets
x_off stdev	0.34
y_off stdev	0.30
rad_off stdev	0.33

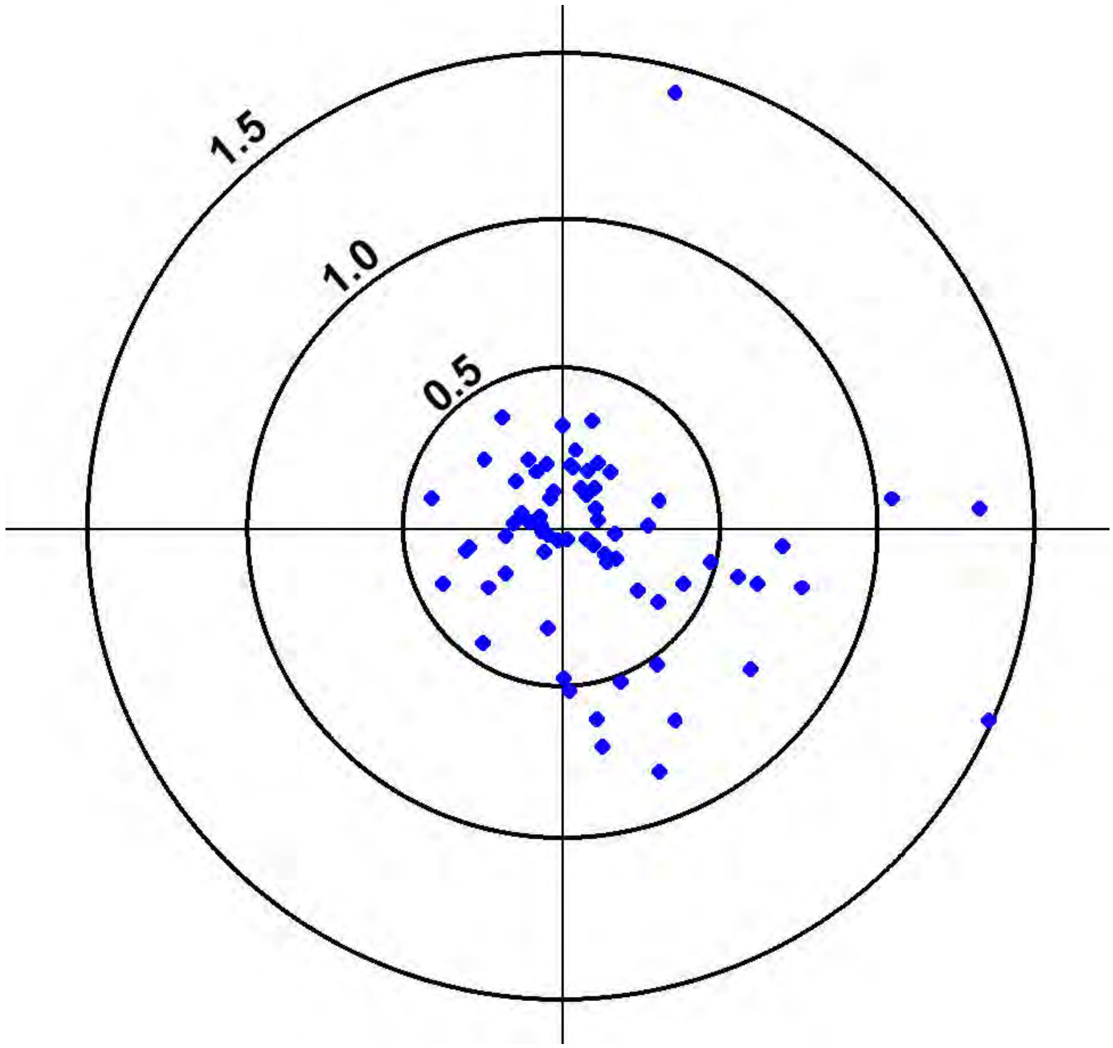

Figure A-8: Standard deviation radial offsets for each target item of each flight for the GPO test line.

A-4 **QC plots**

The results of each day's data collection were subjected to a series of QC tests. These were conducted at the end of each day and problems were reported to the crew by the following morning. Most of these procedures monitored the raw data quality of on-line data for elevated noise levels. A map of each parameter is included in Figures A-9 through A-24. The figures below contain the QC plots for the airborne survey of Martha's Vineyard for Tisbury Great Pond, Cape Poge, and South Beach. These figures include QC plots for altitude, data drops, GPS, noise, and speed. Figures A-9 through A-14 show QC plots for the Tisbury Pond site. The Cape Poge site QC plots are represented in Figures A-15 through A-19. The South Beach QC plots are represented in Figures A-20 through A-24.

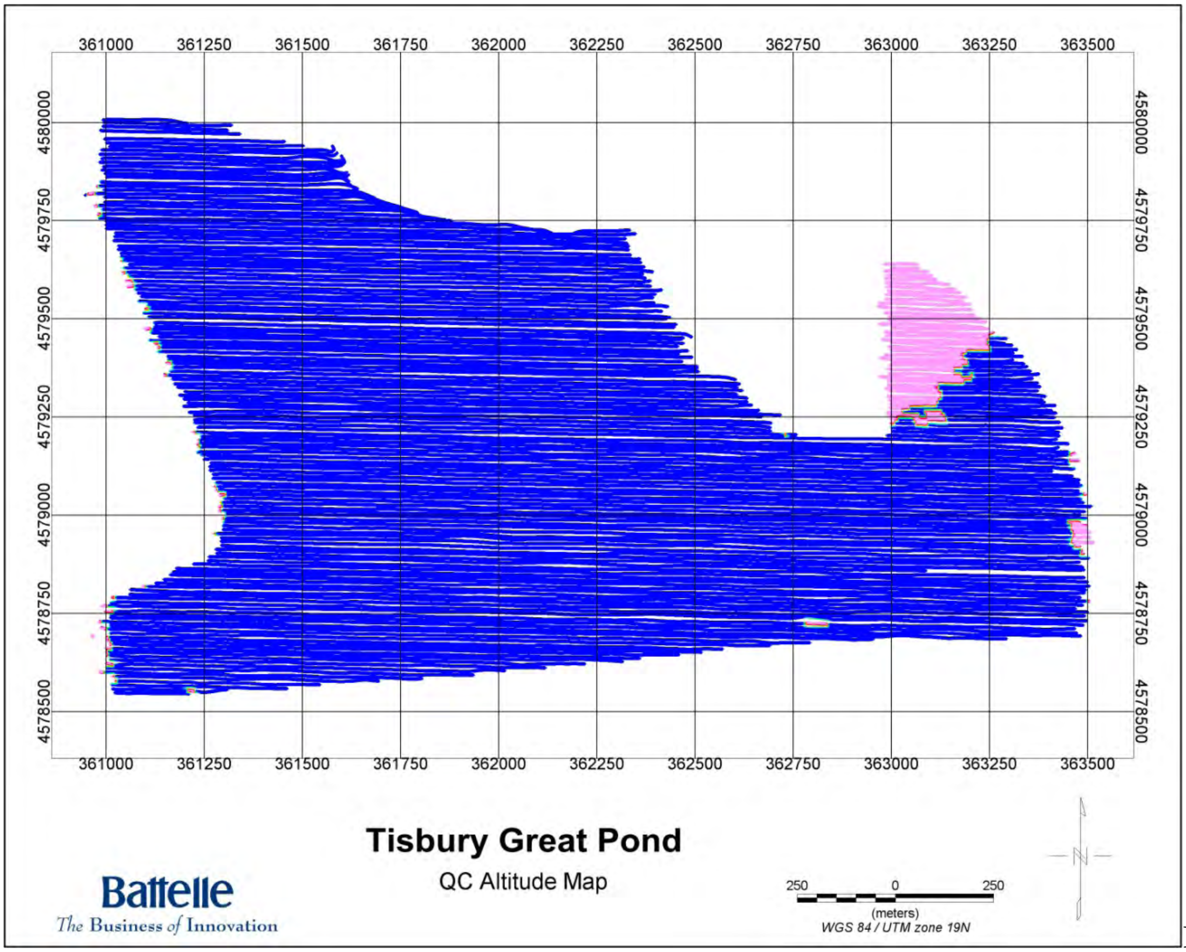

Figure A-9: QC Altitude Map for Tisbury Great Pond. The areas in pink are where the flight altitude reached 5m or more. The high alt sections are due to higher vegetation.

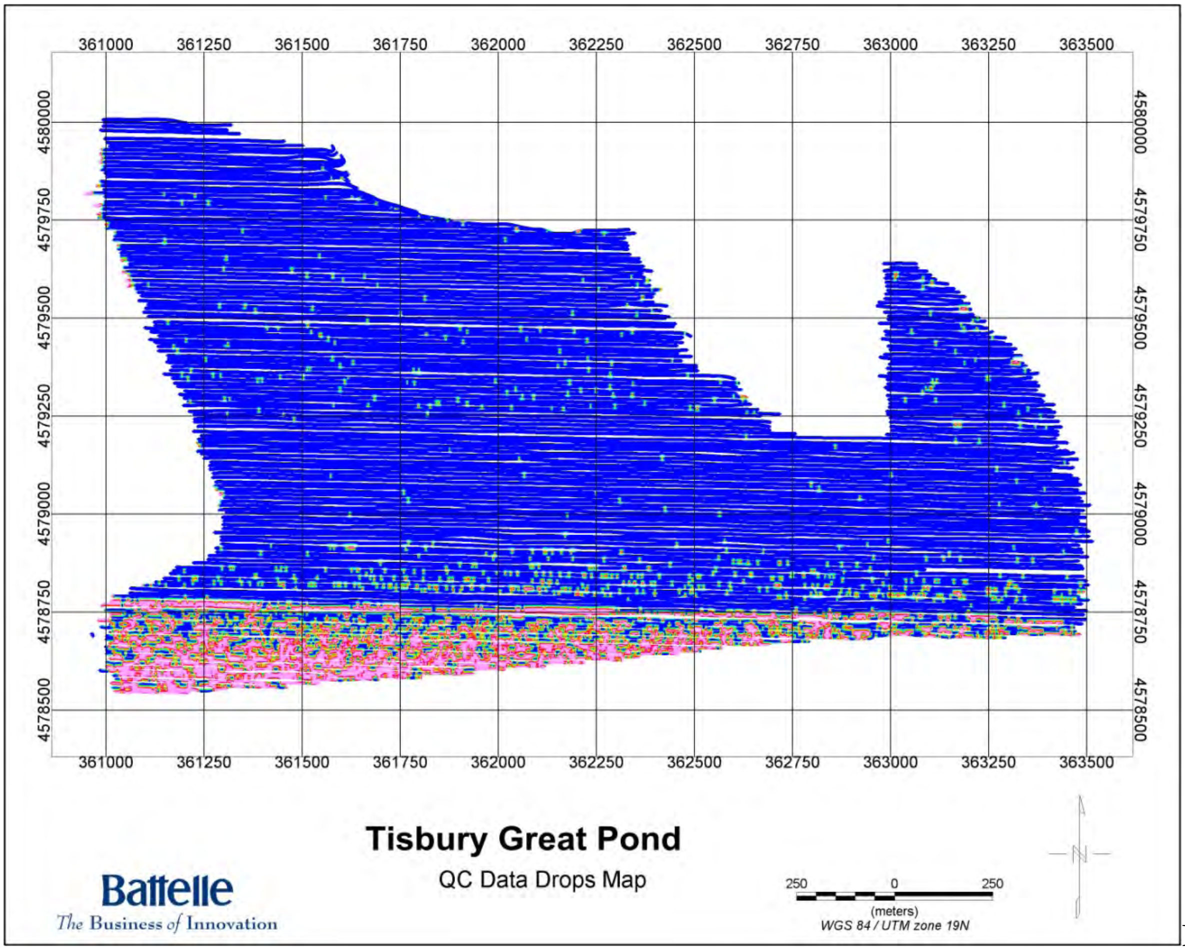

Figure A-10: QC Data Drops Map for Tisbury Great Pond. The pink areas are where there were data drops of more than 2 seconds. A single failing sensor caused the dropouts of some of the data in the southern region. Data were reviewed and it was determined that it was not a critical problem because the sensor was on the front, dense array where sensors have 1m lateral spacing. Therefore, no separation occurred on these data lines that were greater than 2m and hence no data gaps exceeded the threshold.

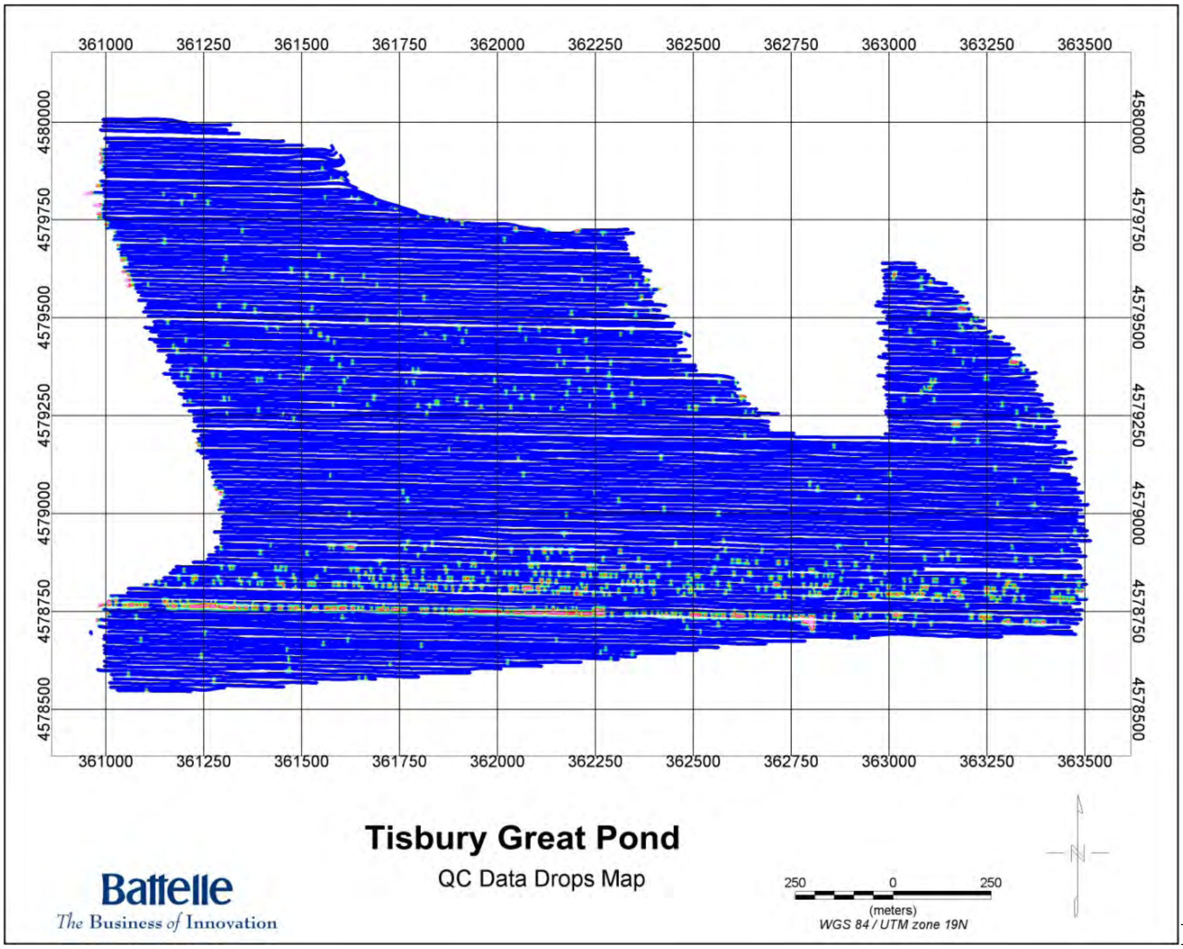

Figure A-11: QC Data Drops Map for Tisbury Great Pond once the failing sensor data were removed.

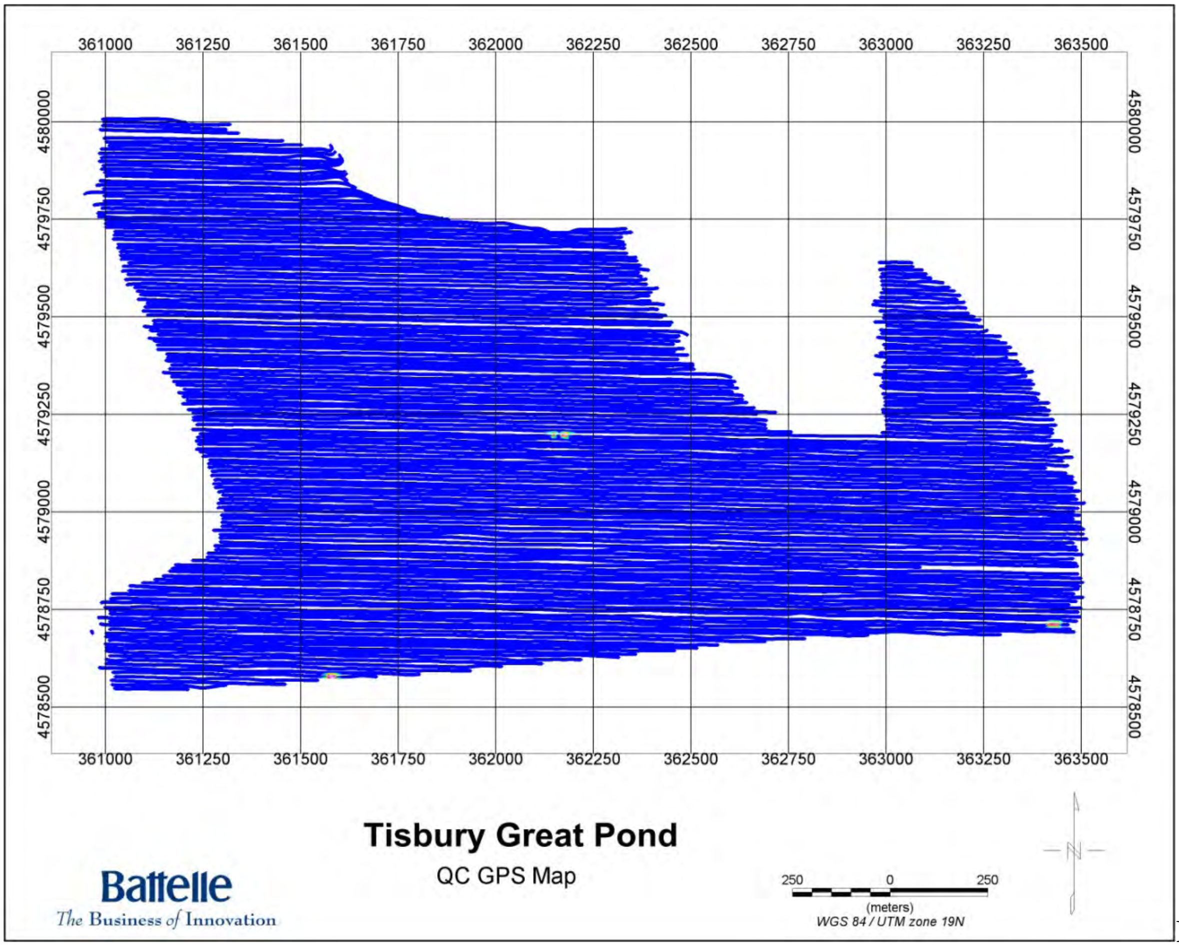

Figure A-12: QC GPS Map for Tisbury Great Pond. The blue areas show where the HDOP of the GPS is greater than 3.5.

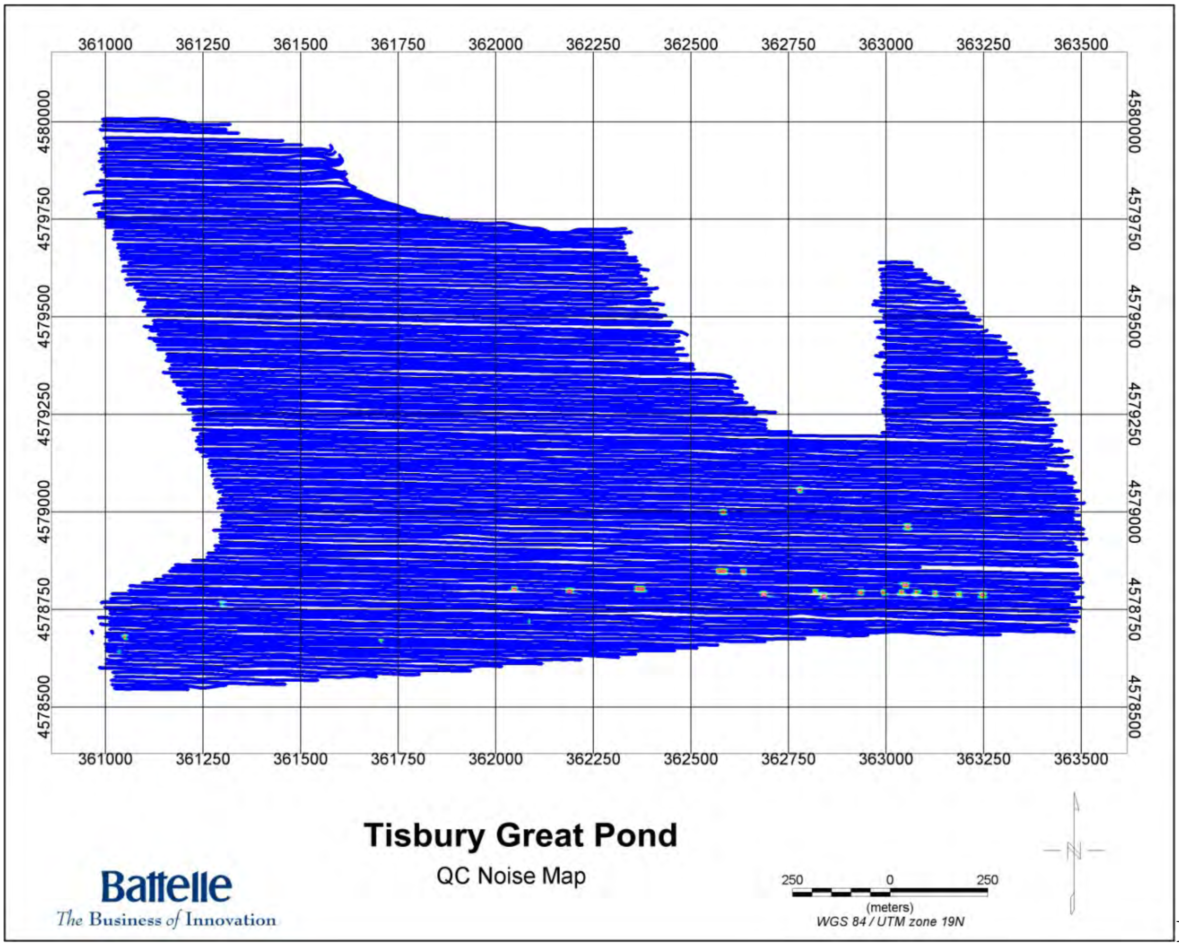

Figure A-13: QC Noise Map for Tisbury Great Pond. The blue represents where the noise was less than $0.5 nT/m/s^4$.

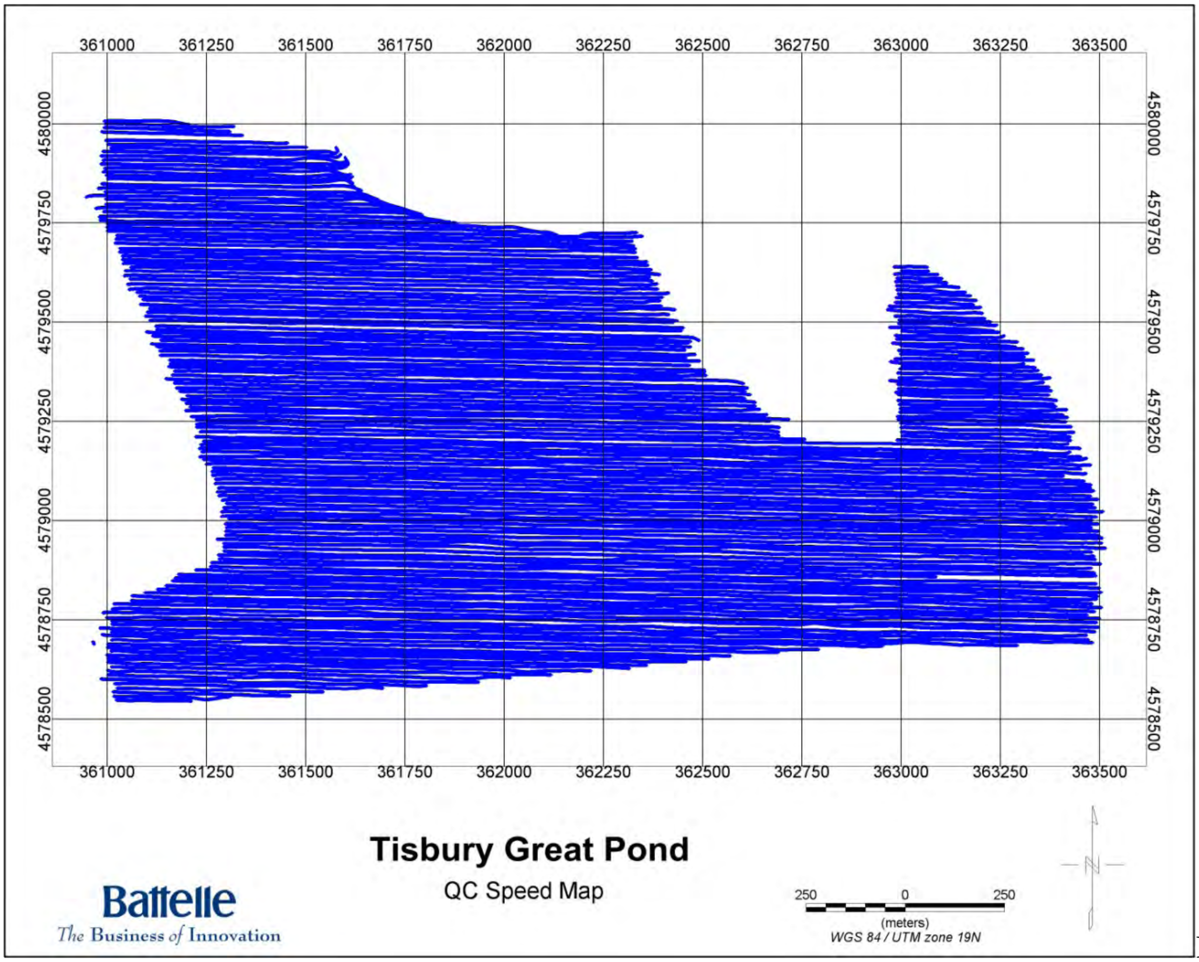

Figure A-14: QC Speed Map for Tisbury Great Pond. The blue represents where the speed of the aircraft is less than 60mph.

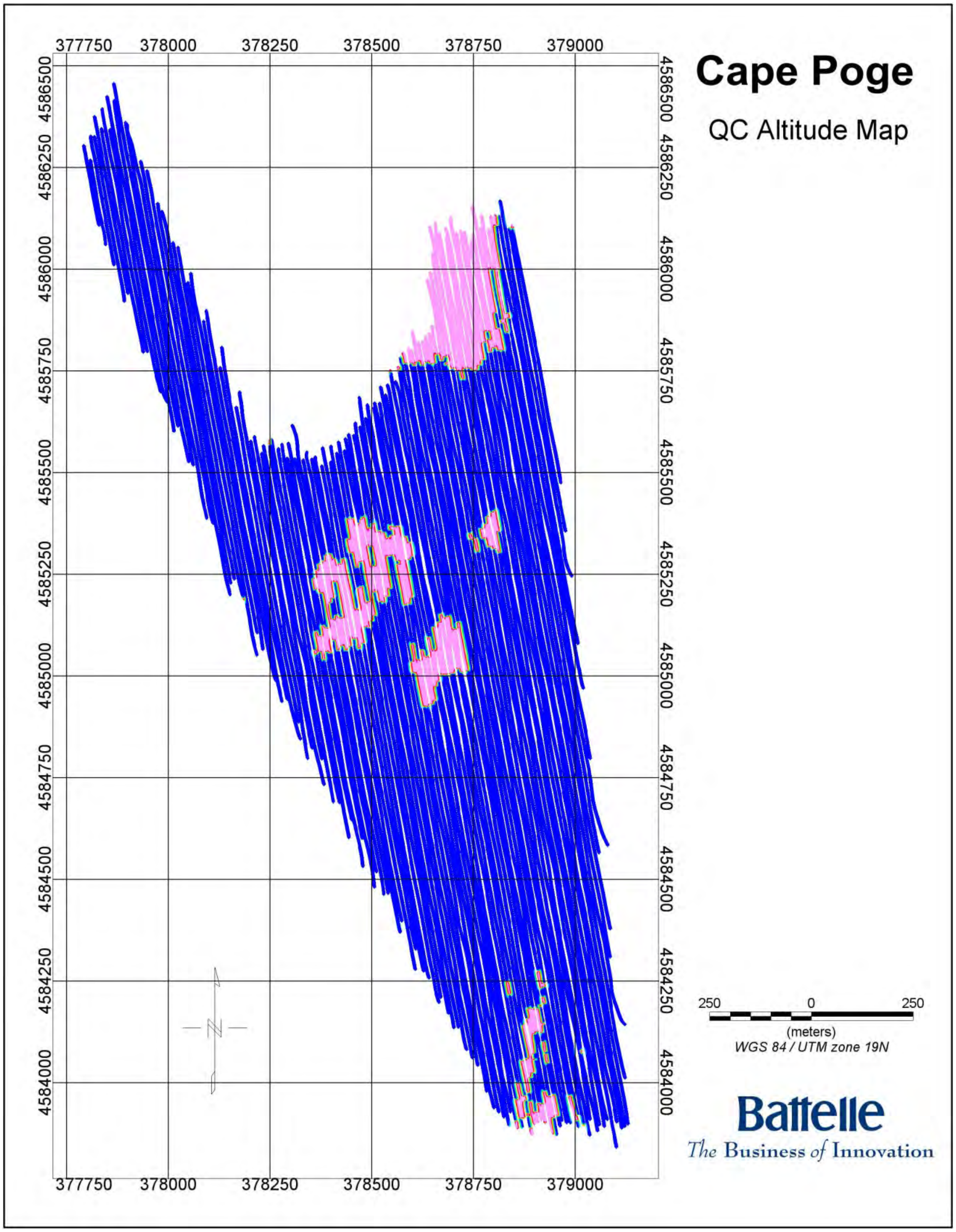

Figure A-15: QC Altitude Map for Cape Poge. The areas in pink are where the flight altitude reached 5m or more. The high alt sections are due to higher vegetation, birds, or manmade obstacles.

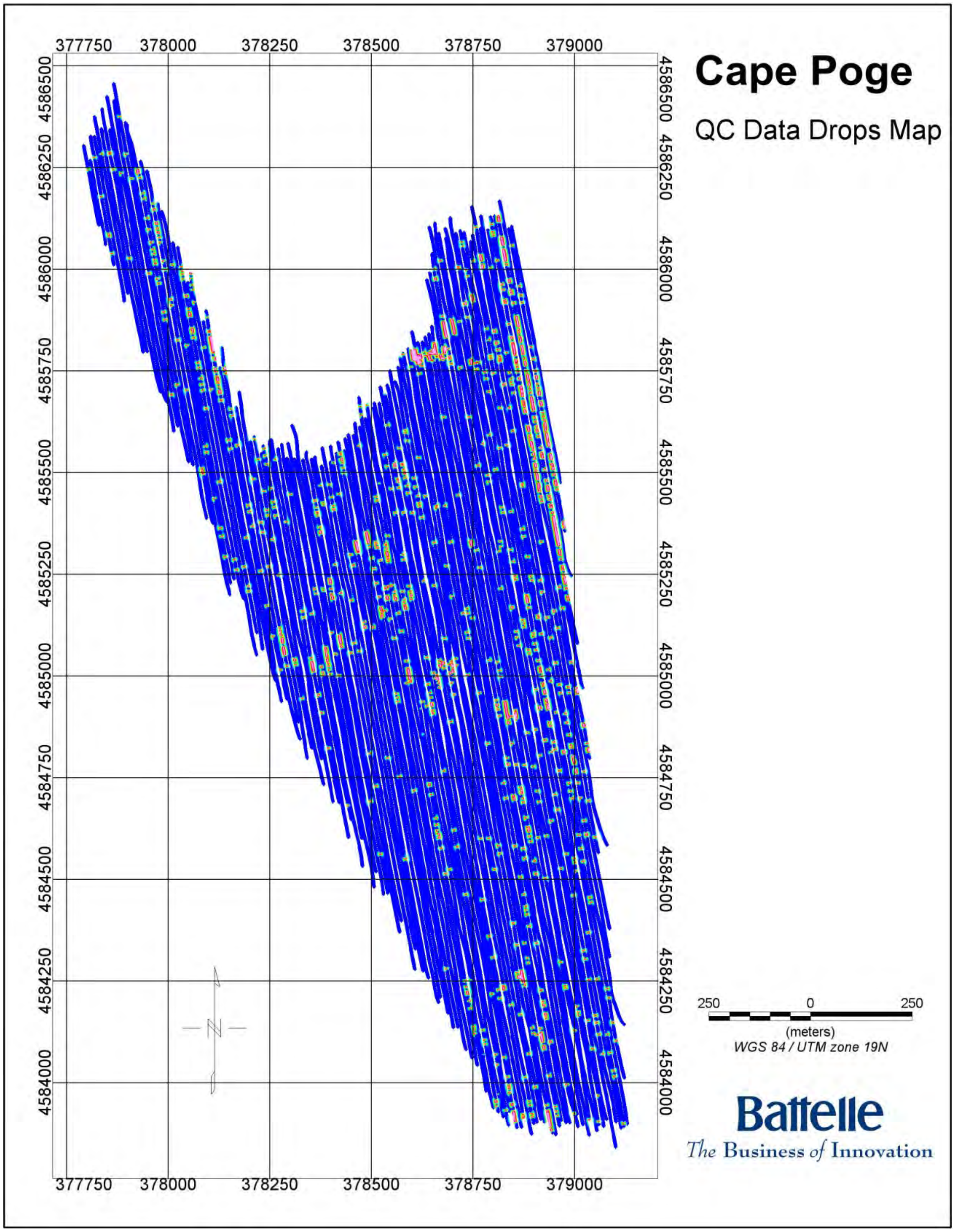

Figure A-16: QC Data Drops Map for Cape Poge. The pink areas represent where there are data drops of more than 2 seconds; however these 2 second drops only occurred over one sensor therefore not created any data gaps (5m x 5m) which would require reflights.

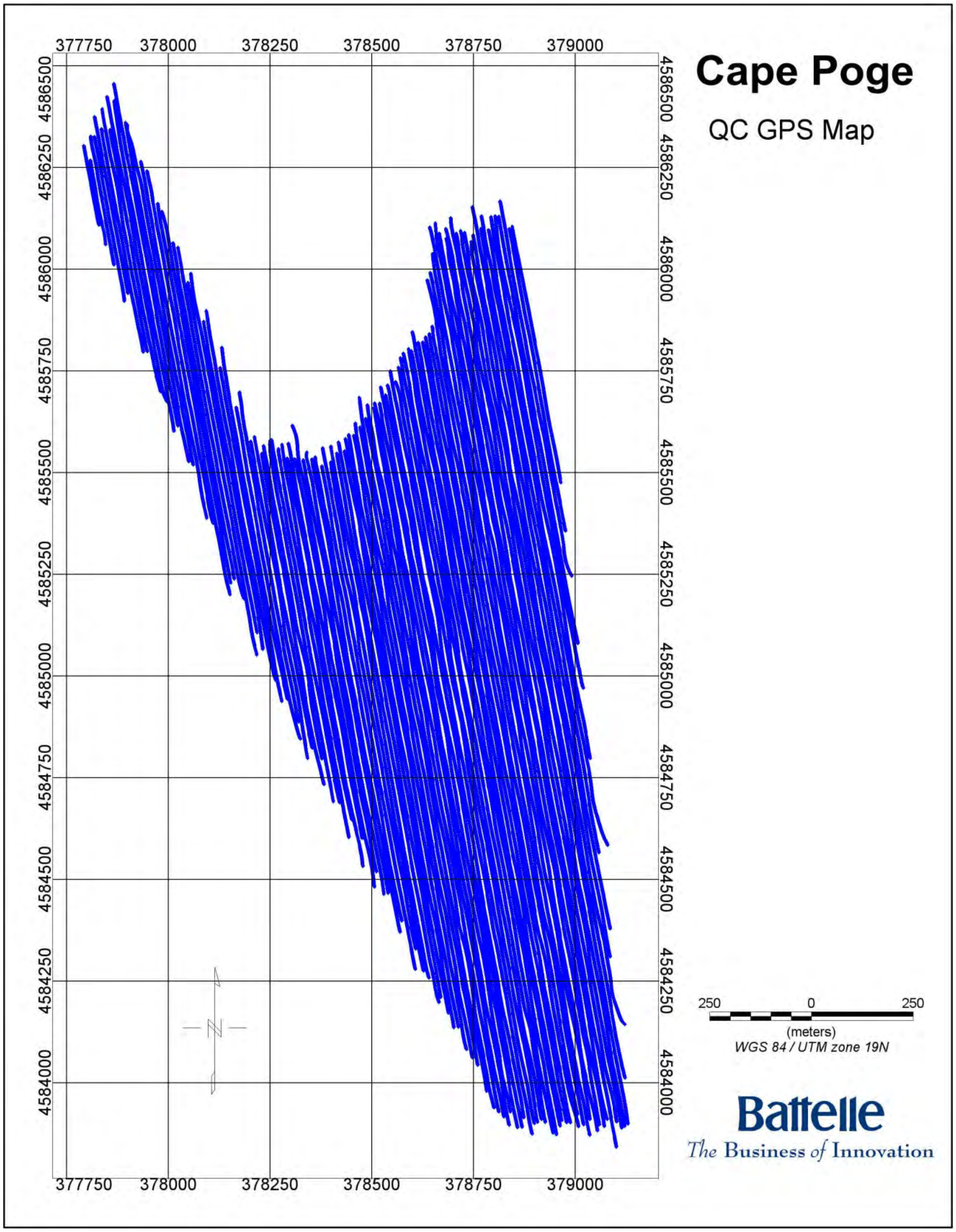

Figure A-17: QC GPS Map for Cape Poge. The blue areas show where the HDOP of the GPS is greater than 3.5.

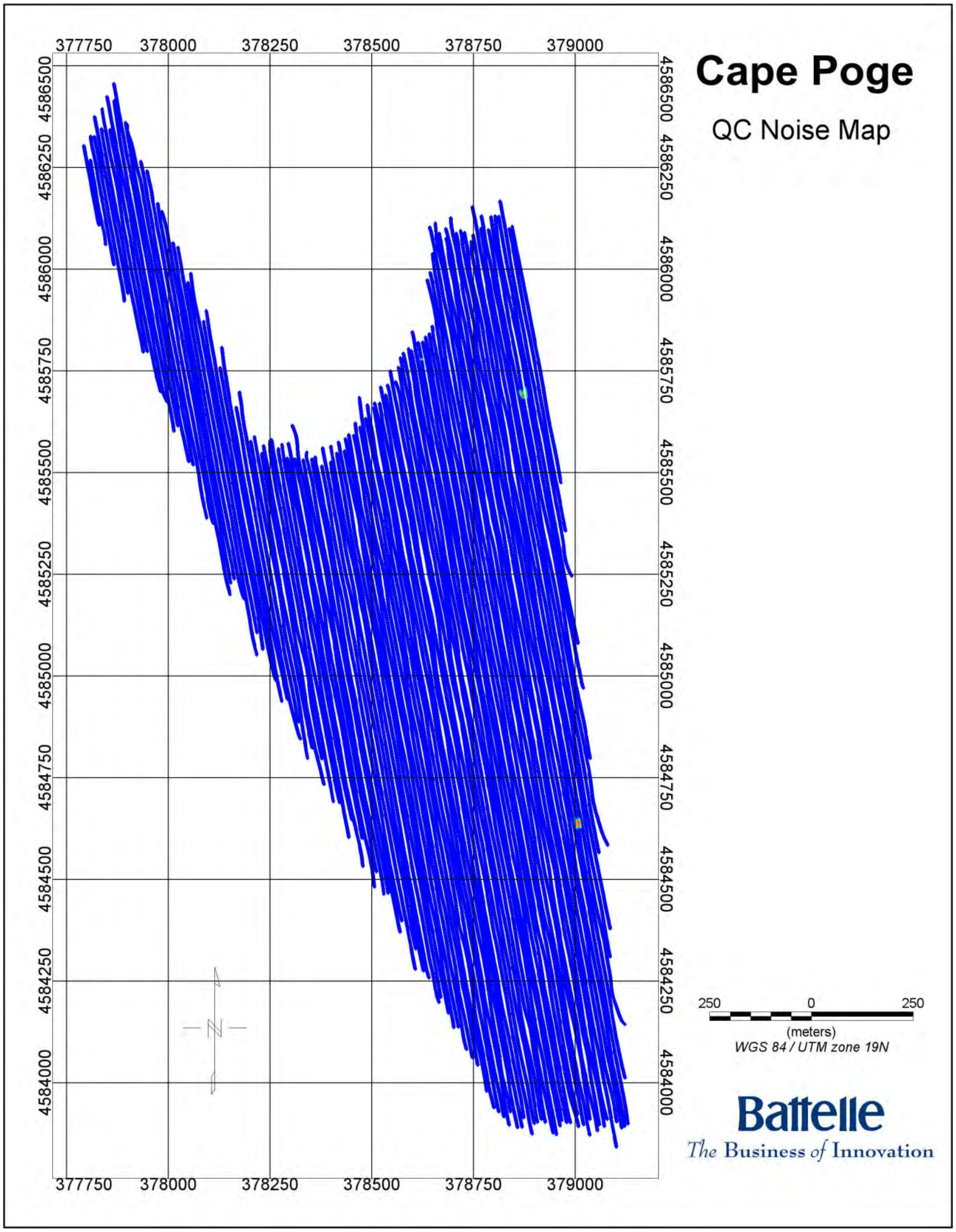

Figure A-18: QC GPS Map for Cape Poge. The blue represents where the noise was less than 0.5nT/m/s^4.

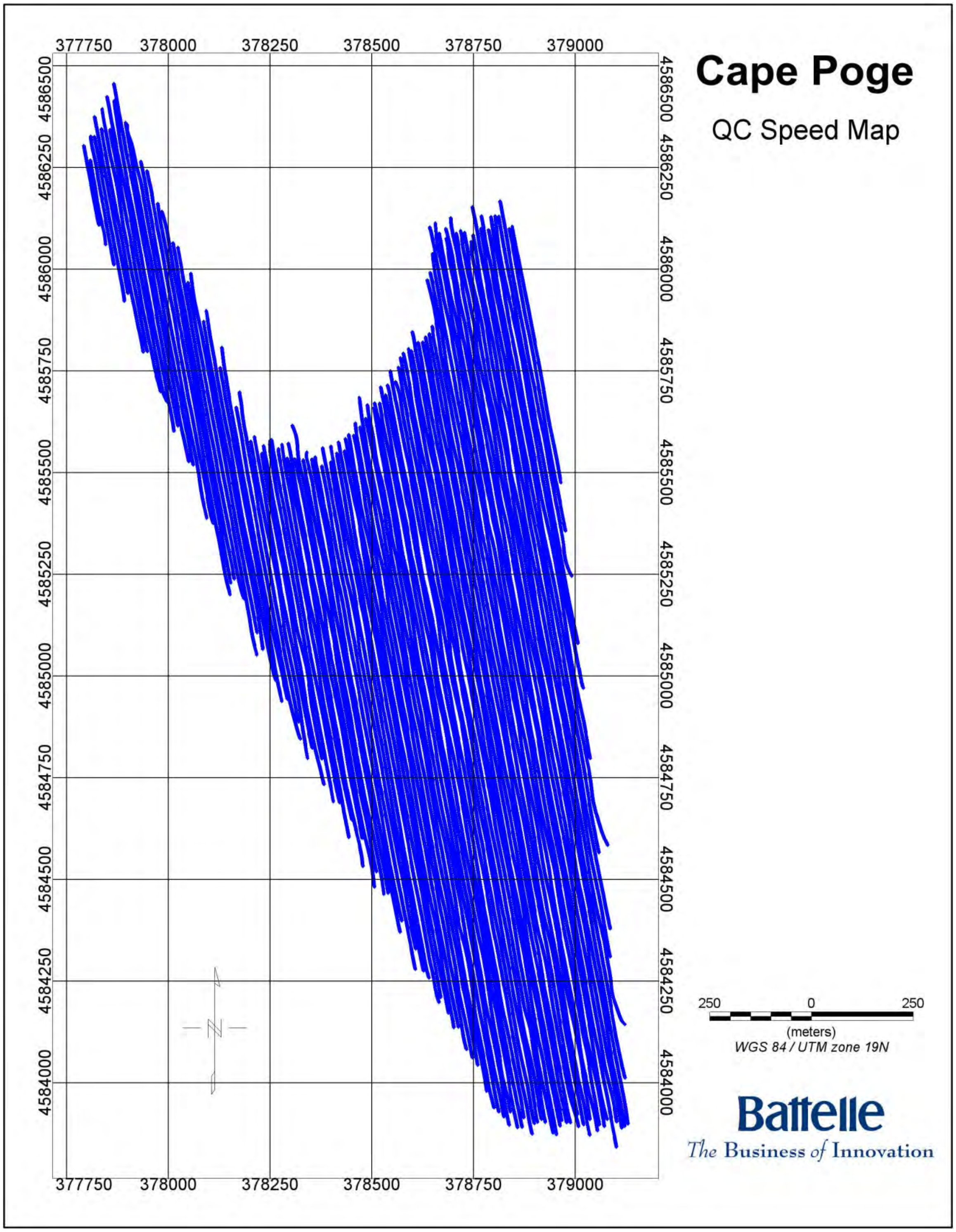

Figure A-19: QC Speed Map for Cape Poge. The blue represents where the speed of the aircraft is less than 60mph.

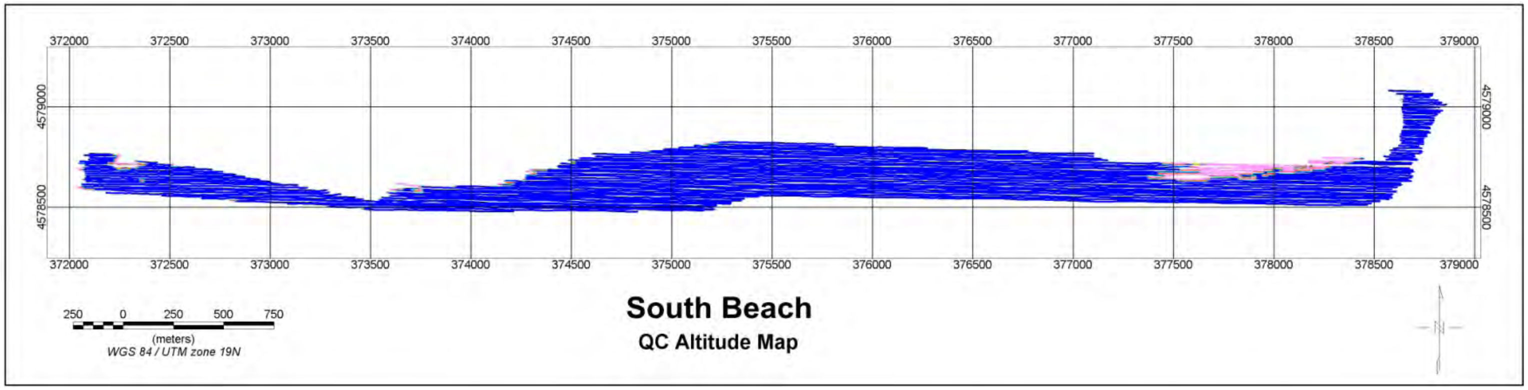

Figure A-20: QC Altitude Map for South Beach. The areas in pink are where the flight altitude reached 5m or more. The high altitude sections are due to higher vegetation or manmade obstacles.

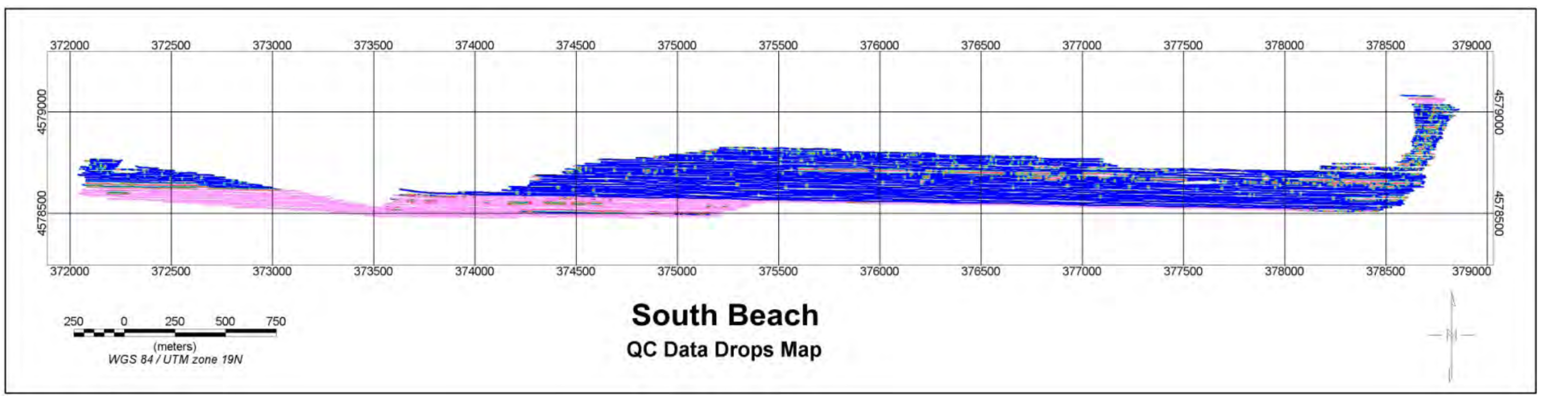

Figure A-21: QC Data Drops Map for South Beach. The pink areas represent where there are data drops of more than 2 seconds. A failing sensor caused the dropouts of the data in the southern region, as previously shown for Tisbury Great Pond, the data were reviewed and it was determined that it was not a critical problem because the sensor was on the front, dense array and hence does not leave data gaps.

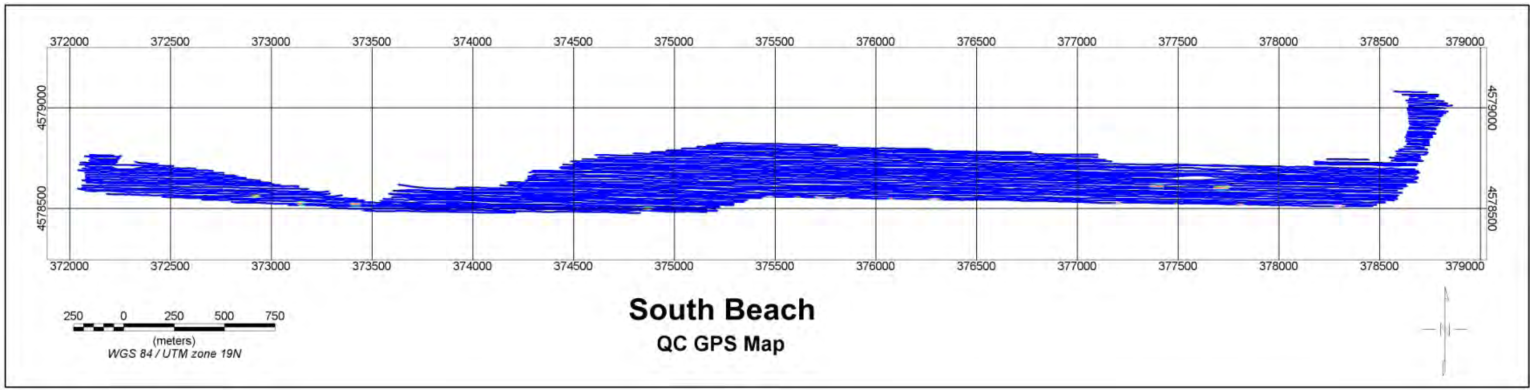

Figure A-22: QC GPS Map for South Beach. The blue areas show where the HDOP of the GPS is greater than 3.5.

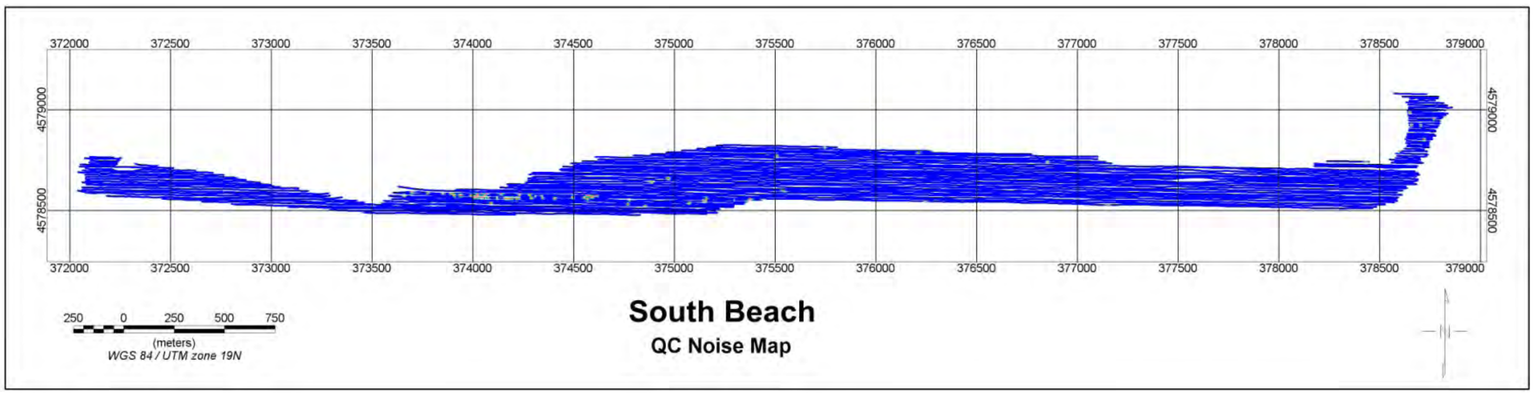

Figure A-23: QC GPS Map for South Beach. The blue represents where the noise was less than 0.5nT/m/s^4.

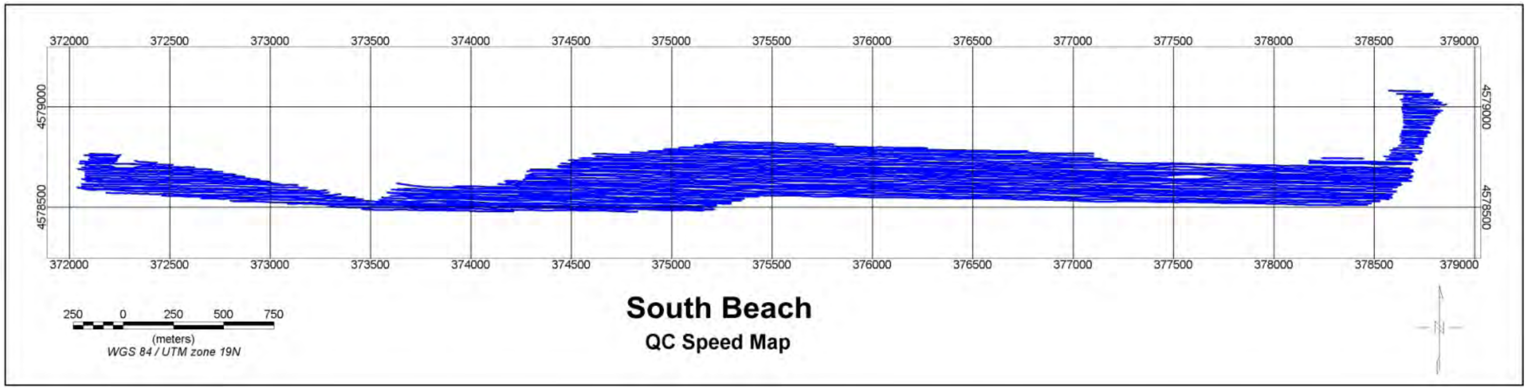

Figure A-24: QC Speed Map for South Beach. The blue represents where the speed of the aircraft is less than 60mph.

A-5 **Reflight Tables**

Table A-25: Lines for Tisbury Great Pond that required reflights. This table includes the coordinates of the data gaps that were greater than 2 seconds.

TISBURY GREAT POND - coordinates of data gaps

	Eastern		Western	
Line	X	Y	X	Y
127	362778.58	4578724.21	362809.54	4578722.93
73	362502.76	4579269.25	362509.01	4579268.87
23	361738.29	4579782.53	361743.69	4579780.78

Table A-26: Lines for South Beach that required reflights. This table includes the coordinates of the data gaps that were greater than 2 seconds.

SOUTH BEACH - coordinates of data gaps

	Eastern		Western	
Line	X	Y	X	Y
59	373969.28	4578580.09	373986.26	4578579.19
	374178.62	4578576.71	374193.25	4578576.64
	374223.43	4578576.50	374236.52	4578576.46
	374290.88	4578576.09	374307.17	4578576.13
	374647.16	4578579.30	374662.16	4578578.82
	374453.93	4578580.50	374472.67	4578580.37
	375068.89	4578571.85	375082.56	4578571.66
56	375130.22	4578603.48	375143.97	4578602.90
	377754.68	4578558.37	377766.34	4578558.03
45	376838.77	4578675.07	376845.99	4578675.00
40	378187.02	4578709.76	378666.92	4578701.39
39	378224.77	4578714.25	378669.16	4578709.19
36	378633.68	4578731.33	378686.64	4578730.69

A-6 **Daily Activity Logs**

This log summarizes project activities. Its primary purpose is to record survey progress and to flag events that may impact progress. Detailed notes of specific meetings or decisions are maintained elsewhere. Notes that have an impact on the billing or deliverables are indicated in red.

Down-days for weather or standby are defined as "one (1) hour or less of flight time during a standard survey project day". Survey days do not include days for mobilization, installation, calibration or reflights. This provides sufficient time for one reconnaissance flight in marginal weather conditions to make an attempt at data collection, but is less than half a single production flight. Provision was also made in the contract for half days, which were defined as "more than one (1) but less than three (3) hours of flight time".

Down-days may be the result of unsafe weather conditions (including rain, fog, high winds or glassy water conditions), maintenance (equipment failure or regularly scheduled helicopter maintenance) or client activities (limited or no site access due to client activities). The onus for each down-day has been attributed to either Battelle or UXB, depending on the circumstances. These are all included in the summary below.

Crew rotations have also been noted in the logs
Details of daily activities:

Date	03-Feb-2011	
Primary Activity	Mobilization	0.0 flt hrs
Survey Block	n/a	
Notes	Battelle field crew depart from Oak Ridge (William Doll, Jeff Gamey), arrive Pittsburgh, PA	
Flags	-	

Date	04-Feb-2011	
Primary Activity	Mobilization	0.0 flt hrs
Survey Block	n/a	
Notes	Battelle en route, arrive Hyannis.	
Flags	-	

Date	05-Feb-2011	
Primary Activity	Mobilization	2.8 flt hrs
Survey Block	n/a	
Notes	Battelle en route, arrive Martha's Vineyard. Mag-flag survey of potential GPO site. National Helicopters crew (Doug Christie, Marcus Watson, Darcy McPhee) mobilize from Toronto, held up in New York due to weather.	
Flags	Half day during mob – Battelle	

Date	06-Feb-2011	
Primary Activity	Installation	2.5 flt hrs

Survey Block	n/a	
Notes	G858 pre-seed survey of GPO area. National Helicopter crew arrives MVY. Begin VG22 system installation on aircraft.	
Flags	Half day during mob – Battelle	

Date	07-Feb-2011	
Primary Activity	Installation	0.0 flt hrs
Survey Block	n/a	
Notes	Complete VG22 system installation on aircraft.	
Flags	-	

Date	08-Feb-2011	
Primary Activity	Survey	0.6 flt hrs
Survey Block	n/a	
Notes	Kick-off safety briefing. Airborne survey of GPO at multiple heights. No survey work due to weather (rain, ceiling, winds), ground support not yet set up.	
Flags	Full day standby – UXB	

Date	09-Feb-2011	
Primary Activity	Survey	2.7 flt hrs
Survey Block	Tisbury	
Notes	Airborne survey of TGP. Operations ceased due to high winds.	
Flags	Half day standby – UXB	

Date	10-Feb-2011	
Primary Activity	Survey	5.6 flt hrs
Survey Block	South Beach	
Notes	Airborne survey of South Beach.	
Flags	-	

Date	11-Feb-2011	
Primary Activity	Survey	3.8 flt hrs
Survey Block	South Beach/Poge	
Notes	Airborne survey of South Beach complete. Attempted Poge but aborted for cross-winds. Reflew compensation flight and GPO.	
Flags	-	

Date	12-Feb-2011	
Primary Activity	Survey	5.6 flt hrs

Survey Block	Tisbury	
Notes	Continued survey of Tisbury.	
Flags	-	

Date	13-Feb-2011	
Primary Activity	Survey	3.6 flt hrs
Survey Block	Tisbury	
Notes	Continued airborne survey of Tisbury. Battelle crew rotation, Jeannie Norton mob to Martha's Vineyard while Jeff Gamey mob back to Oak Ridge, TN.	
Flags	-	

Date	14-Feb-2011	
Primary Activity	Survey	1.0 flt hrs
Survey Block	Tisbury	
Notes	Completed airborne survey of Tisbury Great Pond. Only able to get in one flight before the wind picked up and was too strong to fly.	
Flags	Half day standby – UXB	

Date	15-Feb-2011	
Primary Activity	Survey	0 flt hrs
Survey Block	N/A	
Notes	Down for wind.	
Flags	Full day standby – UXB	

Date	16-Feb-2011	
Primary Activity	Survey	6.0 flt hrs
Survey Block	Cape Poge	
Notes	2 morning flights of Cape Poge flown leaving only 23 lines remaining. Base GPS station failure, the Cape Poge data was unrecoverable.	
Flags		

Date	17-Feb-2011	
Primary Activity	Survey	5.3 flt hrs
Survey Block	Cape Poge	
Notes	Flew all of Cape Poge and was able to finish reflights for both South Beach and Tisbury Great Pond	
Flags	-	

Date	18-Feb-2011	
Primary Activity	N/A	0.0 flt hrs
Survey Block	Deinstall /Mob	
Notes	Complete VG22 system deinstallation on aircraft in the morning. .Battelle field crew depart from Martha's Vineyard (William Doll, Jeannie Norton). National Helicopters crew (Doug Christie, Marcus Watson, Darcy McPhee) demobilize from Martha's Vineyard.	
Flags	-	

Summary of down-time attributable to Battelle

Date	Event	Flt hrs	Standby
02-05-11	Weather during mob (heli crew only)	2.8 flt hrs	Half day
02-06-11	Weather during mob (heli crew only)	2.5 flt hrs	Half-day

Summary of down-time attributable to UXB

Date	Event	Flt hrs	Standby
02-08-11	Weather	0.6	Full day
02-09-11	Weather	2.7	Half day
02-14-11	Weather	0.0	Half day
02-15-11	Weather	0.0	Full day

Standby 1: 2 full days
Standby 2: 2 half days

A-7 **Daily Data Tracking Logs**

Feb 08-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/08/11
Sortie ID	1115-1116
Site ID	GPO
Survey Line File (Track File)	
Survey Lines Flown	GPO preseed/postseed
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeff Gamey
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY020811.gdb
Grid name	Vg020811.grd, as020811.grd
Archive name	MVY_GPO

Feb 09-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/09/11
Sortie ID	1117-1128
Site ID	Tisbury Great Pond
Survey Line File (Track File)	
Survey Lines Flown	122-148
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeff Gamey
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY020911.gdb
Grid name	Vg020911.grd, as020911.grd
Archive name	MVY_Tisbury

Feb 10-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/10/11
Sortie ID	1129-1145
Site ID	South Beach
Survey Line File (Track File)	
Survey Lines Flown	W44-69, E40-58, W2-5
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeff Gamey
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021011.gdb
Grid name	Vg021011.grd, as021011.grd
Archive name	MVY_South

Feb 11-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/11/11
Sortie ID	1147-1159
Site ID	South Beach/Poge/GPO
Survey Line File (Track File)	
Survey Lines Flown	SB E6-39, C59-66 Poge 103-105
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeff Gamey
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021111.gdb
Grid name	Vg021111.grd, as021111.grd
Archive name	MVY_South MVY_Poge MVY_GPO

Feb 12-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/12/11
Sortie ID	1160-1180
Site ID	Tisbury Great Pond
Survey Line File (Track File)	
Survey Lines Flown	TGP 35-121
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeff Gamey
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021211.gdb
Grid name	Vg021211.grd, as021211.grd
Archive name	MVY_Tisbury

Feb 13-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/13/11
Sortie ID	1147-1159
Site ID	Tisbury Great Pond
Survey Line File (Track File)	
Survey Lines Flown	TGP 21-74
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeannie Norton
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021311.gdb
Grid name	Vg021311.grd, as021311.grd
Archive name	MVY_Tisbury

Feb 14-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/14/11
Sortie ID	1196-1201
Site ID	Tisbury Great Pond
Survey Line File (Track File)	
Survey Lines Flown	TGP 2-20
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeannie Norton
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021411.gdb
Grid name	Vg021411.grd, as021411.grd
Archive name	MVY_Tisbury

Feb 16-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/16/11
Sortie ID	1202-1222
Site ID	Cape Poge
Survey Line File (Track File)	
Survey Lines Flown	Poge 2-102
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeannie Norton
Project Geophysicist's name	William Doll
Field notes (comments)	GPS failure, resulting in unusable data
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	
Grid name	
Archive name	

Feb 17-2011

The data processing will be tracked on a daily basis. This sheet will track information on data processing as applied to each day's preliminary GDB. It will cover the following inputs (at a minimum). These will be provided along with each delivery of preliminary field data.

Item	Survey Project Team Input
Date of data collection	2/17/11
Sortie ID	1147-1159
Site ID	Cape Poge / South Beach / Tisbury
Survey Line File (Track File)	
Survey Lines Flown	Poge 2-102 SB 59, 56, 45, 40, 39, 37, 36 TGP 127
Pilot's Name	Doug Christie
System Operator's name	Marcus Watson
Ground Support Technician Name	Darcy
Data Processor's name	Jeannie Norton
Project Geophysicist's name	William Doll
Field notes (comments)	
All Filtering Information (e.g. Demedian, Lpass, etc.)	Std (see report)
Oasis Site Database	MVY021711.gdb
Grid name	Vg021711.grd, as021711.grd
Archive name	MVY_Tisbury MVY_Poge MBY_South

The data analysis will also be tracked on a site basis. The tracking sheet will document the various analysis steps as follows (at a minimum). Data analysis is not conducted until data collection is complete. This tracking report will be included in the Final Report and will cover the entire project.

Item	Survey Project Team Input
Site name	Tisbury Great Pond
Grid name	Tisbury_vg.grd, Tisbury_as.grd
Archive name	Vgcomb_Tisbury.gdb
Anomaly Selection method (manual/wavelet/AS peak detection)	AS peak detection
Anomaly selection analyst name	Jeannie Norton
Anomaly list file name	Tisbury_picklist.xyz
Anomaly QC analyst name	
Final QC-processed anomaly list name	
Dipole fit/classification analyst name	Jeannie Norton
Dipole fit analysis output file name	Tisbury_inversion.xyz
Anomaly classification output file name	
Dipole fit/Classification QC name	
GIS analyst name	
GIS density map output filename	
Density map QC name	

Item	Survey Project Team Input
Site name	South Beach
Grid name	South_vg.grd, South_as.grd
Archive name	Vgcomb_south.gdb
Anomaly Selection method (manual/wavelet/AS peak detection)	AS peak detection
Anomaly selection analyst name	Jeannie Norton
Anomaly list file name	South_picklist.xyz
Anomaly QC analyst name	
Final QC-processed anomaly list name	
Dipole fit/classification analyst name	Jeannie Norton
Dipole fit analysis output file name	South_inversion.xyz
Anomaly classification output file name	
Dipole fit/Classification QC name	
GIS analyst name	
GIS density map output filename	
Density map QC name	

Item	Survey Project Team Input
Site name	Cape Poge
Grid name	Poge_vg.grd, Poge_as.grd
Archive name	Vgcomb_poge.gdb
Anomaly Selection method (manual/wavelet/AS peak detection)	AS peak detection
Anomaly selection analyst name	Jeannie Norton
Anomaly list file name	Poge_picklist.xyz
Anomaly QC analyst name	
Final QC-processed anomaly list name	
Dipole fit/classification analyst name	Jeannie Norton
Dipole fit analysis output file name	Poge_inversion.xyz
Anomaly classification output file name	
Dipole fit/Classification QC name	
GIS analyst name	
GIS density map output filename	
Density map QC name	

MARTHA'S VINEYARD ORDNANCE RESPONSE REPORT

Date: 19 August 2009

Requesting/reporting agency/person: Trustees of the Reservation/Chris Egan

Location: Long Point, West Tisbury

Narrative: VRH was contacted by the Trustees of the Reservation via the West Tisbury Police Department and notified of a suspected ordnance item at the "cut" to West Tisbury Great Pond. VRH mobilized a one person response. The item was located in a precarious position in the bank of the cut where an incoming tide was eroding the sand beneath it. Without time to shore up the item, VRH made the decision to conduct a controlled move. West Tisbury police and Trustees personnel were used to move the public back. The item was moved to a location where it was not at risk of falling or being swept away. The item was heavily encrusted with sand. A nose fuse was visible but the rest of the item was indiscernible. VRH advised West Tisbury police to call the State Police Bomb Squad as the ordnance item was potentially hazardous.

Disposition: Item destroyed by Navy EOD by counter charging. Navy EOD reports it was a high explosive round.

MARTHA'S VINEYARD ORDNANCE RESPONSE REPORT

Date: 20 August 2009

Requesting/reporting agency/person: MASSDEP/Mike Moran

Location: Long Point, West Tisbury

Narrative: VRH was contacted by the MassDEP/Mike Moran to confirm the presence of military ordnance debris at the cut in West Tisbury Great Pond and to determine the feasibility of removing the debris prior to the arrival of President Obama. VRH dispatched one person to the scene and did confirm the presence or ordnance debris. Due to high tide and strong currents, VRH was unable to remove debris at that time.

Disposition: Ordnance debris left in place.

DIVING
BLASTING
ADAPTIVE TECHNOLOGIES

March 9, 2011
PO Box 150
West Tisbury, MA 02575

RE: February Emergency Responses to Potential Ordnance Items, Tisbury Great Pond

1. VRHabilis was called to respond to potential ordnance items on the 23rd, 24th and 26th of February. In each case the items were determined to be munitions debris with no explosive hazard. The debris was removed and place in the secure container in Edgartown.

a. February 23 response, reported at 1830

b. February 24th response, reported at 1330

c. February 26th response, reported 0830

2. All items were found in the vicinity of the cut, N 41º 20.85’, W 070º 38.75’ after at least one rise and fall of the tide.

Sincerely,

Tom Rancich
CEO VRHabilis
Veteran Run Work!.

PO Box 150 ▪▪▪ West Tisbury, MA 02575 ▪▪▪ 865.381.1021 ▪▪▪ VRHabilis.com

Subject: 13 July 2011 Emergency Response

Location: Long Point, West Tisbury Massachusetts

Time: 1335

Narrative: VRHabilis received a call at 1335 from the communications center that potential ordnance items had been found at Long Point near the "cut". VRH responded to the scene 1452 and found several munitions related debris at the site. (photo 1)

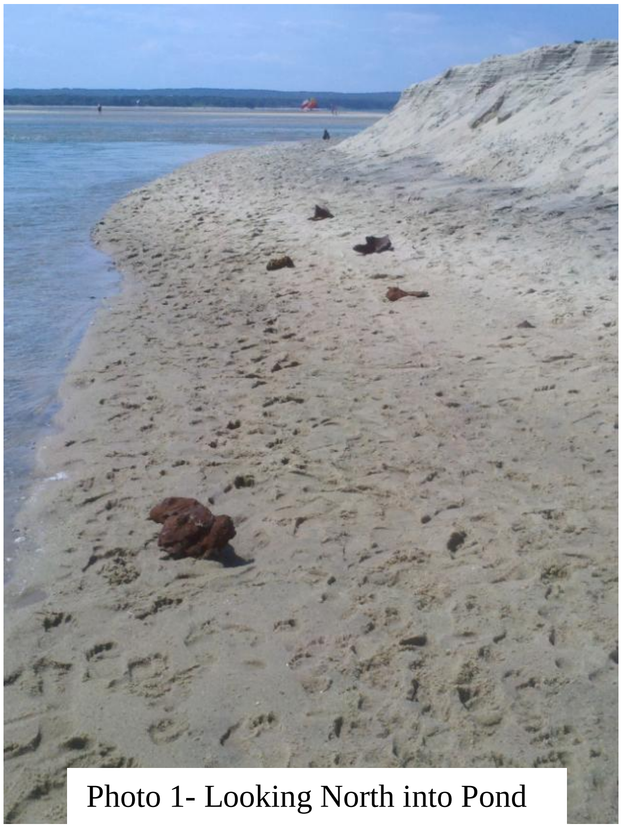

Photo 1- Looking North into Pond

The debris field extended from 41º 20.870"N 070º 38.733W to 41º 20.857"N 070º 38.714W, or a distance of roughly 65'. Two items were reported in the water of the cut but could not be located at time of response. Photos of the six items located are pictured below, with item 1 being the northernmost item and item 6 being the southernmost.

Item 5 and item six were clearly ordnance related debris---item 5 had a nose cone and item 6 was a bomb casing. There was no explosive hazard related to these items. .

The debris was removed and disposed of. Response secured at 1550.

See map below. Please note that this imagery is old and the current "cut" actually located adjacent to the yellow pin markers.

Summary of Work Conducted by Aqua Survey, Inc at Tisbury Great Pond, West Tisbury, Massachusetts from 13 January 2011 to 15 April 2011

Work at Tisbury Great Pond began on 13 January 2011.

The first task was the establishment and QC check of the initial real-time kinematic differential global positioning system (RTK-DGPS) base station location. This system consists of a Trimble 5700 base station with Trimmark 3 radio modem at the base station and a Trimble MS750 rover with Teledyne radio modem. NGS benchmark Hancock 1887 was used to transfer control and QC points to the boat ramp to be used during the project. Between 17 and 20 January 2011 a bathymetric and side scan sonar survey was conducted in the area of concern at Tisbury Great Pond. Delays in the survey were caused by partial ice coverage of the survey area. The bathymetric survey was conducted using an Innerspace 455 survey grade fathometer with narrow beam 200 kHz transducer. The side scan sonar survey was conducted using an Edgetech 4125 dual frequency sonar operating at 400 kHz and 900 kHz. Data was collected along parallel survey lines spaced 25 feet apart. Data was processed and a side scan sonar mosaic and bathymetric contours were created to assist with the planning of EM transects.

The EM survey at Tisbury Great Pond began 16 February 2011 with the preliminary EM survey conducted over the proposed underwater IVS location. The IVS was installed and locations of the objects were recorded with RTK-DGPS from the surface on 20 February 2011.

On 21 February 2011 the EM transect survey at Tisbury Great Pond began. EM transect data was collected using a Geonics EM61-Mk2 HP console and underwater coil through most of the survey area on 21 and 22 February using a boat towed cart system. As the cut was open and water level was too shallow at the southern end of the pond to survey using the boat, the cart was pulled behind an Argo Avenger amphibious vehicle to collect data in this area on 1 March 2011. On 1 March additional RTK control and QC points were installed near the land IVS which was used for that days data collection. The rolling cart was used to collect all EM data in Tisbury Great Pond. A total of 26,271 meters of transect data was collected.

Grids at Tisbury Great Pond were surveyed between 25 March and 15 April 2011. Initially grids were attempted on 25 and 29 March using divers to methodically survey using the cart. This was found to be inefficient and starting 30 March grid data was collected towing the cart behind the boat. A total of seventeen 60 meter by 13 meter grids were surveyed. Grid data was collected using the same EM system and cart as was used during the transect survey. Data was logged both within the designated grids and in the turn arounds resulting in additional coverage and anomalies for investigation.

Work at Tisbury Great Pond was completed as of 15 April 2011.

APPENDIX B

INSTITUTIONAL ANALYSIS AND INSTITUTIONAL ANALYSIS REPORT

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The Institutional Analysis will be provided in the Martha’s Vineyard Tisbury Great Pond Feasibility Study.

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APPENDIX C

PERMITS

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The COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
251 Causeway Street, Suite 800, Boston, MA 02114-2136
Tel. (617) 626-1200 Fax (617) 626-1240 Web Site: www.mass.gov/czm/buar/index.htm

September 30, 2010

Mark Padover
Aqua Survey, Inc.
469 Point Breeze Road
Flemington, NJ 08822

RE: Special Use Permit 10-003 - Remedial Investigation/Feasibility Study, Chilmark, Edgartown and West Tisbury, MA

Dear Mr. Padover:

This letter confirms the vote taken by the Massachusetts Board of Underwater Archaeological Resources on 30 September 2010 to issue a Special Use Permit, 10-003, to Aqua Survey, Inc. for the marine archaeological survey and documentation related to the Remedial Investigation/Feasibility Study, for the project area in the Towns of Chilmark, Edgartown, and West Tisbury as detailed on the charts accompanying the application (as amended). The duration of this permit is one year from the date of issuance with its expiration date as 30 September 2011.

This permit is herein granted dependent upon Agua Survey's compliance with the Board's Regulations (312 CMR 2.00). All work must be conducted in accordance with Board directives, standard conditions and the Scope of Services included in the application (as amended). Activities allowed under this permit include remote sensing, archaeological site examination and recovery to determine the presence or absence of potential submerged archaeological resources and undertake necessary recovery and documentation of these resources in the permit area. For projects subject to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), permittees are directed to consult with and provide their proposed research design and methodology for review and comment to the State Historic Preservation Office/Massachusetts Historical Commission and the lead federal agency in accordance with 36 CFR 800.4, prior to conducting the field investigation. Work must comply with any conditions resulting from that consultation. This permit does not relieve the permittee or any other person of the necessity of complying with all other federal, state and local statutes, regulations, by-laws and ordinances.

If you should have any questions or need further assistance, do not hesitate to contact the Board at the address above or by telephone at (617) 626-1141.

Sincerely,

Victor T. Mastone
Director

/vtm

Cc: Brona Simon, MHC
Marc Paiva, ACOE (via email)
Michael Warminsky, UXB International (via email)

BiodiversityWorks
Wildlife Research, Monitoring and Mentoring

To Whom It May Concern:

I monitored Tisbury Great Pond transects 24 to 16 on the Tisbury Great Pond Map from April 4th to April 20th. During this time I surveyed for any nesting Piping Plovers or American Oystercatchers before UXB conducted work in the area. Least terns were not present. UXB conducted work in this area a total of 5 times between 4/4/2011 and 4/20/2011, and I checked the site before each day of work. During this time, I did not observe any courtship or nesting activity within the area of UXB work, and no nests were found. Throughout the survey one pair of Oystercatchers were seen as well as two piping plovers. UXB completed work by April 20th and I ceased monitoring the site as a sub-contractor for UXB. Mass Audubon at Felix Neck continued with monitoring for the duration of the season. Please feel free to contact me at the email or telephone number below if you have any questions.

Sincerely,

Elizabeth Baldwin
Assistant Director BiodiversityWorks
PO Box 557
Edgartown, MA 02539
biodiversityworksliz@gmail.com
508-494-0061

PO Box 557
Edgartown, MA 02539

(508) 685 2578

www.biodiversityworksMV.org

Classification: UNCLASSIFIED
Caveats: NONE

Tim/Donna/Carol - Excellent subject discourse today to focus on what's really needed and practical in the field at this point in the project. Please revisit the EPP to extract the needed narrative as discussed.

I am attaching the Draft USFWS response letter that should not change too much in the final version. It appears that USFWS is taking the lead with MANHESP following.

The key to completion of our T&E consultations is to provide to both the USFWS/MANHESP our dig maps with the specific location that we will digging up in advance of any RI Phase 2 intrusive investigations. Since all three MRSs are essentially in Priority Habitats of Rare Species they will then check these locations against their potential habitat determinations and actual species occurrence records.

Besides avoiding the birds, at present they are focused on the potential impacts from our RI Phase 2 intrusive work on the Northeastern beach tiger beetle but it all depends on the dig sheet locations. Other concerns for other species may come up at this point but hopefully we have addressed all potential adverse impacts in the EPP by avoiding, minimizing and/or mitigating in our study design and implementation of the measures in the EPP.

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Finally, as discussed I have attached the OSV Driving Guide with an excellent diagram of the driving corridors.

More to follow.

Keep it simple stupid.

Thank you,
Bob

Robert W. Davis, M.S.
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Ecological Risk Assessor
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Classification: UNCLASSIFIED
Caveats: NONE

A Picture Guide to Interesting Flowering Plants

by Lloyd Raleigh
May 25, 1999

Bearberry (*Arctostaphylos uva-ursi*)

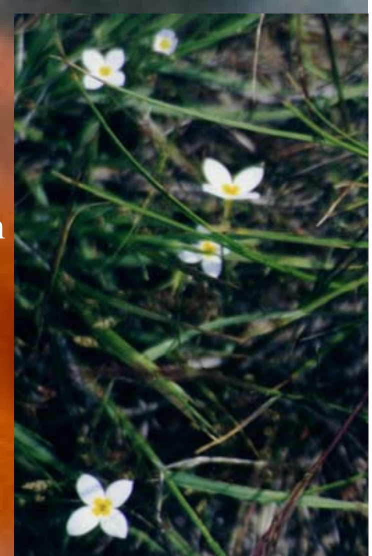
Heath Family

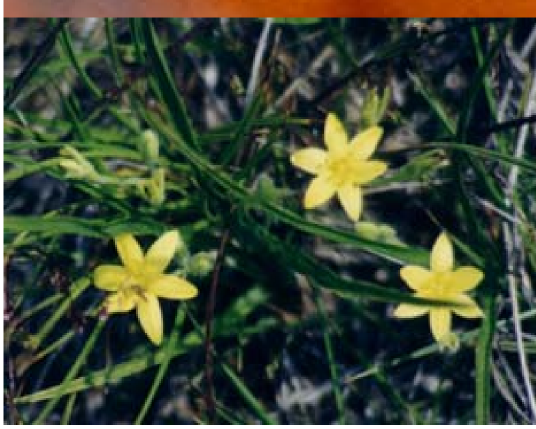
Heathlands at Wasque and Long Point are composed of many species. Some, such as Black Huckleberry, are highly flammable. Others such as Bearberry resist flames. A spring burn can char all vegetation surrounding Bearberry, while barely affecting this species (left). Bearberry forms low mats of dense vegetation and have flowers that are bell-shaped like blueberries (similar in part because they are in the same family). They produce large red fruits similar to cranberries (also a heath species), but they should not be eaten.

Bluets (*Hedyotis caerulea*)

Madder Family

This species is one of the first plants to flower in the spring. It continues to flower until the beginning of June. Bluets occur in open areas of sandplains, mainly where high soil disturbance has occurred. Like violets in the sandplains, these flowers are patchy, occurring in white patches across the landscape.

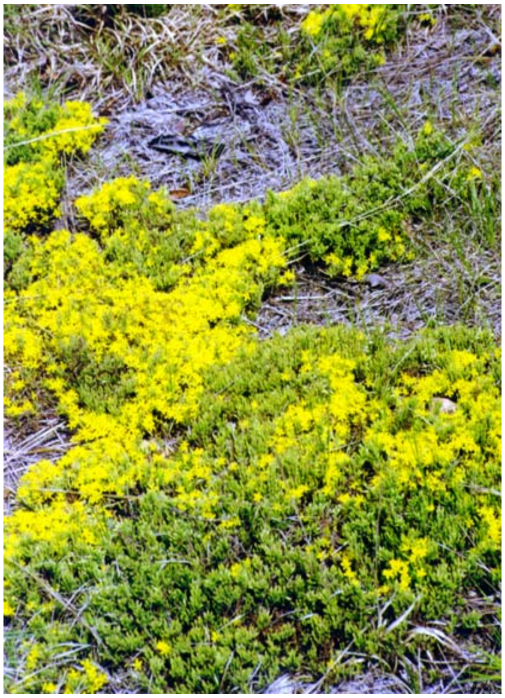




Yellow Stargrass (*Hypoxis hirsuta*)

Amaryllis Family

This species occurs at Long Point in only one known location where the soils are highly disturbed. It blooms in May and is found alongside Bluets in many cases.



Golden Heather (*Hudsonia ericoides*)

Rockrose Family

A low-lying shrub with yellow flowers, Golden Heather blooms beginning in May. This species is found in open areas of the sandplain grasslands and coastal heathlands.

Beach Plum (*Prunus maritima*)

Rose Family

Beach Plum blooms beginning in late May prior to leafing out. Fruit is picked in late summer to make jellies and is excellent for wildlife. This species occurs on well developed dunes or in sandy soils near the shore.

Scrub Oak (*Quercus ilicifolia*)

Beech Family

Blooming in late May, Scrub Oak is a common shrub in open areas. Many rare moth species feed on Scrub Oak as larvae (caterpillars). Scrub Oaks dominate frost bottoms, a glacial relict.

Late Lowbush Blueberry (*Vaccinium angustifolium*)

Heath Family

Three species of blueberries bloom in May. Their berries ripen in the summer. Late lowbush blueberry is low-lying and is abundant, especially at Wasque.

Nantucket Shadbush (*Amelanchier nantucketensis*)

Rose Family

Nantucket Shadbush blooms in May. This species is a rare shrub that occurs only on the Islands of Massachusetts. Shadbush bloom when the shad are arriving in the spring. It is common at Long Point and Wasque.

Dwarf Cinquefoil (*Potentilla canadensis*)

Rose Family

This small plant blooms beginning in early May or late April. This species is a common plant spreading through the sandplains. Its leaves are often mistaken for wild strawberry, which also occurs in these open habitats.

Chokeberry (*Aronia spp.*)

Rose Family

Two species of chokeberry exist in the sandplains: Red and Black Chokeberry. Both closely resemble one another. This species blooms beginning in May and is found in the sandplains along with other shrubs such as Northern Bayberry and Black Huckleberry.

Rockrose (*Helianthemum spp.*)

Rockrose Family

Four species of rockrose inhabit the sandplains. Each of these species is similar in that they all have bright yellow flowers. One of the four species, Bushy Rockrose, is a rare, state-listed plant. These species bloom in late May and early June.

Blackberry (*Rubus allegheniensis*)

Rose Family

Within the sandplains are brambles: dewberries and blackberries. These species all share similar flowers and berries, which are edible in late summer. Blackberries bloom beginning in late May.

Blue Toadflax (*Linaria canadensis*)

Figwort Family

Blue Toadflax is a common plant in the dunes of Cape Poge. It blooms beginning in May. The flowers are small, yet can be seen if one looks carefully.

Sandplain Blue-eyed Grass (*Sisyrinchium fuscatum*)

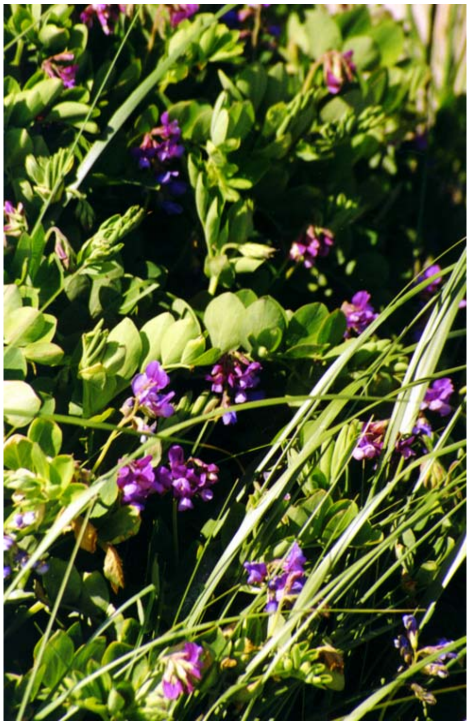
Iris Family

This is a rare species characteristic of the sandplains. It blooms beginning in June. Several species of blue-eyed grass occur on Martha's Vineyard, yet the Sandplain Blue-eyed Grass grows only in the sandplains, in more diverse, disturbed areas.

Yellow Thistle (*Cirsium horridulum*)

Composite Family

This thistle blooms in late May and June. It is a common species in the sandplains. The flower head is actually composed of hundreds of tiny flowers, each of which will produce a seed.



Beach Pea (*Lathyrus japonicus*)

Legume Family

This beach pea blooms beginning in June. Its nitrogen-fixing capabilities enrich the sterile soils of beach dunes. It occurs along with Beach Grass. Later in the summer, beans can be seen. They are edible.

Beach Heather (*Hudsonia tomentosa*)

Rockrose Family

This species is closely related to the Golden Heather found in the sandplains. Found in the foreground of this picture, Beach Heather grows in the sand dunes of Cape Poge. Pictured here is a dune near The Cedars.

Arrow-wood (*Viburnum dentatum*)

Honeysuckle Family

Native Americans made arrows from the narrow, straight branches of this shrub. Arrow-wood blooms in June and is abundant in the sandplains.

Field Thistle (*Cirsium discolor*)

Composite Family

This invasive exotic species blooms in July and is common throughout the sandplains. Its spiny leaves deter herbivores such as deer or grazing sheep.

Goat's Rue (*Tephrosia virginiana*)

Legume Family

Goat's Rue blooms in July and occurs in dense patches within the sandplains. Its flowers are creamy rose.

Wild Morning Glory (*Calystegia sepium*)

Morning Glory Family

This species blooms during the summer, predominately in July. It is found in shrubby areas in the sandplains, near dunes. This species is more common at Long Point.

Virginia Rose (*Rosa virginiana*)

Rose Family

Roses range from Virginia Rose to Salt-spray Rose. Most of these species bloom throughout the summer, predominately in July. Roses are abundant and form dense patches. The rose hips (fruit) are edible and high in Vitamin C.

Wild Indigo (*Baptesia tinctora*)

Legume Family

Wild Indigo blooms in mid summer. It is a common plant in open areas of the sandplains. In the fall, its stem breaks and the plant rolls around like tumbleweeds, dispersing its seed.

Pearly Everlasting (*Anaphalis margaritacea*)

Composite Family

This species blooms in August, yet retains its white blooms into the fall, as its seeds develop. This species favors grassy areas and is fairly common.

Yarrow (*Achillea millefolium*)

Composite Family

This species blooms in July and is commonly found in the sandplains at both Wasque and Long Point. It appears similar to Queen Ann's Lace, which is in the parsley family and occurs in richer meadows.

Sickle-leaved Golden Aster (*Chrysopsis falcata*)

Composite Family

This aster blooms throughout the late summer on dunes and within heavily disturbed areas of the sandplains. Little Copper and other insects (see photo) feed upon its nectar.

Racemed Milkwort (*Polygala polygama*)

Milkwort Family

This species blooms predominately in July in the sandplains, mainly in grassy areas. In this photograph it is blooming along with two common grasses of the sandplains: Sheep Fescue and Poverty Grass.

Wood Lily (*Lilium philadelphicum*)

Lily Family

Wood Lily occurs at Long Point in several locations. This species is more uncommon on our properties. It blooms in August.

Pokeweed (*Phytolacca americana*)

Pokeweed Family

Pokeweed occurs in more disturbed areas. Its small flowers bloom in the summer, but its purple berries in the fall are more conspicuous and provide food for birds. The berries are, however, toxic to humans.

Butterfly Weed (*Asclepias tuberosa*)

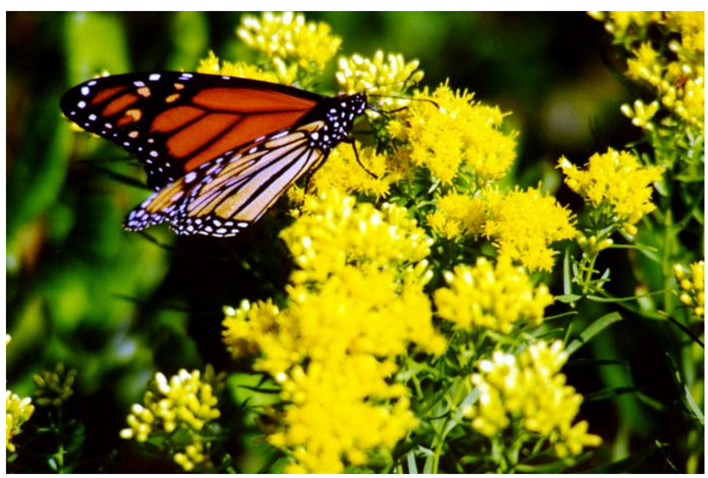
Milkweed Family

This species blooms in August and September, providing food for many insect species feeding on its nectar. It is uncommon at both Wasque and Long Point.

Grass-leaved and Lance-leaved Goldenrods (*Euthamia spp.*)

Composite Family

These two goldenrods are abundant throughout the sandplains, often associated with shrubs such as Northern Bayberry. Their leaves are long and thin, distinguishing them from other goldenrods.



Northern Blazing Star (*Liatris scariosa*)

Composite Family

This brilliant purple flower is common at Wasque. It is a rare species found only in open areas such as the sandplains and blooms in late summer and early fall.

Downy Goldenrod (*Solidago puberula*)

Composite Family

Downy Goldenrods are fairly common. They bloom in the sandplains in September.

Asters (*Aster spp.*)

Composite Family

Asters with purple flowers such as Showy Aster and Stiff Aster cover the sandplains with color in September. They occur in patches along with Little Bluestem, the tall brown grass in the background of this photo.

Asters (*Aster spp.*)

Composite Family

Asters with white flowers are also common in the sandplains. Several species exist, ranging from the Flat-topped Asters, which bloom during the peak of summer, to the Heath Aster, pictured here, which blooms in late summer.

Jointweed (*Polygonella articulata*)

Buckwheat Family

This species (pictured below) has very small white flowers which bloom in late summer. This species is common in sandy areas of Cape Poge and on the sandplains of Wasque.

Rough-stemmed Goldenrod (*Solidago rugosa*)

Composite Family

Rough-stemmed Goldenrod occurs in thick patches with large drooping flower clusters.

Seaside Goldenrod (*Solidago sempervirens*)

Composite Family

Seaside Goldenrod (left) is abundant on dunes and saltmarshes and is the last goldenrod to bloom. It blooms into October and is characterized by thick fleshy leaves.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January 20, 2011
Mr. Anthony T. Mackos
Engineering/Planning Division
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Mackos:

This responds to your December 15, 2010 letter requesting that we concur with your effects determination for federally listed species occurring at three Formerly Used Defense Sites (FUDS) at munitions response sites (MRS) under the Munitions Military Response Program on Martha's Vineyard, Massachusetts. Although your December 15 letter requested concurrence for Phase 1 and 2 of the Remedial Investigation, based on additional communications between Robert Davis of your staff and Susi von Oettingen of this office, we understand that the effects determinations of "not likely to adversely affect" the federally threatened piping plover (*Charadrius melodus*) and the endangered roseate tern (*Sterna dougalii dougalii*) is for Phase 1 and 2, while the determination of "not likely to adversely affect" the threatened Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) is solely for Phase 1 of the Remedial Investigation. Our comments are provided in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1533).

The Remedial Investigation (RI) for the FUDS will be undertaken at Cape Poge Little Neck Bomb Target MRS, the Moving Target Machine Gun Range at South Beach MRS and the Tisbury Great Pond MRS. Sandy beaches found within these project locations are extant or current habitat for piping plovers and roseate terns. Piping plovers may nest, roost and forage on the beaches of the three MRS; roseate terns nested at Norton Point in 2009 and 2010 and may be transient visitors to the other two beaches, primarily for roosting or loafing. The Northeastern beach tiger beetle occurs only at the Tisbury Great Pond MRS. Conservation measures have been incorporated in the proposed RI to minimize and avoid adverse effects to plovers, terns and tiger beetles including a time-of-year restriction for activities, tiger beetle larval habitat delineation by a qualified entomologist, use of an ATV for access and equipment transport and close coordination with biologists for The Trustees of Reservations for work done on their property to locate plovers, terns and tiger beetles and their habitat.

Phase 1 of the RI is the geophysical investigation to develop geophysical mapping survey data at each MRS, including the spatial delineation of the munitions and explosives of concern. The surveys will occur on-foot in 100 m transects where the physical beach configuration allows or will be tailored in eroded locations. Phase 2 of the RI requires more intrusive work in order to identify the nature of the munitions and explosives of concern, including hand digging in beach areas.

We recommend additional measures for Phase 1 of the RI to further avoid and minimize adverse impacts to piping plovers, roseate terns and Northeastern beach tiger beetles based on our review the Environmental Protection Plan (dated November 19, 2010), Chapters 3 and 7 of the *Remedial Investigation Work Plan, Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts*, electronic correspondence from Mr. Davis, and a telephone conference between Mr. Davis, Ms. von Oettingen, and Dr. Scott Melvin and Kristen Black of the Massachusetts Natural Heritage and Endangered Species Program. These measures include the following:

- Extend the April 1 to August 31 time-of-year restriction to include activities occurring on South Beach/Dune, Wasque Point Beach (including access to work proposed for the ocean adjacent to these beaches) and the ocean and beach of North-East to Simon Point (referred to in Table 7-3 Protected Avian Species No Work Windows) in order to avoid adverse effects to piping plovers and roseate terns attempting to establish breeding territories and nests.
- A qualified monitor must survey the area daily prior to any activities to locate plovers or terns that may be establishing territories and report the locations to the work unit should Phase 2 of the RI require additional work between April 1 and April 15 in piping plover or roseate tern habitat.
- Activities occurring within symbolically fenced areas (breeding habitat that has been fenced with stakes and twine) should be coordinated with a qualified piping plover/tern monitor in order to avoid disturbing birds. The monitor should accompany the work unit if it is determined that munitions and explosives of concern are located within the symbolic fencing (following standard safety protocols) and document piping plover and/or tern locations and behavior. Activities may need to be scheduled when birds are feeding (not present within the area).
- No work may occur after April 15 without additional consultation with this office.
- Findings relative to munitions and explosives of concern within Northeastern beach tiger beetle habitat must be reported immediately to this office to coordinate and minimize adverse effects resulting from invasive activities (i.e. Phase 2).

Northeastern beach tiger beetle larvae may occur at depths of 12 to 18 inches at Tisbury Great Pond and are not readily visible or easily located. Intrusive work including hand digging, could adversely affect larvae by destroying their burrows, accidentally moving them to unsuitable habitat (via sand transference) or killing them. Conservation measures identified in the Environmental Plan include: 1) the close supervision of Phase 2 activities, including hand digging, by Dr. Paul Goldstein, expert entomologist, 2) hand screening sand removed during the digging for larvae and relocation to suitable habitat under the Dr. Goldstein's supervision, and 3) time-of-year restriction that minimizes the likelihood of encountering tiger beetle larvae at the lower beach slope (during winter the larvae may be concentrated near the toe of the dunes). Although these activities minimize the likelihood of adverse effects to the tiger beetles, it is likely that larvae will be taken if digging occurs in occupied tiger beetle habitat and detonation of munitions and explosives of concern occur in place. Should munitions and explosives of concern be identified at Tisbury Great Pond beach within suitable tiger beetle habitat, further consultation with this office is required.

We concur with your determination of "not likely to adversely affect" for Phase 1 and Phase 2 of the RI for piping plovers and roseate terns if our recommendations outlined above are included in the project description and implemented. Time of year restrictions will avoid adversely affecting plovers and terns. Adverse effects will be insignificant for activities that may occur between April 1 and April 15 if the additional measures are incorporated to avoid disturbing birds (monitoring and minimizing time spent in symbolically fenced areas). We also concur with your "not likely to adversely affect" determination for Phase 1 of the RI for the Northeastern beach tiger beetle at the Tisbury Great Pond MRS; however, should munitions and explosives of concern be located within tiger beetle habitat, further consultation will be necessary in order to determine whether adverse effects will occur.

Thank you for your cooperation. Please contact Susi von Oettingen of this office at 603-223-2541, extension 22, if you have any questions or need additional assistance.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

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Wasque Ave
Bayview Ave
Washque Ave
Washqua Ave
EO 36
Image © 2010 TerraMetrics
Image MassGIS, Commonwealth of Massachusetts EOEA
© 2010 Google
©2009 Google
396 m
Imagery Date: Jul 29, 2007
41°21'07.87" N
70°27'26.68" W
elev 8 m
Eye alt 1.37 km

Classification: UNCLASSIFIED
Caveats: NONE

Tim/Donna - You should use the attached MANHSEP Fact Sheets as your references for the appropriate habitats that the protected shorebirds, i.e.
Piping plover, Roseate tern, Lease Tern, and Common tern may be found, along with the Northern harrier in the different habitats within our MRSs in Table 7-3. I also included the Northeastern beach tiger beetle (NEBTB) since it is their primary species in concern besides the aforementioned birds.

Tim Simmons/NHESP told me today that it would be very difficult for non-ornithologists to identify the protected tern species among the numerous tern species ones and hence their requirement for a "qualified piping plover/tern monitor." I also understand from Carol that TTOR conducts annual training in the early spring for their shorebird monitors that we will need to contact daily if our work goes beyond April 1st.

Finally, I will also be drafting a simple SOW for the expert Entomologist that UXB will need to hire to oversee the digging along Tisbury Great Pond beach for review/comment.

Take care,
Bob

-----Original Message-----
From: Davis, Robert W NAE
Sent: Wednesday, February 09, 2011 3:25 PM
To: 'tim.fischer@amec.com'; 'Donna Sharp (AMEC)'
Cc: Charette, Carol A NAE; 'Warminsky, Mike F. (UXB)'
Subject: Martha's Vineyard MMRP-RI EPP Field Addendum (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Tim/Donna/Carol - Excellent subject discourse today to focus on what's really needed and practical in the field at this point in the project. Please revisit the EPP to extract the needed narrative as discussed.

I am attaching the Draft USFWS response letter that should not change too much in the final version. It appears that USFWS is taking the lead with MANHESP following.

The key to completion of our T&E consultations is to provide to both the USFWS/MANHESP our dig maps with the specific location that we will digging up in advance of any RI Phase 2 intrusive investigations. Since all three MRSs are essentially in Priority Habitats of Rare Species they will then check these locations against their potential habitat determinations and actual species occurrence records.

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More to follow.

Keep it simple stupid.

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Classification: UNCLASSIFIED
Caveats: NONE

Natural Heritage
& Endangered Species
Program
Massachusetts Division of Fisheries & Wildlife
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www.nhesp.org

COMMON TERN (*Sterna hirundo*)

State Status: **Special Concern**
Federal Status: None

B. Byrne, MDFW

The Common Tern is a small seabird that returns in the spring from warmer locales to enliven Massachusetts beaches with its raucous cries. It is a gregarious and charismatic creature, joining its neighbors to boldly mob, peck, and defecate on intruders to drive them away from their nests, which are situated on the ground. Probably numbering in the hundreds of thousands in the state before 1870, the Common Tern is considerably more scarce today. Protection, management, and restoration of nesting colonies have allowed populations to gradually increase, but the Common Tern remains a Species of Special Concern in Massachusetts.

Description. The Common Tern measures 31-35 cm in length and weighs 110-145 g. Breeding adults have light gray upperparts, paler gray underparts, a white rump, a black cap, orange legs and feet, and a black-tipped orange bill. The tail is deeply forked and mostly white, and does not extend past the tips of the folded wings. In non-breeding adults, the forehead, lores, and underparts become white, the bill becomes mostly or entirely black, legs turn a dark reddish-black, and a dark bar becomes evident on lesser wing coverts. Downy hatchlings are dark-spotted buff above and white below with a mostly pink bill and legs. Juveniles are variable: they have a pale forehead, dark brown crown and ear coverts, buff-tipped feathers on grayish upperparts resulting in a scaly appearance, white underparts, pinkish or orangish legs, and a dark bill. The voice has a sharp, "irritable" timber, and includes a *keeuri* advertising call and *kee-arrrr* alarm call.

Similar Species in Massachusetts. The Arctic Tern (*Sterna paradisaea*) is similar in size, but has a shorter, blood-red bill, very short red legs, much grayer underparts with contrasting white cheeks, a longer tail that extends past the tips of the folded wings, and a higher-pitched voice (although some calls are similar). The Roseate Tern (*Sterna dougallii*) is also similar in size, but has a mostly or entirely black bill during the breeding season, much paler gray upperparts, white or very pale pink underparts, a very long tail (longer than that of the Arctic Tern), and a distinctively different voice. The Least Tern (*Sterna antillarum*) is markedly smaller, with a yellow-orange bill, a white forehead, and a proportionately much shorter tail.

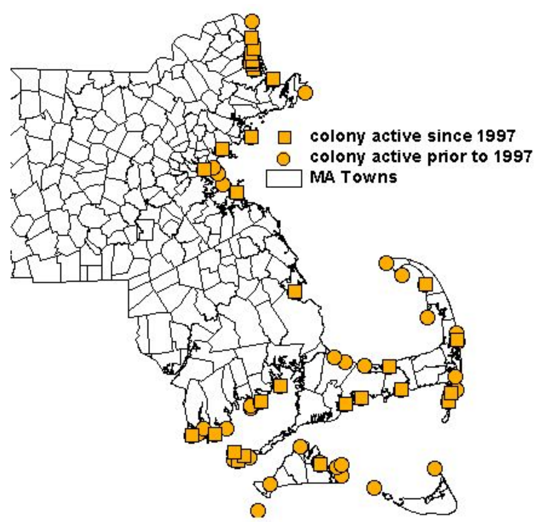

Figure 1. Distribution of present and historic Common Tern nesting colonies in Massachusetts.

Distribution and Migration. Outside the breeding season, the Common Tern is widely distributed primarily at temperate latitudes. It breeds in the northern hemisphere, principally in the temperate zones of Europe, Asia, and North America, and at scattered tropical and sub-tropical locations. In North America, it breeds along the Atlantic Coast from Labrador to South Carolina, and along lakes and rivers as far west as Montana and Alberta. Massachusetts birds arrive in April and May to nest at coastal locations statewide (Fig. 1). The largest populations occur on Cape Cod and in Buzzards Bay (see Status, below). Massachusetts birds depart from breeding colonies in July and August, and concentrate in "staging areas" around Cape Cod to feed before beginning their migratory journeys southward. Birds breeding on the Atlantic coast generally winter on the north and east coasts of South America as far south as northern Argentina.

Breeding and Foraging Habitat. In Massachusetts, the Common Tern generally nests on sandy or gravelly islands and barrier beaches, but also occurs on rocky or cobbly beaches and salt marshes. It prefers areas with scattered vegetation, which is used for cover by chicks. Along the Atlantic coast in the breeding area, it usually feeds within 1 km of shore, often in bays, tidal inlets, or between islands; it may forage as far as 20 km from the breeding colony.

Food Habits. The Common Tern feeds mainly on a wide variety of small fish; frequently it includes crustaceans and insects in its diet. The primary prey item in most Atlantic coast breeding colonies is the American sand lance. In Massachusetts, silversides, cunner, herring, pipefish, and hake are also important. Over water, it captures food by plunge-diving (diving from heights of 1-6 m and submerging to ≤ 50 cm), diving-to-surface, and contact-dipping; it catches flying insects on the wing. It often forages singly or in small groups, but it may congregate in feeding flocks of ≥ 1000 birds, especially over schools of predatory fish that drive smaller prey to the surface. It commonly feeds in association with Roseate and Arctic Terns, and sometimes gulls.

Breeding.

Phenology. Birds begin arriving in late-April or early-May. They select breeding sites and begin courting. Egg dates are 4 May – 15 August. Incubation lasts about 3 wk, and the nestling period about 3-4 wk. Most birds have departed for winter quarters by mid-October.

Colony. The Common Tern is gregarious, nesting in colonies of a few to thousands of pairs. It often breeds in colonies with Roseate and Arctic Terns, Black Skimmers (*Rynchops niger*) and, rarely, with the Least Tern. Pairs vigorously defend their nesting territory and sometimes also maintain a linear near-shore feeding territory. (See also Predation, below).

Pair bond and parental care. Courtship involves both aerial and ground displays, including High Flights (in which a pair spirals to 30-100 m above ground and then glides down), Low Flights (in which a fish-carrying male is chased by a female), Parading (circling on ground), and Scraping. Males feed females during courtship and early incubation. The Common Tern is socially monogamous, but sometimes seeks extra-pair copulations. While both parents incubate eggs and attend chicks, females do more incubating and brooding (especially at night), and males generally do more feeding. Birds of similar age tend to pair. Mate fidelity is high; data from Germany showed that two-thirds of pair bonds were retained from year-to-year; the rest were broken by death or divorce in approximately equal frequencies. Pair-bond durations of up to 14 years have been documented.

Nests. Nests are depressions or "scrapes" in the substrate, to which nesting material, usually dead vegetation or tide wrack, is added throughout incubation. Nest density is highly variable, but usually in the range of 0.06-0.5 nests/m^2.

Eggs. Eggs are cream, buff, or medium brown (sometimes greenish or olivish) with dark spots or streaks. Markings are often evenly distributed on the egg, but may be concentrated at the blunt end -- especially for the third egg of the clutch, which also may be paler than the first two. Eggs measure approximately 40 x 30 mm, and are subelliptical in shape. Clutch size is usually 2-3 eggs, occasionally 1 or 4. Incubation is sporadic until the clutch is complete. The period between laying and hatching is about 23 d for the first egg and about 22 d for the second and third eggs. Incubation shifts last anywhere from <1 min. to several hours.

Young. Chicks are semi-precocial. At hatching, they are downy and eyes are open. They are able to stand and take food within hours after hatching. They wander away from the nest to seek cover, but still remain in the territory, at 2-3 d. Chicks are brooded/attended most of the day and night for the first few days of life. Parental attendance drops off after that, except for cold, wet, or hot weather. Parents carry prey to chicks in their bills. Feeding rates vary by location, but are usually on the order of 1-2 feedings per chick per hour. Chicks fledge at 22 to > 29 d, but they remain at first within the colony and are still dependent on parents for food. After about a week, they venture out with parents to the feeding grounds, but are unable to catch fish for themselves until 3-4 wk post-fledging. Families leave the colony 10-20 d after chicks fledge and remain together during the staging period. Little is known of family cohesion during migration.

Predation.

Predators. In North America, predators of Common Tern eggs, young, and adults include a wide variety of birds and mammals, snakes, ants, and land crabs. Nocturnal mammals (especially fox, mink, and rat; sometimes skunk, raccoon, feral cat, weasel, and coyote) are the most important predators in mainland or near-shore colonies. Mammalian predation often causes birds to abandon the site. A local example of this is Plymouth Beach: in 1999, a family of foxes hunting on the beach displaced a thriving colony of about 5,000 pairs of mostly Common Terns. At islands further from the mainland, Great Horned Owl and Black-crowned Night-Heron are important predators. Herring and Great Black-backed Gulls, Short-eared Owl, American Crow, Ruddy Turnstone, Great Blue Heron, and Peregrine Falcon can also be significant predators.

Responses to predators and intruders. The Common Tern prefers to nest on islands lacking predatory mammals or reptiles. Eggs and chicks are cryptically colored. Hatched eggshells are removed from the nest site and feces are dispersed (the white of the feces and of the inner shell is obvious).

Behavioral response to diurnal predators is very variable, and depends on predator species and behavior, stage in nesting cycle, and degree of habituation to threat. Hunting Peregrine Falcons cause "panics", during which terns rapidly flee the nesting area and fly over the water; Peregrines may delay colony occupation. Many other diurnal predators (including crows, Herring and Great Black-backed Gulls, Northern Harriers, and Bald Eagles) are "mobbed" (chased and attacked) by terns. Common Terns distinguish between hunting and non-hunting gulls and falcons, and respond to them differently. Common Terns attack human intruders by diving at them, pecking exposed body parts, and defecating on them. Inexperienced birds may merely circle overhead and give alarm calls, whereas more experienced birds may launch intense attacks -- to which many researchers will attest. Common Terns also distinguish between individual humans, and familiar humans are attacked more vigorously. Attacks intensify as chicks begin to hatch, but diminish as chicks mature and become less vulnerable. Adults' alarm calls cause very young chicks (≤3 d) to crouch motionless, while older, more mobile chicks seek cover.

There is little information on how the Common Tern responds to nocturnal mammalian predators; however, nocturnal predation by owls and night-herons causes terns to abandon the colony at night. This has several consequences: prolonged incubation periods for eggs; chick deaths due to exposure; increased predation on eggs and chicks, particularly by night-herons and ants; and sometimes inattentiveness to eggs by day, which increases egg vulnerability to diurnal predators.

Life History Parameters. In Massachusetts, most Common Terns breed annually starting at 3 yr, some at 2 or 4 yr. As birds age, they nest progressively earlier in the season. Only one brood per season is raised, but birds renest 8-12 d after losing eggs or chicks. Productivity is highly variable, and may range from zero to > 2.5 chicks fledged per pair, depending on food availability, degree of flooding, and predation. Productivity increases with age through the lifetime of the bird. Survival from fledging to 4 yr was estimated at about 10% for Massachusetts birds. Annual survival of adults in Massachusetts was estimated about 90%. The oldest documented Common Terns are two individuals that bred at age 26 yr.

Status. The Common Tern is listed as a Species of Special Concern in Massachusetts. Populations are well below levels reported pre-1870, when hundreds of thousands are reported to have bred. Egging probably limited populations throughout the 1700s and 1800s. More seriously, hundreds of thousands were killed along the Atlantic coast by plume-hunters in the 1870s and 1880s, reducing the population to a few thousand at fewer than ten known sites by the 1890s. In Massachusetts, only 5,000 to 10,000 pairs survived, almost exclusively at Penikese and Muskeget Is. The state's population grew to 30,000 pairs by 1920, following protection of the birds in the early part of the century. Populations subsequently declined through the 1970s, reaching a low of perhaps 7,000 pairs, largely as a result of displacement of terns from nesting colonies by Herring Gulls and, later, by Great Black-backed Gulls. Since then, numbers have edged upwards (Figure 2). In 2005, 15,447 pairs nested at 34 sites in the state. About 90% of these birds were concentrated at just three sites: Monomoy National Wildlife Refuge (S. Monomoy and Minimoy Is)., Chatham (9,747 pairs); Bird I., Marion (1,857 pairs); and Ram I., Mattapoisett (2,278 pairs). While populations in the state are relatively well-protected during the breeding season, trapping of birds for food on the wintering grounds may be a source of mortality for Common Terns.

Conservation and Management. Populations in Massachusetts continue to be threatened by predators and displacement by gulls. Also, should established nesting colonies be disrupted, lack of suitable (*i.e.*, predator-free) alternative nesting sites is a serious concern in the state. Most colonies are protected by posting of signs, by presence of wardens, and/or by exclusion of visitors. Lethal gull control (initially), continual gull harassment, and predator control at S. Monomoy and Ram Is. have resulted in thriving tern colonies at these restored sites (see Status, above). Two other tern restoration projects are currently underway, both involving clearing gulls from small portions of islands. At Penikese I., in Buzzards Bay, after a pilot project in 1995, aggressive discouragement of gulls (using harassment by trained dogs and human site occupation) was initiated in 1998. The colony increased from 137 pairs of Common Terns in 1998 to 756 pairs in 2006. Non-lethal gull control at Muskeget I., in Nantucket Sound, began in 2000; however, the budding tern colony is struggling against predators. Tern restoration is a long-term commitment that requires annual monitoring and management to track progress, identify threats, manage vegetation, prevent gulls from encroaching on colonies, and remove predators.

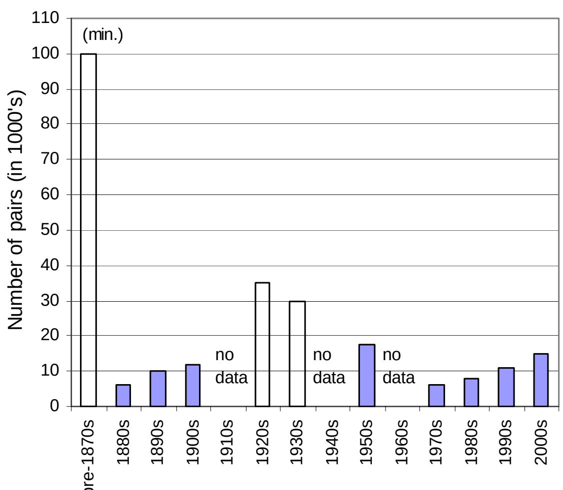

Figure 2. Common Tern population trends in Massachusetts, pre-1870s to 2005 (modified from Blodget and Melvin 1996).

References.

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Nisbet, I. C. T. (2002). Common Tern (*Sterna hirundo*). *In* The Birds of North America, No. 618 (A. Poole and F. Gill, eds.). Birds of North America, Inc., Philadelphia, PA.

Veit, R. R. and W. R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society. Lincoln, MA.

C. S. Mostello, 2007

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Route 135, Westborough, MA 01581
telephone: 508-389-6360; fax: 508-389-7891
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ROSEATE TERN (*Sterna dougallii*)

State Status: **Endangered**
Federal Status: **Endangered**

B. Byrne, MDFW

The elegant Roseate Tern, with its long, white tail-streamers and rapid flight, alights on Massachusetts beaches in the spring. It tunnels under vegetation to nest within colonies of its more rough-and-tumble relative, the Common Tern, from which it derives protection from intruders. The Roseate Tern is a plunge-diver that feeds mainly on the sand lance, and availability of this fish may influence the timing of breeding. Depredations of plume hunters in the 19th century and displacement from breeding sites by gulls and increased predation in the 20th century contributed to a decline in numbers and loss of major breeding sites in the northeast. In a sense, the Roseate Tern is emblematic of the Commonwealth, because for the past century, about half the northeastern population has nested in Buzzards Bay and outer Cape Cod. The Roseate is now considered an Endangered Species. The population, which increased from the 1980s through 2000, is now in decline. Several projects are in progress to restore the Roseate to historical breeding locations in Massachusetts.

Description. The Roseate Tern measures 33-41 cm in length and weighs 95-130 g. Breeding adults have pale gray upperparts, white underparts (flushed with pale pink early in the breeding season), a black cap, orange legs and feet, and a black bill (which becomes more red at the base as the season progresses). The tail is mostly white, and is deeply forked with two very long outer streamers, which extend well past the tips of the folded wings. In non-breeding adults, the forehead becomes white and the crown becomes white marked with black, merging with a black patch that extends from the eyes back to the nape. The down of hatchlings is distinctive: it is grizzled buff/black or gray/black, and is spiky-looking because the down filaments are gathered at the tips. Juveniles are buff or gray above, barred with black chevrons, and have a mottled forehead and crown, black eye-to-nape patch, and black bill and legs. The Roseate's vocal array includes a high-pitched *chi-vik* advertising call, and musical *kliu* and raspy *aaach* alarm calls, the latter sometimes likened to the sound of tearing cloth.

Similar Species in Massachusetts. The Common Tern (*Sterna hirundo*) is similar in size, but has a black-tipped orange bill, darker gray upperparts, pale gray underparts, a shorter tail that does not extend beyond the folded wingtips, and an "irritable" voice. The Arctic Tern (*Sterna paradisaea*) is also similar in size, but has a shorter, blood-red bill, very short red legs, gray underparts with contrasting white cheeks, a shorter tail (which still extends past the folded wingtips), and a very different, high-pitched voice. The Least Tern (*Sterna antillarum*) is markedly smaller, with a yellow-orange bill, a white forehead, and a short tail.

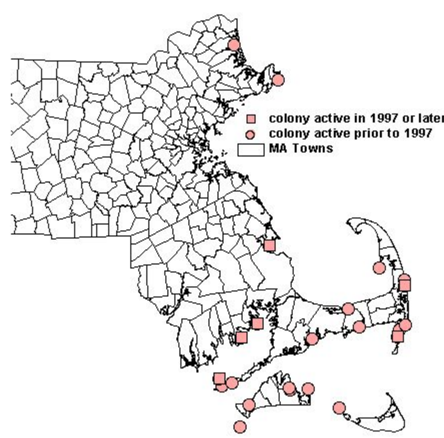

Figure 1. Distribution of present and historic Roseate Tern nesting colonies in Massachusetts.

Distribution and Migration. The Roseate Tern has a scattered breeding distribution primarily in the tropical and sub-tropical Atlantic, Indian, and Pacific Oceans. In North America, it breeds in two discrete populations: from Nova Scotia south to New York and in the Caribbean. The northeast population, at about 40-45° N, is among the most northernmost nesting groups of this mostly tropical species. Roseates arrive in Massachusetts from late-April to mid-May to nest at just a handful of coastal locations (Fig. 1). The largest colonies occur in Buzzards Bay (see Status, below). Massachusetts birds depart from breeding colonies in late-July and August and concentrate in "staging areas" around Cape Cod and the Islands, before departure for wintering grounds in September. Roseates appear to feed offshore and return to the staging areas to rest and roost. Most have departed staging areas and have begun migrating southward by mid- to late-September. The Roseate's wintering range remains poorly known, but increasing evidence indicates that Northeastern birds winter along the north and east coasts of South America southward along the coast of Brazil to approximately 18° S.

Breeding and Foraging Habitat. In Massachusetts, the Roseate Tern generally nests on sandy, gravelly, or rocky islands and, less commonly, in small numbers at the ends of long barrier beaches. Compared to the Common Tern, it selects nest sites with denser vegetation, such as seaside goldenrod and beach pea, which is also used for cover by chicks. Large boulders are used for cover at other locations in the northeast. It feeds in highly specialized situations over shallow sandbars, shoals, inlets or schools of predatory fish, which drive smaller prey to the surface. The Roseate is known to forage up to 30 km from the breeding colony.

Food Habits. The Roseate Tern feeds almost exclusively on small fish; occasionally it includes crustaceans in its diet. It is fairly specialized, consuming primarily sand lance (about 70% of diet in Massachusetts). Other prey species of importance in Massachusetts are herrings, bluefish, mackerel, silversides, and anchovies. In the northeast, it often forages with Common Terns. The Roseate captures food mainly by plunge-diving (diving from heights of 1-12 m and often submerging to ≥ 50 cm), but also by surface-dipping and contact-dipping. Some individuals specialize in stealing fish from Common Terns.

Breeding.

Phenology. Roseates usually begin to arrive in Massachusetts in late-April or the first week of May. Egg dates are 12 May to 18 August, and laying usually begins about 8 d later than that of Common Terns in the host colony. Incubation lasts about 3 wk, and the nestling period about 4 wk.

Colony. The Roseate Tern is gregarious. In the northeast it nests in colonies of a few to about 1,700 pairs, and the largest colony in Massachusetts numbers about 1,100 pairs (see Status, below). In this portion of its range, the Roseate invariably nests with the Common Tern, forming clusters or sub-colonies within larger Common Tern colonies. Pairs defend their nest site. (See also Predation below).

Pair-bond. Courtship involves both aerial and ground displays, including spectacular High Flights (in which ≥ 2 birds spiral up to 30-300 m above ground and then descend in a zig-zag glide), and Low Flights (in which a fish-carrying male is chased by up to 12 other birds). Males feed females before and during the egg-laying period. The Roseate Tern is socially monogamous, but extra-pair copulations occur. Both parents spend roughly equal amounts of time incubating, and incubation shifts last about 26 min. Males and females also contribute approximately equally to brooding and feeding chicks. The average length of pair bonds in Connecticut was 2.5 yr. The sex ratio in Massachusetts (and probably other northeast colonies) is skewed towards females (1.27 females:1 male). This results in multi-female associations (≥ 2 females), and often ≥ 3-egg clutches, at nests.

Nests. Nests (usually beneath vegetation or debris, or in special nest boxes) are depressions or "scrapes" in the substrate, to which nesting material may or may not be added throughout incubation. In the northeast, nests are usually 50-250 cm apart, depending on the distribution of vegetation and rocks.

Eggs. Eggs are various shades of brown with dark spots and streaks. The second egg may be paler than the first. Eggs measure approximately 43 x 30 mm, and are subelliptical in shape. The eggs are difficult to distinguish from those of the Common Tern, but Roseate eggs are generally longer, more conical, less rounded, darker, and more uniformly and finely spotted. Clutch size is usually 1-2 eggs; older females generally lay 2 eggs (laid about 3 d apart), and younger females, 1. Nests with ≥ 3 eggs are often attended by more than one female. Incubation, which begins after laying of the first egg, may be sporadic until the second egg is laid. The period between laying and hatching is about 23 d for both eggs.

Young. Chicks are semi-precocial. They are downy at hatching. Eyes open after a couple hours, and chicks are able to waddle and take food within hours after hatching. In 2-chick broods, there is often a substantial size difference between the young that persists throughout the growth period; this is because the first chick (*A*-chick) is usually 3 d older. Chicks are brooded/attended most of the day and night for the first few days of life. Parental attendance ceases after about a week, except for cold, rainy days. Parents carry prey to chicks in their bills one fish at a time. Feeding rates at sites in Massachusetts and Connecticut are about 1 fish/h. At sheltered nests, undisturbed chicks may remain at the nest site until they are nearly fledged. Where there is more disturbance, chicks may move more than 60 m away to new hiding spots. In 2-chick broods, the younger chick (*B*-chick) is less likely to survive than the *A*-chick. Most losses of *B*-chicks appear to be due to starvation. The peak of fledging is at 27-30 d. Four to 10 d after fledging, young birds accompany parents to fishing grounds. They begin to catch fish after 3 wk, but remain dependent on parents for food at least 6 wk, or until migration in September. This notably long period of dependence reflects the highly specialized fishing techniques that the young must master. At Bird I., MA, family units depart the nesting colony 5-15 d post-fledging to congregate at staging locations. When two chicks are raised, the male leaves first with the older chick and the female leaves up to 7 d later with the younger chick. Nothing is known of family cohesion during migration.

Predation.

Predators. In North America, predators of Roseate Tern eggs, young, and adults include birds and mammals, snakes, ants, and land crabs. In the northeast, the Great Horned Owl is the primary predator on adults, and predation on adults by the Peregrine Falcon has also been documented. Other significant avian predators (on eggs or chicks) include: Black-crowned Night-Heron, Herring and Great Black-backed Gulls, American Crow, and Red-winged Blackbird.

Responses to predators and intruders. The Roseate Tern prefers to nest on islands lacking mammalian predators. Eggs and chicks are cryptically colored and well-concealed under vegetation, debris, or rocks. Roseates are less aggressive birds than Common Terns, and rely on Commons for defense in the nesting colony. Attack rate peaks at hatching. Roseates dive at, and sometimes strike, various avian predators. Roseates circle above humans and dive at them, but do not make physical contact or defecate on them. Roseates in the Caribbean have been shown to respond more vigorously to familiar *versus* unfamiliar humans. As is the case for Common Terns, Roseates desert colonies at night when subject to nocturnal predation. This prolongs incubation periods for eggs, and exposes eggs and chicks to the elements and predation. Roseate nests and chicks, however, are better concealed, and thus less vulnerable, than those of Common Terns. Roseate adults, in contrast, are often disproportionately preyed upon in comparison to Common Terns from the same colony. Perhaps for this reason Roseates are quicker to abandon a site when predators are active.

Life History Parameters. In Massachusetts, most Roseate Terns breed annually starting at 3 yr, some at ≥ 4 yr. Only one brood per season is raised, but birds renest after losing eggs or chicks. Estimating productivity is challenging due to inaccessible nest sites and chicks' hiding behavior, but productivity usually exceeds 1 chick fledged per pair (range: 0-1.6 chicks fledged per pair); older birds are more productive than younger ones. Survival from fledging to first breeding was estimated at about 20% for Connecticut birds. Annual survival of adults in the northeast was estimated to be about 80%. The oldest Roseate Tern documented was 25.6 yr old; it was originally banded as a chick in Massachusetts.

Status. The northeastern population of the Roseate Tern is listed as Endangered federally and in Massachusetts principally because of its range contraction and secondarily because of its declining numbers. Prior to 1870, its status was somewhat obscure, but the Roseate was considered to be an abundant breeder within Common Tern colonies on Nantucket and Muskeget Is., MA. Prior to the 20th century, egging was a problem in northeast colonies, but it was persecution of terns for the plume industry that greatly reduced numbers in the northeast to perhaps 2,000 pairs, mostly at Muskeget and Penikese Is., MA, by the 1880s. Following protection, numbers rose to the 8,500 pair level in 1930. From the 1930s through the 1970s, Roseates were displaced from nesting colonies by Herring and Great Black-backed Gulls, and had declined to 2,500 pairs by 1979. Following two decades of fairly steady increase, the Northeast U.S. population peaked at 4,310 pairs in 2000. Since then, however, the population has declined rapidly to 3,320 pairs (Roseate Tern Recovery Team, unpubl. 2006 data). The cause of this has not been identified, but data suggest that it may be related to mortality on the wintering grounds. Approximately 85% of the population is dangerously concentrated at just 3 colonies: Great Gull Island, NY (1,227 pairs); Bird I., Marion, MA (1,111); and Ram I., Mattapoisett, MA (463). The only other nesting colonies in Massachusetts in 2006 were at Penikese I. (48 pairs) and Monomoy National Wildlife Refuge (NWR) (S. Monomoy and Minimoy Is)., Chatham (26 pairs).

Desertion of ≥ 30 major breeding sites over the past 80 years in most cases has been related to occupation of sites by gulls, and secondarily, to predation in the colonies (which may have intensified as terns were displaced by gulls to sites closer to the mainland). While populations in the state receive protection during the breeding season, the species is unprotected by South American governmental entities and while in international waters. Prior to the 1980s, persecution by humans (trapping for food) on the wintering grounds may have affected Roseates nesting in the northeast. Major wintering areas for this population have not been identified; this, along with investigation of current threats on the wintering grounds, is badly needed.

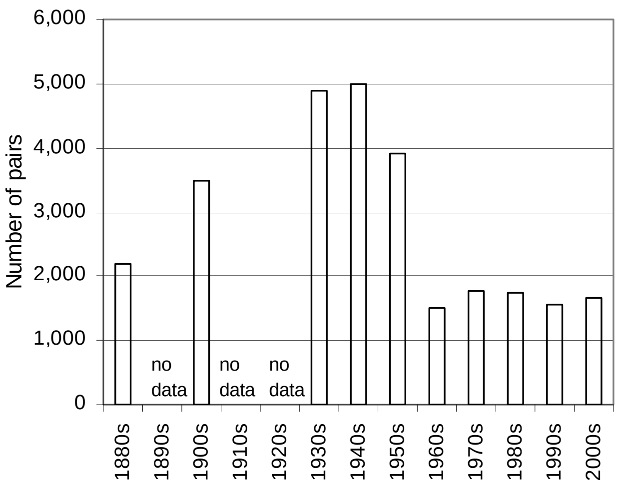

Figure 2. Roseate Tern population trends in Massachusetts, 1880s to 2006 (modified from Blodget and Melvin 1996).

Conservation and Management. Colonies are protected by posting of signs, by presence of wardens, and/or by exclusion of visitors. Wooden nest boxes and boards, partially buried tires, and other structures enhance the number of potential nest sites. Vegetation control is sometimes necessary when plant growth is dense enough to actually impede adults' ability to access nesting sites. The gradual loss of breeding sites in the Northeast, coupled with the Roseate's reluctance to colonize new sites, is a serious obstacle to recovery of the northeast population. The current overwhelming concentration of Roseates in Massachusetts in just two colonies in Buzzards Bay (Bird and Ram Is.), despite suitable conditions elsewhere, does not bode well for the population should one of these sites become unsuitable. Because of the regional importance of Massachusetts for Roseate recovery, several restoration projects have been initiated in the state. Restoring Common Terns to nesting sites is a necessary first step in restoring Roseates because of the Roseate's close association with the Common Tern at breeding colonies. Roseates were successfully restored to Ram I. after a gull control program in 1990-1991. A similar program at Monomoy NWR, begun in 1996, encouraged the expansion of a huge colony of Common Terns (9,747 pairs in 2005), but only a handful of Roseates nest there. Two other tern restoration projects -- at Penikese I., in Buzzards Bay, and at Muskeget I., in Nantucket Sound -- are currently underway, both involving aggressive discouragement of gulls from small portions of the islands; Roseates returned to Penikese in 2003, but numbers have fluctuated widely since then. Tern restoration is a long-term commitment that requires annual monitoring and management to track progress, identify threats, manage vegetation, prevent gulls from encroaching on colonies, and remove predators.

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C. S. Mostello, 2007

Partially funded by the New Bedford Harbor Trustee Council

Classification: UNCLASSIFIED
Caveats: NONE

Good day Scott Melvin/MANHESP & Susi von Oettingen/USFWS - On behalf of Carol Charette, USCAE Project Manager, I am sending this email to continue our subject informal consultation efforts and to notify you that we have experienced delays in execution of our field program, and will be working in actual or potential protected shorebird habitats from April 1st - April 15th, 2011 and beyond.

Attached please find the revised version of Sections 7.3.12.3 and 7.3.12.4 from our Environmental Protection Plan that is being implemented today. As required in the attached protocols our Contractor, UXB, will be coordinating their field activities daily by contacting the respective shorebird monitor(s) for TTOR, BioDiversityWorks and MVLBC when working in these habitats. I will also be forwarding to all shortly a revised Table 7-3 with the updated field schedule.

Please review the attached protocols that USCAE developed collaboratively to protect the shorebirds eggs and chicks, and provide any additional measures to clarify the criteria for the shorebird monitors when UXB MUST stop work (e.g. on pre-nest preparation) to prevent a violation of the Endangered Species Acts.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

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Classification: UNCLASSIFIED
Caveats: NONE

ADDENDUM 1 TO
ENVIRONMENTAL PROTECTION PLAN
for

Remedial Investigation (RI) at Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS Martha's Vineyard

WORKER FIELD MANUAL
REVISED 1 April, 2011

Deleted: *Draft 24 March*

7.3.12.3 Environmental Requirements and Protocols by TTOR and Others for Protected Avian Shorebird Species

As stewards of the environment TTOR, Martha's Vineyard Land Bank Commission (MVLBC) and other involved stakeholders place symbolic fencing each spring in all potential shorebird habitat beginning in April. The fencing is placed from the toe of the dune throughout much of the open facing beach. Symbolic fencing is 5-6 ft stakes placed about 15 ft apart. The stakes are inserted to a sufficient depth to support twine tied 4 ft from the ground. Symbolic fencing is placed parallel to the toe of the dune at Tisbury Great Pond Barrier Beach, Norton Point Beach, and any other potential shorebird nesting areas. This fencing will also protect the larval habitat of the Northeastern Beach Tiger Beetle since they are co-located. Motor vehicles are excluded from the beach habitat throughout the nesting season from April 1- August 31. This means the elimination of public vehicles in the vicinity of chicks while there are chicks on the beach and greatly limiting all use of essential vehicles used by others and by TTOR for their managed properties. Norton Point Beach was closed for most of the summer in 2010 due to the presence of protected nesting birds. TTOR also used wire mesh fencing to surround the tern colony on Norton Point Beach in 2010, and electric fencing may be used in 2011 to protect some nesting areas, especially on Norton Point Beach.

To lessen impact on these Federal and State -listed avian species all field activities including preparation and staging should occur when these species are not present and/or be coordinated daily starting April 1, 2011 with the qualified shorebird monitor as described below. Proper field schedule design will also alleviate any potential impacts on these species through avoidance by working outside of their nesting season. Table 7-3, Protected Avian Species No Work Windows provides the windows for the shorebirds and Northern harrier by MRS, Land Categories and Habitat.

The additional measures to further avoid and minimize adverse impacts to piping plovers and roseate terns as stated in the USFWS response letter dated February, 8, 2011 follows.

1) "Extend the April 1 to August 31 time-of-year restriction to include activities occurring on South Beach/Dune, Wasque Point Beach (including access to work proposed for the ocean adjacent to these beaches) and the ocean and beach of North-East (Cape Poge) to Simon Point referred to in Table 7-3, Protected Avian Species No Work Windows, revised January 28, 2011,

and sent to our office on February 4, 2011) in order to avoid adverse effects to piping plovers and roseate terns that may be establishing breeding territories and nests.

2) A qualified monitor must survey the area daily prior to any activities to locate plovers or terns that may be establishing territories and report the locations to the work unit should Phase 2 of the RI require additional work between April 1 and April 15 in piping plover or roseate tern habitat.

3) Activities occurring within symbolically fenced areas (breeding habitat that has been fenced with stakes and twine) should be coordinated with a qualified piping plover/tern monitor in order to avoid disturbing birds. The monitor should accompany the work unit if it is determined that munitions and explosives of concern are located within the symbolic fencing (following standard safety protocols) and document piping plover and/or tern locations and behavior. Activities may need to be scheduled when birds are feeding (not present within the area)

4) No work may occur after April 15 without additional consultation with this office."

NOTE: In all cased the proposed work must be evaluated as to whether it should be moved to a location outside the nesting area. Approval must be obtained from the monitor prior to proceeding with any work in shorebird nesting areas, whether inside or outside the fenced areas.

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7.3.12.4 Daily Protocol for Remedial Investigation Field Operations at TTOR Managed Properties at Cape Poge Wildlife Refuge (including East Beach Chappaquiddick Island, Little Neck, Wasque Point Beach), Norton Point Beach, Long Point Wildlife Refuge AND at South Beach and Tisbury Great Pond Beach During the Shorebird Nesting Season April 1-August 31, 2011

Nesting Piping Plovers & Other Shorebirds of Concern

For TTOR managed properties, starting on April 1, 2011 by 1000 hours daily, the UXB on-site UXO supervisor will contact the Martha's Vineyard Assistant Superintendent Paul Shultz (Radio Call Sign: Trustees 16) via VHF radio channel 159.465 MHz or cell phone (774-563-0921) for the Cape Poge Wildlife Refuge, Long Point Wildlife Refuge and Norton Point Beach to discuss the last known location of any piping plover nests, feeding piping plover adults or chick locations, and any other protected shorebird species as provided by their qualified shorebird monitors.

Similarly for all other properties starting April 1, 2011 (excluding MVLBC properties), UXB will coordinate their activities daily with their qualified shorebird monitor, Luanne Johnson, Director/Wildlife Biologist, BiodiversityWorks, Edgartown, MA (508-685-2578). BiodiversityWorks will be responsible for monitoring and/or coordinating with the private property owners on Tisbury Great Pond Beach and at South Beach between left and right fork (area not covered by the TTOR shorebird monitor).

Deleted: including the Martha's Vineyard Land Bank Commission (Julie Russell, Ecologist)

For the MVLBC properties on Tisbury Great Pond Beach, UXB will coordinate their activities daily with their qualified shorebird monitor, Julie Russell, Ecologist, MVLBC, Edgartown, MA (508-627-7141).

Vehicle Travel Restrictions. In the opinion of the Shorebird Technicians, if vehicle access presents the potential for adverse impact to shorebird resources they will so notify Martha's Vineyard Assistant Superintendent Paul Shultz daily by 1000 hours. For TTOR properties, Paul Shultz will take any and all measures necessary to assure vehicle access in these areas will not create situations where nesting piping plovers or roseate terns are impacted from passing vehicles, per the Massachusetts Shorebird Protection Guidelines. Similarly, UXB will work closely with their Shorebird Monitors for Tisbury Great Pond Beach and South Beach.

Deleted:

If unfledged chicks are present in the area, only Essential Vehicles will be allowed into the vehicle exclusion area per Massachusetts or USFWS Shorebird Protection Guidelines. UXB vehicles will be treated as Essential Vehicles and will be required to access the impacted area with a TTOR and/or UXB and/or MVLBC Shorebird Monitor present. Logging into and out of the area is also required per the Guidelines noted herein.

Unfledged Piping Plovers. UXB will be required to follow the same vehicle guidelines as the general public. If vehicle corridors are open to the public, UXB would also have access. In the event of vehicle closures due to the presence of unfledged piping plovers, UXB will follow the state and federal provisions for "essential vehicles." Namely:

1. Essential vehicles will travel through chick habitat areas only during daylight hours, and will be guided by a qualified monitor who has first determined the location of all unfledged plover chicks.

2. Speed of vehicles will not exceed five miles per hour.

3. A log will be maintained by the respective shorebird monitor for each beach area of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers will maintain and regularly update a log of the numbers and locations of unfledged plover chicks on each beach. Drivers of essential vehicles will review the log each day to determine the most recent number and location of unfledged chicks.

Reporting Requirements for Mortality of Piping Plover during Intrusive Investigations

In the unlikely event that a piping plover (or roseate tern) chick or adult fatality is discovered during the removal of explosives, whether associated with or the result of our work or not, the following special agent of the U.S. Fish and Wildlife Office of Law Enforcement should be immediately contacted:

David N. Sykes

Resident Agent in Charge
Office of Law Enforcement
U.S. Fish and Wildlife Service
70 Everett Avenue, Suite 315
Chelsea, MA 02150-2363
Phone: 617-889-6616 x 15Fax: 617/889-1980

Revised by:
Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751
978-318-8236/FAX: 318-8560
robert.w.davis@usace.army.mil

Bob: These protocols look OK to me, thanks. Luanne and Liz, Julie, and TTOR folks, be sure and let me and Susi know if you have any issues with these, or activities in the field. Thanks.

Scott

Scott M. Melvin, Ph.D
Senior Zoologist
Natural Heritage and Endangered Species Program Massachusetts Division of Fisheries and Wildlife Rte. 135, Westborough, MA 01581
508-389-6345 (off.)
508-389-7891 (fax)
scott.melvin@state.ma.us

-----Original Message-----
From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Friday, April 01, 2011 2:10 PM
To: Scott Melvin (MANHESP); Susi von Oettingen (USFWS)
Cc: Charette, Carol A NAE; Warminsky, Mike F.; Chris Mazur (UXB); BiodiversityWorks@gmail.com; Liz Baldwin; Paul Schultz (TTOR); Julie Russell (MVLBC); Kristin E. Black (MANHESP)
Subject: Martha's Vineyard MMRP-RI/FS - Informal Consultation Shorebird Monitoring Protocols (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Good day Scott Melvin/MANHESP & Susi von Oettingen/USFWS - On behalf of Carol Charette, USCAE Project Manager, I am sending this email to continue our subject informal consultation efforts and to notify you that we have experienced delays in execution of our field program, and will be working in actual or potential protected shorebird habitats from April 1st - April 15th, 2011 and beyond.

Attached please find the revised version of Sections 7.3.12.3 and 7.3.12.4 from our Environmental Protection Plan that is being implemented today. As required in the attached protocols our Contractor, UXB, will be coordinating their field activities daily by contacting the respective shorebird monitor(s) for TTOR, BioDiversityWorks and MVLBC when working in these habitats. I will also be forwarding to all shortly a revised Table 7-3 with the updated field schedule.

Please review the attached protocols that USCAE developed collaboratively to protect the shorebirds eggs and chicks, and provide any additional measures to clarify the criteria for the shorebird monitors when UXB MUST stop work (e.g. on pre-nest preparation) to prevent a violation of the Endangered Species Acts.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
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Concord, MA 01742-2751
978-318-8236/FAX: 318-8560
robert.w.davis@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Monday, April 18, 2011 4:11 PM
To: Melvin, Scott (FWE); Susi von Oettingen (USFWS); Kristin E. Black (MANHESP)
Cc: Carol Charette; Warminsky, Mike F.; Mazur, Chris D.; BiodiversityWorks@gmail.com; Liz Baldwin; Paul Schultz (TTOR); Chris Buelow; Julie Russell (MVLBC)
Subject: Martha's Vineyard MMRP-RI/FS - Informal Consultation Shorebird Monitoring Protocols + Current Table 7-3 (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Scott/Susi - Attached please find revised Table 7-3 (updated 4-10-11) from the Environmental Protection Plan that was expanded to include the current status of our Anomaly Dig Schedule (start/end) for the RI Phase 2 investigations. I also attached the current version of the subject protocol after accepting the revisions.

UXB has completed their Phase 2 work in all "Beach" Land Categories/Habitats by April 15, 2011 as shown in Table 7-3. However, they are behind schedule in regards to the inland water transects and ocean transects as a result of climatic conditions this past winter and safety diving issues.

Consequently they will continue to use their qualified shorebird monitors for all Land Categories/Habitats in Table 7-3 that they will be working on that have a Apr 1 - Aug 31 No Work Window or Potential No Work Window accordingly.

Take care,
Bob Davis/USACE
DERP-FUDS Environmental Compliance Manager
978-318-8236

-----Original Message-----
From: Melvin, Scott (FWE) [mailto:Scott.Melvin@state.ma.us]
Sent: Monday, April 04, 2011 3:16 PM
To: Davis, Robert W NAE
Cc: Charette, Carol A NAE; Warminsky, Mike F.; Chris Mazur (UXB); BiodiversityWorks@gmail.com; Liz Baldwin; Paul Schultz (TTOR); Julie Russell (MVLBC); Kristin E. Black (MANHESP); Susi von Oettingen (USFWS); Chris Buelow
Subject: RE: Martha's Vineyard MMRP-RI/FS - Informal Consultation Shorebird Monitoring Protocols (UNCLASSIFIED)

Bob: These protocols look OK to me, thanks. Luanne and Liz, Julie, and TTOR folks, be sure and let me and Susi know if you have any issues with these, or activities in the field. Thanks.

Scott

Scott M. Melvin, Ph.D
Senior Zoologist
Natural Heritage and Endangered Species Program Massachusetts Division of Fisheries and Wildlife Rte. 135, Westborough, MA 01581

508-389-6345 (off.)
508-389-7891 (fax)
scott.melvin@state.ma.us

-----Original Message-----
From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Friday, April 01, 2011 2:10 PM
To: Scott Melvin (MANHESP); Susi von Oettingen (USFWS)
Cc: Charette, Carol A NAE; Warminsky, Mike F.; Chris Mazur (UXB);
BiodiversityWorks@gmail.com; Liz Baldwin; Paul Schultz (TTOR); Julie Russell (MVLBC); Kristin E. Black (MANHESP)
Subject: Martha's Vineyard MMRP-RI/FS - Informal Consultation Shorebird Monitoring Protocols (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Good day Scott Melvin/MANHESP & Susi von Oettingen/USFWS - On behalf of Carol Charette, USCAE Project Manager, I am sending this email to continue our subject informal consultation efforts and to notify you that we have experienced delays in execution of our field program, and will be working in actual or potential protected shorebird habitats from April 1st - April 15th, 2011 and beyond.

Attached please find the revised version of Sections 7.3.12.3 and 7.3.12.4 from our Environmental Protection Plan that is being implemented today. As required in the attached protocols our Contractor, UXB, will be coordinating their field activities daily by contacting the respective shorebird monitor(s) for TTOR, BioDiversityWorks and MVLBC when working in these habitats. I will also be forwarding to all shortly a revised Table 7-3 with the updated field schedule.

Please review the attached protocols that USCAE developed collaboratively to protect the shorebirds eggs and chicks, and provide any additional measures to clarify the criteria for the shorebird monitors when UXB MUST stop work (e.g. on pre-nest preparation) to prevent a violation of the Endangered Species Acts.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
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robert.w.davis@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

ADDENDUM 1 TO
ENVIRONMENTAL PROTECTION PLAN
for

Remedial Investigation (RI) at Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS Martha's Vineyard

WORKER FIELD MANUAL
REVISED 1 April 2011

7.3.12.3 Environmental Requirements and Protocols by TTOR and Others for Protected Avian Shorebird Species

As stewards of the environment TTOR, Martha's Vineyard Land Bank Commission (MVLBC) and other involved stakeholders place symbolic fencing each spring in all potential shorebird habitat beginning in April. The fencing is placed from the toe of the dune throughout much of the open facing beach. Symbolic fencing is 5-6 ft stakes placed about 15 ft apart. The stakes are inserted to a sufficient depth to support twine tied 4 ft from the ground. Symbolic fencing is placed parallel to the toe of the dune at Tisbury Great Pond Barrier Beach, Norton Point Beach, and any other potential shorebird nesting areas. This fencing will also protect the larval habitat of the Northeastern Beach Tiger Beetle since they are co-located. Motor vehicles are excluded from the beach habitat throughout the nesting season from April 1- August 31. This means the elimination of public vehicles in the vicinity of chicks while there are chicks on the beach and greatly limiting all use of essential vehicles used by others and by TTOR for their managed properties. Norton Point Beach was closed for most of the summer in 2010 due to the presence of protected nesting birds. TTOR also used wire mesh fencing to surround the tern colony on Norton Point Beach in 2010, and electric fencing may be used in 2011 to protect some nesting areas, especially on Norton Point Beach.

To lessen impact on these Federal and State -listed avian species all field activities including preparation and staging should occur when these species are not present and/or be coordinated daily starting April 1, 2011 with the qualified shorebird monitor as described below. Proper field schedule design will also alleviate any potential impacts on these species through avoidance by working outside of their nesting season. **Table 7-3**, Protected Avian Species No Work Windows provides the windows for the shorebirds and Northern harrier by MRS, Land Categories and Habitat.

The additional measures to further avoid and minimize adverse impacts to piping plovers and roseate terns as stated in the USFWS response letter dated February, 8, 2011 follows.

1) "Extend the April 1 to August 31 time-of-year restriction to include activities occurring on South Beach/Dune, Wasque Point Beach (including access to work proposed for the ocean adjacent to these beaches) and the ocean and beach of North-East (Cape Poge) to Simon Point referred to in Table 7-3, Protected Avian Species No Work Windows, revised January 28, 2011,

and sent to our office on February 4, 2011) in order to avoid adverse effects to piping plovers and roseate terns that may be establishing breeding territories and nests.

2) A qualified monitor must survey the area daily prior to any activities to locate plovers or terns that may be establishing territories and report the locations to the work unit should Phase 2 of the RI require additional work between April 1 and April 15 in piping plover or roseate tern habitat.

3) Activities occurring within symbolically fenced areas (breeding habitat that has been fenced with stakes and twine) should be coordinated with a qualified piping plover/tern monitor in order to avoid disturbing birds. The monitor should accompany the work unit if it is determined that munitions and explosives of concern are located within the symbolic fencing (following standard safety protocols) and document piping plover and/or tern locations and behavior. Activities may need to be scheduled when birds are feeding (not present within the area)
4) No work may occur after April 15 without additional consultation with this office."

NOTE: In all cased the proposed work must be evaluated as to whether it should be moved to a location outside the nesting area. Approval must be obtained from the monitor prior to proceeding with any work in shorebird nesting areas, whether inside or outside the fenced areas.

7.3.12.4 Daily Protocol for Remedial Investigation Field Operations at TTOR Managed Properties at Cape Poge Wildlife Refuge (including East Beach Chappaquiddick Island, Little Neck, Wasque Point Beach), Norton Point Beach, Long Point Wildlife Refuge AND at South Beach and Tisbury Great Pond Beach During the Shorebird Nesting Season April 1-August 31, 2011

Nesting Piping Plovers & Other Shorebirds of Concern

For TTOR managed properties, starting on April 1, 2011 by 1000 hours daily, the UXB on-site UXO supervisor will contact the Martha's Vineyard Assistant Superintendent Paul Shultz (Radio Call Sign: Trustees 16) via VHF radio channel 159.465 MHz or cell phone (774-563-0921) for the Cape Poge Wildlife Refuge, Long Point Wildlife Refuge and Norton Point Beach to discuss the last known location of any piping plover nests, feeding piping plover adults or chick locations, and any other protected shorebird species as provided by their qualified shorebird monitors.

Similarly for all other properties starting April 1, 2011 (excluding MVLBC properties), UXB will coordinate their activities daily with their qualified shorebird monitor, Luanne Johnson, Director/Wildlife Biologist, BiodiversityWorks, Edgartown, MA (508-685-2578). BiodiversityWorks will be responsible for monitoring and/or coordinating with the private property owners on Tisbury Great Pond Beach and at South Beach between left and right fork (area not covered by the TTOR shorebird monitor).

For the MVLBC properties on Tisbury Great Pond Beach, UXB will coordinate their activities daily with their qualified shorebird monitor, Julie Russell, Ecologist, MVLBC, Edgartown, MA (508-627-7141).

Vehicle Travel Restrictions. In the opinion of the Shorebird Technicians, if vehicle access presents the potential for adverse impact to shorebird resources they will so notify Martha's Vineyard Assistant Superintendent Paul Shultz daily by 1000 hours. For TTOR properties, Paul Shultz will take any and all measures necessary to assure vehicle access in these areas will not create situations where nesting piping plovers or roseate terns are impacted from passing vehicles, per the Massachusetts Shorebird Protection Guidelines. Similarly, UXB will work closely with their Shorebird Monitors for Tisbury Great Pond Beach and South Beach.

If unfledged chicks are present in the area, only Essential Vehicles will be allowed into the vehicle exclusion area per Massachusetts or USFWS Shorebird Protection Guidelines. UXB vehicles will be treated as Essential Vehicles and will be required to access the impacted area with a TTOR and/or UXB and/or MVLBC Shorebird Monitor present. Logging into and out of the area is also required per the Guidelines noted herein.

Unfledged Piping Plovers. UXB will be required to follow the same vehicle guidelines as the general public. If vehicle corridors are open to the public, UXB would also have access. In the event of vehicle closures due to the presence of unfledged piping plovers, UXB will follow the state and federal provisions for “essential vehicles.” Namely:

1. Essential vehicles will travel through chick habitat areas only during daylight hours, and will be guided by a qualified monitor who has first determined the location of all unfledged plover chicks.

2. Speed of vehicles will not exceed five miles per hour.

3. A log will be maintained by the respective shorebird monitor for each beach area of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers will maintain and regularly update a log of the numbers and locations of unfledged plover chicks on each beach. Drivers of essential vehicles will review the log each day to determine the most recent number and location of unfledged chicks.

Reporting Requirements for Mortality of Piping Plover during Intrusive Investigations

In the unlikely event that a piping plover (or roseate tern) chick or adult fatality is discovered during the removal of explosives, whether associated with or the result of our work or not, the following special agent of the U.S. Fish and Wildlife Office of Law Enforcement should be immediately contacted:

David N. Sykes
Resident Agent in Charge
Office of Law Enforcement
U.S. Fish and Wildlife Service
70 Everett Avenue, Suite 315
Chelsea, MA 02150-2363
Phone: 617-889-6616 x 15Fax: 617/889-1980

Revised by:

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751
978-318-8236/FAX: 318-8560
robert.w.davis@usace.army.mil

Table 7-3: Protected Avian Species No Work Windows

PROTECTED AVIAN SPECIES NO WORK WINDOWS					
MRS Sites	**Land Categories/Habitats**	**Field Work Schedule (Start/End) Phase 1**	**Anomaly Dig Schedule (Start/End) Phase 2**	**Shorebirds April 1-August 31**	**Northern Harrier March 1-August 31**
FMTMGR at South Beach MRS	**Beach**				
	South Beach & Dune	3/4/11-3/22/11	3/4/11-3/22/11	**Apr 1-Aug 31**	None
	Norton Point Beach & Dune	3/1/11-3/16/11	3/1/11-3/16/11	**Apr 1-Aug 31**	None
	Wasque Point Beach & Dune	3/4/11-3/22/11	3/4/11-3/22/11	**Apr 1-Aug 31**	None
	Inland Water				
	Katama Bay	3/8/11-3/16/11	5/11/11-5/27/11	**Potential Apr 1-Aug 31**	None
	Land				
	Wasque Pt. Upland	3/23/11-4/7/11	3/25/11-4/11/11	None	None
	Ocean				
	Adjacent to South Beach	2/24/11-3/15/11	6/7/11-6/24/11	**Apr 1-Aug 31**	None
	Adjacent to Norton Point Beach & Dune	2/7/11-2/23/11	4/18/11-6/6/11	**Apr 1-Aug 31**	None
	Adjacent to Wasque Point Beach	2/24/11-3/15/11	6/7/11-6/24/11	**Apr 1-Aug 31**	None
Cape Poge/Little Neck MRS	**Beach**				
	North-East to Simon Point	3/21/11-4/5/11	3/23/11-4/7/11	**Apr 1-Aug 31**	None
	Inland Water				
	Cape Poge Bay/Shear Pen Pond	1/14/11-4/15/11	4/15/11-5/13/11	None*	None
	Inland Water Beaches				None
	Land				
	Cape Poge Lighthouse/Upland	2/15/11-2/25/11	2/22/11-2/28/11	None	**Mar 1-Aug 31**
	Little Neck/Upland & Salt Marsh	3/10/11-3/30/11	3/10/11-4/1/11	None*	None
	Ocean				
	North-East to Simon Point	3/16/11-3/31/11	6/27/11-7/22/11	**Apr 1-Aug 31**	None
Tisbury Great Pond MRS	**Beach**				
	Barrier Beach & Dunes	2/24/11-3/11/11	2/24/11-3/11/11	**Apr 1-Aug 31**	None
	Inland Water				
	Tisbury Great Pond (Near Shore)	1/20/11-2/22/11	3/31/11-4/15/11	**Potential Apr 1-Aug 31****	None
	All Other Inland Water/Wetlands	2/23/11-3/7/11	4/6/11-4/21/11	None	None
	Land				
	Western Uplands	2/17/11-2/28/11	2/23/11-2/28/11	None	**Mar 1-Aug 31**
	Eastern Uplands	3/4/11-3/25/11	3/4/11-3/25/11	None	None
	Ocean				
	Adjacent to Barrier Beach/Dunes	1/14/11-2/4/11	1/18/11-4/15/11	**Apr 1-Aug 31**	None

Footnotes (Updated 4-10-11):

For the Remedial Investigation fieldwork in the "Ocean" areas, Phase 1 & 2 will be conducted concurrently as the analog transects and/or grids will be surveyed using mag/dig techniques as all anomalies will be investigated immediately due to the dynamic nature of the environment in these areas.

* - None anticipated based on 2010 reported shorebird occurrences and historical data; however, shorebird nesting locations can vary year to year. In accordance with the Environmental Protection Plan, UXB will contact the TTOR Shorebird Technicians daily during the nesting season (April 1 - August 31) for any reported occurrences for properties that they manage or the USFWS and/or MANHESP for the private properties.

**- Potential no work window if the Inland Water near shore field activities adjacent to northern side of the barrier beach/dunes will disturb the nesting shorebirds.

- A qualified monitor must survey the area daily prior to any activities to locate plovers or terns that may be establishing territories and report the locations to the work unit should Phase 2 of the RI require additional work between April 1 and April 15 in piping plover or roseate tern habitat.

- Activities occurring within symbolically fenced areas (breeding habitat that has been fenced with stakes and twine) should be coordinated with a qualified piping plover/tern monitor in order to avoid disturbing birds. The monitor should accompany the work unit if it is determined that munitions and explosives of concern are located within the symbolic fencing (following standard safety protocols) and document piping plover and/or tern locations and behavior. Activities may need to be scheduled when birds are feeding (not present within the area).

- No work may occur after April 15 without additional consultation with the USFWS and MANHSEP.

Mike/Tom & Richard - I am sending this email to obtain the environmental compliance information that we discussed during yesterday's telephone conference call with the Stakeholders. This information is needed to include in my Endangered Species Act (ESA) Section 7 Consultation letter to the NMFS for the ESTCP Project Demonstration so that I can make the preliminary determination that this proposed action is not likely to adversely affect any species listed by NOAA's National Marine Fisheries Service, hopefully with NMFS concurrence.

A copy of the NMFS approval letter for the TCRA is attached and both Federally listed sea turtles and whales were noted to occur of offshore of Martha's Vineyard off of Cape Poge and South Beach. Relative to our "Environmental Protection Plan" for the ESTCP Project Demo, we need to avoid, minimize or mitigate our potential impacts, if any, accordingly.

Richard - Please send me the information on the sonar frequencies for the multi-beam sonar, side scan sonar and sub-bottom profiling equipment and for the magnetic array if applicable, and any applicable research/studies/papers that show that the frequencies that you will be using are not detrimental to marine mammals and finfish. Certain sonar frequencies (e.g. used by the Navy) have been found to adversely impact marine mammals and perhaps finfish.

Mike/Tom - Besides the potential impacts of your intrusive work in acquiring the picked anomalies, I also have to address the potential adverse impacts if we have to "Blow in Place" (BIP). Please send my your proposed approach to avoid, minimize or mitigate potential adverse impacts. For example you mentioned that one of the measures that you have used successfully is to use nuisance charges to deter or repel aquatic animals to avoid and/or minimize impacts from BIP to the aquatic animals.

In advance I thank you for your prompt attention to my request since the intrusive work is scheduled to begin the week of June 27th and NOAA/NMFS took over one month in responding to my TCRA letter. Please contact me with any questions and/or concerns.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Engineering/Planning Division
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

MAY 11 2009

Anthony T. Machos, Acting Chief
Engineering/Planning Division
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Machos,

This is in response to your letter dated April 1, 2009 requesting consultation pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended regarding the Army Corps of Engineers' proposal to remove Munitions and Explosives of Concern (MEC), Materials Potentially Presenting an Explosive Hazard (MPPEH) and Explosive Hazards as a Time Critical Removal Action (TCRA) at the former Cape Poge Little Neck Bomb Target Site, Chappaquiddick and the former Moving Target Machine Gun Range at South Beach, both on Martha's Vineyard, Massachusetts. The US Army Corps of Engineers (ACOE) New England District is the lead Federal agency and is conducting the proposed project in conjunction with the US Army Engineering and Support Center, Huntsville, the US Environmental Protection Agency, the Massachusetts Department of Environmental Protection and EOD Technology, Inc. The ACOE has made the preliminary determination that the proposed action is not likely to adversely affect any species listed by NOAA's National Marine Fisheries Service (NMFS) and has requested that NMFS concur with this determination.

Proposed Project

The proposed action will take place at two sites: the former Cape Poge Little Neck Bomb Target Site (Cape Poge Site) and the former Moving Target Machine Gun Range at South Beach (South Beach Site), both on Martha's Vineyard, Massachusetts. Actions to be taken at the Cape Poge Site include: removal of munitions and explosives to 4 inches below surface at several beaches, along the dune face at Little Neck, along the creek bank at Little Neck and Drunkard's Cove; removal at surface to 4 inches below surface in water to a maximum water depth of 2 feet in areas where clamming does not take place; subsurface removal up to 18 inches in depth in the mudflats, creek beds and ponds where clamming takes place; removal of unexploded ordinance (UXO) on shore; and, placement of signage on land. Actions to be taken at the South Beach site include: surface/subsurface removal to depth of detection up to 100 feet off shore; removal of

UXO on shore; and, placement of permanent warning signs on land. All materials are proposed to be removed by hand or with hand tools. Any sediment disturbed during removal will be restored.

NMFS Listed Species in the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50CFR§402.02). For this project, the action area includes the project footprint at the Cape Poge and South Beach sites where munitions and explosives will be removed. This area is expected to encompass all of the effects of the proposed project.

Sea Turtles

Several species of listed sea turtles occur seasonally off the coast of Martha's Vineyard. The sea turtles in northeastern near shore waters are typically small juveniles with the most abundant being the federally threatened loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Federally endangered leatherback (*Dermochelys coriacea*) and green *(Chelonia mydas)* sea turtles have also been observed seasonally in the coastal waters off Martha's Vineyard as well. Sea turtles occur in these waters from June through the early November of any year. Research conducted off Eastern Long Island, New York, showed that during the warmer months, sea turtles appear to spend much of their time foraging along the bottom in shallower embayments with water depths between 16 and 49 feet with waters that are slow moving or still (i.e., less than 2 knots) (Morreale and Standora 1990; 1991; 1998). The action area, as described above, includes several types of habitat where sea turtles are extremely unlikely to occur. This includes areas on land where signs will be installed as well as the on shore areas where munitions will be removed. Munitions removal will also take place in shallow mudflat areas with depths of less than 2 feet as well as in creek beds and ponds. All of the coastal areas where munitions removal will take place have depths of less than 5 feet. As the action area is inconsistent with the preferred habitats of sea turtles, it is extremely unlikely that any sea turtles will occur in the action area.

Whales

While listed whales occur in the waters offshore of Martha's Vineyard, due to the shallow depths and nearshore location of the action area, no listed marine mammals are expected to occur in the action area.

Effects of the Action

As noted above, listed species are extremely unlikely to occur in the action area and, as such, such, any effects to these species are extremely unlikely. Therefore, NMFS has determined that the effect of the proposed project on listed species will be insignificant and discountable.

Conclusion

Based on the analysis that all effects of the proposed project will be insignificant and discountable, NMFS is able to concur with the determination that the proposed actions at the Cape Poge and South Beach sites as proposed by the ACOE are not likely to adversely affect any listed species under NMFS jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required. Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action. Should you have any questions about this correspondence please contact Julie Crocker at (978) 282-8480.

Sincerely,

for Patricia A. Kurkul
Regional Administrator

EC: Crocker, F/NER3
Boelke, F/NER4

File Code: Sec 7 ACOE MA – Cape Poge and South Beach Munitions Removal
PCTS I/NER//2009/01916

From: Davis, Robert W NAE
Sent: Wednesday, March 14, 2012 6:36 PM
To: Chris Kennedy (TTOR)
Cc: Charette, Carol A NAE; Warminsky, Mike F. (UXB); Chris Mazur (UXB)
Subject: Resumption of Shorebird Monitoring to Complete Martha's Vineyard MMRP-RI Ocean Transects Spring 2012 (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Chris Kennedy/TTOR - Our current subject schedule has us completing all of the ocean transects as shown on attached Figure 3-2, dated 09-09-2011, on April 16, 2012. We remobilized again on February 29, 2012 but climatic (e.g. high winds, storms) and marine conditions (e.g. waves, severe erosion) have again hampered our efforts. Please see the second figure attached dated 02/23/-2012 that depicts the current conditions at the east end of Norton Point Beach and Wasque Point.

As of March 8, 2012 we completed all ocean transects thru #51 at the western end of Norton Point Beach and are working eastward towards ocean transect #1 at Wasque Point.

It is our understanding that protected shorebird species (e.g. piping plover, roseate tern) nest along Norton Point Beach but not at Wasque Point. Therefore we will need to coordinate our daily work as we have in the past with your TTOR Shorebird Monitors starting April 1st (or perhaps earlier since a very mild winter) in accordance with the protocol in the Environmental Protection Plan as approved by USFWS and MANHSEP.

We look forward to hearing from you and thank you for your past and continued support for this project.

Take care,
Bob Davis

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751
978-318-8236/FAX: 318-8560
robert.w.davis @usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

Table 7-3: Protected Avian Species No Work Windows

PROTECTED AVIAN SPECIES NO WORK WINDOWS					
MRS Sites	**Land Categories/Habitats**	**Field Work Schedule (Start/End) Phase 1**	**Anomaly Dig Schedule (Start/End) Phase 2**	**Shorebirds April 1-August 31**	**Northern Harrier March 1-August 31**
FMTMGR at South Beach MRS	**Beach**				
	South Beach & Dune	3/4/11-3/22/11	3/4/11-3/22/11	**Apr 1-Aug 31**	None
	Norton Point Beach & Dune	3/1/11-3/16/11	3/1/11-3/16/11	**Apr 1-Aug 31**	None
	Wasque Point Beach & Dune	3/4/11-3/22/11	3/4/11-3/22/11	**Apr 1-Aug 31**	None
	Inland Water				
	Katama Bay	3/8/11-3/16/11	5/11/11-5/27/11	**Potential Apr 1-Aug 31**	None
	Land				
	Wasque Pt. Upland	3/23/11-4/7/11	3/25/11-4/11/11	None	None
	Ocean				
	Adjacent to South Beach	2/24/11-3/15/11	6/7/11-6/24/11	**Apr 1-Aug 31**	None
	Adjacent to Norton Point Beach & Dune	2/7/11-2/23/11	4/18/11-6/6/11	**Apr 1-Aug 31**	None
	Adjacent to Wasque Point Beach	2/24/11-3/15/11	6/7/11-6/24/11	**Apr 1-Aug 31**	None
Cape Poge/Little Neck MRS	**Beach**				
	North-East to Simon Point	3/21/11-4/5/11	3/23/11-4/7/11	**Apr 1-Aug 31**	None
	Inland Water				
	Cape Poge Bay/Shear Pen Pond	1/14/11-4/15/11	4/15/11-5/13/11	None*	None
	Inland Water Beaches				None
	Land				
	Cape Poge Lighthouse/Upland	2/15/11-2/25/11	2/22/11-2/28/11	None	**Mar 1-Aug 31**
	Little Neck/Upland & Salt Marsh	3/10/11-3/30/11	3/10/11-4/1/11	None*	None
	Ocean				
	North-East to Simon Point	3/16/11-3/31/11	6/27/11-7/22/11	**Apr 1-Aug 31**	None
Tisbury Great Pond MRS	**Beach**				
	Barrier Beach & Dunes	2/24/11-3/11/11	2/24/11-3/11/11	**Apr 1-Aug 31**	None
	Inland Water				
	Tisbury Great Pond (Near Shore)	1/20/11-2/22/11	3/31/11-4/15/11	**Potential Apr 1-Aug 31****	None
	All Other Inland Water/Wetlands	2/23/11-3/7/11	4/6/11-4/21/11	None	None
	Land				
	Western Uplands	2/17/11-2/28/11	2/23/11-2/28/11	None	**Mar 1-Aug 31**
	Eastern Uplands	3/4/11-3/25/11	3/4/11-3/25/11	None	None
	Ocean				
	Adjacent to Barrier Beach/Dunes	1/14/11-2/4/11	1/18/11-4/15/11	**Apr 1-Aug 31**	None

Footnotes (Updated 4-10-11):

For the Remedial Investigation fieldwork in the "Ocean" areas, Phase 1 & 2 will be conducted concurrently as the analog transects and/or grids will be surveyed using mag/dig techniques as all anomalies will be investigated immediately due to the dynamic nature of the environment in these areas.

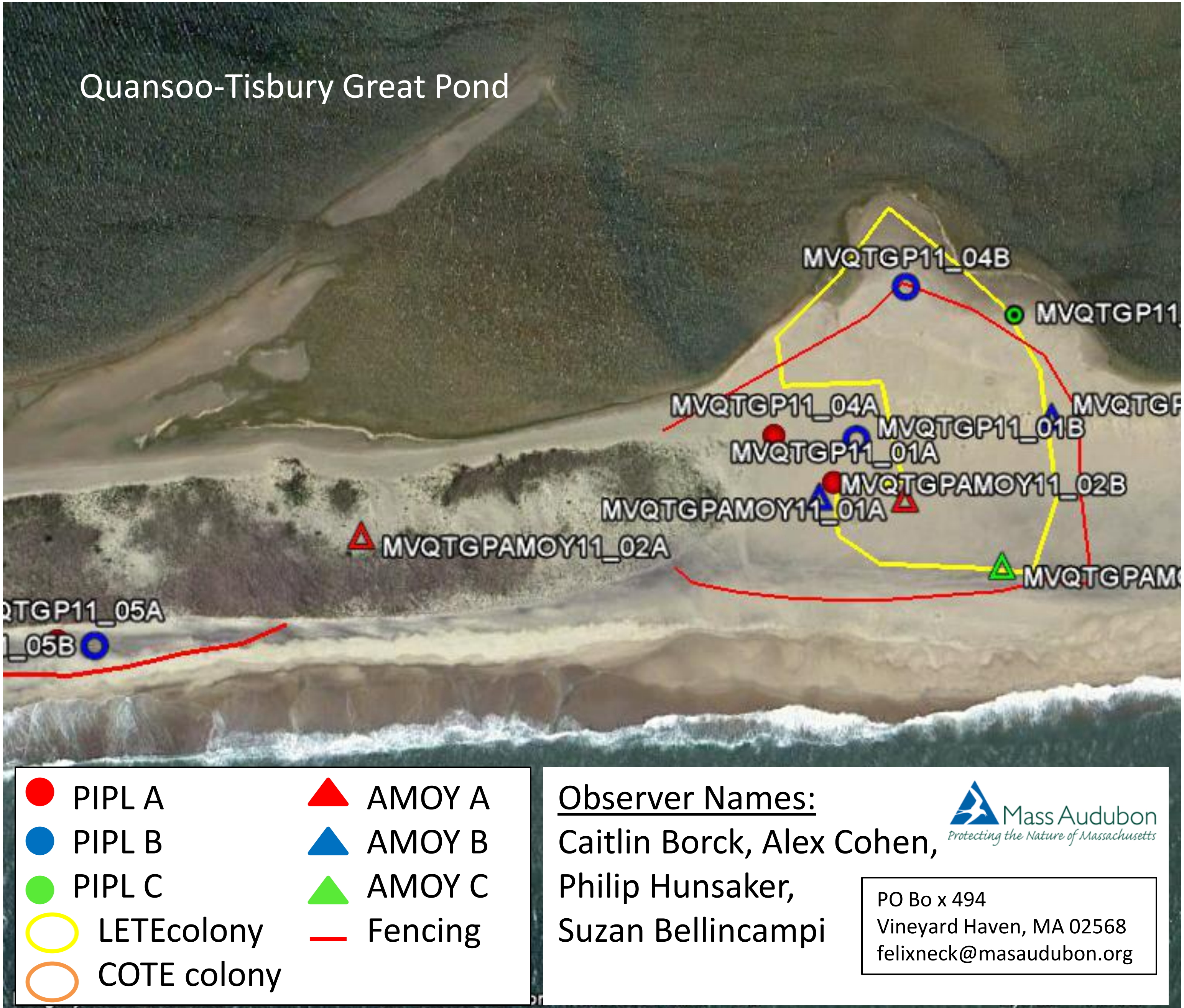
* - None anticipated based on 2010 reported shorebird occurrences and historical data; however, shorebird nesting locations can vary year to year. In accordance with the Environmental Protection Plan, UXB will contact the TTOR Shorebird Technicians daily during the nesting season (April 1 - August 31) for any reported occurrences for properties that they manage or the USFWS and/or MANHESP for the private properties.

**- Potential no work window if the Inland Water near shore field activities adjacent to northern side of the barrier beach/dunes will disturb the nesting shorebirds.

- A qualified monitor must survey the area daily prior to any activities to locate plovers or terns that may be establishing territories and report the locations to the work unit should Phase 2 of the RI require additional work between April 1 and April 15 in piping plover or roseate tern habitat.

- Activities occurring within symbolically fenced areas (breeding habitat that has been fenced with stakes and twine) should be coordinated with a qualified piping plover/tern monitor in order to avoid disturbing birds. The monitor should accompany the work unit if it is determined that munitions and explosives of concern are located within the symbolic fencing (following standard safety protocols) and document piping plover and/or tern locations and behavior. Activities may need to be scheduled when birds are feeding (not present within the area).

- No work may occur after April 15 without additional consultation with the USFWS and MANHSEP.


Quansoo-Tisbury Great Pond
MVQTGP11_04B
MVQTGP11
MVQTGP11_04A
MVQTGP11_01B
MVQTGP11_01A
MVQTGPAMOY11_02B
MVQTGPAMOY11_01A
MVQTGPAMOY11_02A
TGP11_05A
_05B
PIPL A
PIPL B
PIPL C
LETEcolony
COTE colony
AMOY A
AMOY B
AMOY C
Fencing
Observer Names:
Caitlin Borck, Alex Cohen,
Philip Hunsaker,
Suzan Bellincampi
Mass Audubon
Protecting the Nature of Massachusetts
PO Bo x 494
Vineyard Haven, MA 02568
felixneck@masaudubon.org

From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Friday, October 08, 2010 4:18 PM
To: Chris Kennedy; Russell Hopping; Julie Schaeffer (MVLBC); Kristen Fauteux (SMF)
Cc: Patrick K. Fogleson (UXB); Tom Rancich (VRH); Warminsky, Mike F. (UXB); Charette, Carol A NAE; Campbell, Ralph L HNC; Trinchero, Peter J NAE; Pete Trinchero (H)
Subject: Martha's Vineyard MMRP-RI Oct 13th Site Visits

Russ Hopping-TTOR Ecology Program Manager & Chris Kennedy-TTOR Regional Director, Southeast - I am sending this email as a follow-up to my voice messages that I left all of you today. Peter Trinchero and I will be conducting site visits on Wednesday October 13th with Pat Fogleson/UXB and/or Tom Rancich/VRHabilis depending on the MRS and respective land category to be investigated for further development of the EPP in advance of the TPP Meeting on Thursday October 14th. There are approximately 45 federally and/or state-listed protected species along with sensitive habitats/natural communities among the three MRSs so we need to inspect as many areas as possible with emphasis on the land transects and your major concerns.

Talking to Pat Fogleson today we will need access to the respective TTOR areas to be surveyed survey at your both Cape Poge Wildlife Refuge, Wasque, & Norton Point Beach and Long Point Wildlife Refuge for the Former Cape Poge Little Neck Bomb Site MRS (Work Plan Figure 3-1), Former Moving Target Machine Gun Range at South Beach MRS (Work Plan Figure 3-2), and Tisbury Great Pond MRS (Work Plan Figure 3-3), respectively.

I am also interested in your specific concerns for all of these aforementioned areas relative to our proposed methods and equipment and the proposed schedule for each MRS by the four different land categories that were previously forwarded to you via email and/or provided in the Draft Final Work Plan.

In preparation we have downloaded all of the available life history fact sheets from the MANHESP website and other sources for the various species along with the available natural resource documents from your websites for your different properties (e.g. Cape Poge Management Plan - Section 5 Natural Resources; The Ecology of Coastal Ponds: A pilot Study at Long Point Wildlife Refuge); however, some of this invaluable information is dated and we need your current and specific knowledge of the affected resources (e.g. Recent and Historic Rare Species Occurrences within our Action Areas for the protected bird species).

Julie Schaeffer/MVLB Ecologist and Kristen Fauteux/SMF Director of Stewardship - I am also both of you in this email since portions of your properties are also included in the Tisbury Great Pond MRS (Work Plan Figure 3-3), and perhaps Pete and I can also visit these properties during our site visits on October 13th.

I look forward to hearing from you and in advance I thank you and your organization for your assistance.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751
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robert.w.davis@usace.army.mil

-----Original Message-----
From: Davis, Robert W NAE
Sent: Tuesday, October 05, 2010 4:10 PM
To: 'Russell Hopping (TTOR)'; 'Chris Kennedy (TTOR)'
Cc: Charette, Carol A NAE; Campbell, Ralph L HNC; 'Warminsky, Mike F. (UXB)'; 'Patrick K. Fogleson (UXB)'; Trinchero, Peter J NAE
Subject: Martha's Vineyard MMRP-RI Environmental Protection Plan-Request for TTOR Assistance + Oct 13th Site Visit

Russ Hopping-TTOR Ecology Program Manager & Chris Kennedy-TTOR Regional Director, Southeast - I will working on revising the current Section 7 Environmental Protection Plan in the Draft Final Work Plan to address environmental/natural resources concerns by developing adequate measures to avoid, minimize and/or mitigate any potential impacts in order to get NO TAKE determination from MANHESP and USFWS and NMFS for our RI. As noted in prior email, the RI will be conducted in two phases: the first phase will enable us to conduct the required data based on the analog and geophysical surveys in the four land categories at each MRS; and in the second phase which is more intrusive, based on the interpretation of this data by the USACE and their Team along with the MADEP and USEPA, selected anomalies will be acquired (i.e. dug up) to determine if they are MEC and/or cultural debris and/or potentially cultural/archaeological resources. At the end of Phase 1, we will need to consult w/MANHESP and USFWS prior to Phase 2 for ex. if we need to dig up an anomaly in Northeastern beach tiger beetle habitat.

I am again asking for TTOR's assistance and input for your respective properties in making this happen as we did for execution of the TCRA Final Work Plan as detailed for example in the attached Appendix J (minus the 2nd figure w/grids since 5MB) for the Piping plover and other birds of concern.
For example, if Northern harrier nests on the uplands near Cape Poge then we should complete our work by March 1st (not April 1st for the other protected birds) as suggested by MANHESP.

Finally, I want to make arrangements W/TTOR and UXB/Pat Fogleson to conduct a site visit On October 13th with a Corps botanist/biologist (Peter Trinchero) to inspect some of the land areas with Pat who is the UXB SUXOS in order to get a feel for the terrain and habitats (e.g. Northern harriers) and the vegetation (rare flora and pitch pine-oak communities et al.) that we will be dealing with in the EPP in order to get "NO TAKE" determinations. Since we have ROEs from

TTOR and at both Cape Poge and Long Pond we will plan to check these land transect areas out first with Pat, and then perhaps the lands of MVLBC and/or SMF as time permits.

My plan is get the input needed so that I have a draft EPP in hand with the adequate measures required for RI execution (Phase 1 and then Phase 2) for discourse at the TPP on Oct 14-15th.

Thanks!
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
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978-318-8236/FAX: 318-8560
robert.w.davis@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

Susi & Tim - As noted in my previous email the attached files depicts the RI work that we plan to complete at Tisbury Great Pond and South Beach this year in accordance with the approved work plans. Please contact us with any questions and/or concerns or if you need additional information.

Take care,
Bob
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Engineering/Planning Division
USACE-New England District
696 Virginia Road
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Classification: UNCLASSIFIED
Caveats: NONE

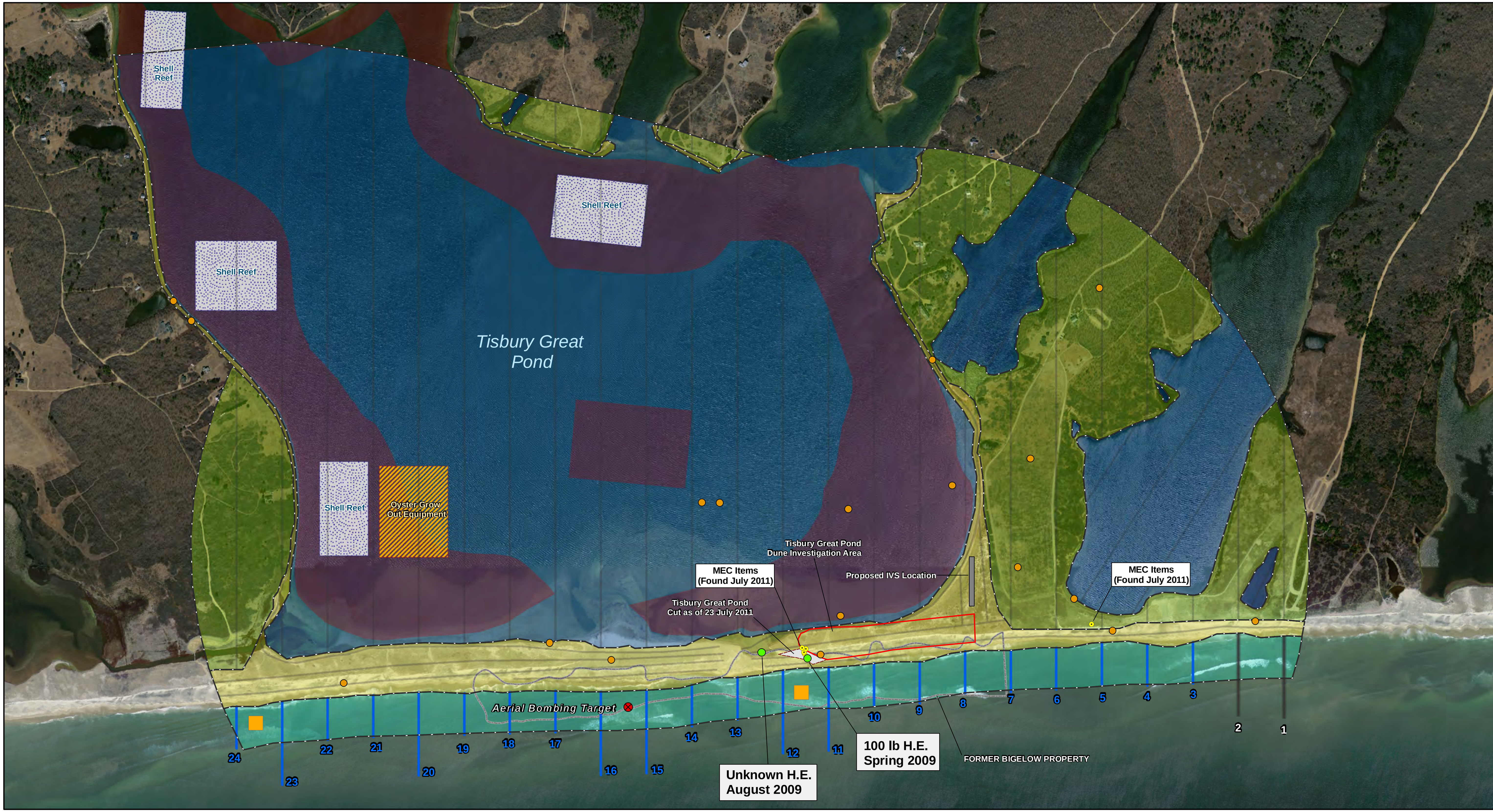
1.0 SELECTION RATIONALE FOR 600-FOOT OCEAN TRANSECTS

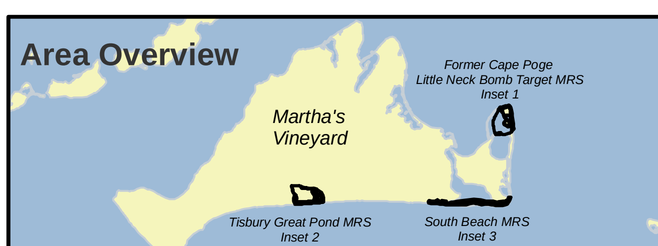
The following table identifies selected ocean transects to be extended from the original proposed length of 300 feet to 600 feet.

MRS	TRANSECT ID	COMPLETE?	SELECTION RATIONALE FOR 600-FOOT LENGTH
TGP[1]	1	Yes	Possible Receptor location long-shore, down-stream of entire TGP ocean frontage.
TGP[1]	2	Yes	Included in original set of extended-length ocean transects, with extended-length ocean transects at Cape Poge.
TGP[1]	11	No	Dual-purpose: 1) Possible Receptor Location for MEC leaving TGP cut 2) Long-shore down-stream of eastern-most TGP MEC transport grid
TGP[1]	12	No	Dual-purpose: 1) Possible Background/up-stream location for MEC leaving TGP cut, or 2) Possible Receptor Location for MEC leaving estimated historical aerial bombing target position
TGP[1]	15	No	Possible Receptor Location for MEC leaving estimated historical aerial bombing target position
TGP[1]	16	No	Possible Background/up-stream location for estimated historical aerial bombing target position
TGP[1]	20	No	Long-shore down-stream of southwestern corner of TGP barrier beach airmag anomalies and ROE-restricted parcels
TGP[1]	23	No	Dual-purpose: 1) Background/up-stream location for entire TGP ocean frontage 2) Long-shore down-stream of western-most TGP MEC transport grid
SB[2]	1	No	Transect provides northeastern bracket bounding area of high airborne magnetometry anomaly density at Wasque Point (Direction of predominant ocean currents undetermined to date)
SB[2]	4	No	Transect provides southwestern bracket bounding area of high airborne magnetometry anomaly density at Wasque Point (Direction of predominant ocean currents undetermined to date)
SB[2]	10	No	Transect nearest center of historical MEC discovery area at Wasque Point
SB[2]	16	No	Background/up-stream location for area of historical MEC discoveries at Wasque Point
SB[2]	39	No	Nearest accessible ocean transect to offshore location of expended rocket motor discovery from ESTCP Ocean Magnetometry study (eastern-most ESTCP find)
SB[2]	50	No	Centered on area of 2009 rocket discoveries (August)
SB[2]	56	No	Dual-purpose: 1) Receptor/down-stream location for MEC potentially migrating from area of TCRA grids 18/19 2) Receptor/down-stream location for eastern-most SB MEC transport grid
SB[2]	57	No	Dual-purpose: 3) Background/up-stream location for MEC discovered in TCRA grids 18/19 4) Background location for eastern-most SB MEC transport grid
SB[2]	60	No	Possible Receptor Location for MEC leaving estimated historical rocket target position
SB[2]	61	No	Possible Background/up-stream location for estimated historical rocket target position
SB[2]	68	No	Dual-purpose: 1) Long-shore, down-stream location for MEC potentially migrating from TCRA grids 5/6 or from offshore 2) Long-shore, down-stream location for western-most SB MEC transport grid
SB[2]	69	No	Dual-purpose: 5) Background/up-stream location for western-most known extent of previous MEC findings at SB 6) Background location for western-most SB MEC transport grid

Footnotes:
1 – Tisbury Great Pond (TGP)
2 – South Beach (SB)


Katama Farm
Katama Bay
Pocha Pond
Wasque Point
SEE INSET A FOR AREA DETAIL
Machine Gun Sampling Area
2.75" Rocket Motors August 2009
Rocket Targets
Transects 34 thru 37 eliminated due to inaccessibility
Proposed IVS Location
Area of Found Munitions:
100 lb H.E., December 2008
100 lb Photo Flash, February 18, 2009
INSET A
Fixed Machine Gun Firing Line
Moving Target Track
Practice Firing Range
Firing Line
Impact Berm
Rocket Target
Target Car Shelter
Suspected Cable Lines
* TCRA Grid B05 obstructed from view by MEC Transport Study Analog Grid and MD items.
Symbol Key for Shorebird Nest Locations
American Oyster Catcher (Hatch)
American Oyster Catcher (Fail)
Black Skimmer (Hatch)
Piping Plover (Fail)
Piping Plover (Hatch)
Common Tern/Roseate Tern Colony
Least Tern Colony
Area Overview
Martha's Vineyard
Former Cape Poge Little Neck Bomb Target MRS Inset 1
Tisbury Great Pond MRS Inset 2
South Beach MRS Inset 3
RI/FS Transects
Revised Proposed Ocean Transects
Target Car Shelter
FormerTarget Areas
MD Items
Moving Target and Machine Gun Range Features
South Beach to Wasque Pt. MRS - Land Categories
Beach
Inland Water
Land
Ocean
ESTCP Survey Area
TCRA Grids (2009)
MEC Transport Study Analog Grid (0.25 Acre)
Proposed IVS Location
US Army Corps of Engineers
UXB International, Inc.
AMEC Earth & Environmental, Inc.
FIGURE 3-2
Revised Ocean Transects Former Moving Target Machine Gun Range at South Beach MRS Martha's Vineyard, MA
NOTES:
Aerial Data Source: NAIP, 2008
620 Total TCRA MEC Items including:
2.25" Rocket Motor (482), 2.75" Rocket Motor (3), 3.25" Rocket Motor (92), 3.5" Rocket Motor (9), 5" Rocket Motor (1), 5" Warhead (33)
09/09/2011
transect_sbeach_RI_wp_092011.mxd
Drawn: JBO
PROJ: 562910000
0 250 500 1,000 Meters
0 500 1,000 2,000 3,000 Feet





RI/FS Transects
- Revised Proposed Ocean Transects
- Completed Ocean Transects
- Former Target Area
- MD Item
- MEC Items (Found July 2011)
- SI Environmental Samples

Tisbury MRS - Land Categories
- Beach
- Inland Water
- Land
- Ocean

- Tisbury Great Pond Dune Investigation Area
- Tisbury Great Pond Cut (as of 23 July 2011)
- Proposed MEC Transport Study Analog Grid (0.25 Acre)
- Proposed IVS Location
- Oyster Growth Area
- Former Bigelow Property

US Army Corps of Engineers

UXB International, Inc.

AMEC Earth & Environmental, Inc.

FIGURE 3-3

Revised Ocean Transects
Tisbury Great Pond MRS
Martha's Vineyard, MA

N

0 125 250 500 Meters

0 250 500 1,000 1,500 Feet

NOTES:
Aerial Data Source: MassGIS, 2009

09/08/2011	transect_tisbury_w_shell_oyster_reef_RI_WP_092011.mxd
Drawn: JBO	PROJ: 562910000

From: Chris Buelow [mailto:cbuelow@ttor.org]
Sent: Wednesday, October 27, 2010 3:38 PM
To: Davis, Robert W NAE
Subject: RE: Martha's Vineyard MMRP-RI Environmental Protection Plan Natural Resources Collaboration

Hi Bob,

Answers to your specific questions:

- Key to map legend: AMOY (American oystercatcher), PIPL (piping plover), BLSK (black skimmer), LETE (least tern), COTE (common tern), ROST (roseate tern).

- Protection efforts consisted of the use of:
- SYMBOLIC FENCING in all potential habitat beginning in April. This is the fencing similar to what is shown in your tiger beetle habitat photo. This fencing was at least the toe of dune throughout much of the ocean facing beach.
- RESTRICTION OF VEHICLES from the beach habitat throughout the nesting season. This meant the elimination of public vehicles in the vicinity of chicks while there were chicks on the beach and greatly limiting all use of essential TTOR vehicles. Essentially, Norton Point was closed for most of the summer.
- WIRE MESH FENCING was used to surround the tern colony on Norton Point.
- ELECTRIC FENCING may be used in 2011 to protect some nesting areas, especially on Norton Point.

- Numbers (in pairs)for 2010 on Chappaquiddick are
- 9 piping plover
- 1400 least tern
- 26 roseate tern
- 191 common tern
- 3 black skimmer

I hope this helps. Please let me know if you need further information.

Best - Chris

Chris Buelow
Coastal Ecologist
The Trustees of Reservations
290 Argilla Road
Ipswich, MA 01938

978-356-4351 x 4011
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-----Original Message-----
From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Tuesday, October 26, 2010 10:43 AM

To: Chris Buelow; Russell Hopping
Cc: Trinchero, Peter J NAE; Susi von Oettingen (USFWS); Kristin E. Black (MANHESP); Tim Simmons (MANHESP)
Subject: RE: Martha's Vineyard MMRP-RI Environmental Protection Plan Natural Resources Collaboration

Chris Buelow & Russ Hopping/TTOR et al.- As a follow-up to my voice message yesterday I am requesting additional information/explanation for your "2010 PIPL, AMOY and BLSK Nest Locations" with "LETE-Colony and COTE-ROST_Colony data" figure (as attached) as we plan to include it in our discussion of our proposed measures to avoid and/or minimize adverse effects to these protected species and shorebirds in general in our Environmental Protection Plan (EPP).

Please provide an explanation for each category in your legend, brief narrative of your shorebird observations in regards to populations by species and/or colony, and any measures that you/TTOR implemented last nesting season that we should be aware of for 2011 and beyond (e.g. closing Norton Beach to vehicular traffic).

I have also attached two photos that Pete Trinchero took at the barrier beaches off of Long Point during our site visit on October 13th: the first appears to be an area roped off to protect the habitat of the Northeastern beach tiger beetles at the base of the dunes; and the second appears to be Northeastern beach tiger beetle burrows. (Kristen, Tim and/or Susi - please check photos and confirm our observations)

The Final Work Plan as coordinated with the MADEP and USEPA, property owners & other stakeholders et al. is scheduled to be completed this Friday and we were requested to have our revised EPP plan in by COB tomorrow. We recognize that the EPP is a dynamic working document that will be subsequently amended as warranted as we proceed with this project once specific activities and locations have been identified based on the data collected and evaluated in the Phase 1 geophysical surveys. We will also re-coordinate before we conduct the Phase 2 intrusive investigations once they select the specific locations with MEC anomalies that need to be acquired or dug up, in order for us to recommend and implement specific actions to avoid and/or minimize potential adverse effects to protected species and their habitats.

Thanks,
Bob Davis
978-318-8236

-----Original Message-----
From: Chris Buelow [mailto:cbuelow@ttor.org]
Sent: Monday, October 18, 2010 1:18 PM
To: Davis, Robert W NAE
Subject: RE: Martha's Vineyard MMRP-RI Environmental Protection Plan Natural Resources Collaboration

Thanks Bob,

We haven't had shorebirds nest at Long Point since 2005 (1 PIPL, 1 AMOY)and I can't find maps of that location. I'll let you know if I find better information. - Chris

Chris Buelow
Coastal Ecologist
The Trustees of Reservations
290 Argilla Road
Ipswich, MA 01938

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-----Original Message-----
From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Monday, October 18, 2010 1:09 PM
To: Russell Hopping; Chris Buelow
Cc: Sarah Trudel; Chris Egan; Chris Kennedy; Trinchero, Peter J NAE; Charette, Carol A NAE; Campbell, Ralph L HNC; Warminsky, Mike F. (UXB)
Subject: Martha's Vineyard MMRP-RI Environmental Protection Plan Natural Resources Collaboration

Russ & Chris/TTOR Ecologists - It was a pleasure to meet both of you on October 13th and thanks for taking the time to conduct the site field visits with Pete Trinchero and myself along with providing the needed logistical support (e.g. 4WD vehicle) to the various MRS study areas and sharing of your knowledge and records which is invaluable to our efforts in preparation of our Environmental Protection Plan.

As discussed with Sarah at the Oct. 14th TPP that we both attended I am including both her and Chris Egan as she requested since they are the respective Refuge Superintendents.

We also be following up w/MANHESP on your concerns about the Nantucket Shadbush, the Northeastern beach tiger beetle, and invasive plant species (e.g. Spotted knapweed (Centaurea maculosa)), et al. as discussed during our field trips.

Chris - I just got your email with the "2010 PIPL, AMOY and BLSK Nest Locations" with "LETE-Colony and COTE-ROST_Colony data" and the general occurrence shadbush maps. Do you have similar data (i.e. shorebird nest
locations) for your Long Point Refuge?

Thanks,
Bob Davis

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2010 PIPL, AMOY and BLSK
Nest Locations
NEST_FATE
AMOY_FAIL
AMOY_HATCH
PIPL_FAIL
PIPL_HATCH
BLSK_HATCH
BLSK_HATCH
LETE_Colony
COTE-ROST_Colony
0 0.15 0.3 0.6 0.9 1.2
Miles

7 ENVIRONMENTAL PROTECTION PLAN

7.1 INTRODUCTION

7.1.1 This Environmental Protection Plan (EPP) has been prepared for the RI to be performed at the following MRSs: 1) Cape Poge Little Neck Bomb Target MRS located on Chappaquiddick Island, within the town of Edgartown, Martha's Vineyard, Massachusetts; 2) Moving Target Machine Gun Range at South Beach MRS, located within the town of Edgartown, Martha's Vineyard, Massachusetts; and 3) Tisbury Great Pond MRS located within the towns of West Tisbury and Chilmark, Martha's Vineyard, Massachusetts. The EPP was prepared in accordance with DID MR-005-12. Procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during site field activities were considered during the design of the RI and are described below in the Natural Resources and Cultural Resource sections, respectively. Natural resources also includes rare, threatened and endangered species and their habitats while cultural resources also includes historical or archaeological sites. The objective of the EPP is to coordinate and consult with the appropriate federal and commonwealth agencies, and stakeholders in advance of commencement of the Remedial Investigation (RI) to obtain their feedback to incorporate adequate natural and/or cultural resource protection measures into the work plan. The purpose of these measures is to avoid, minimize, and/or mitigate potential environmental impacts to the maximum extent practical without compromising the ability to achieve the primary objective of the RI, i.e., to identify and remove munitions and explosives of concern.

7.1.2 All work performed by the USACE as the Lead Agency as part of this RI will be performed in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 and the National Contingency Plan (NCP), Sections 300.120(d) and 300.400(e), and in compliance with applicable federal and commonwealth laws and regulations. CERCLA response actions are exempted by law from the administrative requirement to obtain Federal, State or local permits related to any activities conducted completely on-site. It is the policy of the Department of the Army (and the USEPA and MassDEP) to assure all activities conducted on sites are protective of human health and the environment and to meet (or waive) the substantive provisions of permitting regulations that are applicable or relevant and appropriate requirements (ARARs).

7.2 Coordination and Consultations with Agencies/Organizations/ Stakeholders

7.2.1 Prior to the start of work, the appropriate Federal, Tribal, State and local natural and cultural resource agencies/organizations, and stakeholders were notified as directed by Ms. Carol A. Charette, the CENAE PM. Federal, Tribal, State and local agencies, organizations and stakeholders that were contacted are presented in **Table 7-1**. Prior to the execution of the Work Plan, regular lines of communications were developed and project coordination and consultations conducted between USACE natural and cultural resources staff under the direction of the USACE PM with the appropriate agencies and stakeholders. Continued coordination and consultation with these organizations as warranted during project execution will ensure environmental protection of all natural and cultural resources at the project sites. Copies of project coordination letters and responses received to date are provided at the end of this section.

Table 7-1: Agencies/Organizations/Stakeholders

Resource	Classification	Agency/Organization/Stakeholder	Former Cape Poge Little Neck Bomb Target MRS	Former Moving Target Machine Gun Range at South Beach MRS	Tisbury Great Pond MRS
Threatened and Endangered Species	State	Massachusetts Natural Heritage and Endangered Species Program 1 Rabbit Hill Rd Westborough, MA 01581 Kristen Black Phone: (508) 389 – 6367 Tim Simmons Phone: (508) 389-6325	✓ 1, 2, 3	✓ 1, 2, 3	✓ 1, 2, 3
	State	Massachusetts Division of Marine Fisheries-Habitat Protection 123 Purchase Street, 3rd Floor New Bedford , MA 02740 Dr. Kathryn Ford Phone: (508) 990-2860 ext. 145 –	✓ 1	✓ 1	✓ 1
	State	Massachusetts Department of Conservation and Recreation 251 Causeway St, Suite 600 Boston, MA 02114-2104 Phone: (617) 626 – 1250 Fax: (617) 626 – 1351 email: mass.parks@state.ma.us		✓ 1	
	Federal	US Fish and Wildlife Service New England Field Office 70 Commercial St, Suite 300 Concord, NH 03301-5087 Susi von Oettingen Phone: (603) 223 – 2541 ext. 22 Fax: (603) 223 – 0104	✓ 1, 2, 3	✓ 1, 2, 3	✓ 1, 2, 3

Resource	Classification	Agency/Organization/Stakeholder	Former Cape Poge Little Neck Bomb Target MRS	Former Moving Target Machine Gun Range at South Beach MRS	Tisbury Great Pond MRS
Threatened and Endangered Species	Federal	National Marine Fisheries Service Northeast Office Protected Resources Division 55 Great Republic Dr Gloucester, MA 01930-2276 Julie Crocker Phone: (978) 281 – 9300 ext. 6530 Fax: (978) 281 – 9333	✓ 1	✓ 1	✓ 1
	Stakeholder	The Trustees of Reservations Christopher P. Kennedy Regional Director, Southeast PO Box 2106 Vineyard Haven, MA 02568 Phone: (508)693-7662 ext .12 email: kennedy@ttor.org	✓ 1, 2, 3	✓ 1, 2, 3	✓ 1, 2, 3
	Stakeholder	Edgartown Conservation Commission Jane Varkonda Town Hall 2nd Floor 70 Main St Edgartown, MA 02539 Phone: (508) 627 – 6165 Fax: (508) 627 – 6183	✓ 1	✓ 1	
	Stakeholder	West Tisbury Conservation Commission Maria McFarland P.O BOX 278 West Tisbury, MA 02575 Phone: (508) 696 – 6404 Fax: (508) 696 – 0103			✓ 1
	Stakeholder	Chilmark Conservation Commission Chuck Hodgekinson 401 Middle Rd Chilmark, MA 02535 Phone: (508) 645 – 2114 Fax: (508) 645 – 2110			✓ 1
	Stakeholder	Kristen Fauteux, Director of Stewardship Sheriffs Meadow Foundation Wakeman Conservation Center 57 David Avenue Vineyard Haven, MA 02568 508-693-5207			1, 2, 3
	Stakeholder	Julie Schaeffer, Ecologist Martha's Vineyard Land Bank Commission 167 Main Street, P.O. Box 2057 Edgartown, Massachusetts 02539 508-627-7141			1, 2, 3

Resource	Classification	Agency/Organization/Stakeholder	Former Cape Poge Little Neck Bomb Target MRS	Former Moving Target Machine Gun Range at South Beach MRS	Tisbury Great Pond MRS
Wetlands/Water Resources Environmental Coordination & Consultation	State	Massachusetts Department of Environmental Protection-Southeast Regional Office 20 Riverside Dr Lakeville, MA 02347 Liz Kouloheras Phone: (508) 946 – 2810 Fax: (508) 947 – 6557	✓ 1	✓ 1	✓ 1
	Stakeholder	Edgartown Conservation Commission	✓ 1	✓ 1	
	Stakeholder	West Tisbury Conservation Commission			✓ 1
	Stakeholder	Chilmark Conservation Commission			✓ 1
Cultural and Archeological Resources	State	Massachusetts Historical Commission Secretary of the Commonwealth 220 Morrissey Blvd Boston, MA 02125-3314 Phone: (617) 727 – 8470 email: mhc@sec.state.ma.us	✓ 1	✓ 1	✓ 1
	State	Massachusetts Board of Underwater Archaeological Resources Victor Mastone, Director 251 Causeway St, Suite 800 Boston, MA 02114-2199 Phone: (617) 626 – 1141 email: victor.mastone@state.ma.us	✓ 1	✓ 1	✓ 1
	State	Massachusetts Department of Conservation and Recreation Ellen Berkland, Archaeologist 251 Causeway Street, Suite 700 Boston, MA 02114-2104		1	
	Local	Martha's Vineyard Historical Society Keith Gorman, Executive Director Martha's Vineyard Museum PO Box 1310 Edgartown, MA 02539	1	1	1
	Stakeholder	The Trustees of Reservation Mark Wilson, Cultural Resources Program Manager Archives and Research Center c/o Moose Hill Farm 396 Moose Hill Farm Sharon, MA 02067	1		1

Resource	Classification	Agency/Organization/Stakeholder	Former Cape Poge Little Neck Bomb Target MRS	Former Moving Target Machine Gun Range at South Beach MRS	Tisbury Great Pond MRS
Cultural and Archeological Resources	Tribal Stakeholder	Wampanoag Tribe of Gay Head Tribal Historic Preservation Officer Bettina Washington 20 Black Brook Rd Aquinnah, MA 02535-1546 Phone: (508) 645 - 9265 ext 175 Fax: (508) 645 – 3790	✓ 1	✓ 1	✓ 1
Natural & Water Resources	State	Massachusetts Division of Marine Fisheries-Habitat Protection	✓ 2	✓ 2	✓ 2
	Federal	US Fish and Wildlife Service	✓ 1	✓ 1	✓ 1
	Federal	National Marine Fisheries Service	✓ 1	✓ 1	✓ 1
	Stakeholder	Massachusetts Department of Conservation and Recreation		✓ 2	
	Stakeholder	The Trustees of Reservations	✓ 1, 2		✓ 1, 2
	Stakeholder	Edgartown Shellfish Constable Paul Bagnall Town Hall 3rd Floor 70 Main St Edgartown, MA 02539 Phone: (508) 627 – 6175 Fax: (508) 627 – 6123	✓ 2	✓ 2	
	Stakeholder	Edgartown Harbormaster Charles Blair Jr. 1 Morse St Edgartown, MA 02539 Phone: (508) 627 – 4746 Fax: (508) 627 – 8439	✓ 2	✓ 2	
	Stakeholder	West Tisbury Shellfish constable Raymond Gale P.O. BOX 287 West Tisbury, MA 02575 Phone: (508) 696 – 0102 Fax: (508) 696 – 0103			✓ 2
	Stakeholder	Chilmark Shellfish Constable Isaiah Scheffer Chilmark Town Hall P.O. BOX 119 401 Middle Rd Chilmark, MA 02535 Phone: (508) 645 - 2100 ext 2145			✓ 2

Resource	Classification	Agency/Organization/Stakeholder	Former Cape Poge Little Neck Bomb Target MRS	Former Moving Target Machine Gun Range at South Beach MRS	Tisbury Great Pond MRS
Natural & Water Resources	Stakeholder	Chilmark Harbormaster Dennis Jason Chilmark Town Hall P.O. BOX 119 401 Middle Rd Chilmark, MA 02535 Phone: (508) 645 - 2100 ext 2846 (Town Hall) Phone: (508) 645 - 2846 (Harbor) Fax: (508) 645 – 2110			✓ 2

Notes: 1 Contact as part of Work Plan preparation; 2 Contact on regular basis during implementation of Work Plan; 3 Contact on regular basis during implementation of Work Plan regarding Threatened and Endangered Species habitat locations

7.3 ENVIRONMENTAL PROTECTION PLAN (EPP) FOR NATURAL RESOURCES PROTECTION

7.3.1 Threatened and Endangered Species and Species of Special Concern

7.3.1.1 Federal/State Listed Plants and Animals

7.3.1.1.1 Federal and Commonwealth (i.e. State) agencies and stakeholders associated with threatened and endangered species and species of special concern listed on **Table 7-1** will have the opportunity to review the Work Plan for the three MRS work areas prior to the commencement of any work. The review will allow the USACE to identify work areas which may potentially contain threatened and endangered species or species of special concern (i.e. protected species), and their habitats. **Figure 7-1** illustrates the areas that are designated in the Massachusetts Natural Heritage Atlas 13th Edition (effective October 1, 2008) by the Natural Heritage & Endangered Species Program, MA Division of Fisheries & Wildlife to be Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife at all of the MRSs, which essentially covers each MRS in its entirety. There are approximately thirty seven species reported as Federal and /or State listed that could be present on the three sites. The threatened and endangered species and species of special concern which may be encountered within or near the sites are presented in **Table 7-2**. The presence of the listed birds and reptiles is seasonal. Phase 1 and 2 of the RI Work Plan adjusts the implementation of the field schedule to avoid the presence of the listed birds and reptiles.

7.3.1.1.2 Field personnel will be trained on the identification and avoidance of selected threatened, endangered and/or species of special concern where practical. Field personnel will be briefed on the measures in the EPP, as further described in the section on Worker Education Briefing, and also carry an addendum (Worker Field

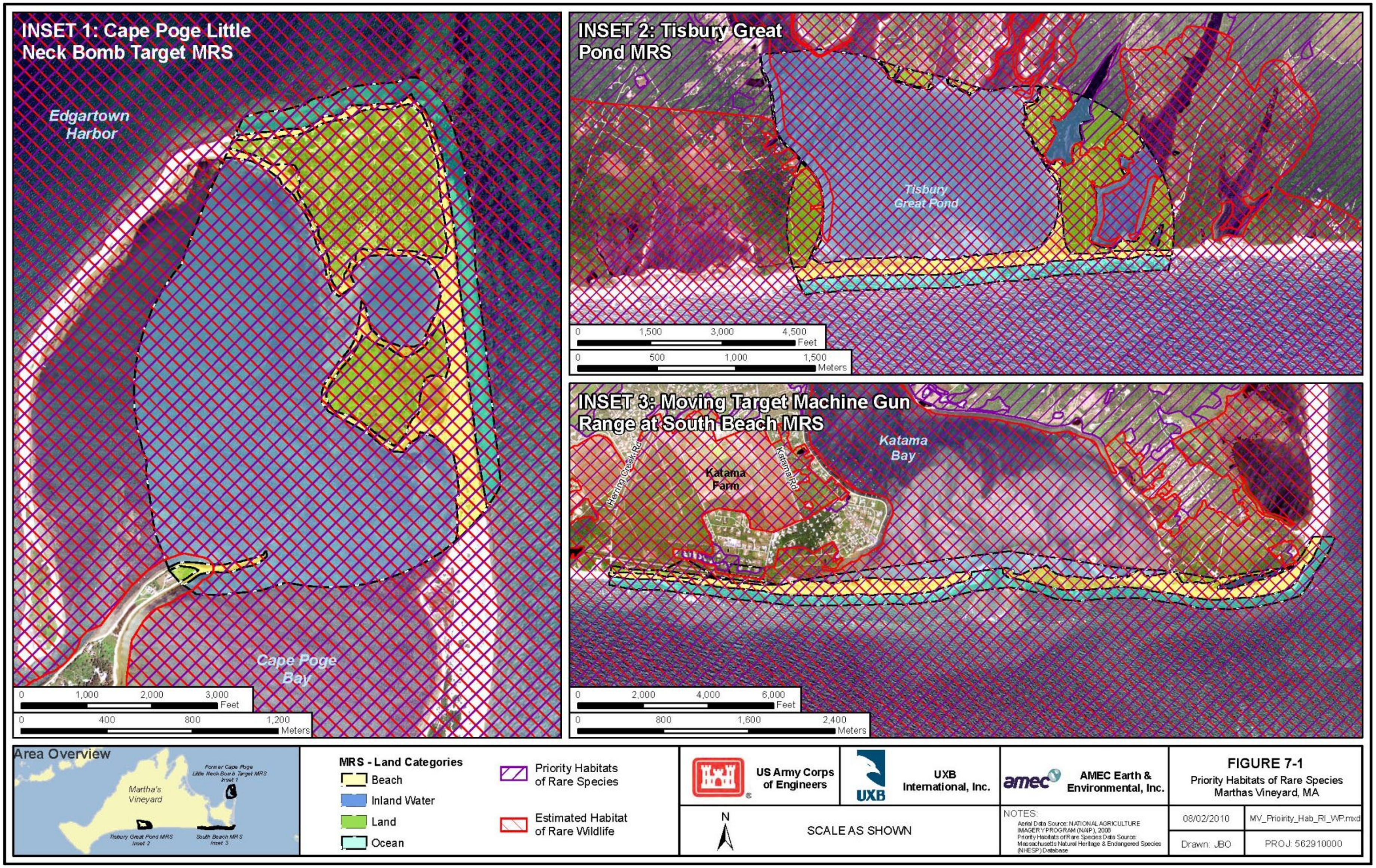
Manual) with additional field information which will include pictures of protected species, habitat information and the months of the year that the seasonal protected species (i.e. shorebirds and Northern harrier) are expected to be present in the investigative or action areas. This information has been summarized in **Table 7-3** "Protected Avian Species No Work Windows" for the three MRSs by each of the four Land Categories (Beach, Inland Water, Land and Ocean) and specific habitats within each of these categories based on TTOR's 2010 avian breeding data, USFWS guidance, and MA Natural Heritage Endangered Species Program data. In addition, if any work is conducted during the shorebird nesting season field teams will receive daily updates as to the presence of threatened and endangered species and species of special concern based on consultations with federal and commonwealth natural resource agencies, and private organizations such as the TTOR.

Table 7-2: Threatened, Endangered and Species of Concern

Type	Name	Listing
Birds	Common Tern (Sterna hirundo)	State Specie of Special Concern
	Least Tern (Sterna antillarum)	State Specie of Special Concern
	Northern Harrier (Circus syneus)	State Threatened Specie
	Piping Plover (Charadrius melodus)	Fed/State Threatened Specie
	Roseate Tern (Sterna dougallii dougallii)	Fed/State Endangered Specie
Reptiles	Green Sea Turtle (Chelonia mydas)	ThreatenedFed/StateSpecie
	Kemp's Ridley Sea Turtle (Lepidochelys kempi)	Fed/StateEndangered Specie
	Leatherback Sea Turtle (Dermochelys coriacea)	Fed/StateEndangered Specie
	Loggerhead Sea Turtle (Caretta caretta)	Fed/StateThreatened Specie
Insects	Chain Dot Geometer (Cingilia catenaria)	State Specie of Special Concern
	Coastal Heathland Cutworm (Abagrotis nefascia)	State Specie of Special Concern
	Gerhard’s Underwing Moth (Catocala Herodias gerhardi)	State Specie of Special Concern
	Faded Grey Geometer (Stenoporpia polygrammaria)	StateThreatened Specie
	Pine Barrens Zale (Zale sp 1 nr lunifera)	State Specie of Special Concern
	Pink Sallow (Psectraglaea carnosa)	State Specie of Special Concern

Type	Name	Listing
Insects	Sandplain Euchlaena (Euchlaena madusaria)	State Specie of Special Concern
	Barrens Buckmoth (Hemileuca maia)	State Specie of Special Concern
	Melsheimer's Sack Bearer (Cicinnus melsheimeri)	State Threatened Specie
	Pine Barrens Lycia (Lycia ypsilon)	State Threatened Specie
	Coastal Swamp Metarranthis Moth (Metarranthis pilosaria)	State Specie of Special Concern
	Slender Clearwing Sphinx Moth (Hemaris gracilis)	State Specie of Special Concern
	Spartina Borer Moth (Spartiniphaga inops)	State Specie of Special Concern
	Imperial Moth (Eacles imperialis)	State Threatened Specie
	Barrens Metarranthis Moth (Metarranthis apiciaria)	State Endangered Specie
	Comet Darner (Anax longipes)	State Specie of Special Concern
	Northeastern Beach Tiger Beetle (Cicindela dorsalis dorsalis)	Endangered Specie
	Purple Tiger Beetle (Cicindela purpurea)	Endangered Specie
	Three-Lined Angle Moth (Digrammia eremiata)	State Threatened Specie
Plants	Bristly Foxtail (Setaria parviflora)	State Specie of Special Concern
	Bushy Rockrose (Crocanthemum dumosum)	State Specie of Special Concern
	Purple Needlegrass (Aristida purpurascens)	StateThreatened Specie
	Sandplain Flax (Linum intercursum)	State Specie of Special Concern
	Nantucket Shadbush (Amelanchier nantucketensis)	State Specie of Special Concern
	Gerardia Sandplain (Agalinus acuta)	StateEndangered Specie
	Saltpond Pennywort (Hydrocotyle verticillata)	State Threatened Specie
	Pygmyweed (Tillaea aquatica)	State Threatened Specie
	Sandplain Blue-eyed Grass (Sisyinchium fuseatum)	State Specie of Special Concern
	Sea-Beach Knotweed (Polygonum glaucum)	State Specie of Special Concern

Figure 7-1: Priority Habitats of Rare Species



7.3.2 Wetlands, Water Resources and Natural Communities

7.3.2.1 To determine the potential for wetlands and water resources within the three project areas, the current MassGIS wetland resources and hydrology layers were obtained for the project areas. **Figure 7-2** illustrates the wetlands and deepwater (i.e. openwater) habitats associated with the Cape Poge Little Neck Bomb Target MRS, the Moving Target Machine Gun Range at South Beach MRS, and the Tisbury Great Pond MRS. All work performed will be in compliance with the substantive requirements of the Commonwealth of Massachusetts Wetland Protection Act, Massachusetts General Law 131 Section 40 as no permit is required for any on-site work. Removal action activities may occur at all sites. Procedures for intrusive investigations are outlined in Chapter 3 of this work plan.

7.3.2.2 Wetlands and Water Resources

7.3.2.2.1 Significant water resource features and their adjacent wetland resource areas encompass Tisbury Great Pond including Big Homer's Pond, portions of Long Cove Pond, Middle Point Cove, Hughe's Thumbs Cove and Deep Bottom Cove, upper reach of Cape Poge Bay including Drunkard's Cove and Shear Pen Pond and South Beach including a portion of Katama Bay and Swan Pond. A primary concern of the remedial investigation relative to the natural resources of the site is "What are the impacts to the local shell fishery?" Tisbury Great Pond and Cape Poge Bay is very important commercial and recreational fishery for oysters, bay scallops, quahogs, and soft shell clams. However, based on coordination to date with all of the three Shellfish Constables no adverse impacts are anticipated. All appropriate parties listed in **Table 7-1** will be notified prior to the start of work. Additionally, the Chilmark, West Tisbury, and Edgartown Shellfish Departments and Shellfish Constables will be contacted daily to coordinate activities as work proceeds in any of the shellfish harvesting areas, including advance notification of any shellfish area closings for safety reasons.

7.3.2.2.2 The investigative and/or removal actions to be conducted at the three MRSs in the Ocean Category in the Atlantic Ocean are planned to extend to about 100 meters offshore from the beach.

7.3.2.3 Natural Communities

7.3.2.3.1 The Cape Poge Little Neck Bomb Target Site, Moving Target Machine Gun Range at South Beach and Tisbury Great Pond MRSs comprise a complex and fragile system of dunes, wetlands and uplands. As evidenced from the previous sections, these diverse habitats support a large number of rare and endangered plants and animals. The natural communities present on these sites include the following (TTOR 2004):

7.3.2.3.1.1 Coastal Salt Ponds;

7.3.2.3.1.2 Sandplain Grasslands and Heathlands;

7.3.2.3.1.3 Dune complexes;

7.3.2.3.1.4 Maritime Eastern Red Cedar Woodlands;

7.3.2.3.1.5 Barrier Beach Strands;

7.3.2.3.1.6 Maritime Shrublands;

7.3.2.3.1.7 Pitch Pine and Oak Forest;

7.3.2.3.1.8 Fresh Water Pond and Emergent Marsh; and

7.3.2.3.1.9 Salt Marsh.

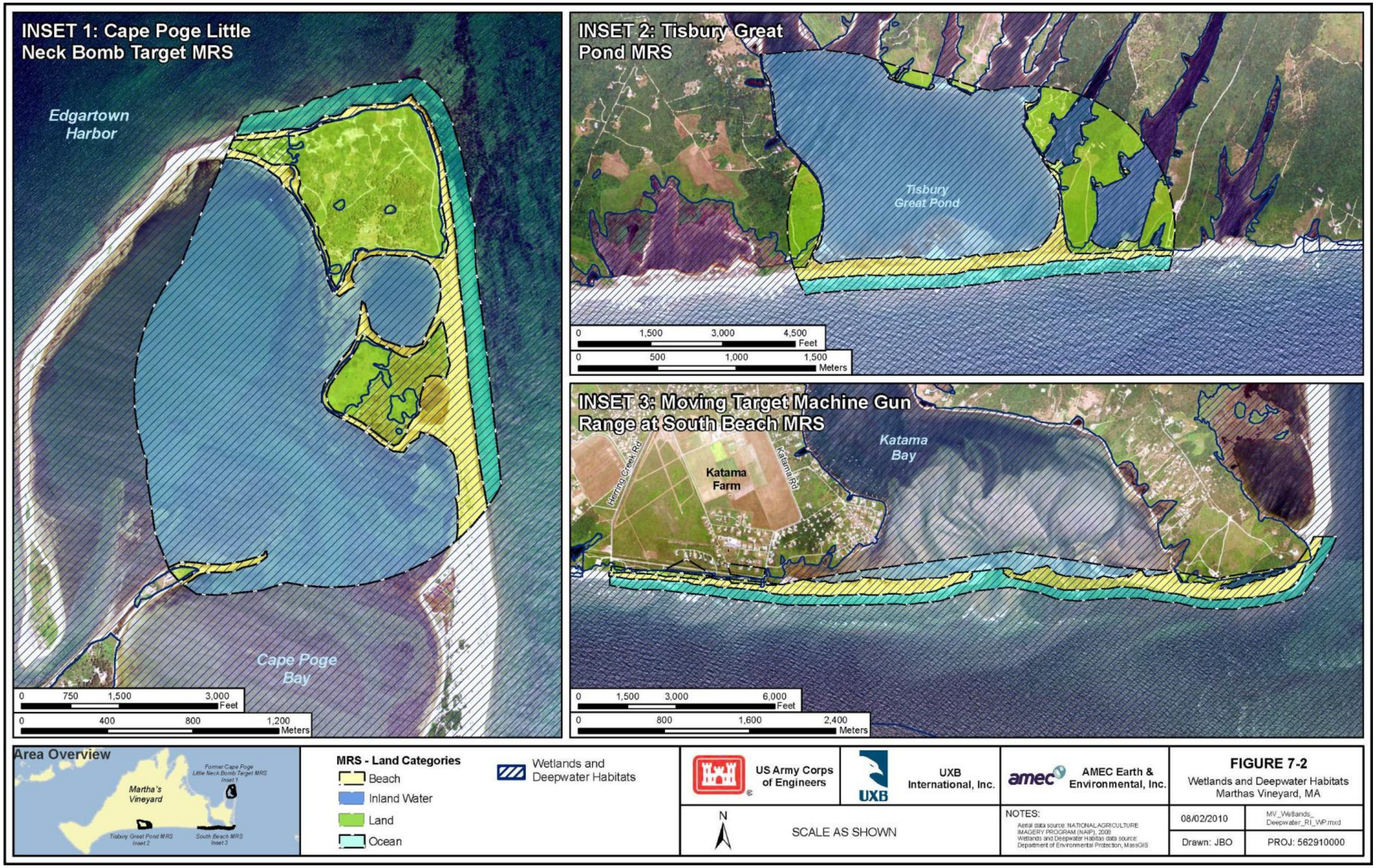
7.3.2.3.2 The various procedures described below to avoid, minimize and/or mitigate potential impacts to protected species and their habitats will also ensure protection of the aforementioned natural communities during execution of the RI.

7.3.3 Measures to Avoid, Minimize, and/or Mitigate Environmental Impacts

7.3.3.1 The procedures outlined in this section will be implemented by UXB to avoid, minimize and/or mitigate environmental effects attributable to the execution of the Task Order. The MEC investigation activities will be implemented in compliance with all applicable federal and state regulations, including those that protect air, water, land, human health and safety, and cultural and biological resources.

7.3.3.2 The collaborative work with the natural resource agencies and stakeholders will not end with the submittal of the Final Work Plan because the EPP is a dynamic living working document that will be updated as needed based on specific field activities in both Phase I, with more consultation and implementation of measures as needed before and during execution of Phase II once the specific locations of the anomalies are determined that need to dug up.

Figure 7-2: Wetlands and Deepwater Habitats



7.3.4 Reasons for Avoidance, Minimization and/or Mitigating Actions

7.3.4.1 Section 9 of the Endangered Species Act prohibits the taking of listed species without special exemption. 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. Under terms of sections 7(b)(4) and 7(o)(2) of the Act, 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 that such taking is in compliance with an incidental take statement.

7.3.5 Worker Education Briefing

7.3.5.1 Before the start of both Phase 1 and Phase 2 RI field activities all on-site personnel will be briefed on health and safety issues and the need for avoiding, minimizing and/or mitigating potential impact on sensitive biological resources based on this Environmental Protection Plan (EPP). A Field Manual for the workers that will summarize all EPP measures is being prepared as an Addendum to the EPP. The Field Manual will list the various measures along with a brief description of the protected animal and/or plant species to provide personnel a general framework for training and for discussion. Methods for avoiding and minimizing the potential impact on the protected species and communities of concern and for the transfer of invasives will be stressed during the on-site training. The UXB SUXOS will coordinate this briefing with UXB team members, including subcontractors, prior to start of work.

7.3.6 Vegetation Clearing for Geophysical Surveys and Acquisition of Selected Anomalies

7.3.6.1 The field crew has great flexibility in obtaining the required linear coverage needed in each land category including the uplands and any other vegetated study area. They do not need to survey and cut the vegetation in straight 3-ft wide paths as depicted on Work Plan **Figures 3-1, 3-2** and **3-3**, since they have flexibility in going around any trees greater than 1 inch dorsal breast height (dbh) and/or other constraints and manmade features by conducting meandering surveys. The following measures will be implemented to minimize the amount of vegetative clearing required and also to control the spread of invasive plant species.

7.3.7 Vegetation Impact Mitigation

7.3.7.1 As needed for the deployment of the appropriate geophysical survey equipment, the vegetation will be cut to a length of six inches above the ground surface to minimize surface disturbance. Therefore, herbaceous vegetation of less than six inches tall will not be cut, and it is also anticipated that many areas with relatively low vegetative cover (e.g. the managed grasslands at Long Point Refuge) will not need to be cut as the pushed survey equipment should be able to roll through these areas. Similarly there is no need to cut any Beach grass or other herbaceous plants during surveys in the vegetated dunes.

7.3.7.2 A narrow three-foot wide corridor will not be cut through the dense vegetation in the uplands on the west side of Tisbury Great Pond as requested by the Sheriff's Meadow Foundation to protect a breeding site of the Northern harrier.

7.3.7.3 Removal of woody vegetation will be limited to specimens with a diameter at breast height (dbh) of less than one inch. Clearing of lower branches of woody vegetation with a dbh greater than 1 inch will be limited to six feet above the ground. All cleared areas of vegetation will be allowed to re-vegetate naturally.

7.3.8 Trees and Shrubs

7.3.8.1 Meandering transect paths are currently planned for the land based portions of this RI. Meandering paths rather than straight line transects will allow the avoidance of most vegetation larger than one inch dbh. Therefore, tree and shrub clearing is not anticipated. If it becomes necessary to remove trees and/or shrubs, the property owner will be notified of the proposed removal prior to any action taken. A protected shrub, the Nantucket shadbush, will survive and recover from cutting based on an active management program being conducted at the Long Point Wildlife Refuge that involves mowing of areas with Nantucket shadbush to maintain sandplain grasslands habitat.

7.3.9 Control/Introduction//Spread of Invasive Plants

7.3.9.1 Island natural communities are protected to a certain degree from the introduction of invasives by their distance from mainland reservoirs of invasive species. On the other hand once invasive species are introduced, the closed, insulated nature of an island facilitates the spread of invasive plant species. The "TTOR Management Plan, 2004, Section 5.8.6, Invasive and Exotic Species" lists Purple Loosestrife (*Lythrum salicaria*), Asiatic bittersweet (*Celastrus orbiculata*), Sea Poppy (*Glaucium flavum*) and *Phragmites* spp. as present at Cape Pogue and Wasque. These plants are listed as invasives in MANHESP's "A Guide to

Invasive Plants in Massachusetts." During a field visit on October 13, 2010 *Phragmites* was located at Swan Pond and an adjacent freshwater marsh. Sea Poppy was located on a gravel berm just inland on the upper beach, slightly west of the former aerial bombing target, south of Shear Pen Pond. Not listed as an invasive in the 2004 TTOR Management Report but visually located just off property boundaries at the Tisbury Great Pond Site and throughout island roadsites is spotted knapweed (*Centaurea maculosa*). Other invasives such as autumn olive (*Elaegnus umbellate*) have been identified as being present on Chappaquiddick ("TTOR 2004").

7.3.9.2 Based on limited field observations and discussions with TTOR and MA Natural Heritage & Endangered Species Program Biologists, the control and limiting of the spread of these and other invasive species within the three sites and to other sites where these invasive species may not be currently present is both a concern and a priority of this mitigation measure.

7.3.9.3 These invasives are spread by the transfer of seeds, fruits and or pieces of the above ground plant or root. For example small, invisible fragments of Phragmites are effective in the propagation of the plant.

7.3.9.4 In Phase 1 and Phase 2 the UXB Team will employ a different array of equipment, depending on habitat to be surveyed and the natural community. The intertidal and offshore habitats offer little if any probability for the transfer of an invasive to these habitats since the plant species listed above will not survive in salt water. However, the equipment used to transport the underwater sled, the tow boat and trailer offers the potential for inter-site and intra-site transfer of invasive plant material.

7.3.9.5 All equipment such as hand held magnetometers and gear such as boots and shovels used in the investigation conducted on/in the terrestrial and fresh water habitats offer the possibility of the transfer of invasive plant material.

7.3.9.6 To avoid the introduction and spread of invasives all equipment will be visually examined and carefully washed with a hand sprayer to remove all plant material and traces of soil/sand prior to the entrance to a site. This includes the boat and trailer used to investigate aquatic/wetland habitats. Maps indicate geophysical investigation will occur in freshwater habitats such as Swan and Long Cove Pond.

7.3.9.7 Included in the worker education briefing training manual provided to the field personnel will be descriptions of the invasive plants that are most likely present on the site. When personnel are working in a site where invasives are known to be present, such as Cape Poge on the gravel berm to the west of the aerial bomb site, the invasive (Sea Poppy) will be identified and plant material will be removed from the equipment and washed with water to avoid the spread of the species within the site to another area where the invasive is not present.

7.3.9.8 When the equipment is removed from the site to be transported to another site or off island the equipment will be again washed to remove any plant material or soil. If possible to reduce time and effort spent on decontamination, equipment could be left on the site until the investigation in the area was completed. Equipment containing petroleum products should be parked on plastic sheeting to avoid possible leakage of fluids.

7.3.9.9 Field personnel should wear gaiters, rubber boots or other clothing and footwear which reduce the likelihood for seed attachment when working in areas infested with invasive species.

7.3.9.10 Field personnel must inspect, remove, and properly dispose weed seed and plant parts found on clothing in a trash bag and dispose off island.

7.3.9.11 Field personnel must wash with hand sprayer soil from boots/footwear prior to entering the work site and before leaving the site post-completion.

7.3.9.12 This protocol to control invasives is applicable for both Phase 1 and 2 of the RI. Execution of Phase 2 of the RI involves more intrusive activity, such as disturbing the surface of the substrate, and increases the possibility for the introduction/spread of invasives.

7.3.9.13 In Phase 2, it is more likely there will be a need to disturb/dig to remove an anomaly and if there are invasives reported in the immediate area, the equipment used, i.e. trowel or shovel, should be rinsed prior to each use. The soil over the object should be placed on a plastic sheet adjacent to the site. Upon removal of the anomaly, the soil will be replaced over the hole. Any plant cover removed with the soil will be replaced and gently hand tamped in place to ensure successful reestablishment of the cover

7.3.10 Federally-Listed and State-Listed Protected Species (Flora and Fauna)

7.3.10.1 The following species are both Federally-listed and State-listed based on consultations with the USFWS, NMFS and MANHESP:

7.3.10.1.1 Piping plover (*Charadrius melodus*);

7.3.10.1.2 Roseate tern (*Sterna dougalii dougalii*);

7.3.10.1.3 Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*);

7.3.10.1.4 Sandplain gerardia (*Agalinus acuta*); and

7.3.10.1.5 Sea turtles, including the loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), leatherback (*Dermochelys coriacea*), and green (*Chelonia mydas*).

7.3.10.2 Sea turtles occur seasonally off the coast of Martha's Vineyard from June through early November of any year. The action area for the three MRSs includes several types of habitat where sea turtles are extremely unlikely to occur. As the action area is inconsistent with the preferred habitats of sea turtles, it is extremely unlikely that and sea turtles will occur in the action area.

7.3.10.3 While listed whales occur in the offshore waters of Martha's Vineyard, due to the shallow depths and nearshore location of the action area, no listed marine mammals are expected to occur in the action area.

7.3.11 State-Listed Species

7.3.11.1 The State-listed species based on consultations with the MANHESP include the following:

7.3.11.1.1 Common tern (*Sterna hirundo*)

7.3.11.1.2 Least tern (*Sterna antilarum*)

7.3.11.1.3 Northern harrier (*Circus syneus*)

7.3.11.1.4 Chain dot Geometer (*Cingulia catenaria*)

7.3.11.1.5 Coastal Heathland Cutworm (*Abagrotis nefascia*)

7.3.11.1.6 Gerhard’s Underwing Moth (*Catocala Herodias gerhardi*)

7.3.11.1.7 Faded Grey Geometer (*Stenoporpia polygrammaaria*)

7.3.11.1.8 Pine Barrens Zale (*Zale sp l nr lunifera*)

7.3.11.1.9 Pink Sallow Moth (*Psectraglea carnosa*)

7.3.11.1.10 Sandplain Euchaena (*Euchlaena madusaria*)

7.3.11.1.11 Barrens Buckmoth (*Hemileuca maia*)

7.3.11.1.12 Melsheimer’s Sack Bearer (*Cicinus melsheimeri*)

7.3.11.1.13 Pine Barrens Lycia (*Lycia ypsilon*)

7.3.11.1.14 Coastal Swamp Metarranthis Moth (*Metarranthis pilosaria*)

7.3.11.1.15 Slender Clearwing Sphinx Moth (*Hemaris pilosaria*)

7.3.11.1.16 Spartina Borer Moth (*Spartiniphagia inops*)

7.3.11.1.17 Imperial Moth (*Eacles imperialis*)

7.3.11.1.18 Barrens Metarranthis Moth (*Metarranthis apiciaria*)

7.3.11.1.19 Comet Darner (*Anax longippes*)

7.3.11.1.20 Purple Tiger Beetle (*Cicindela purpurea*)

7.3.11.1.21 Three-Lined Angle Moth (*Digrammia eremiata*)

7.3.11.1.22 Bristly Foxtail (*Setaria parviflora*)

7.3.11.1.23 Bushy Rockrose (*Crocanthemum dumosum*)

7.3.11.1.24 Purple needlegrass (*Aristida purpurascens*)

7.3.11.1.25 Sandplain Flax (*Linum intercursum*)

7.3.11.1.26 Saltpond Pennywort (*Hydrocotyle verticellata*)

7.3.11.1.27 Pigmyweed (*Tillacea aquatica*)

7.3.11.1.28 Sandplain Blue-eyed grass (*Sisyinchium fuseatum*)

7.3.11.1.29 Sea-Beach Knotweed (*Polygonum glaucm*)

7.3.11.1.30 Nantucket Shadbush (*Amelanchier nantuckensis*)

7.3.12 Discussion of Federal- & State-Listed Species

7.3.12.1 Avian Protected Species

7.3.12.1.1 There are five listed avian species, piping plover and the terns, roseate, common and least, and the northern harrier. The terns and the piping plover generally breed on beach/dune habitats. The northern harrier breeds in dense vegetation in uplands and marsh habitat. All these species could be present at any or all of the three MRS Sites, however, the avian protection plan is based on the most recent nesting or breeding sites based on TTOR and MANHESP data. Due to the unpredictable nature of the breeding behavior of these species regular communication with TTOR and MA Natural Heritage is required for any field activities during the shorebird nesting season.

7.3.12.1.2 Piping plovers and roseate terns could be present at any or all of the three designated project sites or action area. Their presence is most likely during the breeding and fall migration period of April 1 through September 30. These are ground nesting birds with well-camouflaged nests. The unfledged chicks are virtually indistinguishable from their sand substrate. As recommended by the USFWS in their September 27, 2010 letter in order to avoid adversely affecting piping plover or roseate terns, they recommend that activities associated with the remedial investigation (transects and sampling) not occur between April 1 and September 30, or be closely coordinated with the organizations managing piping plover and/or terns.

7.3.12.2 Summary of Shorebird Species Nesting Data for 2009 and 2010

7.3.12.2.1 The following information was provided by TTOR's Ecologists based on their rare species data base for the Cape Poge Refuge and property that they manage (Norton Point Beach). Recent rare species occurrences within our project action areas based on maps prepared by TTOR for 2009 and 2010 are provided as **Figures 7-3** and **7-4**, respectively. This information has been updated with recent communications with both TTOR and MANHESP Biologists. The key to the legend is AMOY, American oystercatcher, PIPL, piping plover, BLSK, black skimmer, LETE, least tern, COTE, common tern and ROST, roseate tern.

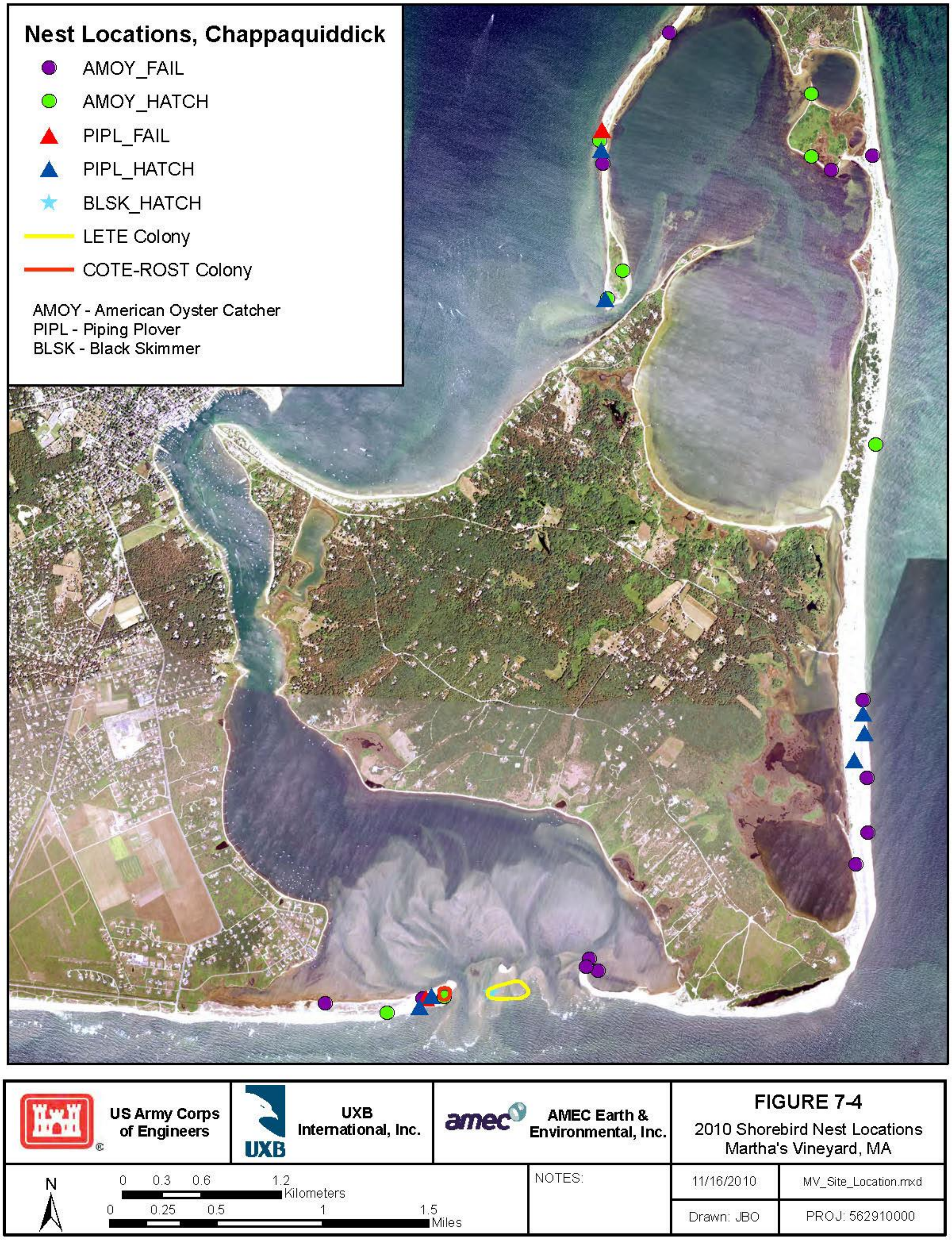
7.3.12.2.2 <u>Piping Plover</u>

7.3.12.2.2.1 The following information was excerpted from the After Action Report to the USFWS included in Appendix N1 in the Final TCRA (March 2010). During the 2009 breeding season, 7 pairs of piping plover bred on Cape Poge Refuge and East Beach on Chappaquiddick Island (**Figure 7-3**), and 5 pairs of piping plovers nested at Norton Point Beach in Edgartown (See **Figure 7-3**). Altogether, the piping plover pairs produced 15 nests, 54 eggs, 35 chicks, and 4 fledglings, resulting in 0.27 fledglings produced per breeding pair. Nest failures in 2009 resulted from storm overwash and predation by skunks and crows.

7.3.12.2.2.2 During the TCRA no piping plover nested or foraged within the action area- either within the removal area or along travel corridors accessing the sites. No other Federally-listed species (roseate tern or northeastern beach tiger beetle) were observed within the action area. In addition, northern harrier, a State-listed species did not nest within the action area.

Figure 7-3: 2009 Shorebird Nest Locations

Figure 7-4: 2010 Shorebird Nest Locations



7.3.12.2.2.3 Nesting data from 2010 provided by TTOR for the Cape Poge Refuge that include portions of our MRS study or action areas illustrates the dynamic nature of the shorebirds (**Figure 7-4**). Piping plover, least and common tern nesting was recorded at Norton Point Beach, along with Piping plover hatchlings resulting from successful hatches .

7.3.12.2.2.4 Piping Plovers nesting has occurred infrequently along the ocean beaches to the east of the action area: between Aruda's Point and the Jetties. One pair of Piping Plovers nested unsuccessfully north of Aruda's Point in 2008. Dense inter-dune vegetation near Aruda's Point precludes travel of unfledged chicks between Aruda's Point and Cape Poge Bay.

7.3.12.2.2.5 Adult Piping Plovers have been observed foraging along the shoreline of Drunkard's Cove—between Simon's Point and Little Neck. This area is part of The Trustees of Reservations publically accessible vehicle travel corridor.

7.3.12.2.3 <u>Roseate Tern</u>

7.3.12.2.3.1 Roseate Terns (15 pairs) nested along the southern shore of Shear Pen Pond in 1982. The colony was flooded out and the site occupied by nesting gulls in 1984. Roseate Terns have not occupied this site since 1982. Roseate Tern activity was not anticipated during the 2009 breeding season. The TTOR field data from 2010 reports 26 roseate tern present on Chappaquiddick (Email Chris Buelow, TTOR 27 Oct 2010). **Figure 7-3** lists common tern/roseate tern colony in the key, but no colonies were located at the Cape Poge Refuge and Norton Point Beach.

7.3.12.2.3.2 According to TTOR, they have not had shorebirds nest at Long Point since 2005. However, the MANHESP has recorded nesting of protected tern species along the Tisbury Great Pond barrier beach to the west of Long Point extending to the western end on the private properties controlled by the Quansoo Beach Association (Personal communication, Tim Simmons, MANHESP 5 November 2010).

7.3.12.2.4 <u>Common and Least Tern</u>

7.3.12.2.4.1 The above protocols for the protection efforts of the Piping plover and Roseate tern will also provide protection for the Common and Least terns. Should any work activity occur when these avian species are present April 1 through August 31, daily consultation with TTOR and MANHESP will occur to coordinate activities to minimize impact. In 2010 a tern colony, common and least, were recorded nesting east of the cut in Katama Bay, off Norton Beach and along the beach/dunes of Tisbury Great Pond barrier beach.

7.3.12.2.5 Northern Harrier

7.3.12.2.5.1 The Northern harrier or Marsh hawk nest in wet meadows, grasslands, abandoned fields and coastal/inland marshes. They are particularly vulnerable from March-August during breeding activity. Nests may be in shallow depressions created on the ground, in low vegetation or in shallow water on a pile of vegetation. Nests are built from grasses, water weeds and other selected vegetative material. These northern harrier areas are vulnerable to foot and vehicular traffic. Each of the three MRS sites have upland areas which are potential harrier nesting sites, with the Cape Poge site the most active nesting area. Since the nests are well camouflaged the protection/ minimizing threat is to avoid this upland habitat from March through August. As with other listed avian species, close coordination with TTOR and MA Natural Heritage is required prior to any activity in the upland during this time period to check northern harrier sightings.

7.3.12.2.5.2 Many northern harriers that nest on Cape Cod and the islands migrate south for the winter. Northern harriers that don't migrate south or those that nest to the north of MA may also winter on the islands off the coast of Massachusetts (MANHESP Program Bulletin). Activities related to Phase 1 and 2 should not impact these overwintering birds.

7.3.12.2.5.3 As with the above mentioned Federal- and State-Listed birds, it is recommended that Phase 1 and 2 RI activities shall not be conducted in their nesting habitat during the Northern harrier's breeding season, March 1-August 31. The one reported northern harrier breeding site is in thick vegetation on the western portion of Tisbury Great Pond. This breeding site is on property managed by the Sheriffs Meadow Foundation. (Personal communication, Kristen Fauteux, Sheriffs Meadow Foundation, 5 November 2010).

7.3.12.2.5.4 A specific recommendation for protection of the breeding northern harrier by MA Natural Heritage is to not mow the low, dense vegetation (probably scrub oak). The cutting of the vegetation will disrupt the cover around the nest and provide access to the harrier nest by predators such as skunk and raccoon. Phase 1 survey will occur on foot with the hand held magnetometer. The elimination of cutting vegetation in this area will be in addition to the exclusion of Phase 1 activity from March 1 to August 31.

7.3.12.3 Environmental Requirements and Protocols by TTOR, MANHESP and Others for Protected Avian Shorebird Species

7.3.12.3.1 As stewards of the environment TTOR, MANHESP and other involved stakeholders place symbolic fencing each spring in all potential habitat beginning in April. The fencing is placed from the toe of the dune throughout much of the ocean facing beach. Symbolic fencing is 5-6 ft stakes placed about 15 ft apart. The stakes are inserted to a sufficient depth to support twine tied 4 ft from the ground. Symbolic fencing is placed parallel to the toe of the dune at Tisbury Great Pond Barrier Beach, Norton Point Beach, and any other potential shorebird nesting areas. This fencing will also protect the larval habitat of the Northeastern Beach Tiger Beetle since they are collocated. Motor vehicles are excluded from the beach habitat throughout the nesting season from April 1- August 31. This means the elimination of public vehicles in the vicinity of chicks while there are chicks on the beach and greatly limiting all use of essential TTOR vehicles for their managed properties. Essentially Norton Point Beach was closed for most of the summer in 2010. TTOR also used wire mesh fencing to surround the tern colony on Norton Point Beach in 2010, and electric fencing may be sued in 2011 to protect some nesting areas, especially on Norton Point Beach.

7.3.12.3.2 To lessen impact on these Federal and State -listed avian species all field activities including preparation and staging should occur when these species are not present. Proper field schedule design will alleviate any potential impact on these species by avoidance by working outside of their nesting season. **Table 7-3** Protected Avian Species No Work Windows provides the windows for the shorebirds and Northern harrier by MRS, Land Categories and Habitat.

7.3.12.4 Daily Protocol for Remedial Investigation Field Operations at Little Neck, Cape Poge Wildlife Refuge and at Norton Point Beach During the Shorebird Nesting Season April 1-August 31, 2011

7.3.12.4.1 <u>Nesting Piping Plovers & Other Shorebirds of Concern</u>. Starting on April 1, 2011 by 1000 hours daily, the UXB on-site UXO supervisor will contact Acting Chappaquiddick Superintendent Sarah Trudel (radio call sign: Trustees 11) via VHF radio channel 159.465 MHz or via land line (508-627-7689) for the Cape Poge Wildlife Refuge to discuss the last known location of any Piping plover nests, feeding Piping plover adults or chick locations, and any other protected shorebird species.

Table 7-3: Protected Avian Species No Work Windows

PROTECTED AVIAN SPECIES NO WORK WINDOWS			
MRS Sites	**Land Categories/Habitats**	**Shorebirds April 1-August 31**	**Northern Harrier March 1-August 31**
FMTMGR at South Beach MRS	**Beach**		
	South Beach/Dune	None*	None
	Norton Point Beach/Dune	**Apr 1-Aug 31**	None
	Wasque Point Beach	None*	None
	Inland Water		
	Katama Bay	**Potential Apr 1-Aug 31****	None
	Land		
	Wasque Pt. Upland	None	None
	Ocean		
	Adjacent to South Beach	None*	None
	Adjacent to Norton Point Beach/Dune	**Apr 1-Aug 31**	None
	Adjacent to Wasque Point Beach	None*	None
Cape Poge/Little Neck MRS	**Beach**		
	North-East to Simon Point	None*	None
	Inland Water		
	Cape Poge Bay/Shear Pen Pond	None	None
	Inland Water Beaches	None*	None
	Land		
	Cape Poge Lighthouse/Upland	None	**Mar 1-Aug 31**
	Little Neck/Upland & Salt Marsh	None*	None
	Ocean		
	North-East to Simon Point	None*	None
Tisbury Great Pond MRS	**Beach**		
	Barrier Beach/Dunes	**Apr 1-Aug 31**	None
	Inland Water		
	Tisbury Great Pond	**Potential Apr 1-Aug 31****	None
	Long Point Ponds/Wetlands	None	None
	Land		
	Western Uplands	None	**Mar 1-Aug 31**
	Eastern Uplands	None	None
	Ocean		
	Adjacent to Barrier Beach/Dunes	**Apr 1-Aug 31**	None

Footnotes:

* - None anticipated based on 2010 reported shorebird occurrences and historical data; however, shorebird nesting locations can vary year to year. In accordance with the Environmental Protection Plan, UXB will contact the TTOR Shorebird Technicians daily during the nesting season (April 1 - August 31) for any reported occurrences for properties that they manage or the MANHESP for the private properties.

**- Potential no work window if the Inland Water near shore field activities adjacent to northern side of the barrier beach/dunes will disturb the nesting shorebirds.

7.3.12.4.2 Similarly for the Long Point Wildlife Refuge, the UXB on-site UXO supervisor will contact Superintendent Chris Egan (radio call sign: Trustees 11) via VHF radio channel 159.465 MHz or via land line (508-693-3678).

7.3.12.4.3 Vehicle Travel Restrictions. In the opinion of TTOR Shorebird Technicians, if vehicle access presents potential for adverse impact to shorebird resources they will so notify Acting Superintendent Sarah Trudel for Cape Poge Wildlife Refuge and Chris Egan for Long Point Wildlife Refuge daily by 1000 hours. Acting Superintendent Trudel or Superintendent Egan will take any and all measures necessary to assure vehicle access in these areas will not create situations where nesting Piping plovers or Least terns are impacted from passing vehicles, per the Massachusetts Shorebird Protection Guidelines.

7.3.12.4.4 If unfledged chicks are present in the area, only Essential Vehicles will be allowed into the vehicle exclusion area per Massachusetts or USFWS Shorebird Protection Guidelines. UXB vehicles will be treated as Essential Vehicles and will be required to access the impacted area with a TTOR Shorebird Technician present. Logging into and out of the area is also required per the Guidelines noted herein.

7.3.12.4.5 Unfledged Piping Plovers. UXB will be required to follow the same vehicle guidelines as the general public. If vehicle corridors are open to the public, UXB would also have access. In the event of vehicle closures due to the presence of unfledged Piping Plovers, UXB will follow the state and federal provisions for "essential vehicles." Namely:

7.3.12.4.6 Essential vehicles will travel through chick habitat areas only during daylight hours, and will be guided by a qualified monitor who has first determined the location of all unfledged plover chicks.

7.3.12.4.7 Speed of vehicles will not exceed five miles per hour.

7.3.12.4.8 A log will be maintained by the beach manager of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers will maintain and regularly update a log of the numbers and locations of unfledged plover chicks on each beach. Drivers of essential vehicles will review the log each day to determine the most recent number and location of unfledged chicks.

7.3.12.4.9 Reporting Requirements for Mortality of Piping Plover during TCRA: In the event that a piping plover (or Roseate tern) chick or adult is found dead during the removal of explosives, the following special agent of the U.S. Fish and Wildlife Office of Law Enforcement should be immediately contacted:

7.3.12.4.9.1 David N. Sykes
Resident Agent in Charge
Office of Law Enforcement
U.S. Fish and Wildlife Service
70 Everett Avenue, Suite 315
Chelsea, MA 02150-2363
Phone: 617-889-6616 x 15
Fax: 617/889-1980

7.3.12.5 Northeastern Beach Tiger Beetle (NEBTB)

7.3.12.5.1 This insect has a full two year life cycle, with dipause/overwintering as a second instar larva. The larva are active through at least November and emerge from diapause in mid-March. Larva live in vertical burrows located in the upper intertidal to high drift zone. Their entire life cycle, adult, egg, larva and emerging adult occur in the foredune portion of the beach. The adults are active predators and will probably not be affected by either Phase 1 or 2 of the Project. Eggs are deposited in the sand on the upper dune. The beetle is most vulnerable in the larval stage while in the burrow. Larvae feed on insects feeding on detritus in the drift line. Their burrows which may be between 4 to 14 inches in the sand with an opening of about 0.5 inches are vulnerable to vehicular traffic. Vehicular traffic and heavy foot traffic on the upper beach just below the level of spring high tide, the drift line and the berm at the base of the dune are responsible for high mortality and their extirpation from much of their range in the Northeast. To limit impact to the beetle, the equipment to be used in Phase 1 on the beach has been modified to include an ATV which will tow the array on the beach. The smaller tires and reduced weight will not impact the beetle

7.3.12.5.2 The Northeastern Beach Tiger Beetle (NEBTB) occurs on the sandy beaches, washover areas and blowouts of the Tisbury Great Pond MRS and possibly other MRS project areas. However, no NEBTB have been observed at the other MRS sites since the 1950's and they have been checked regularly since 1990 (Email Tim Simmons, MANHESP, 27 October 2010). For Phase 1, to minimize impact to the larval stage an ATV towed array will be utilized on the beach. Phase 1 activity will be limited to the hand operated and pushed magnetometer on and in the vegetated dunes.

7.3.12.5.3 Intrusive Phase 2 activity within actual Northeastern Beach Tiger Beetle larval habitat will require additional coordination with the USFWS and the MANHESP.. The location of the NEBTB habitat in our MRS or action area seems to be limited to the Tisbury Great Pond barrier beach to the east by Long Point and to the west of the cut by Quonsoo Beach (personal communication Tim Simmons, MANHESP and Entomologist Paul Goldstein, Ph.D., Vineyard Haven, MA).

7.3.12.5.4 There are two tiger beetle species inhabiting the Atlantic beach, the common hairy collared tiger beetle, *Cicindela hirticollis*, and the northeastern beach tiger beetle, *C. d.dorsalis*. It is not possible to distinguish the larvae of the two species from a photograph. One either needs to probe the burrow with a small skewer to determine the burrow angle or excavate a burrow carefully to examine the larva for diagnostic characteristics. The MANHESP recommended that the project hire someone with the necessary skills to identify tiger beetle larvae when working in the Long Point - Quansoo Beach Association beach areas. When inclement weather arrives or they have recently fed tiger beetle larvae plug their burrows or allow them to be covered by windblown sand. Tiger beetle larvae tend to be concentrated at this time of year (fall-winter) as they retreat landward due to the changing beach profile of the winter beach. It is important to identify larval concentrations before they become dormant or nearly dormant for the winter. Tim Simmons (MANHESP) has excavated larvae in the spring and fall that were 38 inches below the surface.

7.3.12.5.5 When excavating MEC in these areas it may be useful to screen the surrounding sand, retrieve any tiger beetle larvae and restore them to a new burrow in appropriate habitat. This is essentially what the MAHNESP does when translocating larvae for restoration.

7.3.12.6 Sand-plain Gerardia (*Agalinus acuta*)

7.3.12.6.1 An extremely rare, delicate annual herb, averaging 10-20 cm tall, smooth stem with opposite linear leaves. Short lived, bell shaped purple flowers are on 0.5-1.2 inch stalks with 5 petals fused to form a corolla tube. Sandplain gerardia has been located only at the Tisbury Great Pond MRS, east of Long Cove Pond. (USFWS Response Letter, September 27, 2010). Three other species of the genus *Agalinus* could also be present at the site. A description of Sandplain gerardia will be included in the Field manual. The Phase 1 RI investigation will not impact this plant. If Phase 2 requires digging in this habitat to remove an anomaly, the plug of soil and above ground vegetation will be placed on a plastic sheet, the object removed and the soil with vegetation will be replaced in the hole and gently tamped back in place.

7.3.12.7 State-Listed Insects (Dragonfly, Beetle, Butterflies & Moths)

7.3.12.7.1 There are eighteen State-listed insect species in addition to the NEBTB. These species are the 4th-21st as previously listed in the Section on State Listed Species and include primarily butterflies and moths along with one additional beetle (Purple tiger beetle) and one dragonfly (Comet darner). Many of these organisms have complicated life cycles, with as many as four forms, egg/larva/pupa /adult. Each of these life forms may occupy a different habitat.

7.3.12.7.2 Phase 1 of the MRS is minimally intrusive. Adult forms of the insects are motile, easily avoiding contact with equipment. Larva, caterpillar or maggot-like forms are unlikely to be impacted during the transect surveys, no more than they would be affected by someone walking through the habitat.

7.3.12.7.3 Phase 2 could potentially impact the pupa and larva form of the insect. When anomalies are located, they will be removed from the substrate. The soil and any rooted vegetation will be dug from the surface of the anomaly, placed on a sheet of plastic adjacent to the hole and replaced upon removal of the anomaly.

7.3.13 Protection for State-Listed Plants

7.3.13.1 Phase 1 activities will have minimal impact. For example, Nantucket shadbush growth will be encouraged with cutting. Phase 2 digging activity may impact listed plants, but the probability that an anomaly will be present in an area with a listed plant cover is remote. The removal of the plug of soil over the anomaly and its replacement will limit the potential impact to a State-listed plant.

7.3.14 Manifesting, Transportation, and Disposal of Wastes

7.3.14.1 No hazardous wastes are expected to be generated as a result of site activities. Trash will be bagged and disposed of properly off site. Munitions debris will be placed into containers and transported off site for recycling.

7.3.15 Burning Activities

7.3.15.1 There are no burning activities planned for this project.

7.3.16 Dust and Emission Control

7.3.16.1 Due to the limited amount of disturbed area anticipated during the project and the fact that much of the work will be conducted in wet areas, it is not anticipated that dust or emissions controls will be needed on site.

7.3.17 Spill Control and Prevention

7.3.17.1 There will not be any storage of fuel, oil, paint, or similar materials on sites. In the event of a spill in an area cleared of MEC, shovels will be used to remove any contaminated soils, which will be containerized and properly disposed. If the area has not yet been cleared of MEC, the clearance will be performed before soil removal occurs. A spill kit containing absorbent, rags, shovels, and latex gloves will be available on site.

7.3.18 Storage and Temporary Facilities

7.3.18.1 UXB has obtained a temporary secure space at Edgartown Marine for the storage of equipment. All MPPEH/MEC items will be disposed of in accordance with the ESP. Munitions debris and scrap metal will be removed from the site and stored in a locked container sited at the Edgartown Police Station pending recycling/salvage.

7.3.19 Access Routes

7.3.19.1 Access to the site will be via numerous recognized paved roads as well as well-traveled dirt access roads. Check with **Table 7-3** for specific No Work Windows and restrictions to be certain that access and staging sites will not impact protected species or their habitats. No roads will need to be created for the project. Since spotted knotweed was observed growing on many island roadsides, access areas should be checked prior to being traversed into the three MRS sites. Determine whether the access sites are within shorebird, northern harrier breeding and northeastern beach tiger beetle habitat. For example access at Norton Point Beach may be limited between April 1 and August 31. Boat access to freshwater ponds and wetlands will be in areas to limit impact to emergent vegetation.

7.3.20 Control of Water Run-on and Run-off

7.3.20.1 Due to the limited amount of disturbed area expected on site, run-on and run-off controls are not anticipated.

7.3.21 Decontamination and Disposal of Equipment

7.3.21.1 Decontamination will consist of performing a dry-decon of equipment (including scraping dirt and mud from the equipment) before demobilization. See Section 7.3.9 for measures to be implemented relative to the control of invasive species. Disposal of equipment consumed during the project will include the draining and capturing for disposal of any hazardous materials (such as fuel and oil) within the equipment, and that hazardous material will be disposed of properly.

7.3.22 Minimizing Areas of Disturbance – Phase 2

7.3.22.1 Once potential MEC is located, soil and plants covering the device will be excavated and placed to one side. All detonation holes shall be, to the greatest extent feasible, filled, regarded, and returned to their previous state. The excavated soil and plant material will be placed over the detonation hole. The detonation hole will not be filled with soil from another area to minimize the possibility for the introduction of invasive species. Explosive disposal activities may release vapors or gaseous emissions, but since they are temporary and intermittent in nature, they are not anticipated to be detrimental to the local environment. Given the sites are environmentally sensitive and are highly utilized tourist areas, every effort will be made to minimize the spread of shrapnel during explosive evolutions and a thorough clean-up of any shrapnel will occur prior to departing the MRSs.

7.3.23 Post-Activity Cleanup and Site Restoration

7.3.23.1 At the completion of activities, all equipment and materials brought on site will be removed. After the acquisition of Selected Anomalies in Phase 2 and depending on the degree on surface disturbance and existing habitat, restoration measures include replacing the soil that is removed at the surface along with the vegetated root mass (top six inches) as a transplant measure and/or seeding with the appropriate native seed mixture in addition to leaving the site of the excavation bare for natural recolonization. UXB will conduct a final walk-through with the USAESCH PM to ensure that no remaining clean-up items exist. It is anticipated that the majority of excavation sites will be within sub-tidal and inter-tidal areas, and they will be naturally restored when the substrate caves in as the metal object is removed.

7.3.24 Air Monitoring Plan

7.3.24.1 Not applicable.

7.4 ENVIRONMENTAL PROTECTION PLAN (EPP) FOR CULTURAL RESOURCES PROTECTION

7.4.1 Cultural and Archaeological Resources On-Site

7.4.1.1 Federal and commonwealth agencies and stakeholders associated with cultural and archaeological resources listed on **Table 7-1** will have the opportunity to review the Work Plan and/or work areas prior to the commencement of any work. The review will allow the USACE to identify work areas, which may potentially include cultural or archaeological sites. The MA SHPO, via letter dated October 28, 2010, has concurred with our approach stipulating archaeological monitoring of all sub-tidal, intertidal and upland areas as specified in correspondence from USACE dated October 19, 2010. All work performed will be in compliance with all federal, commonwealth, and local laws, regulations and statues. In addition, no work will be performed until all applicable "permits" (i.e. the functional equivalent since exempt from administrative requirements under CERCLA) have been obtained regarding cultural and archaeological resources.

7.4.2 Cape Poge Little Neck Bomb Target MRS and the Moving Target Machine Gun Range at South Beach MRS

7.4.2.1 The Cape Poge Little Neck Bomb Target MRS and the Moving Target Machine Gun Range at South Beach MRS may contain cultural and archaeological sites. Anecdotal evidence indicates there are two areas of remnant shell middens and arrowheads in the Little Neck area of Cape Poge Bay. Additionally, there is a reference to a 19th century smallpox hospital in the northern Cape Poge area. The Trustees of Reservation should indicate the location of known shell middens and other cultural resources to the UXO team prior to initiation of work. These areas should be avoided unless necessary for munitions clearance and remediation. In the event human remains are uncovered, all work will cease. The CENAE PM or designee will notify state and/or local police and the Massachusetts Medical Examiner, Wampanoag Tribe’s Historic Preservation Officer, and Massachusetts State Archaeologist in accordance with the State Burial Law.

7.4.3 Discovery of Human Remains

7.4.3.1 If bones are determined to be human and are less than 100 years old, a criminal investigation may be warranted. If greater than 100 years old, the medical examiner then notifies the state archaeologist who conducts an archaeological investigation of the site. If the state archaeologist determines that the remains are Native American, then the Wampanoag Tribe and the Massachusetts Commission on Indian Affairs will be notified. If it is determined that the burial cannot be adequately protected, the state archaeologist can remove the remains. For archaeological sites and/or human remains on DCR-owned property, the DCR Archaeologist listed in **Table 7-1** will also be contacted.

7.4.4 Escort Visiting Parties to Sites

7.4.4.1 A UXB UXO technician will escort any visiting parties inspecting the find(s). Anecdotal evidence also indicates the presence of a World War II (WWII) bunker several hundred yards off South Beach, approximately South of Katama and southeast of the Katama Air Park between Atlantic Drive and Mattakesett Herring

Creek, visible at low tide. The field team should be aware that there might be other sites or features found in conjunction with the target storage building. The CENAE PM will be notified of any additional findings during the course of work.

7.4.5 Underwater Investigations

7.4.5.1 To mitigate impacts to items of cultural interest underwater, a marine archeologist will evaluate the anomaly signatures in the collected data prior to intrusive investigation and compare them to known items of cultural value. If the item is clearly identified as a cultural item, it will not be disturbed. For items not clearly identified as a cultural item that are selected for further investigation, the diver will make an initial determination as to the nature of the item, with ultimate disposition of MEC items as described in the ESP. For non-MEC items, a visual description of the item will be recorded, and if possible, a digital photo taken with the coordinates of the item recorded. These will be provided to the marine archeologist for further analysis, with ultimate disposition by others, with the item returned to the location found, and replaced in the approximate orientation as found. Similar archaeological monitoring and recordation will be conducted for upland areas with the assistance of a terrestrial archaeologist.

Attachment 7-1: Rare, Threatened, & Endangered Species Consultation Request

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF

July 23, 2010

Engineering/Planning Division
Evaluation Branch

Ms. Mary Colligan
National Marine Fisheries Service
Northeast Regional Office
Protected Resources Division
55 Great Republic Drive
Gloucester, Massachusetts 01930

SUBJECT: Rare, Threatened and Endangered Species Consultation for the ESTCP Technology Demonstration & MEC Support Project at the Former Cape Poge Little Neck Bomb Target Site, Chappaquiddick Island, Former Moving Target Machine Gun Range at South Beach, and Tisbury Great Pond, Martha's Vineyard, Massachusetts

Dear Ms. Colligan:

The U.S. Army Corps of Engineers (USACE), as the Lead Agency, is providing dive operations support as part of an Environmental Security Technology Certification Program (ESTCP) Technical Demonstration & MEC (Munitions and Explosives of Concern) in the ocean waters off of South Beach, Martha's Vineyard. This ESTCP technical demonstration project is being conducted for the Department of Defense (DoD) by Tetra Tech EC, Inc., with dive support by our contractor, UXB International, Inc. Based on your May 11, 2009 response to our Time Critical Removal Action consultation letter dated April 1, 2009, pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended and recent telephone conversation between Julie Crocker of your staff and Robert W. Davis of my staff, we understand that several species of listed sea turtles occur seasonally off the coast of Martha's Vineyard. We also understand that listed whales also occur in offshore waters of Martha's Vineyard. The USACE anticipates that the limited intrusive work being proposed herein will not adversely affect any species or their habitat if present. We therefore request your concurrence with our determination that the proposed action is not likely to adversely affect any species listed by NOAA's National Marine Fisheries Service (NMFS). This support work is anticipated to continue until September 2010, or perhaps longer depending on the amount of MEC that needs to be investigated.

The Department of Defense (DoD) is responsible for assessment and remediation of munitions and explosives of concern (MEC) impacted areas throughout the United States. An estimated 15 million terrestrial acres of land have been impacted by historical ordnance operations and the underwater acreage may be even greater. There are well-developed methodologies and approaches for assessment of terrestrial MEC; however, there are currently no "standardized" approaches for wide area assessment (WAA) for MEC in the fresh water or

-2-

marine environments. This project is one initial step in development of a more standardized approach for underwater assessments. It will demonstrate the effectiveness of equipment systems combining multiple underwater detections and mapping instruments to effectively discriminate and locate underwater MEC. It will also demonstrate methods for fusion of data from multiple instruments into a seamless data stream that provides multi-faceted information for the evaluation of ordnance-related conditions and physical features that will impact the selection of appropriate and effective removal strategies.

This ESTCP special study is a collaborative joint investigation with limited off shore intrusive work by divers in advance of conducting the full blown Remedial Investigation/Feasibility Study (RI/FS) for Martha's Vineyard that is not scheduled to start until later this fall after coordination with all of the involved stakeholders and regulatory approval of the RI/FS Work Plan. The RI/FS will involve intrusive work on land, beach and near shore waters and as such we plan to complete consultations relative to Federal and State listed rare, threatened and endangered species with you, the US Fish and Wildlife Service (USFWS), the MA Natural Heritage & Endangered Species Program (MANHESP), and other applicable resource agencies.

The work for this proposed action is summarized below as excerpted from the enclosed Final Abbreviated Work Plan, ESTCP Technology Demonstration & MEC Survey Dive Support, Martha's Vineyard, Massachusetts, dated June 2010. Figure 1-1 is the general map of the study area that shows the two ESTCP Survey Areas while Figure 3-4 provides detailed bathymetry along with the proposed transects. I have also enclosed a larger full size color plan of Figure 3-4.

UXB International, Inc. (UXB) has been contracted by the US Army Engineering and Support Center, Huntsville (USAESCH) under contract W912DY-04-D-0019, Task Order (TO) DO 0007 to perform a Remedial Investigation/Feasibility Study (RI/FS) at the Former Cape Poge Little Neck Bomb Target Site Chappaquiddick Island, Dukes County, Massachusetts, FUDS D01MA0595, Former Moving Target Machine Gun Range at South Beach, Martha's Vineyard, Edgartown, Massachusetts, FUDS D01MA0486 and Tisbury Great Pond, FUDS D01MA0453. In addition to the RI/FS, UXB and its subcontractor, VRHabilis, will provide dive operations support as part of an Environmental Security Technology Certification Program (ESTCP) Technical Demonstration in the ocean waters off of South Beach. Diving support activities include establishing an underwater instrument verification strip (IVS) and investigating underwater anomalies identified by the principal investigator, Tetra Tech. In addition, UXB will conduct a Munitions and Explosives of Concern (MEC) transport study in the ocean off South Beach and Tisbury Great Pond. This abbreviated Work Plan (WP) describes the goals, methods, procedures, and personnel used for field activities associated with the ESTCP Demonstration and the MEC Transport Study. The areas where work will be performed are located in the Atlantic Ocean adjacent to Tisbury Great Pond and South Beach, and within Edgartown Harbor.

MEC are a safety hazard and may constitute an imminent and substantial endangerment to site personnel and the local populace. The work associated with the activities covered in the work plan shall be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104, and the National Contingency Plan (NCP), Sections 300.120 (d) and 300.400(e). All MEC encountered during this munitions response shall be destroyed on-site. Applicable provisions of Chapter 29 of the Code of Federal Regulations (CFR) 1910.120 apply. All activities involving work in areas potentially containing MEC hazards shall be conducted in full compliance with United States Army Corps of Engineers (USACE), USAESCH, Department of the Army (DA), state and local requirements regarding personnel, equipment and procedures, and Department of Defense (DOD) Standard Operating Procedures (SOPs), safety regulations and Department of Navy Dive Standards. Due to the inherent risk in this type of operation, Unexploded Ordnance (UXO) personnel shall be limited to 40-hours per week on MEC related tasks, exclusively during sunlight hours.

CERCLA response actions are exempted by law from the requirement to obtain Federal, State or local permits related to any activities conducted completely on-site. It is the policy of the USEPA, MassDEP and the DA to assure all activities conducted on sites are protective of human health and the environment and to meet (or waive) the substantive provisions of permitting regulations that are applicable or relevant and appropriate requirements (ARARs). The ESTCP project is also being closely coordinated with the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Environmental Protection Agency (USEPA) and other stakeholders such as the Edgartown Conservation Commission. The final work plan, when available, will be provided to your office, the town of Edgartown Conservation Commission, the Trustees of Reservations, the MADCR, the Dukes County Manager, the MADEP, and the Wampanoag Tribe.

The USACE anticipates that the limited intrusive work being proposed herein will not adversely affect any species or their habitat if present. Adequate measures to avoid, minimize and/or mitigate potential environmental impacts to the maximum extent practical without compromising our ability to achieve the primary objectives of the ESTCP Demonstration Project, were incorporated into the Environmental Protection Plan, Section 7 in the enclosed Work Plan. Upon completion each impacted removal site (i.e. as impacted for each anomaly or explosive munitions hazard investigated and removed by the divers) will be naturally restored to existing conditions. Since all of these sites will be within sub-tidal and inter-tidal areas they will be naturally restored when the substrate caves-in as the metal object is removed.

We appreciate your timely concurrence to our determination and look forward to continued coordination and consultation with your office as the RI/FS proceeds. If you have any questions and/or need additional information, please contact Mr. Robert W. Davis, Environmental Resources Specialist, at 978-318-8236 (Robert.W.Davis@usace.army.mil).

Sincerely,

Anthony T. Mackos, P.E.
Acting Chief, Engineering/Planning Division

Enclosures

Attachment 7-2: Rare, Threatened & Endangered Species Consultation Response

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
http://www.fws.gov/newengland

September 27, 2010

Mr. Robert W. Davis, M.S.
Evaluation Branch
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Davis:

This responds to your electronic transmission, dated August 17, 2010, requesting that we review the proposed Military Munitions Response Program Remedial Investigation/Feasibility Study (RI/FS) to be conducted on Martha's Vineyard at three munitions response sites, and confirm the presence of federally-endangered or threatened species that were listed in your request. The sites proposed for inclusion in the RI/FS are the former Cape Poge Little Neck Bomb Range Target, the former Moving Target Machine Gun Range at South Beach, and the Tisbury Great Pond munitions response sites (MRS). Our comments are provided in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1533).

Based on information currently available to us, we concur with your assessment that the federally-endangered roseate tern (*Sterna dougalii dougalii*) and sandplain gerardia (*Agalinus acuta*) may be present in the project areas, as well as the federally-threatened piping plover (*Charadrius melodus*) and northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). There is no federally-designated critical habitat.

Piping plovers and roseate terns could occur on the sandy beaches at all three project areas during the breeding and fall migration period of April 1 through September 30. Sandplain gerardia is located adjacent to the Tisbury Great Pond MRS in the sandy upland east of Long Pond. The Northeastern beach tiger beetle occurs on sandy beaches, washover areas and blowouts of the Tisbury Great Pond MRS and possibly the South Beach MRS.

In order to avoid adversely affecting piping plover or roseate terns, we recommend that activities associated with the remedial investigation (transects, sampling) not occur between April 1 and September 30, or be closely coordinated with the organizations managing piping plover and/or terns. Northeastern beach tiger beetles are present year round and are difficult to detect. Vehicle

Mr. Robert W. Davis, M.S.
September 27, 2010 2

use or other large-scale sand disturbance activities occurring in tiger beetle habitat could cause adverse impacts to larvae and adults. Once specific activities and locations have been identified, we may be able to recommend actions to avoid and/or minimize adverse effects to this species and its habitat.

We are available to assist you in the development of the RI/FS, identification of potential impacts to federally-listed species, and recommendations to avoid and/or minimize adverse effects. Please contact Susi von Oettingen of this office at 603-223-2541, extension 22, if you have any questions or need additional assistance.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

Attachment 7-3: Massachusetts Historical Commission Concurrence

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751
October 19, 2010

RECEIVED
OCT 20 2010
MASS. HIST. COMM
#45470
#2048
#19046

REPLY TO
ATTENTION OF

Engineering/Planning Division
Evaluation Branch

Ms. Brona Simon, Executive Director and SHPO
Massachusetts Historical Commission
The Massachusetts State Archives Building
220 Morrissey Boulevard
Boston, Massachusetts 02125

Dear Ms. Simon:

The U.S. Army Corps of Engineers, New England District, is preparing to conduct a Remedial Investigation and Feasibility Study (RI/FS) to investigate Munitions and Explosives of Concern (MEC) and to sample for Munitions Constituents (MC), at the former Cape Poge Little Neck Bomb Target Site, the former Moving Target Machine Gun Range at South Beach, and the Tisbury Great Pond Munitions Response Site (MRS), Chilmark and West Tisbury, all on Martha's Vineyard, Massachusetts (see enclosed figures). We have previously coordinated with your office on a Time Critical Removal Action (TCRA) at South Beach and Cape Poge (see enclosed 2009 correspondence). We would like your comments on the planned RI, in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The FS will be conducted after completion of the RI.

Between 1943 and 1944, the Department of the Navy acquired the leases to the properties of the former ranges at Cape Poge Little Neck, South Beach, and Tisbury Great Pond. The sites were used to provide training for the 1st Naval District, whose flight operations were based at Naval Air Station Quonset Point, Rhode Island, and the Naval Auxiliary Air Station Martha's Vineyard. The leases for Cape Poge were held until 1945, and the leases for Little Neck, South Beach and Tisbury Great Pond were held until 1947.

The Former Cape Poge Little Neck Bomb Target MRS is located on Chappaquiddick Island, which is located within the Town of Edgartown, Martha's Vineyard, Massachusetts. The site encompasses an area of approximately 800 acres including: 1) approximately 153 acres of land; 2) approximately 83 acres of beach; 3) approximately 500 acres of inland water; and 4) approximately 64 acres of ocean. The Cape Poge Little Neck MRS has become part of the Cape Poge Wildlife Refuge, which is owned and managed by The Trustees of Reservations (TTOR).

The Former Moving Target Machine Gun Range at South Beach is located within the town of Edgartown along the southern shore of Martha's Vineyard, Massachusetts.

The South Beach MRS encompasses approximately 478 acres including: 1) approximately 18.7 acres of land; 2) approximately 182.7 acres of beach; 3) approximately 7.7 acres of inland water; and 4) approximately 268.7 acres of ocean. Due to extensive beach erosion, the former range is now thought to be approximately 150 yards offshore at South Beach. South Beach is owned by the Commonwealth of Massachusetts, Department of Conservation and Recreation (DCR) and managed by the Edgartown Parks and Recreation Department from the first of May through Labor Day of each year.

The Tisbury Great Pond MRS is located within the towns of Chilmark and West Tisbury, Martha's Vineyard, Massachusetts. The site encompasses approximately 768 acres including: 1) approximately 198.1 acres of land; 2) approximately 61.5 acres of beach; 3) approximately 456.3 acres of inland water; and 4) approximately 52.4 acres of ocean. The majority of the site is owned by the Commonwealth of Massachusetts, TTOR, and private landowners. Tisbury Great Pond has elevations that range from sea level to three feet above mean sea level near the coast line in the southern portion of the site to approximately 15 feet in the northern portion. The majority of the area is flat with sand dunes, some of which are approximately 5 to 10 feet high. The shoreline gently slopes downward to the coast. There is a barrier beach separating Tisbury Great Pond from the Atlantic Ocean. Several times each year the barrier beach is manually breached to lower the elevation of the pond, which is brackish water, and to allow the water to flow into the Atlantic Ocean.

The overall objective of the RI is to determine the nature and extent of the MEC along with the MC (i.e. potential chemical contamination from the MEC) at each MRS. The MEC investigation will include sampling of soil, sediment, surface water, and groundwater. Through the collection of sufficient geophysical, visual, and analytical data, it will be possible to adequately characterize the nature and extent of the MEC and MC in order to determine future response actions at each MRS.

The RI study will be conducted in two phases. The first phase will be to conduct and complete the various surveys to delineate the spatial extent of geophysical anomalies through the acquisition of geophysical data along linear, parallel transects crossing each of the MRSs. These geophysical investigations will serve to delineate the nature and extent of surface and subsurface metallic objects. The second phase will consist of the evaluation of the geophysical survey data in order to select those anomalies that are potential MEC that need to be reacquired (i.e. dug up) to confirm the presence or absence of MEC or Munitions Debris (MD). This characterization will be accomplished through the use of Digital Geophysical Mapping (DGM) over two-dimensional grids and intrusively investigating a percentage of the geophysical anomalies identified within the grid boundaries. See enclosed figures for grid locations.

The anomalies to be reacquired will be selected and prioritized based on a variety of factors such as size, signal intensity, and shape characteristics. The prioritization process will also serve to differentiate anomalies associated with MEC from those not associated with MEC such as cultural debris.

Following this process, the reacquisition team will begin to relocate and flag each anomaly for the intrusive investigation team. Once an anomaly has been reacquired, a certified UXO technician will begin by hand excavating the soil in order to acquire the selected anomaly and determine if it is MEC or cultural debris. Water based anomalies will be excavated through use of an air lift or a water jet. If an anomaly is identified as MEC, it will then be determined whether it is safe to move or if it will require to be blown up in place.

Based on informal conversations with Ed Bell of your staff, we have decided that although significant historic properties may be present in the areas of potential effect, these properties may not be adversely impacted by the characterization and removal of MEC. Due to the need to remove all MEC for public safety, the Corps is proposing a conditional "no historic properties affected" (36 CFR 800.5(d) (1)) determination as recommended by Mr. Bell. This determination will be based on the following approach:

The excavation operations will be monitored by a qualified professional archaeologist experienced in the identification and treatment of ancient and historical period resources, including human remains, in the glaciated Northeast. Additionally, a marine archaeologist will be assisting with the characterization of anomalies in the subtidal areas. A memorandum report and MHC inventory forms for any identified sites will be completed by the archaeological monitors and provided to the MHC and other consulting parties. Any significant historic properties identified during the undertaking will be protected to the extent feasible. If no significant resources are found, a letter will be provided to the MHC and other consulting parties.

The Wampanoag Tribe of Aquinnah has requested that they be notified in the event that human remains are uncovered during the remediation. If remains are discovered, further work near burials will be suspended and the appropriate authorities alerted in accordance with state burial law. If human remains are identified, it may be necessary for the munitions specialists to "clear" that particular area of munitions so that the authorities can be allowed to complete their analysis. In all cases, regard for public safety will be the ultimate factor in determining access and the Corps Huntsville ordnance safety specialist will make the final determination.

We would appreciate your concurrence with this conditional "no historic properties affected" determination. If you have any questions, please contact Mr. Marc Paiva, project archaeologist of the Evaluation Branch, at (978) 318-8796.

CONCURRENCE: Brona Simon
10/28/10
BRONA SIMON
STATE HISTORIC
PRESERVATION OFFICER
MASSACHUSETTS
HISTORICAL COMMISSION

RC. 45470
RC. 2048
Enclosures RC. 19046

Sincerely,

Anthony T. Mackos, P.E.
Acting Chief, Engineering/Planning Division

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From: Davis, Robert W NAE [mailto:Robert.W.Davis@usace.army.mil]
Sent: Friday, November 26, 2010 1:07 PM
To: Kristin E. Black (MANHESP); Tim Simmons (MANHESP); Susi von Oettingen (USFWS); Julie Crocker (NMFS)
Cc: Russell Hopping (TTOR); Chris Buelow (TTOR); Chris Kennedy (TTOR); Sarah Trudel (TTOR); Chris Egan (TTOR); Julie Schaeffer (MVLBC); Kristen Fauteux (SMF); Chuck Hodgkinson (CCC); Jane Varkonda (ECC); Maria McFarland (WTCC); Kathryn Ford (MADMF); John Logan (MADMF); Isaiah L. Scheffer (CSC); Jeffrey Lynch (WTSC); Liz Kouloheras (MADEP); Tena Davies (MADEP); Carol A. Charette; Campbell, Ralph L HNC; Warminsky, Mike F.
Subject: RE: Martha's Vineyard MMRP-Remedial Investigation (RI) ENVIRONMENTAL PROTECTION PLAN (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Good day:

Attached please find the PDF of the Environmental Protection Plan (EPP) for the Military Munitions Response Program (MMRP) Remedial Investigation (RI) for the Cape Poge, South Beach and Tisbury Great Pond Munitions Response Sites (MRS). A hard copy (and CD) of the Final Work Plan (November 2010) was shipped by our Contractor, UXB International, Inc., on November 24, 2010 to the regulators (MADEP, USEPA) and major property owners/stakeholders that also included several organizations on our Natural Resources Coordination List (i.e. Chris Kennedy, Trustees of Reservations; James Lengyel, Martha's Vineyard Land Bank Commission; & Adam Moore, Sheriffs Meadow Foundation. As with the Draft Final Work Plan, I will also be sending a CD of the Final Work Plan to the natural resource agencies and stakeholders on my consultation and coordination list sent November 12, 2010.

The CDs of the Final WPs with the Environmental Protection Plan (Chapter 7.0) sent to the MANHESP, USFWS and NMFS will be formally transmitted with a written letter requesting concurrence of our informal consultation determinations. A copy of the Schedule Summary for each MRS is also attached that was prepared by UXB to be in accordance with the measures developed in the EPP to avoid, minimize and/or mitigate any potential adverse impacts to protected species and their habitats.

In response to MADEP's concerns that the proposed analog survey transect spacing of 100 meters for the preliminary recon transects is too wide and areas may be overlooked albeit additional transects and grids based will be added based on the preliminary data collected, the USACE has agreed to supplement the transect data with airborne magnetometry. The airborne magnetometry survey will provide 100 percent coverage for the three MRSs where site conditions allow low altitude flights. The airborne magnetometry will be conducted on beach areas (land and ocean sides), land areas with low vegetative cover, and inland water bodies with shallow water depths.
Airborne magnetometry will not be conducted in oceans areas. The airborne magnetometry survey will be conducted before March 1st to avoid the nesting seasons of the protected Northern harrier and shorebirds (e.g. Piping plover, Roseate tern, et al.) in accordance with EPP Table 7-3: Protected Avian Species No Work Windows.

Once the contract has been awarded for this work, an amendment to the Work Plan will be prepared to cover the airborne magnetometry. In the interim, work on the transects will commence per the original project plan. The data collected using traditional methods will then be used for comparative analysis for the airborne magnetometry with discretionary transects and grids based on this combined data.

Albeit the Work Plan will be considered Final so that the RI work can begin as soon as possible to achieve the project schedule we recognize that the EPP is a dynamic living working document. We anticipate that the EPP will be updated as needed based on specific activities in Phase 2 with more consultation and implementation of measures as needed for execution of Phase 2 once we determine the specific locations of the selected potential MEC anomalies that need to be acquired or dug up based on the geophysical evaluation of the combined Phase 1 survey data.

Take care,
Bob Davis
DERP-FUDS Environmental Compliance Manager

Robert W. Davis, M.S.
Environmental Resource Specialist &
Ecological Risk Assessor
Environmental Resources Section
Evaluation Branch
Engineering/Planning Division
USACE-New England District
696 Virginia Road
Concord, MA 01742-2751
978-318-8236/FAX: 318-8560
robert.w.davis@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

Martha's Vineyard Schedule Summary by MRS

Date: 27-Sep-10

CAPE POGE

Task 4a Optional Ocean/Inland Water Area, Cape Poge

Task	Start Date	End date	
Civil Survey	Fri 3/4/11	Tue 3/8/11	**Crew Size**
Ocean Survey	Tue 3/22/11	Wed 4/6/11	10-12
Analog Transects	Tue 3/22/11	Wed 4/6/11	
Inland Water Survey	Fri 12/17/10	Thu 3/3/11	7-10
Geophysical Test Strip	Fri 12/17/10	Mon 12/20/10	
DGM Transects	Tue 12/21/10	Mon 1/24/11	
Transect Data Review	Tue 1/25/11	Mon 2/7/11	
DGM Grids	Tue 2/8/11	Thu 3/3/11	
Intrusive Investigation	Fri 2/11/11	Fri 3/11/11	13-15
Prepare Dig Sheets	Fri 2/11/11	Tue 3/8/11	
Reacquire/Dig Anomalies	Mon 2/14/11	Wed 3/9/11	
MEC Disposal	Thu 3/10/11	Thu 3/10/11	
MPPEH/MD Disposal	Fri 3/11/11	Fri 3/11/11	
Task 4a Complete	Fri 3/11/11	Fri 3/11/11	
Task 4b Optional Former Cape Poge Bomb Site Land/Beach Area			
Civil Survey	Tue 1/25/11	Thu 1/27/11	Hand-held for transects;
Clearing	Wed 12/15/10	Thu 12/23/10	Bobcat with cutter head for
Geophysical Test Strip	Tue 12/7/10	Tue 12/7/10	grids
Land Area	Thu 12/9/10	Mon 1/24/11	7-10
Site Recon/Analog Transects	Thu 12/9/10	Tue 12/14/10	
Transect Data Review	Wed 12/15/10	Tue 1/11/10	
DGM Grids	Mon 1/17/11	Mon 1/24/11	
Beach Area	Tue 12/14/10	Fri 1/14/11	3-5
Site Recon/Digital Transects	Tue 12/14/10	Tue 12/14/10	
Transect Data Review	Wed 12/15/10	Tue 1/11/10	
DGM Grids	Wed 1/12/11	Fri 1/14/11	
Intrusive Investigation	Thu 1/20/10	Mon 2/7/11	13-15
Prepare Dig Sheets	Thu 1/20/11	Wed 2/2/11	
Reacquire/Dig Anomalies	Fri 1/21/11	Thu 2/3/11	
MEC Disposal	Fri 2/4/11	Fri 2/4/11	
MPPEH/MD Disposal	Mon 2/7/11	Mon 2/7/11	
Task 4b Complete	Mon 2/7/11	Mon 2/7/11	

Martha's Vineyard Schedule Summary by MRS

Date: 27-Sep-10

SOUTH BEACH

Task 4c Optional Ocean/Inland Water Area, South Beach

Task	Start Date	End date	
Civil Survey	Wed 4/07/11	Wed 4/12/11	**Crew Size**
Ocean Survey	Mon 6/14/10	Tue 5/18/10	10-12
Analog Transects	Thu 4/7/11	Fri 5/13/11	
MEC Transport Study Analog Grid	Mon 6/14/10	Wed 5/18/11	10-12
Delineate Grid	Mon 6/14/10	Thu 6/17/10	
Seed Grid	Fri 6/18/10	Wed 6/23/10	
Monitor Grid	Thu 6/24/10	Wed 3/16/11	
Recover Seeded Items	Mon 5/16/11	Wed 5/18/11	
Inland Water Survey	Mon 12/13/10	Tue 1/18/11	7-10
Geophysical Test Strip	Mon 12/13/10	Mon 12/13/10	
DGM Transects	Tue 12/14/10	Thu 12/16/10	
Transect Data Review	Fri 12/17/10	Thu 1/13/11	
DGM Grids	Fri 1/14/11	Tue 1/18/11	
Intrusive Investigation	Wed 1/19/11	Wed 1/26/11	13-15
Prepare Dig Sheets	Wed 1/19/11	Fri 1/21/11	
Reacquire/Dig Anomalies	Thu 1/20/11	Mon 1/24/11	
MEC Disposal	Tue 1/25/11	Tue 1/25/11	
MPPEH/MD Disposal	Wed 1/26/11	Wed 1/26/11	
Task 4c Complete	Wed 1/26/11	Wed 1/26/11	
Task 4d Optional South Beach Site Land/Beach Area			
Civil Survey	Mon 2/7/11	Tue 2/8/11	Hand-held for transects;
Clearing	Mon 12/20/10	Tue 12/21/10	Bobcat with cutter head for
Geophysical Test Strip	Wed 12/8/10	Wed 12/8/10	grids
Land Area	Wed 12/15/10	Fri 2/4/11	7-10
Site Recon/Analog Transects	Wed 12/15/10	Fri 12/17/10	
Transect Data Review	Mon 12/20/10	Fri 1/14/11	
DGM Grids	Thu 2/3/11	Fri 2/4/11	
Beach Area	Wed 12/15/10	Wed 2/2/11	3-5
Site Recon/Digital Transects	Wed 12/15/10	Thu 12/16/10	
Transect Data Review	Fri 12/17/10	Mon 12/20/10	
DGM Grids	Tue 1/25/11	Wed 2/2/11	
Intrusive Investigation	Tue 2/8/11	Wed 2/16/11	7-10
Prepare Dig Sheets	Tue 2/8/11	Tue 2/15/11	
Reacquire/Dig Anomalies	Wed 2/9/11	Wed 2/16/11	
MEC Disposal	Wed 2/16/11	Wed 2/16/11	
MPPEH/MD Disposal	Wed 2/16/11	Wed 2/16/11	
Task 4d Complete	Wed 2/16/11	Wed 2/16/11	

Martha's Vineyard Schedule Summary by MRS

Date: 27-Sep-10

TISBURY GREAT POND

Task 4e Optional Ocean Area Tisbury Great Pond

Task	Start Date	End date	
Civil Survey	Tue 3/22/11	Fri 3/25/11	**Crew Size**
Ocean Survey	Mon 5/16/11	Mon 6/6/11	10-12
Analog Transects	Mon 5/16/11	Mon 6/6/11	
Task 4e Complete	Mon 6/6/11	Mon 6/6/11	
Task 4f Optional Pond Area of Tisbury Great Pond			
Civil Survey	Thu 3/10/11	Tue 3/15/11	
Pond Survey	Wed 3/16/11	Thu 4/7/11	
Geophysical Test Strip	Wed 3/16/11	Wed 3/16/11	7-10
DGM Transects	Thu 3/17/11	Wed 3/23/11	
Transect Data Review	Thu 3/24/11	Thu 3/24/11	
DGM Grids	Fri 3/25/11	Thu 4/7/11	
Intrusive Investigation	Wed 3/30/11	Fri 4/22/11	
Prepare Dig Sheets	Wed 3/30/11	Tue 4/19/11	13-15
Reacquire/Dig Anomalies	Thu 3/31/11	Wed 4/20/11	
MEC Disposal	Thu 4/21/11	Thu 4/21/11	
MPPEH/MD Disposal	Fri 4/22/11	Fri 4/22/11	
Task 4f Complete	Fri 4/22/11	Fri 4/22/11	
Task 4g Optional Tisbury Great Pond Land/Beach			
Civil Survey	Wed 2/9/11	Mon 2/14/11	
Clearing	Mon 1/10/11	Thu 1/13/11	Hand-held for transects;
Geophysical Test Stip	Mon 12/20/10	Mon 12/20/10	Bobcat with cutter head for
Land Area	Mon 12/20/10	Mon 2/21/11	grids
Site Recon/Analog Transects	Mon 12/20/10	Fri 12/24/10	7-10
Transect Data Review	Mon 1/10/11	Fri 1/21/11	
DGM Grids	Thu 2/10/11	Mon 2/21/11	
Beach Area	Tue 12/21/10	Wed 2/9/11	
Site Recon/Digital Transects	Tue 12/21/10	Tue 12/21/10	3-5
Transect Data Review	Wed 12/22/10	Tue 1/18/11	
DGM Grids	Mon 2/7/11	Wed 2/9/11	
Intrusive Investigation	Tue 2/15/11	Thu 3/10/11	
Prepare Dig Sheets	Tue 2/15/11	Mon 3/7/11	7-10
Reacquire/Dig Anomalies	Wed 2/16/11	Tue 3/8/11	
MEC Disposal	Wed 3/9/11	Wed 3/9/11	
MPPEH/MD Disposal	Thu 3/10/11	Thu 3/10/11	
Task 4g Complete	Thu 3/10/11	Thu 3/10/11	

APPENDIX D

ANALYTICAL RESULTS AND QA/QC EVALUATIONS

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APPENDIX E

FIELD FORMS

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DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Moving Target Machine Gun Range at South Beach MRS
Date: October 13, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team began collecting environmental samples. Today's sampling concentrated on surface and subsurface soil at the Former Moving Target Machine Gun Range. The field team started the sampling effort at the firing line of the Moving Target Machine Gun Range where the evidence of the firing line is still intact (concrete and metal stanchions in place). The IS sample unit (MG19) was staked and 2 IS samples were collected, including a Field Triplicate (FT). Five discrete subsurface soil samples were also collected within the MG 19 sample unit, including a Field Duplicate (FD). Soil samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no coolers shipped to TestAmerica today. Samples are summarized below.

Kim Meacham from the United States Army Engineering Support Center, Huntsville (USAESCH) was at the sight today providing technical oversight.

Equipment Calibrations: No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG19	IS016	Soil	1315	Metals, Explosives	10/17/11	IS sample – 100 increments
MG19	IS017	Soil	1653	Metals, Explosives	10/17/11	IS QC sample – FT of IS016 – 100 increments
MG20	SB090	Soil	1555	Metals, Explosives	10/17/11	Discrete subsurface sample
MG20	SB091	Soil	1625	Metals, Explosives	10/17/11	Discrete subsurface sample
MG22	SB094	Soil	1646	Metals, Explosives	10/17/11	Discrete subsurface sample
MG22	SB095	Soil	1657	Metals, Explosives	10/17/11	Discrete subsurface sample
MG22	SB096	Soil	1646	Metals, Explosives	10/17/11	QC Sample – FD of SB094

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Moving Target Machine Gun Range at South Beach MRS
Date: October 14, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), continued collecting soil samples. The final incremental sample (IS) was collected from sample unit MG19, which was a Field Triplicate (FT). In addition, 7 discrete surface soil samples and 12 discrete subsurface soil samples were collected, including 1 subsurface soil Field Duplicate (FD) sample. Soil samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no coolers shipped to TestAmerica today. Samples are summarized below.

Chris Mazur (Deputy Project Manager, UXB, International, Inc.) was on-site today providing oversight.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG19	IS018	Soil	0945	Metals, Explosives	10/17/11	IS QC sample – FT of IS016 – 100 increments
MG21	SB092	Soil	0905	Metals, Explosives	10/17/11	Discrete surface sample
MG21	SB093	Soil	0911	Metals, Explosives	10/17/11	Discrete subsurface sample
MG23	SB098	Soil	0845	Metals, Explosives	10/17/11	Discrete surface sample
MG23	SB099	Soil	0858	Metals, Explosives	10/17/11	Discrete subsurface sample
MG24	SB100	Soil	0927	Metals, Explosives	10/17/11	Discrete surface sample
MG24	SB101	Soil	0933	Metals, Explosives	10/17/11	Discrete subsurface sample
MG25	SB102	Soil	1029	Metals, Explosives	10/17/11	Discrete surface sample
MG25	SB103	Soil	1033	Metals, Explosives	10/17/11	Discrete subsurface sample
MG26	SB104	Soil	0946	Metals, Explosives	10/17/11	Discrete subsurface sample
MG26	SB105	Soil	0952	Metals, Explosives	10/17/11	Discrete subsurface sample
MG27	SB106	Soil	1009	Metals, Explosives	10/17/11	Discrete surface sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG27	SB107	Soil	1017	Metals, Explosives	10/17/11	Discrete subsurface sample
MG32	SB115	Soil	1410	Metals, Explosives	10/17/11	Discrete subsurface sample
MG32	SB116	Soil	1420	Metals, Explosives	10/17/11	Discrete subsurface sample
MG35	SB123	Soil	1029	Metals, Explosives	10/17/11	Discrete surface sample
MG35	SB124	Soil	1130	Metals, Explosives	10/17/11	Discrete subsurface sample
MG35	SB125	Soil	1130	Metals, Explosives	10/17/11	QC Sample – FD of SB124
MG36	SB126	Soil	1146	Metals, Explosives	10/17/11	Discrete surface sample
MG36	SB127	Soil	1156	Metals, Explosives	10/17/11	Discrete subsurface sample

Deviations from Sampling and Analysis Plan:
Due to non-native soil (i.e., manicured lawn), an IS was not collected at MG28.

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Moving Target Machine Gun Range at South Beach MRS
Date: October 15, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), continued collecting soil samples. The incremental sample (IS) sample units MG01 and MG10 were staked; however, ISs were not collected due to non-native soil (i.e., manicured lawns). Twenty-three discrete surface soil samples, including 2 Field Duplicates, and 23 discrete subsurface soil samples, including 2 FDs, were collected at the Former Moving Target Machine Gun Range. Soil samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no coolers shipped to TestAmerica today. Samples are summarized below.

Chris Mazur (Deputy Project Manager, UXB, International, Inc.) was on-site today providing oversight.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG02	SB054	Soil	1404	Metals, Explosives	10/17/11	Discrete surface sample
MG02	SB055	Soil	1406	Metals, Explosives	10/17/11	Discrete subsurface sample
MG03	SB056	Soil	1351	Metals, Explosives	10/17/11	Discrete surface sample
MG03	SB057	Soil	1353	Metals, Explosives	10/17/11	Discrete subsurface sample
MG04	SB058	Soil	1339	Metals, Explosives	10/17/11	Discrete surface sample
MG04	SB059	Soil	1341	Metals, Explosives	10/17/11	Discrete subsurface sample
MG05	SB060	Soil	1328	Metals, Explosives	10/17/11	Discrete surface sample
MG05	SB061	Soil	1330	Metals, Explosives	10/17/11	Discrete subsurface sample
MG06	SB062	Soil	1311	Metals, Explosives	10/17/11	Discrete surface sample
MG06	SB063	Soil	1316	Metals, Explosives	10/17/11	Discrete subsurface sample
MG06	SB064	Soil	1316	Metals, Explosives	10/17/11	QC Sample – FD of SB063
MG07	SB065	Soil	1628	Metals, Explosives	10/17/11	Discrete surface sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG07	SB066	Soil	1629	Metals, Explosives	10/17/11	Discrete subsurface sample
MG08	SB067	Soil	1614	Metals, Explosives	10/17/11	Discrete surface sample
MG08	SB068	Soil	1617	Metals, Explosives	10/17/11	Discrete subsurface sample
MG09	SB069	Soil	1601	Metals, Explosives	10/17/11	Discrete surface sample
MG09	SB070	Soil	1603	Metals, Explosives	10/17/11	Discrete subsurface sample
MG11	SB071	Soil	1455	Metals, Explosives	10/17/11	Discrete surface sample
MG11	SB072	Soil	1457	Metals, Explosives	10/17/11	Discrete subsurface sample
MG12	SB073	Soil	1440	Metals, Explosives	10/17/11	Discrete surface sample
MG12	SB074	Soil	1443	Metals, Explosives	10/17/11	Discrete subsurface sample
MG12	SB075	Soil	1440	Metals, Explosives	10/17/11	QC Sample – FD of SB073
MG13	SB077	Soil	1524	Metals, Explosives	10/17/11	Discrete surface sample
MG13	SB078	Soil	1526	Metals, Explosives	10/17/11	Discrete subsurface sample
MG14	SB079	Soil	1512	Metals, Explosives	10/17/11	Discrete surface sample
MG14	SB080	Soil	1515	Metals, Explosives	10/17/11	Discrete subsurface sample
MG15	SB081	Soil	1419	Metals, Explosives	10/17/11	Discrete surface sample
MG15	SB082	Soil	1422	Metals, Explosives	10/17/11	Discrete subsurface sample
MG16	SB083	Soil	1537	Metals, Explosives	10/17/11	Discrete surface sample
MG16	SB084	Soil	1540	Metals, Explosives	10/17/11	Discrete subsurface sample
MG17	SB085	Soil	1641	Metals, Explosives	10/17/11	Discrete surface sample
MG17	SB086	Soil	1643	Metals, Explosives	10/17/11	Discrete subsurface sample
MG17	SB087	Soil	1643	Metals, Explosives	10/17/11	QC Sample – FD of SB086
MG18	SB088	Soil	1656	Metals, Explosives	10/17/11	Discrete surface sample
MG18	SB089	Soil	1658	Metals, Explosives	10/17/11	Discrete subsurface sample
MG29	SB109	Soil	1000	Metals, Explosives	10/17/11	Discrete surface sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG29	SB110	Soil	1005	Metals, Explosives	10/17/11	Discrete subsurface sample
MG30	SB111	Soil	0945	Metals, Explosives	10/17/11	Discrete surface sample
MG30	SB112	Soil	0951	Metals, Explosives	10/17/11	Discrete subsurface sample
MG31	SB113	Soil	0926	Metals, Explosives	10/17/11	Discrete surface sample
MG31	SB114	Soil	0933	Metals, Explosives	10/17/11	Discrete subsurface sample
MG33	SB117	Soil	0841	Metals, Explosives	10/17/11	Discrete surface sample
MG33	SB118	Soil	0853	Metals, Explosives	10/17/11	Discrete subsurface sample
MG33	SB119	Soil	0841	Metals, Explosives	10/17/11	QC Sample – FD of SB117
MG34	SB121	Soil	0906	Metals, Explosives	10/17/11	Discrete surface sample
MG34	SB122	Soil	0915	Metals, Explosives	10/17/11	Discrete subsurface sample

Deviations from Sampling and Analysis Plan:
Due to non-native soil (i.e., manicured lawn), ISs were not collected at MG01 and MG10.

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS
Date: October 16, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), continued collecting soil samples. The field team staked the grid corners of CP01 and CP02 and flagged discrete sample locations CP04 through CP11. One incremental sample and two Field Triplicate (FT) samples were collected. Nine discrete surface soil and ten discrete subsurface soil samples were collected, including one subsurface soil Field Duplicate (FD) sample. Samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no coolers shipped to TestAmerica today. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP01	IS01	Soil	1150	Metals, Explosives	10/17/11	IS sample – 100 increments
CP01	IS02	Soil	1321	Metals, Explosives	10/17/11	IS QC sample – FT of IS01 –100 increments
CP01	IS03	Soil	1432	Metals, Explosives	10/17/11	IS QC sample – FT of IS01 –100 increments
CP04	SB001	Soil	1320	Metals, Explosives	10/17/11	Discrete surface sample
CP04	SB002	Soil	1325	Metals, Explosives	10/17/11	Discrete subsurface sample
CP05	SB003	Soil	1401	Metals, Explosives	10/17/11	Discrete surface sample
CP05	SB004	Soil	1404	Metals, Explosives	10/17/11	Discrete subsurface sample
CP06	SB005	Soil	1340	Metals, Explosives	10/17/11	Discrete surface sample
CP06	SB006	Soil	1343	Metals, Explosives	10/17/11	Discrete subsurface sample
CP07	SB007	Soil	1300	Metals, Explosives	10/17/11	Discrete surface sample
CP07	SB008	Soil	1303	Metals, Explosives	10/17/11	Discrete subsurface sample
CP08	SB009	Soil	1155	Metals, Explosives	10/17/11	Discrete surface sample
CP08	SB010	Soil	1159	Metals, Explosives	10/17/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP08	SB011	Soil	1159	Metals, Explosives	10/17/11	QC Sample – FD of SB010
CP09	SB012	Soil	1140	Metals, Explosives	10/17/11	Discrete surface sample
CP09	SB013	Soil	1142	Metals, Explosives	10/17/11	Discrete subsurface sample
CP10	SB014	Soil	1120	Metals, Explosives	10/17/11	Discrete surface sample
CP10	SB015	Soil	1124	Metals, Explosives	10/17/11	Discrete subsurface sample
CP11	SB016a	Soil	1241	Metals, Explosives	10/17/11	Discrete surface sample
CP11	SB016b	Soil	1243	Metals, Explosives	10/17/11	Discrete subsurface sample
CP12	SB017	Soil	1522	Metals, Explosives	10/17/11	Discrete surface sample
CP12	SB018	Soil	1525	Metals, Explosives	10/17/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS
Date: October 17, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Mark Atherton), continued collecting soil samples. One incremental sample and two Field Triplicate (FT) samples were collected. Eight discrete surface soil samples, including one Field Duplicate (FD) sample, and eight discrete subsurface soil samples were collected, including one FD sample. In addition, one subsurface soil matrix spike (MS)/matrix spike duplicate (MSD) sample set was collected. Samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, and samples collected between October 13 and 16 were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP02	IS004	Soil	1337	Metals, Explosives	10/20/11	IS sample – 100 increments
CP02	IS005	Soil	1436	Metals, Explosives	10/20/11	IS QC sample – FT of IS004 –100 increments
CP02	IS006	Soil	1517	Metals, Explosives	10/20/11	IS QC sample – FT of IS004 –100 increments
CP13	SB019	Soil	1246	Metals, Explosives	10/20/11	Discrete surface sample
CP13	SB020	Soil	1250	Metals, Explosives	10/20/11	Discrete subsurface sample
CP13	SB021	Soil	1246	Metals, Explosives	10/20/11	QC Sample – FD of SB019
CP13	SB022	Soil	1250	Metals, Explosives	10/20/11	QC Sample – MS/MSD of SB020
CP14	SB023	Soil	1306	Metals, Explosives	10/20/11	Discrete surface sample
CP14	SB024	Soil	1310	Metals, Explosives	10/20/11	Discrete subsurface sample
CP15	SB025	Soil	1355	Metals, Explosives	10/20/11	Discrete surface sample
CP15	SB026	Soil	1357	Metals, Explosives	10/20/11	Discrete subsurface sample
CP16	SB027	Soil	1420	Metals, Explosives	10/20/11	Discrete surface sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP16	SB028	Soil	1440	Metals, Explosives	10/20/11	Discrete subsurface sample
CP17	SB029	Soil	1453	Metals, Explosives	10/20/11	Discrete surface sample
CP17	SB030	Soil	1503	Metals, Explosives	10/20/11	Discrete subsurface sample
CP18	SB031	Soil	1330	Metals, Explosives	10/20/11	Discrete surface sample
CP18	SB032	Soil	1336	Metals, Explosives	10/20/11	Discrete subsurface sample
CP18	SB033	Soil	1336	Metals, Explosives	10/20/11	QC Sample – FD of SB032
CP19	SB034	Soil	1442	Metals, Explosives	10/20/11	Discrete surface sample
CP19	SB035	Soil	1444	Metals, Explosives	10/20/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS
Date: October 18, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Mark Atherton), continued collecting soil samples. Incremental Sample (IS) unit grid corners at CP03 were staked. One incremental sample and two Field Triplicate (FT) samples were collected. Eight discrete surface soil samples, including one Field Duplicate (FD) sample, and nine discrete subsurface soil samples were collected, including one FD sample. Samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP03	IS007	Soil	1245	Metals, Explosives	10/20/11	IS sample – 100 increments
CP03	IS008	Soil	1345	Metals, Explosives	10/20/11	IS QC sample – FT of IS007 –100 increments
CP03	IS009	Soil	1428	Metals, Explosives	10/20/11	IS QC sample – FT of IS007 –100 increments
CP20	SB036	Soil	1415	Metals, Explosives	10/20/11	Discrete subsurface sample
CP20	SB037	Soil	1330	Metals, Explosives	10/20/11	Discrete surface sample
CP21	SB038	Soil	1220	Metals, Explosives	10/20/11	Discrete surface sample
CP21	SB039	Soil	1228	Metals, Explosives	10/20/11	Discrete subsurface sample
CP22	SB040	Soil	1340	Metals, Explosives	10/20/11	Discrete surface sample
CP22	SB041	Soil	1350	Metals, Explosives	10/20/11	Discrete subsurface sample
CP23	SB042	Soil	1440	Metals, Explosives	10/20/11	Discrete surface sample
CP23	SB043	Soil	1450	Metals, Explosives	10/20/11	Discrete subsurface sample
CP23	SB044	Soil	1440	Metals, Explosives	10/20/11	QC Sample – FD of SB042
CP23	SB045	Soil	1450	Metals, Explosives	10/20/11	QC Sample – MS/MSD of SB020

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP24	SB046	Soil	1300	Metals, Explosives	10/20/11	Discrete surface sample
CP24	SB047	Soil	1315	Metals, Explosives	10/20/11	Discrete subsurface sample
CP25	SB048	Soil	1325	Metals, Explosives	10/20/11	Discrete surface sample
CP25	SB049	Soil	1335	Metals, Explosives	10/20/11	Discrete subsurface sample
CP26	SB050	Soil	1235	Metals, Explosives	10/20/11	Discrete surface sample
CP26	SB051	Soil	1240	Metals, Explosives	10/20/11	Discrete subsurface sample
CP27	SB052	Soil	1355	Metals, Explosives	10/20/11	Discrete surface sample
CP27	SB053	Soil	1405	Metals, Explosives	10/20/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Project Name:	Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number:	W912DY–04–D–0019
Delivery Order:	0006
Site Location:	Tisbury Great Pond MRS
Date:	October 19, 2011
AMEC Contact:	Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Rob Rossi), began collecting soil and sediment samples at Tisbury Great Pond MRS. Nineteen sediment samples were collected, including 2 Field Duplicate (FD) samples. Sediment samples were collected from a small boat using a petite ponar dredge sampler. Three discrete surface soil samples, including one FD sample, and one discrete subsurface soil sample were collected. Soil samples were using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
TP05	SD018	Sediment	1110	Metals, Explosives	10/20/11	Discrete sediment sample
TP06	SD019	Sediment	1115	Metals, Explosives	10/20/11	Discrete sediment sample
TP07	SD020	Sediment	1120	Metals, Explosives	10/20/11	Discrete sediment sample
TP08	SD021	Sediment	1130	Metals, Explosives	10/20/11	Discrete sediment sample
TP09	SD022	Sediment	1125	Metals, Explosives	10/20/11	Discrete sediment sample
TP10	SD023	Sediment	1135	Metals, Explosives	10/20/11	Discrete sediment sample
TP11	SD024	Sediment	1140	Metals, Explosives	10/20/11	Discrete sediment sample
TP12	SD025	Sediment	1145	Metals, Explosives	10/20/11	Discrete sediment sample
TP13	SD026	Sediment	1150	Metals, Explosives	10/20/11	Discrete sediment sample
TP14	SD027	Sediment	0955	Metals, Explosives	10/20/11	Discrete sediment sample
TP14	SD028	Sediment	0955	Metals, Explosives	10/20/11	Sediment QC sample – FD of SD028
TP15	SD029	Sediment	1030	Metals, Explosives	10/20/11	Discrete sediment sample
TP16	SD030	Sediment	1020	Metals, Explosives	10/20/11	Discrete sediment sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
TP17	SD031	Sediment	0948	Metals, Explosives	10/20/11	Discrete sediment sample
TP18	SD032	Sediment	1045	Metals, Explosives	10/20/11	Discrete sediment sample
TP19	SD033	Sediment	1040	Metals, Explosives	10/20/11	Discrete sediment sample
TP20	SD034	Sediment	1105	Metals, Explosives	10/20/11	Discrete sediment sample
TP21	SD035	Sediment	1055	Metals, Explosives	10/20/11	Discrete sediment sample
TP21	SD036	Sediment	1055	Metals, Explosives	10/20/11	Sediment QC sample – FD of SD035
TP01	SB128	Soil	1330	Metals, Explosives	10/20/11	Discrete surface sample
TP01	SB129	Soil	1332	Metals, Explosives	10/20/11	QC sample – FD of SB128
TP01	SB130	Soil	1335	Metals, Explosives	10/20/11	Discrete surface sample
TP01	SB131	Soil	1345	Metals, Explosives	10/20/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS and Former Moving Target Machine Gun Range at South Beach MRS
Date: October 20, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Rob Rossi), continued collecting soil and sediment samples at Cape Poge and South Beach. Four sediment samples were collected, including one Field Duplicate (FD) sample. Sediment samples were collected from a small boat using a petite ponar dredge sampler. One discrete surface soil sample and one discrete subsurface soil sample were collected. Soil samples were using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, and samples collected between October 17 and October 19 were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP44	SD014	Sediment	0950	Metals, Explosives	10/22/11	Discrete sediment
CP45	SD015	Sediment	0940	Metals, Explosives	10/22/11	Discrete sediment
CP45	SD016	Sediment	0940	Metals, Explosives	10/22/11	Sediment QC sample – FD of SD015
CP46	SD017	Sediment	1010	Metals, Explosives	10/22/11	Discrete sediment
MG35	SB123a	Soil	1115	Metals, Explosives	10/22/11	Discrete surface sample
MG35	SB124a	Soil	1125	Metals, Explosives	10/22/11	Discrete subsurface samples

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS
Date: October 22, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Rob Rossi), continued collecting sediment samples. Thirteen sediment samples were collected, including one Field Duplicate (FD) sample. Sediment samples were collected from a small boat using a petite ponar dredge sampler. Samples were packaged and labeled, and samples collected between October 20 and October 22 were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP32	SD001	Sediment	0745	Metals, Explosives	10/22/11	Discrete sediment sample
CP33	SD002	Sediment	0810	Metals, Explosives	10/22/11	Discrete sediment sample
CP34	SD003	Sediment	0755	Metals, Explosives	10/22/11	Discrete sediment sample
CP35	SD004	Sediment	0830	Metals, Explosives	10/22/11	Discrete sediment sample
CP36	SD005	Sediment	0900	Metals, Explosives	10/22/11	Discrete sediment sample
CP37	SD006	Sediment	0930	Metals, Explosives	10/22/11	Discrete sediment sample
CP38	SD007	Sediment	0940	Metals, Explosives	10/22/11	Discrete sediment sample
CP39	SD008	Sediment	0950	Metals, Explosives	10/22/11	Discrete sediment sample
CP40	SD009	Sediment	1020	Metals, Explosives	10/22/11	Discrete sediment sample
CP41	SD010	Sediment	1010	Metals, Explosives	10/22/11	Discrete sediment sample
CP41	SD011	Sediment	1010	Metals, Explosives	10/22/11	Sediment QC sample – FD of SD010
CP42	SD012	Sediment	1030	Metals, Explosives	10/22/11	Discrete sediment sample
CP43	SD013	Sediment	1040	Metals, Explosives	10/22/11	Discrete sediment sample

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Cape Poge Little Neck Bomb Target MRS
Date: November 1, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), began collecting groundwater samples and continued collecting sediment samples. Four groundwater samples were collected, including one Field Duplicate (FD) sample. Groundwater samples were collected using low-flow techniques. Groundwater was purged using a peristaltic pump until parameter stabilization (parameters measured using an YSI 656). Four sediment samples were collected, including one Field Duplicate (FD) sample. Sediment samples were collected from a small boat using a petite ponar dredge sampler. Samples were packaged and labeled; no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
YSI 656
Turbidity Meter

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
CP29	GW002	Groundwater	1305	Metals, Explosives	11/3/11	Discrete groundwater
CP31	GW004	Groundwater	1456	Metals, Explosives	11/3/11	Discrete groundwater
CP31	GW005	Groundwater	1456	Metals, Explosives	11/3/11	QC sample – FD of GW004
CP44	SD014	Sediment	1601	Metals, Explosives	11/3/11	Discrete sediment sample
CP45	SD015	Sediment	1550	Metals, Explosives	11/3/11	Discrete sediment sample
CP45	SD016	Sediment	1550	Metals, Explosives	11/3/11	QC sample – FD of SD015
CP46	SD017	Sediment	1540	Metals, Explosives	11/3/11	Discrete sediment sample
CP47	GW015	Groundwater	1315	Metals, Explosives	11/3/11	Discrete groundwater

Deviations from Sampling and Analysis Plan:
Due to homeowner not wanting a sample collected on property, groundwater sample location CP30 was relocated. A groundwater sample was not collected at Little Neck due to lack of freshwater.

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Moving Target Machine Gun Range at South Beach MRS and Tisbury Great Pond MRS
Date: November 2, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), continued collecting groundwater and soil samples. Eight groundwater samples were collected, including two Field Duplicate (FD) samples. Groundwater samples were collected using low-flow techniques. Groundwater was purged using a peristaltic pump until parameter stabilization (parameters measured using an YSI 656). Two discrete subsurface soil samples were collected. Soil samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled; no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
YSI 656
Turbidity meter

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG37	GW006	Groundwater	0850	Metals, Explosives	11/3/11	Discrete groundwater sample
MG37	GW010	Groundwater	0850	Metals, Explosives	11/3/11	QC sample – FD of GW006
MG38	GW007	Groundwater	1008	Metals, Explosives	11/3/11	Discrete groundwater sample
MG40	GW009	Groundwater	1049	Metals, Explosives	11/3/11	Discrete groundwater sample
TP02	GW011	Groundwater	1317	Metals, Explosives	11/3/11	Discrete groundwater sample
TP03	GW012	Groundwater	1533	Metals, Explosives	11/3/11	Discrete groundwater sample
TP04	GW013	Groundwater	1455	Metals, Explosives	11/3/11	Discrete groundwater sample
TP04	GW014	Groundwater	1455	Metals, Explosives	11/3/11	QC sample – FD of GW013
TP23	SB132	Soil	1255	Metals, Explosives	11/3/11	Discrete subsurface soil
TP24	SB133	Soil	1305	Metals, Explosives	11/3/11	Discrete subsurface soil

Deviations from Sampling and Analysis Plan:
Due to lack of access, a groundwater sample was not collected at MG39.

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: NA
Date: November 3, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team collected one investigation derived waste sample from the collected groundwater purge water. Samples were packaged and labeled, and samples collected from November 1 and November 3 were shipped to Test America.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MV01	IDW01	Water	0900	Metals, Explosives	11/3/11	IDW sample from decontamination fluids

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 01 11
Date of Intrusive: 03 01 11

Project ID: Martha's Vineyard RI/FS W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0001	T00010001	☑	361119	4578848.55	185.136123657227				
T0001	T00010002	☑	361116	4578846.75	18.3869152069092				
T0001	T00010003	☑	361114.65	4578846.75	12.2255849828606				
T0001	T00010004	☑	361111.7787	4578856.9577	8.91026815516008				
T0001	T00010005	☑	361113.6	4578848.7	5.15839052179362				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00010001	Secondary Peak to the South	CD 3 Items	removed from Grid
T00010002		CD 3 Items	
T00010003		CD 2 Items	
T00010004		no find	
T00010005		nail	removed from grid

EM-61 Anomaly Dig List

Date of Reacquisiton

Date of Intrusive

Project ID	Martha's Vineyard RI/FS W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0001	T00010006	☑	361112.2429	4578850.6223	4.29977775230699				

Anomaly Notes	Description of Item	Disposition of Item
Secondary Peak to the South	4 nails	Removed from grid

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0001	T00010007	☑	361112.55	4578849.45	3.62144160270691				

Anomaly Notes	Description of Item	Disposition of Item
	3 nails	removed from grid

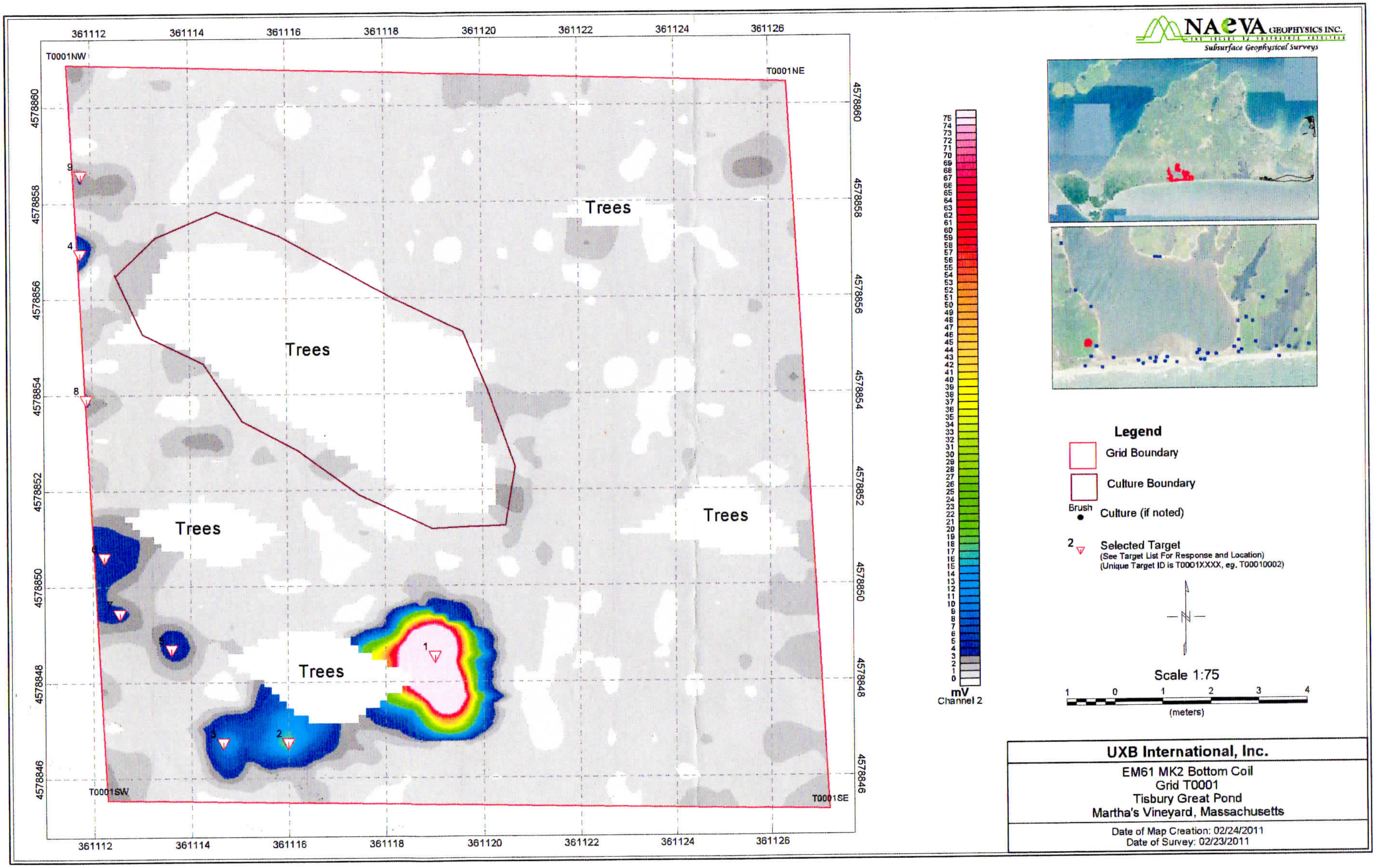
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0001	T00010008	☑	361111.8918	4578853.9215	3.41997274966914				

Anomaly Notes	Description of Item	Disposition of Item
	no find	

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0001	T00010009	☑	361111.8	4578858.6	3.16697120627223				

Anomaly Notes	Description of Item	Disposition of Item
	no find	

Monday, February 28, 2011


NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
T0001NW
T0001NE
T0001SW
T0001SE
Trees
Trees
Trees
Trees
Trees
361112
361114
361116
361118
361120
361122
361124
361126
4578860
4578858
4578856
4578854
4578852
4578850
4578848
4578846
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0001XXXX, eg. T00010002)
Scale 1:75
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0001
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/24/2011
Date of Survey: 02/23/2011

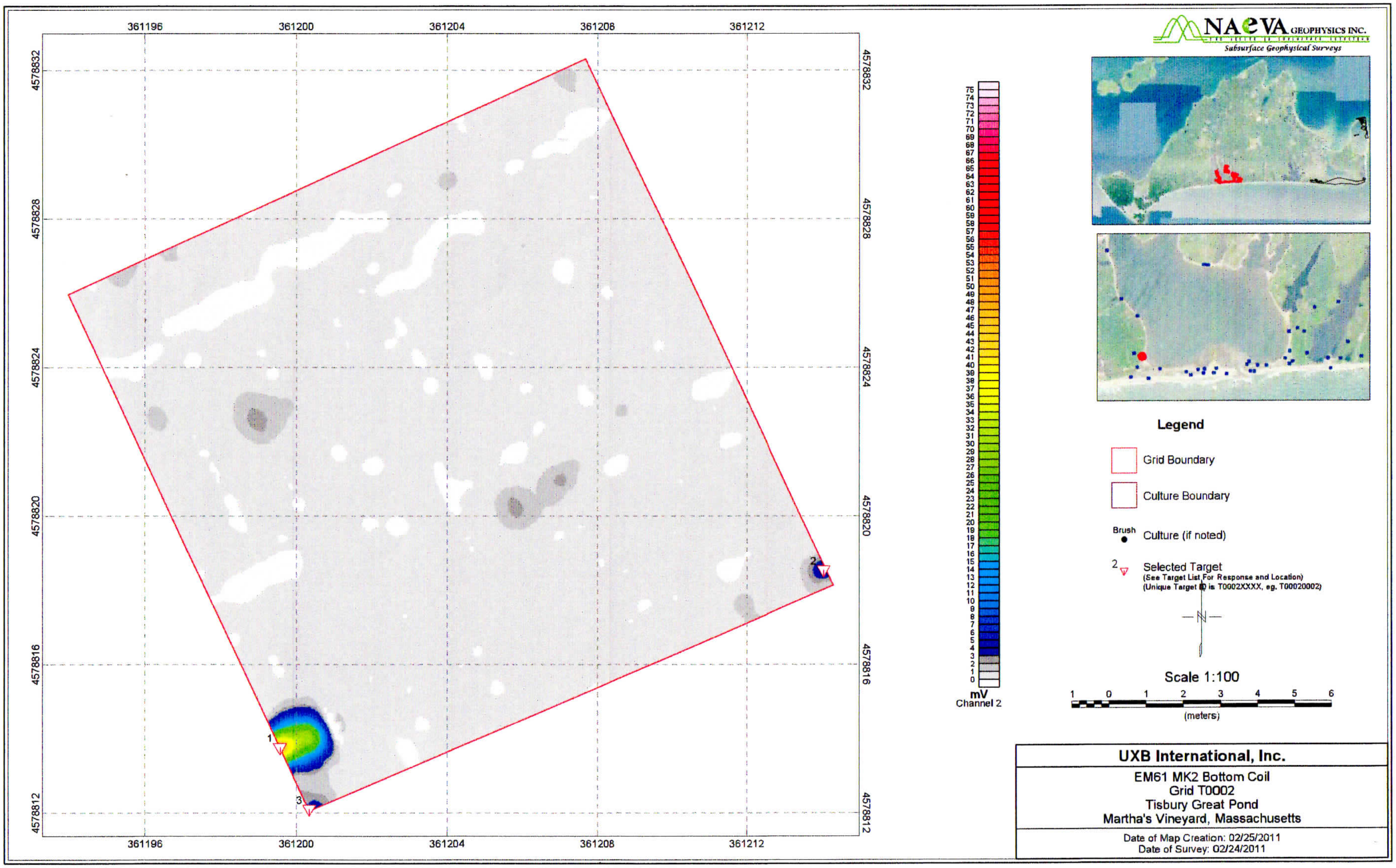
EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019	
Date of Reacquisiton	0304 11	Date of Intrusive	0307 11
Coord Sys.	NAD 83 UTM Zone 19N		

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0002	T00020001	☑	361199.5692	4578813.7756	49.2404612291675				
T0002	T00020002	☑	361214.1	4578818.55	4.87430906285321				
T0002	T00020003	☑	361200.3555	4578812.1102	4.53873318226579				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00020001		CD - chain lock	Removed
T00020002		CD - ~~chain lock~~ metal flake ~~cm~~ Based on pictures	Removed
T00020003	Peak outside the boundary around 20cm SW	CD - ~~metal flake~~ chain lock ~~cm~~ Based on pictures	Removed

Tuesday, March 01, 2011


361196
361200
361204
361208
361212
4578832
4578828
4578824
4578820
4578816
4578812
1
2
3
mV
Channel 2
NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0002XXXX, eg. T00020002)
N
Scale 1:100
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0002
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/25/2011
Date of Survey: 02/24/2011

Demonstration FOR T. Simmons

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	~~03 09 11~~ 03 10 11 SARI
Date of Intrusive	~~03 09 11~~ 03 10 11 SH
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0003	T00030001	✔	361152.0946	4578707.1878	25.2001610832809				
T0003	T00030002	✔	361148.5252	4578716.0321	7.99660054911733				
T0003	T00030003	✔	361158	4578705.15	3.84352040290833				
T0003	T00030004	✔	361146.75	4578712.8	3.60188245773315				
T0003	T00030005	✔	361150.2	4578703.2	3.57451343524382				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00030001	Secondary Peak to the west within 70cm	CD-metal object	removed
T00030002	Secondary Peak to the west within 60cm	CD-nails	Removed
T00030003		~~CD - Clam~~	~~remo~~ 1' water
T00030004		CD-can	removed
T00030005	Possibly Related to Geology		in water

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0003	T00030006	✔	361151.7	4578703.65	3.49706196784973				
T0003	T00030007	✔	361146	4578716.55	3.25933480262756				
T0003	T00030008	✔	361154.6336	4578704.139	3.25052517306461				

T00030006

Anomaly Notes
Possibly Related to Geology

Description of Item

Disposition of Item

In water

T00030007

Anomaly Notes

Description of Item
CD-wire

Disposition of Item
Remove D

T00030008

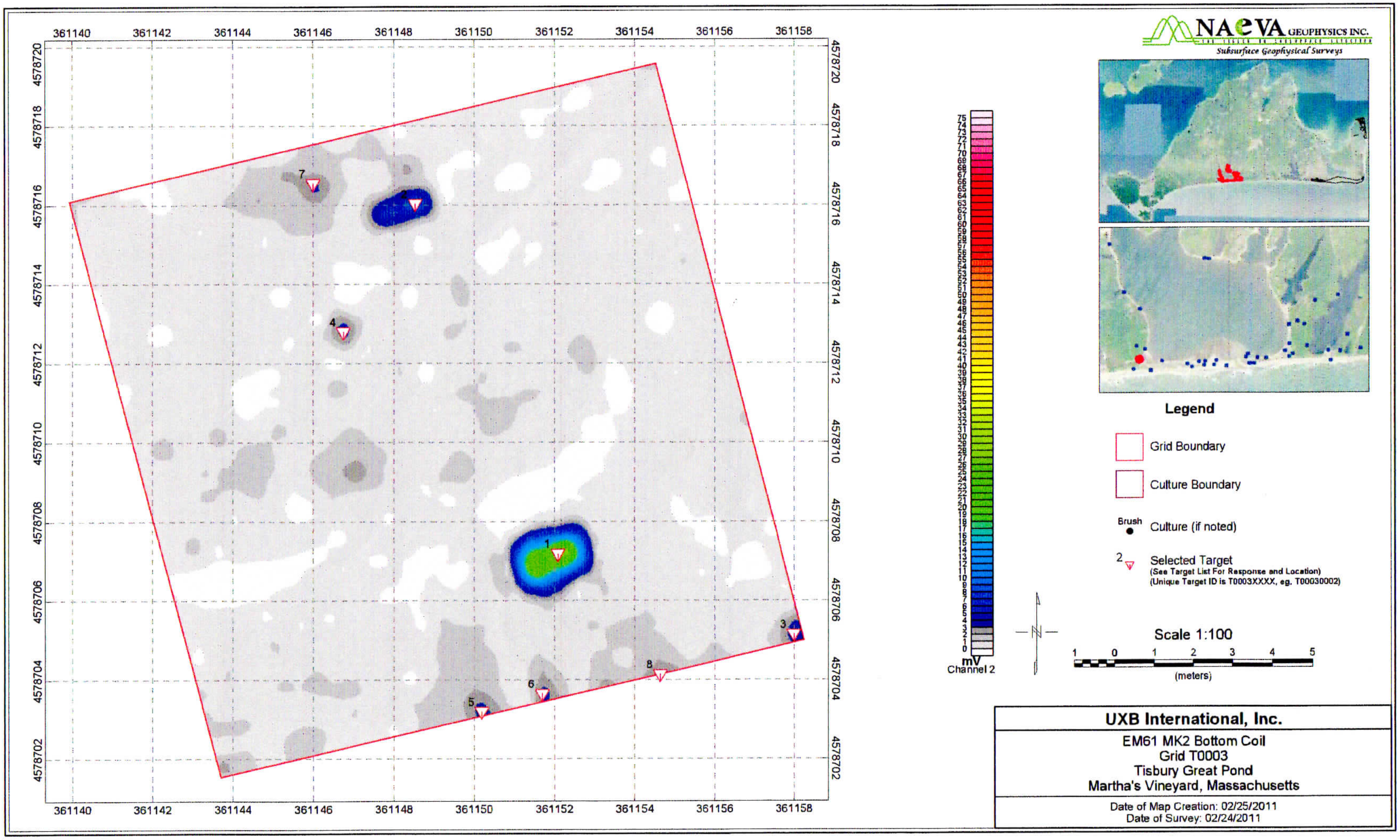
Anomaly Notes
Target Peak outside grid boundary to 25cm South

Description of Item

Disposition of Item

In water

Tuesday, March 01, 2011


NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0003XXXX, eg. T00030002)
Scale 1:100
(meters)
mV
Channel 2
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0003
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/25/2011
Date of Survey: 02/24/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	030411
Date of Intrusive	030711
Coord Sys.	NAD 83 UTM Zone 19N

Project ID: Martha's Vineyard RI/FS — Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0004	T00040001	☑	361157.3	4579238.1	752.727294881647				
T0004	T00040002	☑	361159.2	4579234.5	312.074768066406				
T0004	T00040003	☑	361164.3	4579236.9	180.221405018367			90	0
T0004	T00040004	☑	361160.55	4579241.55	49.5066795325539				
T0004	T00040005	☑	361153.25	4579231.25	5.42999457744649				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00040001	Culture - pipe	pipe	LIP
T00040002	Culture - pipe	pipe	LIP
T00040003		seed #9	removed
T00040004		CD - metal object	removed
T00040005		CD - metal flake	Removed

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys. NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0004	T00040006	☑	361156.4	4579227.4	4.6811981180022				

Anomaly Notes: Target moved within grid boundary; Peak response approx. 0.3m to SSE

Description of Item: CD -

Disposition of Item: Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0004	T00040007	☑	361149.652	4579237.127	4.41351761774374				

Anomaly Notes: Possibly related to geology

Description of Item: CD

Disposition of Item: Removed

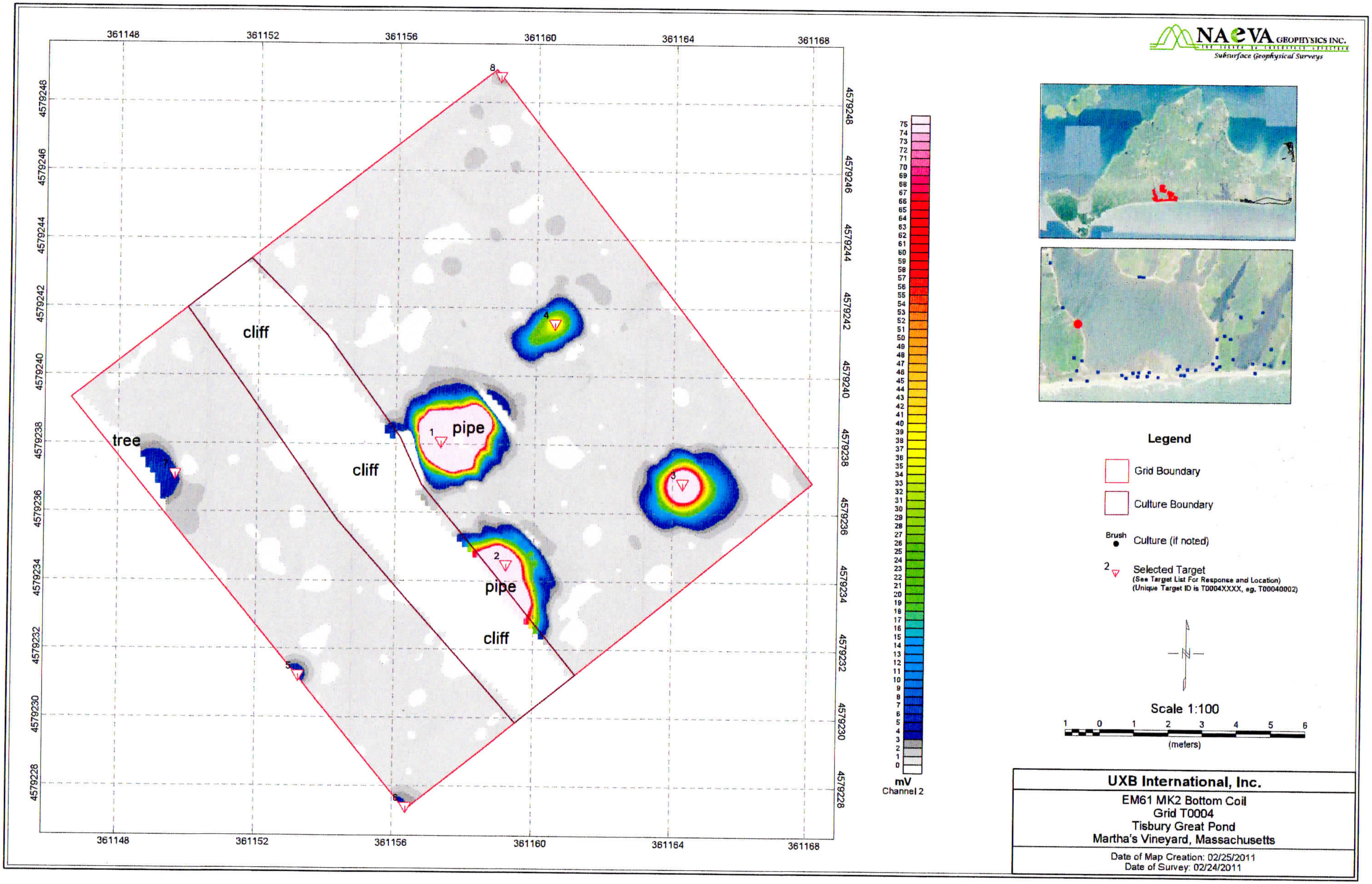
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0004	T00040008	☑	361158.9	4579248.78	3.71923851935867				

Anomaly Notes: Target moved within grid boundary; Primary peak approx. 0.2m to NE

Description of Item: CD

Disposition of Item: Removed

Tuesday, March 01, 2011



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
361148
361152
361156
361160
361164
361168
4579248
4579246
4579244
4579242
4579240
4579238
4579236
4579234
4579232
4579230
4579228
cliff
tree
cliff
pipe
pipe
cliff
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0004XXXX, eg. T00040002)
Scale 1:100
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0004
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/25/2011
Date of Survey: 02/24/2011

EM-61 Anomaly Dig List

Date of Reacquisiton: 030311
Date of Intrusive: 030311

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0005	T00050001	✔	360982	4579420.5	307.382734387108					Target moved to center of anomaly	SEED # 27	Removed
T0005	T00050002	✔	360990.711	4579416.297	53.2819370878056						metal flakes	Removed
T0005	T00050003	✔	360990.777	4579415.066	32.441851947132						metal BAR	Removed
T0005	T00050004	✔	360982.057	4579424.279	8.78203820291185						nail	Removed
T0005	T00050005	✔	360981.381	4579424.185	4.91550743681137						nail	Removed

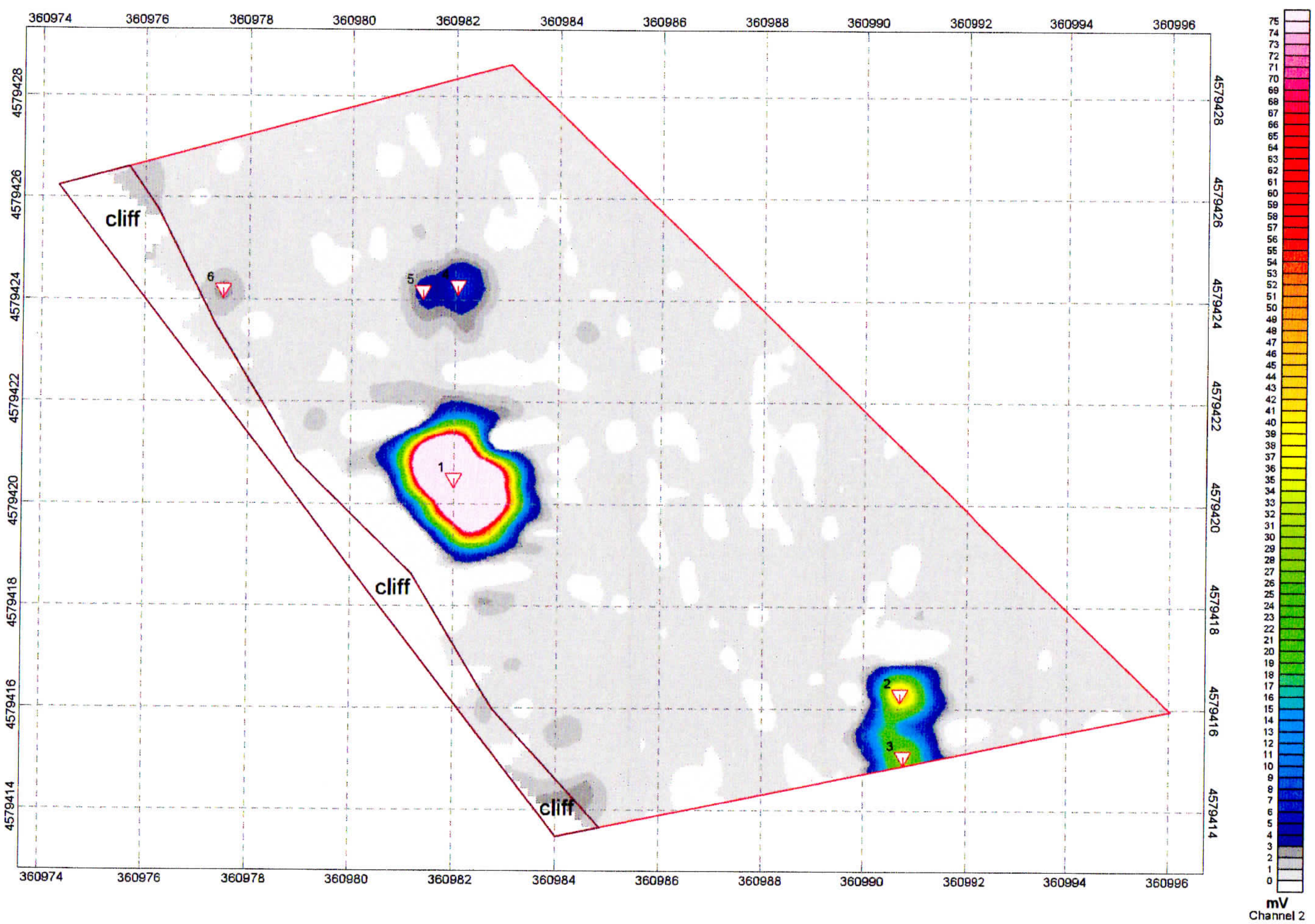
EM-61 Anomaly Dig List

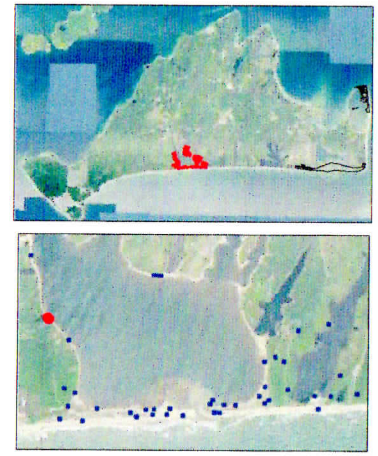
Date of Reacquisiton	030311
Date of Intrusive	030311
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS **Contract No.** W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0005	T00050006	☑	360977.513	4579424.204	3.56449836325512				

Anomaly Notes	Description of Item	Disposition of Item
	metal flakes	Removed





Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0005XXXX, eg. T00050002)

Scale 1:90

(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0005
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 02/25/2011
Date of Survey: 02/24/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	030311
Date of Intrusive	030311
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0006	T00060001	✓	360833.26	4579930.999	95.2380062861941				

Anomaly Notes	Description of Item	Disposition of Item
	Seed #11	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0006	T00060002	✓	360827.188	4579919.939	8.78045801388348				

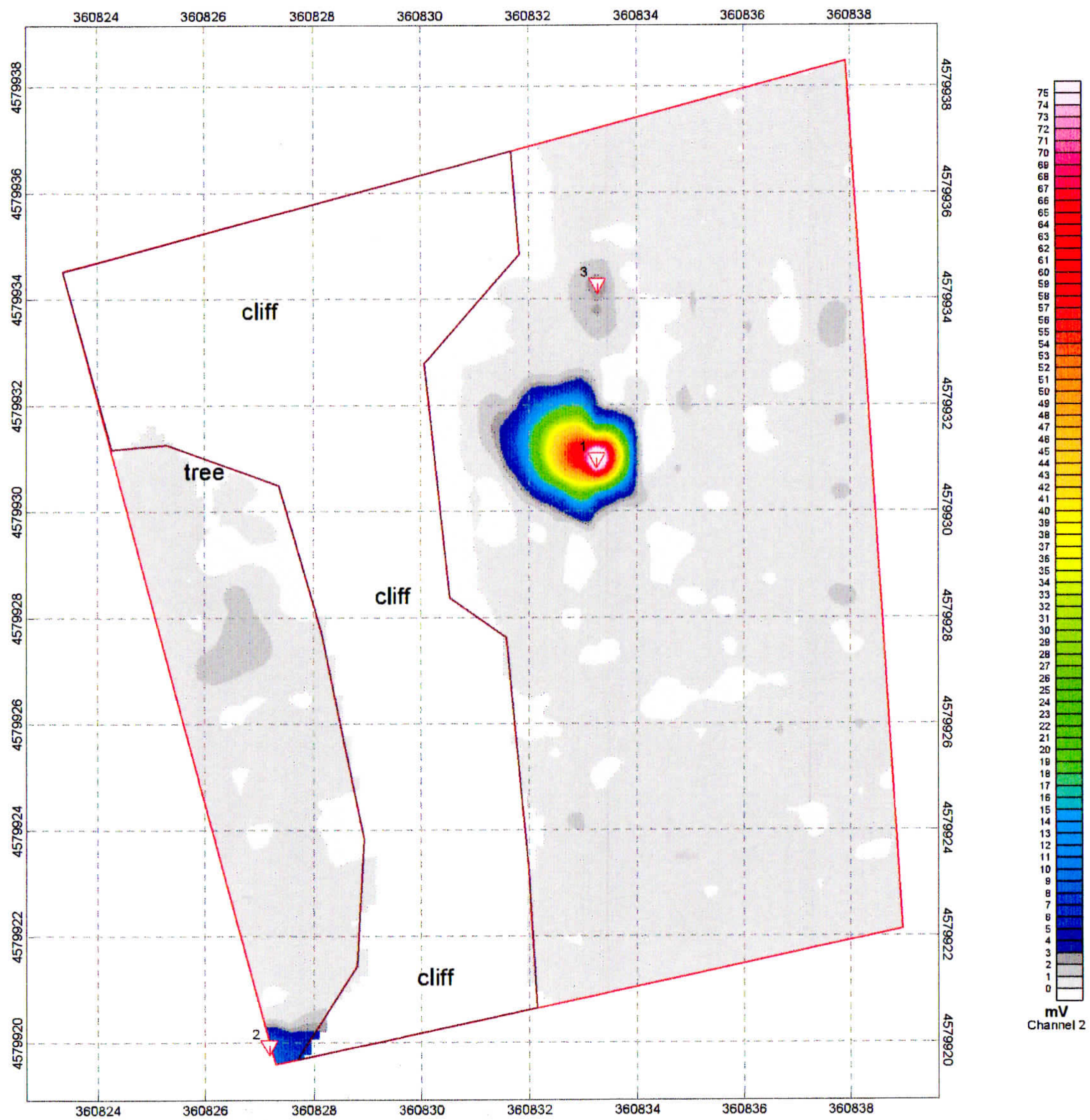
Anomaly Notes	Description of Item	Disposition of Item
Possibly related to culture at grid corner	no find	

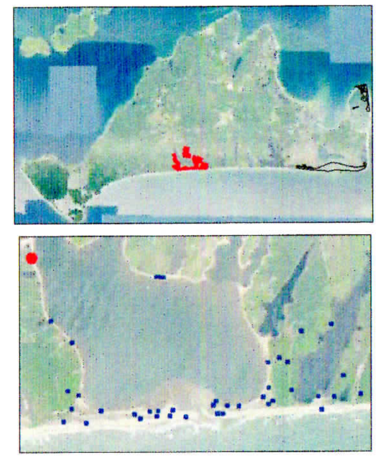
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0006	T00060003	✓	360833.273	4579934.288	3.00371964308215				

Anomaly Notes	Description of Item	Disposition of Item
Possible noise	metal flakes	Removed

Tuesday, March 01, 2011

NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys





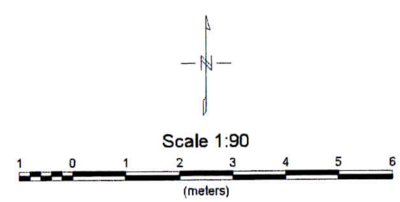
Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

2
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0006XXXX, eg. T00060002)



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0006
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 02/25/2011
Date of Survey: 02/24/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 03 11
Date of Intrusive	03 03 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0007	T00070001	✔	361847.25	4579777.5	243.528945737159					Possibly Related to the Culture	Sign post	Lip
T0007	T00070002	✔	361862.4	4579773	43.6748695181607	12					Seed 14	Removed
T0007	T00070003	✔	361861.0548	4579775.4721	34.5281528804785						metal Debris	Removed
T0007	T00070004	✔	361842.15	4579778.4	20.0895385741498						metal flakes	Removed
T0007	T00070005	✔	361841.7	4579777.65	14.2350149154663						Bolt and nail	Removed

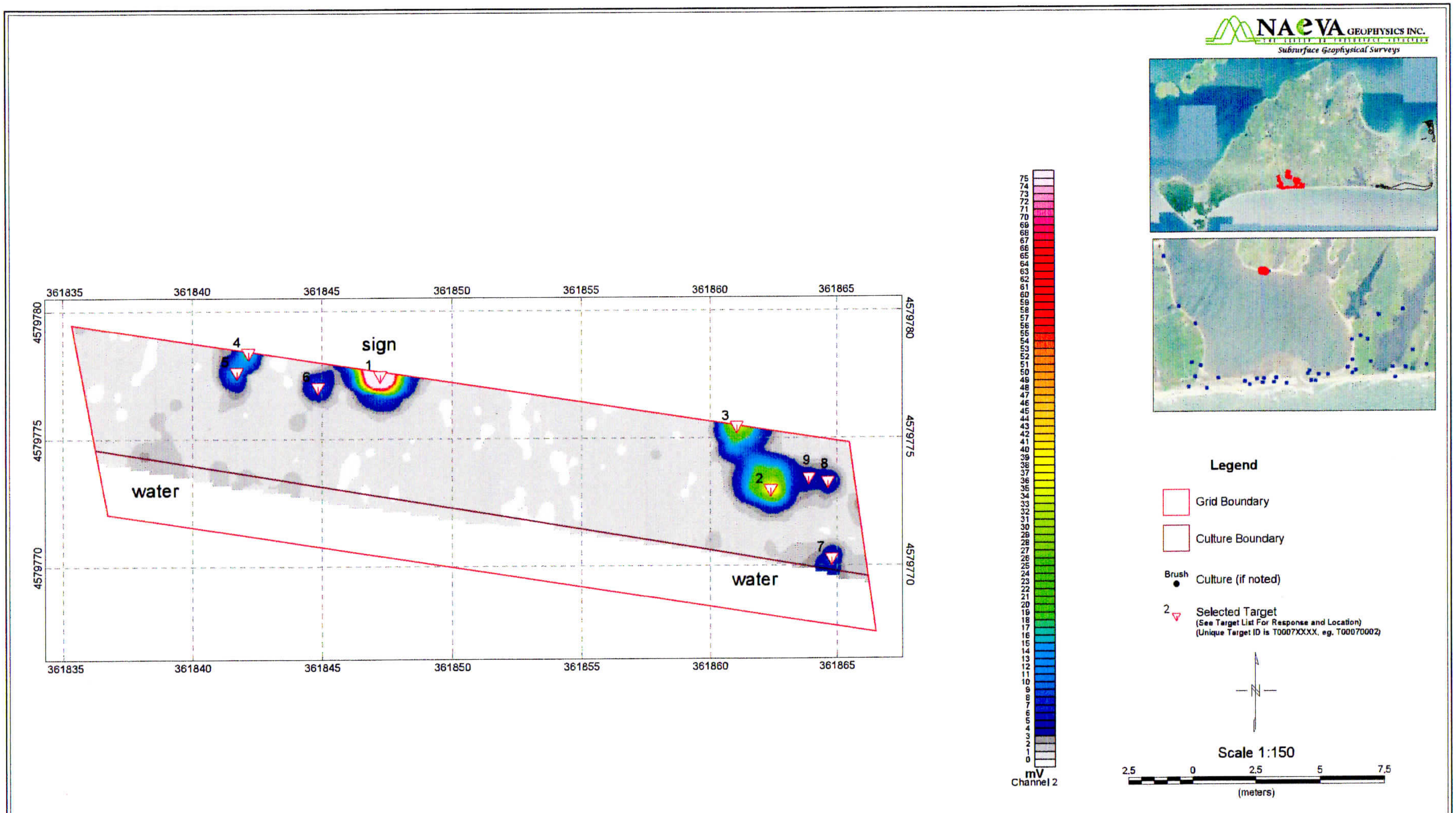
EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	030311
Date of Intrusive	030311
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0007	T00070006	☑	361844.85	4579777.05	10.7012643744161						Bolt and nail	Removed
T0007	T00070007	☑	361864.8	4579770.3	7.84028576976535						2 nails	Removed
T0007	T00070008	☑	361864.65	4579773.3	6.38057087990637						metal Ring	Removed
T0007	T00070009	☑	361863.9	4579773.45	6.17299699769374						wire	Removed

Tuesday, March 01, 2011



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0007
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 02/28/2011
Date of Survey: 02/26/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	030211
Date of Intrusive	030211
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080001	☑	361896.083	4579772.315	2334.98614434556				
T0008	T00080002	☑	361887.133	4579769.913	61.0300224116904	12		30	0-N
T0008	T00080003	☑	361875.947	4579768.931	42.0398824539079				
T0008	T00080004	☑	361888.539	4579770.652	30.488742643887				
T0008	T00080005	☑	361876.246	4579769.558	14.8692347154813				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00080001		Larg Sign (metal)	LiP
T00080002		Seed #12	Removed
T00080003		metal BaR	Removed
T00080004		metal Debris	Removed
T00080005		nail	Removed

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 02 11
Date of Intrusive: 03 02 11

Project ID: Martha's Vineyard RI/FS | Contract No. W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0008	T00080006	☑	361880.779	4579770.944	14.2720935220069						2 metal objects	Removed
T0008	T00080007	☑	361878.555	4579772.92	13.1284393579607						2 metal objects	Removed
T0008	T00080008	☑	361880.49	4579772.361	12.3170787357318						Small metal object	Removed
T0008	T00080009	☑	361879.942	4579772.381	10.9801718493406						fence post	Removed
T0008	T00080010	☑	361877.086	4579772.448	9.49488796631264						metal object	Removed

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080011	✔	361888.176	4579772.151	6.71722549646361				

Anomaly Notes	Description of Item	Disposition of Item
	Small metal object	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080012	✔	361882.008	4579770.869	5.64883552787139				

Anomaly Notes	Description of Item	Disposition of Item
	Live shot gun shell	moved to Disposal site

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080013	✔	361897.779	4579772.938	5.36390597969295				

Anomaly Notes	Description of Item	Disposition of Item
	Same as T0T-1 (sign)	LIP

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080014	✔	361895.743	4579766.34	4.19335262949648				

Anomaly Notes	Description of Item	Disposition of Item
	metal flakes	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080015	✔	361880.464	4579767.196	3.72575604019284				

Anomaly Notes	Description of Item	Disposition of Item
	metal flakes	Removed

EM-61 Anomaly Dig List

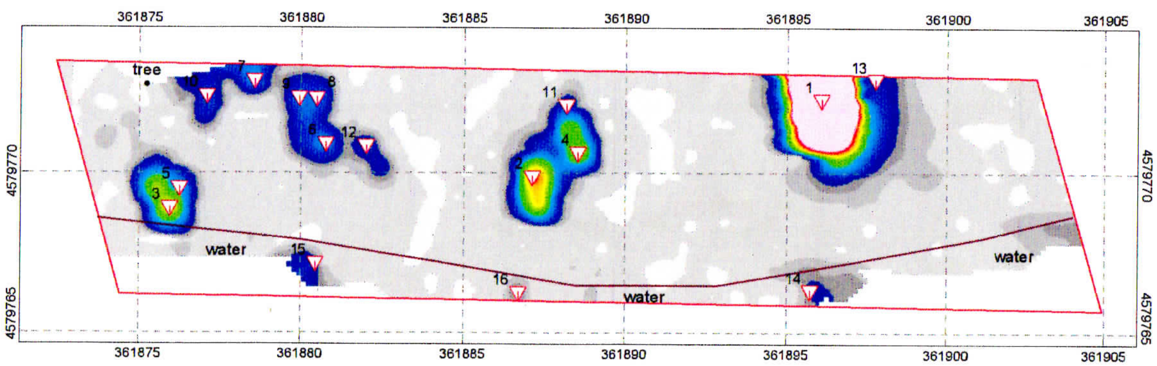
Date of Reacquisiton	03 03 11
Date of Intrusive	03 03 11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID: Martha's Vineyard RI/FS   Contract No. W912DY-04-D-0019

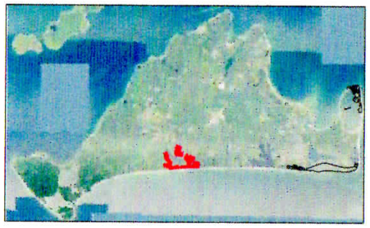
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0008	T00080016	✔	361886.711	4579766.278	3.68113099638983				

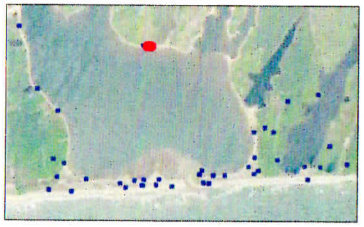
Anomaly Notes	Description of Item	Disposition of Item
	metal flakes	Removed

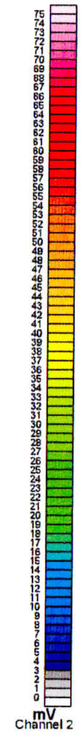
Tuesday, March 01, 2011



NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0008XXXX, eg. T00080002)

Scale 1:150

2.5 0 2.5 5 7.5
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0008
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 02/28/2011
Date of Survey: 02/26/2011

EM-61 Anomaly Dig List

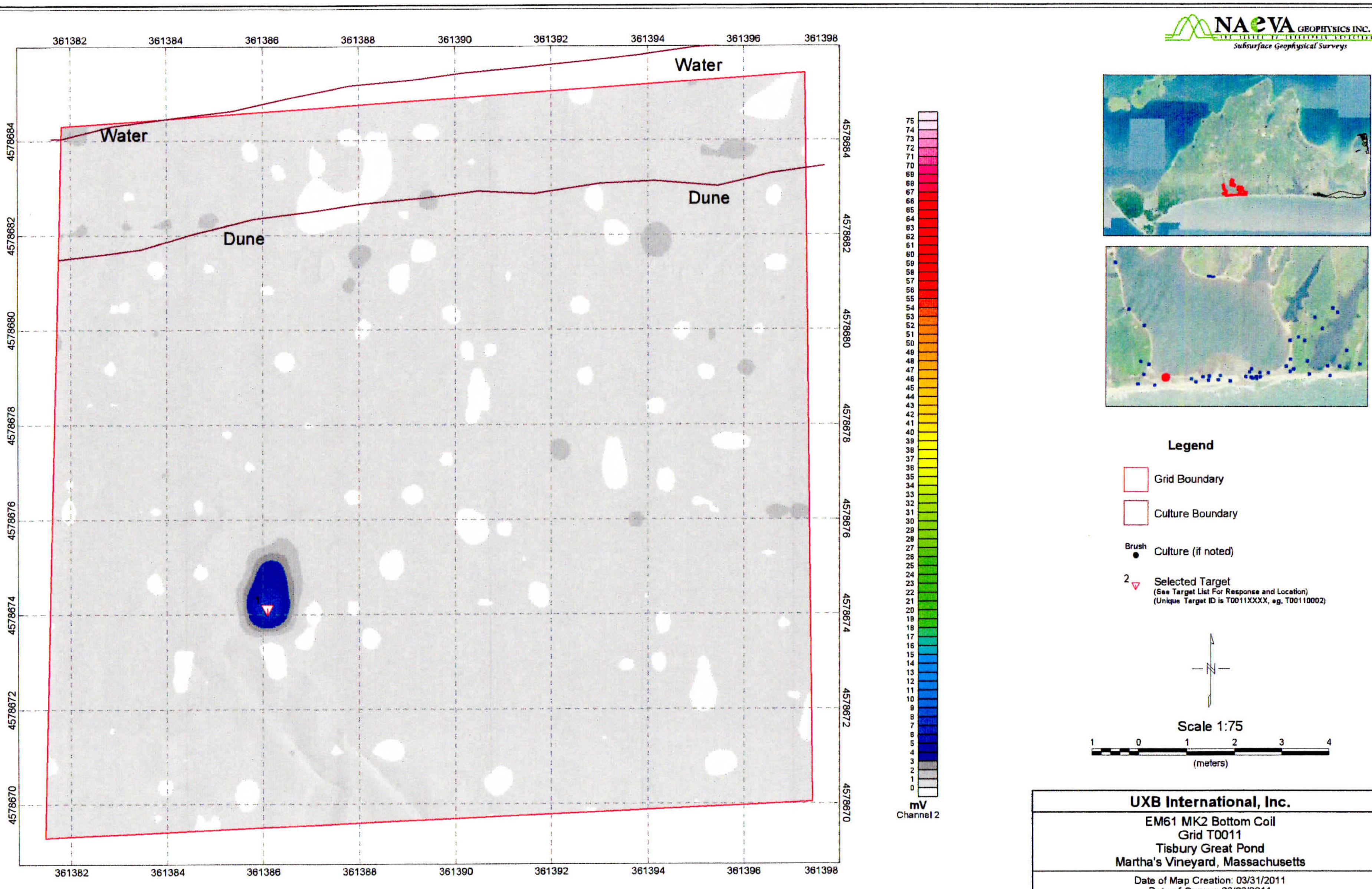
Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0011	T00110001	☑	361386.096	4578674.126	8.48268325654128				

Anomaly Notes	Description of Item	Disposition of Item
	CD - Railroad Tie w/Spike	Removed

Monday, April 04, 2011



NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0011
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/31/2011
Date of Survey: 03/30/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0014	T00140001	☑	361786.4	4578685.45	24.0071627206342				

Anomaly Notes	Description of Item	Disposition of Item
Target moved to center of anomaly	CD - Telephone Pole w/ Bolt	Left in Place

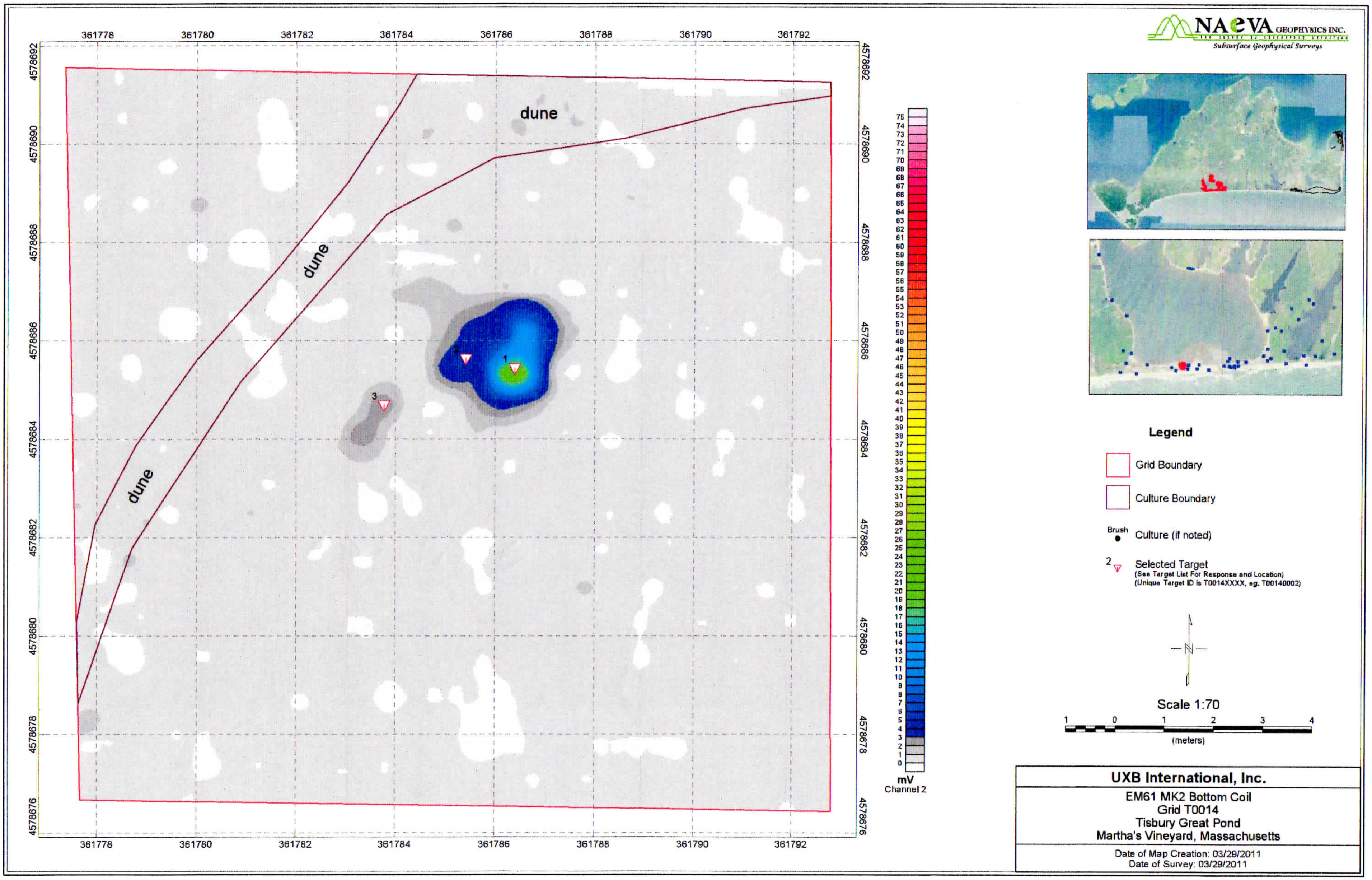
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0014	T00140002	☑	361785.4	4578685.65	4.82370269244423				

Anomaly Notes	Description of Item	Disposition of Item
Target moved to center of anomaly	Same as #1	NA

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0014	T00140003	☑	361783.775	4578684.702	3.02854891376851				

Anomaly Notes	Description of Item	Disposition of Item
	CD - Spike	Removed

Wednesday, March 30, 2011


361778
361780
361782
361784
361786
361788
361790
361792
4578692
4578690
4578688
4578686
4578684
4578682
4578680
4578678
4578676
dune
dune
dune
1
2
3
mV
Channel 2
NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
2
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0014XXXX, eg. T00140002)
Scale 1:70
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0014
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/29/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/6/11

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0015	T00150001	☑	361845.198	4578646.617	37.8891781195477				

Anomaly Notes	Description of Item	Disposition of Item
Secondary peak approx. 0.7m to S	CD- Scrap Metal	Removed

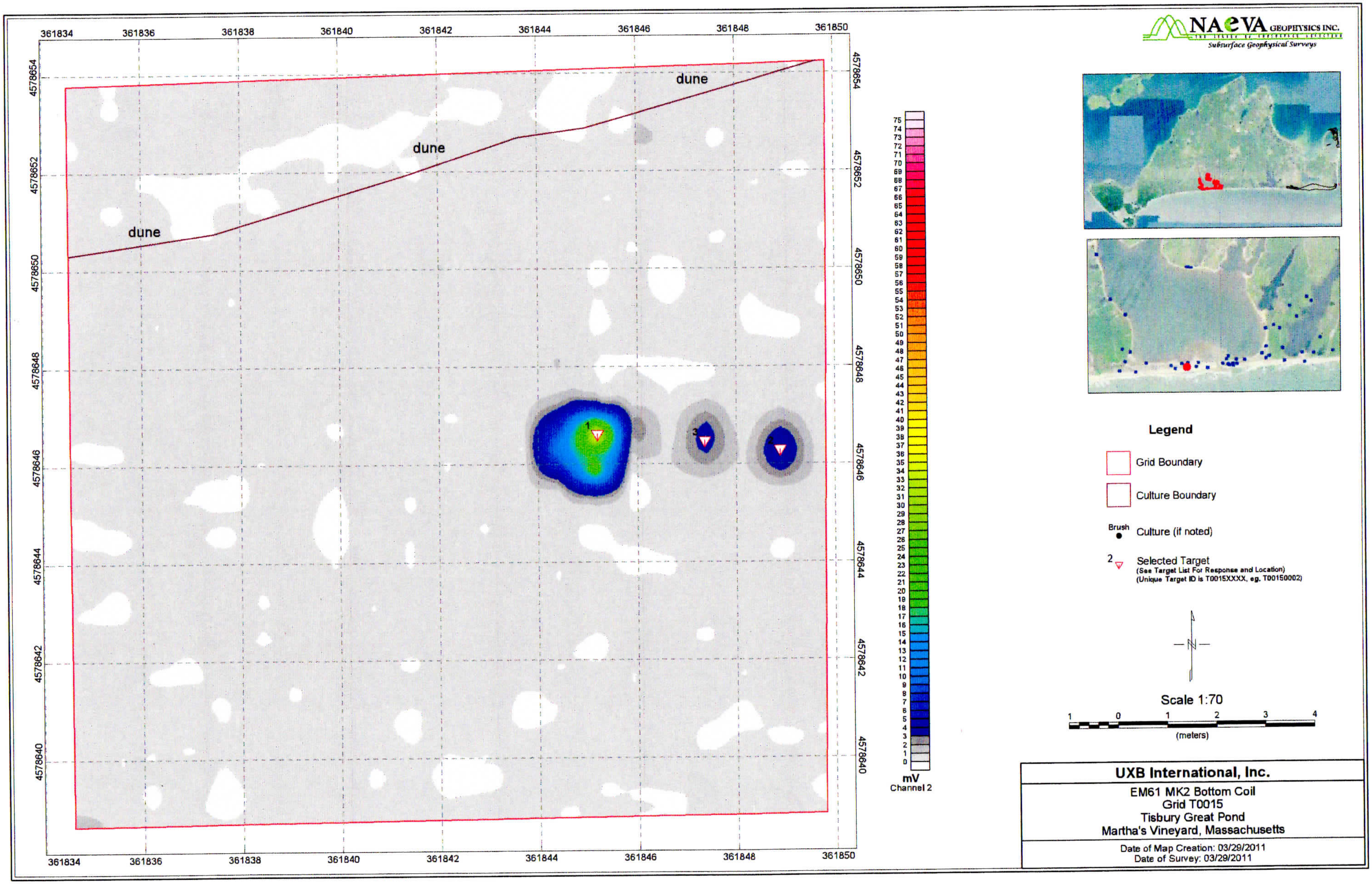
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0015	T00150002	☑	361848.904	4578646.294	5.188120010044				

Anomaly Notes	Description of Item	Disposition of Item
	~~Same as #1~~ No Find	NA

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0015	T00150003	☑	361847.365	4578646.477	3.7975829552158				

Anomaly Notes	Description of Item	Disposition of Item
	No Find	NA

Wednesday, March 30, 2011


NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
dune
dune
dune
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0015XXXX, eg. T00150002)
Scale 1:70
(meters)
mV
Channel 2
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0015
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/29/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	4/6/11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0016	T00160001	☑	361853.1	4578689.993	135.052877198612				

Anomaly Notes	Description of Item	Disposition of Item
Target moved to center of anomaly; Secondary peak approx. 0.8m to SE	CD - Fence Post	Removed

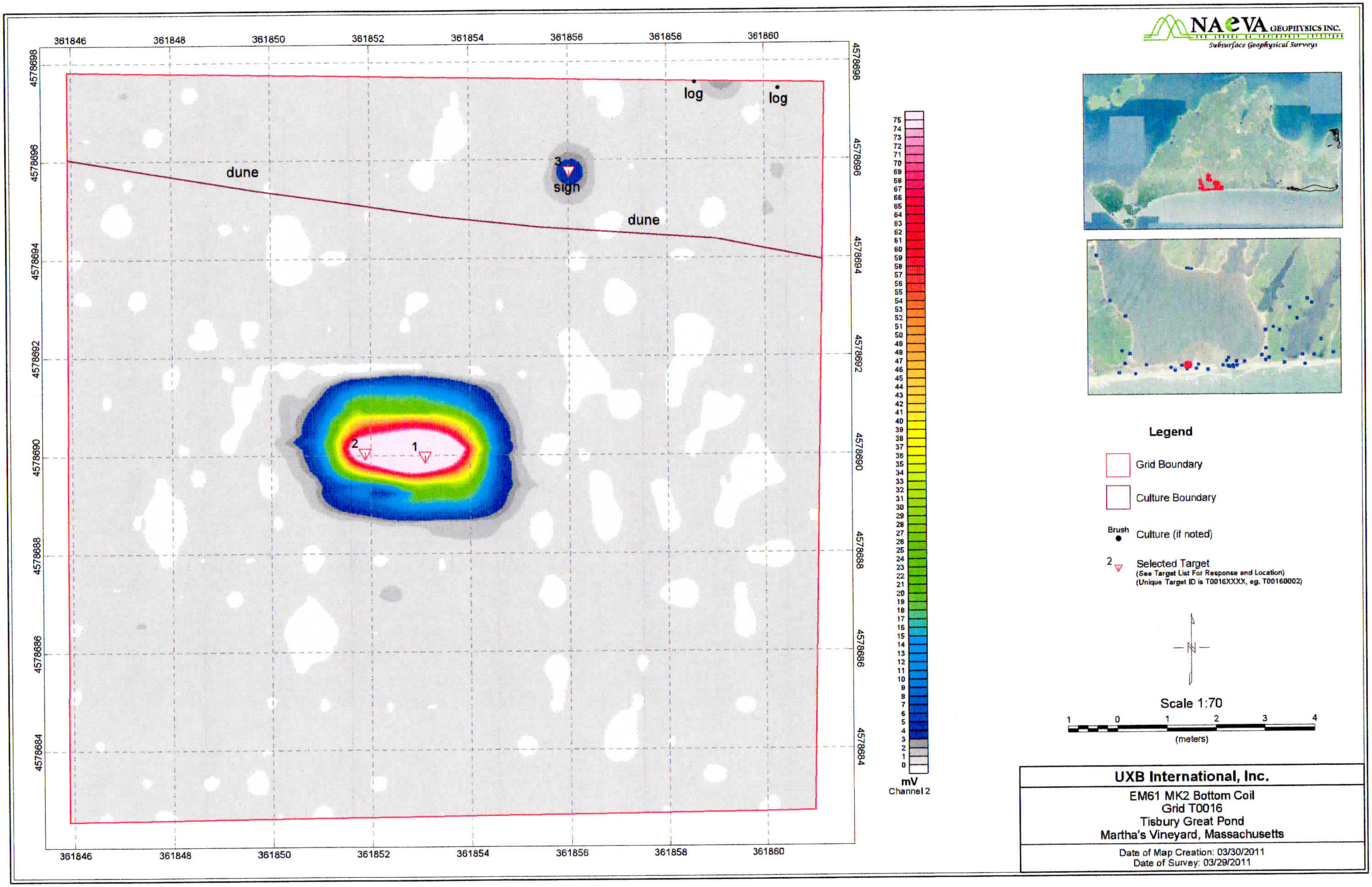
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0016	T00160002	☑	361851.891	4578690.061	104.530358936535				

Anomaly Notes	Description of Item	Disposition of Item
Possibly related to target to E	Same AS # 1	NA

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0016	T00160003	☑	361856.02	4578695.781	5.12556602054375				

Anomaly Notes	Description of Item	Disposition of Item
Culture - sign	CD - Sign	Left in PLACE

Thursday, March 31, 2011


NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
361846
361848
361850
361852
361854
361856
361858
361860
4578698
4578696
4578694
4578692
4578690
4578688
4578686
4578684
log
log
dune
dune
sign
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0016XXXX, eg. T00160002)
N
Scale 1:70
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0016
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/30/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/6/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID | Martha's Vineyard RI/FS | Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0018	T00180001	☑	361970.7	4578695.6	7019.87841796875				

Anomaly Notes: Culture - Pipe

Description of Item: Please confirm Pipe — Pipe

Disposition of Item: Moved to Verify Nothing Below

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0018	T00180002	☑	361969.9	4578697.2	2697.12646451373				

Anomaly Notes: Culture - Pipe

Description of Item: Please confirm Pipe — Same As #1

Disposition of Item: NA

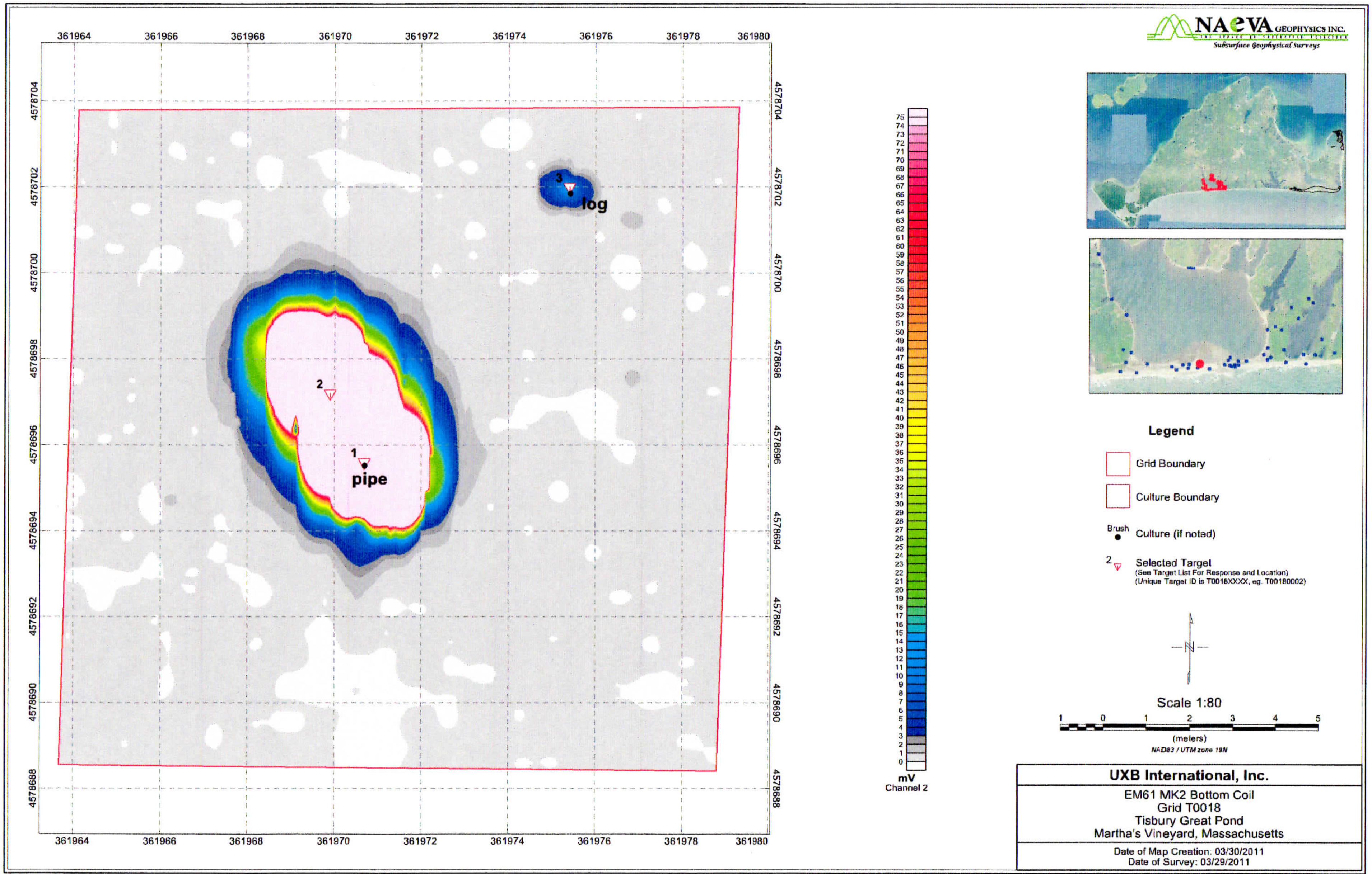
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0018	T00180003	☑	361975.4	4578702	12.3312387428554				

Anomaly Notes: Possibly related to log - coil bump

Description of Item: Telephone Pole w/ Nail

Disposition of Item: Left in place

Thursday, March 31, 2011



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0018
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/30/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

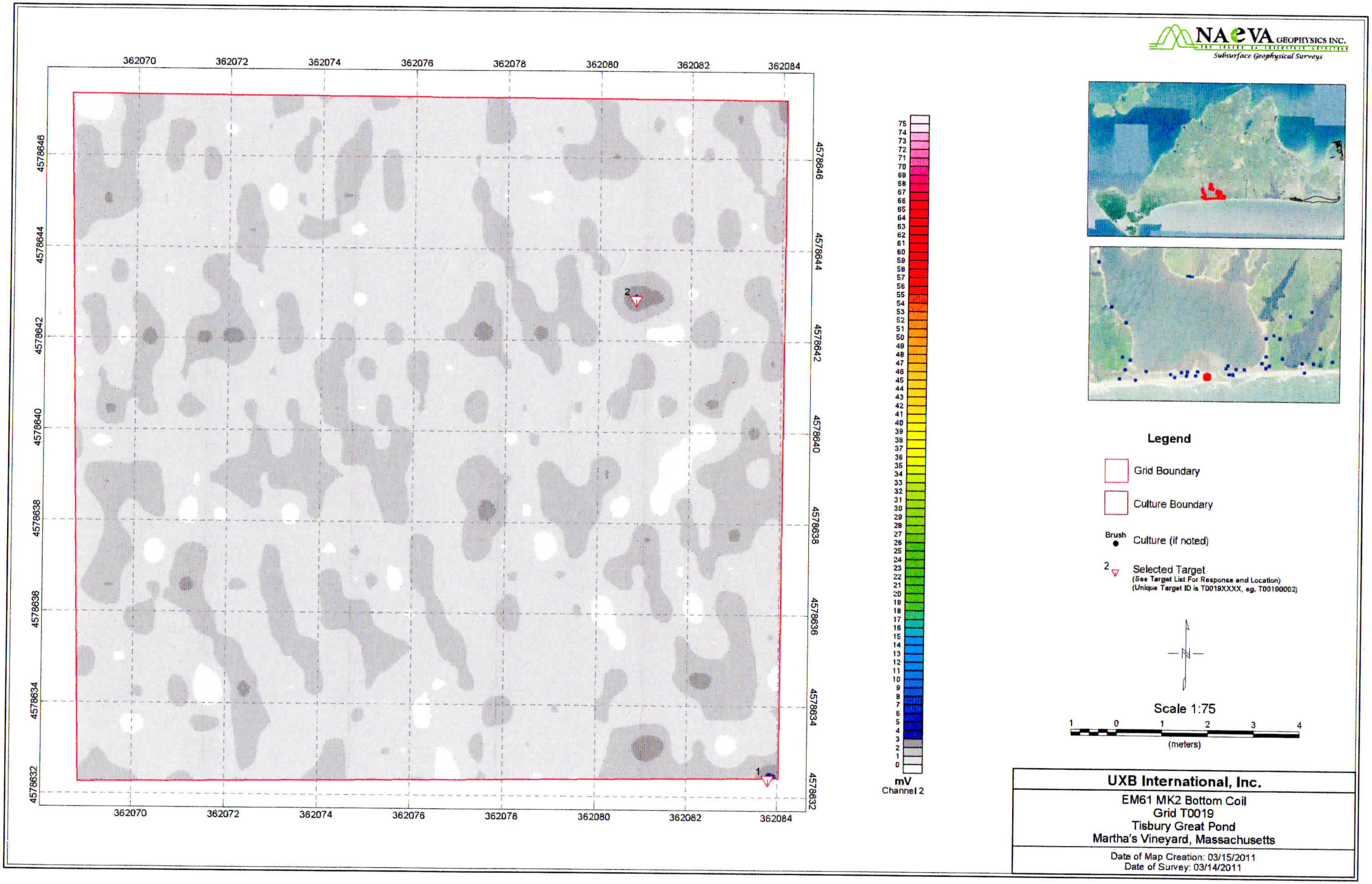
Date of Reacquisiton	03/16/11
Date of Intrusive	03/16/11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0019	T00190001	☑	362083.8	4578632.4	3.98163437542873				

Anomaly Notes	Description of Item	Disposition of Item
	no find	–

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0019	T00190002	☑	362080.8	4578642.9	3.4069817026687				

Anomaly Notes	Description of Item	Disposition of Item
	no find	–


NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
362070
362072
362074
362076
362078
362080
362082
362084
4578632
4578634
4578636
4578638
4578640
4578642
4578644
4578646
1
2
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0019XXXX, eg. T00190002)
N
Scale 1:75
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0019
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/15/2011
Date of Survey: 03/14/2011

EM-61 Anomaly Dig List

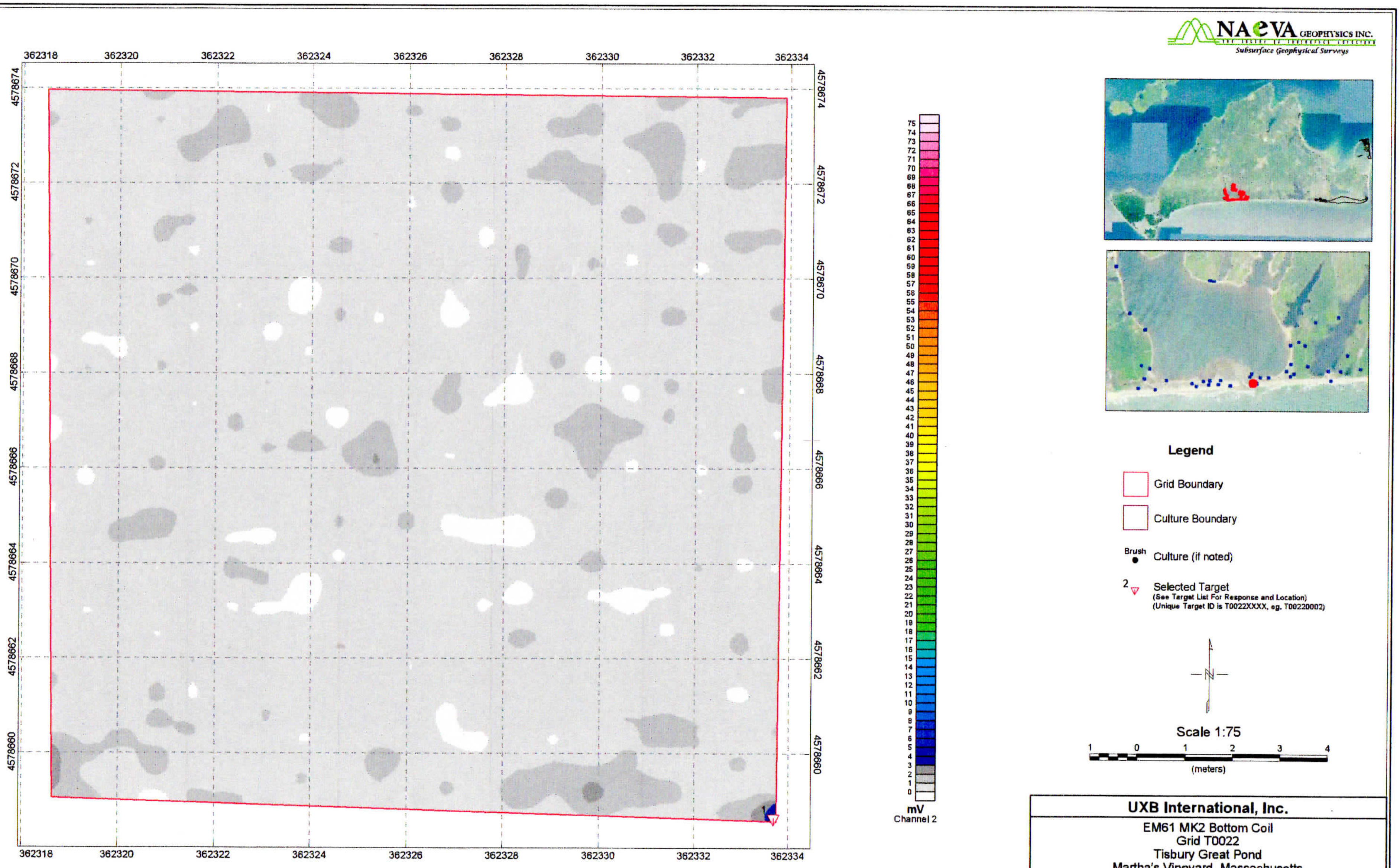
Date of Reacquisiton	03/16/11
Date of Intrusive	03/16/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID | Martha's Vineyard RI/FS | Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0022	T00220001	☑	362333.7	4578658.65	3.70639610290527				

Anomaly Notes	Description of Item	Disposition of Item
	no find	–

Wednesday, March 16, 2011



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0022
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/15/2011
Date of Survey: 03/14/2011

EM-61 Anomaly Dig List

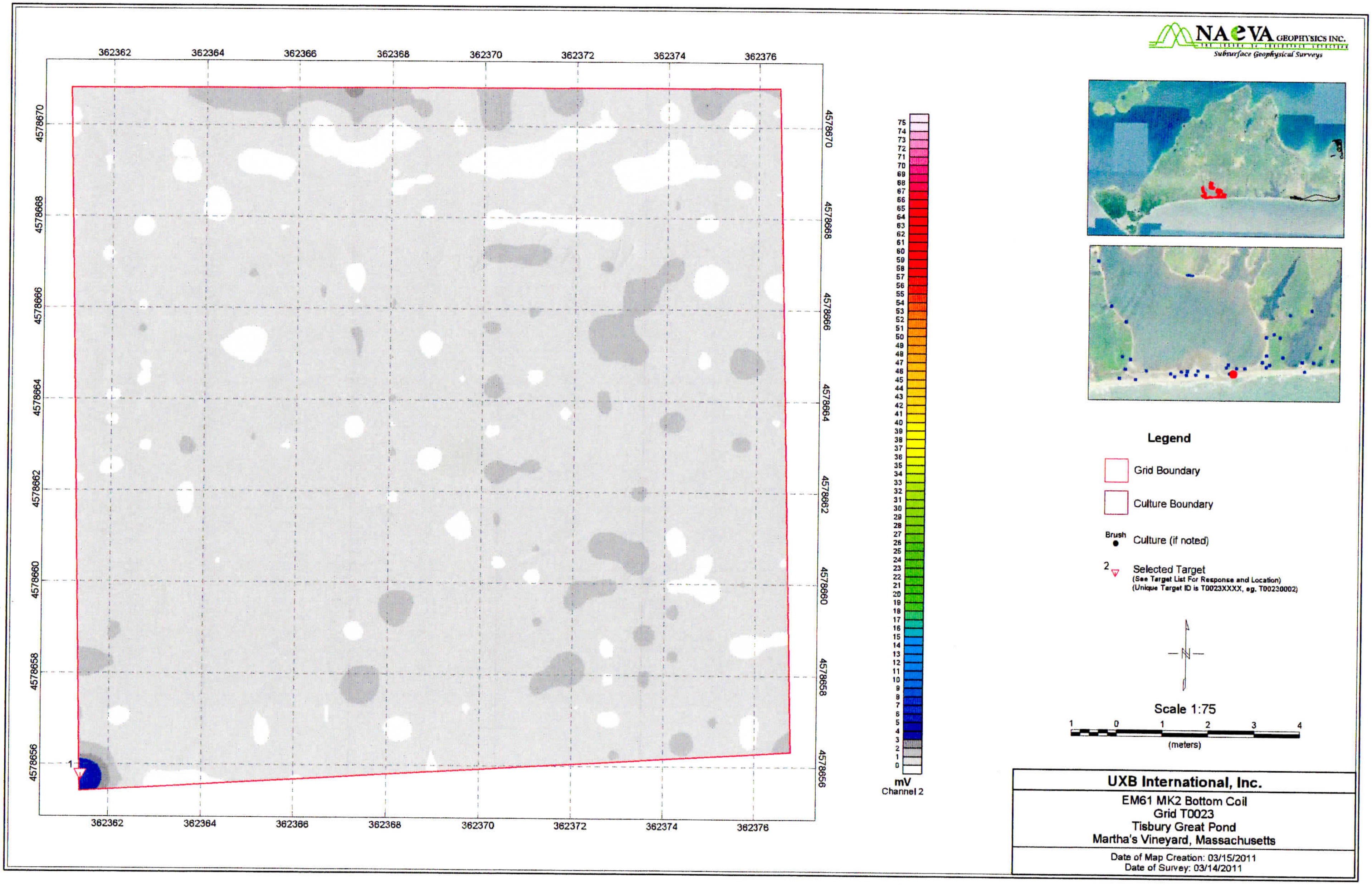
Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	03/16/11
Date of Intrusive	03/16/11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0023	T00230001	☑	362361.4035	4578655.8028	6.65544481939648				

Anomaly Notes	Description of Item	Disposition of Item
	nc fnd	—

Wednesday, March 16, 2011



362362
362364
362366
362368
362370
362372
362374
362376
4578670
4578668
4578666
4578664
4578662
4578660
4578658
4578656
1
mV
Channel 2
NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
2
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0023XXXX, eg. T00230002)
N
Scale 1:75
1 0 1 2 3 4
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0023
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/15/2011
Date of Survey: 03/14/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

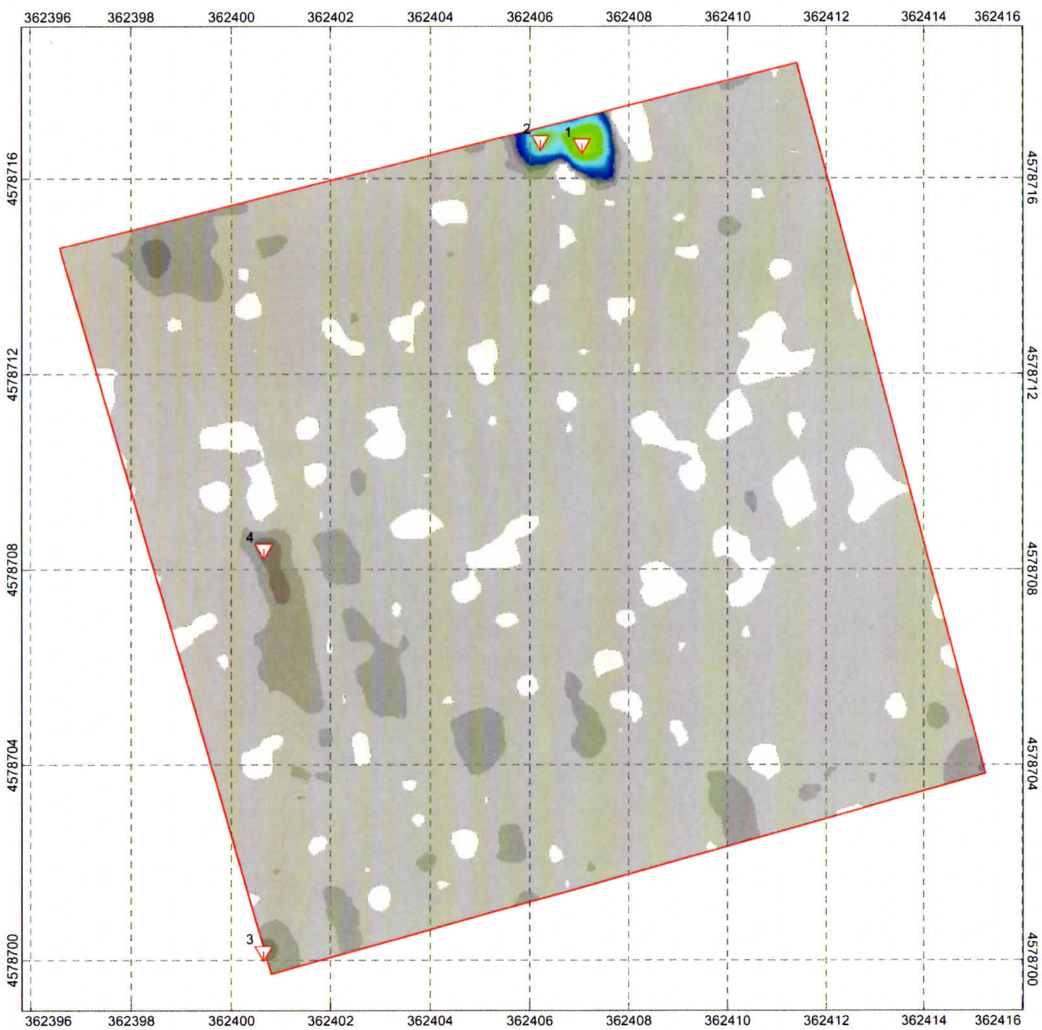
Date of Reacquisiton	03/14/11
Date of Intrusive	03/18/11
Coord Sys.	NAD 83 UTM Zone 19N

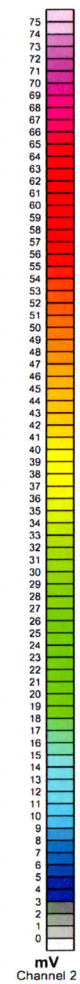
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0024	T00240001	✔	362407.05	4578716.7	36.1604499816895				
T0024	T00240002	✔	362406.21	4578716.771	22.3362583135522				
T0024	T00240003	✔	362400.647	4578700.185	3.36716908763255				
T0024	T00240004	✔	362400.652	4578708.416	3.01155886267118				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00240001		CD - fence post	removed
T00240002		same as 01	—
T00240003		no find	—
T00240004		no find	—

Thursday, March 03, 2011

NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys





Legend

Grid Boundary

Culture Boundary

Brush Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0024XXXX, eg. T00240002)

N

Scale 1:100

1 0 1 2 3 4 5 6
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0024
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/02/2011
Date of Survey: 03/01/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	030911
Date of Intrusive	030911
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250001	☑	362500.761	4578724.186	88.130495699092				

Anomaly Notes	Description of Item	Disposition of Item
Footprint extends roughly 2 x 2.5m.	CD-fence post	RemoveD

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250002	☑	362488.194	4578732.348	62.3390297027791				

Anomaly Notes	Description of Item	Disposition of Item
	CD-fence post	RemoveD

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250003	☑	362487.492	4578733.22	30.5935423972443				

Anomaly Notes	Description of Item	Disposition of Item
	CD-metal object	removeD

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250004	☑	362489.572	4578733.678	26.3776159332775				

Anomaly Notes	Description of Item	Disposition of Item
	CD-fence post	RemoveD

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250005	☑	362501.929	4578725.504	22.4539201837718				

Anomaly Notes	Description of Item	Disposition of Item
Possibly Related to target to SW	Same as 01- CD fence post	removeD

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250006	✔	362502.055	4578724.786	22.3273996189761				

Anomaly Notes	Description of Item	Disposition of Item
Possibly Related to target to W	Same as -01- CD fence post	removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250007	✔	362490.64	4578733.625	4.09339590033094				

Anomaly Notes	Description of Item	Disposition of Item
	Same as -04	—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250008	✔	362494.409	4578733.749	3.8408735934741				

Anomaly Notes	Description of Item	Disposition of Item
	CD - nails	removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250009	✔	362488.189	4578733.672	3.72967361932701				

Anomaly Notes	Description of Item	Disposition of Item
	Same as 04	—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250010	✔	362492.079	4578726.031	3.56048062079828				

Anomaly Notes	Description of Item	Disposition of Item
	CD metal flake	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250011	✔	362495.185	4578725.974	3.19555992209404				

Anomaly Notes

Description of Item
nofind

Disposition of Item

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250012	✔	362492.335	4578724.277	3.14288214820072				

Anomaly Notes

Description of Item
nofind

Disposition of Item

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0025	T00250013	✔	362492.797	4578734.364	3.03386773547094				

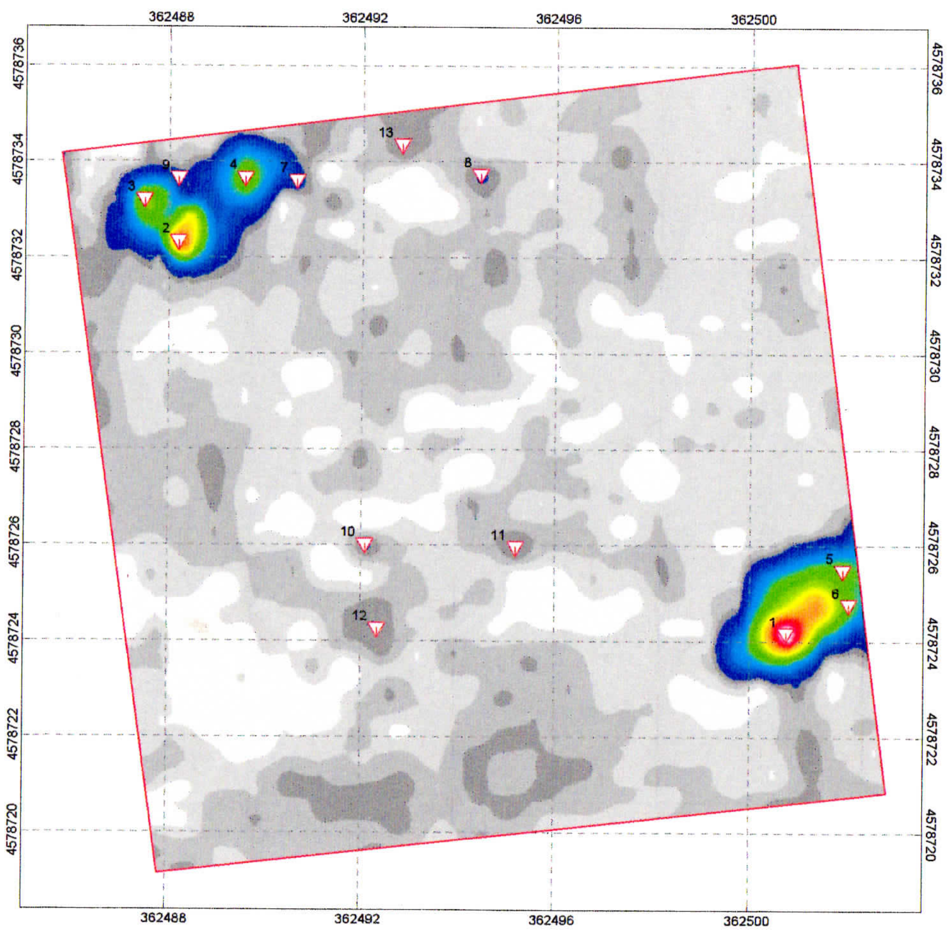
Anomaly Notes

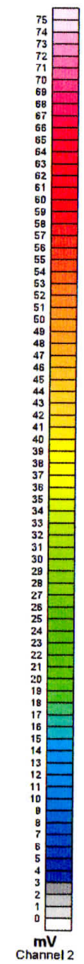
Description of Item
CD · metal flake

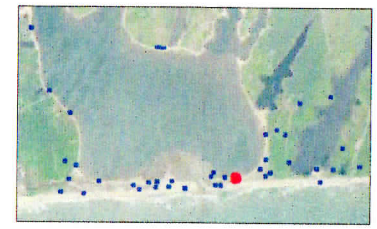
Disposition of Item
removed

Wednesday, March 09, 2011

NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0025XXXX, eg. T00250002)

Scale 1:100

1 0 1 2 3 4 5 6
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0025
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/08/2011
Date of Survey: 03/07/2011

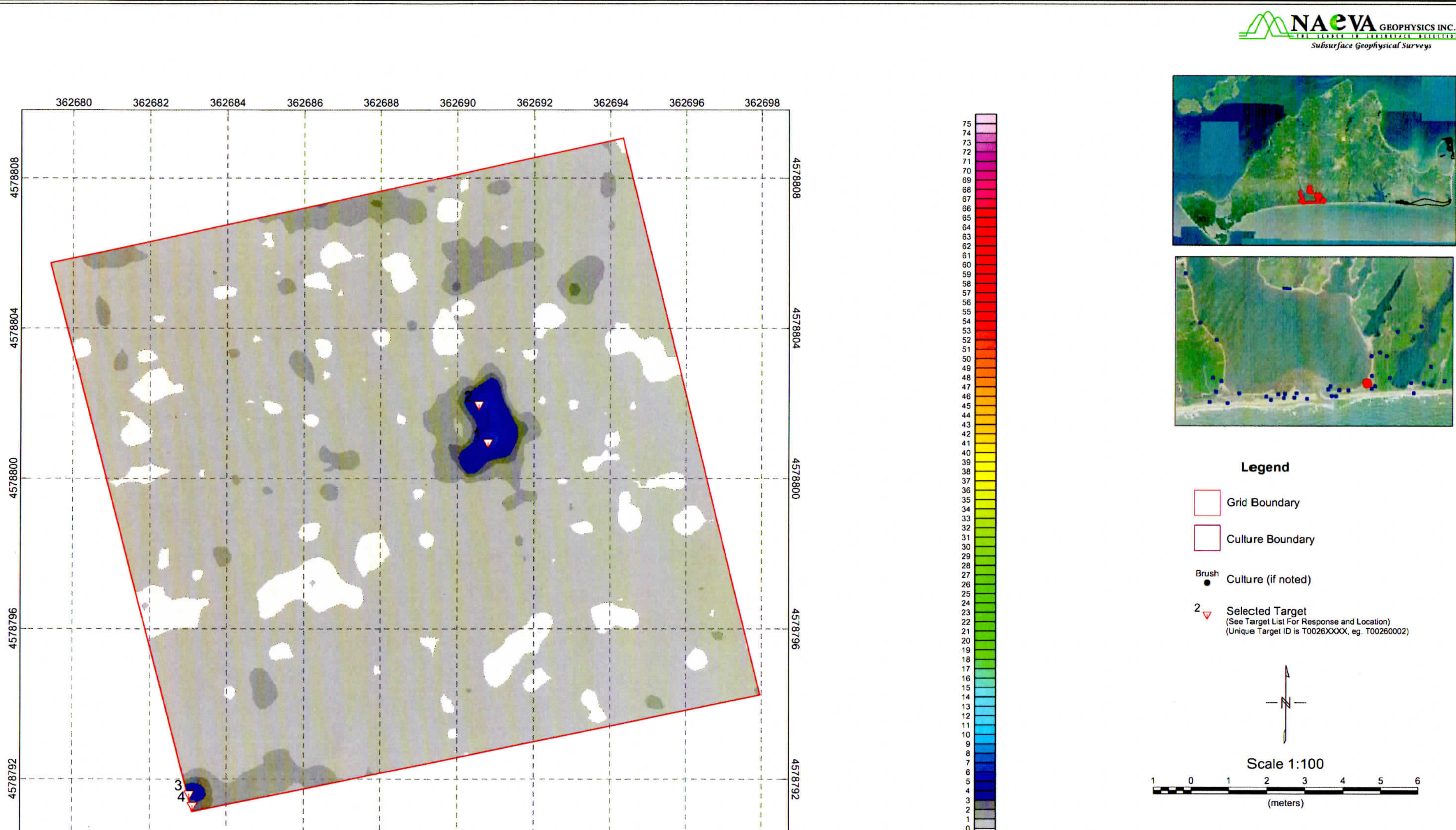
EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	030411
Date of Intrusive	030711
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0026	T00260001	✔	362690.798	4578800.966	6.85259181591856						CD - metal flakes	Removed
T0026	T00260002	✔	362690.562	4578801.969	6.54911824378951						Same as 01	Removed
T0026	T00260003	✔	362683.027	4578791.605	4.70358972979573						CD- metal flake	Removed
T0026	T00260004	✔	362683.11	4578791.301	3.05687406789156						Same as 03	Removed

Thursday, March 03, 2011



UXB International, Inc.
EM61 MK2 Bottom Coil Grid T0026 Tisbury Great Pond Martha's Vineyard, Massachusetts
Date of Map Creation: 03/02/2011 Date of Survey: 03/01/2011

MEC - 0
Non-MD - 2
MD - 0

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS   Contract No. W912DY-04-D-0019

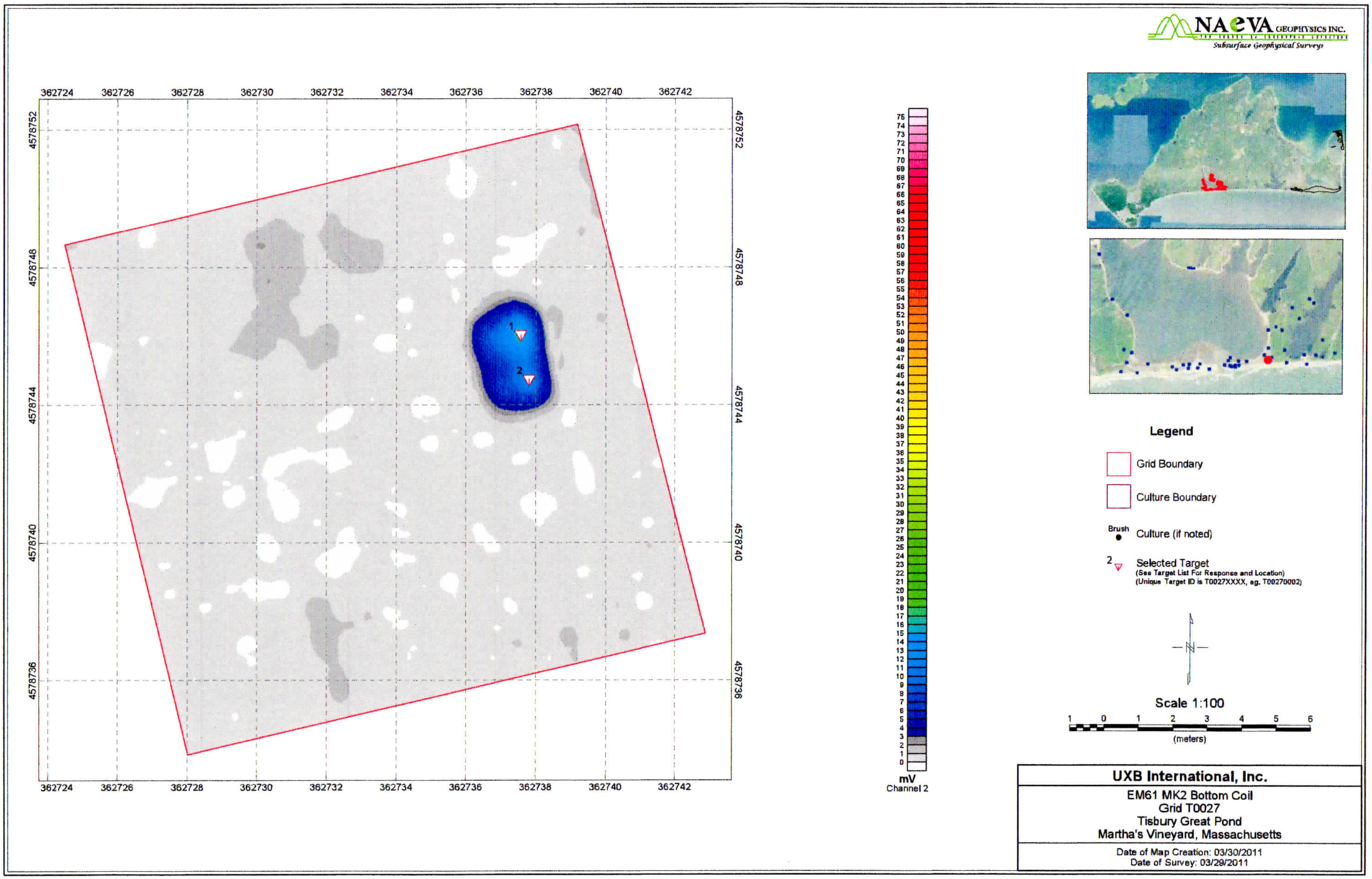
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0027r	T0027r0001	☑	362737.575	4578746.044	16.7659889492948				

Anomaly Notes	Description of Item	Disposition of Item
	CD- Railroad TIE w/ spike	Left in Place

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0027r	T0027r0002	☑	362737.813	4578744.755	12.5861599822091				

Anomaly Notes	Description of Item	Disposition of Item
	Same as #1	NA

Monday, April 04, 2011


NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
362724
362726
362728
362730
362732
362734
362736
362738
362740
362742
4578752
4578748
4578744
4578740
4578736
1
2
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0027XXXX, eg. T00270002)
N
Scale 1:100
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0027
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/30/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

NOTE: This diglist (T0028r) replaces the original T0028 as the grid was remapped due to QC failure. Please discard any paper diglists for T0028, and use this list for T0028r.

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0001	✔	362770.95	4578766.074	186.012077529757	6	1	90	90

Anomaly Notes	Description of Item	Disposition of Item
Target moved to center of anomaly	Seed #1 E. 362770.18m N 4578766.06M	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0002	✔	362766.129	4578769.358	24.0914038776152				

Anomaly Notes	Description of Item	Disposition of Item
	CD - Banding Material	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0003	✔	362767.402	4578769.681	20.7809370616807				

Anomaly Notes	Description of Item	Disposition of Item
	Same as #2	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0004	✔	362767.008	4578768.811	17.6074457332309				

Anomaly Notes	Description of Item	Disposition of Item
	Reaquire - No Find	NA

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0005	✔	362764.128	4578770.719	9.26678941612079				

Anomaly Notes	Description of Item	Disposition of Item
	CD - Banding Metal	Removed

Shirley Rieven

Digitally signed by Shirley Rieven
DN: cn=Shirley Rieven, o=UXB International, ou, email=shirley.rieven@uxb.com, c=US
Date: 2011.03.31 05:39:44 -04'00'

MEC - 0
MD - 0
Non-MD - 5

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019	Date of Reacquisiton	
		Date of Intrusive	
		Coord Sys.	NAD 83 UTM Zone 19N

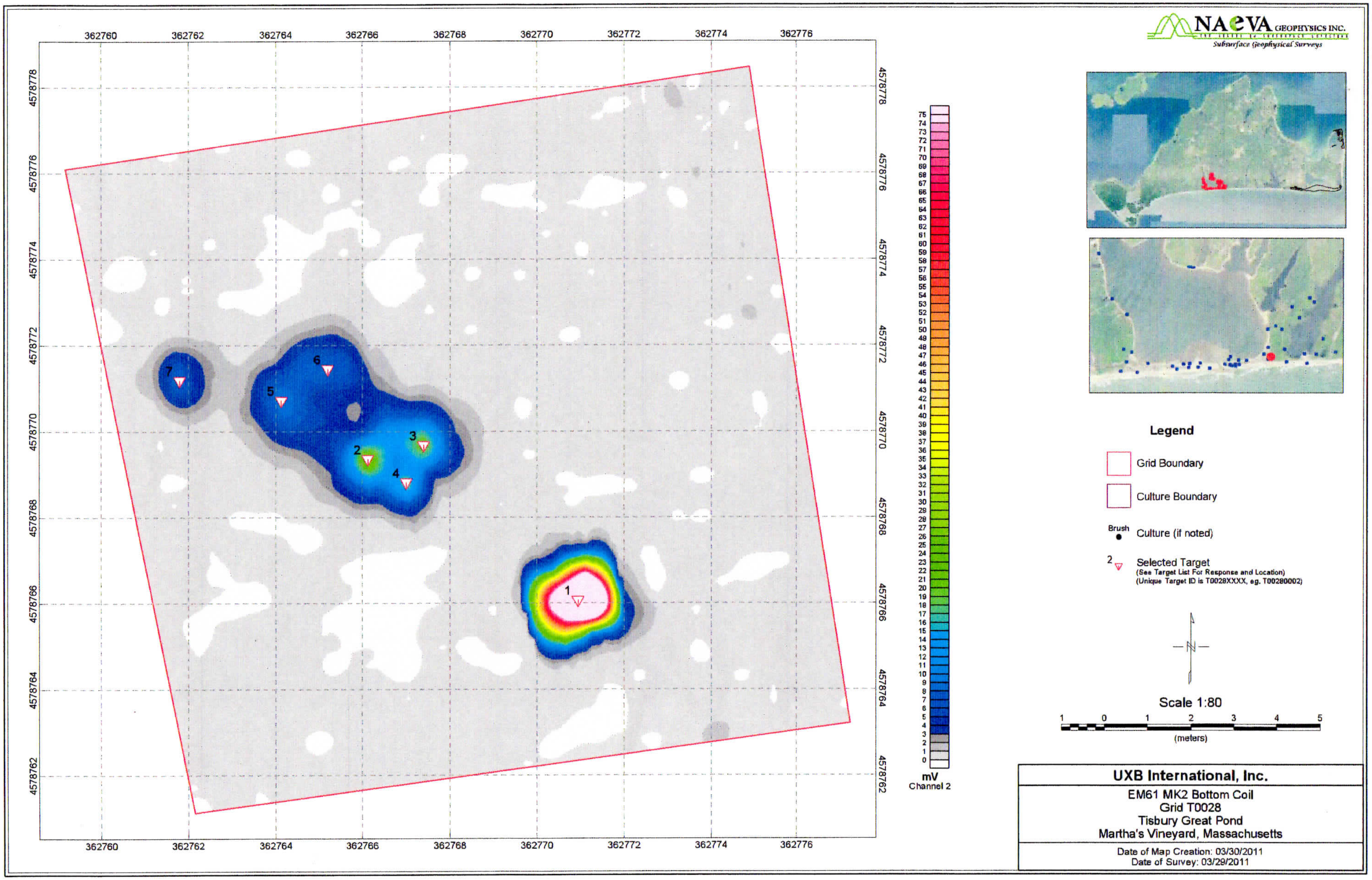
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0006	☑	362765.2	4578771.45	8.22415125068228				

Anomaly Notes	Description of Item	Disposition of Item
Target moved to center of anomaly	CD - SAME AS #5	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0028r	T0028r0007	☑	362761.803	4578771.19	7.50405701795171				

Anomaly Notes	Description of Item	Disposition of Item
	No Find	NA

Thursday, March 31, 2011


NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0028XXXX, eg. T00280002)
Scale 1:80
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0028
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/30/2011
Date of Survey: 03/29/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019
Date of Reacquisiton	[illegible] 030411
Date of Intrusive	030711
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290001	☑	362738.85	4578882.9	311.453551789672			0	0

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290002	☑	362739.45	4578874.05	62.164264677385			0	0

Anomaly Notes	Description of Item	Disposition of Item
	Seed # 5	removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290003	☑	362726.9901	4578881.5596	26.1167851847455				

Anomaly Notes	Description of Item	Disposition of Item
Target Peak .65m NW	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290004	☑	362730.297	4578872.646	13.2031239619824				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290005	☐	362729.893	4578873.945	8.10160044800241				

Anomaly Notes	Description of Item	Disposition of Item
	—	

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

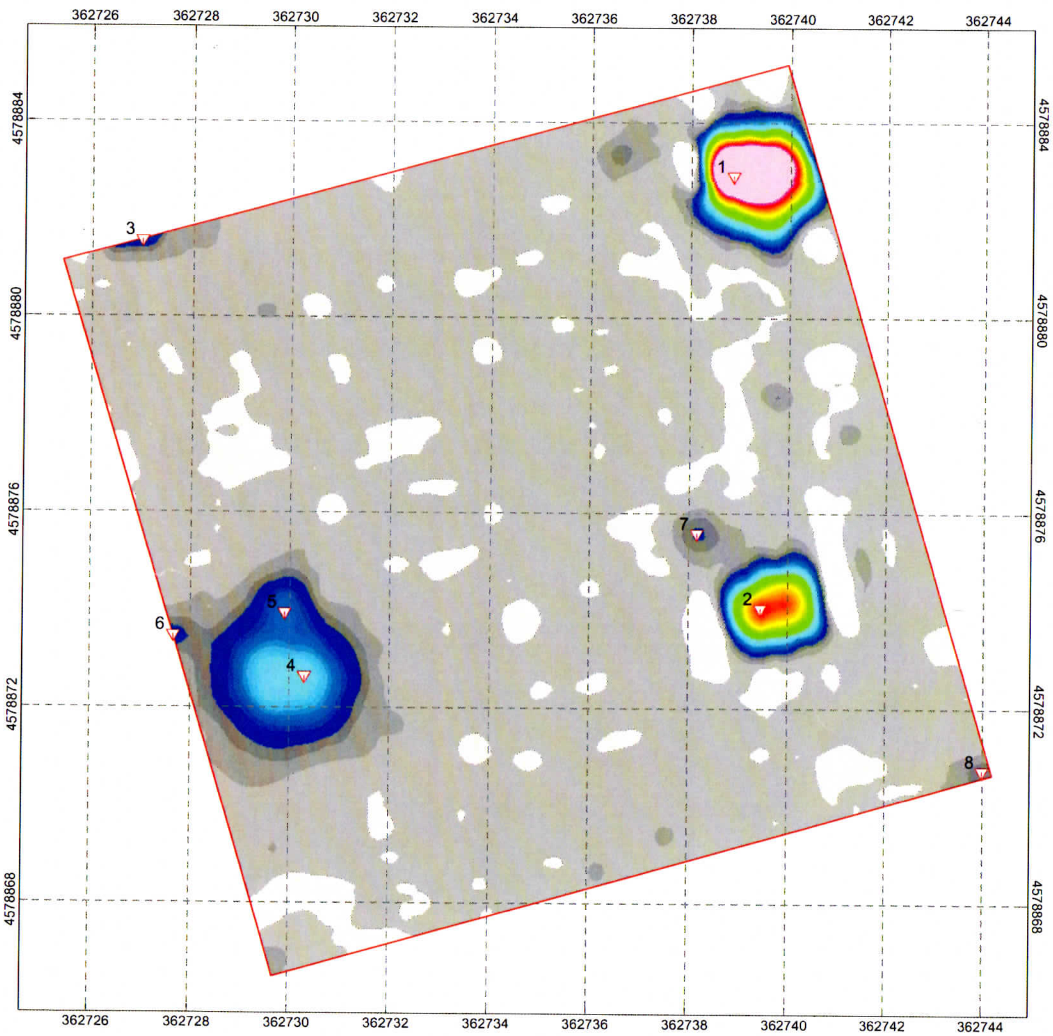
Project ID: Martha's Vineyard RI/FS   Contract No. W912DY-04-D-0019

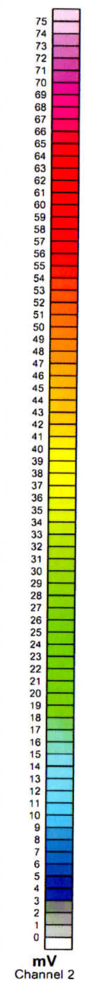
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0029	T00290006	☐	362727.6612	4578873.478	3.73543693229616				
T0029	T00290007	☐	362738.158	4578875.584	3.34177548134243				
T0029	T00290008	☐	362743.988	4578870.74	3.26227711955656				

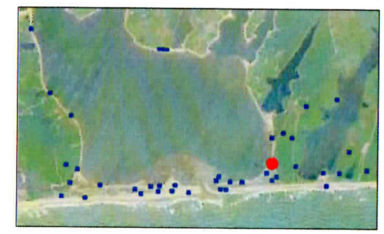
Each target row is followed by blank boxes headed **Anomaly Notes**, **Description of Item** and **Disposition of Item**.

Thursday, March 03, 2011

NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







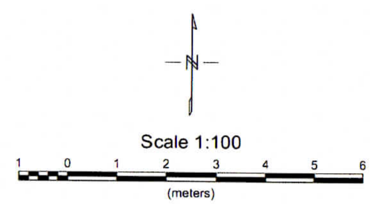
Legend

Grid Boundary

Culture Boundary

Brush ● Culture (if noted)

2 ▽ Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0029XXXX, eg. T00290002)



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0029
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/02/2011
Date of Survey: 03/01/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 02 11 SAC
Date of Intrusive	03 02 11 SAC
Coord Sys.	NAD 83 UTM Zone 19N

X

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0030	T00300001	☑	362734.8	4579083.9	163.022125203961				
T0030	T00300002	☑	362728.95	4579079.85	53.3381538120638				

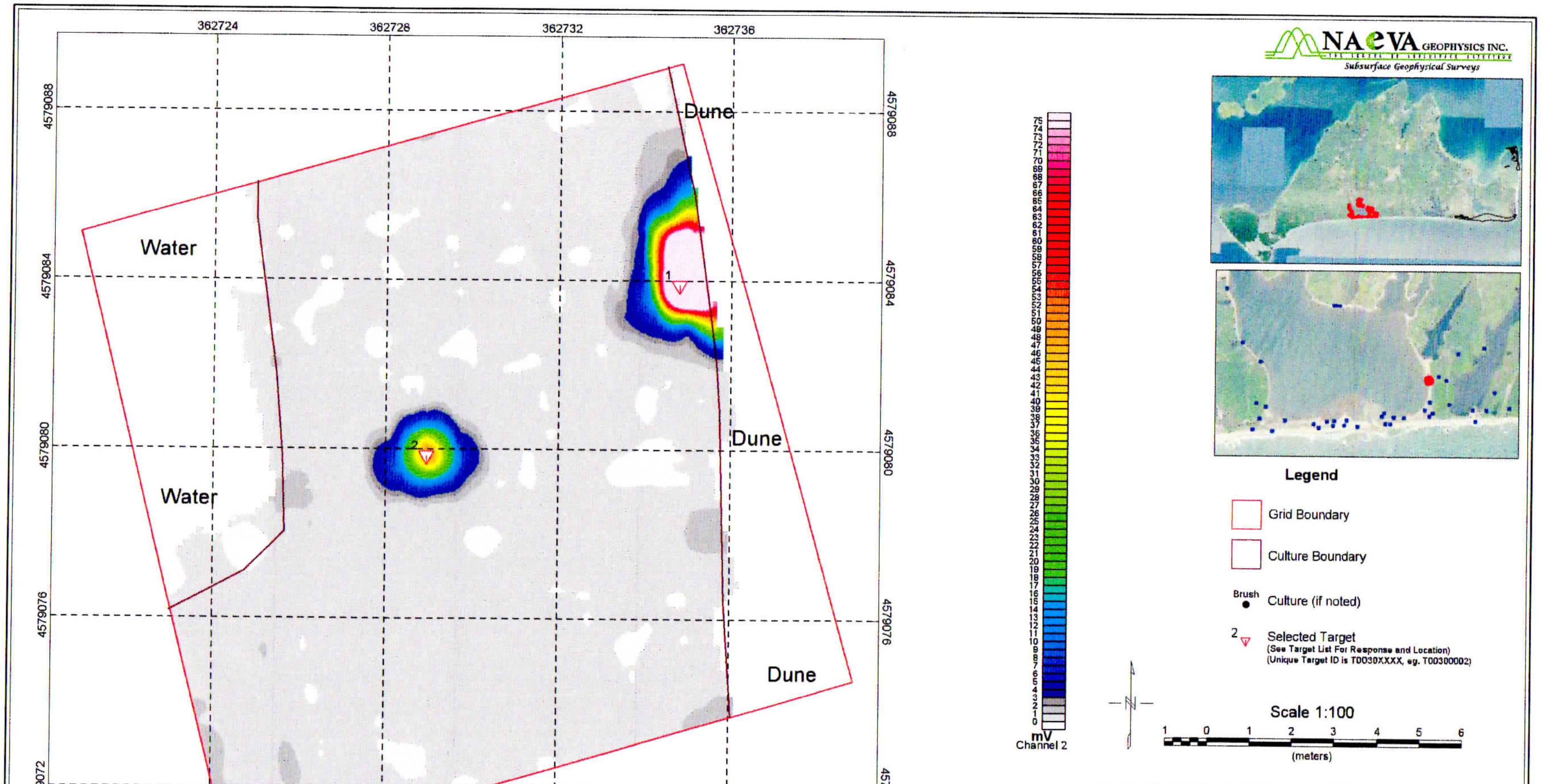
T00300001

Anomaly Notes	Description of Item	Disposition of Item
	Bolt in peice of wood	Lip

T00300002

Anomaly Notes	Description of Item	Disposition of Item
	CD	Lip

Tuesday, March 01, 2011



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0030
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 02/28/2011
Date of Survey: 02/26/2011

EM-61 Anomaly Dig List

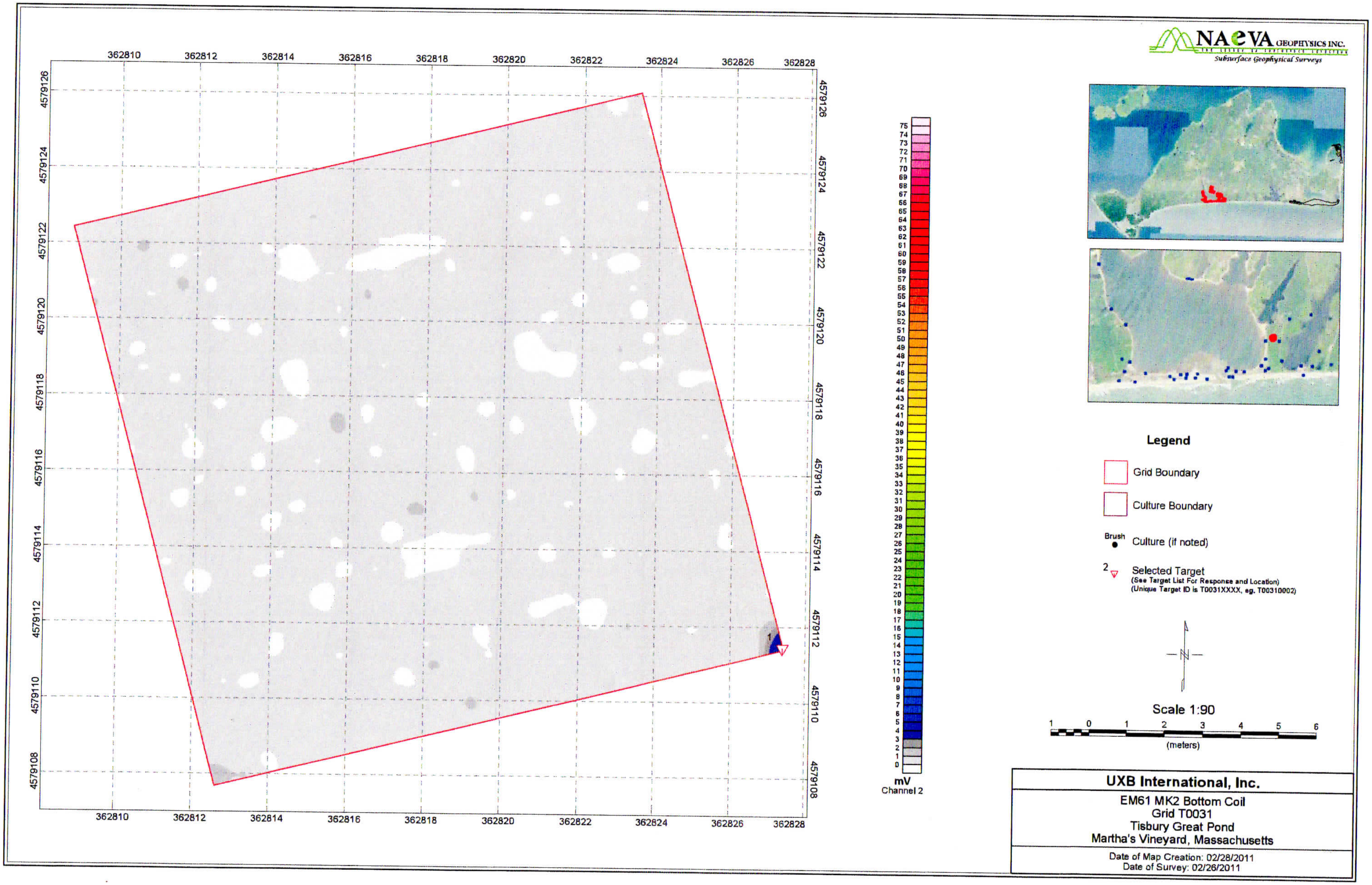
Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 02 11
Date of Intrusive	03 02 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0031	T00310001	☑	362827.4	4579111.45	9.63301729437075				

Anomaly Notes	Description of Item	Disposition of Item
Target moved within grid boundary, peak response approx. 0.24m to SE	wire	Removed from Grid

Tuesday, March 01, 2011



NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
362810
362812
362814
362816
362818
362820
362822
362824
362826
362828
4579108
4579110
4579112
4579114
4579116
4579118
4579120
4579122
4579124
4579126
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0031XXXX, eg. T00310002)
Scale 1:90
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0031
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/28/2011
Date of Survey: 02/26/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	0302 11
Date of Intrusive	0302 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0032	T00320001	☑	362889.8	4579082.4	153.35021707977				
T0032	T00320002	☑	362891.8	4579081.196	26.7649383230443				
T0032	T00320003	☑	362889.28	4579073.588	13.1544372369642			45°	N-0
T0032	T00320004	☑	362894.5	4579082.28	9.9702948590973				
T0032	T00320005	☑	362883.2	4579070.863	4.38746411509499				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00320001	Target moved to center of anomaly	Seed #7	Taken off grid
T00320002	Target moved to center of anomaly	3 metal objects (small)	Taken off grid
T00320003	Secondary peak to SW	mk 23 - MEC	BIP
T00320004	Target moved to center of anomaly; Secondary peaks to SW and NE	3 metal spikes	Removed from Grid
T00320005	Target moved within grid boundary; peak approx. 0.1m to W	metal flakes	Removed from grid

EM-61 Anomaly Dig List

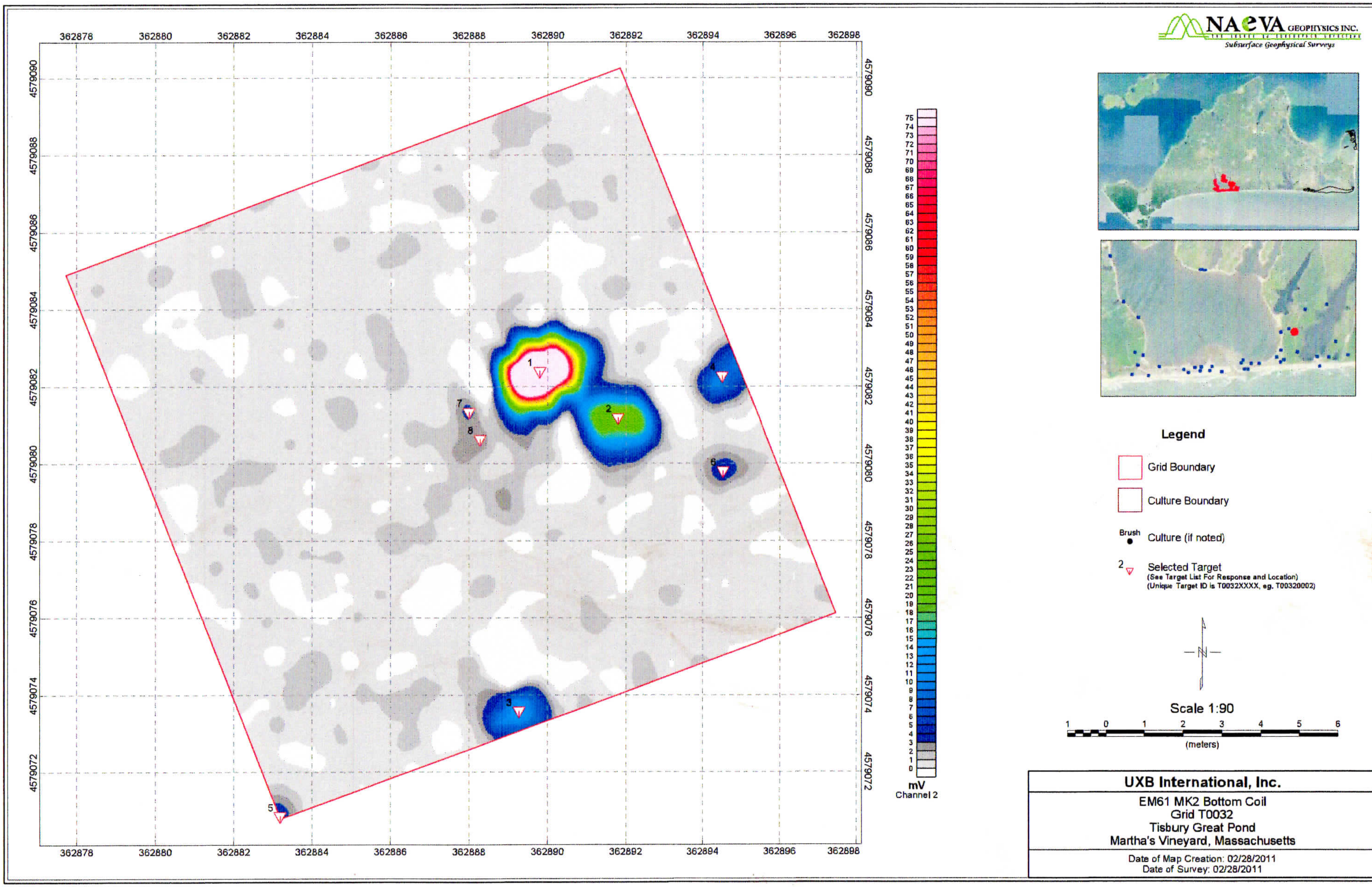
Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0032	T00320006	☑	362894.524	4579079.817	4.27301186466061				
T0032	T00320007	☑	362888.002	4579081.348	3.66970547700951				
T0032	T00320008	☑	362888.286	4579080.646	3.08124354322671				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00320006		Drawer Handle	(RFG) removed From Grid
T00320007	Possibly related to large anomaly to NE	no find	
T00320008	Possibly related to target to NW	small piece of metal	

Tuesday, March 01, 2011



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0032XXXX, eg. T00320002)
Scale 1:90
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0032
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/28/2011
Date of Survey: 02/28/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	030911
Date of Intrusive	030911
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0033	T00330001	✓	362922.3	4578847.05	172.792984008789			0	0
T0033	T00330002	✓	362921.85	4578860.55	98.7181777954102				
T0033	T00330003	✓	362923.3114	4578847.6457	23.5199580220659				
T0033	T00330004	✓	362922.6054	4578855.9356	22.4891690770908				
T0033	T00330005	✓	362923.2	4578860.1	21.4736309044294				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00330001		Seed 17-4	removed
T00330002	Secondary Peak to the West within 0.6m	CD-nails	removed
T00330003		same as -01	
T00330004	Secondary Peak to the West within 0.7m	CD-fence POST	Removed
T00330005		CD-nail	removed

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0033	T00330006	☑	362923.446	4578846.2109	6.11276913259201				

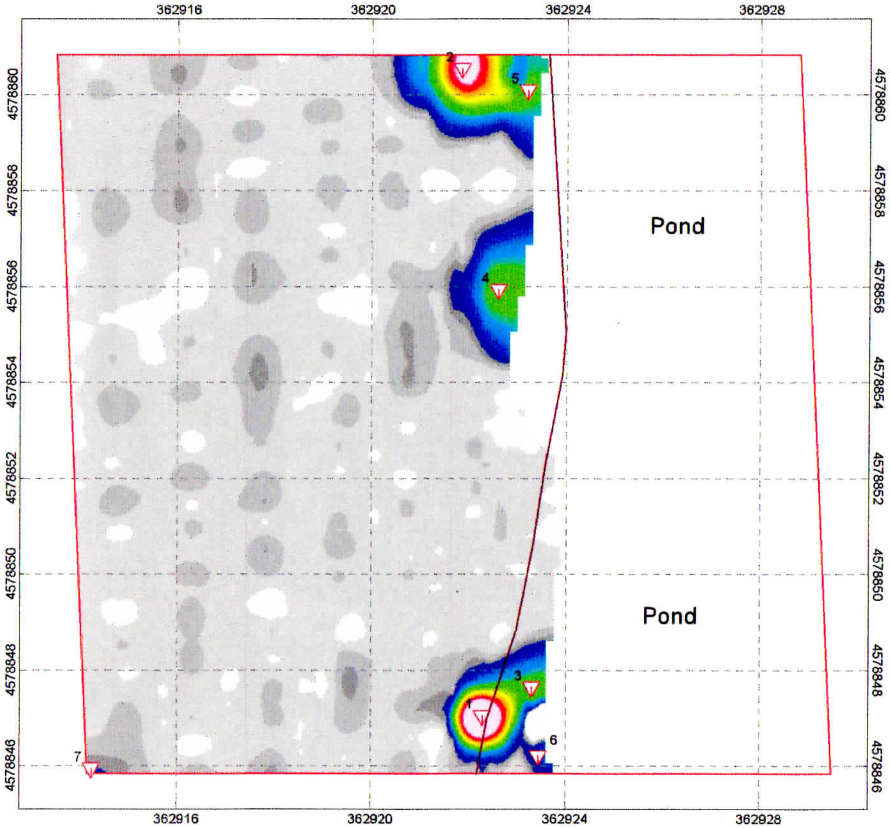
Anomaly Notes	Description of Item	Disposition of Item
	CD - metal object	removed

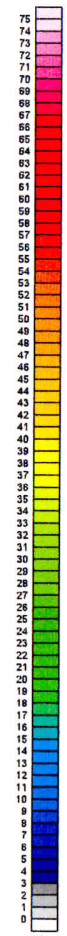
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0033	T00330007	☑	362914.2559	4578845.9487	3.41793616956837				

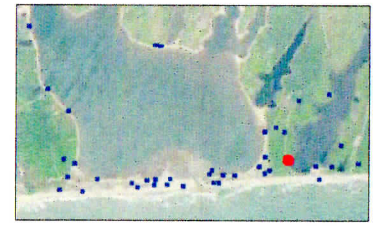
Anomaly Notes	Description of Item	Disposition of Item
Peak outside the grid boundary to SW within 0.7m	CD - metal object	removed

Wednesday, March 09, 2011

NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

- Grid Boundary
- Culture Boundary
- Brush • Culture (if noted)
- 2 ▽ Selected Target (See Target List For Response and Location) (Unique Target ID is T0033XXXX, eg. T00330002)

N

Scale 1:100

1 0 1 2 3 4 5 6
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0033
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/08/2011
Date of Survey: 03/07/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	03 02 11
Date of Intrusive	03 02 11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS **Contract No.** W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0035	T00350001	✔	363142.5	4578784.5	1369.30430582159	0				Culture - stake	Stake	Lip
T0035	T00350002	✔	363147.283	4578789.3	1368.1157198547					Culture - fence	fence and stake	Lip
T0035	T00350003	✔	363149.394	4578791.908	470.399417317136					Culture - fence	Small metal object	Removed from site
T0035	T00350004	✔	363148.518	4578784.836	10.0109850547937						Bottle cap	Removed from site to Disposal area
T0035	T00350005	✔	363143.193	4578790.8	9.0318264201596						Metal ~~Skewer~~ "skewer" / Bobbypin	Taken to Dispo site

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0035	T00350006	☑	363149.068	4578784.274	3.47846759931024				

Anomaly Notes

Possibly related to target to NW

Description of Item

Bobby pin

Disposition of Item

taken To Dispo site

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0035	T00350007	☑	363142.495	4578790.739	3.28290829927928				

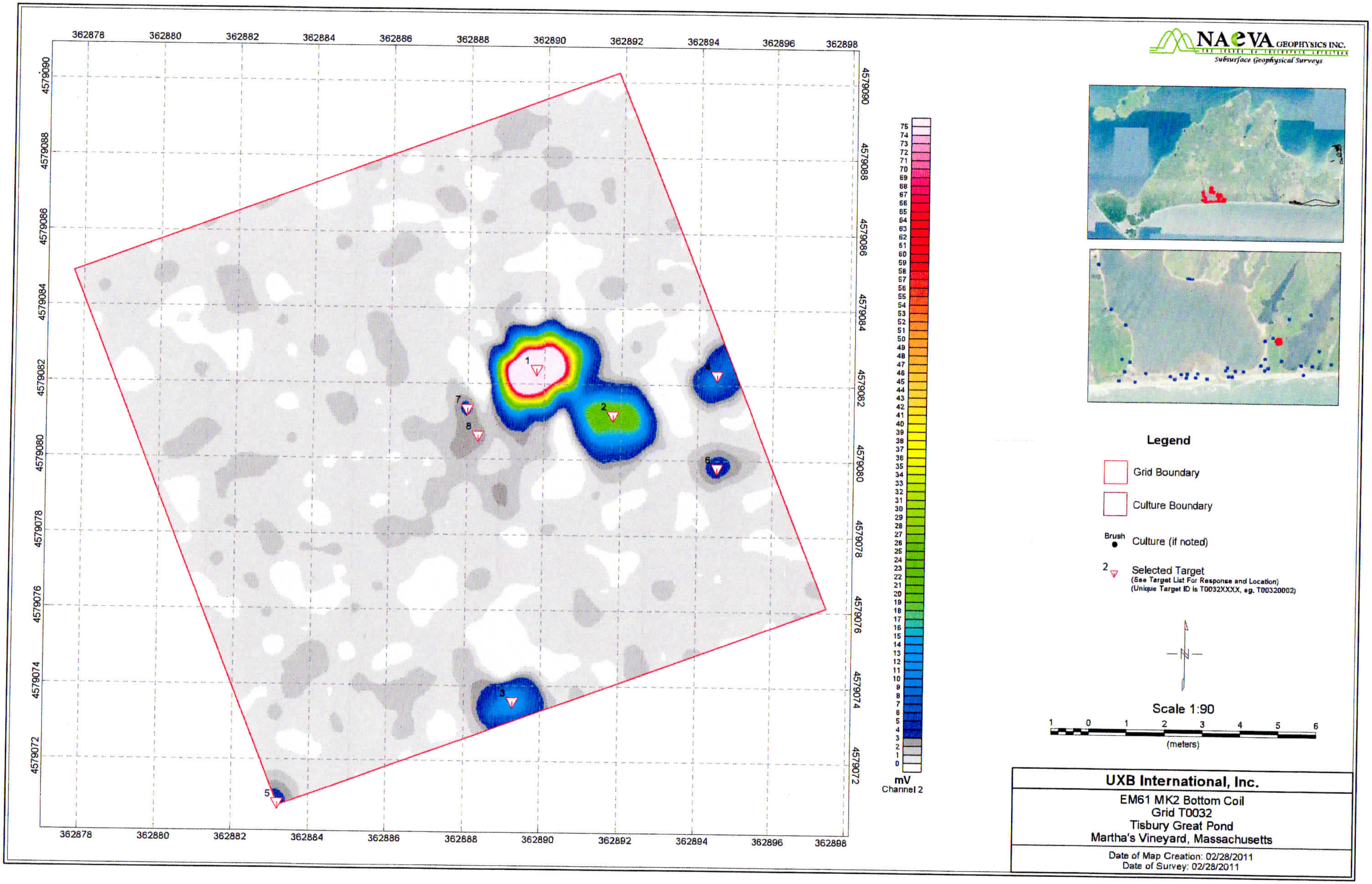
Anomaly Notes

Possibly realted to target to E

Description of Item

2 Bobby pins

Disposition of Item



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
362878
362880
362882
362884
362886
362888
362890
362892
362894
362896
362898
4579072
4579074
4579076
4579078
4579080
4579082
4579084
4579086
4579088
4579090
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0032XXXX, eg. T00320002)
Scale 1:90
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0032
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 02/28/2011
Date of Survey: 02/28/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	030411
Date of Intrusive	030711
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0037	T00370001	☑	363273.3	4578797.85	173.252578735352						CD	Removed
T0037	T00370002	☑	363270.3	4578798.45	142.010421681794			0	0		Seed #3	Removed
T0037	T00370003	☑	363277.65	4578799.5	99.2329025041717						CD	Removed
T0037	T00370004	☑	363270.0103	4578796.2341	95.0453621213214					Secondary Peak to the SE within 0.7m	CD	Removed
T0037	T00370005	☑	363276.3	4578798.6	77.3119354248047						CD	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0037	T00370006	☑	363267.15	4578804	64.2349319007539				
T0037	T00370007	☑	363268.1276	4578803.3479	59.9891678301598				
T0037	T00370008	☑	363268.05	4578791.85	28.9559555053711				
T0037	T00370009	☑	363267.45	4578792.75	21.1527614444071				
T0037	T00370010	☐	363263.9886	4578791.3622	9.42153569513443				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00370006	Secondary Peak to the SE within 0.5m	CD	Removed
T00370007		Same as -06 CD	Removed
T00370008		CD	Removed
T00370009		~~[illegible]~~ No Find	~~Removed~~ NC
T00370010		—	

EM-61 Anomaly Dig List

Date of Reacquisiton | |
Date of Intrusive | |

Project ID | Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

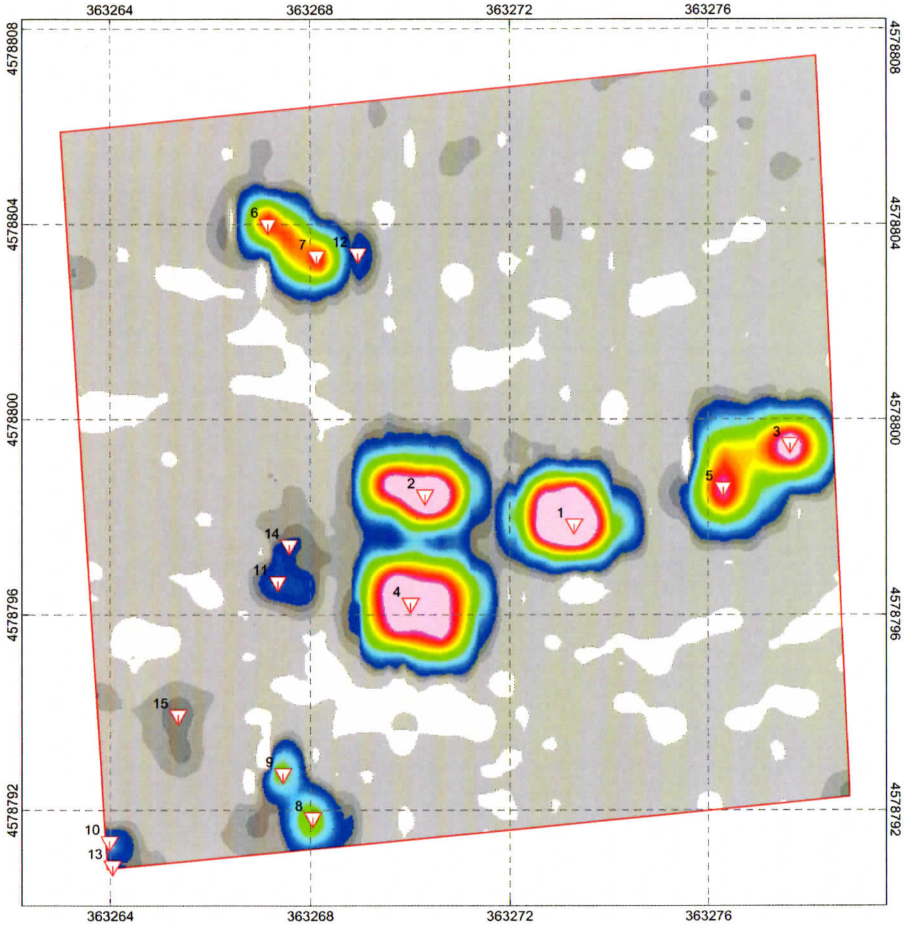
Coord Sys. | NAD 83 UTM Zone 19N

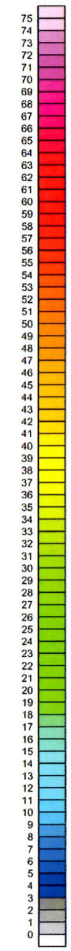
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0037	T00370011	☐	363267.3516	4578796.6796	6.67839861834093				
T0037	T00370012	☐	363268.95	4578803.4	6.44036722103683				
T0037	T00370013	☐	363264.0461	4578790.8592	3.77191865174674				
T0037	T00370014	☐	363267.5815	4578797.4269	3.66657449091805				
T0037	T00370015	☐	363265.35	4578793.95	3.17829265584382				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00370011			
T00370012	Possibly Related to Noise		
T00370013	Peak outside the grid boundary to South within 0.2m		
T00370014			
T00370015			

Thursday, March 03, 2011

NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys





mV
Channel 2

Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0037XXXX, eg. T00370002)

N

Scale 1:100

1 0 1 2 3 4 5 6

(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0037
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/02/2011
Date of Survey: 03/01/2011

EM-61 Anomaly Dig List

Date of Reacquisiton: 030411
Date of Intrusive: 030711

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0039	T00390001	☑	363346.2	4578972.75	1868.73657074574					Target Associated with the Culture	CD=metal Debris	Removed
T0039	T00390002	☑	363348.6	4578971.25	431.036285145921						CD	Removed
T0039	T00390003	☑	363343.8322	4578969.5125	268.882211992142						CD	Removed
T0039	T00390004	☑	363347.25	4578971.1	237.188919067383						CD	Removed
T0039	T00390005	☑	363342	4578973.05	147.647949159828						CD	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390006	✔	363341.7331	4578967.6305	102.870885656876				
T0039	T00390007	✔	363345.8378	4578969.21	78.5471269141476				
T0039	T00390008	✔	363340.8	4578971.25	64.9562835628098				
T0039	T00390009	✔	363345.6	4578969.9	60.606616973877				
T0039	T00390010	✔	363349.8	4578971.25	52.8921775797297				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00390006		CD-	Removed
T00390007		CD-	Removed
T00390008		CD	Removed
T00390009		CD	Removed
T00390010		CD	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0039	T00390011	✔	363343.6818	4578967.5848	25.9834004921065						CD	Removed
T0039	T00390012	✔	363344.55	4578967.35	25.1826801300049						CD	Removed
T0039	T00390013	✔	363341.1	4578966.3	24.8936576636206						CD	Removed
T0039	T00390014	✔	363345.9268	4578974.4881	19.2671359567498					Secondary Peak to the East within 0.5m	CD	Removed
T0039	T00390015	✔	363338.25	4578968.7	18.219051361084						CD	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	
Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0039	T00390016	✔	363341.85	4578965.7	17.8658180236816						CD	Removed
T0039	T00390017	✔	363352.65	4578973.65	16.8033905019468						CD	Removed
T0039	T00390018	✔	363342.9	4578964.65	16.4131717674977						CD	Removed
T0039	T00390019	✔	363352.2	4578967.5	11.9317140531461						CD	Removed
T0039	T00390020	✔	363350.55	4578968.7	11.8594360351563						CD	Removed

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019		
Date of Reacquisiton		Date of Intrusive	
Coord Sys.	NAD 83 UTM Zone 19N		

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390021	☑	363351.45	4578967.5	11.8011465015636				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390022	☐	363342.0916	4578968.9879	9.71388550317765				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390023	☐	363339.45	4578965.85	8.35677242226867				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390024	☐	363340.3518	4578965.5831	8.30418599047684				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390025	☐	363346.75	4578967.8655	7.86997143840214				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys. NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0039	T00390026	☐	363343.289	4578966.2004	7.41606844347988						CD	Removed
T0039	T00390027	☐	363350.9593	4578971.0458	7.16479739896523						CD	Removed
T0039	T00390028	☐	363341.1375	4578972.9728	7.13785163799015						CD	Removed
T0039	T00390029	☐	363349.5	4578969.15	6.86839437484741						CD	Removed
T0039	T00390030	☐	363340.05	4578967.8	6.71007298773032						CD	Removed

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390031	☐	363339.15	4578967.95	5.76298427572867				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390032	☐	363344.918	4578974.7482	4.79605106152642				

Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390033	☐	363353.4	4578969.15	3.89661121355482				

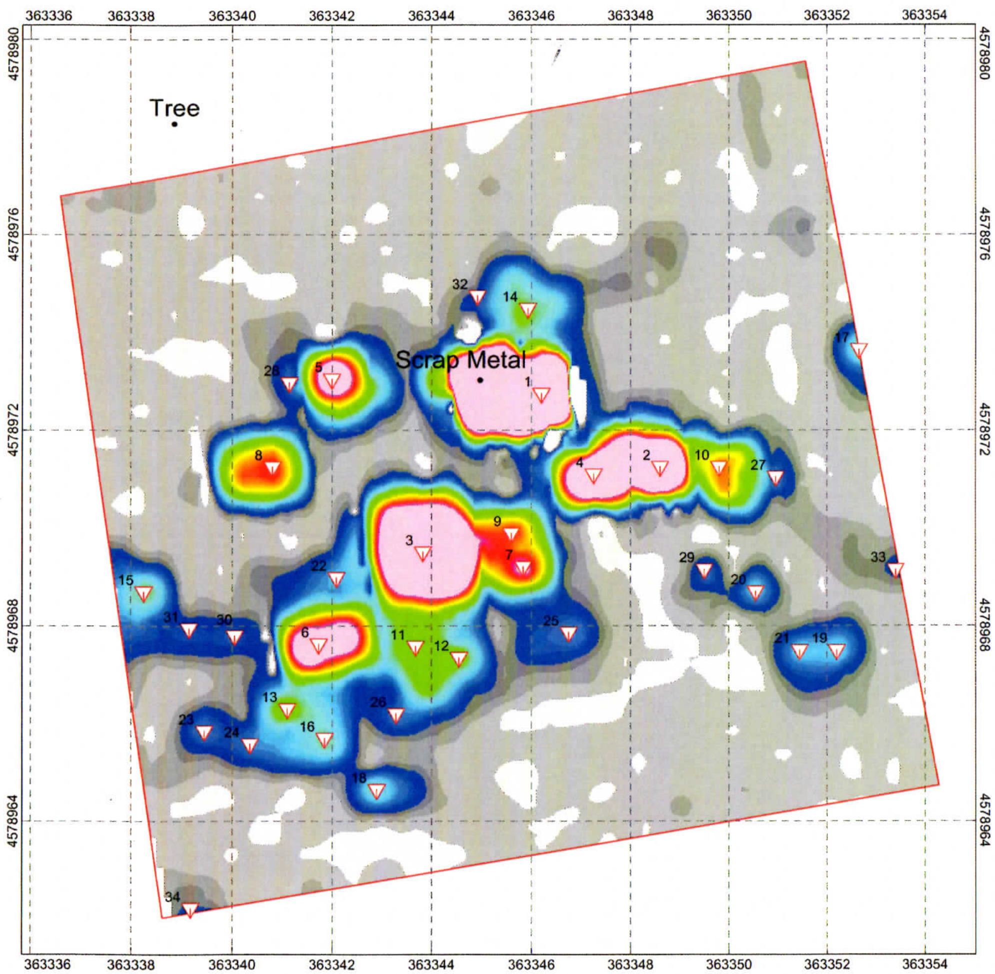
Anomaly Notes	Description of Item	Disposition of Item
	CD	Removed

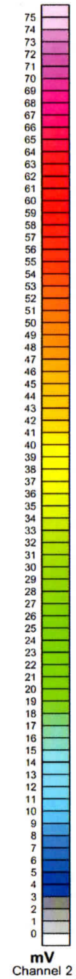
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0039	T00390034	☐	363339.1732	4578962.2156	3.3482031545293				

Anomaly Notes	Description of Item	Disposition of Item
Peak outside the boundary to SE within 0.2m	CD	Removed

Thursday, March 03, 2011

NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys





Legend

Grid Boundary

Culture Boundary

Brush • Culture (if noted)

2 ▽ Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0039XXXX, eg. T00390002)

Scale 1:100

1 0 1 2 3 4 5 6

(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0039
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/02/2011
Date of Survey: 03/01/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	03 09 11
Date of Intrusive	03 09 11

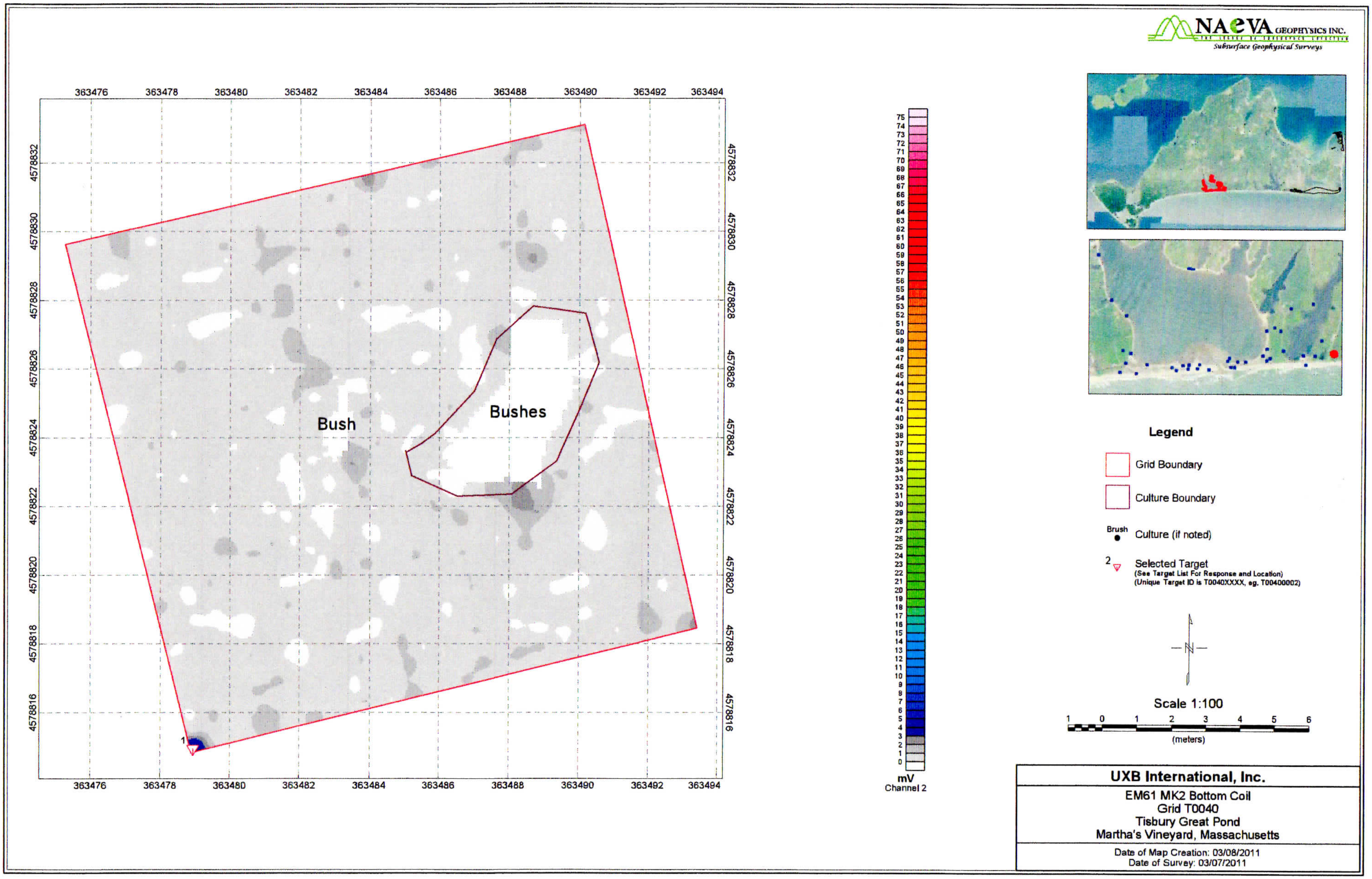
Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0040	T00400001	☑	363478.95	4578814.95	4.9715747833252				

Anomaly Notes	Description of Item	Disposition of Item
	CD - metal flake	Removed

Wednesday, March 09, 2011



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
363476
363478
363480
363482
363484
363486
363488
363490
363492
363494
4578832
4578830
4578828
4578826
4578824
4578822
4578820
4578818
4578816
Bush
Bushes
1
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
2
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0040XXXX, eg. T00400002)
N
Scale 1:100
1 0 1 2 3 4 5 6
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0040
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/08/2011
Date of Survey: 03/07/2011

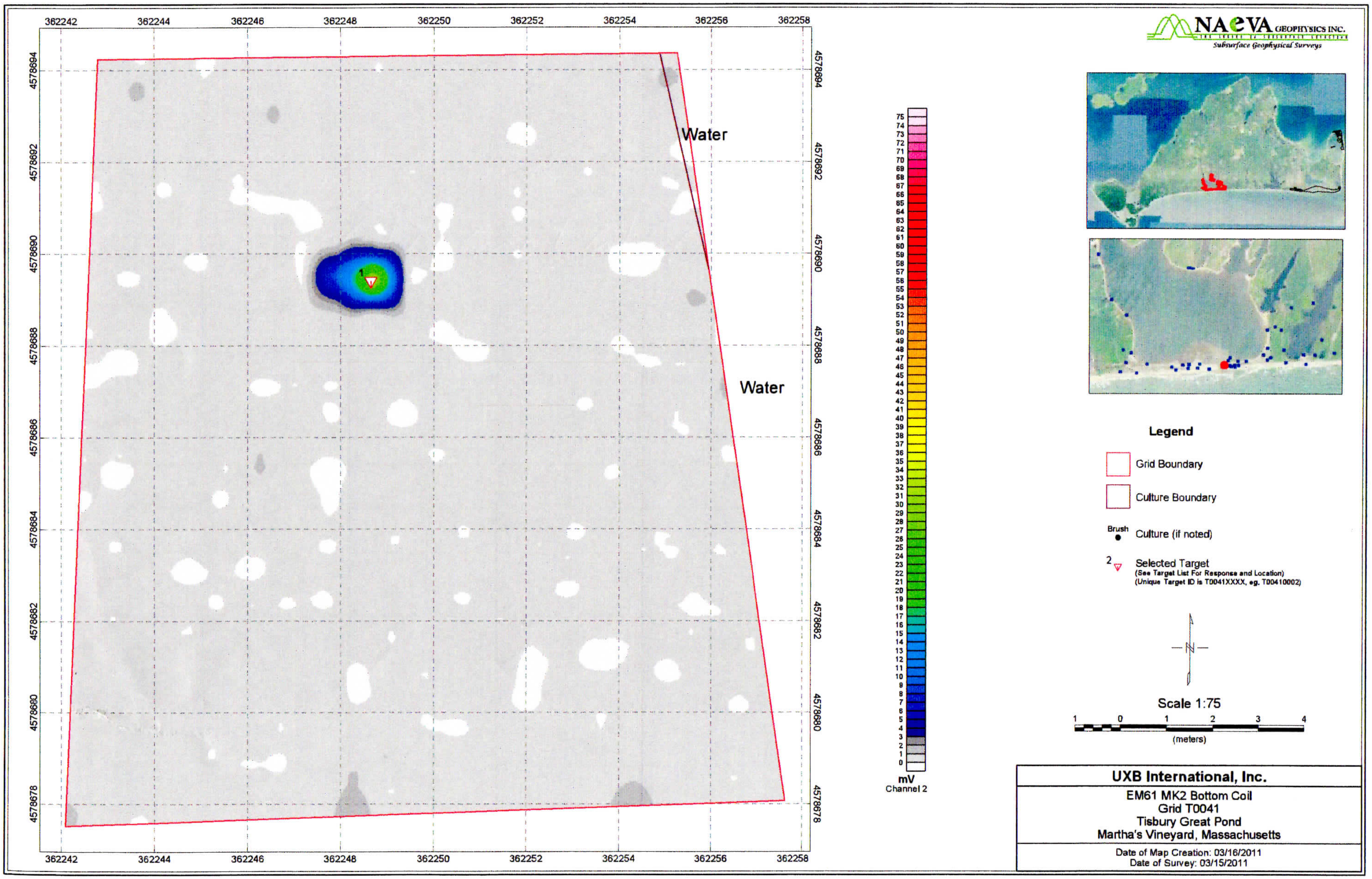
EM-61 Anomaly Dig List

Date of Reacquisiton	03/18/11
Date of Intrusive	03/18/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS **Contract No. W912DY-04-D-0019**

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0041	T00410001	✔	362248.65	4578689.4	31.6292533858602				

Anomaly Notes	Description of Item	Disposition of Item
	CD- metal Object	removed


362242
362244
362246
362248
362250
362252
362254
362256
362258
4578694
4578692
4578690
4578688
4578686
4578684
4578682
4578680
4578678
Water
Water
mV
Channel 2
NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0041XXXX, eg. T00410002)
N
Scale 1:75
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0041
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/16/2011
Date of Survey: 03/15/2011

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

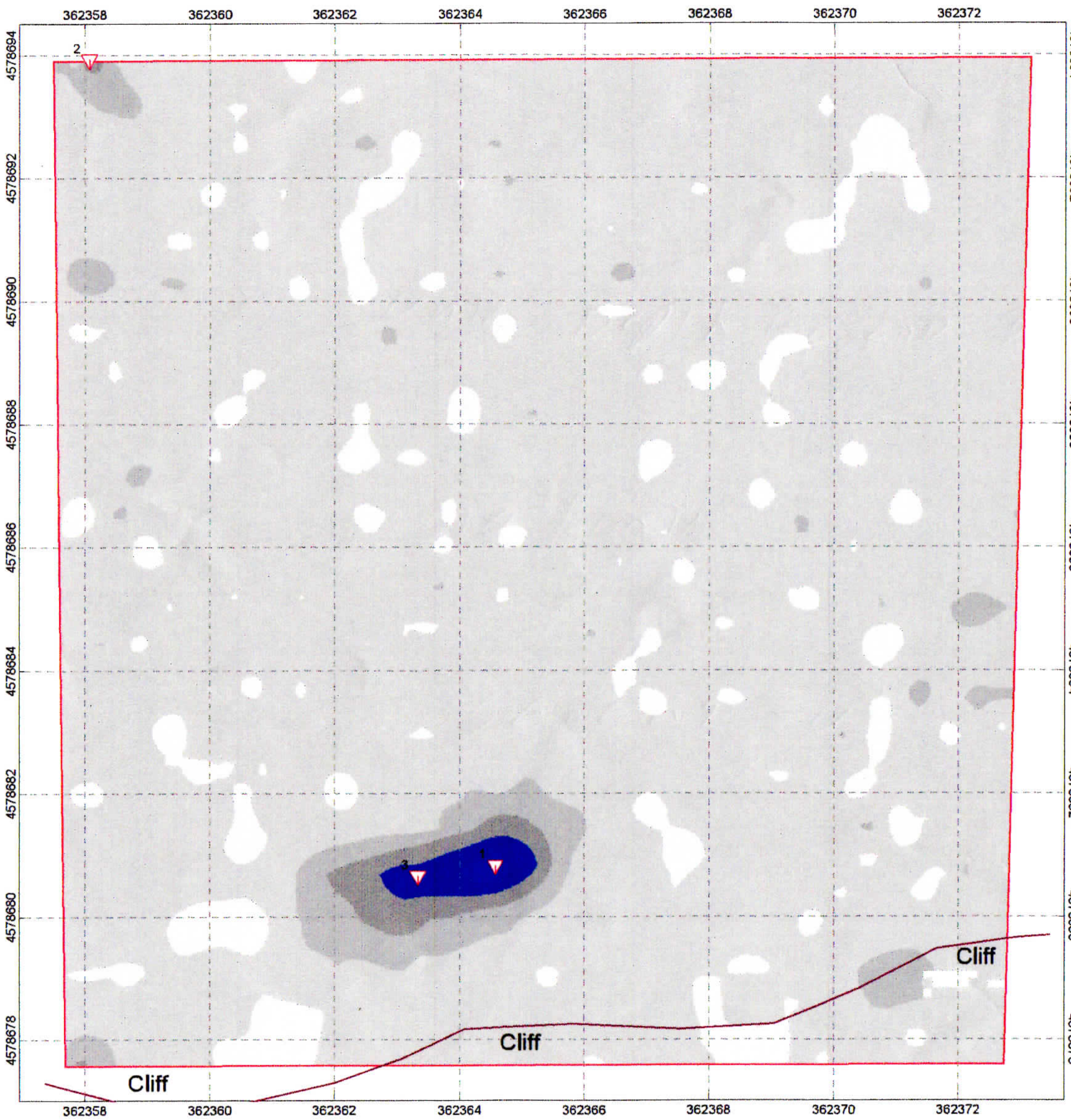
Date of Reacquisiton	0318 11
Date of Intrusive	0318 11
Coord Sys.	NAD 83 UTM Zone 19N

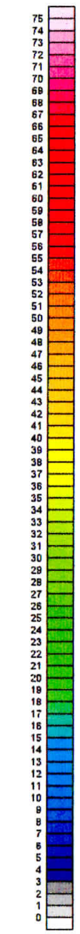
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0043	T00430001	☑	362364.579	4578680.829	4.84328473176587				
T0043	T00430002	☑	362358.076	4578693.936	3.574447028549				
T0043	T00430003	☑	362363.339	4578680.661	3.48315282266182				

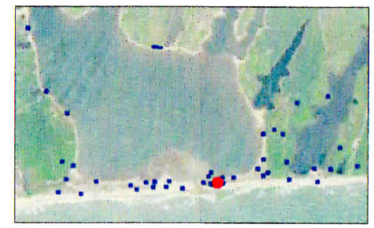
Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00430001		Unk Depth Beyond 3ft	LIP
T00430002		no find	—
T00430003	Possibly related to target to East	Same as -01	—

Thursday, March 17, 2011

NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

Grid Boundary

Culture Boundary

Brush Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0043XXXX, eg. T00430002)

N

Scale 1:75

1 0 1 2 3 4
(meters)

UXB International, Inc.
EM61 MK2 Bottom Coil Grid T0043 Tisbury Great Pond Martha's Vineyard, Massachusetts
Date of Map Creation: 03/16/2011 Date of Survey: 03/15/2011

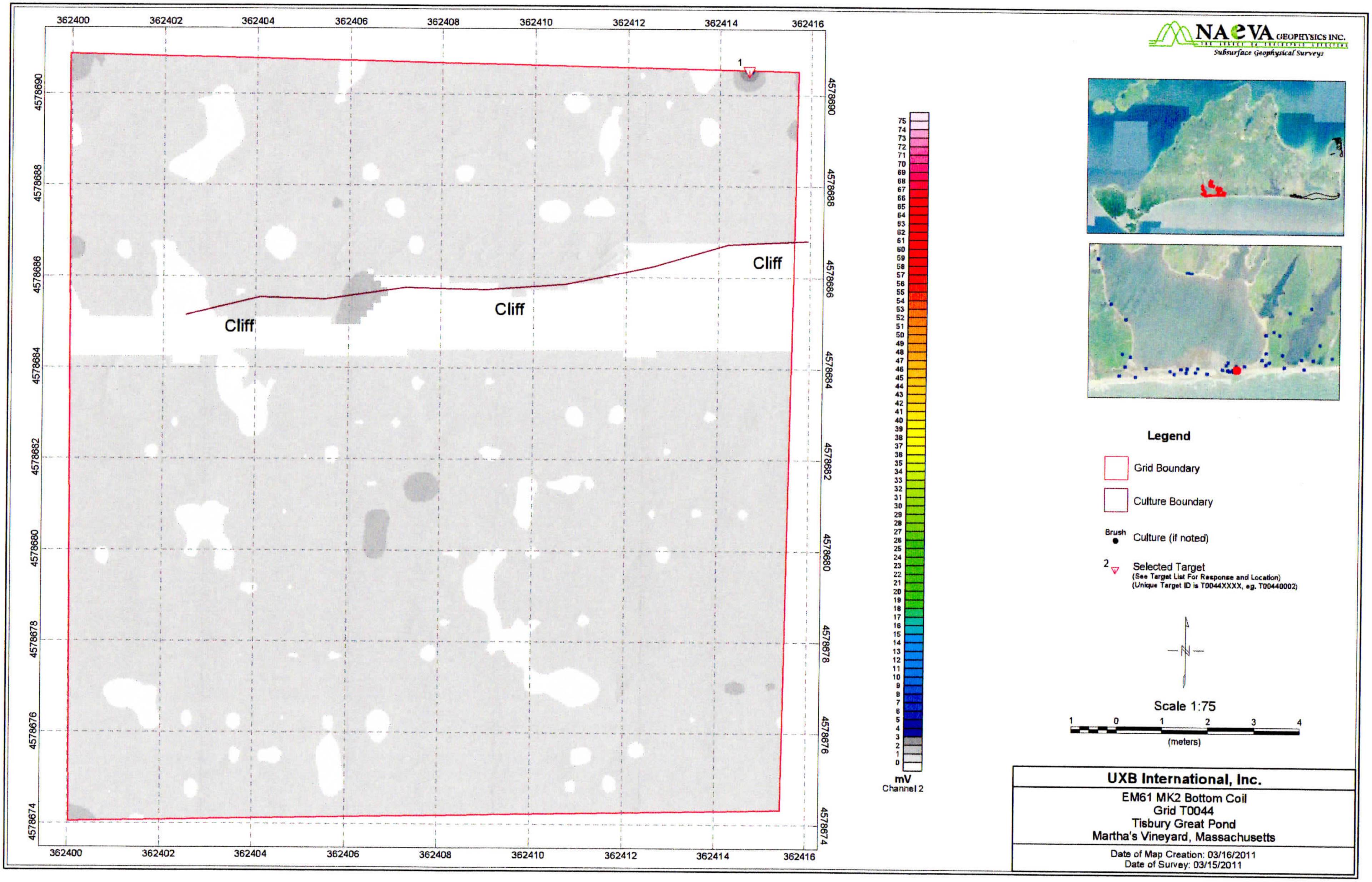
EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03/15/11
Date of Intrusive	03/15/11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0044	T00440001	☑	362414.6259	4578690.5475	4.10323195299494				

Anomaly Notes	Description of Item	Disposition of Item
	CD- screws	removed



UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0044
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/16/2011
Date of Survey: 03/15/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID: Martha's Vineyard RI/FS — Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450001	☑	363082.401	4579206.759	140.71152612149				
T0045	T00450002	☑	363075.8192	4579201.639	13.2096343288988				
T0045	T00450003	☑	363091.208	4579212.705	9.09161581173113				
T0045	T00450004	☑	363077.3163	4579202.416	7.59138147456815				
T0045	T00450005	☑	363081.15	4579214.086	6.93504781651657				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00450001	Footprint extends roughly 1.75 x 2m	CD metal object	removed
T00450002		CD-metal flakes	removed
T00450003		no find	—
T00450004		no find	—
T00450005		no find	—

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0045	T00450006	☑	363078.0365	4579201.9232	6.3769786418275						no find	—
T0045	T00450007	☑	363077.2974	4579203.1551	5.82877940158451							—
T0045	T00450008	☑	363087.1228	4579217.1941	5.42054786907633							—
T0045	T00450009	☑	363091.438	4579211.911	5.35315495272581							—
T0045	T00450010	☑	363079.035	4579217.825	5.30340052513477						no find	—

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450011	☑	363081.258	4579218.085	5.15504781651657				
T0045	T00450012	☑	363075.8003	4579204.9554	5.07963432889876				
T0045	T00450013	☑	363077.97	4579206.966	5.04560149406185				
T0045	T00450014	☑	363088.035	4579216.72	5.00018669113556				
T0045	T00450015	☑	363075.8003	4579203.8373	4.67963432889876				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00450011		no find	—
T00450012			—
T00450013			—
T00450014			—
T00450015		no find	—

EM-61 Anomaly Dig List

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0045	T00450016	✓	363077.105	4579207.142	4.62972190520578						no find	—
T0045	T00450017	✓	363078.759	4579203.497	4.62245440157821							—
T0045	T00450018	✓	363077.914	4579209.633	4.6051343045334							—
T0045	T00450019	✓	363079.085	4579214.96	4.52115424378176							—
T0045	T00450020	✓	363077.431	4579210.266	4.44473191378077						no find	—

EM-61 Anomaly Dig List

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450021	☑	363080.093	4579204.815	4.37542269754503				

Anomaly Notes	Description of Item	Disposition of Item
	no find	—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450022	☑	363076.614	4579210.831	4.25258853841867				

Anomaly Notes	Description of Item	Disposition of Item
		—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450023	☑	363079.06	4579217	4.22359028205094				

Anomaly Notes	Description of Item	Disposition of Item
		—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450024	☑	363082.418	4579202.445	4.144886528564				

Anomaly Notes	Description of Item	Disposition of Item
		—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450025	☑	363077.986	4579208.14	4.13755743965003				

Anomaly Notes	Description of Item	Disposition of Item
	no find	—

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 21 11

Date of Intrusive: 03 21 11

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450026	☑	363076.67	4579206.296	4.10939063802447				
T0045	T00450027	☑	363077.647	4579207.68	4.10917794247187				
T0045	T00450028	☐	363075.883	4579217.692	3.95963432889876				
T0045	T00450029	☐	363085.625	4579217.71	3.93308343332685				
T0045	T00450030	☐	363080.135	4579203.949	3.93020432945471				

T00450026

Anomaly Notes	Description of Item	Disposition of Item
	no find	—

T00450027

Anomaly Notes	Description of Item	Disposition of Item
		—

T00450028

Anomaly Notes	Description of Item	Disposition of Item
		—

T00450029

Anomaly Notes	Description of Item	Disposition of Item
		—

T00450030

Anomaly Notes	Description of Item	Disposition of Item
	no find	—

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 21 11
Date of Intrusive: 03 21 11

Project ID: Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0045	T00450031	☐	363078.563	4579210.226	3.8582540316772						no find	—
T0045	T00450032	☐	363078.63	4579209.449	3.82533355246859							—
T0045	T00450033	☐	363079.099	4579215.755	3.78051755328466							—
T0045	T00450034	☐	363079.287	4579202.399	3.73188704748561							—
T0045	T00450035	☐	363078.601	4579210.971	3.69396149470587						no find	✓

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 21 11
Date of Intrusive: 03 21 11

Project ID: Martha's Vineyard RI/FS   Contract No. W912DY-04-D-0019

Coord Sys.: NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0045	T00450036	☐	363077.37	4579211.881	3.64783061072678						no find	—
T0045	T00450037	☐	363081.129	4579206.367	3.63866003090518							—
T0045	T00450038	☐	363078.709	4579204.952	3.62778689157702							—
T0045	T00450039	☐	363085.326	4579211.135	3.56700814106336							—
T0045	T00450040	☐	363091.678	4579217.704	3.55218038207078						no find	—

EM-61 Anomaly Dig List

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450041	☐	363084.105	4579204.458	3.4585489307486				

Anomaly Notes

Description of Item no find

Disposition of Item —

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450042	☐	363080.136	4579203.283	3.4558563306335				

Anomaly Notes

Description of Item

Disposition of Item —

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450043	☐	363080.967	4579210.473	3.35866003090518				

Anomaly Notes

Description of Item

Disposition of Item —

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450044	☐	363091.595	4579216.964	3.31991502600654				

Anomaly Notes

Description of Item

Disposition of Item —

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0045	T00450045	☐	363081.105	4579213.038	3.29504781651657				

Anomaly Notes

Description of Item no find

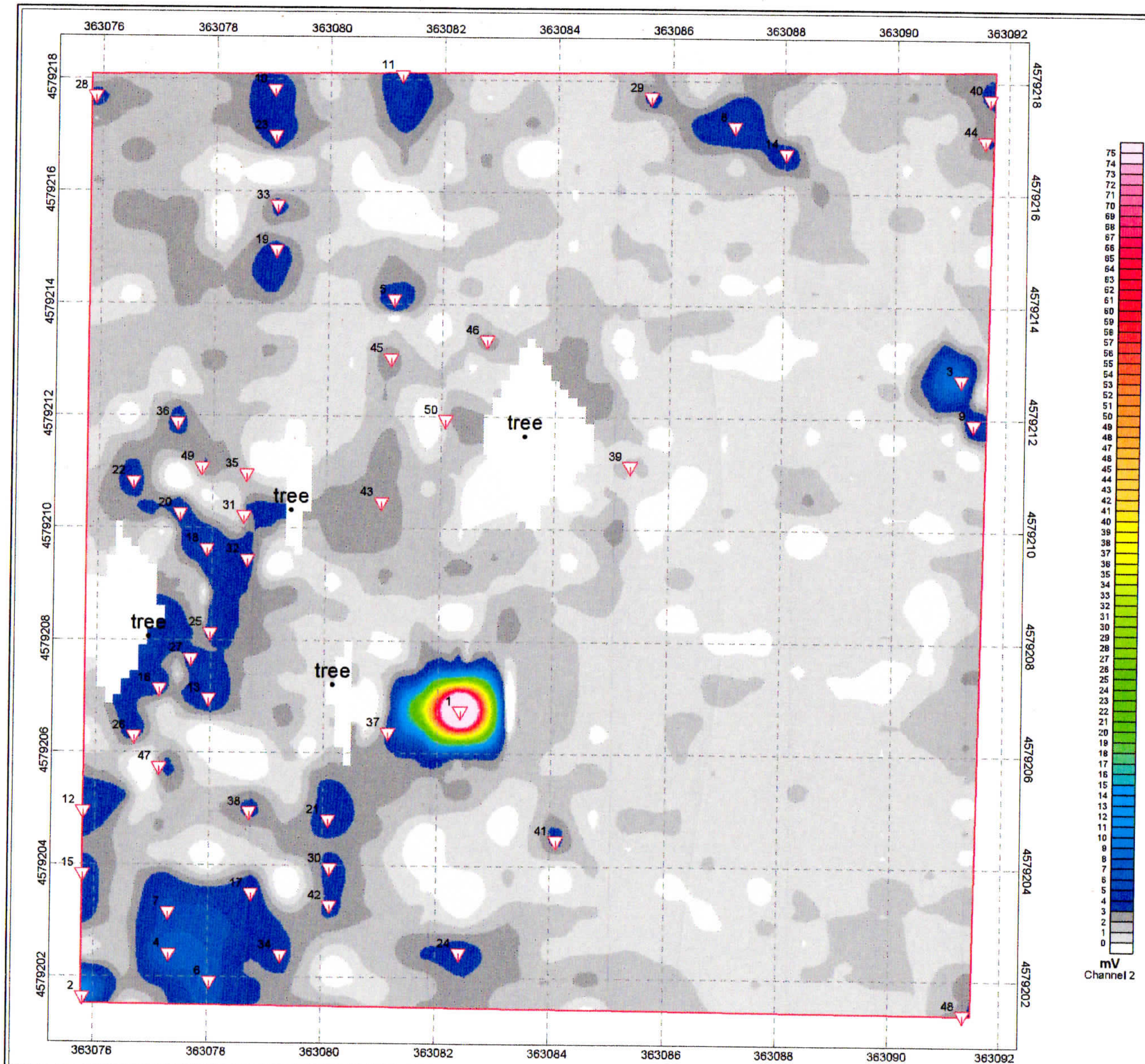
Disposition of Item —

EM-61 Anomaly Dig List

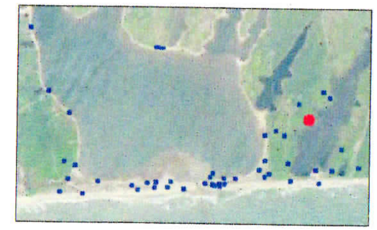
Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11
Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0045	T00450046	☐	363082.799	4579213.369	3.27059471066374						no find	—
T0045	T00450047	☐	363077.118	4579205.743	3.20184856416489							—
T0045	T00450048	☐	363091.3628	4579201.4005	3.15181897641078					Target is roughyl .4m South		—
T0045	T00450049	☐	363077.81	4579211.09	3.14418604204998							—
T0045	T00450050	☐	363082.081	4579211.944	3.0075900053728						no find	—



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys



Legend

Grid Boundary

Culture Boundary

Brush • Culture (if noted)

2 ▽ Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0045XXXX, eg. T00450002)

N

Scale 1:75

1 0 1 2 3 4
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0045
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/17/2011
Date of Survey: 03/16/2011

EM-61 Anomaly Dig List

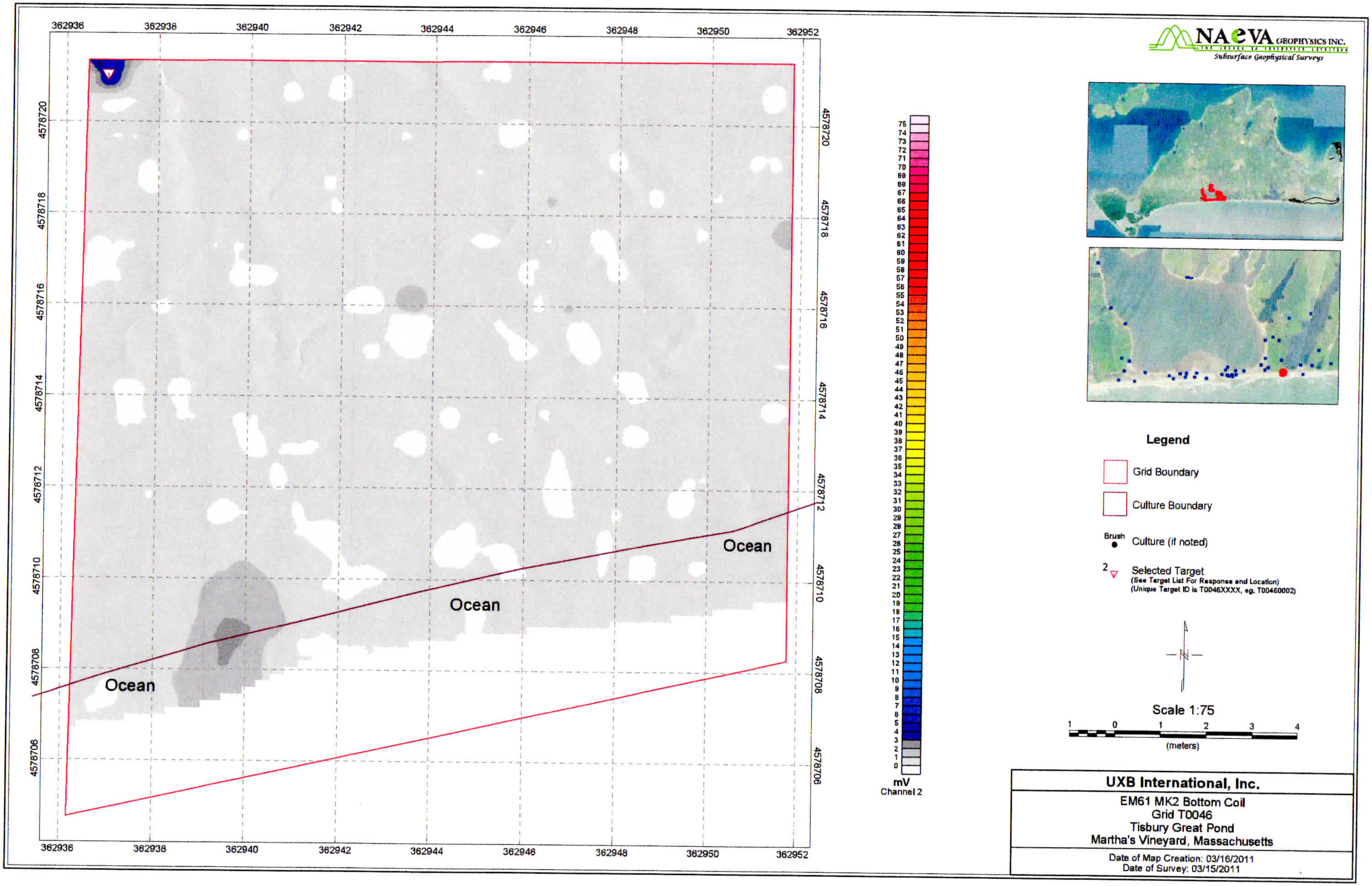
Date of Reacquisiton	03/18/11
Date of Intrusive	03/18/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0046	T00460001	✔	362936.891	4578721.048	8.68580043167754				

Anomaly Notes	Description of Item	Disposition of Item
	no find	—

Thursday, March 17, 2011



362936
362938
362940
362942
362944
362946
362948
362950
362952
4578720
4578718
4578716
4578714
4578712
4578710
4578708
4578706
Ocean
Ocean
Ocean
mV
Channel 2
NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0046XXXX, eg. T00460002)
N
Scale 1:75
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0046
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/16/2011
Date of Survey: 03/15/2011

EM-61 Anomaly Dig List

Date of Reacquisiton: 03 21 11
Date of Intrusive: 03 21 11

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019

Coord Sys.	NAD 83 UTM Zone 19N

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)	Anomaly Notes	Description of Item	Disposition of Item
T0047	T00470001	✓	363196.2	4579426.35	19.7369365692139						no finD	—
T0047	T00470002	✓	363194.7	4579425	6.83085345846414						no finD	—
T0047	T00470003	✓	363206.8786	4579423.2802	3.96101958472718						no finD	—
T0047	T00470004	✓	363200.9371	4579423.3863	3.59939128256513						no finD	—
T0047	T00470005	✓	363201.6788	4579424.9609	3.52365113801072						no finD	—

EM-61 Anomaly Dig List

Date of Reacquisiton	03 21 11
Date of Intrusive	03 21 11

Project ID	Martha's Vineyard RI/FS	Contract No. W912DY-04-D-0019
Coord Sys.	NAD 83 UTM Zone 19N	

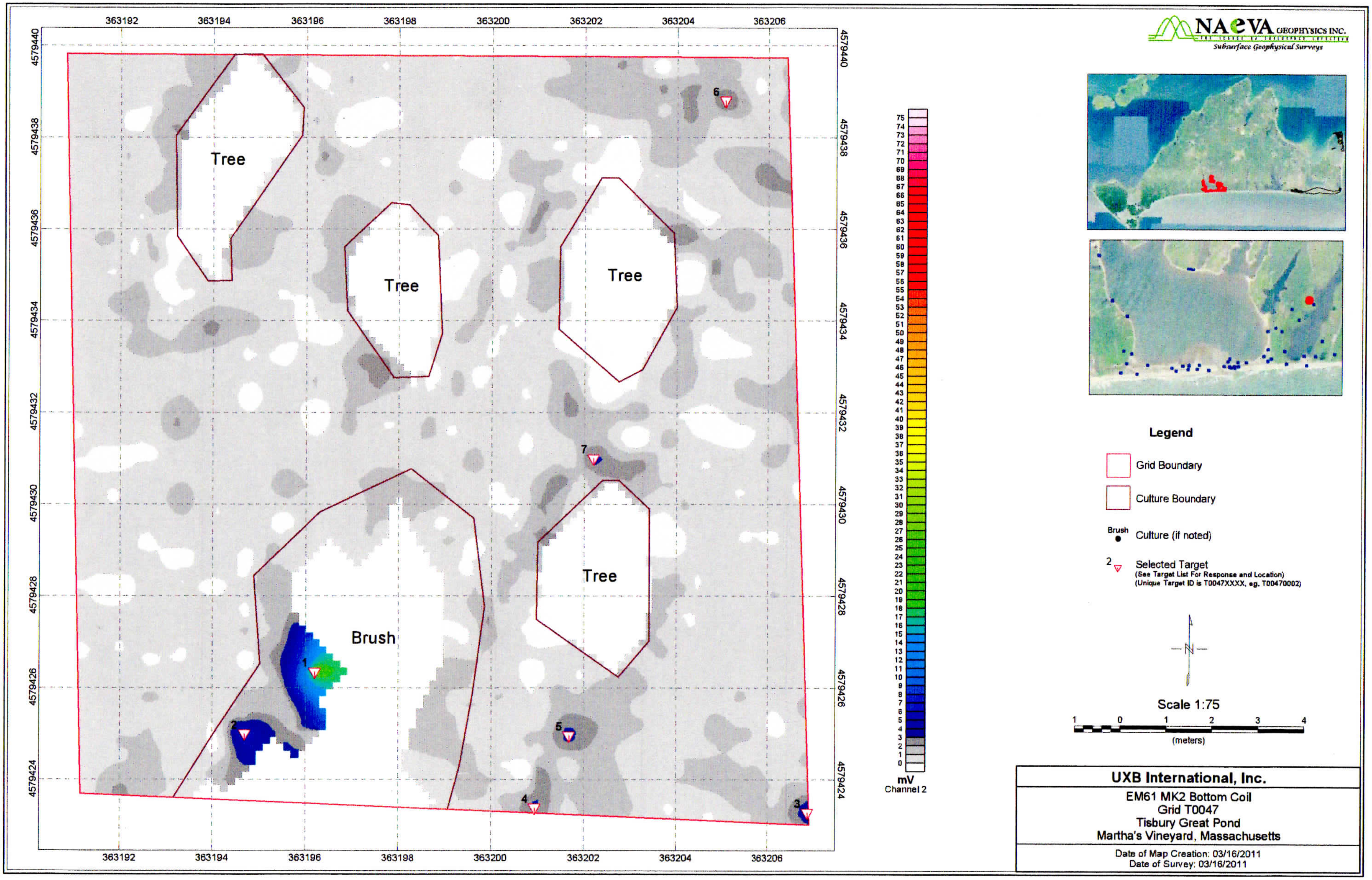
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0047	T00470006	☑	363205.05	4579438.8	3.41063355916263				

Anomaly Notes	Description of Item	Disposition of Item
	no finD	—

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0047	T00470007	☑	363202.2	4579431	3.3744931202858				

Anomaly Notes	Description of Item	Disposition of Item
	no finD	—

Thursday, March 17, 2011



363192
363194
363196
363198
363200
363202
363204
363206
4579440
4579438
4579436
4579434
4579432
4579430
4579428
4579426
4579424
Tree
Tree
Tree
Tree
Brush
1
2
3
4
5
6
7
mV
Channel 2
NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0047XXXX, eg. T00470002)
N
Scale 1:75
1 0 1 2 3 4
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0047
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/16/2011
Date of Survey: 03/16/2011

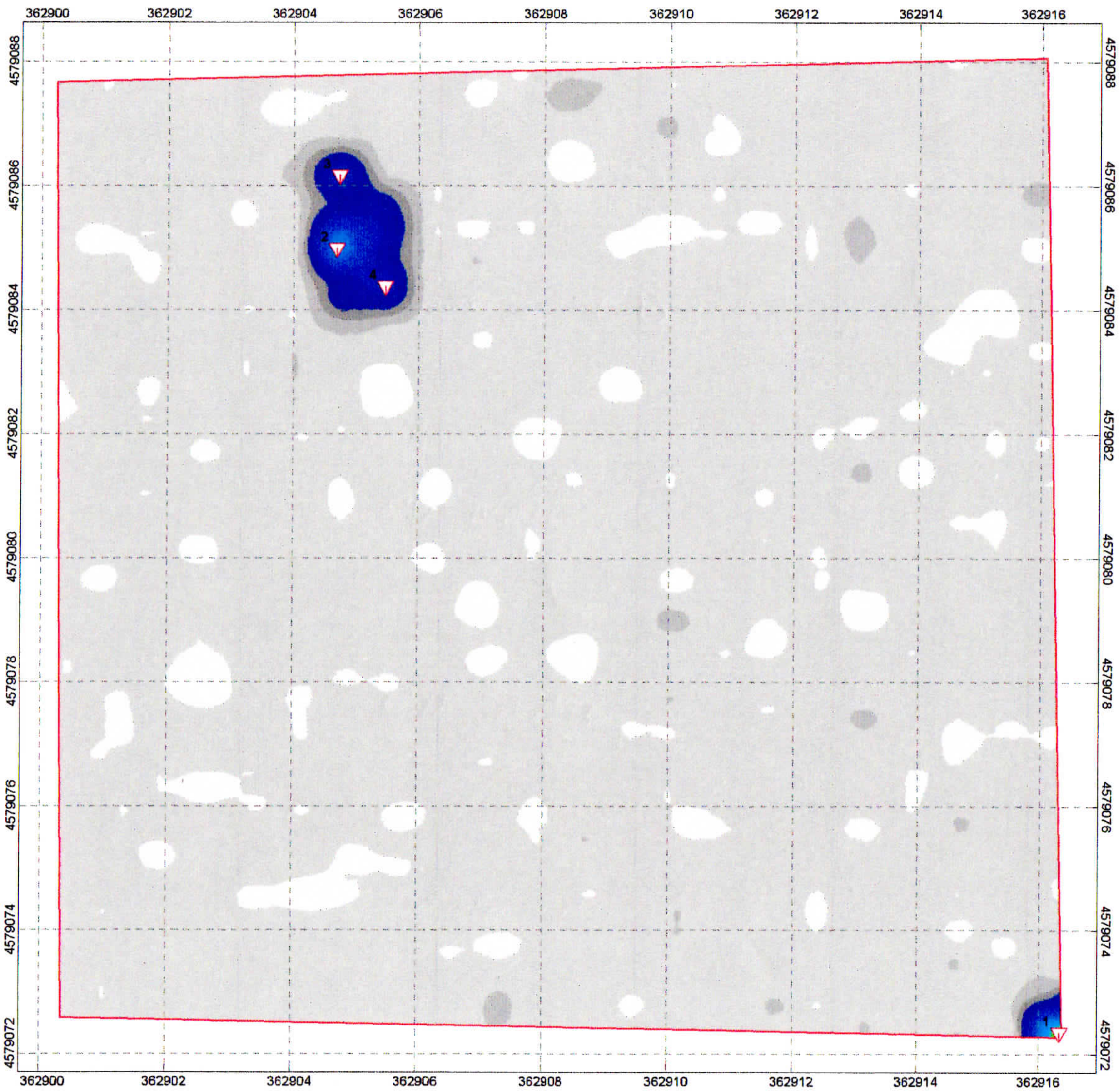
EM-61 Anomaly Dig List

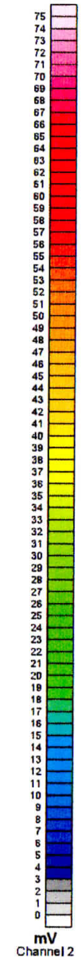
Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID	Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

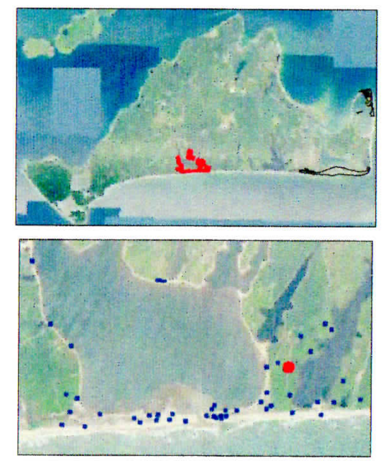
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0048	T00480001	✔	362916.334	4579072.352	30.7964654890829				
T0048	T00480002	✔	362904.693	4579084.992	11.069800030326				
T0048	T00480003	✔	362904.739	4579086.17	6.76795692711614				
T0048	T00480004	✔	362905.468	4579084.379	6.18726991126611				

Target_ID	Anomaly Notes	Description of Item	Disposition of Item
T00480001		Require – CD - Scrap Steel 5' N 12"	Removed
T00480002		CD - Nail	Removed
T00480003		CD - NAIL	Removed
T00480004	Possibly related to target to NW	Same as #2	NA





NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys



Legend

Grid Boundary

Culture Boundary

Brush Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0048XXXX, eg. T00480002)

Scale 1:75

1 0 1 2 3 4
(meters)

UXB International, Inc.
EM61 MK2 Bottom Coil Grid T0048 Tisbury Great Pond Martha's Vineyard, Massachusetts
Date of Map Creation: 03/31/2011 Date of Survey: 03/30/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

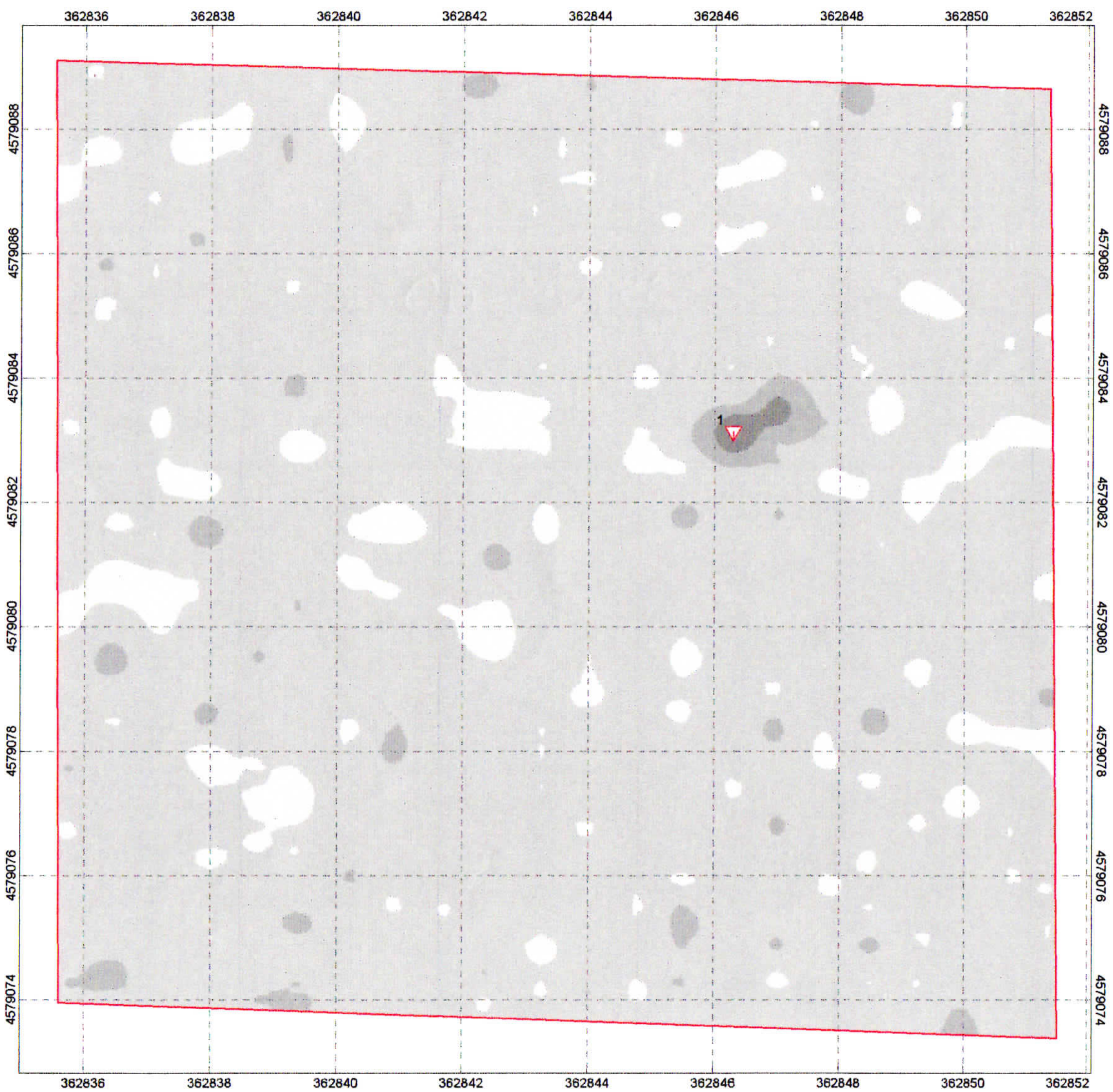
Project ID | Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

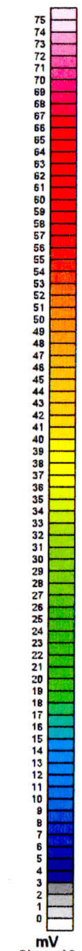
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0049	T00490001	☑	362846.291	4579083.14	3.15412752949853				

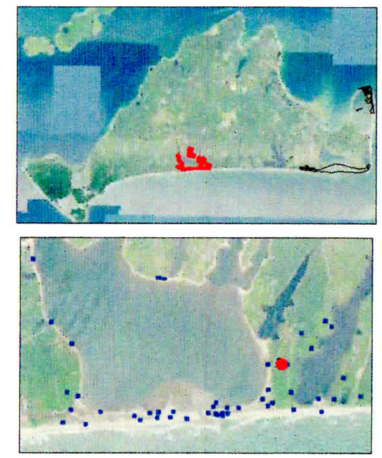
Anomaly Notes	Description of Item	Disposition of Item
	CD- WIRE	Removed

Monday, April 04, 2011

NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

Grid Boundary

Culture Boundary

Brush Culture (if noted)

2 Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0049XXXX, eg. T00490002)

Scale 1:75

(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0049
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/31/2011
Date of Survey: 03/30/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0050	T00500001	☑	362869.999	4579069.291	45.9051513851049				

Anomaly Notes: Footprint extends roughly 1.75x2m

Description of Item: CD- Metal Hook

Disposition of Item: Removed

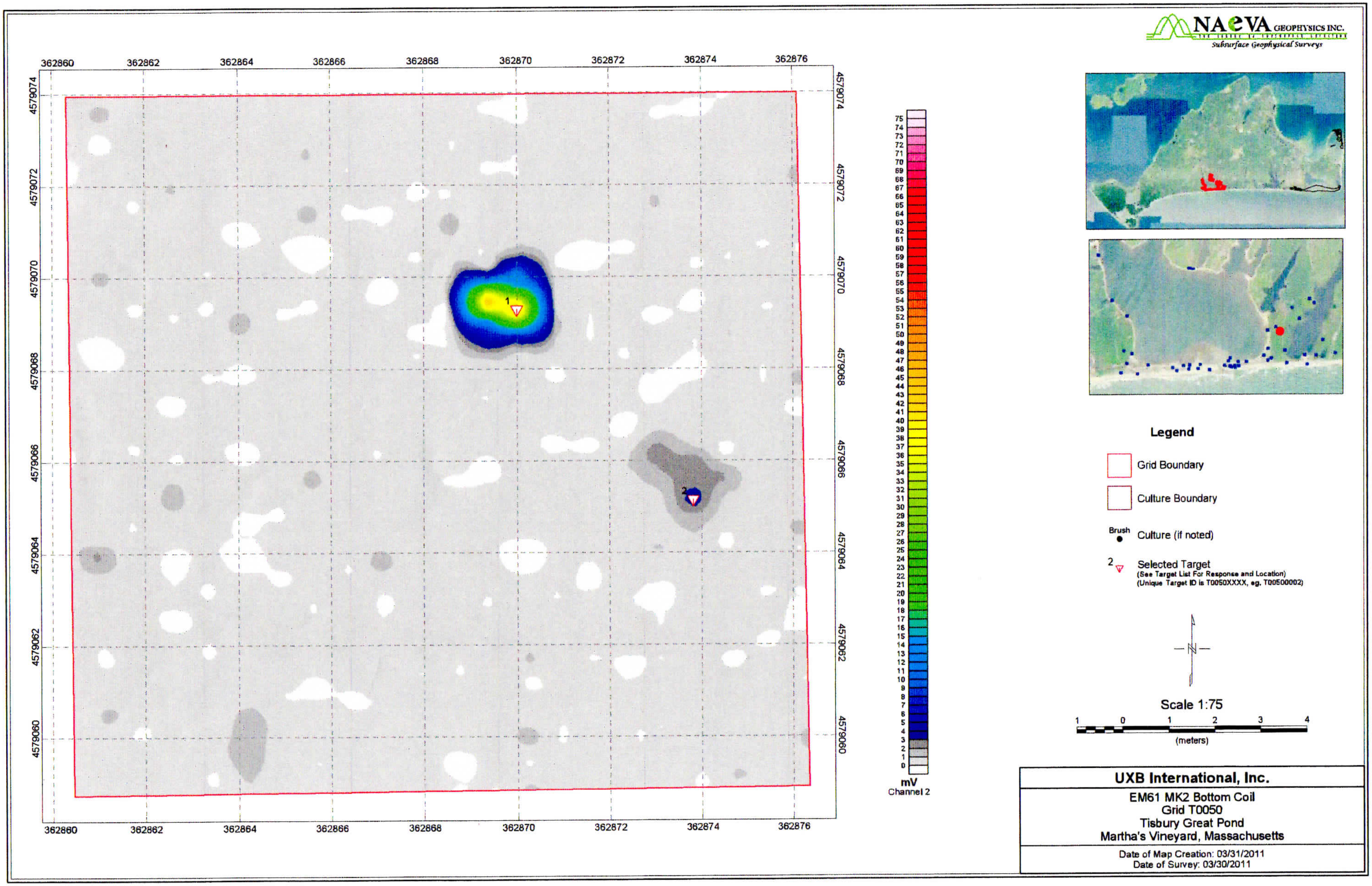
Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0050	T00500002	☑	362873.817	4579065.146	3.92629884854317				

Anomaly Notes:

Description of Item: CD- Nail

Disposition of Item: Removed

Monday, April 04, 2011



NAeVA GEOPHYSICS INC.
Subsurface Geophysical Surveys
362860
362862
362864
362866
362868
362870
362872
362874
362876
4579074
4579072
4579070
4579068
4579066
4579064
4579062
4579060
mV
Channel 2
Legend
Grid Boundary
Culture Boundary
Brush
Culture (if noted)
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0050XXXX, eg. T00500002)
Scale 1:75
(meters)
UXB International, Inc.
EM61 MK2 Bottom Coil
Grid T0050
Tisbury Great Pond
Martha's Vineyard, Massachusetts
Date of Map Creation: 03/31/2011
Date of Survey: 03/30/2011

EM-61 Anomaly Dig List

Date of Reacquisiton	
Date of Intrusive	4/4/11
Coord Sys.	NAD 83 UTM Zone 19N

Project ID | Martha's Vineyard RI/FS Contract No. W912DY-04-D-0019

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0051	T00510001	✔	362835.903	4579035.434	46.7242151302063				

Anomaly Notes: Footprint extends roughly 1.75x2.25m

Description of Item: CD - Scrap Metal

Disposition of Item: Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0051	T00510002	✔	362845.483	4579029.387	27.3787094001633				

Anomaly Notes:

Description of Item: CD - Scrap Metal

Disposition of Item: Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0051	T00510003	✔	362833.451	4579034.624	11.763683545052				

Anomaly Notes:

Description of Item: CD - Scrap Metal

Disposition of Item: Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0051	T00510004	✔	362833.372	4579033.83	7.06159897841198				

Anomaly Notes:

Description of Item: CD - Scrap Metal

Disposition of Item: Removed

Locatio	Target_ID	Dig	Easting(m)	Northing(m	CH2_final (mv)	Depth (bgs) Inches	Weight (approx) Kgs	Object Nose Inclination (0-90 deg)	Object Nose Bearing (0-360 Deg)
T0051	T00510005	✔	362834.404	4579033.81	4.2023222272859				

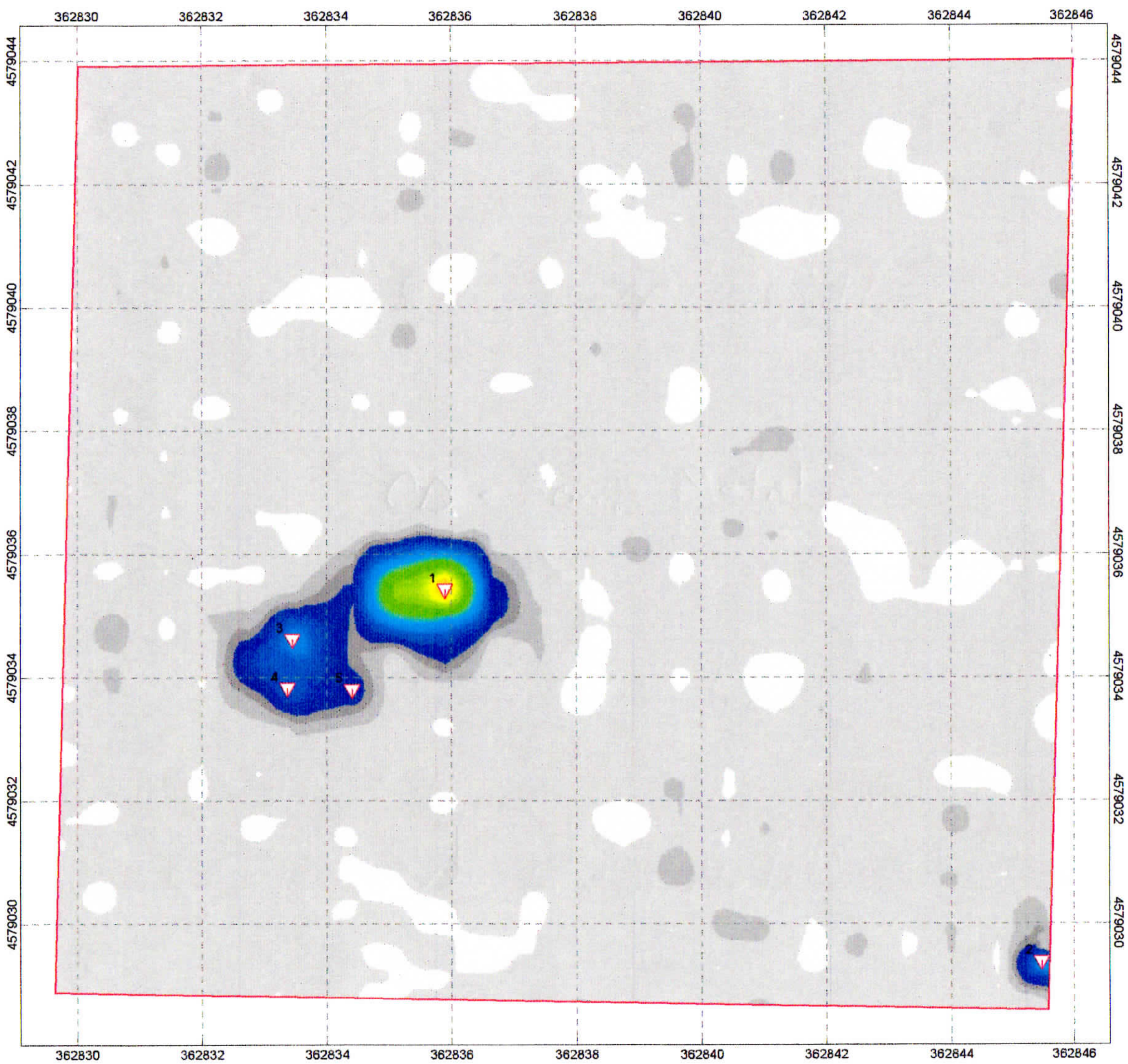
Anomaly Notes:

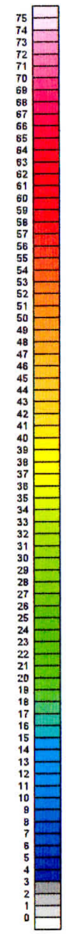
Description of Item: CD - Scrap Metal

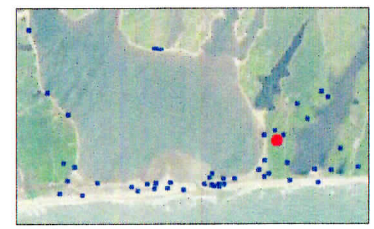
Disposition of Item: Removed

Monday, April 04, 2011

NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys







Legend

Grid Boundary

Culture Boundary

Brush
Culture (if noted)

2
Selected Target
(See Target List For Response and Location)
(Unique Target ID is T0051XXXX, eg. T00510002)

Scale 1:75

1 0 1 2 3 4
(meters)

UXB International, Inc.

EM61 MK2 Bottom Coil
Grid T0051
Tisbury Great Pond
Martha's Vineyard, Massachusetts

Date of Map Creation: 03/31/2011
Date of Survey: 03/30/2011

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Tisbury Great Pond MRS
Date: October 19, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Rob Rossi), began collecting soil and sediment samples at Tisbury Great Pond MRS. Nineteen sediment samples were collected, including 2 Field Duplicate (FD) samples. Sediment samples were collected from a small boat using a petite ponar dredge sampler. Three discrete surface soil samples, including one FD sample, and one discrete subsurface soil sample were collected. Soil samples were using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled, but no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
TP05	SD018	Sediment	1110	Metals, Explosives	10/20/11	Discrete sediment sample
TP06	SD019	Sediment	1115	Metals, Explosives	10/20/11	Discrete sediment sample
TP07	SD020	Sediment	1120	Metals, Explosives	10/20/11	Discrete sediment sample
TP08	SD021	Sediment	1130	Metals, Explosives	10/20/11	Discrete sediment sample
TP09	SD022	Sediment	1125	Metals, Explosives	10/20/11	Discrete sediment sample
TP10	SD023	Sediment	1135	Metals, Explosives	10/20/11	Discrete sediment sample
TP11	SD024	Sediment	1140	Metals, Explosives	10/20/11	Discrete sediment sample
TP12	SD025	Sediment	1145	Metals, Explosives	10/20/11	Discrete sediment sample
TP13	SD026	Sediment	1150	Metals, Explosives	10/20/11	Discrete sediment sample
TP14	SD027	Sediment	0955	Metals, Explosives	10/20/11	Discrete sediment sample
TP14	SD028	Sediment	0955	Metals, Explosives	10/20/11	Sediment QC sample – FD of SD028
TP15	SD029	Sediment	1030	Metals, Explosives	10/20/11	Discrete sediment sample
TP16	SD030	Sediment	1020	Metals, Explosives	10/20/11	Discrete sediment sample

DAILY QUALITY CONTROL REPORT

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
TP17	SD031	Sediment	0948	Metals, Explosives	10/20/11	Discrete sediment sample
TP18	SD032	Sediment	1045	Metals, Explosives	10/20/11	Discrete sediment sample
TP19	SD033	Sediment	1040	Metals, Explosives	10/20/11	Discrete sediment sample
TP20	SD034	Sediment	1105	Metals, Explosives	10/20/11	Discrete sediment sample
TP21	SD035	Sediment	1055	Metals, Explosives	10/20/11	Discrete sediment sample
TP21	SD036	Sediment	1055	Metals, Explosives	10/20/11	Sediment QC sample – FD of SD035
TP01	SB128	Soil	1330	Metals, Explosives	10/20/11	Discrete surface sample
TP01	SB129	Soil	1332	Metals, Explosives	10/20/11	QC sample – FD of SB128
TP01	SB130	Soil	1335	Metals, Explosives	10/20/11	Discrete surface sample
TP01	SB131	Soil	1345	Metals, Explosives	10/20/11	Discrete subsurface sample

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: Former Moving Target Machine Gun Range at South Beach MRS and Tisbury Great Pond MRS
Date: November 2, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team, with UXB UXO escort (Pat Fogelson), continued collecting groundwater and soil samples. Eight groundwater samples were collected, including two Field Duplicate (FD) samples. Groundwater samples were collected using low-flow techniques. Groundwater was purged using a peristaltic pump until parameter stabilization (parameters measured using an YSI 656). Two discrete subsurface soil samples were collected. Soil samples were collected using a stainless steel hand-auger or trowel and homogenized in a stainless steel bowl using a stainless steel spoon. Samples were packaged and labeled; no samples were shipped to TestAmerica. Samples are summarized below.

Equipment Calibrations:
YSI 656
Turbidity meter

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MG37	GW006	Groundwater	0850	Metals, Explosives	11/3/11	Discrete groundwater sample
MG37	GW010	Groundwater	0850	Metals, Explosives	11/3/11	QC sample – FD of GW006
MG38	GW007	Groundwater	1008	Metals, Explosives	11/3/11	Discrete groundwater sample
MG40	GW009	Groundwater	1049	Metals, Explosives	11/3/11	Discrete groundwater sample
TP02	GW011	Groundwater	1317	Metals, Explosives	11/3/11	Discrete groundwater sample
TP03	GW012	Groundwater	1533	Metals, Explosives	11/3/11	Discrete groundwater sample
TP04	GW013	Groundwater	1455	Metals, Explosives	11/3/11	Discrete groundwater sample
TP04	GW014	Groundwater	1455	Metals, Explosives	11/3/11	QC sample – FD of GW013
TP23	SB132	Soil	1255	Metals, Explosives	11/3/11	Discrete subsurface soil
TP24	SB133	Soil	1305	Metals, Explosives	11/3/11	Discrete subsurface soil

Deviations from Sampling and Analysis Plan:
Due to lack of access, a groundwater sample was not collected at MG39.

DAILY QUALITY CONTROL REPORT

Project Name: Remedial Investigation Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, & Tisbury Great Pond MRS
Contract Number: W912DY–04–D–0019
Delivery Order: 0006
Site Location: NA
Date: November 3, 2011
AMEC Contact: Donna Sharp, donna.sharp@amec.com, 865-603-9863

Activities Conducted:
The AMEC Field Sampling Team collected one investigation derived waste sample from the collected groundwater purge water. Samples were packaged and labeled, and samples collected from November 1 and November 3 were shipped to Test America.

Equipment Calibrations:
No calibration required.

Samples Collected: (including Quality Control Samples)

Station ID	Sample ID	Media	Time	Analysis	Shipment Date (TestAmerica)	Comments
MV01	IDW01	Water	0900	Metals, Explosives	11/3/11	IDW sample from decontamination fluids

SOIL SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP01	Collection Date	10/19/2011
Sample Number	SB128	Collection Time	1330
Surface/Sub-Surface	Sub-Surface	Start Depth	0 inch
Sample Method	Boring	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SOIL SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP01	Collection Date	10/19/2011
Sample Number	SB129	Collection Time	1332
Surface/Sub-Surface	Sub-Surface	Start Depth	0 inch
Sample Method	Boring	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**_________________

Reviewed By/Date:________________________________

SOIL SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP01	Collection Date	10/19/2011
Sample Number	SB130	Collection Time	1335
Surface/Sub-Surface	Sub-Surface	Start Depth	6 inch
Sample Method	Boring	End Depth	12 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SOIL SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP01	Collection Date	10/19/2011
Sample Number	SB131	Collection Time	1345
Surface/Sub-Surface	Sub-Surface	Start Depth	6 inch
Sample Method	Boring	End Depth	12 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**_________________

Reviewed By/Date:________________________________

SOIL SAMPLE COLLECTION FORM

		COC Number	148991
		Site	Tisbury Pond
Location Code	TP023	Collection Date	11/2/2011
Sample Number	SB132	Collection Time	1255
Surface/Sub-Surface	Sub-Surface	Start Depth	12 inch
Sample Method	Boring	End Depth	24 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SOIL SAMPLE COLLECTION FORM

		COC Number	148991
		Site	Tisbury Pond
Location Code	TP024	Collection Date	11/2/2011
Sample Number	SB133	Collection Time	1305
Surface/Sub-Surface	Sub-Surface	Start Depth	72 inch
Sample Method	Boring	End Depth	84 inch
Sample Type	Regular	Sample Matrix	Soil
Sample Equipment	Hand Auger	Sample Team	Owens,Barnes
Analytical Method	8321b/6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP05	Collection Date	10/19/2011
Sample Number	SD018	Collection Time	1110
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP06	Collection Date	10/19/2011
Sample Number	SD019	Collection Time	1115
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP07	Collection Date	10/19/2011
Sample Number	SD020	Collection Time	1120
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:______________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP08	Collection Date	10/19/2011
Sample Number	SD021	Collection Time	1130
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:______________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP09	Collection Date	10/19/2011
Sample Number	SD022	Collection Time	1125
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP10	Collection Date	10/19/2011
Sample Number	SD023	Collection Time	1135
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:_________________**

Reviewed By/Date:________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP11	Collection Date	10/19/2011
Sample Number	SD024	Collection Time	1140
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP12	Collection Date	10/19/2011
Sample Number	SD025	Collection Time	1145
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**_________________

Reviewed By/Date:________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP13	Collection Date	10/19/2012
Sample Number	SD026	Collection Time	1150
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP14	Collection Date	10/19/2012
Sample Number	SD027	Collection Time	0955
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP14	Collection Date	10/19/2012
Sample Number	SD028	Collection Time	0955
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments: Duplicate Sample of SD027

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP15	Collection Date	10/19/2012
Sample Number	SD029	Collection Time	1030
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP16	Collection Date	10/19/2012
Sample Number	SD030	Collection Time	1020
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:_________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	291
		Site	Tisbury Pond
Location Code	TP17	Collection Date	10/19/2012
Sample Number	SD031	Collection Time	0948
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:______________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP18	Collection Date	10/19/2012
Sample Number	SD032	Collection Time	1045
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP19	Collection Date	10/19/2012
Sample Number	SD033	Collection Time	1040
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:_________________ **Format Type:**__________________

Reviewed By/Date:__________________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP20	Collection Date	10/19/2012
Sample Number	SD034	Collection Time	1105
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**_________________

Reviewed By/Date:______________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP21	Collection Date	10/19/2012
Sample Number	SD035	Collection Time	1055
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments:

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:______________________________

SEDIMENT SAMPLE COLLECTION FORM

		COC Number	292
		Site	Tisbury Pond
Location Code	TP21	Collection Date	10/19/2012
Sample Number	SD036	Collection Time	1055
Surface/Sub-Surface	Surface	Start Depth	0 inch
Sample Method	Grab	End Depth	6 inch
Sample Type	Regular	Sample Matrix	Sediment
Sample Equipment	Mini Ponar	Sample Team	Owens/Barnes
Analytical Method	8321b,6020a	Container	Jar

Comments: Duplicate Sample of SD035

Coordinates:________________ **Format Type:**________________

Reviewed By/Date:______________________________

GROUNDWATER SAMPLE RECORD

Project Name:	Martha's Vineyard MMRP RIFS
AMEC Proj No:	562910000
Location:	Martha's Vineyard, Dukes County, Massachussetts
Station ID:	TP02
Sample ID:	GW011
Date:	11/2/2011 COC Number 148991
Initial Measurements:	Well Total Depth (TOC) ft.

Well Diameter:		Sample Depth: 8' - 12' BGS
Drilling Company:	Tidewater, Inc.	Sampling Technician: Donna Sharp
Driller:		Drilling Equipment:

Water Quality Parameters

Time	Flow Rate (ml/min)	Turbidity (NTU) (+/- 10% > 10) (< 10 ok)	Temp. (°C) (+/- 0.5°)	Cond. (mS/Cm) (+/- 3%)	Salinity (%)	Disolved Oxygen (mg/l) (+/- 0.3)	ORP (mV) (+/- 10)	DTW (BGS)	Total Lit. Pumped	Comments
1317		500	15.17	0.933	0.60	5.4	-71.30	NA		

Sample Collection Method

	Flow Rate	ml/min	gal/min

Peristaltic Pump	Filtered with 0.45 micron? YES	Unfiltered?
Number of Bottles: 3	Bottle Type: 520 ML HDPE	1 L AMBER

Sample Description:

GROUNDWATER SAMPLE RECORD

Project Name:	Martha's Vineyard MMRP RIFS
AMEC Proj No:	562910000
Location:	Martha's Vineyard, Dukes County, Massachussetts
Station ID:	TP03
Sample ID:	GW012
Date:	11/2/2011 COC Number 148991
Initial Measurements:	Well Total Depth (TOC) ft.
Well Diameter:	Sample Depth: 10' BGS
Drilling Company: Tidewater, Inc.	Sampling Technician: Donna Sharp
Driller:	Drilling Equipment:

Water Quality Parameters

Time	Flow Rate (ml/min)	Turbidity (NTU) (+/- 10% > 10) (< 10 ok)	Temp. (°C) (+/- 0.5°)	Cond. (mS/Cm) (+/- 3%)	Salinity (%)	Disolved Oxygen (mg/l) (+/- 0.3)	ORP (mV) (+/- 10)	DTW (BGS)	Total Lit. Pumped	Comments
1533		>1000	12.82	0.528	0.33	5.57	-57.50	10'		

Sample Collection Method

Flow Rate	ml/min	gal/min

Peristaltic Pump	Filtered with 0.45 micron? YES	Unfiltered?
Number of Bottles: 3	Bottle Type: 520 ML HDPE	1 L AMBER

Sample Description:

GROUNDWATER SAMPLE RECORD

Project Name:	Martha's Vineyard MMRP RIFS
AMEC Proj No:	562910000
Location:	Martha's Vineyard, Dukes County, Massachussetts
Station ID:	TP04
Sample ID:	GW013
Date:	11/2/2011 COC Number 148991
Initial Measurements:	Well Total Depth (TOC) ft.
Well Diameter:	Sample Depth: 8" - 12' BGS
Drilling Company: Tidewater, Inc.	Sampling Technician: Donna Sharp
Driller:	Drilling Equipment:

Water Quality Parameters

Time	Flow Rate (ml/min)	Turbidity (NTU) (+/- 10% > 10) (< 10 ok)	Temp. (°C) (+/- 0.5°)	Cond. (mS/Cm) (+/- 3%)	Salinity (%)	Disolved Oxygen (mg/l) (+/- 0.3)	ORP (mV) (+/- 10)	DTW (BGS)	Total Lit. Pumped	Comments
1455		>1000	14.78	0.904	0.56	9.20	-54.30	10'		

Sample Collection Method

	Flow Rate	ml/min	gal/min		
Peristaltic Pump				Filtered with 0.45 micron? YES	Unfiltered?
Number of Bottles: 3				Bottle Type: 520 ML HDPE	1 L AMBER

Sample Description:

GROUNDWATER SAMPLE RECORD

Project Name:	Martha's Vineyard MMRP RIFS
AMEC Proj No:	562910000
Location:	Martha's Vineyard, Dukes County, Massachussetts
Station ID:	TP04
Sample ID:	GW014
Date:	11/2/2011 COC Number 148991
Initial Measurements:	Well Total Depth (TOC) ft.
Well Diameter:	Sample Depth: 8" - 12' BGS
Drilling Company: Tidewater, Inc.	Sampling Technician: Donna Sharp
Driller:	Drilling Equipment:

Water Quality Parameters

Time	Flow Rate (ml/min)	Turbidity (NTU) (+/- 10% > 10) (< 10 ok)	Temp. (°C) (+/- 0.5°)	Cond. (mS/Cm) (+/- 3%)	Salinity (%)	Disolved Oxygen (mg/l) (+/- 0.3)	ORP (mV) (+/- 10)	DTW (BGS)	Total Lit. Pumped	Comments
1455		>1000	14.78	0.904	0.56	9.20	-54.30	10'		

Sample Collection Method

Flow Rate	ml/min	gal/min

Peristaltic Pump	Filtered with 0.45 micron? YES	Unfiltered?
Number of Bottles: 3	Bottle Type: 520 ML HDPE	1 L AMBER

Sample Description: **Duplicate Sample of GW-013**

Martha's Vineyard 1 of 2

08/07/13 Tisbury Great Pond Sampling

Day - Wednesday

Personnel - Norm Barnes

Weather - warm, overcast, light mist, 70°F - 75°F (at Destination)

0415 - Head to airport - knoxville.

0500 - Board aircraft.

0615 - Arrive charlotte, NC.

1010 - Depart charlotte.

1215 - Arrive Providence, RI

1250 - Pick up rental car.

1530 - Arrive Holiday Inn, Hyannis, MA. Unpacked shipped equipment & re-packed into purchased tote.

1545 - Checking & calibrating YSI.

1620 - Loading & securing tote & YSI to luggage cart, load into car.

1630 - Checking email, one call to Jeremy about additional salinity measurements.

1650 - Called Mike Warminsky - voicemail - left message.

08/07/13 2 of 2

Cynthia wants 3 ind. Sel. readings near ocean. with GPS Loc.

Mike Warminsky needs to meet 908 334 9000 MV

1700 - Time Stop.

08/08/13 Tisbury Great Pond sediment sample, Martha's Vineyard
N. Barnes 1 of

Day - Thursday

Personnel - Norm Barnes, Rob Rossi

Weather - mild, overcast, 68°F - 75°F
rain expected w. wind.

0412 - Head to Ferry parking in Falmouth.

0500 - Arrive Palmer Ave parking, waiting on shuttle.

0600 - On Ferry enroute to M.V.

0645 - Arrive MV, meet Mike, go to pick up water & groceries for lunch.

0800 - Pick up boat - enroute to Pond. Showers now & then.

0842 - At Boat Ramp.

1135 - Saw that there is a strip of land separating us from BG-09, called Donna.

1218 - Talked to Donna - going to Deep Bottom Cove

1300 - off the pond, going to Fed Ex.

Cont. pg 4

08/08/13 2 of

STA ID	Temp	pH	Cond	DO	Sal	Turb	ORP
BG-01	24.57	6.23	29.57	6.42	18.47	4.01	212.0
02	25.19	5.79	29.09	6.85	17.95	3.23	264.8
03	25.15	5.72	28.05	6.67	17.26	3.72	270.0
04	25.86	5.75	28.84	5.96	17.74	5.12	266.7
05	23.98	7.01	29.68	5.42	18.37	2.92	199.2
06	23.64	6.88	29.18	6.34	18.03	3.53	163.0
~~0910~~ 07	23.52	6.76	30.18	6.68	18.72	1.87	483.1
~~0945~~ 08	24.31	~~[illegible]~~	29.06	6.32	17.95	2.31	121.6
09	24.50	5.56	29.39	6.63	18.16	4.00	216.7
10	24.19	5.76	29.67	6.52	18.36	3.02	252.0

BG08 pH is 6.35

BG-07	8 ft	Sample 0910
BG-08 MS/MSD sed	4 ft	Sample 0945
BG-05	6 ft	Sample 1010
		with Dup sed.
BG-06	7 ft	Sample 1025
BG-01	7 ft	Sample 1045
BG-02 DUP sw	8 ft	Sample 1100.
BG-04	5 ft	Sample 1110
		with MS/MSD sw
BG-03	6 ft	Sample 1120
BG-09	7 ft	Sample ~~1135~~ 1230
BG-10	10 ft	Sample ~~1150~~ 1140

Tisbury Pond Sample

08/08/13 N Barnes 3 of 4

1200 - AfterNote - Taking Pond/surf readings.

East Reading: 8 FT

4578903.48 M N.

362457.06 M E.

-28.76 m (HAE)

Temp	pH	Cond	DO	Sal	Turb	ORP
23.50	5.70	30.51	6.92	18.94	2.40	218.7

Center Reading 9 fT

Temp	pH	Cond	DO	Sal	Turb	ORP
23.47	5.44	30.52	6.92	18.95	1.15	208.4

4578932.70 m N 362334.85 m E.

West Reading 6 fT

4578913.36 M N. 362217.15 m E.

Temp	pH	Cond	DO	Sal	Turb	ORP
23.65	5.54	30.51	7.94	18.94	0.96	211.3

BG09 Coordinates:

4579912.22 m N

362630.23 m E

08/08/13 4 of 4

1445 - Dropped off two coolers (iced) of samples at FedEx for next morning delivery, airbills provided by T.A. Also, shipped two containers to Pine Env, large bin has the Ponar mini dredge, peristaltic pump and YSI, the LaMotte turbidity meter shipped as second container.

1500 - Dropped off boat.

1530 - Check in to Clarion.

1540 - Transcribing sample info from field notes to sample sheets. Unable to use sheets in the field due to rain.

~~1645~~ Time stop

1700

Tisbury Great Pond Sample

08/09/13 N. Barnes 1 of 1

Day - Friday

Personnel - N. Barnes

weather - 60% chance of rain + storms, 70°F - 73°F.

0600 - Head to Vineyard Haven Ferry.

1018 - Arrive Providence airport,

4.3 time stop while waiting.

1218 - Boarding plane, resume time, one lay-over in Charlotte, NC.

1730 - Arrive knoxville airport.

1812 - Arrive Home Time stop

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amec

EARTH & ENVIRONMENTAL 000207

Chain of Custody Record/Analysis Request

Temperature of samples upon lab arrival: ______

Issuing AMEC Office: Knoxville
AMEC Office Address: 10239 Technology Drive
Knoxville, TN 37932

Project Name: Tisbury Great Pond Background sampling
Job No.: 56291 0000
Project Manager: Donna Sharp
Phone No.: (865) 671-6774
Sampler (s): Norm Barnes

Laboratory Name/Address: Test America Denver 4955 yarrow ST Arvada, CO 80002
Contact: Debra Henderer
Phone: 303 736 0134
Fax:

NOTES: Disolved Lead and Nickel samples are Filtered

Station ID	Sample ID	Time Collected	Date Collected	Sample Type (reg, dup, eqb, ms, msd)	Matrix (soil, sed, gw, sw)	Depth ft	Lead and Nickel	Total Lead and Nickel	Disolved Lead and Nickel								Notes
						Preservative (HCl, HNO_3, Ice, etc.)	ICE	ICE HNO_3	ICE HNO_3								
BG-01	SD037	1045	08/08/13	reg	sed	8	1										
BG-02	SD038	1100				9	1										
BG-03	SD039	1120				7	1										
BG-04	SD040	1110				6	1										
BG-05	SD041	1010				6	1										
—	SD042	—		dup		—	1										duplicate
BG-06	SD043	1025		reg		8	1										
BG-07	SD044	0910		reg		9	1										
BG-08	SD045	0945		reg MS MSD		5	1										regular, MS MSD
BG-09	SD046	1230		reg		8	1										
BG-10	SD047	1140				11	1										
BG-01	SW001	1045			sw	7		1	1								
BG-02	SW002	1100				8		1	1								
—	SW003	—		dup		—		1	1								Duplicate
						Total # of Containers	11	3	3								

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	Comments:
Signature: [signature]	Signature:	Signature:	
Printed Name: Norm Barnes	Printed Name:	Printed Name:	
Firm: AMEC	Firm:	Firm:	
Date/Time: 8/8/13 1430	Date/Time:	Date/Time:	

amec

EARTH & ENVIRONMENTAL 000206

Chain of Custody Record/Analysis Request

Temperature of samples upon lab arrival: ______

Issuing AMEC Office: Knoxville

AMEC Office Address: 10239 Technology Drive
Knoxville, TN 37932

Project Name: Tisbury Great Pond Background sampling

Job No.: 56291 0000

Project Manager: Donna Sharp

Phone No.: (865) 671-6774

Sampler (s): Norm Barnes

Laboratory Name/Address: Test America, Denver
4955 Yarrow St.
Arvada, CO 80002

Contact: Debra Henderer

Phone: 303 736 0134

Fax:

Station ID	Sample ID	Time Collected	Date Collected	Sample Type (reg, dup, eqb, ms, msd)	Matrix (soil, sed, gw, sw)	Depth ft	Lead and Nickel	Total Lead and Nickel	Disolved Lead and Nickel								NOTES
Preservative (HCl, HNO_3, Ice, etc.)							Ice HNO_3 Ice	Ice HNO_3	Ice HNO_3								Disolved Lead and Nickel samples are Filtered
BG03	SW004	1120	08/08/13	reg	sw	6		1	1								
~~BG-0~~ BG04	SW005	1110		reg MS/MSD		5		1	1								Reg MS/MSD
BG05	SW006	1010		reg		6		1	1								
BG06	SW007	1025		reg		7		1	1								
BG07	SW008	0910		reg		8		1	1								
BG08	SW009	0945		reg		4 ~~7~~		1	1								
BG09	SW010	1230		reg		7		1	1								
BG10	SW011	1140		reg		10		1	1								
Total # of Containers								8	8								

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	Comments:
Signature: [signature]	Signature:	Signature:	
Printed Name: Norm Barnes	Printed Name:	Printed Name:	
Firm: AMEC	Firm:	Firm:	
Date/Time: 8/8/13 1430	Date/Time:	Date/Time:	

INSTRUMENT CALIBRATION LOG

JOB NUMBER: 562910000 **PROJECT:** Tisbury Great Pond sediment sample **LOCATION:** Martha's Vineyard

DATE/TIME	INSTRUMENT	SERIAL NUMBER	SPAN GAS OR STANDARD	CONCENTRATION	GAS/STANDARD LOT NUMBER, DATE	INSTRUMENT READING AT CALIBRATION	COMMENTS
8/7/13 1545	YSI556	10J101748	pH	7.0	2208038 07/14	7.07	
↓	↓	↓	pH	4.0	2210176 09/14	3.99	
			pH	10.0	2211639 05/14	9.95	
			Cond.	1.413 mS/cm³	10020 11/13	1.418	
			ORP	240.0 mV	5245 11/17	240.0	
			DO	Air %	NA	100.3 %	9.03 mg/L

Surface Water and Sediment Sampling Form			
Sampler(s):	N. B.	**Station ID:**	BG-01
		Depth to Bottom:	~~5'~~ 7
Crew:	NB & R.R.	**Tide:**	out
		Weather:	overcast rain

Surface Water Sample Information

Surface Water Sample ID: SW001
Surface Water Sample Depth: ~~7'~~ 6
Surface Water Sample Time: 1045
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^{3})	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
24.57	6.23	29.87	6.42	18.47	4.01	212.0	

Floating Debris (Describe): 0
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: SD037
Sediment Sample Depth: ~~5'~~ 7'
Sediment Sample Time: 1045
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Lead Nickle	none	4oz jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature: [signature]

Surface Water and Sediment Sampling Form

Sampler(s):	N. B.	**Station ID:**	BG-02
		Depth to Bottom:	~~8~~ 7
Crew:	N. B + RR	**Tide:**	out
		Weather:	OC, no rain

Surface Water Sample Information

Surface Water Sample ID: SW002

Surface Water Sample Depth: ~~5~~ 6

Surface Water Sample Time: 1100

QA/QC Sample IDs:

None Duplicate SW003 MS/MSD

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
25.19	5.79	29.09	6.85	17.95	3.23	264.8	

Floating Debris (Describe): none

Water Color: clear

Sheen: no

Sediment Sample Information

Sediment Sample ID: SD038

Sediment Sample Depth: 8'

Sediment Sample Time: 1100

QA/QC Sample IDs:

None Duplicate MS/MSD

Sample Parameters

Analyte	Preservative	Bottleware
Pb, Ni	None	4oz Jar (1)
" "	HNO3	500ml HDPE (2)

Comments/Observations

Sampler Signature:

Surface Water and Sediment Sampling Form

Sampler(s):	N B	**Station ID:**	BG-03
		Depth to Bottom:	~~5'~~ 6'
Crew:	NB & RR	**Tide:**	out
		Weather:	PC, sunny

Surface Water Sample Information

Surface Water Sample ID: SW 004
Surface Water Sample Depth: 5'
Surface Water Sample Time: 1120
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
25.15	5.72	28.05	6.67	17.26	3.72	270.0	

Floating Debris (Describe): none
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: SD 039
Sediment Sample Depth: 6'
Sediment Sample Time: 1120
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature: [signature]

Surface Water and Sediment Sampling Form			
Sampler(s):	NB	**Station ID:**	BG-04
		Depth to Bottom:	5'
Crew:	NB & RR	**Tide:**	out
		Weather:	PC, sun

Surface Water Sample Information

Surface Water Sample ID:	SW005
Surface Water Sample Depth:	4'
Surface Water Sample Time:	1110
QA/QC Sample IDs:	
None / Duplicate	MS/MSD SW005 same bottle

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm3))	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments

Floating Debris (Describe):

Water Color:

Sheen:

Sediment Sample Information

Sediment Sample ID:	SD040
Sediment Sample Depth:	5'
Sediment Sample Time:	1110
QA/QC Sample IDs:	
None / Duplicate	MS/MSD

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature:

Surface Water and Sediment Sampling Form			
Sampler(s):	NB	**Station ID:**	BG-05
		Depth to Bottom:	6'
Crew:	NB & RR	**Tide:**	out
		Weather:	overcast, mist

Surface Water Sample Information

Surface Water Sample ID:	SW 006
Surface Water Sample Depth:	5'
Surface Water Sample Time:	1010
QA/QC Sample IDs:	
None	**Duplicate** ______ **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
23.98	7.01	29.68	5.42	18.37	2.82	199.7	

Floating Debris (Describe):	none
Water Color:	clear
Sheen:	no

Sediment Sample Information

Sediment Sample ID:	SD 041
Sediment Sample Depth:	6'
Sediment Sample Time:	1010
QA/QC Sample IDs:	
None	**Duplicate** SD042 **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz jar (1)
" "	HNO3	500ml HDPE (2)

Comments/Observations

Sampler Signature:

Surface Water and Sediment Sampling Form

Sampler(s):	NB	**Station ID:**	BG-06
		Depth to Bottom:	7'
Crew:	NB & RR	**Tide:**	out
		Weather:	Overcast mist

Surface Water Sample Information

Surface Water Sample ID: SW 007
Surface Water Sample Depth: 6'
Surface Water Sample Time: 1025
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
23.64	6.88	29.18	6.34	18.03	3.53	163.0	

Floating Debris (Describe): none
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: ~~SW 007~~ SD 043
Sediment Sample Depth: 7'
Sediment Sample Time: 1025
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz Jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature:

Surface Water and Sediment Sampling Form			
Sampler(s):	NB	**Station ID:**	BG-07
		Depth to Bottom:	8'
Crew:	NB & RR	**Tide:**	out
		Weather:	cloudy, Rain

Surface Water Sample Information

Surface Water Sample ID: SW 008
Surface Water Sample Depth: 7'
Surface Water Sample Time: 0910
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm$^{3)}$	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
23.52	6.76	30.18	6.68	18.72	1.87	483.1	

Floating Debris (Describe): none
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: SD044
Sediment Sample Depth: 8'
Sediment Sample Time: 0910
QA/QC Sample IDs:
None **Duplicate** ______ **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz Jar (1)
" "	HNO3	500ml HDPE (2)

Comments/Observations

Sampler Signature:

Surface Water and Sediment Sampling Form

Sampler(s): NB
Station ID: BG-08
Depth to Bottom: 4'
Crew: NB & RR
Tide: out
Weather: cloudy, rain, mist

Surface Water Sample Information

Surface Water Sample ID: SW 009
Surface Water Sample Depth: 3'
Surface Water Sample Time: 0945
QA/QC Sample IDs:
None **Duplicate** ________ **MS/MSD** ________

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
24.31	6.35	29.06	6.32	17.95	2.31	121.6	

Floating Debris (Describe): none
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: SD045
Sediment Sample Depth: 4'
Sediment Sample Time: 0945
QA/QC Sample IDs:
None **Duplicate** ________ **MS/MSD** SD045

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature: [signature]

Surface Water and Sediment Sampling Form			
Sampler(s):	NB	Station ID:	BG-09
		Depth to Bottom:	7'
Crew:	NB & RR	Tide:	out
		Weather:	PC Sunny

Surface Water Sample Information

Surface Water Sample ID: SW 010

Surface Water Sample Depth: 6'

Surface Water Sample Time: 1230

QA/QC Sample IDs:

None   Duplicate ______   MS/MSD ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
24.50	5.56	29.39	6.63	18.16	4.00	216.7	

Floating Debris (Describe): none

Water Color: clear

Sheen: no

Sediment Sample Information

Sediment Sample ID: SD 046

Sediment Sample Depth: ~~6~~ 7'

Sediment Sample Time: 1230

QA/QC Sample IDs:

None   Duplicate ______   MS/MSD ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4 oz Jar (1)
" "	HNO3	500 ML HDPE (2)

Comments/Observations

Moved BG-09 to different location due to blocked passage to point - GPS coordinates:
4579912.22 m N.
362630.23 m E.

Sampler Signature: [signature]

Surface Water and Sediment Sampling Form

Sampler(s):	NB	**Station ID:**	BG-10
		Depth to Bottom:	10'
Crew:	NB & RR	**Tide:**	out
		Weather:	PC, Sunny

Surface Water Sample Information

Surface Water Sample ID: SW 011
Surface Water Sample Depth: 9'
Surface Water Sample Time: 1140
QA/QC Sample IDs:
None   **Duplicate** ______   **MS/MSD** ______

Surface Water Data & Conditions

Temperature (°C)	pH (SU)	Conductivity (mS/cm^3)	DO (mg/L)	Salinity (ppt)	Turbidity (NTU)	ORP (mV)	Comments
24.19	5.76	29.67	6.52	18.36	3.02	252.0	

Floating Debris (Describe): none
Water Color: clear
Sheen: no

Sediment Sample Information

Sediment Sample ID: SD 047
Sediment Sample Depth: 10'
Sediment Sample Time: 1140
QA/QC Sample IDs:
None   **Duplicate** ______   **MS/MSD** ______

Sample Parameters

Analyte	Preservative	Bottleware
Pb Ni	none	4oz jar (1)
" "	HNO3	500 ml HDPE (2)

Comments/Observations

Sampler Signature:

APPENDIX F

GEOPHYSICAL DATA

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APPENDIX G

DEMOLITION ACTIVITY SUMMATION TABLES

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Daily Field Activities
(TGP Land)

AOI: Tisbury Great Pond Land/Beach								
Grid	Demo Operation	Date	Items for Demolition	Item	Demolition Materials			
	MEC/MPPEH				19 grain Penetrators	80 grain det cord (ft)	91 grain det cord (ft)	Electric blasting Caps
T-32	1	03-Mar-11	1	MK23	1	6	0	2
Totals	**1**		**1**		**1**	**6**	**0**	**2**

Daily Field Activities
(TGP Inland water)

MRS: Tisbury Great Pond Water								
Grid	Demo Operations	Date	Items for Demolition	Item	Demolition Materials			
	MEC/MPPEH				19 grain Penetrators	80 grain det cord (ft)	91 grain det cord (ft)	Electric blasting Caps
10	1	12-Apr-11	3	MK23	3	10	0	2
11	1	13-May-11	1	Spotting charge (100# bomb)	2	10	0	2
Totals	**2**		**4**		**5**	**20**	**0**	4

APPENDIX H

DOCUMENTATION OF DISPOSAL OF MUNITIONS POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD, MUNITIONS DEBRIS, AND WASTES

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DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

1. TOTAL PRICE	
2. SHIP FROM	Martha's Vineyard storage site, Edgartown, MA Police Department
3. SHIP TO	RM Packer Company Inc.
4. MARK FOR	Disposal
5. DOC DATE	
6. NMFC	
7. FRT RATE	
8. TYPE CARGO	
9. PS	
10. QTY. REC'D	500
11. UP	
12. UNIT WEIGHT	Pounds
13. UNIT CUBE	
14. UFC	
15. SL	
16. FREIGHT CLASSIFICATION NOMENCLATURE	MDAS
17. ITEM NOMENCLATURE	Munitions Debris
18. TY CONT	
19. NO CONT	
20. TOTAL WEIGHT	500 lbs
21. TOTAL CUBE	
22. RECEIVED BY	[signature]
23. DATE RECEIVED	4/15/11

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

27. ADDITIONAL DATA

FOR Munitions Debris,Martha's Vineyard RI\FS

Contract # W912DY-04-D-0019

Box #____________

Security seal # __________

UXB International Inc.
2020 Kraft Dr.
Blacksburg, VA 24060
(540) 443-3700

Certified By: Patrick K. Fogleson

UXB International Inc.
2020 Kraft Dr. Suite 2100
Blacksburg, VA 24060
(540) 443-3700

Verified By: Jeffery Donders

"This certifies and verifies that the material listed has been 100% inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials"

PREVIOUS EDITION MAY BE USED

Adobe Designer 8.0

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1	2	3	4	5	6	7	23	24	25	26	27	28	29	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
DOC	IDENT	RI FROM			M&S		UNIT	ISS	QUANTITY					SER	SUPPLEMENTARY ADDRESS					SIG	FUND	DISTRIBUTION				PROJECT			PRI		REQD	DEL	DATE	ADV		RI			O/P	COND	MGT	UNIT PRICE: DOLLARS / CTS								

1. TOTAL PRICE	2. SHIP FROM	3. SHIP TO
DOLLARS / CTS	Martha's Vineyard storage site, Edgartown, MA Police Department	RM Packer Company Inc.

4. MARK FOR: Disposal

5. DOC DATE	6. NMFC	7. FRT RATE	8. TYPE CARGO	9. PS
5/10/12			BBL	

10. QTY. REC'D	11. UP	12. UNIT WEIGHT	13. UNIT CUBE	14. UFC	15. SL
1		415 Pounds			

16. FREIGHT CLASSIFICATION NOMENCLATURE: MDAS

17. ITEM NOMENCLATURE: Munitions Debris

18. TY CONT	19. NO CONT	20. TOTAL WEIGHT	21. TOTAL CUBE
		415	

22. RECEIVED BY	23. DATE RECEIVED
[signature]	5/14/12

24. DOCUMENT NUMBER & SUFFIX (30-44)

FOR Munitions Debris,Martha's Vineyard RI\FS

Contract # W912DY-04-D-0019

Box # 1A

Security seal # ________

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

UXB International Inc.
2020 Kraft Dr.
Blacksburg, VA 24060
(540) 443-3700

Certified By: Patrick K. Fogleson

UXB International Inc.
2020 Kraft Dr. Suite 2100
Blacksburg, VA 24060
(540) 443-3700

Verified By: Robert Rozzi

27. ADDITIONAL DATA

"This certifies and verifies that the material listed has been 100% inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials"

Adobe Designer 8.0

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

1. TOTAL PRICE	2. SHIP FROM	3. SHIP TO
	Martha's Vineyard storage site, Edgartown, MA Police Department	RM Packer Company Inc.
	4. MARK FOR: Disposal	

5. DOC DATE	6. NMFC	7. FRT RATE	8. TYPE CARGO	9. PS
5-11-12			BBL	

10. QTY. REC'D	11. UP	12. UNIT WEIGHT	13. UNIT CUBE	14. UFC	15. SL
1		Pounds			

16. FREIGHT CLASSIFICATION NOMENCLATURE
MDAS

17. ITEM NOMENCLATURE
Munitions Debris

18. TY CONT	19. NO CONT	20. TOTAL WEIGHT	21. TOTAL CUBE
		425	

22. RECEIVED BY	23. DATE RECEIVED
[signature]	5/11/12

24. DOCUMENT NUMBER & SUFFIX (30-44)

FOR Munitions Debris,Martha's Vineyard RI\FS

Contract # W912DY-04-D-0019

Box # 1

Security seal # ________

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

UXB International Inc.
2020 Kraft Dr.
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Certified By: Patrick K. Fogleson

UXB International Inc.
2020 Kraft Dr. Suite 2100
Blacksburg, VA 24060
(540) 443-3700

Verified By: Robert Rozzi

27. ADDITIONAL DATA

"This certifies and verifies that the material listed has been 100% inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials"

PREVIOUS EDITION MAY BE USED

Adobe Designer 8.0

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

1. TOTAL PRICE	
2. SHIP FROM	Martha's Vineyard storage site, Edgartown, MA Police Department
3. SHIP TO	RM Packer Company Inc.
4. MARK FOR	Disposal
5. DOC DATE	5-11-12
6. NMFC	
7. FRT RATE	
8. TYPE CARGO	BBL
9. PS	
10. QTY. REC'D	1
11. UP	
12. UNIT WEIGHT	Pounds
13. UNIT CUBE	
14. UFC	
15. SL	
16. FREIGHT CLASSIFICATION NOMENCLATURE	MDAS
17. ITEM NOMENCLATURE	Munitions Debris
18. TY CONT	
19. NO CONT	
20. TOTAL WEIGHT	502
21. TOTAL CUBE	
22. RECEIVED BY	[signature]
23. DATE RECEIVED	5/11/12

24. DOCUMENT NUMBER & SUFFIX (30-44)

FOR Munitions Debris,Martha's Vineyard RI\FS

Contract # W912DY-04-D-0019

Box # 2

Security seal # N/A

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

UXB International Inc.
2020 Kraft Dr.
Blacksburg, VA 24060
(540) 443-3700

Certified By: Patrick K. Fogleson

UXB International Inc.
2020 Kraft Dr, Suite 2100
Blacksburg, VA 24060
(540) 443-3700

Verified By: Robert Rozzi

27. ADDITIONAL DATA

"This certifies and verifies that the material listed has been 100% inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials"

PREVIOUS EDITION MAY BE USED

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APPENDIX I

PROJECT PHOTOGRAPHS

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Figure TGP01 B030002 10-31-11
Target ID: B030002 - Dunes
1 MEC Item

Figure TGP02 B03M5 10-31-11
Target ID: B03M5 - Dunes
1 MEC Item

Figure TGP03 T003200-03 03-02-11
Target ID: T00320003a(MK023)_small - Land
1 MEC Item

No Photo Available

Figure TGP04 G0100005 05-06-11
Target ID: G0100005 - Inland Water
3 MEC Items

AMEC Earth & Environmental, Inc.
Photographic Record

Customer: U.S Army Corps of Engineers	**Project Number:** 56291000
Site Name: RI/FS Martha's Vineyard	**Site Location:** Martha's Vineyard, MA

Photographer: D. Sharp **Date:** 10-19-2011 **Direction:** Northeast **Comments:** Sediment sampling at Tisbury Great Pond.	
Photographer: D. Sharp **Date:** 10-19-2011 **Direction:** Southwest **Comments:** Sediment sampling at Tisbury Great Pond.	

AMEC Earth & Environmental, Inc.
Photographic Record

Customer:	**U.S Army Corps of Engineers**	**Project Number:**	**56291000**
Site Name:	**RI/FS Martha's Vineyard**	**Site Location:**	**Martha's Vineyard, MA**

Photographer:
D. Sharp

Date:
10-19-2011

Direction:
NA

Comments:
Sediment sample from Tisbury Great Pond.

Photographer:
N. Barnes

Date:
10-19-2011

Direction:
NA

Comments:
Sediment sample from Tisbury Great Pond.

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APPENDIX J

MEC HA TABLES

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Site ID: **FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of Investigation)**
Date: **7/30/2013**

Activities Currently Occurring at the Site

Activity No.	Activity	Number of people per year who participate in the activity	Number of hours per year a single person spends on the activity	Potential Contact Time (receptor hours/year)	Maximum intrusive depth (ft)	Comments
1	Hiking, Biking, Recreational Activities	25,000	6	**150,000**	1	25,000 registered guests per year (TToR Records), 6 hours per trip
2	Residential	150	5,840	**876,000**	4	16 hours per day, year round
3	TTOR Maintenance	4	390	**1,560**	2	
4						
5						
6						
7						
8						
9						
10						
11						
12						

Total Potential Contact Time (receptor hrs/yr): **1,027,560**

Maximum intrusive depth at site (ft): **4**

Reference(s) for table above:

ASR

MEC HA Summary Information

		Comments
Site ID:	FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of Investigation)	
Date:	7/30/2013	

Please identify the single specific area to be assessed in this hazard assessment. From this point forward, all references to "site" or "MRS" refer to the specific area that you have defined.

A. Enter a unique identifier for the site:

	Comments
Former Tisbury Great Pond Bomb Target, Land/Beach Areas	MEC HA does not include underwater areas (inland water and ocean)

Provide a list of information sources used for this hazard assessment. As you are completing the worksheets, use the "Select Ref(s)" buttons at the ends of each subsection to select the applicable information sources from the list below.

Ref. No.	Title (include version, publication date)	Comments
1	United States Army Corps of Engineers (USACE), 1999. *Final, Archives Search Report for the former Tisbury Great Pond, Martha's Vineyard Massachusetts* . November.	
2	USACE, 2008. Final, Site Inspection Report For Tisbury Great Pond. September.	
3	*Explosives Site Plan, Correction 1, Remedial Investigation/Feasibility Study, Former Cape Poge Little Neck Bomb Target Site, Former Moving Target Machine Gun Range, Tisbury Great Pond, Martha's Vineyard, Massachusetts, D01MA0595* . USAECH, 2010.	
4	*Final Revision 3, Remedial Investigation Work Plan: Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts* . UXB, 2011.	
5	AAR, Emergency Response (Between 19 August 2009 and 13 July 2011, VHR responded to three emergency calls and US Navy EOD responded to a fourth associated with potential ordnance)	

B. Briefly describe the site:

1. Area (include units):	Total area is 768.3 acres of which 259.6 is land/beach, and the balance is inland water/ocean surfzone	The FUDS boundary was expanded based upon previously identified MEC and/or MD.
2. Past munitions-related use:		
Target Area		
3. Current land-use activities (list all that occur):		
Hiking, biking, recreational activities, residential, and TTOR maintenance		
4. Are changes to the future land-use planned?	No	
5. What is the basis for the site boundaries?		
The expanded Area of Investigation boundary was based upon previously identified MEC and/or MD.		
6. How certain are the site boundaries?		
Site boundaries can be reduced based on RI field work, but the vicinity of target areas has documented contamination.		
Reference(s) for Part B:		

United States Army Corps of Engineers (USACE), 1999. Final, Archives Search Report for the former Tisbury Great Pond, Martha's Vineyard Massachusetts. November.

[redacted]

C. Historical Clearances

1. Have there been any historical clearances at the site?	Yes, subsurface clearance
2. If a clearance occurred:	
a. What year was the clearance performed?	2009-2011

b. Provide a description of the clearance activity (e.g., extent, depth, amount of munitions-related items removed, types and sizes of removed items, and whether metal detectors were used):

UXO Emergency Response by VRHabilis and US Navy EOD between August 2009 and July 2011. Items recovered included a suspect HE bomb (BIP) and miscellaneous items of MD removed/recyled.

Reference(s) for Part C:

AAR, UXO Emergency Resopnse, VRHabilis, 2009-2011

D. Attach maps of the site below (select 'Insert/Picture' on the menu bar.)

Site ID: **FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of Investigation)**
Date: **7/30/2013**

Cased Munitions Information

Item No.	Munition Type (e.g., mortar, projectile, etc.)	Munition Size	Munition Size Units	Mark/ Model	Energetic Material Type	Is Munition Fuzed?	Fuzing Type	Fuze Condition	Minimum Depth for Munition (ft)	Location of Munitions	Comments (include rationale for munitions that are "subsurface only")
1	Bombs	3	lb	AN-MK23	Spotting Charge	No			0	Subsurface Only	From RI investigation
2	Bombs	100	lb	Unknown	High Explosive	Yes	UNK	UNK	0	Subsurface Only	From UXO Emergency Response

Reference(s) for table above:

AAR, UXO Emergency Response, VRHabilis, US Navy EOD, 2009-2011;
Final Revision 3, Remedial Investigation Work Plan: Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts. UXB, 2011.

[redacted]

Bulk Explosive Information

Item No.	Explosive Type	Comments
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Reference(s) for table above:

Site ID: **FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of Investigation)**
Date: **7/30/2013**

Energetic Material Type Input Factor Categories

The following table is used to determine scores associated with the energetic materials. Materials are listed in order from most hazardous to least hazardous.

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
High Explosive and Low Explosive Filler in Fragmenting Rounds	100	100	100
White Phosphorus	70	70	70
Pyrotechnic	60	60	60
Propellant	50	50	50
Spotting Charge	40	40	40
Incendiary	30	30	30

The most hazardous type of energetic material listed in the 'Munitions, Bulk Explosive Info' Worksheet falls under the category 'High Explosive and Low Explosive Filler in Fragmenting Rounds'.

	Score
Baseline Conditions:	**100**
Surface Cleanup:	**100**
Subsurface Cleanup:	**100**

Comments

Location of Additional Human Receptors Input Factor Categories

1. What is the Explosive Safety Quantity Distance (ESQD) from the Explosive Siting Plan or the Explosive Safety Submission for the MRS? 6 feet — non-fragmenting round - K40 uesed

2. Are there currently any features or facilities where people may congregate within the MRS, or within the ESQD arc? Yes

3. Please describe the facility or feature.

Residential, TTOR land, Cape Poge Lighthouse

MEC Item(s) used to calculate the ESQD for current use activities

Item #1. Bombs (3lb, Spotting Charge)
Item #2. Bombs (3lb, Spotting Charge)

[redacted]

The following table is used to determine scores associated with the location of additional human receptors (current use activities):

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Inside the MRS or inside the ESQD arc	30	30	30
Outside of the ESQD arc	0	0	0

4. Current use activities are 'Inside the MRS or inside the ESQD arc', based on Question 2.' ***Score***

Baseline Conditions:	**30**
Surface Cleanup:	**30**
Subsurface Cleanup:	**30**

5. Are there future plans to locate or construct features or facilities where people may congregate within the MRS, or within the ESQD arc?

6. Please describe the facility or feature.

MEC Item(s) used to calculate the ESQD for future use activities

[redacted]

The following table is used to determine scores associated with the location of additional human receptors (future use activities):

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Inside the MRS or inside the ESQD arc	30	30	30
Outside of the ESQD arc	0	0	0

7. Please answer Question 5 above to determine the scores. ***Score***

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Site Accessibility Input Factor Categories

The following table is used to determine scores associated with site accessibility:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Full Accessibility	No barriers to entry, including signage but no fencing	80	80	80
Moderate Accessibility	Some barriers to entry, such as barbed wire fencing or rough terrain	55	55	55
Limited Accessibility	Significant barriers to entry, such as unguarded chain link fence or requirements for special transportation to reach the site	15	15	15
Very Limited Accessibility	A site with guarded chain link fence or terrain that requires special equipment and skills (e.g., rock climbing) to access	5	5	5

Current Use Activities ***Score***

Select the category that best describes the site accessibility under the current use scenario:

Full Accessibility

	Score
Baseline Conditions:	**80**
Surface Cleanup:	**80**
Subsurface Cleanup:	**80**

Future Use Activities

Select the category that best describes the site accessibility under the future use scenario:

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

Reference(s) for above information:

Response Alternative No. 6:

Please enter site accessibility information in the 'Planned Remedial or Removal Actions' Worksheet to continue.

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Potential Contact Hours Input Factor Categories

The following table is used to determine scores associated with the total potential contact time:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Many Hours	≥1,000,000 receptor-hrs/yr	120	90	30
Some Hours	100,000 to 999,999 receptor hrs/yr	70	50	20
Few Hours	10,000 to 99,999 receptor-hrs/yr	40	20	10
Very Few Hours	<10,000 receptor-hrs/yr	15	10	5

Current Use Activities :

Input factors are only determined for baseline conditions for current use activities. Based on the 'Current and Future Activities' Worksheet, the Total Potential Contact Time is: **1,027,560** receptor hrs/yr

Based on the table above, this corresponds to a input factor score for baseline conditions of: **120** Score

Future Use Activities :

Input factors are only determined for baseline conditions for future use activities. Based on the 'Current and Future Activities' Worksheet, the Total Potential Contact Time is: receptor hrs/yr

Based on the table above, this corresponds to a input factor score of: Score

Response Alternative No. 5:

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

Total Potential Contact Time

Based on the table above, this corresponds to input factor scores of: **Score**

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

Response Alternative No. 6:

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

Total Potential Contact Time

Based on the table above, this corresponds to input factor scores of: **Score**

Baseline Conditions:

Surface Cleanup:

Subsurface Cleanup:

Amount of MEC Input Factor Categories

The following table is used to determine scores associated with the Amount of MEC:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Target Area	Areas at which munitions fire was directed	180	120	30
OB/OD Area	Sites where munitions were disposed of by open burn or open detonation methods. This category refers to the core activity area of an OB/OD area. See the "Safety Buffer Areas" category for safety fans and kick-outs.	180	110	30

Function Test Range	Areas where the serviceability of stored munitions or weapons systems are tested. Testing may include components, partial functioning or complete functioning of stockpile or developmental items.	165	90	25
Burial Pit	The location of a burial of large quantities of MEC items.	140	140	10
Maneuver Areas	Areas used for conducting military exercises in a simulated conflict area or war zone	115	15	5
Firing Points	The location from which a projectile, grenade, ground signal, rocket, guided missile, or other device is to be ignited, propelled, or released.	75	10	5
Safety Buffer Areas	Areas outside of target areas, test ranges, or OB/OD areas that were designed to act as a safety zone to contain munitions that do not hit targets or to contain kick-outs from OB/OD areas.	30	10	5
Storage	Any facility used for the storage of military munitions, such as earth-covered magazines, above-ground magazines, and open-air storage areas.	25	10	5
Explosive-Related Industrial Facility	Former munitions manufacturing or demilitarization sites and TNT production plants	20	10	5

Select the category that best describes the ***most hazardous*** amount of MEC: ***Score***

Target Area

Baseline Conditions:	**180**
Surface Cleanup:	**120**
Subsurface Cleanup:	**30**

Minimum MEC Depth Relative to the Maximum Intrusive Depth Input Factor Categories

Current Use Activities

The shallowest minimum MEC depth, based on the 'Cased Munitions Information' Worksheet:	**0**	ft
The deepest intrusive depth:	**4**	ft

The table below is used to determine scores associated with the minimum MEC depth relative to the maximum intrusive depth:

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240	150	95
Baseline Condition: MEC located surface and subsurface, After Cleanup: Intrusive depth does not overlap with subsurface MEC.	240	50	25
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth overlaps with minimum MEC depth.	150	N/A	95
Baseline Condition: MEC located only subsurface. Baseline Condition or After Cleanup: Intrusive depth does not overlap with minimum MEC depth.	50	N/A	25

Because the shallowest minimum MEC depth is less than or equal to the deepest intrusive depth, the intrusive depth will overlap after cleanup. MECs are located at both the surface and subsurface, based on the 'Munitions, Bulk Explosive Info' Worksheet. Therefore, the category for this input factor is 'Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.' For 'Current Use Activities', only Baseline Conditions are considered.

240 ***Score***

Future Use Activities

Deepest intrusive depth: ft

Not enough information has been entered to determine the input factor category.

Score

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Response Alternative No. 6:

Expected minimum MEC depth (from the 'Planned Remedial or Removal Actions' Worksheet): ft

Not enough information has been entered in the 'Planned Remedial or Removal Actions' Worksheet. Please complete the table before returning to this section.

Maximum Intrusive Depth ft

Not enough information has been entered to calculate this input factor.

Score

Baseline Conditions:
Surface Cleanup:
Subsurface Cleanup:

Migration Potential Input Factor Categories

Is there any physical or historical evidence that indicates it is possible for natural physical forces in the area (e.g., frost heave, erosion) to expose subsurface MEC items, or move surface or subsurface MEC items? Yes

If "yes", describe the nature of natural forces. Indicate key areas of potential migration (e.g., overland water flow) on a map as appropriate (attach a map to the bottom of this sheet, or as a separate worksheet).

Erosion is most critical

The following table is used to determine scores associated with the migration potential:

	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Possible	30	30	10
Unlikely	10	10	10

Based on the question above, migration potential is 'Possible.' ***Score***

Baseline Conditions: **30**
Surface Cleanup: **30**
Subsurface Cleanup: **10**

Reference(s) for above information:

Draft Preliminary Assessment, Cape Poge Little Neck Bomb Target Site, Chappaquiddick Island, MA, FUDS Property Number - D01MA0595. USACE, 2009.
Final Revision 3, Remedial Investigation Work Plan: Former Cape Poge Little Neck Bomb Target MRS, Former Moving Target Machine Gun Range at South Beach MRS, Tisbury Great Pond MRS, Martha's Vineyard, Massachusetts. UXB, 2011.

MEC Classification Input Factor Categories

Cased munitions information has been inputed into the 'Munitions, Bulk Explosive Info' Worksheet; therefore, bulk explosives do not comprise all MECs for this MRS.

The 'Amount of MEC' category is 'Target Area'. It cannot be automatically assumed that the MEC items from this category are DMM. Therefore, the conservative assumption is that the MEC items in this MRS are UXO.

Has a technical assessment shown that MEC in the OB/OD Area is DMM?

Are any of the munitions listed in the 'Munitions, Bulk Explosive Info' Worksheet: No

· Submunitions
· Rifle-propelled 40mm projectiles (often called 40mm grenades)
· Munitions with white phosphorus filler
· High explosive anti-tank (HEAT) rounds
· Hand grenades
· Fuzes
· Mortars

At least one item listed in the 'Munitions, Bulk Explosive Info' Worksheet was identified as 'fuzed'.

The following table is used to determine scores associated with MEC classification categories:

UXO	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
UXO Special Case	180	180	180
UXO	110	110	110
Fuzed DMM Special Case	105	105	105
Fuzed DMM	55	55	55
Unfuzed DMM	45	45	45
Bulk Explosives	45	45	45

Based on your answers above, the MEC classification is 'UXO'.

	Score
Baseline Conditions:	**110**
Surface Cleanup:	**110**
Subsurface Cleanup:	**110**

MEC Size Input Factor Categories

The following table is used to determine scores associated with MEC Size:

	Description	Baseline Conditions	Surface Cleanup	Subsurface Cleanup
Small	Any munitions (from the 'Munitions, Bulk Explosive Info' Worksheet) weigh less than 90 lbs; small enough for a receptor to be able to move and initiate a detonation	40	40	40
Large	All munitions weigh more than 90 lbs; too large to move without equipment	0	0	0

Based on the definitions above and the types of munitions at the site (see 'Munitions, Bulk Explosive Info' Worksheet), the MEC Size Input Factor is: Small

	Score
Baseline Conditions:	**40**
Surface Cleanup:	**40**
Subsurface Cleanup:	**40**

Scoring Summary

Site ID:	FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of Investigation)	a. Scoring Summary for Current Use Activities	
Date:	7/30/2013	Response Action Cleanup:	Respo
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	100
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	30
III. Site Accessibility		Full Accessibility	80
IV. Potential Contact Hours		≥1,000,000 receptor-hrs/yr	120
V. Amount of MEC		Target Area	180
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth		Baseline Condition: MEC located surface and subsurface. After Cleanup: Intrusive depth overlaps with subsurface MEC.	240
VII. Migration Potential		Possible	30
VIII. MEC Classification		UXO	110
IX. MEC Size		Small	40
		Total Score	930
		Hazard Level Category	1

Site ID:	FUDS No. D01MA0453 (Former T	b. Scoring Summary for Future Use Activities	
Date:	7/30/2013	Response Action Cleanup:	Respo
Input Factor		Input Factor Category	Score
I. Energetic Material Type			
II. Location of Additional Human Receptors			
III. Site Accessibility			
IV. Potential Contact Hours			
V. Amount of MEC			
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth			
VII. Migration Potential			
VIII. MEC Classification			
IX. MEC Size			
		Total Score	
		Hazard Level Category	

Site ID:	FUDS No. D01MA0453 (Former T	c. Scoring Summary for Response Alternative 1:	
Date:	7/30/2013	Response Action Cleanup:	
Input Factor		Input Factor Category	Score
I. Energetic Material Type		High Explosive and Low Explosive Filler in Fragmenting Rounds	
II. Location of Additional Human Receptors		Inside the MRS or inside the ESQD arc	
III. Site Accessibility			
IV. Potential Contact Hours			
V. Amount of MEC		Target Area	
VI. Minimum MEC Depth Relative to Maximum Intrusive Depth			
VII. Migration Potential		Possible	
VIII. MEC Classification		UXO	
IX. MEC Size		Small	
		Total Score	
		Hazard Level Category	

MEC HA Hazard Level Determination			
Site ID:	FUDS No. D01MA0453 (Former Tisbury Great Pond Bomb Target Area of		
Date:	7/30/2013		
		Hazard Level Category	Score
a. Current Use Activities		1	930
b. Future Use Activities			
c. Response Alternative 1:			
d. Response Alternative 2:			
e. Response Alternative 3:			
f. Response Alternative 4:			
g. Response Alternative 5:			
h. Response Alternative 6:			

Characteristics of the MRS	
Is critical infrastructure located within the MRS or within the ESQD arc?	Yes
Are cultural resources located within the MRS or within the ESQD arc?	Yes
Are significant ecological resources located within the MRS or within the ESQD arc?	Yes

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