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FINAL SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM EXPANDED SITE INSPECTION FOR FLEMING KEY DREDGE SPOIL AREA NAS KEY WEST FL

3/4/2013

RESOLUTION CONSULTANTS

Cover Page

Final
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
04-March-2013

for

Munitions Response Program
Expanded Site Inspection
Fleming Key Dredge Spoil Area
Naval Air Station Key West
Key West, Florida

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Southeast
NAS Jacksonville
Jacksonville, Florida 32212

Prepared by:

Resolution Consultants
A Joint Venture of AECOM & EnSafe
1500 Wells Fargo Building
440 Monticello Avenue
Norfolk, Virginia 23510

Prepared under:

Contract Number: N62470-11-D-8013
CTO JM20

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EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP) addresses the expanded Munitions Response Program (MRP) Site Inspection (SI) at the Fleming Key Dredge Spoil Area Munitions Response Site (MRS) located at Naval Air Station (NAS) Key West, Key West, Florida. The Fleming Key Dredge Spoil Area is a 42-acre site located north of the City of Key West in Monroe County, Florida. Fleming Key was originally created as a dredge spoil island prior to World War II and was used as a munitions storage area as early as 1942. This area was used for munitions storage in the past and nine closed magazines remain at the site. The dredge spoils placed at the site in 2003 through 2004 comprise a majority of the site. These spoils consist of an approximately 27-acre relatively flat, well-compacted mound that is 10 feet higher than the surrounding spoils used to form Fleming Key. To determine the current risks associated with the dredge spoils, two phases of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process have been completed thus far: **1)** the initial phase was the Preliminary Assessment (PA) followed by the **2)** the limited Site Inspection (SI). The PA {***December 2010, Malcolm Pirnie Inc. and Osage of Virginia Inc.***} identified the Dredge Spoil Area for further investigation for MEC, while the SI {***April 2012, Tetra Tech NUS***} was conducted to determine whether further response actions are appropriate for the restoration of the site to an acceptable environmental condition. The SI considered the background information provided in the PA and collected supplemental environmental data to determine types and rough orders of magnitude quantities of Munitions and Explosive of Concern (MEC) present.

As a result of the PA/SI's conducted, two maps are provided which summarize the results. **Figure ES-1** shows the location map of the Fleming Key Dredge Spoils Area project site (as indicated by the **red lines**), relative to NAS Key West Trumbo Point Gate Entrance and the town of Key West, both located to the south of the site and labeled in black lettering. **Figure ES-2** shows the location map of Historically Relevant Background Information for the Fleming Key Dredge Spoils Area project site, inclusive of the MRP boundary site (as introduced by Malcolm Pirnie in 2010), the dredge spoils pile boundary (as detailed by Tetra Tech NUS in 2012), the locked fence installation boundary (as referenced by Malcolm Pirnie in 2010), and the surface finds (as summarized by Tetra Tech NUS in 2012), as indicated by the **red lines**, **green lines**, **blue lines**, and **green dots**, respectively. The results of the PA/SI efforts, as shown on the maps, are text summarized in the following two paragraphs.

The results of the limited SI at the Fleming Key Dredge Spoil Area found no surface MEC or MPPEH during an Instrument-Aided Visual Survey (IAVS); however, high counts of shallow subsurface anomalies were found across the site potentially representing MEC/MPPEH or other debris. During the IAVS field activities Tetra Tech NUS did find and document the locations of MD (i.e. seven 20mm casings, four casings ranging between 0.30 to 0.762 calibers, one 75mm x 11in unknown munitions related item) related to the dredge spoils and CD (e.g. manhole covers, EOD magazines, fences, etc.) related to the installation infrastructure. Additionally, the SI referenced the following items were found in the waters near NAS Key West (in the first two cases) or on the surface of dredge spoils of Fleming Key (in the third case of documented items) prior to the initial SI:

1. 7.2 inch Hedgehog rocket and 76mm artillery projectile found during the initial dredge screening documented within an incident memorandum after proper disposal {***August 2004, EOD 8027 via EODMU Six DET Mayport***};

2. M6 underwater mine recovered and stored in the inert building with no incident report documentation regarding the location or timeframe of the find {***February 2009, NOSSA***};

3. Expended munitions cartridges (e.g. 20mm casings, small arms), cables, steel piping, and other items ranging from 1-2 inches to 4 feet in length {***February 2009, NOSSA***}

Observations from a recent site visit {***July 2012, Resolution Consultants***} conducted with NAS Key West and NAS Jacksonville management confirm the similar visual findings on the surface (i.e. MD and CD ranging in size between a few inches to 4 feet) as those documented historically. Additional details of the recently combined site visit and scoping meeting are provided as a part of **Worksheet #9**.

An outcome from the SI results at the Dredge Spoils Area, the following recommendations were made by Tetra Tech NUS (TTNUS) and subsequently approved by NAVFAC SE with regulatory oversight consent:

- ✓ Utilization of statistical techniques (e.g., Visual Sample Plan, UXO Estimator, etc.) to define the quantity and distribution of transect (and/or grid) sampling;
- ✓ Non-invasive subsurface investigation using Digital Geophysical Mapping (DGM) techniques;
- ✓ Utilization of statistical (e.g., Visual Sample Plan, UXO Estimator, etc.) to define the quantity and distribution of intrusive investigation sampling for Munitions and Explosives of Concern (MEC);
- ✓ Munitions Constituents (MC) sampled based on the results from the DGM and MEC sampling.

After preliminary scoping discussions with NAVFAC SE, Resolution Consultants had proposed {***April 2012, Resolution Consultants***} to conduct only non-invasive techniques for the Expanded SI (ESI) stage and reserve any prospective intrusive investigation techniques (e.g. MEC, MC sampling) for the potential Interim Removal Action (IRA), Remedial Investigation (RI), and/or Removal Action (RA) phases to follow. Eliminating invasive investigations also reduced the Explosive Safety Submission (ESS) requirements to a Determination Request (ESS-DR). The proposed non-invasive techniques included the following: Anomaly Avoidance, a real-time version of IAVS, to be conducted to locate, mark, document, and ultimately avoid potential hazardous locations using visual cues and Analogue Geophysical Mapping (AGM) hand-held detectors (e.g., Schonstedt, White Instruments') as guides; standard DGM techniques (e.g., EM61, EM31) to capture anomaly distributions along transects and within grids down to detection depth; and emerging Three-Dimensional (3-D) Cued Interrogation (CI) technology (e.g., 2x2-TemTads, MetalMapper) to assess the subsurface for MEC at peak anomaly locations identified within grids.

Finally, based on the recommendations detailed within the initial SI document {***April 2012, Tetra Tech NUS***}, the follow-on guidance provided within Statement of Work (SOW) {***March 2012, NAFVAC SE***}, and the proposal summary introduced in the previously, Resolution Consultants plans to conduct an ESI conforming to the following **six** scoped tasks with associated goals:

1. **TASK 1 – Project Planning (PP):** consists of sub-tasks to complete project planning meetings and planning documents, inclusive of the current SAP with the associated HASP and ESS-DR planning documents, all of which have the associated goal of adequately and safely sampling the site through non-invasive (e.g. Anomaly Avoidance, DGM, etc.) sampling procedures.

2. **TASK 2 – Field Investigation (FI):** consists of subtasks of Project Startup, Anomaly Avoidance, Vegetation Management, Survey Management, Geophysics Management (i.e. DGM, Anomaly Pin-Pointing, 3-D CI, etc.), and Project Closeout, all of which combined have the associated goal of using statistically guided non-invasive sampling techniques to assess the surface (i.e. Anomaly Avoidance conducted with UXO Tech escorts starting with the Vegetation Management subtask) and subsurface (i.e. DGM, 3-D CI, etc.) for the estimated quantity, size, and distribution of MEC.

3. **TASK 3 – Expanded Site Investigation Report (SI):** consists of subtasks to complete the summarization of the assessment of the site to this juncture of the project, inclusive of a Risk Assessment and SI Report, both of which have the goal of summarizing the non-invasive sampling estimates of MEC and the correlating the risks associated with the estimates.

4. **TASK 5 – Database Management (DM):** consists of a task to import and store the data acquired during the expanded SI with the goal of generating Geographic Information System (GIS) maps for the SI report from the previous task and exporting data for the AR in the subsequent task.

5. **TASK 6 – Administrative Record (AR) Updates:** consists of a task to update the AR with the FI data and ESI report information, inclusive of DM and GIS exports.

6. **TASK 7 – Ordnance (XO):** consists of subtasks to update the Munitions Response Sites Priority Protocol (MRSPP) scores, revise the ESS-DR, and prepare an IRA WP with a full ESS with the ultimate goals of each subtask tailored to focus the removal of MEC at the Fleming Key site.

The primary objective, and ultimate goal, of this ESI is to determine whether further response actions, IRAs, RIs, or RAs are appropriate for the Fleming Key site based on capturing the supplemental information introduced as Task 2 – FI, above, and to determine MRSPP scoring for the remaining 13 sites identified in the PA to restore the sites to an acceptable environmental condition. The ESI considers the background information provided in the PA and the limited SI along with the supplemental site-specific environmental data captured in the ESI field efforts to determine types and rough orders of magnitude quantities of MEC present.

This SAP for the ESI describes the MEC investigation and is designed to be "stand alone" document that includes all information necessary to perform the inspection. This MEC SAP has been prepared in accordance with Department of Defense (DoD) requirements for developing SAPs for the management of environmental data collection and use, as described in the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* {***2005, U.S. EPA***} and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* {***2002, U.S. EPA***}.

DoD has issued a series of 37 worksheets, which are to be utilized in the development of UFP-SAPs. The UFP-SAP worksheets were developed for the collection and evaluation of chemical concentration data in environmental media. These worksheets were not initially designed for the collection of geophysical data for assessing MEC content. The Navy MRP Workgroup has modified the UFP-SAP worksheets to be applicable to MEC investigations. These modified worksheets have been used in the preparation of this MEC SAP, and include **29/37 worksheets**, those not applicable are marked as 'Not Applicable (NA)'.

The information provided in the worksheets was based on the results of project team scoping meetings and a NAS Key West Partnering Meeting. Attendees included representatives of the Navy, Florida Department of Environmental Protection (FDEP), and Resolution Consultants (see Worksheet #9 for attendees). Worksheet #10 contains summaries of the site-specific Conceptual Site Model (CSM) for the site and the problem statement. The CSM was used as the basis for the development of the project specific data quality objectives (DQOs), which are contained in Worksheet #11. The remaining worksheets introduce the field implementation and quality evaluation procedures, inclusive DQO metric requirements specific to the individual FI subtask, or Definable Features of Work (DFWs). Lastly, contained within the worksheet introductions to follow are references to regimented Standard Operating Procedures (SOPs) which provide further details of required methods of how to conduct, monitor, and/or manage each field task, or DFW, based on standard methods used in the industry today.

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ACRONYMS & ABBREVIATIONS

3-D	Three-Dimensional
AGM	Analogue Geophysical Mapping
AM	Ante Meridiem
APP	Accident Prevention Plan
AR	Administrative Record
ASTM	American Society for Standards and Materials
B.S.	Bachelor of Science
CAR	Corrective Action Report
CD	Cultural Debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CI	Cued-Interrogation
CSM	Conceptual Site Model
CTO	Contract Task Order
CWA	Clean Water Act
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DFW	Definable Feature of Work
DGM	Digital Geophysical Mapping
DGPS	Differential Global Positioning System
DID	Data Item Description
DM	Database Management
DQO	Data Quality Objective
EP	Engineering Pamphlet
EPA	Environmental Protection Agency
ESI	Expanded Site Inspection
ESO	Explosives Safety Officer
ESQD	Explosives Safety Quantity Distance
ESS	Explosives Safety Submission
ESS-DR	Explosives Safety Submission - Determination Request
ESTCP	Environmental Security Technology Certification Program
FDEP	Florida Department of Environmental Protection
FI	Field Investigation
FS	Feasibility Study
ft	foot or feet in length
FTMR	Field Task Modification Request
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health & Safety Plan
HSM	Health & Safety Manager
IAVS	Instrument-Aided Visual-Survey
in	inches in length
IRA	Interim Removal Action
ISO	Industry Standard Object
IVS	Instrument Verification Strip
m, mm	meters, millimeters (1/1000 of meter) in length
MC	Munitions Constituent
MEC	Munitions and Explosives of Concern
MD	Munitions Debris
MMRP	Military Munitions Response Program
MPPEH	Munitions Potentially Presenting an Explosive Hazard
MRP	Munitions Response Program
MRS	Munitions Response Site

M.S.	Master of Science
NA	Not Applicable
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NCR	Non-Conformance Report
NFA	No Further Action
NOSSA	Naval Ordnance Safety and Security Activity
NPL	National Priorities List
NRL	Naval Research Laboratory
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PDF	Portable Document Format
PE	Professional Engineer
PG	Professional Geologist
PGp	Professional Geophysicist
PM	Post Meridiem
PM	Project Manager
PP	Project Planning
POC	Point of Contact
PQOs	Project Quality Objectives
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RA	Removal Action
RI	Remedial Investigation
RLS	Registered Land Surveyor
RPM	Remedial Project Manager
RTK-DGPS	Real-Time-Kinematic Differential Global Positioning System
RTS	Robotic Total Station
SAP	Sampling and Analysis Plan
SE	South East
SERDP	Strategic Environmental Research & Development Program
SI	Site Inspection, limited Site Inspection
SOP	Standard Operating Procedure
SOW	Scope of Work, Statement of Work
SUXOS	Senior Unexploded Ordnance Supervisor
TAV	Technical Assistance Visit
TBD	To Be Determined
TP-18	Technical Publication – 18
TTNUS	Tetra Tech NUS, Inc.
UFP	Uniform Federal Policy
UFP-QAPP	Uniform Federal Policy – Quality Assurance (Project) Plans
UFP-SAP	Uniform Federal Policy – Sampling & Analysis Plan
UXO	Unexploded Ordnance
UXOEST	UXO Estimator
UXOSO	Unexploded Ordnance Safety Officer
UXOQCS	Unexploded Ordnance Quality Control Specialist
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VSP	Visual Sample Plan
WS	Worksheet

SAP WORKSHEETS

LIST OF FIGURES

LIST OF ATTACHMENTS

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SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

Final
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
04-March-2013
for
Munitions Response Program
Expanded Site Inspection
Fleming Key Dredge Spoil Area
Naval Air Station Key West
Key West, Florida

Prepared for:
Department of the Navy
Naval Facilities Engineering Command, Southeast
NAS Jacksonville
Jacksonville, Florida 32212

Prepared by:
Resolution Consultants
A Joint Venture of AECOM & EnSafe
1500 Wells Fargo Building
440 Monticello Avenue
Norfolk, Virginia 23510

Prepared under:
Contract Number: N62470-11-D-8013
CTO JM20

Review Signatures:

Contractor Project Manager
Todd Haverkost
Resolution Consultants

Todd Haverkost
Digitally signed by Todd Haverkost
DN: cn=Todd Haverkost, o, ou=Resolution Consultants, email=thaverkost@ensafe.com, c=US
Date: 2013.02.28 08:24:27 -06'00'

Signature Date

Contractor Quality Assurance Manager
Mike Ervine
Resolution Consultants

02-28-13

Signature Date

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

Internal Draft
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
17-August-2012
for
Munitions Response Program
Expanded Site Inspection
Fleming Key Dredge Spoil Area
Naval Air Station Key West
Key West, Florida

Prepared for:
Department of the Navy
Naval Facilities Engineering Command, Southeast
NAS Jacksonville
Jacksonville, Florida 32212

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Resolution Consultants
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1500 Wells Fargo Building
440 Monticello Avenue
Norfolk, Virginia 23510

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Contract Number: N62470-11-D-8013
CTO JM20

Review Signatures:

Contractor Project Manager
Todd Haverkost
Resolution Consultants

Todd Haverkost — Digitally signed by Todd Haverkost, DN: cn=Todd Haverkost, o=Resolution Consultants, ou=Task Order Manager, email=thaverkost@ensafe.com, c=US, Date: 2012.12.03 12:50:50 -06'00'

Signature — Date

Contractor Quality Assurance Manager
Mike Ervine
Resolution Consultants

12-3-2012

Signature — Date

Approval Signatures:

Navy Remedial Project Manager
Brian Syme
NAVFAC SE

SYME.BRIAN.JASON.1108719792 — Digitally signed by SYME.BRIAN.JASON.1108719792, DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=SYME.BRIAN.JASON.1108719792, Date: 2012.12.03 13:12:30 -05'00'

Signature — Date

NAVFAC Quality Assurance Officer
Michael Green
NAVFAC LANT

GREEN.MICHAEL.DAVID.1042977876 — Digitally signed by GREEN.MICHAEL.DAVID.1042977876, DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=GREEN.MICHAEL.DAVID.1042977876, Date: 2012.12.03 13:30:05 -05'00'

Signature — Date

Tracie Bolaños
Florida Department of Environmental Protection

Tracie L Bolaños

Signature — Date

2/7/13

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Naval Air Station (NAS) Key West
Operable Unit: Fleming Key Dredge Spoil Area
Contractor Name: Resolution Consultants
Contract Number: N62470-11-D-8013
Contract Title: Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number: Contract Task Order (CTO) JM20

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (U.S. EPA 2005) and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (U.S. EPA 2002)*.

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Kickoff Meeting/Site Visit	July 13 and 16-19, 2012

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Preliminary Assessment	December 2010
Site Inspection	April 2012

6. List organizational partners (stakeholders) and connection with lead organization:

Naval Facilities Engineering Command Southeast (NAVFAC SE) – Property Owner
Florida Department of Environmental Protection (FDEP) – Regulatory Oversight
United States Environmental Protection Agency (USEPA) – Regulatory Stakeholder

7. Lead organization (see **Worksheet #7** for detailed list of data users)

NAVFAC SE

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

All worksheets were retained in the SAP either as full detailed sections or as placeholder sections with a Not Applicable (NA) footnote for document consistency purposes between projects. Worksheets that are not used and the reason why are noted in the below table.

Detailed Listing of UFP-SAP Worksheet Requirements for Fleming Key Dredge Spoils Area Expanded Site Inspection		
UFP-SAP Worksheet #	**Required Information**	**Included or Excluded**
A. PROJECT MANAGEMENT		
Documentation		
1	Title and Approval Page	**Included**
2	Table of Contents SAP Identifying Information	**Included**
3	Distribution List	**Included**
4	Project Personnel Sign-Off Sheet	**Included**
Project Organization		
5	Project Organizational Chart	**Included**
6	Communication Pathways	**Included**
7	Personnel Responsibilities and Qualifications Table	**Included**
8	Special Personnel Training Requirements Table	**Included**
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	**Included**
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	**Included**
11	Site-Specific Project Quality Objectives	**Included**
12	Measurement Performance Criteria Table	**Included**
13	Sources of Secondary Use Data and Information Secondary Use of Data Criteria and Limitations Table	**Included**
14	Summary of Project Tasks	**Included**
15	Reference Limits and Evaluation Table	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
16	Project Schedule/Timeline Table	**Included**
B. MEASUREMENT DATA ACQUISITION		
Sampling Tasks		
17	Sampling Design and Rationale	**Included**
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	**Included**
19	Analytical Methods/SOP Requirements Table	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
20	Field Quality Control Sample Summary Table	**Included**
21	Project Sampling SOP References Table Sampling SOPs	**Included**
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	**Included**
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
24	Analytical Instrument Calibration Table	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site**

Detailed Listing of UFP-SAP Worksheet Requirements for Fleming Key Dredge Spoils Area Expanded Site Inspection		
UFP-SAP Worksheet #	**Required Information**	**Included or Excluded**
		Inspection.
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
Quality Control Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
Data Management Tasks		
29	Project Documents and Records Table	**Included**
30	Analytical Services Table Analytical and Data Management SOPs	**Excluded – NA, as no samples are proposed for collection & analysis during the Expanded Site Inspection.**
C. ASSESSMENT OVERSIGHT		
31	Planned Project Assessments Table Audit Checklists	**Included**
32	Assessment Findings and Corrective Action Responses Table	**Included**
33	QA Management Reports Table	**Included**
D. DATA REVIEW		
34	Verification (Step I) Process Table	**Included**
35	Validation (Steps IIa and IIb) Process Table	**Included**
36	Validation (Steps IIa and IIb) Summary Table	**Included**
37	Usability Assessment	**Included**

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Certification that project personnel have read the text will be obtained by one of the following three methods as applicable:

1. In the case of regulatory agency personnel with oversight authority approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of the approval letters/e-mails will be retained in project files and listed in **Worksheet #29** as project records.

2. E-mails will be sent to Navy, Resolutions Consultants, and subcontractor project personnel whom will be requested to verify by e-mail that they have read the applicable SAP/sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project fields and identified in **Worksheet #29**.

3. A copy of the signed **Worksheet #4** will be retained in the project files as a project document in **Worksheet #29**.

Distribution List for the Fleming Key Dredge Spoils Area Site

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	Document Control # (Optional)
Brian Syme	NAVFAC SE Remedial Project Manager (RPM)	NAVFAC SE	(904) 542-6151	brian.syme1@navy.mil	NA
Edward Barham	NAS Key West Point of Contact (POC)/ Environmental Program Director	NAS Key West	(305) 293-2911	edward.barham@navy.mil	NA
Michael Green (electronic upload)	NAVFAC MRP Senior Technical Advisor/ Reviews SAP and QA Documentation for Navy	NAVFAC Atlantic	(757) 322-8108	mike.green@navy.mil	NA
Tracie Bolaños	FDEP RPM/ Provides State Regulator Input	FDEP	(850) 245-8998	tracie.bolanos@dep.state.fl.us	NA
Bonnie Capito (cover letter only)	Librarian	NAVFAC Atlantic	(757) 322-4785	bonnie.capito@navy.mil	NA
Todd Haverkost	Resolution Consultants Project Manager (PM)/ Manages Project Activities	Resolution Consultants	(901) 490-7283	thaverkost@ensafe.com	NA

Distribution List for the Fleming Key Dredge Spoils Area Site					
Name of SAP Recipients	**Title/Role**	**Organization**	**Telephone Number (Optional)**	**E-mail Address or Mailing Address**	**Document Control # (Optional)**
Rick Swahn	Resolution Consultants MEC Director/Manages Corporate MEC Hazards and Risks	Resolution Consultants	(703) 706-0710	rick.swahn@aecom.com	NA
Brian Brunette	Resolution Consultants MRP Geophysics Director/Manages MRP Geophysical Operations	Resolution Consultants	(804) 873-7517	brian.brunette@aecom.com	NA
Sean Liddy (Health and Safety Plan [HASP] Only)	Resolution Consultants Health and Safety Manager (HSM)/ Manages Project Safety	Resolution Consultants	(443) 553-1403	sean.liddy@aecom.com	NA
Mike Ervine	Resolution Consultants Quality Assurance Manager (QAM)/Reviews Plans	Resolution Consultants	(410) 920-9071	michael.ervine@aecom.com	NA
Mark Howard	NAEVA Geophysics Project Manager/ Manages NAEVA Geophysical Survey Operations	NAEVA Geophysics	(434) 825-4405	MHoward@naevageophysics.com	NA
Other Field Personnel To Be Determined (TBD)					NA

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)

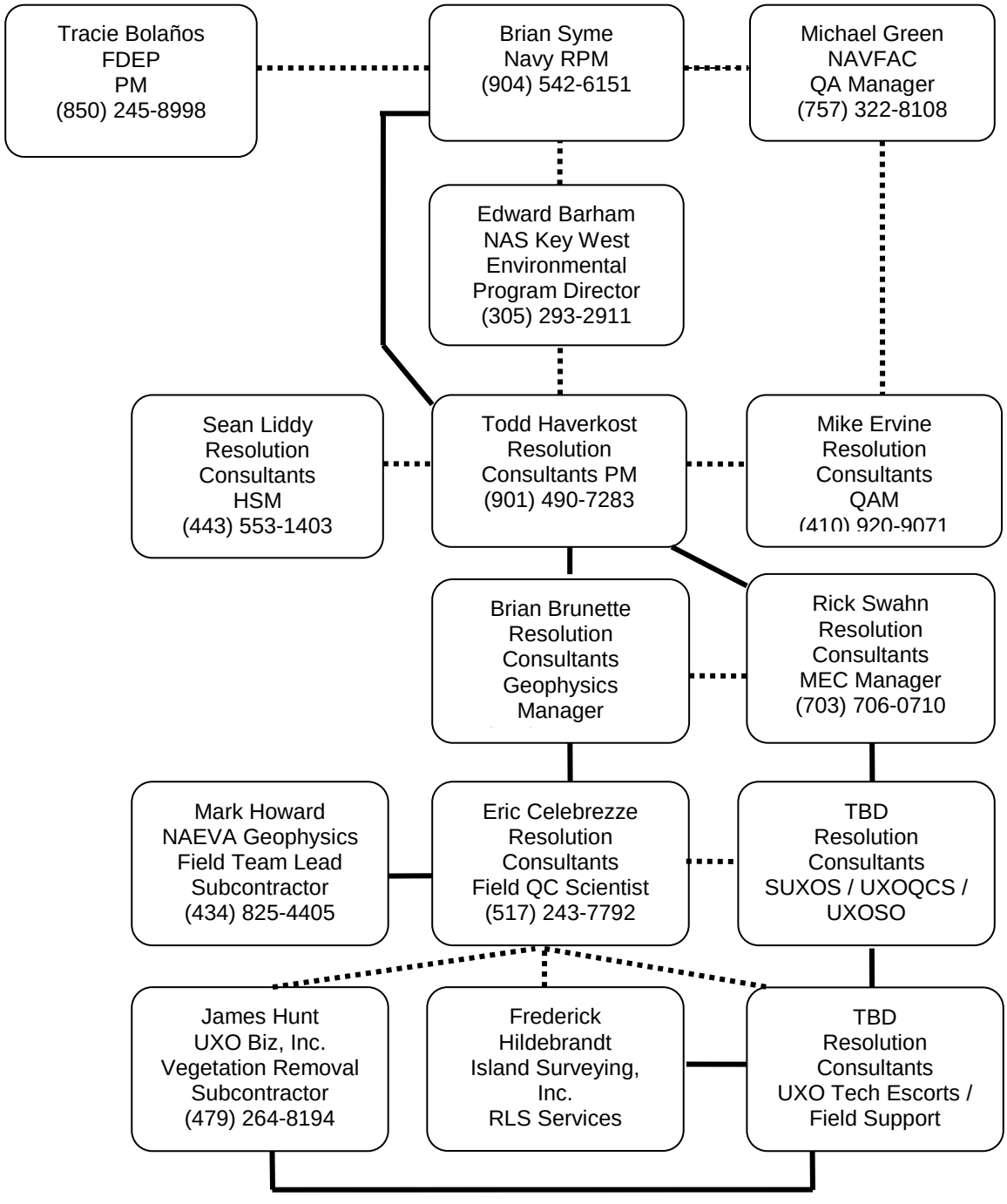
Personnel Sign-Off Sheet for Fleming Key Dredge Spoils Area Site					
Name	**Organization/Title/Role**	**Telephone #**	**Signature/email receipt**	**SAP Section(s) to be Reviewed**	**Date SAP Read**
Navy and Regulator Project Team Personnel					
Brian Syme	NAVFAC SE Remedial Project Manager (RPM)	(904) 542-6151	See **Worksheet #1** for signature	All	
Michael Green	NAVFAC MRP Senior Technical Advisor/ Reviews SAP and QA Documentation for Navy	(757) 322-8108	See **Worksheet #1** for signature	All	
Edward Barham	NAS Key West Point of Contact (POC)/ Environmental Program Director	(305) 293-2911		All	
Tracie Bolanos	FDEP RPM/ Provides State Regulator Input	(850) 245-8998	See **Worksheet #1** for signature	All	
Resolution Consultants Project Team Personnel					
Todd Haverkost	Resolution Consultants PM/Manages Project Activities	(901) 490-7283	See **Worksheet #1** for signature	All	
Rick Swahn	Resolution Consultants MEC Manager/Manages Project MEC Hazards and Risks	(703) 706-0710		All	
Brian Brunette	Resolution Consultants MRP Geophysics Manager/Manages MRP Geophysical Operations	(804) 873-7517		All	
Sean Liddy	Resolution Consultants Health and Safety Manager (HSM)/ Manages Project Safety	(443) 553-1403		HASP **Worksheet #17**	
Mike Ervine	Resolution Consultants Quality Assurance Manager (QAM)/Reviews Plans and Reports	(410) 920-9071	See **Worksheet #1** for signature	All	

Personnel Sign-Off Sheet for Fleming Key Dredge Spoils Area Site					
Name	**Organization/Title/Role**	**Telephone #**	**Signature/email receipt**	**SAP Section(s) to be Reviewed**	**Date SAP Read**
TBD	Resolution Consultants SUXOS	TBD		All	
TBD	Resolution Consultants UXOQCS / UXOSO	TBD		All	
Eric Celebrezze	Resolution Consultants Field Scientist / Conducts and Documents QC Inspections of Field Activities with UXOQCS	(517) 243-7792		All	

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— ····· Lines of Communication



SAP Worksheet #6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

The communication pathways for the SAP are summarized by the following:

Established "Event Driven" Lines of Communication Requirements for the Fleming Key Dredge Spoils Area Site

"Event Driven" Communication	Responsible Affiliation	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
MEC Encountered	Resolution Consultants Field Staff	TBD	TBD	Within 30 minutes, Resolution Consultants UXO Technicians will verbally notify field staff, secure the area, and contact Resolution Consultants MEC Manager and NAS Key West POC for munitions (or alternate).
	Resolution Consultants UXO Staff	TBD	TBD	
	Resolution Consultants MEC Manager	Rick Swahn	(703) 706-0170	Resolution Consultants MEC Manager will verbally inform Resolution Consultants PM on the same day.
	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	Resolution Consultants PM will verbally inform Navy RPM and NAS Key West Explosive Safety Specialist on the same day.
	Navy RPM	Brian Syme	(904) 542-6151	
	NAS Key West POC	Edward Barham	(305) 293-2911	Navy RPM will inform Naval Ordnance Safety and Security Activity (NOSSA) on the same day as informed.
	NAS Key West ESO	Edward Donohue	(305) 797-4412	The NAS Key West Explosive Safety Officer (ESO) or designee will make base emergency notifications on the same day.
Field issues that require change in field tasks	Resolution Consultants Field Staff	TBD	TBD	Resolution Consultants Field Staff will inform Resolution Consultants PM on the day the issue is discovered; Resolution Consultants PM will inform Navy RPM within 1 business day; if warranted, Navy RPM will issue scope change to be implemented before work is executed. Changes will be documented via a Field Task Modification Request (FTMR) form within 2 days of identifying the need for a change.
	Navy RPM	Brian Syme	(904) 542-6151	
	Resolution Consultants MEC Manager	Rick Swahn	(703) 706-0170	
	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	

Established "Event Driven" Lines of Communication Requirements for the Fleming Key Dredge Spoils Area Site

"Event Driven" Communication	Responsible Affiliation	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
SAP amendments	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	Resolution Consultants PM will send scope change to Navy RPM via e-mail within 1 business day.
	Navy RPM	Brian Syme	(904) 542-6151	
Field work schedule changes	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	Verbally inform Navy on the day that schedule change is known and document via schedule impact letter as soon as impact is realized.
	Navy RPM	Brian Syme	(904) 542-6151	
	Resolution Consultants Field Staff	TBD	TBD	
Field issues that require changes in scope	Resolution Consultants Field Staff	TBD	TBD	Resolution Consultants Field Staff or MEC Manager will inform (verbally or via e-mail) the Resolution Consultants PM on the day that the issue is discovered. Resolution Consultants PM will inform the Navy RPM. Navy RPM will issue scope change if warranted. Document change on FTMR Form within 2 days.
	Resolution Consultants MEC Manager	Rick Swahn	(703) 706-0170	
	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	
	Navy RPM	Brian Syme	(904) 542-6151	
Recommendation to stop work and initiate work upon corrective action	Resolution Consultants PM	Todd Haverkost	(901) 490-7283	Within 1 hour, the responsible party will (verbally or via e-mail) inform subcontractors, the Navy RPM, NAS Key West POC, Resolution Consultants PM, Resolution Consultants Field Staff, Resolution Consultants QAM, and Resolution Consultants HSM.
	Resolution Consultants MEC Manager	Rick Swahn	(703) 706-0170	
	Resolution Consultants Field Staff	TBD	TBD	
	Resolution Consultants QAM	Mike Ervine	(410) 920-9071	
	Resolution Consultants HSM	Sean Liddy	(443) 553-1403	
	Navy RPM	Brian Syme	(904) 542-6151	
	NAS Key West POC	Edward Barham	(305) 293-2911	
Corrective action for field program	Resolution Consultants QAM	Mike Ervine	(410) 920-9071	Resolution Consultants QAM will notify Resolution Consultants PM within 1 day that the corrective action has been completed. The Resolution Consultants PM will then notify the Navy RPM within 1 day.

SAP Worksheet #7 -- Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Personnel Roles, Responsibilities and Qualifications for the Fleming Key Dredge Spoils Area Site				
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**	**Education / Experience Qualifications** (Optional)
Brian Syme	RPM	NAVFAC SE	Oversees project scoping, data review, and evaluation.	Available on request
Todd Haverkost	PM	Resolution Consultants	Oversees project, financial, schedule, and technical day-to-day management of the project. • Ensures timely resolution of project-related technical, quality, and safety questions associated with Resolution Consultants operations. • Functions as the primary Resolution Consultants interface with the Navy RPM, NAS Key West, Resolution Consultants field and office personnel. • Ensures that Resolution Consultants health and safety issues related to this project are communicated effectively to all personnel and off-site laboratories. • Monitors and evaluates any Resolutions Consultants or Resolution Consultants subcontractor performance. • Coordinates and oversees work performed by Resolution Consultants field and office technical staff (including data collection, data interpretation, and report preparation). • Coordinates and oversees maintenance of all Resolution Consultants project records. • Coordinates and oversees review of Resolution Consultants project deliverables. • Reviews and submits final Resolution Consultants deliverables to the Navy RPM; Prepares and submits summary of field activities and meeting minutes to Navy RPM.	Available on request
Edward Barham	NAS Key West POC	NAS Key West	Reports field activities to the Navy RPM, participates in scoping, data review, and evaluation.	Available on request
Rick Swahn	MEC Manager	Resolution Consultants	Oversees selection of qualified UXO personnel, establishes overall QC program for MEC activities, and addresses MEC-related issues as identified by field personnel.	Available on request

Personnel Roles, Responsibilities and Qualifications for the Fleming Key Dredge Spoils Area Site				
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**	**Education / Experience Qualifications** (Optional)
TBD	SUXOS	Resolution Consultants	Supervises and supports the conduct of all onsite operations including: • IVS construction outside of elevated dredge spoils area • UXO Tech Anomaly Avoidance assessments to detail and mark locations of potential surface MEC, without digging or moving unless100% certainty that the item is Material Documented as Safe (MDAS) combined with 0% uncertainty that the item is Material Potentially Presenting an Explosive Hazard (MPPEH), as a part of safety escorting of the (vegetation removal, land survey, and geophysical survey) field teams' across the site to complete their tasked DFW. • UXO Tech safety escorting of all non-essential personnel • Preparing daily reports of field activities. • Leading daily site safety briefings. • Communicating daily summary report to PM & MEC Manager	Graduate, Military EOD School, Minimum 8 years UXO experience
TBD	UXO Tech	Resolution Consultants	Responsible for the following, with guidance from SUXOS: • IVS construction outside of elevated dredge spoils area • UXO Tech safety escorting of all field teams, inclusive of subcontractors and all non-essential personnel • Anomaly Avoidance assessments to detail and mark locations of potential surface MEC, without digging or moving unless100% certainty that the item is Material Documented as Safe (MDAS) combined with 0% uncertainty that the tiem is Material Potentially Presenting an Explosive Hazard (MPPEH), as a part of safety escorting of the (vegetation removal, land survey, and geophysical survey) field teams' across the site to complete their tasked DFW. • Conduct anomaly avoidance for any subsurface activities, expected to only consist of IVS construction outside spoils areas and RLS stake emplacement within the first few inches of the subsurface of the dredge spoils area. Stakes will be maneuvered as deemed necessary for safe emplacement. • Maintaining Daily Logbook of field activities & observations. • Communicating daily summary to SUXOS	Graduate, Military EOD School

Personnel Roles, Responsibilities and Qualifications for the Fleming Key Dredge Spoils Area Site				
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**	**Education / Experience Qualifications** (Optional)
Brian Brunette	Geophysics Manager	Resolution Consultants	Reviews Geophysics deliverables, generated by subcontractors or Resolution Consultants Field QC Scientist, including: • First-Pass IVS tabulated results & summary letter • Daily IVS & QC results tabulations, charts, and graphs generated by subcontractors and inspected by Field QC Scientist • Reviews QC field inspection audits, conducted by Field QC Scientist with UXOQCS support, for compliance and recommendations for improvement; • Production and QC summaries for management. • Blind Seed recovery tracking from both Anomaly Avoidance assessments (using hand-held AGM sensors) and Full-Coverage Grid Surveys (using full-sized DGM sensors) • Provides technical advice to the Resolution Consultants PM on matters of Geophysical QC or production rates • Data Deliverables reviews for content, format, and completeness • Final data reviews for overall quality of production data, including the anomaly selection process relative to guidelines established at the start of the project • Non-conformance summaries and corrective action reports, as necessary • Communicates regularly with Field Scientist, UXOQCS, and QAM	PGP, B.S. Environmental Engineering and M.S. in Geophysical Engineering, 12+ years experience in munitions response actions
Sean Liddy	HSM	Resolution Consultants	Oversees project health and safety, including: • Oversees the development and review of the HASP • Conducts health and safety training • Reviews health and safety audits, conducted by UXOSO, for compliance and recommendations for improvement; Communicates regularly with UXOSO • Prepares health and safety reports for management. • Provides technical advice to the Resolution Consultants PM on matters of health and safety • Prepares non-conformance summaries and corrective action	Available on request

Personnel Roles, Responsibilities and Qualifications for the Fleming Key Dredge Spoils Area Site				
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**	**Education / Experience Qualifications** (Optional)
			reports, as necessary	
Mike Ervine	QAM	Resolution Consultants	Reviews UFP-SAP and ensures quality aspects of the project: • Ensures SAP meets Resolution Consultants, Navy, and FDEP requirements • Monitors QA policies and procedures • Provides training to project staff in QA/QC policies and procedures • Conducts performance audits to monitor compliance with contractual and SAP requirements • Audits project records • Monitors subcontractor QA/QC • Assists in development of corrective action plans • Communicates regularly with UXOQCS and Field Scientist regarding QC inspections of Resolution Consultants and subcontractors performance • Prepares non-conformance and corrective action reporting, as deemed necessary	PE, B.S. and M.S. in Civil Engineering, 15 years experience in all phases of munitions response actions
TBD	UXOQCS / UXOSO	Resolution Consultants	Coordinates with SUXO and conducts of all onsite QC / safety roles, with support from others, including: • Ensures site-specific training has occured and all safety control measures are in-place before personnel conduct field activities • Ensures all UXO-specific certifications are filed onsite and are available for Navy inspection. • Enforces personnel limits and safety exclusion zones. • Conducts, documents, and reports safety inspections • Coordinates and communicates feedback to HSM on safety training and inspection results on regular basis • Conducts, documents, and reports QC inspections with support from Field Scientist and Geophysical Manager • Coordinates and communicates feedback to QAM on QC inspection results on regular basis. • Provides site-specific information to HSM or QAM regarding non-	Graduate, Military EOD School, Experience in all phases of munitions response actions or range clearance activities, 8 years of experience

Personnel Roles, Responsibilities and Qualifications for the Fleming Key Dredge Spoils Area Site				
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**	**Education / Experience Qualifications** (Optional)
			conformance or corrective action reporting	
Eric Celebrezze	Field QC Scientist	Resolution Consultants	Coordinates with SUXO and conducts onsite Scientific QC audits / inspections for conformance to project DQO's including: • First-Pass IVS tabulated results & summary letter • Daily IVS & QC results tabulations, charts, and graphs • QC field audits, with UXOQCS support, for compliance and recommendations for improvement • QC inspections for fidelity of production data quality and completeness of deliverables prior to NAVY submittal • Production and QC summaries for management. • Provides technical advice to the Resolution Consultants PM on matters of Geophysical QC or production • Provides site-specific information to Geophysics Manager or QAM regarding non-conformance or corrective action reporting • Communicates regularly with UXOQCS, Geophysics Manager, and QAM	Available on request

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Specialized Personnel Training, Required Before Field Work Starts, for Fleming Key Dredge Spoils Area Site						
Project Function	**Specialized Training By Title or Description of Course**	**Training Provider**	**Training Date**	**Personnel / Groups Receiving Training**	**Personnel Titles / Organizational Affiliation**	**Location of Training Records / Certificates[1]**
Project Operations	Site Orientation, Ethics Training, and UXO Avoidance	SUXOS	Upon arrival at NAS Key West	All personnel	Resolution Consultants and Subcontractors	Documentation of special training requirements will be maintained on site. After the field investigation is complete, special training documentation will be maintained in the project file.
	Accident Prevention and First Aid	HSM				
	Overview of Project Plans	SUXOS				
	29 Code of Federal Regulations (CFR) 1910.120 Training	Vendor	Prior to arrival at NAS Key West	All field personnel		
Munitions Response	MEC Safety Training	UXOSO, SUXOS	Training will occur prior to participation in field activities	Personnel entering exclusion zone		
Anomaly Avoidance assessments	Use of hand-held global positioning system (GPS)	UXO Team Leaders, UXOQCS, SUXOS		UXO Team	Resolution Consultants UXO personnel	
MEC Data Collection	MEC Management and Accountability SOPs	SUXOS		UXO Team		

[1] If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

SAP Worksheet #9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Attendees List for Fleming Key Dredge Soils Area Project Scoping Meeting			
Project Name:	Fleming Key Dredge Spoil Area Expanded SI	**Site Name:**	NAS Key West
Projected Date(s):	March through May 2013	**Site Location:**	Key West, Florida
PM:	Todd Haverkost		
Date(s):	July 13, and 16-19, 2012		
Purpose:	Kickoff Meeting/Site Visit		

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Brian Syme	Navy RPM	NAVFAC SE	(904) 542-6151	brian.syme1@navy.mil	Manages project activities for the Navy
Dana Hayworth	Preceding Navy RPM	NAVFAC SE	(904) 542-6417	dana.hayworth@navy.mil	Assisting the new Navy RPM, Brian Syme
Todd Haverkost	PM	Resolution Consultants	(901) 490-7283	thaverkost@ensafe.com	Provides project management support
Brian Brunette	Geophysics Manager	Resolution Consultants	(804) 873-7517	brian.brunette@aecom.com	Manages overall geophysical program
Mike Ervine	QAM	Resolution Consultants	(410) 920-9071	michael.ervine@aecom.com	Senior MRP QA support
Ron Demes	Business Manager	NAS Key West	(305) 293-2866	ron.demes@navy.mil	NAS Key West POC
Ed Barham	Environmental Director	NAS Key West	(305) 293-2911	edward.barham@navy.mil	NAS Key West POC
Bob Courtright	Navy IR Program Manager	NAS Key West	(305) 293-2881	robert.courtright@navy.mil	NAS Key West POC
Ron Demes	Business Manager	NAS Key West	(305) 293-2866	ron.demes@navy.mil	NAS Key West POC
Tom Spriggs	Green & Sustainable Remediation	NAVFAC Atlantic	(757) 322-4335	thomas.spriggs@navy.mil	Navy Technical Support
Tracie Bolaños	FDEP PM	FDEP	(850) 245-8998	tracie.bolanos@dep.state.fl.us	FDEP RPM

Attendees List for Fleming Key Dredge Soils Area Project Scoping Meeting					
Project Name:	Fleming Key Dredge Spoil Area Expanded SI	**Site Name:**	NAS Key West		
Projected Date(s):	March through May 2013	**Site Location:**	Key West, Florida		
PM:	Todd Haverkost				
Date(s):	July 13, and 16-19, 2012				
Purpose:	Kickoff Meeting/Site Visit				
Shauna Stotler-Hardy	Project Manager	Tetra Tech	(803) 641-4944	shauna.stotlerhardy@tetratech.com	CLEAN Contractor PM
Amy Twitty	Sr. Engineer	CH2M Hill	(850) 232-0320	amy.twitty@ch2m.com	RAC Contractor PM
Steve Rosansky	Sr. Engineer	Battelle	(614) 424-7289	rosansky@battelle.org	Scribe
Damon DeYoung	Sr. Geologist	Battelle	(619) 574-4825	deyoungd@battelle.org	Scribe
Tim Flood	Facilitator	The Management Edge	(727) 867-2610	tflood1@tampabayrr.com	Facilitator

9.1 COMMENTS / DECISIONS

On Friday July 13, 2012 Navy and Resolution Consultants personnel conducted a site visit to the dredge spoil area at Fleming Key starting at 8 AM. NAS Key West personnel, Robert Courtright and Edward Barham, introduced themselves and mentioned Ed Donahue could not attend due to other obligations. The history of the Key, inclusive of findings of small munitions related debris (e.g., expended small arms or 20mm cartridges, fragments, etc.) historically encountered on-island while larger MEC rounds (e.g., 76mm projectile, 7.2-inch hedgehog, etc.) historically encountered off-island on the dredge barge prior to the soil deposited on-island and topics related to dredge soil deposition methods, were discussed. Around 10 AM, all personnel left site to attend other meetings with the intent for NAVFAC SE and Resolution Consultants personnel to reconvene this afternoon to complete a site walkthrough to assess site conditions now that the history of the site was discussed and local Key West contact information was gathered before the Key West personnel attended other meetings in the afternoon. Upon reconvening at 1:30 PM, we waited out a rain storm and then went to the Dredge Spoils site around 2:30. The conditions of the dredge spoil area including access/egress, vegetation, soil conditions, and surface debris was examined for planning purposes. Access/egress of the site is through a locked gate to which we will get a key once field work commences and there is room to stage personnel / equipment for morning preparation activities on site away from the spoils pile on flat non-vegetated ground consistent with the down-to-grade portion of Fleming Key. On the spoils piles, approximately 10 feet above Fleming Key grade, the soil is hard, compact, with abundant vegetation covering over 50% of the site surface, ranging from Australian Pines to waist-high shrubs and grasses. The vegetation had definitely expanded horizontally and grown vertically since the last series of site visits or field work tasks conducted in 2010. Metal surface debris had light blue color and consisted of the same types of expended small arms ammunition and 20mm projectiles as documented in previous PA/SI site visits and reports.

On Monday July 16, 2012 Resolution Consultants personnel met to discuss and finalize the project schedule prior to submitting to the RPM later in the week. On Tuesday July 17 through Thursday July 19, 2012 Navy and Resolution Consultants PM, Todd Haverkost, attended the Partnering Team Meetings at Double Tree Hotel near Key West airport. Brian Brunette, Resolution Consultants Geophysical Manager,

attended only the Tuesday meeting in order to introduce the scope of the project to the Partnering Team. Additional comments or feedback received from the Partnering Team to Todd Haverkost on Wednesday July 18th – Thursday July 19th included:

- ✓ Tracie Bolaños mentioned that following her review of the Final SI Report she provided comments on recommendations contained in the report and expressed concern that some of the recommendations presented in the draft report and agreed upon by the FDEP, were not carried forward into the final report. The Fleming Key Dredge Spoil Area was not one of the sites where the recommendations changed and the proposed scope of the ESI activities is generally consistent with the prior recommendations, however, her comments may affect the outcome of the MRSPP scoring of the other sites required under the current scope but beyond the scope of the current UFP-SAP document which is limited to the Fleming Key Dredge Spoils Area only.

- ✓ Additional input was provided by Bob Courtright who emphasized the importance of completing the ESI in a timely manner because of the large volume of dredge spoil material and the potential economic value to NAS Key West if it could be used as a source of fill material for construction projects elsewhere on the installation.

- ✓ Because the discussion was intended to be informational and provide the partnering team with a generalized description of the technical approach, formal consensus on specific aspects of the technical approach was not sought. The partnering team was in general agreement with the approach and will defer providing specific comments pending review of UFP-SAP.

9.2 ACTION ITEMS

As an outcome from the scoping session meetings, the following four topics were considered action items:

1) Complete preparation of the project schedule and submit to Navy RPM.

2) Begin preparation of SAP.

3) Begin preparation of HASP.

4) Begin preparation of MRSPP scoring of other 13 NAS Key West sites.

The schedule was submitted to the Navy RPM by the close of the same week as the meetings on July 20, 2012, while the remaining documents have been prepared and are in the process of submittal by mid August (in the case of the MRSPP scoring) and by mid September (in the case of the SAP & HASP).

9.3 CONSENSUS DECISIONS

As an outcome from the meetings, the following 3 topics were considered consensus decisions:

1) From the site visit, no conditions had changed except the vegetation had grown vertically and expanded horizontally since the last documented visits in 2010, thus vegetation removal budget will need to be monitored based on significant changes in site conditions.

2) After feedback from the site visit and scoping meeting, all attendees were in agreement with the proposed schedule and methodologies introduced for the Fleming Key Dredge Spoils Area while reserving any detailed comments for the review timeframe of the associated UFP-SAP document.

3) The only areas potentially under dispute would be related to the MRSPP scoring of the other sites based on FDEP feedback regarding the comments not carrying through between draft and final.

SAP Worksheet #10 -- Problem Definition

(UFP-QAPP Manual Section 2.5.2)

10.1 INTRODUCTION

NAS Key West is located in the Florida Keys, between the Gulf of Mexico and the Atlantic Ocean in Monroe County, Florida. The first naval base was constructed in Key West in 1823 to combat piracy in South Florida. Expansion of the base occurred in stages, between 1823 and 1917 and coincided with periods of military activity during the Mexican War, the Spanish-American War, and World War I (WWI). When the war ended the based was decommissioned and many buildings were destroyed, although the land remained property of the U.S. government. At the onset of World War II (WWII), the base was re-opened to support naval destroyers and patrol bomber aircraft. On 15 December 1940, the seaplane base was designated as a Naval Air Station (NAS). The NAS Key West complex comprises 6,249 acres of land distributed over fourteen properties that include: Demolition Key, Fleming Key, Truman Annex, Trumbo Point Annex, Peary Court Annex, Sigsbee Park Annex, Navy Branch Health Clinic - Key West, Boca Chica Field, North Boca Chica, Geiger Key, Big Coppitt Key, Rockland Key, Navy Computer and Telecommunications Station - Saddlebunch Key, and Battery HM-40 - Key Largo Site. The site being investigated under this UFP-SAP at NAS Key West is the Fleming Key Dredge Spoil Area.

The installation's present-day mission is to provide pilot training facilities and services, as well as access to airspace and training ranges for tactical aviation squadrons. Information for the NAS Key West area related to climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and threatened, endangered, and protected species that is relevant to the CSM for the Dredge Spoil Area site is presented below. Other supporting background information is included in the PA {***December 2010, Malcolm Pirnie Inc. and Osage of Virginia Inc.***}.

Two main hydrogeologic units underlie the site. These units are the Biscayne Aquifer (i.e., the surficial aquifer) and the Floridian Aquifer. The Biscayne Aquifer is considered one of the most productive and permeable aquifers in the world. However, the freshwater below the lower Florida Keys is subject to salt water intrusion due to the permeability of the Key Largo limestone formation, which underlies the less porous Miami oolite formation that forms the base layer of the islands. Due to the salt water intrusion, the Biscayne Aquifer at NAS Key West is only available for non-potable use. The average aquifer depth is 5 feet below the center and western half of the island of Key West. NAS Key West is within the Florida Bay-Florida Keys Watershed. Approximately 53 percent of the annual rainfall occurs from June to October, during hurricane season. Due to the porosity of the limestone substrate, most rainfall on the Florida Keys percolates into the limestone rather than running off. The amount of rain that does become overland runoff is carried to tidal waters via overland flow or storm drains {***2008, INRMP***}.

The Fleming Key Dredge Spoil Area is a 42-acre site located north of the City of Key West in Monroe County, Florida. Fleming Key was originally created as a dredge spoil island prior to WWII and was used as a munitions storage area as early as 1942. This area was used for munitions storage in the past and nine closed magazines remain at the site. The dredge spoils placed at the site in 2003 through 2004 comprise a majority of the site. These spoils consist of a 27-acre, relatively flat, well-compacted mound that is approximately 10 feet higher than the surrounding spoils used to form Fleming Key. The location of the Dredge Spoil Area is presented on **Figure ES-1**.

10.2 PROBLEM DEFINITION

Fleming Key comprises 264 acres and is one of the 14 properties associated with NAS Key West. It is located less than 1 mile north of the City of Key West and is bordered to the north, east, and west by the Gulf of Mexico. A narrow channel and Trumbo Point Annex, another one of the 14 Navy properties, are located directly south of Fleming Key. Fleming Key was originally created as a dredge spoil island in the early 1940s using spoils from areas adjacent to the west and northeast of Fleming Key. It was then used as a magazine area, beginning as early as 1942. No munitions related material was documented during

the 1940s dredge spoil construction of the base of Fleming Key, which is clearly a separate from the 2003/2004 event suspected to contain MEC and currently mounded 10 feet above the clean grade.

Figure ES-1 shows the location map of the Fleming Key Dredge Spoils Area project site (as indicated by the **red lines**), relative to NAS Key West Trumbo Point Gate Entrance and the town of Key West, both located to the south of the site and labeled in black lettering. The preliminary figure is important as a visual aide reference for the location and boundaries at the Fleming Key Dredge Spoils Area, relative to Key West, Trumbo Point, and the waterways which surround Fleming Key.

The Dredge Spoil Area comprises approximately 42 acres and is located in the center portion of Fleming Key and the site is bordered to the north and south by other portions of Fleming Key and to the east and west by the Gulf of Mexico. In 2003, the Department of the Army and the FDEP issued permits to NAS Key West for the maintenance dredging of 1,000,000 cubic yards from 465.4 acres of submerged bottom in the existing federal channel (Key West Harbor entrance channel), harbor (Truman Annex harbor), and the adjacent turning basin {***2003, FDEP***}. The portion of the dredged material not approved for ocean disposal, estimated at 400,000 cubic yards, was transported to a designated upland placement site. This upland placement site consisted of 27 acres on Fleming Key. The Dredge Spoil Area includes the entire upland placement site.

Prior to placement of the material at the site, the nine magazines located in the immediate area were inspected, verified empty, and closed. A turtle screen was reportedly used during dredging to limit the size of items transported through the dredging equipment. The dredge material that could not be placed at the off-shore disposal site was off-loaded from a barge onto trucks at Wharf F-389 and was transported to the Dredge Spoil Area (upland placement site) where it was spread with heavy-equipment to dry. After drying, the material was used as fill. During the dredging, two munitions items were reportedly encountered. These included a 7.2-inch Hedgehog rocket and a 76mm artillery projectile (ceremonial round). These items were destroyed in place by EOD personnel {***August 2004, EOD 8027 via EODMU Six DET Mayport***}. Information obtained during discussions with NAS Key West personnel indicate that these items were likely removed from the barge and transported separately to the site rather than deposited with the dredge materials.

In 2008, NAS Key West initiated the planning, scoping, and contractor procurement process to use the dredge materials as fill for airfield improvements. Correspondence from the Naval Ordnance Safety and Security Activity (NOSSA) to NAS Key West regarding the review of an Explosives Safety Submission (ESS) determination request indicates that there is a reported presence of MEC in the dredge material at the Dredge Spoil Area {***May 2008, NOSSA***} . As such, NOSSA determined that an ESS was required for any excavation, movement, or screening of the dredge spoils. Furthermore, NOSSA determined that executing a munitions response in accordance with an approved ESS was required. NOSSA also noted that on-call EOD construction support is not appropriate for any excavation, movement, or screening of the dredge spoils because the "discovered presence of MEC at the site and the origins of the dredge material suggest greater potential (for) MEC contamination than would be acceptable for a low determination" (i.e., "…when the probability of encountering MEC is low; that is, encountering MEC is possible, but not probable").

During a Technical Assistance Visit (TAV) conducted by NOSSA, munitions items were reportedly observed on the ground surface of the Dredge Spoil Area {***February 2009, NOSSA***}. These items included 20mm expended cartridge casings and .50 caliber expended cartridge casings. Non-munitions related metal debris was also observed at the site and included a gas cylinder. Based on the observations made during the TAV, NOSSA documented that the dredge materials contain MEC and Material Potentially Presenting an Explosive Hazard (MPPEH). Subsequently, NOSSA determined that munitions response under the Navy MRP was required.

10.2.1 Site Visits

A limited visual survey of the Dredge Spoil Area was conducted as part of the PA {***December 2010, Malcolm Pirnie Inc. and Osage of Virginia Inc.***}. The spoil material comprising the majority of the

Dredge Spoil Area can be described as a large (approximately 27 acres), relatively flat, well-compacted mound. The spoil material is approximately 10 feet higher than the surrounding spoils used to form Fleming Key in the 1940s. Vegetation, including Australian pines, small shrubs, and grasses, cover much of the ground surface at the site. During the limited visual survey, the team observed 20mm and .30 caliber, .50 caliber, and .762 caliber expended cartridge casings on the ground surface at the Dredge Spoil Area. In addition, non-munitions related metal debris (e.g., dredge piping, valves, and the gas cylinder) was also observed on the ground surface at the site. MEC and MPPEH were not observed during the site reconnaissance. Similar findings were documented during the IAVS surface assessments conducted as a part of the initial SI {***April 2012, Tetra Tech NUS***}.

10.2.2 MEC Presence

Figure ES-2 shows the location map of Historically Relevant Background Information for the Fleming Key Dredge Spoils Area project site, inclusive of the MRP boundary site (as introduced by Malcolm Pirnie in 2010), the dredge spoils pile boundary (as detailed by Tetra Tech NUS in 2012), the locked fence installation boundary (as referenced to by Malcolm Pirnie in 2010), and the surface finds (as summarized by Tetra Tech NUS in 2012), as indicated by the **red lines**, **green lines**, **blue lines**, and **green dots**, respectively. The supplementary figure is important as a visual aide reference for the location of historically relevant boundaries and surface ordnance finds at the Fleming Key Dredge Spoils Area.

The entire site has been subdivided and categorized into one of three levels of MEC presence, Known MEC Areas, Suspected MEC Areas, and Areas Not Expected to Contain MEC, to indicate that MEC are known or are suspected to be at the site. Based on observations made during the limited visual survey conducted during the PA, information obtained during the record review and data collection process during the PA, and observations captured during the IAVS surface assessment conducting during the limited SI, there is no evidence of MEC on site. Thus, there are no known MEC areas associated with the Dredge Spoil Area according to these sources.

According to information obtained during the record review and data collection process, the Dredge Spoil Area is a suspected MEC area. A 7.2-inch Hedgehog rocket and 76mm projectile were screened and removed from dredge spoils prior to placement of the spoils at the site. No subsurface investigations have been conducted to verify the presence or absence of MEC or MPPEH in the stockpiled dredge material. According to historical documents and information obtained during the previous surface assessment data collection events within the PA/SI process, there are no areas of the Dredge Spoil Area not suspected to contain MEC as only MD or CD, in the form of MDAS and none in the form of Material Documented as Explosive Hazard (MDEH), are documented to have been found to this point prior to conducting the ESI.

No penetration depths are associated with the munitions types identified at the Dredge Spoil Area because the munitions were not fired at the site. Placement of dredge spoils potentially containing munitions and subsequent grading of the site may have resulted in deposition of munitions debris (MD) and possibly MEC or MEPPH throughout the entire depth of the dredge spoils (estimated at 10 feet).

10.3 CONCEPTUAL SITE MODEL

The conceptual site models (CSM) for the Dredge Spoil Area is described below.

10.3.1 Potential or Known Contaminant Sources

Based on observations made during the limited visual survey conducted during the PA, information obtained during the record review and data collection process during the PA, and observations captured during the IAVS surface assessment conducting during the limited SI, there is no evidence of MEC on site. Thus, there are no known MEC areas associated with the Dredge Spoil Area. According to information obtained during the data collection process, the Dredge Spoil Area is a suspected MEC area. A 7.2-inch Hedgehog rocket and 76mm projectile were screened and removed from dredge spoils prior to placement of the spoils at the site. No subsurface investigations have been conducted to verify the presence or absence of MEC or MPPEH in the stockpiled dredge material. This area is not suspected to

contain chemical warfare material filled munitions, electrically fuzed munitions, or depleted uranium associated munitions.

10.3.2 Contaminant Migration Pathways

MEC migration may occur naturally due to erosion, or through human activities, such as maintenance (e.g., vegetation removal), grading, or removal of the dredge spoils from the site. Future construction, maintenance, excavation, or other site work could also serve as a migration/release mechanism. No penetration depths are associated with the munitions types identified at the Dredge Spoil Area because the munitions were not fired at the site. Placement of dredge spoils potentially containing munitions (for use as fill) and subsequent grading of the site may have resulted in deposition of MD and possibly MEC or MPPEH throughout the entire depth of the dredge spoils (estimated 10 feet).

10.3.3 MEC Exposure Evaluation

MEC may be present on the ground surface of the Dredge Spoil Area (i.e., on the surface of the stockpiled dredge spoils) based on observations made during previous site visits (i.e., EOD response, TAV conducted by NOSSA). Given the history of the site, MEC presence cannot be confirmed or verified without further investigation. As such, exposure pathways for MEC on the surface via direct contact (e.g., touching or stepping on MEC) are potentially complete for human and ecological receptors.

If present, it is possible for subsurface MEC to migrate to the surface naturally by erosion or through human activity by re-deposition (e.g., maintenance of vegetation or excavation of the fill material). As such, exposure pathways via direct contact for MEC at the surface (e.g., touching or stepping on MEC) are potentially complete for human and ecological receptors.

MEC may be present in the subsurface at the Dredge Spoil Area. No investigations have been conducted to determine if MEC is present in the subsurface (i.e., within the dredge spoils used as fill). Therefore, exposure pathways are potentially complete for Navy personnel and contractors who may be exposed to subsurface MEC during intrusive activities, such as underground utilities maintenance or intrusive environmental investigations. Visitors, trespassers, and ecological receptors could also come in contact with subsurface MEC if digging, or in the case of ecological receptor burrowing, at the site. Exposure pathways are also potentially complete for these receptors.

10.4 PROBLEM STATEMENT

As a result of historical site activities, MEC may exist at the Dredge Spoil Area. NAS Key West facility personnel, contractors, and visitors could potentially be exposed to an explosive hazard from MEC at the site. Potentially complete exposure pathways have been identified. Although assessments and inspections (i.e. PA/SI) were previously conducted to determine MEC presence on the surface, currently no studies have been conducted to confirm MEC presence in the subsurface the Dredge Spoil Area. Conducting an Expanded Site Investigation (ESI) will facilitate characterization of the site and aid in determining a basis for decision on No Further Action (NFA) or Interim Removal Action (IRA) to conduct intrusive investigations to confirm if MEC is present. If the results from the ESI or IRA are inconclusive in some areas of the site, then a follow on Remedial Investigation (RI) may be required to sort out any ambiguities prior to detailing preliminary recommendations for future use of dredge spoils pile, or portions of dredge spoils pile, from the site once discretely defined.

SAP Worksheet #11 -- Project Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1)

11.1 STUDY GOALS (STEP 2)

The study goals are to evaluate whether MEC or MPPEH are present in conditions, quantities, or concentrations that present an immediate human health hazard and require an immediate action, a delayed action, or no action at all for initiating an appropriate remedial response. Further details related to how the goals are to be tested analytically are provided in section 11.3.

11.2 INFORMATION INPUTS (STEP 3)

Information to be gathered will be conducted in **TASK 2 – Field Investigation (FI)**, which consists of subtasks of Vegetation Removal, Registered Land Surveyor (RLS) mapping, Instrument-Aided Visual-Surveys (IAVSs) surface assessments, Digital Geophysical Mapping (DGM), anomaly pin-pointing, and three-dimensional Cued Interrogation (3-D CI) subsurface anomaly assessments which combined have the associated goal of using statistically guided non-invasive sampling techniques to assess the surface (i.e. IAVS) and subsurface (i.e. DGM, 3-D CI, etc.) for the estimated quantity, size, and distribution of MEC/MPPEH. The grouping of tasks into surface and subsurface assessments for MEC / MPPEH is introduced below with further details in the form of Standard Operation Procedures (SOPs) documents' referenced to in a subsequent chapter.

1. **SURFACE ASSESSMENTS: Anomaly Avoidance, Vegetation Management, and Survey Management** will capture surface distribution of MEC / MPPEH along vegetation removal and land survey paths, primarily focused along the pre-defined statistically-based transects and TBD grid locations but secondarily conducted along any path that is required to complete this tasks, due to the fact that a UXO Tech will escort and will provide anomaly avoidance support with the use of a hand-held metal detector (e.g., . White's Spectrum XLT All Metals Detector or Schonstedt GA-52Cx, etc.) to locate metallic items on the surface. Items located on the surface must be visually examined to determine whether they are suspect MEC, MPPEH, MD, or non-MD, and all associated data must be recorded in field logbooks and on an MEC tracking form. Non-MD will be moved to the side of selected transects to reduce clutter and enhance the ability of future DGM tasks to detect near surface anomalies.

2. **SUBSURFACE ASSESSMENTS: DGM, Anomaly Pin-pointing, and 3-D CI Surveys** will capture subsurface distribution of MEC / MPPEH along the pre-defined statistically-based transects using DGM (i.e. EM61-MKII) and within the confines of TBD grid locations using full coverage DGM followed by Anomaly Pin-Pointing and finalized by 3-D CI (e.g., 2x2 TemTads, MetalMapper, etc.). The 3-D CI will use advanced classification techniques to determine whether each pin-pointed location in the grid is MEC / MPPEH, presuming there are no ambiguities from saturated groups of anomalies.

Positioning of MEC / MPPEH finds during surface and subsurface assessments will primarily be based on the transect guidance and grid corner confinement points, as defined by the RLS, with tape-line, wheel-odometer, or fiducial positioning methods to determine the location of discrete points between the surface stakes. A hand-held Global Positioning System (GPS) unit will be supplied on site for the SUXO, UXOSO / UXOQCS, and UXO Team Leaders to use as needed, specifically for documenting surface finds.

11.3 DEFINE THE BOUNDARIES OF THE STUDY (STEP 4)

The study area population of interest is dredge spoils that have the potential to contain MEC. The boundary of this Dredge Spoil Area is defined by both the lateral and vertical extents of the well-compacted mound that has been placed within the north-central portion of the site. The mounded dredge spoils from the 2003/2004 event is approximately 27 acres laterally and 10 feet high vertically above the

Fleming Key down-to-grade surface spoils from the 1940s event, which had no evidence of MEC. The fence-line, 2003/2004 dredge spoil, and MRP boundaries are shown on **Figure 17-1** for reference.

As stated in section 11.2, all field efforts in the Dredge Spoil Area will either be accomplished by UXO technicians or completed by others escorted by UXO technicians, who will ensure that MEC and MPPEH avoidance techniques are practiced.

11.4 DEVELOP THE ANALYTIC APPROACH (STEP 5)

As further detailed in section 10.4, the intent of conducting an ESI for the Fleming Key Dredge Spoils site is to determine preliminary recommendations for future use of the spoils pile, or portions of spoils pile, from the site once discretely defined into areas of No Further Action (NFA) or Interim Removal Action (IRA), The defining of areas into recommendations of NFA or IRA will be based on the presence of MEC/MPPEH as follows:

1. If surface MEC/MPPEH or if subsurface anomalies indicate their potential presence in the subsurface, then return to the site or portion of the site during the IRA, after submitting and receiving approval for an ESS and IRA WP, for further investigation of potential MEC and MC.

2. If no surface MEC/MPPEH are present, and no anomalies indicate the potential presence of subsurface MEC/MPPEH, then no further investigation of the site or portion of the site is required.

Given that the recommendation for an IRA may be followed by additional sampling in the form of a RI, FS, or RA depending on the number of uncertainties and a recommendation of NFA may be followed by dirt removal down to the depth of detection only. Any recommendations made are only valid for areas assessed and down to the detection depth limitations for the sensors deployed, however, the entire process can be repeated until 1940s Fleming Key down-to-grade level is reached at that time or at a later date after further planning documents are submitted and approved prior to future investigations.

11.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA (STEP 6)

The Dredge Spoil Area will be investigated for the presence of MEC/MPPEH. The project team will use the results from both the surface and subsurface assessments introduced in Section 11.2, and further detailed in sections to follow, by verifying that all proposed data were collected, that the data meets the quality specifications and the overall data quality is sufficient to support the attainment of project objectives. This will involve a review of the survey results by Resolution Consultants to determine if they are representative of suspect MEC.

11.6 DEVELOP THE PLAN FOR OBTAINING DATA (STEP 7)

The sampling plan and rationale for this investigation is presented in **Worksheet #17**.

SAP Worksheet #12 -- Measurement Performance Criteria Table

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Requirements for Fleming Key Dredge Spoils Site

Definable Feature of Work	Geophysical Anomaly Data Quality Indicator	QC Sample and/or Activity to Assess Performance	Measurement Performance Criteria	Frequency
Site Preparation [*includes: Mobilization, Security, Equipment Verification, IVS construction*]	Completeness	Verify that approved project plans are reviewed and signed Verify that equipment needed is on site Verify that communications needed are on site and working Verify emergency services Verify site-specific training	Approved project plans reviewed and signed Equipment is on site. Communications verified to work across the site. Emergency services checked Site-Specified training given to personnel and signed	Once
Anomaly Avoidance – transects, grids, and pathways for all field crews {**MRP SOP 01, 02, 03**}	Precision	UXOQCS to independently resurvey transect or grid lanes Surface Seed detection, placed by UXOQCS in grid near no known response using anomaly avoidance IVS Strip	UXO Team must have same performance of marking surface items as UXOQCS Discover and Record all on the surface seeds in grids Audibly detect items verified detectable on day 1	UXOQCS to repeat 25% day 1, 10% days after, failure = rework Daily, failure = rework effected grid Day 1 once, twice daily or equip. change thereafter
Vegetation Management {**MRP SOP 04**}	Completeness	Full-time UXO Tech to conduct escort and anomaly avoidance ahead of brush cutters; verify vegetation removed.	All vegetation and trees less 4" diameter cut to within 2-4" of ground surface, no closer	As needed
(Land) Survey Management {**MRP SOP 05**}	Accuracy	Verify that site benchmarks, boundaries, survey transects, and survey grids established Surveyor has met accuracy guidelines; safety escort and anomaly avoidance by UXO tech.	Site boundaries, survey transects, and survey grids have been established by RLS. Static Position Repeatability for re-occupy of points < 10-cm (4-in)	Once Twice Daily (beginning and end of each day)

Definable Feature of Work	Geophysical Anomaly Data Quality Indicator	QC Sample and/or Activity to Assess Performance	Measurement Performance Criteria	Frequency
Geophysics Management Phase I [*includes: DGM Transect & Grid Surveys*] {**MRP SOP 06 & MRP SOP 07**}	Completeness & Precision	Null followed by personnel, cable shake, static background & spike response tests over "anomaly-free electronically-quiet" area for EM61	Personnel, cable shake, & static background tests exhibit no spikes > +/- threshold w/out documented external noise source	Twice Daily (beginning & end of each day)
		Null followed by background over "anomaly-free electronically-quiet" area and spike near structure (e.g. fence, culvert, magazine) for EM31	EM61 Static Response compared to ISO curve on day 1, compared +/- 10% to day 1 thereafter; EM31 reviewed for qualitative response on both channels	Twice daily (beginning and end of day) or equipment changes
		Instrument Verification Strip dynamic testing for EM61	Digital record shows peak response within 25% or 1mV (whichever is larger) / position within 50-cm along-line direction using fiducial positioning methods, 30-cm along-line RTK-DGPS positioning methods as compared to day 1 results	Day 1 once, twice daily or equip. change thereafter
		Sample Separation & Footprint Coverage for EM61	Sample Separation within 25-cm > 98% of time, no gaps > 60-cm; Footprint coverage within 80-cm > 90% of time	Ultimately per dataset submittal, but must be monitored daily
		Subsurface "blind" seed detection for EM61, placed by UXOQCS in grid near no known response using anomaly avoidance	Peak detected within 90-cm fiducial positioning methods and within 70-cm using RTK-DGPS positioning methods	Ultimately per dataset submittal, but must be monitored daily

Definable Feature of Work	Geophysical Anomaly Data Quality Indicator	QC Sample and/or Activity to Assess Performance	Measurement Performance Criteria	Frequency
Geophysics Management Phase II [*includes: Anomaly Pin-Pointing, 3-D CI with Advanced Classification*] { **MRP SOP 08 & MRP SOP 09**}	Completeness & Precision	Anomaly Peak offset evaluations between interpreted to pin-pointed locations and between pin-pointed to cued interrogation model locations Instrument Verification Strip static cued testing for 3-D CI	Pin-Pointed peak < 100-cm offset from interpreted peak location cued interrogation model position < 40-cm offset from pin-pointed peak location Cued interrogation model results demonstrate > 0.95 (~ 95%) confidence metric as compared to library saved item	Each Anomaly
Project Closeout Phase I [*includes: FI data deliverables check relative to ESI reporting*]	Completeness & Accuracy	**QC of MEC:** Tracking Log and Daily Field Reports **QC of DGM**: Equipment Test Results & Preliminary Target Interpretation Maps Generated **QC of 3-D CI:** Equipment Test Results, Anomaly noise-level assessment, & preliminary results	Quantitative tabulation, including photolog, of MEC items discovered during ESI surface assessments Quantitative tabulation or figure representation subsurface metallic item response assessment Semi-quantitative tabulation of MEC items discovered based on subsurface assessment using non-invasive techniques	Prior to key UXO Personnel or hand-held instrument (e.g., GPS, Schonstedt, White) Demobilization Prior to key DGM personnel or equipment (e.g. EM31, EM61) Demobilization Prior to key 3-D CI personnel or equipment (e.g. 2x2Temtads, MetalMapper) Demobilization
Project Closeout Phase II [*includes: Demobilization*]	Completeness	Verify that sites have been restored and all equipment is inspected, packaged, and shipped to appropriate location	All equipment is off-site and arrived at destination. Discuss with client whether IVS should be removed or remain intact for future project.	Once at the end of field operations

Worksheet 17 *documents the full list of SOPs provided in* ***Attachment 1; Worksheet 22*** *provides additional details for Equipment Testing.*

SAP Worksheet #13 -- Secondary Use of Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Use of Data Criteria and Limitations for Fleming Key Dredge Spoils Area.				
Secondary Use Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (originating organization, data types, data generation / collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
Preliminary Assessment	Malcolm Pirnie / Preliminary Assessment for the Dredge Spoil Area, Fleming Key, United States Coast Guard Parking Lot, Trumbo Point Annex, Naval Air Station Key West, Florida, DECEMBER 2010	Malcolm Pirnie	Basis for UFP-SAP, Site Histories, and CSMs	The information is qualitative and no quantitative (site-specific nature and extent of contamination) information is available for surface or subsurface assessments. The information was used to establish the field work program and identify areas most likely to be contaminated.
Site Inspection	Tetra Tech NUS / Site Inspection Report for Munitions Response Program Site Inspections at Fourteen Munitions Response Program Sites Naval Air Station Key West, Florida, APRIL 2012	Tetra Tech NUS	Basis for MRSPP scoring, UFP-SAP, Site Histories, and CSMs	No digitally recorded quantitative (site-specific nature and extent of contamination) information is available for discrete subsurface assessments. The information was used quantify MRSPP scoring and to establish the field work program in order to identify areas most likely to be contaminated.

SAP Worksheet #14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

Implementation of the MEC investigation has been divided into definable features of work, and the tasks required to complete each definable feature of work have been identified. Procedures for these tasks, including recording data, forms and checklists, data generation, QC checks, data management, and information management, are defined in the SOPs for the project indexed in **Worksheet #21**. Other pertinent worksheets to cross reference include those allotted for detailing sampling design, rationale, and performance requirements (**Worksheets #12, #17, #20**) and others allotted for inspection, verification, and validation of the performance requirements (**Worksheets 22, 34, 35, 36**), all of which are attributable to the requirements for the QC of each DFW as detailed in each cross-referenced table.

Task Details on a Per DFW basis for Fleming Key Dredge Spoils Area

Definable Feature of Work	Tasks
Site Preparation [*includes: Mobilization, Security, Equipment Verification, IVS construction*]	• Prepare Project Plan (SAP review, geographic information system (GIS) setup, review documentation and data management procedures, approve SAP and subcontractors, and schedule confirmed) • Verify Personnel (gather personnel records, vet personal qualifications, obtain & maintain safety training certifications, and collect I-9 & other base access forms) • Coordinate with local authorities (hospital, environmental director, explosive safety officer, etc.) and establish lines of communication after informal introductions • Equipment set-up and checkout to ensure all parts were shipped, arrived, and are working to specification • Remove non-munitions surface related debris; identify, mark (i.e. paint, cones, flagging), and position suspect munitions related items for anomaly avoidance • Initial site orientation and safety training (including HASP / SAP review w/ signoff, emergency response discussion w/ handout of hospital map, contact number list) • Install IVS (anomaly avoidance techniques, place seeds, leave holes open for Site Survey and/or DGM subcontractor, close holes, conduct initial survey)
Anomaly Avoidance – transects, grids, and pathways for all field crews {**MRP SOP 01, 02, 03**}	• Detector-aided survey to locate metallic items, indicative of potential MEC/MPPEH, on the ground surface • Metallic items clearly identified as recyclable material (i.e. CD, MDAS), from the surface, without initially moving or prying from subsurface, will be placed into scrap buckets for subsequent proper disposal in locked storage bin by COB • Metallic items clearly identified as an explosives hazard (i.e. UXO, MDEH) or suspected to have energetic material (i.e. MEC, MPPEH) from the surface will be documented (e.g., GPS, photograph, logbook), Left-In-Place (LIP), and flagged for anomaly avoidance while awaiting EODMU6 demolition • UXO escort and anomaly avoidance duties, as needed, for all visitors and all other field tasks using non-essential personnel

Task Details on a Per DFW basis for Fleming Key Dredge Spoils Area	
Definable Feature of Work	**Tasks**
Vegetation Management {**MRP SOP 04**}	• Check Equipment for proper height • UXO Escort and MEC avoidance • Cut vegetation to proper height • Avoid cutting in close proximity (i.e. 5-10 ft) to large metal or concrete features (e.g., magazines, fences, etc.) which could damage equipment and would interfere with DGM instruments to a level of producing an indiscernible product • Requires full-time UXO Tech for escort and anomaly avoidance
(Land) Survey Management {**MRP SOP 05**}	• Survey benchmarks and establish control points for all future coordinate checks on-site • Survey site boundaries with Theodolite, RTS, GPS, or conventional means • Survey internal grid system (at **100 ft** square grid increments, aligned N-S-E-W) using Theodolite, RTS, GPS, or conventional means • Avoid surveying in close proximity (i.e. 5-10 ft) to large metal or concrete features (e.g., magazines, fences, etc.) which could damage equipment and would interfere with DGM instruments to a level of producing an indiscernible product • Survey IVS (end points and location of items down-hole) • Requires full-time UXO Tech for escort and anomaly avoidance
Geophysics Management Phase I [*includes: DGM Transect & Grid Surveys*] {**MRP SOP 06 &** **MRP SOP 07**}	• DGM transect-pattern surveys to locate metallic items, indicative of potential MEC/MPPEH densities, in the subsurface • DGM grid-pattern surveys to be conducted at areas of interest as identified by either groups of surface MEC/MPPEH finds (as documented in the PA / SI / ESI surface assessments) or elevated densities of MEC/MPPEH (as documented by the elevated anomaly count in the ESI DGM transect surveys) • Data will be downloaded from digital logger each evening and sent (i.e. email, ftp, etc.) to the home office for processing and Field Scientist for record keeping; the data will be maintained on the digital logger for 1 week, or until hard drive is full, for a redundant source of backup for site personnel • All Raw data, QC test (i.e. static, IVS) results, and preliminary processed production data, inclusive of fidelity evaluations (i.e. sample separation, footprint coverage, seed detection, etc.), will be tracked in the appropriate database table with both data and tracking uploaded to the ftp site within 24 hrs • Processed data with preliminary results (i.e. color-coded map showing currently identified areas of interest and historically relevant GIS data) will be uploaded within 48 hours • End-product deliverables with final processed data, *Geosoft* template color-coded map with discrete targets, and target database tabulations will be uploaded within 96 hours

Task Details on a Per DFW basis for Fleming Key Dredge Spoils Area	
Definable Feature of Work	**Tasks**
Geophysics Management Phase II [*includes: Anomaly Pin-Pointing, 3-D CI with Advanced Classification*] { **MRP SOP 08 & MRP SOP 09**}	• Anomaly pin-pointing to flag the peak location, record the peak response, and record the offsets from the original interpretation location • Cued-Interrogation to record the static response over nearest location, within 40cm, that infers a peak response from the previously pin-pointed peak anomaly location • All Raw data, QC test (i.e. static for anomaly pin-pointing or IVS for cued interrogation) results, and preliminary processed interrogation data will be tracked in the appropriate database table and uploaded to the ftp site within 24 hrs • End-product deliverables with final processed data, database tabulations, visual representations, and decision-making summaries, inclusive of confidence metrics, completed within 48 hours and uploaded to ftp site within 72 hours
Project Closeout Phase I [*includes: FI data deliverables check relative to ESI reporting*]	• Gather and QC all field documentation, inclusive of logbooks • Conduct final QC inspections / audits to ensure all FI data reporting deliverables required to complete each DFW, as referenced in **Worksheets 12, 17, and 22**, are completed before demobilizing personnel and equipment
Project Closeout Phase II [*includes: Demobilization*]	• Discuss with client whether IVS should be removed or remain for future field operations (as ESI results may drive decision) • Return rental pool of vehicles and other field equipment to home office or owners/operators of said equipment

.

SAP Worksheet #15 -- Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

WORKSHEET IS NOT APPLICABLE (NA).

This worksheet applies to chemical analysis and reporting, and is not applicable to this UFP-SAP for MEC surveys/investigations.

SAP Worksheet #16 -- Project Schedule / Timeline Table (optional format)

(UFP-QAPP Manual Section 2.8.2)

Based on the recommendations detailed within the initial SI document {***April 2012, Tetra Tech NUS***}, the follow-on guidance provided within Statement of Work (SOW) {***March 2012, NAFVAC SE***}, and the proposal summary introduced in the previously, Resolution Consultants plans to conduct an Expanded SI conforming to the following **six** scoped tasks (with specific implementation methods and associated goals to be detailed in **Worksheet #17** to follow):

1. **TASK 1 – Project Planning (PP):** consists of sub-tasks to complete project planning meetings and planning documents, inclusive of the current SAP with the associated HASP and Explosive Safety Submission (ESS) Determination Request (DR) planning documents, all of which have the associated goal of adequately and safely sampling the site through non-invasive (e.g. IAVS, anomaly avoidance, DGM, etc.) sampling procedures.

2. **TASK 2 – Field Investigation (FI):** consists of subtasks of anomaly avoidance, vegetation removal, DGM, anomaly pin-pointing, and three-dimensional Cued Interrogation (3-D CI) sensor systems which combined have the associated goal of using statistically guided non-invasive sampling techniques to assess the surface (i.e. avoidance) and subsurface (i.e. DGM, 3-D CI, etc.) for the estimated quantity, size, and distribution of MEC.

3. **TASK 3 – Expanded Site Investigation Report (SI):** consists of subtasks to complete the summarization of the assessment of the site to this juncture of the project, inclusive of a Risk Assessment and SI Report, both of which have the goal of summarizing the non-invasive sampling estimates of MEC and the correlating the risks associated with the estimates.

4. **TASK 5 – Database Management (DM):** consists of a task to import and store the data acquired during the expanded SI with the goal of generating Geographic Information System (GIS) maps for the SI report from the previous task and exporting data for the AR in the subsequent task.

5. **TASK 6 – Administrative Record (AR) Updates:** consists of a task to update the AR with the FI data and expanded SI report information, inclusive of DM and GIS exports.

6. **TASK 7 – Ordnance (XO):** consists of subtasks to update the Munitions Response Sites Priority Protocol (MRSPP) scores, revise the ESS DR, and prepare an IRA WP with a full ESS with the ultimate goals of each subtask tailored to focus the removal of MEC while monitoring that the initial planned regimented procedures to mitigate risk are followed at the Fleming Key site.

The series of tasks are the same is listed in the MS Project Schedule provided to the NAVFAC SE {***July 2012, Resolution Consultants***}, with exception that the table below provided anticipated dates of initiation or completion of each task, along with the deliverable due date directly excerpted from the previously provided MS Project submittal, in order to account for either current schedule updates based on deliverables already submitted or changes in efficiencies expected based on current progress.

Projected Schedule and Timelines for Fleming Key Dredge Spoils Area					
Activities	**Organization**	**Dates (MM/DD/YY)**		**Deliverable**	**Deliverable Due Date**
		Anticipated Initiation Dates	**Anticipated Completion Dates**		
TASK 1 – PROJECT PLANNING (PP): inclusive of ESS-DR, HASP, MRSPP scoring, and UFP-SAP.					
Explosives Safety Submission Determination Request (ESS-DR) document submittals and approvals.					
ESS-DR Internal Draft Submittal	Resolution Consultants	July 20, 2012	Delivered September 27, 2012	Digital copy for Internal Review	August 2, 2012 to NAVY
ESS-DR Draft Review	NAVFAC SE, NOSSA	September 28, 2012	October 27, 2012	Comments	September 2, 2012
ESS-DR Final w/ Response to Comments	Resolution Consultants	October 28, 2012	November 5, 2012	Digital copy appended w/in UFP-SAP	September 9, 2012
Health and Safety Plan (HASP) document submittals and approvals.					
HASP Internal Draft Submittal	Resolution Consultants	July 20, 2012	October 10, 2012	Digital copy for Internal Review	September 18, 2012 to NAVY
HASP Internal Draft Review	NAVFAC SE	October 12, 2012	October 31, 2012	Comments returned	November 8, 2012
HASP Draft Final w/ Comment Responses	Resolution Consultants	November 1, 2012	January 01, 2013	Digital and Hard copies	December 10, 2012
Munitions Response Site Prioritization Protocol (MRSPP) scoring updates, submittals, and approvals.					
MRSPP Scoring for 14 AOCs, including Fleming Key	Resolution Consultants	July 20, 2012	September 7, 2012	Spreadsheet submittal for review / comment	August 20, 2012
Navy Review & HQ approval	NAVFAC SE	September 8, 2012	December 5, 2012	Approved scores for each of the 14 AOCs, including Fleming Key	November 19, 2012
Uniform Federal Polity Sampling and Analysis Plan (UFP-SAP) submittals and approvals.					
UFP-SAP Internal Draft Submittal	Resolution Consultants	July 20, 2012	October 10, 2012	Digital copy for Internal Review	September 17, 2012 to NAVY

Projected Schedule and Timelines for Fleming Key Dredge Spoils Area					
Activities	**Organization**	**Dates (MM/DD/YY)**		**Deliverable**	**Deliverable Due Date**
		Anticipated Initiation Dates	**Anticipated Completion Dates**		
UFP-SAP Internal Draft Review	NAVFAC SE	October 10, 2012	October 31, 2012	Comments returned	October 8, 2012 return
UFP-SAP Draft and Response to Comments	Resolution Consultants	November 1, 2012	November 30, 2012	Hard Copy for Regulatory Review	November 7, 2012 to FDEP
UFP-SAP Regulatory Draft Review	FDEP	December 1, 2012	January 30, 2012	Comments returned	January 7, 2013 return
UFP-SAP Draft Final w/ Comment Responses & Feedback	Resolution Consultants	January 31, 2012	February 28, 2013	Hard copy for final review	February 6, 2013
UFP-SAP Final	Resolution Consultants	March 1, 2013	March 30, 2013	Digital and Hard Copies	March 8, 2013
TASK 2 – FIELD INVESTIGATION (FI): inclusive of vegetation removal, RLS, IAVS, DGM, anomaly pin-pointing, and 3-D CI.					
SURFACE ASSESSMENTS portion of Field Investigation (FI) tasks.					
Vegetation Management, UXO escort & anomaly avoidance / Vegetation Removal Services	Resolution Consultants / UXO Biz	April 15, 2013	April 30, 2013	Vegetation cleared from on / near dredge soils	April 7, 2012
Survey Management, UXO escort & anomaly avoidance / RLS	Resolution Consultants / Island Surveying, Inc.	April 22, 2013	May 02, 2013	Survey control established for transects/grids	April 16, 2013
IAVS transects & grids	Resolution Consultants	May 4, 2013 & May 14, 2013	May 13, 2013 & May 23, 2013	Items found documented and positioned	April 30, 2013
SUBSURFACE ASSESSMENTS portion of Field Investigation (FI) tasks.					
DGM transect & grids / DGM Services	Resolution Consultants & NAEVA Geophysics, Inc.	May 14, 2013 & May 25, 2013	May 23, 2013 & June 2, 2013	DGM transects followed by grids	May 10, 2013
Anomaly Pin-pointing & Cued Interrogation	Resolution Consultants & NAEVA Geophysics, Inc.	April 3, 2013	April 10, 2013	Anomaly similarities to ordnance with % confidence metric	May 17, 2013

Projected Schedule and Timelines for Fleming Key Dredge Spoils Area					
Activities	**Organization**	**Dates (MM/DD/YY)**		**Deliverable**	**Deliverable Due Date**
		Anticipated Initiation Dates	**Anticipated Completion Dates**		
TASK 3 – EXPANDED SITE INVESTIGATION REPORTING (SI): inclusive of Risk Assessment and Site Investigation Report.					
ESI REPORT Internal Draft Submittal	Resolution Consultants	April 11, 2013	July 10, 2013	Digital copy for Internal Review	July 16, 2013 to NAVY
ESI REPORT Internal Draft Review	NAVFAC SE	July 11, 2013	September 10, 2013	Comments returned	August 15, 2013 return
ESI REPORT Draft and Response to Comments	Resolution Consultants	September 11, 2013	October 12, 2013	Hard Copy for Regulatory Review	September 16, 2013 to FDEP
ESI REPORT Regulatory Draft Review	FDEP	October 13, 2013	December 13, 2013	Comments returned	November 16, 2013 return
ESI REPORT Draft Final and Response to Comments w/ Feedback	Resolution Consultants	December14, 2013	January 14, 2013	Hard copy for final review, comment resolution	December 16, 2013
ESI REPORT Final	Resolution Consultants	January 14, 2013	February14, 2013	Digital and Hard Copies	January 15, 2014
TASK 5 – DATABASE MANAGEMENT (DM): inclusive of Importing and Storing FI Data and ESI Reporting Information into databases.					
Database Management	Resolution Consultants	July 11, 2013	August 12, 2013	Updates of Databases	August 15, 2013
TASK 6 – ADMININSTRATIVE RECORD UPDATES (AR): inclusive of Updating the AR with the FI Data and ESI Reporting Information.					
Administrative Record	Resolution Consultants	August 13, 2013	September 13, 2013	Updates of Admin Record	September 15, 2013
TASK 7 – ORDNANCE (XO): inclusive of Update of the MRSPP scores, Revise the ESS DR to ESS, and Prepare IRA WP with full ESS.					
Munitions Response Site Prioritization Protocol (MRSPP) scoring update, submittal, and approval.					
Update of MRSPP Scoring for Fleming Key	Resolution Consultants	August 14, 2013	August 30, 2013	Spreadsheet submittal for review / comment	September 13, 2013
Navy Review & HQ approval of Fleming Key MRSPP	NAVFAC SE	September 1, 2013	September 15, 2013	Approved scores	September 30, 2013

Projected Schedule and Timelines for Fleming Key Dredge Spoils Area					
Activities	**Organization**	**Dates (MM/DD/YY)**		**Deliverable**	**Deliverable Due Date**
		Anticipated Initiation Dates	**Anticipated Completion Dates**		
Explosives Safety Submission Determination Request (ESS-DR) revision to full ESS document submittals and approvals.					
REVISED ESS-DR to full ESS Draft Submittal	Resolution Consultants	November 15, 2013	January 15, 2014	Digital copy for Internal Review	February 14, 2014 to NAVY
REVISED ESS-DR to full ESS Draft Review	NAVFAC SE, NOSSA	January 16, 2014	February 16, 2014	Comments returned	March 17, 2014
REVISED ESS-DR to full ESS w/ Response to Comments	Resolution Consultants	February 17, 2014	March 17, 2014	Digital & Hard copy	April 16, 2014
REVISED ESS-DR to full ESS Final Submittal	Resolution Consultants	March 17, 2014	April 17, 2014	Digital copy appended w/in IRA WP	May 16, 2014
Interim Removal Action Work Plan (IRA WP) document submittals and approvals.					
IRA WORK PLAN Internal Draft Submittal	Resolution Consultants	November 15, 2013	February 15, 2014	Digital copy for Internal Review	March 17, 2014 to NAVY
IRA WORK PLAN Internal Draft Review	NAVFAC SE	February 16, 2014	March 16, 2014	Comments returned	April 16, 2014 return
IRA WORK PLAN Draft and Response to Comments	Resolution Consultants	March 17, 2014	April 16, 2014	Hard Copy for Regulatory Review	May 16, 2014 to FDEP
IRA WORK PLAN Regulatory Draft Review	FDEP	April 17, 2014	June 16, 2014	Comments returned	July 16, 2014 return
IRA WORK PLAN Draft Final, Response to Comments w/ Feedback, and fully approved ESS referenced	Resolution Consultants	June 17, 2014	July 15, 2014	Hard copy for final review, comment resolution	August 15, 2014

SAP Worksheet #17 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

17.1 BACKGROUND

The results of the limited SI at the Fleming Key Dredge Spoil Area found no surface MEC or MPPEH during an Instrument-Aided Visual Survey (IAVS); however, high counts of shallow subsurface anomalies were found across the site potentially representing MEC/MPPEH or other debris. During the IAVS field activities Tetra Tech NUS did find and document the locations of MD (i.e. eight 20mm casings, three casings ranging between 0.30 to 0.762 calibers, one 75mm x 11in unknown munitions related item) related to the dredge spoils and CD (e.g. sewer hole covers, EOD magazines, fences, etc.) related to the installation infrastructure. As an overview of the results from the limited SI at the Fleming Key Dredge Spoil Area, the following recommendations were made by Tetra Tech NUS {***April 2012, Tetra Tech NUS***} and subsequently approved by NAVFAC SE with regulatory oversight consent:

- ✓ Utilization of statistical techniques (e.g., Visual Sample Plan, UXO Estimator, etc.) to define the quantity and distribution of transect (and/or grid) sampling;
- ✓ Non-invasive subsurface investigation using Digital Geophysical Mapping (DGM) techniques;
- ✓ Utilization of statistical (e.g., Visual Sample Plan, UXO Estimator, etc.) to define the quantity and distribution of intrusive investigation sampling for Munitions and Explosives of Concern (MEC);
- ✓ Munitions Constituents (MC) sampled based on the results from the DGM and MEC sampling.

Based on the recommendations noted above and follow-on guidance provided within Statement of Work (SOW) {***March 2012, NAFVAC SE***}, Resolution Consultants proposed {***April 2012, Resolution Consultants***} to conduct only non-invasive techniques for the ESI stage and reserve any prospective intrusive investigation techniques (e.g. MEC or MC sampling) for the Interim Removal Action (IRA) or potential Remedial Investigation (RI) and Removal Action (RA) phases to follow. Furthermore, Resolution Consultants proposed to conduct an ESI conforming to the **six** scoped tasks (with associated goals) as introduced in **Worksheet #16**. Of the six tasks, only TASK 2 is relevant to the sampling design and rationale, so the FI sub-tasks will be the discussion focus for the current worksheet. As detailed in Section 11.2, the proposed non-invasive techniques which, in-turn, comprise the entirety of TASK 2, are grouped into two categories based from the design of how the sample will be assessed relative to rationale of the assessment depth for each sample:

1. **SURFACE ASSESSMENTS:** initial safety escorting during pre-DGM site preparation activities (i.e. Vegetation Management, Survey Management) in conjunction with Anomaly Avoidance duties conducted by UXO Techs to locate, mark, and document locations for surface anomaly avoidance and assess the surface MEC/MPPEH;

2. **SUBSURFACE ASSESSMENTS:** standard DGM techniques (e.g., EM61, EM31, etc.) to capture anomaly distributions along transects and within grids down to detection depth followed by recently developed 3-D cued interrogation advanced classification techniques (e.g., MetalMapper, Temtads) to assess the subsurface for MEC/MPPEH.

As a reminder, the primary objective, and ultimate goal, of this ESI is to determine whether further response actions, IRAs, RIs, or RAs are appropriate for the Fleming Key site based on capturing the site-specific environmental data to determine types and rough orders of magnitude quantities of MEC present.

The current section describes the approaches, methods, and operational procedures Resolution Consultants will use to conduct the surface and subsurface assessments for MEC/MPPEH, on a per sub-task basis as excerpted from TASK 2, above. Specifically, this SAP worksheet documents the site-specific application of geophysical sensors, navigation equipment, data analysis, and associated equipment and personnel in a manner capable of meeting the site-specific project performance goals as presented in **Worksheet #11**. Lastly, personnel will follow the Standard Operating Procedures (SOPs) listed below, as provided in **Attachment 1**, and as also referenced in **Worksheets 21, 22, and 29**.

Definable Feature of Work	SOP	Supporting Document(s)
Project Startup [*includes: Mobilization, Security, Equipment Verification, IVS construction*]	NA	UFP-SAPP, HASP, & ESS-DR
Vegetation Management	MRP SOP 04	UFP-SAPP & ESS-DR
Anomaly Avoidance [*includes: Inspection and Disposal of MPPEH, MEC Demolition & Disposal Operations*]	MRP SOP 01, MRP SOP 02, and MRP SOP 03	UFP-SAPP & ESS-DR
Survey Management	MRP SOP 05	UFP-SAPP & ESS-DR
Geophysics Management (*includes: DGM Transect Surveys, DGM Grid Surveys, Anomaly Pin-Pointing, Three-Dimensional (3-D) Cued-Interrogation (CI) with Advance Classification*]	MRP SOP 06, MRP SOP 07, MRP SOP 08, and MRP SOP 09	UFP-SAPP & ESS-DR
Project Closeout [*includes: FI data deliverables check relative to ESI reporting, demobilization*]	NA	UFP-SAPP & ESS-DR

For cross-reference, the performance criteria and bulleted list summary requirements for each of the Definable Features of Work (DFWs) listed above is found other sections of the UFP-SAPP, such as in **Worksheet #12** and **Worksheet #14**, respectively. Prior to conducting the DFWs, a series of subtasks that can be completed while being inspected / audited for Quality Control / Quality Assurance (QC / QA) at key junctures of the project as a part of the FI task, Project Preparation and Project Closeout activities must also be planned for and completed in order to properly begin and finish the project at hand. The DFWs listed in the table above are discussed in detail, with their inspection metrics referenced, quantified, or qualified, in subsequent sections to follow. Lastly, the DFW's have other requirements from supporting documents, as indicated by the reference to either the ESS-DR or HASP in the above table.

17.2 SAMPLING DESIGN & RATIONALE FOR DFW's

Prior to discussing each of the field techniques, the sampling rationale requires introduction along with the corresponding sample design requirements discussion as determined by Visual Sample Plan (VSP) and UXO Estimator (UXOEST), the most commonly used and widely accepted statistical sampling packages used within the MMRP industry. Sampling design input requirements into VSP include expected target area size, pattern, and anomaly density along with the anomaly density of the background non-target area material, whereby target area is defined as an area of focused MEC/MPPEH concentration based on the location formerly used as either a firing point or down-range target area. For the case of Fleming Key, using records to determine standard range fan patterns or sizes based on ordnance sizes is not useful as the potential of MEC/MPPEH on Fleming Key is clearly based on man-made deposition from another location and not resulting from historical use as an impact range from years of practice. In lieu of the unpredictable spread pattern, Resolution Consultants has chosen to use the spread pattern from the previously conducted surface assessments, indicating groups of MEC/MPPEH items were found to be within a 100 ft radius. Additionally, target densities from the SI anomaly counts estimate that the target areas are well in excess of 50 anomalies (and more on the order of 250 anomalies) per acre greater than the background concentrations. After input expected target size and anomaly densities, a statistically valid transect spacing was determined to converge on 50 foot line spacing, with 95% confidence of both transversal and detection. The sample design line spacing resulted in requiring 4.3 miles of straight-line transects, equating to approximately 4.5 - 5.0 miles inclusive of turnarounds, traveling along a cardinal N-S direction. Maps showing the current site boundaries, the proposed transect sampling design, and an example grid sample selection, all overlain on aerial photography are provided as **Figure 17-1, Figure 17-2, and Figure 17-3,** respectively, for reference within the discussion of individual DFW's to follow.

17.2.1 Anomaly Avoidance

As detailed in the Resolution Consultants' ESS-DR submittal and corresponding NOSSA ESS-DR approval letter (**Attachment 2**), the following four precautionary measures are required to be implemented for all field activities: **(1)** notifying Key West Explosives Safety Officer (ESO) regarding the commencement of field work; **(2)** providing adequate UXO-qualified personnel to escort all field teams, site visitors, and non-essential personnel; **(3)** providing adequate UXO-qualified personnel to conduct anomaly avoidance techniques to prevent field personnel contact with potential MEC/MPPEH located on the surface; and **(4)** conducting no intrusive activities or intentional physical contact with MEC/MPPEH. The communication of item #1 is an important precautionary measure required by the approved ESS-DR due to the fact the southern portion of the Fleming Key Dredge Spoils area is within existing Explosives Safety Quantity Distance (ESQD) arcs, but outside of K18 intra-line distance from any Potential Explosion Site (PES), from NAS Key West storage. The key factors in each of the remaining three precautionary measures is to essentially provide a UXO Tech escort to conduct anomaly avoidance procedures, as a part of supporting all future field tasks, using the following standard guidelines:

- Instrument-Aided-Visual-Survey (IAVS) anomaly avoidance technique to locate metallic items, indicative of potential MEC/MPPEH, on the ground surface;
- Instrument-Only-Aided (i.e. no visual) anomaly avoidance technique to locate metallic items, indicative of potential MEC/MPPEH, in the subsurface;
- Metallic items clearly identified as recyclable material (i.e. CD, MDAS), from the surface, without initially moving or prying from subsurface, will be left-in-place; and
- Metallic items clearly identified as an explosives hazard (i.e. UXO, MDEH) or suspected to have energetic material (i.e. MEC, MPPEH) from the surface will be documented (e.g., GPS, photograph, logbook) and red-flagged or orange-coned for anomaly avoidance.

IAVS anomaly avoidance techniques will be implemented on all field activities to follow, while Instrument-Only-Aided techniques will be reserved for shallow surface RLS survey marker emplacements within the Dredge Spoils boundary or IVS construction outside of the Dredge Spoils boundary. Anomaly Avoidance will be accomplished in accordance with **MRP SOP 01** with QC checks documented by UXOQCS and tabulate against metric standards, as listed in **Worksheet #12**.

17.2.2 Project Startup Activities

17.2.2.1 Prepare and Review Project Plans

Site Preparation begins with a series of draft submittals, revisions, and approvals of the current UFP-SAP, a corresponding HASP, and an attached ESS DR, inclusive of obtaining all required signatures documenting said approval and final sending hard copies out for client reference. Finally, both digital and hard copies will be maintained on site for reference, and signoff by each Resolution Consultants or Resolution Consultants subcontract employee as a part of the site orientation detailed in the next section.

17.2.2.2 Site Mobilization, Set-up, and Preliminary Activities

Resolution Consultants will schedule the arrival of its workforce, and subcontracted workforce, in a manner that is most effective and designed to allow immediate productivity. All personnel mobilized to the site will meet the Occupational Safety and Health Administration (OSHA) training and medical surveillance requirements specified in the HASP. The UXO Technicians will have the appropriate level of training and experience as stated in Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). As part of the mobilization process, site-specific training for all on-site personnel will be performed, and each person will sign **Worksheet #4**. The purpose of this training is to ensure that personnel fully understand the operational procedures and methods to be used at NAS Key West, to include individual duties and responsibilities, and all safety and environmental concerns associated with these MEC operations. The training will include, but is not limited to, a review of this MEC UFP-SAP and the

HASP. Any personnel arriving at the site after this initial training session will be trained when they arrive and will sign **Worksheet #4**. Training will be conducted by a UXO Technician III, likely the SUXOS or dual-hat UXOSO / UXOQCS.

Project equipment for the anomaly avoidance surface assessments will come from Resolution Consultants sources and local leases/purchases, while the remaining project equipment used for production activities will be provided by each vendor conducting the field work. Resolution Consultants will also self-provide any equipment required to conduct quality inspection or safety audits of subcontractors, inclusive of instruments, software / hardware, and vehicles. All equipment, regardless of source, will be checked to ensure its completeness and operational readiness. Any equipment found damaged or defective will be returned to the point of origin, and a replacement will be secured. All instruments and equipment that require routine maintenance and/or calibration will be checked initially upon arrival and then prior to use each day, if needed to support that days operations. This system of checks ensures that the equipment is functioning properly. If an equipment check indicates that any piece of equipment is not operating correctly and field repair cannot be made, the equipment will be tagged and removed from service, and a request for replacement equipment will be placed immediately. Replacement equipment will meet the same specifications for accuracy and precision as the equipment removed from service.

17.2.2.3 Site Accessibility and Traffic Control

Fleming Key Dredge Spoils area is locked-in fenced areas with signage that is also within the confines of a controlled area accessible only through guarded access gates at NAS Key West Trumbo Point Entrance, just north of the corner of Palm Avenue and Ely Street. Prior to arrival on site, all site workers will be required to submit I-9 and other personal information as required to gain base access through the Trumbo Point entrance. Once on site, safety regulations require that an active exclusion zone be established at the sites and maintained before any MEC investigation activities occur due to the potential of encountering explosively configured/fuzed munitions. For this project, the exclusion zone will be established at a minimum of 200 feet from the edge of the MEC investigation area. If non-site personnel or non-essential non-UXO personnel enter an exclusion zone, all MEC operations will cease until the exclusion zone is re-established. Since Both routine and emergency response actions dictate the need for prevention of unauthorized site access and for the protection of vital records and equipment. Exclusion zone rules do not apply to non-invasive activities, such as geophysical surveys.

17.2.2.4 Site Security

Site security will be maintained to ensure that non-essential personnel do not access the exclusion zone during the UXO Tech conducted IAVS of the surface or other UXO Tech escorted anomaly avoidance operations at the site. Barricades will be positioned on access routes a minimum of 200 feet from the edge of the investigation site, only during work hours, as permitted by NAS Key West. Notification procedures will be posted on the barricades to ensure that non-essential personnel notify the team working in the area prior to entering the area.

17.2.2.5 Governing Regulations/Guidance and Explosive Safety Submission Determination

The work planned for this ESI does not require an ESS because safety escort and anomaly avoidance measures will be practiced during the non-invasive investigations currently planned. No MEC or MPPEH will be moved or disturbed during this phase of the project. An ESS-DR was prepared describing the general operations planned at the site. NOSSA reviewed the request and issued an ESS-DR for the planned operations allowing the activities using the required precautionary procedures listed in **Attachment 2** approval letter.

MEC activities will be performed in accordance with all local, state, and federal regulations and will include all applicable Department of Defense (DoD) requirements, including those in Engineer Pamphlet (EP)-75-1-2 {***2004, USACE***} and Military Munitions Response Program (MMRP) Data Item Description (DID) 09-005 {**2009, USACE**}. Activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with the Department of the Navy, NOSSA, and DoD requirements regarding personnel, equipment, and procedures. Navy

requirements include OP-5 and NOSSAINST.8020.15B This ESI is being conducted as part of the Defense Environmental Restoration Program (DERP) MMRP. The ESI will be performed in accordance with CERCLA Sections 104 and 121. The sites where surveys will be conducted may contain live munitions and caution should always be exercised while working on these sites.

17.2.2.6 Equipment Verification

The following Equipment Verification steps will be conducted as a part of a checklist (similar to **Worksheet #14**) prior to the commencement of ESI field work and at the start of each day:

1) Inventory and inspection of all equipment to be used during that day's activities to confirm that all components are present and in good condition;

2) Assembling, powering up, and monitoring the general equipment functionality after warm-up; and

3) Conducting daily QC tests as described later in this chapter, as detailed in the referenced SOP, and as prescribed in **Worksheet #12**.

QC tests must be completed and passed on a daily basis and all required final documentation of each QC test (i.e. figure, table, etc.) must be generated and compared against the individual performance requirement metric before demobilizing from site .

17.2.2.7 IVS Construction

The Instrument Verification Strip (IVS) will be constructed as a part of the site preparation activities, yet prior to the ESI FI activities to follow. The IVS will be constructed using anomaly avoidance techniques in an area within the property fence-line yet outside of the dredge spoils pile boundary, with representative site conditions and will contain well-characterized objects seeded in an in-line manner. Specifically, medium-sized Industry Standard Objects (ISOs) as developed by Strategic Environmental Research and Development Program (SERDP) and subsequently demonstrated by Environmental Security Technology Certification Program (ESTCP) will be used. The ISOs are Schedule 40 pipe nipples that are threaded on both ends, and made of welded steel that has been manufactured to the specifications of the American Society for Testing and Materials (ASTM). The ISOs measure 2.375 inches in diameter and 8 inches in length. The objects will be painted blue and tagged with a sequentially numbered ID.

The objects will be placed sufficiently far apart such that the sensor signal returns to the background noise level between objects; it is anticipated that IVS will be less than 100 feet in length and the objects will be buried at depths between 3 and 7 times the diameter of the ISO, equivalent to depths below ground surface (bgs) of between 7 and 17 inches, to ensure adequate signals above the background noise level. Roughly half of the objects will be placed in the least favorable orientation (i.e., horizontal). An accurate measurement will be made from the ground surface to the center point of the objects and their locations will be measured and marked on the ground surface after burial. Finally, the end points will be surveyed and a roped tied between in order to provide a visual cue of controlling the walk-path and limiting controllable sources of errors while providing regimented consistency between passes.

17.2.2.8 Initial IVS Passes with Letter Report

The initial IVS pass using the EM61-MK2 sensor will DGM the line of seed of items along the roped visual cue and physically constrained travel pattern. Immediately after the initial pass, an additional pass will be made and the responses will be compared to ensure constancy. The controlling of coil positions is currently deemed the best method to maximize the repeatability between individual kinematic passes, and to minimize error as much as possible as compared to the Naval Research Laboratory (NRL) curves, keeping in mind the NRL curves were established statically. As a practical supplement to the process, small ISOs will be centrally mounted above the coil and compared to the NRL curves as a part of the daily static tests described in later sections. Thus, data will be collected both statically and kinematically over well-defined ISO

objects at the beginning and the end of each work day, and also after any modifications to the system (e.g., replacement of coils, changing of coil height, etc.).

The initial IVS pass using the hand-held sensor will required each UXO Tech operator to AGM the line of seed of items along the roped visual cue and physically constrained travel pattern. Each location that audibly responds to the sensor will be annotated within their logbook.

The results from day 1 passes along the IVS, for both EM61 and hand-held sensors, will be considered the truth for comparison against each day thereafter and as long as each supplement pass is representative of the previous, and other require daily QC tests are passed successfully, the equipment-operator system is considered to be functioning properly as a cohesive unit. Furthermore, a brief 2-3 page letter report, inclusive of figures, will be submitted after the first day of production and will include the following items:

- map showing as-built design of the IVS;
- pictures of seeded items;
- presentation of kinematic data collected over the IVS;
- comparison of static test data to depth/response curves; and,
- an assessment of the data quality for the first day of production.

The results will show sufficient quality for production operation, thus eliminating the need for additional mobilization and demobilization events. Full-scale data collection will commence the following morning as long as there are no unresolved issues pertaining to equipment performance compared to project goals. The letter will be provided as an attachment to the ESI report.

17.2.2.9 Blind Seeding Program

The Blind Seeding Program will involve the seeding of the dredge spoils mounded area production site with targets at known locations that will be "blind" with respect to the each field team to follow. The general criteria for placing blind seeds are that they should be numerous enough to be encountered on a daily basis, should be selected as potential targets, and the items with their locations should be recovered. As noted previously, the blind seeds will be used to monitor the quality of the full coverage (grid) areas throughout the course of the investigation. Finally, anomaly avoidance procedures will be strictly followed when blind seeding ISOs on the surface for IAVS coverage assessment, as well as when blind seeding ISOs in the subsurface for DGM coverage assessment, not only due to the undesired potential of masking a subsurface item through use of a seed placed on the surface but also due to the undesired potential of impacting a location containing MEC/MPPEH while placing a seed in the subsurface.

17.2.3 Vegetation Management

Vegetation Management will be required prior to performing future field activities as the vegetation (e.g. brush, grass, trees, etc.) can not only present physical impediment challenges (e.g. mobility, balance, tripping, etc.) but also present line-of-sight impairment limitations (e.g., visual, communication signals, electronic signals), all of which hinders: **(1)** the surveyors ability to accurately position the emplaced stakes; **(2)** the DGM, Anomaly Pin-Point, and 3-D CI teams' ability to accurately position and maneuver the metal detectors within close proximity to the ground surface; and **(3)** the UXO techs ability to clearly mark and position surface items identified for anomaly avoidance. Based on a recent site visit, the Fleming Key Dredge Spoils area will require full vegetation removal, to be accomplished in accordance with **MRP SOP 01**, Anomaly Avoidance, and **MRP SOP 04**, Vegetation Management, with the following are the types of equipment/techniques that may be used:

- Hand-held brush cutters will be used to cut light vegetation and small grassy areas;
- Mechanized equipment will be used to remove brush and grasses;
- Chain saws will be used in heavier brush areas and to cut small trees; and
- Brush/vegetation debris will be left on site at the edge of the area cleared.

Vegetation Management operations will be conducted by the preferred subcontractor with Resolution Consultants providing the UXO Techs for anomaly avoidance escort and other safe operation support activities, such as monitoring the field activities for proper use of equipment. Areas which contain suspect surface MEC material, as identified by the UXO Tech escort, or approach close proximity (i.e. 5-10 ft) to large metal or concrete structure (e.g., magazines, fences, etc.) and are within the range of blade height, will be circumvented to avoid the potential of needlessly damaging equipment or injuring personnel in an area which would produce a saturated indiscernible DGM end-product. Lastly, both the UXO Tech escort and dual-hatted UXOQCS/UXOSO will conduct quality inspections and safety audits on a regular basis.

17.2.4 Survey Management

Survey Management will be required prior to performing future field activities in order to provide RLS grade control points, inclusive of benchmarks, MRP boundary delineation, and a series of points as a part of an internal grid system. Five benchmark locations, two at each end of the site and one centrally located will be established for use of either setting up a base station, checking a rover unit for positional quality, or both, depending on the grade of GPS unit used for each task. Horizontal and vertical control of Class I, Third Order or better, shall be established for the network of benchmarks. The MRP boundary for the Fleming Key, as established by the Malcolm Pirnie/TTNUS during the PA/SI stages, will be clearly marked in the field using a series of points which delineate the boundary in which no subsurface investigation activities can currently take place without submitting supplemental ESS documentation. The full site boundary and dredge spoils pile boundary, however, will not be surveyed as both are obvious physical boundaries indicated by the fence-line and mounded soil drop-off down-to-grade, respectively. An internal grid system will be pre-established at 100 foot intervals, oriented N-S-E-W cardinal directions, in order to provide transect guidance and grid corner boundaries to confine future DGM surveys within the dredge spoils pile boundary, the intended boundary to conduct the non-invasive subsurface assessments. As detailed in the SOP's referenced in section 17.1, Survey Management includes a full-time escort for anomaly avoidance procedures during survey pin and indelibly point identification marked wooden lath emplacements. As a reminder, the survey pins provide a permanent location of the actual survey points while the laths placed alongside are for visual cues for ESI FI activities to follow. The intent is to limit future survey activities to replacing the laths alongside the pins, not resurveying the entire area. Ultimately, the initial RLS will:

- avoid surveying within the same close proximity guidelines as the vegetation removal crews;
- follow the directives from the UXO Tech escort, along with safety precautions and field procedures, all in accordance with **MRP SOP 02**; and
- document QC checks and tabulate against metric standards, as listed in **Worksheet #12**.

Lastly, both the UXO Tech escort and dual-hatted UXOQCS/UXOSO will conduct safety audits regularly while the Field Scientist will conduct quality inspections of the field work relative to deliverables provided prior to the RLS demobilizes from site.

17.2.5 Geophysics Management

Geophysics Management is separate into to two generic topics: **(1)** step-by-step field procedures and **(2)** step-by-step processing procedures. Both topics are detailed in the following two sub-sections.

17.2.5.1 Generalized Step-by-Step Field Procedures (with reference to SOPS)

Geophysics Management will be required for conducting and monitoring DGM field activities within the confines of the Fleming Key Dredge Spoils boundary using the RLS survey points as guidance. Resolution Consultants' UXOSO / UXOQCS and Field Scientist will conduct field safety audits and quality control inspections at key points to ensure the following DGM products, in sequential order during the ESI phase, are completed properly:

- **Mobilization / Demobilization / IVS:** Mobilize to site and use pre-established benchmarks to set-up an Instrument Verification Strip (IVS) outside of the work

area to demonstrate day 1 and twice-daily thereafter to demonstrate repeated response over well defined items in addition to the standard equipment functionality tests to the UXO industry (e.g. static response, static position, personnel, etc.). After start of project IVS and standard QC tests have been completed, tabulated, and proven acceptable, the subcontractor will provide a brief 2-page summary report with the findings clearly shown. Additional Details are currently provided as a part of the Project Startup Activities, Sections 17.2.2.7 and 17.2.2.8, as part of the initial IVS design, construction, and delivery requirements while Demobilization is discussed in the Project Closeout Activities, Section 17.2.5 to follow.

- **Transect-Pattern DGM Surveys**: After start of project tests are completed, the DGM subcontractor will conduct transect surveys which cross the site, via pre-defined statistically valid sampling quantities and patterns, along locations that have already completed Vegetation Management and Survey Management tasks. The DGM subcontractor will complete transect-pattern DGM using both a *Geonics* EM61-MKII sensor system, the UXO industry hallmark detector, and a *Geonics* EM31-MKII sensor system, the landfill industry detector known as a terrain conductivity meter, in order to accurately assess the site for near surface MEC or metal debris while also assessing the site for large metal debris piles or large MC type soil conductivity changes throughout the depth of the spoils piles down to grade. Field procedures for the DGM surveys will follow **MRP SOP 06** and **MRP SOP 07**, for EM61 and EM31 sensors, respectively.

- **Grid-Pattern DGM Surveys:** After transect surveys are completed, full coverage grid-pattern surveys, will be completed in across areas adjacent to high response areas identified during the transect DGM surveys using the *Geonics* EM61-MKII system, following the guidance in **MRP SOP 06**, in order to fully capture all responses of interest, MEC at the maximum depth of detection, in the focused areas of interest. Due to the depth of detection considerations, grid-pattern surveys are planned for completion in a single pass for the ESI phase, however, once the IRA is in effect, the current step and next two steps will be required for repeating until the surveys reach original grade.

- **Pin-pointing of DGM Anomalies:** After all anomalies are identified, Resolution Consultants will work with the subcontractor to pin-point up to 500 anomalies within the confines of the grids, using the same system, EM61-MKII sensor, as used during acquisition activities following procedures detailed in **MRP SOP 08**. Advanced classification methods are recommended as an addendum depending on the number of anomalies, the amount of clutter, and the overall complexity identified during previous data analyses.

- **Advanced Classification of DGM Anomalies:** Advanced classification methods using 3-D CI sensors (e.g. TemTads, MetalMapper, etc.) as developed through SERDP/ESTCP funding and to be implemented by the technology provider, depending on anomaly count and client approval, to assess all pin-pointed anomaly types (up to 500 anomalies at a time) in the near subsurface while following the ESS DR approval letter requirements. Once the signals are captured and analyzed from the 3-D CI sensors, a summary of the findings with the confidence metric as compared to library catalogued response from various ordnance types will be listed alongside each anomaly. **MRP SOP 09** is provided, but since this is an emerging technology, the methods detailed here are likely to change between now and the actual field implementation time.

Conducting all five steps on a focused “zoomed-in” area or “site-wide” basis will capture information to allow the analyses to ascertain the potential of ordnance hazards within the first

few feet of soil using non-invasive methods prior to submitting of the final version of the ESS, setting of exclusion zones, and ultimately implementing invasive sampling methods (e.g. MEC intrusive investigation sampling, MC environmental constituent soil sampling), if required.

17.2.5.1 Generalized Step-by-Step Processing Procedures (with reference to SOPS)
Geophysics Management will be required for conducting and monitoring DGM processing activities, with reference to same SOPs detailed in the Field Procedures, as only one SOP was generated per technique to encompass both sets of procedures. Additionally, Data Quality Objectives (DQOs) were developed prior to conducting investigative activities to ensure that the data generated during the execution of the investigation program are of appropriate quality to support the anticipated end use of the data. The geophysical survey DQOs define the performance criteria (as tabulated in **Worksheet #12**) that need to be met to validate the geophysical data collection and processing efforts. In generally, the data will be processed and analyzed using Geosoft's Oasis Montaj™ with the UX-Detect package. The data will be processed into ASCII data files with the delineated fields X, Y, Z, T, V1, V2, etc., where X and Y are project coordinates in Easting and Northing, Z is sensor elevation (optional), T is time as a function of a 24 hour military time, and V1, V2, etc. are the measured electromagnetic response, with additional channel names as needed to transparently display processing steps such as amplitude adjustments or positional corrections. Further details of processing guidelines and key quality inspection locations for performance metric verification are detailed below.

- **Initial Data Review:** The initial data review step is important in order to quickly ascertain and swiftly determine whether any additional data requires collection or whether any erroneous data requires recollection from the previous days' activities. First, the data will be visually inspected in profile-view to check for broad-scale electromagnetic equipment errors such as erratic responses, step responses, incoherent or excessive noise, dropouts, and spikes. The initial review primarily concerns identifying any errors within the data that cannot be predictably corrected through processing techniques. Second, the data will be checked in map-view for down-line sampling (e.g., distance/time separation, speed, etc.), cross-line sampling (e.g., coverage), systematic track-path errors (e.g., excessive overlap or gaps in data), and unique gridding features (e.g., utility features, localized clutter of anomalies, etc.). At this stage gaps will be issued for filling in or recollection based on the available information. The field notes will be reviewed to determine if there is any source(s) of interference such as utilities, radio sources, trees, fences, or metal scrap that might affect data quality which can be correlated to findings during the initial data review process. Any findings which are unique or are not explained through the use of available information of correlating site conditions to equipment responses will be communicated to the project team. The initial data review is important to be completed up front in order to not consume valuable standard and advanced processing time for data that may not meet the project DQOs.

- **Standard Data Analysis:** After the initial data review, various corrections applied at the processors discretion, dependent on sensor type and acquisition method, as follows.

    - ***Positional Offset Adjustment*** corrects for the fixed geometry between the center of the electromagnetic sensors and the positioning system or method.

    - ***Amplitude Adjustments*** corrects the data to a common background level. The amplitude adjustment process generally includes a mixture of filtering (e.g., Demedian, moving demedian, or drift correction) and hand-leveling techniques.
    - ***Spike Removal*** uses a non-linear to remove sporadic spikes which are typical with electromagnetic sensors and usually occur infrequently. The occurrence of numerous spikes indicates sensor problems.

- ***Latency/Lag Correction*** adjusts for inherent timing/distance issues when collecting asynchronous data streams from various unrelated instruments. The results from the IVS will be used as guidance for daily operation.

- ***Data Combination and Overlap Removal*** will adjoin two adjacent data sets with overlap removed between in order to correct gridding artifacts generated from two sets of information coincident to a single point.

- ***Static Noise Calculation*** will assess Peak-to-Peak and statistical noise levels determined for each electromagnetic sensor based on the Static Test.

- ***Kinematic Noise Calculation*** will assess Peak-to-Peak and noise levels will be determined for each sensor based on data collected from an area predetermined to be electromagnetically quiet, such as the IVS.

After processing is complete, the data will be gridded and contoured in preparation for target anomaly selection. The use of a grid cell size between 0.25 to 0.5 times the transect spacing is anticipated. Since some standard data analysis and processing steps change based on site-specific ambient and subsurface conditions, the steps will be initially demonstrated and fine-tuned during the IVS.

❖ **Advanced Data Analysis, Anomaly Selection, and Digsheet Development:** Target anomalies will be selected from using an automatic picking routine within the UX-Detect software package. The routine incorporates the Blakely algorithm with additional criterion constraints (e.g., CH1>CH2>CH3>CH4>0) on picking anomalies applied to limit false positives. The picked anomalies will be visually inspected to ensure their reasonableness and adjusted if needed. Note that in areas with dense concentrations of metal, it may be impossible to clearly pick individual targets. These high density areas will be identified and their locations clearly delineated on maps.

Only trained processors who are working under the oversight of the Project Geophysicist will be responsible for evaluating the geophysical data and identifying target anomalies for the dig lists. The following factors will be assessed prior to generating an anomaly list:

- Geophysical response such as size, shape and amplitude;
- Local background conditions;
- Data completeness, quality and accuracy;
- Field notes and observations; and,
- Proximity of natural and cultural features.

A manual review of the auto-picked anomalies will be performed to optimally locate the target location, as needed. In addition, the manual review may result in the selection of additional anomalies or the deleting of anomalies. An anomaly may be deleted for various reasons such as the anomaly is located outside of the investigation boundaries or the anomaly can be attributed to known surface features (e.g. manhole cover, magazine bunker, fence-line, etc.). For the Fleming Key Dredge Spoils ESI, Resolution Consultants recommends three groups of anomalies will be generated based on the peak amplitude value of EM61-MKII CH2 data:

- Group 1 will be for anomalies with a threshold value >13 mV (as determined based on an estimated response from a 155mm, the closest physical size and response library catalogued item to a 7.2-in Hedgehog, at 4-ft depth);

- Group 2 will be for anomalies with a threshold value > 5.6 mV (as determined based on an estimated response from a 75mm, the closest physical size and response library catalogued item to a 76mm projectile, at 2.7-ft depth); and,

- Group 3 will be for anomalies with a threshold value > 3.5 mV (as determined based on an estimated response from a 20mm, the smallest physical sized response library catalogued item historically found on site, at 1.0-ft depth);

As detailed above, each of the three groups are representative of the lower end response of each item as determined from the EM61-MK2 Response Calculator {***2008, Naval Research Laboratory***}. The groups also represent the lower end (at depth) response for each qualitative size of item—small, medium, and large—that was either found in the turtle screen of the dredge barge (i.e. 7.2-in Hedgehog, 76mm projectile ceremonial round) prior to soil deposition or visible from the surface during site visits (i.e. unknown item 75mm x 11in long, 20mm expended) after soil deposition. In addition to the EM61-MK2 anomaly selection, the EM31 data will be reviewed for locations of interest not currently apparent in the EM61-MK2 data sets, such as large scale subsurface changes as indicated by the in-phase (i.e. metal content) or quadrature (i.e. electrical conductivity) channels. The EM31 data will be interpreted qualitatively with broad-scale changes circled and annotated on a site-wide map. Locations of interest from the EM31 data not already coincident to anomalies identified in the EM61 data will be added to the digsheets discussed next.

Individual grid dig sheets will contain, at a minimum, the following information:

- Project Site Name (i.e. Fleming Key Dredge Spoils);
- Grid ID;
- Project Coordinate System (e.g. Florida State Plane Zone East NAD 1983 US Survey Feet, World Zone 17N NAD 1983 UTM meters, etc.);
- Anomaly ID for Group1-Group 3 EM61 and non-coincident EM31 locations;
- Anomaly Easting and Northing in project coordinate system;
- Geophysical data value;
- Blank spaces for interpretation comments to carry to the field;
- Blank spaces for anomaly pin-point comments to return from the field;
- Blank spaces to insert apparent offset and direction from the field, as gathered during the anomaly pin-point process;
- Blank spaces to insert comments from the anomaly pin-point process to return to be used by either the 3-D CI field team or Data Processors as a part of the feed-back loop process;
- Blank spaces to insert apparent offset and direction from the field, as gathered during the 3-D CI process; and,
- Blank spaces to insert the highest ranked ordnance item(s), as determine by the confidence metric(s), if the items are classified as ordnance.

As noted above, the individual grid dig sheets will be utilized first by the Anomaly Pin-Point field team and then by the 3-D CI field team, dependent on the current step in the process being implemented. After each step has inserted the information into the dig sheet and data quality has been verified complete by the Field Scientist, the field teams may commence project closeout (demobilization) activities detailed next.

17.2.6 Project Closeout Activities

17.2.6.1 Completion of Field Work followed by Site Demobilization Activities

Upon the completion of production field work activities conducted under the ESI, all field forms and field logbooks will be scanned for preservation on digital recording devices (i.e. CD, DVD, etc.). The last grouping of files which have not already been sent back to the home office, will be

sent back for records backup and storage. Included in the last set of field documentation will be final QC inspections (**Worksheets #34, #35, #36**) which verify all of the data deliverable requirements were completed and completed to the specifications required, as listed or detailed within **Worksheets #12, #14, #22**, before demobilizing personnel or equipment. Additionally, discuss with the client whether the IVS or survey control established on site should remain or be removed, given that part of the discussion will likely be contingent on the preliminary results of the ESI FI's and the expected schedule time-line for additional FI's. Upon approval from the Resolution Consultants UXOQCS, Field Scientist, QAM, and PM, demobilization will commence by returning equipment to providers and subsequently personnel will return to home office locations whereby they will work on finalizing their data deliverable product and preparing tabular summaries, figure representations, and preliminary text to be inserted into the final report.

17.2.6.2 Site-Specific Expanded Site Investigation Final Report and Approval

No MC sampling is currently planned for the site. The results of surface and subsurface non-invasive assessments will be evaluated to provide guidance in decisions regarding the necessity and scope to conduct an IRA for portions of the Fleming Key Dredge Spoils Site or provide a recommendation to move forward with an RI, relative to the decision tree further detailed in Section 11.4 and excerpted below for reference:

> **1.** If surface MEC/MPPEH or if subsurface anomalies indicate their potential presence in the subsurface, then return to the site or portion of the site during the IRA, after submitting and receiving approval for an ESS and IRA WP, for further investigation of potential MEC and MC.
>
> **2.** If no surface MEC/MPPEH are present, and no anomalies indicate the potential presence of subsurface MEC/MPPEH, then no further investigation of the site or portion of the site is required down to the detection depth of the sensors implemented.

The corollary to the decision tree is a requirement of direct communication regarding any unanticipated findings that warrant modification of the UFP-SAP will be brought to the attention of the stakeholders listed in **Worksheets #3 and #4.**

Lastly, an SI Report will be prepared summarizing the investigation and will contain summaries of the site background, personnel utilized, objectives and scope, equipment, description of survey activities, results and discussion of the project data. The report will contain noted munitions-related discoveries, site photographs, field notes, checklists, and QC inspection results.

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SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location (Grid) / ID Number	Exclusion Areas	Matrix	Approximate Depth Sampled[1]	Survey Methodology	Degree of Investigation or Coverage	Sampling SOP Reference[2]
Fleming Key Dredge Spoils Area	None	Ground Surface	Surface or Visibly Proud to Surface	*Schonstedt Instruments* Magnetic Metals Locator *White Instruments* All Metals Locator	Anomaly Avoidance Surface Assessment for 100% of Subsurface Assessment Areas	**MRP SOP 01, MRP SOP 02, MRP SOP 03, MRP SOP 04, MRP SOP 05, MRP SOP 06, MRP SOP 07,** **Worksheet #17**
Fleming Key Dredge Spoils Area	None	Ground Surface and Deep Subsurface	Surface to 10 feet Below Ground Surface (BGS).	*Geonics Limited* EM31-MK2 TDEM Terrain Conductivity Meter	Transect Subsurface Assessment Paths	**MRP SOP 06,** **Worksheet #17**
Fleming Key Dredge Spoils Area	None	Ground Surface and Shallow Subsurface	Surface to 4 feet Below Ground Surface (BGS).	*Geonics Limited* EM61-MK2 TDEM All Metals Detector	Transect / Full Coverage DGM Subsurface Assessment Paths / Areas	**MRP SOP 07,** **Worksheet #17**
Fleming Key Dredge Spoils Area	None	Shallow Subsurface	Up to 4 feet Below Ground Surface (BGS).	Advanced Classification Sensors (e.g., *TemTads 2x2, MetalMapper*, etc.)[3]	DGM Subsurface Assessment Areas	**MRP SOP 09,** **Worksheet #17**

[1]Depth sampled is dependent on size and orientation of MEC item, along with other factors such as soil type, relative to the design (e.g., coil size, electronics, power, etc.) of the type of metal detector instrument implemented.

[2]SOPs or worksheets that detail the sample collection and processing methods to be implemented for each method referenced.

[3]Although type of technology and documented success rate will not change between sensors, specific manufacturer and model number of Advanced Classification sensor may change dependent on availability at time of field work, as supplies are limited.

SAP Worksheet #19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

WORKSHEET IS NOT APPLICABLE (NA).

This worksheet applies to chemical analysis and reporting, and is not applicable to this UFP-SAP for MEC surveys/investigations.

SAP Worksheet #20 -- Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	QC Survey Requirements	Field Duplicates / Repeat Data Collection	Sample	Quality Control
Ground Surface	Transect / Grid Anomaly Avoidance Assessment of Paths / Areas using Schonstedt / White	IVS sweep start-end of day; after extensive equipment repair or extended schedule breaks.	NA	Sweep over ISOs seeded in IVS	ISO audibility will be recorded as detailed in **Worksheet #12**
Ground Surface	Grid Anomaly Avoidance Assessment of Areas using Schonstedt / White	Detect ISO seed	NA	Survey over ISO placed in Grid	ISO detection will be compared as detailed in **Worksheet #12**
Ground Surface and Shallow Subsurface	Transect / Grid DGM Subsurface Assessment of Paths / Areas using EM61-MK2	Static Response Test start-end of day; after extensive equipment repair or extended schedule breaks.	NA	Survey ISO placed statically over coil	ISO responses will be charted as detailed in **Worksheet #12**
Ground Surface and Shallow Subsurface	Transect / Grid DGM Subsurface Assessment of Paths / Areas using EM61-MK2	IVS survey start-end of day; after extensive equipment repair or extended schedule breaks.	NA	Survey over ISOs seeded in IVS	ISO responses will be compared as detailed in **Worksheet #12**
Ground Surface and Shallow Subsurface	Grid DGM Subsurface Assessment of Areas using EM61-MK2	Detect ISO seed	NA	Survey over ISO placed in Grid	ISO detection will be compared as detailed in **Worksheet #12**
Ground Surface and Shallow Subsurface	Grid DGM Subsurface Assessment of Areas using 3-D CI sensors	IVS survey start-end of day; after extensive equipment repair or extended schedule breaks.	NA	Survey over ISOs seeded in IVS	ISO responses will be compared as detailed in **Worksheet #12**

SAP Worksheet #21 -- Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and / or Number	Originating of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
MRP SOP 01	Anomaly Avoidance	AECOM	*Schonstedt Instruments* Magnetic Metals Locator; *White Instruments* All Metals Locator	**N**	Describes standard Anomaly Avoidance techniques.
MRP SOP 02	Inspection & Disposal of MPPEH	AECOM	NA	**Y, disposal first option is EODMU**	Describes actions to be taken if suspect MPPEH encountered
MRP SOP 03	MEC Demolition & Disposal Operations	AECOM	NA	**Y, demolition & disposal first options are EODMU**	Describes actions to be taken if suspect MEC identified.
MRP SOP 04	Vegetation Management	AECOM	Mower, Trimmer, Brush-Hog, Chainsaw, etc.	**N**	Describes operational management procedures for tree and vegetation removal activities
MRP SOP 05	Survey Management	AECOM	Global Position System (GPS), Theodolite, etc.	**N**	Describes operational management procedures for land survey activities
MRP SOP 06	EM31-MK2	NAEVA Geophysics	*Geonics Limited* EM31-MK2 TDEM Terrain Conductivity Meter	**N**	Describes methods for operating EM31-MK2 sensor
MRP SOP 07	EM61-MK2	NAEVA Geophysics	*Geonics Limited* EM61-MK2 TDEM All Metals Detector	**N**	Describes methods for operating EM61-MK2 sensor
MRP SOP 08	Reacquisition (Anomaly Pin-Pointing)	NAEVA Geophysics	*Geonics Limited* EM61-MK2 TDEM All Metals Detector	**N**	Describes methods for conducting anomaly reacquisition
MRP SOP 09	Advanced Classification 3-D CI sensors	NAEVA Geophysics	Advanced Classification Sensors[1]	**N**	Describes methods for operating 3-D CI sensors

[1]Although type of technology and documented success rate will not change between sensors, specific manufacturer and model number of Advanced Classification sensor may change dependent on availability at time of field work, as supplies are limited.

SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity1	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference2	Comment
Schonstedt Instruments Magnetic Metals Locator; *White Instruments* All Metals Locator	Operation & Maintenance	Start & End of day; after repairs, replacements, or extended time w/out use	Audible response to metallic item waved visibly in front of coil head	Turn up volume, adjust sensitivity settings, replace batteries, replace unit with spare	UXO Team w/ trouble-shooting support from UXOQCS & SUXO	**MRP SOP 01** – Anomaly Avoidance SOP	None
Schonstedt Instruments Magnetic Metals Locator; *White Instruments* All Metals Locator	Testing & Verification	Start & End of day; after repairs, replacements, or extended time w/out use	Audible response to buried ISO item when instrument waved over flag	Turn up volume, adjust sensitivity settings, replace batteries, replace unit with spare	UXO Team w/ trouble-shooting support from UXOQCS & SUXO	**MRP SOP 01** – Anomaly Avoidance SOP	None
Global Position System (GPS), Theodolite, etc.	Operation & Maintenance	Start & End of day; after repairs, replacements, or extended time w/out use	Digital indicators for battery life, satellites and base station (or beacon) signals w/in tolerances	Replace or charge batteries, check cable connections, adjust radio frequency signals if stepped on	RLS Team w/ trouble-shooting support from Field Scientist	**MRP SOP 04** – RLS Management SOP	None
Global Position System (GPS), Theodolite, etc.	Testing & Verification	Start & End of day; after repairs, replacements, or extended time w/out use	Recorded Position w/in **Worksheet #12** tolerances.	Repeat Test to ensure human error not part of equation and then replace faulty part.	RLS Team w/ trouble-shooting support from Field Scientist	**MRP SOP 04** – RLS Management SOP	None
Geonics Limited EM31-MK2 TDEM Terrain Conductivity Meter	Operation & Maintenance	Start & End of day; after repairs, replacements, or extended time w/out use	Observe stability and qualitative response values over EM quiet / or near large metal structures	Check connections, replace power source, move sensor to different area to ensure equipment related and not localized noise	GEO Team w/ trouble-shooting support from Field Scientist	**MRP SOP 06** – EM31-MK2 SOP	None
Geonics Limited EM31-MK2 TDEM Terrain Conductivity Meter	Calibration & Verification	Start & End of day; after repairs, replacements, or extended time w/out use	Recorded Responses w/in **Worksheet #12** tolerances.	Repeat Test to ensure human error not part of equation and then replace faulty part.	GEO Team w/ trouble-shooting support from Field Scientist	**MRP SOP 06** – EM31-MK2 SOP	None

Field Equipment	Activity1	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference2	Comment
Geonics Limited EM61-MK2 TDEM All Metals Detector	Operation & Maintenance	Start & End of day; after repairs, replacements, or extended time w/out use	Observe stability and qualitative response values over EM quiet / or over ISO at fixed offset	Check connections, replace power source, move sensor to different area to ensure equipment related and not localized noise	GEO Team w/ trouble-shooting support from Field Scientist	**MRP SOP 07** – EM61-MK2 SOP	None
Geonics Limited EM61-MK2 TDEM All Metals Detector	Testing & Verification	Start & End of day; after repairs, replacements, or extended time w/out use	Recorded Responses w/in **Worksheet #12** tolerances.	Repeat Test to ensure human error not part of equation and then replace faulty part.	GEO Team w/ trouble-shooting support from Field Scientist	**MRP SOP 07** – EM61-MK2 SOP	None
Advanced Classification Sensors (e.g., Temtads 2x2, Metal Mapper, etc.)	Operation & Maintenance	Start & End of day; after repairs, replacements, or extended time w/out use	Observe stability and qualitative response values over EM quiet / or over ISO at fixed offset	Check connections, replace power source, move sensor to different area to ensure equipment related and not localized noise	GEO Team w/ trouble-shooting support from Field Scientist, Manufacturer, and/or Vendor Representative	**MRP SOP 09** – Advanced Classification Sensors SOP	None
Advanced Classification Sensors (e.g., Temtads 2x2, Metal Mapper, etc.)	Testing & Verification	Start & End of day; after repairs, replacements, or extended time w/out use	Recorded Responses w/in **Worksheet #12** tolerances.	Repeat Test to ensure human error not part of equation and then replace faulty part.	GEO Team w/ trouble-shooting support from Field Scientist, Manufacturer, and/or Vendor Representative	**MRP SOP 09** – Advanced Classification Sensors SOP	None

[1] Activities may include: calibration, verification, testing, and maintenance.

[2] Specify the appropriate reference letter or number from the Project Sampling SOP References table (**Worksheet #21**).

22.1 REGIMENTED TESTING of LAND SURVEY and GEOPHYSICAL SURVEY EQUIPMENT

Regimented testing of Land Survey and Geophysical Survey equipment includes the following 5 tests:

1. Equipment/Electronics Warm-up
2. Personnel & Cable Shake Tests
3. Static Background & Static Spike Tests
4. Static Position Repeatability Test
5. Instrument Verification Strip Dynamic Response Test

Of the tests, only the Equipment/Electronics Warm-up and Static Position Repeatability Test apply to the land survey crew, while all the tests apply to the geophysical survey crews. Depending on the geophysical survey instrument used, however, the test may require modification as introduced below and detailed further in each SOP document tailored to each set of equipment.

22.1.1 Equipment/Electronics Warm-up

The Equipment/Electronics Warm-up test minimizes sensor drift caused by thermal stabilization. Most instruments need a few minutes to warm-up before data collection begins. All manufacturer instructions will be followed, or if none are given, data readings will be observed until they stabilize. Acceptance Criterion: Equipment Specific, but typically 5 minutes in warm dry weather up to 15-20 minutes in cold damp weather. This warm-up period will be allotted each time the unit is started. Lastly, a secondary key indicator that the equipment is ready for use is that the readings have stabilized for the geophysical survey sensor responses and/or the geodetic survey equipment telemetry signals while within the confines of an electromagnetically quiet area with no overriding ambient noise from EM or RF interference sources (e.g., power line, communication tower, etc). If the telemetry signals are being "stepped on", the frequencies may have to be changed; furthermore, if telemetry signal is verified and if GPS quality is still fluctuating for no other apparent reason, satellite "skyplots" will have to be generated and satellite "sickness" will have to be monitored for determining whether an adequate number of "healthy" satellites are sending proper correction codes from geometrically favorable locations in the sky. For most cases, all of these potential sources of errors, are determined and fixed the first day on site as they do not change dramatically on a short term time scale, such as our project field effort, because they are recurrent on a daily basis with only slight variations.

22.1.2 Personnel & Cable Shake Tests

The Personnel Test ensures that survey personnel have removed all potential interference sources from their bodies. Common interference sources are steel-toed boots and large metallic belt buckles, which can produce anomalies signatures similar to investigation targets. The Cable Shake Test, as it implies, simply requires manipulating cable connections and maneuver cables to simulated movement under normal operation. As a prime example, cables that approach their breaking point often generate spikes from even gentle movement near their connecting points. After the cable shake test is complete, the operators will check all cabling to ensure the connection seals are tight to prevent water or moisture inundation within the connection ports. The Acceptance Criterion: no signals generated greater than the interpretation threshold without clearly documented noise source. Both tests will be conducted at the beginning of each day for the EM61-MK2 sensors only. As a matter of practicality, the tests don't apply to the EM31-MK2 or 3-D CI sensor systems as either the cabling or the entire system itself is static during standard operation; however, as an extra layer of precaution, equipment operators will still be screened for metal before operating any metal detection equipment.

22.1.3 Static Background & Static Spike Tests

This Static Background and Static Spike Tests determine the responses and repeatability of the instrument to representative area of metal free subsurface soil in an electromagnetically quiet ambient

area, both with and without the use of a standard test item, such as an ISO. Both tests will be conducted at the beginning and end of each day for EM61-MK2 sensors only. The Acceptance Criterion: no signals generated greater than the interpretation threshold without clearly documented noise source and 10% of th spike response variation between tests. EM31-MK2 sensor will qualitatively view and null the background response using a static background test only while reserving the spike portion for a large metal structure, such as a culvert, magazine, fence-line, etc., as the instrument is primarily sensitive to larger, deeper, and broader changes. Lastly, the 3-D CI sensors will be statically tested on the IVS only. Incorrect channel or time-gate settings on electronics box, improper coil type or geometry or sample frequency settings within data logger, shorting of electronics box circuit boards or wiring, dampness in connections or coils, and faulty cabling or connectivity are the primary causes of inconsistent non-repeatable readings from improper instrument functionality.

22.1.4 Static Position Repeatability Test

The Static Position Repeatability Test determines the instrument accuracy by surveying and recording coordinate reading(s) over a known control, while not moving, and subsequently compared the recorded reading to the documented coordinates for the control point to measure distance offset. The test will be conducted at the beginning and end of each day for GPS instruments only. Acceptance Criterion: Within 1-m for sub-meter GPS units; within 10-cm for RTK-DGPS, RTS, or Theodolite units; and within manufacture's specifications for varying types of lower accuracy hand-held units. When using GPS instruments, the number of satellite signals being received is a key indicator, along with HDOP which is primarily influenced by the number of satellites, but also secondarily influenced by geometry and health of satellites. Prior to conducting any static position checks using GPS instruments, signals from at least four satellites should be evident.

22.1.5 Instrument Verification Strip Response Tests

The Instrument Verification Strip Tests determines the system repeatability by conducting DGM over a series of metallic items, seeded along a controlled travel path, in order to assess key indicators throughout the life of the project. The test will be conducted at the beginning and end of each day, dynamically for EM61-MK2 sensors only and statically for 3-D CI sensors only. Acceptance Criterion: EM61-MK2 peak response within 25% or 1mV (whichever is larger) and peak response position within 50-cm along-line direction using fiducial positioning methods or 30-cm along-line RTK-DGPS positioning methods; additionally, 3-D CI within 95% convergence metric agreement and 40-cm offset. As with the Static Background and Static Spike Tests, incorrect channel or time-gate settings on electronics box, improper coil type or geometry settings within data logger, shorting of electronics box circuit boards or wiring, dampness in connections or coils, and faulty cabling or connectivity are the primary causes of inconsistent non-repeatable readings. Although uncommon, other sources of error may include line-path deviation, settling down of seed or seed movement, excessive water inundation or other soil chemistry changes, soil disturbances, and other unpredictable occurrences; however, all of which can be sorted out through the daily monitoring of both static response and IVS response tests, since the static response tests pre-approves the equipment functionality which then resides other factors to consider upon reviewing unpredictable results within the IVS response testing. Lastly, the IVS will also be utilized to test the AGM hand-held sensors that the UXO Technicians use for all Anomaly Avoidance techniques. The operator will waive the instrument directly over top of the pre-flagged seed location and determine whether the item is detectable through audible (i.e. Y/N) assessments. All subsequent results will be compared to day 1 results only.

22.2 DATA COLLECTION VARIABLE FOR GEOPHYSICAL SURVEY EQUIPMENT

The same equipment and procedures will be used for the IVS and geophysical survey. In addition, only personnel who have been tested on the IVS will perform the geophysical surveys. Multiple surveys using the planned geophysical instruments will be performed. Some elements of data collection are subject to modification and evaluation. Data collection variables subject to modification and optimization may

include, but not necessarily be limited to, instrument setting selections, measurement interval along survey lines, and transect line spacing.

22.3 GEOPHYSICAL SENSOR SYSTEMS & GEODETIC POSITIONING EQUIPMENT

The detection depth of the metal detectors is limited by the size, material properties, and orientation of the target relative to the size and orientation of the sensor(s), along with consideration to the characteristics of the soil in the work area. Even given the variability of detection, the hand-held analogue detectors to be implemented by Resolution Consultants UXO Technicians are fully capable of detecting on or near surface, as to be demonstrated during the IVS process. The Schonstedt and White Instruments, both Analogue Geophysical Mapping (AGM) detectors, provide an audio signal for response but do not store data. The operator turns on the instrument and slowly moves the locator toward metal to which the audio signal will increase as the probe advances closer. Failure to detect the object is reason to reject the instrument, or determine that a deeply seeded item cannot be detected if ascertained on the first day of the project. . The detector will be checked at the beginning and end of each day and after any battery change. Standard anomaly avoidance procedures, to be implemented using both Schonstedt and White Instruments, are presented in **MRP SOP 01.** The full size digitally record detectors to be implemented by Resolution Consultants subcontractors, and monitored by Resolution Consultants, are fully capable of detecting on or shallow subsurface, as to be demonstrated during the IVS process. The EM-61 MK2 and 3-D CI sensors, both Digital Geophysical Mapping (DGM) sensor systems, provide an digital signal for response and store the data at least 10 times per second. The digital signal will increase as the sensor passes over the target. Failure to detect the object is reason to reject the instrument, or determine that a deeply seeded item cannot be detected if ascertained on the first day of the project. . The sensor systems will be checked at the beginning and end of each day and after any battery change. Standard DGM and 3-D CI procedures, to be implemented separately using tailored guidance for the EM31-MK2, EM61-MK2, and TemTads2x2 sensors, are presented in **MRP SOP 06, MRP SOP 07, and MRP SOP 09,** respectively**.**

During the anomaly avoidance surface assessments, Resolution Consultants will use a GPS unit (on the order of sub-meter accuracy), where possible, to provide x-y coordinate set pairs for each item of interest identified from the surface. The anticipated tree cover at some of the survey areas may dictate that only certain transects in open locations (no or limited tree cover) are located using a GPS, and the remainder of the transects will be tied to these locations. If the GPS accuracy is not sub-meter, data will not be collected until more satellites are available and the accuracy criteria are met, or surveying with alternate positioning techniques (e.g., tape-line, fiducial, RTS, Theodolite, etc.) will be deployed.

22.4 QUALITY ASSURANCE / QUALITY CONTROL

Operational and test procedures will conform to the manufacturers' standard instructions. QC of the instruments' data will be achieved daily by field testing, consisting of checking the detectors and navigation system against a known target to ensure that they are operating properly. All instruments and equipment used to gather and generate field data will be operated in such a manner that the accuracy and reproducibility of the results are consistent with the manufacturers' specifications. Repair or replacement records will be filed and maintained by the UXO Quality Control Specialist (UXOQCS), with support from the Field Scientist, and may be subject to audit by the Resolution Consultants QAM.

SAP Worksheet #23 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

WORKSHEET IS NOT APPLICABLE (NA).

No project sampling is proposed for this Expanded SI to support MEC surveys/investigations (See **Worksheet #21** for project SOPs).

SAP Worksheet #24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

WORKSHEET IS NOT APPLICABLE (NA).

No analytical instrument calibration data will be required for this Expanded SI to support MEC surveys/investigations (See **Worksheet #22** for equipment calibrations).

SAP Worksheet #25 -- Analytical Instrument & Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

WORKSHEET IS NOT APPLICABLE (NA).

No analytical instrument equipment maintenance, testing, or inspections will be required for this Expanded SI to support MEC surveys/investigations. Field instrument maintenance, testing, and inspection for equipment are presented in **Worksheet #22**.

SAP Worksheet #26 – Sample Handling System

(UFP-QAPP Manual Appendix A)

WORKSHEET IS NOT APPLICABLE (NA).

This worksheet is not applicable because no samples will be handled.

SAP Worksheet #27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

WORKSHEET IS NOT APPLICABLE (NA).

No samples are proposed for collection/analysis and no MPPEH will be handled during this SI.

SAP Worksheet #28 -- QC Samples Table

(UFP-QAPP Manual Section 3.4)

WORKSHEET IS NOT APPLICABLE (NA).

No analytical laboratory QC sampling will be required for this SI to support MEC surveys/investigations.

SAP Worksheet #29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document/ Report/Form	Generator	Definable Feature of Work	Completion Frequency	Location Maintained
Site Specific Document Review (i.e. HASP, SAP, etc.) & Site Orientations Sign Off Record	PM	Project Startup	Once	UFP-SAP / ESI Report / Project Files
ESS Determination	UXO Manager	Project Startup	Once	UFP-SAP / ESI Report / Project Files
UXO Tech Field Checklists	UXO Team	Project Startup, Anomaly Avoidance	Field Days	UFP-SAP / ESI Report / Project Files
MEC Accountability Log	SUXOS	Anomaly Avoidance	As needed	**MRP SOPs 02** & **MRP SOP 03** / ESI Report / Project Files
Daily Reports	SUXOS	Anomaly Avoidance	Field Days	**MRP SOPs 0**3 / ESI Report / Project Files
Medical Surveillance and OSHA HAZWOPER Clearance Letters	HSM, PM, & UXOSO	Anomaly Avoidance [*incl. Vegetation, Survey, & Geophysics Management*]	As needed	HASP / Project Files
Daily Safety Brief Sign-In Sheet	UXOSO	Project Startup	Daily	HASP / Project Files
Medical Data Sheet	SUXOS	Project Startup	As needed	HASP / Project Files
Anomaly Avoidance Data	UXO Personnel	Anomaly Avoidance [*incl. Vegetation, Survey, & Geophysics Management*]	Field Days	Field Logbooks / ESI Report / Project Files
Digital Geophysics Data	DGM Teams	Geophysics [*incl, DGM Trans & Grid Surveys, Anomaly Pin-Pointing, 3-D CI w/ Classification*]	Geophysics Field Days	Field Logbooks / ESI Report / Project Files
Field Notes	UXO & DGM Teams	Anomaly Avoidance, Geophysics Management	Field Days	Field Logbooks / ESI Report / Project Files
Surface or Subsurface Assessment Findings, Non-Conformance Report (NCR) & Corrective Action Report (CAR)	Various, (see **Worksheet #31**)	All	As needed	ESI Report / Project Files
QC Surveillance Reports	UXOQCS, Field Scientist	Anomaly Avoidance, Geophysics Management	(see **Worksheet #31**)	UFP-SAP / QC Logbook / Project Files
Daily QC Report	UXOQCS, Field Scientist	Anomaly Avoidance, Geophysics Management	Daily	UFP-SAP / QC Logbook / ESI Report / Project Files
Photographs (may be included in other daily reports)	UXO Field Personnel	Anomaly Avoidance	As needed	UFP-SAP / ESI Report / Project Files
Field Audit Checklist (if an audit is conducted)	PM	Anomaly Avoidance (incl. Vegetation, Survey, & Geophysics Management)	As needed	UFP-SAP / ESI Report / Project Files
ESI Report	Resolution Consultants Personnel	ALL	Once	UFP-SAP / ESI Report / Project Files

SAP Worksheet #30 -- Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

WORKSHEET IS NOT APPLICABLE

No analytical services will be required for this SI to support MEC surveys/investigation.

SAP Worksheet #31 -- Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title & organization)	Person(s) Responsible for Responding to Assessment Findings (title & organization)	Person(s) Responsible for Identifying and Implementing Corrective Action Reporting (CAR) (title & organization)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (CA) (title & organization)
Personnel Qualifications	Once per person	Internal	Resolution Consultants	UXOQCS	SUXOS	UXO Manager	QAM, PM
Accident / Incident Reporting	Per Event	Internal	Resolution Consultants	UXOSO	Project Health & Safety Officer; HSM as alternate	HSM, PM	HSM
Non-Conformance Reporting (NCR)	Per Event Observed	Internal	Resolution Consultants	UXOSO / UXOQCS	Person or Entity responsible for NCR	HSM / QAM, PM	HSM / QAM
Preventive Maintenance	Daily	Internal	Resolution Consultants	UXOQCS	SUXOS	UXO Manager	PM
Communications Equipment Inspection	Daily	Internal	Resolution Consultants	UXO Team Leader	SUXOS	SUXOS	UXO Manager, PM
Safety Inspections & Formal Surveillances	Daily & Weekly, respectively	Internal	Resolution Consultants	UXOSO	SUXOS	SUXOS	UXO Manager, PM
Anomaly Avoidance	10% daily; 25% for 3 days after fail	Internal	Resolution Consultants	UXOQCS	SUXOS & UXO Team Leaders	SUXOS & UXO Team Leaders	QAM, PM
IVS Results	Twice Daily	Internal	Resolution Consultants	UXOQCS (analogue) or Field QC Scientist (digital)	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	QAM, PM
Blind Seeds	Once Daily, on Average	Internal	Resolution Consultants	UXOQCS & Field QC Scientist	SUXOS or Subcontractor Team Leader	SUXOS or Subcontractor Team Leader	Geophysics Manager, QAM, PM
Brush Cutting & Vegetation Management	As needed to support daily operations	Internal	Resolution Consultants	SUXOS	UXO & Subcontractor Team Leaders	UXO & Subcontractor Team Leaders	UXO Manager, PM

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title & organization)	**Person(s) Responsible for Responding to Assessment Findings** (title & organization)	**Person(s) Responsible for Identifying and Implementing Corrective Action Reporting (CAR)** (title & organization)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (CA)** (title & organization)
RLS Surveying & Mapping Operations	Initial Inspection, then weekly	Internal	Resolution Consultants	UXOQCS, Field QC Scientist	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	QAM, PM
DGM Surveying & Mapping Operations	Initial Inspection, then weekly	Internal	Resolution Consultants	UXOQCS, Field QC Scientist	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	SUXOS or Geophysics Manager w/ Subcontractor Team Leader	Field QC Scientist, QAM, PM
MEC Accountability	Weekly	Internal	Resolution Consultants	UXOQCS	SUXOS	SUXOS	UXO Manager, PM
Visitor Briefing	Initial, as needed after	Internal	Resolution Consultants	UXOSO	SUXOS	SUXOS	HSM, PM
Site-Specific Training	Initial, as needed after	Internal	Resolution Consultants	SUXOS, UXO Manager, PM	As designated by PM	As designated by PM	PM
Hazards & Risk Analyses	Initial, as needed after	Internal	Resolution Consultants	HSM, UXOSO	UXOSO, SUXOS	UXOSO, SUXOS	HSM
Field Work Systems Audit	Once per contract year	Internal	Resolution Consultants	QAM	UXO Manager, PM	QAM, UXO Manager	QAM, PM
EOD TechDiv Quality Assess. Audit	Once during project duration	External	EOD Techdiv	Name of EOD Techdiv Lead for Assessment	NAVFAC RPM with assistance of Remedial Contractor	NAVFAC RPM in consultation with QC Manager (contractor) for project	QC Manager for responsible contactor
NOSSA N53 Audit of MRP Action	NOSSA Discretion	External	NOSSA N53	NOSSA POC	NAVFAC RPM with assistance of Remediation Contractor	NAVFAC RPM in consultation with QC Manager (contractor) for project	QC Manager for responsible contactor
State/EPA on site Quality Assess. Site Visit	Twice during project duration	External	State/EPA	State or EPA POC	NAVFAC RPM with assistance of Remediation Contractor	NAVFAC RPM in consultation with QC Manager (contractor) for project	QC Manager for responsible contactor

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Reporting (CAR) (name, title, organization)	Timeframe for Response
Personnel Qualifications	Email	Todd Haverkost, PM, Resolution Consultants	Upon Discovery	Email	Todd Haverkost, PM, Resolution Consultants	Prior to personnel mobilization
Accident / Incident Reporting	Accident/Incident Report Form	Todd Haverkost, PM, Resolution Consultants Sean Liddy, HSM, Resolution Consultants	Immediately	Dependent on nature and severity of Accident/Incident	Todd Haverkost, PM, Resolution Consultants Sean Liddy, HSM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
Non-Conformance Reporting (NCR)	Email	TBD, UXOQCS, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants	Upon Discovery	NCR with Corrective Action Report (CAR) document	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants	Remedy implemented in field ASAP; Documented Reporting for Recordkeeping 48 hours
Preventive Maintenance	Field Checklist	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Annotated: on Field Checklist form for review and feedback, if complicated; as logbook entries if solution is straight-forward and handled immediately	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours

Communications Equipment Inspection	Field Checklist	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Annotated: on Field Checklist form for review and feedback, if complicated; as logbook entries if solution is straight-forward and handled immediately	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
Safety Inspections & Formal Surveillances	Field Checklist completed by UXOQCS / UXOSO with support from SUXOS	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Annotated: on Field Checklist form for review and feedback,	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
Anomaly Avoidance	Field Checklist completed by UXOQCS / UXOSO with support from SUXOS	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Annotated on Field Checklist form for review and feedback, then update of field forms	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
IVS Results	Oral communication from UXOQCS / UXOSO or Field QC Scientist	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants	Within 24 hours	Email	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 48 hours
Blind Seeds	Oral communication from UXOQCS / UXOSO or Field QC Scientist	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution	Within 24 hours	Email	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 48 hours

		Consultants Brian Brunette, Geophysics Manager, Resolution Consultants				
Brush Cutting & Vegetation Management	Email communication from UXOQCS / UXOSO or Field QC Scientist	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
RLS Surveying & Mapping Operations	Email communication from UXOQCS / UXOSO or Field QC Scientist	Todd Haverkost, PM, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 48 hours
DGM Surveying & Mapping Operations	Email communication from UXOQCS / UXOSO or Field QC Scientist	Todd Haverkost, PM, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 48 hours
MEC Accountability	Field Checklist completed by UXOQCS / UXOSO with support from SUXOS	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 24 hours	Annotated on Field Checklist form for review and feedback, then update of field forms	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
Visitor Briefing	Email communication from UXOQCS / UXOSO or SUXOS	Todd Haverkost, PM, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants TBD, SUXOS,	Within 48 hours

		TBD, SUXOS, Resolution Consultants			Resolution Consultants	
Site-Specific Training	Email communication from UXOQCS / UXOSO or SUXOS	Todd Haverkost, PM, Resolution Consultants TBD, SUXOS, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants TBD, SUXOS, Resolution Consultants	Within 48 hours
Hazards & Risk Analyses	Email	Todd Haverkost, PM, Resolution Consultants Sean Liddy, HSM, Resolution Consultants	Within 24 hours	Updated Email	Todd Haverkost, PM, Resolution Consultants Sean Liddy, HSM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants	Within 48 hours
Field Work Systems Audit	Letter Summary Report	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 5 business days of assessment	Updated Letter Summary Report	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 10 business days of receipt
EOD TechDiv Quality Assess. Audit	Summary Memorandum	TBD, Assessment Team Leader, EOD Techdiv	Within 5 business days of assessment	Immediate Verbal Feedback, Updated Summary Memorandum	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 10 business days of receipt
NOSSA N53 Audit of MRP Action	Summary Memorandum	TBD, Assessment Team Leader, NOSSA	Within 5 business days of assessment	Immediate Verbal Feedback, Updated Summary Memorandum	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 10 business days of receipt
State/EPA on site Quality Assess. Site Visit	Summary Memorandum	TBD, Assessment Team Leader, State EPA POC	Within 5 business days of assessment	Immediate Verbal Feedback, Updated Summary Memorandum	Todd Haverkost, PM, Resolution Consultants Michael Ervine, QAM, Resolution Consultants	Within 10 business days of receipt

SAP Worksheet #33 -- QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	**Frequency** (daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Project monthly progress report	Monthly (written) for duration of the project	Monthly	PM, Resolution Consultants	Navy RPM, NAVFAC SE
Daily QC Report	Daily (e-mail)	TBD	UXOQCS / UXOSO & Field QC Scientist, Resolution Consultants	PM, Resolution Consultants and UXO Manager or Geophysics Manager, Resolution COnsultants
QC Meeting Minutes	Twice per month during project performance	TBD	UXO Manager, Resolution Consultants	PM, Resolution Consultants
Rework Items List	Twice per month during project performance; Daily for UXO relate field work	TBD	UXOQCS / UXOSO & Field QC Scientist, Resolution Consultants	PM, Resolution Consultants
Project QC Report	Internal Draft, draft, and final (Appendix to SI Report)	TBD	PM, Resolution Consultants	Navy RPM, NAVFAC SE

This worksheet will be modified to include the project delivery dates after fieldwork is scheduled.

SAP Worksheet #34 -- Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

Definable Feature of Work	Supporting Documentation/Description	Responsible for Verification
Project Startup [*incl.: Project Readiness and Field Plan Reviews; Personnel Qualifications and Security Access Vetting; Equipment Verification and Mobilization Preparedness Planning; and Mobilization (w/ IVS construction activities)*]	*Project readiness review* to be performed by Resolution Consultants PM and Navy RPM, including UFP-SAP, HASP, and ESS-DR reviews. Attendees via conference call include all technical leads identified in **Worksheet #7**. *Field Plan reviews* to be performed by Resolution Consultants PM, including reviews of the UFP-SAP, HASP, DFW details (i.e. **Worksheet #14**), mobilization preparation activities (e.g., equipment lists, and IVS installation procedures), and field procedures (i.e. **Worksheet # 22**, **Worksheet #12**). Attendees via conference call include all technical leads and key subcontractor personnel during discussions of their roles, responsibilities, and requirements of their services in the project.	Todd Haverkost, PM, Resolution Consultants Brian Syme, NAVY RPM, NAVFAC SE Todd Haverkost, PM, Resolution Consultants Mike Ervine, QAM, Resolution Consultants
	Personnel Qualifications to be assessed by the Resolution Consultants PM, inclusive of reviewing resumes and training records, including those for UXO field personnel, to ensure that all required safety training (e.g., EOD certifications, OSHA training, medical surveillance, etc.) and experience requirements identified in **Worksheet #7** have been completed for each crew member, inclusive of subcontractors. *Security Access Vetting* to be completed after receiving required forms (e.g. I-9 Form, base pass entrance form, supplemental documentation, etc.) from all Resolution Consultants or subcontract personnel planned for utilization during field efforts. Substitution of personnel is required if requirements aren't met.	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Sean Liddy, HSM, Resolution Consultants
	Equipment Verification to be delegated by Resolution Consultants PM to each technical lead to verify their personnel or subcontract personnel have either gathered or determined the location of functional equipment for use in field surveys. The equipment should be prepped for shipment, inclusive of packing spares for commonly damaged parts and an inventory of each box. *Mobilization Preparedness Planning* to be completed after equipment verification in order to confirm schedules for transit of all personnel and equipment to the site. Mobilization will be staggered, on a task-by-task basis.	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Mike Ervine, QAM, Resolution Consultants

Definable Feature of Work	Supporting Documentation/Description	Responsible for Verification
	Initial Mobilization to be completed after equipment verification and mobilization preparedness planning and, upon arrival on site, the equipment shipment boxes will be opened with each unit tested for general operational functionality along with determining whether full parts list, inclusive of spare, safely made the transition to site or whether addition parts are required. Additionally, site specific orientation, safety training, and equipment operation training (if required) will be completed and signed-off as such at this time. *IVS Construction* to be completed following guidelines provided in the UFP-SAP, inclusive of communicating exclusion zones to NAS Key West and following anomaly avoidance techniques, discussed next, prior to conducting intrusive activities in order to seed ISO items in the IVS. Lastly, the terms of the ESS-DR approval letter (**see attachment 2**) must be fully implemented.	Rick Swahn, UXO Manager, Resolution Consultants TBD, SUXOS, Resolution Consultants TBD, UXOQCS/UXOSO, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Mike Ervine, QAM, Resolution Consultants
Anomaly Avoidance [*includes: Inspection and Disposal of MPPEH, MEC Demolition & Disposal Operations*]	**Anomaly Avoidance** to be reviewed and completed following guidelines provided in the UFP-SAP and SOP guidance documents (i.e. **MRP SOP 01, MRP SOP 02, MRP SOP 03)** provided for Anomaly Avoidance*, Inspection and Disposal of MPPEH*, and *MEC Demolition and Disposal*, respectively. The documents are to be followed during all aspects of the project, starting with the IVS construction activities. Furthermore, the SUXOS and UXOQCS / UXOSO will verify first hand that the first lot of **Survey** field activities are being conducted properly, safely, and technically correct, inclusive of reviewing the deliverables to ensure that the data not only meets reporting requirements but also exceeds quality requirements of **Worksheet #12**	**Initial Daily Inspections:** TBD, SUXOS, Resolution Consultants TBD, UXOQCS/UXOSO, Resolution Consultants **Final Product Inspection:** Rick Swahn, UXO Manager, Resolution Consultants
Vegetation Management	**Vegetation Management**, inclusive of brush clearing, tall grass mowing, and tree removal will be conducted in accordance with **MRP SOP 04,** inclusive of anomaly avoidance techniques to be implemented as a part of **MRP SOP 01**.	**Initial Daily Inspections:** TBD, SUXOS, Resolution Consultants TBD, UXOQCS / UXOSO, Resolution Consultants **Final Product Inspection:** Eric Celebrezze, Field QC Scientist, Resolution Consultants

Definable Feature of Work	Supporting Documentation/Description	Responsible for Verification
Survey Management	**Survey Management** will be conducted in accordance with **MRP SOP 05**, inclusive of anomaly avoidance techniques implemented as part of **MRP SOP 01**. Prior to the start of field work, the boundaries and benchmarks will be established for the entire site while grid layouts await vegetation removal, just prior to the start of the DGM surveys. Furthermore, the Field QC Scientist and UXOQCS / UXOSO will verify first hand that the first lot of **Survey** field activities are being conducted properly, safely, and technically correct, inclusive of reviewing the deliverables to ensure that the data not only meets reporting requirements but also exceeds quality requirements of **Worksheet #12.**	**Initial Daily Inspections:** TBD, UXOQCS / UXOSO, Resolution Consultants **Final Product Inspection:** Eric Celebrezze, Field QC Scientist, Resolution Consultants
Geophysics Management [*includes: EM31-MK2 DGM Transect Surveys, EM61-MK2 DGM Transect and Grid Surveys, Anomaly Pin-Pointing, 3-D CI with Advanced Classification*]	**Geophysics Management** to be reviewed and completed following guidelines provided in the UFP-SAP and SOP guidance documents (i.e. **MRP SOP 06, MRP SOP 07, MRP SOP 08, MRP SOP 09)** provided for *EM31-MK2 DGM Surveys*, *EM61-MK2 DGM Surveys*, *Anomaly Pin-Pointing*, and *MEC 3-D CI with Advanced Classification*, respectively. The documents are to be followed during all DGM aspects of the project, beginning with the start of project QC / IVS testing activities. Furthermore, the Field QC Scientist and UXOQCS / UXOSO will verify first hand that the first lot of **Geophysics** field activities are being conducted properly, safely, and technically correct, inclusive of reviewing the deliverables to ensure that the data not only meets the reporting requirements but also exceeds the quality requirements of **Worksheet #12**.	**Initial Daily Inspections:** TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants **Final Product Inspection:** Brian Brunette, Geophysics Manager, Resolution Consultants
Project Closeout [*includes: FI data deliverables check,, Demobilization*]	*FI Data Deliverables Check* to be delegated by Resolution Consultants PM to each technical lead to verify their personnel or subcontract personnel have either gathered or determined that the field investigation data is of sufficient quantity, quality, and format to be easily detailed in the final ESI report. As with mobilization, Demobilization will be staggered, on a task-by-task basis. The equipment should be prepped for shipment, inclusive of re-packing spares for commonly damaged parts and an inventory of each box. Upon equipment leaving the site, the transit of personnel can commence.	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Mike Ervine, QAM, Resolution Consultants

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Follow-up QC inspections are conducted to ensure that procedures are being correctly performed, that no changed conditions exist that may affect the quality of work, and that lessons learned are being applied as identified through the communication feedback loop process implemented. The responsible individual will inspect the relevant follow-up items as excerpted from the appropriate SOP at least as often as specified in this worksheet. **Worksheet #21** lists all of the SOPs and **Worksheet #22** details the field equipment calibration, maintenance, and testing protocols, as related to the QC metrics detailed in **Worksheet #12**, while **Worksheet #32** describes actions to be taken in the event that nonconforming conditions are observed during the QC inspections.

Definable Feature of Work	**Frequency of Inspection**	**Supporting QC Documents/Description**	**Responsible for Validation** (name, organization)
Project Startup	After each mobilization event is completed for individual tasks	No follow-up required. Verify that UFP-SAP was implemented as written, with any deviations clearly and transparently documented with sufficient detail in order to summarize as a part of ESI report.	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants
Anomaly Avoidance	Daily	Checklist and field logbooks that document equipment utilization, production progress, and quality control or safety annotations are scanned.	TBD, SUXOS, Resolution Consultants TBD, UXOQCS / UXOSO, Resolution Consultants
Vegetation Management	Daily	Checklist and field logbooks that document equipment utilization, production progress, and quality control or safety annotations are scanned.	TBD, SUXOS, Resolution Consultants TBD, UXOQCS / UXOSO, Resolution Consultants
Survey Management	Daily	Checklist and field logbooks that document equipment utilization, production progress, and quality control or safety annotations are scanned. Interpretation results and final deliverables review are completed upon submittal, a few days after start.	TBD, SUXOS, Resolution Consultants TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants
Geophysics Management	Daily	Checklist and field logbooks that document equipment utilization, production progress, and quality control or	TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist,

Definable Feature of Work	**Frequency of Inspection**	**Supporting QC Documents/Description**	**Responsible for Validation** (name, organization)
		safety annotations are scanned. Includes review of IVS and all other QC tests results. Interpretation results and final deliverables review are completed upon submittal, which is daily starting one week after the first day of field work.	Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants
Project Closeout	After each demobilization event is completed for individual tasks.	Demobilization is preceded by the FI Data Deliveries Check for Site-Specific ESI Final Report(s) and followed by a check for demobilization adequacy and fidelity.	Todd Haverkost, PM, Resolution Consultants Rick Swahn, UXO Manager, Resolution Consultants Brian Brunette, Geophysics Manager, Resolution Consultants Mike Ervine, QAM, Resolution Consultants

SAP Worksheet #36 -- Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa / IIb [1]	Matrix	Analytical Group	Validation Criteria	Data Validator (title, organizational)
IIa	Surface Soils	Anomaly Avoidance	a) 10% Daily inspections conducted by SUXOS and UXOQCS / UXOSO do not find additional items on surface not previously marked or clearly circumvented by field crews b) Seed items placed on surface by UXOQCS are located, marked and recorded in logbook entries	TBD, UXOQCS / UXOSO, Resolution Consultants TBD, SUXOS, Resolution Consultants
IIa	Near Surface (or Shallow Subsurface) Soils	Anomaly Avoidance	a) 10% Daily inspections conducted by UXOQCS / UXOSO do not observe puncturing of subsurface without first observing anomaly avoidance assessment of subsurface b) The same ISO's seeded in IVS are detected each day of equipment use as were detected on day 1	TBD, UXOQCS / UXOSO, Resolution Consultants TBD, SUXOS, Resolution Consultants
IIa	Surface Soils & Near Surface (or Shallow Subsurface) Soils	EM61-MK2 Grid Surveys	a) Random daily Inspections conducted by Field QC Scientist and UXOQCS / UXOSO observe field crews circumventing or stepping over pre-marked avoidance items, as opposed to stepping on them b) Seed items placed in subsurface by UXOQCS are located, marked and recorded so response is evident to Field QC Scientist during the daily review of the EM61-MK2 data	TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants
IIa	Near Surface (or Shallow Subsurface) Soils	EM61-MK2 Surveys	a) Inspections conducted by Field QC Scientist do not determine faulty standardized QC test results or noise-filled data w/out clearly identified noise source or planned rework b) The same ISO's seeded in IVS are detected each day of equipment use as were detected on day 1	TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants
IIa	Near Surface (or Shallow Subsurface) Soils	3-D CI Surveys	a) Inspections conducted by Field QC Scientist do not determine faulty standardized QC test results or noise-filled data w/out clearly identified noise source or planned rework b) The same ISO's seeded in IVS are detected each day of equipment use were detected within the same confidence metric guidelines as recorded and observed on day 1	TBD, UXOQCS / UXOSO, Resolution Consultants Eric Celebrezze, Field QC Scientist, Resolution Consultants

[1] IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.], **APPLICABLE to MEC investigation**.

IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005], **NOT APPLICABLE to MEC Investigation**

SAP Worksheet #37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

37.1 INTRODUCTION

The usability of the data directly affects whether project objectives can be achieved; furthermore, as a part of the data usability assessment, the following characteristics will be evaluated, with certification/verification for equipment operation documented soon thereafter:

1. Data Usability Assessment for Anomaly Avoidance
2. Data Usability Assessment for Registered Land Surveys
3. Data Usability Assessment for EM31-MK2 Sensor DGM Surveys
4. Data Usability Assessment for EM61-MK2 Sensor DGM Surveys
5. Data Usability Assessment for Anomaly Pin-Pointing Surveys
6. Data Usability Assessment for Anomaly 3-D CI Surveys

The results of these evaluations will be included in the project report. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments for each of the data characteristics determined by the assessment. Once all of the daily QC checks and inspections are completed, the results will be compared to the requirements of **Worksheet #12** to verify the data is usable on a daily or per lot basis.

37.2 DATA USABILITY DETAILS

37.2.1 Anomaly Avoidance

Anomaly Avoidance will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP document, by the UXOQCS / UXOSO. The monitoring will occur after the SUXOS has conducted: 1) review and training with the teams on proper techniques, 2) instrument-operator tests at the IVS, and 3) 10% daily inspection of the previous days' work, after 25% inspection of day 1 work. As summarized in **Worksheet #36**, the daily monitoring by the UXOQCS / UXOSO will not only include safety observations but also include quality assessments for data usability via the use of seed items placed on the surface.

37.2.2 Registered Land Surveys

Registered Land Surveys, accompanied by Anomaly Avoidance requirements, will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP documents (i.e. **MRP SOP 01**, **MRP SOP 05**), by the UXOQCS / UXOSO. Quality monitoring will be assessed by reviewing the offsets determined from the static position test results, conducted after day 1 establishment of benchmarks on site. As summarized in **Worksheet #36**, the daily monitoring by the UXOQCS / UXOSO will not only include safety observations but also include quality monitoring and the final quality assessment to be completed by the Field QC Scientist, upon the land surveyors' completion of benchmark establishment, site boundary survey, and internal grid-layout surveys.

37.2.3 EM31-MK2 Sensor DGM Surveys

EM31-MK2 Sensor DGM Surveys, accompanied by Anomaly Avoidance requirements, will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP documents (i.e. **MRP SOP 01**, **MRP SOP 06**), by the UXOQCS / UXOSO. Quality monitoring will be assessed by reviewing static background and kinematic spike tests, conducted after day 1 establishment of an electromagnetically quiet area and large metallic object area, respectively, for testing. Since the EM31-MK2 sensor system primarily detects large objects or large trends, at depth, there are no supplemental requirements in **Worksheet #36**. .

37.2.4 EM61-MK2 Sensor DGM Surveys

EM61-MK2 Sensor DGM Surveys, accompanied by Anomaly Avoidance requirements, will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP documents (i.e. **MRP SOP 01**, **MRP SOP 07**), by the UXOQCS / UXOSO. Quality monitoring will be assessed by reviewing the static background and static spike response tests along with the results from the IVS, conducted after day 1 establishment of both an electromagnetically quiet area to conduct the static tests and an anomaly avoided ISO seeded path for conducting kinematic IVS tests. As summarized in **Worksheet #36**, the daily monitoring will not only include safety observations by the UXOQCS / UXOSO but also include quality and final quality assessment to be completed by the Field QC Scientist, upon the DGM surveyors' completion of all QC tests detailed in **Worksheet #22** and compared to metric requirements tabulated in **Worksheet #12**. Lastly, the final quality assessment for EM61-MK2 sensor data includes review of the production data for adequate sampling, spacing, noise levels, and overall response quality along with seed item detection to be reviewed during grid-pattern surveys only.

37.2.5 Anomaly Pin-Pointing Surveys

Anomaly Pin-Pointing Surveys, commonly termed anomaly reacquisition and accompanied by Anomaly Avoidance requirements, will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP documents (i.e. **MRP SOP 01**, **MRP SOP 08**), by the UXOQCS / UXOSO. Quality monitoring will be assessed by reviewing the static background and static spike response tests, conducted after day 1 establishment of an electromagnetically quiet area to conduct the static tests. As summarized in **Worksheet #36**, the daily monitoring will not only include safety observations by the UXOQCS / UXOSO but also include quality and final quality assessment to be completed by the Field QC Scientist, upon the anomaly pin-pointing surveyors' completion of all QC tests detailed in **Worksheet #22** and compared to metric requirements tabulated in **Worksheet #12**.

37.2.6 Anomaly 3-D CI Sensor Surveys

Anomaly 3-D CI Sensor Surveys, accompanied by Anomaly Avoidance requirements, will be monitored for proper safe operation, as compared to techniques referenced to in both the current UFP-SAP and applicable SOP documents (i.e. **MRP SOP 01**, **MRP SOP 09**), by the UXOQCS / UXOSO. Quality monitoring will be assessed by reviewing the static cued interrogation results from the IVS, conducted after day 1 establishment of an electromagnetically quiet and anomaly avoided ISO seeded path for conducting IVS testing. As summarized in **Worksheet #36**, the daily monitoring will not only include safety observations by the UXOQCS / UXOSO but also include quality and final quality assessment to be completed by the Field QC Scientist, upon the DGM surveyors' completion of all QC tests detailed in **Worksheet #22** and compared to metric requirements tabulated in **Worksheet #12**.

37.3 DATA USABILITY CHECKLIST

The UXO Manager, UXOQCS, or other designee, acting on behalf of the Resolution Consultants PM and Project Team, will determine whether data were collected in all areas planned to be investigated. Data gaps will be identified to which the Resolution Consultants PM will consult with the Project Team to determine the extent to which it is necessary to fill these data gaps during future investigations. The data usability checklist, which documents that either the key requirements were completed as planned or with deviations from the planned requirements, is summarized as follows:

Data Usability Checklist Table			
Phase of Work	**Items to be checked/verified**	**Verified (Yes or No)**	**Comments or Deviations**
Pre-Survey(s)	Personnel Reviewed and Signed-Off on Relevant UFP-SAP sections, inclusive of SOP's		
	Personnel Reviewed & Signed off on HASP		
	Personnel Received Site Orientation, inclusive of reminder of Anomaly Avoidance procedures and protocols to be implemented for all FI tasks.		
Survey	QC evaluation of equipment tests, following **Worksheet #22** guidance relative to **Worksheet #12** metrics		
	Conformance to SAP requirements and procedures for all survey work and rework (including documentation requirements), and all deficiencies documented		
	Coverage of areas to be investigated fulfilled and located within accuracy levels required for the ESI in order to be adequate for the final report.		

The Resolution Consultants management team will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM and FDEP. The review will take place either in a face-to-face meeting or a teleconference, depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle. Ultimately, written documentation will support the non-compliance, estimated, or rejected data results. The project report will identify and describe the data usability limitations and suggest resurveying or other corrective actions, if necessary

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USACE, August, 2009. *MMRP-09-005: Accident Prevention Plan Guidance Document*.

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Figures

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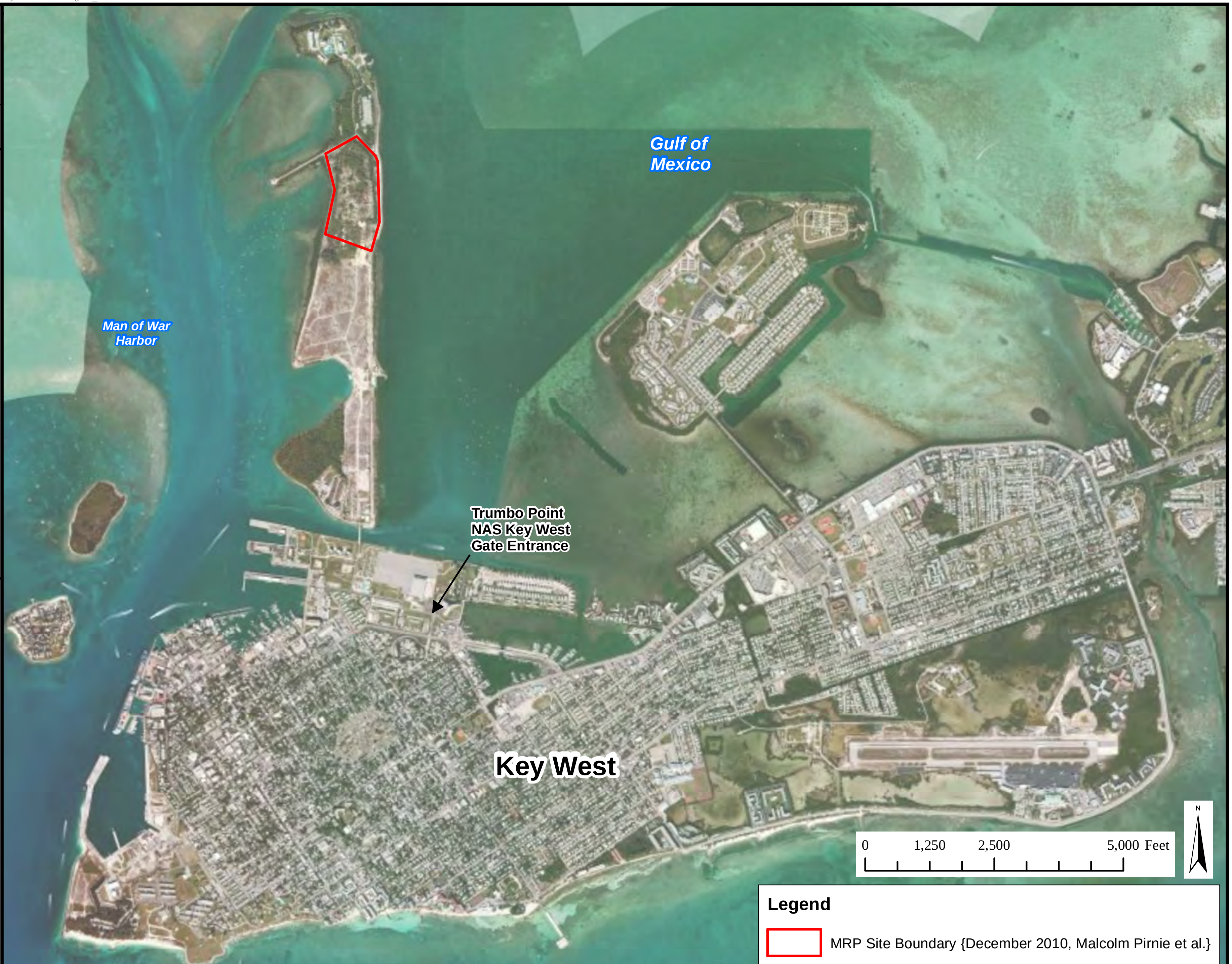

CONTRACT NO. ##########
TASK NO. ####
DESIGNED BY K. Weber
DRAWN BY K. Weber
CHECKED BY B. Brunette
DATE September 2012
SCALE 1" = 2,500'
SHEET 1 of 1
Figure_ES-1_Site_Location.mxd

NAVY Fleming Key West Project Sampling and Analysis Report

FIGURE ES-1

Site Location Map of Fleming Key Dredge Spoils Area

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NAVY Fleming Key West Project Sampling and Analysis Report

FIGURE ES-2

Historically Relevant Background Information for Fleming Key Dredge Spoils Area

CONTRACT NO	TASK NO
############	####
DESIGNED BY K. Weber	DRAWN BY K. Weber
CHECKED BY B. Brunette	DATE September 2012
SCALE 1" = 300'	SHEET 1 of 1

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NAVY Fleming Key West Project Sampling and Analysis Report

FIGURE 17-1
Pre-planned RLS Layout for
Expanded Site Investigation Activities
at Fleming Key Dredge Spoils Area

CONTRACT NO	TASK NO
############	####
DESIGNED BY K. Weber	DRAWN BY K. Weber
CHECKED BY B. Brunette	DATE September 2012
SCALE 1" = 250'	SHEET 1 of 1

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NAVY Fleming Key West Project Sampling and Analysis Report

FIGURE 17-2
Pre-planned Transect DGM Surveys
for Expanded Site Investigation Activities
at Fleming Key Dredge Spoils Area

CONTRACT NO	TASK NO
############	####
DESIGNED BY K. Weber	DRAWN BY K. Weber
CHECKED BY B. Brunette	DATE September 2012
SCALE 1" = 250'	SHEET 1 of 1

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NAVY Fleming Key West Project Sampling and Analysis Report

FIGURE 17-3
Example Selection of Full-Coverage DGM Survey for Expanded Site Investigation Activities at Fleming Key Dredge Spoils Area

CONTRACT NO	TASK NO
############	####
DESIGNED BY K. Weber	DRAWN BY K. Weber
CHECKED BY B. Brunette	DATE September 2012
SCALE 1" = 250'	SHEET 1 of 1

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Attachment 1
MRP SOPs

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MRP SOP 01:
Anomaly Avoidance

STANDARD OPERATING PROCEDURES (SOP) for ANOMALY AVOIDANCE Assessments

Prepared by:
AECOM Technical Services (ATS)

Prepared for:
UXO & Other Personnel
Conducting Field Work at
MMRP sites with MEC Hazards

Version Number:
Updated September 2012

1.0 PURPOSE

The purpose of this Munitions Response Program (MRP) Standard Operating Procedure (SOP), MRP SOP 01 – Anomaly Avoidance, is to provide guidance regarding the technologies, personnel responsibilities, and methods to be implemented in conjunction with adequate health and safety protocol requirements applicable to the proper conduct of Instrument-Aided Visual-Survey (IAVS) surface and near-surface assessments for Material Potentially Presenting an Explosive Hazard (MPPEH) as an anomaly avoidance process. The intent is to incorporate the anomaly avoidance assessment as a part of UXO Tech escorting duties, required for each field team and vitally important for all pre-geophysics tasks (i.e. vegetation removal, land surveying, etc.) and SOP's (i.e. Vegetation Management, (Land) Survey Management, etc.) to follow.

2.0 SCOPE

This SOP applies to all site personnel, including contractor and subcontractor personnel, involved in MEC Investigations at Military Munitions Response Program (MMRP) sites. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Consult the documents listed in Section 3.0 of this SOP for a listing of additional compliance documents for reference. However, the SOP is intended for use by UXO Technicians assigned to this project to review proper anomaly avoidance techniques as a part of their daily safety escort duties of each field team.

3.0 REFERENCE DOCUMENTS

Applicable sections in the documents listed below will be used as references for the safe field procedure requirements during the conduct of anomaly avoidance assessments at MEC sites:

- AECOM Corporate Safety and Health Program;
- OSHA General Industry Standards, 29 CFR 1910;
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards;
- AR 385-64, U.S. Army Explosives Safety Program, AR 385-10, Army Safety Program;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- NOSSAINST 8020.15C, Navy Explosives Safety Program; and
- UFP-SAP, HASP, ESS-DR, & ESS documents approved for field work at this site.

The documents listed above are the primary references for basic guidance at MEC sites regarding: education, experience, training, and certification requirements for personnel; document submittals required for approval prior to conducting field work; forms recommended for use during field work; and equipment-operator tests recommended to validate the combined equipment-operator functionality prior to conducting field work. The current SOP does not directly address Inspection and Disposal of MPPEH (SOP 02), MEC Demolition & Disposal Operations (SOP 03), or Survey / Vegetation Management (SOP 04 / SOP 05) activities.

4.0 PERSONNEL ROLES, RESPONSIBILITIES, AND REQUIREMENTS

The personnel roles and responsibilities in conjunction with associated deliverable requirements are introduced in the following sets of paragraphs with further details regarding site-specific and project-specific roles and responsibilities listed in **Worksheet #7** of the current UFP-SAP.

4.1 Project Manager (PM)

The Project Manager (PM) is responsible for ensuring the availability of the personnel and equipment resources needed to implement this SOP, inclusive of all materials and supplies required to complete each task safely. The PM will also ensure that this SOP is incorporated in plans, procedures and training for sites where MEC has the potential of being encountered. Lastly, although the PM shall delegate all daily site leadership, inclusive of site-specific training aspects, quality inspections, and safety audits, to the UXO operations management team on-site and program management offsite, the PM is ultimately responsible to ensure each aspect has been completed and signed off as such prior to commencing the next stage of field work or reporting requirements.

4.2 On-Site UXO Operations Management

The On-Site UXO Operations Management consists of the following four (4) key personnel:

1. Senior UXO Supervisor (SUXOS),
2. UXO Safety Officer (UXOSO),
3. UXO Quality Control Specialist (UXOQCS), and
4. UXO Field Team Leader (UXOFTL),

For smaller projects or field efforts either without intrusive investigation (and thus minimal UXO field staff or UXO management requirements) activities at the current phase of the project, the operations management staffing plans can be reduced to only require a SUXOS, a dual-hatted UXOSO / UXOQCS, and a multi-hatted UXO Tech II / UXOFTL / UXO Tech escort, as there are only safety escorting MEC anomaly avoidance and emergency response to accident requirements at this phase of project.

4.2.1 Senior UXO Supervisor (SUXOS)

The Senior UXO Supervisor (SUXOS) will ensure that this SOP is implemented for operations that involve personnel exposure to the hazards associated with the surface or near subsurface assessment for MEC, in the form of anomaly avoidance as conducted during UXO Tech safety escort duties for all field teams and site visitors. The SUXOS may also escort teams or visitors, such as near the start of the project, as long as he maintains the communicative lines open to other responsibilities via the use of radios or cell phones. The SUXOS will also ensure that relevant sections of this SOP are discussed in the daily safety briefings and that information related to its daily implementation is

properly recorded in appropriate site documentation. Ultimately, the SUXOS will be responsible for assuring that adequate quality, safety, logistical, and reporting measures are implemented and all site operations are safe, clean, efficient and economical.

4.2.2 UXO Safety Officer (UXOSO)

The UXO Safety Officer (UXOSO) will be responsible for all health and safety duties detailed in the currently approved Uniform Federal Policy – Sampling and Analysis Plan (UFP-SAP), Health & Safety Plan (HASP), Explosives Safety Submission – Determination Request (ESS-DR), and potentially (if required) a full Explosives Safety Submission (ESS) set of documents, in addition to the operational items listed below:

- ✓ Maintains a daily logbook of MEC safety related matters encountered on site;
- ✓ Issues and/or approves "Stop Work" orders for safety and health reasons;
- ✓ Conducts site specific MEC-related health and safety training;
- ✓ Identifies and evaluates any known or potential safety problems that may interfere with or interrupt site MEC operations or endanger site personnel;
- ✓ Consults with the PM and SUXOS on identifying and implementing any necessary MEC safety-related corrective actions; and
- ✓ Coordinates with the HSM for the implementation of the HASP requirements.

4.2.3 UXO QC Specialist (UXOQCS)

The UXO Quality Control Specialist (UXOQCS) has the responsibility and authority to enforce the site MEC-specific requirements detailed in the UFP-SAP. (As stated previously, the UXOSO may perform the duties of the UXOQCS if personnel are limited, and as such, would have all the responsibility requirements of the UXOSO as well as their current role as the UXOQCS) This individual reports to directly to both the MEC Manager and the Quality Assurance Manager (QAM) and coordinates site activities with the PM and SUXOS on site. The UXOQC responsibilities include:

- ✓ Maintains a daily logbook of MEC QC monitoring activities, non-conformances issues, and corrective measures required to be implemented;
- ✓ Conducts periodic QC surveillances of site MEC activities and recording the findings in the Daily Activities Report;
- ✓ Reports noncompliance with MEC QC criteria to the QAM, PM and SUXOS and documents the deviations on a Non-Conformance-Report (NCR);
- ✓ Initiates a Rework Items List from the NCR that must meet quality specifications;
- ✓ Conducts a root cause analysis when a QC failure occurs;
- ✓ Coordinates with the responsible parties to initiate the QC failure remedies and documents these actions on the Corrective Action Report (CAR); and
- ✓ Ensures that the CAR recommendations are followed in order the close-out the QC failure and ensures that all lessons learned are documented and forwarded to the QAM for analysis.

4.2.4 UXO Field Team Leader (UXOFTL)

The UXO Field Team Leader (UXOFTL) has the responsibility and authority to enforce the site health and safety rules while escorting teams across the site and providing anomaly avoidance support. Ultimately, the UXOFTL is responsible for implementing all health, safety, and anomaly avoidance assessment requirements outlined in Sections 5.0, 6.0, and 7.0 of this SOP, as conducted real-time in the field with requested support from the SUXOS or UXOQCS, as needed.

4.3 Off-Site UXO Program Management

The Off-Site UXO Program Management consists of the following three (3) key personnel:

1. MEC Manager,
2. Health and Safety Manager (HSM), and
3. Quality Assurance Manager (QAM).

Since the UXO Managers are at the programmatic level, company-wide, there are no project size restrictions whereby they would have no involvement or required duties, unless the site has no known sources of MEC contamination at which time the MEC Manager can be removed. The ultimate purpose of each manager is to ensure adequate documentation is gathered from the field to readily summarize the results in the Final Report to be submitted post Field Investigation (FI).

4.3.1 Munitions and Explosives of Concern Manager (MECM)

The Munitions and Explosives of Concern Manager (MECM) will coordinate with the PM to ensure adequate staffing, equipment, and supplies are provided to the site at the start of the project, at key junctures, during project surges, and/or on a regimented basis in order to safely complete the project in a timely cost-efficient manner with adequate quality. The MEC Manager is also responsible for addressing MEC related issues, such as accurately and thoroughly documenting MEC finds, effectively reporting MEC finds to the Explosives Ordnance Disposal Mobile Unit (EODMU), and timely decision-making regarding how to handle unpredictable project events, by working with on-site management, other off-site management, and the PM as deemed necessary. Lastly, the MECM is responsible for inspecting the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on requirements detailed in the HASP, UFP-SAP, and the current SOP.

4.3.2 Health and Safety Manager (HSM)

The Health and Safety Manager (HSM) will be responsible for ensuring that the safety and health hazards and control techniques associated with or referenced in this SOP are discussed during the initial site hazard training and the daily tailgate safety briefings. The HSM is also responsible for audits of site operations summary reports from the SUXOS and UXOSO / UXOQCS are adequate with continued compliance with the approved Task Hazard Analyses (THAs), HASP, UFP-SAP, and the current SOP.

The HSM also delegates to the UXOSO to: conduct of daily safety briefings, controls visitor access and entry to the project site; coordination with local emergency response agencies; compliance with Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), and U.S. Army Corps of Engineers (USACE) Safety or U.S. Navy Ordnance Safety and Security Activity (NOSSA) protocols; check compliance with specific state and local ordinances as required; and inspect emergency equipment and maintaining the site emergency vehicle and supplies. Although the tasks are delegated from the UXOSO and other site personnel, ultimately, the HSM is responsible for the adequate documentation and ultimate compliance for the health-safety aspects of the entire project.

4.3.2 Quality Assurance Manager (QAM)

The Quality Assurance Manager (QAM) will be responsible for ensuring that the Quality Control (QC) techniques are implemented and Quality Assurance (QA) inspections are conducted, as associated with techniques introduced in this SOP or inspection frequency versus quality metric requirements detailed in the UFP-SAP. Lastly, the QAM is not only responsible for inspecting quality but also the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on metric requirements detailed in the UFP-SAP and the current SOP.

4.4 Dual-Hatting or Multi-Hatting of Personnel Roles and Responsibilities

The dual-hatting and multi-hatting of UXO Management will only remain viable as long as intrusive operations are not being conducted or the staffing requirements remain relatively small and manageable even with intrusive investigation activities, which is clearly the case for the current project. Other projects which require a limited intrusive investigation of a large area or full intrusive investigation of smaller areas (and thus a limited maximum of UXO field staff or UXO management requirements), may also dual-hat the UXOSO/UXOQCS but may not be able multi-hat the UXO Tech II / UXOFTL / UXO Tech escort duties depending on staffing needs.

5.0 MEC PROCEDURES

5.1 General Site Practices

All personnel, including contractor and subcontractor personnel, involved in MEC operations shall be familiar with the potential safety and health hazards associated with the conduct of this operation, and with the work practices and control techniques to be used to reduce or eliminate these hazards. The site safety practices detailed in the HASP and THA's will be observed.

All MEC-related operational activities at the site will be under the direction of and performed by UXO-qualified personnel as defined by the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). Non-essential personnel will be prohibited from entering within the minimum separation distance (MSD) of subsurface intrusive investigation activities at MMRP sites, and must remain outside of the exclusion zone (EZ) defined by the MSD unless

escorted by a UXO Technician and authorization to access or transit the EZ has been approved by the SUXOS. The EZ rules do not apply to portions of the site that are not characterized to be within a MEC contaminated area. For the current project, since no intrusive investigation activities are planned to be conducted with non-essential personnel within the both the MSD arcs and the well-defined MEC contaminated portion of the site, the EZ rules are for informational purposes or, in-lieu of, tasked project changes at this time.

5.1.1 Anticipated Site Work Hours

Operations will be conducted during daylight hours only and no single workday will exceed 10 hours in the field. The only exception to the rule is that pre work day meetings and setup can occur after hours, but only at pre-designated areas. The currently anticipated work schedule consists of five ten hour (5-10's) days, of which the workday consists of at least forty (40) hours in the field with at least forty-eight (48) hours separating each workweek. Industry standards for UXO operations normally limit personnel to a 40-hour work week, either four 10-hour days or five 8-hour days, however, these rules do not apply until intrusive operations are being conducted.

5.1.2 Site Access Controls

Site access controls are currently maintained not only by base pass entrance requirements at the main gate entrance for the post but also by a locked-entrance to perimeter fencing which surrounds the work area where potential MEC/MPPEH is identified and this pre-established measure will clearly limit access to only those personnel essential to accomplish the specific operation(s) or who have a specific purpose and authorization to be in the work zone. No hazardous operations, such as intrusive operations and demolition operations which currently have no scheduled time-line, will be conducted when non-essential personal are in the vicinity.

5.1.3 Inspection & Disposal of MPPEH

Inspection and disposal of MPPEH will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 02 Inspection and Disposal of MPPEH reference documents, the SUXOS or UXOQC / UXOSO must first clearly identify whether the MPPEH item is determined to be Material Documented as Safe (MDAS) or Material Documented as Explosive Hazard (MDEH) and whether the item has the best-fit nomenclature as Small Arms Ammunition (SAA), Munitions Debris (MD), Cultural Debris (CD), Munitions and Explosives of Concern (MEC), or Munitions Constituent (MC). At this time, on-site UXO technicians may move the item if and only if they are 100% certain, with SUXOS and UXOQCS / UXOSO approval, it is SAA. MD, CD, etc., and clearly determined to be MDAS. If determined to be MDEH, the UXOFTL must coordinate with the SUXOS and UXOQCS / UXOSO to document the item details (e.g. nomenclature, location, etc.) at which time the SUXOS will contact the base Explosives Safety Officer (ESO) and the assigned EODMU named in the approved site-specific ESS-DR or full ESS documents.

5.1.4 MEC Demolition and Disposal Operations

MEC Demolition and Disposal Operations will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 03 MEC Demolition and Disposal Operations reference documents, the SUXOS or UXOQC / UXOSO will have demolition and disposal operations managed by the base ESO and completed by the EODMU, both of which should have already been contacted once the MEC item has been verified at MDEH either through 100% concurrence positive identification or uncertainty whether the item can be 100% considered MDAS. As such, no explosives will be stored, maintained, or accounted for on-site at this time. Additionally, no 24-hour guarding is required due to the extent of the site access controls. Lastly, demolition and disposal operations can be completed by non-NAVY EODMU personnel if and only if we are authorized to increase our breadth of scope based on unavailability of EODMU personnel, however, this is not expected.

5.1.5 Safety Training or Briefing Sessions

Three (3) distinct sets of safety training or briefing sessions will be routinely conducted: **(1)** UXOSO/UXOQCS-lead site-specific training related to familiarity, safety, quality, and project production execution requirements; **(2)** SUXOS-lead work summary pertaining to production, location, and safety debriefs; and **(3)** UXOFTL-lead daily tailgate safety briefing conducted with each field team.

The UXOSO/UXOQCS-lead general briefings for all personnel at the site prior to beginning work. A written record of this training and the signatures of personnel attending the training will be maintained. The briefing will cover general hazards of the project and any new safety issues or hazards identified since the last briefing. The UXOSO and/or SUXOS will also conduct safety briefings on specific hazards anticipated at each work site during that day's operations and the safety measures to eliminate or mitigate those hazards. The brief will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and team locations change within the site, the briefings will also reflect any corresponding changes in ingress/egress routes and emergency evacuation routes. Site visitors must receive a safety briefing prior to entering the operating area. All visitors entering the site will sign the visitor's log and will be escorted by UXO-qualified project personnel regardless of their qualifications. Field activities involving MEC and MPPEH identification and disposal operations will be halted while visitors are within the work zone.

All of these safety training or briefing sessions require employee sign-off, either through pre-prepared sign-in sheets during office reviews or logbook entry sign-offs out in the field discussions. Lastly, the UXOSO and/or SUXOS may hold a safety stand-down at any time they note any degradation of safety or note a safety issue that warrants review.

5.1.6 PPE or Work Attire

Work clothing will be appropriate for the conditions encountered. It is anticipated that this will be Level D PPE. Basic components for EPA level D are outline in the HASP. UXO or GEO personnel will not wear boots with metal components that would interfere with the operation of the geophysical instruments. Hard hats will not be worn unless an overhead hazard exists. If that is the case, the hard hats will be fitted with a chin strap to hold the hard hat in place and not be permitted to fall off and strike MEC or MPPEH

5.2 Compliance with Plans and Procedures

All site-wide field operations or visitations will be conducted in a systematic manner under the direction, supervision and observation of UXO-supervisory personnel (e.g. UXOQCS/UXOSO, SUXOS, UXOFTL, etc.). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted. Any new course of action or desired change in procedures will be submitted to the PM with justification for approval, as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality to meet the task reporting requirements.

6.0 HAND-HELD ANALOGUE GEOPHYSICAL MAPPING (AGM) SENSORS

Hand-held Analogue Geophysical Mapping (AGM) sensors are characterized as a metal detection sensor with no digital readout, recording, or integrated positioning capabilities, that indicates proximity to metal by generating different strengths and pitches of an audible signal based on the size/depth and material properties versus background soil contrast. The two most common hand-helds are the *Schonstedt Instruments* magnetic locator and *White's Instruments* metal detector. Both sets of AGM sensors are well-designed in order to accomplish the goals to which they are intended—aiding visual surface and near subsurface assessment as part of safely escorting field teams across the site without physical contact to unidentified metallic MPPEH, all part of the Anomaly Avoidance tasks introduced in the UFP-SAP and discussed further in Section 7.0 of the current SOP. Lastly, although Digital Geophysical Mapping (DGM) sensors have some advantages, the advantages are outweighed by the lack of mobility originating from deployment platforms and by the reduced ability to pinpoint smaller items as a result of larger coils sizes, both are paramount for safely identifying surface hazards at this phase of the project.

6.1 *Schonstedt Instruments* Magnetic Locator

The *Schonstedt* is a handheld magnetometer with the sensor technology based upon the principles from fluxgate magnetometers organized in a gradiometer format. The *Schonstedt* employs two (2) fluxgate magnetometers that are aligned and mounted a fixed distance apart to detect changes in the earth's ambient magnetic field caused by ferrous metal (as the sensors are fixed and aligned to eliminate a response to the earth's ambient field). The *Schonstedt* is capable of detecting ferrous objects, simple to use, rugged, and requires little field maintenance outside of replacement of standard flashlight batteries every few days of use.

6.2 *White's Instruments* Metal Detector

The *White's* PI Surfmaster and XLT Metal Detectors are microprocessor-controlled metal detectors with a liquid crystal display and a keypad user interface. The *White's* detectors operate on the induction principle -- a transmitter coil induces eddy currents within buried metal. These induced eddy currents are received by a receiver unit. The detectors are capable of detecting all metals and are particularly useful in aiding surface clearance and locating large masses of mixed metals at moderate depths. As with the *Schonstedt*, the *White's* is simple to use, rugged, and requires little field maintenance outside of replacement of standard flashlight batteries every few days of use; conversely, the main difference is the White's detect all metals, ferrous and non-ferrous metals. Since no non-ferrous ordnance items are suspect, both instruments will be operated in the field and instrument selection will be based practicality of use (arising from vegetation and other surface conditions which may limit one instrument over the other) and the Instrument Verification Strip (IVS) results, introduced next.

6.3 Instrument Verification Strip (IVS)

Prior to the start of the project, an Instrument Verification Strip (IVS) will be established outside the known MEC area and constructed using anomaly avoidance technique to seed items along a linear test strip by the guidelines detailed in the UFP-SAP. The preferred construction location is in out in the open, away from trees, power-lines, utility boxes, or other sources of over-hanging obstructions or electrical noise sources which may limit the use of a backhoe (for obvious safety reasons) or may hinder the effectiveness of the sensors given the over-riding cyclical electromagnetic noise. Selecting the correct area is paramount for effective long-term use without imposing limitations from a preventable source. The IVS will be utilized to test the AGM hand-held sensors operator-instrument performance that the UXO Technicians will repeat the techniques demonstrated for all subsequent anomaly avoidance assessments. The operator will waive the instrument directly over top of the pre-flagged seed location and determine whether the item is detectable through audible (i.e. Y/N) assessments. All subsequent twice-daily IVS passes will be compared to day 1 demonstrated results only. Once the twice-daily assessment is documented in the logbook, the UXOFTL is certified to escort the assigned field team to their daily work location (in the case of the morning test) or to put the sensor back in the box for tomorrow's use after handing the logbook over to the SUXOS for scanning. Lastly, any inconsistencies between days' of testing will have to be documented in the logbook with a proposed solution, after further roundtable discussions with the SUXOS and UXOQCS.

6.4 Global Positioning System (GPS) and Additional Documentation for MEC

Where applicable, Global Positioning System (GPS) units will be used to record the x, y locations (or lat, long locations post-processed into x, y locations) of MEC items of interest, after the item has been properly identified as ordnance-related by nomenclature (e.g., 20mm, 75mm, etc.), marked for future reference (e.g., flags, cones, etc), characterized by explosive hazard category (e.g., UXO, CWM, MDAS, MDEH, etc.), documented in the logbook, photographed with ruler and ID in the background, and reported to the SUXO via radio communications.

Where not applicable, relative positions may be recorded based on "paced off" proximity to transect way-points, grid-corners, surface features, etc., or potentially return to the flagged location after additional vegetation, trees, or other sky-view hindrances are removed to allow adequate positioning. As with the IVS testing, the GPS units must be tested twice-daily and compared to day 1 results from the same location with the required accuracy to be within either the limits specified in the UFP-SAP for the type of positioning system used or within the manufacturers specifications. Lastly, if documentation of items is hindering escort duties and subcontractor production, the UXOFTL may rely on the SUXOS and UXOQCS for support.

7.0 GENERAL OPERATIONAL AND SAFETY PROCEDURES

Surface and near-surface AGM sensor aided anomaly avoidance assessment to circumvent preventable contact with ordnance related hazards will be conducted as a part of UXO Tech safety escort duties for Vegetation (removal) Management, (land) Survey Management, and Geophysics (survey) Management activities to follow. The intent is to use the hand-held instruments to audibly detect and aide visual-cues for ordnance-related anomaly avoidance within the work area prior to conducting the current activity, such as vegetation removal down to grade or survey stake emplacement within the first few inches of the subsurface. As a matter of practicality, as further discussed in the MRP SOP 04 Vegetation Management and MRP SOP 05 Survey Management, some modifications to standard procedures may be required such as: vegetated areas may have to be circumvented entirely if apparent to be cluttered with ordnance; tall vegetated areas may have to be trimmed at different height above ground surface until the residual vegetation height reaches a level to which the area can have anomaly avoidance assessments; and survey stakes may require offset from desired location due to surface or subsurface anomalies detected. Ultimately, AECOM is responsible for providing the necessary equipment and personnel to conduct the UXO Tech escort guided anomaly avoidance activities. Details for the procedures to safely prepare the site are detailed in the following paragraphs, the UFP-SAP, or other SOP's (e.g. Vegetation Management, Survey Management, etc.) to follow.

7.1 Site Familiarity, Flag Color Designations, & Communication Requirements

After the site walk is completed to visually recognize the boundaries of the site, apparent by visual cues marked either by physical boundaries (i.e. fencing, terrain changes such as drop-offs, water inundation, building structures, etc.) or surveyor marker boundaries (e.g., stakes, flagging, spray paint, etc.), the SUXOS will determine which areas within the boundaries to start the work and which general direction to work towards or away from in order to prepare personnel that will be working on the site in sequential order. Whether anomaly avoidance surface assessment for MEC or a surface sweep for all metal is desired, or potentially both, the same **ORANGE** or **RED** color-coded flagging is recommended for visual cues red indicates either MPPEH or confirmed MDEH, either of which requires demolition and disposal operations. The remaining non-hazardous items can remain unmarked, moved, or picked up depending on scope of the project, with the surface clearance tasks the only time which such items can be moved without prior authorization from the SUXOS, UXOSO / UXOQCS, or ESO. Ultimately, the SUXOS may select other colors as long as all personnel are briefed on the meaning of each color chosen.

7.2 Anomaly Avoidance

Anomaly avoidance will be the only MEC deterrent used on the current site following the scoped guidelines of only avoiding direct impact and thus not moving, picking up, disposing, or demolition of MPPEH through both the approved UFP-SAP and ESS-DR documents. Once properly identified and documented, the demolition or disposal will be reserved for the EODMU.

7.2.1 Anomaly Avoidance Purpose

Anomaly Avoidance assessments for surface or near subsurface MEC hazards are vital for all site workers' safety and are most prevalently used during the following activities: **(1)** IVS construction activities; **(2)** UXO Tech safety escorting duties for vegetation removal, land surveyor, and geophysics activities; and **(3)** UXO Tech implemented real-time reacquisition and intrusive investigation activities. The intent is to avoid a direct impact on MPPEH during these site-wide preparation activities.

7.2.2 Anomaly Avoidance Methods

Anomaly Avoidance assessments for surface or near subsurface MEC hazards requires the UXOFTL escort to conduct AGM sensor-aided visual scans of either the surface area (in the case of vegetation removal) or point-specific area (in the case of stake emplacement, IVS construction, etc.) to allow the field teams to continue the current set of operations while avoiding direct impact on MPPEH and potentially conducting full reporting of the suspect item following the guidelines outlines in section 6.0. Audible sounds that cannot be attributed to a source will require an offset distance or circumvented depending on the extent of the metallic debris as determined from a localized or pointed sweep conducted by the UXOFTL. Once completed for the near vicinity, the UXOFTL will guide the field teams in a constant motion safely across the site to complete their tasked goals safely and on time. To maintain production, the UXOFTL will rely on the SUXOS and UXOQCS/UXOSO to fully identify the item in cluttered areas as to not hinder production of the field team being escorted.

7.3 Surface Sweep / Clearances

Full surface sweeps or clearances across the entire site are detailed in a separate SOP's, if it is a scoped requirement. Refer to UFP-SAP or other SOP attachments to determine if required.

8.0 AUDIT CRITERIA

The following procedures will be audited to ensure compliance with this SOP and the UFP-SAP:

- ✓ UXOFTL daily logbook entries for tailgate briefs, equipment tests, & MEC hazards;
- ✓ SUXOS & UXOQCS/UXOSO logbook entries documenting results of field procedure inspections, MEC hazard identifications, EODMU communications, and seed detections;
- ✓ SUXOS & UXOQCS/UXOSO "sign-in" sheet documentation of morning meetings; and
- ✓ UXOQCS/UXOSO documentation of "near-misses" or "failures" related to quality or safety hazards, inclusive of recommended solutions and time-line for CAR summary.

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MRP SOP 02:
Inspection & Disposal of MPPEH

STANDARD OPERATING PROCEDURES (SOP) for INSPECTION and DISPOSAL OF MPPEH

Prepared by:
AECOM Technical Services (ATS)

Prepared for:
UXO & Other Personnel
Conducting Field Work at
MMRP sites with MEC Hazards

Version Number:
Updated September 2012

1.0 PURPOSE

The purpose of this Munitions Response Program (MRP) Standard Operating Procedure (SOP), MRP SOP 02 – Inspection and Disposal of MPPEH, is to provide guidance regarding the reference materials, personnel responsibilities, and methodologies to be implemented in conjunction with adequate health and safety protocol requirements applicable to the proper conduct of inspection and disposal of Material Potentially Presenting an Explosive Hazard (MPPEH) after an item has been discovered under other processes (e.g., anomaly avoidance, surface sweeps/clearances, intrusive investigations, etc.). The intent is to incorporate the inspection as part of the UXO site management duties and may only incorporate the disposal if and only if the item can be clearly identified as a non-hazardous safe-to-move item. Otherwise, all procedures will be completed by the Explosives Ordnance Disposal Mobile Unit (EODMU) once a suspect item is found. Thus, a large portion of the current SOP only applies in the rare case that an EODMU is not available and we are authorized to conduct said operations instead.

2.0 SCOPE

This SOP applies to all UXO Tech personnel, including management and field leadership, involved in MEC Investigations at Military Munitions Response Program (MMRP) sites. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Consult the documents listed in Section 3.0 of this SOP for a listing of additional compliance documents for reference. The SOP is intended for use by UXO Technicians' assigned to this project who have a duty of inspecting or confirming ordnance hazards.

3.0 REFERENCE DOCUMENTS

Applicable sections in the documents listed below will be used as references for the requirements associated with managing MPPEH encountered at and collected from MEC sites:

- AECOM Corporate Safety and Health Program;
- OSHA General Industry Standards, 29 CFR 1910;
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards;
- AR 385-64, U.S. Army Explosives Safety Program, AR 385-10, Army Safety Program;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- DoD Policy to Implement the EPA's Military Munitions Rule;
- 40 Code of Federal Regulations Part 261;
- DoD Instruction (DoDI) 4140.62, Material Potentially Presenting and Explosive Hazard;
- Engineering Manual 1110-1-4009, Ordnance and Explosives, Chapter 14;
- Local regulations pertaining to turn-in and disposal of Material Documented as Safe (MDAS) and Material Documented as an Explosive Hazard (MDEH);
- NOSSAINST 8020.15C, Navy Explosives Safety Program; and
- UFP-SAP, HASP, ESS-DR, & ESS documents approved for field work at this site.

The documents listed above are the primary references for basic guidance at MEC sites regarding: education, experience, training, and certification requirements for personnel; field techniques to be implemented during the inspection process; and documentation, communication, and storage/transport directives during the disposal process.

4.0 PERSONNEL ROLES, RESPONSIBILITIES, AND REQUIREMENTS

The personnel roles and responsibilities in conjunction with associated deliverable requirements are introduced in the following sets of paragraphs with further details regarding site-specific and project-specific roles and responsibilities listed in **Worksheet #7** of the current UFP-SAP.

4.1 Project Manager (PM)

The Project Manager (PM) is responsible for ensuring the availability of the personnel and equipment resources needed to implement this SOP, inclusive of all materials and supplies required to complete each task safely. The PM will also ensure that this SOP is incorporated in plans, procedures and training for sites where MPPEH or MEC has the potential of being encountered. Lastly, although the PM shall delegate all daily site leadership, inclusive of site-specific training aspects, quality inspections, and safety audits, to the UXO operations management team on-site and program management offsite, the PM is ultimately responsible to ensure each aspect has been completed and signed off as such prior to commencing the next stage of field work or reporting requirements.

4.2 On-Site UXO Operations Management

The On-Site UXO Operations Management consists of the following four (4) key personnel:

Senior UXO Supervisor (SUXOS),
UXO Safety Officer (UXOSO),
UXO Quality Control Specialist (UXOQCS), and
UXO Field Team Leader (UXOFTL).

For smaller projects or field efforts either without intrusive investigation (and thus minimal UXO field staff or UXO management requirements) activities at the current phase of the project, the operations management staffing plans can be reduced to only require a SUXOS, a dual-hatted UXOSO / UXOQCS, and a multi-hatted UXO Tech II / UXOFTL / UXO Tech.

4.2.1 Senior UXO Supervisor (SUXOS)

The Senior UXO Supervisor (SUXOS) will ensure that this SOP is implemented for operations that involve inspection, classification, disposition, and/or disposal of the MPPEH. The SUXOS will ensure that relevant sections of this SOP are discussed in the daily safety briefings and that information related to its daily implementation is properly recorded in appropriate site documentation (i.e. logbook entries, field forms, etc.). Ultimately, the SUXOS is responsible for the following:

- ✓ Ensuring project planning documents specify the procedures and responsibilities for processing MPPEH and for the final disposition of MDAS and MDEH;
- ✓ Ensure a Requisition and Turn-in Form, DD Form 1348-1A is completed for all MDAS to be transferred;
- ✓ Perform random checks to ensure that the MPPEH is free from explosive hazards, necessary to complete the DD 1348-1A;
- ✓ Certify all scrap metal generated from MPPEH is free of explosive hazards or other dangerous material; and
- ✓ Responsible for ensuring that inspected materials are secured in a closed, labeled and sealed container and documented properly.

4.2.2 UXO Safety Officer (UXOSO)

The UXO Safety Officer (UXOSO) will be responsible for all health and safety duties detailed in the currently approved Uniform Federal Policy – Sampling and Analysis Plan (UFP-SAP), Health & Safety Plan (HASP), Explosives Safety Submission – Determination Request (ESS-DR), and potentially (if required) a full Explosives Safety Submission (ESS) set of documents. THE UXOSO is also responsible for ensuring inspection and (potential) removal of MPPEH is done with due care and attention to the hazards involved in the operation, in addition to the operational items listed below:

- ✓ Maintains a daily logbook of MEC safety related matters encountered on site;
- ✓ Issues and/or approves "Stop Work" orders for safety and health reasons;
- ✓ Conducts site specific MEC-related health and safety training;
- ✓ Identifies and evaluates any known or potential safety problems that may interfere with or interrupt site MEC operations or endanger site personnel;
- ✓ Ensures proper Personal Protective Equipment (PPE) will be worn (e.g., shoes, gloves, eye protection with side shields), including a hard hat only with overhanging hazards, will be worn whenever working with MPPEH;
- ✓ Confers with SUXOS, UXOQCS, and UXOFTL to confirm proper identification of MPPEH and contacts appropriate ESO and EODMU if deemed hazardous;
- ✓ Consults with the PM and SUXOS on identifying and implementing any necessary MEC safety-related corrective actions; and
- ✓ Coordinates with the HSM for the implementation of the HASP requirements;

4.2.3 UXO QC Specialist (UXOQCS)

The UXO Quality Control Specialist (UXOQCS) has the responsibility and authority to enforce the site MEC-specific requirements detailed in the UFP-SAP. (As stated previously, the UXOSO may perform the duties of the UXOQCS if personnel are limited, and as such, would have all the responsibility requirements of the UXOSO as well as their current role as the UXOQCS) This individual reports to directly to both the MEC Manager and the Quality Assurance Manager (QAM) and coordinates site activities with the PM and SUXOS on site. The UXOQC responsibilities include:

- ✓ Maintains a daily logbook of MEC QC monitoring activities, non-conformances issues, and corrective measures required to be implemented;
- ✓ Conducts periodic QC surveillances of site MEC activities and recording the findings in the Daily Activities Report;
- ✓ Confers with SUXOS, UXOSO, and UXOFTL to confirm MPPEH hazard class;
- ✓ Reports noncompliance with MEC QC criteria to the QAM, PM and SUXOS and documents the deviations on a Non-Conformance-Report (NCR);
- ✓ Initiates a Rework Items List from the NCR that must meet quality specifications;
- ✓ Conducts a root cause analysis when a QC failure occurs;
- ✓ Coordinates with the responsible parties to initiate the QC failure remedies and documents these actions on the Corrective Action Report (CAR); and
- ✓ Ensures that the CAR recommendations are followed in order the close-out the QC failure and ensures that all lessons learned are documented and forwarded to the QAM for analysis.
- ✓

4.2.4 UXO Field Team Leader (UXOFTL)

The UXO Field Team Leader (UXOFTL) has the responsibility and authority to enforce the site health and safety rules while escorting teams across the site and providing anomaly avoidance support. Ultimately, the UXOFTL is also responsible for implementing all health/safety and inspection/disposal requirements outlined in Sections 5.0, 6.0, and 7.0 of this SOP, as conducted real-time in the field with required support from the SUXOS or UXOSO/UXOQCS, as needed, on a daily basis.

4.3 Off-Site UXO Program Management

The Off-Site UXO Program Management consists of the following three (3) key personnel:

1. MEC Manager,
2. Health and Safety Manager (HSM), and
3. Quality Assurance Manager (QAM).

Since the UXO Managers are at the programmatic level, company-wide, there are no project size restrictions whereby they would have no involvement or required duties, unless the site has no known sources of MEC contamination at which time the MEC Manager can be removed. The ultimate purpose of each manager is to ensure adequate documentation is gathered from the field to readily summarize the results in the Final Report to be submitted post Field Investigation (FI).

4.3.1 Munitions and Explosives of Concern Manager (MECM)

The Munitions and Explosives of Concern Manager (MECM) will coordinate with the PM to ensure adequate staffing, equipment, and supplies are provided to the site at the start of the project, at key junctures, during project surges, and/or on a regimented basis in order to safely complete the project in a timely cost-efficient manner with adequate quality. The MEC Manager is also responsible for addressing MEC related issues, such as accurately and thoroughly documenting MEC finds, effectively reporting MEC finds to the Explosives Ordnance Disposal

Mobile Unit (EODMU), and timely decision-making regarding how to handle unpredictable project events, by working with on-site management, other off-site management, and the PM as deemed necessary. Lastly, the MECM is responsible for inspecting the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on requirements detailed in the HASP, UFP-SAP, and the current SOP.

4.3.2 Health and Safety Manager (HSM)

The Health and Safety Manager (HSM) will be responsible for ensuring that the safety and health hazards and control techniques associated with or referenced in this SOP are discussed during the initial site hazard training and the daily tailgate safety briefings. The HSM is also responsible for audits of site operations summary reports from the SUXOS and UXOSO / UXOQCS are adequate with continued compliance with the approved Task Hazard Analyses (THAs), HASP, UFP-SAP, and the current SOP.

The HSM also delegates to the UXOSO to: conduct of daily safety briefings, controls visitor access and entry to the project site; coordination with local emergency response agencies; compliance with Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), and U.S. Army Corps of Engineers (USACE) Safety or U.S. Navy Ordnance Safety and Security Activity (NOSSA) protocols; check compliance with specific state and local ordinances as required; and inspect emergency equipment and maintaining the site emergency vehicle and supplies. Although the tasks are delegated from the UXOSO and other site personnel, ultimately, the HSM is responsible for the adequate documentation and ultimate compliance for the health-safety aspects of the entire project.

✓

4.3.2 Quality Assurance Manager (QAM)

The Quality Assurance Manager (QAM) will be responsible for ensuring that the Quality Control (QC) techniques are implemented and Quality Assurance (QA) inspections are conducted, as associated with techniques introduced in this SOP or inspection frequency versus quality metric requirements detailed in the UFP-SAP. Lastly, the QAM is not only responsible for inspecting quality but also the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on metric requirements detailed in the UFP-SAP and the current SOP.

4.4 Dual-Hatting or Multi-Hatting of Personnel Roles and Responsibilities

The dual-hatting and multi-hatting of UXO Management will only remain viable as long as intrusive operations are not being conducted or the staffing requirements remain relatively small and manageable even with intrusive investigation activities, which is clearly the case for the current project. Other projects which require a limited intrusive investigation of a large area or full intrusive investigation of smaller areas (and thus a limited maximum of UXO field staff or UXO management requirements), may also dual-hat the UXOSO/UXOQCS but may not be able multi-hat the UXO Tech II / UXOFTL / UXO Tech escort duties depending on staffing needs.

5.0 MEC PROCEDURES

5.1 General Site Practices

All personnel, including contractor and subcontractor personnel, involved in MEC operations shall be familiar with the potential safety and health hazards associated with the conduct of this operation, and with the work practices and control techniques to be used to reduce or eliminate these hazards. The site safety practices detailed in the HASP and THA's will be observed.

All MEC-related operational activities at the site will be under the direction of and performed by UXO-qualified personnel as defined by the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). Non-essential personnel will be prohibited from entering within the minimum separation distance (MSD) of subsurface intrusive investigation activities at MMRP sites, and must remain outside of the exclusion zone (EZ) defined by the MSD unless escorted by a UXO Technician and authorization to access or transit the EZ has been approved by the SUXOS. The EZ rules do not apply to portions of the site that are not characterized to be within a MEC contaminated area. For the current project, since no intrusive investigation activities are planned to be conducted with non-essential personnel within the both the MSD arcs and the well-defined MEC contaminated portion of the site, the EZ rules are for informational purposes or, in-lieu of, tasked project changes at this time.

5.1.1 Anticipated Site Work Hours

Operations will be conducted during daylight hours only and no single workday will exceed 10 hours in the field. The only exception to the rule is that pre work day meetings and setup can occur after hours, but only at pre-designated areas. The currently anticipated work schedule consists of five ten hour (5-10's) days, of which the workday consists of at least forty (40) hours in the field with at least forty-eight (48) hours separating each workweek. Industry standards for UXO operations normally limit personnel to a 40-hour work week, either four 10-hour days or five 8-hour days, however, the rules do not apply until intrusive operations are being conducted.

5.1.2 Site Access Controls

Site access controls are currently maintained not only by base pass entrance requirements at the main gate entrance for the post but also by a locked-entrance to perimeter fencing which surrounds the work area where potential MEC/MPPEH is identified and this pre-established measure will clearly limit access to only those personnel essential to accomplish the specific operation(s) or who have a specific purpose and authorization to be in the work zone. No hazardous operations, such as intrusive operations and demolition operations which currently have no scheduled time-line, will be conducted when non-essential personal are in the vicinity.

5.1.3 Inspection & Disposal of MPPEH

Inspection and disposal of MPPEH will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 02 Inspection and Disposal of MPPEH reference documents, the SUXOS or UXOQC / UXOSO must first clearly identify whether the MPPEH item is determined to be Material Documented as

Safe (MDAS) or Material Documented as Explosive Hazard (MDEH) and whether the item has the best-fit nomenclature as Small Arms Ammunition (SAA), Munitions Debris (MD), Cultural Debris (CD), Munitions and Explosives of Concern (MEC), or Munitions Constituent (MC). At this time, on-site UXO technicians may move the item if and only if they are 100% certain, with SUXOS and UXOQCS / UXOSO approval, it is SAA. MD, CD, etc., and clearly determined to be MDAS. If determined to be MDEH, the UXOFTL must coordinate with the SUXOS and UXOQCS / UXOSO to document the item details (e.g. nomenclature, location, etc.) at which time the SUXOS will contact the base Explosives Safety Officer (ESO) and the assigned EODMU named in the approved site-specific ESS-DR or full ESS documents.

5.1.4 MEC Demolition and Disposal Operations

MEC Demolition and Disposal Operations will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 03 MEC Demolition and Disposal Operations reference documents, the SUXOS or UXOQC / UXOSO will have demolition and disposal operations managed by the base ESO and completed by the EODMU, both of which should have already been contacted once the MEC item has been verified at MDEH either through 100% concurrence positive identification or uncertainty whether the item can be 100% considered MDAS. As such, no explosives will be stored, maintained, or accounted for on-site at this time. Additionally, no 24-hour guarding is required due to the extent of the site access controls. Lastly, demolition and disposal operations can be completed by non-EODMU personnel if and only if AECOM is authorized to increase our breadth of scope based on unavailability of EODMU personnel, however, this is not expected.

5.1.5 Safety Training or Briefing Sessions

Three (3) distinct sets of safety training or briefing sessions will be routinely conducted: **1)** UXOSO/UXOQCS-lead site-specific training related to familiarity, safety, quality, and project production requirements; **2)** SUXOS-lead work summary pertaining to production, location, and safety topics; and **3)** UXOFTL-lead daily tailgate safety briefing conducted with each field team.

The UXOSO/UXOQCS-lead general briefings for all personnel at the site prior to beginning work. A written record of this training and the signatures of personnel attending the training will be maintained. The briefing will cover general hazards of the project and any new safety issues or hazards identified since the last briefing. The UXOSO/SUXOS will also conduct safety briefings on specific hazards anticipated at each work site during that day's operations and the safety measures to eliminate or mitigate those hazards. The brief will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and team locations change within the site, the briefings will also reflect any corresponding changes in ingress/egress routes and emergency evacuation routes. Site visitors must receive a safety briefing and sign the visitor's log prior to entering the operating area with a UXO Tech escort regardless of their qualifications. Field activities involving MEC and MPPEH identification and disposal operations will be halted while visitors are within the work zone.

All of these safety training or briefing sessions require employee sign-off, either through pre-prepared sign-in sheets during office reviews or logbook entry sign-offs out in the field discussions. Lastly, the UXOSO and/or SUXOS may hold a safety stand-down at any time they note any degradation of safety or note a safety issue that warrants review.

5.1.6 PPE or Work Attire

Work clothing will be appropriate for the conditions encountered. It is anticipated that this will be Level D PPE. Basic components for EPA level D are outline in the HASP. UXO or GEO personnel will not wear boots with metal components that would interfere with the operation of the geophysical instruments. Hard hats will not be worn unless an overhead hazard exists. If that is the case, the hard hats will be fitted with a chin strap to hold the hard hat in place and not be permitted to fall off and strike MEC or MPPEH

5.2 Compliance with Plans and Procedures

All site-wide field operations or visitations will be conducted in a systematic manner under the direction, supervision and observation of UXO-supervisory personnel (e.g. UXOQCS/UXOSO, SUXOS, UXOFTL, etc.). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted. Any new course of action or desired change in procedures will be submitted to the PM with justification for approval, as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality to meet the task reporting requirements.

6.0 DOCUMENTATION AND MARKING OF SUSPECT ITEM

Where applicable, Global Positioning System (GPS) units will be used to record the x, y locations (or lat, long locations post-processed into x, y locations) of MEC items of interest, after the item has been properly identified as ordnance-related by nomenclature (e.g., 20mm, 75mm, etc.), marked for future reference (e.g., flags, cones, etc), characterized by explosive hazard category (e.g., UXO, CWM, MDAS, MDEH, etc.), documented in the logbook, photographed with ruler and ID in the background, and reported to the SUXO via radio communications. Where not applicable, relative positions may be recorded based on “paced off” proximity to transect way-points, grid-corners, surface features, etc., or potentially return to the flagged location after additional vegetation, trees, or other sky-view hindrances are removed to allow adequate positioning. As with the other testing, the GPS units must be tested twice-daily and compared to day 1 results from the same location with the required accuracy to be within either the limits specified in the UFP-SAP for the type of positioning system used or within the manufacturers specifications. Lastly, if documentation of items is hindering escort duties and subcontractor production, the UXOFTL may rely on the SUXOS and UXOQCS for support.

7.0 GENERAL OPERATIONAL AND SAFETY PROCEDURES

All UXO certified personnel, primarily AECOM but also including contractor and subcontractor personnel involved in processing MPPEH removed from project sites, will familiarize themselves with the procedures outlined in this chapter in case disposal operations are required.

7.1 General Terminology & Inspection Procedures

AECOM has implemented procedures detailed in Section 7.2 that ensure unknown explosive hazards are not present when transferring Material Potentially Presenting and Explosive Hazard (MPPEH), Material Documented as an Explosive Hazard (MDEH), or Material Documented as Safe (MDAS) when AECOM possesses, manages, processes, or provides disposition of MPPEH or MDEH to a qualified receiver or releasing MDAS to the public. The following are additional terms and procedures to consider:

MPPEH- Material owned or controlled by the Department of Defense that, prior to determination of its explosives safety status, potentially contains explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (e.g., equipment, drainage systems, tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations).

MDAS - MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

MDEH- MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH. (The MDEH characterization only addresses the explosives safety status of the material.)

The management process in Section 7.2 includes procedures to ensure MDEH is handled in such a manner as to prevent it from being commingled with MPPEH or MDAS and managing MDAS to prevent it from being commingled with MPPEH or MDEH. AECOM will use a closed-circuit process managed by SUXOS that maintains a chain of custody from collection through release from control as MDAS. The explosives safety status of material to be transferred within or released from AECOM control be assessed and documented as either safe or as having known or suspected explosive hazards based on one of the following two conditions:

1. After a 100-percent inspection and an independent 100-percent re-inspection by two UXO personnel; and

2. MPPEH and MDEH are transferred or released only to those individuals that have the licenses and permits required to receive, manage, and process hazardous materials and have technical expertise and trained personnel relating to handling of used and unused military munitions and potential explosive hazards associated with the MPPEH or MDEH being received.
   ✓

AECOM personnel who inspect, process, or document material as safe or hazardous will be trained in recognition and safe handling of used and unused military munitions and specific types of MPPEH and procedures that apply to MPPEH, MDEH, and MDAS that is to be released and meet the qualification requirements of Technical Paper (TP) 18 and demonstrate training and experience in the recognition and safe handling of used and unused military munitions and other MPPEH and processing of this material.

UXOFTL personnel will only quickly inspect and mark suspected items but will not (have the time to) be allowed to perform any detailed assessment of a suspect item to determine its status. Thus, a UXOFTL can tentatively identify a located item as MPPEH, followed by a required confirmation UXO management, such as the SUXOS, UXOSO/UXOQCS, and/or MECM.

7.2 MPPEH Inspection Process

Only the SUXOS and UXOQC/UXOSO will confer, after independently inspecting and determining the item nomenclature with hazards, to verify that MDAS is free of explosive hazards using the MPPEH inspection process as outlined below in the following five steps.

1. perform visual and/or physical inspection of each item as it is recovered
   a. Can the item be 100% confirmed to be MDAS?
   b. Is the item likely a MEC, MDEH or component of military munitions?
   c. Does the item contain explosives or other dangerous materials?
   d. Does the item require detonation?
   e. Does the item require demil or venting to expose internal fillers and/or cavities?
2. Segregate items requiring demil/venting procedures from those determined to be MDAS;
3. Document the material as either MDEH or MDAS;
4. Ensure the chain of custody remains intact through release from AECOM control; and
5. Ensure that MPPEH awaiting documentation of its explosives safety status, MDEH and MDAS are not commingled

This process will ensure that all MPPEH is properly processed and that MDAS that is released for disposal or recycling is free of explosive hazards. Items found to contain dangerous fillers will be set aside for additional processing such as demolition. The SUXOS will designate a MEC scrap recovery team that will respond to the scrap metal consolidation areas to remove the debris from the site. Prior to moving MPPEH, the team will inspect all the items to ensure they are safe to transport prior to placing them in the vehicle for movement to the processing area.

All MPPEH to be disposed of will first be visually inspected to ensure removal of live rounds, primers, and/or explosive materials. Items that cannot be 100 percent visually inspected will be physically inspected (i.e., using depth gauges, mirrors, or other inspection devices) or vented. All munitions fragments, such as those found dispersed within the proximity of demolition or impact ranges and/or found in burial pits will be inspected for the presence of energetic contaminants. Inert fillers will be at a minimum, exposed and preferably removed from MDAS items.

MDAS category requires two independent signatures by trained and certified personnel. The first signatory must be technically qualified and will be an AECOM UXOFTL or SUXOS with the second signature reserved for the UXOSO/UXOQCS or MECM. This signatory must have performed or witnessed the initial 100-percent inspection and processing of the material. Ultimately, the second signatory can be designated to another UXOFTL only if they are a technically qualified AECOM UXO Technician III employee. Regardless of insepector designation or delegation, the senior signatory must have performed or witnessed the independent 100-percent re-inspection or conducted an independent quality assurance inspection of processed material using an approved sampling method.

7.3 Chain of Custody

The process requires that a chain of custody be initiated for the material being inspected and classified. The document will require that both UXO personnel witnessing or performing the inspection sign the document attesting to the explosive status of the material present as being MDAS or MDEH. Each signatory must ensure the chain of custody was maintained before signing the explosives safety documentation.

The containers/hoppers and individual pieces of MPPEH must be under the control and custody of AECOM from the time each is inspected until turned over to the smelter or recycler for final disposition. This chain of custody identifies the quantity, composition, and the origin, routing, and destination of each container/hopper or item during its handling and transportation life cycle, and provides evidence that all containers/lots were properly segregated and secured at all times until final disposition. At random times during the scrap process, photographs of a representative sample of will be taken by AECOM personnel, to verify that this SOP is being followed.

AECOM ensures that chain of custody is maintained until MDEH or MDAS is released from control. A legible copy of the documentation of the determination of the material's explosives safety status shall accompany the material when it is transferred out of AECOM control. The documentation shall be maintained for a period of at least 3 years thereafter or any longer period required by regulations. MDEH and MDAS are no longer considered to be MPPEH as long as the chain of custody remains intact. If the chain of custody is broken, all affected material must undergo the processes be and be re-documented according to the results to re-establish its explosives safety status by completing the following two steps:

1. A second 100-percent inspection and independent 100-percent re-inspection; and
2. Reprocessing by approved means with appropriate post-processing re-inspection.

✓

Ensure that any material transferred within or released from AECOM control that presented an unintentional explosive hazard to either a qualified receiver or the public is investigated and reported. Documentation of the determination of the material's explosives safety status must state either that the material does not present an explosive hazard and is consequently safe from an explosives safety perspective for transfer within or release from AECOM control, or that it is hazardous with the known or suspected explosive hazards stated and is only transferable or releasable to a qualified receiver. AECOM will ensure that only MDAS is released to the public

The MDAS will only be released to an organization that will complete the following two items:

1. First, upon receiving the unopened labeled containers each with unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agree with the provided documentation that the sealed containers contained no explosive hazards when received. (This shall be signed on company letterhead stating that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by basic content); and
2. Second, send notification and supporting documentation to ET that the contents of the sealed containers have been smelted and are now only identifiable by their basic content.

This document will be incorporated into the final report as documentation for supporting the final disposition of this scrap metal.

7.4 Inspection and Storage Locations

The SUXOS, UXOQCS/UXOSO, and MECM are responsible for meeting proper inspection and storage location requirements, inclusive of documentation. The UXO management must determine if MPPEH or MDEH processing points used for processing operations (e.g., consolidation, inspection, sorting, storage, transfer, release of materials) require explosives safety siting approval, unless already completed by another entity or vendor. As much as possible, the intent is to minimize the quantity and time MPPEH is accumulated and retained at any location. Additionally, under some circumstances the accumulation of MPPEH, including "speculative accumulation," or its movement from either an operational range or the site of use, could require its management as waste military munitions under applicable Federal or State requirements. Lastly, the SUXOS is responsible for ensuring that containers and holding areas for material being processed are secured and clearly marked as to the apparent hazards.

7.5 Explosives Risk Evaluations

Explosives risk evaluations are required before allowing the DoD Components to be finalized to send for non-DoD entities or individuals to receive, manage, or process MPPEH or MDEH. Ultimately, the explosives risk evaluation process will evaluate the adequacy of the receiver's management controls (e.g., training, oversight, record keeping) and operational controls (e.g., processing methods, equipment, storage facilities) in order adequately document the processes required in a safe and efficient manner. Lastly, AECOM must complete the documented evaluation indicates to ensure that the receiver of MPPEH or MDEH meets the requirements prior to the transfer within or release from AECOM control of such material.

7.6 Marking and Packaging

Cartridge and flare cases, fuzes, primers, boosters, practice ordnance, and small pieces/fragments from all types of high explosive ordnance and other similar items DO NOT require individual marking. These items will be inspected, placed in containers, then secured with steel band(s) or tagged with an appropriate seal or similar device having a serial number. When large amounts of residue are generated, steel hoppers may be used, provided the hopper has a lid/cover that can be secured and sealed after inspection. **Any evidence of tampering after sealing will require re-inspection and re-certification**. Containers/hoppers will be marked as in paragraph 5.7. Where quantities permit, the contents will be separated by base metal type (i.e., copper, aluminum, steel, etc.) and tagged or marked to identify contents. Large MDAS that cannot be containerized or palletized will be individually inspected and marked similarly. Each will be tagged with a "railroad seal" or similar device having a serial number. When large items are further demilitarized, by, disassembly, breaking, crushing, shredding, or cutting, additional stamping or marking of individual pieces is not required.

7.7 Shipment of MDEH and MDAS

AECOM will ensure that shipments of MDEH and MDAS over public transportation routes comply with USACE and/or NAVY guidance that implements hazardous material transportation regulations, to the extent applicable. For MPPEH transferred within or released from AECOM control, ensure that the determination of whether material is hazardous waste or hazardous material, and its subsequent management, complies with all applicable Federal or State requirements. The container shall be closed and clearly labeled with the following information:

1. The first container will be labeled with a unique identification that shall start with **USACE (if appropriate)/Installation Name/AECOM./0001/Seal's unique identification number (ID#)** and continue sequentially;
2. The container shall be sealed, in such a manner that the seal must be broken in order to open the container. The seal shall bear the same unique ID# as the container or the container shall be clearly marked with the seal's ID#, if different than the container;

3. An Inspection, Certification, and Chain of Custody Form will be provided to the customer and scrap processing company.

Additionally, the following information for each container will be provided: weight of container; location where MDAS was obtained; name of contractor, names of certifying individuals; unique container identification; and seal identification, if required. This documentation will be included in the final report. DD form 1348-1A will be required for documentation. All DD 1348-1A forms must clearly show the typed or printed names of the AECOM SUXOS, AECOM UXOSO/UXOQCS, and the nearest Naval Base ESO, with organization, signature, and AECOM's home office and field office phone number(s) of the persons certifying the MDAS.

Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplement to these procedures. In addition to the data elements required and any local agreed to directives, the DD 1348-1A must clearly indicate the following five specific details for scrap metal recycling:

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

The following certification/verification will be entered on each DD 1348-1A for turn-over of MD or RRD and will be signed by the SUXOS. This statement will be used on any ranges where RRD is being processed along with munitions debris:

"This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards. engine fluids, illuminating dials and other visible liquid HTRW materials".

The following certification/verification will be entered on each 1348-1A for turn-over of MD and will be signed by the SUXOS on properties where only MD is being processed:

"This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."

7.8 Demilitarization Requirements

Demilitarization requirements developed shall address: **(1)** recently identified military munitions and associated material; **(2)** containerizing / packaging materials for recently identified military munitions; and **(3)** equipment used to manufacture, produce, maintain, renovate, demilitarize, or dispose of recently identified military munitions.

7.9 Classification MEC Related Requirements

To ensure accurate classification of munitions-related items (with respect to their explosive hazard), as the information is used to make decisions about the response action, the AECOM UXO Team will inspect suspect MPPEH/MEC and classify these items in accordance with **Table 1**. The list is not all inclusive, but reflects the types of munitions-related material that may be encountered and the footnotes are relevant for different scenarios likely to be observed.

8.0 AUDIT CRITERIA

The following procedures will be audited to ensure compliance with this SOP and the UFP-SAP:

- ✓ UXOFTL daily logbook entries for tailgate briefs, equipment tests, & MEC hazards;
- ✓ SUXOS & UXOQCS/UXOSO logbook entries documenting results of field procedure inspections, MEC hazard identifications, EODMU communications, and seed detections;
- ✓ SUXOS & UXOQCS/UXOSO "sign-in" sheet documentation of morning meetings;
- ✓ Form, DD Form 1348-1A completed for all scrap metal to be transferred; and
- ✓ UXOQCS/UXOSO documentation of "near-misses" or "failures" related to quality or safety hazards, inclusive of recommended solutions and time-line for CAR summary.

Table 1: Classification of MEC Related Items						
Type of Material	**Classification Following Inspection:**					
	Presents Explosive Hazards			**Does Not Present Explosive Hazards**		
	MEC			**MC (3)**	**MDAS**	**Other**
	UXO	**DMM (1)**	**MC (2)**			
Used military munitions, on a range, fired	X				X	
Unused military munitions, on a range, apparently discarded		X			X	
Used military munitions, in a burial pit, on a former range	X(4)				X	
Unused military munitions, in a burial pit on a former range		X(4)			X	
Explosives in the soil			X(5)	X		
Target from a range (other than small arms range)	X(6)	X(6)	X(6)			X(7)
Munitions Remnants from a former range	X(8)	X(8)	X(8)		X(9)	

Footnotes:

(1) Discarded Military Munitions (DMM): Munitions generally considered as DMM include: buried munitions; un-recovered kick outs from open detonations; munitions left behind or discarded accidentally during munitions-related activities; munitions intentionally disposed of without authorization during munitions-related activities. Munitions removed from storage for the purpose of disposal that are awaiting disposal are not DMM.

(2) Munitions Constituents (MC): This is MC that is both (a) an explosive; and (b) present in sufficient concentrations to present explosive hazards.

(3) This is MC that is either (a) not an explosive (e.g., lead, beryllium, and cadmium); or (b) an explosive not present in sufficient concentrations to present explosive hazards.

(4) Although military munitions in a burial pit will normally be DMM, some may be UXO. For explosives safety reasons, munitions in a burial pit should be approached as UXO until assessed by technically qualified personnel (e.g., Explosive Ordnance Disposal (EOD) personnel, UXO-qualified personnel) and determined that they are not UXO or that they do not present explosive hazards similar to UXO.

(5) Explosive soil is typically found in sumps and settling lagoons for explosives-laden wastewater, and in and around drainage ditches and pipes that carry the wastewater to such sumps and lagoons.

(6) A target is a type of range-related debris. Although a target is not MEC, it may contain UXO, DMM, or MC. Prior to its release from DoD control, its explosives safety status must be documented.

(7) A target's explosives safety status must be documented and any demilitarization required to remove its military characteristics must be performed prior to its release from DoD control.

(8) UXO, DMM, or MC may be found on operational ranges and on former ranges (previously referred to as closed, transferring or transferred ranges). An inspection of the material will determine into which category this material falls. For example, if a projectile breaks apart on impact, one could find (a) a sheared-off fuze, which would be UXO or (b) explosive filler, which would be MC that broke away from the projectile's open body. If during an open detonation of an unserviceable munitions that is conducted on an operational range, the donor charge detonates, but the munitions being destroyed breaks up, but does not detonate, the remnants of the munitions would be DMM or, if explosive residue (e.g., clumps of Trinitrotoluene [TNT]), MC.

(9) Fragments, while munitions debris, may be evidence of high explosive (HE) usage at the site. For such fragments, the team will indicate evidence of HE in its classification. After determination of its explosives safety status, scrap metal from used munitions on a range that is documented as safe would, after any demilitarization required removing its military characteristics, be available for release from DoD control. In additions to these DoD requirements, other regulatory criteria may apply.

MRP SOP 03:
MEC Demolition & Disposal Operations

STANDARD OPERATING PROCEDURES (SOP) for DEMOLITION and DISPOSAL OPERATIONS

Prepared by:
AECOM Technical Services (ATS)

Prepared for:
UXO & Other Personnel
Conducting Field Work at
MMRP sites with MEC Hazards

Version Number:
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1.0 PURPOSE

The purpose of this Munitions Response Program (MRP) Standard Operating Procedure (SOP), MRP SOP 03 – Demolition and Disposal Operations, is to provide guidance regarding the reference materials, personnel responsibilities, and methodologies to be implemented in conjunction with adequate health and safety protocol requirements applicable to the proper conduct of demolition and disposal of Material Documented as Explosives Hazard (MDEH) after an item has been discovered under other processes (e.g., anomaly avoidance, surface sweeps/clearances, intrusive investigations, inspections, etc.). All demolition and disposal procedures will be completed by the Explosives Ordnance Disposal Mobile Unit (EODMU) once a suspect item is found. Thus, a large portion of the current SOP only applies in the rare case that an EODMU is not available and AECOM is pre-authorized to conduct the demo ops.

2.0 SCOPE

This SOP applies to all UXO Tech personnel, including management and field leadership, involved in MEC Investigations at Military Munitions Response Program (MMRP) sites. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Consult the documents listed in Section 3.0 of this SOP for a listing of additional compliance documents for reference. The SOP is intended for use by UXO Technicians'.

3.0 REFERENCE DOCUMENTS

Applicable sections in the documents listed below will be used as references for the requirements associated with managing MPPEH encountered at and collected from MEC sites:

- AECOM Corporate Safety and Health Program, OSHA 29 CFR 1910;
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards;
- DoD 4160.21-M, Defense Reutilization and Marketing Manual;
- AR 385-64, U.S. Army Explosives Safety Program, AR 385-10, Army Safety Program;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- TM 9-1300-200, Ammunition General, TM 9-1300-214, Military Explosives;
- TM 60A-1-1-31, EOD Disposal Procedures;
- AR 190-11, Physical Security of Arms, Ammunition and Explosives;
- ATF 5400.7, Alcohol Tobacco and Firearms Explosives Laws and Regulations;
- NOSSAINST 8020.15C, Navy Explosives Safety Program; and
- UFP-SAP, HASP, ESS-DR, & ESS documents approved for field work at this site.

The documents listed above are the primary references for basic guidance at MEC sites regarding: education, experience, training, and certification requirements for personnel; field techniques to be implemented during the demolition and disposal process; and documentation, communication, and storage/transport directives during the disposal process.

4.0 PERSONNEL ROLES, RESPONSIBILITIES, AND REQUIREMENTS

The personnel roles and responsibilities in conjunction with associated deliverable requirements are introduced in the following sets of paragraphs with further details regarding site-specific and project-specific roles and responsibilities listed in **Worksheet #7** of the current UFP-SAP.

4.1 Project Manager (PM)

The Project Manager (PM) is responsible for ensuring the availability of the personnel and equipment resources needed to implement this SOP, inclusive of all materials and supplies required to complete each task safely. The PM will also ensure that this SOP is incorporated in plans, procedures and training for sites where MPPEH or MEC has the potential of being encountered. Lastly, although the PM shall delegate all daily site leadership, inclusive of site-specific training aspects, quality inspections, and safety audits, to the UXO operations management team on-site and program management offsite, the PM is ultimately responsible to ensure each aspect has been completed and signed off as such prior to commencing the next stage of field work or reporting requirements.

4.2 On-Site UXO Operations Management

The On-Site UXO Operations Management consists of the following four (4) key personnel:

1. Senior UXO Supervisor (SUXOS),
2. UXO Safety Officer (UXOSO),
3. UXO Quality Control Specialist (UXOQCS), and
4. UXO Field Team Leader (UXOFTL).

For smaller projects or field efforts either without intrusive investigation (and thus minimal UXO field staff or UXO management requirements) activities at the current phase of the project, the operations management staffing plans can be reduced to only require a SUXOS, a dual-hatted UXOSO / UXOQCS, and a multi-hatted UXO Tech II / UXOFTL / UXO Tech.

4.2.1 Senior UXO Supervisor (SUXOS)

The Senior UXO Supervisor (SUXOS) will ensure that this SOP is implemented for operations that involve will be responsible for assuring that adequate safety measures and housekeeping are taken during all phases of site operation, to include demolition with subsequent disposal and documentation activities, and support the completion of the required tasks though direct actions or indirect action through proper delegation techniques, at each location as deemed necessary to ensure that both the demolition and disposal operations are carried out in a safe, clean, efficient and economical manner. The SUXOS will ensure that relevant sections of this SOP are discussed in the daily safety briefings and that information related to its daily implementation is properly recorded in appropriate site documentation (i.e. logbook entries, field forms, etc.). Ultimately, the SUXOS is responsible for the following regarding the demolition and disposal of ordnance related hazardous material (in the form of previously identified and confirmed MDEH):

- ✓ Planning and preparing for demolition operations;
- ✓ Inspecting and supervising all delegated tasks related to the demolition operation;
- ✓ Providing a pre-demolition briefing as outlined in Section 8.1 of this SOP;
- ✓ Ensuring that Daily Operational Log, the Ordnance Accountability Log, the AECOM Demolition Shot Record, and the explosives inventory record are properly completed; and
- ✓ Certifying that the logs and records accurately reflect the demolition events conducted and the demolition materials used during that day's operations.

The planning, supervising, and conduct may be delegated to a Demolition Supervisor (DS), however, the SUXOS still must support inspecting and documenting the demo days' events.

4.2.2 UXO Safety Officer (UXOSO)

The UXO Safety Officer (UXOSO) will be responsible for all health and safety duties detailed in the currently approved Uniform Federal Policy – Sampling and Analysis Plan (UFP-SAP), Health & Safety Plan (HASP), Explosives Safety Submission – Determination Request (ESS-DR), and potentially (if required) a full Explosives Safety Submission (ESS) set of documents. THE UXOSO is also responsible for ensuring inspection and (potential) removal of MPPEH is done with due care and attention to the hazards involved in the operation, in addition to the operational items listed below:

- ✓ Maintains a daily logbook of MEC safety related matters encountered on site;
- ✓ Issues and/or approves "Stop Work" orders for safety and health reasons;
- ✓ Conducts site specific MEC-related health and safety training;
- ✓ Identifies and evaluates any known or potential safety problems that may interfere with or interrupt site MEC operations or endanger site personnel;
- ✓ Ensures proper Personal Protective Equipment (PPE) will be worn (e.g., shoes, gloves, eye protection with side shields), including a hard hat only with overhanging hazards, will be worn whenever working with MPPEH;
- ✓ Confers with SUXOS, UXOQCS, and UXOFTL to confirm proper identification of MPPEH and contacts appropriate ESO and EODMU if deemed hazardous;
- ✓ Consults with the PM and SUXOS on identifying and implementing any necessary MEC safety-related corrective actions; and
- ✓ Coordinates with the HSM for the implementation of the HASP requirements;

4.2.3 UXO QC Specialist (UXOQCS)

The UXO Quality Control Specialist (UXOQCS) has the responsibility and authority to enforce the site MEC-specific requirements detailed in the UFP-SAP. (As stated previously, the UXOSO may perform the duties of the UXOQCS if personnel are limited, and as such, would have all the responsibility requirements of the UXOSO as well as their current role as the UXOQCS) This individual reports to directly to both the MEC Manager and the Quality Assurance Manager (QAM) and coordinates site activities with the PM and SUXOS on site. The UXOQC responsibilities include:

- ✓ Maintains a daily logbook of MEC QC monitoring activities, non-conformances issues, and corrective measures required to be implemented;
- ✓ Conducts periodic QC surveillances of site MEC activities and recording the findings in the Daily Activities Report;
- ✓ Confers with SUXOS, UXOSO, and UXOFTL to confirm MPPEH hazard class;
- ✓ Reports noncompliance with MEC QC criteria to the QAM, PM and SUXOS and documents the deviations on a Non-Conformance-Report (NCR);
- ✓ Initiates a Rework Items List from the NCR that must meet quality specifications;
- ✓ Conducts a root cause analysis when a QC failure occurs;
- ✓ Coordinates with the responsible parties to initiate the QC failure remedies and documents these actions on the Corrective Action Report (CAR); and
- ✓ Ensures that the CAR recommendations are followed in order the close-out the QC failure and ensures that all lessons learned are documented and forwarded to the QAM for analysis.

Working in conjunction with the SUXOS and/or DS, the UXOQCS is also responsible for ensuring the completeness of demolition operations and for weekly inspecting the Ordnance Accountability Log, the Daily Operational Log, the AECOM Demolition Shot Record and the inventory of MEC and demolition material. Lastly, the UXOQCS, assisted by demolition team personnel, will inspect each demolition pit and an area of up to 250 feet in radius after each demolition shot to ensure there are no kick outs, hazardous MEC components or other hazardous items. In addition, UXOQCs will ensure the pit will be checked with a magnetometer for residual MPPEH. Large metal fragments, and any hazardous debris will be removed after each use if the same site will be used for additional consolidated shots. Any fuzed MEC discovered during the QC check will be properly disposed of in place following the demolition procedures. Extreme caution must be exercised when handling unfuzed MEC that has been exposed to the forces of detonation.

4.2.4 UXO Field Team Leader (UXOFTL)

The UXO Field Team Leader (UXOFTL) has the responsibility and authority to enforce the site health and safety rules while escorting teams across the site and providing anomaly avoidance support. Ultimately, the UXOFTL is also responsible for implementing all health/safety and inspection/disposal requirements outlined in Sections 5.0, 6.0, and 7.0 of this SOP, as conducted real-time in the field with required support from the SUXOS or UXOSO/UXOQCS, as needed, on a daily basis.

4.3 Off-Site UXO Program Management

The Off-Site UXO Program Management consists of the following three (3) key personnel:

1. MEC Manager,
2. Health and Safety Manager (HSM), and
3. Quality Assurance Manager (QAM).

Since the UXO Managers are at the programmatic level, company-wide, there are no project size restrictions whereby they would have no involvement or required duties, unless the site has no known sources of MEC contamination at which time the MEC Manager can be removed. The ultimate purpose of each manager is to ensure adequate documentation is gathered from the field to readily summarize the results in the Final Report to be submitted post Field Investigation (FI).

4.3.1 Munitions and Explosives of Concern Manager (MECM)

The Munitions and Explosives of Concern Manager (MECM) will coordinate with the PM to ensure adequate staffing, equipment, and supplies are provided to the site at the start of the project, at key junctures, during project surges, and/or on a regimented basis in order to safely complete the project in a timely cost-efficient manner with adequate quality. The MEC Manager is also responsible for addressing MEC related issues, such as accurately and thoroughly documenting MEC finds, effectively reporting MEC finds to the Explosives Ordnance Disposal Mobile Unit (EODMU), and timely decision-making regarding how to handle unpredictable project events, by working with on-site management, other off-site management, and the PM as deemed necessary. Lastly, the MECM is responsible for inspecting the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on requirements detailed in the HASP, UFP-SAP, and the current SOP.

4.3.2 Health and Safety Manager (HSM)

The Health and Safety Manager (HSM) will be responsible for ensuring that the safety and health hazards and control techniques associated with or referenced in this SOP are discussed during the initial site hazard training and the daily tailgate safety briefings. The HSM is also responsible for audits of site operations summary reports from the SUXOS and UXOSO / UXOQCS are adequate with continued compliance with the approved Task Hazard Analyses (THAs), HASP, UFP-SAP, and the current SOP.

The HSM also delegates to the UXOSO to: conduct of daily safety briefings, controls visitor access and entry to the project site; coordination with local emergency response agencies; compliance with Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), and U.S. Army Corps of Engineers (USACE) Safety or U.S. Navy Ordnance Safety and Security Activity (NOSSA) protocols; check compliance with specific state and local ordinances as required; and inspect emergency equipment and maintaining the site emergency vehicle and supplies. Although the tasks are delegated from the UXOSO and other site personnel, ultimately, the HSM is responsible for the adequate documentation and ultimate compliance for the health-safety aspects of the entire project.

4.3.2 Quality Assurance Manager (QAM)

The Quality Assurance Manager (QAM) will be responsible for ensuring that the Quality Control (QC) techniques are implemented and Quality Assurance (QA) inspections are conducted, as

associated with techniques introduced in this SOP or inspection frequency versus quality metric requirements detailed in the UFP-SAP. Lastly, the QAM is not only responsible for inspecting quality but also the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on metric requirements detailed in the UFP-SAP and the current SOP.

4.4 Dual-Hatting or Multi-Hatting of Personnel Roles and Responsibilities

The dual-hatting and multi-hatting of UXO Management will only remain viable as long as intrusive operations are not being conducted or the staffing requirements remain relatively small and manageable even with intrusive investigation activities, which is clearly the case for the current project. Other projects which require a limited intrusive investigation of a large area or full intrusive investigation of smaller areas (and thus a limited maximum of UXO field staff or UXO management requirements), may also dual-hat the UXOSO/UXOQCS but may not be able multi-hat the UXO Tech II / UXOFTL / UXO Tech escort duties depending on staffing needs.

5.0 MEC PROCEDURES

5.1 General Site Practices

All personnel, including contractor and subcontractor personnel, involved in MEC operations shall be familiar with the potential safety and health hazards associated with the conduct of this operation, and with the work practices and control techniques to be used to reduce or eliminate these hazards. The site safety practices detailed in the HASP and THA's will be observed.

All MEC-related operational activities at the site will be under the direction of and performed by UXO-qualified personnel as defined by the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). Non-essential personnel will be prohibited from entering within the minimum separation distance (MSD) of subsurface intrusive investigation activities at MMRP sites, and must remain outside of the exclusion zone (EZ) defined by the MSD unless escorted by a UXO Technician and authorization to access or transit the EZ has been approved by the SUXOS. The EZ rules do not apply to portions of the site that are not characterized to be within a MEC contaminated area. For the current project, since no intrusive investigation activities are planned to be conducted with non-essential personnel within the both the MSD arcs and the well-defined MEC contaminated portion of the site, the EZ rules are for informational purposes or, in-lieu of, tasked project changes at this time.

5.1.1 Anticipated Site Work Hours

Operations will be conducted during daylight hours only and no single workday will exceed 10 hours in the field. The only exception to the rule is that pre work day meetings and setup can occur after hours, but only at pre-designated areas. The currently anticipated work schedule consists of five ten hour (5-10's) days, of which the workday consists of at least forty (40) hours in the field with at least forty-eight (48) hours separating each workweek. Industry standards for UXO operations normally limit personnel to a 40-hour work week, either four 10-hour days or five 8-hour days, however, the rules do not apply until intrusive operations are being conducted.

5.1.2 Site Access Controls

Site access controls are currently maintained not only by base pass entrance requirements at the main gate entrance for the post but also by a locked-entrance to perimeter fencing which surrounds the work area where potential MEC/MPPEH is identified and this pre-established measure will clearly limit access to only those personnel essential to accomplish the specific operation(s) or who have a specific purpose and authorization to be in the work zone. No hazardous operations, such as intrusive operations and demolition operations which currently have no scheduled time-line, will be conducted when non-essential personal are in the vicinity.

5.1.3 Inspection & Disposal of MPPEH

Inspection and disposal of MPPEH will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 02 Inspection and Disposal of MPPEH reference documents, the SUXOS or UXOQC / UXOSO must first clearly identify whether the MPPEH item is determined to be Material Documented as Safe (MDAS) or Material Documented as Explosive Hazard (MDEH) and whether the item has the best-fit nomenclature as Small Arms Ammunition (SAA), Munitions Debris (MD), Cultural Debris (CD), Munitions and Explosives of Concern (MEC), or Munitions Constituent (MC). At this time, on-site UXO technicians may move the item if and only if they are 100% certain, with SUXOS and UXOQCS / UXOSO approval, it is SAA. MD, CD, etc., and clearly determined to be MDAS. If determined to be MDEH, the UXOFTL must coordinate with the SUXOS and UXOQCS / UXOSO to document the item details (e.g. nomenclature, location, etc.) at which time the SUXOS will contact the base Explosives Safety Officer (ESO) and the assigned EODMU named in the approved site-specific ESS-DR or full ESS documents.

5.1.4 MEC Demolition and Disposal Operations

MEC Demolition and Disposal Operations will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 03 MEC Demolition and Disposal Operations reference documents, the SUXOS or UXOQC / UXOSO will have demolition and disposal operations managed by the base ESO and completed by the EODMU, both of which should have already been contacted once the MEC item has been verified at MDEH either through 100% concurrence positive identification or uncertainty whether the item can be 100% considered MDAS. As such, no explosives will be stored, maintained, or accounted for on-site at this time. Additionally, no 24-hour guarding is required due to the extent of the site access controls. Lastly, demolition and disposal operations can be completed by non-EODMU personnel if and only if AECOM is authorized to increase our breadth of scope based on unavailability of EODMU personnel, however, this is not expected.

5.1.5 Safety Training or Briefing Sessions

Three (3) distinct sets of safety training or briefing sessions will be routinely conducted: **1)** UXOSO/UXOQCS-lead site-specific training related to familiarity, safety, quality, and project

production requirements; **2)** SUXOS-lead work summary pertaining to production, location, and safety topics; and **3)** UXOFTL-lead daily tailgate safety briefing conducted with each field team.

The UXOSO/UXOQCS-lead general briefings for all personnel at the site prior to beginning work. A written record of this training and the signatures of personnel attending the training will be maintained. The briefing will cover general hazards of the project and any new safety issues or hazards identified since the last briefing. The UXOSO/SUXOS will also conduct safety briefings on specific hazards anticipated at each work site during that day's operations and the safety measures to eliminate or mitigate those hazards. The brief will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and team locations change within the site, the briefings will also reflect any corresponding changes in ingress/egress routes and emergency evacuation routes. Site visitors must receive a safety briefing and sign the visitor's log prior to entering the operating area with a UXO Tech escort regardless of their qualifications. Field activities involving MEC and MPPEH identification and disposal operations will be halted while visitors are within the work zone.

All of these safety training or briefing sessions require employee sign-off, either through pre-prepared sign-in sheets during office reviews or logbook entry sign-offs out in the field discussions. Lastly, the UXOSO and/or SUXOS may hold a safety stand-down at any time they note any degradation of safety or note a safety issue that warrants review.

5.1.6 Demolition Operations Specific Safety Provisions

During demolition operations, the general safety provisions listed below shall be followed by all demolition personnel, at all times. Non-compliance with the general safety provisions listed may result in disciplinary action, to include termination of employment. The safety provisions for demolition operations include:

- ✓ Demolition of any kind is prohibited without the express permission from the Site ESO, if on site. If a safety officer is not assigned, the AECOM SUXOS will grant permission to conduct demolition operations;
- ✓ In the event of an electrical storm immediate action will be taken to cease all demolition range operations and evacuate the area;
- ✓ In the event of a fire or unplanned explosion, if possible, put out the fire, if unable to do so, notify all personnel to evacuate the area. If injuries are involved, remove victims from danger, administer first aid and seek EMT III medical attention;
- ✓ The DS and/or SUXOS are responsible for reporting to the UXOSO all injuries, accidents or near misses that occur during demolition operations;
- ✓ Any defect or unusual condition noted that is not covered by this SOP will be reported immediately to the DS or ESO, and operations will be halted until the condition is addressed and resolved;
- ✓ Adequate fire protection and first aid equipment shall be provided at all times;

- ✓ Consistent with AECOM's operational policies, exposures to demolition hazards shall be limited to the smallest number of personnel, for the shortest time, and to the least hazard;
- ✓ Telephone and/or radio communications will be established and maintained throughout demolition operations; and
- ✓ Prevailing weather condition information will be obtained and the data logged in the Demolition Shot Log before each demolition event.

5.1.7 PPE or Work Attire

Work clothing will be appropriate for the conditions encountered. It is anticipated that this will be Level D PPE. Basic components for EPA level D are outline in the HASP. UXO or GEO personnel will not wear boots with metal components that would interfere with the operation of the geophysical instruments. Hard hats will not be worn unless an overhead hazard exists. If that is the case, the hard hats will be fitted with a chin strap to hold the hard hat in place and not be permitted to fall off and strike MEC or MPPEH.

5.1.7 Demolitions Operations Specific PPE or Work Attire

Work clothing for Demolition Operations personnel requires the following specific provisions:

- ✓ All personnel engaged in the destruction of MEC shall wear under and outer garments made of natural fiber, close-weave clothes, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material;
- ✓ Leather or leather-palmed gloves will be worn when handling wooden boxes, Munitions and Explosives of Concern (MEC) or Material Potentially Presenting an Explosive Hazard (MPPEH);
- ✓ Hardhats will not be worn by the demolition team unless an overhead hazard exists. If a overhead hazard exists, the hardhats will be fitted with "chin" strap to prevent falling off and striking explosive materials; and
- ✓ Eye protection will be worn by all personnel on the demolition team.

5.2 Compliance with Plans and Procedures

All site-wide field operations or visitations will be conducted in a systematic manner under the direction, supervision and observation of UXO-supervisory personnel (e.g. UXOQCS/UXOSO, SUXOS, UXOFTL, etc.). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted. Any new course of action or desired change in procedures will be submitted to the PM with justification for approval, as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality to meet the task reporting requirements.

6.0 EXPLOSIVES MATERIAL TRANSPORTATION

Vehicles (i.e. all-terrain, truck, van, TBD based on terrain, etc.) used for transporting MEC or demolition materials must meet the following requirements:

- ✓ Exhaust systems shall be kept in good mechanical repair at all times;
- ✓ Lighting systems shall be an integral part of the vehicle;
- ✓ No demolition material or MEC shall be loaded into or unloaded from ATVs while their motors are running; and
- ✓ ATVs transporting explosive materials shall be equipped with a fire extinguisher having a rating of 10-BC and placed where accessible to the operator.

Additionally, used to transport demolition material and MEC shall be inspected prior to use to determine that:

- ✓ Fire extinguishers are filled and in good working order;
- ✓ Electrical wiring is in good condition and properly attached;
- ✓ Fuel tanks and piping are secure and not leaking;
- ✓ Brakes, steering and safety equipment are in good condition;
- ✓ The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials;
- ✓ No more than two persons shall ride in the ATV transporting demolition material, MPPEH or MEC and no person shall be allowed to ride in the bed;
- ✓ Vehicles shall not be refueled when carrying demolition material or MEC, and if they must be refueled near such material, the vehicle will be a minimum of 100 feet from magazines containing such items before refueling can occur; and
- ✓ All explosive vehicles will be cleaned of visible explosive and other contamination before releasing the vehicles for other tasks.

7.0 DEMOLITION PROCEDURES

All UXO certified personnel, primarily AECOM but also including contractor and subcontractor personnel involved in processing MPPEH removed from project sites, will familiarize themselves with the procedures outlined in this chapter in case demolition operations are required. The following safety and operational requirements shall be followed during demolition range operations. Any deviations from this procedure shall be allowed only after receipt of written approval from the AECOM PM:

- ✓ The quantity of MEC to be destroyed will be determined by the range limit and fragmentation distance calculations;
- ✓ Material awaiting destruction shall be stored not less than intra-line distance, based on the largest quantity involved, from adjacent explosive materials and from explosives being destroyed. The material shall be protected against accidental ignition or explosion from fragments, grass fires, burning embers or detonating impulses originating in materials being destroyed;

- ✓ The US Army, or similar Navy publication, document entitled "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites," (current edition) will be located on-site and followed when destroying multiple munitions by detonation on site;
- ✓ Unless otherwise directed, all demolition shots will be tamped with a minimum of two feet of clean earth/dirt;
- ✓ An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition range before material is detonated. It shall be the responsibility of the observer to order the DS, SUXOS, and/or UXOSO/UXOQCS to suspend firing if any aircraft, vehicles or personnel are sighted approaching the general demolition area;
- ✓ Two-way radios shall not be operated on the demolition range while the pit is primed or during the priming process. The charts shown in Tables 2 and 3 (located at the end of this document) shall be used to calculate minimum safe distances as they relate to mobile RF, television and FM broadcasting transmitters when electric detonators are in use;
- ✓ No Demolition operation will be left unattended during the active portion of the operation (i.e., during the burn or once any explosives or MEC are setup);
- ✓ All shots shall be dual primed;
- ✓ Demolition shots must be fired during daylight hours (i.e., between 30 minutes after sunrise and 30 minutes before sunset);
- ✓ The components should be placed on their sides or in a position to expose the largest area to the influence of the demolition material. The demolition material should be placed in intimate contact with the item to be detonated and held in place by tape or earth packed over the demolition materials;
- ✓ Detonations will be counted to ensure detonation of all shots. After each series of detonations, a search shall be made of the surrounding area for unexploded MEC. Items such as lumps of explosives or unfuzed ammunition may be picked up and prepared for the next shot. Fuzed ammunition or items, which may have internally damaged components, will be detonated in place;
- ✓ A minimum of 30 seconds will be maintained between each detonation;
- ✓ After each detonation and at the end of each day's operations, surface exposed scrap metal, casings, fragments, and related items shall be recovered and disposed of IAW contractual procedures, as well as all applicable environmental regulations. All collected scrap metal will be 100% inspected for absence of explosive materials by demolition range personnel;
- ✓ Upon completion of the project, all disturbed demolition areas will be thoroughly inspected for MPPEH;
- ✓ The holes or depressions made as a result of the detonation will be filled in and contoured;
- ✓ Prior to and after each shot, the Demolition Shot Record is to be filled out by the DS with all applicable information. This record will be kept with the Ordnance Accountability Log and reflect the data for each shot; and
- ✓ Prior to conducting any other task, personnel shall wash their face and hands after handling demolition material, MPPEH or MEC.

8.0 DEMOLITION MATERIALS

Demolition Materials include the following three (3) most commonly used:

1. Detonating Cord;
2. Time/Safety Fuse; and
3. Perforator/Booster.

As detailed below, the utilization of the above materials have different procedures and the selection will depending on the type of item and hazardous condition, as determined in the previous inspection procedures.

8.1 DETONATING CORD USE

The following procedures are required when using detonating cord (det cord):

- ✓ Det cord should be cut using approved crimpers and only the amount required should be removed from inventory;
- ✓ When cutting det cord, the task should be performed outside the magazine;
- ✓ For ease of inventory control, remove det cord in one-foot increments;
- ✓ Det cord should not be placed in clothing pockets or around the neck, arm or waist, and should be transported to the demolition location in either an approved "day box" or a cloth satchel, depending upon the magazine location and proximity to the demolition site;
- ✓ Det cord should be placed at least 50 feet away from detonators and demolition materials until ready for use. To ensure consistent safe handling, each classification of demolition material shall be separated by at least 50 feet until ready for use;
- ✓ When ready to "tie in" the det cord to demolition materials, or det cord to the detonator, the det cord will be connected to the demolition material and secured to the MEC. The cord is then strung out of the hole and secured in place with soil, being sure to leave a one-foot tail exposed outside the hole;
- ✓ Once the hole is filled, make a loop in the det cord large enough to accommodate the detonator, place the detonator in the loop and secure it with tape. The detonator explosive end will face down the det cord toward the demolition material or parallel to the main line;
- ✓ In all cases, ensure there is sufficient det cord extending out of the hole to allow for ease of detonator attachment and detonator inspection/replacement should a misfire occur;
- ✓ If the det cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonators to the det cord loop. If the det cord detonators are Non-El, simply tape the detonators into the loop as described above; and
- ✓ In the event that a time/safety fuse is used, and an igniter is not available and a field expedient initiation system is used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

8.2 TIME/SAFETY FUSE USE

The following procedures are required when using a time/safety fuse:

- ✓ Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of five minutes needed to conduct demolition operations;
- ✓ To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut six inches off the end of the time/safety fuse roll and place the six inch piece in the time/safety fuse container;
- ✓ If quantity allows, accurately measure and cut off a six foot long piece of the time/safety fuse from the roll;
- ✓ Take the six-foot section out of the magazine and attach a fuse igniter;
- ✓ In a safe location, removed from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the DS's Log;
- ✓ To measure the burn time, use a watch with a second hand or chronograph;
- ✓ To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse; and
- ✓ Whenever using time/safety fuse, for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of five minutes.

8.3 PERFORATOR/Booster USE

The following procedures are required when using perforators or boosters:

- ✓ Only remove from the magazine inventory the number required to perform the task;
- ✓ Transport perforators in an approved “day box,” cloth satchel, or plastic container, depending upon magazine location and proximity to the demolition operations;
- ✓ Keep perforators stored at the demolition site at least 50 feet away from detonators and demolition materials until ready for use;
- ✓ When ready to use, place the det cord through the slot on the perforator or hole through the booster and knot the det cord, ensuring the cord fits securely and has good continuity with the booster or perforator; and
- ✓ Once the det cord is secure, place the perforator in the desired location and secure it in place.

9.0 METEOROLOGICAL CONDITIONS

In order to control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations:

- ✓ Demolition operations will not be conducted during electrical storms or thunderstorms;
- ✓ No demolition operations shall be conducted if the surface wind speed is greater than 20 miles per hour;
- ✓ Demolition operations will not be conducted during periods of visibility of less than one mile caused by, but not limited to, dense fog, blowing snow, or rain, . Demolition shall not be carried out on extremely cloudy days that are defined as: overcast (more than 80% cloud cover) with a ceiling of less than 2,000 feet.
- ✓ Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).
- ✓ Demolition operations will not be conducted during periods of local air quality advisories.
- ✓ Demolition operations will not be initiated until 30 minutes after sunrise, and will be secured at least 30 minutes prior to sunset.

10.0 PRE-DEMOLITION/DISPOSAL PROCEDURES

10.1 Pre-Demo/Disposal Operations Planning Briefing

It is the belief of AECOM that the success of any operation is dependent upon a thorough brief, covering all phases of the task, which is presented to all affected personnel. The DS will brief all personnel involved in range operations in the following areas:

- Type of MEC being destroyed;
- Type, placement and quantity of demolition material being used;
- Method of initiation (electric, non-electric or Non-El);
- Means of transporting and packaging MEC;
- Route to the disposal site;
- Equipment being used;
- Misfire procedures; and
- Post shot clean up of range.

10.2 Pre-Demo/Disposal Operations Safety Briefing

The AECOM Demolition Supervisor will conduct a safety brief for all personnel involved in range operations in the following areas:

- Care and handling of explosive materials;
- Personal hygiene;
- Two man rule and approved exceptions;
- Potential trip/fall hazards;
- Horse play;

- Stay alert for any explosive hazards;
- Location of assembly area;
- Parking area for ATVs (vehicle must be positioned for immediate departure, with the keys in the ignition);
- Location of range emergency vehicle (keep engine running);
- Wind direction (to assess potential toxic fumes);
- Location of first aid kit and fire extinguisher;
- Communications procedures in event of an emergency;
- Storage location of demolition materials and MEC awaiting disposal;
- Demolition schedule.

10.3 Task Assignments

Individuals with assigned tasks will report the completion of the task to the DS. The types of tasks that may be required are:

- Secure all access roads to the area;
- Visually check area for any unauthorized personnel;
- Prepare designated pits as required;
- Check time/safety fuse and its burn rate;
- Designate a custodian of the fuse igniters, or Non-El initiator;
- Secure detonators in a safe location;
- Place MEC in pit and place charge in desired location.

10.4 Preparation for Explosives Charge Initiation

To prepare the explosive charge for initiation, the procedures listed below will be followed:

- ✓ All personnel except the DS and one other UXO Technician will depart the area;
- ✓ Prime the demolition charge;
- ✓ Place the demolition charge on MEC;
- ✓ Check security of the area;
- ✓ Note time and initiate firing devices;
- ✓ Firing team departs the area;
- ✓ Obtain a head count;
- ✓ Remain in designated safe area until DS announces **"All Clear"**. This will occur after a post-shot waiting period of 5-minutes and the DS has inspected the detonation point.

10.5 Post Demolition/Disposal Procedures

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the below listed procedures:

- After the **"All Clear"** signal, check pit for low orders or kick outs;
- Conduct a magnetometer check of the pit and remove any large fragments;
- Collect soil sample and back fill hole as necessary;
- Police up all equipment;
- Notify AECOM PM that the operation is complete.

11.0 MISFIRE PROCEDURES

A thorough check of all equipment, firing wire and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below shall be followed.

11.1 Non-Electric Misfires

Working on a non-electric misfire is the most hazardous of all operations. Occasionally, despite all efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician that placed the charge, using the following procedure:

- ✓ If the charge fails to detonate at the determined time, initiate a 60-minute wait period plus the time of the safety fuse, i.e., 5-minute safety fuse plus 60 minutes for a total of 65 minutes;
- ✓ After the wait period has expired, a designated technician will proceed down range to inspect the firing system. A safety observer must watch from a protected area;
- ✓ Prime the shot with a new non-electric firing system and install a new fuse igniter;
- ✓ Follow normal procedures for initiation of the charge.

11.2 Non-El Misfire

The use of a shock tube for blast initiation can present misfires that require the following actions:

- ✓ If the charge fails to detonate, it could be the result of the shock tube not firing. Visually inspect the shock tube, if it is not discolored (i.e., slightly black), it has not fired;
- ✓ If it has not fired, cut a one-foot piece off the end of the tube, re-insert the tube in the firing device and attempt to fire again;
- ✓ If the device still does not fire, wait 60 minutes and proceed down range to replace the shock tube per instructions outlined below;
- ✓ If the tube is slightly black, then a "Black Tube" misfire has occurred, and the shock tube will have to be replaced. When replacing the shock tube, be sure to remove the tube with the detonator in place.

11.3 Detonating Cord Misfire

Earth Tech uses detonation cord to tie in multiple demolition shots and to ensure that electric detonators are not buried. Since det cord initiation will be either electrical or non-electrical, the procedures presented in Sections 10.1, 10.2, or 10.3, as appropriate to the type of detonator used, will be used to clear a det cord misfire. In addition, the following will be conducted:

- ✓ If there is no problem with the initiating system, wait the prescribed time and inspect the initiator to the cord connection to ensure it is properly connected. If it was a bad connection, simply attach a new initiator;
- ✓ If the initiator detonated and the cord did not, inspect the cord to ensure it is det cord and not time fuze. Also, check to ensure there is PETN in the cord at the connection to the initiator;
- ✓ It may be necessary to uncover the det cord and replace it. This must be accomplished carefully to ensure that the demolition charge and the MEC item are not disturbed.

11.4 Perforator Booster Misfire

The use of perforators is considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, det cord is used as the initiator. Therefore, in the event of a misfire, the procedures presented in Section 10.4 will be followed, along with the items presented below.

If everything went but the perforator, one of four things has occurred:

1. Det cord grain size was insufficient to initiate the perforator;
2. The det cord was dislodged from the perforator when placing tamping materials;
3. The perforator or booster was defective;
4. The perforator was moved during the placement of tamping materials.

A recommended supplementary set of checks/balances is as follows:

- ✓ Check to ensure the grain size of the det cord is sufficient, with 80 grain size or greater being the recommended size;
- ✓ If the detonation cord connection to the perforator was the problem, ensure that the next connection is securely connected (use duct tape if necessary);
- ✓ If it is evident that the perforator was moved, ensure it is properly secured for the next shot;
- ✓ If cord size and connection are sufficient, replace the perforator, leaving the defective one.

12.0 RECORD KEEPING REQUIREMENTS

To document the demolition operations procedures and the completeness of the demolition of MEC, the following record keeping requirements shall be met:

- AECOM will obtain and maintain all required permits;

- The DS will ensure the accurate completion of the logs, and the SUXOS and QCS will monitor the entries in the log for completeness, accuracy and compliance with meteorological conditions;
- The DS shall enter the appropriate data on the Ordnance Accountability Log and the Demolition Shot Record, to reflect the MEC destroyed, and shall complete the appropriate information on the Explosives Accountability Log (a.k.a. the Magazine Data Card) that indicates the demolition materials used to destroy the MEC;
- The quantities of MEC recovered must also be the quantities of MEC destroyed or disposed of;
- AECOM will retain a permanent file of all demolition records, including permits, magazine data cards, training and inspection records, waste manifests if applicable, and operating logs;

Copies of the ATF License and any state or local permits must be on hand.

13.0 AUDIT CRITERIA

The following procedures will be audited to ensure compliance with this SOP and the UFP-SAP:

- ✓ UXOFTL daily logbook entries for tailgate briefs, equipment tests, & MEC hazards;
- ✓ SUXOS & UXOQCS/UXOSO logbook entries documenting results of field procedure inspections, MEC hazard identifications, EODMU communications, and seed detections;
- ✓ SUXOS & UXOQCS/UXOSO "sign-in" sheet documentation of morning meetings;
- ✓ AECOM Demolition Shot Record;
- ✓ Daily Safety Inspection and Audit Log;
- ✓ Explosives Accountability Log; and
- ✓ UXOQCS/UXOSO documentation of "near-misses" or "failures" related to quality or safety hazards, inclusive of recommended solutions and time-line for CAR summary.

Table 1: Classification of MEC Related Items						
Type of Material	**Classification Following Inspection:**					
	Presents Explosive Hazards			**Does Not Present Explosive Hazards**		
	MEC			**MC (3)**	**MDAS**	**Other**
	UXO	**DMM (1)**	**MC (2)**			
Used military munitions, on a range, fired	X				X	
Unused military munitions, on a range, apparently discarded		X			X	
Used military munitions, in a burial pit, on a former range	X(4)				X	
Unused military munitions, in a burial pit on a former range		X(4)			X	
Explosives in the soil			X(5)	X		
Target from a range (other than small arms range)	X(6)	X(6)	X(6)			X(7)
Munitions Remnants from a former range	X(8)	X(8)	X(8)		X(9)	

Footnotes:

(1) Discarded Military Munitions (DMM): Munitions generally considered as DMM include: buried munitions; un-recovered kick outs from open detonations; munitions left behind or discarded accidentally during munitions-related activities; munitions intentionally disposed of without authorization during munitions-related activities. Munitions removed from storage for the purpose of disposal that are awaiting disposal are not DMM.

(2) Munitions Constituents (MC): This is MC that is both (a) an explosive; and (b) present in sufficient concentrations to present explosive hazards.

(3) This is MC that is either (a) not an explosive (e.g., lead, beryllium, and cadmium); or (b) an explosive not present in sufficient concentrations to present explosive hazards.

(4) Although military munitions in a burial pit will normally be DMM, some may be UXO. For explosives safety reasons, munitions in a burial pit should be approached as UXO until assessed by technically qualified personnel (e.g., Explosive Ordnance Disposal (EOD) personnel, UXO-qualified personnel) and determined that they are not UXO or that they do not present explosive hazards similar to UXO.

(5) Explosive soil is typically found in sumps and settling lagoons for explosives-laden wastewater, and in and around drainage ditches and pipes that carry the wastewater to such sumps and lagoons.

(6) A target is a type of range-related debris. Although a target is not MEC, it may contain UXO, DMM, or MC. Prior to its release from DoD control, its explosives safety status must be documented.

(7) A target's explosives safety status must be documented and any demilitarization required to remove its military characteristics must be performed prior to its release from DoD control.

(8) UXO, DMM, or MC may be found on operational ranges and on former ranges (previously referred to as closed, transferring or transferred ranges). An inspection of the material will determine into which category this material falls. For example, if a projectile breaks apart on impact, one could find (a) a sheared-off fuze, which would be UXO or (b) explosive filler, which would be MC that broke away from the projectile's open body. If during an open detonation of an unserviceable munitions that is conducted on an operational range, the donor charge detonates, but the munitions being destroyed breaks up, but does not detonate, the remnants of the munitions would be DMM or, if explosive residue (e.g., clumps of Trinitrotoluene [TNT]), MC.

(9) Fragments, while munitions debris, may be evidence of high explosive (HE) usage at the site. For such fragments, the team will indicate evidence of HE in its classification. After determination of its explosives safety status, scrap metal from used munitions on a range that is documented as safe would, after any demilitarization required removing its military characteristics, be available for release from DoD control. In additions to these DoD requirements, other regulatory criteria may apply.

TABLE 2: MINIMUM SAFE DISTANCE FROM TRANSMITTER ANTENNAS

Average or Peak Transmitter Power in Watts	Minimum Distance to Transmitter in Meters / Feet
0 – 30	30 / 98.4
31 – 50	50 / 164.1
51 – 100	110 / 360
101 – 250	160 / 525
251 – 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3,002
20,001 - 50,000	1,530 / 5,020
50,001 - 100,000	3,050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,001 - 6,400,000	24,400 / 80,056

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

Source: Table 6-3, DA PAM 385-64, 15 December 1999

TABLE 3: MINIMUM SAFE SEPARATION FORMULAS

Unknown (Worst Case)	Un-shielded Munitions		Shielded Munitions	
	Frequency	Formula	Frequency	Formula
Use Table 2	Up to 2.3 KHz	$D = 0.093 \times (PG)^{0.5}$	Up to 73 KHz	$D = 0.093 \times (PG)^{0.5}$
	2.3 KHz – 450 KHz	$D = 39.7 \times F \times (PG)^{0.5}$	73 KHz – 450 KHz	$D = 126 \times F \times (PG)^{0.5}$
	450 KHz - 400 MHz	$D = 18 \times (PG)^{0.5}$	450 KHz - 400 MHz	$D = 0.6 \times (PG)^{0.5}$
	400 MHz - 75 GHz	$D = (7137/F) \times (PG)^{0.5}$	400 MHz - 2.4 GHz	$D = (226 / F) \times (PG)^{0.5}$
	>75 GHz	$D = 0.093 \times (PG)^{0.5}$	>2.4 GHz	$D = 0.093 \times (PG)^{0.5}$

Where :

D = Safe distance to the transmitter in feet (multiply feet by 0.305 to obtain meters)

P = Output power of the transmitter in watts

G = Numerical gain of transmitter antenna

F = Frequency in MHz (divide KHz by 1,000 to obtain MHz, and multiply GHz by 1,000 to obtain MHz)

To properly use this table, the following assumptions are made:

1. No-fire Current of the EED = 10 mA
2. Safety Factor = At least 10 dB below the no-fire current in EED (or 3.16 numerical)

EED's Leads = Tuned to match the transmitter's frequency

Shielding = If metallic, it provides a minimum of 30 dB or 32 times (numerical) of shielding. Non-metal packs provide no shielding

5. At no time should personnel or munitions be exposed to more than 200 volts / meter

Source: Table 6-4, DA PAM 385-64, 15 December 1999

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MRP SOP 04:
Vegetation Management

STANDARD OPERATING PROCEDURES (SOP) for VEGETATION MANAGEMENT

Prepared by:
AECOM Technical Services (ATS)

Prepared for:
UXO & Other Personnel
Conducting Field Work at
MMRP sites with MEC Hazards

Version Number:
Updated September 2012

1.0 PURPOSE

The purpose of this Munitions Response Program (MRP) Standard Operating Procedure (SOP), MRP SOP 04 – Vegetation Management, is to provide guidance regarding the reference materials, personnel responsibilities, and methodologies to be implemented in conjunction with adequate health and safety protocol requirements applicable to the proper conduct of vegetation management (e.g., tree removal, brush clearance, tall grass mowing, weed whacking, etc.) as part of preparing the surface site conditions for future field activities (i.e. land surveys, geophysical surveys, intrusive investigations, etc.) to follow. Previous SOP's detailing detection, identification, demolition, and disposal activities provide instructions that must also followed by the UXO Technicians as a part of conducting anomaly avoidance assessments while safely escorting the vegetation removal teams across the site. The SOP's detail structured procedures that must be followed once a suspect item is found. Thus, a large portion of the current SOP is primarily focused directly on vegetation management safety and reserving additional safe practices required before or after vegetation removal or MPPEH identification for other SOP's.

2.0 SCOPE

This SOP applies to all UXO Tech personnel, including management and field leadership, and vegetation removal crews involved in working at Military Munitions Response Program (MMRP) sites. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Consult the documents listed in Section 3.0 of this SOP for a listing of additional compliance documents for reference. The SOP is intended for use by UXO Technicians' and field crews for reference.

3.0 REFERENCE DOCUMENTS

Applicable sections in the documents below may be referenced for the requirements associated with safely escorting vegetation removal crews across the site without directly impacting MEC:

- AECOM Corporate Safety and Health Program;
- OSHA General Industry Standards, 29 CFR 1910;
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards;
- AR 385-64, U.S. Army Explosives Safety Program, AR 385-10, Army Safety Program;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- NOSSAINST 8020.15C, Navy Explosives Safety Program; and
- UFP-SAP, HASP, ESS-DR, & ESS documents approved for field work at this site.

The documents listed above are the primary references for basic guidance at MEC sites regarding: education, experience, training, and certification requirements for personnel; field techniques to be implemented during the demolition and disposal process; and documentation, communication, and storage/transport directives during the disposal process.

4.0 PERSONNEL ROLES, RESPONSIBILITIES, AND REQUIREMENTS

The personnel roles and responsibilities in conjunction with associated deliverable requirements are introduced in the following sets of paragraphs with further details regarding site-specific and project-specific roles and responsibilities listed in **Worksheet #7** of the current UFP-SAP.

4.1 Project Manager (PM)

The Project Manager (PM) is responsible for ensuring the availability of the personnel and equipment resources needed to implement this SOP, inclusive of all materials and supplies required to complete each task safely. The PM will also ensure that this SOP is incorporated in plans, procedures and training for sites where MPPEH or MEC has the potential of being encountered. Lastly, although the PM shall delegate all daily site leadership, inclusive of site-specific training aspects, quality inspections, and safety audits, to the UXO operations management team on-site and program management offsite, the PM is ultimately responsible to ensure each aspect has been completed and signed off as such prior to commencing the next stage of field work or reporting requirements.

4.2 On-Site UXO Operations Management

The On-Site UXO Operations Management consists of the following four (4) key personnel:

1. Senior UXO Supervisor (SUXOS),
2. UXO Safety Officer (UXOSO),
3. UXO Quality Control Specialist (UXOQCS), and
4. UXO Field Team Leader (UXOFTL).

For smaller projects or field efforts either without intrusive investigation (and thus minimal UXO field staff or UXO management requirements) activities at the current phase of the project, the operations management staffing plans can be reduced to only require a SUXOS, a dual-hatted UXOSO / UXOQCS, and a multi-hatted UXO Tech II / UXOFTL / UXO Tech.

4.2.1 Senior UXO Supervisor (SUXOS)

The Senior UXO Supervisor (SUXOS) will ensure that this SOP is implemented for operations that involve will be responsible for assuring that adequate safety measures and housekeeping are taken during all phases of site operation, to include the proper management while safely escorting vegetation removal crews across the site, and support the completion of the required tasks though direct actions or indirect action through proper delegation techniques, at each location as deemed necessary. The SUXOS will ensure that relevant sections of this SOP are discussed in the daily safety briefings and that information related to its daily implementation is properly recorded in appropriate site documentation (i.e. logbook entries, field forms, etc.). Ultimately, the SUXOS is responsible for the following regarding the management of the UXO Technicians' escorting and anomaly avoidance assessments for the vegetation removal crews:

- ✓ Planning and scheduling areas for vegetation removal in a sequential order;

- ✓ Inspecting and supervising all delegated tasks related to the vegetation removal, including anomaly avoidance assessments and equipment operation;
- ✓ Providing a daily briefing and debriefing as to the progress of the field crews;
- ✓ Ensuring all logbooks and records regarding vegetation management and equipment maintenance are up-to-date; and
- ✓ Certifying that the logs and records accurately reflect the daily events.

The planning, supervising, and conduct may be conducted first hand or delegated to another UXO Technician; however, the SUXOS must still document daily events in the logbook.

4.2.2 UXO Safety Officer (UXOSO)

The UXO Safety Officer (UXOSO) will be responsible for all health and safety duties detailed in the currently approved Uniform Federal Policy – Sampling and Analysis Plan (UFP-SAP), Health & Safety Plan (HASP), Explosives Safety Submission – Determination Request (ESS-DR), and potentially (if required) a full Explosives Safety Submission (ESS) set of documents. The UXOSO is also responsible for ensuring vegetation removal is done with due care and attention to the hazards involved in the operation:

- ✓ Maintains a daily logbook of MEC safety related matters encountered on site;
- ✓ Issues and/or approves "Stop Work" orders for safety and health reasons;
- ✓ Conducts site specific MEC-related health and safety training;
- ✓ Identifies and evaluates any known or potential safety problems that may interfere with or interrupt site MEC operations or endanger site personnel;
- ✓ Ensures proper Personal Protective Equipment (PPE) will be worn (e.g., shoes, gloves, eye protection with side shields), including a hard hat only with overhanging hazards, will be worn whenever working with MPPEH;
- ✓ Confers with SUXOS, UXOQCS, and UXOFTL to confirm proper identification of MPPEH and contacts appropriate ESO and EODMU if deemed hazardous;
- ✓ Monitors that UXO Tech escorted vegetation removal crews follow field procedures and safely circumvent or cut vegetation above the height of MPPEH items as to not damage equipment or themselves in the process;
- ✓ Inspects equipment for wear-tear, blade/chain/string sharpness, and other operation-maintenance considerations in line with manufacturer's specifications;
- ✓ Consults with the PM and SUXOS on identifying and implementing any necessary MEC safety-related corrective actions; and
- ✓ Coordinates with the HSM for the implementation of the HASP requirements;

4.2.3 UXO QC Specialist (UXOQCS)

The UXO Quality Control Specialist (UXOQCS) has the responsibility and authority to enforce the site-specific requirements detailed in the UFP-SAP. (As stated previously, the UXOSO may perform the duties of the UXOQCS if personnel are limited, and as such, would have all the responsibility requirements of the UXOSO as well as their current role) This individual reports to directly to both the MEC Manager and the Quality Assurance Manager (QAM) and coordinates site activities with the SUXOS on site. The UXOQC responsibilities include:

- ✓ Maintains a daily logbook of MEC QC monitoring activities, non-conformances issues, and corrective measures required to be implemented;
- ✓ Conducts periodic QC surveillances of site MEC activities and recording the findings in the Daily Activities Report;
- ✓ Monitors the progress of detecting ISO items placed on the surface and how the field teams adapt to different vegetation areas of the site;
- ✓ Confers with SUXOS, UXOSO, and UXOFTL to confirm MPPEH hazard class;
- ✓ Reports noncompliance with MEC QC criteria to the QAM, PM and SUXOS and documents the deviations on a Non-Conformance-Report (NCR);
- ✓ Initiates a Rework Items List from the NCR that must meet quality specifications;
- ✓ Conducts a root cause analysis when a QC failure occurs;
- ✓ Coordinates with the responsible parties to initiate the QC failure remedies and documents these actions on the Corrective Action Report (CAR); and
- ✓ Ensures that the CAR recommendations are followed in order the close-out the QC failure and ensures that all lessons learned are documented and forwarded to the QAM for analysis.

4.2.4 UXO Field Team Leader (UXOFTL)

The UXO Field Team Leader (UXOFTL) has the responsibility and authority to enforce the site health and safety rules while escorting teams across the site and providing anomaly avoidance support. Ultimately, the UXOFTL is also responsible for implementing all health/safety and inspection/disposal requirements outlined in Sections 5.0, 6.0, and 7.0 of this SOP, as conducted real-time in the field with required support from the SUXOS or UXOSO/UXOQCS, as needed, on a daily basis.

4.3 Off-Site UXO Program Management

The Off-Site UXO Program Management consists of the following three (3) key personnel:

1. MEC Manager,
2. Health and Safety Manager (HSM), and
3. Quality Assurance Manager (QAM).

Since the UXO Managers are at the programmatic level, company-wide, there are no project size restrictions whereby they would have no involvement or required duties, unless the site has no known sources of MEC contamination at which time the MEC Manager can be removed. The ultimate purpose of each manager is to ensure adequate documentation is gathered from the field to readily summarize the results in the Final Report to be submitted post Field Investigation (FI).

4.3.1 Munitions and Explosives of Concern Manager (MECM)

The Munitions and Explosives of Concern Manager (MECM) will coordinate with the PM to ensure adequate staffing, equipment, and supplies are provided to the site at the start of the project, at key junctures, during project surges, and/or on a regimented basis in order to safely complete the project in a timely cost-efficient manner with adequate quality. The MEC Manager

is also responsible for addressing MEC related issues, such as accurately and thoroughly documenting MEC finds then followed by reporting finds to the Explosives Ordnance Disposal Mobile Unit (EODMU), and timely decision-making regarding how to handle unpredictable project events, by working with on-site management, other off-site management, and the PM as necessary. Lastly, the MECM is responsible for inspecting the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on requirements detailed in the HASP, UFP-SAP, and the current SOP.

4.3.2 Health and Safety Manager (HSM)

The Health and Safety Manager (HSM) will be responsible for ensuring that the safety and health hazards and control techniques associated with or referenced in this SOP are discussed during the initial site hazard training and the daily tailgate safety briefings. The HSM is also responsible for audits of site operations summary reports from the SUXOS and UXOSO / UXOQCS are adequate with continued compliance with the approved Task Hazard Analyses (THAs), HASP, UFP-SAP, and the current SOP.

The HSM also delegates to the UXOSO to: conduct of daily safety briefings, controls visitor access and entry to the project site; coordination with local emergency response agencies; compliance with Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), and U.S. Army Corps of Engineers (USACE) Safety or U.S. Navy Ordnance Safety and Security Activity (NOSSA) protocols; check compliance with specific state and local ordinances as required; and inspect emergency equipment and maintaining the site emergency vehicle and supplies. Although the tasks are delegated from the UXOSO and other site personnel, ultimately, the HSM is responsible for the adequate documentation and ultimate compliance for the health-safety aspects of the entire project.

4.3.2 Quality Assurance Manager (QAM)

The Quality Assurance Manager (QAM) will be responsible for ensuring that the Quality Control (QC) techniques are implemented and Quality Assurance (QA) inspections are conducted, as associated with techniques introduced in this SOP or inspection frequency versus quality metric requirements detailed in the UFP-SAP. Lastly, the QAM is also the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on metric requirements detailed in the UFP-SAP.

4.4 Dual-Hatting or Multi-Hatting of Personnel Roles and Responsibilities

The dual-hatting and multi-hatting of UXO Management will only remain viable as long as intrusive operations are not being conducted or the staffing requirements remain relatively small and manageable even with intrusive investigation activities, which is clearly the case for the current project. Other projects which require a limited intrusive investigation of a large area or full intrusive investigation of smaller areas (and thus a limited maximum of UXO field staff or UXO management requirements), may also dual-hat the UXOSO/UXOQCS but may not be able multi-hat the UXO Tech II / UXOFTL / UXO Tech escort duties depending on staffing needs.

5.0 MEC PROCEDURES

5.1 General Site Practices

All personnel, including contractor and subcontractor personnel, involved in MEC operations shall be familiar with the potential safety and health hazards associated with the conduct of this operation, and with the work practices and control techniques to be used to reduce or eliminate these hazards. The site safety practices detailed in the HASP and THA's will be observed.

All MEC-related operational activities at the site will be under the safety escorting direction of and/or performed by UXO-qualified personnel as defined by the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). Non-essential personnel will be prohibited from entering within the minimum separation distance (MSD) of subsurface intrusive investigation activities at MMRP sites, and must remain outside of the exclusion zone (EZ) defined by the MSD unless escorted by a UXO Technician and authorization to access or transit the EZ has been approved by the SUXOS. The EZ rules do not apply to portions of the site that are not characterized to be within a MEC contaminated area. For the current project, since no intrusive investigation activities are planned to be conducted with non-essential personnel within the both the MSD arcs and the well-defined MEC contaminated portion of the site, the EZ rules are for informational purposes or, in-lieu of, tasked project changes at this time.

5.1.1 Anticipated Site Work Hours

Operations will be conducted during daylight hours only and no single workday will exceed 10 hours in the field. The only exception to the rule is that pre work day meetings and setup can occur after hours, but only at pre-designated areas. The currently anticipated work schedule consists of five ten hour (5-10's) days, of which the workday consists of at least forty (40) hours in the field with at least forty-eight (48) hours separating each workweek. Industry standards for UXO operations normally limit personnel to a 40-hour work week, either four 10-hour days or five 8-hour days, however, these rules do not apply until intrusive operations are being conducted.

5.1.2 Site Access Controls

Site access controls are currently maintained not only by base pass entrance requirements at the main gate entrance for the post but also by a locked-entrance to perimeter fencing which surrounds the work area where potential MEC/MPPEH is identified and this pre-established measure will clearly limit access to only those personnel essential to accomplish the specific operation(s) or who have a specific purpose and authorization to be in the work zone. No hazardous operations, such as intrusive operations and demolition operations which currently have no scheduled time-line, will be conducted when non-essential personal are in the vicinity.

5.1.3 Inspection & Disposal of MPPEH

Inspection and disposal of MPPEH will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 02 Inspection and Disposal of MPPEH reference documents, the SUXOS or UXOQC / UXOSO must first clearly identify whether the MPPEH item is determined to be Material Documented as Safe (MDAS) or Material Documented as Explosive Hazard (MDEH) and whether the item has the best-fit nomenclature as Small Arms Ammunition (SAA), Munitions Debris (MD), Cultural Debris (CD), Munitions and Explosives of Concern (MEC), or Munitions Constituent (MC). At this time, on-site UXO technicians may move the item if and only if they are 100% certain, with SUXOS and UXOQCS / UXOSO approval, it is SAA. MD, CD, etc., and clearly determined to be MDAS. If determined to be MDEH, the UXOFTL must coordinate with the SUXOS and UXOQCS / UXOSO to document the item details (e.g. nomenclature, location, etc.) at which time the SUXOS will contact the base Explosives Safety Officer (ESO) and the assigned EODMU named in the approved site-specific ESS-DR or full ESS documents.

5.1.4 MEC Demolition and Disposal Operations

MEC Demolition and Disposal Operations will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 03 MEC Demolition and Disposal Operations reference documents, the SUXOS or UXOQC / UXOSO will have demolition and disposal operations managed by the base ESO and completed by the EODMU, both of which should have already been contacted once the MEC item has been verified at MDEH either through 100% concurrence positive identification or uncertainty whether the item can be 100% considered MDAS. As such, no explosives will be stored, maintained, or accounted for on-site at this time. Additionally, no 24-hour guarding is required due to the extent of the site access controls. Lastly, demolition and disposal operations can be completed by non-NAVY EODMU personnel if and only if we are authorized to increase our breadth of scope based on unavailability of EODMU personnel, however, this is not expected.

5.1.5 Safety Training or Briefing Sessions

Three (3) distinct sets of safety training or briefing sessions will be routinely conducted: **(1)** UXOSO/UXOQCS-lead site-specific training related to familiarity, safety, quality, and project production execution requirements; **(2)** SUXOS-lead work summary pertaining to production, location, and safety debriefs; and **(3)** UXOFTL-lead daily tailgate safety briefing conducted with each field team.

The UXOSO/UXOQCS-lead general briefings for all personnel at the site prior to beginning work. A written record of this training and the signatures of personnel attending the training will be maintained. The briefing will cover general hazards of the project and any new safety issues or hazards identified since the last briefing. The UXOSO and/or SUXOS will also conduct safety briefings on specific hazards anticipated

at each work site during that day's operations and the safety measures to eliminate or mitigate those hazards. The brief will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and team locations change within the site, the briefings will also reflect any corresponding changes in ingress/egress routes and emergency evacuation routes. Site visitors must receive a safety briefing prior to entering the operating area. All visitors entering the site will sign the visitor's log and will be escorted by UXO-qualified project personnel regardless of their qualifications. Field activities involving MEC and MPPEH identification and disposal operations will be halted while visitors are within the work zone.

All of these safety training or briefing sessions require employee sign-off, either through pre-prepared sign-in sheets during office reviews or logbook entry sign-offs out in the field discussions. Lastly, the UXOSO and/or SUXOS may hold a safety stand-down at any time they note any degradation of safety or note a safety issue that warrants review.

5.1.6 PPE or Work Attire

Work clothing will be appropriate for the conditions encountered. It is anticipated that this will be Level D PPE. Basic components for EPA level D are outline in the HASP. UXO or GEO personnel will not wear boots with metal components that would interfere with the operation of the geophysical instruments. Hard hats will not be worn unless an overhead hazard exists. If that is the case, the hard hats will be fitted with a chin strap to hold the hard hat in place and not be permitted to fall off and strike MEC or MPPEH

5.2 Compliance with Plans and Procedures

All site-wide field operations or visitations will be conducted in a systematic manner under the direction, supervision and observation of UXO-supervisory personnel (e.g. UXOQCS/UXOSO, SUXOS, UXOFTL, etc.). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted. Any new course of action or desired change in procedures will be submitted to the PM with justification for approval, as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality to meet the task reporting requirements.

6.0 VEGETATION MANAGEMNT

Vegetation Management activities at MMRP sites can range from minor grass mowing, to tree limb pruning, to a vegetation clearance. The extent and methods of vegetation management are driven primarily by the requirements from the field activities to follow which were, in-turn, a necessity based on the end-product requirements arising from details listed in the original scope of work. The methods and technology selection may also be influenced by munitions' types, terrain, environmental impacts, and land use, all normalized relative to cost considerations. Lastly, anomaly avoidance procedures detailed in MRP SOP 01 will be implemented by the

UXO Tech escort in any work area, and repeated twice in any areas where high vegetation requires clearance down to approximately 1 foot off the deck in order to allow adequate visually unimpaired AGM sensor confirmation prior to finishing the vegetation clearance operation down to within a few inches above the soil surface. Alternatively, the project team may decide to use weed-whackers, or similar equipment with non-metallic wires, edges, etc., which do not pierce metallic items, such as ordnance related material which is the concern. Vegetation management crews will not work within and will circumvent areas of extensive ordnance clutter; furthermore, vegetation management crews will not cut vegetation with metal blades lower than 4 inches off the deck to avoid damaging contact to surface or proud to surface MPPEH.

6.1 *Power Tool or Hand Tool* Tree Cutting Methods

Generally speaking, tree cutting will be limited to two types of tool-use methods: **(1)** power tool (e.g. chain saw, pole saw, edger, pruner, etc.) or **(2)** hand tool (e.g. ax, blade, etc.). Trees starting at 3 inches in diameter and smaller will take down using one of the two types of tree cutting tools, depending on the toughness of the tree relative to other considerations such as cost, fire hazards, and overall size of the area to be cleared. Trees will be sectioned and removed from the work area or placed in a wood-chipper and spread on the surface, to limit the interference with future operations such as DGM activities to follow.

6.2 *Hand-Held or Vehicle-Pushed* Brush Removal Methods

Generally speaking, brush removal will be limited to two types of tool-use methods: **(1)** Hand-held (e.g. weed-whacker, bladed/stringed tools, etc..) or **(2)** Vehicle Pushed tool (e.g. tractor-pushed brush-hog or trimmer, etc.). Large or thicker brush may require the use of chainsaws. As with all vegetation management, brush will not be mowed with metal blades lower than 4 inches off the deck to avoid damaging contact to surface or proud to surface MPPEH.

6.3 *Hand-Held or Hand-Pushed* Grass Mowing Methods

Generally speaking, grass mowing will be limited to two types of tool-use methods: **(1)** Hand-held (e.g. weed-whacker, other bladed/stringed tools, etc..) or **(2)** Hand Pushed tool (e.g. lawn mower, etc.). Large or thicker brush may even require the use of chainsaws. As with all vegetation management, brush will not be mowed with metal blades lower than 4 inches off the deck to avoid damaging contact to surface or proud to surface MPPEH. Stringed attachments are considered an adequate substitute for low level trimming.

6.4 Other Methods to Consider

In rare cases whereby an extraordinary large-scale amount of vegetation removal is required, controlled burning or hydraulic ax deforestation methods may be used after careful consideration of the cost impact requirements not only for the production requirements (i.e. labor, tools, fuel source, etc.) but also for the safety hazard requirements (i.e. fire suppression, widespread tree removal, surface ordnance impacts, surface ordnance heating, etc.), either of which may be an undesirable by product to the land owners. UXO Technicians are required to monitor the progress and impacts, but at no time with the UXO Technicians operate the equipment.

7.0 VEGETATION DISPOSAL

The preferred method of vegetation disposal is on-site, after the vegetation is removed from the immediate work area to avoid interfering with future site activities, and allowed to naturally decompose. Wood chippers or grinders are good alternatives to dispose of vegetation without removing the vegetation from the work site. Disposal of wood chips is also preferred to occur away from the immediate work area, however, in cases this is not feasible, would chips can be spread across the work site surface as long as the thickness doesn't exceed 4 inches, thus not only dramatically impacting future geophysical instrument-aided surface and subsurface survey assessments, but also other investigation activities as well by creating a barrier between the field technician and the ground surface.

8.0 AUDIT CRITERIA

The following procedures will be audited to ensure compliance with this SOP and the UFP-SAP:

- ✓ UXOFTL daily logbook entries for tailgate briefs, equipment tests, & MEC hazards;
- ✓ SUXOS & UXOQCS/UXOSO logbook entries documenting results of field procedure inspections, MEC hazard identifications, EODMU communications, and seed detections;
- ✓ SUXOS & UXOQCS/UXOSO "sign-in" sheet documentation of morning meetings; and
- ✓ UXOQCS/UXOSO documentation of "near-misses" or "failures" related to quality or safety hazards, inclusive of recommended solutions and time-line for CAR summary.

MRP SOP 05:
Survey Management

STANDARD OPERATING PROCEDURES (SOP) for (LAND) SURVEY MANAGEMENT

Prepared by:
AECOM Technical Services (ATS)

Prepared for:
UXO & Other Personnel
Conducting Field Work at
MMRP sites with MEC Hazards

Version Number:
Updated September 2012

1.0 PURPOSE

The purpose of this Munitions Response Program (MRP) Standard Operating Procedure (SOP), MRP SOP 05 – Survey Management, is to provide guidance regarding the reference materials, personnel responsibilities, and methodologies to be implemented in conjunction with adequate health and safety protocol requirements applicable to the proper conduct of survey management (e.g., site-wide establishment of monuments or boundary surveys, localized series of control points in transect and/or grid patterns, etc.) as part of preparing coordinate references for future field activities (i.e. geophysical surveys, intrusive investigations, etc.). Previous SOP's detailing detection, identification, demolition, and disposal activities provide instructions that must also be followed by the UXO Technicians as a part of conducting anomaly avoidance assessments while safely escorting the survey teams across the site. The SOP's detail structured procedures that must be followed once a suspect item is found. A large portion of the current SOP is primarily focused directly on survey management safety and reserving additional safe practices required before or after land survey activities or MPPEH identification for other SOP's.

2.0 SCOPE

This SOP applies to all UXO Tech personnel, including management and field leadership, and land survey field crews involved in working at Military Munitions Response Program (MMRP) sites. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Consult the documents listed in Section 3.0 of this SOP for a listing of additional compliance documents for reference. The SOP is intended for use by UXO Technicians' and field crews for reference.

3.0 REFERENCE DOCUMENTS

Applicable sections in the documents below may be referenced for the requirements associated with safely escorting land survey crews across the site without directly impacting MEC:

- AECOM Corporate Safety and Health Program;
- OSHA General Industry Standards, 29 CFR 1910;
- Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards;
- AR 385-64, U.S. Army Explosives Safety Program, AR 385-10, Army Safety Program;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- NOSSAINST 8020.15C, Navy Explosives Safety Program; and
- UFP-SAP, HASP, ESS-DR, & ESS documents approved for field work at this site.

The documents listed above are the primary references for basic guidance at MEC sites regarding: education, experience, training, and certification requirements for personnel; field techniques to be implemented during the demolition and disposal process; and documentation, communication, and storage/transport directives during the disposal process.

4.0 PERSONNEL ROLES, RESPONSIBILITIES, AND REQUIREMENTS

The personnel roles and responsibilities in conjunction with associated deliverable requirements are introduced in the following sets of paragraphs with further details regarding site-specific and project-specific roles and responsibilities listed in **Worksheet #7** of the current UFP-SAP.

4.1 Project Manager (PM)

The Project Manager (PM) is responsible for ensuring the availability of the personnel and equipment resources needed to implement this SOP, inclusive of all materials and supplies required to complete each task safely. The PM will also ensure that this SOP is incorporated in plans, procedures and training for sites where MPPEH or MEC has the potential of being encountered. Lastly, although the PM shall delegate all daily site leadership, inclusive of site-specific training aspects, quality inspections, and safety audits, to the UXO operations management team on-site and program management offsite, the PM is ultimately responsible to ensure each aspect has been completed and signed off as such prior to commencing the next stage of field work or reporting requirements.

4.2 On-Site UXO Operations Management

The On-Site UXO Operations Management consists of the following four (4) key personnel:

1. Senior UXO Supervisor (SUXOS),
2. UXO Safety Officer (UXOSO),
3. UXO Quality Control Specialist (UXOQCS), and
4. UXO Field Team Leader (UXOFTL).

For smaller projects or field efforts either without intrusive investigation (and thus minimal UXO field staff or UXO management requirements) activities at the current phase of the project, the operations management staffing plans can be reduced to only require a SUXOS, a dual-hatted UXOSO / UXOQCS, and a multi-hatted UXO Tech II / UXOFTL / UXO Tech.

4.2.1 Senior UXO Supervisor (SUXOS)

The Senior UXO Supervisor (SUXOS) will ensure that this SOP is implemented for operations that involve will be responsible for assuring that adequate safety measures and housekeeping are taken during all phases of site operation, to include the proper management while safely escorting land survey crews across the site, and support the completion of the required tasks though direct actions or indirect actions through proper delegation techniques, at each location as deemed necessary. The SUXOS will ensure that relevant sections of this SOP are discussed in the daily safety briefings and that information related to its daily implementation is properly recorded in appropriate site documentation (i.e. logbook entries, field forms, etc.). Ultimately, the SUXOS is responsible for the following regarding the management of the UXO Technicians' escorting and anomaly avoidance assessments for the land survey crews:

- ✓ Planning and scheduling areas for vegetation removal in a sequential order;

- ✓ Inspecting and supervising all delegated tasks related to the land survey, including anomaly avoidance assessments and equipment operation;
- ✓ Providing a daily briefing and debriefing as to the progress of the field crews;
- ✓ Ensuring all logbooks and records regarding vegetation management and equipment maintenance are up-to-date; and
- ✓ Certifying that the logs and records accurately reflect the daily events.

The planning, supervising, and conduct may be conducted first hand or delegated to another UXO Technician; however, the SUXOS must still document daily events in the logbook.

4.2.2 UXO Safety Officer (UXOSO)

The UXO Safety Officer (UXOSO) will be responsible for all health and safety duties detailed in the currently approved Uniform Federal Policy – Sampling and Analysis Plan (UFP-SAP), Health & Safety Plan (HASP), Explosives Safety Submission – Determination Request (ESS-DR), and potentially (if required) a full Explosives Safety Submission (ESS) set of documents. The UXOSO is also responsible for ensuring land surveying is done with due care and attention to the hazards involved in the operation:

- ✓ Maintains a daily logbook of MEC safety related matters encountered on site;
- ✓ Issues and/or approves "Stop Work" orders for safety and health reasons;
- ✓ Conducts site specific MEC-related health and safety training;
- ✓ Identifies and evaluates any known or potential safety problems that may interfere with or interrupt site MEC operations or endanger site personnel;
- ✓ Ensures proper Personal Protective Equipment (PPE) will be worn (e.g., shoes, gloves, eye protection with side shields), including a hard hat only with overhanging hazards, will be worn whenever working with MPPEH;
- ✓ Confers with SUXOS, UXOQCS, and UXOFTL to confirm proper identification of MPPEH and contacts appropriate ESO and EODMU if deemed hazardous;
- ✓ Monitors that UXO Tech escorted land survey crews follow field procedures and safely circumvent or avoid placing pin-flags, laths, or nails over an area not previously screened by the UXO Tech escort, potentially impacting MPPEH items and causing damage to equipment or themselves in the process;
- ✓ Inspects equipment for wear-tear, blade/chain/string sharpness, and other operation-maintenance considerations in line with manufacturer's specifications;
- ✓ Consults with the PM and SUXOS on identifying and implementing any necessary MEC safety-related corrective actions; and
- ✓ Coordinates with the HSM for the implementation of the HASP requirements;

4.2.3 UXO QC Specialist (UXOQCS)

The UXO Quality Control Specialist (UXOQCS) has the responsibility and authority to enforce the site-specific requirements detailed in the UFP-SAP. (As stated previously, the UXOSO may perform the duties of the UXOQCS if personnel are limited, and as such, would have all the responsibility requirements of the UXOSO as well as their current role) This individual reports

to directly to both the MEC Manager and the Quality Assurance Manager (QAM) and coordinates site activities with the SUXOS on site. The UXOQC responsibilities include:

- ✓ Maintains a daily logbook of MEC QC monitoring activities, non-conformances issues, and corrective measures required to be implemented;
- ✓ Conducts periodic QC surveillances of site MEC activities and recording the findings in the Daily Activities Report;
- ✓ Monitors the progress of detecting ISO items placed on the surface and how the field teams adapt to different survey areas of the site;
- ✓ Confers with SUXOS, UXOSO, and UXOFTL to confirm MPPEH hazard class;
- ✓ Reports noncompliance with MEC QC criteria to the QAM, PM and SUXOS and documents the deviations on a Non-Conformance-Report (NCR);
- ✓ Initiates a Rework Items List from the NCR that must meet quality specifications;
- ✓ Conducts a root cause analysis when a QC failure occurs;
- ✓ Coordinates with the responsible parties to initiate the QC failure remedies and documents these actions on the Corrective Action Report (CAR); and
- ✓ Ensures that the CAR recommendations are followed in order the close-out the QC failure and ensures that all lessons learned are documented and forwarded to the QAM for analysis.

4.2.4 UXO Field Team Leader (UXOFTL)

The UXO Field Team Leader (UXOFTL) has the responsibility and authority to enforce the site health and safety rules while escorting teams across the site and providing anomaly avoidance support. Ultimately, the UXOFTL is also responsible for implementing all health/safety and inspection/disposal requirements outlined in Sections 5.0, 6.0, and 7.0 of this SOP, as conducted real-time in the field with required support from the SUXOS or UXOSO/UXOQCS, as needed, on a daily basis.

4.3 Off-Site UXO Program Management

The Off-Site UXO Program Management consists of the following three (3) key personnel:

1. MEC Manager,
2. Health and Safety Manager (HSM), and
3. Quality Assurance Manager (QAM).

Since the UXO Managers are at the programmatic level, company-wide, there are no project size restrictions whereby they would have no involvement or required duties, unless the site has no known sources of MEC contamination at which time the MEC Manager can be removed. The ultimate purpose of each manager is to ensure adequate documentation is gathered from the field to readily summarize the results in the Final Report to be submitted post Field Investigation (FI).

4.3.1 Munitions and Explosives of Concern Manager (MECM)

The Munitions and Explosives of Concern Manager (MECM) will coordinate with the PM to ensure adequate staffing, equipment, and supplies are provided to the site at the start of the

project, at key junctures, during project surges, and/or on a regimented basis in order to safely complete the project in a timely cost-efficient manner with adequate quality. The MEC Manager is also responsible for addressing MEC related issues, such as accurately and thoroughly documenting MEC finds then followed by reporting finds to the Explosives Ordnance Disposal Mobile Unit (EODMU), and timely decision-making regarding how to handle unpredictable project events, by working with on-site management, other off-site management, and the PM as necessary. Lastly, the MECM is responsible for inspecting the adequacy of the site operations summary reports from the SUXOS, UXOSO / UXOQCS, and UXOFTL for direct translation to the Final Report based on requirements detailed in the HASP, UFP-SAP, and the current SOP.

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The Health and Safety Manager (HSM) will be responsible for ensuring that the safety and health hazards and control techniques associated with or referenced in this SOP are discussed during the initial site hazard training and the daily tailgate safety briefings. The HSM is also responsible for audits of site operations summary reports from the SUXOS and UXOSO / UXOQCS are adequate with continued compliance with the approved Task Hazard Analyses (THAs), HASP, UFP-SAP, and the current SOP.

The HSM also delegates to the UXOSO to: conduct of daily safety briefings, controls visitor access and entry to the project site; coordination with local emergency response agencies; compliance with Code of Federal Regulations (CFR), Occupational Safety and Health Administration (OSHA), and U.S. Army Corps of Engineers (USACE) Safety or U.S. Navy Ordnance Safety and Security Activity (NOSSA) protocols; check compliance with specific state and local ordinances as required; and inspect emergency equipment and maintaining the site emergency vehicle and supplies. Although the tasks are delegated from the UXOSO and other site personnel, ultimately, the HSM is responsible for the adequate documentation and ultimate compliance for the health-safety aspects of the entire project.

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4.4 Dual-Hatting or Multi-Hatting of Personnel Roles and Responsibilities

The dual-hatting and multi-hatting of UXO Management will only remain viable as long as intrusive operations are not being conducted or the staffing requirements remain relatively small and manageable even with intrusive investigation activities, which is clearly the case for the current project. Other projects which require a limited intrusive investigation of a large area or full intrusive investigation of smaller areas (and thus a limited maximum of UXO field staff or

UXO management requirements), may also dual-hat the UXOSO/UXOQCS but may not be able multi-hat the UXO Tech II / UXOFTL / UXO Tech escort duties depending on staffing needs.

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All MEC-related operational activities at the site will be under the safety escorting direction of and/or performed by UXO-qualified personnel as defined by the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18). Non-essential personnel will be prohibited from entering within the minimum separation distance (MSD) of subsurface intrusive investigation activities at MMRP sites, and must remain outside of the exclusion zone (EZ) defined by the MSD unless escorted by a UXO Technician and authorization to access or transit the EZ has been approved by the SUXOS. The EZ rules do not apply to portions of the site that are not characterized to be within a MEC contaminated area. For the current project, since no intrusive investigation activities are planned to be conducted with non-essential personnel within the both the MSD arcs and the well-defined MEC contaminated portion of the site, the EZ rules are for informational purposes or, in-lieu of, tasked project changes at this time.

5.1.1 Anticipated Site Work Hours

Operations will be conducted during daylight hours only and no single workday will exceed 10 hours in the field. The only exception to the rule is that pre work day meetings and setup can occur after hours, but only at pre-designated areas. The currently anticipated work schedule consists of five ten hour (5-10's) days, of which the workday consists of at least forty (40) hours in the field with at least forty-eight (48) hours separating each workweek. Industry standards for UXO operations normally limit personnel to a 40-hour work week, either four 10-hour days or five 8-hour days, however, these rules do not apply until intrusive operations are being conducted.

5.1.2 Site Access Controls

Site access controls are currently maintained not only by base pass entrance requirements at the main gate entrance for the post but also by a locked-entrance to perimeter fencing which surrounds the work area where potential MEC/MPPEH is identified and this pre-established measure will clearly limit access to only those personnel essential to accomplish the specific operation(s) or who have a specific purpose and authorization to be in the work zone. No hazardous operations, such as intrusive operations and demolition operations which currently have no scheduled time-line, will be conducted when non-essential personal are in the vicinity.

5.1.3 Inspection & Disposal of MPPEH

Inspection and disposal of MPPEH will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 02 Inspection and Disposal of MPPEH reference documents, the SUXOS or UXOQC / UXOSO must first clearly identify whether the MPPEH item is determined to be Material Documented as Safe (MDAS) or Material Documented as Explosive Hazard (MDEH) and whether the item has the best-fit nomenclature as Small Arms Ammunition (SAA), Munitions Debris (MD), Cultural Debris (CD), Munitions and Explosives of Concern (MEC), or Munitions Constituent (MC). At this time, on-site UXO technicians may move the item if and only if they are 100% certain, with SUXOS and UXOQCS / UXOSO approval, it is SAA. MD, CD, etc., and clearly determined to be MDAS. If determined to be MDEH, the UXOFTL must coordinate with the SUXOS and UXOQCS / UXOSO to document the item details (e.g. nomenclature, location, etc.) at which time the SUXOS will contact the base Explosives Safety Officer (ESO) and the assigned EODMU named in the approved site-specific ESS-DR or full ESS documents.

5.1.4 MEC Demolition and Disposal Operations

MEC Demolition and Disposal Operations will be handled by qualified personnel only. According to the ESS-DR with further details supplied within the UFP-SAP, HASP, and MRP SOP 03 MEC Demolition and Disposal Operations reference documents, the SUXOS or UXOQC / UXOSO will have demolition and disposal operations managed by the base ESO and completed by the EODMU, both of which should have already been contacted once the MEC item has been verified at MDEH either through 100% concurrence positive identification or uncertainty whether the item can be 100% considered MDAS. As such, no explosives will be stored, maintained, or accounted for on-site at this time. Additionally, no 24-hour guarding is required due to the extent of the site access controls. Lastly, demolition and disposal operations can be completed by non-NAVY EODMU personnel if and only if we are authorized to increase our breadth of scope based on unavailability of EODMU personnel, however, this is not expected.

5.1.5 Safety Training or Briefing Sessions

Three (3) distinct sets of safety training or briefing sessions will be routinely conducted: **(1)** UXOSO/UXOQCS-lead site-specific training related to familiarity, safety, quality, and project production execution requirements; **(2)** SUXOS-lead work summary pertaining to production, location, and safety debriefs; and **(3)** UXOFTL-lead daily tailgate safety briefing conducted with each field team.

The UXOSO/UXOQCS-lead general briefings for all personnel at the site prior to beginning work. A written record of this training and the signatures of personnel attending the training will be maintained. The briefing will cover general hazards of the project and any new safety issues or hazards identified since the last briefing. The UXOSO and/or SUXOS will also conduct safety briefings on specific hazards anticipated

at each work site during that day's operations and the safety measures to eliminate or mitigate those hazards. The brief will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and team locations change within the site, the briefings will also reflect any corresponding changes in ingress/egress routes and emergency evacuation routes. Site visitors must receive a safety briefing prior to entering the operating area. All visitors entering the site will sign the visitor's log and will be escorted by UXO-qualified project personnel regardless of their qualifications. Field activities involving MEC and MPPEH identification and disposal operations will be halted while visitors are within the work zone.

All of these safety training or briefing sessions require employee sign-off, either through pre-prepared sign-in sheets during office reviews or logbook entry sign-offs out in the field discussions. Lastly, the UXOSO and/or SUXOS may hold a safety stand-down at any time they note any degradation of safety or note a safety issue that warrants review.

5.1.6 PPE or Work Attire

Work clothing will be appropriate for the conditions encountered. It is anticipated that this will be Level D PPE. Basic components for EPA level D are outline in the HASP. UXO or GEO personnel will not wear boots with metal components that would interfere with the operation of the geophysical instruments. Hard hats will not be worn unless an overhead hazard exists. If that is the case, the hard hats will be fitted with a chin strap to hold the hard hat in place and not be permitted to fall off and strike MEC or MPPEH

5.2 Compliance with Plans and Procedures

All site-wide field operations or visitations will be conducted in a systematic manner under the direction, supervision and observation of UXO-supervisory personnel (e.g. UXOQCS/UXOSO, SUXOS, UXOFTL, etc.). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted. Any new course of action or desired change in procedures will be submitted to the PM with justification for approval, as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality to meet the task reporting requirements.

6.0 SURVEY MANAGEMNT

Survey Management activities at MMRP sites can range from site boundary survey, to benchmark establishment, to a series of transect waypoint or grid corner boundary surveys. The extent and methods of survey management are driven primarily by the requirements from the field activities to follow which were, in-turn, a necessity based on the end-product requirements arising from details listed in the original scope of work and probable future activities since surveying activities have a continual project use until the site is completed. The methods and technology selection may also be influenced by vegetation types, vegetation height, and terrain

limitations along with potential impacts to the environment during marker (e.g., stakes, nails, pins, flags, paint, etc.) emplacement, all normalized relative to cost and land use considerations. Lastly, anomaly avoidance procedures detailed in MRP SOP 01 will be implemented by the UXO Tech escort in any work area, specifically focused on the localized area where the survey marker is planned for emplacement which sometimes may require offset to place the marker on a safe location. Survey management crews will not work within and will circumvent areas of extensive ordnance clutter to avoid damaging contact to surface or proud to surface MPPEH; furthermore, survey crews will avoid placing markers on concrete or other solid foundations on the site to avoid damaging the structure or injuring themselves. Alternatively, spray paint or other non-invasive means may be used for these areas keeping in mind these markers will require touch up by the SUXO or field crews every few days as the paint will wash away.

6.1 *Sky-view Positioning* Survey Methods

Generally speaking, *sky-view positioning* survey methods will be limited to three types of positioning methods in order of precision: **(1)** Real-Time-Kinematic Differential Global Positioning System (RTK-DGPS), **(2)** GPS, or **(3)** Hand-held GPS. RTK-DGPS requires the setup of a base station over a known benchmark coordinate in order to relay accurate real-time corrections to the rover unit which is surveying unit used to mark locations. GPS units require no base station and may be linked to a beacon telemetry system (e.g. WAAS, CORS, etc.). Hand-held GPS units have no base station and are generally not linked to a beacon telemetry system. As a footnote, some beacon systems require a subscription or license to receive the signal and all RTK-DGPS units have RF transmitter/receiver pairs that require licenses with the FAA regarding the allowable frequency ranges and power output for the unit. Although RTK-DGPS units may be preferred, they have the most site-specific limitations pertaining to tree canopy and terrain in all directions from skyward to at within 15 degrees (or less) above the horizon. Furthermore, GPS units are more flexibly in light canopy environments, thus the decision may rely on the project quality requirements relative to the cost and environmental impacts of clearing brush. However, in areas where skyward view is blocked by canopy but horizon-view is not blocked by terrain or shrubs (either before or after removal), the common procedure is to move towards line-of-sight methods, discussed next.

6.2 *Line-of-Sight Positioning* Survey Methods

Generally speaking, *line-of-sight positioning* survey methods will be limited to one type of instrument, a laser-sighted positioning system, such as a Robotic Total Station (RTS) or Theodolite. Both systems require the setup of a base station over a known benchmark coordinate (and check two other coordinates through back-sighting methods) or setup over an unknown location (and calibrate the system to triangulate the current location by using two other coordinates) in order to relay accurate real-time corrections to the rover unit which is surveying unit used to mark locations. The line-of-sight methods are historically the most commonly used survey methods, primarily due to familiarity and maximum flexibility although GPS units are extremely common today. Furthermore, laser units are more flexible in all canopy environments and less flexible with visual impairments (and thus laser impairments) cluttered along the

horizon, thus the decision may rely on the project quality requirements relative to the cost and environmental impacts of clearing brush. In areas where horizon-view is blocked by terrain or shrubs (either before or after removal), the common procedure is to move towards relative positioning methods, discussed next.

6.3 *Relative Positioning* Survey Methods

Generally speaking, *relative positioning* survey methods are the last resort due to precision limitations and the methods will be limited to three types of instruments: **(1)** Tape-Line, **(2)** Survey Wheel, or **(3)** Walking Gate. Both systems require the setup of a base station or base-line to start each work day. The general procedure is to use a hand-held compass to guide the direction you are walking from the base-line starting point and use either a tape, survey wheel, or walking gate to estimate distance traveled along the path. For obvious reasons, tape-line and survey wheel, or odometer, methods are reserved for short distances from known points or for laying out a grid, while walking gates are used for traversing the site. All of the methods require compass guidance relative to a good map with abundant terrain, building, or other viewable features clearly marked. Relative positioning methods are the least accurate and desirable methods for most circumstances, except for area whereby terrain and vegetation are extreme or the localized survey area is in the middle of nowhere yet clearly defined by surface features (e.g. fence, building, mountainside, etc.) for reference, as the costs of removing massive amounts of vegetation or modifying the terrain over 1000's of acres would outweigh the desired end-product.

8.0 AUDIT CRITERIA

The following procedures will be audited to ensure compliance with this SOP and the UFP-SAP:

- ✓ UXOFTL daily logbook entries for tailgate briefs, equipment tests, & MEC hazards;
- ✓ SUXOS & UXOQCS/UXOSO logbook entries documenting results of field procedure inspections, MEC hazard identifications, EODMU communications, and seed detections;
- ✓ SUXOS & UXOQCS/UXOSO "sign-in" sheet documentation of morning meetings; and
- ✓ UXOQCS/UXOSO documentation of "near-misses" or "failures" related to quality or safety hazards, inclusive of recommended solutions and time-line for CAR summary.

MRP SOP 06:
EM31-MK2 DGM Surveys

NAEVA GEOPHYSICS INC.
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Geonics EM31MK2 Standard Operating Procedures

August 2012

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Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the equipment, and specific procedures for data collection and processing for the Geonics EM31MK2.

Equipment and Theory

This SOP is applicable for the Geonics EM31MK2 terrain conductivity meter. The EM31MK2 terrain conductivity meter measures conductivity variations in the earth's near subsurface. Conductivity varies within the earth and is controlled by the composition of the subsurface. Factors affecting the conductivity of a given area include: porosity, moisture content, dissolved electrolyte content, temperature and phase state of pore water, and the amount and composition of colloids.

The terrain conductivity method uses a transmitter coil that produces a primary electromagnetic field that is conducted through the ground. The alternating electric current produces an alternating magnetic field that induces current flow in the subsurface. Current flow in the receiver coil is induced by the electromagnetic fields generated by the transmitter and the induced secondary ground currents. The strength of the secondary field is dependent on intercoil spacing, frequency of the primary field, and ground conductivity.

The EM31MK2 provides an output of both the quadrature-phase (conductivity) and in-phase components of the induced electromagnetic field, which are recorded simultaneously. The quadrature-phase is a measurement of the terrain conductivity in milliSiemens per meter. The ability to identify lateral variations in the shallow subsurface geology makes quadrature-phase EM31MK2 data very useful in the delineation of subsurface anomalous features.

The in-phase component of the EM31MK2 data is primarily used in searching for buried metal, and is measured in units of relative parts per thousand (ppt) of the magnetic field. A negative instrument response is usually expected over areas containing shallow buried metal (both ferrous and nonferrous).

Instrument Standardization

The EM31MK2 is assembled and calibrated as specified in the User's Manual. Additionally, the instrument will be field tested daily to ensure that it is operating properly.

Positional Data

Depending on site conditions, EM31MK2 readings are positioned using either GPS or line and fiducial methods. In open terrain where no vegetative canopy is present to block reception of GPS signals, NAEVA uses Trimble Real Time Kinematic (RTK) GPS to provide data positioning. GPS data are streamed into the data collector to provide cm level accuracy for the EM31MK2 readings. In wooded areas or other scenarios where GPS cannot be used, line and fiducial is used. This method requires the presence of grid corners or transect stakes at known locations for use as survey control. Low stretch polypropylene ropes painted with bands of alternating colors are placed at regular intervals, arranged perpendicular to the direction of travel in a grid. The ropes allow the operator to maintain straight, equidistant survey lines, with fiducials placed at regular spacing for correction of station spacing. Data are later warped during processing to obtain coordinates in State Planes or UTM.

Data Collection and Analysis

Whether the survey area has been established as a grid or as transect lines, the EM31MK2 is operated at a walking pace by one person. Data can be collected in either the horizontal or vertical dipole mode. Data are typically collected in the vertical dipole mode as the exploration depth is greater and the instrument is less sensitive to near surface metals. Data are collected such that the transmitter and receiver coils are parallel to the line direction.

EM31MK2 data are temporarily stored in a Juniper Allegro and then downloaded into a laptop computer for further on-site processing using Geonics' DAT31 and Golden's Surfer for Windows software. Criteria for determining significant anomalous areas to be selected for further investigation include:

- The maximum amplitude of the instrument response
- The maximum amplitude of response with respect the local background conditions
- Lateral extent of the anomalous area
- 2-dimensional shape of the anomaly
- Location of the anomaly with respect to the survey area edge
- Shape and amplitude of the anomalous response with respect to the known or expected response of anomaly sources within the study area.

Quality Control

All instruments will be calibrated according to manufacturer’s instruction each day and evaluated for repeatability. In order to assure proper positioning and data integrity (repeatability), a small percentage of all lines surveyed in a grid or transect area will be repeated. If any significant discrepancies exist in the positioning or repeatability of the data, the problem should be identified and corrected. Should corrective action be necessary, the study area should be resurveyed.

In order to ensure data integrity, all of the raw data will be carefully evaluated for potential problems by a trained geophysicist. Appropriate lag and heading corrections will be applied. If necessary, in-phase data will be normalized (leveled) to a background value of zero. If any significant discrepancies exist in the positioning or repeatability of the data, the problem will be identified, resolved, and documented.

Final Post-Processing and Submittal

Once the initial editing steps have been performed, the data will be transferred to NAEVA's corporate office for advanced analysis and map preparation of deliverables. Necessary corrections for positional latency will be applied and the data positions will be converted to a geographic coordinate system. If necessary, in-phase data will be normalized (leveled) to a background value of zero. Data will then be gridded, contoured, and displayed using Oasis Montaj.

MRP SOP 07:
EM61-MK2 DGM Surveys

NAEVA GEOPHYSICS INC.

THE LEADER IN SUBSURFACE DETECTION

Subsurface Geophysical Surveys

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Standard Operating Procedures for Geophysical Mapping

EM61 MK2

August 2012

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Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide specific procedures for data collection, processing and equipment for the geophysical investigations in support of a Remedial Investigation (RI) for site FTSH-017-R-01 at Fort Sam Houston in San Antonio, Texas.

Equipment and Theory

This SOP is applicable for the Geonics EM61-MK2, and Trimble's 5700/R7/R8 RTK (Real Time Kinematic) GPS.

The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. In comparison with other metal detectors, especially magnetometers, it is much better suited for work in close proximity to man-made structures and in areas of dense subsurface metallic debris (i.e. impact ranges). The Standard 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. Each of the two spatially separated receiver coils measures these eddy currents. The EM61-MK2 offers the ability measure the eddy currents at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded (as planned for this work). Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils are measured in millivolts (mV). The arrangement of coils is such that there is a vertical separation of 40 cm. Assuming accurate data positioning, target resolution of approximately 0.5 meters can be expected. The data is collected into Geomar's Nav61MK2 program and temporarily stored in an Allegro CX prior to downloading to a laptop computer.

Trimble's 5700 GPS is a 24-channel dual frequency RTK receiver that uses both L1 and L2 satellites. This system operates with a base and a rover unit; the base sends corrections to the rover via radio link, thus maintaining a 3cm horizontal accuracy and a 5cm vertical accuracy. For configuration with the EM61-MK2, the rover is set to output a GGA NMEA string at 1 Hz, which is captured into the NAV61MK2 program and on the Allegro CX.

Instrument Standardization

All instruments will be assembled and calibrated (where required) as specified in their User Manuals. Additionally, each instrument will be field tested daily to ensure that the instrument is operating properly (explained in Section 7).

Data Acquisition

Whether the survey area is established as grids or as transect lines, the EM61-MK2 is operated at a walking pace by one or two people. Data will be collected on wheels at one reading/10 cm or in tandem mode (the instrument is carried by two operators) with readings triggered at 10 readings/second. Selection of the appropriate method is based primarily on local terrain conditions. When GPS positioning is used data are collected in automatic mode at 10 readings/second regardless of collection method.

Instrument Setup

When the instrument is operated in wheel mode, it is setup according to Geonics EM61-MK2 manual. For tandem mode, the EM61-MK2 coils are centered and suspended on two 10ft long fiberglass poles. The instrument is attached to the poles using the top coil with zip ties and webbing. The webbing wraps around the poles and is attached to the bottom coil clamps. For both modes of data collection, the cables are taped and secured to prevent them from getting tangled and possibly disturbed by movement or vegetation. If GPS is used, a tripod is attached to the top coil and the satellite antenna is fastened to the top.

Navigation

Depending on site conditions, navigation of the system is accomplished through either Fiducial (FID) method or Global Positioning System (GPS/RTK) method.

The FID method is used in wooded areas where GPS positioning is unavailable. This method uses painted ropes positioned across each grid for the placement of fiducial marks within the recorded data. Local coordinates are warped to geodetic using reference locations (stakes) surveyed in by licensed surveyors on evenly spaced centers.

The second method of navigation is GPS/RTK. The base station is setup on a control point and corrections are sent via radio link to the rover receiver. The rover GPS antenna is mounted over the center of the EM61-MK2 coil and provides real time positional tracking capabilities that is streamed into the same software program as the EM61-MK2 data.

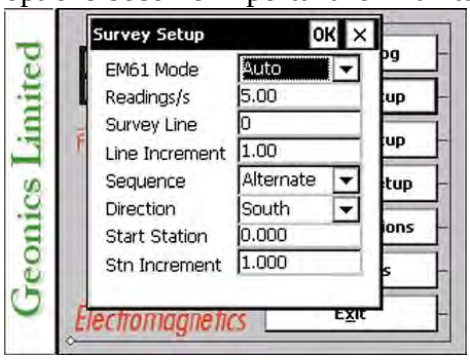
Data collection Steps

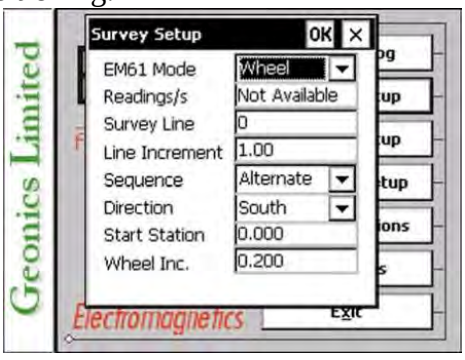
The following steps are followed to begin surveying with the **EM61-MK2 with fiducial positioning**:

1. Turn on the EM61-MK2 by pushing in the fuse on the top of the console/electronics.
2. Allow the instrument to warm up for at least 15 minutes.
3. Turn on the Allegro CX, and open the EM61MK2 program. The screen below will be displayed.

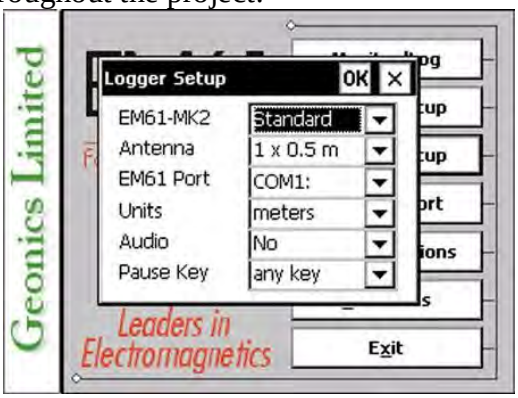
4. Click on “Survey Setup”, and specify the following options. Depending on surface conditions, the Mode is set to “Auto” and Readings/s is set to “10” or the Mode is set

to “Wheel”, Readings/s to “Not Available”, and Wheel Inc. to 0.1. The remaining options become important for maintaining positioning.



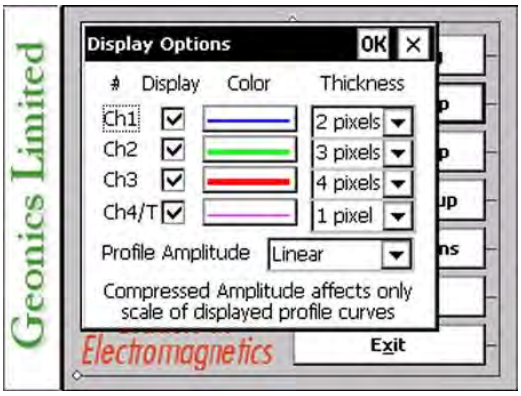


5. Click on “Logger Setup”, and specify the following options. These settings will remain as defaults throughout the project.

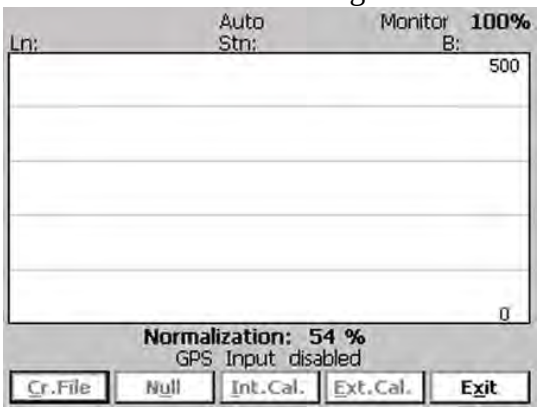


6. Click on “GPS Port Setup”, and make sure the *GPS Input* is set to “Disabled”, and all other options are grayed out.

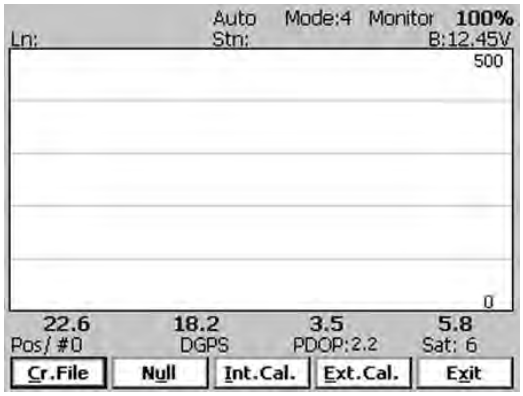
7. Click on “Display Options”, and specify the following options. These options are also operator preferences for aesthetics and do not affect the collected data.

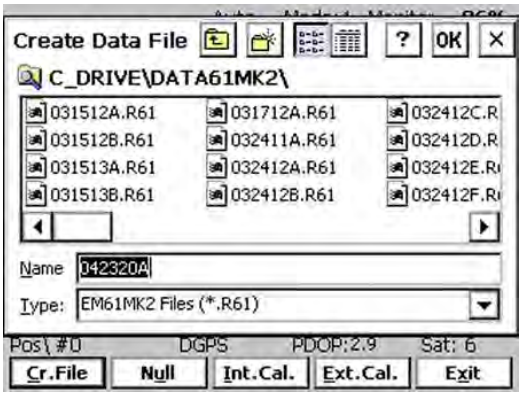


8. Once all parameters are set, click on "Monitor/Log". The screens shown below will be displayed while the instrument is normalizing.

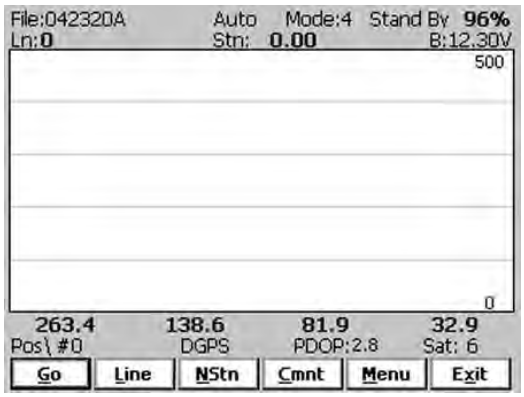


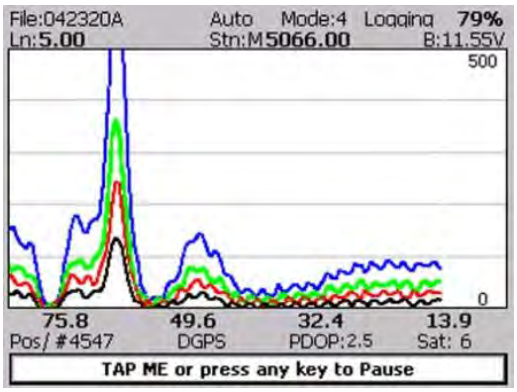
9. Once the Instrument has finished normalizing, find a quiet spot and *Null* the instrument. Then click on *Cr. File* and name and save the file.





10. Line up on the grid or transect and select *Go*. The software will begin logging the readings, and a *Pause* button will appear at the bottom of the screen. As the operator crosses over each rope (reference location) the fiducial button is hit adding a marker in the data which is later used in the editing of the data to accurately position the data. At the end of the line, tap the *Pause* button or hit enter on the keypad.

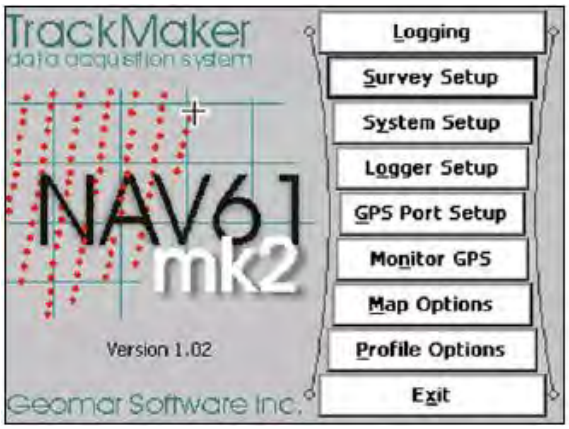




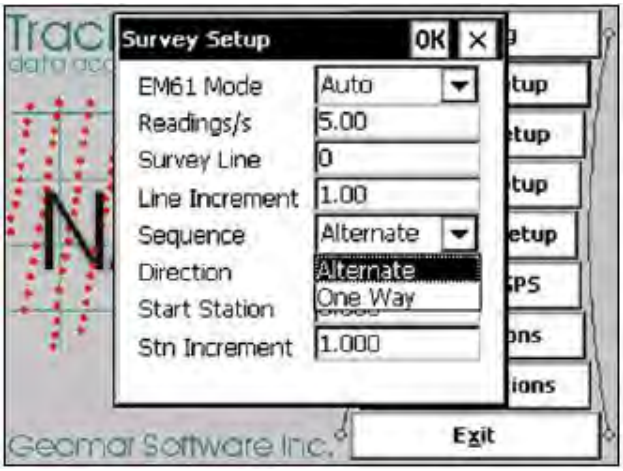
11. On the screens shown above, the EM61-MK2 data are monitored.
12. At the end of the file, select the *Exit* button. The file automatically saves at the end of every line.

The following steps are followed to begin surveying with the **EM61-MK2 with RTK GPS positioning assuming the GPS base station and GPS QC check have already been preformed**:

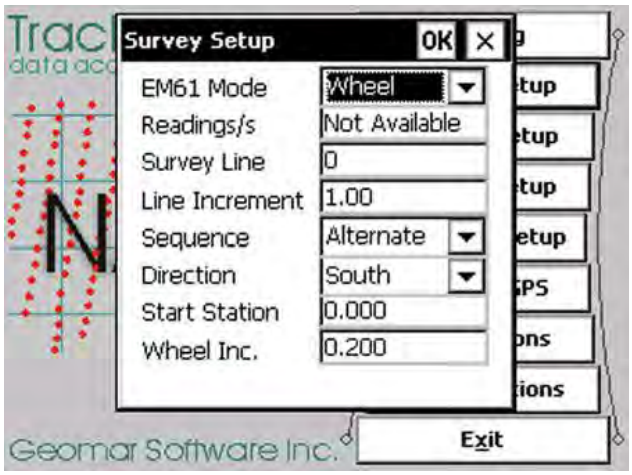
1. Turn on instrument by pushing in the fuse on the top of the console/electronics
2. Allow instrument to warm up for at least 15 minutes
3. Turn on Allegro CX and open NAV61MK2 program. The screen below will be displayed.



4. Click on "Survey Setup" and specify the below options. For this GPS/RTK Method, the Mode is set to "Auto" and Readings/s is set to "10". For Fid Method, the Mode is set to "Wheel", Readings/s is "Not Available", and Wheel Inc. now shows up instead of Stn Increment and it is set to 0.1. If the data is collected in locals using fiducials, the remaining options become important for maintaining positioning.



GPS/RTK Method



Fiducial Method

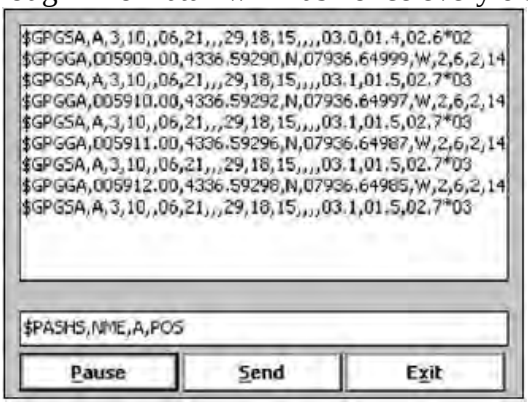
5. Click on "System Setup" and specify the below options. These setting will usually remain the same throughout the project.

6. Click on "Logger Setup" and specify the below options. These setting will remain the same throughout the project.

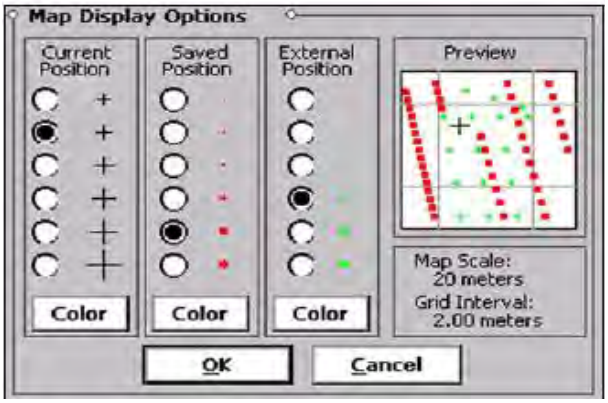
7. Click on "GPS Port Setup" and specify the below options. When using GPS the below setting will be used. For Fiducials, the *GPS Input* is set to "Disabled" and everything

else is grayed out. On the left side of the screen is where parameters can be set for alerts to go off if the GPS string is inadequate.

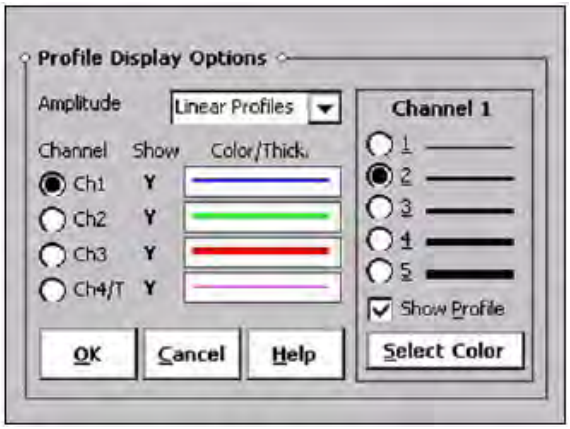
8. Click on "Monitor GPS" and the below window will open. If the NMEA string is coming in correctly, the screen will appear like the one on the left. If there is a problem with the baud rate, "No Data" will appear once a second. If there is nothing coming through "No Data" will flash once every 6 seconds.



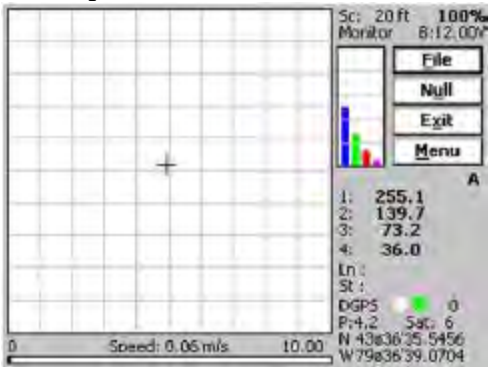
9. Click on "Map Options" and specify the below options. These are more operator preferences for aesthetics then for performance of the software.

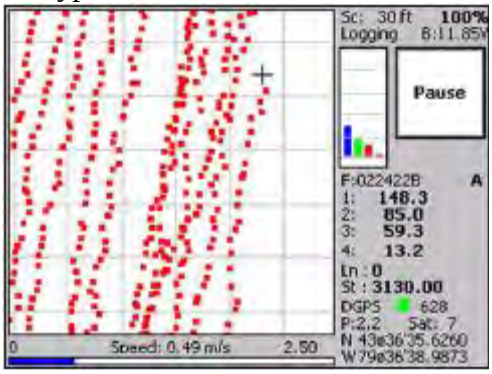


10. Click on "Profile Options" and specify the below options. These are more operator preferences for aesthetics then for performance of the software.



11. Once all the parameters are set click on the logging screen. The below screens will be displayed. Find a quiet spot and *Null* the instrument, then click on *File* and name your file and save it. Line up on the grid or transect and select *Go*. The software will start logging the readings and a large *Pause* button will appear on the screen. At the end of the line, tap the *Pause* button or hit enter on the keypad.





12. On the above screens, both the EM61-MK2 data and the GPS/RTK data are monitored, as well as the data coverage.
13. At the end of the file, the *Exit* button is selected. The file automatically saves at the end of every line.

Data Storage and Preliminary Processing

EM61-MK2 data are temporarily stored in the Allegro data logger via Geonics' EM61MK2 or Geomar's NAV61 software and then downloaded into a laptop computer for further on-site processing using Geonics' DAT61MK2 or Geomar's Trackmaker and Geosoft Oasis Montaj software.

Initial data processing is performed by the field team and includes reviewing data for integrity and repeatability. In the case of traditional surveying methods, positional data are edited based on the known locations of fiducial marks.

Post Processing

Once the initial editing steps have been performed, the data is turned over to NAEVA's processors for advanced analysis, target selection, and preparation of deliverables. The processor will go through five steps before the final data packages are delivered.

Step 1) QC of the field forms that have been uploaded from the PDA into the database. This QC check insures that the forms are filled out correctly with the following item

- The appropriate grid block name
- Transects associated with the block
- QC test file names (Static/Spike Tests, Personnel Test, Cable Shake Test and Latency Tests)
- Block file name
- Repeat file name
- Instrument used (EM61MK2 Wheeled, EM61MK2 Tandem)
- Collection/navigation method (RTK or FID)
- Daily conditions
- Cultural features

Step 2) Preprocessing of the QC tests and block data. The QC test data is actually finalized here but the block data is preprocessed. This step is to check the data for the following:

- Data quality
- Location
- Coverage
- Line path positioning
- Down line density
- Check of QC tests

First, a folder needs to be created where the Geosoft files are to be saved. Next open Geosoft and create a new project in the folder you just made (File – Project – New). There are separate projects for the QC tests and DGM Block(s).

After the project is created, several script files can be used in Geosoft that help expedite the preprocessing/processing procedures. They are listed below with a brief description. Alternately, each step may be conducted manually.

- **QC_Static_QC1.gs, QC_Static_QC2_etc.gs and QC_IVS.gs**. These scripts are partially interactive. *_QC1.gs includes Static/Spike, Personnel and Cable Shake test lines. *_QC2.gs includes just the Static/Spike test lines and the *_IVS.gs contains the IVS test line(s). The scripts do the following:

    - Asks you to name the new Geosoft database it is about to create.
    - Asks you to locate then import the Geosoft xyz file.
    - Asks for the correct import template. For this project, there are two different import templates: GPS/RTK and FID (Locals).
    - Asks for the file name that was just imported.
    - Set X and Y as current (Either in UTM zone or FID locals).
    - Preliminary auto levels and preliminary lag (lags IVS Test ONLY) corrects channels 1, 2, 3 & 4. The leveling gx is similar to the drift correct in Geosoft

except we use a median filter. Preliminary leveling for channel 1 is Low window = 0, High window = 80 and Window length = 100. Preliminary leveling for channel 2 is Low window = 0, High window = 75 and Window length = 100. Preliminary leveling for channel 3 is Low window = 0, High window = 65 and Window length = 100. Preliminary leveling for channel 4 is Low window = 0, High window = 60 and Window length = 100.

- Refine the leveling in the selected targeting channel. A larger or smaller window length if needed i.e. a larger window length may be needed over very high response features. Manual leveling if needed.
- Refine lag/latency of the data if needed (IVS test ONLY).
- Create Geosoft maps and print as PDFs.
- Add QC information to QC Analysis Spreadsheet.
- Export out completed processed Geosoft xyz file with header information.

The following are for the DGM Block Data:

- **01_Setup.gs**. This script is partially interactive. It does the following:
  - Asks you to name the new Geosoft database it is about to create.
  - Asks you to locate then import the Geosoft xyz file.
  - Asks for the correct import template. For this project, there are two different import templates: GPS/RTK and FID (Locals).
  - Asks for the file name that was just imported.

  If there is more than one block xyz file then **02_Import.gs** will be needed. It goes through the same steps as the 01_Setup script except naming and creating a new database. In most cases, there is just one xyz file with an associated repeat xyz file. After all block xyz files are imported, the next script to run is:
- **03_Import_Repeat.gs**. Again this script is partially interactive and does the following:
  - Asks you to locate then import the Geosoft repeat xyz file.
  - Asks for the correct import template. For this project, there are two different import templates: GPS/RTK and FID (Locals).
  - Asks for the file name that was just imported.

  If there is more than one repeat xyz file then run this script again until all repeats are imported.
- **04_Preprocessing.gs** (different ones for GPS/RTK and FID)
  - Warp FID Locals to appropriate coordinate system (FID Locals Preprocessing)
  - Set X_UTM and Y_UTM as current.
  - Makes x_d and y_d channels by using the differences filter by 1.
  - Creates a data_density channel then runs a math expression “data_density = sqrt((x_d*x_d)+(y_d*y_d)).
  - Creates and displays a data density map showing a 1.2m footprint for possible gaps and flags any readings over 0.2m.
  - Creates and displays a GPS Quality map (GPS/RTK Preprocessing)
  - Preliminary auto levels and preliminary lag corrects channels 1, 2, 3 & 4. The leveling gx is similar to the drift correct in Geosoft except we use a median filter.

Preliminary leveling for channel 1 is Low window = 0, High window = 80 and Window length = 100. Preliminary leveling for channel 2 is Low window = 0, High window = 75 and Window length = 100. Preliminary leveling for channel 3 is Low window = 0, High window = 65 and Window length = 100. Preliminary leveling for channel 4 is Low window = 0, High window = 60 and Window length = 100.

- Grids raw, leveled and leveled lagged data using MinCurv or Kriging with a grid cell of 0.2 and a blanking distance of 0.6.
- Creates and displays preliminary contour maps of the selected targeting channel with line paths.
- Selects the appropriate lines and asks for the combined preprocessed xyz file name to be exported with the correct export template. Exported as a Geosoft xyz file with header information.
- Selects the appropriate lines and asks for the combined preprocessed repeat xyz file name to be exported with the correct export template. Exported as a Geosoft xyz file with header information.

To finish the preprocessing, the following steps are to be taken:

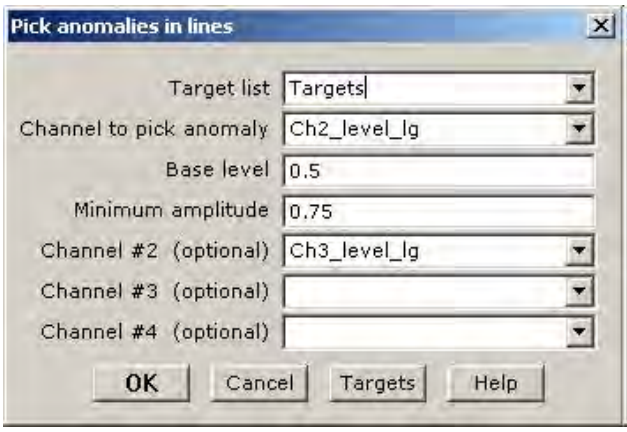
- Add appropriate culture files to the preliminary maps and any GIS/CADD information.
- Create Geosoft maps and pdf files of the preliminary repeat profiles.
- Fill out the Database (MRP Enterprise).

Step 3) QC of the preprocessing. The QC criteria are as follows:

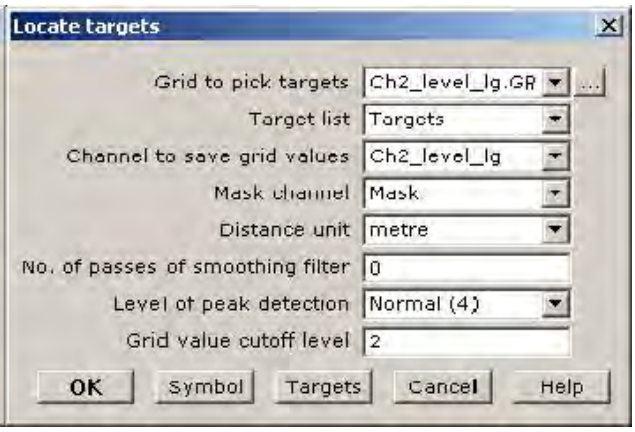
- Check Location & Coverage
- Check grid block name & corresponding grid cells
- Check that the appropriate file names are listed in the correct area in the database
- Check header information on the xyz files.
- Fill out QC of the preprocessing in the database
- Create a DGM Raw Data/Preprocessing Delivery Report
- Upload preprocessing xyz file & Raw Data Delivery Report to client's ftp site.

Step 4) Final processing stage. The final processor opens the Geosoft project created in Step 2 and performs the following:

- Refines the leveling in the selected targeting channel. A larger or smaller window length if needed i.e. a larger window length may be needed over very high response features. Manual leveling if needed.
- Refine lag/latency of the data if needed
- Add filters to the data if needed. Some filters you would expect to see are non-linear, low pass & high pass.
- Grid the data with MinCurv or Kriging. The parameters for both are a grid cell of 0.2 & a blanking distance of 0.6. Kriging better defines high response anomalies. MinCurv on the other hand will usually create false anomalies between lines near high response anomalies.
- Select anomalies in Geosoft's UX-Detect Module by using either "Pick Peaks Along Profile" or "Blakely Test"



Pick Peaks Along Profile



Blakely Test

- Refine target selection. Check validity and position. Targets found to be invalid or incorrectly located are adjusted or removed. Additionally, anomalies not selected by UX-Detect, yet deemed to represent a potential UXO target, are being manually selected.
- Export out completed grid block processed Geosoft xyz file with header information.
- Split target Geosoft databases into their grid cells.
- Re-sort the target database by shortest path and if needed, add any additional four point polygon targets (Data Gap Polygons or Heavily Saturated Area Polygons) to the end of the target list. Export a Geosoft xyz file with header information.
- Create and display a colored contour Geosoft map(s) of the grid cell(s) with the following; title block, color scale, index map, legend, target locations & target numbers.
- Create a pdf of the colored contoured grid cell map(s).
- Create and display final repeat profiles with line path profiles.
- Create pdfs of the final repeat profiles.
- Fill out DGM processing form in the database (MRP Enterprise).
- Export out repeat processed Geosoft xyz file with header information.
- Create a final delivery package that includes the following:
  - All the Geosoft colored contour grid cell maps that are included in the grid block.
  - All the pdfs for the grid cell maps that are included in the grid block.
  - Repeat Geosoft maps with their pdfs. The repeat maps will go into the QC by block folder on the ftp site.
  - Processed Geosoft xyz files of the grid block & repeat data. The repeat xyz files will go into the QC by block folder on the ftp site.
  - Geosoft grd files for the grid block.
  - Target lists in both xls & xyz formats (the xls is in MRP Enterprise format).

Step 5) QC of the processed data. The QC criteria are as follows:

- Check to see if leveling and the lag is appropriate.
- Check anomaly selections on the maps, xyz file and xls file.
- Check maps title block, index map and legend (map & pdf).
- Check repeat data profiles (map & pdf).

- Check header information on xyz files.
- Check entries on the processing form in the database (MRP Enterprise).
- Get QC data (maps, pdf's & xyz files) for the corresponding block. Add repeat data (maps, pdf's & xyz files). Zip it. Upload to client ftp site.
- Fill out QC form in the database then create a "Final Data Delivery Report". Add this report to the final delivery package listed above. Zip it. Upload to client ftp site.

Quality Control

The following quality control (QC) procedures are performed and documented during the data collection process and reviewed by a qualified geophysicist on a daily basis.

1. Equipment Warm-up: For at least 15 minutes
2. Record Sensor Positions: Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each workday.
3. Personnel Test: This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each workday.
4. Cable Shake Test: On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response will be observed in the field for immediate corrective action, transmitted back to the processor, analyzed, and checked for spikes in the data that can possibly create false anomalies. The vibration test will be conducted at the beginning of the survey operation for each workday.
5. Static Background and Static Spike: Static tests will be performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic contacts and collecting data for a 3-minute period. During this time, the instrument will be held in a fixed position without a spike (known standard), with a spike and then without a spike. The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist. The static background and static spike test will be conducted at the beginning and end of each grid block.
6. Repeat Data: This test is performed to verify repeatability of the data and will be performed after the initial survey over an area. At least 2% of the survey lines will be repeated.

All work will follow the extensive QC program laid out in the Work Plan. In addition, the NAEVA will demonstrate the performance of each DGM system prior to its use at an Instrument Verification Strip (IVS), as described in the GSV Plan. The continued performance of each DGM system used will also be documented daily at an IVS.

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MRP SOP 08:
Anomaly Pin-Pointing (Reacquisition) Surveys

NAEVA GEOPHYSICS INC.
THE LEADER IN SUBSURFACE DETECTION
Subsurface Geophysical Surveys

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Standard Operating Procedures for Reacquisition

August 2012

1.

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1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide specific procedures for reacquisition of targets selected by NAEVA for EM61-MK2 data, positioned using GPS.

2. Equipment and Theory

This SOP is applicable for the Geonics EM61-MK2, and Trimble's 5700/R7/R8 RTK (Real Time Kinematic) GPS.

The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. In comparison with other metal detectors, especially magnetometers, it is much better suited for work in close proximity to man-made structures and in areas of dense subsurface metallic debris (i.e. impact ranges). The Standard 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. Each of the two spatially separated receiver coils measures these eddy currents. The EM61-MK2 offers the ability measure the eddy currents at three distinct time intervals in the bottom coil or four intervals if no top coil measurements are recorded (as planned for the Vieques work). Earlier time gates provide enhanced detection of smaller metallic objects. Secondary voltages induced in both coils are measured in millivolts (mV). The arrangement of coils is such that there is a vertical separation of 40 cm. Assuming accurate data positioning, target resolution of approximately 0.5 meters can be expected. Data are collected using Geomar's Nav61MK2 program and temporarily stored in an Allegro CX prior to downloading to a laptop computer.

Trimble's 5700 GPS is a 24-channel dual frequency RTK receiver that uses both L1 and L2 satellites. This system operates with a base and a rover unit; the base sends corrections to the rover via radio link, thus maintaining a 3cm horizontal accuracy and a 5cm vertical accuracy. For configuration with the EM61-MK2, the rover is set to output a GGA NMEA string at 1 Hz, which is captured into the NAV61MK2 program and on the Allegro CX.

3. Instrument Standardization

All instruments will be assembled and calibrated (as required) as specified in their User Manuals. Additionally, each instrument will be field tested daily to ensure that the instrument is operating properly (explained in Section 5).

4. Equipment and Positioning

4.1. Instrument Setup

When the instrument is operated in wheel mode, it is setup according to Geonics EM61-MK2 Manual. For tandem mode, the EM61-MK2 coils are centered suspended on two 10ft long fiberglass poles. The instrument is attached to the poles by the top coil with zip ties and webbing. The webbing wraps around the poles and is attached to the bottom coil clamps. For both modes, the cables are tape to keep them from getting tangled and possible yanked out by brush. If GPS is used, a three-leg tripod is attached to the top coil and the satellite antenna is fastened to the top. Reac is nearly always conducted using the wheel mode configuration for the EM61-MK2.

4.2. Navigation

Depending on site conditions, navigation of the system is accomplished through either Fiducial (FID) method or Global Positioning System (GPS/RTK) method. If fiducials were used for data collection, reac is conducted using tape measures to find the local grid coordinate where the target

is reportedly located. Grid corners for fiducial surveys are known locations surveyed by a Professional Land Surveyor (PLS).

5. Quality Control

The following quality control (QC) procedures are performed, documented, and reviewed by a qualified geophysicist on a daily basis.

- Equipment Warm-up: For at least 15 minutes
- Record Sensor Positions: Positioning accuracy of the final processed data will be demonstrated by operating the equipment over one or more known points. The accuracy of the data positioning will be assessed by calculating the difference between a known location over which a positioning instrument is held and the displayed position. The sensor position test will be conducted at the beginning of the survey operation for each workday.
- Personnel Test: This test checks the response of instruments to personnel and their clothing/proximity to the system. On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to the personnel operating the system. The response will be observed in the field for immediate corrective action and transmitted back to the processor, and analyzed and checked for spikes in the data that can possibly create false anomalies. The personnel test will be conducted at the beginning of the survey operation for each workday.
- Cable Shake Test: On a daily basis, the instrument coils/sensors for those instruments being used that day will be checked for their response to vibrations in the cables. The response is observed in the field for immediate corrective action, transmitted back to the processor, analyzed, and checked for spikes in the data that can possibly create false anomalies. The vibration test is conducted at the beginning of the survey operation for each workday.
- Static Background and Static Spike: Static tests are performed by positioning the survey equipment within or near the survey boundaries in an area free of metallic contacts and collecting data for a 3-minute period. During this time, the instrument will be held in a fixed position without a spike (known standard), with a spike and then without a spike. The purpose of the static test is to determine whether unusual levels of instrument or ambient noise exist.

6. Target Reacquisition

Target reacquisition will be performed using the same equipment (Geonics EM61-MK2 and Trimble RTK GPS) as was used during geophysical data collection. Equipment set-up, calibration, and Quality Control checks will be the same as the descriptions provided above with the exception that the dynamic QC tests (such as collection of repeat data) will not be performed since digital geophysical data will not be recorded during this phase of the investigation.

The coordinates of all targeted anomalies selected for reacquisition and intrusive investigation will be loaded into a Trimble Survey Controller. The field team will then navigate to each target location using a GPS Rover. The Survey Controller's on-screen display will be used to ensure that the anomaly locations are marked to within 6 inches of their targeted coordinates. Targeted anomalies will be marked in the field using a non-metallic pin flag labeled with the target ID.

Once all of the targets in a subset of the field area have been marked with the GPS, the locations will be refined using an EM61 MK2. The instrument is operated in monitor mode in which response from all

four channels can be observed in real time. The operator will slowly maneuver the instrument over each flagged location searching for the peak response in the targeted channel. Once the peak has been located, the operator will turn the instrument 90 degrees and look for the peak again. Each anomaly is checked in at least two perpendicular directions, but more orientations may be used at the operator's discretion. Once the absolute peak has been identified, the response from the targeted channel will be recorded along with any offset from the original targeted location. The pin flag will then be moved to the new location and the team will repeat this procedure at the next target.

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MRP SOP 09:
3-D CI Surveys

NAEVA GEOPHYSICS INC.

THE LEADER IN SUBSURFACE DETECTION

Subsurface Geophysical Surveys

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Standard Operating Procedures for

Three-Dimension Cued-Interrogation (3-D CI)

September 2012

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Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe general procedures for interrogation of selected targets using advanced sensors, including the Geometrics MetalMapper and the TEMTADS 2x2, both of which are considered Three-Dimensional (3-D) Cued-Interrogation (CI) multi-sensor systems. Both 3-D CI sensor systems for the post-acquisition implementation of advanced classification techniques on the multiple sensor readings in order to obtain a much higher confidence of ordnance versus non-ordnance items based on a comparing the multiple readings against a catalogue library of readings. The general concept is to compare the library set of readings against the readings gathered in the field, to obtain a confidence between the two sets of signatures. Ultimately, the two sets of signatures can vary based on geometric shapes, material properties, material thicknesses, and overall size, which are the correspond to signal attributes which are leveraged during the advanced classification process and generated much finer-tuned results than previously available.

Equipment and Theory

The MetalMapper and the TEMTADS 2x2 are described in the paragraphs below. Both systems are most commonly used to interrogate targets that have been identified from previous EM61 MK2 geophysical mapping. Navigating to the selected target is accomplished through the use of a utility in the data acquisition software, using Real Time Kinematic (RTK) Global Positioning System (GPS), or alternatively, the locations may be pre-marked with flags using other positioning methods (e.g., Robotic Total Station (RTS), tape-line, wheel-odometer, etc.) , if RTK-GPS is not available or feasible at the time of reacquisition.

MetalMapper Antenna Platform

The MetalMapper's three transmitting loops are positioned as follows:

- Z transmitter (vertical axis): 1m x 1m, center is ~15cm above ground level. The center of the Z loop is taken to be the local origin of coordinates for the cart.
- Y transmitter (horizontal axis in direction of travel): 1m x 1m, centered 0.56m above the origin.
- X transmitter (horizontal axis clockwise from Y): 0.98m x 0.98m, centered is 0.56m above the origin.

The MetalMapper's seven receivers are positioned as shown in **Figure 1**. Note that the seven receivers traverse profiles that are 13 cm apart in the cross-track (x) dimension. A photo (**Figure 2**) of the MetalMapper 3-D CI sensor system platform, as mounted in front of a tractor as conducted by NAEVA at recent ESTCP sponsored demonstration project at Camp Spencer TN.

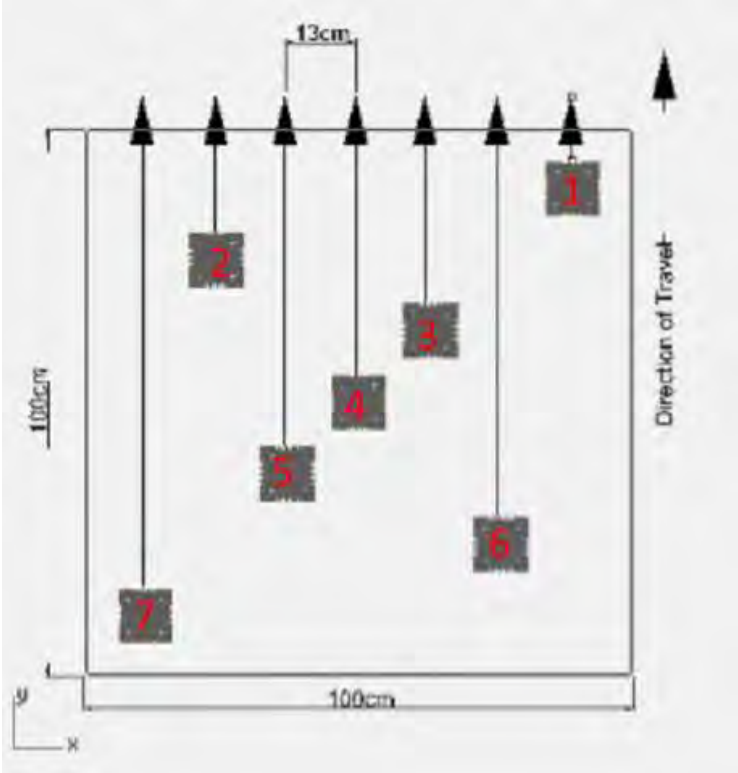

FIGURE 1: METALMAPPER RECEIVER CUBE LOCATIONS

FIGURE 2: METALMAPPER AT SPENCER TN DEMONSTRATION SITE

TEMTADS MP 2x2 Platform

The TEMTADS 2x2 makes use of 4 electromagnetic (EM) coils that serve as transmitters, each with dimensions of 35cm by 35cm. The coils are placed side by side in the arrangement shown below, in Figure 2. The sensors are located 40cm from center to center of each coil. Inside each transmitter coil lies a receiver cube with a vertically oriented receive coil. This system records data from 16 combinations of transmit/receiver coils (4 x 4).

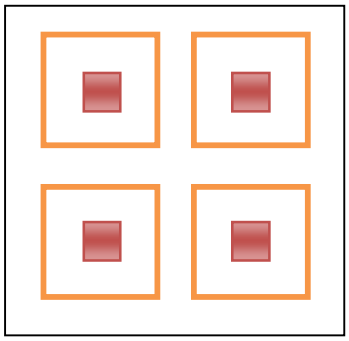

FIGURE 3: TEMTADS 2X 2 TRANSMITTER AND RECEIVER ARRANGEMENT

FIGURE 4: TEMTADS 2X2AT SAN LUIS OBISPO DEMONSTRATION SITE

Signals and Timing

The descriptions below are primarily for the MetalMapper, although key points are common to the TEMTADS system as both systems use very similar hardware for data acquisition and software platforms to monitor and process the data. One major difference is the lack of x and y EM transmit coils in the TEMTADS, so that the EM transmit coils are oriented in only one (Z) direction. Data are acquired in time blocks that consist of a fixed number of transmitter cycle "repeats". Both the period (T) and the repeat factor (N) are operator selectable and are varied in multiplicative factors of 3. The MetalMapper also averages an operator-specified number of acquisition blocks (*nStacks*) together before the acquired data are saved to disk.

The decay transients that are received during the off times are stacked (averaged) with appropriate sign changes for positive and negative half cycles. The decays in an individual acquisition block are stacked and the decays in that block are averaged with other acquisition blocks (assuming the operator has selected *nStack* greater than one). The resultant data are saved as a data point. During the time period that a data point is being collected, the MetalMapper averages all GPS readings received. If no GPS readings are acquired during that period, the most current GPS position and the platform attitude angles (magnetic heading, pitch, and roll) are used. GPS points are non-synchronously acquired at 20 points per second. Therefore, depending on relative timing, GPS coordinates stored with the data are either the most recent fix, or the average of fixes received during the data point collection interval. Using block period and the number of repeats settings, the sample rate can be varied depending on the desired data density.

Timing of all EM signals including transmitter switching and receiver sampling is controlled by hardware that is programmable by software. The MetalMapper collects data in a so-called double-buffered mode, meaning that the data samples from a previously collected data point are processed and stored concurrently with acquisition of the next data point. If computer processing cannot maintain pace, one or more succeeding data points are skipped. For normal surveying activities, data points are rarely skipped.

The MetalMapper has two data acquisition modes: Single Point Mode and Continuous-Mode. Data collection and processing within the DAQ is the same for either mode. In single-point mode the system collects a data point as previously described and then terminates acquisition. The data are stored as a single data point in the output data file. In continuous mode, the system initiates collection of a new data point concurrently with completion of the previous data point and continues until the operator intervenes. All of the data points are stored to the same output data file. TEMTADS is currently configured only for data collection in Single Point Mode.

Once acquired, the decay transients in a data point are decimated into a set of logarithmically spaced time gates. Received signals are sampled at a rate of 250 kHz. After initiating turn-off of the transmitter, the system initiates a time delay (e.g., 100μs) determined by a hold-off (*HOff*) parameter. Thereafter, digital samples falling within a specific time gate are averaged and become the value of the signal for that time gate. The widths of the gates are specified by the *WinWidth* parameter. Window width is specified as a percentage in time, so window widths at later times are wider. A window is never narrower than one data sample (4 μs).

CALIBRATION ACTIVITIES

An initial calibration check of the system is performed when the advanced sensor is first used, which includes the use of a calibration item held near each sensor and performing an inversion on the cued readings to check that user-configurable system configuration options are correctly set. Calibration checks of the MetalMapper system are performed at least two times per day as part of routine QA/QC procedures. Background readings are collected every 60 to 90 minutes using the MetalMapper, and approximately every 30 minutes with the TEMTADS 2x2. An example of IVS system checks conducted at another site listed in **Table 1**, but the system checks and IVS setup can be tailored to the specific project based on the availability of inert ordnance items of interest relative to the commonly available Industry Standard Objects (ISO's).

TABLE 1: EXAMPLE INSTRUMENT VERIFICATION STRIP SETUP

Item ID	Description	Design Easting (m)	Design Northing (m)	Depth (m)	Inclination	Azimuth
T-001	Shot put			0.30	N/A	N/A
T-002	37 mm projectile			0.15	Horizontal	Across Track
T-003	75 mm projectile			0.30	Horizontal	Across Track
T-004	Blank space			N/A	N/A	N/A
T-005	Small ISO			0.15	Horizontal	Across Track

The calibration procedure is enumerated below:

1. Acquire a static background data set over a designated "background" point (T-004 in the IVS). Acquisition parameters are set at the recommended values for data acquisition (**Table 2**).
2. Acquire cued measurements over each IVS target twice-daily.
3. Acquire a dynamic data set over the IVS twice-daily.

TABLE 2: RECOMMENDED ACQUISITION PARAMETERS FOR METALMAPPER

Mode	Tx Coils	Hold-Off Time (µs)	Block Length (s)	Num Blocks	Window Width (%)	Num Stacks	Sample Rate (Hz)
Static	ZXY	50	0.9	27	10	10	N/A

The calibration procedure provides all the data required to perform a variety of QA/QC checks that document that the instrument is functioning correctly. Moreover, the resulting data will be used to establish the long-term stability of the instrument response. A series of static

measurements will also be collected over the Test Pit. These measurements will include the measurement of background over the empty pit plus measurements of four objects at four orientations and at least one depth. **Table 3** indicates an example suite of the minimum data required to be taken at the Test Pit. These measurements will be used as training data.

TABLE 3: EXAMPLE OF MINIMUM TEST PIT CALIBRATION DATA

Items	Depths (cm)	Orientations	
• 37mm projectile • Small ISO • 75mm projectile • 105 mm projectile	At least one to give high SNR	Nose Up	Horizontal
		Nose Down	45° Inclination

DATA COLLECTION PROCEDURES

MetalMapper data are collected using the EM3DAcquire software provided by Geometrics. Static mode data collection is employed for cued surveys, where the antenna platform remains motionless during the period of data acquisition. Depending on the acquisition parameters (i.e., sample period, and stacking parameter) it can take 10's of seconds to complete a static measurement. The results of the static measurement are written into a binary data file containing only a single data point representing the average (stacked) result usually over 10's or even 100's of repetitions of the transmitter's base frequency. Static measurements are acquired over a decay of 8.328 ms using all three transmitter coils while dynamic measurements have a decay of 0.924 ms with a single stack. All field work will be performed by two team members and follow all other site-specific rules in accordance with the Health and Safety Plan (HASP) and the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) documents.

Sample Density

Sample considerations do not apply when acquiring data in static mode. Normally, the target position is reacquired using GPS together with visual feedback from the DAQ (Panasonic touch-screen terminal). Once the platform is positioned approximately over the target, a single data point is acquired using the static-mode acquisition parameters indicated in Table 4. At the end of the acquisition cycle, the acquisition software generates a data plot that provides a visual check on the data quality. Key elements in determining productivity for these type of surveys is 1) the ability to rapidly and accurately maneuver the center of the antenna platform over a desired target point, and 2) how long data must be acquired. For an experienced data collection crew, typical production rates for static data collection using the MetalMapper are on the order of 200-300 pts/day, depending on target density and site terrain. Dynamic data are collected at a sample rate of 10 readings per second with only a single transmitter loop.

Quality Checks

An instrument calibration check will be conducted a minimum of twice a day (at the beginning and the end of the field day) and frequently at more times during the day. These checks provide assurance that the instrumentation is functional, properly calibrated, and stable. A static test will be performed twice daily over a blank space in the IVS. The calibration procedure generates a

measurement of the static background response at a fixed position. However, if there are significant changes in background response between the IVS and the survey location, an adequate number of background points will be selected for daily testing to adequately represent the background variations. Background data at the identified point(s) will collected before and after static data acquisition on actual target points in the vicinity. The necessary frequency and locations for these measurements will be determined on site with the assistance of Geometrics. Cued measurements will be taken over each item in the IVS and evaluated for repeatability in the derived polarizabilities. The IVS will also be surveyed dynamically twice daily and evaluated for consistent amplitude and positioning.

Data Handling

Data are recorded in binary format as files on the hard disk of the MetalMapper DAQ. These data are offloaded to other media at least once, and sometimes more frequently, per day. A data processor will be on site for the duration of the project to facilitate data handling. The data file names acquired each day are cataloged and integrated with any notes or comments that the operator provides in his field book. All data end up on the hard drives of one or more laptop computers used to post-process data. They are also uploaded to NAEVA's office and archived to a large capacity hard drive. The export of each of the raw (binary) static data files to a .CSV file is achieved with the TEM2CSV program. The Program office will be supplied with both raw and pre-processed data in a text readable format as required for archiving and/or transmittal to participating demonstrators not collecting their own data.

Static targets will be identified according to the ID determined for each target picked in the dynamic EM61-MK2 survey. In the case of repeated measurements associated with a single target point, this unique Target ID will be carried forward to the repeat target list. On target lists containing target numbers to be repeated, a letter will be appended to the original Target ID. Static targets identified in the MetalMapper dynamic survey will have a different numbering scheme to differentiate them from the open field EM61-MK2 targets.

The MetalMapper acquisition software has implemented a convention for assigning a unique name to each data file without the need to manually enter the name. The operator supplies a prefix for the root name of the file. The acquisition software then automatically appends a 5-character numerical index to the filename prefix to form a unique root name for the data file. The index is automatically incremented after the file has been successfully written. Although the Target ID is not used as the file name in the raw, binary data file, the Target ID will be incorporated into the file name of the .CSV files exported after preprocessing. QC files require appropriate prefixes to identify test pit measurements, static tests, and cued versus dynamic data.

Data files will be provided in both raw and pre-processed formats. The following operations will have been performed on the pre-processed data files:

1. **Coordinate Conversion:** GPS latitude/longitude will be converted to Universal Transverse Mercator (UTM) NAD83 coordinates.
2. **Coordinate Corrections:** Using cart attitude angles (heading, pitch, and roll) the UTM coordinates will be corrected to the MetalMapper platform reference point. If the platform is stationary and no GPS heading information is available the system can use an approximate magnetic declination specified in the EM3DAcquire.ini file to determine

heading. The magnetic declination at the site will be determined in advance, and will be applied to the system.

3. **Background Removal:** An appropriate background will be removed from all the receiver transients so that values in the file will be estimates of the secondary fields after background has been removed.

Attachment 2
ESS-DR Approval Letter

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DEPARTMENT OF THE NAVY
NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY
FARRAGUT HALL
3817 STRAUSS AVENUE, SUITE 108
INDIAN HEAD, MD 20640-5151

8020
Ser N47/2144
11 Dec 12

From: Commanding Officer, Naval Ordnance Safety and Security Activity
To: Commanding Officer, Naval Facilities Engineering Command Southeast (OPDE3)

Subj: EXPLOSIVES SAFETY SUBMISSION DETERMINATION REQUEST FOR FLEMING KEY 27 ACRE DREDGE SPOIL PILE AREA AT NAVAL AIR STATION, KEY WEST, FLORIDA

Ref: (a) E-mail NAVFAC Southeast (OPDE3) Mr. B. Syme/ NOSSA (N47) Ms. K. Garcia of 29 Nov 12 (w/encl)
(b) NOSSAINST 8020.15C
(c) NAVSEA OP 5, Volume 1, Seventh Revision, Change 10
(d) NOSSA ltr 8020 Ser N535/1175 of Aug 10

1. As requested by reference (a), the Naval Ordnance Safety and Security Activity (NOSSA) reviewed the subject Explosives Safety Submission (ESS) Determination Request (DR) in accordance with references (b) and (c). Based on the information provided, NOSSA has determined that an ESS is not required to conduct an Expanded Site Inspection (SI) at the 27 acre Fleming Key Dredge Spoil pile area, Naval Air Station, Key West, Florida.

2. As outlined in your request, we understand that the likelihood of encountering Munitions and Explosives of Concern (MEC) and/or Material Potentially Presenting an Explosive Hazard (MPPEH) during the proposed project has been determined to be low and that the following conditions apply:

a. Similar to the SI field work authorized by reference (d), anomaly avoidance techniques shall be employed by Unexploded Ordnance (UXO) qualified personnel to support operations and to avoid contact with MEC or MPPEH. No intentional physical contact or other intrusive activities with MEC/MPPEH are authorized.

b. In areas clearly defined as clear of anomalies by UXO qualified personnel, the following operations will be performed: vegetation clearance to no lower than 6 inches above ground

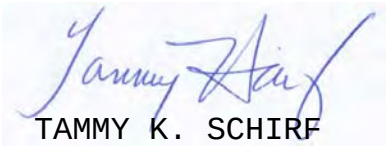
surface; emplacement of benchmarks, transects and grid corners; a detector aided visual survey; surface and subsurface blind seeds placement; and a Digital Geophysical Mapping survey.

c. Any site visitors will be escorted by UXO-qualified personnel.

d. The site is within existing explosives safety quantity distance arcs, but outside of K18 intraline distance from any potential explosion site.

3. If surface MEC or MPPEH is discovered on the site while employing anomaly avoidance techniques, the item will be avoided and its location and description will be reported to the cognizant Explosive Safety Officer and the Navy Project Manager. An emergency response from the cognizant Explosive Ordnance Disposal detachment will be requested, if appropriate.

4. The NOSSA point of contact for this ESS DR is Ms. Kathy Garcia who can be contacted at commercial at 301-744-5636.



TAMMY K. SCHIRF
By direction

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