

DRAFT
SYSTEMATIC PROJECT PLANNING MEMORANDUM
for the
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
FORT MYERS BOMBING AND GUNNERY RANGE
CHARLOTTE COUNTY, FLORIDA

Submitted to:

U.S. Army Corps of Engineers



March 2019

Fort Myers Bombing and Gunnery Range (BGR) Remedial Investigation/Feasibility Study (RI/FS)

SYSTEMATIC PLANNING MEETING MINUTES

Meeting Date / Time 27 February 2019 at 0900-1200 ET

Location: Hive Meeting Room, Founders Square, Babcock Ranch, FL

Prepared by: Parsons

Attendees (Sign-in Sheet presented in Attachment 1):

John Keiser (U.S. Army Corps of Engineers, Jacksonville District (CESAJ) Formerly Used Defense Site [FUDS] Program Manager)

Frank Araico (CESAJ Program/Project Manager [PM])

Hud Heaton (U.S. Army Corps of Engineers, Huntsville Center [CEHNC] Contracting Officer's Representative [COR])

Daryl Donatelli (CEHNC Geophysicist)

Barry Hodges (CEHNC Technical Manager [TM])

Mike Malone (CEHNC Chemist)

Donna West-Barnhill (CESAJ Public Relations Contractor)

Jim McCarthy (Florida Department of Environmental Protection [FDEP])

Mike Kemmerer (Babcock Web Wildlife Management Area [WMA], District Wildlife Biologist)

Laura Kelley (Parsons PM)

Nancy Schur (Parsons Deputy PM)

John Baptiste (Parsons Senior Geophysicist)

Mike Coon (Parsons MEC Operations Manager)

MEETING OBJECTIVE

Review RI/FS Technical Approach through a PowerPoint presentation (Attachment 2) that highlighted the main information from select portions of the Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP). Draft versions of Worksheets 10, 11, 12, and 22 were also provided, included in Attachment 3.

DISCUSSION POINTS

General Discussion

- Prior to the start of the presentation Barry Hodges noted that they had recently discovered that Kelly Longberg (CEHNC) was originally assigned as Technical Manager for this project and that she will be transitioning into the role moving forward. Barry stated he would remain on the project team until Kelly was fully engaged and up to speed.
- Laura Kelley presented a safety brief, discussed the facility layout, and provided options for lunch.
- The team did introductions around the table. The conference call line was open throughout the meeting; however, no invitees participated via phone.

PowerPoint Presentation

- Slide 2 –Laura stated that the slides and the approach presented in this presentation and select Draft UFP-QAPP worksheets provided were intended as a starting point to open discussion on the technical approach. The objective of this meeting was to discuss and refine the approach as a team. Minutes will be provided to document the meeting discussions.

- Slide 3 – Reviewed the meeting agenda to include the Project Communication/Public Involvement, Site History/Overall Project Goals, Conceptual Site Models, and Data Quality Objectives. A site visit was planned for the afternoon portion of the meeting.
- Slide 4 – Reviewed the list of Project Stakeholders. Frank Araico asked Mike Kemmerer if there were any other stakeholders that should have been invited to the SPP Meeting. Mike indicated that he was not aware of any others.
- Slide 6 – Reviewed the project contact list. John Keiser indicated that his phone number had been transposed and the last four digits should be 1758 (corrected on slides included with Memorandum).
- Slides 7&8 – Donna West-Barnhill presented the slides on public involvement. She stated that we are at a point in the CERCLA process with increased public involvement. We are required at this stage to solicit for interest in forming a Restoration Advisory Board (RAB). This is intended to allow the impacted public to have a say in the restoration process. Donna indicated that the present interest indicates to her that a RAB is probably not needed, but the SPP Meeting helps us get information from the stakeholders and get a feel for the need for a RAB at the site. She indicated that as part of the process a public notice will be placed in the newspaper and a fact sheet will be prepared. A list of common questions and answers may be prepared to go along with the fact sheet, if needed. John Keiser brought up that generally the cut-off is having 50 people express interest in order to pursue formation of a RAB. Donna said there are situations where less than 50 people with interest could trigger the need for a RAB. She said an example would be if a local official/representative requested the formation of a RAB. Donna indicated that a Community Survey is part of the process; however, the Wildlife Management Area layout is not conducive to setting up a booth to attempt to survey the public site users. Frank asked Mike K. if there were hunt clubs we should try and contact for interest. Mike indicated that they have done surveys five or six times on the subject and that since he has been involved no one has shown any interest.
- Slide 9 – Laura presented the site layout and history. She pointed out that the slides provide a summary of the detailed information available in the Draft UFP-QAPP worksheets (included in the back of the meeting handout). Mike K. asked what the difference was between what we did before and what we are doing now. Frank explained the previous tasks and that this effort would look closer at the risk and make recommendations for remedial work, if needed. Nancy added that the RI is more about determining the extent of the munitions, the distribution, and what types of munitions may be present. Laura added that the RI is the characterization phase intended to determine the nature/extent and determine if further action is needed. Mike Coon presented a brief description of the different ranges at Fort Myers BGR. He explained that for the skip bombing training, the planes would be dropping the bombs at an angle from a lower altitude. The purpose for this bombing was to skip the bomb along the ground in order to enter an opening like a cave or a bunker. The demolition bombing would have dropped bombs at a straight angle, falling directly towards the ground surface, using both practice and high explosive munitions. The dive bombing training would be similar to the demolition bombing range using steeper angles, using only practice munitions. For the air-to-ground (ATG) gunnery range training they would have flown along the flight path and fired at a single line of target berms across the range as they passed over. Frank added that on this range they would have been assigned a specific target berm to fire upon and they would have a foul line set up that if they fired after crossing it, they would fail the test. Mike C. indicated that the strafing range would have included several targets in a line throughout the interior portion of the range and they would have been trying to hit each of them as they flew over.
- Slide 10 – Laura presented the overall project goals and methods. John K. explained how the RI fits in to the CERCLA process. He stated that the SI was intended to determine if there was a potential problem and that each step in the process looks closer in order to avoid wasting money on future efforts if they aren't needed.
- Slide 11 – Laura presented the Skip Bombing Range Conceptual Site Model (CSM). Mike C. stepped in to explain the three types of spotting charges used in the M38A2 practice bomb. The M1A1 was the most common and gives off a light smoke, the M3 gives off a dark smoke and was generally only used on snow. The munitions were thin walled and tended to crumple on impact. With the M38A2 the hazard is not the bomb itself but the spotting charge that was inside that can contain up to 3lbs of black powder.
- Slide 14 – Frank pointed out that craters tend to have a “spray blanket” where the sand forms a raised ring around the outside. He noted that the palmettos like to grow on that ring (as seen in the bottom left photo of Slide 14) and in the bottom of the crater in the lower areas, wetland vegetation tends to dominate. He pointed

out that that the area of the ATG gunnery range where “potential” craters were noted during the SI, does not show this type of high explosive crater signature.

- Slide 15 – Laura presented the Dive Bombing Range CSM and pointed out that the MRS boundary had shifted since the SI was conducted. The MRS was shifted to the southeast slightly based on historical research. This shift placed the previously identified munitions debris area to the south of the original MRS boundary in the center of the range.
- Slide 16 – Laura pointed out that the reason the qualitative reconnaissance path and sampling occurred outside the MRS boundary on this slide was because the original boundary was more northwest during the SI
- Slide 17 – During the presentation of Slide 17, Laura asked Mike K. if brush cutting would be allowed during the RI. Mike indicated that we would need to propose the vegetation clearance in the special use opportunity application; however, he did not believe there would be an issue cutting brush to 6-inches. Laura added that additional detail on the brush cutting would be spelled out in the UFP-QAPP (work plan).
- Slide 19 – Laura pointed out that the boundary of the ATG gunnery range had been shifted south due to the incorrect positioning of the range around the known berm area. The “potential” crater area to the northeast of the berms was discussed again. Laura pointed out that it is possible they could be alligator nests. Mike K. indicated that they could also be stump holes from removal of tree stumps. He indicated in the past that tree stumps were removed with bull dozers and that holes were left behind after removal.
- Slide 23 – Laura noted that the smallest target of interest would be the 100lb bomb and that John Baptiste would discuss how that is applied to the geophysical technical approach in later slides.
- Slide 28 – Nancy presented the Human Health CSM for Munitions and Explosives of Concern (MEC). Nancy asked Mike K. if there would be a situation under the current and anticipated land use where subsurface contact or construction would be required. Mike responded, “very rarely”. He indicated that the typical construction-type activity would be the cutting of fire breaks. The team discussed if the workers cutting fire breaks should be considered “on-site” workers or “construction” workers. Nancy agreed to discuss the topic with Parsons’ risk assessors to determine the appropriate category.
- Slide 30 – Jim McCarthy stated that FDEP has familiarity with the incremental sampling method (ISM). In addition, they consult with the University of Florida with respect to methods and ISM sampling.
- Slide 31 – Nancy asked Mike K. if there were any identified groundwater receptors, he responded that there were not. Jim asked if that included hunting clubs. Mike said camping is not allowed in the area of the former ranges. When asked, Mike K. also said there wasn’t much potential for foraging for “other biota”. The Project Team agreed to remove “other biota” as a potentially complete pathway. Jim asked if there was any potential chemical weapon hazard at the site. Frank, John Keiser and Laura all responded no.
- Slide 32 – Laura asked about possible ecological receptors burrowing to > 2ft. Mike K. thought it was unlikely that anything out there would burrow that deep.
- Slide 34 – In the discussion of receptors it was asked if the Boy Scouts use the area. Mike K. responded they do not have access to the area of the MRSSs. They are restricted to two areas in the far northeast corner of the WMA.
- Slide 37 – Laura indicated that digital geophysical mapping (DGM) may be used in the ATG gunnery range to conduct additional investigation in the potential crater area to determine the nature of this area. It was noted that the team would try to visit that area during the Site Visit in the afternoon.
- Side note: Donna explained that when working in other WMAs (in forested areas) we have been told not to cut the transects where people can see them because they think the transects are trails. Donna asked Mike K. if this would be a concern for this site. Mike K. said no, they do regular cutting already so it shouldn’t be a problem.
- Side note: Donna asked if, considering the development on the west side of the WMA, the WMA anticipates opening up any additional access points on the west side of the WMA. Mike K. said that Charlotte County and Babcock Ranch have both proposed opening a west entrance. The WMA has resisted this request so far and the immediate plan is to continue this position. He noted, however, that may change at some point in the future.
- Slide 43 – Barry Hodges expressed concern about the presentation of the anomaly density heat map on the slide. He indicated that even though it says it is an example that in the future someone might take this slide out of context and assume it is actual site data. Parsons agreed to add an additional watermark behind the anomaly density data.

- Slide 47 – Frank noted that he did not believe the 250lb and 500lb bombs are in the Advanced Geophysical Classification Library. John Baptiste confirmed that they are not in the library, but they should be very clear in the data and would be selected as a target of interest (TOI) due to their size and symmetry.
- Slide 51 - Jim wondered if groundwater was too shallow for 24” deep soil samples. Mike K. said he thought most groundwater was 3-10 feet, Frank thought maybe part of the site was swampy. Nancy noted that the UFP-QAPP would describe procedures for sampling in the event of saturated soil sample locations.
- Slide 53 – The team discussed the fact that commercial labs may not be able to report some analytes/compounds down to the Project Action Levels (PALs), particularly for explosives. Jim agreed that as long as the lab made a good-faith attempt at achieving the lowest detection possible, he understood that some PALs would not be achievable. Laura said these particular analytes would be identified in the QAPP. Jim said that FDEP usually prefers that the PALs be set at the more conservative of the U.S. Environmental Protection Agency’s (USEPA) Regional Screening Levels (RSLs) and the FDEP Soil Cleanup Target Levels (SCTLs). The team noted that this had been done on other projects in the past and thought it would be fine. Barry reminded Parsons to watch for human error in changing specific unit values as they may not be the same. The need to consider the Florida Sediment Quality Assessment Guidance (SQAG) was discussed. Jim indicated that this is typically used to determine if a risk assessment is required. Nancy noted that we are already planning on completing a risk assessment. Jim agreed that the use of the SQAG was probably not necessary. Post Meeting Note: Internal USACE meetings following the SPP Meeting indicated that the USACE Center of Expertise may not agree to use the lower of two standards. USACE asked that the team defer to the UFP-QAPP review for presentation and comment on the screening criteria to be used on the project.
- Side note: Laura noted that if we found MEC, the preference would be to blow it up in place. Mike K. said to add that request to the special use opportunity application. The team discussed the logistics of blow-in-place operations. Mike C. said Parsons would apply mitigation techniques to the detonation process in an attempt to avoid any road closures.
- Slide 54 – John Baptiste presented the innovative technology approach. The team discussed the innovative technology task and whether it was to add data for project decisions or for a “proof of concept” for future investigations. Parsons confirmed the task was to provide information on applicability of the unmanned drone surveys for this site. It was suggested that a drone survey be conducted over an area surveyed with the EM-61 for comparison. If the drone is used over water, it was recommended Parsons perform a secondary survey of the water area using an EM-61 on floats. John Baptiste explained that the equipment will be evaluated on the instrument verification strip. The team was somewhat concerned about running the equipment over areas we do not know the depth of. The team suggested that Parsons look for a way to do a comparison, so we can confirm the results are viable.
- Slide 55 – Laura asked if there were any questions on the technical approach. Jim indicated that he will take the information back to FDEP and talk to John Winters and Laura Barrett when he gets back and see if they can give us comments on what was presented in the meeting materials. Jim suggested that a review of the meeting slides and worksheets presented might result in fewer comments on the Draft Final version. Jim asked about also receiving the Visual Sample Plan (VSP) inputs used to determine the geophysical transect spacing. He mentioned that USACE had given a presentation on VSP and FDEP has been using the University of Florida to assist with review of VSP and other aspects of projects. Jim stated they have 30 days to review documents, but they typically get things back faster.
- Slide 56 – The schedule was discussed and it was noted that depending upon a review of meeting materials by FDEP, the Draft Final UFP-QAPP may shift to July. The team discussed the potential length of field work. Laura said she will check the schedule and let the team know the current anticipated length. Mike K. noted that February to May are the driest months.
- Side note: Donna reminded Mike K. that USACE will need to obtain right-of-entry. Mike indicated that they typically handle that through the Special Use Opportunity application. Donna and Frank indicated that a USACE right-of-entry form would also be required on their end.
- Slide 57 – Laura recapped the Meeting Objectives, to include project team concurrence. She indicated to Jim McCarthy that we understand we can’t get FDEP concurrence at this meeting but are in agreement to work towards that end. The following additional topics were discussed:

- It was noted that the WMA keeps the gates locked on the west side of the site and there are internal gates around the FUDS. It should be possible to close roads as needed during the intrusive operations.
- Hud Heaton indicated that the VSP software should be able to export a model report. Parsons agreed to generate the VSP report with the inputs used to develop the transect spacing so that FDEP can provide the report to the University of Florida for review.
- Laura stated that Parsons will prepare and send revised slides with the VSP report (Attachment 4) so that FDEP can review the revisions made during the meeting. Frank concurred that Parsons may send new electronic copies of all meeting materials and VSP output for those in attendance at this meeting.

Site Visit

- Mike C. conducted a safety brief for the afternoon Site Visit (Attachment 5). All those in attendance planned to attend the Site Visit and signed the log. Hospital maps and directions to the site were distributed. The team dismissed for lunch and agreed to meet after lunch to caravan to the site.

ATTACHMENT 1
ATTENDANCE SIGN-IN SHEET

SYSTEMATIC PROJECT PLANNING ATTENDANCE SIGN-IN SHEET

Project: Fort Myers Remedial Investigation/ Feasibility Study

Date: February 26, 2019

Place: The Hive Conference Room, Babcock Ranch Development, Babcock Ranch, FL

NAME/ PROJECT ROLE	SIGNATURE	ORGANIZATION/ ADDRESS	PHONE NUMBER	EMAIL ADDRESS
Mr. Frank Araico Project Manager		U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207	904.232.1804	Frank.X.Araico@usace.army.mil
Mr. John Keiser FUDS Program Manager		U.S. Army Corps of Engineers Jacksonville District 701 San Marco Boulevard Jacksonville, FL 32207	904.232.1758	John.E.Keiser@usace.army.mil
Ms. Donna L. West- Barnhill		ARDL, Inc. FUDS Contractor, USACE	904.232.2179	Donna.L.West2@usace.army.mil
Mr. Hud Heaton COR		U.S. Army Engineering and Support Center, Huntsville 4820 University Square Huntsville, AL 35816-1822	256.895.1657	Charles.Heaton@usace.army.mil
Mr. Barry Hodges Technical Manager		U.S. Army Engineering and Support Center, Huntsville 4820 University Square Huntsville, AL 35816-1822	256.895.1894	Barry.A.Hodges@usace.army.mil
Mr. Daryl Donatelli QA Geophysicist		U.S. Army Engineering and Support Center, Huntsville 4820 University Square Huntsville, AL 35816-1822	256.895.1617	Daryl.J.Donatelli@usace.army.mil
Mr. Mike Malone Project Chemist		U.S. Army Engineering and Support Center, Huntsville 4820 University Square Huntsville, AL 35816-1822	256.895.1637	Michael.D.Malone@usace.army.mil

SYSTEMATIC PROJECT PLANNING ATTENDANCE SIGN-IN SHEET

Project: Fort Myers Remedial Investigation/ Feasibility Study

Date: February 26, 2019

Place: The Hive Conference Room, Babcock Ranch Development, Babcock Ranch, FL

NAME/ PROJECT ROLE	SIGNATURE	ORGANIZATION/ ADDRESS	PHONE NUMBER	EMAIL ADDRESS
Mr. John Winters		Florida Department of Environmental Protection 2600 Blair Stone Road MS 4535 Tallahassee, Florida 32399-2400	850.245.8999	John.Winters@dep.state.fl.us
Mr. Jim McCarthy		Florida Department of Environmental Protection 2600 Blair Stone Road MS 4535 Tallahassee, Florida 32399-2400	850.245-8927 - 8984 850.510.1041	Jim.McCarthy@dep.state.fl.us
Mr. Mike Kemmerer District Wildlife Biologist Babcock Webb WMA		Babcock Webb WMA 29200 Tucker Grade Punta Gorda, FL 33955	941.833.2555 239.209-0792	Mike.Kemmerer@MyFWC.com
Ms. Laura Kelley Project Manager		Parsons 3577 Parkway Lane, Suite 100 Peachtree Corners, GA 30092	678.969.2437	Laura.Kelley@parsons.com
Ms. Nancy Heflin Deputy Project Manager		Parsons 3577 Parkway Lane, Suite 100 Peachtree Corners, GA 30092	270.349.4558	Nancy.Heflin@parsons.com
John Baptiste Senior Geophysicist		Parsons 1776 Lincoln Street, Suite 600 Denver, CO 80203	303-764-8840	John.E.Baptiste@parsons.com
Mike Coon MEC Operations		Parsons 9101 Burnet Road, Suite 210 Austin, TX 78758	425-457-1734	Michael.Coon@parsons.com

SYSTEMATIC PROJECT PLANNING
ATTENDANCE SIGN-IN SHEET

Project: Fort Myers Remedial Investigation/ Feasibility Study

Date: February 26, 2019

Place: The Hive Conference Room, Babcock Ranch Development, Babcock Ranch, FL

NAME/ PROJECT ROLE	SIGNATURE	ORGANIZATION/ ADDRESS	PHONE NUMBER	EMAIL ADDRESS

ATTACHMENT 2
MEETING SLIDE PRESENTATION

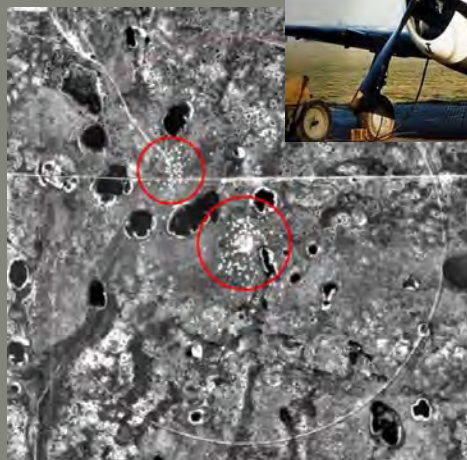
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY, FORT MYERS BOMBING AND GUNNERY RANGE

PROPERTY NO. I04FL0179

CONTRACT NO. W912DY-17-D-0005

TASK ORDER NO. 18-F-0477

Systematic Project Planning Meeting
February 26, 2019



US Army Corps
of Engineers





WELCOME AND OPENING REMARKS

Project Team Introductions

Meeting Objective – review, discuss, revise, and concur with project technical approach

- Participate and provide input
- Discussion documents are provided as handouts/emailed to phone attendees

Meeting Minutes

- Document meeting and summarize decisions made
- To be provided to attendees for review



AGENDA



Systematic Project Planning Meeting – Agenda

9:00 am – Welcome and Opening Remarks

9:10 am – Technical Team Overview

9:15 am – Communication / Public Involvement

9:20 am – Site History / Overall Project Goals

9:30 am – Conceptual Site Models

(Summary of CSM Handout and Worksheet #10)

10:30 am – Data Quality Objectives

(Worksheet #11)

Overview of Technical Approach under Step 5 of the DQO process

12:15 pm – Site Visit Information

12:30 pm – Lunch

2:00 pm – Site Visit



PROJECT STAKEHOLDERS

- USACE
- Parsons
- Charlotte County
- Florida Department of Environmental Protection (FDEP)
- Florida Fish and Wildlife Conservation Commission (FWC)



PROJECT TEAM



USACE Technical Team

Project Manager - Frank Araico, PG
 FUDS Program Manager – John Keiser, PE
 Contracting Officers Rep. - Hud Heaton, PE
 Technical Manager - Barry Hodges
 Project Geophysicist - Daryl Donatelli
 Project Chemist - Mike Malone
 Public Affairs Specialist - Amanda Parker
 FUDS Program Support - Donna West-Barnhill

Regulatory Agencies:

Florida Department of Environmental Protection

Landowners:

**Florida Fish and Wildlife Conservation
 Commission, Fred C. Babcock/Cecil M. Webb
 Wildlife Management Area**

Parsons Technical Team

Project Manager - Laura Kelley
 Deputy Project Manager - Nancy Heflin
 Technical/Site Manager - Jae Yun
 MEC Operations Manager - Mike Coon
 Senior Geophysicist - John Baptiste
 QC Geophysicist - Nagi Khadr
 Project Chemist - Katherine LaPierre
 Health and Safety Manager - Jenny Prince
 Corporate Quality Manager - Tom Kartachak



CONTACT INFORMATION

Organization	Name / Role	Telephone / Email
CEHNC	Kenneth Bryant - Contracting Officer	256-895-5294; Kenneth.W.Bryant@usace.army.mil
CEHNC	Hud Heaton - Contracting Officer's Representative	256-895-1657; Charles.Heaton@usace.army.mil
CESAJ	Frank Araico, P.G. - Project Manager	904-232-1804; Frank.X.Araico@usace.army.mil
CESAJ	John Keiser, P.E.. - FUDS Program Manager	904-232-1758; John.E.Keiser@usace.army.mil
CESAJ	Amanda Parker - Public Affairs Specialist	904-232-1576; Amanda.D.Parker@usace.army.mil
CESAJ	Donna West-Barnhill - FUDS Program Support	904-232-2179; Donna.L.West2@usace.army.mil
CEHNC	Barry Hodges - Technical Manager	256-895-1894; Barry.A.Hodges@usace.army.mil
CEHNC	Daryl Donatelli - Project Geophysicist	256-895-1617; Daryl.J.Donatelli@usace.army.mil
CEHNC	Mike Malone - Project Chemist	256-895-1637; Michael.D.Malone@usace.army.mil
Parsons	Laura Kelley - Project Manager	404-934-1266; Laura.Kelley@parsons.com
Parsons	Nancy Heflin - Deputy Project Manager	270-349-4558; Nancy.Heflin@parsons.com
Parsons	Jae Yun - Technical/Site Manager	678-209-7620; Jae.Yun@parsons.com
Parsons	John Baptiste - Senior Geophysicist	303-764-8840; John.E.Baptiste@parsons.com
Parsons	Nagi Khadr - QC Geophysicist	303-501-2393; Nagi.Khadr@parsons.com
Parsons	Mike Coon - MEC Operations	425-457-1734; Michael.Coon@parsons.com
Parsons	Katherine LaPierre - Project Chemist	512-574-3105; Katherine.Lapierre@parsons.com
Parsons	Jenny Prince - Health & Safety Manager	202-484-3661; Jenny.Prince@parsons.com
Parsons	Tom Kartachak - Corporate Quality Manager	410-596-9178; Tom.Kartachak@parsons.com



COMMUNICATION / PUBLIC INVOLVEMENT



- Communication Tools

- Project Delivery Team (PDT) Methods:
 - Systematic Project Planning (SPP) Meetings
 - Conference Calls
 - Emails
- Community Methods:
 - Community Relations Plan
 - Notices in Newspaper
 - Posters
 - Public Meetings
 - Information Repository



COMMUNICATION / PUBLIC INVOLVEMENT



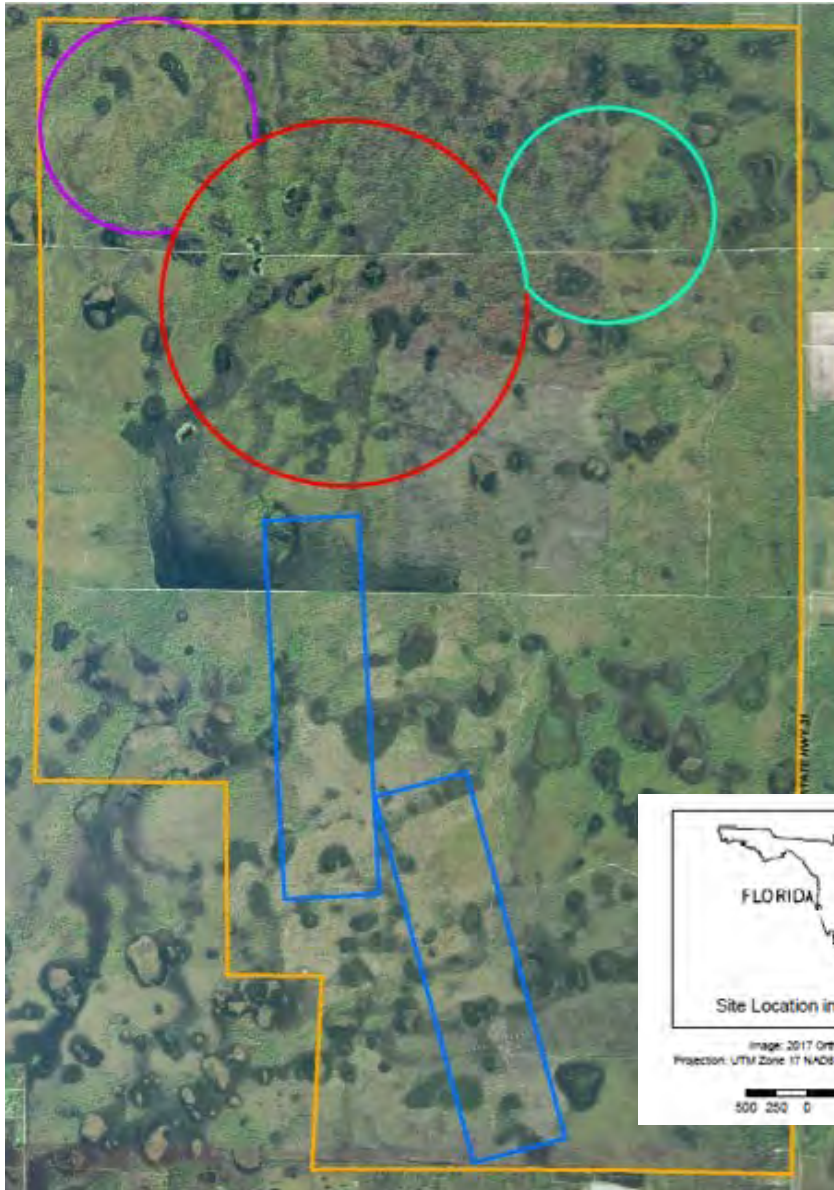
- Restoration Advisory Board (RAB)
 - Objective: To provide citizens with a meaningful way to become actively involved and to provide the PDT with a viable means of learning citizen concerns and attitudes.
 - Board members include public officials and private citizens.
 - The Corps will solicit interest in a RAB and will provide support as appropriate to facilitate its formation.
 - If formed, the Corps will provide administrative support and the Corps' Project Manager will serve as co-chair along with a representative elected from among the community representatives on the board.



SITE LAYOUT AND HISTORY

Site History

- Used Between 1944 and 1945 for training out of Fort Myers Army Airfield
- Three Bombing Ranges for Skip, Dive, and Demolition Bombing Training
- One Strafing Range (west blue) and one Air-to-Ground Gunnery Range (east blue)
- Lease terminated in 1946



Legend

- Demolition Bombing Range
- Strafing & Air-to-Ground Gunnery Range
- Skip Bombing Range
- Dive Bombing Range
- Approximate FUDS Property Boundary



OVERALL PROJECT GOALS AND METHODS

The following is a very basic simplified summary of select parts of the DQO process. The DQO process (Worksheet 11) will be reviewed again after review of the Conceptual Site Models (CSMs)

Study Questions:

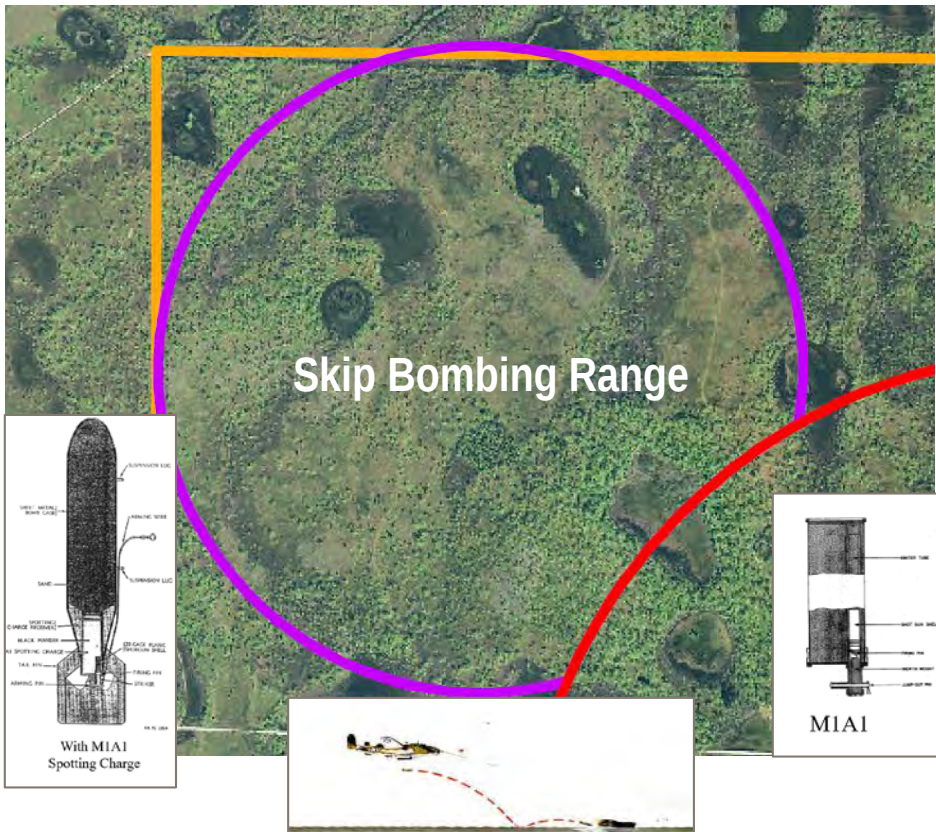
- Do munitions and explosives of concern (MEC) pose an unacceptable risk to human health?
 - Determine the horizontal and vertical extent of MEC contamination.
 - Determine the nature of the hazards and exposure pathways
- Are munitions constituents (MC) present above background and project action limits (PALs)?
 - Determine the horizontal and vertical extent of MC contamination.
 - Do concentrations pose unacceptable risks to human or ecological receptors at the MRSs?

General Data Collection Methods:

- Digital Geophysical Mapping (DGM) transect surveys
- DGM Grid Surveys
- Advanced Geophysical Classification (AGC) of DGM anomalies
- Excavation of anomaly sources (buried metal) (referred to as Intrusive Investigation)
- Phased Soil/Surface Water/ Sediment Sampling and Analysis

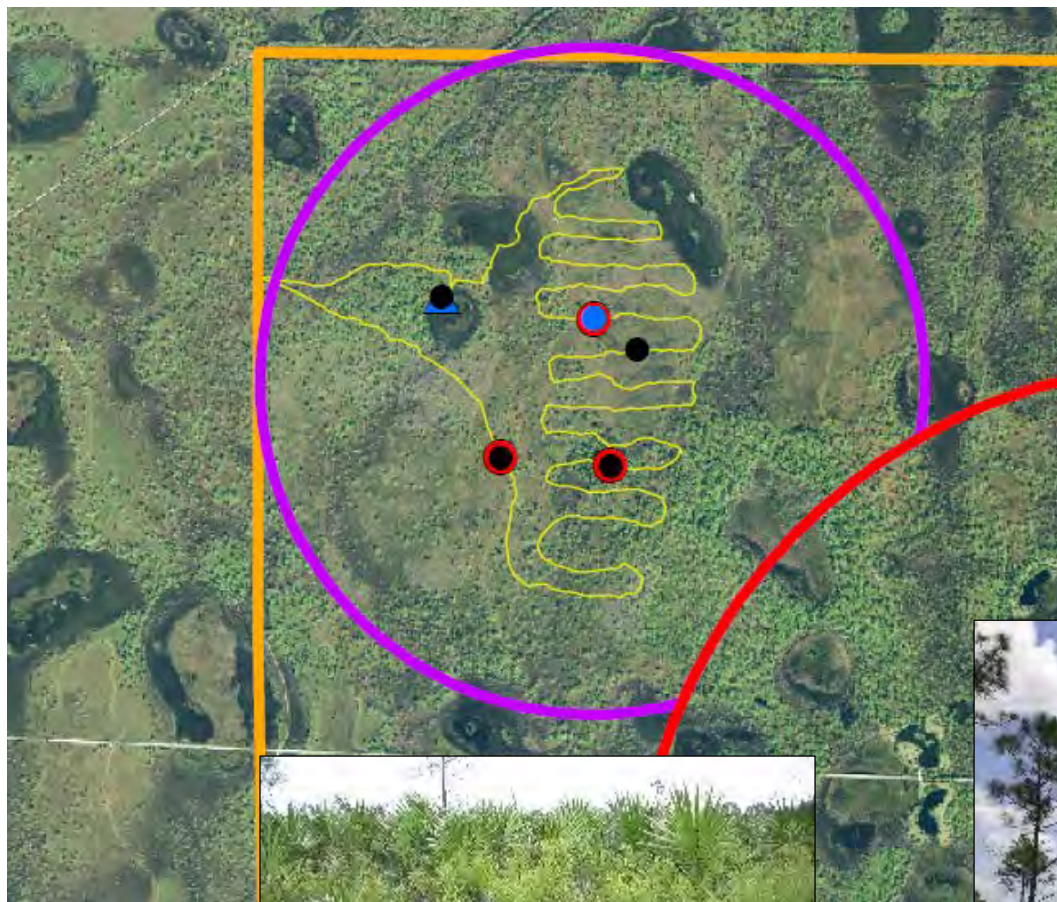


SKIP BOMBING RANGE CONCEPTUAL SITE MODEL

 Skip Bombing Range With M1A1 Spotting Charge M1A1	MRS Description: The 613 acre MRS consists of undeveloped flat grassy open areas mixed with light vegetation, sections of pine trees, and wetlands. There are fire breaks running north south through the site. Consisted of low-level bombing, allowing aircraft to successfully attack shipping by skipping the bomb across the water very close to the surface upon impact. Suspected Munitions: • M38A2 practice bombs with M1A1 spotting charges. • M3 and M5 spotting charges Setting / Receptors/ Land Use: • Dirt roads on the western and southern perimeter. • Nearly flat, low lying land. Portions of the site may be inaccessible due to high water. • Soil classified as "sand/gravel." • Site is part of Fred C. Babcock- Cecil M. Webb WMA and is used for recreational purposes. • Sensitive ecological receptors may include: American alligator, wood stork; Eastern indigo snake, Florida scrub jay, crested caracara, red-cockaded woodpecker, Florida panther, beautiful pawpaw.
Previous Investigation Results This MRS overlaps with the Demolition Bombing Range. During the 1995 ASR site visit, the team was unable to access the site due to high water. The field effort conducted for the 2009 SI included over 5.6 miles of qualitative reconnaissance (QR). No MEC was observed during the QR; however, MD from practice bombs was observed. The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Metals were not detected in any of the surface soil samples. Although antimony, copper, and lead were detected in surface water and/or sediment samples, the metals did not exceed human health or ecological screening levels.	Pathway Concerns Explosive safety risk. Human receptors may encounter MEC during recreational or WMA maintenance activities at the site. Risk to human and ecological receptors cannot be determined based on the sampling data collected, to date.



PREVIOUS MC SAMPLING LOCATIONS AND QR PATH



Skip Bombing Range MRS

- Munitions Debris Location
- Other Field Observation Location
- ▲ Sediment Sample Location
- Soil Sample Location

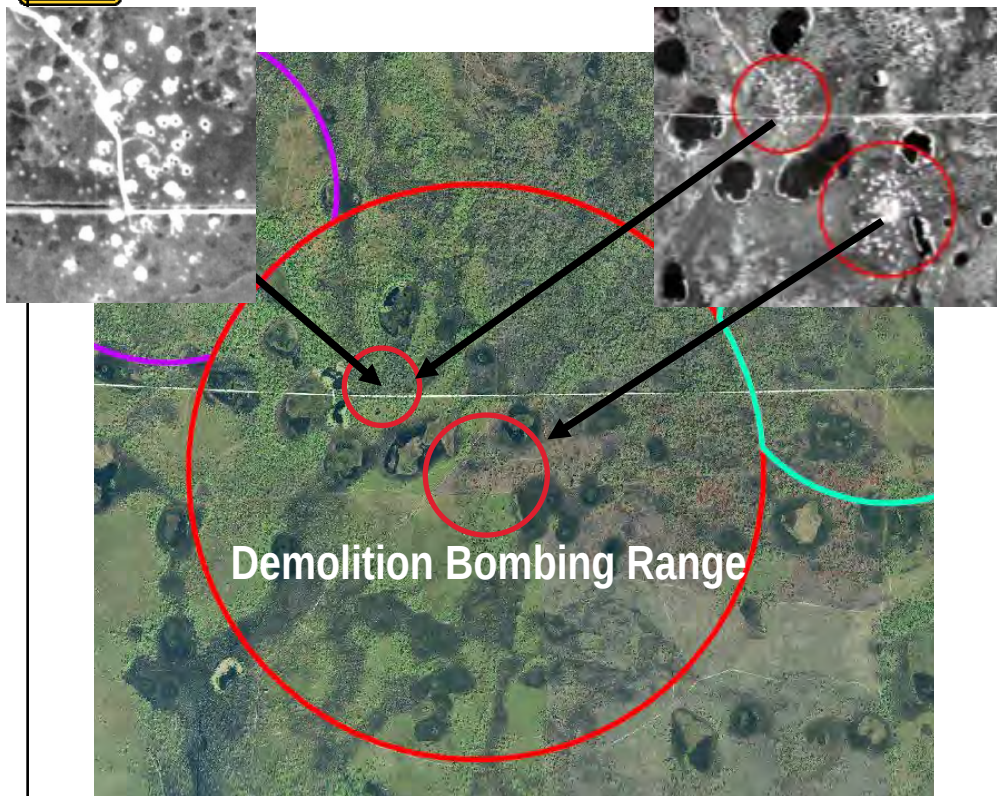




U.S. ARMY



DEMOLITION BOMBING RANGE CONCEPTUAL SITE MODEL



MRS Description: The 1,800-acre MRS consists of undeveloped flat grassy open areas, mixed with low shrub, light vegetation, sections of pine trees, and wetlands. There is a primary road running through center and access roads break off to the south, along with fire breaks throughout the MRS. The center of the site consists of visible large craters surrounded by low shrubs.

Suspected Munitions:

- M38A2 practice bombs with M1A1, M3, M5 spotting charges
- AN-M57 and AN-M64 general purpose (GP) bombs

Setting / Receptors / Land Use

- Major dirt roads running east-west through the site with public access from the western end of the WMA and access roads running south.
- Nearly flat, low lying land with wetland areas.
- Soil classified as "sand/gravel."
- Site is part of Fred C. Babcock- Cecil M. Webb WMA and is used for recreational purposes.
- Sensitive ecological receptors may include: American alligator, wood stork; Eastern indigo snake, Florida scrub jay, crested caracara, red-cockaded woodpecker, Florida panther, beautiful pawpaw.

Previous Investigation Results

This MRS overlaps with the Skip Bombing Range and the Dive Bombing Range. The field effort conducted for the 2009 SI included over 9.1 miles of QR. No MEC was observed during the QR; however, MD from AN-M57 and AN-M64 GP bomb debris and numerous bomb craters were found within the center portion of the MRS.

The field effort conducted for the 2009 SI included collection of two surface water, two sediment, and four surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Metals were not detected in any of the surface soil or sediment samples. Although antimony, copper, and lead were detected in surface water above background, the metals did not exceed human health screening levels. The maximum detected concentration of lead in surface water was slightly greater than the selected ecological screening value.

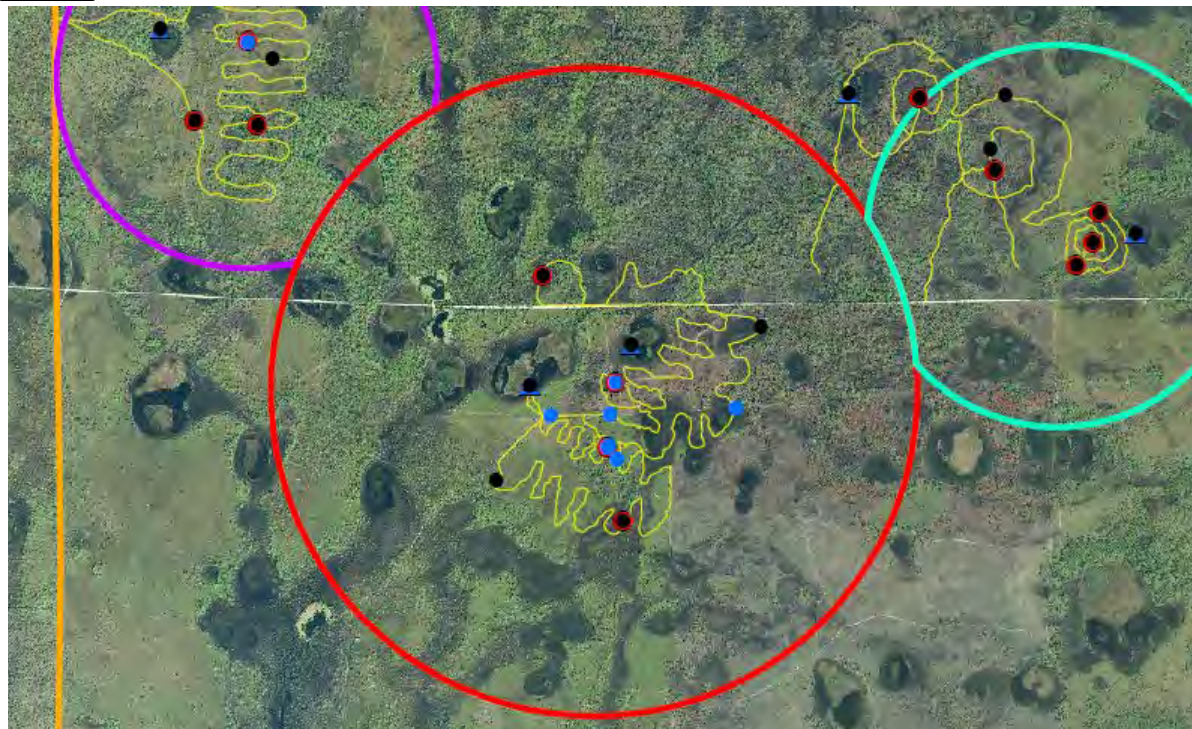
Pathway Concerns

Explosive safety risk. Human receptors may encounter MEC during recreational or WMA maintenance activities at the site.

An unacceptable ecological risk may be present from exposure to lead in surface water at the MRS.



PREVIOUS MC SAMPLING LOCATIONS AND QR PATH



Demolition Bombing Range MRS

- Munitions Debris Location
- Other Field Observation Location
- ▲ Sediment Sample Location
- Soil Sample Location

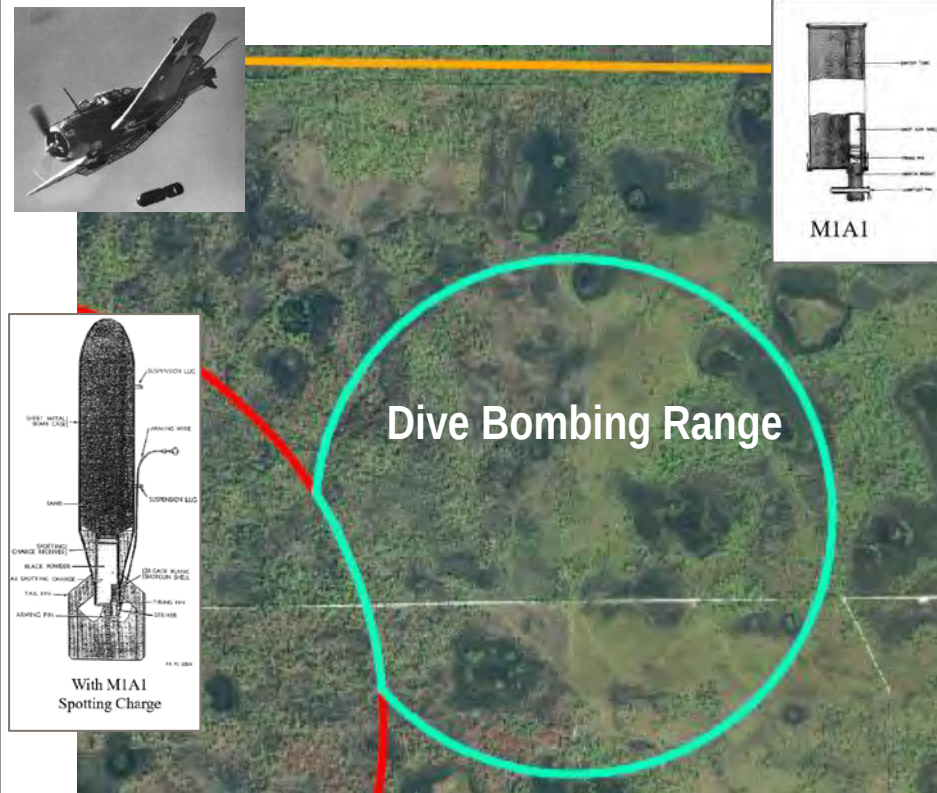




U.S. ARMY



DIVE BOMBING RANGE CONCEPTUAL SITE MODEL



MRS Description: The 634-acre MRS consists of undeveloped flat grassy open areas mixed with light vegetation, sections of pine trees, and wetlands. There are fire breaks running north and south through the site.

Dive Bombing consisted of steeper angles to provide a more direct and accurate line to the target location. When the bomb is released, gravity simply increases its speed along its nearly vertical trajectory.

Suspected Munitions:

- M38A2 practice bombs with M1A1 spotting charges.
- M3 and M5 spotting charges

Setting / Receptors / Land Use

- Dirt roads on the eastern and southern perimeter.
- Nearly flat, low lying land.
- Soil classified as "sand/gravel."
- Site is part of Fred C. Babcock- Cecil M. Webb WMA and is used for recreational purposes.
- Sensitive ecological receptors may include: American alligator, wood stork; Eastern indigo snake, Florida scrub jay, crested caracara, red-cockaded woodpecker, Florida panther, beautiful pawpaw.

Previous Investigation Results

This MRS overlaps with the Demolition Bombing Range. The field effort conducted for the 2009 SI included over 5.5 miles of QR. No MEC or MD was found during the QR. Aerial photo research during the SI indicated a potential bomb target area to the southeast of the MRS. Nothing was observed in this area during the SI; however, MD was observed during the 2017 pre-proposal site visit for this project in this area. The MRS boundary was shifted based on USACE aerial research and the potential target area is now within the range boundary.

The field effort conducted for the 2009 SI included collection of two surface water, two sediment, and five surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Metals were not detected above human health screening levels in any of the surface soil, surface water, or sediment samples. The maximum detected concentrations of copper and lead in surface water were greater than the selected ecological screening values.

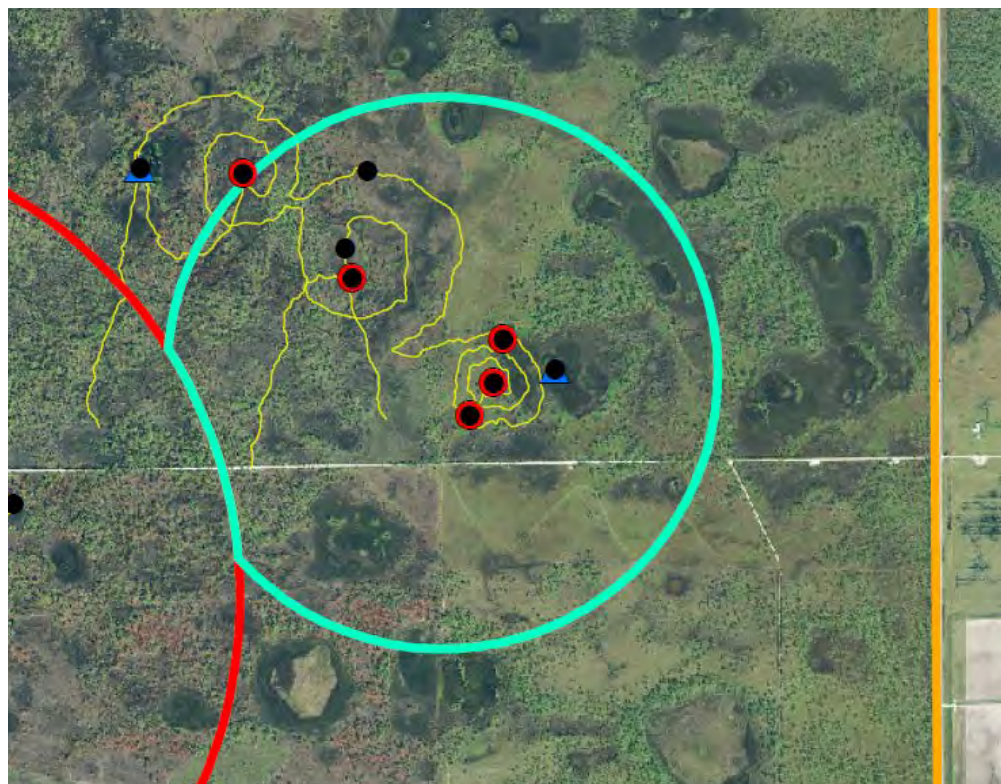
Pathway Concerns

Explosive safety risk. Human receptors may encounter MEC during recreational or WMA maintenance activities at the site.

An unacceptable ecological risk may be present from exposure to copper and lead in surface water at the MRS.



PREVIOUS MC SAMPLING LOCATIONS AND QR PATH



Dive Bombing Range MRS

- Munitions Debris Location
- Other Field Observation Location
- ▲ Sediment Sample Location
- Soil Sample Location

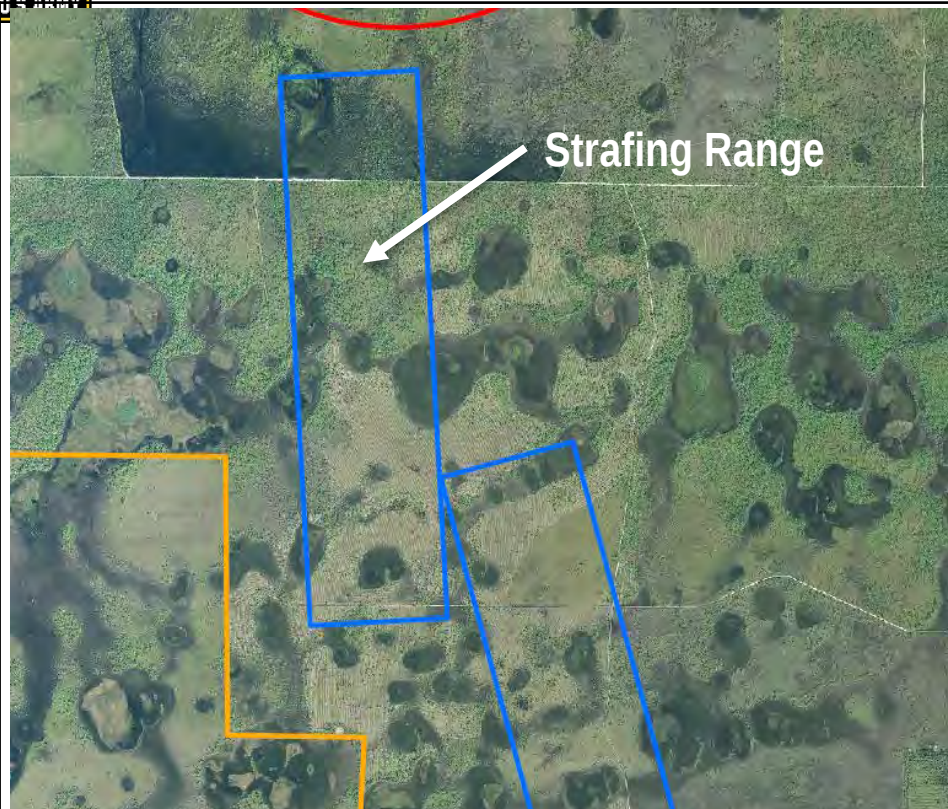




U.S. ARMY



STRAFING RANGE CONCEPTUAL SITE MODEL



MRS Description: The 640-acre Strafing Range consists of medium to heavy vegetation of palmetto and pine trees. The vegetation through most of the site is currently 3- to 4-feet high. A major access road cuts through the north end with no other entry points.

Suspected Munitions:

- Small Arms, General
- .50 caliber Machine Gun

Setting / Receptors / Land Use

- Major access road running east-west through the north end of the site.
- Heavily vegetated in the north, low lying land.
- Soil classified as "sand/gravel."
- Site is part of Fred C. Babcock- Cecil M. Webb WMA and is used for recreational purposes.
- Sensitive ecological receptors may include: American alligator, wood stork; Eastern indigo snake, Florida scrub jay, crested caracara, red-cockaded woodpecker, Florida panther, beautiful pawpaw.

Previous Investigation Results

The field effort conducted for the 2009 SI included over 4.2 miles of QR. No MEC or MD was observed during the QR. A short length of QR extended south of the range to evaluate whether MEC or MD might extend beyond the indicated boundary. No evidence of MEC or MD was observed during the QR.

The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Metals were not detected in any of the sediment samples above background. Although antimony, copper, and lead were detected in surface soils above background, the maximum detected concentrations did not exceed human health screening levels or ecological screening levels. The maximum detected concentrations of copper in surface soil and surface water were greater than the selected ecological screening values.

Pathway Concerns

No MEC expected.

An unacceptable ecological risk may be present from exposure to copper in surface soil and surface water at the MRS.

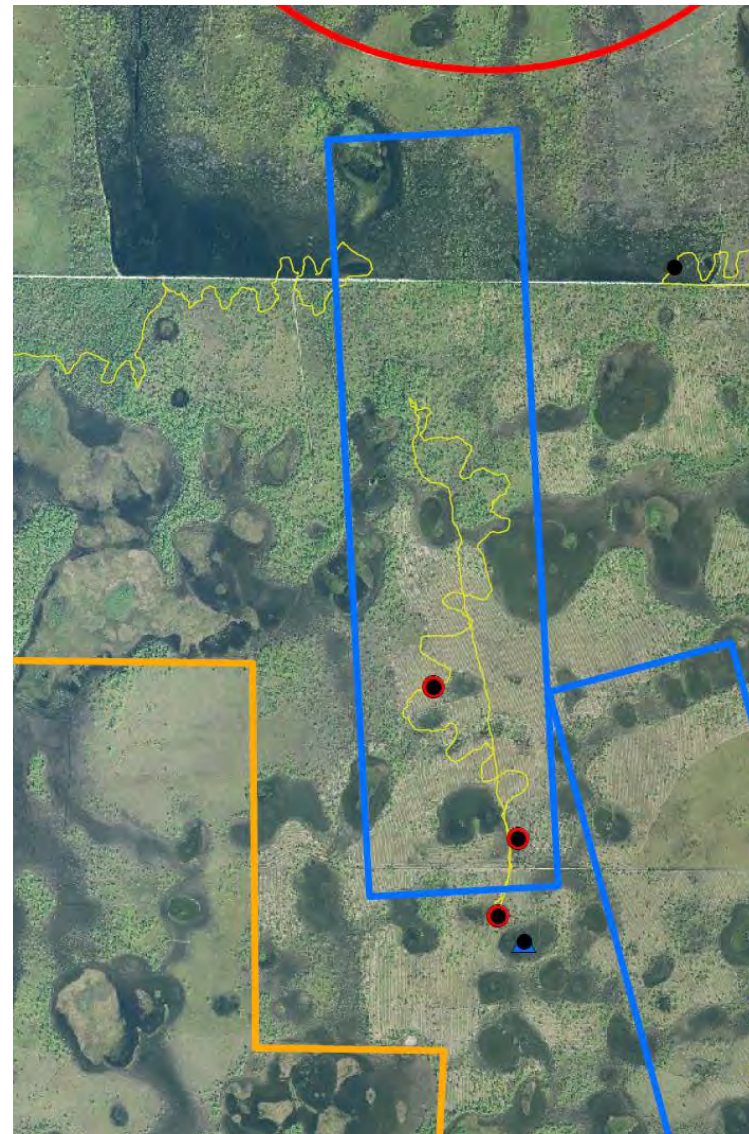


PREVIOUS MC SAMPLING LOCATIONS AND QR PATH



Strafing Range

- Munitions Debris Location
- Other Field Observation Location
- ▲ Sediment Sample Location
- Soil Sample Location





U.S. ARMY



AIR-TO-GROUND GUNNERY RANGE CONCEPTUAL SITE MODEL



MRS Description: The 640-acre ATG Gunnery Range consists of medium to light vegetation and low shrubs. A major access road cuts through from the northeastern to the southern end. A line of target berms are located in the southern portion of the range.

Suspected Munitions:

- Small Arms, General
- .50 caliber Machine Gun

Setting / Receptors / Land Use

- Major access road running east-west on the north perimeter and an access road running north south to the impact berm area.
- Open flat, low lying land.
- Soil classified as "sand/gravel."
- Site is part of Fred C. Babcock- Cecil M. Webb WMA and is used for recreational purposes.
- Sensitive ecological receptors may include: American alligator, wood stork; Eastern indigo snake, Florida scrub jay, crested caracara, red-cockaded woodpecker, Florida panther, beautiful pawpaw.

Previous Investigation Results

The field effort conducted for the 2009 SI included QR of over 3.2 miles. No evidence of MEC was observed during the QR. MD was observed in the form of .50 caliber ammunition debris. A line of target berms was discovered in the southern portion of the range. Due to the observation of possible craters in the area, a short length of QR was extended beyond the presumed target berm location to evaluate whether MEC or MD might extend beyond the range boundary. Note, the range boundary was subsequently adjusted based on research so the SI activities are no longer outside the range boundary.

The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Metals were not detected above background in any of the sediment samples. Although antimony, copper, lead and perchlorate were detected in surface water samples above background, the maximum detected concentrations did not exceed human health screening values. Copper exceeded the ecological screening value in surface water. Antimony, copper, and lead were detected in surface soil above background, of which the maximum detected concentration of lead exceeded human health screening values and copper and lead exceeded ecological screening values.

Pathway Concerns

Possible explosive safety risk. Human receptors may encounter MEC during recreational or WMA maintenance activities at the site (based on possible craters observed that will be investigated to determine the nature of origin).

An unacceptable human health risk may be present from exposure to lead in surface soil at the MRS.
An unacceptable ecological risk may be present from exposure to copper and lead in the surface soil and copper in surface water at the MRS.

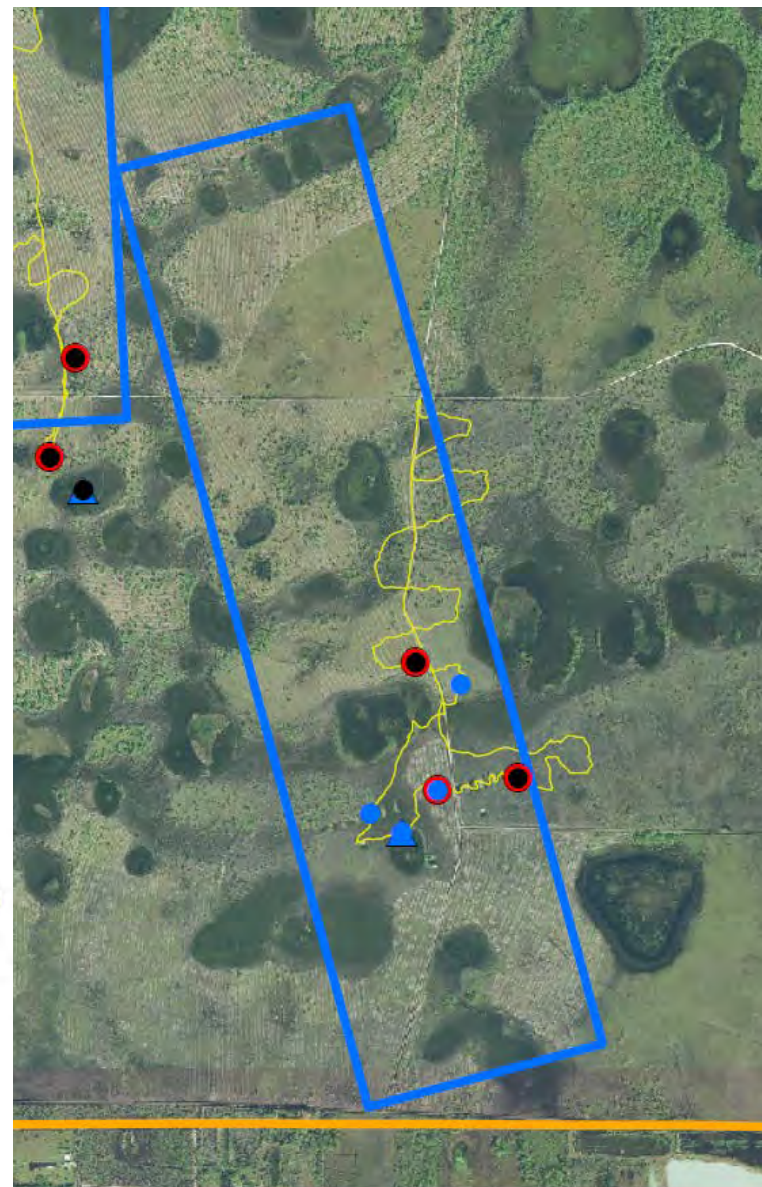


PREVIOUS MC SAMPLING LOCATIONS AND QR PATH



Air-to-Ground Gunnery Range

- Munitions Debris Location
- Other Field Observation Location
- ▲ Sediment Sample Location
- Soil Sample Location





SUMMARY OF PREVIOUS MUNITIONS RELATED FINDINGS

MRS	Study	MEC	MD	Munitions-Related Features
Skip Bombing Range	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	M38A2, 100lb bomb, practice debris	None
Demolition Bombing Range MRS	ASR (USACE, 1995)	None	Bomb fragments	Water filled craters about 30' in diameter
	Site Inspection (Parsons, 2009)	None	AN-M57 and AN-M64 GP Bomb Debris	Bomb Craters
Dive Bombing Range MRS	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	None	None
	Proposal Site Visit 2017	None	Practice bomb debris	Subsurface anomalies using hand held detector
Strafing Range MRS	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	None	None
Air-to-Ground Gunnery Range MRS	ASR (USACE, 1995)	None	.50 caliber projectiles	Target Berms
	Site Inspection (Parsons, 2009)	None	.50 caliber bullets and casings	Target Berms
	Proposal Site Visit 2017	None	.50 caliber bullets and casings	Possible craters or other natural features to the northeast of the target berm area.



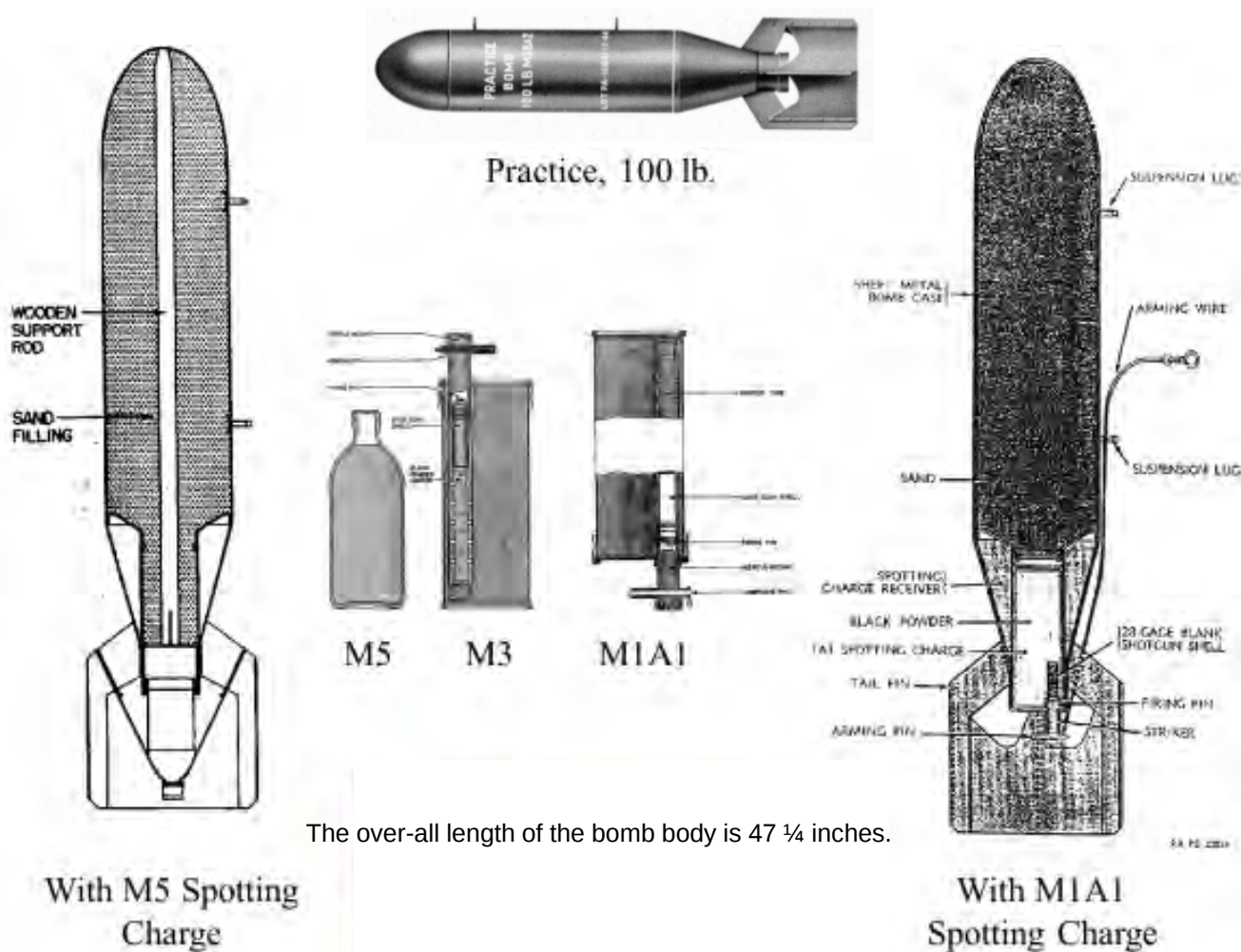
SUSPECTED MUNITIONS TYPES



Suspected Munitions	Skip Bombing Range	Demolition Bombing Range	Dive Bombing Range	Strafing Range	Air-to-Ground Gunnery Range
Small Arms Ammunition, .50 Cal.				X	X
Bombs, Practice, 100lbs, M38A2	X	X	X		
Spotting Charge, M1A1, M3, and M5	X	X	X		
Bombs, HE, 250lbs, AN-M57 and AN-M57A1		X			
Bombs, HE, 500lbs, AN-M64 and AN-M64A1		X			



MUNITIONS USED (SMALLEST TARGET OF INTEREST)



The over-all length of the bomb body is 47 ¼ inches.



SPOTTING CHARGES

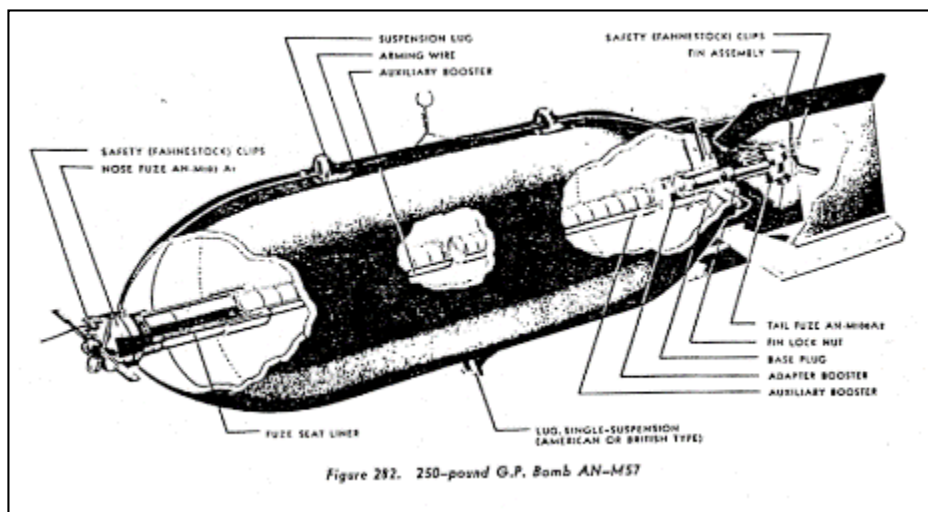
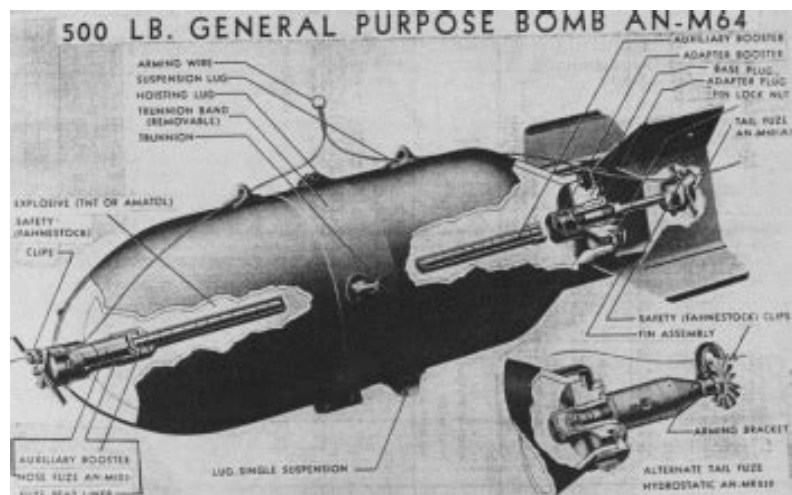
M1A1 Spotting Charge. This type of spotting charge fits in the after end of the 100lb Practice Bomb M38A2. It produces a flash of flame and white smoke for observation of bombing accuracy. It is made from a large tin can, 11.18-inches long, 3.43-inches diameter, weighing 4.25-pounds. At the top of the can is a cover, which has a hole in it for the insertion of a 28-gage blank shotgun shell and firing mechanism. Upon impact, the inertia weight drives the firing pin into the shotgun-type primer, igniting the 3-pounds of black powder.

M3 Spotting Charge. The spotting charge has a 2 1/3-pound dark smoke filling and a black-powder igniter. It is 5/8 of an inch longer than the Spotting Charge M1A1, but otherwise similar. The M3, with its dark smoke filler, is well adapted for bombing practice over snow-covered terrain. The black-powder igniter charge contains approximately 425 grains. It is used in the M38A2 Practice bomb.

M5 Spotting Charge. The spotting charge consists of a glass bottle filled with FS smoke mixture. An ordinary bottle cap seals the mixture. The bottle is held to the Practice Bomb M38A2 by a wire twisted around the neck of the bottle and attached to the tail vanes. The charge assembly weighs 2.54 pounds.

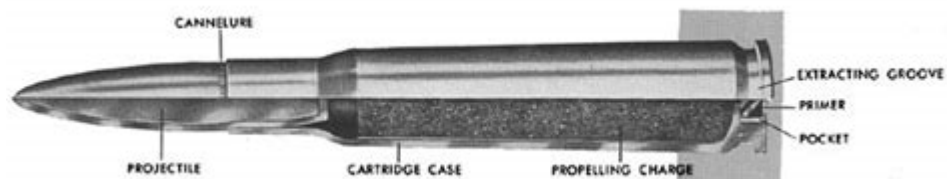


OTHER MUNITIONS USED

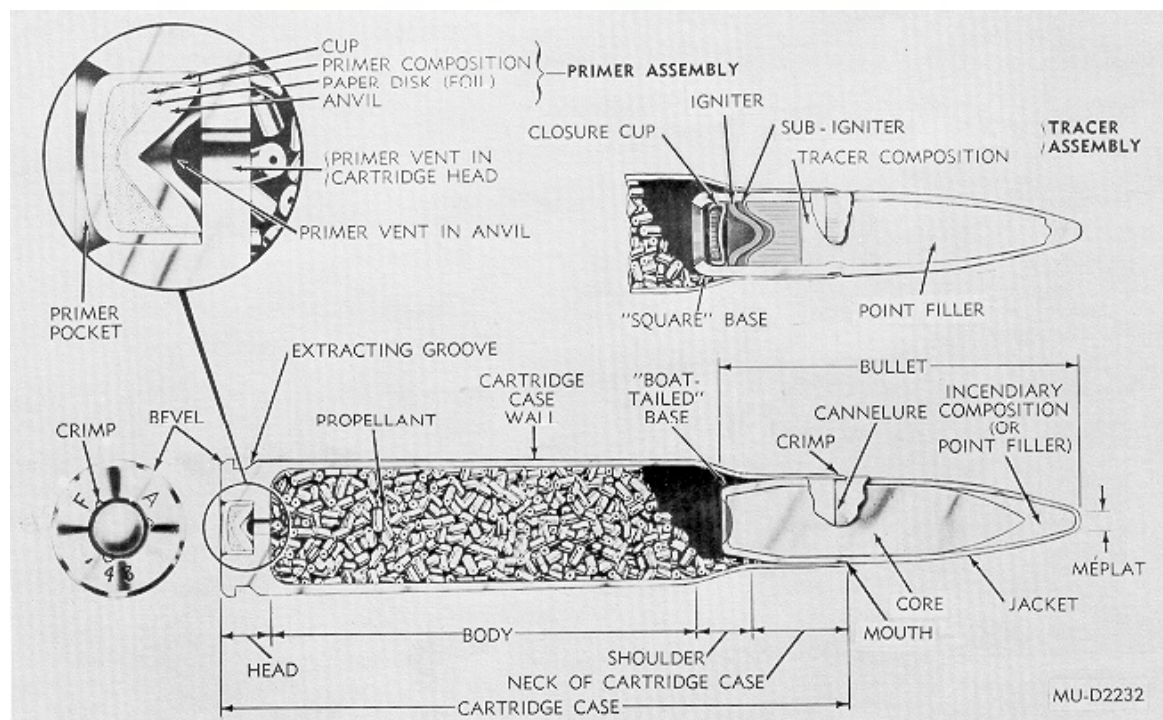




SMALL ARMS AMMUNITION (.50 CALIBER)



-----5.45" MAX-----





.50 CALIBER AMMUNITION COMPOSITION



Cartridge Case

- Brass – copper (70%) and zinc (30%)

Bullet (projectile)

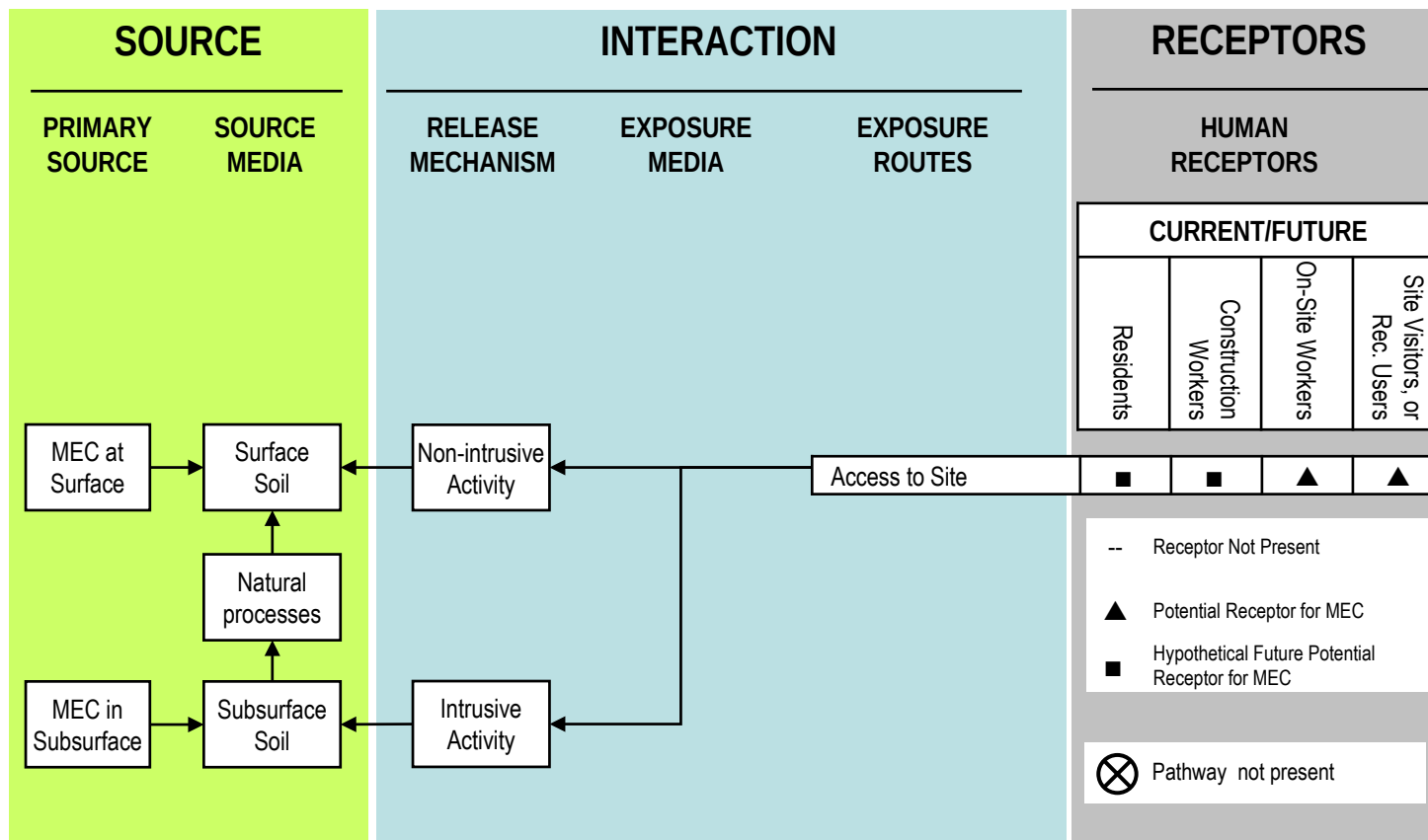
- All military bullets are jacketed
- Bullet jackets are typically gilding metal - copper (95%) and zinc (5%)

Bullet Core

- M2, Ball – steel [iron (99%) and manganese (0.45%)]



Preliminary Human Health Conceptual Site Model for MEC



Current and Future Receptors: On-site workers (i.e., wildlife management area workers, cattle ranchers, and fire break installers), visitors and/or recreational users (i.e., hunters). Hypothetical Future Residents and Construction Workers are considered for evaluation of Unlimited Use/Unrestricted Exposure (UU/UE) scenario.



SUMMARY OF PREVIOUS MC SAMPLING FINDINGS

MRS	Media	Discrete Samples	Above Background	Above Human Health Screening Levels	Above Ecological Screening Levels
Skip Bombing Range	Soil	3	None	N/A	N/A
	Sediment	1	Antimony Copper Lead	None	None
	Surface Water	1	Antimony	None	None
Demolition Bombing Range MRS	Soil	4	None	N/A	N/A
	Sediment	2	None	N/A	N/A
	Surface Water	2	Antimony Copper Lead	None	Lead in surface water
Dive Bombing Range MRS	Soil	5	Lead	None	None
	Sediment	2	Antimony	None	None
	Surface Water	2	Antimony Copper Lead	None	Copper in surface water Lead in surface water
Strafing Range MRS	Soil	3	Antimony Copper Lead	None	Copper in soil
	Sediment	1	None	N/A	N/A
	Surface Water	1	Antimony Copper Perchlorate	None	Copper in surface water
Air-to-Ground Gunnery Range MRS	Soil	3	Antimony Copper Lead	Lead in soil	Copper in soil Lead in soil
	Sediment	1	None	N/A	N/A
	Surface Water	1	Antimony Copper Lead Perchlorate	None	Copper in surface water Lead in surface water



SUMMARY OF PREVIOUS MC SAMPLING FINDINGS

Background Values in the SI were based on:

- Average concentrations of elements in Charlotte County, Florida, identified by the USGS (USGS, 2009);

Or, if no value was established,

- Maximum ambient concentration from 2 surface soil samples and 1 sediment/surface water pair.

Background sampling is planned for this RI.

Soil using Incremental Sampling Methodology (ISM)

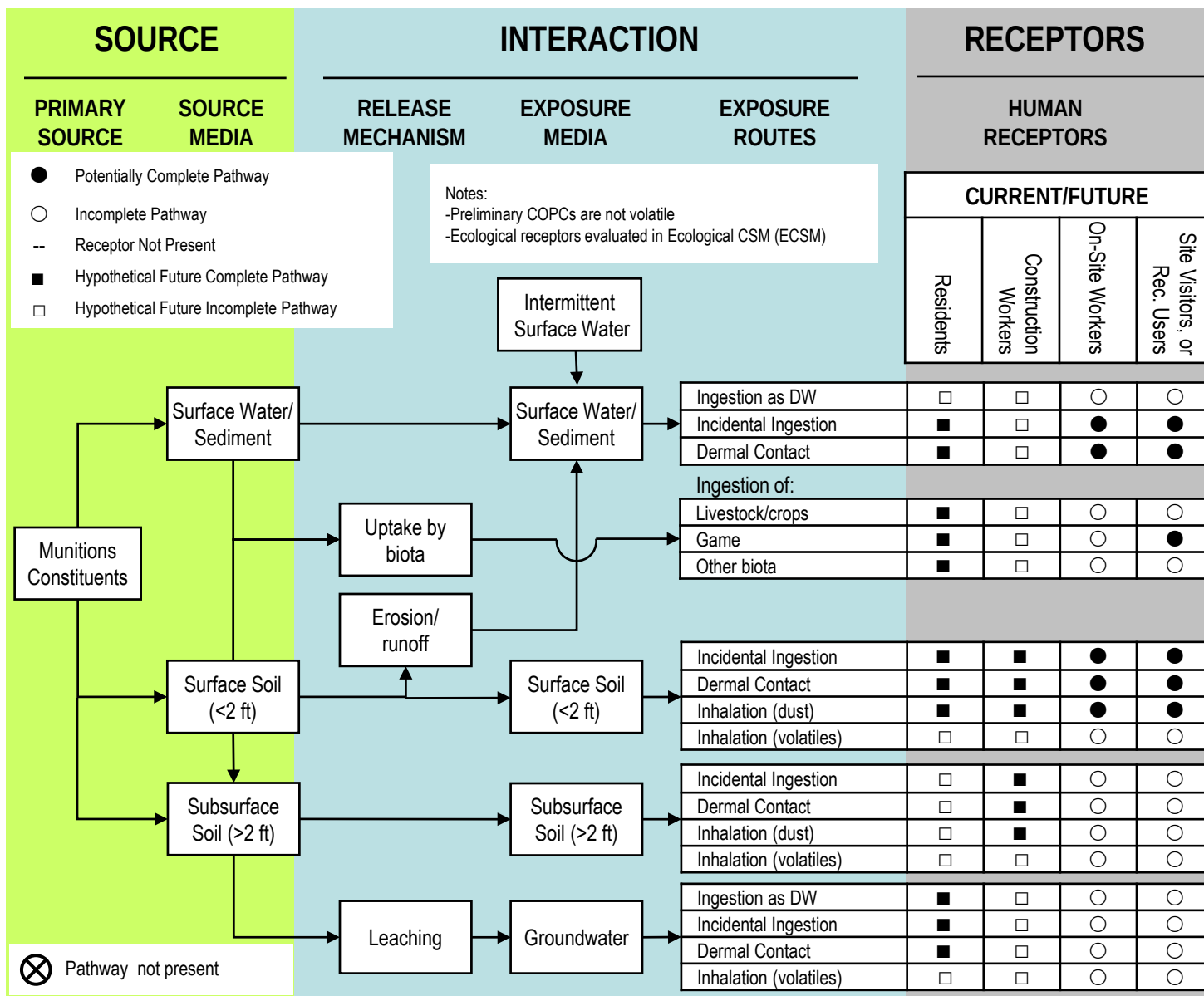
Surface Water/ Sediment (co-located discrete samples)

The risk assessment will include

- ISM soil samples from RI only
- Discrete surface water and sediment samples from SI and RI.



Preliminary Human Health Conceptual Site Model

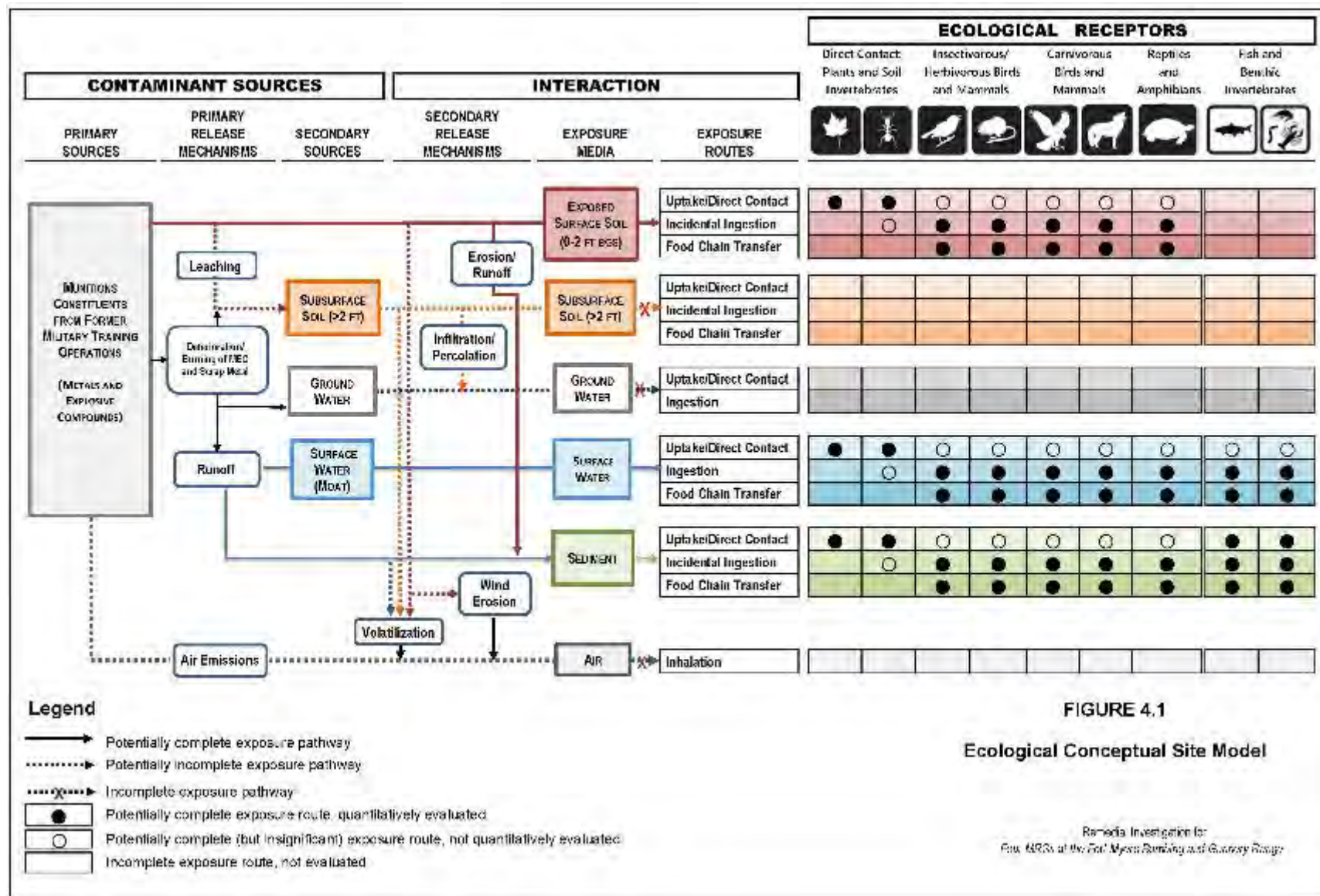


Current and Future Receptors:
On-site workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters)

Hypothetical Future
Residents and Construction Workers will be considered to evaluate UU/UE scenario



Preliminary Ecological Conceptual Site Model





PRELIMINARY DATA QUALITY OBJECTIVES

Please refer to the UFP-QAPP Worksheet #11 handout. Maps and graphics are provided in the slides.

Data Quality Objectives (DQOs) are established using USEPA 7-step process:

- Step 1: State the Problem
- Step 2: Identify the Goals of Data Collection
- Step 3: Identify Information Inputs
- Step 4: Define the Boundaries of the Project
- Step 5: Develop the Project Data Collection and Analysis Approach
- Step 6: Specify Project-Specific Measurement Performance Criteria
- Step 7: Survey Design and Project Work Flow



PRELIMINARY DATA QUALITY OBJECTIVES

STEP 1: STATE THE PROBLEM Worksheet #11, Sections 11.1.1 (MEC) and 11.2.1 (MC)

IN SUMMARY: Previous studies indicated the potential for contamination. Additional data is needed to characterized and delineate contamination, if present, in order to evaluate risk to human health and the environment.

STEP 2: IDENTIFY THE PROJECT GOALS Worksheet #11, Sections 11.1.2 (MEC) and 11.2.2 (MC)

IN SUMMARY: Collect sufficient data to characterize (complete an RI), perform a risk assessment, and evaluate remedial alternatives, if needed (complete an FS)

Worksheet #11 lists each of the questions that must be answered to achieve these project goals.

STEP 3: IDENTIFY INFORMATION INPUTS Worksheet #11, Sections 11.1.3 (MEC) and 11.2.3 (MC)

IN SUMMARY:

- **FOR THE RI:** Site-specific information on anomaly density, background anomaly density, spatial and depth distribution of anomalies, munitions/MEC types and spatial and depth distribution.
- **FOR THE RISK ASSESSMENT:** Current and future land use, receptors, and potential exposure pathways.
- **FOR THE FS:** Effectiveness of various field methods, site conditions, nature and extent of contamination.



PRELIMINARY DATA QUALITY OBJECTIVES

STEP 4: DEFINE THE BOUNDARIES OF THE PROJECT

Worksheet #11, Sections 11.1.4 (MEC) and 11.2.4 (MC)

IN SUMMARY: The target population of the study is expected munitions and MC within the MRS boundaries.

STEP 5: DEVELOP THE PROJECT DATA COLLECTION AND ANALYSIS APPROACH

Worksheet #11, Sections 11.1.5 (MEC) and 11.2.5 (MC)

PRELIMINARY RI STEPS:

Step 1 – Locate Potential Concentrated Munitions Use Areas (CMUAs)

- » Conduct Digital Geophysical Mapping (DGM) transect surveys to estimate anomaly density and identify CMUAs (high density areas) and Non-CMUAs (NCMUAs, low density areas) areas.

Step 2 – Characterize MEC in CMUAs and NCMUAs

- » Perform DGM surveys on grids in potential CMUAs and NCMUAs
- » Perform Advanced Geophysical Classification (AGC) cued surveys over DGM anomalies (within the bombing range MRSs)
- » Intrusively investigate anomalies (targets-of-interest [TOIs] plus validation digs in AGC grids, and all anomalies above background in non-AGC grids)

Step 3 – Characterize Munitions Constituents (MC) at CMUAs

- » Collect and analyze MC soil, surface water, and sediment samples in confirmed CMUAs
- » Collect and analyze step-out samples, as needed based on initial results
- » Make MC characterization decisions for CMUAs based on results



PRELIMINARY DATA QUALITY OBJECTIVES

STEP 6: SPECIFY PROJECT-SPECIFIC MEASUREMENT PERFORMANCE CRITERIA

Worksheet #11, Sections 11.1.6 (MEC) and 11.2.6 (MC), Worksheet #12

IN SUMMARY: Measurement Performance Criteria (MPCs) are identified for all aspects of the project in Worksheet #12.

STEP 7: PROJECT DESIGN AND WORKFLOW Worksheet #11, Sections 11.1.7 (MEC) and 11.2.7 (MC)

IN SUMMARY, MEC:

- The project design decisions for DGM and MEC characterization will be outlined in Worksheet #17 of the UFP-QAPP following the general approach outlined in Step 5.
- Visual sample Plan (VSP) was used to evaluate appropriate transect spacings (See Section 11.1.7, Table 11.4).
- A 354-m transect interval is proposed based on VSP analysis indicating a 95% probability of detecting a target area for a 100lb (M38A2) practice bomb at each of the three bombing targets.



PROPOSED TECHNICAL APPROACH ELEMENTS FOR MEC

MRS	Proposed Tech Approach Elements
Skip Bombing Range, Demolition Bombing Range, and Dive Bombing Range	• Pedestrian and towed array EM61-MK2 surveys along predetermined transects • VSP analysis to identify CMUAs and NCMUAs, • EM61-MK2 grid surveys in low-density and high-density areas • AGC cued surveys using the Metal Mapper 2X2 (MM2X2) to develop a TOI list • The excavation of DGM anomalies based on classification decisions.
Strafing Range	• Instrument-aided reconnaissance (all-purpose metal detector and global positioning system [GPS]) to confirm and verify the site use and to identify potential MC sampling locations. • No DGM based on small arms usage and no evidence of MEC or MD in the past.
ATG Gunnery Range	• Instrument-aided reconnaissance (all-purpose metal detector and GPS). • DGM grids at the target berm collected with AGC sensors to help characterize the target berm. Additional step-out transects will be added as necessary to characterize the extent of the target berm.



PROPOSED TECHNICAL APPROACH ELEMENTS FOR DGM

Perform dynamic DGM surveys

- Three-sensor “towed array”
 - Collect data in open areas
- Single sensor hand-towed
 - Collect data in flat wooded areas, if accessible

Process DGM data and select anomalies for cued surveys

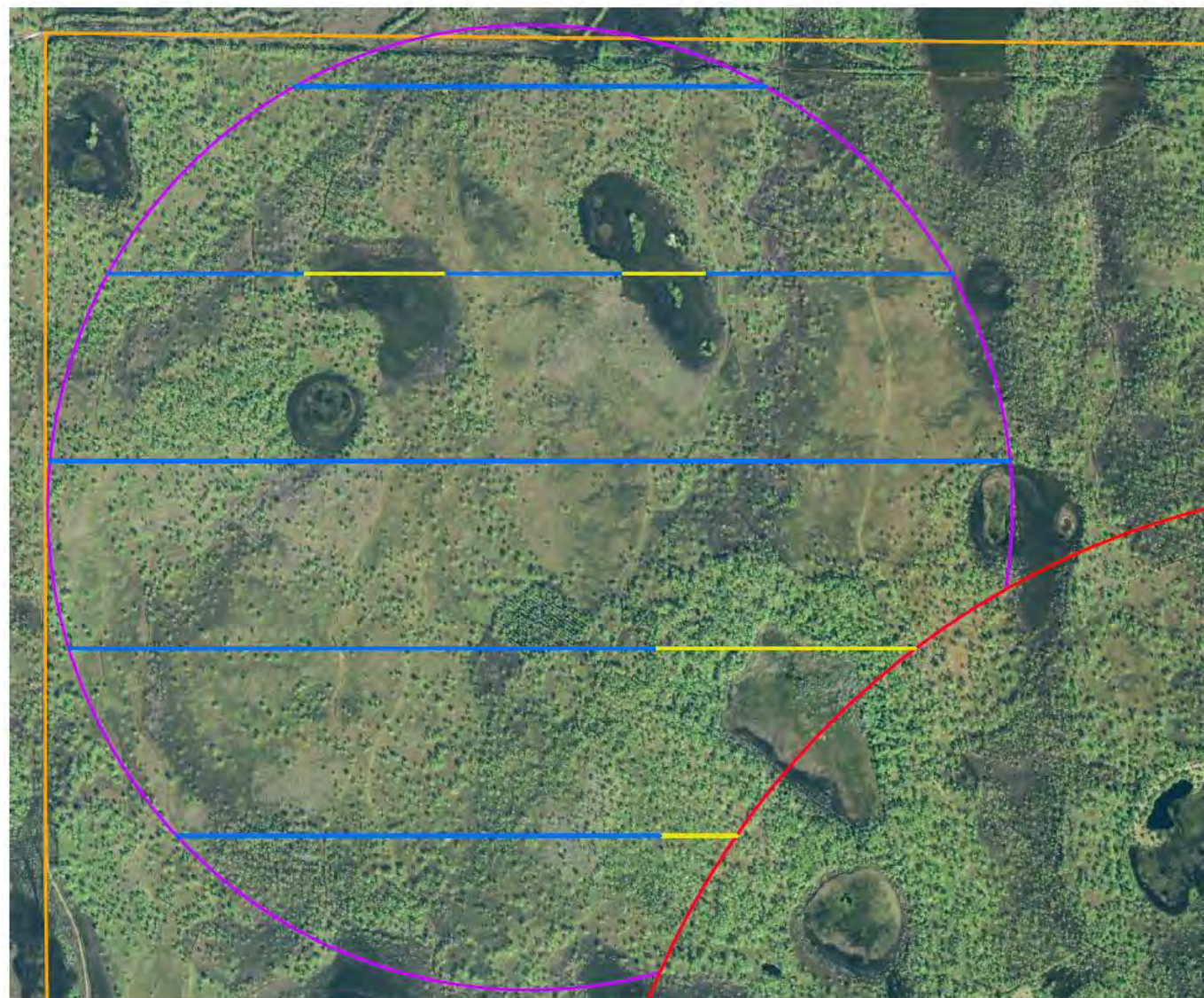
- Process DGM data
- Conduct and document QC evaluations, root cause analyses, and corrective actions
- Generate Cued Target List for intrusive investigation

Examples of DGM surveys





SKIP BOMBING RANGE – PROPOSED TRANSECTS



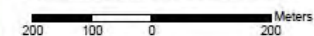
Proposed Transects
Skip Bombing Range
Fort Myers Bombing and Gunnery
Range
FUDS Project No. I04FL017901
 Charlotte County, Florida

Legend

- Pedestrian Towed (3' Width)
(Densely wooded or wetland areas)
- Proposed Towed Array Path (9' Width)
(Open or lightly wooded areas)
- Skip Bombing Range
- Demolition Bombing Range
- Approximate FUDS Property Boundary



Image: 2017 Orthophoto
 Projection: UTM Zone 17 NAD83, Map Units in Meters



PARSONS

U.S. ARMY CORPS
 OF ENGINEERS
 HUNTSVILLE CENTER

DESIGNED BY: BT	Proposed Transects		
DRAWN BY: BT			
CHECKED BY: JY	SCALE: As Shown	PROJECT NUMBER: I04FL017901	
SUBMITTED BY: LK	DATE: February 2019	FROM HUNTSVILLE:	
	FILE:		



DEMOLITION BOMBING RANGE – PROPOSED TRANSECTS



Proposed Transects Demolition Bombing Range Fort Myers Bombing and Gunnery Range FUDS Project No. I04FL017901

Charlotte County, Florida

Legend

- Pedestrian Towed (3' Width)
(Densely wooded or wetland areas)
- Proposed Towed Array Path (9' Width)
(Open or lightly wooded areas)
- - - Crater Area
- Demolition Bombing Range



Image: 2007 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

200 100 0 200 Meters



PARSONS

U.S. ARMY CORPS
OF ENGINEERS
HUNTSVILLE CENTER

DESIGNED BY: BT	Proposed Transects	
DRAWN BY: BT		
CHECKED BY: JY	SCALE: As Shown	PROJECT NUMBER: I04FL017901
SUBMITTED BY: LK	DATE: February 2019	PROJ. NUMBER: I04FL017901
	FILE:	





DIVE BOMBING RANGE – PROPOSED TRANSECTS



Proposed Transects
Dive Bombing Range
Fort Myers Bombing and Gunnery
Range
FUDS Project No. I04FL017901
 Charlotte County, Florida

Legend

- Proposed Transect
- Dive Bombing Range
- Demolition Bombing Range



Image: 2017 Orthophoto
 Projection: UTM Zone 17 NAD83, Map Units in Meters

100 50 0 100 Meters



PARSONS

U.S. ARMY CORPS
 OF ENGINEERS
 HUNTSVILLE CENTER

DESIGNED BY:
 BT

DRAWN BY:
 BT

CHECKED BY:
 JY

SUBMITTED BY:
 LK

Proposed Transects

SCALE: As Shown

DATE: December 2018

FILE:

PROJECT NUMBER:

WPD-00000000

POLY:

NUMBER:





SMALL ARMS RANGES – PROPOSED RECONNAISSANCE



Proposed Transects
Strafing & Air-to-Ground
Gunnery Range
Fort Myers Bombing and Gunnery
Range
FUDS Project No. I04FL017901
 Charlotte County, Florida

Legend

- Proposed Reconnaissance Track
- Strafing Gunnery Range
- Air-to-Ground Gunnery Range
- Approximate FUDS Property Boundary
- Approximate Target Berm



Image: 2017 Orthophoto
 Projection: UTM Zone 17 NAD83, Map Units in Meters

300 150 0 300 Meters



PARSONS

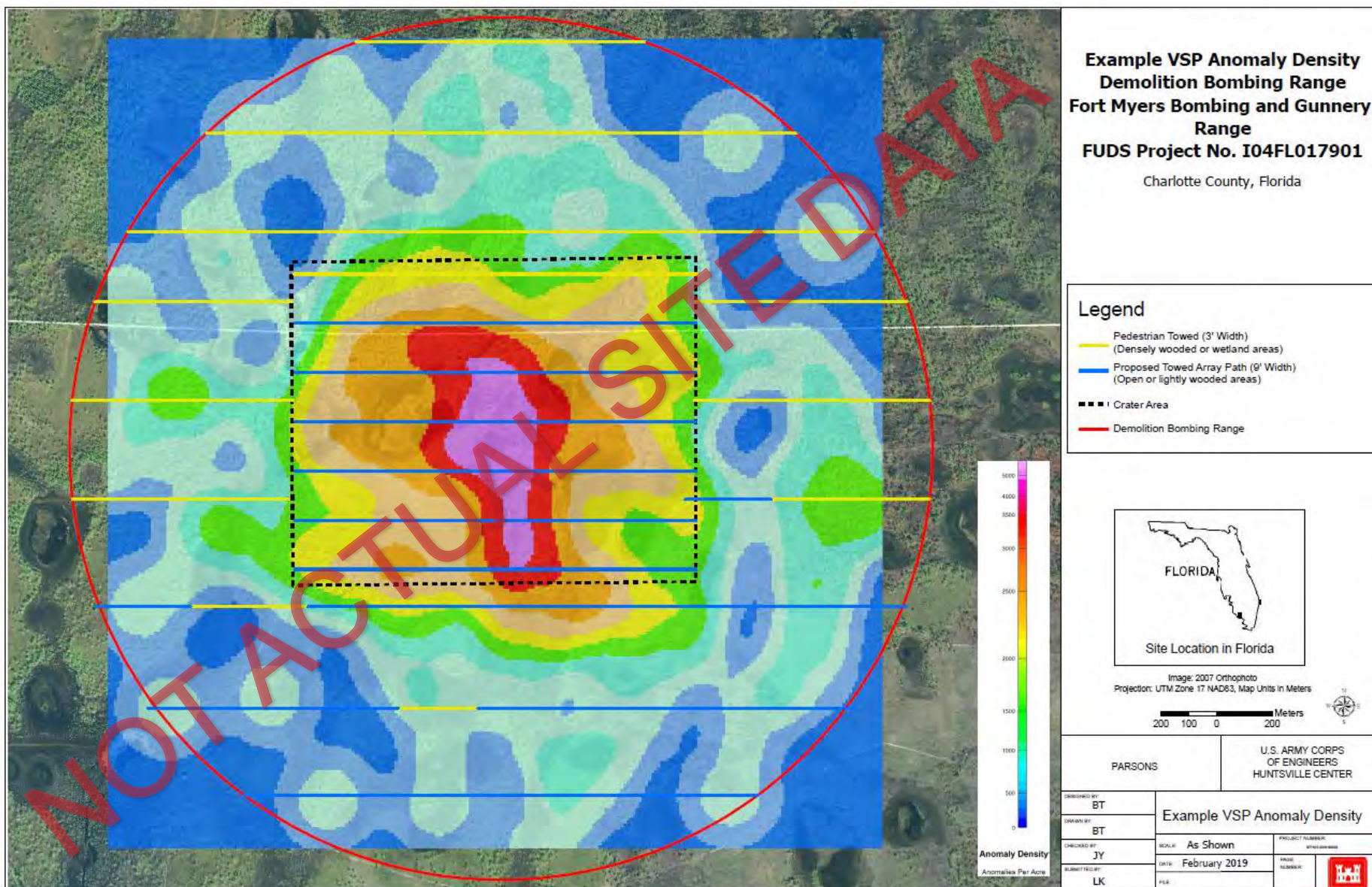
U.S. ARMY CORPS
 OF ENGINEERS
 HUNTSVILLE CENTER

DESIGNED BY BT	Proposed Transects		
DRAWN BY BT			
CHECKED BY JY	SCALE: As Shown	PROJECT NUMBER	ATLAS NUMBER
SUBMITTAL BY DS	DATE: February 2019	PROJ NUMBER	PER





EXAMPLE OF VSP ANOMALY DENSITY MAP (FOR ILLUSTRATION PURPOSES ONLY)





DGM OF CMUA AND NCMUA COVERAGE

Site Information		Instrument Aided Reconnaissance (Miles)	DGM		
FUDS Project Number/ Site Name	Site Acreage		Initial Density Transects (Miles)	CMUA Grids (Acres)	Non- CMUA Grids (Acres)
Skip Bombing Range	613	n/a	4.3	0.46	6.0
Demolition Bombing Range	1,800	n/a	17.4	0.92	6.0
Dive Bombing Range	634 (formerly 568)	n/a	4.6	0.57	6.0
Strafing Range	640	5.5			
Air-to-Ground Gunnery Range	640	5.5	n/a	0.46	0

CMUA Grids – Variable Size*

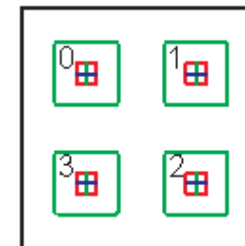
NCMUA Grids – 100ft x 100ft or 100ft x 200ft

*The size of the CMUA Grids will vary depending on the planned acreage in the MRS and the anomaly density results.



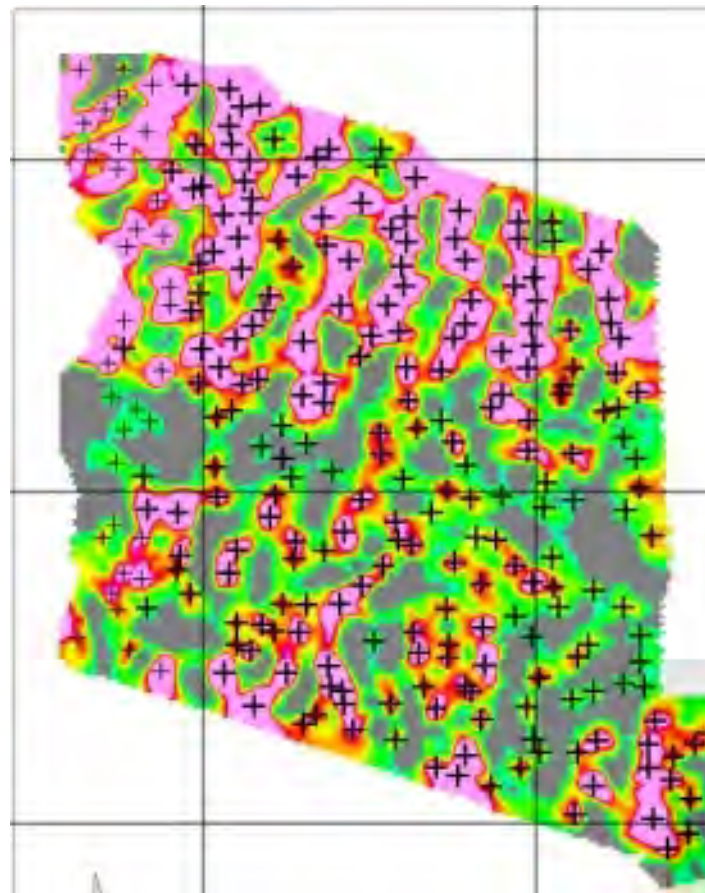
METAL MAPPER 2X2 (MM2X2)

- Based on NRL's TEMTADS sensor
- 4 transmitters, 4 tri-axial receivers
- Sensor and electronics designed to be more compact and more rugged than standard Metal Mapper
- Dynamic and cued data collection modes
 - More feasible for dynamic data collection than larger Metal Mapper given sensor/electronics configuration



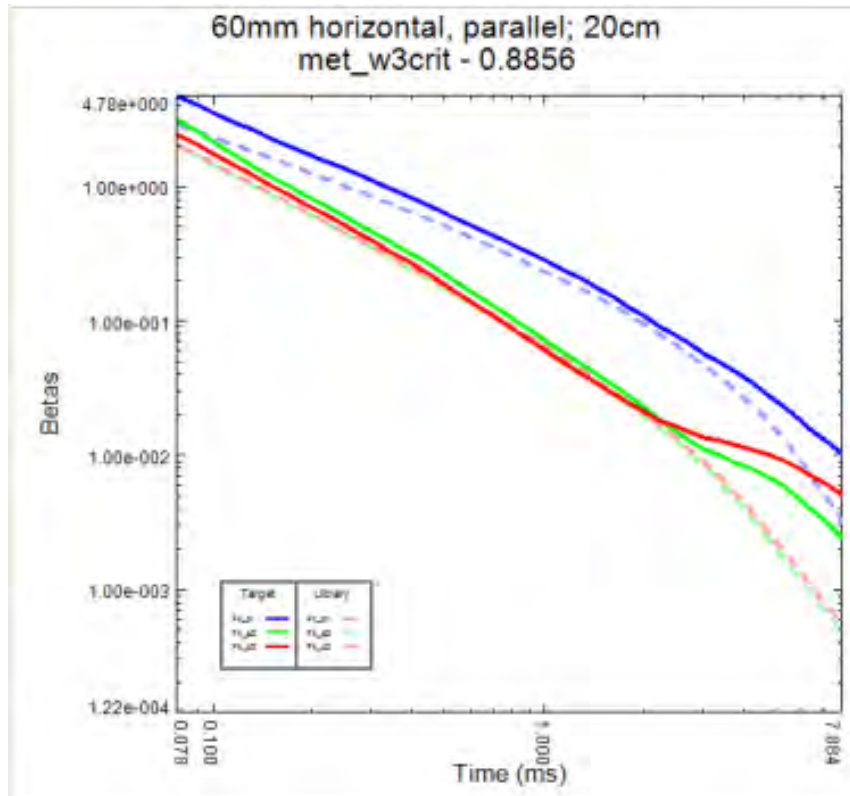


COLLECT CUED DATA





LIBRARY MATCH



- Curves are the same no matter the orientation or depth of the item
- We maintain a library with munitions for the site
- Matching data to library identifies targets of interest (TOI)



CLASSIFICATION

Based on library matching and data quality metrics

Four categories for all collected targets

- Category 0: “Inconclusive”; generally data with questionable quality
- Category 1: Likely TOI; high confidence library match
- Category 2: Questionable TOI; lower confidence library match
- Category 3: Non-TOI; below TOI/Non-TOI library match threshold

All Category 0, 1, and 2 targets will be dug

Separate dig categories indicate likelihood of TOI for dig team



ANTICIPATED DEFINABLE FEATURES OF WORK (DFW)

- DFW 1: Prepare Site
- DFW 2: Construct Instrument Verification Strip (IVS)
- DFW 3: Assemble Detection Sensor, Perform IVS Testing and Confirm Sensor Functionality
- DFW 4: Conduct Detection Survey Transects
- DFW 5: Process Data and Document Anomaly Locations
- DFW 6: Perform VSP Analyses
- DFW 7: Design Additional Sampling For HD Characterization
- DFW 8: Seed Placement
- DFW 9: Conduct Data Collection Grid
- DFW 10: Conduct Anomaly Selection and Data Validation
- DFW 11: Assemble Advanced Geophysical Sensor and Test Sensor at IVS
- DFW 12: Collect Cued Data
- DFW 13: Process Cued Data
- DFW 14: Classify Anomalies and Make Dig/No-Dig Decisions
- DFW 16: Excavate Buried Objects (Ranked Dig List)
- DFW 17: Verify Intrusive Results
- DFW 18: Conduct Final Data Usability Assessment
- DFW 19: Handle, Certify, and Dispose of Materially Potentially Presenting Explosive Hazard (MPPEH)/MEC
- DFW-20: MC Sampling
- DFW-21: Investigative-Derived Waste Disposal, if any



PRELIMINARY DATA QUALITY OBJECTIVES

STEP 7: PROJECT DESIGN AND WORKFLOW Worksheet #11, Sections 11.1.7 (MEC) and 11.2.7 (MC)

IN SUMMARY, MC:

- Samples to be collected using a two phase approach.
- MCs based on anticipated munitions include explosives and select metals (lead, antimony, copper, zinc).
- The proposed approach include ISM soils samples and discrete surface water and sediment (SW/SD) samples.
- Six background ISM soil samples and 10 background co-located SW/SD pairs are planned.
- Table 11.5 in the handout details the proposed MC sampling approach.



PROPOSED TECHNICAL APPROACH FOR MC – BOMBING RANGES

MEC/MD Findings	Soil (0-6 inches bgs)	Soil (6-24 inches bgs)	Surface water	Sediment (0-6 inches bgs)	All Sampling Media
	Phase I				Phase II
Has a CMUA been Identified? If YES ►► If NO ►►	1 ISM SU located in highest anomaly density area within the CMUA.	1 ISM SU located in highest anomaly density area within the CMUA.	8 discrete biased to CMUA	8 discrete biased to CMUA	Additional samples to delineate the extent of chemicals of potential concern (COPCs).
	1 ISM SU at target center or at isolated MEC/MD find, if applicable.	1 ISM SU at target center or at isolated MEC/MD find, if applicable.	5 discrete at random locations	5 discrete at random locations	



PROPOSED TECHNICAL APPROACH FOR MC – SMALL ARMS RANGES



MEC/MD Findings	Soil (0-6 inches bgs)	Soil (6-24 inches bgs)	Surface water	Sediment (0-6 inches bgs)	All Sampling Media	
	Phase I				Phase II	
Strafing Range						
Has small arms use been confirmed?	If YES ►►	1 ISM SU at identified use area	1 ISM SU at identified use area	8 discrete biased to target berm area	8 discrete biased to target berm area	Additional samples to delineate the extent of COPCs.
	If NO ►►	1 ISM SU based on typical range design target area or PDT agreed location.	Reserved for Phase II if needed.	5 discrete at random locations	5 discrete at random locations	
Air-to-Ground Gunnery Range						
Small arms use has already been confirmed.	YES ►►	6 SUs at target berm area, 1 ISM SU in approach (cartridge casing drop area), and 1 ISM SU in the potential crater area if there is evidence of munitions use.	6 SUs at target berm area, 1 ISM SU in approach (cartridge casing drop area), and 1 ISM SU in the potential crater area if there is evidence of munitions use.	8 discrete biased to target berm area	8 discrete biased to target berm area	Additional samples to delineate the extent of COPCs.



DEVELOPMENT OF PROJECT ACTION LIMITS

Slide as presented during SPP Meeting: Final Project Action Limits to be resolved for Final UFP-QAPP

- Project Action Limits are selected from the following sources. COPCs will be identified as chemicals exceeding both the PAL and the site-specific background concentration developed during the RI.

Soil and Sediment:

- HSVs derived from : FDEP FAC 62-777 Soil Cleanup Target Levels, Direct Exposure Residential, Direct Exposure Industrial or Leachability based on Freshwater Surface Water Criteria. Updated April 17, 2005.
- ESVs derived from: USEPA Region 4 Ecological Screening Levels for Soil, last updated 2018 (https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf)

Surface Water:

- HSVs derived from : FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water Criteria and FAC 62-302 Surface Water Quality Standards (for Class III fresh waters).
 - Supplemented with Lead Values from USEPA Maximum Contaminant Levels (MCLs), National Primary Drinking Water Standards, 2006
- ESVs derived from USEPA Region 4 Ecological Screening Levels, Freshwater Screening Values, last updated 2018 (https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf)

Groundwater:

- HSVs derived from : FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria
 - Supplemented with Lead Values from USEPA Maximum Contaminant Levels (MCLs), National Primary Drinking Water Standards, 2006



TECHNICAL APPROACH- INNOVATIVE TECHNOLOGY DEMOLITION RANGE- UAV



Unmanned Aerial Magnetometer

- Deploy a magnetometer attached to a small Unmanned Aerial Vehicle (UAV) to collect magnetic data at an altitude of 1m
- UAV magnetometer system for MEC detection includes the geophysical sensor, positioning system, altimeter, data recording, navigation software, and the UAV itself.
- The DJI M600 UAV
 - capable of flight times up to 20 minutes
 - payload capacity of approximately 8 kg
 - controlled manually or using automated navigation software to follow a pre-planned survey path.

Objective – prove the technology and obtain magnetometer anomaly data over selected wetland areas at Demolition Range MRS



LeddarOne Range Finder



Ublox NEO-M8P RTK GPS



GEM Systems GSMP 35 U Magnetometer



NEXT STEPS / ANTICIPATED PROJECT SCHEDULE



ANTICIPATED SCHEDULE

- Draft Final UFP-QAPP – July / August 2019
- SPP Meeting (Discuss Comments on the UFP-QAPP) – September 2019
- Final UFP-QAPP – October 2019
- Field Work – January through May 2020
- Draft Final RI Report – September / October 2020
- SPP Meeting (Discuss Comments on the RI Report) – October / November 2020
- Draft Final Feasibility Report – March 2021
- Draft Final Proposed Plan – July 2021
- Proposed Plan for Public Review / Public Meeting – September – October 2021
- Draft Final Decision Document – February 2022



MEETING OBJECTIVES ACHIEVED?

- Confirm concurrence on General RI Technical Approach
- Any additional topics anyone would like to discuss?
- Proactively identify and discuss potential site and logistical challenges and resolutions
- Identify hindrances, variables, drivers, and concerns that might impact project performance and success, and seek proactive solutions
- Discuss anticipated key project schedule dates



SITE VISIT INFORMATION



Directions to Site Visit

Exit parking lot and take a left onto Lake Babcock Drive.

Continue 1 Miles to FL-31 N

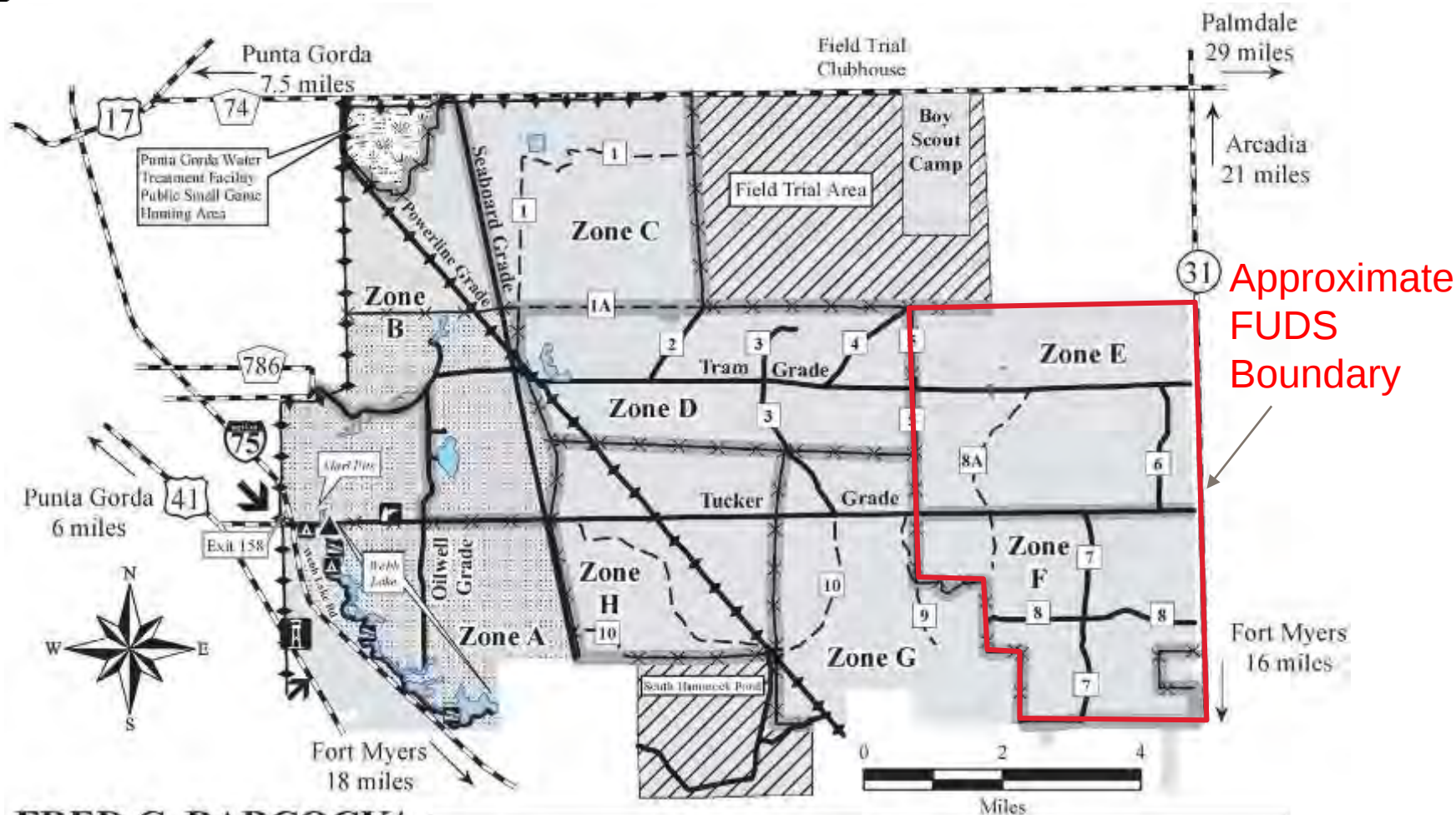
Turn right onto FL-31N.

Continue North for 6.8 Miles to Tram Grade (dirt road).

Turn left onto Tram Grade.



SITE VISIT INFORMATION

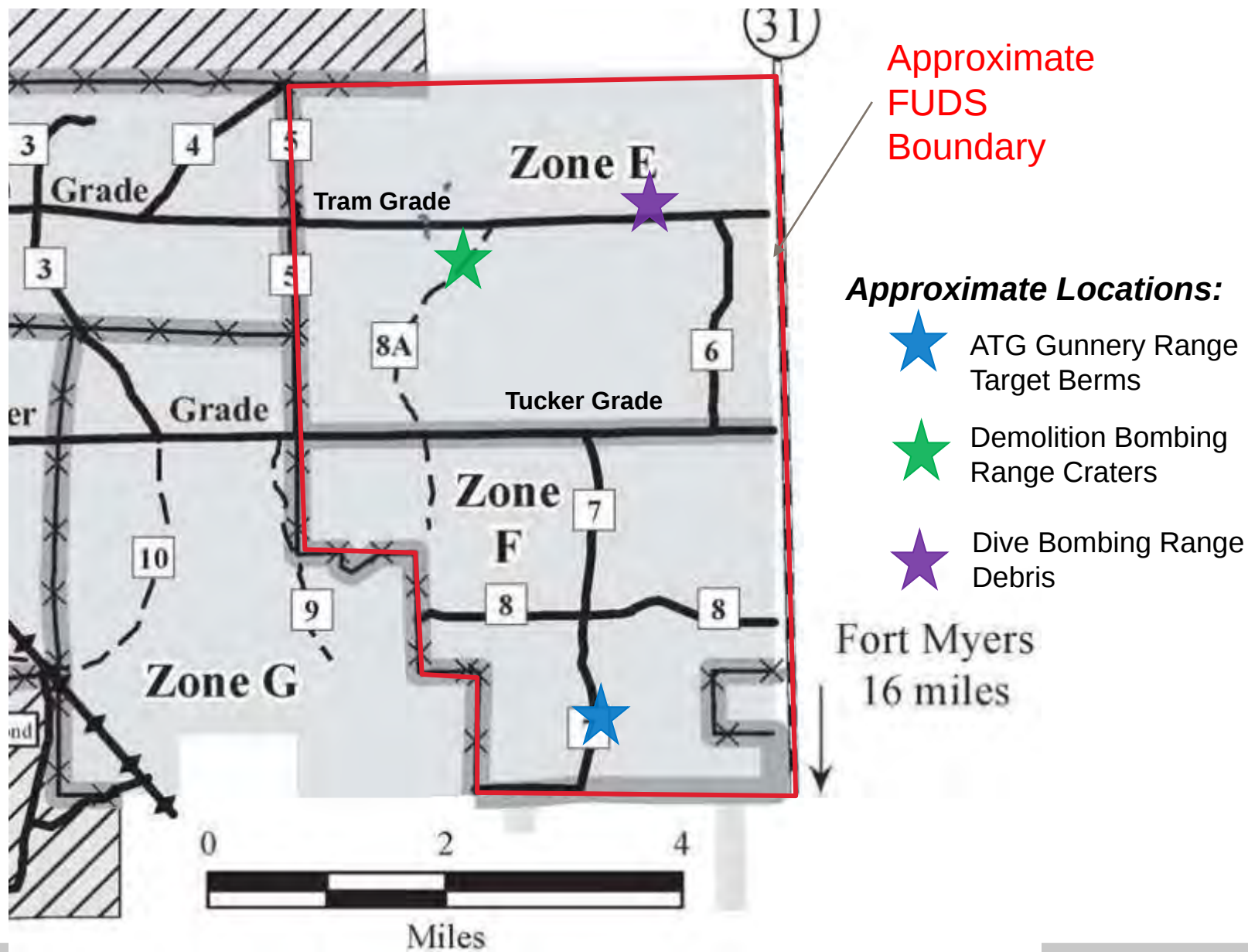


**FRED C. BABCOCK/
CECIL M. WEBB**
WILDLIFE MANAGEMENT AREA
65,758 acres
Charlotte County

Legend			
Management Area	Designated Entrance	Primitive Campground	Powerline
Walk-in Area	Check Station	Fire Tower	Paved Road
Bird Dog Training Area	Field Trial Quail Entrance	Boat Ramp	Unimproved Road
Fishing Area	Shooting Range	Quail Zone Boundaries	Interior Fence



SITE VISIT INFORMATION





REMEMBER TO PRACTICE THE “3 RS”



Recognize

- Suspicious objects found in area should not be touched

Retreat

- Carefully leave the area

Report

- Immediately call 911 or the police/ sheriff
- Report what was found & its approximate location



ATTACHMENT 3

SELECT WORKSHEETS DISCUSSED DURING MEETING

Worksheet #10: Conceptual Site Model

(IDQTF UFP-QAPP Guidance Manual, Section 2.5.2)

10.1 OVERVIEW

The primary purpose of this worksheet is to describe the Conceptual Site Model (CSM) for the project site. In order to provide the basis for this, this worksheet also summarizes observations from previous investigations, secondary data, information from site reports, details of the possible classes of contaminants and the affected media, and other relevant supporting information.

10.2 SITE DESCRIPTION AND BACKGROUND

10.2.1 SITE DESCRIPTION

The Fort Myers BGR is located approximately 20 miles north of the city of Fort Myers, Florida within the Fred C. Babcock-Cecil M. Webb WMA. The site consists of 4 MRSs consisting of three bombing ranges and two gunnery ranges (included as one MRS) listed below (**Figure 10-1**).

10.2.2 HISTORY

Between 1944 and 1945, the United States acquired 13,720 acres of undeveloped land to train personnel stationed at Fort Myers Army Airfield in ground strafing and in various types of bombing. The site consisted of five ranges: skip bombing, dive-bombing, demolition, strafing range, and an air-to-ground gunnery range. Following the end of World War II, the Army Air Forces determined the site was no longer required and in 1946, the leases covering the site were terminated. Munitions used on-site include practice bombs with spotting charges, high explosive bombs, and small arms ammunition.

10.2.3 SKIP BOMBING RANGE

The Skip Bombing Range (MRS 01, **Figure 10-1**) is a 613-acre MRS that was used for bomb training with 100lb practice bombs (M38A2 and spotting charges to potentially include the M1A1, M3, and/or M5). The site consists of undeveloped flat grassy open areas mixed with light vegetation, sections of pine trees, and wetlands. This MRS overlaps with the Demolition Bombing Range. During the 1995 ASR site visit, the team was unable to access the site due to high water. The field effort conducted for the 2009 SI included over 5.6 miles of qualitative reconnaissance (QR). No MEC was observed during the QR; however, munitions debris (MD) from M38A2 100lb practice bombs was observed towards the center of the MRS. The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Munitions constituents (MC) metals were not detected above background in any of the surface soil samples. Although antimony, copper, and lead were detected above background in surface water and/or sediment samples, the metals did not exceed human health or ecological screening levels.

10.2.4 DEMOLITION BOMBING RANGE

The Demolition Bombing Range (MRS 02, **Figure 10-1**) is an 1,800-acre MRS that was used for bomb training using 250lb general purpose (GP) bombs (AN-M57 and AN-M57A1) and 500lb GP bombs (M64 and M64A1), and also may contain 100lb practice bombs (M38A2) and associated spotting charges (M1A1, M3 and M5) within areas overlapping with the nearby Dive and Skip Bombing Ranges. The site consists of undeveloped flat grassy open areas, mixed with low shrub, light vegetation, sections of pine trees, and wetlands. There is a primary road running through the center and access roads break off to the south, along with fire breaks throughout the MRS. The center of the site consists of visible large craters surrounded by low shrubs. This MRS overlaps with the Skip Bombing and the Dive Bombing Ranges. The field effort conducted for the 2009 SI included over 9.1 miles of QR. No MEC was observed during the QR; however, MD from the 250lb GP bomb (AN-M57) and 500lb

GP bomb (AN-M64) were observed. Numerous bomb craters were also found within the center portion of the MRS which may include multiple high density (HD) areas. The field effort conducted for the 2009 SI included collection of two surface water, two sediment, and four surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. MC metals were not detected above background in any of the surface soil or sediment samples. Although antimony, copper, and lead were detected in surface water above background, the metals did not exceed human health screening levels. The maximum detected concentration of lead in surface water was slightly greater than the selected ecological screening value.

10.2.5 DIVE BOMBING RANGE

10.2.5.1 The Dive Bombing Range (MRS 03, **Figure 10-1**) is a 634-acre (formerly 568-acre) MRS that was used for bomb training with 100lb practice bombs (M38A2 and spotting charges to potentially include the M1A1, M3, and/or M5). The site consists of undeveloped flat grassy open areas mixed with light vegetation, sections of pine trees and wetlands. There are fire breaks running north and south through the site. This MRS overlaps with the Demolition Bombing Range. The field effort conducted for the 2009 SI included over 5.5 miles of QR. No MEC or MD was found during the QR; however, review of aerial photographs, indicated a potential target area adjacent to the southeastern boundary of the range. While no MEC or MD was noted in this area during the SI, MD has subsequently been observed in this area. The field effort conducted for the 2009 SI included collection of two surface water, two sediment, and five surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. MC metals were not detected above human health screening levels in any of the surface soil, surface water, or sediment samples. The maximum detected concentrations of copper and lead in surface water were greater than the selected ecological screening values.

10.2.5.2 Prior to the RI, the MRS covered 568 acres and was located in a position slightly more northwest of its current location. During the 2017 site visit walk conducted as part of the RI proposal effort, MD in the form of various practice bombs was discovered in the southeast portion of the current MRS. The area also included a high number of subsurface anomalies detected by a hand held instrument. Review of the historic photos confirmed that the original MRS location was incorrect. The Formerly Used Defense Site Management Information System (FUDSMIS) MRS boundary and acreage (568 acres) are currently incorrect but will be revised at the conclusion of the RI. It was decided to wait to edit FUDSMIS due to the likelihood that the MRS boundary may be further revised based on the findings of the RI. The MRS boundary shown on all figures in this UFP-QAPP reflect the new boundary that will be confirmed during the RI field work and represents an MRS area of 634 acres.

10.2.6 STRAFING RANGE

The Strafing Range (MRS 04, **Figure 10-1**) is a 640-acre range that was used for training strafing techniques using .30 and .50 caliber small arms ammunition. The Strafing Range is part of a single 1280-acre MRS containing both the Strafing range and the Air-to-Ground Gunnery Range. The site consists of medium to heavy vegetation of palmetto trees and pine trees. The vegetation through most of the site is currently 3- to 4- feet high. A major access road cuts through the north end with no other entry points. The field effort conducted for the 2009 SI included over 4.2 miles of QR. No MEC or MD was observed during the QR. A short length of QR extended beyond the presumed target berm location at the south of the range to evaluate whether MEC or MD might extend beyond the indicated boundary. No evidence of MEC or MD was observed during the QR. The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. MC metals were not detected in any of the sediment samples above background. Although antimony, copper, and lead were detected in surface soils above background, the maximum detected concentrations did not exceed human health screening levels. or ecological screening levels. The maximum detected concentrations of copper in surface soil and surface water were greater than the selected ecological screening values.

10.2.7 AIR-TO-GROUND GUNNERY RANGE

10.2.7.1 The Air-to-Ground Gunnery Range (MRS 04, **Figure 10-1**) is a 640-acre range that was used for training air-to-ground firing techniques using .30 and .50 caliber small arms ammunition. The Air-to-Ground Gunnery Range is part of a single 1280-acre MRS containing both the Strafing range and the Air-to-Ground Gunnery Range. The site consists of medium to light vegetation and low shrubs. A major access road cuts through from

the northeastern to the southern end where a strafing target berm is located. The field effort conducted for the 2009 SI included QR of over 3.2 miles. No evidence of MEC was observed during the QR. Debris from .50 caliber ammunition including spent cartridges and projectiles were observed; however, no MD was found. A line of target berms was discovered in the southern portion of the range. A short length of QR was extended beyond the presumed target berm location to evaluate whether MEC or MD might extend beyond the range boundary. The field effort conducted for the 2009 SI included collection of one surface water, one sediment, and three surface soil samples for metals and explosives analysis. Explosives compounds were not detected in any of the samples. Antimony, copper, and lead were detected in surface soil above background, of which the maximum detected concentration of lead exceeded human health screening values and copper and lead exceeded ecological screening values. MC metals were not detected above background in any of the sediment samples. Although antimony, copper, lead and perchlorate were detected in surface water samples above background, the maximum detected concentrations did not exceed human health screening values. Copper exceeded the ecological screening value in surface water. During the proposal site visit in 2017 the site visit team noticed an area of possible craters to the north and just east of the target berm area at the Air-to-Ground Gunnery Range along with some metal debris consistent with practice bomb debris on the surface. This area was identified for additional investigation during the RI data collection.

10.2.7.2 During preparation for the RI, the USACE Center of Expertise (CX) for photogrammetric mapping reviewed the range boundaries for each of the Fort Myers BGR MRSs. During the review it was determined that the range boundaries for the Air-to-Ground Gunnery Range had not been applied properly given the current understanding of the target berm alignment. As such, the MRS boundary was revised to apply an appropriate approach angle and revised the location of the target berm within the range. Which was previously located at the edge of the range fan instead of within the range fan. The revision resulted in a realignment of the boundary which brought the range further to the south and tilted slightly to the left of the original location. The shift and rotation of the range did not change the size of the MRS. This new range boundary represents a more accurate range layout for the Air-to-Ground Gunnery Range MRS and now includes the portion of the range designated for the target overshoots. It was decided to wait to edit the FUDSMIS due to the possibility that the MRS boundary may be revised further based on the findings of the RI. The MRS boundary shown on all figures in the UFP-QAPP reflect the new boundary that will be confirmed during the RI field work.

10.3 PREVIOUS INVESTIGATIONS

10.3.1 **1993 Inventory Project Report (INPR):** An INPR (INPR; USACE 1993) of ordnance contamination was completed for the Fort Myers BGR site by CESAJ in 1993. The INPR confirmed the location and historical use of the site and determined that the site was eligible for the FUDS program. The INPR inspection team did not find MEC or MD during the 1993 site visit. A Risk Assessment Code (RAC) of 3, indicating moderate risk, was assigned to the site in June 1993. A Findings and Determination of Eligibility (FDE), dated September 1, 1993, concluded that the site was formerly used by the DoD and 13,720 acres of the site are eligible for DERP - FUDS.

10.3.2 **1995 Archives Search Report (ASR):** The ASR (USACE, 1995) was completed by the USACE, St. Louis District (CEMVS) in 1995. The ASR was prepared after reviewing available records, interviews, site inspection, analysis, and reports that documented the history of the site. The ASR team reviewed available reports, newspaper articles, historical documents, and reference material pertaining to the use and history of Fort Myers BGR. A site visit was conducted in January 1995. The site visit included on-ground and aerial surveys. No MEC were identified at the MRSs during the 1995 ASR site visit. However, the ASR inspection team observed several 30-foot diameter water-filled craters, one strafing target berm, and numerous .50 caliber bullets. Bomb fragments were found in one of the craters during the 1995 site visit. The ASR concluded that while no MEC were observed directly, MD observations, and other indirect evidence (historical records, aerial photos, interviews, and cratering) support a possibility that conventional ordnance or explosive waste remain at the Fort Myers BGR.

10.3.3 **2004 Archives Search Report Supplement:** The ASR Supplement (USACE, 2004b) was prepared by CEMVS as a supplement to the 1995 ASR. This ASR Supplement identified 5 MRSs and assigned a RAC score to each of the MRSs. No known public injury incidents have been reported since site closure.

10.3.4 **2009 Site Inspection (SI) Report:** An SI was conducted in 2009 which included qualitative reconnaissance and environmental sampling. During the SI, 35 miles of QR was conducted. No MEC items were found;

however, several MD items indicative of MEC were found within the MRSs at the Fort Myers BGR. Additionally, historical reports indicated extensive use of general purpose bombs and practice bombs. Based on these findings, the known use of the MRSs for bombing and strafing activities, and the potential for MEC to remain within the MRS, the MEC exposure pathways for each of the MRSs at Fort Myers BGR were identified as potentially complete. An unacceptable human health risk due to direct exposure to lead in the surface soil or inhalation of re-suspended particulate matter may be present at the Air-to-Ground Gunnery Range MRS. Unacceptable ecological risks from MC may be present at four of the MRSs: from exposure to lead in the surface water at the Demolition Bombing Range MRS; from exposure to copper and lead in the surface water at the Dive Bombing Range MRS; from exposure to copper in surface soil and surface water at the Strafing Range MRS; and from exposure to copper and lead in surface soil and surface water at the Air-to-Ground Gunnery Range MRS.

10.3.5 **Table 10.1** below summarizes the MD that has been found during previous investigations at each of the MRSs. Additional items noted during the 2017 site visit conducted as part of the RI proposal effort has also been included. **Table 10.2** summarizes the findings of the MC sampling completed at the MRSs during the SI.

Table 10.1 Summary of Previous MEC Findings, Fort Myers BGR, Charlotte County, FL

MRS	Study	MEC	MD	Munitions-Related Features
Skip Bombing Range	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	M38A2, 100lb bomb, practice debris	None
Demolition Bombing Range MRS	ASR (USACE, 1995)	None	Bomb fragments	Water filled craters about 30' in diameter
	Site Inspection (Parsons, 2009)	None	AN-M57 and AN-M64 GP Bomb Debris	Bomb Craters
Dive Bombing Range MRS	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	None	None
	Proposal Site Visit 2017	None	Practice bomb debris	Subsurface anomalies using hand held detector
Strafing Range MRS	ASR (USACE, 1995)	Not visited during ASR Site Visit.		
	Site Inspection (Parsons, 2009)	None	None	None
Air-to-Ground Gunnery Range MRS	ASR (USACE, 1995)	None	.50 caliber projectiles	Target Berms
	Site Inspection (Parsons, 2009)	None	.50 caliber bullets and casings	Target Berms
	Proposal Site Visit 2017	None	.50 caliber bullets and casings	Possible craters or other natural features to the north-east of the target berm area.

Table 10.2 Summary of Previous MC Findings, Fort Myers BGR, Charlotte County, FL

MRS	Media	Discrete Samples	Above Background	Above Human Health Screening Levels	Above Ecological Screening Levels
Skip Bombing Range	Soil	3	None	N/A	N/A
	Sediment	1	Antimony Copper Lead	None	None
	Surface Water	1	Antimony	None	None
Demolition Bombing Range MRS	Soil	4	None	N/A	N/A
	Sediment	2	None	N/A	N/A
	Surface Water	2	Antimony Copper Lead	None	Lead in surface water
Dive Bombing Range MRS	Soil	5	Lead	None	None
	Sediment	2	Antimony	None	None
	Surface Water	2	Antimony Copper Lead	None	Copper in surface water Lead in surface water
Strafing Range MRS	Soil	3	Antimony Copper Lead	None	Copper in soil
	Sediment	1	None	N/A	N/A
	Surface Water	1	Antimony Copper Perchlorate	None	Copper in surface water
Air-to-Ground Gunnery Range MRS	Soil	3	Antimony Copper Lead	Lead in soil	Copper in soil Lead in soil
	Sediment	1	None	N/A	N/A
	Surface Water	1	Antimony Copper Lead Perchlorate	None	Copper in surface water Lead in surface water

N/A – NOT APPLICABLE

10.4 ENVIRONMENTAL SETTING

10.4.1 TOPOGRAPHY, GEOLOGY, AND SOILS

10.4.1.1 The area is nearly flat with an approximate elevation range between 55 and 65 feet. Plant communities on-site consist of Florida Dry Prairie, hardwood hammocks, and wetlands. The Florida Dry Prairie community is treeless with low shrubs (such as palmettos) and grasses (such as wiregrass) dominating. The hardwood hammocks typically consist of a dense overstory in which live oaks dominate and a shrub midstory which includes saw palmettos. The entire site is heavily covered in wetland areas as shown in **Figure 10-1**.

10.4.1.2 The Fort Myers BGR is located in the Floridian Section of the Coastal Plain Physiographic Province (USGS, 2009). The Floridian Section is further broken down into three physiographic zones with Charlotte County occurring within the Central or Mid-peninsular Zone. Geologically, the area rocks and sediments are influenced by the Ocala Uplift, a structural anticline which occurs all along west central Florida.

10.4.1.3 The surface materials throughout the area consist of Pleistocene to recent aged fine to medium, light gray to brown, quartz sands with varying amounts of marl (carbonaceous clay). The typical thickness of the surficial sands is between zero and twenty-five feet. The Caloosahatchee Formation (early Pleistocene in age, 1.8 million years ago to 800,000 years ago) underlie most of the county. This formation varies considerably by lithology including limestone, marl, unconsolidated shell beds, lime mud, and quartz sand. The Tamiami Formation underlies the Caloosahatchee Formation and consists of mixed marine and terrestrial clastic deposits with variable lithologies due to rapid lateral changes in depositional environments. The upper part of the formation consists of green clay or marl mixed with some quartz sand or silt, the mid-section contains beds of limestone, sandstone, or unconsolidated quartz sand. These sediments, believed deposited as part of a deltaic depositional environment, form a wedge that thickens from the west to the east. The lower part of the Tamiami Formation typically consists of sandy clay or marl (calcareous clay) and phosphorite nodules. The thickness of the Tamiami Formation in Charlotte County is estimated to be between 75 and 250 feet thick. The Miocene aged (approximately 33.7 million years ago to 5.3 million years ago) Hawthorn Formation is found throughout all of Charlotte County and is divided into an Upper unit and a Lower unit. The Upper unit is comprised of 70 to 260 feet of interbedded gray to grayish-white sandy clay and grayish-white sand limestone. The Lower unit contains interbedded gray to grayish-white limestone and gray to green clay. Some dolomite seams occur in the Lower unit with abundant phosphorite throughout. A clay member defines the bottom of the unit. The thickness of the Lower unit is between 50 and 130 feet (USGS, 1975).

10.4.1.4 Soils along the Fort Myers BGR site are nearly level, poorly drained, and found in sloughs and on low broad flatwood areas. The surface layer of these soils is mainly composed of black and dark gray sand and continues to a depth of 40 inches with the color of the unit changing to light gray to yellowish brown with some mottling. A subsoil layer extends to a depth past 80 inches and consists of a pale brown fine sand with increasing clay content in some areas (USACE, 1995).

10.4.2 SURFACE WATER, GROUNDWATER, AND AQUIFERS

10.4.2.1 The Fort Myers BGR is located in the southwestern part of peninsular Florida. The surrounding swampland continues for five to ten miles to the north, east, west, and south and the entire site experiences large amounts of evaporation.

10.4.2.2 Two aquifer systems, the Floridan aquifer and the surficial aquifer, lie beneath the site. The Floridan aquifer is unconfined at this location since an overlying clay aquitard is absent. The Floridan aquifer is the principal aquifer supplying most of the water used in the region. The configuration of the top of the aquifer is highly variable due to erosion and dissolution in the limestones that form its upper surface. The elevation of the top of the aquifer ranges from slightly below sea level to more than 100 feet above sea level. Subsurface information from nearby water wells indicates that the top of the Floridan aquifer at the site is about elevation 25 feet mean sea level (msl). Recharge of the Floridan aquifer occurs from direct contact with the surficial aquifer, through rainfall percolation through unconsolidated sands and clays, surface exposure, and where there are lakes, sinks, and rivers.

10.4.2.3 The surficial aquifer is found where sands overlie the limestones and dolomites of the Floridan aquifer. This aquifer is exposed at the surface and is in an unconfined condition. The thickness of the surficial aquifer is highly variable due to large variations in the thickness of sands. The thickness of the surficial aquifer system is typically less than 50 feet, but may be as thick as 400 feet; the thickness generally increases coastward. The shallow aquifer may directly overlie the Floridan aquifer, or they may be separated by clays or other relatively impermeable units. Recharge to the surficial aquifer is almost entirely from local rainfall, except in those areas where it is hydraulically connected to the Floridan aquifer, which is the likely condition at this site. Discharge from the surficial aquifer may be by downward percolation into the Floridan aquifer, seepage into streams, lakes, sinkholes, and pumpage from wells.

10.4.3 VEGETATION, WILDLIFE, AND ENDANGERED SPECIES

10.3.3.1 Most of the Fort Myers BGR consists of Florida Dry Prairie, hardwoods hammocks and wetlands (Parsons, 2009). The Florida Dry Prairie community is treeless with low shrubs (palmettos) and grasses. The hardwood hammocks typically consist of a dense overstory in which live oaks dominate and a shrub midstory which includes saw palmettos. The entire site is heavily covered in wetland areas. (Parsons, 2009).

10.3.3.2 The Fort Myers BGR offers a habitat for numerous species of birds, reptiles, amphibians, and mammals. Some sensitive environmental resources occur within some of the areas.

10.4.4 SITE ACCESSIBILITY

Most of the Fort Myers BGR used for recreational purposes such as hunting, hiking, biking, fishing, wildlife viewing, and horseback riding. It is regularly assessed by dirt roads on multiple sides of the site. The site is considered accessible to the public.

10.5 CURRENT AND PROJECTED LAND USE AND EXPOSURE PROFILE

The land comprising the former Fort Myers BGR is currently used as the Fred C. Babcock-Cecil M. Webb Wildlife Management Area and is managed by the Florida Fish and Wildlife Conservation Commission. There is one private landowner that has a hunting camp located within the Formerly Used Defense Site. There are three small hunting cabins near the east central boundary of the Formerly Used Defense Site but outside of any known ranges. The site is used recreationally for activities including hunting, hiking, biking, fishing, wildlife viewing, and horseback riding. Additionally, the property is also leased for cattle grazing. No change is expected in the future. Site details on land use and receptors are provided in **Table 10.3**.

10.6 CONCEPTUAL SITE MODEL

10.6.1 The Conceptual Site Model (CSM) is a description of a site and its environment that can be used to depict the nature of potential contamination, its location, and the possible interactions of human and environmental receptors with that contamination. The CSM summarizes which potential receptor exposure pathways for MEC and MC are (or may be) complete and which are (and are likely to remain) incomplete. An exposure pathway is considered incomplete unless *all four* of the following elements are present:

- a source of contamination;
- an environmental transport and/or exposure medium;
- a point of exposure at which the contaminant can interact with a receptor; and
- a receptor and a likely route of exposure at the exposure point.

10.6.2 If any single factor was not present, the pathway would be incomplete. An incomplete exposure pathway indicates there are no current means by which a receptor (human or ecological) can be exposed to either MEC or MC. In this case no hazards or risks from exposure to MEC or MC would be expected. The CSM is a 'living document' that is based on existing knowledge and, therefore, can and should be updated throughout the course of the project as more data become available.

10.6.3 The CSMs for the MRSs were updated based on investigation results following the SI at Fort Myers BGR (Parsons, 2009). The CSMs for the bombing ranges indicate MEC may be present based on the results of

previous investigations and site visits. These MEC could be found throughout the MRS on the surface or in the subsurface. The CSMs indicate an unacceptable ecological risk from MC may be present at the three bombing ranges and two small arms ranges. The MC CSM for the Air-to-Ground Gunnery Range indicates an unacceptable human health risk from lead may be present.

10.6.4 Complete exposure pathways are present at the site that might result in residents, site workers, recreational users, or site visitors being exposed to MEC. Known or suspected munitions at Fort Myers BGR include 100lb to 500lb bombs and spotting charges (M1A1, M3, and M5) in practice bombs.

10.6.5 The CSMs for the Fort Myers BGR MRSs are summarized in **Table 10.3**. This table describes the known or suspected contamination sources, potential/suspected location and distribution of contamination, contamination source or exposure medium, current and future receptors, and potentially complete exposure pathways. The CSM may be revised based on project results, and Army and stakeholder feedback.

Table 10.3 Overview of Preliminary Conceptual Site Model, Fort Myers BGR, Charlotte County, FL

SITE DETAILS	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
NAME: Skip Bombing Range Acreage: 613 acres Suspected Past United States Department of Defense (DoD) Activities (release mechanisms): Skip Bombing Practice Current and Future Land Use: Wildlife management area; recreational activities to include: hunting, hiking, biking, fishing, wildlife viewing, and horseback riding; cattle ranching.	Bomb, 100lb, Practice M38A2 Signal, Spotting charge, M1A1, M3 and M5	Concentrated Munitions Use Areas (CMUAs): Increased potential to find residual MEC/ material potentially presenting an explosive hazard (MPPEH). MD was observed in the form of M38A2 practice bomb debris in the center of the MRS during the 2009 SI.	Surface and subsurface soil	Commercial and/or industrial workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters), ecological receptors	Exposure to surface and/or subsurface MEC
	MC in soil, surface water, sediment, or groundwater	Potentially present in soil, surface water, sediment, or groundwater in CMUA areas only; not expected in non-CMUAs.	Surface and subsurface soil, sediment, surface water, and groundwater.		Exposure to soil through incidental ingestion, dermal contact, and inhalation of resuspended soil particles. Exposure to surface water and sediment through incidental ingestion and dermal contact. Exposure to groundwater as a potable water source, through ingestion and dermal contact.
NAME: Demolition Bombing Range Acreage: 1800 acres Suspected Past United States DoD Activities (release mechanisms): Demolition Bombing Practice Current and Future Land Use: Wildlife management	Bomb, 250lb, General Purpose, AN-M57 and AN-M57A1 Bomb, 500lb, General Purpose, M64 & M64A1 Bomb, 100lb, Practice, M38A2 Signal, Spotting Charge,	CMUAs: Increased potential to find residual MEC/ material potentially presenting an explosive hazard (MPPEH). MD was found in the form of AN-M57 and AN-M64 general purpose bomb debris during the 2009 SI in the center of the MRS. A number of large craters were observed in the center of the MRS during the 2009 SI.	Surface and subsurface soil	Commercial and/or industrial workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters), ecological receptors	Exposure to surface and/or subsurface MEC

SITE DETAILS	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
area; recreational activities to include: hunting, hiking, biking, fishing, wildlife viewing, and horseback riding; cattle ranching.	M1A1, M3 and M5				
	MC in soil, surface water, sediment, or groundwater	Potentially present in soil, surface water, sediment, or groundwater in CMUA areas only; not expected in non-CMUAs.	Surface and subsurface soil, sediment, surface water, and groundwater.		Exposure to soil through incidental ingestion, dermal contact, and inhalation of resuspended soil particles. Exposure to surface water and sediment through incidental ingestion and dermal contact. Exposure to groundwater as a potable water source, through ingestion and dermal contact.
NAME: Dive Bombing Range Acreage: 634 acres (formerly 568 acres) Suspected Past United States DoD Activities (release mechanisms): Dive Bombing Practice Current and Future Land Use: Wildlife management area; recreational activities to include: hunting, hiking, biking, fishing, wildlife viewing, and	Bomb, 100lb, Practice, M38A2 Signal, Spotting charge, M1A1, M3, and M5	CMUAs: Increased potential to find residual MEC/ material potentially presenting an explosive hazard (MPPEH). No MEC/MD previously found during the 2009 SI During the 2017 site visit walk, MD in the form of various practice bombs was discovered in the southeast portion of the MRS. The area also included a high number of subsurface anomalies detected by a handheld instrument. No evidence of an impact area was found in the center of the target, no craters or anomalies were detected. Based on these findings it was determined that the MRS boundary was incorrectly located, and the boundary of the MRS was revised to surround the new target area location. For this reason, the boundaries	Surface and subsurface soil	Commercial and/or industrial workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters), ecological receptors	Exposure to surface and/or subsurface MEC

SITE DETAILS	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
horseback riding; cattle ranching.		of the MRS are different than those presented in previous documents.			
	MC in soil, surface water, sediment, or groundwater	Potentially present in soil, surface water, sediment, or groundwater in CMUA areas only; not expected in non-CMUAs.	Surface and subsurface soil, sediment, surface water, and groundwater.		Exposure to soil through incidental ingestion, dermal contact, and inhalation of resuspended soil particles. Exposure to surface water and sediment through incidental ingestion and dermal contact. Exposure to groundwater as a potable water source, through ingestion and dermal contact.
NAME: Strafing Range Acreage: 640 acres Suspected Past United States DoD Activities (release mechanisms): Air-to-Ground Strafing Practice Current and Future Land Use: Wildlife management area; recreational activities to include: hunting, hiking, biking, fishing, wildlife viewing, and horseback riding; cattle ranching	Small Arms, General; Cartridge, .30-caliber Cartridge .50 caliber, Machine Gun	No MEC/MD previously found or suspected Shotgun shells also found in the MRS	Surface and subsurface soil	Commercial and/or industrial workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters), ecological receptors	Exposure to surface and/or subsurface MEC
	MC in soil, surface water, sediment, or groundwater	Potentially present in soil, surface water, sediment, or groundwater in CMUA areas only; not expected in non-CMUAs.	Surface and subsurface soil, sediment, surface water, and groundwater.		Exposure to soil through incidental ingestion, dermal contact, and inhalation of resuspended soil particles. Exposure to surface water and sediment through incidental ingestion and dermal contact. Exposure to groundwater as a potable water source, through ingestion and dermal contact.

SITE DETAILS	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
NAME: Air-to-Ground Gunnery Range Acreage: 640 acres Suspected Past United States DoD Activities (release mechanisms): Air-to-Ground Gunnery Practice Current and Future Land Use: Wildlife management area; recreational activities to include: hunting, hiking, biking, fishing, wildlife viewing, and horseback riding; cattle ranching.	Small Arms, General; Cartridge, .30-caliber Cartridge .50 caliber, Machine Gun	CMUAs: Increased potential to find residual MEC/ material potentially presenting an explosive hazard (MPPEH). MD and possible large craters observed in the southern berm area. Expended .50 caliber projectiles and casings (small arms ammunition) found in the southern berm area.	Surface and subsurface soil	Commercial and/or industrial workers (i.e., wildlife management area workers, cattle ranchers, fire break installers), visitors and/or recreational users (i.e., hunters), ecological receptors	Exposure to surface and/or subsurface MEC
	MC in soil, surface water, sediment, or groundwater	Potentially present in soil, surface water, sediment, or groundwater in CMUA areas only; not expected in non-CMUAs.	Surface and subsurface soil, sediment, surface water, and groundwater.		Exposure to soil through incidental ingestion, dermal contact, and inhalation of resuspended soil particles. Exposure to surface water and sediment through incidental ingestion and dermal contact. Exposure to groundwater as a potable water source, through ingestion and dermal contact.

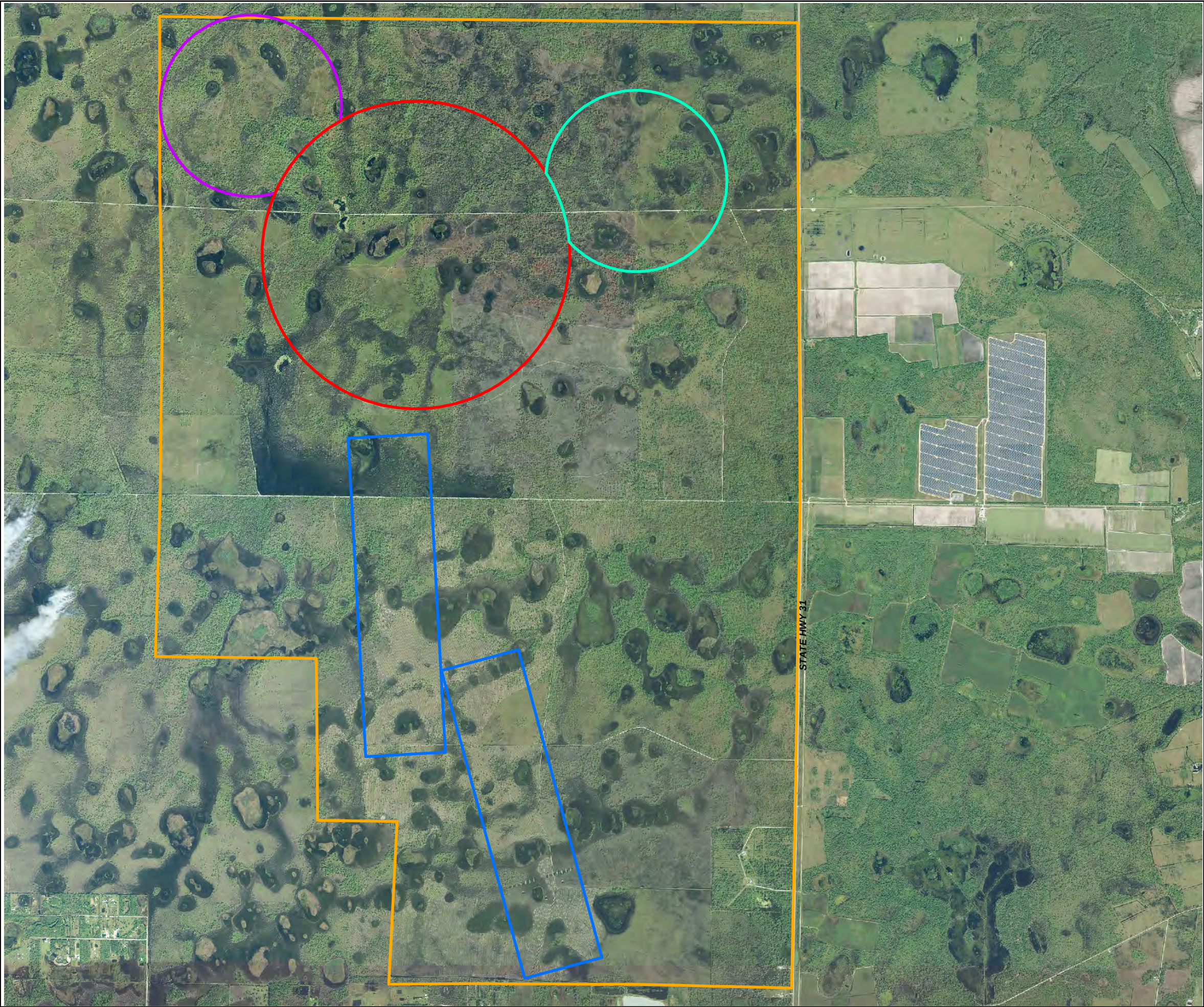


Figure 10.1
Site Setting
Fort Myers Bombing and Gunnery
Range
FUDS Project No. I04FL017901
Charlotte County, Florida

Legend

- Demolition Bombing Range
- Strafing & Air-to-Ground Gunnery Range
- Skip Bombing Range
- Dive Bombing Range
- Approximate FUDS Property Boundary



Image: 2017 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

500 250 0 500 Meters

PARSONS		U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER	
DESIGNED BY: BT	Site Setting		
DRAWN BY: BT			
CHECKED BY: JY	SCALE: As Shown	PROJECT NUMBER: 100132.0477.110095.04000. labor	
SUBMITTED BY: LK	DATE: February 2019	PAGE NUMBER:	
	FILE:		

Worksheet #11: Project Data Quality Objectives

(IDQTF UFP-QAPP Guidance Manual, Section 2.6.1; EPA Guidance QA/G-5, Section 2.1.7)

11.1 MEC DATA QUALITY OBJECTIVES OVERVIEW

11.1.1 This worksheet describes the MEC Data Quality Objectives (DQOs) developed for the project, including the environmental problem, the related decisions that need to be made, the type and quantity of data, and level of data quality needed to ensure that those decisions are based on sound scientific data. The overall goal of this project is to obtain acceptance of an RI/FS, Proposed Plan, and Decision Document for the Bombing Ranges in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and DoD, Army and USACE regulations and guidance. The information collected to meet the DQOs presented in this worksheet will be sufficient to characterize the nature and extent of any MEC and/or MC and assess human health and ecological risks present at the Fort Myers BGR.

11.1.2 The following DQO elements are developed during project planning sessions using a systematic planning process (SPP). Examples of SPP include the EPA's seven-step DQO process defined in EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4, EPA/240/B-06/001, February 2006; Intergovernmental Data Quality Task Force Uniform Federal Policy (UFP)-Quality Assurance Project Plans Manual; and the USACE Technical Project Planning Process (TPP), Engineer Manual (EM) 200-1-2, February 29, 2016.

11.1.3 In addition to these DQOs all data collected during this project are required to attain the Measurement Performance Criteria (MPC) described on [Worksheet #12](#) to be considered adequate to support environmental decisions, unless sufficient alternative justification is provided to and accepted by the project team. Before final environmental decisions are made, data will be verified and validated as described in [Worksheet #34](#), [Worksheet #35](#), [Worksheet #36](#), and [Worksheet #37](#).

11.1.1 STEP 1: STATE THE PROBLEM

Evidence from previous investigations at the Fort Myers BGR MRSs, including the 2009 Site Inspection (SI), 2017 proposal site visit, ASR Supplement (USACE, 2004) and the ASR (USACE, 1995), suggest that MEC, in the form of unexploded ordnance (UXO) or discarded military munitions (DMM), may be present at the four Fort Myers BGR MRSs from their use between 1944 and 1945 as Army training ranges. The list of munitions includes small arms, practice bombs (M38A2) with spotting charges (M1A1, M3, or M5), and general-purpose bombs (AN-M57, AN-M64, and AN-M61A1). Except for small arms munitions, these munitions contain explosives that might present a residual hazard if they remain at the site intact. The most hazardous of these munitions is the 500lb AN-M64 GP bomb. There may be an unacceptable risk from explosive hazards to workers and recreational users. Further study is needed to characterize the types and locations of potential MEC hazards; delineate concentrated munitions use areas (CMUAs), buffer zones, and unused zones; evaluate baseline risks to human health; and gather data to assist in evaluating alternatives for mitigating unacceptable risks.

11.1.2 STEP 2: IDENTIFY THE PROJECT GOALS

11.1.2.1 IDENTIFY THE PRINCIPAL STUDY QUESTION

Does the presence of explosive hazards at this MRS or investigation area pose an unacceptable risk to human health?

11.1.2.2 REMEDIAL INVESTIGATION

The project team will collect geophysical and physical data to refine the CSM and answer the following questions:

- 1) What are the horizontal and vertical extents of MEC contamination?
- 2) Within the MRS, what are boundaries of areas where:

- a. CMUAs exist and MEC is likely to be present?
 - i. What is the anomaly density in these areas?
 - ii. What is the depth distribution profile?
 - b. Areas where MEC presence is less likely but may be found at discrete random locations.
 - i. What is the amount of MEC contamination that could potentially be present in these areas?
 - ii. What is the depth distribution profile?
 - c. There is no evidence of MEC contamination?
- 3) What types of MEC are/may be present within investigation areas?
- 4) What is the background anomaly density?
- 5) What are the site-specific capabilities and limitations of the detection instruments?
 - a. How is confidence in detection depth verified and reported?
 - b. How is the horizontal width of the instrument verified?
 - c. How effective is Advanced Geophysical Classification (AGC) at reducing the number of digs during intrusive operations at this site?

11.1.2.3 BASELINE RISK ASSESSMENT:

The project team will update the CSM using RI results and conduct a baseline risk assessment to answer the following questions:

- 1) What are the potential interactions between MEC and receptors based on the amount and distribution of MEC and the current and reasonably anticipated future land use?
- 2) For each interaction type, what is the frequency of access? (workers, residents, etc.)
 - a. How frequently do people access the site?
 - b. Are there any physical or legal restrictions that affect site access?
 - c. Are there land/deed restrictions enforced on the site?
- 3) Using the “Amount of MEC” determined from the RI geophysical and intrusive investigation, and the “Accessibility” for the MRS, what is the likelihood of encounter?
- 4) If there is an encounter with MEC, what is the likelihood that there will be energy imparted on an item based on land use?
- 5) Based on the types of MEC present, and the specific munitions sensitivities, what is the probability that human interaction will cause an item to function?
- 6) Based on the type of MEC present, what is the severity of an unintentional detonation?
- 7) Based on all of the above, is there an unacceptable risk from MEC hazards?

Identify alternative outcomes (RI/Baseline Risk Determination):

- 1) There is no unacceptable risk.
- 2) There is an unacceptable risk; therefore, remedial alternatives will be evaluated to mitigate unacceptable risk.

11.1.2.4 FEASIBILITY STUDY:

Feasibility Study (FS):

If the results of the baseline risk assessment indicate an unacceptable risk may exist, the project team will conduct a Feasibility Study to identify and evaluate remedial alternatives for mitigating exposure to MEC. The primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected to meet a remedial action objective (RAO). (NCP Section 300.430 (e)).

For each remedy/action evaluated, the FS will identify the expected outcome, e.g.:

- The alternative achieves an acceptable end state.
- The alternative does not achieve an acceptable end state.

11.1.3 STEP 3: IDENTIFY INFORMATION INPUTS

11.1.3.1 INFORMATION NEEDED TO ESTABLISH PRESENCE/ABSENCE OF MEC AND CHARACTERIZE THE POTENTIAL HAZARD:

- The expected background anomaly density (EM61-MK2 detection)
- The average target area density above background
- The horizontal and vertical boundaries of high-use area and low-use area
- The anticipated depth of reliable detection for munitions known to be present
- Mapped anomaly locations and anomaly sources:
 - o To establish whether HD areas are high-use areas
 - o To refine boundaries of high-use areas and low-use areas
 - o To build weight of evidence supporting Non-Impacted Area (NIA) determinations
 - o To estimate anomaly density and distribution
- Types of munitions on the site:
 - o UXO vs DMM
 - o Caliber and type (mortars, bombs, projectiles, etc.)
 - o Nature of explosive hazard
 - o Associated hazardous components

11.1.3.2 ADDITIONAL INFORMATION TO ESTABLISH EXPOSURE

- Current and reasonably anticipated future land use
- Current and reasonably anticipated future receptors
- Potential exposure scenarios based upon current/future land use activities and receptors

11.1.3.3 INFORMATION NEEDED TO SUPPORT THE FS

- If necessary, data to establish the effectiveness of various alternatives, including:
 - o Anticipated detection technology performance
 - Target of Interest (TOI) library
 - Cued survey results
 - Intrusive investigation results
 - Quality Control (QC) results
 - Quality Assurance (QA) results
 - Usability Assessments
 - o Impact of various alternatives on risk
 - Munitions composition and sensitivities
 - Expected severity of unintentional detonations
 - Frequency of use by potential receptors
 - Land use data
- Data to support costing of various alternatives, including:

- o Site access conditions
- o Topography, geology, vegetation
- o Nature and Extent of Contamination

11.1.4 STEP 4: DEFINE THE BOUNDARIES OF THE PROJECT

11.1.4.1 TARGET POPULATION

The target population for this study includes any metallic anomalies detected during the Digital Geophysical Mapping (DGM) survey, with the detection threshold for the DGM survey the higher of the minimum expected response five times the site-specific background noise. Detected DGM anomalies will be studied to differentiate which anomalies are consistent with ordnance used, stored, or discarded at this site, versus those anomalies that result from non-MEC metallic objects. The target population for the remedial response process is UXO and DMM. This remedial investigation will also account for MD as an indicator of the types of munitions used, associated distribution (horizontal and vertical), and as an indicator of potential MEC hazards and potential MC contamination. At this time, the CSM indicates that the following MEC may be present at the site.

Table 11.1 Target Munitions (Confirmed and Suspected)

Known or Suspected Munition (including nomenclature if known)	MEC Type (UXO, DMM, or both)	Potential Hazards/Severity	Expected Frag Distance	Detection Depth	Diameter	Length
<i>Skip Bombing Range</i>						
100lb M38A2 practice bomb	UXO	Explosive	N/A	175cm	208mm	1180mm
M1A1 / M3 / M5 Spotting charge	UXO	Explosive	N/A	40cm	87mm	284mm
<i>Demolition Bombing Range</i>						
100lb M38A2 practice bomb	UXO	Explosive	N/A	175cm	208mm	1180mm
M1A1 / M3 / M5 Spotting charge	UXO	Explosive	N/A	40cm	87mm	284mm
AN-M57 GP Bomb	UXO	Explosive	766m	Not available ⁽¹⁾	274mm	1214mm
AN-M64 GP Bomb	UXO	Explosive	868m	Not available ⁽¹⁾	376mm	1503mm
<i>Dive Bombing Range</i>						
100lb M38A2 practice bomb	UXO	Explosive	N/A	175cm	208mm	1180mm
M1A1 / M3 / M5 Spotting charge	UXO	Explosive	N/A	40cm	87mm	284mm
<i>Strafing Range</i>						
.50cal Machine Gun	Small Arm	Nonexplosive	N/A	20cm	13mm	138mm
<i>Air-to-Ground Gunnery Range</i>						
.50cal Machine Gun	Small Arm	Nonexplosive	N/A	20cm	13mm	138mm

N/A – Not Applicable

(1) No official EM61-MK2 detection threshold values have been determined by Naval Research Laboratory (NRL) for the AN-M57 GP and AN-M64 GP bomb.

11.1.4.2 SPATIAL AND TEMPORAL BOUNDARIES

This study is designed to detect and correctly classify all TOI exceeding the detection threshold and meeting measurement criteria within the established spatial boundaries. The detection threshold will be based on the response five times the site-specific background noise.

The horizontal boundaries of the project are defined by the boundary of the ranges shown on Figure 10.1. The vertical boundary for each munition is the munition-specific maximum depth of detection that will be based on the detection threshold discussed above.

Hunting occurs seasonally within the project site. In addition, summer months are considerably wetter than winter months and makes site access more difficult. While weather and hunting are not hard temporal limits on the project, the project team has agreed to adjust the project schedule to accommodate these conditions and conduct field work during winter months.

11.1.5 STEP 5: DEVELOP THE PROJECT DATA COLLECTION AND ANALYSIS APPROACH

The data collection and analysis approach for the RI/FS at Fort Myers BGR MRSs will involve three steps:

- 1) Delineating high density (HD) areas and low density (LD) areas,
- 2) Characterizing HD areas, and
- 3) Characterizing LD areas.

11.1.5.1 PRELIMINARY MRS CHARACTERIZATION

The project team will perform transect surveys using a EM61-MK2 sensor to locate anomalies and delineate areas of high anomaly density (HD areas) from areas of low anomaly density (LD areas) using Visual Sample Plan (VSP). HD areas will be considered potential CMUA and LD areas will be considered potential non-concentrated munitions use areas (NCMUAs), subject to further investigation. Transect spacing and layout has been designed to detect a target area, at 95% confidence (based on the VSP Transect Spacing module), a high anomaly density area with a radius equal to or greater than the target area (217.6 meters/714 feet) of a 100lb practice bomb. An appropriate target radius size was chosen for each MRS based on specific known and suspected munitions used at the site. Table 11.2 summarizes the transect spacing goals and rationale for each MRS. Table 11.3 summarizes the number of acres of DGM transects and grids that are anticipated to achieve the project objectives.

Table 11.2 Preliminary Characterization Transect Spacing

Project Location	Transect Spacing	Rationale
Skip Bombing Range	354m (1161ft)	Based on the VSP transect spacings for the smallest known munition, a transect spacing of 354 meters was selected, based on VSP for finding an air launched 100lb practice bomb target area.
Demolition Bombing Range	354m (1161ft) and 177m (581ft)	Based on the VSP transect spacings for the smallest known munition, a transect spacing of 354 meters was selected, based on VSP inputs for finding a target area for an 100lb practice bomb air launched, which is the smallest munitions used for this range. 177 meter transects are planned for the crater area located in the center of the MRS to delineate multiple HD areas.
Dive Bombing Range	354m (1161ft)	Based on the VSP transect spacings for the smallest known munition, a transect spacing of 354 meters was selected, based on VSP for finding an air launched 100lb practice bomb target area.
Strafing Range	Approximately 100 to 200 meters	Meandering path Instrumented aided recon will attempt to cover the entire range equally.
Ai- to-Ground Gunnery Range	Approximately 100 to 200 meters	Meandering path Instrumented aided recon will attempt to cover the entire range equally.

Table 11.3 Summary of Investigation Coverage

Site Information		Instrument Aided Reconnaissance (Miles) ¹	DGM			Cued AGC Targets ⁵	Intrusive	
FUDS Project Number/ Site Name	Site Acreage		Initial Density Transects (Miles) ²	CMUA Grids (Acres) ³	Non-CMUA Grids (Acres) ⁴		Validation/ Verification Digs ⁶	TOI Anomalies
Skip Bombing Range	613	N/A	4.3	0.46	6.0	461	60/60	46
Demolition Bombing Range	1,800	N/A	17.4	0.92	6.0	622	60/60	62
Dive Bombing Range	634 (formerly 568)	N/A	4.6	0.46	6.0	500	60/60	50
Strafing Range	640	5.5	N/A					
Air-to-Ground Gunnery Range	640	5.5	N/A	0.46 ⁽⁷⁾	0	161	20/20	16

- (1) Reconnaissance transects based on further characterization of the small arms areas and no MEC anticipated.
(2) Transect spacing of 354-meter spacing based on VSP analysis using 100lb bomb.
(3) Acreage includes CUMA grids (variable size, typically 50ft by 50ft) and extent grids (250ft by 5ft), if needed, to refine the extent of contamination. It is anticipated that the acreage will be half for each element. The SPP team will evaluate grid placement based on DGM transect results.
(4) Coverage based on characterization of MRS acreage to get to 95% confidence of less than or equal to 0.5 UXO per acre.
(5) Estimation based on site history and large TOI; Background = 50/acre, Target = 350/acre.
(6) Validation and Verification digs are planned as part of the AGC process to provide additional data to support a RI recommendation for No Further Action in NCMUAs.
(7) CMUA acreage is based on target berm area which consists of subsurface anomalies, surface MD, and crater or natural depressions

Parameters of interest: Geophysical anomalies exceeding the project-specific detection threshold.

Assumptions: CMUAs with anomaly densities elevated significantly above the background anomaly density.

HD Area Characterization:

If the presence of a CMUA is confirmed, the team will establish the CMUA's approximate horizontal and vertical boundaries, determine which munitions were used, and estimate MEC density. Grids will be investigated within the HD areas to characterize MEC that may be present, and along the boundary of the CMUA, (i.e., extent grids measuring 250ft by 5ft) to establish the vertical boundaries. CMUA grid characterization will include 4 CMUA grids (up to 0.23 acres) plus 8 extent grids (up to 0.23 acres) at the Dive Bombing Range and the Skip Bombing Range. Eight CMUA grids (up to 0.46 acres) plus 16 extent grids (up to 0.46 acres) are planned at the Demolition Bombing Range. A detection survey will be conducted over the entire area of the grid, followed by an AGC cued survey of all detected anomalies (at select MRSs), and intrusive investigation of anomalies. When AGC is included, all anomalies classified as TOI will be intrusively investigated. Cluster analysis of non-TOI will be performed. Additional validation digs of non-TOI will be selected by USACE (based on cluster analysis, location, size, decay, specific polarizability, curve metrics, and other features) over the area to ensure a sufficient number of anomalies are investigated to fully develop the depth distribution profile. Investigation of non-TOI digs will be performed in accordance with Measurement Quality Objectives (MQOs) listed in Table 22A.3. Blind QC seeds and validation seeds will be placed such that the slowest survey (i.e. dynamic or cued) can be expected to cover

1 to 3 seeds per data collection team per day to assess survey performance. The faster survey will cover more than the required number. All placed seeds should be detected in the dynamic surveys and classified as items that must be intrusively investigated in the cued surveys.

LD Area Characterization:

Based on results of the previous steps, the project team will delineate the LD area. Within the LD areas, the placement of grids (100ft by 100ft or 100ft by 200ft) will be designed to test for an upper bound of MEC density less than the target density with 90% confidence. The target UXO density is less than 0.5 UXO/acre for limited use areas for Fort Myers BGR. The team will intrusively investigate 100% of TOI and 200 validation digs in AGC Grids and all anomalies above background within non-AGC grids. Blind QC seeds and validation seeds will be placed in grids such that the slowest survey (i.e. dynamic or cued) can be expected to cover 1 to 3 seeds per data collection team per day to assess survey performance. As with the HD area seed items, all placed seeds should be detected and classified correctly.

Types of inference:

Anomalies meeting the project-specific detection threshold will be used to establish anomaly densities and delineate the site into LD and HD areas.

Decision rules:

- 1) Areas with an anomaly density statistically greater than background (determined using VSP) will be considered HD areas (potential CMUAs).
- 2) Areas with an anomaly density that is not statistically different from background (determined using VSP) will be considered LD areas (potential buffer zones or unused zones).
- 3) If pockets of lower anomaly density are observed within HD areas, they will be subject to additional investigation to determine whether they should be included or excluded from the HD area designation.

11.1.5.2 HIGH DENSITY AREA CHARACTERIZATION

Parameters of interest: Locations of anomalies exceeding the detection threshold anomaly response amplitude; signal to noise ratio; inversion fit coherence, estimated source size based on amplitudes of β_1 , β_2 , β_3 ; 1-, 2- and 3-dipole, and inversion outputs of β_1 , β_2 , β_3 ; and modeled location (x, y, and z), x, y, and z. For excavated anomalies: whether the anomaly is MEC, MD associated with high explosive (HE) rounds, MD associated with practice or training rounds, indeterminate MD, range-related debris (RRD), or other debris not related to DoD use. For excavated anomalies, depth of metallic objects found. The sources of anomalies to determine whether HD areas are high use areas (HUAs), and, if so, the horizontal and vertical distribution of munitions-related anomalies to determine HUA boundaries

Assumptions: Fragments from HE munitions will be recognized as evidence of the use of HE munitions.

Types of inference:

Each anomaly with cued data will be classified as a TOI, non-TOI, or inconclusive as described in SOP AC-08, Process Cued Data (Appendix G). In addition, a statistically representative subsample of all detected anomalies will be identified for intrusive investigational transect anomalies and classified TOI in grids will be excavated. Based on the AGC and intrusive investigation results, the HD area will be determined to be:

- A CMUA potentially containing HE UXO
- A CMUA containing only practice munitions, or
- Not a CMUA.

Decision rules:

- 1) If MEC or MD are identified within the HD area, and the CSM indicates munitions were used in the area, then the area will be confirmed as a high-use area, and the team will characterize and establish a boundary and buffer zone for the area.
- 2) If MEC or MD are identified within the HD area, but the CSM contains no evidence of munition use, then the project team will determine whether further investigation should be conducted.
- 3) If no MEC, MD, or RRD are found, the team will revisit the CSM to confirm use of the area and investigate the area as a presumed low-use area or non-impacted area, based on evidence.
- 4) If no MEC are found in an HD area, but MD are found, the quantity, type, and distribution of MD will be qualitatively evaluated to assess its significance with regard to making determinations about potential MEC contamination; these assessments will be presented to the Project Team.
- 5) If an anomaly is classified as either TOI or inconclusive, or if there is no expectation that it could be reacquired with reasonable accuracy (i.e. all transect anomalies), it may be intrusively investigated. The excavation of transect anomalies is expected to include mostly non-TOI sources and will produce an accurate depth profile for both MEC and MD. Only classified TOI will be excavated in grids.

11.1.5.3 LOW DENSITY AREA CHARACTERIZATION

The primary objective in characterizing the LD area is to delineate areas that were part of the range but not a target area (i.e., a buffer zone) from unused areas. This will be accomplished by intrusively investigating anomalies classified as TOI, all detected anomalies along transects, and anomalies classified as TOI in grids in the LD area, with the total area of investigation sufficient to statistically demonstrate, with 95% confidence (based on the VSP TOI Estimation/Comparison module), that there are no more than 0.5 MEC per acre. It is assumed that the probability of encountering MEC is the same anywhere within the LD area, therefore, random areas of grids and transects will be sampled for the analysis.

Parameters of interest: Locations of anomalies exceeding the detection threshold, inversion fit coherence, estimated source size based on amplitudes of β_1 , β_2 , β_3 , and inversion outputs of β_1 , β_2 , β_3 , x , y , and z . For excavated anomalies: whether the anomaly is MEC, MD associated with HE rounds, MD associated with practice or training rounds, MD associated with shrapnel rounds, indeterminate MD, RRD, or other debris not related to DoD use; and the depth of metallic objects found.

Assumptions: Fragments from HE munitions will be recognized as evidence of the use of HE munitions

Types of inference:

The VSP software tool, "Target of Interest Estimation/Comparison" will be used to test the upper limit of potential MEC density within the LD area(s). Each anomaly classified as TOI will be intrusively investigated. Based on the AC and intrusive investigation results, the LD area will be determined to be:

- A NCMUA (95% confidence that MEC density is ≤ 0.5 MEC/acre)
- A potential CMUA requiring addition to an existing CMUA or further evaluation

Decision rules:

- 1) If an anomaly is classified as either TOI or inconclusive, or if there is no expectation that it could be reacquired with reasonable accuracy (i.e. all transect anomalies), it may be intrusively investigated.
- 2) If no physical evidence of munitions use (i.e., MEC, MD, craters, ground scarring, etc.) is observed, the area will be confirmed to be an unused area where no hazards are suspected.
- 3) If physical evidence of munitions use is observed, the area will be confirmed to be an NCMUA.
- 4) If any MEC are found in the NCMUA, the distribution will be evaluated to determine if the area can reasonably be added to a CMUA.

- a. If the area containing the recovered munitions can be isolated as a separate CMUA, it will be evaluated as a CMUA, and the remaining area will be subject to the placement of additional transects and reinvestigated as a NCMUA.
- b. If the area cannot be isolated or annexed to an existing CMUA, the area will be investigated as a CMUA.

11.1.5.3 BASELINE RISK ASSESSMENT

11.1.5.3.1 The CSM will be updated using the RI results and a baseline risk assessment will be conducted in compliance with USACE's CEMP-CED Memorandum: Trial Period for Risk Management Methodology at FUDS MMRP Projects, dated January 3, 2017 (USACE, 2017). The risk assessment will evaluate MEC types, MEC density estimates, land use, site accessibility, and the severity of reasonably anticipated MEC detonation/deflagration scenarios to characterize baseline risk within the MRS or investigation areas.

11.1.5.3.2 The decision rules for baseline risk assessment are as follows:

If the PDT concludes there is an imminent and substantial threat to public health, welfare, or the environment, then a time-critical removal action (TCRA) will be recommended.

- If MEC items are found on the surface of a CMUA during the investigation, then that CMUA will use the first "Amount of MEC" row in Matrix 1 for the MEC risk assessment.
- If no MEC items are found on the surface of a CMUA during the investigation, then that CMUA will use the second "Amount of MEC" row in Matrix 1 for the MEC risk assessment.
- If MEC items are found in an NCMUA during the investigation, then that NCMUA will use the third "Amount of MEC" row in Matrix 1 for the MEC risk assessment.
- If no MEC items are found in an NCMUA during the investigation, then that NCMUA will use the fifth "Amount of MEC" row in Matrix 1 for the MEC risk assessment.
- If a baseline risk assessment for MEC performed in accordance with USACE's CEMP-CED Memorandum: Trial Period for Risk Management Methodology at Formerly Used Defense Sites (FUDS) Military Munitions Response Program (MMRP) Projects, dated January 3, 2017 (USACE, 2017) determines there are unacceptable risks from explosive hazards, then an FS will be recommended to evaluate future remedial actions.
- If a baseline risk assessment for MEC determines there are no unacceptable risks from explosive hazards, then no further action will be recommended.

11.1.6 STEP 6: SPECIFY PROJECT-SPECIFIC MEASURED PERFORMANCE CRITERIA

MPCs are the criteria that collected data must meet to satisfy the DQOs. Project-specific MPCs are presented in [Worksheet #12 and #22](#). Geophysical and intrusive investigations shall achieve applicable MPCs as confirmed/modified by the instrument verification strip (IVS) Report. Failure to achieve the MPCs may have an impact on end uses of the data, which will be discussed in the Data Usability Assessment (DUA) Report ([Worksheet #37](#)).

11.1.7 STEP 7: PROJECT DESIGN AND WORKFLOW

The MPCs established during Step 6 of the DQO process (to be documented in Worksheet #12) were used to develop the sample design, which is described in Worksheet #17. The sample design is broken down into a series of specific processes and data collection steps, termed Definable Features of Work (DFWs).

The transect sampling plan for the Preliminary MRS Characterization was prepared using VSP with the following inputs and assumptions in Table 11.4:

Table 11.4 – Visual Sampling Plan Target Area Analysis

VSP Input	Skip Bombing Range	Demolition Bombing Range	Dive Bombing Range
VSP Target Area Assumptions	100lb M38A2 practice bomb	100lb M38A2 practice bomb	100lb M38A2 practice bomb
Target Diameter (m)	435.2	435.2	435.2
Average Target Area Density (above background)	300/acre	300/acre	300/acre
Background Density	50/acre	50/acre	50/acre
Target Distribution	Bivariate Normal Density	Bivariate Normal Density	Bivariate Normal Density
Probability of Traversing/Detecting Target Area	100	100	100
Detection System	EM61-MK2	EM61-MK2	EM61-MK2
Transect Width (ft)	3	3	3
Probability of Detection	95%	95%	95%
Detection Pattern	Parallel	Parallel	Parallel
Orientation	EW	EW	EW
VSP Output	Skip Bombing Range	Demolition Bombing Range	Dive Bombing Range
Transect Spacing (m)	354	354	354
Transect Spacing (ft)	1161	1161	1161

11.2 MC DATA QUALITY OBJECTIVES OVERVIEW

This worksheet describes the MC DQOs developed for the project, including the environmental problem, the related decisions that need to be made, the type and quantity of data, and level of data quality needed to ensure that those decisions are based on sound scientific data. The following DQO elements are based on the EPA's seven-step DQO process.

11.2.1 STEP 1: STATE THE PROBLEM

Past munitions detonations or degradation of munitions in CMUAs may have resulted in MC being released to environmental media (soil, subsurface soil, surface water, or sediment). If MC contamination is present, it may pose a risk to human and ecological receptors.

CMUAs are currently not delineated so it is unknown where MEC, thus MC contamination, is most likely located.

MC contamination is not expected in areas not affected by munitions use activities (i.e., NCMUAs); however, naturally occurring metals concentrations are to be expected. Lead was detected at a concentration above screening levels in one sample collected within the Air-to-Ground Gunnery Range during the SI; however, site

specific background concentrations were not established in the SI. Background concentrations need to be established for the site in order to support the identification of chemicals of potential concern (COPCs) and chemicals of potential environmental concern (COPECs) for evaluation in the risk assessment.

11.2.2 STEP 2: IDENTIFY THE GOALS OF THE DATA COLLECTION

Do analytes that are known to be MC of site-specific munitions exist at CMUAs above background and project action limits (PAL)? If so, what is the horizontal and vertical extent?

What is the horizontal and vertical extent of the previously identified MC contamination.

If MC contamination is present, do concentrations pose unacceptable risks to human or ecological receptors at the MRS?

Based on the nature and extent of MC contamination established by the RI and the results of the risk assessment, are further response actions required at the MRS?

Alternative Outcomes Include:

- A recommendation for No Further Action (NFA), with respect to MC, if unacceptable human or ecological risks do not exist.
- An evaluation of remedial alternatives for MC in the FS, if unacceptable risks do exist.

11.2.3 STEP 3: IDENTIFY INFORMATION INPUTS

- Historical data, aerial photographs.
- Munitions suspected to be used at the site.
- Results of geophysical surveys and subsequent intrusive investigation (for determining the extent of CMUAs and, subsequently, sample locations).
- Field sampling data and laboratory analysis results for soil, sediment, or surface water.
- Land use and receptors.

11.2.4 STEP 4: DEFINE THE BOUNDARIES OF THE STUDY

Boundaries of the MRSs are defined on **Figure 10-1**.

The RI is limited to areas where ROE is granted within the MRS.

If no indications of MEC are discovered (i.e., MD, MEC) within an MRS, then the MRS will be determined to be free of MEC contamination within the limits of the investigation and no MC samples will be collected. However, MC samples will be collected if small arms use is identified which justifies the collection of MC samples to characterize the potential for MC contamination from the small arms usage. All of the ranges in this study have confirmed munitions or small arms use (See **Table 10.1**) except for the Strafing Range.

Biased soil samples will be collected via the Incremental Sampling Methodology (ISM) in areas where MC contamination is suspected. In areas where MC samples detect analyte exceedances, step out sample units and vertical extent investigation samples will be collected. The horizontal and vertical extent of the investigation will be the locations where MC concentrations are less than the PALs or equivalent to background.

MC analytes and sample media are limited to those listed in Worksheet #15.

11.2.5 STEP 5: DEVELOP THE PROJECT DATA COLLECTION AND ANALYSIS APPROACH

If MC concentrations in soil, surface water, or sediment samples are less than or equal to the PALs (see Worksheet #15) and/or background, then there is no evidence of a release and no further analysis is required.

If MC concentrations in soil, surface water, or sediment are greater than the PALs (see [Worksheet #15](#)) and background, then there is evidence of a release (i.e., COPCs are present) and additional samples may need to be collected to delineate extent of COPCs and evaluate risk associated with potential exposure to MC in soil, surface water, or sediment.

If MC concentrations in subsurface soil are greater than PALs and background, and show a potential to leach to groundwater, and there is evidence of a potential exposure pathway to groundwater, then wells may need to be installed and groundwater samples collected to assess COPCs in groundwater and evaluate risk associated with potential exposure to MC in groundwater. In addition, discrete subsurface soil samples may be collected to delineate the extent of soil contamination. The need to collect additional soil samples in the subsurface will be based on the results of Phase I sampling and will be discussed with the SPP team prior to Phase II collection.

11.2.6 STEP 6: SPECIFY PROJECT-SPECIFIC MEASUREMENT PERFORMANCE CRITERIA

Sampling and analysis shall achieve applicable MPCs as stated in [Worksheet #12](#), unless MPC failures can be adequately explained or justified.

11.2.7 STEP 7: SURVEY DESIGN AND PROJECT WORKFLOW

Samples will be analyzed for explosives and select metals (copper, lead, antimony, and zinc). All samples collected for delineation purposes will be analyzed only for those COPCs exceeding screening levels. Due to the nature of the MC release mechanisms, the MC sampling approach at the three bombing range MRSs will differ from the Strafing and Air-to-Ground Gunnery Range MRS. MC sample collection will follow a two-phase approach adapted to the findings of the reconnaissance, DGM, and intrusive investigation. The samples planned are described below and summarized in [Table 11.5](#).

Establishing Background:

To establish background concentrations for metals, Six sampling units (SUs) will be placed within the non-munitions use areas (e.g., identified through historical analysis, DGM, intrusive investigation) for the collection of background metals data. Surface soil samples will be collected from these SUs (0-6 inches bgs) and the background concentration will be used for comparisons with all ISM soil samples. Similarly, up to 10 discrete surface water/sediment samples (per media) within the non-munitions use areas will be collected. If deep discrete subsurface soil samples are required to delineate metals contamination, background discrete subsurface soil samples will be collected to establish a background value for comparison.

Table 11.5 – Phase I Sampling Summary

MRS	MEC/MD Findings	Soil (0-6 inches bgs)	Soil (6-24 inches bgs)	Surface water	Sediment (0-6 inches bgs)	All Sampling Media
		Phase I				Phase II
Skip Bombing Range	Has a CMUA been Identified? If YES ►► If NO ►►	1 ISM SU located in highest anomaly density area within the CMUA.	1 ISM SU located in highest anomaly density area within the CMUA.	8 discrete biased to CMUA	8 discrete biased to CMUA	Additional samples to delineate the extent of COPCs.
		1 ISM SU at target center or at isolated MEC/MD find, if applicable.	1 ISM SU at target center or at isolated MEC/MD find, if applicable.	5 discrete at random locations	5 discrete at random locations	
Demolition Bombing Range	Has a CMUA been Identified? If YES ►► If NO ►►	1 ISM SU located in highest anomaly density area within the CMUA.	1 ISM SU located in highest anomaly density area within the CMUA.	8 discrete biased to CMUA	8 discrete biased to CMUA	Additional samples to delineate the extent of COPCs.
		1 ISM SU at target center or at isolated MEC/MD find, if applicable.	1 ISM SU at target center or at isolated MEC/MD find, if applicable.	5 discrete at random locations	5 discrete at random locations	
Dive Bombing Range	Has a CMUA been Identified? If YES ►► If NO ►►	1 ISM SU located in highest anomaly density area within the CMUA.	1 ISM SU located in highest anomaly density area within the CMUA.	8 discrete biased to CMUA	8 discrete biased to CMUA	Additional samples to delineate the extent of COPCs.
		1 ISM SU at target center or at isolated MEC/MD find, if applicable.	1 ISM SU at target center or at isolated MEC/MD find, if applicable.	5 discrete at random locations	5 discrete at random locations	
Strafing Range	Has small arms use been confirmed? If YES ►► If NO ►►	1 ISM SU at identified use area	1 ISM SU at identified use area	8 discrete biased to target berm area	8 discrete biased to target berm area	Additional samples to delineate the extent of COPCs.
		1 ISM SU based on typical range design target area or PDT agreed location.	Reserved for Phase II if needed.	5 discrete at random locations	5 discrete at random locations	
Air-to-Ground Gunnery Range	Small arms use has already been confirmed. YES ►►	6 ISM SUs at target berm area, 1 ISM SU in approach (cartridge casing drop area), and 1 ISM SU in the potential crater area if there is evidence of munitions use.	6 ISM SUs at target berm area, 1 ISM SU in approach (cartridge casing drop area), and 1 ISM SU in the potential crater area if there is evidence of munitions use.	8 discrete biased to target berm area	8 discrete biased to target berm area	Additional samples to delineate the extent of COPCs.

Phase I at the Bombing Range MRSs:

If concentrated areas of MEC/MD (i.e., CMUAs) are found, surface soil samples will be collected from depths of 0-6 inches bgs and 6-24 inches bgs using ISM with the decision unit (DU) representing the CMUA. In most cases a single SU will be collected in triplicate over in the area with the highest anomaly density. If a very large CMUA is identified additional SUs may be collected within the DU.

If surface water bodies are present within the CMUA, up to 8 discrete co-located surface water/sediment samples will be collected within each of the three bombing range MRSs. If no MEC/MD-related CMUA is discovered within the MRS, then up to 5 surface water/sediment sample locations will be randomly placed within the potentially affected areas at each MRS.

Phase I at the Strafing and Air-to-Ground Gunnery Range MRSs:

At the Air-to-Ground Gunnery Range, soil samples will be collected to evaluate potential MC contamination at the target berm. Visual recon will be performed to outline the berm DU for ISM sampling. ISM surface soil samples will be collected from depths of 0-6 inches bgs and 6-24 inches bgs. A standard SU rectangle will be applied over 6 randomly selected berms within the target area. These berm samples will be used to confirm and delineate elevated lead concentrations found during the SI. At the Strafing Gunnery Range, if visual inspection identifies munitions/small arms use, a single SU will be collected at the location visually identified as having the highest concentration of small arms debris present. The SU will be collected from two sample intervals (0-6 inches bgs and 6-24 inches bgs). If no evidence of the target area is found, a sample will be collected at the typical location of a target based on a standard range configuration.

At the Air-to-Ground Gunnery Range MRS, up to 8 discrete co-located surface water/sediment samples will be collected from locations within potentially affected areas near and in front and behind the target berm. Another 8 co-located surface water/sediment samples will be collected from the strafing range if evidence of munitions/small arms use is identified. If no evidence of use is identified at the strafing range, up to 5 random location within the MRS will be sampled for surface water/sediment.

Phase II:

Additional DU/SUs to delineate horizontal extent will be considered if COPCs are found to be present at concentrations greater than the background and PALs during Phase I. All QC samples will be analyzed for the same analytes as the applicable investigation samples. Step out samples will be collected as follows:

- Surface Soil - An iterative step out approach will be implemented until the extent of soil contamination is bounded both laterally and vertically. In high density MEC/MD areas, the same step out approach will be used to determine the extent of the soil contamination area based on the DGM results and the results of the intrusive investigation. The additional sample locations will be determined based on the anomaly density data with consideration of the MEC and MD identified in the intrusive investigation. The number of step-out samples will vary depending on how many exceedances are found.
- Subsurface Soil - If 6-24 inch bgs ISM samples are found to have COPCs, hand auger borings to delineate vertical extent will be considered. Delineation samples will be analyzed for detected COPCs only. If discrete samples are necessary to delineate soil COPCs, background discrete samples will be collected to establish appropriate background values for comparison.
- Sediment Samples - An iterative step-out approach will be implemented until the extent of sediment contamination is bounded both laterally and vertically.
- Groundwater Samples - Where subsurface soil samples show a concentration of MC which is determined to pose a threat to groundwater, and there is evidence of a completed potential exposure pathway to groundwater, shallow groundwater wells may be installed and sampled to assess the COPCs in groundwater.

Worksheet #12: Measurement Performance Criteria

(IDQTF UFP-QAPP Guidance Manual, Section 2.6.2; EPA Guidance QA/G-5, Section 2.1.7)

This worksheet documents the project-specific MPCs in terms of data quality indicators (i.e., accuracy, sensitivity, representativeness, completeness, and comparability) for AGC projects. MPCs are the minimum performance specifications that the AGC survey design, including instruments and procedures, must meet to ensure collected data will satisfy the DQOs documented on [Worksheet #11](#). They are the criteria against which the detection survey, cued survey, and final DUAs will be conducted as documented on [Worksheet #37](#).

Table 12.1 Measurement Performance Criteria for MEC-Related Tasks

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Site Preparation			
1. Accessibility	Completeness	All areas inaccessible to investigation or inaccessible to use of proposed geophysical systems are identified and mapped in a geographic information system (GIS).	Parsons will visually inspect the site and/or review the GIS
Sampling Design			
2. Planned survey coverage (Preliminary MRS Characterization)	Representativeness/Completeness	Planned, initial transect spacing will be sufficient to detect HUA with a radius of 714ft at a confidence level of 100%. Infill transects will be designed to achieve the MPC for anomaly density estimates (see MPC 13).	QC geophysicist reviews VSP output.
3. Detection threshold (transects & grids)	Sensitivity	A detection threshold of five times the site-specific background noise will be used for the transect and grid survey. The thresholds are subject to change based on instrument verification strip (IVS) results and additional testing of TOIs during the IVS. Thresholds could be unique to transects and grid surveys.	1) Review of sampling design 2) Initial verification at instrument verification strip (IVS) 3) Background analysis prior to VSP analysis
4. Background data collection (AGC)	Accuracy	Background locations will be selected such that background data will be representative of the various subsurface conditions expected to be encountered within each survey unit at the site.	Data verification/data validation
5. Positioning requirement (locating transects and sampling grids)	Accuracy	Actual positions must be within 10 meters of planned positions unless documented by obstructions within the transect path.	Review of sampling design QC Geophysicist and lead agency oversight
6. Positioning requirement (mini-grid mapping and reacquisition)	Accuracy	Recorded measurement positions must be within 0.1m of actual positions.	Review of sampling design Initial verification at IVS

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Sampling Design - continued			
7. Survey coverage: maximum speed on transect (analog)	Accuracy/ Completeness	$98\% \leq 0.45$ meter/second (approx. 1 mile/hr); $100\% \leq 0.5$ meter/second. Using distance and time per section.	QC geophysicist/lead agency (or designee) oversight
8. Survey coverage (transects)	Accuracy/ Completeness	95% of planned transects are sampled.	Actual course over ground is recorded and evaluated for each survey unit.
9. Survey coverage (grids)	Accuracy/ Completeness	100% of specified acreage is sampled at the calculated lane spacing.	Data validation
10. QC seeding (AGC and DGM) (grids only)	Accuracy/ Completeness	HD Area Characterization Contractors will place blind QC seeds at the rate of 1 seed/system/day. Planning documents must describe the blind seed fire-wall.	Lead agency verifies all QC seed failures are explained and corrective action implemented
11. QC seeding (analog)	Accuracy/ Completeness	QC seeding is recommended during investigation of mini-grids, but not required.	To be completed by project team if QC seeding is conducted
12. QA Seeding: grids (analog) (Except when analog sensors are used for screening purposes prior to the use of digital sensors.)	Sensitivity/Representativeness/Completeness	HD Area Characterization: Blind quality assurance (QA) seeds will be placed at the site by the Government/independent third party at the rate of 2-6/person/day. The entire transect or grid must be resurveyed until all seeds are located. Blind QA seeds must be detectable as defined by the DQOs and located at depth (defined in Worksheet #11 Step 4) throughout the horizontal survey boundaries defined in the DQOs.	HD Area Characterization: Lead agency oversight
13. Anomaly density estimates (assessed during intrusive investigations associated with population testing)	Accuracy/ Representativeness	Contiguous sub-areas (e.g. grids) within Target Area(s) will be mapped, and all anomalies meeting the project-specific detection threshold will be identified for classification or excavation. The anomaly density in each sub-area (grid) will not differ from that predicted by more than +50% or -30%.	Total number of anomalies divided by the grid area will be compared to the anomaly density predicted from geostatistical anomaly density analyses (i.e. Kriging of transect data) for that location.
Anomaly Resolution/Classification			
14. Anomaly resolution (DGM and analog)	Accuracy	HD Area Characterization: 100% excavation in representative transects/grids. (Sample acreage to be specified in WS #17). Excavation must continue vertically until anomaly is resolved or other obstruction encountered.	QC Geophysicist (or designee) verifies
15. Anomaly resolution (DGM and analog)	Completeness	All items within 1 m laterally and within the threshold depth must be recovered for each flag unless the source can be documented.	QC Geophysicist (or designee) verifies

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Anomaly Resolution/Classification - continued			
16. Anomaly resolution (AGC)	Accuracy/ Representativeness	Preliminary Characterization: All anomalies must be characterized, and all MEC-like anomalies must be excavated. HD Area Characterization: Excavation of anomalies will be performed in representative grids where necessary to fill data gaps in the CSM. Inversion results correctly predict one or more physical properties (e.g. size, symmetry, or wall thickness) of the recovered items (specific tests and test objectives established during project planning)	Qualitative examination and documentation of recovered items
17. Anomaly classification (AGC)	Completeness/ Comparability	Library must include signatures for all items considered by the project team to be TOI, as listed in the CSM.	Verification of site-specific library
18. Anomaly classification (AGC)	Completeness	All detected anomalies classified as: 1. TOI 2. Non-TOI 3. Inconclusive	Data verification
19. Anomaly classification (AGC)	Accuracy	100% of predicted non-TOI that are intrusively investigated are confirmed to be non-TOI.	Visual inspection of recovered items from classification validation
NIA Confirmation			
20. NIA Confirmation	Representativeness/ Completeness	Well-developed CSM, confirmed by RI results, showing no evidence of munitions use.	Data Usability Assessment

Table 12.2 Measurement Performance Criteria for Sample Collection

Measurement Performance Activity	Data Quality Indicator	Specification	Activity Used to Assess Performance
Field Sample Collection	Completeness	Number of field samples collected matches planned number of samples; Completeness $\geq 90\%$	Data Verification
QC Sample Collection	Completeness	Number of QC samples collected matches planned number of QC samples; Completeness $\geq 90\%$	Data Verification
Sample Shipment Documentation	Completeness	Chain-of-custody forms correctly list sample IDs, request appropriate planned / required analytical parameters for each sample, are properly completed, and are signed and dated	Review Laboratory Sample Login against submitted Chain-of-custody form(s), Data Verification

Table 12.3 Measurement Performance Criteria for Explosives in Soil by SW8330B

Measurement Performance Activity or QC Sample	Data Quality Indicator	Specification	Activity Used to Assess Performance
Equipment Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 limit of quantitation (LOQ) or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Source Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Method Blanks	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Grinding Blanks (IS soil only) ⁽²⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Laboratory Control Samples ⁽³⁾	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike Duplicate	Precision	Relative percent difference (RPD) within tolerances listed in DoD QSM v 5.1	Data Validation
Field Duplicates	Precision	For analytes detected at or above the LOQ in both the parent and field duplicate samples, RPD is calculated and must meet the following criteria: Soil: $RPD \leq 50$	Data Validation
Field Triplicates (IS soil only)	Precision	For analytes detected at or above the LOQ in all three field triplicate samples, Relative Standard Deviation (RSD) is calculated and must meet the following criteria: IS Soil: $RSD \leq 50$	Data Validation
Laboratory Triplicates (IS soil only)	Precision	For analytes detected at or above the LOQ in all three laboratory triplicate samples, Relative Standard Deviation (RSD) is calculated and must meet the following criteria: IS Soil: $RSD \leq 20$	Data Validation

(1) Field blanks will only be collected if sample matrix comes into contact with reusable (i.e. decontaminated) equipment.

(2) The grinding blank may serve as the method blank for analysis of IS soils.

(3) LCS will be put through grinding process for batches containing IS soil samples.

Table 12.4 Measurement Performance Criteria for Explosives in Water by SW8330B

Measurement Performance Activity or QC Sample	Data Quality Indicator	Specification	Activity Used to Assess Performance
Equipment Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Source Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Method Blanks	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Laboratory Control Samples	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike Duplicate	Precision	RPD within tolerances listed in DoD QSM v 5.1	Data Validation
Field Duplicates	Precision	For analytes detected at or above the LOQ in both the parent and field duplicate samples, RPD is calculated and must meet the following criteria: Water: $RPD \leq 30$	Data Validation

(1) Field blanks will only be collected if sample matrix comes into contact with reusable (i.e. decontaminated) equipment.

Table 12.5 Measurement Performance Criteria for Metals in Soil by SW6020B

Measurement Performance Activity or QC Sample	Data Quality Indicator	Specification	Activity Used to Assess Performance
Equipment Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Source Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Method Blanks	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Grinding Blanks (IS soil only)	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation

Laboratory Control Samples ⁽²⁾	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike Duplicate	Precision	RPD within tolerances listed in DoD QSM v 5.1	Data Validation
Field Duplicates	Precision	For analytes detected at or above the LOQ in both the parent and field duplicate samples, RPD is calculated and must meet the following criteria: Soil: $RPD \leq 50$	Data Validation
Field Triplicates (IS soil only)	Precision	For analytes detected at or above the LOQ in all three field triplicate samples, Relative Standard Deviation (RSD) is calculated and must meet the following criteria: IS Soil: $RSD \leq 50$	Data Validation
Laboratory Triplicates (IS soil only)	Precision	For analytes detected at or above the LOQ in all three laboratory triplicate samples, Relative Standard Deviation (RSD) is calculated and must meet the following criteria: IS Soil: $RSD \leq 20$	Data Validation

(1) Field blanks will only be collected if sample matrix comes into contact with reusable (i.e. decontaminated) equipment.

(2) LCS will be put through grinding process for batches containing IS soil samples.

Table 12.6 Measurement Performance Criteria for Metals in Water by SW6020B

Measurement Performance Activity or QC Sample	Data Quality Indicator	Specification	Activity Used to Assess Performance
Equipment Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Source Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Method Blanks	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Laboratory Control Samples	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike Duplicate	Precision	RPD within tolerances listed in DoD QSM v 5.1	Data Validation

Field Duplicates	Precision	For analytes detected at or above the LOQ in both the parent and field duplicate samples, RPD is calculated and must meet the following criteria: Water: $RPD \leq 30$	Data Validation
------------------	-----------	---	-----------------

(1) Field blanks will only be collected if sample matrix comes into contact with reusable (i.e. decontaminated) equipment.

Table 12.7 Measurement Performance Criteria for Perchlorate in Water by SW6850

Measurement Performance Activity or QC Sample	Data Quality Indicator	Specification	Activity Used to Assess Performance
Equipment Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Source Blanks ⁽¹⁾	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Method Blanks	Accuracy/Bias	No target analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample, whichever is greater.	Data Validation
Laboratory Control Samples	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike	Accuracy/Bias	Percent recovery within tolerances listed in DoD QSM v 5.1	Data Validation
Matrix Spike Duplicate	Precision	RPD within tolerances listed in DoD QSM v 5.1	Data Validation
Field Duplicates	Precision	For analytes detected at or above the LOQ in both the parent and field duplicate samples, RPD is calculated and must meet the following criteria: Water: $RPD \leq 30$	Data Validation

(1) Field blanks will only be collected if sample matrix comes into contact with reusable (i.e. decontaminated) equipment.

Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection for MEC-Related DFWs

(IDQTF UFP-QAPP Guidance Manual, Section 3.1.2.4)

This worksheet describes the field equipment needed for the project and the associated calibration, maintenance, testing, and inspection procedures for that field equipment.
This worksheet also documents the field equipment's frequency of activity, criteria, and corrective action requirements.

Table 22.1 Site Preparation

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Vegetation clearance Verification (All clearance mechanisms)	SP1	Random locations at frequency of 4 per acre	Project QC/ Surface Clearance Technical Memorandum/ Lead Organization or designee	All vegetation removed to height not exceeding 15cm for transects as needed and approximately 3 inches for AGC grids; No obstacles (e.g. felled trees or limbs) remain	Root cause analysis (RCA)/Corrective Action (CA); Re-verify
Vegetation clearance: Verify correct assembly (Mechanized, brush hog mower or similar) (1 of 2)	SP2	Once following assembly	Field Team Leader/ Instrument Assembly Checklist/ Lead Organization or designee	As specified in Assembly Checklist	RCA/CA: Make necessary adjustments, and re-verify
Vegetation clearance: Verify correct deployment (Mechanized, brush hog mower or similar) (2 of 2)	SP3	Daily prior to operations	Field Team Leader/ Daily QC Report/ UXOQC, UXOSO	Deck height is set to 30cm	RCA/CA: Make necessary adjustments, and re-verify
Construct IVS: Verify as-built IVS against design plan (Digital sensors)	SP4 SOP DGM-01	Once following IVS construction	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	Small ISO seed items buried at 15cm; All seeds buried horizontally in the cross-track orientation	RCA/CA: Make necessary changes to seeded items and re-verify

Table 22.1 Site Preparation Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Construct IVS: Verify as-built IVS against design plan (Analog sensors)	SP5 SOP DGM-01	Once following IVS construc- tion	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	Small ISO seed items for analog methods buried at 30cm; All seeds buried horizontally in the cross-track orientation	RCA/CA: Make necessary changes to seeded items and re-verify
Verify correct assembly (All sensors)	SP6 SOP DGM-01 SOP AC-01	Once following assembly	Field Team Leader/ Instrument Assembly Checklist Project Geo- physicist	As specified in Assembly Check- list	RCA/CA: Make necessary adjustments and re-verify
Initial instrument func- tion test (AGC)	SP7 SOP AC-02	Once following assembly	Field Team Leader/ In- strument Assembly Checklist/ Project Geophysicist	Sensor passes initial function test specified in SOP AC-01	RCA/CA: Make necessary adjustments, and re-verify
Initial Instrument Func- tion Test (EM61-MK2)	SP8 SOP DGM-01 SOP DGM-03	Once following assembly	Field Geophysicist/ Initial IVS Memorandum/ Project Geophysicist	Response (mean static spike mi- nus mean static background) within 20% of predicted re- sponse	RCA/CA: Make necessary adjustments, and re-verify
Initial Instrument Func- tion Test (Analog)	SP9 SOP MEC-03 SOP MEC-04	Once upon arrival at the pro- ject site	Field Geophysicist or UXO Team Lead/ Initial IVS Memorandum/ Project Geophysicist or designee	Audible response consistent with expected change in tone in pres- ence of standard object	RCA/CA: Make necessary adjustments, and re-verify

Table 22.1 Site Preparation Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Initial detection survey positioning accuracy (IVS) (Digital)	SP10 SOP DGM-01 SOP DGM-02	Once prior to start of data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	Derived positions of IVS target(s) are within 25cm of the ground truth locations	RCA/CA: Make necessary adjustments, and re-verify
Initial detection survey Check for interference surrounding seed response (IVS) (All sensors)	SP11 SOP DGM-01 SOP DGM-02 SOP AC-02	Once prior to start of data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	All seeds placed in locations that are free of detected anomalies within a radius of $\geq 1.5\text{m}$	RCA/CA; and re-verify MQO

Table 22.2 Preliminary Characterization (To delineate HD and LD areas)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing instrument function test (AGC)	PC12 SOP AC-02 SOP AC-06	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary (Excel/Geosoft)/ Project or QC Geophysicist	Response (mean static spike minus mean static background within 20% of predicted response for all Tx/Rx combinations)	RCA/CA: Make necessary repairs and reverify
Ongoing instrument function test (DGM)	PC13 SOP DGM-01	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project or QC Geophysicist	Response (mean static spike minus mean static background within 20% of predicted response)	RCA/CA: Make necessary repairs and reverify
Ongoing instrument function test (Analog)	PC14 SOP-MEC-04	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	Audible response consistent with expected change in tone in presence of standard object	RCA/CA

Table 22.2 Preliminary Characterization (To delineate HD and LD areas) Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing instrument settings check (Analog)	PC15 SOP-MEC-04	Hourly	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	All instrument settings adjusted to [insert instrument-specific specification]	RCA/CA
Ongoing detection survey positioning precision (IVS) (Digital)	PC16 SOP DGM-01	Beginning and end of each day	Project Geophysicist/ Running QC Summary/ QC Geophysicist	Derived positions of IVS target(s) within 25cm of the average locations	RCA/CA
In-line measurement spacing (Digital)	PC17 SOP DGM-03	Verified for each transect using UX-Detect sample separation gx for fiducial, RTS, or RTK GPS positioned data	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% $\leq$ 0.25m between successive measurements; 100% $\leq$ 1.0m	RCA/CA Coverage gaps are filled or adequately explained
Maximum velocity (Analog)	PC18 SOP DGM-03	Verified for each transect using distance and time based upon recorded survey track (filtered) of each individual operator	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% $\leq$ 0.45meter per second (~1 mile per hour); 100% $\leq$ 0.5 meter/second	RCA/CA
Coverage – Transect mapping (All sensors)	PC19 SOP DGM-03	Verified with target radius from WS#11 for each MRS using VSP 'Post-survey probability of traversal' tool	Project Geophysicist/ VSP Report/ QC Geophysicist	Probability of traversal and detection is 100% (excluding site-specific access limitations, e.g., obstacles, unsafe terrain, ROE refusal)	RCA/CA: Coverage gaps are filled or adequately explained
Sensor Tx current (AGC)	PC20 SOP AC-07	Per measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	Current must be $\geq$ 3.5A	RCA/CA: out of spec data rejected
Battery voltage (DGM)	PC21 SOP DGM-01 SOP DGM-03	Verify battery voltage is within operating specifications of sensor	Field Team Leader/ Running QC Summary/ Project Geophysicist	Voltage must be $\geq$ 11.0V	RCA/CA: out of spec data rejected

Table 22.2 Preliminary Characterization (To delineate HD and LD areas) Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Transect Survey repeatability in LD area (Analog)	PC22 SOP-MEC-04	Daily check of each system (operator), repeating random 10% of 100m (or other appropriate and specified length) sections of transect	QC Geophysicist or designee/ Running QC Summary/ Lead Organization	Number of counts repeatable within a factor of five	RCA/CA; recollect all transects from failed system (operator)
Valid position data: Transects (Analog)	PC23 SOP-MEC-04	Per measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	GPS estimated error indicates position accuracy is within ± 10 m	RCA/CA: Out-of-spec data rejected
Valid position data: Transects (Analog)	PC24 SOP-MEC-04	Per measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	Track plots in GPS-obstructed areas are filtered to mimic actual survey paths	RCA/CA

Table 22.3 HD Area Characterization – Detection Survey

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Surface Clearance: Documenting recovered surface MEC and debris within mini-grids (All sensors)	HD25 SOP-MEC-04	Daily	UXOQC/ GIS data recorded/ Project QC or designee	All metallic debris collected is counted and documented in the project database for the following attributes: designation as UXO, MD, RRD or other debris; UXO and MD described by type, weight, and as TOI or non-TOI. Photos displaying all MD recovered (individual MD photos not necessary), and photos showing all surfaces of each MEC/TOI are recorded.	RCA/CA; document questionable information in database; justify safety concerns

Table 22.3 HD Area Characterization – Detection Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Geodetic Equipment Function Test	HD26 SOP DGM-02 -6	Daily (RTK GPS) Each time equipment is moved (Robotic Total Station [RTS])	Field Team Leader/ GIS data recorded/ Project QC or designee	Measured position of control point within 10cm of ground truth	RCA/CA; document questionable information in database
Geodetic Accuracy (Confirm Valid Position)	HD27 SOP DGM-02 -6	Evaluated for each measurement	Field Team Leader/ GIS data recorded/ Project QC or designee	GPS status flag indicates RTK fix (RTK GPS) RTS passes Geodetic Function Test	RCA/CA; document questionable information in database
Vegetation Clearance Inspection (All sensors)	HD28	Random locations at frequency between four and twelve per acre	Project QC Geophysicist/ Surface Clearance Technical Memorandum/ Lead Organization	All vegetation removed to ≤ 15 cm or determined suitable for the proposed survey type; All trees less than 3" diameter at breast height are removed; No obstacles (e.g. felled trees or limbs) remain	RCA/CA; and re-verify
Ongoing Instrument Function Test (AGC)	HD29 SOP-AC-02 SOP-AC-04	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary (Excel/Geosoft)/ Project or QC Geophysicist	Response (mean static spike minus mean static background) within 20% of predicted response for all Tx/Rx combinations	RCA/CA: Make necessary repairs and re-verify

Table 22.3 HD Area Characterization – Detection Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing Instrument Function Test (DGM)	HD30 SOP DGM-01	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project or QC Geophysicist	Response (mean static spike minus mean static background) within 20% of predicted response	RCA/CA: Make necessary repairs and re-verify
Ongoing Instrument Function Test (Analog)	HD31 SOP-MEC-04	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	Audible response consistent with expected change in tone in presence of standard object	RCA/CA: Make necessary repairs and re-verify
Ongoing Instrument Settings Check (Analog)	HD32 SOP-MEC-04	Hourly	Field Team Leader/ Running QC Summary Project/QC Geophysicist or designee	All instrument settings adjusted to [insert instrument-specific settings]	RCA/CA
Ongoing derived target position precision (IVS) (AGC all phases)	HD33 SOP AC-02	Beginning and end of each day as part of IVS testing	Project Geophysicist/ Running QC Summary QC Geophysicist	All IVS items fit locations within 0.25m of average of derived fit locations	RCA/CA
In-line measurement spacing (Digital, all detection phases)	HD34 SOP DGM-03	Verified for each transect/grid using UX-Detect sample separation gx for fiducial, RTS, or RTK GPS positioned data	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% $\leq$ 0.25m between successive measurements; 100% $\leq$ 1.0m	RCA/CA Coverage gaps are filled or adequately explained (e.g., unsafe terrain)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Coverage (Digital using electronic positioning, all phases)	HD35 SOP DGM-03	Verified for each transect/grid using Geosoft coverage tool.	Project Geophysicist/ Running QC Summary/ QC Geophysicist	≥90% at project design cross-track measurement spacing; 98% ≤ 1.0m	RCA/CA: Collect additional data to increase coverage percentage to meet acceptance criterion CA assumption: For non-AGC grids, gaps require fill-in lines to achieve required coverage or collected data includes enough area to meet intended grid size For AGC grids, gaps require fill-in lines to achieve required coverage unless no indication of subsurface metal in gap

Table 22.3 HD Area Characterization – Detection Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Coverage – Full coverage (Analog and Digital, using line and fiducial positioning, all phases)	HD36 SOP DGM-03 SOP MEC-04	Verified for each transect/grid	Field Team/ Running QC Summary/ QC Geophysicist	Visual inspection and photographic records of survey lanes/lines established using: tape measures and rope lanes; OR tapes and marking paint; OR sub-meter accuracy track-plot (filtered) of each operator's progress through assigned survey lanes (Specific procedure must be described in SOP)	RCA/CA
Transmit current levels (AGC)	HD37 SOP AC-07	Evaluated for each sensor measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	Current must be $\geq 3.5A$	RCA/CA: stop data acquisition activities until condition corrected
Confirm adequate spacing between units (EM61-MK2, all phases)	HD38 SOP DGM-03 SOP AC-07	Evaluated at start of each day (or grid)	Field Team Leader/ Field Logbook/ Project Geophysicist	Minimum separation of 50m	RCA/CA: Recollect all coincident measurements
Confirm adequate spacing between units (Metal Mapper 2X2 [MM2x2] all phases)	HD39 SOP AC-07	Evaluated at start of each day (or grid)	Field Team Leader/ Field Logbook/ Project Geophysicist	Minimum separation of 25m	RCA/CA: Recollect all coincident measurements
Detection survey performance (Digital)	HD40 SOP DGM-03	Average one blind QC seed per instrument per day. Seeds to be placed throughout expected detection depth range	QC Geophysicist/ Running QC Summary/ Lead Organization QA Geophysicist	For QC and validation seeds: offset between selected anomaly location and seed item location is ≤ 55 cm for digital positioning systems or ≤ 50 cm + $\frac{1}{2}$ line spacing for fiducially positioned data.	RCA/CA: Verify instrument is functioning correctly; if so, reduce threshold, or determine if item is buried too deep. If instrument is not functioning correctly, recollect data.

Table 22.3 HD Area Characterization – Detection Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Detection survey performance (Analog)	HD41 SOP MEC-04	Average one blind QC seed per instrument per day. Seeds to be placed throughout expected detection depth range	QC Geophysicist/ Running QC Summary/ Lead Organization QA Geophysicist	All blind QC seeds must be detected and positioned within 40 cm radius of ground truth	RCA/CA: Verify instrument is functioning correctly; if so, reduce threshold, or determine if item is buried too deep. If instrument is not functioning correctly, recollect data.
Detection survey and coverage performance (Analog)	HD42 SOP MEC-04	Between two and six blind QA seeds per operator per day, placed at anticipated 100% detection depth	QC Geophysicist/ Daily QC Report/ Lead organization QA Geophysicist	All blind QA seeds must be recovered	RCA/CA

Table 22.4 HD Characterization – Cueing Survey

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Geodetic Equipment Function Test	HD26 SOP AC-02	Daily (RTK GPS) Each time equipment is moved (RTS)	Field Team Leader/ GIS data recorded/ Project QC or designee	Measured position of control point within 10cm of ground truth	RCA/CA; document questionable information in database
Geodetic Accuracy (Confirm Valid Position)	HD27 SOP AC-02 SOP AC-06 SOP AC-07	Evaluated for each measurement	Field Team Leader/ GIS data recorded/ Project QC or designee	GPS status flag indicates RTK fix (RTK GPS) RTS passes Geodetic Function Test	RCA/CA; document questionable information in database

Table 22.4 HD Characterization – Cueing Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Initial measurement of production area background locations and background verification (AGC)	HD43 SOP AC-02 SOP AC-06	Once per background location	Field Team Leader/ IVS Memorandum Project Geophysicist	All five measurements have a library match within 0.9 using the UX-Analyze back-ground verification tool	RCA/CA: reject BG location and find alternative
Ongoing production area background measurements (AGC)	HD44 SOP AC-06	Background (BG) data collected a minimum of every two hours during production	Field Team Leader/ Field Log and Running QC Summary/ Project Geophysicist	BG data from a verified location collected within two hours of all cued data points	RCA/CA: Document environmental changes; Project Geophysicist must approve before proceeding.
Ongoing production area background measurements Confirm measurements are valid (AGC)	HD45 SOP AC-06 SOP AC-08	Evaluated for each background measurement over verified background locations	Project Geophysicist/ Running QC Summary/ QC Geophysicist	A TOI synthetically seeded in the ongoing background, and background-corrected using the initial background measurement results in polarizabilities with a library match of ≥ 0.9	RCA/CA: BG measurement rejected and removed from active BG measurements. Earlier/later background point used if background measurements are consistent throughout the day; re-collect affected data if varying background results indicate loss of point is significant
Ongoing derived target position precision (IVS) (Digital)	HD46 SOP AC-02	Beginning and end of each day as part of IVS testing	Project Geophysicist/ Running QC Summary/ QC Geophysicist	All IVS items fit locations within 0.25m of average of derived fit locations	RCA/CA

Table 22.4 HD Characterization – Cueing Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing Instrument Function Test (Instrument response amplitudes) (AGC)	HD47 SOP AC-02	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary (Excel/Geosoft)/ Project or QC Geophysicist	Response (mean static spike minus mean static background) within 20% of predicted response for all Tx/Rx combinations	RCA/CA: Make necessary repairs and re-verify
Transmit current levels (AGC)	HD48 SOP AC-07	Evaluated for each sensor measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	Current must be $\geq 7.0A$	RCA/CA: stop data acquisition activities until condition corrected
Confirm adequate spacing between units (AGC)	HD49 SOP AC-07	Evaluated at start of each day (or grid)	Field Team Leader/ Field Logbook/ Project Geophysicist	MM2x2: minimum separation of 25m	RCA/CA: Recollect data
Confirm inversion model supports classification(AGC, 1 of 3)	HD50 SOP AC-07 SOP AC-08	Evaluated for all models derived from a measurement (i.e., single item and multi-item models)	Project Geophysicist/ UX/A Source GDB/ QC Geophysicist	Derived model response must fit the observed data with a fit coherence ≥ 0.80	CA: Target classified as inconclusive or recollected unless analyst can justify poor coherence (dynamic target looks like noise, pick on edge of anomaly, etc.)
Confirm inversion model supports classification (AGC, 2 of 3)	HD51 SOP AC-07 SOP AC-08	Evaluated for derived target	Project Geophysicist/ UX/A Source GDB/ QC Geophysicist	Fit location estimates of item $\leq 0.4m$ from center of sensor	CA: Re-shot at in-field or post-processed inversion location unless fit location is within 0.4 m of another cued target.
Confirm inversion model supports classification (AGC, 3 of 3)	HD52 SOP AC-07 SOP AC-08	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ Lead Organization QA Geophysicist	100% of predicted seed positions $\leq 0.25m$ radially from known position (x, y). $Z \leq 0.15m$.	RCA/CA

Table 22.4 HD Characterization – Cueing Survey Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Confirm reacquisition GPS precision (Digital)	HD53 SOP AC-01 -07	Daily	UXO Tech or Field Tech/ Daily QC Report/ Project Geophysicist	Benchmark positions re- peatable to within 10cm	RCA/CA
Classification perfor- mance (AGC)	HD54 SOP AC-08	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ USACE QA Geophysicist	100% of QC seeds classi- fied as TOI	RCA/CA

Table 22.5 Intrusive Investigation

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Documenting recovered sources (All sensors)	HD55 SOP MEC-05	Daily	UXOQC/ GIS data recorded/ QC Geophysicist	All metallic debris col- lected is documented for the following attributes: Designation as UXO, MD, RRD or other debris; UXO and MD described by type, weight, depth, and as TOI or non-TOI. Photos display- ing all MD recovered (indi- vidual MD photos not nec- essary), and photos show- ing all surfaces of each MEC are recorded.	RCA/CA; document questionable information in database

Table 22.5 Intrusive Investigation Continued

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Confirm derived features match ground truth (AGC, 1 of 2)	HD56 SOP AC-09	Evaluated for all sources classified as TOI and not noted as possible noise by the data analyst	Project Geophysicist/ Running QC Summary or Intrusive Database/QC Geophysicist	100% of TOI source locations within 0.25m (x, y) and 0.15m (z) of a recovered item	RCA/CA
Confirm derived features match ground truth (AGC, 2 of 2)	HD57 SOP AC-09	Evaluated for all recovered items including seeds	Project Geophysicist/ Dig List and Intrusive Database/ Project or QC Geophysicist	Cued data analysis shows 100% have recovered items consistent with the size, shape/symmetry, and wall thickness indicated by the polarizability curves	RCA/CA
Confirm anomaly resolution (DGM)	HD58 SOP DGM-05	Evaluated for all intrusive results	Project Geophysicist/ Intrusive Database/ QC Geophysicist	Verification of anomaly footprint after excavation, using original instrument, confirms anomaly is resolved AND Reported excavation findings match expectations	RCA/CA

ATTACHMENT 4
VISUAL SAMPLE PLAN OUTPUT

Transect Sampling for Unexploded Ordnance (UXO) Target Detection

Summary

This report summarizes the probability of traversing and detecting a target area of specific size and shape for different transect spacings. Simulation details and a power curve estimate how well the specified design would detect the target. The selected design statement is:

If 1 meter wide transects with a parallel pattern are spaced 353 meters between transects (354 meters on centers) over the entire site, these transects have an approximately 95% chance of traversing and detecting any 435.2 meter diameter (217.6 meter radius) circular target area having a bivariate normal distribution with an average density of 300 anomalies per acre above the background density of 50 anomalies per acre. This assumes the instrument false negative rate is 0% and flagged windows have at least 95% confidence they have density greater than background.

The following table summarizes the sampling design developed. A figure that shows the transect placement in the field and a table that lists the transect placement coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Ensure high probability of traversing and detecting a target area that has a specified size and shape
Required Probability of Traversing the Target	100%
TARGET AREA AND TRANSECT INPUTS	
Type of Sampling Design	Transects
Transect Pattern	Parallel
Transect Width	1 meters
Target Area Definition	VSP Default for Air Launched Munition Up to 100 Pounds**
Area of target area	36.76 acres
Shape of target area of concern	Circular
Radius of target area of concern	217.6 meters
SIMULATION PARAMETERS FOR PROBABILITY OF DETECTION	
Formula for calculating the probability of traversing and detecting target area	Monte Carlo Simulation (method described below)
Background Density of the Site	50 anomalies / acre
Expected Target Area Density Above Background	300 anomalies / acre Target average
Distribution of target area density above background	Bivariate Normal
Transect spacing evaluation range	72 to 450 meters
Minimum precision	0.03
Maximum error	0.01
Search Window Diameter	391.68 meters
PROPOSED TRANSECT DESIGN AND COST INFORMATION	
Number of selected sample areas ^a	3
Specified sampling area ^b	3115.70 acres
Computed spacing between transects	353 meters
Computed spacing between transect centers	354 meters
Number of transects to be surveyed	18
Transect Coverage	0.28% of total site area
Linear transect coverage	35.04 km
Area of transect coverage	8.6578 acres

Total cost of sampling ^c	\$37,837.01
-------------------------------------	-------------

^a The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.

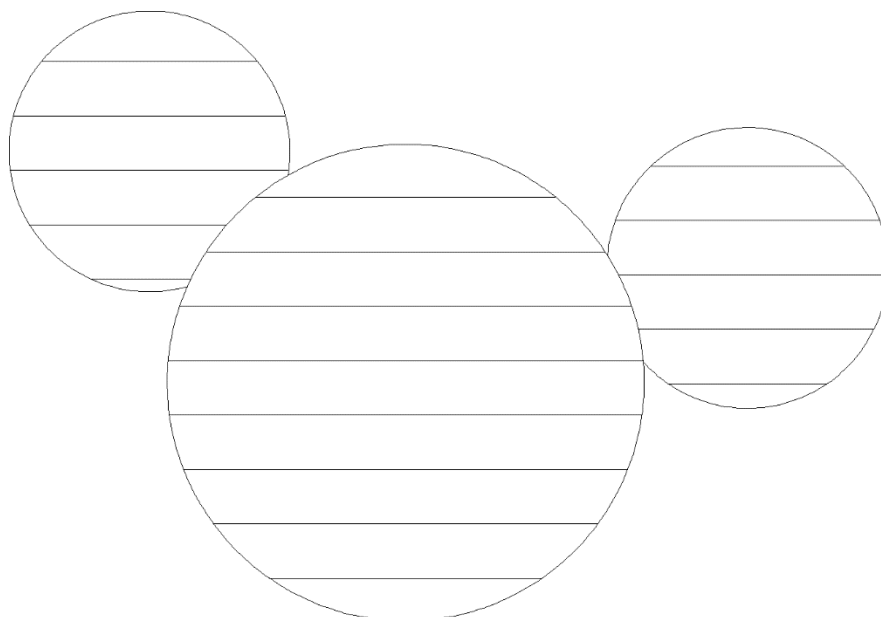
^b The sampling area is the total surface area of the selected colored sample areas on the map of the site.

^c See the Cost of Sampling section for an explanation of the costs presented here.

** For full documentation on the methods for the VSP default values see:

Hathaway JE, BA Pulsipher, JE Wilson, and LLN Newburn. 2013. *Simplified Target Sizing Model for Visual Sample Plan (VSP) - Redacted Version: Methodology for Munition Specific Fragmentation Distances for use in VSP based on TP-16 Methodology*. PNNL-22394, Pacific Northwest National Laboratory, Richland, WA.

Site Map With Proposed Transect Design



Summary of Transect Survey Design for Area: Area 1							
(All measurements are in meters)							
Start Coordinate		End Coordinate		Transect			
X	Y	X	Y	Width	Length	ID	Label
418597.0169	2974067.4172	419244.6604	2974067.4172	1.0000	647.6435	0	
418196.6839	2974421.4172	419479.6531	2974421.4172	1.0000	1282.9692	1	
418070.2477	2974775.4172	419881.5644	2974775.4172	1.0000	1811.3167	2	
418091.2932	2975129.4172	419860.5946	2975129.4172	1.0000	1769.3014	3	
418272.7805	2975483.4172	419679.0075	2975483.4172	1.0000	1406.2270	4	

Summary of Transect Survey Design for Area: Area 2							
(All measurements are in meters)							
Start Coordinate		End Coordinate		Transect			
X	Y	X	Y	Width	Length	ID	Label
419755.1749	2972121.7854	421530.1974	2972121.7854	1.0000	1775.0225	0	
419392.2659	2972475.7854	421892.9483	2972475.7854	1.0000	2500.6824	1	
419197.4919	2972829.7854	422087.8562	2972829.7854	1.0000	2890.3644	2	
419105.4696	2973183.7854	422179.7912	2973183.7854	1.0000	3074.3216	3	
419097.7323	2973537.7854	422187.5169	2973537.7854	1.0000	3089.7846	4	

419172.8894	2973891.7854	422112.2892	2973891.7854	1.0000	2939.3998	5	
419345.5017	2974245.7854	421939.7723	2974245.7854	1.0000	2594.2707	6	
419665.6953	2974599.7854	421619.5381	2974599.7854	1.0000	1953.8428	7	

Summary of Transect Survey Design for Area: Area 3							
(All measurements are in meters)							
Start Coordinate		End Coordinate		Transect			
X	Y	X	Y	Width	Length	ID	Label
422348.3928	2973387.3817	423384.2477	2973387.3817	1.0000	1035.8550	0	
422154.8862	2973741.3817	423688.7595	2973741.3817	1.0000	1533.8733	1	
422026.8721	2974095.3817	423779.3238	2974095.3817	1.0000	1752.4517	2	
422006.0653	2974449.3817	423726.7642	2974449.3817	1.0000	1720.6989	3	
422236.8539	2974803.3817	423495.8364	2974803.3817	1.0000	1258.9825	4	

Primary Sampling Objective

The primary purpose of sampling at this site is to traverse and detect target areas of a given size and shape with required high probability. The transect design tools provide a statistically defensible method to use transect survey data that covers only a small proportion of the total study area.

Selected Sampling Approach

The specified sampling approach was random parallel transect sampling. If parameters change from those specified in the table above, then the probability of detecting the target area will be different from those computed by VSP and reported here.

Simulation Details

To generate an estimated probability on a graph, VSP runs a Monte Carlo simulation based on the entered parameters. For each iteration, VSP creates a square site with the target area centered at the origin and rotated at a random angle. A parallel transect pattern is placed randomly so that 1 meters wide transects are parallel to the x axis.

VSP calculates the total area of the site traversed by transects, A_b , which can vary for each iteration.

The expected number of detected background anomalies, λ_b , is calculated as $\lambda_b = D_b A_b (1 - P_{fn})$ where D_b is the background density of 50 anomalies / acres and P_{fn} is the instrument false negative rate of 0. A random number of detected background anomalies is generated using a Poisson distribution with parameter λ_b . VSP randomly places these anomalies within the traversed areas of the site.

To simulate the number of additional anomalies in the target area, VSP uses an approximation technique to randomly place additional detected anomalies in the traversed areas of the target area. Portions of transects overlapping the target area are divided into small sections. For each section, the quantile of the target area in which it lies is determined, the expected number of additional anomalies is determined, and a random number of detected anomalies is determined using a Poisson distribution and placed within the section.

VSP uses a moving window along each transect to determine which areas have density significantly greater than background density. The window moves 1/6 of the search window diameter for each iteration. Where D_a is the actual density for the current window, the null and alternative hypotheses for determining if the area inside the window has density significantly greater than background density, D_b , are as follows:

Null Hypothesis: $H_o : D_a \leq D_b$

Alternative Hypothesis: $H_a : D_a > D_b$

VSP checks each window to see if the actual number of detected anomalies is significantly greater than the expected number of anomalies for a Poisson distribution. If any windows intersecting the target area are flagged as significant, then we determine the target area has been detected.

250 iterations are run to begin the simulation to estimate a probability of detection. If the specified Maximum Error has not been achieved, additional iterations are run until the Maximum Error is met. If the total number of iterations is n and the proportion of target areas detected is p , then another iteration is run if

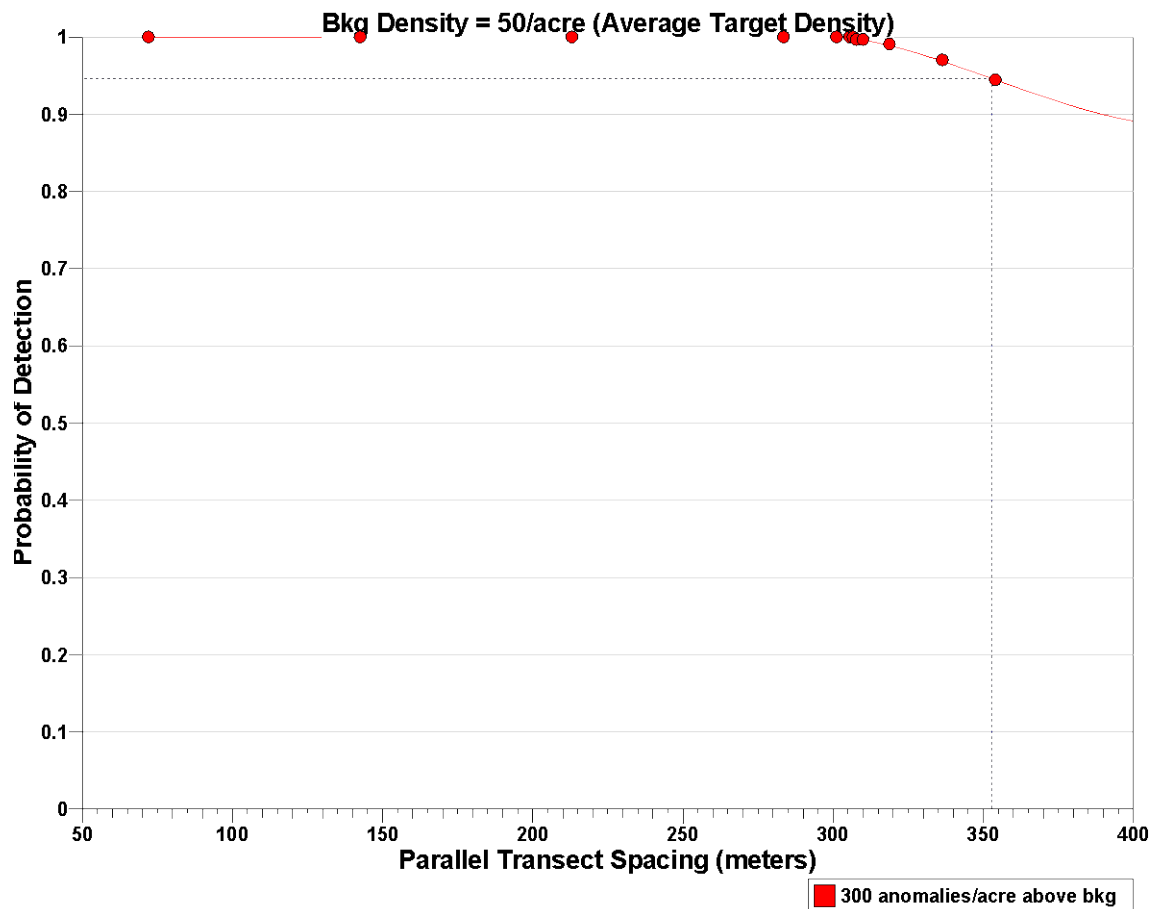
$$\text{Maximum Error} < 1.96 * \sqrt{\frac{p(1-p)}{n}}$$

The quantity $1.96 * \sqrt{\frac{p(1-p)}{n}}$ is the 95th percentile of the standard error of the mean for a binomial distribution. We are 95% certain that the estimated probability is close to the true probability (within the maximum error). When all iterations are completed, VSP tabulates the estimated probability the target area has been detected, p / n . VSP repeats this process for a number of transect spacings determined by simulation results and the minimum precision specified. The results are plotted in the power curve below.

Target Detection Power Curve

The following figure is a target detection performance diagram. It shows the probability of detecting the specified target area for a range of transect spacings. The estimated probability of detecting the target area is on the vertical axis, and a range of possible transect spacings are shown on the horizontal axis.

The legend at the bottom of the graph indicates the color of the line representing the target area densities above background used. Lines are fit by first smoothing the points using a moving average, then fitting the line using a cubic spline.



The transect spacings and the simulated probabilities of detecting the target area are shown in the table below:

Curve	Transect Spacing	Estimated Probability of Detecting the Target Area
1	72	1
1	142.5	1
1	213	1
1	283.5	1
1	301.125	1
1	305.531	1
1	306.633	1
1	307.734	0.996711
1	309.938	0.996711
1	318.75	0.990909
1	336.375	0.970304
1	354	0.944592

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number and length of the transects. Based on the number of transects determined above, the estimated total cost of surveying this site is \$37,837.01, which averages

out to a per transect cost of \$2,102.06. Note: these costs are for the geophysical survey only, and do not include any excavation or follow-up investigations. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	Cost / Unit	Units	Total
Collection costs	\$1.00 / meter	35037.01 meters	\$35,037.01
Setup costs	\$100.00 / transect	18 transects	\$1,800.00
Fixed planning and validation costs			\$1,000.00
Total cost			\$37,837.01

This report was automatically produced* by Visual Sample Plan (VSP) software version 7.9.

This design was last modified 10/10/2018 4:19:15 PM.

Software and documentation available at <http://vsp.pnnl.gov>

Software copyright (c) 2018 Battelle Memorial Institute. All rights reserved.

* - The report contents may have been modified or reformatted by end-user of software.

ATTACHMENT 5
SITE VISIT INFORMATION



US Army Corps
of Engineers

U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER (CEHNC)



SITE VISIT ABBREVIATED ACCIDENT PREVENTION PLAN (SVAAPP)

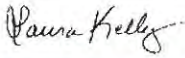
FOR SITE VISITS ONLY

Purpose: This SVAAPP is **ONLY TO BE USED FOR SITE SURVEY/VISITS** and must be accepted by the CEHNC Safety Office prior to survey/visit. No type of physical work shall be allowed/conducted with this form. If physical work is required the CEHNC Safety Office must be notified because the task will require a Limited Scope Abbreviated Accident Prevention Plan (AAPP) or a full Accident Prevention Plan (APP) per the EM 385-1-1, Appendix A.

Process: With the assistance of the CEHNC PM, coordination shall be made with the installation prior to conducting the site survey. Coordination with the PM is also required if photographs and/or video recordings are determined necessary/required.

Responsibility: The Prime Contractor shall ensure ALL members (including subcontractors) of the site survey team are briefed on and comply with the provisions within this SVAAPP and the applicable EM 385-1-1 safety requirements prior to survey/visit beginning. After the brief the Team Lead shall ensure each Team Member signs the Survey Team Statement on the last page of this document.

Note: CEHNC personnel, contractors, and all subcontractors must comply with all Occupational Safety and Health Administration (OSHA) laws, EM 385-1-1, and all state and local mandates. This SVAAPP is not intended to define full compliance with OSHA or other safety laws, codes, or regulations. Compliance with these requirements is to maintain a safe work environment for the contractor or subcontractor employees remains the Contractor's responsibility.

1. Contractor Information	a. Date Prepared: 3/30/2018
b. Contract Number: W912DY-17-D-0005	c. Task Order Number: W912DY18F0477
d. Contractor's Name: Parsons	e. Contractor's Address: 100 W. Walnut, Pasadena, CA 91124
f. Project Site Location: Fort Myers Bombing and Gunnery Range	g. Date of Site Visit: 2/26/2019
h. Prepared by: Laura Kelley	i. Telephone Number: 678-969-2437
j. Signature: 	k. E-mail Address: laura.kelley@parsons.com

2. CEHNC Information	
a. Project Manager (PM) Name: Charles "Hud" Heaton, PE	b. Telephone Number: 256-895-1657
3. Purpose of Site Visit (Examples: Field survey, records search/review, site investigation, inspection)	

Detailed Description:

Site visit by the Project Delivery Team as part of the SPP Meeting to be held on February 26, 2019. No geophysical surveys, intrusive investigation, MEC operations, or sampling will be conducted during this survey and site visit. A minimal tour of the area will be provided to the Systematic Project Planning Meeting attendees. The team will stay on or near roads/trails.

4. Personnel Responsibilities

- a. **Team Leader (TL)** is responsible for ensuring all the information/requirements contained in this SVAAPP and any other applicable topics are correct and effectively communicated to all involved team members prior to the commencement of the activity. The TL is responsible for submitting the signed SVAAPP to the CEHNC PM after survey/visit is completed for recordkeeping purposes.

i. TL Name:
Nancy Schur

ii. TL Telephone Number:
270-415-5599

- b. **Safety Officer/Designated Representative (SO/DR)** will assist the TL in the instruction/briefing and oversight of the requirements of this SVAAPP during all activities.

i. SO/DR Name:
Mike Coon

ii. SO Telephone Number:
425-457-1734

- c. Will activities stop if site conditions change or hazards arise that are not addressed on this SVAAPP? Yes: ☒ No: ☐

- d. **Team Members (TMs)** will all read or be briefed on the contents of this SVAAPP during the tailgate meeting (required)? Yes: ☒ No: ☐

- e. Will all TMs sign the Survey Statement at the end of this document prior to the actual site visit commencing (required)? Yes: ☒ No: ☐

5. Emergency Response.

Note: Prior to site survey, arrangements shall be made for first aid and emergency medical treatment.

- a. What method/s will be utilized to summon emergency services (cell phone, two-way radio, land line, etc.)? Cell phone

Emergency POC	Phone #	Emergency POC	Phone #
Medical Facility	Bayfront Health Punta Gorda 941-639-3131	Facility Contact	Click here to enter text.
Fire Department	911	Local Police	911
Military Police	N/A	CEHNC PM	256-895-1657
Local Police	911	Click here to enter text.	Click here to enter text.

- b. What means of transport will be readily available to transport injured or ill personnel (e.g., POV, Company Vehicle, etc.)? Personal/rental vehicles will be used to transport personnel with minor injuries to medical facility. An ambulance will be called if injury is life threatening.

- c. When emergency medical services are not accessible within 5 minutes of work location and there are 2 or more workers at the location, at least one employee (preferably two) on each shift shall

be qualified to administer first aid and CPR. Provide name/s of CPR trained individuals below if survey team is larger than two people.

1. Name: Mike Coon

Telephone number: 425-457-1734

2. Name: Jae Yun

Telephone number: 678-969-2463

Not applicable (Survey will be completed by one individual): ☐

Note: If task involves access to a remote or restricted area, the Two Person or Buddy System will be used. The two persons must maintain contact by line of sight and orally at all times. Emergency communication (Cell phone, radios, etc.) must be readily available at all times.

d. A map delineating the best route to the nearest medical facility shall be prepared and readily available onsite for TMs to access? Yes ☒ No ☐

e. Briefly Describe Emergency Response Procedures:

Team members are to be alert to the dangers associated with the site at all times. If an unanticipated hazardous condition arises, stop work, evacuate the immediate area, and notify the USACE and Parsons Project Manager. Personal/rental vehicles will be used to transport personnel with minor injuries to medical facility. An ambulance will be called if injury is life threatening.

6. General Description of Survey Activities (Check all that apply)

Walk-through	☒	Drive-through	☐	Off Road	☒	Off Paths/Trails	☒
--------------	-------------------------------------	---------------	--------------------------	----------	-------------------------------------	------------------	-------------------------------------

On/Near Roadway	☒	Over on Water	☐	Fly Over	☐	Fence Line	☐
-----------------	-------------------------------------	---------------	--------------------------	----------	--------------------------	------------	--------------------------

Crawlspace	☐	Basement	☐	Attic	☐	Roof near edges	☐
------------	--------------------------	----------	--------------------------	-------	--------------------------	-----------------	--------------------------

Warehouse	☐	Hospital	☐	Clinic	☐	Office Building	☐
-----------	--------------------------	----------	--------------------------	--------	--------------------------	-----------------	--------------------------

Equipment Room	☐	Control Tower	☐	Mechanical Room	☐	Penthouse	☐
----------------	--------------------------	---------------	--------------------------	-----------------	--------------------------	-----------	--------------------------

Mezzanine	☐	Pits and Sumps	☐	Catwalks	☐		☐
-----------	--------------------------	----------------	--------------------------	----------	--------------------------	--	--------------------------

	☐		☐		☐		☐
--	--------------------------	--	--------------------------	--	--------------------------	--	--------------------------

	☐		☐		☐		☐
--	--------------------------	--	--------------------------	--	--------------------------	--	--------------------------

7. Types of Hazards to consider (Check all that apply)

7. Types of Hazards to consider (Check all that apply)

Eye	☐	Head	☐	Foot	☐	Slips/Trips/Falls	☒
-----	--------------------------	------	--------------------------	------	--------------------------	-------------------	-------------------------------------

Heat Stress	☒	Cold Stress	☐	Climbing	☐	Fall From Heights	☐
-------------	-------------------------------------	-------------	--------------------------	----------	--------------------------	-------------------	--------------------------

Electrical	☐	High Traffic Area	☐	Vehicle	☒	Heavy Equipment	☐
------------	--------------------------	-------------------	--------------------------	---------	-------------------------------------	-----------------	--------------------------

Work from height	☐	Water	☐	Material Handling	☐	Lifting	☐
------------------	--------------------------	-------	--------------------------	-------------------	--------------------------	---------	--------------------------

Environment	☐	Insects	☒	Snakes	☐	Biological	☐
-------------	--------------------------	---------	-------------------------------------	--------	--------------------------	------------	--------------------------

Flammable Mat.	☐	Toxic Materials	☐	Chemicals	☐	Fire	☐
----------------	--------------------------	-----------------	--------------------------	-----------	--------------------------	------	--------------------------

Electrical Tools	☐	Hand Tools	☐	Excavations	☐	Mechanical	☐
------------------	--------------------------	------------	--------------------------	-------------	--------------------------	------------	--------------------------

Confined Space	☐	Squatting/Bending	☐	Hand/Finger	☐	Near Energized	☐
----------------	--------------------------	-------------------	--------------------------	-------------	--------------------------	----------------	--------------------------

Explosive	☒		☐		☐	Equipment	
-----------	-------------------------------------	--	--------------------------	--	--------------------------	-----------	--

	☐		☐		☐		☐
--	--------------------------	--	--------------------------	--	--------------------------	--	--------------------------

Note: All checked hazards shall be addressed in Section 8 below

8. Hazard Evaluation (Risk Management)

a. Hazards

b. Controls

c. Risk Level								
---------------	--	--	--	--	--	--	--	--

Heat stress	Dress appropriately. Take sufficient breaks and drink plenty of fluids. Watch for signs/symptoms of heat stress.
-------------	--

Low

Explosive	Have UXO escort present at all times. DO NOT TOUCH or MOVE suspected ordnance items regardless of the markings or apparent condition.
-----------	---

Low

Insects	Apply DEET (vapor-active repellent), Picardin, or other insect repellant to any exposed skin surface (except eyes and lips) in accordance with the manufacturer's instructions.	Low	
Vehicle	Personnel operating motor vehicles shall possess a valid license. Use of communication devices (e.g., cell phone, radio) while driving is prohibited. Personnel shall wear seat/shoulder belts when vehicle is in motion.	Low	
Slips/Trips/Falls	Site personnel will be instructed to look for potential safety hazards and immediately inform the safety officer about any encountered or new slip, trip, or fall hazards. If the hazard cannot be immediately removed or mitigated, action will be taken to notify site personnel about the hazard.	Low	
Click here to enter text.		Choose an item.	
Click here to enter text.	Click here to enter text.	Choose an item.	
Click here to enter text.	Click here to enter text.	Choose an item.	
d. Overall Risk Level (<i>After all controls are implemented</i>) Extremely High ☐ High ☐ Medium ☐ Low ☒ Note: Only LOW Risk Site Surveys are permitted to use this SVAAPP. If Risk is above LOW then the CEHNC Safety Office must be notified and the work will require an AAPP or an APP per the EM 385-1-1, Appendix A.			
9. Personnel Protective Equipment (PPE).			
a. Employees shall wear clothing suitable for the weather and work conditions. Check the minimum PPE that will be utilized:			
i. Short/long sleeve shirt	☒	ii. Long pants	☒
iii. Leather or other protective boots <i>Open-toed shoes are prohibited</i>	☐	iv. Hard Hat <i>In areas with potential hazard of head injury</i>	☐
v. Safety glasses with side shields <i>When eye hazards exist.</i>	☐	vi. Hearing protection <i>When noise hazards are known or expected</i>	☐
vii. Click here to enter text.	☐	viii. Click here to enter text.	☐
10. Mishap Reporting			
a. Will the Prime Contractor report all mishaps per the requirements of EM 385-1-1 Section 01.D to the Contracting Officer/Contracting Officer Representative OR as soon as possible but not more than 24 hours afterwards? Yes ☒ No ☐			
11. Contractor Additional Comments:			

Click here to enter text.

12. CEHNC Safety Office

a. Name:
John Zimmer

b. Date Reviewed:
2/15/2019

c. Accepted: Yes: ☒

No: ☐

13. CEHNC Additional Comments:

Click here to enter text.

U.S. ARMY CORPS OF ENGINEERS

Engineering and Support Center, Huntsville

SVAAPP Team Statement

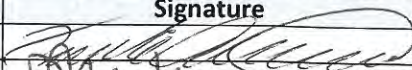
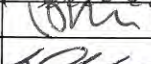
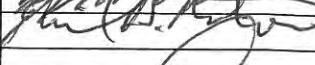
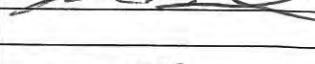
Note: This statement is the record to be maintained in the government/Contractor's on-site files through the entire life of the task order or project. The statement should only be completed prior to the actual visit taking place.

1. Team members will sign this statement:

a. Prior to the start of the site visit

b. When a change is made to this document.

2. I have read, or have read to me, and understand the specific safety and environmental requirements, and will abide by the contents contained in this SVAAPP. I have been briefed and trained in, and am familiar with, my requirements to safely conduct the site visit.

Print Name	Office	Signature	Date
Frank Araico	CESAJ		2/26/2019
John Keiser	CESAJ		2/26/2019
Donna West-Barnhill	CESAJ Contractor		2/26/2019
Hud Heaton	CEHNC		2/26/2019
Barry Hodges	CEHNC		2/26/2019
Daryl Donatelli	CEHNC		2/26/2019
Mike Malone	CEHNC		2/26/2019
John Winters	FDEP		2/26/2019
Jim McCarthy	FDEP		2/26/2019
Mike Kemmerer	FL FWC		2/26/2019
Laura Kelley	Parsons		2/26/2019
Nancy Heflin	Parsons		2/26/2019
John Baptiste	Parsons		2/26/2019
3. Team Leader/Safety Officer presenting briefing: Mike Coon			2/26/2019

Attach any additional information

YOUR TRIP TO:

BAYFRONT HEALTH PUNTA GORDA



30 MIN | 31.1 MI

Est. fuel cost: \$2.27

Trip time based on traffic conditions as of 4:13 PM on November 1, 2018. Current Traffic: Light



Print a full health report of your car with HUM vehicle diagnostics **(800) 906-2501**



1. Start out going **south** on State Road 31/FL-31 toward Little Farm Rd.

Then 5.27 miles

5.27 total miles



2. Turn **right** onto Bayshore Rd/FL-78.

Bayshore Rd is 0.2 miles past Old Rodeo Dr.

Then 3.20 miles

8.47 total miles



3. Merge onto I-75 N toward **Tampa**.

Then 20.56 miles

29.03 total miles



4. Take the **US-17** exit, EXIT 164, toward **Punta Gorda/Arcadia**.

Then 0.33 miles

29.36 total miles



5. Keep **left** to take the ramp toward **Punta Gorda/IMPAC Univ.**

Then 0.11 miles

29.47 total miles



6. Turn **left** onto Duncan Rd/US-17 S. Continue to follow US-17 S.

Then 1.66 miles

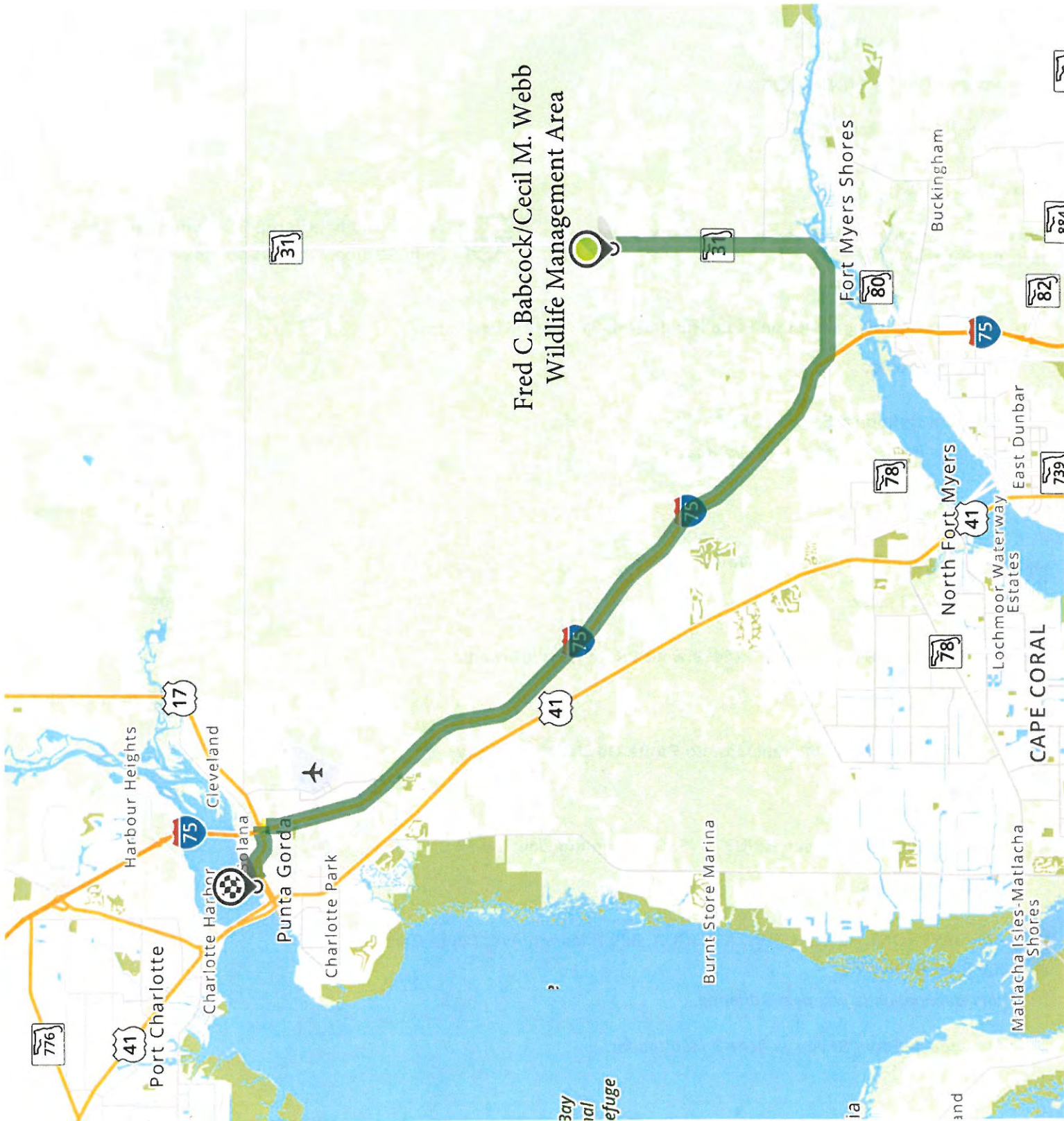
31.13 total miles



7. BAYFRONT HEALTH PUNTA GORDA, 809 E Marion Ave, Punta Gorda, FL,
809 E MARION AVE.

Your destination is just past Adrienne.

If you reach Booth St you've gone a little too far.



Fred C. Babcock/Cecil M. Webb
Wildlife Management Area