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FINAL

Site Inspection Report
Bostwick Bomb Target
Putnam County, Florida

U.S. Army Corps of Engineers
Southeast and Pacific IMA Region

FUDS Project No. I04FL091401
Contract: W912DY-04-D-0005
Task Order: 0008

Prepared For:
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207
and
U.S. Army Engineering & Support Center, Huntsville
4820 University Square
Huntsville, Alabama 35816-1822

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

Prepared By:
PARSONS
3577 Parkway Lane, Suite 100
Norcross, Georgia 30092

January 2010

FINAL

Site Inspection Report

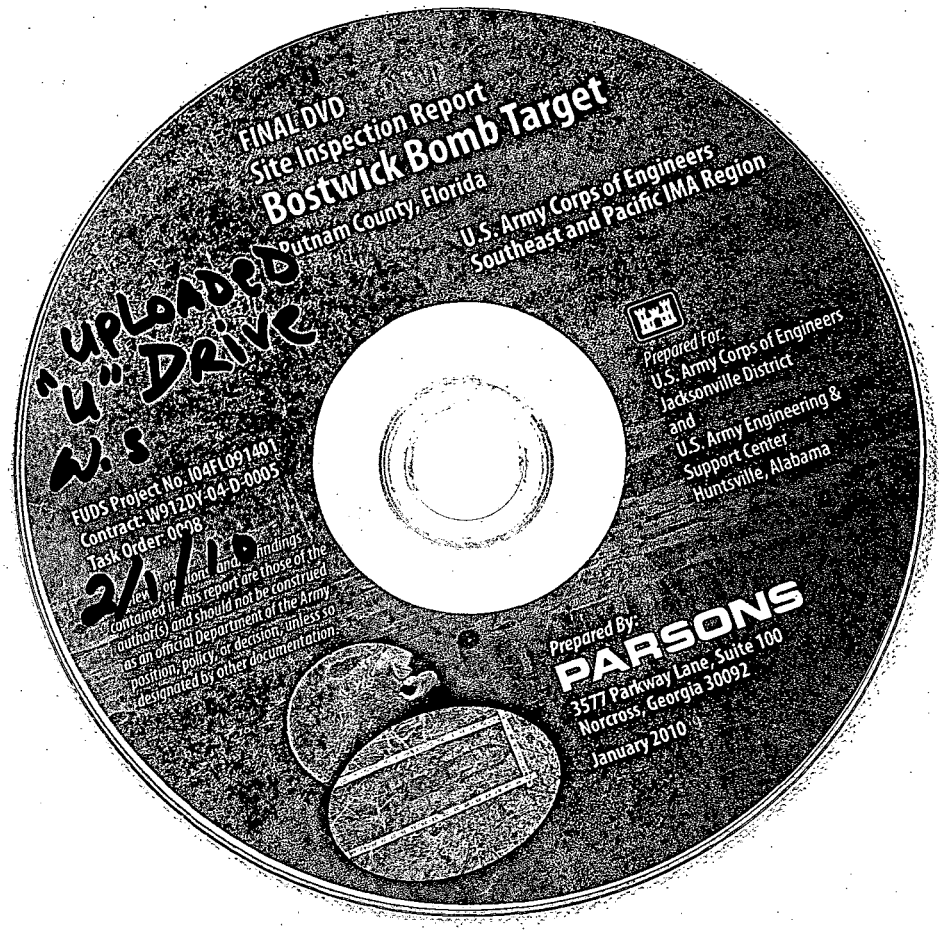
Bostwick Bomb Target

Putnam County, Florida

U.S. Army Corps of Engineers Southeast and Pacific IMA Region

PARSONS

January 2010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Site Inspection Report
Bostwick Bomb Target
Putnam County, Florida
U.S. Army Corps of Engineers
Southeast and Pacific IMA Region
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W.S
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2/1/10
Prepared For:
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Jacksonville District
and
U.S. Army Engineering &
Support Center
Huntsville, Alabama
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Norcross, Georgia 30092
January 2010

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

December 21, 2009

William Spence
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: Draft Final Site Inspection Report
Bostwick Bomb Target, Putnam County, Florida

Dear Mr. Spence:

The Department has reviewed the above-referenced document dated November 2009 and received November 24, 2009. Based on the findings of potential munitions debris (MD) and munitions explosives constituents (MEC) during the site visit and the detection of barium in sediment above its ecological screening value, we concur with the recommendation to proceed to the Remedial Investigation/ Feasibility Study (RI/FS) phase.

As has previously been discussed, the contaminant levels in soils should have been compared to the residential SCTLs in 62-777, F.A.C., rather than "ambient" or background levels of analytes. We reviewed the soil analytical results and found no exceedances of these SCTLs. As we go forward, all contaminant levels in the soils must be compared to the Department's residential SCTLs.

We acknowledge that Defense Environmental Restoration Program Formerly Used Defense Sites (FUDS) projects are difficult to assess. Often it is difficult to make the right decision about a site. Decisions are made using the best and most current information. If at sometime in the future additional information becomes available that may warrant reassessing any decisions that have been made about a site, we will address the matter at that time.

If I can be of any further assistance with this matter, please contact me at (850) 245-7504.

Sincerely,

Jeffrey D. Lockwood, P.E., BCEE
Professional Engineer III
Federal Programs Section

JDL/jl

cc: Doug Garretson, US Army Engineering and Support Center, Huntsville, AL
Don Silkebakken, Parsons Engineering, Norcross, GA

JJC JJC ESN ESN
by
ESN

U. S. ARMY ENGINEERING AND SUPPORT CENTER - HUNTSVILLE — CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS PROJECT Bostwick Bomb Target, FL CN 12-082-09 SD 28DEC09

- ☐ SITE DEV & GEO
- ■ ENVIR PROT& UTIL
- ☐ ARCHITECTURAL
- ☐ STRUCTURAL
- ☐ MECHANICAL
- ☐ MFG TECHNOLOGY
- ☐ ELECTRICAL
- ☐ INST & CONTROLS
- ☐ SAFETY
- ☐ ADV TECH
- ☐ ESTIMATING
- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW: SI Report Draft Final
DATE: 21Dec09
NAME: Teresa Carpenter/ 256-895-1659

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		All comments have been adequately addressed.	A. Noted

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEER DIVISION HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS Bostwick Bomb Target, Putnam Co, FL

PROJECT CN: 12-082-09 SD: 28DEC09

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- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW Draft Final SI Report

DATE 17 Dec 2009

NAME Nixon, ED-CS-P

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		Comments adequately addressed.	A. Noted

ACTION CODES
A - ACCEPTED/CONCUR
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CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BNX

U. S. ARMY ENGINEERING AND SUPPORT CENTER – HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT: CN: 12-082-09 NAME: Bostwick Bomb Target, FL SD: 28-DEC-09

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- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW: DRAFT-FINAL SI Report

DATE: December 22, 2009

NAME: Michael D'Auben / 256-895-1460 MO

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1	Section ES.3 Page ES-1	Acceptable response.	A. Noted.
2	Section 1.3.2 Page 1-3	Acceptable response.	A. Noted.
3	Table 3-1 Page 3-6	Acceptable response.	A. Noted.
4	Table 4-1 Page 4-2	Acceptable response.	A. Noted.
5	Table 4.4 Page 4-18	Acceptable response.	A. Noted.
6	Section 5.2.6.4 Page 5-11	Acceptable response.	A. Noted.

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U. S. ARMY ENGINEER DIVISION HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT: CN: 12-082-09 – Backcheck Draft Final Site Inspection Report Bostwick Bomb Target, Putnam County, FL Dated November 2009 Cont. No. W912DY-04-D-0005 T.O. 0008, Proj. No. [04FL091401]

- ☐ SITE DEV & GEO
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- ☐ ESTIMATING
- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW: Backcheck Draft Final SI Report
DATE: 22 Dec 2009
NAME: James B. Walker Jr. (256) 656-2407

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.	General	A backcheck of previous comments generated by Mr. Emmett Hopkins, CEHNC-OE-S October 20, 2009 was complete. The Draft Final Site Inspection Report, Bostwick Bomb Target, Putman County, Florida Revision 1, dated November 2009 adequately addressed and incorporated all comments generated by Mr. Hopkins therefore I am recommending approval of the Draft Final Report as written.	A. Noted

ACTION CODES
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D - ACTION DEFERRED
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N - NON-CONCUR
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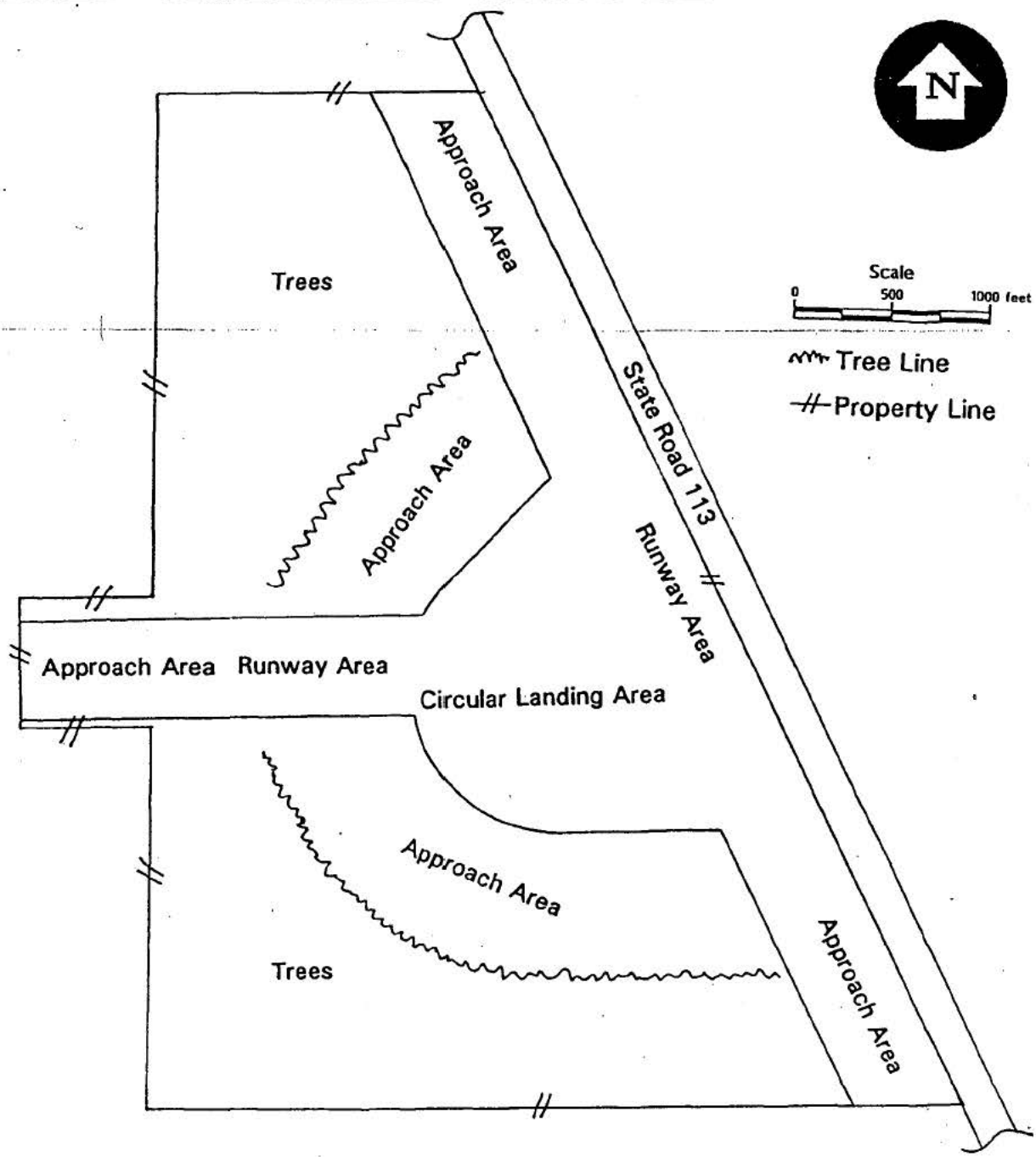
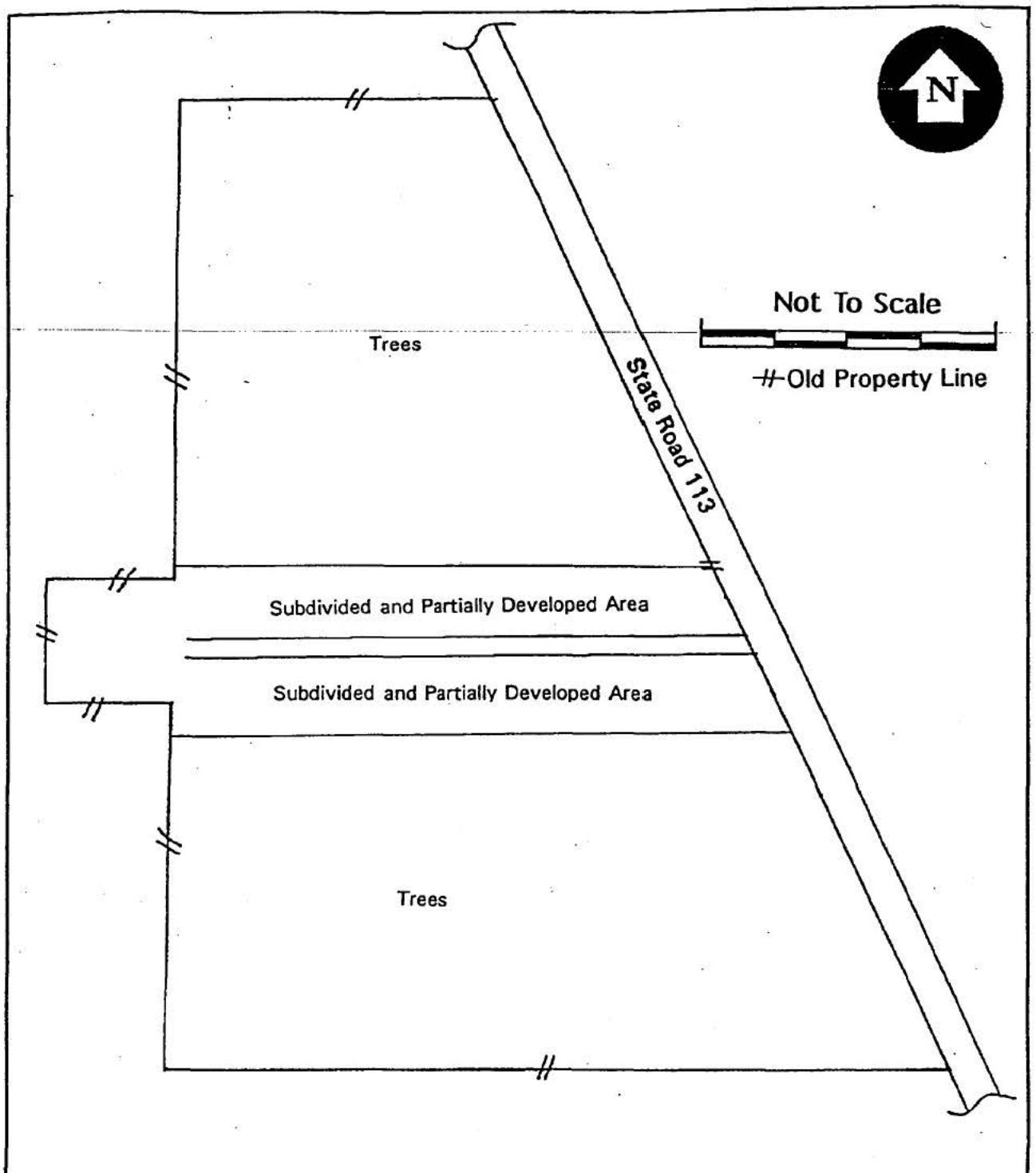


Source: *Map adapted from a drawing by Robert and Company, Inc., Bostwick, Florida. - Outlying Field, 12 December 1940, obtained from Army Corps of Engineers office in Jacksonville, Florida.*

DYNAMAC CORPORATION
Environmental Services

Figure 2: Site Layout Map, 1940
BOSTWICK OUTLYING FIELD
Bostwick, Putnam County, Florida



Source: *Observations from Dynamac site reconnaissance, 5 May 1994.*

DYNAMAC CORPORATION
Environmental Services

Figure 3: Site Layout Map, 1994
BOSTWICK OUTLYING FIELD
Bostwick, Putnam County, Florida

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
FORMERLY USED DEFENSE SITES
FINDINGS AND DETERMINATION OF ELIGIBILITY

Bostwick Outlying Field (OLF), FL

Site No. I04FL010700

FINDINGS OF FACT

1. On 21 September 1940, the United States (U.S.) acquired a total of 397.00 acres in fee from various owners by condemnation for a Navy outlying airfield. This site was located in Putnam County approximately 32 miles south of Jacksonville Naval Air Station (NAS) on U.S. Highway No. 17 between the towns of Green Cove Springs and Palatka, Florida. The site was developed and named the Bostwick Outlying Field (OLF).

2. The site was utilized by the Navy for an outlying airfield in conjunction with various training operations associated with the Jacksonville NAS. The only known Naval improvements consisted of a graded grass landing strip, landing markers, one small building mounted on skids, a drainage system and fencing to make the field operational. The site remained active until August 1947 when its functions were no longer required by the Navy.

3. The Navy determined the 397.00 acre site and improvements were excess to their needs and reported it surplus to the War Assets Administration (WAA) on 25 August 1947. The WAA assumed custody and accountability of the acreage and improvements on 17 November 1947 for disposal purposes. The U.S., acting by and through the War Assets Administrator, conveyed the 397.00 acre site and improvements to Putnam County, Florida, by quit claim deed dated 22 March 1948. The deed contained a maintenance clause, a recapture clause and restricted the property to public airport use only. However, the Federal Aviation Administration has since terminated the public airport use restrictions and released the recapture clause. The conveyance to Putnam County was subject to existing easements for public highways, roads, railroads, pipelines, and utilities. Currently, the site is privately owned and used for residential areas and timberland.

DETERMINATION

Based on the foregoing findings of fact, the Bostwick Outlying Field (OLF), Florida, has been determined to be formerly used by the Department of Defense. It is therefore eligible for the Defense Environmental Restoration Program - Formerly Used Defense Sites established under 10 USC 2701 et seq.

9-15-94
DATE

RALPH V. LOCURCIO
Brigadier General, USA
Commanding

18 Apr 94
Previous editions obsolete

RISK ASSESSMENT PROCEDURES FOR ORDNANCE AND EXPLOSIVE WASTE (OEW) SITES

Site Name Bostwick Outlying Field
Site Location Bostwick, Putnam County, FL
DERP Project # IOFL010700
Completed 14 June 1994

Rater's Name David L. Fortune
Phone No. (404) 681-0933
Organization Dynamac Corporation Date
RAC Score RAC 5

OEW RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD-882C and AR 385-10. The RAC score will be used by CEHND to prioritize the remedial action at Formerly Used Defense Sites. The OEW risk assessment should be based upon best available information resulting from records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. This information is used to assess the risk involved based upon the potential OEW hazards identified at the site. The risk assessment is composed of two factors, **hazard severity and hazard probability**. Personnel involved in visits to potential OEW sites should view the CEHND videotape entitled "A Life Threatening Encounter: OEW."

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

TYPE OF ORDNANCE
(Circle all values that apply)

A. Conventional Ordnance and Ammunition	VALUE
Medium/Large Caliber (20 mm and larger)	10
Bombs, Explosive	10
Grenades, Hand and Rifle, Explosive	10
Landmines, Explosive	10
Rockets, Guided Missiles, Explosive	10
Detonators, Blasting Caps, Fuzes, Boosters, Bursters	6
Bombs, Practice (w/spotting charges)	6
Grenades, Practice (w/spotting charges)	4
Landmines, Practice (w/spotting charges)	4
Small Arms (.22 cal - .50 cal)	1
Conventional Ordnance and Ammunition	0

(Select the largest single value)

What evidence do you have regarding conventional OEW? _____

B. Pyrotechnics (for munitions not described above.)

	VALUE
Munition (Container) Containing White Phosphorous (WP) or other Pyrophoric Material (i.e., Spontaneously Flammable)	10
Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethaliuminum Metal Incendiaries)	6
Flares, Signals, Simulators, Screening Smokes (other than WP)	4
Pyrotechnics (Select the largest single value)	0

What evidence do you have regarding pyrotechnics None.

C. Bulk High Explosives (Not an integral part of conventional ordnance; uncontainerized).

	VALUE
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, Tetracene, etc.)	10
Demolition Charges	10
Secondary Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	8
Military Dynamite	6
Less Sensitive Explosives (Ammonium Nitrate, Explosive D, etc.)	3
High Explosives (Select the largest single value).	0

What evidence do you have regarding bulk explosives? None.

D. Bulk Propellants (Not an integral part of rockets, guided missiles or other conventional ordnance; uncontainerized)

	VALUE
Solid or Liquid Propellants	6
Propellants	0

What evidence do you have regarding bulk propellants? None.

E. Chemical Warfare Materiel and Radiological Weapons

	VALUE
Toxic Chemical Agent (Choking, Nerve, Blood, Blister)	25
War Gas Identification Sets	20
Radiological	15
Riot Control Agents (Vomiting, Tear)	5

Chemical and Radiological (Select the largest single value) 0

What evidence do you have of chemical/radiological OEW? None.

TOTAL HAZARD SEVERITY VALUE 0
(Sum of Largest Values for A through E--Maximum of 61).
Apply this value to Table 1 to determine Hazard Severity Category.

TABLE 1

HAZARD SEVERITY*

Description	Category	Hazard Severity Value
CATASTROPHIC	I	21 and greater
CRITICAL	II	10 to 21
MARGINAL	III	5 to 9
NEGLIGIBLE	IV	1 to 4
**NONE		0

* Apply Hazard Severity Category to Table 3.

** If Hazard Severity Value is 0, you do not need to complete Part II. Proceed to Part III and use a RAC Score of 5 to determine your appropriate action.

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons has completed the Final Site Inspection report for the Bostwick Bomb Target, Putnam County, Florida. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Kathleen A. Rowland Jim L. Davis

Courtnie K Lewis Kari Bonluwe

January 28, 2010

Study/Design Team Leader and Team Members

Jim L. Davis Carol Moore

January 28, 2010

Independent Technical Review Team Leader

Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from independent technical review of the project have been considered.

Dan Laura Kelly

January 28, 2010

Parsons Program Manager(s)

PARSONS

Parsons Infrastructure & Technology Group, Inc.

3577 Parkway Lane • Suite 100 • Norcross, Georgia 30092 • (770) 446-4900 • Fax: (770) 446-4910 • www.parsons.com

January 28, 2010

U.S. Army Engineer Center Huntsville
CEHNC-OE-DC (Mr. Doug Garretson)
4820 University Square
Huntsville, AL 35816-1822
(256) 895-1066

Subject: Contract W912DY-04-D-0005, Delivery Order 0008
MMRP SI for SE and Pacific IMA Region –Final SI Report
Bostwick Bomb Target, Putnam County, Florida

Dear Mr. Garretson:

Parsons has prepared this Final Site Inspection (SI) Report in accordance with the Performance Work Statement (PWS) to include the completed Munitions Response Site Prioritization Protocol (MRSPP). Two copies have been provided for your records.

We have forwarded eight copies of the document to Mr. William Spence of the Jacksonville District for his records and distribution to FDEP and other stakeholders. We have also submitted single copies of this Final document to CX EG. Electronic copies have also been provided.

If you have any questions or comments, please contact me at (678) 969-2437 or (404) 934-1266 (cell).

Sincerely,

PARSONS

Laura Kelley

Laura Kelley
MMRP SI Program Manager

cc: William Spence – 8 copies/8 DVDs
Deborah Walker (CX MM) – 1 copy/1 DVD
Dwayne Ford (CX-MM) - EKO
Terry Walker (CX EG) - 1 DVD
Rochelle Hance (CEMVS EC P) – 1 DVD
Don Silkebakken, MMRP SI Program Manager
Project File (744647.84115)

U.S. Army Corps of Engineers
Southeast and Pacific IMA Region

FINAL
Site Inspection Report
Bostwick Bomb Target
Putnam County, Florida

FUDS Project No. I04FL091401
January, 2010

In Support of

FUDS MMRP Site Inspections Project

Prepared by:
PARSONS
3577 Parkway Lane, Suite 100
Norcross, Georgia 30092

Prepared for:
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207

and

U.S. Army Engineering and Support Center, Huntsville
4820 University Square
Huntsville, Alabama 35816

Contract: W912DY-04-D-0005
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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
ARC	Annual Report to Congress
ASR	Archive Search Report
bgs	Below Ground Surface
BT	Bomb Target
CEMVS	U.S. Army Corps of Engineers, St. Louis District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	U.S. Army Corps of Engineers, Jacksonville District
CFR	Code of Federal Regulations
CHE	CWM Hazard Evaluation
CSEM	Conceptual Site Exposure Model
CSM	Conceptual Site Model
CWM	Chemical Warfare Material
CZMP	Coastal Zone Management Program
DEP	Defense Environmental Programs
DERP	Defense Environmental Response Program
DoD	Department of Defense
DQO	Data Quality Objective
EHE	Explosive Hazard Evaluation
EOD	Explosive Ordnance Disposal
EPP	Environmental Protection Plan
ER	Engineer Regulation
ESV	Ecological Screening Value
FAC	Florida Administrative Code
FDE	Findings and Determination of Eligibility
FDEP	Florida Department of Environmental Protection
FL SHPO	Florida State Historic Preservation Office
FMSF	Florida Master Site File
FNAI	Florida Natural Areas Inventory
FTL	Field Team Leader
FUDS	Formerly Used Defense Site
FUDSMIS	FUDS Management Information System
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information System
GP	General Purpose
gpm	Gallons Per Minute
GPS	Global Positioning System
HE	High Explosives
HHE	Health Hazard Evaluation
HQ	Hazard Quotient
HRS	Hazard Ranking Score
HTW	Hazardous Toxic Waste
IGD	Interim Guidance Document

ACRONYMS AND ABBREVIATIONS (CONTINUED)

INPR	Inventory Project Report
MC	Munitions Constituents
MD	Munitions Debris
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams Per Kilograms
MMRP	Military Munitions Response Program
MRDS	Mineral Resources Data System
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
msl	Mean Sea Level
mya	Million Years Ago
NAATC	Naval Air Advanced Training Command
NAD	North American Datum
NAS	Naval Air Station
NCP	National Contingency Plan
NDAI	No Department of Defense Action Indicated
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHP	Natural Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHD	National Register of Historic Districts
NRHP	National Register of Historic Places
NRIS	National Register Information System
NTCRA	Non-time Critical Removal Action
NWI	National Wetlands Inventory
NWRS	National Wildlife Refuge System
OCHP	Office of Cultural and Historical Programs
PA	Preliminary Assessment
Parsons	Parsons Corporation
ppm	Parts Per Million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PSAP	Programmatic Sampling and Analysis Plan
PWP	Programmatic Work Plan
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QR	Qualitative Reconnaissance
RAC	Risk Assessment Code
RI/FS	Remedial Investigation and Feasibility Study
ROE	Right-of-Entry

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RSL	Regional Screening Level
SAP	Sampling & Analysis Plan
SCTL	Soil Cleanup Target Levels
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SLRA	Screening Level Risk Assessment
SOP	Standard Operating Procedure
SQAG	Sediment Quality Assessment Guidelines
SS-WP	Site-Specific Work Plan
SSL	Soil Screening Level
SVT	Site Visit Team
T&E	Threatened and Endangered
TCRA	Time Critical Removal Action
TESS	Threatened and Endangered Species System
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USAESCH	USACE, Engineering and Support Center, Huntsville
USC	United States Code
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
WMA	Wildlife Management Area

GLOSSARY OF TERMS

Anomaly	Any item that deviates from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.).
Inhabited Structure	Permanent or temporary structure, other than military munitions-related structures, routinely occupied by one or more persons for any portion of the day.
Magnetometer	An instrument for measuring the strength of a magnetic field; used to detect buried ferrous objects.
Military Munitions	All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof.
Munitions and Explosives of Concern (MEC)	Military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive or other health hazard.
Munitions Constituents (MC)	Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.
Munitions Debris	Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

GLOSSARY OF TERMS (CONTINUED)

Munitions Response	Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required.
Munitions Response Site (MRS)	A discrete location within an MRA that is known to require a munitions response.
Projectile	Object projected by an applied force and continuing in motion by its own inertia. This includes bullets, bombs, shells, grenades, guided missiles, and rockets.
Unexploded Ordnance (UXO)	Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and that remain unexploded whether by malfunction, design, or any other cause.

EXECUTIVE SUMMARY

ES.1 The objective of this site inspection (SI) was to determine whether the former Bostwick Bomb Target (BT) located in Putnam County, Florida warrants further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) beyond the SI stage. The Bostwick BT has been declared a Formerly Used Defense Site (FUDS) and assigned FUDS project # I04FL091401. The SI was performed to evaluate the evidence for the presence of munitions and explosives of concern (MEC) and munitions constituents (MC) at the site. To accomplish this objective, qualitative reconnaissance (QR) and MC sampling were performed. The work was performed under Contract No. W912DY-04-D-0005, Task Order No. 0008 from the United States Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH).

ES.2 The Bostwick BT is located approximately 3 miles west-northwest of the Town of Bostwick, Florida. In 1940, the United States acquired 3,111 acres of land that was used by the Naval Air Advanced Training Command (NAATC), quartered at Jacksonville Naval Air Station (NAS), for operational training and practice dive-bombing. The Navy established a 40-acre circular target in the center of the range and the site consists of a rocket range safety fan overlying the original FUDS boundary and the 649-acre bomb target safety circle. The Navy declared Bostwick BT excess to their needs in 1977 and terminated the lease on December 15, 1977. Munitions used on-site include 2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), Mk-82 low drag 500 lb. bomb, 30mm projectiles, Mk-15 water/sand fill practice bomb, Mk-81 250 lb. low drag bomb, and Mk-5 miniature practice bomb.

ES.3 The Technical Project Planning (TPP) Team agreed upon the SI technical approach at the December 17, 2008, TPP meeting. It was determined during the TPP process that QR and the collection of eight biased surface soil samples, four surface water/sediment sample couples would be sufficient to meet the SI project objectives. These samples were collected in locations representing the most likely places for MC contamination. Since there was no water present at the agreed upon sample location, samples BBT-MRS01-SW-04 and BBT-MRS01-SD-04 were converted to a surface soil sample (BBT-MRS01-SS-02-11) resulting in the collection of nine biased surface soil samples and three surface water/sediment sample couples, a minor deviation from the site-specific work plan (SSWP). A groundwater sample was planned, but the pump was broken and a sample could not be obtained. One ambient surface water/sediment sample couple and one ambient surface soil sample were collected outside the MRS to provide ambient metals data.

ES.4 The site visit was conducted on July 5 through 10, 2009. The SI evaluation included approximately 20 miles of walked QR and the collection of the

surface soil, surface water, and sediment samples (Figure ES.1). All of the soil samples were composed of sandy soil.

ES.5 Based on visual observations only, potential MEC items found during the site visit, include an intact Mk76 25 lb. practice bomb, , one AN-Mk23 3 lb. practice bomb with a Mk4 signal, one Mk76, Mod 0 or 1, with a signal of unknown type, one 2.75-inch HE rocket warhead, and a possible fuze of unknown type. MD was also found, including parts from an Mk76 practice bomb, half of an AN-Mk43 3 lb. practice bomb, AN-Mk23 bomb parts, and one 2.25-inch practice rocket. Table ES.1 summarizes the results of the SI for the Bostwick BT.

ES.6 TestAmerica (Denver) analyzed the environmental samples for explosives, selected metals (antimony, barium, copper, lead, and zinc), and perchlorate for the surface water samples. The ambient surface water/sediment sample couples were not analyzed for explosives. Any detection of explosives is considered potential MC contamination and is evaluated in the screening level risk assessment (SLRA); however, no explosives were detected in any of the samples collected during the SI. The analytical results for total metals from the surface soil and sediment samples were compared to the concentrations of elements in Putnam County, Florida (based on the mean concentration for the county plus two times the standard deviation to approximate the 95% Upper Confidence Limit of the mean), identified by the United States Geological Survey (USGS) and the ambient surface soil and sediment samples collected. The analytical results for total metals from the surface water samples were compared to the results from the ambient sample collected. The analytical results were then compared to the following criteria to determine the need to perform a SLRA for each particular analyte:

- Was the analyte a potential constituent of munitions known or suspected of being used on site?
- Was the analyte detected above background screening levels?

ES.7 No explosives were detected in any of the samples. None of the human health screening values for surface water, sediment, or surface soil were exceeded for the retained analytes for this MRS. Therefore, based on the analytical results presented in this report, an unacceptable human health risk is not expected from exposure to MC in surface soil, surface water, or sediment at the Bostwick BT MRS. No groundwater samples were collected, so the groundwater exposure pathway was not quantitatively assessed.

ES.8 The maximum detected value of barium in the sediment at the MRS was slightly *greater than* the selected ecological screening value, resulting in a Hazard Quotient of 1.6. None of the other retained analytes exceeded their ecological screening value. An unacceptable ecological risk due to MC may be present from exposure to barium in the sediment at the Bostwick BT MRS.

ES.9 A qualitative risk assessment for MEC was conducted based on SI field observations and historical data regarding previous site visits and removal actions (Chapter 6). Based on the MEC and MD observations made during this investigation, as well as the MD items identified prior to the SI field activities (as detailed in Chapter 4), it is possible that additional MEC exist on portions of the Bostwick BT. Munitions used at the MRS contain compounds and/or components which may pose a safety hazard if any remain on-site intact. The MEC exposure pathway for the Bostwick BT MRS at the Bostwick BT is potentially complete.

ES.10 As shown in Table ES.1, the MRS at Bostwick BT is recommended to proceed to Remedial Investigation and Feasibility Study (RI/FS) status, with no immediate removal action warranted at this time.

TABLE ES.1
SUMMARY OF 2009 SITE INSPECTION RESULTS
BOSTWICK BOMB TARGET, PUTNAM COUNTY, FLORIDA

MRS	Acreage	Munitions and Explosive of Concern and/or Munitions Debris Assessment (1)	Munitions Constituents Assessment (2)	Recommendation
Bostwick Bomb Target MRS	3,111	***YES*** USACE documents issued since site closing confirm the use of the site as a bombing range. The munitions suspected to have been used at this MRS (2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), Mk-82 low drag 500 lb. bomb, 30mm projectiles, Mk-15 water/sand fill practice bomb, Mk-81 250 lb. low drag bomb, and Mk-5 miniature practice bomb) contain explosives that might present a residual hazard if they remain at the site intact. MEC and MD was found by the 2009 SVT while conducting QR.	***YES*** An unacceptable ecological risk due to MC may be present from exposure to barium in the sediment at the Bostwick Bomb Target MRS.	***RI/FS*** Further MC sediment sampling may be warranted.

- Notes:
- (1) "Yes" in this column indicates confirmed MEC or MD presence indicative of potential MEC presence, resulting in an RI/FS recommendation for the MRS. "No" in this column indicates no confirmed MEC or MD indicative of potential MEC presence.
- (2) "Yes" in this column indicates the presence of MC at levels indicating a potential elevated risk to human health or ecological receptors, resulting in a recommendation for further MC sampling during an RI/FS. "No" in this column of the table indicates the absence of MC at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for no further MC sampling for the MRS.

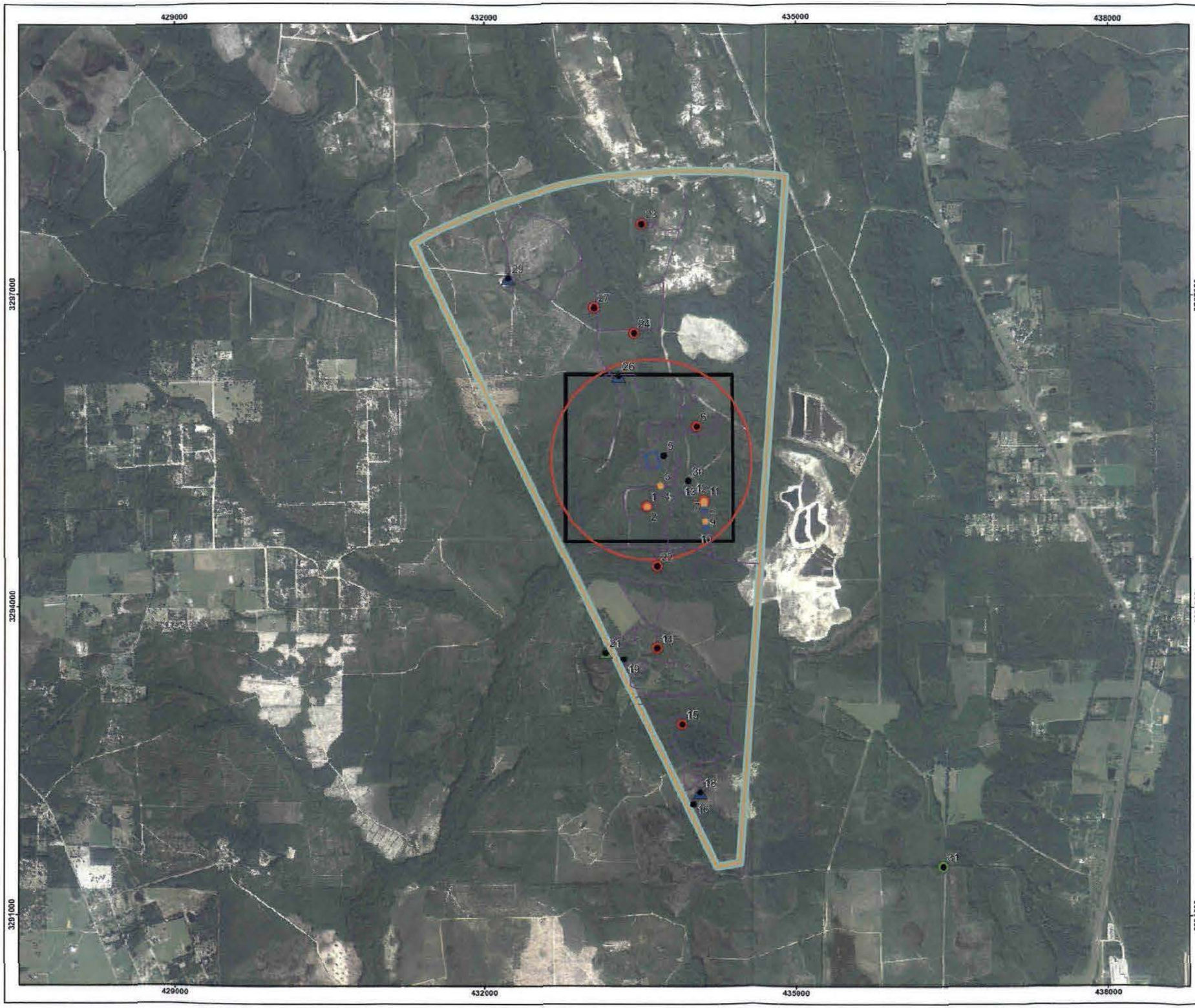


Figure ES.1

General Site Overview
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida

Legend

- MEC Location
- Munition Debris Observation Location
- Field Observation Location
- Ambient Soil Sample Location
- Ambient Surface Water/Sediment Sample Location
- Soil Sample Location
- Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS

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

1 0.5 0 1 Kilometers

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT
DRAWN BY: BT
CHECKED BY: JU
SUBMITTED BY: DS

General Site Overview

SCALE: As Shown
PROJECT NUMBER: 744647.84115
DATE: October 2009
PAGE NUMBER: ES-5
FILE: X:\GIS\Site_Inspections_nel\Maps\bostwick_FL\FigES_1.mxd

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

1.1.1 Parsons Corporation (Parsons) received Contract No. W912DY-04-D-0005, Task Order No. 0008, from the United States Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH) to perform a Site Inspection (SI) at the Bostwick Bomb Target (BT) Formerly Used Defense Site (FUDS) located in Putnam County, Florida. This site has been assigned FUDS project number I04FL091401.

1.1.2 The Bostwick BT, also known as the Putnam Bomb Target, is located approximately three miles west-northwest of the Town of Bostwick, Florida. In 1940, the United States acquired 3,111 acres of land through lease and condemnation from Union Bag and Paper Company. The acquisition included 650 acres of unimproved land. The Navy established a 40-acre circular target in the center of the range for practice bombing. The FUDS consists of a rocket range safety fan overlying the original FUDS boundary and the 649-acre bomb target safety circle (Figure 1.1). The Naval Air Advanced Training Command (NAATC), quartered at Jacksonville Naval Air Station (NAS), used Bostwick BT for operational training and conducted practice dive-bombing (ASR, USMVR, 1996). Historical information and field observations during the 2009 site visit also confirm the use of the property as a practice rocket range. The Navy declared Bostwick BT excess to their needs in 1977 and terminated the lease on December 15, 1977. The site is currently used as a pine tree plantation, growing pine trees for the pulp and paper industry. Portions of the site are also used for surface mining for titanium metal precursors and as a hunting preserve. The site has one Munitions Response Site (MRS) - Bostwick BT MRS. The coordinates for the center points of the MRS are listed in Table 1.1. The coordinates are in meters [Universal Transverse Mercator (UTM) Zone 17 North American Datum (NAD) 83]. Figures 1.1 and 1.2 depict the FUDS property and MRS boundaries for the site.

Table 1.1
Bostwick Bomb Target MRS Acreage and Coordinates

MRS	MRS Acreage(1)	X-Coordinate (meters)	Y-Coordinate (meters)
Bostwick Bomb Target	3,111	433544.33	3295542.26

(1) - Acreage based on Archives Search Report (ASR) Supplement.

1.2 PROJECT OBJECTIVES

1.2.1 The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, DoD's Executive Agent for the FUDS program.

1.2.2 Pursuant to USACE's Engineer Regulation (ER) 200-3-1 (USACE, 2004a) and the Management Guidance for the Defense Environmental Response Program (DERP) (Office of the Deputy Under Secretary of Defense, Installations and Environment, September 2001), USACE is conducting FUDS response activities in accordance with the DERP statute (10 United States Code [USC] 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC §9620), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). As such, USACE is conducting remedial SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

1.2.3 While not all MEC/MC constitute CERCLA hazardous substances, pollutants or contaminants, the DERP statute provides DoD the authority to respond to releases of MEC/MC, and DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.2.4 This report summarizes the work performed during the SI and presents an accounting of any MEC and MC contamination identified on the site. The SI was limited exclusively to MEC and MC contamination issues requiring collection of a sufficient and appropriate amount of information, but does not consider other unrelated hazardous and toxic waste (HTW) concerns the site may pose. Per ER 200-3-1, guidance for conducting a SI, Section 4-4.1.2:

> *The SI is not intended as a full-scale study of the nature and extent of contamination or explosive hazards. The objectives of the remedial SI are to: (i) Eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) Determine the potential need for removal action; (iii) Collect or develop additional data, appropriate for HRS [Hazard Ranking Score] scoring by [US]EPA [United States Environmental Protection Agency]; and (iv) Collect data, as appropriate, to characterize the release for effective and rapid initiation of the RI/FS [Remedial Investigation/Feasibility Study].*

1.2.5 An additional objective of the SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSPP).

1.2.6 The SI was performed as a result of findings identified in the 1994 Inventory Project Report (INPR), 1996 Archives Search Report (ASR) and the 2004 ASR Supplement conducted and written by the USACE- Jacksonville District (CESAJ), the USACE- St. Louis District (CEMVS), and the US Army Defense Ammunition Center and School. All work adhered to the DERP for FUDS and relevant U.S. Army regulations and guidance for MEC programs. As specified in the task order, this report is prepared to summarize the SI sampling events and presents an accounting of the MEC/MC contamination identified on-site.

1.3 PROJECT SCOPE

1.3.1 Due to the historical findings of MEC and munitions debris (MD) at the Bostwick BT MRS, associated with the Bostwick BT, the Technical Project Planning (TPP) Team concurred that the SI would proceed in a manner to support a RI/FS.

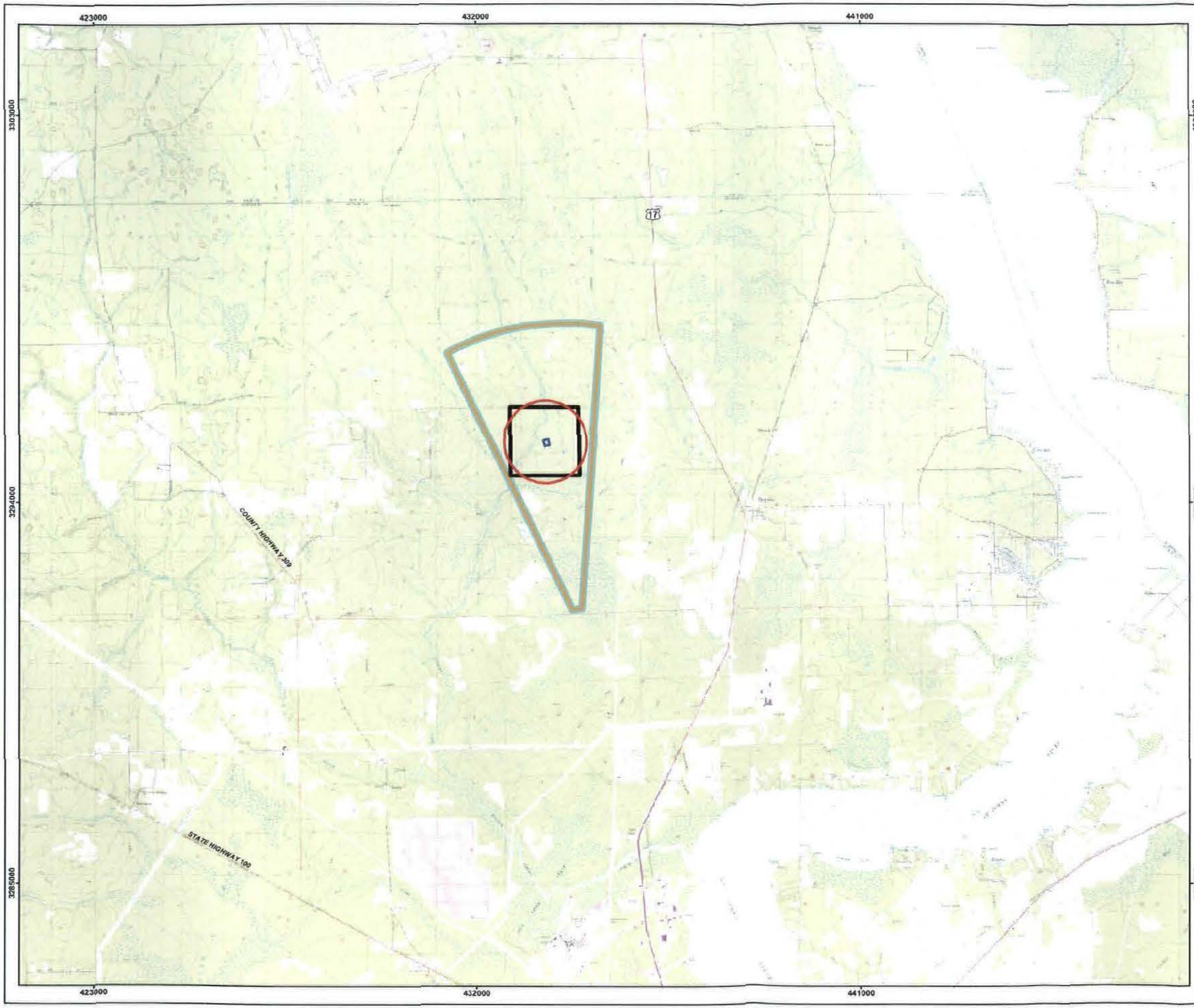
1.3.2 The TPP Team agreed that the SI data collection efforts would focus on screening for MC presence in surface water, sediment, and soil. A total of eight biased surface soil samples, three biased surface water/sediment sample couples, along with the appropriate Quality Control (QC) samples and field duplicates were collected from within the Bostwick BT boundaries. Since there was no water present at the agreed upon sample location, samples BBT-MRS01-SW-04 and BBT-MRS01-SD-04 were converted to a surface soil sample (BBT-MRS01-SS-02-11). This deviation from the work plan is discussed in Chapter 3 and later chapters of this report. A groundwater sample was not collected because the hand pump at the well was broken at the time of the Site Visit Team (SVT) visit. All of the biased samples were analyzed for explosives and selected MC metals (antimony, barium, copper, lead, and zinc). The surface water sample was also analyzed for perchlorate. One surface soil sample and one surface water/sediment sample couple were collected from outside the MRS boundary to reflect ambient site conditions. Ambient samples were analyzed for the selected MC metals and the ambient surface water sample was also analyzed for perchlorate.

1.3.3 The primary project planning documents used to perform the SI include the Site-Specific Work Plan (SS-WP) Addendum for the Bostwick BT (Parsons, 2009b), the USAESCH Programmatic Work Plan (PWP) (Parsons, 2005), the Programmatic Sampling and Analysis Plan (PSAP) (USACE, 2005), and the PSAP Addendum (Parsons, 2006). The performance work statement (PWS) for this project is included in Appendix A.

Figure 1.1

Site Location
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida



Legend

- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS

N

Image Source: USGS 7.5' Topo Quadrangles, Date Unknown
Projection: UTM Zone 17 NAD83, Map Units in Meters

2 1 0 2 Kilometers

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Site Location		
DRAWN BY: BT			
CHECKED BY: JU	SCALE: As Shown	PROJECT NUMBER: 744647.84115	
SUBMITTED BY: DS	DATE: October 2009	PAGE NUMBER: 1 - 4	
	FILE: X:\GIS\Site_inspections_nel\Maps\bostwick_FL\Fig1_1.mxd		

CHAPTER 2

PROPERTY DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

The Bostwick BT is located in Putnam County, Florida. The SI for Bostwick BT includes the evaluation of one MRS (3,111-acres Bostwick BT MRS). The Bostwick BT is currently primarily used as a pine tree plantation, growing pine trees for the pulp and paper industry. The site is also used for surface mining for titanium metal precursors and as a hunting preserve. Figure 2.1 shows the location of the FUDS and MRS boundaries.

2.2 SITE LOCATION AND SETTING

2.2.1 Topography and Vegetation

The Bostwick BT area is relatively flat with elevations ranging from 40 to 75 feet above sea level. Much of the area is low lying with several marshy areas present. Most of the higher portions of the land are used for timber production and are covered with pine trees.

2.2.2 Geology and Soils

2.2.2.1 The Bostwick BT is within the Floridian section of the Coastal Plain Physiographic Province and is underlain by a series of Eocene to Pleistocene aged limestone and dolomite rock units to depths of several thousands of feet. The region is affected structurally by the Ocala Uplift, an anticlinal fold that crests along southwest Alachua County west of Putnam County. Rocks east of the crest typically dip approximately 6 feet/mile to the east or northeast. Of the sedimentary sequences underlying the site, the Lake City Limestone is the oldest formation (Eocene) that is used for freshwater supply. This formation is made up of hard, finely crystalline dolomite and dolomitic limestone with some soft layers of porous fossiliferous limestone. The thickness of the Lake City Limestone in northern Florida is known to be as much as 400 feet. The Avon Park Limestone overlies the Lake City Limestone and consists of a hard to soft limestone to dolomitic limestone. Thickness of the formation ranges from 150 to 245 feet in the region. The Ocala Group uncomformably overlies the Avon Park Limestone and is made up of several limestone units including the Inglis, Williston, and Crystal River Formations. The oldest is the Inglis Formation which is made up of coarsely granular, fragmental limestone. The Williston Formation is quite similar in composition to the underlying Inglis Formation and is often distinguished by its fossil content. It has been reduced in thickness and

extent due to erosion in portions of Putnam and surrounding counties and ranges in thickness between 30 and 50 feet when overlain by the Crystal River Formation. The Crystal River Formation has been completely removed by erosion in most of eastern Putnam County. In the western part of the county, this formation ranges in thickness from 70 to over 100 feet. Lithologically, the Crystal River Formation consists of light colored, massive, soft chalky, marine limestone and is distinguished by fossil content. The homogenous sequence of the above mentioned limestone formations that comprise the Ocala Group act essentially as a single hydrologic unit. These formations differ from the underlying Lake City and Avon Park Limestones in that they contain few relatively impermeable indurated zones to restrict vertical movement of water. The Miocene aged Hawthorn Formation uncomformably overlies the Ocala Group and is made up of thick clays and sandy clays with interbedded lenses of sand and soft limestone. The top of the Hawthorn Formation ranges in altitude from about 100 feet above mean sea level (msl) in western Putnam County to more than 130 feet below msl in northern St. Johns County. The thickness of the formation averages about 50 to 100 feet in eastern Putnam County and increases in thickness in the northern and western parts of the county and attains a maximum thickness of about 120 to 200 feet. The Hawthorn Formation consists of gray to green, plastic, phosphatic, sandy clay and marl, interbedded with lenses of phosphatic sand and sandy limestone. The sandy limestone occurs mainly at the base of the formation and is thickest in western Putnam County. Due to the amount of clay layers, the Hawthorn Formation acts as a confining layer to the Floridan aquifer. Overlying the Hawthorn Formation is the Pleistocene Caloosahatchee Marl which consists of interbedded lenses of marine, fine to medium sand, shell and green, calcareous, silty clay. The uppermost stratigraphic unit in western Putnam County is the Citronelle Formation which is comprised of clastic sediments ranging from 0 to 15 feet. These sediments were deposited as deltaic sands, clayey sand, and some localized gravel. Unnamed sediments cover the surface of Putnam and surrounding counties and are Pleistocene to Recent in age and range in thickness of about 20 feet in Flagler County located to the southeast of the study area to about 140 feet in western Putnam County. The Pleistocene deposits consist of fine to medium quartz sand and thin lenses of clay and shell in eastern parts of Putnam County to fine to coarse poorly sorted sand and sandy clay in western portions of the county. Recent deposits consist of alluvial sand and clay in stream valleys, with sand along the coastline and isolated peat deposits (Florida Geological Survey, 1964).

2.2.2.2 The Bostwick BT site consists of two different soil types. Most of the soil present is found in flat to slight depressions. This soil is poorly drained, fine sand with a black to dark gray sand occurring in the upper 8 to 12 inches. A subsurface layer of gray fine sand extends down to 28 inches. The subsoil is black fine sand down to 60 inches. These sands are prone to flooding, have a low to medium high water capacity, moderately to rapid permeability with a water table of 1 to 2 feet for most of the year. A second soil type is less common and occurs on slightly sloped areas mostly along the northwest corner of the site. This soil also consists of fine sand but is moderately drained and has a high water table of 40 to 60 inches for 2 to 6 months of the year (USACE, 1996)

2.2.3 Climate

The Bostwick BT site area weather is characterized by long, warm, humid summers and mild relatively dry winters. The normal daily maximum temperature in the summer is in the upper 80s and rarely exceeds 90 degrees Fahrenheit. The normal daily average temperature is around 55 degrees Fahrenheit. The prevailing winds are from a northeasterly direction in the fall and winter and southeasterly in the spring and summer. Tropical disturbance or hurricanes are not considered a major threat in this area. Average precipitation is 46.89 inches. About 57 percent of the rainfall occurs in June through October.

2.2.4 Hydrology

Simms Creek flows from north to south through the center of the Bostwick BT site with all surface water runoff draining into the creek. Simms Creek is a tributary to Rice Creek which flows to the south of the site then east where flow from the creek discharges into the St Johns River approximately 6 miles south of the Bostwick BT center (Google Earth, 2009). The St. Johns River flows north, passes through the city of Jacksonville, and empties into the Atlantic Ocean about 60 miles downstream from the point of discharge.

2.2.5 Groundwater

2.2.5.1 The information regarding the groundwater associated with the Bostwick BT was obtained from the 1996 ASR (USACE, 1996). Additional detail regarding regional groundwater is included in Subchapters 5.2.2 and 5.2.3. Two aquifer systems, the Floridan aquifer and the surficial aquifer, lie beneath the site. The upper (surficial) aquifer is the water table aquifer, which consists of shallow sand or clayey sand that contain water under water table conditions. This aquifer will yield sufficient water for domestic well use, but is unpotable due to salt content. The Floridan aquifer is commonly used in the area due to its freshwater content and consists of hundreds of feet of soft, porous limestone and hard, dense limestone and dolomite that act as a hydrologic unit (USGS, 1990). The Floridan aquifer has high permeability in a lateral direction and a low permeability in a vertical direction. Water in the Floridan aquifer is under artesian conditions in the site area. 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. 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.

2.2.5.2 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.

2.2.6 Significant Structures

The majority of the Bostwick BT is used as a pine tree plantation, with other portions covered by wetlands. There are no known permanent structures within the MRS boundary. However, because the 2000 census data reports a population of 34 within the MRS boundary, residential structures can not be ruled out.

2.2.7 Demographics

2.2.7.1 The demographics information for Putnam County, Florida was obtained from the 2000 United States Census Bureau website and from the American Fact Finder Fast Access to Information link on the United States Census Bureau website (US Census Bureau, 2000).

2.2.7.2 In 2000, the population of Putnam County was estimated to be approximately 70,423. There were 27,839 occupied households with an average household size of 2.48. Population density for Putnam County was 98 persons per square mile. See Figure 2.2 for a breakdown of population within a 4-mile buffer of the site. The segment of the population under the age of 18 was 24.6 percent, while 12.4 percent was over the age of 65. The median age was 40.5 years. Approximately 75.1 percent of the population was Caucasian, 12.3 percent Black or African American, 3.6 percent Asian, 0.9 percent American Indian and Alaska Native, and 12.5 percent of the population were Hispanic or Latino of any race. The estimated occupational breakdown in Putnam County was as follows:

- Management, professional, and related occupations –22.2 percent
- Service occupations – 17.5 percent
- Sales and office occupations – 24.9 percent
- Farming, fishing, and forestry occupations – 3.3 percent
- Construction, extraction, and maintenance occupations – 13.9 percent
- Production, transportation, and material moving occupations – 18.2 percent

2.2.7.3 As noted in Table 2.1, approximately 2,173 individuals live within a 4-mile buffer of the Bostwick Bomb Target MRS. The estimate was derived from a combination of map examination, 2000 census population information, and information gathered during the SI.

Table 2.1
Population within 4-Mile Buffer of the
Bostwick Bomb Target MRS, Putnam County, Florida

On-Site	0 to 1/4 Mile	1/4 to 1/2 Mile	1/2 to 1 Mile	1 to 2 Miles	2 to 3 Miles	3 to 4 Miles	Total
34	31	45	322	233	685	823	2,173

Source: U.S. Census 2000 data. The population within the site, MRS, or within any buffer area is determined using a conservative approach to calculate the population of an area by including the total number of people for any census block that falls within or overlaps the site boundary, MRS boundaries, or buffer line.

2.2.8 Current and Future Land Use

The land that was the former Bostwick BT is a pine tree plantation, growing pine trees for the pulp and paper industry. Additional use consists of surface mining for titanium metal precursors and as a hunting preserve. The census data indicates a population of 34 within the MRS boundary, so a small number of residences are possible. The projected land use of the area is expected to remain the same.

2.2.9 Site Ownership and History

2.2.9.1 In 1940, the United States acquired 3,111 acres of land through lease and condemnation from Union Bag and Paper Company. This land was identified as the Bostwick BT (or the Putnam Bomb Target) and was used by the NAATC for operational training, practice dive-bombing, and as a rocket range (USACE, 1996).

2.2.9.2 The Navy declared Bostwick BT excess to their needs in 1977 and terminated the lease on December 15, 1977. The terms and conditions of the leases and termination notices, including if any restorations were required, are unknown.

2.2.9.3 Currently, the land is privately owned and used primarily as a pine tree plantation in which the trees are harvested for use in the pulp and paper industry. Additional use consists of surface mining for titanium metal precursors (Iluka Resources) and as a private hunting preserve (Whitehill Hunting Club).

2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS

2.3.1 MRS-Specific Descriptions/Operations

2.3.1.1 The Bostwick BT consists of one MRS, the Bostwick BT MRS. A description of the MRS follows below. The risk assessment code (RAC) score assigned to this MRS was based on the 2004 ASR Supplement evaluation of hazard severity (type of munitions) and hazard probability.

Bostwick Bomb Target MRS: Comprised of 3,111 land acres as depicted on Figure 2.1. The MRS consists of a rocket range safety fan overlying the original FUDS boundary and the 649-acre bomb target safety circle. The NAATC, quartered at Jacksonville NAS, used Bostwick BT for operational training, practice dive-bombing, and as a rocket range (USACE, 1996). A RAC score of 3 was assigned to the MRS based on a marginal hazard severity and a probable hazard probability. Information provided in the INPR, ASR, ASR Supplement, reported findings, visual observations, and other

sources were used to develop the list of known or potential MEC items for the Bostwick BT site. Munitions used on-site include 2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), 30mm projectiles, Mk-15 water/sand fill practice bomb, and Mk-5 miniature practice bomb. Mk-81 250 lb. low drag bomb and Mk-82 500 lb. low drag bomb are also indicated; however, the available data does not specify whether these are general purpose or practice bombs.

2.3.1.2 The USACE is conducting the SI at Bostwick BT as part of FUDS response activities pursuant to and in accordance with the guidance, regulations, and legislation listed in Chapter 1.

2.4 PREVIOUS INVESTIGATIONS

2.4.1 1994 Inventory Project Report

An INPR (USACE, 1994) of ordnance contamination was completed for the Bostwick BT site by CESAJ in 1994. 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 1994 site visit; however, no attempt was made to survey the site because of safety concerns. A RAC of 3, indicating moderate risk, was assigned to the site in January 1995. A Findings and Determination of Eligibility (FDE), dated July 1994, concluded that the site was formerly used by the DoD and is eligible for DERP - FUDS.

2.4.2 1996 Archives Search Report

2.4.2.1 The ASR (USACE, 1996) was completed by USACE in 1996. The ASR was prepared after reviewing available records, interviews, a site inspection, and analysis of information and reports that documented the history of the site. The ASR is the source of most of the historical information pertaining to site operations and identifies the key areas of focus for the SI.

2.4.2.2 The ASR team reviewed all reports, newspaper articles, historical documents, and reference material pertaining to the use and history of Bostwick BT (see Subchapter 2.2.9 here). A site visit was conducted in December 1995. The site visit included on-ground and aerial photo surveys. No MEC were identified at the MRS; however, MD was observed during the 1995 ASR site visit. The ASR concluded that while no MEC were observed directly, MD observations, historical reports, and other indirect evidence (historical records, aerial photos, and interviews) support a possibility that conventional ordnance or explosive waste remain at the Bostwick BT.

2.4.3 2004 Archives Search Report Supplement

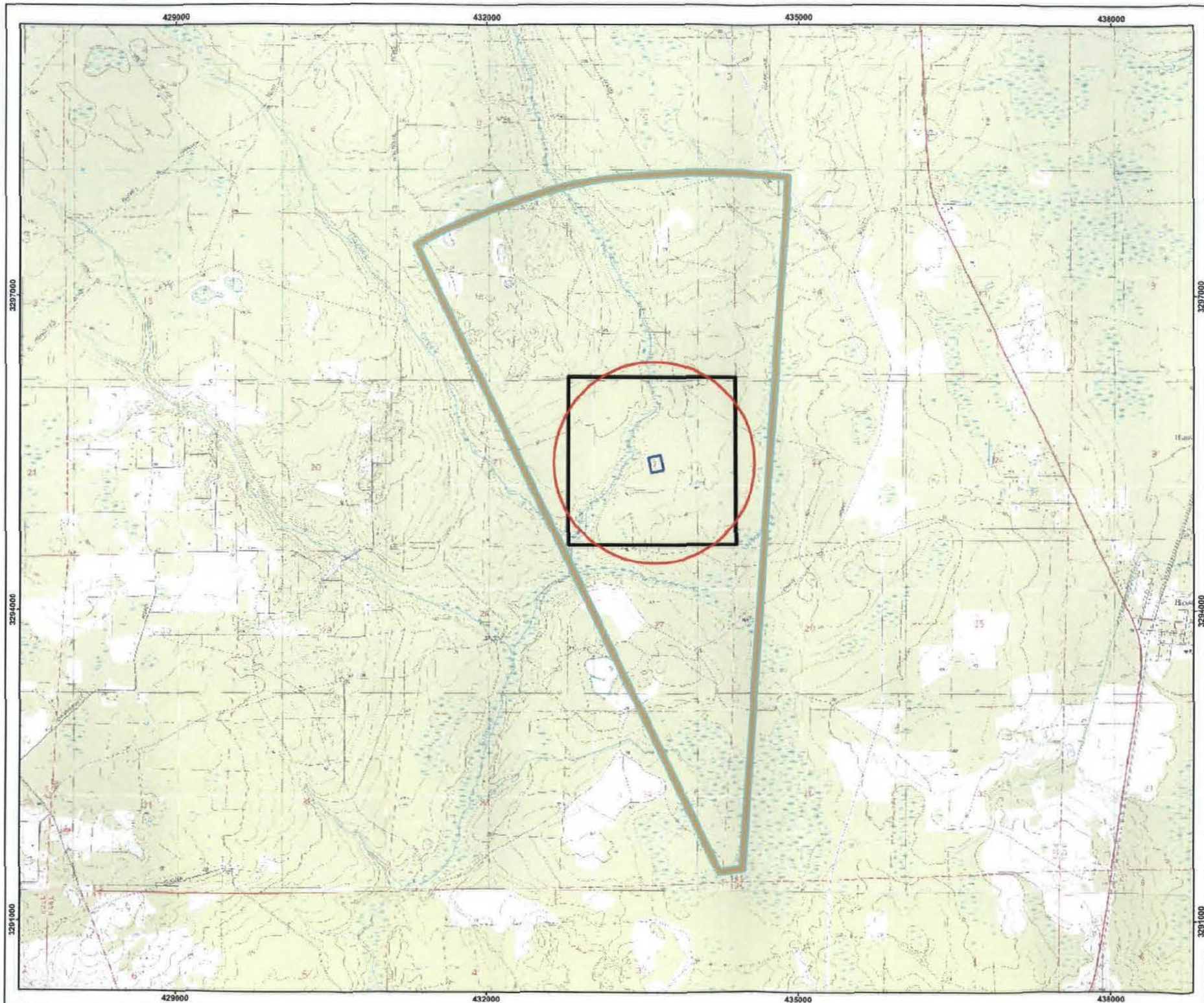
2.4.3.1 The ASR Supplement (USACE, 2004b) was prepared by USACE as a supplement to the 1996 ASR. This ASR Supplement identified one MRS and assigned a RAC score of 3 (as detailed above in paragraph 2.3.1). The specific data for this MRS is in the Conceptual Site Model (CSM) in Appendix B.

2.4.3.2 No other investigations have been conducted to date. No known public injury incidents have been reported since site closure.

Figure 2.1

Site Setting
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida



Legend

- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS

Site Location in Florida

Image Source: USGS 7.5' Topo Quadrangles, Date Unknown
Projection: UTM Zone 17 NAD83, Map Units in Meters

1 0.5 0 1 Kilometers

N

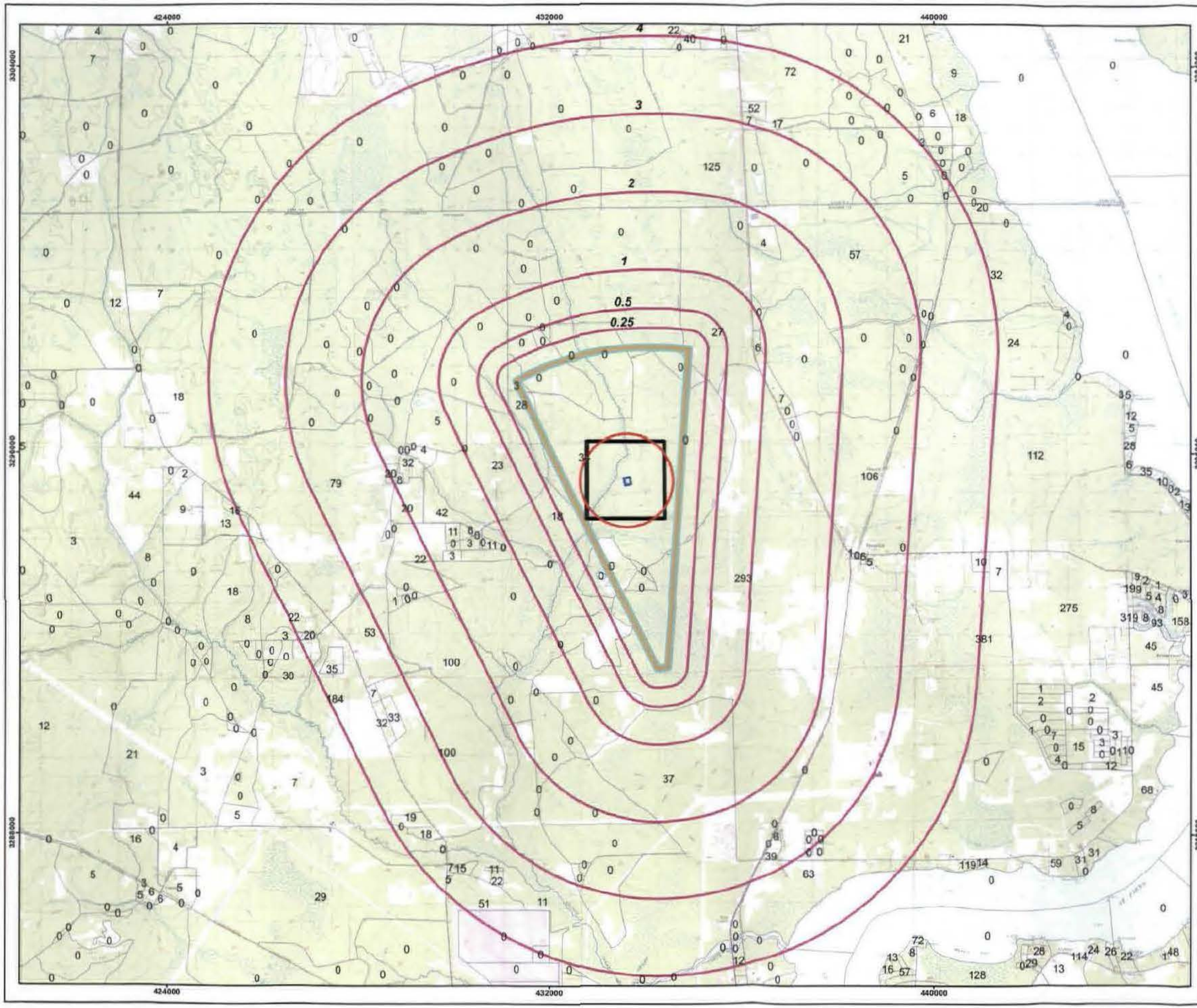
PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Site Setting	
DRAWN BY: BT		
CHECKED BY: JU	SCALE: As Shown	PROJECT NUMBER: 744647.84115
SUBMITTED BY: DS	DATE: October 2009	PAGE NUMBER: 2-7
	FILE: X:\GIS\Site_inspections_ne\Maps\bostwick_FL\Fig2_1.mxd	

Figure 2.2

2000 Census Data
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida



Legend

- 4 — 2000 Census Block Boundary with Total Population
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS
- Buffer (Mile)

Image Source: USGS 7.5' Topo Quadrangles, Date Unknown
Projection: UTM Zone 17 NAD83, Map Units in Meters

2 1 0 2 Kilometers

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	2000 Census Data	
DRAWN BY: BT		
CHECKED BY: JU	SCALE: As Shown	PROJECT NUMBER: 744647.84115
SUBMITTED BY: DS	DATE: October 2009	PAGE NUMBER: 2-8
	FILE: X:\GIS\Site_Inspections_mil\Maps\bostwick_FU\Fig2_2.mxd	

CHAPTER 3

SITE INSPECTION TASKS

3.1 HISTORICAL RECORD REVIEW

The existing body of information pertinent to the Bostwick BT site was thoroughly reviewed in advance of the TPP Meeting and summarized to the TPP Team as part of the development and concurrence of the selected Technical Approach for the site. Documents reviewed included the 1994 INPR (USACE, 1994), the 1996 ASR (USACE, 1996), and the 2004 ASR Supplement (USACE, 2004b). Sampling locations and Qualitative Reconnaissance (QR) planning, as presented in the SS-WP Addendum and implemented during the SI were the direct result of this review process. This information has been augmented with institutional knowledge and additional documentation provided by USACE or obtained by Parsons during coordination of the field effort. As part of mobilization preparation for the SI, the SVT became re-familiarized with all existing site information.

3.2 TECHNICAL PROJECT PLANNING SUMMARY

The Bostwick BT falls under the purview of the CESAJ. A TPP meeting was facilitated by CESAJ on December 17, 2008, and included representatives of CESAJ, USAESCH, Parsons, the Florida Department of Environmental Protection (FDEP), and the Putnam County Department of Emergency Services. Unanimous TPP Team concurrence with the Technical Approach presented in the Final TPP Memorandum (Parsons, 2009a) issued on March 6, 2009, was achieved (see Appendix B). Key TPP facts and decisions are summarized below:

- The TPP Team concurred with the Technical Approach as presented and refined at the TPP meeting on December 17, 2008, inclusive of number, type, and location of samples as well as sampling methodology and laboratory analyses.

- The SVT would sample in accordance with the FDEP request for discrete samples but, based on the possible sandy nature of the soils at this site, move sample locations as necessary to acquire samples with more organic matter that are more likely to hold contaminants. Sample depths up to 6 inches are approved for this endeavor. Sampling procedures are described in more detail in the SS-WP Addendum.

- The TPP Team agreed that the following screening criteria will be used to evaluate risk for human health risk: for soil and sediment, the more stringent of USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Residential Soil, September 12, 2008, <u>and</u> FDEP FAC 62-777

Soil Cleanup Target Levels (SCTL), (the more stringent of Direct Exposure Residential, Leachability Based on Freshwater Surface Water Criteria, and Leachability Based on Groundwater Criteria), February 2005; for surface water, the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tapwater, September 12, 2008 and 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 water).

- *This is a minor revision in the surface soil and sediment criteria as documented in the TPP Memorandum and Associated Documentation to be consistent with the screening criteria applied to all Florida SIs.*

- *The USEPA RSLs were revised on May 19, 2009. The revised values will be used as appropriate.*

- The TPP Team agreed that the following screening criteria will be used to evaluate ecological risk: for soil, USEPA Region 4 Ecological Screening Values for Soil supplemented with ecological screening value sources from 2005 PSAP, updated with the most current values; for sediment, the more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 4 Ecological Screening Values for Sediment supplemented with ecological screening value sources from 2005 PSAP, updated with most current values, in absence of available value from FDEP SQAG and Region 4 values; for surface water, the more stringent of FAC 62-302 Surface Water Quality Standards (for Class III water) and USEPA Region 4 Ecological Screening Values for Freshwater Surface Water supplemented with ecological screening value sources from 2005 PSAP, updated with most current values, in absence of available value from FAC 62-302 SWQS and Region 4 values.

- The TPP Team agreed that the following screening values would be used to evaluate human health risk for groundwater, the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Protection of Groundwater September 12, 2008, and FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria.

  - *The USEPA RSLs were revised on May 19, 2009. The revised values will be used as appropriate.*

- Additional biased surface soil samples are added to the project per the request of Mr. Eric Nuzie of FDEP. Additional QR and samples are placed to include more of the southern and northern portion of the MRS, outside of the bomb target center area (Figures 3.1 and 3.2).

- A groundwater sample would be collected from a well located near the bomb target center. The groundwater will be analyzed for explosives, selected metals, and perchlorate.

- *A groundwater sample was not collected. The well pump was broken and not operational at the time of the site visit.*

- Mr. Quin Romay, Chief of Emergency Operations and Preparedness for Putnam County, stated that most of the FUDS-eligible property was likely owned by the Williams Trust.

- Mr. Nuzie asked if the Williams Trust managers or family knew of the former bomb target at the site. No one could answer whether they did or not.

- Mr. Nuzie asked how the Corps of Engineers knew that high explosives (HE) were used on the site. Parsons replied that the HE was noted in the historical munitions listed for the site.

- Chief Romay asked what an RI/FS project would entail. The Corps of Engineers, FDEP, and Parsons described various RI/FS scenarios for Chief Romay.

- The TPP Team agreed that an expedited review process was not necessary for this project.

- No documented threatened or endangered (T&E) species are known to exist on the site according to TPP Team members.

- Parsons will contact the company (Iluka Resources) conducting the surface mining on, and adjacent to, the FUDS—eligible property, to determine whether the mining company has discovered any munitions debris during their activities.

  - *Contact with Iluka was attempted, but no response at this time.*

- Chief Romay noted that while the site is a hunting preserve, no conflict with hunting season should occur based on the anticipated field visit later this year.

3.3 NON-MEASUREMENT DATA COLLECTION

3.3.1 The following sources were consulted for identifying environmental and cultural resources at Bostwick BT:

- Topographic Map – U.S. Geological Survey (USGS)
- Wetlands Online Mapper – National Wetlands Inventory (NWI), U.S. Fish and Wildlife Service (USFWS)
- Threatened and Endangered Species System (TESS) – Endangered Species Program, USFWS
- National Wildlife Refuge System (NWRS) – USFWS
- Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Natural Areas Inventory (FNAI) – Putnam County
- National Register Information System (NRIS)
- National Register of Historic Places (NRHP)

- National Register of Historic Districts (NRHD)
- National Historic Landmarks (NHL)
- National Heritage Areas (NHA)
- Florida State Historic Preservation Office (FL SHPO) – Florida Office of Cultural and Historical Programs (OCHP) Florida Master Site File (FMSF)
- National Oceanic and Atmospheric Administration (NOAA) - Coastal Zone Management Program (CZMP): National Marine Sanctuaries (NMS), National Estuarine Research Reserve System (NERR), National Marine Fisheries (NMF)/Fishery Management Areas (FMA), and Marine Protected Areas (MPA)
- ASR Findings Bostwick Bomb Target (Putnam Bomb Target), Bostwick, Florida, Putnam County, March 1996
- USACE 2006 - (Attachment 2) Army Checklist for Important Ecological Places
- NatureServe Explorer Database
- USFWS Critical Habitat Portal Database
- USFWS Southeast Region T&E Species Database

3.3.2 According to the NRIS, NHL, NRHP databases, NHA, and NRHD databases, the Bostwick BT site is not registered as an archaeological or cultural area. The FMSF has reviewed the site for known archaeological and cultural areas within the site boundary. According to the FMSF there are no previously recorded cultural resources within the FUDS boundary. The SVT did not encounter any additional cultural or archeological resources during the July 2009 visit.

3.3.3 Ecological resources are identified in Subchapter 5.2 of this report.

3.4 SITE-SPECIFIC WORK PLAN ADDENDUM

3.4.1 The SS-WP Addendum (Parsons, 2009b) augments the PWP and PSAP, as warranted, to present pertinent site-specific information and procedural adjustments that could not be readily captured in the programmatic documents or that resulted from TPP Team agreements that required modifying the preliminary SI technical approach.

3.4.2 The PWP and PSAP are intended to be umbrella documents that set overall programmatic objectives and approaches, whereas the SS-WP Addendum provides site-specific details and action plans. The PWP, PSAP, and SS-WP were taken to the site for reference by the SVT during SI field activities.

3.4.3 The SS-WP Addendum included the project description, the field investigation plan, the sampling and analysis plan, the environmental protection plan, and the health and safety plan specific to the Bostwick BT. The field investigation plan developed a technical approach to guide sample collection and analysis for MEC and MC to ensure that the results were sufficient to determine whether additional investigations or implementation of a remedy are necessary for the site. Key elements of the technical approach included the CSM and Conceptual Site Exposure Model (CSEM) to help determine types of samples and their locations, data quality objectives (DQOs) to ensure

the data acquired are sufficient to characterize MEC and MC at the site and QR to confirm the known target locations. The SS-WP Addendum included a sampling rationale for each sample location and the latitude and longitude of the final sample locations. The sampling rationale has been updated to show actual conditions observed by the SVT and is included in Table 3.1

3.4.4 The sampling and analysis plan (SAP) discusses procedures for surface soil, sediment, surface water, and groundwater acquisition from locations biased toward the highest potential for MEC contamination; QC and QA for the sampling process; sample shipment to an approved, independent laboratory; and analysis of the samples by the laboratory. The environmental protection plan (EPP) evaluates compliance with Army Regulation 200-2 by presenting procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during site field activities. The accident prevention plan (APP) supplements the programmatic accident prevention plan with site-specific emergency contact information and directions to the nearest hospital.

3.5 DEPARTURES FROM PLANNING DOCUMENTS

There were minor deviations from the approved planning documents (such as, SS-WP Addendum) during the SI phase of the project. These deviations are described below.

- Sample BBT-MRS01-SS-02-02 was moved to where a possible MEC item was found, approximately 800 feet from its original location.
- Sample BBT-MRS01-SS-02-01 and the field duplicate BBT-MRS01-SS-02-10 were moved from their original location to where possible MEC items were found.
- Deviation from the proposed QR path was necessary in some areas due to swampy areas.
- Ambient samples BBT-AMB-SW-05 and BBT-AMB-SD-05 were moved to a large pond outside the western border of the FUDS boundary.
- Samples BBT-MRS01-SW-04 and BBT-MRS01-SD-04 were converted to a surface soil sample (BBT-MRS01-SS-02-11) due to a lack of water at the planned location.
- Samples BBT-MRS01-SW-01 and BBT-MRS01-SD-01 were moved to a location approximately 800 feet away from the original location due to a lack of water at the planned location.
- Groundwater sample BBT-MRS01-GW-01 was not collected because the well hand pump was broken and unusable.

TABLE 3.1
SAMPLING RATIONALE
BOSTWICK BOMB TARGET, PUTNAM COUNTY, FLORIDA

Sample ID	Sample Coordinates Latitude	Longitude	Media	Analysis	Munitions	Rationale
BBT-MRS01-SS-02-01	29.78380	-81.68163	Surface Soil	Total Explosives, Selected Metals*	Bombs, Practice, AN-MK5, AN-MK23, AN-MK43, Practice; MK-15 series, Practice Bomb, 100 lbs; Spotting Charge, M1A1; MK76, Practice Bomb; MK89, Practice Bomb, 56 lbs; MK106, Practice Bomb, 5 lbs; Signal, Practice Bomb, MK4; MK86, MK87, MK88, Practice 250-1000 lbs; Signal, Practice Bomb, MK7; 30mm TP, M788; 2.25-inch, Practice Rocket; 2.25-inch, Practice Rocket, MK-4; 2.75-inch, Practice Rocket, FFAR; 2.75-inch, Rockets General, Practice[1]	Sample collected near target center of MRS to reflect MC presence from DoD range activities. Moved from original location to area near observed possible MEC.
BBT-MRS01-SS-02-02	29.78326	-81.68731	Surface Soil	Total Explosives, Selected Metals*	See Above	Sample collected near target center of MRS to reflect MC presence from DoD range activities. Moved from original location (approximately 800 feet) to area near observed possible MEC.
BBT-MRS01-SS-02-03	29.79025	-81.68243	Surface Soil	Total Explosives, Selected Metals*	See Above	Sample collected near target center of MRS to reflect MC presence from DoD range activities.
BBT-AMB-SS-02-04	29.75190	-81.65759	Surface Soil	Total Explosives, Selected Metals	None	Sample collected outside MRS to reflect ambient conditions.
BBT-MRS01-SS-02-05	29.77805	-81.68628	Surface Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	Sample collected south of bomb target to reflect MC presence from DoD range activities.
BBT-MRS01-SS-02-06	29.80765	-81.68804	Surface Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	Sample collected north of bomb target to reflect possible overshoot from gunnery range.
BBT-MRS01-SS-02-07	29.79826	-81.68869	Surface Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	Sample collected north of bomb target to reflect possible overshoot from gunnery range.
BBT-MRS01-SS-02-08	29.76416	-81.68370	Surface Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	Sample collected south of bomb target to reflect MC presence from DoD range activities.
BBT-MRS01-SS-02-09	29.77090	-81.68623	Surface Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	Sample collected south of bomb target to reflect MC presence from DoD range activities.
BBT-MRS01-SS-02-11**	29.80045	-81.69271	Soil	Total Explosives, Selected Metals*	See above for BBT-MRS01-SS-02-01	This sample was originally BBT-MRS01-SW/SD-04 and was converted to a soil sample because of no water at planned location. Sample collected north of target center of MRS to reflect MC presence from DoD range activities.
BBT-MRS01-SW-01	29.7945	-81.69022	Surface Water	Total Explosives, Selected Metals, Perchlorate*	Bombs, Practice, AN-MK5, AN-MK23, AN-MK43, Practice; MK-15 series, Practice Bomb, 100 lbs; Spotting Charge, M1A1; MK76, Practice Bomb; MK89, Practice Bomb, 56 lbs; MK106, Practice Bomb, 5 lbs; Signal, Practice Bomb, MK4; MK86, MK87, MK88, Practice 250-1000 lbs; Signal, Practice Bomb, MK7; 30mm TP, M788; 2.25-inch, Practice Rocket; 2.25-inch, Practice Rocket, MK-4; 2.75-inch, Practice Rocket, FFAR; 2.75-inch, Rockets General, Practice[1]	Sample collected near target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same place as sample ID BBT-MRS01-SD-01. Sample moved to a location approximately 800' away from the original location due to a lack of water at the planned location.
BBT-MRS01-SD-01	29.79455	-81.69023	Sediment	Total Explosives, Selected Metals*	See Above	Sample collected near target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same location as sample ID BBT-MRS01-SW-01. Sample moved to a location approximately 800' away from the original location due to a lack of water at the planned location.
BBT-MRS01-SW-02	29.80292	-81.7012	Surface Water	Total Explosives, Selected Metals, Perchlorate*	See Above	Sample collected north of target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same location as sample ID BBT-MRS01-SD-02

TABLE 3.1 (CONTINUED)
SAMPLING RATIONALE
BOSTWICK BOMB TARGET, PUTNAM COUNTY, FLORIDA

Sample ID	Sample Coordinates Latitude	Sample Coordinates Longitude	Media	Analysis	Munitions	Rationale
BBT-MRS01-SD-02	29.80292	-81.70129	Sediment	Total Explosives, Selected Metals*	See Above	Sample collected north of target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same place as sample ID BBT-MRS01-SW-02.
BBT-MRS01-SW-03	29.75824	-81.68187	Surface Water	Total Explosives, Selected Metals, Perchlorate*	See Above	Sample collected south of target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same location as sample ID BBT-MRS01-SD-03.
BBT-MRS01-SD-03	29.75824	-81.68187	Sediment	Total Explosives, Selected Metals*	See Above	Sample collected south of target center of MRS to reflect MC presence from DoD range activities. Sample collected in the same location as sample ID BBT-MRS01-SW-03.
BBT-AMB-SW-05	29.77047	-81.69140	Surface Water	Selected Metals, Perchlorate*	None	Sample collected outside MRS to reflect ambient conditions. Sample collected in the same location as sample ID BBT-AMB-SD-05. Sample location moved to a large pond outside the western border of the FUDS boundary.
BBT-AMB-SD-05	29.77047	-81.69141	Sediment	Selected Metals*	None	Sample collected outside MRS to reflect ambient conditions. Sample collected in the same location as sample ID BBT-AMB-SW-05. Sample location moved to a large pond outside the western border of the FUDS boundary.
BBT-MRS01-GW-01	--	--	Groundwater	Total Explosives, selected metals, Perchlorate*	See BBT-MRS01-SW-01	Sample could not be collected. Pump was broken.

* See Table 4.4, Target Compound List.
** Sample BBT-MRS01-SS-02-10 is a field duplicate sample. See Chapter 5 for lab analytical results.
Source: **1**-ASR Supplement (USACE, 2004b). **2**-ASR (USACE, 1996).

CHAPTER 4

MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS

4.1 GENERAL INFORMATION

4.1.1 Qualitative Reconnaissance

4.1.1.1 The primary task of the SI is to assess the presence or absence of MEC and MC. To assess the presence or absence of MEC, the SVT conducted the QR by walking approximately 20 miles throughout the FUDS during the field work on July 6 through 10, 2009.

4.1.1.2 Site QR consisted of visual reconnaissance of the site surface to identify visual indicators of suspect areas, including earthen berms, distressed vegetation, stained soil, ground scars or craters, target remnants, and visible metallic debris. QR activities focused on the bomb target portions of the MRS located within the Bostwick BT. Several potential MEC and MD items were noted and are discussed in detail below.

4.1.1.3 The QR involved a three-person SVT walking single file at a nominal 3- to 5-foot separation distance along the QR track shown on Figure 4.1. An Unexploded Ordnance (UXO) Technician led the group using a Schonstedt GA-92XT*i* magnetometer primarily for anomaly avoidance. SVT members stopped occasionally to note field observations and/or to collect soil, sediment, and surface water samples. Sampling results are presented in Chapter 5.

4.1.1.4 Figure 4.1 shows the QR paths and observation locations. If MD was observed along the path, the SVT stopped to note an observation. The SVT also stopped at other locations to take photographs and to note field conditions, vegetation, or other features of interest. As discussed in the SS-WP Addendum (Parsons, 2009b), the QR route was not limited to the proposed path, but was determined in the field by the FTL based on the baseline QC procedures described in Chapter 3 of the PWP, visual observations, and areas of predetermined focus. The QR was conducted by the SVT on July 6 (July 5 was mobilization to site) through 10, 2009. All biased samples were collected in tandem with the QR. Table 4.1 presents the potential MEC anticipated to be present at the site based on the ASR and ASR Supplement. The MEC CSM and MC CSEM are included in Appendix J.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Cartridge, .30 Caliber	M2 Ball M1 Tracer M2 Armor Piercing M1 Ball M16 Tracer	Brass, Steel, Aluminum	Lead antimony Single- or double-base powder Primer Composition Tungsten Chrome Steel Tracer Composition	Aluminum, antimony, barium ***Lead, antimony***, Antimony Sulfide, Barium Nitrate, Barium Peroxide, ***Copper, Nitrocellulose****, Antimony Sulfide, Calcium Carbonate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Lead Styphnate, Potassium Chlorate, Potassium Sulfate, Potassium Nitrate, PETN (Pentaerythritol Tetranitrate), Silicon, Sodium Sulfide, Sulfur, Phosphorus, Aluminum, Magnesium, Manganese, Nickel, ***Nitroglycerin****, Nickel, ***Dinitrotoluene*, Diphenylamine*, Dibutylphthalate*, Tetrazene, Zinc******
Cartridge , 50 Caliber, Machine Gun	M2 Ball M2 Armor Piercing (AP) M1 Tracer M10 Tracer M17 Tracer M21 Tracer M20 API M1Incendiary M23 Incendiary M1 Blank	Brass, steel, aluminum	Lead antimony, Tungsten chrome steel, Tracer Composition, Incendiary Composition, Single based propellant, Double based propellant, Primer composition	Aluminum, Antimony, Antimony Sulfide, Barium, Calcium, Chromium, ***Copper****, Dibutylphthalate, ***Dinitrotoluene****, Diphenylamine, ***Iron, Lead***, Lead Thiocyanate, Magnesium, Manganese, Molybdenum, ***Nitrocellulose****, Nitroglycerin, Potassium Chlorate, Potassium Sulfate, Potassium, Perchlorate, PETN, Strontium, Tetrazene, Tungsten, ***Zinc****
Bomb, 3-lb, Miniature Practice	AN-Mk 5	Zinc Alloy	N/A	***Aluminum,*** Cadmium, Copper, Iron, Lead, Magnesium , Tin, ***Zinc***
Bomb, 3-lb, Miniature Practice	AN-Mk 23	Iron Alloy	N/A	Aluminum, Carbon, Chromium, Cobalt, Copper, ***Iron,*** Manganese, Molybdenum, Nickel, Phosphorus, Silicon, Sulfur, Vanadium, Zinc
Bomb, 4.5-lb,	AN-Mk 43	Cast Lead	N/A	Antimony, ***Lead***

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Miniature Practice				
Cartridge, Signal, Bomb	Mk4 Mod 0	Cardboard, Steel	Black Powder, Primer Mixture, Red Phosphorus	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Phosphorus, Pentaerythritoltetranitrate, Potassium Chlorate, ***Potassium Nitrate, Red Phosphorus***[(2)], ***Sulfur***, TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 1	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 2	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2)], TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 4	Aluminum	Primer Mixture, Smokeless Powder, Zinc Oxide	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, Nitrocellulose, Pentaerythritoltetranitrate, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk5	Plastic	Fluorescein Dye	N/A
Bomb, 5lb, Practice	Mk106 Mod0	Steel	N/A	Cadmium Chromate, Carbon, ***Iron***, Manganese,

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
				Naphtha, Phosphorus, Sulfur, Zinc Phosphate
Fuze, Bomb, Nose (Modified)	M173	Steel	Inert	Carbon, ***Iron***, Manganese, Phosphorus, Sulfur
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Lead Azide, Lead Styphnate, Lead Thiocyanate, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2)], TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk5	Plastic	Fluorescein Dye	N/A
Bomb, 5lb, Practice	Mk106 Mods 1 thru 5	Steel	N/A	Cadmium Chromate, Carbon, ***Iron***, Manganese, Naphtha, Phosphorus, Sulfur, Zinc Phosphate
Cartridge, Signal, Bomb	Mk4 Mod 0	Cardboard, Steel	Black Powder, Primer Mixture, Red Phosphorus.	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Phosphorus, Pentaerythritoltetranitrate, Potassium Chlorate, ***Potassium Nitrate, Red Phosphorus***[(2)], ***Sulfur***, TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 1	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 2	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2)], TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 4	Aluminum	Primer Mixture, Smokeless Powder, Zinc Oxide	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, Nitrocellulose, Pentaerythritoltetranitrate, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	MK5	Plastic	Fluorescein Dye	N/A
Cartridge, Signal, Bomb	CXU-3B, CXU-3A/B	Aluminum	Black Powder, FM Smoke Mixture	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, Iron, Lead Azide, Lead Thiocyanate, Manganese, Potassium Chlorate, Pentaerythritoltetranitrate, Potassium Nitrate, Silicon, ***Titanium Tetrachloride***, TNT (Trinitrotoluene), Zinc
Cartridge, Signal, Bomb	CXU-1/B	Aluminum, Glass	Black Powder, Primer Mixture, FM Smoke Mixture	***Aluminum***, Copper, Iron, Lead Styphnate , Manganese, Potassium Nitrate, Silicon, ***Titanium Tetrachloride***, Zinc
Bomb, 25 lb, Practice	Mk 76 Mods 0,2,3,4,5	Steel	N/A	***Carbon, Iron***, Manganese, Phosphorus, ***Silicon***, Sulfur
Cartridge, Signal, Bomb	CXU-3B, CXU-3A/B	Aluminum	Black Powder, FM Smoke Mixture	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, Iron, Lead Azide, Lead Thiocyanate, Manganese, Potassium Chlorate, Pentaerythritoltetranitrate, Potassium Nitrate, Silicon, ***Titanium Tetrachloride***, TNT (Trinitrotoluene), Zinc

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Cartridge, Signal, Bomb	Mk4 Mod 0	Cardboard, Steel	Black Powder, Primer Mixture, Red Phosphorus	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Phosphorus, Pentaerythritoltetranitrate, Potassium Chlorate, ***Potassium Nitrate, Red Phosphorus***[(2)]***, Sulfur***, TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 1	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 2	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulos***e, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2),] TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 4	Aluminum	Primer Mixture, Smokeless Powder, Zinc Oxide	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, Nitrocellulose, Pentaerythritoltetranitrate, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk5	Plastic	Fluorescein Dye	N/A
Bomb, 25 lb, Practice	Mk 76 Mod 1	Steel	N/A	***Carbon, Iron***, Manganese, Phosphorus, ***Silicon***, Sulfur

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Fuze, Bomb,	Mk 146	Aluminum Alloy	Black Powder, Primer Mixture,	***Aluminum***, Antimony Sulfide, Chromium, Copper, Iron, ***Lead Azide***, Lead Thiocyanate, Magnesium, Manganese, Potassium Chlorate, ***Potassium Nitrate, Silicone, Sulfur,*** Tetryl, Titanium, Zinc
Bomb, 56 lb, Practice	Mk89 Mod 0	Cast Iron		Carbon, ***Iron***, Manganese, Phosphorus, Silicon
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Lead Azide, Lead Styphnate, Lead Thiocyanate, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(1)], TNT (Trinitrotoluene)
Bomb, 56 lb, Practice	Mk89 Mod 1	Cast Iron		Carbon, ***Iron***, Manganese, Phosphorus, Silicon
Fuze, Bomb	AN-M146A1	Steel	Black Powder	Carbon, ***Iron,*** Manganese, Phosphorus, ***Potassium Nitrate,*** Silicon, ***Sulfur***
Bomb, 100 lb, Practice	Mk 15 Mods 1 and 2[3]	Steel	Water OR Sand	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Bomb, 100 lb, Practice	Mk 15 Mod 3	Steel	Water OR Sand	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Cartridge, Signal, Bomb	Mk 7	Steel, Brass	Black Powder, .38 caliber Blank Cartridge	Antimony Sulfide, Barium Nitrate, ***Copper***, Dibutylphthalate, Diphenylamine, Lead Styphnate, ***Nitroglycerin, Nitrocellulose***, Potassium Nitrate, ***Potassium Sulfate, Sulfur***, Tetrazene, ***Zinc***
Fuze, Bomb, Tail, Practice	Mk 247	Steel	Inert	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Bomb, 100 lb, Practice	Mk 15 Mod 4	Steel	Water OR Sand	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Cartridge, Signal, Bomb	Mk4 Mod 0	Cardboard, Steel	Black Powder, Primer Mixture, Red Phosphorus	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese,

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
				Phosphorus, Pentaerythritoltetranitrate, Potassium Chlorate, ***Potassium Nitrate, Red Phosphorus*** [(2)], ***Sulfur***, TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 1	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 2	Cardboard, Steel	Black Powder, Primer Mixture, Zinc Oxide	Antimony Sulfide, Barium Nitrate, Carbon, Iron, Lead Azide, Lead Thiocyanate, Manganese, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate, Sulfur***, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2),] TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 4	Aluminum	Primer Mixture, Smokeless Powder, Zinc Oxide	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, Nitrocellulose, Pentaerythritoltetranitrate, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk5	Plastic	Fluorescein Dye	N/A
Bomb, 100 lb, Practice	M38A2	Steel	Sand OR Sand with Tetrytol Spotting Charge (Modified	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur OR Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur, ***Tetryl, TNT (Trinitrotoluene)***

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
			M38A2)	
Charge, Spotting, Bomb	M1A1	Steel, Tin	Black Powder Smokeless Powder Primer Mix	Antimony Sulfide, Barium Nitrate, Dinitrotoluene, Diphenylamine, ***Iron***, Lead Azide, Lead Thiocyanate, Manganese, Nitrocellulose, Nitroglycerin, Pentaerythritoltetranitrate, Phosphorus, Potassium Chlorate, ***Potassium Nitrate***, Potassium Sulfate, ***Sulfur***, ***Tin***, TNT (Trinitrotoluene)
Charge, Spotting, Bomb	M3	Steel, Tin	Black Powder. Dark Smoke Composition, Primer Mix	***Aluminum, Anthracene***, Antimony Sulfide, Barium Nitrate, Copper, Dinitrotoluene, Diphenylamine, ***Hexachloroethane***, ***Iron***, Lead Dioxide, Lead Styphnate, ***Magnesium***, Manganese, Nitrocellulose, Nitroglycerin, PETN (Pentaerythritol Tetranitrate), Phosphorus, ***Potassium Nitrate***, ***Sulfur***, Tetrazene, ***Tin***, Zinc, Zirconium
Charge, Spotting, Bomb	M5	Glass	FS smoke mixture (Sulfur-trioxide chlorsulfonic acid solution)	N/A
Bomb, 250lb, Practice	Mk86	Steel	Wet Sand or Water	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***(2), TNT (Trinitrotoluene)
Bomb, 500 lb, Practice	Mk87	Steel	Wet Sand or Water	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur
Bomb, 1,000 lb, Practice	Mk88	Steel	Wet Sand or Water	Carbon, ***Iron,*** Manganese, Phosphorus, Sulfur

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Cartridge, Signal, Bomb	Mk4 Mod 3	Aluminum	Primer Mixture, Smokeless Powder, Red Phosphorus	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, ***Nitrocellulose***, Pentaerythritoltetranitrate, ***Red Phosphorus***[(2),] TNT (Trinitrotoluene)
Cartridge, Signal, Bomb	Mk4 Mod 4	Aluminum	Primer Mixture, Smokeless Powder, Zinc Oxide	***Aluminum***, Antimony Sulfide, Barium Nitrate, Copper, ***Dinitrotoluene, Diphenylamine, Dibutylphthalate***, Iron, Lead Azide, Lead Styphnate, Lead Thiocyanate, Manganese, Nitrocellulose, Pentaerythritoltetranitrate, TNT (Trinitrotoluene), ***Zinc***
Cartridge, Signal, Bomb	Mk5	Plastic	Fluorescein Dye	N/A
Bomb, 250 lb, Low Drag (practice or general purpose type is unknown)	Mk81	Steel	Tritonal OR Composition H6	Carbon, ***Flaked Aluminum, Iron,*** Manganese, Phosphorus, Sulfur, ***TNT (Trinitrotoluene)*** OR ***Aluminum, Calcium Chlorate,*** Carbon, ***Iron,*** Manganese, Phosphorus, ***RDX (Cyclotrimethylenetrinitramine),*** Sulfur, ***TNT (Trinitrotoluene)***
Bomb, 500 lb, Low Drag (practice or general purpose type is unknown)	Mk82	Steel	Tritonal OR Composition H6	Carbon, ***Flaked Aluminum, Iron,*** Manganese, Phosphorus, Sulfur, ***TNT (Trinitrotoluene)*** OR ***Aluminum, Calcium Chlorate,*** Carbon, ***Iron,*** Manganese, Phosphorus, ***RDX (Cyclotrimethylenetrinitramine),*** Sulfur, ***TNT (Trinitrotoluene)***
Fuze, Bomb, Nose	M904	Aluminum Alloy	Booster, Detonator, Relay	***Aluminum***, Barium Stearate, Calcium Stearate, Chromium, Copper, Iron, Lead Azide, Magnesium, Manganese, Nickel, ***Silicon, Tetryl,***

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
				Titanium, Tin, Zinc
Fuze, Bomb, Tail	M990	Aluminum Alloy	Booster, Detonator, Ignition Assembly	***Aluminum***, Chromium, Copper, Iron, Lead Azide, Lead Styphnate, Magnesium, Manganese, PETN (Pentaerythritol Tetranitrate), Silicon, ***Tetryl***, Titanium, Zinc
Rocket, Aircraft, 2.25-inch sub-caliber, SCAR	Mk 4, Mk 6	N/A	N/A	N/A
Rocket Motor	Mk 15 Mods 0 & 2 Mk 16 Mods 4,5,6	Steel	Ballistite, Black Powder, Ignition compound	Barium Peroxide, Carbon, Diphenylamine, ***Iron***, Magnesium, Manganese, ***Nitrocellulose, Nitroglycerin***, Potassium Nitrate, Sulfur
Rocket, Warhead 2.25 inch, Practice, SCAR	Mk 3 Mods 0, 2, 3	Steel Zinc Cast Iron	Solid	Carbon, ***Iron***, Manganese, Phosphorus, Sulfur, Zinc
Rocket, 2.75 inch, Practice, FFAR	MKI	N/A	N/A	N/A
Fuze, Rocket	Mk178	Steel	Inert	***Iron***
Rocket Motor	Mk1, Mk2, Mk3	Aluminum Alloy	Ignition Charge, Propellant	***Aluminum***, Chromium, Copper, Diazodinitrophenol, Diphenylamine, Manganese, Magnesium Powder, ***Nitrocellulose, Nitroglycerin***, Potassium Chlorate, Potassium Nitrate, Silicon, Sulfur, Titanium, ***Zinc***
Warhead, Rocket, Practice	Mk1	Steel	Inert	Carbon, ***Iron***, Manganese, Phosphorus, Sulfur, Zinc
Rocket, 2.75 inch, HE, FFAR	MK1			
Fuze, Rocket	Mk178	Steel	Primer Mixture, Tetryl	Carbon, ***Iron***, Lead Azide, Manganese, Phosphorus, Sulfur, ***Tetryl***
Rocket	Mk1	Aluminum Alloy	Ignition Charge, Propellant	***Aluminum***, Chromium, Copper,

Table 4.1 (continued)
Chemical Composition of MEC and Potential Munitions Constituents
Bostwick BT, Putnam County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Motor				Diazodinitrophenol, Diphenylamine, Manganese, Magnesium Powder, ***Nitrocellulose, Nitroglycerin***, Potassium Chlorate, Potassium Nitrate, Silicon, Sulfur, Titanium, ***Zinc***
Warhead, Rocket	Mk1	Steel	HBX-1	***Aluminum Powder***, Calcium Chloride, Carbon, ***Iron,*** Manganese, Phosphorus, ***RDX (Cyclotrimethylenetrinitramine),*** Sulfur, ***TNT (Trinitrotoluene)***
Cartridge, 30mm, Target Practice	M788	N/A	N/A	N/A
Cartridge Case		Aluminum Alloy	Propellant, Primer Mixture, Flash Composition	***Aluminum***, Barium Nitrate, Boron Amorphous Powder, Calcium Silicide, Calcium Carbonate, Chromium, Copper, ***Dibutylphthalate,*** Dinitrotoluene, Diphenylamine, Iron, Lead, Lead Styphnate, ***Magnesium,*** Manganese, ***Nitrocellulose, Nitroglycerin,*** Potassium Nitrate, Potassium Oxalate, Potassium Sulfate, Silicon, Polyvinyl Acetate, Sodium Sulfate, Sulfur, Titanium, Trinitroresorcinol, ***Zinc***, 2-Nitrdiphenylamine
Projectile, 30mm, Target Practice (TP)	M788	Aluminum Alloy, Copper, Steel		***Aluminum***, Bismuth, Carbon, ***Copper, Iron,*** Lead, Manganese, Phosphorus, Silicon, Sulfur, ***Zinc***, Zinc Chromate

Note – Munitions information for Table 1 was supplied by the 1994 INPR, 1996 ASR and 2004 ASR Supplement. See subchapter 4.2.3 for an explanation of the site-specific MC selection process.

(1) - Chlorosulfonic acid reacts violently with water evolving heat and large quantities of white fumes of hydrochloric acid and sulfuric acid. Sulfur-trioxide reacts with the moisture in the air to produce sulfuric acid mist. The mixture of these two compounds does not have any potential MC constituents.

(2) - Although red phosphorus is a potential constituent, there is no analysis method for red phosphorus at this time.

(3) – The Mk15 Mod1 and Mod 2 do not contain any type of spotting charge or signal cartridge.

4.1.1.5 As shown in Appendix E, the SVT noted discrete field observations throughout the course of the SI, including detail on topography, soil color, drainage features, the presence of any barriers, and indications of surface MD and subsurface metal anomalies using the Schonstedt magnetometer. Pertinent field observations are summarized in Table 4.2. Appendix D includes related field forms.

Table 4.2
Summary of Qualitative Reconnaissance Observations
Bostwick BT

MRS	MEC	MD	Munitions-Related Features
Bostwick Bomb Target MRS	Mk76 25 lb. practice bomb, one unexpended fuze of unknown type, one AN-Mk23 3 lb. practice bomb with a Mk4 signal, one Mk76, Mod 0 or 1, an unknown signal, and one 2.75-inch HE rocket warhead	M38A2, 100 lb. bomb, practice debris, parts from a Mk76 practice bomb, half of a AN-Mk 43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket	None

4.2 Data Quality Objectives

4.2.1 Introduction

4.2.1.1 DQOs are qualitative and quantitative statements that clarify study objectives and specify the type and quality of the data necessary to support decisions. The development of DQOs for a specific site takes into account factors that determine whether the quality and quantity of data are adequate for project needs, such as data collection, uses, types, and needs. While developing these DQOs in accordance with the process presented in Chapter 3, paragraph 3.1.2 of the PWP, Parsons followed the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, USEPA QA/G-4, USEPA/240/B-06/001 (USEPA, 2006).

4.2.1.2 The goal of the TPP process is to achieve stakeholder, USACE, and applicable state and federal regulatory concurrence with the DQOs for a given site. The TPP Team discussed the Bostwick BT DQOs at the TPP meeting held on December 17, 2008. Appendix B of this SI Report presents the TPP documentation. Tables 4.3 through 4.6 present the DQO worksheets. *All the DQOs for the MRS have been met.*

4.2.1.3 As stated in Subchapter 1.2 of this SI Report, data must be sufficient to do the following: 1) determine whether a removal action is necessary; 2) enable HRS scoring by the USEPA; 3) characterize the release for effective and rapid initiation of a RI/FS; and 4) complete the MRSPP.

4.2.1.4 DQOs cover four project objectives that SI data must satisfy: 1) evaluate potential presence of MEC; 2) evaluate potential presence of MC; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring.

4.2.2 Munitions and Explosives of Concern Data Quality Objective

The MEC DQO was achieved by evaluating potential presence of MEC on the MRS at the Bostwick BT. The SVT searched for visual evidence of MEC and MD during the QR. Several potential MEC and MD items were noted within the FUDS. No munitions-related features (berms or bomb craters) were visually identified by the SVT during the QR. A summary of potential MEC and MD findings are included in Table 4.2.

4.2.3 Munitions Constituents Data Quality Objective

The MC DQO was achieved by evaluating potential presence of MC at the MRS located at Bostwick BT. Parsons uses the potential MC list as a guide for developing a list of MC specific for each SI project. Varying quantities of the listed MC are found in munitions depending upon the type of munitions of interest. Many of the MC names appear in bold typeface, indicating the quantity of that MC is greater than 2 percent of the components of the munitions (for example, a projectile from the intact bullet or the propellant component of an intact bullet). This does not indicate the MC is necessarily present at a concentration greater than 2 percent of the entire munitions of interest. For example, if barium nitrate is present at a concentration greater than 2 percent of the amount of propellant in a .30 cal round, then it is substantially less than 2 percent of the composition of the complete round whereas lead composes greater than 2 percent of the projectile and the complete round. Therefore, it is more likely that lead would be detected as a remnant of DoD use than barium, in this example. Parsons focuses on the major MC that are likely found in higher amounts of the complete munition and those potentially hazardous MC that may remain on-site at concentrations that may be hazardous to human health and the environment. Because USACE cannot respond to non-CERCLA hazardous substances under the FUDS program, the MC analytes selected are typically limited to CERCLA-hazardous substances. In addition, some major MC are the same as common materials found in the environment in high quantities (such as magnesium, potassium, manganese, iron, and others depending on the type of native soils and waters). Some of these MC also are key nutrients for humans, flora, and fauna and are not expected to pose a risk to those potential receptors. Parsons evaluates all of these factors when selecting the key target MC for the project. There are occasions when the selection of the metals will deviate from this process, typically during the TPP and SS-WP stages to address local and/or state regulatory concerns. The TPP Team evaluated the composition of the munitions (and fillers) used on the practice bombing and rocket range and developed a list of compounds/analytes for sample analysis. The complete list of munitions potentially used at Bostwick BT and their chemical composition is provided in Table 4.1. Chapter 5 presents the MC results.

4.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective

The MRSPP DQO was achieved by obtaining sufficient information to complete the MRSPP scoring sheets. Specific input data were collected, and the three modules for

the MRSPP were populated as part of the SI. The scoring sheets for the MRSPP are included in Appendix K.

4.2.5 Hazard Ranking System Data Quality Objective

The HRS DQO was achieved by including information in the SI report necessary for the USEPA to include when developing the HRS score sheets. Source documents for the HRS information include the INPR, ASR, and ASR Supplement documents, as well as the MC sampling results reported in Chapter 5 and information from local and state agencies regarding population, groundwater well users, and drinking water well use.

4.3 BOSTWICK BOMB TARGET MUNITIONS RESPONSE SITE

4.3.1 Historical Munitions and Explosives of Concern

The Bostwick Bomb Target MRS is comprised of 3,111 acres as depicted on Figure 2.1. During the 1996 ASR site visit, the inspection team observed MD but did not identify any MEC. This MRS received a RAC score of 3, indicating a potential risk. The ASR Supplement lists the following munitions associated with this MRS: practice bombs of various types with spotting charges, medium caliber ammunition, and aerial rockets of various types. For a complete list, see Table 4.1.

4.3.2 Inspection Activities

The field effort for the Bostwick Bomb Target MRS was conducted July 5 through July 10, 2009. The SVT collected three biased surface water/sediment sample couples and nine biased surface soil samples from within this MRS. One ambient surface soil sample and 1 surface water/sediment sample couple were collected outside the MRS but within the FUDS boundary. The SVT also conducted over 20 miles of walking reconnaissance on the FUDS, which included portions of this MRS (Figure 4.1). Potential MEC and MD were observed during the QR, as detailed in Table 4.2. Photographs and site observations collected in this MRS are included in Appendix E.

Table 4.3 - MEC Data Quality Objective Worksheet

SITE: **Bostwick BT, Putnam County, FL**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL091401**

DQO Element Number *	DQO Element Description *	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate presence/lack there of MEC.	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, Remedy	Y
3	Contaminant or Characteristic of Interest	MEC, MD	Y
4	Media of Interest	N/A	N/A
5	Required Sampling Locations or Areas and Depths	MRS01-Bostwick Bomb Target	Y
6	Number of Samples Required	N/A	N/A
7	Reference Concentration of Interest or Other Performance Criteria	Indication of target areas. Visual Confirmation of absence/presence of MEC.	Y
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	Qualitative Reconnaissance (limited)	Y
9	Analytical Method	N/A	N/A

* Refer to EM 200-1-2, Paragraph 4.2.1

Table 4.4 - MC Data Quality Objective Worksheet

SITE: **Bostwick BT, Putnam County, FL**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL091401**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate presence/lack thereof of MC	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, Remedy	Y
3	Contaminant or Characteristic of Interest	Explosives and specific metals. Perchlorate in surface water samples.	Y
4	Media of Interest	Surface soil, sediment, and surface water	Y
5	Required Sampling Locations or Areas and Depths	As determined by the Project Team, see Figure 5.1. Locations based on range configuration.	Y
6	Number of Samples Required	9 biased surface soil samples, 3 biased surface water/sediment sample couples, 1 ambient surface soil sample, 1 ambient surface water/sediment sample couple and associated field duplicates and QC samples	Y
7	Reference Concentration of Interest or Other Performance Criteria	Soil and sediment screening levels for human health to include the more stringent of the Florida Administrative Code (FAC) 62-777 Soil Cleanup Target Levels and the USEPA Residential RSLs; for surface water the more stringent of USEPA RSLs for Tap Water, FAC 62-302 Criteria for Surface Water Quality Classifications, and FAC 62-	Y

		777 Freshwater Surface Water Criteria. Soil ESVs include USEPA Region 4 ESVs for Soil supplemented with values from references cited by the 2005 PSAP. Sediment ESVs include FDEP SQAG, January 2003 and USEPA Region 4 ESVs for Sediment supplemented with ecological screening value sources from 2005 PSAP. Surface water ESVS include FAC 62-302 Surface Water Quality Standards (for Class III water) and USEPA Region 4 Ecological Screening Values for Freshwater Surface Water supplemented with ecological screening value sources from 2005 PSAP. All sources are cited in Chapter 6.	
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	Discrete samples in accordance with the FDEP and TPP Team concurrence	Y
9	Analytical Method	Explosives - SW8321A. Metals- SW6020. Perchlorate – SW6860.	Y

* Refer to EM 200-1-2, Paragraph 4.2.

Table 4.5 - MRSPP Data Quality Objective Worksheet

Site:	Bostwick BT				
Project:	MMRP Site Inspection / FUDS No. I04FL091401				
Module	Table #	Table Description	Known Data	Current Data Gap	Data Source
Explosive Hazard Evaluation (EHE)	1	Munitions Type	X		Historical Records/Findings
	2	Source of Hazard	X		Historical Maps
	3	Location of Munitions	X		Historical or Field Findings
	4	Ease of Access	X		Field Findings
	5	Status of Property	X		Historical Records
	6	Population Density	X		U.S. Census Bureau
	7	Population Near Hazard	X		Field Findings
	8	Types of Activities/Structures	X		Regional Zoning
	9	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	10	Determining the EHE	X		Scores from Tables 1 through 9
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration	X		Historical Records/Findings
	12	Sources of CWM	X		Historical Records/Findings
	13	Location of CWM	X		Historical or Field Findings
	14	Ease of Access	X		Field Findings
	15	Status of Property	X		Historical Records
	16	Population Density	X		U.S. Census Bureau
	17	Population Near Hazard	X		Field Findings
	18	Types of Activities/Structures	X		Regional Zoning
	19	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	20	Determining the CHE	X		Scores from Tables 11 through 19
Health Hazard Evaluation (HHE)	21	Groundwater Data	X		N/A
	22	Surface Water - Human Endpoint	X		Surface Water Sampling Results
	23	Sediment - Human Endpoint	X		Sediment Sampling Results
	24	Surface Water - Ecological Endpoint	X		Surface Water Sampling Results
	25	Sediment - Ecological Endpoint	X		Sediment Sampling Results
	26	Surface Soil	X		Surface Soil Sampling Results
	27	Supplemental Contaminant Hazard Factor	X		All MC Sampling Results
	28	Determining the HHE	X		Scores from Tables 21 through 27
	29	MRS Priority	X		Scores from Tables 10, 20, and 28
	A	MRS Background Information	X		DoD Databases

Table 4.6 - HRS Data Quality Objective Worksheet

Site: Bostwick BT
Project:
MMRP Site Inspection / FUDS No. I04FL091401
DQO Statement Number: 4 of 4

Data Description	Known Data	Current Data Gap	Data Source
Source Type	X		Historical Records/Findings
Estimated Volume or Area	X		Field Findings
Hazardous Substance	X		Constituents of Suspected Munitions
Groundwater Sample Concentration	X		N/A
Groundwater Use	X		Well Records/Municipal Data
Surface Water Sample Concentration	X		Sample Results
Surface Water Pathways	X		Field Findings
Soil Sample Concentration	X		Sample Results
Soil Pathways	X		Municipal Data
Sensitive Environments	X		State Historic Preservation Office, US Fish and Wildlife Service, various government agencies
Attractiveness/Accessibility	X		Field Findings/Land Use Records

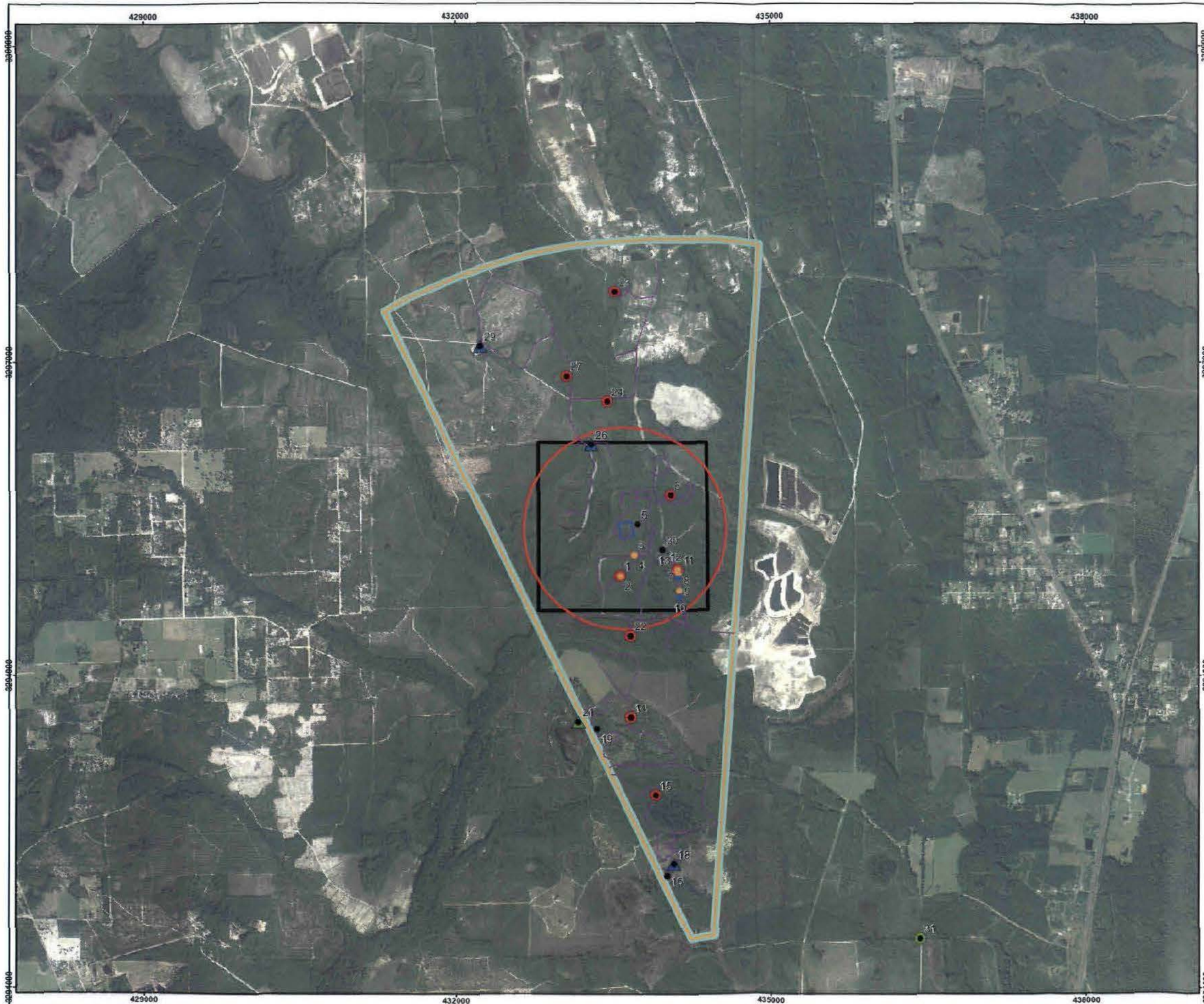


Figure 4.1

Qualitative Reconnaissance and Field Observation Locations Bostwick Bomb Target FUDS Project No. I04FL091401

Putnam County, Florida

Legend

- 8 MEC Location
- 9 Munition Debris Observation Location
- 5 Field Observation Location
- Ambient Soil Sample Location
- Ambient Surface Water/Sediment Sample Location
- Soil Sample Location
- Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS

Site Location in Florida

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

1 0.5 0 1 Kilometers

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	Qualitative Reconnaissance and Field Observation Locations		
DRAWN BY BT			
CHECKED BY JU	SCALE: As Shown		PROJECT NUMBER: 744647.84115
SUBMITTED BY DS	DATE: October 2009		PAGE NUMBER: 4-21
	FILE: X:\GIS\Site_inspections_ne\Maps\bostwick_FL\Fig4_1.mxd		

CHAPTER 5

MIGRATION/EXPOSURE PATHWAYS AND RECEPTORS

5.1 INTRODUCTION

5.1.1 This chapter of the SI report evaluates the potential for release of MC to the environment based on site-specific conditions. It is necessary to evaluate site-specific conditions and land use to evaluate risks posed to potential receptors under current and future land use scenarios for each MRS. This chapter of the SI report evaluates exposure pathways for groundwater, surface water, sediment, soil, and air. The CSEM for the Bostwick BT (Appendix J) summarizes which potential receptor exposure pathways are (or may be) complete and which are (and are likely to remain) incomplete for each MRS. For an exposure pathway to be considered complete, all four of the following elements must be present (USEPA, 1989). An example regarding a hypothetical groundwater exposure pathway accompanies each pathway element.

- *A source of contamination.* For example, a site has known MEC from which MC have leached and contaminated surface soil.
- *An environmental transport and/or exposure medium.* In the example, the MC in soil is mobile and can contaminate groundwater.
- *A point of exposure at which the contaminant can interact with a receptor.* A drinking water well drawing from the contaminated aquifer is at the site.
- *A receptor and a likely route of exposure at the exposure point.* An on-site resident uses groundwater as a source of drinking water.

5.1.2 In the hypothetical example of the resident, all four factors are present and, therefore, the groundwater exposure pathway is complete. If any single factor was not present (for example, MC were not present in soil, or the resident used drinking water from another source), the pathway would be incomplete.

5.2 GENERAL INFORMATION

The general information regarding the geology, hydrogeology, and hydrology of the Bostwick BT presented below was obtained from the ASR (USACE, 1996), except where noted. Regional information is followed by a discussion of MRS-specific characteristics and sampling results for the MRS investigated as part of the SI.

5.2.1 Regional Geologic Setting

5.2.1.1 The Bostwick BT is within the Floridian section of the Coastal Plain Physiographic Province and is underlain by a series of Eocene to Pleistocene aged limestone and dolomite rock units to depths of several thousands of feet. The region is

affected structurally by the Ocala Uplift, an anticlinal fold that crests along southwest Alachua County west of Putnam County. Rocks east of the crest typically dip approximately 6 feet/mile to the east or northeast. Of the sedimentary sequences underlying the site, the Lake City Limestone is the oldest formation (Eocene) that is used for freshwater supply. This formation is made up of hard, finely crystalline dolomite and dolomitic limestone with some soft layers of porous fossiliferous limestone. The thickness of the Lake City Limestone in northern Florida is known to be as much as 400 feet. The Avon Park Limestone overlies the Lake City Limestone and consists of a hard to soft limestone to dolomitic limestone. Thickness of the formation ranges from 150 to 245 feet in the region. The Ocala Group uncomformably overlies the Avon Park Limestone and is made up of several limestone units including the Inglis, Williston, and Crystal River Formations. The oldest is the Inglis Formation which is made up of coarsely granular, fragmental limestone. The Williston Formation is quite similar in composition as the underlying Inglis Formation and is often distinguished by its fossil content. It has been reduced in thickness and extent due to erosion in portions of Putnam and surrounding counties and ranges in thickness between 30 and 50 feet when overlain by the Crystal River Formation. The Crystal River Formation has been completely removed by erosion in most of eastern Putnam County. In the western part of the county, this formation ranges in thickness from 70 to over 100 feet. Lithologically, the Crystal River Formation consists of light colored, massive, soft chalky, marine limestone and is distinguished by fossil content. The homogenous sequence of the above mentioned limestone formations that comprise the Ocala Group act essentially as a single hydrologic unit. These formations differ from the underlying Lake City and Avon Park Limestones in that they contain few relatively impermeable indurated zones to restrict vertical movement of water. The Miocene aged Hawthorn Formation uncomformably overlies the Ocala Group and is made up of thick clays and sandy clays with interbedded lenses of sand and soft limestone. The top of the Hawthorn Formation ranges in altitude from about 100 feet above msl in western Putnam County to more than 130 feet below msl in northern St. Johns County. The thickness of the formation averages about 50 to 100 feet in eastern Putnam County and increases in thickness in the northern and western parts of the county and attains a maximum thickness of about 120 to 200 feet. The Hawthorn Formation consists of gray to green, plastic, phosphatic, sandy clay and marl, interbedded with lenses of phosphatic sand and sandy limestone. The sandy limestone occurs mainly at the base of the formation and is thickest in western Putnam County. Due to the amount of clay layers, the Hawthorn Formation acts as a confining layer to the Floridan aquifer. Overlying the Hawthorn Formation is the Pleistocene Caloosahatchee Marl which consists of interbedded lenses of marine, fine to medium sand, shell and green, calcareous, silty clay. The uppermost stratigraphic unit in western Putnam County is the Citronelle Formation which is comprised of clastic sediments ranging from 0 to 15 feet. These sediments were deposited as deltaic sands, clayey sand, and some localized gravel. Unnamed sediments cover the surface of Putnam and surrounding counties and are Pleistocene to Recent in age and range in thickness of about 20 feet in Flagler County located to the southeast of the study area to about 140 feet in western Putnam County. The Pleistocene deposits consist of fine to medium quartz sand and thin lenses of clay and shell in eastern parts of Putnam County to fine to coarse poorly sorted sand and sandy clay in western portions of the county. Recent deposits consist of alluvial sand and

clay in stream valleys, with sand along the coastline and isolated peat deposits (Florida Geological Survey, 1963).

5.2.1.2 The Bostwick BT site consists of two different soil types. Most of the soil present is found in flat to slight depressions. This soil is poorly drained, fine sand with a black to dark gray sand occurring in the upper 8 to 12 inches. A subsurface layer of gray fine sand extends down to 28 inches. The subsoil is a black fine sand down to 60 inches. These sands are prone to flooding, have a low to medium high water capacity, moderately to rapid permeability with a water table of 1 to 2 feet for most of the year. A second soil type is less common and occurs on slightly sloped areas mostly along the northwest corner of the site. This soil also consists of fine sand but is moderately drained and has a high water table of 40 to 60 inches for 2 to 6 months of the year (USACE, 1996).

5.2.2 Regional Hydrogeologic Setting

5.2.2.1 Aquifers found in Putnam County include the surficial aquifer and the Floridan aquifer system.

5.2.2.2 The surficial aquifer is the water table aquifer, which consists of shallow sand or clayey sand that contain water under water table conditions. This aquifer will yield sufficient water for domestic well use, but is unpotable due to salt content. The surficial aquifer is exposed at the ground surface at Bostwick BT. Based on land surface elevation data and USGS water table contour maps (USGS, 1990), the groundwater in the surficial aquifer is estimated to range in depth from surface to 40 feet below ground surface (bgs).

5.2.2.3 The Floridan aquifer is commonly used in the area due to its freshwater content and consists of hundreds of feet of soft, porous limestone and hard, dense limestone and dolomite that act as a hydrologic unit (USGS, 1990). The Floridan aquifer has high permeability in a lateral direction and a low permeability in a vertical direction. Water in the Floridan aquifer is under artesian conditions in the site area. Normally found 150 to 200 feet deep, it has a transmissivity of 50,000 or more square feet per day, is highly permeable, and provides large quantities of water for domestic, industrial, and agricultural uses (USACE, 1996).

5.2.3 Regional Groundwater Use

Table 5.1 lists the registered groundwater wells within 4 miles of the Bostwick BT MRS. There are approximately six registered groundwater wells within a 4-mile radius of the Bostwick BT MRS (Figure 5.2). None of these are within the MRS. These wells have drilled depths ranging from 280 to 800 ft. Two of these wells are registered as "proposed" or "inactive." Information regarding the specific use for these wells was not available. The well report is included in Appendix L. Although the well report listed no wells within the MRS (Banks, 2008), the SVT located one well near the bomb target center. This well is a hand-pump type and not connected to any residential housing. This brings the total number of wells within a 4-mile radius to seven.

Table 5.1
Active Groundwater Wells within a
4-Mile Radius of the Bostwick Bomb Target MRS

MRS	Domestic	Public Supply Wells	Use Unknown
On-site	0	0	1
0 to ¼ mile	0	0	0
¼ to ½ mile	0	0	0
½ to 1 mile	0	0	0
1 to 2 miles	0	0	1
2 to 3 miles	0	0	5
3 to 4 miles	0	0	0

5.2.4 Regional Hydrologic Setting

Simms Creek flows from north to south through the center of the Bostwick BT site with all surface water runoff draining into the creek. Simms Creek is a tributary to Rice Creek that flows to the south of the site then east where flow from the creek discharges into the St Johns River approximately 6 miles south of the Bostwick BT center (Google Earth, 2009). The St. Johns River flows north, passes through the city of Jacksonville, and empties into the Atlantic Ocean about 60 miles downstream from the point of discharge.

5.2.5 Regional Sensitive Ecological Resources

5.2.5.1 The state of Florida supports 114 federally listed T&E species consisting of 59 animals and 55 plants. According to FNAI and USFWS databases of T&E species for Putman County, there are ten federally listed species that may habitat within the county. However, due to the site not being located on a coast or river, only eight of the federally listed species may be located within the MRS boundary. The two other species require habitat types that the site does not support. The eight federally listed species potentially within the MRS boundary are shown in Table 5.2.

5.2.5.2 The USFWS Wetlands Online Mapper, through the NWI, was used to identify wetlands within the Bostwick BT site (Figure 5.3). The site consists of large wetland areas associated with ponds. The three main wetland types located within the FUDS and MRS are:

- PFO6F – Palustrine, forested, deciduous, semi-permanently flooded;
- PEM1F – Palustrine, emergent, persistent, semi-permanently flooded; and

- PSS7/EM1A – Palustrine, scrub-shrub, evergreen/Emergent, persistent, temporarily flooded.

5.2.5.3 Other wetlands not identified in the Wetland Online Mapper may be present on the site.

5.2.5.4 Based on the above information and a review of the Army Checklist for Important Ecological Places (USACE, 2006b), the Bostwick BT MRS is classified as an important ecological place. This classification is made due to the presence of wetlands and habitat known to support T&E species. Therefore, ecological receptors are potential receptors for exposure pathways at this site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within the Bostwick BT, Putnam County, FL

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2009)	Habitat Present on-site?
American Alligator	*Alligator mississippiensis*	Threatened (by similarity of appearance)	Species of Concern	Fresh and brackish marshes, ponds, lakes, rivers, swamps, bayous, large spring runs. Basks on land next to water. Digs dens in river or lake margins or in marshes; spends cold winter and drought periods in den. Depends on access to air holes to survive in ice-covered ponds. Copulation occurs in shallow water. Lays eggs in large mounded nest made of leaves, mud, rotting vegetation, rocks, or other debris. Nests are built in marshes or at lake or river margins. In north-central Florida, nested in close proximity to permanent water, used a wide variety of available plant materials and soil in constructing nest.	Possibly

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within the Bostwick BT, Putnam County, FL

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2009)	Habitat Present on-site?
Wood Stork	*Mycteria americana*	Endangered	Endangered	Chiefly freshwater situations: marshes, swamps, lagoons, ponds, flooded fields; depressions in marshes are important during drought; also occurs in brackish wetlands. Nests mostly in upper parts of cypress trees, mangroves, or dead hardwoods over water or on islands along streams or adjacent to shallow lakes. Feeds in freshwater marshes, swamps, lagoons, ponds, flooded pastures and flooded ditches, depressions in marshes (especially during drought).	Yes
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened	Habitat includes sandhill regions dominated by mature longleaf pines, turkey oaks, and wiregrass; flatwoods; most types of hammocks; coastal scrub; dry glades; palmetto flats; prairie; brushy riparian and canal corridors; and wet fields. Occupied sites are often near wetlands and frequently are in association with gopher tortoise burrows. Pineland habitat is maintained by periodic fires. Viable populations of this species require relatively large tracts of suitable habitat. Refuges include tortoise burrows, stump holes, land crab burrows, armadillo burrows, or similar sites.	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within the Bostwick BT, Putnam County, FL

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2009)	Habitat Present on-site?
Florida Scrub-Jay	*Aphelocoma coerulescens*	Threatened	Threatened	Oak scrub on white, drained sand, in open areas without a dense canopy. Palmetto, sand pine and rosemary may co-occur. Includes scrub with no canopy, sandpine scrub, scrubby flatwoods, and coastal scrub. Fire-suppressed scrubs with dense, tall understories or encroaching pine canopies provide poor habitat. Rarely in areas with greater than 50% canopy cover that is taller than 3 meters.	Yes
Red-Cockaded Woodpecker	*Picoides borealis*	Endangered	Species of Concern	Habitat consists of open, mature pine woodlands, rarely deciduous or mixed pine-hardwoods located near pine woodlands. Optimal habitat is characterized as a broad savanna with a scattered overstory of large pines and a dense groundcover containing a diversity of grasses, forbs, and shrub species. Mid-story vegetation is sparse or absent Roosting and nesting cavities have been found in longleaf (*Pinus palustrus*), loblolly (*Pinus taeda*), shortleaf (*Pinus echinata*), slash (*Pinus ellioti*), pond pine (*Pinus rigida*), and even bald cypress (*Taxodium disthicus*).	Possibly

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within the Bostwick BT, Putnam County, FL

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2009)	Habitat Present on-site?
Sand Skink	*Neoseps reynoldsi*	Threatened	Threatened	It inhabits loose sands of sand pine-rosemary scrub, less often longleaf pine-turkey oak (sandhill) or turkey oak "barrens" adjacent to scrub, especially high pine-scrub ecotones. Sometimes this lizard occurs in areas with dense undergrowth and extensive canopy closure. It is basically fossorial (usually within 8 cm of surface) but sometimes can be found under logs, leaf litter, and other surface debris.	Yes
Chaffseed	*Schwalbea americana*	Endangered	Endangered	Acidic, sandy or peaty soils in open pine flatwoods, pitch pine lowland forests, seepage bogs, palustrine (wetland) pine savannahs, and other grass- and sedge-dominated plant communities. Frequently grows in ecotonal areas between peaty wetlands and xeric sandy soils.	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within the Bostwick BT, Putnam County, FL

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2009)	Habitat Present on-site?
Etonia Rosemary	*Conradina etonia*	Endangered	Endangered	Florida scrub vegetation with sand pine, shrubby evergreen oaks; in openings, edges, and disturbed areas.	Yes

5.2.6 Sample Locations/Methods

5.2.6.1 The SVT mobilized to the site on July 5, 2009. The field work was conducted on July 6 through July 10, 2009, and included MC sampling and QR. No intrusive MEC investigations, explosives handling, or MEC detonations were conducted. Extensive QR of the parcels was not performed beyond a visual assessment to further evaluate the condition of the site. Preliminary QR routes were identified by the TPP Team with the understanding that the SVT could determine alternate routes to accommodate conditions on the ground.

5.2.6.2 Based on TPP Team concurrence, nine biased surface soil samples and three biased surface water/sediment sample couples were collected from locations within the FUDS boundary (Figure 5.1). The sample locations were selected to represent areas with the highest likelihood for the presence of MEC or MC contamination, per the SS-WP Addendum (Parsons, 2009b) and do not necessarily reflect the conditions throughout the site. One ambient surface water/sediment sample couple and one ambient surface soil sample were collected outside the MRS boundaries to reflect ambient metals concentrations in sediment, surface water, and surface soil in the site area. Field duplicate samples were also collected and are not included in the above counts. Discrete soil samples were collected from zero to 2 inches bgs up to a maximum depth of 6 inches bgs, approved by FDEP based on soil type, with grass or other vegetative cover being removed prior to sample collection. The sampling locations were recorded with the Global Positioning System (GPS) unit. A groundwater sample was originally proposed to be collected and agreed upon by the TPP Team; however, the well pump was broken at the time of the site visit and a sample could not be collected.

5.2.6.3 Sample locations were determined by the preliminary sample locations identified before the SI team arrived on-site and were approved by the UXO technician prior to final location selection and sample collection. Some samples were moved from their original proposed locations as detailed in the Sample Rationale table (Table 3.1). For safety reasons, the UXO technician used a Schonstedt magnetometer for anomaly avoidance and screening prior to collection of the samples.

5.2.6.4 The collected samples were packaged and shipped to TestAmerica, formerly Severn Trent Laboratories, in Arvada, Colorado for analysis. The biased samples were analyzed for explosives (Method SW8321A) and select metals (Method SW6020). Ambient samples were analyzed for select metals (Method SW6020). Both ambient and biased surface water samples were also analyzed for perchlorate (Method SW6860). Sample results are presented in Tables 5.3 (surface water), 5.4 (sediment), and 5.5 (surface soil).

5.2.6.5 The sample collection procedures presented in the Final PSAP (USACE, 2005) and the Parsons Final PSAP Addendum (Parsons, 2006) were followed.

Table 5.3
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR BOSTWICK BOMB TARGET MMRP WATER SAMPLES COLLECTED IN JULY 2009

SAMPLE ID:		BBT-AMB-SW-05*		BBT-MRS01-SW-01		BBT-MRS01-SW-06**		BBT-MRS01-SW-02		BBT-MRS01-SW-03	
DATE SAMPLED:		07/09/09		07/10/09		07/10/09		07/10/09		07/09/09	
LAB SAMPLE ID:		D9G100295007		D9G110173001		D9G110173003		D9G110173002		D9G100295006	
	Units										
Explosives - SW8321A											
1,3,5-Trinitrobenzene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
1,3-Dinitrobenzene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
2,4,6-Trinitrotoluene (TNT)	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
2,4-Dinitrotoluene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
2,6-Dinitrotoluene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
2-Amino-4,6-dinitrotoluene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
2-Nitrotoluene	µg/L			0.20	UJ	0.20	UJ	0.20	UJ	0.20	UJ
3-Nitrotoluene	µg/L			0.20	UJ	0.20	UJ	0.20	UJ	0.20	UJ
4-Amino-2,6-dinitrotoluene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
4-Nitrotoluene	µg/L			0.20	UJ	0.20	UJ	0.20	UJ	0.20	UJ
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L			2.4	U	0.12	UJ	2.4	U	2.4	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Nitrobenzene	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Nitroglycerin	µg/L			0.15	UJ	0.15	UJ	0.15	UJ	0.15	UJ
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L			2.4	U	2.4	U	2.4	U	2.4	U
Pentaerythritol Tetranitrate (PETN)	µg/L			0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Total Metals - SW6020											
Antimony	µg/L	**0.096**	J	6.0	U	6.0	U	**0.12**	J	**0.084**	J
Barium	µg/L	**4.8**		**3.5**		**3.9**		**3.4**		**20**	
Copper	µg/L	2.0	U	**1.1**	J	**1.5**	J	**1.3**	J	**0.56**	J
Lead	µg/L	**0.69**	J	**0.24**	J	**0.27**	J	**1.1**	J	**1.0**	J
Zinc	µg/L	**2.1**	J	**8.6**	J	**11**	J	**8.5**	J	**4.6**	J
Perchlorate - SW6860											
Perchlorate	µg/L	**0.019**	J	**0.016**	J	**0.011**	J	**0.013**	J	1.0	U

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.4
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR BOSTWICK BOMB TARGET MMRP SEDIMENT SAMPLES COLLECTED IN JULY 2009

SAMPLE ID:		BBT-AMB-SD-05*		BBT-MRS01-SD-01		BBT-MRS01-SD-06**		BBT-MRS01-SD-02		BBT-MRS01-SD-03	
DATE SAMPLED:											
LAB SAMPLE ID:											
	Units										
Explosives - SW8321A											
1,3,5-Trinitrobenzene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
1,3-Dinitrobenzene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
2,4,6-Trinitrotoluene (TNT)	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
2,4-Dinitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
2,6-Dinitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
2-Amino-4,6-dinitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
2-Nitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
3-Nitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
4-Amino-2,6-dinitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
4-Nitrotoluene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Nitrobenzene	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Nitroglycerin	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg			0.10	U	0.10	U	0.10	U	0.40	U
Pentaerythritol Tetranitrate (PETN)	mg/kg			0.10	U	0.10	U	0.10	U	0.10	U
Metals - SW6020											
Antimony	mg/kg	0.32	U	0.33	UJ	0.32	U	**0.033**	J	**0.15**	J
Barium	mg/kg	**2.7**		**2.4**	J	**0.45**	J	**0.79**		**32**	
Copper	mg/kg	**0.54**		**2.9**		0.41	U	**0.59**		**4.5**	
Lead	mg/kg	**2.5**		**2.9**	J	**0.76**	J	**2.6**		**8.3**	
Zinc	mg/kg	**1.4**	J	**2.2**	J	**0.48**	J	**0.99**	J	**8.4**	J
Percent Moisture											
Moisture, percent	%	**23**		**25**		**22**		**22**		**83**	

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.5
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR BOSTWICK BOMB TARGET MMRP SOIL SAMPLES COLLECTED IN JULY 2009

SAMPLE ID:		BBT-AMB-SS-02-04*		BBT-MRS01-SS-02-01		BBT-MRS01-SS-02-10**		BBT-MRS01-SS-02-02		BBT-MRS01-SS-02-03		BBT-MRS01-SS-02-05		BBT-MRS01-SS-02-06		BBT-MRS01-SS-02-07		BBT-MRS01-SS-02-08		BBT-MRS01-SS-02-09		BBT-MRS01-SS-02-11	
DATE SAMPLED:																							
LAB SAMPLE ID:																							
	Units																						
Explosives - SW8321A																							
1,3,5-Trinitrobenzene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
1,3-Dinitrobenzene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
2,4,6-Trinitrotoluene (TNT)	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
2,4-Dinitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
2,6-Dinitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
2-Nitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
3-Nitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
4-Nitrotoluene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Nitrobenzene	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Nitroglycerin	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Pentaerythritol Tetranitrate (PETN)	mg/kg	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Metals - SW6020																							
Antimony	mg/kg	0.27	U	0.31	U J	0.31	U	0.30	U	0.32	U	0.33	U	**0.025**	J	0.30	U	**0.20**	J	**0.015**	J	0.30	U
Barium	mg/kg	**1.1**		**1.0**		**1.2**		**3.5**		**3.4**		**0.63**		**12**		**2.9**		**6.8**		**2.1**		**4.2**	
Copper	mg/kg	0.35	U	**2.1**		**2.0**		**0.99**		**0.22**	J	0.42	U	**0.52**		**0.97**		**6.8**		**0.61**		0.39	U
Lead	mg/kg	**1.5**		**15**		**17**		**3.0**		**4.4**		**2.7**		**6.7**		**1.2**		**20**		**2.5**		**2.4**	
Zinc	mg/kg	**0.70**	J	**6.3**		**7.6**		**0.96**	J	3.2	U	**0.67**	J	**1.4**	J	**0.63**	J	**2.3**	J	**2.5**	J	**0.64**	J
Percent Moisture																							
Moisture, percent	%	**8.4**		**20**		**20**		**18**		**22**		**24**		**23**		**15**		**72**		**4.8**		**16**	

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

5.2.7 Ambient Metals Concentrations

5.2.7.1 No site-specific statistical evaluation of background metals concentrations is available. Due to the limited scope of the SI, conducting a site-specific statistical background evaluation of metals concentrations (which typically requires collection of at least 10 background samples) was not considered practical or warranted at this stage of investigation. Two sources of information, each described in detail in the following paragraphs, were used to approximate background metals concentrations at the site:

- Background concentrations of elements in Putnam County, Florida, identified by the USGS (USGS, 2008; see Appendix L), based on the mean concentration for the county plus two times the standard deviation to approximate the 95% Upper Confidence Limit of the mean; and
- Analytical results of one ambient surface water/sediment sample couple and one ambient surface soil sample collected during the 2009 SI field activities that are not expected to be affected by munitions activities, used in the absence of a background concentration for Putnam County from the USGS.

5.2.7.2 The nationwide Mineral Resources Data System (MRDS) database of concentrations of elements provides county-specific background values for selected metals. The MRDS includes mineral resource occurrence data covering the world, most thoroughly within the United States. This database contains the records previously provided in the MRDS of USGS and the Mineral Availability System/Mineral Industry Locator System originated by the U.S. Bureau of Mines, which is now part of the USGS. According to the USGS, the MRDS is a large and complex relational database developed over several decades by hundreds of researchers and reporters (USGS, 2008). This dataset is considered to be representative of soil and sediment concentrations within Putnam County. The USGS Background Concentrations for Putnam County are defined as the mean plus two times the standard deviation, and the USGS Background Concentrations were used as one of the criteria used to evaluate whether or not potential MC contamination is present in soil and sediment (subchapter 5.2.8), for all metals considered in this SI.

5.2.7.3 In addition to the USGS data described above, one ambient soil sample (BBT-AMB-SS-02-04) and one ambient surface water/sediment sample couple (BBT-AMB-SW-05 /BBT-AMB-SD-05), as shown on Figure 5.1, were collected during the SI. No MEC or MD was observed in the vicinity of the sample locations, which suggests that these samples are likely representative of the naturally occurring soil, surface water, and sediment in the area. For surface water, the background concentrations consist of the detected ambient concentration in the absence of any other background data (Table 5.6). As agreed by the TPP team, data from the USGS Background Concentrations were used for comparison in this SI report for sediment and soil supplemented with the maximum ambient concentration (Tables 5.7 and 5.8, respectively).

Table 5.6
Surface Water Background Concentrations
Bostwick Bomb Target

Analyte	Units	Maximum Ambient Concentration	Selected Background Concentration
Metals			
Antimony	µg/L	0.096 J	0.096 J
Barium	µg/L	4.8	4.8
Copper	µg/L	2.0 U	2.0 U
Lead	µg/L	0.69 J	0.69 J
Zinc	µg/L	2.1 J	2.1 J
Perchlorate			
Perchlorate	µg/L	0.019 J	0.019 J

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

J - Analyte detected, estimated concentration.

Table 5.7
Sediment Background Concentrations
Bostwick Bomb Target

Analyte	Units	Putnam County USGS Background Concentration (1)	Maximum Ambient Concentration	Selected Background Concentration (2)
Metals				
Antimony	mg/kg	NA	0.32 U	0.32 U
Barium	mg/kg	NA	2.7	2.7
Copper	mg/kg	13	0.54	13
Lead	mg/kg	162	2.5	162
Zinc	mg/kg	207	1.4 J	207

(1) - USGS derived background concentration for Putnam County. Value equals the mean + 2xSD (http://tin.er.usgs.gov/geochem/county.php?place=f12107&el=Pb&rf=southeastern).

(2) - The background concentrations are selected from those available in the column order shown (i.e., the USGS value is used if there is one; if there is no USGS value, then the maximum ambient concentration value is used).

NA – Concentration not available from USGS.

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

J - Analyte detected, estimated concentration.

Table 5.8
Soil Background Concentrations
Bostwick Bomb Target

Analyte	Units	Putnam County USGS Background Concentration (1)	Maximum Ambient Concentration	Selected Background Concentration (2)
Metals				
Antimony	mg/kg	NA	0.27 U	0.27 U
Barium	mg/kg	NA	1.1	1.1
Copper	mg/kg	13	0.35 U	13
Lead	mg/kg	162	1.5	162
Zinc	mg/kg	207	0.70 J	207

(1) - USGS derived background concentration for Putnam County. Value equals the mean + 2xSD (http://tin.er.usgs.gov/geochem/county.php?place=f12107&el=Pb&rf=southeastern).

(2) - The background concentrations are selected from those available in the column order shown (i.e., the USGS value is used if there is one; if there is no USGS value, then the maximum ambient concentration value is used).

NOTE: No explosives were detected in the ambient surface soil samples.

NA – Concentration not available from USGS.

J - Analyte detected, estimated concentration.

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

5.2.8 MC Source Evaluation

5.2.8.1 As explained earlier in this chapter, an exposure pathway is not considered complete unless there is potential MC contamination present. To make this determination, analytical results for MC are screened against several criteria to evaluate whether or not potential MC contamination is present. For a chemical to be considered MC contamination that is related to a release from munitions-related activities at the site, it is necessary for the following conditions to be true:

- The chemical is detected in the sample medium; AND
- The chemical is present above the selected background concentration (see subchapter 5.2.7); AND
- The chemical is a potential constituent of the munitions formerly used at the range (Table 4.1).

5.2.8.2 Each of the MC analyzed at the range were evaluated against these criteria to determine whether potential MC contamination was present at the MRS. Only detections of metals that meet the conditions above are evaluated further in the screening level risk assessments in Chapter 6. Any detection of explosives at the MRS would be considered potential MC contamination and would be evaluated in the Screening Level Risk Assessment (SLRA). However, explosives were not detected in any samples collected at this site.

5.3 BOSTWICK BOMB TARGET MUNITIONS RESPONSE SITE

This section of the SI Report evaluates exposure pathways for the Bostwick BT MRS. The analysis of each pathway is described in detail. The related CSEM for this MRS is provided in Appendix J.

5.3.1 Historical MC Information

To date, no historical MC-related groundwater, surface water, soil, sediment, or air sampling has been documented at this MRS.

5.3.2 Groundwater Exposure Pathway

Groundwater can serve as a contaminant transport mechanism that may affect surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environmental areas such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of MC in soil at the ground surface that can be transported to the groundwater, site-specific geology, climate, and the expected future land use. No groundwater samples were collected within the Bostwick BT MRS.

5.3.2.1 Geologic and Hydrogeologic Setting

There are no known differences between the geologic and hydrogeologic setting at the Bostwick BT MRS and the setting described for the overall range in subchapter 5.2. There is one known well inside the MRS boundary (Figure 5.2).

5.3.2.2 Releases and Potential Releases to Groundwater

There are no known releases of MC to groundwater at the Bostwick BT MRS. Based on the estimated depth of the water table in the region (zero to 40 feet bgs), groundwater may have been directly affected by bombing activities. Contaminant migration to groundwater is possible at this MRS. If there were releases of MC to soil, sediment, or surface water because of the munitions-related activities, it is possible that the constituents could leach to groundwater at the Bostwick BT MRS.

5.3.2.3 Groundwater Exposure Pathways and Receptors

The regional groundwater use setting of the Bostwick BT site is described in subchapter 5.2.2. Based on the current and future land use of the Bostwick BT MRS, potential receptors in this MRS include residents (based on census data), commercial or industrial workers (such as plantation employees), and site visitors or recreational users. Groundwater is not directly accessible to most ecological receptors, so this pathway is incomplete at this MRS. As shown in Table 5.1 and Figure 5.2, there are six wells located over 1 mile from the MRS boundary and one well located within the MRS.

5.3.2.4 Groundwater Sample Locations and Methods

No groundwater samples were collected at the Bostwick BT MRS during the SI. The SVT located the well near the bomb target center, but the pump handle was broken at the time of the site visit, so no sample could be collected.

5.3.2.5 Groundwater Analytical Results

Not applicable. Groundwater samples were not collected at this MRS. Shallow groundwater exposed at the surface is evaluated as a surface water pathway.

5.3.2.6 Groundwater Exposure Pathway Conclusions

No explosives were detected in the surface soil at this MRS (subchapter 5.3.4). MC metals antimony and barium were detected in the surface soil above background, so there is potential for MC to leach from the surface soil to the groundwater. Additionally, because of the shallow depth to groundwater, munitions activities could have directly affected groundwater. Because there is a well located within the MRS, the groundwater exposure pathways are considered potentially complete, but not quantitatively assessed for all receptors.

5.3.3 Surface Water and Sediment Exposure Pathways

Surface water can serve as a contaminant transport mechanism that may affect surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environmental areas such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of MC in soil at the ground surface that can be transported to surface water and sediment through runoff and erosion.

5.3.3.1 Hydrologic Setting

The hydrologic setting of the Bostwick BT site is described in subchapter 5.2.2. As shown on Figure 5.3, the Bostwick BT MRS has a large number of wetlands within its boundary, consisting of semi-permanently and temporarily flooded wetlands.

5.3.3.2 Releases and Potential Releases to Surface Water and Sediment

Due to the extensive presence of wetlands within this MRS, direct release of MC to surface water or sediment is possible at this MRS. The presence of local surface water and sediment provides a potential migration pathway through which direct releases of MC to surface water and/or sediment via munitions-related activities could occur. It is also possible that MC in surface soil could migrate to surface water and sediment via runoff and erosion.

5.3.3.3 Surface Water and Sediment Exposure Pathways and Receptors

There is surface water and sediment located within the Bostwick BT MRS. Based on the current and future land use of this MRS, potential receptors include residents, commercial or industrial workers (such as plantation employees), site visitors or recreational users, and ecological receptors. These receptors may be exposed to MC in surface water or sediment via incidental ingestion or dermal exposure. The drinking water exposure pathway is incomplete for humans, as surface water is not used as a drinking water source. However, ecological receptors could be exposed to MC in surface water through ingestion as a drinking water source.

5.3.3.4 Surface Water and Sediment Sample Locations and Methodologies

Because there is surface water and sediment present within the Bostwick BT MRS, the TPP Team agreed the collection of surface water and sediment samples was necessary. Three biased surface water/sediment sample couples (BBT-MRS01-SW-01/BBT-MRS01-SD-01, BBT-MRS01-SW-02/BBT-MRS01-SD-02, and BBT-MRS01-SW-03/BBT-MRS01-SD-03) were collected. One field duplicate surface water/sediment sample couple (BBT-MRS01-SW-05/BBT-MRS01-SD-05) was also collected from within the MRS. The samples were analyzed for explosives (Method SW8321A), antimony, barium, copper, lead, and zinc (Method SW6020). Surface water was also analyzed for perchlorate (Method SW6860).

5.3.3.5 Surface Water and Sediment Analytical Results

5.3.3.5.1 The analytical results for the surface water and sediment samples collected from the Bostwick BT MRS during the SI are presented in Table 5.3 and Table 5.4, respectively. These results were evaluated using the criteria described in Subchapter 5.2.8. No explosives were detected in the surface water or sediment samples, so this evaluation was performed for metals and perchlorate only.

5.3.3.5.2 As shown in Table 5.9, antimony, barium, copper, lead, and zinc were detected in the surface water at concentrations exceeding their respective background concentrations. Copper was detected in biased samples, but not in the ambient sample; therefore, copper is assumed to be present above background concentrations and will be retained for further consideration in the SLRA. Perchlorate was not detected above the ambient concentration and will not be considered further in the SLRA. Therefore, based on these sample results, there is potential MC contamination present in the surface water at the Bostwick BT MRS.

5.3.3.5.3. As shown in Table 5.10, only antimony and barium were detected in the sediment at concentrations exceeding their respective background concentrations. Antimony was detected in biased samples, but not in the ambient sample; therefore, antimony is assumed to be present above background concentrations and will be retained for further consideration in the SLRA. Therefore, based on these sample results, there is potential MC contamination present in the sediment at the Bostwick BT MRS.

5.3.3.6 Surface Water and Sediment Exposure Pathway Conclusions

Five MC metals (antimony, barium, copper, lead, and zinc) were detected in the surface water exceeding the background concentration and two MC metals (antimony and barium) were detected in the sediment at concentrations exceeding background. Based on these results, the surface water and sediment incidental exposure and dermal contact exposure pathways are considered complete for all present receptors. The ingestion as a drinking water exposure pathway is incomplete for humans, but is complete for ecological receptors. These analytes are retained for further consideration in the SLRA (Chapter 6).

Table 5.9
Surface Water Source Evaluation
Bostwick Bomb Target MRS
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Metals							
Antimony	µg/L	0.12 J	0.096 J	**Yes**	**Yes**	**Yes**	--
Barium	µg/L	20	4.8	**Yes**	**Yes**	**Yes**	--
Copper	µg/L	1.5 J	2.0 U	**Yes**	**Yes**	**Yes**	--
Lead	µg/L	1.1 J	0.69 J	**Yes**	**Yes**	**Yes**	--
Zinc	µg/L	11 J	2.1 J	**Yes**	**Yes**	**Yes**	--
Perchlorate							
Perchlorate	µg/L	0.016 J	0.019 J	No	**Yes**	No	Not detected above background

(1) – Background concentration as established in Table 5.6.
(2) – Potential MCs as listed in Table 4.1.
U – Analyte not detected above the adjusted PQL.
J - Analyte detected, estimated concentration.

Table 5.10
Sediment Source Evaluation
Bostwick Bomb Target MRS
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Metals							
Antimony	mg/kg	0.15 J	0.32 U	**Yes**	**Yes**	**Yes**	--
Barium	mg/kg	32	2.7	**Yes**	**Yes**	**Yes**	--
Copper	mg/kg	4.5	13	No	**Yes**	No	Not detected above background
Lead	mg/kg	8.3	162	No	**Yes**	No	Not detected above background
Zinc	mg/kg	8.4	207	No	**Yes**	No	Not detected above background

(1) – Background concentration as established in Table 5.7.
(2) – Potential MCs as listed in Table 4.1.
U – Analyte not detected above the adjusted PQL.
J - Analyte detected, estimated concentration.

5.3.4 Soil Exposure Pathway

Potential soil exposure pathways include incidental ingestion, dermal contact, and inhalation of re-suspended particulates by both human and ecological receptors, as well as leaching of constituents to groundwater and runoff and erosion to surface water and sediment. The likelihood of exposure is influenced by such factors as the mass and concentration of MC in soil exposed at the ground surface, site-specific geology, climate, and expected future land use.

5.3.4.1 Physical Source Access Conditions

The Bostwick BT MRS property is currently privately owned and used primarily as a pine tree plantation. The site is also used for surface mining for titanium metal precursors and as a hunting preserve. Much of the area is low lying with several marshy areas present. Most of the higher portions of the land are used for timber production and are covered with pine trees. There are no known significant restrictions to access.

5.3.4.2 Actual or Potential Contamination Areas

Prior to the SI, there were no known contamination areas within the Bostwick BT MRS. In 1940, the United States acquired 3,111 acres of land through lease and condemnation from Union Bag and Paper Company. This land was identified as the Bostwick BT (or the Putnam BT) and was used by the NAATC for operational training and practice dive-bombing (USACE, 1996). Munitions used on-site include 2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56-lb low drag sub-caliber), Mk-82 low drag 500-lb bomb,, 30mm projectiles, Mk-15 water/sand fill practice bomb; Mk-81 250-lb low drag bomb, and Mk-5 miniature practice bomb. The most likely location for contamination is considered to be the target center. Although, the 1995 ASR site visit team did not observe any MEC the team observed MD in the form of pieces from miniature practice bombs, an expended fuze believed to have been from a 2.25 inch SCAR as well as debrisI in the form of aluminum skin from a rocket pod..

5.3.4.3 Soil Exposure Pathways and Receptors

The soil exposure pathway accounts for the potential threat to human and ecological receptors on or near the Bostwick BT MRS who may be exposed to contamination in soil. Based on the known current and future uses of the land, the potential receptors at this MRS would include residents (based on census data), commercial workers (such as plantation employees), site visitors or recreational users, and ecological receptors. These receptors may be exposed to MC via dermal contact, incidental ingestion, or inhalation of re-suspended particulate matter.

5.3.4.4 Soil Sample Locations and Methods

During the December 17, 2008, TPP meeting, the TPP Team agreed to establish the sample scheme for the Bostwick BT MRS with eight biased surface soil sample locations (BBT-MRS01-SS-02-01, FMBGR-MRS01-SS-02-02, FMBGR-MRS01-SS-02-03, BBT-MRS01-SS-02-05, BBT-MRS01-SS-02-06, BBT-MRS01-SS-02-07, BBT-MRS01-SS-02-08, BBT-MRS01-SS-02-09) plus QC samples and one field duplicate (BBT-MRS01-

SS-02-10) to be collected within the central area of the former target. Sample BBT-MRS01-SS-02-11 was originally proposed as a surface water/sediment sample couple (BBT-MRS01-SW/SD-04), but the location was not wet at the time of the site visit so the sample was collected as a soil sample, bringing the total number of biased soil samples to nine. The soil samples were analyzed for explosives (Method SW8321A), antimony, barium, copper, lead, and zinc (SW6020). Figure 5.1 shows the actual QR paths and sample locations for this MRS.

5.3.4.5 Soil Analytical Results

5.3.4.5.1 The analytical results for the surface soil samples collected from the Bostwick BT MRS during the SI are presented in Table 5.5. These results were evaluated using the criteria described in Subchapter 5.2.8. No explosives were detected in the surface soil samples, so this evaluation was performed for metals only.

5.3.4.5.2 As shown in Table 5.11, the MC metals antimony and barium were detected in the surface soil samples at concentrations exceeding the selected background concentrations. Therefore, based on these sample results, there is potential MC contamination present in the surface soil at the Bostwick BT MRS.

5.3.4.6 Soil Exposure Pathway Conclusions

The surface soil exposure pathways are complete for all receptors at the Bostwick BT MRS. Explosives were not detected in the surface soil samples collected from this MRS. The MC metals antimony and barium were detected in the surface soil samples at concentrations exceeding the selected background values. Based on these results, the surface soil exposure pathways are complete for all receptors present. Antimony and barium will be retained for further consideration in the SLRA in Chapter 6.

Table 5.11
Soil Source Evaluation
Bostwick Bomb Target MRS
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary reason for exclusion from SLRA
Metals							
Antimony	mg/kg	0.20 J	0.27 U	**Yes**	**Yes**	**Yes**	--
Barium	mg/kg	12	1.1	**Yes**	**Yes**	**Yes**	--
Copper	mg/kg	6.8	13	No	**Yes**	No	Not detected above background
Lead	mg/kg	20	162	No	**Yes**	No	Not detected above background
Zinc	mg/kg	7.6	207	No	**Yes**	No	Not detected above background

(1) – Background concentration as established in Table 5.8.
(2) – Potential MCs as listed in Table 4.1.
J - Analyte detected, estimated concentration.
U – Analyte not detected above the adjusted PQL.

5.3.5 Air Exposure Pathway

The air exposure pathway accounts for hazardous substance exposure in gaseous or particulate form through the air. Inhalation of a contaminant can be a potential exposure pathway for human and ecological receptors. No air sampling has been performed at this site, and the TPP Team agreed that air sampling would not be performed as part of this SI.

5.3.5.1 Climate

The climate at the site is described in subchapter 2.2.3.

5.3.5.2 Releases and Potential Releases to Air

There are no known direct releases of MC to air at Bostwick BT MRS. However, the occurrence of windblown dust may occur at the site, so MC contamination could migrate from soil to air.

5.3.5.3 Air Exposure Pathway and Receptors

Because there are no known volatile MC associated with the munitions used at the site, the only remaining air exposure pathway would be via the inhalation of fugitive dust. Based on the known uses of the land, the potential receptors at the Bostwick BT MRS would include residents, commercial workers (such as plantation employees), site visitors or recreational users, and ecological receptors. These receptors could be exposed to MC in air through inhalation of fugitive dust.

5.3.5.4 Air Sample/Monitoring Locations and Methods

No air sampling is known to have been previously performed at the Bostwick BT MRS and the TPP Team agreed that air sampling would not be conducted as part of this SI.

5.3.5.5 Air Analytical Results

Not applicable.

5.3.5.6 Air Exposure Pathway Conclusions

Based on the current information available for the site, the air exposure pathway is complete for all receptors at the Bostwick BT MRS. As discussed in subchapter 5.3.4, explosives were not detected in the soil samples collected from the Bostwick BT MRS. However, the MC metals antimony and barium were detected above background concentrations and; therefore, based on the analytical results presented in this report; there is potential MC contamination in the surface soil. Consequently, there is potential for a receptor's windblown exposure to contaminated particulates.

Figure 5.1

Qualitative Reconnaissance and Sample Locations Bostwick Bomb Target FUDS Project No. I04FL091401

Putnam County, Florida

Legend

- Ambient Soil Sample Location
- Ambient Surface Water/Sediment Sample Location
- Soil Sample Location
- Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS

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

1 0.5 0 1 Kilometers

N

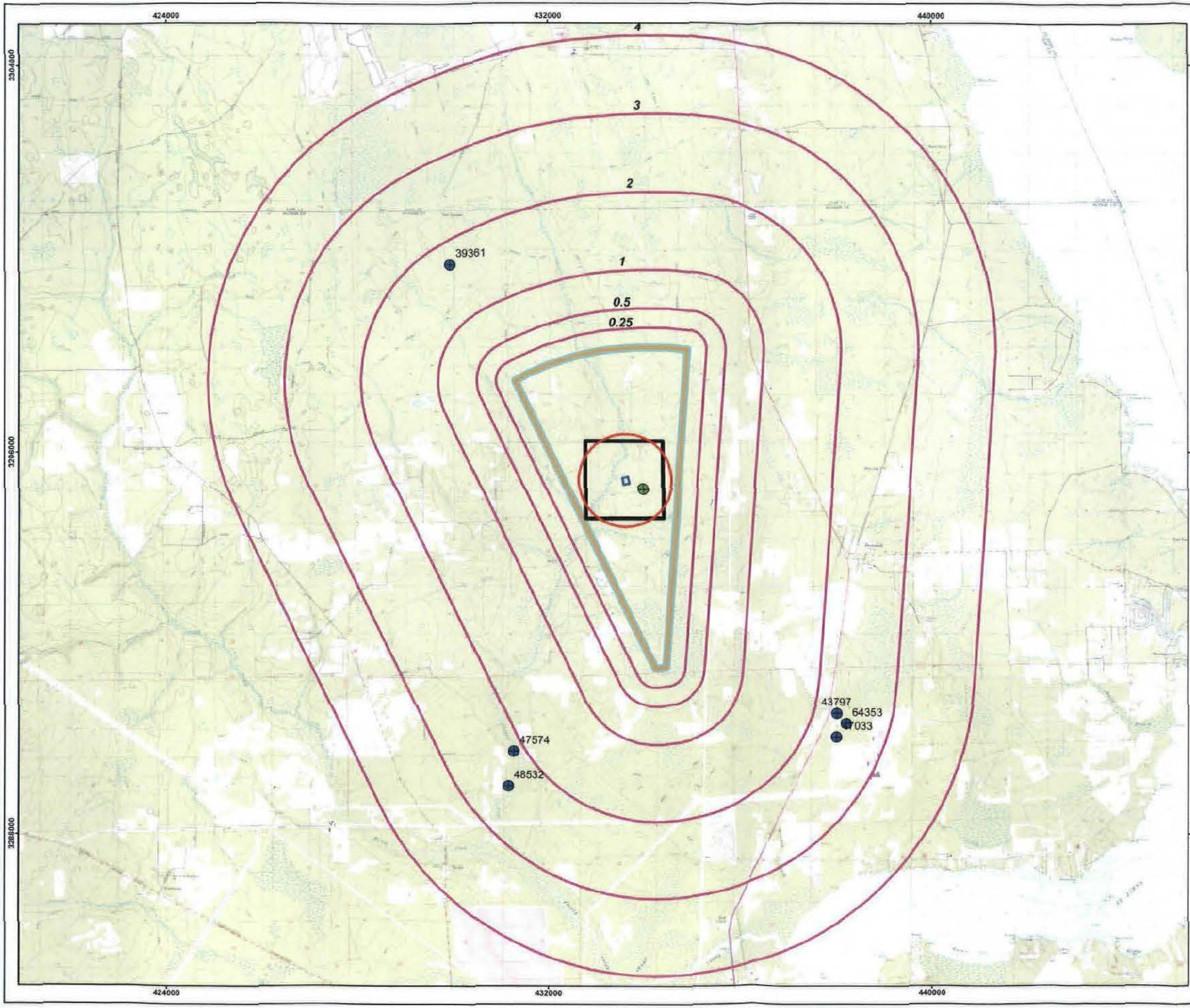
PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Qualitative Reconnaissance and Sample Locations		
DRAWN BY: BT			
CHECKED BY: JU	SCALE: As Shown	PROJECT NUMBER: 744647.84115	
SUBMITTED BY: DS	DATE: October 2009	PAGE NUMBER: 5-27	
	FILE: X:\GIS\Site_Inspections_ne\Maps\bostwick_FL\Fig5_1.mxd		

Figure 5.2

Water Wells within 4-Mile Buffer
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida



Legend

- Well identified by SVT
- Drinking Water Well Location
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS
- Buffer (Mile)

Image Source: USGS 7.5' Topo Quadrangles, Date Unknown
Projection: UTM Zone 17 NAD83, Map Units in Meters

2 1 0 2 Kilometers

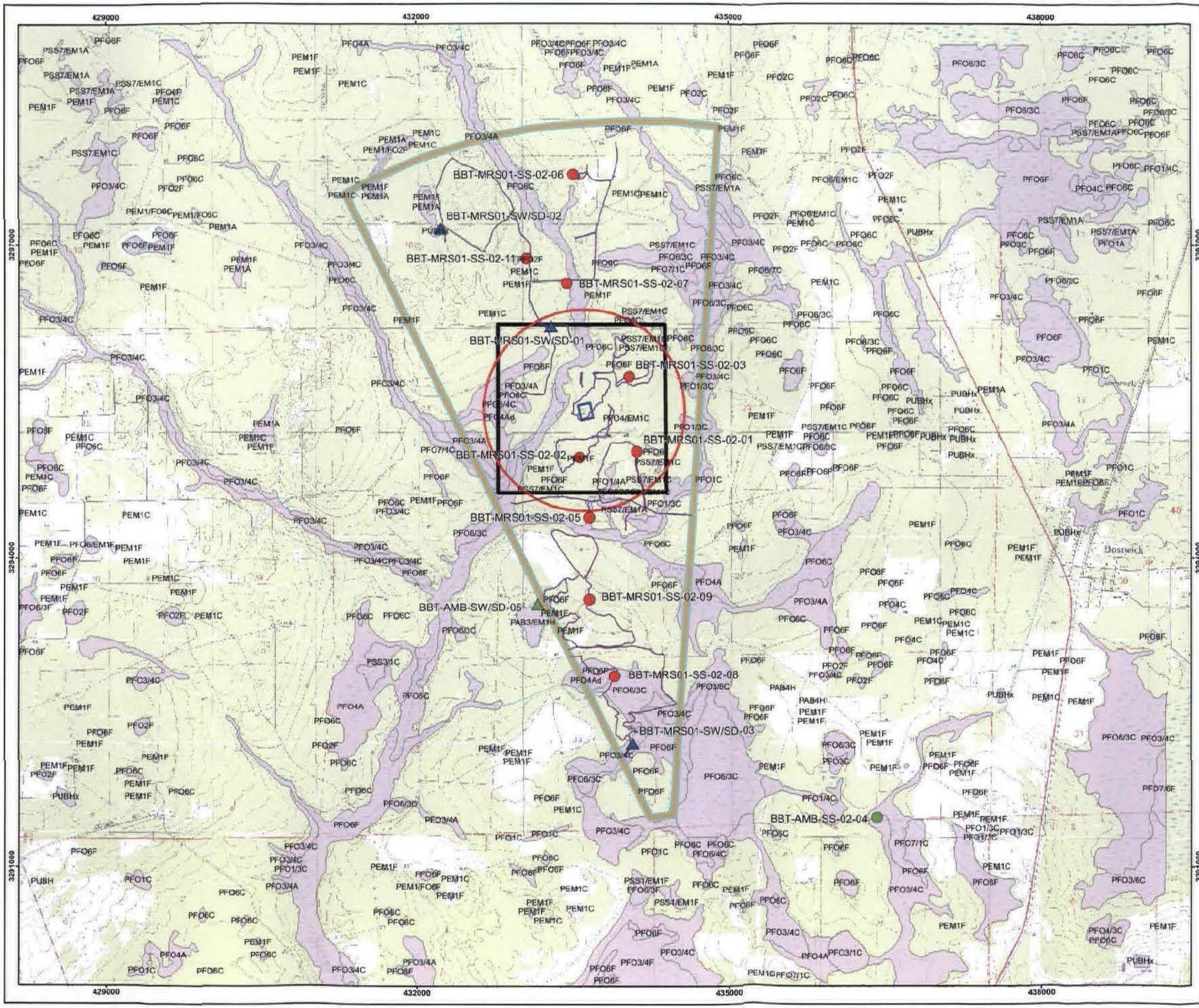
N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY: BT	Water Wells within 4-Mile Buffer
DRAWN BY: BT	
CHECKED BY: JU	SCALE: As Shown — PROJECT NUMBER: 744647.84115
SUBMITTED BY: DS	DATE: October 2009 — PAGE NUMBER: 5-28
	FILE: X:\GIS\Site_inspections_ne\Maps\bostwick_FL\Fig5_2.mxd

Figure 5.3

Wetlands
Bostwick Bomb Target
FUDS Project No. I04FL091401

Putnam County, Florida



Legend

- Ambient Soil Sample Location
- Ambient Surface Water/Sediment Sample Location
- Soil Sample Location
- Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Approximate FUDS Boundary
- Bombing Range
- Multiple/Combined Use Range
- Rocket Air-To-Ground Gunnery Range
- Bostwick Bomb Target MRS
- Wetland (Obtained from U.S. Fish & Wildlife Service)

Predominant Wetland Types:

PFO6F - Palustrine, forested, deciduous, semi-permanently flooded
PEM1F - Palustrine, persistent, semi-permanently flooded
PSS7/EM1A - Palustrine, scrub-shrub, evergreen/emergent, persistent, temporarily flooded

Site Location in Florida

Image Source: USGS 7.5' Topo Quadrangles, Date Unknown
Projection: UTM Zone 17 NAD83, Map Units in Meters

1 0.5 0 1 Kilometers

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Wetlands		
DRAWN BY: BT			
CHECKED BY: JU	SCALE: As Shown	PROJECT NUMBER: 744647.84115	
SUBMITTED BY: DS	DATE: October 2009	PAGE NUMBER: 5-29	
	FILE: X:\GIS\Site_inspections_ne\Maps\bostwick_FL\Fig5_3.mxd		

CHAPTER 6

SCREENING-LEVEL RISK ASSESSMENT

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT

6.1.1 Conceptual Site Model

The CSM for Bostwick BT, included in Appendix J, summarizes conditions at the site that could result in human exposure to MEC. It describes the types of MEC potentially present in each MRS, past MEC and MD findings, and current and projected future land use and receptors.

6.1.2 Introduction

6.1.2.1 A qualitative risk evaluation was conducted to assess the potential explosive safety risk to the public at the Bostwick BT. The purpose of this risk evaluation is to qualitatively communicate whether a potential risk is present at the site and the primary causes of that potential risk. The risk evaluation presented here is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR.

6.1.2.2 An explosive safety risk exists if a person can come near or into contact with a MEC item and interact with it in a manner that results in a detonation. The potential for an explosive safety risk depends on the presence of three critical elements:

- a source (*such as,* presence of MEC), AND
- a human receptor (*such as,* a person), AND
- the potential for interaction between the source and receptor (such as, the possibility the item might be picked up or disturbed by the receptor).

6.1.2.3 All three of these elements must be present for there to be an explosive safety risk. There is no risk if any one element is missing. Each of these three elements provides a basis for implementing effective risk-management response actions.

6.1.3 Qualitative Risk Evaluation

6.1.3.1 The potential risk posed by MEC was characterized qualitatively by evaluating three primary risk factors for the MRS at the site. These factors are related to the three critical elements listed above and are:

1) MEC Presence: whether there is the potential for MEC to be present at the MRS;

2) MEC Type: the type(s) of MEC that might be present at the MRS and the related potential explosive hazards; and

3) Site Accessibility: the potential receptors at the MRS and how they might interact with the MEC.

6.1.3.2 The known or suspected presence of an explosive hazard and any potential human receptors at an MRS will typically be considered sufficient justification for RI/FS. The following paragraphs describe each of the primary risk factors.

6.1.3.3 **MEC Presence**: this factor describes whether MEC either has been confirmed or is suspected to be present at the MRS, either at the surface or in the subsurface, and is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR. Note that if there is historical evidence of potential MEC presence at a site, lack of confirmation of MEC presence during the SI QR will not be considered as evidence of MEC absence for this qualitative risk evaluation. Table 6.1 lists the three possible categories used to describe MEC Presence for this evaluation.

Table 6.1
Categories of MEC Presence

MEC Presence	Description
Confirmed or suspected	There is physical or confirmed historical evidence of MEC presence at the MRS, or there is physical or historical evidence indicating that MEC may be present at the MRS.
Small arms only(1)	The presence of small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Evidence of no munitions	Following investigation of the MRS, there is physical or historical evidence that there are no UXO or discarded military munitions (DMM) present.

(1) Small arms ammunition is defined as "ammunition, without projectiles that contain explosives (other than tracers), that is .50-caliber or smaller or for shotguns" (Department of the Army, 2005).

6.1.3.4 **MEC Type**: this factor describes whether the MEC potentially present at the MRS might be detonated, resulting in injury to one or more human receptors. If multiple MEC items are potentially present at an MRS, the item that poses the greatest risk to public health is selected for purposes of this qualitative risk evaluation. This

determination is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR. Table 6.2 lists the three possible categories used to describe MEC Type for this evaluation.

Table 6.2
Categories of MEC Type

MEC Type	Description
Potentially Hazardous	Fuzed or unfuzed MEC that may result in physical injury to an individual if detonated by an individual's activities.
Small arms only(1)	Small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Inert	Munitions debris or other items that will cause no injury (for example, training ordnance containing no explosives, fuzes, spotting charges, etc.).

(1) Small arms ammunition is defined as "ammunition, without projectiles that contain explosives (other than tracers), that is .50-caliber or smaller or for shotguns" (Department of the Army, 2005).

6.1.3.5 **Site Accessibility**: this factor describes whether human receptors have any access to the MRS and, therefore, may interact with any MEC present at the surface or in the subsurface. For purposes of this qualitative risk evaluation, if MEC is confirmed or suspected to be present at the MRS, it is assumed that human receptors might come into contact with that MEC unless there is "Complete Restriction to Access." A description of the potential receptors will also be given with this assessment. Table 6.3 lists the two possible categories used to describe Site Accessibility for this evaluation.

Table 6.3
Categories of Site Accessibility

Site Accessibility	Description
Accessible	Access control is not complete: residents, site workers, visitors, or trespassers can gain access to all or part of the MRS.
Complete restriction to access	Human receptors are completely prevented from gaining access to the MRS.

6.1.3.6 With regard to this qualitative risk evaluation, further evaluation (such as, RI/FS) for the MRS will typically be justified if the following conditions are true:

- MEC is confirmed or suspected to be present, AND
- The MEC confirmed or suspected to be present is potentially hazardous, AND
- The MRS is accessible.

6.1.3.7 The primary risk factors identified above were evaluated for each MRS at Bostwick BT using data collected during the SI field investigation and the historical data available from other studies. The following sections discuss the qualitative risk evaluation by each primary risk factor to determine whether or not further evaluation is justified at each MRS.

6.1.4 Munitions and Explosives of Concern Risk Assessment – Bostwick BT MRS

6.1.4.1 MD (parts from a Mk76 practice bomb, half of a AN-Mk 43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket) and potential UXO (a Mk76 25 lb. practice bomb, one AN-Mk23 3 lb. practice bomb with a Mk4 signal, one Mk76, Mod 0 or 1, with a signal of unknown type, one 2.75-inch HE rocket warhead and a possible fuze of unknown type). were found during the July 2009 SI. MD was observed during the 1995 ASR site visit (USACE, 1996). Based on this information, the presence of MEC at the Bostwick BT MRS is assessed to be "Confirmed or suspected."

2.25-inch practice rocket

6.1.4.2 Based on the INPR, ASR, ASR Supplement, reported findings, visual observations, and other sources, the munitions known or suspected to have been disposed of within the Bostwick BT MRS are 2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), 30mm projectiles, Mk-15 water/sand fill practice bomb, and Mk-5 miniature practice bomb. Mk-81 250 lb. low drag bomb and Mk-82 500 lb. low drag bomb are also indicated; however, the available data does not specify whether these are general purpose or practice bombs. All of these munitions may contain explosives, and might present a residual explosive hazard if they remain at the site intact. Based on this information, the MEC Type at the Bostwick BT MRS is assessed to be "Potentially Hazardous".

6.1.4.3 The Bostwick BT MRS consists of 3,111 acres and is used primarily as a pine tree plantation. Other uses are surface mining for titanium metal precursors and as a private hunting preserve. The land use is not expected to change. Potential human receptors within the MRS would include residents (based on census data), commercial workers (for example, plantation employees), site visitors, and recreational users. Based on this information, the Site Accessibility at the Bostwick BT MRS is considered" Accessible".

6.1.5 Risk Summary

6.1.5.1 The qualitative MEC risk evaluation for the Bostwick BT is summarized in Table 6.4.

Table 6.4
MEC Risk Evaluation
Bostwick BT
Putnam County, Florida

MRS	MEC Presence	MEC Type[1]		Site Accessibility	Further Evaluation?
Bostwick BT MRS	Confirmed or suspected	2.75-inch HE rocket warhead	Potentially Hazardous	Accessible	YES

[1] Where multiple MEC items were used at an MRS, only the item which poses the greatest risk to public health is listed for purposes of this risk assessment.

6.1.5.2 Based on this qualitative MEC risk evaluation, there is the possibility that human receptors might come into contact with explosively hazardous MEC at the Bostwick BT MRS. Therefore, there is the potential for an explosive safety risk at this MRS.

6.2 MUNITIONS CONSTITUENT HUMAN HEALTH SCREENING LEVEL RISK ASSESSMENT

6.2.1 Conceptual Site Model

Based on the current and future land use, potential human receptors for the Bostwick BT MRS associated with the former Bostwick BT FUDS include residents (based on census data), commercial or industrial workers (such as plantation employees), and site visitors or recreational users. A large portion of the land within the MRS consists of wetlands. Receptors may be exposed to MC through direct contact with soil (incidental ingestion, dermal contact, and inhalation of fugitive dust) or surface water and sediment (incidental ingestion and dermal contact). There is one known groundwater well within the MRS that was not operational at the time of the site visit. Groundwater at the ground surface is evaluated as a surface water exposure pathway. The MC CSEM for the MRS (Appendix J) identifies affected media, transport mechanism, exposure routes, and potential receptors.

6.2.2 Affected Media

Direct release of MC from munitions activities within the MRS would be primarily to surface soil. Due to the extensive presence of wetlands throughout the MRS, direct releases to the wetlands surface water and sediment may have occurred from munitions activities. Based on the shallow depth of the surficial aquifer in Putnam County (1 – 40 feet bgs [USGS, 2009]), the munitions used at this target and the sandy soil, groundwater could also have been directly affected by bombing activities. If releases of MC to surface soil occur, MC could migrate to surface water and sediment through runoff and erosion or to groundwater through leaching. MC in the surface soil can also become airborne in fugitive dust. If releases of MC to surface water occur, MC could migrate to the groundwater via recharge. Based on decisions made at the TPP meeting, surface soil, surface water, and sediment samples were collected during the SI field effort at the

Bostwick BT. Groundwater was originally proposed for sampling, but the well pump handle was broken at the time of the SI, so no groundwater sample could be collected. Air was not sampled at this site.

6.2.3 Screening Levels

6.2.3.1 The human health screening levels for surface water, sediment, and surface soil were selected by the TPP Team for the Bostwick BT and were identified in the SS-WP Addendum. The human health risk screening levels used here for surface water include the more stringent of: USEPA RSLs for Chemical Contaminants at Superfund Sites for Tap Water (May 19, 2009) and 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 waters). As a human health screening value for lead in surface water was not available from the primary sources, the value provided in the USEPA Maximum Contaminant Levels (MCLs), National Primary Drinking Water Standards, 2006 (http://www.epa.gov/safewater/contaminants/index.html) was used. The perchlorate screening value is the DOD PRG, Perchlorate Release Management Policy, April 22, 2009. The screening levels used are noted in the SLRA tables below.

6.2.3.2 The human health risk screening levels used here for soil and sediment include the more stringent of: USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil (May 19, 2009) and FDEP FAC 62-777 Soil Cleanup Target Levels, Direct Exposure Residential, Leachability based on Freshwater Surface Water Criteria, or Leachability based on Groundwater Criteria. The screening levels used are noted in the SLRA tables.

6.2.4 Risk Characterization

6.2.4.1 As discussed in Subchapter 5.2.8, the MC source evaluation is used to determine which analytes are retained for consideration in a SLRA. Only those analytes retained for further consideration in the SLRA following the source evaluation are evaluated in this chapter.

6.2.4.2 To complete the risk characterization at the Bostwick BT MRS, the maximum detected concentrations of each analyte that exceeded the selected background concentration for surface water, sediment, and surface soil were retained for consideration in the SLRA (Tables 5.9 through 5.11). These maximum detected concentrations were compared to the screening values selected during the TPP and SS-WP Addendum process described above. For an analyte to be considered as a possible health concern related to a release from munitions activities at the Bostwick BT, the analyte needs to be present in a concentration above the selected human health screening value. The following subchapters evaluate the MRS at the former Bostwick BT and any potential effects on human health.

6.2.5 Bostwick BT Munitions Response Site

6.2.5.1 The groundwater, surface soil, surface water, sediment, and air exposure pathways were determined to be complete for all receptors present at the Bostwick BT MRS (subchapters 5.3.2, 5.3.4, and 5.3.5).

6.2.5.2 Surface Water. Antimony, barium, copper, lead, and zinc in surface water were retained for further evaluation in the SLRA (Table 5.9). All of these analytes were detected at concentrations *less than* their respective human health screening values (Table 6.5). Based on the analysis of MC samples collected, ***an unacceptable human health risk is not expected from exposure to MC in surface water at this MRS.***

Table 6.5
Bostwick BT MRS
Surface Water Screening Level Human Health Risk Assessment
Bostwick BT, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Site Specific Human Health Screening Values		Exceeds Screening Level?
Metals					
Antimony	µg/L	0.12 J	5.5	(1)	No
Barium	µg/L	20	1,000	(1)	No
Copper	µg/L	1.5 J	1,500	(2)	No
Lead	µg/L	1.1 J	15	(3)	No
Zinc	µg/L	11 J	11,000	(2)	No

J – Analyte detected, estimated concentration.
(1) More stringent of Florida Administrative Code (FAC) 62-777, cleanup target levels for freshwater surface water, February 2005 (http://www.dep.state.fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf) and FAC 62-302 Criteria for Surface Water Quality Classifications, July 1, 2008 (http://www.dep.state.fl.us/water/wqssp/docs/tr_review/62-302_530-draft-table.pdf).
(2) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, updated May 19, 2009 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_APRIL2009.pdf).
(3) USEPA Maximum Contaminant Level (MCL), National Primary Drinking Water Standard, 2006 (http://www.epa.gov/safewater/contaminants/index.html).

6.2.5.3 Sediment. Antimony and barium in sediment were retained for further evaluation in the SLRA (Table 5.10). Both of these analytes were detected at concentrations *less than* their respective human health screening values (Table 6.6). Based on the analysis of MC samples collected, ***an unacceptable human health risk is not expected from exposure to MC in sediment at this MRS.***

Table 6.6
Bostwick BT MRS
Sediment Screening Level Human Health Risk Assessment
Bostwick BT, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Site Specific Human Health Screening Values		Exceeds Screening Level?
Metal					
Antimony	mg/kg	0.15 J	5.4	(1)	No
Barium	mg/kg	32	120	(1)	No

J – Analyte detected, estimated concentration.
(1) – Florida Administrative Code 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, Leachability Based on Freshwater Surface Water Criteria, and Leachability Based on Groundwater Criteria, February 2005
(http://www.dep.state.fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf)

6.2.5.4 Soil. Antimony and barium were retained for evaluation in the SLRA (Tables 5.11). Both of these analytes were detected at concentrations *less than* their respective human health screening values (Table 6.7). Based on the analysis of MC samples collected, ***an unacceptable human health risk is not expected from exposure to MC in surface soil at this MRS***.

Table 6.7
Bostwick BT MRS
Soil Screening Level Human Health Risk Assessment
Bostwick BT, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Site Specific Human Health Screening Values		Exceeds Screening Level?
Metal					
Antimony	mg/kg	0.20 J	5.4	(1)	No
Barium	mg/kg	12	120	(1)	No

J – Analyte detected, estimated concentration.
(1) – Florida Administrative Code 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, Leachability Based on Freshwater Surface Water Criteria, and Leachability Based on Groundwater Criteria, February 2005
(http://www.dep.state.fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf)

6.2.5.5 Groundwater. Groundwater is a potentially complete human exposure pathway at this MRS, but was not quantitatively assessed. Several MC metals in surface soil, surface water, and sediment exceeded their background values and could potentially

leach into groundwater. In addition, based on the presence of shallow groundwater, it is possible that MC could have been directly released to groundwater at the MRS.

6.2.6 Discussion

6.2.6.1 The surface soil, surface water, sediment, and air exposure pathways were determined to be complete for all receptors present at the Bostwick BT MRS. None of the human health screening values for surface water, sediment, or surface soil were exceeded for the retained analytes for this MRS (Tables 6.5 through 6.7). The air exposure pathway is included in the soil exposure pathway analysis. Therefore, based on the analytical results presented in this report, an unacceptable human health risk is not expected from exposure to MC in surface soil, surface water, or sediment at the Bostwick BT MRS.

6.2.6.2 Groundwater is a potentially complete human exposure pathway at this MRS, but was not quantitatively assessed. Based on the presence of shallow groundwater, it is possible that MC could have been directly released to groundwater at the MRS. Several MC metals in surface soil, surface water, and sediment exceeded their background values and could potentially leach into groundwater. However, none of those analytes in surface soil or sediment exceeded their screening values based on leachability to groundwater.

6.3 MUNITIONS CONSTITUENT SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Based on the information presented in Subchapter 5.2.5, the Bostwick BT MRS is classified as an important ecological place. This classification is made due to the presence of wetlands and the possibility of habitat known to support T&E species within the MRS boundary. This is based on a review of the Army Checklist for Important Ecological Places (USACE, 2006). Therefore, ecological receptors are potential receptors for exposure pathways at this site.

6.3.1 Conceptual Site Model

Because the site is considered an important ecological place, exposure of wildlife to MC could occur through direct exposure to contaminated soil as well as through ingestion of biota that have been exposed to MC. Further, wildlife may be exposed to MC through direct exposure to contaminated surface water and sediment. In general, ecological receptors do not have access to groundwater, so that is not considered a complete exposure pathway. The MC CSEM identifies affected media, transport mechanisms, exposure routes, and potential receptors and is included in Appendix J.

6.3.2 Affected Media

Direct release of MC from munitions activities within the MRS would be primarily to surface soil. Due to the extensive presence of wetlands throughout the MRS, direct releases to the wetlands surface water and sediment may have occurred from munitions

activities. Based on the shallow depth of the surficial aquifer in Putnam County (1 – 40 feet bgs [USGS, 2009]), the munitions used at this target, and the sandy soil, groundwater could also have been directly affected by bombing activities. If releases of MC to surface soil as a result of munitions-related activities occur, MC could migrate to surface water and sediment through runoff and erosion or to groundwater through leaching. MC in the surface soil can also become airborne in fugitive dust. If releases of MC to surface water occur, MC could migrate to the groundwater via recharge. However, groundwater is not directly accessible to most ecological receptors and is not evaluated in this section. Based on decisions made at the TPP meeting, surface soil, surface water, and sediment samples were collected during the SI field effort at the Bostwick BT. Groundwater was originally proposed for sampling, but the well pump handle was broken at the time of the SI, so no groundwater sample could be collected. Air was not sampled at this site.

6.3.3 Screening Levels

6.3.3.1 The TPP Team for the Bostwick BT SI identified the ecological screening values for surface soil, surface water, and sediment in the SS-WP Addendum. The ecological screening values for surface soils consist of USEPA Region 4 Ecological Screening Values (ESVs) for soil supplemented with ecological screening values obtained from sources identified in the 2005 PSAP. The screening levels used are noted in the Screening Level Ecological Risk Assessment (SLERA) tables.

6.3.3.2 The ecological screening values for sediment consist of the more stringent of: FDEP Sediment Quality Assessment Guidelines, January 2003 and USEPA Region 4 ESVs for Sediment, supplemented with ecological screening values obtained from sources identified in the 2005 PSAP, updated with most current values. The screening levels used are noted in the SLERA tables.

6.3.3.3 The ecological screening values for surface water consist of the more stringent of: FAC 62-302 Surface Water Quality Standards (for Class III waters) and USEPA Region 4 ESVs for Freshwater Surface Water, supplemented with ecological screening values obtained from sources identified in the 2005 PSAP, updated with most current values. The perchlorate screening value is the DOD PRG, Perchlorate Release Management Policy, April 22, 2009. The screening levels used are noted in the SLERA tables below.

6.3.3.4 The ESVs are based on a number of conservative assumptions, including assumptions about the types of receptors present (e.g., insectivores, terrestrial mammals, etc.) and assumptions about exposure parameters such as soil ingestion rate and receptor range. Site-specific information was not used to develop these screening values. The use of site-specific information typically results in less conservative and higher screening values.

6.3.4 Ecological Risk Characterization

Subchapter 5.2.8 describes how the sample data for the MRS associated with the Bostwick BT were evaluated to determine whether analytes were present above

background concentrations. Only those analytes retained for consideration in the SLERA following the source evaluation are evaluated in this chapter. To complete the ecological risk characterization for this site, the maximum detected concentration of each selected retained analyte was evaluated against the agreed upon screening levels (Subchapter 6.3.3). This comparison resulted in the calculation of a Hazard Quotient (HQ) for each analyte. The HQ was calculated by determining the ratio of the maximum detected site concentration to the screening value. If the HQ is equal to or less than one, the potential for ecological risk for that receptor group is considered to be negligible. If the HQ is greater than one, then there is reason to believe that ecological risks are possible.

6.3.5 Bostwick Bomb Target Munitions Response Site

6.3.5.1 The surface soil, surface water, and sediment exposure pathways were determined to be complete for all ecological receptors present at the Bostwick BT MRS (subchapter 5.3.4).

6.3.5.2 Surface Water. Antimony, barium, copper, lead, and zinc were detected in surface water and were retained for evaluation in the SLERA (Table 5.9). As shown in Table 6.8, all of these analytes were detected at concentrations ***less than*** their respective ecological screening values. The resulting HQ values are less than one. Therefore, based on the analytical results presented in this report, ***an unacceptable ecological risk due to exposure of MC in surface water is not expected at the Bostwick BT MRS***.

Table 6.8
Bostwick Bomb Target MRS
Surface Water Screening Level Ecological Risk Assessment
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Ecological Receptors	
			Ecological Screening Values Surface Water (1)	HQ
Metals				
Antimony	µg/L	0.12 J	160	≤1
Barium	µg/L	20	1000 (2)	≤1
Copper	µg/L	1.5 J	6.5	≤1
Lead	µg/L	1.1 J	1.3	≤1
Zinc	µg/L	11 J	59	≤1

J – Analyte detected, estimated concentration.
(1) USEPA Region 4 Ecological Screening Values for Fresh Surface Water, updated November 30, 2001 (http://www.epa.gov/Region4/waste/ots/ecolbul.htm#tbl1).
(2) No ESV available from primary source. Used San Francisco Bay Regional Water Quality Control Board, Final Surface Water Screening Level, May 2008 (http://www.waterboards.ca.gov/sanfranciscobay/water_issues/available_documents/ESL_May_2008.pdf).

6.3.5.3 Sediment. In sediment, antimony and barium were retained for evaluation in the SLERA (Tables 5.10). As shown in Table 6.9, antimony was detected at a concentration ***less than*** the respective ecological screening values with a resulting HQ value less than one. Barium slightly exceeded its ecological screening value with a

resulting HQ value of 1.6. Therefore, based on the analytical results presented in this report, ***an unacceptable ecological risk due to exposure of MC in sediment is possible at the Bostwick BT MRS***.

Table 6.9
Bostwick Bomb Target MRS
Sediment Screening Level Ecological Risk Assessment
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Ecological Receptors: Sediment Ecological Screening Values (1)	HQ
Metals				
Antimony	mg/kg	0.15 J	12 (1)	≤1
Barium	mg/kg	32	20 (2)	1.6

J – Analyte detected, estimated concentration.
(1) USEPA Region 4 Ecological Screening Values for Sediment, updated November 30, 2001 (http://www.epa.gov/Region4/waste/ots/ecolbul.htm#tbl3).
(2) FDEP Sediment Quality Assessment Guidelines, January 2003. TEC for sediment-dwelling organisms (Table 5.1) (http://www.dep.state.fl.us/water/monitoring/docs/seds/SQAGs_for_Florida_Inland_Waters_01_03.PDF).

6.3.5.4 Soil. Antimony and barium were detected in soil and were retained for evaluation in the SLERA (Table 5.11). As shown in Table 6.10, these analytes were detected at concentrations ***less than*** their respective ecological screening values. The resulting HQ values are less than one. Therefore, based on the analytical results presented in this report, ***an unacceptable ecological risk due to exposure of MC in soil is not expected at the Bostwick BT MRS***.

Table 6.10
Bostwick Bomb Target MRS
Soil Screening Level Ecological Risk Assessment
Bostwick Bomb Target, Putnam County, Florida

Analyte	Units	Maximum Detected Site Concentration	Ecological Receptors: USEPA Region 4 Soil Ecological Screening Values (1)	HQ
Metals				
Antimony	mg/kg	0.20 J	3.5	≤1
Barium	mg/kg	12	165	≤1

J – Analyte detected, estimated concentration.
(1) USEPA Region 4 Ecological Screening Values for Soil, updated November 30, 2001 (http://www.epa.gov/region04/waste/ots/epatab4.pdf).

6.3.6 Discussion

None of the ecological screening values for surface water or surface soil were exceeded for the retained analytes for the Bostwick BT MRS (Tables 6.8 through 6.10). Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to exposure to MC in surface water or surface soil is not expected at this MRS. In sediment, barium slightly exceeded its ecological screening value with a resulting HQ value of 1.6. Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to exposure to MC in sediment is possible at the Bostwick BT MRS.

CHAPTER 7
SUMMARY AND CONCLUSIONS

7.1 SUMMARY

7.1.1 The Bostwick BT MRS at the Bostwick BT FUDS in Putnam County, Florida, was identified and evaluated to determine if historic military training use had affected the FUDS and subsequently presented a potential to cause significant contamination to the environment or adversely affect human and ecological receptors. The evaluation included the collection of three biased surface water/sediment sample couples (plus one ambient surface water/sediment sample couple) and nine biased surface soil samples (plus one ambient soil sample) as well as the completion of approximately 20 miles of QR within the MRS during July 6 through 10, 2009.

7.1.2 The Bostwick BT was used by the NAATC for operational training and practice dive-bombing from 1940 through December 1977. Bostwick BT is currently primarily used as a pine tree plantation, growing pine trees for the pulp and paper industry. The site is also used for surface mining for titanium metal precursors and as a hunting preserve. There are currently some restrictions such as gates and fences to accessing the site. However, hunters and mining industry employees are routinely within the MRS.

7.1.3 During the site visit conducted from July 6 through 10, 2009, the SVT completed approximately 20 miles of QR. ***Several potential MEC and MD items were identified during the SI.*** The potential MEC items found included Mk76 25 lb. practice bomb, one AN-Mk23 3 lb. practice bomb with a Mk4 signal, one Mk76, Mod 0 or 1, with a signal of unknown type, one 2.75-inch HE rocket warhead and a possible fuze of unknown type. MD found included a M38A2 100 lb. practice bomb debris, parts from a Mk76 practice bomb, half of a AN-Mk 43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket.

7.1.4 The following paragraphs summarize the MC sampling results for the MRS. All surface soil samples and biased surface water/sediment sample couples collected were analyzed for explosives and indicator metals (antimony, barium, copper, lead, and zinc). The ambient surface water/sediment sample couple was analyzed for indicator metals. Both the ambient and biased surface water samples collected were also analyzed for perchlorate. The USGS derived background concentrations for Putnam County and the ambient soil, sediment, and surface water sample results were used for comparison to the biased sample results.

7.1.5 *Bostwick BT MRS*: Three surface water/sediment sample couples (and one duplicate surface water/sediment sample couple), and nine biased surface soil samples (and one duplicate soil sample) were collected from the Bostwick BT MRS. One

ambient surface water/sediment sample couple and one ambient surface soil sample were collected. Explosive compounds were not detected in any of the samples. MC metals (antimony and barium) were detected in the surface soil samples at concentrations that exceeded the selected background values, but neither of them exceeded their human health or ecological screening values. In surface water, antimony, barium, copper, lead, and zinc were detected at a concentration greater than the background concentration, but each was less than the human health and ecological screening values. Antimony and barium were detected in the sediment samples at concentrations that exceeded the selected background values, but neither of them exceeded their human health screening value. However, the detected concentration of barium did exceed its ecological screening value. Therefore, an unacceptable ecological risk due to MC may be present from exposure to barium in the sediment at the Bostwick BT MRS.

7.2 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS

7.2.1 A MEC Screening Level Risk Assessment was conducted based on the QR conducted in the field and historical data regarding previous site visits and removal actions (Chapter 6). Based on the ASR Supplement (USACE, 2004) and the ASR (USACE, 1996), the munitions known or suspected to have been used at the Bostwick BT MRS include 2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), Mk-82 low drag 500 lb. bomb, 30mm projectiles, Mk-15 water/sand fill practice bomb, Mk-81 256 lb. low drag bomb, and Mk-5 miniature practice bomb. With the exception of 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 500 lb. Mk-82 low drag bomb.

7.2.2 Bostwick BT MRS. ***Potential MEC items were found during the SI,*** including Mk76 25 lb. practice bomb, one AN-Mk23 3 lb. practice bomb with a Mk4 signal, one Mk76, Mod 0 or 1, with a signal of unknown type, one 2.75-inch HE rocket warhead and a possible fuze of unknown type. MD was also observed during the SI including parts from a Mk76 practice bomb, half of a AN-Mk43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket. In addition, the ASR inspection team found MD during the 1996 ASR visit.

7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENTS EXPOSURE PATHWAYS

7.3.1 An exposure pathway is not considered to be completed unless all four of the following elements are present (USEPA, 1989):

- A source and mechanism for chemical release;
- An environmental transport/exposure medium;
- A receptor exposure point; and
- A receptor and a likely route of exposure at the exposure point.

7.3.2 The surface soil, surface water, sediment, and air exposure pathways were determined to be complete for all receptors present at the Bostwick BT MRS. None of

the human health screening values for surface water, sediment, or surface soil were exceeded for the retained analytes for this MRS. Therefore, based on the analytical results presented in this report, an unacceptable human health risk is not expected from exposure to MC in surface soil, surface water, or sediment at the Bostwick BT MRS.

7.3.3 Groundwater is a potentially complete human exposure pathway at this MRS, but was not quantitatively assessed. Based on the presence of shallow groundwater, it is possible that MC could have been directly released to groundwater at the MRS. Several MC metals in surface soil, surface water, and sediment exceeded their background values and could potentially leach into groundwater. However, none of those analytes in surface soil or sediment exceeded their screening values based on leachability to groundwater.

7.3.4 None of the ecological screening values for surface water or surface soil were exceeded for the retained analytes for the Bostwick BT MRS. Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to exposure to MC in surface water or surface soil is not expected at this MRS. In sediment, the maximum detected concentration of barium (32 mg/kg) slightly exceeded its ecological screening value (20 mg/kg), resulting in an HQ value of 1.6. Therefore, based on the analytical results presented in this report, ***an unacceptable ecological risk due to exposure to MC in sediment is possible*** at the Bostwick BT MRS.

7.4 OVERALL CONCLUSIONS

7.4.1 Several potential MEC and MD items were found within the MRS associated with Bostwick BT during this SI. Additionally, historical reports indicate extensive use of general purpose bombs and practice bombs at the Bostwick BT. Based on these findings, the known use of the MRS for bombing activities, and the potential for MEC to remain within the MRS, ***the MEC exposure pathway for the MRS at Bostwick BT is potentially complete.***

7.4.2 An unacceptable <u>human health risk</u> is not expected from exposure to MC in surface soil, surface water, or sediment at the Bostwick BT MRS.

7.4.3 An unacceptable <u>ecological risk</u> due to exposure to barium in sediment is possible at the Bostwick BT MRS.

CHAPTER 8

RECOMMENDATIONS

Based on the July 2009 SI field effort, the analysis results, and the historical record review, the Bostwick BT MRS at the Bostwick BT FUDS is recommended for RI/FS (Table 8.1). ***Munitions removal actions are not warranted at this time.*** The RI/FS recommendation is based on the following:

- MD has been found at the site since DoD closure and during the site visit for the SI during July 2009. There is a potential for additional MD to be present at the site. Several MEC items were also found during the SI visit. Based on the qualitative MEC risk evaluation (Subchapter 6.1), there is a possibility that human receptors might come into contact with explosively hazardous MEC at the MRS associated with the Bostwick BT; therefore, ***there is the potential for an explosive safety risk at this MRS.***
- Hunters and mining employees are routinely within the MRS boundary and could be exposed to remaining munitions.
- An unacceptable ecological risk due to MC may be present from exposure to barium in the sediment at the Bostwick BT MRS. ***Further sediment sampling may be warranted to confirm and define any potential impact from munitions at this MRS.***

TABLE 8.1
RECOMMENDATIONS
BOSTWICK BOMB TARGET, PUTNAM COUNTY, FLORIDA

MRS	Acreage	Munitions and Explosive of Concern and/or Munitions Debris Assessment (1)	Munitions Constituents Assessment (2)	Recommendation
Bostwick Bomb Target MRS	3,111	***YES*** USACE documents issued since site closing confirm the use of the site as a bombing range. The munitions suspected to have been used at this MRS (2.75-inch rockets, Mk-76 practice bombs, Mk-106 practice bombs, Mk-23 practice bombs, Mk-89 practice bomb (56 lb. low drag sub-caliber), Mk-82 low drag 500 lb. bomb, 30mm projectiles, Mk-15 water/sand fill practice bomb, Mk-81 256 lb. low drag bomb, and Mk-5 miniature practice bomb) contain explosives that might present a residual hazard if they remain at the site intact. MEC and MD was found by the 2009 SVT while conducting QR.	***YES*** An unacceptable ecological risk due to MC may be present from exposure to barium in the sediment at the Bostwick Bomb Target MRS.	***RI/FS*** Further MC sediment sampling may be warranted.

- Notes:
- (1) "Yes" in this column indicates confirmed MEC or MD presence indicative of potential MEC presence, resulting in an RI/FS recommendation for the MRS. "No" in this column indicates no confirmed MEC or MD indicative of potential MEC presence.
- (2) "Yes" in this column indicates the presence of MC at levels indicating a potential elevated risk to human health or ecological receptors, resulting in a recommendation for further MC sampling during an RI/FS. "No" in this column of the table indicates the absence of MC at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for no further MC sampling for the MRS.

CHAPTER 9

REFERENCES

Banks Environmental Data, 2008. *Water Well Report – Bostwick Bomb Target.* December, 2008.

Department of the Army, 2005. *Memorandum for the Assistant Chief of Staff for Installation Management, Subject: Munitions Response Terminology.* Department of the Army, Office of the Assistant Secretary, Installations and Environment, 110 Army Pentagon, Washington, DC. April 21, 2005.

DERP, 2001. Management Guidance for the Defense Environmental Restoration Program, Department of Defense, Office of the Deputy Under the Secretary of Defense (Installations and Environment), ODUSC (I&E). September, 2001.

Florida Alligator Information, http://www.floridaalligator.info/habitat.php, Accessed March 2009.

Florida Department of Environmental Protection, 2009. Florida's Aquatic Preserve Program. http://www.dep.state.fl.us/coastal/programs/aquatic.htm. Accessed March 2009.

Florida Fish and Wildlife Conservation Commission, Florida's Venomous Snakes, http://myfwc.com/viewing/species/snakesv.html, Accessed March 2009.

Florida Fish and Wildlife Conservation Commission, 2009. *Florida's Endangered Species, Threatened Species, and Species of Special Concern.* http://myfwc.com/imperiledspecies/pdf/threatened-and-endangered-species-2006.pdf. Accessed March 24, 2009.

Florida Geological Survey 1964. Report of Investigations No. 35: Water Resources of Alachua, Bradford, Putnam, and Union counties, Florida. (Clark, Musgrove, Menke and Cagle).

Florida Natural Areas Inventory (FNAI) – Putnam County, 2009. Florida Resources and Environmental Analysis Center. http://fnai.org/bioticssearch.cfm. Accessed March 24, 2009.

Florida Office of Cultural and Historical Programs - Florida Master Site File (FMSF), 2009. Accessed February 6, 2009.

Florida State Parks, 2009. http://www.stateparks.com/fl.html. Accessed March 24, 2009.

Google Earth, 2009. Google™ Mapping Software. Satellite Image for Bostwick Bomb Target, http://earth.google.com/. Accessed June, 2009.

National Park Service, 2009a. National Register of Historic Places: Historic Districts. http://www.historicdistricts.com/districts.html. Accessed March 24, 2009.

National Park Service, 2009b. National Register of Historic Places: State Listings. http://www.historicdistricts.com/state.html. Accessed March 24, 2009.

National Park Service, 2009c. National Register Information System. http://www.nr.nps.gov/. Accessed March 24, 2009.

National Park Service, 2009d. National Historic Landmarks. http://www.cr.nps.gov/nhl/designations/listsofNHLs.htm. Accessed March 24, 2009.

National Park Service, 2009e. National Heritage Areas. http://www.cr.nps.gov/heritageareas/VST/INDEX.HTM. Accessed March 24, 2009.

National Park Service, 2009f. National Park Guide by State. http://home.nps.gov/applications/parksearch/geosearch.cfm. Accessed March 24, 2009.

National Oceanic and Atmospheric Administration, 2009a. Coastal Zone Management Program, Office of Ocean and Coastal Resource Management, National Ocean Service. http://www.ocrm.nos.noaa.gov/czm/national.html. Accessed March 24, 2009.

National Oceanic and Atmospheric Administration, 2009b. National Marine Fisheries Service, http://sero.nmfs.noaa.gov. Accessed March 24, 2009.

National Oceanic and Atmospheric Administration, 2009c. National Marine Sanctuaries. http://sanctuaries.noaa.gov/visit/welcom.html. Accessed March 24, 2009.

National Oceanic and Atmospheric Administration, 2009d. National Estuarine Research Reserve System. http://nerrs.noaa.gov/Background_Overview.html. Accessed March 24, 2009.

NatureServe Explorer, 2009. Plants and Animals Data Search. http://www.natureserve.org/explorer/servlet/NatureServe. Accessed March 24, 2009.

Parsons, 2005. *Final Programmatic Work Plan for Southeast and Pacific IMA Region Military Munitions Response Program for Site Inspections at Multiple Sites.* October 2005.

Parsons, 2006. *Final Addendum to the Final Programmatic Sampling and Analysis Plan.* March 2006.

Parsons, 2009a. *Final Technical Project Planning Memorandum and Associated Documentation for Bostwick Bomb Target, Putnam County, Florida.* March 2009.

Parsons, 2009b. *Final Site-Specific Work Plan Addendum to the Programmatic Work Plan, Bostwick Bomb Target, Putnam, County, Florida FUDS Project No. I04FL0091401.* June 2009.

Present Geographic Distribution of Killer Bees in Florida, http://www.stingshield.com/fl.htm, Accessed March 2009.

USACE, 1994. *Inventory Project Report for the former Bostwick Bomb Target, Putnam County, Florida*, February 1994.

USACE, 1996. Archives Search Report Findings for Bostwick Bomb Target (Putnam Bomb Target), Bostwick, Florida. March 1996.

USACE, 2003. Environmental Protection Program. *Military Munitions Center of Expertise Munitions Response (MR). Data Item Description (DID) MR-005-12.* http://www.hnd.usace.army.mil/oew/policy/dids/FY04DIDs/MR/mr005-12.pdf. December 1. 2 p. Accessed March 24, 2009.

USACE, 2004a. Environmental Quality – Formerly Used Defense Sites (FUDS) Program Policy. ER 200-3-1.USACE, 2005. Final Programmatic Sampling and Analysis Plan: Military Munitions Response Program Site Inspections. Prepared by USACE Engineering Support Center, Huntsville, September 2005.

USACE, 2004b. Archives Search Report Supplement for Bostwick Bomb Target, Putnam County, Florida.

USACE, 2005. Final Programmatic Sampling and Analysis Plan: Military Munitions Response Program Site Inspections. Prepared by USACE Engineering Support Center, Huntsville, September 2005.

USACE, 2006a. Interim Guidance Document 06-05, March 2006.

USACE, 2006b. *Screening-Level Ecological Risk Assessments for FUDS MMRP Site Inspections*. Presentation at the MMRP SI IPR, San Diego, CA, 11 August 2006. http://www.environmental.usace.army.mil/pps/august.ipr.ppt. Accessed March 24, 2009.

U.S. Census Bureau, 2000a. State and County Quick Facts for Putnam County, Florida. http://quickfacts.census.gov/qfd/states/. Accessed September 2009.

U.S. Census Bureau, 2000b. American FactFinder Fact Sheet for Putnam County, Florida, 2000. http://factfinder.census.gov/. Accessed September 2009.

U.S. Department of Agriculture - National Forest Service, 2009. National Forests and Grasslands. http://www.fs.fed.us/recreation/map/finder.shtml. Accessed March 24, 2009.

USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002.

USEPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, USEPA QA/G-4, USEPA/240/B-06/001.

U.S. Fish and Wildlife Service, 2009a. Wetlands Online Mapper - National Wetlands Inventory. http://wetlandsfws.er.usgs.gov/wtlnds/launch.html. Accessed March 24, 2009.

U.S. Fish and Wildlife Service, 2009b. Threatened and Endangered Species System (TESS) Florida. Listings by State and Territory as of 03/24/09. http://ecos.fws.gov/tess_public/StateListing.do?state=all. Accessed March 24, 2009.

U.S. Fish and Wildlife Service, 2009c. National Wildlife Refuge System. http://www.fws.gov/refuges/profiles/bystate.cfm. Accessed March 24, 2009.

U.S. Fish and Wildlife Service, 2009e. Critical Habitat Portal Database. http://crithab.fws.gov/. Accessed March 24, 2009.

U.S. Geological Survey, 1990. Ground Water Atlas of the United States. Alabama, Florida, Georgia, South Carolina.

USGS, 2008. *USGS Mineral Resources On-Line Spatial Data, Average Concentration of elements in Putnam County, Florida* http://tin.er.usgs.gov/geochem/county.php?place=f12107&el=Pb&rf=southeastern Accessed September 2009.

APPENDIX A

Performance Work Statement
Electronic Only

APPENDIX B

TPP Session Documentation/Meeting Minutes
Electronic Only

APPENDIX C

Interview Documentation
Not Applicable

APPENDIX D

Field Notes and Field Forms

FINAL

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84115	DATE/DAY:	5-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	1
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Partly Cloudy, Hi 87° F; Low 73° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
425	*Miles Driven*	425
2/775	*Number of Flights/Miles Flown*	2/775
3	*Number of Personnel*	3

2. Reconnaissance Details

0	*Linear Feet:*	0

3. MC Sampling Details

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

4. QC Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

6. Safety Activities

No safety briefing on the mobilization day.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	No	No
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	No	No
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	No	No
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

Mobilized to Florida. Daron Gibson flew from Atlanta, GA. Patrick Bussenius drove from Atlanta, GA. Blair Oakes flew from Nashville, TN.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

SVT will begin QR and sampling for the Bostwick Bomb Target.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0
PREPARED BY FTL: Daron Gibson

Signed by:

Name	Daron Gibson	
Date:	5-Jul-09	
Phone	Mobile: 770-634-1318	Office#: 678-969-2446
Copies sent to:		
	Deborah Walker (EM CX)	William Spence (CESAJ PM)
	Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
	Rebecca Terry (CX MM)	Tammy Chang (Parsons)
	Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
	Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

DAILY FIELD REPORT
MMRP SITE INSPECTION

FINAL

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84115	DATE/DAY:	6-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	2
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Thunderstorms, Hi 88° F; Low 74° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
125	*Miles Driven*	550
0	*Number of Flights/Miles Flown*	2/775
3	*Number of Personnel*	3

2. Reconnaissance Details

0	*Linear Feet:*	0

3. MC Sampling Details

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

4. QC Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Sampling Notes: No QA split for this site

6. Safety Activities

Safety briefing topics covered: heat stress, dehydration, biological hazards, trip hazards, and ordnance safety.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	Yes	Yes
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	Yes	Yes
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

The SVT met at the hotel lobby at 0600, held safety brief, and drove to the site. SVT had difficulty accessing the site today due to numerous locked gates and private property/no trespassing signs everywhere. Team was finally able to contact a landowner @ approximately 1130 to access the property. However, at around 1200, thunderstorms moved into the area with heavy rain and lightning. Waited for approximately 1 hour and the storms were still in the area. SSO decided that conditions were unsafe so the team returned to the hotel to complete sample labeling and preparing field sampling kits. Arrived at hotel at approximately 1430.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

SVT will begin QR and sampling at the Bostwick Bomb Target.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0
PREPARED BY FTL: Daron Gibson

Signed by:

Name	Daron Gibson	
Date:	6-Jul-09	
Phone	Mobile: 770-634-1318	Office#: 678-969-2446
Copies sent to:		
	Deborah Walker (EM CX)	William Spence (CESAJ PM)
	Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
	Rebecca Terry (CX MM)	Tammy Chang (Parsons)
	Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
	Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84116	DATE/DAY:	7-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	3
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Thunderstorms and heavy rain, Hi 83° F; Low 71° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
100	*Miles Driven*	650
0	*Number of Flights/Miles Flown*	2/775
3	*Number of Personnel*	3

2. Reconnaissance Details

9,442	*Linear Feet:*	9,442

3. MC Sampling Details

1	*Soil Samples*	1
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Note: See DQCR

4. QC Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Sampling Notes: No QA split for this site

6. Safety Activities

Safety briefing topics covered: heat stress, dehydration, biological hazards, trip hazards, and ordnance safety.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	Yes	Yes
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	Yes	Yes
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	Yes	Yes
VISITORS				
Putnam County Sheriff's Office -	Scott Surrency	Phone: 386-329-0801	Yes	No
Putnam County Dept. of Emer. Svs. -	Quin Romay	Phone: 386-329-0801	Yes	No

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

All other site details recorded in data logging device (Trimble).

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

SVT will resume QR and sampling at the Bostwick Bomb Target.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0

PREPARED BY FTL: Daron Gibson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912DY-04-D-0005
Delivery Order Number: 0008
Project Name: Bostwick Bomb Target
Project Number: 744647- 84116
Site Location: Putnam County, Florida
Date: 7-Jul-09

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT met at the hotel lobby at 0700, held safety brief, and drove to the site. SVT began QR and discovered a possible unexpended Mk76 25lb practice bomb. UXOIII was unable to determine if the signal had been expended. Landowner, Mr. James Knabb (904-259-3201), was contacted and the proper authorities were contacted regarding removal. The authorities will contact the SVT when the item will be removed/destroyed. Team spent most of the day guiding the local authorities to the item and speaking with the landowner. However SVT did collect one sample (SS2) and found MD as well (parts from a Mk76 practice bomb and half of a AN-Mk 43 3lb practice bomb) prior to meeting with the authorities/landowner. SS2 was moved from its orginal location to where the MEC item was found for a more biased sample (approximately 800' from original location). Team was going to resume QR when the Schonstedt stopping operating correctly. Team ceased QR and attempted to collect a groundwater sample at GW1 location. This hand operated pump does not work. Team attempted to remove the pump, however more handtools will be needed to collect the sample. More thunderstorms this evening forced the SVT to stop working again.

Team left the site at 1730. Arrived at hotel at approximately 1900 to pack sample on ice for shipment tomorrow.

TOMORROW'S OPERATIONS PLAN

SVT will resume QR and sampling at the Bostwick Bomb Target.

Equipment Calibrations (list or provide attachment)

Comments: Tested Schonstedt prior to soil sampling and QR. Operating normally this morning. However this afternoon the unit started to malfunction. New unit will be delivered tomorrow morning.

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
BBT-MRS01-SS-02-02	Surface Soil	0955	Metals and Explosives	7/8/2009	TA	

Departures from approved SAP:

Moved BBT-MRS01-SS-02-02 from original location to where the possible MEC item was found.

Instructions given by government personnel:

Local authorities informed the SVT that a bomb disposal squad from Jacksonville was contacted to remove the item. The authorities will contact the SVT when the item will be removed/destroyed.

Check all attachments:

_____ Field sampling forms (in separate submittal)
_____ Field-generated analytical results
_____ Chain-of-custody forms (in separate submittal)

Signed by:

Name Daron Gibson
Date: 7-Jul-09
Phone Mobile: 770-634-1318 Office#: 678-969-2446
Copies sent to:

Deborah Walker (EM CX)	William Spence (CESAJ PM)
Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
Rebecca Terry (CX MM)	Tammy Chang (Parsons)
Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84116	DATE/DAY:	8-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	4
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Scattered Thunderstorms, Hi 85° F; Low 73° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
100	*Miles Driven*	750
0	*Number of Flights/Miles Flown*	2/775
3	*Number of Personnel*	3

2. Reconnaissance Details

26,389	*Linear Feet:*	35,831

3. MC Sampling Details

2	*Soil Samples*	3
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Note: See DQCR

4. QC Activities

3	*Soil Samples*	3
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Note: See DQCR

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Sampling Notes: No QA split for this site

6. Safety Activities

Safety briefing topics covered: heat stress, dehydration, biological hazards, trip hazards, and ordnance safety.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	Yes	Yes
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	Yes	Yes
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

All other site details recorded in data logging device (Trimble).

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

SVT will resume QR and sampling at the Bostwick Bomb Target.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0

PREPARED BY FTL: Daron Gibson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912DY-04-D-0005
Delivery Order Number: 0008
Project Name: Bostwick Bomb Target
Project Number: 744647- 84116
Site Location: Putnam County, Florida
Date: 8-Jul-09

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT met at the hotel lobby at 0800, picked up new Schonstedt, held safety brief, and drove to the site. SVT began QR and sampling. Four MEC items were discovered today. One unexpended noze fuze (type unknown), one AN-Mk23 3lb. practice bomb w/unexpended Mk4 signal, one Mk76, Mod 0 or 1, with unexpended signal, and one 2.75in HE rocket warhead. Team also found MD in the form of AN-Mk23 bomb parts and one 2.25in practice rocket. All of the items found today were on a 4x4 road traversing that part of the site. The landowner, Mr. James Knabb (904-259-3201), was notified and he contacted the local authorities. They agreed to wait until the end of our site visit to dispose/destroy the MEC we have found as well as any more we might discover. Coordinates of the items were sent to the authorities. Team left the site at 1530 to pack and ship collected samples via UPS Next Day Air. Arrived at hotel at approximately 1800. *Update* The MEC item discovered yesterday was destroyed by the St. Johns County Bomb Squad at the site.

TOMORROW'S OPERATIONS PLAN

SVT will resume QR and sampling at the Bostwick Bomb Target.

Equipment Calibrations (list or provide attachment)

Comments: Tested Schonstedt prior to soil sampling and QR. Operating normally.

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
BBT-MRS01-SS-02-01	Surface Soil	1515	Metals and Explosives	7/8/2009	TA	MS/MSD
BBT-MRS01-SS-02-03	Surface Soil	1209	Metals and Explosives	7/8/2009	TA	
BBT-MRS01-SS-02-10	Surface Soil	1739	Metals and Explosives	7/8/2009	TA	FD of BBT-MRS01-SS-02-01

Departures from approved SAP:

Moved BBT-MRS01-SS-02-01/10 from orignal location to where the possible MEC item was found.

Instructions given by government personnel:

Local authorities informed the SVT that a bomb disposal squad from St. Johns County will be contacted to remove/destroy all MEC items found after the site visit is completed.

Check all attachments:

_____ Field sampling forms (in separate submittal)
_____ Field-generated analytical results
__X__ Chain-of-custody forms (in separate submittal)

Signed by:

Name Daron Gibson
Date: 8-Jul-09
Phone Mobile: 770-634-1318 Office#: 678-969-2446
Copies sent to:

Deborah Walker (EM CX)	William Spence (CESAJ PM)
Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
Rebecca Terry (CX MM)	Tammy Chang (Parsons)
Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84115	DATE/DAY:	9-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	4
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Cloudy, Hi 85° F; Low 73° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
100	*Miles Driven*	850
0	*Number of Flights/Miles Flown*	2/775
3	*Number of Personnel*	3

2. Reconnaissance Details

35,071	*Linear Feet:*	70,902

3. MC Sampling Details

3	*Soil Samples*	6
2	*Sediment Samples*	2
0	*Groundwater Samples*	0
2	*Surface Water Samples*	2
	Note: See DQCR	

4. QC Activities

0	*Soil Samples*	3
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0
	Sampling Notes: No QA split for this site	

6. Safety Activities

Safety briefing topics covered: heat stress, dehydration, biological hazards, trip hazards, and ordnance safety.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	Yes	Yes
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	Yes	Yes
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

All other site details recorded in data logging device (Trimble).

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

SVT will complete QR and sampling at the Bombing Range. Team will pack and ship samples via UPS Next Day Air (SATURDAY DELIVERY) and demobilize from Florida.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0

PREPARED BY FTL: Daron Gibson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912DY-04-D-0005
Delivery Order Number: 0008
Project Name: Bostwick Bomb Target
Project Number: 744647- 84115
Site Location: Putnam County, Florida
Date: 9-Jul-09

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT met at the hotel lobby at 0700, held safety brief, and drove to the site. SVT began QR and sampling. QR was deviated today due to swampy areas in the southern portion of the FUDS boundary as well as the area where SS5 is located. Perchlorate sample was filtered on-site according to DoD Perchlorate Handbook. No signs of MD/MEC today. Team left the site at 1600 to pack and ship collected samples via UPS Next Day Air. Arrived at hotel at approximately 1830.

TOMORROW'S OPERATIONS PLAN

SVT will complete QR and sampling at the Bombing Range. Team will pack and ship samples via UPS Next Day Air (SATURDAY DELIVERY) and demobilize from Florida.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (°C)	Time
Equip. Reading:	4.00	4.49	0	25.46	900

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp.	Cond.	Turbidity	pH (s.u.)
BBT-MRS01-SW-03	28.51	0.151	135	5.98
BBT-AMB-SW-05	30.45	0.133	25.1	6.59

Comments: NA

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
BBT-MRS01-SW-03	surface water	1140	Metals, Explosives, Perchlorate	7/9/2009	TA	
BBT-AMB-SW-05	surface water	1430	Metals, Perchlorate	7/9/2009	TA	AMBIENT
BBT-MRS01-SD-03	sediment	1151	Metals and Explosives	7/9/2009	TA	
BBT-AMB-SD-05	sediment	1440	Metals	7/9/2009	TA	AMBIENT
BBT-MRS01-SS-02-05	soil	1550	Metals and Explosives	7/9/2009	TA	
BBT-MRS01-SS-02-08	soil	1025	Metals and Explosives	7/9/2009	TA	
BBT-MRS01-SS-02-09	soil	0930	Metals and Explosives	7/9/2009	TA	

Departures from approved SAP:

QR deviation due to swampy areas. Also SW/SD 5 ambient samples were moved to a large pond outside the western border of the FUDS boundary.

Instructions given by government personnel:

None

Check all attachments:

_____ Field sampling forms (in separate submittal)
_____ Field-generated analytical results
__X__ Chain-of-custody forms (in separate submittal)

Signed by:		
Name	Daron Gibson	
Date:	9-Jul-09	
Phone	Mobile: 770-634-1318	Office#: 678-969-2446
Copies sent to:		
	Deborah Walker (EM CX)	William Spence (CESAJ PM)
	Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
	Rebecca Terry (CX MM)	Tammy Chang (Parsons)
	Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
	Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	W912DY-04-D-0005	DELIVERY ORDER NO.	0008
JOB NO:	744647- 84115	DATE/DAY:	10-Jul-09
SITE NAME:	Bostwick Bomb Target	REPORT NO:	5
USACE DISTRICT:	CESAJ	SHEET:	1
WEATHER:	Cloudy, Hi 85° F; Low 73° F		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
100	*Miles Driven*	1380
2/775	*Number of Flights/Miles Flown*	4/1550
3	*Number of Personnel*	3

2. Reconnaissance Details

34,946	*Linear Feet:*	105,848

3. MC Sampling Details

4	*Soil Samples*	10
2	*Sediment Samples*	4
0	*Groundwater Samples*	0
2	*Surface Water Samples*	4

4. QC Activities

0	*Soil Samples*	3
3	*Sediment Samples*	3
0	*Groundwater Samples*	0
3	*Surface Water Samples*	3

5. QA Activities

0	*Soil Samples*	0
0	*Sediment Samples*	0
0	*Groundwater Samples*	0
0	*Surface Water Samples*	0

Sampling Notes: No QA split for this site

6. Safety Activities

Safety briefing topics covered: heat stress, dehydration, biological hazards, trip hazards, and ordnance safety.

PARSONS SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader -	Daron Gibson	Cell Phone: 770-634-1318	Yes	Yes
Parsons Sampling Technician -	Patrick Bussenius	Cell Phone: 678-227-8499	Yes	Yes
Parsons UXO Technician/SSHO -	Blair Oakes	Cell Phone: 931-638-2445	Yes	Yes
VISITORS				
Putnam County DES Chief - Quin Romay		Phone: 386-329-0416	Yes	Yes

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt, 3 Rino GPS, Laptop, Trimble, and Camera.
Water Sampling Equipment:	Horiba U-10, Peristaltic Pump

ADDITIONAL INFORMATION:

All other site details recorded in data logging device (Trimble).

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

Parsons SVT completed the scheduled field activities of this site.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0

PREPARED BY FTL: Daron Gibson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912DY-04-D-0005
Delivery Order Number: 0008
Project Name: Bostwick Bomb Target
Project Number: 744647- 84115
Site Location: Putnam County, Florida
Date: 10-Jul-09

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT met at the hotel lobby at 0600, held safety brief, and drove to the site. SVT began QR and sampling. SW/SD sample number 04 was converted to a surface soil sample (SS11) due to a lack of water at the planned location. SW/SD number 01 was moved to a location approximately 800' away due to a lack of water at the planned location. No MD or MEC was found today. Chief Quin Romay met the team this afternoon to acquire the locations of the previously found MEC. SVT had a quick safety brief and showed Chief Romay where the items were. Team left the site at 1400 to pack and ship collected samples via UPS Next Day Air (Saturday Delivery). SVT packed up gear and demobilized from Florida this evening. Daron Gibson flew to Atlanta, GA, Patrick Bussenius drove to Atlanta, GA, and Blair Oakes flew to Nashville, TN.

TOMORROW'S OPERATIONS PLAN

Parsons SVT completed the scheduled field activities of this site.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (°C)	Time
Equip. Reading:	4.00	4.49	0	24.97	935

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp.	Cond.	Turbidity	pH (s.u.)
BBT-MRS01-SW-01	28.14	0.166	9.2	6.14
BBT-MRS01-SW-02	31.14	0.171	7.6	6.07

Comments: NA

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
BBT-MRS01-SW-01	surface water	0943	Metals, Explosvies, Perchlorate	7/10/2009	TA	MS/MSD
BBT-MRS01-SW-02	surface water	1135	Metals, Explosvies, Perchlorate	7/10/2009	TA	
BBT-MRS01-SW-06	surface water	1429	Metals, Explosvies, Perchlorate	7/10/2009	TA	FD of BBT-MRS01-SW-01
BBT-MRS01-SD-01	sediment	0954	Metals and Explosives	7/10/2009	TA	MS/MSD
BBT-MRS01-SD-02	sediment	1145	Metals and Explosives	7/10/2009	TA	
BBT-MRS01-SD-06	sediment	1442	Metals and Explosives	7/10/2009	TA	FD of BBT-MRS01-SD-01
BBT-AMB-SS-02-04	soil	1410	Metals and Explosives	7/10/2009	TA	Ambient
BBT-MRS01-SS-02-06	soil	0750	Metals and Explosives	7/10/2009	TA	
BBT-MRS01-SS-02-07	soil	0833	Metals and Explosives	7/10/2009	TA	
BBT-MRS01-SS-02-11	soil	1057	Metals and Explosives	7/10/2009	TA	Originally BBT-MRS01-SW/SD-04

Departures from approved SAP:

SW/SD sample number 04 was converted to a surface soil sample (SS11) due to a lack of water at the planned location. SW/SD number 01 was moved to a location approximately 800' away due to a lack of water at the planned location.

Instructions given by government personnel:

Quin Romay, Putnam Co. DES stated that the items found on Wednesday were scheduled for removal/destruction on Monday July, 13 2009.

Check all attachments:

_____ Field sampling forms (in separate submittal)
_____ Field-generated analytical results
__X__ Chain-of-custody forms (in separate submittal)

Signed by:		
Name	Daron Gibson	
Date:	10-Jul-09	
Phone	Mobile: 770-634-1318	Office#: 678-969-2446
Copies sent to:		
	Deborah Walker (EM CX)	William Spence (CESAJ PM)
	Heidi Novotny (EM CX)	Michael D'Auben (CX - ES)
	Rebecca Terry (CX MM)	Tammy Chang (Parsons)
	Don Silkebakken (Parsons PM)	Tim Davis (Parsons GL)
	Laura Kelley (Parsons Co-PM)	Cortnie Lewis (Parsons)

APPENDIX E

Photo-documentation Log

Field Team Leader's Site Observations
Bostwick Bomb Target, Putnam County, Florida

Tuesday, July 07, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 9:42:57 AM | **Point_ID:** 1

Team Leader		**MRSPP Menu:**	None	Latitude:	29.783264457
Sampler:	None	**MRSPP Note:**		Longitude:	-81.687318047
Sample ID:	None				

Found possible MEC

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	
Drainage:	None	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Bomb, 25lb Prac

N29.78324 W081.68731

DSCN2301.jpg
Possible MEC

DSCN2302.jpg
Possible MEC

DSCN2303.jpg
Possible MEC

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 9:53:45 AM | **Point_ID:** 2

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.783260013
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.687316556
Sample ID:	BBT-MRS01-SS-02-02				

SS2

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	
Drainage:	None	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Bomb, 25lb Prac

DSCN2304.jpg
SS2

DSCN2305.jpg
SS2

DSCN2306.jpg
SS2

Tuesday, July 07, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 10:55:25 AM | **Point_ID:** 3

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.78506487
Sampler:		**MRSPP Note:**		Longitude:	-81.685975863
Sample ID:	None				
Barrier:		**Topography:**	Flat	MD	
Vegetation:	Dense Trees	**Surface Feature:**	4WD road		
Drainage:	None	**Surface Debris:**	Low Density		
SoilType:	Sand	**Subsurface Met:**	Low Density		
SoilColor:	Mixed	**MECMD:**	Bomb, 25lb Prac		

DSCN2307.jpg
MD, MK76

DSCN2308.jpg
MD, MK76

DSCN2309.jpg
MD, MK76

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 11:01:41 AM | **Point_ID:** 4

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.785054631
Sampler:	None	**MRSPP Note:**		Longitude:	-81.685998158
Sample ID:	None				
Barrier:		**Topography:**		MD,MK43	
Vegetation:		**Surface Feature:**			
Drainage:	None	**Surface Debris:**	Single Item		
SoilType:		**Subsurface Met:**	N/A		
SoilColor:		**MECMD:**	Bomb, 3lb Prac		

DSCN2310.jpg
MK43

DSCN2311.jpg
MK43

DSCN2312.jpg
MK43

Wednesday, July 08, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 9:56:03 AM | **Point_ID:** 5

Team Leader Daron Gibson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note:

Latitude: 29.787715996
Longitude: -81.685699718

Observation at target center, 16 subsurface hits

Barrier:
Vegetation: Dense Trees
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature: Target
Surface Debris: None
Subsurface Met: Medium Density
MECMD: None

N29.78780 W081.68563

DSCN2313.jpg
Target center

DSCN2314.jpg
Target center

DSCN2315.jpg
Target center

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 12:07:48 PM | **Point_ID:** 6

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SS-02-03

MRSPP Menu: None
MRSPP Note:

Latitude: 29.790252573
Longitude: -81.682430509

Collection of SS3

Barrier:
Vegetation: Dense Trees
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: No Detect
MECMD: None

N29.79023 W081.68246

DSCN2316.jpg
SS3

DSCN2317.jpg
SS3

DSCN2318.jpg
SS3

Wednesday, July 08, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 12:44:37 PM | **Point_ID:** 7

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.78349284
Sampler:	None	**MRSPP Note:**		Longitude:	-81.681622187
Sample ID:	None				

MD MK23 debris

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	4WD road
Drainage:	Manmade Ditch	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Bomb, 3lb Prac

N29.78345 W081.68168

DSCN2319.jpg
MD

DSCN2320.jpg
MD

DSCN2321.jpg
MD

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 12:53:48 PM | **Point_ID:** 8

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.783043941
Sampler:	None	**MRSPP Note:**		Longitude:	-81.681606916
Sample ID:	None				

MEC, unexpended fuze, in the road

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	4WD road
Drainage:	None	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Fuze, Nose

N29.78300 W081.68166

DSCN2322.jpg
MEC fuze

DSCN2323.jpg
MEC fuze

DSCN2324.jpg
MEC fuze

Wednesday, July 08, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 1:14:40 PM | **Point_ID:** 9

Team Leader Daron Gibson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note:

Latitude: 29.782018335
Longitude: -81.681503395

MD, 2.25in practice rocket

Barrier:
Vegetation: Dense Trees
Drainage: Manmade Ditch
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature: 4WD road
Surface Debris: Single Item
Subsurface Met: No Detect
MECMD: Rocket, 2.25in SCAR

N29.78206 W081.68147

DSCN2325.jpg
MD, 2.25in Rocket

DSCN2326.jpg
MD, 2.25in Rocket

DSCN2327.jpg
MD, 2.25in Rocket

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 1:38:32 PM | **Point_ID:** 10

Team Leader Daron Gibson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note:

Latitude: 29.781397404
Longitude: -81.681455842

MEC. 2.75in rocket warhead

Barrier:
Vegetation: Dense Trees
Drainage: Manmade Ditch
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature: 4WD road
Surface Debris: Single Item
Subsurface Met: No Detect
MECMD: Other

N29.78133 W081.68153

DSCN2328.jpg
MEC, 2.75 Rocket

DSCN2329.jpg
MEC, 2.75 Rocket

DSCN2330.jpg
MEC, 2.75 Rocket

Wednesday, July 08, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 2:48:28 PM | **Point_ID:** 11

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.783837591
Sampler:	None	**MRSPP Note:**		Longitude:	-81.681628581
Sample ID:	None				

MEC, MK23

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	4WD road
Drainage:	Manmade Ditch	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Bomb, 3lb Prac

N29.78378 W081.68163

DSCN2331.jpg
MEC MK23

DSCN2332.jpg
MEC MK23

DSCN2333.jpg
MEC MK23

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 3:10:48 PM | **Point_ID:** 12

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.783821836
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.681628801
Sample ID:					

MEC, MK76

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	4WD road
Drainage:	Manmade Ditch	**Surface Debris:**	Single Item
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	Bomb, 25lb Prac

N29.78376 W081.68163

DSCN2334.jpg
MEC, MK76

DSCN2335.jpg
MEC, MK76

DSCN2336.jpg
MEC, MK76

Wednesday, July 08, 2009

Property:	Bostwick BT FL	***Area:***	MRS01	***Time***	3:14:12 PM	***Point_ID:***	13

Team Leader	Daron Gibson	***MRSPP Menu:***	None	Latitude:	29.783803434
Sampler:	Patrick Bussenius	***MRSPP Note:***		Longitude:	-81.681634647
Sample ID:	BBT-MRS01-SS-02-01				

SS1, moved over to MEC location

Barrier:		***Topography:***	Flat
Vegetation:	Dense Trees	***Surface Feature:***	4WD road
Drainage:	Manmade Ditch	***Surface Debris:***	Single Item
SoilType:	Sand	***Subsurface Met:***	No Detect
SoilColor:	Mixed	***MECMD:***	Bomb, 25lb Prac

N29.78376 W081.68163

DSCN2337.jpg
SS1

DSCN2338.jpg
SS1

DSCN2339.jpg
SS1

Thursday, July 09, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 9:30:52 AM | **Point_ID:** 14

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.770905341
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.686237796
Sample ID:	BBT-MRS01-SS-02-09				

Collection of SS9

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	
Drainage:	None	**Surface Debris:**	None
SoilType:	Sand	**Subsurface Met:**	No Detect
SoilColor:	Mixed	**MECMD:**	None

N29.77092 W081.68629

DSCN2340.jpg
SS9

DSCN2341.jpg
SS9

DSCN2342.jpg
SS9

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 10:27:18 AM | **Point_ID:** 15

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.764168959
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.683704848
Sample ID:	BBT-MRS01-SS-02-08				

Collection of SS8

Barrier:		**Topography:**	Flat
Vegetation:	Dense Trees	**Surface Feature:**	
Drainage:	None	**Surface Debris:**	None
SoilType:	Loam	**Subsurface Met:**	No Detect
SoilColor:	Black	**MECMD:**	None

N29.76428 W081.68372

DSCN2343.jpg
SS8

DSCN2344.jpg
SS8

DSCN2345.jpg
SS8

Thursday, July 09, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 11:20:57 AM | **Point_ID:** 16

Team Leader Daron Gibson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note:

Latitude: 29.757228131
Longitude: -81.682548893

QR deviation due to swamp

Barrier:
Vegetation: GraSSes
Drainage: Wetland
SoilType: Loam
SoilColor: Mixed

Topography: Broken Terrain
Surface Feature:
Surface Debris: None
Subsurface Met: N/A
MECMD: None

N29.75716 W081.68246

DSCN2346.jpg
SW AMB

DSCN2347.jpg
SW AMB

DSCN2348.jpg
SW AMB

Property: Bostwick BT FL | **Area:** | **Time** 11:41:34 AM | **Point_ID:** 17

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SW-03

MRSPP Menu:
MRSPP Note:

Latitude: 29.758245786
Longitude: -81.681877418

Collection of SW3

Barrier:
Vegetation:
Drainage:
SoilType:
SoilColor:

Topography:
Surface Feature:
Surface Debris:
Subsurface Met:
MECMD:

DSCN2349.jpg
SW3

DSCN2350.jpg
SW3

DSCN2351.jpg
SW3

Thursday, July 09, 2009

Property: Bostwick BT FL ***Area:*** MRS01 ***Time*** 11:45:51 AM ***Point_ID:*** 18

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SD03

MRSPP Menu: None
MRSPP Note:

Latitude: 29.758243469
Longitude: -81.681879121

Collection of SD3

Barrier:
Vegetation:
Drainage: Wetland
SoilType: Loam
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: N/A
MECMD: None

N29.75822 W081.68188

DSCN2352.jpg
SD3

DSCN2353.jpg
SD3

DSCN2354.jpg
SD3

Property: Bostwick BT FL ***Area:*** MRS01 ***Time*** 1:24:31 PM ***Point_ID:*** 19

Team Leader Daron Gibson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note:

Latitude: 29.76987
Longitude: -81.68958

General observation, no MD/MEC in this area

Barrier:
Vegetation: Dense Trees
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: No Detect
MECMD: None

N29.76987 W081.68958

DSCN2355.jpg
General observation

DSCN2356.jpg
General observation

DSCN2357.jpg
General observation

Thursday, July 09, 2009

Property: Bostwick BT FL | **Area:** | **Time** 2:40:27 PM | **Point_ID:** 20

Team Leader	Daron Gibson	**MRSPP Menu:**		Latitude:	29.770473232
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.691409194
Sample ID:	BBT-AMB-SW-05				

collection of SW5 AMB

Barrier:		**Topography:**	
Vegetation:		**Surface Feature:**	
Drainage:		**Surface Debris:**	
SoilType:		**Subsurface Met:**	
SoilColor:		**MECMD:**	

DSCN2358.jpg
SW5 AMB

DSCN2359.jpg
SW5 AMB

DSCN2360.jpg
SW5 AMB

Property: Bostwick BT FL | **Area:** Ambient | **Time** 2:48:00 PM | **Point_ID:** 21

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.770472384
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.691410384
Sample ID:	BBT-AMB-SD-05				

Collection of SD5 AMB

Barrier:		**Topography:**	Flat
Vegetation:		**Surface Feature:**	
Drainage:	Pond	**Surface Debris:**	None
SoilType:	Sand	**Subsurface Met:**	N/A
SoilColor:	Mixed	**MECMD:**	None

N29.77046 W081.69142

DSCN2361.jpg
SD5 AMB

DSCN2362.jpg
SD5 AMB

DSCN2363.jpg
SD5 AMB

Thursday, July 09, 2009

Property:	Bostwick BT FL	***Area:***	MRS01	***Time***	3:48:58 PM	***Point_ID:***	22

Team Leader	Daron Gibson	***MRSPP Menu:***	None	Latitude:	29.778056998
Sampler:	Patrick Bussenius	***MRSPP Note:***		Longitude:	-81.686282388
Sample ID:	BBT-MRS01-SS-02-05				

Collection of SS5

Barrier:		***Topography:***	Flat
Vegetation:	Dense Trees	***Surface Feature:***	
Drainage:	Wetland	***Surface Debris:***	None
SoilType:	Loam	***Subsurface Met:***	No Detect
SoilColor:	Mixed	***MECMD:***	None

N29.77809 W081.68626

DSCN2364.jpg
SS5

DSCN2365.jpg
SS5

DSCN2366.jpg
SS5

Friday, July 10, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 7:46:26 AM | **Point_ID:** 23

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SS-02-06

MRSPP Menu: None
MRSPP Note:

Latitude: 29.807657608
Longitude: -81.688046307

Collection of SS6

Barrier:
Vegetation: Heavy Brush
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: No Detect
MECMD: None

N29.80765 W081.68804

DSCN2367.jpg
SS6

DSCN2368.jpg
SS6

DSCN2369.jpg
SS6

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 8:32:35 AM | **Point_ID:** 24

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SS-02-07

MRSPP Menu: None
MRSPP Note:

Latitude: 29.798269669
Longitude: -81.688692584

Collection of SS7

Barrier:
Vegetation: Dense Trees
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: No Detect
MECMD: None

N29.79826 W081.68870

DSCN2370.jpg
SS7

DSCN2371.jpg
SS7

DSCN2372.jpg
SS7

Friday, July 10, 2009

Property:	Bostwick BT FL	***Area:***		***Time***	9:40:28 AM	***Point_ID:***	25

Team Leader	Daron Gibson	***MRSPP Menu:***		Latitude:	29.79455683
Sampler:	Patrick Bussenius	***MRSPP Note:***		Longitude:	-81.690225491
Sample ID:	BBT-MRS01-SW-01				

Collection of SW1

Barrier:		***Topography:***	
Vegetation:		***Surface Feature:***	
Drainage:		***Surface Debris:***	
SoilType:		***Subsurface Met:***	
SoilColor:		***MECMD:***	

DSCN2373.jpg
SW1

DSCN2374.jpg
SW1

DSCN2375.jpg
SW1

Property:	Bostwick BT FL	***Area:***	MRS01	***Time***	9:48:57 AM	***Point_ID:***	26

Team Leader	Daron Gibson	***MRSPP Menu:***	None	Latitude:	29.794557702
Sampler:	Patrick Bussenius	***MRSPP Note:***		Longitude:	-81.690239328
Sample ID:	BBT-MRS01-SD-01				

Collection of SD1

Barrier:		***Topography:***	Flat
Vegetation:	GraSSes	***Surface Feature:***	
Drainage:	Pond	***Surface Debris:***	None
SoilType:	Sand	***Subsurface Met:***	N/A
SoilColor:	Mixed	***MECMD:***	None

N29.79459 W081.69022

DSCN2376.jpg
SD1

DSCN2377.jpg
SD1

DSCN2378.jpg
SD1

Friday, July 10, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 10:57:57 AM | **Point_ID:** 27

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SW-04

MRSPP Menu: None
MRSPP Note:

Latitude: 29.80041085
Longitude: -81.692717928

SS11, changed to soil due to no water

Barrier:
Vegetation: Dense Trees
Drainage: None
SoilType: Sand
SoilColor: Mixed

Topography: Flat
Surface Feature:
Surface Debris: None
Subsurface Met: No Detect
MECMD: None

N29.80038 W081.69275

DSCN2379.jpg
SS11

DSCN2380.jpg
SS11

DSCN2381.jpg
SS11

Property: Bostwick BT FL | **Area:** | **Time** 11:34:42 AM | **Point_ID:** 28

Team Leader Daron Gibson
Sampler: Patrick Bussenius
Sample ID: BBT-MRS01-SW02

MRSPP Menu:
MRSPP Note:

Latitude: 29.802926086
Longitude: -81.70129775

Collection of SW2

Barrier:
Vegetation:
Drainage:
SoilType:
SoilColor:

Topography:
Surface Feature:
Surface Debris:
Subsurface Met:
MECMD:

DSCN2382.jpg
SW2

DSCN2383.jpg
SW3

DSCN2384.jpg
SW3

Friday, July 10, 2009

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 11:38:16 AM | **Point_ID:** 29

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.802925545
Sampler:	Patrick Bussenius	**MRSPP Note:**		Longitude:	-81.701294437
Sample ID:	BBT-MRS01-SD-02				

Collection of SD2

Barrier:		**Topography:**	Flat
Vegetation:	GraSSes	**Surface Feature:**	
Drainage:	Pond	**Surface Debris:**	None
SoilType:	Sand	**Subsurface Met:**	N/A
SoilColor:	Mixed	**MECMD:**	None

N29.80292 W081.70129

DSCN2385.jpg
SD2

DSCN2386.jpg
SD2

DSCN2387.jpg
SD2

Property: Bostwick BT FL | **Area:** MRS01 | **Time** 12:20:13 PM | **Point_ID:** 30

Team Leader	Daron Gibson	**MRSPP Menu:**	None	Latitude:	29.785524787
Sampler:	None	**MRSPP Note:**		Longitude:	-81.683223598
Sample ID:	None				

Couldn't get GW sample due to broken pump

Barrier:		**Topography:**	Flat
Vegetation:	GraSSes	**Surface Feature:**	
Drainage:	None	**Surface Debris:**	None
SoilType:	Sand	**Subsurface Met:**	N/A
SoilColor:	Mixed	**MECMD:**	None

N29.78555 W081.68315

DSCN2388.jpg
Broken pump

DSCN2389.jpg
Broken pump

DSCN2390.jpg
Broken pump

Friday, July 10, 2009

Property:	Bostwick BT FL	***Area:***	Ambient	***Time***	2:08:20 PM	***Point_ID:***	31

Team Leader	Daron Gibson	***MRSPP Menu:***	None	Latitude:	29.751907698
Sampler:	Patrick Bussenius	***MRSPP Note:***		Longitude:	-81.657594699
Sample ID:	BBT-AMB-SS-02-04				

Collection of SS4, ambient

Barrier:		***Topography:***	Flat
Vegetation:	Dense Trees	***Surface Feature:***	
Drainage:	None	***Surface Debris:***	None
SoilType:	Sand	***Subsurface Met:***	No Detect
SoilColor:	Mixed	***MECMD:***	None

N29.75190 W081.65751

DSCN2391.jpg
SS4

DSCN2392.jpg
SS4

DSCN2393.jpg
SS4

APPENDIX F

Analytical Data
Electronic Only

APPENDIX G

Analytical Data QA/QC Report

DATA VALIDATION SUMMARY REPORT

for samples collected from

Bostwick Bomb Target

Putnam County, Florida

Data Validation by: David Badio

Parsons – Washington, D.C.

INTRODUCTION

The following data validation summary report covers soil samples and associated quality control (QC) samples collected from the Bostwick Bomb Target site in Putnam County, Florida on July 7 - 8, 2009. Samples were logged in under the following Sample Delivery Group (SDG):

D9G090326

All samples were analyzed for explosives and metals. The table below details the field sample IDs and requested parameters for each sample. The field QC samples collected in this SDG included one soil matrix spike/matrix spike duplicate (MS/MSD) pair and one soil field duplicate (FD) sample. The field QC samples were analyzed for the same parameters as the associated parent sample.

All samples were collected by Parsons. All analyses were performed by TA-Denver following the procedures outlined in the Standard Subcontract and the Programmatic Sampling and Analysis Plan (PSAP) Addendum for the Southeast Region. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at temperature of 3.2°C which was within the 2-6°C range recommended by the PSAP.

SAMPLE IDS AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives	Metals	Comments
BBT-MRS01-SS-02-02	S	X	X	
BBT-MRS01-SS-02-03	S	X	X	
BBT-MRS01-SS-02-01	S	X	X	MS/MSD
BBT-MRS01-SS-02-10	S	X	X	FD of BBT-MRS01-SS-02-01

S = soil

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETERS	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT.
Explosives	S	8330B	8321A	mg/kg	Dry Wt.
ICP/MS Metals	S	3050B	6020	mg/kg	Dry Wt.

ICP/MS = Inductively Coupled Plasma Mass Spectroscopy

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) form. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software and Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the reporting limit for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was also received from a United States Army Corps of Engineers (USACE) chemist for laboratory to use the historically developed control limits for the explosive analysis. See table below.

Analyte	Accuracy Control Limits for Soil	Maximum RPD (%)
HMX	53-115	30
RDX	70-121	30
1,3,5-Trinitrobenzene	47-131	30
1,3-dinitrobenzene	69-128	30
Nitrobenzene	59-150	30
Tetryl	10-160	30
Nitroglycerin	32-135	30
2,4,6-Trinitrotoluene	58-130	30
4-Amino-2,6-dinitrotoluene	60-133	30
2-Amino-4,6-dinitrotoluene	53-141	30
2,4-Dinitrotoluene	61-128	30
2,6-Dinitrotoluene	59-134	30
3-Nitrotoluene	51-153	30
PETN	28-178	30
2-Nitrotoluene	55-147	30
4-Nitrotoluene	65-146	30

Nitrobenzene-d5 (surr)	50-150	NA

For metals, the accuracy control limits are 80-120% for the LCS, MS, and MSD. The maximum allowable RPD for precision of the MS/MSD pair is 20%.

The field duplicate tolerance (RPD ≤ 70 for soil) was approved by Deborah Walker and Rebecca Terry for the Southeast portion of the program.

EXPLOSIVES

General

The explosives portion of this SDG consisted of four (4) soil samples which were collected on July 7 – 8, 2009 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to USEPA SW846 Method 8321A. All samples in this SDG were analyzed following the procedures outlined in the laboratory Standard Operating Procedure (SOP). All samples were prepared and analyzed within the holding time required by the method.

The explosives samples were extracted in analytical batch #9194153. The extracts were analyzed under one initial calibration (ICAL).

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the laboratory control spike (LCS) sample, MS/MSD samples, and the surrogate spikes. Sample BBT-MRS01-SS-02-01 was designated for MS/MSD analysis on the COC.

All LCS recoveries were within acceptance criteria.

All MS/MSD recoveries were within acceptance criteria.

All surrogate recoveries were within acceptance criteria.

Precision

Precision was evaluated using the relative percent difference (RPD) obtained from the MS/MSD concentrations. Precision was further assessed by comparing the parent and FD analyte values. Sample BBT-MRSS01-SS-02-10 is the field duplicate of sample BBT-MRSS01-SS-01-01.

All MS/MSD RPDs were within acceptance criteria.

All target explosives were non-detect in both the parent and the FD samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and

- Examining laboratory blank for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The MDL study was conducted within 12 months of sample analyses.

There was one method blank associated with the explosives analyses in this SDG which was non-detect at practical quantitation limit (PQL) level for all target explosives.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the samples in this SDG were considered usable. Thus, the completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

ICP/MS METALS

General

The ICP/MS metals portion of this SDG consisted of four (4) soil samples which were collected on July 7 – 8, 2009 and were analyzed for antimony, barium, copper, lead, and zinc.

The ICP/MS metals analyses were performed using USEPA SW846 Method 6020. The samples were analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

The samples for ICP/MS metals were digested in one analytical batch, #9194376. The digestates were analyzed in one batch under one ICAL.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS and MS/MSD samples. Sample BBT-MRS01-SS-02-01 was designated for MS/MSD analysis on the COC.

All LCS recoveries were within acceptance criteria.

All recoveries were within acceptance criteria for the MS/MSD pair, except for the following:

Metal	MS %R	MSD %R	Criteria, %R
Antimony	67	63	80 – 120%

Antimony result was flagged "UJ" in the parent sample, in accordance with the PSAP. Precision

Precision was evaluated using the RPD obtained from the MS/MSD concentrations. Precision was further assessed by comparing the parent and FD analyte values. Sample BBT-MRSS01-SS-02-10 is the field duplicate of sample BBT-MRSS01-SS-01-01.

All MS/MSD RPDs met acceptance.

Barium, copper, lead and zinc were detected above the PQL in both the parent and field duplicate samples, and both RPDs met RPD criteria:

Metal	Parent Conc. (mg/kg)	FD Conc. (mg/kg)	RPD	Criteria
Barium	1.0	1.2	18	RPD ≤ 70
Copper	2.1	2.0	5.0	
Lead	15	17	13	
Zinc	6.3	7.6	19	

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. The samples were prepared and analyzed within the holding times required by the method.

- All instrument tune criteria were met.
- All initial calibration criteria were met.
- All metals met criteria in the low-level check standard.
- All second source verification criteria were met. The ICV sample was prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.

- The DT was performed on a batch sample unrelated to this site. The DT was not applicable since all target metals were detected less than 100 times the MDL.

- The PDS was performed on the same sample as the DT. The PDS was applicable for all metals.

Metal	%R	Criteria
Antimony	92	75 – 125%
Barium	77	
Copper	93	
Lead	89	
Zinc	91	

There were one method blank and several calibration blanks associated with the ICP/MS analyses in this SDG. Antimony was detected in the method blank at a concentration (0.046 mg/kg) comparable to the reported concentrations for samples BBT-MRS01-SS-02-01 (0.083 mg/kg) and BBT-MRS01-02-10 (0.14 mg/kg). Results for these samples have been raised to the reporting limit (0.31 mg/kg) and qualified as not detected ('U'). <Pam: Please verify this against the ADR rule.>

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All ICP/MS results for the samples in this SDG were considered usable. Therefore, the completeness for the ICP/MS portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project.

DATA VALIDATION SUMMARY REPORT
for samples collected from
BOSTWICK BOMB TARGET

Putnam County, Florida

Data Validation by: David Badio

Parsons – Washington, D.C.

INTRODUCTION

The following data validation summary report covers soil and surface water samples collected from the Bostwick Bomb Target site in Putnam County, Florida on July 9, 2009. Samples were logged in under the following Sample Delivery Group (SDG):

D9G100295

The soil, sediment and surface water samples in this SDG were analyzed for explosives and metals except for the ambient samples which were analyzed for metals only. The water samples were also analyzed for perchlorate. The table below details the requested parameters for each sample. No field duplicate or MS/MSD was designated for this SDG.

All samples were collected by Parsons. All analyses were performed by TestAmerica-Denver following the procedures outlined in the Standard Subcontract and the Sampling and Analysis Plan Addendum for the Southeast Region. The samples in this SDG were shipped to the laboratory in two coolers. The coolers were received by the laboratory at temperatures of 2.8°C and 5.8°C, both of which were within the 2-6° C range recommended by the Work Plan.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Perchlorate	Explosives	Metals	Comments
BBT-MRS01-SW-03	SW	X	X	X	
BBT-AMB-SW-05	SW	X		X	Ambient sample
BBT-MRS01-SD-03	SD		X	X	
BBT-AMB-SD-05	SD			X	Ambient sample
BBT-MRS01-SS-02-05	S		X	X	
BBT-MRS01-SS-02-08	S		X	X	
BBT-MRS01-SS-02-09	S		X	X	

SW = surface water, SD = sediment, S = surface soil

EXTRACTION AND ANALYTICAL METHODS:

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	SW	3535	8321A	µg/L	NA
Explosives	S/SD	8330B	8321A	mg/kg	Dry Wt.
Perchlorate	SW	6860	6860	µg/L	NA
ICP/MS Metals	SW	3020A	6020	µg/L	NA
ICP/MS Metals	S/SD	3050B	6020	mg/kg	Dry Wt.

ICP-MS = Inductively Coupled Plasma / Mass Spectroscopy

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the PSAP (consisting of the Field Sampling Plan [FSP] and the Quality Assurance Project Plan [QAPP]) for the MMRP SI Program, prepared by the USACE Military Munitions Center of Expertise (MM CX). Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the reporting limit for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was received from a United States Army Corps of Engineers (USACE) chemist for the laboratory to use the historically developed control limits for explosives, as listed in the table below.

Analyte	Accuracy Control Limits for Soil/Sediment	Accuracy Control Limits for Water	Maximum RPD (%)
HMX	53-115	57–138	30
RDX	70-121	74–129	30
1,3,5-Trinitrobenzene	47-131	47–139	30
1,3-dinitrobenzene	69-128	65-133	30
Nitrobenzene	59-150	39-143	30
Tetryl	10-160	10-136	30
Nitroglycerin	32-135	39-144	30
2,4,6-Trinitrotoluene	58-130	33-142	30
4-Amino-2,6-dinitrotoluene	60-133	65-129	30
2-Amino-4,6-dinitrotoluene	53-141	64-136	30
2,4-Dinitrotoluene	61-128	66-129	30
2,6-Dinitrotoluene	59-134	63-131	30
3-Nitrotoluene	51-153	30-134	30
PETN	28-178	23-175	30
2-Nitrotoluene	55-147	32-129	30
4-Nitrotoluene	65-146	35-138	30

For metals, the accuracy control limits are 80-120% for the LCS and MS/MSD, and the maximum allowable RPD for the precision of the MS/MSD pair is 20%.

For perchlorate, the control limits are 85-115% for the LCS, and 75-125% for the MS/MSD. The maximum allowable RPD for the precision of the MS/MSD pair is 20%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of three (3) soil samples, one (1) sediment sample and one (1) water samples. The samples were collected on July 9, 2009 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to USEPA SW846 Method 8321A. All samples in this SDG were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP). All samples were prepared and analyzed within the holding time required by the method.

The samples for explosives analyses were extracted in two batches, one for water (#9194438) and two for soil/sediment (#9196450 and #9197842). The samples were analyzed in two batches under two different initial calibrations (ICALs).

Due to matrix interference, all surface water samples were diluted 20 fold for HMX and/or RDX. Elevated RLs of HMX were lower than the lowest criteria listed in Table 4.5c of the SAP for this site. The elevated RLs of RDX were higher than the lowest criteria listed in Table 4.5c, however, the elevated method detection limits (MDLs) were lower than the lowest criteria. Lab reported all results down to MDL. The method quality objectives were.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the LCS samples and the surrogate spikes. No MS/MSD was designated for this SDG.

Three LCS samples were analyzed, one for water and two for soil/sediment. All analytes met criteria in the LCS samples.

All surrogate recoveries were within acceptance criteria for the soil/sediment samples. The surrogate recovery was outside acceptance criteria for the water sample. Reported results for the water sample have been qualified as estimated and flagged 'UJ' for the non-diluted run. No flags were applied due to the diluted out surrogates on the diluted run since the surrogate failure had assignable cause.

Precision

No MS/MSD or field duplicate was designated for this SDG therefore precision was not evaluated.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All continuing calibration verification (CCV) criteria were met except for the CCV for PETN associated with the solid samples and the CCV for tetryl associated with the water samples. The CCV for PETN, associated with the solid samples, was above the upper control limit. Since PETN was not detected in the samples no action was required. The CCV for tetryl was below the control limits. The associated tetryl results of the water samples have been flagged 'UJ'.

- The MDL study for soil and water were conducted within 12 months of sample analysis.

Three method blanks, one for each batch, were associated with this SDG. Both method blanks were non-detect for all target explosives.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the samples in this SDG were considered usable. Thus, the completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

ICP/MS METALS

General

The ICP/MS portion of this SDG consisted of three (3) soil samples, two (2) sediment samples and two (2) water samples. The samples were collected on July 9, 2009 and were analyzed for antimony, barium, copper, lead and zinc.

The ICP/MS metals analyses were performed using USEPA SW846 Method 6020. The samples were analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

The samples for ICP/MS metals analyses were digested in two batches, one for soil/sediment (#9194384) and one for water (#9194390). The samples were analyzed in two batches under two different ICALs.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS samples. No MS/MSD was designated for this SDG.

Two LCS samples were analyzed, one for each batch. All LCS recoveries were within acceptance criteria.

Precision

Precision was not evaluated because no MS/MSD or field duplicate was designated for this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;

- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. The samples were prepared and analyzed within the holding times required by the method.

- All instrument tune criteria were met.
- All initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The soil/sediment DT was performed sample BBT-MRS01-SD-01 collected from the same site, but delivered in a different SDG. The DT met criteria for lead the only metal detected in the soil/sediment samples at a concentration of 100 times the MDL or greater, as follows:

Metal	%D	Criteria
Lead	0.8	%D $\leq$ 10

- The sediment PDS was performed on the same sample as the DT. The PDS was only applicable for those metals not listed above. All metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	104	75-125%
Barium	103	
Copper	107	
Zinc	101	

- The water DT was performed on a batch sample unrelated to this site. The water DT was not applicable since no metals were detected in the parent sample at a concentration of 100 times the MDL or greater.
- A PDS for water was analyzed on a batch sample unrelated to this site. All metals met criteria in the water PDS, as follows:

Metal	%R	Criteria
Antimony	99	75-125%
Barium	101	
Copper	103	
Lead	102	
Zinc	99	

Two method blanks, one for soil/sediment and one for water, and several calibration blanks were analyzed in association with the ICP/MS analyses in this SDG. All blanks were compliant. Copper was detected in sample BBT-MRS01-SS-02-05 at a concentration comparable to the concentration in the method blank. The affected copper detection has been qualified as not detected ('U') at the PQL.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All ICP/MS results for the samples in this SDG were considered usable. Therefore, the completeness for the ICP/MS portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

PERCHLORATE

General

The perchlorate portion of this SDG consisted of two (2) water samples. The samples were collected on July 9, 2009 and were field-filtered on site. The samples were analyzed for perchlorate as specified in the Work Plan.

The perchlorate analyses were performed according to USEPA SW846 Method 6860 and the procedures outlined in the laboratory Standard Operation Procedure (SOP). All samples were prepared and analyzed within the holding time required by the method.

The perchlorate analyses were performed in one analytical batch (#9196278) under a single ICAL.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS sample. No MS/MSD was designated for this SDG.

The LCS recovery was within the control limits.

Precision

No MS/MSD or field duplicate was designated for this SDG, therefore, precision was not evaluated.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial and continuing calibration verification criteria were met.
- All interference check sample criteria were met.
- All MDL verification standard criteria were met.
- The MDL study for water was conducted within 12 months of sample analyses.

One method blank was associated with this SDG. The method blank was free of perchlorate at method detection limit.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All perchlorate results for the samples in this SDG were considered usable. Thus, the completeness for the perchlorate portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project.

DATA VALIDATION SUMMARY REPORT

for samples collected from

BOSTWICK BOMB TARGET

Putnam County, Florida

Data Validation by: David Badio

Parsons – Washington, D.C.

INTRODUCTION

The following data validation summary report covers soil, sediment and surface water samples collected from the Bostwick Bomb Target site in Putnam County, Florida on July 10, 2009. Samples were logged in under the following Sample Delivery Group (SDG):

D9G110173

The soil, sediment and surface water samples in this SDG were analyzed for explosives and metals. The water samples were also analyzed for perchlorate. The table below details the requested parameters for each sample. The field quality control (QC) samples collected in this SDG included one water and one sediment field duplicate (FD) and one water and one sediment matrix spike/matrix spike duplicate (MS/MSD) pair. The field QC samples were analyzed for the same parameters as the associated parent sample.

All samples were collected by Parsons. All analyses were performed by TestAmerica-Denver following the procedures outlined in the Standard Subcontract and the Sampling and Analysis Plan Addendum for the Southeast Region. The samples in this SDG were shipped to the laboratory in three coolers. The coolers were received by the laboratory at temperatures of 5.6°C, 5.7°C and 5.1°C, all of which were within the 2-6° C range recommended by the Work Plan.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Perchlorate	Explosives	Metals	Comments
BBT-MRS01-SW-01	SW	X	X	X	MS/MSD
BBT-MRS01-SW-02	SW	X	X	X	
BBT-MRS01-SW-06	SW	X	X	X	FD of BBT-MRS01-SW-01
BBT-MRS01-SD-01	SD		X	X	MS/MSD
BBT-MRS01-SD-02	SD		X	X	
BBT-MRS01-SD-06	SD		X	X	FD of BBT-MRS01-SD-01
BBT-AMB-SS-02-04	S		X	X	Ambient sample
BBT-MRS01-SS-02-06	S		X	X	
BBT-MRS01-SS-02-07	S		X	X	
BBT-MRS01-SS-02-11*	S		X	X	

SW = surface water, SD = sediment, S = surface soil

* This sample was originally listed as BBT-MRS01-SW/SD-04 but was converted to surface soil due to lack of water at the planned location.

EXTRACTION AND ANALYTICAL METHODS:

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	W	3535	8321A	µg/L	NA
Explosives	S/SD	8330B	8321A	mg/kg	Dry Wt.
Perchlorate	W	6860	6860	µg/L	NA
ICP/MS Metals	W	3020A	6020	µg/L	NA
ICP/MS Metals	S/SD	3050B	6020	mg/kg	Dry Wt.

ICP-MS = Inductively Coupled Plasma / Mass Spectroscopy

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the PSAP (consisting of the Field Sampling Plan [FSP] and the Quality Assurance Project Plan [QAPP]) for the MMRP SI Program, prepared by the USACE Military Munitions Center of Expertise (MM CX). Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the reporting limit for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was received from a United States Army Corps of Engineers (USACE) chemist for the laboratory to use the historically developed control limits for explosives, as listed in the table below.

Analyte	Accuracy Control Limits for Soil/Sediment	Accuracy Control Limits for Water	Maximum RPD (%)
HMX	53-115	57–138	30
RDX	70-121	74–129	30
1,3,5-Trinitrobenzene	47-131	47–139	30
1,3-dinitrobenzene	69-128	65-133	30
Nitrobenzene	59-150	39-143	30
Tetryl	10-160	10-136	30
Nitroglycerin	32-135	39-144	30
2,4,6-Trinitrotoluene	58-130	33-142	30
4-Amino-2,6-dinitrotoluene	60-133	65-129	30
2-Amino-4,6-dinitrotoluene	53-141	64-136	30
2,4-Dinitrotoluene	61-128	66-129	30
2,6-Dinitrotoluene	59-134	63-131	30
3-Nitrotoluene	51-153	30-134	30
PETN	28-178	23-175	30
2-Nitrotoluene	55-147	32-129	30
4-Nitrotoluene	65-146	35-138	30

For metals, the accuracy control limits are 80-120% for the LCS and MS/MSD, and the maximum allowable RPD for the precision of the MS/MSD pair is 20%.

For perchlorate, the control limits are 85-115% for the LCS, and 75-125% for the MS/MSD. The maximum allowable RPD for the precision of the MS/MSD pair is 20%.

The field duplicate tolerances (RPD $\leq$ 70 for soil/sediment and RPD $\leq$ 40 for water) were approved by Deborah Walker and Rebecca Terry.

EXPLOSIVES

General

The explosives portion of this SDG consisted of four (4) soil samples, three (3) sediment samples and three (3) surface water samples. The samples were collected on July 10, 2009 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to USEPA SW846 Method 8321A. All samples in this SDG were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP). All samples were prepared and analyzed within the holding time required by the method.

The samples for explosives analyses were extracted in two batches, one for water (#9194438) and one for soil/sediment (#9197364). The samples were analyzed in two batches under two different initial calibrations (ICALs).

Due to matrix interference, all water samples were diluted 20 fold for HMX and/or RDX. Elevated RLs of HMX were lower than the lowest criteria listed in Table 4.5c of the SAP for this site. The elevated RLs of RDX were higher than the lowest criteria listed in Table 4.5c, however, the elevated method detection limits (MDLs) were lower than the lowest criteria. Lab reported all results down to MDL. The method quality objectives were met

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the LCS samples, MS/MSD samples, and the surrogate spikes. Water sample BBT-MRS01-SW-01 was designated for MS/MSD analyses on the COC. Sediment sample BBT-MRS01-SD-01 was designated for MS/MSD analyses on the COC.

Two LCS samples were analyzed, one for water and one for soil/sediment. All analytes met criteria in the LCS samples.

All surrogate recoveries were within acceptance criteria for the soil/sediment samples. All surrogate recoveries were outside acceptance criteria for the water samples. Reported results for the water samples have been qualified as estimated and flagged 'UJ' for the non-diluted runs. No flags were applied due to the diluted out surrogates on the diluted runs since the surrogate failure had assignable cause.

All MS/MSD recoveries were within acceptance criteria for the soil/sediment sample. All MS/MSD recoveries were outside acceptance criteria for the surface water sample as presented below:

BBT-MRS01-SW-01

Compound	MS %R	MSD %R	Criteria
1,3,5-Trinitrobenzene	7.6	8.5	47 – 139%
1,3-Dinitrobenzene	8.0	12	65 – 133%
2,4,6-trinitrotoluene	0.0	0.0	33 – 142%
2,4-Dinitrotoluene	7.1	9.1	66 – 129%
2,6-Dinitrotoluene	8.6	8.7	63 – 131%
2-Amino-4,6-dinitrotoluene	6.6	11	64 – 136%
2-Nitrotoluene	0.0	0.0	32 – 129%
3-Nitrotoluene	0.0	0.0	30 – 134%
4-Amino-2,6-dinitrotoluene	0.0	0.0	65 – 129%
4-Nitrotoluene	0.0	0.0	35 – 138%
Nitrobenzene	0.0	0.0	39 – 143%
Nitroglycerin	9.0	12	39 – 144%
PETN	4.6	6.3	23 – 175%
Tetryl	0.0	4.4	10 – 136%
HMX	NC*	NC*	57 – 138%
RDX	NC*	NC*	74 – 129%

* NC – Not calculated, parent sample diluted due to matrix interference.

Precision

Precision was evaluated using the relative percent difference (RPD) obtained from the MS/MSD samples. Precision was further assessed by comparing the field duplicate analyte results. Water sample BBT-MRS01-SW-06 was collected as a field duplicate of sample BBT-MRS01-SW-01. Sediment sample BBT-MRS01-SD-06 was collected as a field duplicate of sample BBT-MRS01-SD-01.

All MS/MSD RPDs for the sediment sample were within acceptance criteria.

All MS/MSD RPDs for the surface water samples were within acceptance criteria, except:

Compound	RPD%	Criteria, %RPD
1,3-Dinitrobenzene	41	30
2-Amino-4,6-dinitrotoluene	46	30
PETN	31	30
Tetryl	200	30

The results for the affected analytes were already qualified due to the surrogate %R outliers therefore no addition action was required due to the RPD outliers.

For the water and sediment field duplicate pairs, all analytes were non-detect in both the parent and field duplicate samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All continuing calibration verification (CCV) criteria were met except for the CCV for PETN associated with the solid samples and the CCV for tetryl and PETN associated with the water samples. The CCV for PETN, associated with the solid samples, was above the upper control limit. Since PETN was not detected in the samples no action was required. The CCV for tetryl and PETN were below the control limits. The results for tetryl and PETN for the water samples have been qualified as estimated and flagged 'UJ'.
- The MDL study for soil and water were conducted within 12 months of sample analysis.

Two method blanks, one for each batch, were associated with this SDG. Both method blanks were non-detect for all target explosives.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the samples in this SDG were considered usable. Thus, the completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

ICP/MS METALS

General

The ICP/MS portion of this SDG consisted of four (4) soil samples, three (3) sediment samples and three (3) water samples. The samples were collected on July 10, 2009 and were analyzed for antimony, barium, copper, lead and zinc.

The ICP/MS metals analyses were performed using USEPA SW846 Method 6020. The samples were analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

The samples for ICP/MS metals analyses were digested in two batches, one for soil/sediment (#9194384) and one for water (#9194390). The samples were analyzed in two batches under two different ICALs.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS samples and MS/MSD samples. Water sample BBT-MRS01-SW-01 was designated for MS/MSD analyses on the COC. Sediment sample BBT-MRS01-SD-01 was designated for MS/MSD analyses on the COC.

Two LCS samples were analyzed, one for each batch. All LCS recoveries were within acceptance criteria.

All analyte recoveries were within acceptance criteria for the water MS/MSD.

All analyte recoveries were within acceptance criteria for the sediment MS/MSD, except for the following:

BBT-MRS01-SD-01

Metal	MS%R	MSD %R	Criteria
Antimony	65	71	80 – 120%

The result of antimony in the parent sample was flagged "J", in accordance with the PSAP.

Precision

Precision was evaluated using the RPD obtained from the MS/MSD samples. Precision was further assessed by comparing the field duplicate analyte results. Water sample BBT-MRS01-SW-06 was collected as a field duplicate of sample BBT-MRS01-SW-01. Sediment sample BBT-MRS01-SD-06 was collected as the field duplicate of sample BBT-MRS01-SD-01.

All MS/MSD RPDs were within acceptance criteria for the water and sediment samples.

Barium was the only metal detected above the PQL in both the water parent and field duplicate sample and met criteria as follows:

BBT-MRS01-SW-01

Metal	Parent Conc. (µg/L)	FD Conc. (µg/L)	RPD	Criteria
Barium	3.5	3.9	11	RPD ≤ 40

Barium and lead were detected above the PQL in both the sediment parent and field duplicate samples and did not meet RPD criteria as follows:

BBT-MRS01-SD-01

Metal	Parent Conc. (mg/kg)	FD Conc. (mg/kg)	RPD	Criteria
Barium	2.4	0.45	164	RPD ≤ 70
Lead	2.9	0.76	117	

Reported results for barium and lead in the parent and field duplicate samples have been qualified as estimated and flagged 'J'.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. The samples were prepared and analyzed within the holding times required by the method.

- All instrument tune criteria were met.
- All initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The soil/sediment DT was performed on sample BBT-MRS01-SD-01. The sediment DT met criteria for lead, the only metal detected in the parent sample at a concentration of 100 times the MDL or greater, as follows:

Metal	%D	Criteria
Lead	0.8	%D ≤ 10

- The soil/sediment PDS was performed on the same sample as the DT. The PDS was only applicable for those metals not listed above. All metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	104	75-125%
Barium	103	
Copper	107	
Zinc	101	

- The water DT was performed on a sample unrelated to this site. The water DT was not applicable since no metals were detected in the parent sample at a concentration of 100 times the MDL or greater.

- A PDS for water was analyzed on the same sample as the DT. The PDS was applicable for all metals and met criteria, as follows:

Metal	%R	Criteria
Antimony	99	75-125%
Barium	101	
Copper	103	
Lead	102	
Zinc	99	

Two method blanks, one for soil/sediment and one for water, and several calibration blanks were analyzed in association with the ICP/MS analyses in this SDG. All blanks were compliant. It should be noted that the soil/sediment method blank contained low-level copper contamination. Some soil/sediment results for copper were changed to non-detect at the PQL or the concentration detected if the sample result was within five times the amount detected in the method blank. .

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All ICP/MS results for the samples in this SDG were considered usable. Therefore, the completeness for the ICP/MS portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

PERCHLORATE

General

The perchlorate portion of this SDG consisted of three (3) water samples. The samples were collected on July 10, 2009 and were field-filtered on site according to DoD Perchlorate Handbook. The samples were analyzed for perchlorate as specified in the Work Plan.

The perchlorate analyses were performed according to USEPA SW846 Method 6860 and the procedures outlined in the laboratory Standard Operation Procedure (SOP). All samples were prepared and analyzed within the holding time required by the method.

The perchlorate analyses were performed in one analytical batch (#9196278) under a single ICAL.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS sample and MS/MSD samples. Sample BBT-MRS01-SW-01 was designated for MS/MSD analyses on the COC for this SDG.

All LCS and MS/MSD recoveries were within the control limits.

Precision

Precision was evaluated using the RPD obtained from the MS/MSD samples. Precision was further assessed by comparing the field duplicate analyte results. Sample BBT-MRS01-SW-06 was collected as a field duplicate of sample BBT-MRS01-SW-01.

The MS/MSD RPD was within acceptance criteria.

Perchlorate was detected in both the parent and field duplicate samples at concentrations below the PQL. The RPD is not applicable.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial and continuing calibration verification criteria were met.
- All interference check sample criteria were met.
- All MDL verification standard criteria were met.
- The MDL study for water was conducted within 12 months of sample analyses.

One method blank was associated with this SDG. The method blank was free of perchlorate.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All perchlorate results for the samples in this SDG were considered usable. Thus, the completeness for the perchlorate portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project.

APPENDIX H

Geographic Information Systems Data
Electronic Only

APPENDIX I

Geophysical Data
Not Applicable

APPENDIX J

Conceptual Site Model

CONCEPTUAL SITE MODEL – MUNITIONS AND EXPLOSIVES OF CONCERN
BOSTWICK BOMB TARGET
PUTNAM COUNTY, FLORIDA

Munitions Response Site (MRS)	Acreage	Suspect Past DoD Activities	Potential MEC/MD Presence	MEC/MD Found Since Closure	Previous Investigation/Clearance Actions	Post-DoD Land Use and Current Land Use	Potential Receptors	Potential Source and Receptor Interaction	Field Sampling/ Qualitative Reconnaissance
BOSTWICK BOMB TARGET	3,111	Practice bombing and rocket range. Possible HE use. [2]	Bombs, Practice, AN-MK5, AN-MK23, AN-MK43, Practice; MK-15 series, Practice Bomb, 100lbs; Spotting Charge, M1A1; MK76, Practice Bomb; MK89, Practice Bomb, 56lbs; MK106, Practice Bomb, 5lbs; Signal, Practice Bomb, MK4; MK86, MK87, MK88, Practice 250-1000lbs; Signal, Practice Bomb, MK7; 30mm TP, M788; 2.25-inch, Practice Rocket; 2.25-inch, Practice Rocket, MK-4; 2.75-inch, Practice Rocket, FFAR; 2.75-inch, Rockets General, Practice[2]	ASR team observed numerous munitions debris items including 3-4 pound practice bombs, one "spent" fuze (possibly from 2.25"scar), and aluminum pieces (possibly from a rocket pod).[2] Several types of "dud" or expended ordnance as well as complete rounds were observed.[3] SVT found MEC (possible unexpended Mk76 25 lb. practice bomb, One unexpended noze fuze (type unknown), one AN-Mk23 3 lb. practice bomb w/unexpended Mk4 signal, one Mk76, Mod 0 or 1, with unexpended signal, and one 2.75-inch HE rocket warhead) and MD (M38A2, 100 lb. bomb, practice debris, parts from a Mk76 practice bomb, half of a AN-Mk 43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket) during July 2009 site visit.	ASR Field Visit Dec.5-6,1995 INPR Field Visit May 9, 1977;	Agricultural-growing pine trees for pulp paper industry. Also some surface mining for titanium precursors, hunting preserve	Commercial or industrial workers, visitors or recreational users, ecological receptors. Census data reports 34 residents within MRS boundary, so residents included as potential receptors.	Possibly - Intrusive or non-intrusive activity, MEC potentially at surface and subsurface, access available.	10 surface soil samples (9 biased and 1 ambient), and 4 surface water/ sediment sample couples (3 biased and 1 ambient) and associated QC samples. Proposed groundwater sample not collected. QR path as shown on Figures 4.1 and 5.1

Source
1 = 1996 ASR
2 = 2004 ASR Supplement
3 = 1994 INPR
4 = EOD response
5 = Other government correspondence

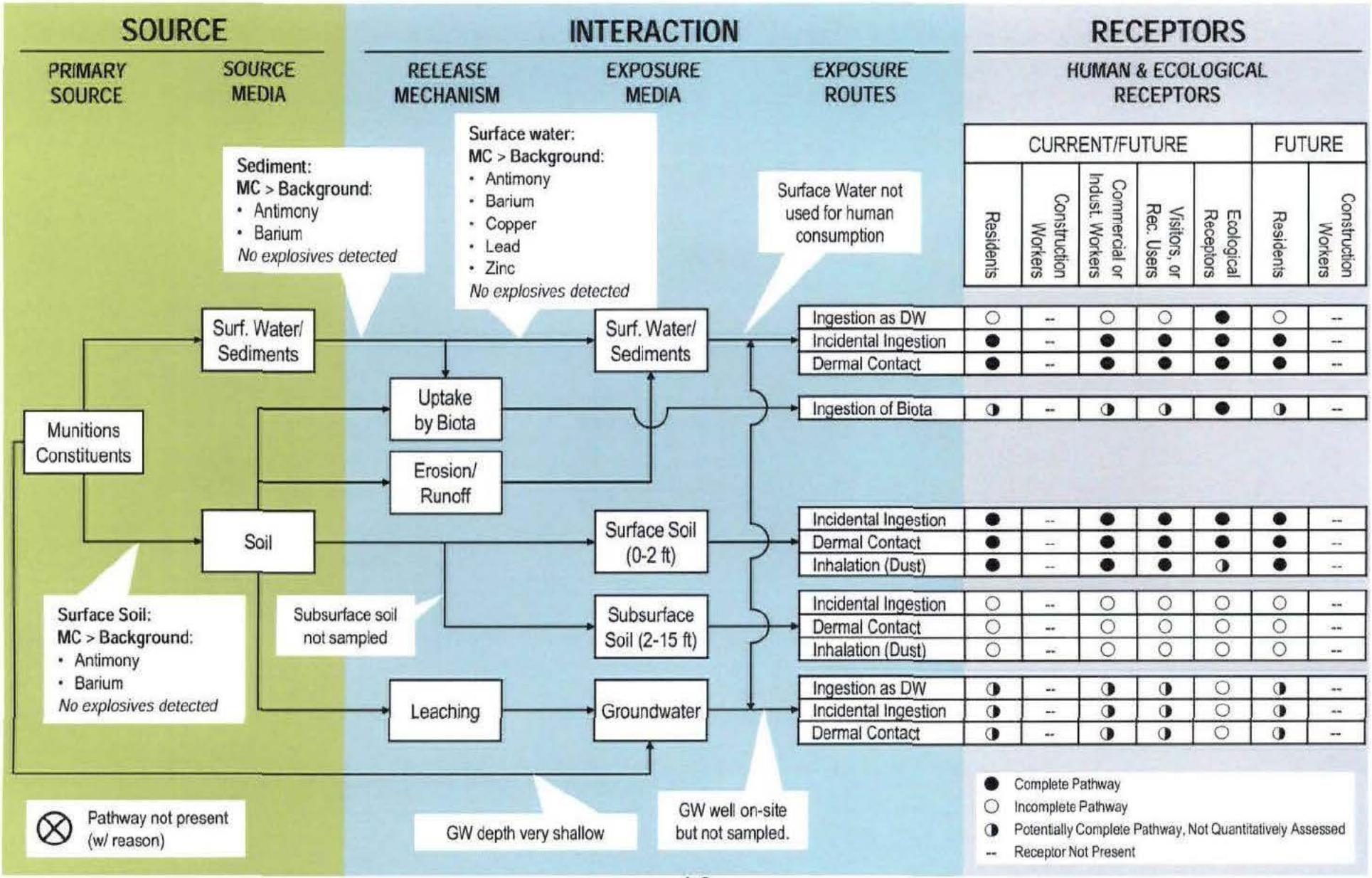
ASR = Archives Search Report
DoD = Department of Defense
EOD = Explosives Ordnance Disposal
MEC = Munitions and explosives of concern
N/A = Not Available
TBD = To be determined
QR = Qualitative Reconnaissance

FINAL

CONCEPTUAL SITE EXPOSURE MODEL

MRS Name: BOSTWICK BOMB TARGET – Bostwick Bomb Target Munitions Response Site

Completed By: Kathy Rowland, PARSONS ***Date Completed:*** September 23, 2009



APPENDIX K

Munitions Response Site Prioritization Protocol Evaluations (MRSPP)

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site Name: Bostwick Bomb Target

Component: US Army

Installation/Property Name: Bostwick Bomb Target

Location (City, County, State): Putnam County ,Florida

Site Name (RMIS ID)/Project Name (Project No.): I04FL091401R01/I04FL091401/FL49799F471200

Date Information Entered/Updated: 10/12/2009 1:58:45 AM

Point of Contact (Name/Phone): Mr. William A. Spence (904) 232-3459

Project Phase (check only one):

☐ PA	■ SI	☐ RI	☐ FS	☐ RD
☐ RA-C	☐ RIP	☐ RA-O	☐ RC	☐ LTM

Media Evaluated (check all that apply):

☐ Groundwater	■ Sediment (human receptor)
■ Surface soil	■ Surface Water (ecological receptor)
■ Sediment (ecological receptor)	■ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present):

In 1940, the United States acquired 3,111 acres of for use by the Naval Air Advanced Training Command (NAATC) for operational training and practice dive-bombing. The land was identified as the Bostwick Bomb Target and was active until 1977. The MRS consists of a rocket range safety fan overlying the original FUDS boundary and the 649-acre bomb target safety circle. Munitions used on the MRS include 2.75-inch HE rockets; practice bombs ranging from 3lb to 500lb (AN-Mk5, ANMk 23, ANMk 43, Mk106, Mk76, Mk89, Mk15, M3A2, Mk86,Mk87, Mk88), practice rockets (2.75-in FFAR (MkI) and SCAR, and 30mmTP projectiles (M788). Mk-81 250 lb. low drag bomb and Mk-82 500 lb. low drag bomb are also indicated; however, the available data does not specify whether these are general purpose or practice bombs. MD consisting of parts from a Mk76 practice bomb, half of a AN-Mk 43 3lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket, and MEC consisting of a possible unexpended Mk76 25lb. practice bomb, one unexpended noze fuze (type unknown), one AN-Mk23 3lb. practice bomb w/unexpended Mk4 signal, one Mk76, Mod 0 or 1, with unexpended signal, and one 2.75-inch HE rocket warhead, were found on the MRS during the July 2009 SI. MD was observed on the MRS during the 1995 ASR site visit.

Description of Pathways for Human and Ecological Receptors:

Direct release of MC from munitions activities within the MRS would be primarily to surface soil. Due to the extensive presence of wetlands throughout the MRS, direct releases to the wetlands surface water and sediment may have occurred from munitions activities. Based on the shallow depth of the surficial aquifer in Putnam County (1 – 40 feet bgs), the munitions used at this target, and the sandy soil, groundwater could also have been directly affected by bombing activities. If releases of MC to surface soil occur, MC could migrate to surface water and sediment through runoff and erosion or to groundwater through leaching. There is one well on the MRS and there are 6 wells within a 4-mile radius of the MRS.

Description of Receptors (Human and Ecological):

Based on the current and future land use, potential receptors for associated with the MRS include residents (based on census data), commercial or industrial workers (such as plantation employees), site visitors or recreational users, and ecological receptors.

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms practice munitions, small arms, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorus (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. ◆ All hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazardard.	30
High explosive (used or damaged)	◆ All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ All DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ◆ All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ All DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrothechnics, or propellant	◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. ◆ Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ All DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ All UXO that are practice munitions that are not associated with a sensitive fuze. ◆ All DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	25

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

Munitions used on the MRS that are classified as high explosive are 2.75-inch HE rockets; Practice munitions used on the MRS are practice bombs ranging from 3lb to 500lb (AN-Mk5, ANMk 23, ANMk 43, Mk106, Mk76, Mk89, Mk15, M3A2, Mk86,Mk87, Mk88), practice rockets (2.75-in FFAR(MkI) and SCAR, and 30mmTP projectiles (M788). Mk-81 250 lb. low drag bomb and Mk-82 500 lb. low drag bomb are also indicated; however, the available data does not specify whether these are general purpose or practice bombs. (2009 SI Report, Subchapter 6.1.4.2 and Table 4.1)

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the score(s) that correspond with **all** sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms former range, practice munitions, small arms, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	• The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include: impact or target areas, associated buffer and safety zones, firing points, and live-fire maneuver areas.	*10*
Former munitions treatment (i.e., OB/OD) unit	• The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	• The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	• The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	• The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	• The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	• The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	• The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	• The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	• The MRS is a former military range where only small arms ammunition was used [There must be evidence that no other types of munitions (e.g., grenades) were used or are present to place an MRS into this category.].	1
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	*10*

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

The MRS was used for for operational training and practice dive-bombing from 1940 through December 1977. Practice and high explosive muntions were used on the MRS. (2009 SI Report, Subchapters 2.3.1.1 and 5.3.4.2)

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms surface, subsurface, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	• Physical evidence indicates that there are UXO or DMM on the surface of the MRS • Historical evidence (e.g., a confirmed incident report or accident report) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS,and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	• There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	• There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	• There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	• The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability [There must be evidence that no other types of munitions (e.g., grenades) were used or are present at the MRS to place an MRS into this category.].	1
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	25

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

MEC in the form of a possible unexpended Mk76 25 lb. practice bomb, one unexpended noze fuze (type unknown), one AN-Mk23 3 lb. practice bomb w/unexpended Mk4 signal, one Mk76, Mod 0 or 1, with unexpended signal, and one 2.75-inch HE rocket warhead, and MD consisting of debris from a Mk76 practice bomb, half of a AN-Mk 43 3 lb. practice bomb, AN-Mk23 bomb parts and one 2.25-inch practice rocket were found on the MRS during the site visit performed in support of the 2009 SI Report. In addition, MD was observed during the 1995 ASR site visit. (2009 SI Report, Subchapters 2.4.2.2, 6.1.4.1and Table 4.2)

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to any explosive materiel. Circle the score that corresponds with the ease of access to the MRS.

Note: The term barrier is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	• There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	*10*
Barrier to MRS access is incomplete	• There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	• There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	• There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	*10*

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classifications in the space provided.

Access to the MRS is not restricted. (2009 SI Report, Subchapters 5.3.4.1 and 6.1.4.3)

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	• The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	5
Scheduled for transfer from DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the rule is applied.	3
DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classifications in the space provided.

The MRS is privately owned. (2009 SI Report, Subchapter 2.2.9.3)

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications of population density and their descriptions. Determine the population density per square mile in the vicinity of the MRS and circle the score that corresponds with the associated population density.

Note: If an MRS is located in more than one county, use the largest population density value among the counties. If the MRS is within or borders a city or town, use the population density for the city or town, rather than that of the county.

Classification	Description	Score
> 500 persons per square mile	• There are more than 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	5
100–500 persons per square mile	• There are 100 to 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	3
< 100 persons per square mile	• There are fewer than 100 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	1

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classifications in the space provided.

The 2000 US Census reports the population density for Putnam County as 98 persons per square mile. (2009 SI Report, Subchapter 2.2.7.2)

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the population near the hazard. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the associated population near the known or suspected hazard.

Note: The term inhabited structures is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	• There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	• There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	• There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	• There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	• There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	• There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classifications in the space provided.

There are no known inhabited structures within the MRS. The US Census indicates that 631 people live within a two mile radius of the MRS. (2009 SI Report, Subchapter 2.2.6 and Table 2.1)

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures near the hazard and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the score(s) that correspond with **all** the activities/structures classifications at the MRS.

Note: The term inhabited structure is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	• There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The MRS is used as a pine tree plantation. Additional uses consist of surface mining for titanium metal precursors and a hunting preserve. US Census data indicate a population of 631 people within a two mile radius of the MRS. (2009 SI Report, Subchapter 2.2.8 and Table 2.1)

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resource classifications at the MRS.

Note: The terms ecological resources and cultural resources are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	• There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	• There are ecological resources present on the MRS.	3
Cultural resources present	• There are cultural resources present on the MRS.	3
No ecological or cultural resources present	• There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	3

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classifications in the space provided.

Cultural resources are not present. (2009 SI Report, Subchapter 3.3.2)
The MRS is an important ecological place. (2009 SI Report, Subchapter 5.2.5.4)

Table 10

Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	25	40
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	1	14
Population Near Hazard	Table 7	5	
Types of Activities/ Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	3	
EHE MODULE TOTAL			*89*

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	*B*
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	*B*

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms CWM/UXO, CWM/DMM, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is: • Explosively configured CWM that are UXO (i.e., CWM/UXO). • Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	• The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	• The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: • Nonexplosively configured CWM/DMM. • Bulk CWM/DMM (e.g., ton container).	15
CAIS K941 and CAIS K942	• The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	• Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	• Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	*0*
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	*0*

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

There is no historical evidence that CWM is present on the MRS. (2009 SI Report, Subchapters 2.3 and 2.4). Therefore, Tables 12-19 have been omitted.

Table 20

Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		0
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		0
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			*0*

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	***No Known or Suspected CWM Hazard***

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios

CHF Scale	CHF Value	Sum The Ratios
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ☐

Table 21 Comments: Groundwater was not sampled during the SI. Based on the shallow depth of the water table in the region, the geology, and the munitions used at the target, munitions activities could have directly affected groundwater. If there were releases of MC to soil, surface water
or sediment because of the munitions-related activities, it is possible that the constituents could leach to groundwater at the MRS.There are six wells located over one mile from the MRS boundary and one well located within the MRS. (2009 SI Report, Subchapters 5.3.2.3 and 5.3.2.6)

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Barium	20	7300	ug/L	0.0027
Zinc	11	11000	ug/L	0.001
Copper	1.5	1500	ug/L	0.001
Lead	1.1	15	ug/L	0.073
Antimony	0.12	15	ug/L	0.008

CHF Scale	CHF Value	Sum The Ratios	0.086
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*H*

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ☐

Table 22 Comments: Surface water was analyzed for explosives, metals and perchlorate. No explosives were detected in the surface water, and perchlorate was not detected above ambient concentratons. Five MC metals were detected above selected background concentrations (2009 SI Report, Tables 5.3 and 5.9). MPF is rated M given available information, RF is rated H as the MRS is used for residential and recreational use and there are no access restrictions (2009 SI Report Subchapter 2.2.8).

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Barium	32	16000	mg/Kg	0.002
Antimony	0.15	31	mg/Kg	0.0048

CHF Scale	CHF Value	Sum The Ratios	0.0068
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*H*
	No Known or Suspected Sediment (Human Endpoint) MC Hazard	☐

Table 23 Comments: Sediment was sampled for explosives and MC metals. No explosives were detected in the sediment. Two MC metals were detected above background concentrations. (2009 SI Report, Tables 5.5 and 5.10). MPF is rated M given available information, RF is rated H as the MRS is used for residential and recreational use and there are no access restrictions (2009 SI Report Subchapter 2.2.8).

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface water and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Barium	20	4	ug/L	5
Zinc	11	120	ug/L	0.092
Copper	1.5	9	ug/L	0.17
Lead	1.1	2.5	ug/L	0.44
Antimony	0.12	30	ug/L	0.004

CHF Scale	CHF Value	Sum The Ratios	5.7
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*M*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*H*

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ☐

Table 24 Comments: Surface water was analyzed for explosives, metals and perchlorate. No explosives were detected in the surface water, and perchlorate was not detected above ambient concentratons. Five MC metals were detected above selected background concentrations (2009 SI Report, Tables 5.3 and 5.9). MPF is rated M given available information, RF is rated H as the MRS is classified as an important ecological place (2009 SI Report Subchapter 5.2.5.4).

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's sediment and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Barium	32	20	mg/Kg	1.6
Antimony	0.15	2	mg/Kg	0.075
			Sum The Ratios	**1.7**

CHF Scale	CHF Value
CHF > 100	H (High)
100 > CHF > 2	M (Medium)
2 > CHF	L (Low)

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*H*

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ☐

Table 25 Comments: Sediment was sampled for explosives and MC metals. No explosives were detected in the sediment. Two MC metals were detected above background concentrations. (2009 SI Report, Tables 5.5 and 5.10). MPF is rated M given available information, RF is rated H as the MRS is an important ecological place (2009 SI Report Subchapter 5.2.5.4).

Table 26

HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface soil and their comparison values (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Barium	12	16000	mg/Kg	0.00075
Antimony	0.2	31	mg/Kg	0.0065

CHF Scale	CHF Value	Sum The Ratios	0.0072
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*H*
	No Known or Suspected Surface Soil MC Hazard	☐

Table 26 Comments: Surface soil was sampled for explosives and MC metals. No explosives were detected in the soil samples. Two MC metals were detected above background concentrations. (2009 SI Report, Tables 5.5 and 5.10). MPF is rated M given available information, RF is rated H as the MRS is used for residential and recreational use and there are no access restrictions (2009 SI Report Subchapter 2.2.8).

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the media in which these contaminants are present. Then record all contaminants, their maximum concentrations and their comparison values (from Appendix B) in the table below. Calculate and record the ratio for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF for each medium on the appropriate media-specific tables.

Note: Remember not to add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the Contaminant Hazard, Migration Pathway, and Receptor Factors for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the Three-Letter Combination boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each media's rating (A–G) and record the letter in the corresponding Media Rating box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)					
Surface Water/Human Endpoint (Table 22)	L	M	H	HML	D
Sediment/Human Endpoint (Table 23)	L	M	H	HML	D
Surface Water/Ecological Endpoint (Table 24)	M	M	H	HMM	C
Sediment/Ecological Endpoint (Table 25)	L	M	H	HML	D
Surface Soil (Table 26)	L	M	H	HML	D

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the HHE Module Rating box below.

HHE MODULE RATING	C

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter rating for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical priority for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the MRS or Alternative Priority box at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	*3*	C	3	B	3
C	4	D	4	*C*	*4*
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		*No Known or Suspected CWM Hazard*		No Known or Suspected MC Hazard	
MRS or ALTERNATIVE PRIORITY				*3*	

APPENDIX L

Reference Copies

Please see CD/DVD for ASR documents

ORDLABEL	BANKSID	STATEID	NAME	PROPUSE	COMPLETED	TOTDEPTH	X	Y
3	43797	22491	Lafarge Gypsum	Active		800	-81.641	29.74346
4	48532	708	GP Palatka Operations	Active		600	-81.7118	29.72931
1	39361	13592	Don P Hunt Farms	Active		0	-81.7249	29.82751
5	47033	22493	Lafarge Gypsum	Proposed		500	-81.641	29.73897
2	47574	709	GP Palatka Operations	Active		700	-81.7107	29.73585
5	64353	35670	Lafarge Gypsum	Inactive		280	-81.639	29.74155

BANKS ENVIRONMENTAL DATA
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Water Well Report ™

December 22, 2008

CLIENT

PARSONS, INC.-NORCROSS
5390 Triangle Parkway, Ste 100
Norcross, GA 30092

SITE

Bostwick Bomb Target
Putnam County, FL
744647-00002
ES45160

P.O. Box 12851, Capitol Station, Austin, TX 78711
1601 Rio Grande Street, Suite 500 Austin, TX 78701
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Water Well Report™

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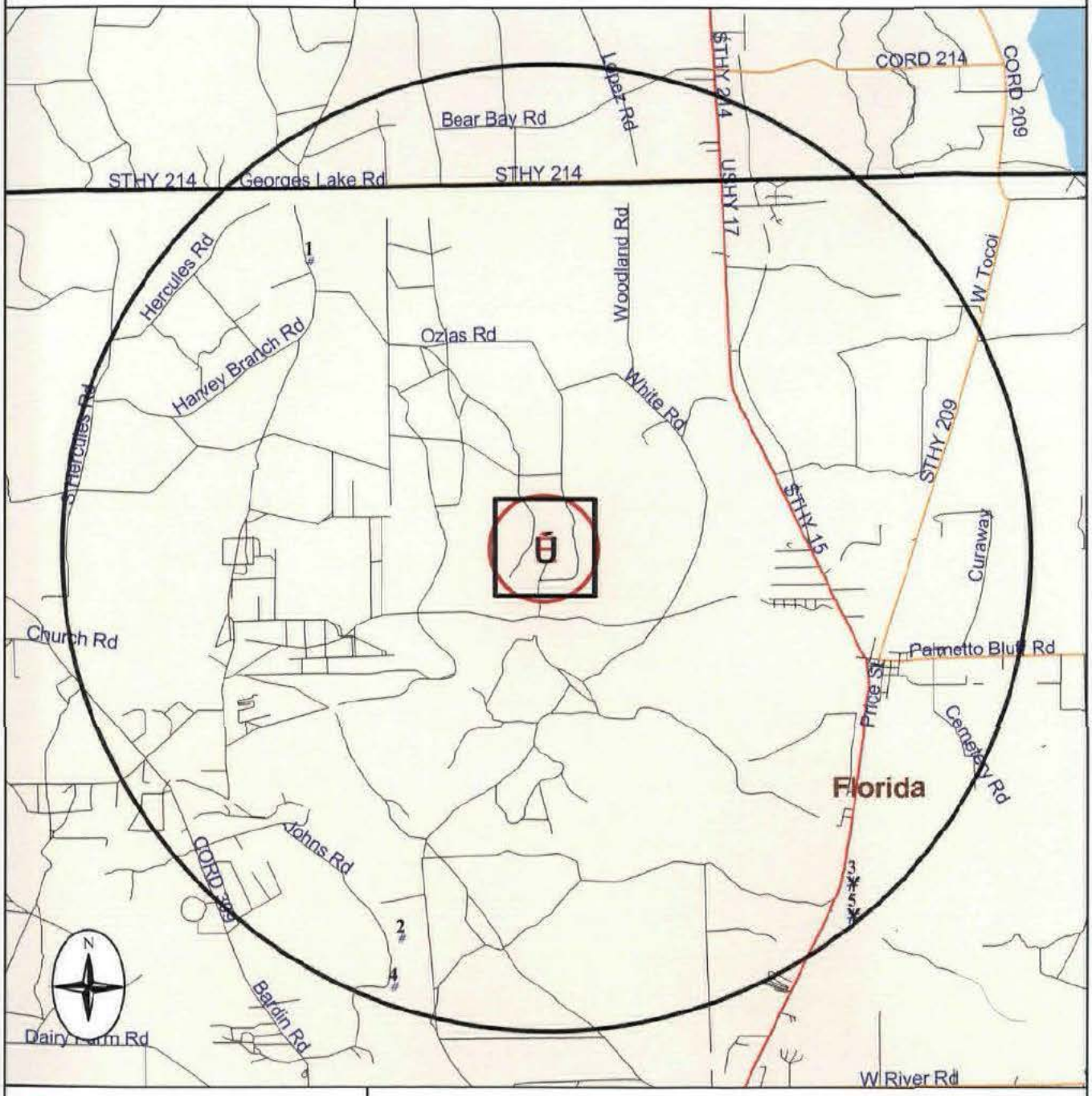
Map of Wells within Four and One-Half Miles



Subject Site
Ground Water Wells (Cluster)
Ground Water Well
Airport
Hospital
Highway
Primary road
Secondary and connecting road
Local road
Access road
Water body
Park
State

0 1 2 3 4 5 Miles

Banks Environmental Data, Inc.
P.O. Box 12851, Capitol Station Austin, Texas 78711
512-478-0059 FAX 512-478-1433 E Mail: BANKS@BANKSINFO.COM

December 22, 2008

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Water Well Report ™

DETAILS

		MAP ID
State ID	13592	1
Banks ID	39361	
Owner Of Well	Don P Hunt Farms	
Type Of Well	Active	
Depth Drilled	0 '	
Completion Date	N/A	
Longitude	-81.72489	
Latitude	29.82751	

		MAP ID
State ID	709	2
Banks ID	47574	
Owner Of Well	GP Palatka Operations	
Type Of Well	Active	
Depth Drilled	700 '	
Completion Date	N/A	
Longitude	-81.71067	
Latitude	29.73585	

		MAP ID
State ID	22491	3
Banks ID	43797	
Owner Of Well	Lafarge Gypsum	
Type Of Well	Active	
Depth Drilled	800 '	
Completion Date	N/A	
Longitude	-81.64104	
Latitude	29.74346	

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DETAILS

State ID	708	MAP ID 4
Banks ID	48532	
Owner Of Well	GP Palatka Operations	
Type Of Well	Active	
Depth Drilled	600 '	
Completion Date	N/A	
Longitude	-81.71176	
Latitude	29.72931	

State ID	22493	MAP ID 5
Banks ID	47033	
Owner Of Well	Lafarge Gypsum	
Type Of Well	Proposed	
Depth Drilled	500 '	
Completion Date	N/A	
Longitude	-81.64102	
Latitude	29.73897	

State ID	35670	MAP ID 5
Banks ID	64353	
Owner Of Well	Lafarge Gypsum	
Type Of Well	Inactive	
Depth Drilled	280 '	
Completion Date	N/A	
Longitude	-81.63896	
Latitude	29.74155	

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Water Well Report™ Research Mapping Protocol

Banks Environmental Data, Inc. Water Well Report™ is prepared from existing state water well databases and additional file data/records research conducted at the St. Johns Water Management District located in Palatka, Florida. With this information, groundwater wells are geocoded/geoplotted using a GIS application, ArcView 3.0a, and the water well report is produced from the database information provided by the state district.

Banks Environmental Data, Inc. has performed a thorough and diligent search of all groundwater well information provided and recorded with the St. Johns Water Management District. All mapped locations are based on information obtained from the SJWMD. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Environmental Data, Inc. cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the Florida regulatory authorities.

U.S. Census Bureau
American FactFinder

FACT SHEET

Putnam County, Florida

View a Fact Sheet for a **race, ethnic, or ancestry group**

Census 2000 Demographic Profile Highlights:

General Characteristics - show more >>	Number	Percent	U.S.		
Total population	70,423			map	brief
Male	34,791	49.4	49.1%	map	brief
Female	35,632	50.6	50.9%	map	brief
Median age (years)	40.5	(X)	35.3	map	brief
Under 5 years	4,326	6.1	6.8%	map	
18 years and over	53,119	75.4	74.3%		
65 years and over	13,009	18.5	12.4%	map	brief
One race	69,579	98.8	97.6%		
White	54,868	77.9	75.1%	map	brief
Black or African American	12,003	17.0	12.3%	map	brief
American Indian and Alaska Native	297	0.4	0.9%	map	brief
Asian	311	0.4	3.6%	map	brief
Native Hawaiian and Other Pacific Islander	29	0.0	0.1%	map	brief
Some other race	2,071	2.9	5.5%	map	
Two or more races	844	1.2	2.4%	map	brief
Hispanic or Latino (of any race)	4,168	5.9	12.5%	map	brief
Household population	69,025	98.0	97.2%	map	brief
Group quarters population	1,398	2.0	2.8%	map	
Average household size	2.48	(X)	2.59	map	brief
Average family size	2.95	(X)	3.14	map	
Total housing units	33,870			map	
Occupied housing units	27,839	82.2	91.0%		brief
Owner-occupied housing units	22,269	80.0	66.2%	map	
Renter-occupied housing units	5,570	20.0	33.8%	map	brief
Vacant housing units	6,031	17.8	9.0%	map	

Social Characteristics - show more >>	Number	Percent	U.S.		
Population 25 years and over	47,761				
High school graduate or higher	33,601	70.4	80.4%	map	brief
Bachelor's degree or higher	4,507	9.4	24.4%	map	
Civilian veterans (civilian population 18 years and over)	10,076	19.0	12.7%	map	brief
Disability status (population 5 years and over)	19,711	30.3	19.3%	map	brief
Foreign born	2,371	3.4	11.1%	map	brief
Male, Now married, except separated (population 15 years and over)	15,983	58.8	56.7%		brief
Female, Now married, except separated (population 15 years and over)	15,529	53.8	52.1%		brief
Speak a language other than English at home (population 5 years and over)	4,790	7.3	17.9%	map	brief

Economic Characteristics - show more >>	Number	Percent	U.S.		
In labor force (population 16 years and over)	27,959	50.7	63.9%		brief
Mean travel time to work in minutes (workers 16 years and over)	29.3	(X)	25.5	map	brief
Median household income in 1999 (dollars)	28,180	(X)	41,994	map	
Median family income in 1999 (dollars)	34,499	(X)	50,046	map	
Per capita income in 1999 (dollars)	15,603	(X)	21,587	map	
Families below poverty level	3,080	15.8	9.2%	map	brief
Individuals below poverty level	14,449	20.9	12.4%	map	

Housing Characteristics - show more >>	Number	Percent	U.S.		
Single-family owner-occupied homes	11,325				brief

Median value (dollars)	68,500	(X)	119,600	map	brief
Median of selected monthly owner costs	(X)	(X)			brief
With a mortgage (dollars)	686	(X)	1,088	map	
Not mortgaged (dollars)	209	(X)	295		

(X) Not applicable.
Source: U.S. Census Bureau, Summary File 1 (SF 1) and Summary File 3 (SF 3)

The letters PDF or symbol indicate a document is in the Portable Document Format (PDF). To view the file you will need the Adobe® Acrobat® Reader, which is available for **free** from the Adobe web site.

U.S. Census Bureau
American FactFinder

DP-3. **Profile of Selected Economic Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Putnam County, Florida**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**55,103**	**100.0**
In labor force	27,959	50.7
Civilian labor force	27,921	50.7
Employed	26,326	47.8
Unemployed	1,595	2.9
Percent of civilian labor force	5.7	(X)
Armed Forces	38	0.1
Not in labor force	27,144	49.3
Females 16 years and over	**28,340**	**100.0**
In labor force	13,060	46.1
Civilian labor force	13,054	46.1
Employed	12,176	43.0
Own children under 6 years	**4,833**	**100.0**
All parents in family in labor force	2,671	55.3
COMMUTING TO WORK		
Workers 16 years and over	**25,758**	**100.0**
Car, truck, or van -- drove alone	20,094	78.0
Car, truck, or van -- carpooled	4,346	16.9
Public transportation (including taxicab)	170	0.7
Walked	251	1.0
Other means	385	1.5
Worked at home	512	2.0
Mean travel time to work (minutes)	29.3	(X)
Employed civilian population 16 years and over	**26,326**	**100.0**
OCCUPATION		
Management, professional, and related occupations	5,845	22.2
Service occupations	4,600	17.5
Sales and office occupations	6,560	24.9
Farming, fishing, and forestry occupations	869	3.3
Construction, extraction, and maintenance occupations	3,666	13.9
Production, transportation, and material moving occupations	4,786	18.2
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	1,287	4.9
Construction	2,669	10.1
Manufacturing	3,441	13.1
Wholesale trade	798	3.0
Retail trade	3,363	12.8
Transportation and warehousing, and utilities	1,549	5.9
Information	495	1.9
Finance, insurance, real estate, and rental and leasing	1,179	4.5
Professional, scientific, management, administrative, and waste management services	1,397	5.3
Educational, health and social services	5,128	19.5
Arts, entertainment, recreation, accommodation and food services	1,822	6.9
Other services (except public administration)	1,178	4.5
Public administration	2,020	7.7
CLASS OF WORKER		
Private wage and salary workers	19,312	73.4
Government workers	5,119	19.4
Self-employed workers in own not incorporated business	1,807	6.9

Subject	Number	Percent
Unpaid family workers	88	0.3
INCOME IN 1999		
Households	**27,813**	**100.0**
Less than $10,000	4,624	16.6
$10,000 to $14,999	2,569	9.2
$15,000 to $24,999	5,141	18.5
$25,000 to $34,999	4,234	15.2
$35,000 to $49,999	4,452	16.0
$50,000 to $74,999	3,941	14.2
$75,000 to $99,999	1,559	5.6
$100,000 to $149,999	797	2.9
$150,000 to $199,999	192	0.7
$200,000 or more	304	1.1
Median household income (dollars)	28,180	(X)
With earnings	18,424	66.2
Mean earnings (dollars)	39,102	(X)
With Social Security income	11,052	39.7
Mean Social Security income (dollars)	11,175	(X)
With Supplemental Security Income	1,780	6.4
Mean Supplemental Security Income (dollars)	6,008	(X)
With public assistance income	1,254	4.5
Mean public assistance income (dollars)	2,034	(X)
With retirement income	5,999	21.6
Mean retirement income (dollars)	17,690	(X)
Families	**19,451**	**100.0**
Less than $10,000	2,080	10.7
$10,000 to $14,999	1,448	7.4
$15,000 to $24,999	3,326	17.1
$25,000 to $34,999	2,992	15.4
$35,000 to $49,999	3,733	19.2
$50,000 to $74,999	3,368	17.3
$75,000 to $99,999	1,404	7.2
$100,000 to $149,999	712	3.7
$150,000 to $199,999	153	0.8
$200,000 or more	235	1.2
Median family income (dollars)	34,499	(X)
Per capita income (dollars)	15,603	(X)
Median earnings (dollars):		
Male full-time, year-round workers	29,975	(X)
Female full-time, year-round workers	20,955	(X)
POVERTY STATUS IN 1999 (below poverty level)		
Families	**3,080**	**(X)**
Percent below poverty level	(X)	15.8
With related children under 18 years	2,282	(X)
Percent below poverty level	(X)	26.6
With related children under 5 years	1,081	(X)
Percent below poverty level	(X)	32.0
Families with female householder, no husband present	**1,382**	**(X)**
Percent below poverty level	(X)	41.4
With related children under 18 years	1,202	(X)
Percent below poverty level	(X)	52.6
With related children under 5 years	560	(X)
Percent below poverty level	(X)	65.0
Individuals	**14,449**	**(X)**
Percent below poverty level	(X)	20.9
18 years and over	9,212	(X)
Percent below poverty level	(X)	17.6
65 years and over	1,690	(X)
Percent below poverty level	(X)	13.1
Related children under 18 years	5,180	(X)
Percent below poverty level	(X)	30.6
Related children 5 to 17 years	3,698	(X)
Percent below poverty level	(X)	29.3
Unrelated individuals 15 years and over	3,660	(X)

Subject	Number	Percent
Percent below poverty level	(X)	31.9

(X) Not applicable.
Detailed Occupation Code List (PDF 42KB)
Detailed Industry Code List (PDF 44KB)
User note on employment status data (PDF 63KB)
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P32, P33, P43, P46, P49, P50, P51, P52, P53, P58, P62, P63, P64, P65, P67, P71, P72, P73, P74, P76, P77, P82, P87, P90, PCT47, PCT52, and PCT53

Mineral Resources On-Line Spatial Data

Counties page > Pb in Conterminous US > Pb in southeastern US > Averages in Putnam County

Average concentrations of elements in Putnam County, Florida

(Calculated from cells in the geochemical grid plotting in this area.)

Element	Symbol	Mean	Std. dev.	Minimum	Maximum
Aluminum	Al (wt%)	0.639	0.473	0.075	3.982
Arsenic	As (ppm)	1.402	0.567	0.348	3.947
Calcium	Ca (wt%)	0.263	0.201	0.018	1.412
Copper	Cu (ppm)	4.241	4.263	1.077	29.290
Iron	Fe (wt%)	0.330	0.116	0.069	0.791
Mercury	Hg (ppm)	0.028	0.022	0.011	0.218
Magnesium	Mg (wt%)	0.030	0.020	0.003	0.175
Manganese	Mn (ppm)	80.159	26.892	19.508	167.369
Sodium	Na (wt%)	0.020	0.019	0.003	0.179
Phosphorus	P (wt%)	0.024	0.015	0.003	0.093
Lead	Pb (ppm)	34.824	63.752	3.931	628.259
Selenium	Se (ppm)	0.167	0.079	0.101	0.722
Titanium	Ti (wt%)	0.453	0.125	0.133	1.098
Zinc	Zn (ppm)	35.497	85.978	1.657	833.787

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