APPENDIX L – EXPLOSIVES SITE PLAN

FINAL EXPLOSIVES SITE PLAN

REMEDIAL INVESTIGATION FOR THE RICOCHET AREA MUNITIONS RESPONSE SITE IN STATE GAME LANDS 211, PENNSYLVANIA

Contract No.: W9133L-09-F-0304

March 2010

Prepared for:

National Guard Bureau
Arlington, VA 22202-3231

and

Pennsylvania Army National Guard
Department of Military and Veterans Affairs
Fort Indiantown Gap Military Reservation
Annville, PA 17003

Prepared by:

Weston Solutions, Inc.
West Chester, PA 19380

09P-1439-3

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NATIONAL GUARD BUREAU
1411 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202-3231

and

PENNSYLVANIA ARMY NATIONAL GUARD
DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
FORT INDIANTOWN GAP MILITARY RESERVATION
ANNVILLE, PA 17003

WESTON SOLUTIONS, INC.
1400 WESTON WAY
WEST CHESTER, PA 19380

WESTON PROJECT NO.: 12767.099.001.0030

MARCH 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

BIP	blow-in-place
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DDESB	Department of Defense Explosive Safety Board
DGM	digital geophysical mapping
DoD	Department of Defense
ESP	Explosives Site Plan
ESQD	Explosive Safety Quantity Distance
ft	feet
FIG	Fort Indiantown Gap Military Reservation
HE	high explosive
HEAT	high explosive anti-tank
HFD	hazardous fragment distance
MEC	munitions and explosives of concern
MGFD	munitions with the greatest fragmentation distance
MMRP	Military Munitions Response Program
MPPEH	materials potentially presenting an explosive hazard
MRS	Munitions Response Site
MSD	minimum separation distance
NGB	National Guard Bureau
PAARNG	Pennsylvania Army National Guard
PGC	Pennsylvania Game Commission
RI	Remedial Investigation
SGL	State Game Lands
UXO	unexploded ordnance

1. Site Location

a. Ricochet Area Munitions Response Site (MRS) (FIG-003-R-02) in Pennsylvania State Game Lands (SGL) 211 and adjacent to Fort Indiantown Gap Military Reservation (FIG), Annville, Pennsylvania.

b. Ricochet Area MRS is located north of FIG's current Impact Area and Installation boundary.

2. Anticipated Dates of Field Effort

a. Early Start: February 1, 2010

b. Late Finish: July 1, 2010

3. Purpose

a. This Explosives Site Plan (ESP) is required for the Remedial Investigation (RI) at the Ricochet Area MRS due to the intentional and expected physical contact with munitions and explosives of concern (MEC) during field activities.

b. The RI is being performed under the Military Munitions Response Program (MMRP) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and is part of the overall remedial action process. Subsequent removal responses may be dictated during the remainder of the remedial response process, as determined by action memoranda or other decision documents. If subsequent removal responses are determined to be necessary in the full remedial process, an Explosive Safety Submission will be prepared and submitted for review and approval as necessary to support that response.

4. Site Background and Current Conditions

a. The Ricochet Area MRS is located north of the FIG boundary and consists of approximately 8,000 acres. **Figure 1** in Appendix A shows the location of the Ricochet Area MRS.

b. The Ricochet Area MRS is located in Pennsylvania SGL 211 in Dauphin and Lebanon Counties, and the land is owned by the Commonwealth of Pennsylvania.

c. The Ricochet Area MRS was identified in the US Army Garrison Documents as a Ricochet Area to the Installation's 1,351-acre impact area for live-direct and indirect fire. Munitions were not intentionally fired into the area; however, the Active Component US Army Garrison at FIG had agreements with Pennsylvania Game Commission (PGC) for some weapons safety fans to extend beyond the

Installation boundary into SGL 211. Also reported is a special license from the PGC for 264 acres north of the impact area as a safety measure in case projectiles were fired beyond the impact area.

d. A portion within the Ricochet Area MRS (Former Cold Springs Military Reservation) was used for bivouacs and artillery training in the late 1940s/early 1950s.

e. Current land use: The Ricochet Area MRS is currently undeveloped and is host to recreational activities (e.g., hiking, fishing, bicycle riding). It is frequently used by hunters.

f. Accessibility: The public has unrestricted access.

g. Munitions that have been recovered within the Ricochet Area MRS include:

i. High explosive (HE) 105-mm projectile
ii. 12 practice high explosive anti-tank (HEAT) 105-mm projectiles, 8 practice SABOT 105-mm projectiles
iii. M106 8-inch projectile, empty
iv. BDU 33
v. Inert 75-mm projectiles
vi. Inert illumination canisters
vii. 105-mm practice fuze
viii. HE 75-mm projectile
ix. 105-mm projectile

5. Executing Agencies

a. National Guard Bureau (NGB)

b. Pennsylvania Army National Guard (PAARNG)

6. Scope of Investigation

a. A surface and subsurface investigative action is required to fully characterize the site to determine the extent and boundaries of MEC at the site.

b. The selected investigative technique for conducting the RI for MEC is as follows:

i. Analog instrument-assisted visual survey transects will be conducted across the MRS, with a focus on streams and trails. A total of 42 linear miles of transects is anticipated.
ii. The geophysical survey instrument (G-858 magnetometer or similar instrument) will be used to conduct digital geophysical mapping (DGM) in focused areas. Based on the DGM data, focused grids will be determined and surveyed to achieve 95% confidence levels.

iii. Intrusive investigations will coincide with survey transect, DGM transect, and DGM grid data and investigation targets.

7. Safety Criteria

a. Based on munitions recovered within the MRS (see Item 4g) and information from the Historical Records Review, Site Inspection, and interviews with FIG personnel, the munition with the greatest fragmentation distance (MGFD) anticipated is the 105-mm HE M1 projectile. **Figure 2** in Appendix A shows the explosive safety quantity distance (ESQD) arc for the hazardous fragment distance (HFD) for unintentional detonation. During the course of this investigative action, if MEC with a greater MGFD is encountered, the minimum separation distance (MSD) will be adjusted in accordance with Department of Defense Explosive Safety Board (DDESB) Technical Paper 16, operations will continue, and an amendment to this ESP will be submitted.

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c. Intrusive activities will be conducted using hand methods. No mechanical equipment use is anticipated during the RI.

d. See Table 7-1 for Minimum Separation Distances.

Table 7-1 Minimum Separation Distances

Minimum Separation Distances [1]						
Area		**Feet (ft)**				
		For Unintentional Detonations		**For Intentional Detonations**		
FIG Ricochet Area MRS	**MEC**	**Team Separation Distance (K40)**	**Hazardous Fragment Distance (HFD)**	**Without Engineering Controls**	**Using Sandbag Mitigation**	**Using Water Mitigation Carboys/Pool**
	105-mm HE M1	78	341	1,939	200	200

Notes:
1. See Appendix B for calculation sheets and documentation of MSD.

8. Methods of Disposal

a. Demolition activities will be conducted by Weston Solutions, Inc. (WESTON) Unexploded Ordnance (UXO) personnel under the supervision of Demolition Supervisor who hold a current PA Blaster's License.

b. WESTON will not maintain the storage of materials potentially presenting an explosive hazard (MPPEH) and/or MEC, or donor explosives. Rather, MPPEH and/or MEC that require demolition will be destroyed on a daily basis.

c. WESTON will utilize local vendors for explosives delivery on a daily basis, as needed. In the event that item(s) cannot be destroyed the same day as discovery, they will be guarded until demolition can be conducted the following day.

d. Demolition activities will be coordinated with Fort Indiantown Gap Range Operations. All MPPEH/MEC will be blow-in-place (BIP) with appropriate engineering controls (see Paragraph e) to reduce the fragmentation distance (i.e., sandbag mitigation). All explosive operations will follow the procedures outlined in the TM 60A-1-1-31 and the EM 385-1-97, Explosives Safety and Health Requirements Manual.

e. Engineering Controls, Sandbag Mitigation, shall be used for intentional detonations as delineated in the "Use of Sand Bags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions," HNC-ED-CS-S 98-7, dated August 1998. This EC may be applied to mitigate fragmentation and blast hazards to the MSD identified in Table 7-1. A copy of HNC-ED-CSS-98-7 will be available on-site if this EC is applied. Only one MEC item will be destroyed at a time using this technique.

f. The ESQD arc for intentional detonations when conducting BIP disposal using engineering controls (i.e., sandbag mitigation) is 200 feet and is depicted in **Figure 2**. The ESQD arc for intentional detonations without engineering controls (HFD-horizontal) is 1,939 ft and is depicted in **Figure 3** (Appendix A).

g. MPPEH that has been determined as safe and is considered munitions debris will be certified, verified, and released for disposal in accordance with Department of Defense (DoD) Instruction 4140.62.

9. Maps

a. Maps are provided in Appendix A. **Figure 1** shows the site location of the Ricochet Area MRS Boundary**.** **Figure 2** shows the hazardous fragmentation distance for unintentional detonations and intentional detonations with

engineering controls. **Figure 3** shows the maximum fragment range for intentional detonations without engineering controls.

APPENDIX A

FIGURES

Legend

- FIG Boundary
- Ricochet Area MRS Boundary
- Location of Former Cold Springs Military Reservation

Source: Grantville and Indiantown Gap PA USGS 7.5 minute Topographic Map, 1996

N
W E
S

0 125 250
Miles

Figure 1
Site Location
Fort Indiantown Gap, Annville, PA

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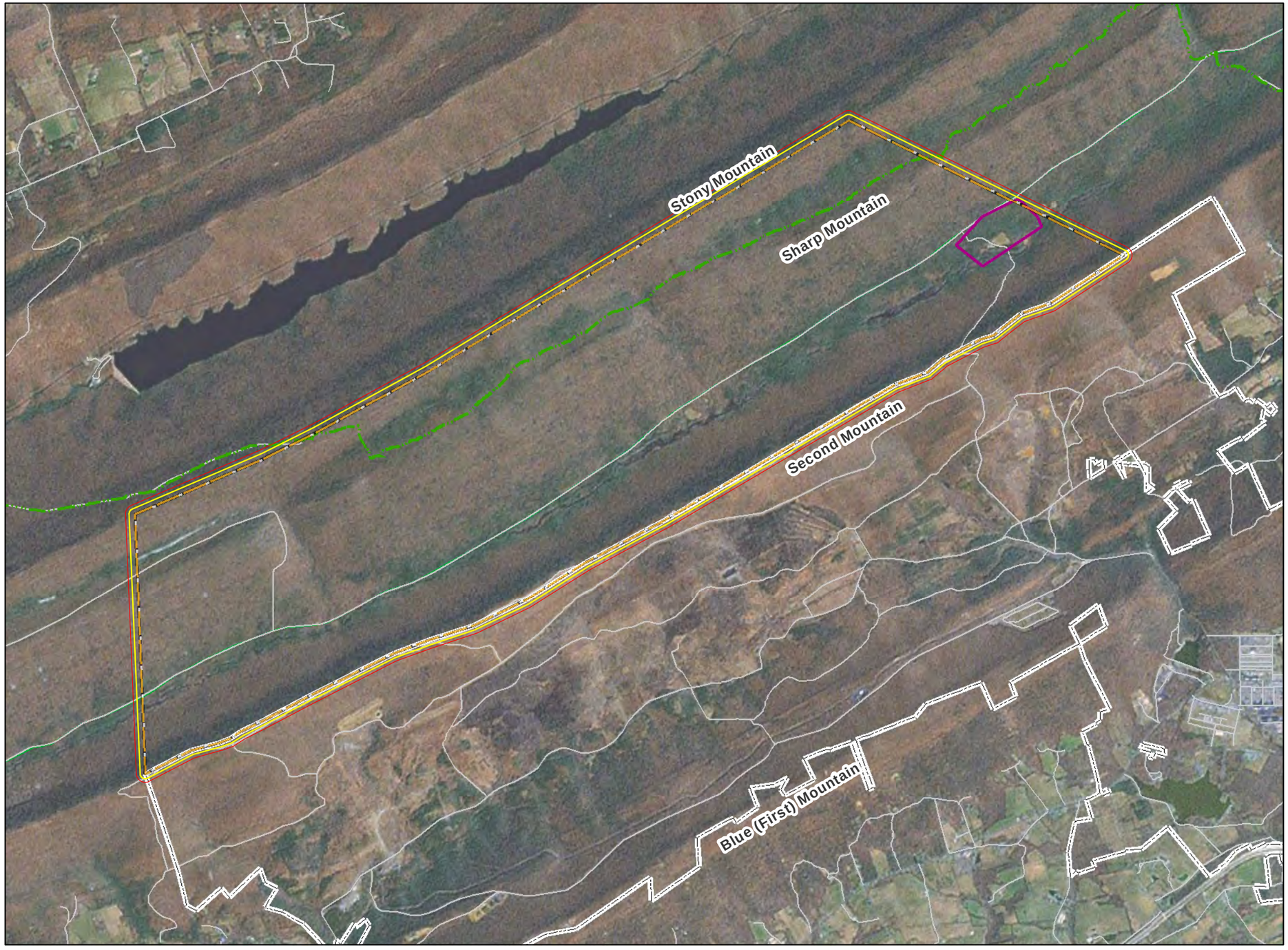


Legend

- Installation Boundary
- Ricochet Area Boundary
- Unintentional Detonation Hazardous Fragmentation Distance - 341 ft
- Intentional Detonation with Engineering Controls (sandbags) Hazardous Fragmentation Distance - 200 ft
- Location of Former Cold Springs Military Reservation

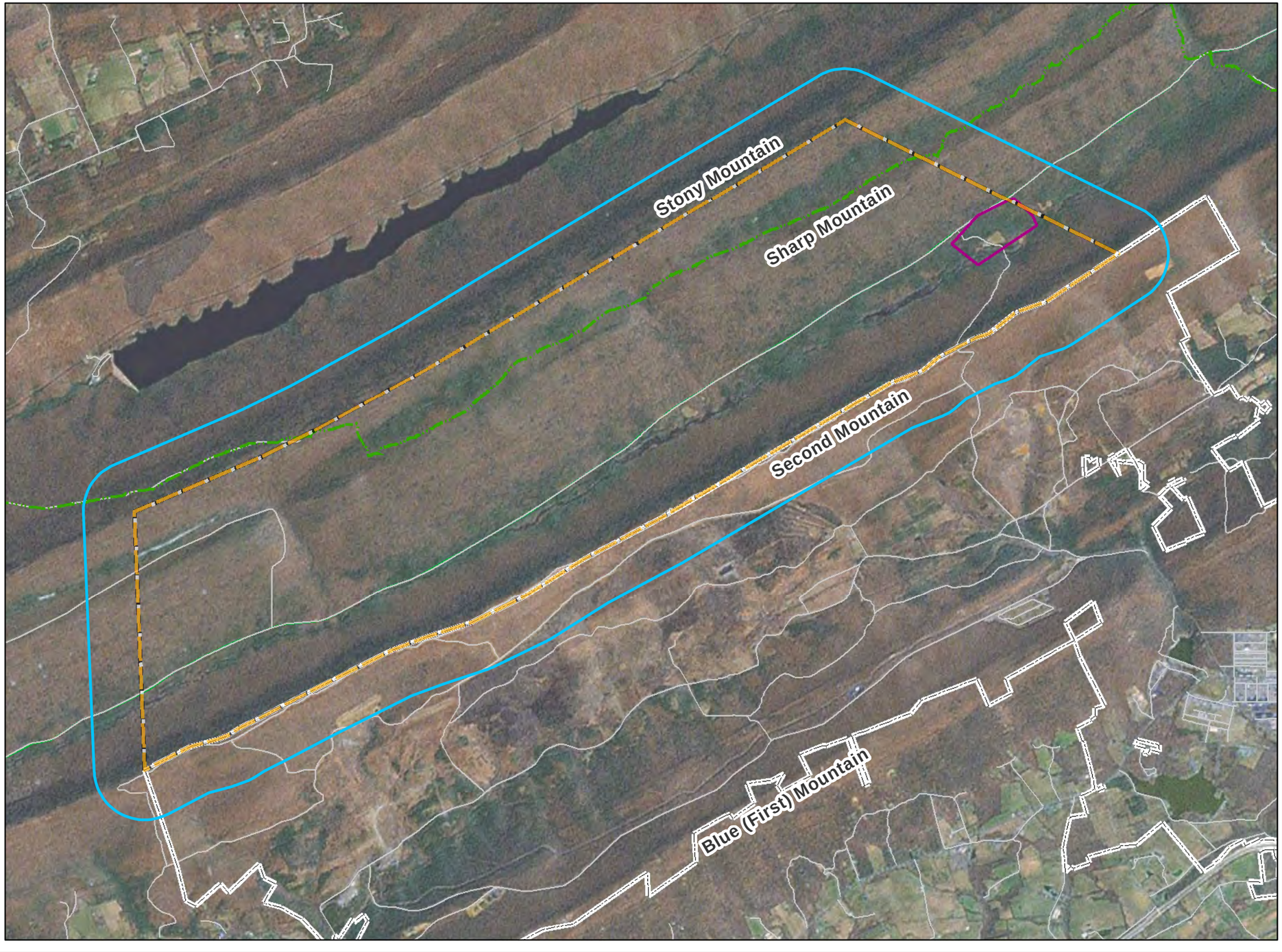
N
W E
S

0 2,000 4,000 8,000
Feet

Imagery Source: National Agriculture Imagery Program (NAIP) Date 9/2/2004
1 meter Color Infrared

Figure 2
Explosive Safety Quantity Distance (ESQD) Arcs
Fort Indiantown Gap, Annville, PA

File: \\fsfed01\tig\FIG\mxd\MMRP_RIFS\SAP\HazFrag_341.mxd, 10-Dec-09 15:49, ricksc



Legend

- Installation Boundary
- Ricochet Area Boundary
- Maximum Fragment Range -1,939 ft
- Location of Former Cold Springs Military Reservation

N
W E
S

0 2,000 4,000 8,000
Feet

Imagery Source: National Agriculture Imagery Program (NAIP) Date 9/2/2004
1 meter Color Infrared

Figure 3
Maximum Fragment Range
Fort Indiantown Gap, Annville, PA

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APPENDIX B

FRAGMENTATION CALCULATION DATA SHEETS

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 5/14/09

Category:	HE Rounds	DODIC:	C445
Munition:	105 mm M1	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	105 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	5.07000
Diameter (in):	4.1339
Max Fragment Weight (lb):	0.205734
Critical Fragment Velocity (fps):	4055

Theoretical Calculated Fragment Range

HFD [Distance to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	341
MFD-V [Vertical Distance of Max Weight Fragment] (ft):	1494
MFD-H [Horizontal Distance of Maximum Weight Fragment] (ft):	1939

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	78
Inhabited Building Distance (09 psi), K50 Distance:	97
Intentional MSD (0065 psi), K328 Distance:	636

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	4.79
Mild Steel:	0.90
Hard Steel:	0.74
Aluminum:	1.87
LEXAN:	5.36
Plexi-glass:	3.84
Bullet Resist Glass:	3.19

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.205734
Critical Fragment Velocity (fps)SB:	4055
Kinetic Energy 106 (lb-ft2/s2)SB:	1.6914
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	135
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.205734
Critical Fragment Velocity (fps)W:	4055
Kinetic Energy 106 (lb-ft2/s2)W:	1.6914
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

◄ ► Print This Form Close Form

MEMORANDUM

DEPARTMENT OF DEFENSE
EXPLOSIVES SAFETY BOARD (DDESB)

MARCH 18, 2010

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-PE

MAR 18 2010

MEMORANDUM FOR DIRECTOR, U.S. ARMY DEFENSE AMMUNITION CENTER
ATTENTION: JMAC-ESM

SUBJECT: DDESB Approval of Request for DDESB Approval of Explosives Site Plan for Remedial Investigation of Ricochet Area Munitions Response Site, Fort Indiantown Gap Military Reservation, Annville, PA

References: (a) DAC JMAC-ESM Memorandum, 2 March 2010, Subject: Request for DDESB Approval of Fort Indiantown Gap Military Reservation Explosive Site Plan for Remedial Investigation of Ricochet Area Munitions Response Site

(b) DoD 6055.09-STD, DoD Ammunition and Explosives Safety Standards, 29 February 2008, Incorporating Change 2, 21 August 2009

(c) DDESB TP-15, Approved Protective Construction, Version 2.0, June 2004

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject explosives site plan (ESP) forwarded by reference (a), against the requirements of reference (b). Based on the information provided, approval is granted for the removal and disposal of material potentially presenting an explosive hazard (MPPEH) and munitions and explosives of concern (MEC) from the Ricochet Area Munitions Response Site (MRS), Fort Indiantown Gap Military Reservation, Annville, PA. This approval is based on the following:

a. The effort addressed in this ESP involves manual operations and intentional detonations to characterize the extent of MEC within the Ricochet Area MRS. The results of this ESP will be used to prepare an explosives safety submission per reference (b).

b. The munition with the greatest fragmentation distance (MGFD) is the 105 mm M1 Projectile; the minimum separation distance (MSD) for teams is 78 feet (ft) based on K40 of the MGFD: the MSD for unintentional detonations for nonessential personnel is 341 ft based on the hazardous fragment distance of the MGFD; and the MSD for single in-grid intentional detonations for nonessential personnel is 1,939 ft based on the maximum fragment distance of the MGFD.

c. The use of sand bags are authorized as engineering controls for intentional detonation operations involving the MEC identified in reference (a) provided the Army ensures usage per reference (c), paragraph C6.2.4.8.

d. Demolition explosives per reference (a) will be delivered as needed.

e. Prior to initiation and through completion of on-site explosives operations, all nonessential personnel will be evacuated and prevented from entering any area/facility encumbered by the MSD required for the operation being conducted, or explosives operations will be suspended if nonessential personnel enter the MSD.

f. MPPEH will be inspected and classified as material documented as safe prior to release to the public.

If changes occur during or after completion of this effort that could increase explosive hazards to site workers or the public due to the presence of military munitions at the site, an amendment to this ESP must be submitted to DDESB for review and approval.

The point of contact for this action is Mr. Tony Dunay, (703) 325-3513, DSN 221-3513, E-mail address: tony.dunay@ddesb.osd.mil.

FOR
CURTIS M. BOWLING
Chairman
DDESB

MEMORANDUM

U.S. ARMY TECHNICAL CENTER FOR EXPLOSIVE SAFETY (USATCES) TO DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD (DDESB)

DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNITION CENTER
1 C TREE ROAD
MCALESTER OK 74501-9053

REPLY TO ATTENTION OF

JMAC-ESM 02 March 2010

MEMORANDUM FOR Department of Defense Explosives Safety Board (DDESB-PE/Mr. Alchowiak), 2461 Eisenhower Avenue, Alexandria, VA 22331-0600

SUBJECT: Request for DDESB Approval of Fort Indiantown Gap Military Reservation Explosive Site Plan for Remedial Investigation of Ricochet Area Munitions Response Site

1. References:

a. Memorandum, National Guard Bureau, NGB-AVS, 1 February 2010, Subject: Remedial Investigation for Ricochet Area Munitions Response Site at Fort Indiantown Gap Military Reservation Annville, PA – Contract No: W9233L-09-F-0304 December, 2009.

b. DOD 6055.09-STD, Ammunition and Explosives Safety Standards, 29 Feb 08 with change dated 21 August 2009.

2. Reference 1.a with attached ESP is provided for your review in accordance with chapter 12 of reference 1.b. We have reviewed the ESP and find it acceptable as written.

3. Per telephone conservation between Mr. Clifford Doyle (USATCES) and Ms. Kim Harriz (NGPA), the anticipated start date is 15 March 2010.

4. The point of contact is Charlotte G. Curtis, JMAC-ESM, DSN 956-8742 or Commercial (918) 420-8742.

FOR THE DIRECTOR:

1 Encl
as

CLIFFORD H. DOYLE
MEC Team Leader
Explosives Safety Knowledge, OE and Chemical Division
US Army Technical Center for Explosives Safety

JMAC-ESM 02 March 2010

SUBJECT: Request for DDESB Approval of Fort Indiantown Gap Military Reservation Explosive Site Plan for Remedial Investigation of Ricochet Area Munitions Response Site

CF: (w/encl)

Office of the Director of Army Safety (DACS-SF/Mr. Patton), 223 23rd Street, Crystal Plaza 5, Suite 980, Arlington, VA 22202

Office of the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health, Special Assistant for Munitions, (DASA-DESOH/Mr. King), 110 Army Pentagon, Washington, DC 20310-0110

National Guard Bureau, (NGB-AVS/COL Jensen), 111 South George Mason Drive, Arlington, VA 22204-1382

Pennsylvania Army National Guard, (SSO/Ms. Hengeveld), State Safety Office, Bldg 11-9, Fort Indiantown Gap, Annville, PA 17003-5002

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON, VA 22204–1382

NGB–AVS

1 February 2010

MEMORANDUM FOR Commander, US Army Technical Center for Explosive Safety, ATTN: SJMAC-ESM (Mr. Cliff Doyle), 1 C Tree Road, Building 35, McAlester, OK 74501

SUBJECT: Remedial Investigation for Ricochet Area Munitions Response Site at Fort Indiantown Gap Military Reservation Annville, PA – Contract No: W9233L-09-F-0304 December, 2009

1. References:

a. Memorandum, Pennsylvania Army National Guard, SSO, 16 December 2009, Concurrence with Final Explosive Safety Plan for Remedial investigation for the Ricochet Area Response site in State Game Lands 211, Pennsylvania (Enclosure).

b. Explosive Site Plan - Remedial Investigation for Ricochet Area Munitions Response Site at Fort Indiantown Gap Military Reservation Annville, PA – Contract No: W9233L-09-F-0304 January 2010 (Enclosure).

2. Reference 1.a. is PA ARNG review and approval of subject site plan.

3. Reference 1.b. adds paragraph 4.g. identifying specific munitions/minimal safe separation distances that apply during this portion of the remedial investigation; paragraph 7.b. identifying existence of public outreach program communicating specific hazards and safety awareness to the public; and paragraph 8.g. describing required method of disposal for detected / treated munitions debri IAW DoD Instruction 4140.62.

4. I approve reference 1.b. and forward for final Department of the Army and Department of Defense approval.

5. The point of contact is Brian I. Vargas at DSN 327-7776, 703-607-7776, or brian.vargas@us.army.mil.

for Robin P. Jordan

GARRETT P. JENSEN
COL, AV
Chief, Aviation and Safety Division

Encl
1. Memo, SSO, 16 Dec 2009
2. Site Plan, 19 Jan 2010

TYPOGRAPHICAL ERRORS & CORRECTIONS
J.G. 3/25/10

FINAL
EXPLOSIVES SITE PLAN

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CONTRACT NO.: W9133L-09-F-0304

Prepared For:

NATIONAL GUARD BUREAU
1411 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202-3231

and

PENNSYLVANIA ARMY NATIONAL GUARD
DEPARTMENT OF MILITARY AND VETERANS AFFAIRS
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JANUARY 2010

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1. See Appendix B for calculation sheets and documentation of MSD.

8. Methods of Disposal

a. Demolition activities will be conducted by Weston Solutions, Inc. (WESTON) Unexploded Ordnance (UXO) personnel under the supervision of Demolition Supervisor who hold a current PA Blaster's License.

b. WESTON will not maintain the storage of materials potentially presenting an explosive hazard (MPPEH) and/or MEC, or donor explosives. Rather, MPPEH and/or MEC that require demolition will be destroyed on a daily basis.

c. WESTON will utilize local vendors for explosives delivery on a daily basis, as needed. In the event that item(s) cannot be destroyed the same day as discovery, they will be guarded until demolition can be conducted the following day.

d. Demolition activities will be coordinated with Fort Indiantown Gap Range Operations. All MPPEH/MEC will be blow-in-place (BIP) with appropriate engineering controls (see Paragraph e) to reduce the fragmentation distance (i.e., sandbag mitigation). All explosive operations will follow the procedures outlined in the TM 60A-1-1-31 and the EM 385-1-97, Explosives Safety and Health Requirements Manual.

e. Engineering Controls, Sandbag Mitigation, shall be used for intentional detonations as delineated in the "Use of Sand Bags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions," HNC-ED-CS-S 98-7, dated August 1998. This EC may be applied to mitigate fragmentation and blast hazards to the MSD identified in Table 7-1. A copy of HNC-ED-CSS-98-7 will be available on-site if this EC is applied. Only one MEC item will be destroyed at a time using this technique.

f. The ESQD arc for intentional detonations when conducting BIP disposal using engineering controls (i.e., sandbag mitigation) is 200 feet and is depicted in **Figure 2**. The ESQD arc for intentional detonations without engineering controls (HFD-horizontal) is ~~1,559~~ 1,939 ft and is depicted in **Figure 3** (Appendix A).

g. MPPEH that has been determined as safe and is considered munitions debris will be certified, verified, and released for disposal in accordance with Department of Defense (DoD) Instruction 4140.62.

9. Maps

a. Maps are provided in Appendix A. **Figure 1** shows the site location of the Ricochet Area MRS Boundary. **Figure 2** shows the hazardous fragmentation distance for unintentional detonations and intentional detonations with

engineering controls. **Figure 3** shows the maximum fragment range for intentional detonations without engineering controls.

APPENDIX A

FIGURES

Legend

- FIG Boundary
- Ricochet Area MRS Boundary
- Location of Former Cold Springs Military Reservation

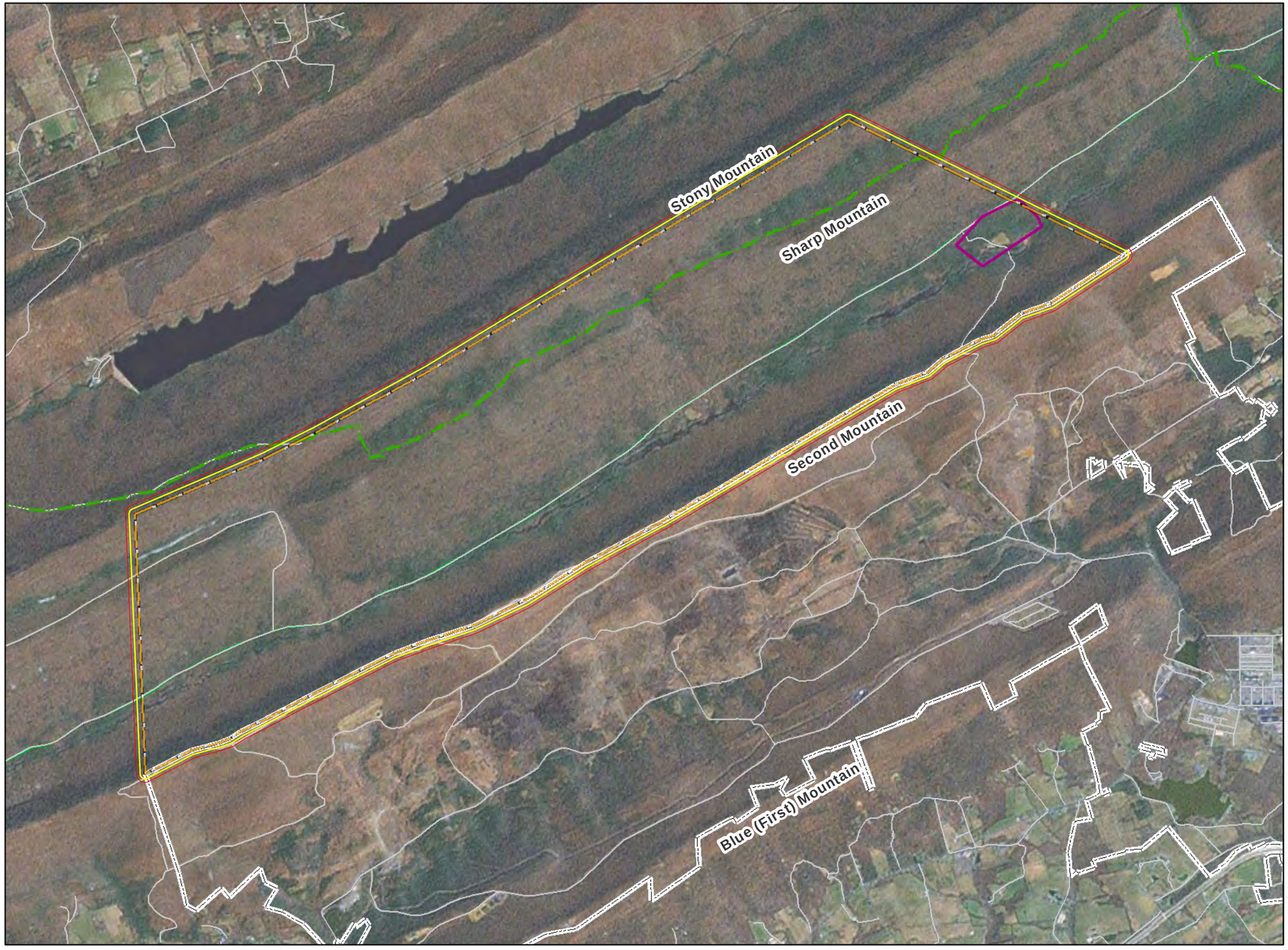
Source: Grantville and Indiantown Gap PA USGS 7.5 minute Topographic Map, 1996

N
W E
S

0 125 250
Miles

Figure 1
Site Location
Fort Indiantown Gap, Annville, PA

File: \\Fsfed01\TIG\FIG\mxd\MMRP_RIFS\SAP\site_location.mxd, 20-Oct-09 12:02, lathamj



Legend

- Installation Boundary
- Ricochet Area Boundary
- Unintentional Detonation Hazardous Fragmentation Distance - 341 ft
- Intentional Detonation with Engineering Controls (sandbags) Hazardous Fragmentation Distance - 200 ft
- Location of Former Cold Springs Military Reservation

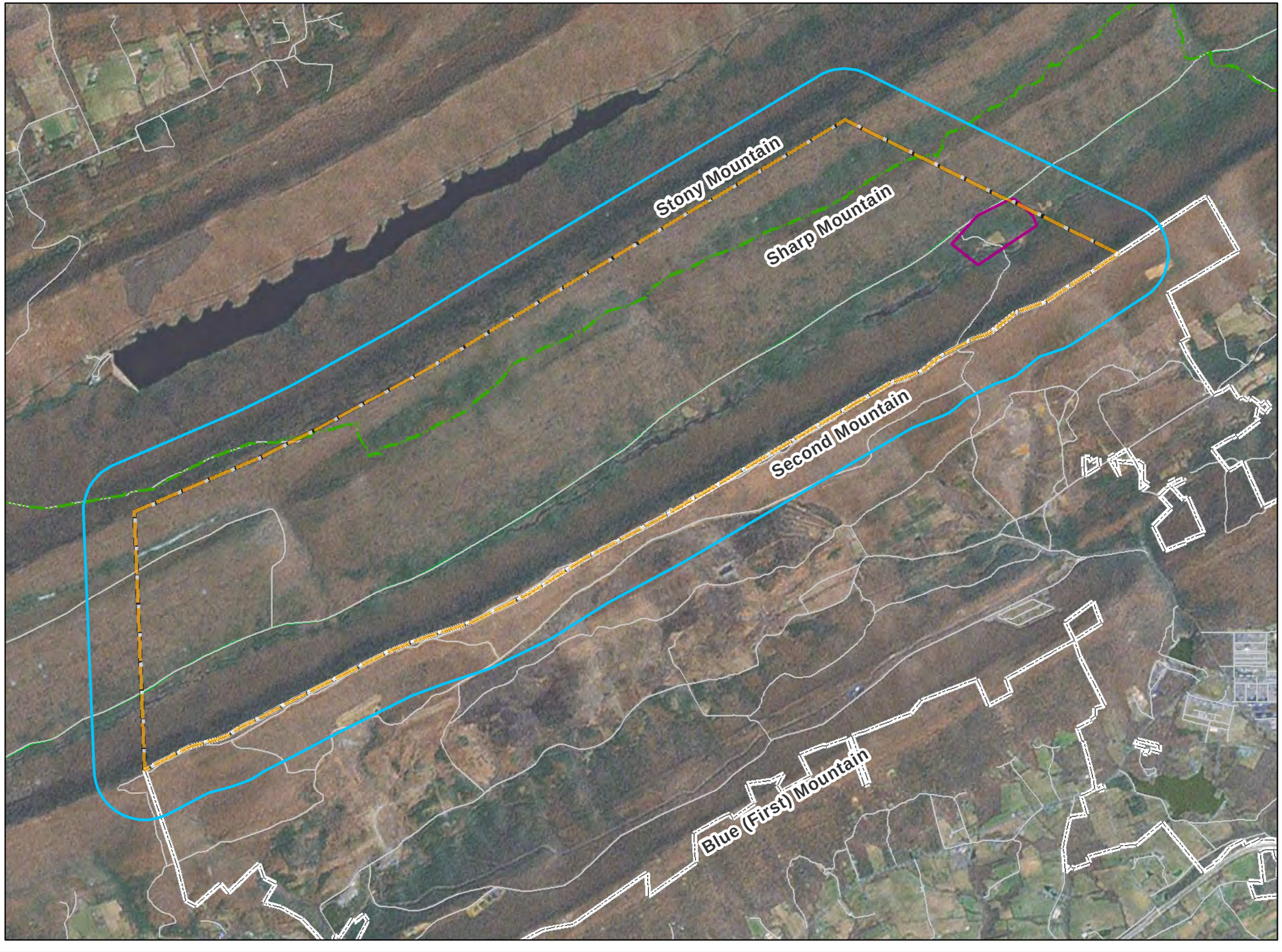
N
W E
S

0 2,000 4,000 8,000
Feet

Imagery Source: National Agriculture Imagery Program (NAIP) Date 9/2/2004
1 meter Color Infrared

Figure 2
Explosive Safety Quantity Distance (ESQD) Arcs
Fort Indiantown Gap, Annville, PA

File: \\fsfed01\tig\FIG\mxd\MMRP_RIFS\SAP\HazFrag_341.mxd, 10-Dec-09 15:49, ricksc



Legend

- Installation Boundary
- Ricochet Area Boundary
- Maximum Fragment Range -1,939 ft
- Location of Former Cold Springs Military Reservation

N
W E
S

0 2,000 4,000 8,000
Feet

Imagery Source: National Agriculture Imagery Program (NAIP) Date 9/2/2004
1 meter Color Infrared

Figure 3
Maximum Fragment Range
Fort Indiantown Gap, Annville, PA

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APPENDIX B

FRAGMENTATION CALCULATION DATA SHEETS

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 5/14/09

Category:	HE Rounds	DODIC:	C445
Munition:	105 mm M1	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	105 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	5.07000
Diameter (in):	4.1339
Max Fragment Weight (lb):	0.205734
Critical Fragment Velocity (fps):	4055

Theoretical Calculated Fragment Range

HFD [Distance to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	341
MFD-V [Vertical Distance of Max Weight Fragment] (ft):	1494
MFD-H [Horizontal Distance of Maximum Weight Fragment] (ft):	1939

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	78
Inhabited Building Distance (09 psi), K50 Distance:	97
Intentional MSD (0065 psi), K328 Distance:	636

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	4.79
Mild Steel:	0.90
Hard Steel:	0.74
Aluminum:	1.87
LEXAN:	5.36
Plexi-glass:	3.84
Bullet Resist Glass:	3.19

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.205734
Critical Fragment Velocity (fps)SB:	4055
Kinetic Energy 106 (lb-ft2/s2)SB:	1.6914
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	135
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.205734
Critical Fragment Velocity (fps)W:	4055
Kinetic Energy 106 (lb-ft2/s2)W:	1.6914
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

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