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

REPLY TO
ATTENTION OF

SJMAC-ESM

1 July 2009

MEMORANDUM FOR US Army Engineering and Support Center, Huntsville, (CEHNC-CX-MM/Mr. Becker or Mr. Zange), P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: DDESB Approval of Request for Approval for Amendment 4 to an Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL

1. References:

a. Memorandum, Huntsville Center, Corps of Engineers, (CEHNC-CX-MM/Mr. Zange or Mr. Becker), 19 Jun 09, subject: Explosives Safety Submission (ESS), Amendment 4, Munitions and Explosives of Concern Removal Action, Choccolocco Area of Fort McClellan Alabama, June 2009.

b. DA PAM 385-64, Ammunition and Explosives Safety Standards, 15 December 1999.

c. Memorandum, Department of Defense Explosives Safety Board, DDESB-PE, 30 Jun 09, SAB (encl).

2. The subject amendment transmitted by reference 1.a has been reviewed in accordance with reference 1.b. Reference 1.c provides DDESB approval. This approval will be made part of the administrative record for the site.

3. The POC is Mr. James Toburen, SJMAC-ESM, (918) 420-8784 or DSN 956-8784, email james.toburen@us.army.mil.

TOBURENJAMES.E.1231125198
Digitally signed by TOBUREN.JAMES.E.1231125198
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=TOBURENJAMES.E.1231125198
Date: 2009.07.01 16:01:20 -05'00'

Encl
as

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

SJMAC-ESM 1 July 2009

SUBJECT: DDESB Approval of Request for Approval for Amendment 4 to an Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL

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 Assistant Secretary of the Army for Installations & Environment), (Asst. for Munitions) (DESOH/Mr. King), 110 Army Pentagon, Washington, DC 20310-0110
Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Office (DAIM-BD/Mr. Haughs), 600 Army Pentagon, Washington, DC 20310-0600
U.S. Army Corps of Engineers (CESO/Ms Roberts), 441 G Street, NW, Washington, DC 20314-1000

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

JUN 30 2009

DDESB-PE

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

SUBJECT: DDESB Approval of Request for Approval for Amendment 4 to an Explosives Safety Submission (ESS) for Choccolocco Area Removal Action at Fort McClellan, AL

References: (a) DAC SJMAC-ESM Memorandum of 23 June 2009, Subject: Request for Approval for Amendment 4 to an Explosives Safety Submission (ESS) for Choccolocco Area Removal Action at Fort McClellan, AL

(b) DoD 6055.09-STD, DoD Ammunition and Explosives Safety Standards, 29 February 2008, Incorporating Change 1, 24 March 2009

(c) DDESB-PE Memorandum of 13 February 2009 Subject: DDESB Approval of Request for Approval for Amendment 3 to an Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL

(d) 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 safety submission (ESS) forwarded by reference (a), against the requirements of reference (b). Based on the information provided, approval is granted for Amendment 4 to the ESS for removal and treatment of material potentially presenting an explosive hazard at Choccolocco Area, Fort McClellan, AL. This approval is based on the following:

a. This amendment changes the minimum separation distances (MSD) commensurate with current Army and DDESB requirements and incorporates the reference (c) site approval for two Type II aboveground magazines.

b. The attached table lists the munition with the greatest fragmentation distance (MGFD), team separation distance (TSD), MSD for unintentional detonations for nonessential personnel, and MSD for intentional detonations for nonessential personnel for munition response areas (MRA) FWS-1Ha, FWS-1Hb, FWS-1Hc, FWS-2H, FWS-3H, FWS-4H and FWS-5H.

c. Per reference (c), the relocated BATF Type II aboveground magazines, sited as a complex approximately 1,700 feet (ft) north of Bains Gap Road, are approved to store up to 100 pounds net explosive weight of hazard division (HD) 1.1 and mission essential quantities of HD 1.4. The applicable inhabited building distance is 658 ft and the public transportation route

distance (PTRD) is 395 ft, both based on the hazardous fragment distance. The K24 low density PTRD is 111 ft, the K18 intraline distance is 84 ft and the K11 intermagazine distance is 51 ft.

d. The use of the Open Front Barricade and Miniature Open Front Barricade are authorized as engineering controls for unintentional detonations operations involving the MEC identified in reference (a) provided the Army ensures usage per reference (d), paragraph C6.2.4.8.

e. The use of sand bags and water mitigation systems are authorized as engineering controls for intentional detonation operations involving the items identified in reference (a) provided the Army ensures usage per reference (d), paragraph C6.2.4.8.

f. All other stipulations and requirements established via the original ESS and subsequent amendments remain in effect.

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.

E. Cribbs /for

Attachment
As stated

CURTIS M. BOWLING
Chairman
DDESB

TABLE

MRA	MGFD	TSD[1] (ft)	MSD[2] (ft) unintentional detonation	MSD[3] (ft) intentional detonation
FWS-1Ha and FWS-2H	81 mm HE M43 Mortar	49	230	1,395
FWS-1Hb and FWS-3H	155 mm M107 Projectile	112	447	2,577
FWS-1Hc	2.36" Rocket HEAT (case only)	39	125	780
FWS-4H	60 mm HE M49 Mortar	42[4]	183[4]	1,127[5]
FWS-5H	105 mm HE M1 Projectile	78	341	1,939

[1] Based on K40 of MGFD
[2] For nonessential personnel based on the hazardous fragment distance of the MGFD
[3] For nonessential personnel based on the maximum fragment distance of the MGFD
[4] Based on the 60 mm HE M49A2 Mortar
[5] Based on the 60 mm HE M49A5 Mortar

Attachment

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

REPLY TO
ATTENTION OF

SJMAC-ESM 23 June 2009

MEMORANDUM FOR Huntsville Center, Corps of Engineers, (CEHNC-CX-MM/Mr. Becker or Mr. Zange), P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: Interim Approval for an Amendment 4 to a Previously Approved Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL

1. References:

a. Your memorandum, 19 Jun 09, subject: Explosives Safety Submission (ESS), Amendment 4, Munitions and Explosives of Concern Removal Action, Choccolocco Area of Fort McClellan, Alabama, June 2009.

b. Our memorandum, 23 Jun 09, subject: Request for Approval for Amendment 4 to an Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL.

c. DOD 6055.09-STD, Ammunition and Explosives Safety Standards, dated 29 Feb 08 with Change 1 dated 24 Mar 09.

2. This office has reviewed the subject amendment as requested by reference 1.a, granted Army level approval and forwarded it via reference 1.b, to the Department of Defense Explosives Safety Board (DDESB) for final approval. You may implement this amendment upon receipt of this memorandum, without waiting for final approval, in accordance with paragraph C12.5.1.2 of reference 1.c, which allows a munitions response to proceed prior to final approval if circumstances dictate. This interim approval is based on the need to implement the provisions in the amendment as soon as possible. Bear in mind that by implementing the amendment prior to the DDESB final approval, the Army is accepting responsibility for any additional requirements that the DDESB may impose.

3. The POC is Mr. James Toburen, SJMAC-ESM, DSN 956-8784, or COMML (918) 420-8784, email james.toburen@us.army.mil.

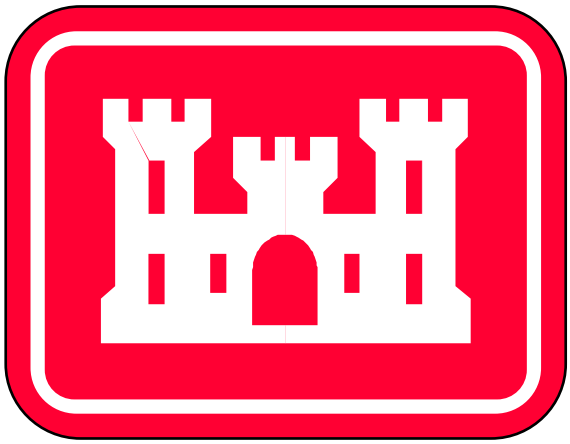
SJMAC-ESM 23 June 2009

SUBJECT: Interim Approval for an Amendment 4 to a Previously Approved Explosives Safety Submission (ESS) for the Choccolocco Area Removal Action at Fort McClellan, AL

FOR THE DIRECTOR:

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

CF:
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
U.S. Army Corps of Engineers (CESO/Ms Roberts), 441 G Street, NW, Washington, DC 20314-1000



Explosives Safety Submission
Amendment 4

MUNITIONS AND EXPLOSIVES OF CONCERN
REMOVAL ACTION

CHOCCOLOCCO AREA
U.S. FISH AND WILDLIFE TRANSFER
Of
Fort McClellan, Alabama

June 2009

Prepared by
US ARMY CORPS OF ENGINEERS
Engineering and Support Center, Huntsville

This Amendment is not in the current standard format. For continuity purposes it is in the same format as the original ESS.

TABLE OF CONTENTS

Section Page

1.0 INTRODUCTION 1
1.1 CHANGE IN Q-D ARCS AND TEAM SEPARATION DISTANCE 2
1.2 RELOCATION OF EXISTING EXPLOSIVE STORAGE FACILITY 2
2.0 REASON FOR MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) 3
3.0 AMOUNT AND TYPE OF MEC 3
3.1 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORTS 3
3.2 MUNITION WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD) ..3
4.0 START DATE 4
5.0 FROSTLINE 4
6.0 CLEARANCE TECHNIQUES 4
6.1 DETECTION METHODS 4
6.2 RECOVERY AND DISPOSAL 5
6.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN 5
6.4 MUNITIONS DEBRIS EXPLOSIVE HAZARDS 5
7.0 ALTERNATE TECHNIQUES 5
8.0 OFFSITE DESTRUCTION 5
9.0 TECHNICAL SUPPORT 5
9.1 MILITARY SUPPORT 5
9.2 CONTRACTOR 5
10.0 LAND USE RESTRICTIONS 5
11.0 PUBLIC INVOLVEMENT 6
12.0 MAPS 6
13.0 QUANTITY-DISTANCE (Q-D) 6
13.1 Q-D CRITERIA FOR EXPLOSIVE STORAGE FACILITY SITING 6

LIST OF TABLES

Table 1-1 SUMMARY INFORMATION OF APPROVED ESP/ESS AND AMENDMENTS 1
Table 2-1 Munition with the Greatest Fragmentation Distance (MGFD) 2
Table 3-1 Minimum Separation Distances 4

APPENDIX A MAPS
APPENDIX B CALCULATION SHEETS

1.0 INTRODUCTION

The original Explosives Safety Submission and three amendments were developed and approved for Fort McClellan, AL. This submission is Amendment 4. The purpose of this amendment is to change the Quantity-Distance (Q-D) Arcs to reflect the Hazardous Fragmentation Distance (HFD) for intrusive work, change the Team Separation Distance from 200 feet to the K40 value of each area's Munition with the Greatest Fragmentation Distance (MGFD). In addition, this amendment will incorporate Amendment 3 for the relocation of the existing explosive storage facility from its current location in order to keep the format of the amendment consistent with the original ESS. The Q-D Arcs for this Amendment will replace figures in the original ESS and figures from ESS Amendments 1 and 3. Table 1-1 consists of a summary of ESS Amendment activities.

TABLE 1-1

SUMMARY INFORMATION OF APPROVED ESP/ESS AND AMENDMENTS

ESS/Amendment	Area Covered	Reason
Original ESS	U.S. Fish and Wildlife Service (FWS) Roads, Fire Breaks, and High Use Areas (1H, 2H, 3H, 4H, and 5H)	Removal Action of Clearance of Depth-to-Detection
1	FWS-1H	FWS-1H to be split into three areas: FWS-1Ha, FWS-1Hb, FWS-1Hc
2	Road segments 67, 68, 69, 70, 71, 72, and 72A along Bains Gap Road, within the Choccolocco Area	Expand the clearance depth for road segments to the depth of detection under road, and to address the land mass areas in and around those segments that are to be cleared to depth of detection.
Correction 1 to Amend. 2	Bains Gap Road Area	Add acreage to removal response
3	Existing Magazine Location	To change the location of the Magazine location to FWS property
4	Areas 1Ha, 1Hb, 1Hc, 2H, 3H, 4H and 5H	Change Q-D Arcs to reflect the HFD for intrusive work, and change the Team

		Separation Distance from 200 to the K40 value of each area's MGFD. Include the magazine location from Amendment 3 in order to make the format of this document consistent with the original.

The MGFD for the removal action areas are shown in Table 2-1. The MGFD was taken from Table 3-2 of Amendment 1 of the ESS.

Table 2-1

FWS[1] Area	MGFD	Clearance Depth
FWS-1Ha	81mm HE M43	Depth-of-Detection
FWS-1Hb	155 mm HE M107	Depth-of-Detection
FWS-1Hc	2.36" Rocket, HEAT (case only)	Depth-of-Detection
FWS-2H	81mm HE M43	Depth-of-Detection
FWS-3H	155mm HE M107	Depth-of-Detection
FWS-4H	60mm HE M49	Depth-of-Detection
FWS-5H	105mm HE M1	Depth-of-Detection
Note: [1]FWS is the Fish and Wildlife Service.		

1.1 CHANGE IN Q-D ARCS AND TEAM SEPARATION DISTANCE

The munitions with the greatest fragment distance (MGFD) for the removal action areas are outlined in Table 3-1. The Hazardous Fragmentation Distance (HFD) for intrusive work Q-D arcs for these removal action areas are shown in Appendix A.

The Team Separation Distance shall change from 200 feet to the K40 value of each area's MGFD.

1.2 RELOCATION OF EXISTING EXPLOSIVE STORAGE FACILITY

The existing storage facility is on property that is no longer owned by the U.S. Government, and will have to be relocated to an area within federally owned property. The new location is a previous borrow pit area that is now used by the Fish and Wildlife Service (FWS) as

an aggregate storage yard. The area has limited access through a locked barricade. The FWS will need access to the area for the aggregate. However, the FWS is willing to accept limited access with UXO escort, if necessary.

Two magazines will be located at the new explosives storage facility location. The magazines will be two ATF Type II magazines sited as one magazine (see paragraph 4.1.3 of the original 2001 ESS). The combined total maximum net explosive weight (NEW) stored in the magazines will not exceed 100 pounds. These commercial explosives will have assigned DOD hazard division/storage compatibility groups (HD/SCG) and will be stored in accordance with DOD 6055.9-STD, DA Pam 385-64 and any local installation regulations. The magazines will be positioned such that the FWS aggregate storage yard and the access to the yard are outside the Low Density Traffic – Public Traffic Route Distance (LDT-PTRD).

2.0 REASON FOR MUNITIONS AND EXPLOSIVES OF CONCERN (MEC)

No change from original ESS.

3.0 AMOUNT AND TYPE OF MEC

No change from original ESS or previous amendments.

3.1 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORTS

No change from original ESS.

3.2 MUNITION WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD)

No change from original ESS or previous amendments.

Table 3-1
Minimum Separation Distances (MSD)

Area	MEC	MSD (ft) [1]					
		For Unintentional Detonations			For Intentional Detonations		
		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)	To Sides & Rear Using MOFB or OFB[2]	Without Engineering Controls	Using Sandbag Mitigation	Using Water Mitigation (5-gallon carboys/inflatable pool)
FWS-1Ha	81mm HE M43	49	230	200 [B]	1395	200	264/200
FWS-1Hb	155 mm HE M107	112	447	300 [A]	2577	220	275[3]
FWS-1Hc	2.36" Rocket, HEAT (case only)	39	125	200 [B]	780	200	200/200
FWS-2H	81mm HE M43	49	230	200 [B]	1395	200	264/200
FWS-3H	155mm HE M107	112	447	300 [A]	2577	220	275[3]
FWS-4H	60mm HE M49	42[5]	183[5]	200 [B]	1127[4]	200	264/200[4]
FWS-5H	105mm HE M1	78	341	300 [A]	1939	200	200[3]

Notes:
1. Appendix B provides calculation sheets and documentation of MSD
2. A = OFB; B=MOFB
3. 1100 Gallon Tank for Water Mitigation
4. Based on 60mm M49A2
5. Based on 60mm M49A5

4.0 START DATE

The projected start date for this project is 29 June 2009.

5.0 FROSTLINE

No change from original ESS.

6.0 CLEARANCE TECHNIQUES

No change from original ESS or previous amendments.

6.1 DETECTION METHODS

No change from original ESS or previous amendments.

6.2 RECOVERY AND DISPOSAL

No change from original ESS or previous amendments.

6.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN

No change from original ESS or previous amendments.

6.4 MUNITIONS DEBRIS EXPLOSIVE HAZARDS

No change from original ESS or previous amendments.

7.0 ALTERNATE TECHNIQUES

No change from original ESS or previous amendments.

8.0 OFFSITE DESTRUCTION

No change from original ESS.

9.0 TECHNICAL SUPPORT

No change from original ESS or previous amendments.

9.1 MILITARY SUPPORT

No change from original ESS or previous amendments.

9.2 CONTRACTOR

Tetra Tech EC, Inc. and it's subcontractors will provide the technical support required during the removal action. If recovered MEC is identified or suspected of containing Chemical Warfare Materiel (CWM), all intrusive activities will cease, the site will be evacuated in an upwind direction and secured. The U.S. Army Engineering and Support Center (USAESCH) Safety Representative and Fort McClellan Transition Force Operations will be notified and disposition instructions requested.

All on-site UXO personnel will meet the training and minimum experience required by Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP 18), "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personell" and USAESCH MM-CX Interim Guidance Document 05-01, "Implementation of TP 18".

10.0 LAND USE RESTRICTIONS

No change from original ESS.

11.0 PUBLIC INVOLVEMENT

No change from original ESS.

12.0 MAPS

Figures 1a, 1b, 1c, 2, 3, 4 and 5 in Appendix A show the areas covered by this amendment and the associated Quantity-Distance (Q-D) arcs that will be used during the munitions response action. Figure 6 shows the Explosives Storage Magazine location and siting distances. All figures included in this Amendment shall supersede previous figures in the original ESS and ESS Amendments 1 and 3. The Q-D arcs shown are based on the Hazardous Fragmentation Distance (HFD) for intrusive work for non-essential personnel, as shown in Table 3-1. These may be reduced as shown in Table 3-1 if the appropriate engineering controls are used.

13.0 QUANTITY-DISTANCE (Q-D)

The Fragmentation Data Review Forms in Appendix B supersede the previous Fragmentation Data Review Forms for these areas.

13.1 Q-D CRITERIA FOR EXPLOSIVE STORAGE FACILITY SITING

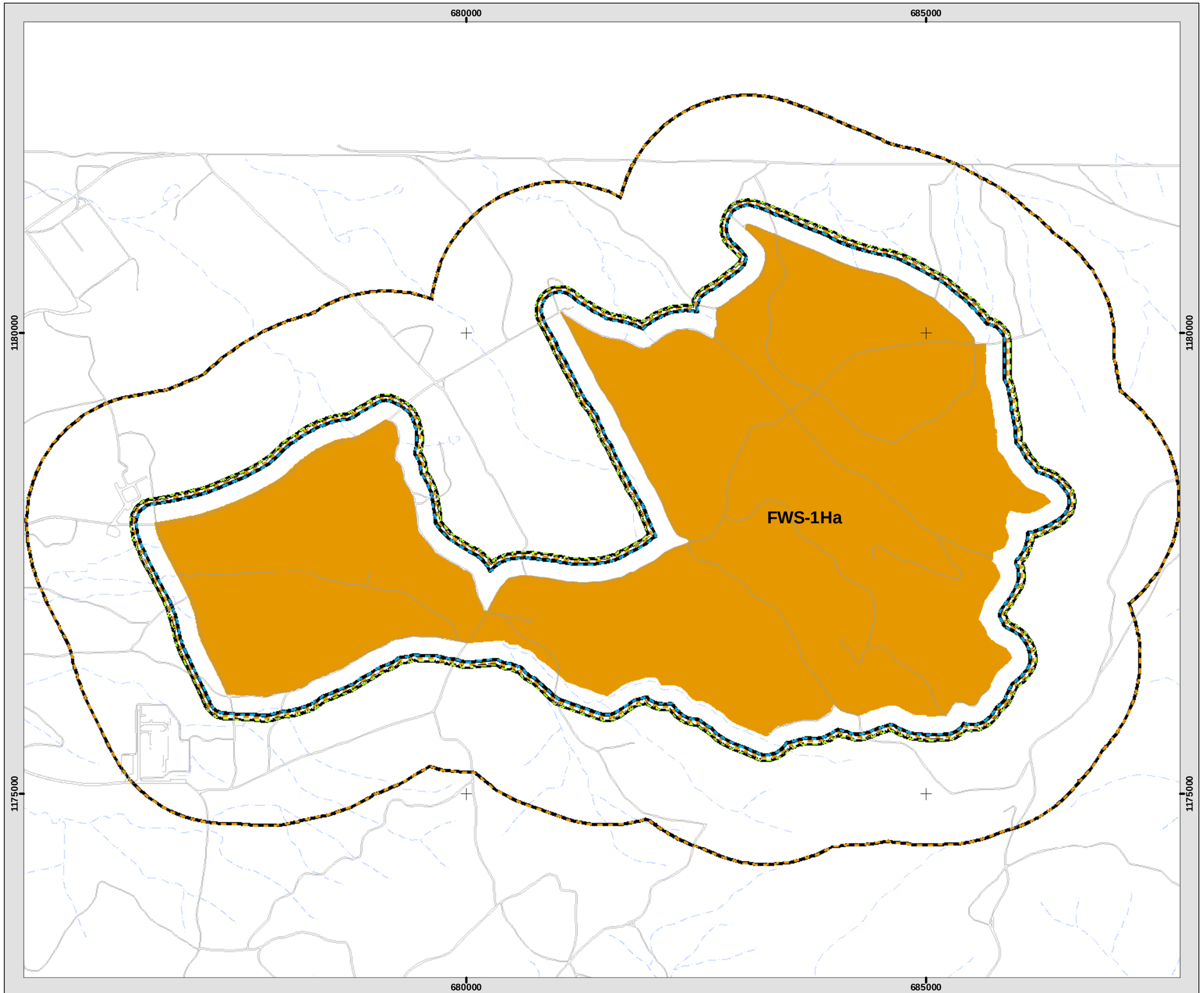
The distance of 658 feet for inhabited buildings is established in accordance with DOD 6055.09-STD, Table C9.T2. The closest inhabited building is approximately 2400 feet.

The Public Traffic Routes Distance (PTRD) is 395 feet (for a medium traffic density road) and the Low Traffic Density - Public Traffic Routes Distance (LTD-PTRD) is 111 feet. The PTRD and LTD-PTRD are established in accordance with C9.4.1.2.1.1.5 of DOD 6055.09-STD. The closest road to the site is Bains Gap Road, and is approximately 1700 feet from the site. The aggregate storage yard and the gravel road to the storage yard are located outside of the boundaries of the LTD-PTRD. Refer to Figure 6 for the PTRD and LTD-PTRD.

APPENDIX A
MAPS

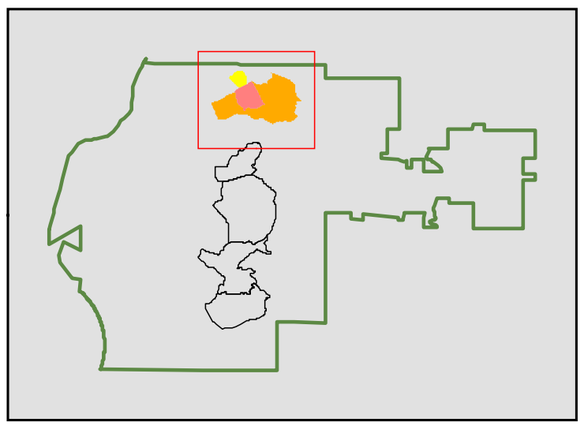
Figure 1a
FWS-1Ha Area
Q-D Arcs

Fort McClellan, AL
June 2009



Legend

- FWS-1Ha
- FWS-1Ha MFD w/o EC (1395')
- Water Mitigation Using 5-gal.carboys (264')
- FWS-1Ha HFD (230')
- Water Mitigation Using inflatable pool (200')



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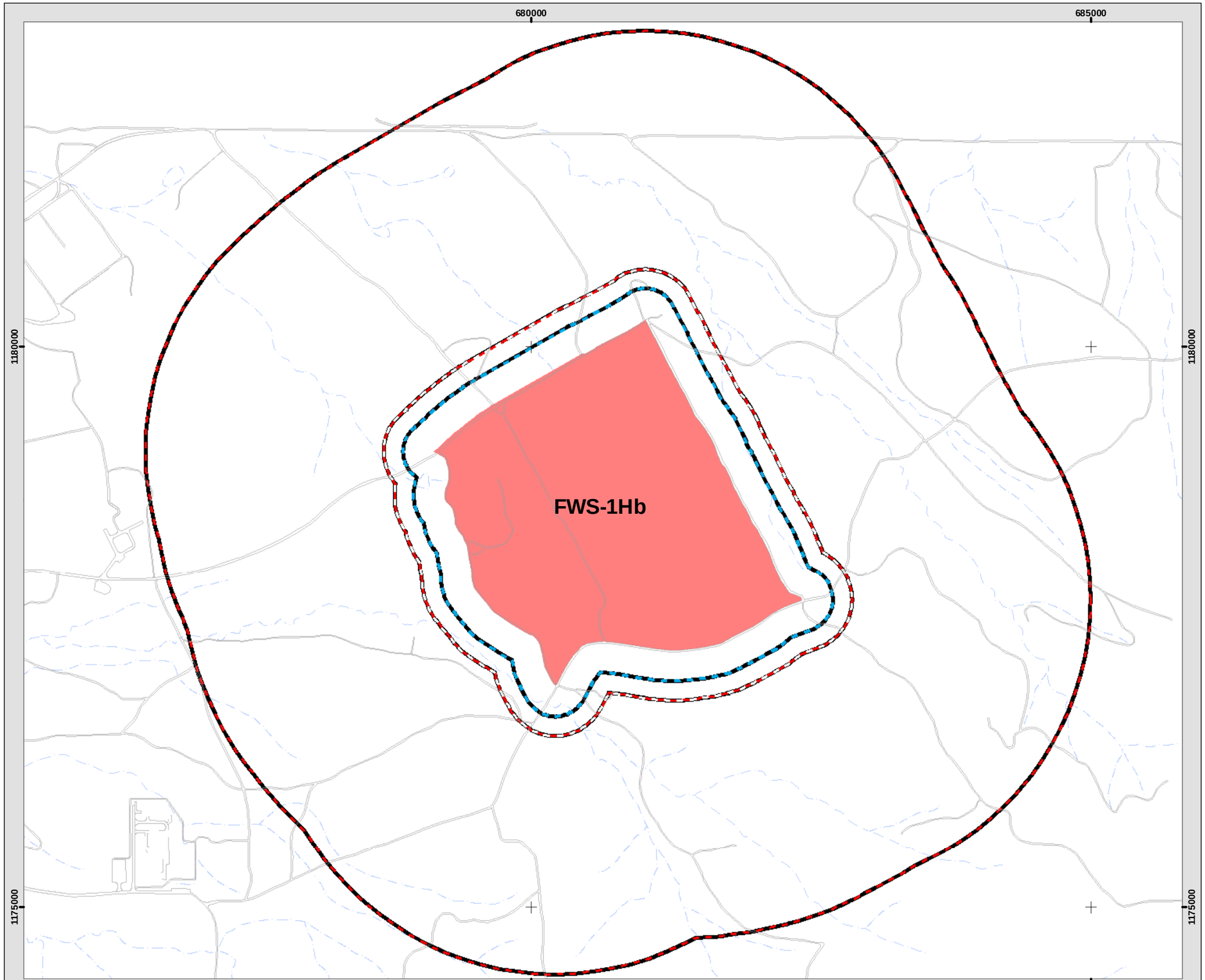
U.S. Army Engineering & Support Center Huntsville

Figure 1b
FWS-1Hb Area
Q-D Arcs

Fort McClellan, AL
June 2009



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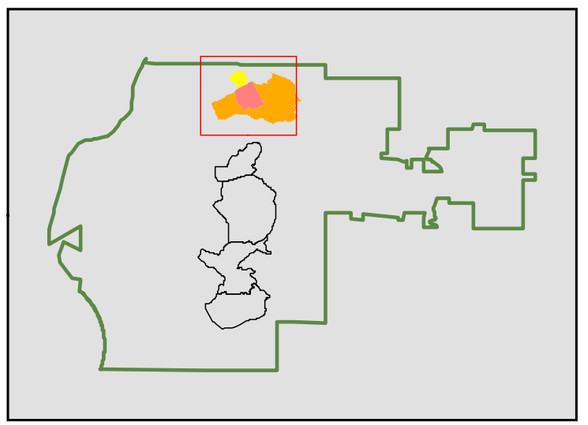
- FWS-1Hb MFD w/o EC (2577')
- FWS-1Hb HFD (447')
- Water Mitigation Using inflatable pool (275')



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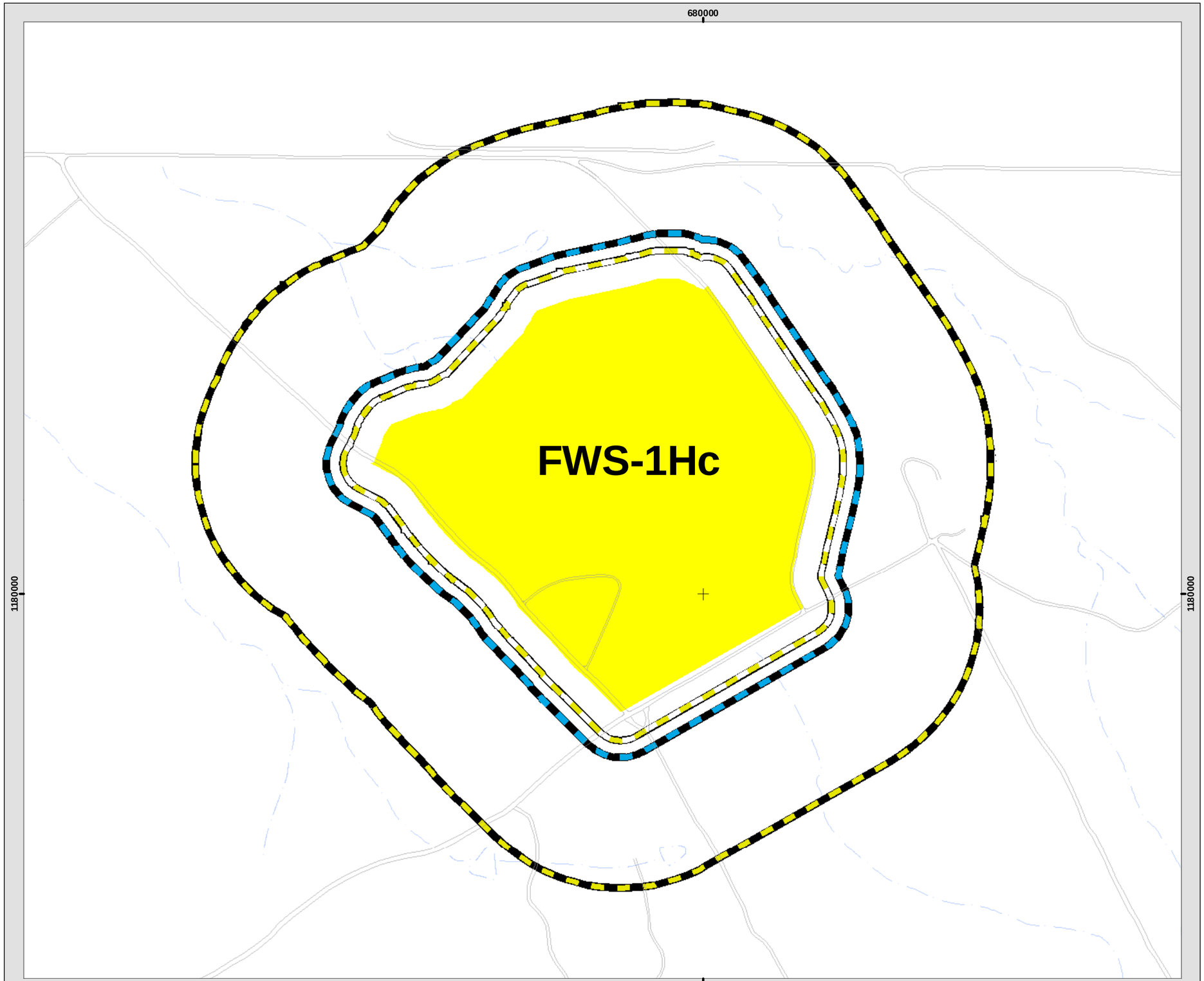
U.S. Army Engineering & Support Center Huntsville

Figure 1c
FWS-1Hc Area
Q-D Arcs

Fort McClellan, AL
June 2009



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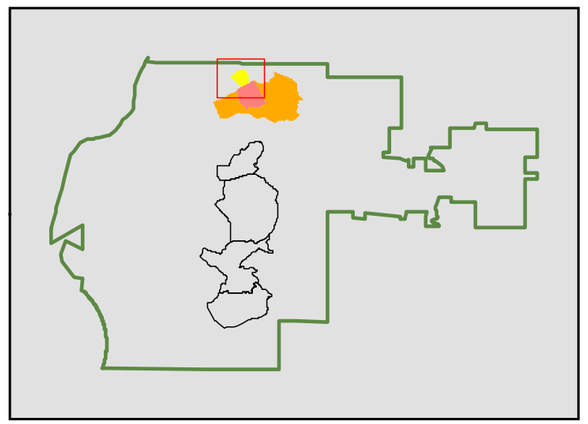
- FWS-1Hc
- FWS-1Hc MFD w/o EC (780')
- Water Mitigation using 5-gal carboys or inflatable pool (200')
- FWS-1Hc HFD (125')



U.S. Army Engineering & Support Center Huntsville

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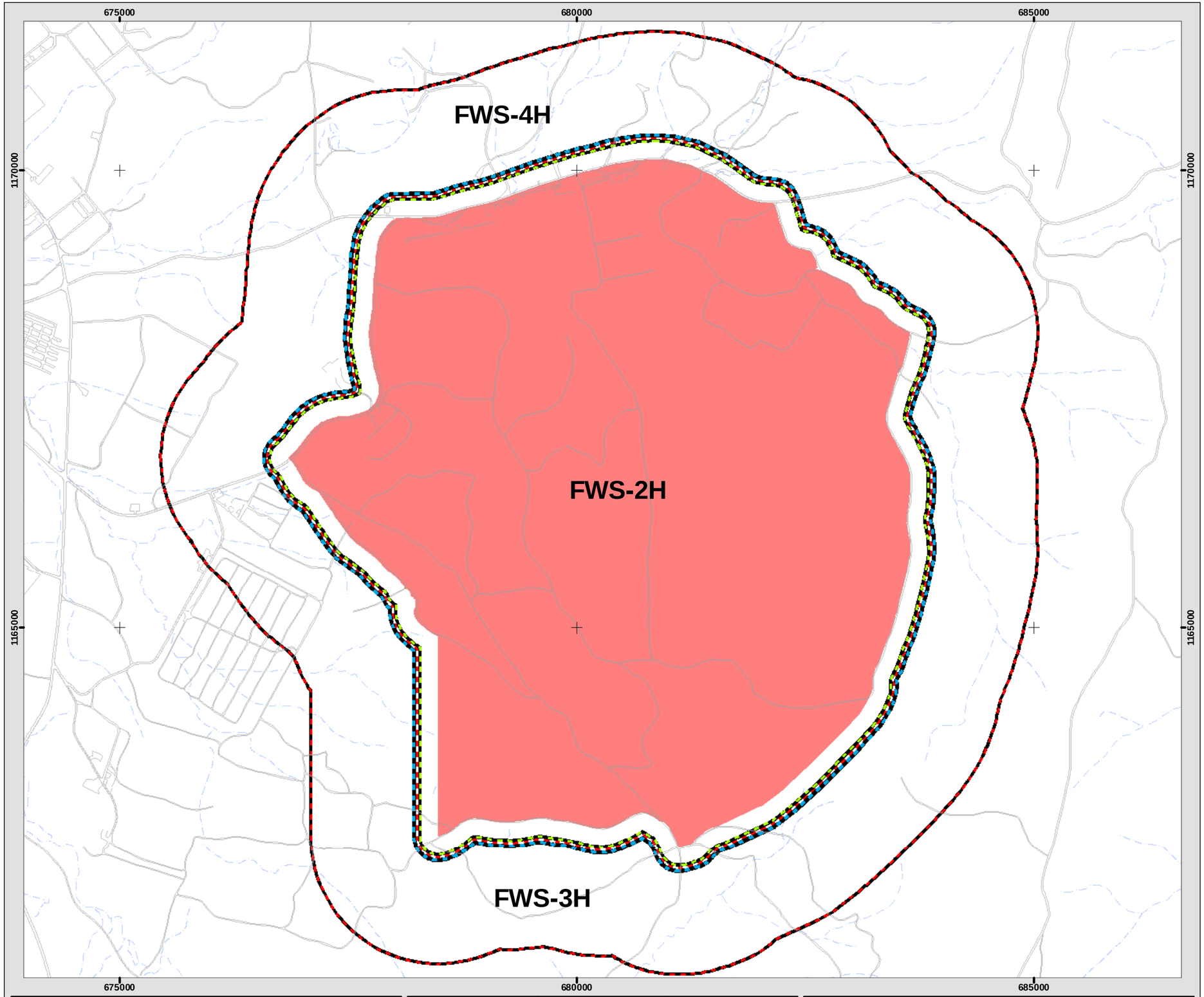
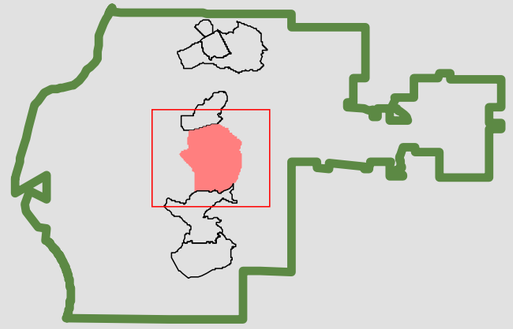
Figure 2
FWS-2H Area
Q-D Arcs

Fort McClellan, AL
June 2009



Legend

- FWS-2H
- FWS-2H MFD w/o EC (1395')
- Water Mitigation using 5-gal carboys (264')
- FWS-2H HFD (230')
- Water Mitigation using inflatable pool (200')



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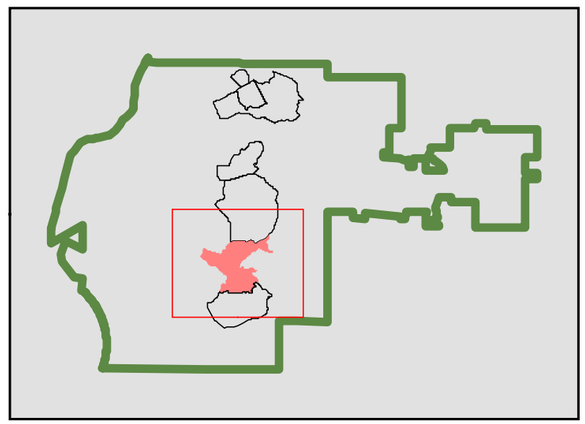
U.S. Army Engineering & Support Center Huntsville

Figure 3
FWS-3H Area
Q-D Arcs

Fort McClellan, AL
June 2009

Legend

- FWS-3H
- FWS-3H MFD w/o EC (2577')
- FWS-3H HFD (447')
- Water Mitigation using 1100 gal tank (275')



0 430 860 1,290 1,720 2,150
Feet

Drawn By: GDW	Date Drawn: 11JUN09	Project No.:	
Coordinate System: NAD83 SP Alabama East, Feet			

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PDF: PROJECTS\States\AL\McClellan\ESS_ChoccoloccoMtn\PDF\choccolocco_ESS_4_3H_061609.pdf

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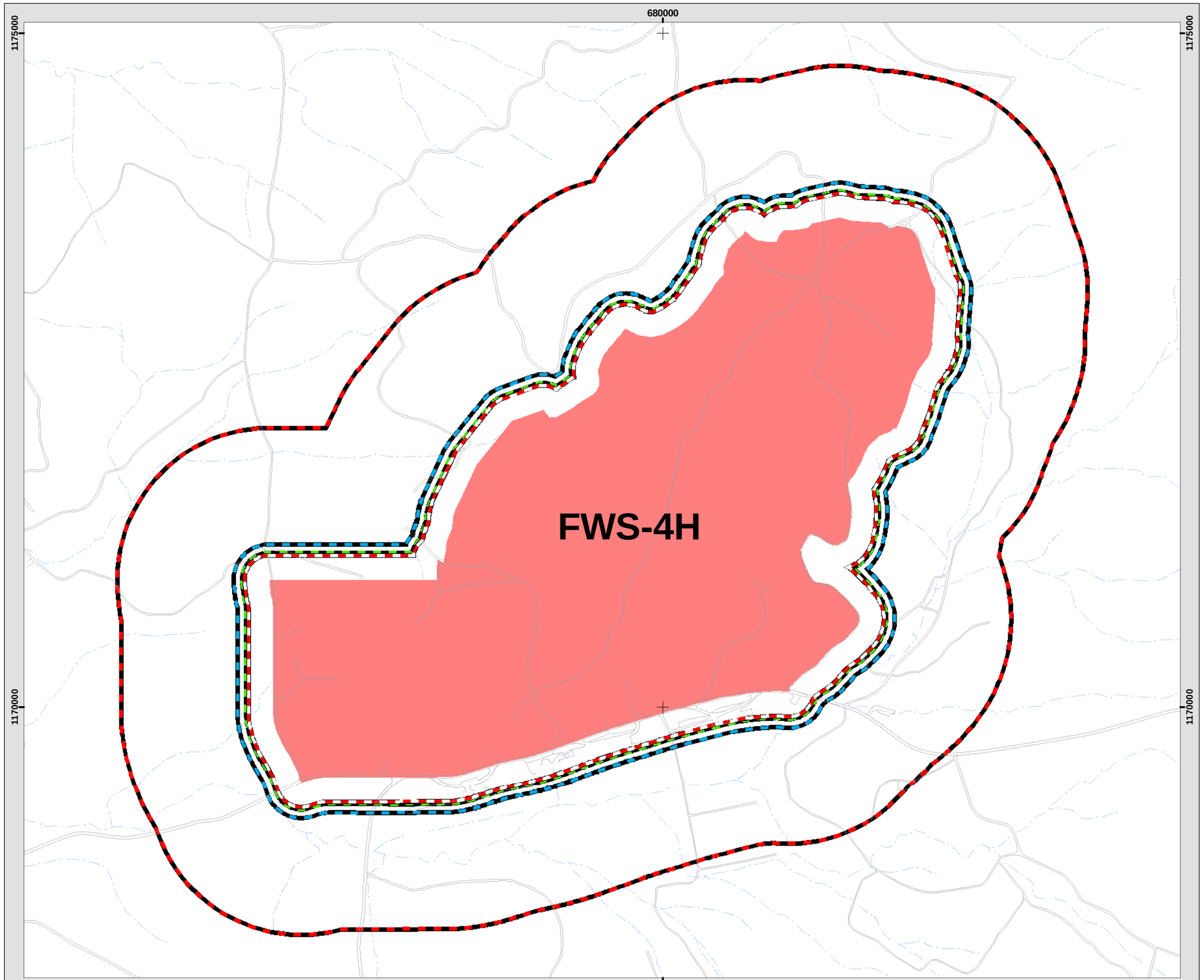
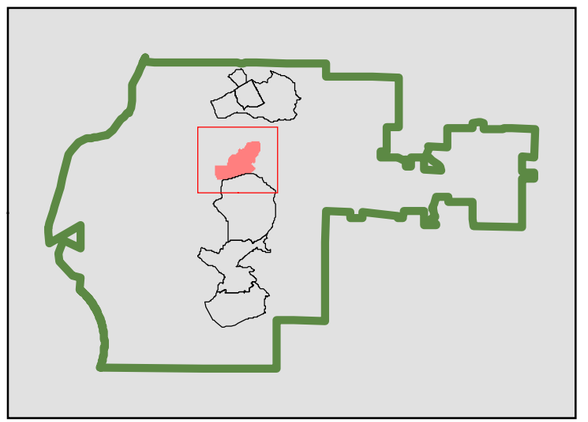
Figure 4
FWS-4H Area
Q-D Arcs

Fort McClellan, AL
June 2009



Legend

- FWS-4H
- FWS-4H HFD (183')
- Water Mitigation using inflatable pool (200')
- Water Mitigation using 5-gal carboys (264')
- MFD w/o EC (1127')



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

Drawn By:	GDW	Date Drawn: 25JUN09	Project No.:
Coordinate System:	NAD83 SP Alabama East, Feet		

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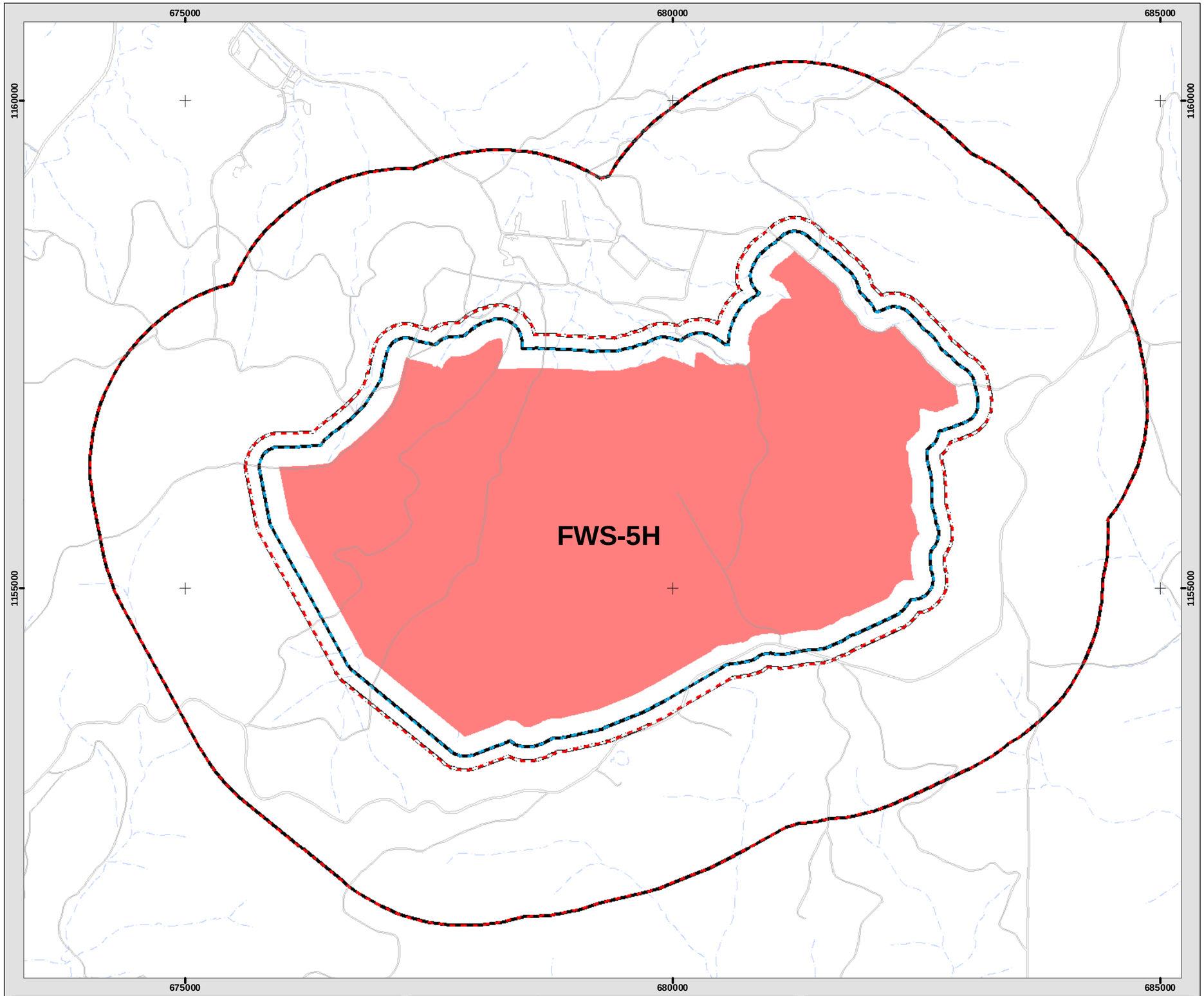
DISCLAIMER- The data and the results of data collection/ for a specific U.S. Army Corps of Engineers activity and includes the following conditions. As such, it is only valid for its intended use, content, time, accuracy specifications. The user is responsible for the results of application of the data for other than its intended purpose.

DRAFT

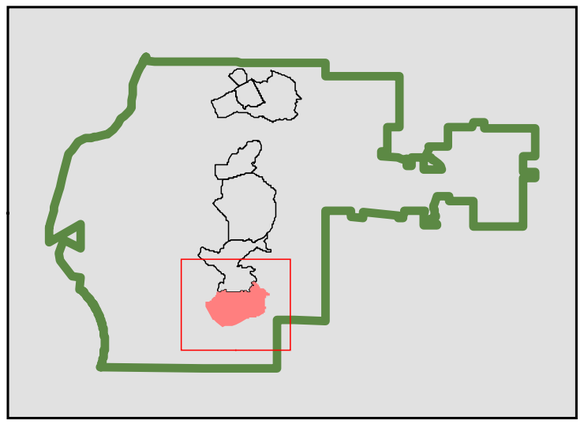
Figure 5
FWS-5H Area
Q-D Arcs

Fort McClellan, AL
June 2009



Legend

- FWS-5H
- FWS-5H MFD w/o EC (1939')
- FWS-5H HFD (341')
- Water Mitigation using 1100-gal Tank (200')



0 480 960 1,440 1,920 2,400
Feet

Drawn By: GDW	Date Drawn: 11JUN09	Project No.:	
Coordinate System: NAD83 SP Alabama East, Feet			

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PDF: PROJECTS\States\AL\McClellan\ESS_ChoccoloccoMtn\PDF\choccolocco_ESS_4_5H_061609.pdf

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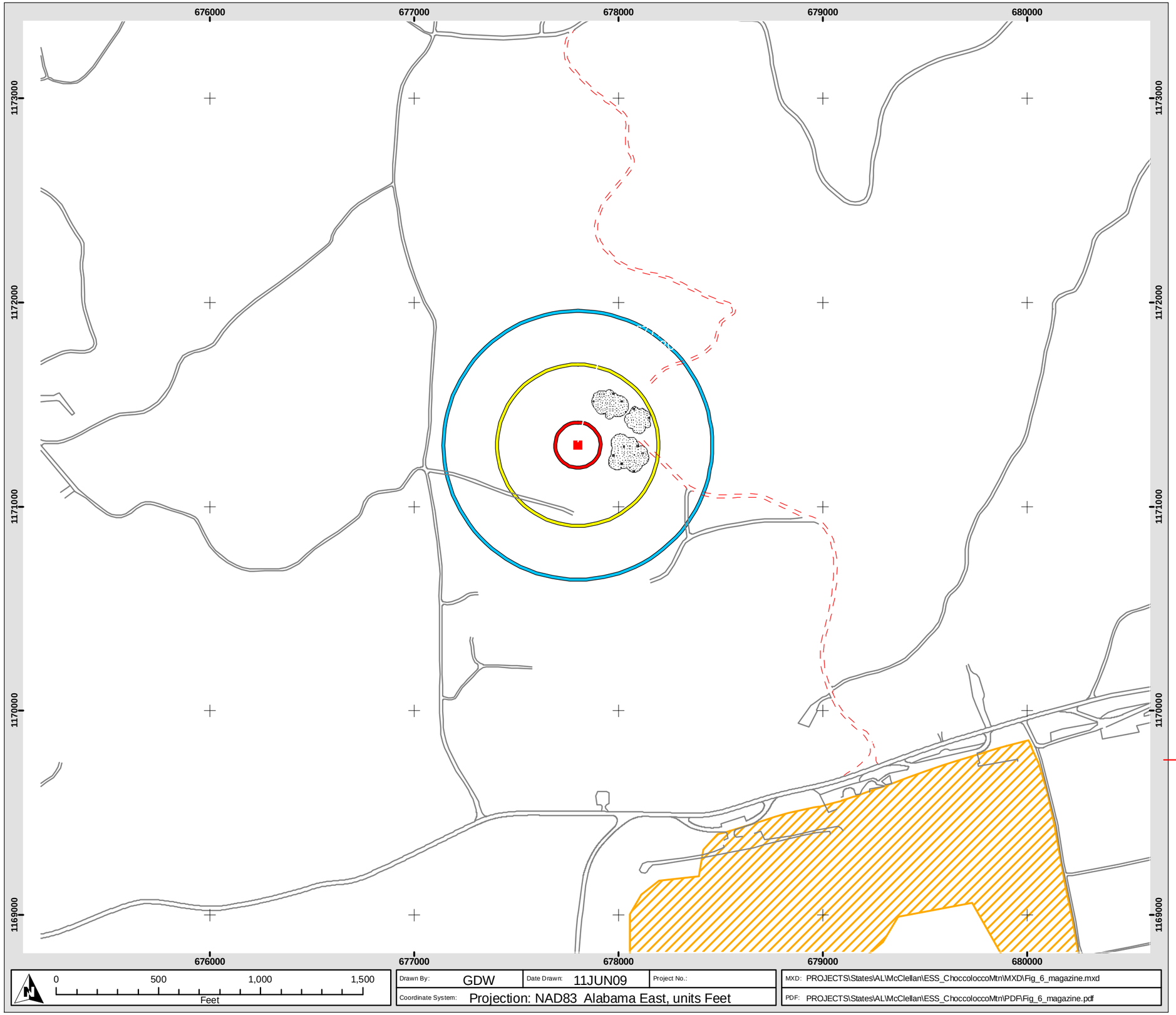
Figure 6

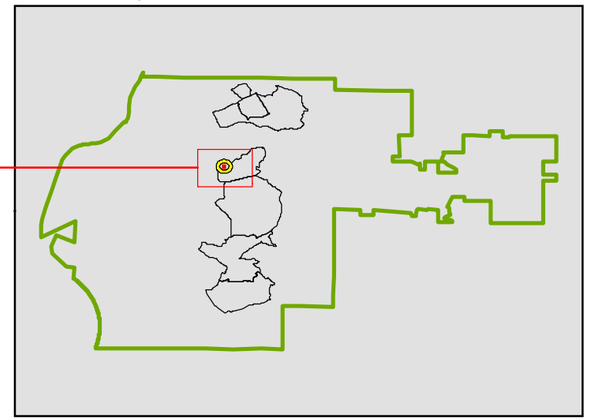
New Explosives Storage Magazine

Location Map



- *New Magazine Location*
- *Gravel Roads*
- *111 ft LTD - PTRD*
- *395 ft PTRD*
- *658 ft IBD*
- *Revised Bains Gap Road MEC Clearnace for Lead Removal*
- *Aggregate Stockpile*

Overview Map of Fort McClellan



Drawn By: GDW	Date Drawn: 11JUN09	Project No.:	
Coordinate System: Projection: NAD83 Alabama East, units Feet			

MXD: PROJECTS\States\AL\McClellan\ESS_ChoccoloccoMtn\MXD\Fig_6_magazine.mxd

PDF: PROJECTS\States\AL\McClellan\ESS_ChoccoloccoMtn\PDF\Fig_6_magazine.pdf

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APPENDIX B
CALCULATION SHEETS

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 7/31/07

Category:	HE Rounds	DODIC:	B632
Munition:	60 mm M49A2	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/9/2007
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	60 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.34000
Diameter (in):	2.3622
Max Fragment Weight (lb):	0.036402
Critical Fragment Velocity (fps):	4411

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	150
MFR-V [Vertical Range of Max Weight Fragment] (ft):	885
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1127

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	30
Inhabited Building Distance (09 psi), K50 Distance:	37
Intentional MSD (0065 psi), K328 Distance:	243

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.12
Mild Steel:	0.59
Hard Steel:	0.48
Aluminum:	1.25
LEXAN:	4.19
Plexi-glass:	2.72
Bullet Resist Glass:	2.16

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.036402
Critical Fragment Velocity (fps)SB:	4422
Kinetic Energy 106 (lb-ft2/s2)SB:	0.3559
Required Wall Roof Sandbag Thickness (in)SB:	20
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.036402
Critical Fragment Velocity (fps)W:	4422
Kinetic Energy 106 (lb-ft2/s2)W:	0.3559
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	264/200

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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 7/31/07

Category:	HE Rounds	DODIC:	B632
Munition:	60 mm M49A5	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/9/2007
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	60 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	0.79000
Diameter (in):	2.3622
Max Fragment Weight (lb):	0.016600
Critical Fragment Velocity (fps):	6290

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	183
MFR-V [Vertical Range of Max Weight Fragment] (ft):	806
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1013

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	42
Inhabited Building Distance (09 psi), K50 Distance:	52
Intentional MSD (0065 psi), K328 Distance:	342

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.39
Mild Steel:	0.51
Hard Steel:	0.42
Aluminum:	1.11
LEXAN:	3.75
Plexi-glass:	2.34
Bullet Resist Glass:	1.81

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.016600
Critical Fragment Velocity (fps)SB:	6290
Kinetic Energy 106 (lb-ft2/s2)SB:	0.3284
Required Wall Roof Sandbag Thickness (in)SB:	20
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.016600
Critical Fragment Velocity (fps)W:	6290
Kinetic Energy 106 (lb-ft2/s2)W:	0.3284
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 6/30/08

Category:	HE Rounds	DODIC:	
Munition:	2.36" Rocket M6A3 (Case Only)	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/1/2007
Primary Database Category:	rocket	Individual Last Updated Record:	Crull
Secondary Database Category:	2.36 in	Date Record Retired:	
Munition Case Classification:	Non-Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Pentolite
Explosive Weight (lb):	0.50000
Diameter (in):	2.3600
Max Fragment Weight (lb):	0.006416
Critical Fragment Velocity (fps):	7290

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	125
MFR-V [Vertical Range of Max Weight Fragment] (ft):	630
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	780

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	39
Inhabited Building Distance (09 psi), K50 Distance:	48
Intentional MSD (0065 psi), K328 Distance:	317

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.14
Mild Steel:	0.39
Hard Steel:	0.32
Aluminum:	0.87
LEXAN:	3.02
Plexi-glass:	1.76
Bullet Resist Glass:	1.30

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.001035
Critical Fragment Velocity (fps)SB:	8888
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0409
Required Wall Roof Sandbag Thickness (in)SB:	12
Expected Maximum Sandbag Throw Distance (ft)SB:	25
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.001035
Critical Fragment Velocity (fps)W:	8888
Kinetic Energy 106 (lb-ft2/s2)W:	0.0409
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 6/30/08

Category:	HE Rounds	DODIC:	C225
Munition:	81 mm M43	Date Record Created:	7/30/2004
		Last Date Record Updated:	3/26/2008
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	81 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	1.29000
Diameter (in):	3.1890
Max Fragment Weight (lb):	0.057300
Critical Fragment Velocity (fps):	4933

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	230
MFR-V [Vertical Range of Max Weight Fragment] (ft):	1097
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1395

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	49
Inhabited Building Distance (09 psi), K50 Distance:	61
Intentional MSD (0065 psi), K328 Distance:	403

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.62
Mild Steel:	0.68
Hard Steel:	0.56
Aluminum:	1.43
LEXAN:	4.51
Plexi-glass:	3.00
Bullet Resist Glass:	2.40

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.057300
Critical Fragment Velocity (fps)SB:	4933
Kinetic Energy 106 (lb-ft2/s2)SB:	0.6972
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.057300
Critical Fragment Velocity (fps)W:	4933
Kinetic Energy 106 (lb-ft2/s2)W:	0.6972
Water Containment System:	5 gallon carboys/ inflatable pool
Minimum Separation Distance (ft)W:	264/200

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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 6/30/08

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 [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	341
MFR-V [Vertical Range of Max Weight Fragment] (ft):	1494
MFR-H [Horizontal Range 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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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 7/31/07

Category:	HE Rounds	DODIC:	D571
Munition:	155 mm M107	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:	155 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	15.44800
Diameter (in):	6.1024
Max Fragment Weight (lb):	0.648213
Critical Fragment Velocity (fps):	3426

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	447
MFR-V [Vertical Range of Max Weight Fragment] (ft):	1983
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	2577

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	112
Inhabited Building Distance (09 psi), K50 Distance:	141
Intentional MSD (0065 psi), K328 Distance:	922

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	6.82
Mild Steel:	1.27
Hard Steel:	0.64
Aluminum:	2.59
LEXAN:	6.76
Plexi-glass:	5.13
Bullet Resist Glass:	4.43

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.648213
Critical Fragment Velocity (fps)SB:	3426
Kinetic Energy 106 (lb-ft2/s2)SB:	3.8042
Required Wall Roof Sandbag Thickness (in)SB:	36
Expected Maximum Sandbag Throw Distance (ft)SB:	220
Minimum Separation Distance (ft)SB:	220

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.648213
Critical Fragment Velocity (fps)W:	3426
Kinetic Energy 106 (lb-ft2/s2)W:	3.8042
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	275

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