



FINAL

EXPLOSIVES SAFETY SUBMISSION
AND
AFTER ACTION REPORT

FORMER
LADD AIR FORCE BASE
COMMUNICATIONS SITE
FORT WAINWRIGHT, ALASKA

JULY 2010

Prepared by



For the
U.S. Army Corps of Engineers
ALASKA DISTRICT

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1. SITE:

- a. Name: Former Communications Site (commonly referred to as Taku Gardens).
- b. Location: Fort Wainwright, Alaska, Figure 1-1.
- c. The work described in this report was performed as a Remedial Investigation (RI) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986. The work was conducted in accordance with the provisions Explosives Safety Plan (ESP), Appendix A as approved by the Department of Defense Explosive Safety Board (DDESB) and applicable site specific Munitions and Explosives of Concern (MEC) and Debris and Drum removal work plans.

2. PURPOSE:

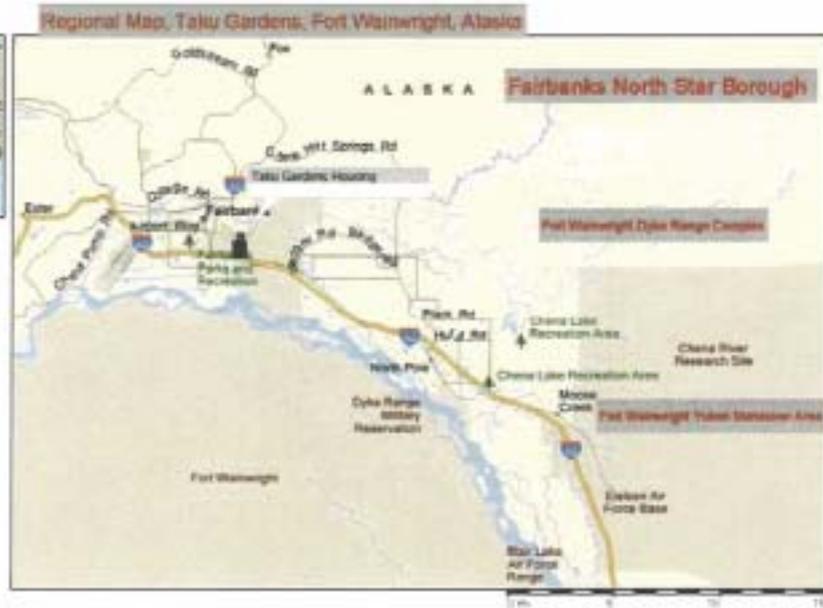
- a. To describe the actions taken as part of the Remedial Investigation to identify, remove and dispose of all MEC located. This area was not a range and only unfuzed and unarmed military munitions were expected to be present.
- b. To request DDESB review and approve those actions as fully satisfying DOD Explosives Safety Standards allowing the property to be used for family housing as intended.

3. BACKGROUND – REASON FOR MILITARY MUNITIONS RESPONSE

- a. The approximate 55 acre site was selected for future military family housing in 2002-2003. Clearing and grubbing at the site began in 2004. The construction of the family housing began in April 2005 with the excavation of utility trenches and building foundations. Vertical construction has been completed at the site but additional work remains including the installation of roads, sidewalks, driveways, lighting and landscaping.
- b. The site was never used as an impact area for munitions or as a range, therefore only discarded military munitions (DMM), munitions debris (MD), and munitions potentially presenting an explosive hazard (MPPEH), were expected to be present.

FIGURE 1-1 REGIONAL MAP

Figure 1-1, Regional Map



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- c. The entire area was originally designed and used as a temporary billeting and work area for Army and Air Force Units while their permanent barracks, motor pools, dining facilities, etc. were being constructed. During routine activities at the Communications Site between 1940 and 1959 inert practice and training munitions, construction debris and other metallic debris were buried as a means of routine disposal, the extent of which was not known prior to the start of construction activities. Additionally, this disposal was an effective way of filling old slough channels and low areas that were a breeding ground for mosquitoes and other unwanted pests. No organic material or medical waste was found at this site. In 1959 the site was closed and the site was vegetated. No historical records of the types and quantities of material buried at the site were ever located.
- d. During construction activities, buried debris was encountered, including material potentially presenting an explosive hazard (MPPEH), range related debris (RRD) and munitions debris (MD). The construction workers did not apparently recognize many of these items as potentially being hazardous. In 2006, intrusive investigations were performed as part of a Preliminary Source Evaluation (PSE) in an attempt to determine the nature and extent of contamination and debris. The results of the PSE indicated that further investigations were necessary to fully characterize the area.
- e. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) conducted a thorough and extensive geophysical survey of those areas within the site that were accessible using an EM61 to determine the extent of the buried debris. The footprints of the housing units could not be surveyed because they were in place. Based on the results of the geophysical survey and the PSE, the site was divided into two major areas — one area where the potential to encounter DMM was low and the second area (approximately 20 acres) where the probability of encountering DMM was moderate to high. This area is depicted as "Area A" on Figure 3-1.
- f. In 2007, the USACE tasked Jacobs Engineering to perform remedial investigations to further characterize the site, gain additional data, and classify the types of contamination, debris, and munitions-related debris. An ESP was prepared, submitted and approved prior to work in 2008. Intrusive work prior to 2008 was done following local and Corps of Engineer approved site specific work plans. These work plans addressed all aspects of safety including explosives safety. All intrusive work within the 55 acre site, regardless of the probability of encountering DMM, was conducted under the supervision of on-site UXO technicians.
- g. All of the houses at the site remain unoccupied.

- h.** An eight feet high chain linked fence with barbed wire at the top surrounds the entire site. Locked gates are located on the northern and southern boundaries of the site. Site access is limited and controlled by the Fort Wainwright Directorate of Public Works.

DISCUSSION OF MUNITIONS RESPONSE AND SITE ACTIVITIES

- a. The work performed in 2007/2008/2009 was intended to both gather data for the RI while using the intrusive activities to remove all drums, debris and MPPEH uncovered.
- b. The RI was designed to determine both the extent and nature of all potential and actual environmental or explosive issues. The ESP outlined the general actions taken to identify, remove and dispose of DMM.
- c. The initial and subsequent geophysical surveys were not designed to find specific point targets since the site was obviously used as a disposal (burial) site for typical military trash and debris, 55 gallon drums, MD and RRD.
- d. A geophysical prove out (GPO) was not conducted prior to the survey since individual targets were not distinguishable from the larger signals. There was no benefit to be added to the survey by comparing different technologies against a variety of targets since the objective was to find gross areas of debris for investigation.
- e. The geophysicist recommended specific anomalies that should be investigated based on anomaly signal strength. Additional anomalies (those below the threshold determined to represent large debris fields) were also selected for excavation and were used as Quality Assurance (QA) checks.
- f. The excavations ranged in size from 100 feet x 100 feet to 2½ acres in size and from surface to a depth of 18 feet. Approximately 8 surface acres were excavated, removing over 160,000 cubic yards (cy) of soil and debris. The margins of each excavated area were searched with Schonstedt Magnetometers and all anomalies were removed to the depth of detection including horizontally into the sidewalls. As a means of internal quality control the excavations were resurveyed with an EM61 and all anomalies detected were removed.
- g. Excavation was accomplished in six inch lifts via mechanical means. UXO qualified personnel visually screening each lift as it was removed and then spread out for inspection. The bottoms and margins of each excavated area were inspected with Schonstedt Magnetometers. For the final quality check the bottoms and margins of each excavation were re-surveyed with an EM61 to ensure all debris or MPPEH was removed. Originally the ESP proposed excavating to a minimum depth of four feet; however the site specific work plans were prepared to permit excavation to a depth where the work team determined the anomaly would be completely removed.
- h. Soil inspections were first performed visually and confirmed with a magnetometer. All soil:
 - i. was screened as it was removed,
 - ii. was screened when spreading and staging prior to loading,
 - iii. was screened when loaded for transport to the stockpile,

- iv. was screened when unloaded for stockpile,
 - v. was screened when the stockpiled soil was removed for backfill,
 - vi. was screened as it was dumped and spread as backfill, and
 - vii. the final survey was performed of the filled excavation with an EM61 to ensure the filled excavation was cleared of munitions-related debris
- i. When MPPEH were identified as potential DMM by the on-site UXO qualified personnel, the Fort Richardson Army EOD unit was immediately notified. The items were transported to an approved storage magazine and then destroyed by military EOD.
 - j. The site work teams maintained the separation distances between site operations as prescribed in the approved ESP. Additionally, installation roads were closed and personnel were evacuated from buildings when they were within the exclusion zone.
 - k. Both groundwater and soil sampling was performed throughout the site for contaminants of concern. The analytical results of the samples indicated the presence of several different types of chemical compounds. All of the contaminated soil discovered was removed and properly disposed of. The contamination found in groundwater is currently being monitored. Additionally, the only source of drinking water for the post is cross gradient from the site.
 - l. Sampling for munitions constituents was performed by two separate contractors for nitrates (EPA method E300A), RDX (EPA method 8330), and perchlorates (EPA method 6850). The results of the first sample taken in 2006 indicated the presence of RDX. However, high levels of petroleum compounds were found in these samples. Because the presence of elevated petroleum compounds has the potential to interfere with the explosives analytical method (EPA SW-846 method 8330) EPA method 8321 was used to analyze subsequent samples. Subsequent sampling events were performed in the same monitoring wells in 2007 - 2010 that resulted in "non-detect" for explosive compounds in all the wells sampled. Based on the new analytical results, the Army and local regulators concluded the presence of explosives in groundwater is unlikely.

4. SUMMARY OF MUNITIONS-RELATED DEBRIS

- a. Those items destroyed explosively by Army EOD with an appropriate (small) donor charge (24) were identified as inert/practice, see photographs 5-1 and 5-2. All of the items destroyed by Army EOD with excessive amounts of explosives (large) donor charges (5) were completely destroyed and the filler could not be determined. Based on the fact that filler in the munitions that were not destroyed was inert (detonated with the appropriate amount of donor

charge); it is very unlikely that any of the items contained explosive filler. None of the items located or destroyed were fuzed or had evidence of fuzing.

PHOTOGRAPH 5-1



Inert filled M106 after detonation

PHOTOGRAPH 5-2



No filler present, M41 after detonation

- b. Excavation activities removed over 350 tons (approximately 50,000 cy) of debris, and excavation activity is depicted in photographs 5-3, and 5-4. All MD and RRD that was commingled with other buried debris was inspected, certified inert, free of explosives and explosive residues, and turned over to a recycler for smelting. During excavation activities the only DMM found were two 3.5-inch M29 series unfired rocket motors. Additional MD items found were inert M41 fragmentation bombs, inert M47 100-pound dual use bombs, and inert M106 8-inch projectiles. The amounts and types of items found during all site investigations are provided in Appendix B, Tables 5-1 through 5-5. No munitions-related items were located during the 2009 field season.

PHOTOGRAPH 5-3



50,000 cy scrap staged for recycling

PHOTOGRAPH 5-4



Excavating soil and other debris

5. MIGRATION OF MEC

- a. Migration of MEC on to the site is not expected because the property that bounds the site on all sides is developed and has no history of munitions being found, used, or buried. Because extensive MEC investigation activities have been performed at the site, the Army believes there is no possibility that the migration of munitions off site could be possible.

6. FROST HEAVE

- a. According to Table 1, of the U.S. Army Corps of Engineers Technical Instruction 809-01 Frost Depths, dated 3 August 1998, the frost depth at the site is heavily influenced by permafrost. There is no established depth of permafrost at the site.
- b. The Army team has considered the potential for frost jacking at the site. The Fairbanks area has an average temperature of 27 degrees Fahrenheit with an average of 222 days with temperatures below freezing. The average temperatures in the months of October through April are below freezing. Frost jacking depends on a number of criteria such as the type of the soil, moisture content of the soil, and freezing temperatures.
- c. The National Defense Center for Environmental Excellence published a report in August 2006 on frost jacking. The report, based on limited test results, did not show any significant upward migration of munitions from frost jacking. The results did show some limited potential for upward movement if MEC were near the surface and if the MEC's volume to weight (mass) ratio was large.
- d. Frost jacking (frost heave) although common in Alaska, is not a factor regarding upward migration of munitions-related items at the site. The excavation removed any debris that would be subject to frost jacking.

7. STAKEHOLDER INVOLVEMENT

- a. Several public meetings have been held and attended by US Military personnel, military dependents, local civilians, and state and federal regulatory officials.
- b. Federal and State regulatory officials have been involved in the approval process of all investigation activities performed at the site.

8. ANALYSIS

- a. The Taku Gardens site at Fort Wainwright was thoroughly investigated through an extensive review of historical records and photographs, a detailed geophysical review and analysis and by considerable excavation.
- b. Only two Practice Rockets, 3.5 inch M29 series rocket motors were positively identified as DMM. Each M29 rocket motor was destroyed.

- c. Originally, there was concern that DMM included unfuzed and unarmed M41 20 pound fragmentation bombs, M47 100 pound dual purpose bombs, and M106 8-inch projectiles. However, several factors make that highly unlikely.
 - i. First, the M106 projectiles found in 2006 were inert.
 - ii. Second, the Army EOD team used very large donor charges in 2007 (more than 15 lbs per item) on each suspected DMM (M106, and M41). From the appropriate safe distance, one cannot absolutely distinguish whether or not the explosion is due solely to the donor charge or if there is a contribution from the suspected DMM.
 - iii. Last, the contractor's UXO qualified personnel found the same items (M106, M41 and M47) in 2008. The EOD team, at the request of the Fort Wainwright environmental team, used small donor charges to determine if the items were inert or explosively filled. In each instance, the suspected DMM was inert filled with plaster of paris or empty.
 - iv. Of the 2901 munitions items located, only five cannot be positively identified as inert or training. These five were detonated with such a large donor charge the filler could not be positively determined.
- d. Total items found (DMM, MD, and RRD - Appendix B)
- e. Approximately 160,000 cubic yards of soil and 50,000 cubic yards of debris were excavated within the Taku Gardens housing area. The excavated soil was inspected both visually and with magnetometers each time it was moved, at least 6 separate and distinct times. The bottoms and sides of each excavation were surveyed with an EM61 to ensure the margins of the excavation were free of anomalies. After backfilling, each excavation was surveyed with an EM61 to ensure the soil was free of anomalies.
- f. This area was never used as a firing range for any military munitions.
- g. The site requires extensive work before occupancy. Roads, sidewalks, final utilities and landscaping are required. Raised flower beds will also be used. Based on the current grade, at least one foot of soil will need to be added in many locations. Considering the footprint of the building and hard surfaces (streets and sidewalks), the underground utilities and those areas where excavation to four feet and deeper was performed, there remain few areas where a hypothetical potential risk might exist.
- h. The installation has base-wide land use controls that prohibit residents of family housing from digging. Facility maintenance and contract personnel are also restricted from intrusive activities unless they have made prior arrangements with the installation environmental staff.
- i. The Army team realized that there was a possibility, however remote, that MPPEH might remain undetected under the housing unit. The team believed that since the footprint of the housing unit footprint was excavated several feet below the slab, and since there would be no way for an individual to

come in contact with any potential MPPEH buried beneath several feet of earth and a concrete slab, that the explosive safety risk was negligible.

9. RESIDUAL RISK

- a. Site conditions will be reviewed every five years as part of the CERCLA process.
- b. Land use controls that restrict intrusive activities are in place, Appendix C.
- c. Annual surface inspections of the site will be performed to ensure that no munitions-related items have surfaced.
- d. The UXO safety policies, Recognize, Retreat, and Report are currently part of military and dependent "in processing", Post employment process, and contractor orientation.
- e. The 65th Ordnance (EOD) Company has been activated at Fort Wainwright. Part of their mission includes post wide munitions identification training and response.

10. CONCLUSION

- a. The installation understands that this is a somewhat unique document being both an ESS and an after action report. The DDESB-approved ESP noted that the installation would prepare and submit an ESS that defined the actions proposed to reach a safe end state where the housing could be used safely by military families. The expectation was that a response with a corresponding ESS would be required to address removing DMM. However the RI was more extensive than originally conceived, and the debris fields needed to be completely removed to insure that both the nature and extent of any environmental or explosive issue was addressed. Thus both an ESS and after action report are submitted as a single document.
- b. The installation believes that action taken, and the results of these actions, make this area safe for residential use. The area has been geophysically surveyed, extensively excavated to depths beyond four feet and in most cases below six feet. Only DMM were found, two Practice Rockets, 3.5 inch M29 series rocket motors. The Army team is convinced that the items that originally caused the greatest concern were inert MD and not DMM.

11. RECOMMENDATION

That the DDESB approve this Explosives Safety Submission and approve Taku Gardens for residential use.

APPENDIX – A
APPROVED ESP



REPLY TO
ATTENTION OF

CEHNC-CX-MM

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

02 April 2008

MEMORANDUM FOR US Army Corps of Engineers, (CEPOA-PM-C/Mr. Robert Brock), PO Box 6898, Elmendorf AFB, AK 99506-6898

SUBJECT: Explosive Site Plan (ESP) for Remedial Investigation, Former Ladd Air Force Base Communications Site, Ft. Wainwright, AK, April 2008

1. References:

a. ER 385-1-95, Safety and Health Concerns for Munitions and Explosives of Concern (MEC) Projects, March 2007.

b. DOD 6055.9-STD, Ammunition and Explosives Safety Standards, February 2008.

2. This ESP is submitted under the provisions of paragraph C12.5.4, reference 1b.

3. This memorandum provides the Direct Reporting Unit approval for US Army Corps of Engineers participation per reference 1a.

4. If you have any questions, please contact Mr. Hank Hubbard, at (256) 895-1586.

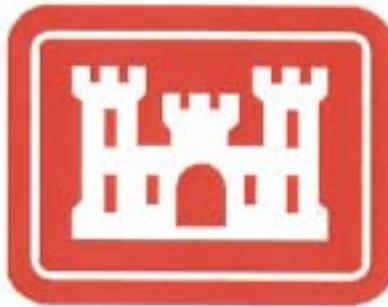
Encl

JOHN A. SIKES
Chief, Military Munitions Division
Environmental and Munitions
Center Of Expertise

CF: w/o encls

Commander, US Army Corps of Engineers, (CESO-SWD/Ms. Blanca Roberts) 441 G Street, NW, Washington, DC 20314-1000

Commander, US Army Corps of Engineers, (CEHNC-CX/EC/EG/ES/Ms. Sandi Zebrowski), 12565 West Center Road, Omaha, NE 68144



Draft

Explosive Site Plan

REMEDIAL INVESTIGATION

Former
LADD AIR FORCE BASE
COMMUNICATIONS SITE
FORT WAINWRIGHT, ALASKA

APRIL 2008

Prepared by

 **JACOBS**

for the USACE, Alaska District

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1. Site:

- a. Name: Former Communications Site, Former Ladd AFB, Fort Wainwright
- b. State: Alaska
- c. This investigation is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and is part of the overall Remedial Action Process. Subsequent removal responses may be dictated in the future 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 ESS will be prepared and submitted for review and approval as necessary to support that response.

2. Anticipated Dates:

- a. Start: May 2008
- b. Complete: November 2008

3. Purpose:

- a. To identify potential MEC areas for future removal responses within the project location.
- b. Clarifies that U.S. Army EOD personnel will perform all explosive ordnance disposal activities at the site.

4. Site Background and Current Conditions:

- a. The Former Communications Site was located on the former Ladd Field, which is currently part of Fort Wainwright. Between 1940 and 1959 MEC was mixed with construction debris and other metallic debris and buried as a means of routine disposal, which was not known prior to the start of construction activities.
- b. The site was selected for future military family housing in 2002-2003. The construction of the family housing began in summer of 2004 with ground clearing. Actual construction of the housing area began in April 2005 with the excavation of utility trenches and building foundations. Vertical construction has been completed at the site but additional work remains including the installation of roads, sidewalks, driveways, lighting and landscaping. Construction at the site has been suspended indefinitely because of the presence of MEC.
- c. During construction activities, buried debris was encountered, including MEC. In 2006, intrusive investigations were performed as part of a Preliminary Source Evaluation (PSE) in an attempt to determine the extent and types of debris and

potential chemical contamination. The results of the PSE indicated that further investigations were necessary to fully characterize the area.

- d. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) has performed extensive geophysical surveys to determine the extent of the buried debris. Based on the results of the geophysical survey and the PSE, the site has been divided into two major areas.
- e. In 2007, the Army tasked Jacobs Engineering to perform intrusive investigations to further characterize the site, gain additional data, and classify the types of debris and MEC present.
- f. None of the houses at the site are occupied.
- g. An eight feet high chain linked fence with barbed wire at the top surrounds the entire site. Locked gates are located on the northern and southern boundaries of the site. Site access is limited and controlled by the Fort Wainwright Directorate of Public Works personnel.

5. Executing Agencies:

- a. U.S. Army Environmental Center
- b. U.S. Army Directorate of Public Works
- c. U.S. Army Corps of Engineers, Alaska District

6. Scope of Investigative/Characterization action:

- a. A surface and subsurface investigative action is required to fully characterize the site to determine the extent and boundaries of contamination, MEC and HTRW, on the site.
- b. The selected investigative technique for conducting the investigation for contaminants at Taku Gardens in 2008 is a surface sweep and investigation of potential MEC, debris, and other contaminants to a minimum depth of 4 feet.
- c. The geophysical survey instrument (EM61) was used to delineate the boundaries of the potentially contaminated areas. A mechanical excavator will be used to assist in the removal of overburden and debris from the pits.

7. Safety Criteria:

- a. The potential MEC that has been discovered on site is an unfuzed M106, 8-inch projectile. During the course of this investigative action, if MEC with a greater fragmentation distance is encountered, the MSD will be adjusted in accordance with DDESB Technical Paper 16.
- b. See Table 7-1 for Minimum Separation Distances.

Table 7-1 Minimum Separation Distances (MSD)						
Area	MEC	MSD (ft)				
		For Unintentional Detonations		For Intentional Detonations		
Taku Gardens		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)	Without Engineering Controls	Using Sandbag Mitigation	Using Water Mitigation Carboys/Pool
	8" HE projectile, M 106 ²	153	530	3,287	NA	NA

Notes:
 1. See Appendix A for calculation sheets and documentation of MSD.
 2. Denotes MGF during intrusive operations within the area indicated.

- c. Any occupied buildings or public roadways in the MSD areas will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of intrusive investigations. The base gas station and Neely Road are within the 530-foot Hazardous Fragmentation Distance of the northern three-fourths of the building-17 investigation site. Therefore, intrusive activities will not be conducted north of the line drawn across this area when Neely Road is open and/or the gas station is open, see Figure-2.
- d. The surface materials will be removed in six inch lifts, with magnetometer surveys conducted between lifts, to preclude the probability of encountering MEC with the mechanical equipment. If the metallic debris becomes too dense for magnetometer surveys, a visual survey will be conducted prior to debris removal.

8. Methods of Disposal:

- a. The contractor will not maintain any explosives on site or perform any munitions disposal activities. If munitions are found that contain explosives and are considered "acceptable to move" they will be transported, as directed by installation personnel, to the base Ammunition Supply Point (ASP) and staged in explosive storage magazine #2209 that is certified and licensed, until disposed of by U.S. Army EOD personnel.
- b. The contractor will not maintain control of any explosive storage magazines.
- c. If disposal activities are required, they will be performed by U.S. Army EOD personnel at an established and permitted disposal range within the boundary of Fort Wainwright, as identified by installation personnel.
- d. The ESQD arc for intentional detonations when conducting BIP disposal or RSP procedures is 3,287 feet and is depicted in Figure 3. Disposal will be performed by U.S. Army EOD personnel, who may choose to perform a "Render Safe Procedure" (RSP) instead of a BIP, per their TM 60 Series EOD publications.

The contractor's UXO and site personnel will assist the EOD personnel as necessary to construct engineering controls they prescribe as necessary to suppress the noise, blast, distribution of fragments, and protect the public.

9. Maps:

Figure 1 shows the regional location of the former communications site within the boundary of Fort Wainwright, Alaska. Figure 2 depicts the Hazardous Fragmentation Distance around each investigation area. Figure 3 identifies the Maximum Fragment Range - Horizontal (MFR-H) distance each area for the munition with the greatest fragmentation distance (MGFD).

APPENDIX A
Figures

Fairbanks, Alaska

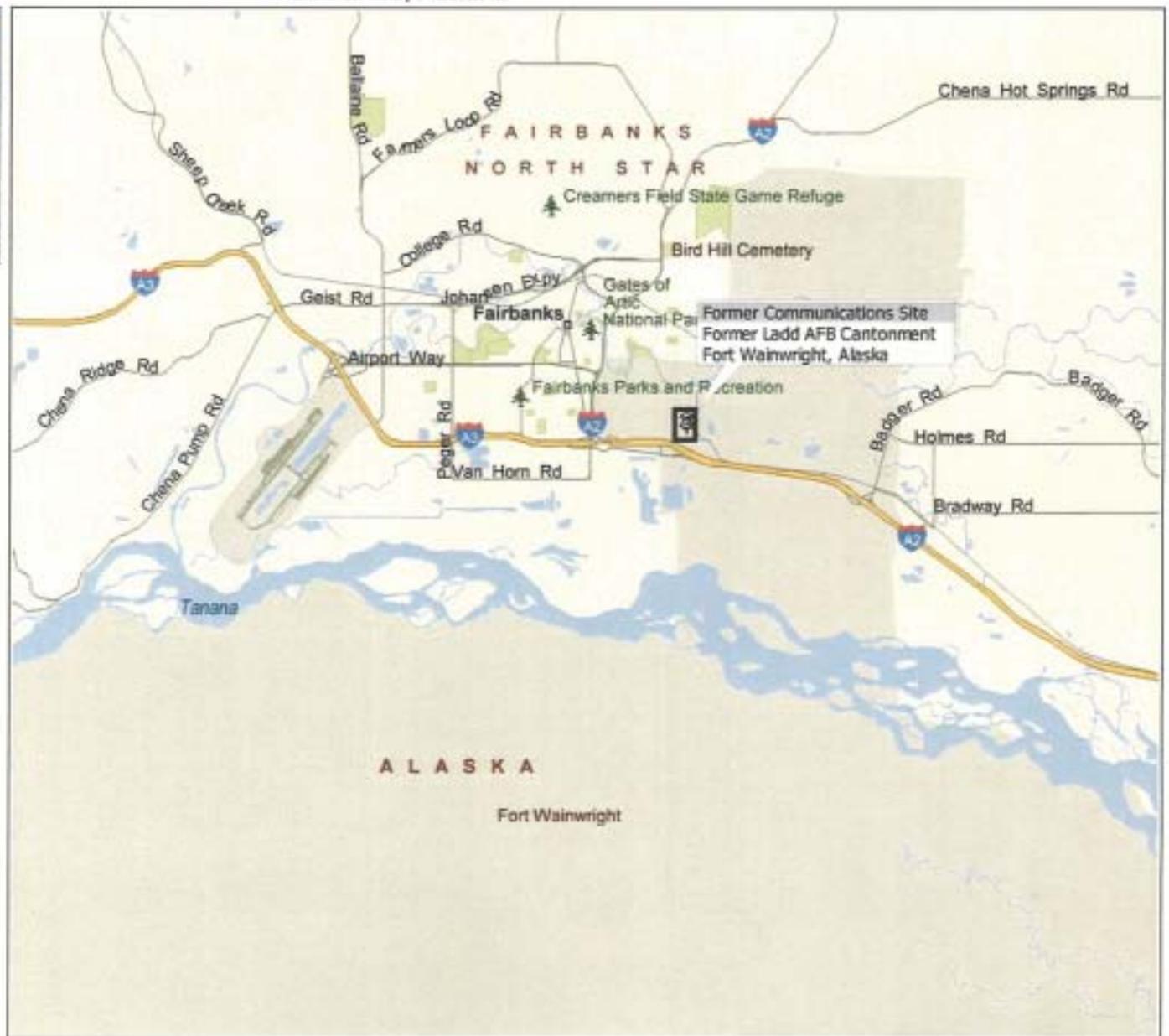
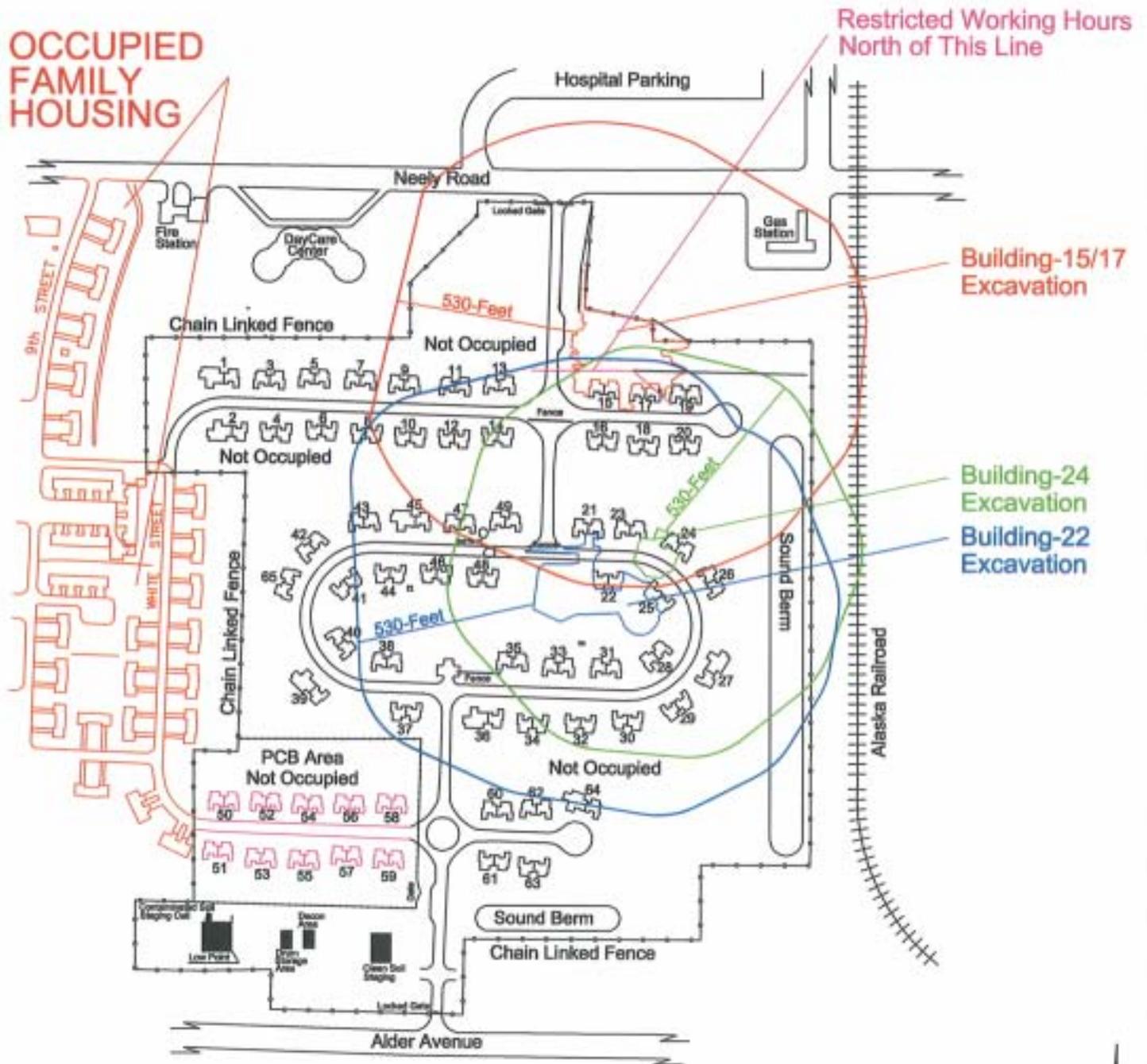


Figure 1

FIGURE-2 ESQD ARCS

FORMER COMMUNICATIONS SITE FORMER LADD FIELD FORT WAINWRIGHT, ALASKA CANTONMENT AREA



Jacobs Engineering, Inc.
125 Broadway Avenue
Oak Ridge, TN 37830
Phone: 865-2204939
Fax: 865-220-4848

Date Drawn: 18 FEB 2008
Drawn BY: DJF Rev: 00

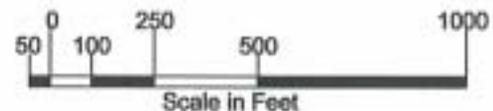


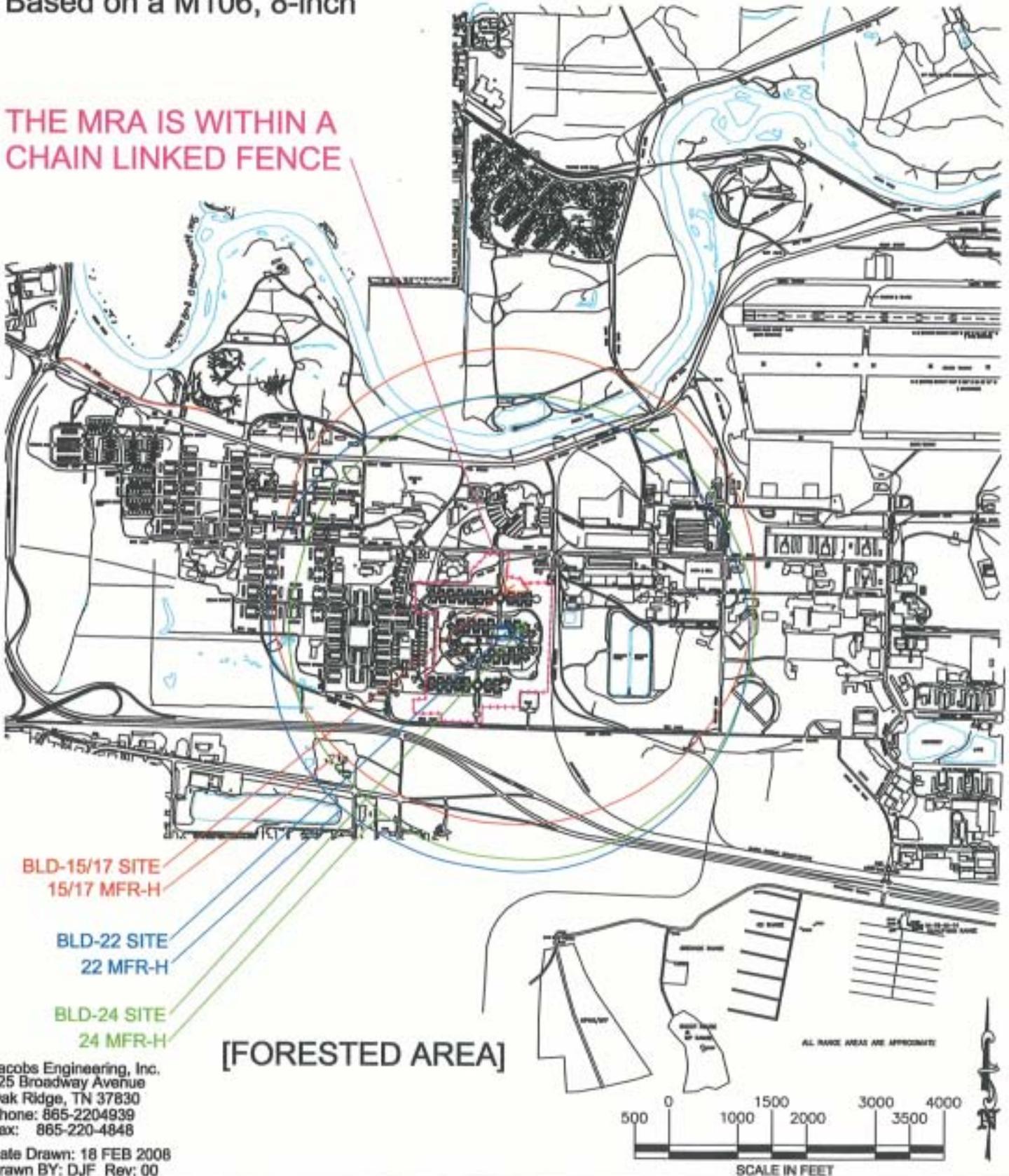
FIGURE-3 MFR-H

FORMER COMMUNICATIONS SITE
FORMER LADD FIELD
FORT WAINWRIGHT, AK
NORTHWESTERN AREA OF BASE

The MFR-H is 3287-feet
Based on a M106, 8-inch

See Figure-2 for more MRA Detail

THE MRA IS WITHIN A
CHAIN LINKED FENCE



Jacobs Engineering, Inc.
125 Broadway Avenue
Oak Ridge, TN 37830
Phone: 865-2204939
Fax: 865-220-4848

Date Drawn: 18 FEB 2008
Drawn BY: DJF Rev: 00

APPENDIX B
Fragmentation Calculation Sheets

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 12/31/07

Category:	HE Rounds	DODIC:	D680
Munition:	8" M106	Date Record Created:	7/30/2004
Primary Database Category:	projectile	Last Date Record Updated:	7/30/2004
Secondary Database Category:	8 in	Individual Last Updated Record:	Crull
Munition Case Classification:	Robust	Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	38.80000
Diameter (in):	8.0000
Max Fragment Weight (lb):	1.693113
Critical Fragment Velocity (fps):	3091

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	530
MFR-V [Vertical Range of Max Weight Fragment] (ft):	2440
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	3287

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	153
Inhabited Building Distance (09 psi), K50 Distance:	191
Intentional MSD (0065 psi), K328 Distance:	1254

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	9.48
Mild Steel:	1.70
Hard Steel:	1.40
Aluminum:	3.44
LEXAN:	8.02
Plexi-glass:	6.45
Bullet Resist Glass:	5.74

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	1.693113
Critical Fragment Velocity (fps)SB:	3091
Kinetic Energy 106 (lb-ft ² /s ²)SB:	8.0882
Required Wall Roof Sandbag Thickness (in)SB:	NA
Expected Maximum Sandbag Throw Distance (ft)SB:	NA
Minimum Separation Distance (ft)SB:	NA

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	1.693113
Critical Fragment Velocity (fps)W:	3091
Kinetic Energy 106 (lb-ft ² /s ²)W:	8.0882
Water Containment System:	NA
Minimum Separation Distance (ft)W:	NA

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APPENDIX – B

TABLES OF DMM, MD, AND RRD

TABLE 5-1 MD LOCATED IN 2004

2004 Season	Quantity
Munitions Debris (MD)	
Bomb Fins (old style box)	1
Cartridge Case, 75mm RR, empty	1
Projectile Fragments, 37mm	2
Projectile, 8-inch M 106, Practice/Inert	5
Total	9

TABLE 5-2 MD LOCATED IN 2005

2005 Season	Quantity
Munitions Debris (MD)	
Projectile, 8-inch M106 Practice/Inert	1
Total	1

TABLE 5-3 MD, RRD, AND *DMM LOCATED IN 2006

2006 Season	Quantity
Munitions Debris (MD)	
57mm RR Cartridge Case	Quantity Not Known
Bomb, M47 100 pound dual purpose	4
Projectile, 8-inch M106 Practice/Training	2
Smoke Tank, M10	Quantity Not Known
Total	6
Range Residue & Debris (RRD)	
Container, 105mm Howitzer	Quantity Not Known
Container, 75mm Projectile	Quantity Not Known
Container, Shipping 2.36-inch Rocket	Quantity Not Known
Container, Ammunition	Quantity Not Known
Total	Unknown
*Discarded Military Munitions (DMM)	
*&*Bomb, M41 20lb Fragmentation	1
*&*Bomb, M47 100 pound dual purpose	2
*&*Rocket, 3.5-inch T-85	1
Total	4

*&*These items were initially identified as explosively configured. After disposal by Army EOD, they were determined to be inert.

TABLE 5-4 MD, RRD, AND *DMM LOCATED IN 2007

2007 Season	Quantity
Munitions Debris (MD)	
40mm Dummy Cart M17	3
57mm RR Cartridge Case	2
75mm RR Cartridge Case	10
Bomb Fins, (20-lb Fragmentation Bomb)	1
Bomb Fins, GP	1
Bomb, M37 17-lb Practice	1
Bomb, M38A1 Smoke	1
Bomb, M75 Smoke	1
Hand Grenade, MK 2 Practice	1
JATO Bottle	15
Mortar Tail, 60mm Illumination	1
Rocket Fins 2.75-inch	2
Rocket Fins 5-inch	6
Rocket Fuze, M6 Dummy	44
Rocket Fuze, MK3 Dummy	2
Rocket Motor 4.5-inch	4
Rocket Motor, 2.25-inch SCAR	1
Rocket, 3.5-inch M29 Practice	27
VB-3 Guided Bomb Elec. Section	19
Total	142
Range Residue & Debris (RRD)	
Container, 105mm Howitzer	451
Container, 75mm Projectile	84
Container, M29 Practice Rocket	125
Container, Mortar	15
Total	675
Discarded Military Munitions (DMM)	
**Bomb, M41 20-lb Fragmentation	3
**Projectile, 8-inch M106	2
Total	5

**Because the donor charge was so large the type of filler could not be positively identified as inert or explosive

TABLE 5-5 MD, RRD, DMM LOCATED IN 2008

Nomenclature*, 2008 Season	Quantity
Munitions Debris (MD)	
40mm Cart Case	2
40mm Dummy Cart M17	10
57mm RR Cartridge Case	21
75mm RR Cartridge Case	47
Arming Vane for Bomb Tail Fuze	55
Bomb Fins, (20-lb Fragmentation Bomb)	4
Bomb Fins, GP	17
Bomb, M37 17-lb Practice	11
Bomb, M38A1 Smoke	8
Bomb, M41 20-lb Fragmentation	15
Bomb, M47 100 pound dual purpose	11
Bomb, M75 Smoke	5
Hand Grenade, MK 2 Practice	2
JATO Bottle	90
Mortar Tail, 60mm Illumination	1
Mortar, 81mm Practice M68 w/M3 Cart	3
Parachute Assembly (20-lb Fragmentation Bomb)	135
Projectile, 8-inch M106	9
Rifle Grenade, M11 Series, Practice	2
Rocket Fins 2.75-inch	1
Rocket Fins 5-inch	503
Rocket Fuze, M6 Dummy	484
Rocket Fuze, MK3 Dummy	9
Rocket Motor 4.5-inch	4
Rocket Motor, 2.25-inch SCAR	21
Rocket, 3.5-inch M29 Practice	168
Total	1631

TABLE 5-5 CONTINUED MD, RRD, DMM LOCATED IN 2008

Nomenclature, 2008 Season	Quantity
Range Residue & Debris (RRD)	
Container, 105mm Howitzer	410
Container, 75mm Projectile	3
Container, M29 Practice Rocket	3
Container, M7 Teargas Grenade	1
Container, Mortar	2
Total	419
Discarded Military Munitions (DMM)	
Rocket, 3.5-inch M29 Practice (residue in motor)	2
Total	2

APPENDIX – C

CERTIFICATE OF CLEARANCE

5 July 2010

Mr. Joseph Malen
IMPC-FWA-PWE
1060 Gaffney Road, #4500
Fort Wainwright, AK 99703-4500
(907) 361-4512

Subject: Certificate of Clearance for the Former Ladd Air Force Base, Communications Site
(AKA Taku Gardens Housing Area), Fort Wainwright, Alaska.

Dear Mr. Malen:

This letter certifies that the site investigation for Remedial Investigation (RI) performed under the approved Explosive Site Plan at the Former Ladd Air Force Base, Communications Site (Taku Gardens Housing Area), Fort Wainwright, Alaska has been completed. All remedial investigation activities have been completed. All munitions-related debris, including two discarded military munitions (DMM) located have been removed from the site and disposed of in accordance with appropriate regulations contained in EM 385 1-97. The two DMM were 3.5-inch practice rocket motors with M405 fuzes. Each had propellant residue in the motors and was disposed of by Army EOD. All other munitions-related items (Range Related Debris and Munitions Debris) were certified to be inert and free of explosive residues and turned into a local recycler for smelting.

The RI activities included intrusive investigations from the surface to the depth of detection (18-feet) below ground surface. In addition to the munitions-related debris, over 300 tons of metallic scrap was removed from the site and recycled. Both EM61 MK2's and Schonstedt GA-52Cx geophysical instruments were used to map and/or detect subsurface anomalies. All significant anomalies identified by the Remedial Project Managers were investigated. No unexploded ordnance was located at the site during site investigations.

Approximately 2,901 munitions-related items were located and removed during the investigation. A complete list of these items is contained in the remedial investigation report. All munitions-related items were inspected by two or more UXO qualified personnel and certified inert and free of explosive materials and residues.

Please contact us if you have any questions relating to the remedial investigation at Taku Gardens. The point of contact is Ms. Sarah Belway, PE at (907) 382-2569, email sarah.belway@jacobs.com.

Sincerely,



David J Frandsen,
Jacobs Military Munitions Response Manager
Senior UXO Supervisor