# Final

# Site Investigation Report
# Former Security Operational Test Site, Parcel 102(7)

## Fort McClellan
## Calhoun County, Alabama

**Prepared for:**

**U.S. Army Corps of Engineers, Mobile District**
**109 St. Joseph Street**
**Mobile, Alabama 36602**

**Prepared by:**

**IT Corporation**
**312 Directors Drive**
**Knoxville, Tennessee 37923**

**Task Order CK12**
**Contract No. DACA21-96-D-0018**
**IT Project No. 773019**

**May 2002**

**Revision 0**

## *Table of Contents*

**Page**

## *Table of Contents (Continued)*

**Page**

## *List of Appendices*

## *List of Tables*



## *List of Figures*

# *Executive Summary*

In accordance with Contract Number DACA21-96-D-0018, Task Order CK12, IT Corporation (IT) completed a site investigation (SI) at the Former Security Operational Test Site, Parcel 102(7), at Fort McClellan (FTMC), in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site, and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the Former Security Operational Test Site, Parcel 102(7), consisted of the sampling and analysis of three surface soil samples, three subsurface soil samples, one surface water sample, and one sediment sample. In addition, three permanent monitoring wells were installed at the site to provide site-specific geological characterization information.

Chemical analysis of samples collected at the site indicates that metals, volatile organic compounds (VOC), and semivolatile organic compounds (SVOC) were detected in the environmental media sampled. Explosives were not detected in any of the samples collected. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. In addition, a preliminary risk assessment (PRA) was performed to further characterize potential human health risk.

The potential threat to human receptors is expected to be minimal. Although the site is projected for continued military training reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted future use. Metals were the only constituents detected above SSSLs. Antimony (at RNG-102-MW02), arsenic (at RNG-102-MW02), and chromium (at RNG-102-MW03) exceeded their SSSLs and upper background range in surface water. The PRA concluded that arsenic does not pose an unacceptable human health threat in the residential reuse scenario.

The potential threat to ecological receptors is expected to be very low. Concentrations of metals and one VOC (trichlorofluoromethane) exceeded ESVs. The trichlorofluoromethane concentration was detected in the sediment sample collected at the site. In soils collected at the site, three metals (arsenic, antimony, and lead) exceeded ESVs and their upper background range. In surface water, thallium was detected at a concentration exceeding its ESV and the upper background range. However, the site does not readily support substantial ecological

receptors. Because the relatively small site is fenced and mostly covered with buildings and pavement, the threat to ecological receptors is expected to be minimal.

Based on the results of the SI, past operations at the Former Security Operational Test Site, Parcel 102(7), do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health or the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Former Security Operational Test Site, Parcel 102(7).

# 1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE), Mobile District. The USACE contracted IT Corporation (IT) to perform the site investigation (SI) at the Former Security Operational Test Site, Parcel 102(7), under Contract Number DACA21-96-D-0018, Task Order CK12.

This SI report presents specific information and results compiled from the SI, including field sampling and analysis and monitoring well installation activities conducted at the Former Security Operational Test Site, Parcel 102(7).

## 1.1 Project Description

The Former Security Operational Test Site was identified as an area to be investigated prior to property transfer. The site was classified as a Category 7 site in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 sites are areas that are not evaluated and/or that require further evaluation.

A site-specific field sampling plan (SFSP) attachment (IT, 1999) and a site-specific safety and health plan (SSHP) attachment were finalized in November 1999. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Former Security Operational Test Site, Parcel 102(7). The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect three surface soil samples, three subsurface soil samples, one surface water, and one sediment sample. In addition, three permanent monitoring wells were installed at the site to provide site-specific geological characterization information. Data from the field investigation were used to determine whether potential site-specific chemicals are present at the site and to provide data useful for supporting any future corrective measures and closure activities.

## 1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at the Former Security Operational Test Site, Parcel 102(7), at concentrations that present an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs and ESVs are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BRAC Cleanup Team will decide either to propose "No Further Action" at the site or to conduct additional work at the site.

## 1.3 Site Description and History

The Former Security Operational Test Site, Parcel 102(7), is located in the central portion of Pelham Range (Figure 1-1). Elevation at the site ranges from approximately 610 to 630 feet above mean sea level (msl) and occupies approximately 7.3 acres. The Former Security Operational Test Site consists of two separate facilities: an administration center and a building test site (Parcel 102). The building test site was constructed to replicate a nuclear weapons storage facility for the purpose of testing and evaluating various security systems. Tests sometimes included the use of high explosives. Data collected by sensors at the building test site were transmitted to the administration center, where they were recorded for later analysis. Testing reportedly began at the Former Security Operational Test Site in 1982 and ended in 1994 (ESE, 1998).

Presently, the former building test site consists of a guard building, maintenance and assembly building, two ammunition bunkers (igloos), and one igloo headwall (Figure 1-2). The maintenance and assembly building provided general storage, workshop, electrical/electronics room, and latrine facilities and was also used to billet troops. Certain explosive devices were assembled in the workshop using C-4 explosive. The test site was equipped with a fire pond to provide water for fire fighting at a weapons storage site. According to interviews conducted during the EBS, fire fighting was not conducted at this facility. Troops reportedly discarded materials in the fire pond following training exercises. However, the nature of any material discarded in the fire pond was not disclosed (ESE, 1998).

Materials used during the tests/intrusions included torches, carry cable (aluminum cable with a plastic coating to convey oxygen gas), various ceramic and steel saws, high explosives, various types of armor plating, survivable overpack containers, methyl ethyl-ketone, sticky foam, proprietary organic solvent, and Thermolag (a proprietary substance to protect contents from torches). Explosives were used during many of the security tests, including copper-clad charges and lead-clad charges. Explosives were used at both igloos and at the headwall. Titanium oxide smoke was used at Igloo No. 2. Caustic chemicals were used to make the smoke. Two smoke generators were also installed in Igloo No. 2. Small arms ammunition was rarely authorized and was generally restricted to blank ammunition (ESE, 1998).

An aboveground storage tank located west of the guard building was used at the test site to service diesel generators. Underground storage tanks were not present at the test site. Temporary structures were present at the west end of the loop road, but the function of these temporary structures is unknown. One weapons container remains at this location (ESE, 1998).

Testing was conducted on a material called “sticky foam,” which was developed for the purpose of immobilizing intruders. One field test was conducted in late 1988 behind the headwall, and another field test was conducted in 1994 on concrete and grass at the headwall. Developmental testing of the sticky foam was conducted earlier in 1991 in front of Igloo No. 1. A proprietary organic solvent was used to render the sticky foam inoperative. Solvent was not detected on wipe samples or in soil samples collected following the cleanup of the 1988 test (ESE, 1998).

The FTMC Directorate of Environment Office heavily regulated testing conducted in 1994. The sticky foam was tested for hazardous characteristics; however, the foam was determined to be nonhazardous. The facility closed after 1994. During facility closure doors were removed and cleaned. Manifolded tanks, chain-link cages, and angle iron frames covered with dried sticky foam were dismantled and disposed (ESE, 1998).

## 2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with protocols of the Community Environmental Response Facilitation Act (CERFA [Public Law 102-426]) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region IV, and Calhoun County, as well as a database search of Comprehensive Environmental Response, Compensation, and Liability Act-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

The Former Security Operational Test Site, Parcel 102(7), was classified as a CERFA Category 7 parcel:  areas that are not evaluated or require additional evaluation.  The parcel required additional evaluation to determine its environmental condition.

# 3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the Former Security Operational Test Site, Parcel 102(7), including unexploded ordnance (UXO) avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

## 3.1 UXO Avoidance

UXO avoidance was performed at Parcel 102(7) following methodology outlined in Section 4.1.7 of the SAP (IT, 2000a). IT UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were cleared using a Foerster Ferex Electromagnetic Detector, following procedures outlined in Section 4.1.7.3 of the SAP (IT, 2000a).

## 3.2 Environmental Sampling

The environmental sampling performed during the SI at Parcel 102(7) included the collection of surface soil samples, subsurface soil samples, and surface water/sediment samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walkover and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

### 3.2.1 Surface Soil Sampling

Three surface soil samples were collected at Parcel 102(7) as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Soil sample designations and quality assurance/quality control (QA/QC) samples are listed in Table 3-2. Sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

***Sample Collection.*** Surface soil samples were collected from the upper 1 foot of soil using a stainless-steel hand auger or stainless-steel split-spoon following the methodology specified in Section 4.9.1.1 of the SAP (IT, 2000a). The samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000a). The soil fraction for volatile organic compound (VOC) analysis was collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

### *3.2.2 Subsurface Soil Sampling*

Subsurface soil samples were collected from three soil borings at Parcel 102(7) as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography. IT contracted Miller Drilling, Inc. to assist in subsurface soil sample collection.

***Sample Collection.*** Subsurface soil samples were collected from soil borings at depths greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and samples collected using hollow-stem auger (HSA) sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000a). Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected during monitoring well installation activities. From ground surface to 12 feet bgs, soil samples were continuously collected using a stainless-steel split-spoon sampler in accordance with Section 4.9.1.1 of the SAP (IT, 2000a). Samples were field screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000a) to measure for volatile organic vapors. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the 10-to-12-foot bgs sample interval was submitted for analysis. The soil collected for VOC analysis was collected directly from the split-spoon sampler using three EnCore samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring (Appendix B). After sampling was completed, drilling procedures continued for the purpose of monitoring well installation.

### 3.2.3 Well Installation

Three permanent groundwater monitoring wells were installed at the parcel. The well/groundwater sampling locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the wells. The well construction logs are included in Appendix B.

IT contracted Miller Drilling, Inc. to install the permanent wells with a hollow-stem auger drill rig. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000a). The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone or until HSA refusal. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. Where split-spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered or until HSA refusal. The on-site geologist logging the auger boreholes continued the lithological log for each borehole from the depth of split-spoon refusal to the bottom of the auger borehole by logging the auger drill cuttings. The drill cuttings were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. The boring log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 10-to-15-foot length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a PVC end cap or a PVC sump was placed through the auger to the bottom of the borehole. The screen and end cap (or sump) were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 3 feet above the top of the well screen as the augers were removed. The well was surged using a solid PVC surge block for approximately 10 minutes, or until no more settling of the filter sand occurred inside the borehole. A bentonite seal, consisting of approximately 2.5 feet of bentonite pellets, was placed immediately on top of the sand pack and hydrated with potable water. Bentonite seal placement and hydration followed procedures in Appendix C of the SAP (IT, 2000a). The remaining annular space of the well was filled with bentonite-cement grout. The well surface completion included installing a protective steel casing and concrete surface pad around the PVC well casing. A locking well cap was placed on the protective steel casing. After drilling and monitoring well installation was complete, groundwater was not encountered in any of the wells; therefore, the wells were not developed or sampled for groundwater.

### 3.2.4 Surface Water Sampling

One surface water sample was collected at the location shown on Figure 3-1. The surface water sample location and rationale are listed in Table 3-1. The surface water sample designation and QA/QC samples are listed in Table 3-4. The sampling location was determined in the field, based on drainage pathways and actual field observations.

***Sample Collection.*** The surface water sample was collected in accordance with the procedures specified in Section 4.9.1.3 of the SAP (IT, 2000a). The surface water sample was collected by dipping a stainless-steel pitcher in the water and pouring the water into the sample containers or by dipping the sample containers in the water and allowing the water to fill the sample containers. Surface water samples were collected after field parameters had been measured using a calibrated water-quality meter. Surface water field parameters are listed in Table 3-5. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-4 using methods outlined in Section 3.4.

### 3.2.5 Sediment Sampling

One sediment sample was collected at the same location as the surface water sample presented in Section 3.2.4, as shown on Figure 3-1. The sediment sampling location and rationale are presented in Table 3-1. The sediment sample designation and QA/QC samples are listed in Table 3-4. The actual sediment sampling location was determined in the field, based on drainage pathways and actual field observations.

***Sample Collection.*** Sediment samples were collected in accordance with the procedures specified in Section 4.9.1.2 of the SAP (IT, 2000a). Sediments were collected with a stainless-steel spoon and placed in a clean stainless-steel bowl. Samples for VOC analysis were then immediately collected from the stainless-steel bowl with three EnCore samplers. The remaining portion of the sample was homogenized and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The sediment samples were analyzed for the parameters listed in Table 3-4 using methods outlined in Section 3.4.

## 3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000a). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the

North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix C.

### 3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at Parcel 102(7) were analyzed for the following parameters:

- Target analyte list metals – EPA Method 6010B/7471A
- Target compound list VOCs – EPA Method 8260B
- Target compound list semivolatile organic compounds (SVOC) – EPA Method 8270C
- Nitroaromatic and nitramine explosives – EPA Method 8330.

In addition, the sediment sample was analyzed for:

- Total organic carbon - EPA Method 9060
- Grain size - ASTM D421/D422.

The samples were analyzed using EPA SW-846 methods, including Update III Methods where applicable, as presented in Table 6-1 in Appendix B of the SAP (IT, 2000a).

### 3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000a). Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Table 5-1 of Appendix B of the SAP (IT, 2000a). Sample documentation and chain-of-custody records were completed as specified in Section 4.13 of the SAP (IT, 2000a).

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to Quanterra Environmental Services, Knoxville, Tennessee.

### 3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000a). The IDW generated during the SI at Parcel 102(7) was segregated as follows:

- Drill cuttings
- Purge water from well development and decontamination fluids
- Personal protective equipment (PPE).

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, drill cuttings and PPE generated during the SI were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

### 3.7 Variances

One variance to the SFSP was recorded during completion of the SI. Groundwater was not encountered in any of the monitoring wells installed at the site. Therefore, the wells were not developed and groundwater samples were not collected. The variance to the SFSP is included in Appendix D. There were not any nonconformances to the SFSP recorded during completion of the SI at the Former Security Operational Test Site.

### 3.8 Data Quality

The validated analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and installation-wide quality assurance plan; and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data (Section 3.1.2 of Appendix B of the SAP [IT, 2000a]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

***Data Validation.*** The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. Appendix F consists of a quality assurance report, including a data validation summary report that discusses the results of the validation. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System (ITEMS™) database for tracking and reporting. The qualified data were used in comparisons to the SSSLs and ESVs developed by IT. Rejected data (assigned an "R" qualifier) were not used in comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

# 4.0 Site Characterization

Subsurface investigations performed at Parcel 102(7) provided soil and surface water data used to characterize the geology and hydrogeology of the site.

## 4.1 Regional and Site Geology

### 4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992) and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appear to dominate the unit and consist primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consist of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark-gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone consists of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne, et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty, clay shale and mudstone with interbedded light to medium gray very fine - to fine-grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium- to dark gray, argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama, and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation; north by the Conasauga Formation; northeast, east, and southwest by the Shady Dolomite; and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three quarters of Pelham Range is located within the Pell City thrust sheet while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet, a large-scale thrust sheet containing Cambrian and Ordovician rocks, is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window, and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et. al., 1988). The Coosa deformed belt is a narrow (approximately 5 to 20 miles wide) northeast-to-southwest-trending linear (approximately 90 miles in length) zone of complex structure consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

### 4.1.2 Site Geology

Soils at Parcel 102(7) are mapped as the Clarksville-Fullerton stony loams. The Clarksville series consists of strongly acidic, well-drained soils that have developed from the cherty limestone residuum (U.S. Department of Agriculture [USDA], 1961). The soils in this mapping unit have poor tilth. Their capacity for available moisture is low, and the soil is not suitable for cultivation. About 99 percent of the acreage is in forest. The typical soil description is 1 to 3 feet of well-drained cherty silt loam to cherty silty clay loam, developed from deeply weathered cherty dolomitic limestone (USDA, 1961).

Bedrock at the site is mapped as the undifferentiated Cambrian/Ordovician Knox group (Osborne et al., 1997). In Calhoun County, the Knox Group consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). Based on the boring logs from the three monitoring wells, soils at the site are predominantly clay and sand, with some silt, chert, and quartzite gravel.

## 4.2 Site Hydrology

### 4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water feature at Pelham Range is Cane Creek, which flows to the west through the central portion of Pelham Range. Cane Creek and its associated tributaries drain almost all of Pelham Range. Other surface water features at Pelham Range include Lake Contreras, Cane Creek Lake, Willet Springs, and the Blue Hole (SAIC, 2000). Drainage from Cane Creek ultimately empties into the Coosa River on the western boundary of Calhoun County.

The man-made fire pond is the only surface water feature located at the Former Security Operational Test Site, Parcel 102(7). Surface water runoff generally follows topography, flowing to the southwest.

### *4.2.2 Hydrogeology*

Surface elevation in the immediate vicinity of the site ranges from approximately 610 to 630 feet msl. Depth to bedrock in these soils is typically greater than 20 feet bgs. Well screens were installed from approximately 17 to 32 feet bgs. Groundwater was encountered at approximately 20 to 24 feet bgs during drilling. However, groundwater was not encountered in any of the monitoring wells at the site. Presently, groundwater at the site is greater than 32 feet bgs.

# 5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Former Security Operational Test Site, Parcel 102(7), indicate that metals, VOCs, and one SVOC were detected in the site media. Explosives were not detected in any of the samples collected. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metals concentrations are within natural background concentrations (SAIC, 1998). Summary statistics for background metals samples collected at FTMC are included in Appendix G.

Six compounds were quantified by both SW-846 Method 8260B (as VOCs) and Method 8270C (as SVOCs), including 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields a reporting limit of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has a reporting limit of 0.330 mg/kg, which is typical for a soil matrix sample. Due to the direct nature of the Method 8260B analysis and its resulting lower reporting limit, this method should be considered superior to Method 8270C when quantifying low levels (0.005 to 0.330 mg/kg) of these compounds. Method 8270C and its associated methylene chloride extraction step is superior, however, when dealing with samples that contain higher concentrations (greater than 0.330 mg/kg) of these compounds. Therefore, all data were considered and none were categorically excluded. Data validation qualifiers were helpful in evaluating the usability of data, especially if calibration, blank contamination, precision, or accuracy indicator anomalies were encountered. The validation qualifiers and concentrations reported (e.g., whether concentrations were less than or greater than 0.330 mg/kg) were used to determine which analytical method was likely to return the more accurate result.

The following sections and Tables 5-1 through 5-4 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix E.

## 5.1 Surface Soil Analytical Results

Three surface soil samples were collected for chemical analysis at the Former Security Operational Test Site, Parcel 102(7). Surface soil samples were collected from the upper 1 foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values as presented in Table 5-1.

***Metals.*** Nineteen metals were detected in surface soils collected at the site. Six of the metals (aluminum, antimony, arsenic, iron, manganese, and thallium) were detected at concentrations exceeding SSSLs. Of these metals, arsenic (25.4 and 32.9 mg/kg) at RNG-102-MW01 and RNG-102-MW03 and antimony (4.8 mg/kg) at RNG-102-MW02 also exceeded background values determined by SAIC (1998) (Appendix G). However, the arsenic results were within the range of background values (Appendix G). The antimony result exceeded the upper background range (2.6 mg/kg); however, the result was flagged with a "J" data qualifier, indicating that the concentration was estimated.

The concentrations of 10 metals (aluminum, antimony, arsenic, chromium, iron, lead, manganese, thallium, vanadium, and zinc) exceeded ESVs. Four of these metals (arsenic, antimony, lead, and zinc) also exceeded their respective background concentrations in one or two samples each (Appendix G). These metals results were within the range of background values except for the following:

- Antimony (4.8 mg/kg) exceeded its ESV (3.5 mg/kg) and upper background range (2.6 mg/kg) in one sample (RNG-102-MW02).
- Lead (333 mg/kg) exceeded its ESV (50 mg/kg) and upper background range (83 mg/kg) in one sample (RNG-102-MW02).

***Volatile Organic Compounds.*** Methylene chloride and trichlorofluoromethane were the only VOCs detected in the surface soil samples collected at the site. However, the methylene chloride results were flagged with a "B" data qualifier, signifying that the compound was also detected in a laboratory or field blank sample. The trichlorofluoromethane results were flagged with a "J" data qualifier, signifying that the reported concentrations were estimated. The detected VOC concentrations were below SSSLs and ESVs.

***Semivolatile Organic Compounds.*** The SVOC, bis(2-ethylhexyl)phthalate, was detected in each of the surface soil samples collected at the site; however, the results were flagged with a "B" data qualifier. The bis(2-ethylhexyl)phthalate results were below the SSSL and ESV.

### *5.2 Subsurface Soil Analytical Results*

Three subsurface soil samples were collected for chemical analysis at the Former Security Operational Test Site, Parcel 102(7). Subsurface soil samples were collected at depths greater than 1 foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-2.

***Metals.*** Eighteen metals were detected in subsurface soil samples collected at the site. The concentrations of five metals (arsenic, chromium, iron, manganese, and thallium) exceeded SSSLs. The concentrations of these metals were below their respective background concentrations or within the range of background values except for the following:

- Arsenic (45.5 mg/kg) exceeded its SSSL (0.426 mg/kg) and upper background range (38 mg/kg) in one sample (RNG-102-MW02).

- Chromium (83.6 mg/kg) exceeded its SSSL (23.2 mg/kg) and upper background range (55 mg/kg) in one sample (RNG-102-MW03).

***Volatile Organic Compounds.*** Three VOCs (acetone, methylene chloride, and trichlorofloromethane) were detected in subsurface soil samples collected at the site. The acetone and methylene chloride results were flagged with a "B" data qualifier, indicating that these compounds were also detected in an associated laboratory or field blank sample. The VOC concentrations in subsurface soils were below SSSLs.

***Semivolatile Organic Compounds.*** The SVOC, bis(2-ethylhexyl)phthalate, was detected in each of the subsurface soil samples collected at the site. The SVOC results were flagged with a "B" data qualifier. The bis(2-ethylhexyl)phthalate results were below the SSSL.

### *5.3 Surface Water Analytical Results.*

One surface water sample was collected for chemical analysis at the Former Security Operational Test Site, Parcel 102(7), at the location shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-3.

***Metals.*** Fourteen metals were detected in the surface water sample collected at the site. Arsenic (0.0035 milligrams per liter [mg/L]) and thallium (0.0087 mg/L) were detected at concentrations exceeding SSSLs and their respective background concentrations. The arsenic result was within the range of background values established by SAIC (Appendix G). The thallium result exceeded the upper background range (0.0042 mg/L); however, the result was flagged with a "B" data qualifier, indicating that thallium was also detected in an associated laboratory or field blank sample. The concentrations of four metals (aluminum, barium, iron, and thallium) exceeded ESVs. These metals concentrations, however, were below their respective background concentrations except for the aforementioned thallium result.

***Volatile Organic Compounds.*** Acetone was the only detected VOC in the surface water sample collected at the site. The acetone result was flagged with a "B" data qualifier. The result was below the SSSL and ESV.

***Semivolatile Organic Compounds.*** SVOCs were not detected in the surface water sample.

### 5.4 Sediment Analytical Results

One sediment sample was collected for chemical and physical analyses at the Former Security Operational Test Site, Parcel 102(7). The sediment sample was collected from the upper 0.5 foot of sediment at the location shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-4.

***Metals.*** Eighteen metals were detected in the sediment sample at concentrations below SSSLs. Arsenic (24 mg/kg) exceeded its ESV (7.24 mg/kg) and the upper background range (20 mg/kg) (SAIC, 1998) (Appendix G).

***Volatile Organic Compounds.*** Two VOCs (methylene chloride and trichlorofluoromethane) were detected in the sediment sample at concentrations below SSSLs. The trichlorofluoromethane result (0.0042 mg/kg) marginally exceeded its ESV (0.003 mg/kg); however, the result was flagged with a "J" data qualifier, indicating the result was estimated.

***Semivolatile Organic Compounds.*** The SVOC, bis(2-ethylhexyl)phthalate, was detected in the sediment sample collected at the site. The bis(2-ethylhexyl)phthalate concentration (0.29

mg/kg) was below its SSSL but exceeded its ESV (0.182 mg/kg); however, the result was flagged with a "B" data qualifier.

***Total Organic Carbon.*** The sediment sample was analyzed for total organic carbon (TOC). The TOC concentration was 2,820 mg/kg, as summarized in Appendix E.

***Grain Size.*** The grain size analytical results are included in Appendix E.

### 5.5 Preliminary Risk Assessment

A preliminary risk assessment (PRA) was performed to further characterize the potential threat to human health from exposure to environmental media at the Former Security Operational Test Site, Parcel 102(7). The PRA approach was developed at the request of EPA and ADEM to provide a fast and inexpensive estimation of risk for relatively simple sites. It was derived from the streamlined risk assessment (SRA) protocol developed for FTMC and documented in the installation-wide work plan (IT, 1998). A PRA is a simplified version of an SRA, differing primarily in that the maximum detected concentration (MDC) rather than an estimate of average is adopted as the source-term concentration (STC) for use in the risk assessment. Documentation is not provided herein to save space and time. However, a PRA cannot be less conservative (protective) than an SRA and is generally more protective. The PRA for Parcel 102(7) is included as Appendix H. It discusses the environmental media of interest, selection of site-related chemicals, selection of chemicals of potential concern (COPC), risk characterization, and conclusions.

The foundation of the SRA (and the PRA) is the SSSL, which incorporates all the exposure and toxicological assumptions and precision of a full-blown baseline risk assessment. SSSLs are receptor-, medium- and chemical-specific risk-based concentrations that are used to screen media to select COPCs and to characterize the risk, i.e., compute the incremental lifetime cancer risk (ILCR) and hazard index (HI) for noncancer effects associated with exposure to the media at the site.

The SSSLs applied to a given site represent the most highly exposed receptor scenario for each of several plausible uses for the site. Three receptor scenarios were evaluated for Parcel 102(7): National Guardsperson, recreational site user, and on-site resident. COPCs were selected from the site-related chemicals identified in the previous sections by comparing the MDC of the site-related chemical with the appropriate SSSL. Chemicals that were identified as not being site-related were dropped from further consideration because their presence was not attributed to site activities. The COPCs selected in this manner are the chemicals in each medium that may contribute significantly to cancer risk or to the potential for noncancer effects. As noted above, the MDC was selected as the STC for use in risk characterization. ILCR and HI values were estimated for each COPC in each medium and were summed to obtain total ILCR and HI values for each receptor.

COPCs for the National Guardsperson were limited to arsenic (in surface and subsurface soil) and chromium (in subsurface soil). The PRA concluded, however, that exposure to site media poses no unacceptable human health threat for the National Guardsperson.

COPCs for the recreational site user were limited to arsenic in surface soil and surface water. The PRA concluded that exposure to site media poses no unacceptable human health threat for the recreational site user.

COPCs for the on-site resident were limited to arsenic (in soils and surface water) and chromium (in subsurface soil). Arsenic was identified as the only chemical of concern (COC) at Parcel 102(7). Based on further refinement of the exposure assumptions and consideration of the uncertainty associated with the oral reference dose for arsenic, the PRA concluded that arsenic does not pose an unacceptable human health threat in the residential reuse scenario.

# 6.0 Summary, Conclusions, and Recommendations

IT, under contract to USACE, completed an SI at the Former Security Operational Test Site, Parcel 102(7), at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site, and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the Former Security Operational Test Site, Parcel 102(7), consisted of the sampling and analysis of three surface soil samples, three subsurface soil samples, one surface water sample, and one sediment sample. In addition, three permanent monitoring wells were installed at the site to provide site-specific geological characterization information.

Chemical analysis of samples collected at the site indicates that metals, VOCs, and SVOCs were detected in the environmental media sampled. Explosives were not detected in any of the samples collected. Analytical results were compared to the SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Metals concentrations exceeding SSSLs and ESVs were compared to medium-specific background screening values (SAIC, 1998). In addition, a PRA was performed to further characterize potential human health risk.

The potential threat to human receptors is expected to be minimal. Although the site is projected for continued military training reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted future use. Metals were the only constituents detected above SSSLs. Antimony (at RNG-102-MW02), arsenic (at RNG-102-MW02), and chromium (at RNG-102-MW03) exceeded their SSSLs and upper background range in surface water. The PRA concluded that arsenic does not pose an unacceptable human health threat in the residential reuse scenario.

The potential threat to ecological receptors is expected to be very low. Concentrations of metals and one VOC (trichlorofluoromethane) exceeded ESVs. The trichlorofluoromethane concentration was detected in the sediment sample collected at the site. In soils collected at the site, three metals (arsenic, antimony, and lead) exceeded ESVs and their upper background range. In surface water, thallium was detected at a concentration exceeding its ESV and the upper background range. However, the site does not readily support substantial ecological receptors. Because the relatively small site is fenced and mostly covered with buildings and pavement, the threat to ecological receptors is expected to be minimal.

Based on the results of the SI, past operations at the Former Security Operational Test Site, Parcel 102(7), do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health or the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Former Security Operational Test Site, Parcel 102(7).

# 7.0 References


Cloud, P. E., Jr., 1966, ***Bauxite Deposits in the Anniston, Fort Payne and Ashville areas, Northeast Alabama***, U. S. Geological Survey Bulletin 1199-O, 35 p.

Environmental Science and Engineering, Inc. (ESE), 1998, ***Final Environmental Baseline Survey, Fort McClellan, Alabama***, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, January.

IT Corporation (IT), 2000a, ***Final Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun County, Alabama***, March.

IT Corporation (IT), 2000b, ***Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama***, July.

IT Corporation (IT), 1999, ***Final Site-Specific Field Sampling Plan and Health Plan Attachments for the Relative Risk Screening for the Former Security Operational Test Site, Parcel 102(7); the Anniston Army Depot, Former Shell Tapping Area, Parcel 208(7); and the Former Agent Training Area, Range K, Parcel 203(7), Fort McClellan, Calhoun County, Alabama,*** November.

IT Corporation (IT), 1998, ***Final Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama***, August.

Moser, P. H., and S. S. DeJarnette, 1992, ***Groundwater Availability in Calhoun County, Alabama***, Geological Survey of Alabama Special Map 228.

Osborne, W. E., 1999, Personal Communication with John Hofer (IT), November 16.

Osborne, W. Edward, and Michael W. Szabo, 1984, ***Stratigraphy and Structure of the Jacksonville Fault, Calhoun County, Alabama***, Alabama Geological Survey Circular 117.

Osborne, W. E., G. D. Irving, and W. E. Ward, 1997, ***Geologic Map of the Anniston 7.5' Quadrangle, Calhoun County, Alabama***, Alabama Geologic Survey Preliminary Map, 1 sheet.

Osborne, W. E., M. W. Szabo, C. W. Copeland, Jr., and T. L. Neathery, 1989, ***Geologic Map of Alabama***, Alabama Geologic Survey Special Map 221, scale 1:500,000, 1 sheet.

Osborne, W. E., M. W. Szabo, C. W. Copeland, Jr., and T. L. Neathery, 1988, ***Geologic Map of Alabama, Northeast Sheet***, Geologic Survey of Alabama Special Map 220, scale 1:250,000.

Raymond, D. E., W. E. Osborne, C. W. Copeland, and T. L. Neathery, 1988, ***Alabama Stratigraphy***, Geological Survey of Alabama, Tuscaloosa, Alabama, 97 p.

Science Applications International Corporation (SAIC), 2000, ***Final Remedial Investigation/Baseline Risk Assessment Report, Fort McClellan, Alabama***, July.

Science Applications International Corporation (SAIC), 1998, ***Final Background Metals Survey Report, Fort McClellan, Alabama***, July.

Thomas, W. A., and T. L. Neathery, 1982, ***Appalachian Thrust Belts in Alabama: Tectonics and Sedimentation***, Geologic Survey of America 1982 Annual Meeting, New Orleans, Louisiana, Field Trip, Alabama Geological Society Guidebook 19A, 78 p.

Thomas, W. A., and J. A. Drahovzal, 1974, The ***Coosa Deformed Belt in the Alabama Appalachians***, Alabama Geological Society, 12th Annual Field Trip Guidebook, 98 p.

U.S. Army Corps of Engineers (USACE), 1994, ***Requirements for the Preparation of Sampling and Analysis Plans***, Engineer Manual EM 200-1-3, September.

U.S. Department of Agriculture, 1961, ***Soil Survey, Calhoun County, Alabama***, Soil Conservation Service, Series 1958, No. 9, September.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1998, Unedited Local Climatological Data, Anniston, Alabama, January - December 1998.

Warman, J. C, and L. V. Causey, 1962, ***Geology and Groundwater Resources of Calhoun County, Alabama***, Alabama Geological Survey County Report 7, 77 p.