Final

Site Investigation Report
Former Trap and Skeet Range, Parcel 127Q

Fort McClellan
Calhoun County, Alabama

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK10, IT Corporation completed a site investigation (SI) at the Former Trap and Skeet Range, Parcel 127Q, at Fort McClellan 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 Trap and Skeet Range, Parcel 127Q, consisted of the sampling and analysis of six surface soil samples, two depositional soil samples, six subsurface soil samples, and four groundwater samples. In addition, four permanent groundwater monitoring wells were installed in the residuum groundwater zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Former Trap and Skeet Range, Parcel 127Q, indicates that metals, semivolatile organic compounds (SVOC), and explosive compounds were detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan. In addition, a preliminary risk assessment was performed to further characterize potential human health risk.

The Former Trap and Skeet Range, Parcel 127Q, is located within the Alabama Army National Guard enclave and is projected for continued use as a military training area. Based on the results of the SI, the site does not pose an unacceptable risk to human health in the projected land reuse scenario. However, the SI analytical data indicate that without further mitigating measures the site is unsuitable for unrestricted (i.e., residential) reuse. Specifically, lead and polynuclear aromatic hydrocarbons (PAH) in surface soils were identified as chemicals of concern precluding use of the site as a residential area. Possible actions that may minimize or eliminate residential human health risk include, but are not limited to:

- Implementation of land-use controls
- Collection of additional data to refine the human health risk assessment
- Removal of contaminated soils
- Installation of engineered structures.

Lead and PAHs were also identified as chemicals of potential ecological concern in surface soils. However, the parcel is located within the developed portion of the Main Post and is projected for continued use by the Alabama Army National Guard. Viable ecological habitat is limited and is not expected to increase in the projected land reuse scenario. Therefore, the potential threat to ecological receptors is expected to be minimal.

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 Trap and Skeet Range, Parcel 127Q, under Contract Number DACA21-96-D-0018, Task Order CK10.

This report presents specific information and results compiled from the SI, including field sampling and analysis, and monitoring well installation activities conducted at the Former Trap and Skeet Range, Parcel 127Q.

1.1 Project Description

The Former Trap and Skeet Range was identified as an area to be investigated prior to property transfer. The site was classified as a Category 1 Qualified parcel in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 1 parcels are areas where no storage, release, or disposal (including migration) of hazardous substances or petroleum products has occurred. The parcel does not have a history of environmental hazards, such as asbestos, lead-based paint, polychlorinated biphenyls (PCB), radon, radionuclides, unexploded ordnance, or chemical warfare material. However, the parcel was qualified because of the potential presence of lead shot (ESE, 1998).

A site-specific field sampling plan (SFSP) attachment (IT, 2000a) and a site-specific safety and health plan (SSHP) attachment were finalized in November 2000. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Former Trap and Skeet Range, Parcel 127Q. 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, 2000b). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect six surface soil samples, two depositional soil samples, six subsurface soil samples, and four groundwater samples 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 Trap and Skeet Range, Parcel 127Q, 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, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000c). The PAH background screening values were developed by IT at the direction of the BRAC Cleanup Team to address the occurrence of PAH compounds in surface soils as a result of anthropogenic activities at FTMC. 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 Trap and Skeet Range, Parcel 127Q, is an approximately 6.4-acre area located at the east end of Signal Street (formerly 5th Street) in the northern portion of the FTMC Main Post (Figure 1-1). The range and associated structures were visible on aerial photographs taken from March 1973 through 1994. However, the EBS indicates that the range was operable for only a relatively short period around 1973. Other information regarding the dates of use or ordnance fired at this range was not available; however, it is reasonable to assume that range use was limited to shotguns (ESE, 1998).

Remnants of the concrete walkways used for trap and skeet practice also currently exist at the site. One small concrete walkway is located at the west end of the parcel, directly east of Building 1345. Two other concrete walkways are located at the southern portion of the parcel. The smaller concrete walkway is believed to have been used for trap shooting, as interpreted from the 1973 aerial photograph. The 1973 photograph depicts a small structure 50 feet in front, northeast, of the walkway. This structure most likely housed the machinery used for launching the target trapshooting practice.

The two walkways at the southern portion of the parcel are much larger than the concrete walkway located at the western portion of the site. This most likely is the location of the majority of activity during the use of the parcel for skeet and trap shooting. Aerial photographs from 1973 through 1994 depict houses used for launching clay pigeons for skeet practice along with at least one concrete walkway. These houses are no longer present.

The Former Trap and Skeet Range was most recently used as a Special Forces airborne training area. Training exercises at the site included the use of a parachute Landing Fall Practice Area, a mock aircraft, grounding anchors, a jump tower, and an observation tower (Figure 1-2).

Site elevation at the Former Trap and Skeet Range, Parcel 127Q, varies from about 765 to 790 feet above mean sea level, with the highest elevation near the northwest corner, at the base of Trench Hill. An intermittent stream is located south of the parcel and flows to the west-southwest (Figure 1-2).

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.

For non-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) environmental or safety issues, the parcel label includes the following components: a unique non-CERCLA issue number (the letter "Q" designating the parcel as a Community Environmental Response Facilitation Act [CERFA] Category 1 Qualified Parcel), and the code for the specific non-CERCLA issue(s) present (ESE, 1998). The non-CERCLA issue codes used are:

- A = Asbestos (in buildings)
- L = Lead-based paint (in buildings)
- P = Polychlorinated biphenyls (PCB)
- R = Radon (in buildings)

- RD = Radionuclides/radiological issues
- X = Unexploded ordnance
- CWM = Chemical warfare material.

The EBS was conducted in accordance with CERFA protocols (CERFA-Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the 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 CERCLA-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historic maps and aerial photographs were reviewed to document historic 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 Trap and Skeet Range, Parcel 127Q, was classified as a CERFA Category 1 Qualified parcel where no known or recorded storage, release, or disposal (including migration) has occurred. The Former Trap and Skeet Range, Parcel 127Q, 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 Trap and Skeet Range, Parcel 127Q, including environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 Environmental Sampling

The environmental sampling performed during the SI at the Former Trap and Skeet Range, Parcel 127Q, included the collection of surface and depositional soil samples, subsurface soil samples, and groundwater 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 3.3.

3.1.1 Surface and Depositional Soil Sampling

Six surface soil samples and two depositional soil samples were collected at the Former Trap and Skeet Range, Parcel 127Q, as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on the sampling rationale, presence of surface structures, site topography, and proximity to buried utilities.

Sample Collection. Surface and depositional soil samples were collected from the upper 1 foot of soil with a stainless-steel hand auger using the methodology specified in Section 4.9.1.1 of the SAP (IT, 2000b). Surface and depositional soil samples were collected by first removing surface debris (e.g., rocks or 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, 2000b). The soil was then 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 3.3.

3.1.2 Subsurface Soil Sampling

Subsurface soil samples were collected from six soil borings at the Former Trap and Skeet Range, Parcel 127Q, 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 sampling rationale, presence of surface structures, site topography, and proximity to utilities. IT contracted Environmental Services Network, Inc. (ESN), a direct-push technology (DPT) subcontractor, to assist in subsurface soil sample collection.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1-foot bgs in the unsaturated zone. The soil borings were advanced and soil samples collected using the DPT sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000b). 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 3.3.

Subsurface soil samples were collected continuously until DPT sampler refusal was encountered. Samples were field-screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000b) to measure for volatile organic vapors. The soil 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 deepest soil sample interval above the saturated zone was submitted for analysis. The soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.3. The on-site geologist constructed a detailed boring log for each soil boring (Appendix B).

At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in Appendix B of the SAP (IT, 2000b).

3.1.3 Monitoring Well Installation

Four permanent monitoring wells were installed in the residuum groundwater zone at the Former Trap and Skeet Range, Parcel 127Q, to collect groundwater samples for laboratory analysis. The well locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the monitoring wells installed at the site. The well construction logs are included in Appendix B.

IT contracted Miller Drilling, Inc. to install the wells using a hollow-stem auger rig at four of the DPT soil boring locations. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000b). The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the first water-bearing zone in residuum. The borehole was augered to the completion depth of the DPT boring and samples were collected at that depth to the bottom of the borehole. 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. The on-site geologist logging the auger boreholes continued the lithological log for each borehole from the depth of split-spoon sampler 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 geologic and hydrogeologic information. The lithological log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 15-foot-length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a 3-inch PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap 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 sand pack occurred inside the borehole. A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the sand pack and hydrated with potable water. If the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. Bentonite seal placement and hydration followed procedures in Appendix C of the SAP (IT, 2000b). Bentonite-cement grout was tremied into the remaining annular space of the well and a concrete pad was installed flush to ground surface. An 8-inch-diameter, traffic-bearing steel vault was placed around the well casing flush to the concrete surface pad. A locking well cap was placed on the PVC well casing.

The wells were developed by surging and pumping with a submersible pump in accordance with methodology outlined in Section 4.8 and Appendix C of the SAP (IT, 2000b). The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to re-establish the natural hydraulic flow conditions. Development continued until the water turbidity was equal to or less than 20 nephelometric turbidity units (NTU), or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.1.4 Water Level Measurements

The depth to groundwater was measured in the permanent wells at the site on June 13, 2001, following procedures outlined in Section 4.18 of the SAP (IT, 2000b). Depth to groundwater was measured with an electronic water-level meter. The meter probe and cable were cleaned after use at each well following decontamination methodology presented in Section 4.10 of the SAP (IT, 2000b). Measurements were referenced to the top of the PVC well casing, as summarized in Table 3-4.

3.1.5 Groundwater Sampling

Groundwater samples were collected from each of the four permanent monitoring wells installed at the Former Trap and Skeet Range, Parcel 127Q. The well/groundwater sample locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and analytical parameters are listed in Table 3-5.

Sample Collection. Groundwater sampling was performed following procedures outlined in Section 4.9.1.4 of the SAP (IT, 2000b). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (i.e., temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Purging and sampling were performed with a peristaltic pump equipped with Teflon™ tubing. Field parameters were measured using a calibrated water-quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.3.

3.2 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, 2000b). 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 D.

3.3 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on the potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Former Trap and Skeet Range, Parcel 127Q, were analyzed for the following parameters:

- Target analyte list metals – EPA Method 6010B/7000
- Target compound list semivolatile organic compounds (SVOC) – EPA Method 8270C
- Nitroaromatic and nitramine explosives – EPA Method 8330.

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, 2000b).

3.4 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000b). 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, 2000b). Sample documentation and chain-of-custody records were completed as specified in Section 4.13 of the SAP (IT, 2000b).

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California. Split samples were shipped to the USACE South Atlantic Division Laboratory in Marietta, Georgia.

3.5 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000b). The IDW generated during the SI at the Former Trap and Skeet Range, Parcel 127Q, was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment.

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 analysis. Based on the results, drill cuttings, spent well materials, and personal protective equipment 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 volatile organic compounds, 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.

3.6 Variances/Nonconformances

There were no variances or nonconformances to the SFSP recorded during completion of the SI at the Former Trap and Skeet Range, Parcel 127Q.

3.7 Data Quality

The field sample 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 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, 2000b]). 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 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™ database for tracking and reporting. The qualified data were used in the comparison to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in the comparison 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 the Former Trap and Skeet Range, Parcel 127Q, provided soil, geologic, and groundwater 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 is 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 (Szabo 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 appears 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 is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped together as undifferentiated at FTMC and 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 (Szabo 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 on the basis of fossil data.

The Jacksonville Thrust Fault is the most significant structural geologic feature in the vicinity 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).

4.1.2 Site Geology

The soils at the Former Trap and Skeet Range, Parcel 127Q, are classified as Rarden silty clay loam, shallow, 2 to 6 percent slopes, severely eroded (ReB3) (U.S. Department of Agriculture, 1961). The Rarden series consists of moderately well drained, strongly acidic to very strongly acidic soils. The parent material washed from the adjacent higher lying Montevallo, Lehew, Conasauga, and Enders soils. The typical soil description is 0.7 to 2.5 feet of moderately well drained silt loam to silty clay or clay, developed from interbedded shale; platy sandstone, and limestone; surface of some areas has platy sandstone gravel 3 inches in diameter.

Bedrock beneath the site is mapped as the Mississippian/Ordovician-Floyd/Athens Shale, (undifferentiated) (Osborne et al., 1997). This unit is dark-gray to black shale with interbedded dark-gray limestone. The Cambrian Shady Dolomite is mapped north of the northwestern section of Parcel 127Q.

A geologic cross-section was constructed from the DPT and hollow-stem auger boring data, as shown on Figure 4-1. The geologic cross-section location is shown on Figure 3-1. The soil encountered during drilling activities at the Former Trap and Skeet Range was a reddish-brown to yellowish-brown to yellowish-orange clay and silt mixture with varying amounts of sand and gravel from ground surface to approximately 13 to 17 feet bgs. Medium-gray to light-brown weathered siltstone was encountered beneath the clay and silt in the northwestern and central portions of the parcel. Highly weathered, medium- to dark-gray shale with dolomitic laminations and occasional chert nodules was encountered beneath the siltstone in the northwestern and central portion of the parcel and directly beneath the clay and silt in the southeastern portion of the parcel.

4.2 Site Hydrology

4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 54 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

An intermittent stream is located approximately 100 feet south of Parcel 127Q and flows to the west-southwest. Surface water runoff from the site follows topography and flows generally to the south towards the intermittent stream.

4.2.2 Hydrogeology

Static groundwater levels were measured in the monitoring wells at the site on June 13, 2001 (Table 3-4). Groundwater elevations were calculated by measuring the depth to groundwater relative to the surveyed top-of-casing elevations. A groundwater flow map was constructed using the June 2001 data, as shown on Figure 4-2. Horizontal groundwater flow at the site is generally to the south towards the intermittent stream. The hydraulic gradient across this area is approximately 0.016 feet per foot.

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Former Trap and Skeet Range, Parcel 127Q, indicate that metals, SVOCs, and explosive compounds were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, 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. Additionally, PAH compound concentrations in surface and depositional soils that exceeded SSSLs and ESVs were compared to PAH background screening values. The PAH background screening values were derived from PAH analytical data from 18 parcels at FTMC that were determined to represent anthropogenic activity (IT, 2000c). PAH background screening values were developed for two categories of surface soils: beneath asphalt and adjacent to asphalt. The PAH background screening values for soils adjacent to asphalt are the more conservative (i.e., lower) of the PAH background values and are the values used herein for comparison.

The following sections and Tables 5-1 through 5-3 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 and Depositional Soil Analytical Results

Six surface soil samples and two depositional soil samples were collected for chemical analysis at the Former Trap and Skeet Range, Parcel 127Q. Surface and depositional 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 background screening values (metals and PAHs), as presented in Table 5-1.

Metals. Eighteen metals were detected in surface and depositional soil samples collected at the site. The concentrations of seven metals (aluminum, arsenic, chromium, iron, lead, manganese, and thallium) exceeded SSSLs. With the exception of lead in two samples, the concentrations of the metals that exceeded SSSLs were below their respective background concentrations. Lead concentrations (424 mg/kg and 434 mg/kg) marginally exceeded the SSSL (400 mg/kg), background (40 mg/kg), and the upper background range (83 mg/kg) at sample locations HR-127Q-GP01 and HR-127Q-MW03.

The concentrations of eight metals (aluminum, chromium, iron, lead, manganese, thallium, vanadium, and zinc) exceeded ESVs. With the exception of lead (in four samples) and zinc (one sample), the concentrations of the metals that exceeded ESVs were below their respective background concentrations. The zinc result (52.7 mg/kg) was below the upper background range (209 mg/kg) of zinc values determined by SAIC (Appendix G). Lead concentrations (143 to 434 mg/kg) exceeded the ESV (50 mg/kg) and upper background range (83 mg/kg) at three sample locations (HR-127Q-GP01, HR-127Q-MW01, and HR-127Q-MW03).

Semivolatile Organic Compounds. A total of eleven SVOCs, all of which were PAH compounds, were detected in four of the surface and depositional soil samples collected at the site. SVOCs were not detected at the remaining surface and depositional soil sample locations. PAH concentrations exceeded SSSLs, ESVs, and PAH background values at two surface soil sample locations (HR-127Q-GP02 and HR-127Q-MW03). PAH concentrations in the sample collected at HR-127Q-MW03 (7.3 to 74 mg/kg) were markedly higher than PAH concentrations in the sample collected at HR-127Q-GP02 (0.49 to 5.3 mg/kg).

Explosives. One explosive compound (tetryl) was detected in one surface soil sample (HR-127Q-MW03) at an estimated concentration (0.24 mg/kg) below its SSSL (77.7 mg/kg) and ESV (25 mg/kg). Explosives were not detected in any of the other surface and depositional soil samples collected at the site.

5.2 Subsurface Soil Analytical Results

Six subsurface soil samples were collected for chemical analysis at the Former Trap and Skeet Range, Parcel 127Q. 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 concentrations, as presented in Table 5-2.

Metals. Twenty-one metals were detected in subsurface soil samples collected at the site. The cadmium and thallium results were flagged with a "B" data qualifier indicating that these metals were also detected in an associated laboratory or field blank sample. The concentrations of seven metals (aluminum, antimony, arsenic, chromium, iron, manganese, and thallium) exceeded SSSLs. Of these metals, aluminum (in six samples), antimony (two samples), iron (one sample), and thallium (six samples) concentrations also exceeded their respective background concentrations. However, the aluminum, iron, and thallium results were within the range of background values established by SAIC (Appendix G). Antimony concentrations (5.61 mg/kg and 4.69 mg/kg) exceeded the SSSL (3.11 mg/kg) and background (1.31 mg/kg) in two subsurface soil samples (HR-127Q-MW02 and HR-127Q-MW04). The antimony results were flagged with a "J" data qualifier indicating that the concentrations were estimated. Antimony was not detected in any of the other soil samples collected at the site.

Semivolatile Organic Compounds. Ten SVOCs, all of which were PAH compounds, were detected in one subsurface soil sample (HR-127Q-MW03). SVOCs were not detected in any of the other subsurface soil samples. SVOC concentrations in the sample ranged from 0.5 to 5.4 mg/kg. The concentrations of four compounds (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene) exceeded SSSLs.

Explosives. Explosive compounds were not detected in the subsurface soil samples collected at the site.

5.3 Groundwater Analytical Results

Four groundwater samples were collected for chemical analysis at the Former Trap and Skeet Range, Parcel 127Q, at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-3.

Metals. Eleven metals were detected in groundwater samples collected at the site. The concentrations of three metals (arsenic, iron, and manganese) exceeded SSSLs but were below their respective background concentrations.

Semivolatile Organic Compounds. SVOCs were not detected in the groundwater samples collected at the site.

Explosives. One explosive compound (2-nitrotoluene) was detected in one groundwater sample (HR-127Q-MW01) at an estimated concentration (0.0003 milligrams per liter [mg/L]) below its SSSL (0.015 mg/L). Explosives were not detected in any of the other groundwater samples collected at the site.

5.4 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 Trap and Skeet Range, Parcel 127Q. 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 a SRA, and is generally more protective. The PRA for Parcel 127Q 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. Both the residential and national guardsperson receptor scenarios were evaluated for Parcel 127Q. 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.

The PRA concluded that the Former Trap and Skeet Range can be released for use by the National Guard requiring no further action. Furthermore, residential exposure to subsurface soil and groundwater is unlikely to pose any unacceptable threat to human health. However, lead and PAHs in surface soils were identified as chemicals of concern that may pose an unacceptable human health risk in the residential reuse scenario.

6.0 Summary, Conclusions, and Recommendations

IT, under contract with USACE, completed an SI at the Former Trap and Skeet Range, Parcel 127Q, at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site at concentrations that present an unacceptable risk to human health or the environment. The SI at the Former Trap and Skeet Range, Parcel 127Q, consisted of the sampling and analysis of six surface soil samples, two depositional soil samples, six subsurface soil samples, and four groundwater samples. In addition, four permanent monitoring wells were installed in the residuum groundwater zone to facilitate groundwater sample collection and provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Former Trap and Skeet Range, Parcel 127Q, indicates that metals, SVOCs, and explosive compounds were detected in site media. 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. Additionally, metals concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998), and PAH concentrations exceeding SSSLs and ESVs in surface and depositional soils were compared to PAH background screening values (IT, 2000c). A preliminary risk assessment was also performed to further characterize potential human health risk.

The Former Trap and Skeet Range, Parcel 127Q, is located within the Alabama Army National Guard enclave and is projected for continued use as a military training area. Based on the results of the SI, the site does not pose an unacceptable risk to human health in the projected land reuse scenario. However, the SI analytical data indicate that without further mitigating measures the site is unsuitable for unrestricted (i.e., residential) reuse. Specifically, lead and PAHs in surface soils were identified as chemicals of concern precluding use of the site as a residential area. Possible actions that can be taken to minimize or eliminate residential human health risk include, but are not limited to:

- Implementation of land-use controls
- Collection of additional data to refine the human health risk assessment

- Removal of contaminated soils
- Installation of engineered structures.

Lead and PAHs were also identified as chemicals of potential ecological concern in surface soils. However, the parcel is located within the developed portion of the Main Post and is projected for continued use by the Alabama Army National Guard. Viable ecological habitat is limited and is not expected to increase in the projected land reuse scenario. Therefore, the potential threat to ecological receptors is expected to be minimal.

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