# Final

# Site Investigation Report
# Chemical School Laboratory Sump, Buildings 2281 and 2282
# Parcels 90(7) and 225(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

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# 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 CK08, IT Corporation (IT) completed a site investigation (SI) at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), 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 Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), consisted of the sampling and analysis of two surface soil samples, four subsurface soil samples, and two groundwater samples. In addition, two 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. As part of this SI, IT incorporated data previously collected by QST Environmental, Inc. at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7).

The analytical results indicate that metals, volatile organic compounds (VOC), and semivolatile organic compounds (SVOC) were detected in the environmental media sampled. To evaluate whether the detected constituents present 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 Fort McClellan.

The potential threat to human health is expected to be very low. Although the site is projected for reuse by the Alabama Army National Guard, the analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted land reuse. Metals concentrations exceeding SSSLs in site media were below their respective background concentrations or within the range of background values and do not pose an unacceptable risk to human receptors. VOC and SVOC concentrations in site media were below SSSLs.

Selenium (less than 1.6 milligrams per kilogram [mg/kg]) exceeded its ESV and background concentration in both of the surface soil samples. In addition, two VOCs (tetrachloroethene and trichloroethene) were detected in surface soils at concentrations (less than 0.05 mg/kg) exceeding ESVs. However, the site is located within the developed area of the Main Post and does not support significant ecological habitat. Based on site conditions and the low levels of chemical constituents detected, the potential threat to ecological receptors is expected to be very low.

Based on the results of the SI, past operations at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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 at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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 provide environmental services for completion of the site investigation (SI) at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), under Contract Number DACA21-96-D-0018, Task Order CK08.

The U.S. Army Environmental Center (AEC) originally contracted QST Environmental, Inc. (QST) to perform the SI at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). QST prepared an SI work plan (QST, 1998) and conducted field activities in May 1998. QST collected soil samples and installed two temporary groundwater monitoring wells at the site using direct-push technology (DPT). However, the DPT wells were dry, and groundwater samples were not collected. Therefore, the USACE contracted IT to install and collect groundwater samples from two permanent groundwater monitoring wells.

This SI report summarizes SI field activities, including field sampling and analysis and monitoring well installation activities, and data compiled by IT and QST for the SI conducted at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7).

## 1.1 Project Description

The Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), was identified as an area to be investigated prior to property transfer. The parcels were classified as Category 7 sites 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.

Field work performed by IT during the SI was conducted in accordance with 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. Sample locations and analytical parameters were specified in the QST work plan (QST, 1998).

The SI included field work to collect two surface soil samples (by QST), four subsurface soil samples (QST), and two groundwater samples (IT) to determine if potential site-specific chemicals are present at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7).

### 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 Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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 Chemical School Laboratory Sump (Buildings 2281 and 2282) is located west of Galloway Road in the northwestern portion of the FTMC Main Post (Figure 1-1). The U.S. Army Chemical School Laboratory was located in Building 2281 and provided classroom and laboratory training in basic analytical and laboratory techniques until 1985 (ESE, 1998).

A sump (Parcel 90[7]) was located adjacent to Building 2281. The sump, which was called an "acid neutralization basin," was illustrated on 1980 plans titled "Renovation of Building 2281" by the Directorate of Engineering (ESE, 1998). The plans showed the sump to be located outside the southwest side of Building 2281 (Figure 1-2). According to the engineering plans, the sump was constructed of concrete sewer pipe and was approximately 42 inches in diameter by 6 feet deep. The sump contained 12 inches of crushed limestone and was connected to the sanitary sewer system (QST, 1998). Chemical wastes generated in the building, including small quantities of acids, bases, solvents, and inorganic chemicals, were drained to the sump. When the laboratory was closed in 1985, chemicals from the laboratory were discharged to the sump, causing a chemical reaction. The sump contents were subsequently tested and determined to be nonhazardous. The sump was later pumped out, backfilled, and sealed (ESE, 1998).

Parcel 225(7) includes an area encompassing a small concrete block building (Building 2282), which is located just west of Building 2281 (Figure 1-2). Building 2282 was used by laboratory personnel as a solvent storage building. No releases were reported at Building 2282, and no evidence of release was observed by QST personnel during a visual site inspection (QST, 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 the Community Environmental Response Facilitation Act (CERFA) (CERFA-Public Law 102-426) protocols 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 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.

Previous investigations to document site environmental conditions have not been conducted at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). Therefore, the parcels were classified as Category 7 CERFA sites: areas that have not been evaluated or that require further evaluation.

# 3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT and QST at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), including environmental sampling and analysis and groundwater monitoring well installation activities.

## 3.1 Environmental Sampling

The environmental sampling performed during the SI at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), included the collection of surface and 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. Samples collected by IT are designated with the prefix "GSBP-90," and samples collected by QST are designated with the prefix "SI05." 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 Soil Sampling

QST collected two surface soil samples during the SI at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). Soil sampling locations and rationale are presented in Table 3-1. Sampling locations are shown on Figure 3-1. Sample designations and quality assurance/quality control (QA/QC) samples 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 buried utilities.

***Sample Collection.*** Surface soil samples were collected from 0 to 1 foot below ground surface (bgs) using a DPT sampling system in accordance with the QST work plan (QST, 1998). The samples were analyzed for parameters listed in Table 3-2 using methods outlined in Section 3.3. Sample collection logs are included in Appendix A.

### 3.1.2 Subsurface Soil Sampling

QST collected a total of four subsurface soil samples from two soil borings at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). Two subsurface soil samples were collected from each of the soil borings at the locations shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and QA/QC samples 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 buried utilities.

***Sample Collection.*** QST contracted Graves Service Company, Inc. to complete the soil borings using DPT in accordance with procedures outlined in the QST work plan (QST, 1998). Subsurface soil samples were collected at depths of 3 to 4 feet bgs and 7 to 8 feet bgs in each of the borings. The samples were analyzed for parameters listed in Table 3-2 using methods outlined in Section 3.3. Sample collection logs are included in Appendix A.

### 3.1.3 Well Installation

IT installed two permanent groundwater monitoring wells at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), as shown on Figure 3-1. In addition, QST installed two temporary wells (SI05-GWS01and SI05-GWS02) using DPT. However, the QST DPT wells were dry, and no groundwater samples were collected. QST subsequently abandoned the two DPT wells. Table 3-3 summarizes construction details of the wells installed at the site. The well construction logs are included in Appendix B.

***IT Well Installation.*** IT contracted Miller Drilling, Inc. to install the wells with a hollow-stem auger rig. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000a). The borehole at each 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. 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 constructed a lithological log for each 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 hydrogeologic information. The lithological logs are included in Appendix B.

Upon reaching the target depth at each borehole, a 5- or 15-foot-length of 2-inch ID, 0.010-inch factory slotted, 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 sand 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 2 feet above the top of the well screen as the augers were removed. The wells were 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 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, 2000a). The wells were then grouted to ground surface using a bentonite-cement grout. A locking well cap was placed on the PVC well casing. The well surface completion included placing a protective steel casing over the PVC riser and installing a concrete pad around the protective steel 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, 2000a). 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 in order to re-establish the natural hydraulic flow conditions. Development continued until the water turbidity was equal to or less than 20 nephelometric turbidity units or for a maximum of 8 hours. Monitoring well GSBP-90-MW02 was pumped dry, allowed to recover, and then pumped dry a second time. 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 installed by IT on March 14, 2000, following procedures outlined in Section 4.18 of the SAP (IT, 2000a). Depth to groundwater was measured with an electronic water level meter. Groundwater elevations were referenced to the top of the well casing, as summarized in Table 3-4.

### *3.1.5 Groundwater Sampling*

IT collected groundwater samples from the two permanent monitoring wells installed at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). The well locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and QA/QC samples are listed in Table 3-5.

***Sample Collection.*** Groundwater sample collection was performed following procedures outlined in Section 4.9.1.4 of the SAP (IT, 2000a). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Purging and sampling were performed with a submersible 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 sample was analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.3.

### 3.2 Surveying of Sample Locations

IT sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP (IT, 2000a) 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 D.

QST sample locations were surveyed using global positioning system survey techniques or traditional surveying techniques described in the QST work plan (QST, 1998). Map coordinates for each sample location were determined using a Transverse Mercator or State Planar grid to within ± 3 feet (± 1 meter). Horizontal coordinates 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 historically at the site and on EPA, ADEM, FTMC, and USACE requirements. The samples collected at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), were analyzed for the following parameters:

- Target compound list volatile organic compounds (VOC) – EPA Method 8260B
- Target compound list semivolatile organic compounds (SVOC) – EPA Method 8270C
- Target analyte list metals – EPA Method 6010B/7000
- Total organic carbon (TOC) – EPA Method 9060 (two subsurface soil samples only).

The samples were analyzed using EPA SW-846 methods, including Update III Methods where applicable.

### 3.4 Sample Preservation, Packaging, and Shipping

IT preserved, packaged, and shipped samples following 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 Chapter 5.0, Table 5-1, of Appendix B of the SAP (IT, 2000a). Sample documentation and chain-of-custody records were recorded 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 in Knoxville, Tennessee.

QST preserved, packaged, and shipped samples following guidelines specified in the QST work plan (QST, 1998).

### 3.5 Investigation-Derived Waste Management and Disposal

***IT Investigation-Derived Waste.*** IT 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 the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), was segregated as follows:

- Drill cuttings
- Purge water from well development and 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 (TCLP) analyses. Based on the results, drill cuttings 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 existing 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.

***QST Investigation-Derived Waste.*** QST-generated IDW was managed and disposed as outlined in the QST work plan (QST, 1998).

### 3.6 Variances/Nonconformances

Neither IT nor QST documented any variances or nonconformances during completion of the SI at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7).

### 3.7 Data Quality

***IT Data.*** 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, 2000a]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms. A summary of validated analytical data is included in Appendix E. A complete (100 percent) Level III data validation effort was performed on the reported analytical data. Appendix F includes a data validation summary report that discusses the results of the IT data 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.

***QST Data.*** QST data were submitted to the Installation Restoration Data Management Information System (IRDMIS) database at the conclusion of QST field activities. Hard-copy data packages were sent to the AEC in Edgewood, Maryland, for storage. IT retrieved the electronic data via IRDMIS and the original data packages from the AEC for evaluation. From the IRDMIS data, IT was able to identify the key fields of information and translate the data into the ITEMS database.

The field sample analytical data are presented in tabular form in Appendix E. QST hard-copy analytical data packages were validated during a complete (100 percent) Level III data validation effort. Appendix F includes a data validation summary report that discusses the results of the QST data validation. Selected results were rejected or qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the data validation report. In addition, during the validation the electronic results were compared to the hard-copy results. Concentrations in the database were corrected where necessary and validation qualifiers added to the QST data using ITEMS to reflect the findings summarized in the QST data validation report.

After the QST data validation was complete and the results were updated, the QST and IT data were merged using ITEMS for inclusion in this SI report. The validated data were used in the comparisons to the SSSLs and ESVs developed by IT. The IT and QST 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 Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), 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 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 consists primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists 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 mapped at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), consist of Philo and Stendal fine sandy loams (PhA), 2 to 6 percent slopes. The Philo and Stendal series of soils are mapped as undifferentiated in Calhoun County and consist of somewhat poorly to moderately well drained, strongly acidic soils that formed from local and general alluvium. The Philo and Stendal series of soils developed primarily from the sandstone and shale, but some originated from limestone (U.S. Department of Agriculture, 1961).

Parcels 90(7) and 225(7) are situated less than one mile southeast of the Pell City Fault. Bedrock beneath the site is mapped as Mississippian/Ordovician Floyd and Athens Shale, undifferentiated. Bedrock west of the Pell City Fault is mapped as Cambrian Rome Formation (Osborne et al., 1997).

Based on hollow-stem auger boring data collected by IT during the SI, residuum beneath the site consists of predominantly silt and clay overlying weathered limestone. Although the presence of limestone underlying the site may seem inconsistent with the mapped bedrock, there are known occurrences of thin limestone beds within the Floyd and Athens Shale (Osborne et al., 1989) Competent bedrock was not encountered during drilling.

## 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 (National Oceanic and Atmospheric Administration, 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.

Surface runoff at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), follows the general topography and flows west and south towards Cane Creek, which is located approximately 500 feet south of the site.

### 4.2.2 Hydrogeology

Static groundwater levels were measured in the permanent monitoring wells at the site on March 14, 2000. Based on the base-wide groundwater flow map, groundwater flow at the site is predominantly to the south towards Cane Creek.

During boring and well installation activities, groundwater was encountered in residuum at depths ranging from 6 to 33 feet bgs. Static groundwater levels measured in the monitoring wells (Table 3-4) were between approximately 1 to 5 feet above the depth to water data from the corresponding boring logs. This indicates that the groundwater is under unconfined to semi-confined conditions.

# 5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), indicate that metals, VOCs, and SVOCs were detected in the various 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 (background concentrations) (SAIC, 1998) to determine if the metals concentrations are within natural background concentrations. Summary statistics for background metals samples collected at FTMC (SAIC, 1998) are included in Appendix G.

Six compounds were quantified by both SW-846 Method 8260B (as VOC) and Method 8270C (as SVOC), including 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields a reporting limit (RL) of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has an RL 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 RL, 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 5-3 summarize the results of the comparisons 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

Two surface soil samples were collected for chemical analysis at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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 soil samples collected at the site. The concentrations of two metals (arsenic and iron) exceeded SSSLs in both of the samples but were below their respective background concentrations.

The concentrations of six metals (aluminum, chromium, iron, manganese, selenium, and vanadium) exceeded ESVs. With the exception of the selenium results (1.01 mg/kg and 1.59 mg/kg), the concentrations of these metals were below their respective background concentrations.

***Volatile Organic Compounds.*** Twelve VOCs (1,1,1-trichloroethane, 1,2-dichloropropane, 2-butanone, 4-methyl-2-pentanone, acetone, benzene, ethylbenzene, methylene chloride, tetrachloroethene, toluene, trichloroethene, and xylenes) were detected in surface soil samples collected at the site. The methylene chloride results were flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. Each sample contained 11 of the 12 detected VOCs. VOC concentrations in the surface soil samples ranged from 0.00047 mg/kg to 0.28 mg/kg.

VOC concentrations in surface soils were below SSSLs. The concentrations of tetrachloroethene and trichloroethene exceeded ESVs in both of the samples.

***Semivolatile Organic Compounds.*** Bis(2-ethylhexyl)phthalate was detected in both of the surface soil samples at concentrations below the SSSL and ESV.

## 5.2 Subsurface Soil Analytical Results

Four subsurface soil samples were collected for chemical analysis at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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.*** Nineteen metals were detected in subsurface soil samples collected at the site. The concentrations of four metals (aluminum, arsenic, iron, and manganese) exceeded SSSLs. With the exception of aluminum and manganese in one sample (SI05-SS02A), these metals concentrations were below their respective background concentrations. However, the aluminum and manganese results were within the range of background values established by SAIC (Appendix G).

***Volatile Organic Compounds.*** Twelve VOCs (1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, 1,2-dichloropropane, 2-butanone, benzene, ethylbenzene, methylene chloride, tetrachloroethene, toluene, trichloroethene, and xylenes) were detected in subsurface soil samples collected at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). The methylene chloride results were flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. Two of the samples (SI05-SS01B and SI05-SS02B) each contained 11 of the 12 detected VOCs. VOC concentrations in the subsurface soil samples ranged from 0.00053 mg/kg to 0.068 mg/kg.

The VOC concentrations in subsurface soils were below SSSLs.

***Semivolatile Organic Compounds.*** Bis(2-ethylhexyl)phthalate was detected in each of the subsurface soil samples at concentrations below the SSSL.

***Total Organic Carbon.*** Two of the subsurface soil samples (SI05-SS01A and SI05-SS01B) were analyzed for TOC content. TOC concentrations in the samples were 5,680 mg/kg and 29,700 mg/kg, as summarized in Appendix E.

## *5.3 Groundwater Analytical Results*

Groundwater samples were collected from the two permanent monitoring wells installed at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7). The well locations are shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-3.

***Metals.*** Thirteen metals were detected in groundwater samples collected at the site. The concentrations of four metals (arsenic, barium, iron, and manganese) exceeded SSSLs in the sample collected from GSBP-90-MW02. The barium, iron, and manganese results also exceeded their respective background concentrations but were within the range of background values (Appendix G).

***Volatile Organic Compounds.*** Six VOCs (2-butanone, acetone, carbon disulfide, chloroform, naphthalene, and trichlorofluoromethane) were detected in groundwater samples collected at the site. The 2-butanone result was flagged with a "B" data qualifier, indicating that the compound was also detected in an associated laboratory or field blank sample. The remaining VOC results were flagged with a "J" data qualifier, indicating that the results were greater than the method detection limit but less than the reporting limit. VOC concentrations in the groundwater samples ranged from 0.00014 mg/L to 0.0041 mg/L.

The VOC concentrations in groundwater were below SSSLs.

***Semivolatile Organic Compounds.*** Phenanthrene was detected in one groundwater sample (GSBP-90-MW02) at a concentration below the SSSL.

# 6.0 Summary, Conclusions, and Recommendations

IT, under contract with the USACE, completed an SI at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), 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 Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), consisted of the sampling and analysis of two surface soil samples, four subsurface soil samples, and two groundwater samples. In addition, two 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. As part of the SI, IT incorporated data previously collected by QST at the site.

Chemical analysis of samples collected at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7), indicates that metals, VOCs, and SVOCs 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).

The potential threat to human health is expected to be very low. Although the site is projected for reuse by the Alabama Army National Guard, the analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted land reuse. Metals concentrations exceeding SSSLs in site media were below their respective background concentrations or within the range of background values and do not pose an unacceptable risk to human receptors. VOC and SVOC concentrations in site media were below SSSLs.

Selenium (less than 1.6 mg/kg) exceeded its ESV and background concentration in both of the surface soil samples. In addition, two VOCs (tetrachloroethene and trichloroethene) were detected in surface soils at concentrations (less than 0.05 mg/kg) exceeding ESVs. However, the site is located within the developed area of the Main Post and does not support significant ecological habitat. Based on site conditions and the low levels of chemical constituents detected, the potential threat to ecological receptors is expected to be very low.

Based on the results of the SI, past operations at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(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 at the Chemical School Laboratory Sump, Buildings 2281 and 2282, Parcels 90(7) and 225(7).

# 7.0 References

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

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

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

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

QST Environmental, Inc. (QST), 1998, ***Final Site Investigation Work Plan, Fort McClellan, Alabama,*** March.

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

Szabo, M. W., Osborne, W. E., Copeland, C. W., Jr., and Neathery, T. L., compilers, 1988, ***Geologic Map of Alabama***, Alabama Geological Survey Special Map 220, scale 1:250,000, 5 sheets.

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 Causey, L. V., 1962, ***Geology and Ground-Water Resources of Calhoun County, Alabama***, Alabama Geological Survey County Report 7, 77 p.