Final

Site Investigation Report
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor

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 (IT) completed a site investigation (SI) at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, at Fort McClellan (FTMC), in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI consisted of the sampling and analysis of 13 surface and depositional soil samples, 10 subsurface soil samples, 2 surface water samples, 2 sediment samples and 3 groundwater samples. In addition, three permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at Parcels 237Q-X and 238Q-X indicate that metals and explosive compounds were detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV) and background screening values for FTMC. A preliminary risk assessment (PRA) was also performed to further characterize the potential threat to human health.

Although the site is located within an undeveloped area of the Choccolocco Corridor owned by the State of Alabama, the analytical data were evaluated against a residential reuse scenario to determine if the site is suitable for unrestricted land reuse. Constituents of potential concern included four metals (aluminum, arsenic, chromium, and vanadium) in soils and 2,6-dinitrotoluene in groundwater. The PRA concluded, however, that exposure to site media poses no unacceptable risk for the resident.

The potential threat to ecological receptors is also expected to be low. Constituents of potential ecological concern were limited to metals, all of which were below their respective background concentrations except for beryllium, copper, and iron in one surface soil sample. Although iron exceeded its ESV and upper background range, it was present at levels within the same order of magnitude as background. Iron is a common element in native soils whose concentration varies over a wide range. Therefore, the elevated iron concentration is attributed to naturally occurring background levels. The beryllium (1.3 mg/kg) and copper (56 mg/kg) results marginally exceeded their ESVs (1.1 and 40 mg/kg, respectively) but were within the same order of magnitude. Beryllium and copper concentrations in all other surface and depositional soil

samples were below ESVs and/or background concentrations. Given the conservatism inherent in the ESVs, the relatively small magnitude of the exceedances, and the limited spatial distribution of these metals, beryllium, and copper are not expected to pose a threat to ecological receptors.

Based on the results of the SI, past operations at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, do not appear to have adversely impacted the environment. The metals and explosive compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor.

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 Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, under Contract Number DACA21-96-D-0018, Task Order CK10.

This SI report presents specific information and results compiled from the SI, including field sampling and analysis, and monitoring well installation activities, conducted at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor.

1.1 Project Description

The Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, were identified as areas to be investigated prior to property transfer. The parcels were classified as Category 1 Qualified parcels in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 1 parcels are areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas). The parcels were qualified because chemicals of potential concern may be present as a result of range activities. The parcels were also qualified (X) for potential unexploded ordnance (UXO).

A site-specific field sampling plan (SFSP) (IT, 2001) and a site-specific safety and health plan (SSHP) were finalized in June 2001. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor. The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect ten surface soil samples, three depositional soil samples, ten subsurface soil samples, two surface water samples, two sediment samples and three groundwater samples. Data from the field investigation were used to determine whether potential site-specific chemicals are present at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor.

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 Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, 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", or to conduct additional work at the site.

1.3 Site Description and History

The U.S. Environmental Protection Agency (EPA) Environmental Photographic Interpretation Center (EPIC) (EPA, 1990) reported a Possible Range, Parcel 237Q-X and a nearby Impact Area, Parcel 238Q-X, within southeastern Choccolocco Corridor (Figures 1-1 and 1-2). A review of EPIC photographs by the ESE staff indicated that the Possible Range and Impact Area appeared more closely to resemble a landing strip designed to accommodate small aircraft than a weapons range. The impact area is difficult to resolve on the EPIC aerial photograph composite (ESE, 1998).

According to the Archive Search Report (ASR), a training site identified as T-46 Practice Grenade Assault Range was observed on the 1967 range map within southeastern Choccolocco Corridor (USACE, 1999). This site partially overlaps the northwestern end of the Possible Range, Parcel 237Q-X. According to the ASR, training debris (e.g., expended rifle blanks and

pyrotechnic devices such as smoke grenades) probably remain on the Possible Range site (USACE, 1999). There was no other information about the T-46 Practice Grenade Assault Range provided in the ASR.

The 1937 and 1940 aerial photographs show the site before FTMC use with most of the site barren of trees and used for cultivation. The 1940 aerial photograph appears to show a farm site with a driveway, large trees and buildings in the center of Parcel 238Q-X (Figure 1-3). A 1969 aerial photograph shows the two parcels covered with more trees and a cleared area extending from the western end of Parcel 237Q-X through most of Parcel 238Q-X (Figure 1-4). A review of aerial photographs revealed that the site appears to more closely resemble a dirt landing strip than a range and impact area. There is no evidence of the buildings and trees that appeared on the 1940 aerial photograph.

The 1976 aerial photograph shows the site with more trees and a dirt road that connects a large bare area in the western part of Parcel 237Q-X with a small bare area in the center of Parcel 238Q-X (Figure 1-5). The dirt road connecting the two bare areas is hardly distinguishable in the 1998 aerial photograph because it appears overgrown with trees. The Possible Range, or airstrip, would have been in use between 1940 and 1976 based on the review of the available aerial photographs. The Impact Area, Parcel 238Q-X, is located to the east of the Possible Range and adjacent to State Route 9. This is an unlikely site for an impact area given the slight elevation increase and the proximity of State Route 9, which existed on the aerial photographs prior to any sign of FTMC use.

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
- 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), 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 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 carried out to verify conditions of specific property parcels.

The Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, are parcels where no known or recorded storage, release, or disposal (including migration) has occurred on site property. The parcels were qualified because chemicals of potential concern and UXO may be present as a result of range activities. Therefore, Parcels 237Q-X and 238Q-X required additional evaluation to determine their environmental condition.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, including UXO avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO Avoidance

UXO avoidance was performed at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, following methodology outlined in Section 4.1.7 of the SAP (IT, 2000a). IT UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcels prior to site access. After the site was cleared for access, sample locations were monitored by UXO personnel following procedures outlined in Section 4.1.7.3 of the SAP (IT, 2000a).

3.2 Environmental Sampling

The environmental sampling performed during the SI at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, included the collection of surface and depositional soil samples, subsurface soil samples, groundwater samples, and surface water/sediment samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walk and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4. IT contracted Environmental Services Network, Inc, a direct-push technology (DPT) subcontractor, to assist in surface and subsurface soil sample collection.

3.2.1 Surface and Depositional Soil Sampling

Surface soil samples were collected from ten locations and depositional soil samples were collected from three locations at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, 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 UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface soil samples were collected from the upper foot of soil using a DPT sampling system following the methodology specified in Section 4.9.1.1 of the SAP (IT, 2000a). Depositional soil samples were collected from the upper 0.5-foot of soil using a

Table 3-1

Sampling Locations And Rationale
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-237Q-GP01	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the vicinity of surface depressions near the northeast corner of the T-46 practice grenade assault range, northwest of Parcel 237Q-X, to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-GP02	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the western end of Parcel 237Q-X, downslope of most of the parcel, to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-GP03	Surface soil and subsurface soil	Surface and subsurface soil samples were collected north of Parcel 237Q-X to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-GP04	Surface soil and subsurface soil	Surface and subsurface soil samples were collected north of the central area of Parcel 237Q-X, to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil and groundwater samples were collected in the northwestern area of Parcel 237Q-X and in the northeast corner of T-46 practice grenade assault range to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-MW02	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil and groundwater samples were collected in the western half of the Parcel 237Q-X, south of T-46 practice grenade assault range, to determine if contaminant releases into the environment have occurred from use of this area.
HR-237Q-SW/SD01	Surface water and sediment	Surface water and sediment samples were collected south of the eastern end of Parcel 237Q-X in the intermittent stream that flows west along the southern boundary of the parcel to determine if potential site-specific chemicals have impacted the creek.
HR-237Q-SW/SD02	Surface water and sediment	Surface water and sediment samples were collected from the intermittent stream that flows west along the southern boundary of Parcel 237Q-X to determine if potential site-specific chemicals have impacted the creek.
HR-237Q-DEP01	Depositional soil	A depositional soil sample was collected south of the western end of Parcel 237Q-X from a dry section of the intermittent stream bed south of the parcel to determine if contaminant releases have occurred from run off in the area of Parcel 237Q-X.

Table 3-1

Sampling Locations And Rationale
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-237Q-DEP02	Depositional soil	A depositional soil sample was collected north of the western end of Parcel 237Q-X in a dry creek bed that runs through the T-46 practice grenade assault range to determine if contaminant releases have occurred from run off in the area of Parcel 237Q-X and T-46 practice grenade assault range.
HR-238Q-GP01	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the western area of Parcel 238Q-X to determine if contaminant releases into the environment have occurred from use of this area.
HR-238Q-GP02	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the southern area of Parcel 238Q-X to determine if contaminant releases into the environment have occurred from use of this area.
HR-238Q-GP03	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the eastern area of Parcel 238Q-X to determine if contaminant releases into the environment have occurred from use of this area.
HR-238Q-MW01	Surface soil, subsurface soil, and groundwater	Surface soil, subsurface soil and groundwater samples were collected in the western end of Parcel 238Q-X to determine if contaminant releases into the environment have occurred from use of this area.
HR-238Q-DEP01	Depositional soil	A depositional soil sample was collected south of Parcel 238Q-X in the bed of the intermittent stream that flows west under State Route 9, to determine if contaminant releases have occurred from run off upstream of Parcel 238Q-X.

Table 3-2

Soil Sample Designations and Analytical Parameters
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples		Analytical Parameters
			Field Duplicates	MS/MSD	
HR-237Q-GP01	HR-237Q-GP01-SS-JA0001-REG	0-1			TAL Metals and Explosives
	HR-237Q-GP01-DS-JA0002-REG	11-12			
HR-237Q-GP02	HR-237Q-GP02-SS-JA0003-REG	0-1			TAL Metals and Explosives
	HR-237Q-GP02-DS-JA0004-REG	10-12		HR-237Q-GP02-DS-JA0004-MS/MSD	
HR-237Q-GP03	HR-237Q-GP03-SS-JA0005-REG	0-1			TAL Metals and Explosives
	HR-237Q-GP03-DS-JA0006-REG	11-12			
HR-237Q-GP04	HR-237Q-GP04-SS-JA0007-REG	0-1			TAL Metals and Explosives
	HR-237Q-GP04-DS-JA0008-REG	11-12			
HR-237Q-MW01	HR-237Q-MW01-SS-JA0009-REG	0-1			TAL Metals and Explosives
	HR-237Q-MW01-DS-JA0010-REG	11-12			
HR-237Q-MW02	HR-237Q-MW02-SS-JA0011-REG	0-1			TAL Metals and Explosives
	HR-237Q-MW02-DS-JA0012-REG	11-12	HR-237Q-MW02-DS-JA0013-FD		
HR-237Q-DEP01	HR-237Q-DEP01-DEP-JA0014-REG	0-0.5			TAL Metals and Explosives
HR-237Q-DEP02	HR-237Q-DEP02-DEP-JA0015-REG	0-0.5	HR-237Q-DEP02-DEP-JA0016-FD		TAL Metals and Explosives
HR-238Q-GP01	HR-238Q-GP01-SS-JC0001-REG	0-1			TAL Metals and Explosives
	HR-238Q-GP01-DS-JC0002-REG	6-7			
HR-238Q-GP02	HR-238Q-GP02-SS-JC0003-REG	0-1			TAL Metals and Explosives
	HR-238Q-GP02-DS-JC0004-REG	3-4			
HR-238Q-GP03	HR-238Q-GP03-SS-JC0005-REG	0-1			TAL Metals and Explosives
	HR-238Q-GP03-DS-JC0006-REG	11-12	HR-238Q-GP03-DS-JC0007-FD		
HR-238Q-MW01	HR-238Q-MW01-SS-JC0008-REG	0-1			TAL Metals and Explosives
	HR-238Q-MW01-DS-JC0009-REG	11-12			
HR-238Q-DEP01	HR-238Q-DEP01-DEP-JC0010-REG	0-0.5			TAL Metals and Explosives

ft - Feet.
FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TAL - Target analyte list.

stainless-steel hand auger. Surface and depositional soil samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was collected with the sampling device and screened with a photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000a). The soil was transferred to a clean stainless-steel bowl, homogenized and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from ten soil borings at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, 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 locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

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

Subsurface soil samples were collected continuously to 12 feet bgs or 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, 2000a) to measure for volatile organic vapors. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the deepest sample interval above the saturated zone was submitted for analysis. The soil was transferred to a clean stainless-steel bowl, homogenized and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring. The boring log for each borehole is included in 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, 2000a).

3.2.3 Monitoring Well Installation

Three permanent groundwater monitoring wells were installed in the saturated zone at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, to

collect groundwater samples for laboratory analysis. The well locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the wells installed at the site. The well construction logs are included in Appendix B.

IT contracted Miller Drilling Company to install the permanent wells with a hollow-stem auger rig at three of the DPT soil boring locations. The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000a). The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augured to the completion depth of the DPT boring and samples were collected from 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. The samples were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. The boring log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 10- or 15-foot-length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with 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. 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. A bentonite seal, consisting of approximately 4 feet of bentonite pellets, was placed immediately on top of the filter sand and hydrated with potable water. At wells where the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. The bentonite seal placement and hydration followed procedures in Appendix C of the SAP (IT, 2000a). In monitoring well HR-238Q-MW01, bentonite-cement grout was tremied into the remaining annular space of the well from the top of the bentonite seal to the ground surface. A locking protective steel casing was placed over the PVC well riser and a concrete pad was constructed around the well. Four protective steel posts were installed around the well pad. A locking well cap was placed on the PVC well riser.

The monitoring wells were developed by surging and pumping with a 2-inch diameter 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

Table 3-3

Monitoring Well Construction Summary
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Well Material
HR-237Q-MW01	1168185.09	702386.48	682.49	684.56	25	15	10 - 25	2" ID Sch. 40 PVC
HR-237Q-MW02	1167636.46	702285.49	680.08	682.04	15.8	10	5.8 - 15.8	2" ID Sch. 40 PVC
HR-238Q-MW01	1167789.34	704191.89	691.76	694.05	33	15	18 - 33	2" ID Sch. 40 PVC

Permanent wells installed using hollow-stem auger.
Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983 (NAD83).
Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.

materials were then pumped out of the well in order to re-establish the natural hydraulic flow conditions. Development was performed until the water turbidity was less than or equal to 20 nephelometric turbidity units (NTU) or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in the permanent wells at the site on January 9, 2002, following procedures outlined in Section 4.18 of the SAP (IT, 2000a). Depth to groundwater was measured with an electronic water level meter. Each meter probe and cable were cleaned between uses at each well following decontamination methodology presented in Section 4.10 of the SAP (IT, 2000a). Measurements were referenced to the top of each well casing, as summarized in Table 3-4.

3.2.5 Groundwater Sampling

Groundwater samples were collected from each of the three permanent wells installed at the site. The well/groundwater sampling 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 samples were collected using either a submersible pump or a peristaltic pump equipped with Teflon™ tubing following the 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. At sample location HR-238Q-MW01 after following the procedures outlined in the SAP and initiating low-flow purging, the turbidity was still moderately elevated (52 NTUs) and therefore the sample was decanted. 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 3.4.

3.2.6 Surface Water Sampling

Two surface water samples were collected at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, at the locations shown on Figure 3-1. The surface water sampling locations and rationale are listed in Table 3-1. The surface water sample designations and analytical parameters are listed in Table 3-7. The actual sampling locations were determined in the field, based on drainage pathways and field observations.

Table 3-4

Groundwater Elevations
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
HR-237Q-MW01	9-Jan-02	12.50	684.56	682.49	672.06
HR-237Q-MW02	9-Jan-02	10.84	682.04	680.08	671.20
HR-238Q-MW01	9-Jan-02	21.96	694.05	691.76	672.09

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).

amsl - Above mean sea level.
BTOC - Below top of casing.
ft - Feet.

Table 3-5

Groundwater Sample Designations and Analytical Parameters
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples		Analytical Parameters
		Field Duplicates	MS/MSD	
HR-237Q-MW01	HR-237Q-MW01-GW-JA3001-REG		HR-237Q-MW01-GW-JA3001-MS/MSD	TAL Metals and Explosives
HR-237Q-MW02	HR-237Q-MW02-GW-JA3002-REG			TAL Metals and Explosives
HR-238Q-MW01	HR-238Q-MW01-GW-JC3001-REG	HR-238Q-MW01-GW-JC3002-FD		TAL Metals and Explosives

Groundwater samples were collected from the approximate midpoint of the saturated screened interval of the monitoring well.
FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TAL - Target analyte list.

Table 3-6

Groundwater and Surface Water Field Parameters
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Date	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
HR-237Q-MW01	GW	3-Aug-01	0.198	13.04	150	22.4	7.4	7.40
HR-237Q-MW02	GW	6-Aug-01	0.395	3.88	144	21.9	3	6.75
HR-237Q-SW/SD01	SW	28-Aug-01	0.492	5.64	135	21.8	5	7.65
HR-237Q-SW/SD02	SW	28-Aug-01	0.473	3.36	155	21.0	31	7.09
HR-238Q-MW01	GW	2-Aug-01	0.355	1.04	135	18.9	52	7.54

GW - Groundwater.
mg/L - Milligrams per liter.
mS/cm - Millisiemens per centimeter.
mV - Millivolts.
NTU - Nephelometric turbidity units.
ORP - Oxidation-reduction potential.
SU - Standard units.
SW - Surface Water.

Table 3-7

Surface Water and Sediment Sample Designations and Analytical Parameters
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	Sample Depth (ft)	QA/QC Samples MS/MSD	Analytical Parameters
HR-237Q-SW/SD01	HR-237Q-SW/SD01-SW-JA2001-REG	Surface Water	NA		TAL Metals and Explosives (TOC, Grain Size for sediment only)
	HR-237Q-SW/SD01-SD-JA1001-REG	Sediment	0-0.5		
HR-237Q-SW/SD02	HR-237Q-SW/SD02-SW-JA2002-REG	Surface Water	NA		TAL Metals and Explosives (TOC, Grain Size for sediment only)
	HR-237Q-SW/SD02-SD-JA1002-REG	Sediment	0-0.5	HR-237Q-SW/SD02-SD-JA1002-MS/MSD	

MS/MSD - Matrix spike/matrix spike duplicate.
NA - Not applicable.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TAL - Target analyte list.
TOC - Total organic carbon.

Sample Collection. The surface water samples were collected in accordance with the procedures specified in Section 4.9.1.3 of the SAP (IT, 2000a). The surface water samples were collected by dipping a stainless-steel pitcher into the water and pouring the water into the sample containers. The surface water samples were collected after field parameters had been measured using a calibrated water quality meter. Surface water field parameters are listed in Table 3-6. The sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.2.7 Sediment Sampling

Two sediment samples were collected at the same locations as the surface water samples, as shown on Figure 3-1. The sediment sampling locations and rationale are presented in Table 3-1. The sediment sample designations and analytical parameters are listed in Table 3-7. The actual sediment sampling locations were determined in the field, based on drainage pathways and field observations.

Sample Collection. The sediment samples were collected in accordance with the procedures specified in Section 4.9.1.2 of the SAP (IT, 2000a). Sediments were collected with a stainless-steel hand-auger and placed in a clean stainless-steel bowl. The samples were homogenized and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The sediment samples were analyzed for the parameters listed in Table 3-7 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000a). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, were analyzed for the following parameters:

- Target analyte list metals – EPA Method 6010B/7000
- Nitroaromatic and nitramine explosives – EPA Method 8330.

The sediment samples were analyzed for the following additional parameters:

- Total organic carbon – EPA Method 9060
- Grain Size – American Society for Testing and Materials Method D-421/D-422.

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

3.5 Sample Preservation, Packaging, and Shipping

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

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000a). The IDW generated during the SI at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, was segregated as follows:

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

Solid IDW was stored on site 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 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 compound, semivolatile

organic compound, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

Two variances to the SFSP were recorded during completion of the SI at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, as summarized in Table 3-8. The variances did not alter the intent of the investigation or the sampling rationale presented in the SFSP (IT, 2001). The variance reports are presented in Appendix E.

No nonconformances were recorded during completion of the SI.

3.8 Data Quality

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

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in quality assurance reports, which include the data validation summary reports (Appendix G). Selected results were qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the reports. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System database for tracking and reporting. The qualified data were used in comparing to the SSSLs and ESVs developed by IT. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

Table 3-8

Variances to the Site-Specific Field Sampling Plan
Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor
Fort McClellan, Calhoun County, Alabama

Variance to the SFSP	Justification for Variance	Impact to Site Investigation
Surface water and sediment samples were not collected at sample locations HR-237Q-SW/SD03 and HR-237Q-SW/SD04.	The surface water and sediment samples were not collected at the proposed locations because surface water and sediment were not present in the creek at the time of sample collection. Several attempts were made to collect the samples, but all were unsuccessful. Therefore, depositional soil samples (HR-237Q-DEP01 and HR-237Q-DEP02) were collected at these locations.	None. Data from the depositional soil samples were used to characterize the site.
Surface water and sediment samples were not collected at sample location HR-238Q-SW/SD01.	Surface water and sediment samples were not collected at the proposed location because surface water and sediment were not present in the creek at the time of sample collection. Several attempts were made to collect the samples, but all were unsuccessful. Therefore, a depositional soil sample (HR-238Q-DEP01) was collected at this location.	None. Data from the depositional soil sample were used to characterize the site.

SFSP - Site-specific field sampling plan.

4.0 Site Characterization

Subsurface investigations performed at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, provided soil, bedrock 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 (Osborne, et. al., 1988). These two formations are mapped only in the eastern part of the county.

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

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

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

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weathers 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 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 (Osborne, et. al., 1988). This unit locally occurs in the western portion of Pelham Range.

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

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty, clay shale and mudstone with interbedded light to medium gray very fine to fine

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

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

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

The eastern three quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window, and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982 and Osborne, et. al., 1988). The Coosa deformed belt is a narrow (approximately 5 to 20 miles wide) northeast- to-southwest-trending linear

(approximately 90 miles in length) zone of complex structure consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

Soils at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, fall into the following four soil series (U.S. Department of Agriculture [USDA], 1961):

- The Rarden soil series
- The Captina soil series
- The Robertsville soil series
- The Sequatchie soil series.

Most of Parcel 238Q-X is covered by Rarden silty clay loam, shallow, 6 to 10 percent slopes, severely eroded (ReC3) (USDA, 1961). Soils at this site consist of severely eroded soils that have 6 to 10 percent slopes and a thin solum (USDA, 1961). Erosion has removed all of the original brown silt loam surface soil. The 2- to 4- inch plow layer is now a yellowish-red to dark red silty clay loam. Shallow gullies are common. Tilth is poor.

Parcel 237Q-X is covered by three soil mapping units. The eastern half of the parcel is covered by Captina silt loam, 0 to 6 percent slopes (CcB) (USDA, 1961). This soil has a thick surface soil, a high rate of infiltration and slow to medium runoff. The surface soil is dark brown to very dark grayish-brown silt loam, has a weak, fine-crumb structure, is friable and strongly acidic. The subsoil ranges from yellowish-brown to yellowish-red. The fragipan ranges in thickness from 4 to 20 inches and in compactness from weak to strong. Also included are places where the plow layer is severely eroded; it is brown to reddish-brown silty clay loam.

Two soil mapping units cover the western half of Parcel 237Q-X. The northern area of the western half of the Parcel 237Q-X consists of Robertsville silt loam, 0 to 2 percent slopes (RoA) (USDA, 1961). The surface soil for this mapping unit ranges from dark grayish-brown and dark brown to light brownish-gray in color and is usually mottled. The subsoil ranges from light brownish-gray to light gray; the color and number of mottles are variable. A few small areas have gravel on the surface. The fragipan is at depths ranging from 12 to 27 inches. The fragipan ranges in thickness from 8 to 18 inches and in compactness from weak to strong. The soil has fair to good tilth and runoff is very slow. Permeability and infiltration are slow and the capacity for available moisture is low.

The southwestern portion of Parcel 237Q-X is covered by Sequatchie fine sandy loam, 0 to 2 percent slopes (ScA) (USDA, 1961). This soil is friable and found on low stream terraces. The surface soil ranges from dark grayish-brown to dark brown in color. The subsoil ranges from dark brown to yellowish-brown in color and from fine sandy clay loam to light silty clay loam in texture. In some areas, the lower soil is mottled. Some areas include a gravelly fine sandy surface soil. Also, a few areas are underlain by a firm, silty clay subsoil. This soil has good tilth and runoff is slow. Infiltration and internal drainage are medium. Permeability is moderate and the capacity for available moisture is moderate to high.

The bedrock at this site is mapped as the Cambrian Rome Formation (Osborne et al., 1988). The Rome Formation consists of interbedded sandstone, siltstone and shale. The Cambrian Weisner and Wilson Ridge Formation is mapped to the northwest of Parcel 237Q-X and consists of fluvial to shallow marine sandstones, conglomerates and mudstones.

The residuum encountered during drilling activities at Parcels 237Q-X and 238Q-X was a reddish-brown to yellowish-brown to yellowish-orange clay with varying amounts of silt, sand and gravel. Bedrock was encountered at only one monitoring well location (HR-237Q-MW02) at 15.8 feet bgs. The bedrock at this location was described as fine to medium-grained quartz-rich sandstone. Total depths of 25 and 35 feet bgs were reached in monitoring wells HR-237Q-MW01 and HR-238Q-MW01, respectively, without encountering bedrock.

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 feature within the Choccolocco Corridor is Choccolocco Creek, which flows south through the central portion of Choccolocco Corridor. Choccolocco Creek and its tributaries drain Choccolocco Corridor and flows southward to the Coosa River.

Elevation of the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, ranges from approximately 675 to 700 feet above mean sea level. Willis Branch Creek flows west along the southern boundary of parcel 237Q-X and into Choccolocco Creek, approximately 1,600 feet southwest of the site. An unnamed intermittent stream originates near the western end of Parcel 237Q-X and flows to the west. Surface drainage at the two parcels follow site topography and flow south into Willis Branch Creek and west into the unnamed intermittent creek.

4.2.2 Hydrogeology

During soil boring and well installation activities, groundwater was encountered at depths ranging from approximately 15 to 23 feet bgs (Appendix B). Based on groundwater level data collected at the sites on January 9, 2002 (Table 3-4), the water table underlying the site appears to be almost flat. Groundwater flow direction at this site likely follows the topography and flows to the west.

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, indicate that metals and explosive compounds were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the on-going SIs being performed under the BRAC Environmental Restoration Program at FTMC.

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

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

5.1 Surface and Depositional Soil Analytical Results

Ten surface soil samples and three depositional soil samples were collected for chemical analysis at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor. Surface and depositional soil samples were collected from the upper foot of soil at 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. Twenty-two metals were detected in surface and depositional soil samples collected at the site. The concentrations of seven metals (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) exceeded SSSLs. The concentrations of six of these metals also exceeded their respective background concentrations in one or more samples each with the exception of iron in one sample, the metals results that exceeded SSSLs and their respective background concentrations were within the range of background values established by SAIC (Appendix H). Iron (69,600 mg/kg) exceeded its SSSL (2,345 mg/kg) and upper background range (56,300 mg/kg) in the surface soil sample collected at HR-238Q-GP01.

The concentrations of thirteen metals (aluminum, arsenic, beryllium, chromium, cobalt, copper, iron, lead, manganese, mercury, thallium, vanadium, and zinc) exceeded ESVs. Twelve of these metals also exceeded their respective background concentrations in one or more samples each. However, these metals concentrations were within the range of background values except for the following:

- Beryllium (1.3 mg/kg) exceeded its ESV (1.1 mg/kg) and upper background range (0.87 mg/kg) in one sample (HR-238Q-GP01).
- Copper (56 mg/kg) exceeded its ESV (40 mg/kg) and upper background range (24 mg/kg) in one sample (HR-238Q-GP01).
- Iron (69,600 mg/kg) exceeded its ESV (200 mg/kg) and upper background range (56,300 mg/kg) in one sample (HR-238Q-GP01).

Explosives. Explosive compounds were not detected in the surface and depositional soil samples.

5.2 Subsurface Soil Analytical Results

Ten subsurface soil samples were collected for chemical analysis at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor. 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. Twenty metals were detected in subsurface soil samples collected at site. The concentrations of seven metals (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) exceeded SSSLs. The concentrations of these metals also exceeded their respective background concentrations in one or more samples each. With the exception of iron and vanadium, the metals results that exceeded SSSLs and their respective background concentrations were within the range of background values (Appendix H). Iron (50,000 to 88,600 mg/kg) exceeded its SSSL (2,345 mg/kg) and upper background range (48,000 mg/kg) in four samples; vanadium (104 mg/kg) exceeded its SSSL (53 mg/kg) and upper background range (99 mg/kg) in one sample (HR-237Q-GP01). The vanadium analytical result was flagged with a "J" data qualifier indicating that the compound was positively identified but that the concentration was estimated.

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

5.3 Groundwater Analytical Results

Three groundwater samples were collected for chemical analysis at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, 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 5-3.

Metals. Ten metals were detected in groundwater samples collected at the site. The concentration of manganese exceeded its SSSL in one sample, but was below its background concentration.

Explosives. A total of six explosive compounds were detected in two of the groundwater samples collected at the site. Explosive compound concentrations ranged from 0.0004 to 0.001 mg/L and were below SSSLs except for 2,6-dinitrotoluene. The concentrations of 2,6-dinitrotoluene (0.00095 mg/L and 0.00042 mg/L) exceeded its SSSL in both samples.

5.4 Surface Water Analytical Results

Two surface water samples were collected for chemical analysis at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs and metals background screening values, as presented in Table 5-4.

Metals. Eight metals were detected in surface water samples collected at the site. All of the metal concentrations in surface water were below their respective SSSLs.

The concentrations of three metals (aluminum, barium, and manganese) exceeded ESVs, but were below their respective background concentrations.

Explosives. Explosive compounds were not detected in the surface water samples.

5.5 Sediment Analytical Results

Two sediment samples were collected for chemical and physical analyses at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs and metals background screening values, as presented in Table 5-5.

Metals. Seventeen metals were detected in sediment samples collected at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor. All of the metal concentrations in sediment were below their respective SSSLs.

The concentrations of two metals (arsenic and lead) exceeded ESVs in one sample. The lead result was below its background concentration; the arsenic result (12.5 mg/kg) marginally exceeded its background concentration (11.3 mg/kg) but was within the range of background values.

Explosives. Explosive compounds were not detected in the surface water samples.

Total Organic Carbon. The total organic carbon concentrations in the sediment samples were 21.2 mg/kg and 34.6 mg/kg.

Grain Size. The results of grain size analysis for the sediment samples are included in Appendix F.

5.6 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 Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor. 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 a 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 Parcels 237Q-X and 238Q-X is included as Appendix I. 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 non-cancer effects associated with exposure to site media.

The SSSLs applied to a given site represent the most highly exposed receptor scenario for each of several plausible uses for the site. The recreational site user, groundskeeper, and residential receptor scenarios were evaluated for Parcels 237Q-X and 238Q-X. 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 exposure to environmental media at Parcels 237Q-X and 238Q-X poses no unacceptable risk for the recreational site user, groundskeeper, or resident.

6.0 Summary, Conclusions, and Recommendations

IT Corporation, under contract to the USACE, completed an SI at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at concentrations that present an unacceptable risk to human health or the environment. The SI consisted of the sampling and analysis of 13 surface and depositional soil samples, 10 subsurface soil samples, 3 groundwater samples, and 2 surface water/sediment samples. In addition, 3 permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, indicate that metals and explosive compounds were detected in site media. Analytical results were compared to the SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metals concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998). A PRA was also performed to further characterize the potential threat to human health.

Although the site is located within an undeveloped area of the Choccolocco Corridor owned by the State of Alabama, the analytical data were evaluated against a residential reuse scenario to determine if the site is suitable for unrestricted land reuse. Constituents of potential concern included four metals (aluminum, arsenic, chromium, and vanadium) in soils and 2,6-dinitrotoluene in groundwater. The PRA concluded, however, that exposure to site media poses no unacceptable risk for the resident.

The potential threat to ecological receptors is expected to be low. Constituents of potential ecological concern were limited to metals, all of which were below their respective background concentrations except for beryllium, copper, and iron in one surface soil sample (HR-238Q-GP01). Although iron exceeded its ESV and upper background range, it was present at levels within the same order of magnitude as background. Iron is a common element in native soils whose concentration varies over a wide range. Therefore, the elevated iron concentration is attributed to naturally occurring background levels. The beryllium (1.3 mg/kg) and copper (56 mg/kg) results marginally exceeded their ESVs (1.1 and 40 mg/kg, respectively) but were within

the same order of magnitude. Beryllium and copper concentrations in all other surface and depositional soil samples were below ESVs and/or background concentrations. Given the conservatism inherent in the ESVs, the relatively small magnitude of the exceedances, and the limited spatial distribution of these metals, beryllium, and copper are not expected to pose a threat to ecological receptors.

Based on the results of the SI, past operations at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor, do not appear to have adversely impacted the environment. The metals and explosive compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Possible Range, Parcel 237Q-X and Impact Area, Parcel 238Q-X, Choccolocco Corridor.

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