Final

Site Investigation Report
11th Chemical Motor Pool Area,
Parcels 29(7), 30(7), and 74(7)

Fort McClellan
Calhoun County, Alabama

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK05, IT Corporation completed a site investigation (SI) at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), at Fort McClellan in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), consisted of the sampling and analysis of four surface soil samples, two depositional soil samples, ten subsurface soil samples, fourteen groundwater samples, and three surface water and sediment samples. In addition, ten groundwater monitoring wells were installed in the residuum groundwater zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analyses of samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), indicate that metals, volatile organic compounds (VOC), and semivolatile organic compounds (SVOC) were detected in the environmental media sampled. To evaluate whether detected constituents pose an unacceptable risk to human health or the environment, analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan.

Five metals (aluminum, arsenic, chromium, iron, and manganese) were detected in surface/depositional and subsurface soils at concentrations exceeding SSSLs but within background concentrations or the range of background values. The PAH benzo(a)pyrene was detected at a concentration (0.31 milligrams per kilogram [mg/kg]) exceeding its SSSL (0.085 mg/kg) in one subsurface soil sample; benzo(a)pyrene was not detected in any of the other subsurface soil samples. Given the limited distribution and low concentration of benzo(a)pyrene, this compound is not expected to pose a threat to human health or the environment. Volatile organic compound concentrations in surface/depositional and subsurface soils were below SSSLs.

In groundwater, several metals were detected at concentrations exceeding SSSLs and background concentrations. The majority of these metals were present in samples that had high turbidity at the time of sample collection that likely influenced the results. Excluding the high-turbidity samples, the concentrations of six metals (aluminum, barium, iron, manganese, thallium, and vanadium) exceeded SSSLs and background concentrations. Naphthalene and

2-methylnaphthalene were detected at concentrations exceeding SSSLs in one groundwater sample located in an underground storage tank excavation area.

Currently, there is no established U.S. Environmental Protection Agency drinking water standard (maximum contaminant level) for either compound. The concentration of naphthalene (0.078 milligrams per liter [mg/L]) is well below its U.S. Environmental Protection Agency Lifetime Health Advisory (0.1 mg/L) and is not expected to induce adverse health effects. A health advisory value does not exist for 2-methylnaphthalene (detected at a concentration of 0.092 mg/L). The hazard index estimated from the SSSL (0.025 mg/L), however, is well below the threshold limit of 1, suggesting that adverse health effects are unlikely. It is concluded that exposure to the two VOCs in groundwater does not represent an unacceptable human health risk.

Several metals were detected in site media (primarily surface and depositional soils) at concentrations exceeding ESVs and background concentrations. In addition, four polynuclear aromatic hydrocarbons (PAH) (anthracene, benzo[a]pyrene, fluoranthene, and pyrene) were detected in one surface soil sample, and the SVOC bis(2-ethylhexyl)phthalate was detected in one surface water sample at concentrations exceeding ESVs. The concentrations of the four PAHs in the surface soil sample were below PAH background screening values.

The potential impact to ecological receptors is expected to be minimal, based on existing habitat and site conditions. The site is located in a well-developed portion of the Main Post. Viable ecological habitat is limited and is not expected to increase in the future land-use scenario. Consequently, the potential threat to ecological receptors is expected to be low.

Based on the results of the SI, past operations at 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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 with IT Corporation (IT) to perform the site investigation (SI) at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), under Contract Number DACA21-96-D-0018, Task Order CK05.

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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7).

1.1 Project Description

The 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), was identified as an area to be investigated prior to property transfer. The site was classified as a Category 7 site in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 sites are areas that are not evaluated and/or that require further evaluation.

A site-specific field sampling plan (SFSP) attachment (IT, 1998a) and a site-specific safety and health plan (SSHP) attachment were finalized in September 1998 to provide technical guidance for sample collection and analysis at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The SFSP and SSHP were used in conjunction with the installation-wide work plan (IT, 1998b) 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 four surface soil samples, two depositional soil samples, ten subsurface soil samples, fourteen groundwater samples, three sediment samples, and three surface water samples. Data from the field investigation were used to determine whether potential site-specific chemicals are present at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). The PAH background screening values were developed by IT at the direction of the BRAC Cleanup Team (BCT) to address the occurrence of PAH compounds in surface soils as a result of anthropogenic activities at FTMC. Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BCT 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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), is located in the central part of the Main Post at the intersection of 14th Avenue and 20th Street (Figures 1-1 and 1-2). The 11th Chemical Motor Pool Area, which covers approximately six acres, consists of three sites: Building 3299 (Parcel 29[7]), Building 3298 (Parcel 30[7]), and Building 3262 (Parcel 74[7]).

Building 3299 (Parcel 29[7]) is located in the southern part of the 11th Chemical Motor Pool Area. In 1953, a 10,000-gallon steel underground storage tank (UST) was installed at the site to store diesel fuel and was replaced in 1986 with a 10,000-gallon fiberglass UST.

Building 3298 (Parcel 30[7]) is located northeast of Building 3299. A 2,000-gallon steel waste oil UST was closed in place in 1994, and a new 2,500-gallon waste oil UST was installed nearby.

Building 3362 (Parcel 74[7]) is located in the central portion of the 11th Chemical Motor Pool Area, along the eastern fence line. The site consists of a vehicle washrack and an oil-water separator (OWS), originally constructed in 1953 and rebuilt in 1991.

Remount Creek is located approximately 90 feet east of the site and flows south to north across the eastern border of the site. A small tributary is located approximately 800 feet west of the parcel and drains into Remount Creek to the north. The parcel is located on a nearly flat, broad crest, which slopes gently to the east/northeast and lies at an elevation of approximately 750 to 760 feet above mean sea level. The parcel is approximately 220 feet wide (east to west) by 1,140 feet long (north to south) and is bounded on all sides by chain-link fence.

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 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. The 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), was identified as a Category 7 CERFA site: areas that are not evaluated or require further evaluation. Previous investigations conducted at the 11th Chemical Motor Pool Area are described in the following paragraphs.

Building 3299 (Parcel 29[7]). Building 3299 (Parcel 29[7]) is located in the southern part of the 11th Chemical Motor Pool Area (Figure 1-2). In 1953, a 10,000-gallon steel UST was installed at the site to store diesel fuel. The 10,000-gallon UST was located approximately 120 feet east of Building 3299, next to a chain-link fence (Figure 2-1). In 1986, the tank was removed and replaced with a new 10,000-gallon fiberglass UST. In November 1989, tank tightness tests revealed that the new UST was leaking. The tank was emptied and removed from service (Ecology & Environment, Inc. [E&E], 1991). Analysis of soil samples collected from borings in January 1990 by Aroclor Services, Inc. indicated total recoverable petroleum hydrocarbon (TRPH) concentrations ranging from 80 to 2,000 milligrams per kilogram (mg/kg) (E&E, 1991). The analytical results of the soil samples collected by Aroclor Services, Inc. were not available. The UST and surrounding soils were removed in 1990. At that time, four monitoring wells (MW5-1, MW5-2, MW5-3, and MW5-4) were installed by the USACE to determine if any contamination associated with the tank was present (ESE, 1998). During the installation of the four monitoring wells, soil samples were collected and analyzed for TRPH. TRPH concentrations in the soil samples ranged from 5.3 to 2,718 mg/kg. Subsurface soil samples collected from the soil borings at monitoring wells MW5-3 and MW5-4 had TRPH concentrations exceeding 100 mg/kg. The highest concentration of TRPH in soil (2,718 mg/kg) was detected in monitoring well MW5-4 at a depth of 5 to 6.5 feet below ground surface (bgs). Soil sample analytical results are presented in Table 2-1.

Soil samples collected from monitoring wells MW5-3 and MW5-4 were within five feet of the groundwater table. ADEM's *Corrective Action Limits for Petroleum Contaminated Soil* (Rule 335-6-15) specifies that soils exhibiting concentrations greater than 100 mg/kg within five feet of the groundwater table may require additional investigation and/or corrective measures. Consequently, E&E initiated a preliminary investigation in 1990.

During the preliminary investigation, groundwater samples were collected from the four monitoring wells and analyzed for volatile organic compounds (VOC), PAHs, and lead. The groundwater sample collected from monitoring well MW5-4 contained benzene at a concentration of 8.3 micrograms per liter (µg/L), which exceeded the ADEM and EPA maximum contaminant level of 5 µg/L. Benzene was detected at a concentration of 2.8 µg/L in the groundwater sample collected from monitoring well MW5-3. Lead was detected in groundwater samples collected from monitoring wells MW5-3 and MW5-4 at concentrations of

8.1 μg/L and 9.3 μg/L, respectively. PAHs were not detected in any of the groundwater samples collected.

Based on the preliminary investigation findings, a secondary investigation was recommended. The secondary investigation was performed by E&E (1992) to determine the lateral and vertical extent of soil and/or groundwater contamination, as outlined in ADEM Rule 335-6-15. During the investigation, three soil borings (B5-7, B5-10, and B5-11) and two additional monitoring wells (MW5-5 and MW5-6) were installed in January 1992. During the advancement of the soil borings and installation of the two monitoring wells, soil samples were collected and analyzed for TRPH. TRPH concentrations in the soil samples ranged from 34 to 47 mg/kg. TRPH was not detected in the soil samples collected during the installation of monitoring wells MW5-5 and MW5-6. The highest concentration of TRPH in soil (47 mg/kg) was detected in boring B5-11 at a depth of 2 to 3.5 feet bgs (E&E, 1992). Soil sample analytical results are presented in Table 2-2. Groundwater samples were collected from the four monitoring wells installed during the preliminary investigation (MW5-1, MW5-2, MW5-3, and MW5-4) and from monitoring wells MW5-5 and MW5-6. Benzene was detected in monitoring wells MW5-3 and MW5-4 at concentrations of 0.89 μg/L and 5.8 μg/L, respectively. Benzene concentrations in groundwater from the preliminary (1990) and secondary (1992) investigations are shown on Figure 2-2. Lead was detected in monitoring well MW5-6 at a concentration of 16 μg/L (E&E, 1992). The results of the preliminary and secondary field investigations indicated contaminant concentrations in groundwater and soil had decreased with time. Groundwater analytical data from the preliminary and secondary investigations are presented in Table 2-3.

On January 16, 1992, E&E collected two surface water samples (SW-51 and SW-52) from Remount Creek. One sample was collected immediately upstream of the site, and one sample was collected downstream of the site. The samples were analyzed for VOCs, PAHs, and lead. None of the parameters analyzed for was detected in either of the samples. The locations of the surface water samples are shown on Figure 2-2.

E&E recommended "No Further Action" based on continued use of the site as a motor pool; however, the BCT felt the site required further evaluation before transferring the property. Specifically, the BCT was concerned with the change in land use from a motor pool to residential classification.

Building 3298 (Parcel 30[7]). Building 3298 (Parcel 30[7]) is located northeast of Building 3299 (Figure 2-1). Approximately 150 feet northeast of Building 3298, positioned between two concrete truck ramps, is a 2,000-gallon steel waste oil UST (Figure 2-3). The 2,000-gallon UST was closed in place (filled with concrete) in May 1994 by Braun Intertec Corporation (Braun, 1995). A new 2,500 gallon waste oil UST was later installed about 30 feet to the southwest (Figure 2-3).

Four soil borings (one on each side) were advanced around the abandoned 2,000-gallon waste oil UST by Braun in April 1994 (Figure 2-4). Soil samples were collected at 7.5 feet bgs in each of the four soil borings and analyzed for total petroleum hydrocarbons (TPH) and total lead (Table 2-4). A fifth soil sample was collected from the south side of the tank at 5 feet bgs. The highest TPH concentration (775 mg/kg) was detected in the south soil sample (sample number 3298-S) at a depth of 5 feet bgs. Groundwater was not encountered during the UST closure, and groundwater sampling was not conducted at this site. According to the closure report, approximately 10 cubic yards of soil were removed from the tank excavation (Braun, 1995). A soil sample was collected from the excavated soil stockpile and analyzed for TPH and total lead. TPH was detected at a concentration of 2,900 mg/kg in the sample collected from the soil stockpile. The excavated soil was taken to an off-site landfill for disposal. During excavation activities, silty sand and clay were encountered at approximately 7.5 feet bgs. Shale bedrock was encountered from 7.5 to 15.5 feet bgs. The closure report concluded that a release had occurred on site; however, the vertical and horizontal extent of contamination in the soil had not been determined (Braun, 1995).

Building 3262 (Parcel 74[7]). Building 3262 (Parcel 74[7]) was built in approximately 1953 and originally had a vehicle washrack and associated baffle-type OWS. The facility was rebuilt in 1991 and now has a settling basin attached to a coalescing-plate OWS, which discharges to the sanitary sewer (ESE, 1998). The vehicle washrack is connected to the OWS by a concrete surface drain (Figure 2-3). The vehicle washrack and OWS were used until about September 1999.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), included the collection of surface and depositional soil samples, subsurface soil samples, surface water and sediment samples, and groundwater samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walkover and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analyses of site-related parameters listed in Section 3.3.

3.1.1 Surface and Depositional Soil Sampling

Surface soil samples were collected from four locations and depositional soil samples were collected from two locations at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Soil sampling locations and rationales 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 the upper 1 foot of soil with a 3-inch diameter stainless-steel hand auger using the methodology specified in Section 4.9 of the SAP (IT, 2000a). Depositional soil samples were collected from the upper 1 foot of soil with a stainless-steel trowel or spoon. Surface and depositional soil samples were collected by first removing surface debris, such as 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). Samples for VOC analyses were collected directly from the sampler with three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The samples were analyzed for the 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

Subsurface soil samples were collected from ten soil borings at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), as shown on Figure 3-1. Subsurface sampling locations and rationales 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 the sampling rationale, presence of surface structures, site topography, and buried and overhead utilities. IT contracted TEG, Inc., a direct-push technology subcontractor, to assist in subsurface soil sample collection.

Sample Collection. Subsurface soil samples were collected from soil borings at a depth greater than 1 foot bgs in the unsaturated zone. The soil borings were advanced and soil samples collected using the direct-push 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 3.3.

Subsurface soil samples were collected continuously to 12 feet bgs or until direct-push 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 analyses. Samples to be analyzed for VOCs were collected directly from the sampler with three EnCore samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Samples submitted for laboratory analyses are summarized in Table 3-2. The on-site geologist constructed a detailed boring log for each soil boring. The lithological log for each borehole is included in Appendix B.

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

3.1.3 Well Installation

Ten temporary wells were installed in the residuum groundwater zone at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), to collect groundwater samples for laboratory analysis. The well/groundwater sampling locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the wells installed at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The well construction logs are included in Appendix B.

Three of the temporary wells (FTA-29-GP01, FTA-29-GP04, and FTA-29-GP09) were installed by TEG, Inc. using direct-push technology. The direct-push temporary wells were installed by advancing a 2-inch outside diameter direct-push sampler to 12 feet bgs or until direct-push sampler refusal was encountered. The direct-push sampler was removed from the borehole, and a 5-foot length of 1-inch inside diameter (ID), 0.010-inch factory-slotted Schedule 40 polyvinyl chloride (PVC) screen with a 1-inch PVC end cap was placed at the bottom of the borehole and attached to 1-inch ID, flush-threaded Schedule 40 PVC riser. A number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was placed in the annular space of the borehole around the screen from the bottom of the borehole to approximately 1 foot above the top of the screen. A seal was created from the top of the filter sand to the ground surface by placing bentonite chips in the annular space and hydrating with potable water. Following groundwater sampling, the direct-push temporary wells were abandoned by removing the PVC riser and screen from the borehole, adding bentonite chips to ground surface, and hydrating with potable water. Well-abandonment procedures followed guidelines outlined in Appendix C of the SAP (IT, 2000a).

IT contracted Miller Drilling, Inc. to install the remaining temporary wells with a hollow-stem auger rig at the well locations shown on Figure 3-1. IT attempted to install the temporary wells at the locations where direct-push soil samples were collected. However, at locations where this was not possible because of rig access issues and overhead and underground utilities, the temporary well location was offset from the soil boring location. The soil sampling location was identified with "(SS)," and the associated temporary well location was identified with "(W)." The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000a). The boreholes at these locations were advanced with a 4.25-inch ID hollow-stem auger from ground surface to the first water-bearing zone in residuum at the well location. The borehole was augered to the depth of direct-push sampler refusal, and soil samples were collected from the depth of direct-push refusal to the bottom of the borehole. A 2-foot long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. Where split-spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered. The on-site geologist logging the auger boreholes at the site continued the detailed lithological log for each borehole from the depth of split-spoon refusal to the bottom of the auger borehole by logging the auger drill cuttings. The drill cuttings were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geologic and hydrogeologic information. The lithological log for each borehole is included in Appendix B.

Upon reaching the target depth, a 5- or 10-foot length of 2-inch ID, 0.010-inch machine-slotted, Schedule 40 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 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 chips, was placed immediately on top of the filter sand and hydrated with potable water. A locking well cap was placed on the PVC well casing. The temporary well surface completion included attaching plastic sheeting around the PVC riser using duct tape. Additionally, sand bags were used to secure the sheeting to the ground surface around the temporary well.

The 2-inch diameter temporary wells that were installed using hollow-stem augers 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 less than or equal to 20 nephelometric turbidity units (NTU) or until the well had been pumped dry and allowed to recharge repeatedly, or for a maximum of four hours. The well development logs for the 2-inch temporary wells are included in Appendix C.

3.1.4 Water Level Measurements

The depth to groundwater was measured in seven temporary wells and four existing wells at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), in March 2000 following procedures outlined in Section 4.18 of the SAP (IT, 2000a). Water level measurements were not taken at the direct-push wells (FTA-29-GP01, FTA-29-GP04, and FTA-29-GP09); these wells had been previously abandoned. Depth to groundwater was measured with an electronic water level meter. The meter probe and cable were cleaned before use at each well following decontamination methodology presented in Section 4.10 of the SAP (IT, 2000a). Measurements were referenced to the top of the PVC casing. A summary of groundwater level measurements is presented in Table 3-4. For the purpose of the SI, existing monitoring wells MW5-1 through MW5-6 (Figure 2-2) were redesignated FTA-29-MW01 through FTA-29-MW06, respectively.

3.1.5 Groundwater Sampling

Groundwater was sampled from ten temporary wells and four existing wells at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Well FTA-29-MW06 was not sampled as scheduled because the well was damaged by utilities workers prior to the groundwater sampling event. The well/groundwater sampling locations are shown on Figure 3-1. The groundwater sampling locations and rationales are listed in Table 3-1. The groundwater sample designations and QA/QC samples are listed in Table 3-5.

Sample Collection. Groundwater sampling was completed at the direct-push temporary well locations (FTA-29-GP01, FTA-29-GP04, and FTA-29-GP09) following methodology outlined in Section 4.7 of the SAP (IT, 2000a). At these locations, groundwater was sampled using a peristaltic pump equipped with Teflon™ tubing. Groundwater sampling was performed at the remaining temporary and existing monitoring well locations following procedures outlined in Section 4.9.1.4 of the SAP (IT, 2000a). Groundwater was sampled after purging a minimum three well volumes and after field parameters (including temperature, pH, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Purging and sampling were performed using either a submersible pump with Teflon tubing or a peristaltic pump with Teflon tubing. Field parameters were measured using a calibrated water quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.3.

3.1.6 Surface Water Sampling

Three surface water samples were collected from Remount Creek along the eastern boundary of the parcel to determine if site activities had impacted the creek. The surface water sample locations are shown on Figure 3-1. Surface water and sediment sampling was conducted in the following sequence: downstream surface water, downstream sediment, upstream surface water, and upstream sediment. This sampling sequence prevented possible cross-contamination caused by disturbing the sediment during sampling. The surface water sampling locations and rationales are listed in Table 3-1. The surface water sample designations are listed in Table 3-7. The sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. Surface water samples were collected in accordance with the procedures specified in Section 4.9.1.3 of the SAP (IT, 2000a). The samples were collected by dipping a stainless-steel pitcher in the water and pouring the water into the appropriate sample containers. The samples were collected after the field parameters described in Section 3.1.5 had been measured. Field parameters were measured using a calibrated water quality meter. The field parameter readings are presented in Table 3-6. 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 3.3.

3.1.7 Sediment Sampling

Three sediment samples were collected from Remount Creek at the same locations as the surface water samples presented in Section 3.1.6 (Figure 3-1). The sediment sampling locations and rationales are listed in Table 3-1. The sediment sample designations are listed in Table 3-7. The sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. Sediment samples were collected in accordance with the procedures outlined in Section 4.9.1.2 of the SAP (IT, 2000a). Samples were collected from the upper 0.5 foot of sediment with a stainless-steel spoon and placed in a stainless-steel bowl. Sediment to be analyzed for VOCs was immediately collected from the bowl using three EnCore samplers. The remaining portion of the sediment was 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 3-7 using methods outlined in Section 3.3.

3.2 Surveying of Sample Locations

New and existing sample locations (except FTA-29-MW01 and FTA-29-MW06) 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). Well FTA-29-MW06 was not surveyed because the well was damaged before surveying was completed. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum, 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.3 Analytical Program

Samples collected during the SI were analyzed for various physical and chemical properties. The specific suite of analyses performed was based on the potential site-specific chemicals historically at the site and EPA, ADEM, FTMC, and USACE requirements. Target analyses for samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7) included the following:

- Target compound list VOCs - EPA Method 5035/8260B
- 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 (sediment only)
- Grain size – American Society for Testing and Materials D421/D422 (sediment only).

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). 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. These packages were validated in accordance with EPA National Functional Guidelines by Level III criteria. A summary of validated data is included in Appendix E. The Data Validation Summary Report is included as Appendix F.

3.4 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 Chapter 5.0, Table 5-1, of Appendix B of the SAP (IT, 2000a). Sample documentation and chain-of-custody 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. Split samples were shipped to USACE South Atlantic Division Laboratory in Marietta, Georgia.

3.5 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000a). The IDW generated from the field sampling at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), was segregated as follows:

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

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, drill cuttings, spent well materials, and personal protective equipment generated during the SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), 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.

3.6 Variances/Nonconformances

This section describes the variances and nonconformances to the SFSP that occurred during completion of the SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7).

3.6.1 Variances

Three variances to the SFSP were recorded during completion of the SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The variances did not alter the intent of the investigation or the sampling rationale presented in Table 4-2 of the SFSP (IT, 1998a). The variances to the SFSP are summarized in Table 3-8 and included in Appendix G.

3.6.2 Nonconformances

There were not any nonconformances to the SFSP recorded during completion of the SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7).

3.7 Data Quality

The field sample analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and QAP; and standard, accepted methods and procedures. Sample collection logs pertaining to the collection of these samples were reviewed and organized for this report and are included in Appendix A. As discussed in Section 3.6, three variances to the SFSP were recorded during completion of the SI. However, the variances did not impact the usability of the data.

Data Validation. A complete (100 percent) Level III data validation effort was performed on the reported analytical data. Appendix F consists of a data validation summary report that was prepared to discuss the results of the validation. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System^{TM} database for tracking and reporting. The qualified data were used in the comparisons to the SSSLs and ESVs developed by IT. Rejected data (assigned an "R" qualifier) were not used in comparison to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), provided soil, bedrock, and groundwater data. These data were 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 appear to dominate the unit and consist primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consist of sandy and micaceous shale and silty, micaceous mudstone which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

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

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

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

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone 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 make 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 soil type at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), is classified as Montevallo. Montevallo soils are generally characterized by severely eroded, shaley silty clay soils developed from interbedded shale and fine-grained sandstone. These soils are formed either by erosional forces, surface runoff, or natural reworking processes. The high erosion hazard, low capacity for moisture, and thin root zone make this soil unsuitable for cultivation (U.S. Department of Agriculture, 1961).

The 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), is situated on the western boundary of the Ordovician window. Bedrock beneath the majority of the site is mapped as Ordovician-Mississippian Athens and Floyd Shales, undifferentiated. The contact of the Athens and Floyd Shales, undifferentiated, and the Little Oak and Newala Limestones, undifferentiated, is mapped along the southern perimeter of the parcel, roughly paralleling 20th Street (Osborne et al., 1997). Figure 4-1 is a site geologic map showing the bedrock units in the vicinity of the site.

Two geologic cross sections (A-A' and B-B') were constructed with boring log data from the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), and are presented on Figures 4-2 and 4-3. The geologic cross section locations are shown on Figure 3-1.

Cross section A-A' (Figure 4-2) depicts the subsurface units along a line trending southwest to northeast between borings FTA-29-GP08 and FTA-29-GP09. Residuum consisting primarily of clay and silt (with some gravel) was encountered along the cross section A-A'. Weathered shale was encountered below the clay unit in the two deeper wells depicted in cross section A-A'.

Cross section B-B' (Figure 4-3) depicts the subsurface units along a line trending southwest to northeast between borings FTA-29-GP06 and FTA-29-GP05. Residuum consisting primarily of clay was encountered along the entire length of cross section B-B'. A gravel lens was encountered along the cross section at a depth of 6 to 10 feet bgs. Weathered shale was encountered below the clay unit along the entire length of cross section B-B'.

4.2 Site Hydrology

4.2.1 Surface Hydrology

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

Remount Creek flows northward along the eastern boundary of the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The land surface of the site slopes to the east toward Remount Creek. Surface runoff in the immediate vicinity of the site is directed to Remount Creek by surface grading and storm drains. Surface water must also drain to the tributary noted on Figure 1-3.

4.2.2 Hydrogeology

During boring and well installation activities, groundwater was generally encountered in residuum near Remount Creek at depths of 5.5 to 10 feet bgs. Based on drill cuttings from temporary well locations on the western perimeter of the parcel, groundwater was encountered in the weathered shale at depths ranging from about 24 to 30 feet bgs.

Static groundwater levels were measured in temporary and existing monitoring wells on March 14, 2000. Table 3-4 summarizes static groundwater elevations at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). A groundwater elevation map was constructed from the March 2000 data, as shown on Figure 4-4. The groundwater elevation map shows that groundwater flow is to the east-northeast and discharges to Remount Creek. The hydraulic gradient across the site is approximately 0.06 foot per foot.

Static groundwater levels in temporary wells completed in residuum on the eastern perimeter of the parcel are about 3.5 to 7 feet above the depth that water was observed in the associated borings during SI drilling activities. In addition, static groundwater levels in temporary wells completed in weathered shale along the western perimeter of the parcel are about 20 to 22 feet above the depth that water was observed from drill cuttings during SI drilling activities. This suggests that groundwater has an upward hydraulic head in both residuum and weathered shale.

5.0 Summary of Analytical Results

The results of the chemical analyses of samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), indicate that metals, VOCs, and SVOCs have been detected in the various site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, detected constituent concentrations 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 the range of natural background concentrations. Summary statistics for background metals samples collected at FTMC (SAIC, 1998) are included in Appendix H. Additionally, SVOC concentrations in surface and depositional soils that exceeded the SSSLs and ESVs were compared to PAH background screening values, where available. The PAH background screening values were derived from PAH analytical data from 18 parcels at FTMC that were determined to represent anthropogenic activity (IT, 2000b). PAH background screening values were developed for two categories of surface soils: beneath asphalt and adjacent to asphalt. The PAH background screening values for soils adjacent to asphalt are the more conservative (i.e., lower) of the PAH background values and are the values used herein for comparison.

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 mg/kg, while Method 8270C has a RL of 0.330 mg/kg, which is typical for a soil matrix sample. Because of 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 5-5 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 and Depositional Soil Analytical Results

Four surface soil samples and two depositional soil samples were collected for chemical analyses at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Surface and depositional soil samples were collected from the upper 1 foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and background screening values (metals and PAHs), as presented in Table 5-1.

Metals. Eighteen metals were detected in surface and depositional soil samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The selenium results were flagged with a "B" data qualifier, indicating that the selenium was also detected in an associated laboratory or field blank. Sample location FTA-29-DEP01 contained all of the detected metals except cadmium.

Five metals (aluminum, arsenic, chromium, iron, and manganese) were detected at concentrations exceeding residential human health SSSLs. With the exception of iron (at two locations), the concentrations of these metals were within background concentrations. The iron results were within the range of background values (Appendix H).

The following 11 metals were detected at concentrations exceeding ESVs: aluminum, arsenic, beryllium, cadmium, chromium, iron, lead, manganese, selenium, vanadium, and zinc. Of these metals, the concentrations of beryllium (1 location), cadmium (2 locations), iron (2 locations), lead (1 location), selenium (2 locations), and zinc (4 locations) also exceeded background concentrations. With the exception of the beryllium and cadmium results, these metals concentrations were within the range of background values (Appendix H).

Volatile Organic Compounds. Twenty-nine VOCs were detected in surface and depositional soil samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Every detected VOC except trichlorofluoromethane was present in the sample from location FTA-29-DEP02. None of the remaining sample locations contained more than three of the detected VOCs, and all but two of these results were flagged with a "B" data qualifier, indicating that these compounds were also detected in an associated laboratory or field blank. With the exception of the methylene chloride result, the VOC analytical results at sample location FTA-29-DEP02 were flagged with a "J" data qualifier, signifying that the compounds were positively identified but the reported concentrations were estimated.

None of the detected VOCs was present at a concentration exceeding residential human health SSSLs or ESVs.

Semivolatile Organic Compounds. Fifteen SVOCs were detected in surface and depositional soil samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). All of the detected SVOCs were present in the sample collected at FTA-29-GP01; SVOCs were not detected at sample location FTA-29-GP02.

Two SVOCs (benzo[a]pyrene and dibenz[a,h]anthracene) were detected in one sample (FTA-29-GP01) at concentrations exceeding residential human health SSSLs but below PAH background screening values for soils adjacent to asphalt. Also at sample location FTA-29-GP01, the concentrations of four SVOCs (anthracene, benzo[a]pyrene, fluoranthene, and pyrene) exceeded ESVs but were below PAH background screening values.

5.2 Subsurface Soil Analytical Results

Ten subsurface soil samples were collected for chemical analysis at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The selenium results were flagged with a "B" data qualifier, signifying that selenium was also detected in an associated laboratory or field blank.

The concentrations of five metals (aluminum, arsenic, chromium, iron, and manganese) exceeded residential human health SSSLs. However, with the exception of aluminum (two locations) and manganese (one location), the concentrations of these metals were within background concentrations. The aluminum and manganese results were within the range of background values (Appendix H).

Volatile Organic Compounds. Thirteen VOCs were detected in subsurface soil samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The acetone and methylene chloride results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. In addition, acetone and/or methylene chloride were the only detected VOCs at six sample locations (FTA-29-GP03, FTA-29-GP04, FTA-29-GP06, FTA-29-GP07, FTA-29-GP09, and FTA-29-GP10). None of the other detected VOCs was present at more than one of the sample locations. Sample location FTA-29-GP02 contained nine of the thirteen detected VOCs.

None of the detected VOCs was present at a concentration exceeding residential human health SSSLs.

Semivolatile Organic Compounds. Seventeen SVOCs were detected in the sample collected at FTA-29-GP02. SVOCs were not detected at any of the other subsurface soil sample locations. The benzo(a)pyrene concentration (0.31 mg/kg) at one sample location (FTA-29-GP02) exceeded the residential human health SSSL (0.0851 mg/kg).

5.3 Groundwater Analytical Results

Fourteen monitoring wells were sampled at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), 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. Twenty-one metals were detected in groundwater samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Beryllium, cadmium, and selenium were detected at only one sample location (FTA-29-GP01). Mercury was detected at six locations, and thallium was detected at seven locations; however, the analytical results were flagged with a "B" data qualifier, signifying that these metals were also detected in an associated laboratory or field blank. Sample location FTA-29-GP01 contained all of the detected metals except thallium.

Thirteen metals (aluminum, arsenic, barium, beryllium, cadmium, cobalt, copper, iron, lead, manganese, vanadium, thallium, and zinc) were detected at concentrations exceeding both residential human health SSSLs and background concentrations. However, the majority of these metals were present in samples FTA-29-GP01 and FTA-29-GP05 that had elevated turbidity (greater than 1,000 NTUs) at the time of sample collection. As shown in Table 3-6 and in the purge records in Appendix A, the groundwater samples collected at sample locations FTA-29-GP01 and FTA-29-GP05 had markedly higher turbidity than samples collected at the other locations. Sample location FTA-29-GP01 contained twelve of the thirteen detected metals exceeding both SSSLs and background concentrations. Sample location FTA-29-GP05 contained seven of the thirteen metals exceeding SSSLs and background concentrations.

Based on the results of a groundwater resampling effort conducted by IT at FTMC to evaluate the effects of turbidity on the concentrations of metals in groundwater, high turbidity at the time of sample collection results in elevated concentrations of metals (IT, 2000c). The resampling effort demonstrated that the concentrations of most metals in the lower turbidity samples were significantly lower than in the higher turbidity samples (Appendix I).

This correlation indicates that suspended particulates contributed to the total concentration of metals detected in the groundwater samples collected at FTA-29-GP01, FTA-29-GP05, and FTA-29-GP06. Excluding the three high turbidity samples, the concentrations of six metals exceeded both SSSLs and background concentrations: aluminum (one location), barium (eight locations), iron (five locations), manganese (six locations), thallium (five locations), and vanadium (three locations). The thallium results were flagged with a "B" data qualifier, signifying that thallium was also detected in an associated laboratory or field blank.

Volatile Organic Compounds. Twenty-seven VOCs were detected in groundwater samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Chlorobenzene (FTA-29-MW05), 1,2,3-trichlorobenzene (FTA-29-MW04), 1,2,-dichloropropane (FTA-29-GP05), 1,4-dichlorobenzene (FTA-29-MW05), 2-butanone (FTA-29-GP04), cis-1,2-dichloroethene (FTA-29-MW05), and hexachlorobutadiene (FTA-29-MW04) were each detected in only one of the samples. VOCs were not detected at five sample locations (FTA-29-GP03, FTA-29-GP06, FTA-29-GP07, FTA-29-GP08, and FTA-29-GP10). Sample locations FTA-29-MW04, FTA-29-MW03, and FTA-29-GP02 contained 19, 12, and 11, respectively, of the 27 detected VOCs.

Naphthalene was the only VOC detected at a concentration (0.078 mg/L) exceeding the residential human health SSSL (0.003 mg/L), at one sample location (FTA-29-GP02).

Semivolatile Organic Compounds. Ten SVOCs were detected in groundwater samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Phenol and/or di-n-butyl phthalate were the only detected SVOCs at eight sample locations (FTA-29-GP01,

FTA-29-GP03, FTA-29-GP04, FTA-29-GP05, FTA-29-GP06, FTA-29-GP07, FTA-29-GP09, and FTA-29-GP10). The phenol results were flagged with a "B" data qualifier, signifying that the compound was also detected in an associated laboratory or field blank. Dibenzofuran (FTA-29-GP02), 1,4-dichlorobenzene (FTA-29-MW05), 2-methylnaphthalene (FTA-29-GP02), bis(2-ethylhexyl)phthalate (FTA-29-MW02), and phenanthrene (FTA-29-GP02) were each detected in only one of the samples. Sample location FTA-29-GP02 contained six of the ten detected SVOCs.

Two SVOCs (2-methylnaphthalene [0.092 mg/L] and naphthalene [0.049 mg/L]) were detected at concentrations exceeding residential human health SSSLs at one sample location (FTA-29-GP02).

5.4 Surface Water Analytical Results

Three surface water samples were collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), 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. Aluminum, calcium, iron, magnesium, and manganese were detected in unfiltered surface water samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7).

None of the detected metals was present at a concentration exceeding its recreational site user human health SSSL. The concentrations of aluminum (one location) and manganese (two locations) exceeded ESVs but were within background concentrations.

Volatile Organic Compounds. Acetone, bromodichloromethane, and chloroform were detected in surface water samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The acetone and chloroform results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. Bromodichloromethane was detected only at sample location FTA-29-SW/SD01, and the analytical result was flagged with a "J" data qualifier, signifying that the compound was positively identified but the reported value is an estimated concentration.

None of the detected VOCs was present at a concentration exceeding its recreational site user human health SSSL or ESV.

Semivolatile Organic Compounds. Phenol and bis(2-ethylhexyl)phthalate were detected in surface water samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The phenol analytical results were flagged with a "B" data qualifier, signifying that phenol was also detected in an associated laboratory or field blank. Bis(2-ethylhexyl)phthalate was detected only at sample location, FTA-29-SW/SD02, and the analytical result was flagged with a "J" data qualifier, signifying that the result was estimated.

The phenol and bis(2-ethylhexyl)phthalate concentrations were below recreational site user human health SSSLs. The bis(2-ethylhexyl)phthalate concentration exceeded the ESV at sample location FTA-29-SW/SD02.

5.5 Sediment Analytical Results

Three sediment samples were collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). Samples were collected from the upper 0.5 foot of sediment at the sample 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. Sixteen metals were detected in sediment samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). None of the detected metals was present at a concentration exceeding SSSLs. The concentrations of arsenic (FTA-29-SW/SD01), copper (FTA-29-SW/SD01), and lead (two locations) exceeded ESVs. However, with the exception of the copper result, these metals concentrations were within background concentrations. The copper result was within the range of background values (Appendix H).

Volatile Organic Compounds. Four VOCs, including 2-butanone, acetone, methylene chloride, and naphthalene, were detected in the sediment samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The acetone and methylene chloride results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. Naphthalene (FTA-29-SW/SD02) and 2-butanone (FTA-29-SW/SD01) were each detected in only one of the sediment samples.

None of the detected VOCs was present at a concentration exceeding SSSLs or ESVs.

Semivolatile Organic Compounds. The SVOC bis(2-ethylhexyl)phthalate was detected at sample location FTA-29-SW/SD03 at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7). The analytical result was flagged with a "J" data qualifier, signifying that the result was estimated. The bis(2-ethylhexyl)phthalate concentration was below the SSSL and ESV.

Total Organic Carbon. Three sediment samples were collected and analyzed for TOC content. TOC content ranged from 2,450 to 5,020 mg/kg. TOC results can be found in Appendix E.

Grain Size. Grain size distribution was determined in each of the three sediment samples collected. Grain size results can be found in Appendix E.

6.0 Summary, Conclusions, and Recommendations

IT, under contract with USACE, completed an SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), at FTMC, Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7) and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), consisted of the sampling and analysis of four surface soil samples, two depositional soil samples, ten subsurface soil samples, fourteen groundwater samples, and three surface water and sediment samples. In addition, ten temporary monitoring wells were installed in the residuum groundwater zone to facilitate groundwater sample collection and provide site-specific geological and hydrogeological characterization information.

Chemical analyses of samples collected at the 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7), indicate that metals, VOCs, and SVOCs were detected in the environmental media sampled. Analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metals concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998), and SVOC concentrations exceeding SSSLs and ESVs in surface and depositional soils were compared to PAH background screening values, where available (IT, 2000b).

Five metals (aluminum, arsenic, chromium, iron, and manganese) were detected in surface/depositional and subsurface soils at concentrations exceeding SSSLs but within background concentrations or the range of background values (SAIC, 1998). The PAH benzo(a)pyrene was detected at a concentration (0.31 mg/kg) exceeding its SSSL (0.085 mg/kg) in one subsurface soil sample (FTA-29-GP02); benzo(a)pyrene was not detected in any of the other subsurface soil samples. Given the limited distribution and low concentration of benzo(a)pyrene, this compound is not expected to pose a threat to human health or the environment. VOC concentrations in surface/depositional and subsurface soils were below SSSLs.

In groundwater, several metals were detected at concentrations exceeding SSSLs and background concentrations. The majority of these metals were present in samples that had high-turbidity at the time of sample collection that likely influenced the results. Excluding the high turbidity samples, the concentrations of six metals (aluminum, barium, iron, manganese, thallium, and vanadium) exceeded SSSLs and background concentrations. Naphthalene and 2-methylnaphthalene were detected at concentrations exceeding SSSLs in one groundwater sample located in an underground storage tank excavation area.

Currently, there is no established EPA drinking water standard (maximum contaminant level) for either compound. The concentration of naphthalene (0.078 mg/L) is well below its EPA Lifetime Health Advisory (0.1 mg/L) (EPA, 2000) and is not expected to induce adverse health effects. A health advisory value does not exist for 2-methylnaphthalene (detected at a concentration of 0.092 mg/L). The hazard index estimated from the SSSL (0.025 mg/L), however, is well below the threshold limit of 1, suggesting that adverse health effects are unlikely. It is concluded that exposure to the two VOCs in groundwater does not represent an unacceptable human health risk.

Several metals were detected in site media (primarily surface and depositional soils) at concentrations exceeding ESVs and background concentrations. In addition, four PAHs (anthracene, benzo[a]pyrene, fluoranthene, and pyrene) were detected in one surface soil sample and the SVOC bis(2-ethylhexyl)phthalate was detected in one surface water sample at concentrations exceeding ESVs. The concentrations of the four PAHs in the surface soil sample were below PAH background screening values.

The potential impact to ecological receptors is expected to be minimal, based on existing habitat and site conditions. The site is located in a well-developed portion of the Main Post. Viable ecological habitat is limited and is not expected to increase in the future land-use scenario. Consequently, the potential threat to ecological receptors is expected to be low.

Based on the results of the SI, past operations at 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(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. There, IT recommends "No Further Action" and unrestricted reuse at 11th Chemical Motor Pool Area, Parcels 29(7), 30(7), and 74(7).

7.0 References

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