atlanta testing & engineering

CORRECTIVE ACTION PLAN
FINAL SUBMITTAL
HUNTER ARMY AIRFIELD
BUILDING 710 AREA
CONTRACT DACA21-91-D-0001
JOB NO. 10675

DOCUMENT 2

CORRECTIVE ACTION PLAN

FINAL SUBMITTAL
HUNTER ARMY AIRFIELD
BUILDING 710 AREA
CONTRACT DACA21-91-D-0001
JOB NO. 10675

Corrective Action Plan Certification

I hereby certify that: this plan and all attachments have been prepared in accordance with EPD's "Requirements for Underground Storage Tank Release: Corrective Action Plan Content"; the information submitted is true, accurate and complete; and the plan satisfies all the criteria and requirements of Rule 391-3-15-.09 of the Georgia Rules for Underground Storage Tank Management.

_____

Signature (Owner/Operator)

CORRECTIVE ACTION PLAN
BUILDING NO. 710 AREA
CONTRACT NO. DACA21-91-D-0001
JOB NO. 10675

TABLE OF CONTENTS

LIST OF APPENDICES

APPENDICES

1.0 EXECUTIVE SUMMARY

In March, 1990, Tracer Research Corporation performed leak tests on two of four underground storage tanks (USTs) located at Building 710 at Hunter Army Airfield (HAAF) in Savannah, Georgia. These tests indicated that a 12,000-gallon diesel tank was leaking. Prior to the leak tests, a 10,000-gallon diesel tank was condemned in 1988 because it contained mud and water and thus was thought to be leaking. Based on this information, a preliminary contamination assessment (a shallow soil gas survey) was conducted by Tracer Research Corporation. Results of this investigation indicated that soils in the vicinity of the USTs had been impacted by the leak.

To further evaluate the vertical and horizontal extent of contamination, soil borings and monitor wells were installed and samples were collected by the U.S. Army Corps of Engineers (COE). Results of samples collected and observations made indicated that approximately 700 cubic yards of soil have possibly been highly contaminated and that phase separated product is floating on the groundwater surface. Also, dissolved hydrocarbons appear to be present in the groundwater.

Since contamination exists, a water system survey was conducted by Atlanta Testing & Engineering (AT&E) to determine required corrective action. In accordance with Rule 391-3-15-.09 of the Georgia Rules for UST Management, the extent of corrective action required is based on the location of the hydrocarbon plume with respect to nearby water withdrawal systems and surface water bodies. Based on this survey, it was determined that water withdrawal systems and surface water bodies exist within three miles of the site. However, the water withdrawal systems are all wells that receive water from aquifers other than the surficial aquifer and, therefore, are not hydraulically interconnected with the contaminant plume.

Based on these findings, it was proposed that the four USTs be removed. The contaminated soil plume will be excavated and phase separated product will be recovered during tank removal. Confirmatory soil samples will be collected and analyzed and one monitor well will be installed in the area of the former plume to evaluate the efficiency of the remedial action.

The nearest public withdrawal system within HAAF is less than 150 feet away from the contaminant plume. While this well is upgradient and not hydraulically interconnected with the contaminated plume, a confirmatory sample of the groundwater will be collected and analyzed.

Two lakes are located near the site. One lake is located just outside the HAAF's boundaries approximately 0.5 miles downgradient of the contaminated plume. The other lake is located within HAAF approximately 1,200 feet southwest and crossgradient of the contaminated plume. The dissolved hydrocarbon plume movement will be monitored to evaluate potential impacts to the water quality of the lake.

2.0 INTRODUCTION

2.1 FACILITY INFORMATION

The Corrective Action Plan (CAP) has been prepared in general accordance with Rule 391-3-15-.09 of the Georgia Rules for UST Management and "Requirements for Underground Storage Tank (UST) Release: CAP Content:" guidance document, dated July, 1991. The CAP will address the cleanup of subsurface impacts caused by leaking USTs containing diesel and gasoline at Building 710 at HAAF in Savannah, Georgia.

The subject facility and parties associated with the environmental activities being conducted at the site are presented below:

Location Name:	Building 710 Area
Location Address:	Hunter Army Airfield (HAAF) Savannah, Georgia 31409-5026 (912) 652-5675
Location County:	Chatham
Facility Contact:	Commander, 24th Infantry Division (Mech) and Fort Stewart Fort Stewart, Georgia 31314-5000 Directorate of Engineering and Housing (DEH), Environmental Office (AFZP-DEV) (912) 767-2010 Attention: Mr. Thomas D. Houston, Rep.
On-Site Environmental Consultant:	U. S. Army Corps of Engineers (COE) Savannah District 100 W. Oglethorpe Avenue Savannah, Georgia 31402-0889 (912) 944-5675 Attention: Ms. Toni F. Nicholson
Environmental Report Consultant:	Atlanta Testing & Engineering (AT&E) 11420 Johns Creek Parkway Duluth, Georgia 30136 (404) 476-3555 Attention: Mr. Gregory R. Fischer, P.G. Ga. Reg. No. 633

Gregory R. Fischer 4/1/93
Signature

2.2 FACILITY DESCRIPTION

2.2.1 Location and Physiographic Setting

The Building 710 area, the project site, is located on the southeast corner of Douglas Street and the railroad crossing of HAAF in Savannah, Georgia. The location of HAAF is shown on Plate 1 and the site location within HAAF is shown on Plate 2 in Appendix A.

The project site is located in the Coastal Plain Province of Georgia near the coast and toward the northern end of the Barrier Island Sequence District. Area topography consists of step-like terraces with decreasing altitudes toward the Atlantic Ocean (Clark and Zisa, 1976). As shown on Plate 3, the land immediately surrounding the site is relatively flat, with elevation ranging from approximately 18 feet above mean sea level (msl) to 20 feet msl. Surface drainage across the site is directed to a storm drain located at the northwest corner of the site.

Surface water features in the area include small lakes, rivers and streams. Numerous small lakes are outside HAAF located in an area northwest of the site. The closest of these lakes is approximately 0.5 miles away. Hallstrom Lake is within HAAF and is located approximately 2.5 miles southeast of the project site. Salt Creek, a tributary of Little Ogeechee River is approximately 4 miles to the west and flows into the Little Ogeechee River to the south. Hayner's Creek, the headwaters to Vernon River, is located approximately 4 miles to the east and flows to the south.

2.2.2 Former Facility Operations

Building 710 formerly housed the base motor pool. The project site consisted of one building (710) for operators, four USTs and three pump islands. The USTs are approximately 45 years old and are constructed of steel. The two 10,000-gallon tanks which were installed around 1940, held diesel and gasoline and were managed by the 260th Quartermaster Battalion (QMBN). The two 12,000-gallon tanks, which were installed around 1941, held diesel and gasoline, and were managed by the Transportation Motor Pool. Plate 3 is a Site Plan showing the features described.

In 1988, the Directorate of DEH condemned and prohibited the use of the 260th QMBN (10,000-gallon) diesel tank because it contained a large quantity of mud and water. At this time, the 260th QMBN ceased using the other 10,000-gallon tank. The other two tanks were in operation until 1990, when it was determined that the 12,000-gallon diesel tank was leaking. At this time, the Transportation Motor Pool ceased using the other 12,000-gallon tank. Presently, the tanks are empty and the Transportation Motor Pool and the 260th QMBN are operating at other locations.

2.3 RELEASE CONFIRMATION AND INITIAL RESPONSE

As stated earlier, large amounts of mud and water were being pumped from the 10,000-gallon diesel tank in 1988. At this time, it was recommended by DFH that the two 10,000-gallon USTs be removed and that a site assessment be performed to determine the extent of contamination. It was also recommended that the two 12,000-gallon USTs be tested for leaks.

In March 1990, the COE retained the Tracer Research Corporation to perform the Tracer Tight ™ Leak Test on the two 12,000-gallon USTs. The Tracer Tight method consists of introducing into the tank a very volatile tracer. Soil gas probes are then used to obtain vapor samples. If the tracer is detected, then the tank is considered to be leaking. Using this method it was determined that the 12,000-gallon diesel UST has a small or intermittent product leak of less than 0.05 gallons per hour. Hydrocarbons were also detected in the soil gas at concentrations ranging from 310,000 to 1,200,000 micrograms per liter (µg/l). A more detailed description of the methodology used and the Tracer Tight ™ Leak Test Report are included in Appendix C-1.

Based on the results of the Tracer Tight ™ Leak Test and observations made in 1988, a shallow soil gas survey was conducted by Tracer Research Corporation in July, 1990, to determine the extent of contamination. In summary, 11 soil gas probes were used to collect soil gas samples in the vicinity of Building 710 and the tank pit. Samples were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total hydrocarbon. All samples collected had elevated concentrations that ranged from 4.2 to 5,500 µg/l total BTEX and 9 to 180,000 µg/l total hydrocarbons. Based upon these findings, it was determined that the hydrocarbon plume extended at least 100 feet in all directions from the northwest corner of Building 710. The Shallow Soil Gas Investigation Report is included in Appendix C-2.

Based on the results of the soil gas survey, soil borings and monitor wells were placed to further assess the vertical and horizontal extent of contamination. The contamination assessment methodology and findings are discussed in Sections 3.0 through 5.0.

2.4 PURPOSE AND SCOPE

Based on the results of the soil gas survey, the objective of the environmental program is to complete the following objectives:

- Remove the source of contamination;
- Assess the vertical and horizontal extent of hydrocarbon contamination in the soils adjacent to the pump island and petroleum USTs;
- Assess potential hydrocarbon impact to groundwater in the vicinity of the USTs; and
- Prepare a CAP as required by the Environmental Protection Division (EPD).

The work scope required to meet the environmental program objectives consists of the following principal components:

- UST removal:
- Installation of Soil Borings and Monitoring Wells;
- Elevation Survey/Liquid Level Measurements;

- Area and Site Hydrogeology Evaluation;
- Area Groundwater Utilization Evaluation;
- Soil and Groundwater Quality Analysis; and
- Removal of Contaminated Soil and Liquid Hydrocarbons.

Data gathering activities such as the installation of soil borings and monitor wells, the collection of liquid level measurements and laboratory analytical results are discussed in Section 3.0. Area and site hydrogeology and groundwater utilization are discussed in Section 4.0. The extent of contamination based on analytical results and aquifer properties is discussed in Section 5.0 and the CAP and its requirements are discussed in Sections 6 through 10.

2.5 SEQUENCE OF ENVIRONMENTAL INVESTIGATIONS

The following is a list of work completed.

Date		Work Completed
Dec. 1989	-	Completed auger boring (Boring T-1 (A-3) next to tanks to be leak tested using the Tracer (vapor monitoring) Method. Purpose of this boring was to determine if soil in backfill zone were sufficiently porous to allow this type of leak detection method to work. The drilling log and Hazardous and Toxic Waste (HTW) Log for Boring T-3 (A-3) are in Appendix C-3.
March 1990	-	Tanks leak tested by Tracer Research Corporation. Report completed and included in Appendix C-1.
July 1990	-	Shallow Soil Gas Investigation conducted by Tracer Research Corporation. Report completed and included in Appendix C-2.
March 1991	-	Completed topographic survey of site by Savannah District COE.
May 1991	-	Installed monitor wells MW-1, MW-3 through MW-6, MW-10 and MW-11 and drilled soil borings A-1 through A-7 and A-9 through A-11. Collected soil and groundwater samples to be analyzed by EPA Methods 8020 or 602, 418.1 and for lead. Conducted headspace tests on soils with organic vapor analyzer (OVA).
August 1991	-	The COE retained AT&E under A-E Contract No. DACA21-91-D-0001 to prepare a Corrective Action Plan.

3.0 METHODS OF INVESTIGATION AND STATEMENT OF RESULTS

3.1 DRILLING AND WELL INSTALLATION

To further assess the vertical and horizontal extent of hydrocarbon contamination in the soils and the potential impact to groundwater, soil borings and monitor wells were installed in the vicinity of the USTs. The following sections discuss the installation of soil borings (Section 3.1.1) and monitor wells (3.1.3) as well as the screening of soil for organic vapors during these installations (3.1.2).

3.1.1 Soil Borings

From May 1 through 14, 1991, 19 soil borings (MW-1, MW-3 through MW-8, MW-10, MW-11, A-1 through A-7, and A-9 through A-11) were installed at the site by the COE. Nine of these borings (MW-1, MW-3 through MW-8, MW-10 and MW-11) were completed as monitor wells. Soil boring and monitor well locations are shown on Plate 4. Soil boring construction data are summarized in Table 1 in Appendix B. Details regarding boring/well construction and soil descriptions are included in the drilling logs in Appendix D-1.

All borings were installed using 3.5 inch diameter hand augers. Borings MW-1, MW-3 through MW-8, MW-10, MW-11 and A-11 were extended further with a drill rig using 4.25 inch inner diameter hollow stem augers. Boring depths ranged from 5 feet below land surface (fbls) in A-2 and A-3 to 12.5 fbls in MW-4 with an average depth of 8.2 fbls. Initial water level depths ranged from 3.10 fbls in MW-5 to 6.41 in A-4 with an average depth of 4.28 fbls. Water levels after 24 hours ranged from 2.15 fbls in A-9 to 4.40 fbls in A-5 with an average depth of 3.58 fbls. Locations of the borings were surveyed by the COE for horizontal and vertical control. Land surface elevations ranged from 18.08 feet msl at A-9 and A-11 to 21.05 feet msl at MW-6 with an average elevation of 18.93 feet msl across the site.

3.1.2 Soil Organic Vapor Screening, Headspace Analysis

In order to preliminarily assess potential hydrocarbon impacts to soil, soil samples were collected during drilling and screened in the field for organic vapors. Soil samples were collected with a hand auger from land surface to a few feet below the water's surface at approximately 1-foot centers. Samples were then placed in a jar, filling it half full. A sheet of aluminum foil was placed over the jar before closing the jar lid. This foil was later pierced with the OVA probe to take a headspace reading.

Results of the headspace analyses are presented in the HTW Boring Logs in Appendix D-2 and summarized in Table 2. As shown on Table 2, maximum organic vapor concentrations of greater than 1000 parts per million (ppm) were detected in Borings MW-1, MW-4, MW-7, MW-8, A-5 and A-6, between 150 ppm and 740 in MW-11, A-1, A-4, A-11; and between 0 ppm to 25 ppm in MW-3, MW-5, MW-6, MW-10, A-2, A-7, A-9, A-10, in at least one sample interval.

3.1.3 Well Installation

As mentioned in Section 3.1.1, nine soil borings (MW-1, MW-3 through MW-8, MW-10 and MW-11) were completed as monitor wells. All monitor wells consist of 2-inch diameter PVC casings and screens, are finished below grade and protected by manhole structures. Monitor Wells MW-1 and MW-3 consist

of 4 feet of 0.010-inch slotted screen, MW-4 consists of 9 feet of 0.010-inch slotted screen, and Monitor Wells MW-5 through MW-8, MW-10 and MW-11 consist of 6.75 feet of 0.010-inch slotted screen. Screens were placed to bracket the liquid interface. Sand filter packs were placed in the annulus space from the bottom of the wells to approximately 1 foot above the top of the screen, then sealed with approximately 0.5 feet of bentonite in all wells. Remaining annulus space was then filled with concrete. Well locations were surveyed by the COE for horizontal and vertical control. Well construction details are presented in Appendix D-1 and summarized on Table 3.

3.2 LIQUID LEVEL MEASUREMENTS

To evaluate the presence of phase separated product and the direction of groundwater flow, liquid level measurements were taken by the COE on August 29, 1991. Water level measurements were taken with an electric tape and the presence of phase separated product was visually checked by collecting a sample at the liquid interface with a clear bailer.

Depth to water ranged from 2.31 feet below top of casing (BTOC) in MW-11 to 3.86 feet BTOC in MW-1 with an average depth of 3.04 feet BTOC. Phase separated product was observed in one well (MW-1) at a thickness of 0.61 feet. A summary of fluid level measurements is presented in Table 4.

3.3 HYDRAULIC CONDUCTIVITY TESTS

To evaluate the surficial aquifer's ability to horizontally transmit water, hydraulic conductivity of the soil is required. The hydraulic conductivity is expressed as the volume of water that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow (Heath, 1987).

To calculate the hydraulic conductivity, the COE conducted slug tests on September 5, 1991 in seven monitor wells (MW-1, MW-4 through MW-8, and MW-11). The methodology used, calculations and results of these tests are described in detail in Appendix E. The values of hydraulic conductivity calculated ranged from 0.9×10^{-3} feet per minute (fpm) in MW-11 to 3.1×10^{-3} fpm in MW-5 and averaged 1.9×10^{-3} fpm. The hydraulic conductivity data is summarized in Table 5.

3.4 ENVIRONMENTAL SAMPLING AND ANALYSIS

To quantitatively evaluate hydrocarbon impact to the soil and groundwater, selected soil samples and a groundwater sample from each well were analyzed for gasoline constituents - BTEX, TPH and in some cases lead, by Savannah Laboratories and Environmental Services, Inc. of Savannah, Georgia. Soil and groundwater samples were shipped to the laboratory with proper chain of custody documentation. Laboratory analytical reports and chain of custody documentation are included in Appendix F.

3.4.1 Soils

Selected soil samples collected during drilling were analyzed for BTEX and TPH by EPA Methods 8020 and 418.1, respectively. Soil samples MW-710-1-1, MW-710-3-1, MW-710-4-1, MW-710-6-1, and A-5-1 were also analyzed for lead. Soil Sample A-5-1 was analyzed on two separate occasions. The second A-5-1 soil sample was obtained by drilling next to the original A-5 boring with a hand auger. The intent

was to collect a soil sample for lead analysis only. A summary of soil quality data including date of sample collection, sample interval, OVA readings, and quantitative results are presented in Table 6.

Total BTEX concentrations ranged from below detection limits in samples MW-710-3-1, MW-710-5-1, MW-7-1-C, MW-10-1, MW-11-1, A-1-1, A-2-1, A-3-1, A-4-1, A-4-2, A-5-1, A-7-1, A-8-1, A-10-1, MW-9-1, and MW-9-2 to 8,050 ppm in MW-710-1-1. Of the seven remaining samples, only MW-710-2-1 had a total BTEX concentration (10.9 ppm) that exceeded 10 ppm.

TPH concentrations ranged from below detection limits in A-2-1 to 25,000 ppm in MW-710-1-1. TPH concentrations in MW-7-1 (990 ppm) and MW-710-2-1 (1,400 ppm) exceeded 500 ppm and TPH concentrations in MW-8-1 (310 ppm) exceeded 100 ppm. In the remaining 19 samples, TPH concentrations ranged from 12 ppm in A-4-1 to 64 ppm in MW-10-1.

Five soil samples were analyzed for lead. Lead concentrations range from 3.4 ppm in MW-710-3-1 to 18 ppm in A-5-1.

3.4.2 Groundwater

On May 29, 1991, groundwater samples were collected from all nine monitor wells and analyzed for BTEX and TPH by EPA Methods 602 and 418.1, respectively. A duplicate sample (MW-7-1C) was also collected from MW-7. Groundwater samples MW-1-1, MW-4-1, and MW-6-1 were also analyzed for lead. A summary of groundwater quality data is presented in Table 7.

Benzene concentrations ranged from below detection limits in MW-5-1, MW-6-1, MW-7-1, MW-7-1C, and MW-10-1 to 5,200 parts per billion (ppb) in MW-1-1. In the remaining four samples, benzene concentrations ranged from 9.2 ppb in MW-11-1 to 600 ppb in MW-4-1.

Total BTEX concentrations ranged from below detection limits in MW-5-1, MW-7-1, MW-7-1C, and MW-10-1 to 48,000 ppb in MW-1-1. In the remaining five samples, total BTEX concentrations ranged from 1.5 ppb in MW-6-1 to 801.8 ppb in MW-4-1.

TPH concentrations ranged from below detection limits in Samples MW-3-1, MW-4-1, MW-5-1, MW-6-1, MW-7-1C, MW-10-1, and MW-11-1 to 55 ppm in MW-1-1. Of the remaining two samples, TPH concentrations were less than 3.0 ppm.

Three groundwater samples were analyzed for lead. Lead concentrations ranged from below detection limits in MW-4-1 and MW-6-1 to 0.038 ppm in MW-1-1.

4.0 REGIONAL AND SITE HYDROGEOLOGY

4.1 REGIONAL HYDROGEOLOGY

4.1.1 Geology

This site is located in the Coastal Plain of Georgia and is approximately 18 miles west of the Atlantic Coast. Geologic formations underlying the coastal plain in this area consist of unconsolidated sand and clay, limestone and dolomite, and were deposited during the Late Cretaceous Period to the Quaternary Period (Holocene Epoch). A generalized hydrogeologic stratigraphic column is presented in Plate 5. A general discussion of the units is presented below.

4.1.1.1 Undifferentiated Surficial Sand

The undifferentiated surficial sand of late to Pleistocene to Holocene age occurs at the top of local geologic features and underlies local soil profiles. These deposits consist of massive-bedded, structureless, well to moderately-sorted, fine- to medium-grained, white to buff colored sand and range in thickness of 0 to 10 feet (Huddlestun, 1988).

4.1.1.2 Undifferentiated Alluvial Deposits

The undifferentiated alluvial deposits of Pleistocene age occur throughout the drainage systems of the Coastal Plain and consist of modern floodplain deposits and river terrace deposits. These deposits are predominantly sand with a little clay and range in thickness of 20 to 50 feet (Huddlestun, 1988).

4.1.1.3 Cypresshead Formation

The undifferentiated surficial sands and alluvial deposits are underlain by the Cypresshead Formation of early Pleistocene age. The Cypresshead Formation generally consists of quartz sand with prominent clay beds in some down dip areas. Two lithofacies are dominant in this unit. The up dip facies generally consist of fine- to coarse-grained well to poorly sorted sand with scattered gravel stringers. The down dip facies generally consist of fine-grained, well sorted sand with thin layers of clay. The Cypresshead Formation disconformably overlies the Coosawhatchie Formation of the Hawthorn Group (Huddlestun, 1987).

4.1.1.4 Hawthorn Group

The Cypresshead Formation is underlain by the Hawthorn Group of Miocene age. The Hawthorn Group generally consists of a basal calcareous unit, a middle clastic unit, and an upper unit that is a mixture of clastic and carbonate rocks (Miller, 1986). The Hawthorn Group has been divided into three formations, Coosawhatchie Formation, Markshead Formation, and the Parachula Formation, listed here from youngest to oldest (Huddlestun, 1987).

The Coosawhatchie Formation is composed predominantly of clay, but also has sandy clay, argillaceous sand, and phosphorite units and is approximately 170 thick in the Savannah area. This unit

disconformably or para-conformably overlies the Marks Head Formation and is distinguished from the underlying unit by consisting of dark phospathic clays or phosphorite in the lower part and fine-grained sand in the upper part (Huddlestun, 1987).

The Marks Head Formation is approximately 70 feet thick in the Savannah area and consists of light colored phosphatic, slightly dolomitic, argillaceous sand to fine-grained sandy clay with scattered beds of dolostone, limestone, and siliceous claystone. The Marks Head Formation disconformably overlies the Parachula Formation and is distinguished from the underlying unit by being more phosphatic, siliceous, and dolomitic and is less calcareous (Huddlestun, 1987).

The Parachula Formation consists of sand, clay, limestone and dolomite, and is approximately 10 feet thick in the Savannah area. The Parachula Formation generally overlies the Suwanee Limestone in Georgia. Huddlestun, 1987, also stated that the Parachula Formation disconformably overlies the Lazaretto Creek Formation in Chatham County, Georgia; however, other references regarding the Lazaretto Creek Formation were not located. Therefore, details of this formation have not been included in this report (Huddlestun, 1987).

4.1.1.5 Suwanee and Ocala Limestone

The Suwanee Limestone of Oligocene age consists of a cream to tan, crystalline, highly vuggy limestone and is approximately 100 feet thick in the Savannah area (Miller, 1986) and overlies the Ocala Limestone. The Ocala Limestone of late Eocene age is a gray to cream, dense, highly fossiliferous limestone (Furlow, 1969).

4.1.2 Groundwater Occurrence and Movement

The principal source of water in the coastal area of Georgia is the Floridan aquifer system. Secondary sources of water in the area are the surficial aquifer and the upper and lower Brunswick aquifers (Clark, et al, 1990). These aquifers are discussed in the following sections.

Recharge to aquifers is dependent on precipitation, evapotranspiration, and surface water infiltration. Average annual precipitation is less than 46 inches in Chatham County, Georgia. Average annual runoff is 10 inches. Evapotranspiration rates ranged from 31 to 41 inches per year in the Coastal area of Georgia (Clarke, et al, 1990).

Discharge from aquifers occurs naturally as flows to streams, springs, and adjacent aquifers. Groundwater is also discharged off shore and to wells in the area (Clark, et al, 1990).

4.1.2.1 Surficial Aquifer

The surficial aquifer consists of interlayered sand and clay of the undifferentiated deposits, Cypresshead Formation, and the Coosawhatchie Formation. A dense phosphatic silty clay of the Coosawatchie Formation acts as a basal confining unit. Locally, layers of clay that are really extensive act as confining units and at that location, the aquifer is under confined or artesian conditions (Clark, et al, 1990).

Generally, the aquifer is under water table conditions and is recharged by infiltration throughout the area of its occurrence. Water in the aquifer flows east to the coast and the water level near the coast

is influenced by the tidal changes. The thickness of this aquifer ranges from 65 feet to 230 feet and is approximately 100 feet thick in the Savannah area (Clarke, et al, 1990).

Wells in the aquifer reportedly yield 2 to 180 gallons per minute (gpm). In Chatham County, wells yield 10 to 40 gpm, and the aquifer has an estimated hydraulic conductivity of 2 to 65 feet per day (fpd) and transmissivity of 14 to 1,100 square feet per day (ft^2/d) in the unconfined water bearing zone, and a hydraulic conductivity of 40 to 400 fpd and a transmissivity of 150 to 6,000 ft^2/d in the lower semiconfined water bearing zone (Clarke, et al, 1990).

The lower confining unit ranges in thickness of 15 feet to 90 feet and is approximately 30 feet in the Savannah area. In the Brunswick area, the vertical hydraulic conductivity of the confining unit ranges from 5.3×10^{-5} to 13.0×10^{-5} feet per day (Clark, et al, 1990).

4.1.2.2 Upper Brunswick Aquifer

The upper Brunswick aquifer consists of poorly sorted, fine-to-coarse-grained, slightly phosphatic and dolomitic quartz sand of the Markshead Formation. Silty clay and dense, phosphatic dolomite of the Markshead Formation and the Parachula Formation acts as a basal confining unit. The lower Brunswick aquifer is not evident in the Savannah area; therefore, it is not discussed in this report (Clark, et al, 1990).

The aquifer is under confined conditions and is recharged where Miocene sediments outcrop northwest of the site in Screven and Bulloch Counties, Georgia. Water levels in the aquifer respond to seasonal climatic changes and fluctuations are similar to those in the Upper Floridan aquifer. The thickness of the aquifer ranges from 20 to 150 feet and is approximately 25 feet in the Savannah area (Clark, et al, 1990).

Reported well yields for the upper and lower Brunswick aquifer range from 3 to 180 gpm. There are no available data on the hydraulic properties of the upper Brunswick aquifer. Based on data from the lower Brunswick aquifer, an average hydraulic conductivity of 38 ft/d and a transmissivity of 680 ft^2/d to 5,700 ft^2/d have been estimated (Clark, et al, 1990).

The lower confining unit ranges in thickness of 14 feet to 120 feet and is approximately 90 feet in the Savannah area. In the Brunswick area, the vertical hydraulic conductivity in the lower half of the confining unit ranges from 5.3×10^{-5} to $1,300 \times 10^{-5}$ fpd (Clark, et al, 1990).

4.1.2.3 Upper Floridan Aquifer

The Upper Floridan aquifer consists of limestone of the Suwanee Limestone formation and limestone and dolomite of the Ocala Limestone formation. Dense dolomitic limestone of the Ocala Limestone acts as a semi-confining basal unit (Clark, et al, 1990).

The aquifer is under confined conditions and is recharged northwest and west of the coastal area of Georgia. Water levels in the aquifer respond to seasonal climatic changes and in the Savannah area groundwater flows toward the pumping center created by water withdrawal from wells for the City of Savannah. The thickness of the aquifer ranges from 200 feet to 700 feet and is approximately 250 feet thick in the Savannah area (Clark, et al, 1990).

Withdrawal from the Upper Floridan aquifer during 1986, was approximately 73 million gallons per day. The average transmissivity for the Savannah area ranges from 28,000 to 33,000 ft^2/d (Clark, et al, 1990).

The lower confining unit ranges in thickness of 160 to 280 feet. In the Brunswick area, the vertical hydraulic conductivity ranges from 0.4×10^{-5} to 5.3×10^{-5} fpd. Joints and fractures in this unit have produced zones of higher secondary vertical hydraulic conductivity.

4.2 SITE HYDROGEOLOGY

4.2.1 Geology

From 19 soil borings, soil samples were collected and their lithology is described and recorded on boring logs in Appendix D-1. Lithology beneath the site consists predominantly of brown and tan, loose, fine to very fine sand with 10 percent silt (silty sand). Layers of sand, silt, and clayey sand have also been observed. A poorly graded, tan, loose, fine to very fine-grained sand layer approximately 1 foot thick is located in the vicinity of Well MW-4. A poorly graded, white, loose, very fine-grained sand layer, approximately 0.5 feet thick is located from 3 (Boring A-3) to 5.5 (A-9) fbls in the north-northeast corner of the site and an inorganic, black, soft, fat, organic silt layer approximately 0.5 feet thick and containing roots is located from 2 (Boring MW-1) to 4 (Boring A-9) fbls north of the pump island area. Soils appear to be finer to the east-southeast. At Boring MW-8, a gray, medium- to fine-grained clayey sand layer, approximately 0.5 feet thick is located 1.5 fbls and is underlain by a 3-foot thick black, organic-rich silt. At approximately 5.5 fbls in this area, a tan, very fine- to medium-grained clayey sand layer exists. A subsurface cross-section of the area showing lithology is presented in Plate 6. Surficial lithology beneath the site is consistent with undifferentiated alluvial deposits.

4.2.2 Groundwater Occurrence and Movement

Groundwater beneath the site is present at a depth of less than 5 feet and flows to the northwest. A water table contour map is presented in Plate 7. As previously mentioned, the hydraulic conductivity of the aquifer ranges from 0.9×10^{-3} to 3.1×10^{-3} feet per minute and averages 1.9×10^{-3} feet per minute (fpm) which corresponds to silty sand (Heath, 1987). Using the average hydraulic conductivity (k), a hydraulic gradient (dh/dl) of 0.01 ft/ft, and an assumed effective porosity (n) of 0.20 for a silty sand (Heath, 1987), an average groundwater seepage velocity (v) of 1.0×10^{-4} fpm for the movement of groundwater across the site has been calculated using the following equation:

$$V = \frac{ki}{n}$$

As stated in Section 4.2.1, the lithology is finer in grain size to the southeast. With the exception of MW-6, the hydraulic conductivity value calculated for each well increases in value from the east to the west. This information supports data indicating that the lithology is finer in grain size to the east. As shown in Plate 5, the surficial aquifer extends to approximately 100 fbls.

4.3 GROUNDWATER UTILIZATION

According to EPD UST Regulations Chapter 391-3-15-.09, target cleanup concentrations for soil and groundwater are dependent on the site's location with respect to nearby water supply systems. In accordance with the above mentioned regulations, an attempt was made to locate points of withdrawal from public drinking water systems within a 3-mile radius of the site and points of withdrawal for non-public water systems within a 0.5-mile radius of the site. Information was obtained from HAAF, the City of Savannah, and U.S. Geological Survey, and from a windshield survey conducted within a 0.5-mile radius of the site. Information obtained from HAAF, the City of Savannah, and the U.S. Geological Survey (U.S.G.S.) are included in Appendix G. The Chatham County Health Department was also visited; however, no relevant information was obtained.

HAAF has 11 groundwater supply wells. Locations of these wells are shown on Plate 8 and well details are presented in Table 8. Of these 11 wells, eight are located within 3 miles of the site and four of the eight are used for drinking water. Casing depths of the drinking water wells range from 259 to 324 fbls with an average depth of 278 fbls. Flow rates range from 30 to 1,400 gpm of water, and averages 713 gpm. Where discrepancies occur between the U.S.G.S. data and HAAF data regarding well construction details, U.S.G.S. data were used for depth of well and bottom of casing data in the preparation of Table 8. HAAF data were used for well usage.

HAAF Well No. 1, a public supply well, is nearest to the site and is located approximately 170 feet southeast (water tank) of the UST area. This well is cased from the surface to approximately 259 fbls; has the capacity to discharge 1,300 gpm; and is located hydraulically upgradient of the UST area. This is shown on Plate 8. HAAF receives its water from the Upper Floridan aquifer, which is separated from the surficial aquifer by two confining units and the upper Brunswick aquifer. This stratigraphic relationship is shown in Plate 5.

Seven public supply wells were located within 3 miles of the site, but outside HAAF. Locations of these wells are shown on Plate 9 and well details are presented in Table 8. All information obtained from the owner(s) were used on Table 8 when applicable. These wells were located through the U.S.G.S. Water Well Survey and their locations were verified in the field. Casing depths to these seven wells range from 146 to 290 fbls with an average depth of 250 fbls. Flows range from 150 gpm to 3,500 gpm (of known discharges), and average 1,321 gpm.

Four of the seven public water supply wells, located outside HAAF, are owned and operated by the City of Savannah. All well construction information received from the City of Savannah was consistent with data from the U.S.G.S. The only discrepancies were discharge rates and usage of some wells. Rates and well usage provided by the City of Savannah were used in Table 8.

According to Harry Jue, City of Savannah's Water Director, the only surface water withdrawal point is located on the Wilmington River. This river is more than 3 miles away from the site. HAAF receives all its water from on-wells located at the base.

5.0 EXTENT OF CONTAMINATION

5.1 HYDROCARBONS IN THE SOIL

Soil samples collected from boreholes and during well installation indicate that soil in the vicinity of the site has been impacted by petroleum product. BTEX concentrations above method detection limits were detected in eight of the 24 samples analyzed. TPH concentrations above method detection limits were detected in 23 of 24 samples analyzed. Lead concentrations were detected in all five samples analyzed.

As shown on Plate 10, the highest concentrations of total BTEX (8,050 ppm at MW-1) and TPH (25,000 ppm at MW-1) are in the vicinity of the USTs.

Concentrations decrease with increasing distance from this area. However, the concentration decrease is not proportional to distance. There are some localized high concentration areas like MW-7 that suggest past spills unrelated to tank releases. However, for a conservative estimate of contaminated soil one continuous hydrocarbon plume of soils with concentrations exceeding EPD's most liberal clean up criteria for BTEX and TPH concentrations have been drawn. Based on the areal extent of this plume (5,920 square feet) and the average depth to water (3.04 feet), approximately 700 cubic yards of soil appears to be grossly contaminated.

Lead concentrations in the samples analyzed ranged from 3.4 ppm to 18 ppm. In general, soil consists of an abundance of chemical elements including lead that are naturally occurring. Naturally occurring lead concentrations for soil within the Savannah area generally ranges from 20 to 30 ppm (Hansford, et al, 1971). These concentrations are higher than lead concentrations detected at the site; therefore, the lead concentrations alone detected at the site do not clearly indicate that a petroleum release has occurred.

5.2 LIQUID HYDROCARBON OCCURRENCE

Phase-separated product was observed at a thickness of 0.61 feet in Well MW-1. As shown in Plate 11, MW-1 is located approximately 5 feet west of the western-most UST. For this reason, it is assumed the phase-separated product is localized as shown in Plate 11. No evidence of phase-separated product has been observed in any of the other wells.

5.3 DISSOLVED HYDROCARBON OCCURRENCE

The presence of phase-separated product in MW-1 and elevated concentrations of BTEX and TPH in groundwater samples collected indicate that groundwater in the vicinity of the site has been impacted by petroleum product. BTEX concentrations above method detection limits were detected in six of the ten samples analyzed. TPH concentrations above method detection limits were detected in three of ten samples analyzed.

As shown on Plate 11, the highest concentration of total BTEX (28,200 µg/l) and TPH (55 µg/l) were detected in the well containing phase separated product. Concentrations decrease with increasing

distance from the UST area. However, as with the soil concentrations, the concentration decrease is not proportional to distance because of localized areas of elevated concentrations.

5.4 CONCEPTUAL MOVEMENT OF HYDROCARBONS

The case scenario at this site consists of leaking USTs that are partially submerged below the water table. In this instance, one would expect to find:

1. Contaminated soil in the immediate vicinity of the tank because of the leak;

2. Contaminated soil spreading laterally from the tank area because vertical movement of contaminants has been impeded by denser layers and extends laterally on top of these layers while moving vertically;

3. Phase-separated product in the immediate vicinity of the UST as well as downgradient to the UST; and

4. Dissolved hydrocarbons in the groundwater surrounding the leaking USTs and downgradient of the UST area.

Localized "hot" areas with respect to soil and groundwater are common in areas near tanks and pump islands because releases associated with the handling of the product have accumulated over time.

Soil and groundwater quality data, along with field observations, have indicated that the "hottest" area at the site is in the immediate tank area. Phase-separated product and high concentrations of dissolved hydrocarbon occurred in MW-1 (downgradient to the tanks). Considerably lower concentrations occurred in MW-3 and MW-4 (upgradient of the tanks). This indicates that the contaminants are stationary or migrating in the direction of groundwater flow.

With the exception of MW-6, elevated concentrations of BTEX and TPH in samples collected throughout the site, except in the area of the tank, can be attributed to releases occurring during the product handling. The location of MW-6 is upgradient and away from the work area at Building 710. The source of elevated concentrations of BTEX and TPH on the soil and BTEX in the groundwater is not known.

6.0 REMEDIAL ACTION PLAN

6.1 CORRECTIVE ACTION COMPLETED OR IN PROGRESS

At this time, correction action is in the planning stage. To date, no remediation of contaminated soil and groundwater has occurred, nor has any phase-separated product been recovered.

6.2 OBJECTIVES OF CORRECTIVE ACTION

The objective of the corrective action is to remediate soil contamination and to recover phase-separated product in general accordance with EPD Regulations Chapter 391-3-15-.09.

6.2.1 Proposed Remedial Action Levels

It is proposed that all soil in the vicinity of the USTs with concentrations exceeding 100 ppm total BTEX and 500 ppm TPH be remediated to lower concentrations. Visible phase-separated product will be removed from the subsurface and the movement of dissolved hydrocarbons in groundwater will be monitored.

6.2.2 Basis for Proposed Remedial Action Levels

According to EPD Regulations Chapter 391-3-15-.09(2), one of the following clean up objectives must be proposed:

- At UST corrective action sites where a point of withdrawal for a public drinking water system exists within 3 miles of the contaminant plume boundary or a point of withdrawal for a non-public water system exists within 0.5 miles of the contaminant plume boundary, the UST owner or operator will:

    1. Remediate soil contamination that exceeds 100 ppm TPH, or 20 ppm total BTEX;

    2. Remove visible phase separated product; and

    3. Remediate groundwater contamination that exceeds federal and state Maximum Contaminant Levels (MCLs) or alternate concentration limits as established by the Director.

- At other UST corrective action sites, the UST owner or operator will:

    1. Remediate soil contamination that exceeds 500 ppm TPH or 100 ppm total BTEX;

    2. Remove visible phase separated product; and

    3. Delineate the full extent of groundwater contamination.

Below Chapter 391-3-15-.09(b), the regulations state that the remediation of soil contamination that exceeds 100 mg/kg TPH or 20 mg/kg total BTEX, the remediation of groundwater contamination that exceeds federal and state MCLs or alternate concentration limits as established by the Director, and delineation of the extent of groundwater contamination may not apply if it can be demonstrated that existing public or non-public water systems or surface waters are upgradient from the contaminant plume or are not hydraulically interconnected with the contaminant plume.

As shown on Plates 8 and 9 and Table 8, 14 public wells are within 3 miles of the contaminant plume and the nearest well is located within 150 feet of the plume. Of these 14 wells, only three lie to the north-northwest in the direction of groundwater flow. The remaining wells lie in various directions and are considered crossgradient and upgradient with the nearest well being upgradient of the site.

None of the above wells are cased off in the surficial aquifer. All but one well receives its water from the Upper Floridan aquifer. This well receives its water from the Upper Brunswick aquifer. The top of the Upper Floridan aquifer is approximately 230 fbls and the top of the Upper Brunswick is approximately 130 fbls in the Savannah area. The confining unit between the surficial aquifer and the Upper Brunswick aquifer is approximately 30 feet thick with a range of vertical hydraulic conductivity values consistent with that of a clay. The confining unit between the Upper Brunswick aquifer and the Upper Floridan aquifer is approximately 80 feet thick and the lower half of the unit has a range of vertical hydraulic conductivity values that are consistent with that of silt to clay. As indicated by the hydraulic properties of the two confining units, existing public water systems are not hydraulically interconnected with the contaminant plume.

As mentioned earlier, surface water bodies are located in the area. The closest surface water body is within HAAF and is located crossgradient approximately 1,200 feet to the southwest. A lake is located approximately 0.5 miles northwest of the site just outside HAAF's boundaries. The lakes, while being crossgradient and downgradient of the site, are located sufficient distances away to not be affected by contamination of this magnitude. However, additional monitor wells will be installed to monitor the movement of dissolved hydrocarbons once the USTs, contaminated soil, and phase-separated product are removed.

6.3 PROPOSED REMEDIAL ACTION AND IMPLEMENTATION

6.3.1 Underground Storage Tank Closure

To eliminate the source, the four USTs and associated piping will be removed and disposed of properly by a licensed contractor. This UST closure plan is in accordance with EPD's UST closure guidelines, "So You Want to Close an UST?", dated April, 1992.

Notification

EPD will be notified at least 30 days prior to the removal of the USTs and be furnished with the following information:

- Owner(s) of the tanks;
- The tank location (street address);

- The capacity and liquid stored in each tank; and
- The date that on-site closure activity is scheduled to begin; and
- Method of contaminated soil disposal.

Within 30 days after the tank has been removed and the excavation backfilled, EPD will be notified that the closure has been completed. An amended version of the original EPA Form 7530-1 "Notification for USTs" will be submitted by Fort Stewart, DEH, Environmental Office at this time.

Prior to tank removal, DEH, the military division equivalent to the Fire Marshall will be notified.

Confirmatory Sampling

Since it is already known that contaminated soil and phase-separated product exists, confirmation samples will be collected after the removal of all contaminated soil and phase-separated product. One water sample will be collected from the base of the tank pit and analyzed for BTEX and TPH by EPA Methods 602 and 418.1, respectively. Six to eight soil samples will be collected from the sidewalls of the tank pit and pump island area to be analyzed for BTEX and TPH by EPA Methods 8020 and 418.1, respectively. Results of the confirmatory sampling will be known within 24 hours and excavation activities can proceed as needed.

Backfill Procedures

The tank pits will be backfilled with "clean" material.

6.3.2 Soil Excavation

During the removal of the USTs, the known contaminated soil plume as shown on Plate 10 will be excavated. The estimated volume to be removed is calculated by using 5,920 square feet for surface area and 5 feet (approximately 2 feet below the water table). Based on this in-place volume, it is estimated that approximately 1,000 cubic yards of contaminated soil will be removed. Soils from borrow areas within HAAF will be used to backfill the excavation.

If contaminated soil is temporarily stored on site, it will be placed on and covered with plastic. Contaminated soil will either be bioremediated and aerated on base, thermally treated using a mobile incinerator unit, or transported to an asphalt plant or to an acceptable landfill. Disposal of the soil will be handled by a permitted treatment/storage/disposal facility. Soil samples will be obtained from the stockpile for laboratory analyses. The type of analyses performed will be based upon the method of remediation that is selected.

6.3.3 Liquid Hydrocarbon Recovery

After the tanks are removed, contaminated soil will be removed as discussed in the previous section. Soil will be removed from 1 to 2 feet below the water table in areas of the pit where phase-separated product is observed. If phase-separated product is observed in any appreciable thickness, a sump(s)/trench(es) will be excavated in order to facilitate its removal. The product will be skimmed off

the top of the water, stored in a tank and transported off site for proper disposal, or if the thickness of product is relatively small, absorbent pads may be sufficient to effect its removal. This work will be performed by an outside contractor.

7.0 RECOVERY SYSTEM DESIGN

7.1 LIQUID HYDROCARBON RECOVERY

7.1.1 Monitor Well Design and Installation

During tank closure and excavation of contaminated soil, Monitor Wells MW-1 and MW-2 will be destroyed. These wells will be replaced by one well located in the area of the now existing MW-1. One to two more wells will be installed northwest (downgradient) of the exiting plume area.

The newly installed wells will consist of 2-inch diameter PVC casing and screen and will be sealed with a watertight locking cap. Five feet of No. 0.010 slotted screen will be placed to bracket the water table. A sand filter pack will be placed in the annulus space and will extend from the bottom of the well to approximately 1 foot above the top of the screen. A bentonite seal, approximately 0.5 feet thick will be placed on top of the filter pack. The remainder of the annular space will be filled with cement. The well will be completed below grade and protected by a manhole structure.

7.1.2 Product Recovery

If phase-separated product is detected in the monitor wells after the initial remedial action, product bail down tests will be performed to evaluate relative quantity. These data will be used to determine what action should be taken to enhance product recovery, such as the installation of recovery wells, trenches, etc.

7.2 Dissolved Hydrocarbon Plume Assessment

One or two more monitor wells will be installed northwest (downgradient) of the existing plume area. These wells, along with existing wells, will be used to observe the movement of the dissolved hydrocarbon plume in the groundwater. Monitor well design will be as described in Section 7.1.1.

The wells will be installed using hollow-stem augers and soil samples will be collected with split-spoon samplers at continuous intervals. Lithology will be described, and samples will be screened with an OVA.

If any OVA readings exceed 10 ppm above background for a given well, a sample from the "hottest" interval will be sent to a laboratory to be analyzed for BTEX and TPH by EPA Methods 8020 and 418.1.

One soil sample from each of the downgradient wells will be collected from the screen interval for sieve analysis. This data will be used to design a recovery well if needed.

7.3 MONITORING AND MAINTENANCE PROGRAM

This program will address monitoring for the absence or presence of phase-separated product and the movement of dissolved hydrocarbons after the initial remediation. It does not cover additional

remediation activities. If additional remediation is required, an amended monitoring and maintenance program will be addressed in the appropriate status report.

7.3.1 Monitoring

Quarterly fluid level measurements from all monitor wells will be taken to evaluate the direction of groundwater flow. Wells will also be checked for the presence of phase-separated product. Groundwater samples will be collected from all wells and analyzed for BTEX and TPH by EPA Method 602 and 418.1, respectively. Based on the direction of groundwater flow, selected upgradient wells will be eliminated from the monitoring program if product is not evident after three events. The monitoring will continue until it is evident that the water quality of the nearby surface water bodies will not be affected.

Since one drinking water well is located within 150 feet of the plume, a water sample will be obtained and analyzed for BTEX and TPH by EPA Methods 602 and 418.1, respectively. If BTEX and/or TPH concentrations are detected above method detection limits, the well will immediately be resampled. A rinse water blank, equipment blank, and trip blank will also be analyzed for BTEX by EPA Method 602.

If it is determined that water from the supply well has been contaminated by the plume, a groundwater remediation system will be designed and implemented.

7.3.2 Maintenance

To maintain the integrity of the monitor wells, all sampling equipment will be decontaminated prior to and after sampling each well. Decontamination procedures will be as follows:

- Alconox/tap water wash;
- Deionized water rinse;
- Pesticide propanol rinse; and
- Then allowed to air dry.

During sampling, all wells will be inspected for missing or damaged parts. Observations will be recorded and parts will be replaced or repaired. Wells will be inspected for:

- Missing locks. All wells are to be locked when not being sampled.
- Standing water in the manhole. Standing water will be removed prior to sampling.
- Wells not sealed. Faulty seals will be replaced.

8.0 OVERALL CORRECTIVE ACTION IMPLEMENTATION

8.1 SCHEDULE

The tank closure and initial remediation activities will be conducted after completion of the remedial design and award of a contract. Award of a contract is expected to be accomplished by September, 1993. Laboratory turnaround time for the confirmatory samples will be expedited to 24-hour turnaround time. See Section 6.3.1 for the confirmation sampling plan. If additional remediation is not required, the monitor wells will be installed at that time. If needed, monitor wells will be installed approximately two weeks after the second excavation. Monitor wells will be sampled one to two weeks after their installation. This will allow time for stabilization. The nearby drinking water supply well (HAAF #1) will be sampled at this time.

Assuming that all contaminated soil and phase separated product has been removed, and the drinking water well is not contaminated, quarterly sampling of wells will be conducted until it is evident that the nearby lake's water quality will not be affected. At this time sufficient information is not available to estimate the duration of the sampling program. If contamination, as stated above, still exists at the site, then the schedule will be modified to include new remedial activities. Modifications will be made in the appropriate status reports.

8.2 STATUS REPORTS

8.2.1 Final Completion Report

After completion of the tank closure and initial remedial activities, the final completion report will be submitted to EPD by the 24th Infantry Division (Mech) and Fort Stewart, Environmental Office, Fort Stewart, Georgia. This report will contain a section summarizing remedial activities. Remedial activities will be divided into three sections:

1) Tank removal;
2) Soil excavation and disposal; and
3) Phase separated product recovery and disposal.

The report will also include a section on confirmatory sampling and analysis. This section will include details on sample collection and a rationale on sample locations. A plate showing sample locations and soil concentrations will be provided. Analytical results for soil and groundwater samples will also be included. Conclusions and recommendations will close out the report.

It is envisioned that the Table of Contents will consist of the following:

CONTENTS

1.2 Soil Excavation and Disposal
1.3 Phase Separated Product Recovery and Disposal

2.0 Confirmatory Sampling and Analysis

2.1 Sample Collection
2.2 Analytical Results

3.0 Conclusions

4.0 Recommendations

The Appendices will contain a map showing sample locations and sample concentrations, a summary table of analytical results, if needed, and laboratory reports.

8.2.2 Quarterly Progress Reports

Status reports will be submitted to the State on a quarterly basis. These reports will include liquid level and groundwater flow information and groundwater sample collection and analysis information. The report will also summarize changes in the monitoring plan and planned actions. The Table of Contents will consist of the following items:

CONTENTS

1.0 Summary

1.1 Activities
1.2 Results

2.0 Liquid Levels and Groundwater Flow

3.0 Groundwater Quality

3.1 Sample Collection
3.2 Analytical Results

4.0 Planned Actions

The Appendices will contain maps showing 1) water table elevations and contours; and 2) sample locations and concentrations. Hydrographs of selected wells will also be included. Analytical reports will be provided along with a summary.

If additional remediation is needed, a plan including design and implementation will be included in a "stand alone" Appendix.

9.0 PUBLIC NOTICE REQUIREMENTS

The project site is located within the boundaries of HAAF, with the closest property boundary being 0.4 miles away. Since no private property is contiguous to the UST site, public notification of the Corrective Action Plan is not required.

10.0 CLAIM FOR REIMBURSEMENT

Claims for reimbursement will not be made at this time.

REFERENCES

Clarke, John S., Hacke, Charles M. and Peck, Michael F., 1990. Geology and Ground Water Resources of the Coastal Area of Georgia: Department of Natural Resources, Bulletin 113, 106p.

Clark, William Z., and Zisa, Arnold C., 1976. Physiographic Map of Georgia: Georgia Department of Natural Resources.

Furlow, James W., 1969. Stratigraphy and Economic Geology of the Eastern Chatham County Phosphate Deposit: Georgia State Division of Conservation, Bulletin 82, 40p.

Georgia Department of Natural Resources, Atlanta, Georgia, 1991. Underground Storage Tank (UST) Release: Corrective Action Plan (CAP) Content, July, 1991.

Hansford, T.S., Hamilton, J.C., Boerngen, J.G., and Bowles, J.M., 1971. Elemental Composition of Surficial Materials in the Conterminious United States: U.S. Geological Survey Professional Paper 574-D, 71p.

Heath, Ralph, 1987. Basic Groundwater Hydrology: U.S. Geological Survey Water-Supply Paper 2220, 84p.

Huddleston, Paul F., 1988. A Revision of the Lithostratigraphic Units of the Coastal Plain of Georgia, The Miocene through Holocene: Georgia Department of Natural Resources, Bulletin 104, 162p.

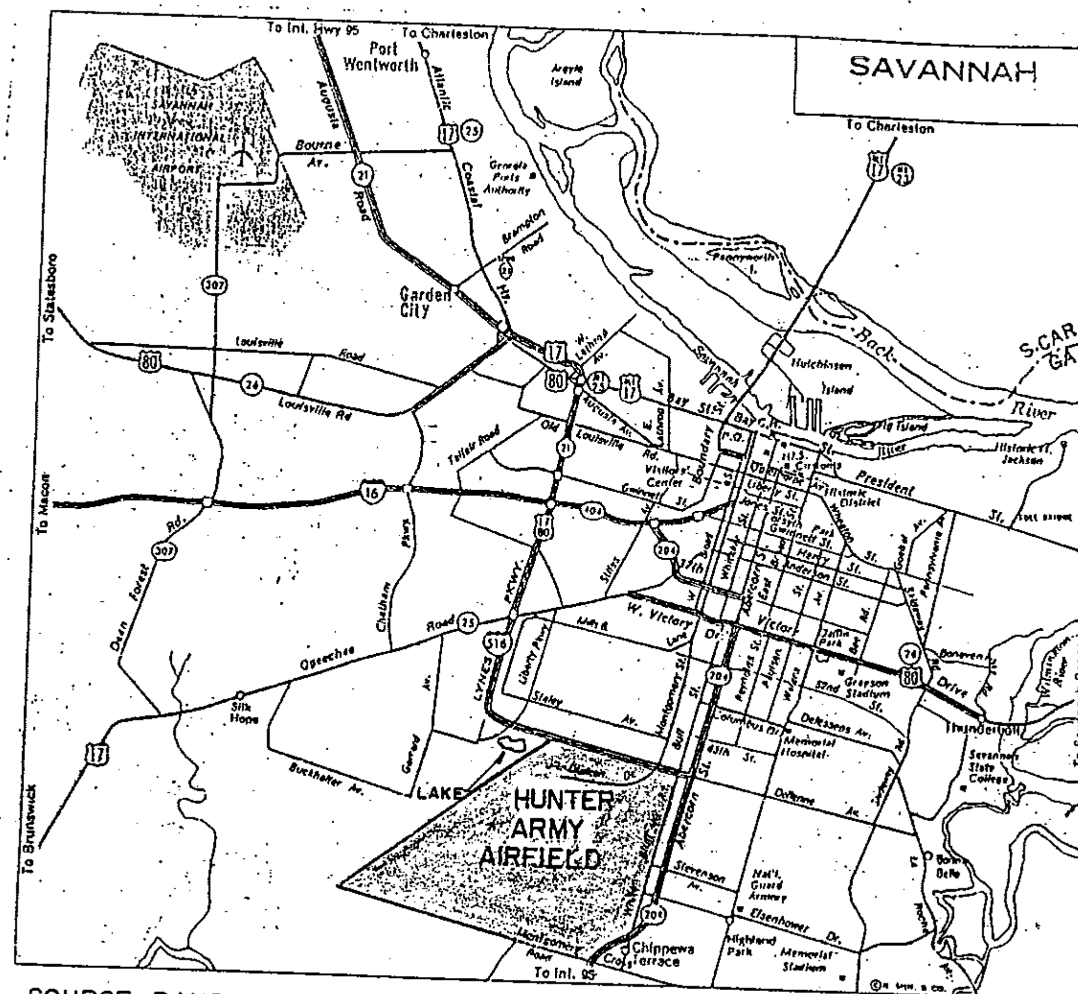
Hvorslov, M.J., 1951. Time Log and Soil Permeability in Groundwater Observations: U.S. Army Corps of Engineers, Waterways Station, Vicksburg, MS, Bulletin 36.

Miller, James A., 1986. Hydrogeologic Framework of the Floridan Aquifer System in Florida and in Parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Professional Paper 1403-B, 91p.

Wylie, A. and Wood, T.R., 1990. A Computer Program: SLUGTST to Calculate Hydraulic Conductivity Using Slug Test Data, Groundwater, Vol. 28, No. 5, pp 783-786.

APPENDIX A

PLATES



SOURCE: RAND McNALLY GEORGIA STATE ROAD MAP

SCALE 0 1 2 MILES

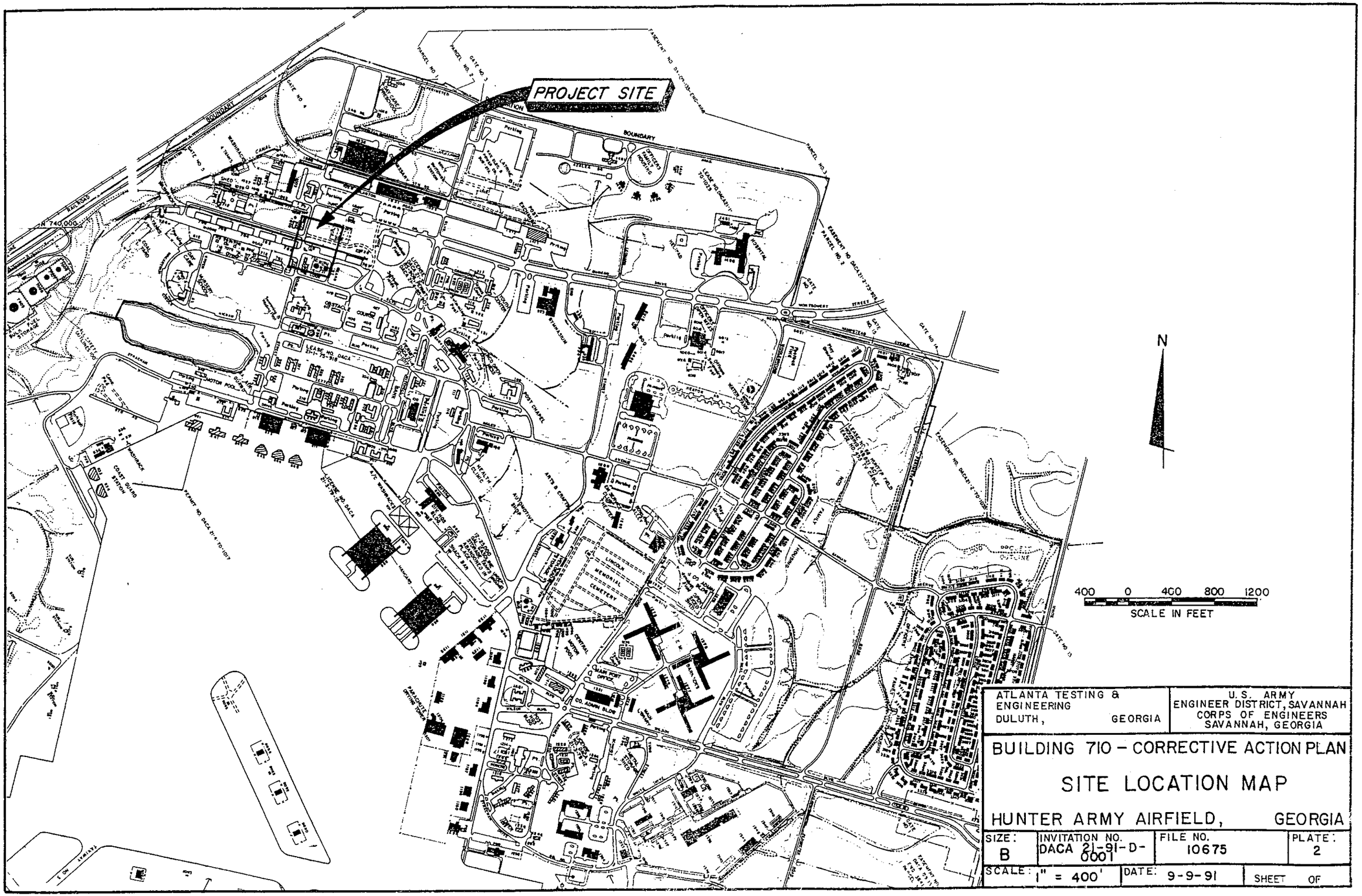
ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

BUILDING 710 - CORRECTIVE ACTION PLAN

SITE AREA MAP

HUNTER ARMY AIRFIELD, GEORGIA

SIZE	INVITATION NO. DACA 21-91-D 0001	FILE NO. 10675	PLATE 1
SCALE 1" = 2.6 MILES	DATE 9-9-91		SHEET OF



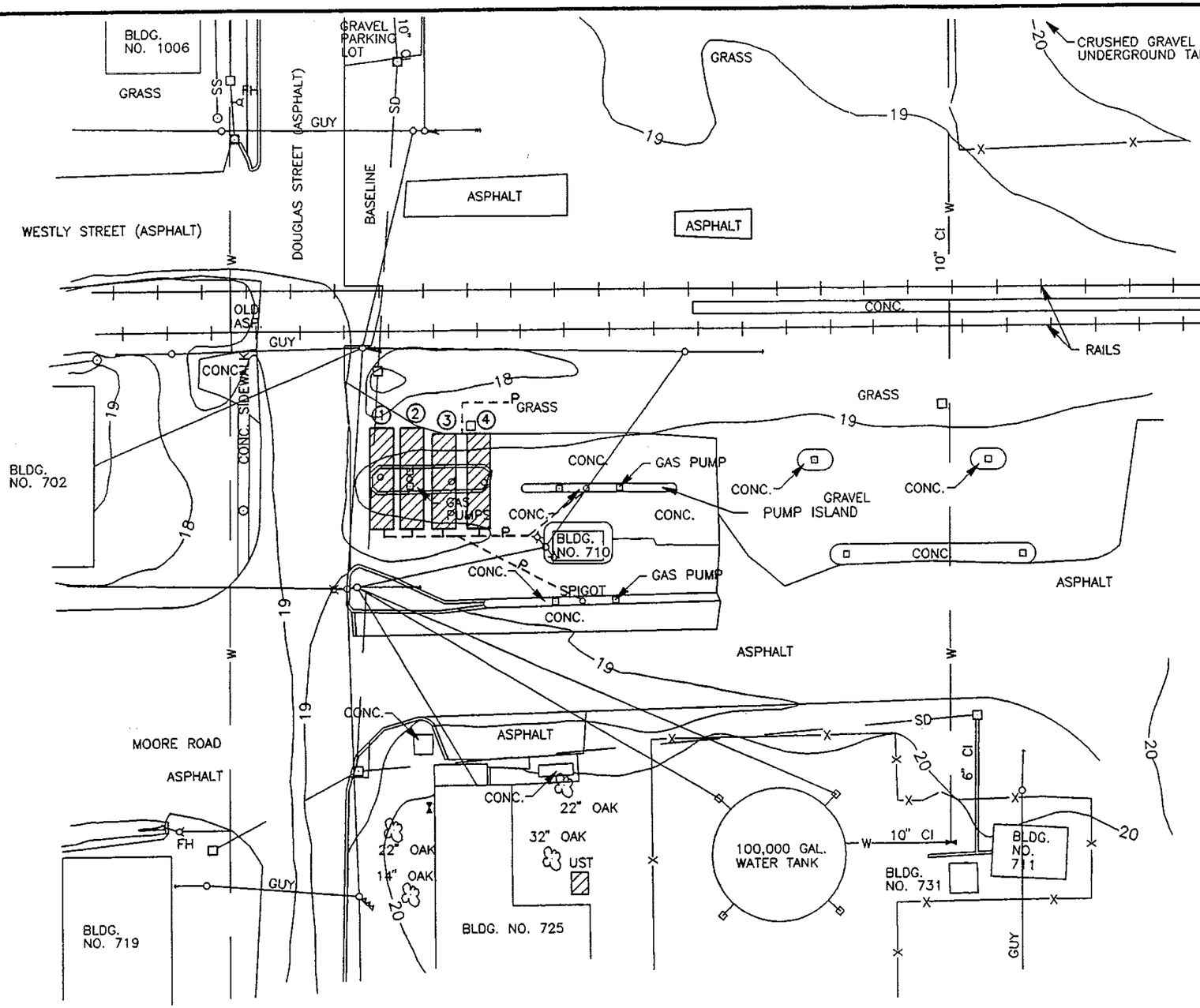
ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U. S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

BUILDING 710 – CORRECTIVE ACTION PLAN

SITE LOCATION MAP

HUNTER ARMY AIRFIELD, GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE:
B	DACA 21-91-D-0001	10675	2
SCALE: 1" = 400'	DATE: 9-9-91	SHEET	OF



LEGEND

- UNDERGROUND STORAGE TANK
- TOPOGRAPHIC CONTOUR, CONTOUR INTERVAL=1.0 FEET
- FENCE
- POWER LINE AND POLE
- FH — FIRE HYDRANT
- IRON GRATE
- VENTS
- MANHOLE
- SD — STORM DRAIN
- SS — SANITARY SEWER
- W — WATER LINE
- PETROLEUM LINE

TANK NO. 1. 12,000 GALLONS DIESEL
TANK NO. 2. 12,000 GALLONS GASOLINE
TANK NO. 3. 10,000 GALLONS GASOLINE OR DIESEL
TANK NO. 4. 10,000 GALLONS GASOLINE OR DIESEL

SCALE: 1"=40'

40' 0 40' 80'

TOPOGRAPHIC SURVEY COMPLETED MARCH 1991 BY COE.

TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

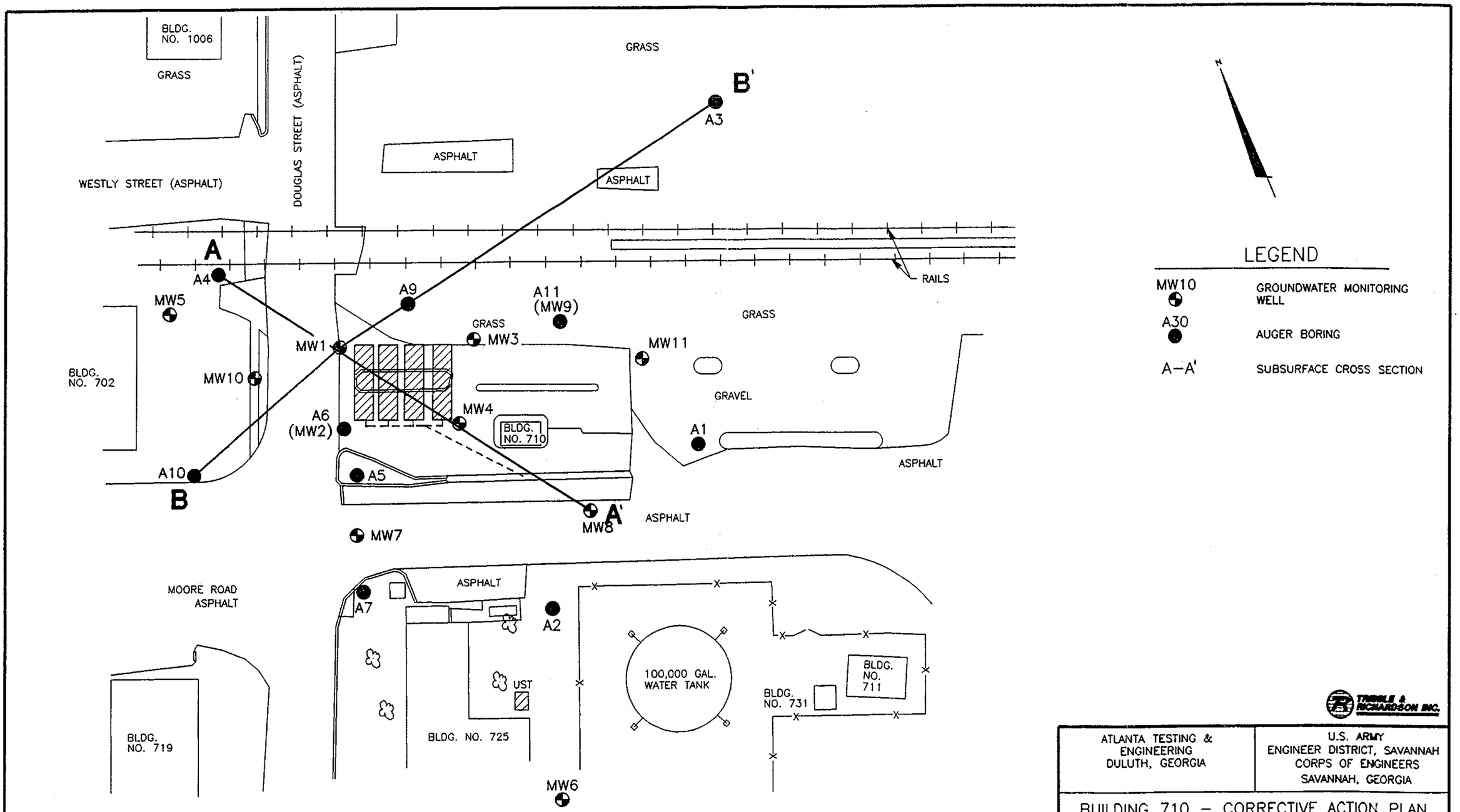
BUILDING 710 – CORRECTIVE ACTION PLAN

SITE PLAN AND TOPOGRAPHIC MAP

HUNTER ARMY AIRFIELD, GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D-0001	10675	3

SCALE: 1"=40' DATE: 09-09-91



TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

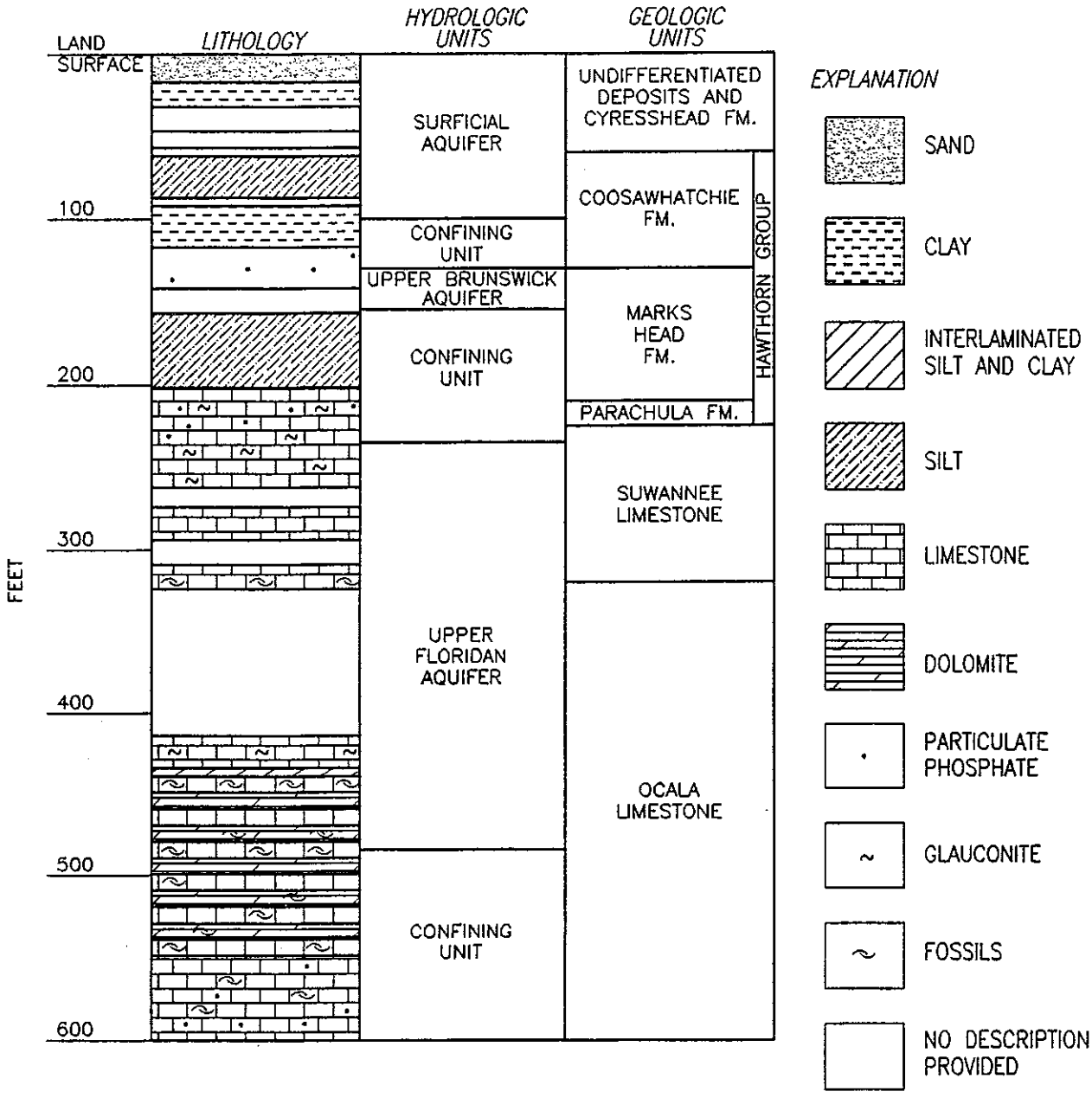
BUILDING 710 – CORRECTIVE ACTION PLAN

SOIL BORING & MONITOR WELL LOCATION MAP

HUNTER ARMY AIRFIELD, GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	4

SCALE: 1"=40' DATE: 09-09-91



Source: Modified from Clarke, et al., 1990 and Huddleston, 1988

TRIPLETT & RICHARDSON INC.

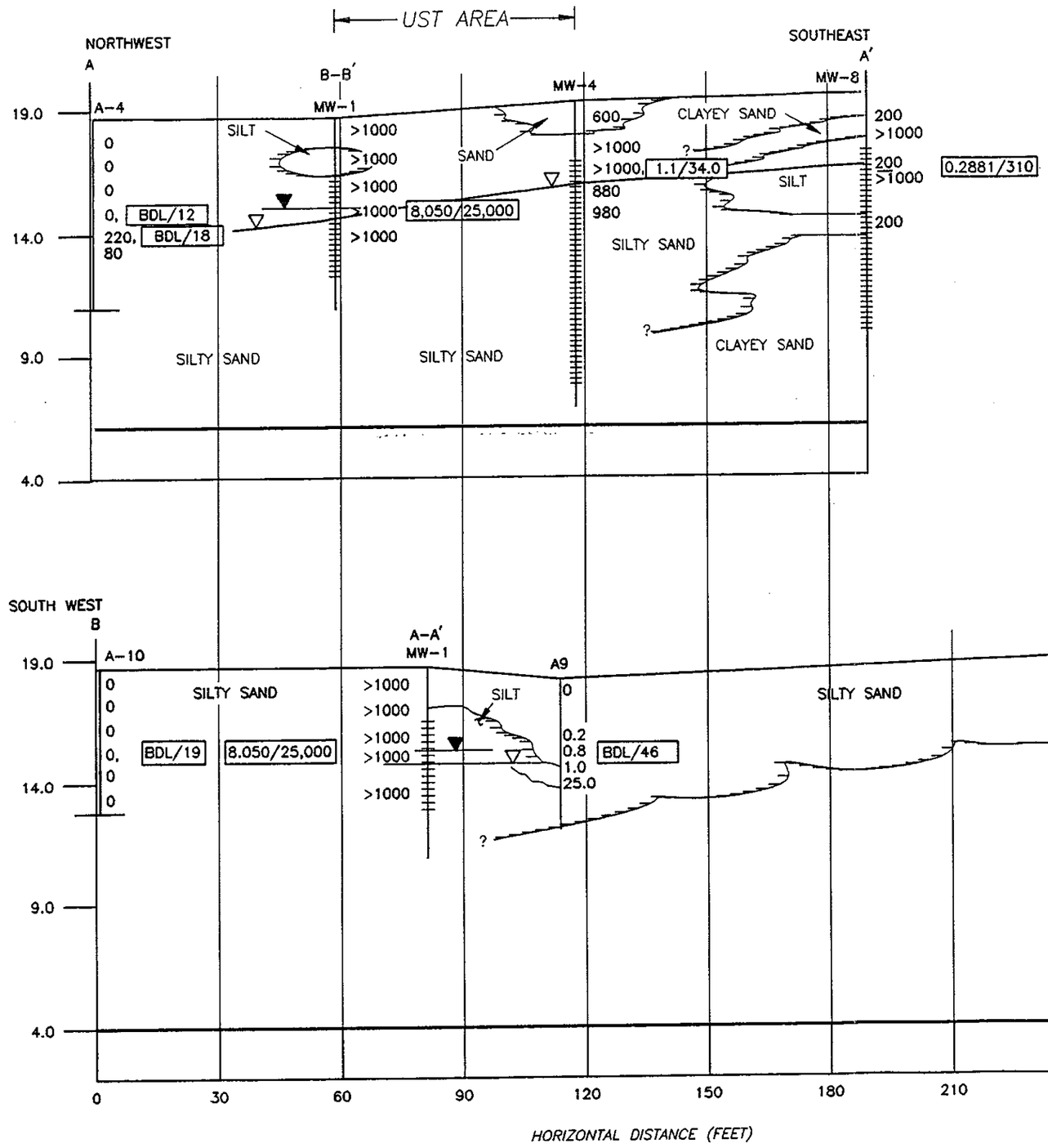
ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

BUILDING 710 – CORRECTIVE ACTION PLAN

GENERALIZED HYDROGEOLOGIC STRATIGRAPHIC COLUMN

HUNTER ARMY AIRFIELD, GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
A	DACA21-91-D 0001	10675	5
SCALE: 1" = 100'	DATE: 09-09-91		



EXPLANATION

BORING/WELL NUMBER

LITHOLOGIC CONTACT

LIQUID HYDROCARBON LEVEL 8-29-91

GROUNDWATER LEVEL 8-29-91

SCREEN INTERVAL

BTEX CONC. / TPH CONC.

OVA CONC.

NOTE:
ALL CONCENTRATIONS IN PARTS PER MILLION.

SCALE: 0 15 30 FEET

VERTICAL EXAGGERATION: X6

ABBREVIATIONS
UST= UNDERGROUND STORAGE TANK
BDL= BELOW DETECTION LIMIT

TRIBBLE & RICHARDSON INC.

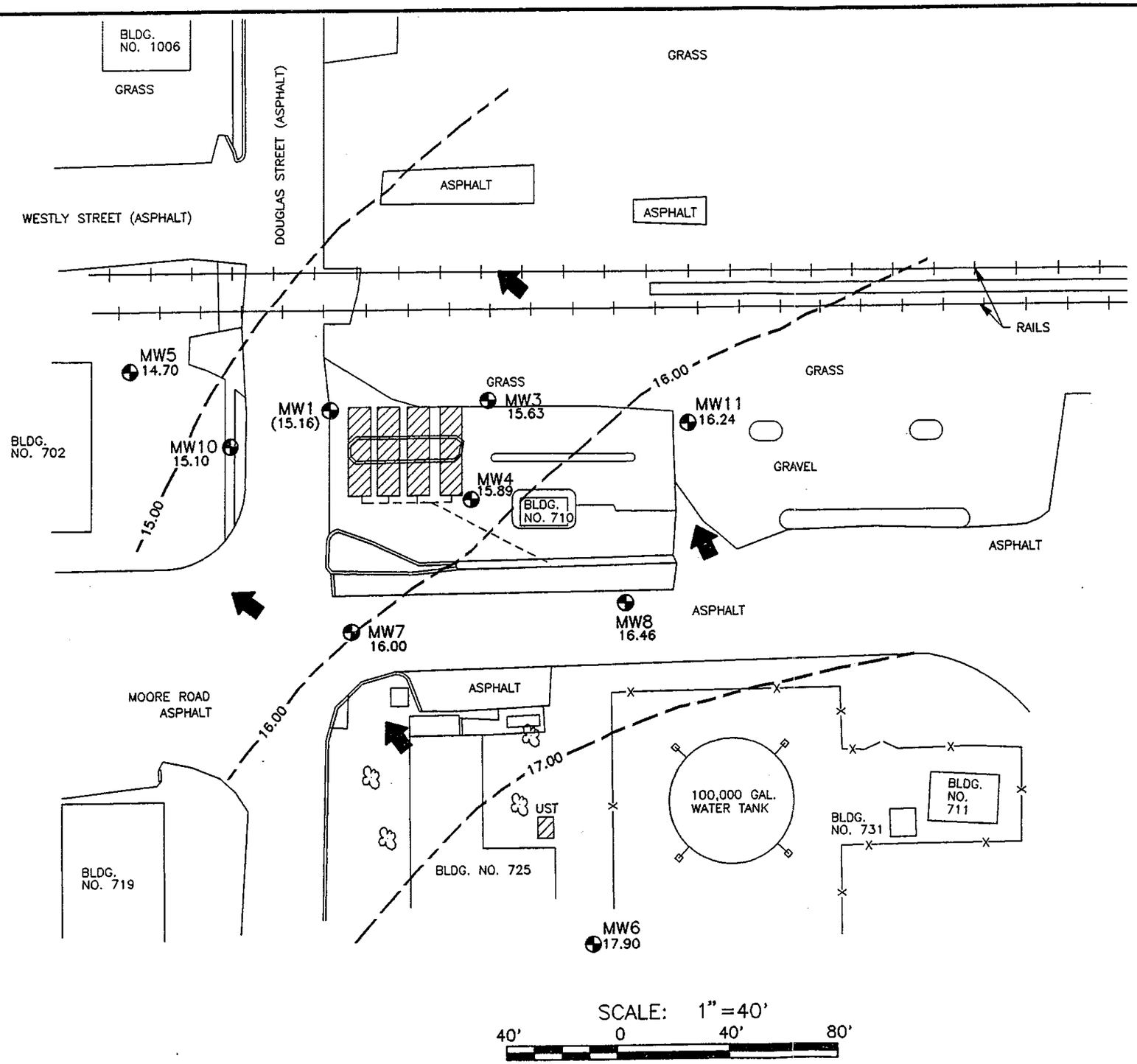
ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

BUILDING 710 – CORRECTIVE ACTION PLAN
SUBSURFACE CROSS SECTIONS A–A' AND B–B'

HUNTER ARMY AIRFIELD GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	6

SCALE: 1" = 30' DATE: 09-09-91



N

LEGEND

MW10 — GROUNDWATER MONITORING WELL

GROUNDWATER FLOW

17.00 — GROUNDWATER CONTOURS INTERVAL=1.0 FT.

NOTES:

1. NUMBERS NEXT TO WELLS INDICATE ELEVATION OF WATER LEVEL IN WELLS. NUMBERS IN PARENTHESIS WERE CONVERTED FROM TOP OF LIQUID HYDROCARBON MEASUREMENTS. USDUG CONVERSION FACTOR OF 0.75.

2. ALL READINGS WERE TAKEN ON AUGUST 29 ,1991

TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

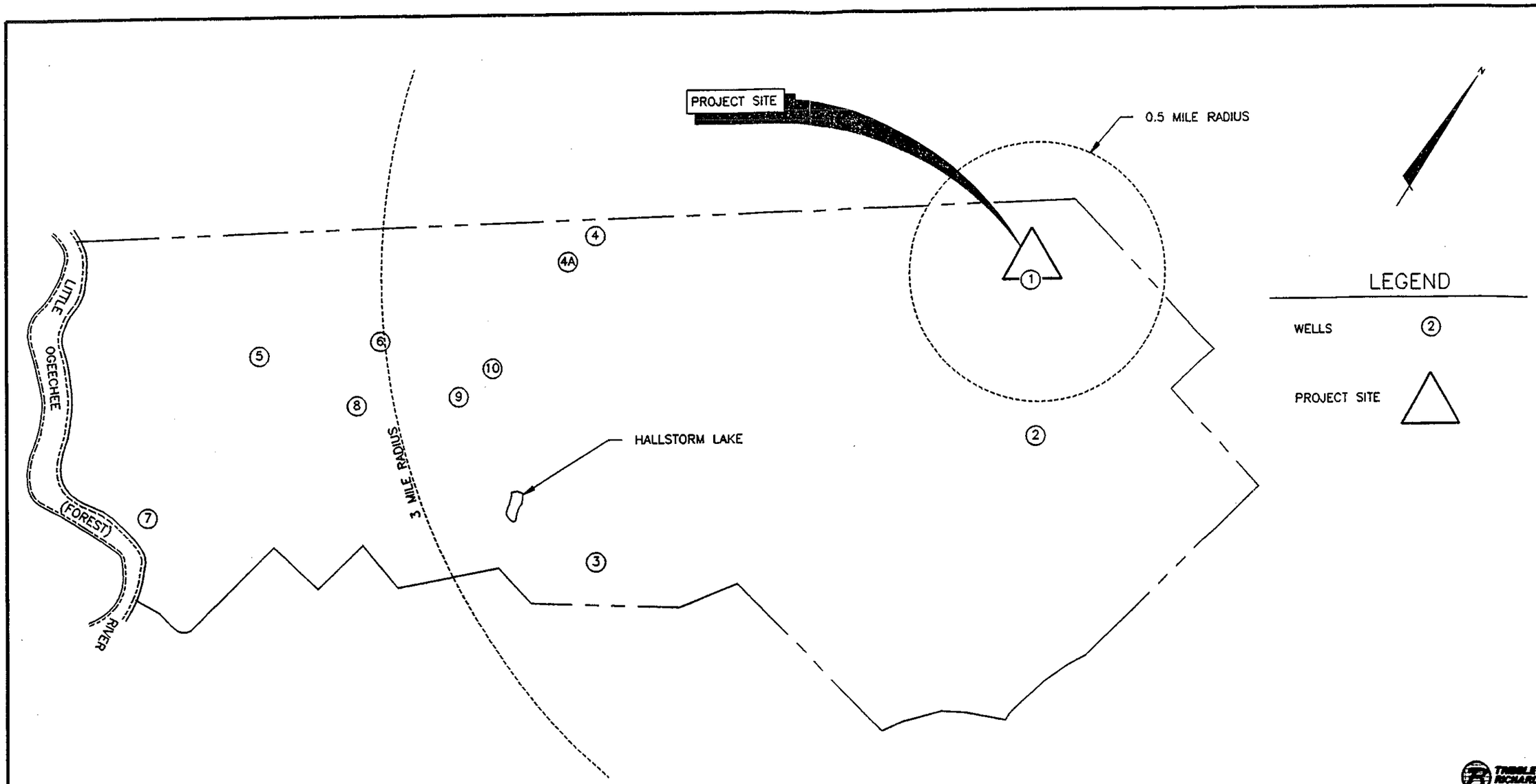
BUILDING 710 – CORRECTIVE ACTION PLAN

WATER TABLE CONTOUR MAP AUGUST 29, 1991

HUNTER A.A.F. GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	7

SCALE: 1"=40' DATE: 09-09-91



SCALE:

1200 0 1200 2400 FEET

400 0 400 800 METERS

NOTE:
WELL DETAILS ARE GIVEN ON TABLE 8
SOURCE:
FT. STEWART DIRECTORATE OF FACILITIES ENGINEERING, 1977

TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

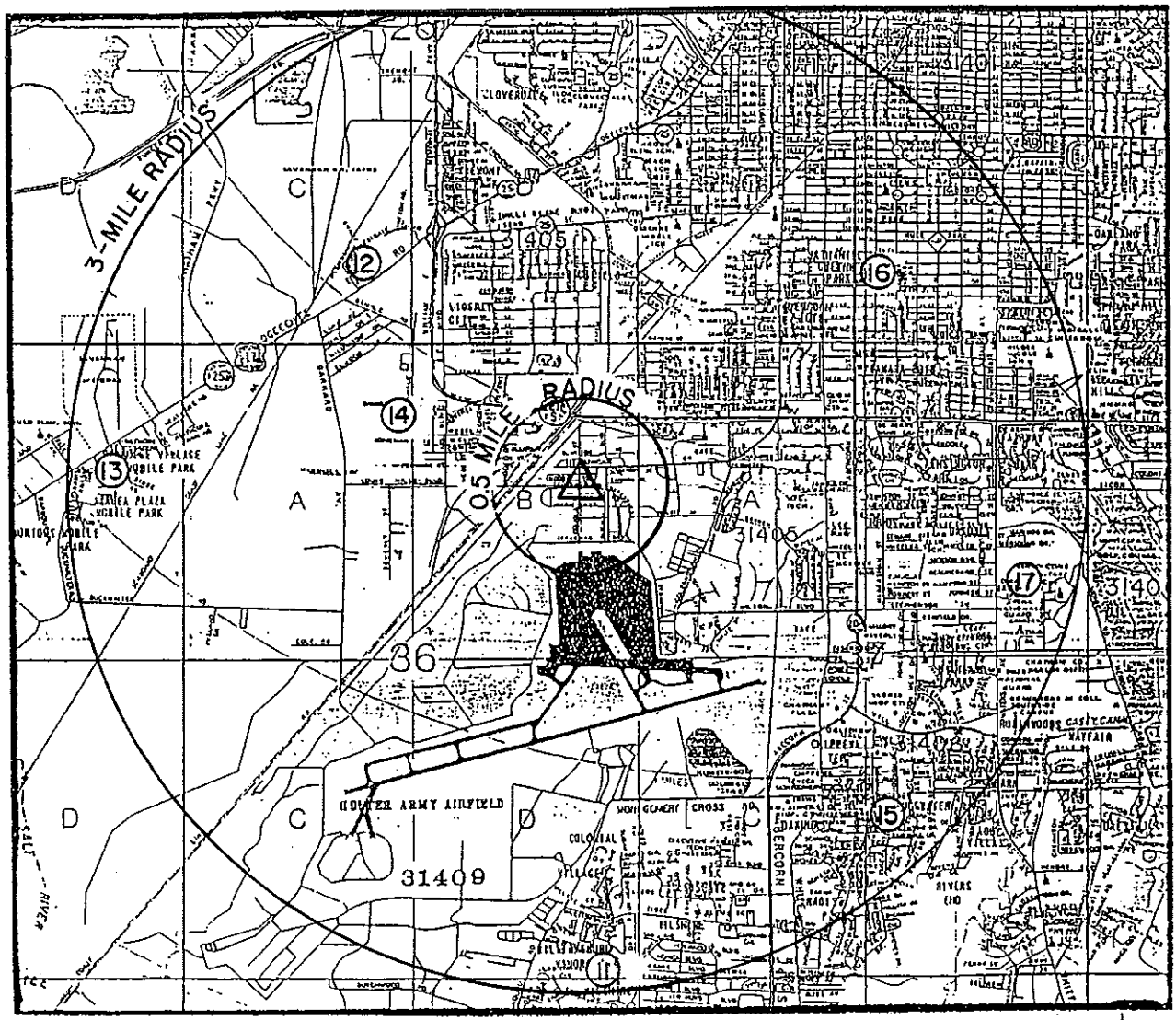
BUILDING 710 – CORRECTIVE ACTION PLAN

WATER SUPPLY WELLS LOCATED ON HUNTER ARMY AIRFIELD

HUNTER ARMY AIRFIELD GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	8

SCALE: 1"=2400' DATE: 09-09-91



LEGEND

① WELLS

△ PROJECT SITE

NOTE: WELL DETAILS ARE GIVEN ON TABLE 8.

TRIMBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

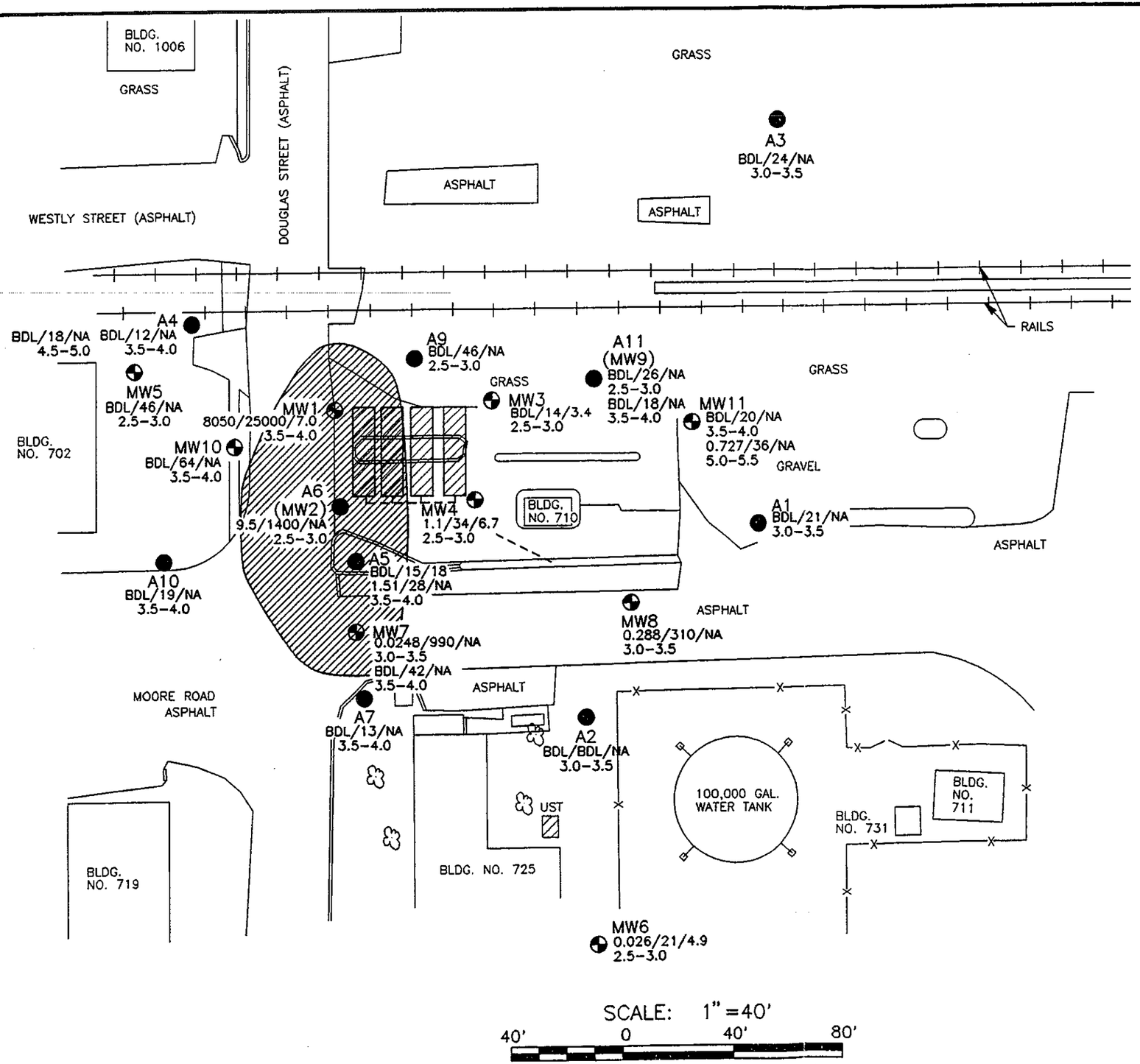
BUILDING 710 - CORRECTIVE ACTION PLAN

WATER SUPPLY WELLS LOCATED OUTSIDE HUNTER ARMY AIRFIELD BOUNDRIES

HUNTER A.A.F. GEORGIA

SIZE:	INVITATION	FILE NO.	PLATE
A	DACA21-91-D 0001	10675	9

SCALE: 1" = 5556' DATE: 09-09-91



TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

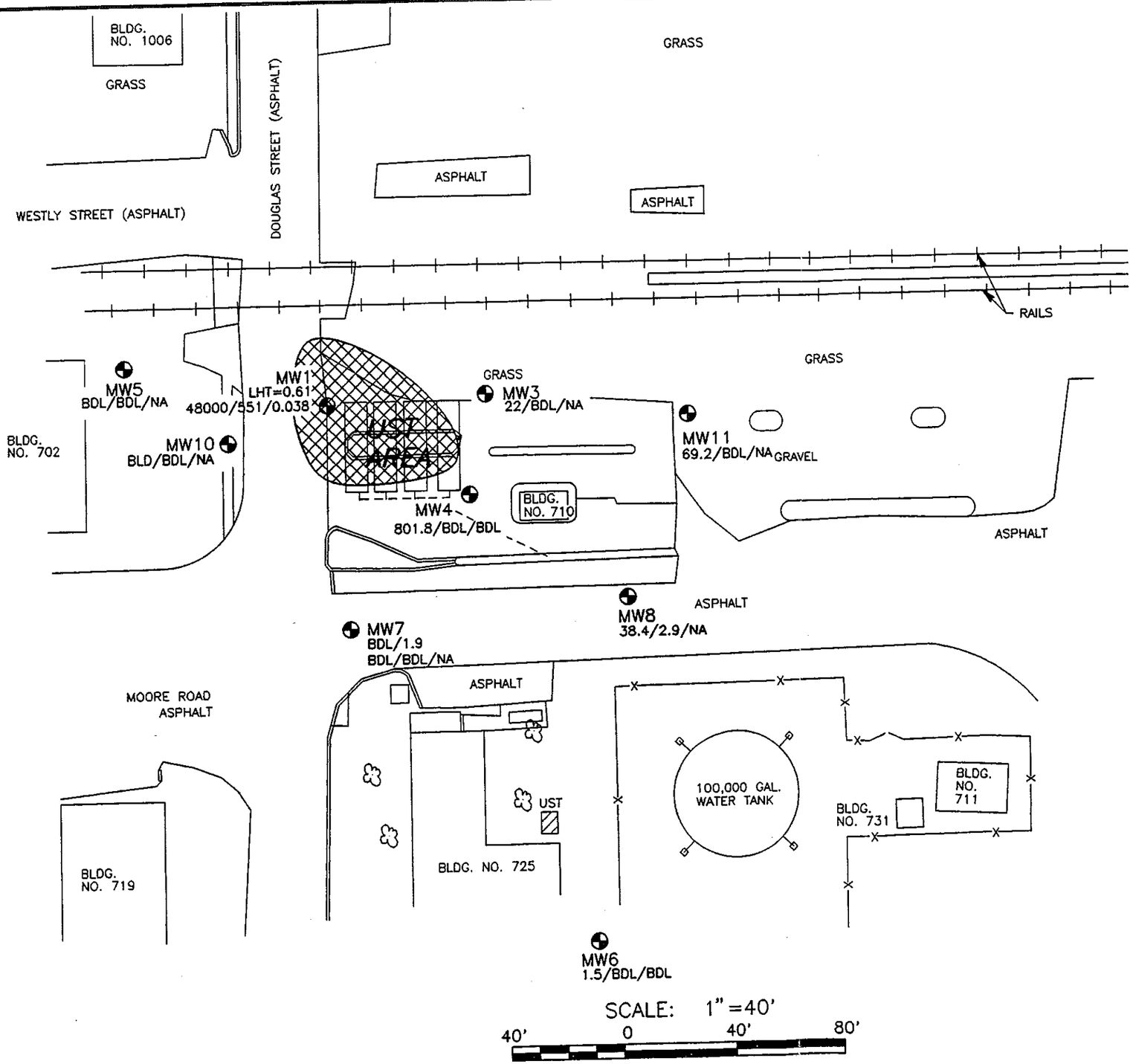
BUILDING 710 - CORRECTIVE ACTION PLAN

PLAN VIEW OF CONTAMINATION PLUME IN SOIL

WITH BTEX, TPH, AND LEAD CONCENTRATIONS

HUNTER ARMY AIRFIELD GEORGIA

SIZE:	IMITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	10
SCALE: 1"=40'		DATE: 09-09-91	



N

LEGEND

MW10 — GROUNDWATER MONITORING WELL

APPROX. LIQUID HYDROCARBON PLUME BOUNDARY

NOTE:

1. NUMBERS NEXT TO WELLS ARE DEFINED AS FOLLOWS:

   WELL I.D.

   TOTAL BTEX CONC./TPH CONC./LEAD CONC.
   (PPB) (PPM) (PPM)
   NA – NOT ANALYZED
   LHT – LIQUID HYDROCARBON THICKNESS AS OF AUGUST 29, 1991

2. GROUNDWATER SAMPLES WERE COLLECTED ON MAY 28–29, 1991

TRIBBLE & RICHARDSON INC.

ATLANTA TESTING & ENGINEERING DULUTH, GEORGIA	U.S. ARMY ENGINEER DISTRICT, SAVANNAH CORPS OF ENGINEERS SAVANNAH, GEORGIA

BUILDING 710 – CORRECTIVE ACTION PLAN
PLAN VIEW OF LIQUID HYDROCARBON PLUME W/ DISSOLVED BTEX, TPH, AND LEAD CONCENTRATIONS
HUNTER ARMY AIRFIELD GEORGIA

SIZE:	INVITATION NO.	FILE NO.	PLATE
B	DACA21-91-D 0001	10675	11

SCALE: 1"=40' DATE: 09-09-91

APPENDIX B

TABLES

TABLE 1

Summary of Soil Boring Construction Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Boring No.	Date	Elevation Land Surface (ft - MSL)	Driller	Drill Method	Initial Depth to Water (ft)	24-Hour Water Level Reading (ft)	Boring Depth (ft)	Comments
MW-710-1 (MW-1)	5/1/91	18.76	COE	HSA HA	4.80	3.57	8.0	well installed
MW-710-3 (MW-3)	5/2/91	19.13	COE	HSA HA	3.85	3.15	8.0	well installed
MW-710-4 (MW-4)	5/2/91	19.15	COE	HSA HA	3.15	3.30	12.5	well installed
MW-710-5 (MW-5)	5/3-6/91	17.85	COE	HSA HA	3.10	3.87	11.0	well installed
MW-6	5/14/91	21.05	COE	HSA/HA	5.61	4.29	11.0	well installed
MW-710-7 (MW-7)	5/13/91	18.18	COE	HSA HA	4.54	3.73	11.0	well installed
MW-8	5/14/91	19.35	COE	HSA/HA	3.61	3.47	11.0	well installed
MW-10	5/7-13/91	19.00	COE	HSA/HA	4.34	4.34	11.0	well installed
MW-11	5/14/91	18.95	COE	HSA/HA	3.98	3.40	11.0	well installed
A-1	5/6/91	19.35	COE	HA	5.00	3.63	6.0	
A-2	5/6/91	19.62	COE	HA	3.55	3.31	5.0	
A-3	5/6/91	18.97	COE	HA	4.00	---	5.0	hole caved
A-4	5/7/91	18.79	COE	HA	6.41	---	8.0	hole caved

TABLE 1

Summary of Soil Boring Construction Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Boring No.	Date	Elevation Land Surface (ft - MSL)	Driller	Drill Method	Initial Depth to Water (ft)	24-Hour Water Level Reading (ft)	Boring Depth (ft)	Comments
A-5	5/7/91	19.10	COE	HA	4.38	4.40	6.0	
A-6 (MW-710-2) [MW-2]	5/2/91	18.58	COE	HA	---	---	8.0	hole caved; well not installed
A-7	5/8/91	19.06	COE	HA	3.56	3.75	6.0	
A-9	5/7/91	18.08	COE	HA	4.15	2.15	6.0	
A-10	5/8/91	18.66	COE	HA	4.78	4.27	6.0	
A-11 (MW-9)	5/7/91	18.08	COE	HSA HA	4.15	2.61	6.0	well not installed

ABBREVIATIONS:

FT - *Feet*
MSL - *Mean Sea Level*
COE - *Corps of Engineers*
HSA - *Hollow Stem Auger*
HA - *Hand Auger*

TABLE 2

Organic Vapor Concentrations
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Boring Number	Date	Depth (feet)	Organic Vapor Concentrations (ppm)
MW-710-1 (MW - 1)	5/1/91	0.4 - 1.0	>1000
		1.5 - 2.0	>1000
		2.5 - 3.0	>1000
		3.5 - 4.0	>1000
		4.5 - 5.0	>1000
MW-710-3 (MW - 3)	5/2/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.0
		5.5 - 6.0	5.0
MW-710-4 (MW - 4)	5/2/91	0.6 - 1.0	600
		1.5 - 2.0	>1000
		2.5 - 3.0	>1000
		3.5 - 4.0	880
		4.5 - 5.0	980
MW-710-5 (MW - 5)	5/3/91	0.5 - 1.0	0.2
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.2
MW - 6	5/14/91	0.5 - 1.0	0.2
		1.5 - 2.0	6.0
		2.5 - 3.0	22.0
		3.5 - 4.0	6.2
		4.5 - 5.0	10.0
MW - 7	5/13/91	0.4 - 1.0	1.0
		1.5 - 2.0	300.0
		2.5 - 3.0	>1000
		3.5 - 4.0	250.0
		4.5 - 5.0	20.0
MW - 8	5/14/91	0.5 - 1.0	200
		1.5 - 2.0	>1000
		2.5 - 3.0	200
		3.5 - 4.0	>1000
		4.5 - 5.0	200

TABLE 2

Organic Vapor Concentrations
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Boring Number	Date	Depth (feet)	Organic Vapor Concentrations (ppm)
MW - 10	5/7/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.0
MW - 11	5/15/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	740.0
A - 1	5/6/91	1.0.- 1.5	150.0
		2.0 - 2.5	40.0
		3.0 - 3.5	10.0
		4.0 - 4.5	2.0
		5.0 - 5.5	0.0
A - 2	5/6/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.0 - 4.5	0.0
A - 3	5/6/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.0
A - 4	5/7/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	220.0
		5.5 - 6.0	80.0
A - 5	5/7/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	>1000
		3.5 - 4.0	800.0
		4.5 - 5.0	30.0
		5.0 - 6.0	30.0

TABLE 2

Organic Vapor Concentrations
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Boring Number	Date	Depth (feet)	Organic Vapor Concentrations (ppm)
A - 6 (MW-710-2) [MW - 2]	5/2/91	0.4 - 1.0	>1000
		1.5 - 2.0	>1000
		2.5 - 3.0	>1000
		3.5 - 4.0	>1000
		4.5 - 5.0	740.0
A - 7	5/8/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.2
A - 9	5/7/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.2
		2.5 - 3.0	0.8
		3.5 - 4.0	1.0
		4.5 - 5.0	25.0
A - 10	5/8/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	0.0
		3.5 - 4.0	0.0
		4.5 - 5.0	0.0
		5.5 - 6.0	0.0
A - 11	5/7/91	0.5 - 1.0	0.0
		1.5 - 2.0	0.0
		2.5 - 3.0	3.0
		3.5 - 4.0	500.0
		4.5 - 5.0	85.0

NOTE: Organic vapors detected with an organic vapor analyzer.

ABBREVIATIONS AND SYMBOLS:

ppm - Parts Per Million
> - Greater Than

TABLE 3

Summary of Well Construction Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Well No.	Date	Elevation Land - Surface (ft - MSL)	Elevation, Top of Casing (ft - MSL)	Drill Method	Casing Diameter (inches)	Boring Depth (ft)	Well Depth (ft)	Screened Interval (ft)	Driller	Comments
MW-1	5/1/91	18.76	18.56	HSA/HA	2	8.0	7.5	2.5-6.5	COE	
MW-3	5/2/91	19.13	18.85	HSA/HA	2	8.0	7.5	2.5-6.5	COE	
MW-4	5/2/91	19.15	19.00	HSA/HA	2	12.5	12.5	2.5-11.25	COE	
MW-5	5/3-6/91	17.85	17.65	HSA/HA	2	11.0	10.0	2.5-9.25	COE	
MW-6	5/14/91	21.05	20.79	HSA/HA	2	11.0	10.0	2.5-9.25	COE	
MW-7	5/13/91	18.18	18.68	HSA/HA	2	11.0	10.0	2.5-9.25	COE	
MW-8	5/14/91	19.35	19.11	HSA/HA	2	11.0	10.0	2.5-9.25	COE	
MW-10	5/7-13/91	19.00	18.80	HSA/HA	2	11.0	10.0	2.5-9.25	COE	
MW-11	5/14/91	18.95	18.55	HSA/HA	2	11.0	10.0	2.5-9.25	COE	

ABBREVIATIONS:

FT - *Feet*
MSL - *Mean Sea Level*
COE - *Corps of Engineers*
HSA - *Hollow Stem Auger*
HA - *Hand Auger*

TABLE 4

Summary of Fluid Level Measurements
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Well No.	Date	Elevation Top of Casing (ft - MSL)	Depth to Water (ft)	Liquid Hydrocarbon Thickness (ft)	Water Level Elevation (ft - MSL)	Corrected* Water Level Elevation (ft - MSL)
MW - 1	8/29/91	18.56	3.86	0.61	14.70	15.16
MW - 3	8/29/91	18.85	3.22	0.00	15.63	15.63
MW - 4	8/29/91	19.00	3.11	0.00	15.89	15.89
MW - 5	8/29/91	17.65	2.95	0.00	14.70	14.70
MW - 6	8/29/91	20.79	2.89	0.00	17.90	17.90
MW - 7	8/29/91	18.68	2.68	0.00	16.00	16.00
MW - 8	8/29/91	19.11	2.65	0.00	16.46	16.46
MW - 10	8/29/91	18.80	3.70	0.00	15.10	15.10
MW - 11	8/29/91	18.55	2.31	0.00	16.24	16.24

NOTE: * Corrected groundwater level elevation equation:
water level elevation + (0.75 x liquid hydrocarbon thickness).
0.75 = specific gravity of gasoline.

ABBREVIATIONS:

ft - Feet
MSL - Mean Sea Level

TABLE 5

Summary of Hydraulic Conductivity Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Well Number	Soil Type	K-Hydraulic Conductivity (ft/min)
MW - 1	Silty Sand	2.5×10^{-3}
MW - 4	Silty Sand	1.7×10^{-3}
MW - 5	Silty Sand	3.1×10^{-3}
MW - 6	Silty Sand	2.2×10^{-3}
MW - 7	Poorly Graded Sand	1.8×10^{-3}
MW - 8	Clayey Sand	1.4×10^{-3}
MW - 11	Inorganic Silt	0.9×10^{-3}
		Average: 1.9×10^{-3}

TABLE 6

Summary of Soil Quality Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

	SAMPLE ID							
	MW-710-1-1	MW-710-3-1	MW-710-4-1	MW-710-5-1	MW-6-1	MW-7-1	MW-7-1-C	MW-8-1
BORING NO.	MW-1	MW-3	MW-4	MW-5	MW-6	MW-7	MW-7	MW-8
PARAMETERS*								
Depth (feet)	3.5 - 4.0	2.5 - 3.0	2.5 - 3.0	2.5 - 3.0	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	3.0 - 3.5
Date	5/1/91	5/2/91	5/2/91	5/3/91	5/14/91	5/13/91	5/13/91	5/14/91
OVA Reading	> 1,000	0.0	> 1,000	0.0	22.0	---	250.0	---
Benzene	150	BDL	0.200	BDL	BDL	BDL	BDL	0.0410
Toluene	2,200	BDL	0.073	BDL	0.015	0.0180	BDL	0.1600
Ethylbenzene	1,200	BDL	BDL	BDL	BDL	BDL	BDL	0.0091
Xylenes	4,500	BDL	0.830	BDL	0.011	0.0068	BDL	0.0780
Total BTEX	8,050	BDL	1.103	BDL	0.026	0.0248	BDL	0.2881
TPH	25,000	14	34	46	21	990	42	310
Lead	7.9	3.4	6.7	---	4.9	---	---	---

NOTE: * All parameter concentrations reported in mg/kg (ppm), unless otherwise stated.

ABBREVIATIONS:

BDL - Below Detection Limit
ppm - Parts Per Million
TPH - Total Petroleum Hydrocarbon
BTEX - Benzene, Toluene, Ethylbenzene, & Xylenes

SYMBOLS:

> - Greater Than
--- - Not Analyzed

TABLE 6

Summary of Soil Quality Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

	SAMPLE ID							
	MW-10-1	MW-11-1	MW-11-2	A-1-1	A-2-1	A-3-1	A-4-1	A-4-2
BORING NO.	MW-10	MW-11	MW-11	A-1	A-2	A-3	A-4	A-4
PARAMETERS*								
Depth (feet)	4.5 - 5.0	3.5 - 4.0	5.0 - 5.5	3.0 - 3.5	3.0 - 3.5	3.0 - 3.5	3.5 - 4.0	4.5 - 5.0
Date	5/7/91	5/15/91	5/15/91	5/6/91	5/6/91	5/6/91	5/7/91	5/7/91
OVA Reading	0.0	0.0	---	10.0	---	---	0.0	220.0
Benzene	BDL	BDL	0.048	BDL	BDL	BDL	BDL	BDL
Toluene	BDL	BDL	0.019	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Xylenes	BDL	BDL	0.660	BDL	BDL	BDL	BDL	BDL
Total BTEX	BDL	BDL	0.727	BDL	BDL	BDL	BDL	BDL
TPH	64	20	36	21	BDL	24	12	18
Lead	---	---	---	---	---	---	---	---

NOTE: * All parameter concentrations reported in mg/kg (ppm), unless otherwise stated.

ABBREVIATIONS:

BDL - Below Detection Limit
ppm - Parts Per Million
TPH - Total Petroleum Hydrocarbon
BTEX - Benzene, Toluene, Ethylbenzene, & Xylenes

SYMBOLS:

> - Greater Than
--- - Not Analyzed

TABLE 6

Summary of Soil Quality Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

	SAMPLE ID							
	A-5-1		MW-710-2-1	A-7-1	A-9-1	A-10-1	MW-9-1	MW-9-2
BORING NO.	A-5		A-6	A-7	A-9	A-10	A-11	A-11
PARAMETERS*								
Depth (feet)	3.5 - 4.0		2.5 - 3.0	3.5 - 4.0	2.5 - 3.0	3.5 - 4.0	2.5 - 3.0	3.5 - 4.0
Date	5/7/91	5/14/91	5/2/91	5/8/91	5/7/91	5/8/91	5/7/91	5/7/91
OVA Reading	800.0	---	> 1,000.0	0.0	0.8	0.0	3.0	500.0
Benzene	1.10	BDL	1.4	BDL	BDL	BDL	BDL	BDL
Toluene	0.41	BDL	1.6	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	BDL	BDL	4.9	BDL	BDL	BDL	BDL	BDL
Xylenes	BDL	BDL	3.0	BDL	BDL	BDL	BDL	BDL
Total BTEX	1.51	BDL	10.9	BDL	BDL	BDL	BDL	BDL
TPH	28	15	1,400	13	46	19	26	18
Lead	---	18	---	---	---	---	---	---

NOTE: * All parameter concentrations reported in mg/kg (ppm), unless otherwise stated.

ABBREVIATIONS:

BDL - Below Detection Limit
ppm - Parts Per Million
TPH - Total Petroleum Hydrocarbon
BTEX - Benzene, Toluene, Ethylbenzene, & Xylenes

SYMBOLS:

> - Greater Than
--- - Not Analyzed

TABLE 7

Summary of Water Quality Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

	SAMPLE ID									
	MW-1-1	MW-3-1	MW-4-1	MW-5-1	MW-6-1	MW-7-1	MW-7-1C	MW-8-1	MW-10-1	MW-11-1
WELL NO.	MW-1	MW-3	MW-4	MW-5	MW-6	MW-7	MW-7	MW-8	MW-10	MW-11
PARAMETERS*										
Date	5/29/91	5/28/91	5/29/91	5/28/91	5/28/91	5/29/91	5/29/91	5/29/91	5/28/91	5/29/91
Benzene	5,200	22	600	BDL	BDL	BDL	BDL	36	BDL	9.2
Toluene	22,000	BDL	5.8	BDL	BDL	BDL	BDL	2.4	BDL	16.0
Ethylbenzene	3,800	BDL	26	BDL	BDL	BDL	BDL	BDL	BDL	17.0
Xylenes	17,000	BDL	170	BDL	1.5	BDL	BDL	BDL	BDL	27.0
Total BTEX	48,000	22	801.8	BDL	1.5	BDL	BDL	41.3	BDL	69.2
TPH (ppm)	55	BDL	BDL	BDL	BDL	1.9	BDL	2.9	BDL	BDL
Lead (ppm)	0.038	---	BDL	---	BDL	---	---	---	---	---

NOTE: * All parameters reported in parts per billion, unless otherwise stated.

ABBREVIATIONS:

BDL - Below Detection Limits
TPH - Total Petroleum Hydrocarbons
ppm - Parts Per Million

TABLE 8

Summary of Water System Survey Data
Hunter Army Airfield
Building No. 710 Area
Savannah, Georgia
Job No. 10675, Report No. 53855

Map Number	Well Owner and Number	Information Source	Depth of Well (ft)	Bottom of Casing (ft)	Discharge (GPM)	Primary Use of Water	Comments
1	Hunter Army Airfield #1	HAA/USGS	504	259	1300	Public	
2	Hunter Army Airfield #2	HAA/USGS	555	260	1440	Public	
3	Hunter Army Airfield #3	HAA/USGS	370	324	30	Public	
4	Hunter Army Airfield #4	HAA/USGS	300	90	---	Not Used	
4A	Hunter Army Airfield #4A	HAA/USGS	360	267	80	Public	
5	Hunter Army Airfield #5	HAA	380	85	30	Public	Outside 3-mile radius
	Hunter Army Airfield #6	HAA/USGS	180	---	---	Not Used	
7	Hunter Army Airfield #7	HAA	450	330	70	Public	Outside 3-mile
8	Hunter Army Airfield #8	HAA/USGS	375	255	80	Public	Outside 3-mile
9	Hunter Army Airfield #9	HAA/USGS	623	270	1000	Emergency	
10	Hunter Army Airfield #10	HAA	---	---	180	Vehicle Wash	
11	City of Savannah #15	USGS/C of S	414	252	1000	Public	USGS has well listed as #36
12	Mrs. McCallan	USGS	341	146	---	Public	
13	Biltmore Gardens Mobile Home Park	USGS/Owner	380	290	150	Public	
14	City of Savannah #25	USGS/C of S	540	287	1100	Public	
15	City of Savannah #13	USGS/C of S	1000	270	1300	Public	
16	City of Savannah #9	USGS/C of S	710	267	1600	Public	
17	City of Savannah #6	USGS/C of S	750	240	1400	Public	

NOTE: Map Well Numbers correspond to Plates 8 and 9.

ABBREVIATIONS AND SYMBOLS:

Ft	-	Feet
GPM	-	Gallons Per Minute
HAA	-	Hunter Army Airfield
USGS	-	United States Geological Survey
C of S	-	City of Savannah

APPENDIX C

C-1 - TRACER TIGHT™ LEAK TEST REPORT

C-2 - SHALLOW SOIL GAS INVESTIGATION REPORT

C-3 - DRILLING LOGS AND HTW LOG FOR BORING T-1 (A-3)

C-1 - TRACER TIGHT™ LEAK TEST REPORT

Tracer Research Corporation

Tracer Tight™ LEAK TEST
FOUR UNDERGROUND STORAGE TANKS
HUNTER ARMY AIR FIELD
SAVANNAH, GEORGIA

MARCH 1990

8555 North Business Center Drive • Tucson, Arizona 85705 • (602) 888-9400

TRACER TIGHT TANK TESTS

Tracer Tight leak testing is performed by mixing a tracer, a volatile chemical concentrate, with the product inside of a tank or pipe. If the product leaks out of the system the tracer escapes from the liquid product by evaporation. The tracer vapors are released into the soil and migrate in all directions from the leak through the soil porosity. Special probes or tubing are placed in the soil near the tanks and pipes to collect the tracer vapors that will appear in the soil in the event of a leak. The vapors are collected from the soil and analyzed for the presence of tracer by means of an extremely sensitive chromatographic measurement. The tracer is added to the product in very low concentrations typically only a few ppm. Thus, it has no impact on the physical properties of the product. The tracer vapors can be detected in the low parts per trillion level in the soil. For this reason the method is capable of detecting very small leaks in the tanks and pipes.

The tracer chemical, being highly volatile, distributes itself into both the fuel and the vapor space above the fuel inside the tank. Because of its ability to escape through leaks in the vapor space of a partially full tank, there is no requirement to top-off tanks with fuel before testing.

There are several fundamental advantages to the non-volumetric Tracer Tight test over the volumetric testing approach. First, the use of the Tracer Tight method will provide leak testing with a much greater degree of convenience and assurance. For example, the tracer method is completely non-disruptive to normal operations involving the tanks. Two weeks prior to testing, a tracer is released into the product inside the tank. Only normal fuel usage is required to distribute the tracer throughout the entire system. No addition of fuel to top off the tank is required. No additional personnel are required to coordinate the day to day activities of the leak detection operations. All leaks are typically identified and located without any tank modifications or digging. As a result the Tracer Tight method is much more convenient to both the tank users and contract administrators than volumetric tank testing.

The Tracer Tight method will also bring much greater assurance of quality than volumetric testing. The TRC method, like other vapor detection methods, is known to be a quantum leap beyond volumetric methods in terms of sensitivity. For example, when the U.S. Army Corps of Engineers evaluated the Tracer Tight method along with several volumetric methods at March AFB in June 1986, TRC detected and quantified leakage simulated as low as 0.0003 gallons per hour.

Because variables such as tank size, thermal expansion of fuel, air pockets, or other variables that effect volumetric methods, do not impact the tracer testing method, the results are far less ambiguous. Therefore, the greater sensitivity coupled with absence of potentially misleading variables makes the tracer method the most accurate and most quality assured method available.

EQUIPMENT

TRC has designed and built a fleet of field vehicles that are capable of sampling and performing all chemical analyses on-site. The TRC analytical field vehicles are normally operated by a two-person crew consisting of a GC operater and a field assistant. A list of equipment used by TRC in a leak detection investigation is given below.

(A) General Equipment

- One ton Ford E350 chassis, van or flatbed
- Onan 5 kW gasoline powered generators (110 volt/AC)
- Hydraulic pusher/puller/pounder mechanism capable of driving probes 20 feet deep in some soils
- Evacuation probes fabricated from a galvanized pipe
- Safety Equipment: first aid, fire, hazardous chemical protection
- Two vacuum pumps
- A pneumatic rock drill capable of drilling through asphalt and concrete pads

(B) Gas Chromatographic Equipment In Each Van

. Two (2) Varian 3300 gas chromatographs
. Two Spectra-Physics model SP4270 computing integrators
. Electron capture, flame ionization, photo ionization and thermo conductivity detectors on the various GCs.
. Analytical standards for tracers and petroleum hydrocarbons, pure compounds obtained from Chemservice Inc. of West Chester, Pennsylvania
. Glass syringes ranging from 10 ul to 10 ml in volume
. Various packed and capillary gas chromatographic columns
. Gas cylinders containing compressed nitrogen, air and hydrogen
. 40 ml glass sampling vials in which the chemical standards are prepared
. Various fittings and tools required for normal operation

PREPARED FOR:

Card Smith
Army Corps of Engineers
100 W. Oglethorde
Savannah, Georgia 31401
(912)944-5674

Tracer Tight™ LEAK TEST
FOUR UNDERGROUND STORAGE TANKS
HUNTER ARMY AIR FIELD
SAVANNAH, GEORGIA

MARCH 1990

SUBMITTED BY:

Karen L. Lucas

TRACER RESEARCH CORPORATION

COEHAAF.REP
1-90-156-T

TABLE OF CONTENTS

INTRODUCTION

Tracer Research Corporation (TRC) performed Tracer Tight™ leak testing of four underground storage tanks at Hunter Army Air Field located in Savannah, Georgia. Tracer was added to the tanks in February 1990 and testing was conducted on March 14, 1990. Testing was performed under contract to the Army Corps of Engineers, Savannah District.

CONCEPT OF OPERATION AND IMPLEMENTATION

The tracer leak detection method relies upon the addition of a highly volatile liquid chemical to the fuel. If a leak occurs in the underground fuel system, fuel is released into the surrounding soil. The tracer escapes from the fuel by vaporization and disperses into the soil by molecular diffusion. Various means are used to sample the soil vapors in the immediate vicinity of the underground tanks and pipes. In this case, sampling was performed by driving probes into the ground in the vicinity of the tanks and pipes. Each probe has an effective detection radius of approximately 10 to 12 feet. This means that a given probe should detect a leak anywhere within the area described by the 10 foot radius around the probe. The tracer is placed in the tank at least two weeks prior to the probe sampling for this method to be effective. This process of leak detection by placing a liquid tracer in a liquid product followed by detection of the tracer underground in the vapor phase is protected under TRC patents.

BACKGROUND ON VAPOR LEAK DETECTION METHODS

TRC has developed several different tracer methods for leak testing underground fuel systems. These include rapid tests for all sizes of tanks that require circulation of tracer with fuel inside the tank and high volume evacuation of air from the backfill around the tank. The rapid tests are relatively costly because they are labor and equipment intensive. However, the method has the advantages of providing relatively fast and sensitive leak location and quantification.

As priorities and requirements for tank testing have evolved in the past five years, the need to quantify the leak rate has been deemphasized and both "passive" and "aspirated" vapor leak detection systems have been gaining acceptance, particularly in the western United States. Passive leak detection refers to methods where the vapors move to the sensor or pick-up probes entirely by molecular diffusion. Aspirated leak detection refers to methods where soil air is continuously drawn or evacuated through the pick-up probe to aid transport of vapors. Both methods are equally sensitive but more probes are required to cover the same area using the passive method as compared to the aspirated method. However, the installation cost of the passive method is much lower.

Vapor methods are typically much more sensitive than the volumetric methods for leak detection. With the exception of the TRC leak detection method, all other vapor methods are dependent on product vapors themselves to detect leakage. This means that low volatility fuels such as kerosene, diesel or heating oil present problems due to their low vapor pressures. Conventional vapor methods that rely on product vapors commonly encounter problems distinguishing between existing leaks and previous spills. By adding tracer to the tank, the volatility of the product becomes unimportant because the tracer becomes the volatile component used to detect leakage.

The tracer is present in the product only in very low part per million concentrations. For this reason the tracer does not impact the physical properties or use of the product. The method requires extremely selective and sensitive detection ability for the tracer. Typically, the tracers are detected in the low part per trillion range. Due to the sensitivity of the detection, the tracer can be used economically to test even multimillion gallon tanks with no reduction in sensitivity.

Tracer is not normally present in or around the tank before the leak test begins. As a result, there is no potential confusion between present leakage and previous spills. Several tracers are available for general use. This means that a given tank or system can be retested several times, each time with a different tracer to resolve special problems and provide completely unambiguous conclusions about the system integrity.

TRC has emphasized development of the passive leak detection technology because of the simplicity and reliability of this approach.

TESTING RESULTS

Testing was performed on two underground storage tanks at Hunter Army Air Field Fire Station. One 1,500 gallon diesel tank (Tank A) was inoculated with DDM tracer and one 1,000 gallon gasoline tank (Tank B) was inoculated with 114B2 tracer. The target concentration of tracer in each of the four tanks was approximately 10 ppm.

A total of two vapor samples were collected next to each tank. Samples were collected at depths ranging from three to six feet. A map showing the orientation of the tanks and sampling locations is included in Appendix A (Figure 1). Samples were analyzed for DDM, 114B2, and total petroleum hydrocarbons, which are reported C4-C9 aliphatic, alicyclic and aromatic compounds. Data from the sample analyses are reported in Appendix B. The tracers were not detected in any of the four sampling locations. The hydrocarbon concentrations were non-detectable except for sampling location A-1 which had a concentration of 0.9 ug/L. These data indicate that Tanks A and B do not leak.

Testing was also performed on two 12,000 gallon tanks at Hunter Army Air Field Building 710. The gasoline tank (Tank C1) was inoculated with DDM tracer and the diesel tank (Tank C2) was inoculated with 114B2 tracer. A total of six vapor sampling locations were placed in the vicinity of Tanks C1 and C2 as shown in Figure 2. Samples were collected at depths ranging from two to three feet below grade. Vapor samples were not collected below three feet due to the presence of water.

Low concentrations of 114B2 tracer were detected in vapor collected at sampling locations C-1,2,3,4 and 6 at depths of two to three feet below grade. Samples could not be collected at greater depths due to the presence of groundwater below two feet. The DDM tracer was not detected in any of the sampling locations placed in the vicinity of the tanks. Hydrocarbons were detected at very high concentrations ranging from 310,000 to 1,200,000 ug/L. The distribution of hydrocarbons is greater than 200 square feet total area. The tracer data indicates that Tank C2 has a small or intermittent product leak. Due to the excessively high levels of hydrocarbons detected, the tanks should be closely monitored.

CERTIFICATION

Location: Hunter Army Air Field
Savannah, Georgia

Date: March 1990

Tank	Capacity (gal)	Product	Tracer	Pass/Fail	Leak Status
Tank A	1,500	diesel	DDM	Pass	1
Tank B	1,000	gasoline	114B2	Pass	1
Tank C1	12,000	gasoline	DDM	Pass	1
Tank C2	12,000	diesel	114B2	Fail	3

Tracer Research Corporation certifies that the tanks and pipe systems listed in the above table have been tested by means of Tracer Tight™, which meets the criteria set forth in NFPA 329 for a precision leak test.

Submitted by: Karen L. Swess
Tracer Research Corporation

The following criteria are used for the classification of leaks when tracer is detected.

LEAK STATUS

1 NO LEAKAGE - Rate less than 0.005 gallons per hour.

2 VAPOR LEAK - Maximum tracer concentration less than 1 ug/L in soil vapor diminishing at depths below three feet. Total volatile hydrocarbon concentrations less than 20,000 ug/L in soil vapor (if diesel is the only fuel present, substitute 100 ug/L in place of 20,000 ug/L).

3 SMALL OR INTERMITTENT PRODUCT LEAK less than 0.05 gph -Maximum tracer concentration less than 1 ug/L in soil vapor, sustaining or increasing at depths below three feet or to the top of the groundwater table. Hydrocarbon concentrations approximately equal to or greater than 20,000 ug/L in soil vapor (100 ug/L for diesel) sustaining or increasing below three feet. Distribution of elevated hydrocarbons is less than 200 square feet total area.

4 SIGNIFICANT PRODUCT LEAK 0.05 gph or greater - Maximum tracer concentration greater than 1 ug/L near source, increasing or sustaining concentration below three feet or to the top of the groundwater table. Hydrocarbon concentrations greater than 20,000 ug/L in soil vapor (100 ug/L for diesel) sustaining or increasing below three feet. Distribution of elevated hydrocarbons is equal to or greater than 200 square feet total area.

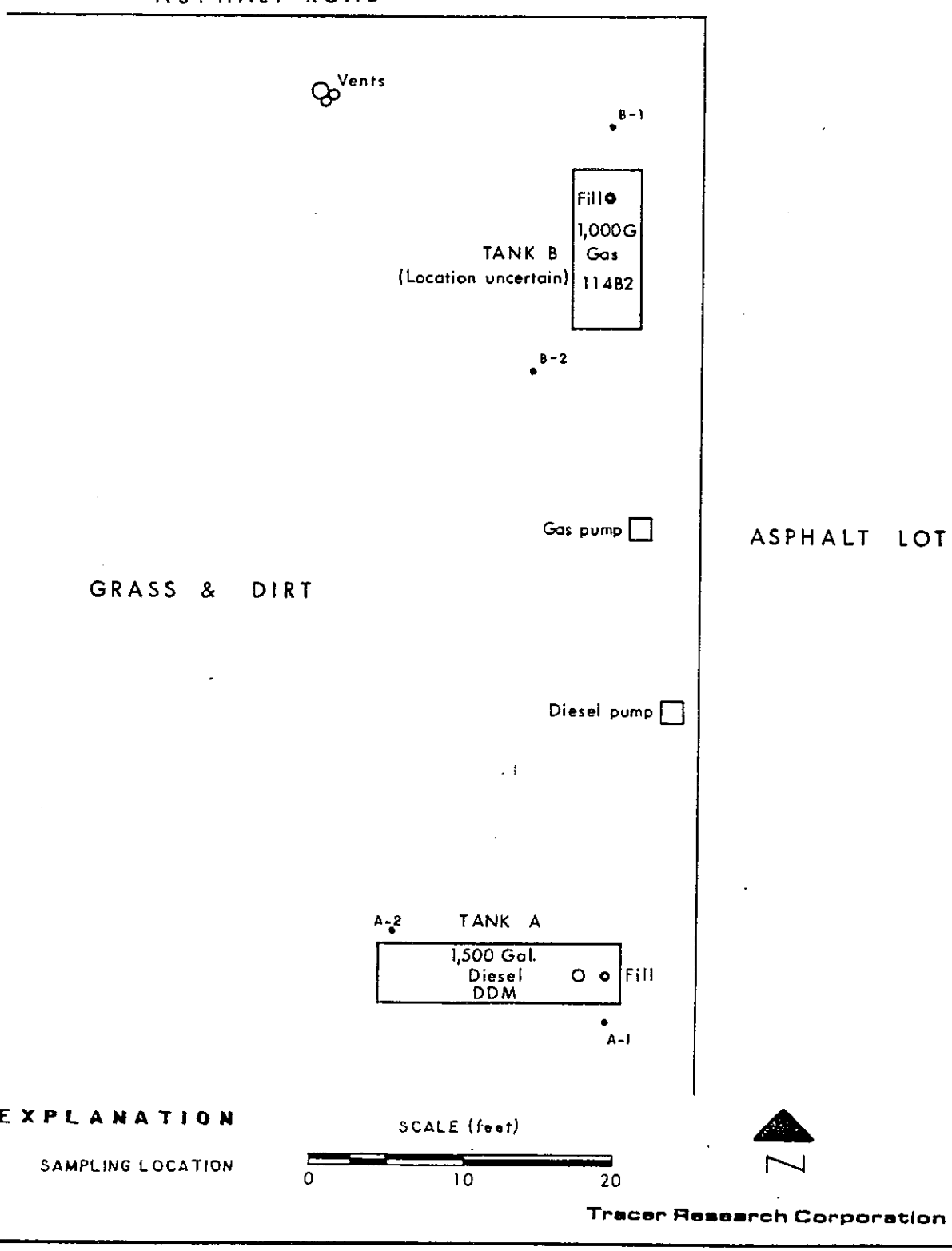
APPENDIX A: FIGURES

FIGURE 1

SAMPLING LOCATIONS

AIRFIELD FIRE STATION PUMPS

Army Corps Of Engineers
Ft. Stewart
Savannah, Georgia

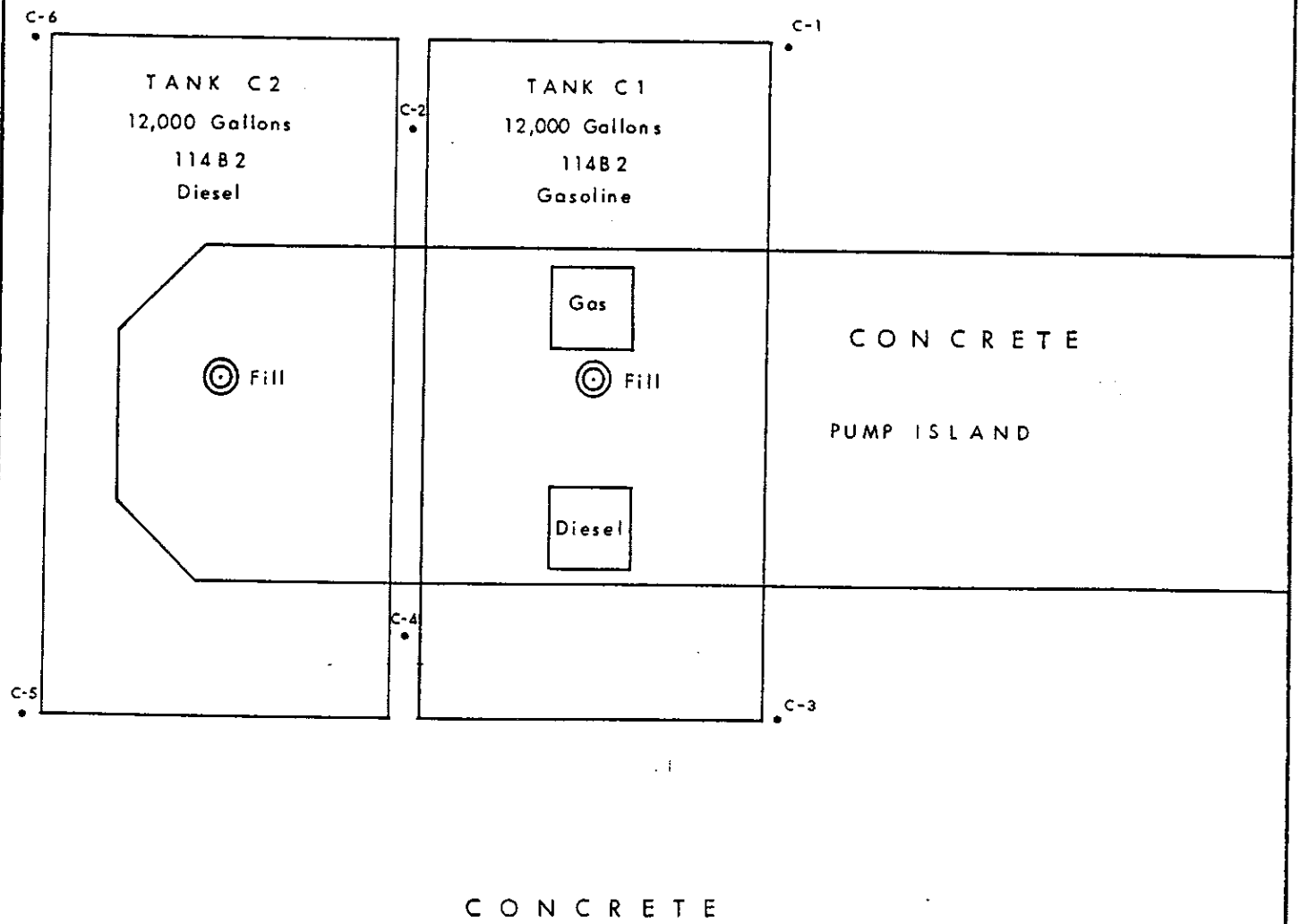


Tracer Research Corporation

FIGURE 2

SAMPLING LOCATIONS
BUILDING No. 710

Army Corps Of Engineers
Ft. Stewart
Savannah, Georgia



EXPLANATION

C-3 ● SAMPLING LOCATION

SCALE (feet)

0 5 10

N

Tracer Research Corporation

APPENDIX B: ANALYTICAL RESULTS

CORPS OF ENGINEERS/HUNTER FIELD-FT.STEWART/SAVANNAH, GEORGIA JOB#1-90-156-T
03-14-90
CONDENSED DATA

SAMPLE	DDM ug/l	11482 ug/l	THC ug/l
AIR	<0.00004	<0.00005	<0.2
A-1-4'	<0.00004	<0.00005	0.9
A-1-6'	<0.00004	<0.00005	0.4
A-2-3'	<0.00004	<0.00005	<0.2
B-1-3'	<0.00004	<0.00005	<0.2
B-2-3'	<0.00004	<0.00005	<0.2
B-2-6'	<0.00004	<0.00005	<0.2
C-1-3'	<0.00004	0.005	496000
C-2-2'	<0.00004	0.006	642000
C-3-2'	<0.00004	0.006	1210000
C-4-3'	<0.00004	0.004	632000
C-5-3'	<0.00004	<0.00005	328000
C-6-2'	<0.00004	0.0001	312000
TANK C-1-HS	0.1	<0.0002	N/A
TANK C-2-HS	<0.0002	0.009	N/A
TANK B-HS	0.004	17	N/A
TANK A-HS	12	0.04	N/A

N/A not analyzed

Analyzed by: K. Ptak
Checked by: A. Hooper
Proofed by: L. Kaplander

Tracer Research Corporation

C-2 - SHALLOW SOIL GAS INVESTIGATION REPORT

Tracer Research Corporation

SHALLOW SOIL GAS INVESTIGATION
HUNTER ARMY AIR FIELD
BUILDINGS 133 AND 710
SAVANNAH, GEORGIA

JULY 1990

3855 North Business Center Drive • Tucson, Arizona 85705 • (602) 888-9400

PREPARED FOR:

U.S. Army Corps of Engineers
Savannah District
100 West Oglethorpe Avenue
Savannah, Georgia 31402-0889
(912)944-5674

SHALLOW SOIL GAS INVESTIGATION
HUNTER army AIR FIELD
BUILDINGS 133 AND 710
SAVANNAH, GEORGIA

JULY 1990

SUBMITTED BY:

Karen L. Guess

Tracer Research Corporation

384[illegible].MSG
1-90-384-S

TABLE OF CONTENTS

INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at Hunter Army Air Field located in Savannah, Georgia. The investigation was conducted on July 11-12, 1990 under contract to the Army Corps of Engineers, Savannah District. The purpose of the investigation was to delineate the areal extent of hydrocarbon contamination in the subsurface at two site locations (Building 133 and 710).

During this survey, a total of twenty-one soil gas samples were collected and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

benzene
toluene
ethylbenzene
xylenes
total hydrocarbons (THC)

Xylenes are reported as the total of the three xylene isomers and total hydrocarbons are reported as gasoline range compounds consisting of approximately C_4-C_9 aliphatic, alicyclic and aromatic compounds.

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with a flame ionization detector (FID).

SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large data base. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus, the likelihood

of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be a substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical field van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van has two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

SAMPLING PROCEDURES

Sampling probes consist of 7 foot lengths of 3/4 inch diameter hollow steel pipe that are fitted with detachable drive tips. Soil gas probes were advanced 4-5 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow is monitored by a vacuum gauge to insure that an adequate flow is obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas is evacuated with a vacuum pump. During the soil gas evacuation, samples are collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas are collected for immediate analysis in the TRC analytical field van. Soil gas is subsampled (duplicate injections) in volumes ranging from 1 uL to 2 Ml, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from two to eleven inches Hg. The maximum pump vacuum was measured at twenty-three inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph, equipped with a flame ionization detector (FID), was used for the soil gas analyses. Compounds were separated on a 6' by 1/8" OD packed column with OV-101 as the stationary phase in a temperature controlled oven at 100°. Nitrogen was used as the carrier gas.

Hydrocarbon compounds detected in soil gas were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest are a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varies with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest must be kept within the linear range of the analytical equipment. If any compound has a high concentration, it is necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may cause decreased detection limits for other compounds in the analyses.

The detection limits for the selected compounds were approximately 0.07 ug/L depending on the conditions of the measurement, in particular, the sample size. If any component being analyzed is not detected, the detection limit for that compound in that analysis is given as a "less than" value (e.g. <0.1 ug/L). Detection limits obtained from GC analyses are calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples.

- Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.
- Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.
- Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- Subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.

- Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to a concurrently sampled ambient air analysis.
- All sampling and subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.

RESULTS

A total of twenty-one soil gas samples were collected and analyzed in the field. Analytical data is condensed in Appendix A. Isoconcentration contour maps with sampling locations and compound concentrations (Figures 1-4) are in Appendix B. Figures 1 and 3 are maps showing the sampling locations.

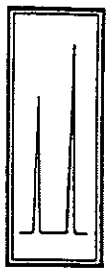
Ambient air samples were collected during the course of the investigation to help evaluate the level of significance for the selected VOC's. The level of significance is simply the level above which concentrations are considered to be significant in terms of groundwater or soil contamination. None of the selected compounds were detected in the ambient air samples. The level of significance for each target compound is based on several factors; concentrations in ambient air, background levels, and TRC's past experience. Based on the evaluation of these factors, the level of significance for the selected target compounds was determined to be approximately 1 ug/L. In other words, soil gas concentrations of benzene, toluene, ethylbenzene, xylenes and THC greater than 1 ug/L may indicate possible VOC contamination in the vicinity.

Benzene, toluene, and THC were detected in nine of the ten soil gas samples collected at Building 133. Benzene concentrations ranged from non-detect (<0.08 ug/L) at sampling locations SG-8 and SG-9 to 38,000 ug/L at SG-6. Toluene concentrations ranged from non-detect (<0.07 ug/L) at SG-8 and SG-9 to 18,000 ug/L at SG- 6. Only the THC concentrations were contoured because no additional information would have been gained by contouring benzene and toluene concentrations. THC concentrations ranged from non-detect (<0.08 ug/L) at sampling location SG-8 to 750,000 ug/L at SG-6. The hydrocarbon plume extends at least 325 feet to the east and 100 feet to the north of SG-6. The western and southern boundaries can not be defined due to insufficient data.

At Building 710, toluene, xylenes, and THC were detected in the collected soil gas samples. Toluene concentrations ranged from 4 ug/L at sampling location GS-8 to 5,500 ug/L at GS-9. Xylene concentrations ranged from 0.2 ug/L at GW-6 to 4 ug/L at GW-1. Xylenes could not be detected at concentrations lower than 30 ug/L at GW-9, 37 ug/L at GW-11 and 150 ug/L at GW-10 due to elevated concentrations of the other selected compounds which required small injection sizes of the samples. Again, only THC concentrations were contoured for Building 710. The hydrocarbon plume extends at least 100 feet in all directions from the northwest corner of Building 710. Hydrocarbon concentrations were detected above the level of significance (1 ug/L) at all of the sampling locations.

CONCLUSIONS

Significant concentrations of benzene, toluene, xylenes, and THC were detected in the soil gas near Buildings 133 and 710 at Hunter Army Air Field. The isoconcentration contours for total hydrocarbons indicate possible source areas, for subsurface contamination, to the west of Buildings 133 and 710. These areas may coincide with the location of underground storage tanks at these sites. Further investigations are needed to better define the source and extent of subsurface contamination.



APPENDIX A: ANALYTICAL DATA

ARMY CORPS OF ENGINEERS/HUNTER AAF/SAVANNAH, GEORGIA JOB#1-90-384-T
07/11/90
CONDENSED DATA

SAMPLE	BENZENE ug/l	TOLUENE ug/l	ETHYL BENZENE ug/l	XYLENE ug/l	THC ug/l
AIR	<0.2	<0.1	<0.2	<0.1	<0.2
SG-1-4'	4	4	<0.08	<0.07	40
SG-2-4'	4	4	<0.08	<0.07	32
SG-3-4'	27	14	<0.8	<0.7	1600
SG-4-4'	6	4	<0.2	<0.1	36
SG-5-4'	1	0.8	<0.2	<0.1	4
SG-6-4'	38000	18000	<42	<35	750000
SG-7-4'	26000	14000	<42	<35	120000
SG-8-4'	<0.08	<0.07	<0.08	<0.07	<0.08
SG-9-5'	<0.08	<0.07	<0.08	<0.07	0.8
SG-10-5'	2	2	<0.08	<0.07	14

Analyzed by: K. Ptak
Checked by: M. Flack
Proofed by: L. Laplander

ARMY CORPS OF ENGINEERS/HUNTER AAF/SAVANNAH, GEORGIA JOB#1-90-384-T
07/12/90
CONDENSED DATA

SAMPLE	BENZENE ug/l	TOLUENE ug/l	ETHYL BENZENE ug/l	XYLENE ug/l	THC ug/l
AIR	<0.08	<0.07	<0.08	<0.07	<0.3
GS-1-4'	4	20	<0.4	4	50
GS-2-4'	<0.1	6	<0.1	0.8	12
GS-3-4'	<0.3	5	<0.2	0.3	8
GS-4-4'	<0.2	6	<0.08	0.6	20
GS-5-4'	<0.3	10	<0.2	0.3	41
GS-6-4'	<0.2	4	<0.08	0.2	14
GS-7-4'	<0.2	8	<0.08	0.3	27
GS-8-4'	<0.2	4	<0.08	0.5	9
GS-9-5'	I	5500	<31	<30	180000
GS-10-5'	I	1800	<150	<150	160000
GS-11-4'	<78	<37	<39	<37	3800

I interference with adjacent peaks

Analyzed by: K. Ptak
Checked by: M. Flack
Proofed by: L. Laplander

APPENDIX B: FIGURES

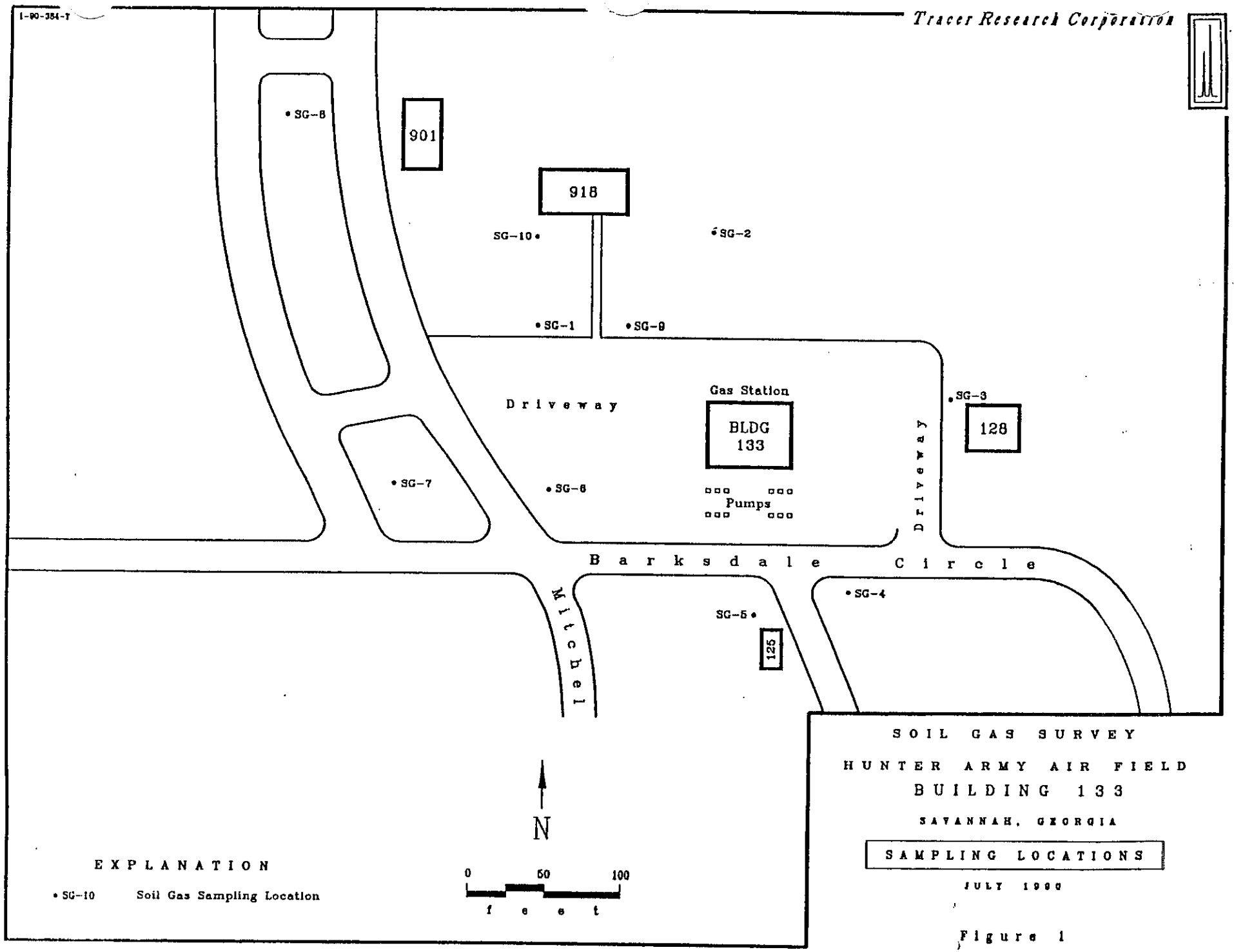

1-90-384-T
Tracer Research Corporation
SG-8
901
918
SG-10
SG-2
SG-1
SG-9
Gas Station
Driveway
BLDG
133
SG-3
128
SG-7
SG-6
Pumps
Driveway
Barksdale Circle
Mitchel
SG-4
SG-5
125
N
EXPLANATION
SG-10 Soil Gas Sampling Location
0 50 100
feet
SOIL GAS SURVEY
HUNTER ARMY AIR FIELD
BUILDING 133
SAVANNAH, GEORGIA
SAMPLING LOCATIONS
JULY 1990

Figure 1

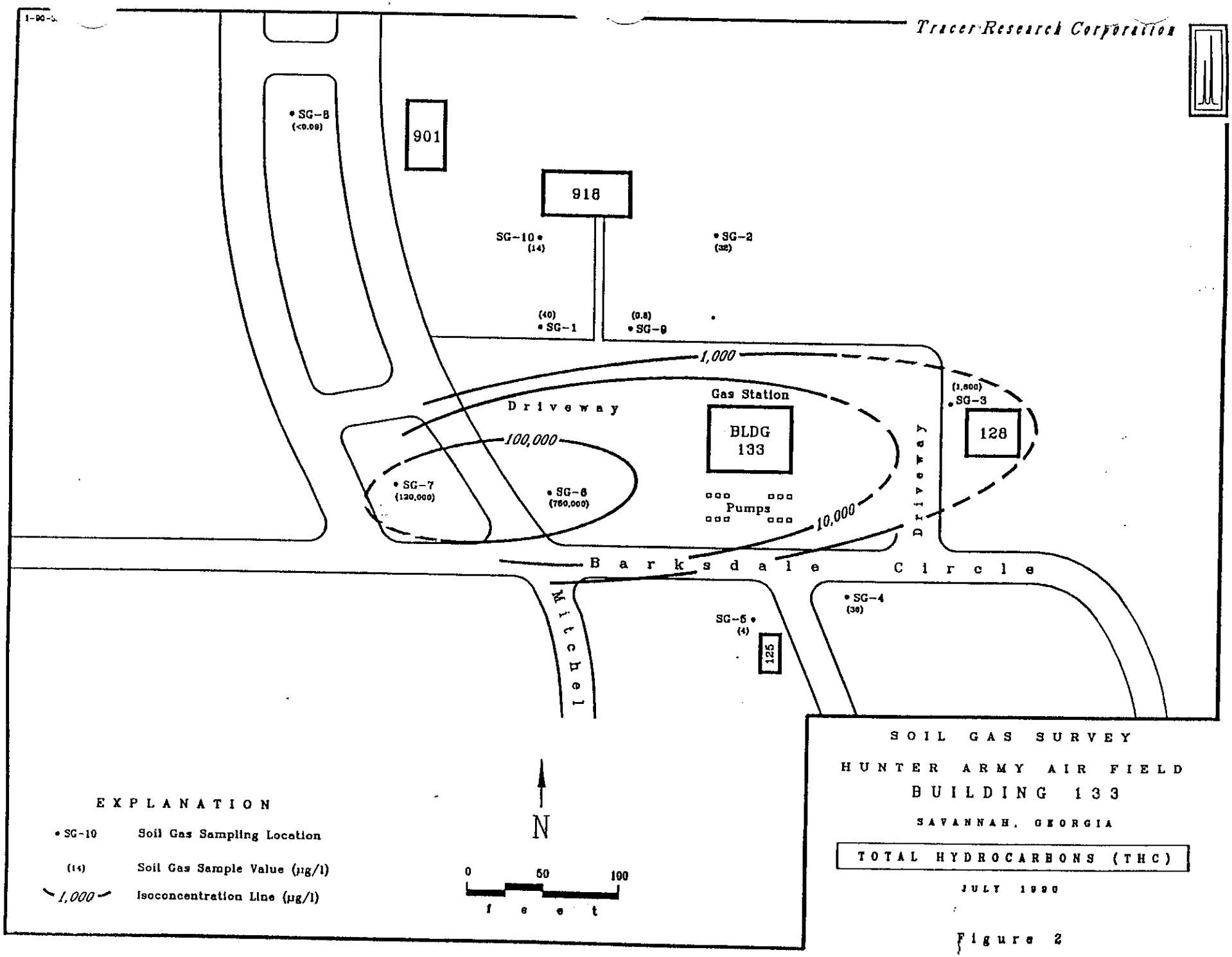

Tracer Research Corporation
• SG-8
(<0.08)
901
918
SG-10 •
(14)
• SG-2
(32)
(40)
• SG-1
(0.8)
• SG-9
1,000
Gas Station
Driveway
(1,600)
• SG-3
128
BLDG
133
100,000
• SG-7
(120,000)
• SG-6
(760,000)
Pumps
10,000
Driveway
Barksdale Circle
Mitchel
• SG-4
(30)
SG-5 •
(4)
125
N
0 50 100
f e e t
EXPLANATION
• SG-10 Soil Gas Sampling Location
(14) Soil Gas Sample Value (µg/l)
1,000 Isoconcentration Line (µg/l)
SOIL GAS SURVEY
HUNTER ARMY AIR FIELD
BUILDING 133
SAVANNAH, GEORGIA
TOTAL HYDROCARBONS (THC)
JULY 1990

Figure 2

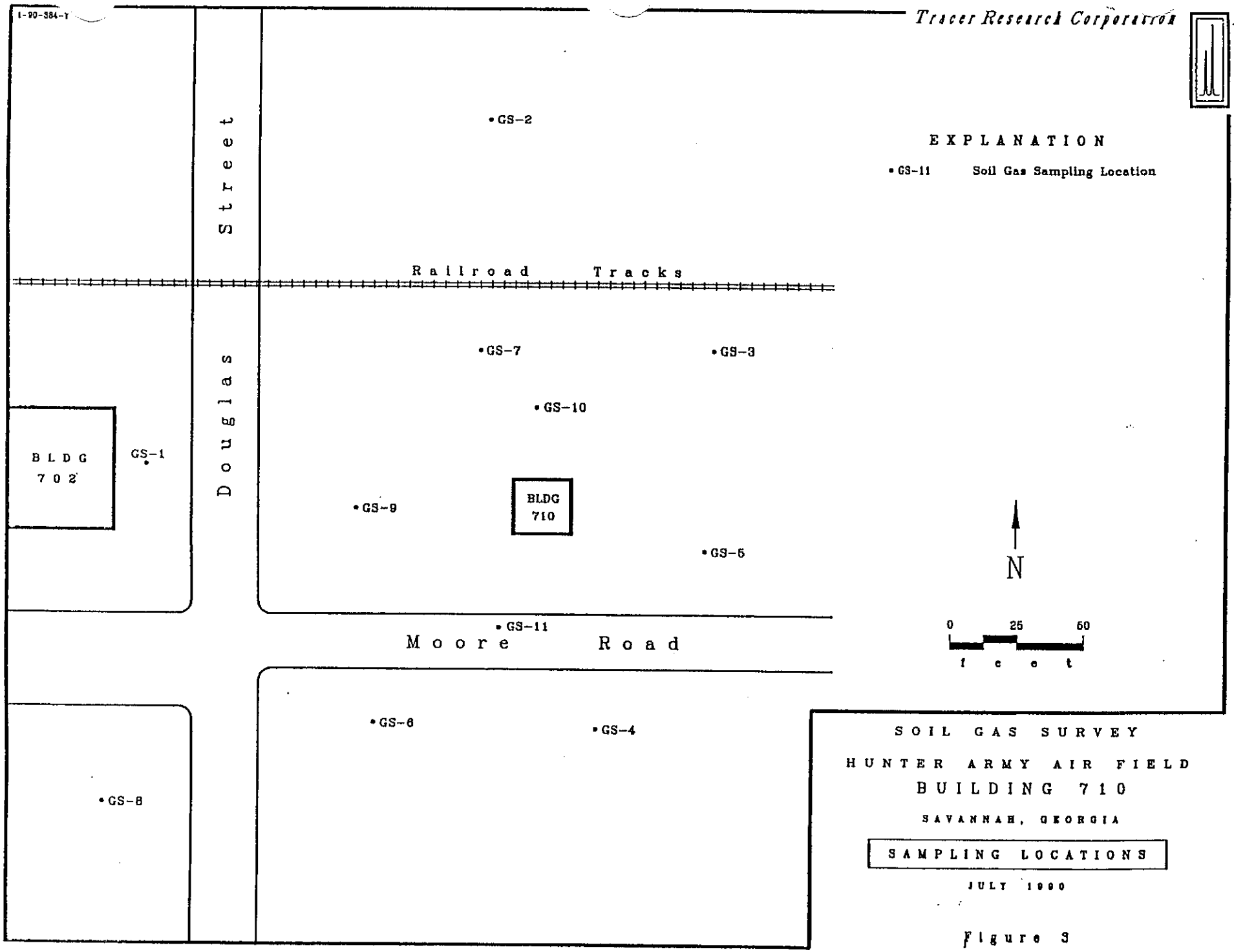

1-90-384-T
Tracer Research Corporation
Douglas Street
GS-2
EXPLANATION
GS-11 Soil Gas Sampling Location
Railroad Tracks
GS-7
GS-3
GS-10
BLDG 702
GS-1
BLDG 710
GS-9
GS-5
N
GS-11
0 25 50
feet
Moore Road
GS-6
GS-4
GS-8
SOIL GAS SURVEY
HUNTER ARMY AIR FIELD
BUILDING 710
SAVANNAH, GEORGIA
SAMPLING LOCATIONS
JULY 1990

Figure 3

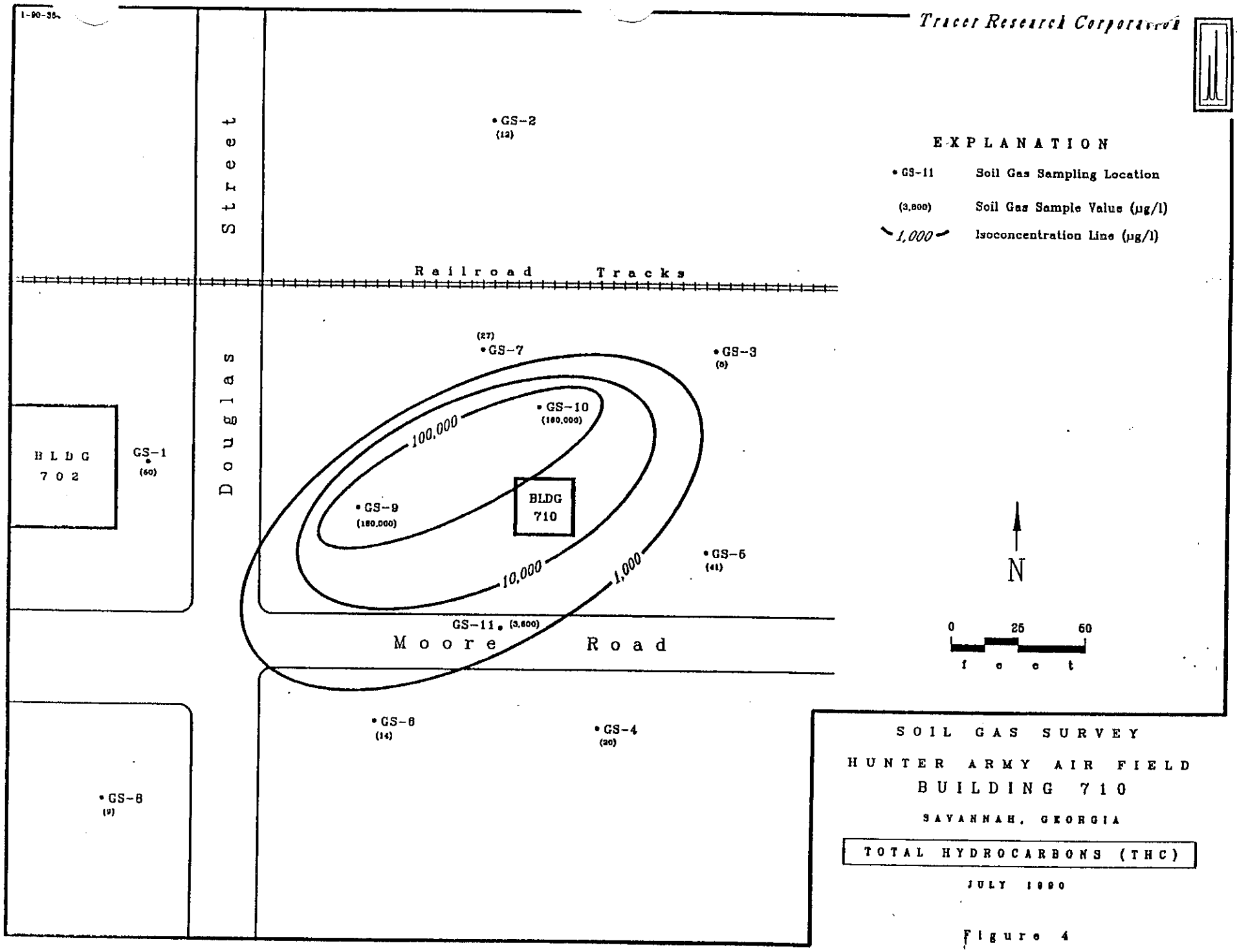

1-90-38
Tracer Research Corporation
Douglas Street
Railroad Tracks
Moore Road
BLDG 702
BLDG 710
GS-1 (60)
GS-2 (12)
GS-3 (6)
GS-4 (20)
GS-5 (41)
GS-6 (14)
GS-7 (27)
GS-8 (9)
GS-9 (180,000)
GS-10 (180,000)
GS-11 (3,600)
100,000
10,000
1,000
EXPLANATION
GS-11 Soil Gas Sampling Location
(3,600) Soil Gas Sample Value (µg/l)
1,000 Isoconcentration Line (µg/l)
N
0 25 50
feet
SOIL GAS SURVEY
HUNTER ARMY AIR FIELD
BUILDING 710
SAVANNAH, GEORGIA
TOTAL HYDROCARBONS (THC)
JULY 1990

Figure 4

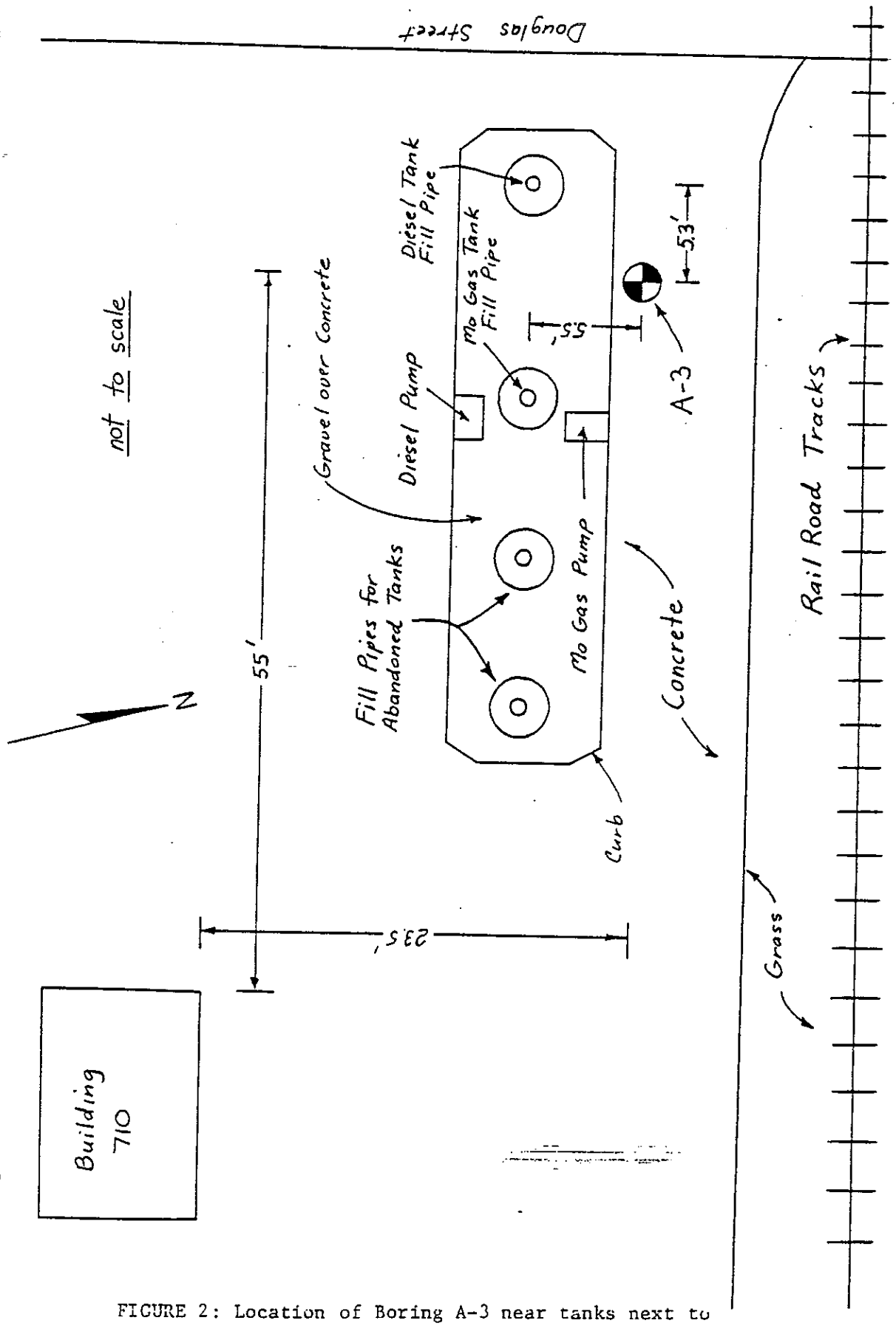


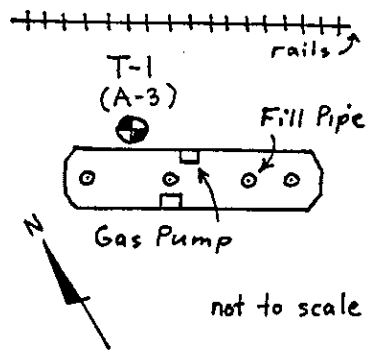
FIGURE 2: Location of Boring A-3 near tanks next to Building 710, Hunter AAF, Ga.

C-3 - DRILLING LOGS AND HTW LOG FOR BORING T-1 (A-3)

Hole No. T-1 (A-3)

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
	South Atlantic	Hunter AAF, Ga.	

1. PROJECT	Underground Storage Tank Testing
2. LOCATION (Coordinates or Station)	Near gas pump at Building 710
3. DRILLING AGENCY	
4. HOLE NO. (As shown on drawing title and file number)	T-1 (A-3)
5. NAME OF DRILLER	James E. Bolen
6. DIRECTION OF HOLE	XX VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	9.7'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	9.7'
10. SIZE AND TYPE OF BIT	Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 3 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	-
16. DATE HOLE	STARTED 16 Dec 89 / COMPLETED 16 Dec 89
17. ELEVATION TOP OF HOLE	20'± (from Topo)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	Toni F. Nicholson, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
20±0'	0					
			Concrete			Water level during drilling: 4.5'
19.0'			(SM)SILTY SAND, light grey, fine to med., silty. Odor, see note 1.		1	24 hour water level reading: Not taken, hole backfilled after drilled.
	2		Brownish-tan.			Note 1: See HTW log for further information.
	4		Dark grey, wet.			
			Saturated.		2	LOCATION MAP
	6					
	8		Dark brown-grey.		3	
10.3'	10		Bottom of Boring = 9.7'			
			NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			

HTW BORING LOG

PROJECT: BUILDING 710 UNDERGROUND STORAGE TANK LEAK TESTING	BORING NO. T-1 (A-3)
LOCATION: HUNTER ARMY AIRFIELD, GEORGIA	ELEVATION: 20.0'± (FROM TOPO)
WATER LEVEL DURING DRILLING: 4.5'	24-HOUR WATER LEVEL READING: NOT TAKEN HOLE BACKFILLED
WEATHER: 45 DEGREES, COLD, SUNNY, WINDY	DRILLER: JAMES E. BOLEN
REMARKS: THERE WAS 1.0' OF CONCRETE AT SURFACE	GEOLOGIST: TONI F. NICHOLSON

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
1	ST	1.0	1.5	12/15	-	DAMP	SM	LIGHT TAN	410				
	ST	2.0	2.5	12/15	-	DAMP	SM	BRN/ TAN	1000+				
	ST	3.0	3.5	12/15	-	DAMP	SM	BRN/ TAN	1000+				
	ST	4.0	4.5	12/15	-	WET	SM	DK. GRA	1000+				
2	ST	5.0	5.5	12/15	-	SAT.	SM	DK. GRA	1000+				
	ST	6.0	6.5	12/15	-	SAT.	SM	DK. GRA	1000+				
	ST	7.0	7.5	12/15	-	SAT.	SM	DK. GRA	1000+				
	M	8.0	8.5	12/15	-	SAT.	SM	DK.BRN GRA	1000+				
3	M	9.0	9.5	12/15	-	SAT.	SM	DK. BRN	1000+				
	M	9.4	9.7	12/15	-	SAT.	SM	DK. BRN	1000+				

APPENDIX D

BORING LOGS AND WELL CONSTRUCTION DETAILS

D - 1 - DRILLING LOGS

D - 2 - HTW BORING LOGS

D-1 - DRILLING LOGS

Hole No. MW-710-1

DRILLING LOG

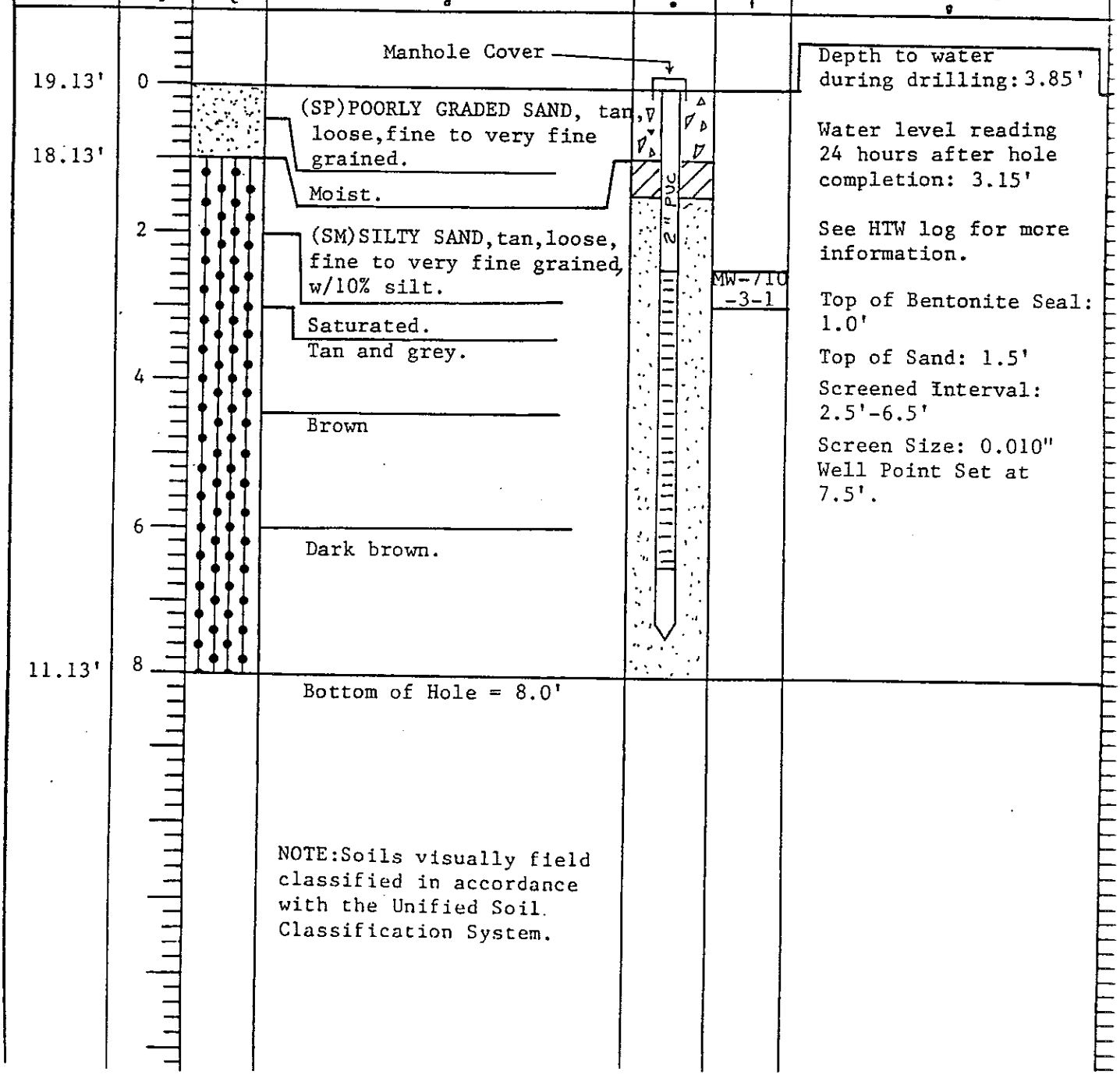
DIVISION	South Atlantic
INSTALLATION	Hunter AAF, Georgia
SHEET 1 OF 1 SHEETS	
1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	MW-710-1
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	8.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	8.0'
10. SIZE AND TYPE OF BIT	4"ID Hollow Stem Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
	3 1/2"Hand Auger
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED 1 May 91 / COMPLETED 1 May 91
17. ELEVATION TOP OF HOLE	18.76'(TOH) 18.56'(TOR)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.76'	0		Manhole Cover			Depth to water during drilling: 4.80'
18.36'			Concrete & gravel.			
			(SM) SILTY SAND, brown and tan, loose, fine to very fine grained SAND. 10% silt. Moist. Strong fuel odor.			Water level reading 24 hours after hole completion: 3.57'
16.76'	2					See HTW log for more information.
16.26'			(MH) INORGANIC SILT, black, soft, fat, organic rich, w/ some roots.			Top of Bentonite Seal: 1.0'
			(SM) SILTY SAND, brown and tan, loose, fine to very fine grained w/10% silt.			Top of Sand: 1.5'
	4		Very moist.		MW-710-1-1	
			Brown, saturated.			Screened interval: 2.5'-6.5'
			30% silt.			Screen Size: 0.010"
	6		Some clay.			Well Point Set at 7.5'
			Grey			
10.76'	8		Bottom of Hole = 8.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. MW-710-3

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS
1. PROJECT: Building 710 - Site Investigation		10. SIZE AND TYPE OF BIT: 4"ID Hollow Stem Auger, 3 1/2" Hand Auger	
2. LOCATION (Coordinates or Station): See Plan		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: Savannah District		12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45	
4. HOLE NO. (As shown on drawing title and file number): MW-710-3		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 0	
5. NAME OF DRILLER: Douglas LaRoche		14. TOTAL NUMBER CORE BOXES: -	
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Below	
		16. DATE HOLE: STARTED 2 May 91; COMPLETED 2 May 91	
7. THICKNESS OF OVERBURDEN: 8.0'		17. ELEVATION TOP OF HOLE: 19.13'(TOH) 18.85'(TOR)	
8. DEPTH DRILLED INTO ROCK: 0.0'		18. TOTAL CORE RECOVERY FOR BORING: - %	
9. TOTAL DEPTH OF HOLE: 8.0'		19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist	



NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. MW-710-4

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Hunter AAF, Georgia

SHEET 1 OF 1 SHEETS

1. PROJECT: Building 710 - Site Investigation
2. LOCATION (Coordinates or Station): See Plan
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): MW-710-4
5. NAME OF DRILLER: Douglas LaRoche
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 12.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 12.5'
10. SIZE AND TYPE OF BIT: 4"ID Hollow Stem Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL — 3 1/2" Hand Auger
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: –
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 2 May 91; COMPLETED 2 May 91
17. ELEVATION TOP OF HOLE: 19.15' (TOH) 19.00' (TOR)
18. TOTAL CORE RECOVERY FOR BORING: – %
19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
19.15'	0		Manhole Cover			Depth to water during drilling: 3.15'
			Concrete and gravel.			
18.55'			(SP) POORLY GRADED SAND, tan, loose, fine to very fine grained. Moist			
18.15'						Water level reading 24 hours after hole completion: 3.30'
	2		(SM) SILTY SAND, brown and tan, loose, fine to very fine grained, w/10% silt. Strong fuel odor.	2" PVC	MW-710-4-1	See HTW log for more information.
			Saturated			Top of Bentonite Seal: 1.0'
	4		Wood			Top of Sand: 1.5'
			Brown			Screened Interval: 2.5'-11.5'
						Screen Size: 0.010"
	6					Well Point Set at 12.5'.
	8					Interval from 8.0'-12.5' was not logged.
	10		NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			
	12					
6.65'			Bottom of Hole = 12.5'			

Hole No. MW-710-5

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	MW-710-5
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	11.0'
10. SIZE AND TYPE OF BIT	4"ID Hollow Stem Auger, 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1; UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 3 May 91; COMPLETED: 6 May 91
17. ELEVATION TOP OF HOLE	17.85'(TOH) 17.65'(TOR)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
17.85'	0		Manhole Cover			Depth to water during drilling: 3.10'
			(SM) SILTY SAND, brown, loose, fine to very fine grained, w/10% silt.			Water level reading 24 hours after hole completion: 3.87'
			Dark brown w/30% silt.			
15.85'	2		Black.			See HTW log for more information.
			(SC) CLAYEY SAND, black, soft very fine grained, w/40% clay.		MW-710-5-1	
			Very moist.			Top of Bentonite Seal: 1.0'
	4		Saturated.			Top of Sand: 1.5'
13.35'			(SM) SILTY SAND, black, loose, very fine grained, w/30% silt.			Screened Interval: 2.5'-9.25
	6		Tan and black.			
			Tan.			
	8					
	10		Bottom of Hole = 11.0' NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			
6.85'						

Hole No. MW-6

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	MW-6
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	11.0'
10. SIZE AND TYPE OF BIT	4"ID Hollow Stem Auger, 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 14 May 91 COMPLETED: 14 May 91
17. ELEVATION TOP OF HOLE	21.05' (TOH) 20.79' (TOR)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Manhole Cover			Depth to water during drilling: 5.61'
21.05'	0		(SM) SILTY SAND, Black, loose, very fine grained, w/10% silt. Moist.			Water level reading 24 hours after hole completion: 4.29'
			Brown.			
19.05'	2		Black.	2" PVC		See HTW log for more information.
			(MH) INORGANIC SILT, black, loose, fat silt, w/20% sand.			Top of Bentonite Seal: 1.0'
18.05'			Roots.			Top of Sand: 1.5'
			(SM) SILTY SAND, brown, loose, very fine grained, w/25% silt.		MW-6-1	Screened Interval from 2.5'-9.25'.
	4		Very moist.			Well Point Set at 10.0'
			Roots, saturated.			
			Some clay. Approximately 25%			
	6					
	8					
	10		Bottom of Hole = 11.0'			
10.05'			NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			

Hole No. MW-710-7

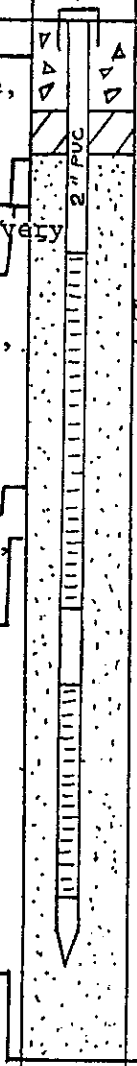
DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS
1. PROJECT: Building 710 - Site Investigation		10. SIZE AND TYPE OF BIT: 4"ID Hollow Stem Auger, 3 1/2" Hand Auger	
2. LOCATION (Coordinates or Station): See Plan		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: Savannah District		12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45	
4. HOLE NO. (As shown on drawing title and file number): MW-710-7		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED 0	
5. NAME OF DRILLER: Douglas LaRoche		14. TOTAL NUMBER CORE BOXES: -	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Below	
		16. DATE HOLE: STARTED 13 May 91; COMPLETED 13 May 91	
7. THICKNESS OF OVERBURDEN: 11.0'		17. ELEVATION TOP OF HOLE: 18.88'(TOH) 18.68'(TOR)	
8. DEPTH DRILLED INTO ROCK: 0.0'		18. TOTAL CORE RECOVERY FOR BORING: - %	
9. TOTAL DEPTH OF HOLE: 11.0'		19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.88'	0		Manhole Cover			Depth to water during drilling: 4.54'
			Asphalt and gravel.			
			(SM)SILTY SAND,black & tan, loose,very fine grained, w/10% silt.			Water level reading 24 hours after hole completion:3.73'
	2		25% silt. Moist.	2" PVC		See HTW log for more information.
			Dark brown,organic rich.			Top of Bentonite Seal: 1.0'
			Very moist.		MW-7-1C	MW-7-1 MW-7-1A
	4		Brown & tan,45% silt. Saturated.			Top of Sand: 1.5'
13.88'			(SP)POORLY GRADED SAND,tan, loose,very fine grained.			Screened Interval from 2.5'-9.25'
	6					Well Point Set at 10.0'.
	8					
	10		Bottom of Hole = 11.0'			
7.88'			NOTE:Soils visually field classified in accordance with the Unified Soil Classification System.			

Hole No. MW-8

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS
1. PROJECT: Building 710 - Site Investigation		10. SIZE AND TYPE OF BIT: 4'ID Hollow Stem Auger, 3 1/2" Hand Auger	
2. LOCATION (Coordinates or Station): See Plan		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: Savannah District		12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45	
4. HOLE NO. (As shown on drawing title and file number): MW-8		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 0	
5. NAME OF DRILLER: Douglas LaRoche		14. TOTAL NUMBER CORE BOXES: -	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Below	
		16. DATE HOLE: STARTED 14 May 91; COMPLETED 14 May 91	
7. THICKNESS OF OVERBURDEN: 11.0'		17. ELEVATION TOP OF HOLE: 19.35'(TOH) 19.11(TOR)	
8. DEPTH DRILLED INTO ROCK: 0.0'		18. TOTAL CORE RECOVERY FOR BORING: - %	
9. TOTAL DEPTH OF HOLE: 11.0'		19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
19.35'	0		Manhole Cover			Depth to water during drilling: 3.61'
			Asphalt & gravel.			
			(SM)SILTY SAND,black,loose, very fine grained, w/10% silt. Moist.			Water level reading 24 hours after hole completion: 3.47'
17.35'	2		Tan & brown.			
			(SC)CLAYEY SAND,grey,med.-very fine grained ,w/40%clay.			See HTW log for more information.
			(MH)INORGANIC SILT,black, organic rich,soft,fat silt, w/10% sand.		MW-8-1	
	4		Very moist.			
			Roots.			
14.35'			Saturated.			Top of Bentonite Seal: 1.0'
			(SM)SILTY SAND,black,loose, very fine grained,w/40% silt.			Top of Sand: 1.5'
	6					Screened Interval from 2.5'-9.25'.
			(SC)CLAYEY SAND,tan,med.-very fine grained,w/40% clay.			Well Point Set at 10.0'.
	8					
	10		Bottom of Hole = 11.0'			
8.35'			NOTE:Soils visually field classified in accordance with the Unified Soil Classification System.			



Hole No. MW-10

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	MW-10
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	11.0'
10. SIZE AND TYPE OF BIT	4"ID Hollow Stem Auger, 3 1/2"Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger/CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 7 May 91 COMPLETED: 13 May 91
17. ELEVATION TOP OF HOLE	19.0'(TOH) 18.8'(TOR)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
19.0'	0		Manhole Cover			Depth to water during drilling: 4.34'
			(SP) POORLY GRADED SAND, brown, loose, very fine grained. Moist.			Water level reading 24 hours after hole completion: 4.88'
	2		(SM) SILTY SAND, broen, w/trace of orange, loose, very fine grained, w/10% silt. Black & brown.	2" PVC		See HTW log for more information.
16.00'			Black, 30% silt w/trace of clay.			Top of Bentonite Seal: 1.0'
	4		(MH) INORGANIC SILT, black, fat silt, w/trace of sand (≤5%).		MW-10	Top of Sand: 1.5' Screened Interval from 2.5'-9.25'. Well Point Set at 10.0'.
15.00'			Saturated.			
	6		(SM) SILTY SAND, tan, loose, very fine grained, w/10% silt.			
	8					
	10		Bottom of Hole = 11.0' NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			
8.00'						

Hole No. MW-11

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Hunter AAF, Georgia
SHEET 1 OF 1 SHEETS	
1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	MW-11
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	11.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	11.0'
10. SIZE AND TYPE OF BIT	4"ID HOllow Stem Auger, 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED 14 May 91 / COMPLETED 14 May 91
17. ELEVATION TOP OF HOLE	18.95'(TOH) 18.55'(TOR)
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.95'	0		Manhole Cover			Depth to water during drilling: 3.98'
18.50'			Gravel (Parking Lot)			
			(SM) SILTY SAND, light brown, loose, very fine grained, w/10% silt. Moist.			Water level reading 24 hours after hole completion: 3.40'
	2		Tan.			See HTW log for more information.
			Very moist.			Top of Bentonite Seal: 1.0'
						Top of Sand: 1.5'
14.95'	4		(MH) INORGANIC SILT, black, soft, fat silt, w/trace of sand, saturated.		MW-11-1	Screened Interval from 2.5'-9.25'.
					MW-11-2	
	6		Some 2-3 CM silty sand lenses.			Well Point Set at 10.0'.
	8					
	10		Bottom of Hole = 11.0' NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			
7.95'						

Hole No. A-1

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-1
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 / UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 6 May 91 / COMPLETED: 6 May 91
17. ELEVATION TOP OF HOLE	19.35'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
19.35'	0		Gravel fill material.			Depth to water during drilling: 5.0' Water level reading 24 hours after hole completion: 3.63' See HTW log for more information.
18.85'			(SM) SILTY SAND, brown and tan, loose, fine-very fine grained, w/20% silt & 5% clay. Moist.			
17.35'	2		(SC) CLAY SAND, grey, stiff, fine-very fine grained, w/50% clay.			
16.85'			(SM) SILTY SAND, grey, loose, fine-very fine grained w/ 15% silt. Moist.		A-1-1	
	4		(ML) INORGANIC SILT, dark brown/ black, med lean, w/trace of sand.			
			Saturated.			
13.85'			Roots.			
13.35'	6		10% sand.			
			Black, loose, very fine grained sand w/40% silt.			
			Bottom of Hole = 6.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-2

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Hunter AAF, Georgia

SHEET 1 OF 1 SHEETS

1. PROJECT: Building 710 - Site Investigation
2. LOCATION (Coordinates or Station): See Plan
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): A-2
5. NAME OF DRILLER: Douglas LaRoche
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 5.0'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 5.0'
10. SIZE AND TYPE OF BIT: 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Hand A ger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: -
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 6 May 91; COMPLETED 6 May 91
17. ELEVATION TOP OF HOLE: 19.62'
18. TOTAL CORE RECOVERY FOR BORING: -
19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
19.62'	0					Depth to water during drilling: 3.55' Water level reading 24 hours after hole completion: 3.31' See HTW log for more information.
			(SM) SILTY SAND, brown, loose, fine to very fine grained, w/10% silt, moist.			
			Tan.			
	2		Very moist.			
			Some black lenses.		A-2-1	
			Brown & tan. Saturated.			
	4		Brown, w/some roots. 25% silt. Saturated.			
14.62'			Bottom of Hole = 5.0'			
	6					

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-3

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Hunter AAF, Georgia
SHEET 1 OF 1 SHEETS	
1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-3
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	5.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	5.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED 6 May 91 / COMPLETED 6 May 91
17. ELEVATION TOP OF HOLE	18.97'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
18.97'	0					Depth to water during drilling: 4.0'
18.47'			Gravel fill			
			(SM)SILTY SAND,brown,loose, fine-very fine grained,w/10% silt.			Water level reading 24 hours after hole completion: Caved
	2		Brown & tan. Moist			
			Brown,very moist.			See HTW log for more information.
15.97'			Tan.		A-3-1	
			Brown & tan.			
	4		(SP)POORLY GRADED SAND,white, loose,very fine grained.			
13.97'			Saturated.			
			(SM)SILTY SAND,tan,loose, very fine grained,w/10% silt.			
	6		Bottom of Hole = 5.0'			

NOTE:Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-4

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Hunter AAF, Georgia

SHEET 1 OF 1 SHEETS

1. PROJECT: Building 710 - Site Investigation
2. LOCATION (Coordinates or Station): See Plan
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): A-4
5. NAME OF DRILLER: Douglas LaRoche
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 8.0'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 8.0'
10. SIZE AND TYPE OF BIT: 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: -
15. ELEVATION GROUND WATER: See Below
16. DATE HOLE: STARTED 7 May 91; COMPLETED 7 May 91
17. ELEVATION TOP OF HOLE: 18.79'
18. TOTAL CORE RECOVERY FOR BORING: - %
19. SIGNATURE OF INSPECTOR: David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.79'	0					Depth to water during drilling: 6.41'
18.29'			Gravel fill.			
			(SM) SILTY SAND, brown, orange, loose, very fine grained, w/ 10% silt.			Water level reading 24 hours after hole completion: Caved
			Brown & tan, moist.			
	2		Brown.			See HTW log for more information.
			Brown & tan w/trace of clay.			
			Very moist.			
			No clay.		A-4-1	
	4		Brown & tan.			
14.29'			(ML) INORGANIC SILT, black, med, organic rich, lean.		A-4-2	
			Trace of sand.			
	6		Saturated.			
12.29'			(SM) SILTY SAND, brown & tan, loose, very fine grained, w/40% silt.			
10.79'	8		Bottom of Hole = 8.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-5

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-5
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 / UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 7 May 91 / COMPLETED: 7 May 91
17. ELEVATION TOP OF HOLE	19.10'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						Depth to water during drilling: 4.38'
19.10'	0		(SM) SILTY SAND, brown, loose, fine-very fine grained, w/ 10% silt, moist.			Water level reading 24 hours after hole completion: 4.40'
			Brown & tan.			
			Brown.			See HTW log for more information.
17.10'	2		Brown & orange.			
			(MH) INORGANIC SILT, black, soft, organic rich, fat.			
			10% sand.		A-5-1	
15.10'	4		(SM) SILTY SAND, black, loose, very fine grained, w/45% silt, very moist.			
			Saturated.			
			Tan, 25% silt.			
13.10'	6		Bottom of Hole = 6.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-6(MW-710-

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Hunter AAF, Georgia
SHEET 1 OF 1 SHEETS	
1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-6(MW-710-2)
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	8.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	8.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED 2 May 91 / COMPLETED 2 May 91
17. ELEVATION TOP OF HOLE	18.58'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.58'	0					Depth to water during drilling: Hole caved in. Water level reading 24 hours after hole completion: Hole caved in. See HTW log for more information. NOTE: This was originally to be a well but was changed to an Auger boring. (MW-2).
18.38'			Gravel and gravel fill.			
			(SM) SILTY SAND, brown & tan, loose, fine to very fine grained, w/10% silt, moist. Strong fuel odor.			
	2		Saturated, very strong fuel odor.		MW-710-2-1	
			Brown, fuel sheen.			
	4		Brown & tan.			
			Dark brown & tan.			
	6		Brown, 25% silt.			
			Brown & tan.			
10.58'	8		Bottom of Hole = 8.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-7

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-7
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	3½-inch Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 / UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 8 May 91 / COMPLETED: 8 May 91
17. ELEVATION TOP OF HOLE	19.06'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
19.06'	0					Depth to water during drilling: 3.56'
			(SM)SILTY SAND,brown,loose, very fine grained,w/10% silt, moist.			Water level reading 24 hours after hole completion: 3.75'
			Dark brown.			
	2		Roots.			See HTW log for more information.
			25% silt,very moist.			
			Saturated.		A-7-1	
	4					
			Light brown,roots.			
13.06'	6		Bottom of Hole = 6.0'			
			NOTE:Soils visually field classified in accordance with the Unified Soil Classification System.			

Hole No. A-9

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Hunter AAF, Georgia
SHEET	1 OF 1 SHEETS
1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-9
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED 7 May 91 / COMPLETED 7 May 91
17. ELEVATION TOP OF HOLE	18.08'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	Well Construction e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
18.08'	0		(SM)SILTY SAND,light brown, loose, fine grained,w/10% silt. Moist.			Depth to water during drilling: 4.15'
			Some orange.			
	2		Tan w/trace or orange, very moist.			Water level reading 24 hours after hole completion: 2.15'
			Tan & grey,w/trace of orange.		A-9-1	See HTW log for more information.
			Grey,w/some wood. Saturated.			
			Grey & tan.			
14.08'	4		(MH)INORGANIC SILT,black, soft,fat,w/roots,organic rich.			
13.58'						
12.58'			(SM)SILTY SAND,black,loose, very fine grained,w/40% silt,organic rich,w/roots.			
12.08'	6		(SP)POORLY GRADED SAND, white,loose,very fine grained.			
			Bottom of Hole = 6.0'			

NOTE:Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-10

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-10
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 1 / UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 8 May 91 / COMPLETED: 8 May 91
17. ELEVATION TOP OF HOLE	18.66'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
18.66'	0					Depth to water during drilling: 4.78' Water level reading 24 hours after hole completion: 4.27' See HTW log for more information.
			(SM) SILTY SAND, brown & tan, loose, very fine grained, w/ 10% silt.			
			Brown, moist.			
	2		Black.			
			35% silt, very moist.			
			Roots			
			Saturated.		A-10-1	
	4		40% silt.			
			20% silt.			
12.66'	6		Bottom of Hole = 6.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

Hole No. A-11(MW-9)

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Hunter AAF, Georgia	SHEET 1 OF 1 SHEETS

1. PROJECT	Building 710 - Site Investigation
2. LOCATION (Coordinates or Station)	See Plan
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	A-11 (MW-9)
5. NAME OF DRILLER	Douglas LaRoche
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	4"ID Hollow Stem Auger, 3 1/2" Hand Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	CME 45
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 2; UNDISTURBED: 0
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	See Below
16. DATE HOLE	STARTED: 7 May 91; COMPLETED: 7 May 91
17. ELEVATION TOP OF HOLE	18.08'
18. TOTAL CORE RECOVERY FOR BORING	- %
19. SIGNATURE OF INSPECTOR	David C. Leeth, Geologist

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	Well Construction (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
18.08'	0					Depth to water during drilling: 4.15'
			(SM) SILTY SAND, dark brown, loose, fine-very fine grained, w/10% silt.			Water level reading 24 hours after hole completion: 2.61'
			Moist.			
			Light brown, very moist.			See HTW log for more information.
	2		Brown & tan.			
			Brown, 40% silt.		MW-9-1	
15.08'			(MH) INORGANIC SILT, black, soft, organic rich, fat, saturated.		MW-9-2	
14.08'	4		Roots.			
			(SM) SILTY SAND, black & tan, very fine grained, w/40% silt, many roots.			
			Black.			
12.08'	6		Grey			
			Bottom of Hole = 6.0'			

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

D-2 - HTW BORING LOGS

LIST OF ABBREVIATIONS USED ON HTW BORING LOGS

ODOR

N = NONE
T = TRACE
SL = SLIGHT
M = MEDIUM
ST = STRONG
VS = VERY STRONG

MOISTURE CONTENT

V.D. = VERY DAMP
MST. = MOIST
V.MST. = VERY MOIST
SAT. = SATURATED

COLOR

BK = BLACK
BRN = BROWN
GRA = GRAY
ORG = ORANGE
YLW = YELLOW
WHT = WHITE
DK = DARK
LT = LIGHT

MATERIAL

GVL = GRAVEL
ASP = ASPHALT
CON = CONCRETE
SP = POORLY GRADED SAND
SM = SILTY SAND
SC = CLAYEY SAND
MH = INORGANIC SILT (FAT)
ML = INORGANIC SILT (LEAN)
CH = FAT CLAY
CL = LEAN CLAY

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-710-1
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.76 (TOH) 18.56 (TOR)
WATER LEVEL DURING DRILLING: 4.80	24-HOUR WATER LEVEL READING: 3.57
WEATHER: PARTLY CLOUDY & HOT, 81°	DRILLER: JAMES ROUNTREE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	SL	0.0	0.4	5/01	-	-	CON	LT. GRA					
	ST	0.4	1.0	5/01	-	MST.	SM	BRN/ TAN	>1000				>1000
	ST	1.0	1.5	5/01	-	MST.	SM	BRN/ TAN					
	VS	1.5	2.0	5/01	-	MST.	SM	BRN/ TAN	>1000				>1000
	VS	2.0	2.5	5/01	-	MST	MH	BLK					
	VS	2.5	3.0	5/01	-	MST.	SM	BRN/ TAN	>1000				>1000
	VS	3.0	3.5	5/01	-	V.MST	SM	BRN/ TAN					
MW-710-1-1	VS	3.5	4.0	5/01	-	V.MST	SM	BRN/ TAN	>1000				>1000
	VS	4.0	4.5	5/01	-	SAT.	SM	BRN					
	VS	4.5	5.0	5/01	-	SAT.	SM	BRN	>1000				>1000
	VS	5.0	5.5	5/01	-	SAT.	SM	BRN					
	VS	5.5	6.0	5/01	-	SAT.	SM	BRN					>1000
	VS	6.0	6.5	5/01	-	SAT.	SM	BRN					
	VS	6.5	7.0	5/01	-	SAT.	SM	BRN					>1000
	VS	7.0	7.5	5/01	-	SAT.	SM	BRN					
	VS	7.5	8.0	5/01	-	SAT.	SM	BRN					>1000

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-710-3
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.13 (TOH) 18.85 (TOR)
WATER LEVEL DURING DRILLING: 3.85	24-HOUR WATER LEVEL READING: 3.15
WEATHER: CLEAR & COOL, 83°	DRILLER: JAMES ROUNTREE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/02	-	DRY	SP	TAN					
	N	0.5	1.0	5/02	-	MST	SP	TAN	0.0				0.0
	N	1.0	1.5	5/02	-	MST.	SM	TAN					
	N	1.5	2.0	5/02	-	MST.	SM	TAN	0.0				0.0
	N	2.0	2.5	5/02	-	SAT	SM	TAN					
MW-710-3-1	N	2.5	3.0	5/02	-	SAT.	SM	TAN	0.0				3.0
	SL	3.0	3.5	5/02	-	SAT.	SM	TAN/ GRA					
	SL	3.5	4.0	5/02	-	SAT.	SM	TAN/ GRA	0.0				0.0
	SL	4.0	4.5	5/02	-	SAT.	SM	TAN/ GRA					
	SL	4.5	5.0	5/02	-	SAT.	SM	BRN	0.0				0.0
	SL	5.0	5.5	5/02	-	SAT.	SM	BRN					
	SL	5.5	6.0	5/02	-	SAT.	SM	BRN	5.0				5.0
	SL	6.0	6.5	5/02	-	SAT.	SM	BRN					
	SL	6.5	7.0	5/02	-	SAT.	SM	DK. BRN					38.0
	SL	7.0	7.5	5/02	-	SAT.	SM	DK. BRN					30.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-710-4
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.19 (TOH) 19.00 (TOR)
WATER LEVEL DURING DRILLING: 3.15	24-HOUR WATER LEVEL READING: 3.30
WEATHER: HOT & CLEAR, 85°	DRILLER: JAMES ROUNTREE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.6	5/02	-	-	CON	LT. GRA					
	SL	0.6	1.0	5/02	-	MST.	SP	TAN	600				>1000
	ST	1.0	1.5	5/02	-	MST.	SM	BRN/ TAN					
	ST	1.5	2.0	5/02	-	V.MST	SM	BRN/ TAN	>1000				>1000
	ST	2.0	2.5	5/02	-	V.MST	SM	BRN/ TAN					
MW-710-4-1	ST	2.5	3.0	5/02	-	V.MST	SM	BRN/ TAN	>1000				>1000
	ST	3.0	3.5	5/02	-	V.MST	SM	BRN/ TAN					
	VS	3.5	4.0	5/02	-	SAT.	SM	BRN/ TAN	880				>1000
	VS	4.0	4.5	5/02	-	SAT.	SM	BRN/ TAN					
	VS	4.5	5.0	5/02	-	SAT.	SM	BRN	980				>1000
	VS	5.0	5.5	5/02	-	SAT.	SM	BRN					
	VS	5.5	6.0	5/02	-	SAT.	SM	BRN					>1000
	VS	6.0	6.5	5/02	-	SAT.	SM	BRN					
	VS	6.5	7.0	5/02	-	SAT.	SM	BRN					>1000
	VS	7.0	8.0	5/02	-	SAT.	SM	BRN					>1000

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-710-5
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 17.85 (TOH) 17.65 (TOR)
WATER LEVEL DURING DRILLING: 3.10	24-HOUR WATER LEVEL READING: 3.87
WEATHER: CLEAR & HOT, 92°	DRILLER: JAMES ROUNTREE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/03	-	DRY	SM	BRN					
	N	0.5	1.0	5/03	-	MST.	SM	DK. BRN	0.2		0.0	21.1	0.0
	N	1.0	1.5	5/03	-	MST.	SM	BLK					
	N	1.5	2.0	5/03	-	MST.	SM	BLK	0.0		0.0	20.7	0.0
	N	2.0	2.5	5/03	-	MST	SC	GRA/ BLK					
MW-710-5-1	SL	2.5	3.0	5/03	-	MST.	SC	BLK	0.0		0.0	20.8	1.0
	SL	3.0	3.5	5/03	-	MST.	SC	BLK					
	N	3.5	4.0	5/03	-	MST.	SC	BLK	0.0		0.0	20.9	1.0
	N	4.0	4.5	5/03	-	MST.	SM	BLK					
	N	4.5	5.0	5/03	-	MST	SM	BLK	0.2		0.0	20.7	0.4
	N	5.0	5.5	5/03	-	MST.	SM	TAN/ BLK					
	N	5.5	6.0	5/03	-	MST.	SM	TAN			0.0	20.9	0.4

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-6
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 21.05 (TOH) 20.79 (TOR)
WATER LEVEL DURING DRILLING: 5.61	24-HOUR WATER LEVEL READING: 4.29
WEATHER: OVERCAST & WARM, 80°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING PROPERLY ODOR IS ORGANIC	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/14	-	MST.	SM	BLK					
	N	0.5	1.0	5/14	-	MST.	SM	BRN	0.2		-7	20.6	0.0
	N	1.0	1.5	5/14	-	MST.	SM	BRN					
	N	1.5	2.0	5/14	-	MST	SM	BLK	6.0		-8	20.5	4.0
	N	2.0	2.5	5/14	-	MST.	ML	BLK					
MW-6-1	N	2.5	3.0	5/14	-	MST.	ML	BLK	22.0		-7	20.6	60.0
	N	3.0	3.5	5/14	-	MST.	SM	BRN					
	N	3.5	4.0	5/14	-	V.MST	SM	BRN	6.2		-7	20.6	50.0
	N	4.0	4.5	5/14	-	SAT.	SM	BRN					
	SL	4.5	5.0	5/14	-	SAT.	SM	BRN	10.0		-7	20.7	30.0
	SL	5.0	5.5	5/14	-	SAT.	SM	BRN					
	SL	5.5	6.0	5/14	-	SAT.	SM	BRN			-6	20.6	50.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-7
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.88 (TOH) 18.68 (TOR)
WATER LEVEL DURING DRILLING: 4.54	24-HOUR WATER LEVEL READING: 3.75
WEATHER: OVERCAST & WARM, 78°, GUSTS	DRILLER: DOUGLAS LAROCHE
REMARKS: ODOR WAS ORGANIC CGI NOT WORKING PROPERLY	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.4	5/13	-	DRY	ASP	-					
	N	0.4	1.0	5/13	-	DRY	SM	BLK/TAN	1.0		0.0	20.7	2.0
	SL	1.0	1.5	5/13	-	MST.	SM	BLK/TAN					
	SL	1.5	2.0	5/13	-	MST.	SM	BRN	300.0		0.0	20.7	>1000.0
	SL	2.0	2.5	5/13	-	V.MST	SM	BRN					
	SL	2.5	3.0	5/13	-	V.MST	SM	BRN	>1000.0		0.0	20.9	>1000.0
MW-7-1 MW-7-1A	SL	3.0	3.5	5/13	-	V.MST	SM	BRN					
MW-7-1C	SL	3.5	4.0	5/13	-	SAT.	SM	BRN	250.0		-13	20.8	>1000.0
	SL	4.0	4.5	5/13	-	SAT.	SM	BRN/TAN					
	SL	4.5	5.0	5/13	-	SAT.	SM	BRN/TAN	20.0		-8	20.8	200.0
	N	5.0	5.5	5/13	-	SAT.	SP	TAN					
	N	5.5	6.0	5/13	-	SAT.	SP	TAN			-8	20.9	400.0

CESAS-EN-GGH (MARCH 1991)

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-8
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.35 (TOH) 19.11 (TOR)
WATER LEVEL DURING DRILLING: 3.61	24-HOUR WATER LEVEL READING: 3.47
WEATHER: PARTLY CLOUDY & HOT, 90°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING PROPERLY	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: OVM (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.5	5/14	-	-	ASP	-					
	SL	0.5	1.0	5/14	-	MST.	SM	BLK	200.0	8.0	-5	10.0	50.0
	N	1.0	1.5	5/14	-	MST.	SM	BRN					
	N	1.5	2.0	5/14	-	MST.	SC	GRA	>1000.0	0.0	-6	20.5	400.0
	ORG	2.0	2.5	5/14	-	MST.	MH	BLK					
	N	2.5	3.0	5/14	-	V.MST	MH	BLK	200.0	0.0	0	20.7	>1000.0
MW-8-1	ORG	3.0	3.5	5/14	-	V.MST	MH	BLK					
	SL	3.5	4.0	5/14	-	SAT.	MH	BLK	>1000.0	12.0	-3	20.8	>1000.0
	SL	4.0	4.5	5/14	-	SAT.	MH	BLK					
	SL	4.5	5.0	5/14	-	SAT.	MH	BLK	200.0	0.0	-2	20.8	>1000.0
	N	5.0	5.5	5/14	-	SAT.	SM	BLK					
	N	5.5	6.0	5/14	-	SAT.	SC	TAN					

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-10
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.0 (TOH) 18.80 (TOR)
WATER LEVEL DURING DRILLING: 4.34	24-HOUR WATER LEVEL READING: 4.88
WEATHER: OVERCAST & WARM, 74°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/07	-	DRY	SP	BRN					
	N	0.5	1.0	5/07	-	MST.	SP	BRN	0.0				0.0
	N	1.0	1.5	5/07	-	MST.	SM	BRN					
	N	1.5	2.0	5/07	-	MST.	SM	BRN/BLK	0.0				0.0
	N	2.0	2.5	5/07	-	MST.	SM	BLK					
	N	2.5	3.0	5/07	-	MST.	SM	BLK	0.0				0.0
	N	3.0	3.5	5/07	-	MST.	MH	BLK					
	N	3.5	4.0	5/07	-	MST.	MH	BLK	0.0				0.0
	N	4.0	4.5	5/07	-	V.MST	MH	BLK					
MW-10-1	N	4.5	5.0	5/07	-	SAT.	MH	BLK	0.0				0.0
	N	5.0	6.0	5/07	-	SAT.	SM	TAN					
	N	6.0	7.0	5/07	-	SAT.	SM	TAN					0.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. MW-11
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.95 (TOH) 18.55 (TOR)
WATER LEVEL DURING DRILLING: 3.98	24-HOUR WATER LEVEL READING: 3.40
WEATHER: PARTLY CLOUDY & HOT, 82°	DRILLER: JAMES ROUNTREE
REMARKS: CGI NOT WORKING PROPERLY	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/15	-	-	GVL	LT. BRN					
	N	0.5	1.0	5/15	-	MST.	SM	LT. BRN	0.0		-2	20.6	0.0
	N	1.0	1.5	5/15	-	MST.	SM	LT. BRN					
	N	1.5	2.0	5/15	-	MST.	SM	LT. BRN	0.0		-2	20.6	0.0
	N	2.0	2.5	5/15	-	MST.	SM	TAN					
	N	2.5	3.0	5/15	-	V.MST	SM	TAN	0.0		-3	20.7	0.0
	N	3.0	3.5	5/15	-	V.MST	SM	TAN					
MW-11-1	SL	3.5	4.0	5/15	-	SAT.	SM	TAN	0.0		-2	20.7	20.0
	SL	4.0	4.5	5/15	-	SAT.	MH	BLK					
	SL	4.5	5.0	5/15	-	SAT.	MH	BLK	740.0		-2	20.8	60.0
MW-11-2	SL	5.0	5.5	5/15	-	SAT.	MH	BLK					
	SL	5.5	6.0	5/15	-	SAT.	MH	BLK/ TAN			-1	20.8	>1000.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-1
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.35
WATER LEVEL DURING DRILLING: 5.0	24-HOUR WATER LEVEL READING: 3.63
WEATHER: MOSTLY CLOUDY & HOT, 88°	DRILLER: DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/06	-	DRY	GVL	-					
	N	0.5	1.0	5/06	-	DRY	GVL	-					
	SL	1.0	1.5	5/06	-	MST.	SM	BRN/ TAN	150.0		0	20.7	1.0
	SL	1.5	2.0	5/06	-	MST.	SC	GRA					
	SL	2.0	2.5	5/06	-	MST.	SM	GRA	40.0		0	20.7	24.0
	SL	2.5	3.0	5/06	-	MST.	ML	BLK					
A-1-1	SL	3.0	3.5	5/06	-	V.MST	ML	BLK	10.0		0	20.7	15.0
	SL	3.5	4.0	5/06	-	V.MST	ML	BLK					
	SL	4.0	4.5	5/06	-	SAT.	ML	BLK	2.0		0	20.8	15.0
	SL	4.5	5.0	5/06	-	SAT.	ML	BLK					
	N	5.0	5.5	5/06	-	SAT.	ML	BLK	0.0		0	20.7	5.0
	N	5.5	6.0	5/06	-	SAT.	SM	BLK			0	20.6	3.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-2
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.62
WATER LEVEL DURING DRILLING: 3.55	24-HOUR WATER LEVEL READING: 3.31
WEATHER: PARTLY CLOUDY & HOT, 86°	DRILLER: DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.5	5/06	-	MST.	SM	BRN					
	N	0.5	1.0	5/06	-	MST.	SM	TAN	0.0		0.0	20.9	0.0
	N	1.0	1.5	5/06	-	MST.	SM	TAN					
	N	1.5	2.0	5/06	-	V.MST	SM	TAN	0.0		0.0	20.8	0.0
	N	2.0	2.5	5/06	-	V.MST	SM	TAN					
	N	2.5	3.0	5/06	-	V.MST	SM	TAN	0.0		0.0	20.9	0.0
A-2-1	N	3.0	3.5	5/06	-	SAT.	SM	BRN/ TAN					
	N	3.5	4.0	5/06	-	SAT.	SM	BRN	0.0		0.0	20.8	0.0
	N	4.0	4.5	5/06	-	SAT.	SM	BRN	0.0		0.0	20.9	0.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-3
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.97
WATER LEVEL DURING DRILLING: 4.0	24-HOUR WATER LEVEL READING: CAVED
WEATHER: PARTLY CLOUDY & HOT, 96°	DRILLER: DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/06	-	DRY	GVL	-					
	N	0.5	1.0	5/06	-	MST.	SM	TAN	0.0		0.0	20.9	0.0
	N	1.0	1.5	5/06	-	MST.	SM	BRN/ TAN					
	N	1.5	2.0	5/06	-	V.MST	SM	BRN	0.0		0.0	20.9	0.0
	N	2.0	2.5	5/06	-	V.MST	SM	TAN					
	N	2.5	3.0	5/06	-	V.MST	SM	BRN/ TAN	0.0		0.0	20.9	0.0
A-3-1	N	3.0	3.5	5/06	-	V.MST	SW	WHT					
	N	3.5	4.0	5/06	-	SAT.	SW	WHT	0.0		0.0	20.8	0.0
	N	4.0	4.5	5/06	-	SAT.	SW	WHT					
	N	4.5	5.0	5/06	-	SAT.	SM	TAN	0.0		0.0	20.9	0.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-4
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.79
WATER LEVEL DURING DRILLING: 6.41	24-HOUR WATER LEVEL READING: CAVED
WEATHER: CLEAR & WARM, 72°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING ODOR IS ORGANIC	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/07	-	DRY	NA						
	N	0.5	1.0	5/07	-	DRY	SM	BRN/ ORG	0.0				0.0
	N	1.0	1.5	5/07	-	MST.	SM	BRN/ ORG					
	N	1.5	2.0	5/07	-	MST.	SM	BRN/ TAN	0.0				0.0
	N	2.0	2.5	5/07	-	MST.	SM	BRN					
	N	2.5	3.0	5/07	-	MST.	SM	BRN/ TAN	0.0				0.0
	N	3.0	3.5	5/07	-	V.MST	SM	BRN/ TAN					
A-4-1	N	3.5	4.0	5/07	-	V.MST	SM	BRN/ TAN	0.0				0.0
	N	4.0	4.5	5/07	-	V.MST	SM	BRN/ TAN					
A-4-2	ST	4.5	5.0	5/07	-	V.MST	ML	BLK	220.0				12.0
	ST	5.0	5.5	5/07	-	V.MST	ML	BLK					
	ST	5.5	6.0	5/07	-	V.MST	ML	BLK	80.0				20.0
	ST	6.0	6.5	5/07	-	SAT.	ML	BLK					
	ST	6.5	7.0	5/07	-	SAT.	SM	BRN/ TAN					19.0
	SL	7.0	8.0	5/07	-	SAT.	SM	BRN/ TAN					

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-5
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.10
WATER LEVEL DURING DRILLING: 4.38	24-HOUR WATER LEVEL READING: 4.40
WEATHER: OVERCAST & WARM, 78°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/07	-	MST.	SM	BRN					
	N	0.5	1.0	5/07	-	MST.	SM	BRN/ TAN	0.0				0.0
	N	1.0	1.5	5/07	-	MST.	SM	BRN					
	N	1.5	2.0	5/07	-	MST.	SM	BRN/ ORG	0.0				0.0
	SL	2.0	2.5	5/07	-	V.MST	MH	BLK					
	SL	2.5	3.0	5/07	-	V.MST	MH	BLK	>1000.0				100.0
	SL	3.0	3.5	5/07	-	V.MST	MH	BLK					
A-5-1	SL	3.5	4.0	5/07	-	V.MST	MH	BLK	800.0				700.0
	ST	4.0	4.5	5/07	-	V.MST	SM	BLK					
	ST	4.5	5.0	5/07	-	SAT.	SM	BLK	30.0				90.0
	SL	5.0	6.0	5/07	-	SAT.	SM	TAN	30.0				60.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-6 (MW-710-2)
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.58
WATER LEVEL DURING DRILLING: CAVED	24-HOUR WATER LEVEL READING: CAVED
WEATHER: CLEAR, WINDY & HOT, 87°	DRILLER: JAMES ROUNTREE / DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	-	0.0	0.4	5/02	-	-	CON	-					
	SL	0.4	1.0	5/02	-	MST.	SM	BRN/ TAN	>1000.0				52.0
	ST	1.0	1.5	5/02	-	MST.	SM	BRN/ TAN					
	ST	1.5	2.0	5/02	-	MST.	SM	BRN/ TAN	>1000.0				>1000.0
	ST	2.0	2.5	5/02	-	SAT.	SM	BRN/ TAN					
MW-710-2-1	VS	2.5	3.0	5/02	-	SAT.	SM	BRN/ TAN	>1000.0				>1000.0
	VS	3.0	3.5	5/02	-	SAT.	SM	BRN					
	VS	3.5	4.0	5/02	-	SAT.	SM	BRN	>1000.0				>1000.0
	VS	4.0	4.5	5/02	-	SAT.	SM	BRN/ TAN					
	VS	4.5	5.0	5/02	-	SAT.	SM	BRN/ TAN	740.0				>1000.0
	VS	5.0	5.5	5/02	-	SAT.	SM	BRN/ TAN					
	VS	5.5	6.0	5/02	-	SAT.	SM	BRN/ TAN					>1000.0
	VS	6.0	6.5	5/02	-	SAT.	SM	BRN/ TAN					
	VS	6.5	7.0	5/02	-	SAT.	SM	BRN					>1000.0
	VS	7.0	8.0	5/02	-	SAT.	SM	BRN/ TAN					>1000.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-7
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 19.06
WATER LEVEL DURING DRILLING: 3.56	24-HOUR WATER LEVEL READING: 3.75
WEATHER: HAZY & WARM, 75°	DRILLER: DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.5	5/08	-	MST.	SM	BRN					
	N	0.5	1.0	5/08	-	MST.	SM	BRN	0.0		0.0	20.8	0.0
	N	1.0	1.5	5/08	-	MST.	SM	BRN					
	N	1.5	2.0	5/08	-	MST,	SM	BRN	0.0		0.0	20.9	0.0
	N	2.0	2.5	5/08	-	V.MST	SM	BRN					
	N	2.5	3.0	5/08	-	V.MST	SM	BRN	0.0		0.0	20.7	0.0
	N	3.0	3.5	5/08	-	SAT.	SM	BRN					
A-7-1	N	3.5	4.0	5/08	-	SAT.	SM	BRN	0.0		0.0	20.8	0.0
	N	4.0	4.5	5/08	-	SAT.	SM	BRN					
	N	4.5	5.0	5/08	-	SAT.	SM	LT. BRN	0.2		0.0	20.8	0.0
	N	5.0	5.5	5/08	-	SAT.	SM	LT. BRN					
	N	5.5	6.0	5/08	-	SAT.	SM	LT. BRN					

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-9
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.08
WATER LEVEL DURING DRILLING: 4.15	24-HOUR WATER LEVEL READING: 2.15
WEATHER: OVERCAST & WARM, 84°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.5	5/07	-	MST	SM	LT. BRN					
	N	0.5	1.0	5/07	-	MST.	SM	LT. BRN	0.0				0.0
	N	1.0	1.5	5/07	-	V.MST	SM	SOME ORG.					
	SL	1.5	2.0	5/07	-	V.MST	SM	TAN	0.2				0.0
	N	2.0	2.5	5/07	-	V.MST.	SM	TAN					
A-9-1	N	2.5	3.0	5/07	-	V.MST	SM	GRA/ TAN	0.8				0.0
	N	3.0	3.5	5/07	-	SAT.	SM	GRA					
	N	3.5	4.0	5/07	-	SAT.	SM	GRA/ TAN	1.0				6.0
	SL	4.0	4.5	5/07	-	SAT.	MH	BLK					
	SL	4.5	5.0	5/07	-	SAT.	SM	BLK	25.0				90.0
	SL	5.0	5.5	5/07	-	SAT.	SM	BLK					
	SL	5.5	6.0	5/07	-	SAT.	SP	WHT					60.0

CESAS-EN-GGH (MARCH 1991)

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-10
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.66
WATER LEVEL DURING DRILLING: 4.78	24-HOUR WATER LEVEL READING: 4.27
WEATHER: CLEAR, WINDY & WARM, 78°	DRILLER: DOUGLAS LAROCHE
REMARKS:	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE CGI LEL %	AT TOP OF HOLE CGI O_2 %	AT TOP OF HOLE OVA / HNU (ppm)
	N	0.0	0.5	5/08	-	DRY	SM	BRN/TAN					
	N	0.5	1.0	5/08	-	MST.	SM	BRN	0.0		0.0	20.8	0.0
	N	1.0	1.5	5/08	-	MST	SM	BRN					
	N	1.5	2.0	5/08	-	MST.	SM	BLK	0.0		0.0	20.5	0.0
	N	2.0	2.5	5/08	-	V.MST	SM	BLK					
	N	2.5	3.0	5/08	-	V.MST	SM	BLK	0.0		0.0	20.7	0.0
	N	3.0	3.5	5/08	-	V.MST	SM	BLK					
A-10-1	N	3.5	4.0	5/08	-	SAT.	SM	BLK	0.0		0.0	20.7	0.0
	N	4.0	4.5	5/08	-	SAT.	SM	BLK					
	N	4.5	5.0	5/08	-	SAT.	SM	BLK	0.0		0.0	20.9	0.0
	N	5.0	5.5	5/08	-	SAT.	SM	BLK					
	N	5.5	6.0	5/08	-	SAT.	SM	TAN	0.0		0.0	20.8	0.0

HTW BORING LOG

PROJECT: BUILDING 710 SITE INVESTIGATION	BORING NO. A-11 (MW-9)
LOCATION: HUNTER ARMY AIRFIELD, SAVANNAH, GEORGIA	ELEVATION: 18.08
WATER LEVEL DURING DRILLING: 4.15	24-HOUR WATER LEVEL READING: 2.61
WEATHER: OVERCAST & WARM, 79°	DRILLER: DOUGLAS LAROCHE
REMARKS: CGI NOT WORKING	GEOLOGIST: CHRIS LEETH

SAMPLE NO.	ODOR	DEPTH (FT.) FROM	DEPTH (FT.) TO	DATE (1991)	BLOWS PER FOOT	MOISTURE CONTENT	CLASSIFICATION	COLOR	SAMPLES: OVA (ppm) FIELD HEADSPACE ANALYSIS	SAMPLES: HNU (ppm) FIELD HEADSPACE ANALYSIS	AT TOP OF HOLE: CGI LEL %	AT TOP OF HOLE: CGI O_2 %	AT TOP OF HOLE: OVA / HNU (ppm)
	N	0.0	0.5	5/07	-	DRY	SM	BRN					
	N	0.5	1.0	5/07	-	MST.	SM	BRN	0.0				0.0
	N	1.0	1.5	5/07	-	V.MST	SM	LT. BRN					
	N	1.5	2.0	5/07	-	V.MST	SM	BRN/ TAN	0.0				0.0
	N	2.0	2.5	5/07	-	V.MST	SM	BRN					
MW-9-1	N	2.5	3.0	5/07	-	V.MST	SM	BRN	3.0				0.0
	SL	3.0	3.5	5/07	-	SAT.	MH	BLK					
MW-9-2	ST	3.5	4.0	5/07	-	SAT.	MH	BLK	500.0				680.0
	SL	4.0	4.5	5/07	-	SAT.	SM	BLK/ TAN					
	SL	4.5	5.0	5/07	-	SAT.	SM	BLK	85.0				350.0
	SL	5.0	5.5	5/07	-	SAT.	SM	BLK					
	SL	5.5	6.0	5/07	-	SAT.	SM	GRA					420.0

APPENDIX E

HYDRAULIC CONDUCTIVITY DATA REPORT

HYDRAULIC CONDUCTIVITY TESTS
FOR
CAP INVESTIGATION AT BUILDING NO. 710
HUNTER ARMY AIRFIELD, SAVANNAH, GA

INTRODUCTION:

Slug tests were conducted September 5, 1991 in seven (7) ground-water monitoring wells adjacent to Buildings 710 and 725, at Hunter Army Airfield, Georgia. These monitoring wells were 2" diameter PVC with screens intercepting the ground-water surface. Slug-in tests were performed, which consisted of lowering a weighted cylinder to the bottom of the well, and measuring time and water level until the water level reached the static level. These data were then used to calculate the hydraulic conductivity of the aquifer.

METHODOLOGY:

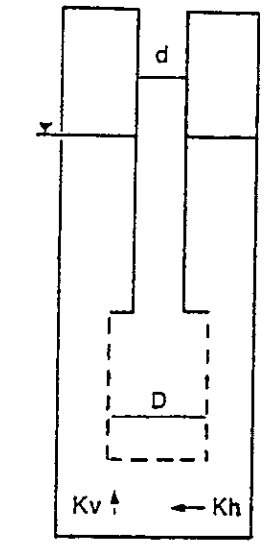
The equipment used to perform the slug tests consisted of a slug with nylon cord, water level indicator, ruler and stop watch. The slug was a 1-1/2" diameter PVC pipe with a length of about 2.7'. This pipe was filled with silica sand and capped. The water level indicator was a model No. 51453 made by Slope Indicator Company. Before each slug test, the slug and water level indicator were decontaminated using a three phase wash consisting of an Alconox soap wash, tap water rinse and an alcohol rinse. A new nylon cord was used on the slug for each slug test. A static water level reading was made before the start of the slug test. The slug was then lowered to the bottom of the well. Immediately (less than 5 seconds) after inserting the slug, an initial water level reading was made. Water level readings were then made at one minute intervals until the water level has reached the static level. The field data is listed in Appendix 1.

CALCULATIONS:

The computer program SLUGTST was used to calculate the actual K values. SLUGTST is a program, written by Wylie and Wood (1990) in TURBOBASIC, which employs the method developed by Hvorslev (1951) to calculate the hydraulic conductivity. The formula shown in Figure 1 was used by the program for the case of an unconfined aquifer with a well point in uniform soil. The values in the formula are:

kh = horizontal permeability
kv = vertical permeability
d = casing diameter
m = transformation ratio = $\sqrt{Kh/Kv}$
L = intake length
D = intake diameter
T = basic time lag

FIGURE 1



$$Kh = \frac{d^2 \cdot \ln\left[\frac{m \cdot L}{D} + \sqrt{1+\left[\frac{m \cdot L}{D}\right]^2}\right]}{8 \cdot L \cdot T}$$

FOR $\frac{m \cdot L}{D} > 4$ $Kh = \frac{d^2 \cdot \ln\left[\frac{2 m L}{D}\right]}{8 \cdot L \cdot T}$

Well point-filter in uniform soil

RESULTS:

The values of hydraulic conductivity (K) varied from 0.0011 ft/min to 0.0031 ft/min (see Table 1). This range is normal for the silty fine sand found at the site.

TABLE 1

WELL #	K (ft/min)	Soil Type
MW-710-1	0.0025	silty sand
MW-710-4	0.0017	silty sand
MW-710-5	0.0031	silty sand
MW-710-6	0.0022	silty sand
MW-710-7	0.0018	poorly graded sand
MW-710-8	0.0014	clayey sand
MW-710-11	0.0009	inorganic silt

REFERENCES:

Hvorslov, M. J., 1951, Time lag and soil permeability in ground water observations, U.S. Army Corps of Engineers, Waterways Station, Vicksburg, MS, Bul. 36.

Wylie, A. and Wood, T. R., 1990, A program to calculate hydraulic conductivity using slug test data, Ground Water, Vol. 28, No. 5, pp. 783-786.

APPENDIX 1
FIELD DATA

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-1
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	3.40
INITIAL W/ (ft):	3.23
SCREEN LENGTH (ft):	3.27
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	13

TIME	W/L
0.0	3.23
1.0	3.33
2.0	3.37
3.0	3.40
4.0	3.40
5.0	3.40
6.0	3.40
7.0	3.40
8.0	3.40
9.0	3.40
10.0	3.40
11.0	3.40
12.0	3.40

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-4
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	3.07
INITIAL W/ (ft):	2.98
SCREEN LENGTH (ft):	8.10
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	13

TIME	W/L
0.0	2.98
1.0	3.05
2.0	3.06
3.0	3.07
4.0	3.07
5.0	3.07
6.0	3.07
7.0	3.07
8.0	3.07
9.0	3.07
10.0	3.07
11.0	3.07
12.0	3.07

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-5
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	2.86
INITIAL W/ (ft):	2.58
SCREEN LENGTH (ft):	6.39
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	16

TIME	W/L
0.0	2.58
1.0	2.84
2.0	2.85
3.0	2.85
4.0	2.86
5.0	2.86
6.0	2.86
7.0	2.86
8.0	2.86
9.0	2.86
10.0	2.86
11.0	2.86
12.0	2.86
13.0	2.86
14.0	2.86
15.0	2.86

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-6
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	2.89
INITIAL W/ (ft):	2.16
SCREEN LENGTH (ft):	7.09
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	16

TIME	W/L
0.0	2.16
1.0	2.77
2.0	2.85
3.0	2.88
4.0	2.89
5.0	2.89
6.0	2.89
7.0	2.89
8.0	2.89
9.0	2.89
10.0	2.89
11.0	2.89
12.0	2.89
13.0	2.89
14.0	2.89
15.0	2.89

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-7
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	2.68
INITIAL W/ (ft):	2.16
SCREEN LENGTH (ft):	6.57
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	21

TIME	W/L
0.0	2.16
1.0	2.63
2.0	2.64
3.0	2.66
4.0	2.66
5.0	2.67
6.0	2.67
7.0	2.67
8.0	2.67
9.0	2.67
10.0	2.67
11.0	2.67
12.0	2.67
13.0	2.67
14.0	2.67
15.0	2.67
16.0	2.67
17.0	2.67
18.0	2.67
19.0	2.67
20.0	2.67

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-8
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	2.65
INITIAL W/ (ft):	1.99
SCREEN LENGTH (ft):	6.60
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	18

TIME	W/L
0.0	1.99
1.0	2.54
2.0	2.61
3.0	2.63
4.0	2.64
5.0	2.64
6.0	2.65
7.0	2.65
8.0	2.65
9.0	2.65
10.0	2.65
11.0	2.65
12.0	2.65
13.0	2.65
14.0	2.65
15.0	2.65
16.0	2.65
17.0	2.65

HUNTER AAF, BUILDING 710
HYDRAULIC CONDUCTIVITY TESTS ON MONITORING WELL MW-11
THURSDAY, 5 SEPTEMBER 1991
David C. Leeth

TYPE OF TEST:	Slug-in
AQUIFER TYPE:	Unconfined
STATIC W/L (ft):	2.27
INITIAL W/ (ft):	1.57
SCREEN LENGTH (ft):	6.98
CASING DIAM. (ft):	0.16699
SAND PACK DIAM. (ft):	0.64600
RATIO OF Kh:Kv:	1:1
DATA SETS:	40

TIME	W/L
0.0	1.57
1.0	2.02
2.0	2.13
3.0	2.17
4.0	2.20
5.0	2.20
6.0	2.21
7.0	2.21
8.0	2.22
9.0	2.22
10.0	2.22
11.0	2.22
12.0	2.22
13.0	2.23
14.0	2.23
15.0	2.23
16.0	2.23
17.0	2.23
18.0	2.24
19.0	2.24
20.0	2.24
21.0	2.24
22.0	2.24
23.0	2.24
24.0	2.24
25.0	2.25
26.0	2.25
27.0	2.25
28.0	2.25
29.0	2.25
30.0	2.25
31.0	2.26
32.0	2.26
33.0	2.26
34.0	2.26
35.0	2.26
36.0	2.26
37.0	2.26
38.0	2.26
39.0	2.26

APPENDIX F

LABORATORY ANALYTICAL REPORTS AND CHAIN OF CUSTODY DOCUMENTATION

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33097

Received: 01 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33097-1	MW-710-1-1 (5/1/91)	Client

PARAMETER	33097-1
Aromatic Volatiles (8020)	
Benzene, ug/kg dw	150000
Ethylbenzene, ug/kg dw	1200000
Toluene, ug/kg dw	2200000
Xylenes, ug/kg dw	4500000
Petroleum Hydrocarbons (418.1), mg/kg dw	25000
Lead, mg/kg dw	7.9
Percent Solids, %	92

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33097

Received: 01 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
33097-2	Method Blank-Soil	Client
33097-3	Accuracy (Mean % Recovery)-Soil	
33097-4	Precision (% RPD)-Soil	
33097-5	Date Analyzed-Soil	

PARAMETER	33097-2	33097-3	33097-4	33097-5
Aromatic Volatiles (8020)				
Benzene, ug/kg dw	<5.0	92 %	6.5 %	05.13.91
Ethylbenzene, ug/kg dw	<5.0	---	---	05.13.91
Toluene, ug/kg dw	<5.0	103 %	4.9 %	05.13.91
Xylenes, ug/kg dw	<5.0	---	---	05.13.91
Petroleum Hydrocarbons (418.1), mg/kg dw	<10	98 %	5.1 %	05.14.91
Lead, mg/kg dw	<0.50	102 %	2.9 %	06.06.91

Methods: EPA SW-846.

Steven J. White WDS
Steven J. White

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA 31404
Phone: (912) 354-7858

JOB NO. | P.O. NO. | PROJECT NAME: HAAF-BLD 710

CLIENT NAME: COE (SAVANNAH) | TELEPHONE

CLIENT ADDRESS: P.O. BOX 889 EN-GGH SAV. GA. 31402

CLIENT PROJECT MANAGER: TOJI F. NICHOLSON

PAGE | OF

STANDARD ☐ RUSH ☐ DATE REPORT REQUESTED _____

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	REQUIRED ANALYSES: BTEX	REQUIRED ANALYSES: TPH	REMARKS
5/1		MW-710-1-1					

RELINQUISHED BY: (SIGNATURE) | DATE/TIME: 3:03 5/1 | RECEIVED BY: (SIGNATURE) | DATE/TIME | RELINQUISHED BY: (SIGNATURE) | DATE/TIME

RECEIVED BY: (SIGNATURE) | DATE/TIME | RELINQUISHED BY: (SIGNATURE) | DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
J. Johnson	5/1/91 3:01	(YES) NO		33096 LJ	

33097

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33152

Received: 03 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Purchase Order: DACA21-91-M0378

Project: HAAF BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33152-1	MW-710-2-1 (5/2/91)	Client
33152-2	MW-710-3-1 (5/2/91)	
33152-3	MW-710-4-1 (5/2/91)	
33152-4	MW-5-1 (5/3/91)	

PARAMETER	33152-1	33152-2	33152-3	33152-4
Petroleum Hydrocarbons (418.1), mg/kg dw	1400	14	34	46
Aromatic Volatiles (8020)				
Benzene, ug/kg dw	<1100	<6.1	200	<6.8
Ethylbenzene, ug/kg dw	4900	<6.1	<6.1	<6.8
Toluene, ug/kg dw	1600	<6.1	73	<6.8
Xylenes, ug/kg dw	3000	<6.1	830	<6.8
Percent Solids, %	89	82	82	74

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33152

Received: 03 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Purchase Order: DACA21-91-M0378

Project: HAAF BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
33152-5	Method Blank-Soil	Client
33152-6	Accuracy (Mean % Recovery)-Soil	
33152-7	Precision (% RPD)-Soil	
33152-8	Date Analyzed-Soil	

PARAMETER	33152-5	33152-6	33152-7	33152-8
Petroleum Hydrocarbons (418.1), mg/kg dw	<10	96 %	10.4 %	05.21.91
Aromatic Volatiles (8020)				
Benzene, ug/kg	<5.0	85 %	2.4 %	05.15.91
Ethylbenzene, ug/kg	<5.0	---	---	05.15.91
Toluene, ug/kg	<5.0	100 %	2.0 %	05.15.91
Xylenes, ug/kg	<5.0	---	---	05.15.91
Lead, mg/kg dw	<0.50	102 %	2.9 %	06.06.91

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33152

Received: 03 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Purchase Order: DACA21-91-M0378

Project: HAAF BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33152-9	MW-710-3-1 (5/2/91)	Client
33152-10	MW-710-4-1 (5/2/91)	

PARAMETER	33152-9	33152-10
Lead, mg/kg dw	3.4	6.7

Methods: EPA SW-846

Steven J. White

Steven J. White

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA. 31404
Phone: (912) 354-7858

JOB NO.	P.O. NO.	PROJECT NAME
		BLD 710 HAAF

CLIENT NAME: COE (SAVANNAH) — TELEPHONE: 944-5675

CLIENT ADDRESS: P.O. BOX 889 SAVANNAH GA 31401

CLIENT PROJECT MANAGER: TONI F. NICHOLSON

PAGE ____ OF ____

STANDARD ☐ RUSH ☐

DATE REPORT REQUESTED ____

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	REQUIRED ANALYSES: BTEX	REQUIRED ANALYSES: TPH	REMARKS
5/2		MW-710-2-1			✓	✓	
11		MW-710-3-1			✓	✓	
4		MW-710-4-1			✓	✓	
5/3		MW-5-1			✓	✓	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
[signature]	5/3 2:41				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
L. Bond	5/3/91 2:44 pm	YES / NO		33152	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33215

Received: 08 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-M0378

Project: BLD 710 PHASE 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33215-1	A-3-1 (5/6/91)	Client
33215-2	A-1-1 (5/6/91)	
33215-3	A-2-1 (5/6/91)	
33215-4	A-4-1 (5/7/91)	
33215-5	A-4-2 (5/7/91)	

ARAMETER	33215-1	33215-2	33215-3	33215-4	33215-5
etroleum Hydrocarbons (418.1), mg/kg dw	24	21	<12	12	18
Aromatic Volatiles (8020)					
Benzene, ug/kg dw	<6.3	<6.7	<6.0	<5.8	<6.8
Ethylbenzene, ug/kg dw	<6.3	<6.7	<6.0	<5.8	<6.8
Toluene, ug/kg dw	<6.3	<6.7	<6.0	<5.8	<6.8
Xylenes, ug/kg dw	<6.3	<6.7	<6.0	<5.8	<6.8
Percent Solids, %	80	75	83	86	74

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33215

Received: 08 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-M0378

Project: BLD 710 PHASE 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33215-6	A-5-1 (5/7/91)	Client
33215-7	A-9-1 (5/7/91)	
33215-8	MW-10-1 (5/7/91)	
33215-9	MW-9-1 (5/7/91)	
33215-10	MW-9-2 (5/7/91)	

ARAMETER	33215-6	33215-7	33215-8	33215-9	33215-10
etroleum Hydrocarbons (418.1), mg/kg dw	28	46	64	26	18
Aromatic Volatiles (8020)					
Benzene, ug/kg dw	1100	<5.5	<7.4	<6.6	<6.8
Ethylbenzene, ug/kg dw	<65	<5.5	<7.4	<6.6	<6.8
Toluene, ug/kg dw	410	<5.5	<7.4	<6.6	<6.8
Xylenes, ug/kg dw	<65	<5.5	<7.4	<6.6	<6.8
Percent Solids, %	77	81	68	76	74

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33215

Received: 08 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-M0378

Project: BLD 710 PHASE 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33215-11	A-10-1 (5/8/91)	Client
33215-12	A-7-1 (5/8/91)	

PARAMETER	33215-11	33215-12			
Petroleum Hydrocarbons (418.1), mg/kg dw	19	13			
Aromatic Volatiles (8020)					
Benzene, ug/kg dw	<6.0	<6.1			
Ethylbenzene, ug/kg dw	<6.0	<6.1			
Toluene, ug/kg dw	<6.0	<6.1			
Xylenes, ug/kg dw	<6.0	<6.1			
Percent Solids, %	83	82			

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33215

Received: 08 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: BLD 710 PHASE 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
33215-13	Method Blank-Soil	Client
33215-14	Accuracy (Mean % Recovery)-Soil	
33215-15	Precision (% RPD)-Soil	
33215-16	Date Analyzed-Soil	

PARAMETER	33215-13	33215-14	33215-15	33215-16
troleum Hydrocarbons (418.1), mg/kg dw	<10	94 %	7.4 %	05.21.91
romatic Volatiles (8020)				
Benzene, ug/kg dw	<5.0	90 %	4.4 %	05.15.91
Ethylbenzene, ug/kg dw	<5.0	---	---	05.15.91
Toluene, ug/kg dw	<5.0	108 %	3.7 %	05.15.91
Xylenes, ug/kg dw	<5.0	---	---	05.15.91

Methods: EPA SW-846.

Steven J. White

Steven J. White

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA. 31404
Phone: (912) 354-7858

JOB NO. | P.O. NO. | PROJECT NAME: BLD 710 PHASE I

CLIENT NAME: COE EN-GSU SAVANNAH | TELEPHONE: 944-5675

CLIENT ADDRESS: P.O. Box 889 SAVANNAH, GA 31402

CLIENT PROJECT MANAGER: TONI F. NICHOLSON

PAGE | OF

STANDARD ☐ RUSH ☐

DATE REPORT REQUESTED _____

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	TPH	BTEX	REQUIRED ANALYSES	REMARKS
5/8		A-10-1		✓	✓	✓		
"		A-7-1		✓	✓	✓		
"		A-4-1		✓	✓	✓		
"		A-4-2		✓	✓	✓		
"		MW-9-1		✓	✓	✓		
"		MW-9-2		✓	✓	✓		
"		A-9-1		✓	✓	✓		
"		A-5-1		✓	✓	✓		
"		MW-10-1		✓	✓	✓		

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
[signature]	5/8 12:03				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
Y. Johnson	5/8/91 12:03	(YES) NO		33215	

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.
ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA. 31404
Phone: (912) 354-7858

JOB NO. | P.O. NO. | PROJECT NAME: 340 1ID PHASE I

CLIENT NAME: COE (CAS) EN-GH | TELEPHONE: 944-5675

CLIENT ADDRESS: P.O. BOX 889 SAV. GA. 31402

CLIENT PROJECT MANAGER:

PAGE | OF

STANDARD ☐ RUSH ☐ DATE REPORT REQUESTED _____

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	REQUIRED ANALYSES: TPH	BTEX							REMARKS
5/6		A-3-1		✓	✓	✓							
"		A-1-1		✓	✓	✓							
"		A-2-1		✓	✓	✓							

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
DLC	5/8 12:03				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
Y. Johnson	5/8/91 12:03	(YES) NO		33345	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33340

Received: 16 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO424

Requisition: 910111

Project: HAAF-Building 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33340-1	MW-7-1 (5/13/91)	Client
33340-2	MW-7-1-C (5/13/91)	
33340-3	MW-8-1 (5/14/91)	
33340-4	MW-11-1 (5/15/91)	
33340-5	MW-11-2 (5/15/91)	

PARAMETER	33340-1	33340-2	33340-3	33340-4	33340-5
Aromatic Volatiles (8020)					
Benzene, ug/kg dw	<6.3	<6.4	41	<6.1	48
Ethylbenzene, ug/kg dw	<6.3	<6.4	9.1	<6.1	<6.3
Toluene, ug/kg dw	18	<6.4	160	<6.1	19
Xylenes, ug/kg dw	6.8	<6.4	78	<6.1	660
Petroleum Hydrocarbons (418.1), mg/kg dw	990	42	310	20	36
Percent Solids, %	80	78	68	82	80

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33340

Received: 16 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO424

Requisition: 910111

Project: HAAF-Building 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
33340-6	MW-6-1 (5/14/91)	Client
33340-7	A-5-1 (5/14/91)	

PARAMETER	33340-6	33340-7	
Aromatic Volatiles (8020)			
Benzene, ug/kg dw	<6.0	<6.4	
Ethylbenzene, ug/kg dw	<6.0	<6.4	
Toluene, ug/kg dw	15	<6.4	
Xylenes, ug/kg dw	11	<6.4	
Petroleum Hydrocarbons (418.1), mg/kg dw	21	15	
Lead, mg/kg dw	4.9	18	
Percent Solids, %	84	78	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33340

Received: 16 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO424

Requisition: 910111

Project: HAAF-Building 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
33340-8	Method Blank-Soil	Client
33340-9	Accuracy (Mean % Recovery)-Soil	
33340-10	Precision (% RPD)-Soil	
33340-11	Date Analyzed-Soil	

PARAMETER	33340-8	33340-9	33340-10	33340-11
Aromatic Volatiles (8020)				
Benzene, ug/kg dw	<5.0	104 %	6.7 %	05.27.91
Ethylbenzene, ug/kg dw	<5.0	---	---	05.27.91
Toluene, ug/kg dw	<5.0	110 %	15.4 %	05.27.91
Xylenes, ug/kg dw	<5.0	---	---	05.27.91
Petroleum Hydrocarbons (418.1), mg/kg dw	<10	89 %	3.4 %	05.29.91
Lead, mg/kg dw	<0.50	104 %	6.7 %	05.31.91

Methods: EPA SW-846.

Steven J. White WDS
Steven J. White

A-5 - PS
MW-6 - PD

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA 31404
Phone: (912) 354-7858

JOB NO. | P.O. NO. | PROJECT NAME: HAAF - Building 710

CLIENT NAME: COE Savannah District | TELEPHONE: 944-5675

CLIENT ADDRESS: P.O. Box 889 EN-GGH, Sav. GA 31402

CLIENT PROJECT MANAGER: Toni F. Nicholson

PAGE | OF

STANDARD ☒ RUSH ☐

DATE REPORT REQUESTED

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	REQUIRED ANALYSES: BTEX	TPH	LEAD							REMARKS
5/13/91		MW-7-1		✓	✓	✓								
"		MW-7-1C		✓	✓	✓								
5/14/91		MW-6-1		✓	✓	✓	✓							
"		MW-8-1		✓	✓	✓								
"		A-5-1		✓	✓	✓	✓							
5/15/91		MW-11-1		✓	✓	✓								
"		MW-11-2		✓	✓	✓								

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
[signature]	5/16 8:40				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT (YES) NO	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
L. Bonds	5/16/91 8:40 am	(YES) NO		33340	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	SAMPLED BY
33561-1	MW-3-1 (05.28.91)	Client
33561-2	MW-5-1 (05.28.91)	
33561-3	MW-7-1 (05.29.91)	
33561-4	MW-7-1C (05.29.91)	
33561-5	MW-8-1 (05.29.91)	

PARAMETER	33561-1	33561-2	33561-3	33561-4	33561-5
Purgeable Aromatics (EPA 602)					
Benzene, ug/l	22	<1.0	<1.0	<1.0	36
Ethylbenzene, ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene, ug/l	<1.0	<1.0	<1.0	<1.0	2.4
Xylenes, ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Petroleum Hydrocarbons (418.1), mg/l	<1.0	<1.0	1.9	<1.0	2.9

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	SAMPLED BY
33561-6	MW-10-1 (05.28.91)	Client
33561-7	MW-11-1 (05.29.91)	

PARAMETER	33561-6	33561-7
Purgeable Aromatics (EPA 602)		
Benzene, ug/l	<1.0	9.2
Ethylbenzene, ug/l	<1.0	17
Toluene, ug/l	<1.0	16
Xylenes, ug/l	<1.0	27
Petroleum Hydrocarbons (418.1), mg/l	<1.0	<1.0

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	SAMPLED BY
33561-8	MW-1-1 (05.29.91)	Client
33561-9	MW-4-1 (05.29.91)	
33561-10	MW-6-1 (05.28.91)	

PARAMETER	33561-8	33561-9	33561-10
Purgeable Aromatics (EPA 602)			
Benzene, ug/l	5200	600	<1.0
Ethylbenzene, ug/l	3800	26	<1.0
Toluene, ug/l	22000	5.8	<1.0
Xylenes, ug/l	17000	170	1.5
Petroleum Hydrocarbons (418.1), mg/l	55	<1.0	<1.0
Lead, mg/l	0.038	<0.0050	<0.0050

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	SAMPLED BY
33561-11	Rinsate (05.29.91)	Client

PARAMETER	33561-11
Petroleum Hydrocarbons (418.1), mg/l	<1.0

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	SAMPLED BY
33561-12	Trip	Client

PARAMETER	33561-12
Purgeable Aromatics (EPA 602)	
Benzene, ug/l	<1.0
Ethylbenzene, ug/l	<1.0
Toluene, ug/l	<1.0
Xylenes, ug/l	<1.0

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue (31404) • P.O. Box 13548 • Savannah, GA 31416-0548 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S1-33561

Received: 29 MAY 91

Ms. Toni Nicholson
U.S. Army Engineer District, Savh
P. O. Box 889
Savannah, Georgia 31402-0889

Contract: DACA21-91-MO378

Project: HAAF-BLD 710

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	SAMPLED BY
33561-13	Method Blank-Water	Client
33561-14	Accuracy (Mean % Recovery)-Water	
33561-15	Precision (% RPD)-Water	
33561-16	Date Analyzed-Water	

PARAMETER	33561-13	33561-14	33561-15	33561-16
Petroleum Hydrocarbons (418.1), mg/l	<1.0	110 %	5.5 %	06.07.91
Purgeable Aromatics (EPA 602)				
Benzene, ug/l	<1.0	94 %	2.2 %	06.10.91
Ethylbenzene, ug/l	<1.0	---	---	06.10.91
Toluene, ug/l	<1.0	92 %	3.7 %	06.10.91
Xylenes, ug/l	<1.0	---	---	06.10.91
Lead, mg/l	<0.0050	113 %	7.1 %	06.07.91

Methods: EPA 40 CFR Part 136

Steven J. White

Steven J. White

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA. 31404
Phone: (912) 354-7858

JOB NO. | P.O. NO. | PROJECT NAME: HAAF - OLD - 710

CLIENT NAME: COE (SAS) | TELEPHONE: 944-5675

CLIENT ADDRESS: P.O Box 889 SAV. GA 31402 EN-GGH

CLIENT PROJECT MANAGER: TONI E. NICHOLSON

PAGE: | OF:

STANDARD ☐ RUSH ☐

DATE REPORT REQUESTED: _____

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	REQUIRED ANALYSES: BTEX	TPH	LEAD							REMARKS
5/29/91		MW-1-1	✓		✓	✓	✓							
5/28/91		MW-3-[redacted]-1	✓		✓	✓								
5/29/91		MW-4-1	✓		✓	✓	✓							
5/28/91		MW-5-1	✓		✓	✓								
5/28/91		MW-6-1	✓		✓	✓	✓							
5/29/91		MW-7-1	✓		✓	✓								
5/29/91		MW-7-1C	✓		✓	✓								
5/29/91		MW-8-1	✓		✓	✓								
5/28/91		MW-10-1	✓		✓	✓								

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
	5/29 12:47				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
J. Johnson	5/29/91 12:45	(YES) NO		33561	

SL SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Savannah Division
5102 LaRoche Avenue
Savannah, GA. 31404
Phone: (912) 354-7858

JOB NO.	P.O. NO.	PROJECT NAME
		HAAF - BLD. 710

CLIENT NAME: COE (SAS) — TELEPHONE: 944-5675

CLIENT ADDRESS: P.O. BOX 889 SAV. GA 31402 EN-GGH

CLIENT PROJECT MANAGER: TONI F. NICHOLSON

REQUIRED ANALYSES — PAGE ___ OF ___

STANDARD ☐ RUSH ☐ DATE REPORT REQUESTED ___

SAMPLING DATE	SAMPLING TIME	SAMPLE ID	AQUEOUS MATRIX	NONAQUEOUS MATRIX	BTEX	TPH	REMARKS
5/29		MW-H-1	✓		✓	✓	
5/29		RINSATE	✓		✓	✓	
		TRIP BLANK	✓		✓	✓	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME
[signature]	12:40 5/29				
	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	5/29/91 12:45	YES NO		33561	

APPENDIX G

WATER SYSTEM SURVEY DATA

G-1 - HUNTER ARMY AIRFIELD DATA

G-2 - USGS WATER WELL SURVEY

G-3 - CITY OF SAVANNAH DATA

TABLE 1
Information on Water Supply Wells at
Hunter Army Airfield, Savannah, Georgia

No. 1 Well: Building 711

Tank capacity	100,000 gal
Pump capacity	1300 GPM Type - Layne Turbine
Elect. Mtr	100 hp
Drilled	1941
Depth	550 ft
Diameter	12 in.
Cased to	250 ft
Pump setting	140 ft
Static level	92 ft
Dynamic level	100 ft

No. 2 Well: Building 1205

Tank capacity	200,000 gal
Pump capacity	1300 GPM Type - Layne Turbine
Elect. Mtr	100 hp
Drilled	1941
Depth	600 ft
Diameter	12 in.
Cased to	250 ft
Pump setting	140 ft
Static level	108 ft
Dynamic level	116 ft

No. 3 Well: Building 8455

Tank capacity	1,000 gal
Pump capacity	30 GPM Type - 'Sta-rite 4' Submersible Pump
Drilled	1951
Depth	360 ft
Diameter	4 in.
Cased to	40 ft-Casing mdl 20P4E02E 1K76
Pump	121 ft

Notes:

1. Information was obtained from the HAAF Environmental Office during March of 1991.

TABLE 1 (con't)
Information on Water Supply Wells at
Hunter Army Airfield, Savannah, Georgia

No. 4 Well: Not in use, information unavailable.

No. 4A Well: Building 8581

Tank capacity	1,000 gal
Pump capacity	80 GPM
Elect. Mtr	5 hp
Depth	300 ft
Diameter	4 in.
Cased to	92 ft
Mtr Mfr	Holloshaft Mtr

No. 5 Well: Building 8641

Tank capacity	80 gal
Pump capacity	30 GPM Type- -Kenco Mdl 59A
Drilled	1955
Depth	380 ft
Diameter	4 in.
Cased to	85 ft
Water Level	30 ft

No. 6 Well: Not in use, information unavailable.

No. 7 Well: Building 8703

Tank capacity	5,000 gal
Pump capacity	70 GPM Type - Gould
Drilled	1980
Depth	450 ft
Cased to	330 ft
Water Level	37 ft

Notes:

1. Information was obtained from the HAAF Environmental Office during March of 1991.

TABLE 1 (Con't)
Information on Water Supply Wells at
Hunter Army Airfield, Savannah, Georgia

No. 8 Well: Building 8632

Tank capacity	15,000 gal
Pump capacity	80 GPM Type - Layne Turbine
Elect. Mtr	7.5 hp
Drilled	1956
Depth	370 ft
Diameter	8 in.
Overflow	107 ft
Cased to	255 ft
Pump setting	126 ft (Well could be deeper).
Static level	80 ft
Pump will produce	75 GPM

No. 9 Well: Building 8661

Pump	Sabre Hall
Storage capacity	0 gals
Pumping capacity	1,000 GPM
Depth	Deep well, exact depth unknown
Drilled	"Old", exact age unknown
Emergency standby equipment installed	100 hp gas driven engine

Well is presently used as a non-potable water source for emergency fire control.

Notes:

1. Information was obtained from the HAAF Environmental Office during March of 1991.

G-1 - HUNTER ARMY AIRFIELD DATA

G-2 - USGS WATER WELL SURVEY

GWSI CODES

USE OF WATER :
A, aircond.; B, bottling; C, commercial; D, dewater; E, power; F, fire; H, domestic; I, irrigation; J, industrial (cooling); K, mining; M, medical; N, industrial; P, public supply; Q, aquaculture; R, recreation; S, stock; T, institutional; U, unused; Y, desalination; Z, other.

TOPOGRAPHIC SETTING:
A, alluvial fan; B, playa; C, stream channel; D, depression; E, dunes; F, flat; G, flood plain; H, hilltop; K, sinkhole; L, lake or swamp; M, mangrove swamp; O, offshore; P, pediment; S, hillside; T, terrace; U, undulating; V, valley flat; W, upland draw.

SOURCE OF DATA:
A, other gov't; D, driller; G, geologist; L, logs; M, memory; O, owner; R, other reported; S, reporting agency; Z, other.

METHOD OF CONSTRUCTION:
A, air-rotary; B, bored or augered; C, cable tooled; D, dug; H, hydraulic rotary; J, jetted; P, air percussion; R, reverse rotary; T, trenching; V, driven; W, drive wash; Z, other.

CASING MATERIAL :
B, brick; C, concrete; D, copper; G galv. iron; I, wrought iron; M, other metal; P, pvc or plastic; R, rock or stone; S, steel; T, tile; U, coated steel, W, wood; Z, other material.

TYPE OF FINISH:
C, porous concrete; F, gravel with perf.; G, gravel screen; H, horiz. gallery; O, open hole; P, perf. or slotted; S, screen; T, sand point; W, walled; X, open hole; Z, other.

TYPE OF MATERIAL FOR OPEN SECTIONS:
B, brass; C, concrete; G, galv. iron; I, wrought iron; M, other metal; P, pvc or plastic; R, stainless steel; S, steel; T, tile; Z, other.

TYPE OF LIFT (PUMP TYPE):
A, air; B, bucket; C, centrifugal; J, jet; P, piston; R, rotary: S, submersible; T, turbine; U, unknown; Z, other.

TYPE OF LOGS:
A, time; B, caller; C, calliper; D, driller's; E, electric; F, fluid conduct.; G, geologist; H, magnetic; I, induction; J, gamma ray; K, dip meter; L, lateral log; M, microlog; N, neutron; O, microlateral log; P, photo video; Q, radioactive; S, sonic; T, temperature; U, gamma-gamma; V, fluid velocity; X, core; Z, other.

METHOD OF DISCHARGE MEASUREMENT:
A, accoustic meter; B, baller; C, current meter; D, Doppler meter; E, estimated; F, flume; M, totaling meter; O, orifice; P, pitot-tube meter; R, reported; T, trajectory; U, venturi meter; V, volumetric measurement; W, weir; Z, other.

METHOD OF WATER LEVEL MEASUREMENT:
A, airline; B, analog; C, calibrated airline; E, estimated; G, pressure gage; H, calibrated pressure gage; L, geophysical logs; M, manometer; N, non-rec. gage; R, reported; S, steel tape; T, electric tape; V, calibrated electric tape; Z, other.

DATE: 08/30/91 320142/0810804 -- Half Mile Radius 10675 PAGE 1

R	STATION NAME	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	TOP OF CASING (FEET)	DEPTH OF WELL (FEET)	BOTTOM OF CASING (FEET)	DIAMETER OF CASING (IN)	DATE OF CONSTRUCTION	DISCHARGE (GPM)	PRIMARY USE OF WATER
S	US ARMY, HUNTER 01	320145	0810806	.00	504	259.00	12.00	11-01-40	1300.00	A

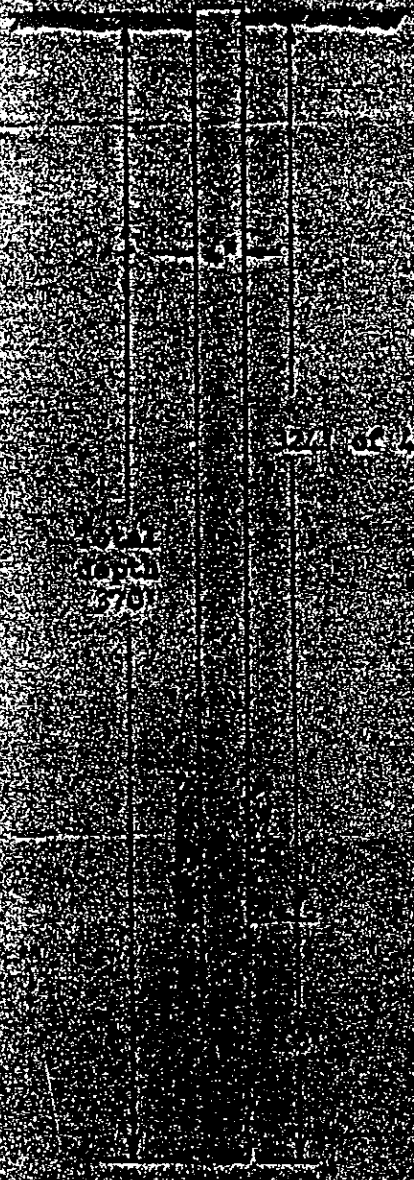
DATE: 08/30/91 320142/0810804 -- 3 Mile Radius 10675 PAGE 1

GRID NUMBER	STATION NAME	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	TOP OF CASING (FEET)	DEPTH OF WELL (FEET)	BOTTOM OF CASING (FEET)	DIAMETER OF CASING (IN)	DATE OF CONSTRUCTION	DISCHARGE (GPM)	PRIMARY USE OF WATER
36P036	SAVANNAH, GA 36	315922	0810845	.00	414	252.00	10.00	11-18-60	703.00	P
36Q017	HOWARD JOHNSONS MTL	320314	0810850	.00	448	294.00	4.00	08-05-53	--	C
36Q112	SCL RR,SAV SHOPS	320149	0810853	.00	508	275.00	8.00	-25	450.00	C
36Q125	MCCALLAN, MRS.	320309	0810858	.00	341	146.00	4.00	09- -38	--	P
				146.00		249.00	3.00	--	--	
36Q164	RAHN DAIRY	320150	0811038	.00	375	310.00	4.00	10-14-58	20.00	H
36Q181	BILTMORE GARDENS MHP	320239	0811048	.00	380	290.00	3.00	01-01-~~1969~~	150.00	P
36Q284	US ARMY, HUNTER 09	320019	0811008	.00	623	270.00	12.00	04- -59	--	F
36Q285	US ARMY, HUNTER 01	320145	0810806	.00	504	259.00	12.00	11-01-40	1300.00	A
36Q286	US ARMY, HUNTER 02	320115	0810745	.00	555	260.00	16.00	-42	1440.00	T
36Q287	US ARMY, HUNTER 03	320003	0810912	.00	370	324.00	4.00	-51	30.00	P
	US ARMY, HUNTER 04A	320103	0810958	0	360	267	4	06-01-58	--	H
	US ARMY, HUNTER 04	320058	0810955	.00	300	90.00	3.00	-26	--	T
	US ARMY, HUNTER 06	320017	0811034	--	180	--	--	--	--	P
	US ARMY, HUNTER 08	320003	0811023	--	375	--	--	--	--	P
36Q302	SAVANNAH, GA 25	320225	0810854	.00	540	287.00	10.00	-73	930.00	P
37P006	SAVANNAH, GA 13	315948	0810705	.00	1000	270.00	12.00	04-01-54	--	U
37P078	RIVERS END SUBDIV 01	315929	0810646	.00	440	200.00	4.00	-45	55.00	P
37P079	RIVERS END SUBDIV 02	315924	0810646	.00	400	227.00	4.00	-54	80.00	P
37Q023	US GEOL SURVEY TW 05 PT 1	320404	0810659	.00	930	870.00	3.00	-17	--	U
37Q029	E & W LAUNDRY	320352	0810622	.00	516	199.00	8.00	-31	134.00	N
37Q031	SAVANNAH, GA 09	320219	0810614	.00	710	267.00	16.00	05-01-41	3500.00	P
37Q033	DERST BAKING CO	320258	0810728	.00	568	258.00	10.00	11-03-47	632.00	N
37Q034	BENEDICTINE SCHOOL	320029	0810522	.00	327	100.00	4.00	09-01-55	--	U
37Q035	SAVANNAH, GA 06	320040	0810547	.00	750	240.00	12.00	10- -50	--	P
37Q095	CHATHAM CO BD OF ED (9/19	320352	0810729	.00	325	270.00	4.00	09-10-51	--	U
37Q096	REYNOLDS-MANLEY L1	320243	0810659	.00	346	68.00	6.00	-36	800.00	U
				68.00		128.00	4.00	--	--	
37Q097	REYNOLDS-MANLEY L2	320248	0810706	.00	514	258.00	6.00	11-17-53	--	N
37Q101	DUNN, T T	320102	0810521	.00	542	250.00	6.00	04-19-55	--	H
37Q175	SAV ELEC & PWR CO OP 2	320317	0810716	0	561	276	6	06- -57	--	N
37Q180	MEMORIAL MEDICAL CTR	320148	0810524	.00	1000	283.00	10.00	06- -63	500.00	T
37Q181	US GEOL SURVEY TW 05 PT 2	320404	0810659	.00	830	515.00	10.00	-17	--	U
				.00		180.00	12.00	--	--	
37Q184	CANDLER HOSPITAL	320146	0810557	0	600	50	24	06-13-85	1001	C
				0		290	16	--	--	

BY _____ DATE _____ SUBJECT: WATER WELL FOR INDUSTRIAL PARK SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ ARMY SHOP JOB NO. 933

LAYNE ATLANTIC CO. SAVANNAH, GA. JULY 13, 1955



WELL DATA

Total depth of well 370'
Casing 324' of 4" black steel
Cement 10 bags pumped around casing

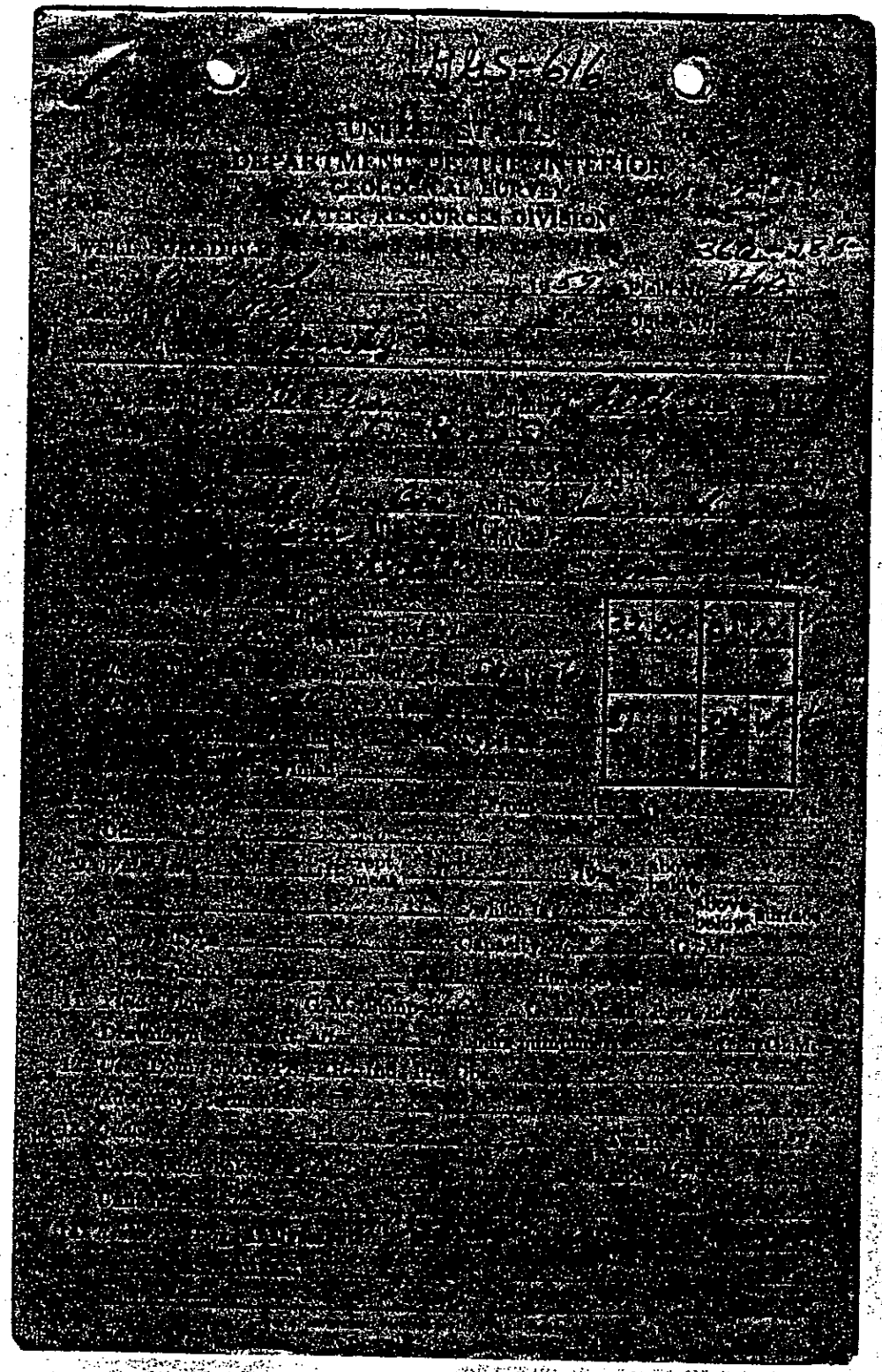
PUMP DATA

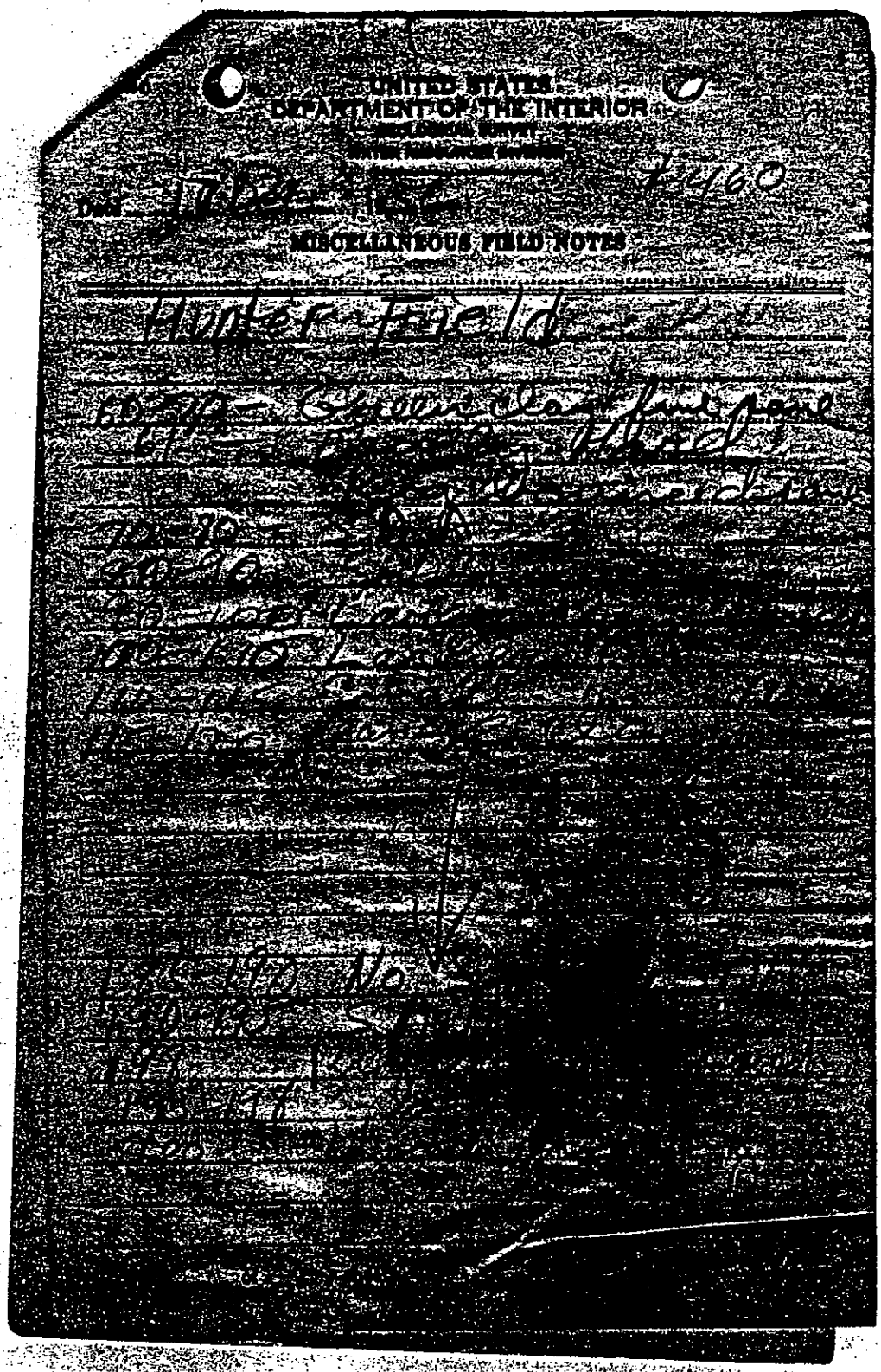
Static water level
Pumping level
Drawdown
Production

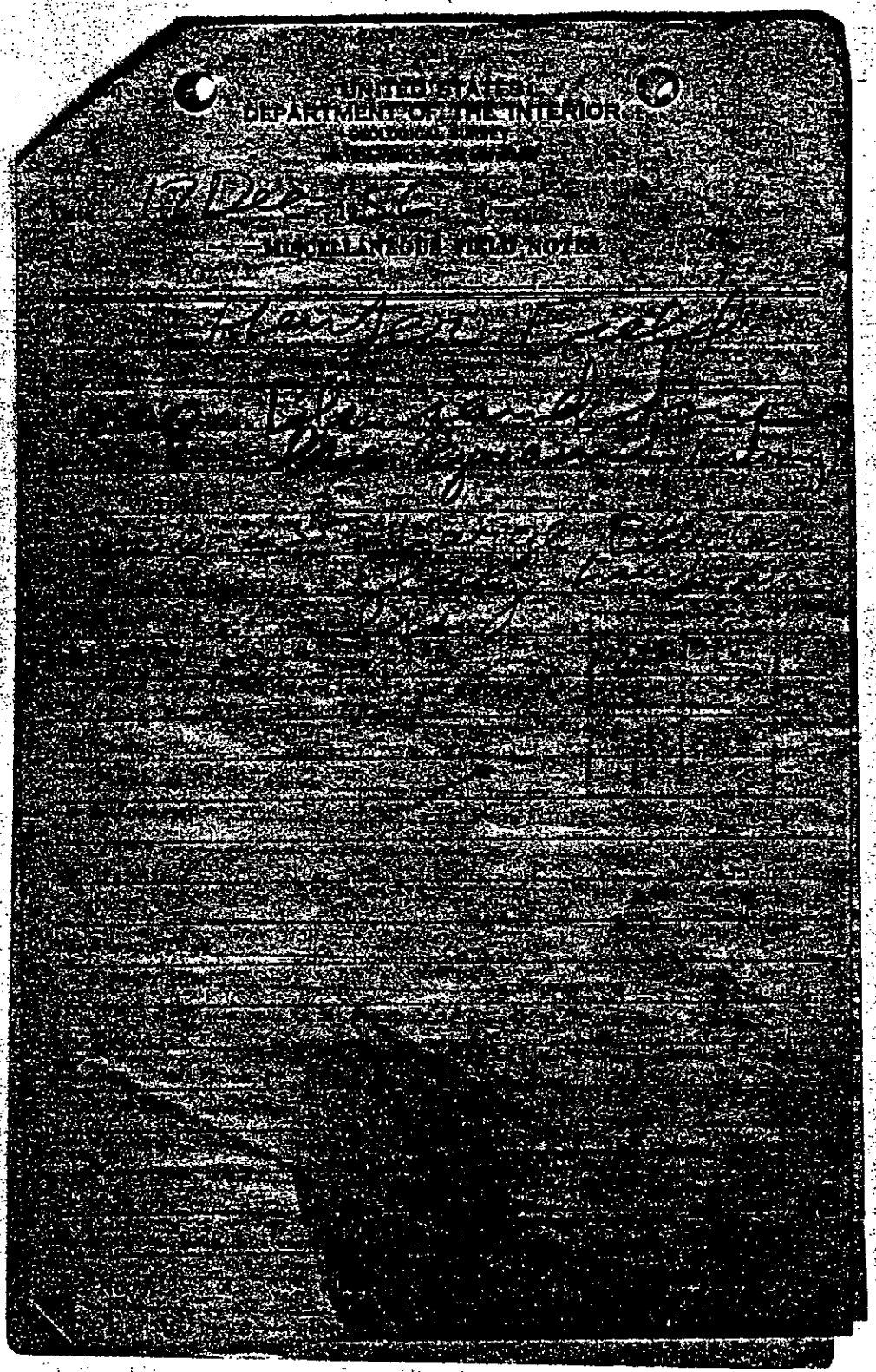
Pump 5 hp Jacuzzi Jet

FORMATION DATA

0-2 Top soil
2-7 Red and white clay
7-18 White clay and sand
18-25 Blue clay
25-35 Coarse sand
35-45 Coarse sand, gravel
45-55 Gravel streaks sand, clay
55-65 Blue clay, [illegible]
65-70 [illegible]
70-74 [illegible]
74-85 Blue clay and shell
85-240 Blue clay
240-287 White clay, shell limestone
287-[illegible] [illegible]
[illegible]-[illegible] Gray limestone
[illegible]-370 Gray limestone


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION


UNITED STATES
DEPARTMENT OF THE INTERIOR
MISCELLANEOUS FIELD NOTES


UNITED STATES
DEPARTMENT OF THE INTERIOR

9-068
(December 1949)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. GGS 80

Other Nos. 37031

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location Abercorn and 59th Street, Savannah, Georgia

Drilled by Layne-Atlantic Co. Address

Date May 1941 Casing diam. Land-surf. alt. 18 feet

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	No samples	30	30
	Sand, fine- to medium-grained, argillaceous, micaceous	10	40
	Sand, medium-grained, with occasional fragments of macro-shells	?	60
	Sand, coarse-grained, with occasional fragments of macro-shells (80-84)	4	84
	No samples	31	115
	Clay, dark green, silty	30	145
	No samples	20	165
	Rock, light brown, sandy, dolomitic, impregnated with brown to black, phosphatic pebbles & brown chert	18	183
	Limestone, light gray, crystalline(re-crystallized) sandy	17	200
	Clay, dark green, sandy, with brown, phosphatic pebbles	20	220
	Limestone, gray, crystalline(re-crystallized), sandy, with occasional macro-shells & fish teeth	10	230
	Limestone, some gray, crystalline(re-crystallized), sandy, nodular, with occasional macro-shells & fish teeth shells & fish teeth	20	250
	Limestone, nodular, re-crystallized, fossiliferous	20	270
	No samples	40	310
	Limestone, cream, re-crystallized, fossiliferous	?	310
	Limestone, dense, gray, re-crystallized, fossiliferous	15	325
	Limestone, cream, to light brown, re-crystallized, saccharoidal, much calcitized	5	330

Record by S. M. Herrick Date

U. S. GOVERNMENT PRINTING OFFICE 16—61687-1

9-068
(December 1949)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. GGS 80

Other Nos. 37Q31

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location Abercorn and 59th Street, Savannah, Georgia

Drilled by Layne-Atlantic Co. Address

Date May 1941 Casing diam. Land-surf. alt. 18 feet

Source of data Well Cutting

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Limestone, considerable dense, light gray, re-crystalliged, saccharoidal, much calcitized	17	347
	Limestone, dense, gray, re-crystallized	39	386
	No samples	80	466
	Limestone, light gray, sandy, saccharoidal	20	486
	Limestone, light gray, sandy, saccharoidal, with abundant Echinoid spines	20	506
	Limestone, somewhat softer, saccharoidal, re-crystallized	99	605
	No samples	15	620
	Limestone, light gray to white, re-crystallized, saccharoidal	20	640
	Limestone, light gray to white, re-crystallized, saccharoidal, sparsely glauconitic	20	660
	Limestone, light gray to white, re-crystallized, saccharoidal, with appreciable amount of gray	40	700
	Summary:		
	Formation:		
	Pliocene - Recent? (155') from 0 to 155 feet		
	Miocene(107') from 155 to 260(±) feet		
	Oligocene(Suwannee;65') from 260 to 325 feet		
	Ocala(375'+) from 325 to 700(+) feet		
	Possible Water-Bearing Horizons:		
	Somewhat porous limestone from 310 to 700 feet		

Record by S. M. Herrick Date

U. S. GOVERNMENT PRINTING OFFICE 16—61587-1

3783

9-068
(December 1949)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. GGS 809

Other Nos. 89

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location Abercorn and 59th Streat, Savannah, Georgia

Drilled by Layne-Atlantic Co. Address

Date May 1941 Casing diam. 20" to 267 Land-surf. alt. 18 feet

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Sand, fine- to medium-grained, with some gray, micaceous, silty clay	-	30
	Sand, fine-grained, micaceous, lignitic, finely-phosphatic marl	-	40
	Sand, medium- to coarse-grained, sparsely-phosphatic, with occasional shell fragments	-	60
	Sand, medium- to coarse-grained, sparsely-phosphatic, with frequent fragments of pale green, sandy, phosphatic clay	-	80
	Sand, coarse-grained, sparsely-phosphatic, with frequent fragments of pale green, sandy, phosphatic clay	-	82
	Sand, coarse-grained, sparsely-phosphatic, with frequent fragments of light brown, sandy, saccharoidal, dolomitic rock	-	84
	Clay, pale green, sandy, with scattered fragments of white, sandy, phosphatic limestone	-	115
	Clay, pale green, blocky, phosphatic	-	125
	Clay, pale green, blocky, phosphatic, with occasional fragments of white, sandy, phosphatic limestone	-	145
	Rock, light brown, sandy, cherty, phosphatic, dolomitic, phosphatic pebbles abundant	18	183
	Rock, light brown, sandy, cherty, phosphatic, dolomitic, with frequent fragments of white, re-crystallized, saccharoidal, fossiliferous limestone, with macro-shells, bryozoan re-mains and foraminifera(sample probably out-of-place)	-	200
	Clay, pale green, sandy, with scattered fragments of white, sandy, phosphatic limestone	-	220
	Limestone, dense, sandy, re-crystallized, saccharoidal, phosphatic	-	230

Record by S. M. Herrick Date

U. S. GOVERNMENT PRINTING OFFICE 16—61587-1

9-068
(December 1949)

37931

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. GGS 80

Other Nos.

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location Abercorn and 59th Street, Savannah, Georgia

Drilled by Layne-Atlantic Co. Address

Date May 1941 Casing diam. Land-surf. alt. 18 feet

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Limestone, light gray, sandy, somewhat weathered, with occasional macro-shells and foraminifera	20	270
	Limestone, rather dense, white to cream, re-crystallized, highly calcitized, fossiliferous, with foraminifera of Oligocene & Middle Eocene Age, latter re-worked	40	310
	Limestone, dense, light gray, calcitized, fossiliferous, with frequent Echinoid spines, bryozoan colonies, and large foraminifera	15	325
	Limestone, rather dense, white to cream, re-crystallized, highly calcitized, fossiliferous, with foraminifera of Oligocene & Middle Eocene Age, latter re-worked	5	330
	Limestone, dense, cream, with some light gray, rather unfossiliferous limestone	17	347
	Limestone, dense, gray, re-crystallized	39	386
	No samples	80	466
	Limestone, light gray, sandy, saccharoidal	20	486
	Limestone, light gray, sandy, saccharoidal, with abundant Echinoid spines	20	506
	Limestone, somewhat softer, saccharoidal, re-crystallized	99	605
	No samples	15	620
	Limestone, light gray to white, re-crystallized, saccharoidal	20	640
	Limestone, light gray to white, re-crystallized, saccharoidal, sparsely glauconitic	20	660
	Limestone, light gray to white, re-crystallized, saccharoidal, with appreciable amount of gray	40	700

Record by S. M. Herrick Date

U. S. GOVERNMENT PRINTING OFFICE 16—61687-1

9-068
(December 1949)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

5143
31431

No. GGS 80

Other Nos.

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location Abercorn and 59th Street, Savannah, Georgia

Drilled by Layne-Atlantic Co. Address

Date May 1941 Casing diam. Land-surf. alt. 18 feet

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Summary:		
	Formations:		
	Pliocene - Recent? (155') from 0 to 155 feet		
	Miocene (107') from 155 to 260 feet(+)		
	Oligocene(Suwannee; 65') from 260 to 325 feet		
	Ocala(375'+) from 325 to 700 feet(+)		
	Possible Water-Bearing Horizons:		
	Somewhat porous limestone from 310 to 700 feet		

Record by S. M. Herrick Date

U. S. GOVERNMENT PRINTING OFFICE 16—61587-1

9-4088 (December 1949)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

3776 37 PG

No. GO8S3799

Other Nos.

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah #13

Location

Drilled by Layne-Atlantic Co. Address

Date April 1954 Casing diam. Land-surf. alt.

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Limestone, soft, cream, highly fossiliferous, with scat- [illegible] fragments of gray, rather dense, sparsely glau- conitic, with abundant bryozoan remains	80	780
	Sand, fine- to medium-grained	36	38
	Limestone, soft, cream, highly fossiliferous, with scat- [illegible] sparsely glau- conitic, with abundant bryozoan remains; with scattered	42	80
	[illegible] micaceous, silty	39	1730
	[illegible] with frequent frag- [illegible] phosphatic, dolomitic rock	18	2230
	brown, phosphatic pebbles, abundant		
	Limestone, granular and progressively finer-grained	70	890
	Limestone, mostly [illegible] sandy, [illegible] micro- shells and molds of shells with scattered fragments of	60	950
	weathered, [illegible] relatively soft, fossiliferous, and [illegible] (latter probably weathered lime- stone	29	2500(+)
	[illegible]		
	Limestone, cream, soft, fossiliferous	63	313
	Limestone, [illegible] gray) [illegible] crystallized [illegible] fossiliferous [illegible] abundant bryozoan remains, echinoid spines, and foraminifera 373 to 221 feet	60	373
	[illegible] from 221 to 215 feet(+)		
	Limestone [illegible] calcitized, fossiliferous [illegible] echinoid spines [illegible] foraminifera; top not determined because of long sample interval, 615 - 700') from 700 to	61	434
	Limestone [illegible] dense than above; with abundant echinoid spines (x-sections)	90	524
	Limestone, [illegible] highly fossiliferous	91	615
	Limestone, soft, cream, highly fossiliferous, with sca- ttered fragments of gray, rather dense, sparsely glauco- nitic, with abundant bryozoan remains	85	700

Record by S. M. Herrick Date Sheet 1 of 22

9-068
(December 1949)

3796

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. GGS 379

Other Nos.

WELL LOG

State Georgia County Chatham Subarea

Owner City of Savannah

Location

Drilled by Layne-Atlantic Co. Address

Date April 1954 Casing diam. Land-surf. alt.

Source of data Well Cuttings

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Limestone, soft, cream, highly fossiliferous, with scattered fragments of gray, rather dense, sparsely glauconitic, with abundant bryozoan remains	80	780
	Limestone, soft, cream, highly fossiliferous, with scattered fragments of gray, rather dense, sparsely glauconitic, with abundant bryozoan remains; with scattered grains of sand	10	790
	Limestone, dense, fossiliferous, with frequent fragments of shells and casts of shells	30	820
	Limestone, granular and progressively finer-grained	70	890
	Limestone, mostly granular, fine-grained, or granular marl	60	950
	Limestone, dense, unfossiliferous, nodular, with abundant light brown chert	50	1000(+)

Summary:

Formation:
Undifferentiated Pliocene - Recent from 0 to 173 feet
Miocene from 173 to 235 feet(+)
Hawthorne from 173 to 221 feet
Tampa from 221 to 235 feet(+)
Oligocene (Suwannee) from 235 to 313 feet(+)
Upper Eocene (Ocala) from 313 to 700 feet(+)
Middle Eocene (Claiborne; top not determined because of long sample interval, 615 - 700') from 700 to 1000 feet(+)

Possible Water-Bearing Horizons:
Limestone from 221 to 890 feet
Limestone from 950 to 1000 feet(+)

	Limestone, soft, cream, highly fossiliferous, with scattered fragments of gray, rather dense, sparsely glauconitic, with abundant bryozoan remains	63	313
	Limestone, same as above; with abundant echinoid spines, Hawthorne from 173 to 221 feet	60	373
	Limestone, same as above, but calcitized, with abundant echinoid spines, top not determined because of long sample interval, 615 - 700')	62	435
	Limestone, less dense than above; with abundant echinoid spines (x-sections)	90	525
	Limestone, same as above, fossiliferous	91	616
	Limestone, soft, cream, highly fossiliferous, with scattered fragments of gray, rather dense, sparsely glauconitic, with abundant bryozoan remains	84	700

RECORD BY S. M. Herrick DATE

SHEET 2 OF 2

U. S. GOVERNMENT PRINTING OFFICE 16-61867-1

G-3 CITY OF SAVANNAH DATA

✓ w/in 3-mile radius
X outside 3-mile radius

WELL #	WELL LOCATION
#1	WALZ DRIVE NEXT TO JULIETT LOWE SCHOOL X – USGS has listed as within 3-miles of site. Checked in the field. Site is more than 3 miles away.
#2	STILES AVENUE BEHIND CITY LOT X
#3	IN CITY LOT YARD X
#4	GWINNETT STREET AT WEST BOUNDARY AND I-16 X
#5	IN CORNER OF WHITAKER STREET AND PARK AVENUE X FORSYTH PARK
#6	CORNELL AVENUE BETWEEN WATERS AVENUE AND ✓ B. C. SCHOOL
#7	CORNER OF VICTORY DRIVE AND WATERS AVENUE X DAFFIN PARK
#8	EDGEWOOD RD. AND PIERPONT AVENUE X GIRL SCOUT PARK - GORDONSTON
#9	COLUMBUS DRIVE AND ABERCORN STREET ✓
#10	AUGUSTA AVENUE AT EAST LATHROP AVENUE X
#11	PENNSYLVANIA AVENUE AT HARRISON STREET X BEHIND FIRE STATION
#12	35TH STREET AND LINCOLN STREET ✓
#13	MONTGOMERY CROSSROADS AT BARTLETT SCHOOL ✓
#14	WINDSOR FOREST ON BRIARCLIFF CIRCLE X OFF WINDSOR ROAD
#15	WILSHIRE ESTATES ON LARGO DRIVE NEAR ✓ TIBET AVENUE — USGS has listed as City of Savannah #36
#16	SOUTHEASTERN SHIPYARD X
#17	TRAVIS FIELD ACROSS FROM AIRPORT TERMINAL X
#18	TRAVIS FIELD NEXT TO QUALITY COURTS MOTEL X
#19	TRAVIS FIELD AT EDGE OF RUNWAY BEHIND HANGER X BUILDING
#20	AT END OF SAPELO ROAD - ISLANDWOOD X WILMINGTON ISLAND
#21	WELLINGTON CIRCLE OFF MILLWARD ROAD - X WILMINGTON

#22 WILMINGTON ISLAND ROAD X

#23 OFF LARGO DRIVE JUST BEFORE BERKSHIRE WEST AT WATER STORAGE TANK X

#24 OFF LEANING OAKS DRIVE - WOODRIDGE ESTATES WILMINGTON ISLAND X

#25 BAMBLE ROAD BETWEEN ACL BLVD AND HIGHWAY 17 ✓

#26 COFFEE BLUFF AT COFFEE BLUFF ESTATES X

#27 BY ST. JOSEPH'S HOSPITAL ON MCAULEY DRIVE X

#28 BRYAN WOODS ROAD - WILMINGTON ISLAND HIGHWAY 80 X

#29 GEORGETOWN - BARKSDALE DRIVE & RED FOX DRIVE X

#30 G-2 GEORGETOWN - KING GEORGE BLVD - VILLAGE GREEN X

#31 CHATHAM PARKWAY - BESIDE SAV GAS OFFICE X

#32 JOHNNY MERCER BLVD & HIGHWAY 80 - WHITEMARSH X

#33 DUTCH ISLAND - HERB RIVER DRIVE - BETWEEN 401 AND 405 X

#34 DUTCH ISLAND - KOLB DRIVE - BET 840 AND 841 X

#35 I-95 & 204 - BEHIND CHEVRON STATION X

#36 I-95 & 204 - ROAD BET. DAYS INN MOTEL AND AMOCO STATION - GATEWAY BLVD. X

#37 I-16 & DEAN FOREST ROAD - ADJ. TO TENNIS CLUB X

#38 DUTCH ISLAND - DUTCH ISLAND DRIVE BETWEEN VERDELL DRIVE AND TERRAPIN X

WELL NO.	BORE DEPTH	PUMP SET	CASING LENGTH	CASING SET	DATE DRILLED	GPM	FREQUENCY OF USE
WELL #1	1000'	175'	300'	20"	1954	1200	24 HR/DAY
WELL #6	750'	180'	240'	12"	1949	1400	24 HR/DAY
WELL #7	525'	200'	200'	24"	1921	3000	18 HR/DAY
WELL #9	710'	220'	267'	20"	1941	1600	24 HR/DAY
WELL #12	550'	200'	265'	14"	1920	1500	12 HR/DAY
WELL #13	1000'	210'	270'	12"	1956	1300	24 HR/DAY
WELL #14	800'	140'	338'	12"	1956	700	24 HR/DAY
WELL #15	414'	130'	252'	10"	1960	1000	24 HR/DAY
WELL #23	639'	100'	320'	16"	1970	1100	20 HR/DAY
WELL #25	540'	200'	287'	10"	1973	1100	24 HR/DAY
WELL #27	550'	120'	321'	16"	1981	1470	24 HR/DAY
WELL #36							