

REVISED FINAL

**RCRA FACILITY INVESTIGATION REPORT
FOR THE
FIRE TRAINING AREA AT WRIGHT ARMY AIRFIELD
(SWMU 13)
FORT STEWART, GEORGIA**

REGULATORY AUTHORITY
RESOURCE CONSERVATION AND RECOVERY ACT
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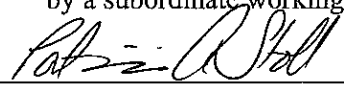
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LIST OF ACRONYMS

amsl	Above Mean Sea Level
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
AUF	Area Use Factor
BAF	Bioaccumulation Factor
bgs	Below Ground Surface
BRA	Baseline Risk Assessment
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CAP	Corrective Action Plan
CAPE	CAPE Environmental Management, Inc.
CDAP	Chemical Data Acquisition Plan
CLP	Contract Laboratory Program
cm/sec	Centimeters per Second
CMCOPC	Contaminant Migration Chemical of Potential Concern
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CQAP	Comprehensive Quality Assurance Plan
CRQL	Contract Required Quantitation Limits
CSM	Conceptual Site Model
DAF	Dilution Attenuation Factor
DMP	Data Management Plan
DO	Dissolved Oxygen
DPW	Directorate of Public Works
DQCR	Data Quality Control Report
DQO	Data Quality Objective
e.g.	For Example
Eh	Oxidation-Reduction Potential
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EPRE	Ecological Preliminary Risk Evaluation
ERA	Ecological Risk Assessment
ESE	Environmental Sciences Engineering, Inc.
ESV	Ecological Screening Value
FID	Flame Ionization Detector
FSMR	Fort Stewart Military Reservation
FST	Fire Training Area 13
ft/day	Feet per Day
ft ² /day	Square Feet per Day
FTP	Fire Training Pad
G&M	Geraghty & Miller, Inc.
GA EPD	Georgia Environmental Protection Division
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GDAP	Geologic Data Acquisition Plan
GSSL	Generic Soil Screening Level
HHBRA	Human Health Risk Assessment
HI	Hazard Index

HQ	Hazard Quotient
ID	Identification or Inside Diameter
IDW	Investigative-Derived Waste
i.e.	In Other Words
IM	Interim Measures
LCS	Laboratory Control Standard
LD	Laboratory Duplicate
LIMS	Laboratory Information Management System
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/l	Milligrams per Liter
MIBK	4-Methyl-2-Pentanone
ml	Milliliter
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
MV	Millivolts
MWIP	Monitoring Well Installation Program
NA	Not Analyzed
NC	Not Calculated
NCR	Nonconformance Report
NFA	No Further Action
NIST	National Institute of Science and Technology
NL	Not Listed
NOAEL	No Observed Adverse Effect Level
NTU	Nephelometric Turbidity Unit
OVA	Organic Vapor Analyzer
OVS	Oil/Water Separator
PAH	Polynuclear Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCT	Preliminary Cleanup Targets
PID	Photo-Ionization Detector
PMP	Project Management Plan
POW	Prisoner of War
ppg	Pounds per Gallon
PPM	Parts per Million
PQL	Practical Quantitation Limit
PRE	Preliminary Risk Evaluation
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QCSR	Quality Control Summary Report
RAS	Routine Analytical Services
RBC	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RSD	Relative Standard Difference
REI	Rust Environmental & Infrastructure
RL	Remedial Levels

SAIC	Science Applications International Corporation
SAS	Spatial Analytical Services
SDG	Sample Delivery Group
SESOIL	Seasonal Soil Compartment Model
SL	Savannah Labs
SOP	Standard Operating Procedure
SOW	Scope of Work
SRC	Site Related Contaminant
SSHP	Site Safety & Health Plan
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbon
TPH-DRO	Total Petroleum Hydrocarbon-Diesel Range Organics
TPH-GRO	Total Petroleum Hydrocarbon-Gasoline Range Organics
TRV	Toxicity Reference Values
μ	Micron
μg/kg	Micrograms per Kilogram
μg/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USAR	U.S. Army Reserve
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WAAF	Wright Army Airfield
WWII	World War II

EXECUTIVE SUMMARY

This report summarizes the results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the Fire Training Area at Wright Army Airfield (WAAF), Solid Waste Management Unit (SWMU) 13, at Fort Stewart, Georgia. This report has been prepared by Science Applications International Corporation (SAIC) and Earth Tech, Inc. (formerly Rust Environment & Infrastructure) for the U.S. Army Corps of Engineers (USACE), Savannah District, under Contract DACA21-95-D-0022, Delivery Order No. 0049. The RFI sampling was conducted in accordance with USACE guidance EM200-1-3 and the Georgia Environmental Protection Division (GA EPD) approved RFI Work Plan.

The Fire Training Area was located on the western edge of the WAAF runway system, which is in the southern portion of the Fort Stewart Military Reservation (FSMR). The Fire Training Area consisted of a 5,000-square-foot concrete pad with an integral berm that was used by fire-fighting personnel for training. An oil/water separator sump, underground piping, and an above ground fuel (JP-4) storage tank adjoined the main concrete pad and combined to make up the entire Fire Training Area. All of these structures and appurtenances were removed during the Interim Measures (IM) conducted in 1997 by CAPE Environmental. Also as part of the IM, the top four feet of contaminated soil was excavated, removed, and replaced with clean soil. The IM was summarized in the Final Interim Measures Report for SWMU 13, dated May 1998, submitted to GA EPD in August 1998.

The Fire Training Area was used as a training area for the airfield's firefighters from its construction, prior to 1982, until 1992. During training exercises, fuel [water contaminated jet fuel (JP-4), diesel fuel, or waste oil] was pumped onto the surface of a simulated aircraft and ignited. The fires were then extinguished with water and foam.

Prior to the IM, three field investigations had been conducted at SWMU 13. Based on the analytical results obtained from these studies and confirmatory sampling done as part of the IM, the GA EPD instructed the Fort Stewart Directorate of Public Works (DPW) to conduct an RFI at the site.

The objectives of the RFI for SWMU 13, as defined in the Work Plan (August 1998) and approved by GA EPD, are as follows:

- Determine the horizontal and vertical extent of contamination at SWMU 13.
- Determine whether contaminants present constitute a threat to human health or the environment.
- Determine the need for further actions and/or no further action, and gather necessary data to support development of a Corrective Action Plan (CAP), if warranted.

Summary of Investigation Activities

The information provided in this report is based upon data collected as part of the RFI field sampling and analysis. The scope of the RFI field work included the following activities:

- Collecting direct-push technology (DPT) soil samples using a push probe at a total of 12 locations. Direct-push soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and RCRA metals.
- Collecting direct-push groundwater screening samples using a push probe at a total of 23 locations, including 3 vertical profiles. Direct-push groundwater samples were analyzed for VOCs and SVOCs.
- Installing six permanent groundwater monitoring wells. One soil sample was collected from each well borehole and analyzed for VOCs, SVOCs, and RCRA metals.
- Collecting groundwater samples from the new and existing monitoring wells for a total of ten groundwater samples. Groundwater samples were analyzed for VOCs, SVOCs, and RCRA metals.
- Collecting surface soil samples at a total of three locations at the site for VOC, SVOC, and RCRA metals analyses.

Physical Characteristics of the Site

The FSMR occupies a low-lying, flat region on the coastal plain of Georgia. The Fire Training Area (SWMU 13) is situated in the southern portion of the FSMR and is approximately 45 feet above mean sea level (amsl).

The soils at SWMU 13 are essentially similar and generally a dark yellowish orange to light brown silty sand interbedded with sandy clay and clayey silty sand layers. A deep boring at the site showed silty clayey sand to 4-foot depth, followed by a sandy clay layer to 8 feet, underlain by silty clayey sand to 27 feet below ground surface (bgs). At this depth, a dense greenish gray silty sand was encountered and extended to the completion depth of 55 feet bgs.

Geotechnical analyses were conducted on various samples for grain size distribution, Atterberg limits, moisture content, specific gravity, porosity, and permeability. Results of the geotechnical analyses indicate that tested soils are non-plastic silty sands.

The uppermost hydrogeologic unit is the surficial aquifer that consists of widely varying amounts of sand, silt, and clay ranging from 55 to 150 feet in thickness. This aquifer is primarily utilized for domestic lawn and agricultural irrigation with wells typically yielding 2 to 180 gallons per minute. The top of the water table ranges from 2 to 10 feet below ground level. Groundwater flow within the water table at SWMU 13 is to the southeast, ultimately discharging to Peacock Creek. The hydraulic gradient within the water table is approximately 0.004 foot/foot at the site.

Contaminant Nature and Extent

Results of this investigation indicate that there is contamination present in both soil and groundwater at the site. Site-related contaminants (SRCs) were identified by comparing inorganic chemical concentrations to reference background concentrations. All organic chemicals that were detected were considered site-related.

SRCs for surface soil are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, pyrene, and barium. These chemicals were identified in only one of three surface soil samples taken for this investigation. The location of this sample was adjacent to a weathered and corroded asphalt pavement. SRCs for subsurface soil identified as part of this RFI sampling include those listed above for surface soils plus anthracene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, phenanthrene, chromium, and lead. Additional subsurface soil SRCs were identified from samples taken as part of the IM confirmatory sampling. These are acenaphthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, arsenic, and mercury. SRCs for groundwater are benzene, toluene, ethylbenzene, xylenes, naphthalene, and 2-methylnaphthalene.

The areal extent of groundwater contamination is limited to approximately one acre, and there is evidence that contaminant biodegradation is taking place in groundwater at the site. The groundwater contaminant plume is not increasing in size nor moving from the source area.

Contaminant Fate and Transport

A soil leachability analysis was performed for surface and subsurface soil SRCs that exceeded U.S. Environmental Protection Agency (EPA) suggested generic soil screening levels (GSSLs). One volatile SRC, four semi-volatile SRCs, and two RCRA metals had concentrations that exceeded their respective GSSLs (Table 6.3) and were identified as preliminary contaminant migration chemicals of potential concern (CMCOPCs).

The SESOIL leachate model was used to estimate maximum groundwater concentrations of preliminary CMCOPCs beneath the source. SESOIL modeling results indicated that the predicted groundwater concentration of volatile and semi-volatile organic preliminary CMCOPCs did not exceed their respective groundwater target concentration. Therefore, there are no organic CMCOPCs for SWMU 13.

SESOIL predicted groundwater concentrations of inorganic preliminary CMCOPCs, arsenic and chromium, exceeded their respective groundwater target concentration (Table 6.4). SESOIL predicted maximum groundwater concentrations for arsenic and chromium are 0.21 mg/L [maximum contaminant level (MCL) 0.05 mg/L] and 2.13 mg/L (MCL 0.1 mg/L), respectively. Due to slow groundwater movement at the site (14 feet/year) and retardation of arsenic and chromium, arsenic and chromium would take more than 15,000 years to reach the nearest surface water receptor, Peacock Creek [Section 6.4.4]. Both inorganic CMCOPCs (arsenic and chromium) were evaluated in the baseline risk assessment for their potential to leach into the groundwater.

The organics detected in the groundwater include both VOCs and SVOCs. However, groundwater movement off-site is very slow (14 feet/year) and may take 178 years to reach the nearest receptor location (i.e., Peacock Creek).

Human Health Preliminary Risk Evaluation

Human health contaminants of potential concern (COPCs) were identified in surface soils, subsurface soils, and groundwater. These COPCs are listed below.

Surface Soil COPCs	Subsurface Soil COPCs	Soil CMCOPCs	Groundwater COPCs
Benzo(a)pyrene	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Dibenzo(a,h)anthracene	Arsenic Chromium	Benzene Ethylbenzene Toluene Xylenes, Total 2-Methylnaphthalene Naphthalene

Benzo(a)pyrene was detected above its risk-based concentration (RBC) in surface soils at one location. This one location was adjacent to weathered asphalt, so it is likely this lone sample incorporated some of the asphalt and resulted in the reported concentration.

Arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and dibenzo(a,h)anthracene were reported at concentrations above their respective RBCs in subsurface soil.

Six human health COPCs for groundwater (benzene, ethylbenzene, toluene, xylenes, 2-methylnaphthalene, and naphthalene) were identified because they present a potential threat to human health as a result of using groundwater as a source of drinking water. It should be noted that given the shallow depth of the surficial aquifer and the presence of the deeper Principal Artesian aquifer, a common source of drinking water throughout the region, the use of the surficial aquifer is not considered to be a viable exposure scenario.

Because COPCs are identified in various media at SWMU 13, a HHBRA was conducted for the site and is presented in Appendix H.

Ecological Preliminary Risk Evaluation

At SWMU 13, the nearest perennial surface water body, Peacock Creek, is 2,500 feet downgradient of the site and there are no other features nearby to receive groundwater discharges. Specifically, the four drainage swales located around the perimeter of the site are approximately 5 to 6 feet above the surficial aquifer, and only retain water during heavy rain events. The ponded water then percolates down into the surficial aquifer, clearly indicating that none of the swales receive water from the surficial aquifer. Therefore, aquatic biota are not exposed by surface water. The "sediment" in the bottom of each swale is considered as surface soil in the Ecological Preliminary Risk Evaluation (EPRE). In addition, surface soil is also evaluated.

Barium was the only metal detected above reference background criteria in surface soil at SWMU 13, but the maximum detected concentration was below its Ecological Screening Value (ESV). Therefore, no metals are identified as ecological COPCs.

The EPRE provided a Phase 1 Preliminary Risk Evaluation for terrestrial receptors potentially exposed at the site. Preliminary risk calculations included a comparison of detected concentrations to Toxicity Reference Values (TRVs) for surrogate species representing ecological receptors for the seven polycyclic aromatic hydrocarbons (PAHs) evaluated. Based on the comparison, none of the PAHs were identified as ecological COPCs.

There is uncertainty about whether benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene are ecological COPCs in surface soil, because no TRVs could be derived for these substances. These six SVOCs were detected in only one surface soil sample, A-GP-9-0s, south of the former Fire Training Area. This sample was collected from an area adjacent to a weathered and eroded asphalt pavement. It is reasonable to expect that some of the asphalt fragments eroded from the weathered pavement that could have been incorporated into the sample during collection and biased the sample. All PAHs detected were at low concentrations, and are unlikely to pose a risk to ecological receptors given the low concentrations relative to their proposed TRVs, which are one-tenth the TRV for benzo(a)pyrene. There are, therefore, no organic ecological COPCs in surface soil.

The EPRA provided a Preliminary Risk Evaluation for aquatic and terrestrial receptors potentially exposed to groundwater at the site. Risk calculations for the four VOCs and one SVOC detected in groundwater indicated no exposures of terrestrial receptors exceed TRVs associated with adverse effect. Mean concentrations of VOCs and SVOCs do not exceed screening values for freshwater biota with the exception of xylenes. These VOCs and SVOCs are not expected to be present in groundwater migrating to Peacock Creek 2500 feet away. Based on these results neither the VOCs nor the SVOC were identified as ecological COPCs.

There are no ecological COPCs in either soil, sediment, surface water, or groundwater at SWMU 13 site. Therefore, no remedial levels are required to be developed for ecological receptors, and additional ecological assessment is not warranted for this site.

Conclusions and Recommendations

Estimated hazards and risks were calculated for exposure of two current (on-site groundskeeper, off-site FSMR worker) and three hypothetical future (on-site groundskeeper, off-site FSMR worker, on-site resident) exposure scenarios.

Surface Soil

All of the estimated hazard quotient (HQ) and hazard index (HI) values for surface soil exposures are less than one. Estimated risks to the current and future workers are all below the *deminimis* level of 1×10^{-6} . Estimated risks to a hypothetical future resident exceed 1×10^{-6} due to ingestion of benzo(a)pyrene.

Benzo(a)pyrene is identified as a contaminant of concern (COC) for surface soil. Remedial levels derived for this site address the potential risk to a hypothetical future resident exposed to constituents in surface soil via ingestion, inhalation, and dermal contact. Given that benzo(a)pyrene is the only COC in surface soil, a remedial level of 0.98 mg/kg is recommended see (Table ES.1). This remedial level corresponds to a total residential cancer risk of 1×10^{-5} .

Table ES.1
Proposed Remediation Levels for Chemicals of Concern
SWMU 13, Fort Stewart, Georgia

Site-Related Contaminants (SRCs)	units	Maximum Detect	Federal MCL	RBC	Proposed RL ¹
Surface Soil					
Benzo(a)pyrene	mg/kg	390	NA	0.0875	0.98
Subsurface Soil					
Arsenic	mg/kg	10.4	NA	8.04	8.04
Chromium	mg/kg	40.4	NA	11.6	11.6
Groundwater					
Benzene	µg/l	440	5	—	5
Ethylbenzene	µg/l	940	700	—	700
2 - Methyl naphthalene	µg/l	72	—	142	142
Naphthalene	µg/l	140	—	149	149

¹See HHBRA contained in Appendix H.

Notes:

µg/l = micrograms per liter

MCL = maximum contaminant level

RBC = USEPA Region III risk-based concentration

RL = remedial level

Subsurface Soil

Estimated hazards and risks were calculated for exposure to subsurface soil by a hypothetical future construction worker. All of the estimated HQ and HI values are less than one. Estimated risks to the future worker are all below the *deminimis* level of 1×10^{-6} . No COCs are identified for subsurface soil.

Estimated hazards and risks were calculated for exposure to groundwater containing CMCOPCs leached from overlying soil. Estimated hazards and risks exceed target levels for all receptors exposed to arsenic and chromium, therefore, these two metals are identified as CMCOCs. Soil remedial levels for CMCOCs are derived based on the concentration of constituents in soil that will not leach into groundwater at unacceptable levels. Acceptable (target) groundwater concentrations are used to back-calculate acceptable soil concentrations using the leachate model (SESOIL).

The hypothetical residential exposure scenarios provide the most conservative remedial levels. Target groundwater concentrations for a residential receptor include risk-based values and MCLs. Potential remedial levels corresponding to both MCLs and a range of risk levels for residential exposure were calculated. All of the calculated remedial levels are below the reference background concentrations for

these two metals. Therefore, the background concentrations for arsenic (8.04 mg/kg) and chromium (11.6 mg/kg) are recommended as their respective remedial levels (see Table ES.1).

Groundwater

Estimated hazards and risks were calculated for exposure to groundwater by three hypothetical future exposure scenarios (on-site groundskeeper, off-site FSMR worker, on-site resident). For the worker exposures, all of the estimated HI values are less than one. Total estimated cancer risk exceeds 1×10^{-6} due to ingestion of benzene. Estimated HIs for the hypothetical future residential scenario are 2.0 for the adult and 4.4 for the child receptor. Estimated HQ values for benzene are 1.7 (adult) and 3.7 (child). Three other COPCs (2-methylnaphthalene, ethylbenzene, and naphthalene) have HQ values greater than 0.1. Therefore, all four of these constituents are identified as COCs for groundwater.

Remedial levels for groundwater may include both risk-based concentrations and regulatory levels such as MCLs. Given that MCLs take into consideration both human health and the limitations of technology to remove constituents from water, these regulatory levels have been selected for remedial levels for groundwater when available. Benzene and ethylbenzene have MCLs of 0.005 mg/L and 0.7 mg/L, respectively. These MCL values are recommended as the remedial levels for these constituents.

MCL values are not available for naphthalene or 2-methylnaphthalene. The remedial levels for COCs in groundwater should not exceed a cumulative HI of 3.0 (GA EPD 1996). Given the number of potential COCs identified for groundwater, the recommended target groundwater concentration is based on HQs of 0.5 for each constituent. The recommended remedial levels for 2-methylnaphthalene and naphthalene are 0.142 mg/L and 0.149 mg/L, respectively (see Table ES.1).

To address the identified HHCOCs and CMCOCs, a CAP will be prepared for SWMU 13. It is anticipated that the CAP will be submitted to the GAEPD in the first quarter of fiscal year 2001 (October–December).

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1.0 INTRODUCTION

This report is a summary of the results from the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the former Fire Training Area at Wright Army Airfield, Solid Waste Management Unit (SWMU) 13, at Fort Stewart, Georgia. The information provided in this report is based on data provided by the United States Army Corps of Engineers (USACE) and previous studies conducted by the United States Army Environmental Hygiene Agency (USAEHA), Environmental Sciences Engineering, Inc. (ESE) and CAPE Environmental Management, Inc. (CAPE). This report has been prepared in accordance with the requirements as defined in the USACE guidance EM-200-1-3 (September 1, 1994). This report has been prepared by Science Applications International Corporation (SAIC) and Earth Tech Environment & Infrastructure (Earth Tech) for the USACE, Savannah District, Contract No. DACA21-95-D-0022, Delivery Order 0049.

1.1 Regulatory Status

In August 1987, Fort Stewart was issued a RCRA permit [HW-045(S&T)] by the Georgia Environmental Protection Division (GA EPD) to store and treat hazardous waste. The initial RCRA Facility Assessment (RFA), completed in April 1987 by the USAEHA, listed twenty-five (25) total SWMUs with nine (9) of these SWMUs (including SWMU 13) requiring further action. In September 1989, the RCRA permit was amended to include an expanded Section III on corrective action for SWMUs and other releases. The amended permit listed 16 of the original SWMUs (including SWMU 13) and four (4) new units that would require an RFI. In June 1990, a supplemental RFA report was issued by the GA EPD that added five (5) additional SWMUs to the list of twenty (20), resulting in a final list of twenty-five (25) SWMUs requiring an RFI. Two of the sites on that list were actually the same site; therefore, the final number of SWMUs requiring some type of RFI action is twenty-four (24). In September 1992, the GA EPD required two (2) additional SWMUs to be added to the list, resulting in a total of 26 SWMUs requiring some type of RFI action. To date, a Final Phase I RFI Report has been prepared on twenty-four (24) of the SWMUs, submitted to GA EPD, and reviewed/approved by GA EPD. In addition, the Final Phase II RFI Report for 16 SWMUs was submitted to GA EPD in February 1999; the Revised Final Phase II RFI for the South Central Landfill (SWMU 1) was submitted to GA EPD in March 1999; the Revised Final Phase II RFI for the Burn Pits (SWMUs 4A-4F) was submitted to GA EPD in February 1999; and the Revised Final Phase II RFI for the Tanker Purge Facility (SWMU 26) was submitted to GA EPD in January 1999.

SWMU 13 (former Fire Training Area at Wright Army Airfield) and SWMU 8 (Inactive Explosive Ordnance Disposal (EOD) Area located approximately nine [9] miles northeast of Garrison Area) were not included in the Final Phase I RFI Report discussed above. Thus, the Installation contracted with Earth Tech to perform the RFI at SWMU 13 and sampling was conducted at SWMU 8 by Dames and Moore in the early 90s. SWMU 35 (Wright Army Airfield Bulk Fuel System) was also not included in the report, and the Phase II RFI Report was submitted to GA EPD in July 1999.

1.2 Objectives

The Scope of Work (SOW) to conduct an RFI at SWMU 13 was issued by the USACE on September 28, 1994. The RFI was performed by combining information obtained from previous studies with information obtained from the field investigations to achieve the following objectives:

- Determine the horizontal and vertical extent of contamination at SWMU 13.
- Determine whether contaminants present constitute a threat to human health or the environment.
- Determine the need for further actions and/or no further action, and gather necessary data to support development of a Corrective Action Plan (CAP), if warranted.

The information provided in this report is based upon data previously collected during earlier studies and data collected as part of the RFI field sampling and analysis. The RFI sampling program incorporated an observational approach to sampling, as defined in the GA EPD approved RFI Work Plan. This observational approach utilized field screening techniques to determine the horizontal and vertical extent of contamination at SWMU 13 and to identify suitable locations for installation of permanent monitoring wells. The scope of the field work included the following activities:

- Collection of direct-push soil samples using a push probe at a total of 12 locations, including 3 surface soil sample locations.
- Collection of direct-push groundwater samples using a push probe at a total of 23 locations, including three (3) vertical profiles.
- Installation of six (6) permanent groundwater monitoring wells both sidegradient and downgradient of the site.
- Collection of groundwater samples from all (10) on-site monitoring wells.
- Surveying the position of all sample locations.

2.0 SITE HISTORY AND CONTAMINANTS

2.1 Installation Description

Fort Stewart (located approximately 34 miles southwest of Savannah, Georgia; Figure 2.1) was established in June 1940 as an Antiaircraft Artillery Center to prepare artillery troops for overseas deployment. Training activities associated with World War II (WWII) decreased by the end of 1944. Between January and September 1945, the Installation operated as a Prisoner of War (POW) camp and served as a separation center. The post was deactivated in September 1945.

In August 1950, Fort Stewart was reactivated to train antiaircraft artillery units for the Korean Conflict. The training mission was expanded to include armor training concurrent with antiaircraft artillery training in 1953. In 1956, Fort Stewart was designated a permanent Army installation and an element of the U.S. Army Aviation School from Fort Rucker, Alabama. The aviation school was stationed there from 1966 to 1973.

The 1st Battalion, 75th Infantry (Ranger) was activated at Fort Stewart on January 31, 1974. As a result, Fort Stewart became a training and maneuver area, providing tank, field artillery, helicopter gunnery, and small arms training for regular Army, United States Army Reserve (USAR), and National Guard units. The 24th Infantry Division was permanently stationed at Fort Stewart in 1975, and reflagged the 3rd Infantry Division in May 1996.

2.2 Site Location and History

Wright Army Airfield is located in Liberty County, Georgia approximately 40 miles southwest of Savannah, Georgia and within the confines of Fort Stewart, Georgia. The nearest city is Hinesville, approximately 1-1/2 miles to the south. The former Fire Training Area (SWMU 13) is located on the northwest periphery of Wright Army Airfield, approximately 3000 feet northwest of the control tower.

SWMU 13 consisted of a 5000 square feet concrete pad with an integral berm that was used by fire-fighting personnel for training. An oil/water separator sump, underground piping, and an above ground fuel (JP-4) storage tank combined to make up the entire former Fire Training Area. All of these structures and appurtenances were removed during the interim measures (IM) conducted in 1997 by CAPE Environmental. The area is mostly enclosed by a series of drainage swales. An asphalt roadway adjoins the former Fire Training Area to the south and east. See Figures 2.2 and 2.3 for the site location map and the original site conditions/layout, respectively. The former Fire Training Area was used as a training area for the airfield's firefighters from its construction, prior to 1982, until 1992. During training exercises, fuel [water contaminated jet fuel (JP-4), diesel fuel, or waste oil] was pumped onto the surface of a simulated aircraft and ignited. The fires were then extinguished with water and foam. The former Fire Training Area was constructed such that water and foam used during the training would be drained to the oil/water separator. Effluent water flowed to the western drainage swale, and the lighter-than-water portion (oil) was reportedly pumped by vacuum truck and disposed of at the Fort Stewart Industrial Wastewater Treatment Plant. Occasionally, some of the water (and fuel) would either be splashed onto adjacent soil or it would run over the concrete berm onto the adjacent soil.

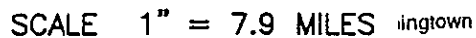
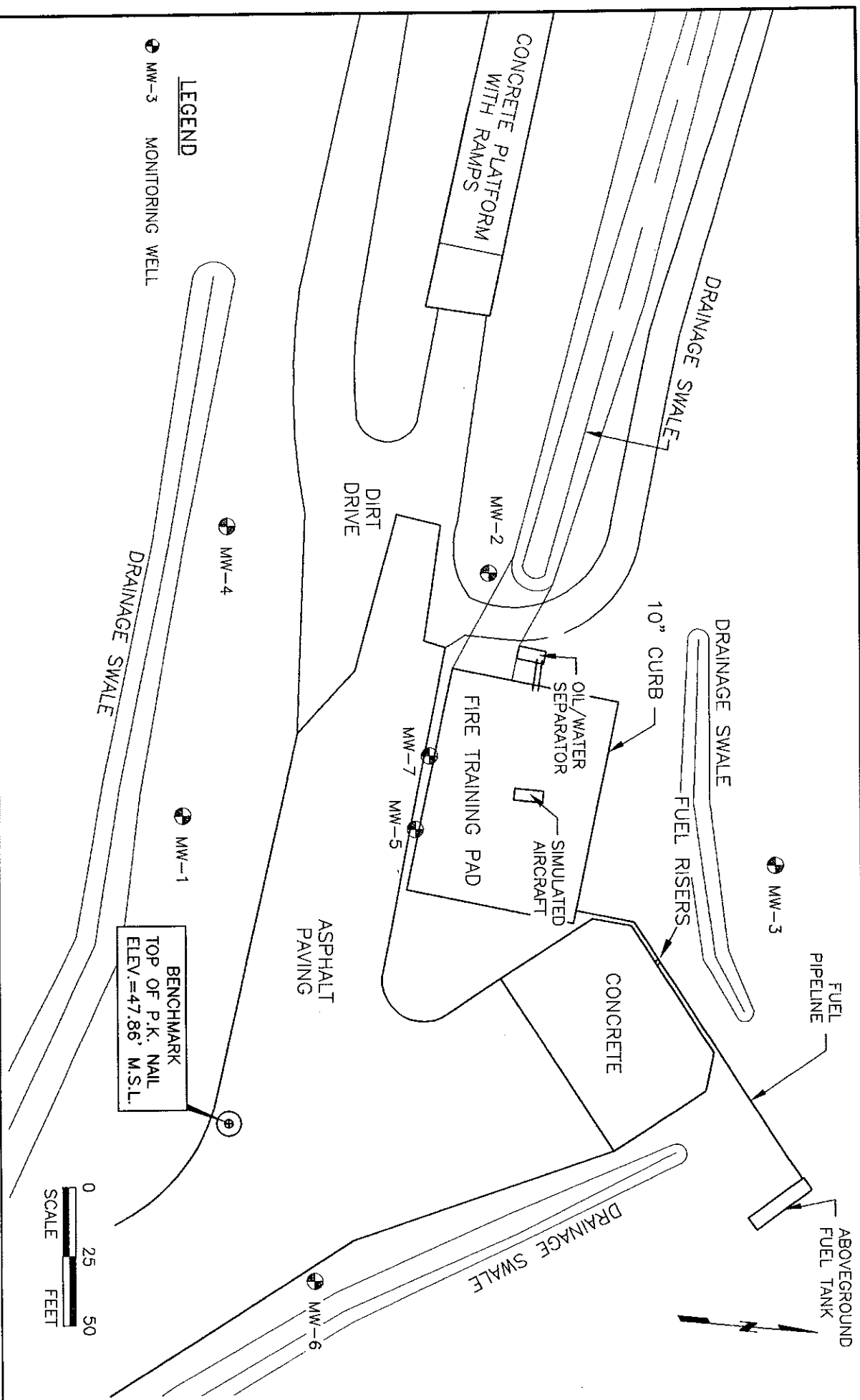




FIGURE 2.2

LOCATION MAP OF THE FORMER FIRE
TRAINING AREA AT WAAF (SWMU 13)

FORT STEWART, GEORGIA



LEGEND

⊕ MW-3 MONITORING WELL

SOURCE
ESE, APRIL 1993

E A R T H T E C H



FIGURE 2.3

SITE CONDITIONS (PRE-INTERIM MEASURES) AT FIRE TRAINING AREA AT WAAF (SWMU 13)

AUGUST 1999 FORT STEWART, GEORGIA 29350.10900

The fuel risers shown on Figure 2.3 were never used. During a training exercise, the fuel was pumped via a small pump brought on-site; thus the system was not pressurized and there was no need for venting. In addition, the fuel risers were never used for diverting fuel or any other purpose. It is suspected that the former Fire Training Area was constructed just like all others in the Army at that time (i.e., with the fuel risers); however, the fuel risers were not required for operation of the facility and were never used.

2.3 Previous Studies

Three (3) site investigations were conducted at the former Fire Training Area (SWMU 13) prior to the RFI summarized in this report. The first investigation was conducted in 1987 by the USAEHA. During this study, soil samples were collected from four (4) locations around the immediate perimeter of the main concrete pad. Metals (lead, mercury, barium, chromium, and arsenic) and several polyaromatic hydrocarbons (PAHs) were detected in several of the samples.

The other two site investigations were conducted in 1990 and 1992 by ESE, and the reports are dated November 1990 and April 1993. During these studies, soil and groundwater samples were collected from various locations throughout the entire former Fire Training Area. In the November 1990 field study, soil samples were collected from three (3) locations and groundwater samples were collected from three (3) monitoring wells. Metals (lead, barium, chromium, arsenic, and selenium), methylene chloride, and toluene were detected in the soil samples and metals (lead, barium, and chromium) were detected in the groundwater samples. PAHs were not detected in either the soil or the groundwater.

In the 1992 site investigation, soil samples were collected from three (3) locations, sediment samples were collected from two (2) locations in the drainage swales, and groundwater samples were collected from seven (7) monitoring wells (three existing wells and four new wells). Metals (lead, barium, chromium, arsenic, cadmium and selenium), several PAHs, and trichloroethene were detected in the soil samples. Metals (lead, barium, chromium, arsenic, and cadmium), several PAHs, trichloroethene and trichlorofluoromethane were detected in the sediment samples. Metals (barium, chromium, arsenic, and selenium), naphthalene, benzene, ethylbenzene, and xylene were detected in the groundwater samples.

Data presented in the ESE May 1994 Closure Plan indicated that semi-volatile contamination in the drainage swale sediments and benzene in the groundwater could present a potential threat to human health and/or the environment. The extent of lateral and vertical environmental contamination was not defined. Specifically, the southern and eastern limits of groundwater contamination were not identified, and it is possible that semi-volatile contamination may have leached from the drainage swale sediments into adjacent and underlying soils.

IM were performed at SWMU 13 between the dates of October 13 and December 3, 1997 by CAPE Environmental. The intent of the IM was to remove and properly dispose of the following: an aboveground storage tank (AST) and mock aircraft with associated foundations and piping; the concrete fire training pad (FTP) and cover soils; a concrete oil/water separator (OWS) sump and appurtenances; and soil and sediments on-site which exceeded the Preliminary Cleanup Targets (PCTs) established in the project

Specifications under the then current GA EPD Guidelines. Additionally, confirmatory soil samples were collected. Soil Certificates of Disposal indicated 2,449.59 tons of soil were disposed of at Soil Safe Technologies (CAPE 1998). After removal of the fire training facilities and contaminated soil (to approximately 4 feet bgs) and after the completion of the confirmatory sampling, the excavated area was backfilled with clean soil and seeded.

Recently, and subsequent to the field work conducted for this RFI, it was reported that monitoring wells MW-01 and MW-06 at SWMU 13 have been destroyed by heavy equipment backing over them (i.e., army equipment). The need to replace these wells should be evaluated in the Corrective Action Plan recommended as a result of this RFI.

As part of this RFI, SAIC and Earth Tech screened the IM confirmatory soil sample results to determine if detected chemicals were site-related contaminants (SRCs). Any detected organic chemical was identified as an SRC because all organic compounds are considered to be potentially man-made. Inorganic chemicals (metals) were compared to reference background criteria. A discussion regarding the reference background criteria is presented in Section 5.1 of this report. A summary of the IM Confirmatory Sampling results and comparison to subsurface soil reference background criteria are presented in Table 2.1. Sampling locations are provided in Figure 2.4. Based on the comparison, thirty (30) SRCs are identified from the IM confirmatory sampling:

MIBK (4-Methyl-2-pentanone)	Fluoranthene
Acetone	Fluorene
Benzene	Indeno (1,2,3-cd) pyrene
Carbon disulfide	Dibenzo(a,h)anthracene
Chlorobenzene	Phenanthrene
Ethylbenzene	Anthracene
Toluene	Pyrene
Xylenes	1-Methylnaphthalene
Acenaphthene	2-Methylnaphthalene
Benzo(a)pyrene	Naphthalene
Benzo(g,h,i)perylene	Arsenic
Benzo(b)fluoranthene	Barium
Benzo(k)fluoranthene	Chromium
Benzo(a)anthracene	Lead
Chrysene	Mercury

These SRCs, along with those identified from sampling during this RFI, are addressed in Section 5.0 Contaminant Nature and Extent, Section 6.0 Contaminant Fate and Transport, Section 7.0 Human Health Preliminary Risk Evaluation, and Section 8.0 Ecological Preliminary Risk Evaluation.

Table 2: 1 of 2
Summary of Analytes Detected in Initial Measures Confirmatory Samples
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Reference Background Criteria	Confirmation Soil Sample ID																				
		SA-1.1	SA-1.2	SA-2.1	SA-3.2	SA-3.3	SA-4.2	SA-4.3	SA-5.2	SA-6.2	SA-7.2	SA-8.2	SA-9.4.5	SA-9.5.5	SA-10.4.5	SA-11.2	SA-11.3	SA-12.2	SA-12.3	SA-13.2	SA-13.3	
TPH-GRO (mg/kg)	NA	89	180	5700	-	-	-	2.6	200	-	-	-	-	-	-	-	-	-	-	-	-	
TPH-DRO (mg/kg)	NA	810	1100	1800	-	-	-	86	620	130	-	-	-	-	-	-	-	-	-	11	-	
Volatile Organic Compounds (µg/kg)																						
MIBK	0	69	-	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Acetone	0	-	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzene	0	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbon disulfide	0	-	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chlorobenzene	0	-	-	930	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	0	-	-	1600	-	-	-	14	97	-	-	-	-	-	-	-	-	-	-	-	-	
Methylene chloride	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	0	-	-	980	-	-	-	63	150	-	-	-	-	-	-	-	-	-	-	-	-	
Xylenes	0	-	44	61000	-	-	-	94	580	-	-	-	-	-	-	-	-	-	-	-	-	
Semivolatile Organic Compounds (µg/kg)																						
Acenaphthene	0	4500	2800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Acenaphthylene	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a)pyrene	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a,h)perylene	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(b)fluoranthene ¹	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(k)fluoranthene ¹	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a)anthracene ²	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chrysene ²	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fluoranthene	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fluorene	0	2000	4400	-	-	-	-	-	-	1200	-	-	-	-	-	-	-	-	-	-	-	
Indeno (1,2,3-cd) pyrene ¹	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibenzo(a,h)anthracene ³	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phenanthrene ⁴	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Anthracene ⁴	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pyrene	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1-Methylnaphthalene	0	7400	8300	18000	-	-	-	-	-	1700	-	-	-	-	-	-	-	-	-	-	-	
2-Methylnaphthalene	0	-	-	24000	-	-	-	-	-	3000	-	-	-	-	-	-	-	-	-	-	-	
Naphthalene	0	-	-	-	-	-	-	-	-	1800	-	-	-	-	-	-	-	-	-	-	-	
Metals (mg/kg)																						
Arsenic	8.04	-	-	-	1.8	2.7	4	7.8	3.3	4.7	1.5	2.2	1.2	3	-	2.8	4.3	1.7	4.7	3.9	3.3	2.9
Barium	17	24.7	16.7	20.9	9.6	12.2	7.4	11.2	10.3	12	20.9	22.4	26.6	15.9	16.7	13	9.1	20.3	16	16.2	14.5	20.8
Cadmium	0.231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium	11.6	6.4	14.3	6.6	13.6	14.3	23.3	39.7	18.4	26.3	10.2	11.5	8.1	15.5	6.8	15.2	17.5	6.5	16.5	15.2	14.5	6.6
Copper	11.1	4.3	5.9	3.9	4.5	4.9	6.5	11.4	10.1	8.5	4.4	4.8	4.7	4.9	3.6	6.6	9	4.1	6	5.7	5.7	3.6
Lead	0.048	-	-	-	-	-	-	-	-	0.036	0.013	0.025	-	0.021	-	0.015	-	0.019	0.035	0.031	0.03	0.017
Mercury	1.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Selenium	0.453	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Silver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

EPA Method 8100 was used for analyses of PAHs. This GC Method could not distinguish between the following compounds:
¹ Benzo(b)fluoranthene and benzo(k)fluoranthene
² Chrysene and benzo(a)anthracene
³ Indeno(1,2,3-cd)pyrene and Dibenzo(a,h)anthracene
⁴ Phenanthrene and Anthracene
Therefore, each compound within the pair were assigned the reported concentration for screening purposes.

µg/kg = micrograms per kilogram
NA = Not Applicable
Shaded indicates exceedance of reference background criteria, compound considered a site related contaminant (SRC)
TPH-GRO = Total Petroleum Hydrocarbons - Gasoline Range Organics (reported, but not used for screening)
TPH-DRO = Total Petroleum Hydrocarbons - Diesel Range Organics (reported, but not used for screening)
MIBK = 4-Methyl-2-pentanone
"-": Below reporting limits

Table 2.1 (Page 2 of 2)
Summary of Analytes Detected in Interim Measures Confirmatory Samples
SWMU 13, Fort Stewart, Georgia

Detected Analytes		Confirmation Soil Sample ID																							
		SA-14.2	SA-14.3	SA-15.1	SA-15.2	SA-16.1	SA-16.2	SA-17.1	SA-17.2	SA-18.2.5	SA-18.3.5	SA-19.3.5	SA-20.2.5	SA-20.3.5	SA-21.2	SA-21.3	SA-22.2.5	SA-22.3.5	SA-24.1	SA-25.1	SA-26.1	SA-27.1	SA-28.1	SA-29.1	
TPH-GRO (mg/kg)		-	-	-	-	-	-	-	-	-	-	140	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH-DRO (mg/kg)		-	-	-	-	-	-	-	-	-	-	180	45	20	-	-	69	30	-	65	49	22	-	-	-
Volatile Organic Compounds (µg/kg)																									
MIBK		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone		-	-	-	-	-	-	-	-	100	110	-	-	79	73	-	-	-	-	-	-	-	-	-	-
Benzene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide		-	-	-	-	-	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene		-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes		-	-	-	-	-	-	-	-	-	-	24	6.4	-	-	-	-	-	-	-	-	-	-	-	-
Semi-volatile Organic Compounds (µg/kg)																									
Acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	760	3700	1200	-	-	-
Benzo(a,h)perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	2400	990	-	-	-
Benzo(b)fluoranthene ¹		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8200	-	-	-	-
Benzo(k)fluoranthene ¹		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8200	-	-	-	-
Benzo(a)anthracene ²		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	2800	-	-	-
Chrysene ²		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	2800	-	-	-
Fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500	9100	2200	-	-	-
Fluorene		-	-	-	-	-	-	-	-	-	-	500	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno (1,2,3-cd) pyrene ³		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1200	4500	1900	-	-	-
Dibenz(a,h)anthracene ³		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1200	4500	1900	-	-	-
Phenanthrene ⁴		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1100	-	-	-	-
Anthracene ⁴		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1100	-	-	-	-
Pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	810	1400	2000	-	-
1-Methylnaphthalene		-	-	-	-	-	-	-	-	-	-	720	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene		-	-	-	-	-	-	-	-	-	-	640	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals (mg/kg)																									
Arsenic		1.8	2.8	-	13.8	9.1	9.6	-	1.8	2.9	4.4	-	5.3	10.4	9	-	-	1.9	1.8	4.3	4.1	3.1	6.9	2.9	
Barium		17.4	7.9	-	-	-	-	-	20.6	16.2	12.2	16.9	8.6	9.5	13.5	15.3	17.4	16.5	11.6	18	18.6	20	8.3	12.4	8.8
Cadmium		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium		2.7	10.8	3.5	3.6	2.8	3.1	3.4	8.3	19.1	19.7	5.1	5.5	22.7	38.4	40.4	5	5.4	8	9.5	17.9	19.6	16.3	31.4	16.6
Lead		4.6	5.6	3.3	3.5	2.5	3.4	3	4.7	6.5	5.7	5.4	3.8	6.8	7.8	9.7	3.3	4	5.5	6.1	9.6	9.7	7.6	10.8	6.4
Mercury		-	0.017	0.013	0.018	-	0.015	0.013	0.017	0.024	0.029	0.013	0.018	0.03	0.034	0.023	0.013	0.014	0.097	0.021	0.016	-	0.016	-	-
Selenium		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

EPA Method 8100 was used for analyses of PAHs. This GC Method could not distinguish between the following compounds:

¹ Benzo(b)fluoranthene and benzo(k)fluoranthene

² Chrysene and benzo(a)anthracene

³ Indeno(1,2,3-cd)pyrene and Dibenz(a,h)anthracene

⁴ Phenanthrene and Anthracene

Therefore, each compound within the pair were assigned the reported concentration for screening purposes.

mg/kg = milligrams per kilogram. µg/kg = micrograms per kilogram.

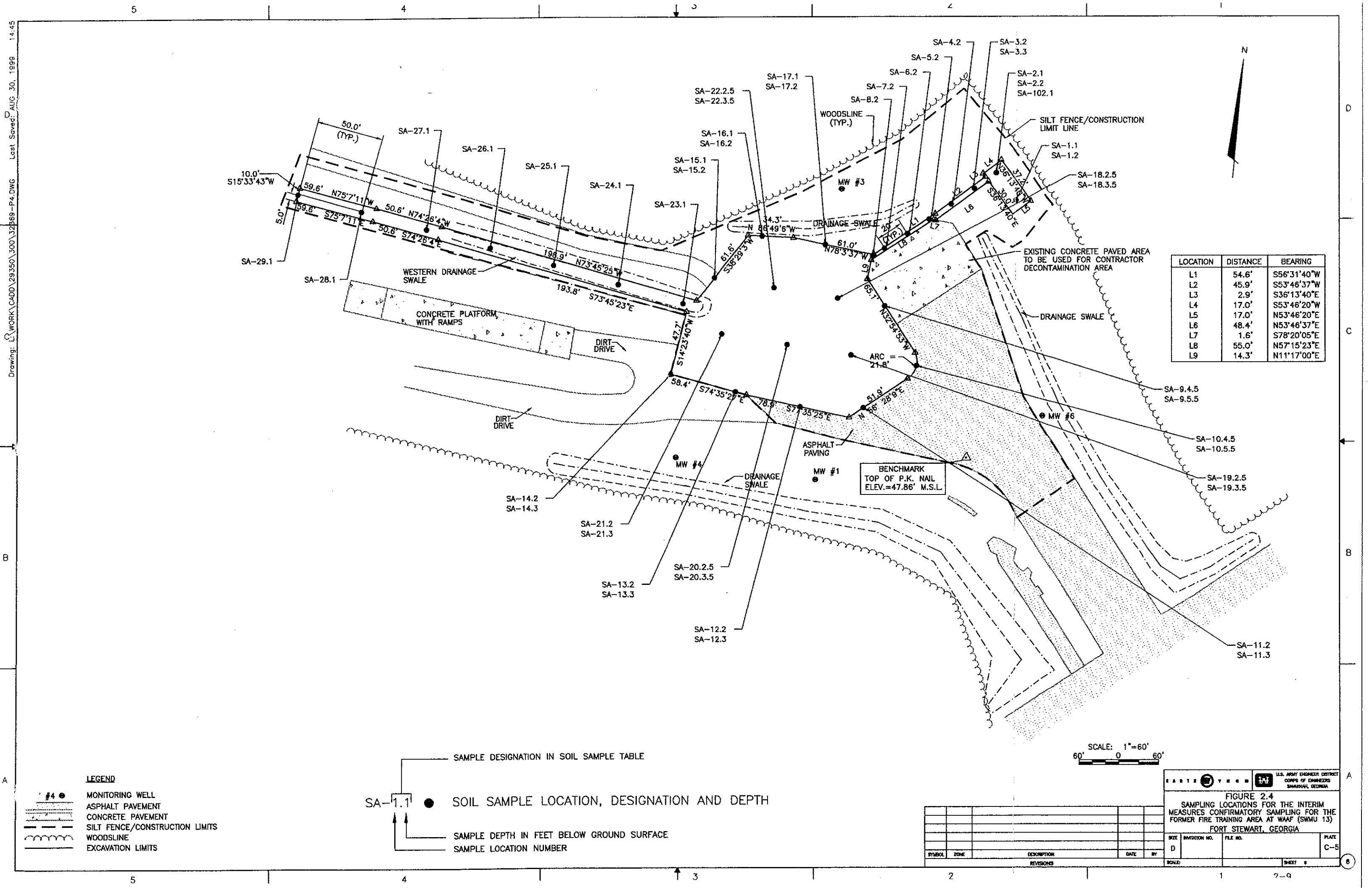
Shaded indicates exceedance of reference background criteria, compound considered a site related contaminant (SRC)

TPH-GRO = Total Petroleum Hydrocarbons - Gasoline Range Organics (reported, but not used for screening)

TPH-DRO = Total Petroleum Hydrocarbons - Diesel Range Organics (reported, but not used for screening)

MIBK = 4-Methyl-2-pentanone

"-" = Below reporting limits



2.4 Preliminary Conceptual Site Model

Based on the results of the investigations conducted at SWMU 13, a release occurred at this site. Contaminated soils and groundwater were detected in the immediate vicinity of the former fire training pad and fuel pipe line.

The SRCs include constituents of diesel and JP-4. Release of these chemicals may have occurred either through subsurface leakage or surface overflow from the fire training pad or piping.

The most likely pathways for contaminant migration at this site are: (1) via overland flow to the western swale, and (2) via groundwater flow toward Peacock Creek, located 2,500 feet southeast of the site. Past releases have probably followed these migration pathways and may form a plume of contaminated groundwater emanating from SWMU 13. In addition, contaminated soils at the site may continue to cause leaching to the swale or groundwater. However, since the top four feet of contaminated soil was removed during the IM the pathway of contamination leaching from soil has been limited.

Potential human receptors include on-site workers or soldiers on maneuvers who may come into contact with contaminated soils or waters, and hypothetical future residents who may ingest groundwater. Because the surficial aquifer is not used as a source of potable water, any ingestion of groundwater by future residents would be accidental. Potential ecological receptors include terrestrial soil-dwelling animals and their predators that may ingest contaminated soil or waters at the site or within the swale west of the site.

3.0 SUMMARY OF INVESTIGATION ACTIVITIES

3.1 Sampling Methodologies

This section describes the RFI field investigations conducted at the former Fire Training Area from November 2, 1998 through January 26, 1999. The sampling methodologies and types of testing for physical and chemical characterization of the site are also described. Locations of the RFI sampling stations are shown on Figure 3.1. The sampling strategy included groundwater screening in the vicinity of the former Fire Training Area, soil sampling at direct push and monitoring well locations and sampling of monitoring wells.

3.1.1 Soil Sampling

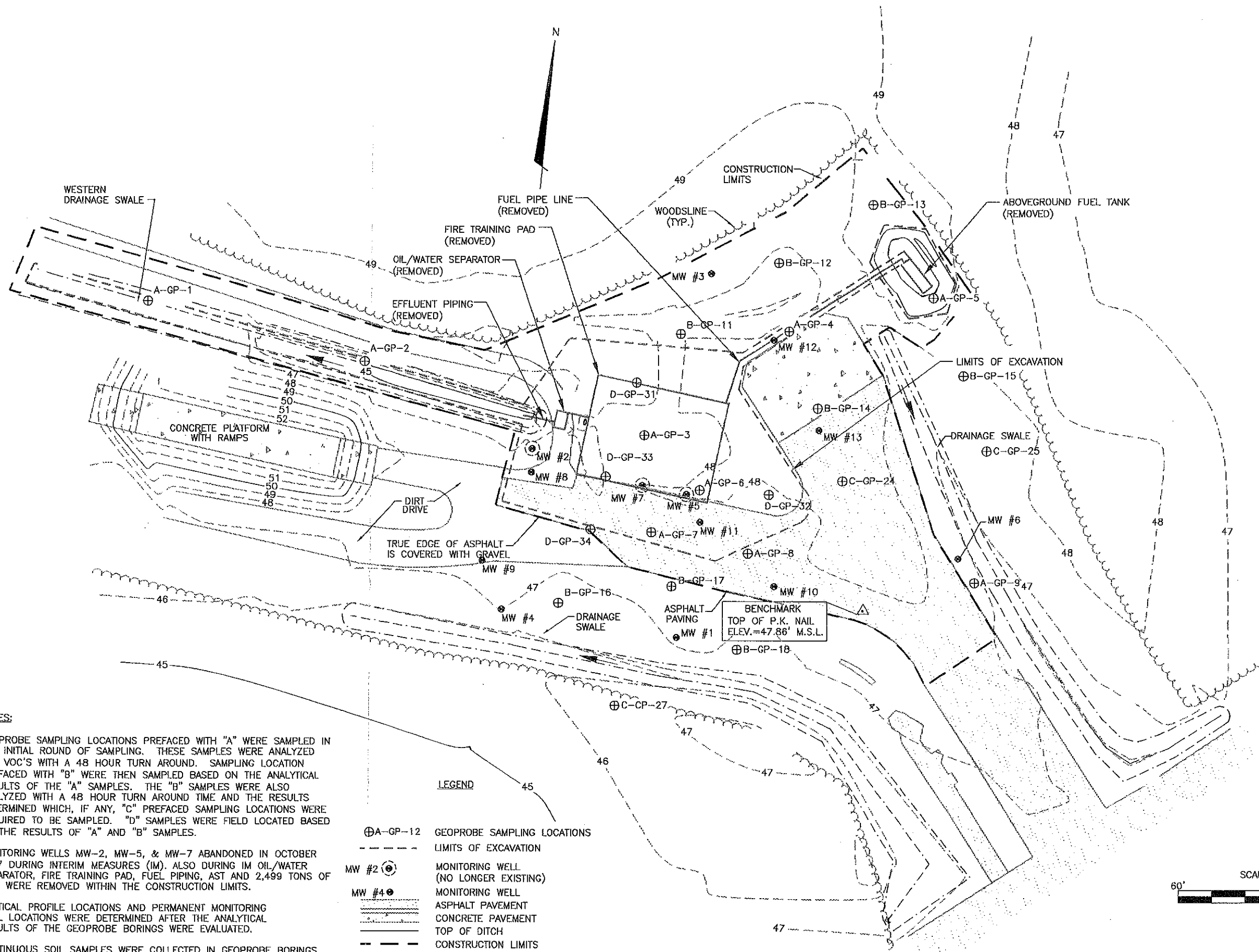
Soil sampling was conducted using two methods: (1) soil sampling using direct-push methods and (2) soil sampling using hollow-stem augers during installation of monitoring wells.

3.1.1.1 Direct-Push Soil Sampling

A total of 12 direct-push soil probes were completed in and around the former Fire Training Area. The locations of the direct-push soil probes are shown on Figure 3.1. The locations were selected using a field decision approach to sampling. The results of groundwater volatile organic compound (VOC) analysis of initial ("primary" – A series) samples were used to determine locations of subsequent ("secondary" – B and C series) samples. Primary samples from stations A-GP-1 through A-GP-9 were collected on November 2, 3, and 4, 1998, and secondary samples from B-GP-11 through C-GP-24 were collected on November 5, 6 and 9. The direct-push soil probes were made for the following reasons:

- to determine the horizontal and vertical extent of contamination in soil, and
- to minimize generation of investigation-derived waste (IDW).

The samples were taken using a 4-foot Macro-Core soil sampler by pushing the sampler from the ground surface down to the water table in continuous 4-foot intervals. Total depth of sampling varied between 0 and 8 feet bgs. Two samples designated for possible VOC laboratory analysis were collected first from each Macro-Core soil sampler section using the EnCore sampler. The EnCore sampler is a specially designed coring device that seals the soil, allowing shipment to the laboratory. Use of the EnCore sampler is an accepted option for complying with Update III to the Third Edition of SW-846, "Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples" (Method 5035). A sample may be held in the EnCore sampler for up to 48 hours if the temperature is held at 4 degrees Celsius. The analytical laboratory must extract and preserve the sample prior to expiration of this 48-hour period. The extracted samples are then analyzed for VOCs by USEPA Method 8260. Soil samples from each 2-foot section were field tested for VOCs in the headspace gas using a photoionization detector (PID). The EnCore sample from each boring having the highest detected organic vapor concentration in the headspace gas was then sent off site for quantitative laboratory analysis for VOCs. If no VOCs were detected in the headspace gas, then the sample from the 2-foot interval directly above the water table was



NOTES:

GEOPROBE SAMPLING LOCATIONS PREFACED WITH "A" WERE SAMPLED IN THE INITIAL ROUND OF SAMPLING. THESE SAMPLES WERE ANALYZED FOR VOC'S WITH A 48 HOUR TURN AROUND. SAMPLING LOCATION PREFACED WITH "B" WERE THEN SAMPLED BASED ON THE ANALYTICAL RESULTS OF THE "A" SAMPLES. THE "B" SAMPLES WERE ALSO ANALYZED WITH A 48 HOUR TURN AROUND TIME AND THE RESULTS DETERMINED WHICH, IF ANY, "C" PREFACED SAMPLING LOCATIONS WERE REQUIRED TO BE SAMPLED. "D" SAMPLES WERE FIELD LOCATED BASED ON THE RESULTS OF "A" AND "B" SAMPLES.

MONITORING WELLS MW-2, MW-5, & MW-7 ABANDONED IN OCTOBER 1997 DURING INTERIM MEASURES (IM). ALSO DURING IM OIL/WATER SEPARATOR, FIRE TRAINING PAD, FUEL PIPING, AST AND 2,499 TONS OF SOIL WERE REMOVED WITHIN THE CONSTRUCTION LIMITS.

VERTICAL PROFILE LOCATIONS AND PERMANENT MONITORING WELL LOCATIONS WERE DETERMINED AFTER THE ANALYTICAL RESULTS OF THE GEOPROBE BORINGS WERE EVALUATED.

CONTINUOUS SOIL SAMPLES WERE COLLECTED IN GEOPROBE BORINGS A-GP-1 THROUGH B-GP-17 EXCEPT FOR BORING LOCATIONS A-GP-3, A-GP-4, A-GP-5, A-GP-6 AND A-GP-7 SINCE THESE LOCATIONS FELL WITHIN THE BOUNDARY OF THE EXCAVATED SOIL.

SOIL SAMPLES WERE TAKEN IN THE 0-1ft BGS INTERVAL AND WITHIN 2ft OF THE WATER TABLE AT A-GP-9, B-GP-15, AND B-GP-17.

LEGEND

- ⊕A-GP-12 GEOPROBE SAMPLING LOCATIONS
- LIMITS OF EXCAVATION
- MW #2 (⊕) MONITORING WELL (NO LONGER EXISTING)
- MW #4 (⊕) MONITORING WELL
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT
- TOP OF DITCH
- CONSTRUCTION LIMITS
- F --- FUEL PIPE
- CONTOUR LINE (5' INTERVAL)
- CONTOUR LINE (1' INTERVAL)
- WOODSLINE
- △ BENCHMARK

SCALE: 1"=60'

U.S. ARMY ENGINEER CORPS OF ENGRS SAVANNAH, GE.

FIGURE 3.1

SAMPLING LOCATIONS FOR THE RFI FOR THE FORMER FIRE TRAINING AREA AT WAAF (SWMU 13) FORT STEWART, GEORGIA

SYMBOL	ZONE	DESCRIPTION	DATE	BY
D				
REVISIONS				
SCALE: 1"=60'				
SHEET				

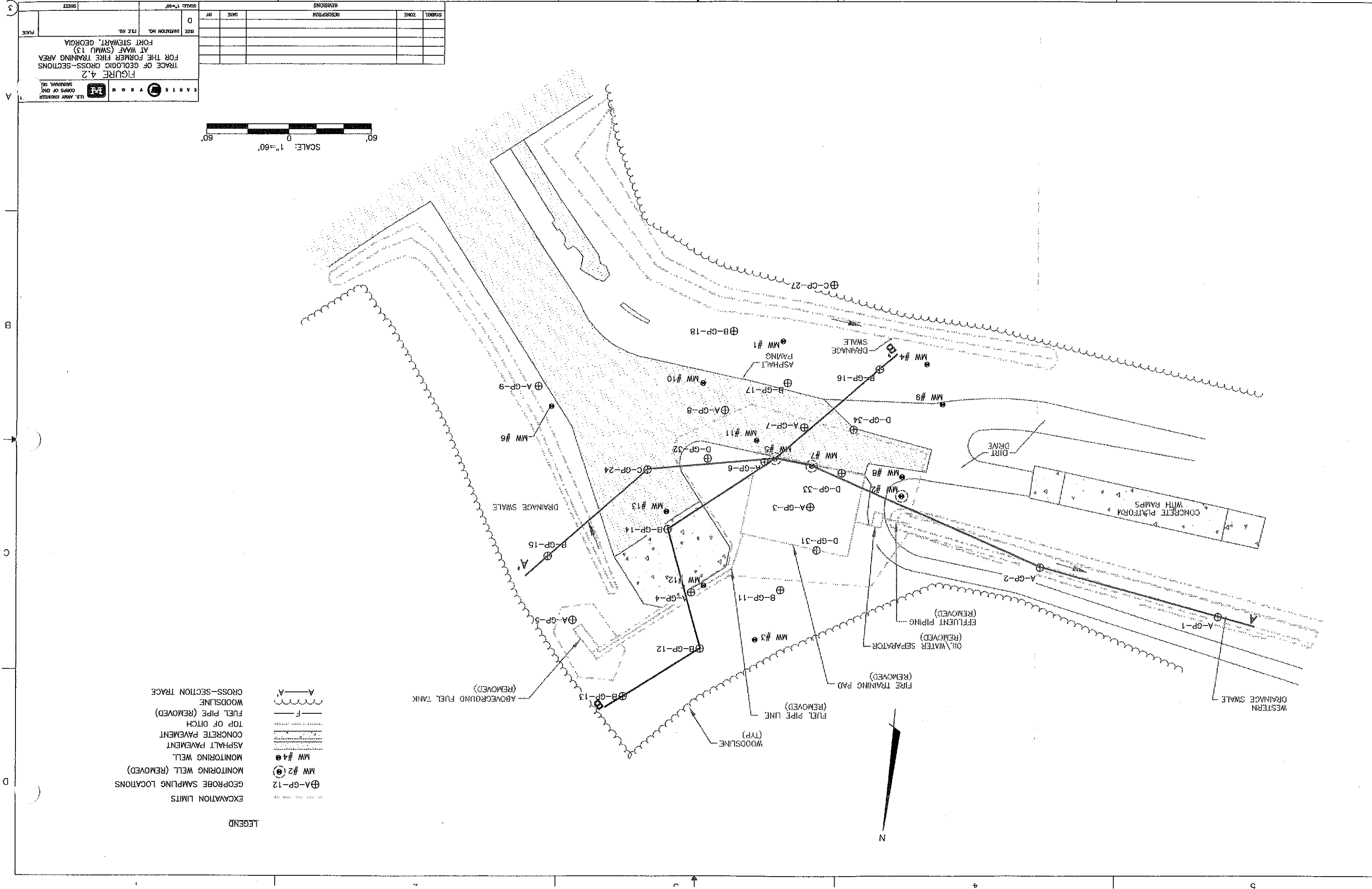
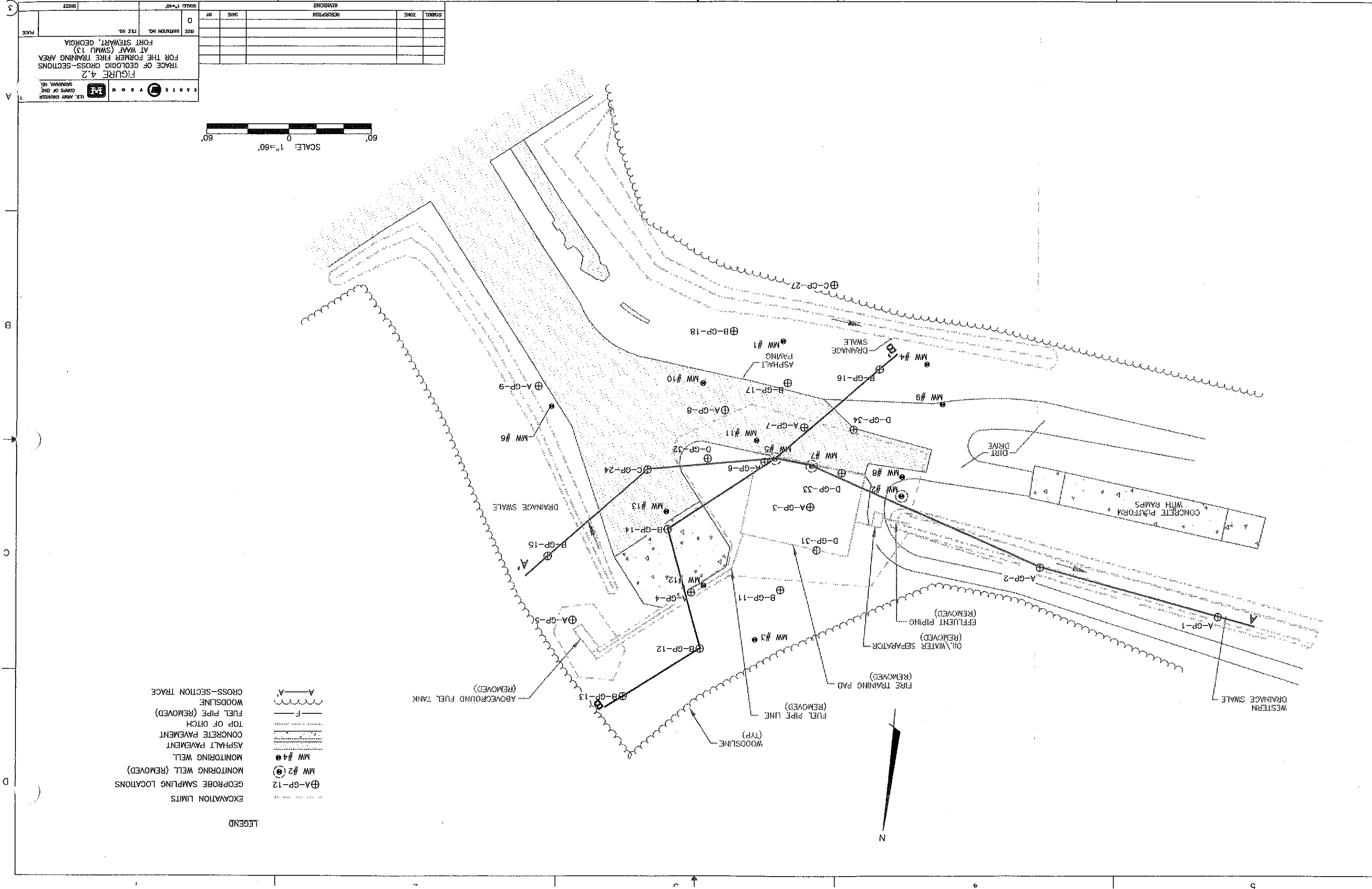
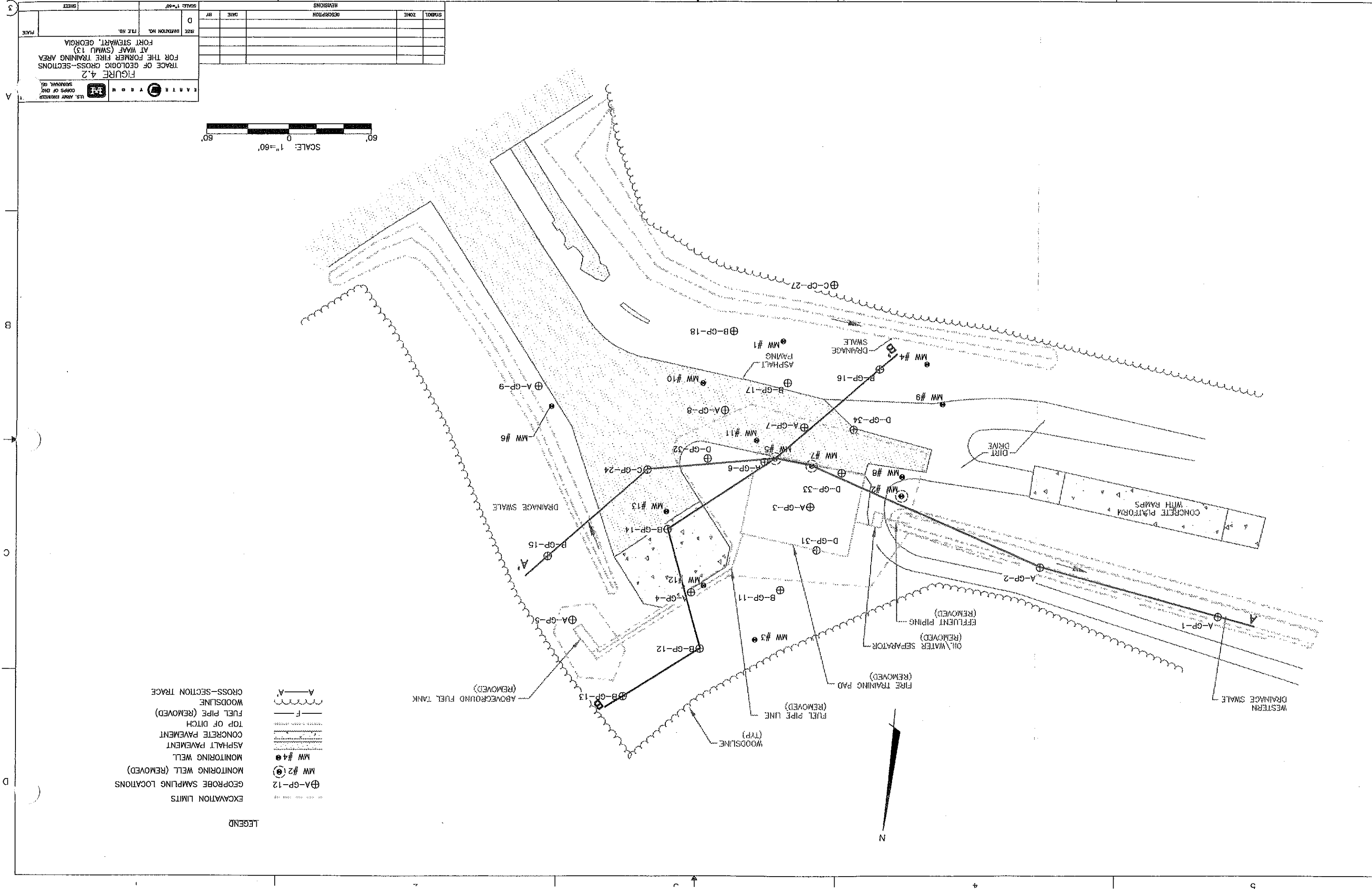
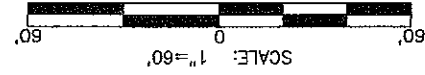
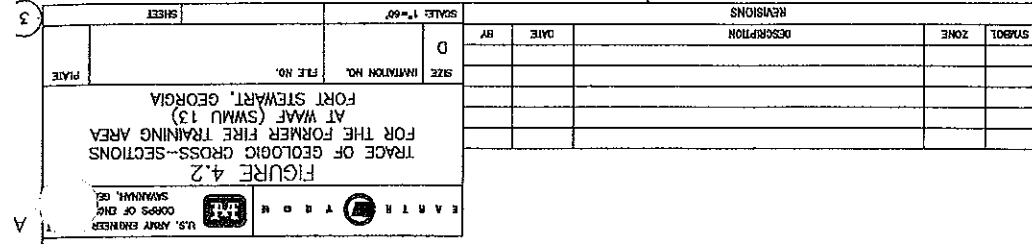
The interval from approximately 110 feet to the surface is Quaternary in age and composed primarily of sand with interbeds of clay or silt. This section is undifferentiated (Metcalf and Eddy 1996).

State geologic records contain information regarding a well drilled in October 1942, 1.8 miles north of Flemington at Liberty Field of Camp Stewart (now known as Fort Stewart). This well is believed to be an artesian well located approximately one-quarter mile north of the runway at Wright Army Airfield within the FSMR. The log for this well describes a 410-foot section, the lowermost 110 feet of which consisted predominantly of limestone above which 245 feet of dark green phosphatic clay typical of the Hawthorn Group were encountered. The uppermost 55-foot interval was Quaternary-age interbedded sands and clays. The top 15 feet of these sediments were described as sandy clay (Metcalf and Eddy 1996).

4.5 Soils

Boring logs showing the types of soils encountered during the RFI at SWMU 13 in soil and groundwater screening probes, and monitoring well boreholes are given in Appendix A. A trace of the geological cross-sections are shown in Figure 4.2. Geological cross-sections of the site are shown on Figures 4.3 and 4.4, and depict the lithology and stratigraphy of the unconsolidated soil deposits beneath the site, as inferred from the soil boring logs. The cross-sections indicate that the soils are essentially similar and generally a dark yellowish orange to light brown silty sand interbedded with sandy clay and clayey silty sand layers. A pale yellowish orange to light brown clay layer was encountered in boreholes MW-10, MW-11 and MW-12 from depths ranging from 3 feet bgs to almost 7 feet bgs. The soil and groundwater screening borings were advanced to depths of 12 to 13 feet bgs. These borings were terminated in light gray to moderate reddish brown silty sand, poorly graded sand or clayey sand. The monitoring well borings were advanced to 20 feet bgs and were terminated in light gray to moderate red silty sand or poorly graded sand. ESE conducted a site investigation in March 1992. During this investigation, the soil boring for monitoring well MW-7 was advanced to 55 feet bgs. A review of this boring showed silty clayey sand to 4 foot depth, followed by a sandy clay layer to 8 feet, underlain by silty clayey sand to 27 feet. At this depth, a dense greenish gray silty sand was encountered and extended to the completion depth of 55 feet bgs.

Geotechnical analyses were conducted on various samples taken from soil and groundwater screening probes and four Shelby tube samples taken from the monitoring well boreholes. The soil samples from the soil probes were analyzed for grain size distribution in accordance with ASTM D422 and Atterberg limits (ASTM D4318). The samples from the monitoring well boreholes were analyzed for moisture content (ASTM D2216), specific gravity (ASTM D854), porosity (EM1110-2-1906), and permeability (ASTM D5084). Results of the geotechnical analyses are summarized in Table 4.1. The geotechnical laboratory data sheets are included in Appendix D. These results indicate that tested soils are non-plastic silty sands. Soil from the screened intervals in monitoring wells MW-9 and MW-10 are non-plastic silty sands with permeabilities ranging from 1.17×10^{-3} centimeters per second (cm/sec) to 6.91×10^{-4} cm/sec, respectively. Soils in the screened intervals of the remaining monitoring wells are of similar lithology and would therefore be expected to have similar permeabilities.



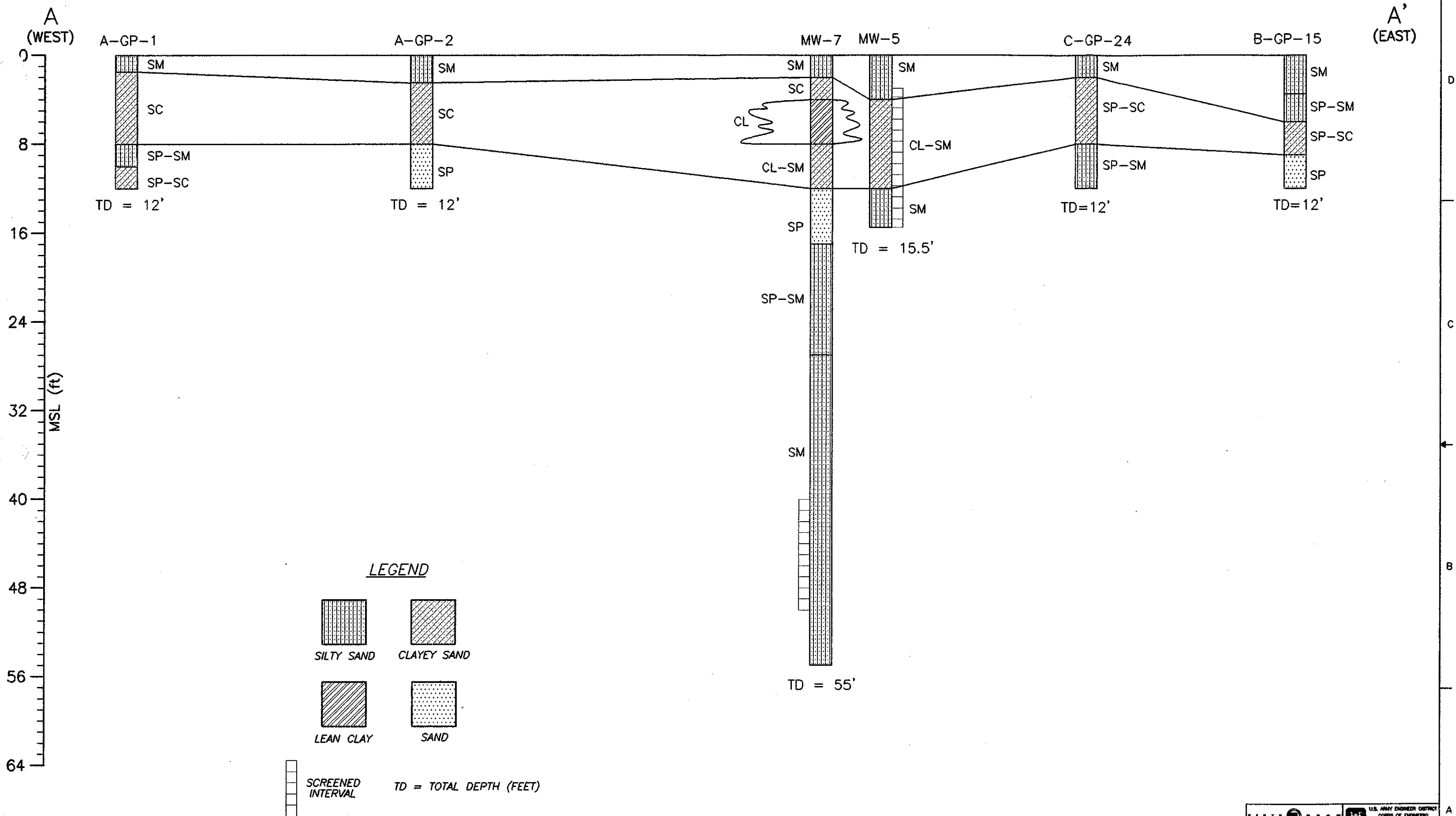
Drawing: L:\WORK\29350\CADD\29350-8.DWG
Last Saved: SEP 08, 1999 16:02

3

3

A

3



HORIZONTAL SCALE = 1" = 40'
VERTICAL SCALE = 1" = 8'

SYMBOL		ZONE	DESCRIPTION	DATE	BY
REVISIONS					

FIGURE 4.3 GEOLOGIC CROSS-SECTION A-A' FOR THE FORMER FIRE TRAINING AREA AT WAAF (SWMU 13) FORT STEWART, GEORGIA			
SIZE	DATE	FILE NO.	PLATE
D			
SCALE: 1"=40'		SHEET	
WORKBOOK NO. 1		4-5	

Drawing: L:\WORK\29350\CADD\29350-9.DWG Last Saved: SEP 08, 1999 16:04

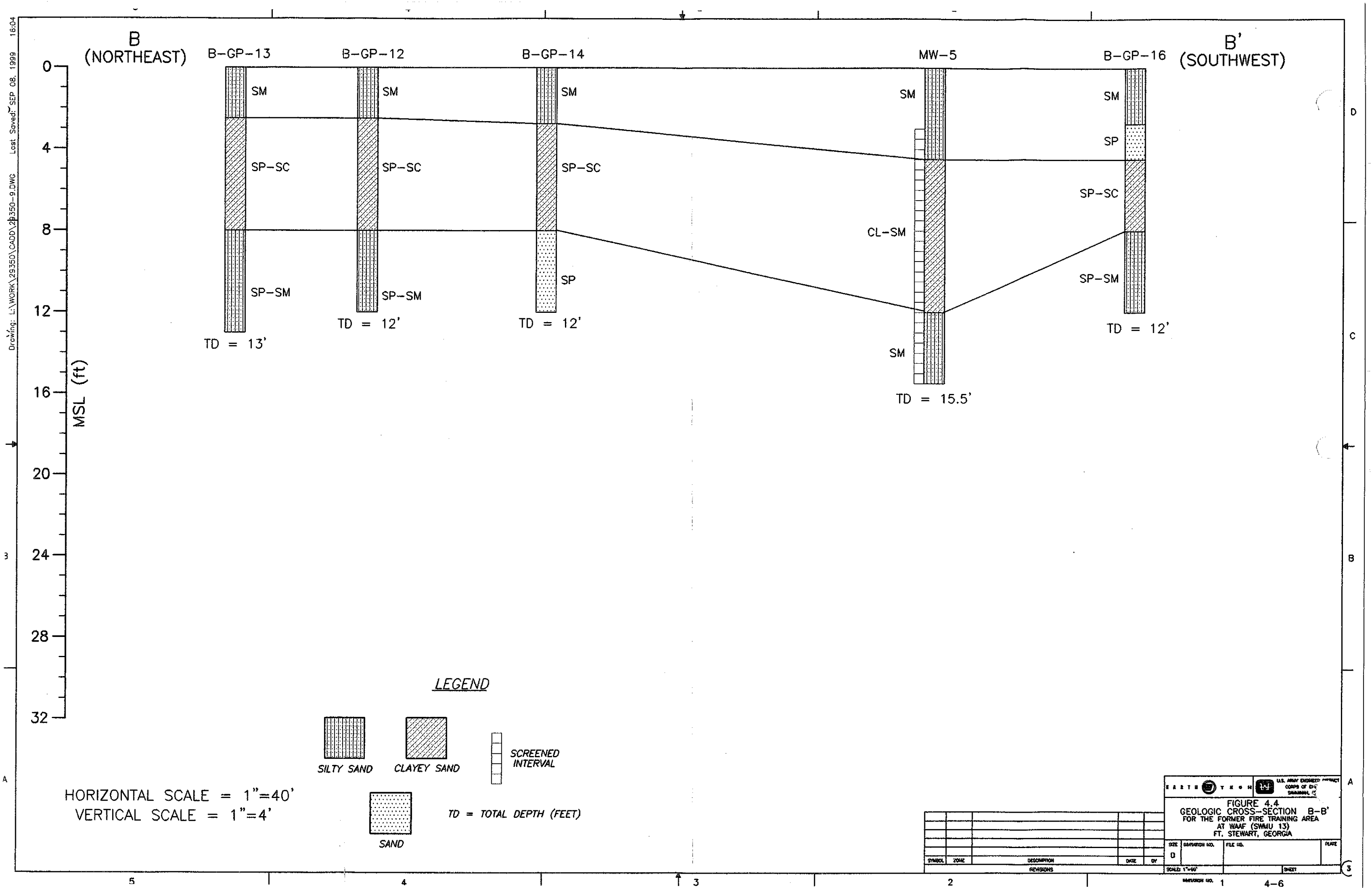


Table 4.1
Summary of Geotechnical Analyses for the former Fire Training Area
SWMU 13, Fort Stewart, Georgia

				Atterberg Limits			Grain Size Distribution					
Location	Depth (ft)	Sample No.	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Fines (%)	Specific Gravity	Soil Porosity	Permeability (cm/sec)
A-GP-4	13-15	A-GP-4-13r	23.35	NP	NP	NP	0	81	19	NA	NA	NA
A-GP-4	23-25	A-GP-4-23r	27.73	NP	NP	NP	0	83	17	NA	NA	NA
MW-9	2-4	MW-9-2r	20.1	NA	NA	NA	NA	NA	NA	2.71	0.358	1.66E-06
MW-9	18-20	MW-9-18r	19.1	NA	NA	NA	NA	NA	NA	2.67	0.361	1.17E-03
MW-10	8-10	MW-10-8r	20.8	NA	NA	NA	NA	NA	NA	2.64	0.385	6.91E-04
MW-13	4-6	MW-13-4r	22.2	NA	NA	NA	NA	NA	NA	2.72	0.407	5.03E-07

Aquifer (slug) tests were performed by ESE during the previous site investigation in August 1992. The hydraulic conductivities of the surficial aquifer in the vicinities of monitoring wells MW-5 and MW-7 ranged from 1.12×10^{-3} cm/sec to 4.06×10^{-5} cm/sec, respectively. MW-5 was screened from 3 feet to 15.5 feet bgs in silty sand; MW-7 was screened from 40 feet to 50 feet bgs in dense fine-grained silty sand. It should be noted that both of these wells were abandoned during the IM in October 1997. However, the calculated hydraulic conductivities are assumed to be representative of current site conditions.

4.6 Hydrogeology

The hydrogeology in the vicinity of the FSMR is dominated by two aquifers referred to as the Principal Artesian and the surficial aquifer that are separated by a confining unit (i.e., the Hawthorne Clay Layer).

The Principal Artesian aquifer is the lowermost hydrologic unit and is regionally extensive from South Carolina through Georgia, Alabama, and most of Florida, and is regionally known as the Floridan Aquifer. This aquifer is subdivided into upper and lower hydrogeologic units. The upper hydrogeologic unit is composed primarily of Miocene-age argillaceous sands and clays and Oligocene-to-Eocene-age limestones (including the Ocala Group and the Suwannee Limestone, where present) at the top. The upper hydrogeologic unit ranges in thickness from 200 to 260 feet and is most productive where it is thickest and where secondary permeability is most developed. The lower hydrologic unit is comprised of the Eocene-age Avon Park Limestone at the base. The transmissivity of the aquifer in the Savannah area ranges from about 28,000 to 33,000 square feet/day (Krause and Randolph 1989). Groundwater from this aquifer is primarily used for drinking water (Arora 1984). Thirteen groundwater production wells are used for potable water supply on the FSMR, and one additional production well is available for use in fire protection.

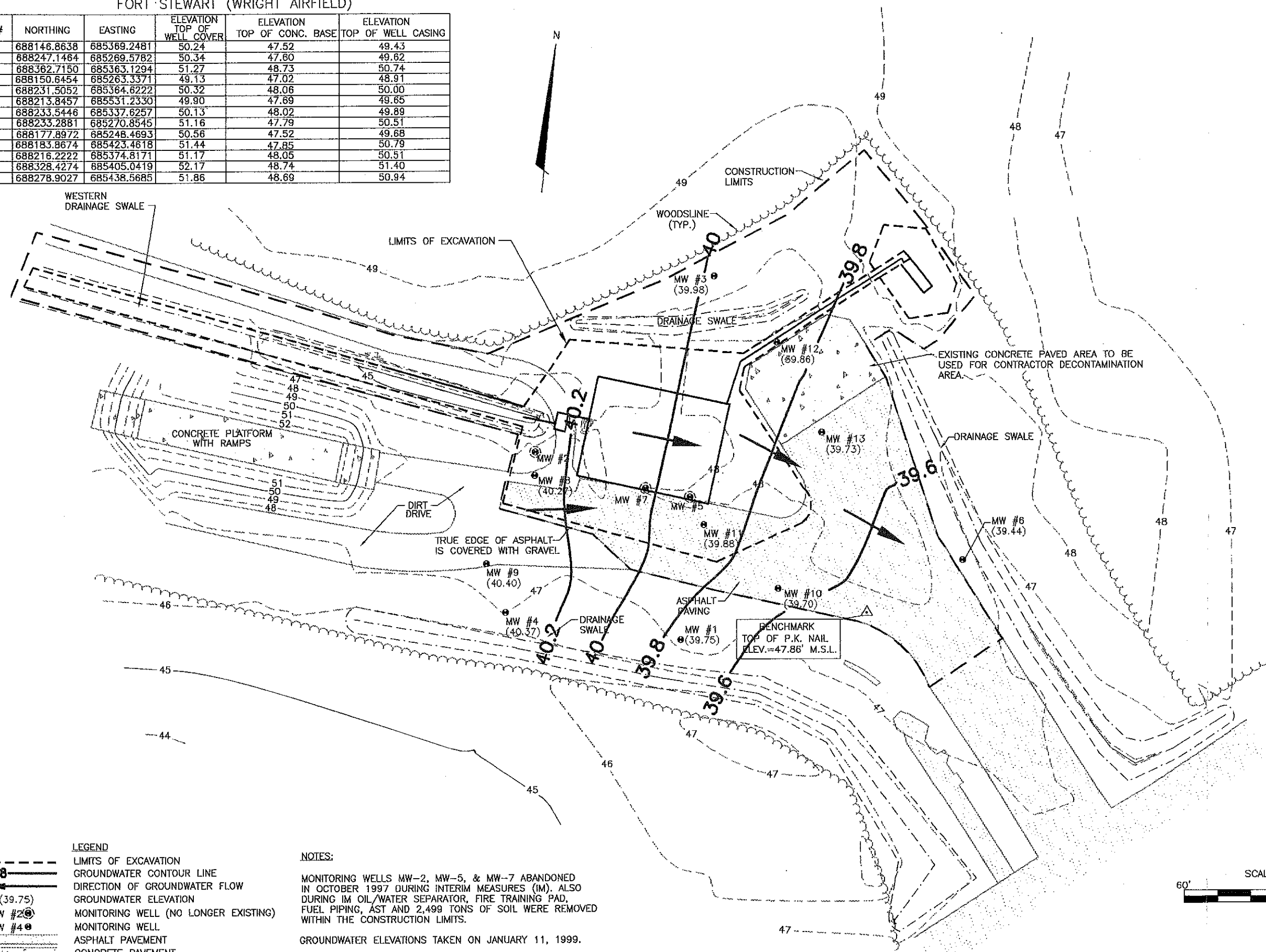
The confining layer for the Principal Artesian aquifer is the phosphatic clay of the upper Hawthorn Group. These sediments are regionally extensive and range from 60 to 80 feet in thickness at the FSMR. There are minor occurrences of aquifer material within the Hawthorn Group, however, they have limited utilization (Miller 1990).

The uppermost hydrologic unit is the surficial aquifer, which consists of widely varying amounts of sand, silt, and clay ranging from 55 to 150 feet in thickness. This aquifer is primarily utilized for domestic lawn and agricultural irrigation with wells typically yielding 2 to 180 gallons per minute. The top of the water table ranges from 2 to 10 feet below ground level (Geraghty and Miller 1992).

Water levels were measured on January 11 and 26, 1999, in the 10 existing monitoring wells at SWMU 13. Figures 4.5 and 4.6 are maps of the water table contours. Groundwater flow within the water table varied from east/southeast to southeast between those two dates, respectively, ultimately discharging to Peacock Creek. The groundwater elevations on January 26 were 2 to 3 feet higher than the groundwater elevations on January 11, reflecting the recharge to the surficial aquifer from rain events that occurred between these two dates. The difference in groundwater elevations could result in slight variations of groundwater

FORT STEWART (WRIGHT AIRFIELD)

WELL#	NORTHING	EASTING	ELEVATION TOP OF WELL COVER	ELEVATION TOP OF CONC. BASE	ELEVATION TOP OF WELL CASING
1	688146.8638	685369.2481	50.24	47.52	49.43
2	688247.1464	685269.5782	50.34	47.60	49.62
3	688362.7150	685363.1294	51.27	48.73	50.74
4	688150.6454	685263.3371	49.13	47.02	48.91
5	688231.5052	685364.6222	50.32	48.06	50.00
6	688213.8457	685531.2330	49.90	47.69	49.65
7	688233.5446	685337.6257	50.13	48.02	49.89
8	688233.2881	685270.8545	51.16	47.79	50.51
9	688177.8972	685248.4693	50.56	47.52	49.68
10	688183.8674	685423.4618	51.44	47.85	50.79
11	688216.2222	685374.8171	51.17	48.05	50.51
12	688328.4274	685405.0419	52.17	48.74	51.40
13	688278.9027	685438.5685	51.86	48.69	50.94



- LEGEND**
- LIMITS OF EXCAVATION
 - GROUNDWATER CONTOUR LINE
 - DIRECTION OF GROUNDWATER FLOW
 - GROUNDWATER ELEVATION
 - MONITORING WELL (NO LONGER EXISTING)
 - MONITORING WELL
 - ASPHALT PAVEMENT
 - CONCRETE PAVEMENT
 - TOP OF DITCH
 - CONSTRUCTION LIMITS
 - FUEL PIPE
 - CONTOUR LINE (5' INTERVAL)
 - CONTOUR LINE (1' INTERVAL)
 - WOODSLIME
 - BENCHMARK

NOTES:

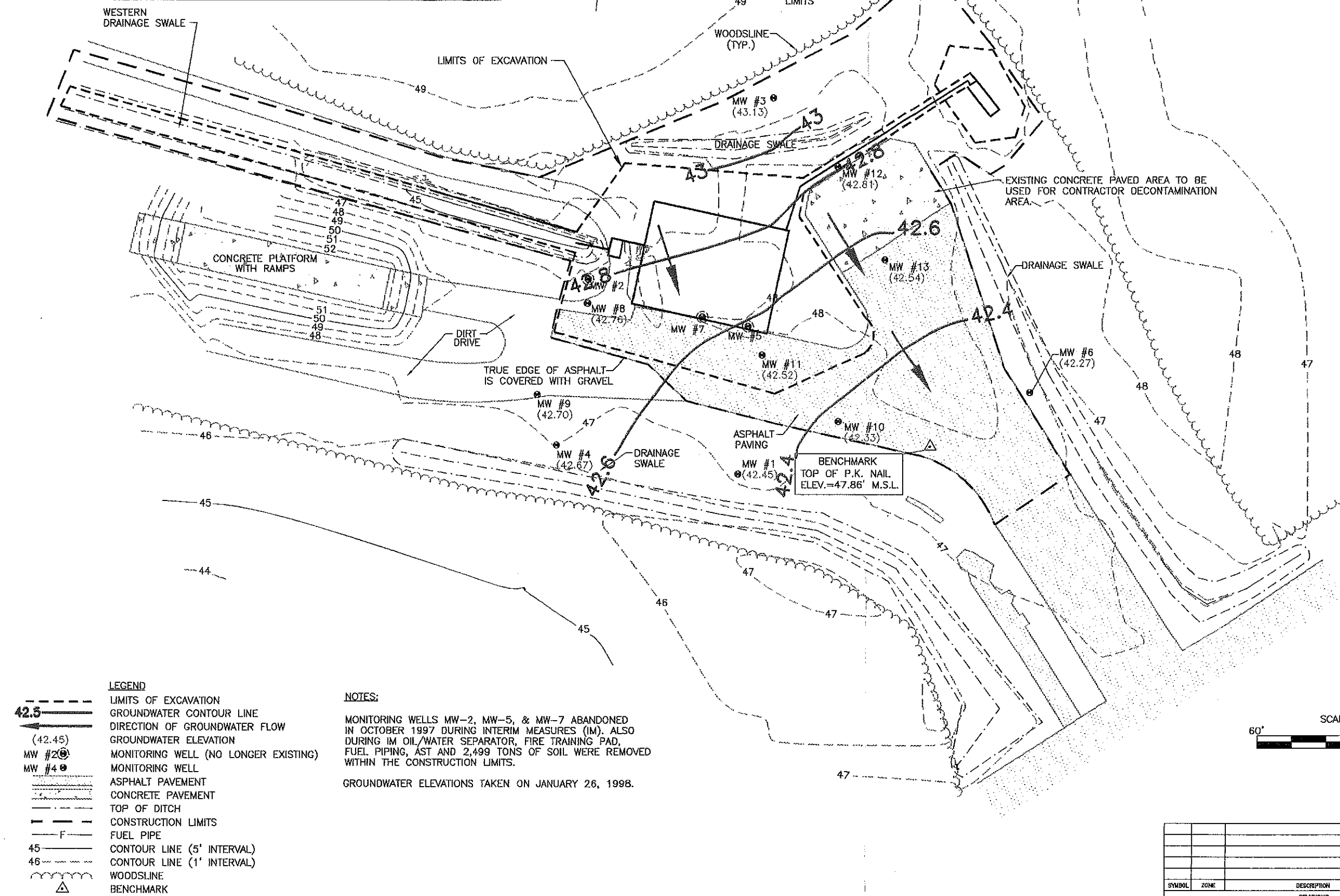
MONITORING WELLS MW-2, MW-5, & MW-7 ABANDONED IN OCTOBER 1997 DURING INTERIM MEASURES (IM). ALSO DURING IM OIL/WATER SEPARATOR, FIRE TRAINING PAD, FUEL PIPING, AST AND 2,499 TONS OF SOIL WERE REMOVED WITHIN THE CONSTRUCTION LIMITS.

GROUNDWATER ELEVATIONS TAKEN ON JANUARY 11, 1999.

EARTH TEAM		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA	
FIGURE 4.5 GROUNDWATER ELEVATION MAP (1/11/99) FOR THE FORMER FIRE TRAINING AREA AT WAAF (SWMU 13) FORT STEWART, GEORGIA			
SIZE	IMMEDIATE NO.	FILE NO.	PLATE
D			
SYMBOL	ZONE	DESCRIPTION	DATE BY
REVISIONS			
SCALE: 1"=60'			
SHEET			

FORT STEWART (WRIGHT AIRFIELD)

WELL#	NORTHING	EASTING	ELEVATION TOP OF WELL COVER	ELEVATION TOP OF CONC. BASE	ELEVATION TOP OF WELL CASING
1	688146.8638	685369.2481	50.24	47.52	49.43
2	688247.1464	685269.5782	50.34	47.60	49.62
3	688362.7150	685363.1294	51.27	48.73	50.74
4	688150.6454	685263.3371	49.13	47.02	48.91
5	688231.5052	685364.6222	50.32	48.06	50.00
6	688213.8457	685331.2330	49.90	47.89	49.65
7	688233.5446	685337.6257	50.13	48.02	49.89
8	688233.2881	685270.8545	51.16	47.79	50.51
9	688177.8972	685248.4693	50.56	47.52	49.68
10	688183.8674	685423.4618	51.44	47.85	50.79
11	688216.2222	685374.8171	51.17	48.05	50.51
12	688328.4274	685405.0419	52.17	48.74	51.40
13	688278.9027	685438.5685	51.86	48.69	50.94



flow direction as shown on Figures 4.5 and 4.6. Hydraulic gradient remained constant within the water table and was approximately 0.004 foot/foot at the site on these two dates.

4.7 Ecology

Approximately 7.8 square miles of the 436.8 square miles at FSMR comprise the garrison area. The remainder is used for ranges and training areas (approximately 11 percent) or held as non-use areas.

Eighty-four percent of the land is forested (approximately 367.2 square miles). Sixty-six percent of the forest area is pine with the major species including the slash pine, loblolly pine, and longleaf pine. Thirty-four percent of the forest is composed of river bottom lands and swamps whose major species include the tupelo, other gum trees, water oak, and bald cypress trees. The open range and training areas comprise 11 percent of the base and consist of grasses, shrubs, and scrub tree (oak) growth.

Aquatic habitats on FSMR include a number of natural or man-made ponds and lakes, the Canoochee River, Canoochee Creek and tributaries, and a number of bottom land swamps and pools. The Ogeechee River borders the installation along its northeast boundary. Organic detritus content is high, and dark coloring of the water is not unusual. Dense growths of aquatic vegetation are also typical, especially during the summer months.

Both terrestrial and aquatic fauna are abundant in the unimproved areas of FSMR. Major game species found on the installation include white-tailed deer, feral hog, wild turkey, rabbit, squirrel, and bobwhite in addition to numerous other mammal, bird, reptile, and amphibian species (Environmental Science and Engineering 1982). Dominant fish include bluegill, largemouth bass, crappie, sunfish, channel catfish, minnows, and shiners. Three federally listed threatened or endangered species reside at FSMR: the American bald eagle, Eastern indigo snake, and the red-cockaded woodpecker.

4.8 Meteorology

Fort Stewart has a humid, subtropical climate with long, hot summers. Average temperatures range from 50°F in the winter to 80°F in the summer. Average annual precipitation is 48 inches, with slightly over half falling from June through September. Prolonged drought is rare in the area, but severe local storms (tornadoes and hurricanes) do occur. Under normal conditions, wind speeds rarely exceed 5 knots, but gusty winds of over 25 knots may occur during summer thunderstorms (Geraghty and Miller 1992).

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5.0 CONTAMINANT NATURE AND EXTENT

This section is a summary of the results of the chemical laboratory analyses of the soil and groundwater samples collected at SWMU 13, former Fire Training Area at WAAF as part of this RFI. Laboratory analytical reports for the chemical data are included in Appendix E of this report.

5.1 Background Data Analysis and Screening

The reference background criteria for SWMU 13 have been developed based on data from background samples collected from SWMUs across the FSMR (SAIC 1998). In general, reference background samples were collected in each medium at locations upgradient or upstream of each site so as to be representative of naturally occurring conditions at SWMUs under investigation. In addition, soil samples collected during the Phase I investigation [i.e., Burn Pits (SWMUs 4A, 4B, 4D, 4E, and 4F), Active EOD Area (SWMU 12A), etc.] were included as reference background samples if they were upgradient of the site and if the data were of sufficient quality to be representative of natural background conditions at the FSMR. A summary of the sample stations, SWMUs, and the source of the data (Phase I or II RFI) is presented in Appendix F, Table F.1 for each medium.

EPA Region IV methodology (EPA 1996a) was used as guidance for the development of the background data set for screening metals data. In cases where enough samples (e.g., more than 20) are collected to define background, a background upper tolerance level can be calculated. In cases where fewer samples (e.g., less than 20) are collected to define background, background can be calculated as 2 times the mean background concentration (EPA 1996a). Given that fewer than 20 background samples were collected for the FSMR, the latter method was used for calculating reference background concentrations for metals.

Appendix F presents the summary of background data and presents the two-times-mean background concentrations for metals. Given the limited number of reference background samples, the mean concentration of metals for soils in the eastern United States is also presented, for comparative purposes only.

The detected concentrations of organics in background samples were not used to calculate reference background criteria because all organic compounds are considered to be potentially man-made. Organic compounds were not screened against background. All detected organic compounds are considered to be SRCs, unless an organic analyte is a common laboratory contaminant. The following sections discuss the background data analysis for each medium.

5.1.1 Surface Soil

Surface soil samples were taken from the ground surface to a depth of 1 or 2 feet bgs depending on the amount of recovery from the sampling device. Thirteen surface soil samples were used in the development of the surface soil background data set (Table F.1). The reference background concentration for metals in surface soils was calculated as 2 times the average concentration of these 13 locations. Phase I data from SWMU 12A and SWMU 35 were determined to be of sufficient quality to include in

the background data set. If a chemical was not detected at a site, then one-half the detection limit was used as the concentration in calculating the mean background concentration. The sample results included in the data set are presented in Table F.2, Appendix F. Metals are considered SRCs if their concentrations exceed the calculated reference background concentration. Organics were not screened against background; all organic compounds are considered SRCs if they were detected.

5.1.2 Subsurface Soil

Subsurface soil samples were taken from the interval between a depth of 2 feet bgs and the water table. Eighteen subsurface soil samples were used in the development of the subsurface soil background data set (Table F.1). Phase I data from SWMUs 4A, 4B, 4D, 4E, 4F, SWMU 12A, and 35 were determined to be of sufficient quality to include in the subsurface soil background set. The reference background concentration for metals in subsurface soil was calculated as 2 times the mean of the chemical detected at the 19 locations. If a chemical was not detected in a sample, then one-half the detection limit was used in calculating the mean background concentration. The sample results included in the background data set are presented in Table F.3, Appendix F. Metals are considered SRCs if their concentrations exceed the calculated reference background concentration. Organics were not screened against background; all organic compounds are considered SRCs if they were detected.

5.1.3 Groundwater

Only groundwater samples collected using low-flow techniques (Phase II RFI) were used in the development of the groundwater background data set. Groundwater samples from 19 SWMUs were used (Table F.1). The reference background concentration groundwater was calculated as two times the average of these 19 samples. If a chemical was not detected at a site, then one-half the detection limit was used in calculating the mean background concentration. The sample results included in background data set are presented in Table F.4, Appendix F. Metals in groundwater are considered SRCs if their concentrations exceed the calculated reference background concentration. Organics were not screened against background; all organic compounds are considered SRCs if they were detected.

5.1.4 Surface Water/Sediment

Surface water and sediment background samples were collected during the Phase II RFI for the Former 724th TPS and are site specific. The reference background surface water concentration was calculated as two times the average of the data taken at the site-specific background location (SWS-1). If a chemical was not detected at a site, then one-half the detection limit was used as the average background concentration. The sample results comprising the site-specific background data for surface water and sediment are presented in Tables F.5 and F.6, respectively, Appendix F. Metals are considered SRCs if their concentrations exceed site-specific reference background concentration. Organics are considered SRCs if they were detected.

5.1.5 Site-related Contaminants

Inorganics for surface soil, subsurface soil, and groundwater were screened against the reference background criteria. As discussed in the preceding sections, all organics that are detected are considered SRCs

because organic constituents are considered potentially man-made. Organic analytes that were detected at least once, and those inorganic analytes where at least one sample result exceeded background, are considered SRCs. Only the SRCs are carried through for evaluation under fate and transport (Chapter 6.0), human health PRE (Chapter 7.0), and ecological PRE (Chapter 8.0).

5.2 Surface Soil Contamination

The nature and extent of surface soil contamination was evaluated using the results from surface soil samples taken from three direct-push soil sample locations (A-GP-9, B-GP-15, and B-GP-17) at the site. These samples were taken outside the area that was excavated during the IM. The samples were analyzed for VOCs, SVOCs, and RCRA metals. Table 5.1 summarizes the analytical results for surface soil samples, and Figure 5.1 shows the distribution of SRCs.

Table 5.1
Summary of Analytes Detected in RFI Surface Soil Results
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Reference Background Criteria	A-GP-9-0s (0-1 ft)	B-GP-15-0s (0-1 ft)	B-GP-17-0s (0-1 ft)
Semivolatile Organic Compounds (µg/kg)				
Benzo(a)anthracene	0.00	<340	<360	430
Benzo(a)pyrene	0.00	<340	<360	390
Benzo(b)fluoranthene	0.00	<340	<360	560
Benzo(k)fluoranthene	0.00	<340	<360	490
Chrysene	0.00	<340	<360	430
Fluoranthene	0.00	<340	<360	720
Phenanthrene	0.00	<340	<360	<350
Pyrene	0.00	<340	<360	620
Metals (mg/kg)				
Arsenic	2.10	<1.0	<0.92	<1.1
Barium	14.70	20	12	10
Chromium	6.21	3.6	3.6	2.2
Lead	8.81	3.2	3.3	2.9
Mercury	0.03	<0.010	<0.010	0.015

Notes:

µg/kg = micrograms per kilogram

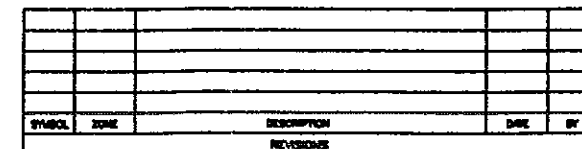
mg/kg = milligrams per kilogram

Bold indicates that the chemical was detected in that sample

Shaded indicates that the chemical was identified as an SRC

VOCs. All VOCs in surface soils were reported to be below laboratory detection limits. No VOCs were identified as SRCs for surface soil.

SVOCs. Benzo(a)anthracene (430 µg/kg), benzo(a)pyrene (390 µg/kg), benzo(b)fluoranthene (560 µg/kg), benzo(k)fluoranthene (490 µg/kg), chrysene (430 µg/kg), fluoranthene (720 µg/kg), and pyrene (620 µg/kg) were detected in the surface soil sample B-GP-17-0s, which is located south of the former fire training pad. These constituents were reported at concentrations near their respective detection limits, but in excess of



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the reference background criteria. The analytical results for all other SVOCs are reported to be below laboratory detection limits in samples A-GP-9-0s and B-GP-15-0s. Therefore, only the SVOCs listed above are considered SRCs for surface soil.

RCRA Metals. Barium was detected in surface soils at a concentration exceeding its reference background criteria at A-GP-9-0s (20 mg/kg). All other metals were reported below detection limits, or below the reference background criteria. Barium is the only RCRA metal considered an SRC for surface soil.

5.3 Subsurface Soil Contamination

5.3.1 IM Data

The discussion in Section 2.3 of this report identified thirty (30) SRCs. The SRCs and concentrations reported for each sample taken are summarized in that section and presented in Table 2.1. The samples were analyzed for VOCs, SVOCs, and RCRA metals, and the following presents the SRCs identified.

VOCs. The following VOCs were detected with respective maximum concentrations: 4-Methyl-2-pentanone (MIBK) at 3,800 µg/kg; acetone at 110 µg/kg; benzene at 21 µg/kg; carbon disulfide at 13 µg/kg; chlorobenzene at 930 µg/kg; ethylbenzene at 1,600 µg/kg; toluene at 980 µg/kg; and xylenes at 61,000 µg/kg. These VOCs were identified in the area where the above ground fuel tank was formerly located, with some detections in the vicinity of the former fuel line from the tank.

SVOCs. The highest concentrations of SVOCs (with the exceptions of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene) were identified in samples taken from the swale just west of the former fire training area. Naphthalene, 1-methylnaphthalene and 2-methylnaphthalene concentrations were reported for the same locations as were identified for the VOCs. The following SVOCs were detected with respective maximum concentrations: Acenaphthene at 4,500 µg/kg; anthracene at 1,100 µg/kg; benzo(a)pyrene at 3,700 µg/kg; benzo(g,h,i)perylene at 2,400 µg/kg; benzo(b) fluoranthene at 8,200 µg/kg; benzo(a)anthracene at 10,000 µg/kg; chrysene at 10,000 µg/kg; fluoranthene at 9,100 µg/kg; fluorene at 4,400 µg/kg; indeno(1,2,3-cd)pyrene at 4,500 µg/kg; dibenzo(a,h)anthracene at 4,500 µg/kg; phenanthrene at 1,100 µg/kg; pyrene at 8,100 µg/kg; 1-methylnaphthalene at 18,000 µg/kg; 2-methylnaphthalene at 24,000 µg/kg; and naphthalene at 1,800 µg/kg.

RCRA Metals. The following metals were detected at concentrations exceeding their reference background criteria with respective maximum concentrations: arsenic at 10.4 mg/kg; barium at 26.6 mg/kg, chromium at 40.4 mg/kg; lead at 11.4 mg/kg ; and mercury at 0.097 mg/kg.

5.3.2 Data Derived During This RFI

The nature and extent of subsurface soil contamination were evaluated using the results from both direct-push soil samples and discrete soil samples taken from monitoring well boreholes. A summary of the subsurface soil analytical results for detected analytes is provided in Table 5.2, and the distribution of contamination is shown in Figure 5.2.

Table 5.2 (Page 1 of 2)
Summary of Analytes Detected in RFI Subsurface Soil Samples
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Reference Background Criteria	Samples from Geoprobe Borings											
		A-GP-1-6s (6-8 ft)	A-GP-2-6s (6-8 ft)	A-GP-8-6s (6-8 ft)	A-GP-9-6s (6-8 ft)	B-GP-11-6s (6-8 ft)	B-GP-12-6s (6-8 ft)	B-GP-13-6s (6-8 ft)	B-GP-14-6s (6-8 ft)	B-GP-15-6s (6-8 ft)	B-GP-16-6s (6-8 ft)	B-GP-17-6s (6-8 ft)	C-GP-24-6s (6-8 ft)
Volatile Organic Compounds (µg/kg):													
Ethylbenzene	0.00	<6.8	<5.7	<7.4	<5.6	<5.6	<5.8	<6.0	<6.3	<7.4	<6.1	<6.0	<5.5
Xylenes	0.00	<6.8	<5.7	<7.4	<5.6	<5.6	<5.8	<6.0	<6.3	<7.4	<6.1	<6.0	<5.5
Semivolatile Organic Compounds (µg/kg):													
Anthracene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Benzo (a) anthracene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Benzo (a) pyrene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Benzo (b) fluoranthene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Benzo (g,h,i) perylene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Benzo (k) fluoranthene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Chrysene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Fluoranthene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Indeno (1,2,3-cd) pyrene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	890
Phenanthrene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	<390
Pyrene	0.00	<390	<390	<400	<390	<390	<380	<330	<380	<390	<390	<390	710
Metals (mg/kg):													
Arsenic	8.04	<1.1	<1.2	2.0	<1.1	<1.1	<1.2	<1.1	1.1	<1.2	1.7	1.3	1.1
Barium	17.00	20	6.8	14	16	22	12	9.8	11	8.6	11	5.6	6.4
Chromium	11.60	6.1	4.6	15	3.1	7.5	15	12	9.7	6.2	23	14	9.1
Lead	11.10	3.4	2.2	10	16	17	13	9.5	9.4	7.5	10	11	6.6
Mercury	0.048	<0.012	<0.012	<0.011	<0.011	<0.010	<0.012	<0.011	<0.012	<0.012	<0.012	<0.011	<0.011
Other Analytes (mg/kg):													
Total Organic Carbon	2200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

NA = not analyzed

Bold indicates that the chemical was detected in that sample

Shaded indicates that the chemical was identified as an SRC

Table 5.2 (Page 2 of 2)
Summary of Analytes Detected in RFI Subsurface Soil Samples
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Reference Background Criteria	Samples from Monitoring Well Borings									
		MW-8-6s (6-8 ft)	MW-9-2R (2-4 ft)	MW-9-6s (6-8 ft)	MW-9-18R (18-20 ft)	MW-10-2s (2-4 ft)	MW-10-8R (8-10 ft)	MW-11-6s (6-8 ft)	MW-12-4s (4-6 ft)	MW-13-4R (4-6 ft)	MW-13-6s (6-8 ft)
Volatile Organic Compounds (µg/kg):											
Ethylbenzene	0.00	<5.7	NA	<4.9	NA	<5.0	NA	<4.9	1100	NA	<4.8
Xylenes	0.00	<5.7	NA	<4.9	NA	<5.0	NA	<4.9	4100	NA	<4.8
Semivolatile Organic Compounds (µg/kg):											
Anthracene	0.00	<390	NA	510	NA	<380	NA	<390	<380	NA	<380
Benzo (a) anthracene	0.00	470	NA	1500	NA	<380	NA	<390	<380	NA	1100
Benzo (a) pyrene	0.00	440	NA	1100	NA	<380	NA	<390	<380	NA	960
Benzo (b) fluoranthene	0.00	710	NA	1800	NA	<380	NA	<390	550	NA	1100
Benzo (g,h,i) perylene	0.00	<390	NA	770	NA	<380	NA	<390	<380	NA	710
Benzo (k) fluoranthene	0.00	<390	NA	730	NA	<380	NA	<390	<380	NA	1000
Chrysene	0.00	470	NA	1400	NA	<380	NA	<390	<380	NA	1200
Fluoranthene	0.00	1000	NA	4200	NA	<380	NA	<390	580	NA	2400
Indeno (1,2,3-cd) pyrene	0.00	<390	NA	730	NA	<380	NA	<390	<380	NA	710
Phenanthrene	0.00	<390	NA	2200	NA	<380	NA	<390	390	NA	570
Pyrene	0.00	730	NA	2800	NA	<380	NA	<390	470	NA	1900
Metals (mg/kg):											
Arsenic	8.04	<1.1	NA	<1.2	NA	2.2	NA	2.7	4.5	NA	2.1
Barium	17.00	8.1	NA	9.0	NA	15	NA	14	13	NA	16
Chromium	11.60	11	NA	6.7	NA	9.6	NA	11	24	NA	15
Lead	11.10	7.5	NA	6.4	NA	4.0	NA	12	9.7	NA	12
Mercury	0.048	<0.012	NA	<0.011	NA	0.027	NA	<0.011	0.023	NA	<0.012
Other Analytes (mg/kg):											
Total Organic Carbon	2200	NA	2600	NA	300	NA	680	NA	NA	12000	NA

Notes:

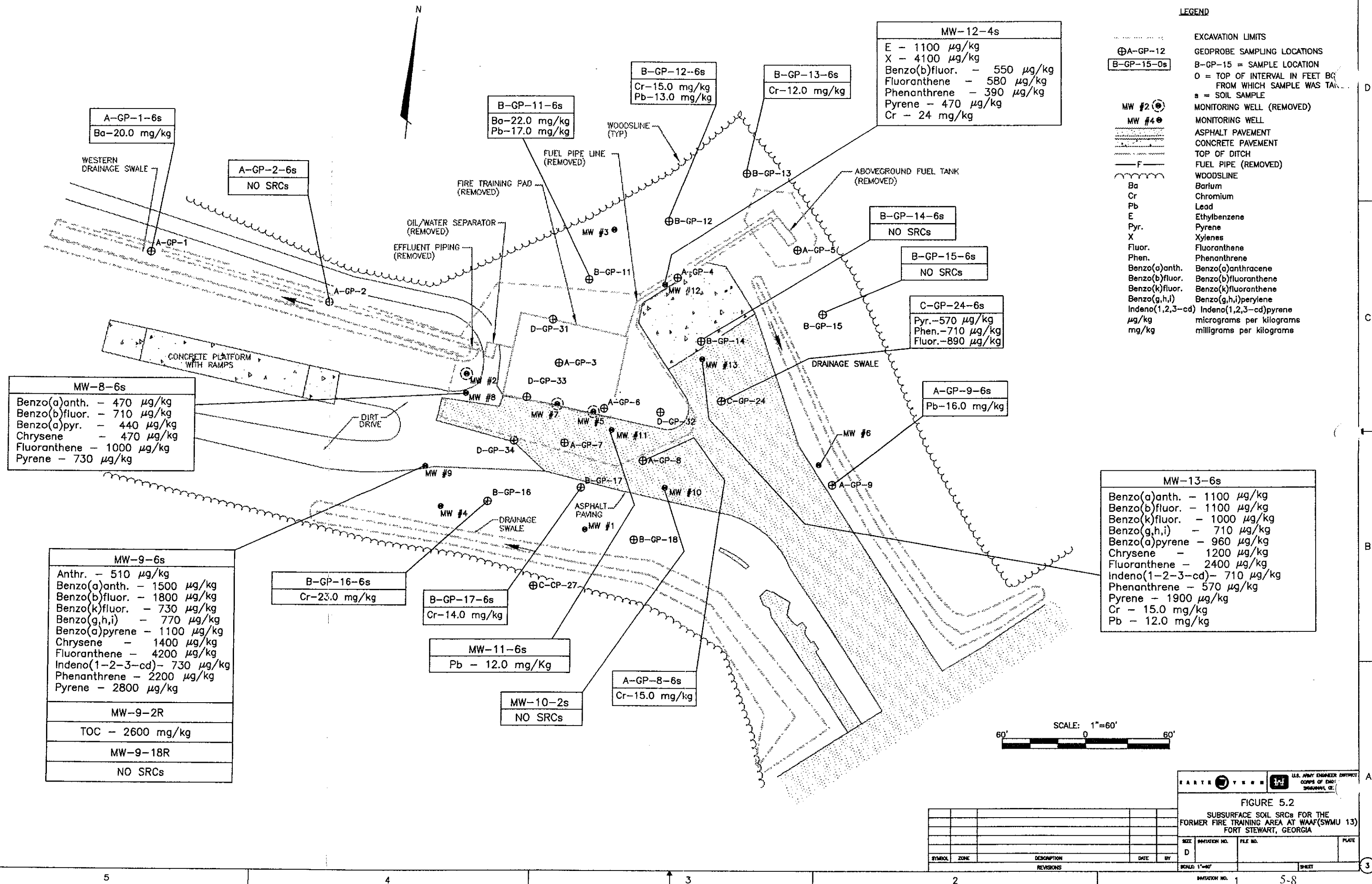
µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

NA = not analyzed

Bold indicates that the chemical was detected in that sample

Shaded indicates that the chemical was identified as an SRC



VOCs. Ethylbenzene (1100 µg/kg) and xylenes (4100 µg/kg) were detected in subsurface soils at MW-12 (4-6 feet bgs) which is located adjacent to the former fuel tank piping. Samples from all other discrete soil sampling locations had VOCs reported below laboratory detection limits. Both of these contaminants were identified as SRCs from the IM data.

SVOCs. SVOCs were detected in subsurface soil samples from monitoring wells MW-8, MW-9, MW-12, and MW-13. Those SVOCs detected include anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. Benzo(a)anthracene (470 µg/kg), benzo(b)fluoranthene (710 µg/kg), benzo(a)pyrene (440 µg/kg), chrysene (470 µg/kg), fluoranthene (1000 µg/kg), and pyrene (730 µg/kg) were detected in subsurface soils in MW-8. SVOCs detected in MW-9 include anthracene (510 µg/kg), benzo(a)anthracene (1500 µg/kg), benzo(b)fluoranthene (1800 µg/kg), benzo(k)fluoranthene (730 µg/kg), benzo(g,h,i)perylene (770 µg/kg), chrysene (1400 µg/kg), fluoranthene (4200 µg/kg), indeno(1,2,3-cd)pyrene (730 µg/kg), phenanthrene (2200 µg/kg), and pyrene (2800 µg/kg). Benzo(b)fluoranthene (550 µg/kg), fluoranthene (580 µg/kg), phenanthrene (390 µg/kg), and pyrene (470 µg/kg) were detected in MW-12. SVOCs reported in MW-13 include benzo(a)anthracene (1100 µg/kg), benzo(b)fluoranthene (1100 µg/kg), benzo(k)fluoranthene (1000 µg/kg), benzo(g,h,i)perylene (710 µg/kg), benzo(a)pyrene (960 µg/kg), chrysene (1200 µg/kg), fluoranthene (2400 µg/kg), indeno(1,2,3-cd)pyrene (710 µg/kg), phenanthrene (570 µg/kg), and pyrene (1900 µg/kg).

Only one direct push soil sample had SVOCs detected. C-GP-24-6s (6-8 feet bgs) had the following concentrations detected: fluoranthene (890 µg/kg), phenanthrene (710 µg/kg), and pyrene (570 µg/kg).

RCRA Metals. Barium, chromium, and lead were detected in subsurface soil samples at concentrations exceeding their respective reference background criteria. Barium was detected above its reference background criterion at A-GP-1-6s (20.0 mg/kg) and B-GP-11-6s (22.0 mg/kg). Chromium was detected above its reference background criterion at A-GP-8-6s (15.0 mg/kg), B-GP-12-6s (15.0 mg/kg), B-GP-13-6s (12.0 mg/kg), B-GP-16-6s (23 mg/kg), B-GP-17-6s (14.0 mg/kg), MW-12-4s (24.0 mg/kg), and MW-13-6s (15.0 mg/kg). Lead was detected above its reference background criterion at A-GP-9-6s (16.0 mg/kg), B-GP-11-6s (17.0 mg/kg), B-GP-12-6s (13.0 mg/kg), MW-11-6s (12.0 mg/kg), and MW-13-6s (12.0 mg/kg). Samples from all other locations had metal concentrations below laboratory detection limits, or their respective reference background criteria.

5.3.3 SRCs for Subsurface Soil

The following are considered to be SRCs for subsurface soil:

VOCs – acetone, benzene, carbon disulfide, chlorobenzene, ethylbenzene, toluene, xylenes, and 4-methyl-2-pentanone.

SVOCs – acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene,

fluorene, indeno (1,2,3-cd) pyrene, phenanthrene, pyrene, naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.

RCRA Metals – arsenic, barium, chromium, lead, and mercury.

5.4 Groundwater Contamination

A total of 31 direct-push groundwater samples (20 shallow direct-push technology locations and 3 vertical profile locations) and 10 groundwater monitoring well samples were collected as part of this RFI investigation. Direct-push groundwater samples were only used for screening to establish the location of monitoring wells and to determine if deep monitoring wells were required at the site (i.e., screening data were not used in determining SRCs due to the fact that the data are not reproducible). The monitoring well sample data were used to confirm the extent of contamination indicated by the screening direct-push samples, and to establish the nature and extent of groundwater contamination to assess risk to human health and the environment.

As part of the screening process, existing monitoring well MW-1 was sampled instead of installing a direct-push push probe in the vicinity of the existing well. Therefore, an analytical result for MW-1 is included with direct-push groundwater screening data.

5.4.1 Direct-Push Groundwater Sampling Results (Groundwater Screening)

The direct-push groundwater samples were collected from a total of 23 push-probe stations and analyzed for VOCs and SVOCs. The results of VOC and SVOC analyses on groundwater samples taken from both the direct-push probes and monitoring well MW-1 are shown in Table 5.3, and depicted on Figure 5.3 (for samples within 20 feet of land surface) and Figure 5.4 (for samples deeper than 20 feet below ground surface).

VOCs. VOCs were detected at eight (8) push-probe locations (A-GP-3-10g, A-GP-4-10g, A-GP-6-10g, A-GP-7-10g, B-GP-17-8g, D-GP-32-10g, D-GP-33-10g, and D-GP-34-9g). The VOCs detected include acetone, benzene, ethylbenzene, methylene chloride and xylenes (Table 5.3). As described in Section 3.0, the VOC results were acquired via rapid laboratory turn-around, and used to determine the location for the construction of monitoring wells and also to determine the need for constructing deeper well(s) at the site.

The VOC results of the groundwater screening were forwarded to the GA EPD, with recommendations for the location of proposed monitor wells, and also with the recommendation that deep monitoring wells were not required based on the analytical results from vertical profiles A-GP-4, A-GP-7, and A-GP-14. GA EPD concurred with the recommendations, and monitoring wells MW-8 through MW-13 were installed at the proposed locations and deep monitoring wells were not installed.

SVOCs. SVOCs were detected in groundwater samples from direct-push locations and analytical results are provided in Table 5.3 and depicted on Figures 5.3 and 5.4. These SVOCs include carbazole, 2,4-dimethylphenol, fluoranthene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene.

Table 5.3 (Page 1 of 3)
Summary of Analytes Detected in RFI Groundwater Screening Samples
SWMIU 13, Fort Stewart, Georgia

Detected Analytes	MW-1*	Samples from Geoprobe Borings									
		A-GP-1-8g (8-10 ft)	A-GP-2-8g (8-10 ft)	A-GP-3-10g (10-13 ft)	A-GP-4-10g (10-13 ft)	A-GP-4-20g (20-23 ft)	A-GP-4-30g (30-33 ft)	A-GP-4-40G (40-42.5 ft)	A-GP-5-10g (10-13 ft)	A-GP-6-10G (10-12 ft)	A-GP-7-10G (10-13 ft)
VOCs (µg/L):											
Acetone	<5	<50	<50	<50	<2500	<500	<250	<50	58	<100	<100
Benzene	<5	<5.0	<5.0	8.6	400	<10 **F35	<5 *F35	<5.0	<5.0	230	240
Ethylbenzene	<5	<5.0	<5.0	<5.0	800	330	130	30	<5.0	210	41
Methylene Chloride	<5	<5.0	<5.0	<5.0	<250	<50	<25	<5.0	<5.0	<10	<10
Toluene	<5	<5.0	<5.0	<5.0	320	<50	<25	7.3	<5.0	<10	<10
Xylenes	<5	<5.0	<5.0	<5.0	4600	1800	760	180	<5.0	340	<10
SVOCs (µg/L):											
Carbazole	NA	<10	<10	<10	<50	<10	<10	<10	<10	<20	<10
2,4 - Dimethylphenol	NA	<10	<10	<10	<50	<10	<10	<10	<10	28	<10
Fluoranthene	NA	<10	<10	<10	<50	<10	<10	<10	<10	<20	<10
2 - Methylanthracene	NA	<10	<10	13	430	75	42	34	<10	120	88
Naphthalene	NA	<10	<10	14	490	96	37	29	<10	210	91
Phenanthrene	NA	<10	<10	<10	<50	<10	<10	<10	<10	<20	<10
Pyrene	NA	<10	<10	<10	<50	<10	<10	<10	<10	<20	<10

Notes:

µg/L = micrograms per liter

* = A grab sample was taken from MW-1 and used as a groundwater screening sample.

**F35 = Due to analyte abundance, target compound concentrations are reported from multiple runs to achieve requested detection limits.

NA = not analyzed

Bold = the chemical was detected in that sample

Table 5.3 (Page 2 of 3)
Summary of Analytes Detected in RFI Groundwater Screening Samples
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Samples from Geoprobe Borings										
	A-GP-7-20g (20-23 ft)	A-GP-7-30g (31-33 ft)	A-GP-7-38g (38-39 ft)	A-GP-8-8g (8-10 ft)	A-GP-9-8g (8-11 ft)	B-GP-11-8g (8-11 ft)	B-GP-12-8G (8-12 ft)	B-GP-13-9g (9-13 ft)	B-GP-14-8g (8-12 ft)	B-GP-14-18g (18-20 ft)	B-GP-14-31g (31-32 ft)
VOCs (µg/L):											
Acetone	<50	<50	330	<50	<50	<50	<50	<50	<50	<50	<50
Benzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene Chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
SVOCs (µg/L):											
Carbazole	<10	<10	<10	<10	<10	<10	<10	<10	16	<10	<10
2,4 - Dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fluoranthene	<10	<10	<10	<10	<10	<10	<10	<10	40	23	<10
2 - Methylnaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	36	<10	<10
Naphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	<10	<10	<10	<10	<10	<10	<10	<10	38	18	13
Pyrene	<10	<10	<10	<10	<10	<10	<10	<10	16	17	<10

Notes:

µg/L = micrograms per liter

NA = not analyzed

Bold = the chemical was detected in that sample

Table 5.3 (Page 3 of 3)
Summary of Analytes Detected in RFI Groundwater Screening Samples
SWNU 13, Fort Stewart, Georgia

Detected Analytes	Samples from Geoprobe Borings									
	B-GP-15-8g (8-11 ft)	B-GP-16-8g (8-12 ft)	B-GP-17-8g (8-11 ft)	B-GP-18-9g (9-12 ft)	C-GP-24-8g (8-11 ft)	C-GP-27-9g (9-12 ft)	D-GP-31-10g (10-14 ft)	D-GP-32-10g (10-13 ft)	D-GP-33-10g (10-13 ft)	D-GP-34-9G (9-12 ft)
VOCs (µg/L):										
Acetone	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Benzene	<5.0	<5.0	21	<5.0	<5.0	<5.0	<5.0	10	9.9	29
Ethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	9.9	41
Methylene Chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.6	<5.0	<5.0
Toluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	19	7.1
SVOCs (µg/L):										
Carbazole	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4 - Dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fluoranthene	<10	<10	<10	<10	13	<10	<10	<10	<10	<10
2 - Methylanthracene	<10	<10	17	<10	<10	<10	<10	<10	38	77
Naphthalene	<10	<10	13	<10	<10	<10	<10	<10	59	82
Phenanthrene	<10	<10	<10	<10	17	<10	<10	<10	<10	<10
Pyrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Notes:

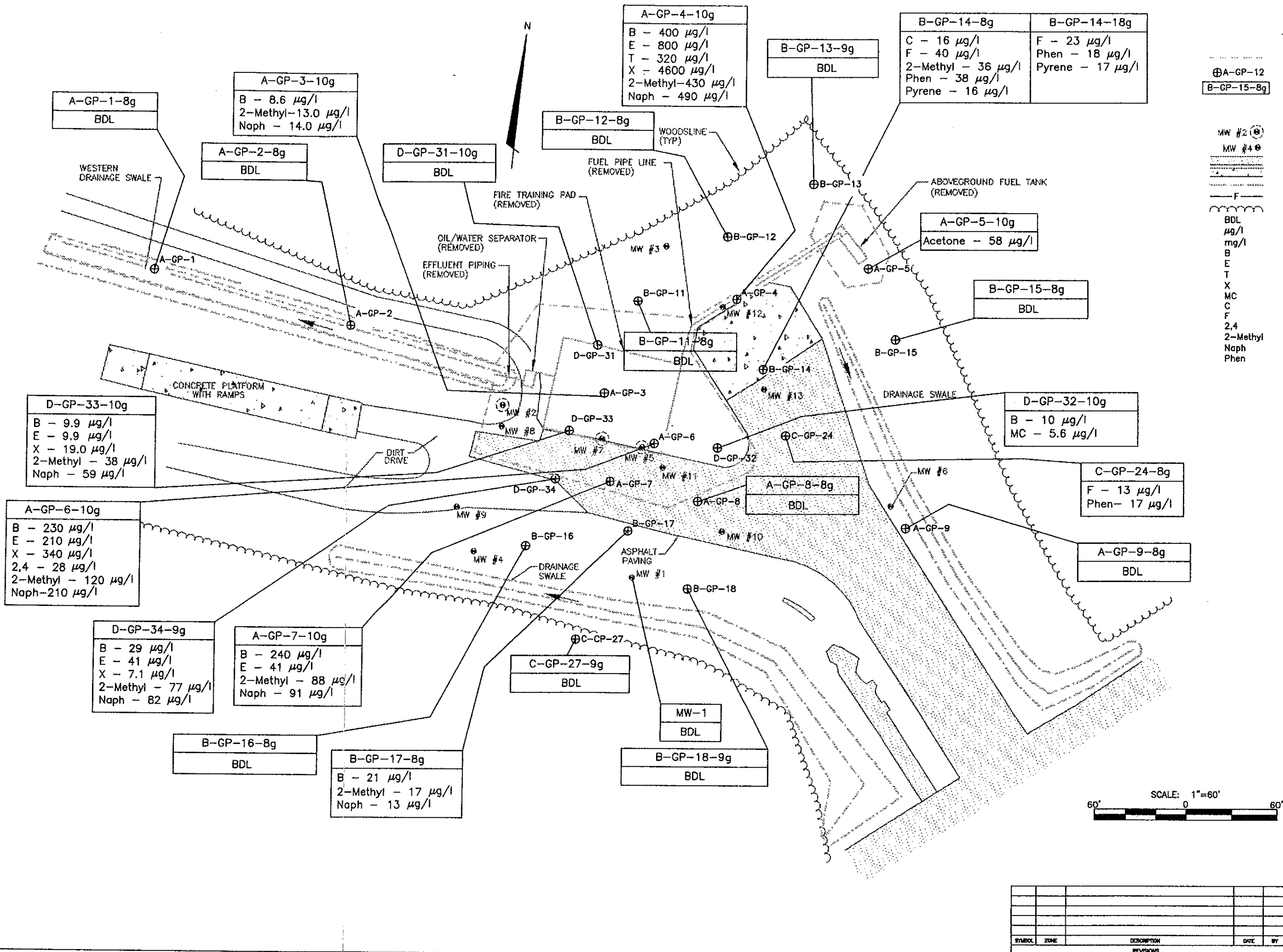
µg/L = micrograms per liter

NA = not analyzed

Bold = the chemical was detected in that sample

The "D" series of samples (e.g., D-GP-31-10g) were not provided for in the Workplan. These groundwater screening DPT b were added in the field to achieve horizontal delineation of the contamination plume.

14-42
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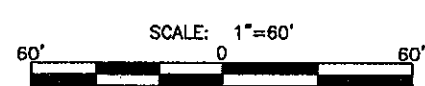


LEGEND

EXCAVATION LIMITS
GEOPROBE SAMPLING LOCATIONS
B-GP-15 = SAMPLE LOCATION
8 = TOP OF INTERVAL IN FEET BGS
FROM WHICH SAMPLE WAS TAKEN
g = GROUNDWATER SAMPLE
MONITORING WELL (REMOVED)
MONITORING WELL

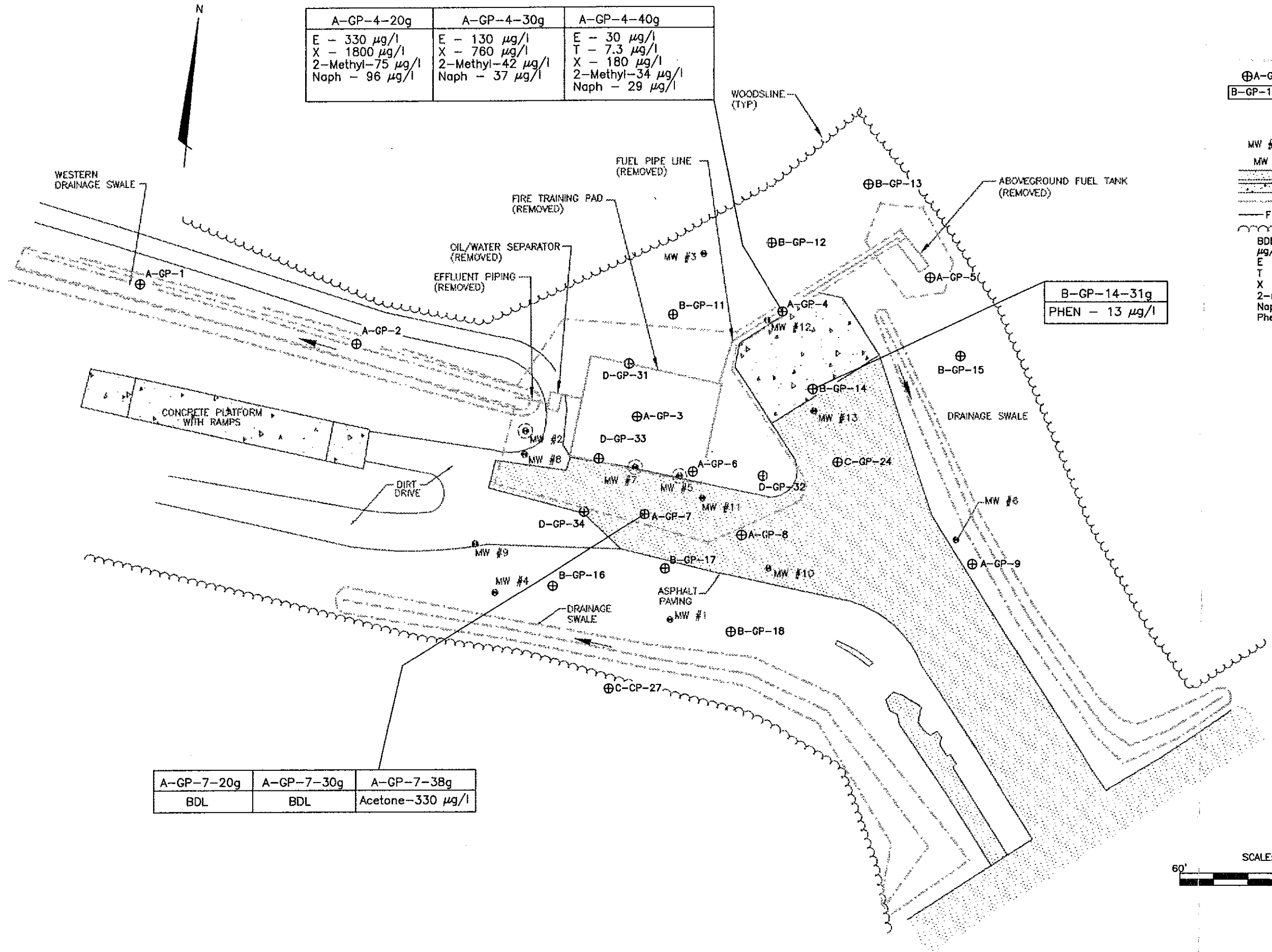
ASPHALT PAVEMENT
CONCRETE PAVEMENT
TOP OF DITCH
FUEL PIPE (REMOVED)
WOODSLINE
BELOW DETECTION LIMIT
micrograms per liter
Milligrams Per Liter
Benzene
Ethylbenzene
Toluene
Xylenes
Methylene Chloride
Carbazole
Fluoranthene
2,4-Dimethylphenol
2-Methylnaphthalene
Naphthalene
Phenanthrene

BDL
µg/l
mg/l
B
E
T
X
MC
C
F
2,4
2-Methyl
Naph
Phen



EASTERN		U.S. ARMY ENGINEER DISTRICT	
CORPS OF ENGINEERS		SANDWICH, GA	
FIGURE 5.3 GROUNDWATER SCREENING RESULTS (< 20 FEET BELOW GROUND SURFACE) FOR THE FORMER FIRE TRAINING AREA AT WAAF(SWMU 13) FORT STEWART, GEORGIA			
DATE	11/1/97	FILE NO.	
BY	D	SCALE	1"=60'
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LEGEND

⊕A-GP-12
⊕B-GP-15-20g

MW #2
MW #4

BDL
 $\mu\text{g/l}$
E
T
X
2-methyl
Naph
Phen

EXCAVATION LIMITS

GEOPROBE SAMPLING LOCATIONS

B-GP-15 = SAMPLE LOCATION
20 = TOP OF INTERVAL IN FEET BGS
FROM WHICH SAMPLE WAS TAKEN
g = GROUNDWATER SAMPLE

MONITORING WELL (REMOVED)

MONITORING WELL

ASPHALT PAVEMENT

CONCRETE PAVEMENT

TOP OF DITCH

FUEL PIPE (REMOVED)

WOODSLINE

BELOW DETECTION LEVEL

Micrograms Per Liter

Ethylbenzene

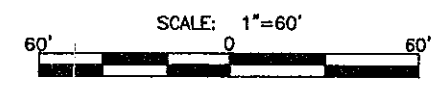
Toluene

Xylenes

2-Methylnaphthalene

Naphthalene

Phenanthrene



EAST		T		EAST		T		EAST		T	
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS SAVANNAH, GEORGIA											
FIGURE 5.4 GROUNDWATER SCREENING RESULTS (> 20 FEET BELOW GROUND SURFACE) FOR THE FORMER FIRE TRAINING AREA AT WAAF(SWMU 13) FORT STEWART, GEORGIA											
SIZE	DATE	BY	DATE	BY	DATE	BY	DATE	BY	DATE	BY	DATE
D											
SCALE: 1"=60'											
SHEET											

15-15

5.4.2 Groundwater Monitoring Well Sampling Results

Groundwater contamination was evaluated using the results from groundwater samples collected from ten permanent monitoring wells, four existing and six newly installed during the RFI field work at the site. These samples were analyzed for VOCs, SVOCs, RCRA metals, and other natural attenuation parameters (i.e., ferric iron, iron and dissolved oxygen). Table 5.4 is a summary of the analytical results of detected analytes for groundwater samples from monitoring wells and Figure 5.5 shows their distribution at the site.

VOCs. MW-12 is located nearest the former fuel pipeline and had the highest contaminant concentration levels measured in monitoring wells at the site. Benzene (440 µg/L), toluene (520 µg/L), ethylbenzene (940 µg/L), and xylene (5300 µg/L) were detected. Benzene was also detected in monitoring wells MW-1, MW-10, MW-11, and MW-13 at concentrations of 6.2 µg/L, 24 µg/L, 260 µg/L, and 120 µg/L, respectively. Ethylbenzene was also detected in MW-11 and MW-13 at concentrations of 45 µg/L and 310 µg/L, respectively. Benzene, toluene, ethylbenzene and xylenes are considered SRCs for groundwater.

SVOCs. Naphthalene and 2-methylnaphthalene were the only SVOCs detected in groundwater samples from monitoring wells. Naphthalene was reported at concentrations of 27 µg/L in MW-11, 140 µg/L in MW-12, and 98 µg/L in MW-13. 2-methylnaphthalene was detected at concentrations of 21 µg/L in MW-11, 72 µg/L in MW-12, and 62 µg/L in MW-13. Both naphthalene and 2-methylnaphthalene are SRCs for groundwater.

RCRA Metals. Barium was the only RCRA metal detected in monitoring well samples, and it was detected in nine of the ten wells sampled. All barium concentrations were below the reference background criteria of 0.030 µg/L. Therefore, no RCRA metals are SRCs for groundwater at SWMU 13.

Other Analytes. Other geochemical parameters, including sulfate, dissolved oxygen, total iron and ferric iron were analyzed in monitoring wells MW-8, MW-9, MW-10, and MW-11 to assist in geochemical evaluation of contaminant fate and transport.

Total iron was detected in all four monitoring wells which were sampled and at concentrations ranging from 0.052 mg/L to 0.71 mg/L. Ferric iron was detected in three monitoring wells, MW-8, MW-9, and MW-11 at concentrations of 0.22 mg/L, 0.22 mg/L, and 0.71 mg/L, respectively. Total iron and ferric iron concentrations were similar, indicating the iron present is in the ferric form rather than the ferrous form. Ferrous iron tends to deplete dissolved oxygen in the groundwater as it is oxidized to the ferric form. Therefore, because the iron is present in the more stable ferric form, the dissolved oxygen that was observed in the groundwater is available for contaminant aerobic biodegradation. Sulfates were reported to be below laboratory detection limits in all wells, and dissolved oxygen values ranged from 1.8 mg/L in MW-11 to 6.0 mg/L in MW-10.

Figure 5.5 shows the distribution of contaminants detected in groundwater at the site. Included on this figure is an interpretation of the areal extent of benzene contamination, primarily interpreted from monitoring

Table 5.4
Summary of Analytes Detected in RFI Groundwater Samples (Monitoring Wells)
SWMU 13, Fort Stewart, Georgia

Detected Analytes	Reference Background Criteria	MW-1	MW-3	MW-4	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13
VOCs (µg/L)											
Benzene	0.00	6.2	<5.0	<5.0	<5.0	<5.0	<5.0	24	260	440	120
Ethylbenzene	0.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	45	940	310
Toluene	0.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	520	<25
Xylenes	0.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	5300	350
SVOCs (µg/L)											
2-Methylnaphthalene	0.00	<10	<10	<10	<10	<10	<10	<10	21	72	62
Naphthalene	0.00	<10	<10	<10	<10	<10	<10	<10	27	140	98
Metals (mg/L)											
Barium	0.030	0.019	0.015	0.015	<0.010	0.019	0.023	0.024	0.021	0.020	0.019
Other Analytes											
Ferric Iron (mg/L)	0.00	NA	NA	NA	NA	0.22	0.22	<0.10	0.71	NA	NA
Iron (mg/L)	0.00	NA	NA	NA	NA	0.22	0.22	0.052	0.71	NA	NA
Dissolved Oxygen (mg/L)	0.00	NA	NA	NA	NA	5.7	5.3	6.0	1.8	NA	NA
Sulfate (mg/L)	0.00	NA	NA	NA	NA	<5.0	<5.0	<5.0	<5.0	NA	NA

Notes:

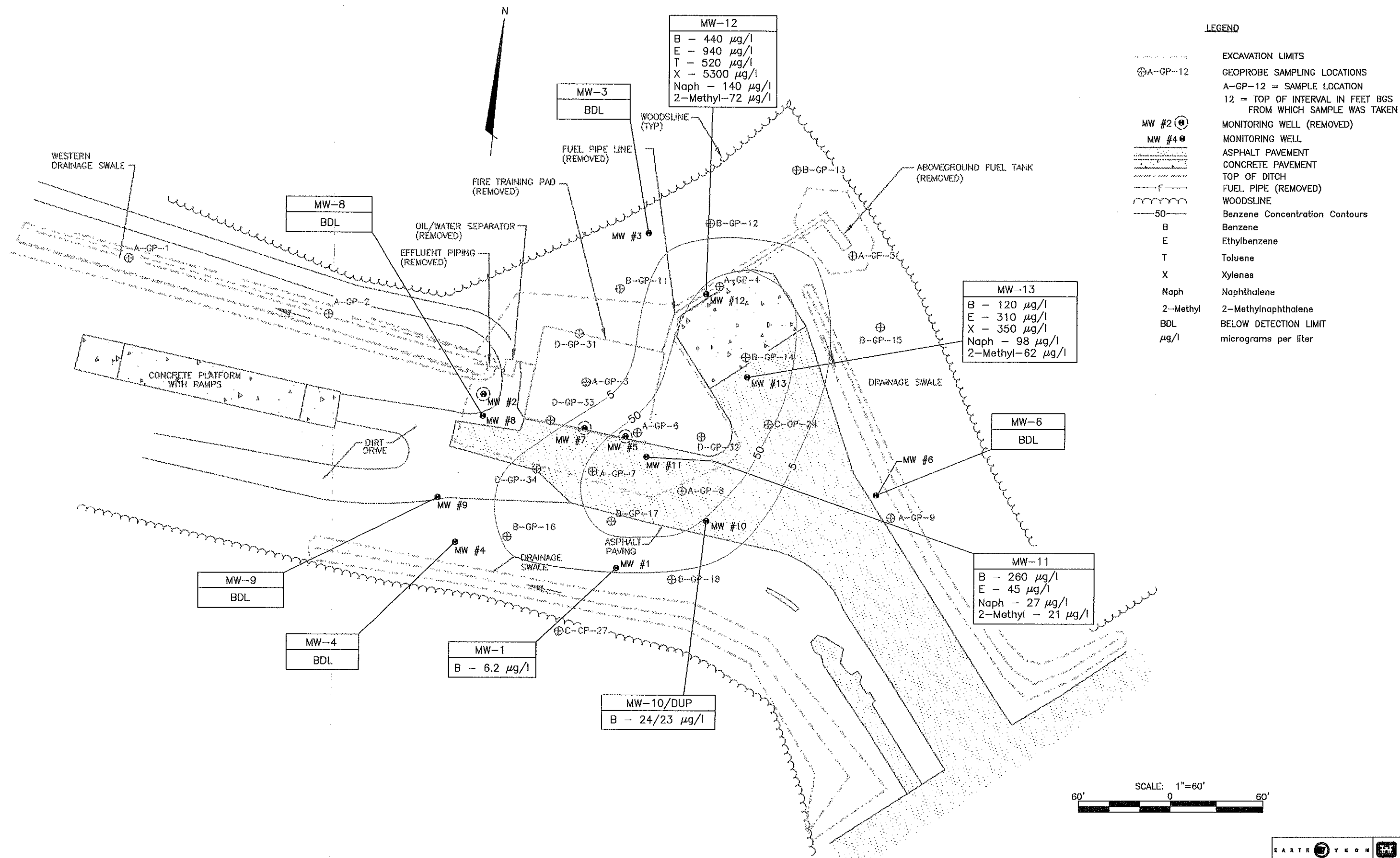
µg/L = micrograms per liter

mg/L = milligrams per liter

NA = not analyzed

Bold = the chemical was detected in that sample

Shaded = the chemical was identified as an SRC



SYMBOL		ZONE	DESCRIPTION	DATE	BY
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SCALE: 1"=60'

FIGURE 5.5
GROUNDWATER ANALYTICAL RESULTS
FROM MONITORING WELLS FOR THE
FORMER FIRE TRAINING AREA AT WAAF(SWMU 13)
FORT STEWART, GEORGIA

U.S. ARMY ENVIRONMENTAL CORPS OF ENGINEERS
SAVANNAH, GA

well data, but also considering screening data from geoprobe samples. Based on the results of this investigation, it is concluded that all SRCs identified for groundwater lie within the footprint of the benzene contamination plume. The areal extent of contamination is relatively limited, being approximately 150 feet by 300 feet (approximately 1 acre).

From groundwater oxygen concentrations, it appears that contaminant biodegradation is taking place. On the fringes of, or outside the area of, contamination, dissolved oxygen concentrations are between 5 and 6 mg/L, whereas, the dissolved oxygen concentration within the contaminant plume (MW-11) is at 1.8 mg/L. The lower dissolved oxygen level within the plume provides evidence that aerobic biodegradation is taking place.

There is evidence to conclude that the contaminant plume is immobile. This evidence includes the time frame available for groundwater contaminant transport (5 to 15 years), evidence of biodegradation, and the fact that the analytical results indicate that the contaminant plume is not increasing in size nor moving from the source area. Contaminant transport will be further addressed in Section 6.0.

5.5 Summary and Conclusions of the Nature and Extent of Contamination

The following summarizes the significant findings of the RFI sampling and analysis for SWMU 13:

- Contamination is present in both soil and groundwater at the site.
- SRCs for surface soil include SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, and pyrene) and barium.
- SRCs for subsurface soil include VOCs (benzene and ethylbenzene), SVOCs (anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene), and metals (barium, chromium and lead).
- The following *additional* subsurface soil SRCs were identified from IM data: VOCs (4-methyl-2-pentanone, acetone, carbon disulfide, chlorobenzene, and toluene); SVOCs (acenaphthene, dibenzo(a,h)anthracene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene); and metals (arsenic and mercury).
- Site related contaminants for groundwater include VOCs (benzene, toluene, ethylbenzene and xylenes) and SVOCs (naphthalene and 2-methylnaphthalene).
- The areal extent of groundwater contamination is limited to approximately one acre.
- There is evidence that contaminant biodegradation is taking place in groundwater at the site.
- The groundwater contaminant plume is not increasing in size nor moving from the source area.

A summary of the SRCs by medium and their maximum concentrations are presented in Table 5.5. SRCs include all organics that are detected and inorganics detected above reference background criteria. These SRCs are carried through for evaluation under fate and transport (Chapter 6.0), human health PRE (Chapter 7.0), and ecological PRE (Chapter 8.0).

Table 5.5
Summary of Site-Related Contaminants
SWMU 13, Fort Stewart, Georgia

Site-Related Contaminants (SRCs)	Surface Soil	Subsurface Soil	IM Data Subsurface Soil	Groundwater Monitoring Well Samples ^a
Volatile Organic Compounds	(µg/kg)	(µg/kg)		(µg/L)
Acetone (SSS)	N/A	N/A	110	N/A
Benzene (SSS,GW)	N/A	N/A	21	440
Carbon disulfide (SSS)	N/A	N/A	13	N/A
Chlorobenzene (SSS)	N/A	N/A	930	N/A
Ethylbenzene (SSS,GW)	N/A	1100	1600	940
4-methyl-2-pentanone (SSS)	N/A	N/A	3800	N/A
Toluene (SSS,GW)	N/A	N/A	980	520
Xylenes (SSS,GW)	N/A	4100	61000	5300
Semivolatile Organic Compounds	(µg/kg)	(µg/kg)		(µg/L)
Acenaphthene (SSS)	N/A	N/A	4500	N/A
Anthracene (SSS)	N/A	510	1100	N/A
Benzo (a) anthracene (SS,SSS)	430	1500	10000	N/A
Benzo (b) fluoranthene (SS,SSS)	560	1800	8200	N/A
Benzo (k) fluoranthene (SS,SSS)	490	1000	8200	N/A
Benzo (g,h,i) perylene (SSS)	N/A	770	2400	N/A
Benzo (a) pyrene (SS,SSS)	390	1100	3700	N/A
Dibenzo (a,h) anthracene (SSS)	NA	NA	4500	N/A
Chrysene (SS,SSS)	430	1400	10000	N/A
Fluorene (SSS)	N/A	NA	4400	N/A
Fluoranthene (SS,SSS)	720	4200	9100	N/A
Indeno (1,2,3-cd) pyrene (SSS)	N/A	730	4500	N/A
1 - Methylanthracene (SSS)	N/A	N/A	18000	N/A
2 - Methylanthracene (SSS,GW)	N/A	N/A	24000	72
Naphthalene (SSS,GW)	N/A	N/A	1800	140
Phenanthrene (SSS)	N/A	2200	1100	N/A
Pyrene (SS,SSS)	620	2800	8100	N/A
Metals	(mg/kg)		(mg/kg)	(mg/L)
Arsenic (SSS)	N/A	N/A	10.4	N/A
Barium (SS,SSS)	20	22	26.6	N/A
Chromium (SSS)	N/A	24	40.4	N/A
Lead (SSS)	N/A	17	11.4	N/A
Mercury (SSS)	N/A	N/A	0.097	N/A

Notes:

µg/L = micrograms per liter

mg/L = milligrams per liter

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

SS = SRC for Surface Soil

SSS = SRC for Subsurface Soil

GW = SRC for Groundwater

N/A = Not applicable

Numerical values represent the maximum detected concentration for the identified SRC for the indicated medium.

^a Groundwater screening data were not used in determining SRCs due to the fact that the data are not reproducible. Groundwater SRCs were determined only from data obtained from permanent monitoring wells at the SWMU 13 site.

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6.0 CONTAMINANT FATE AND TRANSPORT

6.1 Introduction

This chapter is a description of the potential groundwater migration pathways and mechanisms for transport of SRCs found in surface soils, subsurface soils, and groundwater at SWMU 13. Based on the information presented in previous sections, the refined conceptual site model (CSM) is developed in this chapter. Section 6.2 discusses the persistence, mobility, and other physical and chemical properties of the organics and metals found at SWMU 13. Section 6.3 presents the components of the conceptual model and describes contaminant release mechanisms through the primary transport medium (groundwater). Section 6.4 discusses the fate and transport of the contaminants at SWMU 13 with respect to their leachability and natural attenuation in the groundwater.

6.2 Physical and Chemical Properties

The fate and transport of organic compounds and metals are functions of both site characteristics and the physical/chemical properties of the contaminants. Such properties include solubility in water, tendency to transform or degrade (usually described by a half-life or an environmental half-life in a given medium), and chemical affinity for solids or organic matter (usually described by a partitioning coefficient K_d , K_{oc} , or K_{ow}). These properties and how they affect inorganic and organic contaminant behavior are described below.

6.2.1 Metals

No inorganic SRCs were identified in the groundwater at this site. The inorganic SRCs identified at SWMU 13 for soils are arsenic, barium, chromium, lead, and mercury. These metals are subject to movement with soil moisture, and may be transported through the vadose zone to groundwater. Metals do not degrade, although some metals can transform to other oxidation states in soil, altering their mobility and toxicity. Metals also react with soils or other solid surfaces by ion exchange, adsorption, precipitation, or complexation. Such reactions are affected by pH, oxidation-reduction conditions, and the type and amount of organic matter, clay, and hydrous oxides present. In general, these reactions are reversible and cause a chemical's mobility to be retarded. The retardation factor (R_d) is the ratio of the rate of groundwater flow to the rate of chemical transport (i.e., if $R_d = 2$, the groundwater moves twice as fast as the chemical). The R_d can be derived from the partitioning coefficient (K_d), expressed by the following relation (assuming linear sorption):

$$R_d = 1 + K_d \cdot \rho_b / \theta \quad (6-1)$$

where: K_d = the linear partition coefficient for the contaminant (ml/g),
 ρ_b = the soil bulk density (g/cm³),
 θ = porosity (unitless).

K_d for the metals at this site may vary by large ranges. It has been found that K_d can even vary by orders of magnitude among samples from the same site. The range of K_d values (obtained from EPA 1996a) and the corresponding range of calculated R_d for SWMU 13 are presented in Table 6.1.

Table 6-1
List of Distribution Coefficients for the Inorganic SRCs for the SWMU 13

SRCs	K_d^a (L/kg)	R_d^b
Arsenic	29	135
Barium	4	19.5
Chromium	19	89
Lead	270 (100 to 59,000) ^c	1,250 (464 to 270,000)
Mercury	52	242

^aThe K_d values correspond to pH=6.8 (EPA 1996a) unless otherwise indicated.

^b R_d is calculated using K_d , average bulk density of 1.68 gm/cm³ and the average moisture content of 36.3%.

^cSheppard and Thibault 1990.

K_d = Distribution coefficient

R_d = Retardation factor

6.2.2 Organic Compounds

The organic SRCs in soils at SWMU 13 site include both VOCs and SVOCs. These contaminants may be degraded in the environment by various processes, including hydrolysis, oxidation/reduction, photolysis, or biodegradation. Half-lives of organic compounds in various media can vary from minutes to years, depending on both the chemical properties and the environmental conditions. Degradation may either enhance or reduce the toxicity of a chemical. Biodegradation rates for the organic SRCs are presented in Table 6.2. These values are based on the biodegradation half-lives taken from the *Handbook of Environmental Degradation Rates* (Howard et al. 1991). Although a range of values is presented in this book, only the lowest biodegradation rates, corresponding to the highest half-lives, are presented here to ensure conservatism in discussing contaminant loss through degradation/decay.

The mobility of an organic compound in environmental media is affected by its volatility, its partitioning behavior between solids and water, its water solubility, and its concentration. The Henry's Law constant (K_H) for a compound is a measure of the ratio of the compound's vapor pressure to its aqueous solubility. The K_H value can be used to make general predictions about the compound's tendency to volatilize from water. Substances with K_H values less than 10⁻⁷ atm/m³/mol will generally volatilize slowly while compounds with K_H greater than 10⁻³ atm/m³/mol will volatilize rapidly. Vapor pressure is a measure of the pressure at which a compound and its vapor are in equilibrium. The value can be used to determine the extent to which a compound would travel in air, as well as the rate of volatilization from soils and solution. In general, compounds with vapor pressures lower than 10⁻⁷ mm Hg will not be present in the atmosphere or soil air in significant amounts, while compounds with vapor pressures higher than 10⁻² mm Hg will exist primarily in the air. Unless the soil is saturated, VOCs will exist primarily in the atmosphere and soil air. PAHs and other SVOCs will exist in both the air and the soil.

Table 6-2. Physical and Chemical Properties of Organic Site-related Contaminants at SWMU 13

Constituents	Mol. Wt	Solubility S _w (mg/L)	S _w @ Temp. °C	K _{ow} (mL/mL)	Vapor Pressure (torr @ °C)	Henry's Constant (K _h) atm·m ³ /mol	K _h @ Temp. °C	Air Diff. Coeff. cm ² /s	K _{oc} mL/g	Biodegradation Rate λ 1/day	Log (K _{ow})
<i>Volatile Organic Compounds</i>											
4-Methyl-2-pentanone	100.2	1.91E+04		5.25E+00	10 @ 30	1.03E-06		0.078	3.31E+00	2.48E-02	0.72
Acetone	58.1	1.00E+06	e	5.75E-01	270 @ 30	3.88E-05	e	0.110	5.75E-01	2.48E-02	-0.24
Benzene	78.1	1.75E+03	e	1.35E+02	95 @ 25	5.55E-03	e	0.088	6.20E+01	9.63E-04	2.13
Carbon disulfide	76.1	2.90E+03	e	1.45E+02	298 @ 20	2.94E-04	e	0.105	4.57E+01		2.16
Chlorobenzene	112.6	4.88E+02	e	6.92E+02	11.8 @ 25	3.93E-03	e	0.073	2.24E+02	1.16E-03	2.84
Ethylbenzene	106.2	1.52E+02	e	1.41E+03	10 @ 25.9	7.88E-03	e	0.075	2.04E+02	3.04E-03	3.15
Toluene	92.1	5.15E+02	e	4.90E+02	28 @ 25	6.64E-03	e	0.087	1.40E+02	3.30E-03	2.69
Xylenes	106.2	2.00E+02	e	5.89E+02	5 @ 20	5.25E-03	e	0.073	1.96E+02	1.93E-03	2.77
<i>Semivolatile Organic Compounds</i>											
1-Methylnaphthalene	142.2	2.70E+01	e	7.41E+03	10 @ 108	7.1E-04	h	0.056	4.67E+03		3.87
2-Methylnaphthalene	142.2	2.60E+01	e	7.24E+03	10 @ 105	2.20E-02		0.056	4.56E+03		3.86
Acenaphthene	154.2	3.42E+00	e	8.32E+03	10 @ 131	2.41E-04	e	0.062	4.90E+03	1.70E-03	3.92
Anthracene	178.2	1.29E+00	e	2.82E+04	1.95E-4 L	6.50E-05	e	0.042	2.35E+04	3.77E-04	4.45
Benzo(a)anthracene	228.3	9.4E-03	e	4.07E+05	5E-9 @ 20	3.35E-06	e	0.051	3.58E+05	2.55E-04	5.61
Benzo(a)pyrene	252.3	3.80E-03	e	9.55E+05	5E-9 @ 21	1.13E-06	e	0.043	9.69E+05	3.27E-04	5.98
Benzo(b)fluoranthene	252.3	1.50E-03	e	3.72E+06	5E-7 L	1.11E-04	e	0.0226	1230000	2.84E-04	6.57
Benzo(k)fluoranthene	252.3	3.00E-04	#	6.92E+06	1E-11 @ 20	8.29E-07	e	0.044	1.23E+06	8.10E-05	6.84
Benzo(g,h,i)perylene	276.3	2.60E-04	e	1.70E+07	1E-10 @ 20	1.40E-07	e	0.042	1.07E+07	2.67E-04	7.23
Chrysene	228.3	6.00E-03	e	4.07E+05	6.3E-9 @ 25	9.46E-05	e	0.046	3.98E+05	1.73E-04	5.61
Fluoranthene	202.3	2.06E-01	e	2.14E+05	5E-6 L	1.61E-05	e	0.0302	4.91E+04	3.94E-04	5.12
Fluorene	166.2	1.98E+00	e	1.62E+04	10 @ 146	6.36E-05	e	0.0363	7.71E+03	2.89E-3	4.21
Dibenzo(a,h)anthracene	278.4	2.49E-03	e	9.33E+05	1E-10 L	7.30E-08	e	0.0202	1.79E+06	1.84E-04	5.97
Naphthalene	128.2	3.10E+01	e	2.29E+03	0.082 @ 25	4.83E-04	e	0.059	1.19E+03	2.69E-03	3.36
Phenanthrene	178.2	8.16E-01	e	2.88E+04	1 @ 118	3.93E-05	e	0.054	1.82E+04	8.66E-04	4.46
Pyrene	202.3	1.35E-01	e	1.51E+05	2.5 @ 200	1.10E-05	e	0.0272	6.80E+04	9.12E-05	5.18

* = Represents calculated values.

e = Soil Screening Guidance: Technical Background Document (EPA 1996) is the source.

h = EPA 1987

m = Measured K_{oc} values.

x = Calculated K_{oc} values from Soil Screening Guidance: Technical Background Document (EPA 1996).

= Indicates STF database (EPA 1991a) as the source.

A blank indicates value not available.

Air diffusion coefficients were obtained from EPA 1987 unless otherwise indicated.

Biodegradation half-lives were taken from the Handbook of Environmental Degradation Rates (Howard et al. 1991) unless otherwise indicated.

Solubilities, Henry's Constant, and Log (K_{ow}) were taken from Risk Reduction Engineering Laboratory (RREL) Treatability Database (EPA 1994a) unless otherwise indicated.

Water solubility and the tendency to adsorb to particles or organic matter can correlate with retardation in groundwater transport. The K_d of an organic compound is related to the organic carbon/water partition coefficient (K_{oc}) by the following equation:

$$K_d = f_{oc} \times K_{oc} \quad (6-2)$$

where:

- K_d = the linear partition coefficient (ml/g),
- f_{oc} = fraction of soil organic carbon content,
- K_{oc} = organic/water partitioning coefficient (ml/g).

Chemical-specific K_{oc} values may be obtained from the literature or may be calculated using empirical formulas relating the octanol-water partitioning coefficient (K_{ow}) to the K_{oc} . The K_{ow} (mL/mL) is the ratio of a contaminant's concentrations in a system containing water and octanol. The most commonly used formula to relate K_{ow} to K_{oc} is given by Mills et al. 1985:

$$K_{oc} = 0.63 \times K_{ow}. \quad (6-3)$$

Chemicals with relatively high water solubilities and low adsorption coefficients (e.g., benzene) are expected to remain primarily as dissolved phases and be transported at rates more closely to that of the groundwater flow. Chemicals with lower water solubilities and higher adsorption coefficients [e.g., benzo(a)pyrene] are expected to remain primarily adsorbed to the surface of the soils, and their transportation with the groundwater would be much more retarded. Table 6.2 presents physical and chemical properties of the organic SRCs that includes the solubility, Henry's Law constant (K_H), vapor pressure, biodegradation rate constants, and partitioning coefficients.

6.3 Conceptual Site Model

The CSM is a statement of expected site conditions (sources, impacted media, release mechanisms, and migration pathways) that serves as a system within which observations can be compared and predictions can be made. The predictive function of the CSM, of primary importance to contaminant fate and transport analysis, relies on known information and informed assumptions about the site. The better the information and the greater the accuracy of the assumptions, the more accurately the CSM describes the site, resulting in more reliable predictions.

The CSM presented in this section summarizes the hydrogeologic components (presented in Section 4.0) and the distribution of contaminants in the subsurface soils and groundwater (presented in Section 5.0). Contaminant migration pathways and release mechanisms are also based on the information presented in Section 5.0. The CSM for contaminant fate and transport at SWMU 13 is illustrated in Figure 6.1. A summary of the model elements follows.

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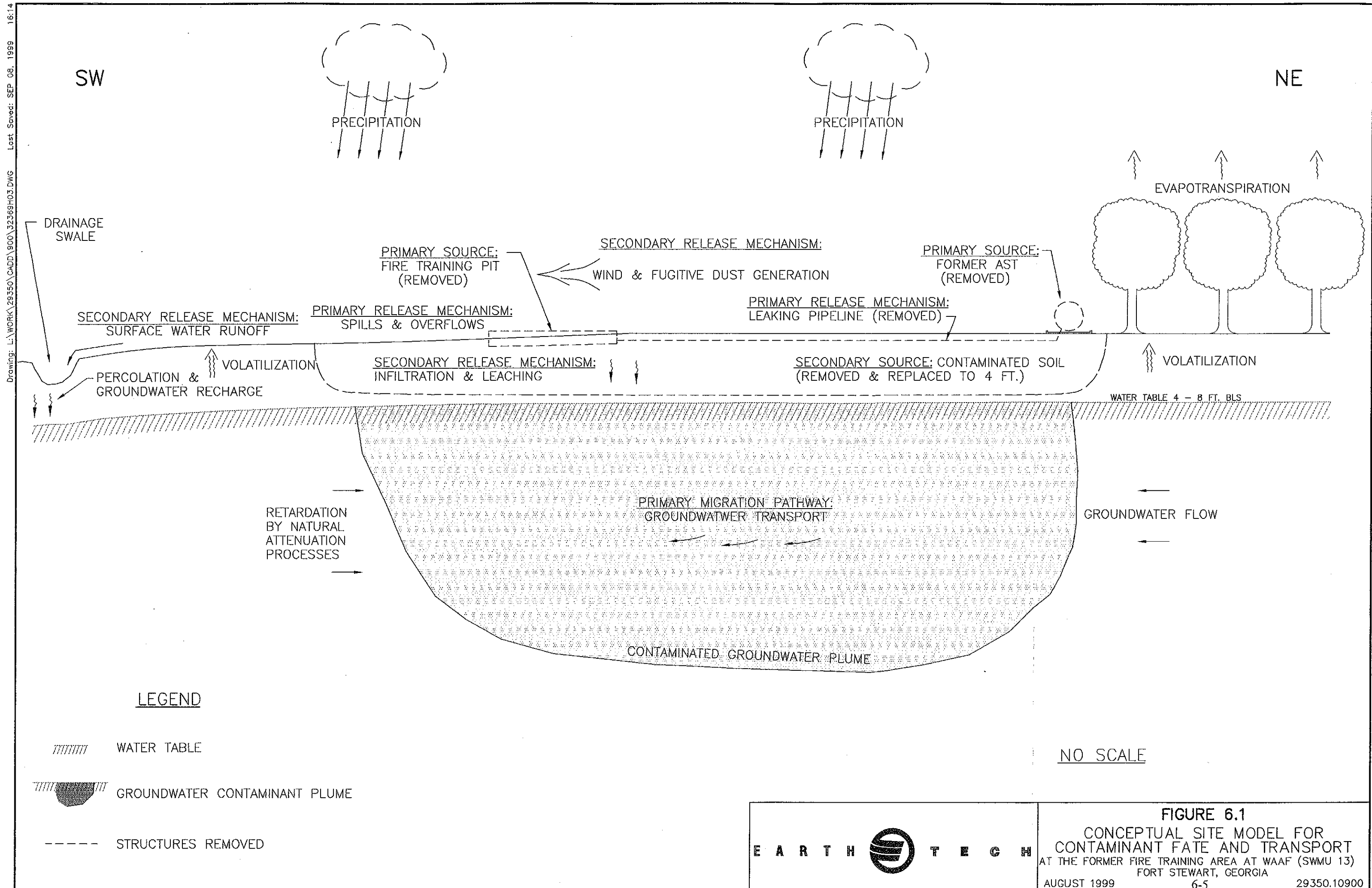


FIGURE 6.1
CONCEPTUAL SITE MODEL FOR
CONTAMINANT FATE AND TRANSPORT
AT THE FORMER FIRE TRAINING AREA AT WAAF (SWMU 13)
FORT STEWART, GEORGIA
AUGUST 1999 6-5 29350.10900

6.3.1 Water Balance Components

The potential for contaminant transport begins with precipitation. The actual amount of rainwater available for flow is highly variable and dependent upon soil type and climatic conditions. A water balance calculation can be used as a tool to quantitatively account for all the components of the hydrologic cycle at SWMU 13. The components of a simple steady-state water balance model include: precipitation (P), evapotranspiration (ET), surface runoff (Sr), and groundwater recharge or percolation (Gr), and is defined as follows:

$$P = ET + Sr + Gr. \quad (6-4)$$

Or, after rearranging to solve for the amount of rain water available for flow (Sr + Gr):

$$\text{Rainwater available for flow} = Sr + Gr = P - ET. \quad (6-5)$$

Water balance estimates for the Fort Stewart area were based on Hydrologic Evaluation of Landfill Performance (HELP) model calculations (EPA 1994) using precipitation and temperature data for the years 1974 through 1978 at Savannah, Georgia. These estimates indicate that average annual precipitation is 48 inches. Evapotranspiration accounts for 31.4 inches (65%) of this total, and surface runoff (1.8 inches, or 4%) and groundwater recharge (14.7 inches, or 31%) make up the remainder. The rainfall available for flow, to potentially transport contaminants at the site, is 16.6 inches, or 35 percent of the rain falling on the site.

6.3.2 Contaminant Sources and Impacted Media

Past and current pathways are listed below:

- Liquids (fuel, water, and other fire-fighting chemicals) used at the former Fire Training Area overflowed by way of dousing the fire on the pad with water during fire-fighting exercises, or they were spilled during operations. These liquids infiltrated the surface and subsurface site soils and contaminated the surface and subsurface soil with petroleum hydrocarbons.
- Rainwater percolating through contaminated soil below SWMU 13 leached contaminants and transported contaminants to the water table.
- Runoff from surface contaminants and/or drainage/overflow from the oil/water separator migrated to the wooded swale west of the site.
- Fluctuating groundwater levels contacted contaminated soil and distributed contaminants in the soil at the water table interface.
- Groundwater flow transported contaminants within the water table aquifer toward Peacock Creek.

Additional current pathways may include:

- Organic compounds in groundwater and probably in soil are being attenuated by biological, physical, and chemical processes.
- Organic compounds in soil and probably in groundwater are being volatilized.
- Contaminants migrate in the local surficial groundwater via advection.

It should be noted that the first four feet of contaminated soil were excavated and disposed as part of the IM in 1997. Only the first four feet were excavated because the water table fluctuates between approximately 4 to 8 feet below land surface, and excavation below the saturated zone was determined not to be advantageous. The SRCs determined to still be present in subsurface soils are at depths greater than 4 feet, and are most likely present due to contaminant transfer between the soil and groundwater as the water table fluctuates. Therefore, because of the IM, the leaching of contaminants by rainfall percolation is essentially limited as a contaminant migration pathway.

6.3.3 Release Mechanisms

Historically, the principal release mechanism was the spilling of waste liquids and fuel during operations or overflow of the oil/water separator, directly contaminating both surface and subsurface soils. Precipitation that does not leave the site as surface runoff infiltrates into the subsurface soil. Some of this infiltrating water leaves the subsurface environment via evapotranspiration after little or no subsurface flow. The remainder of the water percolates into the subsurface flow system. The rate of percolation is controlled by soil cover, ground slope, saturated conductivity of the soil, and meteorological conditions. As discussed previously, the rate of groundwater recharge at this site is quite high (14.7 inches per year).

Water infiltrating through any contaminated surface and subsurface soils leached contaminants into the groundwater as a secondary release mechanism. The factors that affect leaching rate include a contaminant's solubility and K_d and the amount of percolation. Insoluble compounds will not dissolve into percolating groundwater and will tend to remain in their insoluble form with little leaching. Those contaminants with a small adsorption coefficient, K_d , exhibiting low degrees of adsorption, will be leached more effectively than those with a larger K_d . As previously mentioned, the near surface soils were removed during the IM, so the contamination seen in the subsurface soil and groundwater was likely transported to these media prior to the IM.

Another factor that affects the persistence of a contaminant is the contaminant's rate of decay. Most of the organic compounds decay or breakdown at characteristic rates that are described by the substance's half-life. For a given percolation rate, those contaminants with long half-lives have a greater potential for contaminating groundwater than do those contaminants with shorter half-lives. Organic contaminants with shorter half-lives and higher adsorption coefficients can be completely degraded before reaching the water table.

Release by gaseous emission and airborne particulates is often an important mechanism, although it is not significant at SWMU 13. VOCs in surface soil are emitted to air by volatilization. The rate of emission is controlled by the vapor pressure of the organic compounds and decreases rapidly over a short period of time as the volatiles are depleted by release to the atmosphere. VOCs in the subsurface soils are emitted to the atmosphere by vertical diffusion through soil pores. In SWMU 13, concentrations of contaminants in the surface soil are relatively insignificant so gaseous emissions to the atmosphere would be minor. However, volatilization of subsurface contaminants could be an important mechanism for redistributing volatile compounds in the subsurface.

Particulate matter from contaminated surface soil can become airborne as a result of wind erosion. This process is controlled by vegetative cover, wind speed, moisture and other fluids, and soil grain size in the surface soils. Wind erosion is not likely to be significant at SWMU 13 because of vegetative cover and pavements.

6.3.4 Migration Pathways

The most likely pathways of contaminant migration at this site are via (1) leaching of any remaining surface and/or subsurface contaminant to groundwater; (2) groundwater flow east/southeast toward Peacock Creek; (3) surface water drainage and overland flow from SWMU 13 to the drainage swales located north, east, south, and west of the site; and (4) infiltration of surface water runoff from the swales to groundwater.

In the saturated zone, the contaminants are carried laterally, either in solution or adsorbed to fine particulates (colloids), to the hypothetical receptor locations. The flow rate is a function of aquifer characteristics (hydraulic conductivity) and the hydraulic gradient. The average saturated hydraulic conductivity for the SWMU 13 site is 1.12×10^{-3} cm/sec, or 3.17 ft/day (Section 4.0). The average horizontal hydraulic gradient at the site is 0.004 ft/ft with groundwater flow predominantly to the south and east. Assuming an effective porosity of 0.33 [based on specific yield of fine sands (Mills et. al. 1985)], the groundwater seepage velocity is calculated to be approximately 14 feet/year towards the Peacock Creek, the nearest potential receptor which is located approximately 2,500 feet downgradient from SWMU 13. Therefore, it is expected to take 178 years for the site groundwater to reach the nearest potential receptor.

6.4 Fate and Transport Analysis

6.4.1 Soil Leachability Analysis

Contaminant fate and transport analysis at SWMU 13 under the RFI involves a series of screening steps to define the contaminant migration constituents of potential concern (CMCOPCs). The CMCOPCs are defined as the constituents that may pose the greatest problem if they migrate from the site source.

The first step of the screening process represents the development of the SRCs. The SRCs are selected by comparing the maximum detected concentrations of all the analytes measured in surface and subsurface soils with their respective FMSR reference background criteria. The FMSR reference background criteria represent the average background concentration multiplied by a factor of two. If the maximum concentration

of an analyte in the soil exceeds its reference background criterion, then that analyte is selected as an SRC. SRCs for surface and subsurface soil are identified in Section 5.0, and are summarized in Table 5.5.

The second step of the screening process involves comparing the maximum concentrations of the SRCs, developed in the previous step, with EPA generic soil screening levels (GSSLs). The GSSLs are set for Superfund sites for the migration to the groundwater pathway (GAEPD 1996).

If an EPA-suggested GSSL for a constituent was not available, the GSSL was either obtained from EPA Region 3 suggested risk based soil screening levels (EPA 1999) or back-calculated from the target leachate concentration following EPA's soil screening guidance (EPA 1996a). The target leachate concentration was assumed to be equal to the maximum contaminant level (MCL) of the constituent, if available; otherwise, the EPA Region 3-suggested risk-based concentration (RBC) for tap water corresponding to a 10^{-6} risk or hazard index (HI) = 1 was used (SAIC 1999).

The equation given in the soil screening guidance (EPA 1996a) is as follows:

$$\text{Screening Level in Soil} = C_w [K_d + (\theta_w + \theta_a H') / \rho_b],$$

where

C_w = target leachate concentration in (mg/L),

K_d = soil-water partition coefficient (L/kg) = $K_{oc} \times foc$ (for organics),

K_{oc} = soil organic carbon/water partition coefficient (L/kg),

foc = 0.002 (EPA 1996a),

θ_w (water-filled porosity) = 0.3 (EPA 1996a),

θ_a (air-filled porosity) = 0.13 (EPA 1996a),

H' = dimensionless Henry's Law constant,

ρ_b (bulk density) = 1.5 gm/cubic-meter (EPA 1996a).

In the derivation of EPA GSSLs [dilution attenuation factor (DAF) = 1], direct partitioning is used, assuming groundwater is in contact with the analytes in soil; the groundwater concentration is assumed to be equal to the leachate concentration. However, as soil leachate moves through soil, contaminant concentrations are attenuated by adsorption and degradation. When the leachate reaches the water table, dilution by groundwater further reduces leachate concentrations. This reduction in concentration can be expressed by a DAF. A DAF of 20 is protective for sources up to 0.5 acre in size (EPA 1996a). Analyses presented in Appendix A of EPA's soil screening guidance (EPA 1996a) indicate that DAF of 20 can be protective of larger source areas as well. Considering the small soil contamination area of the majority of Fort Stewart's SWMUs, a DAF of 20 was used for organics. Although metals have higher adsorption factors, they do not biodegrade in the environments. The adsorption factor of a metal is a function of pH. Usually, adsorption of metals in soil is lower for a lower pH. For conservatism, a DAF of 20 was used for metals if the average pH of groundwater at the site was greater than or equal to 5 and the soil contamination area of the site was less than or equal to 0.5 acre in size. If the average pH of groundwater

was less than 5 and the soil contamination area of the site was greater than 0.5 acre, then a DAF of 1 was used for metals. The average pH in groundwater at SWMU 13 was lower than 5 (Table 3.3).

The GSSL is defined as the concentration of a contaminant in soil that represents a level of contamination below which there is no concern under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), provided conditions associated with soil screening levels (SSLs) are met. Generally, if contaminant concentrations in soil fall below the GSSL and there are no significant ecological receptors of concern, then no further study or action is warranted for that area. However, it should be noted here that the purpose of this screening is not to identify the contaminants that may pose a risk at a downgradient location, but to target those contaminants that may pose the greatest problem if they migrate from the site. SRCs were identified as preliminary CMCOPCs if they exceeded the GSSL. To evaluate leaching of CMCOPCs at the SWMU 13 from soil to groundwater, modeled and observed groundwater concentrations of CMCOPCs were compared to MCLs. If an MCL for the chemical was not available, the groundwater concentration was compared to the EPA Region 3-suggested RBCs corresponding to a 10^{-6} risk or an HQ of 0.1, whichever is lower.

The results of the GSSL screening are presented in Table 6.3. Among the volatile organic chemicals, only 4-methyl-2-pentanone exceeded its respective GSSL. Among the semivolatile organics, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and 2-methylnaphthalene exceeded their respective GSSLs. Two RCRA metals (arsenic and chromium) exceeded their GSSLs. The constituents that exceeded their GSSLs were identified as preliminary CMCOPCs.

These inorganic and organic preliminary CMCOPCs were further evaluated using the SESOIL modeling, as discussed in the following section.

6.4.2 SESOIL Modeling of the Contaminant Migration COPCs

Vadose zone modeling of preliminary CMCOPCs using the Seasonal Soil Compartment (SESOIL) model (Appendix G) was performed for SWMU 13. The SESOIL model was used to predict the maximum groundwater concentration of the CMCOPCs in soil.

The input data for SESOIL can be grouped into four types: climatic, chemical, soil, and application data. There are a total of 61 separate parameters contained in these four data groups. Wherever possible, site-specific parameter values were used for modeling. Certain parameters, however, were not available and were estimated based on a pertinent scientific literature search, geochemical investigations, and consistency checks between model results and historical data. Conservative estimates were used when a range of values was indicated or when parameter values were not available.

6.4.2.1 Climate data

The climatic data file of SESOIL consists of an array of values for various climatic parameters (Appendix G, Table G-1). The climatic parameters were taken from the SESOIL database. The nearest climatic station to SWMU 13 in the SESOIL database is Savannah, Georgia.

Table 6.3
GSSL Screening of SRCs in Soil
SWMU 13, Fort Stewart, Georgia

Site-Related Contaminants (SRCs)	Max Concentration in Surface and Subsurface Soil	GSSL ^a	Preliminary CMCOPC?
Volatile Organic Compounds	(µg/kg)	(µg/kg)	
Acetone	110	16,000	No
Benzene	21	30	No
Carbon disulfide	13	32,000	No
Chlorobenzene	930	1,000	No
Ethylbenzene	1,600	13,000	No
4-methyl-2-pentanone ^c	3,800	1,300	Yes
Toluene	980	12,000	No
Xylenes	61,000	190,000	No
Semivolatile Organic Compounds	(µg/kg)	(µg/kg)	
Acenaphthene	4,500	570,000	No
Anthracene	1,100	12,000,000	No
Benzo(a)anthracene	10,000	2,000	Yes
Benzo(b)fluoranthene	8,200	5,000	Yes
Benzo(k)fluoranthene	8,200	49,000	No
Benzo(g,h,i)perylene ^{b,d}	2,400	394,000	No
Benzo(a)pyrene	3,700	8,000	No
Dibenzo(a,h)anthracene	4,500	2,000	Yes
Chrysene	10,000	160,000	No
Fluoranthene	9,100	4,300,000	No
Fluorene	4,400	560,000	No
Indeno(1,2,3-cd)pyrene	4,500	14,000	No
1-Methylnaphthalene ^{c,e}	18,000	22,231	No
2-Methylnaphthalene ^c	24,000	22,231	Yes
Naphthalene	1,800	84,000	No
Phenanthrene ^{b,f}	2,200	80,400	No
Pyrene	8,100	4,200,000	No
Metals	(mg/kg)	(mg/kg)	
Arsenic	10.4	1	Yes
Barium	26.6	82	No
Chromium	40.4	2	Yes
Lead ^g	17	400	No
Mercury	0.097	0.1	No

Notes:

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

^a GSSL = EPA GSSL with a DAF of 1 for inorganics and a DAF of 20 for volatile and semivolatile organics. A DAF of 1 for inorganics was used because average pH of groundwater is less than 5 (Table 3.3); unless otherwise indicated (SAIC 1999a), GSSL is taken from Soil Screening Guidance: Technical Background Document (EPA 1996a).

^b EPA-suggested GSSL is not available; GSSL is calculated following Soil Screening Guidance: Technical Background Document (EPA 1996a). GSSLs are back-calculated from MCL, if available; otherwise, GSSLs are back-calculated based on EPA Region III RBCs corresponding to 10⁻⁶ risk or HQ = 1 (SAIC 1999).

^c GSSL taken from EPA Region III suggested SSL for groundwater migration (EPA 1999a).

^d To develop GSSL, RBC is taken from benzo(b)fluoranthene with a TEF = 0.01.

^e GSSL is taken from the GSSL of 2-methylnaphthalene.

^f RBC to develop GSSL is taken from the surrogate pyrene.

^g A screening level of 400 mg/kg is used for lead based on Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (EPA 1994c).

The pollutant fate cycle of SESOIL focuses on the various chemical transport and transformation processes that may occur in the soil zone. These processes include volatilization/diffusion, adsorption/desorption, cation exchange, biodegradation, hydrolysis, and metal complexation. The chemical's solubility in water, air diffusion coefficient, Henry's Law constant, and organic carbon partitioning coefficient are parameters required as input to the model. These chemical-specific values are presented in Table 6.2.

The lowest biodegradation rates from the Handbook of Environmental Degradation Rates (Howard et al. 1991), presented in Table 6.2, were used. If the biodegradation rate of a chemical was not found in the literature, it was assumed to be zero. The process of hydrolysis was not considered in this study because the rates of hydrolysis for certain organic chemicals may vary by more than 14 orders of magnitude. The use of such values in the model would place a high degree of uncertainty on the SESOIL results. Therefore, hydrolysis parameters were set to zero for this analysis, resulting in conservative output.

6.4.2.2 Soil data

The soil data file of SESOIL contains input parameters describing the physical characteristics of the subsurface soil. The parameters include: soil bulk density, intrinsic permeability, soil disconnectedness index, soil porosity, organic carbon content, soil moisture content, infiltration rate, depth to the water table, aquifer thickness, and area of the source. The infiltration rate was based on a water balance calculation using the HELP model (EPA 1994b) (see Section 6.3.1).

If a site-specific soil parameter was not available, a conservative default value was used (Appendix G, Table G-2.). There is no measurement method for the Freundlich exponent (used in calculating the adsorbed contaminant concentration); therefore, the SESOIL default value was used for this parameter. The intrinsic permeability for the vadose zone was calibrated. The soil disconnectedness index replaces moisture retention curves (or characteristic curves) used by other unsaturated zone leaching models. The SESOIL User's Guide (General Sciences Corporation 1996) defines this parameter as being the exponent relating the "wetting" and "drying" time-dependent permeability of soil to its saturated permeability. This one-variable approach of using the soil disconnectedness index in SESOIL simplifies the data estimation process and reduces computation time.

6.4.2.3 Initial condition/source-term concentrations

Analytical data from soil samples collected from within SWMU 13 were used as initial concentrations for SESOIL modeling. These data are presented in Chapter 2.0 (IM data) and Chapter 5.0 (RFI data). The loading of initial concentrations as input to SESOIL was based on the soil sampling intervals. The initial condition/source-term concentrations are presented in Appendix G, Table G-3.

6.4.2.4 Model application

The SESOIL model used for leachate modeling in the RFI estimates pollutant concentrations introduced into the subsurface via direct application and/or interaction with other media. The model defines the soil compartment as a column extending from the ground surface through the unsaturated zone to the upper level of the saturated soil zone. Processes simulated in SESOIL are categorized in three cycles: hydrologic cycle,

sediment cycle, and pollutant cycle. Each cycle is a separate submodule in the SESOIL code. The hydrologic cycle includes rainfall, surface runoff, infiltration, soil-water content, evapotranspiration, and groundwater recharge. The pollutant cycle includes advective transport, volatilization, adsorption/desorption, and degradation/decay. A contaminant in SESOIL can partition into up to four phases (aqueous, gaseous, adsorbed, and free liquid). Data requirements for SESOIL are not extensive because the model uses a minimum number of soil and chemical parameters and meteorological values as input. Output from the SESOIL model includes pollutant concentrations at various soil depths and pollutant loss through surface runoff, percolation to groundwater, volatilization, and degradation. The mathematical formulations used in the SESOIL code generally consider the rate at which the modeled processes occurs, the interaction of these processes, and the initial conditions of the waste area and surrounding hydrogeologic formations. The models were arranged in three layers (Appendix G, Table G-3). Layers 1 and 2 were divided into sublayers to facilitate contaminant loading at intervals closely approximating the actual sampling points and the analytical results. The first two layers are constituent loading zones. The third layer represents the leaching zone. This layer was divided into sublayers to improve model precision. The third layer is very thin and lies just above the water table; it was used to record predicted leachate concentrations at the water table/vadose zone interface. The SESOIL simulations were continued until the maximum concentration in groundwater was attained.

6.4.2.5 SESOIL modeling results

SESOIL modeling results are presented in Table 6.4; Figure 6.2 and Figure 6.3. The SESOIL predicted leachate concentrations were converted into likely average groundwater concentrations by using a dilution factor (DF) of 1.19. The DF was developed by using the hydraulic analysis method (EPA 1996), which involves calculating the rate of flow through the aquifer system and the rate of rainwater percolation into the aquifer. The parameters used in the development of the DF are presented in Appendix G, Table G-2. The thickness of the zone of mixing in the groundwater aquifer was conservatively assumed to be 20 feet.

SESOIL modeling results for the organic preliminary CMCOPCs show that benzo(a)anthracene, benzo(b)fluoranthene and dibenzo(a,h)anthracene naturally attenuate before reaching the water table. The predicted groundwater concentrations of 2-methylnaphthalene and 4-methyl-2-pentanone do not exceed their respective RBCs. Therefore, all preliminary organic CMCOPCs were eliminated from the list of CMCOPCs.

The inorganic preliminary CMCOPCs, arsenic and chromium, were predicted to reach the water table. The maximum groundwater concentrations of arsenic and chromium were predicted to be 0.21 mg/L and 2.13 mg/L, respectively (Table 6.4; Figures 6.2 and 6.3). The predicted groundwater concentrations of both arsenic and chromium exceed their respective groundwater target concentrations. The maximum groundwater concentrations of arsenic and chromium are predicted to be reached after 135 years and 67 years, respectively.

Therefore, the only CMCOPCs identified after the SESOIL modeling are arsenic and chromium.

6.4.3 Groundwater Contaminant Migration

The SRCs identified for groundwater at this site include benzene, toluene, ethylbenzene, xylenes, naphthalene, and 2-methylnaphthalene as listed in Table 5.5, along with their maximum detected concentrations.

Table 6.4. Summary of Leachate Modeling Results
SWMU 13, Fort Stewart, Georgia

Preliminary CMCOPCs ^a	Maximum Concentration mg/kg	Predicted C _{leachate,max} beneath the source mg/L	Predicted T _{max} years	Predicted C _{gw,max} at the source ^b mg/L	Maximum observed groundwater Conc. mg/L	Groundwater Target Conc. mg/L	Source ^c	CMCOPC?
<i>Inorganics</i>								
Arsenic	1.04E+01	2.50E-01	135	2.10E-01	ND	5.00E-02	M	Yes
Chromium	4.04E+01	2.53E+00	67	2.13E+00	ND	1.00E-01	M	Yes
<i>Organics</i>								
2-Methylnaphthalene	2.40E+01	9.10E-04	51	7.65E-04	0.072	1.20E-02	R	No
4-Methyl-2-pentanone	3.80E+00	4.70E-03	<1	3.95E-03	ND	1.40E-02	R	No
Benzo(a)anthracene	1.00E+01	0.00E+00	N/A	0.00E+00	ND	9.20E-05	R	No
Benzo(b)fluoranthene	8.20E+00	0.00E+00	N/A	0.00E+00	ND	9.20E-05	R	No
Dibenzo(a,h)anthracene	4.50E+00	0.00E+00	N/A	0.00E+00	ND	9.20E-06	R	No

^a These constituents were selected for SESOIL modeling from this site

^b The predicted maximum concentration in groundwater (C_{gw,max}) at the source was calculated by applying a dilution factor to the predicted maximum leachate concentration (C_{leachate,max}).

^c M = MCL, R = EPA Region 3 suggested risk based concentration corresponding to HI = 0.1 or 10⁻⁶ risk (GA EPD 1999)

N/A = not applicable; constituents naturally attenuates before reaching the water table.

ND = Not detected

Figure 6.2. Predicted groundwater concentration of arsenic in groundwater at SWMU 13 based on leachate modeling using SESOIL.

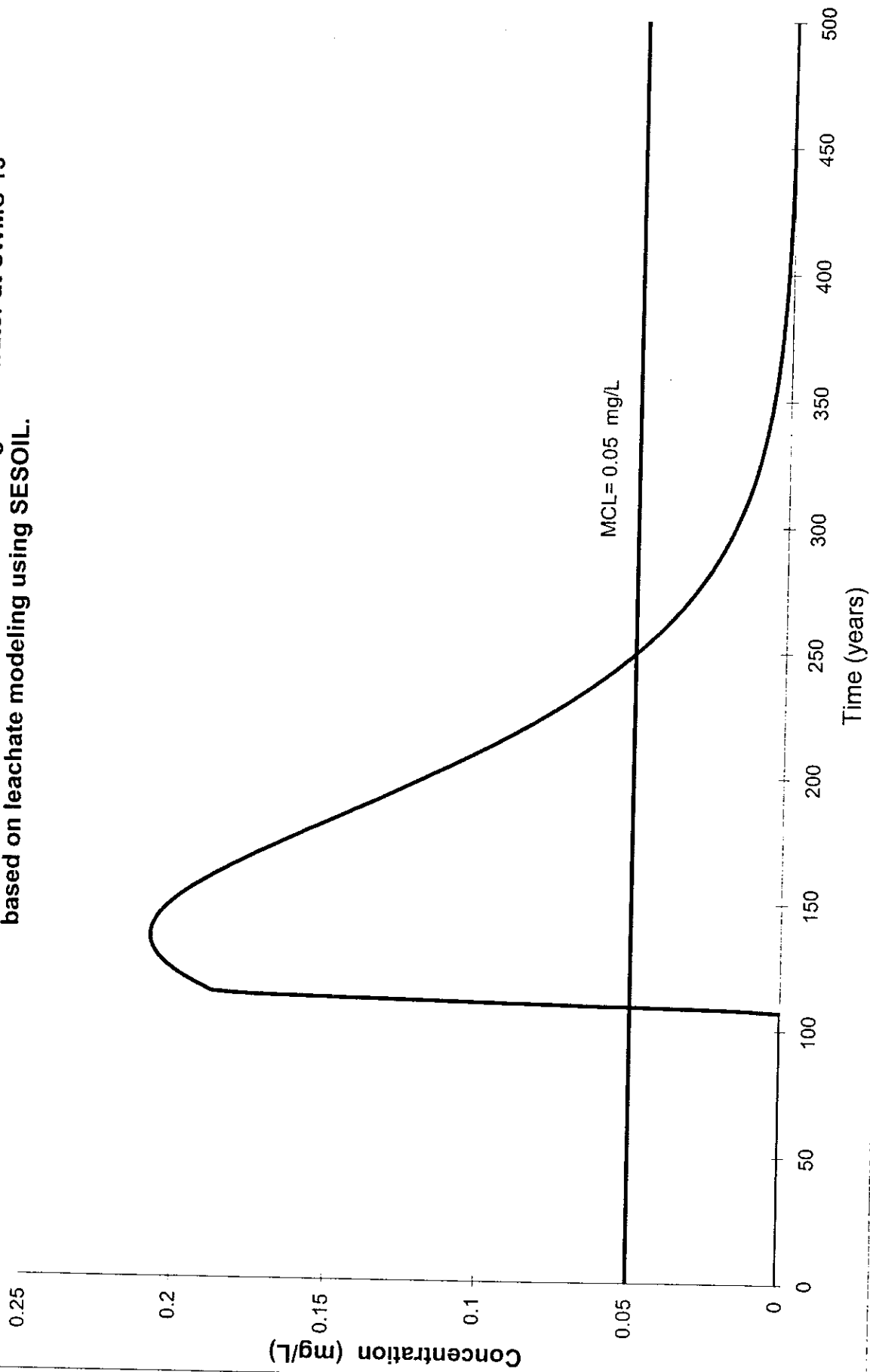
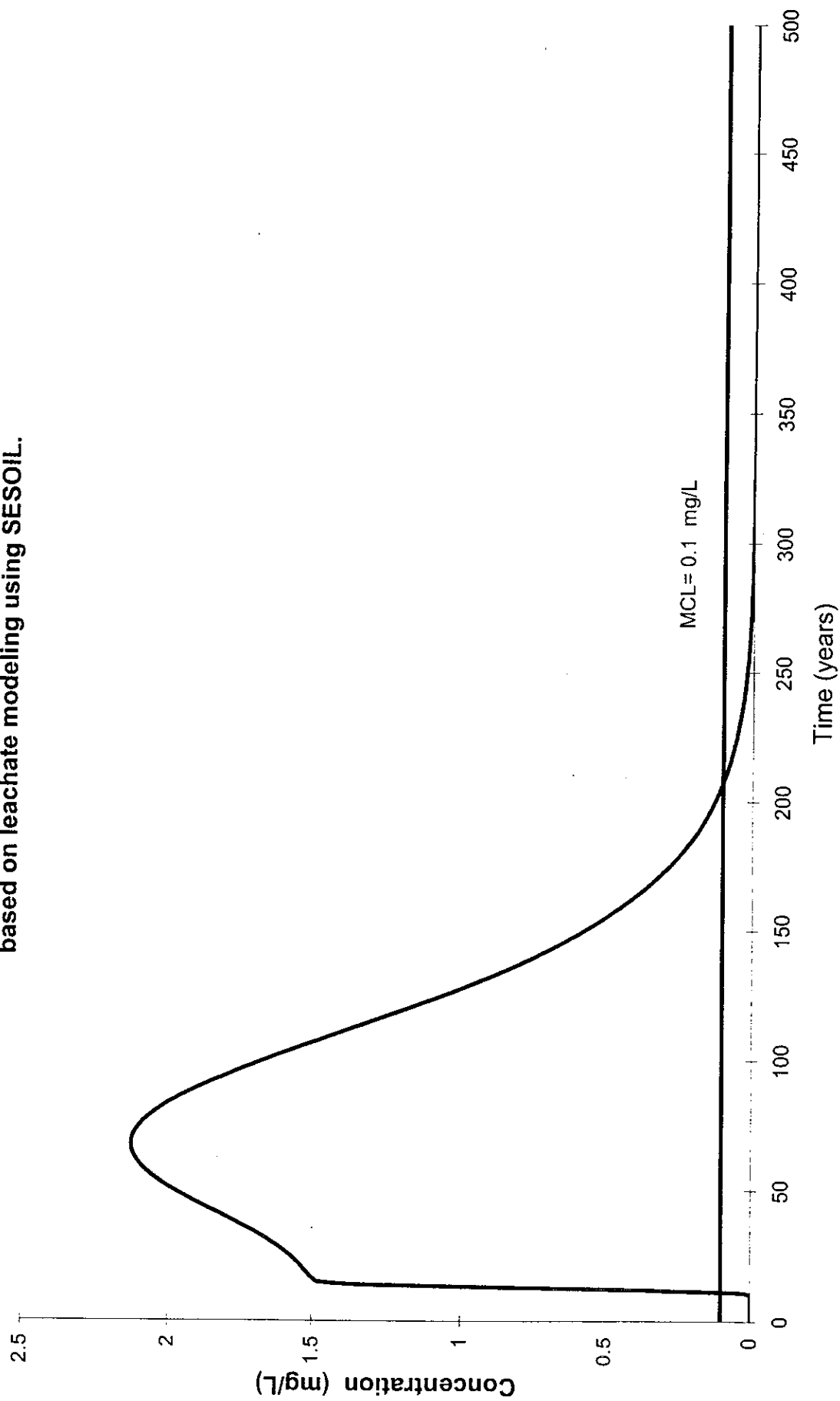


Figure 6.3. Predicted groundwater concentration of chromium in groundwater at SWMU 13 based on leachate modeling using SESOIL.



These SRCs, as well as arsenic and chromium, which was identified as a CMCOPC in the previous section, are considered for groundwater contaminant migration and addressed in the next section.

6.4.4 Natural Attenuation of the SRCs

The organic SRCs in groundwater at SWMU 13 may be degraded in the environment by various processes, including hydrolysis, oxidation/reduction, photolysis, or biodegradation. As already discussed in Section 6.2, environmental half-lives of organic compounds in various media can vary by orders of magnitude, depending on the chemical and on environmental conditions. Organic chemicals with differing chemical structures will biodegrade at different rates. Primary biodegradation consists of any biologically induced structural change in an organic chemical, while complete biodegradation is the biologically mediated degradation of an organic compound into carbon dioxide, water, oxygen, and other metabolic inorganic products. The biodegradation rate of an organic compound is proportional to the concentration:

$$-dC/dt = kC^n \quad (6-6)$$

where:

- C = concentration,
- k = biodegradation rate constant
- t = time,
- n = reaction order, $n=1$ (first order kinetics, typical for biodegradation).

Integrating equation (6-6) from time = 0 to any time, t, results in:

$$C_t = C_o e^{-kt} \quad (6-7)$$

where:

- C_t = the concentration of contaminant at any time (t),
- C_o = the initial concentration of contaminant,
- k = the first order biodegradation rate constant (time^{-1}).

Equation (6-7) can be rearranged to solve for C/C_o ,

$$C/C_o = e^{-kt} \quad (6-8)$$

At the half life ($t_{1/2}$), $C/C_o = 0.5$. Substituting these values into equation (6-8) and solving for k yields:

$$k = 0.693/t_{1/2} \quad (6-9)$$

Equation (6-9) was used to calculate biodegradation rates for each SRC (Table 6.2). Equation (6-7) was then rearranged to solve for t:

$$t = \ln(C/C_o)/k \quad (6-10)$$

Where C_0 = the maximum detected concentration and C = target concentration, which is equal to MCL, if available, otherwise, EPA Region 3 RBC for tap water corresponding to $HI = 0.1$ or 10^{-6} risk. The time (t) required for this reduction in concentration was calculated for each SRC. The rate constants (k) are those presented in Table 6.2, and these are the most conservative values available.

Table 6.5 summarizes the results for biodegradation of the organic SRCs detected in the groundwater. The time required for toluene and xylenes to degrade to target concentration was not calculated, because the maximum detected concentrations are less than their respective target concentration. The time required for 2-methylnaphthalene to biodegrade to its target concentration could not be calculated, because its degradation rate could not be obtained from the literature. Time required for benzene, ethylbenzene, and naphthalene to degrade to their respective MCL/RBCs is presented in Table 6.5. The time-frame for groundwater to travel from SWMU 13 to the nearest downgradient receptor location (Peacock Creek) is 178 years (Section 6.3.4). Contaminant transport would be slower than this due to retardation, and contaminant concentrations would be reduced by other attenuation factors. Clearly, this analysis indicates that all contaminants would be attenuated to levels well below their respective RBCs and/or MCLs by the time contamination reached a downgradient receptor.

Table 6.5
Timeframes for the Natural Attenuation of SRCs in Groundwater
SWMU 13, Fort Stewart, Georgia

SRCs	C, Target Concentration, (µg/l)		C ₀ , Initial Concentration, (µg/l)	k, Degradation Rate Constant (days ⁻¹)	Time Required (years)
Volatile Organic Compounds					
Benzene	5.00	**	440	9.63E-04	13
Ethylbenzene	700	**	940	3.04E-03	0.27
Toluene	1,000	*	520	3.30E-03	NC
Xylenes	10,000	**	5,300	1.93E-03	NC
Semivolatile Organic Compounds					
2-Methylnaphthalene	12	*	72	NA	NA
Naphthalene	0.65	*	140	2.69E-03	5.47

* = RBC

** = MCL

NC = Not calculated - the initial concentration is below the target concentration

NA = Not available

For the inorganic CMCOPC arsenic and chromium, biological degradation is not a factor when considering its fate in the environment. The contaminant may be used by microorganisms in biotic processes, which can affect its migration rates; however, the inorganics are not "degraded" to simpler compounds as seen for organic materials. Other mechanisms such as redox reactions, which may affect the speciation of the constituent (and, hence, its migration rates), and dispersion of the contaminant in the aquifer are responsible for the attenuation of inorganic contaminant concentrations. The nearest potential surface water receptor, Peacock Creek, is located approximately 2,500 feet downgradient from the site.

Using the groundwater velocity of 14 feet/year and the retardation factors presented in Table 6.1, arsenic and chromium will take more than 15,000 years to reach the nearest potential surface water receptor.

6.5 Conclusion

Based on the results of soil leachability analysis and SESOIL modeling, arsenic and chromium are identified as CMCOPCs. However, due to the slow groundwater movement at the site (14 feet/year) and the high retardation factors, arsenic and chromium are not expected to migrate to the nearest surface water receptor, Peacock Creek, located 2,500 feet downgradient from the site. SESOIL modeling results for the preliminary organic CMCOPCs indicate that the constituents will either naturally attenuate before reaching the water table or the predicted groundwater concentrations will not exceed the respective RBCs. Therefore, all five organic preliminary CMCOPCs were eliminated from further evaluation.

The modeled groundwater concentrations for arsenic and chromium due to leaching from soil will be evaluated in the human health baseline risk assessment (HHBRA) (Appendix H).

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7.0 HUMAN HEALTH PRELIMINARY RISK EVALUATION

This human health preliminary risk evaluation is conducted in accordance with Appendix A of the approved Work Plan (Rust 1998). This process involves a Step-1 risk evaluation, based on guidance from GA EPD (1996). This is done to evaluate the potential for the existence of risks to human health associated with contamination detected at SWMU 13 and involves the following steps:

- for inorganics, compare detected concentrations to reference background criteria to determine if detected inorganics are naturally occurring or are associated with past activities at the site (completed in Section 5.0 in developing the list of SRCs);
- identify potential migration and exposure pathways associated with the site and identify potential exposure scenarios to identify appropriate screening levels;
- identify available risk-based action levels for each SRC, or develop those screening levels if they do not already exist; and
- compare sample concentrations in each sampled medium to screening levels and determine if further evaluation is warranted. Constituents that exceed screening levels will be identified as human health COPCs, and may be recommended for further evaluation in a baseline risk assessment.

7.1 Data Evaluation

The objective of this data evaluation is to develop a set of analytical data suitable for use in the HHBRA. The data for SWMU 13 were evaluated to accomplish the following:

1. establish that the data are of sufficient quality for use in the quantitative risk assessment (Section 3.0 and Appendix C), and
2. ascertain which detected constituents are identified as SRCs (Section 5.0).

The data used in the human health preliminary risk evaluation assessment were verified and validated in Section 3, using the methodology described in the CDAP of the GA EPD approved Work Plan. No data were qualified as rejected during the validation stage (flagged with an "R"). Detection limits achieved during sample analysis were reviewed to ensure that the required detection limits presented in the CDAP were met. These detection limit requirements were established in the CDAP to ensure that characterization has occurred to levels that are low enough to identify that constituents are present at hazardous levels. These levels are constituent-specific and are related to the toxicity of each constituent. In some cases the laboratory could not achieve the recommended detection limits, because the sample had to be diluted to overcome interference from either the sample matrix or from the other constituents present in the sample.

No detected organic compounds were classified as common laboratory contaminants and removed from consideration.

7.2 Exposure Evaluation

The objective of this exposure evaluation is to identify potential human populations and complete exposure pathways to SRCs at SWMU 13 under current and future land use conditions. A complete exposure pathway consists of five elements:

1. a potential receptor population,
2. a source of contamination,
3. a transport or retention medium,
4. a point of contact or exposure for a receptor, and
5. a route of exposure (ingestion, dermal absorption, or inhalation) at the point of contact through which the constituent may be taken into the body.

Only when all five of these exposure pathway elements are present, can the exposure of a receptor population take place. This exposure evaluation considers both on-site and off-site receptors, their relationships to the potential migration pathways, and the possible points and routes of exposure for SRCs by receptor populations.

7.2.1 Receptor Assessment

This section identifies those populations that may be exposed to SRCs. The receptor populations are identified under both current and future conditions. Potential changes in land use are evaluated to determine whether this may result in the presence of more sensitive receptor populations in the future.

Generally, receptor populations are divided into two groups: on-site and off-site receptors. On-site receptors are those individuals who may be present within the site boundaries and come into direct contact with constituents present. The exposure of an off-site receptor requires a migration pathway that transports a constituent off-site to a point where the potential receptor may be exposed.

Current Use

SWMU 13 is located within a remote area of the FSMR, adjacent to a paved asphalt taxiway at the Wright Army Airfield. The site has not been used as a fire training area since 1992, but the area surrounding it is used for training maneuvers and hunting, and the site does not have institutional controls in place to restrict access. Other FSMR personnel not on training maneuvers may come on site on a regular basis for grass cutting or other routine maintenance. Given the open access to the site, a trespasser (e.g., FSMR worker crossing the site) may also visit the site. The adult trespasser is likely to be a short-term, occasional event, possibly for deer hunting. Under current land-use conditions, a groundskeeper is selected to represent the on-site receptors, because his exposure would be more routine and long-term than would the transient hunter or fisherman.

The current land use in the area surrounding the site primarily consists of undeveloped areas. Off-site receptors at greatest potential risk to exposure would be individuals working in, or conducting training maneuvers in, areas adjacent to the site.

Future Use

The SWMU 13 site is projected to remain an undeveloped area at the FSMR (Master Plan), and the land use will remain unchanged. Given this scenario, the future receptor populations would also remain the same as those identified under the current use receptor scenario (on-site groundskeeper, and off-site worker). This site could be developed for other military/ industrial uses, bringing construction workers on the site, in addition to normal FSMR personnel. However, given the knowledge of the contamination present, personnel involved in excavation, construction, or similar activity will likely be required to wear appropriate protective gear to reduce their exposure to any remaining constituents. Additionally, if the site is developed for industrial use, it is likely to be secured by a fence, and the presence of a trespasser is unlikely. For the purposes of this risk evaluation, it is assumed that the site will be developed for industrial use, the area surrounding it will remain undeveloped for maneuvers, and the receptors would remain unchanged from the current use scenario. Residential development is not considered a potential future land use; however, hypothetical future residential receptors (adult and child) are evaluated in compliance with GA EPD guidance. Potential receptor populations to be evaluated at SWMU 13 are:

- Current on site – Groundskeeper.
- Current off site – FSMR worker.
- Future on site – Groundskeeper, construction worker.
- Future off site – FSMR worker
- Future on site – Resident (Adult and Child)

7.2.2 Migration Pathway Analysis

This section describes the potential pathways related to constituent transport that may result in potential exposure points for humans. In general, the major routes of migration from this site are volatilization into air, wind erosion resulting in fugitive dust, surface water runoff, leaching of constituents into groundwater, and groundwater transport to off-site locations. Figure 6.1 is a visual depiction of the CSM for this site, and shows these migration pathways.

Soil. The site is currently covered by asphalt and vegetation, and the contaminated soil has been excavated to a depth of four feet bgs and replaced with clean fill. As a result, under current conditions, the migration of constituents into the atmosphere as fugitive dust is not a viable pathway. However, future activities may cause the surface cover to be removed, subsurface soil to be exposed, and fugitive dust could become a viable pathway.

Constituents in soils may migrate through the actions of runoff, leaching into groundwater, or volatilizing into air. Surface water runoff may transport constituents adsorbed to eroded soil particles and deposit them as sediments in the swales surrounding the site. Runoff may also result in the transport of particulate-

bound water-soluble compounds to infrequently ponded surface waters in the swale. Volatilization of some constituents from the soil four feet bgs to the air may occur.

Groundwater. Migration of soil constituents to groundwater occurs from infiltration and percolation of rainwater through contaminated soil. It is reasonable to conclude that migration of soil constituents at SWMU 13 to the surficial aquifer occurred prior to the IM, which removed the contaminated soil to a depth of four feet bgs. Minimal migration may still occur due to residual contamination on the site and/or fluctuation of the water table.

Within the saturated zone, the extent of constituent migration depends primarily on the amount of rainfall, evaporation, solubility of the constituent in water, absorption coefficient, and distance to the groundwater. In general, VOCs travel more easily through soils than do the SVOCs, such as high boiling-point fuel hydrocarbons. Solubility of metals is dependent on the metal species and is difficult to generalize.

Groundwater leaving the site may eventually discharge into Peacock Creek, located approximately 2,500 feet southeast of the site. However, given the low groundwater flow rate, and the shallow depth to the water table, both organic and inorganic constituents are likely to become attenuated through both physical and biological processes before reaching Peacock Creek (Section 6.0). Inorganics, which are less mobile than organics, are likely to be significantly diluted in the groundwater or adsorbed to formation materials, reducing their concentrations. Therefore, exposure to constituents in groundwater, through discharge into Peacock Creek is expected to be insignificant.

Surface water. Only one perennial surface water body exists near the site, Peacock Creek. The surface water in Peacock Creek (2,500 feet east of the study area) feeds into the Canoochee River that drains much of the western portion of the FSMR. Peacock Creek is not considered a major migration pathway, because of the low potential for constituents to be transported in significant quantities across that distance.

There are four drainage swales at the site. The surface water that occasionally collects in the swales does not discharge into any other surface water features, but either evaporates or percolates into the groundwater over time. Because the elevation of the base of the swales is greater than 3.5 feet from the highest groundwater elevation observed at the site, groundwater does not discharge into the swales.

Sediment. Sediments at this site include those within the swales. Since the sediments are not usually covered by water, the migration pathways for sediments in the swales would be the same as those given for surface soils, therefore, sediments are included with surface soil in this evaluation. Also, because constituent migration to Peacock Creek is not considered to be significant; exposure to the sediment in Peacock Creek is also not considered to be a viable pathway.

7.2.3 Identification of Exposure Pathways

If the first three elements (a potential receptor population, a contaminant source, and a transport/retention medium) of an exposure pathway are present as well as a point of contact and a route of exposure, an exposure pathway is complete. Potentially complete pathways are discussed below by receptor.

Current and future on-site worker. The current on-site worker may be exposed to constituents in surface soils that were not removed during the IM. Potential exposure pathways for surface soils and sediments include incidental ingestion of soils and inhalation of volatile organics. An on-site worker is not expected to come in direct contact with surface water in the swale because the workers' primary activity is mowing grass. In addition, water is only occasionally ponded in the swale. Therefore, exposure to surface water is unlikely.

The future on-site worker is expected to have the same pathways as the current worker for soil exposure. For the purpose of assessing risk to potential future populations, it is assumed that the surficial aquifer is used as a source of drinking water. This is an unlikely scenario, given that the surficial aquifer is not a probable source of drinking water. The deeper Principal Artesian aquifer is used as a source of drinking water in the area. This aquifer is separated from the surficial aquifer by a confining layer of phosphatic clays ranging from 60 feet to 80 feet thick. The GA EPD mandates that all groundwater should be considered to be a potential drinking water source (GA EPD 1996); therefore, it is assumed that the future on-site worker may be exposed to groundwater via ingestion.

A future construction worker may be exposed to subsurface soils as a result of excavation. Incidental ingestion, inhalation of constituents (as dust or volatiles), and dermal absorption are complete exposure pathways for this receptor.

Because of the intermittent nature of its occurrence, there are few jobs that would require a future on-site worker to come in contact with surface water at the site. Although incidental exposure may occur, these events are likely to be limited to one-time events and the potential exposure would be insignificant. Therefore, surface water is eliminated as an exposure pathway.

Current and future off-site worker. A current off-site worker may be exposed to volatile organics released into the air from the soil. This receptor population could be exposed to fugitive dust, if the soils are uncovered and the current vegetation is removed. A future off-site worker may also be exposed to groundwater via ingestion if the shallow aquifer is used as a potable water source.

Future On-Site Resident. Although not a likely receptor for this site, the on-site resident is evaluated as a worst-case scenario for exposure to soil and groundwater. This scenario assumes that a family lives on the site and obtains its drinking water from a groundwater well screened in the surficial aquifer.

A future resident may be exposed to constituents in surface soil not removed during the IM and groundwater used as drinking water. Potential exposure pathways to constituents in groundwater include

ingestion, dermal contact with household water, and inhalation of VOCs released during use of household water.

The RBCs used in the following screening are based on a residential receptor population. The potential exposure pathways addressed in deriving the screening values for soils include soil ingestion, inhalation of fugitive dust and volatiles, and ingestion of constituents which leached into groundwater from soils. Exposure pathways for groundwater include ingestion, dermal contact, and inhalation of volatiles during showering. The residential exposure scenario addresses all of the potential exposure pathways identified for SWMU 13. However, the derivation of the risk-based screening values is discussed further in the following section.

7.3 Selection of Screening Values

Screening values represent concentrations that are readily accessible in the literature and, due to their conservative nature, can be used with a high degree of confidence to indicate sites, or areas of sites, for which no further action is required. Screening levels inherently incorporate assumptions about land use. In identifying human health COPCs, it is generally accepted that screening levels will reflect any potential future land uses, and thus usually reflect a conservative residential use scenario (EPA 1991a, 1996a; ASTM 1995).

If risk-based values are not available, it generally reflects one or more of the following conditions:

1. the constituent is not considered to be toxic, except perhaps at extremely high concentrations (e.g., sodium);
2. no dose-response data indicate a toxic effect; or
3. EPA is currently reviewing toxicity information and neither the reference dose nor the cancer slope factor is currently available.

Screening values for soil were used to screen the sediment because the sediments present at SWMU 13 are not constantly covered by water, and exposure pathways for this medium are the same as for surface soils.

7.3.1 Screening Values for Soil

The EPA Region III RBCs for ingestion of soil were used for screening values for both soil and sediment (EPA 1999). The RBCs were adjusted to reflect a hazard index of 0.1. Even though residential land use is unlikely to occur at this site, as a conservative measure, residential land use RBCs were used to screen surface soil sample concentrations. Exposure to subsurface soil (i.e., greater than 2 feet bgs) would be limited to an industrial construction worker exposure scenario. Therefore, the industrial land use RBCs were used to screen the subsurface soil values.

Step 1 screening levels generally reflect residential land uses to ensure that no constituent is prematurely screened from consideration. The EPA provides guidance and default parameter values for developing

screening levels that reflect industrial land-use assumptions. These levels are developed using equations and default values from EPA (1991). Residential land use is unlikely to occur at SWMU 13, given that it is located within a training area adjacent to an industrial area (i.e., Wright Army Airfield).

The default residential exposure assumptions for soil are as follows:

- Soil ingestion. For noncarcinogens, the receptor is a child (age 1 to 6) who ingests 200 mg soil/day for 6 years; for carcinogens, the soil ingestion rate is adjusted over a time period of birth until age 30, this age-adjusted ingestion rate is 114 mg/day (EPA 1997).
- Inhalation of volatiles or fugitive dust, where a resident is exposed to airborne constituents for 30 years (EPA 1997).
- Leaching of constituents to groundwater, with subsequent ingestion of groundwater (EPA 1997).

Based on site conditions and the SRCs under consideration, risk-based concentrations for soil ingestion provide conservative screening values. Also, as a conservative assumption, the screening concentration for hexavalent, rather than trivalent, chromium is used.

Subsurface soil concentrations were previously (Section 6) screened against EPA GSSLs to identify CMCOPCs which may migrate to groundwater

7.3.2 Screening Values for Groundwater

The groundwater RBCs reflect the use of groundwater as a source of drinking water (EPA 1996b, 1996d). These values include the Region III screening values for tap water, based on a cancer risk of 10^{-6} and an HI of 0.1. As previously discussed, groundwater at this site is unlikely to be used as a drinking water source, but may be used as a source of water for irrigation in the future. The drinking water screening values are considered to be health-protective, given the conservative assumptions used.

Residential use is not a possible future land use; however, it is assumed because it is regulatorily mandated.

The default residential exposure assumptions for groundwater are as follows:

- Groundwater ingestion. For noncarcinogens the receptor is an adult who ingests 2 L of groundwater/day; for carcinogens, the water ingestion rate is adjusted to account for the different ingestion rates of a child (1 L/day) and an adult (2 L/day) over a time period of birth until age 30.
- Inhalation of volatiles during showering.

7.4 Risk Evaluation

The risk evaluation compares the maximum concentration of each constituent detected in each medium to its respective screening value. Exceeding the screening value means that a risk may exist at the site, and that those constituents exceeding their respective screening values designated as COPCs may be evaluated more fully in a baseline risk assessment.

The selection of human health COPCs for each environmental medium (surface soil, subsurface soil, and groundwater) is addressed below. The selection process involves two steps. The initial step is the comparison of the maximum concentrations to the appropriate screening values. Given the conservative nature of the screening values, a second step, called a weight-of-evidence analysis, of those constituents which exceed their respective screening values will be done to determine if those COPCs should be analyzed further in a baseline risk assessment.

7.4.1 Surface Soils

All of the constituents detected in surface soils were below their respective screening concentrations, except for benzo (a) pyrene, which was detected at a concentration of 390 µg/kg, four times the RBC of 87 µg/kg (Table 7.1). This sample was collected from an area adjacent to a weathered and eroded asphalt pavement. It is reasonable to expect that some asphalt fragments eroded from the weathered pavement, could have been incorporated into the sample during collection, and biased the sample.

Based on this screening evaluation, benzo(a)pyrene is identified as a human health COPC for surface soil for inclusion in a baseline HHBRA.

7.4.2 Subsurface Soils

In subsurface soils, five PAHs (polynuclear aromatic hydrocarbons) benzo(a)pyrene, benzo(a) anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene, and one metal (arsenic) were detected above their RBCs in soil samples from the IM and samples from this RFI (Table 7.2).

The PAHs were detected in 4 - 7 of 64 samples, and several of these samples had concentrations greater than the RBCs. Many of the samples with detected PAHs were from the IM data and located along the bottom of the swale just west of the site. The top one foot of soil was removed as part of the IM in the vicinity of these samples. Soil was not excavated below 1 foot bgs during the IM due to the occurrence of groundwater at that depth. Other PAH detections were from the depth range of 6 to 8 feet bgs. This depth is within the fluctuation of the water table (approximately 5 to 8 feet bgs).

Arsenic was detected in 43 of 64 samples, and its reference background concentration of 8.04 mg/kg indicates it is prevalent throughout the FSMR. The reference background concentration for arsenic exceeds its RBC of 3.8 mg/kg. None of the RFI data had arsenic concentrations that exceeded the reference background concentration, however, one sample, MW-12-4s with a concentration of 4.5 mg/kg, at 4 to 6 feet bgs, exceeded the arsenic RBC. From the IM data, 10 samples had arsenic concentrations that slightly exceeded the RBC, and two samples from the same bore hole that exceeded the reference

Table 7.1
Analyte Screening of Surface Soil Results to Action Levels
SWMU 13, Fort Stewart, Georgia

Analyte	Results > Detection Limit	Minimum Detect	Maximum Detect	EPA Region III Residential Values ^a	Human Health COPC?	Justification
Semivolatile Organics (mg/kg)						
Benzo(a)anthracene	1/3	0.43	0.43	0.875	No	Max Detect < Risk Criteria
Benzo(a)pyrene	1/3	0.39	0.39	0.0875	Yes	Max Detect > Risk Criteria
Benzo(b)fluoranthene	1/3	0.56	0.56	0.875	No	Max Detect < Risk Criteria
Benzo(k)fluoranthene	1/3	0.49	0.49	8.75	No	Max Detect < Risk Criteria
Chrysene	1/3	0.43	0.43	87.5	No	Max Detect < Risk Criteria
Fluoranthene	1/3	0.72	0.72	312.9	No	Max Detect < Risk Criteria
Pyrene	1/3	0.62	0.62	234.6	No	Max Detect < Risk Criteria
Metals (mg/kg)						
Barium	3/3	10	20	547.5	No	Max Detect < Risk Criteria

^a EPA Region III residential soil ingestion values are modified by dividing noncarcinogenic-based values by 10 to represent a Hazard Index of 0.1.

COPC = Constituent of Potential Concern

EPA = U.S. Environmental Protection Agency

Table 7.2
Analyte Screening of Subsurface Soil Results to Action Levels
SWMU 13, Fort Stewart, Georgia

Analyte	Results > Detection Limit	Minimum Detect	Maximum Detect	EPA Region III Industrial Values ^a	Human Health COPC?	Justification
Volatile Organics (mg/kg)						
4-Methyl-2-pentanone	2/64	0.069	3.8	1.64E+04	No	Max Detect < Risk Criteria
Acetone	4/64	0.073	0.11	2.04E+04	No	Max Detect < Risk Criteria
Benzene	1/64	0.021	0.021	1.97E+02	No	Max Detect < Risk Criteria
Carbon Disulfide	3/64	0.0066	0.013	2.04E+04	No	Max Detect < Risk Criteria
Chlorobenzene	1/64	0.93	0.93	4.09E+03	No	Max Detect < Risk Criteria
Ethylbenzene	5/64	0.01	1.6	2.04E+04	No	Max Detect < Risk Criteria
Toluene	3/64	0.063	0.98	4.09E+04	No	Max Detect < Risk Criteria
Xylenes, Total	7/64	0.0064	61	4.09E+05	No	Max Detect < Risk Criteria
Semivolatile Organics (mg/kg)						
1-Methylnaphthalene	5/50	0.72	18	4.09E+03 ^b	No	Max Detect < Risk Criteria
2-Methylnaphthalene	3/64	0.64	24	4.09E+03	No	Max Detect < Risk Criteria
Acenaphthene	2/64	2.8	4.5	1.23E+04	No	Max Detect < Risk Criteria
Anthracene	2/64	0.51	1.1	6.13E+04	No	Max Detect < Risk Criteria
Benzo(a)anthracene	5/64	0.47	10	7.84E+00	Yes	Max Detect > Risk Criteria
Benzo(a)pyrene	7/64	0.44	3.7	7.84E-01	Yes	Max Detect > Risk Criteria
Benzo(b)fluoranthene	6/64	0.55	8.2	7.84E+00	Yes	Max Detect > Risk Criteria
Benzo(g,h,i)perylene	6/64	0.42	2.4	7.84E-02 ^c	Yes	Max Detect > Risk Criteria
Benzo(k)fluoranthene	4/64	0.73	8.2	7.84E+01	No	Max Detect < Risk Criteria
Chrysene	5/64	0.47	10	7.84E+02	No	Max Detect < Risk Criteria
Dibenzo(a,h)anthracene	4/64	0.68	4.5	7.84E-01	Yes	Max Detect > Risk Criteria
Fluoranthene	9/64	0.58	9.1	8.18E+03	No	Max Detect < Risk Criteria
Fluorene	4/64	0.5	4.4	8.18E+03	No	Max Detect < Risk Criteria
Indeno(1,2,3-cd)pyrene	6/64	0.68	4.5	7.84E+00	No	Max Detect < Risk Criteria
Naphthalene	1/64	1.8	1.8	4.09E+03	No	Max Detect < Risk Criteria
Phenanthrene	5/64	0.39	2.2	6.13E+03 ^d	No	Max Detect < Risk Criteria
Pyrene	9/64	0.47	8.1	6.13E+03	No	Max Detect < Risk Criteria
Metals (mg/kg)						
Arsenic	43/64	1.1	10.4	3.82E+00	Yes	Max Detect > Risk Criteria
Barium	64/64	5.6	26.6	1.43E+04	No	Max Detect < Risk Criteria
Chromium	64/64	2.7	40.4	6.13E+02 ^f	No	Max Detect < Risk Criteria
Lead	64/64	2.2	17	4.00E+02 ^g	No	Max Detect < Risk Criteria
Mercury	35/64	0.013	0.097	6.13E+01 ^h	No	Max Detect < Risk Criteria

^a EPA Region III industrial soil ingestion values are modified by dividing noncarcinogenic-based values by 10 to represent a Hazard Index of 0.1.

^b Value for 2-Methylnaphthalene used.

^c TEF of 0.1 used with RBC for Benzo(a)pyrene

^d Value for pyrene used.

^e Value for Chromium VI used.

^f RCRA action level for soil.

^g Value for Mercuric Chloride used.

COPC = Constituent of Potential Concern

EPA = U.S. Environmental Protection Agency

background concentrations. Reference background concentrations were exceeded at one location at 2 feet bgs (10.4 mg/kg) and 3 feet bgs (9 mg/kg) and was located at SA-21. At this location, soils to a depth of 2 feet bgs were excavated during the IM. Due to the ubiquitousness of arsenic at the FSMR, and the fact that only one sample location exceeded the reference background concentration, remediation of subsurface soils for arsenic is not recommended.

Based on the comparison to screening values, six constituents are considered as human health COPCs for subsurface soil for inclusion in a HHBRA.

Subsurface soil concentrations were previously (Section 6) screened against EPA GSSLs to identify CMCOPCs which may migrate to groundwater. These CMCOPCs are identified in Table 6.4.

7.4.3 Groundwater

All six groundwater SRCs (benzene, ethylbenzene, toluene, xylenes, 2-methylnaphthalene, and naphthalene) exceeded their respective screening criteria for groundwater, and are designated as human health COPCs (Table 7.3).

Table 7-3
Analyte Screening of Groundwater Results to Action Levels
SWMU 13, Fort Stewart, Georgia

Analyte	Results > Detection Limit	Minimum Detect	Maximum Detect	EPA Region III Tap Water (µg/L) A	MCL (µg/L) B	Human Health COPC?	Justification
Volatile Organics (µg/L)							
Benzene	5/10	6.2	440	0.3638	5	Yes	Max Detect ≥ AB
Ethylbenzene	3/10	45	940	134	700	Yes	Max Detect ≥ AB
Toluene	1/10	520	520	74.7	1000	Yes	Max Detect ≥ A
Xylenes, Total	2/10	350	5300	1217	10000	Yes	Max Detect ≥ A
Semivolatile Organics (µg/L)							
2-Methylnaphthalene	3/10	21	72	12.17	NA	Yes	Max Detect ≥ A
Naphthalene	3/10	27	140	0.6511	NA	Yes	Max Detect ≥ A

COPC = Constituent of Potential Concern

EPA = U.S. Environmental Protection Agency

MCL = USEPA Maximum Contaminant Level

NA = No value available

7.5 Conclusions of the Human Health Preliminary Risk Evaluation

Based on the results of the screening the following human health COPCs are identified for SWMU 13.

Surface Soil COPCs	Subsurface Soil COPCs	Soil CMCOPCs ^a	Groundwater COPCs
Benzo(a)pyrene	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Dibenzo(a,h)anthracene	Arsenic Chromium	Benzene Ethylbenzene Toluene Xylenes, Total 2-Methylnaphthalene Naphthalene

^a From Section 6

These COPCs are further evaluated in a HHBRA (Appendix H).

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8.0 ECOLOGICAL PRELIMINARY RISK EVALUATION

The State of Georgia requires that all RCRA facilities choosing to set remediation levels based on an assessment of risk to human health and the environment prepare risk assessment documentation and propose remediation levels according to the *Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units* (GA EPD 1996). GA EPD (1996) guidance is based on the guidance contained in the USEPA Region 4 Bulletins, *Supplemental Guidance to RAGS, Ecological Risk Assessment* (EPA 1996b) and *Ecological Risk Assessment for Superfund, Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997). The USEPA has also finalized *Guidelines for Conducting Ecological Risk Assessments* (EPA 1996c). The GA EPD guidance document takes precedence over EPA Region 4 guidance and RAGS.

Risk is the likelihood of experiencing adverse effects. Ecological risk assessments identify and evaluate the risk to biota exposed to chemical contaminants and physical and biological hazards. The ecological risk assessment for SWMU 13 focuses on evaluating the potential of harmful effects to ecological receptors as a result of exposure to chemicals at the site.

The assessment of risk for ecological receptors at SWMU 13 is being conducted in a phased approach according to GA EPD guidance (1996). As shown in the flowchart of the GA EPD ecological risk assessment process (Figure 8.1), the two phases are:

- Preliminary Risk Evaluation (PRE) and
- Ecological Risk Assessment (ERA).

The PRE compares measured concentrations of SRCs to conservative ecological screening values for one or more ecological receptors. SRCs are identified by medium in Section 5.0 (Table 5.5). Only those SRCs that are indicated to be potential hazards in the PRE are evaluated as ecological COPCs in an ERA, if one is required. The basic approach to ERAs is similar to that of the PRE, but site-specific data are used to quantify exposures and evaluate effects in the ERA (GA EPD 1996). Appropriate site-specific data include concentrations of contaminants in animals and plants (tissue residues) and toxicity tests (EPA 1997). Remediation levels for protection of ecological resources will be developed and proposed only for those ecological COPCs that are identified as ecological COCs in the ERA.

Generally, the media of concern to ecological receptors are surface soil, sediment, and surface water, because these media can be contacted directly by ecological receptors, and their presence in these media can result in the accumulation of contaminants in plants and animals, causing exposure to ecological receptors ingesting them. At SWMU 13, the nearest perennial surface water body, Peacock Creek, is 2,500 feet away, and there are no other features nearby to receive groundwater discharges. Therefore, sediment and surface water samples were not collected and there are no data to evaluate potential risk from substances in these media. Groundwater from SWMU 13 is evaluated per EPA guidance (EPA 1996a). Therefore, the media evaluated during this PRE are surface soil and groundwater.

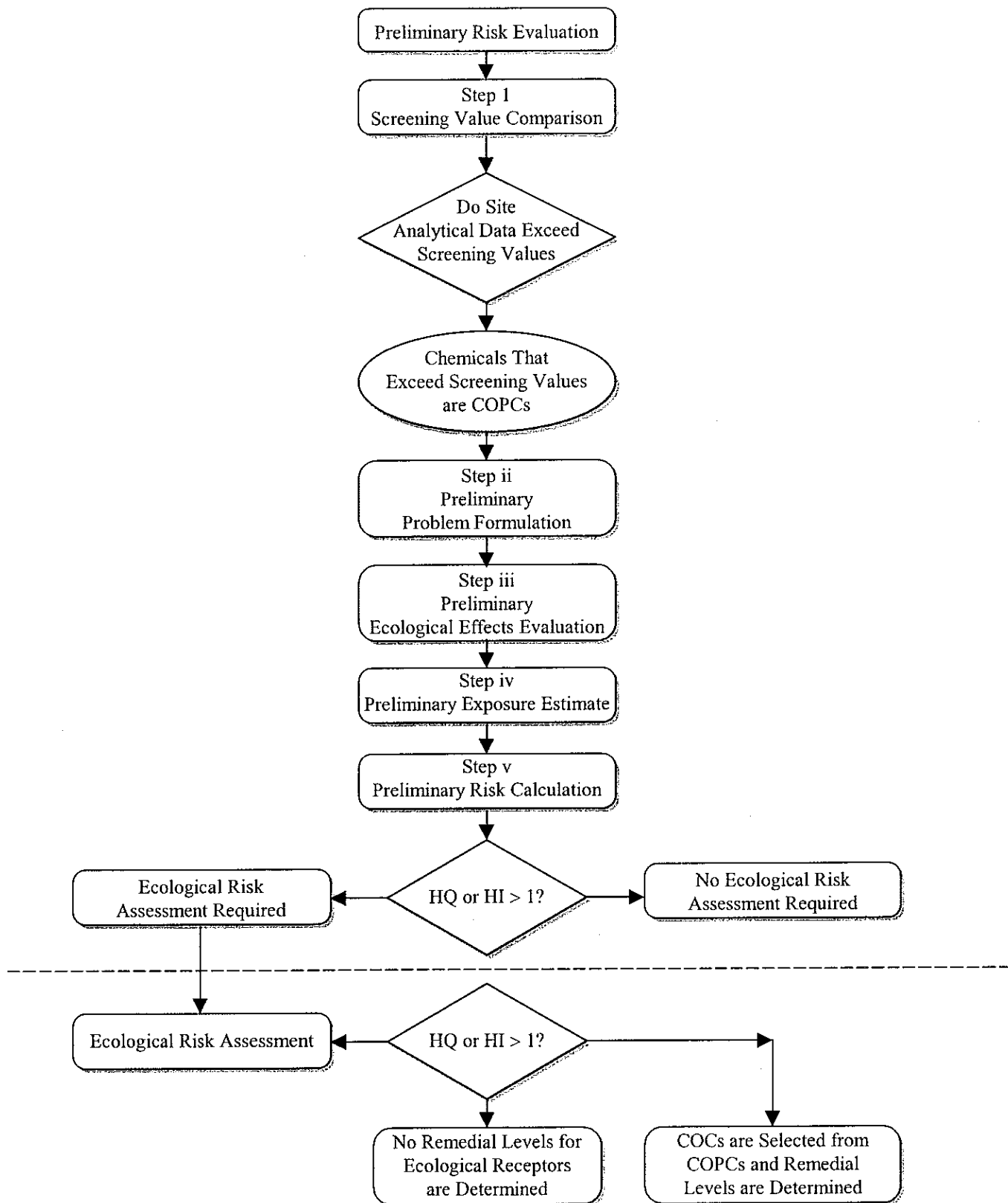


Figure 8.1. General Process for Assessing Risk and Selecting Remedial Levels for Ecological Receptors at SWMU 13, Fort Stewart, Georgia (GA EPD 1996)

8.1 Preliminary Risk Evaluation

The purpose of the PRE is to identify substances detected at the facility that pose a potential hazard to ecological receptors. Ecological COPCs are those substances that are detected at SWMU 13 at concentrations exceeding ecological screening values (ESVs).

According to GA EPD (1996), the PRE consists of five steps:

- i. ESV comparison (Section 8.1.1),
- ii. Preliminary problem formulation (Section 8.1.2),
- iii. Preliminary ecological effects evaluation (Section 8.1.3),
- iv. Preliminary exposure estimate (Section 8.1.4), and
- v. Preliminary risk calculation (Section 8.1.5).

8.1.1 Ecological Screening Value Comparison (Step i)

As shown in the flowchart of the GA EPD ecological risk assessment process (Figure 8.1), all SRCs are screened as ecological COPCs by comparing the maximum detected concentration to the ESVs. The PRE compares the maximum detected concentrations of analytes directly to conservative screening values for those substances. This approach assumes that the most sensitive receptors are those that live in direct contact with the medium and are exposed by multiple pathways to contaminants. If no ecological COPCs are identified based on the screening (Step i), then no further evaluation is required. If ecological COPCs are identified based on the screening, then they are evaluated further (Steps ii through v).

Table 8.1 lists SRCs identified in surface soils, the maximum detected concentration, the EPA Region 4 surface soil ESVs (EPA 1998), and whether each SRC found in surface soil at SWMU 13 must be evaluated in Steps ii through v of this PRE. Barium is eliminated as a COPC because its concentration is below the ESV, however, all of the SVOCs are retained for further evaluation.

Table 8.1
EPA Region IV Ecological Screening Value Comparison for SRCs in Surface Soil
SWMU 13, Fort Stewart, Georgia

Analyte	Maximum detected concentration (mg/kg)	ESV* (mg/kg)	Retained as COPC?
RCRA Metal (mg/kg)			
Barium	20	165	No
Semivolatile Organic Compounds (mg/kg)			
Benzo(a)anthracene	0.430	—	Yes
Benzo(a)pyrene	0.390	0.1	Yes
Benzo(b)fluoranthene	0.560	—	Yes
Benzo(k)fluoranthene	0.490	—	Yes
Chrysene	0.430	—	Yes
Fluoranthene	0.720	0.1	Yes
Pyrene	0.620	0.1	Yes

— = No ESV data available

* ESV data from: Simon, T.D., EPA Region 4 Memorandum, Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders.

For the protection of aquatic biota exposed to groundwater potentially discharging to surface water, EPA Region 4 ESVs are chronic ambient water quality criteria for the protection of aquatic life, such as aquatic plants, invertebrates, and fish, or similarly derived values (EPA 1996c). There are no EPA Region 4 ESVs for xylenes and 2-methylnaphthalene. The proposed ESV for xylenes (0.0018 mg/L) is the chronic Tier II value from Suter and Tsao (1996). The proposed ESV for 2-methylnaphthalene (161.7 mg/L) is derived from the EPA Assessment and Remediation of Contaminated Sediment (ARCS) lowest sediment threshold effects level (TEL) value for the amphipod, *Hyallela azteca*, published in Buchman (1998). The ARCS sediment TEL is used to calculate the proposed surface water ESV by equilibrium partitioning, assuming 1 percent sediment organic carbon.

Table 8.2 lists SRCs identified in groundwater, the maximum detected concentrations, the ESVs, and whether each SRC found in groundwater at SWMU 13 must be evaluated in Steps ii through v of this PRE. All four VOCs – benzene, ethylbenzene, toluene, and xylenes – and the SVOC, naphthalene, were detected at concentrations exceeding the ESVs and are retained for further evaluation.

**Table 8.2. EPA Region IV Ecological Screening Value Comparison for SRCs in Groundwater
SWMU 13, Ft. Stewart, Georgia**

Analyte	Maximum detected concentration (mg/L)	Surface water ESV (mg/L)	Retained as COPC?
Volatile Organic Compounds			
Benzene	.440	0.053	Yes
Ethylbenzene	0.94	0.453	Yes
Toluene	0.52	0.175	Yes
Xylenes	5.3	0.0018 ^a	Yes
Semivolatile Organic Compounds			
2-Methylnaphthalene	0.072	161.7 ^b	No
Naphthalene	0.14	0.062	Yes

ESV = EPA Region 4 Ecological Screening Values (EPA 1996c), unless otherwise indicated where no EPA Region 4 ESV is available.

^a Chronic Tier II value (Suter and Tsao 1996)

^b Proposed surface water ESV = Sediment Benchmark/ ($K_{ow} \times F_{oc}$), where fraction organic carbon (F_{oc}) assumed to be 1 percent, see table below.

Analyte	K_{ow}^* (L/kg)	Sediment Benchmark (mg/kg)	Source of Sediment Benchmark
2-methylnaphthalene	0.0125	0.02021	lowest ARCS TEL for <i>Hyallela azteca</i> (Buchmann 1998)

* K_{ows} from log K_{ows} reported in HAZWRAP (1994)

8.1.2 Preliminary Problem Formulation (Step ii)

The preliminary problem formulation qualitatively identifies categories of potential ecological receptors and the SRCs that may pose a risk to those receptors in the environmental setting of SWMU 13. Preliminary assessment endpoints, ecological receptors, and surrogate species representative of ecological receptors are selected for evaluation in the preliminary risk calculation.

GA EPD (1996) specifies that the PRE develop “risk characterization for a model ecological receptor.” The ecological COPCs in surface soil to be evaluated are seven PAH compounds. PAHs are extensively metabolized by vertebrates and many invertebrates. As a result, bioaccumulation and food chain biomagnification of PAHs generally are not significant. Thus, their ecological impacts are most likely to

affect receptors with significant direct exposures (e.g., earthworms). Earthworm toxicity data are not available for the COPCs and, in order to obtain this data, toxicity testing would have to be conducted. A toxicological benchmark for the types of SVOCs to be evaluated is available for a mammal. Therefore, even though bioaccumulation is not likely to occur, a higher trophic level will be evaluated; the risk characterization for surface soil at SWMU 13 considers mammals as ecological receptors.

Environmental Setting

SWMU 13 is located on the northwestern edge of the WAAF and is bordered to the north and west by forest and to the south and east by the airfield and its appurtenant runways, taxiways, and grassy fields. Surface water features are not present, except after heavy rains as infrequent standing pools in the drainage swales that almost surround the study area. The closest groundwater discharge point to the site is Peacock Creek, which is approximately 2,500 feet southeast of the site.

The terrestrial habitat in the vicinity of SWMU 13 consists primarily of palmetto-pine flatwoods forest. Loblolly pine (*Pinus taeda*) and long-leaf pine (*P. palustris*) comprise the forest canopy. The understory is thick with saw-palmetto (*Serenoa repens*).

Field personnel in the vicinity of SWMU 13 noted numerous mammals and birds either through observation, hearing a call, or seeing scat or tracks. The red-headed woodpecker (*Melanerpes erythrocephalus*) and the turkey vulture (*Cathartes aura*) were observed in the area on numerous occasions. Scat or tracks of white-tailed deer (*Odocoileus virginianus*), armadillo (*Dasypus novemcinctus*), and raccoon (*Procyon lotor*) were also noted.

Surface Soil

The PRE for surface soil (0 to 1 feet) at SWMU 13 evaluates the potential for risk to ecological receptors from ecological COPCs detected at soil sampling locations near the study area. The categories of ecological receptors that are potentially directly exposed to substances in surface soil at SWMU 13 are soil bacteria and fungi, vegetation, and animals that come in direct contact with or ingest soil, e.g., soil-dwelling invertebrates and vertebrates that incidentally ingest soil while feeding, grooming, or burrowing. Receptors also are potentially exposed indirectly to soil contaminants that are taken up and stored in the cells or tissues of those organisms directly exposed. Herbivorous invertebrates (e.g., insects) and vertebrates (e.g., birds and mammals) are potentially indirectly exposed when they ingest vegetation growing in contaminated soil. Carnivorous animals are potentially exposed when they ingest animals that are directly or indirectly exposed to contaminated soil such as soil-dwelling invertebrates (e.g., earthworms).

As previously discussed, based on the greater amount of published data on the effects of the seven SVOCs on vertebrate wildlife, mammals in particular, the proposed ecological receptors for surface soil at SWMU 13 are carnivorous small mammals that prey upon soil-dwelling invertebrates.

The preliminary assessment endpoint for surface soil at SWMU 13 is the protection of small mammals from adverse effects on populations. The surrogate species to represent this receptor group is the

southern short-tailed shrew (*Blarina carolinensis*). The home range of the shrew is small, and earthworms and other soil-dwelling invertebrates potentially represent a large percentage of its diet. The life history and behavior of this species ensure a conservative estimate of risk.

Groundwater

Per EPA (1996a) guidance, the PRE for groundwater at SWMU 13 evaluates the potential for risk to ecological receptors from exposure to groundwater potentially discharging to nearby surface water bodies.

The ecological receptors that are potentially directly exposed to substances in groundwater after it has emerged as surface water are aquatic plants and animals, terrestrial animals that come in direct contact with or ingest surface water, and those animals ingesting aquatic biota that live in the creeks, such as fish. Amphibians potentially breed in Peacock Creek and standing water on its floodplain. Other terrestrial animals potentially drink from creeks or wetland pools. Terrestrial predators of aquatic biota, such as fish-eating mammals, are also likely to be indirectly exposed, through ingestion of aquatic prey, to contaminants in groundwater discharging to surface water.

BTEX and one SVOC are ecological COPCs in groundwater. Based on the ecological COPCs, the habitat, and potential exposure pathways at the SWMU 13, the proposed ecological receptors for the evaluation of groundwater are aquatic biota, such as fish and amphibians, and terrestrial animals. Aquatic animals and plants are exposed directly to ecological COPCs in groundwater potentially discharging to surface water. Terrestrial animals are potentially exposed by ingestion of surface water and ingestion of aquatic biota that have bioaccumulated substances in their tissues.

The preliminary assessment endpoints for groundwater at the SWMU 13 are:

- protection of aquatic biota,
- protection of terrestrial mammal populations from adverse effects of drinking surface water, and
- protection of fish-eating mammal populations from adverse effects from ingesting fish and other aquatic biota.

The aquatic biota assessment endpoint is not evaluated further in the PRE. The results of the ESV comparison for groundwater identify the ecological COPCs for aquatic biota at the SWMU 13. No additional evaluation of this assessment endpoint is included because EPA Region 4 ESVs for surface water are the only reasonable published values that might serve as surface water toxicity reference values (TRVs), and there are no additional adjustments to exposure for aquatic biota.

The mink (*Mustela vison*) is the surrogate species representing terrestrial ecological receptors exposed to groundwater discharging as surface water. Mink ingest surface water and ingest fish and other aquatic biota living in streams. This species is potentially found at Fort Stewart (GA EPD 1997c) and potentially

obtains food and water from creeks. Thus, the life history and behavior of this species ensures a conservative estimate of risk per GA EPD (1996) and EPA (1997) guidance.

8.1.3 Preliminary Effects Evaluation (Step iii)

The preliminary ecological effects evaluation (Step iii) identifies TRVs for use in the preliminary risk calculation. TRVs are derived from no observed adverse effect levels (NOAELs) from laboratory toxicity studies on test species. In this PRE, TRVs are based on results for mammalian test species that can be extrapolated to predict effects on wildlife, such as shrews.

For all receptors in the PRE for SWMU 13, which are exposed directly or indirectly by ingestion, TRVs are expressed as threshold concentrations of the contaminant in the abiotic medium (i.e., soil). The TRVs for soil are calculated from dietary concentrations corresponding to the NOAEL doses (Table 8.3). The TRVs for mink exposed to groundwater are calculated from drinking water limits and dietary limits corresponding to NOAEL doses (Table 8.4). Dietary limit concentrations (mg/kg) are calculated from the NOAELs (mg/kg/d) by multiplying by the body weight (kg) and dividing by the ingestion rate (kg/d) and converting from mg to μg , where necessary. That is,

$$\text{dietary limit} = \text{NOAEL} \times \text{body weight/ingestion rate.}$$

Similarly for drinking water limit concentrations, that is,

$$\text{drinking water limit (mg/L)} = \text{NOAEL} \times \text{body weight/water ingestion rate (L/d).}$$

Table 8.3
Derivation of Toxicity Reference Values for Ecological COPCs in Surface Soil
SWMU 13, Fort Stewart, Georgia

Analyte	NOAEL ^a (mg/kg BW/d)	Dietary limit ^{a, b} (mg/kg BW/d)	Earthworm BAF*	TRV (mg/kg)
	Mammal	Shrew		Shrew
Semivolatile Organic Compounds				
Benzo(a)anthracene	—	—	0.05	3.96 ^d
Benzo(a)pyrene	1.0	1.98	0.05	39.6
Benzo(b)fluoranthene	—	—	0.05	3.96 ^d
Benzo(k)fluoranthene	—	—	0.05	3.96 ^d
Chrysene	—	—	0.05	3.96 ^d
Fluoranthene	—	—	0.05	3.96 ^d
Pyrene	—	—	0.05	3.96 ^d

^aNOAELs for test species used to derive NOAELs and dietary limits for shrew (see Table 12 in Sample et al. 1996).

^bDietary limit = NOAEL $\times$ shrew BW (kg)/shrew food ingestion rate (kg/d); see Table 8.5 for shrew body weight (BW) and ingestion rate.

TRV = Toxicity reference value = dietary limit/BAF_{earthworm}.

*Earthworm BAFs from Beyer (1990) as reported in HAZWRAP (1994).

— = No data to derive TRV.

^dTRVs for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene cannot be derived, proposed TRV = 1/10 TRV for benzo(a)pyrene.

BAF = bioaccumulation factor

Table 8.4
Derivation of Toxicity Reference Values for Ecological COPCs in Groundwater
SWMU 13, Fort Stewart, Georgia

Analyte	NOAEL (mg/kg BW/d)	TRV _w (mg/L)	Dietary limit (mg/kg BW/d)	Fish BCF (L/kg)	TRV _F (mg/L)
	Mink	Mink	Mink		Mink
Volatile Organic Compounds					
Benzene	11 ^a	110.8 ^a	80.1 ^a	32	2.50
Ethylbenzene	7.47 ^b	75.5	54.5	290	0.19
Toluene	10.8 ^a	109.3 ^a	79 ^a	83	0.95
Xylenes	0.874 ^a	8.828 ^a	6.379 ^a	17	0.375
Semivolatile Organic Compounds					
Naphthalene	5.46 ^b	55.15	39.85	430	0.09

^aSample et al. (1996); Table 12

^bCalculated from published subchronic NOAEL for rat in U.S. EPA IRIS Substance file, <http://www.epa.gov/iris/subst/o436.htm>; where Mink NOAEL = NOAEL_{rat} [bw_{rat}/bw_{mink}]^{0.25}; where NOAEL = published subchronic NOAEL × 0.1; bw_{rat} = 0.35kg; bw_{mink} = 1 kg

TRV_w = Dietary water limit; Values in Table 12 in Sample et al. (1996) or calculated as follows:

Drinking water limit (mg/L) = NOAEL_{mink} (mg/kg BW/d) × BW (kg) / water ingestion rate (L/d); see Table 8.5

Dietary limit value in Table 12 in Sample et al. (1996) or calculated as follows:

Dietary limit (mg/kg) = NOAEL_{mink} (mg/kg BW/d) × BW (kg) / food ingestion rate (kg/d); see Table 8.5

BCF = water-to-fish bioconcentration factor (HAZWRA 1994)

TRV_F = Dietary limit (mg/kg) / BCF (L/kg)

For shrews, which are exposed indirectly by ingestion of biota, the maximum detected soil concentration is compared to the threshold soil concentration (i.e., the TRV), which is calculated as the dietary concentration associated with the NOAEL dose divided by the unitless bioaccumulation factor (BAF) for the contaminant in the tissue of the ingested soil-dwelling biota. That is,

$$\text{TRV (mg/kg)} = \text{dietary limit (mg/kg)} / \text{BAF}.$$

For mink, which are exposed directly to COPCs in groundwater potentially discharging to surface water, the maximum detected concentration in groundwater (mg/L) is compared to the TRV_w calculated as the limit concentration for ingested water. That is,

$$\text{TRV}_w \text{ (mg/L)} = \text{drinking water limit (mg/L)}.$$

For mink, which are also exposed to groundwater COPCs indirectly by ingestion of biota, the maximum detected groundwater concentration is compared to the threshold water concentration for ingestion of food (i.e., the TRV_F). The TRV_F is calculated as the dietary limit associated with the NOAEL dose divided by the bioconcentration factor (BCF) for the contaminant in the tissue of the ingested aquatic biota. That is,

$$\text{TRV}_F \text{ (mg/L)} = [\text{dietary limit (mg/kg)}] / \text{BCF (L/kg)}.$$

This approach allows direct comparison of measured concentrations of COPCs in the abiotic media against the abiotic media concentration assumed to be protective of the ecological receptor by both exposure pathways. If a NOAEL is not available for a contaminant, the TRV associated with the lowest observed adverse effect level (LOAEL) divided by a conservative uncertainty factor of 10 (LOAEL/10) will be used as the screening value (EPA 1996a).

If toxicity data are not available for the surrogate species, data for a test species of the same taxonomic class is sometimes used, i.e., toxicity test for a surrogate mammal. The NOAEL for the test species is adjusted for the body weight of the receptor species to derive the NOAEL for the receptor species. NOAELs for test species based on daily dose (mg/kg body weight/day) are adjusted to surrogate species according to the following equation:

$$\text{wildlife receptor species NOAEL} = \text{test species NOAEL} \times (\text{bw}_{\text{ts}}/\text{bw}_{\text{ws}})^z,$$

where bw_{ts} and bw_{ws} are the body weights (kg) of the test species and wildlife receptor species, respectively, and $z = 0.25$ for mammals (Sample et al. 1996). For example, the published NOAEL for a COPC might be based on data for a 0.35 kg laboratory rat. The NOAEL for a 0.022 kg field mouse would be nearly two times larger than the rat NOAEL. NOAELs for shrews are derived from test species data published in Sample et al. (1996).

The TRVs derived for shrews for COPCs detected in soil at SWMU 13 are presented in Table 8.3. Because TRVs were not available for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene; a TRV is derived for each of these PAHs based on benzo(a)pyrene as a surrogate. A TRV is proposed for the shrew that is one tenth the TRV for benzo(a)pyrene (i.e., an uncertainty factor of 10 is applied). The potency of benzo(a)pyrene has been used as a basis for estimating the potency of other PAHs (EPA 1992). Because benzo(a)pyrene is equally or more potent than other PAHs (EPA 1992), using its TRV, reduced by an uncertainty factor of 10, as a surrogate TRV for the other PAHs is a conservative approach to estimating TRVs for PAHs without published NOAELs. Conservative benchmarks are appropriate for screening-level risk assessments.

The TRVs derived for mink for COPCs detected in groundwater at SWMU 13 are presented in Table 8.4. Because NOAELs and LOAELs for ethylbenzene and naphthalene were not available in Sample et al. (1996), proposed TRVs are calculated using NOAELs derived from other sources.

8.1.4 Preliminary Exposure Estimate (Step iv)

The preliminary exposure estimate (Step iv) evaluates the potential pathways of exposure appropriate to the ecological receptors being evaluated at SWMU 13.

Exposures of the representative receptor species, the shrew and mink, are estimated using conservative assumptions. It is assumed that these receptors spend their entire lives and obtain 100 percent of their diet or drinking water at the facility, i.e., the Area Use Factor (AUF) equals 1. Shrews are assumed to eat only

soil-dwelling invertebrates, such as worms, which may bioaccumulate contaminants from soil, in accordance with EPA Region 4 requirements that the screen be based on exposure through two trophic transfers (EPA 1997). Likewise, mink are assumed to eat only aquatic biota, such as fish, which may bioaccumulate contaminants from water. Contaminant levels are assumed to bioaccumulate in the soil-dwelling invertebrate prey of the shrew, and aquatic biota prey of mink are based, respectively, on published BAFs for earthworms and other invertebrates and BCFs for fish and aquatic biota. The exposure parameters for shrews exposed to COPCs in soil and mink exposed to COPCs in groundwater are presented in Table 8.5.

Table 8.5
Exposure Parameters for Surrogate Species Exposed to Ecological COPCs in Surface Soil or Groundwater
SWMU 13, Fort Stewart, Georgia

Parameter	Surrogate species	
	Shrew	Mink
Body Weight (kg)	0.015 ^a	1 ^a
Food Ingestion Rate (kg/d)	0.009 ^a	0.137 ^a
Water Ingestion Rate (L/d)	—	0.099 ^a
AUF	1	1
Bioavailability	100%	100%
Diet	100% earthworm	100% fish
Source medium	Surface Soil	Groundwater

^aSample et al. (1996), Table 1.

— = not required for preliminary risk calculation.

AUF = Area Use Factor.

Based on EPA (1996a) guidance, the analyte concentrations to which receptors at SWMU 13 are directly or indirectly exposed are estimated from the maximum detected concentrations in soil and groundwater.

8.1.5 Preliminary Risk Calculation (Step v)

The preliminary risk calculation (Step v) calculates hazard quotients (HQs) as the ratio of the measured maximum concentration and the TRV. The HQs of ecological COPCs with consistent modes of toxicity and effects endpoints are added to produce an HI. An HI greater than 1 for a category of COPCs is a useful indicator of potential risk when no individual COPC in that category has an HQ greater than 1. An HI assumes that the effect of the individual COPCs in the category are additive.

Because of uncertainties in quantifying exposure and effects, the exposure and effects assessments for SWMU 13 are designed to produce HQs that minimize the probability of falsely concluding that there is no risk when in fact there is. Therefore, ecological COPCs with HQs and HIs less than 1.0 indicate little to no likelihood of risk to the ecological receptors.

Surface Soil

The preliminary risk calculations for shrews exposed to ecological COPCs detected in soil at SWMU 13 are presented in Table 8.6. This table shows the maximum detected concentrations and the TRVs for shrews. The HQs are the simple ratio of the measured concentration divided by the TRV.

Table 8.6
Preliminary Risk Evaluation of Ecological COPCs in Surface Soil
SWMU 13, Fort Stewart, Georgia

Analyte	TRV shrew	Maximum detected concentration	HQ	Ecological COPC?
Semivolatile Organic Compounds (mg/kg)				
Benzo(a)anthracene	3.96 ^a	0.430	0.11	No
Benzo(a)pyrene	39.6	0.390	0.01	No
Benzo(b)fluoranthene	3.96 ^a	0.560	0.14	No
Benzo(k)fluoranthene	3.96 ^a	0.490	0.12	No
Chrysene	3.96 ^a	0.430	0.11	No
Fluoranthene	3.96 ^a	0.720	0.18	No
Pyrene	3.96 ^a	0.620	0.16	No
		Sum SVOC HQs = HI =	0.83	No

TRV = Toxicity reference value = (NOAEL × BW/food ingestion rate)/BAF_{earthworm} (see Table 8.3).

HQ = Maximum concentration/TRV, if detected concentration exceeds TRV, HQ > 1.

^a TRV for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene cannot be derived; proposed TRV = 1/10 TRV for benzo(a)pyrene.

An HI can be calculated for the shrew using the seven PAHs detected in surface soil, assuming that they have similar mechanisms of toxicity in small mammals. The HI is 0.83. Because the HI is less than 1, these PAHs in surface soil at SWMU 13 are not ecological COPCs for populations of small mammals ingesting earthworms and other soil-dwelling invertebrates and are eliminated as ecological COPCs in surface soil.

Groundwater

The preliminary risk calculation for mink exposed to ecological COPCs detected in groundwater at SWMU 13 are presented in Table 8.7. These tables show the maximum detected concentrations in each sample, the TRVs, and HQs. A HQ is a simple ratio of the maximum detected concentration (C_{max}) and a TRV. The HQ for water (HQ_w) and the HQ for food (HQ_f) are added together to give a HQ for the combined exposures to ecological COPCs. An HI is not calculated for groundwater because there is one or more ecological COPC in each class of contaminant with an HQ exceeding 1.

Two VOCs and naphthalene have HQs exceeding 1 for the mink. The mink HQs for ethylbenzene and xylenes are 4.96 and 14.73, respectively. The mink HQs for naphthalene is 1.56. Thus, there are three ecological COPCs with HQs exceeding 1 for terrestrial ecological receptors exposed to groundwater at SWMU 13.

8.1.6 Conclusions of the Ecological Preliminary Risk Evaluation

The media of concern to ecological receptors are surface soil, sediment, and surface water, because these media can be contacted directly by ecological receptors, and their presence in these media can result in the accumulation of contaminants in plants and animals, causing exposure to ecological receptors ingesting them. At SWMU 13, the nearest perennial surface water body, Peacock Creek, is 2,500 feet away and there are no other features nearby to receive groundwater discharges. Therefore, sediment and surface water samples were not collected and there is no data to evaluate potential risk from substances in these media. Groundwater from SWMU 13 is evaluated per EPA guidance (EPA 1996a). Therefore, the media evaluated in this PRE are surface soil and groundwater.

Table 8.7
Preliminary Risk Evaluation of Ecological COPCs in Groundwater
SWMU 13, Fort Stewart, Georgia

Analyte	C _{max} (mg/L)	TRV _w (mg/L)	HQ _w = C _{max} /TRV _w	TRV _F (mg/L)	HQF = C _{max} /TRV _F	HQ = HQ _w + HQ _F	Ecological COPC?
		Mink		Mink			
Volatile Organic Compounds							
Benzene	0.44	110.8	0.004	2.5	0.18	0.18	No
Ethylbenzene	0.94	75.50	0.01	0.19	4.95	4.96	Yes
Toluene	0.52	109.3	0.0048	0.95	0.55	0.55	No
Xylenes	5.3	8.83	0.6	0.375	14.13	14.73	Yes
Semivolatile Organic Compound							
Naphthalene	0.14	55.15	0.003	0.09	1.56	1.56	Yes

C_{max} = Maximum detected concentration

TRV_w = Toxicity Reference Value (water) = Drinking water limit (mg/L)

HQ_w = Hazard Quotient (water)

TRV_F = Toxicity Reference Value (food) = Dietary limit (mg/kg) / BCF (L/kg)

HQ_F = Hazard Quotient (food)

The EPRE provided a Phase 1 PRE for potential terrestrial receptors at the site. Preliminary risk calculations identified potential ecological COPCs in surface soil and groundwater, based on a comparison of detected concentrations to TRVs for surrogate species representing ecological receptors.

Barium was detected above reference background criteria in surface soil at SWMU 13 but was below its ESV. There is uncertainty about whether benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene are ecological COPCs in surface soil, because toxicity data specific to these PAHs were not available. These six PAHs were detected in only one surface soil sample, B-GP-17-0s, south of the former fire training area. As discussed in Section 7.0, this sample was collected from an area adjacent to weathered and eroded asphalt pavement. It is reasonable to expect that some of the asphalt fragments eroded from the weathered pavement could have been incorporated into the sample during collection and biased the sample. All PAHs detected were at low concentrations, and are unlikely to pose a risk to ecological receptors given the low concentrations relative to their proposed TRVs, which are one tenth the TRV for benzo(a)pyrene. There are, therefore, no organic ecological COPCs in surface soil.

The risks to ecological receptors from ecological COPCs in groundwater at SWMU 13 are overestimated by the ESV comparison and preliminary risk calculations. The nearest surface water to SWMU 13 is Peacock Creek, which is 2,500 feet away. If dilution and degradation before or after discharge reduces the concentrations of ecological COPCs by a factor of 10, none of the maximum concentrations would exceed ESVs for surface water. The supplemental risk calculations for mink exposed to ethylbenzene, total xylenes, and naphthalene in groundwater at SWMU 13 are presented in Table 8.8. The ADDs, calculated using realistic diets, the site-specific AUF, and mean groundwater concentrations, do not exceed LOAEL-based TRVs (HQs < 1). Therefore, ethylbenzene, total xylenes, and naphthalene in groundwater at SWMU 13 are unlikely to pose a risk to wildlife receptors.

Table 8.8.
Supplemental Risk Calculations for COPCs in Groundwater, SWMU 13: Mink

Analyte	Site concentration Mean (mg/L)	BCF	ADD _A (mg/kgBW/d) Mean × BCF × I _A × AUF	ADD _W (mg/kgBW/d) Mean × IR _W × AUF	ADD _{total} (mg/kgBW/d) ADD _A + ADD _W	Body Weight Adjusted LOAEL TRV (mg/kgBW/d)	HQ ADD _{total} / TRV
Volatile Organic Compounds							
Ethylbenzene	1.31E-01	2.90E+02	4.16E-01	1.04E-03	4.17E-01	7.47E+01	5.59E-03
Xylene, Total	5.68E-01	1.70E+01	1.06E-01	4.50E-03	1.10E-01	1.08E+00	1.02E-01
Semivolatile Organic Compounds							
Naphthalene	3.00E-02	4.30E+02	1.41E-01	2.38E-04	1.42E-01	5.46E+01	2.59E-03

ADD_A = Average daily dose; animal

AUF = 0.08

BCF = Water-to-animal transfer factor

AUF assumes 100m of stream is contaminated

I_A = 0.137 kg/kgBW/d

at mean concentration and home range of mink = 1.23 km (EPA 1993)

I_A = TUF × IR_F × AF × BW

ADD_W = Average daily dose; drinking water

TUF = Temporal use factor = 1

IR_W = 0.099 L/kgBW/d = BW × Water ingestion rate (Table 8.5)

IR_F = Food ingestion rate (Table 8.5)

ADD_{total} = Average daily dose; total

AF = Animal fraction

TRV = Toxicity reference value; LOAEL = 10 × NOAEL (Table 8.4), except Xylenes

BW = body weight = 1 kg (Table 8.5)

^a Total xylenes LOAEL = 1.08 mg/kgBW/d from Table 12 (Sample et al. 1996)

HQ = Hazard quotient

In conclusion, there are no ecological COPCs in either soil, sediment, surface water, or groundwater at SWMU 13. Therefore, no remedial levels are required to be developed for ecological receptors and an ERA is not warranted for this site.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary of Findings

The RFI presented in this report was conducted to collect additional analytical data for determining the nature and extent of contamination in environmental media in the vicinity of SWMU 13. The data were derived from a series of screening and primary samples collected from surface and subsurface soils and groundwater in the study area. The samples collected were analyzed for metals, VOCs, and SVOCs.

Results of these analyses, and analyses conducted as part of the IM confirmatory sampling (Table 2.1), indicated that the SRCs in soils at SWMU 13 are 8 VOCs, 17 SVOCs and 5 metals. Groundwater SRCs are fuel-related contaminants: benzene, toluene, ethylbenzene, xylene, naphthalene, and 2-methylnaphthalene.

The following summarizes the significant findings of this RFI:

- Contamination is present in both soil and groundwater at the site, dominated by BTEX compounds, with secondary PAH contaminants. The soil in the vicinity of the former Fire Training Area has been removed to a depth of four feet, and replaced with clean fill. The contaminated surface soil that was found during this RFI was in a single sample adjacent to weathered asphalt pavement and not in the area where soil had been excavated and replaced. Contamination was also found in the samples from deeper borings where seasonal water table fluctuations have smeared dissolved contamination onto the soil.
- VOCs and SVOCs were detected in groundwater screening to a depth of approximately 40 feet below the water table.
- The groundwater contamination covers a plume area approximately 125 feet wide by 250 feet long.
- The groundwater contamination is more than 2,500 feet from the nearest surface water feature, Peacock Creek, and is not impacting the surface water there.
- Biodegradation of the VOCs is likely occurring, as evidenced by the depressed dissolved oxygen in the plume.

9.2 Conclusions

Several assessments were conducted to determine the significance of the contaminant concentrations found at SWMU 13 with respect to their impact on human health and the environment. The assessments included:

- A contaminant fate and transport analysis (Section 6.0) which provided an assessment of the potential migration pathways and transport mechanisms affecting the chemical compounds found at the site.

- A preliminary human health assessment (Section 7.0) which employed a Step 1 risk evaluation to determine potential human health risks associated with the SRCs.
- An ecological assessment (Section 8.0) which provided a Phase 1 PRE for terrestrial habitats in the study area.

The following summarizes the conclusions regarding contaminant fate and transport:

- A soil leachability analysis was conducted for surface and subsurface soil SRCs that exceeded GSSLs (Section 6.4.1). Only one volatile organic chemical (4-methyl-2-pentanone) exceeded its GSSL. Among the semivolatile organics, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and 2-methylnaphthalene exceeded their respective GSSLs. Two RCRA metals (arsenic and chromium) exceeded their GSSLs. The constituents that exceeded their GSSLs were identified as preliminary CMCOPCs (Table 6.3). SESOIL modeling was performed for preliminary CMCOPCs to estimate the maximum groundwater concentration expected beneath the site due to the maximum soil concentrations reported during the IM confirmatory sampling and this RFI sampling.
- The SESOIL modeling results for semi-volatile preliminary CMCOPCs show that benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene naturally attenuate before reaching the water table. The predicted groundwater concentrations of 2-methylnaphthalene and 4-methyl-2-pentanone do not exceed their respective RBCs. Therefore, all preliminary volatile and semi-volatile CMCOPCs were eliminated from the list of CMCOPCs for the HHBRA (Table 6.4).
- Arsenic and chromium were the only metal preliminary CMCOPCs, and their SESOIL predicted maximum groundwater concentrations are 0.21 mg/L and 2.13 mg/L, respectively. The predicted groundwater concentrations of both arsenic and chromium exceeded their respective MCLs of 0.05 mg/L and 0.1 mg/L. SESOIL modeling results indicate that arsenic and chromium reach their maximum concentrations in groundwater after 135 and 67 years, respectively. Arsenic and chromium were retained in the CMCOPC list for the further evaluation in the HHBRA (Table 6.4).
- Off-site migration of arsenic and chromium will be very limited due to slow groundwater movement at the site (14 feet/year) and also due to their high retardation factors. The nearest potential surface water receptor, Peacock Creek, is located approximately 2,500 feet downgradient from the site. Using the groundwater velocity of 14 feet/year and the retardation factors presented in Table 6.1, arsenic and chromium will take more than 15,000 years to reach the nearest potential surface water receptor.
- The organics detected in the groundwater include both VOCs and SVOCs. However, groundwater movement off site is very slow (14 feet/year) and may take 178 years to reach the receptor location (i.e., Peacock Creek). Considering these contaminants are retarded with respect to groundwater flow, the actual time required for contamination to reach Peacock Creek is even greater.

9.3 Conclusions of the Human Health Preliminary Risk Evaluation

The following summarizes the conclusion of the human health preliminary risk evaluation:

- At SWMU 13, the nearest perennial surface water body, Peacock Creek, is 2,500 feet downgradient of the site and there are no other features nearby to receive groundwater discharges. Specifically, the drainage swales located around the perimeter of the site, are approximately 3.5 feet above the highest groundwater elevation observed at the site, and only retain water during heavy rain events. The ponded water then percolates down into the surficial aquifer, clearly indicating that none of the swales receive water from the surficial aquifer. Therefore, there is no exposure by surface water. The "sediment" in the bottom of each swale is considered as surface soil at the site.
- Benzo(a)pyrene was detected above its RBC in surface soils at one location. This one location was adjacent to weathered asphalt, it is likely this lone sample incorporated some of the asphalt and resulted in the reported concentration. However, as a conservative approach, benzo(a)pyrene is retained as a human health COPC for surface soil (Table 7.1).
- Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene, and arsenic were reported at concentrations above their respective RBCs. These constituents are identified as human health COPCs for subsurface soil (Table 7.2).
- Six human health COPCs were identified for groundwater (benzene, ethylbenzene, toluene, xylenes, 2-methylnaphthalene, and naphthalene) because they present a potential threat to human health as a result of using groundwater as a source of drinking water. It should be noted that given the shallow depth of the surficial aquifer and the presence of the deeper Principal Artesian aquifer, a common source of drinking water throughout the region, the use of the surficial aquifer is not considered to be a viable exposure scenario (Section 7.4.3).
- Based on the results of the screening, the following human health COPCs were identified for SWMU 13.

Surface Soil COPCs	Subsurface Soil COPCs	Soil CMCOPCs	Groundwater COPCs
Benzo(a)pyrene	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Dibenzo(a,h)anthracene	Arsenic Chromium	Benzene Ethylbenzene Toluene Xylenes, Total 2-Methylnaphthalene Naphthalene

- Because COPCs are identified in various media at SWMU 13, a HHBRA was conducted for the site and is presented in Appendix H.

9.4 Conclusions of the Preliminary Ecological Assessment

- At SWMU 13, the nearest perennial surface water body, Peacock Creek, is 2,500 feet away and there are no other features nearby to receive groundwater discharges. Therefore, there is no ecological

exposure by sediment and surface water, and the only media evaluated during this PRE was surface soil and groundwater, per EPA guidance.

- Barium was the only metal detected above reference background criteria in surface soil at SWMU 13, but the maximum detected concentration was below its ESV. Therefore, no metals are identified as ecological COPCs for SWMU 13 (Table 8.1).
- Preliminary risk calculations included a comparison of detected concentrations to TRVs for surrogate species representing ecological receptors for the seven PAHs evaluated. Based on the comparison, none of the PAHs were identified as ecological COPCs (Table 8.6).
- There is uncertainty about whether benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene are ecological COPCs in surface soil, because toxicity values (NOAELs) were not available for these substances. These six PAHs were detected in only one surface soil sample, B-GP-17-0s, south of the former fire training area. This sample was collected from an area adjacent to a weathered and eroded asphalt pavement. It is reasonable to expect that some of the asphalt fragments eroded from the weathered pavement could have been incorporated into the sample during collection and biased the sample. All detected PAHs were at low concentrations, and are unlikely to pose a risk to ecological receptors given the low concentrations relative to their proposed TRVs, which are conservatively estimated as one tenth the TRV for benzo(a)pyrene. The combined Hazard Index for all PAHs is less than 1.0. Therefore there are no organic ecological COPCs in surface soil (Table 8.6).
- Four VOCs (BTEX) and naphthalene in groundwater at SWMU 13 are ecological COPCs for aquatic biota because they were detected at concentrations that exceed EPA surface water ESVs. Ethylbenzene, xylenes, and naphthalene are ecological COPCs for wildlife receptors because preliminary HQs for mink exceed 1. Supplemental risk calculations for ethylbenzene, xylenes, and naphthalene result in HQs less than 1 for the mink. Therefore, these VOCs and SVOC in groundwater are unlikely to pose a risk to terrestrial receptors exposed to groundwater. Groundwater concentrations of the ecological COPCs in the nearest surface water body 2,500 feet away, if discharge is occurring, are unlikely to exceed freshwater ESVs. Therefore, substances in groundwater at SWMU 13 are unlikely to pose a risk to aquatic biota and wildlife receptors.
- There are no ecological COPCs in either soil, sediment, surface water, or groundwater at SWMU 13. Therefore, no remedial levels are required to be developed for ecological receptors and an ERA is not warranted for this site (Section 8.1.6).

9.5 Conclusions of the Human Health Baseline Risk Assessment

Estimated hazards and risks were calculated for exposure of two current (on-site groundskeeper, off-site FSMR worker) and three hypothetical future (on-site groundskeeper, off-site FSMR worker, on-site resident) exposure scenarios.

9.5.1 Surface Soil

All of the estimated HQ and HI values for surface soil exposures are less than one. Estimated risks to the current and future workers are all below the *deminimis* level of 1×10^{-6} . Estimated risks to a hypothetical future resident exceed 1×10^{-6} due to ingestion of benzo(a)pyrene. Benzo(a)pyrene is identified as a COC for surface soil. Remedial levels derived for this site address the potential risk to a hypothetical future resident exposed to constituents in surface soil via ingestion, inhalation, and dermal contact. Given that benzo(a)pyrene is the only COC in surface soil, a remedial level of 0.98 mg/kg is recommended. This remedial level corresponds to a total residential cancer risk of 1×10^{-5} (see Table 9.1).

9.5.2 Subsurface Soil

Estimated hazards and risks were calculated for exposure to subsurface soil by a hypothetical future construction worker. All of the estimated HQ and HI values are less than one. Estimated risks to the future worker are all below the *deminimis* level of 1×10^{-6} . No COCs are identified for subsurface soil.

Estimated hazards and risks were calculated for exposure to groundwater containing CMCOPCs leached from overlying soil. Estimated hazards and risks exceed target levels for all receptors exposed to arsenic and chromium, therefore, these two metals are identified as CMCOCs. Soil remedial levels for CMCOCs are derived based on the concentration of constituents in soil that will not leach into groundwater at unacceptable levels. Acceptable (target) groundwater concentrations are used to back-calculate acceptable soil concentrations using the leachate model (SESOL).

The hypothetical residential exposure scenarios provide the most conservative remedial levels. Target groundwater concentrations for a residential receptor include risk-based values and MCLs. Potential remedial levels corresponding to both MCLs and a range of risk levels for residential exposure were calculated. All of the calculated remedial levels are below the reference background concentrations for these two metals. Therefore, the background concentrations for arsenic (8.04 mg/kg) and chromium (11.6 mg/kg) are recommended as their respective remedial levels (see Table 9.1).

9.5.3 Groundwater

Estimated hazards and risks were calculated for exposure to groundwater by three hypothetical future exposure scenarios (on-site groundskeeper, off-site FSMR worker, on-site resident). For the worker exposures, all of the estimated HI values are less than one. Total estimated cancer risk exceeds 1×10^{-6} due to ingestion of benzene. Estimated HIs for the hypothetical future residential scenario are 2.0 for the adult and 4.4 for the child receptor. Estimated HQ values for benzene are 1.7 (adult) and 3.7 (child). Three other COPCs (2-methylnaphthalene, ethylbenzene, and naphthalene) have HQ values greater than 0.1. Therefore, all four of these constituents are identified as COCs for groundwater.

Remedial levels for groundwater may include both risk-based concentrations and regulatory levels such as MCLs. Given that MCLs take into consideration both human health and the limitations of technology to remove constituents from water, these regulatory levels have been selected for remedial levels for

groundwater when available. Benzene and ethylbenzene have MCLs of 0.005 mg/L and 0.7 mg/L, respectively. These MCL values are recommended as the remedial levels for these constituents.

MCL values are not available for naphthalene or 2-methylnaphthalene. The remedial levels for COCs in groundwater should not exceed a cumulative hazard index of 3.0 (GA EPD 1996). Given the number of potential COCs identified for groundwater, the recommended target groundwater concentration is based on HQs of 0.5 for each constituent. The recommended remedial levels for 2-methylnaphthalene and naphthalene are 0.142 mg/L and 0.149 mg/L, respectively (see Table 9.1).

Table 9.1
Proposed Remediation Levels for Chemicals of Concern
SWMU 13, Fort Stewart, Georgia

Site-Related Contaminants (SRCs)	units	Maximum Detect	Federal MCL	RBC	Proposed RL ¹
Surface Soil					
Benzo(a)pyrene	mg/kg	390	NA	0.0875	0.98
Subsurface Soil					
Arsenic	mg/kg	10.4	NA	8.04	8.04
Chromium	mg/kg	40.4	NA	11.6	11.6
Groundwater					
Benzene	µg/l	440	5	—	5
Ethylbenzene	µg/l	940	700	—	700
2 - Methylnaphthalene	µg/l	72	—	142	142
Naphthalene	µg/l	140	—	149	149

Notes: ¹See HHBRA contained in Appendix H.

µg/l = micrograms per liter

MCL = maximum contaminant level

RBC = USEPA Region III risk-based concentration

RL = remedial level

To address the HHCOCs and CMCOCs, a Corrective Action Plan (CAP) will be prepared for SWMU 13. It is anticipated that the CAP will be submitted to the GAEPD in the first quarter of fiscal year 2001 (October–December).

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APPENDIX A
BORING LOGS

HTW DRILLING LOG							HOLE NO. A-GP-1	
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1	
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13				
5. NAME OF DRILLER Mark Decker				6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig				
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION Swale N of concrete ramp		11. DATE COMPLETED 11-2-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-2-98				
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls				
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED				
14. TOTAL DEPTH OF HOLE 12 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)				
18. GEOTECHNICAL SAMPLES			DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS A-GP-1-8g			VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
			X	soil only	SVOCs			
22. DISPOSITION OF HOLE			BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Pauling</i>		
			X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Moist, dark yellowish brown (10 YR 4/2), fine sand with silt, organic rich.		0.0 ppm				
	2	<u>CLAYEY SAND (SC)</u> Stiff, dry, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6) and dark yellowish gray (5 Y 7/2) mottling, mostly fine sand, little clay.		0.0 ppm				
	3							
	4	Similar to above, except moist, increasing silt (SM).		0.0 ppm		A-GP-1-6s (6 - 8' bls)		
	5							
	6			0.0 ppm				
	7							
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Moist, light brown (5 YR 5/6), mostly medium to fine sand, few silt, trace micas.		0.0 ppm				
	9							
	10	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Wet, yellowish gray (5 Y 7/2), mostly fine sand, little clay with occasional lenses of light brown (5 YR 5/6) sand.				A-GP-1-8g (8 - 10' bls)		
	11							
	12	Boring terminated at 12.0 ft. bls						
	13							
	14							

PROJECT Ft. Stewart - SWMU 13							HOLE NO. A-GP-1

HTW DRILLING LOG

HOLE NO. A-GP-2
SHEET 1 OF 2

1. COMPANY NAME Earth Tech		2. DRILLING SUBCONTRACTOR FUGRO	
3. PROJECT Ft. Stewart		4. LOCATION SWMU 13	
5. NAME OF DRILLER Mark Decker		6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 ft. macro sampler (2" diameter)	8. HOLE LOCATION Swale N of concrete ramp	11. DATE COMPLETED 11-2-98
	1 3/4" diam. ground-water sampler	9. SURFACE ELEVATION	
		10. DATE STARTED 11-3-98	
12. OVERBURDEN THICKNESS		15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls	
13. DEPTH DRILLED INTO ROCK N/A		16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED	
14. TOTAL DEPTH OF HOLE 12 ft. bls		17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
20. SAMPLES FOR CHEMICAL ANALYSIS A-GP-2-6s A-GP-2-8g	VOC	METALS	OTHER (SPECIFY)
	X	soil only	SVOCs
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
	X		
		23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>	

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Moist, pale yellowish brown (10 YR 6/2), mostly fine sand, little silt, trace organics and roots.	0.0 ppm				
	2						
	3	<u>CLAYEY SAND (SC)</u> Stiff, dry, pale yellowish brown (10 YR 6/2), dark yellowish orange (10 YR 6/6), and moderate reddish brown (10 R 4/6) mottling, mostly fine sand, little clay, trace mica.	0.0 ppm				
	4						
	5	Similar to above, except light gray (N7) lenses.	0.0 ppm				
	6						
	7	Similar to above, except less clay.			A-GP-2-6s (6 - 8')		

PROJECT
Ft. Stewart - SWMU 13

HOLE NO. A-GP-2

HTW DRILLING LOG

HOLE NO. A-GP-2

PROJECT Ft. Stewart SWMU 13

INSPECTOR Melanie D. Hill

SHEET 2 OF 2

LEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	7						
	8	<u>POORLY GRADED SAND (SP)</u> Wet, grayish orange (10 YR 7/4), mostly medium sand, some fine sand, trace mica.	0.0 ppm		A-GP-2-8g (8 - 10' bls)		Ground-water at 8.0' bls
	9						
	10	Similar to above, except occasional laminated yellowish gray (5 Y 7/2) clay, sands coarsening downward.	0.0 ppm				
	11	Similar to above, except occasional laminated white (N9) kaolinitic clay.	0.0 ppm				
	12	Similar to above, except trace gravel.					
	13	Boring terminated at 12.0 ft. bls					
	14						
	15						
	16						
	17						
	18						

PROJECT Ft. Stewart - SWMU 13

HOLE NO. A-GP-2

HTW DRILLING LOG										HOLE NO. A-GP-2	
1. COMPANY NAME Earth Tech					2. DRILLING SUBCONTRACTOR FUGRO					SHEET 1 OF 2	
3. PROJECT Ft. Stewart					4. LOCATION SWMU 13						
5. NAME OF DRILLER Mark Decker					6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig						
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)			8. HOLE LOCATION Swale N of concrete ramp			11. DATE COMPLETED 11-2-98			
		1 3/4" diam. ground-water sampler			9. SURFACE ELEVATION						
					10. DATE STARTED 11-3-98						
12. OVERBURDEN THICKNESS					15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls						
13. DEPTH DRILLED INTO ROCK N/A					16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED						
14. TOTAL DEPTH OF HOLE 12 ft. bls					17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)						
18. GEOTECHNICAL SAMPLES				DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS A-GP-2-6s A-GP-2-8g				VOC		METALS		OTHER (SPECIFY)		21. TOTAL CORE RECOVERY %	
				X		soil only		SVOCs			
22. DISPOSITION OF HOLE				BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>	
				X							
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c			FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h		
	1	<u>SILTY SAND (SM)</u> Moist, pale yellowish brown (10 YR 6/2), mostly fine sand, little silt, trace organics and roots.			0.0 ppm						
	2										
	3	<u>CLAYEY SAND (SC)</u> Stiff, dry, pale yellowish brown (10 YR 6/2), dark yellowish orange (10 YR 6/6), and moderate reddish brown (10 R 4/6) mottling, mostly fine sand, little clay, trace mica.			0.0 ppm						
	4	Similar to above, except light gray (N7) lenses.			0.0 ppm						
	5										
	6	Similar to above, except less clay.					A-GP-2-6s (6 - 8')				
	7										

PROJECT Ft. Stewart - SWMU 13								HOLE NO. A-GP-2	

HTW DRILLING LOG							HOLE NO.
PROJECT				INSPECTOR		SHEET	
Ft. Stewart SWMU 13				Melanie D. Hill		2 OF 2	
LEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	7						
	8	<u>POORLY GRADED SAND (SP)</u> Wet, grayish orange (10 YR 7/4), mostly medium sand, some fine sand, trace mica.	0.0 ppm				Ground-water at 8.0' bls
	9						
	10	Similar to above, except occasional laminated yellowish gray (5 Y 7/2) clay, sands coarsening downward.	0.0 ppm				
	11	Similar to above, except occasional laminated white (N9) kaolinitic clay.					
	12	Similar to above, except trace gravel.	0.0 ppm				
	12	Boring terminated at 12.0 ft. bls					
	13						
	14						
	15						
	16						
	17						
	18						
PROJECT				Ft. Stewart - SWMU 13		HOLE NO. A-GP-2	

HTW DRILLING LOG							HOLE NO. A-GP-8	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		8. HOLE LOCATION SE of excavation		11. DATE COMPLETED 11-3-98				
4 ft. macro sampler (2" diameter)		9. SURFACE ELEVATION		10. DATE STARTED 11-3-98				
1 3/4" diam. ground-water sampler								
12. OVERBURDEN THICKNESS			15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES		DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
A-GP-8-8g		X	soil only	SVOCs				
A-GP-8-6s								
22. DISPOSITION OF HOLE		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>			
		X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
		Asphalt						
	1	<u>POORLY GRADED SAND (SP)</u> Dry, dark yellowish orange (10 YR 6/6), mostly fine sand, few silt, trace clay.		0.0 ppm				
	2	<u>CLAYEY SAND (SC)</u> Dry, moderate reddish brown (10 R 4/6) and dark yellowish gray (5 Y 7/2) mottling, mostly fine sand, few clay, trace silt.						
	3							
	4							
	5	Similar to above, except increasing clay.		0.0 ppm		A-GP-8-6s (6 - 8' bls)		
	6							
	7	Similar to above.		0.0 ppm				
	8							
	9	<u>POORLY GRADED SAND (SP)</u> Wet, moderate reddish brown (10 R 4/6), mostly very fine (running) sand, few silt.						
	10	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Wet, dark yellowish orange (10 YR 6/6), moderate reddish brown (10 R 4/6), yellowish gray (5 Y 7/2), mostly fine sand, little silt and clay, trace heavy minerals, trace mica.				A-GP-8-8g (8 - 10' bls)		
	11							
	12	Boring terminated at 12.0 ft. bls						Ground-water at 8.0' bls
	13							
	14							

HTW DRILLING LOG							HOLE NO. A-GP-9	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION SE of excavation		11. DATE COMPLETED 11-5-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-4-98				
12. OVERBURDEN THICKNESS			15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES A-GP-9-8r		DISTURBED	UNDISTURBED X	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS A-GP-9-0s, A-GP-9-6s A-GP-9-8g		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
		X	soil only	SVOCs				
22. DISPOSITION OF HOLE		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>			
		X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	Asphalt				A-GP-9-0s (0 - 1' bls)		Mini ram - 0.01 mg/m ³
	2	<u>SILTY SAND (SM)</u> Loose, dry, dusky yellow (5 Y 6/4), mostly fine sand, few silt.		0.0 ppm				
	3	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Moist, light brown (5 YR 6/4), dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2) mottling, mostly medium sand, some fine sand, little silt.		0.0 ppm				
	4							
	5	Similar to above, except stiff, dry, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), trace heavy minerals.		0.0 ppm		A-GP-9-6s (6 - 8' bls)		Mini ram - 0.01 mg/m ³
	6			0.0 ppm				
	7	Similar to above, except occasional white (N9) kaolin stringers.						
	8			0.0 ppm	A-GP-9-8r (6 - 8' bls)			Ground-water at 8.0' bls
	9	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), mostly fine sand, few silt, coarsening downward.		0.0 ppm		A-GP-9-8g (8 - 10' bls)		Mini ram - 0.03 mg/m ³
	10							
	11							
	12	Boring terminated at 12.0 ft. bls						
	13							
	14							

PROJECT Ft. Stewart - SWMU 13						HOLE NO. A-GP-9	

HTW DRILLING LOG								HOLE NO. B-GP-11	
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR FUGRO				SHEET 1 OF 1	
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker				6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION NW of concrete pad			11. DATE COMPLETED 11-6-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION					
				10. DATE STARTED 11-6-98					
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES			DISTURBED	UNDISTURBED X	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS B-GP-11-6s B-GP-11-8g			VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
			X	soil only	SVOCs				
22. DISPOSITION OF HOLE			BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Paul</i>			
			X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c			FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4) grades to light brown (5 YR 6/4), mostly fine to very fine sand, few silt, trace clay.			0.8 ppm				Mini ram - 0.00 mg/m ³
	2								
	3								
	4	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Stiff, dry, light brown (5 YR 6/4) to dark yellowish orange (10 YR 6/6), light gray (N7) mottling, mostly fine sand, few clay, trace silt.			1.8 ppm		B-GP-11-6s (6 - 8' bls)		Mini ram - 0.00 mg/m ³
	5								
	6	Similar to above, except moist, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2) mottling.			2.0 ppm				
	7								
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), mostly fine sand, few silt, coarsening downward.			1.0 ppm		B-GP-11-8g (8 - 10' bls)		Ground-water at 8.0' bls
	9								
	10								Mini ram - 0.00 mg/m ³
	11								
	12	Boring terminated at 12.0 ft. bls							
	13								
	14								

PROJECT Ft. Stewart - SWMU 13								HOLE NO. B-GP-11	

HTW DRILLING LOG							HOLE NO. B-GP-12	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		8. HOLE LOCATION N of concrete pad		11. DATE COMPLETED 11-6-98				
4 ft. macro sampler (2" diameter)		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-6-98				
12. OVERBURDEN THICKNESS			15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES		DISTURBED	UNDISTURBED X	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
B-GP-12-6s				SVOCs				
B-GP-12-8g		X	soil only					
22. DISPOSITION OF HOLE		BACKFILLED	MONITORING WELL	23. SIGNATURE OF INSPECTOR				
		X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Loose, dry, dusky yellow (5 Y 6/4), grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt, trace clay.		0.2 ppm				Mini ram - 0.00 mg/m ³
	2	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Stiff, dry, light brown (5 YR 6/4) to dark yellowish orange (10 YR 6/6) and light gray (N7) mottling, mostly fine sand, few clay, trace silt; grades into moderate reddish brown (10 R 4/6) mottling.		0.8 ppm				
	3	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.		0.6 ppm		B-GP-12-6s (6 - 8' bls)		Mini ram - 0.00 mg/m ³
	4	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.		1.0 ppm				
	5	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.		0.0 ppm		B-GP-12-8g (8 - 10' bls)		Ground-water at 8.0' bls Mini ram - 0.00 mg/m ³
	6	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	7	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	9	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	10	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	11	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Loose, wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.						
	12	Boring terminated at 12.0 ft. bls						
	13	Boring terminated at 12.0 ft. bls						
	14	Boring terminated at 12.0 ft. bls						

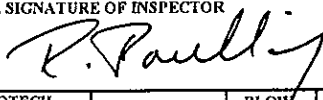
HTW DRILLING LOG							HOLE NO. B-GP-13		
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1			
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13						
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig						
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION NE of concrete pad		11. DATE COMPLETED 11-9-98			
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION					
				10. DATE STARTED 11-9-98					
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 13 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED X		19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC		METALS		OTHER (SPECIFY)		21. TOTAL CORE RECOVERY %	
B-GP-13-6s									
B-GP-13-8g		X		soil only		SVOCs			
22. DISPOSITION OF HOLE		BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR	
		X						<i>R. Pauley</i>	
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h	
	1	<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt, trace clay.		0.2 ppm				Mini ram - 0.00 mg/m ³	
	2								
	3	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Stiff, dry, light brown (5 YR 6/4) to dusky yellow (5 Y 6/4) mottling, mostly fine sand, few clay, trace silt.		0.4 ppm				Mini ram - 0.00 mg/m ³	
	4								
	5	Similar to above, except moderate reddish brown (10 R 4/6), light brown (5 YR 6/4), dusky yellow (5 Y 6/4) mottling, trace heavy minerals.		0.4 ppm		B-GP-13-6s (6 - 8' bls)		Mini ram - 0.00 mg/m ³	
	6								
	7			0.8 ppm					
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Moist to wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), mostly fine sand, few silt, trace heavy minerals, coarsening downward.		0.0 ppm		B-GP-13-8g (8 - 10' bls)		Ground-water at 8.0' bls	
	9							Mini ram - 0.00 mg/m ³	
	10								
	11								
	12								
	13	Boring terminated at 13.0 ft. bls							
	14								

PROJECT Ft. Stewart - SWMU 13	HOLE NO. B-GP-13

HTW DRILLING LOG							HOLE NO. B-GP-14		
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1		
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker				6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION NE of concrete pad		11. DATE COMPLETED 11-9-98			
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION					
				10. DATE STARTED 11-9-98					
				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
12. OVERBURDEN THICKNESS				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
13. DEPTH DRILLED INTO ROCK N/A				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
14. TOTAL DEPTH OF HOLE 13 ft. bls				18. GEOTECHNICAL SAMPLES					
				DISTURBED		UNDISTURBED X		19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS				VOC		METALS		OTHER (SPECIFY)	
B-GP-14-6s								21. TOTAL CORE RECOVERY %	
B-GP-14-8g				X		soil only		SVOCs	
22. DISPOSITION OF HOLE				BACKFILLED		MONITORING WELL		23. SIGNATURE OF INSPECTOR	
				X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h		
	1	Asphalt					Mini ram - 0.00 mg/m ³		
	2	<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt.	0.2 ppm						
	3	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Stiff, dry, light brown (5 YR 6/4) to dusky yellow (5 Y 6/4), moderate reddish brown (10 R 4/6) mottling, mostly fine sand, few clay, trace silt.	0.4 ppm				Mini ram - 0.00 mg/m ³		
	4								
	5	Similar to above, except moist, occassional laminated clayey zones, increasing moderate reddish brown (5 YR 4/6).	0.4 ppm		B-GP-14-6s (6 - 8' bls)		Mini ram - 0.00 mg/m ³		
	6								
	7		0.8 ppm						
	8	<u>POORLY GRADED SAND (SP)</u> Moist to wet, laminated moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), and yellowish gray (5 Y 7/2), mostly medium to fine sand, few silt.	0.0 ppm		B-GP-14-8g (8 - 10' bls)		Ground-water at 8.0' bls		
	9						Mini ram - 0.00 mg/m ³		
	10								
	11								
	12	Boring terminated at 12.0 ft. bls							
	13								
	14								

PROJECT
Ft. Stewart - SWMU 13

HOLE NO.
B-GP-14

HTW DRILLING LOG							HOLE NO. B-GP-15	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO				SHEET 1 OF 1	
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION SE of concrete pad		11. DATE COMPLETED 11-5-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-5-98				
12. OVERBURDEN THICKNESS			15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES B-GP-15-8r		DISTURBED	UNDISTURBED X	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS B-GP-15-0s and duplicate, and B-GP-15-6s B-GP-15-8g		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
		X	soil only	SVOCs				
22. DISPOSITION OF HOLE		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR 			
		X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
1	1	<u>SILTY SAND (SM)</u> Loose, dry, dusky yellow (5 Y 6/4), mostly fine to very fine sand, few silt.		0.0 ppm		B-GP-15-0s and duplicate (0-1' bls)		Mini ram - 0.02 mg/m ³
2	2							
3	3	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Stiff, dry, grayish orange (10 YR 7/4) to moderate yellowish brown (10 YR 5/4), mostly fine sand, few silt; with occasional thinly laminated clay stringers.		0.0 ppm		B-GP-15-6s (6 - 8' bls)		Mini ram - 0.00 mg/m ³
4	4							
5	5	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Moist, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), light gray (N7) mottling, mostly medium to fine sand; with occasional thinly laminated white (N9) kaolin stringers.		0.0 ppm				Mini ram - 0.00 mg/m ³
6	6							
7	7							
8	8			0.0 ppm	B-GP-15-8r (8 - 10' bls)			Ground-water at 8.0' bls
9	9	<u>POORLY GRADED SAND (SP)</u> Moist to wet, laminated moderate reddish brown (10 R 4/6) dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), mostly medium to fine sand, trace heavy minerals.				B-GP-15-8g (8 - 10' bls)		Mini ram - 0.00 mg/m ³
10	10							
11	11							
12	12	Boring terminated at 12.0 ft. bls						
13	13							
14	14							

PROJECT Ft. Stewart - SWMU 13							HOLE NO. B-GP-15

HTW DRILLING LOG							HOLE NO. B-GP-16	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1		
PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker			6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION SW of concrete pad		11. DATE COMPLETED 11-9-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-9-98				
				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls				
12. OVERBURDEN THICKNESS			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
13. DEPTH DRILLED INTO ROCK N/A			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
14. TOTAL DEPTH OF HOLE 12 ft. bls			18. GEOTECHNICAL SAMPLES					
			DISTURBED		UNDISTURBED X		19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS			VOC		METALS		OTHER (SPECIFY)	
B-GP-16-6s and duplicate, and B-GP-16-RB					soil only		SVOCs	
B-GP-16-8g and duplicate			X					
22. DISPOSITION OF HOLE			BACKFILLED		MONITORING WELL		23. SIGNATURE OF INSPECTOR	
			X				<i>R. Paulley</i>	
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h	
1		<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt.	0.0 ppm				Mini ram - 0.00 mg/m ³	
2		<u>POORLY GRADED SAND (SP)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine sand, trace clay.	0.0 ppm				Mini ram - 0.00 mg/m ³	
3		<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Dry, light brown (5 YR 6/4), light gray (N7), grayish orange (10YR 7/4) mottling, few clay, trace silt.	0.0 ppm				Mini ram - 0.00 mg/m ³	
4			0.0 ppm					
5			0.0 ppm					
6		Similar to above, except mottled colors also include moderate reddish brown (10 R 4/6), trace heavy minerals.	0.0 ppm				Mini ram - 0.00 mg/m ³	
7			0.0 ppm					
8		<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Moist, moderate reddish brown (10 R 4/6), grayish orange (10 YR 7/4), light gray (N7) mottling, mostly medium to fine sand, few silt; with occassinal thinly laminated clay lenses.	0.0 ppm				Ground-water at 8.0' bls	
9			0.0 ppm				Mini ram - 0.00 mg/m ³	
10			0.0 ppm					
11			0.0 ppm					
12		Boring terminated at 12.0 ft. bls	0.0 ppm					
13			0.0 ppm					
14			0.0 ppm					

PROJECT
Ft. Stewart - SWMU 13

HOLE NO.
B-GP-16

HTW DRILLING LOG								HOLE NO. B-GP-17	
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR FUGRO				SHEET 1 OF 1	
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13					
5. NAME OF DRILLER Mark Decker				6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION SW of concrete pad			11. DATE COMPLETED 11-5-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION					
				10. DATE STARTED 11-5-98					
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 12 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES B-GP-17-8r		DISTURBED		UNDISTURBED X		19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS B-GP-17-0s, B-GP-17-6s B-GP-17-8g		VOC		METALS		OTHER (SPECIFY)		OTHER (SPECIFY)	
		X		soil only		SVOCs			
22. DISPOSITION OF HOLE		BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR	
		X							
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c			FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt.			0.0 ppm		B-GP-17-0s (0 - 1' bls)		Mini ram - 0.00 mg/m ³
	2	Similar to above, except moderate yellowish brown (10 YR 5/4).			0.0 ppm				
	3								Mini ram - 0.00 mg/m ³
	4	<u>POORLY GRADED SAND (SP)</u> Dry, moderate yellowish brown (10 YR 5/4), mostly fine sand, with occassional thinly laminated clay stringers.			0.0 ppm				
	5								Mini ram - 0.02 mg/m ³
	6								
	7	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Dry, moderate reddish brown (10 R 4/6), grayish orange (10 YR 7/4), light gray (N7) mottling, mostly medium to fine sand; with occassional thinly laminated clay stringers.			0.0 ppm	B-GP-17-8r (6 - 8' bls)	B-GP-17-6s (6 - 8' bls)		
	8								
	9						B-GP-17-8g (8 - 12' bls)		Ground-water at 8.0' bls
	10								
	11								
	12	Boring terminated at 12.0 ft. bls							
	13								
	14								

PROJECT Ft. Stewart - SWMU 13								HOLE NO. B-GP-17	

HTW DRILLING LOG							HOLE NO. C-GP-24	
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR FUGRO			SHEET 1 OF 1	
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13				
5. NAME OF DRILLER Mark Decker				6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe rig				
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4 ft. macro sampler (2" diameter)		8. HOLE LOCATION SE of concrete pad		11. DATE COMPLETED 11-5-98		
		1 3/4" diam. ground-water sampler		9. SURFACE ELEVATION				
				10. DATE STARTED 11-5-98				
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED 8 ft. bls				
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED				
14. TOTAL DEPTH OF HOLE 12 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)				
18. GEOTECHNICAL SAMPLES C-GP-24-8r		DISTURBED		UNDISTURBED X		19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS C-GP-24-6s C-GP-24-8g		VOC		METALS		OTHER (SPECIFY)		21. TOTAL CORE RECOVERY %
		X		soil only		SVOCs		
22. DISPOSITION OF HOLE		BACKFILLED		MONITORING WELL		23. SIGNATURE OF INSPECTOR <i>R. Paullig</i>		
		X						
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	Asphalt						
	2	<u>SILTY SAND (SM)</u> Loose, dry, grayish orange (10 YR 7/4), mostly fine to very fine sand, few silt.		0.0 ppm				Mini ram - 0.01 mg/m ³
	3	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Dry, light brown (5 YR 5/6), mostly medium to fine sand; with occasional thinly laminated clay stringers.		0.0 ppm				Mini ram - 0.01 mg/m ³
	4							
	5	<u>POORLY GRADED SAND WITH CLAY (SP-SC)</u> Stiff, dry, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), light gray (N7) mottling, mostly medium to fine sand; with occasional thinly laminated clay stringers.		0.0 ppm				Mini ram - 0.02 mg/m ³
	6							
	7				C-GP-24-8r (6 - 8' bls)	C-GP-24-6s (6 - 8' bls)		
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Dry, moderate reddish brown (10 R 4/6), dark yellowish orange (10 YR 6/6), light gray (N7) mottling, mostly medium to fine sand; with occasional thinly laminated clay stringers.		0.0 ppm				
	9					C-GP-24-8g (8 - 12' bls)		
	10							
	11							
	12	Boring terminated at 12.0 ft. bls						Ground-water at 8.0' bls
	13							
	14							

PROJECT Ft. Stewart - SWMU 13		HOLE NO. C-GP-24

HTW DRILLING LOG							HOLE NO. MW-8
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.			SHEET 1 OF 2	
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13				
5. NAME OF DRILLER Brian Giesecke			6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61				
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		8. HOLE LOCATION South of western drainage swale		11. DATE COMPLETED 12-9-98			
4.25" ID HSA		2.0" ID by 3' long split-spoon sampler		9. SURFACE ELEVATION			
				10. DATE STARTED 12-9-98			
12. OVERBURDEN THICKNESS N/A			15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls				
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED				
14. TOTAL DEPTH OF HOLE 20 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)				
18. GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS MW-8-6s		VOC		METALS		OTHER (SPECIFY)	
		X		X		SVOCs	
22. DISPOSITION OF HOLE Vertical		BACKFILLED		MONITORING WELL		23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>	
				X			
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	<u>SILTY SAND (SM)</u> Dry, moderate yellowish brown (10 YR 5/4), mostly fine sand, little medium sand and silt, little roots.	0.0 ppm				Mini ram - 0.00 mg/m ³
	2	<u>CLAYEY SAND (SC)</u> Moist, dark yellowish orange (10 YR 6/6), moderate brown (5 YR 3/4) and very pale orange (10 YR 8/2) mottling, mostly fine sand, little medium sand and lean clay, few silt.	0.0 ppm				Mini ram - 0.00 mg/m ³
	4	<u>CLAYEY SAND (SC)</u> Similar to above, except some lean clay, few mica.	0.0 ppm				Mini ram - 0.00 mg/m ³
	6	<u>CLAYEY SAND (SC)</u> Similar to above, except colors becoming more banded.	0.0 ppm				Mini ram - 0.00 mg/m ³
	8	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Wet, colors similar to above, except occasional light gray (N7) lean clay stringers, mostly fine sand, little medium sand and silt.	0.0 ppm				Ground-water at 8.0' bls
	9						
	10	<u>POORLY GRADED SAND WITH SILT (SP-SM)</u> Similar to above, except moderate reddish brown mottling (10 R 4/6).	0.0 ppm				Mini ram - 0.00 mg/m ³
	11						
	12	<u>NO RECOVERY</u>					Mini ram - 0.00 mg/m ³
	13		0.0 ppm				
	14						

PROJECT Ft. Stewart - SWMU 13	HOLE NO. MW-8

HTW DRILLING LOG

HOLE NO. MW-8

PROJECT Ft. Stewart SWMU 13

INSPECTOR Melanie D. Hill

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	<u>NO RECOVERY</u> Water dripping off spoon - catcher caught.	0.0 ppm				Mini ram- 0.0 mg/m ³
	16	<u>POORLY GRADED SAND (SP)</u> Wet, grayish orange (10 YR 7/4), mostly medium to	0.0 ppm				Mini ram- 0.0 mg/m ³
	17	coarse sand, trace mica.					
	18	Similar to above.	0.0 ppm				
	19	<u>SILTY SAND (SM)</u> Wet, pale greenish yellow (10 Y 8/2) to pale olive (10	0.0 ppm				Mini ram- 0.0 mg/m ³
	20	Y6/2), mostly very fine to fine sand, some silt.					
	21	BORING TERMINATED ~ 20' bls					
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PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-8

HTW DRILLING LOG								HOLE NO. MW-9	
1. COMPANY NAME Earth Tech				2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.				SHEET 1 OF 2	
3. PROJECT Ft. Stewart				4. LOCATION SWMU 13					
5. NAME OF DRILLER Brian Giesecke				6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4.25" ID HSA		8. HOLE LOCATION South of western drainage swale			11. DATE COMPLETED 12-9-98		
		2.0" ID by 3' long split-spoon sampler		9. SURFACE ELEVATION					
		2.0" ID by 2.5' long shelby tube sampler		10. DATE STARTED 12-9-98					
12. OVERBURDEN THICKNESS N/A				15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A				16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 20 ft. bls				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES MW-9-2r		DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS MW-9-6s		VOC		METALS		OTHER (SPECIFY)		OTHER (SPECIFY)	
		X		X		SVOCs			
22. DISPOSITION OF HOLE Vertical		BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>	
				X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h	
	1	SILTY SAND (SM) Dry, moderate yellowish brown (10 YR 5/4), mostly fine sand, little medium sand and silt, little roots.		0.0 ppm				Mini ram - 0.00 mg/m ³	
	2	CLAYEY SAND (SC) Dense, moist, moderate reddish brown (10 R 4/6), very pale orange (10 YR 8/2), and dark yellowish orange (10 YR 6/6) mottling, mostly fine sand, little medium sand, some clay and silt.		0.0 ppm	MW-9-2r (2 - 4' bls) for TOC			Shelby Tube #2	
	3							Mini ram - 0.00 mg/m ³	
	4	CLAYEY SAND (SC) Similar to above, except less dense, some lean clay, few mica.		0.0 ppm				Mini ram - 0.00 mg/m ³	
	5							Mini ram - 0.00 mg/m ³	
	6	CLAYEY SAND (SC) Similar to above, except grading to less silt and clay.		0.0 ppm		MW-9-6s (6-8' bls)		Mini ram - 0.00 mg/m ³	
	7							Mini ram - 0.00 mg/m ³	
	8	CLAYEY SAND (SC) Similar to above, except wet, grading to more medium sand, banded colors with clay stringers.		0.0 ppm				Ground-water at 8.0' bls	
	9							Mini ram - 0.00 mg/m ³	
	10	POORLY GRADED SAND (SP) Wet, moderate reddish brown (10 R 4/6), very pale orange (10 YR 8/2), and dark yellowish orange (10 YR 6/6), mostly fine to medium sand, little silt and light gray clay lenses.		0.0 ppm				Mini ram - 0.00 mg/m ³	
	11							Mini ram - 0.00 mg/m ³	
	12	POORLY GRADED SAND (SP) Similar to above.		0.0 ppm				Mini ram - 0.00 mg/m ³	
	13							Mini ram - 0.00 mg/m ³	
	14							Mini ram - 0.00 mg/m ³	
PROJECT Ft. Stewart - SWMU 13								HOLE NO. MW-9	

HTW DRILLING LOG

HOLE NO. MW-9

PROJECT Ft. Stewart SWMU 13

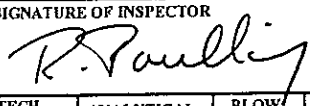
INSPECTOR Melanie D. Hill

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	<u>POORLY GRADED SAND (SP)</u> Similar to above, except medium to coarse sand, few small pebbles (lower 2").	0.0 ppm				Mini ram- 0.0 mg/m ³
	16	<u>POORLY GRADED SAND (SP)</u> Similar to above (almost "running" sand).	0.0 ppm				Mini ram- 0.0 mg/m ³
	17						
	18		0.0 ppm				
	19		0.0 ppm	MW-9-18r (18-20' bls)			Shelby Tube #1 (18 - 20' bls)
	20	BORING TERMINATED ~ 20' bls					
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PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-9

HTW DRILLING LOG							HOLE NO. MW-10	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.			SHEET 1 OF 2		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Brian Giesecke			6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4.25" ID HSA		8. HOLE LOCATION Sidegradient		11. DATE COMPLETED 12-10-98		
		2.0" ID by 3' long split-spoon sampler		9. SURFACE ELEVATION 47.85'				
				10. DATE STARTED 12-10-98				
12. OVERBURDEN THICKNESS N/A			15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 16 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES MW-10-8r		DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS MW-10-2s		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
		X	X	SVOCs				
22. DISPOSITION OF HOLE Vertical		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR 			
			X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	1	Asphalt 0 - 6" <u>SILTY SAND (SM)</u> Moist, pale yellowish orange (10 YR 8/6), mostly fine sand, some silt, little mica.		1.0 ppm				Mini ram - 0.00 mg/m ³
	2	<u>(Upper 8") SILTY SAND (SM)</u> Similar to above.				MW-10-2s (2-4' bls)		
	3	<u>(Lower 16") CLAYEY SAND (SC)</u> Moist, dark yellowish orange (10 YR 6/6) with moderate red (5 R 4/6) mottling, mostly fine sand, little lean clay and silt.		1.4 ppm				Mini ram - 0.00 mg/m ³
	4	<u>SANDY FAT CLAY (CH)</u>		0.0 ppm				Undisturbed sample for RBCA analyses
	5	Moist, moderate red (5 R 4/6) with light gray (N7) and dark yellowish orange (10 YR 6/6) mottling, mostly fat clay, few fine sand.						Mini ram - 0.00 mg/m ³
	6	<u>SILTY SAND (SM)</u>		0.8 ppm				
	7	Moist, moderate red (5 R 4/6) and light gray (N7) mottling, mostly fine sand, some silt, little lean clay and mica.						
	8	<u>SILTY SAND (SM)</u>			MW-10-8r (8-10' bls)			Ground-water at 8.0' bls
	9	Similar to above, except moist to wet.						Undisturbed sample for RBCA analyses
	10							
	11	<u>SILTY SAND (SM)</u> Similar to above.		0.5 ppm				Mini ram - 0.00 mg/m ³
	12	<u>SILTY SAND (SM)</u>						
	13	Similar to above, except wet, some silt and lean clay, trace mica.		7.5 ppm				Mini ram - 0.00 mg/m ³
	14							

PROJECT Ft. Stewart - SWMU 13		HOLE NO. MW-10

HTW DRILLING LOG

HOLE NO. MW-10

PROJECT Ft. Stewart SWMU 13

INSPECTOR Ronald Paulling

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	(Upper 12") SILTY SAND (SM) Similar to above.	3.5 ppm				Mini ram-
	16	(Lower 12") POORLY GRADED SAND (SP) Wet, moderate pink (5 R 7/4) grading to moderate reddish orange (10 R 6/6), mostly fine sand, some medium sand, few silt and fine gravel.					0.0 mg/m ³
	17	BORING TERMINATED ~ 16' bls					
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PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-10

HTW DRILLING LOG							HOLE NO. MW-11		
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.			SHEET 1 OF 2			
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13						
5. NAME OF DRILLER Brian Giesecke			6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61						
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4.25" ID HSA			8. HOLE LOCATION Sidegradient		11. DATE COMPLETED 12-10-98		
		2.0" ID by 3' long split-spoon sampler			9. SURFACE ELEVATION 48.05'				
					10. DATE STARTED 12-10-98				
					15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls				
12. OVERBURDEN THICKNESS N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED						
13. DEPTH DRILLED INTO ROCK N/A			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)						
14. TOTAL DEPTH OF HOLE 16 ft. bls			19. TOTAL NUMBER OF CORE BOXES						
18. GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED		21. TOTAL CORE RECOVERY %			
20. SAMPLES FOR CHEMICAL ANALYSIS MW-11-6s		VOC		METALS		OTHER (SPECIFY)		OTHER (SPECIFY)	
		X		X		SVOCs			
22. DISPOSITION OF HOLE Vertical		BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR <i>R. Paulley</i>	
				X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h	
	1	<u>SILTY SAND (SM)</u> Moist, dark yellowish orange (10 YR 6/6) and medium dark gray (N4), mostly fine sand, some silt, trace roots.		0.0 ppm				Mini ram - 0.00 mg/m ³	
	2	<u>(Upper 12") SILTY SAND (SM)</u> Similar to above.							
	3	<u>(Lower 12") SANDY LEAN CLAY (CL)</u> Moist, pale yellowish orange (10 YR 8/6) with dark yellowish orange (10 YR 6/6) mottling, mostly lean clay, little fine sand.		4.0 ppm				Mini ram - 0.00 mg/m ³	
	4	<u>SANDY FAT CLAY (CH)</u> Moist, pale yellowish orange (10 YR 8/6) with dark yellowish orange (10 YR 6/6) mottling, mostly fat clay, little fine sand.		3.0 ppm				Mini ram - 0.00 mg/m ³	
	5	<u>(Upper 4") SANDY FAT CLAY (CH)</u> Similar to above.						Moderate hydrocarbon odor	
	7	<u>(Lower 20") SILTY SAND (SM)</u> Moist to wet, light gray (N7) with moderate red (5 R 4/6) mottling, mostly fine sand, some silt, little lean clay.		10.0 ppm		MW-11-6s (6-8' bls)		Ground-water at 8.0' bls	
	8	<u>SILTY SAND (SM)</u> Similar to above, except wet.		5.0 ppm				Slight hydrocarbon odor	
	9							Mini ram - 0.00 mg/m ³	
	10	<u>(Upper 6") SILTY SAND (SM)</u> Similar to above.						Slight hydrocarbon odor	
	11	<u>(Lower 18") CLAYEY SAND (SC)</u> Wet, moderate red (5 R 4/6) with light gray (N7) mottling, mostly fine sand, little lean clay.		5.0 ppm				Mini ram - 0.00 mg/m ³	
	12	<u>POORLY GRADED SAND (SP)</u> Wet, moderate red (5 R 4/6) with light gray (N7) and dark yellowish orange (10 YR 6/6) banding, mostly fine sand, few medium sand and lean clay, lower 4" moderate orange pink banding.		2.0 ppm				Slight hydrocarbon odor	
	13							Mini ram - 0.00 mg/m ³	
	14								

PROJECT Ft. Stewart - SWMU 13							HOLE NO. MW-11	

HTW DRILLING LOG

HOLE NO. MW-11

PROJECT Ft. Stewart SWMU 13

INSPECTOR Ronald Paulling

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	<u>POORLY GRADED SAND (SP)</u> Similar to above, except mostly medium sand, little fine sand and lean clay seams (1/2" to 1" thick).	2.0 ppm				Mini ram- 0.0 mg/m ³
	16	BORING TERMINATED ~ 16' bls					
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PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-11

HTW DRILLING LOG							HOLE NO. MW-12	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.			SHEET 1 OF 2		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Brian Giesecke			6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4.25" ID HSA	8. HOLE LOCATION Upgradient		11. DATE COMPLETED 12-10-98			
		2.0" ID by 3' long split-spoon sampler	9. SURFACE ELEVATION 48.74'					
			10. DATE STARTED 12-10-98					
12. OVERBURDEN THICKNESS N/A			15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 16 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES		DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS MW-12-4s		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
		X	X	SVOCs				
22. DISPOSITION OF HOLE Vertical		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Paul</i>			
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	FLOW COUNTS g	REMARKS h
1	1	<u>SILTY SAND (SM)</u> Moist, light brown (5 YR 6/4), mostly fine sand, some silt, few roots.		2.5 ppm				Mini ram - 0.00 mg/m ³
2	2	<u>(Upper 10") SILTY SAND (SM)</u> Similar to above.						Moderate Hydrocarbon odor
3	3	<u>(Lower 14") SANDY LEAN CLAY (CL)</u> Moist, light brown (5 YR 6/4) with dark yellowish orange (10 YR 6/6) and light gray (N7) mottling,		12.0 ppm				Mini ram - 0.00 mg/m ³
4	4	mostly lean clay, little fine sand.						Strong hydrocarbon odor
5	5	<u>CLAYEY SAND (SC)</u> Moist, light gray (N7) with dark yellowish orange (10 YR 6/6) and moderate red (5 R 4/6) mottling, mostly fine sand, some to little lean clay.		1000+ ppm		MW-12-4s (4-6' bls)		Mini ram - 0.00 mg/m ³
6	6	<u>CLAYEY SAND (SC)</u> Similar to above, except lower 3" contain lean clay partings (~ 1/16" thick).		1000+ ppm				Strong hydrocarbon odor
7	7	<u>CLAYEY SAND (SC)</u> Similar to above, except wet.		1000+ ppm				Ground-water at 8.0' bls
8	8	<u>CLAYEY SAND (SC)</u> Similar to above, except wet.		1000+ ppm				Strong hydrocarbon odor
9	9	<u>SILTY SAND (SM)</u> Wet, light gray (N7) with dark yellowish orange (10 YR 6/6) and moderate red (5 R 4/6) mottling, mostly fine sand, some silt, few lean clay and mica.		1000+ ppm				Mini ram - 0.00 mg/m ³
10	10	<u>POORLY GRADED SAND (SP)</u> Wet, light gray (N7) with grayish orange (10 YR 7/4) banding, mostly fine sand, little medium sand and mica, few silt.		600 ppm				Mini ram - 0.00 mg/m ³
11	11							
12	12							
13	13							
14	14							

PROJECT
Ft. Stewart - SWMU 13

HOLE NO.
MW-12

HTW DRILLING LOG

HOLE NO. MW-12

PROJECT Ft. Stewart SWMU 13

INSPECTOR Ronald Paulling

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	POORLY GRADED SAND (SP) Similar to above.	3.0 ppm				Mini ram- 0.0 mg/m ³
	16	BORING TERMINATED ~ 16' bls					
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PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-12

HTW DRILLING LOG							HOLE NO. MW-13	
1. COMPANY NAME Earth Tech			2. DRILLING SUBCONTRACTOR Alliance Environmental, Inc.			SHEET 1 OF 2		
3. PROJECT Ft. Stewart			4. LOCATION SWMU 13					
5. NAME OF DRILLER Brian Giesecke			6. MANUFACTURER'S DESIGNATION OF DRILL Mobile B-61					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT		4.25" ID HSA		8. HOLE LOCATION Downgradient		11. DATE COMPLETED 12-10-98		
		2.0" ID by 3' long split-spoon sampler		9. SURFACE ELEVATION 48.69'				
				10. DATE STARTED 12-10-98				
12. OVERBURDEN THICKNESS N/A			15. DEPTH GROUNDWATER ENCOUNTERED ~ 8 ft. bls					
13. DEPTH DRILLED INTO ROCK N/A			16. DEPTH TO WATER AND ELAPSED TIME AFTER RILLING COMPLETED					
14. TOTAL DEPTH OF HOLE 16 ft. bls			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES MW-13-4r		DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES				
20. SAMPLES FOR CHEMICAL ANALYSIS MW-13-6s and duplicate		VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
		X	X	SVOCs				
22. DISPOSITION OF HOLE Vertical		BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR <i>R. Pauling</i>			
			X					
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	FLOW COUNTS g	REMARKS h
		Asphalt 0 - 4"						
	1	<u>SILTY SAND (SM)</u> Moist, grayish orange (10 YR 7/4) and pale yellowish orange (10 YR 8/6), mostly fine sand, some silt.		4.8 ppm				Mini ram - 0.00 mg/m ³
	2	<u>SILTY SAND (SM)</u> Similar to above, except black partings in upper 3"						
	3	and few lean clay.		3.2 ppm				Mini ram - 0.00 mg/m ³
	4							
	5				MW-13-4r (4-6' bls)			Undisturbed sample for RBCA analyses
	6	<u>CLAYEY SAND (SC)</u>						
	7	Moist, light gray (N7) with dark yellowish orange (10 YR 6/6) and moderate red (5 R 4/6) mottling, mostly fine sand, little silt and lean clay, few mica.		6.0 ppm		MW-13-6s and duplicate (6-8' bls)		Mini ram - 0.00 mg/m ³
	8	<u>CLAYEY SAND (SC)</u>						
	9	Similar to above, except wet.		0.0 ppm				Ground-water at 8.0' bls
	10							Mini ram - 0.00 mg/m ³
	11	<u>CLAYEY SAND (SC)</u> Similar to above.		0.0 ppm				
	12	<u>POORLY GRADED SAND (SP)</u>						Mini ram - 0.00 mg/m ³
	13	Wet, light gray (N7) with grayish orange (10 YR 7/4) banding, mostly medium sand, little fine sand, few lean clay partings (~ 1/8" thick).		5.5 ppm				
	14							
PROJECT Ft. Stewart - SWMU 13			HOLE NO. MW-13					

HTW DRILLING LOG

HOLE NO. MW-13

PROJECT Ft. Stewart SWMU 13

INSPECTOR Ronald Paulling

SHEET 2 OF 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX # e	ANALYTICAL SAMPLE # f	BLOW COUNTS g	REMARKS h
	15	POORLY GRADED SAND (SP) Similar to above.	2.0 ppm				Mini ram- 0.0 mg/m ³
	16	BORING TERMINATED ~ 16' bls					
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
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	30						
	31						
	32						
	33						
	34						
	35						
	36						

PROJECT Ft. Stewart - SWMU 13

HOLE NO. MW-13

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APPENDIX B

**MONITORING WELL CONSTRUCTION DIAGRAMS,
MONITORING WELL DEVELOPMENT LOGS,
AND FIELD DATA INFORMATION LOGS
FOR GROUNDWATER SAMPLING**

Boring No. X-Ref: MW-8

Survey Coords: N 688,233.2881 Elevation Ground Level: 47.79 NAVD
 E 685,270.8545 Top of Casing: 50.51 NAVD

Protective Casing: Extension of C1

Bentonite Seal: 1.0' - 3.5' 3/8" diam Baroid
Bentonite Pellets

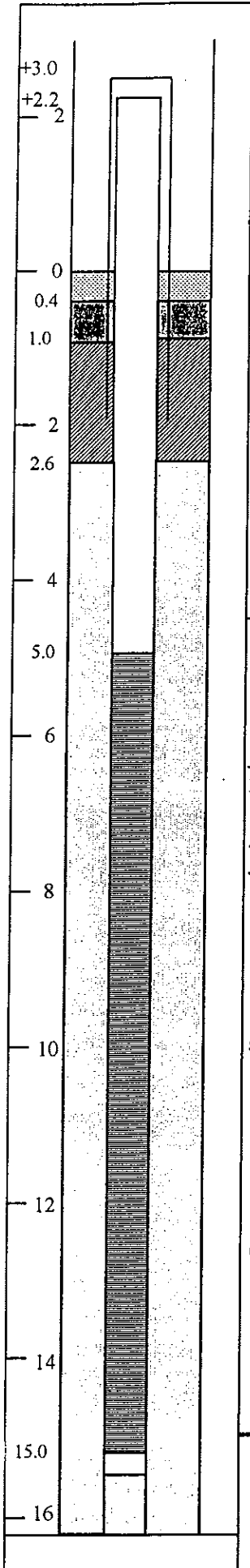
Comments:

LOCATION: Fort Stewart, GA

DATE: December 8, 1998

Boring No. X-Ref: MW-9

Survey Coords: N 688,177.8972 Elevation Ground Level: 47.52 NAVD
E 685,248.4693 Top of Casing: 49.68 NAVD



Total Depth: 17.5' (TOC)
Borehole Diameter: 9" Nominal
Casing Stick-up Height: +2.2
Driller: Alliance Environmental, Inc
Aiken, SC

Rig: Mobile B-61
Bit(s): 8.875" finger bit
Drilling Fluid: None

Protective Casing: Extension of C1

Depth	String(s)	Elevation
+3.0 - 2.0	C-1	50.56 - 45.56
+2.2 - 5.0	C-2	49.68 - 42.48
5.0 - 15.0	S-1	42.48 - 32.48
15.0 - 15.3	P-1	32.48 - 32.18

Bentonite Seal: 1.0' - 2.6' 3/8" diam Baroid
Bentonite Pellets

Task	Start		Finish	
	Date	Time	Date	Time
Drilling				
HSA	12/8/98	1400	12/8/98	1530
Geophys. Logging:				
Casing:				
C1	12/10/98	1110	12/10/98	1135
C2	12/8/98	1530	12/8/98	1540
Filter Placement:	12/8/98	1540	12/8/98	1555
Bentonite Seal:	12/8/98	1555	12/8/98	1600
Development	12/15/98	1300	12/15/98	1345

12/15/98 1300-1345: Development performed by
surge pumping using a bailer and a submersible pump.
Total gallons removed ~36 gallons.

Time	pH	Spec. Cond.	Temp(C)
1300	4.00	0.115	19.0
1314	4.35	0.041	20.1
1330	4.19	0.032	21.3
1345	4.21	0.031	21.0

Comments: _____

SITE NAME: SWMU 13, Wright Army Airfield
LOCATION: Fort Stewart, GA

SUPERVISED BY: Melanie Hill
 C December 8, 1998

Boring No. X-Ref: MW-10

Survey Coords: N 688,183.8674 Elevation Ground Level: 47.85 NAVD
E 685,423.4618 Top of Casing: 50.79 NAVD

Well No.: MW-11

Boring No. X-Ref: MW-11

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 688,216.2222

Elevation Ground Level: 48.05 NAVD

E 685,374.8171

Top of Casing: 50.51 NAVD

Drilling Summary:

Total Depth: 17.9' (TOC)

Borehole Diameter: 9" Nominal

Casing Stick-up Height: +2.5

Driller: Alliance Environmental, Inc
Aiken, SC

Rig: Mobile B-61

Bit(s): 8.875" finger bit

Drilling Fluid: None

Protective Casing: Extension of C1

Well Design & Specifications

Basis: Geologic Log: ☒ Geophysical Log: ☐Casing String(s): C= casing S= screen
P= plug

Depth	String(s)	Elevation
+3.1 - 1.9	C-1	51.17 - 46.17
+2.5 - 5.1	C-2	50.51 - 42.91
5.1 - 15.1	S-1	42.91 - 32.91
15.1 - 15.4	P-1	32.91 - 32.61

Casing: C1: 5' by 4" square steel protective casing
C2: Johnson Fil Sys 2" diam. flush threaded sch. 40 PVC

Screen: S1: Johnson Fil Sys 2" diam. flush threaded, Sch. 40 PVC w/ 0.01" slots

Filter Pack: 3.9' - 16.0' Southern Sand and Silica No.1

Grout Seal: 0.5' - 2.0' Portland Type 1 Cement w/ ~ 5% bentonite by weight

Bentonite Seal: 2.0' - 3.9' 3/8" diam Baroid Bentonite Pellets

Comments:

Construction Time Log:

Task	Start		Finish	
	Date	Time	Date	Time
Drilling				
HSA	12/10/98	0930	12/10/98	1050
Geophys. Logging:				
Casing:				
C1	12/11/98	1340	12/11/98	1410
C2	12/10/98	1055	12/10/98	1100
Filter Placement:	12/10/98	1100	12/10/98	1105
Bentonite Seal:	12/10/98	1105	12/10/98	1110
Development	12/16/98	0900	12/16/98	1730

Well Development:

12/16/98 0900-1730: Development performed by

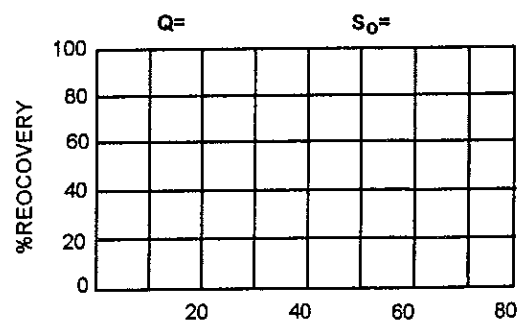
surge pumping using a bailer and a submersible pump.

Total gallons removed ~60 gallons.

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp(C)
0900	4.09	0.111	19.6
0955	4.68	0.036	21.4
1045	4.87	0.038	22.4
1728	4.82	0.033	21.4

Recovery Data:

SITE NAME: SWMU 13, Wright Army Airfield
LOCATION: Fort Stewart, GASUPERVISED BY: Ron Paulling
D. December 10, 1998

Well No. : MW-12

Boring No. X-Ref: MW-12

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 688,328.4274

Elevation Ground Level: 48.74 NAVD

E 685,405.0419

Top of Casing: 51.40 NAVD

Drilling Summary:

Total Depth: 18.0' (TOC)

Borehole Diameter: 9" Nominal

Casing Stick-up Height: +2.7

Driller: Alliance Environmental, Inc

Aiken, SC

Rig: Mobile B-61

Bit(s): 8.875" finger bit

Drilling Fluid: None

Protective Casing: Extension of C1

Well Design & Specifications

Basis: Geologic Log: ☒ Gephysical Log: ☐

Casing String(s): C= casing S= screen

P= plug

Depth	String(s)	Elevation
+3.4 - 1.6	C-1	52.17 - 47.17
+2.7 - 5.0	C-2	51.40 -
5.0 - 15.0	S-1	43.70 - 33.70
15.0 - 15.3	P-1	33.70 - 33.40

Casing: C1: 5' by 4" square steel protective casing

C2: Johnson Fil Sys 2" diam, flush threaded sch 40 PVC

Screen: S1: Johnson Fil Sys 2" diam, flush threaded, Sch. 40 PVC w/ 0.01" slots

Filter Pack: 3.4' - 16.0' Southern Sand and

Grout Seal: 0.4' - 1.8' Portland Type 1 Cement

Bentonite Seal: 1.8' - 3.4' 3/8" diam Baroid

Comments:

Construction Time Log:

Task	Start		Finish	
	Date	Time	Date	Time
Drilling				
HSA	12/10/98	1140	12/10/98	1220
Geophys. Logging:				
Casing:				
C1	12/11/98	1540	12/11/98	1630
C2	12/10/98	1220	12/10/98	1222
Filter Placement:	12/10/98	1225	12/10/98	1230
Bentonite Seal:	12/10/98	1230	12/10/98	1235
Development	12/16/98	1600	12/16/98	1800

Well Development:

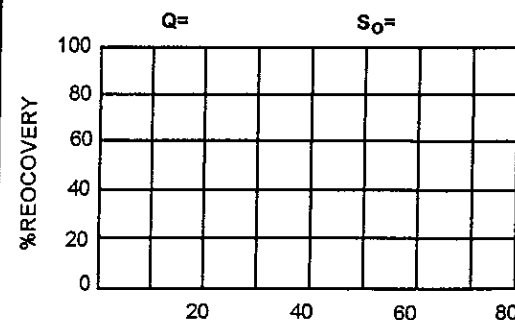
12/16/98 1600-1800: Development performed by surge pumping using a bailer and a submersible pump.

Total gallons removed ~65 gallons.

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp(C)
1600	4.95	0.078	22.9
1615	4.55	0.039	23.0
1650	4.04	0.032	22.8
1755	4.10	0.029	20.2

Recovery Data:



SITE NAME: SWMU 13, Wright Army Airfield

LOCATION: Fort Stewart, GA

SUPERVISED BY: Ron Paulling

DATE: December 10, 1998

Well No. : MW-13

Boring No. X-Ref: MW-13

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: N 688,278.9027

Elevation Ground Level: 48.69 NAVD

E 685,438.5685

Top of Casing: 50.94 NAVD

Drilling Summary:

Total Depth: 18.0' (TOC)

Borehole Diameter: 9" Nominal

Casing Stick-up Height: +2.3

Driller: Alliance Environmental, Inc
Aiken, SC

Rig: Mobile B-61

Bit(s): 8.875" finger bit

Drilling Fluid: None

Protective Casing: Extension of C1

Well Design & Specifications

Basis: Geologic Log: ☒ Gephysical Log: ☐Casing String(s): C= casing S= screen
P= plug

Depth	String(s)	Elevation
+3.2 - 1.8	C-1	51.86 - 46.86
+2.3 - 5.4	C-2	50.94 - 43.24
5.4 - 15.4	S-1	43.24 - 33.24
15.4 - 15.7	P-1	33.24 - 32.94

Casing: C1: 5' by 4" square steel protective casing
C2: Johnson Fil Sys 2" diam, flush threaded sch. 40 PVC

Screen: S1: Johnson Fil Sys 2" diam, flush threaded, Sch. 40 PVC w/ 0.01" slots

Filter Pack: 3.6' - 16.0' Southern Sand and

Grout Seal: 0.4' - 1.3' Portland Type 1 Cement

Bentonite Seal: 1.3' - 3.6' 3/8" diam Baroid

Comments:

Construction Time Log:

Task	Start		Finish	
	Date	Time	Date	Time
Drilling				
HSA	12/10/98	1400	12/10/98	1520
Geophys. Logging:				
Casing:				
C1	12/11/98	1215	12/11/98	1245
C2	12/10/98	1521	12/10/98	1522
Filter Placement:	12/10/98	1522	12/10/98	1525
Bentonite Seal:	12/10/98	1525	12/10/98	1530
Development	12/16/98	1240	12/16/98	1345

Well Development:

12/16/98 1240-1345: Development performed by

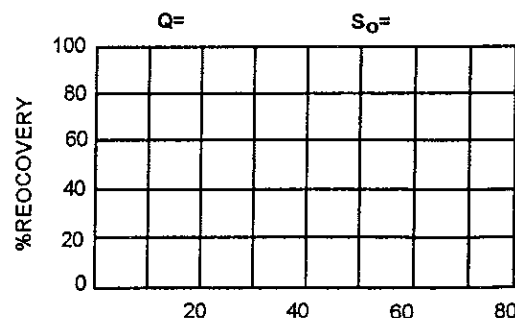
surge pumping using a bailer and a submersible pump.

Total gallons removed ~60 gallons.

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp(C)
1243	4.99	0.046	24.7
1304	4.87	0.040	26.2
1321	4.81	0.030	26.4
1345	4.51	0.028	26.2

Recovery Data:



SITE NAME: SWMU 13, Wright Army Airfield

LOCATION: Fort Stewart, GA

SUPERVISED BY: Ron Paulling

December 10, 1998



E A R T H T E C H

Monitoring Well Development Log

Page 1 of 1

Date Started (mo/day/yr)	12/15/98	Date Completed	12/15/98
Field Personnel	D. Turner & M. Cain		
Site Name	Ft. Stewart	SWMU #13	
Project Number	29350		
☒ Upgradient	☐ Downgradient		
Weather Conditions	Rain, cold		
Air Temperature	45		°F
Well Identification #	MW-8		

Total Well Depth (TWD) =	18.56	1/100 ft
Depth to Ground Water (DGW) =	11.41	1/100 ft
Length of Water Column (LWC) = TWD - DGW =	7.15	1/100 ft
1 Casing Volume (OCV)=LWC x	0.163	1/100 ft
5 Casing Volumes =	5.83	gallons
Method of Well Development	Disposable submersible pump	
Total Volume of Water Removed	80	gallons

Field Parameters

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temp. °C	pH	Eh	Specific Conductivity uS/m	Turbidity (NTU)	Sand Content (%)	DO (mg/L)	Remarks
12/15/98 1416		Initial	18.7	3.78	168	0.04	999	3	6.65	
12/15/98 1420		5	20.3	4.19	189	0.035	826	2	6.58	
12/15/98 1423		10	19.6	4.42	193	0.033	300	1	6.70	
12/15/98 1430		20	20.7	4.19	191	0.033	1170	<1	6.81	
12/15/98 1436		30	21.2	4.29	197	0.030	44	<1	6.95	
12/15/98 1442		40	20.1	4.41	190	0.032	18	<1	6.65	
12/15/98 1448		50	21.0	4.16	200	0.025	20	<1	6.80	
12/15/98 1453		60	20.4	4.32	200	0.028	7	<1	6.63	
12/15/98 1459		70	21.2	4.22	202	0.028	8	<1	6.25	
12/15/98 1508		80	20.5	4.21	202	0.028	9	<1	6.99	

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.

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E A R T H T E C H

Monitoring Well Development Log

Page 1 of 1

Date Started (m/day/yr)	12/15/98	Date Completed	12/15/98
Field Personnel	D. Turner & M. Cain		
Site Name	Ft. Stewart	SWMU #13	
Project Number	29350		
X Upgradient		Downgradient	
Weather Conditions	Rain, cold		
Air Temperature	45	°F	
Well Identification #	MW-9		

Total Well Depth (TWD) =	18.44	1/100 ft
Depth to Ground Water (DGW) =	10.57	1/100 ft
Length of Water Column (LWC) = TWD - DGW =	7.87	1/100 ft
1 Casing Volume (OCV)=LWC x 0.163 =	1.28	1/100 ft
5 Casing Volumes =	6.41	gallons
Method of Well Development	Disposable submersible pump	
Total Volume of Water Removed	36	gallons

Field Parameters

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temp. °C	pH	Eh	Specific Conductivity uS/m	Turbidity (NTU)	Sand Content (%)	DO (mg/L)	Remarks
12/15/98 1300		Initial	19.0	4.00	85	0.155	717	<1	6.71	
12/15/98 1306		2	19.8	4.32	93	0.045	240	<1	6.59	
12/15/98 1309		4	20.3	4.33	117	0.043	87	<1	6.58	
12/15/98 1311		6	20.7	4.35	123	0.033	52	<1	6.53	
12/15/98 1314		10	20.1	4.35	148	0.041	13	<1	6.49	
12/15/98 1320		12	21.0	4.27	155	0.033	16	<1	6.34	
12/15/98 1326		15	21.1	4.20	153	0.038	13	<1	6.65	
12/15/98 1330		20	21.3	4.19	156	0.032	16	<1	6.78	
12/15/98 1340		30	21.0	4.23	180	0.030	2	<1	6.64	
12/15/98 1345		35	21.0	4.21	185	0.031	2	<1	6.53	

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.

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Page 1 of 1

Date Started (mo/day/yr) 12/16/98 Date Completed 12/16/98
Field Personnel D. Turner & M. Cain
Site Name Ft. Stewart SWMU #13
Project Number 29350
_____ Upgradient _____ Downgradient
Weather Conditions Clear, sunny, cool
Air Temperature 60 °F
Well Identification # MW-10

Total Well Depth (TWD) =	18.04	1/100 ft
Depth to Ground Water (DGW) =	12.18	1/100 ft
Length of Water Column (LWC) = TWD - DGW =	5.86	1/100 ft
1 Casing Volume (OCV)=LWC x	0.163 =	0.955
5 Casing Volumes =	4.77	gallons
Method of Well Development	Disposable submersible pump	
Total Volume of Water Removed	11	gallons

Field Parameters

[illegible]

COMMENTS/OBSERVATIONS:	"Washed" inside of well casing with purge water after development. Surged with disposable bailer prior to development



Monitoring Well Development Log

Page 1 of 1

Date Started (mo/day/yr) 12/16/98 Date Completed 12/16/98
 Field Personnel D. Turner & M. Cain
 Site Name Ft. Stewart SWMU #13
 Project Number 29350
Upgradient Downgradient
 Weather Conditions Clear, sunny, cool
 Air Temperature 60 °F
 Well Identification # MW-11

Total Well Depth (TWD) = 18.63 1/100 ft
 Depth to Ground Water (DGW) = 11.70 1/100 ft
 Length of Water Column (LWC) = TWD - DGW = 6.93 1/100 ft
 1 Casing Volume (OCV)=LWC x 0.163 = 1.129 1/100 ft
 5 Casing Volumes = 5.65 gallons
 Method of Well Development Disposable submersible pump
 Total Volume of Water Removed 60 gallons

Field Parameters

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temp. °C	pH	Eh	Specific Conductivity uS/m	Turbidity (NTU)	Sand Content (%)	DO (mg/L)	Remarks
12/16/98 0900		Initial	19.6	4.09	190	0.111	999	3	6.80	
12/16/98 0905		5	20.2	4.98	193	0.059	999	2	6.56	
12/16/98 0915		10	20.4	4.93	195	0.040	999	2	6.59	
12/16/98 0924		15	21.6	4.92	195	0.039	327	1	6.85	
12/16/98 0935		20	20.8	4.91	195	0.039	190	<1	6.89	
12/16/98 0955		30	21.4	4.68	200	0.036	334	<1	7.10	
12/16/98 1010		40	21.2	4.62	206	0.033	30	<1	7.61	
12/16/98 1024		45	22.0	4.86	203	0.033	14	<1	7.98	
12/16/98 1028		47.5	22.5	4.88	208	0.030	12	<1	7.93	
12/16/98 1034		50	22.2	4.88	209	0.030	38	<1	8.44	
12/16/98 1045		55	22.4	4.87	209	0.038	63	<1	8.73	
12/16/98 1647		57	21.1	4.84	206	0.033	10	<1	8.67	
12/16/98 1728		60	21.4	4.82	206	0.033	10	<1	8.63	

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.
 Surged with disposable bailer prior to development

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Monitoring Well Development Log

Page 1 of 2

Date Started (mo/day/yr) 12/16/98 Date Completed 12/16/98

Field Personnel D. Turner & M. Cain

Site Name Ft. Stewart SWMU #13

Project Number 29350

Upgradient Downgradient

Weather Conditions Clear, sunny, cool

Air Temperature 60 °F

Well Identification # MW-12

Total Well Depth (TWD) = 18.51 1/100 ft

Depth to Ground Water (DGW) = 12.51 1/100 ft

Length of Water Column (LWC) = TWD - DGW = 6.00 1/100 ft

1 Casing Volume (OCV)=LWC x 0.163 = 0.98 1/100 ft

5 Casing Volumes = 4.89 gallons

Method of Well Development Disposable submersible pump

Total Volume of Water Removed 65 gallons

Field Parameters

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temp. °C	pH	Eh	Specific Conductivity uS/m	Turbidity (NTU)	Sand Content (%)	DO (mg/L)	Remarks
12/16/98 1600		Initial	22.9	4.95	156	0.078	999	3	9.48	
12/16/98 1604		3	23.3	4.86	153	0.049	999	3	9.06	
12/16/98 1607		6	22.9	4.81	147	0.043	999	2	8.62	
12/16/98 1615		11	23.0	4.55	150	0.039	183	2	8.77	
12/16/98 1625		15	22.5	4.21	151	0.036	215	1	8.87	
12/16/98 1630		20	22.7	4.17	139	0.034	230	<1	8.55	
12/16/98 1640		25	22.7	4.21	140	0.033	61	<1	8.14	
12/16/98 1650		30	22.8	4.04	NA	0.032	69	<1	7.90	
12/16/98 1703		35	21.4	4.16	NA	0.031	15	<1	7.77	
12/16/98 1710		40	22.1	4.05	144	0.030	43	<1	7.89	
12/16/98 1717		45	22.0	4.08	139	0.031	29	<1	7.49	
12/16/98 1721		47	22.1	4.10	138	0.030	13	<1	7.45	
12/16/98 1730		55	20.7	4.16	137	0.030	22	<1	7.35	
12/16/98 1745		58	21.1	4.07	133	0.029	13	<1	7.44	

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.
Surged with disposable bailer prior to development

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Page 2 of 2

Total Well Depth (TWD) =	18.51	1/100 ft
Depth to Ground Water (DGW) =	12.51	1/100 ft
Length of Water Column (LWC) = TWD - DGW =	6.00	1/100 ft
1 Casing Volume (OCV)=LWC x	0.163	= 0.98
5 Casing Volumes =	4.89	gallons
Method of Well Development	Disposable submersible pump	
Total Volume of Water Removed	65	gallons

[illegible]

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.
Surged with disposable bailer prior to development

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Monitoring Well Development Log

Page 1 of 1

Date Started (m/day/yr) 12/16/98 Date Completed 12/16/98
 Field Personnel D. Turner & M. Cain
 Site Name Ft. Stewart SWMU #13
 Project Number 29350
Upgradient Downgradient
 Weather Conditions Clear, sunny, cool
 Air Temperature 60 °F
 Well Identification # MW-13

Total Well Depth (TWD) = 18.57 1/100 ft
 Depth to Ground Water (DGW) = 12.22 1/100 ft
 Length of Water Column (LWC) = TWD - DGW = 6.35 1/100 ft
 1 Casing Volume (OCV)=LWC x 0.163 = 1.035 1/100 ft
 5 Casing Volumes = 5.175 gallons
 Method of Well Development Disposable submersible pump
 Total Volume of Water Removed 60 gallons

Field Parameters

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temp. °C	pH	Eh	Specific Conductivity uS/m	Turbidity (NTU)	Sand Content (%)	DO (mg/L)	Remarks
12/16/98 1243		Initial	24.7	4.99	198	0.046	999	3	7.44	
12/16/98 1247		2.5	24.4	5.02	191	0.043	999	2	7.82	
12/16/98 1254		5.0	25.1	4.89	200	0.036	999	2	8.07	
12/16/98 1257		7.5	25.9	4.89	191	0.035	999	1	8.16	
12/16/98 1304		15	26.2	4.87	193	0.040	553	1	8.29	
12/16/98 1308		20	26.0	4.82	188	0.040	183	<1	8.20	
12/16/98 1312		25	26.1	4.84	184	0.031	64	<1	8.26	
12/16/98 1318		30	25.9	4.79	202	0.030	14	<1	8.22	
12/16/98 1321		35	26.4	4.81	197	0.030	12	<1	7.77	
12/16/98 1324		36	26.2	4.76	190	0.030	9	<1	7.90	
12/16/98 1331		46	25.7	4.61	206	0.030	61	<1	7.68	
12/16/98 1338		52	26.2	4.39	201	0.029	44	<1	7.77	
12/16/98 1342		55	26.3	4.45	198	0.029	8	<1	7.74	
12/16/98 1345		60	26.2	4.51	198	0.028	7	<1	7.73	

COMMENTS/OBSERVATIONS: "Washed" inside of well casing with purge water after development.
 Surged with disposable bailer prior to development

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Field Data Information Log for Groundwater Sampling

Page 1 of 2

Date (mo/day/yr) 1/12/99

Field Personnel D. Wheeler, D. Turner, R. Pauling

Site Name MW-1 Ft. Stewart SWMU #13

Project Number 29350

☒ Upgradient ☐ Downgradient

Weather Conditions Clear, cold

Air Temperature 40 °F

Total Well Depth (TWD) 15.38 1/100 ft

Depth to Groundwater (DGW) 9.63

Length of Water Column (LWC=TWD-DGW) = 5.70 1/100 ft

1 Casing Volume (OCV) = LWC x 0.163 = 0.93 gal

5 Casing Volumes = 4.67 gal=Standard Evacuation Volume

Method of Well Evacuation peristaltic pump

Method of Sample Collection peristaltic pump

Total Volume of Water Removed 9.0 gal

Casing Diameter 2 inches

Casing Material PVC

Measuring Point Elevation TOC 1/100 ft

Height of Riser (above land surface) 1/100 ft

Land Surface Elevation 1/100 ft

Screened Interval 1/100 ft

Dedicated Pump or Bailer YES ☒ NO ☐

Steel Guard Pipe Around Casing YES ☒ NO ☐

Locking Cap YES ☒ NO ☐

Protective Post/Abutment YES ☒ NO ☐

Well Integrity Satisfactory YES ☒ NO ☐

Well Yield LOW MODERATE HIGH ☒

Remarks _____

Field Analysis

Volume (gallons)	1.5	3.5	5.5	6.5	8.0	8.5	9.0
Time (military)	0847	0852	0902	0910	0915	0920	0927
pH (S.U.)	5.19	5.38	5.31	5.38	5.20	5.27	5.31
Salinity (%)	---	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.049	0.057	0.047	0.047	0.047	0.046	0.046
Water Temp. (°C)	14.9	16.5	16.5	16.8	16.7	16.7	16.7
Turbidity (NTU)	33	48	32.7	21.1	16.4	10.27	8.22
D.O. (mg/L)	6.78	6.56	7.16	7.09	7.36	7.50	7.42
Eh (mV)	237	213	205	198	192	190	190

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

Page 2 of 2

Date (mo/day/yr) <u>1/12/99</u>	
Field Personnel <u>D. Wheeler, D. Turner, R. Paulling</u>	
Site Name <u>MW-1</u>	Ft. Stewart <u>SWMU #13</u>
Project Number <u>29350</u>	
<u>X</u> Upgradient Downgradient	
Weather Conditions <u>Clear, cold</u>	
Air Temperature <u>40</u>	°F
Total Well Depth (TWD) <u>15.38</u>	1/100 ft
Depth to Groundwater (DGW) <u>9.63</u>	
Length of Water Column (LWC=TWD-DGW) = <u>5.70</u> 1/100 ft	
1 Casing Volume (OCV) = LWC x 0.163 = <u>0.93</u>	gal
5 Casing Volumes = <u>4.67</u>	gal=Standard Evacuation Volume
Method of Well Evacuation <u>peristaltic pump</u>	
Method of Sample Collection <u>peristaltic pump</u>	
Total Volume of Water Removed <u>9.0</u>	gal

Casing Diameter <u>2</u>	inches
Casing Material <u>PVC</u>	
Measuring Point Elevation <u>TOC</u>	1/100 ft
Height of Riser (above land surface)	1/100 ft
Land Surface Elevation	1/100 ft
Screened Interval	1/100 ft
Dedicated Pump or Bailer <u>YES</u> <u>X</u> <u>NO</u>	
Steel Guard Pipe Around Casing <u>YES</u> <u>X</u> <u>NO</u>	
Locking Cap <u>YES</u> <u>X</u> <u>NO</u>	
Protective Post/Abutment <u>YES</u> <u>X</u> <u>NO</u>	
Well Integrity Satisfactory <u>YES</u> <u>X</u> <u>NO</u>	
Well Yield <u>LOW</u> <u>MODERATE</u> <u>HIGH</u> <u>X</u>	
Remarks <u>GW OVA reading = 1.6 ppm</u>	

Field Analysis

Volume (gallons)	After sample
Time (military)	<u>1035</u>
pH (S.U.)	<u>5.26</u>
Salinity (%)	<u>---</u>
Sp. Cond. (µS/m)	<u>0.044</u>
Water Temp. (°C)	<u>17.4</u>
Turbidity (NTU)	<u>17.7</u>
D.O. (mg/L)	<u>8.31</u>
Eh (mV)	<u>239</u>

COMMENTS/OBSERVATIONS:

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E A R T H T E C H

Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (mo/day/yr)	1/12/99
Field Personnel	D. Wheeler, D. Turner, R. Paulling
Site Name	MW-3 Fort Stewart SWMU #13
Project Number	29350
X Upgradient	Downgradient
Weather Conditions	Clear, cool
Air Temperature	60 °F
Total Well Depth (TWD)	16.35 1/100 ft
Depth to Groundwater (DGW)	10.76 1/100 ft
Length of Water Column (LWC=TWD-DGW)	5.59 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 0.91 gal
5 Casing Volumes = 4.55	gal=Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	5.5 gal

Casing Diameter	2	inches
Casing Material	PVC	
Measuring Point Elevation	TOC	1/100 ft
Height of Riser (above land surface)		1/100 ft
Land Surface Elevation		1/100 ft
Screened Interval		1/100 ft
Dedicated Pump or Bailer	YES X NO	
Steel Guard Pipe Around Casing	YES X NO	
Locking Cap	YES X NO	
Protective Post/Abutment	YES X NO	
Well Integrity Satisfactory	YES X NO	
Well Yield	LOW MODERATE HIGH X	
Remarks	GW OVA reading = 0.6 ppm	
	Dissolved oxygen meter not working properly.	

Field Analysis

Volume (gallons)	Initial	2	3	4	4.5	After sample
Time (military)	1651	1658	1703	1711	1716	1724
pH (S.U.)	4.37	4.28	4.29	4.27	4.29	4.29
Salinity (‰)	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.034	0.023	0.023	0.024	0.024	0.024
Water Temp. (°C)	19.2	19.2	19.0	18.5	18.9	18.9
Turbidity (NTU)	102	22.8	17.16	10.20	8.86	6.80
D.O. (mg/L)	---	---	---	---	---	---
Eh (mV)	248	256	270	288	285	279

COMMENTS/OBSERVATIONS:

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E A R T H T E C H

Field Data Information Log for Groundwater Sampling

Page 1 of 2

Date (mo/day/yr)	1/11/99
Field Personnel	D. Wheeler, D. Turner, R. Paulling
Site Name	MW-4 Fort Stewart SWMU #13
Project Number	29350
X Upgradient Downgradient	
Weather Conditions	Partly cloudy
Air Temperature	61 °F
Total Well Depth (TWD)	18.04 1/100 ft
Depth to Groundwater (DGW)	8.54
Length of Water Column (LWC=TWD-DGW)	9.5 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 1.55 gal
5 Casing Volumes = 7.29 gal	Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	10.0 gal

Casing Diameter	2	inches
Casing Material	PVC	
Measuring Point Elevation	TOC	1/100 ft
Height of Riser (above land surface)		1/100 ft
Land Surface Elevation		1/100 ft
Screened Interval		1/100 ft
Dedicated Pump or Bailer	YES X NO	
Steel Guard Pipe Around Casing	YES X NO	
Locking Cap	YES X NO	
Protective Post/Abutment	YES X NO	
Well Integrity Satisfactory	YES X NO	
Well Yield	LOW MODERATE HIGH X	
Remarks		

Field Analysis

Volume (gallons)	Initial	1.75	2.5	3.75	4.75	6.25
Time (military)	1734	1740	1745	1750	1755	1800
pH (S.U.)	4.25	4.58	4.35	5.02	5.23	5.26
Salinity (%)	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.140	0.069	0.052	0.043	0.043	0.042
Water Temp. (°C)	16	17.7	18.1	18.3	18.3	18.5
Turbidity (NTU)	178	45.7	17.0	8.8	5.2	4.0
D.O. (mg/L)	8.78	8.05	7.98	7.77	7.92	7.98
Eh (mV)	151	178	180	198	201	208

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

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Date (mo/day/yr) 1/12/99

Field Personnel D. Wheeler, D. Turner, R. Paulling

Site Name MW-4 Fort Stewart SWMU #13

Project Number 29350

☒ Upgradient ☐ Downgradient

Weather Conditions Clear, cold

Air Temperature 40 °F

Total Well Depth (TWD) 18.04 1/100 ft

Depth to Groundwater (DGW) 8.54

Length of Water Column (LWC=TWD-DGW) = 9.5 1/100 ft

1 Casing Volume (OCV) = LWC x 0.163 = 1.55 gal

5 Casing Volumes = 7.29 gal=Standard Evacuation Volume

Method of Well Evacuation peristaltic pump

Method of Sample Collection peristaltic pump

Total Volume of Water Removed 10.0 gal

Casing Diameter 2 inches

Casing Material PVC

Measuring Point Elevation TOC 1/100 ft

Height of Riser (above land surface) 1/100 ft

Land Surface Elevation 1/100 ft

Screened Interval 1/100 ft

Dedicated Pump or Bailer YES ☒ NO ☐

Steel Guard Pipe Around Casing YES ☒ NO ☐

Locking Cap YES ☒ NO ☐

Protective Post/Abutment YES ☒ NO ☐

Well Integrity Satisfactory YES ☒ NO ☐

Well Yield LOW MODERATE HIGH ☒

Remarks GW OVA reading = 0.0ppm

Field Analysis

Volume (gallons)	6.25	7.25	8.25	After sample
Time (military)	0840	0850	0858	0940
pH (S.U.)	4.32	5.24	5.24	5.19
Salinity (%)	---	---	---	---
Sp. Cond. (µS/m)	0.108	0.038	0.036	0.038
Water Temp. (°C)	14.9	16.5	17.3	16.2
Turbidity (NTU)	6	3	1	5
D.O. (mg/L)	6.44	6.46	6.60	7.32
Eh (mV)	235	232	215	195

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

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Date (mo/day/yr) <u>1/12/99</u>	
Field Personnel <u>D. Wheeler, D. Turner, R. Paulling</u>	
Site Name <u>MW-6</u>	Ft. Stewart <u>SWMU #13</u>
Project Number <u>29350</u>	
<u>X</u> Upgradient Downgradient	
Weather Conditions <u>Partly cloudy</u>	
Air Temperature <u>40</u>	°F
Total Well Depth (TWD) <u>17.77</u>	1/100 ft
Depth to Groundwater (DGW) <u>10.21</u>	
Length of Water Column (LWC=TWD-DGW) = <u>7.56</u> 1/100 ft	
1 Casing Volume (OCV) = LWC x 0.163 = <u>1.23</u> gal	
5 Casing Volumes = <u>6.16</u> gal=Standard Evacuation Volume	
Method of Well Evacuation <u>peristaltic pump</u>	
Method of Sample Collection <u>peristaltic pump</u>	
Total Volume of Water Removed <u>4.0</u>	gal

Casing Diameter <u>2</u>	inches
Casing Material <u>PVC</u>	
Measuring Point Elevation <u>TOC</u>	1/100 ft
Height of Riser (above land surface) <u></u>	1/100 ft
Land Surface Elevation <u></u>	1/100 ft
Screened Interval <u></u>	1/100 ft
Dedicated Pump or Bailer <u>YES</u> <u>X</u> <u>NO</u>	
Steel Guard Pipe Around Casing <u>YES</u> <u>X</u> <u>NO</u>	
Locking Cap <u>YES</u> <u>X</u> <u>NO</u>	
Protective Post/Abutment <u>YES</u> <u>X</u> <u>NO</u>	
Well Integrity Satisfactory <u>YES</u> <u>X</u> <u>NO</u>	
Well Yield <u>LOW</u> <u>MODERATE</u> <u>HIGH</u> <u>X</u>	
Remarks <u>GW OVA reading = 0.8ppm</u>	
<u>DO recalibrated - readings keep climbing(bad probe)</u>	

Field Analysis

Volume (gallons)	Initial	0.75	1.25	1.75	2.25	3	3.75
Time (military)	1100	1106	1111	1116	1121	1137	1142
pH (S.U.)	5.04	5.07	5.03	5.00	5.02	5.04	5.06
Salinity (%)	---	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.013	0.011	0.012	0.011	0.012	0.012	0.011
Water Temp. (°C)	20	20.5	20.9	21.9	21.6	21.4	21.7
Turbidity (NTU)	4.4	6.2	2.8	1.23	0.86	1.00	0.91
D.O. (mg/L)	8.51	8.14	8.58	8.90	9.12	9.63	9.55
Eh (mV)	258	272	267	271	255	248	250

COMMENTS/OBSERVATIONS:



Field Data Information Log for Groundwater Sampling

Page 2 of 2

Date (mo/day/yr) 1/12/99
 Field Personnel D. Wheeler, D. Turner, R. Paulling
 Site Name MW-6 Ft. Stewart SWMU #13
 Project Number 29350
X Upgradient Downgradient
 Weather Conditions Partly cloudy
 Air Temperature 40 °F
 Total Well Depth (TWD) 17.77 1/100 ft
 Depth to Groundwater (DGW) 10.21
 Length of Water Column (LWC=TWD-DGW) = 7.56 1/100 ft
 1 Casing Volume (OCV) = LWC x 0.163 = 1.23 gal
 5 Casing Volumes = 6.16 gal=Standard Evacuation Volume
 Method of Well Evacuation peristaltic pump
 Method of Sample Collection peristaltic pump
 Total Volume of Water Removed 4.0 gal

Casing Diameter 2 inches
 Casing Material PVC
 Measuring Point Elevation TOC 1/100 ft
 Height of Riser (above land surface) 1/100 ft
 Land Surface Elevation 1/100 ft
 Screened Interval 1/100 ft
 Dedicated Pump or Bailer YES X NO
 Steel Guard Pipe Around Casing YES X NO
 Locking Cap YES X NO
 Protective Post/Abutment YES X NO
 Well Integrity Satisfactory YES X NO
 Well Yield LOW MODERATE HIGH X
 Remarks GW OVA reading = 0.8ppm
DO recalibrated - readings keep climbing(bad probe)

Field Analysis

Volume (gallons)	After sample		
Time (military)	1155		
pH (S.U.)	4.87		
Salinity (%)	---		
Sp. Cond. (µS/m)	0.023		
Water Temp. (°C)	22.1		
Turbidity (NTU)	1.5		
D.O. (mg/L)	11.25		
Eh (mV)	266		

COMMENTS/OBSERVATIONS:

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E A R T H T E C H

Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (m/day/yr)	1/12/99
Field Personnel	D. Wheeler, D. Turner, R. Pauling
Site Name	MW-8 Ft. Stewart SWMU #13
Project Number	29350
Upgradient	Downgradient
Weather Conditions	Partly cloudy
Air Temperature	60 °F
Total Well Depth (TWD)	18.27 1/100 ft
Depth to Groundwater (DGW)	10.22 1/100 ft
Length of Water Column (LWC=TWD-DGW)	8.05 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 1.31 gal
5 Casing Volumes = 6.56	gal=Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	5.5 gal

Casing Diameter	2 inches
Casing Material	PVC
Measuring Point Elevation	TOC 1/100 ft
Height of Riser (above land surface)	1/100 ft
Land Surface Elevation	1/100 ft
Screened Interval	1/100 ft
Dedicated Pump or Bailer	YES X NO
Steel Guard Pipe Around Casing	YES X NO
Locking Cap	YES X NO
Protective Post/Abutment	YES X NO
Well Integrity Satisfactory	YES X NO
Well Yield	LOW MODERATE HIGH X
Remarks	GW OVA reading = 0.6 ppm Dissolved oxygen meter not working properly.

Field Analysis

Volume (gallons)	Initial	1	3.5	4.5	5.5	After sample
Time (military)	1338	1344	1410	1419	1424	1558
pH (S.U.)	4.96	4.92	5.05	5.00	4.98	4.22
Salinity (%)	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.031	0.030	0.030	0.029	0.030	0.035
Water Temp. (°C)	21.2	21.8	21.1	21.0	21.8	19.0
Turbidity (NTU)	48	22	5.24	2.84	2.61	3.7
D.O. (mg/L)	---	---	---	---	---	---
Eh (mV)	279	283	283	296	294	304

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (mo/day/yr)	<u>1/12/99</u>		
Field Personnel	<u>D. Wheeler, D. Turner, R. Pauling</u>		
Site Name	<u>MW-9</u>	<u>Ft. Stewart</u>	<u>SWMU #13</u>
Project Number	<u>29350</u>		
<u>X</u> Upgradient	<u>Downgradient</u>		
Weather Conditions	<u>Clear, cool</u>		
Air Temperature	<u>55</u>	°F	
Total Well Depth (TWD)	<u>18.18</u>	<u>1/100 ft</u>	
Depth to Groundwater (DGW)	<u>9.28</u>	<u>1/100 ft</u>	
Length of Water Column (LWC=TWD-DGW)	<u>8.90</u>	<u>1/100 ft</u>	
1 Casing Volume (OCV) = LWC x 0.163	<u>1.45</u>	<u>gal</u>	
5 Casing Volumes =	<u>7.25</u>	<u>gal=Standard Evacuation Volume</u>	
Method of Well Evacuation	<u>peristaltic pump</u>		
Method of Sample Collection	<u>peristaltic pump</u>		
Total Volume of Water Removed	<u>4.0</u>	<u>gal</u>	

Casing Diameter	<u>2</u>	inches
Casing Material	<u>PVC</u>	
Measuring Point Elevation	<u>TOC</u>	<u>1/100 ft</u>
Height of Riser (above land surface)		<u>1/100 ft</u>
Land Surface Elevation		<u>1/100 ft</u>
Screened Interval		<u>1/100 ft</u>
Dedicated Pump or Bailer	<u>YES</u>	<u>X</u> <u>NO</u>
Steel Guard Pipe Around Casing	<u>YES</u>	<u>X</u> <u>NO</u>
Locking Cap	<u>YES</u>	<u>X</u> <u>NO</u>
Protective Post/Abutment	<u>YES</u>	<u>X</u> <u>NO</u>
Well Integrity Satisfactory	<u>YES</u>	<u>X</u> <u>NO</u>
Well Yield	<u>LOW</u>	<u>MODERATE</u> <u>HIGH</u> <u>X</u>
Remarks	<u>GW OVA reading = 0.0 ppm</u>	
<u>Dissolved oxygen meter not working properly.</u>		

Field Analysis

	Initial	0.75	1.5	2.75	3.75	After sample
Volume (gallons)						
Time (military)	<u>1500</u>	<u>1505</u>	<u>1510</u>	<u>1518</u>	<u>1527</u>	<u>1708</u>
pH (S.U.)	<u>4.98</u>	<u>4.93</u>	<u>4.70</u>	<u>4.12</u>	<u>3.99</u>	<u>4.08</u>
Salinity (%)	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
Sp. Cond. (µS/m)	<u>0.043</u>	<u>0.040</u>	<u>0.037</u>	<u>0.036</u>	<u>0.036</u>	<u>0.033</u>
Water Temp. (°C)	<u>21.0</u>	<u>20.4</u>	<u>20.6</u>	<u>20.1</u>	<u>19.9</u>	<u>18.3</u>
Turbidity (NTU)	<u>7.21</u>	<u>8.15</u>	<u>5.91</u>	<u>2.10</u>	<u>2.82</u>	<u>4.59</u>
D.O. (mg/L)	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
Eh (mV)	<u>256</u>	<u>292</u>	<u>305</u>	<u>321</u>	<u>319</u>	<u>305</u>

COMMENTS/OBSERVATIONS:

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E A R T H T E C H

Field Data Information Log for Groundwater Sampling

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Date (mo/day/yr)	1/12/99
Field Personnel	D. Wheeler, D. Turner, R. Pauling
Site Name	MW-10 Ft. Stewart SWMU #13
Project Number	29350
X Upgradient Downgradient	
Weather Conditions	Partly cloudy
Air Temperature	40 °F
Total Well Depth (TWD)	17.66 1/100 ft
Depth to Groundwater (DGW)	11.10 1/100 ft
Length of Water Column (LWC=TWD-DGW)	6.56 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 1.07 gal
5 Casing Volumes =	5.37 gal=Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	6.0 gal

Casing Diameter	2	inches
Casing Material	PVC	
Measuring Point Elevation	TOC	1/100 ft
Height of Riser (above land surface)		1/100 ft
Land Surface Elevation		1/100 ft
Screened Interval		1/100 ft
Dedicated Pump or Bailer	YES X NO	
Steel Guard Pipe Around Casing	YES X NO	
Locking Cap	YES X NO	
Protective Post/Abutment	YES X NO	
Well Integrity Satisfactory	YES X NO	
Well Yield	LOW MODERATE HIGH X	
Remarks	GW OVA reading = 11.0ppm	

Field Analysis

Volume (gallons)	Initial	1.25	2.5	3.75	5.25	6.0	After sample
Time (military)	1012	1017	1025	1030	1042	1051	1131
pH (S.U.)	4.85	5.08	5.06	5.03	4.94	4.98	4.94
Salinity (%)	---	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.045	0.045	0.047	0.045	0.046	0.044	0.040
Water Temp. (°C)	18.6	18.6	19.0	20	20.7	20.9	21.4
Turbidity (NTU)	4.02	17.25	25.1	24.4	8.60	6.3	3
D.O. (mg/L)	7.25	7.30	7.05	6.99	7.48	7.45	9.40
Eh (mV)	225	237	249	254	256	267	254

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

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Date (mo/day/yr)	1/12/99
Field Personnel	D. Wheeler, D. Turner, R. Paulling
Site Name	MW-11 Fort Stewart SWMU #13
Project Number	29350
X Upgradient	Downgradient
Weather Conditions	Partly cloudy
Air Temperature	50 °F
Total Well Depth (TWD)	18.36 1/100 ft
Depth to Groundwater (DGW)	10.63 1/100 ft
Length of Water Column (LWC=TWD-DGW)	7.73 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 1.26 gal
5 Casing Volumes =	6.30 gal=Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	5.0 gal

Casing Diameter	2	inches
Casing Material	PVC	
Measuring Point Elevation	TOC	1/100 ft
Height of Riser (above land surface)		1/100 ft
Land Surface Elevation		1/100 ft
Screened Interval		1/100 ft
Dedicated Pump or Bailer	YES X NO	
Steel Guard Pipe Around Casing	YES X NO	
Locking Cap	YES X NO	
Protective Post/Abutment	YES X NO	
Well Integrity Satisfactory	YES X NO	
Well Yield	LOW MODERATE HIGH X	
Remarks	GW OVA reading = 6.0ppm DO recalibrated due to high readings, no change.	

Field Analysis

Volume (gallons)	Initial	2	4
Time (military)	1151	1201	1215
pH (S.U.)	4.94	4.68	4.80
Salinity (%)	---	---	---
Sp. Cond. (µS/m)	0.033	0.058	0.037
Water Temp. (°C)	21.1	20.8	21.5
Turbidity (NTU)	5.71	1.14	1.27
D.O. (mg/L)	9.75	---	---
Eh (mV)	276	265	259
After sample	1220	4.84	---

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (mo/day/yr)	1/13/99	Casing Diameter	2	inches
Field Personnel	D. Turner	Casing Material	PVC	
Site Name	MW-11 Fort Stewart SWMU #13	Measuring Point Elevation	TOC	1/100 ft
Project Number	29350	Height of Riser (above land surface)		1/100 ft
X Upgradient Downgradient		Land Surface Elevation		1/100 ft
Weather Conditions	Mostly cloudy, warm	Screened Interval		1/100 ft
Air Temperature	70 °F	Dedicated Pump or Bailer	YES X NO	
Total Well Depth (TWD)	18.36	Steel Guard Pipe Around Casing	YES X NO	
Depth to Groundwater (DGW)	10.56	Locking Cap	YES X NO	
Length of Water Column (LWC=TWD-DGW)	7.80	Protective Post/Abutment	YES X NO	
1 Casing Volume (OCV) = LWC x 0.163	1.27	Well Integrity Satisfactory	YES X NO	
5 Casing Volumes = 6.36	gal=Standard Evacuation Volume	Well Yield	LOW MODERATE X HIGH	
Method of Well Evacuation	peristaltic pump	Remarks	GW OVA reading = 42.0ppm	
Method of Sample Collection	peristaltic pump	Resampled well for additional parameters		
Total Volume of Water Removed	4.0	gal		

Field Analysis

Volume (gallons)	Initial	1	2	3	After sample
Time (military)	1450	1457	1504	1510	1520
pH (S.U.)	4.15	4.61	4.66	4.65	4.61
Salinity (%)	216	220	224	226	228
Sp. Cond. (µS/m)	0.083	0.044	0.047	0.044	0.043
Water Temp. (°C)	20.3	21.0	20.4	20.4	20.8
Turbidity (NTU)	3.3	0.95	0.55	0.45	0.61
D.O. (mg/L)	9.77	10.26	9.69	9.74	9.69
Eh (mV)					

COMMENTS/OBSERVATIONS:

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Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (m/day/yr)	1/12/99	Casing Diameter	2	inches
Field Personnel	D. Wheeler, D. Turner, R. Paulling	Casing Material	PVC	
Site Name	MW-12 Ft. Stewart SWMU #13	Measuring Point Elevation	TOC	1/100 ft
Project Number	29350	Height of Riser (above land surface)		1/100 ft
☒ Upgradient ☐ Downgradient		Land Surface Elevation		1/100 ft
Weather Conditions	Clear, cold	Screened Interval		1/100 ft
Air Temperature	60	Dedicated Pump or Bailer	YES ☒ NO ☐	
Total Well Depth (TWD)	18.24	Steel Guard Pipe Around Casing	YES ☒ NO ☐	
Depth to Groundwater (DGW)	11.54	Locking Cap	YES ☒ NO ☐	
Length of Water Column (LWC=TWD-DGW)	6.70	Protective Post/Abutment	YES ☒ NO ☐	
1 Casing Volume (OCV) = LWC x 0.163	= 1.09	Well Integrity Satisfactory	YES ☒ NO ☐	
5 Casing Volumes = 5.46	gal=Standard Evacuation Volume	Well Yield	LOW ☐ MODERATE ☐ HIGH ☒	
Method of Well Evacuation	peristaltic pump	Remarks	GW OVA reading = 6.9 ppm	
Method of Sample Collection	peristaltic pump	DO meter not operating properly		
Total Volume of Water Removed	5.5	gal		

Field Analysis

Volume (gallons)	Initial	0.75	1.25	4.0	5.0	5.25	After sample
Time (military)	1732	1738	1743	1801	1807	1812	1840
pH (S.U.)	4.35	4.43	4.15	4.54	4.30	4.46	4.66
Salinity (%)	---	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.048	0.045	0.044	0.036	0.036	0.035	0.034
Water Temp. (°C)	18.8	18.9	19.4	19.1	19.2	19.6	18.3
Turbidity (NTU)	9.97	10.04	10.92	1.61	1.37	1.51	19.4
D.O. (mg/L)	---	---	---	---	---	---	---
EH (mV)	203	174	162	133	129	131	145

COMMENTS/OBSERVATIONS:

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E A R T H T E C H

Field Data Information Log for Groundwater Sampling

Page 1 of 1

Date (mo/day/yr)	1/12/99
Field Personnel	D. Wheeler, D. Turner, R. Paulling
Site Name	MW-13 Ft. Stewart SWMU #13
Project Number	29350
Upgradient	X Downgradient
Weather Conditions	Partly cloudy
Air Temperature	60 °F
Total Well Depth (TWD)	18.30 1/100 ft
Depth to Groundwater (DGW)	11.21 1/100 ft
Length of Water Column (LWC=TWD-DGW)	7.09 1/100 ft
1 Casing Volume (OCV) = LWC x 0.163	= 1.16 gal
5 Casing Volumes =	5.78 gal=Standard Evacuation Volume
Method of Well Evacuation	peristaltic pump
Method of Sample Collection	peristaltic pump
Total Volume of Water Removed	5.75 gal

Casing Diameter	2 inches
Casing Material	PVC
Measuring Point Elevation	TOC 1/100 ft
Height of Riser (above land surface)	1/100 ft
Land Surface Elevation	1/100 ft
Screened Interval	1/100 ft
Dedicated Pump or Bailer	YES X NO
Steel Guard Pipe Around Casing	YES X NO
Locking Cap	YES X NO
Protective Post/Abutment	YES X NO
Well Integrity Satisfactory	YES X NO
Well Yield	LOW MODERATE HIGH X
Remarks	GW OVA reading = 1.4 ppm Dissolved oxygen meter not working properly.

Field Analysis

Volume (gallons)	2	2.75	3.75	4.75	5.75	After sample
Time (military)	1253	1258	1303	1308	1313	1500
pH (S.U.)	4.97	4.99	5.00	5.01	4.99	5.03
Salinity (%)	---	---	---	---	---	---
Sp. Cond. (µS/m)	0.029	0.027	0.027	0.027	0.026	0.028
Water Temp. (°C)	24.3	24.3	24.4	24.3	24.3	24.2
Turbidity (NTU)	8.79	4.96	4.13	2.02	2.36	4.2
D.O. (mg/L)	---	---	---	---	---	---
Eh (mV)	251	253	250	258	266	253

COMMENTS/OBSERVATIONS:

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APPENDIX C

QUALITY CONTROL SUMMARY REPORT

**RCRA FACILITY INVESTIGATION
SWMU 13, FORMER FIRE TRAINING AREA
FORT STEWART, GEORGIA**

**QUALITY CONTROL SUMMARY REPORT
RCRA FACILITY INVESTIGATION
SWMU 13, FORMER FIRE TRAINING AREA
FORT STEWART, GEORGIA
May 2000**

1.0 Introduction

The purpose of this project was to perform a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the former Fire Training Area, Solid Waste Management Unit (SWMU) 13 at Fort Stewart, Georgia, to determine the nature and extent of contamination and to gather data to support a Corrective Action Plan (CAP).

Wright Army Airfield is located in Liberty County, Georgia approximately 40 miles southwest of Savannah, Georgia and within the confines of Fort Stewart, Georgia. The nearest city is Hinesville, approximately 1-1/2 miles to the south. The former Fire Training Area (SWMU 13) is located on the northwest periphery of Wright Army Airfield, approximately 3,000 feet northwest of the control tower.

SWMU 13 consisted of a 5,000 square foot concrete pad with an integral berm that was used by firefighting personnel for training. An oil/water separator sump, a separate concrete pad, underground piping, and an aboveground fuel (JP-4) storage tank adjoined the main concrete pad and combined to make up the entire fire training area. All of these structures and appurtenances were removed during the Interim Measures (IM). The area is also mostly enclosed by a series of drainage swales. An asphalt runway adjoins the fire training area to the south and east.

The former Fire Training Area was used by the airfield's firefighters from its construction, prior to 1982, until 1992. During training exercises, fuel (water-contaminated jet fuel [JP-4], diesel fuel, or waste oil) was pumped onto the surface of a simulated aircraft and ignited. The fires were then extinguished with water and foam. The former Fire Training Area was constructed such that water and foam used during the training would be drained to the oil/water separator. Effluent water flowed to the western drainage swale, and the lighter-than-water portion (oil) was reportedly pumped by vacuum truck and disposed at the Fort Stewart Industrial Wastewater Treatment Plant. Occasionally, some of the water (and fuel) would either be splashed onto adjacent soil or it would run over the concrete berm onto the adjacent soil.

1.1 Project Description

RFI field sampling activities for the site were conducted from November 1998 and January 1999. Investigation activities consisted of the collection of screening soil samples, using a push probe at 12 locations; the collection of screening groundwater samples from 23 push probe locations, including three vertical profile probes; and the installation and sampling of six permanent monitoring wells.

Sample results were screened against background levels, Georgia Department of Natural Resources action levels, and risk-based action levels for those compounds identified by the Georgia Environmental Protection Division (GA EPD).

1.2 Project Objectives

The scope of the project involved performance of site investigation activities, relative to the GA EPD instructions, and preparation of an RFI Report. The overall purpose of the study was to determine

contamination extent and corrective action measures. Specific objectives for the RFI were defined in the RFI Work Plan (Rust, 1998). In summary, the objectives of the project were as follows:

1. Determine the horizontal and vertical extent of contamination.
2. Determine whether contaminants present constitute a threat to human health or the environment.
3. Determine the need for future action or no further action.
4. Gather necessary data to support a CAP, if warranted.

The general quality assurance (QA) objectives of the project are as follows:

1. Ensure that the method used for borehole drilling will allow for collection of soil samples representative of surface and subsurface soil contamination conditions, and for description of the hydrogeologic environment.
2. Ensure that the method used for collection of groundwater samples will allow for collection of samples representative of water table contamination conditions.
3. Ensure that sampling methods used for soil and groundwater collection minimize alteration of contaminant concentrations, and that drilling and sampling equipment decontamination methods prevent cross-contamination between sampling locations.
4. Ensure that field measurement and analytical laboratory results are accurate, representative of site conditions, and fulfill data quality objectives (DQOs) defined for the project.

The first three QA objectives were accomplished through implementation of the procedures and requirements described in the Work Plan. The fourth QA objective was accomplished through data management practices, associated internal laboratory quality control (QC) analyses, related procedures and requirements defined in the Chemical Data Acquisition Plan (CDAP), and through collection and analysis of field QC samples.

1.3 Project Implementation

Earth Tech, formerly Rust, conducted the field work from November 1998 through January 1999. A project-specific Site Health and Safety Plan was compiled for the work completed by Earth Tech and sub-tier contractors. Ms. Melanie Hill was designated as Field Team Leader for the project. She was responsible for the collection of samples in accordance with the work plan, completion of Daily Quality Control Reports (DQCRs), coordination of site access, shipment of samples to the laboratories, and documentation and correction of problems as they occurred. Quality Control Officer for the project was Ms. Dana Turner. She was responsible for data quality control for the Earth Tech sampling effort. This included but was not limited to validation of both field and laboratory data in accordance with the CDAP and the Sampling and Analysis Plan. As laboratory and analytical data coordinator, Mr. Mike Cain was responsible for maintaining analytical files for the project, and documentation and correction of problems as they occurred. As the Earth Tech project manager, Mr. Ronald Paulling was responsible for overall project success, budgetary control, interfacing with US Army Corps of Engineers (USACE) personnel, and completion of Monthly Progress Reports (MPRs).

Savannah Labs of Savannah, Georgia was utilized by Earth Tech for testing all of the samples during the project. Water and soil samples were analyzed for: volatile organic compounds (VOCs); benzene,

toluene, ethylbenzene, and xylenes (BTEX); semivolatile organic compounds (SVOCs) or polyaromatic hydrocarbons (PAHs); RCRA metals; and miscellaneous parameters. The laboratory employed EPA analytical methods and is validated through the USACE Missouri River Division (MRD) laboratory review process. The QA laboratory for the entire project was the USACE South Atlantic Savannah Division (SAS) Laboratory in Marietta, Georgia.

1.4 Purpose of This Report

Environmental data must always be interpreted relative to its known limitations and its intended use. As can be expected in environmental media of this type, there are areas and data points where the user needs to be cautioned relative to the quality of the project information presented. The data validation process and this data quality assessment are intended to provide current and future data users assistance throughout the interpretation of this data.

The purposes of this Quality Control Summary Report (QCSR) are: 1) to describe the QC procedures followed to ensure data generated by Earth Tech during these investigations at Fort Stewart would meet project requirements; 2) to describe the quality of the data collected; and 3) to describe the problems encountered during the course of the study and their solutions. A QA report will be completed by the USACE Project Chemist covering data generated from Earth Tech collected samples remanded to their custody.

This appendix provides an assessment of the analytical information gathered during the course of the former Fire Training Area investigation and documents that the quality of the data employed for the report met the objectives. Evaluation of field and laboratory QC measures will constitute the majority of this assessment; however, references will also be directed toward those QA procedures which establish data credibility. The primary intent of this assessment is to illustrate that data generated for this investigation can withstand scientific scrutiny, are appropriate for their intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy.

Multiple activities were performed to achieve the desired data quality in this project. As discussed in the text, decisions were made during the initial scoping to define the quality and quantity of data required. DQOs were established to guide the implementation of the field sampling and laboratory analysis. A QA program was established to standardize procedures and to document activities. This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data were subjected to a verification and validation review which identified and qualified problems related to the analysis. These review steps contribute to this final Data Quality Assessment (DQA) which defines that data used in the investigation met the criteria and are employed appropriately.

2.0 Quality Assurance Program

A CDAP was developed for this project and may be found as part of the official Work Plan (Rust, 1998). The purpose of that document was to enumerate the quantity and type of samples to be taken to inspect the various sites, and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The CDAP established requirements for both field and laboratory QC procedures. In general: field QC duplicates and QA split samples were required at a frequency of 10% for each environmental sample matrix collected at sites being investigated; VOC trip blanks were to accompany each cooler containing water samples for VOC determinations; and analytical laboratory control samples and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the QA program was to ensure that the quality of results for all environmental measurements were appropriate for their intended use. To this end, a CDAP and standardized field procedures were compiled to guide the investigation. Through the process of readiness review, training, equipment calibration, QC implementation, and detailed documentation, the project has successfully accomplished the goals set by the QA program.

2.1 Monthly Progress Reports

An MPR was completed by the Earth Tech project manager for every month during project implementation. The MPRs contain the following information: work completed, problems encountered, corrective actions/solutions, summary of findings and upcoming work. These reports were issued to the Savannah Corps project manager and may be obtained through that office.

2.2 Daily Quality Control Reports

The Field Team Leader produced all DQCRs. These include information such as, but not limited to: sub-tier contractors on-site, equipment on-site, work performed summaries, QC activities, Health and Safety activities, problems encountered, and corrective actions. The DQCRs were submitted to the Earth Tech and Savannah Corps project managers, and are on file with them.

2.3 Laboratory "Definitive" Level Data Reporting

The CDAP for this project identified requirements for laboratory data reporting and identified Savannah Labs as the lab for the project. EPA "definitive" data has been reported including the following basic information:

- a. laboratory case narratives
- b. sample results
- c. laboratory method blank results
- d. laboratory control standard results
- e. surrogate recoveries (VOCs, SVOCs, PAHs)
- f. sample extraction dates
- g. sample analysis dates
- h. LCSDs
- i. MS/MSDS
- j. temperature upon arrival at the laboratory.

This information from the laboratory, along with field information, provides the basis for subsequent data evaluation relative to sensitivity, precision, accuracy, representativeness and completeness.

3.0 Data Validation

The objective when evaluating the quality of the project data is to determine its usability. The evaluation is based on the interpretation of laboratory QC measures, field QC measures, and the project DQOs.

This project implemented the use of data validation checklists to facilitate laboratory data validation. These checklists were completed by the project designated validation staff and were reviewed by the project laboratory coordinator. Data validation checklists for each laboratory sample delivery group (SDG) have been retained with laboratory data deliverables by Earth Tech.

3.1 Field Data Validation

DQCRs were completed by the Field Team Leader. The DQCRs and other field generated documents such as sampling logs, boring logs, daily health and safety summaries, daily safety inspections, equipment calibration and maintenance logs, and sample management logs were peer reviewed on-site. These logs and all associated field information has been delivered to the Savannah Corps project manager and can be obtained through that office.

3.2 Laboratory Data Validation

Analytical data generated for this project have been subjected to a process of data verification, validation, and review. The following describes this systematic process and the evaluation of activities performed. Several criteria have been established against which the data are compared and from which a judgement is rendered regarding the acceptance and qualification of the data. Because it is beyond the scope of this report to cite those criteria, the reader is directed to the following documents for specific detail:

- Region I EPA – Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses, July, 1998;
- Region I EPA – Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses, February, 1998; and
- Work Plan for the Phase II RCRA Facility Investigation at the Former Fire Training Area at Wright Army Airfield, Fort Stewart, Georgia, August 1998.

Upon receipt of field and analytical data, verification staff performed a systematic examination of the reports, following standardized data package checklists to ensure the content, presentation, and administrative validity of the data. Discrepancies identified during this process were recorded and documented utilizing the QA program Analytical Data Nonconformance Report (ADNCR) and Nonconformance Report (NCR) systems.

During the validation phase of the review and evaluation process, data were subjected to a systematic technical review by examining all field and analytical QC results and laboratory documentation, following appropriate guidelines for laboratory data validation. These data validation guidelines define the technical review criteria, methods for evaluation of the criteria, and actions to be taken resulting from the review of these criteria. The primary objective of this phase was to assess and summarize the quality and reliability of the data for the intended use and to document factors that may affect the usability of the data. Data verification/validation included but was not necessarily limited to the following parameters:

Inorganic	Organic
Data Completeness	Data Completeness
Holding Times	Holding Times
Calibration	Calibration
Initial	Initial
Continuing	Continuing
Blanks	Blanks
Sample results verification	Sample results verification
Field duplicate sample analysis	
Laboratory control sample (LCS) analysis	Internal standards performance
Furnace atomic absorption QC (when implemented)	
Detection Limits	Compound quantitation and reported Detection limits
Secondary dilutions	Secondary dilutions

As an end result of this phase of the review, the data were qualified based on the technical assessment of the validation criteria. Qualifiers were applied to each field and analytical result to indicate the usability of the data for its intended purpose.

3.3 Definition of Data Qualifiers (Flags)

During the data validation process, no laboratory data validation flags were assigned to the data. A data qualifier of "<" was used to depict a concentration was not present above the presented quantitation limit.

3.4 Data Acceptability

A total of 81 environmental soil samples were collected. They included 25 soil, 41 groundwater, and 15 field QC samples analyzed for 2105, 4206, and 1295, respectively (discrete analyses, i.e., analytes). These analyses were completed, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The project successfully collected all required investigation samples. No data were rejected; however the following samples required re-extraction due to low laboratory control standard recovery for various analytes:

A-GP-1-8g	A-GP-7-10g
A-GP-1-6s	A-GP-7-10DUP
A-GP-2-8g	A-GP-3-10g
A-GP-8-8g	A-GP-4-10g
A-GP-6-10g	A-GP-5-10g
A-GP-6-10FB	A-GP-9-8g

In addition, the surrogate recovery for one of three parameters associated with the analysis of A-GP-1-6S was outside established limits, and due to analyte abundance the benzene detection limits from A-GP-3-20g and A-GP-4-30g were reported from multiple runs.

Table C-1 presents a summary of the number of collected investigation samples. It also tallies the successful collection of appropriate targeted field QC and QA split samples. Table C-2 provides a summary of analyses grouped by media and analyte category. Copies of the project Chain-of-Custody forms are provided in appendices to the report.

4.0 Data Evaluation

4.1 Accuracy

Accuracy provides a gauge or measure of the agreement between an observed result and the true value for that analysis. Analytical accuracy is evaluated by measuring the agreement between an analytical result and its known or true value. This is generally determined through use of Laboratory Control Samples (LCSs) and Performance Evaluation (PE) Samples. Accuracy as measured through the use of LCSs determine the method implementation accuracy independent of sample matrix. They document laboratory analytical process control. Tables C-3 and C-4 present LCS and Method Blank surrogate recovery values for the various parameters under investigation during these studies.

Volatile Organic Compounds

Volatile organic compounds LCS recovery and surrogate recovery information provide measures of accuracy. Recoveries determined for laboratory volatile organic method blank and LCS blank surrogate

analyses indicate the analytical processes for procedures were in control. Individual sample surrogate recoveries indicate analytical accuracy for these compounds was in control and the data are usable.

Method blank surrogate recoveries (Table C-3) were all within 95-105% for the volatile analyses. Summaries in Table C-4 show soil and water LCS values range from 97.5 to 108.8%.

One qualifier was reported for volatile organic compound analyses for soil samples collected 11/2/98. One of the three surrogates, 4-bromofluorobenzene, was recovered above established limits for a soil sample. Because the other two surrogate recoveries were inside the established limits, these data were not excluded or flagged.

Semivolatile Organic Compounds

Average LCS percent recovery values for semivolatile organic compounds in soils and groundwater range from 46.0 to 102.8%. These values are well within the normally accepted advisory limits established by the analytical methods. They are also within project accuracy goals of 35 – 140% for semivolatile compounds. Ten groundwater samples and a field blank required re-extraction due to low laboratory control standard recoveries. Each re-extraction had recoveries within established limits and no data were excluded. Method blank surrogate recoveries (Table C-3) were all well within acceptable ranges for semivolatile compounds, also indicating that the analytical process was in control.

Total Organic Carbon

The laboratory analytical process for these measurements was demonstrated to be under control by maintaining a general 94-100% LCS percent recovery for soil matrices.

RCRA Metals and Miscellaneous Parameters

All metal soil LCS values fall within a 93.5-107.3% range, while the single groundwater LCS recoveries ranged from 100 to 112%.

LCS recoveries for sulfate, ferric iron, and iron provided satisfactory results for these parameters.

4.2 Precision

Field Precision

Field duplicate samples were collected to ascertain the contribution to variability (i.e., precision) created by the combination of environmental media, sampling consistency, and analytical precision. Field duplicate samples were collected from the same spatial and temporal conditions as the primary environmental sample. Soil samples were collected from the same sampling device, after homogenization for all analytes.

Table C-5 provides a summary of field duplicate comparisons, by analyte. The table presents both absolute difference and RPD evaluations for field duplicate measurements. RPD was calculated only when both samples were greater than 5 times the analyte reporting level. When one or both sample values were between the quantitation level and 5 times the analyte reporting level the absolute difference was evaluated. If both samples were not detected for a given analyte, precision was considered acceptable. Only duplicate pairs having measurable values are included in the tabulation.

In order to review information, this data quality assessment has implemented general criteria for comparison of absolute difference measurements and RPDs. RPD criteria are identified below. The absolute difference criteria was set at three times the analyte reporting level.

RPD EVALUATION CATEGORIES				
Matrix	Good	Fair	Poor	Unacceptable
Water	<30%	<60%	<100%	>100%
Soil	<50%	<90%	<150%	>150%

Soil metal comparisons were "good", with average RPDs less than 30% for all analytes detected in both samples. All other detected metal analytes were within the absolute difference criteria. Calculated RPD values for groundwater analytes were "fair", with average RPD values for ethylbenzene and xylenes greater than the 30% standard. All the detected analytes were within the absolute difference criteria.

No metal concentrations were detected in the duplicate samples at a level 5 times greater than the reporting level; however, all of the detected analytes were within the absolute difference criteria demonstrating a "good" agreement between each of the sample pairs.

4.3 Sensitivity

Determination of minimum detectable values allows the investigation to assess the relative confidence which can be placed in a value in comparison to the magnitude or level of analyte concentration observed. Variations can be caused by fluctuations in moisture content or the need to dilute high concentration analytes into linear range for analysis. The closer a measured value comes to the minimum detectable concentration, the less confidence and more variation the measurement will have. Project sensitivity goals were expressed as quantitation level goals in the CDAP. These levels were achieved or exceeded throughout the analytical process. There were no individual exceptions that generated qualification of the data or elevation of detection levels when the original goal was not achieved.

Evaluation of overall project sensitivity can be gained through review of field blank information. These actual sample analyses may provide a comprehensive look at the combined sampling and analysis sensitivity attained by the project. Field QC blanks obtained during sampling activities included samples of VOC trip blanks, three rinsate blanks, and two field blanks. In addition, both field blanks were analyzed for volatile and semivolatile organic compounds and one field blank was additionally analyzed for metals. The rinsate blanks were analyzed for VOCs only. One rinsate blank analysis detected acetone above method detection limits. Acetone is a common laboratory contaminant and this detection is not felt to be significant.

No VOCs were detected in project trip blanks above the laboratory instrument detection levels. According to earlier described protocols, a VOC trip blank was to be placed in each cooler transporting liquid samples for VOC analysis. However, the shipment on November 2, 1998, was inadvertently delivered to Savannah Labs without a trip blank. In addition, chain-of-custody documents for samples collected on November 6, 9, and 12, 1998, indicate that trip blank samples were included with those shipments, but Savannah Labs has no record of those analyses being completed. An ADNCR has been completed for these variances from protocol and is included in this appendix. Despite the omission of four trip blank analyses, because there were no detectable contaminants in the eight trip blanks that were analyzed, it is believed that the VOC analyses have not been affected through the transportation and storage process, and that the procedures and precautions employed were effective in preserving the integrity of the samples.

4.4 Representativeness and Comparability

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and is the qualitative term most concerned with the proper design of the sampling program (EPA 1988). Factors that affect the representativeness of analytical data include proper preservation, holding times, use of standard sampling and analytical methods, and determination of matrix or analyte interferences. No data points were rejected based on extended holding times, and no analyses were estimated and qualified. Sample preservation, analytical methodologies, and sampling methodologies were documented to be adequate and consistently applied. Both soil and groundwater sampling methods have been proven to be effective, and applicable for this study.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. These investigations employed appropriate sampling methodologies, site surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through the proper implementation and documentation of these standard practices, the project has established the confidence that the data will be comparable to other project and programmatic information.

4.5 Completeness

Usable data are defined as those data which pass individual scrutiny during the verification and validation process and are accepted for unrestricted application to the human health risk assessment evaluation or equivalent type applications.

Objectives for this investigation have been achieved. The project produced valid results for all sample analyses performed and successfully collected all required investigation samples.

5.0 Data Quality Assessment Summary

The overall quality of the data set for the Phase II RFI at SWMU 13, the former Fire Training Area at Wright Army Airfield meets or exceeds the established project objectives. Through proper implementation of the project data verification, validation, and assessment process, project information has been determined to be acceptable for use.

Data produced for this study demonstrates that it can withstand scientific scrutiny, is appropriate for its intended purpose, is technically defensible, and is of known and acceptable sensitivity, precision, and accuracy. Data integrity has been documented through proper implementation of Quality Assurance and Quality Control measures. The environmental information presented has an established confidence which allows utilization for the project objectives and provides data for future needs.

6.0 References

Rust, 1998. Revised Final RCRA Facility Investigation Work Plan for SWMU 13, Fire Training Area at Wright Army Airfield, Fort Stewart, Georgia, August, 1998.

US Environmental Protection Agency (EPA), February, 1988. Laboratory Data Validation Functional Guidelines for Evaluation Organic Analyses.

US Environmental Protection Agency (EPA), 1988. National Functional Guidelines for Inorganic Data Review. Hazardous Site Evaluation Division. Contract Laboratory Program, July 1998.

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APPENDIX D
GEOTECHNICAL LABORATORY TEST RESULTS

C

C

C



Celebrating 25 Years of Excellence

January 7, 1999

Earth Tech, Inc.
2694 Lake Park Drive
Charleston, South Carolina 29406

Attention: Mr. Ron Pauling

Reference: Results of Soils Analysis
Project No. 32369-10800
Ft. Stewart / USACE

Dear Mr. Pauling:

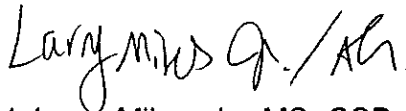
S&ME is pleased to provide you with the results of the soil analysis you requested. Permeability, moisture content and total soil porosity was determined on each of the four soil samples submitted for analysis by the appropriate ASTM standard. Air porosity was also requested to be performed on each of the samples, however there is not an ASTM method for determining the air porosity of the samples. Based on the intended use of the data, i.e., conducting an environmental risk assessment, air porosity was calculated for each sample based on the standard risk based assessment methods for characterizing soil as per EPA Publication 9355.4-23, titled "Soil Screening Guidance; User's Guide". As per the EPA method, air filled porosity was obtained by subtracting a default value of 0.15 for water porosity from the total soil porosity as determined by ASTM method 854. The results of the air porosity are listed below, all other results are attached.

Air Porosity

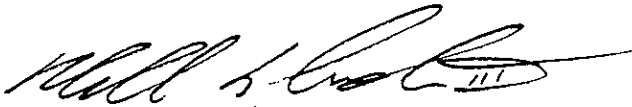
MW-9-18r	$0.361 - 0.15 = 0.211$
MW-9-2r	$0.358 - 0.15 = 0.208$
MW-13-4r	$0.407 - 0.15 = 0.257$
MW-10-8r	$0.385 - 0.15 = 0.235$

If you have any questions regarding these results, we may be reached at 912-353-8885.
S&ME appreciates the opportunity to perform these services and we look forward to
assisting you in the future.

Very truly yours,
S&ME, Inc.



J. Larry Miles, Jr., MS, CSP
Environmental Services Manager



William S. Anderson, III, PE
Branch Manager

East Tech, Inc.

RUST rust Environment & Infrastructure

Call Ron Paulding
@ 843/572-3620

Chain of Custody Record

Project Number 32369-10800		Project Name/Client FA Stewart / USAF		Sample Custodian: (Signature) Melanie D. Neep		Custody Seal #		Rust E&I Cooler #				
Item No.	Sample Description (Field ID Number)	Date	Time	Grab	Comp.	PID Reading (ppm)	Label Number	Analysis Required (ASTM D2246) (ASTM B574) (ASTM D5246) (ASTM D2246)	Disposition of by: (Signature)	Disposition of by: (Signature)	Items:	Date / Time
1	MW-9-18r	12/18/15	1540	X		0		X			2.57 5.14 2.57 2.57	2.57 5.14 2.57 2.57
2	MW-9-2r	12/18/15	1540	X		0		X			1	1
3												
4	MW-13-4r	12/18/15	1540	X		0		X			1	1
5												
6	MW-10-8r	12/18/15	1645	X		0		X			1	1
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
Relinquished by: (Signature) Melanie D. Neep		Date / Time 12/18/15 1700		Received by: (Signature) Ron Paulding				Disposed of by: (Signature)		Items:		Date / Time
Relinquished by: (Signature) Ron Paulding		Date / Time 12/18/15 1205		Received by: (Signature) Melanie D. Neep				Disposed of by: (Signature)		Items:		Date / Time
Send Lab Results To: Ron Paulding 2694 Lake Park Drive Charleston, SC 29406		Remarks: Check Delivery Method: ☒ Samples delivered in person ☐ Common carrier		Federal Express Airbill No.: Lab:				Laboratory Receiving Notes: Custody Seal Intact? Temp. of Shipping Container: Sample Condition:				



HYDRAULIC CONDUCTIVITY TEST (FALLING HEAD\INCREASING TAILWATER) ASTM D-5084 METHOD (C)

Job No.: 1143-98-300 Job Name: Earthtec
Date Sample: 12/8/98 Date Tested: 12/16/98 Boring No.: MW-9-18r Depth: 18 - 20 ft. Lab No.: 1
Soil Description: Tan Orange Silty Fine to Medium SAND

Notes: Specimen was taken from the middle portion of U.D. tube.
Location:

Undisturbed (X)	Remolded ()	Standard Proctor	Cell Pressure:	83 PSI
	Max Dry Density	lbs./cu.ft.	Back Pressure:	
	Optimum Moisture	%	Head:	80 PSI
	% Compaction	%	Tail:	80 PSI

Sample Data, Initial.				Sample Data, Final.			
Length	5.18	cm.	Moisture Content	19.1	%	5.18	cm. 22.9 %
Diameter	4.69	cm.	Wet Density	126.8	PCF	4.69	cm. 126.8 PCF
Area	17.28	sq.cm.	Dry Density	106.5	PCF	17.28	sq.cm. 103.2 PCF
Volume	89.49	cu.cm.	Initial Saturation	90.2	%	89.49	cu.cm. 99.4 %
Wet Weight	181.81	grams	Final Saturation	98.2	%	181.81	grams 98.2 %
Dry Weight	152.65	grams	Initial Void Ratio	0.565		147.93	grams 0.615
WATER TEMP. (C)	25.0		Porosity	0.361		25.0	0.381
CORRECTION FACTOR	0.8893		Specific Gravity	2.67		0.8893	2.67

TEST DATA:

$k = (aL/2At) \times \ln(h_1/h_2)$ $k =$ HYDRAULIC CONDUCTIVITY
 $RATIO = H_{v1} - H_{v2} / H_{c2}$ $L =$ 5.18 cm. Length of Sample
 $(h_{v1} - h_{c1} = h_1) INITIAL LOSS$ $A =$ 17.28 sq.cm. Area of Sample
 $(h_{v2} - h_{c2} = h_2) FINAL LOSS$ $a =$ 0.72 sq.cm. Area of Buret
 $i = h_2/L$ $i =$ HYDRAULIC GRADIENT
 $t =$ Elapsed time of test (second)

t/sec.	Hv1	Hc1	Hv2	Hc2	h1	h2	Out/In	H.G.
30	8.0	0.0	6.7	1.3	8.0	5.4	1.00	1.04
30	8.0	0.0	6.8	1.2	8.0	5.6	1.00	1.08
30	8.0	0.0	6.8	1.2	8.0	5.6	1.00	1.08
30	8.0	0.0	6.8	1.2	8.0	5.6	1.00	1.08

1. $k =$ 1.41E-03 cm./sec. AVERAGE :
 2. $k =$ 1.28E-03 cm./sec. $k =$ 1.17E-03 cm./sec.
 3. $k =$ 1.28E-03 cm./sec. $i =$ 1.07
 4. $k =$ 1.28E-03 cm./sec. $R =$ 1.00

FINAL (k) VALUE AVERAGE WITH WATER TEMPERATURE CORRECTION.

Tested by: M. KRAJAN

Checked by: D. CARVER



HYDRAULIC CONDUCTIVITY TEST
(FALLING HEAD\INCREASING TAILWATER)
ASTM D-5084 METHOD (C)

Job No.: 1143-98-300 Job Name: Earthtec
Date Sample: 12/8/98 Date Tested: 12/16/98 Boring No.: MW-9-2r Depth: 2 - 4 ft. Lab No.: 2
Soil Description: Red, Tan & Gray Fine Sandy CLAY

Notes: Specimen was taken from the bottom portion of U.D. tube.
Location:

Undisturbed (X)	Remolded ()	Standard Proctor	Cell Pressure: 83 PSI
	Max Dry Density	lbs./cu.ft.	Back Pressure:
	Optimum Moisture	%	Head: 80 PSI
	% Compaction	%	Tail: 80 PSI

Sample Data, Initial.				Sample Data, Final.					
Length	5.49	cm.	Moisture Content	20.1	%	5.49	cm.	23.8	%
Diameter	4.68	cm.	Wet Density	130.5	PCF	4.68	cm.	132.8	PCF
Area	17.20	sq.cm.	Dry Density	108.7	PCF	17.20	sq.cm.	107.3	PCF
Volume	94.44	cu.cm.	Initial Saturation	97.9	%	94.44	cu.cm.	111.8	%
Wet Weight	197.47	grams	Final Saturation	98.8	%	200.90	grams	98.8	%
Dry Weight	164.42	grams	Initial Void Ratio	0.557		162.28	grams	0.577	
WATER TEMP. (C)	25.0		Porosity	0.358		25.0		0.366	
CORRECTION FACTOR	0.8893		Specific Gravity	2.71		0.8893		2.71	

TEST DATA:

$k = (aL/2At) \times \ln(h_1/h_2)$	$k =$	HYDRAULIC CONDUCTIVITY
$RATIO = H_{v1} - H_{v2} / H_{c2}$	$L =$	5.49 cm. Length of Sample
$(h_{v1} - h_{c1} = h_1) INITIAL LOSS$	$A =$	17.20 sq.cm. Area of Sample
$(h_{v2} - h_{c2} = h_2) FINAL LOSS$	$a =$	0.72 sq.cm. Area of Buret
$i = h_2/L$	$i =$	HYDRAULIC GRADIENT
	$t =$	Elapsed time of test (second)

t/sec.	Hv1	Hc1	Hv2	Hc2	h1	h2	Out/In	H.G.
3480	30.0	0.0	29.1	0.9	30.0	28.2	1.00	5.14
2820	30.0	0.0	29.4	0.6	30.0	28.8	1.00	5.25
2520	29.4	0.6	28.8	1.2	28.8	27.6	0.50	5.03
3000	30.0	0.0	29.3	0.7	30.0	28.6	1.00	5.21

1. $k =$	2.04E-06	cm./sec.	AVERAGE :	$k =$	1.66E-06	cm./sec.
2. $k =$	1.66E-06	cm./sec.		$i =$	5.15	
3. $k =$	1.94E-06	cm./sec.		$R =$	0.88	
4. $k =$	1.83E-06	cm./sec.				

FINAL (k) VALUE AVERAGE WITH WATER TEMPERATURE CORRECTION.

Tested by: M. KRAJAN

Checked by: D. CARVER



HYDRAULIC CONDUCTIVITY TEST (FALLING HEAD\INCREASING TAILWATER) ASTM D-5084 METHOD (C)

Job No.: 1143-98-300 Job Name: Earthtec
 Date Sample: 12/10/98 Date Tested: 12/16/98 Boring No.: MW-13-4r Depth: 4 - 6 ft. Lab No.: 3
 Soil Description: Red, Tan & Gray Fine Sandy CLAY

Notes: Specimen was taken from the bottom portion of U.D. tube.
 Location:

Undisturbed (X)	Remolded ()	Standard Proctor	Cell Pressure:	83 PSI
	Max Dry Density	lbs./cu.ft.	Back Pressure:	
	Optimum Moisture	%	Head:	80 PSI
	% Compaction	%	Tail:	80 PSI

Sample Data, Initial.					Sample Data, Final.				
Length	5.11	cm.	Moisture Content	22.2 %	5.11	cm.	24.3 %		
Diameter	4.68	cm.	Wet Density	123.0 PCF	4.68	cm.	125.3 PCF		
Area	17.20	sq.cm.	Dry Density	100.7 PCF	17.20	sq.cm.	100.8 PCF		
Volume	87.90	cu.cm.	Initial Saturation	88.0 %	87.90	cu.cm.	96.7 %		
Wet Weight	173.24	grams	Final Saturation	98.9 %	176.50	grams	98.9 %		
Dry Weight	141.77	grams	Initial Void Ratio	0.687	142.00	grams	0.684		
WATER TEMP. (C)	25.0		Porosity	0.407	25.0		0.406		
CORRECTION FACTOR	0.8893		Specific Gravity	2.72	0.8893		2.72		

TEST DATA:

$k = (aL/2At) \times \ln(h_1/h_2)$ $k =$ HYDRAULIC CONDUCTIVITY
 RATIO = $Hv_1 - Hv_2 / Hc_2$ $L =$ 5.11 cm. Length of Sample
 ($h_{v1} - h_{c1} = h_1$) INITIAL LOSS $A =$ 17.20 sq.cm. Area of Sample
 ($h_{v2} - h_{c2} = h_2$) FINAL LOSS $a =$ 0.72 sq.cm. Area of Buret
 $i = h_2/L$ $i =$ HYDRAULIC GRADIENT
 $t =$ Elapsed time of test (second)

t/sec.	Hv1	Hc1	Hv2	Hc2	h1	h2	Out/In	H.G.
7320	25.0	0.0	24.5	0.5	25.0	24.0	1.00	4.70
7860	25.0	0.0	24.5	0.5	25.0	24.0	1.00	4.70
10920	25.0	0.0	24.3	0.7	25.0	23.6	1.00	4.62
11280	25.0	0.0	24.3	0.7	25.0	23.6	1.00	4.62

1. $k =$ 5.96E-07 cm./sec. **AVERAGE :**
 2. $k =$ 5.55E-07 cm./sec. $k =$ 5.03E-07 cm./sec.
 3. $k =$ 5.64E-07 cm./sec. $i =$ 4.66
 4. $k =$ 5.46E-07 cm./sec. $R =$ 1.00

FINAL (k) VALUE AVERAGE WITH WATER TEMPERATURE CORRECTION.

Tested by: M. KRAJAN Checked by: D. CARVER



HYDRAULIC CONDUCTIVITY TEST
(FALLING HEAD INCREASING TAILWATER)
ASTM D-5084 METHOD (C)

Job No.: 1143-98-300

Job Name: Earthtec

Date Sample: 12/10/98

Date Tested: 12/16/98

Boring No.: MW-10-8r

Depth: 8 - 10 ft.

Lab No.: 4

Soil Description:

Tan Silty Fine SAND

Notes: Specimen was taken from the middle portion of U.D. tube.

Location:

Undisturbed (X)	Remolded ()	Standard Proctor	Cell Pressure:	83 PSI
	Max Dry Density	lbs./cu.ft.	Back Pressure:	
	Optimum Moisture	%	Head:	80 PSI
	% Compaction	%	Tail:	80 PSI

Sample Data, Initial.

Sample Data, Final.

Length	5.15	cm.	Moisture Content	20.8	%	5.15	cm.	24.4	%
Diameter	4.67	cm.	Wet Density	122.4	PCF	4.67	cm.	125.1	PCF
Area	17.13	sq.cm.	Dry Density	101.3	PCF	17.13	sq.cm.	100.6	PCF
Volume	88.21	cu.cm.	Initial Saturation	87.7	%	88.21	cu.cm.	100.9	%
Wet Weight	173.00	grams	Final Saturation	97.2	%	176.80	grams	97.2	%
Dry Weight	143.21	grams	Initial Void Ratio	0.626		142.12	grams	0.639	
WATER TEMP. (C)	25.0		Porosity	0.385		25.0		0.390	
CORRECTION FACTOR	0.8893		Specific Gravity	2.64		0.8893		2.64	

TEST DATA:

$k = (aL/2At) \times \ln(h_1/h_2)$	$k =$	HYDRAULIC CONDUCTIVITY
$RATIO = H_{v1} - H_{v2} / H_{c2}$	$L =$	5.15 cm. Length of Sample
$(h_{v1} - h_{c1} = h_1)$ INITIAL LOSS	$A =$	17.13 sq.cm. Area of Sample
$(h_{v2} - h_{c2} = h_2)$ FINAL LOSS	$a =$	0.72 sq.cm. Area of Buret
$i = h_2/L$	$i =$	HYDRAULIC GRADIENT
	$t =$	Elapsed time of test (second)

t/sec.	Hv1	Hc1	Hv2	Hc2	h1	h2	Out/In	H.G.
60	8.0	0.0	6.6	1.4	8.0	5.2	1.00	1.01
60	8.0	0.0	6.6	1.4	8.0	5.2	1.00	1.01
60	8.0	0.0	6.6	1.4	8.0	5.2	1.00	1.01
60	8.0	0.0	6.6	1.4	8.0	5.2	1.00	1.01

1. $k =$	7.77E-04	cm./sec.	AVERAGE :	
2. $k =$	7.77E-04	cm./sec.	$k =$	6.91E-04 cm./sec.
3. $k =$	7.77E-04	cm./sec.	$i =$	1.01
4. $k =$	7.77E-04	cm./sec.	$R =$	1.00

FINAL (k) VALUE AVERAGE WITH WATER TEMPERATURE CORRECTION.

Tested by: M. KRAJAN

Checked by: D. CARVER

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APPENDIX E
ANALYTICAL LABORATORY DATA

**SOIL AND
GROUNDWATER
ANALYTICAL
SCREENING
DATA**

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 161081113

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816-1	A-GP-9-Os	11-04-98/1620
86816-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816-1	86816-2
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<16	<11
Bromomethane, ug/kg dw	<16	<11
Vinyl chloride, ug/kg dw	<16	<11
Chloroethane, ug/kg dw	<16	<11
Methylene chloride (Dichloromethane), ug/kg dw	<8.1	<5.6
Acetone, ug/kg dw	<81	<56
Carbon disulfide, ug/kg dw	<8.1	<5.6
1,1-Dichloroethene, ug/kg dw	<8.1	<5.6
1,1-Dichloroethane, ug/kg dw	<8.1	<5.6
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<8.1	<5.6
Chloroform, ug/kg dw	<8.1	<5.6
1,2-Dichloroethane, ug/kg dw	<8.1	<5.6
2-Butanone (MEK), ug/kg dw	<41	<28
1,1,1-Trichloroethane, ug/kg dw	<8.1	<5.6
Carbon tetrachloride, ug/kg dw	<8.1	<5.6
Bromodichloromethane, ug/kg dw	<8.1	<5.6
1,1,2,2-Tetrachloroethane, ug/kg dw	<8.1	<5.6
1,2-Dichloropropane, ug/kg dw	<8.1	<5.6
trans-1,3-Dichloropropene, ug/kg dw	<8.1	<5.6
Trichloroethene, ug/kg dw	<8.1	<5.6
Dibromochloromethane, ug/kg dw	<8.1	<5.6

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REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816-1	A-GP-9-Os	11-04-98/1620
86816-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816-1	86816-2
1,1,2-Trichloroethane, ug/kg dw	<8.1	<5.6
Benzene, ug/kg dw	<8.1	<5.6
cis-1,3-Dichloropropene, ug/kg dw	<8.1	<5.6
Bromoform, ug/kg dw	<8.1	<5.6
2-Hexanone, ug/kg dw	<41	<28
4-Methyl-2-pentanone (MIBK), ug/kg dw	<41	<28
Tetrachloroethene, ug/kg dw	<8.1	<5.6
Toluene, ug/kg dw	<8.1	<5.6
Chlorobenzene, ug/kg dw	<8.1	<5.6
Ethylbenzene, ug/kg dw	<8.1	<5.6
Styrene, ug/kg dw	<8.1	<5.6
Xylenes, ug/kg dw	<8.1	<5.6
Surrogate - Toluene-d8	98 %	98 %
Surrogate - 4-Bromofluorobenzene	112 %	107 %
Surrogate - Dibromofluoromethane	91 %	98 %
Analysis Date	11.09.98	11.09.98
Batch ID	1M1109	1M1109
Dilution Factor	1.0	1.0

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RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 161081113

Page 3

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES					DATE/ TIME SAMPLED
86816-3	A-GP-6-10g					11-04-98/1050
86816-4	A-GP-6-10FB					11-04-98/1100
86816-5	A-GP-7-10g					11-04-98/1150
86816-6	A-GP-7-10 Dup					11-04-98/1155
86816-7	A-GP-3-10g					11-04-98/1240
PARAMETER	86816-3	86816-4	86816-5	86816-6	86816-7	
Volatiles by GC/MS (8260)						
Chloromethane, ug/l	<20	<10	<20	<20	<10	
Bromomethane, ug/l	<20	<10	<20	<20	<10	
Vinyl chloride, ug/l	<4.0	<2.0	<4.0	<4.0	<2.0	
Chloroethane, ug/l	<20	<10	<20	<20	<10	
Methylene chloride (Dichloromethane), ug/l	<10	<5.0	<10	<10	<5.0	
Acetone, ug/l	<100	<50	<100	<100	<50	
Carbon disulfide, ug/l	<10	<5.0	<10	<10	<5.0	
1,1-Dichloroethene, ug/l	<10	<5.0	<10	<10	<5.0	
1,1-Dichloroethane, ug/l	<10	<5.0	<10	<10	<5.0	
Cis/Trans-1,2-Dichloroethene, ug/l	<10	<5.0	<10	<10	<5.0	
Chloroform, ug/l	<10	<5.0	<10	<10	<5.0	
1,2-Dichloroethane, ug/l	<10	<5.0	<10	<10	<5.0	
2-Butanone (MEK), ug/l	<50	<25	<50	<50	<25	
1,1,1-Trichloroethane, ug/l	<10	<5.0	<10	<10	<5.0	
Carbon tetrachloride, ug/l	<10	<5.0	<10	<10	<5.0	
Bromodichloromethane, ug/l	<10	<5.0	<10	<10	<5.0	
1,1,2,2-Tetrachloroethane, ug/l	<10	<5.0	<10	<10	<5.0	

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N. Charleston, SC 29406

LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 161081113

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86816-3	A-GP-6-10g	11-04-98/1050			
86816-4	A-GP-6-10FB	11-04-98/1100			
86816-5	A-GP-7-10g	11-04-98/1150			
86816-6	A-GP-7-10 Dup	11-04-98/1155			
86816-7	A-GP-3-10g	11-04-98/1240			
PARAMETER	86816-3	86816-4	86816-5	86816-6	86816-7
1,2-Dichloropropane, ug/l	<10	<5.0	<10	<10	<5.0
trans-1,3-Dichloropropene, ug/l	<10	<5.0	<10	<10	<5.0
Trichloroethene, ug/l	<10	<5.0	<10	<10	<5.0
Dibromochloromethane, ug/l	<10	<5.0	<10	<10	<5.0
1,1,2-Trichloroethane, ug/l	<10	<5.0	<10	<10	<5.0
Benzene, ug/l	230	<5.0	240	320	8.6
cis-1,3-Dichloropropene, ug/l	<10	<5.0	<10	<10	<5.0
Bromoform, ug/l	<10	<5.0	<10	<10	<5.0
2-Hexanone, ug/l	<50	<25	<50	<50	<25
4-Methyl-2-pentanone (MIBK), ug/l	<50	<25	<50	<50	<25
Tetrachloroethene, ug/l	<10	<5.0	<10	<10	<5.0
Toluene, ug/l	<10	<5.0	<10	<10	<5.0
Chlorobenzene, ug/l	<10	<5.0	<10	<10	<5.0
Ethylbenzene, ug/l	210	<5.0	41	75	<5.0
Styrene, ug/l	<10	<5.0	<10	<10	<5.0
Xylenes, ug/l	340	<5.0	<10	<10	<5.0
Surrogate - Toluene-d8	110 %	110 %	106 %	106 %	112 %
Surrogate - 4-Bromofluorobenzene	98 %	104 %	102 %	98 %	108 %
Surrogate - Dibromofluoromethane	106 %	106 %	122 %	114 %	104 %
Analysis Date	11.06.98	11.06.98	11.06.98	11.06.98	11.06.98
Batch ID	101106	101106	101106	101106	101106
Dilution Factor	2.0	1.0	2.0	2.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 161081113

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816-8	A-GP-4-10g	11-04-98/1445		
86816-9	A-GP-5-10g	11-04-98/1515		
86816-10	A-GP-9-8g	11-04-98/1715		
86816-11	Trip Blank	11-04-98/1030		
PARAMETER	86816-8	86816-9	86816-10	86816-11
Volatiles by GC/MS (8260)				
Chloromethane, ug/l	<500	<10	<10	<10
Bromomethane, ug/l	<500	<10	<10	<10
Vinyl chloride, ug/l	<100	<2.0	<2.0	<2.0
Chloroethane, ug/l	<500	<10	<10	<10
Methylene chloride (Dichloromethane), ug/l	<250	<5.0	<5.0	<5.0
Acetone, ug/l	<2500	58	<50	<50
Carbon disulfide, ug/l	<250	<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l	<250	<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l	<250	<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<250	<5.0	<5.0	<5.0
Chloroform, ug/l	<250	<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l	<250	<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l	<1200	<25	<25	<25
1,1,1-Trichloroethane, ug/l	<250	<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l	<250	<5.0	<5.0	<5.0
Bromodichloromethane, ug/l	<250	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<250	<5.0	<5.0	<5.0
1,2-Dichloropropane, ug/l	<250	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l	<250	<5.0	<5.0	<5.0

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LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 161081113

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86816-8	A-GP-4-10g	11-04-98/1445			
86816-9	A-GP-5-10g	11-04-98/1515			
86816-10	A-GP-9-8g	11-04-98/1715			
86816-11	Trip Blank	11-04-98/1030			
PARAMETER	86816-8	86816-9	86816-10	86816-11	
Trichloroethene, ug/l	<250	<5.0	<5.0	<5.0	
Dibromochloromethane, ug/l	<250	<5.0	<5.0	<5.0	
1,1,2-Trichloroethane, ug/l	<250	<5.0	<5.0	<5.0	
Benzene, ug/l	400	<5.0	<5.0	<5.0	
cis-1,3-Dichloropropene, ug/l	<250	<5.0	<5.0	<5.0	
Bromoform, ug/l	<250	<5.0	<5.0	<5.0	
2-Hexanone, ug/l	<1200	<25	<25	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<1200	<25	<25	<25	
Tetrachloroethene, ug/l	<250	<5.0	<5.0	<5.0	
Toluene, ug/l	320	<5.0	<5.0	<5.0	
Chlorobenzene, ug/l	<250	<5.0	<5.0	<5.0	
Ethylbenzene, ug/l	800	<5.0	<5.0	<5.0	
Styrene, ug/l	<250	<5.0	<5.0	<5.0	
Xylenes, ug/l	4600	<5.0	<5.0	<5.0	
Surrogate - Toluene-d8	114 %	114 %	114 %	114 %	
Surrogate - 4-Bromofluorobenzene	106 %	112 %	110 %	116 %	
Surrogate - Dibromofluoromethane	98 %	102 %	102 %	104 %	
Analysis Date	11.06.98	11.06.98	11.06.98	11.06.98	
Batch ID	101106	101106	101106	101106	
Dilution Factor	50.0	2.0	1.0	1.0	

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LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 161081113

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86816-12	Method Blank	
86816-13	Lab Control Standard % Recovery	
PARAMETER	86816-12	86816-13
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	136 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	98 %
Dibromochloromethane, ug/kg dw	<5.0	---

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LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 161081113

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86816-12	Method Blank	
86816-13	Lab Control Standard % Recovery	
PARAMETER	86816-12	86816-13
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	94 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	95 %
Chlorobenzene, ug/kg dw	<5.0	104 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	104 %	104 %
Surrogate - 4-Bromofluorobenzene	88 %	94 %
Surrogate - Dibromofluoromethane	104 %	108 %
Analysis Date	11.09.98	11.09.98
Batch ID	1M1109	1M1109
Dilution Factor	1.0	1.0

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N. Charleston, SC 29406

LOG NO: S8-86816
Received: 04 NOV 98
Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 161081113

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86816-14	Method Blank	
86816-15	Lab Control Standard % Recovery	
PARAMETER	86816-14	86816-15
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	121 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	97 %
Dibromochloromethane, ug/l	<5.0	---

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LOG NO: S8-86816
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Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
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Code: 161081113

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86816-14	Method Blank	
86816-15	Lab Control Standard % Recovery	
PARAMETER	86816-14	86816-15
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	104 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	98 %
Chlorobenzene, ug/l	<5.0	100 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	112 %	111 %
Surrogate - 4-Bromofluorobenzene	108 %	108 %
Surrogate - Dibromofluoromethane	108 %	110 %
Analysis Date	11.06.98	11.06.98
Batch ID	101106	101106
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☒ 5102 LaRoche Avenue, Savannah, GA 31404
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Drestrehan, LA 70047

Phone: (912) 354-7858 Fax: (912) 352-0165
Phone: (904) 878-3994 Fax: (904) 878-9504
Phone: (954) 421-7400 Fax: (954) 421-2554
Phone: (334) 666-5633 Fax: (334) 666-6696
Phone: (813) 885-7427 Fax: (813) 885-7059
Phone: (504) 764-1100 Fax: (504) 725-1163

11-1-77

PROJECT REFERENCE Ft Stewart/Sumnu 13		PROJECT NO. 32369		PO NUMBER 10900	
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE (843) 572-5005		FAX (843) 572-5001	
CLIENT NAME GA	Melanie Hill		CLIENT PROJECT MANAGER Ron Rauling		
CLIENT ADDRESS (CITY, STATE, ZIP) Earth Tech					
2694 Lake Park Dr, Oas, SC 29418					

SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	MATERIAL TYPE			NUMBER OF CONTAINERS SUBMITTED	REMARKS
					AQUEOUS (WATER)	SOLID OR SEMISOLID	NONAQUEOUS LIQUID (oil, solvent, etc)		
11/4/98	1030			A-GP-6-10g	X			3	2
	1100			A-GP-6-10g FB	X			3	2
	1150			A-GP-7-10g	X			3	2
	1155			A-GP-7-10g Dup	X			3	2
	1240			A-GP-3-10g	X			3	2
	1445			A-GP-4-10g	X			3	2
	1515			A-GP-5-10g	X			3	2
	1620			A-GP-9-0g	X			2	1
	1715			A-GP-9-0g	X			3	2
	1710			A-GP-9-0g	X			2	1
	1030			Trip Blank	X			3	

RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>		DATE 11/5/98	TIME 8:00	CUSTODY INTACT ☒ YES ☐ NO	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS: 58-86816
RECEIVED BY: (SIGNATURE) <i>[Signature]</i>		DATE 10/29/98	TIME 0900	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 11/4/98	TIME 1915	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>

RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>		DATE 11/19/98	TIME 1915	RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 11/19/98	TIME 1915	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>

RUSH

STANDARD REPORT ☒ EXCEPT DELIVERY ☐ EXPEDITED REPORT ☐ (DETERMINED BY CHARGE)

Date Due _____

REMARKS: **600 VOA's**
*** 48 hr**
*** 48 hr**

encore sample
** Reanalyze = 20 pp*

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86781
Received: 03 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 171781110

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781-1	A-GP-2-6s	11-03-98/0845
86781-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781-1	86781-2
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<11	<15
Bromomethane, ug/kg dw	<11	<15
Vinyl chloride, ug/kg dw	<11	<15
Chloroethane, ug/kg dw	<11	<15
Methylene chloride (Dichloromethane), ug/kg dw	<5.7	<7.4
Acetone, ug/kg dw	<5.7	<7.4
Carbon disulfide, ug/kg dw	<5.7	<7.4
1,1-Dichloroethene, ug/kg dw	<5.7	<7.4
1,1-Dichloroethane, ug/kg dw	<5.7	<7.4
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.7	<7.4
Chloroform, ug/kg dw	<5.7	<7.4
1,2-Dichloroethane, ug/kg dw	<5.7	<7.4
2-Butanone (MEK), ug/kg dw	<29	<37
1,1,1-Trichloroethane, ug/kg dw	<5.7	<7.4
Carbon tetrachloride, ug/kg dw	<5.7	<7.4
Bromodichloromethane, ug/kg dw	<5.7	<7.4
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.7	<7.4
1,2-Dichloropropane, ug/kg dw	<5.7	<7.4
trans-1,3-Dichloropropene, ug/kg dw	<5.7	<7.4
Trichloroethene, ug/kg dw	<5.7	<7.4
Dibromochloromethane, ug/kg dw	<5.7	<7.4

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LOG NO: S8-86781
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Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781-1	A-GP-2-6s	11-03-98/0845
86781-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781-1	86781-2
1,1,2-Trichloroethane, ug/kg dw	<5.7	<7.4
Benzene, ug/kg dw	<5.7	<7.4
cis-1,3-Dichloropropene, ug/kg dw	<5.7	<7.4
Bromoform, ug/kg dw	<5.7	<7.4
2-Hexanone, ug/kg dw	<29	<37
4-Methyl-2-pentanone (MIBK), ug/kg dw	<29	<37
Tetrachloroethene, ug/kg dw	<5.7	<7.4
Toluene, ug/kg dw	<5.7	<7.4
Chlorobenzene, ug/kg dw	<5.7	<7.4
Ethylbenzene, ug/kg dw	<5.7	<7.4
Styrene, ug/kg dw	<5.7	<7.4
Xylenes, ug/kg dw	<5.7	<7.4
Surrogate - Toluene-d8	107 %	105 %
Surrogate - 4-Bromofluorobenzene	105 %	103 %
Surrogate - Dibromofluoromethane	110 %	108 %
Analysis Date	11.05.98	11.05.98
Batch ID	1H1105	1H1105
Dilution Factor	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86781
Received: 03 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 171781110

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-3	A-GP-2-8g	11-03-98/0848
86781-4	A-GP-8-8g	11-03-98/1235
PARAMETER	86781-3	86781-4
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	<10
Bromomethane, ug/l	<10	<10
Vinyl chloride, ug/l	<2.0	<2.0
Chloroethane, ug/l	<10	<10
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0
Acetone, ug/l	<50	<50
Carbon disulfide, ug/l	<5.0	<5.0
1,1-Dichloroethene, ug/l	<5.0	<5.0
1,1-Dichloroethane, ug/l	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0
Chloroform, ug/l	<5.0	<5.0
1,2-Dichloroethane, ug/l	<5.0	<5.0
2-Butanone (MEK), ug/l	<25	<25
1,1,1-Trichloroethane, ug/l	<5.0	<5.0
Carbon tetrachloride, ug/l	<5.0	<5.0
Bromodichloromethane, ug/l	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0
1,2-Dichloropropane, ug/l	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0
Trichloroethene, ug/l	<5.0	<5.0
Dibromochloromethane, ug/l	<5.0	<5.0

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LOG NO: S8-86781
Received: 03 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-3	A-GP-2-8g	11-03-98/0848
86781-4	A-GP-8-8g	11-03-98/1235
PARAMETER	86781-3	86781-4
1,1,2-Trichloroethane, ug/l	<5.0	<5.0
Benzene, ug/l	<5.0	<5.0
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0
Bromoform, ug/l	<5.0	<5.0
2-Hexanone, ug/l	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25
Tetrachloroethene, ug/l	<5.0	<5.0
Toluene, ug/l	<5.0	<5.0
Chlorobenzene, ug/l	<5.0	<5.0
Ethylbenzene, ug/l	<5.0	<5.0
Styrene, ug/l	<5.0	<5.0
Xylenes, ug/l	<5.0	<5.0
Surrogate - Toluene-d8	110 %	112 %
Surrogate - 4-Bromofluorobenzene	108 %	112 %
Surrogate - Dibromofluoromethane	102 %	102 %
Analysis Date	11.04.98	11.04.98
Batch ID	101104	101104
Dilution Factor	1.0	1.0

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Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-5	Trip Blank	11-03-98/0800
PARAMETER	86781-5	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-5	Trip Blank	11-03-98/0800
PARAMETER	86781-5	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	112 %	
Surrogate - 4-Bromofluorobenzene	108 %	
Surrogate - Dibromofluoromethane	102 %	
Analysis Date	11.04.98	
Batch ID	101104	
Dilution Factor	1.0	

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N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 171781110

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86781-6	Method Blank	
86781-7	Lab Control Standard % Recovery	
PARAMETER	86781-6	86781-7
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	156 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	114 %
Dibromochloromethane, ug/kg dw	<5.0	---

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Received: 03 NOV 98
Reported: 10 NOV 98

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2694 Lake Park Drive
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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
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Code: 171781110

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86781-6	Method Blank	
86781-7	Lab Control Standard % Recovery	
PARAMETER	86781-6	86781-7
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	110 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	106 %
Chlorobenzene, ug/kg dw	<5.0	112 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	106 %
Surrogate - 4-Bromofluorobenzene	102 %	108 %
Surrogate - Dibromofluoromethane	114 %	112 %
Analysis Date	11.05.98	---
Batch ID	1H1105	---
Dilution Factor	1.0	---

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-8	Method Blank	
86781-9	Lab Control Standard % Recovery	
PARAMETER	86781-8	86781-9
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	114 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	87 %
Dibromochloromethane, ug/l	<5.0	---

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

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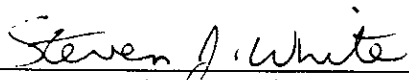
Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86781-8	Method Blank	
86781-9	Lab Control Standard % Recovery	
PARAMETER	86781-8	86781-9
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	90 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	86 %
Chlorobenzene, ug/l	<5.0	88 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	110 %	110 %
Surrogate - 4-Bromofluorobenzene	108 %	105 %
Surrogate - Dibromofluoromethane	108 %	112 %
Analysis Date	11.04.98	11.04.98
Batch ID	101104	101104
Dilution Factor	1.0	---

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

Serial Number 10571

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☒ 5102 LaRoche Avenue, Savannah, GA 31404
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

Phone: (912) 354-7858
 Phone: (904) 878-3994
 Phone: (954) 421-7400
 Phone: (334) 666-6633
 Phone: (813) 885-7427
 Phone: (504) 764-1100

Fax: (912) 352-0165
 Fax: (904) 878-9504
 Fax: (954) 421-2594
 Fax: (334) 666-6696
 Fax: (813) 885-7049
 Fax: (504) 725-1163

PROJECT REFERENCE		PROJECT NO.		P.O. NUMBER	
FT Stewart KumUB 32369		10900			
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX		
GA	Melanie H11	(843) 572-5600	(843) 572-5661		
CLIENT NAME	CLIENT PROJECT MANAGER				
Earth Tech	Ron Paulding				
CLIENT ADDRESS (CITY, STATE, ZIP)					
2094A Lake Park Dr, Chas, SC 29418					
SAMPLE	SL NO.	SAMPLE IDENTIFICATION			
DATE	TIME				
11/3/98	0845	A-GP-2-65			
	0848	A-GP-2-89			
	1230	A-GP-8-63			
	1235	A-GP-8-89			
	0800	Trip Blank			
REMARKS					
66W VOCs					
*48 hr THX					
encore					
samplers					
Date Due					
STANDARD REPORT DELIVERY					
EXCEPT					
EXPEDITED REPORT DELIVERY (surcharge)					
DATE					
NUMBER OF CONTAINERS SUBMITTED					
2 1 1 1					
3 2					
2 1 1 1					
3 2					
3					
RUSH					
RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Melanie D. Hill	11/3/98	1:40	Melanie D. Hill	11/3/98	1:00
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
Melanie D. Hill	11/3/98	0900			
RECEIVED FOR LABORATORY BY: (SIGNATURE)			LABORATORY USE ONLY		
DATE			SL LOG NO.		
11/3/98			58-86781		
CUSTODY SEAL NO.			LABORATORY REMARKS:		
YES ☒ NO ☐					

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86752
Received: 02 NOV 98
Reported: 10 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752-1	
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw		<14
Bromomethane, ug/kg dw		<14
Vinyl chloride, ug/kg dw		<14
Chloroethane, ug/kg dw		<14
Methylene chloride (Dichloromethane), ug/kg dw		<6.8
Acetone, ug/kg dw		<68
Carbon disulfide, ug/kg dw		<6.8
1,1-Dichloroethene, ug/kg dw		<6.8
1,1-Dichloroethane, ug/kg dw		<6.8
Cis/Trans-1,2-Dichloroethene, ug/kg dw		<6.8
Chloroform, ug/kg dw		<6.8
1,2-Dichloroethane, ug/kg dw		<6.8
2-Butanone (MEK), ug/kg dw		<34
1,1,1-Trichloroethane, ug/kg dw		<6.8
Carbon tetrachloride, ug/kg dw		<6.8
Bromodichloromethane, ug/kg dw		<6.8
1,1,2,2-Tetrachloroethane, ug/kg dw		<6.8
1,2-Dichloropropane, ug/kg dw		<6.8
trans-1,3-Dichloropropene, ug/kg dw		<6.8
Trichloroethene, ug/kg dw		<6.8
Dibromochloromethane, ug/kg dw		<6.8
1,1,2-Trichloroethane, ug/kg dw		<6.8

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Page 2

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752-1	
Benzene, ug/kg dw	<6.8	
cis-1,3-Dichloropropene, ug/kg dw	<6.8	
Bromoform, ug/kg dw	<6.8	
2-Hexanone, ug/kg dw	<34	
4-Methyl-2-pentanone (MIBK), ug/kg dw	<34	
Tetrachloroethene, ug/kg dw	<6.8	
Toluene, ug/kg dw	<6.8	
Chlorobenzene, ug/kg dw	<6.8	
Ethylbenzene, ug/kg dw	<6.8	
Styrene, ug/kg dw	<6.8	
Xylenes, ug/kg dw	<6.8	
Surrogate - Toluene-d8	119 %	
Surrogate - 4-Bromofluorobenzene	143 %*F36	
Surrogate - Dibromofluoromethane	138 %	
Analysis Date	11.05.98	
Batch ID	1H1105	
Dilution Factor	1.0	

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Sampled By: Client
Code: 171781110

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752-2	A-GP-1-8g	11-02-98/1645
PARAMETER	86752-2	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752-2	A-GP-1-8g	11-02-98/1645
PARAMETER	86752-2	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	110 %	
Surrogate - 4-Bromofluorobenzene	112 %	
Surrogate - Dibromofluoromethane	110 %	
Analysis Date	11.04.98	
Batch ID	101104	
Dilution Factor	1.0	

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Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86752-3	Method Blank	
86752-4	Lab Control Standard % Recovery	
PARAMETER	86752-3	86752-4
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	156 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	114 %
Dibromochloromethane, ug/kg dw	<5.0	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86752
Received: 02 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 171781110

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86752-3	Method Blank	
86752-4	Lab Control Standard % Recovery	
PARAMETER	86752-3	86752-4
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	110 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	106 %
Chlorobenzene, ug/kg dw	<5.0	112 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	106 %
Surrogate - 4-Bromofluorobenzene	102 %	108 %
Surrogate - Dibromofluoromethane	114 %	112 %
Analysis Date	11.05.98	---
Batch ID	1H1105	---
Dilution Factor	1.0	---

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Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 171781110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86752-5	Method Blank	
86752-6	Lab Control Standard % Recovery	
PARAMETER	86752-5	86752-6
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	114 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	87 %
Dibromochloromethane, ug/l	<5.0	---

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Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 171781110

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86752-5	Method Blank	
86752-6	Lab Control Standard % Recovery	
PARAMETER	86752-5	86752-6
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	90 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	86 %
Chlorobenzene, ug/l	<5.0	88 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	110 %	110 %
Surrogate - 4-Bromofluorobenzene	108 %	105 %
Surrogate - Dibromofluoromethane	108 %	112 %
Analysis Date	11.04.98	11.04.98
Batch ID	101104	101104
Dilution Factor	1.0	---

Methods: EPA SW-846, Update III.

*F36 = Surrogate recovery was outside established limits due to coeluting matrix interference in the sample.


Steven J. White, Project Manager

Final Page Of Report

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER
Ft Stewart/Summers		32369	10900
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX
GA	Melanie D. Hill	(843) 572-5600	(843) 572-5661
CLIENT NAME		CLIENT PROJECT MANAGER	
Earth Tech		Ron Paulding	
CLIENT ADDRESS (CITY, STATE, ZIP)			
2694A Lake Park Drive, Chas, SC 29118			

SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	MATERIAL TYPE	
					AIR	NON-AQUEOUS LIQUID (oil, solvent, etc)
11/2/98 1635				A-GP-1-65		
11/2/98 1645				A-GP-1-89		

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
<i>[Signature]</i>	10/27/98	1:40	Melanie D. Hill	11/2/98	1903
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
Melanie D. Hill	10/27/98	0930	<i>[Signature]</i>	11/2/98	1915

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
<i>[Signature]</i>	11/3/98	8:00AM	☒ YES ☐ NO		58-86752	

MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
VOCs (40)	VOCs (40)	40	40
SUDCs (40)	SUDCs (40)	40	40
Metals (40)	Metals (40)	40	40
encore (250)	encore (250)	40	40
back VOCs (40)	back VOCs (40)	40	40
encore (250)	encore (250)	40	40

NUMBER OF CONTAINERS SUBMITTED		REMARKS
1	2	VOCs for GWP (4866) and encore
3	2	sampled

STANDARD REPORT DELIVERY ☒ EXCEPTED REPORT DELIVERY (surcharge) ☐	
Date Due	

LABORATORY USE ONLY	
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE
<i>[Signature]</i>	11/3/98

RUSH

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87109A
Received: 16 NOV 98
Reported: 02 DEC 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 11168123

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED				
87109A-1	D-GP-34-9g	11-16-98/1410				
87109A-2	D-GP-34-9 Dup	11-16-98/1415				
87109A-3	D-GP-33-10g	11-16-98/1520				
87109A-4	D-GP-32-10g	11-16-98/1620				
87109A-5	D-GP-31-10g	11-16-98/1705				
PARAMETER	87109A-1	87109A-2	87109A-3	87109A-4	87109A-5	
TCL Semivolatiles (8270)						
Phenol, ug/l	<10	<10	<10	<10	<10	
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10	<10	
2-Chlorophenol, ug/l	<10	<10	<10	<10	<10	
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10	
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10	
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10	
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10	<10	
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10	<10	
3-Methylphenol/4-Methylphen ol (m&p-cresol), ug/l	<10	<10	<10	<10	<10	
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10	<10	
Hexachloroethane, ug/l	<10	<10	<10	<10	<10	
Nitrobenzene, ug/l	<10	<10	<10	<10	<10	
Isophorone, ug/l	<10	<10	<10	<10	<10	
2-Nitrophenol, ug/l	<10	<10	<10	<10	<10	
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10	<10	

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REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
87109A-1	D-GP-34-9g	11-16-98/1410			
87109A-2	D-GP-34-9 Dup	11-16-98/1415			
87109A-3	D-GP-33-10g	11-16-98/1520			
87109A-4	D-GP-32-10g	11-16-98/1620			
87109A-5	D-GP-31-10g	11-16-98/1705			
PARAMETER	87109A-1	87109A-2	87109A-3	87109A-4	87109A-5
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10	<10
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10	<10
Naphthalene, ug/l	82	59	59	<10	<10
4-Chloroaniline, ug/l	<20	<20	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10	<10
2-Methylnaphthalene, ug/l	77	59	38	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50	<50	<50

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
87109A-1	D-GP-34-9g	11-16-98/1410			
87109A-2	D-GP-34-9 Dup	11-16-98/1415			
87109A-3	D-GP-33-10g	11-16-98/1520			
87109A-4	D-GP-32-10g	11-16-98/1620			
87109A-5	D-GP-31-10g	11-16-98/1705			
PARAMETER	87109A-1	87109A-2	87109A-3	87109A-4	87109A-5
Dibenzofuran, ug/l	<10	<10	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10	<10
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10	<10

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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
87109A-1	D-GP-34-9g	11-16-98/1410			
87109A-2	D-GP-34-9 Dup	11-16-98/1415			
87109A-3	D-GP-33-10g	11-16-98/1520			
87109A-4	D-GP-32-10g	11-16-98/1620			
87109A-5	D-GP-31-10g	11-16-98/1705			
PARAMETER	87109A-1	87109A-2	87109A-3	87109A-4	87109A-5
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10	<10
Chrysene, ug/l	<10	<10	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10	<10
Carbazole, ug/l	<10	<10	<10	<10	<10
Surrogate - Phenol d5	75 %	70 %	70 %	70 %	69 %
Surrogate - 2-Fluorophenol	74 %	73 %	70 %	73 %	68 %
Surrogate - 2,4,6-Tribromophenol	98 %	97 %	91 %	92 %	79 %
Surrogate - Nitrobenzene - d5	80 %	74 %	70 %	72 %	72 %
Surrogate - 2-Fluorobiphenyl	92 %	84 %	70 %	76 %	82 %
Surrogate - Terphenyl - d14	62 %	50 %	36 %	46 %	60 %
Prep Date	11.19.98	11.19.98	11.19.98	11.19.98	11.19.98
Analysis Date	11.30.98	12.01.98	12.01.98	12.01.98	12.01.98
Batch ID	1119A	1119A	1119A	1119A	1119A
Dilution Factor	1.0	1.0	1.0	1.0	1.0

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Received: 16 NOV 98
Reported: 02 DEC 98

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N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 11168123

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109A-6	Method Blank	
87109A-7	Lab Control Standard % Recovery	
PARAMETER	87109A-6	87109A-7
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	75 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	73 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	60 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	74 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	66 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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Project: FT. Stewart/32369
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Code: 11168123
Page 6

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109A-6	Method Blank	
87109A-7	Lab Control Standard % Recovery	
PARAMETER	87109A-6	87109A-7
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	76 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	78 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	50 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	62 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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Code: 11168123

REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109A-6	Method Blank	
87109A-7	Lab Control Standard % Recovery	
PARAMETER	87109A-6	87109A-7
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	67 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	102 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87109A
Received: 16 NOV 98
Reported: 02 DEC 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

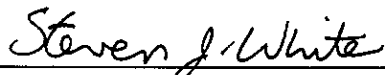
Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 11168123
Page 8

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109A-6	Method Blank	
87109A-7	Lab Control Standard % Recovery	
PARAMETER	87109A-6	87109A-7
Surrogate - Phenol d5	60 %	71 %
Surrogate - 2-Fluorophenol	62 %	70 %
Surrogate - 2,4,6-Tribromophenol	71 %	76 %
Surrogate - Nitrobenzene - d5	64 %	74 %
Surrogate - 2-Fluorobiphenyl	72 %	76 %
Surrogate - Terphenyl - d14	84 %	102 %
Prep Date	11.19.98	11.19.98
Analysis Date	11.30.98	11.20.98
Batch ID	1119A	1119A
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

Serial Number 1072

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

5102 LaRoche Avenue, Savannah, GA 31404
2846 Industrial Plaza Drive, Tallahassee, FL 32301
414 SW 12th Avenue, Deerfield Beach, FL 33442
900 Lakeside Drive, Mobile, AL 36693
6712 Benjamin Road, Suite 100, Tampa, FL 33634
100 Alpha Drive, Suite 110, Destrehan, LA 70047

Phone: (912) 354-7858
Phone: (904) 878-3994
Phone: (954) 421-7400
Phone: (334) 666-6633
Phone: (813) 885-7427
Phone: (504) 764-1100

Fax: (912) 352-0165
Fax: (904) 878-9504
Fax: (954) 421-2584
Fax: (334) 666-6696
Fax: (813) 885-7049
Fax: (504) 725-1163

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER	REQUIRED ANALYSES		MATRIX TYPE	PAGE	OF
Ft Stewart		32369	10800					
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX					
GA	Melanie H'11	(843) 572-5600	(843) 572-5664					
CLIENT NAME	CLIENT PROJECT MANAGER							
Earth Tech	Ron Paulding							
CLIENT ADDRESS (CITY, STATE, ZIP)								
2094A Lake Parker Dr, NChas, SC 29907								
SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED	REMARKS		
11/16/98 1400				D - GP-34-99	3			
11/16/98 1415				D - GP-34-99 Dup	3			
11/16/98 1520				D - GP-23-109	3			
11/16/98 1620				D - GP-32-109	3			
11/16/98 1705				D - GP-31-109	3			
11/16/98 1535				MW #1	3			
Stewart, East of Samples								
11/16/98 1400				TRIP Bottle	3			
RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Sen Labs	11/30/98	0900	Melanie H'11	11/16/98	1915			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
MDHill	11/30/98	0900	(checked)	11/16/98	1900			
LABORATORY USE ONLY								
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:			
J Swafford	11/17/98	8:30		5887109A				

ORIGINAL

RUSH

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

Mr. Ron Paulling
Earth Tech
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-87033
Received: 12 NOV 98
Reported: 24 NOV 98

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 110581217

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
87033-2	A-GP-7-38g	11-12-98/1000		
87033-3	B-GP-14-18g	11-12-98/1430		
87033-4	B-GP-14-31g	11-12-98/1700		
PARAMETER		87033-2	87033-3	87033-4
Volatiles by GC/MS (8260)				
Chloromethane, ug/l		<10	<10	<10
Bromomethane, ug/l		<10	<10	<10
Vinyl chloride, ug/l		<2.0	<2.0	<2.0
Chloroethane, ug/l		<10	<10	<10
Methylene chloride (Dichloromethane), ug/l		<5.0	<5.0	<5.0
Acetone, ug/l		330	<50	<50
Carbon disulfide, ug/l		<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l		<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l		<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0	<5.0	<5.0
Chloroform, ug/l		<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l		<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l		<25	<25	<25
1,1,1-Trichloroethane, ug/l		<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l		<5.0	<5.0	<5.0
Bromodichloromethane, ug/l		<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0	<5.0	<5.0
1,2-Dichloropropane, ug/l		<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l		<5.0	<5.0	<5.0
Trichloroethene, ug/l		<5.0	<5.0	<5.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87033
Received: 12 NOV 98
Reported: 24 NOV 98

Mr. Ron Paulling
Earth Tech
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 110581217

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
87033-2	A-GP-7-38g	11-12-98/1000		
87033-3	B-GP-14-18g	11-12-98/1430		
87033-4	B-GP-14-31g	11-12-98/1700		
PARAMETER		87033-2	87033-3	87033-4
Dibromochloromethane, ug/l		<5.0	<5.0	<5.0
1,1,2-Trichloroethane, ug/l		<5.0	<5.0	<5.0
Benzene, ug/l		<5.0	<5.0	<5.0
cis-1,3-Dichloropropene, ug/l		<5.0	<5.0	<5.0
Bromoform, ug/l		<5.0	<5.0	<5.0
2-Hexanone, ug/l		<25	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l		<25	<25	<25
Tetrachloroethene, ug/l		<5.0	<5.0	<5.0
Toluene, ug/l		<5.0	<5.0	<5.0
Chlorobenzene, ug/l		<5.0	<5.0	<5.0
Ethylbenzene, ug/l		<5.0	<5.0	<5.0
Styrene, ug/l		<5.0	<5.0	<5.0
Xylenes, ug/l		<5.0	<5.0	<5.0
Surrogate - Toluene-d8		114 %	112 %	114 %
Surrogate - 4-Bromofluorobenzene		102 %	102 %	102 %
Surrogate - Dibromofluoromethane		100 %	98 %	96 %
Analysis Date		11.16.98	11.16.98	11.16.98
Batch ID		1L1116	1L1116	1L1116
Dilution Factor		1.0	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-87033
Received: 12 NOV 98
Reported: 24 NOV 98

Mr. Ron Paulling
Earth Tech
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 110581217

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033-6	Method Blank	11-12-98/0800
87033-7	Lab Control Standard % Recovery	
PARAMETER	87033-6	87033-7
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	121 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	109 %
Dibromochloromethane, ug/l	<5.0	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87033
Received: 12 NOV 98
Reported: 24 NOV 98

Mr. Ron Paulling
Earth Tech
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

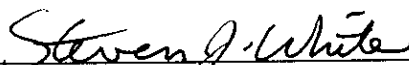
Project: FT. Stewart/32369
Sampled By: Client
Code: 110581217

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033-6	Method Blank	11-12-98/0800
87033-7	Lab Control Standard % Recovery	
PARAMETER	87033-6	87033-7
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	109 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	101 %
Chlorobenzene, ug/l	<5.0	101 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	113 %	114 %
Surrogate - 4-Bromofluorobenzene	104 %	105 %
Surrogate - Dibromofluoromethane	107 %	103 %
Analysis Date	11.16.98	11.16.98
Batch ID	1L1116	1L1116
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Phone: (912) 354-7858 Fax: (912) 352-0165
Phone: (904) 878-3994 Fax: (904) 878-9504
Phone: (954) 421-7400 Fax: (954) 421-2584
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Phone: (813) 885-7427 Fax: (813) 885-7049
Phone: (504) 764-1100 Fax: (504) 725-1163

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☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

PROJECT REFERENCE		PROJECT NO.		P.O. NUMBER		MATRIX TYPE		REQUIRED ANALYSES		PAGE		OF	
FT Stewart		32-369		10000									
PROJECT LOC. SAMPLER(S) NAME		PHONE		FAX									
6A Melanied Hill		(843) 572-9200		(843) 572-5261									
CLIENT NAME		CLIENT PROJECT MANAGER											
Farr Tech													
CLIENT ADDRESS (CITY, STATE, ZIP)													
2094A Lake Park Dr, N. Ches, SC 29418													
SAMPLE		SL NO.		SAMPLE IDENTIFICATION		NUMBER OF CONTAINERS SUBMITTED		REMARKS					
DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME
11/12/90	0900			Trip B Clark									
	1000			A-GP-7-389									
	1430			B-GP-14-189									
	1720			B-GP-14-200									
RUSH													
RELINQUISHED BY: (SIGNATURE)		DATE		TIME		RELINQUISHED BY: (SIGNATURE)		DATE		TIME			
Saw Labs		10/30/90		0900		Melanied Hill		11/12/90		1815			
RECEIVED BY: (SIGNATURE)		DATE		TIME		RECEIVED BY: (SIGNATURE)		DATE		TIME			
Melanied Hill		10/30/90		0900		Melanied Hill		11/12/90		1825			
LABORATORY USE ONLY													
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE		TIME		CUSTODY SEAL NO.		SL LOG NO.		LABORATORY REMARKS:			
J. L. ...		11/13/90		7:15				5887033					

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-87033A
Received: 12 NOV 98
Reported: 01 DEC 98

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
87033A-1	A-GP-7-38g	11-12-98/1000		
87033A-2	B-GP-14-18g	11-12-98/1430		
87033A-3	B-GP-14-31g	11-12-98/1700		
PARAMETER		87033A-1	87033A-2	87033A-3
TCL Semivolatiles (8270)				
Phenol, ug/l		<10	<10	<10
bis(2-Chloroethyl)ether, ug/l		<10	<10	<10
2-Chlorophenol, ug/l		<10	<10	<10
1,3-Dichlorobenzene, ug/l		<10	<10	<10
1,4-Dichlorobenzene, ug/l		<10	<10	<10
1,2-Dichlorobenzene, ug/l		<10	<10	<10
2-Methylphenol (o-cresol), ug/l		<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l		<10	<10	<10
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l		<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l		<10	<10	<10
Hexachloroethane, ug/l		<10	<10	<10
Nitrobenzene, ug/l		<10	<10	<10
Isophorone, ug/l		<10	<10	<10
2-Nitrophenol, ug/l		<10	<10	<10
2,4-Dimethylphenol, ug/l		<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l		<10	<10	<10
2,4-Dichlorophenol, ug/l		<10	<10	<10
1,2,4-Trichlorobenzene, ug/l		<10	<10	<10
Naphthalene, ug/l		<10	<10	<10

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Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED	
87033A-1	A-GP-7-38g	11-12-98/1000	
87033A-2	B-GP-14-18g	11-12-98/1430	
87033A-3	B-GP-14-31g	11-12-98/1700	
PARAMETER	87033A-1	87033A-2	87033A-3
4-Chloroaniline, ug/l	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10
2-Methylnaphthalene, ug/l	<10	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50
Dibenzofuran, ug/l	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10
2,6-Dinitrotoluene, ug/l	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10
Fluorene, ug/l	<10	<10	<10

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
87033A-1	A-GP-7-38g	11-12-98/1000		
87033A-2	B-GP-14-18g	11-12-98/1430		
87033A-3	B-GP-14-31g	11-12-98/1700		
PARAMETER		87033A-1	87033A-2	87033A-3
4-Nitroaniline, ug/l		<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l		<50	<50	<50
N-Nitrosodiphenylamine/Diphenylamine, ug/l		<10	<10	<10
4-Bromophenyl phenyl ether, ug/l		<10	<10	<10
Hexachlorobenzene, ug/l		<10	<10	<10
Pentachlorophenol, ug/l		<50	<50	<50
Phenanthrene, ug/l		<10	18	13
Anthracene, ug/l		<10	<10	<10
Di-n-butylphthalate, ug/l		<10	<10	<10
Fluoranthene, ug/l		<10	23	<10
Pyrene, ug/l		<10	17	<10
Butylbenzylphthalate, ug/l		<10	<10	<10
3,3'-Dichlorobenzidine, ug/l		<20	<20	<20
Benzo(a)anthracene, ug/l		<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l		<10	<10	<10
Chrysene, ug/l		<10	<10	<10
Di-n-octylphthalate, ug/l		<10	<10	<10
Benzo(b)fluoranthene, ug/l		<10	<10	<10
Benzo(k)fluoranthene, ug/l		<10	<10	<10
Benzo(a)pyrene, ug/l		<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l		<10	<10	<10

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LOG NO: S8-87033A
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Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
87033A-1	A-GP-7-38g	11-12-98/1000		
87033A-2	B-GP-14-18g	11-12-98/1430		
87033A-3	B-GP-14-31g	11-12-98/1700		
PARAMETER	87033A-1	87033A-2	87033A-3	
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	
Carbazole, ug/l	<10	<10	<10	
Surrogate - Phenol d5	78 %	82 %	46 %	
Surrogate - 2-Fluorophenol	80 %	83 %	56 %	
Surrogate - 2,4,6-Tribromophenol	78 %	86 %	71 %	
Surrogate - Nitrobenzene - d5	78 %	86 %	52 %	
Surrogate - 2-Fluorobiphenyl	80 %	90 %	70 %	
Surrogate - Terphenyl - d14	20 %	46 %	42 %	
Prep Date	11.16.98	11.16.98	11.16.98	
Analysis Date	11.28.98	11.28.98	11.30.98	
Batch ID	1116A	1116A	1116A	
Dilution Factor	1.0	1.0	1.0	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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Received: 12 NOV 98
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121
Page 5

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033A-4	Method Blank	
87033A-5	Lab Control Standard % Recovery	
PARAMETER	87033A-4	87033A-5
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	50 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	54 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	46 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	64 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	56 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87033A
Received: 12 NOV 98
Reported: 01 DEC 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 12098121

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033A-4	Method Blank	
87033A-5	Lab Control Standard % Recovery	
PARAMETER	87033A-4	87033A-5
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	61 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	60 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	42 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	60 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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N. Charleston, SC 29406

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Sampled By: Client
Code: 12098121

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033A-4	Method Blank	
87033A-5	Lab Control Standard % Recovery	
PARAMETER	87033A-4	87033A-5
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	67 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	88 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-87033A
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Reported: 01 DEC 98

Client PO. No.: 10800

Project: FT. Stewart/32369

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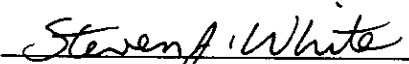
Code: 12098121

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87033A-4	Method Blank	
87033A-5	Lab Control Standard % Recovery	
PARAMETER	87033A-4	87033A-5
Surrogate - Phenol d5	25 %	52 %
Surrogate - 2-Fluorophenol	25 %	53 %
Surrogate - 2,4,6-Tribromophenol	34 %	72 %
Surrogate - Nitrobenzene - d5	32 %	64 %
Surrogate - 2-Fluorobiphenyl	30 %	60 %
Surrogate - Terphenyl - d14	36 %	76 %
Prep Date	11.16.98	11.16.98
Analysis Date	11.28.98	11.28.98
Batch ID	1116A	1116A
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report



SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Serial Number 1565

Phone: (912) 354-7858
Phone: (904) 878-3994
Phone: (954) 421-7400
Phone: (334) 666-6633
Phone: (813) 885-7427
Phone: (504) 764-1100

☒ 5102 LaRoche Avenue, Savannah, GA 31404
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER
FT Stewart		32369	10800
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX
GA	Melanie D Hill	(843) 572-8000	(843) 572-5061
CLIENT NAME	CLIENT PROJECT MANAGER		
Earth Tech			
CLIENT ADDRESS (CITY, STATE, ZIP)			
2094A Lake Park Dr, N. Chas, SC 29418			
SAMPLE	DATE	TIME	SL NO.
11/2/98	0900		
1000			
1430			
1720			
SAMPLE IDENTIFICATION			
Trip Blank			
A-GP-7-39g			
B-GP-14-18g			
B-GP-14-20g 31g			
REQUIRED ANALYSES			
MATRIX TYPE	NUMBER OF CONTAINERS SUBMITTED		
WCS (oil, solvent, etc)	3		
NONAQUEOUS LIQUID (oil, solvent, etc)	3		
AIR	3		
SOLID OR SEMISOLID	3		
AQUEOUS (WATER)	3		
REMARKS			
GW VOA's			
x 40 not			
Date Due:			
STANDARD REPORT DELIVERY ☒ EXEDITED REPORT DELIVERY (surcharge) ☐			
PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER
PROJECT LOC. (State)		SAMPLER(S) NAME	PHONE
CLIENT NAME		CLIENT PROJECT MANAGER	
CLIENT ADDRESS (CITY, STATE, ZIP)			
2094A Lake Park Dr, N. Chas, SC 29418			
DATE		TIME	SL NO.
11/2/98		0900	
1000			
1430			
1720			
SAMPLE IDENTIFICATION			
Trip Blank			
A-GP-7-39g			
B-GP-14-18g			
B-GP-14-20g 31g			
REQUIRED ANALYSES			
MATRIX TYPE			
NUMBER OF CONTAINERS SUBMITTED			
WCS (oil, solvent, etc)			
NONAQUEOUS LIQUID (oil, solvent, etc)			
AIR			
SOLID OR SEMISOLID			
AQUEOUS (WATER)			
REMARKS			
GW VOA's			
x 40 not			
Date Due:			
STANDARD REPORT DELIVERY ☒ EXEDITED REPORT DELIVERY (surcharge) ☐			
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Saw Labs		11/2/98	0900
RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D Hill		11/2/98	0900
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Melanie D Hill		11/2/98	1815
RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D Hill		11/2/98	1825
LABORATORY USE ONLY			
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE	TIME
J. Swafford		11/3/98	2115
CUSTODY INTACT		CUSTODY SEAL NO.	SL LOG NO.
☐ YES ☐ NO			58 87033
LABORATORY REMARKS:			

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86996A
Received: 11 NOV 98
Reported: 01 DEC 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86996A-1	A-GP-4-40g	11-11-98/0950
86996A-2	A-GP-4-40 Dup	11-11-98/0955
86996A-3	C-GP-27-9g	11-11-98/1430
86996A-4	A-GP-7-20g	11-11-98/1540
86996A-5	A-GP-7-30g	11-11-98/1640

PARAMETER	86996A-1	86996A-2	86996A-3	86996A-4	86996A-5
TCL Semivolatiles (8270)					
Phenol, ug/l	<10	<10	<10	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10	<10
2-Chlorophenol, ug/l	<10	<10	<10	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10	<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10	<10
Hexachloroethane, ug/l	<10	<10	<10	<10	<10
Nitrobenzene, ug/l	<10	<10	<10	<10	<10
Isophorone, ug/l	<10	<10	<10	<10	<10
2-Nitrophenol, ug/l	<10	<10	<10	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10	<10

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Sampled By: Client
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Page 2

REPORT OF RESULTS

REPORT OF ANALYSIS		DATE/ TIME SAMPLED			
LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES				
86996A-1	A-GP-4-40g	11-11-98/0950			
86996A-2	A-GP-4-40 Dup	11-11-98/0955			
86996A-3	C-GP-27-9g	11-11-98/1430			
86996A-4	A-GP-7-20g	11-11-98/1540			
86996A-5	A-GP-7-30g	11-11-98/1640			
PARAMETER	86996A-1	86996A-2	86996A-3	86996A-4	86996A-5
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10	<10
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10	<10
Naphthalene, ug/l	29	46	<10	<10	<10
4-Chloroaniline, ug/l	<20	<20	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10	<10
2-Methylnaphthalene, ug/l	34	46	<10	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50	<50	<50

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Page 3

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86996A-1	A-GP-4-40g	11-11-98/0950			
86996A-2	A-GP-4-40 Dup	11-11-98/0955			
86996A-3	C-GP-27-9g	11-11-98/1430			
86996A-4	A-GP-7-20g	11-11-98/1540			
86996A-5	A-GP-7-30g	11-11-98/1640			
PARAMETER	86996A-1	86996A-2	86996A-3	86996A-4	86996A-5
Dibenzofuran, ug/l	<10	<10	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10	<10
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10	<10

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Code: 12098121

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86996A-1	A-GP-4-40g	11-11-98/0950			
86996A-2	A-GP-4-40 Dup	11-11-98/0955			
86996A-3	C-GP-27-9g	11-11-98/1430			
86996A-4	A-GP-7-20g	11-11-98/1540			
86996A-5	A-GP-7-30g	11-11-98/1640			
PARAMETER	86996A-1	86996A-2	86996A-3	86996A-4	86996A-5
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10	<10
Chrysene, ug/l	<10	<10	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10	<10
Carbazole, ug/l	<10	<10	<10	<10	<10
Surrogate - Phenol d5	49 %	49 %	51 %	52 %	52 %
Surrogate - 2-Fluorophenol	48 %	36 %	50 %	55 %	51 %
Surrogate - 2,4,6-Tribromophenol	61 %	63 %	61 %	61 %	60 %
Surrogate - Nitrobenzene - d5	52 %	54 %	50 %	56 %	52 %
Surrogate - 2-Fluorobiphenyl	44 %	44 %	52 %	58 %	56 %
Surrogate - Terphenyl - d14	9 %	8 %	24 %	17 %	15 %
Prep Date	11.13.98	11.13.98	11.13.98	11.13.98	11.13.98
Analysis Date	11.22.98	11.22.98	11.22.98	11.22.98	11.22.98
Batch ID	1113B	1113B	1113B	1113B	1113B
Dilution Factor	1.0	1.0	1.0	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86996A
Received: 11 NOV 98
Reported: 01 DEC 98

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 12098121

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86996A-6	Method Blank	
86996A-7	Lab Control Standard % Recovery	
PARAMETER	86996A-6	86996A-7
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	58 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	58 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	52 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	66 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	56 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86996A
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RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86996A-6	Method Blank	
86996A-7	Lab Control Standard % Recovery	
PARAMETER	86996A-6	86996A-7
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	60 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	62 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	55 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	70 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86996A
Received: 11 NOV 98
Reported: 01 DEC 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86996A-6	Method Blank	
86996A-7	Lab Control Standard % Recovery	
PARAMETER	86996A-6	86996A-7
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	55 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	60 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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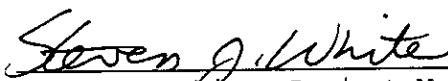
Project: FT. Stewart/32369
Sampled By: Client
Code: 12098121

Page 8

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86996A-6	Method Blank	
86996A-7	Lab Control Standard % Recovery	
PARAMETER	86996A-6	86996A-7
Surrogate - Phenol d5	56 %	57 %
Surrogate - 2-Fluorophenol	57 %	56 %
Surrogate - 2,4,6-Tribromophenol	58 %	62 %
Surrogate - Nitrobenzene - d5	56 %	52 %
Surrogate - 2-Fluorobiphenyl	58 %	56 %
Surrogate - Terphenyl - d14	52 %	56 %
Prep Date	11.13.98	11.13.98
Analysis Date	11.22.98	11.22.98
Batch ID	1113B	1113B
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: **F+ Stewart** PROJECT NO.: **32369** P.O. NUMBER: **10800**

PROJECT LOC. (State): **GA** SAMPLER(S) NAME: **Melanie D. Hill** PHONE: **(843) 572-888**

CLIENT NAME: **EarthTech** CLIENT PROJECT MANAGER: **Ron Paulding**

CLIENT ADDRESS (CITY, STATE, ZIP): **260 94A Lake Park Dr, N. Ches, SC 29418**

DATE: **11/16/98** TIME: **0915** SL NO.: **1430**

SAMPLE IDENTIFICATION: **A-GP-4-40RB**

SAMPLE: **1430** DATE: **11/16/98** TIME: **0915**

SAMPLE: **1540** DATE: **11/16/98** TIME: **0915**

SAMPLE: **1640** DATE: **11/16/98** TIME: **0915**

RELINQUISHED BY: (SIGNATURE) **Saw. Labs** DATE: **10/30/98** TIME: **0900**

RECEIVED BY: (SIGNATURE) **Melanie D. Hill** DATE: **10/30/98** TIME: **0900**

RELINQUISHED BY: (SIGNATURE) **Whitney L. Hill** DATE: **11/12/98** TIME: **8:00**

RECEIVED BY: (SIGNATURE) **Melanie D. Hill** DATE: **11/12/98** TIME: **8:00**

RECEIVED FOR LABORATORY BY: (SIGNATURE) **[Signature]** DATE: **11/12/98** TIME: **8:00**

RECEIVED BY: (SIGNATURE) **[Signature]** DATE: **11/12/98** TIME: **8:00**

MATRIX TYPE: **NOGS (DIPING)**

REQUIRED ANALYSES: **NOGS (DIPING)**

STANDARD REPORT DELIVERY: ☒ **except**

EXPEDITED REPORT DELIVERY (surcharge): ☐

REMARKS: **to GW VOLS**

***48 hrs**

with

enclosed

samples

(48 hrs to extract)

NUMBER OF CONTAINERS SUBMITTED: **3**

DATE: **11/16/98** TIME: **0915**

RELINQUISHED BY: (SIGNATURE) **Melanie D. Hill** DATE: **11/16/98** TIME: **0900**

RECEIVED BY: (SIGNATURE) **Whitney L. Hill** DATE: **11/16/98** TIME: **0900**

RELINQUISHED BY: (SIGNATURE) **[Signature]** DATE: **11/16/98** TIME: **0900**

RECEIVED BY: (SIGNATURE) **[Signature]** DATE: **11/16/98** TIME: **0900**

RECEIVED FOR LABORATORY BY: (SIGNATURE) **[Signature]** DATE: **11/16/98** TIME: **0900**

RECEIVED BY: (SIGNATURE) **[Signature]** DATE: **11/16/98** TIME: **0900**

Serial Number 108554

Phone: (912) 354-7858
Phone: (904) 878-3994
Phone: (954) 421-7400
Phone: (334) 666-6633
Phone: (813) 885-7427
Phone: (504) 764-1100

5102 LaRoche Avenue, Savannah, GA 31404
2846 Industrial Plaza Drive, Tallahassee, FL 32301
414 SW 12th Avenue, Deerfield Beach, FL 33442
900 Lakeside Drive, Mobile, AL 36693
6712 Benjamin Road, Suite 100, Tampa, FL 33634
100 Alpha Drive, Suite 110, Destrehan, LA 70047

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86961A
Received: 10 NOV 98
Reported: 23 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 153481123

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86961A-1	B-GP-18-9g	11-10-98/0835			
86961A-2	B-GP-18-9 Dup	11-10-98/0840			
86961A-3	A-GP-4-20g	11-10-98/1540			
86961A-4	A-GP-4-30g	11-10-98/1720			
PARAMETER	86961A-1	86961A-2	86961A-3	86961A-4	
TCL Semivolatiles (8270)					
Phenol, ug/l	<10	<10	<10	<10	
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10	
2-Chlorophenol, ug/l	<10	<10	<10	<10	
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10	
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10	
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10	
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10	
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10	
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	<10	<10	<10	
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10	
Hexachloroethane, ug/l	<10	<10	<10	<10	
Nitrobenzene, ug/l	<10	<10	<10	<10	
Isophorone, ug/l	<10	<10	<10	<10	
2-Nitrophenol, ug/l	<10	<10	<10	<10	
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10	
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10	
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10	

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Mr. Ron Paulling
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Client PO. No.: 10800

Project: FT. Stewart/32369
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REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86961A-1	B-GP-18-9g	11-10-98/0835			
86961A-2	B-GP-18-9 Dup	11-10-98/0840			
86961A-3	A-GP-4-20g	11-10-98/1540			
86961A-4	A-GP-4-30g	11-10-98/1720			
PARAMETER	86961A-1	86961A-2	86961A-3	86961A-4	
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10	
Naphthalene, ug/l	<10	<10	96	37	
4-Chloroaniline, ug/l	<20	<20	<20	<20	
Hexachlorobutadiene, ug/l	<10	<10	<10	<10	
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10	
2-Methylnaphthalene, ug/l	<10	<10	75	42	
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10	
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10	
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10	
2-Chloronaphthalene, ug/l	<10	<10	<10	<10	
2-Nitroaniline, ug/l	<50	<50	<50	<50	
Dimethylphthalate, ug/l	<10	<10	<10	<10	
Acenaphthylene, ug/l	<10	<10	<10	<10	
3-Nitroaniline, ug/l	<50	<50	<50	<50	
Acenaphthene, ug/l	<10	<10	<10	<10	
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50	
4-Nitrophenol, ug/l	<50	<50	<50	<50	
Dibenzofuran, ug/l	<10	<10	<10	<10	
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10	
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10	

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Mr. Ron Paulling
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LOG NO: S8-86961A
Received: 10 NOV 98
Reported: 23 NOV 98

Client PO. No.: 10800

Project: FT. Stewart/32369
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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86961A-1	B-GP-18-9g	11-10-98/0835		
86961A-2	B-GP-18-9 Dup	11-10-98/0840		
86961A-3	A-GP-4-20g	11-10-98/1540		
86961A-4	A-GP-4-30g	11-10-98/1720		
PARAMETER	86961A-1	86961A-2	86961A-3	86961A-4
Diethylphthalate, ug/l	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10
Chrysene, ug/l	<10	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10	<10

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LOG NO: S8-86961A
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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 153481123

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86961A-1	B-GP-18-9g	11-10-98/0835			
86961A-2	B-GP-18-9 Dup	11-10-98/0840			
86961A-3	A-GP-4-20g	11-10-98/1540			
86961A-4	A-GP-4-30g	11-10-98/1720			
PARAMETER	86961A-1	86961A-2	86961A-3	86961A-4	
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10	
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10	
Benzo(a)pyrene, ug/l	<10	<10	<10	<10	
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10	
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10	
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10	
Carbazole, ug/l	<10	<10	<10	<10	
Surrogate - Phenol d5	66 %	50 %	60 %	58 %	
Surrogate - 2-Fluorophenol	67 %	55 %	59 %	59 %	
Surrogate - 2,4,6-Tribromophenol	85 %	66 %	74 %	79 %	
Surrogate - Nitrobenzene - d5	84 %	76 %	68 %	70 %	
Surrogate - 2-Fluorobiphenyl	72 %	64 %	44 %	56 %	
Surrogate - Terphenyl - d14	42 %	22 %	13 %	14 %	
Prep Date	11.12.98	11.12.98	11.12.98	11.12.98	
Analysis Date	11.22.98	11.22.98	11.22.98	11.22.98	
Batch ID	1112F	1112F	1112F	1112F	
Dilution Factor	1.0	1.0	1.0	1.0	

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Mr. Ron Paulling
RUST Environment & Infrastructure
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Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 153481123

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961A-5	Method Blank	
86961A-6	Lab Control Standard % Recovery	
PARAMETER	86961A-5	86961A-6
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	57 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	61 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	51 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol (m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	71 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	59 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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LOG NO: S8-86961A
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Mr. Ron Paulling
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

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Sampled By: Client
Code: 153481123

REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961A-5	Method Blank	
86961A-6	Lab Control Standard % Recovery	
PARAMETER	86961A-5	86961A-6
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	72 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	67 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	55 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	66 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 153481123

REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961A-5	Method Blank	
86961A-6	Lab Control Standard % Recovery	
PARAMETER	86961A-5	86961A-6
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	72 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	82 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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Page 8

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961A-5	Method Blank	
86961A-6	Lab Control Standard % Recovery	
PARAMETER	86961A-5	86961A-6
Surrogate - Phenol d5	62 %	62 %
Surrogate - 2-Fluorophenol	64 %	60 %
Surrogate - 2,4,6-Tribromophenol	73 %	78 %
Surrogate - Nitrobenzene - d5	68 %	71 %
Surrogate - 2-Fluorobiphenyl	70 %	66 %
Surrogate - Terphenyl - d14	68 %	77 %
Prep Date	11.12.98	11.12.98
Analysis Date	11.22.98	11.22.98
Batch ID	1112F	1112F
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.

Steven J. White

Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

Phone: (912) 352-0165
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 Fax: (904) 878-9504
 Phone: (954) 421-7400
 Fax: (954) 421-2584
 Phone: (334) 666-6633
 Fax: (334) 666-6696
 Phone: (813) 885-7427
 Fax: (813) 885-7049
 Phone: (504) 764-1100
 Fax: (504) 725-1163

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: **Pf Stewart** PROJECT NO.: **32369** P.O. NUMBER: **10800**

PROJECT LOC. (State): **GA** SAMPLER(S) NAME: **Melanie D. Hill** PHONE: **(843) 572-5600** FAX: **(843) 572-5600**

CLIENT NAME: **EarthTech** CLIENT PROJECT MANAGER: **Ron Paulling**

CLIENT ADDRESS (CITY, STATE, ZIP): **2694 Lake Park Dr, N. Cross, SC 29418**

MATRIX TYPE: **NONAQUEOUS LIQUID (oil, solvent, etc.)**

REQUIRED ANALYSES: **See attached list**

STANDARD REPORT ☒ DELIVERY (surcharge) ☐

EXPEDITED REPORT ☐ DELIVERY (surcharge) ☐

Date Due: **11/10/98**

SAMPLE		SL NO.		SAMPLE IDENTIFICATION		NUMBER OF CONTAINERS SUBMITTED		REMARKS	
DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME
11/10/98	0820			B-GP-18-9RUB		3		100% G.W. 4/4500	
11/10/98	0835			B-GP-18-9g		3		not submitted	
11/10/98	0840			B-GP-18-9 Dup		3		not submitted	
11/10/98	1035			B-GP-19-10g		3		not submitted	
11/10/98	1330			B-GP-20-10g		3		not submitted	
11/10/98	1540			A-GP-4-20g		3		hydrocarbon (4 ppm)	
11/10/98	1720			A-GP-4-30g		3			
RUSH									
11/10/98	0900			Trip Barber		3			
RELINQUISHED BY: (SIGNATURE)		DATE		TIME		RELINQUISHED BY: (SIGNATURE)		DATE	
Saw Lab		10/30/98		0900		Melanie D. Hill		11/10/98	
RECEIVED BY: (SIGNATURE)		DATE		TIME		RECEIVED BY: (SIGNATURE)		DATE	
M. D. Hill		10/30/98		0900		Whitney L. Mann		11/10/98	

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE) **11/10/98** TIME **8:00**

CUSTODY INTACT ☒ YES ☐ NO

SL LOG NO. **58-86961**

LABORATORY REMARKS:

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-87109

Received: 16 NOV 98

Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 165981118

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
87109-1	D-GP-34-9g	11-16-98/1410			
87109-2	D-GP-34-9 Dup	11-16-98/1415			
87109-3	D-GP-33-10g	11-16-98/1520			
87109-4	D-GP-32-10g	11-16-98/1620			
87109-5	D-GP-31-10g	11-16-98/1705			
PARAMETER	87109-1	87109-2	87109-3	87109-4	87109-5
Volatiles by GC/MS (8260)					
Chloromethane, ug/l	<10	<10	<10	<10	<10
Bromomethane, ug/l	<10	<10	<10	<10	<10
Vinyl chloride, ug/l	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroethane, ug/l	<10	<10	<10	<10	<10
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0	<5.0	5.6	<5.0
Acetone, ug/l	<50	<50	<50	<50	<50
Carbon disulfide, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroform, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l	<25	<25	<25	<25	<25
1,1,1-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Bromodichloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
87109-1	D-GP-34-9g	11-16-98/1410			
87109-2	D-GP-34-9 Dup	11-16-98/1415			
87109-3	D-GP-33-10g	11-16-98/1520			
87109-4	D-GP-32-10g	11-16-98/1620			
87109-5	D-GP-31-10g	11-16-98/1705			
PARAMETER	87109-1	87109-2	87109-3	87109-4	87109-5
1,2-Dichloropropane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene, ug/l	29	34	9.9	10	<5.0
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Bromoform, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone, ug/l	<25	<25	<25	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25	<25	<25	<25
Tetrachloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Chlorobenzene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene, ug/l	41	50	9.9	<5.0	<5.0
Styrene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes, ug/l	7.1	8.7	19	<5.0	<5.0
Surrogate - Toluene-d8	96 %	98 %	100 %	96 %	96 %
Surrogate - 4-Bromofluorobenzene	98 %	96 %	100 %	104 %	104 %
Surrogate - Dibromofluoromethane	96 %	94 %	88 %	94 %	92 %
Analysis Date	11.18.98	11.18.98	11.18.98	11.18.98	11.18.98
Batch ID	2M1117	2M1117	2M1117	2M1117	2M1117
Dilution Factor	1.0	1.0	1.0	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-6	MW#1	11-16-98/1555
PARAMETER	87109-6	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

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LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118

REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-6	MW#1	11-16-98/1555
PARAMETER	87109-6	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	98 %	
Surrogate - 4-Bromofluorobenzene	102 %	
Surrogate - Dibromofluoromethane	90 %	
Analysis Date	11.18.98	
Batch ID	2M1117	
Dilution Factor	1.0	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-7	Trip Blank	11-16-98/1400
PARAMETER	87109-7	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118
Page 6

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-7	Trip Blank	11-16-98/1400
PARAMETER	87109-7	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	98 %	
Surrogate - 4-Bromofluorobenzene	100 %	
Surrogate - Dibromofluoromethane	90 %	
Analysis Date	11.18.98	
Batch ID	2M1117	
Dilution Factor	1.0	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 165981118

Page 7

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-8	Method Blank	
87109-9	Lab Control Standard % Recovery	
PARAMETER	87109-8	87109-9
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	96 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	106 %
Dibromochloromethane, ug/l	<5.0	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-87109
Received: 16 NOV 98
Reported: 18 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

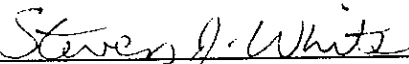
Project: FT. Stewart/32369
Sampled By: Client
Code: 165981118

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
87109-8	Method Blank	
87109-9	Lab Control Standard % Recovery	
PARAMETER	87109-8	87109-9
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	100 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	101 %
Chlorobenzene, ug/l	<5.0	110 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	96 %	98 %
Surrogate - 4-Bromofluorobenzene	106 %	109 %
Surrogate - Dibromofluoromethane	84 %	96 %
Prep Date	---	11.17.98
Analysis Date	11.17.98	---
Batch ID	2M1117	2M1117
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: **Ft Stewart** PROJECT NO.: **32369** PO NUMBER: **10800**

PROJECT LOC: **GA** SAMPLER(S) NAME: **Melanie H'11** PHONE: **(843) 572-5600** FAX: **(843) 572-5600**

CLIENT NAME: **Earth Tech** CLIENT PROJECT MANAGER: **Ron Pauline**

CLIENT ADDRESS (CITY, STATE, ZIP): **2094A Lake Park Dr, NChas, SC 29405**

MATRIX TYPE: **VOCs (cont'd)**

REQUIRED ANALYSES: **VOCs (cont'd)**

STANDARD REPORT ☒ EXPEDITED REPORT ☐ DELIVERY (surcharge) ☐

DATE DUE: **11/16/98**

SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED	REMARKS	DATE	TIME	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
11/16/98 1400				D - GP-34-99	3									
11/16/98 1415				D - GP-34-99 Dup	3									
11/16/98 1520				D - GP-33-109	3									
11/16/98 1620				D - GP-32-109	3									
11/16/98 1705				D - GP-31-109	3									
11/16/98 1555				MW #1	3									
11/16/98 1400				Trip Bottle	3									
11/16/98 0900				Melanie D. H'11										
11/16/98 0900				(unlabeled)										

RUSH

Stare, last of samples

RECEIVED FOR LABORATORY BY (SIGNATURE): **F. Se Ford** DATE: **11/17/98** TIME: **8:30**

CUSTODY INTACT: ☒ YES ☐ NO

CUSTODY SEAL NO.: **588709**

LABORATORY USE ONLY

RECEIVED BY (SIGNATURE): **MD Hill** DATE: **11/16/98** TIME: **1930**

RELINQUISHED BY (SIGNATURE): **Melanie D. H'11** DATE: **11/16/98** TIME: **1915**

LABORATORY REMARKS:

Phone: (912) 354-7858
Phone: (904) 878-3994
Phone: (954) 421-7400
Phone: (334) 666-6633
Phone: (813) 885-7427
Phone: (504) 764-1100

102 LaRoche Avenue, Savannah, GA 31404
2846 Industrial Plaza Drive, Tallahassee, FL 32301
414 SW 12th Avenue, Deerfield Beach, FL 33442
900 Lakeside Drive, Mobile, AL 36693
6712 Benjamin Road, Suite 100, Tampa, FL 33634
100 Alpha Drive, Suite 110, Destrehan, LA 70047

Fax: (912) 352-0165
Fax: (904) 878-9504
Fax: (954) 421-2584
Fax: (334) 666-6696
Fax: (813) 885-7049
Fax: (504) 725-1163

Serial Number 1115572

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86996
Received: 11 NOV 98
Reported: 13 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86996-1	A-GP-4-40RB	11-11-98/0915			
86996-2	A-GP-4-40g	11-11-98/0950			
86996-3	A-GP-4-40 Dup	11-11-98/0955			
86996-4	C-GP-27-9g	11-11-98/1430			
86996-5	A-GP-7-20g	11-11-98/1540			
PARAMETER	86996-1	86996-2	86996-3	86996-4	86996-5
Volatiles by GC/MS (8260)					
Chloromethane, ug/l	<10	<10	<10	<10	<10
Bromomethane, ug/l	<10	<10	<10	<10	<10
Vinyl chloride, ug/l	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroethane, ug/l	<10	<10	<10	<10	<10
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone, ug/l	120	<50	<50	<50	<50
Carbon disulfide, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroform, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l	<25	<25	<25	<25	<25
1,1,1-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Bromodichloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86996
Received: 11 NOV 98
Reported: 13 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

Page 2

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86996-1	A-GP-4-40RB	11-11-98/0915			
86996-2	A-GP-4-40g	11-11-98/0950			
86996-3	A-GP-4-40 Dup	11-11-98/0955			
86996-4	C-GP-27-9g	11-11-98/1430			
86996-5	A-GP-7-20g	11-11-98/1540			
PARAMETER	86996-1	86996-2	86996-3	86996-4	86996-5
1,2-Dichloropropane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Bromoform, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone, ug/l	<25	<25	<25	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25	<25	<25	<25
Tetrachloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene, ug/l	<5.0	7.3	<5.0	<5.0	<5.0
Chlorobenzene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene, ug/l	<5.0	30	16	<5.0	<5.0
Styrene, ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes, ug/l	<5.0	180	93	<5.0	<5.0
Surrogate - Toluene-d8	112 %	112 %	110 %	108 %	108 %
Surrogate - 4-Bromofluorobenzene	110 %	96 %	100 %	102 %	104 %
Surrogate - Dibromofluoromethane	108 %	112 %	106 %	108 %	106 %
Analysis Date	11.12.98	11.13.98	11.13.98	11.13.98	11.13.98
Batch ID	101112	101112	101112	101112	101112
Dilution Factor	1.0	1.0	1.0	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86996
Received: 11 NOV 98
Reported: 13 NOV 98

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

Page 3

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86996-6	A-GP-7-30g	11-11-98/1640
PARAMETER	86996-6	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

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Mr. Ron Paulling
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

Page 4

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86996-6	A-GP-7-30g	11-11-98/1640
PARAMETER	86996-6	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	110 %	
Surrogate - 4-Bromofluorobenzene	104 %	
Surrogate - Dibromofluoromethane	104 %	
Analysis Date	11.13.98	
Batch ID	101112	
Dilution Factor	1.0	

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LOG NO: S8-86996
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Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

REPORT OF RESULTS

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LOG NO SAMPLE DESCRIPTION , LIQUID SAMPLES

86996-7 Trip Blank

PARAMETER 86996-7

Volatiles by GC/MS (8260)

Chloromethane, ug/l	<10
Bromomethane, ug/l	<10
Vinyl chloride, ug/l	<2.0
Chloroethane, ug/l	<10
Methylene chloride (Dichloromethane), ug/l	<5.0
Acetone, ug/l	<50
Carbon disulfide, ug/l	<5.0
1,1-Dichloroethene, ug/l	<5.0
1,1-Dichloroethane, ug/l	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0
Chloroform, ug/l	<5.0
1,2-Dichloroethane, ug/l	<5.0
2-Butanone (MEK), ug/l	<25
1,1,1-Trichloroethane, ug/l	<5.0
Carbon tetrachloride, ug/l	<5.0
Bromodichloromethane, ug/l	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<5.0
1,2-Dichloropropane, ug/l	<5.0
trans-1,3-Dichloropropene, ug/l	<5.0
Trichloroethene, ug/l	<5.0
Dibromochloromethane, ug/l	<5.0
1,1,2-Trichloroethane, ug/l	<5.0

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LOG NO: S8-86996
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RUST Environment & Infrastructure
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N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

REPORT OF RESULTS

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LOG NO SAMPLE DESCRIPTION , LIQUID SAMPLES

86996-7 Trip Blank

PARAMETER	86996-7
Benzene, ug/l	<5.0
cis-1,3-Dichloropropene, ug/l	<5.0
Bromoform, ug/l	<5.0
2-Hexanone, ug/l	<25
4-Methyl-2-pentanone (MIBK), ug/l	<25
Tetrachloroethene, ug/l	<5.0
Toluene, ug/l	<5.0
Chlorobenzene, ug/l	<5.0
Ethylbenzene, ug/l	<5.0
Styrene, ug/l	<5.0
Xylenes, ug/l	<5.0
Surrogate - Toluene-d8	110 %
Surrogate - 4-Bromofluorobenzene	108 %
Surrogate - Dibromofluoromethane	104 %
Analysis Date	11.13.98
Batch ID	101112
Dilution Factor	1.0

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LOG NO: S8-86996
Received: 11 NOV 98
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N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 090581116

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED	
		86996-8	86996-9
86996-8	Method Blank		
86996-9	Lab Control Standard % Recovery		
Volatiles by GC/MS (8260)			
	Chloromethane, ug/l	<10	---
	Bromomethane, ug/l	<10	---
	Vinyl chloride, ug/l	<2.0	---
	Chloroethane, ug/l	<10	---
	Methylene chloride (Dichloromethane), ug/l	<5.0	---
	Acetone, ug/l	<50	---
	Carbon disulfide, ug/l	<5.0	---
	1,1-Dichloroethene, ug/l	<5.0	90 %
	1,1-Dichloroethane, ug/l	<5.0	---
	Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
	Chloroform, ug/l	<5.0	---
	1,2-Dichloroethane, ug/l	<5.0	---
	2-Butanone (MEK), ug/l	<25	---
	1,1,1-Trichloroethane, ug/l	<5.0	---
	Carbon tetrachloride, ug/l	<5.0	---
	Bromodichloromethane, ug/l	<5.0	---
	1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
	1,2-Dichloropropane, ug/l	<5.0	---
	trans-1,3-Dichloropropene, ug/l	<5.0	---
	Trichloroethene, ug/l	<5.0	85 %
	Dibromochloromethane, ug/l	<5.0	---

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86996
Received: 11 NOV 98
Reported: 13 NOV 98

Client PO. No.: 10800

Project: FT. Stewart/32369

Sampled By: Client

Code: 090581116

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86996-8	Method Blank	
86996-9	Lab Control Standard % Recovery	
PARAMETER	86996-8	86996-9
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	93 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	89 %
Chlorobenzene, ug/l	<5.0	85 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	110 %	113 %
Surrogate - 4-Bromofluorobenzene	110 %	109 %
Surrogate - Dibromofluoromethane	100 %	97 %
Analysis Date	11.12.98	11.12.98
Batch ID	101112	101112
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.

Steven J. White

Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES

& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☒ 102 LaRoche Avenue, Savannah, GA 31404
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

Phone: (912) 354-7858
 Phone: (904) 878-3994
 Phone: (954) 421-7400
 Phone: (334) 666-8633
 Phone: (813) 885-7427
 Phone: (504) 764-1100

Fax: (912) 352-0165
 Fax: (904) 878-9504
 Fax: (954) 421-2584
 Fax: (334) 666-8696
 Fax: (813) 885-7049
 Fax: (504) 725-1163

PROJECT REFERENCE	PROJECT NO.	P.O. NUMBER
F-4 Stewart	32369	10800
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE (843) 572-8000
GA	Melanie D. Hill	FAX
CLIENT NAME	CLIENT PROJECT MANAGER	
Earth Tech	Ron Paulding	
CLIENT ADDRESS (CITY, STATE, ZIP)		
200 94A Lake Park Dr, N. Chas, SC 29418		

SAMPLE DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED			REMARKS
				AQUEOUS (WATER)	SOLID OR SEMISOLID	NONAQUEOUS LIQUID (oil, solvent, etc.)	
11/11/98	0915		A-GP-4-40 PB	X		3	6 GW Vols
	0950		A-GP-4-46 g	X		3	*48 hrs
	0955		A-GP-4-46 J DUP	X		3	with
	1430		C-GP-27-9 g	X		3	enclosed
	1540		A-GP-7-20 g	X		3	samples
	1640		A-GP-7-30 g	X		3	(48 hrs to extract)

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Caro. Labs	11/13/98	0900	Melanie D. Hill	11/10/98	1900
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
Melanie D. Hill	11/15/98	0900	Whitney L. Ham		

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
	11/12/98	8:00	☒ YES ☐ NO		58-86976	

RUSH

Note: only 1 SVOC bottle per sample due to limited quantity.

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86961
Received: 10 NOV 98
Reported: 12 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86961-1	B-GP-18-9RB	11-10-98/0820			
86961-2	B-GP-18-9g	11-10-98/0835			
86961-3	B-GP-18-9 Dup	11-10-98/0840			
86961-4	A-GP-4-20g	11-10-98/1540			
86961-5	A-GP-4-30g	11-10-98/1720			
PARAMETER	86961-1	86961-2	86961-3	86961-4	86961-5
Volatiles by GC/MS (8260)					
Chloromethane, ug/l	<10	<10	<10	<100	<50
Bromomethane, ug/l	<10	<10	<10	<100	<50
Vinyl chloride, ug/l	<2.0	<2.0	<2.0	<20	<10
Chloroethane, ug/l	<10	<10	<10	<100	<50
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0	<5.0	<50	<25
Acetone, ug/l	<50	<50	65	<500	<250
Carbon disulfide, ug/l	<5.0	<5.0	<5.0	<50	<25
1,1-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<50	<25
1,1-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<50	<25
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<50	<25
Chloroform, ug/l	<5.0	<5.0	<5.0	<50	<25
1,2-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<50	<25
2-Butanone (MEK), ug/l	<25	<25	<25	<250	<120
1,1,1-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<50	<25
Carbon tetrachloride, ug/l	<5.0	<5.0	<5.0	<50	<25
Bromodichloromethane, ug/l	<5.0	<5.0	<5.0	<50	<25
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0	<5.0	<50	<25

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LOG NO: S8-86961
Received: 10 NOV 98
Reported: 12 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86961-1	B-GP-18-9RB	11-10-98/0820			
86961-2	B-GP-18-9g	11-10-98/0835			
86961-3	B-GP-18-9 Dup	11-10-98/0840			
86961-4	A-GP-4-20g	11-10-98/1540			
86961-5	A-GP-4-30g	11-10-98/1720			
PARAMETER	86961-1	86961-2	86961-3	86961-4	86961-5
1,2-Dichloropropane, ug/l	<5.0	<5.0	<5.0	<50	<25
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<50	<25
Trichloroethene, ug/l	<5.0	<5.0	<5.0	<50	<25
Dibromochloromethane, ug/l	<5.0	<5.0	<5.0	<50	<25
1,1,2-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<50	<25
Benzene, ug/l	<5.0	<5.0	<5.0	<10*F35	<5.0*F35
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<50	<25
Bromoform, ug/l	<5.0	<5.0	<5.0	<50	<25
2-Hexanone, ug/l	<25	<25	<25	<250	<120
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25	<25	<250	<120
Tetrachloroethene, ug/l	<5.0	<5.0	<5.0	<50	<25
Toluene, ug/l	<5.0	<5.0	<5.0	<50	<25
Chlorobenzene, ug/l	<5.0	<5.0	<5.0	<50	<25
Ethylbenzene, ug/l	<5.0	<5.0	<5.0	330	130
Styrene, ug/l	<5.0	<5.0	<5.0	<50	<25
Xylenes, ug/l	<5.0	<5.0	<5.0	1800	760
Surrogate - Toluene-d8	92 %	94 %	94 %	94 %	92 %
Surrogate - 4-Bromofluorobenzene	98 %	98 %	100 %	97 %	96 %
Surrogate - Dibromofluoromethane	92 %	88 %	88 %	90 %	92 %
Analysis Date	11.11.98	11.11.98	11.11.98	11.12.98	11.12.98
Batch ID	2B1111	2B1111	2B1111	2B1111	2B1111
Dilution Factor	1.0	1.0	1.0	10.0	5.0

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LOG NO: S8-86961
Received: 10 NOV 98
Reported: 12 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 3

LOG NO SAMPLE DESCRIPTION , LIQUID SAMPLES

86961-6 Trip Blank

PARAMETER 86961-6

Volatiles by GC/MS (8260)

Chloromethane, ug/l	<10
Bromomethane, ug/l	<10
Vinyl chloride, ug/l	<2.0
Chloroethane, ug/l	<10
Methylene chloride (Dichloromethane), ug/l	<5.0
Acetone, ug/l	<50
Carbon disulfide, ug/l	<5.0
1,1-Dichloroethene, ug/l	<5.0
1,1-Dichloroethane, ug/l	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0
Chloroform, ug/l	<5.0
1,2-Dichloroethane, ug/l	<5.0
2-Butanone (MEK), ug/l	<25
1,1,1-Trichloroethane, ug/l	<5.0
Carbon tetrachloride, ug/l	<5.0
Bromodichloromethane, ug/l	<5.0
1,1,2,2-Tetrachloroethane, ug/l	<5.0
1,2-Dichloropropane, ug/l	<5.0
trans-1,3-Dichloropropene, ug/l	<5.0
Trichloroethene, ug/l	<5.0
Dibromochloromethane, ug/l	<5.0
1,1,2-Trichloroethane, ug/l	<5.0

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Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 4

LOG NO SAMPLE DESCRIPTION , LIQUID SAMPLES

86961-6 Trip Blank

PARAMETER 86961-6

Benzene, ug/l	<5.0
cis-1,3-Dichloropropene, ug/l	<5.0
Bromoform, ug/l	<5.0
2-Hexanone, ug/l	<25
4-Methyl-2-pentanone (MIBK), ug/l	<25
Tetrachloroethene, ug/l	<5.0
Toluene, ug/l	<5.0
Chlorobenzene, ug/l	<5.0
Ethylbenzene, ug/l	<5.0
Styrene, ug/l	<5.0
Xylenes, ug/l	<5.0
Surrogate - Toluene-d8	96 %
Surrogate - 4-Bromofluorobenzene	100 %
Surrogate - Dibromofluoromethane	90 %
Analysis Date	11.12.98
Batch ID	2B1111
Dilution Factor	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86961
Received: 10 NOV 98
Reported: 12 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961-7	Method Blank	
86961-8	Lab Control Standard % Recovery	
PARAMETER	86961-7	86961-8
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	87 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	94 %
Dibromochloromethane, ug/l	<5.0	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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Mr. Ron Paulling
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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10800

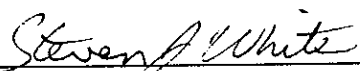
Project: FT. Stewart/32369
Sampled By: Client
Code: 143981112

REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86961-7	Method Blank	
86961-8	Lab Control Standard % Recovery	
PARAMETER	86961-7	86961-8
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	92 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	91 %
Chlorobenzene, ug/l	<5.0	93 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	94 %	92 %
Surrogate - 4-Bromofluorobenzene	100 %	101 %
Surrogate - Dibromofluoromethane	92 %	93 %
Analysis Date	11.11.98	---
Batch ID	2B1111	---
Dilution Factor	1.0	---

*F35 = Due to the analyte abundance, target compound concentrations are reported from multiple runs to achieve requested detection limits.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

5102 LaRoche Avenue, Savannah, GA 31404
2846 Industrial Plaza Drive, Tallahassee, FL 32301
414 SW 12th Avenue, Deerfield Beach, FL 33442
900 Lakeside Drive, Mobile, AL 36693
6712 Benjamin Road, Suite 100, Tampa, FL 33634
100 Alpha Drive, Suite 110, Destrehan, LA 70047

Phone: (912) 354-7858
Phone: (904) 878-3994
Phone: (954) 421-7400
Phone: (334) 666-6633
Phone: (813) 885-7427
Phone: (504) 764-1100

Fax: (912) 352-0165
Fax: (904) 878-9504
Fax: (954) 421-2584
Fax: (334) 666-6696
Fax: (813) 885-7049
Fax: (504) 725-1163

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER								
P4 Stewart		32369	10800								
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX								
GA	Melanie D. Hill	(843) 572-5600	(843) 572-5600								
CLIENT NAME		CLIENT PROJECT MANAGER									
EarthTech		Ron Paylling									
CLIENT ADDRESS (CITY, STATE, ZIP)											
2694 A Lake Park Dr, N. Ga., X 29418											
SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	NONAQUEOUS LIQUID (oil, solvent, etc)	MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
11/10/98	0820			B-GP-18-9RB	X			3			
11/10/98	0835			B-GP-18-9g	X			3			
11/10/98	0840			B-GP-18-9Dup	X			3			
1035				B-GP-19-10g	X			3			
1330				B-GP-20-10g	X			3			
11/10/98	1540			A-GP-4-20g	X			3			
11/10/98	1720			A-GP-4-30g	X			3			
11/10/98	0900			Trip Barker	X			3			
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Saw Lab		10/30/98	0900	Melanie D. Hill		11/10/98	1900				
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME
MD Hill		10/30/98	0900	Whitney A. Hill		11/10/98	1905				
LABORATORY USE ONLY											
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE	TIME	CUSTODY INTACT		CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:			
C. Hill		11/11/98	8:00	YES ☐ NO ☐			58-36961				

RUSH

REMARKS
VOC GW
not submitted
not submitted
hydrocarbon delay (4 ppm)

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86934A

Received: 09 NOV 98

Reported: 23 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 085881124

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86934A-1	B-GP-13-6s	11-09-98/1145			
86934A-2	B-GP-16-6s	11-09-98/1635			
86934A-3	B-GP-16-6-Dup	11-09-98/1640			
PARAMETER	86934A-1	86934A-2	86934A-3		
TCL Semivolatiles (8270)					
Phenol, ug/kg dw	<330	<390	<390		
bis(2-Chloroethyl)ether, ug/kg dw	<330	<390	<390		
2-Chlorophenol, ug/kg dw	<330	<390	<390		
1,3-Dichlorobenzene, ug/kg dw	<330	<390	<390		
1,4-Dichlorobenzene, ug/kg dw	<330	<390	<390		
1,2-Dichlorobenzene, ug/kg dw	<330	<390	<390		
2-Methylphenol (o-cresol), ug/kg dw	<330	<390	<390		
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	<390	<390		
3-Methylphenol/4-Methylphenol (m&p-cresol), ug/kg dw	<330	<390	<390		
N-Nitroso-di-n-propylamine, ug/kg dw	<330	<390	<390		
Hexachloroethane, ug/kg dw	<330	<390	<390		
Nitrobenzene, ug/kg dw	<330	<390	<390		
Isophorone, ug/kg dw	<330	<390	<390		
2-Nitrophenol, ug/kg dw	<330	<390	<390		
2,4-Dimethylphenol, ug/kg dw	<330	<390	<390		
bis(2-Chloroethoxy)methane, ug/kg dw	<330	<390	<390		
2,4-Dichlorophenol, ug/kg dw	<330	<390	<390		
1,2,4-Trichlorobenzene, ug/kg dw	<330	<390	<390		
Naphthalene, ug/kg dw	<330	<390	<390		

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REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	
86934A-1	B-GP-13-6s	11-09-98/1145	
86934A-2	B-GP-16-6s	11-09-98/1635	
86934A-3	B-GP-16-6-Dup	11-09-98/1640	
PARAMETER	86934A-1	86934A-2	86934A-3
4-Chloroaniline, ug/kg dw	<660	<780	<780
Hexachlorobutadiene, ug/kg dw	<330	<390	<390
4-Chloro-3-methylphenol, ug/kg dw	<330	<390	<390
2-Methylnaphthalene, ug/kg dw	<330	<390	<390
Hexachlorocyclopentadiene, ug/kg dw	<330	<390	<390
2,4,6-Trichlorophenol, ug/kg dw	<330	<390	<390
2,4,5-Trichlorophenol, ug/kg dw	<330	<390	<390
2-Chloronaphthalene, ug/kg dw	<330	<390	<390
2-Nitroaniline, ug/kg dw	<1700	<2000	<2000
Dimethylphthalate, ug/kg dw	<330	<390	<390
Acenaphthylene, ug/kg dw	<330	<390	<390
3-Nitroaniline, ug/kg dw	<1700	<2000	<2000
Acenaphthene, ug/kg dw	<330	<390	<390
2,4-Dinitrophenol, ug/kg dw	<1700	<2000	<2000
4-Nitrophenol, ug/kg dw	<1700	<2000	<2000
Dibenzofuran, ug/kg dw	<330	<390	<390
2,4-Dinitrotoluene, ug/kg dw	<330	<390	<390
2,6-Dinitrotoluene, ug/kg dw	<330	<390	<390
Diethylphthalate, ug/kg dw	<330	<390	<390
4-Chlorophenylphenyl ether, ug/kg dw	<330	<390	<390
Fluorene, ug/kg dw	<330	<390	<390

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	
86934A-1	B-GP-13-6s	11-09-98/1145	
86934A-2	B-GP-16-6s	11-09-98/1635	
86934A-3	B-GP-16-6-Dup	11-09-98/1640	
PARAMETER	86934A-1	86934A-2	86934A-3
4-Nitroaniline, ug/kg dw	<1700	<2000	<2000
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	<2000	<2000
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	<390	<390
4-Bromophenyl phenyl ether, ug/kg dw	<330	<390	<390
Hexachlorobenzene, ug/kg dw	<330	<390	<390
Pentachlorophenol, ug/kg dw	<1700	<2000	<2000
Phenanthrene, ug/kg dw	<330	<390	<390
Anthracene, ug/kg dw	<330	<390	<390
Di-n-butylphthalate, ug/kg dw	<330	<390	<390
Fluoranthene, ug/kg dw	<330	<390	<390
Pyrene, ug/kg dw	<330	<390	<390
Butylbenzylphthalate, ug/kg dw	<330	<390	<390
3,3'-Dichlorobenzidine, ug/kg dw	<660	<780	<780
Benzo(a)anthracene, ug/kg dw	<330	<390	<390
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	<390	<390
Chrysene, ug/kg dw	<330	<390	<390
Di-n-octylphthalate, ug/kg dw	<330	<390	<390
Benzo(b)fluoranthene, ug/kg dw	<330	<390	<390
Benzo(k)fluoranthene, ug/kg dw	<330	<390	<390
Benzo(a)pyrene, ug/kg dw	<330	<390	<390
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	<390	<390

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934A-1	B-GP-13-6s	11-09-98/1145		
86934A-2	B-GP-16-6s	11-09-98/1635		
86934A-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER	86934A-1	86934A-2	86934A-3	
Dibenzo(a,h)anthracene, ug/kg dw	<330	<390	<390	
Benzo(g,h,i)perylene, ug/kg dw	<330	<390	<390	
Carbazole, ug/kg dw	<330	<390	<390	
Surrogate - Phenol d5	54 %	56 %	59 %	
Surrogate - 2-Fluorophenol	52 %	54 %	54 %	
Surrogate - 2,4,6-Tribromophenol	67 %	64 %	72 %	
Surrogate - Nitrobenzene - d5	52 %	50 %	55 %	
Surrogate - 2-Fluorobiphenyl	59 %	60 %	65 %	
Surrogate - Terphenyl - d14	58 %	55 %	60 %	
Prep Date	11.12.98	11.12.98	11.12.98	
Analysis Date	11.19.98	11.19.98	11.19.98	
Batch ID	1112A	1112A	1112A	
Dilution Factor	1.0	1.0	1.0	
Arsenic (6010)				
Arsenic, mg/kg dw	<1.1	1.7	3.0	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	

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REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934A-1	B-GP-13-6s	11-09-98/1145		
86934A-2	B-GP-16-6s	11-09-98/1635		
86934A-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER	86934A-1	86934A-2	86934A-3	
Barium (6010)				
Barium, mg/kg dw	9.8	11	18	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	
Cadmium (6010)				
Cadmium, mg/kg dw	<0.54	<0.54	<0.54	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	
Chromium (6010)				
Chromium, mg/kg dw	12	23	23	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	

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REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934A-1	B-GP-13-6s	11-09-98/1145		
86934A-2	B-GP-16-6s	11-09-98/1635		
86934A-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER	86934A-1	86934A-2	86934A-3	
Lead (6010)				
Lead, mg/kg dw	9.5	10	25	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	
Selenium (6010)				
Selenium, mg/kg dw	<1.1	<1.1	<1.1	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	
Silver (6010)				
Silver, mg/kg dw	<1.1	<1.1	<1.1	
Prep Date	11.17.98	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	11.20.98	
Batch ID	1117C	1117C	1117C	
Dilution Factor	1.0	1.0	1.0	

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REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934A-1	B-GP-13-6s	11-09-98/1145		
86934A-2	B-GP-16-6s	11-09-98/1635		
86934A-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER	86934A-1	86934A-2	86934A-3	
Mercury (7471)				
Mercury, mg/kg dw	<0.011	<0.012	0.012	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111W	1111W	1111W	
Dilution Factor	1.0	1.0	1.0	

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Page 8

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86934A-4	B-GP-13-9g	11-09-98/1200		
86934A-6	B-GP-16-8g	11-09-98/1700		
86934A-7	B-GP-16-8-Dup	11-09-98/1705		
PARAMETER		86934A-4	86934A-6	86934A-7
TCL Semivolatiles (8270)				
Phenol, ug/l		<10	<10	<10
bis(2-Chloroethyl)ether, ug/l		<10	<10	<10
2-Chlorophenol, ug/l		<10	<10	<10
1,3-Dichlorobenzene, ug/l		<10	<10	<10
1,4-Dichlorobenzene, ug/l		<10	<10	<10
1,2-Dichlorobenzene, ug/l		<10	<10	<10
2-Methylphenol (o-cresol), ug/l		<10	<10	<10
2,2'-Oxybis(1-Chloropropane)		<10	<10	<10
(bis-2-chloroisopropyl ether), ug/l				
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l		<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l		<10	<10	<10
Hexachloroethane, ug/l		<10	<10	<10
Nitrobenzene, ug/l		<10	<10	<10
Isophorone, ug/l		<10	<10	<10
2-Nitrophenol, ug/l		<10	<10	<10
2,4-Dimethylphenol, ug/l		<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l		<10	<10	<10
2,4-Dichlorophenol, ug/l		<10	<10	<10
1,2,4-Trichlorobenzene, ug/l		<10	<10	<10
Naphthalene, ug/l		<10	<10	<10

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED	
86934A-4	B-GP-13-9g	11-09-98/1200	
86934A-6	B-GP-16-8g	11-09-98/1700	
86934A-7	B-GP-16-8-Dup	11-09-98/1705	
PARAMETER	86934A-4	86934A-6	86934A-7
4-Chloroaniline, ug/l	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10
2-Methylnaphthalene, ug/l	<10	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50
Dibenzofuran, ug/l	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10
2,6-Dinitrotoluene, ug/l	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10
Fluorene, ug/l	<10	<10	<10

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Reported: 23 NOV 98

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

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86934A-4	B-GP-13-9g	11-09-98/1200	
86934A-6	B-GP-16-8g	11-09-98/1700	
86934A-7	B-GP-16-8-Dup	11-09-98/1705	
PARAMETER	86934A-4	86934A-6	86934A-7
4-Nitroaniline, ug/l	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10
Anthracene, ug/l	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10
Pyrene, ug/l	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10
Chrysene, ug/l	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10

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86934A-4	B-GP-13-9g	11-09-98/1200		
86934A-6	B-GP-16-8g	11-09-98/1700		
86934A-7	B-GP-16-8-Dup	11-09-98/1705		
PARAMETER		86934A-4	86934A-6	86934A-7
Dibenzo(a,h)anthracene, ug/l		<10	<10	<10
Benzo(g,h,i)perylene, ug/l		<10	<10	<10
Carbazole, ug/l		<10	<10	<10
Surrogate - Phenol d5		72 %	74 %	74 %
Surrogate - 2-Fluorophenol		76 %	74 %	76 %
Surrogate - 2,4,6-Tribromophenol		120 %	120 %	130 %
Surrogate - Nitrobenzene - d5		94 %	86 %	92 %
Surrogate - 2-Fluorobiphenyl		84 %	82 %	92 %
Surrogate - Terphenyl - d14		24 %	24 %	90 %
Prep Date		11.12.98	11.12.98	11.12.98
Analysis Date		11.19.98	11.19.98	11.19.98
Batch ID		1112E	1112E	1112E
Dilution Factor		1.0	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934A-8	Method Blank	
86934A-9	Lab Control Standard % Recovery	
PARAMETER	86934A-8	86934A-9
TCL Semivolatiles (8270)		
Phenol, ug/kg dw	<330	62 %
bis(2-Chloroethyl)ether, ug/kg dw	<330	---
2-Chlorophenol, ug/kg dw	<330	60 %
1,3-Dichlorobenzene, ug/kg dw	<330	---
1,4-Dichlorobenzene, ug/kg dw	<330	62 %
1,2-Dichlorobenzene, ug/kg dw	<330	---
2-Methylphenol (o-cresol), ug/kg dw	<330	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/kg dw	<330	---
N-Nitroso-di-n-propylamine, ug/kg dw	<330	67 %
Hexachloroethane, ug/kg dw	<330	---
Nitrobenzene, ug/kg dw	<330	---
Isophorone, ug/kg dw	<330	---
2-Nitrophenol, ug/kg dw	<330	---
2,4-Dimethylphenol, ug/kg dw	<330	---
bis(2-Chloroethoxy)methane, ug/kg dw	<330	---
2,4-Dichlorophenol, ug/kg dw	<330	---
1,2,4-Trichlorobenzene, ug/kg dw	<330	68 %
Naphthalene, ug/kg dw	<330	---
4-Chloroaniline, ug/kg dw	<660	---

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934A-8	Method Blank	
86934A-9	Lab Control Standard % Recovery	
PARAMETER	86934A-8	86934A-9
Hexachlorobutadiene, ug/kg dw	<330	---
4-Chloro-3-methylphenol, ug/kg dw	<330	70 %
2-Methylnaphthalene, ug/kg dw	<330	---
Hexachlorocyclopentadiene, ug/kg dw	<330	---
2,4,6-Trichlorophenol, ug/kg dw	<330	---
2,4,5-Trichlorophenol, ug/kg dw	<330	---
2-Chloronaphthalene, ug/kg dw	<330	---
2-Nitroaniline, ug/kg dw	<1700	---
Dimethylphthalate, ug/kg dw	<330	---
Acenaphthylene, ug/kg dw	<330	---
3-Nitroaniline, ug/kg dw	<1700	---
Acenaphthene, ug/kg dw	<330	74 %
2,4-Dinitrophenol, ug/kg dw	<1700	---
4-Nitrophenol, ug/kg dw	<1700	69 %
Dibenzofuran, ug/kg dw	<330	---
2,4-Dinitrotoluene, ug/kg dw	<330	77 %
2,6-Dinitrotoluene, ug/kg dw	<330	---
Diethylphthalate, ug/kg dw	<330	---
4-Chlorophenylphenyl ether, ug/kg dw	<330	---
Fluorene, ug/kg dw	<330	---
4-Nitroaniline, ug/kg dw	<1700	---
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	---

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/	TIME SAMPLED
86934A-8	Method Blank		
86934A-9	Lab Control Standard % Recovery		
PARAMETER	86934A-8	86934A-9	
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---	
4-Bromophenyl phenyl ether, ug/kg dw	<330	---	
Hexachlorobenzene, ug/kg dw	<330	---	
Pentachlorophenol, ug/kg dw	<1700	63 %	
Phenanthrene, ug/kg dw	<330	---	
Anthracene, ug/kg dw	<330	---	
Di-n-butylphthalate, ug/kg dw	<330	---	
Fluoranthene, ug/kg dw	<330	---	
Pyrene, ug/kg dw	<330	70 %	
Butylbenzylphthalate, ug/kg dw	<330	---	
3,3'-Dichlorobenzidine, ug/kg dw	<660	---	
Benzo(a)anthracene, ug/kg dw	<330	---	
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	---	
Chrysene, ug/kg dw	<330	---	
Di-n-octylphthalate, ug/kg dw	<330	---	
Benzo(b)fluoranthene, ug/kg dw	<330	---	
Benzo(k)fluoranthene, ug/kg dw	<330	---	
Benzo(a)pyrene, ug/kg dw	<330	---	
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	---	
Dibenzo(a,h)anthracene, ug/kg dw	<330	---	
Benzo(g,h,i)perylene, ug/kg dw	<330	---	
Carbazole, ug/kg dw	<330	---	

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86934A-8	Method Blank	
86934A-9	Lab Control Standard % Recovery	
PARAMETER	86934A-8	86934A-9
Surrogate - Phenol d5	61 %	64 %
Surrogate - 2-Fluorophenol	61 %	64 %
Surrogate - 2,4,6-Tribromophenol	79 %	74 %
Surrogate - Nitrobenzene - d5	59 %	65 %
Surrogate - 2-Fluorobiphenyl	70 %	74 %
Surrogate - Terphenyl - d14	70 %	72 %
Prep Date	11.12.98	11.12.98
Analysis Date	11.19.98	11.20.98
Batch ID	1112A	1112A
Dilution Factor	1.0	1.0
Arsenic (6010)		
Arsenic, mg/kg dw	<1.0	101 %
Prep Date	11.17.98	11.17.98
Analysis Date	11.20.98	11.20.98
Batch ID	1117C	1117C
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	<1.0	107 %
Prep Date	11.17.98	11.17.98
Analysis Date	11.20.98	11.20.98
Batch ID	1117C	1117C
Dilution Factor	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/	TIME SAMPLED
86934A-8	Method Blank		
86934A-9	Lab Control Standard % Recovery		
PARAMETER	86934A-8	86934A-9	
Cadmium (6010)			
Cadmium, mg/kg dw	<0.50	103 %	
Prep Date	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	
Batch ID	1117C	1117C	
Dilution Factor	1.0	1.0	
Chromium (6010)			
Chromium, mg/kg dw	<1.0	105 %	
Prep Date	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	
Batch ID	1117C	1117C	
Dilution Factor	1.0	1.0	
Lead (6010)			
Lead, mg/kg dw	<0.50	106 %	
Prep Date	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	
Batch ID	1117C	1117C	
Dilution Factor	1.0	1.0	
Selenium (6010)			
Selenium, mg/kg dw	<1.0	104 %	
Prep Date	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	
Batch ID	1117C	1117C	
Dilution Factor	1.0	1.0	

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/	TIME SAMPLED
86934A-8	Method Blank		
86934A-9	Lab Control Standard % Recovery		
PARAMETER	86934A-8	86934A-9	
Silver (6010)			
Silver, mg/kg dw	<1.0	101 %	
Prep Date	11.17.98	11.17.98	
Analysis Date	11.20.98	11.20.98	
Batch ID	1117C	1117C	
Dilution Factor	1.0	1.0	
Mercury (7471)			
Mercury, mg/kg dw	<0.010	85 %	
Prep Date	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	
Batch ID	1111W	1111W	
Dilution Factor	1.0	1.0	

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86934A-10 Method Blank
86934A-11 Lab Control Standard % Recovery

PARAMETER	86934A-10	86934A-11
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	84 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	93 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	82 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane)	<10	---
(bis-2-chloroisopropyl ether), ug/l		
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	98 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	96 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86934A-10 Method Blank
86934A-11 Lab Control Standard % Recovery

PARAMETER	86934A-10	86934A-11
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	110 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	98 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	110 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	104 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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86934A-10 Method Blank
86934A-11 Lab Control Standard % Recovery

PARAMETER	86934A-10	86934A-11
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	120 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	102 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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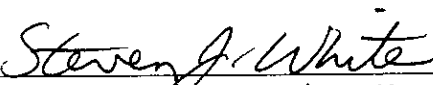
LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86934A-10 Method Blank
86934A-11 Lab Control Standard % Recovery

PARAMETER	86934A-10	86934A-11
Surrogate - Phenol d5	74 %	91 %
Surrogate - 2-Fluorophenol	74 %	90 %
Surrogate - 2,4,6-Tribromophenol	120 %	150 %
Surrogate - Nitrobenzene - d5	86 %	96 %
Surrogate - 2-Fluorobiphenyl	82 %	92 %
Surrogate - Terphenyl - d14	24 %	106 %
Prep Date	11.12.98	11.12.98
Analysis Date	11.19.98	11.19.98
Batch ID	1112E	1112E
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905A-1	B-GP-14-6s	11-06-98/0910		
86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER		86905A-1	86905A-2	86905A-3
TCL Semivolatiles (8270)				
Phenol, ug/kg dw		<380	<380	<400
bis(2-Chloroethyl)ether, ug/kg dw		<380	<380	<400
2-Chlorophenol, ug/kg dw		<380	<380	<400
1,3-Dichlorobenzene, ug/kg dw		<380	<380	<400
1,4-Dichlorobenzene, ug/kg dw		<380	<380	<400
1,2-Dichlorobenzene, ug/kg dw		<380	<380	<400
2-Methylphenol (o-cresol), ug/kg dw		<380	<380	<400
2,2'-Oxybis(1-Chloropropane)		<380	<380	<400
(bis-2-chloroisopropyl ether), ug/kg dw				
3-Methylphenol/4-Methylphenol (m&p-cresol), ug/kg dw		<380	<380	<400
N-Nitroso-di-n-propylamine, ug/kg dw		<380	<380	<400
Hexachloroethane, ug/kg dw		<380	<380	<400
Nitrobenzene, ug/kg dw		<380	<380	<400
Isophorone, ug/kg dw		<380	<380	<400
2-Nitrophenol, ug/kg dw		<380	<380	<400
2,4-Dimethylphenol, ug/kg dw		<380	<380	<400
bis(2-Chloroethoxy)methane, ug/kg dw		<380	<380	<400
2,4-Dichlorophenol, ug/kg dw		<380	<380	<400
1,2,4-Trichlorobenzene, ug/kg dw		<380	<380	<400
Naphthalene, ug/kg dw		<380	<380	<400

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Reported: 23 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED	
86905A-1	B-GP-14-6s	11-06-98/0910	
86905A-2	B-GP-12-6s	11-06-98/1050	
86905A-3	B-GP-11-6s	11-06-98/1255	
PARAMETER	86905A-1	86905A-2	86905A-3
4-Chloroaniline, ug/kg dw	<760	<760	<790
Hexachlorobutadiene, ug/kg dw	<380	<380	<400
4-Chloro-3-methylphenol, ug/kg dw	<380	<380	<400
2-Methylnaphthalene, ug/kg dw	<380	<380	<400
Hexachlorocyclopentadiene, ug/kg dw	<380	<380	<400
2,4,6-Trichlorophenol, ug/kg dw	<380	<380	<400
2,4,5-Trichlorophenol, ug/kg dw	<380	<380	<400
2-Chloronaphthalene, ug/kg dw	<380	<380	<400
2-Nitroaniline, ug/kg dw	<2000	<2000	<2000
Dimethylphthalate, ug/kg dw	<380	<380	<400
Acenaphthylene, ug/kg dw	<380	<380	<400
3-Nitroaniline, ug/kg dw	<2000	<2000	<2000
Acenaphthene, ug/kg dw	<380	<380	<400
2,4-Dinitrophenol, ug/kg dw	<2000	<2000	<2000
4-Nitrophenol, ug/kg dw	<2000	<2000	<2000
Dibenzofuran, ug/kg dw	<380	<380	<400
2,4-Dinitrotoluene, ug/kg dw	<380	<380	<400
2,6-Dinitrotoluene, ug/kg dw	<380	<380	<400
Diethylphthalate, ug/kg dw	<380	<380	<400
4-Chlorophenylphenyl ether, ug/kg dw	<380	<380	<400
Fluorene, ug/kg dw	<380	<380	<400

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905A-1	B-GP-14-6s	11-06-98/0910		
86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER		86905A-1	86905A-2	86905A-3
4-Nitroaniline, ug/kg dw		<2000	<2000	<2000
4,6-Dinitro-2-methylphenol, ug/kg dw		<2000	<2000	<2000
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw		<380	<380	<400
4-Bromophenyl phenyl ether, ug/kg dw		<380	<380	<400
Hexachlorobenzene, ug/kg dw		<380	<380	<400
Pentachlorophenol, ug/kg dw		<2000	<2000	<2000
Phenanthrene, ug/kg dw		<380	<380	<400
Anthracene, ug/kg dw		<380	<380	<400
Di-n-butylphthalate, ug/kg dw		<380	<380	<400
Fluoranthene, ug/kg dw		<380	<380	<400
Pyrene, ug/kg dw		<380	<380	<400
Butylbenzylphthalate, ug/kg dw		<380	<380	<400
3,3'-Dichlorobenzidine, ug/kg dw		<760	<760	<790
Benzo(a)anthracene, ug/kg dw		<380	<380	<400
bis(2-Ethylhexyl)phthalate, ug/kg dw		<380	<380	<400
Chrysene, ug/kg dw		<380	<380	<400
Di-n-octylphthalate, ug/kg dw		<380	<380	<400
Benzo(b)fluoranthene, ug/kg dw		<380	<380	<400
Benzo(k)fluoranthene, ug/kg dw		<380	<380	<400
Benzo(a)pyrene, ug/kg dw		<380	<380	<400
Indeno(1,2,3-cd)pyrene, ug/kg dw		<380	<380	<400

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905A-1	B-GP-14-6s	11-06-98/0910		
86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER		86905A-1	86905A-2	86905A-3
Dibenzo(a,h)anthracene, ug/kg dw		<380	<380	<400
Benzo(g,h,i)perylene, ug/kg dw		<380	<380	<400
Carbazole, ug/kg dw		<380	<380	<400
Surrogate - Phenol d5		66 %	56 %	58 %
Surrogate - 2-Fluorophenol		60 %	51 %	50 %
Surrogate - 2,4,6-Tribromophenol		110 %	82 %	100 %
Surrogate - Nitrobenzene - d5		63 %	52 %	55 %
Surrogate - 2-Fluorobiphenyl		68 %	63 %	60 %
Surrogate - Terphenyl - d14		79 %	74 %	80 %
Prep Date		11.12.98	11.12.98	11.12.98
Analysis Date		11.18.98	11.18.98	11.18.98
Batch ID		1112C	1112C	1112C
Dilution Factor		1.0	1.0	1.0
Arsenic (6010)				
Arsenic, mg/kg dw		1.1	<1.2	<1.1
Prep Date		11.11.98	11.11.98	11.11.98
Analysis Date		11.12.98	11.12.98	11.12.98
Batch ID		1111A	1111A	1111A
Dilution Factor		1.0	1.0	1.0

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86905A-1	B-GP-14-6s	11-06-98/0910		
86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER	86905A-1	86905A-2	86905A-3	
Barium (6010)				
Barium, mg/kg dw	11	12	22	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	
Cadmium (6010)				
Cadmium, mg/kg dw	<0.48	<0.58	<0.55	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	
Chromium (6010)				
Chromium, mg/kg dw	9.7	15	7.5	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	

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86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER	86905A-1	86905A-2	86905A-3	
Lead (6010)				
Lead, mg/kg dw	9.4	13	17	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	
Selenium (6010)				
Selenium, mg/kg dw	<0.97	<1.2	<1.1	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	
Silver (6010)				
Silver, mg/kg dw	<0.97	<1.2	<1.1	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111A	1111A	1111A	
Dilution Factor	1.0	1.0	1.0	

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905A-1	B-GP-14-6s	11-06-98/0910		
86905A-2	B-GP-12-6s	11-06-98/1050		
86905A-3	B-GP-11-6s	11-06-98/1255		
PARAMETER	86905A-1	86905A-2	86905A-3	
Mercury (7471)				
Mercury, mg/kg dw	<0.012	<0.012	<0.010	
Prep Date	11.11.98	11.11.98	11.11.98	
Analysis Date	11.12.98	11.12.98	11.12.98	
Batch ID	1111W	1111W	1111W	
Dilution Factor	1.0	1.0	1.0	

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED	
86905A-4	B-GP-14-8g	11-06-98/0915	
86905A-5	B-GP-12-8g	11-06-98/1100	
86905A-6	B-GP-11-8g	11-06-98/1300	
PARAMETER	86905A-4	86905A-5	86905A-6
TCL Semivolatiles (8270)			
Phenol, ug/l	<10	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10
2-Chlorophenol, ug/l	<10	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10
Hexachloroethane, ug/l	<10	<10	<10
Nitrobenzene, ug/l	<10	<10	<10
Isophorone, ug/l	<10	<10	<10
2-Nitrophenol, ug/l	<10	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10
2,4-Dichlorophenol, ug/l	<10	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10
Naphthalene, ug/l	<10	<10	<10

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86905A-4	B-GP-14-8g	11-06-98/0915			
86905A-5	B-GP-12-8g	11-06-98/1100			
86905A-6	B-GP-11-8g	11-06-98/1300			
PARAMETER	86905A-4	86905A-5	86905A-6		
4-Chloroaniline, ug/l	<20	<20	<20		
Hexachlorobutadiene, ug/l	<10	<10	<10		
4-Chloro-3-methylphenol, ug/l	<10	<10	<10		
2-Methylnaphthalene, ug/l	36	<10	<10		
Hexachlorocyclopentadiene, ug/l	<10	<10	<10		
2,4,6-Trichlorophenol, ug/l	<10	<10	<10		
2,4,5-Trichlorophenol, ug/l	<10	<10	<10		
2-Chloronaphthalene, ug/l	<10	<10	<10		
2-Nitroaniline, ug/l	<50	<50	<50		
Dimethylphthalate, ug/l	<10	<10	<10		
Acenaphthylene, ug/l	<10	<10	<10		
3-Nitroaniline, ug/l	<50	<50	<50		
Acenaphthene, ug/l	<10	<10	<10		
2,4-Dinitrophenol, ug/l	<50	<50	<50		
4-Nitrophenol, ug/l	<50	<50	<50		
Dibenzofuran, ug/l	<10	<10	<10		
2,4-Dinitrotoluene, ug/l	<10	<10	<10		
2,6-Dinitrotoluene, ug/l	<10	<10	<10		
Diethylphthalate, ug/l	<10	<10	<10		
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10		
Fluorene, ug/l	<10	<10	<10		

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86905A-4	B-GP-14-8g	11-06-98/0915	
86905A-5	B-GP-12-8g	11-06-98/1100	
86905A-6	B-GP-11-8g	11-06-98/1300	
PARAMETER	86905A-4	86905A-5	86905A-6
4-Nitroaniline, ug/l	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50
Phenanthrene, ug/l	38	<10	<10
Anthracene, ug/l	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10
Fluoranthene, ug/l	40	<10	<10
Pyrene, ug/l	16	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10
Chrysene, ug/l	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10

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86905A-5	B-GP-12-8g	11-06-98/1100			
86905A-6	B-GP-11-8g	11-06-98/1300			
PARAMETER	86905A-4	86905A-5	86905A-6		
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10		
Benzo(g,h,i)perylene, ug/l	<10	<10	<10		
Carbazole, ug/l	16	<10	<10		
Surrogate - Phenol d5	87 %	84 %	75 %		
Surrogate - 2-Fluorophenol	89 %	82 %	77 %		
Surrogate - 2,4,6-Tribromophenol	150 %	130 %	120 %		
Surrogate - Nitrobenzene - d5	92 %	98 %	100 %		
Surrogate - 2-Fluorobiphenyl	98 %	98 %	98 %		
Surrogate - Terphenyl - d14	46 %	40 %	40 %		
Prep Date	10.11.98	11.10.98	11.10.98		
Analysis Date	11.18.98	11.18.98	11.18.98		
Batch ID	1110B	1110B	1110B		
Dilution Factor	1.0	1.0	1.0		

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905A-7	Method Blank	
86905A-8	Lab Control Standard % Recovery	
PARAMETER	86905A-7	86905A-8
TCL Semivolatiles (8270)		
Phenol, ug/kg dw	<330	69 %
bis(2-Chloroethyl)ether, ug/kg dw	<330	---
2-Chlorophenol, ug/kg dw	<330	70 %
1,3-Dichlorobenzene, ug/kg dw	<330	---
1,4-Dichlorobenzene, ug/kg dw	<330	68 %
1,2-Dichlorobenzene, ug/kg dw	<330	---
2-Methylphenol (o-cresol), ug/kg dw	<330	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/kg dw	<330	---
N-Nitroso-di-n-propylamine, ug/kg dw	<330	80 %
Hexachloroethane, ug/kg dw	<330	---
Nitrobenzene, ug/kg dw	<330	---
Isophorone, ug/kg dw	<330	---
2-Nitrophenol, ug/kg dw	<330	---
2,4-Dimethylphenol, ug/kg dw	<330	---
bis(2-Chloroethoxy)methane, ug/kg dw	<330	---
2,4-Dichlorophenol, ug/kg dw	<330	---
1,2,4-Trichlorobenzene, ug/kg dw	<330	73 %
Naphthalene, ug/kg dw	<330	---
4-Chloroaniline, ug/kg dw	<660	---

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

LOG NO: S8-86905A
Received: 06 NOV 98
Reported: 23 NOV 98

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 153381123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905A-7	Method Blank	
86905A-8	Lab Control Standard % Recovery	
PARAMETER	86905A-7	86905A-8
Hexachlorobutadiene, ug/kg dw	<330	---
4-Chloro-3-methylphenol, ug/kg dw	<330	81 %
2-Methylnaphthalene, ug/kg dw	<330	---
Hexachlorocyclopentadiene, ug/kg dw	<330	---
2,4,6-Trichlorophenol, ug/kg dw	<330	---
2,4,5-Trichlorophenol, ug/kg dw	<330	---
2-Chloronaphthalene, ug/kg dw	<330	---
2-Nitroaniline, ug/kg dw	<1700	---
Dimethylphthalate, ug/kg dw	<330	---
Acenaphthylene, ug/kg dw	<330	---
3-Nitroaniline, ug/kg dw	<1700	---
Acenaphthene, ug/kg dw	<330	78 %
2,4-Dinitrophenol, ug/kg dw	<1700	---
4-Nitrophenol, ug/kg dw	<1700	81 %
Dibenzofuran, ug/kg dw	<330	---
2,4-Dinitrotoluene, ug/kg dw	<330	81 %
2,6-Dinitrotoluene, ug/kg dw	<330	---
Diethylphthalate, ug/kg dw	<330	---
4-Chlorophenylphenyl ether, ug/kg dw	<330	---
Fluorene, ug/kg dw	<330	---
4-Nitroaniline, ug/kg dw	<1700	---
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905A-7	Method Blank	
86905A-8	Lab Control Standard % Recovery	
PARAMETER	86905A-7	86905A-8
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---
4-Bromophenyl phenyl ether, ug/kg dw	<330	---
Hexachlorobenzene, ug/kg dw	<330	---
Pentachlorophenol, ug/kg dw	<1700	87 %
Phenanthrene, ug/kg dw	<330	---
Anthracene, ug/kg dw	<330	---
Di-n-butylphthalate, ug/kg dw	<330	---
Fluoranthene, ug/kg dw	<330	---
Pyrene, ug/kg dw	<330	91 %
Butylbenzylphthalate, ug/kg dw	<330	---
3,3'-Dichlorobenzidine, ug/kg dw	<660	---
Benzo(a)anthracene, ug/kg dw	<330	---
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	---
Chrysene, ug/kg dw	<330	---
Di-n-octylphthalate, ug/kg dw	<330	---
Benzo(b)fluoranthene, ug/kg dw	<330	---
Benzo(k)fluoranthene, ug/kg dw	<330	---
Benzo(a)pyrene, ug/kg dw	<330	---
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	---
Dibenzo(a,h)anthracene, ug/kg dw	<330	---
Benzo(g,h,i)perylene, ug/kg dw	<330	---
Carbazole, ug/kg dw	<330	---

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905A-7	Method Blank	
86905A-8	Lab Control Standard % Recovery	
PARAMETER	86905A-7	86905A-8
Surrogate - Phenol d5	67 %	72 %
Surrogate - 2-Fluorophenol	61 %	70 %
Surrogate - 2,4,6-Tribromophenol	91 %	106 %
Surrogate - Nitrobenzene - d5	65 %	73 %
Surrogate - 2-Fluorobiphenyl	70 %	79 %
Surrogate - Terphenyl - d14	94 %	95 %
Prep Date	11.12.98	11.12.98
Analysis Date	11.17.98	11.17.98
Batch ID	1112C	1112C
Dilution Factor	1.0	1.0
Arsenic (6010)		
Arsenic, mg/kg dw	<1.0	103 %
Prep Date	11.11.98	11.11.98
Analysis Date	11.12.98	11.12.98
Batch ID	1111A	1111A
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	<1.0	104 %
Prep Date	11.11.98	11.11.98
Analysis Date	11.12.98	11.12.98
Batch ID	1111A	1111A
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED	
		86905A-7	86905A-8
86905A-7	Method Blank		
86905A-8	Lab Control Standard % Recovery		
PARAMETER		86905A-7	86905A-8
Cadmium (6010)			
Cadmium, mg/kg dw		<0.50	107 %
Prep Date		11.11.98	11.11.98
Analysis Date		11.12.98	11.12.98
Batch ID		1111A	1111A
Dilution Factor		1.0	1.0
Chromium (6010)			
Chromium, mg/kg dw		<1.0	105 %
Prep Date		11.11.98	11.11.98
Analysis Date		11.12.98	11.12.98
Batch ID		1111A	1111A
Dilution Factor		1.0	1.0
Lead (6010)			
Lead, mg/kg dw		<0.50	106 %
Prep Date		11.11.98	11.11.98
Analysis Date		11.12.98	11.12.98
Batch ID		1111A	1111A
Dilution Factor		1.0	1.0
Selenium (6010)			
Selenium, mg/kg dw		<1.0	107 %
Prep Date		11.11.98	11.11.98
Analysis Date		11.12.98	11.12.98
Batch ID		1111A	1111A
Dilution Factor		1.0	1.0

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905A-7	Method Blank	
86905A-8	Lab Control Standard % Recovery	
PARAMETER	86905A-7	86905A-8
Silver (6010)		
Silver, mg/kg dw	<1.0	100 %
Prep Date	11.11.98	11.11.98
Analysis Date	11.12.98	11.12.98
Batch ID	1111A	1111A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	85 %
Prep Date	11.11.98	11.11.98
Analysis Date	11.12.98	11.12.98
Batch ID	1111W	1111W
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905A-9	Method Blank	
86905A-10	Lab Control Standard % Recovery	
PARAMETER	86905A-9	86905A-10
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	78 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	92 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	83 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane)	<10	---
(bis-2-chloroisopropyl ether), ug/l		
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	106 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	87 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905A-9	Method Blank	
86905A-10	Lab Control Standard % Recovery	
PARAMETER	86905A-9	86905A-10
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	98 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	101 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	100 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	105 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905A-9	Method Blank	
86905A-10	Lab Control Standard % Recovery	
PARAMETER	86905A-9	86905A-10
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	115 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	109 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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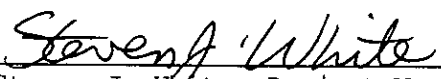
Code: 153381123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905A-9	Method Blank	
86905A-10	Lab Control Standard % Recovery	
PARAMETER	86905A-9	86905A-10
Surrogate - Phenol d5	70 %	81 %
Surrogate - 2-Fluorophenol	72 %	90 %
Surrogate - 2,4,6-Tribromophenol	110 %	135 %
Surrogate - Nitrobenzene - d5	80 %	100 %
Surrogate - 2-Fluorobiphenyl	78 %	97 %
Surrogate - Terphenyl - d14	96 %	117 %
Prep Date	11.10.98	11.10.98
Analysis Date	11.18.98	11.18.98
Batch ID	1110B	1110B
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

Serial Number 10558

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Phone: (912) 354-7858 Fax: (912) 352-0165
 Phone: (904) 878-3994 Fax: (904) 878-9504
 Phone: (954) 421-7400 Fax: (954) 421-2584
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☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER	MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
Ft Stewart / Summ 13		32369	10900			1	1
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX				
GA	Melanie D. Hill	(843) 572-8200	(843) 572-8261				
CLIENT NAME	CLIENT PROJECT MANAGER						
Earth Tech	Ron Pauling						
CLIENT ADDRESS (CITY, STATE, ZIP)							
2694A Lake Park Dr, Chapel St 29418							
SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED	REMARKS	
11/6/98	0910			B-6P-14-65	2	1	1
	0915			B-6P-14-89	3	2	1
	1030			B-6P-12-65	2	1	1
	1100			B-6P-12-89	3	2	1
	1255			B-6P-11-5	2	1	1
	1300			B-6P-11-89	3	2	1
RUSH							
11/6/98	0830			Trip Blank	3		
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Sen. Labs		11/6/98	0900	Melanie D. Hill		11/6/98	1545
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D. Hill		11/6/98	0930				

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
C. V. ...	11/6/98	8:05	☒ YES ☐ NO		3886905	

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LOG NO: S8-86816A
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Reported: 23 NOV 98

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2694 Lake Park Drive
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Project: FT. Stewart/SWMU 13/32369

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Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
TCL Semivolatiles (8270)		
Phenol, ug/kg dw	<340	<390
bis(2-Chloroethyl)ether, ug/kg dw	<340	<390
2-Chlorophenol, ug/kg dw	<340	<390
1,3-Dichlorobenzene, ug/kg dw	<340	<390
1,4-Dichlorobenzene, ug/kg dw	<340	<390
1,2-Dichlorobenzene, ug/kg dw	<340	<390
2-Methylphenol (o-cresol), ug/kg dw	<340	<390
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<340	<390
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<340	<390
N-Nitroso-di-n-propylamine, ug/kg dw	<340	<390
Hexachloroethane, ug/kg dw	<340	<390
Nitrobenzene, ug/kg dw	<340	<390
Isophorone, ug/kg dw	<340	<390
2-Nitrophenol, ug/kg dw	<340	<390
2,4-Dimethylphenol, ug/kg dw	<340	<390
bis(2-Chloroethoxy)methane, ug/kg dw	<340	<390

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
2,4-Dichlorophenol, ug/kg dw	<340	<390
1,2,4-Trichlorobenzene, ug/kg dw	<340	<390
Naphthalene, ug/kg dw	<340	<390
4-Chloroaniline, ug/kg dw	<680	<780
Hexachlorobutadiene, ug/kg dw	<340	<390
4-Chloro-3-methylphenol, ug/kg dw	<340	<390
2-Methylnaphthalene, ug/kg dw	<340	<390
Hexachlorocyclopentadiene, ug/kg dw	<340	<390
2,4,6-Trichlorophenol, ug/kg dw	<340	<390
2,4,5-Trichlorophenol, ug/kg dw	<340	<390
2-Chloronaphthalene, ug/kg dw	<340	<390
2-Nitroaniline, ug/kg dw	<1800	<2000
Dimethylphthalate, ug/kg dw	<340	<390
Acenaphthylene, ug/kg dw	<340	<390
3-Nitroaniline, ug/kg dw	<1800	<2000
Acenaphthene, ug/kg dw	<340	<390
2,4-Dinitrophenol, ug/kg dw	<1800	<2000
4-Nitrophenol, ug/kg dw	<1800	<2000
Dibenzofuran, ug/kg dw	<340	<390
2,4-Dinitrotoluene, ug/kg dw	<340	<390
2,6-Dinitrotoluene, ug/kg dw	<340	<390

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES,	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
Diethylphthalate, ug/kg dw	<340	<390
4-Chlorophenylphenyl ether, ug/kg dw	<340	<390
Fluorene, ug/kg dw	<340	<390
4-Nitroaniline, ug/kg dw	<1800	<2000
4,6-Dinitro-2-methylphenol, ug/kg dw	<1800	<2000
N-Nitrosodiphenylamine/Diph enylamine, ug/kg dw	<340	<390
4-Bromophenyl phenyl ether, ug/kg dw	<340	<390
Hexachlorobenzene, ug/kg dw	<340	<390
Pentachlorophenol, ug/kg dw	<1800	<2000
Phenanthrene, ug/kg dw	<340	<390
Anthracene, ug/kg dw	<340	<390
Di-n-butylphthalate, ug/kg dw	<340	<390
Fluoranthene, ug/kg dw	<340	<390
Pyrene, ug/kg dw	<340	<390
Butylbenzylphthalate, ug/kg dw	<340	<390
3,3'-Dichlorobenzidine, ug/kg dw	<680	<780
Benzo(a)anthracene, ug/kg dw	<340	<390
bis(2-Ethylhexyl)phthalate, ug/kg dw	<340	<390

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Reported: 23 NOV 98

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2694 Lake Park Drive
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Client PO. No.: 10900

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
Chrysene, ug/kg dw	<340	<390
Di-n-octylphthalate, ug/kg dw	<340	<390
Benzo(b)fluoranthene, ug/kg dw	<340	<390
Benzo(k)fluoranthene, ug/kg dw	<340	<390
Benzo(a)pyrene, ug/kg dw	<340	<390
Indeno(1,2,3-cd)pyrene, ug/kg dw	<340	<390
Dibenzo(a,h)anthracene, ug/kg dw	<340	<390
Benzo(g,h,i)perylene, ug/kg dw	<340	<390
Carbazole, ug/kg dw	<340	<390
Surrogate - Phenol d5	40 %	32 %
Surrogate - 2-Fluorophenol	40 %	32 %
Surrogate - 2,4,6-Tribromophenol	48 %	40 %
Surrogate - Nitrobenzene - d5	34 %	26 %
Surrogate - 2-Fluorobiphenyl	41 %	32 %
Surrogate - Terphenyl - d14	55 %	42 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109C	1109C
Dilution Factor	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
Arsenic (6010)		
Arsenic, mg/kg dw	<1.0	<1.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	20	16
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Cadmium (6010)		
Cadmium, mg/kg dw	<0.52	<0.54
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Chromium (6010)		
Chromium, mg/kg dw	3.6	3.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86816A-1	A-GP-9-Os	11-04-98/1620
86816A-2	A-GP-9-6s	11-04-98/1710
PARAMETER	86816A-1	86816A-2
Lead (6010)		
Lead, mg/kg dw	3.2	16
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.0	<1.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Silver (6010)		
Silver, mg/kg dw	<1.0	<1.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	<0.011
Prep Date	11.06.98	11.06.98
Analysis Date	11.09.98	11.09.98
Batch ID	1106S	1106S
Dilution Factor	1.0	1.0

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86816A-3	A-GP-6-10g	11-04-98/1050		
86816A-3-RE	A-GP-6-10g	11-04-98/1050		
86816A-4	A-GP-6-10FB	11-04-98/1100		
86816A-4-RE	A-GP-6-10FB	11-04-98/1100		
PARAMETER	86816A-3	86816A-3-RE	86816A-4	86816A-4-RE
TCL Semivolatiles (8270)				
Phenol, ug/l	<20	<20	<10	<10
bis(2-Chloroethyl)ether, ug/l	<20	<20	<10	<10
2-Chlorophenol, ug/l	<20	<20	<10	<10
1,3-Dichlorobenzene, ug/l	<20	<20	<10	<10
1,4-Dichlorobenzene, ug/l	<20	<20	<10	<10
1,2-Dichlorobenzene, ug/l	<20	<20	<10	<10
2-Methylphenol (o-cresol), ug/l	<20	<20	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<20	<20	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<20	<20	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<20	<20	<10	<10
Hexachloroethane, ug/l	<20	<20	<10	<10
Nitrobenzene, ug/l	<20	<20	<10	<10
Isophorone, ug/l	<20	<20	<10	<10
2-Nitrophenol, ug/l	<20	<20	<10	<10
2,4-Dimethylphenol, ug/l	27	28	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<20	<20	<10	<10

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86816A-3	A-GP-6-10g	11-04-98/1050		
86816A-3-RE	A-GP-6-10g	11-04-98/1050		
86816A-4	A-GP-6-10FB	11-04-98/1100		
86816A-4-RE	A-GP-6-10FB	11-04-98/1100		
PARAMETER	86816A-3	86816A-3-RE	86816A-4	86816A-4-RE
2,4-Dichlorophenol, ug/l	<20	<20	<10	<10
1,2,4-Trichlorobenzene, ug/l	<20	<20	<10	<10
Naphthalene, ug/l	210	210	<10	<10
4-Chloroaniline, ug/l	<40	<40	<20	<20
Hexachlorobutadiene, ug/l	<20	<20	<10	<10
4-Chloro-3-methylphenol, ug/l	<20	<20	<10	<10
2-Methylnaphthalene, ug/l	130	120	<10	<10
Hexachlorocyclopentadiene, ug/l	<20	<20	<10	<10
2,4,6-Trichlorophenol, ug/l	<20	<20	<10	<10
2,4,5-Trichlorophenol, ug/l	<20	<20	<10	<10
2-Chloronaphthalene, ug/l	<20	<20	<10	<10
2-Nitroaniline, ug/l	<100	<100	<50	<50
Dimethylphthalate, ug/l	<20	<20	<10	<10
Acenaphthylene, ug/l	<20	<20	<10	<10
3-Nitroaniline, ug/l	<100	<100	<50	<50
Acenaphthene, ug/l	<20	<20	<10	<10
2,4-Dinitrophenol, ug/l	<100	<100	<50	<50
4-Nitrophenol, ug/l	<100	<100	<50	<50
Dibenzofuran, ug/l	<20	<20	<10	<10
2,4-Dinitrotoluene, ug/l	<20	<20	<10	<10

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86816A-3-RE	A-GP-6-10g	11-04-98/1050		
86816A-4	A-GP-6-10FB	11-04-98/1100		
86816A-4-RE	A-GP-6-10FB	11-04-98/1100		
PARAMETER	86816A-3	86816A-3-RE	86816A-4	86816A-4-RE
2,6-Dinitrotoluene, ug/l	<20	<20	<10	<10
Diethylphthalate, ug/l	<20	<20	<10	<10
4-Chlorophenylphenyl ether, ug/l	<20	<20	<10	<10
Fluorene, ug/l	<20	<20	<10	<10
4-Nitroaniline, ug/l	<100	<100	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<100	<100	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<20	<20	<10	<10
4-Bromophenyl phenyl ether, ug/l	<20	<20	<10	<10
Hexachlorobenzene, ug/l	<20	<20	<10	<10
Pentachlorophenol, ug/l	<100	<100	<50	<50
Phenanthrene, ug/l	<20	<20	<10	<10
Anthracene, ug/l	<20	<20	<10	<10
Di-n-butylphthalate, ug/l	<20	<20	<10	<10
Fluoranthene, ug/l	<20	<20	<10	<10
Pyrene, ug/l	<20	<20	<10	<10
Butylbenzylphthalate, ug/l	<20	<20	<10	<10
3,3'-Dichlorobenzidine, ug/l	<40	<40	<20	<20
Benzo(a)anthracene, ug/l	<20	<20	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<20	<20	<10	<10

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES			DATE/ TIME SAMPLED
86816A-3	A-GP-6-10g			11-04-98/1050
86816A-3-RE	A-GP-6-10g			11-04-98/1050
86816A-4	A-GP-6-10FB			11-04-98/1100
86816A-4-RE	A-GP-6-10FB			11-04-98/1100
PARAMETER	86816A-3	86816A-3-RE	86816A-4	86816A-4-RE
Chrysene, ug/l	<20	<20	<10	<10
Di-n-octylphthalate, ug/l	<20	<20	<10	<10
Benzo(b)fluoranthene, ug/l	<20	<20	<10	<10
Benzo(k)fluoranthene, ug/l	<20	<20	<10	<10
Benzo(a)pyrene, ug/l	<20	<20	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<20	<20	<10	<10
Dibenzo(a,h)anthracene, ug/l	<20	<20	<10	<10
Benzo(g,h,i)perylene, ug/l	<20	<20	<10	<10
Carbazole, ug/l	<20	<20	<10	<10
Surrogate - Phenol d5	72 %	79 %	68 %	74 %
Surrogate - 2-Fluorophenol	68 %	76 %	72 %	73 %
Surrogate - 2,4,6-Tribromophenol	85 %	130 %	78 %	88 %
Surrogate - Nitrobenzene - d5	72 %	90 %	66 %	88 %
Surrogate - 2-Fluorobiphenyl	68 %	78 %	74 %	86 %
Surrogate - Terphenyl - d14	*F33	*F33	90 %	82 %
Prep Date	11.06.98	11.14.98	11.06.98	11.14.98
Analysis Date	11.13.98	11.20.98	11.12.98	11.19.98
Batch ID	1106C	1114D	1106C	1114D
Dilution Factor	2.0	2.0	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816A-5	A-GP-7-10g	11-04-98/1150		
86816A-5-RE	A-GP-7-10g	11-04-98/1150		
86816A-6	A-GP-7-10 Dup	11-04-98/1155		
86816A-6-RE	A-GP-7-10 Dup	11-04-98/1155		
PARAMETER	86816A-5	86816A-5-RE	86816A-6	86816A-6-RE
TCL Semivolatiles (8270)				
Phenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10
2-Chlorophenol, ug/l	<10	<10	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10
Hexachloroethane, ug/l	<10	<10	<10	<10
Nitrobenzene, ug/l	<10	<10	<10	<10
Isophorone, ug/l	<10	<10	<10	<10
2-Nitrophenol, ug/l	<10	<10	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10

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86816A-5	A-GP-7-10g	11-04-98/1150		
86816A-5-RE	A-GP-7-10g	11-04-98/1150		
86816A-6	A-GP-7-10 Dup	11-04-98/1155		
86816A-6-RE	A-GP-7-10 Dup	11-04-98/1155		
PARAMETER	86816A-5	86816A-5-RE	86816A-6	86816A-6-RE
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10
Naphthalene, ug/l	84	91	82	76
4-Chloroaniline, ug/l	<20	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10
2-Methylnaphthalene, ug/l	86	88	81	74
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50	<50
Dibenzofuran, ug/l	<10	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10

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86816A-5-RE	A-GP-7-10g	11-04-98/1150		
86816A-6	A-GP-7-10 Dup	11-04-98/1155		
86816A-6-RE	A-GP-7-10 Dup	11-04-98/1155		
PARAMETER	86816A-5	86816A-5-RE	86816A-6	86816A-6-RE
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10

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86816A-5-RE	A-GP-7-10g			11-04-98/1150
86816A-6	A-GP-7-10 Dup			11-04-98/1155
86816A-6-RE	A-GP-7-10 Dup			11-04-98/1155
PARAMETER	86816A-5	86816A-5-RE	86816A-6	86816A-6-RE
Chrysene, ug/l	<10	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10
Carbazole, ug/l	<10	<10	<10	<10
Surrogate - Phenol d5	63 %	83 %	56 %	64 %
Surrogate - 2-Fluorophenol	64 %	78 %	48 %	59 %
Surrogate - 2,4,6-Tribromophenol	82 %	140 %	77 %	120 %
Surrogate - Nitrobenzene - d5	66 %	88 %	66 %	68 %
Surrogate - 2-Fluorobiphenyl	64 %	90 %	62 %	66 %
Surrogate - Terphenyl - d14	30 %	24 %	28 %	46 %
Prep Date	11.06.98	11.14.98	11.06.98	11.14.98
Analysis Date	11.12.98	11.19.98	11.12.98	11.19.98
Batch ID	1106C	1114D	1106C	1114D
Dilution Factor	1.0	1.0	1.0	1.0

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86816A
Received: 04 NOV 98
Reported: 23 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 165581123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816A-7	A-GP-3-10g	11-04-98/1240		
86816A-7-RE	A-GP-3-10g	11-04-98/1240		
86816A-8	A-GP-4-10g	11-04-98/1445		
86816A-8-RE	A-GP-4-10g	11-04-98/1445		
PARAMETER	86816A-7	86816A-7-RE	86816A-8	86816A-8-RE
TCL Semivolatiles (8270)				
Phenol, ug/l	<10	<10	<40	<50
bis(2-Chloroethyl)ether, ug/l	<10	<10	<40	<50
2-Chlorophenol, ug/l	<10	<10	<40	<50
1,3-Dichlorobenzene, ug/l	<10	<10	<40	<50
1,4-Dichlorobenzene, ug/l	<10	<10	<40	<50
1,2-Dichlorobenzene, ug/l	<10	<10	<40	<50
2-Methylphenol (o-cresol), ug/l	<10	<10	<40	<50
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<40	<50
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10	<40	<50
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<40	<50
Hexachloroethane, ug/l	<10	<10	<40	<50
Nitrobenzene, ug/l	<10	<10	<40	<50
Isophorone, ug/l	<10	<10	<40	<50
2-Nitrophenol, ug/l	<10	<10	<40	<50
2,4-Dimethylphenol, ug/l	<10	<10	<40	<50
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<40	<50

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86816A-7	A-GP-3-10g	11-04-98/1240			
86816A-7-RE	A-GP-3-10g	11-04-98/1240			
86816A-8	A-GP-4-10g	11-04-98/1445			
86816A-8-RE	A-GP-4-10g	11-04-98/1445			
PARAMETER	86816A-7	86816A-7-RE	86816A-8	86816A-8-RE	
2,4-Dichlorophenol, ug/l	<10	<10	<40	<50	
1,2,4-Trichlorobenzene, ug/l	<10	<10	<40	<50	
Naphthalene, ug/l	<10	14	320	490	
4-Chloroaniline, ug/l	<20	<20	<80	<100	
Hexachlorobutadiene, ug/l	<10	<10	<40	<50	
4-Chloro-3-methylphenol, ug/l	<10	<10	<40	<50	
2-Methylnaphthalene, ug/l	<10	13	230	430	
Hexachlorocyclopentadiene, ug/l	<10	<10	<40	<50	
2,4,6-Trichlorophenol, ug/l	<10	<10	<40	<50	
2,4,5-Trichlorophenol, ug/l	<10	<10	<40	<50	
2-Chloronaphthalene, ug/l	<10	<10	<40	<50	
2-Nitroaniline, ug/l	<50	<50	<200	<250	
Dimethylphthalate, ug/l	<10	<10	<40	<50	
Acenaphthylene, ug/l	<10	<10	<40	<50	
3-Nitroaniline, ug/l	<50	<50	<200	<250	
Acenaphthene, ug/l	<10	<10	<40	<50	
2,4-Dinitrophenol, ug/l	<50	<50	<200	<250	
4-Nitrophenol, ug/l	<50	<50	<200	<250	
Dibenzofuran, ug/l	<10	<10	<40	<50	
2,4-Dinitrotoluene, ug/l	<10	<10	<40	<50	

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816A-7	A-GP-3-10g	11-04-98/1240		
86816A-7-RE	A-GP-3-10g	11-04-98/1240		
86816A-8	A-GP-4-10g	11-04-98/1445		
86816A-8-RE	A-GP-4-10g	11-04-98/1445		
PARAMETER	86816A-7	86816A-7-RE	86816A-8	86816A-8-RE
2,6-Dinitrotoluene, ug/l	<10	<10	<40	<50
Diethylphthalate, ug/l	<10	<10	<40	<50
4-Chlorophenylphenyl ether, ug/l	<10	<10	<40	<50
Fluorene, ug/l	<10	<10	<40	<50
4-Nitroaniline, ug/l	<50	<50	<200	<250
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<200	<250
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<40	<50
4-Bromophenyl phenyl ether, ug/l	<10	<10	<40	<50
Hexachlorobenzene, ug/l	<10	<10	<40	<50
Pentachlorophenol, ug/l	<50	<50	<200	<250
Phenanthrene, ug/l	<10	<10	<40	<50
Anthracene, ug/l	<10	<10	<40	<50
Di-n-butylphthalate, ug/l	<10	<10	<40	<50
Fluoranthene, ug/l	<10	<10	<40	<50
Pyrene, ug/l	<10	<10	<40	<50
Butylbenzylphthalate, ug/l	<10	<10	<40	<50
3,3'-Dichlorobenzidine, ug/l	<20	<20	<80	<100
Benzo(a)anthracene, ug/l	<10	<10	<40	<50
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<40	<50

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86816A-7	A-GP-3-10g	11-04-98/1240			
86816A-7-RE	A-GP-3-10g	11-04-98/1240			
86816A-8	A-GP-4-10g	11-04-98/1445			
86816A-8-RE	A-GP-4-10g	11-04-98/1445			
PARAMETER	86816A-7	86816A-7-RE	86816A-8	86816A-8-RE	
Chrysene, ug/l	<10	<10	<40	<50	
Di-n-octylphthalate, ug/l	<10	<10	<40	<50	
Benzo(b)fluoranthene, ug/l	<10	<10	<40	<50	
Benzo(k)fluoranthene, ug/l	<10	<10	<40	<50	
Benzo(a)pyrene, ug/l	<10	<10	<40	<50	
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<40	<50	
Dibenzo(a,h)anthracene, ug/l	<10	<10	<40	<50	
Benzo(g,h,i)perylene, ug/l	<10	<10	<40	<50	
Carbazole, ug/l	<10	<10	<40	<50	
Surrogate - Phenol d5	51 %	82 %	55 %	82 %	
Surrogate - 2-Fluorophenol	55 %	81 %	58 %	*F33	
Surrogate - 2,4,6-Tribromophenol	74 %	140 %	94 %	120 %	
Surrogate - Nitrobenzene - d5	62 %	92 %	*F33	112 %	
Surrogate - 2-Fluorobiphenyl	60 %	90 %	*F33	*F33	
Surrogate - Terphenyl - d14	22 %	38 %	*F33	*F33	
Prep Date	11.06.98	11.14.98	11.06.98	11.14.98	
Analysis Date	11.12.98	11.19.98	11.13.98	11.20.98	
Batch ID	1106C	1114D	1106C	1114D	
Dilution Factor	1.0	1.0	4.0	5.0	

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816A-9	A-GP-5-10g	11-04-98/1515		
86816A-9-RE	A-GP-5-10g	11-04-98/1515		
86816A-10	A-GP-9-8g	11-04-98/1715		
86816A-10-RE	A-GP-9-8g	11-04-98/1715		
PARAMETER	86816A-9	86816A-9-RE	86816A-10	86816A-10-RE
TCL Semivolatiles (8270)				
Phenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10
2-Chlorophenol, ug/l	<10	<10	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10
Hexachloroethane, ug/l	<10	<10	<10	<10
Nitrobenzene, ug/l	<10	<10	<10	<10
Isophorone, ug/l	<10	<10	<10	<10
2-Nitrophenol, ug/l	<10	<10	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86816A-9	A-GP-5-10g	11-04-98/1515			
86816A-9-RE	A-GP-5-10g	11-04-98/1515			
86816A-10	A-GP-9-8g	11-04-98/1715			
86816A-10-RE	A-GP-9-8g	11-04-98/1715			
PARAMETER	86816A-9	86816A-9-RE	86816A-10	86816A-10-RE	
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10	
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10	
Naphthalene, ug/l	<10	<10	<10	<10	
4-Chloroaniline, ug/l	<20	<20	<20	<20	
Hexachlorobutadiene, ug/l	<10	<10	<10	<10	
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10	
2-Methylnaphthalene, ug/l	<10	<10	<10	<10	
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10	
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10	
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10	
2-Chloronaphthalene, ug/l	<10	<10	<10	<10	
2-Nitroaniline, ug/l	<50	<50	<50	<50	
Dimethylphthalate, ug/l	<10	<10	<10	<10	
Acenaphthylene, ug/l	<10	<10	<10	<10	
3-Nitroaniline, ug/l	<50	<50	<50	<50	
Acenaphthene, ug/l	<10	<10	<10	<10	
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50	
4-Nitrophenol, ug/l	<50	<50	<50	<50	
Dibenzofuran, ug/l	<10	<10	<10	<10	
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10	

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86816A-9	A-GP-5-10g	11-04-98/1515		
86816A-9-RE	A-GP-5-10g	11-04-98/1515		
86816A-10	A-GP-9-8g	11-04-98/1715		
86816A-10-RE	A-GP-9-8g	11-04-98/1715		
PARAMETER	86816A-9	86816A-9-RE	86816A-10	86816A-10-RE
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10

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RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES				DATE/ TIME SAMPLED
86816A-9	A-GP-5-10g				11-04-98/1515
86816A-9-RE	A-GP-5-10g				11-04-98/1515
86816A-10	A-GP-9-8g				11-04-98/1715
86816A-10-RE	A-GP-9-8g				11-04-98/1715
PARAMETER	86816A-9	86816A-9-RE	86816A-10	86816A-10-RE	
Chrysene, ug/l	<10	<10	<10	<10	
Di-n-octylphthalate, ug/l	<10	<10	<10	<10	
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10	
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10	
Benzo(a)pyrene, ug/l	<10	<10	<10	<10	
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10	
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10	
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10	
Carbazole, ug/l	<10	<10	<10	<10	
Surrogate - Phenol d5	50 %	82 %	42 %	71 %	
Surrogate - 2-Fluorophenol	54 %	78 %	45 %	73 %	
Surrogate - 2,4,6-Tribromophenol	71 %	150 %	62 %	140 %	
Surrogate - Nitrobenzene - d5	58 %	90 %	52 %	94 %	
Surrogate - 2-Fluorobiphenyl	58 %	94 %	52 %	96 %	
Surrogate - Terphenyl - d14	22 %	80 %	14 %	92 %	
Prep Date	11.06.98	11.14.98	11.06.98	11.14.98	
Analysis Date	11.12.98	11.19.98	11.12.98	11.19.98	
Batch ID	1106C	1114D	1106C	1114D	
Dilution Factor	1.0	1.0	1.0	1.0	

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86816A-11 Method Blank
86816A-12 Lab Control Standard % Recovery

PARAMETER 86816A-11 86816A-12

TCL Semivolatiles (8270)

Phenol, ug/kg dw	<330	39 %
bis(2-Chloroethyl)ether, ug/kg dw	<330	---
2-Chlorophenol, ug/kg dw	<330	39 %
1,3-Dichlorobenzene, ug/kg dw	<330	---
1,4-Dichlorobenzene, ug/kg dw	<330	35 %
1,2-Dichlorobenzene, ug/kg dw	<330	---
2-Methylphenol (o-cresol), ug/kg dw	<330	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	---
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<330	---
N-Nitroso-di-n-propylamine, ug/kg dw	<330	39 %
Hexachloroethane, ug/kg dw	<330	---
Nitrobenzene, ug/kg dw	<330	---
Isophorone, ug/kg dw	<330	---
2-Nitrophenol, ug/kg dw	<330	---
2,4-Dimethylphenol, ug/kg dw	<330	---
bis(2-Chloroethoxy)methane, ug/kg dw	<330	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86816A-11 Method Blank
86816A-12 Lab Control Standard % Recovery

PARAMETER	86816A-11	86816A-12
2,4-Dichlorophenol, ug/kg dw	<330	---
1,2,4-Trichlorobenzene, ug/kg dw	<330	37 %
Naphthalene, ug/kg dw	<330	---
4-Chloroaniline, ug/kg dw	<660	---
Hexachlorobutadiene, ug/kg dw	<330	---
4-Chloro-3-methylphenol, ug/kg dw	<330	46 %
2-Methylnaphthalene, ug/kg dw	<330	---
Hexachlorocyclopentadiene, ug/kg dw	<330	---
2,4,6-Trichlorophenol, ug/kg dw	<330	---
2,4,5-Trichlorophenol, ug/kg dw	<330	---
2-Chloronaphthalene, ug/kg dw	<330	---
2-Nitroaniline, ug/kg dw	<1700	---
Dimethylphthalate, ug/kg dw	<330	---
Acenaphthylene, ug/kg dw	<330	---
3-Nitroaniline, ug/kg dw	<1700	---
Acenaphthene, ug/kg dw	<330	43 %
2,4-Dinitrophenol, ug/kg dw	<1700	---
4-Nitrophenol, ug/kg dw	<1700	43 %
Dibenzofuran, ug/kg dw	<330	---
2,4-Dinitrotoluene, ug/kg dw	<330	46 %
2,6-Dinitrotoluene, ug/kg dw	<330	---

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LOG NO: S8-86816A
Received: 04 NOV 98
Reported: 23 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 165581123

REPORT OF RESULTS

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DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86816A-11 Method Blank
86816A-12 Lab Control Standard % Recovery

PARAMETER	86816A-11	86816A-12
Diethylphthalate, ug/kg dw	<330	---
4-Chlorophenylphenyl ether, ug/kg dw	<330	---
Fluorene, ug/kg dw	<330	---
4-Nitroaniline, ug/kg dw	<1700	---
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	---
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---
4-Bromophenyl phenyl ether, ug/kg dw	<330	---
Hexachlorobenzene, ug/kg dw	<330	---
Pentachlorophenol, ug/kg dw	<1700	46 %
Phenanthrene, ug/kg dw	<330	---
Anthracene, ug/kg dw	<330	---
Di-n-butylphthalate, ug/kg dw	<330	---
Fluoranthene, ug/kg dw	<330	---
Pyrene, ug/kg dw	<330	58 %
Butylbenzylphthalate, ug/kg dw	<330	---
3,3'-Dichlorobenzidine, ug/kg dw	<660	---
Benzo(a)anthracene, ug/kg dw	<330	---
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86816A-11 Method Blank
86816A-12 Lab Control Standard % Recovery

PARAMETER	86816A-11	86816A-12
Chrysene, ug/kg dw	<330	---
Di-n-octylphthalate, ug/kg dw	<330	---
Benzo(b)fluoranthene, ug/kg dw	<330	---
Benzo(k)fluoranthene, ug/kg dw	<330	---
Benzo(a)pyrene, ug/kg dw	<330	---
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	---
Dibenzo(a,h)anthracene, ug/kg dw	<330	---
Benzo(g,h,i)perylene, ug/kg dw	<330	---
Carbazole, ug/kg dw	<330	---
Surrogate - Phenol d5	30 %	40 %
Surrogate - 2-Fluorophenol	33 %	41 %
Surrogate - 2,4,6-Tribromophenol	36 %	51 %
Surrogate - Nitrobenzene - d5	25 %	35 %
Surrogate - 2-Fluorobiphenyl	31 %	42 %
Surrogate - Terphenyl - d14	45 %	61 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.13.98
Batch ID	1109C	1109C
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED		DATE/
86816A-11	Method Blank		
86816A-12	Lab Control Standard % Recovery		
PARAMETER	86816A-11	86816A-12	
Arsenic (6010)			
Arsenic, mg/kg dw	<1.0	101 %	
Prep Date	11.06.98	11.06.98	
Analysis Date	11.10.98	11.10.98	
Batch ID	1106A	1106A	
Dilution Factor	1.0	1.0	
Barium (6010)			
Barium, mg/kg dw	<1.0	107 %	
Prep Date	11.06.98	11.06.98	
Analysis Date	11.10.98	11.10.98	
Batch ID	1106A	1106A	
Dilution Factor	1.0	1.0	
Cadmium (6010)			
Cadmium, mg/kg dw	<0.50	104 %	
Prep Date	11.06.98	11.06.98	
Analysis Date	11.10.98	11.10.98	
Batch ID	1106A	1106A	
Dilution Factor	1.0	1.0	
Chromium (6010)			
Chromium, mg/kg dw	<1.0	104 %	
Prep Date	11.06.98	11.06.98	
Analysis Date	11.10.98	11.10.98	
Batch ID	1106A	1106A	
Dilution Factor	1.0	1.0	

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86816A-11 Method Blank
86816A-12 Lab Control Standard % Recovery

PARAMETER	86816A-11	86816A-12
Lead (6010)		
Lead, mg/kg dw	<0.50	103 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.0	105 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Silver (6010)		
Silver, mg/kg dw	<1.0	103 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	90 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.09.98	11.09.98
Batch ID	1106S	1106S
Dilution Factor	1.0	1.0

LOG NO: S8-86816A
 Received: 04 NOV 98
 Reported: 23 NOV 98

Mr. Ron Paulling
 RUST Environment & Infrastructure
 2694 Lake Park Drive
 N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 165581123

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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86816A-13 Method Blank
 86816A-14 Lab Control Standard % Recovery
 86816A-17 Method Blank
 86816A-18 Lab Control Standard % Recovery

PARAMETER 86816A-13 86816A-14 86816A-17 86816A-18

TCL Semivolatiles (8270)

Phenol, ug/l	<10	17 %	<10	85 %
bis(2-Chloroethyl)ether, ug/l	<10	---	<10	---
2-Chlorophenol, ug/l	<10	27 %	<10	98 %
1,3-Dichlorobenzene, ug/l	<10	---	<10	---
1,4-Dichlorobenzene, ug/l	<10	26 %	<10	88 %
1,2-Dichlorobenzene, ug/l	<10	---	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---	<10	---
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	---	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	38 %	<10	112 %
Hexachloroethane, ug/l	<10	---	<10	---
Nitrobenzene, ug/l	<10	---	<10	---
Isophorone, ug/l	<10	---	<10	---
2-Nitrophenol, ug/l	<10	---	<10	---
2,4-Dimethylphenol, ug/l	<10	---	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---	<10	---

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES			
86816A-13	Method Blank			
86816A-14	Lab Control Standard % Recovery			
86816A-17	Method Blank			
86816A-18	Lab Control Standard % Recovery			
PARAMETER	86816A-13	86816A-14	86816A-17	86816A-18
2,4-Dichlorophenol, ug/l	<10	---	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	36 %	<10	92 %
Naphthalene, ug/l	<10	---	<10	---
4-Chloroaniline, ug/l	<20	---	<20	---
Hexachlorobutadiene, ug/l	<10	---	<10	---
4-Chloro-3-methylphenol, ug/l	<10	46 %	<10	100 %
2-Methylnaphthalene, ug/l	<10	---	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---	<10	---
2-Chloronaphthalene, ug/l	<10	---	<10	---
2-Nitroaniline, ug/l	<50	---	<50	---
Dimethylphthalate, ug/l	<10	---	<10	---
Acenaphthylene, ug/l	<10	---	<10	---
3-Nitroaniline, ug/l	<50	---	<50	---
Acenaphthene, ug/l	<10	42 %	<10	104 %
2,4-Dinitrophenol, ug/l	<50	---	<50	---
4-Nitrophenol, ug/l	<50	64 %	<50	79 %
Dibenzofuran, ug/l	<10	---	<10	---
2,4-Dinitrotoluene, ug/l	<10	68 %	<10	108 %

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Code: 165581123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES			
86816A-13	Method Blank			
86816A-14	Lab Control Standard % Recovery			
86816A-17	Method Blank			
86816A-18	Lab Control Standard % Recovery			
PARAMETER	86816A-13	86816A-14	86816A-17	86816A-18
2,6-Dinitrotoluene, ug/l	<10	---	<10	---
Diethylphthalate, ug/l	<10	---	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---	<10	---
Fluorene, ug/l	<10	---	<10	---
4-Nitroaniline, ug/l	<50	---	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---	<50	---
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	---	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---	<10	---
Hexachlorobenzene, ug/l	<10	---	<10	---
Pentachlorophenol, ug/l	<50	72 %	<50	94 %
Phenanthrene, ug/l	<10	---	<10	---
Anthracene, ug/l	<10	---	<10	---
Di-n-butylphthalate, ug/l	<10	---	<10	---
Fluoranthene, ug/l	<10	---	<10	---
Pyrene, ug/l	<10	70 %	<10	124 %
Butylbenzylphthalate, ug/l	<10	---	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---	<20	---
Benzo(a)anthracene, ug/l	<10	---	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---	<10	---

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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86816A-13	Method Blank
86816A-14	Lab Control Standard % Recovery
86816A-17	Method Blank
86816A-18	Lab Control Standard % Recovery

PARAMETER	86816A-13	86816A-14	86816A-17	86816A-18
Chrysene, ug/l	<10	---	<10	---
Di-n-octylphthalate, ug/l	<10	---	<10	---
Benzo(b)fluoranthene, ug/l	<10	---	<10	---
Benzo(k)fluoranthene, ug/l	<10	---	<10	---
Benzo(a)pyrene, ug/l	<10	---	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---	<10	---
Carbazole, ug/l	<10	---	<10	---
Surrogate - Phenol d5	63 %	18 %	86 %	88 %
Surrogate - 2-Fluorophenol	64 %	12 %	86 %	100 %
Surrogate - 2,4,6-Tribromophenol	65 %	62 %	150 %	130 %
Surrogate - Nitrobenzene - d5	66 %	32 %	104 %	106 %
Surrogate - 2-Fluorobiphenyl	64 %	36 %	108 %	110 %
Surrogate - Terphenyl - d14	92 %	72 %	108 %	136 %
Prep Date	11.06.98	11.06.98	11.14.98	11.14.98
Analysis Date	11.12.98	11.12.98	11.19.98	11.17.98
Batch ID	1106C	1106C	1114D	1114D
Dilution Factor	1.0	---	1.0	---

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

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REPORT OF RESULTS

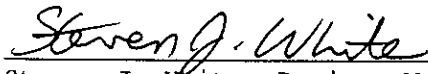
LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

PARAMETER

Methods: EPA SW-846, Update III.

*Water Samples A-GP-10-10g, A-GP-6-10FB, A-GP-7-10g, A-GP-7-10 Dup, A-GP-3-10g, A-GP-5-10g, A-GP-4-10g, A-GP-9-8g were re-extracted for semivolatiles due to low laboratory control standard recovery for phenol in analytical batch 1106C. Both sets of data are reported.

*F33 = Because the sample was diluted prior to analysis, surrogate recoveries are not reported.



Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Phone: (912) 354-7858
 Phone: (904) 878-3994
 Phone: (954) 421-7400
 Phone: (334) 666-6633
 Phone: (813) 885-7427
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5102 LaRoche Avenue, Savannah, GA 31404
 2846 Industrial Plaza Drive, Tallahassee, FL 32301
 414 SW 12th Avenue, Deerfield Beach, FL 33442
 900 Lakeside Drive, Mobile, AL 36693
 6712 Benjamin Road, Suite 100, Tampa, FL 33634
 100 Alpha Drive, Suite 110, Destrehan, LA 70047

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER	MATRIX TYPE		REQUIRED ANALYSES		PAGE 1 OF
F4 Stewart/SWMU 13		32369	10900					
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX					
GA	Melanie Hill	(843) 572-5200	(843) 572-5200					
CLIENT NAME	CLIENT PROJECT MANAGER							
Earth Tech	Ron Paulding							
CLIENT ADDRESS (CITY, STATE, ZIP)								
2694A Lake Park Dr, Uvas, SC 29418								
SAMPLE	SL NO.	SAMPLE IDENTIFICATION	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)
11/4/98 1030		A-GP-6-10g			Melanie D. Hill	11/19/98	1915	
1100		A-GP-6-10 FB						
1150		A-GP-7-10g						
1155		A-GP-7-10 Dup						
1240		A-GP-3-10g						
1445		A-GP-4-10g						
1515		A-GP-5-10g						
1620		A-GP-9-0s						
1715		A-GP-9-8g						
1710		A-GP-9-6s						
1030		Trip Blank						
RELINQUISHED BY: (SIGNATURE)					RELINQUISHED BY: (SIGNATURE)			
Saw Dal					Melanie D. Hill			
RECEIVED BY: (SIGNATURE)					RECEIVED BY: (SIGNATURE)			
Melanie D. Hill					M. Paulding			
DATE		TIME		DATE		TIME		
11/5/98		8:00		11/19/98		1915		
RECEIVED FOR LABORATORY BY: (SIGNATURE)				RECEIVED FOR LABORATORY BY: (SIGNATURE)				
E. Hill				M. Paulding				
DATE				DATE				
11/5/98				11/19/98				
TIME				TIME				
8:00				1915				
CUSTODY SEAL NO.				SL LOG NO.				
YES ☒ NO ☐				58-86816				
LABORATORY USE ONLY								
LABORATORY REMARKS:								

STANDARD REPORT DELIVERY ☒ EXCEPT
 EXPEDITED REPORT DELIVERY (surcharge) ☐

Date Due:

REMARKS

NUMBER OF CONTAINERS SUBMITTED

6W VOA's
 * 48 hr *
 * core
 sample
 * Headspace = 50ppm

RUSH

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86934
Received: 09 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 100981123

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934-1	B-GP-13-6s	11-09-98/1145		
86934-2	B-GP-16-6s	11-09-98/1635		
86934-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER		86934-1	86934-2	86934-3
Volatiles by GC/MS (8260)				
Chloromethane, ug/kg dw		<12	<12	<12
Bromomethane, ug/kg dw		<12	<12	<12
Vinyl chloride, ug/kg dw		<12	<12	<12
Chloroethane, ug/kg dw		<12	<12	<12
Methylene chloride (Dichloromethane), ug/kg dw		<6.0	<6.1	<6.1
Acetone, ug/kg dw		<60	<61	<61
Carbon disulfide, ug/kg dw		<6.0	<6.1	<6.1
1,1-Dichloroethene, ug/kg dw		<6.0	<6.1	<6.1
1,1-Dichloroethane, ug/kg dw		<6.0	<6.1	<6.1
Cis/Trans-1,2-Dichloroethene, ug/kg dw		<6.0	<6.1	<6.1
Chloroform, ug/kg dw		<6.0	<6.1	<6.1
1,2-Dichloroethane, ug/kg dw		<6.0	<6.1	<6.1
2-Butanone (MEK), ug/kg dw		<30	<30	<30
1,1,1-Trichloroethane, ug/kg dw		<6.0	<6.1	<6.1
Carbon tetrachloride, ug/kg dw		<6.0	<6.1	<6.1
Bromodichloromethane, ug/kg dw		<6.0	<6.1	<6.1
1,1,2,2-Tetrachloroethane, ug/kg dw		<6.0	<6.1	<6.1
1,2-Dichloropropane, ug/kg dw		<6.0	<6.1	<6.1
trans-1,3-Dichloropropene, ug/kg dw		<6.0	<6.1	<6.1
Trichloroethene, ug/kg dw		<6.0	<6.1	<6.1

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Page 2

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934-1	B-GP-13-6s	11-09-98/1145		
86934-2	B-GP-16-6s	11-09-98/1635		
86934-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER		86934-1	86934-2	86934-3
Dibromochloromethane, ug/kg dw		<6.0	<6.1	<6.1
1,1,2-Trichloroethane, ug/kg dw		<6.0	<6.1	<6.1
Benzene, ug/kg dw		<6.0	<6.1	<6.1
cis-1,3-Dichloropropene, ug/kg dw		<6.0	<6.1	<6.1
Bromoform, ug/kg dw		<6.0	<6.1	<6.1
2-Hexanone, ug/kg dw		<30	<30	<30
4-Methyl-2-pentanone (MIBK), ug/kg dw		<30	<30	<30
Tetrachloroethene, ug/kg dw		<6.0	<6.1	<6.1
Toluene, ug/kg dw		<6.0	<6.1	<6.1
Chlorobenzene, ug/kg dw		<6.0	<6.1	<6.1
Ethylbenzene, ug/kg dw		<6.0	<6.1	<6.1
Styrene, ug/kg dw		<6.0	<6.1	<6.1
Xylenes, ug/kg dw		<6.0	<6.1	<6.1
Surrogate - Toluene-d8		107 %	103 %	103 %
Surrogate - 4-Bromofluorobenzene		105 %	108 %	106 %
Surrogate - Dibromofluoromethane		118 %	115 %	115 %
Analysis Date		11.11.98	11.11.98	11.11.98
Batch ID		2H1110	2H1110	2H1110
Dilution Factor		1.0	1.0	1.0

LOG NO: S8-86934
Received: 09 NOV 98
Reported: 19 NOV 98Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 100981123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86934-4	B-GP-13-9g	11-09-98/1200			
86934-5	B-GP-16-8-RB	11-09-98/1625			
86934-6	B-GP-16-8g	11-09-98/1700			
86934-7	B-GP-16-8-Dup	11-09-98/1705			
PARAMETER	86934-4	86934-5	86934-6	86934-7	
Volatiles by GC/MS (8260)					
Chloromethane, ug/l	<10	<10	<10	<10	
Bromomethane, ug/l	<10	<10	<10	<10	
Vinyl chloride, ug/l	<2.0	<2.0	<2.0	<2.0	
Chloroethane, ug/l	<10	<10	<10	<10	
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0	<5.0	<5.0	
Acetone, ug/l	<50	<50	<50	<50	
Carbon disulfide, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Chloroform, ug/l	<5.0	<5.0	<5.0	<5.0	
1,2-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
2-Butanone (MEK), ug/l	<25	<25	<25	<25	
1,1,1-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Carbon tetrachloride, ug/l	<5.0	<5.0	<5.0	<5.0	
Bromodichloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,2-Dichloropropane, ug/l	<5.0	<5.0	<5.0	<5.0	
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: S8-86934
Received: 09 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 100981123

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86934-4	B-GP-13-9g	11-09-98/1200			
86934-5	B-GP-16-8-RB	11-09-98/1625			
86934-6	B-GP-16-8g	11-09-98/1700			
86934-7	B-GP-16-8-Dup	11-09-98/1705			
PARAMETER	86934-4	86934-5	86934-6	86934-7	
Trichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Dibromochloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1,2-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Benzene, ug/l	<5.0	<5.0	<5.0	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	
Bromoform, ug/l	<5.0	<5.0	<5.0	<5.0	
2-Hexanone, ug/l	<25	<25	<25	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25	<25	<25	
Tetrachloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Toluene, ug/l	<5.0	<5.0	<5.0	<5.0	
Chlorobenzene, ug/l	<5.0	<5.0	<5.0	<5.0	
Ethylbenzene, ug/l	<5.0	<5.0	<5.0	<5.0	
Styrene, ug/l	<5.0	<5.0	<5.0	<5.0	
Xylenes, ug/l	<5.0	<5.0	<5.0	<5.0	
Surrogate - Toluene-d8	112 %	112 %	112 %	114 %	
Surrogate - 4-Bromofluorobenzene	102 %	104 %	102 %	104 %	
Surrogate - Dibromofluoromethane	112 %	108 %	112 %	112 %	
Analysis Date	11.11.98	11.11.98	11.11.98	11.11.98	
Batch ID	2L1110	2L1110	2L1110	2L1110	
Dilution Factor	1.0	1.0	1.0	1.0	

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Code: 100981123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934-8	Method Blank	
86934-9	Lab Control Standard % Recovery	
PARAMETER	86934-8	86934-9
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	151 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	92 %
Dibromochloromethane, ug/kg dw	<5.0	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934-8	Method Blank	
86934-9	Lab Control Standard % Recovery	
PARAMETER	86934-8	86934-9
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	92 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	85 %
Chlorobenzene, ug/kg dw	<5.0	94 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	106 %
Surrogate - 4-Bromofluorobenzene	108 %	108 %
Surrogate - Dibromofluoromethane	120 %	134 %
Analysis Date	11.10.98	11.10.98
Batch ID	2H1110	2H1110
Dilution Factor	1.0	1.0

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Code: 100981123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86934-10	Method Blank	
86934-11	Lab Control Standard % Recovery	
PARAMETER	86934-10	86934-11
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	106 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	93 %
Dibromochloromethane, ug/l	<5.0	---

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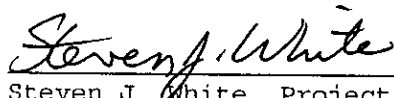
Code: 100981123

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86934-10	Method Blank	
86934-11	Lab Control Standard % Recovery	
PARAMETER	86934-10	86934-11
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	93 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	88 %
Chlorobenzene, ug/l	<5.0	92 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	112 %	113 %
Surrogate - 4-Bromofluorobenzene	104 %	105 %
Surrogate - Dibromofluoromethane	108 %	107 %
Analysis Date	11.10.98	---
Batch ID	2L1110	2L1110
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.



Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

- ☒ 5102 LaRoche Avenue, Savannah, GA 31404
- ☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
- ☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
- ☐ 900 Lakeside Drive, Mobile, AL 36693
- ☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
- ☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

- Phone: (912) 354-7858
- Phone: (904) 878-3994
- Phone: (954) 421-7400
- Phone: (334) 666-6633
- Phone: (813) 885-7427
- Phone: (504) 764-1100

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER	MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
Ft Stewart		32369	10900			1	1
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX				
GA	Melanie D. Hill	(843) 572-5000	(843) 572-5000				
CLIENT NAME	CLIENT PROJECT MANAGER						
Earthtech	Ron Paulding						
CLIENT ADDRESS (CITY, STATE, ZIP)							
2604A Lake Park Dr, N. Cross, SC 29418							
SAMPLE	DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED	REMARKS	
11/9/98	1145			B-GP-13 - 65	2	1	1
	1200			B-GP-13 - 99	3	2	
	1635			B-GP-14 - 63	2	1	1
	1640			B-GP-16 - 6-Dup	2	1	1
	1625			B-GP-16 - 8-RB	3		
	1700			B-GP-16 - 8 - g	3	2	
	1705			B-GP-16 - 8 - Dup	3	2	
RUSH							
11/9/98	1000			Trip Blank	3		
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME
S. Cunningham		11/9/98		Melanie D. Hill		11/9/98	1945
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME
MDHue		11/5/98		K. L. K.		11/9/98	1950

LABORATORY USE ONLY				LABORATORY REMARKS:	
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.
	11/10/98	8:00	☒ YES ☐ NO		58-86934

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86934
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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 130281119

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934-1	B-GP-13-6s	11-09-98/1145		
86934-2	B-GP-16-6s	11-09-98/1635		
86934-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER		86934-1	86934-2	86934-3
Volatiles by GC/MS (8260)				
Chloromethane, ug/kg dw		<12	<12	<12
Bromomethane, ug/kg dw		<12	<12	<12
Vinyl chloride, ug/kg dw		<12	<12	<12
Chloroethane, ug/kg dw		<12	<12	<12
Methylene chloride (Dichloromethane), ug/kg dw		<6.0	<6.1	<6.1
Acetone, ug/kg dw		<60	<61	<61
Carbon disulfide, ug/kg dw		<6.0	<6.1	<6.1
1,1-Dichloroethene, ug/kg dw		<6.0	<6.1	<6.1
1,1-Dichloroethane, ug/kg dw		<6.0	<6.1	<6.1
Cis/Trans-1,2-Dichloroethene, ug/kg dw		<6.0	<6.1	<6.1
Chloroform, ug/kg dw		<6.0	<6.1	<6.1
1,2-Dichloroethane, ug/kg dw		<6.0	<6.1	<6.1
2-Butanone (MEK), ug/kg dw		<30	<30	<30
1,1,1-Trichloroethane, ug/kg dw		<6.0	<6.1	<6.1
Carbon tetrachloride, ug/kg dw		<6.0	<6.1	<6.1
Bromodichloromethane, ug/kg dw		<6.0	<6.1	<6.1
1,1,2,2-Tetrachloroethane, ug/kg dw		<6.0	<6.1	<6.1
1,2-Dichloropropane, ug/kg dw		<6.0	<6.1	<6.1
trans-1,3-Dichloropropene, ug/kg dw		<6.0	<6.1	<6.1
Trichloroethene, ug/kg dw		<6.0	<6.1	<6.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86934-1	B-GP-13-6s	11-09-98/1145		
86934-2	B-GP-16-6s	11-09-98/1635		
86934-3	B-GP-16-6-Dup	11-09-98/1640		
PARAMETER	86934-1	86934-2	86934-3	
Dibromochloromethane, ug/kg dw	<6.0	<6.1	<6.1	
1,1,2-Trichloroethane, ug/kg dw	<6.0	<6.1	<6.1	
Benzene, ug/kg dw	<6.0	<6.1	<6.1	
cis-1,3-Dichloropropene, ug/kg dw	<6.0	<6.1	<6.1	
Bromoform, ug/kg dw	<6.0	<6.1	<6.1	
2-Hexanone, ug/kg dw	<30	<30	<30	
4-Methyl-2-pentanone (MIBK), ug/kg dw	<30	<30	<30	
Tetrachloroethene, ug/kg dw	<6.0	<6.1	<6.1	
Toluene, ug/kg dw	<6.0	<6.1	<6.1	
Chlorobenzene, ug/kg dw	<6.0	<6.1	<6.1	
Ethylbenzene, ug/kg dw	<6.0	<6.1	<6.1	
Styrene, ug/kg dw	<6.0	<6.1	<6.1	
Xylenes, ug/kg dw	<6.0	<6.1	<6.1	
Surrogate - Toluene-d8	107 %	103 %	103 %	
Surrogate - 4-Bromofluorobenzene	105 %	108 %	106 %	
Surrogate - Dibromofluoromethane	118 %	115 %	115 %	
Analysis Date	11.11.98	11.11.98	11.11.98	
Batch ID	2H1110	2H1110	2H1110	
Dilution Factor	1.0	1.0	1.0	

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86934-4	B-GP-13-9g	11-09-98/1200			
86934-5	B-GP-16-8-RB	11-09-98/1625			
86934-6	B-GP-16-8g	11-09-98/1700			
86934-7	B-GP-16-8-Dup	11-09-98/1705			
PARAMETER	86934-4	86934-5	86934-6	86934-7	
Volatiles by GC/MS (8260)					
Chloromethane, ug/l	<10	<10	<10	<10	
Bromomethane, ug/l	<10	<10	<10	<10	
Vinyl chloride, ug/l	<2.0	<2.0	<2.0	<2.0	
Chloroethane, ug/l	<10	<10	<10	<10	
Methylene chloride (Dichloromethane), ug/l	<5.0	<5.0	<5.0	<5.0	
Acetone, ug/l	<50	<50	<50	<50	
Carbon disulfide, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Chloroform, ug/l	<5.0	<5.0	<5.0	<5.0	
1,2-Dichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
2-Butanone (MEK), ug/l	<25	<25	<25	<25	
1,1,1-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Carbon tetrachloride, ug/l	<5.0	<5.0	<5.0	<5.0	
Bromodichloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1,2,2-Tetrachloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,2-Dichloropropane, ug/l	<5.0	<5.0	<5.0	<5.0	
trans-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	

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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86934-4	B-GP-13-9g	11-09-98/1200			
86934-5	B-GP-16-8-RB	11-09-98/1625			
86934-6	B-GP-16-8g	11-09-98/1700			
86934-7	B-GP-16-8-Dup	11-09-98/1705			
PARAMETER	86934-4	86934-5	86934-6	86934-7	
Trichloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Dibromochloromethane, ug/l	<5.0	<5.0	<5.0	<5.0	
1,1,2-Trichloroethane, ug/l	<5.0	<5.0	<5.0	<5.0	
Benzene, ug/l	<5.0	<5.0	<5.0	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	<5.0	<5.0	<5.0	
Bromoform, ug/l	<5.0	<5.0	<5.0	<5.0	
2-Hexanone, ug/l	<25	<25	<25	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	<25	<25	<25	
Tetrachloroethene, ug/l	<5.0	<5.0	<5.0	<5.0	
Toluene, ug/l	<5.0	<5.0	<5.0	<5.0	
Chlorobenzene, ug/l	<5.0	<5.0	<5.0	<5.0	
Ethylbenzene, ug/l	<5.0	<5.0	<5.0	<5.0	
Styrene, ug/l	<5.0	<5.0	<5.0	<5.0	
Xylenes, ug/l	<5.0	<5.0	<5.0	<5.0	
Surrogate - Toluene-d8	112 %	112 %	112 %	114 %	
Surrogate - 4-Bromofluorobenzene	102 %	104 %	102 %	104 %	
Surrogate - Dibromofluoromethane	112 %	108 %	112 %	112 %	
Analysis Date	11.11.98	11.11.98	11.11.98	11.11.98	
Batch ID	2L1110	2L1110	2L1110	2L1110	
Dilution Factor	1.0	1.0	1.0	1.0	

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Received: 09 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130281119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934-8	Method Blank	
86934-9	Lab Control Standard % Recovery	
PARAMETER	86934-8	86934-9
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	151 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	92 %
Dibromochloromethane, ug/kg dw	<5.0	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86934-8	Method Blank	
86934-9	Lab Control Standard % Recovery	
PARAMETER	86934-8	86934-9
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	92 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	85 %
Chlorobenzene, ug/kg dw	<5.0	94 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	106 %
Surrogate - 4-Bromofluorobenzene	108 %	108 %
Surrogate - Dibromofluoromethane	120 %	134 %
Analysis Date	11.10.98	11.10.98
Batch ID	2H1110	2H1110
Dilution Factor	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86934-10	Method Blank	
86934-11	Lab Control Standard % Recovery	
PARAMETER	86934-10	86934-11
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	106 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	93 %
Dibromochloromethane, ug/l	<5.0	---

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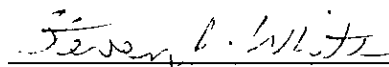
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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86934-10	Method Blank	
86934-11	Lab Control Standard % Recovery	
PARAMETER	86934-10	86934-11
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	93 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	88 %
Chlorobenzene, ug/l	<5.0	92 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	112 %	113 %
Surrogate - 4-Bromofluorobenzene	104 %	105 %
Surrogate - Dibromofluoromethane	108 %	107 %
Analysis Date	11.10.98	---
Batch ID	2L1110	2L1110
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES
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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

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Page 1

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
TCL Semivolatiles (8270)		
Phenol, ug/kg dw	<390	<400
bis(2-Chloroethyl)ether, ug/kg dw	<390	<400
2-Chlorophenol, ug/kg dw	<390	<400
1,3-Dichlorobenzene, ug/kg dw	<390	<400
1,4-Dichlorobenzene, ug/kg dw	<390	<400
1,2-Dichlorobenzene, ug/kg dw	<390	<400
2-Methylphenol (o-cresol), ug/kg dw	<390	<400
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<390	<400
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<390	<400
N-Nitroso-di-n-propylamine, ug/kg dw	<390	<400
Hexachloroethane, ug/kg dw	<390	<400
Nitrobenzene, ug/kg dw	<390	<400
Isophorone, ug/kg dw	<390	<400
2-Nitrophenol, ug/kg dw	<390	<400
2,4-Dimethylphenol, ug/kg dw	<390	<400
bis(2-Chloroethoxy)methane, ug/kg dw	<390	<400

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
2,4-Dichlorophenol, ug/kg dw	<390	<400
1,2,4-Trichlorobenzene, ug/kg dw	<390	<400
Naphthalene, ug/kg dw	<390	<400
4-Chloroaniline, ug/kg dw	<770	<800
Hexachlorobutadiene, ug/kg dw	<390	<400
4-Chloro-3-methylphenol, ug/kg dw	<390	<400
2-Methylnaphthalene, ug/kg dw	<390	<400
Hexachlorocyclopentadiene, ug/kg dw	<390	<400
2,4,6-Trichlorophenol, ug/kg dw	<390	<400
2,4,5-Trichlorophenol, ug/kg dw	<390	<400
2-Chloronaphthalene, ug/kg dw	<390	<400
2-Nitroaniline, ug/kg dw	<2000	<2000
Dimethylphthalate, ug/kg dw	<390	<400
Acenaphthylene, ug/kg dw	<390	<400
3-Nitroaniline, ug/kg dw	<2000	<2000
Acenaphthene, ug/kg dw	<390	<400
2,4-Dinitrophenol, ug/kg dw	<2000	<2000
4-Nitrophenol, ug/kg dw	<2000	<2000
Dibenzofuran, ug/kg dw	<390	<400
2,4-Dinitrotoluene, ug/kg dw	<390	<400
2,6-Dinitrotoluene, ug/kg dw	<390	<400

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
Diethylphthalate, ug/kg dw	<390	<400
4-Chlorophenylphenyl ether, ug/kg dw	<390	<400
Fluorene, ug/kg dw	<390	<400
4-Nitroaniline, ug/kg dw	<2000	<2000
4,6-Dinitro-2-methylphenol, ug/kg dw	<2000	<2000
N-Nitrosodiphenylamine/Diph enylamine, ug/kg dw	<390	<400
4-Bromophenyl phenyl ether, ug/kg dw	<390	<400
Hexachlorobenzene, ug/kg dw	<390	<400
Pentachlorophenol, ug/kg dw	<2000	<2000
Phenanthrene, ug/kg dw	<390	<400
Anthracene, ug/kg dw	<390	<400
Di-n-butylphthalate, ug/kg dw	<390	<400
Fluoranthene, ug/kg dw	<390	<400
Pyrene, ug/kg dw	<390	<400
Butylbenzylphthalate, ug/kg dw	<390	<400
3,3'-Dichlorobenzidine, ug/kg dw	<770	<800
Benzo(a)anthracene, ug/kg dw	<390	<400
bis(2-Ethylhexyl)phthalate, ug/kg dw	<390	<400

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
Chrysene, ug/kg dw	<390	<400
Di-n-octylphthalate, ug/kg dw	<390	<400
Benzo(b)fluoranthene, ug/kg dw	<390	<400
Benzo(k)fluoranthene, ug/kg dw	<390	<400
Benzo(a)pyrene, ug/kg dw	<390	<400
Indeno(1,2,3-cd)pyrene, ug/kg dw	<390	<400
Dibenzo(a,h)anthracene, ug/kg dw	<390	<400
Benzo(g,h,i)perylene, ug/kg dw	<390	<400
Carbazole, ug/kg dw	<390	<400
Surrogate - Phenol d5	41 %	52 %
Surrogate - 2-Fluorophenol	38 %	48 %
Surrogate - 2,4,6-Tribromophenol	46 %	62 %
Surrogate - Nitrobenzene - d5	42 %	55 %
Surrogate - 2-Fluorobiphenyl	37 %	46 %
Surrogate - Terphenyl - d14	32 %	44 %
Prep Date	11.05.98	11.05.98
Analysis Date	11.11.98	11.11.98
Batch ID	1105A	1105A
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
Arsenic (6010)		
Arsenic, mg/kg dw	<1.2	2.0
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	6.8	14
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Cadmium (6010)		
Cadmium, mg/kg dw	<0.59	<0.55
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Chromium (6010)		
Chromium, mg/kg dw	4.6	15
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86781A-1	A-GP-2-6s	11-03-98/0845
86781A-2	A-GP-8-6s	11-03-98/1230
PARAMETER	86781A-1	86781A-2
Lead (6010)		
Lead, mg/kg dw	2.2	10
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.2	<1.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Silver (6010)		
Silver, mg/kg dw	<1.2	<1.1
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.012	<0.011
Prep Date	11.06.98	11.06.98
Analysis Date	11.09.98	11.09.98
Batch ID	1106S	1106S
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86781A-3	A-GP-2-8g	11-03-98/0848		
86781A-3-RE	A-GP-2-8g	11-03-98/0848		
86781A-4	A-GP-8-8g	11-03-98/1235		
86781A-4-RE	A-GP-8-8g	11-03-98/1235		
PARAMETER	86781A-3	86781A-3-RE	86781A-4	86781A-4-RE
TCL Semivolatiles (8270)				
Phenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10	<10	<10
2-Chlorophenol, ug/l	<10	<10	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10	<10	<10
Hexachloroethane, ug/l	<10	<10	<10	<10
Nitrobenzene, ug/l	<10	<10	<10	<10
Isophorone, ug/l	<10	<10	<10	<10
2-Nitrophenol, ug/l	<10	<10	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<10	<10	<10	<10

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86781A-3	A-GP-2-8g	11-03-98/0848		
86781A-3-RE	A-GP-2-8g	11-03-98/0848		
86781A-4	A-GP-8-8g	11-03-98/1235		
86781A-4-RE	A-GP-8-8g	11-03-98/1235		
PARAMETER	86781A-3	86781A-3-RE	86781A-4	86781A-4-RE
2,4-Dichlorophenol, ug/l	<10	<10	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10	<10	<10
Naphthalene, ug/l	<10	<10	<10	<10
4-Chloroaniline, ug/l	<20	<20	<20	<20
Hexachlorobutadiene, ug/l	<10	<10	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10	<10	<10
2-Methylnaphthalene, ug/l	<10	<10	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10	<10	<10
2-Chloronaphthalene, ug/l	<10	<10	<10	<10
2-Nitroaniline, ug/l	<50	<50	<50	<50
Dimethylphthalate, ug/l	<10	<10	<10	<10
Acenaphthylene, ug/l	<10	<10	<10	<10
3-Nitroaniline, ug/l	<50	<50	<50	<50
Acenaphthene, ug/l	<10	<10	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50	<50	<50
4-Nitrophenol, ug/l	<50	<50	<50	<50
Dibenzofuran, ug/l	<10	<10	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10	<10	<10

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RUST Environment & Infrastructure

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86781A-3	A-GP-2-8g	11-03-98/0848		
86781A-3-RE	A-GP-2-8g	11-03-98/0848		
86781A-4	A-GP-8-8g	11-03-98/1235		
86781A-4-RE	A-GP-8-8g	11-03-98/1235		
PARAMETER	86781A-3	86781A-3-RE	86781A-4	86781A-4-RE
2,6-Dinitrotoluene, ug/l	<10	<10	<10	<10
Diethylphthalate, ug/l	<10	<10	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10	<10	<10
Fluorene, ug/l	<10	<10	<10	<10
4-Nitroaniline, ug/l	<50	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50	<50
Phenanthrene, ug/l	<10	<10	<10	<10
Anthracene, ug/l	<10	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10	<10
Fluoranthene, ug/l	<10	<10	<10	<10
Pyrene, ug/l	<10	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10	<10

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86781A-3-RE	A-GP-2-8g			11-03-98/0848
86781A-4	A-GP-8-8g			11-03-98/1235
86781A-4-RE	A-GP-8-8g			11-03-98/1235
PARAMETER	86781A-3	86781A-3-RE	86781A-4	86781A-4-RE
Chrysene, ug/l	<10	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10	<10
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10	<10
Benzo(g,h,i)perylene, ug/l	<10	<10	<10	<10
Carbazole, ug/l	<10	<10	<10	<10
Surrogate - Phenol d5	65 %	79 %	61 %	76 %
Surrogate - 2-Fluorophenol	66 %	82 %	62 %	74 %
Surrogate - 2,4,6-Tribromophenol	86 %	100 %	83 %	120 %
Surrogate - Nitrobenzene - d5	72 %	98 %	70 %	88 %
Surrogate - 2-Fluorobiphenyl	76 %	96 %	72 %	86 %
Surrogate - Terphenyl - d14	36 %	36 %	32 %	120 %
Prep Date	11.06.98	11.14.98	11.06.98	11.14.98
Analysis Date	11.11.98	11.17.98	11.11.98	11.17.98
Batch ID	1106C	1114D	1106C	1114D
Dilution Factor	1.0	1.0	1.0	1.0

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER 86781A-5 86781A-6

TCL Semivolatiles (8270)

Phenol, ug/kg dw	<330	32 %
bis(2-Chloroethyl)ether, ug/kg dw	<330	---
2-Chlorophenol, ug/kg dw	<330	32 %
1,3-Dichlorobenzene, ug/kg dw	<330	---
1,4-Dichlorobenzene, ug/kg dw	<330	29 %
1,2-Dichlorobenzene, ug/kg dw	<330	---
2-Methylphenol (o-cresol), ug/kg dw	<330	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	---
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<330	---
N-Nitroso-di-n-propylamine, ug/kg dw	<330	34 %
Hexachloroethane, ug/kg dw	<330	---
Nitrobenzene, ug/kg dw	<330	---
Isophorone, ug/kg dw	<330	---
2-Nitrophenol, ug/kg dw	<330	---
2,4-Dimethylphenol, ug/kg dw	<330	---
bis(2-Chloroethoxy)methane, ug/kg dw	<330	---

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER	86781A-5	86781A-6
2,4-Dichlorophenol, ug/kg dw	<330	---
1,2,4-Trichlorobenzene, ug/kg dw	<330	31 %
Naphthalene, ug/kg dw	<330	---
4-Chloroaniline, ug/kg dw	<660	---
Hexachlorobutadiene, ug/kg dw	<330	---
4-Chloro-3-methylphenol, ug/kg dw	<330	36 %
2-Methylnaphthalene, ug/kg dw	<330	---
Hexachlorocyclopentadiene, ug/kg dw	<330	---
2,4,6-Trichlorophenol, ug/kg dw	<330	---
2,4,5-Trichlorophenol, ug/kg dw	<330	---
2-Chloronaphthalene, ug/kg dw	<330	---
2-Nitroaniline, ug/kg dw	<1700	---
Dimethylphthalate, ug/kg dw	<330	---
Acenaphthylene, ug/kg dw	<330	---
3-Nitroaniline, ug/kg dw	<1700	---
Acenaphthene, ug/kg dw	<330	36 %
2,4-Dinitrophenol, ug/kg dw	<1700	---
4-Nitrophenol, ug/kg dw	<1700	27 %
Dibenzofuran, ug/kg dw	<330	---
2,4-Dinitrotoluene, ug/kg dw	<330	35 %
2,6-Dinitrotoluene, ug/kg dw	<330	---

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER	86781A-5	86781A-6
Diethylphthalate, ug/kg dw	<330	---
4-Chlorophenylphenyl ether, ug/kg dw	<330	---
Fluorene, ug/kg dw	<330	---
4-Nitroaniline, ug/kg dw	<1700	---
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	---
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---
4-Bromophenyl phenyl ether, ug/kg dw	<330	---
Hexachlorobenzene, ug/kg dw	<330	---
Pentachlorophenol, ug/kg dw	<1700	34 %
Phenanthrene, ug/kg dw	<330	---
Anthracene, ug/kg dw	<330	---
Di-n-butylphthalate, ug/kg dw	<330	---
Fluoranthene, ug/kg dw	<330	---
Pyrene, ug/kg dw	<330	41 %
Butylbenzylphthalate, ug/kg dw	<330	---
3,3'-Dichlorobenzidine, ug/kg dw	<660	---
Benzo(a)anthracene, ug/kg dw	<330	---
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	---

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER	86781A-5	86781A-6
Chrysene, ug/kg dw	<330	---
Di-n-octylphthalate, ug/kg dw	<330	---
Benzo(b)fluoranthene, ug/kg dw	<330	---
Benzo(k)fluoranthene, ug/kg dw	<330	---
Benzo(a)pyrene, ug/kg dw	<330	---
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	---
Dibenzo(a,h)anthracene, ug/kg dw	<330	---
Benzo(g,h,i)perylene, ug/kg dw	<330	---
Carbazole, ug/kg dw	<330	---
Surrogate - Phenol d5	30 %	35 %
Surrogate - 2-Fluorophenol	33 %	36 %
Surrogate - 2,4,6-Tribromophenol	42 %	47 %
Surrogate - Nitrobenzene - d5	26 %	29 %
Surrogate - 2-Fluorobiphenyl	29 %	47 %
Surrogate - Terphenyl - d14	41 %	47 %
Prep Date	11.05.98	11.05.98
Analysis Date	11.09.98	11.09.98
Batch ID	1105A	1105A
Dilution Factor	1.0	1.0

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER 86781A-5 86781A-6

Arsenic (6010)

Arsenic, mg/kg dw	<1.0	101 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

Barium (6010)

Barium, mg/kg dw	<1.0	107 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

Cadmium (6010)

Cadmium, mg/kg dw	<0.50	104 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

Chromium (6010)

Chromium, mg/kg dw	<1.0	104 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0

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86781A-5 Method Blank
86781A-6 Lab Control Standard % Recovery

PARAMETER	86781A-5	86781A-6
Lead (6010)		
Lead, mg/kg dw	<0.50	103 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.0	105 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Silver (6010)		
Silver, mg/kg dw	<1.0	103 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.10.98	11.10.98
Batch ID	1106A	1106A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	90 %
Prep Date	11.06.98	11.06.98
Analysis Date	11.09.98	11.09.98
Batch ID	1106S	1106S
Dilution Factor	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED		
86781A-7	Method Blank			
86781A-8	Lab Control Standard % Recovery			
86781A-11	Method Blank			
86781A-12	Lab Control Standard % Recovery			
PARAMETER	86781A-7	86781A-8	86781A-11	86781A-12
TCL Semivolatiles (8270)				
Phenol, ug/l	<10	17 %	<10	85 %
bis(2-Chloroethyl)ether, ug/l	<10	---	<10	---
2-Chlorophenol, ug/l	<10	27 %	<10	98 %
1,3-Dichlorobenzene, ug/l	<10	---	<10	---
1,4-Dichlorobenzene, ug/l	<10	26 %	<10	98 %
1,2-Dichlorobenzene, ug/l	<10	---	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---	<10	---
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	---	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	38 %	<10	88 %
Hexachloroethane, ug/l	<10	---	<10	---
Nitrobenzene, ug/l	<10	---	<10	---
Isophorone, ug/l	<10	---	<10	---
2-Nitrophenol, ug/l	<10	---	<10	---
2,4-Dimethylphenol, ug/l	<10	---	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---	<10	---

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86781A-7	Method Blank			
86781A-8	Lab Control Standard % Recovery			
86781A-11	Method Blank			
86781A-12	Lab Control Standard % Recovery			
PARAMETER	86781A-7	86781A-8	86781A-11	86781A-12
2,4-Dichlorophenol, ug/l	<10	---	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	36 %	<10	112 %
Naphthalene, ug/l	<10	---	<10	---
4-Chloroaniline, ug/l	<20	---	<20	---
Hexachlorobutadiene, ug/l	<10	---	<10	---
4-Chloro-3-methylphenol, ug/l	<10	46 %	<10	92 %
2-Methylnaphthalene, ug/l	<10	---	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---	<10	---
2-Chloronaphthalene, ug/l	<10	---	<10	---
2-Nitroaniline, ug/l	<50	---	<50	---
Dimethylphthalate, ug/l	<10	---	<10	---
Acenaphthylene, ug/l	<10	---	<10	---
3-Nitroaniline, ug/l	<50	---	<50	---
Acenaphthene, ug/l	<10	42 %	<10	100 %
2,4-Dinitrophenol, ug/l	<50	---	<50	---
4-Nitrophenol, ug/l	<50	64 %	<50	104 %
Dibenzofuran, ug/l	<10	---	<10	---
2,4-Dinitrotoluene, ug/l	<10	68 %	<10	108 %

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86781A-7	Method Blank
86781A-8	Lab Control Standard % Recovery
86781A-11	Method Blank
86781A-12	Lab Control Standard % Recovery

PARAMETER	86781A-7	86781A-8	86781A-11	86781A-12
2,6-Dinitrotoluene, ug/l	<10	---	<10	---
Diethylphthalate, ug/l	<10	---	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---	<10	---
Fluorene, ug/l	<10	---	<10	---
4-Nitroaniline, ug/l	<50	---	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---	<50	---
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	---	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---	<10	---
Hexachlorobenzene, ug/l	<10	---	<10	---
Pentachlorophenol, ug/l	<50	72 %	<50	94 %
Phenanthrene, ug/l	<10	---	<10	---
Anthracene, ug/l	<10	---	<10	---
Di-n-butylphthalate, ug/l	<10	---	<10	---
Fluoranthene, ug/l	<10	---	<10	---
Pyrene, ug/l	<10	70 %	<10	124 %
Butylbenzylphthalate, ug/l	<10	---	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---	<20	---
Benzo(a)anthracene, ug/l	<10	---	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---	<10	---

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86781A-8	Lab Control Standard % Recovery			
86781A-11	Method Blank			
86781A-12	Lab Control Standard % Recovery			
PARAMETER	86781A-7	86781A-8	86781A-11	86781A-12
Chrysene, ug/l	<10	---	<10	---
Di-n-octylphthalate, ug/l	<10	---	<10	---
Benzo(b)fluoranthene, ug/l	<10	---	<10	---
Benzo(k)fluoranthene, ug/l	<10	---	<10	---
Benzo(a)pyrene, ug/l	<10	---	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---	<10	---
Carbazole, ug/l	<10	---	<10	---
Surrogate - Phenol d5	63 %	18 %	87 %	88 %
Surrogate - 2-Fluorophenol	64 %	12 %	92 %	100 %
Surrogate - 2,4,6-Tribromophenol	65 %	62 %	110 %	130 %
Surrogate - Nitrobenzene - d5	66 %	32 %	112 %	106 %
Surrogate - 2-Fluorobiphenyl	64 %	36 %	116 %	110 %
Surrogate - Terphenyl - d14	92 %	72 %	150 %	136 %
Prep Date	11.06.98	11.06.98	11.14.98	11.14.98
Analysis Date	11.12.98	11.12.98	11.17.98	11.17.98
Batch ID	1106C	1106C	1114D	1114D
Dilution Factor	1.0	---	1.0	---

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LOG NO: S8-86781A
Received: 03 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 083981120

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED

PARAMETER

Methods: EPA SW-846, Update III.

* Water Samples A-GP-2-8g and A-GP-8-8g were re-extracted for semivolatiles due to low laboratory control standard recoveries for phenol and 2,4-dinitrotoluene.

No semivolatile hits were detected in either sample in the original or re-extraction.

Both sets of data are reported.


Steven J. White, Project Manager

Final Page Of Report

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☒ 5102 LaRoche Avenue, Savannah, GA 31404	Phone: (912) 354-7858	Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301	Phone: (904) 878-3994	Fax: (904) 878-9504
☐ 914 SW 12th Avenue, Deerfield Beach, FL 33442	Phone: (954) 421-7400	Fax: (954) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693	Phone: (334) 666-5633	Fax: (334) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634	Phone: (813) 885-7427	Fax: (813) 885-7049
☐ 100 Alpha Drive, Suite 110, Desrehan, LA 70047	Phone: (504) 764-1100	Fax: (504) 725-1163

PROJECT REFERENCE		PROJECT NO.		P.O. NUMBER	
Ft Stewart KUMUB		32369		10900	
PROJECT LOC. (State)		SAMPLE(S) NAME		PHONE (843) 572-5600	
6A		Melanie Hill		FAX (843) 572-5661	
CLIENT NAME		CLIENT PROJECT MANAGER			
Earth Tech		Ron Paulding			
CLIENT ADDRESS (CITY, STATE, ZIP)					
2094A Lake Park Dr, Chas, SC 29418					
SAMPLE		SL NO.		SAMPLE IDENTIFICATION	
DATE	TIME				
11/3/98	0845			A-GP-2-65	
	0848			A-GP-2-89	
	1230			A-GP-8-63	
	1235			A-GP-8-89	
	0800			Trip Blank	
REMARKS					
66W VOCs					
*48m TAT					
encore					
samplers					
Date Due:					
STANDARD REPORT DELIVERY					
EXCEPTED REPORT					
EXPEDITED REPORT					
DELIVERY (surcharge)					
Date Due:					
MATRIX TYPE		REQUIRED ANALYSES		REMARKS	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (19)		2	
NONAQUEOUS LIQUID (oil, solvent, etc)		VOCs (19)		2	
AQUEOUS (WATER)		VOCs (19)		2	
SOLID OR SEMI-SOLID		VOCs (19)		2	
AIR		VOCs (1			

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86752A
Received: 02 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 130181119

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
TCL Semivolatiles (8270)		
Phenol, ug/kg dw	<390	
bis(2-Chloroethyl)ether, ug/kg dw	<390	
2-Chlorophenol, ug/kg dw	<390	
1,3-Dichlorobenzene, ug/kg dw	<390	
1,4-Dichlorobenzene, ug/kg dw	<390	
1,2-Dichlorobenzene, ug/kg dw	<390	
2-Methylphenol (o-cresol), ug/kg dw	<390	
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<390	
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<390	
N-Nitroso-di-n-propylamine, ug/kg dw	<390	
Hexachloroethane, ug/kg dw	<390	
Nitrobenzene, ug/kg dw	<390	
Isophorone, ug/kg dw	<390	
2-Nitrophenol, ug/kg dw	<390	
2,4-Dimethylphenol, ug/kg dw	<390	
bis(2-Chloroethoxy)methane, ug/kg dw	<390	

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Page 2

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
2,4-Dichlorophenol, ug/kg dw	<390	
1,2,4-Trichlorobenzene, ug/kg dw	<390	
Naphthalene, ug/kg dw	<390	
4-Chloroaniline, ug/kg dw	<780	
Hexachlorobutadiene, ug/kg dw	<390	
4-Chloro-3-methylphenol, ug/kg dw	<390	
2-Methylnaphthalene, ug/kg dw	<390	
Hexachlorocyclopentadiene, ug/kg dw	<390	
2,4,6-Trichlorophenol, ug/kg dw	<390	
2,4,5-Trichlorophenol, ug/kg dw	<390	
2-Chloronaphthalene, ug/kg dw	<390	
2-Nitroaniline, ug/kg dw	<2000	
Dimethylphthalate, ug/kg dw	<390	
Acenaphthylene, ug/kg dw	<390	
3-Nitroaniline, ug/kg dw	<2000	
Acenaphthene, ug/kg dw	<390	
2,4-Dinitrophenol, ug/kg dw	<2000	
4-Nitrophenol, ug/kg dw	<2000	
Dibenzofuran, ug/kg dw	<390	
2,4-Dinitrotoluene, ug/kg dw	<390	
2,6-Dinitrotoluene, ug/kg dw	<390	
Diethylphthalate, ug/kg dw	<390	

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Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
4-Chlorophenylphenyl ether, ug/kg dw	<390	
Fluorene, ug/kg dw	<390	
4-Nitroaniline, ug/kg dw	<2000	
4,6-Dinitro-2-methylphenol, ug/kg dw	<2000	
N-Nitrosodiphenylamine/Diph enylamine, ug/kg dw	<390	
4-Bromophenyl phenyl ether, ug/kg dw	<390	
Hexachlorobenzene, ug/kg dw	<390	
Pentachlorophenol, ug/kg dw	<2000	
Phenanthrene, ug/kg dw	<390	
Anthracene, ug/kg dw	<390	
Di-n-butylphthalate, ug/kg dw	<390	
Fluoranthene, ug/kg dw	<390	
Pyrene, ug/kg dw	<390	
Butylbenzylphthalate, ug/kg dw	<390	
3,3'-Dichlorobenzidine, ug/kg dw	<780	
Benzo(a)anthracene, ug/kg dw	<390	
bis(2-Ethylhexyl)phthalate, ug/kg dw	<390	
Chrysene, ug/kg dw	<390	

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Mr. Ron Paulling
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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
Di-n-octylphthalate, ug/kg dw	<390	
Benzo(b)fluoranthene, ug/kg dw	<390	
Benzo(k)fluoranthene, ug/kg dw	<390	
Benzo(a)pyrene, ug/kg dw	<390	
Indeno(1,2,3-cd)pyrene, ug/kg dw	<390	
Dibenzo(a,h)anthracene, ug/kg dw	<390	
Benzo(g,h,i)perylene, ug/kg dw	<390	
Carbazole, ug/kg dw	<390	
Surrogate - Phenol d5	31 %	
Surrogate - 2-Fluorophenol	28 %	
Surrogate - 2,4,6-Tribromophenol	36 %	
Surrogate - Nitrobenzene - d5	25 %	
Surrogate - 2-Fluorobiphenyl	30 %	
Surrogate - Terphenyl - d14	43 %	
Prep Date	11.04.98	
Analysis Date	11.06.98	
Batch ID	1104C	
Dilution Factor	1.0	
Arsenic (6010)		
Arsenic, mg/kg dw	<1.1	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	

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REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
Barium (6010)		
Barium, mg/kg dw	20	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	
Cadmium (6010)		
Cadmium, mg/kg dw	<0.54	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	
Chromium (6010)		
Chromium, mg/kg dw	6.1	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	
Lead (6010)		
Lead, mg/kg dw	3.4	
Prep Date	11.04.98	
Analysis Date	11.11.98	
Batch ID	1104A	
Dilution Factor	1.0	

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Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86752A-1	A-GP-1-6s	11-02-98/1635
PARAMETER	86752A-1	
Selenium (6010)		
Selenium, mg/kg dw	<1.1	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	
Silver (6010)		
Silver, mg/kg dw	<1.1	
Prep Date	11.04.98	
Analysis Date	11.04.98	
Batch ID	1104A	
Dilution Factor	1.0	
Mercury (7471)		
Mercury, mg/kg dw	<0.012	
Prep Date	11.10.98	
Analysis Date	11.10.98	
Batch ID	1110S	
Dilution Factor	1.0	

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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752A-2	A-GP-1-8g	11-02-98/1645
86752A-2-RE	A-GP-1-8g	11-02-98/1645
PARAMETER	86752A-2	86752A-2-RE
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	<10
bis(2-Chloroethyl)ether, ug/l	<10	<10
2-Chlorophenol, ug/l	<10	<10
1,3-Dichlorobenzene, ug/l	<10	<10
1,4-Dichlorobenzene, ug/l	<10	<10
1,2-Dichlorobenzene, ug/l	<10	<10
2-Methylphenol (o-cresol), ug/l	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	<10
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/l	<10	<10
N-Nitroso-di-n-propylamine, ug/l	<10	<10
Hexachloroethane, ug/l	<10	<10
Nitrobenzene, ug/l	<10	<10
Isophorone, ug/l	<10	<10
2-Nitrophenol, ug/l	<10	<10
2,4-Dimethylphenol, ug/l	<10	<10
bis(2-Chloroethoxy)methane, ug/l	<10	<10
2,4-Dichlorophenol, ug/l	<10	<10
1,2,4-Trichlorobenzene, ug/l	<10	<10

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Project: FT. Stewart/SWMU 13/32369
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Code: 130181119

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752A-2	A-GP-1-8g	11-02-98/1645
86752A-2-RE	A-GP-1-8g	11-02-98/1645
PARAMETER	86752A-2	86752A-2-RE
Naphthalene, ug/l	<10	<10
4-Chloroaniline, ug/l	<20	<20
Hexachlorobutadiene, ug/l	<10	<10
4-Chloro-3-methylphenol, ug/l	<10	<10
2-Methylnaphthalene, ug/l	<10	<10
Hexachlorocyclopentadiene, ug/l	<10	<10
2,4,6-Trichlorophenol, ug/l	<10	<10
2,4,5-Trichlorophenol, ug/l	<10	<10
2-Chloronaphthalene, ug/l	<10	<10
2-Nitroaniline, ug/l	<50	<50
Dimethylphthalate, ug/l	<10	<10
Acenaphthylene, ug/l	<10	<10
3-Nitroaniline, ug/l	<50	<50
Acenaphthene, ug/l	<10	<10
2,4-Dinitrophenol, ug/l	<50	<50
4-Nitrophenol, ug/l	<50	<50
Dibenzofuran, ug/l	<10	<10
2,4-Dinitrotoluene, ug/l	<10	<10
2,6-Dinitrotoluene, ug/l	<10	<10
Diethylphthalate, ug/l	<10	<10
4-Chlorophenylphenyl ether, ug/l	<10	<10
Fluorene, ug/l	<10	<10

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2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752A-2	A-GP-1-8g	11-02-98/1645
86752A-2-RE	A-GP-1-8g	11-02-98/1645
PARAMETER	86752A-2	86752A-2-RE
4-Nitroaniline, ug/l	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10
Hexachlorobenzene, ug/l	<10	<10
Pentachlorophenol, ug/l	<50	<50
Phenanthrene, ug/l	<10	<10
Anthracene, ug/l	<10	<10
Di-n-butylphthalate, ug/l	<10	<10
Fluoranthene, ug/l	<10	<10
Pyrene, ug/l	<10	<10
Butylbenzylphthalate, ug/l	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20
Benzo(a)anthracene, ug/l	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10
Chrysene, ug/l	<10	<10
Di-n-octylphthalate, ug/l	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10
Benzo(a)pyrene, ug/l	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10

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LOG NO: S8-86752A
Received: 02 NOV 98
Reported: 19 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 130181119

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86752A-2	A-GP-1-8g	11-02-98/1645
86752A-2-RE	A-GP-1-8g	11-02-98/1645
PARAMETER	86752A-2	86752A-2-RE
Dibenzo(a,h)anthracene, ug/l	<10	<10
Benzo(g,h,i)perylene, ug/l	<10	<10
Carbazole, ug/l	<10	<10
Surrogate - Phenol d5	65 %	68 %
Surrogate - 2-Fluorophenol	64 %	73 %
Surrogate - 2,4,6-Tribromophenol	88 %	110 %
Surrogate - Nitrobenzene - d5	72 %	94 %
Surrogate - 2-Fluorobiphenyl	72 %	86 %
Surrogate - Terphenyl - d14	46 %	30 %
Prep Date	11.06.98	11.14.98
Analysis Date	11.11.98	11.17.98
Batch ID	1106C	1114D
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER 86752A-3 86752A-4

TCL Semivolatiles (8270)

Phenol, ug/kg dw	<330	32 %
bis(2-Chloroethyl)ether, ug/kg dw	<330	---
2-Chlorophenol, ug/kg dw	<330	35 %
1,3-Dichlorobenzene, ug/kg dw	<330	---
1,4-Dichlorobenzene, ug/kg dw	<330	34 %
1,2-Dichlorobenzene, ug/kg dw	<330	---
2-Methylphenol (o-cresol), ug/kg dw	<330	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<330	---
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<330	---
N-Nitroso-di-n-propylamine, ug/kg dw	<330	37 %
Hexachloroethane, ug/kg dw	<330	---
Nitrobenzene, ug/kg dw	<330	---
Isophorone, ug/kg dw	<330	---
2-Nitrophenol, ug/kg dw	<330	---
2,4-Dimethylphenol, ug/kg dw	<330	---
bis(2-Chloroethoxy)methane, ug/kg dw	<330	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER	86752A-3	86752A-4
2,4-Dichlorophenol, ug/kg dw	<330	---
1,2,4-Trichlorobenzene, ug/kg dw	<330	36 %
Naphthalene, ug/kg dw	<330	---
4-Chloroaniline, ug/kg dw	<660	---
Hexachlorobutadiene, ug/kg dw	<330	---
4-Chloro-3-methylphenol, ug/kg dw	<330	43 %
2-Methylnaphthalene, ug/kg dw	<330	---
Hexachlorocyclopentadiene, ug/kg dw	<330	---
2,4,6-Trichlorophenol, ug/kg dw	<330	---
2,4,5-Trichlorophenol, ug/kg dw	<330	---
2-Chloronaphthalene, ug/kg dw	<330	---
2-Nitroaniline, ug/kg dw	<1700	---
Dimethylphthalate, ug/kg dw	<330	---
Acenaphthylene, ug/kg dw	<330	---
3-Nitroaniline, ug/kg dw	<1700	---
Acenaphthene, ug/kg dw	<330	42 %
2,4-Dinitrophenol, ug/kg dw	<1700	---
4-Nitrophenol, ug/kg dw	<1700	27 %
Dibenzofuran, ug/kg dw	<330	---
2,4-Dinitrotoluene, ug/kg dw	<330	37 %
2,6-Dinitrotoluene, ug/kg dw	<330	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER	86752A-3	86752A-4
Diethylphthalate, ug/kg dw	<330	---
4-Chlorophenylphenyl ether, ug/kg dw	<330	---
Fluorene, ug/kg dw	<330	---
4-Nitroaniline, ug/kg dw	<1700	---
4,6-Dinitro-2-methylphenol, ug/kg dw	<1700	---
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---
4-Bromophenyl phenyl ether, ug/kg dw	<330	---
Hexachlorobenzene, ug/kg dw	<330	---
Pentachlorophenol, ug/kg dw	<1700	34 %
Phenanthrene, ug/kg dw	<330	---
Anthracene, ug/kg dw	<330	---
Di-n-butylphthalate, ug/kg dw	<330	---
Fluoranthene, ug/kg dw	<330	---
Pyrene, ug/kg dw	<330	55 %
Butylbenzylphthalate, ug/kg dw	<330	---
3,3'-Dichlorobenzidine, ug/kg dw	<660	---
Benzo(a)anthracene, ug/kg dw	<330	---
bis(2-Ethylhexyl)phthalate, ug/kg dw	<330	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER	86752A-3	86752A-4
Chrysene, ug/kg dw	<330	---
Di-n-octylphthalate, ug/kg dw	<330	---
Benzo(b)fluoranthene, ug/kg dw	<330	---
Benzo(k)fluoranthene, ug/kg dw	<330	---
Benzo(a)pyrene, ug/kg dw	<330	---
Indeno(1,2,3-cd)pyrene, ug/kg dw	<330	---
Dibenzo(a,h)anthracene, ug/kg dw	<330	---
Benzo(g,h,i)perylene, ug/kg dw	<330	---
Carbazole, ug/kg dw	<330	---
Surrogate - Phenol d5	42 %	34 %
Surrogate - 2-Fluorophenol	42 %	35 %
Surrogate - 2,4,6-Tribromophenol	45 %	37 %
Surrogate - Nitrobenzene - d5	36 %	31 %
Surrogate - 2-Fluorobiphenyl	42 %	37 %
Surrogate - Terphenyl - d14	54 %	48 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.06.98	11.05.98
Batch ID	1104C	1104C
Dilution Factor	1.0	1.0

LOG NO: S8-86752A

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER	86752A-3	86752A-4
Arsenic (6010)		
Arsenic, mg/kg dw	<1.0	103 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	<1.0	103 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Cadmium (6010)		
Cadmium, mg/kg dw	<0.50	107 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Chromium (6010)		
Chromium, mg/kg dw	<1.0	105 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

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LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID TIME SAMPLED

86752A-3 Method Blank
86752A-4 Lab Control Standard % Recovery

PARAMETER	86752A-3	86752A-4
Lead (6010)		
Lead, mg/kg dw	<0.50	106 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.0	109 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Silver (6010)		
Silver, mg/kg dw	<1.0	101 %
Prep Date	11.04.98	11.04.98
Analysis Date	11.04.98	11.04.98
Batch ID	1104A	1104A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	94 %
Prep Date	11.10.98	11.10.98
Analysis Date	11.10.98	11.10.98
Batch ID	1110S	1110S
Dilution Factor	1.0	1.0

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES		DATE/
			TIME SAMPLED
86752A-5	Method Blank		
86752A-6	Lab Control Standard % Recovery		
86752A-9	Method Blank		
86752A-10	Lab Control Standard % Recovery		
PARAMETER	86752A-5	86752A-6	86752A-9 86752A-10
TCL Semivolatiles (8270)			
Phenol, ug/l	<10	17 %	<10 85 %
bis(2-Chloroethyl)ether, ug/l	<10	---	<10 ---
2-Chlorophenol, ug/l	<10	27 %	<10 98 %
1,3-Dichlorobenzene, ug/l	<10	---	<10 ---
1,4-Dichlorobenzene, ug/l	<10	26 %	<10 88 %
1,2-Dichlorobenzene, ug/l	<10	---	<10 ---
2-Methylphenol (o-cresol), ug/l	<10	---	<10 ---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---	<10 ---
3-Methylphenol/4-Methylphen ol (m&p-cresol), ug/l	<10	---	<10 ---
N-Nitroso-di-n-propylamine, ug/l	<10	38 %	<10 112 %
Hexachloroethane, ug/l	<10	---	<10 ---
Nitrobenzene, ug/l	<10	---	<10 ---
Isophorone, ug/l	<10	---	<10 ---
2-Nitrophenol, ug/l	<10	---	<10 ---
2,4-Dimethylphenol, ug/l	<10	---	<10 ---
bis(2-Chloroethoxy)methane, ug/l	<10	---	<10 ---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED		
86752A-5	Method Blank			
86752A-6	Lab Control Standard % Recovery			
86752A-9	Method Blank			
86752A-10	Lab Control Standard % Recovery			
PARAMETER	86752A-5	86752A-6	86752A-9	86752A-10
2,4-Dichlorophenol, ug/l	<10	---	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	36 %	<10	92 %
Naphthalene, ug/l	<10	---	<10	---
4-Chloroaniline, ug/l	<20	---	<20	---
Hexachlorobutadiene, ug/l	<10	---	<10	---
4-Chloro-3-methylphenol, ug/l	<10	46 %	<10	100 %
2-Methylnaphthalene, ug/l	<10	---	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---	<10	---
2-Chloronaphthalene, ug/l	<10	---	<10	---
2-Nitroaniline, ug/l	<50	---	<50	---
Dimethylphthalate, ug/l	<10	---	<10	---
Acenaphthylene, ug/l	<10	---	<10	---
3-Nitroaniline, ug/l	<50	---	<50	---
Acenaphthene, ug/l	<10	42 %	<10	104 %
2,4-Dinitrophenol, ug/l	<50	---	<50	---
4-Nitrophenol, ug/l	<50	64 %	<50	79 %
Dibenzofuran, ug/l	<10	---	<10	---
2,4-Dinitrotoluene, ug/l	<10	28 %	<10	108 %

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED		
86752A-5	Method Blank			
86752A-6	Lab Control Standard % Recovery			
86752A-9	Method Blank			
86752A-10	Lab Control Standard % Recovery			
PARAMETER	86752A-5	86752A-6	86752A-9	86752A-10
2,6-Dinitrotoluene, ug/l	<10	---	<10	---
Diethylphthalate, ug/l	<10	---	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---	<10	---
Fluorene, ug/l	<10	---	<10	---
4-Nitroaniline, ug/l	<50	---	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---	<50	---
N-Nitrosodiphenylamine/Diph enylamine, ug/l	<10	---	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---	<10	---
Hexachlorobenzene, ug/l	<10	---	<10	---
Pentachlorophenol, ug/l	<50	72 %	<50	94 %
Phenanthrene, ug/l	<10	---	<10	---
Anthracene, ug/l	<10	---	<10	---
Di-n-butylphthalate, ug/l	<10	---	<10	---
Fluoranthene, ug/l	<10	---	<10	---
Pyrene, ug/l	<10	70 %	<10	124 %
Butylbenzylphthalate, ug/l	<10	---	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---	<20	---
Benzo(a)anthracene, ug/l	<10	---	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---	<10	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED		
86752A-5	Method Blank			
86752A-6	Lab Control Standard % Recovery			
86752A-9	Method Blank			
86752A-10	Lab Control Standard % Recovery			
PARAMETER	86752A-5	86752A-6	86752A-9	86752A-10
Chrysene, ug/l	<10	---	<10	---
Di-n-octylphthalate, ug/l	<10	---	<10	---
Benzo(b)fluoranthene, ug/l	<10	---	<10	---
Benzo(k)fluoranthene, ug/l	<10	---	<10	---
Benzo(a)pyrene, ug/l	<10	---	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---	<10	---
Carbazole, ug/l	<10	---	<10	---
Surrogate - Phenol d5	63 %	18 %	87 %	88 %
Surrogate - 2-Fluorophenol	64 %	12 %	92 %	100 %
Surrogate - 2,4,6-Tribromophenol	65 %	62 %	110 %	130 %
Surrogate - Nitrobenzene - d5	66 %	32 %	112 %	106 %
Surrogate - 2-Fluorobiphenyl	64 %	36 %	116 %	110 %
Surrogate - Terphenyl - d14	92 %	72 %	150 %	136 %
Prep Date	11.06.98	11.06.98	11.14.98	11.14.98
Analysis Date	11.12.98	11.12.98	11.17.98	11.17.98
Batch ID	1106C	1106C	1114D	1114D
Dilution Factor	1.0	---	1.0	---

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REPORT OF RESULTS

DATE/

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES TIME SAMPLED

PARAMETER

Methods: EPA SW-846, Update III.

* Water Sample A-GP-1-8g was re-extracted for semivolatiles due to low laboratory control standard recoveries for phenol and 2,4-dinitrotoluene in analytical batch 1106C. No semivolatile hits were detected in that sample in either the original or re-extraction.
Both sets of data are reported.

Steven J. White
Steven J. White, Project Manager

Final Page Of Report

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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

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☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301	Phone: (904) 878-3994	Fax: (904) 878-9504
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442	Phone: (954) 421-7400	Fax: (954) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693	Phone: (334) 666-6633	Fax: (334) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634	Phone: (813) 885-7427	Fax: (813) 885-7049
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047	Phone: (504) 764-1100	Fax: (504) 725-1163

PROJECT REFERENCE FT Stewart / SUMURB		PROJECT NO. 32369		P.O. NUMBER 10900	
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX		
GA	Melanie D. Hill	(843) 572-5200	(843) 572-5261		
CLIENT NAME Earth Tech		CLIENT PROJECT MANAGER Ron Pauling			
CLIENT ADDRESS (CITY, STATE, ZIP) 2694 A Lake Park Drive, Chas, SC 29418					

SAMPLE	SL NO.	SAMPLE IDENTIFICATION		DATE	TIME	AQUEOUS (WATER) SOLID OR SEMISOLID	NONAQUEOUS LIQUID (oil, solvent, etc)	MATRIX TYPE	REQUIRED ANALYSES	REMARKS
		DATE	TIME							
11/2/98	1635	A-GP-1-65		11/2/98	1635	X			VOCs (4028) SVOCs (4028) Metals (2318) Encore (2318) Back VOCs (1548) SVOCs (1548) Metals (1548) Encore (1548)	VOCs for GW (4028) and encore samples
11/2/98	1645	A-GP-1-89		11/2/98	1645	X				
RUSH										
RECEIVED BY: (SIGNATURE) <i>Melanie D Hill</i> DATE: 11/13/98 TIME: 8:00AM RECEIVED BY: (SIGNATURE) <i>Melanie D Hill</i> DATE: 11/21/98 TIME: 1915										

RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>	DATE: 11/13/98	TIME: 8:00AM	CUSTODY INTACT ☒ YES ☐ NO	CUSTODY SEAL NO.	SL LOG NO. 58-86752	LABORATORY REMARKS:

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LOG NO: S8-86856A
Received: 05 NOV 98
Reported: 17 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 123081117

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856A-1	C-CP-24-6s	11-05-98/0940			
86856A-2	B-GP-15-Os	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-Os	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
TCL Semivolatiles (8270)					
Phenol, ug/kg dw	<390	<360	<360	<390	<350
bis(2-Chloroethyl)ether, ug/kg dw	<390	<360	<360	<390	<350
2-Chlorophenol, ug/kg dw	<390	<360	<360	<390	<350
1,3-Dichlorobenzene, ug/kg dw	<390	<360	<360	<390	<350
1,4-Dichlorobenzene, ug/kg dw	<390	<360	<360	<390	<350
1,2-Dichlorobenzene, ug/kg dw	<390	<360	<360	<390	<350
2-Methylphenol (o-cresol), ug/kg dw	<390	<360	<360	<390	<350
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw	<390	<360	<360	<390	<350
3-Methylphenol/4-Methylphen ol(m&p-cresol), ug/kg dw	<390	<360	<360	<390	<350
N-Nitroso-di-n-propylamine, ug/kg dw	<390	<360	<360	<390	<350
Hexachloroethane, ug/kg dw	<390	<360	<360	<390	<350
Nitrobenzene, ug/kg dw	<390	<360	<360	<390	<350
Isophorone, ug/kg dw	<390	<360	<360	<390	<350

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED				
86856A-1	C-CP-24-6s	11-05-98/0940				
86856A-2	B-GP-15-Os	11-05-98/1035				
86856A-3	B-GP-15-O Dup	11-05-98/1040				
86856A-4	B-GP-15-6s	11-05-98/1120				
86856A-5	B-GP-17-Os	11-05-98/1515				
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5	
2-Nitrophenol, ug/kg dw	<390	<360	<360	<390	<350	
2,4-Dimethylphenol, ug/kg dw	<390	<360	<360	<390	<350	
bis(2-Chloroethoxy)methane, ug/kg dw	<390	<360	<360	<390	<350	
2,4-Dichlorophenol, ug/kg dw	<390	<360	<360	<390	<350	
1,2,4-Trichlorobenzene, ug/kg dw	<390	<360	<360	<390	<350	
Naphthalene, ug/kg dw	<390	<360	<360	<390	<350	
4-Chloroaniline, ug/kg dw	<790	<720	<720	<780	<710	
Hexachlorobutadiene, ug/kg dw	<390	<360	<360	<390	<350	
4-Chloro-3-methylphenol, ug/kg dw	<390	<360	<360	<390	<350	
2-Methylnaphthalene, ug/kg dw	<390	<360	<360	<390	<350	
Hexachlorocyclopentadiene, ug/kg dw	<390	<360	<360	<390	<350	
2,4,6-Trichlorophenol, ug/kg dw	<390	<360	<360	<390	<350	
2,4,5-Trichlorophenol, ug/kg dw	<390	<360	<360	<390	<350	
2-Chloronaphthalene, ug/kg dw	<390	<360	<360	<390	<350	
2-Nitroaniline, ug/kg dw	<2000	<1800	<1800	<2000	<1800	
Dimethylphthalate, ug/kg dw	<390	<360	<360	<390	<350	
Acenaphthylene, ug/kg dw	<390	<360	<360	<390	<350	

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856A-1	C-CP-24-6s	11-05-98/0940			
86856A-2	B-GP-15-0s	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-0s	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
3-Nitroaniline, ug/kg dw	<2000	<1800	<1800	<2000	<1800
Acenaphthene, ug/kg dw	<390	<360	<360	<390	<350
2,4-Dinitrophenol, ug/kg dw	<2000	<1800	<1800	<2000	<1800
4-Nitrophenol, ug/kg dw	<2000	<1800	<1800	<2000	<1800
Dibenzofuran, ug/kg dw	<390	<360	<360	<390	<350
2,4-Dinitrotoluene, ug/kg dw	<390	<360	<360	<390	<350
2,6-Dinitrotoluene, ug/kg dw	<390	<360	<360	<390	<350
Diethylphthalate, ug/kg dw	<390	<360	<360	<390	<350
4-Chlorophenylphenyl ether, ug/kg dw	<390	<360	<360	<390	<350
Fluorene, ug/kg dw	<390	<360	<360	<390	<350
4-Nitroaniline, ug/kg dw	<2000	<1800	<1800	<2000	<1800
4,6-Dinitro-2-methylphenol, ug/kg dw	<2000	<1800	<1800	<2000	<1800
N-Nitrosodiphenylamine/Diph enylamine, ug/kg dw	<390	<360	<360	<390	<350
4-Bromophenyl phenyl ether, ug/kg dw	<390	<360	<360	<390	<350
Hexachlorobenzene, ug/kg dw	<390	<360	<360	<390	<350

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856A-1	C-CP-24-6s	11-05-98/0940			
86856A-2	B-GP-15-Os	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-Os	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
Pentachlorophenol, ug/kg dw	<2000	<1800	<1800	<2000	<1800
Phenanthrene, ug/kg dw	710	<360	<360	<390	<350
Anthracene, ug/kg dw	<390	<360	<360	<390	<350
Di-n-butylphthalate, ug/kg dw	<390	<360	<360	<390	<350
Fluoranthene, ug/kg dw	890	<360	<360	<390	720
Pyrene, ug/kg dw	570	<360	<360	<390	620
Butylbenzylphthalate, ug/kg dw	<390	<360	<360	<390	<350
3,3'-Dichlorobenzidine, ug/kg dw	<790	<720	<720	<780	<710
Benzo(a)anthracene, ug/kg dw	<390	<360	<360	<390	430
bis(2-Ethylhexyl)phthalate, ug/kg dw	<390	<360	<360	<390	<350
Chrysene, ug/kg dw	<390	<360	<360	<390	430
Di-n-octylphthalate, ug/kg dw	<390	<360	<360	<390	<350
Benzo(b)fluoranthene, ug/kg dw	<390	<360	<360	<390	560
Benzo(k)fluoranthene, ug/kg dw	<390	<360	<360	<390	490
Benzo(a)pyrene, ug/kg dw	<390	<360	<360	<390	390
Indeno(1,2,3-cd)pyrene, ug/kg dw	<390	<360	<360	<390	<350
Dibenzo(a,h)anthracene, ug/kg dw	<390	<360	<360	<390	<350
Benzo(g,h,i)perylene, ug/kg dw	<390	<360	<360	<390	<350

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86856A-2	B-GP-15-Os	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-Os	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
Carbazole, ug/kg dw	<390	<360	<360	<390	<350
Surrogate - Phenol d5	30 %	58 %	42 %	40 %	44 %
Surrogate - 2-Fluorophenol	25 %	50 %	36 %	38 %	42 %
Surrogate - 2,4,6-Tribromophenol	45 %	78 %	61 %	55 %	61 %
Surrogate - Nitrobenzene - d5	23 %	51 %	35 %	34 %	40 %
Surrogate - 2-Fluorobiphenyl	27 %	61 %	42 %	38 %	47 %
Surrogate - Terphenyl - d14	36 %	78 %	61 %	60 %	67 %
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.13.98	11.13.98	11.13.98	11.13.98	11.13.98
Batch ID	1109C	1109C	1109C	1109C	1109C
Dilution Factor	1.0	1.0	1.0	1.0	1.0
Arsenic (6010)					
Arsenic, mg/kg dw	1.1	<0.92	<1.1	<1.2	<1.1
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856A-1	C-CP-24-6s	11-05-98/0940			
86856A-2	B-GP-15-Os	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-Os	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
Barium (6010)					
Barium, mg/kg dw	6.4	12	17	8.6	10
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0
Cadmium (6010)					
Cadmium, mg/kg dw	<0.50	<0.46	<0.54	<0.60	<0.54
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0
Chromium (6010)					
Chromium, mg/kg dw	9.1	3.6	3.8	6.2	2.2
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856A-1	C-CP-24-6s	11-05-98/0940			
86856A-2	B-GP-15-Os	11-05-98/1035			
86856A-3	B-GP-15-O Dup	11-05-98/1040			
86856A-4	B-GP-15-6s	11-05-98/1120			
86856A-5	B-GP-17-Os	11-05-98/1515			
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5
Lead (6010)					
Lead, mg/kg dw	6.6	3.3	3.2	7.5	2.9
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0
Selenium (6010)					
Selenium, mg/kg dw	<1.0	<0.92	<1.1	<1.2	<1.1
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0
Silver (6010)					
Silver, mg/kg dw	<1.0	<0.92	<1.1	<1.2	<1.1
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98	11.12.98	11.12.98	11.12.98
Batch ID	1109A	1109A	1109A	1109A	1109A
Dilution Factor	1.0	1.0	1.0	1.0	1.0

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED				
86856A-1	C-CP-24-6s	11-05-98/0940				
86856A-2	B-GP-15-Os	11-05-98/1035				
86856A-3	B-GP-15-O Dup	11-05-98/1040				
86856A-4	B-GP-15-6s	11-05-98/1120				
86856A-5	B-GP-17-Os	11-05-98/1515				
PARAMETER	86856A-1	86856A-2	86856A-3	86856A-4	86856A-5	
Mercury (7471)						
Mercury, mg/kg dw	<0.011	<0.010	<0.0099	<0.012	0.015	
Prep Date	11.09.98	11.09.98	11.09.98	11.09.98	11.09.98	
Analysis Date	11.10.98	11.10.98	11.10.98	11.10.98	11.10.98	
Batch ID	1109R	1109R	1109R	1109R	1109R	
Dilution Factor	1.0	1.0	1.0	1.0	1.0	

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
TCL Semivolatiles (8270)		
Phenol, ug/kg dw		<390
bis(2-Chloroethyl)ether, ug/kg dw		<390
2-Chlorophenol, ug/kg dw		<390
1,3-Dichlorobenzene, ug/kg dw		<390
1,4-Dichlorobenzene, ug/kg dw		<390
1,2-Dichlorobenzene, ug/kg dw		<390
2-Methylphenol (o-cresol), ug/kg dw		<390
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/kg dw		<390
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/kg dw		<390
N-Nitroso-di-n-propylamine, ug/kg dw		<390
Hexachloroethane, ug/kg dw		<390
Nitrobenzene, ug/kg dw		<390
Isophorone, ug/kg dw		<390
2-Nitrophenol, ug/kg dw		<390
2,4-Dimethylphenol, ug/kg dw		<390
bis(2-Chloroethoxy)methane, ug/kg dw		<390
2,4-Dichlorophenol, ug/kg dw		<390
1,2,4-Trichlorobenzene, ug/kg dw		<390
Naphthalene, ug/kg dw		<390
4-Chloroaniline, ug/kg dw		<780
Hexachlorobutadiene, ug/kg dw		<390

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
4-Chloro-3-methylphenol, ug/kg dw	<390	
2-Methylnaphthalene, ug/kg dw	<390	
Hexachlorocyclopentadiene, ug/kg dw	<390	
2,4,6-Trichlorophenol, ug/kg dw	<390	
2,4,5-Trichlorophenol, ug/kg dw	<390	
2-Chloronaphthalene, ug/kg dw	<390	
2-Nitroaniline, ug/kg dw	<2000	
Dimethylphthalate, ug/kg dw	<390	
Acenaphthylene, ug/kg dw	<390	
3-Nitroaniline, ug/kg dw	<2000	
Acenaphthene, ug/kg dw	<390	
2,4-Dinitrophenol, ug/kg dw	<2000	
4-Nitrophenol, ug/kg dw	<2000	
Dibenzofuran, ug/kg dw	<390	
2,4-Dinitrotoluene, ug/kg dw	<390	
2,6-Dinitrotoluene, ug/kg dw	<390	
Diethylphthalate, ug/kg dw	<390	
4-Chlorophenylphenyl ether, ug/kg dw	<390	
Fluorene, ug/kg dw	<390	
4-Nitroaniline, ug/kg dw	<2000	
4,6-Dinitro-2-methylphenol, ug/kg dw	<2000	
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<390	
4-Bromophenyl phenyl ether, ug/kg dw	<390	

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
Hexachlorobenzene, ug/kg dw	<390	
Pentachlorophenol, ug/kg dw	<2000	
Phenanthrene, ug/kg dw	<390	
Anthracene, ug/kg dw	<390	
Di-n-butylphthalate, ug/kg dw	<390	
Fluoranthene, ug/kg dw	<390	
Pyrene, ug/kg dw	<390	
Butylbenzylphthalate, ug/kg dw	<390	
3,3'-Dichlorobenzidine, ug/kg dw	<780	
Benzo(a)anthracene, ug/kg dw	<390	
bis(2-Ethylhexyl)phthalate, ug/kg dw	<390	
Chrysene, ug/kg dw	<390	
Di-n-octylphthalate, ug/kg dw	<390	
Benzo(b)fluoranthene, ug/kg dw	<390	
Benzo(k)fluoranthene, ug/kg dw	<390	
Benzo(a)pyrene, ug/kg dw	<390	
Indeno(1,2,3-cd)pyrene, ug/kg dw	<390	
Dibenzo(a,h)anthracene, ug/kg dw	<390	
Benzo(g,h,i)perylene, ug/kg dw	<390	
Carbazole, ug/kg dw	<390	
Surrogate - Phenol d5	23 %	
Surrogate - 2-Fluorophenol	21 %	
Surrogate - 2,4,6-Tribromophenol	38 %	

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Client PO. No.: 10900

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86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
Surrogate - Nitrobenzene - d5	24 %	
Surrogate - 2-Fluorobiphenyl	24 %	
Surrogate - Terphenyl - d14	39 %	
Prep Date	11.09.98	
Analysis Date	11.13.98	
Batch ID	1109C	
Dilution Factor	1.0	
Arsenic (6010)		
Arsenic, mg/kg dw	1.3	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	
Barium (6010)		
Barium, mg/kg dw	5.6	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	
Cadmium (6010)		
Cadmium, mg/kg dw	<0.54	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	

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LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
Chromium (6010)		
Chromium, mg/kg dw	14	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	
Lead (6010)		
Lead, mg/kg dw	11	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	
Selenium (6010)		
Selenium, mg/kg dw	<1.1	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	
Silver (6010)		
Silver, mg/kg dw	<1.1	
Prep Date	11.09.98	
Analysis Date	11.12.98	
Batch ID	1109A	
Dilution Factor	1.0	

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86856A-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856A-6	
Mercury (7471)		
Mercury, mg/kg dw	<0.011	
Prep Date	11.09.98	
Analysis Date	11.10.98	
Batch ID	1109R	
Dilution Factor	1.0	

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86856A-7	C-GP-24-8g	11-05-98/0945		
86856A-8	B-GP-15-8g	11-05-98/1125		
86856A-9	B-GP-17-8g	11-05-98/1610		
PARAMETER		86856A-7	86856A-8	86856A-9
TCL Semivolatiles (8270)				
Phenol, ug/l		<10	<10	<10
bis(2-Chloroethyl)ether, ug/l		<10	<10	<10
2-Chlorophenol, ug/l		<10	<10	<10
1,3-Dichlorobenzene, ug/l		<10	<10	<10
1,4-Dichlorobenzene, ug/l		<10	<10	<10
1,2-Dichlorobenzene, ug/l		<10	<10	<10
2-Methylphenol (o-cresol), ug/l		<10	<10	<10
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l		<10	<10	<10
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l		<10	<10	<10
N-Nitroso-di-n-propylamine, ug/l		<10	<10	<10
Hexachloroethane, ug/l		<10	<10	<10
Nitrobenzene, ug/l		<10	<10	<10
Isophorone, ug/l		<10	<10	<10
2-Nitrophenol, ug/l		<10	<10	<10
2,4-Dimethylphenol, ug/l		<10	<10	<10
bis(2-Chloroethoxy)methane, ug/l		<10	<10	<10
2,4-Dichlorophenol, ug/l		<10	<10	<10
1,2,4-Trichlorobenzene, ug/l		<10	<10	<10
Naphthalene, ug/l		<10	<10	13

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86856A-7	C-GP-24-8g	11-05-98/0945		
86856A-8	B-GP-15-8g	11-05-98/1125		
86856A-9	B-GP-17-8g	11-05-98/1610		
PARAMETER		86856A-7	86856A-8	86856A-9
4-Chloroaniline, ug/l		<20	<20	<20
Hexachlorobutadiene, ug/l		<10	<10	<10
4-Chloro-3-methylphenol, ug/l		<10	<10	<10
2-Methylnaphthalene, ug/l		<10	<10	17
Hexachlorocyclopentadiene, ug/l		<10	<10	<10
2,4,6-Trichlorophenol, ug/l		<10	<10	<10
2,4,5-Trichlorophenol, ug/l		<10	<10	<10
2-Chloronaphthalene, ug/l		<10	<10	<10
2-Nitroaniline, ug/l		<50	<50	<50
Dimethylphthalate, ug/l		<10	<10	<10
Acenaphthylene, ug/l		<10	<10	<10
3-Nitroaniline, ug/l		<50	<50	<50
Acenaphthene, ug/l		<10	<10	<10
2,4-Dinitrophenol, ug/l		<50	<50	<50
4-Nitrophenol, ug/l		<50	<50	<50
Dibenzofuran, ug/l		<10	<10	<10
2,4-Dinitrotoluene, ug/l		<10	<10	<10
2,6-Dinitrotoluene, ug/l		<10	<10	<10
Diethylphthalate, ug/l		<10	<10	<10
4-Chlorophenylphenyl ether, ug/l		<10	<10	<10
Fluorene, ug/l		<10	<10	<10

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86856A-8	B-GP-15-8g	11-05-98/1125	
86856A-9	B-GP-17-8g	11-05-98/1610	
PARAMETER	86856A-7	86856A-8	86856A-9
4-Nitroaniline, ug/l	<50	<50	<50
4,6-Dinitro-2-methylphenol, ug/l	<50	<50	<50
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	<10	<10
4-Bromophenyl phenyl ether, ug/l	<10	<10	<10
Hexachlorobenzene, ug/l	<10	<10	<10
Pentachlorophenol, ug/l	<50	<50	<50
Phenanthrene, ug/l	17	<10	<10
Anthracene, ug/l	<10	<10	<10
Di-n-butylphthalate, ug/l	<10	<10	<10
Fluoranthene, ug/l	13	<10	<10
Pyrene, ug/l	<10	<10	<10
Butylbenzylphthalate, ug/l	<10	<10	<10
3,3'-Dichlorobenzidine, ug/l	<20	<20	<20
Benzo(a)anthracene, ug/l	<10	<10	<10
bis(2-Ethylhexyl)phthalate, ug/l	<10	<10	<10
Chrysene, ug/l	<10	<10	<10
Di-n-octylphthalate, ug/l	<10	<10	<10
Benzo(b)fluoranthene, ug/l	<10	<10	<10
Benzo(k)fluoranthene, ug/l	<10	<10	<10
Benzo(a)pyrene, ug/l	<10	<10	<10
Indeno(1,2,3-cd)pyrene, ug/l	<10	<10	<10

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86856A-7	C-GP-24-8g	11-05-98/0945			
86856A-8	B-GP-15-8g	11-05-98/1125			
86856A-9	B-GP-17-8g	11-05-98/1610			
PARAMETER	86856A-7	86856A-8	86856A-9		
Dibenzo(a,h)anthracene, ug/l	<10	<10	<10		
Benzo(g,h,i)perylene, ug/l	<10	<10	<10		
Carbazole, ug/l	<10	<10	<10		
Surrogate - Phenol d5	79 %	72 %	77 %		
Surrogate - 2-Fluorophenol	71 %	65 %	72 %		
Surrogate - 2,4,6-Tribromophenol	120 %	110 %	110 %		
Surrogate - Nitrobenzene - d5	80 %	70 %	84 %		
Surrogate - 2-Fluorobiphenyl	82 %	74 %	80 %		
Surrogate - Terphenyl - d14	92 %	78 %	32 %		
Prep Date	11.09.98	11.09.98	11.09.98		
Analysis Date	11.13.98	11.13.98	11.13.98		
Batch ID	1109A	1109A	1109A		
Dilution Factor	1.0	1.0	1.0		

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	38 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	39 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	35 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	39 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	37 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	46 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	43 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	43 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	46 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<10	---
4-Bromophenyl phenyl ether, ug/l	<10	---
Hexachlorobenzene, ug/l	<10	---
Pentachlorophenol, ug/l	<50	46 %
Phenanthrene, ug/l	<10	---
Anthracene, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Fluoranthene, ug/l	<10	---
Pyrene, ug/l	<10	58 %
Butylbenzylphthalate, ug/l	<10	---
3,3'-Dichlorobenzidine, ug/l	<20	---
Benzo(a)anthracene, ug/l	<10	---
bis(2-Ethylhexyl)phthalate, ug/l	<10	---
Chrysene, ug/l	<10	---
Di-n-octylphthalate, ug/l	<10	---
Benzo(b)fluoranthene, ug/l	<10	---
Benzo(k)fluoranthene, ug/l	<10	---
Benzo(a)pyrene, ug/l	<10	---
Indeno(1,2,3-cd)pyrene, ug/l	<10	---
Dibenzo(a,h)anthracene, ug/l	<10	---
Benzo(g,h,i)perylene, ug/l	<10	---
Carbazole, ug/l	<10	---

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86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
Surrogate - Phenol d5	63 %	40 %
Surrogate - 2-Fluorophenol	64 %	41 %
Surrogate - 2,4,6-Tribromophenol	65 %	51 %
Surrogate - Nitrobenzene - d5	66 %	35 %
Surrogate - 2-Fluorobiphenyl	64 %	42 %
Surrogate - Terphenyl - d14	92 %	61 %
Prep Date	11.06.98	11.09.98
Analysis Date	11.12.98	11.13.98
Batch ID	1106C	1109C
Dilution Factor	1.0	1.0
Arsenic (6010)		
Arsenic, mg/kg dw	<1.0	103 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0
Barium (6010)		
Barium, mg/kg dw	<1.0	105 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0

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86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
Cadmium (6010)		
Cadmium, mg/kg dw	<0.50	105 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0
Chromium (6010)		
Chromium, mg/kg dw	<1.0	123 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0
Lead (6010)		
Lead, mg/kg dw	<0.50	104 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0
Selenium (6010)		
Selenium, mg/kg dw	<1.0	111 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0

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86856A-10	Method Blank	
86856A-11	Lab Control Standard % Recovery	
PARAMETER	86856A-10	86856A-11
Silver (6010)		
Silver, mg/kg dw	<1.0	97 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.12.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0
Mercury (7471)		
Mercury, mg/kg dw	<0.010	99 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.10.98	11.10.98
Batch ID	1109R	1109R
Dilution Factor	1.0	1.0

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LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86856A-12 Method Blank
86856A-13 Lab Control Standard % Recovery

PARAMETER	86856A-12	86856A-13
TCL Semivolatiles (8270)		
Phenol, ug/l	<10	59 %
bis(2-Chloroethyl)ether, ug/l	<10	---
2-Chlorophenol, ug/l	<10	66 %
1,3-Dichlorobenzene, ug/l	<10	---
1,4-Dichlorobenzene, ug/l	<10	63 %
1,2-Dichlorobenzene, ug/l	<10	---
2-Methylphenol (o-cresol), ug/l	<10	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether), ug/l	<10	---
3-Methylphenol/4-Methylphenol(m&p-cresol), ug/l	<10	---
N-Nitroso-di-n-propylamine, ug/l	<10	76 %
Hexachloroethane, ug/l	<10	---
Nitrobenzene, ug/l	<10	---
Isophorone, ug/l	<10	---
2-Nitrophenol, ug/l	<10	---
2,4-Dimethylphenol, ug/l	<10	---
bis(2-Chloroethoxy)methane, ug/l	<10	---
2,4-Dichlorophenol, ug/l	<10	---
1,2,4-Trichlorobenzene, ug/l	<10	78 %
Naphthalene, ug/l	<10	---
4-Chloroaniline, ug/l	<20	---

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LOG NO: S8-86856A
Received: 05 NOV 98
Reported: 17 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 123081117

REPORT OF RESULTS

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LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86856A-12 Method Blank
86856A-13 Lab Control Standard % Recovery

PARAMETER	86856A-12	86856A-13
Hexachlorobutadiene, ug/l	<10	---
4-Chloro-3-methylphenol, ug/l	<10	84 %
2-Methylnaphthalene, ug/l	<10	---
Hexachlorocyclopentadiene, ug/l	<10	---
2,4,6-Trichlorophenol, ug/l	<10	---
2,4,5-Trichlorophenol, ug/l	<10	---
2-Chloronaphthalene, ug/l	<10	---
2-Nitroaniline, ug/l	<50	---
Dimethylphthalate, ug/l	<10	---
Acenaphthylene, ug/l	<10	---
3-Nitroaniline, ug/l	<50	---
Acenaphthene, ug/l	<10	75 %
2,4-Dinitrophenol, ug/l	<50	---
4-Nitrophenol, ug/l	<50	70 %
Dibenzofuran, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	82 %
2,6-Dinitrotoluene, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
4-Chlorophenylphenyl ether, ug/l	<10	---
Fluorene, ug/l	<10	---
4-Nitroaniline, ug/l	<50	---
4,6-Dinitro-2-methylphenol, ug/l	<50	---

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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86856A-12 Method Blank

86856A-13 Lab Control Standard % Recovery

PARAMETER

86856A-12

86856A-13

N-Nitrosodiphenylamine/Diphenylamine, ug/l

<10

4-Bromophenyl phenyl ether, ug/l

<10

Hexachlorobenzene, ug/l

<10

Pentachlorophenol, ug/l

<50

72 %

Phenanthrene, ug/l

<10

Anthracene, ug/l

<10

Di-n-butylphthalate, ug/l

<10

Fluoranthene, ug/l

<10

Pyrene, ug/l

<10

89 %

Butylbenzylphthalate, ug/l

<10

3,3'-Dichlorobenzidine, ug/l

<20

Benzo(a)anthracene, ug/l

<10

bis(2-Ethylhexyl)phthalate, ug/l

<10

Chrysene, ug/l

<10

Di-n-octylphthalate, ug/l

<10

Benzo(b)fluoranthene, ug/l

<10

Benzo(k)fluoranthene, ug/l

<10

Benzo(a)pyrene, ug/l

<10

Indeno(1,2,3-cd)pyrene, ug/l

<10

Dibenzo(a,h)anthracene, ug/l

<10

Benzo(g,h,i)perylene, ug/l

<10

Carbazole, ug/l

<10

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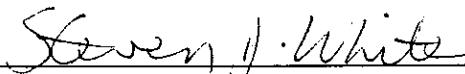
REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

86856A-12 Method Blank
86856A-13 Lab Control Standard % Recovery

PARAMETER	86856A-12	86856A-13
Surrogate - Phenol d5	67 %	63 %
Surrogate - 2-Fluorophenol	67 %	63 %
Surrogate - 2,4,6-Tribromophenol	110 %	97 %
Surrogate - Nitrobenzene - d5	80 %	73 %
Surrogate - 2-Fluorobiphenyl	82 %	76 %
Surrogate - Terphenyl - d14	102 %	91 %
Prep Date	11.09.98	11.09.98
Analysis Date	11.12.98	11.13.98
Batch ID	1109A	1109A
Dilution Factor	1.0	1.0

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

Serial Number

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☒ 5102 LaRoche Avenue, Savannah, GA 31404
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Drestrehan, LA 70047

Phone: (912) 354-7858
Phone: (904) 878-3994
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Phone: (334) 656-6633
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Fax: (904) 878-9504
Fax: (954) 421-2584
Fax: (334) 666-8696
Fax: (813) 885-7049
Fax: (504) 725-1163

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER				
Ft Stewart/SWNU13		32369	10900				
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX				
GA	Melanie D. Hill	(843) 572-5000	(843) 572-5661				
CLIENT NAME		CLIENT PROJECT MANAGER					
Earth Tech		Ron Pauling					
CLIENT ADDRESS (CITY, STATE, ZIP)							
2694 A Lake Park Dr, Chas, SC 29418							
SAMPLE		SL		SAMPLE IDENTIFICATION			
DATE	TIME	NO.					
11/5/98	0940			B-GP-14 - 6S	X	AIR	
0945				B-GP-14 - 8g	X	SOLID OR SEMISOLID	
1035				B-GP-15 - 0S	X	NONAQUEOUS LIQUID (oil solvent etc.)	
1040				B-GP-15 - 0DUP	X		
1125				B-GP-15 - 8g	X		
1120				B-GP-15 - 6S	X		
1515				B-GP-17 - 0S	X		
1600				B-GP-17 S	X		
1610				B-GP-17 G	X		
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Sam. Lab		11/24/98	0900	Melanie D. Hill		11/28/98	1010
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D. Hill		11/24/98	0900	[Signature]		11/28/98	1810
LABORATORY USE ONLY				LABORATORY REMARKS:			
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	
[Signature]		11/18/98	1410	☒		58-86856	

PROJECT REFERENCE		PROJECT NO.	P.O. NUMBER				
Ft Stewart/SWNU13		32369	10900				
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX				
GA	Melanie D. Hill	(843) 572-5000	(843) 572-5661				
CLIENT NAME		CLIENT PROJECT MANAGER					
Earth Tech		Ron Pauling					
CLIENT ADDRESS (CITY, STATE, ZIP)							
2694 A Lake Park Dr, Chas, SC 29418							
SAMPLE		SL		SAMPLE IDENTIFICATION			
DATE	TIME	NO.					
11/5/98	0940			B-GP-14 - 6S	X	AIR	
0945				B-GP-14 - 8g	X	SOLID OR SEMISOLID	
1035				B-GP-15 - 0S	X	NONAQUEOUS LIQUID (oil solvent etc.)	
1040				B-GP-15 - 0DUP	X		
1125				B-GP-15 - 8g	X		
1120				B-GP-15 - 6S	X		
1515				B-GP-17 - 0S	X		
1600				B-GP-17 S	X		
1610				B-GP-17 G	X		
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Sam. Lab		11/24/98	0900	Melanie D. Hill		11/28/98	1010
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D. Hill		11/24/98	0900	[Signature]		11/28/98	1810
LABORATORY USE ONLY				LABORATORY REMARKS:			
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	
[Signature]		11/18/98	1410	☒		58-86856	

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LOG NO: S8-86856
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Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856-1	C-CP-24-6s	11-05-98/0940			
86856-2	B-GP-15-0s	11-05-98/1035			
86856-3	B-GP-15-O Dup	11-05-98/1040			
86856-4	B-GP-15-6s	11-05-98/1120			
86856-5	B-GP-17-0s	11-05-98/1515			
PARAMETER	86856-1	86856-2	86856-3	86856-4	86856-5
Volatiles by GC/MS (8260)					
Chloromethane, ug/kg dw	<11	<20	<17	<15	<14
Bromomethane, ug/kg dw	<11	<20	<17	<15	<14
Vinyl chloride, ug/kg dw	<11	<20	<17	<15	<14
Chloroethane, ug/kg dw	<11	<20	<17	<15	<14
Methylene chloride	<5.5	<10	<8.5	<7.4	<7.1
(Dichloromethane), ug/kg dw					
Acetone, ug/kg dw	<55	<100	<85	<74	<71
Carbon disulfide, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
1,1-Dichloroethene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
1,1-Dichloroethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Cis/Trans-1,2-Dichloroethen	<5.5	<10	<8.5	<7.4	<7.1
e, ug/kg dw					
Chloroform, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
1,2-Dichloroethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
2-Butanone (MEK), ug/kg dw	<27	<51	<42	<37	<35
1,1,1-Trichloroethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Carbon tetrachloride, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Bromodichloromethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856-1	C-CP-24-6s	11-05-98/0940			
86856-2	B-GP-15-0s	11-05-98/1035			
86856-3	B-GP-15-0 Dup	11-05-98/1040			
86856-4	B-GP-15-6s	11-05-98/1120			
86856-5	B-GP-17-0s	11-05-98/1515			
PARAMETER	86856-1	86856-2	86856-3	86856-4	86856-5
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
1,2-Dichloropropane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
trans-1,3-Dichloropropene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Trichloroethene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Dibromochloromethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
1,1,2-Trichloroethane, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Benzene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
cis-1,3-Dichloropropene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Bromoform, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
2-Hexanone, ug/kg dw	<27	<51	<42	<37	<35
4-Methyl-2-pentanone (MIBK), ug/kg dw	<27	<51	<42	<37	<35
Tetrachloroethene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Toluene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Chlorobenzene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Ethylbenzene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Styrene, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1

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LOG NO: S8-86856
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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369

Sampled By: Client

Code: 160881110

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED			
86856-1	C-CP-24-6s	11-05-98/0940			
86856-2	B-GP-15-0s	11-05-98/1035			
86856-3	B-GP-15-0 Dup	11-05-98/1040			
86856-4	B-GP-15-6s	11-05-98/1120			
86856-5	B-GP-17-0s	11-05-98/1515			
PARAMETER	86856-1	86856-2	86856-3	86856-4	86856-5
Xylenes, ug/kg dw	<5.5	<10	<8.5	<7.4	<7.1
Surrogate - Toluene-d8	107 %	110 %	108 %	109 %	106 %
Surrogate - 4-Bromofluorobenzene	105 %	110 %	109 %	104 %	113 %
Surrogate - Dibromofluoromethane	114 %	120 %	115 %	118 %	118 %
Analysis Date	11.10.98	11.10.98	11.10.98	11.10.98	11.10.98
Batch ID	1H1110	1H1110	1H1110	1H1110	1H1110
Dilution Factor	1.0	1.0	1.0	1.0	1.0

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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856-6	
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw		<12
Bromomethane, ug/kg dw		<12
Vinyl chloride, ug/kg dw		<12
Chloroethane, ug/kg dw		<12
Methylene chloride (Dichloromethane), ug/kg dw		<6.0
Acetone, ug/kg dw		<60
Carbon disulfide, ug/kg dw		<6.0
1,1-Dichloroethene, ug/kg dw		<6.0
1,1-Dichloroethane, ug/kg dw		<6.0
Cis/Trans-1,2-Dichloroethene, ug/kg dw		<6.0
Chloroform, ug/kg dw		<6.0
1,2-Dichloroethane, ug/kg dw		<6.0
2-Butanone (MEK), ug/kg dw		<30
1,1,1-Trichloroethane, ug/kg dw		<6.0
Carbon tetrachloride, ug/kg dw		<6.0
Bromodichloromethane, ug/kg dw		<6.0
1,1,2,2-Tetrachloroethane, ug/kg dw		<6.0
1,2-Dichloropropane, ug/kg dw		<6.0
trans-1,3-Dichloropropene, ug/kg dw		<6.0
Trichloroethene, ug/kg dw		<6.0
Dibromochloromethane, ug/kg dw		<6.0
1,1,2-Trichloroethane, ug/kg dw		<6.0

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Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
86856-6	B-GP-17-6s	11-05-98/1600
PARAMETER	86856-6	
Benzene, ug/kg dw	<6.0	
cis-1,3-Dichloropropene, ug/kg dw	<6.0	
Bromoform, ug/kg dw	<6.0	
2-Hexanone, ug/kg dw	<30	
4-Methyl-2-pentanone (MIBK), ug/kg dw	<30	
Tetrachloroethene, ug/kg dw	<6.0	
Toluene, ug/kg dw	<6.0	
Chlorobenzene, ug/kg dw	<6.0	
Ethylbenzene, ug/kg dw	<6.0	
Styrene, ug/kg dw	<6.0	
Xylenes, ug/kg dw	<6.0	
Surrogate - Toluene-d8	107 %	
Surrogate - 4-Bromofluorobenzene	107 %	
Surrogate - Dibromofluoromethane	117 %	
Analysis Date	11.10.98	
Batch ID	1H1110	
Dilution Factor	1.0	

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REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86856-7	C-GP-24-8g	11-05-98/0945		
86856-8	B-GP-15-8g	11-05-98/1125		
86856-9	B-GP-17-8g	11-05-98/1610		
PARAMETER		86856-7	86856-8	86856-9
Volatiles by GC/MS (8260)				
Chloromethane, ug/l		<10	<10	<10
Bromomethane, ug/l		<10	<10	<10
Vinyl chloride, ug/l		<2.0	<2.0	<2.0
Chloroethane, ug/l		<10	<10	<10
Methylene chloride (Dichloromethane), ug/l		<5.0	<5.0	<5.0
Acetone, ug/l		<50	<50	<50
Carbon disulfide, ug/l		<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l		<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l		<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0	<5.0	<5.0
Chloroform, ug/l		<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l		<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l		<25	<25	<25
1,1,1-Trichloroethane, ug/l		<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l		<5.0	<5.0	<5.0
Bromodichloromethane, ug/l		<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0	<5.0	<5.0
1,2-Dichloropropane, ug/l		<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l		<5.0	<5.0	<5.0
Trichloroethene, ug/l		<5.0	<5.0	<5.0

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2694 Lake Park Drive
N. Charleston, SC 29406

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Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86856-7	C-GP-24-8g	11-05-98/0945		
86856-8	B-GP-15-8g	11-05-98/1125		
86856-9	B-GP-17-8g	11-05-98/1610		
PARAMETER		86856-7	86856-8	86856-9
Dibromochloromethane, ug/l		<5.0	<5.0	<5.0
1,1,2-Trichloroethane, ug/l		<5.0	<5.0	<5.0
Benzene, ug/l		<5.0	<5.0	21
cis-1,3-Dichloropropene, ug/l		<5.0	<5.0	<5.0
Bromoform, ug/l		<5.0	<5.0	<5.0
2-Hexanone, ug/l		<25	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l		<25	<25	<25
Tetrachloroethene, ug/l		<5.0	<5.0	<5.0
Toluene, ug/l		<5.0	<5.0	<5.0
Chlorobenzene, ug/l		<5.0	<5.0	<5.0
Ethylbenzene, ug/l		<5.0	<5.0	<5.0
Styrene, ug/l		<5.0	<5.0	<5.0
Xylenes, ug/l		<5.0	<5.0	<5.0
Surrogate - Toluene-d8		94 %	94 %	94 %
Surrogate - 4-Bromofluorobenzene		100 %	100 %	98 %
Surrogate - Dibromofluoromethane		92 %	92 %	90 %
Analysis Date		11.09.98	11.09.98	11.09.98
Batch ID		1B1109	1B1109	1B1109
Dilution Factor		1.0	1.0	1.0

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LOG NO: S8-86856
Received: 05 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86856-10	Method Blank	
86856-11	Lab Control Standard % Recovery	
PARAMETER	86856-10	86856-11
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	154 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	108 %
Dibromochloromethane, ug/kg dw	<5.0	---

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N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86856-10	Method Blank	
86856-11	Lab Control Standard % Recovery	
PARAMETER	86856-10	86856-11
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	106 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	104 %
Chlorobenzene, ug/kg dw	<5.0	106 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	110 %
Surrogate - 4-Bromofluorobenzene	102 %	102 %
Surrogate - Dibromofluoromethane	120 %	122 %
Analysis Date	11.10.98	11.10.98
Batch ID	1H1110	1H1110
Dilution Factor	1.0	1.0

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Code: 160881110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86856-12	Method Blank	
86856-13	Lab Control Standard % Recovery	
PARAMETER	86856-12	86856-13
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	82 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	90 %
Dibromochloromethane, ug/l	<5.0	---

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86856-12	Method Blank	
86856-13	Lab Control Standard % Recovery	
PARAMETER	86856-12	86856-13
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	89 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	88 %
Chlorobenzene, ug/l	<5.0	92 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	94 %	93 %
Surrogate - 4-Bromofluorobenzene	100 %	101 %
Surrogate - Dibromofluoromethane	94 %	92 %
Analysis Date	11.09.98	---
Batch ID	1B1109	---
Dilution Factor	1.0	---

Methods: EPA SW-846, Update III.

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Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 12

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86856-14	Trip Blank	11-05-98/0930
PARAMETER	86856-14	
Volatiles by GC/MS (8260)		
Chloromethane, ug/l		<10
Bromomethane, ug/l		<10
Vinyl chloride, ug/l		<2.0
Chloroethane, ug/l		<10
Methylene chloride (Dichloromethane), ug/l		<5.0
Acetone, ug/l		<50
Carbon disulfide, ug/l		<5.0
1,1-Dichloroethene, ug/l		<5.0
1,1-Dichloroethane, ug/l		<5.0
Cis/Trans-1,2-Dichloroethene, ug/l		<5.0
Chloroform, ug/l		<5.0
1,2-Dichloroethane, ug/l		<5.0
2-Butanone (MEK), ug/l		<25
1,1,1-Trichloroethane, ug/l		<5.0
Carbon tetrachloride, ug/l		<5.0
Bromodichloromethane, ug/l		<5.0
1,1,2,2-Tetrachloroethane, ug/l		<5.0
1,2-Dichloropropane, ug/l		<5.0
trans-1,3-Dichloropropene, ug/l		<5.0
Trichloroethene, ug/l		<5.0
Dibromochloromethane, ug/l		<5.0
1,1,2-Trichloroethane, ug/l		<5.0

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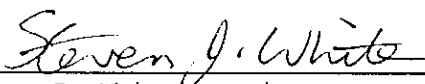
Sampled By: Client

Code: 160881110

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
86856-14	Trip Blank	11-05-98/0930
PARAMETER	86856-14	
Benzene, ug/l	<5.0	
cis-1,3-Dichloropropene, ug/l	<5.0	
Bromoform, ug/l	<5.0	
2-Hexanone, ug/l	<25	
4-Methyl-2-pentanone (MIBK), ug/l	<25	
Tetrachloroethene, ug/l	<5.0	
Toluene, ug/l	<5.0	
Chlorobenzene, ug/l	<5.0	
Ethylbenzene, ug/l	<5.0	
Styrene, ug/l	<5.0	
Xylenes, ug/l	<5.0	
Surrogate - Toluene-d8	92 %	
Surrogate - 4-Bromofluorobenzene	100 %	
Surrogate - Dibromofluoromethane	92 %	
Analysis Date	11.10.98	
Batch ID	1B1110	
Dilution Factor	1.0	


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

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Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905-1	B-GP-14-6s	11-06-98/0910		
86905-2	B-GP-12-6s	11-06-98/1050		
86905-3	B-GP-11-6s	11-06-98/1255		
PARAMETER		86905-1	86905-2	86905-3
Volatiles by GC/MS (8260)				
Chloromethane, ug/kg dw		<13	<12	<11
Bromomethane, ug/kg dw		<13	<12	<11
Vinyl chloride, ug/kg dw		<13	<12	<11
Chloroethane, ug/kg dw		<13	<12	<11
Methylene chloride (Dichloromethane), ug/kg dw		<6.3	<5.8	<5.6
Acetone, ug/kg dw		<63	<58	<56
Carbon disulfide, ug/kg dw		<6.3	<5.8	<5.6
1,1-Dichloroethene, ug/kg dw		<6.3	<5.8	<5.6
1,1-Dichloroethane, ug/kg dw		<6.3	<5.8	<5.6
Cis/Trans-1,2-Dichloroethene, ug/kg dw		<6.3	<5.8	<5.6
Chloroform, ug/kg dw		<6.3	<5.8	<5.6
1,2-Dichloroethane, ug/kg dw		<6.3	<5.8	<5.6
2-Butanone (MEK), ug/kg dw		<32	<29	<28
1,1,1-Trichloroethane, ug/kg dw		<6.3	<5.8	<5.6
Carbon tetrachloride, ug/kg dw		<6.3	<5.8	<5.6
Bromodichloromethane, ug/kg dw		<6.3	<5.8	<5.6
1,1,2,2-Tetrachloroethane, ug/kg dw		<6.3	<5.8	<5.6
1,2-Dichloropropane, ug/kg dw		<6.3	<5.8	<5.6
trans-1,3-Dichloropropene, ug/kg dw		<6.3	<5.8	<5.6
Trichloroethene, ug/kg dw		<6.3	<5.8	<5.6

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2694 Lake Park Drive
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Project: FT. Stewart/SWMU 13/32369
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Code: 160881110

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED		
86905-1	B-GP-14-6s	11-06-98/0910		
86905-2	B-GP-12-6s	11-06-98/1050		
86905-3	B-GP-11-6s	11-06-98/1255		
PARAMETER	86905-1	86905-2	86905-3	
Dibromochloromethane, ug/kg dw	<6.3	<5.8	<5.6	
1,1,2-Trichloroethane, ug/kg dw	<6.3	<5.8	<5.6	
Benzene, ug/kg dw	<6.3	<5.8	<5.6	
cis-1,3-Dichloropropene, ug/kg dw	<6.3	<5.8	<5.6	
Bromoform, ug/kg dw	<6.3	<5.8	<5.6	
2-Hexanone, ug/kg dw	<32	<29	<28	
4-Methyl-2-pentanone (MIBK), ug/kg dw	<32	<29	<28	
Tetrachloroethene, ug/kg dw	<6.3	<5.8	<5.6	
Toluene, ug/kg dw	<6.3	<5.8	<5.6	
Chlorobenzene, ug/kg dw	<6.3	<5.8	<5.6	
Ethylbenzene, ug/kg dw	<6.3	<5.8	<5.6	
Styrene, ug/kg dw	<6.3	<5.8	<5.6	
Xylenes, ug/kg dw	<6.3	<5.8	<5.6	
Surrogate - Toluene-d8	108 %	103 %	104 %	
Surrogate - 4-Bromofluorobenzene	106 %	107 %	105 %	
Surrogate - Dibromofluoromethane	121 %	117 %	118 %	
Analysis Date	11.10.98	11.10.98	11.10.98	
Batch ID	1H1110	1H1110	1H1110	
Dilution Factor	1.0	1.0	1.0	

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LOG NO: S8-86905
Received: 06 NOV 98
Reported: 10 NOV 98

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Project: FT. Stewart/SWMU 13/32369

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REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
86905-7	Method Blank	
86905-8	Lab Control Standard % Recovery	
PARAMETER	86905-7	86905-8
Volatiles by GC/MS (8260)		
Chloromethane, ug/kg dw	<10	---
Bromomethane, ug/kg dw	<10	---
Vinyl chloride, ug/kg dw	<10	---
Chloroethane, ug/kg dw	<10	---
Methylene chloride (Dichloromethane), ug/kg dw	<5.0	---
Acetone, ug/kg dw	<50	---
Carbon disulfide, ug/kg dw	<5.0	---
1,1-Dichloroethene, ug/kg dw	<5.0	154 %
1,1-Dichloroethane, ug/kg dw	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/kg dw	<5.0	---
Chloroform, ug/kg dw	<5.0	---
1,2-Dichloroethane, ug/kg dw	<5.0	---
2-Butanone (MEK), ug/kg dw	<25	---
1,1,1-Trichloroethane, ug/kg dw	<5.0	---
Carbon tetrachloride, ug/kg dw	<5.0	---
Bromodichloromethane, ug/kg dw	<5.0	---
1,1,2,2-Tetrachloroethane, ug/kg dw	<5.0	---
1,2-Dichloropropane, ug/kg dw	<5.0	---
trans-1,3-Dichloropropene, ug/kg dw	<5.0	---
Trichloroethene, ug/kg dw	<5.0	108 %
Dibromochloromethane, ug/kg dw	<5.0	---

LOG NO: S8-86905
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Reported: 10 NOV 98Mr. Ron Paulling
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REPORT OF RESULTS

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LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID DATE/
TIME SAMPLED86905-7 Method Blank
86905-8 Lab Control Standard % Recovery

PARAMETER	86905-7	86905-8
1,1,2-Trichloroethane, ug/kg dw	<5.0	---
Benzene, ug/kg dw	<5.0	106 %
cis-1,3-Dichloropropene, ug/kg dw	<5.0	---
Bromoform, ug/kg dw	<5.0	---
2-Hexanone, ug/kg dw	<25	---
4-Methyl-2-pentanone (MIBK), ug/kg dw	<25	---
Tetrachloroethene, ug/kg dw	<5.0	---
Toluene, ug/kg dw	<5.0	104 %
Chlorobenzene, ug/kg dw	<5.0	106 %
Ethylbenzene, ug/kg dw	<5.0	---
Styrene, ug/kg dw	<5.0	---
Xylenes, ug/kg dw	<5.0	---
Surrogate - Toluene-d8	108 %	110 %
Surrogate - 4-Bromofluorobenzene	102 %	102 %
Surrogate - Dibromofluoromethane	120 %	122 %
Analysis Date	11.10.98	11.10.98
Batch ID	1H1110	1H1110
Dilution Factor	1.0	1.0

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Reported: 10 NOV 98

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Project: FT. Stewart/SWMU 13/32369

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905-9	Method Blank	
86905-10	Lab Control Standard % Recovery	
PARAMETER	86905-9	86905-10
Volatiles by GC/MS (8260)		
Chloromethane, ug/l	<10	---
Bromomethane, ug/l	<10	---
Vinyl chloride, ug/l	<2.0	---
Chloroethane, ug/l	<10	---
Methylene chloride (Dichloromethane), ug/l	<5.0	---
Acetone, ug/l	<50	---
Carbon disulfide, ug/l	<5.0	---
1,1-Dichloroethene, ug/l	<5.0	82 %
1,1-Dichloroethane, ug/l	<5.0	---
Cis/Trans-1,2-Dichloroethene, ug/l	<5.0	---
Chloroform, ug/l	<5.0	---
1,2-Dichloroethane, ug/l	<5.0	---
2-Butanone (MEK), ug/l	<25	---
1,1,1-Trichloroethane, ug/l	<5.0	---
Carbon tetrachloride, ug/l	<5.0	---
Bromodichloromethane, ug/l	<5.0	---
1,1,2,2-Tetrachloroethane, ug/l	<5.0	---
1,2-Dichloropropane, ug/l	<5.0	---
trans-1,3-Dichloropropene, ug/l	<5.0	---
Trichloroethene, ug/l	<5.0	90 %
Dibromochloromethane, ug/l	<5.0	---

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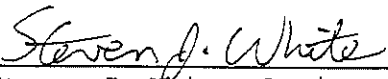
Project: FT. Stewart/SWMU 13/32369
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Code: 160881110

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
86905-9	Method Blank	
86905-10	Lab Control Standard % Recovery	
PARAMETER	86905-9	86905-10
1,1,2-Trichloroethane, ug/l	<5.0	---
Benzene, ug/l	<5.0	89 %
cis-1,3-Dichloropropene, ug/l	<5.0	---
Bromoform, ug/l	<5.0	---
2-Hexanone, ug/l	<25	---
4-Methyl-2-pentanone (MIBK), ug/l	<25	---
Tetrachloroethene, ug/l	<5.0	---
Toluene, ug/l	<5.0	88 %
Chlorobenzene, ug/l	<5.0	92 %
Ethylbenzene, ug/l	<5.0	---
Styrene, ug/l	<5.0	---
Xylenes, ug/l	<5.0	---
Surrogate - Toluene-d8	94 %	93 %
Surrogate - 4-Bromofluorobenzene	100 %	101 %
Surrogate - Dibromofluoromethane	94 %	92 %
Analysis Date	11.09.98	---
Batch ID	1B1109	---
Dilution Factor	1.0	---

Methods: EPA SW-846, Update III.


Steven J. White, Project Manager

Final Page Of Report

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

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☒ 5102 LaRoche Avenue, Savannah, GA 31404
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☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442
☐ 900 Lakeside Drive, Mobile, AL 36693
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047

PROJECT REFERENCE		PROJECT NO.	PO NUMBER
Ft Stewart/Summit 13		32369	10900
PROJECT LOC. (State)	SAMPLER(S) NAME	PHONE	FAX
GA	Melanie D. Hill	(943) 572-5600	(943) 572-5661
CLIENT NAME	CLIENT PROJECT MANAGER		
Earth Tech	Ron Paulding		
CLIENT ADDRESS (CITY, STATE, ZIP)			
2694A Lake Park Dr, Cham, GA 31918			
SAMPLE	SL NO.	SAMPLE IDENTIFICATION	
11/6/98	0910	B-6P-14-65	
	0915	B-6P-14-89	
	1030	B-6P-12-65	
	1100	B-6P-12-89	
	1255	B-6P-11-65	
	1300	B-6P-11-89	
DATE	TIME		
11/6/98	0830	Trip Blank	
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Sen. Labs		10/30/98	0900
RECEIVED BY: (SIGNATURE)		DATE	TIME
Melanie D. Hill		10/30/98	0900
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
Melanie D. Hill		11/4/98	1545
RECEIVED BY: (SIGNATURE)		DATE	TIME
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
RECEIVED BY: (SIGNATURE)		DATE	TIME
RELINQUISHED BY: (SIGNATURE)		DATE	TIME
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RELINQUISHED BY: (SIGNATURE)			

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SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S8-86905
Received: 06 NOV 98
Reported: 10 NOV 98

Mr. Ron Paulling
RUST Environment & Infrastructure
2694 Lake Park Drive
N. Charleston, SC 29406

Client PO. No.: 10900

Project: FT. Stewart/SWMU 13/32369
Sampled By: Client
Code: 160881110

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED			
86905-4	B-GP-14-8g	11-06-98/0915			
86905-5	B-GP-12-8g	11-06-98/1100			
86905-6	B-GP-11-8g	11-06-98/1300			
PARAMETER			86905-4	86905-5	86905-6
Volatiles by GC/MS (8260)					
Chloromethane, ug/l			<10	<10	<10
Bromomethane, ug/l			<10	<10	<10
Vinyl chloride, ug/l			<2.0	<2.0	<2.0
Chloroethane, ug/l			<10	<10	<10
Methylene chloride (Dichloromethane), ug/l			<5.0	<5.0	<5.0
Acetone, ug/l			<50	<50	<50
Carbon disulfide, ug/l			<5.0	<5.0	<5.0
1,1-Dichloroethene, ug/l			<5.0	<5.0	<5.0
1,1-Dichloroethane, ug/l			<5.0	<5.0	<5.0
Cis/Trans-1,2-Dichloroethene, ug/l			<5.0	<5.0	<5.0
Chloroform, ug/l			<5.0	<5.0	<5.0
1,2-Dichloroethane, ug/l			<5.0	<5.0	<5.0
2-Butanone (MEK), ug/l			<25	<25	<25
1,1,1-Trichloroethane, ug/l			<5.0	<5.0	<5.0
Carbon tetrachloride, ug/l			<5.0	<5.0	<5.0
Bromodichloromethane, ug/l			<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane, ug/l			<5.0	<5.0	<5.0
1,2-Dichloropropane, ug/l			<5.0	<5.0	<5.0
trans-1,3-Dichloropropene, ug/l			<5.0	<5.0	<5.0
Trichloroethene, ug/l			<5.0	<5.0	<5.0

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Page 4

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED		
86905-4	B-GP-14-8g	11-06-98/0915		
86905-5	B-GP-12-8g	11-06-98/1100		
86905-6	B-GP-11-8g	11-06-98/1300		
PARAMETER		86905-4	86905-5	86905-6
Dibromochloromethane, ug/l		<5.0	<5.0	<5.0
1,1,2-Trichloroethane, ug/l		<5.0	<5.0	<5.0
Benzene, ug/l		<5.0	<5.0	<5.0
cis-1,3-Dichloropropene, ug/l		<5.0	<5.0	<5.0
Bromoform, ug/l		<5.0	<5.0	<5.0
2-Hexanone, ug/l		<25	<25	<25
4-Methyl-2-pentanone (MIBK), ug/l		<25	<25	<25
Tetrachloroethene, ug/l		<5.0	<5.0	<5.0
Toluene, ug/l		<5.0	<5.0	<5.0
Chlorobenzene, ug/l		<5.0	<5.0	<5.0
Ethylbenzene, ug/l		<5.0	<5.0	<5.0
Styrene, ug/l		<5.0	<5.0	<5.0
Xylenes, ug/l		<5.0	<5.0	<5.0
Surrogate - Toluene-d8		96 %	96 %	94 %
Surrogate - 4-Bromofluorobenzene		102 %	106 %	102 %
Surrogate - Dibromofluoromethane		90 %	90 %	94 %
Analysis Date		11.09.98	11.09.98	11.09.98
Batch ID		1B1109	1B1109	1B1109
Dilution Factor		1.0	1.0	1.0

APPENDIX F

**RCRA FACILITY INVESTIGATION
FORMER FIRE TRAINING AREA (SWMU 13)
FORT STEWART, GEORGIA**

BACKGROUND DATA SUMMARY

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F. BACKGROUND DATA SUMMARY

F.1 BACKGROUND DATA ANALYSIS

The reference background criteria for the former Fire Training Area have been developed based on data from background samples collected from solid waste management units (SWMUs) across the Fort Stewart Military Reservation (FSMR). In general, reference background samples were collected in each medium at locations upgradient or upstream of each site so as to be representative of naturally occurring conditions at SWMUs under Phase II investigation. In addition, soil samples collected during the Phase I investigation [i.e., Burn Pits (SWMUs 4A, 4B, 4D, 4E, and 4F), Active Explosive Ordnance Disposal (EOD) Area (SWMU 12A), etc.] were included as reference background samples if they were upgradient of the site and if the data were of sufficient quality to be representative of natural background conditions at the FSMR. A summary of the sample SWMUs, and the source of the data (Phase I or II RFI), is presented in Table F-1 for each medium.

U.S. Environmental Protection Agency (EPA) Region IV methodology (EPA 1996b) was used as guidance for the development of the background data set for screening metals data. In cases where enough samples (e.g., more than 20) are collected to define background, a background upper tolerance level can be calculated. In cases where fewer samples (e.g., less than 20) are collected to define background, background can be calculated as two times the mean background concentration (EPA 1996b). Given that fewer than 20 background samples were collected for the FSMR, the latter method was used for calculating reference background concentrations for metals.

Tables F-2 through F-6 present the analytical results for the individual background samples as well as the two-times-mean background concentrations for surface soil, subsurface soil, groundwater, surface water, and sediment, respectively. If a chemical was not detected at a site then one-half the detection limit was used as the concentration in calculating the mean background concentration. Given the limited number of background samples, the mean concentration for soils in the eastern United States is also presented for comparative purposes only. A statistical analysis of the surface soil, subsurface soil, groundwater, surface water, and sediment data is presented in Tables F-7 through F-11, respectively.

The use of background data from multiple SWMUs across the FSMR is appropriate for soil and groundwater for the following reasons:

1. The soil types for both surface and subsurface soils consist of similar coastal plain deposits (both former barrier island and backwater marsh deposits) with varying amounts of sands, silts, and clays. The variation in soil types occurs vertically at a given site to the same extent that it occurs across the installation. No correlation between the metal concentration and either soil type or geological facies is apparent. The range of variation in the concentration of any given analyte across the background samples is relatively narrow, and generally significantly less than the mean concentration for soils in the eastern United States.

2. The turbidity of groundwater samples was minimized through the use of low-flow micropurging techniques during sample collection. The turbidity values ranged from 1.8 to 136 across all samples. No correlation between the metal concentration and turbidity is apparent. All samples were collected at the water table in the same type of aquifer unit.

Definitions of acronyms and abbreviations used in Appendix F tables

SWMU:	Solid Waste Management Unit
Sample ID:	sample identification number on chain-of-custody
USGS:	United States Geological Survey
Det. Limit:	detection limit reported by the analytical laboratory
CV:	coefficient of variation
Min. Detect:	minimum detected value
Distr.:	distribution of data (normal, lognormal)
Site-specific background criteria:	Surface water and sediment background samples were collected upgradient of this particular SWMU and are specific to this site only. No installation-wide background data set has been established for surface water or sediment.

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Table F.1. Background Media Summary

SWMU Number	SWMU Name on Hazardous Waste Permit HW-045	Station				
		Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
1	South Central Landfill	SC-M17	SC-M17	MW10	NA	NA
2	Camp Oliver Landfill	MW5	MW5	MW5	NA	NA
3	TAC-X Landfill	MW5	MW5	MW5	NA	NA
4A	Burn Pit A		MW1 (Phase I)	MW1	NA	NA
4B	Burn Pit B		MW3 (Phase I)	MW3	NA	NA
4C	Burn Pit C	MW7	MW7	MW7	NA	NA
4D	Burn Pit D		MW2 (Phase I)	MW2	NA	NA
4E	Burn Pit E		MW3 (Phase I)	MW3	NA	NA
4F	Burn Pit F		MW1 (Phase I)	MW1	NA	NA
10	Inactive EOD Area				NA	NA
12A	Active EOD containing Open Detonation Unit and Open Burn Pit	MW1 (Phase I)	MW1 (Phase I)	MW1	NA	NA
14	Old Fire Training Area			MW8	NA	NA
17	DRMO Hazardous Waste Storage Area	MW1	MW1	MW1	NA	NA
18	Industrial Wastewater Treatment Plant	MW1	MW1	MW1	NA	NA
26	Former 724th Tanker Purging Station	MW1	MW1	MW1	SWS-1	SWS-1
29	Evans Army Heliport POL Storage Facility	MW5	MW5	MW5	NA	NA
31	DEH Asphalt Tanks	MW1	MW1	MW1	NA	NA
32	Supply Diesel Tank	MW1	MW1	MW1	NA	NA
34	DEH Equipment Wash Rack	MW1	MW1	MW1	NA	NA
35	Wright Army Airfield Bulk Fuel System	HA-05 (Phase I)	HA-05 (Phase I)	MW9 (Phase I)	NA	NA

DEH =

DRMO = Defense Reutilization and Marketing Office.

EOD = Explosive Ordnance Disposal.

NA = Not applicable, surface water and sediment background are site-specific.

Bold indicates background groundwater sample collected from the same borehole as sample for soil (i.e., monitoring well was constructed in the borehole).

Table F.2. Surface Soil Background

Location Station Sample ID Date Depth (feet)	Mean Background	2 × Mean Background	USGS Eastern U.S. Reference Value	SWMU 2 02-MW5 021511 01/14/98 0 to 2	SWMU 3 03-MW5 031511 01/16/98 0 to 2	SWMU 17 17-MW1 171111 01/30/98 1 to 2	SWMU 18 18-MW1 181111 02/01/98 0 to 1	SWMU 29 29-MW5 291511 01/29/98 0 to 1	SWMU 31 31-MW1 311111 01/28/98 0 to 1	SWMU 32 32-MW1 321111 01/30/98 0 to 1
<i>Volatile Organic Compounds (mg/kg)</i>										
1,1-Dichloroethene	0.00	0.00		<0.0057	<0.0059	0.00037	<0.006	<0.006	<0.0055	0.0003
2-Butanone	0.01	0.01		<0.0114	<0.0118			0.0016	<0.011	
2-Hexanone	0.01	0.01		<0.0114	<0.0118	<0.0103	<0.0119	0.0011	<0.011	<0.011
4-Methyl-2-pentanone	0.01	0.01		<0.0114	<0.0118	<0.0103	<0.0119	0.0011	<0.011	<0.011
Acetone	0.01	0.01		<0.0114	<0.0118			0.0053	<0.0325	
Benzene	0.00	0.00		<0.0057	<0.0059	<0.0052	<0.006	<0.006	<0.0055	<0.0055
Bromomethane	0.01	0.01		<0.0114	<0.0118	<0.0103	<0.0119	0.0018	<0.011	<0.011
Carbon disulfide	0.00	0.00		<0.0057	<0.0059	<0.0052	<0.006	0.0016	<0.0055	<0.0055
Ethylbenzene	0.00	0.00		<0.0057	<0.0059	0.00044	<0.006	<0.006	<0.0055	<0.0055
Toluene	0.01	0.01		<0.0057	0.00043	0.0266	<0.006	0.0114	0.004	0.0067
Trichloroethene	0.00	0.01		<0.0057	<0.0059	0.00035	<0.006	<0.006	<0.0055	<0.0055
<i>Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)</i>										
4,4'-DDE	0.00	0.00		0.0011	<0.0015					
4,4'-DDT	0.00	0.00		0.0024	<0.0015					
Methoxychlor	0.00	0.01		0.0029	<0.0077					
<i>Metals (mg/kg)</i>										
Arsenic	1.05	2.10	7.4	2.2	<0.35	<0.33	<0.38	0.45	5.1	0.62
Barium	7.37	14.70	420	21.9	7.1	2.3	0.77	3.7	7	8.4
Cadmium	0.09	0.18	2	<0.05	<0.04	<0.04	<0.05	0.05	0.1	0.33
Chromium	3.10	6.21	52	12.1	2.5	0.98	0.21	1	1.5	3.1
Lead	4.41	8.81	17	6.8	1.6	0.91	0.48	11	2.6	7.4
Mercury	0.02	0.03	0.12	0.04	<0.02	<0.02	<0.01	0.02	<0.02	0.03
Selenium	0.20	0.41	0.45	<0.16	<0.15	<0.14	<0.16		<0.16	
Silver	0.08	0.15	2.8	<0.07	<0.07	<0.06		<0.07	<0.06	<0.07
<i>Radionuclides (pCi/g)</i>										
Radium-226	0.43	0.86								
Radium-228	0.85	1.70								

Table F.2. Surface Soil Background (continued)

Location	Mean Background	2 x Mean Background	USGS Eastern U.S. Reference Value	SWMU 34 34-MW1	SWMU 35 HA-05	Burn Pit C MW-7	Former 724th TPS MW1	SWMU 12A SB01-MW-1	SWMU 1 SC-M17
Station									
Sample ID									
Date									
Depth (feet)									
Volatile Organic Compounds (mg/kg)									
1,1-Dichloroethene	0.00	0.00	0.00				<0.0023		<0.0114
2-Butanone	0.01	0.01	0.01	<0.0054			<0.0057		<0.0227
2-Hexanone	0.01	0.01	0.01				<0.0057		<0.0227
4-Methyl-2-pentanone	0.01	0.01	0.01	<0.0109			<0.0057		<0.0227
Acetone	0.01	0.01	0.01	<0.0109			<0.0057		<0.0227
Benzene	0.00	0.01	0.01	0.0036	<0.0055		<0.0023		<0.0114
Bromomethane	0.01	0.01	0.01	0.00042			<0.0023		<0.0227
Carbon disulfide	0.00	0.01	0.01	<0.0109			<0.0057		<0.0114
Ethylbenzene	0.00	0.01	0.01	<0.0054	<0.0055		<0.0023		<0.0114
Toluene	0.01	0.01	0.01	<0.0054	<0.0055		<0.0023		<0.0114
Trichloroethene	0.00	0.01	0.01	0.0024			<0.0023		<0.0114
Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)									
4,4'-DDE	0.00	0.00	0.00						<0.0015
4,4'-DDT	0.00	0.00	0.00						<0.0015
Methoxychlor	0.00	0.01	0.01						<0.0074
Metals (mg/kg)									
Arsenic	1.05	2.10	7.4	0.43	1.2	<0.32	<0.17		1.8
Barium	7.37	14.70	420	9.8	12	5.2	0.94		9.3
Cadmium	0.09	0.18	2	0.12	<0.5	<0.11	<0.06		<0.05
Chromium	3.10	6.21	52	2.2	3.5	0.67	<0.38	3	9.4
Lead	4.41	8.81	17	7.5	7.5	3.1	1.3	3.8	3.3
Mercury	0.02	0.03	0.12	0.04	<0.03	<0.02	<0.01		0.01
Selenium	0.20	0.41	0.45		<1	<0.21	0.63		<0.41
Silver	0.08	0.15	2.8	<0.07	<1	<0.04	<0.02		0.06
Radionuclides (pCi/g)									
Radium-226	0.43	0.86							0.428
Radium-228	0.85	1.70							0.851

Table F.3. Subsurface Soil Background

Location		USGS Eastern U.S. Reference Values	2 x Mean Background	Mean Background	Depth (feet)	Volatile Organic Compounds (mg/kg)										Semivolatile Organic Compounds (mg/kg)										Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)										Metals (mg/kg)										Radionuclides (pCi/g)										Other Analytes (mg/kg)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Station	Sample ID					Date	SWMU 2					SWMU 3					SWMU 17					SWMU 18					SWMU 29					SWMU 31					SWMU 32					Radium-226					Radium-228					Total organic carbon																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
							02-MW5					03-MW5					17-MW1					18-MW1					29-MW5					31-MW1					32-MW1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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Table F.3. Subsurface Soil Background (continued)

Location	Station	Sample ID	Date	Depth (feet)	Mean Background	2 x Mean Background	USGS Eastern U.S. Reference Values	SWMU 34 34-MW1	SWMU 35 HA-05	Burn Pit C MW-7	Former 724th TPS MW1	Burn Pit A MW1	Burn Pit F MW1
Volatiles Organic Compounds (mg/kg)													
2-Butanone				0.01	0.01			<0.0054		<0.0054		<0.0058	
2-Hexanone				0.01	0.01			<0.0054		<0.0054		<0.0058	
4-Methyl-2-pentanone				0.01	0.01			<0.0054		<0.0054		<0.0058	
Acetone				0.02	0.05			<0.0054		<0.0054		<0.0058	<0.057
Bromomethane				0.01	0.01			<0.0054		<0.0054		<0.0058	<0.0057
Carbon disulfide				0.00	0.01			<0.0054		<0.0054		<0.0058	<0.0057
Methylene chloride				0.00	0.01			<0.0057		<0.0057		<0.0058	0.006
Tetrachloroethene				0.00	0.01			<0.0057		<0.0057		<0.0058	<0.0057
Toluene				0.00	0.01			<0.0057		<0.0057		<0.0058	<0.0057
Xylenes, total				0.00	0.01			<0.0057		<0.0057		<0.0058	<0.0057
Semivolatiles Organic Compounds (mg/kg)													
1,2,4-Trichlorobenzene				0.24	0.48			<0.383					
Bis(2-ethylhexyl)phthalate				0.32	0.64			0.712					
Di-N-butyl phthalate				0.26	0.52			0.193					
Fluoranthene				7.14	14.30			<0.383	<0.37			<0.376	
Pyrene				7.31	14.60			<0.383	<0.37			<0.376	
Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)													
alpha-BHC				0.00	0.00								
Metals (mg/kg)													
Arsenic				4.02	8.04	7.4		<0.37	56	<0.3		<0.3	<1.1
Barium				8.49	17.00	420		5.2	30	1.1		5.7	6.2
Cadmium				0.12	0.24	2		<0.05	<0.5	<0.1		<0.57	<0.57
Chromium				5.81	11.60	52		2.8	19	1.2		9	5.1
Lead				5.56	11.10	17		2.1	23	1.6		9.4	16
Mercury				0.02	0.05	0.12		0.05	<0.03	0.03		0.059	<0.011
Selenium				0.56	1.12	0.45			<1	<0.2		<5.7	<1.1
Silver				0.23	0.46	2.8		<0.07	<1	<0.07		<1.1	<1.1
Radionuclides (pCi/g)													
Radium-226				0.55	1.09								
Radium-228				0.45	0.89								
Other Analytes (mg/kg)													
Total organic carbon				1,100.00	2,200.00							1,100	

Table F.3. Subsurface Soil Background (continued)

Location	Mean	USGS	Burn Pit D	Burn Pit B	Burn Pit E	SWMU 12A	SWMU 12A	SWMU 1
Station	Background	Eastern U.S.	MW2	MW3	MW3	SB01-MW-1	SB01-MW-1	SC-M17
Sample ID		Reference	FST004D-SL	FST004B-SL	FST004E-SL	SB1SL2	SB1SL3	011712
Date		Values	06/24/93	06/28/93	06/30/93	9/24/96	9/24/96	11/16/97
Depth (feet)	2 x Mean Background		4 to 6	6 to 8	6 to 8	2 to 4	4 to 6	5 to 8
Volatile Organic Compounds (mg/kg)								
2-Butanone	0.01	0.01						<0.0222
2-Hexanone	0.01	0.01						<0.0222
4-Methyl-2-pentanone	0.01	0.01						<0.0222
Acetone	0.02	0.05	0.11	<0.057	<0.058			0.0254
Bromomethane	0.01	0.01						<0.0222
Carbon disulfide	0.00	0.01	<0.0056	<0.0057	<0.0058			<0.0111
Methylene chloride	0.00	0.01	<0.0056	<0.0057	<0.0058			<0.0111
Tetrachloroethene	0.00	0.01	<0.0056	<0.0057	<0.0058			<0.0111
Toluene	0.00	0.01	0.021	<0.0057	<0.0058			<0.0111
Xylenes, total	0.00	0.01	0.022	<0.0057	<0.0058			<0.0111
Semivolatile Organic Compounds (mg/kg)								
1,2,4-Trichlorobenzene	0.24	0.48						0.0022
Bis(2-ethylhexyl)phthalate	0.32	0.64						<0.363
Di-N-butyl phthalate	0.26	0.52						<0.363
Fluoranthene	7.14	14.30				83		<0.363
Pyrene	7.31	14.60				85		<0.363
Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)								
alpha-BHC	0.00	0.00						<0.00073
Metals (mg/kg)								
Arsenic	4.02	8.04	7.4	<1.1	<1.2			<0.13
Barium	8.49	17.00	420	3.7	8.5	20	30	7.1
Cadmium	0.12	0.24	2	<0.57	<0.58			<0.04
Chromium	5.81	11.60	52	3.3	9.5	4	9	2.8
Lead	5.56	11.10	17	2.7	5.2	4.1	7.5	3.2
Mercury	0.02	0.05	0.12	<0.011	0.062			0.01
Selenium	0.56	1.12	0.45	<1.1	<2.3			<0.29
Silver	0.23	0.46	2.8	<1.1	<1.2			<0.02
Radionuclides (pCi/g)								
Radium-226	0.55	1.09						0.547
Radium-228	0.45	0.89						0.445
Other Analytes (mg/kg)								
Total organic carbon	1,100.00	2,200.00						

Table F.4. Groundwater Background

Location	Mean Background	2 x Mean Background	SWMU 2 02-MW5 024511 35841	SWMU 3 03-MW5 034511 35842	SWMU 12A 12A-MW10 124111 35851	SWMU 14 14-MW8 144811 35840	SWMU 17 17-MW1 174111 35844	SWMU 18 18-MW1 184111 35851	SWMU 29 29-MW5 294511 35852	SWMU 31 31-MW1 314111 35850	SWMU 32 32-MW1 324111 35844
Volatiles Organic Compounds (µg/L)											
1,1,1-Trichloroethane	1.75	3.50	<5	0.23	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	1.77	3.53	<5	<5	<5	<5	<5	<5	<5	<5	0.53
1,3-trans-Dichloropropene	1.75	3.50	<5	<5	<5	<5	<5	0.24	<5	<5	<5
Acetone	3.61	7.21	<10	3.6	<10	<10	<10	5.2	<10	1.7	<10
Chloromethane	3.71	7.42	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethylbenzene	1.49	2.97	<5	<5	<5	<5	<5	0.23	0.21	0.34	<5
Methylene chloride	2.04	4.07	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	0.97	1.94	<2	0.26	<2	<2	<2	0.35	<5	0.35	<2
Trichloroethene	1.75	3.50	<5	<5	<5	<5	<5	0.29	<5	<5	<5
Xylenes, total	1.55	3.10	<5	<5	<5	<5	<5	0.42	0.69	0.71	<5
Metals (µg/L)											
Aluminum	1,200.00	2,400	<3	<3	1,200	<3	<3	<3	<3	<3	<3
Arsenic	1.51	3.02	<3	<3	<3	<3	<3	<3	<3	<3	<3
Barium	35.86	71.72	3.8	18.8	35.5	41.8	27.5	32.1	177	57.4	7.8
Cadmium	0.21	0.43	<0.21	<0.21	<0.21	<0.21	<0.21	0.32	<0.21	<0.21	<0.21
Calcium	1,630.00	3,260	<0.42	0.85	1,630	0.53	0.52	1.9	2.2	1.1	<0.42
Chromium	1.78	3.56	<0.42	0.85	2.6	0.53	0.52	1.9	2.2	1.1	<0.42
Copper	2.00	4.00	<0.42	0.85	2	0.53	0.52	1.9	2.2	1.1	<0.42
Iron	2,189.00	4,378	<0.42	0.85	598	0.53	0.52	1.9	2.2	1.1	<0.42
Lead	2.35	4.69	25.5	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	1.6
Magnesium	814.00	1,628	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
Manganese	17.30	34.60	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96
Mercury	0.07	0.14	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1.90	3.80	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Potassium	643.00	1,286	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	0.95	1.90	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Silver	0.56	1.12	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Sodium	3,520.00	7,040	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Vanadium	2.00	4.00	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Radionuclides (pCi/L)											
Radium-226	0.58	1.16	<2	<2	<2	<2	<2	<2	<2	<2	<2
Radium-228	1.71	3.42	<2	<2	<2	<2	<2	<2	<2	<2	<2

Table F.4. Groundwater Background (continued)

Location Station Sample ID Date	Mean Background	2 x Mean Background	Anions (mg/L)									
			SWMU 2	SWMU 3	SWMU 12A	SWMU 14	SWMU 17	SWMU 18	SWMU 29	SWMU 31	SWMU 32	
			02-MW5	03-MW5	12A-MW10	14-MW8	17-MW1	18-MW1	29-MW5	31-MW1	32-MW1	
			024511	034511	124111	144811	174111	184111	294511	314111	324111	
	35841	35842	35851	35840	35844	35851	35852	35850	35844			
Alkalinity	45,100.00	90,200										
Sulfate	13,358.75	26,717.50	1,100		4,200	38,900		32,900		10,600		
Other Analytes (mg/L)												
Methane	53.70	107.40										
Total organic carbon	3,160.00	6,320	3,160									

Table F.4. Groundwater Background (continued)

Location	Mean Background	2 x Mean Background	SW/MU 34	Burn Pit A	Burn Pit F	Burn Pit D	Burn Pit B	Burn Pit E	Burn Pit C	Former 724th TPS	SWMU 1
Station			34-MW1	MW-1	MW-1	MW-2	MW-3	MW-3	MW-7	MW1	SC-M10
Sample ID			344111	4A4111	4F4111	4D4211	4B4311	4E4311	4C4711	264111	012T11
Date			35844	08/08/97	07/30/97	07/29/97	08/09/97	07/29/97	08/07/97	08/13/97	12/11/97
<i>Volatile Organic Compounds (µg/L)</i>											
1,1,1-Trichloroethane	1.75	3.50	<5	<2	<2	<2	<2	<2	<2	<2	<5
1,1-Dichloroethane	1.77	3.53	<5	<2	<2	<2	<2	<2	<2	<2	<5
1,3-trans-Dichloropropene	1.75	3.50	<5	<2	<2	<2	<2	<2	<2	<2	<5
Acetone	3.61	7.21	<10	<5	<5	<5	<5	<5	<5	<5	<5
Chloromethane	3.71	7.42	<10	<2	<2	<2	<2	<2	<2	7.1	<10
Ethylbenzene	1.49	2.97	<5	<2	<2	<2	<2	<2	<2	<2	<5
Methylene chloride	2.04	4.07	<5	<2	<2	<2	<5	<2	<5	2.1	<2
Toluene	0.97	1.94	<2	<2	<2	<2	<2	<2	<2	<2	<2
Trichloroethene	1.75	3.50	<5	<2	<2	<2	<2	<2	<2	<2	<5
Xylenes, total	1.55	3.10	<5	<2	<2	<2	<2	<2	<2	<2	<5
<i>Metals (µg/L)</i>											
Aluminum	1,200.00	2,400									
Arsenic	1.51	3.02	<3	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	10.1	<0.6
Barium	35.86	71.72	15	18.5	22.8	58	<14.6	6.9	26.6	50.7	38
Cadmium	0.21	0.43	<0.21	0.34	1.1	0.43	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	1,630.00	3,260									
Chromium	1.78	3.56	1.1	2.4	<0.6	<0.6	3.7	1.5	<0.6	<10	7.3
Copper	2.00	4.00									
Iron	2,189.00	4,378									3,780
Lead	2.35	4.69	<0.96	1.1	0.08	0.2	2.2	<1	<0.06	3.3	3.9
Magnesium	814.00	1,628									
Manganese	17.30	34.60									
Mercury	0.07	0.14	<0.1	<0.06	<0.04	<0.04	<0.05	<0.04	0.28	0.2	<0.03
Nickel	1.90	3.80									
Potassium	643.00	1,286									
Selenium	0.95	1.90	2.5	<0.4	<0.4	<0.82	<0.4	<0.4	<0.4	0.62	
Silver	0.56	1.12	<0.86	0.14	<0.07	0.37	0.14	<0.07	0.08	4.9	<0.07
Sodium	3,520.00	7,040.00									
Vanadium	2.00	4.00									
<i>Radionuclides (pCi/L)</i>											
Radium-226	0.58	1.16									0.581
Radium-228	1.71	3.42									1.71

Table F.5. Surface Water Background

Location	Former 724th TPS	Mean Background	2 × Mean Background
Station	SWS1		
Sample ID	263111		
Date	08/13/97		
Metals (µg/L)			
Arsenic	<0.94	0.47	0.94
Barium	22.4	22.4	44.8
Cadmium	<0.2	0.1	0.2
Chromium	<0.6	0.3	0.6
Lead	2.6	2.6	5.2
Mercury	0.09	0.09	0.18
Selenium	<0.4	0.2	0.4
Silver	0.15	0.15	0.3

Table F.6. Sediment Background

Station	SWS-1	Mean Background	2 × Mean Background
Sample ID	262111		
Date	08/13/97		
RCRA Metals (mg/kg)			
Arsenic	<0.37	0.185	0.37
Barium	1.5	1.5	3.0
Cadmium	<0.12	0.06	0.12
Chromium	<0.37	0.185	0.37
Lead	0.69	0.69	1.38
Mercury	<0.02	0.01	0.02
Selenium	<0.24	0.12	0.24
Silver	<0.17	0.085	0.17

Table F.7. Statistical Analysis of Surface Soil Background Data

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
<i>Metals (mg/kg)</i>									
Arsenic	7.4	7/12	58.33	1.05	139	0.43	5.10	L	2.1
Barium	420	12/12	100.00	7.37	79	0.77	21.90	L	14.7
Cadmium	2	4/12	33.33	0.0875	116	0.05	0.33	D	0.175
Chromium	52	12/13	92.31	3.1	116	0.21	12.10	L	6.21
Lead	17	13/13	100.00	4.41	74.4	0.48	11.00	L	8.81
Mercury	0.12	5/12	41.67	0.0171	74.3	0.01	0.04	D	0.0342
Selenium	0.45	1/9	11.11	0.203	105	0.63	0.63	D	0.406
Silver	2.8	1/11	9.09	0.075	189	0.06	0.06	D	0.15
<i>Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)</i>									
4,4'-DDD		0/3	0.00	0.00075	0			O	0.0015
4,4'-DDE		1/3	33.33	0.000867	23.3	0.00	0.00	D	0.00173
4,4'-DDT		1/3	33.33	0.0013	73.3	0.00	0.00	D	0.0026
Aldrin		0/3	0.00	0.000375	2.31			O	0.00075
alpha-Chlordane		0/3	0.00	0.000375	2.31			O	0.00075
alpha-BHC		0/3	0.00	0.000375	2.31			O	0.00075
Aroclor-1016		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1221		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1232		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1242		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1248		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1254		0/3	0.00	0.00187	1.55			O	0.00373
Aroclor-1260		0/3	0.00	0.00187	1.55			O	0.00373
beta-BHC		0/3	0.00	0.000375	2.31			O	0.00075
delta-BHC		0/3	0.00	0.000375	2.31			O	0.00075
Dieldrin		0/3	0.00	0.00075	0			O	0.0015
Endosulfan I		0/3	0.00	0.000375	2.31			O	0.00075
Endosulfan II		0/3	0.00	0.00075	0			O	0.0015
Endosulfan sulfate		0/3	0.00	0.00075	0			O	0.0015
Endrin		0/3	0.00	0.00075	0			O	0.0015
Endrin ketone		0/3	0.00	0.00075	0			O	0.0015
gamma-Chlordane		0/3	0.00	0.000375	2.31			O	0.00075
gamma-BHC (Lindane)		0/3	0.00	0.000375	2.31			O	0.00075
Heptachlor		0/3	0.00	0.000375	2.31			O	0.00075
Heptachlor epoxide		0/3	0.00	0.000375	2.31			O	0.00075
Methoxychlor		1/3	33.33	0.00348	14.7	0.00	0.00	D	0.00697
Toxaphene		0/3	0.00	0.0188	1.93			O	0.0376

Table F.7. Statistical Analysis of Surface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
<i>Semivolatile Organic Compounds (mg/kg)</i>									
1,2,4-Trichlorobenzene		0/10	0.00	0.245	69.1			O	0.49
1,2-Dichlorobenzene		0/10	0.00	0.245	69.1			O	0.49
1,3-Dichlorobenzene		0/10	0.00	0.245	69.1			O	0.49
1,4-Dichlorobenzene		0/10	0.00	0.245	69.1			O	0.49
1-Methylnaphthalene		0/1	0.00	0.18				O	0.36
2,2'-Oxybis (1-chloropropane)		0/9	0.00	0.251	70.9			O	0.503
2,4,5-Trichlorophenol		0/10	0.00	0.554	82.7			O	1.11
2,4,6-Trichlorophenol		0/10	0.00	0.245	69.1			O	0.49
2,4-Dichlorophenol		0/10	0.00	0.245	69.1			O	0.49
2,4-Dimethylphenol		0/10	0.00	0.245	69.1			O	0.49
2,4-Dinitrophenol		0/10	0.00	0.593	72.7			O	1.19
2,4-Dinitrotoluene		0/10	0.00	0.245	69.1			O	0.49
2,6-Dinitrotoluene		0/10	0.00	0.245	69.1			O	0.49
2-Chloronaphthalene		0/11	0.00	0.24	67.5			O	0.479
2-Chlorophenol		0/10	0.00	0.245	69.1			O	0.49
2-Methylnaphthalene		0/11	0.00	0.239	67.7			O	0.478
2-Methylphenol		0/10	0.00	0.245	69.1			O	0.49
2-Nitroaniline		0/10	0.00	0.554	82.7			O	1.11
2-Nitrophenol		0/10	0.00	0.245	69.1			O	0.49
3,3'-Dichlorobenzidine		0/10	0.00	0.605	63.4			O	1.21
3-Nitroaniline		0/10	0.00	0.554	82.7			O	1.11
4,6-Dinitro-o-cresol		0/10	0.00	0.593	72.7			O	1.19
4-Bromophenyl-phenyl ether		0/10	0.00	0.245	69.1			O	0.49
4-Chloroaniline		0/10	0.00	0.245	69.1			O	0.49
4-Chlorophenyl-phenyl ether		0/10	0.00	0.245	69.1			O	0.49
4-Methylphenol		0/10	0.00	0.245	69.1			O	0.49
4-Nitroaniline		0/10	0.00	0.554	82.7			O	1.11
4-Nitrophenol		0/10	0.00	0.593	72.7			O	1.19
4-Chloro-3-methylphenol		0/10	0.00	0.245	69.1			O	0.49
Acenaphthene		0/12	0.00	0.235	66.1			O	0.469
Acenaphthylene		0/12	0.00	0.235	66.1			O	0.469
Anthracene		0/12	0.00	0.235	66.1			O	0.469
Benzo(a)anthracene		0/12	0.00	0.235	66.1			O	0.469
Benzo(a)pyrene		0/12	0.00	0.235	66.1			O	0.469
Benzo(b)fluoranthene		0/13	0.00	0.23	64.8			O	0.461
Benzo(g,h,i)perylene		0/12	0.00	0.235	66.1			O	0.469
Benzo(k)fluoranthene		0/12	0.00	0.235	66.1			O	0.469

Table F.7. Statistical Analysis of Surface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
Benzoic acid		0/1	0.00	0.373				O	0.746
Benzyl alcohol		0/1	0.00	0.187				O	0.373
Bis(2-chloroisopropyl)ether		0/1	0.00	0.187				O	0.373
Bis(2-chloroethoxy)methane		0/10	0.00	0.245	69.1			O	0.49
Bis(2-chloroethyl)ether		0/10	0.00	0.245	69.1			O	0.49
Bis(2-ethylhexyl)phthalate		0/10	0.00	0.245	69.1			O	0.49
Butyl benzyl phthalate		0/10	0.00	0.245	69.1			O	0.49
Carbazole		0/12	0.00	0.235	66.1			O	0.469
Chrysene		0/10	0.00	0.245	69.1			O	0.49
Di-N-butyl phthalate		0/10	0.00	0.245	69.1			O	0.49
Di-N-octyl phthalate		0/10	0.00	0.245	69.1			O	0.49
Dibenzo(a,h)anthracene		0/12	0.00	0.235	66.1			O	0.469
Dibenzofuran		0/10	0.00	0.245	69.1			O	0.49
Diethyl phthalate		0/10	0.00	0.245	69.1			O	0.49
Dimethyl phthalate		0/12	0.00	0.235	66.1			O	0.469
Fluoranthene		0/12	0.00	0.235	66.1			O	0.469
Fluorene		0/10	0.00	0.245	69.1			O	0.49
Hexachlorobenzene		0/10	0.00	0.245	69.1			O	0.49
Hexachlorobutadiene		0/10	0.00	0.245	69.1			O	0.49
Hexachlorocyclopentadiene		0/10	0.00	0.245	69.1			O	0.49
Hexachloroethane		0/10	0.00	0.245	69.1			O	0.49
Indeno(1,2,3-cd)pyrene		0/12	0.00	0.235	66.1			O	0.469
Isophorone		0/10	0.00	0.245	69.1			O	0.49
N-Nitroso-di-N-propylamine		0/10	0.00	0.245	69.1			O	0.49
N-Nitrosodiphenylamine		0/10	0.00	0.245	69.1			O	0.49
Naphthalene		0/12	0.00	0.235	66.1			O	0.469
Nitrobenzene		0/10	0.00	0.245	69.1			O	0.49
Pentachlorophenol		0/10	0.00	0.554	82.7			O	1.11
Phenanthrene		0/12	0.00	0.235	66.1			O	0.469
Phenol		0/10	0.00	0.245	69.1			O	0.49
Pyrene		0/12	0.00	0.235	66.1			O	0.469
Volatile Organic Compounds (mg/kg)									
1,1,1-Trichloroethane		0/10	0.00	0.00295	37.7			O	0.00589
1,1,2,2-Tetrachloroethane		0/10	0.00	0.00295	37.7			O	0.00589
1,1,2-Trichloroethane		0/10	0.00	0.00295	37.7			O	0.00589
1,1-Dichloroethane		0/10	0.00	0.00295	37.7			O	0.00589
1,1-Dichloroethene		2/10	20.00	0.00248	63.6	0.00	0.00	D	0.00495
1,2-Dichloroethane		0/10	0.00	0.00295	37.7			O	0.00589
1,2-Dichloroethene		0/8	0.00	0.00283	5.27			O	0.00565

Table F.7. Statistical Analysis of Surface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
1,2-Dichloropropane		0/10	0.00	0.00295	37.7			O	0.00589
1,2-cis-Dichloroethene		0/2	0.00	0.00343	93.9			O	0.00685
1,2-trans-Dichloroethene		0/2	0.00	0.00343	93.9			O	0.00685
1,3-cis-Dichloropropene		0/10	0.00	0.00295	37.7			O	0.00589
1,3-trans-Dichloropropene		0/10	0.00	0.00295	37.7			O	0.00589
2-Butanone		1/6	16.67	0.00548	61.4	0.00	0.00	D	0.011
2-Hexanone		1/10	10.00	0.00545	47.9	0.00	0.00	D	0.0109
4-Methyl-2-pentanone		1/10	10.00	0.00545	47.9	0.00	0.00	D	0.0109
Acetone		2/7	28.57	0.00728	66	0.00	0.01	D	0.0146
Benzene		1/11	9.09	0.00272	47.8	0.00	0.00	D	0.00544
Bromodichloromethane		0/10	0.00	0.00295	37.7			O	0.00589
Bromoform		0/10	0.00	0.00295	37.7			O	0.00589
Bromomethane		1/10	10.00	0.00535	51.1	0.00	0.00	D	0.0107
Carbon disulfide		1/10	10.00	0.00298	34.8	0.00	0.00	D	0.00595
Carbon tetrachloride		0/10	0.00	0.00295	37.7			O	0.00589
Chlorobenzene		0/10	0.00	0.00295	37.7			O	0.00589
Chloroethane		0/10	0.00	0.00576	42.2			O	0.0115
Chloroform		0/10	0.00	0.00295	37.7			O	0.00589
Chloromethane		0/10	0.00	0.00576	42.2			O	0.0115
Dibromochloromethane		0/10	0.00	0.00295	37.7			O	0.00589
Ethylbenzene		1/11	9.09	0.00273	47.4	0.00	0.00	D	0.00546
Methylene chloride		0/10	0.00	0.0037	45.8			O	0.00739
Styrene		0/10	0.00	0.00295	37.7			O	0.00589
Tetrachloroethene		0/10	0.00	0.00295	37.7			O	0.00589
Toluene		6/11	54.55	0.00609	122	0.00	0.03	L	0.0122
Trichloroethene		1/10	10.00	0.00272	50.8	0.00	0.00	D	0.00544
Vinyl chloride		0/10	0.00	0.00576	42.2			O	0.0115
Xylenes, total		0/11	0.00	0.00293	36			O	0.00585
Radionuclides (pCi/g)									
Radium-226		1/1	100.00	0.428		0.43	0.43	X	0.856
Radium-228		1/1	100.00	0.851		0.85	0.85	X	1.7

^aResults less than the detection limit were set to one-half the reported detection limit. For radionuclides, the reported result was used to calculate the mean.

Distribution codes:

D = Distribution not determined because fewer than 5 detects or less than 50 percent detects (t-distribution).

L = Distribution most similar to lognormal [land statistic used for upper confidence limit (UCL)].

N = Distribution most similar to normal (t-distribution used for UCL).

O = Analyte not detected in any sample.

X = Distribution significantly different from normal and lognormal (t-distribution used for UCL).

^bIf a chemical was not detected, the reference background criterion was the mean of the detection limit. However, organic constituents were screened against zero because they are considered man-made.

CV = Coefficient of variation.

Table F.8. Statistical Analysis of Subsurface Soil Background Data

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
<i>Metals (mg/kg)</i>									
Arsenic	7.40	8/17	47.06	4.02	334	0.44	56.00	D	8.04
Barium	420.00	19/19	100.00	8.49	101	1.10	30.00	L	17
Cadmium	2.00	0/17	0.00	0.115	109			O	0.231
Chromium	52.00	19/19	100.00	5.81	84.5	0.76	19.00	L	11.6
Lead	17.00	19/19	100.00	5.56	103	1.10	23.00	L	11.1
Mercury	0.12	9/17	52.94	0.024	81.4	0.01	0.06	L	0.048
Selenium	0.45	1/14	7.14	0.558	131	0.67	0.67	D	1.12
Silver	2.80	0/16	0.00	0.227	115			O	0.453
<i>Other Analytes</i>									
Total organic carbon		1/1	100.00	1,100		1,100.00	1,100.00	X	2,200
<i>Pesticides/Polychlorinated Biphenyls (PCBs) (mg/kg)</i>									
4,4'-DDD		0/3	0.00	0.00075	6.67			O	0.0015
4,4'-DDE		0/3	0.00	0.00075	6.67			O	0.0015
4,4'-DDT		0/3	0.00	0.00075	6.67			O	0.0015
Aldrin		0/3	0.00	0.000378	3.33			O	0.000757
alpha-Chlordane		0/3	0.00	0.000378	3.33			O	0.000757
alpha-BHC		1/3	33.33	0.000562	56.8	0.00	0.00	D	0.00112
Aroclor-1016		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1221		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1232		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1242		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1248		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1254		0/3	0.00	0.00188	4.06			O	0.00377
Aroclor-1260		0/3	0.00	0.00188	4.06			O	0.00377
beta-BHC		0/3	0.00	0.000378	3.33			O	0.000757
delta-BHC		0/3	0.00	0.000378	3.33			O	0.000757
Dieldrin		0/3	0.00	0.00075	6.67			O	0.0015
Endosulfan I		0/3	0.00	0.000378	3.33			O	0.000757
Endosulfan II		0/3	0.00	0.00075	6.67			O	0.0015
Endosulfan sulfate		0/3	0.00	0.00075	6.67			O	0.0015
Endrin		0/3	0.00	0.00075	6.67			O	0.0015
Endrin ketone		0/3	0.00	0.00075	6.67			O	0.0015
Gamma chlordane		0/3	0.00	0.000378	3.33			O	0.000757
gamma-BHC (Lindane)		0/3	0.00	0.000378	3.33			O	0.000757
Heptachlor		0/3	0.00	0.000378	3.33			O	0.000757
Heptachlor epoxide		0/3	0.00	0.000378	3.33			O	0.000757

Table F.8. Statistical Analysis of Subsurface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
Methoxychlor		0/3	0.00	0.00378	3.33			O	0.00757
Toxaphene		0/3	0.00	0.0189	3.58			O	0.0378
<i>Semivolatile Organic Compounds (ng/kg)</i>									
1,2,4-Trichlorobenzene		1/9	11.11	0.241	90.5	0.00	0.00	D	0.481
1,2-Dichlorobenzene		0/9	0.00	0.26	77.1			O	0.521
1,3-Dichlorobenzene		0/9	0.00	0.26	77.1			O	0.521
1,4-Dichlorobenzene		0/9	0.00	0.26	77.1			O	0.521
1-Methylnaphthalene		0/1	0.00	0.185				O	0.37
2,2'-Oxybis (1-chloropropane)		0/9	0.00	0.26	77.1			O	0.521
2,4,5-Trichlorophenol		0/9	0.00	0.618	84.4			O	1.24
2,4,6-Trichlorophenol		0/9	0.00	0.26	77.1			O	0.521
2,4-Dichlorophenol		0/9	0.00	0.26	77.1			O	0.521
2,4-Dimethylphenol		0/9	0.00	0.26	77.1			O	0.521
2,4-Dinitrophenol		0/9	0.00	0.64	79			O	1.28
2,4-Dinitrotoluene		0/9	0.00	0.26	77.1			O	0.521
2,6-Dinitrotoluene		0/9	0.00	0.26	77.1			O	0.521
2-Chloronaphthalene		0/10	0.00	0.253	75.3			O	0.506
2-Chlorophenol		0/9	0.00	0.26	77.1			O	0.521
2-Methylnaphthalene		0/10	0.00	0.253	75.4			O	0.506
2-Methylphenol		0/9	0.00	0.26	77.1			O	0.521
2-Nitroaniline		0/9	0.00	0.618	84.4			O	1.24
2-Nitrophenol		0/9	0.00	0.26	77.1			O	0.521
3,3'-Dichlorobenzidine		0/9	0.00	0.586	72.5			O	1.17
3-Nitroaniline		0/9	0.00	0.618	84.4			O	1.24
4,6-Dinitro-o-cresol		0/9	0.00	0.64	79			O	1.28
4-Bromophenyl-phenyl ether		0/9	0.00	0.26	77.1			O	0.521
4-Chloroaniline		0/9	0.00	0.26	77.1			O	0.521
4-Chlorophenyl-phenyl ether		0/9	0.00	0.26	77.1			O	0.521
4-Methylphenol		0/9	0.00	0.26	77.1			O	0.521
4-Nitroaniline		0/9	0.00	0.618	84.4			O	1.24
4-Nitrophenol		0/9	0.00	0.64	79			O	1.28
4-Chloro-3-methylphenol		0/9	0.00	0.26	77.1			O	0.521
Acenaphthene		0/11	0.00	0.247	73.7			O	0.494
Acenaphthylene		0/11	0.00	0.247	73.7			O	0.494
Anthracene		0/11	0.00	0.247	73.7			O	0.494
Benzo(a)anthracene		0/11	0.00	0.247	73.7			O	0.494
Benzo(a)pyrene		0/11	0.00	0.247	73.7			O	0.494
Benzo(b)fluoranthene		0/11	0.00	0.247	73.7			O	0.494

Table F.8. Statistical Analysis of Subsurface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
Benzo(<i>g,h,i</i>)perylene		0/11	0.00	0.247	73.7			O	0.494
Benzo(<i>k</i>)fluoranthene		0/11	0.00	0.247	73.7			O	0.494
Benzoic acid		0/9	0.00	0.26	77.1			O	0.521
Benzyl alcohol		0/9	0.00	0.26	77.1			O	0.521
Bis(2-chloroisopropyl)ether		1/9	11.11	0.318	77.9	0.71	0.71	D	0.637
Bis(2-chloroethoxy)methane		0/9	0.00	0.26	77.1			O	0.521
Bis(2-chloroethyl)ether		0/9	0.00	0.26	77.1			O	0.521
Bis(2-ethylhexyl)phthalate		0/11	0.00	0.247	73.7			O	0.494
Butyl benzyl phthalate		1/9	11.11	0.261	77	0.19	0.19	D	0.521
Carbazole		0/9	0.00	0.26	77.1			O	0.521
Chrysene		0/11	0.00	0.247	73.7			O	0.494
Di- <i>N</i> -butyl phthalate		0/9	0.00	0.26	77.1			O	0.521
Di- <i>N</i> -octyl phthalate		0/9	0.00	0.26	77.1			O	0.521
Dibenzo(<i>a,h</i>)anthracene		0/9	0.00	0.26	77.1			O	0.521
Dibenzofuran		1/12	8.33	7.14	334	83.00	83.00	D	14.3
Diethyl phthalate		0/11	0.00	0.247	73.7			O	0.494
Dimethyl phthalate		0/9	0.00	0.26	77.1			O	0.521
Fluoranthene		0/9	0.00	0.26	77.1			O	0.521
Fluorene		0/9	0.00	0.26	77.1			O	0.521
Hexachlorobenzene		0/9	0.00	0.26	77.1			O	0.521
Hexachlorobutadiene		0/11	0.00	0.247	73.7			O	0.494
Hexachlorocyclopentadiene		0/9	0.00	0.26	77.1			O	0.521
Hexachloroethane		0/9	0.00	0.26	77.1			O	0.521
Indeno(1,2,3- <i>cd</i>)pyrene		0/9	0.00	0.26	77.1			O	0.521
Isophorone		0/11	0.00	0.247	73.7			O	0.494
<i>N</i> -Nitroso-di- <i>N</i> -propylamine		0/9	0.00	0.26	77.1			O	0.521
<i>N</i> -Nitrosodiphenylamine		0/9	0.00	0.618	84.4			O	1.24
Naphthalene		0/11	0.00	0.247	73.7			O	0.494
Nitrobenzene		0/9	0.00	0.26	77.1			O	0.521
Pentachlorophenol		1/12	8.33	7.31	335	85.00	85.00	D	14.6
Phenanthrene		0/16	0.00	0.00285	33.2			O	0.00569
Phenol		0/10	0.00	0.00285	42.9			O	0.00569
Pyrene		0/11	0.00	0.00285	40.7			O	0.00569
Volatile Organic Compounds (mg/kg)									
1,1-Dichloroethane		0/11	0.00	0.00285	40.7			O	0.00569
1,1-Dichloroethene		0/11	0.00	0.00285	40.7			O	0.00569
1,2-Dichloroethane		0/11	0.00	0.00285	40.7			O	0.00569
1,2-Dichloroethene		0/8	0.00	0.00294	4.62			O	0.00588
1,2-Dichloropropane		0/11	0.00	0.00285	40.7			O	0.00569

Table F.8. Statistical Analysis of Subsurface Soil Background Data (continued)

Analyte	USGS Eastern U.S. Reference	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
1,2-cis-Dichloroethene		0/3	0.00	0.0026	98.3			O	0.0052
1,2-trans-Dichloroethene		0/3	0.00	0.0026	98.3			O	0.0052
1,3-cis-Dichloropropene		0/11	0.00	0.00285	40.7			O	0.00569
1,3-trans-Dichloropropene		0/11	0.00	0.00285	40.7			O	0.00569
2-Butanone		1/7	14.29	0.00505	64.3	0.00	0.00	D	0.0101
2-Hexanone		1/11	9.09	0.00535	48.2	0.00	0.00	D	0.0107
4-Methyl-2-pentanone		1/11	9.09	0.00535	48.2	0.00	0.00	D	0.0107
Acetone		6/15	40.00	0.0249	110	0.01	0.11	D	0.0498
Benzene		0/17	0.00	0.00284	32.2			O	0.00569
Bromodichloromethane		0/11	0.00	0.00285	40.7			O	0.00569
Bromoform		0/11	0.00	0.00285	40.7			O	0.00569
Bromomethane		1/11	9.09	0.00513	55.8	0.00	0.00	D	0.0103
Carbon disulfide		1/16	6.25	0.00298	25	0.00	0.00	D	0.00596
Carbon tetrachloride		0/11	0.00	0.00285	40.7			O	0.00569
Chlorobenzene		0/11	0.00	0.00285	40.7			O	0.00569
Chloroethane		0/11	0.00	0.00549	48.6			O	0.011
Chloroform		0/11	0.00	0.00285	40.7			O	0.00569
Chloromethane		0/11	0.00	0.00549	48.6			O	0.011
Dibromochloromethane		0/11	0.00	0.00285	40.7			O	0.00569
Ethylbenzene		0/17	0.00	0.00284	32.2			O	0.00569
Methylene chloride		1/16	6.25	0.0032	35.1	0.01	0.01	D	0.00639
Styrene		0/11	0.00	0.00285	40.7			O	0.00569
Tetrachloroethene		1/16	6.25	0.00305	40.9	0.01	0.01	D	0.0061
Toluene		5/17	29.41	0.00406	115	0.00	0.02	D	0.00813
Trichloroethene		0/11	0.00	0.00285	40.7			O	0.00569
Vinyl chloride		0/11	0.00	0.00549	48.6			O	0.011
Xylenes, total		2/17	11.76	0.00416	114	0.01	0.02	D	0.00833
Radionuclides (pCi/g)									
Radium-226		1/1	100.00	0.547		0.55	0.55	X	1.09
Radium-228		1/1	100.00	0.445		0.45	0.45	X	0.89

^aResults less than the detection limit were set to one-half the reported detection limit. For radionuclides, the reported result was used to calculate the mean.

Distribution codes:

D = Distribution not determined because fewer than 5 detects or less than 50 percent detects (t-distribution).

L = Distribution most similar to lognormal [land statistic used for upper confidence limit (UCL)].

N = Distribution most similar to normal (t-distribution used for UCL).

O = Analyte not detected in any sample.

X = Analyte significantly different from normal and lognormal (t-distribution used for UCL).

^bIf a chemical was not detected, the reference background criterion was the mean of the detection limit. However, organic constituents were screened against zero because they are considered man-made.

CV = Coefficient of variation.

Table F.9. Statistical Analysis of Groundwater Background Data

Analyte	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
<i>Anions (mg/L)</i>								
Alkalinity	1/1	100.00	45,100.00		45,100.00	45,100.00	X	90,200.00
Nitrate	0/1	0.00	250.00				O	500.00
Nitrite	0/1	0.00	250.00				O	500.00
Sulfate	8/8	100.00	13,400.00	110.00	1,100.00	38,900.00	L	26,717.50
Sulfide	0/1	0.00	50.00				O	100.00
<i>Metals (mg/L)</i>								
Aluminum	1/1	100.00	1,200.00		1,200.00	1,200.00	X	2,400.00
Antimony	0/1	0.00	1.20				O	2.40
Arsenic	1/18	5.56	1.51	147.14	10.10	10.10	D	3.02
Barium	17/18	94.44	35.90	109.00	3.80	177.00	L	71.72
Beryllium	0/1	0.00	0.08				O	0.15
Cadmium	4/16	25.00	0.21	121.03	0.32	1.10	D	0.43
Calcium	1/1	100.00	1,630.00		1,630.00	1,630.00	X	3,260.00
Chromium	12/18	66.67	1.78	107.61	0.52	7.30	L	3.56
Cobalt	0/1	0.00	0.23				O	0.46
Copper	1/1	100.00	2.00		2.00	2.00	X	4.00
Iron	2/2	100.00	2,190.00	102.79	598.00	3,780.00	N	4,378.00
Lead	8/18	44.44	2.35	250.54	0.08	25.50	D	4.69
Magnesium	1/1	100.00	814.00		814.00	814.00	X	1,628.00
Manganese	1/1	100.00	17.30		17.30	17.30	X	34.60
Mercury	3/18	16.67	0.07	107.16	0.20	0.28	D	0.14
Nickel	1/1	100.00	1.90		1.90	1.90	X	3.80
Potassium	1/1	100.00	643.00		643.00	643.00	X	1,286.00
Selenium	2/17	11.76	0.95	68.62	0.62	2.50	D	1.90
Silver	5/18	27.78	0.56	196.74	0.08	4.90	D	1.12
Sodium	1/1	100.00	3,520.00		3,520.00	3,520.00	X	7,040.00
Thallium	0/1	0.00	1.60				O	3.20
Vanadium	1/1	100.00	2.00		2.00	2.00	X	4.00
Zinc	0/1	0.00	8.45				O	16.90
<i>Other Analytes</i>								
Total organic carbon	1/1	100.00	3,160.00		3,160.00	3,160.00	X	6,320.00
<i>Volatile Organic Compounds (mg/L)</i>								
Ethane	0/1	0.00	2.50				O	5.00
Ethene	0/1	0.00	2.50				O	5.00
Methane	1/1	100.00	53.70		53.70	53.70	X	107.40

Table F.9. Statistical Analysis of Groundwater Background Data (continued)

Analyte	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
Explosives (mg/L)								
1,3,5-Trinitrobenzene	0/1	0.00	1.00				O	2.00
1,3-Dinitrobenzene	0/1	0.00	1.50				O	3.00
2,4,6-Trinitrotoluene	0/1	0.00	1.50				O	3.00
2,4-Dinitrotoluene	0/1	0.00	0.05				O	0.10
2,6-Dinitrotoluene	0/1	0.00	0.05				O	0.10
2-Nitrotoluene	0/1	0.00	5.00				O	10.00
3-Nitrotoluene	0/1	0.00	5.00				O	10.00
4-Nitrotoluene	0/1	0.00	5.00				O	10.00
HMX	0/1	0.00	10.00				O	20.00
Nitrobenzene	0/1	0.00	5.00				O	10.00
RDX	0/1	0.00	10.00				O	20.00
Tetryl	0/1	0.00	25.00				O	50.00
Pesticides/Polychlorinated Biphenyls (PCBs) (mg/L)								
4,4'-DDD	0/3	0.00	0.02	0.00			O	0.04
4,4'-DDE	0/3	0.00	0.02	0.00			O	0.04
4,4'-DDT	0/3	0.00	0.02	0.00			O	0.04
Aldrin	0/3	0.00	0.01	0.00			O	0.02
alpha-Chlordane	0/3	0.00	0.01	0.00			O	0.02
alpha-BHC	0/3	0.00	0.01	0.00			O	0.02
Aroclor-1016	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1221	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1232	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1242	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1248	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1254	0/3	0.00	0.05	0.58			O	0.10
Aroclor-1260	0/3	0.00	0.05	0.58			O	0.10
beta-BHC	0/3	0.00	0.01	0.00			O	0.02
delta-BHC	0/3	0.00	0.01	0.00			O	0.02
Dieldrin	0/3	0.00	0.02	0.00			O	0.04
Endosulfan I	0/3	0.00	0.01	0.00			O	0.02
Endosulfan II	0/3	0.00	0.02	0.00			O	0.04
Endosulfan sulfate	0/3	0.00	0.02	0.00			O	0.04
Endrin	0/3	0.00	0.02	0.00			O	0.04
Endrin aldehyde	0/2	0.00	0.02	0.00			O	0.04
Endrin ketone	0/3	0.00	0.02	0.00			O	0.04
gamma-Chlordane	0/3	0.00	0.01	0.00			O	0.02
gamma-BHC (Lindane)	0/3	0.00	0.01	0.00			O	0.02

Table F.9. Statistical Analysis of Groundwater Background Data (continued)

Analyte	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
<i>Semivolatile Organic Compounds (mg/L)</i>								
Heptachlor	0/3	0.00	0.01	0.00			O	0.02
Heptachlor epoxide	0/3	0.00	0.01	0.00			O	0.02
Methoxychlor	0/3	0.00	0.10	0.00			O	0.20
Toxaphene	0/3	0.00	0.50	0.58			O	0.99
1,2,4-Trichlorobenzene	0/11	0.00	5.05	2.28			O	10.10
1,2-Dichlorobenzene	0/11	0.00	5.05	2.28			O	10.10
1,3-Dichlorobenzene	0/11	0.00	5.05	2.28			O	10.10
1,4-Dichlorobenzene	0/11	0.00	5.05	2.28			O	10.10
2,2'-Oxybis (1-chloropropane)	0/11	0.00	5.05	2.28			O	10.10
2,4,5-Trichlorophenol	0/10	0.00	12.60	2.14			O	25.20
2,4,6-Trichlorophenol	0/10	0.00	5.03	2.16			O	10.06
2,4-Dichlorophenol	0/10	0.00	5.03	2.16			O	10.06
2,4-Dimethylphenol	0/10	0.00	5.03	2.16			O	10.06
2,4-Dinitrophenol	0/10	0.00	12.60	2.14			O	25.20
2,4-Dinitrotoluene	0/11	0.00	5.05	2.28			O	10.10
2,6-Dinitrotoluene	0/11	0.00	5.05	2.28			O	10.10
2-Chloronaphthalene	0/12	0.00	4.23	45.64			O	8.46
2-Chlorophenol	0/10	0.00	5.03	2.16			O	10.06
2-Methylnaphthalene	0/11	0.00	5.05	2.28			O	10.10
2-Methylphenol	0/10	0.00	5.03	2.16			O	10.06
2-Nitroaniline	0/11	0.00	12.60	2.26			O	25.20
2-Nitrophenol	0/10	0.00	5.03	2.16			O	10.06
3,3'-Dichlorobenzidine	0/11	0.00	10.10	2.28			O	20.20
3-Nitroaniline	0/11	0.00	12.60	2.26			O	25.20
4,6-Dinitro-o-cresol	0/10	0.00	12.60	2.14			O	25.20
4-Bromophenyl-phenyl ether	0/11	0.00	5.05	2.28			O	10.10
4-Chloroaniline	0/11	0.00	5.05	2.28			O	10.10
4-Chlorophenyl-phenylether	0/11	0.00	5.05	2.28			O	10.10
4-Methylphenol	0/10	0.00	5.03	2.16			O	10.06
4-Nitroaniline	0/11	0.00	12.60	2.26			O	25.20
4-Nitrophenol	0/10	0.00	12.60	2.14			O	25.20
4-Chloro-3-methylphenol	0/10	0.00	5.03	2.16			O	10.06
Acenaphthene	0/12	0.00	4.23	45.64			O	8.46
Acenaphthylene	0/12	0.00	4.23	45.64			O	8.46
Anthracene	0/12	0.00	4.23	45.64			O	8.46
Benzo(a)anthracene	0/12	0.00	4.23	45.64			O	8.46
Benzo(a)pyrene	0/12	0.00	4.23	45.64			O	8.46
Benzo(b)fluoranthene	0/12	0.00	4.23	45.64			O	8.46

Table F-9. Statistical Analysis of Groundwater Background Data (continued)

Analyte	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
Benzo(<i>g,h,i</i>)perylene	0/12	0.00	4.23	45.64			O	8.46
Benzo(<i>k</i>)fluoranthene	0/12	0.00	4.23	45.64			O	8.46
Bis(2-chloroethoxy)methane	0/11	0.00	5.05	2.28			O	10.10
Bis(2-chloroethyl)ether	0/11	0.00	5.05	2.28			O	10.10
Bis(2-ethylhexyl)phthalate	0/11	0.00	5.05	2.28			O	10.10
Butyl benzyl phthalate	0/11	0.00	5.05	2.28			O	10.10
Carbazole	0/11	0.00	5.05	2.28			O	10.10
Chrysene	0/12	0.00	4.23	45.64			O	8.46
Di- <i>N</i> -butyl phthalate	0/11	0.00	5.05	2.28			O	10.10
Di- <i>N</i> -octyl phthalate	0/11	0.00	5.05	2.28			O	10.10
Dibenzo(<i>a,h</i>)anthracene	0/12	0.00	4.23	45.64			O	8.46
Dibenzofuran	0/11	0.00	5.05	2.28			O	10.10
Diethyl phthalate	0/11	0.00	5.05	2.28			O	10.10
Dimethyl phthalate	0/11	0.00	5.05	2.28			O	10.10
Fluoranthene	0/12	0.00	4.23	45.64			O	8.46
Fluorene	0/12	0.00	4.23	45.64			O	8.46
Hexachlorobenzene	0/11	0.00	5.05	2.28			O	10.10
Hexachlorobutadiene	0/11	0.00	5.05	2.28			O	10.10
Hexachlorocyclopentadiene	0/11	0.00	5.05	2.28			O	10.10
Hexachloroethane	0/11	0.00	5.05	2.28			O	10.10
Indeno(1,2,3- <i>cd</i>)pyrene	0/12	0.00	4.23	45.64			O	8.46
Isophorone	0/11	0.00	5.05	2.28			O	10.10
<i>N</i> -Nitroso-di- <i>N</i> -propylamine	0/11	0.00	5.05	2.28			O	10.10
<i>N</i> -Nitrosodiphenylamine	0/11	0.00	5.05	2.28			O	10.10
Naphthalene	0/12	0.00	4.23	45.64			O	8.46
Nitrobenzene	0/11	0.00	5.05	2.28			O	10.10
Pentachlorophenol	0/10	0.00	12.60	2.14			O	25.20
Phenanthrene	0/12	0.00	4.23	45.64			O	8.46
Phenol	0/10	0.00	5.03	2.16			O	10.06
Pyrene	0/12	0.00	4.63	30.87			O	9.26
Volatile Organic Compounds (mg/L)								
1,1,1-Trichloroethane	1/17	5.88	1.75	48.08	0.23	0.23	D	3.50
1,1,2,2-Tetrachloroethane	0/17	0.00	1.88	40.43			O	3.76
1,1,2-Trichloroethane	0/17	0.00	1.88	40.43			O	3.76
1,1,1-Dichloroethane	1/17	5.88	1.77	45.82	0.53	0.53	D	3.54
1,1-Dichloroethane	0/17	0.00	1.88	40.43			O	3.76
1,2-Dichloroethane	0/17	0.00	1.88	40.43			O	3.76
1,2-Dichloroethane	0/9	0.00	2.50	0.00			O	5.00
1,2-Dichloropropane	0/17	0.00	1.88	40.43			O	3.76

Table F.9. Statistical Analysis of Groundwater Background Data (continued)

Analyte	Results >Det. Limit	%Results >Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist. ^a	Reference Background Criteria ^b
1,2- <i>cis</i> -Dichloroethene	0/8	0.00	1.19	44.66			O	2.38
1,2- <i>trans</i> -Dichloroethene	0/8	0.00	1.19	44.66			O	2.38
1,3- <i>cis</i> -Dichloropropene	0/17	0.00	1.88	40.43			O	3.76
1,3- <i>trans</i> -Dichloropropene	1/17	5.88	1.75	48.00	0.24	0.24	D	3.50
2-Butanone	0/9	0.00	3.06	36.08			O	6.12
2-Hexanone	0/17	0.00	3.97	31.94			O	7.94
4-Methyl-2-pentanone	0/12	0.00	4.58	21.23			O	9.16
Acetone	3/14	21.43	3.61	37.06	1.70	5.20	D	7.22
Benzene	0/17	0.00	1.53	48.31			O	3.06
Bromodichloromethane	0/17	0.00	1.88	40.43			O	3.76
Bromoform	0/17	0.00	1.88	40.43			O	3.76
Bromomethane	0/17	0.00	3.35	60.52			O	6.70
Carbon disulfide	0/17	0.00	2.50	0.00			O	5.00
Carbon tetrachloride	0/17	0.00	1.88	40.43			O	3.76
Chlorobenzene	0/17	0.00	1.88	40.43			O	3.76
Chloroethane	0/17	0.00	3.35	60.52			O	6.70
Chloroform	0/17	0.00	1.88	40.43			O	3.76
Chloromethane	1/17	5.88	3.71	57.23	7.10	7.10	D	7.42
Dibromochloromethane	0/17	0.00	1.88	40.43			O	3.76
Ethylbenzene	3/17	17.65	1.49	61.47	0.21	0.34	D	2.98
Methylene chloride	1/17	5.88	2.04	34.17	2.10	2.10	D	4.08
Styrene	0/17	0.00	1.88	40.43			O	3.76
Tetrachloroethene	0/17	0.00	1.88	40.43			O	3.76
Toluene	3/17	17.65	0.97	49.16	0.26	0.35	D	1.94
Trichloroethene	1/17	5.88	1.75	47.60	0.29	0.29	D	3.50
Vinyl acetate	0/1	0.00	5.00				O	10.00
Vinyl chloride	0/17	0.00	1.24	78.54			O	2.48
Xylenes, total	3/17	17.65	1.55	53.94	0.42	0.71	D	3.10
Radionuclides (pCi/L)								
Radium-226	1/1	100.00	0.58		0.58	0.58	X	1.16
Radium-228	1/1	100.00	1.71		1.71	1.71	X	3.42

^aResults less than the detection limit were set to one-half the reported detection limit. For radionuclides, the reported result was used to calculate the mean.

Distribution codes:

D = Distribution not determined because fewer than 5 detects or less than 50 percent detects (t-distribution).

I = Distribution most similar to lognormal (land statistic used for upper confidence limit (UCL)).

N = Distribution most similar to normal (t-distribution used for UCL).

O = Analyte not detected in any sample.

X = Distribution significantly different from normal and lognormal (t-distribution used for UCL).

^bIf a chemical was not detected, the reference background criterion was the mean of the detection limit. However, organic constituents were screened against zero because they are considered man-made.

CV = Coefficient of variation.

Table F.10. Summary of Surface Water Background for Former Fire Training Area, Fort Stewart

Analyte	Units	Results > Det. Limit	%Results > Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist.	Site-specific Background Criteria
Arsenic	µg/L	0/1	0	0.47	.	.	.	O	0.94
Barium	µg/L	1/1	100	22.4	.	22.4	22.4	X	44.8
Cadmium	µg/L	0/1	0	0.1	.	.	.	O	0.2
Chromium	µg/L	0/1	0	0.3	.	.	.	O	0.6
Lead	µg/L	1/1	100	2.6	.	2.6	2.6	X	5.2
Mercury	µg/L	1/1	100	0.09	.	0.09	0.09	X	0.18
Selenium	µg/L	0/1	0	0.2	.	.	.	O	0.4
Silver	µg/L	1/1	100	0.15	.	0.15	0.15	X	0.3
2-Chloronaphthalene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Acenaphthene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Acenaphthylene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Anthracene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Benzo(a)anthracene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Benzo(a)pyrene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Benzo(b)fluoranthene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Benzo(g,h,i)perylene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Benzo(k)fluoranthene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Chrysene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Dibenzo(a,h)anthracene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Fluoranthene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Fluorene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Indeno(1,2,3-cd)pyrene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Naphthalene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Phenanthrene	µg/L	0/1	0	0.11	.	.	.	O	0.22
Pyrene	µg/L	0/1	0	0.11	.	.	.	O	0.22
1,1,1-Trichloroethane	µg/L	0/1	0	1	.	.	.	O	2
1,1,2,2-Tetrachloroethane	µg/L	0/1	0	1	.	.	.	O	2
1,1,2-Trichloroethane	µg/L	0/1	0	1	.	.	.	O	2
1,1-Dichloroethane	µg/L	0/1	0	1	.	.	.	O	2
1,1-Dichloroethene	µg/L	0/1	0	1	.	.	.	O	2
1,2-Dichloroethane	µg/L	0/1	0	1	.	.	.	O	2
1,2-Dichloropropane	µg/L	0/1	0	1	.	.	.	O	2
1,2-cis-Dichloroethene	µg/L	0/1	0	1	.	.	.	O	2
1,2-trans-Dichloroethene	µg/L	0/1	0	1	.	.	.	O	2
1,3-cis-Dichloropropene	µg/L	0/1	0	1	.	.	.	O	2
1,3-trans-Dichloropropene	µg/L	0/1	0	1	.	.	.	O	2
2-Butanone	µg/L	0/1	0	2.5	.	.	.	O	5
2-Hexanone	µg/L	0/1	0	2.5	.	.	.	O	5

Table F.10. Summary of Surface Water Background for Former Fire Training Area, Fort Stewart (continued)

Analyte	Units	Results > Det. Limit	%Results > Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist.	Site-specific Background Criteria
4-Methyl-2-pentanone	µg/L	0/1	0	2.5	.	.	.	O	5
Benzene	µg/L	0/1	0	1	.	.	.	O	2
Bromodichloromethane	µg/L	0/1	0	1	.	.	.	O	2
Bromoform	µg/L	0/1	0	1	.	.	.	O	2
Bromomethane	µg/L	0/1	0	1	.	.	.	O	2
Carbon Disulfide	µg/L	0/1	0	2.5	.	.	.	O	5
Carbon Tetrachloride	µg/L	0/1	0	1	.	.	.	O	2
Chlorobenzene	µg/L	0/1	0	1	.	.	.	O	2
Chloroethane	µg/L	0/1	0	1	.	.	.	O	2
Chloroform	µg/L	0/1	0	1	.	.	.	O	2
Chloromethane	µg/L	0/1	0	1	.	.	.	O	2
Dibromochloromethane	µg/L	0/1	0	1	.	.	.	O	2
Ethylbenzene	µg/L	0/1	0	1	.	.	.	O	2
Methylene Chloride	µg/L	0/1	0	1.05	.	.	.	O	2.1
Styrene	µg/L	0/1	0	1	.	.	.	O	2
Tetrachloroethene	µg/L	0/1	0	1	.	.	.	O	2
Toluene	µg/L	0/1	0	1	.	.	.	O	2
Trichloroethene	µg/L	0/1	0	1	.	.	.	O	2
Vinyl Chloride	µg/L	0/1	0	1	.	.	.	O	2
Xylenes, Total	µg/L	0/1	0	1	.	.	.	O	2

CV = Coefficient of variation.

Distribution codes:

D = Distribution not determined because fewer than 5 detects or less than 50 percent detects (t-distribution).

L = Distribution most similar to lognormal (land statistic used for upper confidence limit (UCL)).

N = Distribution most similar to normal (t-distribution used for UCL).

O = Analyte not detected in any sample.

X = Distribution significantly different from normal and lognormal (t-distribution used for UCL).

Table F.11. Summary of Sediment Background for Former Fire Training Area, Fort Stewart

Analyte	Units	Results > Det. Limit	%Results > Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist.	Site-specific Background Criteria
Arsenic	mg/kg	0/1	0	0.185	.	.	.	O	0.37
Barium	mg/kg	1/1	100	1.5	.	1.5	1.5	X	3
Cadmium	mg/kg	0/1	0	0.06	.	.	.	O	0.12
Chromium	mg/kg	0/1	0	0.185	.	.	.	O	0.37
Lead	mg/kg	1/1	100	0.69	.	0.69	0.69	X	1.38
Mercury	mg/kg	0/1	0	0.01	.	.	.	O	0.02
Selenium	mg/kg	0/1	0	0.12	.	.	.	O	0.24
Silver	mg/kg	0/1	0	0.085	.	.	.	O	0.17
2-Chloronaphthalene	µg/kg	0/1	0	210	.	.	.	O	420
Acenaphthene	µg/kg	0/1	0	210	.	.	.	O	420
Acenaphthylene	µg/kg	0/1	0	210	.	.	.	O	420
Anthracene	µg/kg	0/1	0	210	.	.	.	O	420
Benzo(a)anthracene	µg/kg	0/1	0	210	.	.	.	O	420
Benzo(a)pyrene	µg/kg	0/1	0	210	.	.	.	O	420
Benzo(b)fluoranthene	µg/kg	0/1	0	210	.	.	.	O	420
Benzo(g,h,i)perylene	µg/kg	0/1	0	210	.	.	.	O	420
Benzo(k)fluoranthene	µg/kg	0/1	0	210	.	.	.	O	420
Chrysene	µg/kg	0/1	0	210	.	.	.	O	420
Dibenzo(a,h)anthracene	µg/kg	0/1	0	210	.	.	.	O	420
Fluoranthene	µg/kg	0/1	0	210	.	.	.	O	420
Fluorene	µg/kg	0/1	0	210	.	.	.	O	420
Indeno(1,2,3-cd)pyrene	µg/kg	0/1	0	210	.	.	.	O	420
Naphthalene	µg/kg	0/1	0	210	.	.	.	O	420
Phenanthrene	µg/kg	0/1	0	210	.	.	.	O	420
Pyrene	µg/kg	0/1	0	210	.	.	.	O	420
1,1,1-Trichloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,1,2,2-Tetrachloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,1,2-Trichloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,1-Dichloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,1-Dichloroethene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,2-Dichloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,2-Dichloropropane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,2-cis-Dichloroethene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,2-trans-Dichloroethene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,3-cis-Dichloropropene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
1,3-trans-Dichloropropene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
2-Butanone	µg/kg	0/1	0	3.15	.	.	.	O	6.3
2-Hexanone	µg/kg	0/1	0	3.15	.	.	.	O	6.3

Table F.11. Summary of Sediment Background for Former Fire Training Area, Fort Stewart (continued)

Analyte	Units	Results > Det. Limit	%Results > Det. Limit	Average Result	CV	Min Detect	Max Detect	Dist.	Site-specific Background Criteria
Acetone	µg/kg	0/1	0	3.15	.	.	.	O	6.3
Benzene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Bromodichloromethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Bromoform	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Bromomethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Carbon Disulfide	µg/kg	0/1	0	3.15	.	.	.	O	6.3
Carbon Tetrachloride	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Chlorobenzene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Chloroethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Chloroform	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Chloromethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Dibromochloromethane	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Ethylbenzene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Methylene Chloride	µg/kg	0/1	0	3.15	.	.	.	O	6.3
Styrene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Tetrachloroethene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Toluene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Trichloroethene	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Vinyl Chloride	µg/kg	0/1	0	1.25	.	.	.	O	2.5
Xylenes, Total	µg/kg	0/1	0	1.25	.	.	.	O	2.5

CV = Coefficient of variation.

Distribution codes:

D = Distribution not determined because fewer than 5 detects or less than 50 percent detects (t-distribution).

L = Distribution most similar to lognormal [land statistic used for upper confidence limit (UCL)].

N = Distribution most similar to normal (t-distribution used for UCL).

O = Analyte not detected in any sample.

X = Distribution significantly different from normal and lognormal (t-distribution used for UCL).

SEASONAL SOIL COMPARTMENT MODEL

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SEASONAL SOIL COMPARTMENT MODEL

"SESOL" is the acronym for the Seasonal Soil Compartment Model and refers to a one-dimensional model for estimating vertical transport in the unsaturated soil zone. This model was used to predict leachate concentrations of the constituents identified at the SWMU 13 as contaminant migration contaminants of potential concern (CMCOPCs) in soils based on leaching to groundwater. The model is designed to simultaneously model water transport, sediment transport, and pollutant fate. An acceptable groundwater concentration is identified that is protective of human health in the baseline risk assessment (HHBRA). Site-specific or default soil, chemical, and meteorological data are input into the model to predict a leachate concentration. This leachate concentration is used to develop the remedial levels in soil. The SESOIL model is then used to back-calculate a concentration in soils that ensures that the groundwater goal is achieved. The groundwater goal for a constituent is calculated in the BRA. The following sections more fully describe the SESOIL model.

The SESOIL program was developed for the U.S. Environmental Protection Agency's Office of Water and its Office of Toxic Substances in 1981 by Arthur D. Little, Inc. (ADL). ADL updated the SESOIL model in 1984 to include a fourth soil compartment (the original model included up to three layers) and the soil erosion algorithms (Bonazountas, Wagner, and Goodwin 1982; Bonazountas and Wagner 1984). A comprehensive evaluation of SESOIL, performed by Watson and Brown (1985), uncovered numerous deficiencies in the model, and subsequently SESOIL was extensively modified (1985-1993) to enhance its capabilities (Hetrick et al. 1989; Hetrick et al. 1986; Hetrick and Travis 1988; Hetrick and Scott 1993). This model was designed to perform "long-term" simulations of chemical transport and transformations in soil.

SESOIL uses fewer soil, chemical, and meteorological values as inputs than do most other similar models. The potential applications of this model include long-term leaching studies from waste disposal sites, pesticide and sediment transport on watersheds, studies of hydrologic cycles and water balances of soil compartments, and precalibration runs for other simulation models. The model may also be run to estimate the effect of various site management or design strategies on pollutant distributions and concentrations in the environment.

SESOIL is well recognized and accepted by the scientific community using soil-chemical fate models. It has been extensively validated and shown to work under a number of scenarios. A number of studies have been conducted on this model including sensitivity analysis, comparison with other models, and comparison with field data (Bonazountas, Wagner, and Goodwin 1982; Wagner, Bonazountas, and Alsterberg 1983; Hetrick 1984; Kincaid et al. 1984; Watson and Brown 1985; Hetrick et al. 1986; Melancol, Pollard, and Hern 1986; Hetrick and Travis 1988; Hetrick et al. 1989; Hetrick, Luxmoore, and Tharp 1993).

The SESOIL model estimates pollutant concentrations in the soil profile following introduction via direct application and/or interaction with other media (e.g., deposition from air). The model defines the soil compartment as a soil column extending from the ground surface through the unsaturated zone and to the upper level of the saturated soil zone. Processes simulated in SESOIL are categorized in three cycles: the hydrologic cycle, the sediment cycle, and the pollutant cycle. Each of the three cycles is a separate submodule in the SESOIL code. The hydrologic cycle includes rainfall, surface runoff, infiltration, soil water content,

evapotranspiration, and groundwater runoff. The sediment cycle includes sediment washload as a result of rainstorms (i.e., soil erosion that results from surface runoff). The pollutant cycle includes convective transport, volatilization, adsorption/desorption, and degradation/decay. A contaminant in SESOIL can partition into a maximum of four phases (i.e., liquid, adsorbed, air, and pure). The model, however, does not address pollutant movement in saturated groundwater (General Sciences Corporation, Inc. 1987).

Data requirements for SESOIL are not extensive, using a minimum of soil and chemical parameters and monthly or seasonal meteorological values as input. Output of the SESOIL model includes pollutant concentrations at various soil depths and pollutant loss from the unsaturated soil zone in terms of surface runoff, percolation to groundwater, volatilization, and degradation. SESOIL has the advantages of faster computer run times than those of more complex unsaturated zone models.

SELECTION OF THE MODEL

SESOIL is well recognized and accepted by the scientific community using soil-chemical fate models. It has been extensively validated and shown to work under a number of scenarios. Output of the SESOIL model includes pollutant concentrations at various soil depths and pollutant loss from the unsaturated soil zone in terms of percolation to groundwater, volatilization, and degradation. This information will be used to obtain contaminant concentrations in the soil that may serve as guidelines for deep soil remediation. SESOIL has the advantage of fewer input requirements and faster computer run times than those of more complex unsaturated zone models, while still maintaining considerable resolution of the pollutant front in terms of both time and space.

Some of the attributes of SESOIL that make it particularly attractive and suitable for predicting groundwater concentrations of CMCOPCs leaching from vadose zone at SWMU 13 are iterated below.

- SESOIL has been extensively validated and shown to work under a number of scenarios. It has also been used for similar applications in other parts of the country and is capable of providing the information required from this study (Bonazountas, Wagner, and Goodwin 1982; Hetrick 1984; Watson and Brown 1985; Hetrick et al. 1986; Melancol, Pollard, and Hern 1986; Hetrick and Travis 1988; Hetrick et al. 1989; Hetrick, Luxmoore, and Tharp 1993).
- SESOIL has the advantage of fewer input requirements and faster run times than those of more complex unsaturated zone models, while still maintaining considerable resolution of the pollutant front in both time and space.
- Documentation of SESOIL is readily available, including numerous publications on the subject and a user's guide developed by Hetrick and Scott (1993).
- The model can be divided into as few as two and as many as four layers. The model's compartmental nature allows for user-specified tailoring to suit a particular site.

- SESOIL is a one-dimensional soil compartment model that takes adsorption, volatilization, degradation/decay, convective transport, and metal complexation processes into account. At the same time, the input data requirements are not extensive, making it simpler than more complex models.

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Watson, D.B., and S. M. Brown 1985. Testing and Evaluation of the SESOIL Model, Anderson-Nichols and Co., Inc., Palo Alto, California.

Table G-1. Climatic Data Used in the SESOIL Model for SWMU 13

Month	Air Temperature (°C)	Cloud Cover	Humidity	ALBEDO	Evapotranspiration ^a (cm/d)	Precipitation (cm)	Duration (d)	Storms/ Month	Length of Rainy Season (d/mo)
October	20.17	0.50	0.75	0.14	0.00	5.7	0.44	3.17	30.4
November	14.83	0.50	0.75	0.14	0.00	4.85	0.38	3.08	30.4
December	11.17	0.55	0.75	0.14	0.00	7.24	0.44	4.97	30.4
January	10.83	0.55	0.75	0.14	0.00	7.55	0.48	4.97	30.4
February	11.94	0.55	0.70	0.14	0.00	8.02	0.44	5.14	30.4
March	15.00	0.55	0.70	0.14	0.00	9.83	0.37	5.69	30.4
April	19.33	0.50	0.70	0.14	0.00	8.3	0.37	4.26	30.4
May	23.17	0.50	0.70	0.14	0.00	11.14	0.31	5.49	30.4
June	26.22	0.60	0.70	0.14	0.00	14.22	0.29	7.36	30.4
July	27.28	0.60	0.80	0.14	0.00	18.2	0.26	9.56	30.4
August	27.17	0.60	0.80	0.14	0.00	17.44	0.29	7.92	30.4
September	24.94	0.60	0.80	0.14	0.00	13.78	0.38	6.39	30.4

^a0.00 indicates evapotranspiration is calculated by the SESOIL model using climatic data.

Source: RISKPRO® SESOIL for Windows 95, Version 3, General Science Corporation, copyright© General Science Corporation 1993–1998.

Table G-2
Hydrogeological Parameters used for SESOIL modeling
SWMU 13, Fort Stewart, Georgia

Parameter type	Parameter value	Source
Soil Type	Silty sand	Site specific
Bulk density (gm/cm ³)	1.68	Laboratory analysis ; average of the samples collected from unsaturated zone
Percolation rate, (cm/yr)	37.34	From HELP model (Section 6.3.1)
Intrinsic permeability (cm ²)	1.00E-09	calibrated
Disconnectednex index	8	calibrated
Porosity, (%)	0.38	Laboratory analysis ; average of the samples collected from unsaturated zone
Depth to water table (ft)	8.25	Site-specific
Organic carbon content (%)	0.28	Geometric mean of TOCs measured in 2 feet to 10 feet interval
Frendlich equn. exponent	1	SESOIL default value
Hydraulic gradient (foot/foot)	0.004	Site specific
Thickness of aquifer (feet)	20	Conservatively estimated
Length parallel to groundwater flow (feet)	390	Approximated from soil contaminated area
DAF	1.19	Calculated
Area of source (m ²)	1.00E+04	Approximate site specific soil contamination area

Table G-3
SESOIL Application Data Used
SWMU 13, Fort Stewart, Georgia

COPCs	No. of Layers	Layer No.	Thickness of layer (ft)	No. of sublayers	Sublayer No.	Conc. (µg/g)
Benzo(a)anthracene	3	1	3	3	1	0.43
					2	10
					3	0
		2	5	5	1	0
					2	0
					3	0
					4	1.5
					5	1.5
		3	0.25	2	1	0
					2	0
Benzo(b)fluoranthene	3	1	3	3	1	0.56
					2	8.2
					3	0
		2	5	5	1	0
					2	0.55
					3	0.55
					4	1.8
					5	1.8
		3	0.25	2	1	0
					2	0
Dibenzo(a,h)anthracene	3	1	3	3	1	0
					2	4.5
					3	0
		2	5	5	1	0
					2	0
					3	0
					4	0
					5	0
		3	0.25	2	1	0
					2	0
2-Methylnaphthalene	3	1	3	3	1	0
					2	24
					3	3
		2	5	5	1	0.64
					2	0
					3	0
					4	0
					5	0
		3	0.25	2	1	0
					2	0
4-Methyl-2-pentanone	3	1	3	3	1	0
					2	3.8
					3	0
		2	5	5	1	0
					2	0
					3	0
					4	0
					5	0

Table G-3. (continued)

COPCs	No. of Layers	Layer No.	Thickness of layer (ft)	No. of sublayers	Sublayer No.	Conc. (µg/g)
4-Methyl-2-pentanone (continued)		3	0.25	2	1	0
					2	0
Arsenic	3	1	3	3	1	0
					2	0
					3	10.4
		2	5	5	1	9
					2	0
					3	0
					4	0
					5	0
		3	0.25	2	1	0
					2	0
Chromium	3	1	3	3	1	0
					2	31.4
					3	39.7
		2	5	5	1	40.4
					2	24
					3	24
					4	23
					5	23
		3	0.25	2	1	0
					2	0

APPENDIX H

HUMAN HEALTH BASELINE RISK ASSESSMENT

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HUMAN HEALTH BASELINE RISK ASSESSMENT

This appendix presents the technical approach used to estimate risk to human health for SWMU 13, the former Fire Training Area, at the Fort Stewart Military Reservation (FSMR). A human health baseline risk assessment (HHBRA) has five components:

- identification of HHBRA constituents of potential concern (COPCs),
- exposure assessment,
- toxicity assessment,
- risk characterization, and
- uncertainty assessment.

If constituents are identified that represent a potential risk to human health, remedial goal objectives are calculated for those constituents.

H.1 Identification of Constituents of Potential Concern

The objective of this evaluation is to identify site-related constituents (SRCs) that may pose a potentially significant risk to human health. The selection of SRCs and the screening of these constituents to identify human health COPCs have previously been addressed in Section 6.0 (Contaminant Fate and Transport), and Section 7.0 (Human Health Preliminary Risk Evaluation).

The following COPCs have been identified at SWMU 13:

<u>Surface Soil</u>	<u>Subsurface Soil</u>	<u>Groundwater</u>
benzo(a)pyrene	Arsenic	Benzene
	benzo(a)pyrene	Ethylbenzene
	benzo(a)anthracene	Toluene
	benzo(b)fluoranthene	total xylenes
	dibenzo(a,h,)anthracene	2-methylnaphthalene
	Benzo(g,h,i)perylene	naphthalene.

Benzo(g,h,i)perylene was identified as a COPC in subsurface soil; however, this constituent is not included in the quantitative HHBRA because appropriate toxicity data are not available.

In addition to these COPCs arsenic and chromium were identified as contaminant migration COPCs (CMCOPC) in soils based on the results of the leachate modeling which show that these metals may migrate to groundwater in concentrations that present a significant risk to human health.

H.2 Exposure Assessment

The exposure assessment quantifies the amount of a COPC an individual may come in contact with at the site. The exposure assessment considers all pathways of potential human exposure, the magnitude of the

exposure, and the frequency and duration of exposure. The process for estimating exposure consists of the following elements: (1) characterization of the exposure setting in terms of the physical and demographic characteristics of the site, (2) identification of receptor populations, (3) identification of the exposure pathways by which an individual may come in contact with a COPC, (4) estimation of the exposure point concentration, and (5) quantification of the intake or dose to which an individual is exposed.

H.2.1 Exposure Setting

The exposure setting describes the physical features at the site and identifies the human populations that may be exposed to COPCs, either currently or in the future.

Fort Stewart is under the control of the U.S. Army as an active facility and is expected to remain so for the foreseeable future. Currently, the Installation is relatively open to the public, except for certain restricted areas. SWMU 13 is located within a remote area of the FSMR adjacent to a paved asphalt taxiway at the Wright Army Airfield. SWMU 13 consisted of a 5,000-square-foot concrete pad with an integral berm that was used by fire-fighting personnel for training. An oil/water separator sump, underground piping, and an above ground fuel (JP-4) storage tank adjoined the main concrete pad and combined to make up the entire Fire Training Area. All of these structures and appurtenances were removed during the Interim Measures (IM) conducted in 1997 by CAPE Environmental. Also as part of the IM, the top four feet of contaminated soil was excavated, removed, and replaced with clean soil. The site has not been used as a fire training area since 1992, but the area surrounding it is used for training maneuvers and hunting, and the site does not have institutional controls in place to restrict access.

The hydrogeology in the vicinity of the FSMR is dominated by two aquifers, referred to as the surficial aquifer and the Principal Artesian aquifer, which are separated by a confining unit. The uppermost hydrologic unit is the surficial aquifer, that consists of widely varying amounts of sand, silt, and clay ranging from 35 feet to 150 feet in thickness. Outside of the Army facility, this aquifer is primarily used for domestic lawn and agricultural irrigation. Constituents at SWMU 13 are limited to the surficial aquifer.

H.2.2 Identification of Migration Pathways

The release and migration of constituents at this site have been discussed in detail in Sections 6.3.3 and 6.3.4 of this report. In general, the major routes of migration from this site are volatilization into air, wind erosion resulting in fugitive dust, surface water runoff, leaching of constituents into groundwater, and groundwater transport to off-site locations. Figure 6.1 is a visual depiction of the conceptual site model (CSM) for this site, and shows these migration pathways.

Soil. The site is currently covered by asphalt and vegetation, and the contaminated soil has been excavated to a depth of four feet bgs and replaced with clean fill. As a result, under current conditions, the migration of constituents into the atmosphere as fugitive dust is not a viable pathway. However, future activities may cause the surface cover to be removed, subsurface soil to be exposed, and fugitive dust could become a viable pathway.

Constituents in soils may migrate through the actions of runoff, leaching into groundwater, or volatilizing into air. Surface water runoff may transport constituents adsorbed to eroded soil particles and deposit them as sediments in the swales surrounding the site. Runoff may also result in the transport of particulate-bound water-soluble compounds to infrequently ponded surface waters in the swale. Volatilization of some constituents from the soil four feet bgs to the air may occur.

Groundwater. Migration of soil constituents to groundwater occurs from infiltration and percolation of rainwater through contaminated soil. It is reasonable to conclude that migration of soil constituents at SWMU 13 to the surficial aquifer occurred prior to the Interim Measure (IM), which removed the contaminated soil to a depth of four feet bgs. Minimal soil constituent migration may still occur due to residual contamination on the site and/or fluctuation of the water table.

Groundwater leaving the site may eventually discharge into Peacock Creek, located approximately 2,500 feet southeast of the site. However, given the low groundwater flow rate, and the shallow depth to the water table, both organic and inorganic constituents are likely to become attenuated through both physical and biological processes before reaching Peacock Creek (Section 6.0). Inorganics, which are less mobile than organics, are likely to be significantly diluted in the groundwater or adsorbed to formation materials, reducing their concentrations. Therefore, exposure to constituents in groundwater, through discharge into Peacock Creek, is expected to be insignificant. Therefore, surface water will not be evaluated in the HHBRA as there is no surface water pathway.

Sediment. Sediments at this site are located within the swales. Since the sediments are not usually covered by water, the migration pathways for sediments in the swales would be the same as those given for surface soils; therefore, sediments are included with surface soil in this assessment.

H.2.3 Identification of Receptor Populations

Potential receptor populations are generally divided into two groups: current receptors and receptors that may be exposed in the future given a change in land use at the site. Potential risk to human receptor populations may occur as a result of exposure to surface soil, subsurface soil, and groundwater. Currently, surficial groundwater at the site is not used. In addition, constituents present in groundwater are not likely to migrate to surface waters. Therefore, under the current conditions, there are no potential receptor populations that may be exposed to constituents in groundwater.

Future populations may be exposed to COPCs if the groundwater in the surficial aquifer is used as a source of drinking water or for other purposes. However, it is unlikely that a receptor would be exposed to groundwater given that the surficial aquifer is not a likely source of potable water because of its low groundwater yield. The deeper Principal Artesian aquifer, located between 115 feet to 230 feet bgs, is used as a source of drinking water in the area because it has a greater groundwater yield. This Principal Artesian aquifer is separated from the surficial aquifer by a confining layer of phosphatic clays ranging from 60 to 80 feet in thickness.

The Georgia Environmental Protection Division (GA EPD) states that all groundwater should be considered a potential drinking water source (GA EPD 1996). Therefore, the risk associated with use of groundwater as a drinking water source is addressed in this HHBRA for SWMU 13. Land use in the area is restricted to industrial/military operations. Therefore, Installation workers make-up the only likely receptor population. However, residential receptors are evaluated for comparative purposes.

H.2.4 Identification of Potential Exposure Pathways

A complete exposure pathway consists of four elements: (1) a source of contamination, (2) a transport or retention medium, (3) a point of contact with the constituent, and (4) a route of exposure (ingestion, dermal absorption, or inhalation) at the point of contact through which the constituent may be taken into the body. When all of these elements are present, the pathway is considered complete.

Current and future on-site worker. The site has not been used since 1992; however, FSMR personnel not on training maneuvers may come on-site on a regular basis for grass cutting or other routine maintenance. Therefore, the current and future on-site worker is assumed to be a groundskeeper. The current on-site worker may be exposed to constituents in surface soils that were not removed during the IM. Potential exposure pathways for surface soils and sediments include incidental ingestion of soils and inhalation of volatile organics. An on-site worker is not expected to come in direct contact with surface water in the swale because the workers' primary activity is mowing grass. In addition, water is only occasionally ponded in the swale. Therefore, exposure to surface water is unlikely.

The future on-site worker is expected to have the same pathways as the current worker. The future on-site worker may also be exposed to groundwater through ingestion.

A future construction worker may be exposed to subsurface soils as a result of excavation. Incidental ingestion, inhalation of constituents (as dust or volatiles), and dermal absorption are complete exposure pathways for this receptor.

Current and future off-site worker. A current off-site worker may be exposed via soil ingestion and inhalation of volatile organics released into the air from the soil. This receptor population could be exposed to fugitive dust, if the soils are uncovered and the current vegetation is removed. A future off-site worker may also be exposed to groundwater via ingestion if the shallow aquifer is used as a potable water source.

On-Site Resident. Although not a likely receptor for this site, the on-site resident is included as a worst-case scenario for exposure to soil and groundwater. This scenario assumes that a family lives on the site and obtains its drinking water from a groundwater well screened in the surficial aquifer. This scenario uses both an adult and a child receptor. The adult is used as the more conservative scenario for estimating potential cancer risks given the longer exposure duration for an adult. The child is used to evaluate potential risks associated with systemic risks given the child's lower body weight and relatively higher soil and water ingestion rate per unit body weight.

Potential exposure pathways include ingestion of groundwater used as drinking water, dermal contact with household water, and inhalation of volatile organic compounds (VOCs) released during use of household water. The exposure pathways evaluated for an adult include ingestion and inhalation of VOCs. Inhalation of VOCs during household use of water is evaluated only for showering because both the receptor and vapors from hot water are confined in a relatively small and closed space, which probably represents the upper bound on inhalation exposure. Other household uses of water occur in more open areas where vapors are likely to be diluted in a larger quantity of ambient air. Dermal uptake during showering is also evaluated; however, exposure via dermal uptake is not considered to be significant given the relatively short exposure period (15 minutes or fewer).

The exposure pathways evaluated for the child resident include ingestion of water and dermal uptake. Young children are more likely to bathe than shower; therefore, inhalation exposure to VOCs released from household use of groundwater is not evaluated for the child receptor. However, dermal uptake of constituents is quantified.

H.2.5 Estimation of Exposure Concentration

This HHBRA is based on a reasonable maximum exposure assumption. The intent is to provide an estimate of the highest exposure concentration with which a receptor may reasonably be expected to come in contact (EPA 1989; EPA 1991). Exposure concentrations were estimated for on-site and off-site receptors based on current and future land-use scenarios.

Exposure Concentrations for On-Site Receptors. On-site receptors may be exposed to COPCs in surface soil, subsurface soil, and groundwater. Exposure concentrations were calculated using analytical data collected during the RFI.

The exposure point concentrations for surface soil, subsurface soil, and groundwater are equal to the upper 95 percent confidence limit on the mean [upper confidence limit (UCL)], unless this value is greater than the maximum detected concentration. Then, the exposure concentration defaults to the maximum concentration. The data sets were tested for normality and lognormality based on the Shapiro-Wilkes test to determine the type of distribution that best fits the data, and the UCLs were calculated accordingly. Some constituents were not detected in all of the samples from a given medium. When a compound was not detected in all of the samples, the detected values were used in combination with one-half of the sample quantitation limit for nondetected values to calculate the exposure concentrations. If a constituent was detected in fewer than 50 percent of the samples or in fewer than three samples, the data were considered to be insufficient for the purposes of determining the type of distribution. For the purposes of this risk assessment, it was assumed that these data were normally distributed. A summary of the analytical data and an analysis of their distribution are given in Table H.1.

The constituent concentration in air as a result of volatilization during showering is estimated by multiplying the exposure point concentration in groundwater by a volatilization factor of 0.5 (EPA 1992).

Constituent Concentrations in Ambient Air. Constituents present in soils may migrate into air as a result of the volatilization or generation of fugitive dust.

The concentration of a COPC in air as a result of the generation of fugitive dust was estimated using a particulate emission factor (PEF). The U.S. Environmental Protection Agency (EPA) has developed a model for estimating the dust PEF:

$$PEF = Q/C \frac{CF}{0.036(1-V)(U_m/U_t)^3 F(x)},$$

where

- PEF = particulate emission factor (m^3/kg),
- Q/C = inverse of the mean concentrations at center of square source (g/m^2 -sec per kg/m^3 , site specific),
- CF = conversion factor (3,600 seconds/hour),
- V = fraction of surface covered with vegetation (0.5 unitless),
- U_m = mean annual wind speed (4.69 m/sec),
- U_t = equivalent threshold value of wind speed at 7 m (11.32 m/sec), and
- $F(x)$ = function dependent on U_m/U_t (0.194) (EPA 1996).

The Q/C values were obtained from the Soil Screening Guidance: User Guide (EPA 1996). The values listed for Atlanta, Georgia, were used in estimating the PEF. Default values came from the Soil Screening Guidance: User Guidance (EPA 1996). A default value for the fraction of surface covered with vegetation was used because this represents a future land-use scenario. This is a conservative assumption and may result in an overestimation of risk.

The constituent concentrations in air are calculated as follows:

$$C_a = \frac{C_s}{PEF},$$

where

- C_a = constituent concentration in air (mg/m^3),
- C_s = constituent concentration in soil (mg/kg), and
- PEF = particulate emission factor (m^3/kg).

Both on-site and off-site receptors may be exposed to COPCs in fugitive dust. In addition, an on-site resident may be exposed to fugitive dust both in the household and while participating in activities outside. For the purposes of this risk assessment, it is assumed that the concentration of contaminated fugitive dust in the air is the same for both indoor and outdoor air and does not dilute as it migrates away from the site. The concentration of fugitive dust indoors will be less because the particles are likely to settle onto various surfaces within the structure. In addition, the use of a heating/air-conditioning unit will filter the air, removing some of the particulates. As the particulates migrate from the site, their

concentration will become more dilute. The exposure of off-site receptors to contaminated fugitive dust will be less than that for an on-site receptor. Therefore, the use of the estimated air concentration for an on-site outdoor receptor to estimate the exposure of all the potential receptors is a conservative measure that is likely to overestimate the actual exposure of these receptors.

The construction worker may be exposed to VOCs in subsurface soils as a result of working in an excavation. The constituent concentration of VOCs is calculated using the following equation:

$$C_a = \frac{C_s}{VF},$$

where

- C_a = constituent concentration in air (mg/m³),
- C_s = constituent concentration in soil (mg/kg), and
- VF = constituent-from-soil volatilization factor (m³/kg, constituent specific).

The constituent-from-soil volatilization factor is calculated as follows:

$$VF = Q/C \times CF \left(\frac{[3.14 \times D_A \times T]^{1/2}}{2 \times \rho_b \times D_A} \right),$$

where

- VF = constituent-from-soil volatilization factor (m³/kg, constituent specific),
- Q/C = inverse of the mean concentrations at center of square source (g/m²-sec per kg/m³, site specific),
- CF = conversion factor (10⁻⁴ m²/cm²),
- D_A = apparent diffusivity (cm²/second, constituent specific),
- T = exposure interval (seconds, exposure duration $\times$ 3.15 $\times$ 10⁷ secs/year), and
- ρ_b = dry soil bulk density (1.5 g/cm³).

The apparent diffusivity (D_A) is estimated as follows:

$$D_A = \frac{\frac{10}{\theta_a^{13}} \times D_i \times H' \times \frac{10}{\theta_w^{13}} \times D_w}{\rho_b \times K_d + \theta_w + \theta_a \times H'},$$

where

- D_A = apparent diffusivity (cm²/second, constituent specific),
- θ_a = air-filled soil porosity (0.28 unitless), and
- D_i = diffusivity in air (cm²/second, constituent specific),
- H' = unitless Henry's Law constant (constituent specific),
- θ_w = water-filled soil porosity (0.15 L_{water}/L_{soil}),
- D_w = diffusivity in water (cm²/sec, constituent specific),

n = total soil porosity ($1 - \left(\frac{\rho_b}{\rho_s}\right) = 0.43$, unitless),

ρ_s = soil particle density (2.65 g/cm^3), and

K_d = soil-water partition coefficient (cm^3/g , constituent specific).

Exposure concentrations resulting from constituents leaching into groundwater were estimated using the Seasonal Soil Compartment Model (SESOIL) model. As a conservative measure, the maximum detected soil concentration was used as the source concentration in the SESOIL model. A detailed discussion of the assumptions and modeling procedures are given in Section 6.0 of this report.

Exposure Concentrations for Off-Site Receptors. For the purposes of assessing the reasonable maximum exposure for off-site receptors, it was assumed that the receptors would be exposed to the same concentrations as on-site receptors.

H.2.6 Estimation of Intake and Dose

The quantification of exposure of receptors to COPCs involves estimating the amount of constituent that is taken into the body via various routes of exposure. This section describes the models used to quantify doses or intakes of the COPC by the exposure pathways previously identified.

The estimated potential intakes represent the reasonable maximum for each defined receptor population. Most of the exposure factors used in the risk assessment represent upper bounds or conservative values. Some physiological variables (e.g., body weight and skin surface area) are mean values. These are used because these physiological variables generally vary with their corresponding physiological factors; therefore, the actual exposure dose remains equal. For example, a person with a large skin surface area is also likely to have a higher than average weight. Therefore, the estimated dose (mg/kg) is likely to average out over the range of values for these parameters. These physiological variables are used in conjunction with other upper-bound estimates and values. The conservatism used in deriving individual variables ensures that the exposure estimates represent upper-bound values on the potential range of exposures. The values used for the intake variables are given in Table H.2.

H.2.6.1 Estimated Intakes and Doses from Soil

Potential exposure pathways for soil include incidental ingestion, inhalation of VOCs, inhalation of fugitive dust, and dermal contact. The equations used to estimate potential intakes and doses from these exposure pathways are discussed below.

Incidental Ingestion of COPCs in Soil. The ingested doses of COPCs in surface soil for the groundskeeper, installation worker, adult resident, and child resident and of COPCs in subsurface soil for the construction worker are estimated using the following equation:

$$I_s = \frac{(C_s)(IR_s)(FI_s)(EF_T)(ED)(CF)}{(BW)(AT)},$$

where

I_s = ingested intake of COPC in soil (mg/kg-day, calculated),
 C_s = concentration of COPC in soil (mg/kg),
 IR_s = ingestion rate of soil (mg/day),
 FI_s = fraction of exposure attributed to site soil (unitless),
 EF_T = exposure frequency (days/year),
 ED = exposure duration (years),
 CF = conversion factor (10^{-6} kg/mg),
 BW = body weight (kg), and
 AT = averaging time (days).

Inhalation of COPCs in Air. The following equation is used to estimate the inhalation intake of COPCs in air from airborne dust and VOCs:

$$I_a = \frac{(C_a)(IR_a)(FI_a)(ET_a)(EF_T)(ED)}{(BW)(AT)},$$

where

I_a = inhaled intake of COPC (mg/kg-day, calculated),
 C_a = concentration of COPC in air (mg/m³),
 IR_a = inhalation rate (m³/hour),
 FI_a = fraction of exposure attributed to the medium (unitless),
 ET_a = exposure time (hours/day),
 EF_T = exposure frequency (days/year),
 ED = exposure duration (years),
 BW = body weight (kg), and
 AT = averaging time (days).

Dermal Contact with COPCs in Soil. Methodologies for estimating inhaled or ingested intake of a constituent account for the amount of constituent presented to the barrier membrane of the pulmonary or gastrointestinal mucosa, respectively. However, the dermal dose is estimated as the dose that crosses the skin and is systematically absorbed. For this reason, dermal toxicity values are also based on absorbed dose. The dermal dose of COPC is estimated from the following equation:

$$DAD = \frac{(DA)(SA)(EF_T)(ED)}{(BW)(AT)},$$

where

DAD = average dermally absorbed dose of the COPC (mg/kg-day, calculated),
 DA = dose absorbed per unit body surface area (mg/cm²),
 SA = surface area of the skin available for contact with contaminated medium (cm²/event),

EF_T = exposure frequency (events/year),
 ED = exposure duration (years),
 BW = body weight (kg), and
 AT = averaging time (days).

Dermal uptake of constituents from soil assumes that absorption is a function of the fraction of a dermally applied dose that is absorbed. It is calculated from the following equation:

$$DA = (C_s)(FI_s)(CF)(AF)(ABS),$$

where

DA = dose absorbed per unit body surface area per day (mg/cm^2 , calculated),
 C_s = concentration of COPC in soil (mg/kg),
 FI_s = fraction of exposure attributed to site soil or sediment (unitless),
 CF = conversion factor ($10^{-6} \text{ kg}/\text{mg}$),
 AF = soil-to-skin adherence factor (mg/cm^2), and
 ABS = absorption fraction (unitless, constituent specific).

GAEPD recommends a soil-to-skin adherence factor of $1.0 \text{ mg}/\text{cm}^2$ [the high end of the EPA-recommended (EPA 1992) range of $0.2 \text{ mg}/\text{cm}^2$ to $1.0 \text{ mg}/\text{cm}^2$] as an average coefficient for soil-to-skin adherence.

Absorption fraction (ABS) values have been empirically determined for very few constituents. EPA (1992) discusses the available empirical data, as well as several predictive approaches for estimating ABS, but refrains from recommending any single approach. EPA (1999a) recommends reasonable default values of 0.1 percent for inorganic constituents and 1 percent for organic constituents, to reflect the matrix effect (i.e., binding to organic matter in soil), that will be used when empirical data are not available.

Intake parameters used in these equations are provided in Tables H.2 and H.3.

H.2.6.2 Estimated Intakes and Doses from Groundwater

Potential exposure pathways for groundwater include incidental ingestion, inhalation of VOCs, and dermal contact. The equations used to estimate potential intakes and doses from these exposure pathways are discussed below.

Ingestion of COPCs in Groundwater. Ingestion of groundwater is quantified by the following equation:

$$I_w = \frac{(C_w)(IR_w)(FI_w)(EF_T)(ED)}{(BW)(AT)},$$

where

I_w = ingested intake of COPC in drinking water (mg/kg-day),
 C_w = concentration of COPC in drinking water (mg/L),
 IR_w = drinking water ingestion rate (L/day),
 FI_w = fraction of exposure attributed to site medium (unitless),
 EF_T = exposure frequency (days/year),
 ED = exposure duration (years),
 BW = body weight (kg), and
 AT = averaging time (days).

Intake Parameters used in these equations are provided in Table H.2.

Inhalation of VOCs Released from Groundwater. Exposure to VOCs in groundwater is likely to occur during showering. The adult resident is the only receptor population who is likely to shower using groundwater from the surficial aquifer, assuming that groundwater is used as a source of potable water. Children are more likely to take baths than showers; therefore, their exposure is expected to be minimal. Exposure of Installation workers is also likely to be minimal given the dilution of vapors into a large area. The inhalation dose of COPC is estimated using the following equation:

$$INH_w = \frac{(C_w)(IR_a)(K)(EF_T)(ED)}{(BW)(AT)},$$

where

INH_w = intake of COPC via inhalation (mg/kg-day),
 C_w = concentration of COPC in groundwater (mg/L),
 IR_a = daily indoor inhalation rate (m³/day),
 K = volatilization factor (L/m³),
 EF_T = exposure frequency (days/year),
 ED = exposure duration (years),
 BW = body weight (kg), and
 AT = averaging time (days).

Dermal Contact with COPCs in Groundwater. The dermal dose is estimated as the dose that crosses the skin and is systemically absorbed. The dermal dose of COPC is estimated from the following equation:

$$DAD = \frac{(DA)(SAS)(EF_T)(ED)}{(BW)(AT)},$$

where

DAD = average dermally absorbed dose of the COPC (mg/kg-day, calculated),
 DA = dose absorbed per unit body surface area per day (mg/cm²-day),

SAS = surface area of the skin available for contact with contaminated medium (cm²),
 EF_T = exposure frequency (days/year),
 ED = exposure duration (years),
 BW = body weight (kg), and
 AT = averaging time (days).

Quantification of dermal uptake of metals and organic constituents from groundwater is relevant for the adult and child resident.

Quantification of dermal uptake of constituents from water depends on the permeability coefficient (PC), which describes the rate of movement of a constituent from water across the dermal barrier to the systemic circulation. For inorganic constituents, the dose absorbed per unit body surface area per day is calculated from the following equation:

$$DA = (C_w)(PC)(ET_w)(CF) ,$$

where

DA = dose absorbed per unit body surface area per day (mg/cm²-day, calculated),
 C_w = concentration of constituents of concern in water (mg/L),
 PC = permeability coefficient (cm/hour),
 ET_w = time of exposure (hours/day), and
 CF = conversion factor (0.001 L/cm³).

The PC has been determined for very few inorganic compounds. For those inorganic compounds for which empirical data are not available, the U.S. Environmental Protection Agency (EPA) recommends a default of 10⁻³ cm/hour (EPA 1992).

The PC for organic constituents varies by several orders of magnitude (EPA 1992). The PC for organic constituents is highly dependent on lipophilicity, expressed as a function of the octanol/water partition coefficient (K_{ow}). When possible, values for PC were taken from EPA 1992. If PC values for organics were not available, they were calculated from the following formula:

$$\log (PC) = 2.72 + 0.71(\log K_{ow}) - 0.0061(MW) ,$$

where

PC = permeability coefficient (cm/hour, calculated),
 K_{ow} = octanol/water partition coefficient (unitless), and
 MW = molecular weight.

Intake Parameters used in these equations are provided in Tables H.2 and H.3.

H.2.6.3 Exposure Results

A potential intake was estimated for each receptor population for all applicable pathways. The estimated intakes for the current receptors, the on-site groundskeeper and off-site worker are provided in Tables H.4 and H.5, respectively.

Future receptor populations assessed in this risk assessment are an on-site groundskeeper, an off-site worker, an on-site construction worker, and an on-site adult and child resident. The estimated intakes for the on-site groundskeeper, off-site worker, and on-site construction worker are provided in Tables H.6, H.7, and H.8, respectively. The resident population is divided into an adult and child resident, given the differences in behavior, exposure duration, and physiological differences between an adult and a child result in different doses of constituents in various environmental media. The estimated intakes for the adult and child resident are provided in Tables H.9 and H.10.

H.3 Toxicity Assessment

To understand the potential human health risk associated with a potentially hazardous constituent, information on toxicity is required. Toxicity information is used in conjunction with the results of the exposure assessment to characterize potential human health risks. The toxic mechanisms for constituents are divided into two categories—carcinogenicity and systemic toxicity.

H.3.1 Assessment of Carcinogens

Although few constituents are known human carcinogens, many constituents are suspected of being human carcinogens based on the results of animal studies. The evaluation of the potential carcinogenicity of a constituent includes both a qualitative and a quantitative aspect (EPA 1989). The qualitative aspect is a weight-of-evidence evaluation of likelihood that a constituent might induce cancer in humans. EPA recognizes six weight-of-evidence group classifications for carcinogenicity:

- **Group A – Human Carcinogen.** Data for humans are sufficient to identify the constituent as a human carcinogen.
- **Group B1 – Probable Human Carcinogen.** Human data indicate a causal association is credible, but alternative explanations cannot be dismissed.
- **Group B2 – Probable Human Carcinogen.** Human data are insufficient to support a causal association, but testing data support a causal association in animals.
- **Group C – Possible Human Carcinogen.** Human data are inadequate or lacking, but animal data suggest a causal association, although the studies have deficiencies that limit interpretation.
- **Group D – Not Classifiable as to Human Carcinogenicity.** Human and animal data are lacking or inadequate.

- **Group E – Evidence of Noncarcinogenicity to Humans.** Data for humans show negative results or are lacking, and adequate animal data indicate no association with cancer.

The quantitative evaluation is an estimate of carcinogenic potency. Potency estimates are developed only for constituents in Groups A, B1, B2, and C. The potency estimates are statistically derived from the dose-response curve from the best human or animal study or studies available for a given constituent. In the case of animal studies, pharmacokinetic data or principles are used to estimate an equivalent human dose. The potency estimates are referred to as the cancer slope factors (CSFs) and are expressed as risk per unit dose (per mg/kg-day). In order to be appropriately conservative, the CSF is usually the 95 percent upper bound on the slope of the dose-response curve extrapolated from high (experimental) doses to the low-dose range expected in environmental exposure scenarios. It is assumed that there is no threshold for carcinogens (i.e., a dose below which exposure is safe), and therefore, any exposure represents some quantifiable risk. The CSFs used in evaluating the carcinogenic risks associated with exposure to the COPCs were obtained from the Integrated Risk Information Service (IRIS) computer database or the Health Effects Assessment Summary Tables (HEAST) (EPA 2000, EPA 1997). The discussion of carcinogenicity includes EPA's classification of carcinogenicity.

The potential Incremental Lifetime Cancer Risks (ILCRs) for inhalation are estimated by multiplying the estimated exposure concentration by the inhalation unit risk factors [i.e., risk per ($\mu\text{g}/\text{m}^3$)]. This value is converted to a CSF [i.e., value per (mg/kg-day)] by dividing the unit risk factor by the average respiration rate of an adult ($20 \text{ m}^3/\text{day}$) and multiplying it by the average weight (70 kg) and then by 1,000 to convert micrograms to milligrams.

H.3.2 Noncancer Effects

Many constituents pose a potential risk of a health effect other than cancer. The range of potential noncancer effects is great (e.g., ranging from liver damage to dental fluorosis). The evaluation of noncancer effects (EPA 1989) involves the following points:

- Identification of the critical effect (or threshold effect) for each duration of exposure [i.e., the adverse effect that occurs at the lowest dose (e.g., if liver damage occurs at 20 mg/kg-day, and mortality occurs at 100 mg/kg-day, liver damage is the critical effect)].
- Quantification of the threshold dose for the critical effect for each duration of exposure (i.e., the dose at or above which the effect occurs and below which the effect does not occur).
- Development of an uncertainty factor for developing a reference dose (RfD) for human exposure (i.e., quantification of the uncertainty associated with interspecies extrapolation, intraspecies variation in sensitivity, severity of the critical effect, and slope of the dose-response curve, and deficiencies in the database).
- Identification of the target organ(s) for the critical effect for each route of exposure.

The information described above is used to derive RfDs, expressed as mg/kg-day, which are considered to be the maximum doses to humans at which adverse effects are not expected to occur. Because it is assumed that there is a threshold (i.e., a safe dose for noncarcinogens), the RfD is a nonprobabilistic expression of the potential for an adverse effect. RfDs are derived separately for oral and inhalation exposure pathways because of possible differences in the rate of absorption, target organs, and mechanisms of toxicity.

The inhalation RfD is generally expressed as a reference concentration (i.e., that concentration of a constituent in air that is not likely to have an adverse effect upon human receptors). The reference concentration is converted to an RfD by multiplying the reference concentration (in $\mu\text{g}/\text{m}^3$) by the average respiration rate of an adult ($20 \text{ m}^3/\text{day}$) and dividing by the average weight (70 kg). The final RfD value is converted from micrograms to milligrams by dividing by 1,000.

For the purposes of this risk assessment, a chronic exposure is defined as an exposure equal to or greater than 6 years. Chronic RfDs will be used to evaluate the potential adverse health effects associated with exposure to constituents at this site.

The RfDs used in evaluating the noncarcinogenic risks associated with the exposure to the COPCs were obtained from the IRIS computer database or HEAST (EPA 1999; EPA 1997).

Evaluation of Chromium. Chromium may exist in two valence states, trivalent (Cr^{+3}) and hexavalent (Cr^{+6}) chromium. Hexavalent chromium is significantly more toxic than trivalent chromium, and hexavalent chromium is more mobile in the environment. However, hexavalent chromium is not naturally occurring and is unstable in the environment, oxidizing to the trivalent state. It is unlikely that the chromium present is hexavalent chromium, given there is no likely source for hexavalent chromium. In addition, the concentration value given represents the total chromium present, which includes the naturally occurring trivalent chromium. As a conservative assumption; however, the hexavalent chromium toxicity values are used to assess the potential risk.

H.3.3 Dermal Evaluation of Constituents

Dermal RfD and slope factor (SF) values are derived from their corresponding oral values. To derive a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (GAF), expressed as a unitless fraction. The resulting dermal RfD is an RfD based on absorbed dose, which is the appropriate value with which to compare dermal doses because dermal doses are expressed as absorbed rather than exposed doses. In a similar manner, and for the same reasons, a dermal SF is derived by dividing the oral CSF by the GAF.

Not all COPCs have specific GAF values. When quantitative data are insufficient, a default GAF is used. EPA (1995) recommends a GAF of 0.8 for VOCs, 0.5 for semivolatile organic compounds, and 0.2 for inorganic constituents.

H.4 Risk Characterization

Risk characterization is the final step in the HHBRA. Exposure and toxicity information are integrated to qualitatively or quantitatively evaluate the potential health risks associated with estimated exposures to COPCs at each site. Quantitative estimates of both carcinogenic and noncarcinogenic risks are calculated for each COPC and each potentially complete exposure pathway. The potential carcinogenic risk for the resident adult is greater than the risk for the child because of the adult's longer exposure period (30 years as compared to 6 years for the resident child). However, the resident child has a greater potential risk from systemic toxicity because a child has a higher daily exposure rate relative to the body weight. For the purposes of this risk assessment, both the carcinogenic and noncarcinogenic risks are calculated for both residents.

As part of the risk analysis, the potential concentration of CMCOPCs in groundwater resulting from constituents leaching from soils was modeled. This analysis was done to evaluate whether constituent concentrations in soils present a potential future risk to receptor populations using groundwater as a drinking water source.

H.4.1 Methodology for Carcinogens

The risk attributed to exposure to carcinogens is estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. At low doses, the risk of developing cancer is determined as follows (EPA 1989):

$$Risk = (CDI)(CSF),$$

where

- Risk = risk of cancer incidence, expressed as a unitless probability,
- CDI = chronic daily intake averaged over 70 years (mg/kg-day), and
- CSF = cancer slope factor (mg/kg-day)⁻¹.

Chronic daily intakes estimated using the equations provided in Section H.2 are summarized in Tables H.4 through H.10. Cancer Slope Factor values for all carcinogenic COPCs are provided in Table H.11.

For a given pathway with simultaneous exposure of a receptor to several carcinogens, the following equation is used to sum cancer risks:

$$Risk_{\Sigma} = Risk(chem_1) + Risk(chem_2) + \dots Risk(chem_i),$$

where

- Risk_Σ = total risk of cancer incidence and
- Risk (chem_i) = risk due to the ith carcinogenic constituent.

Constituents with an estimated risk exceeding 1×10^{-6} are identified as constituent of concern (COC) for calculation of remedial levels.

H.4.2 Methodology for Noncarcinogens

The risk of adverse effects due to noncarcinogenic hazardous constituents is evaluated by comparing an estimated exposure level or intake for a given receptor to an RfD. The ratio of intake over the RfD is termed the hazard quotient (HQ) (EPA 1989) and is defined as:

$$HQ = I/RfD ,$$

where

- HQ = hazard quotient (unitless),
- I = intake of a constituent (mg/kg-day), and
- RfD = reference dose (mg/kg-day).

When using this equation to estimate potential risk, both the intake and the RfD must refer to exposures of equivalent duration (i.e., subchronic, chronic, or less than 2 weeks). Constituent exposures are evaluated on a chronic basis in all cases, using chronic RfD values.

This approach is different from the probabilistic approach used to evaluate carcinogens. An HQ of 0.01 does not imply a 1-in-100 chance of an adverse effect, but indicates only that the estimated intake is 100 times less than the RfD. An HQ of unity (1) indicates that the exposure intake is equal to the RfD. If the HQ is greater than 1 or above unity, there may be concern for potential health effects. In the case of simultaneous exposure of a receptor to several noncarcinogenic constituents, a hazard index (HI) is calculated as the sum of the HQs:

$$HI = I_1/RfD_1 + I_2/RfD_2 + \dots I_i/RfD_i ,$$

where

- I_i = intake for the i^{th} toxicant, where $i = 1, 2, 3 \dots$ and
- RfD_i = reference dose for the i^{th} toxicant, where $i = 1, 2, 3 \dots$

HI's are determined by assuming dose additivity for those constituents acting by the same mechanism and inducing the same effects (EPA 1989). Initially all of the constituents are assumed to have the same mechanism of toxicity. If the HI is below 1, then the target-organ-specific HI's will also be below 1.0 and are not calculated. If the HI exceeds 1.0, then HI's are calculated for each target organ. This approach provides a more accurate estimation of the potential systemic toxicity associated with exposure to the constituent mixture.

H.5 Results

The results of the risk characterization for SWMU 13 are summarized in Tables H.12 through H.18 and are described below. Toxicity Profiles for all COCs are provided in Appendix I.

H.5.1 Current Land-use Scenarios

Current potential receptors are the on-site groundskeeper and off-site installation worker. There is no current use of groundwater at this site. Therefore, current land use receptors are not at risk from exposure to COPCs in groundwater. The potential risks to each of these receptor populations are discussed below.

Current On-Site Groundskeeper. Estimated risks are summarized in Table H.12 for exposure of an on-site groundskeeper to surface soil. Estimated risk to a current worker is 2.07×10^{-7} . This is below the target level of 1×10^{-6} . The only COPC in surface soil, benzo(a)pyrene does not have a toxicity value available for evaluating potential systemic effects.

Current Off-Site Worker. Estimated risks are summarized in Table H.13 for exposure of an off-site worker to surface soil. Estimated risk to an off-site worker is 2.49×10^{-7} . This is below the target level of 1×10^{-6} . The only COPC in surface soil, benzo(a)pyrene does not have a toxicity value available for evaluating potential systemic effects.

H.5.2 Future Land-use Scenarios

Future potential on-site receptors are the groundskeeper, construction worker, and resident. The future off-site receptor is an installation worker. The potential risks to each of these receptor populations are discussed below.

Future On-Site Groundskeeper. Estimated hazards and risks are summarized in Table H.14 for exposure to surface soil and groundwater by a future on-site groundskeeper. The total HI value of 3.01 exceeds the target level of one. Constituents with HQ values greater than 0.1 are arsenic and chromium potentially leaching to groundwater and benzene in groundwater. The total estimated cancer risk to the future groundskeeper of 2.33×10^{-4} exceeds the target level of 1×10^{-6} due to arsenic potentially leaching to groundwater and benzene in groundwater.

Future Off-Site Worker. Estimated hazards and risks are summarized in Table H.15 for exposure to surface soil and groundwater by a future off-site worker. The total HI value of 14.5 exceeds the target level of one. Constituents with HQ values greater than 0.1 are arsenic and chromium potentially leaching to groundwater and benzene in groundwater. The total estimated cancer risk to the future off-site worker of 1.12×10^{-3} exceeds the target level of 1×10^{-6} due to arsenic potentially leaching to groundwater and benzene in groundwater.

Future On-Site Construction Worker. Estimated hazards and risks are summarized in Table H.16 for exposure of an on-site construction worker to subsurface soil. The total HI value of 0.020 is below the target level of one. The total estimated risk to the on-site construction worker of 5.17×10^{-7} is below the target level of 1×10^{-6} .

Future On-Site Resident. Estimated hazards and risks are summarized in Tables H.17 and H.18 for exposure to surface soil and groundwater by a future adult and child on-site resident. The total HI value exceeds the target level of one for both the adult (HI = 42.3) and child (HI = 95.8) exposure. Constituents

with HQ values greater than 0.1 are arsenic and chromium potentially leaching to groundwater; and 2-methylnaphthalene, benzene, ethylbenzene, and naphthalene in groundwater. Total estimated cancer risks to the future on-site adult (3.78×10^{-3}) and child (1.76×10^{-3}) resident exceed the target level of 1×10^{-6} due to arsenic potentially leaching to groundwater, benzene in groundwater, and benzo(a)pyrene in surface soil.

H.6 Uncertainty

There are uncertainties associated with all phases of the HHBRA, including collection and laboratory analysis of environmental samples, exposure assessment, toxicity assessment, and risk characterization. These uncertainties are summarized in Table H.19 and discussed in the following narrative.

H.6.1 Uncertainties Associated with the COPC Selection Process

Uncertainties are present in the selection process for COPCs. Procedures used for the selection of COPCs are consistent with current EPA guidance (1989).

Uncertainties associated with the collection and laboratory analysis of the sampling data may impact the results of the COPC selection process as well as the estimation of exposure concentrations. These uncertainties result from the potential for contamination of samples during collection, preparation, or analysis, and from normal error in the analytical techniques. These uncertainties are minimized by the laboratory validation process.

The use of blank contamination data is intended to reduce uncertainty by identifying if samples have been contaminated during collection or analysis. Uncertainty remains because common laboratory contaminants may be excluded from the risk assessment because the associated blank samples were contaminated when these constituents were actually present in the site-related samples. Conversely, a constituent may be included in the risk assessment because its corresponding blank was "clean" when, in fact, the constituent was a result of laboratory contamination. The consideration of site activities and the constituents expected to result from these activities when interpreting the results helps to minimize this uncertainty.

Uncertainties are inherent in the comparison to background because there can be large variations in background concentrations. Background values obtained from other areas of Fort Stewart were used for background screening. There can be significant variations in groundwater as a result of variations in the types of soils present.

Uncertainty is associated with the criteria used for the selection of COPCs. Uncertainties are inherent in development of screening values. The use of conservative assumptions when selecting the screening values coupled with the use of low toxicity assessment endpoints (i.e., the use of an HI of 0.1 and an ILCR of 1:1,000,000) ensures that those constituents most likely to contribute significantly to potential risks are evaluated.

H.6.2 Uncertainty Associated with Exposure Assessment

Three major types of uncertainties should be considered when reviewing the results of the exposure assessment: (1) uncertainty associated with predicting future land use, (2) uncertainty associated with

estimating constituent concentrations at receptor locations, and (3) uncertainty associated with assumptions used in the exposure models.

For the purposes of this risk assessment, the most conservative land-use scenario (residential) was evaluated in addition to more realistic scenarios. The probability that SWMU 13 will be used for residential purposes or that the shallow aquifer underlying the site will be used for drinking water is extremely low. In addition, off-site receptors are not likely to be exposed to the on-site concentrations used in the HHBRA.

The 95 percent UCL or the maximum detected concentration, whichever is smaller, of the soil and groundwater analytical data is used to estimate potential exposure to soil and groundwater. This value is used to provide an upper-bound estimate for the exposure concentrations for a current land-use scenario. However, these concentrations are likely to decrease over time as the organic compounds degrade and the amount of constituents present in source material decreases.

The SESOIL leachate model estimates the concentration of a constituent in leachate based on leaching from four soil horizons (i.e., the depth to groundwater may be divided into four horizons of equal thickness). For the purposes of estimating the leachate concentration, the maximum concentration of the constituent from each sampling depth was used for the purpose of estimating the groundwater concentrations. This is a conservative assumption given that the maximum concentrations of every constituent were not found in a single sample. The maximum values were used for the purposes of modeling to estimate potential exposure concentrations as a result of off-site migration. In addition, conservative assumptions were always used in the leachate and groundwater migration models. The use of the maximum values, in conjunction with conservative assumptions, will result in an overestimation of exposure concentrations.

Physiological values (e.g., body weight, inhalation rates) and behavioral values (e.g., average time spent in one place, amount of groundwater ingested) used to model the reasonable maximum exposure are a combination of average and upper-bound levels taken from reliable sources. The use of upper-bound estimates will tend to overestimate exposure for reasonable maximum exposure. Therefore, the estimated potential risks are likely to be greater than the actual risks. This approach provides conservative, health-protective values for the risk assessment.

H.6.3 Uncertainty Associated with Toxicity Assessment

The toxicological parameters used to quantify potential risk to a receptor include CSFs and RfDs. These values are often derived from laboratory animal studies. The overriding uncertainties associated with the use of laboratory animal studies are:

- the extrapolation of toxic effects observed at the high dose necessary to conduct animal studies to effects that might occur at the much lower, environmentally relevant doses; and

- the extrapolation from toxic effects in animals to toxic effects in humans (i.e., the potential for animal responses to differ from human responses).

In addition, the absence of established toxicity criteria for some COPCs may result in an underestimation of risks.

EPA has derived CSFs using a weight-of-evidence approach from studies in the scientific literature. The CSFs represent the upper 95 percent confidence limits on the slope of the dose response curve for carcinogenic responses. Because CSFs represent the near upper limits of the slope of the line, the use of the CSF is more likely to overestimate the actual risk than underestimate it.

Uncertainties also arise in the development of the RfDs used to characterize noncarcinogenic effects. These reference values are derived using studies in humans or animals by identifying the lowest-observed-adverse-effect level (LOAEL) or no-observed-adverse-effect level (NOAEL). Uncertainty associated with the use of these values is offset by an uncertainty factor that is actually a product of as many as five separate factors, each intended to account for one type of uncertainty (EPA 1989). The LOAEL and NOAEL are divided by this composite uncertainty factor. The uncertainty factors usually range from 10 to 10,000. The five types of uncertainty (each representing an uncertainty factor of 5 to 10) included in the assignment of the uncertainty factor are the following:

- sensitive subpopulations in the general population,
- extrapolation from animals to humans,
- extrapolation from a subchronic study to a chronic estimate,
- extrapolation from a LOAEL to a NOAEL, and
- additional uncertainties in the critical study used in setting the RfD or reference concentration.

H.6.4 Uncertainty in Risk Characterization

The risk characterization evaluates the potential risks associated with exposure to numerous constituents via multiple pathways. There is uncertainty associated with exposure to constituent mixtures because constituents may have synergistic or antagonistic effects on other constituents. For the purposes of this risk assessment, it was assumed that all constituents have additive toxicity and that the potential health effects would be equal to the sum of each of the individual actions for constituents that act upon the same target organ. This approach may result in the overestimation or underestimation of certain risks.

In general, sources of uncertainty may be categorized into site-specific factors (e.g., variability in analytical data, modeling results, and exposure parameter assumptions) and toxicity factors. The use of conservative assumptions in the risk assessment is believed to result in an overestimation of risk. Actual site risks are likely to be lower than the estimates presented in this report.

H.7 Summary of Risk Characterization

The purpose of the risk summary is to provide an overview of the risk assessment results, including identification of the COPCs assessed, the receptor populations, and the risk characterization results.

The HHBRA addressed the risks associated with exposure to the following COPCs in soil: arsenic (subsurface soil), benzo(a)pyrene (surface and subsurface soil), benzo(a)anthracene (subsurface soil), benzo(b)fluoranthene (subsurface soil), dibenzo(a,h,)anthracene (subsurface soil). Benzo(g,h,i)perylene was identified as a COPC in subsurface soil; however, this constituent is not included in the quantitative HHBRA because appropriate toxicity data are not available. The following constituents were identified as contaminant migration COPCs in soils: arsenic and chromium based on the results of the leachate modeling which show that these metals may migrate to groundwater in concentrations that present a significant risk to human health. The following constituents were identified as COPCs in groundwater: benzene, ethylbenzene, toluene, total xylenes, 2-methylnaphthalene, and naphthalene.

Given that the site is currently secure, potential on-site receptors are limited to authorized personnel represented by a groundskeeper. The groundskeeper may be exposed to COPCs in surface soil. Exposure pathways for this receptor are incidental ingestion and inhalation.

Changes in future land-use include removal of institutional controls at the site, removal of the current vegetation and placement of an on-site drinking water well. Hypothetical future on-site receptor populations include a groundskeeper, a construction worker and a resident.

The groundskeeper may be exposed to COPCs in surface soil (incidental ingestion and inhalation) and in groundwater (ingestion). The construction worker is used to assess exposure to subsurface soil (via ingestion, dermal contact, and inhalation).

The on-site resident may be exposed to COPCs in surface soil and groundwater. The residential receptor population was divided into an adult and a child because differences in behavior, exposure duration, and physiology result in different intakes for these receptors. The child receptor is assessed for exposure to COPCs in surface soil (incidental ingestion, dermal contact, and inhalation) and groundwater (ingestion and dermal contact). The resident adult is assessed for exposure to COPCs in surface soil (incidental ingestion, dermal contact, and inhalation) and groundwater (ingestion, dermal contact, and inhalation).

The off-site receptor is an Installation worker. The off-site worker may currently be exposed to COPCs in surface soil (incidental ingestion and inhalation). A future off-site installation worker may be exposed to COPCs in surface soil (incidental ingestion and inhalation) and groundwater (ingestion).

Benzo(a)pyrene in surface soil was identified as a COC based on the exposure of resident child and the resident adult.

None of the subsurface soil COPCs were identified as COCs.

Benzene was identified as a COC in groundwater based on the exposure of the future on-site groundskeeper, future off-site installation worker, future on-site resident child, and future on-site resident adult.

Ethylbenzene, 2-methylnaphthalene, and naphthalene were identified as COCs based on the exposure of the future on-site resident child.

Both arsenic and chromium were identified as CMCOCs. Arsenic is a COC based on the exposure of the future on-site groundskeeper, future off-site installation worker, future on-site resident child, and future on-site resident adult. Chromium is also a COC based on the potential exposure of the future on-site groundskeeper, future off-site installation worker, future on-site resident child, and future on-site resident adult.

Remedial levels are derived for benzo(a)pyrene in surface soil and benzene in groundwater. Soil remedial values were derived for arsenic and chromium in soil, based on the protection of receptors using groundwater as a source of drinking water.

H.8 Remedial Levels

Remedial levels are required for all constituents that contribute significantly to excess cancer risk (total site ILCR greater than 1×10^{-6}) or noncancer health hazard (total site HI for all constituents combined greater than 1). A significant contribution to cancer risk is defined as contributing an ILCR across all exposure pathways of greater than 1×10^{-6} (GA EPD 1996). A significant contribution to noncancer health hazard is a constituent-specific HI greater than 0.1 (GA EPD 1996).

Remedial levels for COCs should not result in a cancer risk greater than 1×10^{-4} or an HI greater than 3.0 (GA EPD 1996). In addition to risk-based values, remedial levels may also include regulatory values such as maximum contaminant levels (MCLs) for groundwater or background concentrations for soil.

The derivation of remedial levels and recommendations for the selection of a remedial level are provided below.

H.8.1 Remedial Levels for Surface Soil

Benzo(a)pyrene was identified as a COC in surface soil based on the potential cancer risk to an on-site resident (adult and child). Remedial levels derived for this site address the potential risk to a hypothetical future resident exposed to constituents in surface soil via ingestion, inhalation, and dermal contact.

Remedial levels for surface soil at various risk/hazard levels are provided in Table H.20. Given that benzo(a)pyrene is the only COC in surface soil, a remedial level of 0.98 mg/kg is recommended. This remedial level corresponds to a total residential cancer risk of 1×10^{-5} . This takes into account the potential contributions of carcinogens present in groundwater in addition to surface soil.

H.8.2 Remedial Levels for Groundwater

Benzene, ethylbenzene, naphthalene, and 2-methylnaphthalene were identified as COCs in groundwater. Remedial levels for groundwater may include both risk-based concentrations and regulatory levels such as MCLs. Given that MCLs take into consideration both human health and the limitations of technology to remove constituents from water, these regulatory levels have been selected for remedial levels for groundwater when available. The remedial levels for groundwater are provided in Table H.20.

Benzene and ethylbenzene have MCLs of 0.005 mg/L and 0.7 mg/L, respectively. These MCL values are recommended as the remedial levels for these constituents.

MCL values are not available for naphthalene or 2-methylnaphthalene. The remedial levels for COCs in groundwater should not exceed a cumulative hazard index of 3.0 (GA EPD 1996). Given the number of potential COCs identified for groundwater, the recommended target groundwater concentration is based on HQs of 0.5 for each constituent. The recommended remedial levels for 2-methylnaphthalene and naphthalene are 0.142 mg/L and 0.149 mg/L, respectively.

H.8.3 Remedial Levels for Total Soil for Protection of Groundwater

Arsenic and chromium were identified as CMCOCs. Soil remedial levels for CMCOCs are derived based on the concentration of constituents in soil that will not leach into groundwater at unacceptable levels. Acceptable (target) groundwater concentrations are used to calculate acceptable soil concentrations using the leachate model (SESOL) described in Section 6.

The hypothetical residential exposure scenarios provide the most conservative remedial levels. Target groundwater concentrations for a residential receptor include risk-based values and MCLs. Target groundwater concentrations are summarized in Table H.21. Potential Remedial Levels corresponding to both MCLs and a range of risk levels for residential receptors are provided in Table H.22. All of the calculated remedial levels are below the reference background concentrations for these two metals. Therefore, the background concentration for each of these constituents is recommended as the remedial level.

H.9 References

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Table H.1
Estimation of Exposure Concentrations

Analyte	Units	Frequency of Detection	Distribution	Minimum Detect	Maximum Detect	Mean	95% UCL of Mean	Exposure Concentration
Surface Soil								
Benzo(a)pyrene	mg/kg	1/3	D	0.39	0.39	0.247	0.456	0.39
Subsurface Soil								
Benzo(a)anthracene	mg/kg	5/64	D	0.47	10	0.461	0.727	0.727
Benzo(a)pyrene	mg/kg	7/64	D	0.44	3.7	0.342	0.446	0.446
Benzo(b)fluoranthene	mg/kg	6/64	D	0.55	8.2	0.422	0.637	0.637
Benzo(g,h,i)perylene	mg/kg	6/64	D	0.42	2.4	0.305	0.376	0.376
Dibenzo(a,h)anthracene	mg/kg	4/64	D	0.68	4.5	0.345	0.471	0.471
Arsenic	mg/kg	43/64	X	1.1	10.4	2.44	2.89	2.89
Groundwater								
Benzene	µg/L	5/10	X	6.2	440	86.3	173	173
Ethylbenzene	µg/L	3/10	D	45	940	131	305	305
Toluene	µg/L	1/10	D	520	520	56.3	151	151
Xylenes, Total	µg/L	2/10	D	350	5300	568	1530	1530
2-Methylnaphthalene	µg/L	3/10	D	21	72	19	34	34
Naphthalene	µg/L	3/10	D	27	140	30	58.1	58.1

D = Distribution not determined (n < 8 or frequency of detection less than 50%), UCL calculated using t-statistic.

X = Not similar to normal or lognormal, UCL calculated using t-statistic.

Selected exposure concentration (maximum detect or 95% UCL) is shown in bold.

Table H.2
Parameters used to quantify exposures for each media and receptor, SWMU 13

Media/ Pathway	Parameter	Units	Current On-site Worker (Groundskeeper)	Future On-site Worker (Groundskeeper)	Future On-site Worker (Construction)	Current Off- site Worker	Future Off- site Worker	Future On- site Resident Adult	Future On- site Resident Child
Surface Soil									
Incidental Ingestion	Soil Ingestion Rate	kg/day	0.0001	0.0001	NA	0.0001	0.0001	0.0001	0.0002
	Fraction Ingested from Area	unitless	1	1	NA	0.25	0.25	1	1
	Exposure Frequency	days/year	52	52	NA	250	250	350	350
	Exposure Duration	years	25	25	NA	25	25	30	6
	Body Weight	kg	70	70	NA	70	70	70	15
Dermal Contact	Carcinogen Averaging Time	days	25550	25550	NA	25550	25550	25550	25550
	Noncarcinogen Averaging Time	days	9125	9125	NA	9125	9125	10950	2190
	Skin Area	cm ² /event	NA	NA	NA	NA	NA	5000	1700
	Adherence Factor	mg/cm ²	NA	NA	NA	NA	NA	1.0	1.0
	Exposure Frequency	events/year	NA	NA	NA	NA	NA	350	350
Inhalation of Dust or VOCs	Exposure Duration	years	NA	NA	NA	NA	NA	30	6
	Body Weight	kg	NA	NA	NA	NA	NA	70	15
	Carcinogen Averaging Time	days	NA	NA	NA	NA	NA	25550	25550
	Noncarcinogen Averaging Time	days	NA	NA	NA	NA	NA	10950	2190
	Inhalation Rate	m ³ /hr	2.5	2.5	NA	2.5	2.5	0.80	0.68
	Exposure Time	hr/day	8	8	NA	8	8	18.40	18.40
	Exposure Frequency	days/year	52	52	NA	250	250	350	350
	Exposure Duration	years	25	25	NA	25	25	30	6
	Body Weight	kg	70	70	NA	70	70	70	15
	Carcinogen Averaging Time	days	25550	25550	NA	25550	25550	25550	25550
	Noncarcinogen Averaging Time	days	9125	9125	NA	9125	9125	10950	2190
Subsurface Soil									
Incidental Ingestion	Soil Ingestion Rate	kg/day	NA	NA	0.0002	NA	NA	NA	NA
	Fraction Ingested from Area	unitless	NA	NA	1	NA	NA	NA	NA
	Exposure Frequency	days/year	NA	NA	250	NA	NA	NA	NA
	Exposure Duration	years	NA	NA	1	NA	NA	NA	NA
	Body Weight	kg	NA	NA	70	NA	NA	NA	NA
Dermal Contact	Carcinogen Averaging Time	days	NA	NA	25550	NA	NA	NA	NA
	Noncarcinogen Averaging Time	days	NA	NA	365	NA	NA	NA	NA
	Skin Area	cm ² /event	NA	NA	5000	NA	NA	NA	NA
	Adherence Factor	mg/cm ²	NA	NA	1.0	NA	NA	NA	NA
	Exposure Frequency	events/year	NA	NA	250	NA	NA	NA	NA
	Exposure Duration	years	NA	NA	1	NA	NA	NA	NA
	Body Weight	kg	NA	NA	70	NA	NA	NA	NA
	Carcinogen Averaging Time	days	NA	NA	25550	NA	NA	NA	NA
	Noncarcinogen Averaging Time	days	NA	NA	365	NA	NA	NA	NA
	Skin Area	cm ² /event	NA	NA	5000	NA	NA	NA	NA

Table H.2. (continued)

Media/ Pathway	Parameter	Units	Current On-site Worker (Groundskeeper)	Future On-site Worker (Groundskeeper)	Future On-site Worker (Construction)	Current Off- site Worker	Future Off- site Worker	Future On- site Resident Adult	Future On- site Resident Child
Inhalation of Dust or VOCs	Inhalation Rate	m ³ /hr	NA	NA	2.5	NA	NA	NA	NA
	Exposure Time	hr/day	NA	NA	8	NA	NA	NA	NA
	Exposure Frequency	days/year	NA	NA	250	NA	NA	NA	NA
	Exposure Duration	years	NA	NA	1	NA	NA	NA	NA
	Body Weight	kg	NA	NA	70	NA	NA	NA	NA
	Carcinogen Averaging Time	days	NA	NA	25550	NA	NA	NA	NA
	Noncarcinogen Averaging Time	days	NA	NA	365	NA	NA	NA	NA
Groundwater									
Drinking Water Ingestion	Drinking Water Ingestion	L/day	NA	1	NA	NA	1	2	1
	Fraction Ingested from Area	unitless	NA	1	NA	NA	1	1	1
	Exposure Frequency	days/year	NA	52	NA	NA	250	350	350
	Exposure Duration	years	NA	25	NA	NA	25	30	6
	Body Weight	kg	NA	70	NA	NA	70	70	15
	Carcinogen Averaging Time	days	NA	25550	NA	NA	25550	25550	25550
	Noncarcinogen Averaging Time	days	NA	9125	NA	NA	9125	10950	2190
Inhalation of VOCs	Inhalation Rate	m ³ /hr	NA	NA	NA	NA	NA	0.4	NA
	Exposure Time	hr/day	NA	NA	NA	NA	NA	0.17	NA
	Exposure Frequency	days/year	NA	NA	NA	NA	NA	350	NA
	Exposure Duration	years	NA	NA	NA	NA	NA	30	NA
	Body Weight	kg	NA	NA	NA	NA	NA	70	NA
	Carcinogen Averaging Time	days	NA	NA	NA	NA	NA	25550	NA
	Noncarcinogen Averaging Time	days	NA	NA	NA	NA	NA	10950	NA
Dermal Contact while bathing	Skin Area	m ²	NA	NA	NA	NA	NA	2	0.170
	Exposure Time	hours/day	NA	NA	NA	NA	NA	0.17	0.33
	Exposure Frequency	days/year	NA	NA	NA	NA	NA	350	350
	Exposure Duration	years	NA	NA	NA	NA	NA	30	6
	Body Weight	kg	NA	NA	NA	NA	NA	70	15
	Carcinogen Averaging Time	days	NA	NA	NA	NA	NA	25550	25550
	Noncarcinogen Averaging Time	days	NA	NA	NA	NA	NA	10950	2190

Table H.3
Chemical-Specific Exposure Parameters - SWMU 13

Constituent	Dermal Absorption Factor	Particle Emission Factor (PEF) (m³/kg)	Volatilization Factor (m³/kg)
Surface soil COPCs			
Benzo(a)pyrene	0.01	5.38E+09	2.72E+07
Subsurface Soil COPCs			
Arsenic	0.001	5.38E+09	NA
Benzo(a)anthracene	0.01	5.38E+09	1.05E+07
Benzo(a)pyrene	0.01	5.38E+09	2.72E+07
Benzo(b)fluoranthene	0.01	5.38E+09	5.13E+06
Dibenzo(a,h)anthracene	0.01	5.38E+09	1.16E+08

Table H.4
Estimated Intakes for the Current On-site Groundskeeper - SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	7.9E-08	2.8E-08	NA	NA	2.9E-12	1.1E-12

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

Table H.5
Estimated Intakes for the Current Off-site Worker - SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	9.5E-08	3.4E-08	NA	NA	1.4E-11	5.1E-12

Table H.6
Estimated Intakes for the Future On-site Groundskeeper - SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	7.9E-08	2.8E-08	NA	NA	2.9E-12	1.1E-12
Groundwater	2-Methylnaphthalene	0.034	mg/L	6.9E-05	2.5E-05	NA	NA	NA	NA
Groundwater	Benzene	0.173	mg/L	3.5E-04	1.3E-04	NA	NA	NA	NA
Groundwater	Ethylbenzene	0.305	mg/L	6.2E-04	2.2E-04	NA	NA	NA	NA
Groundwater	Naphthalene	0.058	mg/L	1.2E-04	4.2E-05	NA	NA	NA	NA
Groundwater	Toluene	0.151	mg/L	3.1E-04	1.1E-04	NA	NA	NA	NA
Groundwater	Xylenes, Total	1.530	mg/L	3.1E-03	1.1E-03	NA	NA	NA	NA
Modeled Concentrations									
Groundwater	Arsenic	0.21	mg/L	4.3E-04	1.5E-04	NA	NA	NA	NA
Groundwater	Chromium	2.13	mg/L	4.3E-03	1.5E-03	NA	NA	NA	NA

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

Table H.7
Estimated Intakes for the Future Off-site Worker, SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	9.5E-08	3.4E-08	NA	NA	1.4E-11	5.1E-12
Groundwater	2-Methylnaphthalene	0.034	mg/L	3.3E-04	1.2E-04	NA	NA	NA	NA
Groundwater	Benzene	0.173	mg/L	1.7E-03	6.0E-04	NA	NA	NA	NA
Groundwater	Ethylbenzene	0.305	mg/L	3.0E-03	1.1E-03	NA	NA	NA	NA
Groundwater	Naphthalene	0.058	mg/L	5.7E-04	2.0E-04	NA	NA	NA	NA
Groundwater	Toluene	0.151	mg/L	1.5E-03	5.3E-04	NA	NA	NA	NA
Groundwater	Xylenes, Total	1.530	mg/L	1.5E-02	5.3E-03	NA	NA	NA	NA
Modeled Concentrations									
Groundwater	Arsenic	0.21	mg/L	2.1E-03	7.3E-04	NA	NA	NA	NA
Groundwater	Chromium	2.13	mg/L	2.1E-02	7.4E-03	NA	NA	NA	NA

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

Table H.8
Estimated Intakes for the Future On-site Construction Worker SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Subsurface Soil	Arsenic	2.89	mg/kg	5.7E-06	8.1E-08	1.4E-07	2.0E-09	1.1E-10	1.5E-12
Subsurface Soil	Benzo(a)anthracene	0.727	mg/kg	1.4E-06	2.0E-08	3.6E-07	5.1E-09	2.6E-11	3.8E-13
Subsurface Soil	Benzo(a)pyrene	0.446	mg/kg	8.7E-07	1.2E-08	2.2E-07	3.1E-09	1.6E-11	2.3E-13
Subsurface Soil	Benzo(b)fluoranthene	0.637	mg/kg	1.2E-06	1.8E-08	3.1E-07	4.5E-09	2.3E-11	3.3E-13
Subsurface Soil	Dibenzo(a,h)anthracene	0.471	mg/kg	9.2E-07	1.3E-08	2.3E-07	3.3E-09	1.7E-11	2.4E-13

Table H.9
Estimated Intakes for the Future On-site Resident Adult, SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	5.3E-07	2.3E-07	2.67E-07	1.14E-07	1.5E-11	6.3E-12
Groundwater	2-Methylnaphthalene	0.034	mg/L	9.3E-04	4.0E-04	2.4E-04	1.0E-04	NA	NA
Groundwater	Benzene	0.173	mg/L	4.7E-03	2.0E-03	1.7E-04	7.3E-05	8.1E-05	3.5E-05
Groundwater	Ethylbenzene	0.305	mg/L	8.4E-03	3.6E-03	1.1E-03	4.5E-04	1.4E-04	6.1E-05
Groundwater	Naphthalene	0.058	mg/L	1.6E-03	6.8E-04	1.9E-04	8.0E-05	NA	NA
Groundwater	Toluene	0.151	mg/L	4.1E-03	1.8E-03	3.2E-04	1.4E-04	7.0E-05	3.0E-05
Groundwater	Xylenes, Total	1.530	mg/L	4.2E-02	1.8E-02	6.8E-03	2.9E-03	7.1E-04	3.1E-04
Modeled Concentrations									
Groundwater	Arsenic	0.21	mg/L	5.8E-03	2.5E-03	9.8E-06	4.2E-06	NA	NA
Groundwater	Chromium	2.13	mg/L	5.8E-02	2.5E-02	9.9E-05	4.3E-05	NA	NA

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

Table H.10
Estimated Intakes for the Future On-site Resident Child, SWMU 13

Environmental Media	Constituent	Exposure Concentration	Units	Oral Exposure		Dermal Exposure		Inhalation Exposure	
				Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)	Average Daily Dose for Noncarcinogens (mg/kg/day)	Average Daily Dose for Carcinogens (mg/kg/day)
				Measured Concentrations					
Surface soil	Benzo(a)pyrene	0.39	mg/kg	5.0E-06	4.3E-07	4.24E-07	3.63E-08	5.8E-11	5.0E-12
Groundwater	2-Methylnaphthalene	0.034	mg/L	2.2E-03	1.9E-04	1.8E-04	1.6E-05	NA	NA
Groundwater	Benzene	0.173	mg/L	1.1E-02	9.5E-04	1.3E-04	1.1E-05	NA	NA
Groundwater	Ethylbenzene	0.305	mg/L	1.9E-02	1.7E-03	8.1E-04	6.9E-05	NA	NA
Groundwater	Naphthalene	0.058	mg/L	3.7E-03	3.2E-04	1.4E-04	1.2E-05	NA	NA
Groundwater	Toluene	0.151	mg/L	9.7E-03	8.3E-04	2.4E-04	2.1E-05	NA	NA
Groundwater	Xylenes, Total	1.530	mg/L	9.8E-02	8.4E-03	5.2E-03	4.5E-04	NA	NA
Modeled Concentrations									
Groundwater	Arsenic	0.21	mg/L	1.3E-02	1.2E-03	7.5E-06	6.5E-07	NA	NA
Groundwater	Chromium	2.13	mg/L	1.4E-01	1.2E-02	7.6E-05	6.5E-06	NA	NA

NA- Not applicable, this exposure pathway is not applicable for this environmental medium or COPC.

NA = Not applicable, this exposure pathway is not applicable for this environmental medium or COPC

Table H.11
Constituent-Specific Toxicity Factors - SWMU 13

Constituent	G.I. ABS Factor	Chronic RfD (mg/kg-day)			Cancer Slope Factor (mg/kg-day) ⁻¹		
		Oral	Dermal	Inhalation	Oral	Dermal	Inhalation
Surface soil COPCs							
Benzo(a)pyrene	3.10E-01				7.30E+00	2.35E+01	3.10E+00
Subsurface Soil COPCs							
Arsenic	4.10E-01	3.00E-04	1.23E-04		1.50E+00	3.66E+00	1.51E+01
Benzo(a)anthracene	3.10E-01				7.30E-01	2.35E+00	
Benzo(a)pyrene	3.10E-01				7.30E+00	2.35E+01	3.10E+00
Benzo(b)fluoranthene	3.10E-01				7.30E-01	2.35E+00	
Dibenzo(a,h)anthracene	3.10E-01				7.30E+00	2.35E+01	3.10E+00
Groundwater COPCs							
2-Methylnaphthalene	8.00E-01	2.00E-02	1.60E-02				
Benzene	9.70E-01	3.00E-03	2.91E-03	1.70E-03	2.90E-02	2.99E-02	2.90E-02
Ethylbenzene	9.70E-01	1.00E-01	9.70E-02	2.86E-01			
Naphthalene	8.00E-01	2.00E-02	1.60E-02	8.57E-04			
Toluene	8.00E-01	2.00E-01	1.60E-01	1.14E-01			
Xylenes, Total	9.20E-01	2.00E+00	1.84E+00				
Soil CMCOPCs for Groundwater							
Arsenic	4.10E-01	3.00E-04	1.23E-04		1.50E+00	3.66E+00	1.51E+01
Chromium	2.00E-02	3.00E-03	6.00E-05	2.29E-06			4.10E+01

Table H.12
Hazard Index and Carcinogenic Risk for Current On-site Groundskeeper, SWMU 13

Constituent	Surface Soil			Total Hazard Index
	Oral HQ	Inhalation HQ	Total	
Benzo(a)pyrene	ND	ND	—	—
Pathway Total	—	—	—	—
Constituent	Surface Soil			Total Cancer Risk
	Oral ILCR	Inhalation ILCR	Total	
Benzo(a)pyrene	2.07E-07	3.26E-12	2.07E-07	2.07E-07
Pathway Total	2.07E-07	3.26E-12	2.07E-07	2.07E-07

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

— = No data

Table H.13
Hazard Index and Carcinogenic Risk for Current Off-site Worker, SWMU 13

Constituent	Surface Soil			Total Hazard Index
	Oral HQ	Inhalation HQ	Total	
Benzo(a)pyrene	ND	ND	—	—
Pathway Total	—	—	—	—
Constituent	Surface Soil			Total Cancer Risk
	Oral ILCR	Inhalation ILCR	Total	
Benzo(a)pyrene	2.49E-07	1.57E-11	2.49E-07	2.49E-07
Pathway Total	2.49E-07	1.57E-11	2.49E-07	2.49E-07

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

— = No data

Table H.14
Hazard Index and Carcinogenic Risk for Future On-site Groundskeeper, SWMU 13

Constituent	Surface Soil		Total	Groundwater - Measured Concentrations		Groundwater - Modeled Concentrations		Total Hazard Index
	Oral HQ	Inhalation HQ		Oral HQ	Total	Oral HQ	Total	
Arsenic	NA ^a	NA ^a	—	NA ^c	—	1.4E+00	1.42E+00	1.42E+00
Chromium	NA ^a	NA ^a	—	NA ^c	—	1.4E+00	1.45E+00	1.45E+00
Benzo(a)pyrene	ND	ND	—	NA ^a	—	NA ^a	—	—
2-Methylnaphthalene	NA ^a	NA ^a	—	3.46E-03	3.46E-03	NA ^b	—	3.46E-03
Benzene	NA ^a	NA ^a	—	1.17E-01	1.17E-01	NA ^b	—	1.17E-01
Ethylbenzene	NA ^a	NA ^a	—	6.21E-03	6.21E-03	NA ^b	—	6.21E-03
Naphthalene	NA ^a	NA ^a	—	5.91E-03	5.91E-03	NA ^b	—	5.91E-03
Toluene	NA ^a	NA ^a	—	1.54E-03	1.54E-03	NA ^b	—	1.54E-03
Xylenes, Total	NA ^a	NA ^a	—	1.56E-03	1.56E-03	NA ^b	—	1.56E-03
Pathway Total	—	—	—	1.36E-01	1.36E-01	2.9E+00	2.9E+00	3.01E+00
Constituent	Surface Soil		Total	Groundwater - Measured Concentrations		Groundwater - Modeled Concentrations		Total Cancer Index
	Oral ILCR	Inhalation ILCR		Oral ILCR	Total	Oral ILCR	Total	
Arsenic	NA ^a	NA ^a	—	NA ^c	—	2.3E-04	2.29E-04	2.29E-04
Chromium	NA ^a	NA ^a	—	NA ^c	—	ND	—	—
Benzo(a)pyrene	2.1E-07	3.3E-12	2.07E-07	NA ^b	—	NA ^b	—	2.07E-07
2-Methylnaphthalene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Benzene	NA ^a	NA ^a	—	3.6E-06	3.6E-06	NA ^b	—	3.65E-06
Ethylbenzene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Naphthalene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Toluene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Xylenes, Total	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Pathway Total	2.1E-07	3.3E-12	2.07E-07	3.6E-06	3.6E-06	2.3E-04	2.29E-04	2.33E-04

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

— = No data

NA^a = Not Applicable, this chemical is not present in this environmental medium

NA^b = Not Applicable, chemical has only a measured concentration

NA^c = Not Applicable, chemical only has a modeled concentration

Table H.15
Hazard Index and Carcinogenic Risk for Future Off-site Worker, SWMU 13

Constituent	Surface Soil		Total	Groundwater - Measured Concentrations		Groundwater - Modeled Concentrations		Total Hazard Index
	Oral HQ	Inhalation HQ		Oral HQ	Total	Oral HQ	Total	
Arsenic	NA ^a	NA ^a	—	NA ^c	—	6.8E+00	6.85E+00	6.85E+00
Chromium	NA ^a	NA ^a	—	NA ^c	—	6.9E+00	6.95E+00	6.95E+00
Benzo(a)pyrene	ND	ND	—	NA ^a	—	NA ^a	—	—
2-Methylnaphthalene	NA ^a	NA ^a	—	1.7E-02	1.66E-02	NA ^b	—	1.66E-02
Benzene	NA ^a	NA ^a	—	5.6E-01	5.64E-01	NA ^b	—	5.64E-01
Ethylbenzene	NA ^a	NA ^a	—	3.0E-02	2.98E-02	NA ^b	—	2.98E-02
Naphthalene	NA ^a	NA ^a	—	2.8E-02	2.84E-02	NA ^b	—	2.84E-02
Toluene	NA ^a	NA ^a	—	7.4E-03	7.39E-03	NA ^b	—	7.39E-03
Xylenes, Total	NA ^a	NA ^a	—	7.5E-03	7.49E-03	NA ^b	—	7.49E-03
Pathway Total	—	—	—	6.5E-01	6.54E-01	1.4E+01	1.38E+01	1.45E+01
Constituent	Surface Soil		Total	Groundwater - Measured Concentrations		Groundwater - Modeled Concentrations		Total Cancer Index
	Oral ILCR	Inhalation ILCR		Oral ILCR	Total	Oral ILCR	Total	
Arsenic	NA ^a	NA ^a	—	NA ^c	—	1.1E-03	1.10E-03	1.10E-03
Chromium	NA ^a	NA ^a	—	NA ^c	—	ND	—	—
Benzo(a)pyrene	2.49E-07	1.57E-11	2.49E-07	NA ^a	—	NA ^a	—	2.49E-07
2-Methylnaphthalene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Benzene	NA ^a	NA ^a	—	1.8E-05	1.75E-05	NA ^b	—	1.75E-05
Ethylbenzene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Naphthalene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Toluene	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Xylenes, Total	NA ^a	NA ^a	—	ND	—	NA ^b	—	—
Pathway Total	2.49E-07	1.57E-11	2.49E-07	1.8E-05	1.75E-05	1.1E-03	1.10E-03	1.12E-03

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

— = No data

NA^a = Not Applicable, this chemical is not present in this environmental medium

NA^b = Not Applicable, chemical has only a measured concentration

NA^c = Not Applicable, chemical only has a modeled concentration

Table H.16
Hazard Index and Carcinogenic Risk for Future On-site Construction Worker, SWMU 13

Constituent	Subsurface Soil			Total Hazard Index
	Oral HQ	Dermal HQ	Inhalation HQ	
Arsenic	1.9E-02	1.1E-03	ND	2.0E-02
Benzo(a)anthracene	ND	ND	ND	—
Benzo(a)pyrene	ND	ND	ND	—
Benzo(b)fluoranthene	ND	ND	ND	—
Dibenzo(a,h)anthracene	ND	ND	ND	—
Pathway Total	1.9E-02	1.1E-03	—	2.0E-02
Constituent	Subsurface Soil			Total Cancer Index
	Oral ILCR	Dermal ILCR	Inhalation ILCR	
Arsenic	1.2E-07	7.4E-09	2.3E-11	1.3E-07
Benzo(a)anthracene	1.5E-08	1.2E-08	ND	2.7E-08
Benzo(a)pyrene	9.1E-08	7.3E-08	7.2E-13	1.6E-07
Benzo(b)fluoranthene	1.3E-08	1.0E-08	ND	2.3E-08
Dibenzo(a,h)anthracene	9.6E-08	7.8E-08	7.6E-13	1.7E-07
Pathway Total	3.36E-07	1.8E-07	2.41E-11	5.17E-07

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

Table H.17
Hazard Index and Carcinogenic Risk for Future On-site Resident Adult, SWMU 13

Constituent	Surface Soil				Groundwater - Measured Concentrations				Groundwater - Modeled Concentrations			Total Hazard Index
	Oral HQ	Dermal HQ	Inhalation HQ	Total	Oral HQ	Dermal HQ	Inhalation HQ	Total	Oral HQ	Dermal HQ	Total	
	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	1.9E+01	8.0E-02	1.93E+01	
Arsenic	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	1.9E+01 <td>1.7E+00<td>2.11E+01<td>2.11E+01</td></td></td>	1.7E+00 <td>2.11E+01<td>2.11E+01</td></td>	2.11E+01 <td>2.11E+01</td>	2.11E+01
Chromium	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	NA ^a	NA ^a	—	—
Benzo(a)pyrene	ND	ND	ND	—	NA ^a	NA ^a	NA ^a	—	NA ^a	NA ^a	—	—
2-Methylnaphthalene	NA ^a	NA ^a	NA ^a	—	4.7E-02	1.5E-02	ND	6.1E-02	NA ^b	NA ^b	—	6.14E-02
Benzene	NA ^a	NA ^a	NA ^a	—	1.6E+00	5.8E-02	4.7E-02	1.7E+00	NA ^b	NA ^b	—	1.69E+00
Ethylbenzene	NA ^a	NA ^a	NA ^a	—	8.4E-02	1.1E-02	5.0E-04	9.5E-02	NA ^b	NA ^b	—	9.49E-02
Naphthalene	NA ^a	NA ^a	NA ^a	—	8.0E-02	1.2E-02	ND	9.1E-02	NA ^b	NA ^b	—	9.13E-02
Toluene	NA ^a	NA ^a	NA ^a	—	2.1E-02	2.0E-03	6.2E-04	2.3E-02	NA ^b	NA ^b	—	2.33E-02
Xylenes, Total	NA ^a	NA ^a	NA ^a	—	2.1E-02	3.7E-03	ND	2.5E-02	NA ^b	NA ^b	—	2.46E-02
Pathway Total	—	—	—	—	1.8E+00	1.0E-01	4.9E-02	2.0E+00	3.9E+01	1.7E+00	4.04E+01	4.23E+01
Constituent	Surface Soil				Groundwater - Measured Concentrations				Groundwater - Modeled Concentrations			Total Cancer Index
	Oral H ILCR Q	Dermal ILCR	Inhalation ILCR	Total	Oral ILCR	Dermal ILCR	Inhalation ILCR	Total	Oral ILCR	Dermal ILCR	Total	
	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	3.7E-03	1.5E-05	3.71E-03	
Arsenic	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	ND	ND	—	—
Chromium	NA ^a	NA ^a	NA ^a	—	NA ^c	NA ^c	NA ^c	—	NA ^a	NA ^a	—	4.4E-06
Benzo(a)pyrene	1.7E-06	2.7E-06	1.9E-11	4.4E-06	NA ^a	NA ^a	NA ^a	—	NA ^b	NA ^b	—	—
2-Methylnaphthalene	NA ^a	NA ^a	NA ^a	—	ND	ND	ND	—	NA ^b	NA ^b	—	—
Benzene	NA ^a	NA ^a	NA ^a	—	5.9E-05	2.2E-06	1.0E-06	6.2E-05	NA ^b	NA ^b	—	6.21E-05
Ethylbenzene	NA ^a	NA ^a	NA ^a	—	ND	ND	ND	—	NA ^b	NA ^b	—	—
Naphthalene	NA ^a	NA ^a	NA ^a	—	ND	ND	ND	—	NA ^b	NA ^b	—	—
Toluene	NA ^a	NA ^a	NA ^a	—	ND	ND	ND	—	NA ^b	NA ^b	—	—
Xylenes, Total	NA ^a	NA ^a	NA ^a	—	ND	ND	ND	—	NA ^b	NA ^b	—	—
Pathway Total	1.7E-06	2.7E-06	1.9E-11	4.4E-06	5.9E-05	2.2E-06	1.0E-06	6.2E-05	3.7E-03	1.5E-05	3.71E-03	3.78E-03

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

--- = No data

NA^a = Not Applicable, this chemical is not present in this environmental medium

NA^b = Not Applicable, chemical has only a measured concentration

NA^c = Not Applicable, chemical only has a modeled concentration

Table H.18
Hazard Index and Carcinogenic Risk for Future On-site Resident Child, SWMU 13

Constituent	Surface Soil			Groundwater - Measured Concentrations			Groundwater - Modeled Concentrations			Total Hazard Index
	Oral HQ	Dermal HQ	Inhalation HQ	Oral HQ	Dermal HQ	Total	Oral HQ	Dermal HQ	Total	
Arsenic	NA ^a	NA ^a	NA ^a	NA ^c	NA ^c	—	4.5E+01	6.1E-02	4.48E+01	4.48E+01
Chromium	NA ^a	NA ^a	NA ^a	NA ^c	NA ^c	—	4.5E+01	1.3E+00	4.67E+01	4.67E+01
Benzo(a)pyrene	ND	ND	ND	NA ^a	NA ^a	—	NA ^a	NA ^a	—	—
2-Methylnaphthalene	NA ^a	NA ^a	NA ^a	1.1E-01	1.1E-02	1.2E-01	NA ^b	NA ^b	—	1.20E-01
Benzene	NA ^a	NA ^a	NA ^a	3.7E+00	4.5E-02	3.7E+00	NA ^b	NA ^b	—	3.73E+00
Ethylbenzene	NA ^a	NA ^a	NA ^a	1.9E-01	8.3E-03	2.0E-01	NA ^b	NA ^b	—	2.03E-01
Naphthalene	NA ^a	NA ^a	NA ^a	1.9E-01	9.0E-03	1.9E-01	NA ^b	NA ^b	—	1.95E-01
Toluene	NA ^a	NA ^a	NA ^a	4.8E-02	1.5E-03	5.0E-02	NA ^b	NA ^b	—	4.98E-02
Xylenes, Total	NA ^a	NA ^a	NA ^a	4.9E-02	2.8E-03	5.2E-02	NA ^b	NA ^b	—	5.17E-02
Pathway Total	—	—	—	4.3E+00	7.8E-02	4.4E+00	9.0E+01	1.3E+00	9.1E+01	9.58E+01
Constituent	Surface Soil			Groundwater - Measured Concentrations			Groundwater - Modeled Concentrations			Total Cancer Index
	Oral ILCR	Dermal ILCR	Inhalation ILCR	Oral ILCR	Dermal ILCR	Total	Oral ILCR	Dermal ILCR	Total	
Arsenic	NA ^a	NA ^a	NA ^a	NA ^c	NA ^c	—	1.7E-03	2.4E-06	1.73E-03	1.73E-03
Chromium	NA ^a	NA ^a	NA ^a	NA ^c	NA ^c	—	ND	ND	—	—
Benzo(a)pyrene	3.1E-06	8.6E-07	1.5E-11	NA ^a	NA ^a	—	NA ^a	NA ^a	—	3.98E-06
2-Methylnaphthalene	NA ^a	NA ^a	NA ^a	ND	ND	—	NA ^b	NA ^b	—	—
Benzene	NA ^a	NA ^a	NA ^a	2.7E-05	3.3E-07	2.8E-05	NA ^b	NA ^b	—	2.78E-05
Ethylbenzene	NA ^a	NA ^a	NA ^a	ND	ND	—	NA ^b	NA ^b	—	—
Naphthalene	NA ^a	NA ^a	NA ^a	ND	ND	—	NA ^b	NA ^b	—	—
Toluene	NA ^a	NA ^a	NA ^a	ND	ND	—	NA ^b	NA ^b	—	—
Xylenes, Total	NA ^a	NA ^a	NA ^a	ND	ND	—	NA ^b	NA ^b	—	—
Pathway Total	3.1E-06	8.6E-07	1.5E-11	2.7E-05	3.3E-07	2.8E-05	1.7E-03	2.4E-06	1.73E-03	1.76E-03

HQ = Hazard quotient

ILCR = Incremental lifetime cancer risk

ND = The toxicity data required to quantify the risk are not available

— = No data

NA^a = Not Applicable, this chemical is not present in this environmental medium

NA^b = Not Applicable, chemical has only a measured concentration

NA^c = Not Applicable, chemical only has a modeled concentration

Table H.19
Potential Sources of Uncertainty in Human Health Risk Assessment

Potential Source	Effect	Justification
Uncertainty Associated with Selection of COPCs		
Evaluation of laboratory contamination (i.e., "blank" comparisons)	Unknown	Potential exists for both false "negatives" and false "positives."
Comparison to background	Unknown	Quality of background data set impacts selection of COPCs.
Uncertainties Associated with Exposure Assessment		
Likelihood of exposure pathways	Overestimate	Future pathways may not actually occur.
Exposure assumptions (e.g., frequency, duration)	Overestimate	Parameters selected are conservative estimates of exposure.
Degradation of constituents not considered	Overestimate	Risk estimates are based on recent constituent concentrations. Concentrations will tend to decrease over time as a result of degradation.
Use of maximum detected concentration as the source concentration when using transport models	Overestimate	By using the maximum concentration in environmental fate models, the overall site risk may be overestimated.
Uncertainties Associated with Toxicity Assessment		
Extrapolation of animal toxicity data to humans	Unknown, probably overestimate	Animals and humans differ with respect to absorption, metabolism, distribution, and excretion of a constituent. The magnitude and direction of the difference will vary with each constituent. Animal studies typically involve high-dose exposures, whereas humans are exposed to low doses in the environment.
Use of uncertainty factors in the derivation of reference doses	Unknown	Ten-fold uncertainty factors are incorporated to account for various sources of uncertainty. Although some data seem to support the ten-fold factor, its selection is somewhat arbitrary.
Use of a linearized, multistage model to derive cancer slope factors	Overestimate	Model assumes a nonthreshold, linear-at-low-dose relationship for carcinogens. Many compounds induce cancer by nongenotoxic mechanisms. Model results in a 95 percent upper confidence limit of the cancer risk. The true risk is unlikely to be higher and may be as low as zero.
Use of chronic RfDs to evaluate subchronic exposures	Overestimate	Although some constituents have the same chronic and subchronic RfDs, many do not. The subchronic RfD can be an order of magnitude lower than the chronic RfD.
Uncertainties in Risk Characterization		
Summarization of effects (cancer risks and hazard indices) from multiple substances	Unknown	The assumption that effects are additive ignores potential synergistic and/or antagonistic effects. Assumes similarity in mechanism of action, which is not the case for many substances. Compounds may induce tumors or other toxic effects in different organs or systems.
No evaluation of constituents lacking toxicity data	Underestimate	Certain constituents were evaluated only qualitatively and may contribute to overall site risks.
Multiple conservative assumptions	Overestimate	Cumulative impact of multiple conservative assumptions may yield high risk to receptors.

Source: EPA 1989.

COPCs = Constituents of potential concern.

RfD = Reference dose.

Table H.20
Remedial Levels for Surface Soil and Groundwater, SWMU 13

Constituent of Concern	Environmental Medium	Units	Maximum Detected Concentration	Reference Background Concentration	Maximum Contaminant Level	Risk-Based Remedial Levels			
						Hazard Index		Incremental Lifetime Cancer Risk	
						0.1	0.5	1	1×10^{-6}
Benzo(a)pyrene	Surface Soil	mg/kg	0.39	NA ^d	NA ^c	2.32E-02	1.16E-01	2.32E-01	9.8E-02
2-Methylnaphthalene	Groundwater	mg/L	0.072	NA ^d	NA ^f	2.83E-02	1.42E-01	2.83E-01	NA ^b
Benzene	Groundwater	mg/L	0.44	NA ^d	5.00E-03	NA ^c	NA ^c	NA ^c	NA ^c
Ethylbenzene	Groundwater	mg/L	0.94	NA ^d	7.00E-01	NA ^c	NA ^c	NA ^c	NA ^c
Naphthalene	Groundwater	mg/L	0.14	NA ^d	NA ^f	2.98E-02	1.49E-01	2.98E-01	NA ^b

Bold indicates values that are the recommended remedial values

NA^a = Not applicable, constituent or concern based on carcinogenic risk only

NA^b = Not applicable, constituent or concern based on systemic risk only

NA^c = Not applicable, maximum contaminant level is not applicable for this environmental medium

NA^d = Not applicable, reference background concentrations are not available for organic constituents

NA^e = Not applicable, this constituent has a maximum contaminant level

NA^f = Not applicable, a MCL is not available for this constituent

Table H.21
Target Groundwater Concentrations for Contaminant Migration Constituents of Concern, SWMU 13

Constituent of Concern (CMCOC)	Maximum Contaminant Level (mg/L)	Target Groundwater Concentrations (mg/L)				
		Hazard Indices			ILCR	
		0.1	0.5	1	1.00E-06	1.00E-05
Arsenic	0.05	4.69E-04	2.34E-03	4.69E-03	5.66E-05	5.66E-04
Chromium	0.1	4.56E-03	2.28E-02	4.56E-02	NA	NA

CMCOC = Contaminant migration chemical of concern

ILCR = Incremental lifetime cancer risk

NA = not applicable, a cancer slope factor is not available for this constituent

Values appearing in bold print are the recommended target levels

Table H.22
Remedial Levels for Contaminant Migration Constituents of Concern, SWMU 13

Constituent of Concern (CMCOC)	Remedial levels (mg/kg)							Reference Background Concentration (mg/kg)
	Hazard Index			ILCR			Based on MCL	
	0.1	0.5	1	1.00E-06	1.00E-05	1.00E-04		
Arsenic	2.32E-02	1.16E-01	2.32E-01	2.80E-03	2.80E-02	2.80E-01	2.48E+00	8.04
Chromium	8.65E-02	4.33E-01	8.65E-01	NA	NA	NA	1.90E+00	11.6

CMCOC = Contaminant migration chemical of concern

ILCR = Incremental lifetime cancer risk

MCL = Maximum contaminant level

NA = not applicable, a cancer slope factor is not available for this constituent

Values appearing in bold print are the recommended remedial levels

APPENDIX I

**TOXICITY PROFILES FOR HUMAN HEALTH
CONSTITUENTS OF CONCERN**

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TOXICITY PROFILES FOR HUMAN HEALTH CONSTITUENTS OF CONCERN

This appendix contains the toxicity profiles for human health constituents of concern (HHCOCs). The toxicity profiles provide pertinent information concerning the uptake, mechanisms of toxicity, and toxicity values for the HHCOCs. In addition to the toxicity profiles, a toxicity summary (Table I-1) is given for all of the site-related contaminants. The toxicity summary consists of the essential data used to derive toxicity values [reference doses (RfDs) and cancer slope factors] obtained from U.S. Environmental Protection Agency (EPA) toxicity databases [Integrated Risk Information System (IRIS; EPA 1999a) and Health Effects Assessment Summary Tables (HEAST; EPA 1997)].

Arsenic. Arsenic is a metallic, steel-gray, crystalline, brittle, trivalent and pentavalent, solid, poisonous element that is commonly used in pesticides (Opresko 1992).

Water-soluble inorganic arsenic compounds are absorbed through the gastrointestinal tract and lungs. Symptoms of acute inorganic arsenic poisoning in humans are nausea, anorexia, vomiting, epigastric and abdominal pain, and diarrhea. In addition, dermatitis, muscle cramps, cardiac abnormalities, hepatotoxicity, bone marrow suppression and hematologic abnormalities, vascular lesions, and peripheral neuropathy have also been reported. Severe exposures can result in acute encephalopathy, congestive heart failure, stupor, convulsions, paralysis, coma, and death. Possible reproductive effects include a high frequency of spontaneous abortions and reduced birth weights. Occupational exposure studies show a clear correlation between exposure to arsenic and lung cancer mortality (Opresko 1992).

The RfD for chronic oral exposures (0.0003 mg/kg-day) is based on an no-observed-adverse-effect level (NOAEL) of 0.0008 mg/kg-day for hyperpigmentation, keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water (EPA 1999a). No chronic reference concentrations (RfCs) have been derived for arsenic (EPA 1999a; EPA 1997). EPA has placed inorganic arsenic in weight-of-evidence classification Group A, human carcinogen. The oral slope factor is 1.5/(mg/kg-day), and the inhalation unit risk is 0.0043/($\mu\text{g}/\text{m}^3$) (EPA 1999a).

Benzene. Benzene is a volatile, colorless liquid with a characteristic aromatic odor that is used primarily in the production of other chemicals such as ethylbenzene, cumene, and cyclohexane. Benzene is emitted into the workplace and environment (aquatic, terrestrial, and atmospheric) from industrial and other man-made sources, including gasoline from filling stations, tobacco products, and auto exhaust. According to the Occupational Safety and Health Act, workers employed in industries that produce or use benzene are at risk from exposure to high levels of the chemical. Exposure of the general population may occur in residential areas near chemical manufacturing sites and has also been associated with the ingestion of contaminated food and drinking water and inhalation of cigarette smoke and gas fumes (Daugherty 1992a).

The autopsy of a youth who died while sniffing benzene revealed that the chemical was distributed to the urine, stomach, bile, liver, kidney, abdominal fat, and brain. Numerous studies indicate that the liver is the

main site for metabolism of benzene; bone marrow is believed to be a minor site. Lethal oral doses of benzene are estimated to be 10 milliliters (7.9 grams) in humans; these data indicate that benzene is of low acute toxicity. Limited data show that nonlethal oral doses of benzene can impact the nervous, hematological, and immunological systems. In addition, inhalation of benzene vapor concentrations of 20,000 parts per million (ppm) for 5 to 10 minutes can be fatal to humans, and death results from central nervous system depression. Furthermore, benzene has been shown to be carcinogenic in humans and animals by inhalation and in animals by oral exposure (Daugherty 1992a).

The RfDs and RfCs for benzene have not been established (EPA 1999a; EPA 1997). EPA has placed benzene in weight-of-evidence classification Group A, known human carcinogen (EPA 1999a). The oral slope factor for benzene is 0.029/(mg/kg-day) (EPA 1999a). The air unit risk for benzene is not defined in EPA's IRIS database (EPA 1999a). EPA gives a range of carcinogenic risks of 2.2×10^{-6} to 7.8×10^{-6} , for a lifetime exposure of $1 \mu\text{g}/\text{m}^3$. This corresponds to an inhalation unit risk range of $2.2 \times 10^{-6}/(\mu\text{g}/\text{m}^3)$ to $7.7 \times 10^{-6}/(\mu\text{g}/\text{m}^3)$.

Benzo(a)pyrene. Benzo(a)pyrene is a PAH that can be derived from coal tar. It occurs ubiquitously in products of incomplete combustion of fossil fuels and has been identified in ambient air, surface water, drinking water, waste water, and char-broiled foods. Benzo(a)pyrene is primarily released to the air and removed from the atmosphere by photochemical oxidation and dry deposition to land or water. Biodegradation is the most important transformation process in soil or sediment (Faust 1994).

Benzo(a)pyrene is readily absorbed after inhalation, ingestion, and dermal contact. After inhalation exposure, benzo(a)pyrene is rapidly distributed to several tissues in rats. The metabolism of the compound is complex and includes the formation of a proposed ultimate carcinogen, benzo(a)pyrene 7,8 diol-9,10-epoxide. The major route of excretion is hepatobiliary followed by elimination in the feces (Faust 1994).

Numerous epidemiologic studies have shown a clear association between exposure to various mixtures of PAHs containing benzo(a)pyrene (e.g., coke oven emissions, roofing tar emissions, and cigarette smoke) and increased risk of lung cancer and other tumors. However, each of the mixtures also contained other potentially carcinogenic PAHs; therefore, distinguishing the contribution of benzo(a)pyrene to the carcinogenicity of these mixtures is not possible. An extensive database is available for the carcinogenicity of benzo(a)pyrene in experimental animals. Dietary administration of the compound has produced papillomas and carcinomas of the forestomach in mice, and treatment by gavage has produced mammary tumors in rats and pulmonary adenomas in mice. Exposure by inhalation and intratracheal instillation has resulted in benign and malignant tumors of the respiratory and upper digestive tracts of hamsters. Numerous topical application studies have shown that benzo(a)pyrene induces skin tumors in several species, although mice appear to be the most sensitive species. Benzo(a)pyrene is a complete carcinogen and also an initiator of skin tumors. It has been reported to induce tumors in animals when administered by other routes, such as intravenous, intraperitoneal, subcutaneous, intrapulmonary, and transplacental (Faust 1994).

No oral RfD or inhalation RfC has been calculated for this chemical (EPA 1997, EPA 1999a). Benzo(a)pyrene is classified as a Group B2 carcinogen, probable human carcinogen, with an oral slope factor of 7.30/(mg/kg-day) (EPA 1999a).

Chromium. Chromium is a metal that occurs in nature primarily as the mineral chromite. Although chromium exists in several valence states, the trivalent (III) and hexavalent (VI) valence states are the only two of any biological significance (Amdur, Doull, and Klassan 1991). Trivalent chromium is considered an essential element in man and animals.

Acute animal studies indicate that chromium (III) compounds are consistently less toxic than chromium (VI) (Friberg, Nordberg, and Vouk 1986), but neither oxidation state is very toxic by the oral route (Daugherty 1992b). No adverse effects were observed in long-term drinking water studies in rats.

Chromium compounds (and particularly hexavalent compounds) are very strong skin irritants and sensitizers in humans, producing dermatitis, dermatosis, eczema, erythema, and skin ulceration. Exposure to chromium has caused respiratory effects such as nasal irritation, nasal ulcers, nasal perforation, asthmatic attacks, pneumoconiosis, bronchitis, and chronic lung congestion in humans under various occupational conditions (Daugherty 1992b). Both hexavalent and trivalent chromium compounds are known to be nephrotoxic, with some reports indicating that they may also be hepatotoxic and neurotoxic (EPA 1984b).

Chromium compounds, both trivalent and hexavalent, have induced developmental effects in hamsters and mice (but only at maternally toxic doses) and testicular effects in rabbits after intraperitoneal, intravenous, or subcutaneous injections (EPA 1984b). Bacterial test systems have consistently demonstrated that chromium (VI) compounds are directly mutagenic, while chromium (III) compounds are not (EPA 1984b). An increased frequency of chromosome aberrations in lymphocytes from workers exposed to chromates during production of such compounds has been reported (EPA 1984b), and several occupational epidemiology studies have shown that occupational exposure to chromium is associated with an increase in lung cancer deaths for workers. Evidence also suggests increased risk of developing nasal, pharyngeal, and gastrointestinal cancers (IARC 1980; Daugherty 1992b).

An oral RfD value of 0.003 mg/kg-day has been calculated for chromium (VI) (EPA 1999a). The RfD is based on a chronic drinking water study with rats. No adverse effects were noted in the study (EPA 1999a). The inhalation RfC for chromium (VI) is 8×10^{-6} $\mu\text{g}/\text{m}^3$ based on nasal septum atrophy in exposed occupational populations (EPA 1999a). EPA has placed chromium (VI) in weight-of-evidence group A, known human carcinogen, for its carcinogenicity via inhalation. The air unit risk is 0.012/($\mu\text{g}/\text{m}^3$) (EPA 1999a).

Ethylbenzene. Ethylbenzene is a colorless liquid with a pungent aromatic odor. It is mainly used as a precursor to styrene, but it also used in the production of synthetic rubber and the manufacturing of cellulose acetate. Ethylbenzene is an unrecovered component of automotive gas and aviation fuels. Releases into the environment are primarily through the refining, handling (i.e. spillage, evaporation, etc.) and burning of fossil fuels (HSDB 1999).

Ethylbenzene can be absorbed through the lungs, digestive tract, and skin (Opresko 1997). Human populations are generally exposed via inhalation, however, ethylbenzene can be absorbed through the skin at a low rate (HSDB 1999).

Ingestion of sublethal amounts of ethylbenzene may cause central nervous system (CNS) depression and oral-pharyngeal and gastric discomfort and possible burns; however, specific data is not available (HSDB 2000). Acute exposures to high atmospheric concentrations of ethylbenzene may cause eye and respiratory tract irritation and CNS effects (e.g., coordination disorders, dizziness, vertigo, narcosis, convulsions, pulmonary irritation, and conjunctivitis) (Opresko 1997). No evidence is available to suggest that occupational exposures to ethylbenzene result in chronic toxic effects (Opresko 1997).

The EPA has calculated an oral RfD of 0.1 mg/kg-day, based on liver and kidney toxicity in a chronic rat study (EPA 1999a). An RfC of 1 mg/m³ has been calculated based on developmental toxicity observed in rat and rabbit inhalation studies (EPA 1999a). Ethylbenzene is classified by EPA in weight-of-evidence Group D, not classifiable as to human carcinogenicity (EPA 1999a).

2-Methylnaphthalene. 2-Methylnaphthalene belongs to a group of chemicals called polycyclic aromatic hydrocarbons (PAHs) that are found in various types of fossil fuel including coal, oil, gas, and other organic substances (ATSDR 1989c).

Little is known about the toxicity of this chemical in humans. In studies with mice, the oral application of 2-methylnaphthalene and the dermal painting with a mixture of 1-methylnaphthalene and 2-methylnaphthalene induced pulmonary alveolar proteinosis (Murata et al. 1997).

Neither an RfD nor an RfC has been calculated for the chemical (EPA 1999a; EPA 1997). 2-Methylnaphthalene does not appear to be carcinogenic (Murata et al. 1997).

Naphthalene. Naphthalene also belongs to the group of chemicals called PAHs that are found in various types of fossil fuel, including coal, oil, gas, and other organic substances (ATSDR 1989d).

Humans exposed via inhalation, combined inhalation and dermal exposure, and combined inhalation and oral exposure have developed hemolytic anemia (lowered hemoglobin, hematocrit, and erythrocyte values). In severe cases, the hemolytic anemia was accompanied by jaundice, high serum levels of bilirubin, cyanosis, and kernicterus with pronounced neurological signs (EPA 1999a). In laboratory experiments, the target organs appeared to be the kidneys, thymus, liver, and spleen (EPA 1999a).

EPA has calculated an oral RfD of 0.02 mg/kg-day based on decreased mean body weight in exposed laboratory animals (EPA 1999a). The RfC for naphthalene is 0.003 mg/m³ based on respiratory effects in exposed rats (EPA 1999a). EPA classifies naphthalene in weight-of-evidence Group C, possible human carcinogen (EPA 1999a).

Table I.1. Summary of Toxicity Data for Chemicals of Concern

Chemical	CSFo (1/mg/kg/day)	Ref	CSFi (1/mg/kg/day)	Ref	WOE	RfDo (mg/kg/day)	Ref	UF-MF	Target Organs	RfDi (mg/kg/day)	Ref	UF-MF	Target Organs
Arsenic	1.50E+00	I	1.51E+01	I		3.00E-04	I	3	Skin				
Benzene	2.90E-02	I	2.90E-02	I	A								
Benzo(a)pyrene	7.30E+00	I	3.10E+00	E	B2								
Chromium VI			4.10E+01	H		3.00E-03	I	300	Clinical	3.00E-05	I	90	Resp
Ethylbenzene						1.00E-01	I	1,000	Kidney, liver	2.90E-01	I	300	Develop
Methylnaphthalene						2.00E-02	E		Resp				
Naphthalene						2.00E-02	I	3,000	Clinical	9.00E-04	I		

CSFi = Inhalation cancer slope factor.

CSFo = Oral cancer slope factor.

Ref = Source of information: I = Integrated Risk Information System, on-line database, <www.epa.gov/IRIS>; H = Health Effects Assessment Summary Tables, U.S. Environmental Protection Agency;

E = EPA's National Center for Environmental Assessment (EPA 1999b).

RfDi = Inhalation reference dose.

RfDo = Oral reference dose.

UF-MF = Product of the uncertainty and modifying factors.

Target Organs = Primary organ systems affected by noncarcinogenic chemicals.

Clinical = Endpoints included clinical effects such as change in body weight, enzyme levels, etc. Effects cannot be associated with any specific organ system.

Develop = Developmental toxicity.

Resp = Respiratory system.

WOE = Cancer weight-of-evidence classification.

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