WORKPLAN

SOIL, SEDIMENT, AND GROUNDWATER SAMPLING

CSX/VAUGHN LANDFILL

CSX Transportation
Greenville, South Carolina

October, 1994

APPLIED ENGINEERING & SCIENCE, INC.

Atlanta, Georgia

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I. INTRODUCTION

On August 24, 1994, the South Carolina Department of Health and Environmental Control (DHEC) notified CSX Transportation by certified mail of the departments investigation of an unpermitted landfill on CSX property (the Site) in Greenville, South Carolina. **Figure 1 - Site Location Map**, indicates the location of the Site west of the city of Greenville. DHEC, along with the U.S. Army Corps of Engineers, visited the Site in Spring, 1994, noticed leachate and a sludge-like material at the base of the landfill and in the surrounding wetlands, and collected a sample. Laboratory analysis of the sample indicated that a hazardous constituent release to the environment had occurred. In a letter to CSX dated August 24, 1994, DHEC requested a work plan from CSX to assess vertical and horizontal impact to the environment in soil and groundwater from landfilling and other activities on the property. A copy of the DHEC letter is included in Appendix A - DHEC Letter to CSX.

A. Site Description

The Site is located on Bramlette Road approximately one (1) mile west of the city of Greenville, South Carolina in Greenville County. CSX Transportation property includes land on both sides of Bramlette Road, both sides of the Reedy River, and right-of-ways which contain trackage. The landfill Site is contained on property south of Bramlette

SCALE ---	Applied Engineering & Science	SITE LOCATION MAP VAUGHN LANDFILL CSXT PROPERTY GREENVILLE, S.C.	DATE OCT., 1994
DWN. BY SKN			DWG. NO. 4365A
CHK'D. BY GEW			SHEET NO
APPR. BY GEW			

Road and east of the Reedy River. **Figure 2 - Site Plan,** is a copy of a Greenville County tax map indicating the layout of the property which contains the landfill in relation to the Reedy River and Bramlette Road.

This section of Greenville contains light industry, schools, and residences along with several rail facilities and supporting trackage. CSX maintains a small office east of the river.

B. Landfilling Activities

The CSX property off Bramlette Road has been used as a construction debris landfill for at least six (6) years. According to Mr. Robert Vaughn, Vaughn Construction and Demolition Company of Greenville has been the primary user of the landfill since 1987. Some of the materials noted during a Site visit by AES include concrete, bricks, wood, plastic, metals, roofing materials, insulation, and glass. Approximately seven (7) acres of the Site have been filled with debris to an average depth of eight (8) feet. Access to the Site is from Bramlette Road through a locked gate.

The fill area has been cut through by a ditch which allows water to flow from the wetland on the east side of the landfill to the floodplain and into the Reedy River to the west. This ditch is located approximately four hundred (400) feet from the entrance. A dirt

SCALE IN 1/10 OF AN INCH

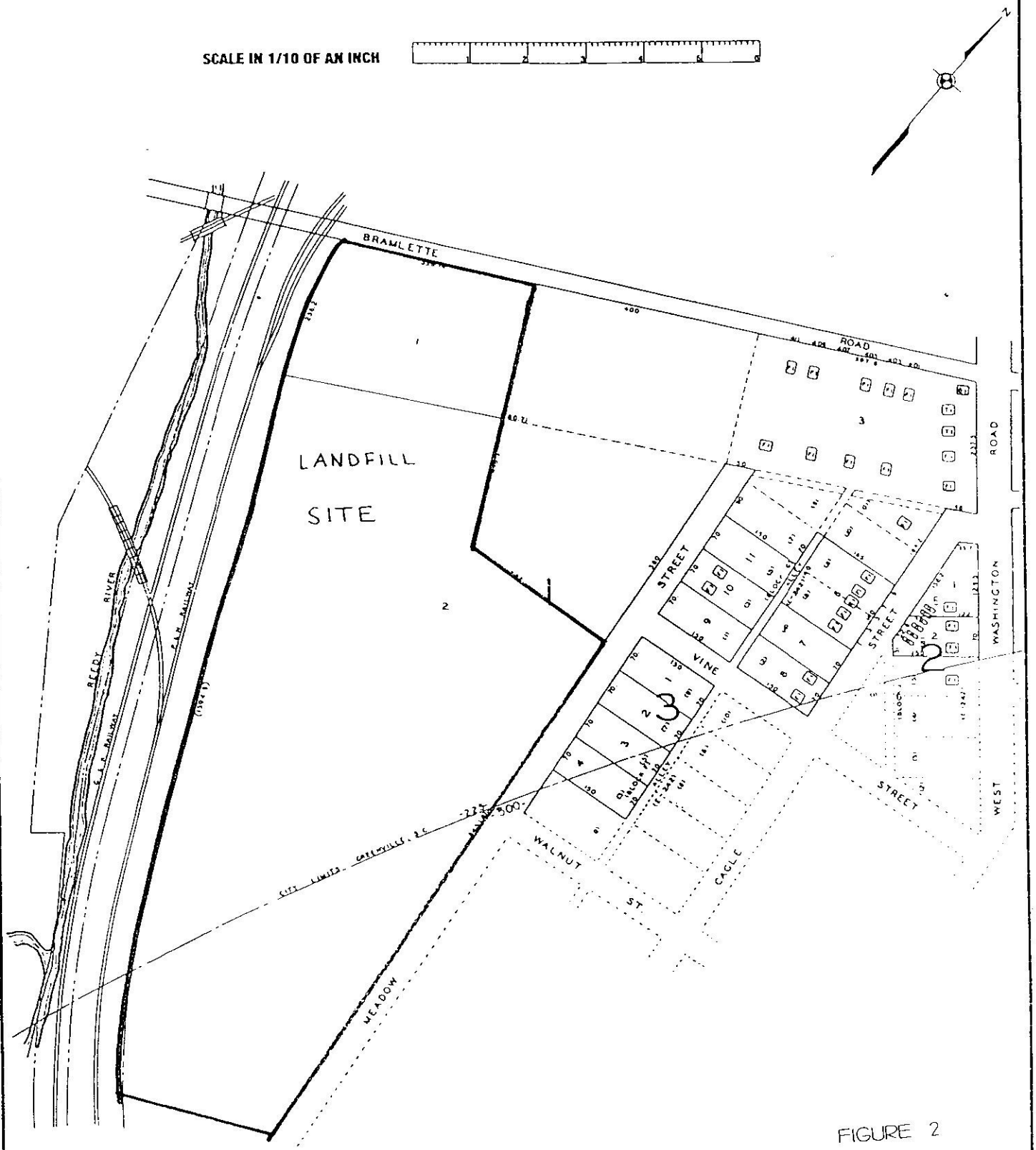

FIGURE 2

SCALE ---	Applied Engineering & Science	SITE PLAN CSXT PROPERTY GREENVILLE, S.C.	DATE OCT., 1994
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covered culvert across the ditch allows access to the back of the landfill. A large portion of the landfill has been covered with a thin layer of soil to allow passage of dump trucks to the rear where dumping continued until recently. The back one hundred (100) feet or so of the fill area is uncovered.

C. Hydrogeology

The floodplain and adjoining wetlands (as delineated by the Corps of Engineers) south of Bramlette Road and east of the river are at an elevation of 285 feet above mean sea level (msl). The landfill covers approximately seven (7) acres on the property.

The Reedy River borders the property one hundred (100) feet to the west. Depth to groundwater in the area of the Site is within ten (10) feet, as determined by monitoring wells installed across the river on adjacent CSX property (described in AES report "Monitoring Well Installations and Soils Investigation" submitted to DHEC in July, 1993). Groundwater flow is expected to be toward the river in a southwesterly direction. Soils in the area consist of Chewacla (Cv) well drained to poorly drained silty, clay loams and a combination of Cartecay and Chewacla (Ca) sandy loam and silty clay. Both are alluvium found in floodplains and are listed as hydric by the USDA Soil Conservation Service (SCS). Copies of the soils map and the hydric soils list are included in Appendix B - Soil Survey. Thicknesses of the soils are reported to average fifty four (54) feet above the granite gneiss bedrock. The hydraulic and sorptive characteristics of these clay

soils generally makes them poor conductors of groundwater; therefore, groundwater flow and contaminant migration are normally slow. Hydraulic conductivity of these materials typically ranges from 10^{-5} to 10^{-7} cm/s and attenuation of contaminants is relatively high.

D. Well Survey

A well survey conducted by AES in 1992 during installation of the monitoring wells referenced in the report in Section I-C above indicated that there were no registered production wells (potable or industrial) within a 1/2 mile radius of the CSX property west of the Reedy River. That property is less than one thousand (1,000) feet from the landfill Site. Information for this survey was provided by the South Carolina Water Resources Commission, Greenville office, in a computer printout, and by the Commission report entitled "Ground-Water Resources of Greenville County, South Carolina; Bulletin no. 38" published in 1968. This information is included in Appendix C - Well Survey.

II. PURPOSE, OBJECTIVES, AND SCOPE

In October, 1994 CSX Transportation, in response to the DHEC request, retained Applied Engineering and Science, Inc. (AES) to prepare a workplan for the assessment of vertical and horizontal impact to the environment from landfilling activities at the Bramlette Road Site.

A. Purpose

The primary purpose of this investigation is to provide DHEC and Corps of Engineers with an analytical data set from which decisions with regard to appropriate future actions, if any, for the site can be based. The data set must be comprehensive and of defendable quality so as to assess the current character of the material which has been placed on the site. The initial phase of the investigation is addressed in this work plan and the data collected during this initial phase will be used to:

1. Assess the character of the material

2. Identify the chemicals of concern for the site

3. Provide information on which decisions for the placement of monitoring wells

and/or additional material sampling needs can be made

B. Objectives

The objectives of the work to be performed are as follows:

- Assess surface water and sediment content in the wetland east of the fill area
- Assess the quality of the native soils and groundwater beneath the fill
- Collect representative samples of leachate on the perimeter of the fill
- Assess surface water and sediment content in the floodplain and wetlands west of the fill area
- Identify surface pathways by which migration of material may enter the Reedy River
- Identify and characterize possible sources of contamination within the fill
- Assess field and analytical data to determine additional information and/or

sampling requirements

- Report findings and recommendations to CSX and DHEC

C. Scope

The scope of this investigation includes direct observation, surface water sampling, sediment sampling, soil sampling, leachate collection, head space analysis, laboratory analysis, data review and analysis, and report preparation. Details of the scope of work for this investigation are given in Section III of this workplan.

III. CHEMICAL DATA ACQUISITION

A. Data Quality Objectives

To meet the primary objectives of the initial site investigation, AES plans to implement a data quality objectives (DQO) program that includes four categories of analytical methods and data uses. The various categories within the DQO program are presented in **Table 1**. This table identifies typical data uses and analytical levels. These levels range from a basic field survey technique (EPA Level 1) used as an aid to the investigation process to very comprehensive laboratory analysis (EPA Level IV), as might be required for development of remedial alternatives or a risk assessment. This DQO program reflects EPA's DQO format as presented in Data Quality Objectives for Remedial Response Activities, EPA 540/G-87/003A, March 1987.

The DQO program is based on integration of data use categories with a menu of analytical levels that complement one another. Selective implementation of this program can benefit the investigation process by providing quick turnaround of data with no loss of data quality on critical samples. This method is used to accomplish the objectives of the investigation by effective use of resources and manpower, and by channeling samples of critical nature into the analyses that are of suitable quality.

AES will employ two independent analytical resources during the investigation. As previously shown in **Table I**, those include field surveys (Level 1) and laboratory analysis of samples at a DHEC approved analytical laboratory (Level IV).

1. Level I - Field Surveys - For Level I, field surveys, portable organic vapor analyzers will be used to survey samples taken by the investigation team at the time of collection. These real-time analyzers will be instruments such as HNu Systems Model PI#101 and Foxboro's Model 128 organic vapor analyzers. Data from the sample surveys, along with pertinent data concerning the samples, will be logged in the field log. The procedures for surveying samples collected for field surveys will be EPA Method 3810, Standard Head Space Analysis, 3rd Edition, November 1986. Data generated from the field monitoring will typically be used to make decisions concerning the execution of the investigation, such as approximating the relative degree of contamination to assist the investigation activities or providing a general screening before laboratory analysis of the collected samples.

2. Level IV - Laboratory Analysis - The purpose of Level IV analysis is to broaden the characterization of contaminants. Level IV analysis may be required to document remediation of a given area or to obtain data suitable for risk assessment. Samples collected during the investigation at the CSX/Vaughn Landfill site will

require the level of completeness and quality offered by Level IV analysis. Because the samples collected during this investigation will be used to identify and characterize source materials and to make future decisions on chemicals of concern at the site, all samples collected during this investigation will be analyzed under Level IV procedures. The table below presents an analytical suite of parameters typical of a Level IV analysis.

Parameter	Method
Volatile Organics	EPA Method 8240/8260
Semi-Volatile Organics	EPA Method 8270
Metals	EPA Method 6010/7060/7471/7841
Pesticides	EPA Method 8080
Herbicides	EPA Method 8150

TABLE 1
SUMMARY OF ANALYTICAL LEVELS APPROPRIATE TO DATA USES

DATA USES	ANALYTICAL LEVEL	TYPE OF ANALYSIS	LIMITATIONS	DATA QUALITY
Site characterization monitoring during implementation	Level I	Total organic/inorganic vapor detection using portable instruments Field test kits	instruments respond to naturally occurring compounds	if instruments calibrated and data interpreted correctly, can provide indication of contamination
Site characterization evaluation of alternatives engineering design monitoring during implementation	Level II	Variety of organics by GC; inorganics by AA; XRF Tentative ID; analyte specific Detection limits vary from low ppm to low ppb	Tentative ID Techniques/instruments limited mostly to volatiles, metals	Dependent on QA/QC steps employed Data typically reported in concentration ranges
Risk Assessment site characterization evaluation of alternatives engineering design monitoring during implementation	Level III	Organics/inorganics using EPA procedures other than CLP, can be analyte specific RCRA characteristics tests	Tentative ID in some cases Can provide data of same quality as Level IV	Similar detection limits to CLP Less rigorous QA/QC
Risk Assessment PRP determination evaluation of alternatives engineering design	Level IV	TCL organic/inorganics by GC/MS; AA; ICP Low ppb detection limit	Tentative identification of non-TCL parameters Some time may be required for validation of packages	Goal is data of known quality via CLP Rigorous QA\QC

B. Contaminants of Concern

Sample analysis conducted by DHEC on a sample collected at the Site revealed the presence of *toluene* at 3.04 mg/kg. Toluene is a petroleum derived organic constituent and is toxic through exposure by inhalation, ingestion, or absorption. No other compounds were identified in the sample. However, a representative of the U.S. Army Corps of Engineers mentioned *creosote* as a possible contaminant. The Site Health and Safety Plan will be written to address possible exposure to these contaminants and will be updated if additional compounds are suspected or identified.

C. Sample Locations

Three separate areas have been designated for sample collection activities on the site. **Area 1** includes floodplain, wetlands, and woodlands east of the fill area and south of Bramlette Road up to the adjoining property along Meadow Street. **Area 2** includes the actual fill material which covers approximately 6.6 acres and includes the drainage ditch through the center of the fill. **Area 3** includes the floodplain, wetlands, and woodlands west of the fill, south of Bramlette Road, and east of the Reedy River. CSX property extends south past the end of the landfill and into the woodland. The extent of investigation to the south will be determined from field observations during site operations.

Figure 3 - Sample Locations indicates the proposed sample locations for each area. Sediment samples will be collected in the wetlands and floodplain surrounding the fill area using a hand auger, stainless steel spoon, or shelby tube, depending on conditions. Surface water will be collected using a clean glass vessel. A Geoprobe systems truck-mounted rig will be used to advance collection rods into the landfill to collect soil samples at the fill/soil interface and groundwater samples at the water table. No monitoring well installations are planned at this time. Data review of the samples collected by hand auger and Geoprobe will provide a better indication of well placement.

Sample parameters include volatile organics (EPA Method 8240/8260), TAL metals (EPA Method 6010, and pesticides/herbicides (EPA Methods 8080/8150). **Table 2 - Sample Designations** indicates the sample designations, sample type (soil, water, sediment, etc.), and the analytical parameters.

1. Area 1 - Wetlands east of the fill - a minimum of two sediment and two surface water samples will be collected to assess the impact from possible dumping directly in the area or from leachate migrating from the fill. A representative of the US Army Corps of Engineers observed sludge-like material in the surface waters in the area. Samples to be collected by AES will take into account any visible sludge-like material during field operations. The locations noted on **Figure 2** are proposed and may vary depending on site conditions, access, and field observations.

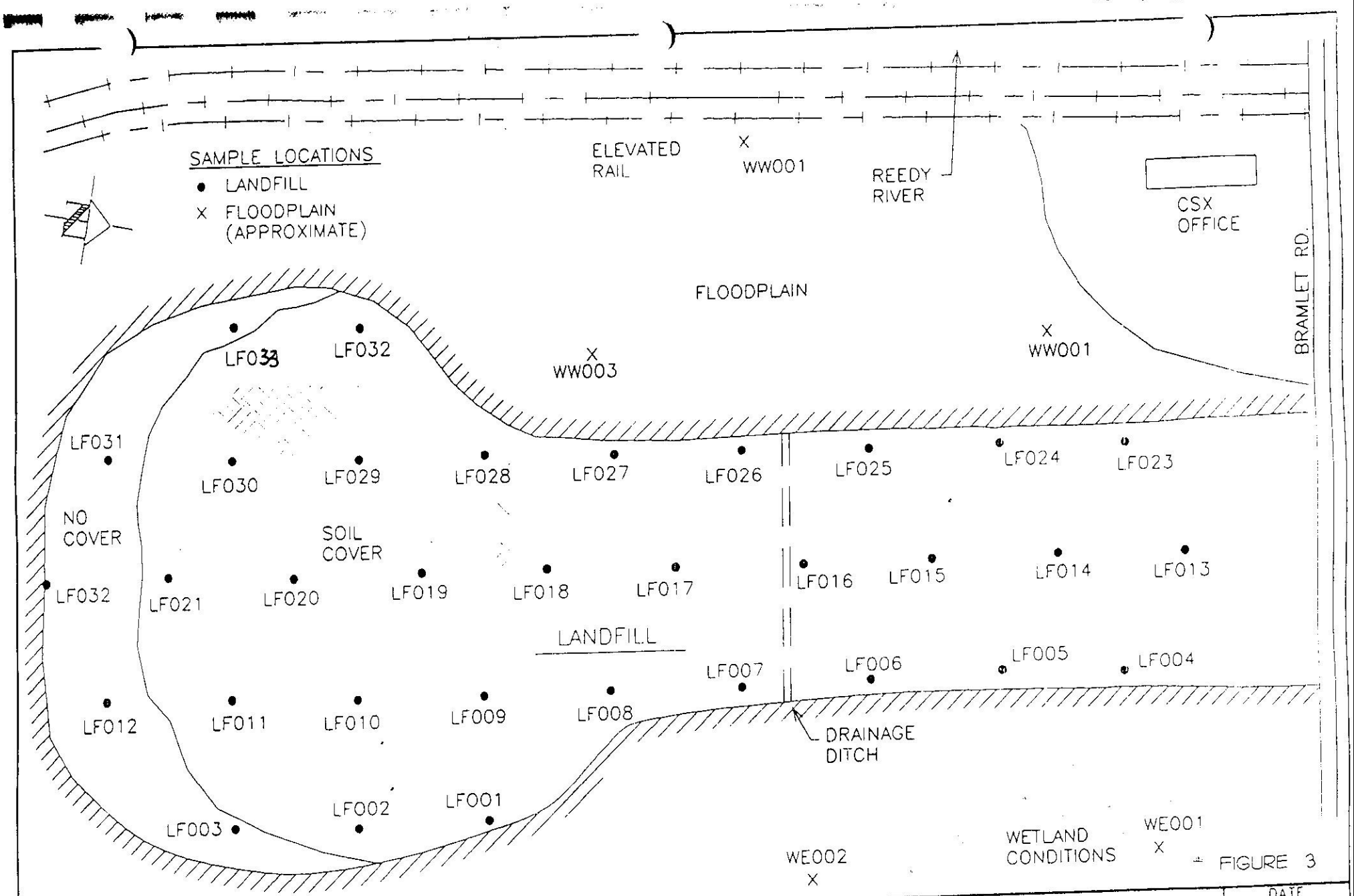

FIGURE 3

SCALE 1" = 100'	Applied Engineering & Science	CSXT PROPERTY GREENVILLE, SC	SAMPLE LOCATIONS VAUGHN LANDFILL	DATE OCT. 1994
DWN. BY KMK				DWG. NO. 4365A
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TABLE 2
SAMPLE DESIGNATIONS
CSX\VAUGHN LANDFILL
GREENVILLE, SC
AES, October 1994

SAMPLE ID	SAMPLE TYPE/MATRIX	ANALYTICAL PARAMETERS
WE001[1]	Surface water/sediment*	8240/8260, 6010, 8080/8150
WE002	Surface water/sediment*	8240/8260, 6010, 8080/8150
WW001[2]	Surface water/sediment*	8240/8260, 6010, 8080/8150
WW002	Surface water/sediment*	8240/8260, 6010, 8080/8150
WW003	Surface water/sediment*	8240/8260, 6010, 8080/8150
LF001[3]	Soils/groundwater	8240/8260, 6010, 8080/8150
LF002	Soils/groundwater	8240/8260, 6010, 8080/8150
LF003	Soils/groundwater	8240/8260, 6010, 8080/8150
LF004	Soils/groundwater	8240/8260, 6010, 8080/8150
LF005	Soils/groundwater	8240/8260, 6010, 8080/8150
LF006	Soils/groundwater	8240/8260, 6010, 8080/8150
LF007	Soils/groundwater	8240/8260, 6010, 8080/8150
LF008	Soils/groundwater	8240/8260, 6010, 8080/8150
LF009	Soils/groundwater	8240/8260, 6010, 8080/8150

TABLE 2
SAMPLE DESIGNATIONS
CSX\VAUGHN LANDFILL
GREENVILLE, SC
AES, October 1994

SAMPLE ID	SAMPLE TYPE/MATRIX	ANALYTICAL PARAMETERS
LF010	Soils/groundwater	8240/8260, 6010, 8080/8150
LF011	Soils/groundwater	8240/8260, 6010, 8080/8150
LF012	Soils/groundwater	8240/8260, 6010, 8080/8150
LF013	Soils/groundwater	8240/8260, 6010, 8080/8150
LF014	Soils/groundwater	8240/8260, 6010, 8080/8150
LF015	Soils/groundwater	8240/8260, 6010, 8080/8150
LF016	Soils/groundwater	8240/8260, 6010, 8080/8150
LF017	Soils/groundwater	8240/8260, 6010, 8080/8150
LF018	Soils/groundwater	8240/8260, 6010, 8080/8150
LF019	Soils/groundwater	8240/8260, 6010, 8080/8150
LF020	Soils/groundwater	8240/8260, 6010, 8080/8150
LF021	Soils/groundwater	8240/8260, 6010, 8080/8150
LF022	Soils/groundwater	8240/8260, 6010, 8080/8150
LF023	Soils/groundwater	8240/8260, 6010, 8080/8150
LF024	Soils/groundwater	8240/8260, 6010, 8080/8150

TABLE 2
SAMPLE DESIGNATIONS
CSX\VAUGHN LANDFILL
GREENVILLE, SC
AES, October 1994

SAMPLE ID	SAMPLE TYPE/MATRIX	ANALYTICAL PARAMETERS
LF025	Soils/groundwater	8240/8260, 6010, 8080/8150
LF026	Soils/groundwater	8240/8260, 6010, 8080/8150
LF027	Soils/groundwater	8240/8260, 6010, 8080/8150
LF028	Soils/groundwater	8240/8260, 6010, 8080/8150
LF029	Soils/groundwater	8240/8260, 6010, 8080/8150
LF030	Soils/groundwater	8240/8260, 6010, 8080/8150
LF031	Soils/groundwater	8240/8260, 6010, 8080/8150
LF032	Soils/groundwater	8240/8260, 6010, 8080/8150
LF033	Soils/groundwater	8240/8260, 6010, 8080/8150

* Sludge/leachate may also be collected if observed (same parameters apply)

1. WE - Wetland East

2. WW - Wetland West

3. LF - Landfill

2. Area 2 - Landfill - Sample locations in the fill area have been proposed on a grid which is shown in **Figure 2**. The grid will be laid out across the fill area prior to sample collection. Thirty three sample locations are shown on the grid. The actual number of samples may vary according to site conditions and accessibility but collection of thirty samples is anticipated. This sampling plan is aimed at providing the best coverage to attempt to locate any hot spots within the fill and to provide data for additional sample collection at a later date.

A Geoprobe unit will advance collection rods through the fill material, identify the fill/native soil interface, and collect a soil sample from native soils at the natural surface. Following soil collection, the rods will be advanced to groundwater. Approximate depth to the water table will be determined and noted in the field book. Samples will be collected using a peristaltic pump, placed in precleaned sample containers with appropriate preservatives, and labeled. Appendix D - Geoprobe is a summary of Geoprobe system capabilities.

AES anticipates that advancing the Geoprobe through the fill material may be extremely difficult due to the amount of large construction type material involved. The grid will be used as a basis for sampling locations but actual sampling points may vary. The final boring locations will be noted on a revised site drawing in relation to a fixed surveyed datum point which will be installed before sampling

activities begin.

3. Area 3 - Wetlands, floodplain west of the fill - DHEC detected leachate from the fill and a sludge-like material in this area and collected a sample which revealed the presence of toluene at 3.04 mg/kg. A minimum of three sediment and three surface water samples will be collected in this area. A leachate sample will be collected and a full suite of analyses run to confirm the presence of toluene and to identify other contaminants present. The analytical results will be reviewed to assess impact to wetland soils and surface waters which enter the Reedy River.

D. Sampling Procedures

1. Quality Control - This section provides a discussion of the procedures to be utilized for all the sampling that is to be completed during this preliminary investigation at the CSX Vaughn Landfill. The methods to be utilized in collecting the samples for this study will strictly adhere to the EPA Region IV Standard Operating Procedures and Quality Assurance Manual, April, 1986. The standard operating procedures utilized by AES personnel in all sampling activities follow a standardized QA/QC procedure. The procedures are documented in the AES Field Quality Assurance/Quality Control Procedures Manual (QA/QP).

Groundwater, surface water, sediment and soil samples will be collected. The purpose of collecting surface water, sediment and subsurface soil samples is to prepare a basis for additional sample collection and to compare future analytical results. In addition to utilizing standard operating procedures, other means will be utilized to reduce variability in sampling and handling procedures. The sampling containers will be precleaned prior to use. Shipping blanks will detect problems associated with the handling and shipment of samples. Shipping blanks will be included with sample containers provided by the DHEC certified laboratory chosen to perform sample analyses. Field blanks will be used to monitor decontamination techniques. Field blanks will be obtained by running analyte free deionized water through sample collection equipment after decontamination has been completed (Geoprobe rods and hand auger buckets). Field blanks will be collected at a rate of one (1) per sampling day.

The samples will be shipped to the laboratory at the end of each sample day. At that point, the sample will remain in the custody of the laboratory until final disposal of the samples. The laboratory will be given the responsibility of final disposal of the samples.

2. Documentation - An integral part of the sampling effort will be the documentation of all field operations. The documentation process will include completion of

sample labels, field logbook and chain of custody forms. Immediately after collecting a sample, a completed sample label will be affixed to the same container. The label will contain the following information:

- Sample identification number
- AES Job Number
- Name of Sample collected
- Date and time of collection
- Project location
- Preservatives used (if any)
- Parameters requested

A logbook will be maintained by sampling personnel to document field activities. The following information will be documented in the field logbook:

- Persons present onsite, their title and affiliation
- Date of each day onsite
- The times on and offsite
- The time each sample is collected or other significant events occur
- The daily weather conditions and approximate temperatures
- All equipment to be used during field activities and their decontamination

procedures (if applicable)

- Any comments, observations, discrepancies or changes in sampling procedures
- Groundwater levels, method of measurement and where the measurement is taken, (approximate for Geoprobe sampling)
- The type of sample collected, (groundwater, soil) whether it is a grab or composite sample
- Appearance, odor, pH, and the temperature (if required) of the sample
- The number and type of sample containers to be used
- The number of bails to be used to collect each water sample
- All data related to the calibration of field equipment
- Sample preservatives to be used, type of packaging, where the samples are to be sent

A chain-of custody form will be completed for each set of samples collected in order to document sample possession from the time the samples are sent to the analytical laboratory. All samples will be transported to the laboratory by overnight courier the same day they are collected.

E. Sample Designation

Figure 3 indicates the location and designations of thiry eight (38) proposed sampling points. AES proposes collecting two samples in the wetland east of the fill, thirty three samples within the fill, and three samples in the floodplain west of the fill. As explained in Section III-C above, the number and actual locations of samples collected may vary depending on site conditions, obstructions, and location of any suspected contaminants noted during field observations. The exact location of sampling points will be documented using a reference point, in this case the surveyed datum point tied to a USGS bench mark. Samples will be designated as follows:

WE001 - Samples designated with the alpha prefix WE (wetland east) will be those collected within the wetlands or adjoining areas east of the fill. A sequential numeric code will also be assigned to each sample and appropriately recorded on all field documentation. A minimum of two sediment and two surface water samples shall be collected from this area.

LF001 - Samples collected below the fill material at the fill/native soil interface shall be designated with the alpha prefix LF (landfill) and sequentially numbered. A minimum of thirty samples shall be collected in the fill material.

WW001 - Samples collected in the wetlands, floodplain, or adjoining areas west of the fill shall be designated with the alpha prefix WW (wetland west) and sequentially numbered. A minimum of three samples shall be collected in this area.

F. Decontamination Procedures

Before sampling activities begin, and between sampling intervals and locations, decontamination of equipment shall be performed. A temporary decontamination area will be constructed using 4" x 4" timbers and 6-mil visqueen at the north end of the landfill off Bramlette Road. All downhole and sample collection equipment shall be cleaned using laboratory-grade detergent and potable water. Isopropanol and 1% dilute hydrochloric acid will follow and precede deionized water rinses. A field blank will be collected at least once per day from rinseate of deionized water from selected equipment. Wash water collected in the decon area will be pumped into drums and labeled for proper disposal.

All personnel handling downhole equipment, sampling tools, or sample bottles will be required to wear disposable vinyl or latex gloves.

IV. REPORT PREPARATION

A report will be prepared and submitted to DHEC following receipt and analysis of laboratory data. The report will include details of all field activities, record reviews, sample collection, and sample data results. Tables and graphics will be submitted which indicate the types and extent of contaminants found during the field investigation. Recommendations will be presented for additional sampling or remediation of affected soils or groundwater.

V. SCHEDULE OF EVENTS

Following DHEC approval of the workplan, field activities will proceed within ten (10) working days. Field operations are expected to take approximately one (1) week. Laboratory results are expected to be received within two (2) weeks of sample submittal. Because of the large number of samples to be collected and data to be reviewed, AES expects thirty (30) days will be required to prepare and submit a report to DHEC. Total time between the initiation of field activities and submittal of the report to DHEC is projected to be seven (7) weeks. Factors affecting this schedule include unforseen field conditions and/or additional sampling requirements which involve a return to the Site.