REF 6

SITE INVESTIGATION/ FEASIBILITY STUDY

FOR

CREEK SEGMENT A

JUNE 1990

VOLUME I

SITE INVESTIGATION/

REMEDIAL ALTERNATIVES EVALUATION

for

CREEK SEGMENT A

VOLUME I

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1.0 INTRODUCTION

The Avendt Group, Inc., was retained by Lowenstein, Sandler, Kohl, Fisher & Boylan to perform a Site Investigation and Remedial Alternatives Evaluation at Creek Segment A, located in Sauget, St. Clair County, Illinois. The Site Investigation portion of the study was performed to fully evaluate Creek Segment A (CS-A). The information gathered through this portion of the project was utilized to evaluate alternatives for the remediation of CS-A. This study presents the results of the site investigation in Volume I, and the results of the Remedial Alternatives Evaluation in Volume II.

1.1 Study Objectives

The objectives of the Site Investigation and Remedial Alternatives Evaluation are:

1. Research the historical uses of CS-A.

2. Characterize and define the constituents in CS-A and determine the volume of sediments requiring action.

3. Identify and evaluate the methods feasible for the remediation of CS-A which is consistent with the National Contingency Plan (NCP).

4. Recommend a remedial alternative which is consistent with the NCP.

2.0 SITE CHARACTERISTICS

2.1 Site Location

CS-A is located on the eastern one-third portion of Cerro Copper Products Co. property, which is located on Illinois Route 3 in the Village of Sauget, St. Clair County, Illinois, across the Mississippi River from St. Louis, Missouri (Plate 1).

The site is defined by the visible banks of CS-A.

2.2 Operational History

2.2.1 Site Ownership

Cerro Copper Products Co. and its predecessors purchased the site in stages beginning in 1927, and ending in 1969, with ownership to the center of CS-A accompanying the ownership of adjoining property. Land on the west side of CS-A, including a portion of CS-A, was purchased in 1927 and 1948, by predecessor owners, the Lewin Metals Company and Lewin-Mathes Company, respectively. The latter sold the property to Cerro de Pasco Corporation in 1957, which went through a series of corporate reorganizations leaving Cerro Copper Products Co. as current owner.

Land along the east side of CS-A, including the remaining portions of CS-A, was acquired in 1955 from the Sauget family, in 1967 from Rogers Cartage Company, and in 1969 from Harold Waggoner and Lillie Mifflin.

2.3 Site Use

2.3.1 Description and Past Uses

The legendary history of Dead Creek is as a man-made drainage path originating to the north of CS-A. Various documents establish that the drainage path extended at least 600 feet north of the current boundary onto Monsanto property and the Site received flow from the northern

section (Agreement Alton & Southern Railroad Company and Monsanto Chemical Works with the Village of Monsanto; October, 1939). This northern portion on Monsanto property was subsequently filled in. At another point in this history, the Village of Sauget plugged the southern outflow of CS-A and thereafter CS-A drained exclusively to the north into the Village sewer system.

CS-A receives runoff of stormwaters and drains into a pipe at its northern terminus into the Village sewer system (Figure 1). The CS-A drain system was designed to provide for backflow of effluent from the Village system into Creek Segment A. Hence, Creek Segment A has received, in addition to stormwater runoff, backflow of sanitary and industrial effluent from the Village sewer system.

2.3.1.1 Industrial Discharges

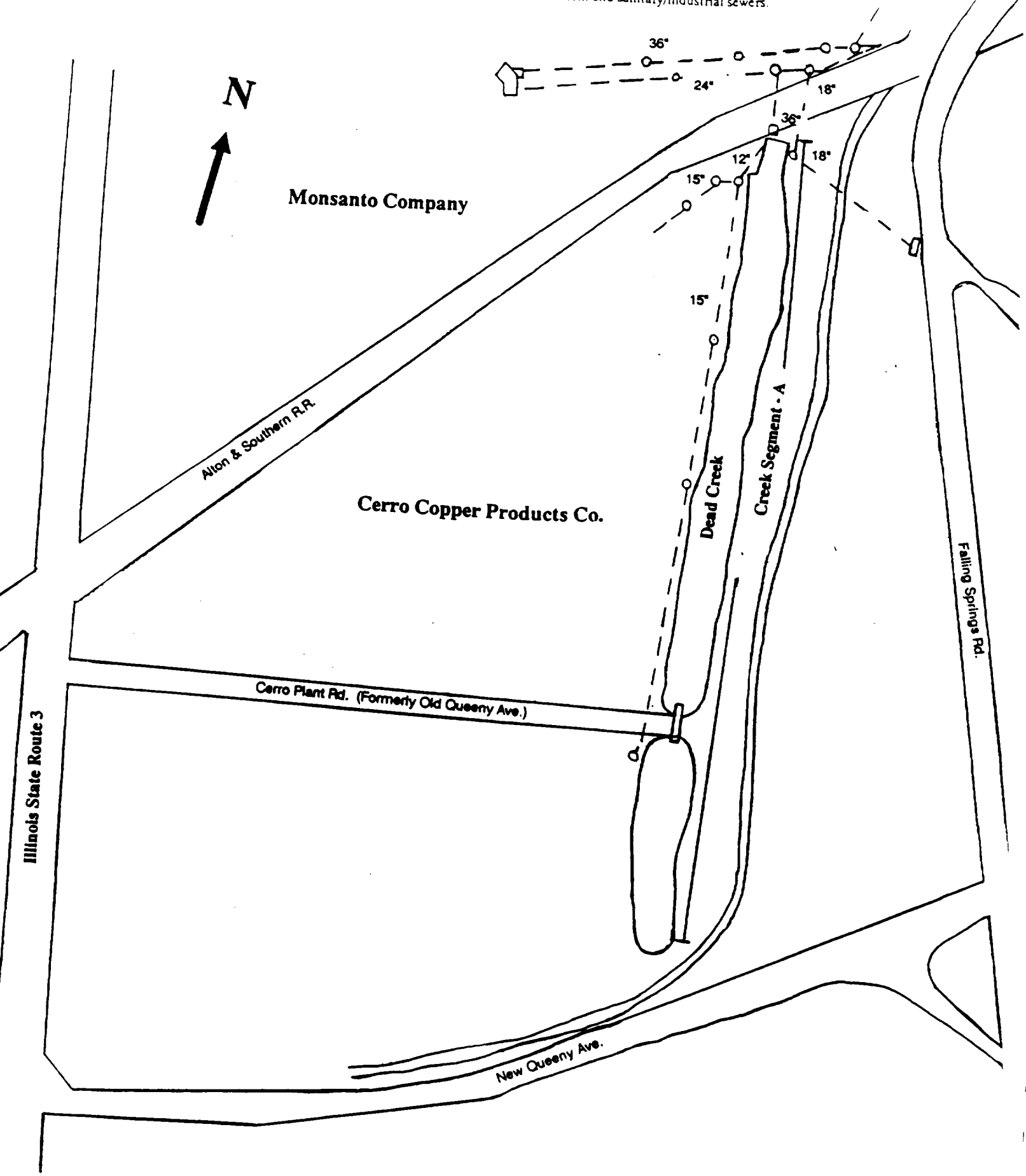
According to E&E (Ecology & Environment, May, 1988, pg. IA-1), "Creek Segment A received discharges from Monsanto and other companies prior to 1970." (Figure 1). E&E had no specific information as to the constituents of these industrial discharges.

2.3.1.2 Sanitary Discharges

CS-A received sanitary discharges through two sources. The first is a Village combined sewer overflow located at the northern terminus, which was plugged in 1989. The second is combined sanitary/industrial back flow through the existing 36-inch pipe located under the Alton and Southern Railroad tracks (Figure 1).

Figure 1: Site Location Map

This diagram shows the location of Creek Segment - A on the Cerro Copper Products Co. property as well as the location and size of storm and sanitary/industrial sewers.



2.3.2 Description of Current Uses

2.3.2.1 Utilization for Stormwater Retention

In addition to the surcharges described above in Sections 2.3.1.1 and 2.3.1.2, drainage to CS-A are area runoff and roof drainage from Cerro Copper Products Co., through runoff drain pipes projecting from the west bank. When the water level in CS-A rises, the water discharges through a 36-inch pipe to the Village sewer system, which ultimately drains to the Sauget Wastewater Treatment Plant. The Village of Sauget recently sealed the overflow opening of its combined sewer manhole that is near the north end of CS-A to prevent sanitary or combined industrial sanitary waste from entering CS-A via that route.

2.3.2.2 Temporary Recharge Basin for Dewatering Operations

Cerro has under current construction a stormwater interceptor system as described in Section 3.3. During the construction of the Cerro stormwater interceptor system (sewers, detention basin and pumping station) the areas of construction will be dewatered as a result of a high groundwater table located in the construction zones. Seven dewatering wells have been placed along the construction zones approximately 35 to 40 feet deep. Each dewatering well has a capacity to pump approximately 750 gallons per minute. Only those wells adjacent to the current working areas are pumped during construction. The groundwater pumped from these wells is being directed to CS-A. As a result of the dewatering operations, CS-A is acting as a temporary recharge basin to this area and also as a conduit for the water to flow to Sauget's Wastewater Treatment facility during construction of the stormwater facilities.

2.4 Access Restrictions

2.4.1 Cerro Property

Access to Cerro Copper Products Co. is restricted by a combination of barrier fences and a 24-hour security system. The fence extends around the entire perimeter of the Cerro property. This limits access only to secured gates.

These security measures have been supplemented by the installation of a closed-circuit television monitoring system throughout the property. The cameras are mounted on poles at strategic locations throughout the property, giving remote sensing capability to the security personnel.

2.4.2 Creek Segment A Access Restrictions

In addition to the access barrier around the Cerro property, a fence was erected around both sections of CS-A in September, 1989. These fences encircle the entire perimeter of the creek sections and leave up to a 40-foot barrier between the creek bank and the fence line. Access to the creek sections is limited to the gates along the roadway that divide the two sections, except when portions of the fence are temporarily dismantled for construction access. Otherwise, these gates are locked at all times.

2.5 Current Surrounding Land Use

2.5.1 Industrial Characterization

The predominant land use in the area surrounding CS-A is heavy industrial with some commercial, agricultural and residential areas interspersed throughout the vicinity. Industrial sites that surround Cerro Copper Products Co., and consequently CS-A, include a rail line for the Alton and Southern Railroad, Monsanto Krummrich Plant, and Big River Zinc to the north; Sterling Steel Foundry and Mobil Oil tank farm to the

northeast; Wiese Planning and Engineering Company, Metro Construction Company and Keeley Construction Company to the south, though land usage is unknown for these sites; Midwest Rubber Company, a rubber reclaiming facility, to the southwest; and the Sauget Wastewater Treatment Plant, Trade Waste Incineration, a hazardous waste incinerator, and Clayton Chemical Company, a solvent recycling facility to the west.

2.5.2 Residential Population

CS-A is located within the Village of Sauget, Illinois which has a population of 205, according to the 1980 census.

2.6 Groundwater Usage

Information regarding groundwater usage in the Sauget area is based on the findings of the E&E report (E&E, May, 1988), and is summarized as follows:

2.6.1 Current Groundwater Usage

There are currently few demands for groundwater in the Sauget area. The primary source of drinking water for area residents is an intake in the Mississippi River approximately three (3) miles north of the Sauget area. The E&E report indicated that the total current groundwater pumpage was estimated to be less than 0.5 mgd.

2.6.2 Historical Groundwater Usage

Groundwater withdrawals increased in the Sauget area from approximately 100,000 gpd in 1905, to a high of 35.5 mgd in 1962. The withdrawals have gradually declined as a result of conservation; the closing of two major groundwater using facilities; and the conversion of some industrial facilities from the use of groundwater to public water supplies.

2.7 Site Topography

CS-A is located in the southwest portion of the Springfield Plain within the Till Plain portion of the Central Lowland Province of Illinois. The Springfield Plain is a flat till plain which consists of glaciated till material from the Illinoisan ice age period. The till plain consists of morainic and flood plain features which include broad and flat swampy areas, terraces, curved ridges and swales, and oxbow lakes.

The region encompassing the CS-A site is known as the American Bottoms, or valley bottom of the Mississippi River. The physiographic features in the area are controlled by bedrock structures. The American Bottoms is defined by the high bluffs located on the east side of the river.

The geologic formations within the region consist of an unconsolidated alluvium and glacial outwash, underlain by Mississippian and older bedrock layers. These rock layers are underlain by crystalline granite rock of Precambrian age. CS-A, the American Bottoms, the Mississippi River and associated tributaries are situated in a large, deeply cut bedrock valley highlighted by high bluffs on both sides. The Mississippi River has been the dominant factor which has controlled the formation of geology and hydrogeology within the region surrounding the site. However, glaciation during the Quaternary ice age has also played a role in the geological developments in the area.

Unconsolidated material within the Mississippi River cut valley ranges in thickness from 70 to 120 feet in the project area. The unconsolidated material consists of two formations, the Cahokia Alluvium and Henry Formation. The Cahokia Alluvium consists of silty sands and sandy silts. The Henry Formation consists of medium to coarse sands and gravel.

2.8 Regional Climatic Conditions

The regional climate in the site area is continental, with hot, humid summers and mild winters, occasionally interrupted with extremely cold periods of short duration. The project area is located in an area where cold fronts

converge from the north and warm moist fronts converge from the south. This zone of frontal convergence produces a variety of rapid changes in weather conditions.

The average precipitation in the project area is 35.4 inches per year. June is normally the wettest month. The average annual temperature is 56 degrees fahrenheit with a January mean temperature of 32 degrees F and a July mean temperature of 79 degrees F.

3.0 SITE INVESTIGATION

3.1 Previous Work (E&E Investigation)

The following Findings and Conclusions concerning CS-A have been taken directly from the E&E Report, May, 1988. Relevant portions concerning CS-A have been excerpted from the E&E Report.

3.1.1 Findings

Creek Sector A

"Historical aerial photographs indicate evidence of waste material being discharged to CS-A before 1950. Staining is evident in photographs of CS-A since that time. Presently, only surface and roof drainage from the Cerro Copper Products Company plant is discharged into CS-A. Water in CS-A is currently directed to an interceptor at the north end of the Cerro property, and is eventually discharged to the Sauget Waste Water Treatment Plant. Water in CS-A is currently extremely discolored and oily, and dark staining is evident along the entire length of the creek bank. Flow from CS-A to the south is restricted by a blocked culvert under Queeny Avenue." (E&E Report; Pg. 7-3)

Geology and Soils

"The upper 14 to 50 feet of the unconsolidated valley fill deposits found in the American Bottoms were investigated during the Sauget Sites Area study. The valley fill deposits are typically composed of two main formations which extend as deep as 120 feet in the Sauget Sites Area."

"The Cahokia Alluvium is the uppermost formation and comprises thin, generally discontinuous beds of silt, clay, and silty sand. In study area soil borings, an average of 13 to 20 feet of sandy silt and clay deposits was found overlying silty sands, which gradually grade into a fine- to medium-grained clean sand in lower portions of the formation."
(E&E Report; Pg.7-9)

"Underlying the alluvium is the Mackinaw member of the Henry Formation. The upper portion of the Henry Formation consists of light brown to gray fine- to coarse-grained sand which coarsens with depth. The literature indicates that bands of coarse gravel, cobbles, and occasional boulders are found at depths greater than 75 feet. These sand and gravel deposits directly overlie the Mississippian Age St. Genevieve Limestone."

Geology of Soils - Creek Sector A

"Sediment samples from both the northern and southern segments of CS-A consisted predominantly of sandy silt, suggesting that the creek bottom may be heavily silted along its entire length." (E&E Report; Pg. 7-12)

Groundwater Hydrology

The research performed indicates that groundwater exists in both the Cahokia Alluvium and Henry Formation valley fill materials under hydrostatic pressure and leaky artesian conditions.

The Cahokia and Henry formations should be classified as a single hydrogeologic unit due to; 1) the hydrologic relationship which exists between the units; and 2) the lack of continuous confining layers between or within the individual units.

E&E simplified the hydrogeology by dividing the aquifer system into three zones based on hydraulic conductivity. The three zones are:

1) The Shallow Zone - a relatively lower conductivity zone consisting of the alluvial silty sand and fine-grained sand deposits found in the lower portions of the Cahokia Unit and the upper portions of the Henry Formation. This zone extends from the water table to a depth of approximately 45 feet below the surface;

2) The Intermediate Zone - this zone includes the medium to coarse valley fill sand and gravel of the Henry Formation which is encountered from 45 to 75 feet below the surface. It is considerably more permeable than the shallow zone; and

3) The Deep Zone - this zone includes the coarsest, most permeable portions of the Henry Formation which rests directly on top of the limestone bedrock. The deep zone extends from 75 feet to approximately 110 to 120 feet below the surface.
(E&E Report; Pg. 7-17)

Current Groundwater Flow - Area 1

"Based on water level measurements at Site I, it was concluded that water in CS-A is not heavily influenced by groundwater, but appears to be the result of storm runoff and drainage from the Cerro plant. This water is perched, due to the heavily silted creek bed above the water table."
(E&E Report Pg. 7-19)

Chemical Results/Surface Water and Sediments

The analytical results of the surface water and sediment sampling revealed contamination in CS-A. Volatile organic contaminants were detected in two samples collected from CS-A. Eight volatile compounds were detected within the two samples, with the highest concentration being 0.041 mg/l of 1,1,1-trichloroethane. The semi-volatile organic compound, 4-chloroaniline, was also detected in CS-A at a concentration of 0.003 mg/l.

Elevated concentrations of several heavy metals were detected in surface water samples collected from CS-A. Cadmium, mercury, copper, barium, arsenic, chromium, and lead were all detected. (E&E; Pg. 7-22&23)

3.1.2 Conclusions

"The analytical data from sediment sampling, the physical evidence of stained soils, discolored and oily water, and the presence of effluent pipe outlets in CS-A indicate that the contamination found in CS-A resulted from several sources. Organic contaminants detected in sediment samples from CS-A included chlorobenzene, pentachlorophenol, dichlorobenzenes, PAHs, and PCBs. Additionally, IEPA and Illinois Attorney General's Office file information contain several reports of past direct discharge of process water and wastes from the Monsanto Krummrich Plant to Dead Creek. Historical aerial photographs show staining in CS-A resulted, at least in part, from direct discharge of waste materials from Monsanto."

"Although rough [sic] drainage and surface runoff from the Cerro property are the only known continuing discharges to CS-A, the extreme discoloration and oily consistency of the water in CS-A suggests the existence of an ongoing unidentified source. The elevated concentrations of heavy metals, including copper, lead, and chromium, detected in surface water samples from CS-A support the supposition that discharges from the Cerro property have contributed to the contamination in CS-A."
(E&E Report; Page 7-41)

3.2 Work Performed by The Avendt Group, Inc.

3.2.1 Objectives

The Avendt Group, Inc., was retained by Lowenstein, Sandler, Kohl, Fisher & Boylan to perform a Site Investigation and Remedial Alternatives Evaluation at Creek Segment A, located in Sauget, St. Clair County, Illinois. The Site Investigation portion of the study was being performed to fully evaluate CS-A. The information gathered through this portion of the project was utilized to evaluate alternatives for the remediation of CS-A. Field activities designed to characterize CS-A began July 5, 1989, and continued through July 21, 1989.

3.2.2 Health and Safety Considerations

The Health and Safety Plan for the CS-A project is contained in Appendix A of this report.

3.2.3 Sampling Rationale

In order to properly delineate and characterize CS-A, a systematic sampling scheme was devised. CS-A was divided into ten transverses oriented in an east-west direction. Locations of the transverses are shown in Plate 2 and described below:

A16 - 1050 feet from the south end of CS-A1.
A15 - 850 feet from the south end of CS-A1.
A14 - 650 feet from the south end of CS-A1.
A13 - 450 feet from the south end of CS-A1.
A12 - 250 feet from the south end of CS-A1.
A11 - 50 feet from the south end of CS-A1.
A10 - South Edge of Cerro Plant Road (Old Queeny Avenue)
A21 - 100 feet from the north end of CS-A2.
A22 - 100 feet from the south end of CS-A2.
A23 - 450 feet from the north end of CS-A2.

The sediment/soil borings were identified by letter from west to east. Creek transverses A11, A12, A13, A14, A15, and A22 contain four sediment/soil borings. The borings located on the east and west banks of the creek are approximately five feet from the edge of the creek. Two borings per transverse were performed within the creek channel. These borings were located five feet from the west and east creek banks, respectively.

Transverse A21 contained three (3) sediment/soil borings. These borings were also identified by a letter from west to east. The borings were performed as previously discussed, except one boring location was eliminated due to confined space and overhead power lines (Plate 2).

Transverse A16 contained five sediment/soil borings. As with the other borings, this was identified by a letter from west to east. The borings were performed as previously discussed except one additional boring was performed 20 feet east of the creek bank along this transverse (Plate 2). The additional borings were necessary because of the larger area at the north end of CS-A1.

Two boring methods were employed for the characterization of sediments/soils in CS-A. Characterization of bottom sediments, when working within the creek channel, were accomplished with a small drilling rig, utilizing five foot long hollow stem augers. The drilling rig was mounted on a 28 foot long, eight foot wide reinforced aluminum pontoon. The pontoon was anchored to the creek channel bank with cables and metal stakes.

Boring operations on the creek banks were performed with an all-terrain vehicle (ATV) drilling rig utilizing five foot long hollow stem augers.

The five foot long hollow stem augers produced a six-inch outer diameter borehole. The inner diameter of the hollow stem auger is 4-1/4 inches. During core classification and sampling, the hollow stem augers were decontaminated with a hand-held, high-pressure steam cleaner.

A continuous core sample was collected for each boring. The core sample was collected by utilizing a 4-1/4 inch diameter, five foot long continuous split spoon sampler. The sampler was advanced into the sediments approximately two to four inches ahead of the auger flights. The continuous core sampler was decontaminated between each boring with Alconox detergent and a steam-cleaning rinse.

All boreholes were plugged after making strata observations and sediment/soil sample collection. The shallow boreholes were plugged with "Holeplug" 100% granular bentonite. When bridging occurred, identified by breakthrough when tamping the holeplug pellets, a bentonite slurry was trimmied into the borehole. The borehole was filled to within one foot of the ground surface. The remaining foot or so was filled with clean soil.

The depth of each borehole varied according to the location of the boring within the creek section. Sediment borings were advanced to the Dead Creek sediment/Mississippi River flood plain strata interface, and included the upper few inches of the Mississippi River flood plain sediments.

The borehole cores were logged by AGI personnel. Bottom sediments were described in accordance with the Unified Soil Classification System. The borehole log information included:

- Boring number
- Project number
- Site Location
- Time
  - Beginning
  - End
- Total Depth (feet)
- Hole Diameter (inches)
- Type of Sampling/Coring Device
- Length and Diameter of Coring Device
- Sampling Interval
- Boring Method
- Boring Contractor
- Driller
- Hammer Weight and Drop (if applicable)

In addition to the items outlined above, all related observations about boring rate, equipment operation or unusual conditions were noted.

This information included:

- Rig reactions such as chatter, auger drops, and bouncing;
- Boring rate changes
- Material changes
- Grouting material (if necessary)

All boring equipment (i.e. augers, drilling rods, etc.) was steam-cleaned between borings. Avendt Group personnel observed the steam-cleaning operations to maintain quality assurance/quality control (QA/QC) (Appendix B). All dirt and material was removed from the auger flights. The five-foot continuous core sampler was decontaminated with Alconox detergent and rinsed with deionized water.

3.2.4 Geotechnical Characterization

3.2.4.1 Description of Sediment Sampling Events

CS-A was characterized by collecting 99 samples through a network of 34 sediment-soil borings distributed on ten east-west transverses across CS-A1 and CS-A2 (Plate 2). The borings were performed using two drilling methods; 1) the borings inside the creek channel were performed using a pontoon-mounted drilling rig utilizing five-foot long hollow stem augers, and 2) the borings performed on the creek banks were performed using an ATV drilling rig utilizing five-foot long hollow stem augers. The samples were collected using either a three-inch diameter, five-foot long continuous core sampler, or a three-inch diameter, 18-inch long split spoon sampler. Samples were collected at three depth intervals; shallow, intermediate, and deep, and/or at sediment/soil interfaces.

Strict quality assurance/quality control procedures were established in the Quality Assurance Project Plan (QAPP). The Qapp is included in Appendix B of this document. All drilling and sampling equipment were steam-cleaned prior to moving to the next boring location. Water from steam cleaning was allowed to drain back into the creek. All sample jars were sealed and stored in coolers prior to use. Once the cooler seal was broken, the sample jars were not left unattended until the cooler was sealed prior to shipment to the laboratory.

Two planned boring locations were eliminated due to overhead power lines and trees; however, two additional borings were performed, borings A10B and A23C (Plate 2).

3.2.4.2 Physical Description of Lithologies Encountered in Boreholes

The site investigation performed at the CS-A site disclosed a generalized stratigraphic cross section which consists of four identifiable stratigraphic units; 1) fill material, 2) fluidized creek bottom sediments, 3) the Cahokia Unit, and 4) the Henry Formation (Figure 2). However, in isolated instances, a thin clay layer was encountered. Boring logs were kept in the field during drilling operations (Appendix C). The unit descriptions are as follows:

Fill Material

Tan to black, stained, dry, sandy silt to silty sand, intermixed with concrete, bricks, road aggregate, rags, slag, and vitreous pellets. It was often characterized by a chemical odor. The fill material varied from one to 15 feet thick depending on the location along the creek bank (Figure 3).

Fluidized Creek Bottom Sediments

Brown to yellowish brown, black, mottled, wet, fluidized silt. Contained organic matter and exhibited a chemical odor. The fluidized creek sediments ranged from one-half to 11 feet thick (Figure 4).

Generalized Stratigraphic Units

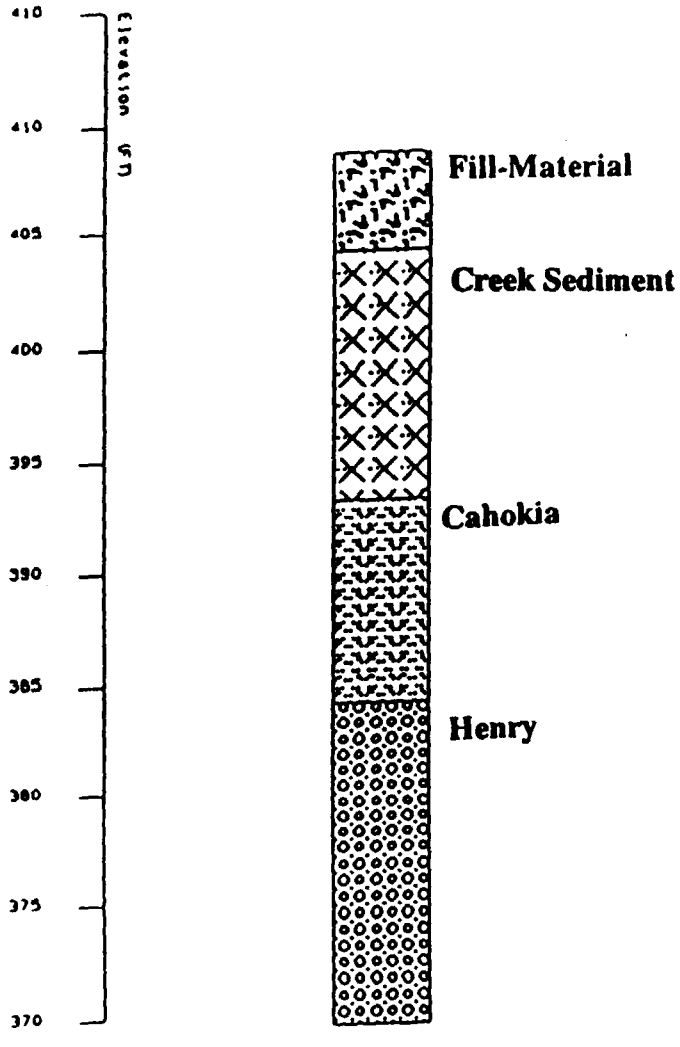
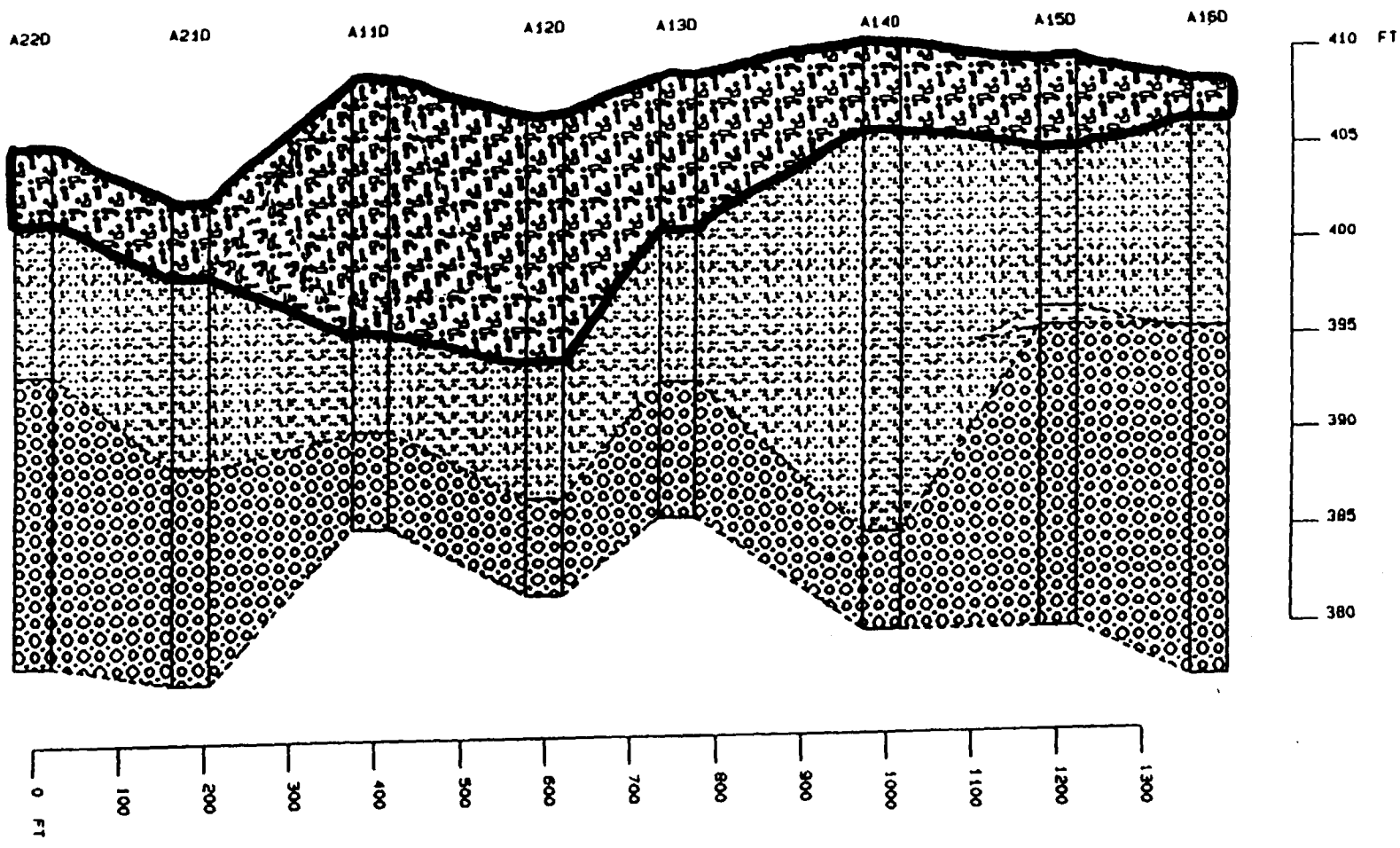


Figure 2
Generalized stratigraphic cross section of the units encountered during drilling operations at the CS - A



LEGEND

CLAY

HENRY

CAHOKIA

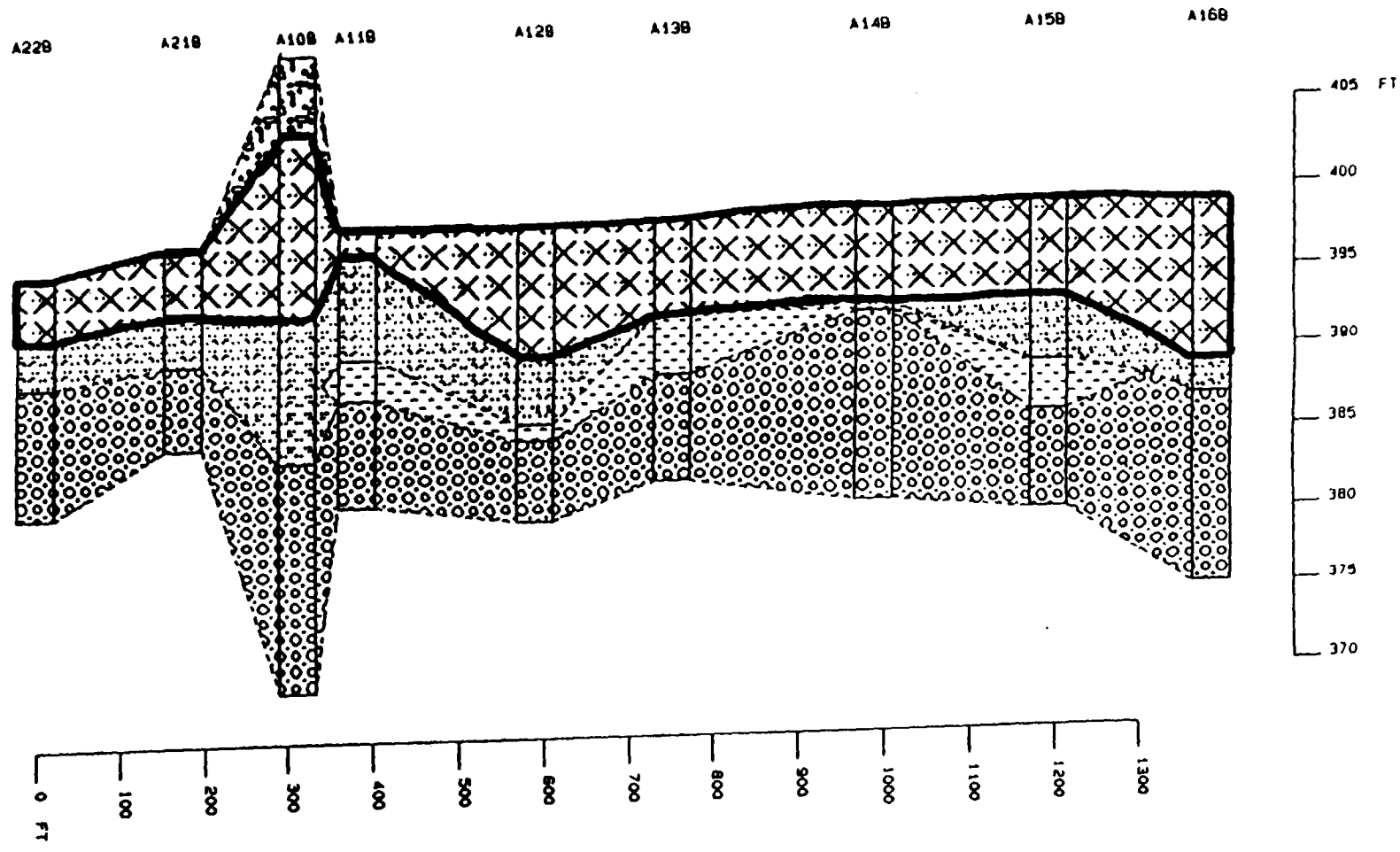
FILL MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 3

THE AVENOT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

FILL-MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 4

THE AVENDT GROUP, INC.

The Cahokia Unit

Light brown, tan to black, dry to moist clayey silt to silty clay. The lower portion of the unit was frequently gray in color. The unit was moderately plastic and contained minor amounts of organic matter. This unit also contained a chemical odor. This unit also exhibited a moderately continuous, thin clay lens which pinches in and out along the entire length of the creek. This clay seam ranging from one-half inch to three feet in thickness. The Cahokia unit ranges from one to 20 feet thick (Figure 5).

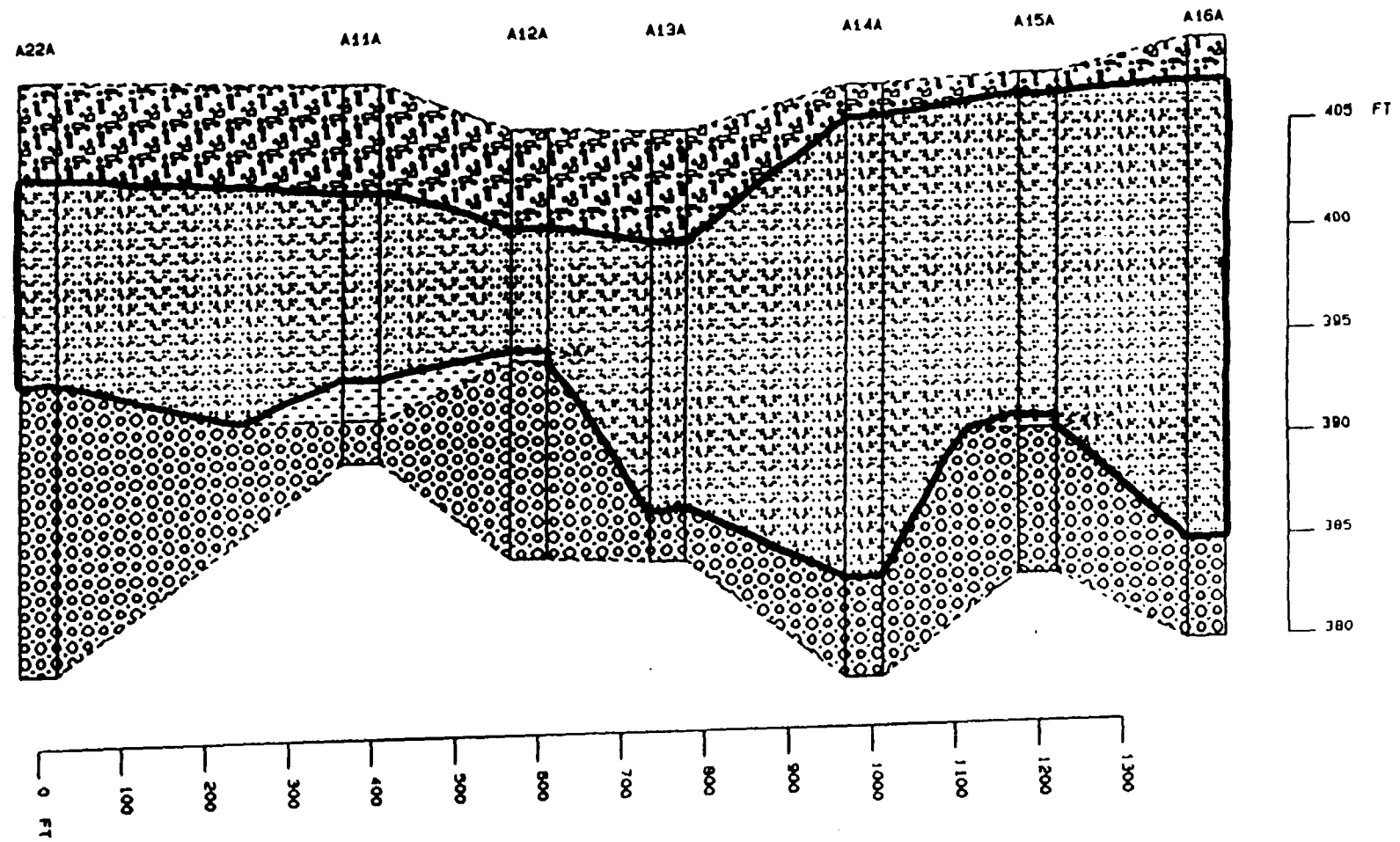
The Henry Formation

Gray to greenish gray, moist to wet silty sand to medium sand. Quartz grains were easily identified without a hand lens. Small black specks were intermixed throughout the unit. Thin clay lenses were frequently found within the upper portions of the unit. The bottom of the Henry Formation was not determined; however, review of the literature indicates that the Henry extends to bedrock which is 110 feet below the land surface (Figure 6). This unit also exhibited a chemical odor.

3.2.5 Criteria Utilized in Determining Extent of Contamination

In order to define the limits of the fluidized creek bottom sediments, boring samples were visually inspected by a geologist during drilling operations. The fluidized creek sediments were readily distinguished from the underlying soils by visual indicators of the differing soil types indigenous to the area, as explained in Section 3.2.4.2.

No fluidized sediments were found beyond the limits of the creek.



LEGEND

CLAY

HENRY

CAHOKIA

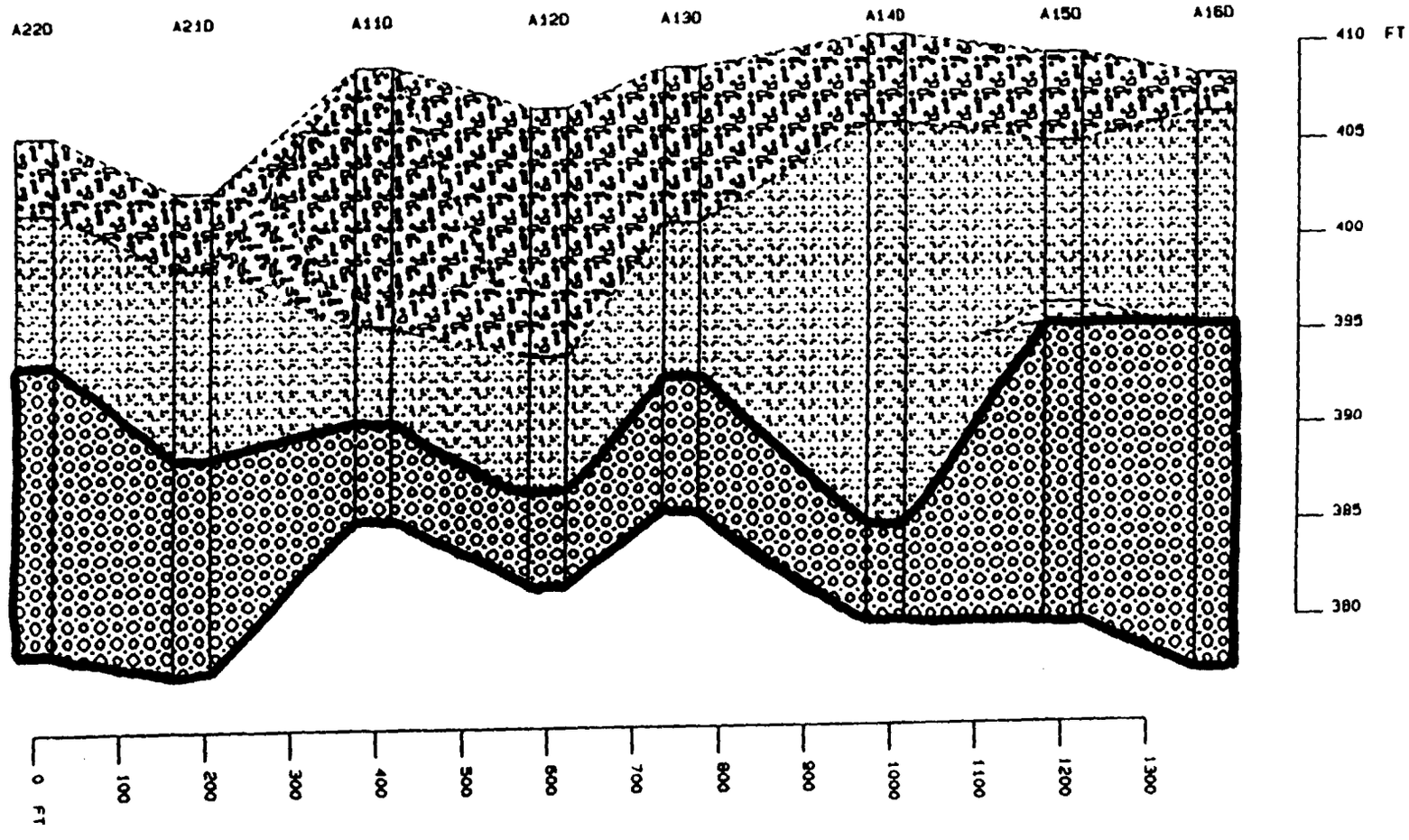
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 5

THE AVENDT GROUP, INC.



LEGEND

CLAY | HENRY | CAHOKIA | FILL-MATERIAL | CREEK SEDIMENT

CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC.

Figure 6

3.2.6 Transverse/Zone Diagram

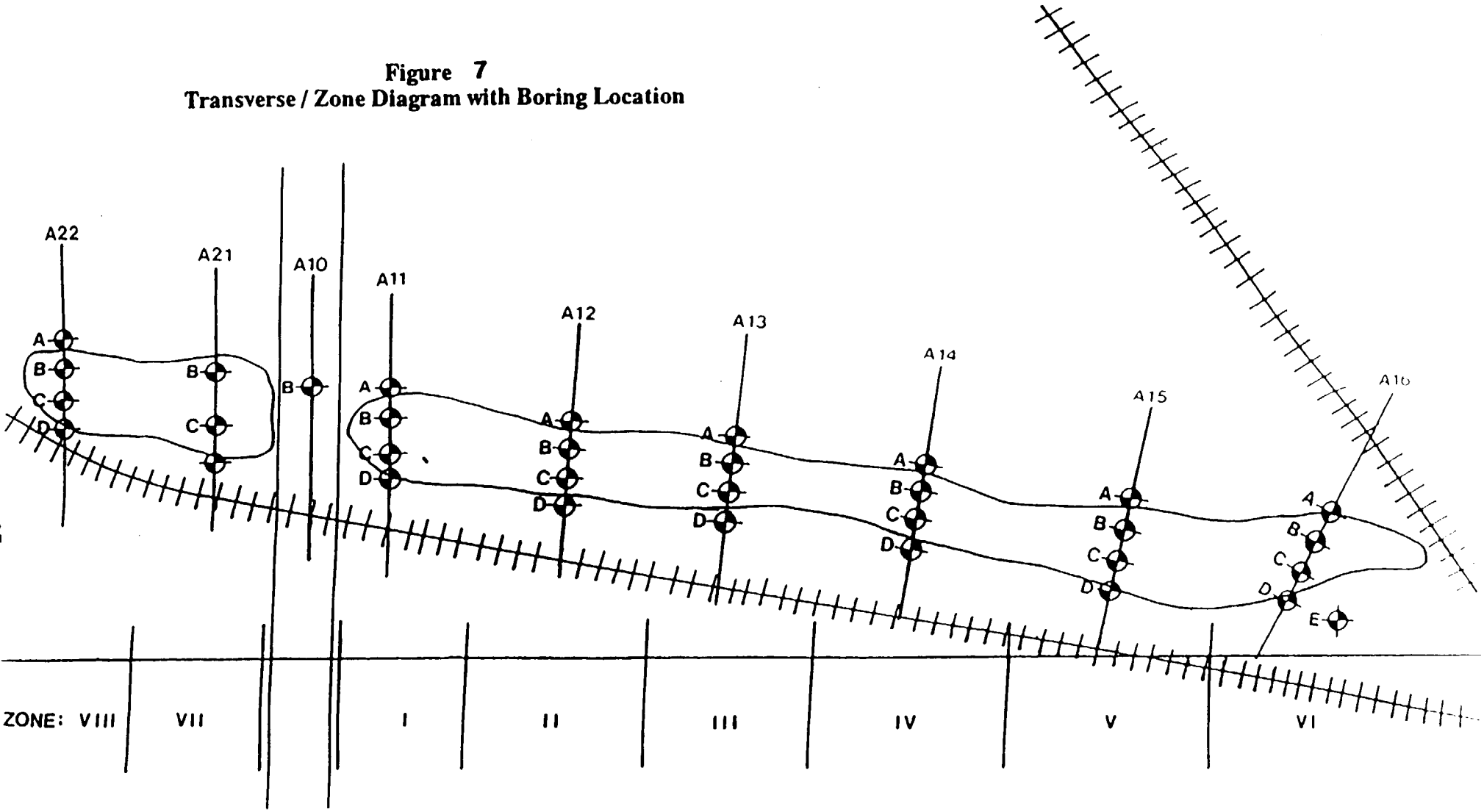
See figure on the following page

3.2.6

TRANSVERSE / ZONE DIAGRAM

(Indicate A,B,C,D Series on Map)

Figure 7
Transverse / Zone Diagram with Boring Location



3.2.7 Boring Log Data and Explanation

Boring logs were compiled during each boring performed at the CS-A site. The boring logs were documented by a qualified geologist of AGI (Appendix C).

The data generated through the documentation of each boring indicated that the stratigraphy at the CS-A site consisted of four unconsolidated units (Figures 8-17). These units were described in the previous section 3.2.4.2. The stratigraphy was characterized to determine unit thickness, unit contacts and sample depth intervals.

Figure 8
CS - A
Boring Logs

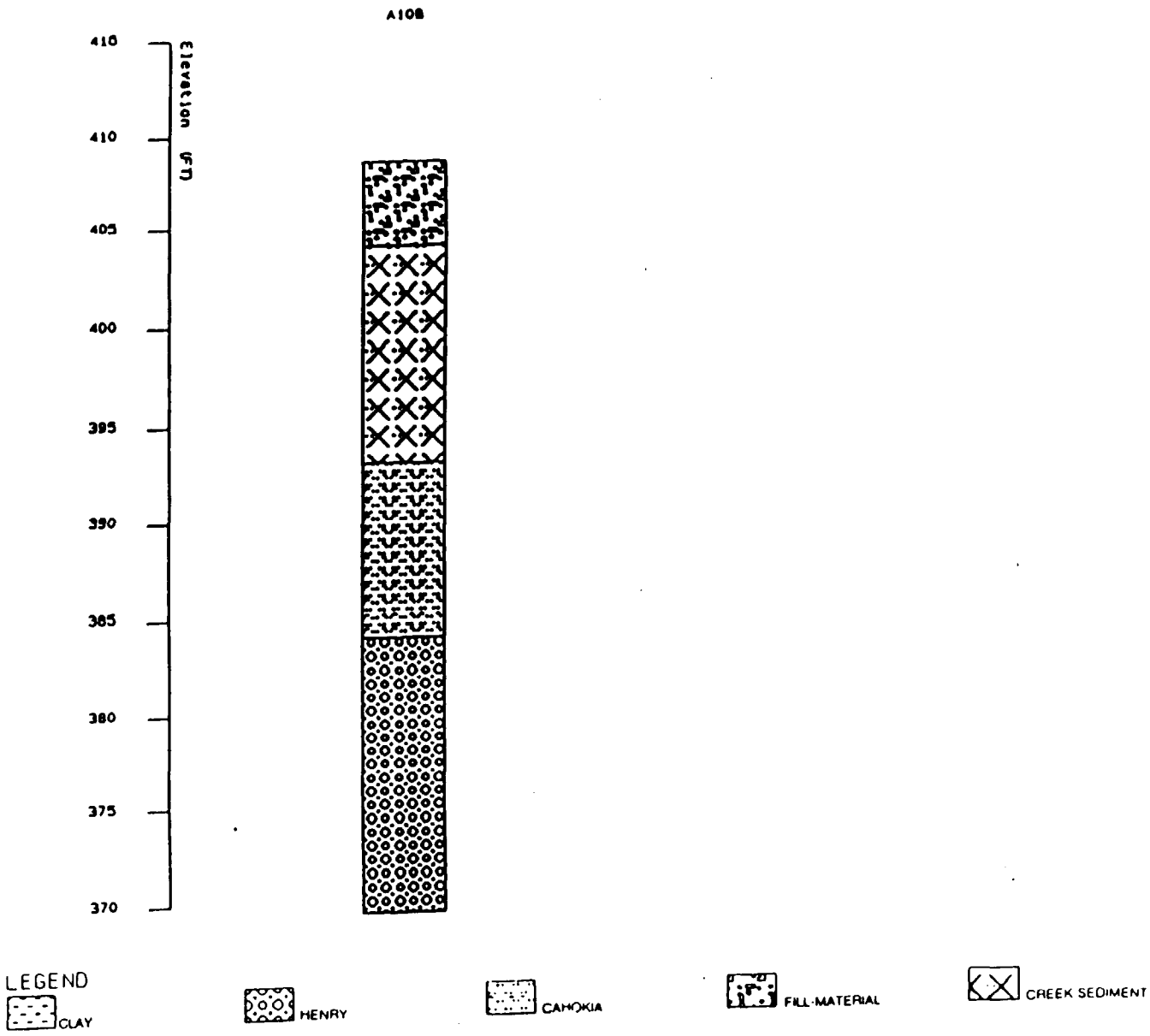


Figure 9

CS - A
Boring Logs

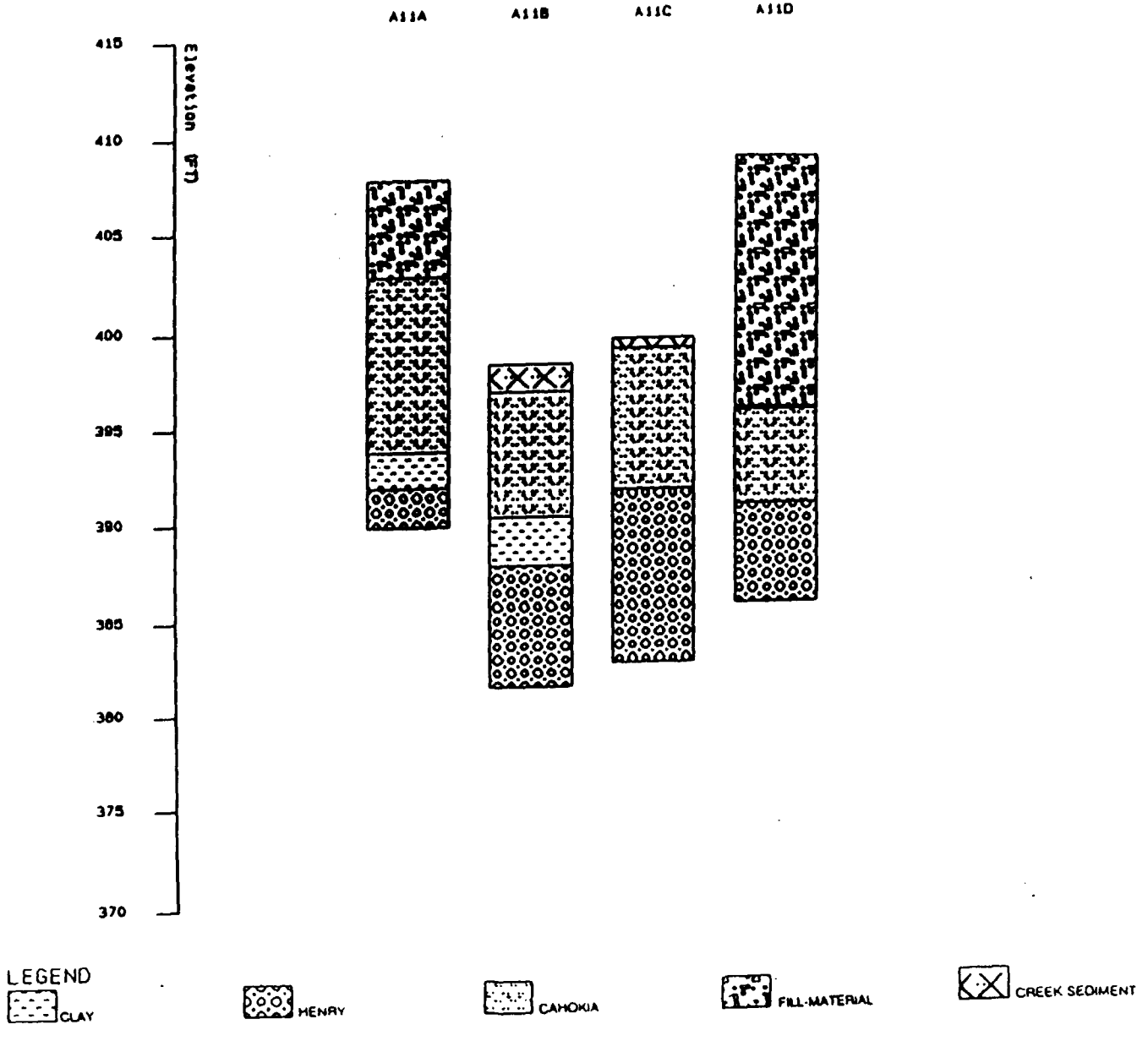


Figure 10
CS - A
Boring Logs

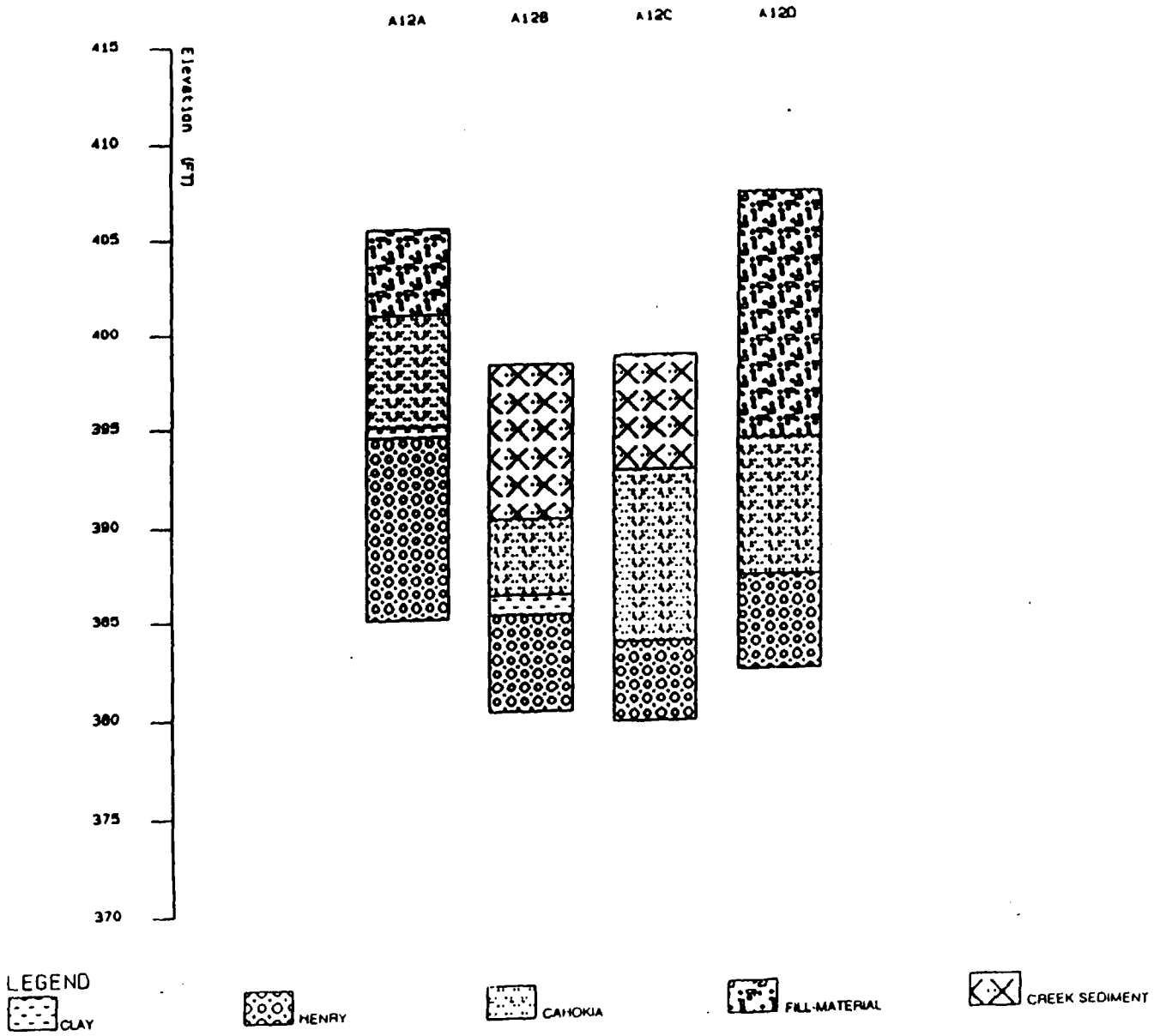


Figure 11

CS - A
Boring Logs

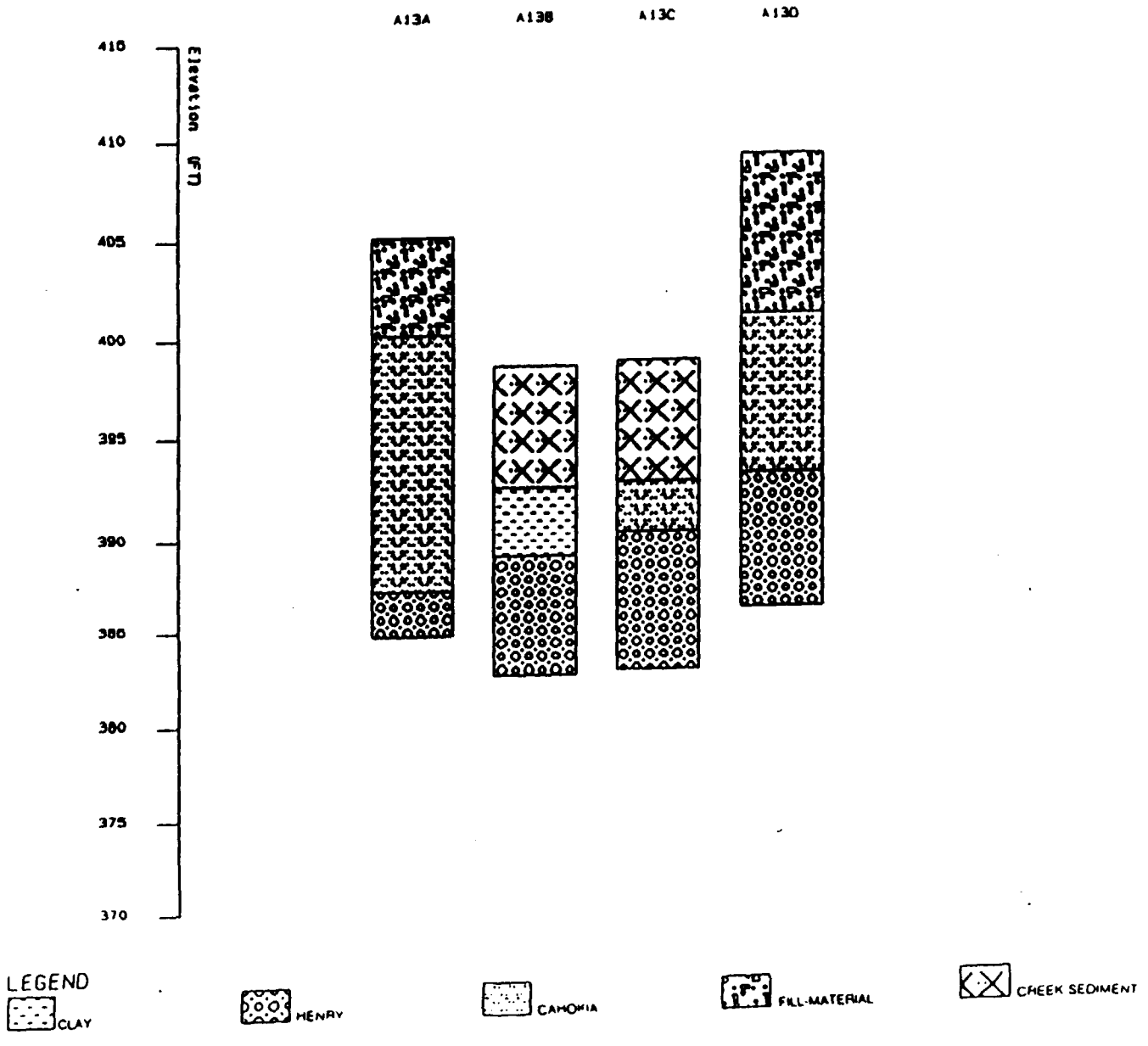


Figure 12

CS - A
Boring Logs

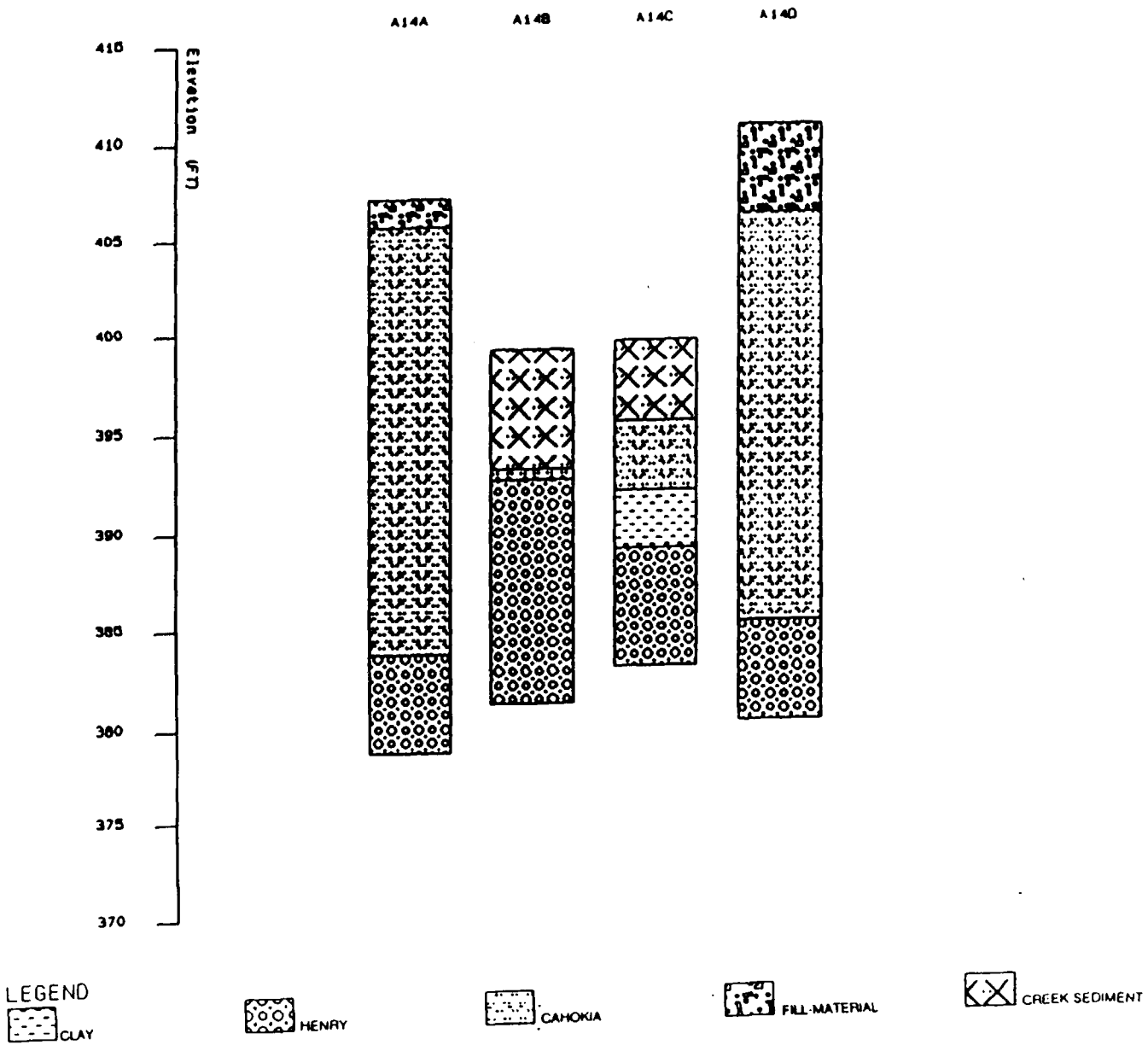


Figure 13

CS - A
Boring Logs

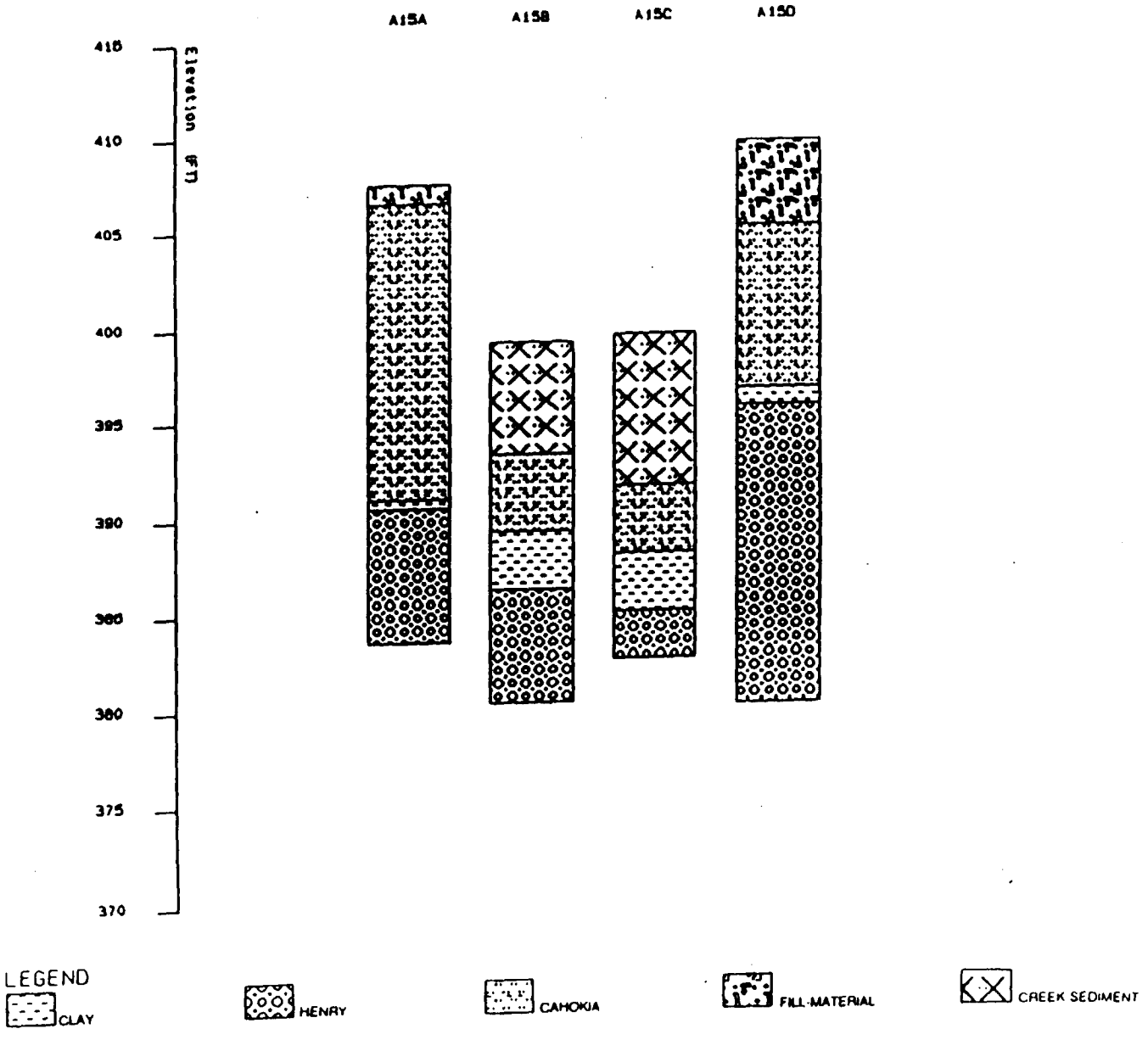


Figure 14

CS - A
Boring Logs

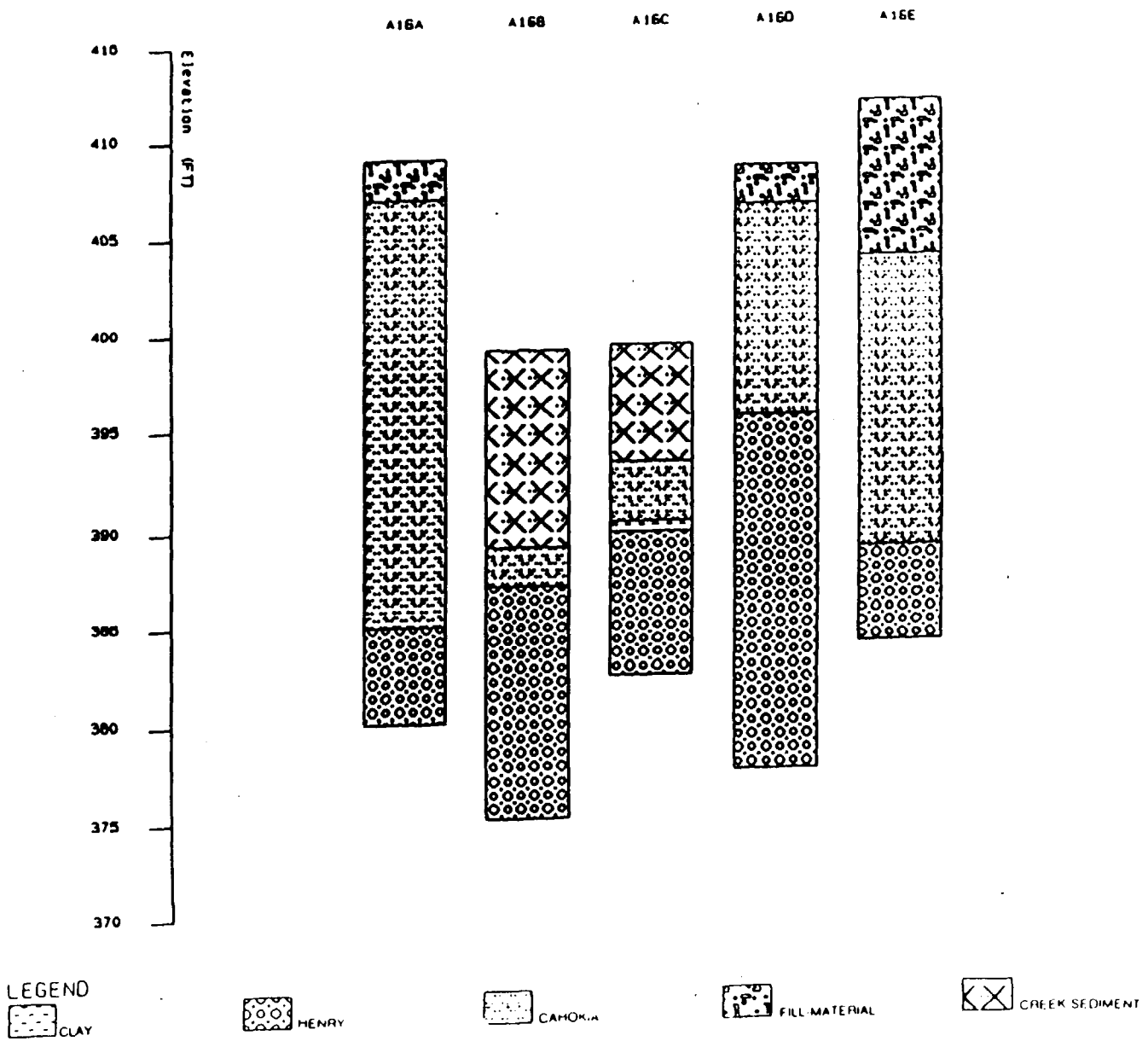


Figure 15

CS - A
Boring Logs

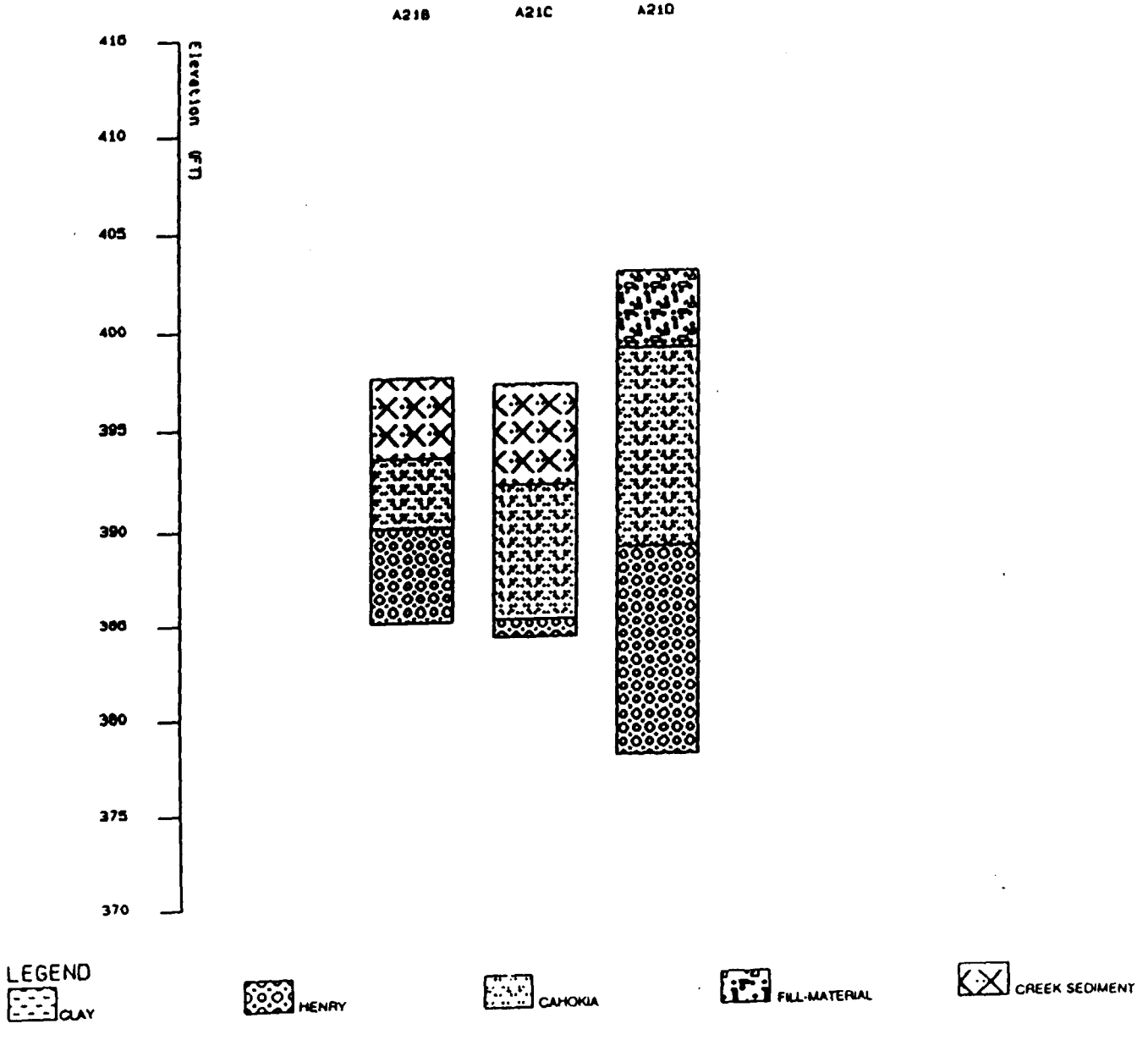


Figure 16
CS - A
Boring Logs

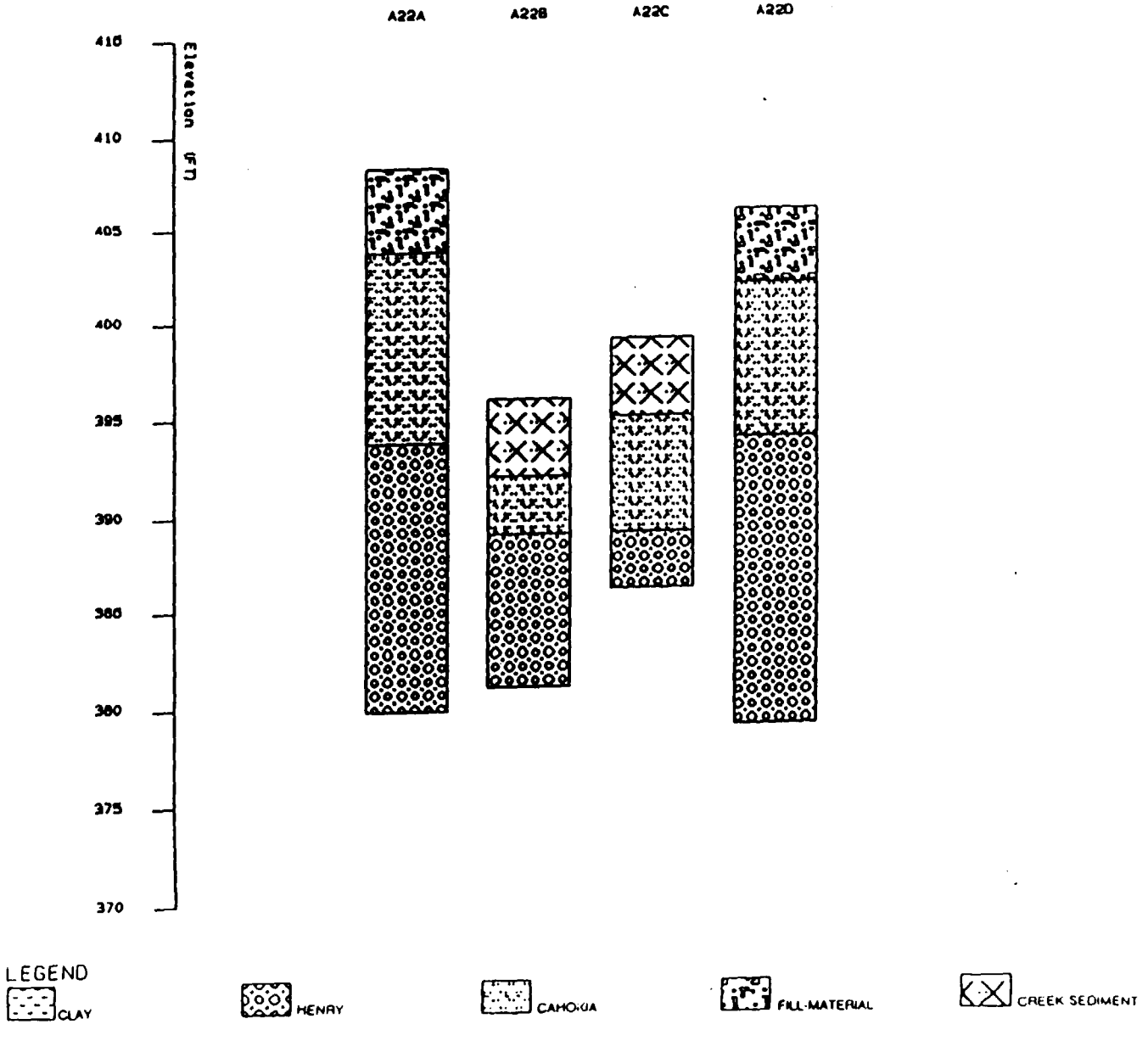
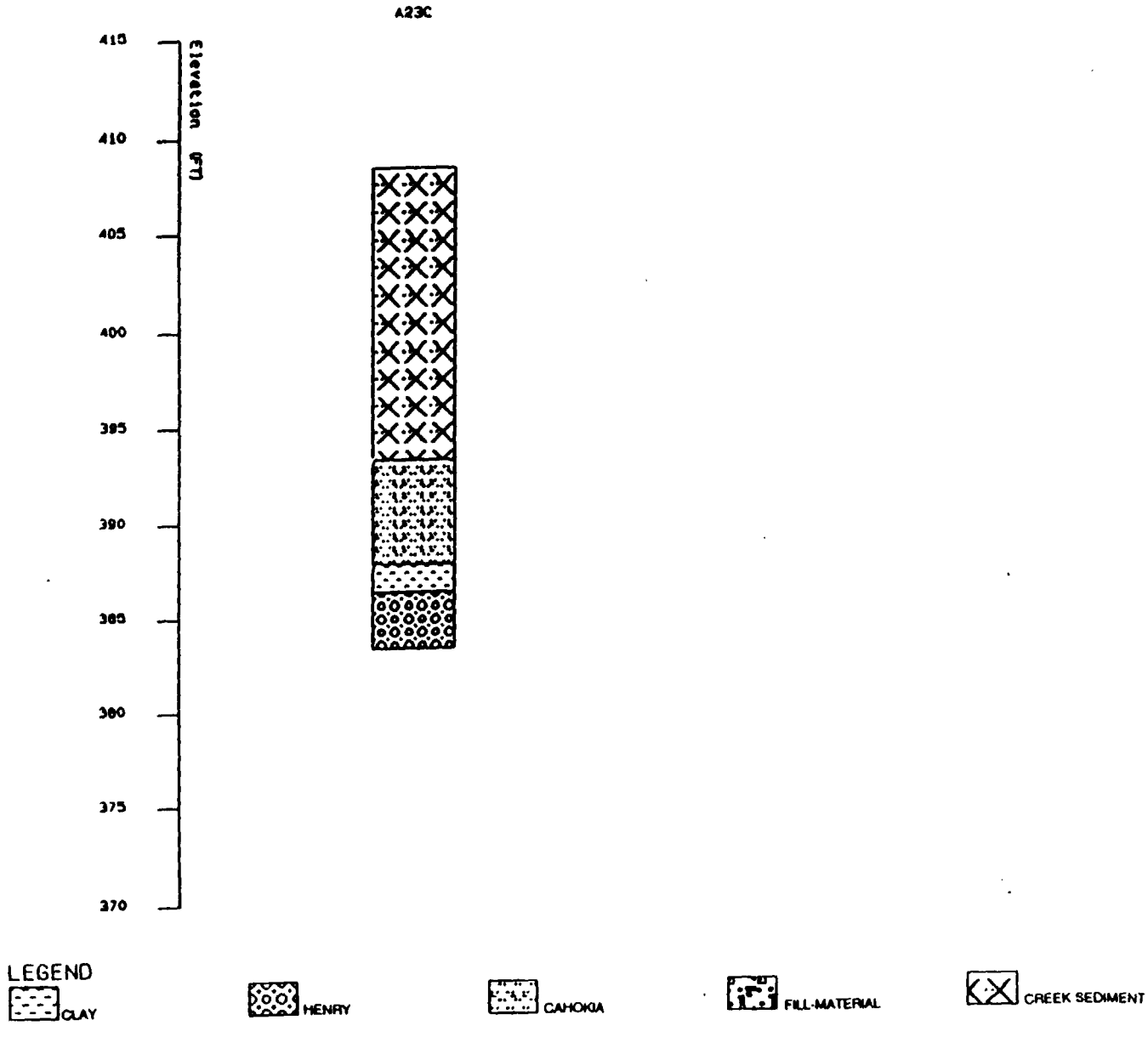


Figure 17

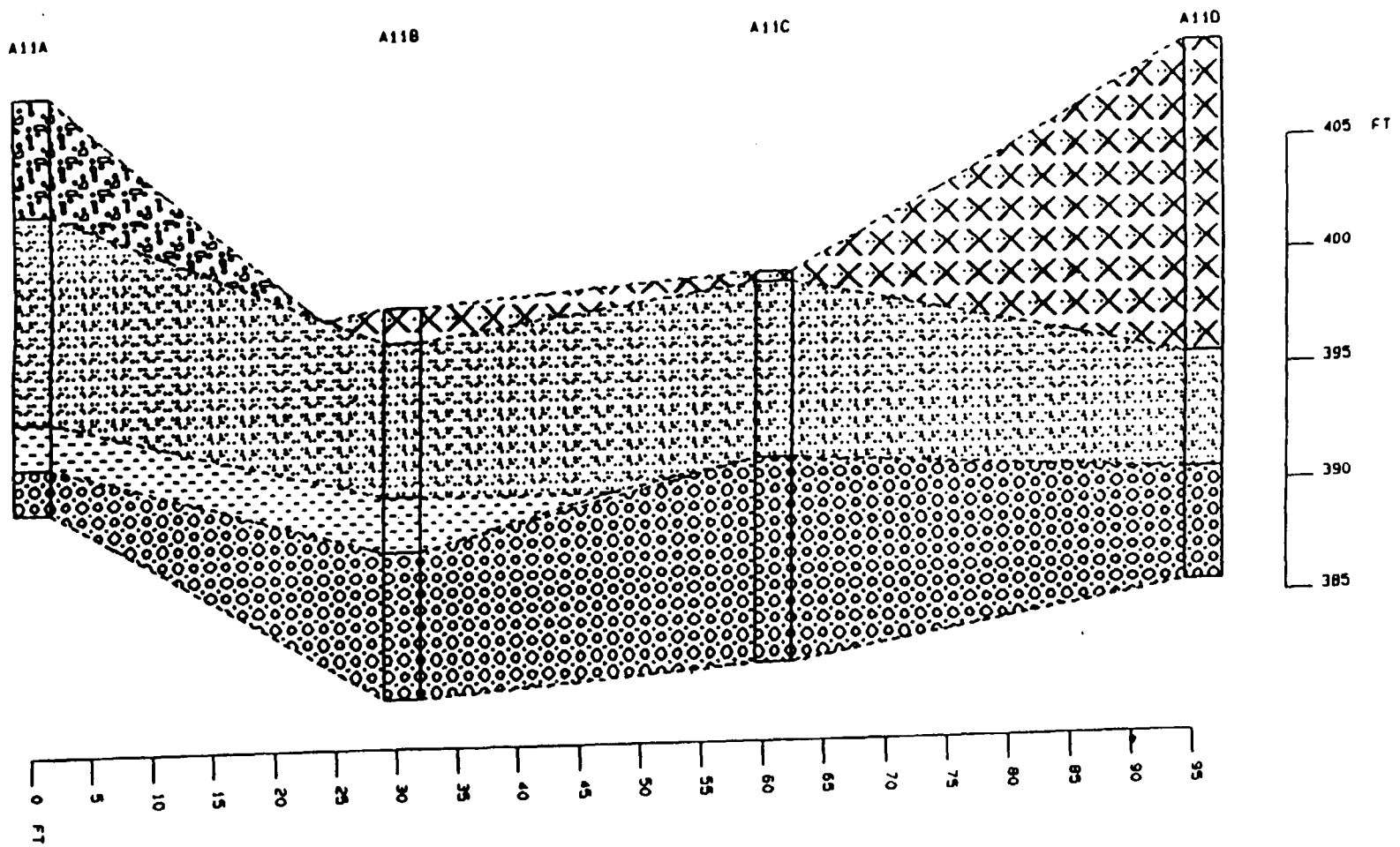
CS - A
Boring Logs



3.2.7.1 Transverse Sections

See figures on the following pages.

3.2.7.1
TRANSVERSE SECTIONS



LEGEND

CLAY

HENRY

CAHOKIA

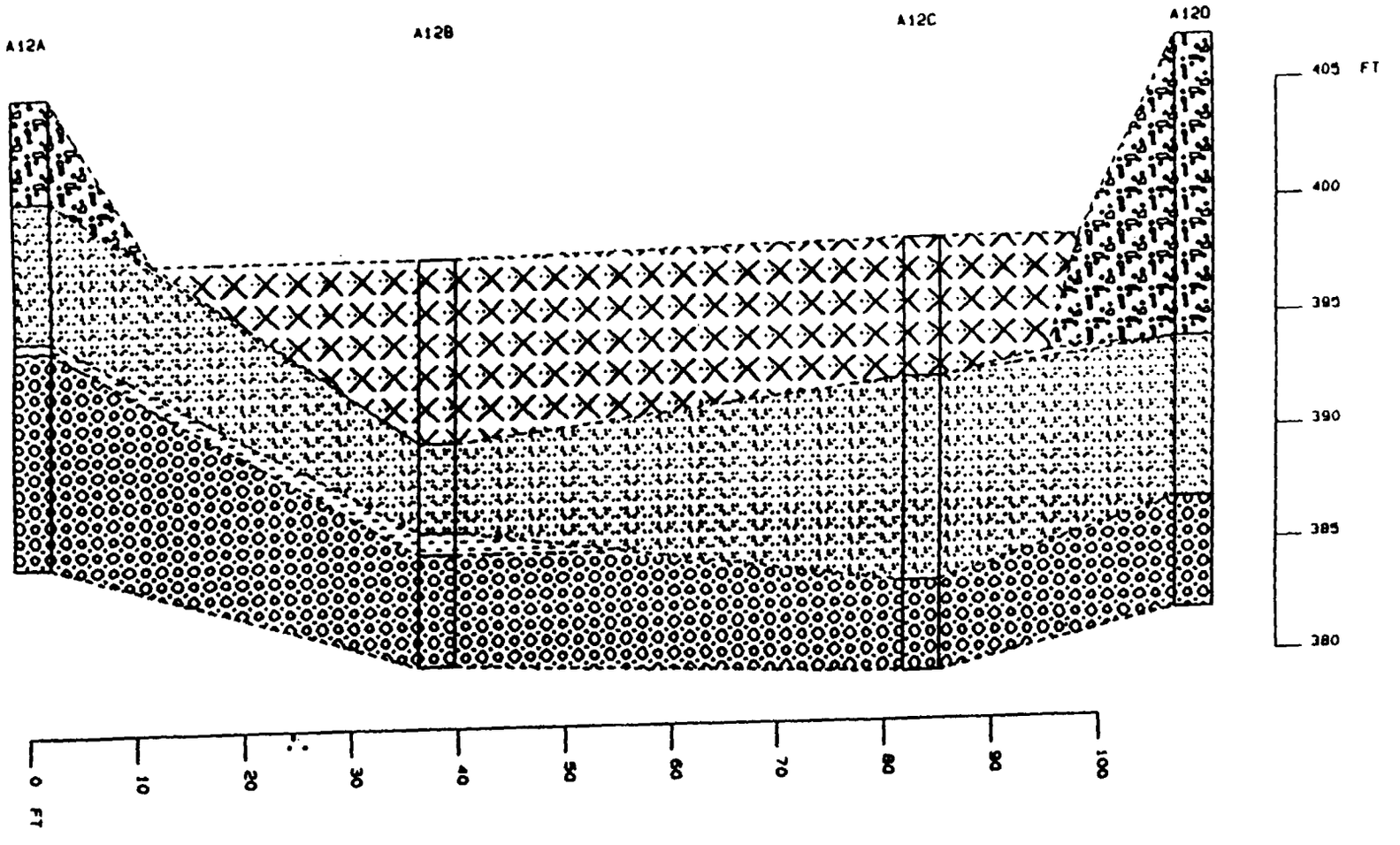
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 18

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOOJA

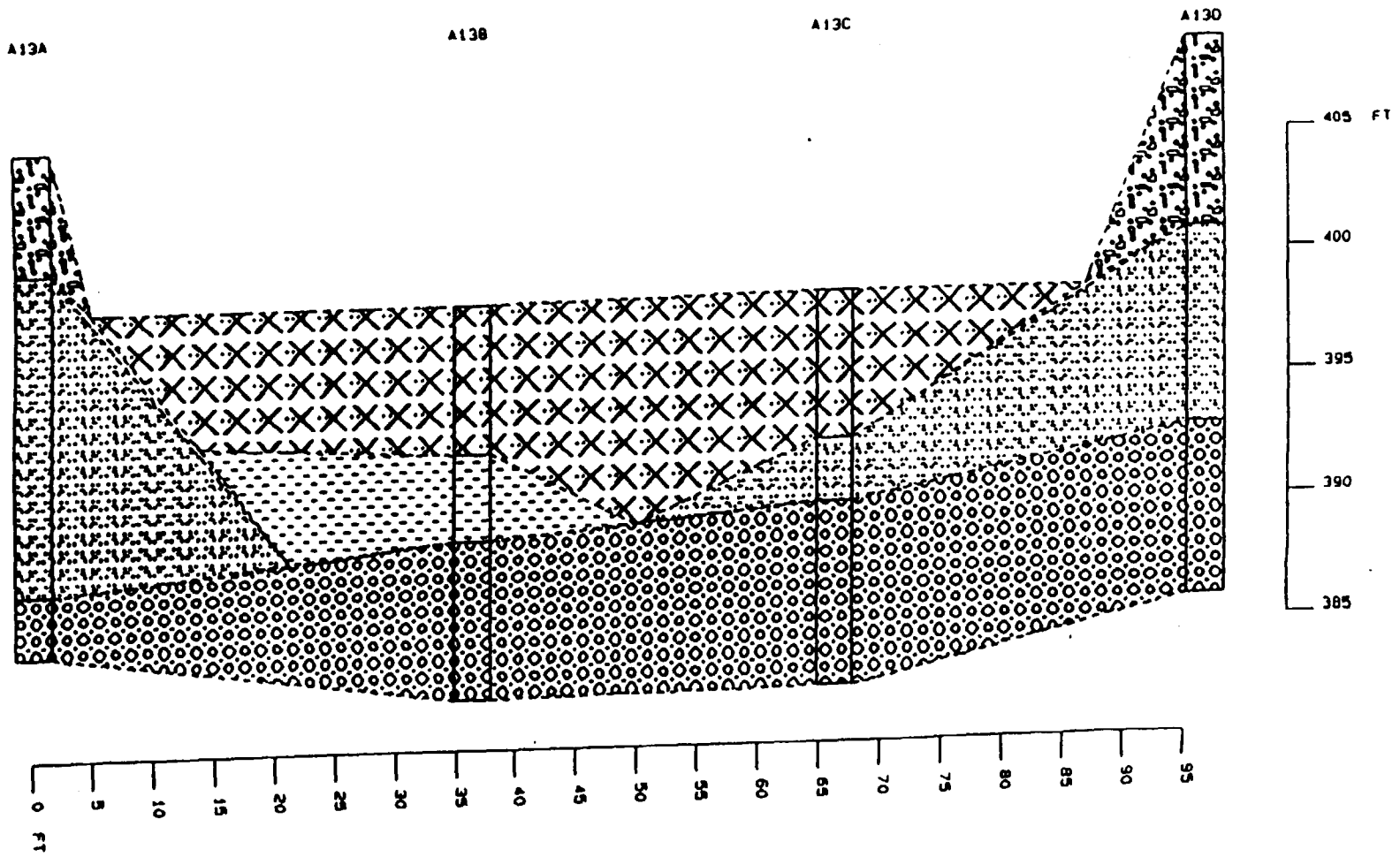
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 19

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

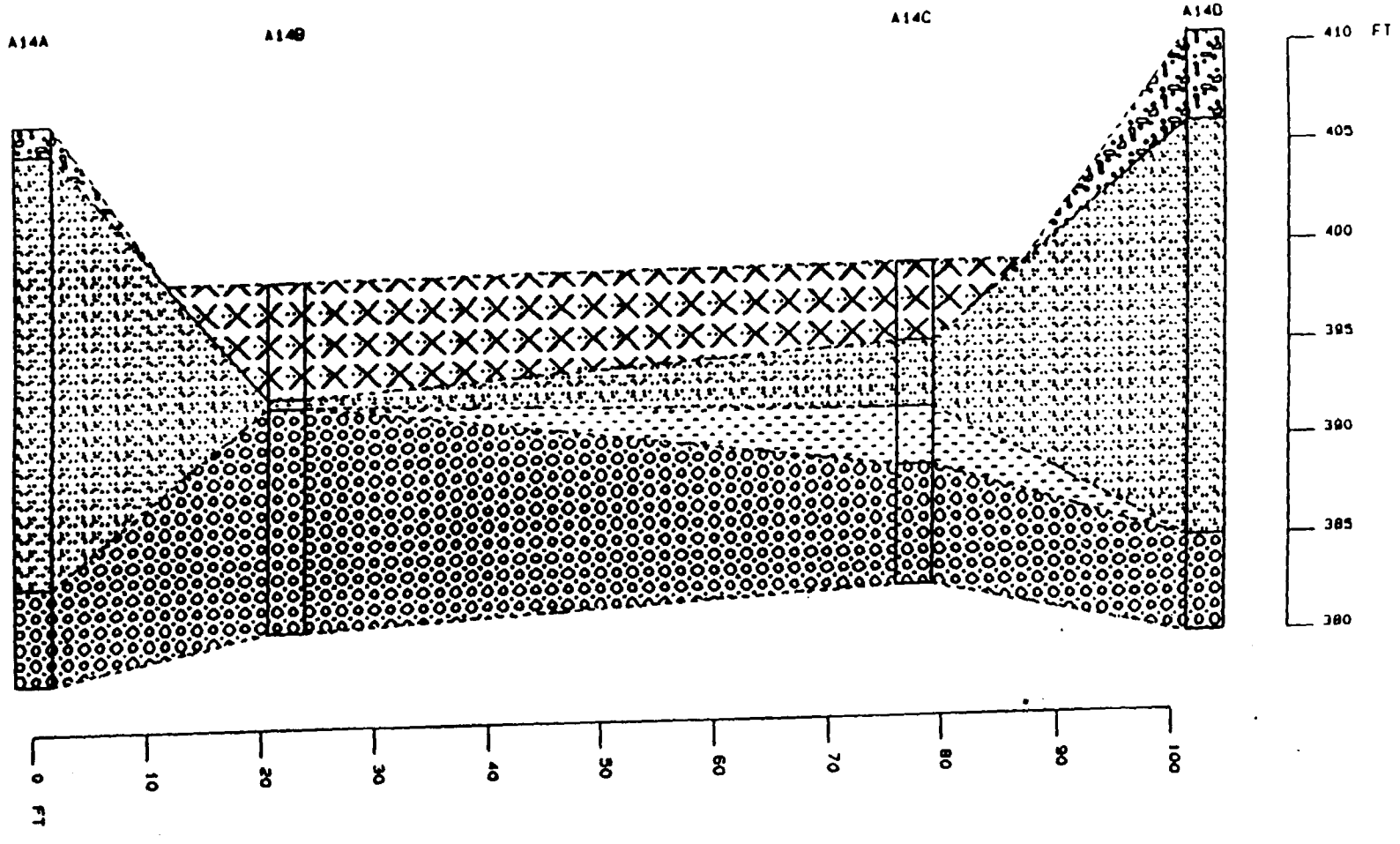
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 20

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

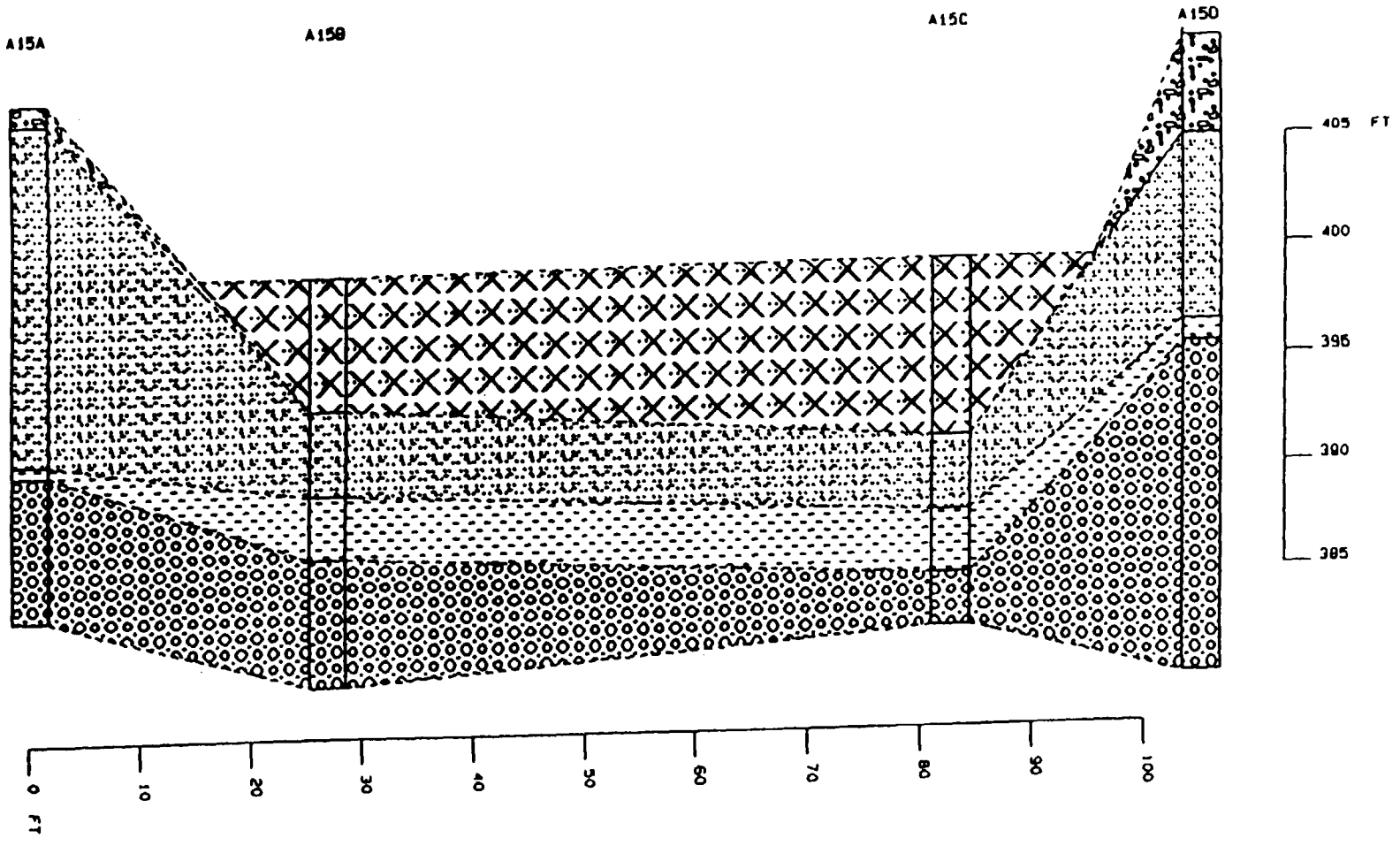
FILL MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 21

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

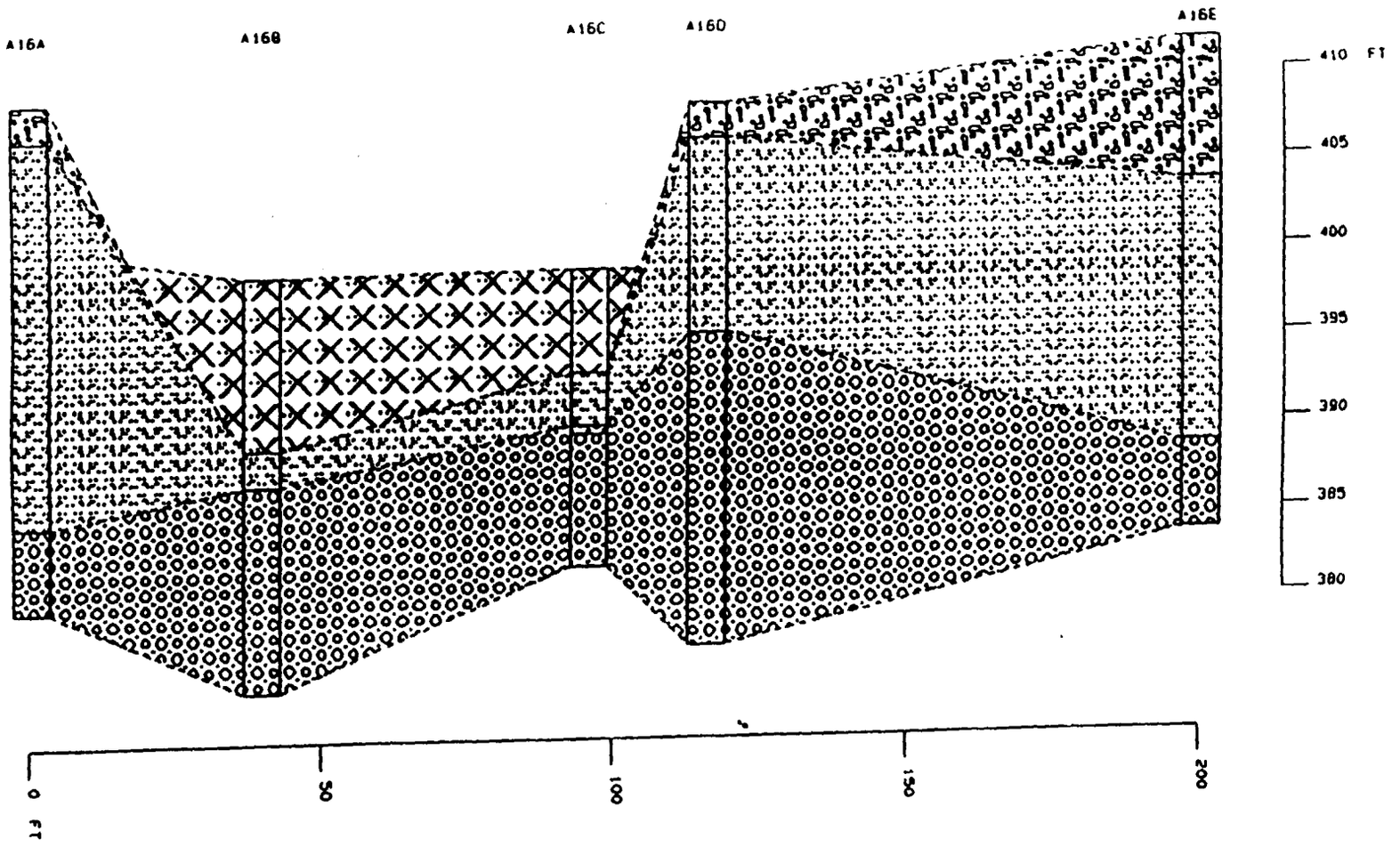
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 22

THE AVENDT GROUP, INC.



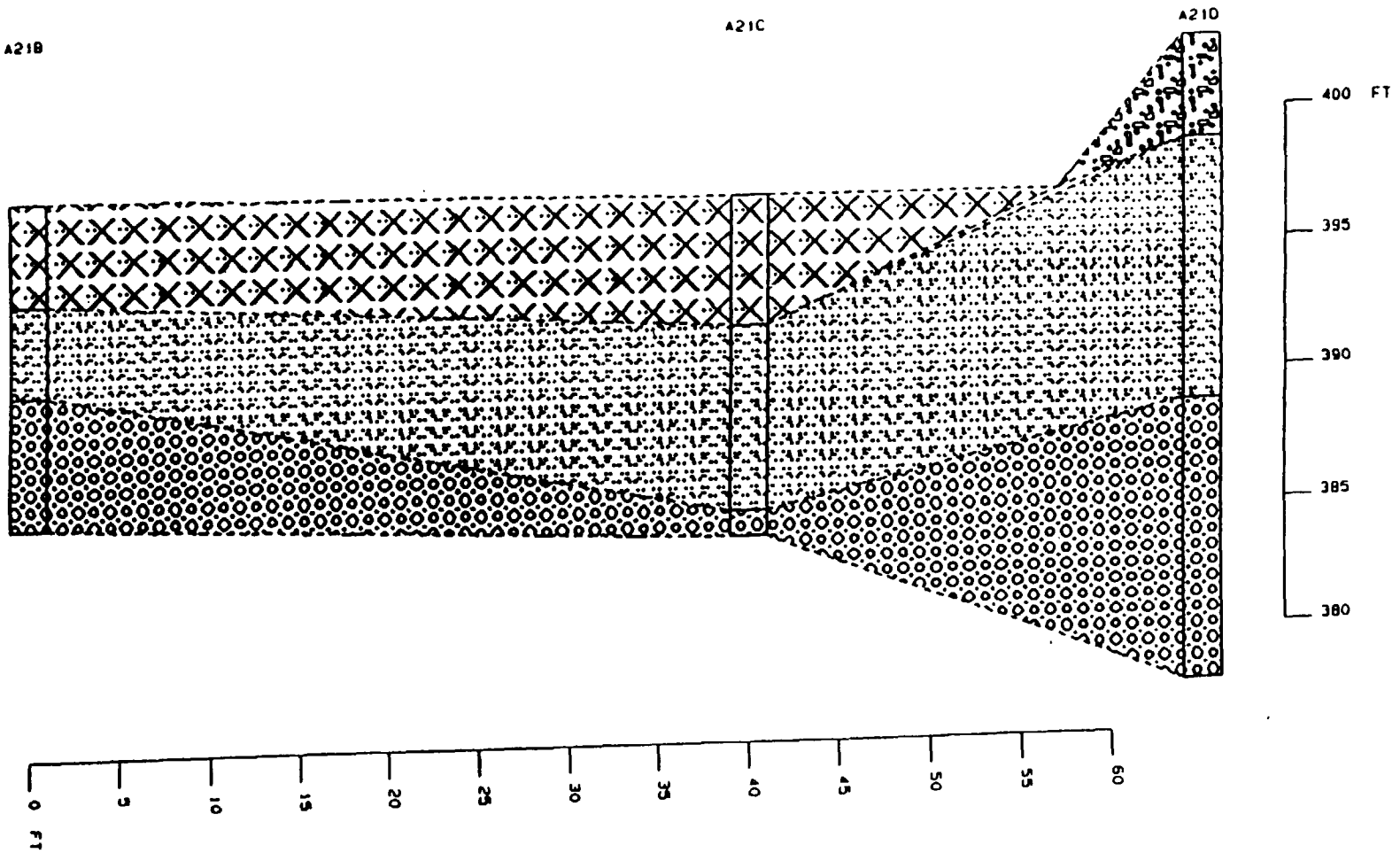
LEGEND

CLAY | HENRY | CAHOKIA | FILL-MATERIAL | CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 23

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

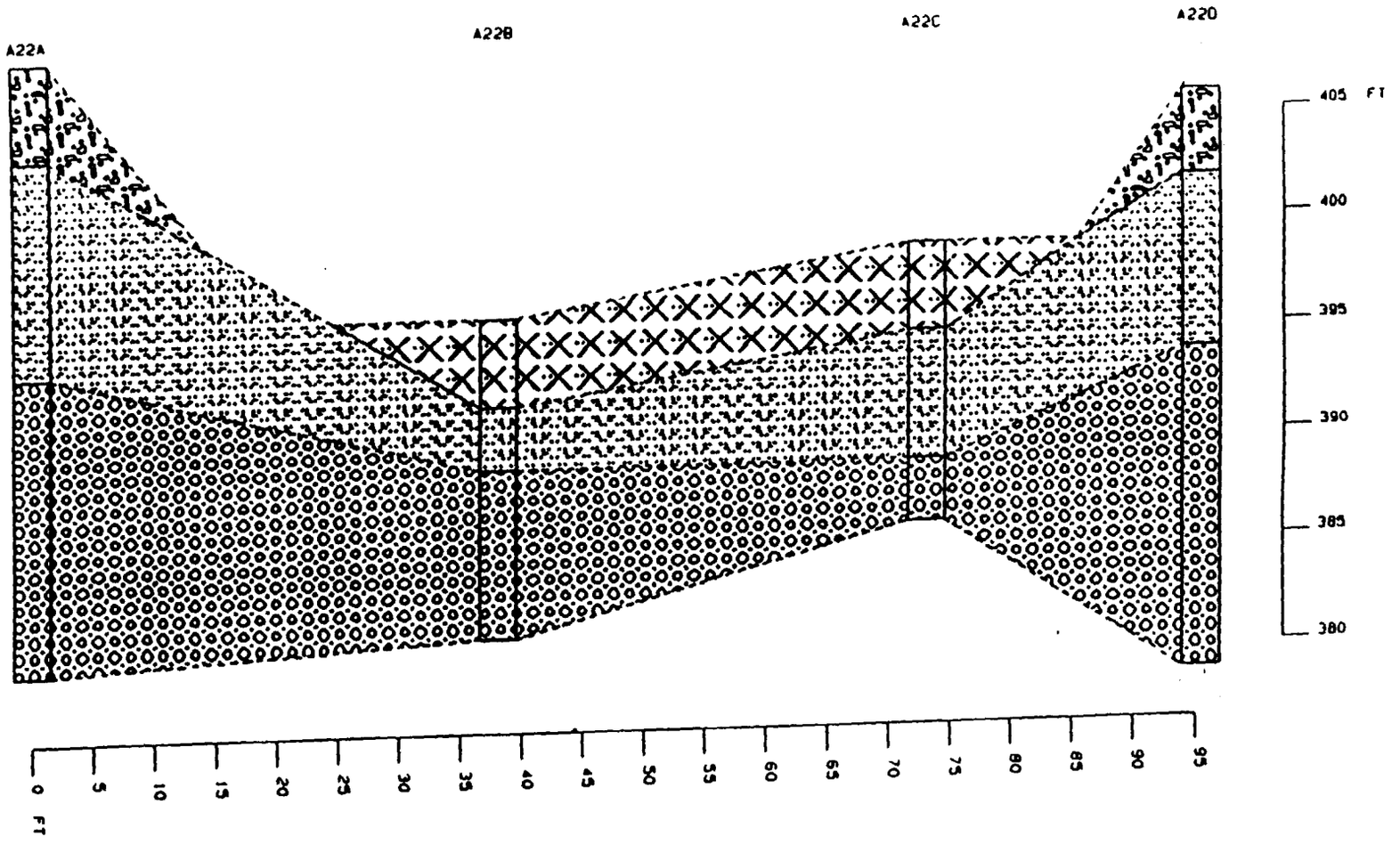
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 24

THE AVENDT GROUP, INC.



LEGEND

CLAY

HENRY

CAHOKIA

FILL MATERIAL

CREEK SEDIMENT

CS - A
Transverse Cross Section

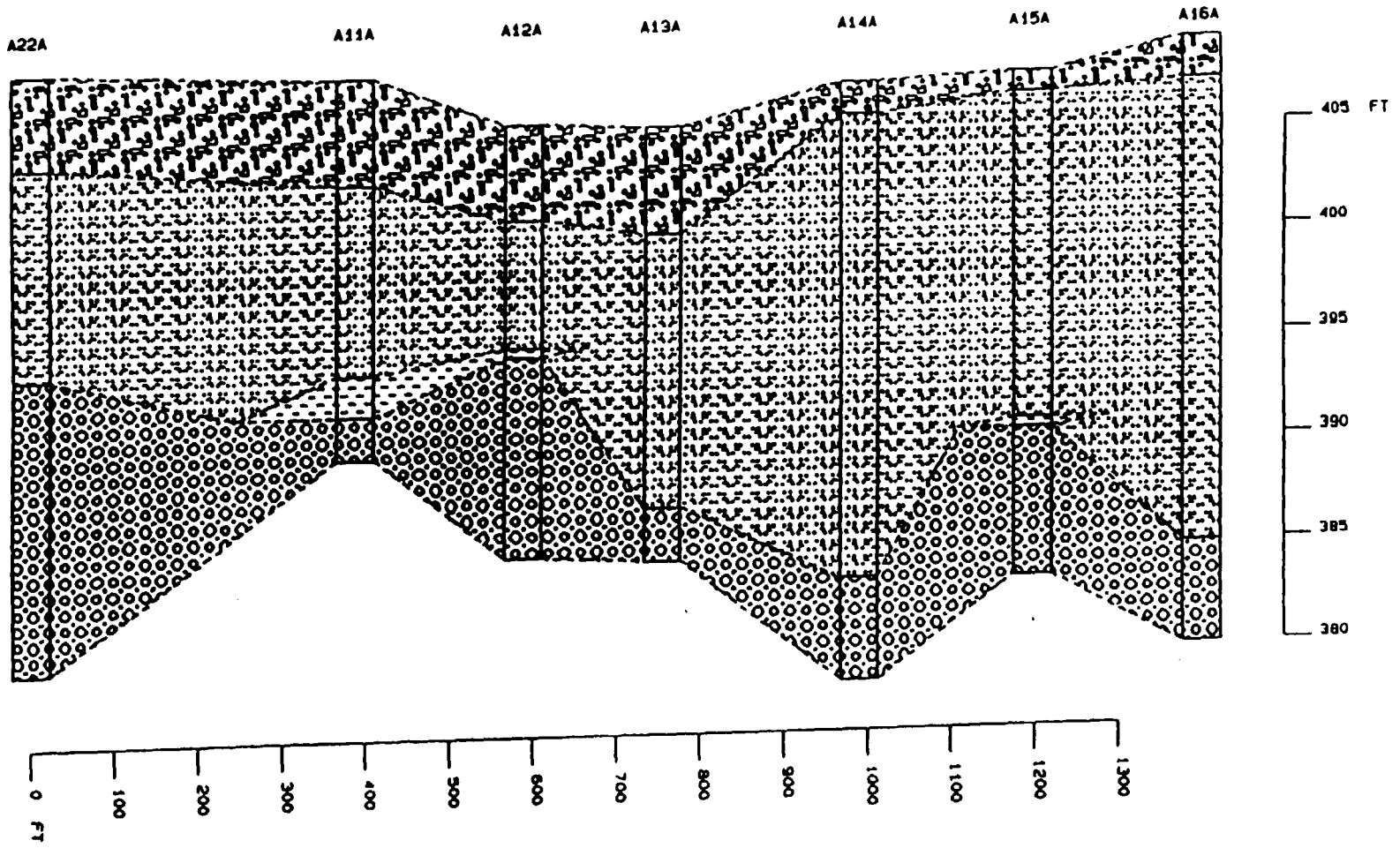
Figure 25

THE AVENDT GROUP, INC.

3.2.7.2 Longitudinal Sections

See figures on the following pages.

3.2.7.2
LONGITUDINAL SECTIONS



LEGEND

CLAY

HENRY

CAHOKIA

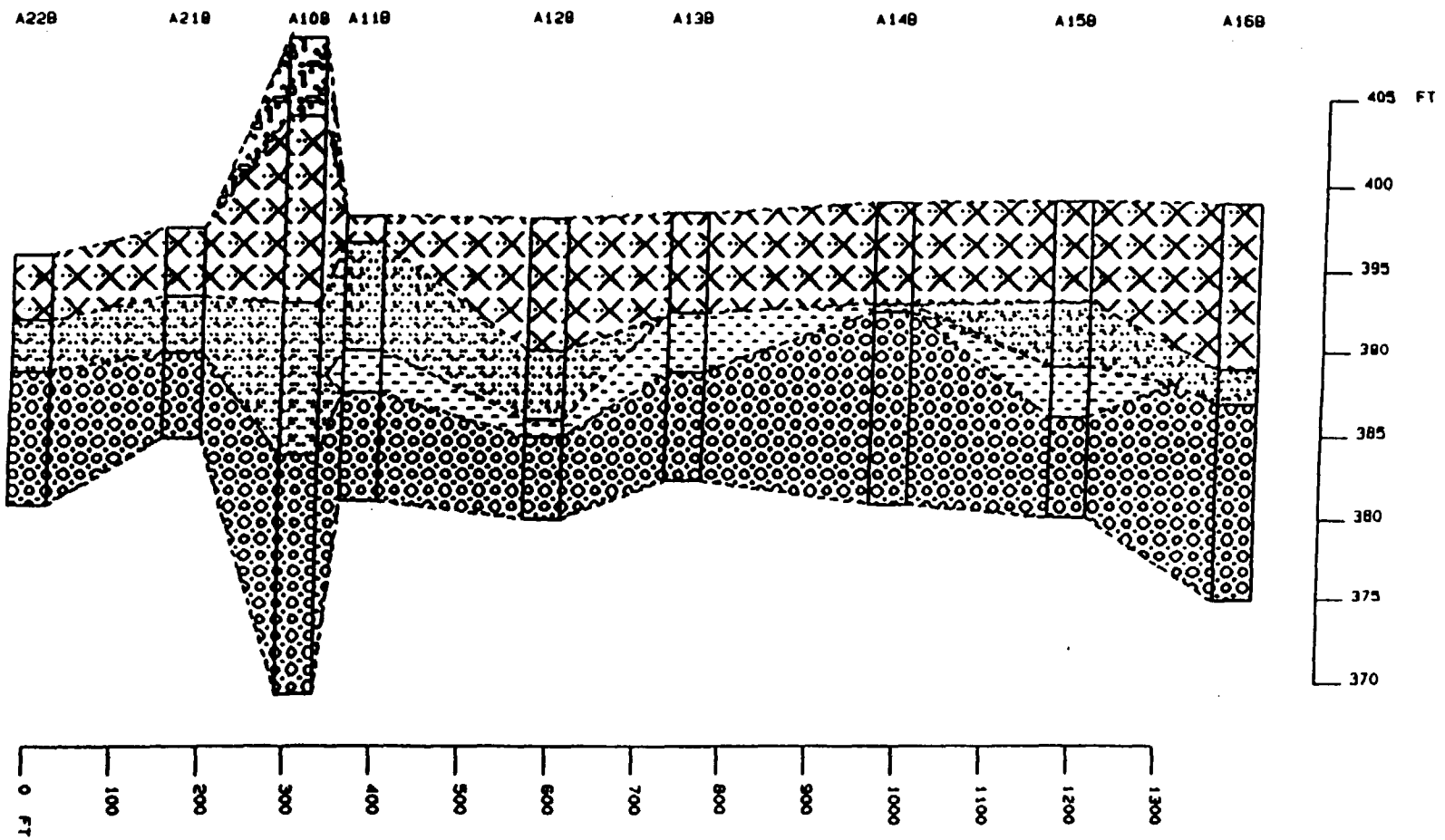
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 26

THE AVENDT GROUP, INC.



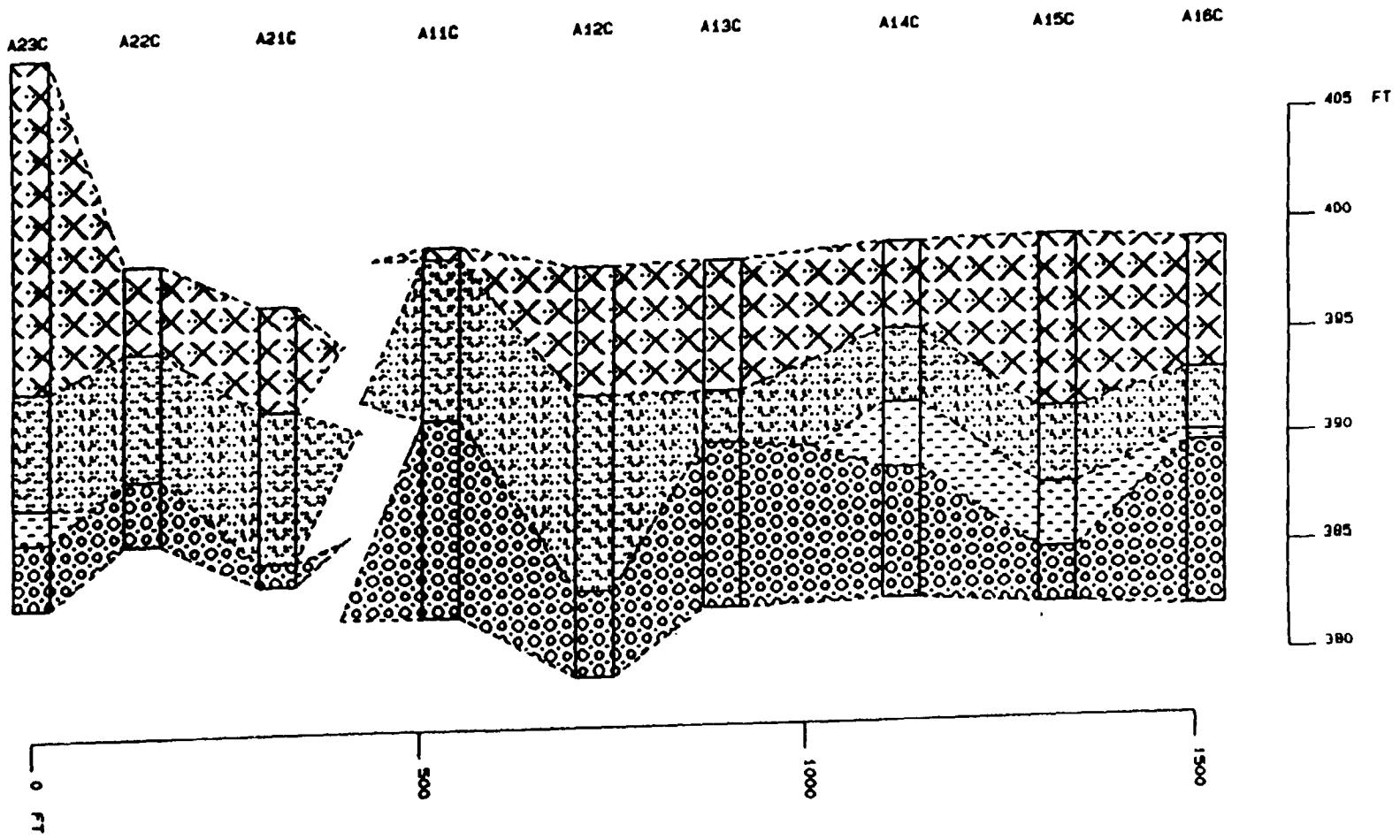
LEGEND

CLAY | HENRY | CAHOKIA | FILL-MATERIAL | CREEK SEDIMENT

CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC.

Figure 27



LEGEND

CLAY

HENRY

CAHOKIA

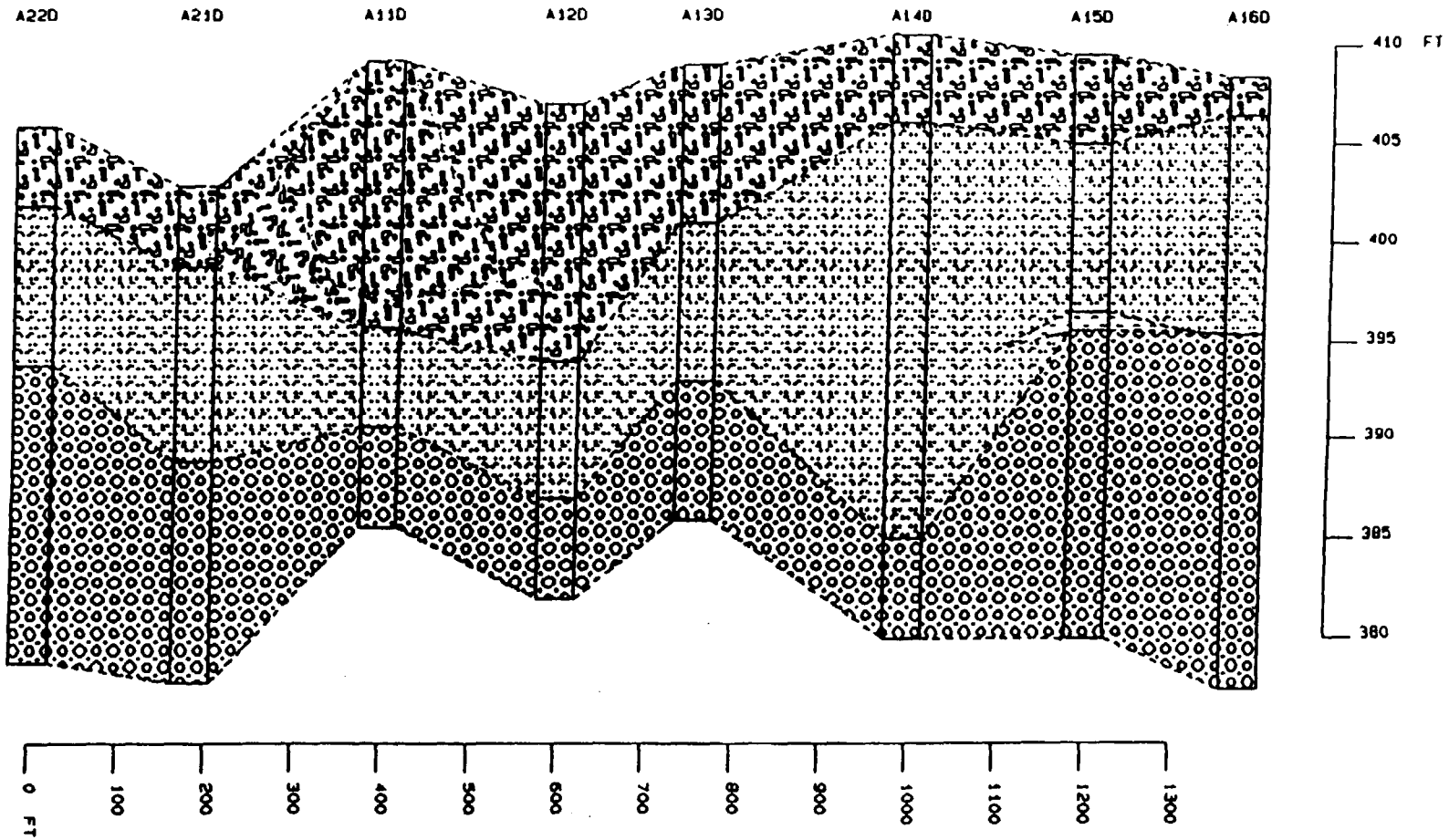
FILL-MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 28

THE AVENOT GROUP, INC.



LEGEND

CLAY | HENRY | CAHOKIA | FILL-MATERIAL | CREEK SEDIMENT

CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC.

Figure 29

3.2.7.3 Sediment Volume Determination and Physical Characteristics

It is estimated that there are nearly 19,500 cubic yards of bottom sediments in the Dead Creek Channel. The estimated volume of sediments was derived by subdividing the creek into eight discrete zones (Figure 17), measuring the width and length of each zone, and determining the average depth of the creek sediments in each zone. The volume of sediments in each zone was calculated and added together to determine the total volume of creek bottom sediments in the creek channel (Table 1).

The physical characteristics of the creek bottom sediments were characterized for the percent solids, water, ash and volatile content of the sediments, and are summarized in Table 2. The percent solids ranged from 12.2 to 72.9, and averaged 39.85 percent. The standard deviation for percent solids was 19.37. The percent water ranged from 27.1 to 87.8, and averaged 60.15 percent. The standard deviation for percent water was 19.63. The percent ash ranged from 75.3 to 94.9, and averaged 87.91 percent. The standard deviation for percent ash was 5.22. The percent volatiles ranged from 5.1 to 24.7, and averaged 12.10 percent. The standard deviation for percent volatiles was 5.75.

Review of the physical characteristics data indicates that the creek bottom sediments are relatively wet with a low total volatile organic content.

TABLE 1

CREEK SEGMENT A SEDIMENT VOLUME

Zone	Average Dimensions	(Feet)	Estimated Volume (Cubic Feet)	Estimated Volume (Cubic Yards)
I	Width	60		
	Length	127	7,620	282
	Depth	1		
II	Width	66		
	Length	182	84,084	3,114
	Depth	7		
III	Width	61		
	Length	190	69,540	2,576
	Depth	6		
IV	Width	59		
	Length	223	65,785	2,436
	Depth	5		
V	Width	63		
	Length	201	88,641	3,283
	Depth	7		
VI	Width	67		
	Length	251	134,536	4,983
	Depth	8		
VII	Width	46		
	Length	156	28,704	1,063
	Depth	4		
VIII	Width	54		
	Length	189	45,927	1,701
	Depth	4.5		
Estimated Volume of Total Creek Sediment			524,837 cubic feet	19,438 cubic yards

TABLE 2

PHYSICAL CHARACTERISTICS
OF THE
CREEK SEGMENT A BOTTOM SEDIMENTS

SAMPLE	% Solids	% Water	% Ash*	% Volatile*
A12B 3 -7	12.2	87.8	89.0	11.0
A12C 4 -9	55.8	44.2	91.7	8.3
A13B 4.5-6	32.9	67.1	86.1	13.9
A13C 4 -8.5	41.0	59.0	91.3	8.7
A14B 4 -8.5	59.9	40.1	94.3	5.7
A14C 4 -8.5	23.1	76.9	87.2	12.8
A15C 4.5 -9	26.0	74.0	85.4	14.6
A16B 9 -12	23.5	76.5	75.3	24.7
A16C 2 -5	20.2	79.8	84.6	15.4
A21B 1 -6	40.3	59.7	80.6	19.4
A22B 0 -7	72.9	27.1	94.7	5.3
A22C 3 -9	70.4	29.6	94.9	5.1
Average	39.85	60.15	87.91	12.10
Standard Deviation	19.37	19.63	5.22	5.75

*Based on Dry Weight

3.3 Work Performed by Patterson Schafer, Inc.

3.3.1 Objectives

The overall purpose of the work being performed by Patterson Schafer, Inc., is to intercept and reroute all flows going to and from CS-A. The major objectives to accomplish this removal of flows were:

1) Intercept the stormwater presently discharged to CS-A and deliver the stormwater at a controlled rate to the Village of Sauget's combined sewerage system.

2) Design a new process water pumping station and system to provide a more controllable and measurable flow rate to the Village's sewerage system. This includes the prevention of any overflows into CS-A during overloads or power failures.

3) Seal the overflow opening of the Village of Sauget's sewer manhole near the north end of CS-A to prevent sanitary or combined sanitary/industrial wastewater from entering the creek via this route. (The Village of Sauget has already performed this task.)

4) Seal the north outfall of CS-A to prevent backflow of combined sanitary industrial wastes into the creek. This will be the final element of the project.

3.3.2 Description

The previous objectives are being accomplished through the construction of stormwater management facilities on Cerro Copper Products Co. property (Plate 3). This included a stormwater interceptor sewer system; junction manholes; a stormwater detention basin, including inlet and outlet structures, a stormwater pumping station and associated emergency generator; a force main; and associated piping, connections and appurtenances.

The interceptor sewer system is being constructed along the west side of CS-A. It is approximately 1,577 feet in length, and is constructed of ten-foot wide by five-foot high precast concrete culvert pipe, with walls approximately eight inches thick. The culvert will be three feet below grade along its southern half and approximately six inches below grade along its northern half. The slope of the culvert will drop approximately one foot along its length, from south to north.

Once the waters are transported through the sewer system, they are collected in a stormwater storage basin. Requirements and restrictions concerning the acceptable stormwater discharge rate to the Village sewer system were used in sizing this basin. It is roughly rectangular in shape, with dimensions of 215 feet by 50 feet, and capacity for approximately one million gallons, which includes the entire culvert system. The basin walls will be constructed of reinforced concrete, one foot thick, and the floor will be one and one-half feet thick. The basin is approximately five feet deep, with six inches above surface grade. The bottom slopes towards CS-A.

Flow into the basin will be controlled by gravity, and effluent from the storage basin will be controlled by a new pumping station. This station will prevent any overflows into CS-A. An emergency power generator will be provided in case of power failures.

The inlet to the Village's sewerage system will be modified to include "hardpiping" the 12-inch force main directly to the Village's sewerage system. This eliminates the use of the junction chamber and prevents any back flow into CS-A. All work is scheduled for completion by May 7, 1990.

4.0 CHEMICAL CHARACTERIZATION

4.1 Sample Testing Summary and Explanation

The major objectives of the sampling and analysis rationale were the characterization and definition of hazardous constituents in CS-A, and their spatial distribution. To accomplish these objectives, CS-A was divided into two sections and characterized by collecting 99 samples through a network of 34 sediment/soil borings distributed on ten east-west transverses across CS-A. Characterization of CS-A was accomplished in a representative manner through various chemical analyses of samples from each boring and transverse. The chemical characterization of the samples included analysis for the following:

- Appendix IX Compounds
- Polychlorinated Biphenyls (PCBs)
- PCB Precursors
- EP Toxic Metals
- EP Toxic Pesticides and Herbicides
- HSL Total Metals
- Flash Point
- Reactivity
- pH

Table 3 indicates the type of analysis performed on each sample, the date that the sample was collected, and the sample number. The sampling program began July 5, 1989, and continued through July 21, 1989.

Fourteen (14) samples were analyzed for Appendix IX Compounds. The sampling and analysis rationale indicates there would be one Appendix IX analysis per transverse. However, an additional Appendix IX analysis was performed on transverses A11, A12, A15 and A16. These four additional analyses were based on field monitoring. Two additional Appendix IX analyses were also performed on transverse A10 and A23. These transverses were added to the project as a result of field conditions.

Table 3

CS-A

Sample Testing Summary

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A10B	6-7	7/13/89		XXX	XXX							
A10B	9-10	7/13/89		XXX	XXX							
A10B	15-17	7/13/89	XXX	XXX	...	...	XXX	XXX	XXX	XXX	XXX	XXX
A10B	20-22	7/13-89		XXX	XXX							
A10B	24-29	7/13/89		XXX	XXX							
A10B	37-38	7/13/89		XXX	XXX							
A11A	8-13	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX			
A11A	13-18	7/19/89		XXX	XXX							
A11B	4-8	7/18/89	XXX	XXX	...	...	XXX	XXX	XXX	XXX	XXX	XXX
A11B	8.1-10.6	7/18/89		XXX	XXX							
A11B	12-17	7/18/89		XXX	XXX							
A11C	2-6/5	7/18/89	XXX	XXX	...	...	XXX	XXX	XXX	XXX	XXX	XXX
A11C	6.5-10.5	7/18/89		XXX	XXX							
A11C	12.5-16.5	7/18/89		XXX	XXX							
A11D	8-10	7/18/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A11D	18.5-23.5	7/18.89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A12A	8-11	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX			
A12A	11-20.5	7/19/89		XXX	XXX							
A12B	3-7	7/13/89	XXX	XXX	...	...	XXX			XXX	XXX	XXX
A12B	9-12	7/13/89		XXX	XXX							
A12B	14-17	7/13/89		XXX	XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A12B	17-19	7/13/89		XXX	XXX							
A12C	14-16	7/12/89			XXX		XXX					
A12C	10-13	7/12/89			XXX		XXX					
A12C	4-9	7/12/89	XXX		•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A12D	6-13	7/18/89		XXX	XXX							
A12D	17-20	7/18/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A12D	20-25	7/18/89		XXX	XXX							
A13A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A13A	14-19	7/20/89		XXX	XXX							
A13A	19-20.5	7/20/89		XXX	XXX							
A13B	4.5-6.0	7/11/89	XXX		•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A13B	6-9.5	7/11/89			XXX							
A13B	9.5-12	7/11/89			XXX							
A13C	13-16	7/12/89			XXX		XXX					
A13C	6-13	7/12/89			XXX		XXX					
A13C	4-8.5	7/12/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A13D	18-23	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14A	4-9	7/20/89		XXX	XXX	XXX	XXX	XXX	XXX			
A14A	13.5-23.5	7/20/89		XXX	XXX							
A14A	23.5-28.5	7/20/89		XXX	XXX							
A14B	4-8.5	7/11/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14B	8.5-13	7/11/89			XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A14C	4-8.5	7/11/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14C	8.5-10.5	7/11/89	XXX		...	...						
A14C	13.5-16.5	7/11/89			XXX							
A14C	9-14	7/11/89			XXX		XXX					
A14D	10-14	7/12/89			XXX	XXX	XXX			XXX	XXX	XXX
A14D	15-19	7/12/89			XXX							
A14D	24-29	7/12/89			XXX							
A15A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A15A	14-19	7/20/89		XXX	XXX							
A15A	19-24	7/20/89		XXX	XXX							
A15B	6-9	7/7/89	XXX		...	...	XXX			XXX	XXX	XXX
A15B	13-16	7/7/89			XXX	XXX	XXX	XXX	XXX			
A15B	16-19	7/7/89			XXX							
A15C	4.5-9	7/7/89	XXX		...	...	XXX	XXX	XXX	XXX	XXX	XXX
A15C	9.5-14.5	7/10/89			XXX							
A15C	14.5-17.5	7/10/89			XXX							
A15D	4-9	7/12/89			XXX	XXX	XXX			XXX	XXX	XXX
A15D	12-14	7/2/89			XXX							
A15D	19-24	7/12/89			XXX							
A15D	24-29	7/12/89			XXX							
A16A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A16A	14-19	7/20/89		XXX	XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A16A	24-29	7/20/89		XXX	XXX							
A16B	9-12	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A16B	14-19	7/18/89		XXX	XXX							
A16C	2-5	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A16C	7-12	7/18/89		XXX	XXX							
A16C	12-17	7/18/89		XXX	XXX							
A16D	13-18	7/20/89		XXX	XXX							
A16D	18-23	7/20/89		XXX	XXX							
A16D	23-31	7/20/89		XXX	XXX							
A16E	13-18	7/20/89		XXX	XXX		XXX	XXX	XXX			
A16E	18-23	7/20/89		XXX	XXX							
A16E	25.5-28	7/20/89		XXX	XXX							
A21B	1-6	7/17/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A21B	6-10	7/17/89		XXX	XXX							
A21B	10-13	7/17/89		XXX	XXX							
A21C	4-8	7/14/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A21C	8-11	7/14/89		XXX	XXX							
A21C	13-14.5	7/14/89		XXX	XXX							
A21D	4-9	7/10/89			XXX							
A21D	9-14	7/10/89			XXX							
A21D	14-19	7/10/89			XXX	XXX	XXX	XXX	XXX			
A22A	19-22	7/11/89			XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A22A	24-28	7/11/89			XXX							
A22B	0-7	7/17/89	XXX	XXX	***	***	XXX	XXX	XXX	XXX	XXX	XXX
A22B	7-13	7/17/89		XXX	XXX							
A22C	3-9	7/17/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A22C	10-15	7/17/89		XXX	XXX							
A22D	4-9	7/11/89			XXX							
A22D	9-14	7/11/89			XXX							
A22D	24-27	7/11/89			XXX							
A23C	12-13	7/14/89		XXX	XXX							
A23C	13-19	7/14/98		XXX	XXX							
A23C	19-20	7/14/89	XXX	XXX	***	***	XXX	XXX	XXX	XXX	XXX	XXX
A23C	21-23	7/14/89		XXX	XXX							

*** Included in the Appendix IX Parameter Lists

Pre : indicates PCB precursor analysis

All samples taken during the investigation were analyzed for Polychlorinated Biphenyls (PCBs). This resulted in a total of ninety-nine (99) samples being analyzed for PCBs. Furthermore, sixty-three (63) of these samples were also analyzed for characteristic PCB Precursors.

- Biphenyl
- Chlorobiphenyl
- Dichlorobiphenyl
- Trichlorobiphenyl
- Tetrachlorobiphenyl
- Pentachlorobiphenyl
- Hexachlorobiphenyl
- Decachlorobiphenyl

Thirty-nine (39) samples were analyzed for the eight RCRA metals using the EP Toxicity Test. The eight RCRA metals consisted of Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Silver (Ag) and Selenium (Se). According to the sampling and analysis rationale, a sample for EP Toxicity was to be taken from each boring. However, five additional EP Toxicity tests were performed based on sample appearance in the field. These five additional tests were performed on borings A12C (two samples), A13C (two samples), and A11D. Twenty-nine (29) samples were analyzed for herbicides and pesticides using the EP Toxicity Test.

Thirty (30) samples were characterized for the HSL Total Metals concentrations. The sampling and analysis rationale indicates that one HSL Total Metals analysis was to have been analyzed in each boring. However, no HSL Total Metals analyses were performed on any sample from borings A13A, A15A, A16A, A16D, A16E, A22A and A22D. This was based on sample appearance in the field.

Twenty-four (24) samples were analyzed for the characteristics of ignitability, reactivity and corrosivity.

4.2 PCB/PCB Precursor Analysis

4.2.1 PCB Analysis

Ninety-nine samples were analyzed for PCB concentrations using SW-846, Method 8080. Review of the analytical results indicate that Aroclor-1221, Aroclor-1232, Aroclor-1248, Aroclor-1254, and Aroclor-1260 were detected in CS-A (Table 4). The highest concentrations of PCBs are located at the north end of CS-A1 or along transverse A16 (Figures 30 & 31). Further review of the PCB data indicates that the PCB concentration in the creek sediments decreases south along the creek except for the A13 transverse where PCB levels increase slightly (Figure 31).

4.2.2 PCB Precursor Analysis

Sixty-three samples were analyzed for the PCB precursors, using SW-846, Method 8270. The compounds analyzed were biphenyl, chlorobiphenyl, dichlorobiphenyl, trichlorobiphenyl, tetrachlorobiphenyl, pentachlorobiphenyl, hexachlorobiphenyl, and decachlorobiphenyl (Table 5). Laboratory reports for these precursors list results described by a "J," which indicates that an estimated value for either a TIC or an analyte that meets the identification criteria but the result is less than the specified detection limit. The distribution of biphenyl followed a similar concentration trend as the PCBs in the creek sediment/soil analysis. The concentrations were highest at the north end of the creek and generally decreased toward the south end of the creek (Figures 32 & 33). The estimated biphenyl concentrations ranged from non-detect (N/D) to 24 mg/kg (Table 5).

Table 4

CS - A

PCB Analysis (ppb)

Sample I.D.		Date	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
A10	6-7	07/13	ND	ND	ND	ND	ND	ND	ND
A10	9-10	07/13	ND	ND	ND	ND	ND	ND	ND
A10	15-17		ND	ND	ND	ND	ND	480	ND
A10	20-22	07/13	ND	ND	ND	ND	ND	1400	ND
A10	24-29	07/13	ND	10000	ND	ND	ND	4300	ND
A10	37-38	07/13	ND	3200	ND	ND	ND	880	ND
A11A	8-13	07/19	ND	ND	ND	ND	ND	0.00	ND
A11A	13-18	07/19	ND	ND	ND	ND	ND	ND	ND
A11B	4-8		ND	ND	ND	ND	ND	530	ND
A11B	8.1-10.6	07/18	ND	ND	ND	ND	ND	210	ND
A11B	12-17	07/18	ND	ND	ND	ND	ND	920	ND
A11C	2-6.5		ND	ND	45000	ND	ND	10000	ND
A11C	6.5-10.5	07/18	ND	ND	ND	ND	ND	13000	ND
A11C	12.5-16.5	7/18	ND	ND	ND	ND	ND	1300	ND
A11D	8-10	07/18	ND	ND	ND	ND	ND	ND	ND
A11D	18.5-23.5	7/18	ND	ND	ND	ND	ND	ND	38000
A12A	8-11	07/19	ND	ND	ND	ND	ND	ND	ND
A12A	11-20.5	07/19	ND	ND	ND	ND	ND	67	ND
A12B	3-7		ND	ND	32000	ND	ND	ND	ND
A12B	9-12	07/13	ND	13000	ND	ND	ND	830	ND
A12B	14-17	07/13	ND	ND	ND	ND	ND	ND	ND
A12B	17-19	07/13	ND	ND	ND	ND	ND	270	ND
A12C	4-9		ND	ND	ND	ND	ND	ND	ND
A12C	10-13	07/12	ND	ND	ND	ND	ND	ND	ND
A12C	14-16	07/12	ND	ND	ND	ND	ND	ND	ND
A12D	6-13	07/18	ND	ND	ND	ND	ND	530000	ND
A12D	17-20	07/18	ND	ND	ND	ND	29000	ND	72000
A12D	20-25	07/18	ND	ND	ND	ND	6700	ND	9100
A13A	9-14	07/20	ND	ND	ND	ND	ND	ND	ND
A13A	14-19	07/20	ND	ND	ND	ND	ND	ND	ND
A13A	19-20.5	07/20	ND	ND	ND	ND	ND	ND	ND
A13B	4.5-6		ND	ND	340000	ND	ND	100000	ND
A13B	6-9.5	07/11	ND	ND	32000	ND	ND	18000	ND
A13B	9.5-12	07/11	ND	1900	ND	ND	ND	350	ND
A13C	4-8.5	07/12	ND	780000	ND	ND	ND	130000	ND
A13C	6-13	07/12	ND	20000	ND	ND	ND	5500	ND
A13C	13-16	07/12	ND	ND	ND	ND	ND	ND	ND
A13D	18-23	07/19	ND	ND	ND	ND	ND	670	630
A14A	4-9	07/20	ND	ND	ND	ND	ND	99	ND
A14A	13.5-23.5	7/20	ND	ND	ND	ND	ND	62	ND
A14A	23.5-28.5	7/20	ND	ND	ND	ND	ND	ND	ND
A14B	4-8.5	07/11	ND	100000	ND	ND	ND	14000	ND
A14B	8.5-13	07/11	ND	5200	ND	ND	ND	1100	ND
A14C	4-8.5	07/11	ND	190000	ND	ND	ND	350000	ND
A14C	8.5-10.5		ND	ND	1700	ND	ND	520	ND
A14C	13.5-16.5	07/11	ND	5200	ND	ND	ND	1000	ND
A14D	10-14	07/12	ND	ND	ND	ND	ND	ND	ND
A14D	15-19	07/12	ND	ND	ND	ND	ND	ND	ND
A14D	24-29	07/12	ND	ND	ND	ND	ND	ND	ND

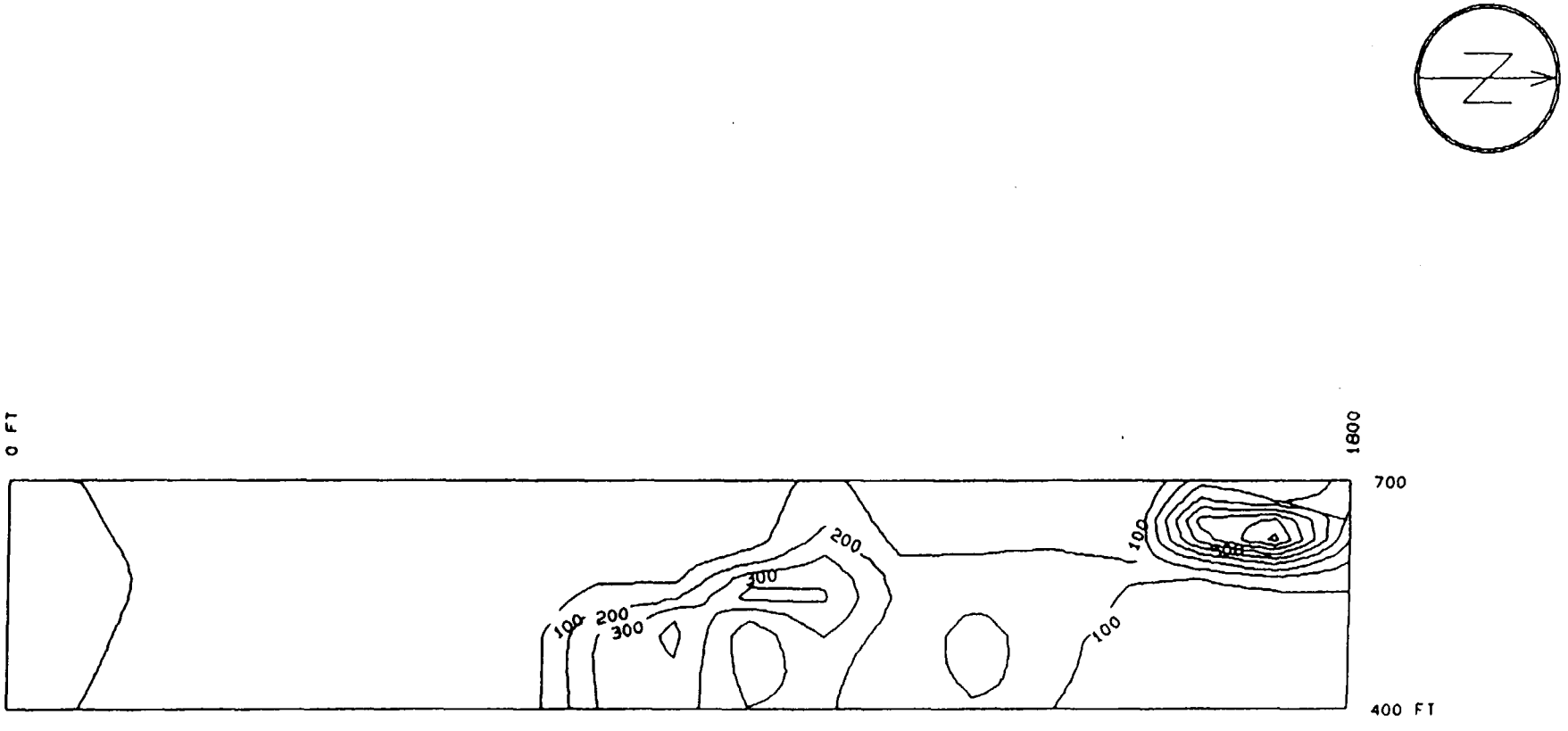
Table 4
(Cont.)

Sample I.D.	Date	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
A15B 6-9		ND	ND	3700	ND	ND	ND	ND
A15B 13-16	07/07	ND	ND	7200	ND	ND	1800	ND
A15B 16-19	07/07	ND	ND	ND	ND	ND	ND	ND
A15C 4.5-9		ND	ND	300000	ND	ND	68000	ND
A15C 9.5-14.5	07/10	ND	1500	ND	ND	ND	160	ND
A15C 14.5-17.5	07/10	ND	15000	ND	ND	ND	2300	ND
A15D 4-9	07/12	ND	ND	ND	ND	ND	ND	ND
A15D 12-14	07/12	ND	ND	ND	ND	ND	ND	ND
A15D 19-24	07/12	ND	ND	ND	ND	ND	ND	ND
A15D 24-29	07/12	ND	ND	ND	ND	ND	ND	ND
A16A 9-14	07/20	ND	ND	ND	ND	ND	ND	ND
A16A 14-19	07/20	ND	ND	ND	ND	ND	2100	860
A16A 24-29	07/20	ND	ND	ND	ND	ND	ND	ND
A16B 9-12		ND	ND	1600000	ND	ND	ND	ND
A16B 14-19	07/18	ND	ND	ND	5400	ND	ND	ND
A16C 2-5		ND	ND	ND	ND	BDL	ND	ND
A16C 7-12	07/18	ND	ND	ND	13000	ND	ND	ND
A16C 12-17	07/18	ND	ND	ND	1100	ND	450	ND
A16D 13-18	07/20	ND	ND	ND	ND	ND	ND	ND
A16D 18-23	07/20	ND	ND	ND	ND	ND	90	ND
A16D 23-31	07/20	ND	ND	ND	ND	ND	ND	ND
A16E 13-18	07/20	ND	ND	ND	ND	520	290	ND
A16E 18-23	07/20	ND	ND	ND	ND	1300	690	ND
A16E 25.5-28	07/20	ND	ND	ND	ND	550	400	ND
A21B 1-6	07/17	ND	ND	ND	ND	ND	ND	27000
A21B 6-10	07/17	ND	ND	ND	ND	ND	200	ND
A21B 10-13	07/17	ND	ND	ND	ND	ND	ND	ND
A21C 4-8		ND	ND	ND	ND	ND	ND	30000
A21C 8-11	07/14	ND	ND	ND	ND	ND	ND	ND
A21C 13-14.5	07/14	ND	ND	ND	ND	ND	ND	ND
A21D 4-9	07/10	ND	ND	ND	ND	ND	90	ND
A21D 9-14	07/10	ND	ND	ND	ND	ND	150	ND
A21D 14-19	07/10	ND	ND	ND	ND	ND	ND	ND
A22A 9-14	07/11	ND	ND	ND	ND	ND	ND	ND
A22A 19-22	07/11	ND	ND	ND	ND	ND	ND	ND
A22A 24-28	07/11	ND	ND	ND	ND	ND	ND	ND
A22B 0-7		ND	ND	ND	ND	120000	ND	ND
A22B 7-13	07/17	ND	ND	ND	ND	ND	ND	ND
A22C 3-9	07/17	ND	ND	ND	ND	ND	19000	ND
A22C 10-15	07/17	ND	ND	ND	ND	ND	ND	ND
A22D 4-9	07/11	ND	ND	ND	ND	ND	ND	12000
A22D 9-14	07/11	ND	ND	ND	ND	ND	ND	ND
A22D 24-27	07/11	ND	ND	ND	ND	ND	ND	ND
A23A 12-13	07/14	ND	ND	ND	ND	3300	ND	690
A23A 13-19	07/14	ND	ND	ND	ND	5700	ND	1200
A23A 19-20		ND	ND	ND	ND	150000	ND	ND
A23A 21-23	07/14	ND	ND	ND	ND	1600	ND	ND

** units : ug/kg **

4.2.3 Contour Maps - PCB/Biphenyls

See Figures on the following pages.



CS - A
PCB's Greatest Concentrations

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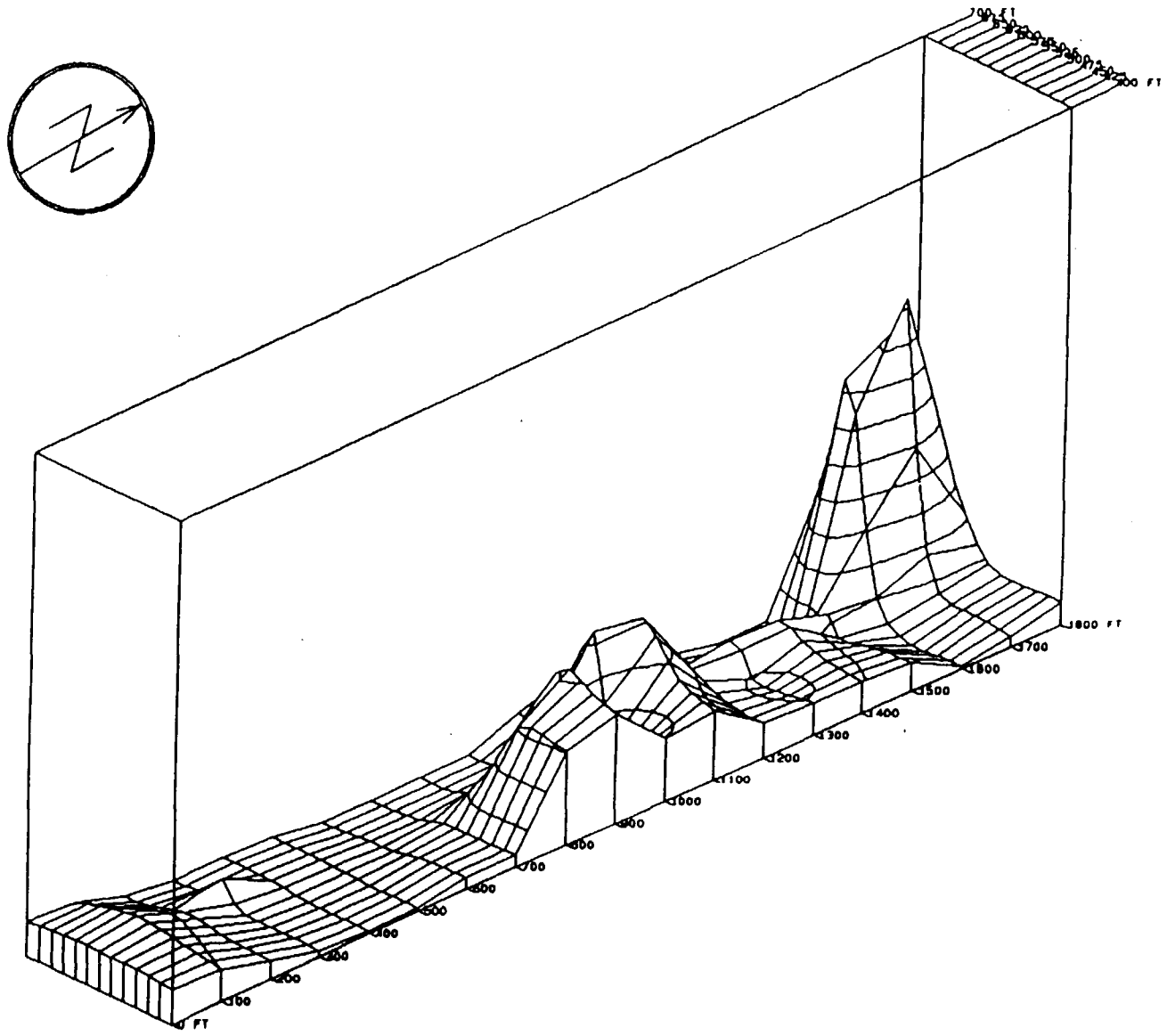
Figure 30



CS - A
PCB's Greatest Concentrations

X, Y, Z=1, 1, 1

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Figure 31

Table 5

CS - A

PCB Precursor Concentrations

Sample:	A11b	A11b	A11b	A11c	A11c	A11c	A11d	A12a	A12d	A12d	A12d	A16a	A16b	A16b	A16c	A16c	A16d	A16d	A16e	A16e	A16e
Depth:	4-8	8.1-10.6	12-17	2-6.5	6.5-10.5	12.5-16.5	18.5-23.5	18-23	6-13	17-20	20-25	14-19	9-12	14-19	2-5	7-12	18-23	23-31	13-18	18-23	25.5-28
Compounds:																					
Biphenyl	6.6 J	1.5 J	0.2	5.2 J	BDL	BDL	BDL	BDL	BDL	0.3	0.04	BDL	8.3 J	1.0 J	24.0 J	1.2 J	0.02	BDL	BDL	BDL	BDL
Chlorobiphenyl	BDL	BDL	BDL	0.9 J	BDL	BDL	BDL	0.04	3.6 J	0.03	0.04	BDL	1.8 J	0.3 J	6.0 J	0.4 J	BDL	BDL	BDL	BDL	BDL
Dichlorobiphenyl	BDL	BDL	BDL	1.5 J	BDL	BDL	BDL	BDL	35.0 J	0.3	0.06	BDL	5.3 J	0.7 J	26.0 J	0.8 J	0.03	BDL	BDL	BDL	BDL
Trichlorobiphenyl	BDL	BDL	BDL	0.2 J	BDL	BDL	BDL	BDL	60.0 J	0.7	0.2	0.01	3.8 J	0.5 J	24.0 J	0.7 J	0.04	BDL	BDL	0.02	0.03
Tetrachlorobiphenyl	BDL	BDL	0.01	0.1 J	0.3 J	BDL	0.5	0.01	75.0 J	1.0	0.3	0.06	4.3 J	0.3 J	21.0 J	0.4 J	0.06	0.02	0.04	0.09	0.10
Pentachlorobiphenyl	BDL	BDL	0.04	0.1 J	0.9 J	0.03	1.3	0.02	69.0 J	1.0	0.3	0.13	BDL	0.2 J	8.6 J	BDL	0.10	0.02	BDL	0.05	0.03
Hexachlorobiphenyl	BDL	BDL	0.04	BDL	BDL	0.07	3.8	0.05	210.0 J	2.3	0.7	0.12	BDL	0.08 J	BDL	BDL	0.23	BDL	BDL	BDL	BDL
Decachlorobiphenyl	BDL	BDL	BDL	BDL	BDL	BDL	3.0	BDL	BDL	BDL	BDL	0.09	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

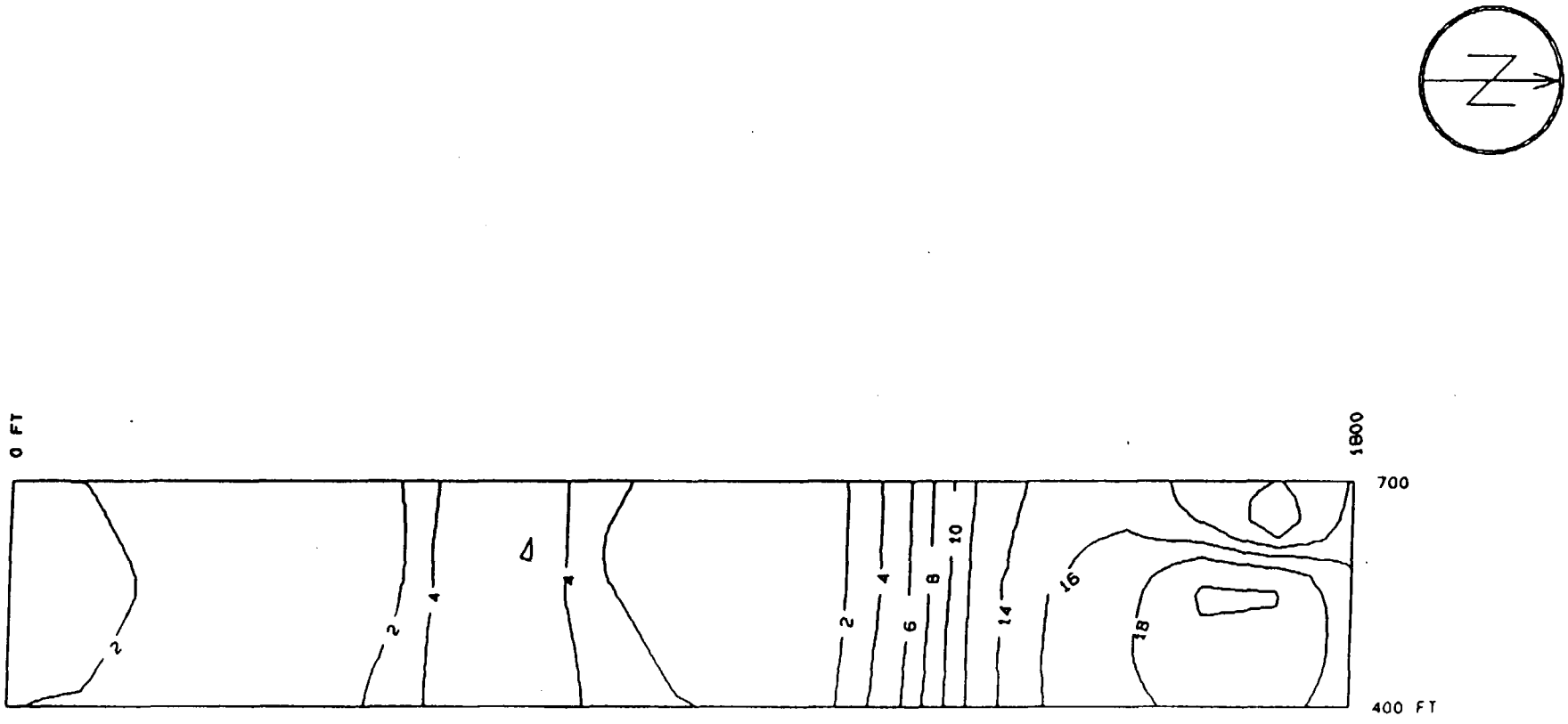
Units: Mg/Kg

J = Indicates a positive identification of the compound, however the concentration is an estimated value.

BDL = Below detection limits

** The following samples showed BDL readings for all precursor parameters:

A10 6-7; A10 9-10; A10 15-17; A11a 13-18; A11a 8-13; A11d 8-10; A12a 8-11; A12a 11-20.5; A12a 18-23; A12b 3-7 A12b 9-12; A12b 14-17; A12b 17-19; A13a 9-14; A13a 14-19; A13a 19-20.5; A14a 4-9; A14a 13.5-23.5; A14a 23.5-28.5 A15a 9-14; A15a 14-19; A15a 19-24; A16a 9-14; A16a 24-29; A16c 12-17; A16d 13-18; A16d 18-23; A16e 25.5-28; A21b 6-10; A21b 10-13; A21c 4-8; A21c 8-11; A21c 13-14.5; A22b 7-13; A22c 10-15



CS - A
Biphenyl Concentrations

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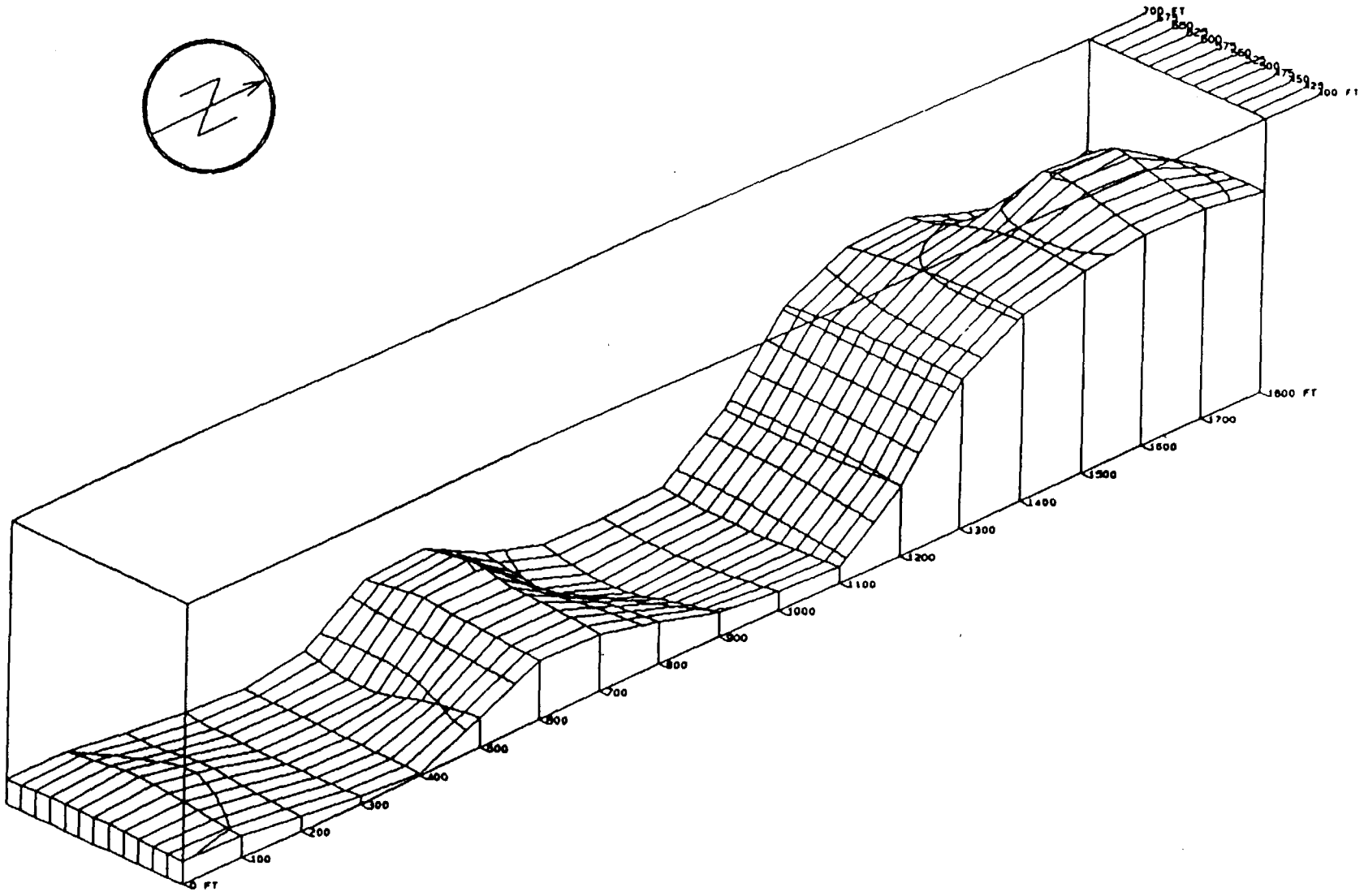
Figure 32



CS - A
Biphenyl Concentrations

X, Y, Z=1: 1: 30

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Figure 33

4.3 Extraction Procedure Toxicity Test (EP Tox)

There were 39 samples characterized for the eight RCRA metals through the EP Toxicity test, SW-846 Method 1310. The eight RCRA metals consisted of Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Silver (Ag), and Selenium (Se). The sampling and analysis rationale indicated that one sample from each boring would be analyzed for EP Toxicity. However, five additional EP Toxicity tests were performed, two in boring A12C, two in boring A13C, and one in boring A11D, based on sample appearance in the field. The pesticides and herbicides were analyzed through the EP Tox procedure.

4.3.1 EP Toxicity Metals Analysis

The method of analyses for the eight RCRA metals were as follows:

Arsenic	SW 846 Method 7061
Barium	SW 846 Method 7080
Cadmium	SW 846 Method 7130
Chromium	SW 846 Method 7190
Lead	SW 846 Method 7420
Mercury	SW 846 Method 7470
Selenium	SW 846 Method 7741
Silver	SW 846 Method 7760

EP Tox analysis was run for the eight (8) EP Tox RCRA metals (Table 6). Laboratory data for arsenic, barium, chromium, mercury, selenium and silver were within allowable EP Tox limits (Table 6). Isolated samples from locations in the southern one-third to one-half of CS-A analyzed for Cd and Pb were above EP Tox values (Table 6; Figures 34 through 37).

Table 6

CS - A

EPTOX Analyses

Sample ID	A10 15-17	A11A 8-13	A11B 4-8	A11C 2-6.5	A11D 8-10	A11D 18.5-23.5	A12A 8-11	A12B 3-7	A12C 4-9	A12C 10-13	A12C 14-16	A12D 17-20	A13B 4.5-6	A13C 4-8.5	A13C 6-13	A13C 13-16	A13D 18-23	A14B 4-8.5	A14C 4-8.5	A14D 10-14	A15B 6-9	A15B 13-16	A15C 4.5-9	A15D 4-9	A16A 9-14	A16B 9-12	A16C 2-5	A16E 13-18	A21B 1-6	A21C 4-8	A21D 14-19	A22A 9-14	A22B 0-7	A22C 3-9	A22D 4-9	A23A 19-20	Maximum Allowable Concentrations
Parameters																																					
Silver	ND	ND	ND	0.024	0.037	0.028	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.032	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.024	5.0
Arsenic	ND	ND	ND	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.018	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND	5.0
Barium	1.3	ND	1.8	1.2	2.6	1.0	1.4	ND	1.0	ND	ND	2.0	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	1.1	ND	ND	ND	1.5	3.3	ND	ND	3.9	1.7	ND	ND	100.0
Cadmium	ND	0.069	ND	0.047	0.018	ND	4	0.057	1.0	0.048	0.32	0.010	2.6	4.0	1.9	ND	0.017	0.47	1.2	ND	0.018	ND	0.74	ND	ND	1.0	0.64	ND	3.4	3.9	ND	ND	0.10	0.011	0.045	0.012	1.0
Chromium	0.024	0.030	ND	ND	0.030	0.022	0.025	ND	ND	ND	ND	ND	ND	ND	0.028	ND	0.025	ND	ND	ND	0.027	ND	ND	0.038	0.044	ND	ND	0.030	0.13	ND	ND	ND	0.60	ND	ND	0.033	5.0
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Lead	0.11	0.069	0.076	0.23	0.33	0.092	0.096	8.4	0.62	ND	ND	0.086	14.6	0.85	ND	ND	0.074	0.31	5.5	0.13	0.14	0.061	0.32	0.13	0.15	4.2	1.8	0.085	35.4	15.6	0.061	0.16	0.68	0.10	0.12	0.17	5.0
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0

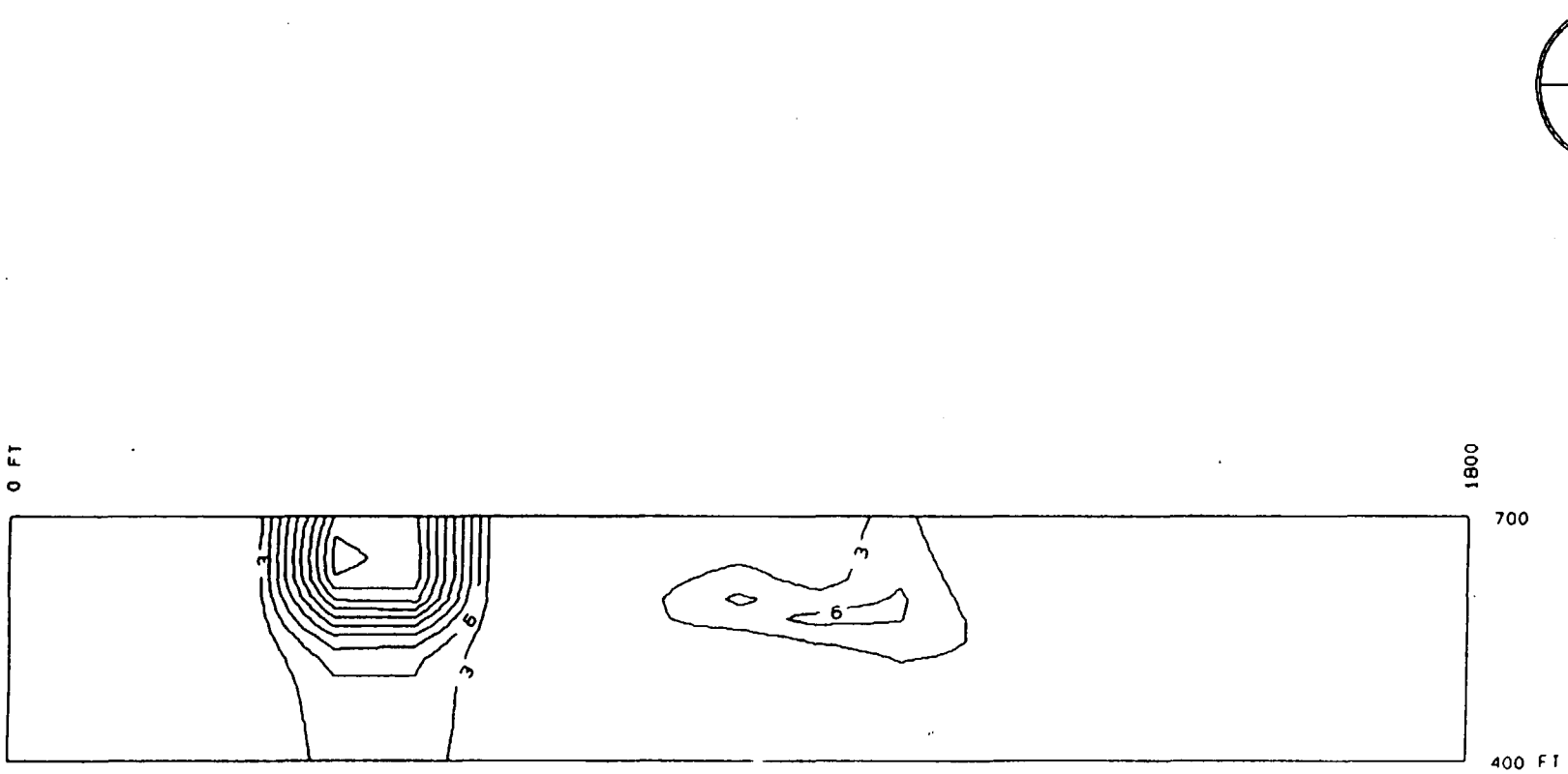
** units : mg/L **

4.3.2 EP Toxicity Pesticides and Herbicides

The EP Toxicity pesticide and herbicide analysis was performed on 29 samples collected from various borings and various boring depths (Table 3). The method for analyses for EP Toxic pesticides was performed using Method SW-846, 8080. The method used in analyzing for herbicides was SW-846, 8150. Results of the pesticide and herbicide analysis were all below the detectable limits.

4.3.3 Contour Maps - EP Tox

See Figures on the following pages.



CS - A
EPTOX: Lead

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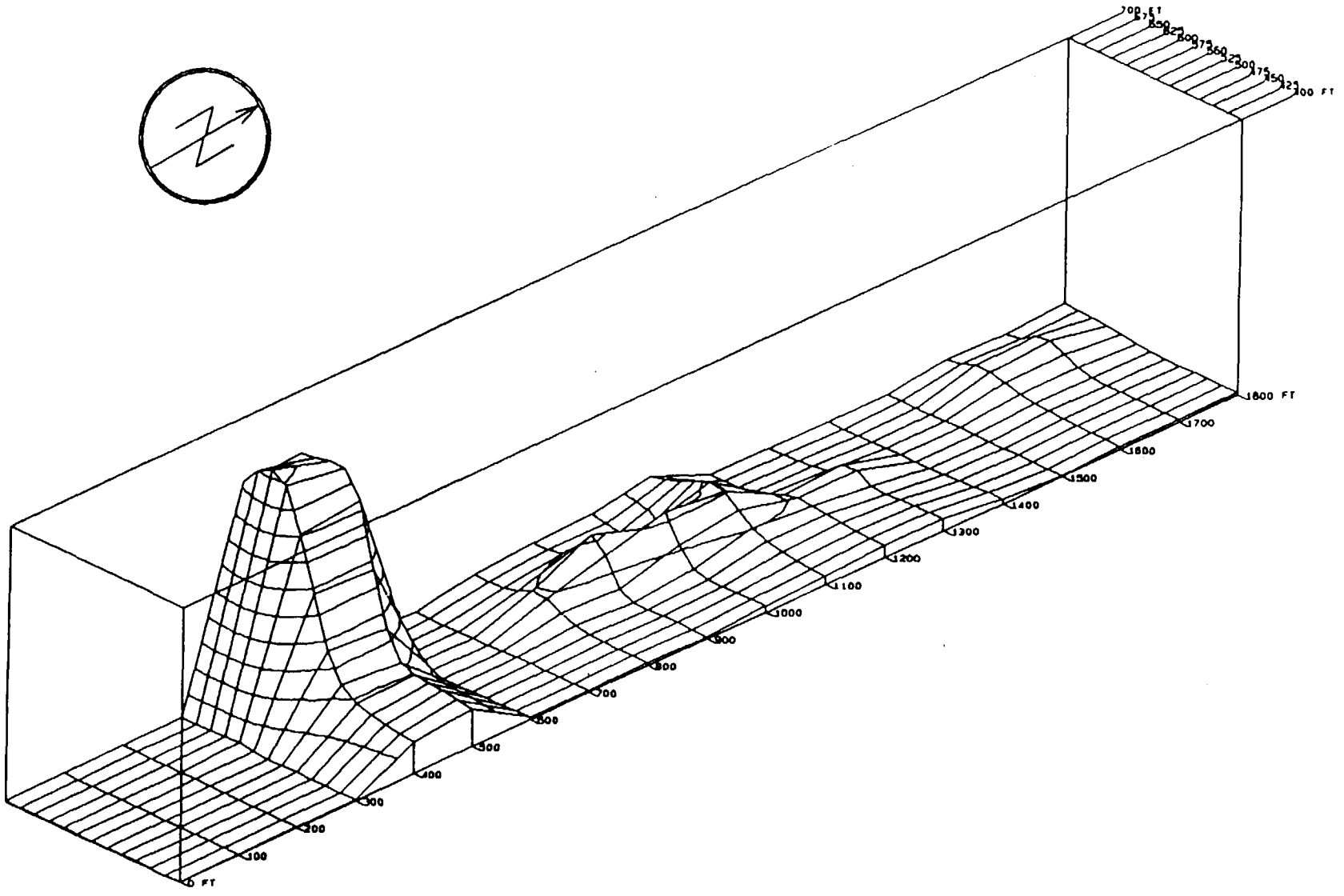
Figure 34



CS - A
EPTOX: Lead

X, Y: Z=1: 1: 20

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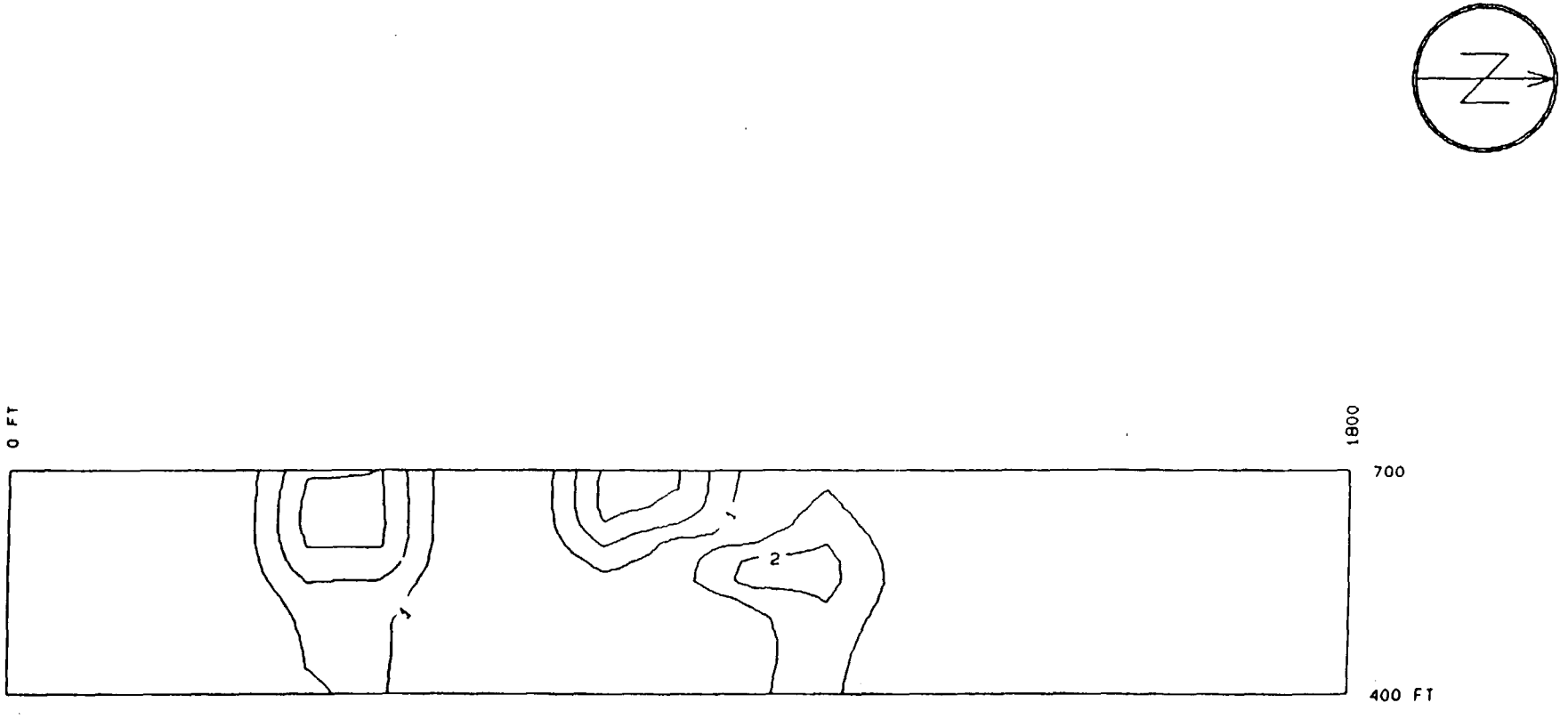
Figure 35



CS - A
EPTOX: Cadmium

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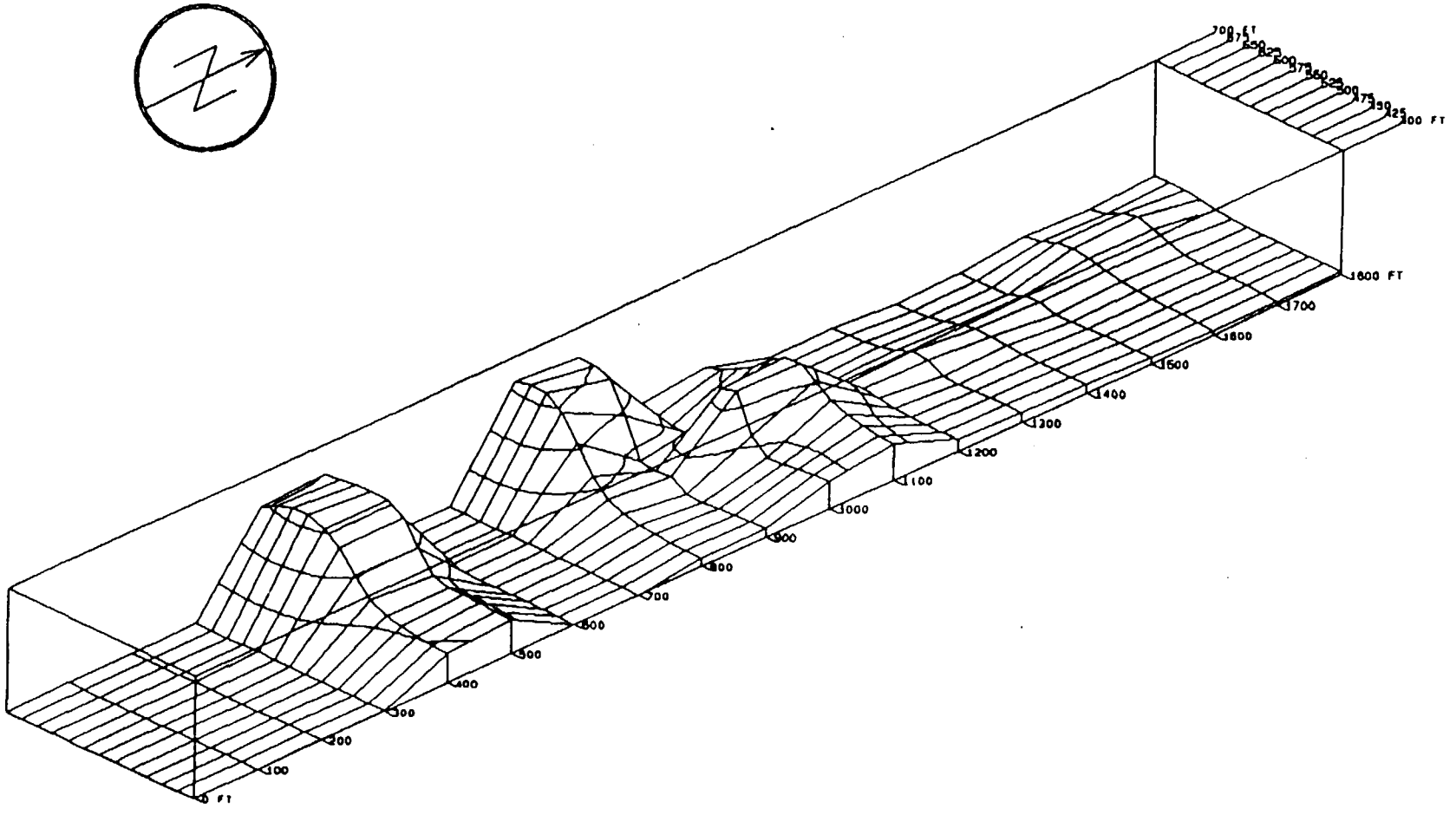
Figure 36



CS - A
EPTOX: Cadmium

X, Y, Z=1: 1: 75

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Figure 37

4.4 Hazardous Substance List (HSL), Total Metals Analysis

4.4.1 Test Results

The method of analyses for the HSL total metals was as follows:

Mercury	SW 846 Method 7471
Arsenic	SW 846 Method 7061
Selenium	SW 846 Method 7741
All remaining metals	SW 846 ICAP Method 6010

Thirty (30) samples were characterized for HSL Total Metals concentrations (Table 3). The digestive procedure for the preparation of metals analyses was performed using SW-846, Method 3050. The metals which were quantified through this procedure are presented in Table 7, were located generally in the southern one-third to one-half of CS-A, and are graphically shown in Figures 38 - 65.

4.4.2 Table of Results

See Table 7 on the following page.

4.4.3 Contour Maps - Total Metals

See Figures on the following pages.

Table 7

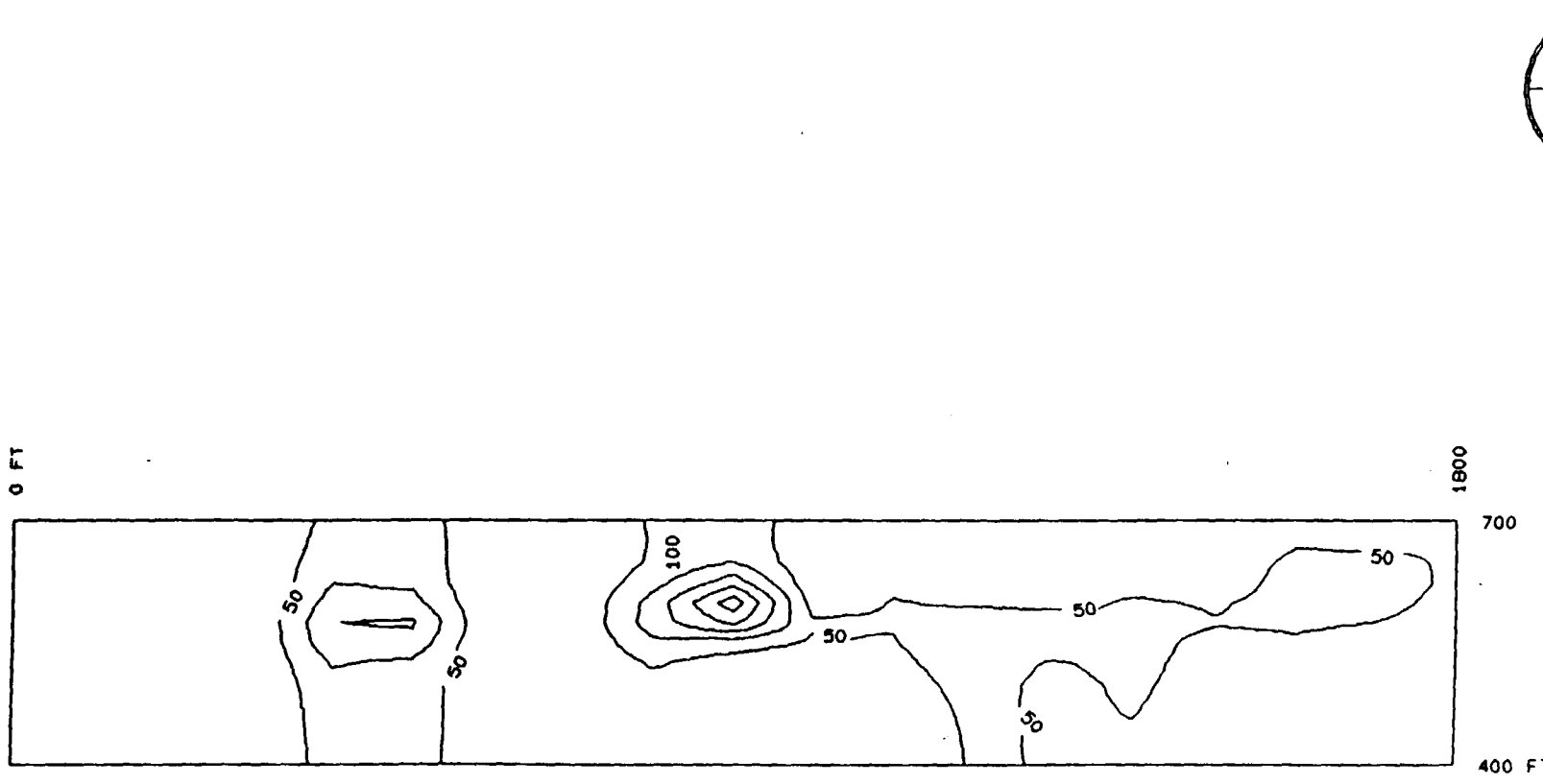
CS - A

Total Metals

Sample	A10	A11A	A11B	A11C	A11D	A12A	A12B	A12C	A12D	A13B	A13C	A13D	A14A	A14B	A14C	A14C	A14D	A15B	A15B	A15C	A15D	A16B	A16C	A21B	A21C	A21D	A22B	A22C	A23A
Date:	15-17	8-13	4-8	2-6.5	8-10	8-11	3-7	4-9	17-20	4.5-6	4-8.5	18-23	4-9	4-8.5	4-8.5	8.5-10	10-14	6-9	13-16	4.5-9	4-9	9-12	2-5	1-6	4-8	14-19	0-7	3-9	19-20
Parameters																													
Silver	ND	ND	ND	8.0	ND	ND	328	93.0	ND	154	73.5	ND	ND	44.1	141	ND	ND	ND	ND	63.8	ND	55.8	91.9	132	348	ND	2.4	11.9	ND
Aluminum	5150	7380	5870	5430	10300	8270	8050	3780	3170	5480	4350	5930	5450	3740	4970	7200	4550	7180	1520	4540	4980	1980	1400	2800	5120	4550	3110	2970	5590
Arsenic	3.4	13	4.7	23.1	4.4	3.9	ND	194	3.0	78.0	145	4.6	2.9	99.5	122	7.8	5.5	11.9	2.4	105	6.4	10.8	7.5	7.6	25.3	ND	6.9	18.5	5.6
Barium	252	240	212	182	2450	197	516	500	244	1980	2180	219	201	5200	1560	250	191	242	57.9	2180	170	712	473	529	1050	148	241	414	198
Beryllium	ND	ND	ND	ND	ND	ND	44.1	1.9	ND	9.1	3.4	ND	ND	ND	25.2	ND	ND	1.6	ND	27.8	ND	3.1	2.5	2.9	36.0	ND	ND	ND	ND
Calcium	17700	3940	20100	8090	11700	15900	ND	5330	9130	14600	12800	15000	15700	12600	5260	22700	14500	21900	6270	7350	13500	9030	7270	17000	12100	12600	12700	12000	26200
Cadmium	ND	5.2	ND	4.9	ND	ND	393	47.0	ND	529	228	ND	ND	49.7	316	2.7	ND	7.3	ND	532	ND	52.5	49.4	135	470	ND	2.6	29.2	ND
Cobalt	ND	ND	15.7	15.3	38.4	ND	ND	ND	ND	ND	31.4	ND	ND	23.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23.0
Chromium	10.7	222	11.7	27.2	94.2	12.6	553	695	10.0	581	452	15.4	10.8	329	402	17.0	9.8	22.9	4.9	333	11.3	128	119	434	397	12.4	28.7	62.0	15.6
Copper	19.9	1130	117	3330	2100	103	77700	34800	298	42600	25900	151	48.1	15600	41300	338	41.4	722	28.4	17800	25.0	26000	16600	29400	91800	24.7	1160	3510	591
Iron	9990	13800	13800	16700	13100	12100	312000	68100	7310	118000	83100	12100	11800	78100	172000	19800	11200	21200	4240	254000	10600	52300	69900	45700	199000	11300	10100	12600	13500
Mercury	ND	ND	ND	3.1	3.3	ND	27	5.3	ND	17.7	2.3	ND	ND	28.7	12.8	0.16	ND	ND	ND	81.2	ND	124	93.0	8.2	16.3	ND	0.17	ND	ND
Potassium	ND	1870	1490	1090	ND	1420	ND	ND	ND	ND	ND	1220	1250	ND	ND	1720	ND	1630	ND	ND	1060	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	6700	2860	6890	4130	2500	7330	ND	ND	3840	ND	ND	6400	6580	2710	ND	5980	5180	5880	2100	ND	5350	1560	ND	1600	ND	4320	4220	2740	5160
Manganese	236	56.0	440	197	160	150	41.6	139	101	379	305	249	173	265	163	671	351	622	116	230	379	47.7	40.1	228	235	167	194	133	318
Sodium	ND	ND	ND	ND	4540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1310	ND	ND	ND	ND	ND	ND	ND
Nickel	27.5	303	23	301	6940	133	1530	959	47.7	1420	2230	27.4	27.7	1220	1240	47.7	14.2	73.4	ND	1820	15.0	705	716	562	6410	47.7	95.2	317	56.3
Lead	10.8	72.0	12.9	278	718	7.6	32400	2380	29.7	15700	4180	30.2	13.6	1840	20800	88.5	10.6	250	ND	5860	9.5	3760	2910	10000	30400	12.9	145	749	24.0
Antimony	ND	ND	ND	ND	ND	ND	356	66.1	ND	98.0	46.0	ND	ND	22.6	175	ND	ND	ND	ND	136	ND	117	114	51.8	305	ND	ND	ND	ND
Selenium	ND	ND	1.3	1.0	0.60	2.5	38.9	28.8	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	10.9	5.3	8.8	41.6	ND	0.73	2.0	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	18.5	21.0	19.4	17.0	33.5	19.4	ND	27.4	12.9	41.5	35.4	19.4	17.4	34.8	ND	25.0	15.9	24.8	ND	43.0	15.2	ND	ND	ND	ND	20.3	10.3	11.9	17.4
Zinc	82.5	1410	68.5	1200	655	333	26800	4020	172	21300	11500	209	69.8	6080	15000	187	47.9	337	28.1	13700	52.1	2290	2120	9300	26700	270	373	1510	237

Units: Mg/Kg
ppm

: No value found in natural soils



CS - A
Antimony Concentrations

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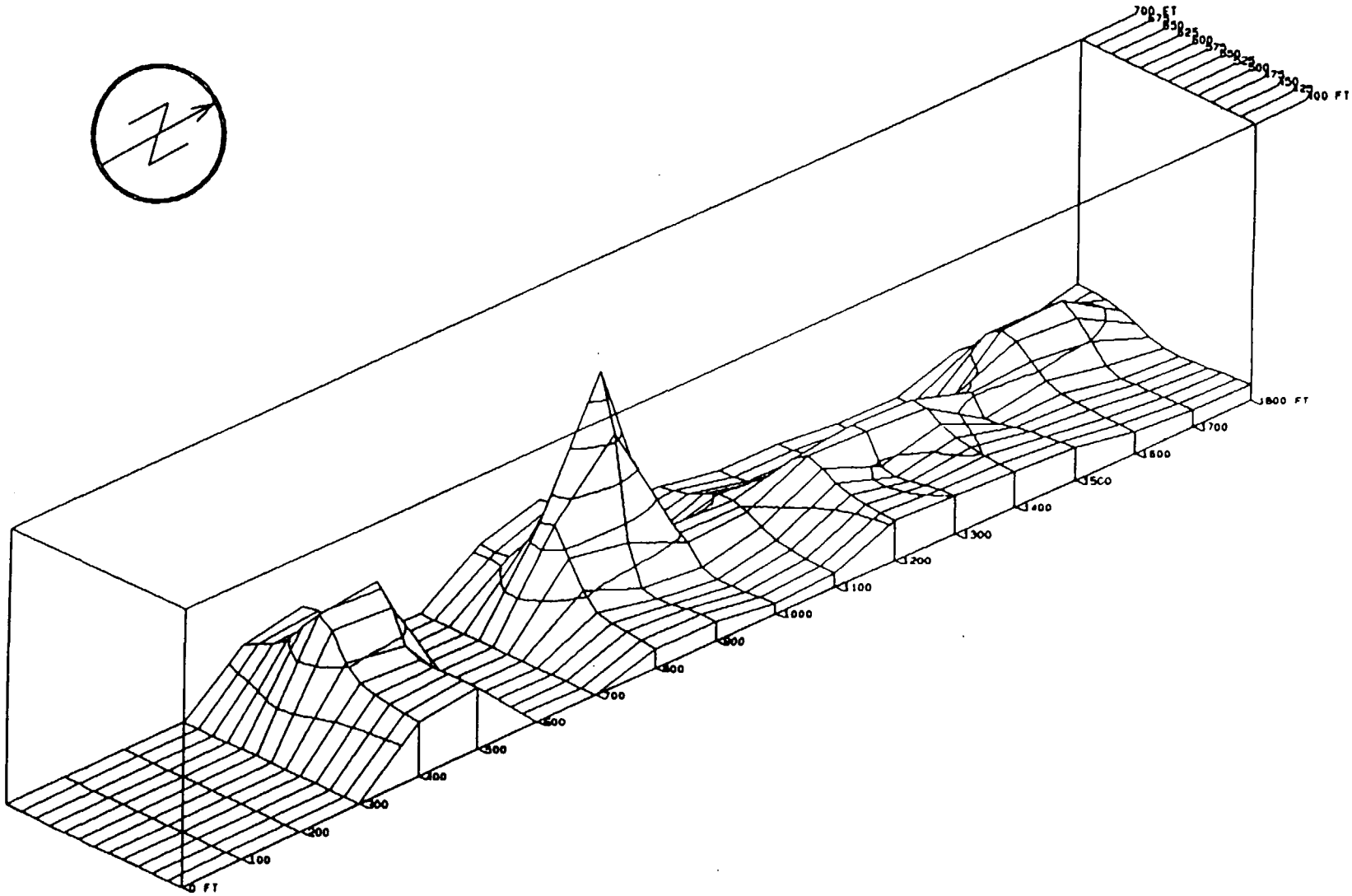
Figure 38



CS - A
Antimony Concentrations

X, Y: Z=1, 1: 2

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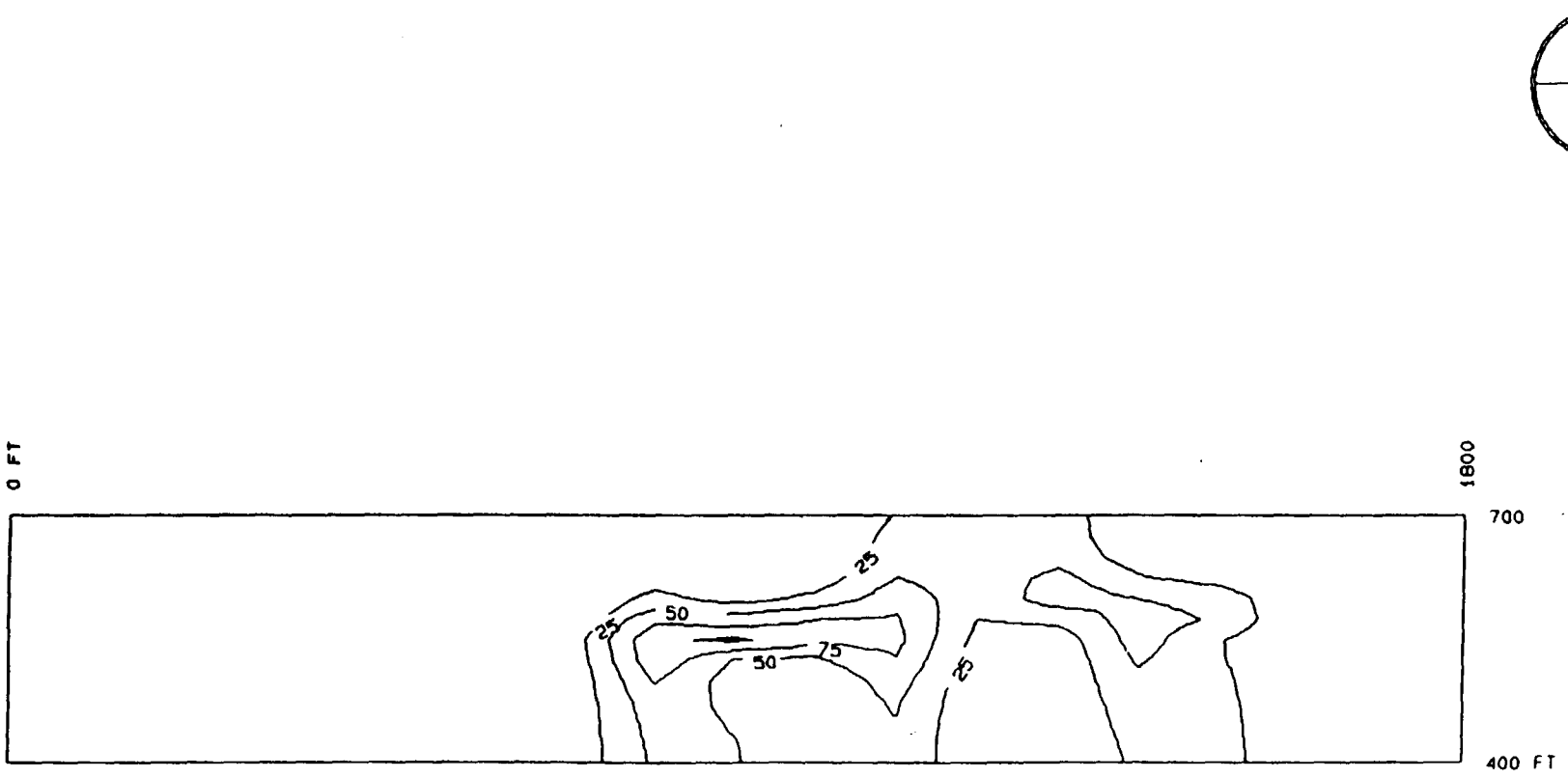
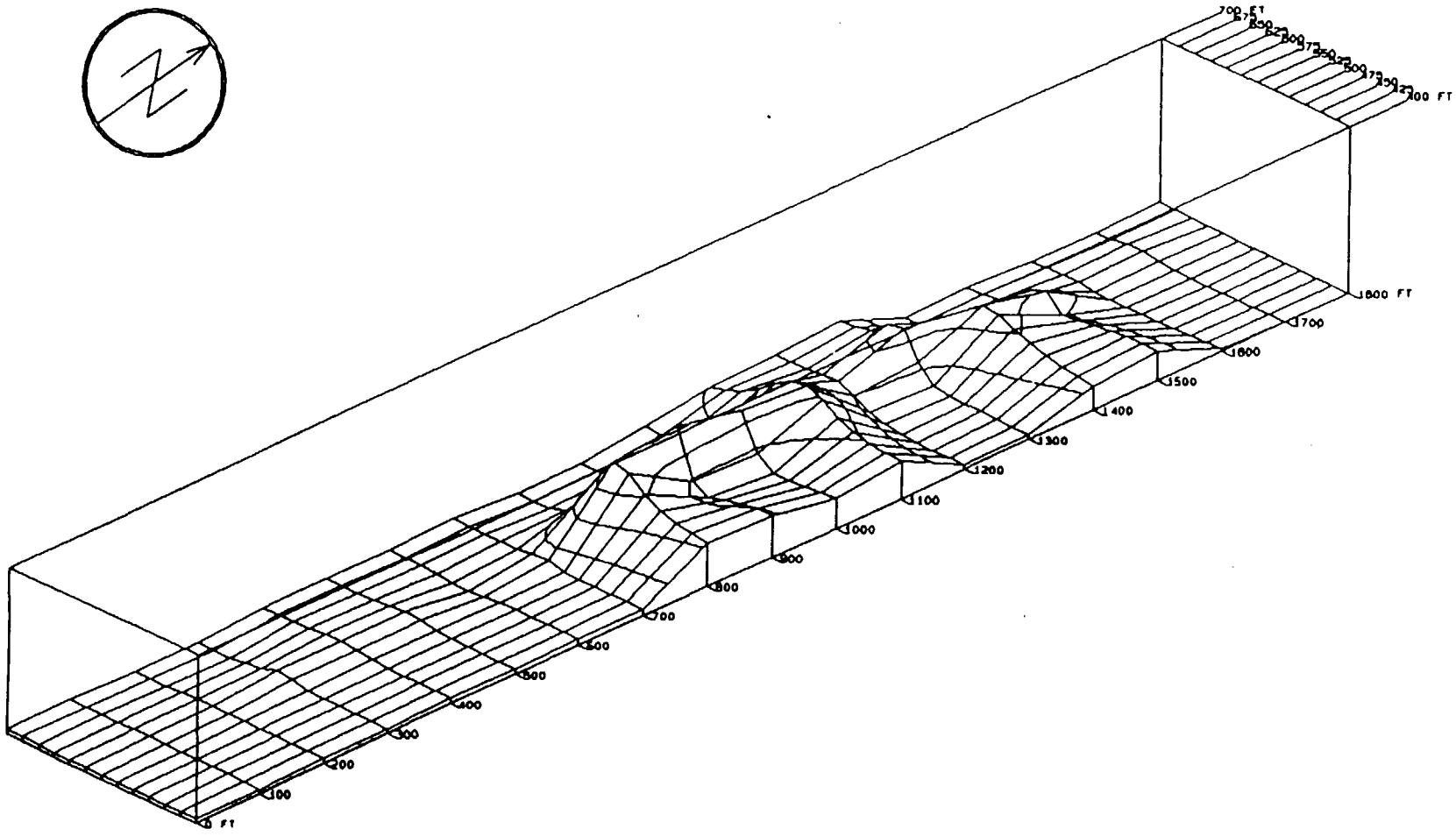
Figure 39



CS - A
Arsenic Concentrations

THE AVENDT GROUP, INC.

Figure 40



CS - A
Arsenic Concentrations

X Y Z=1. 1. 2

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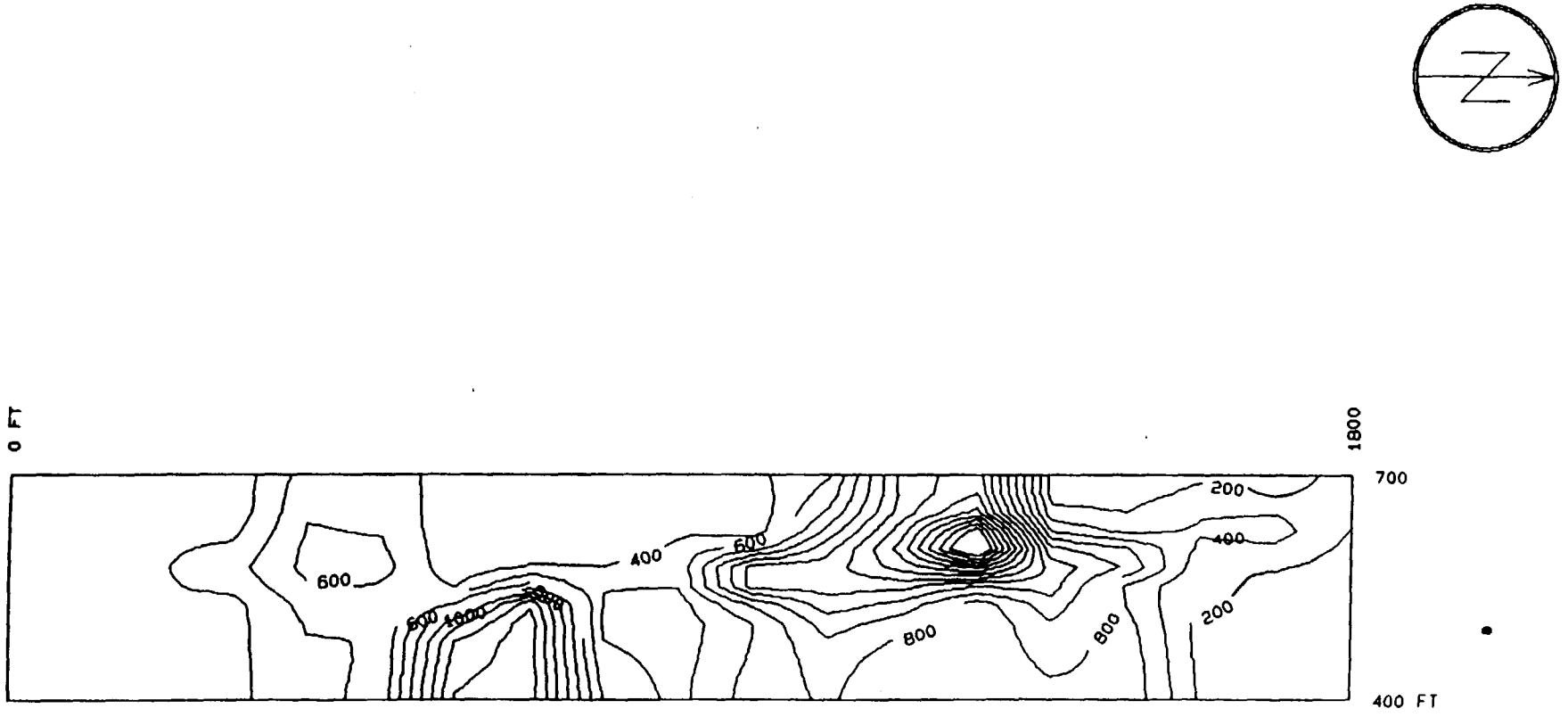
Figure 41



CS - A
Barium Concentrations

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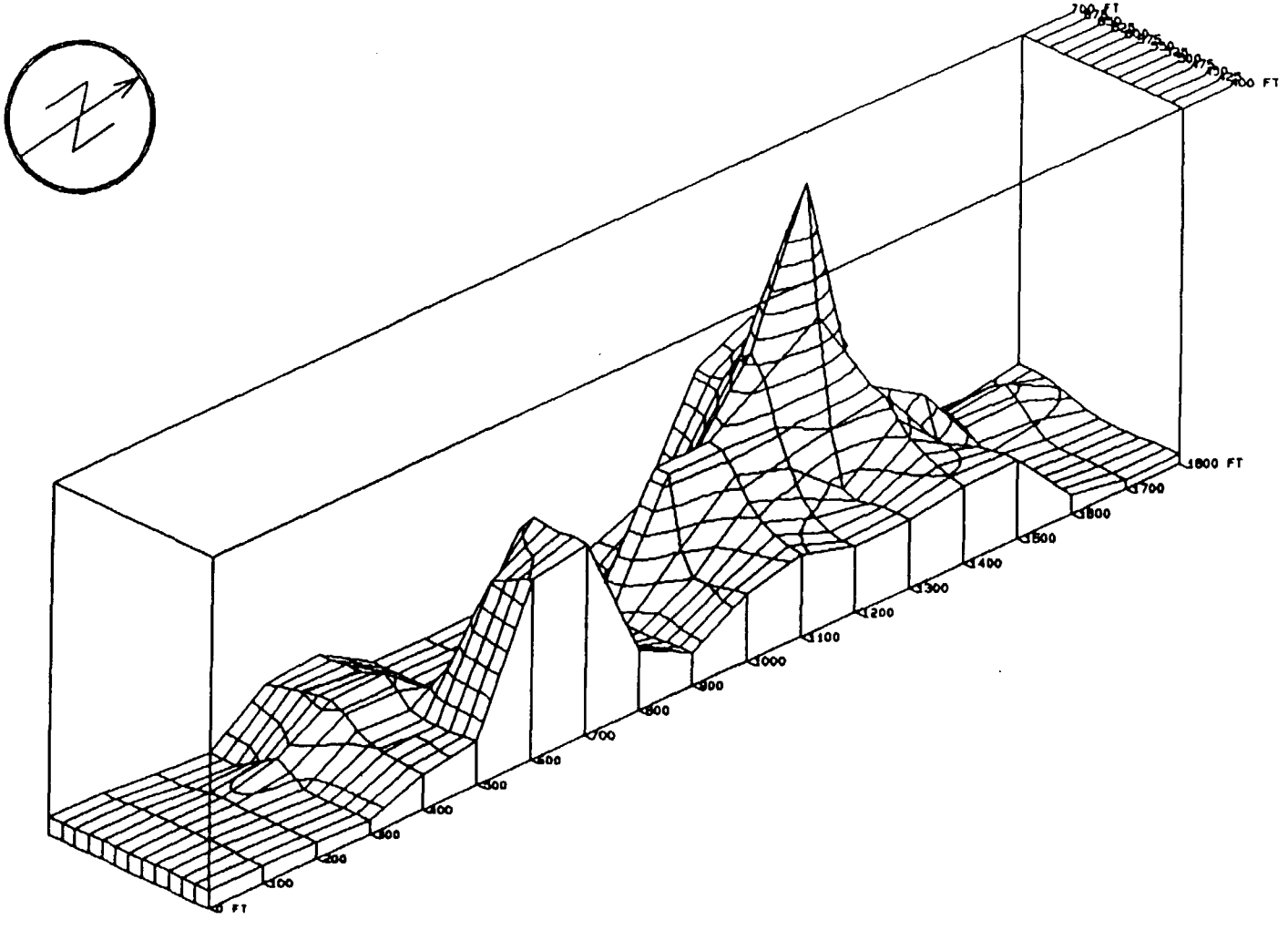
Figure 42



CS - A
Barium Concentrations

X, Y: Z=1.75, 1.75, .5

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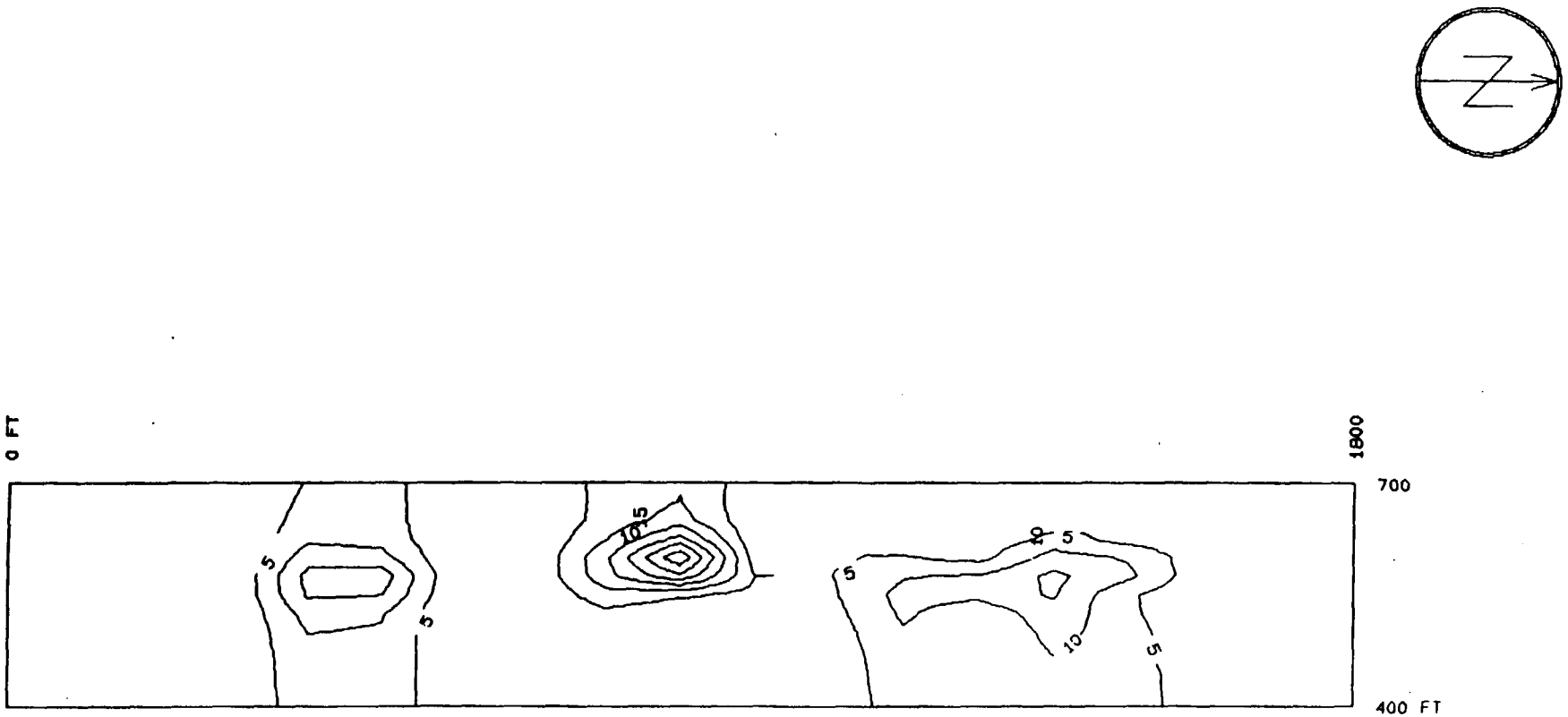
Figure 43



CS - A
Beryllium Concentrations

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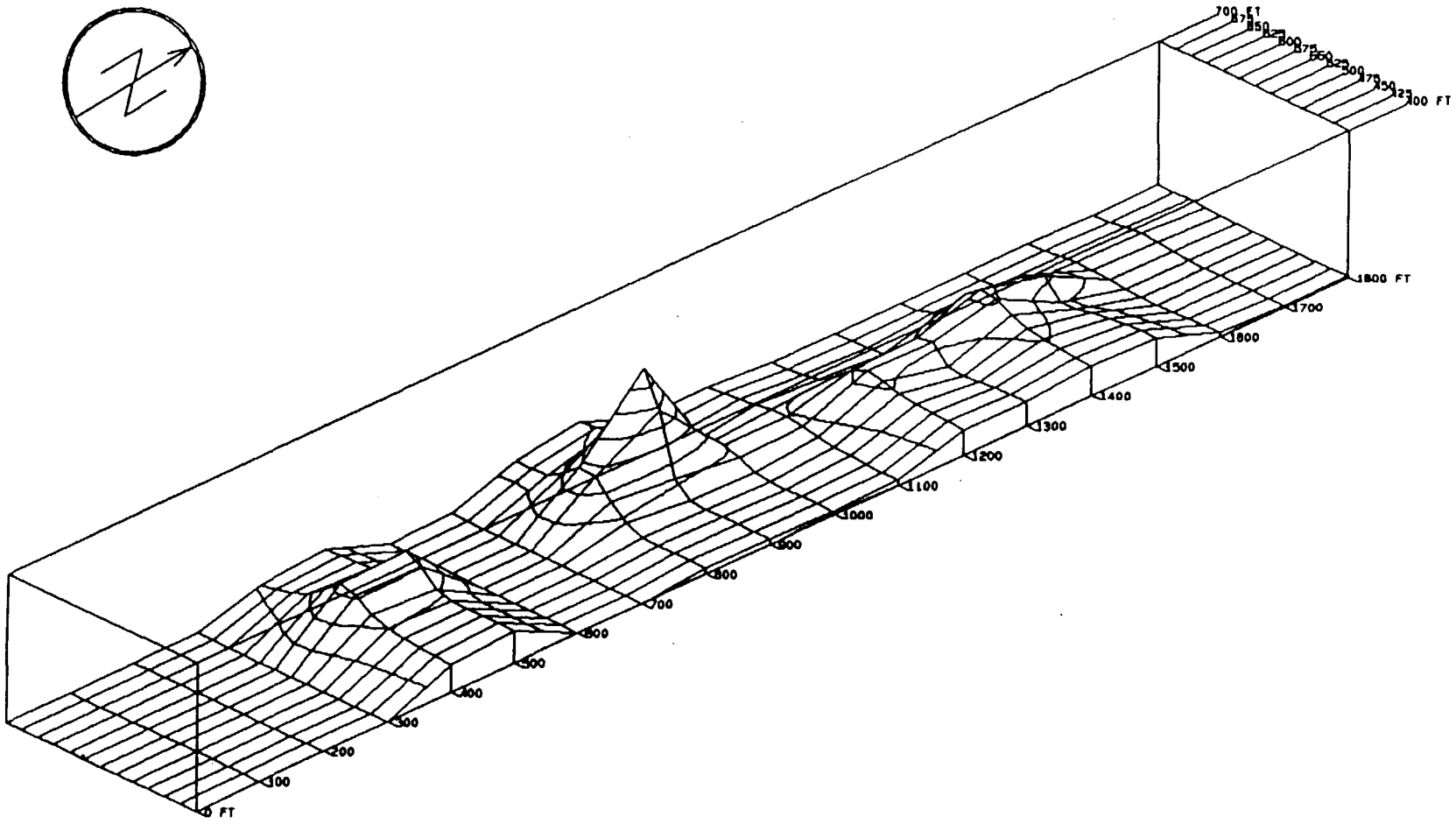
Figure 44



CS - A
Beryllium Concentrations

X, Y, Z=1: 1: 8

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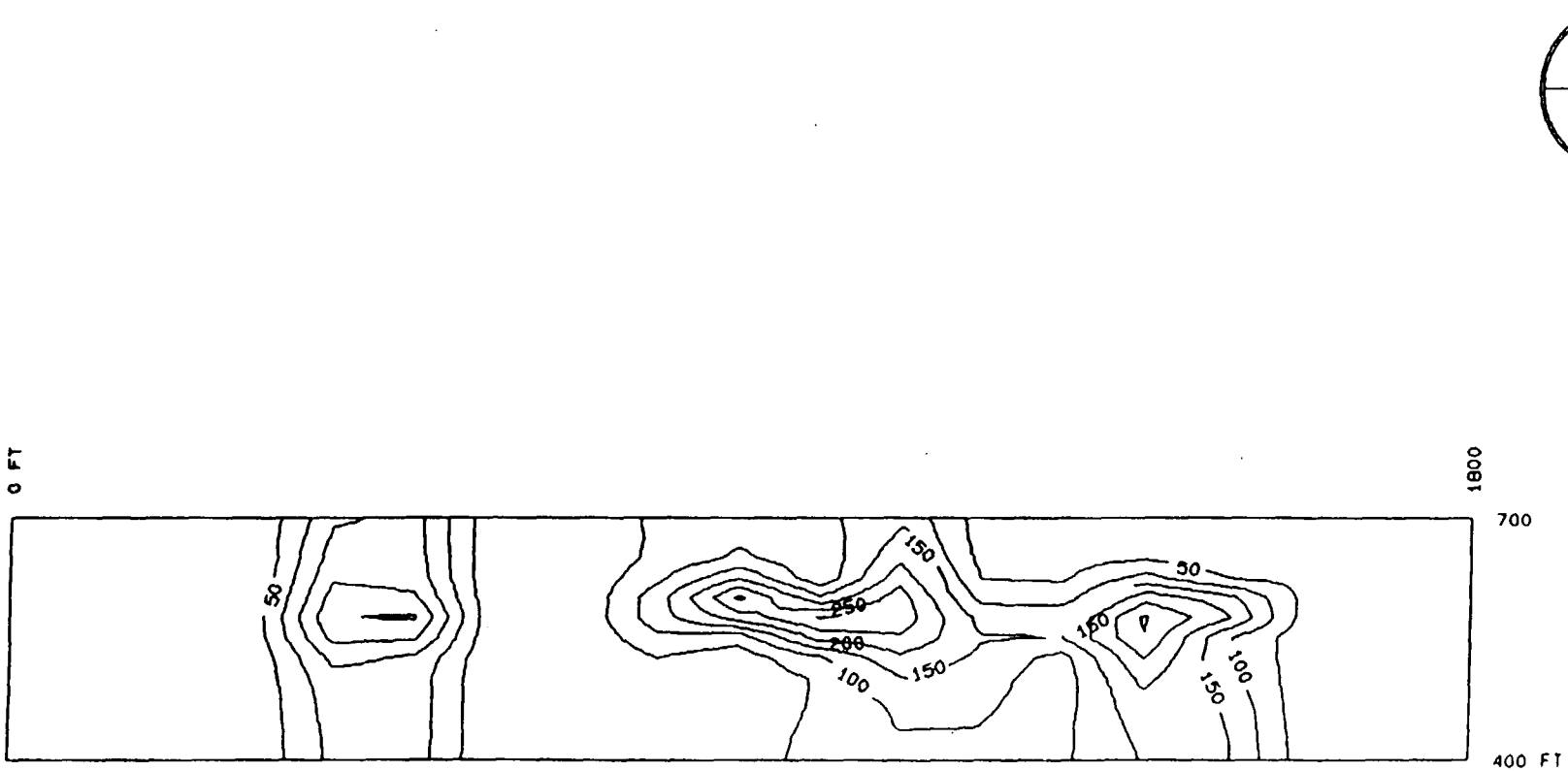
Figure 45



CS - A
Cadmium Concentrations

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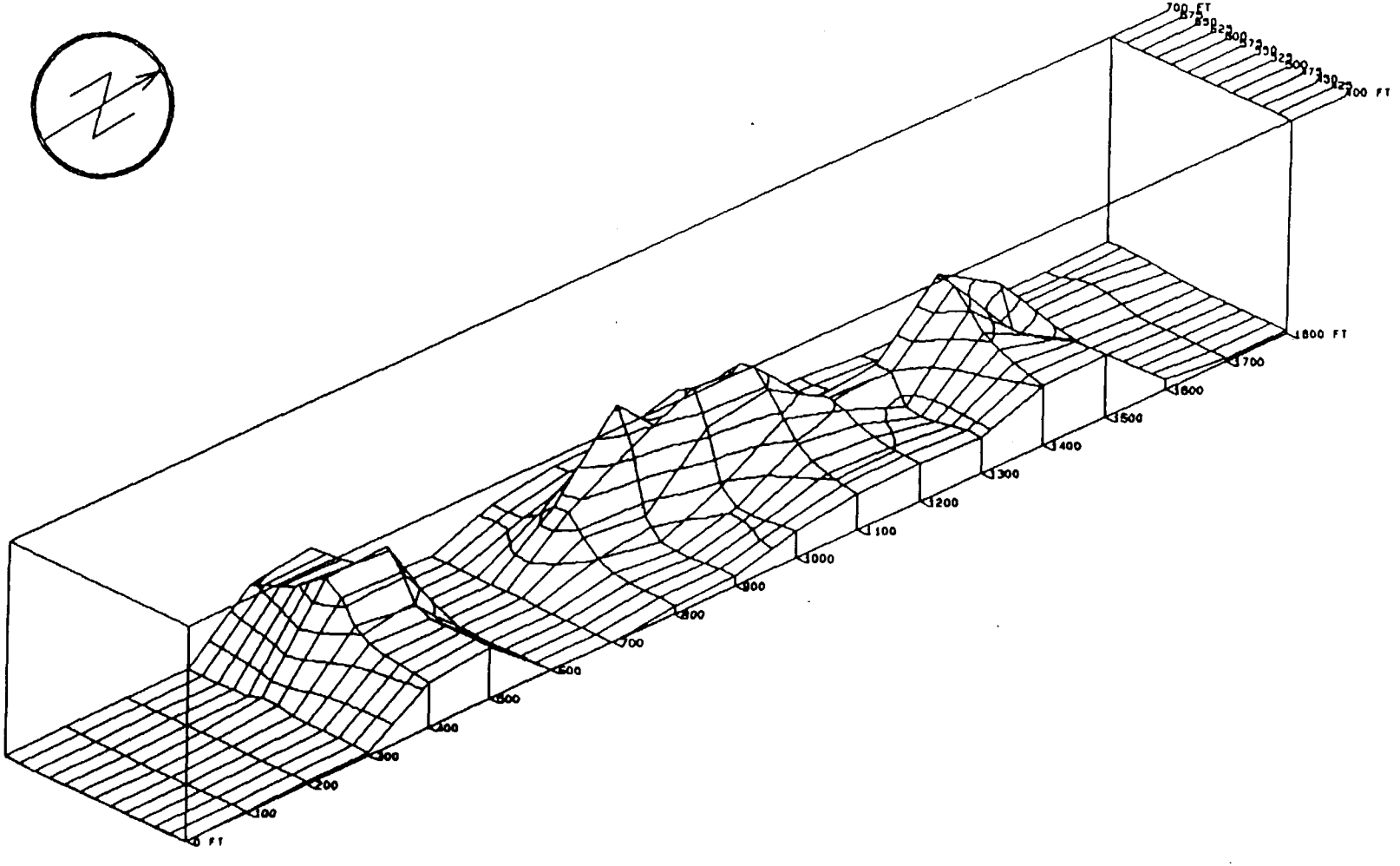
Figure 46



CS - A
Cadmium Concentrations

X, Y, Z=1; 1; 1

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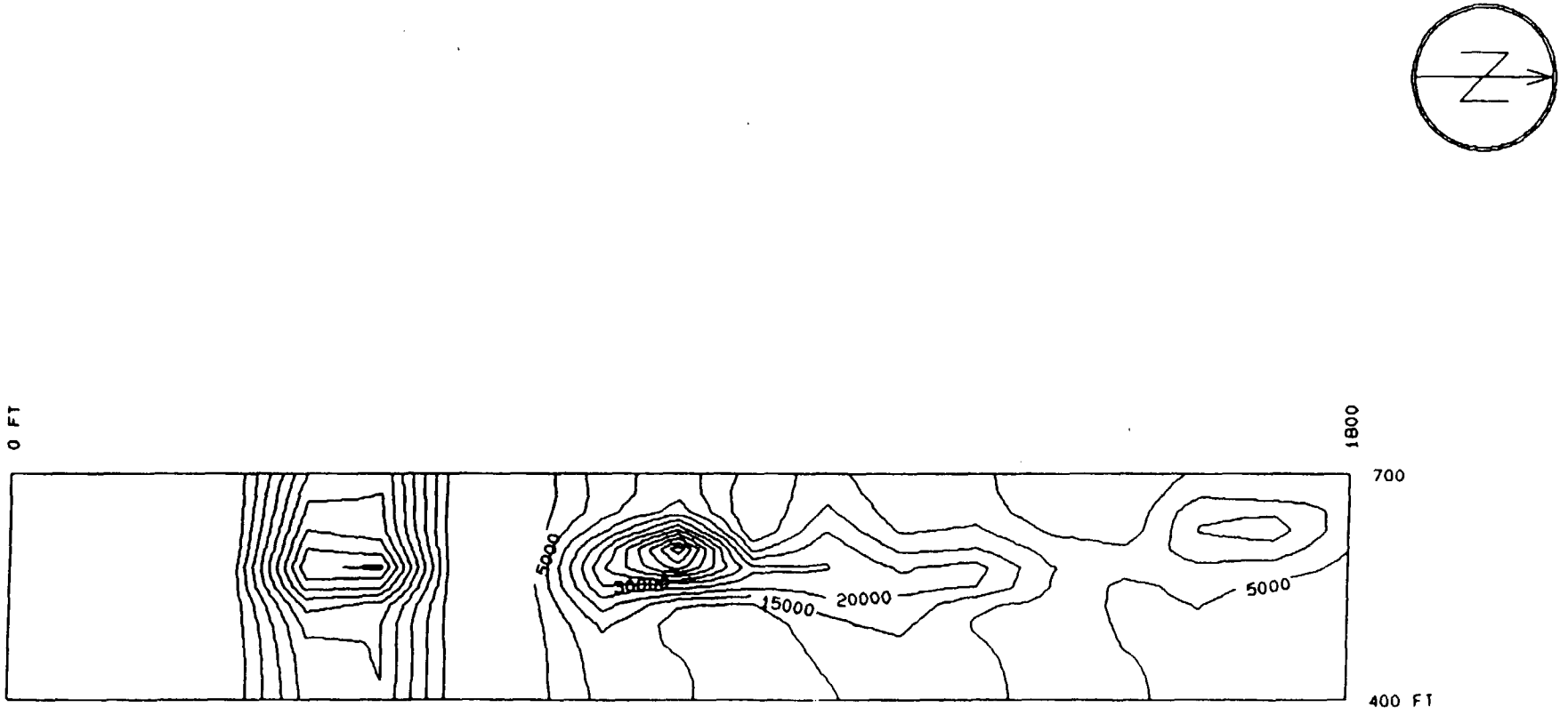
Figure 47



CS - A
Copper Concentrations

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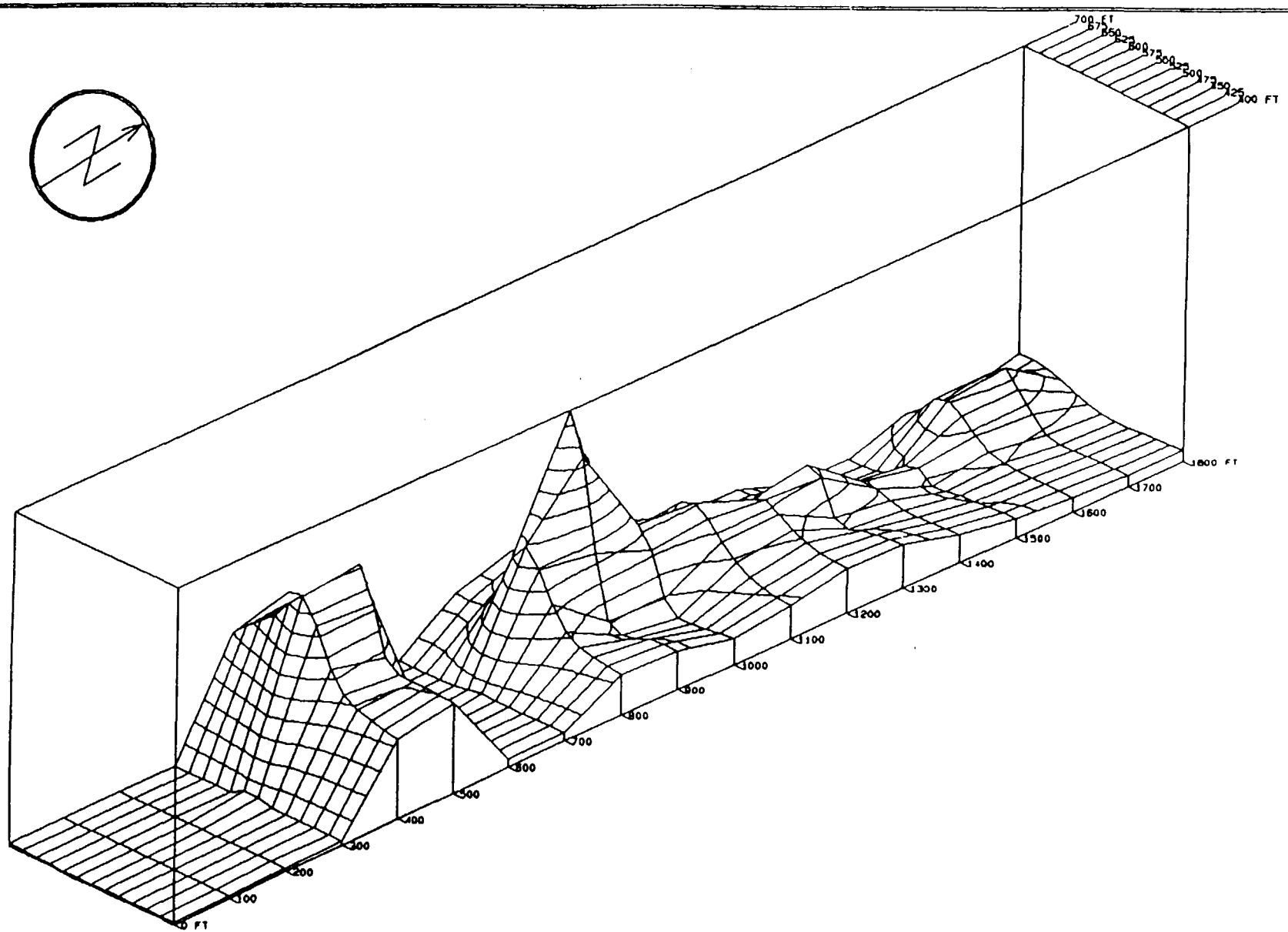
Figure 48



CS - A
Copper Concentrations

X: Y: Z=50: 50: .5

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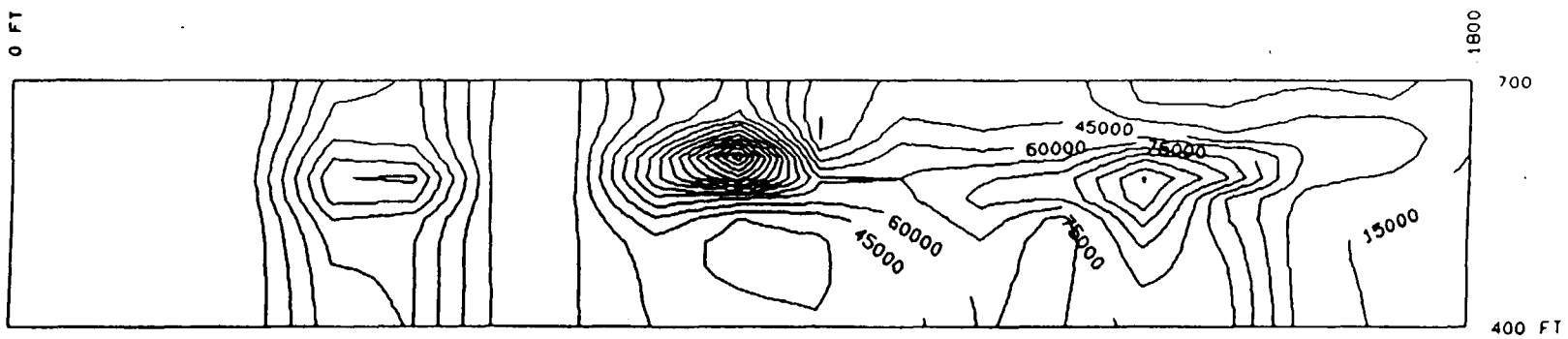
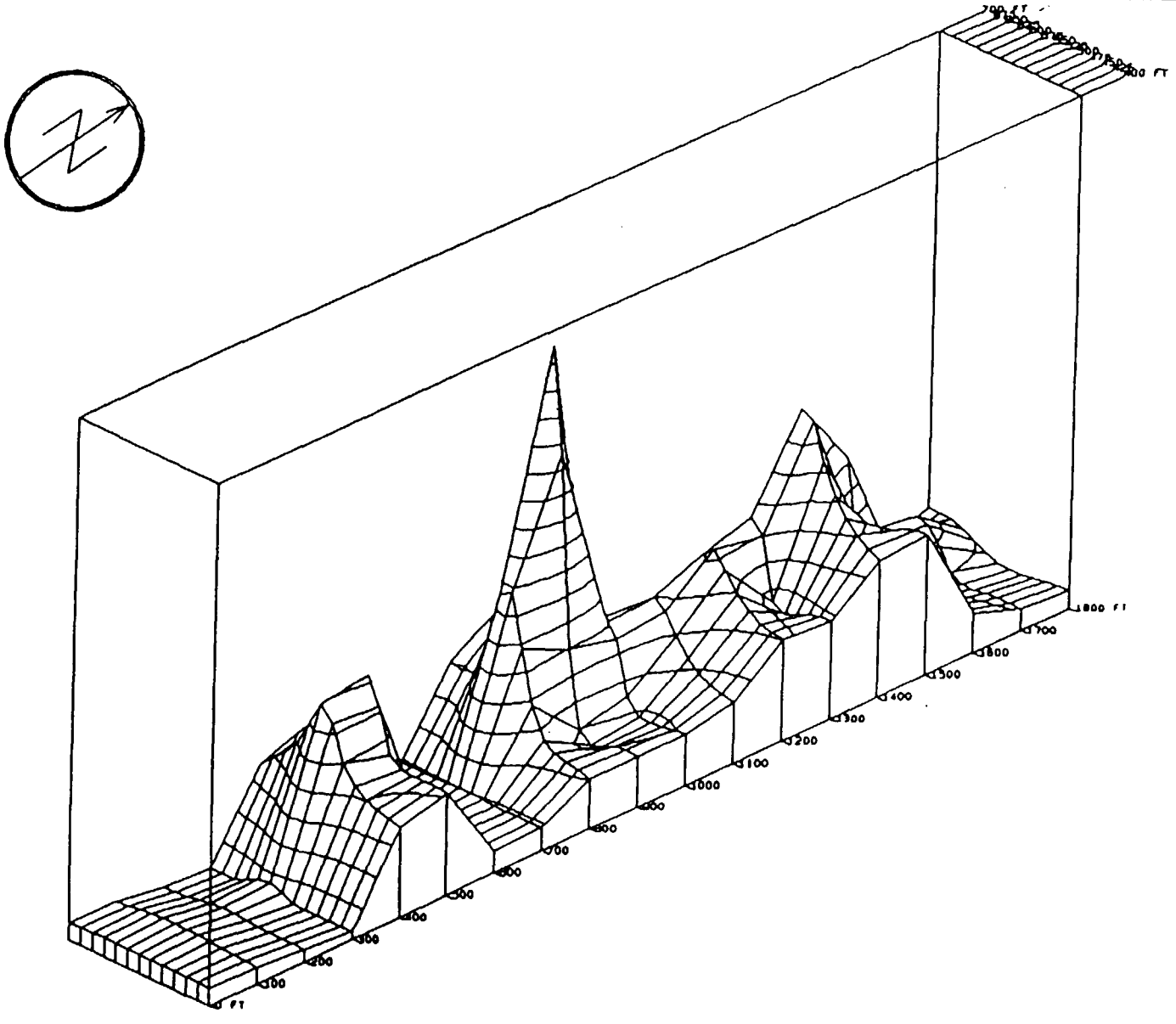
Figure 49



CS - A
Iron Concentrations

THE AVENOT GROUP, INC.

Figure 50



CS - A
Iron Concentrations

X: Y: Z=330: 130. . 7

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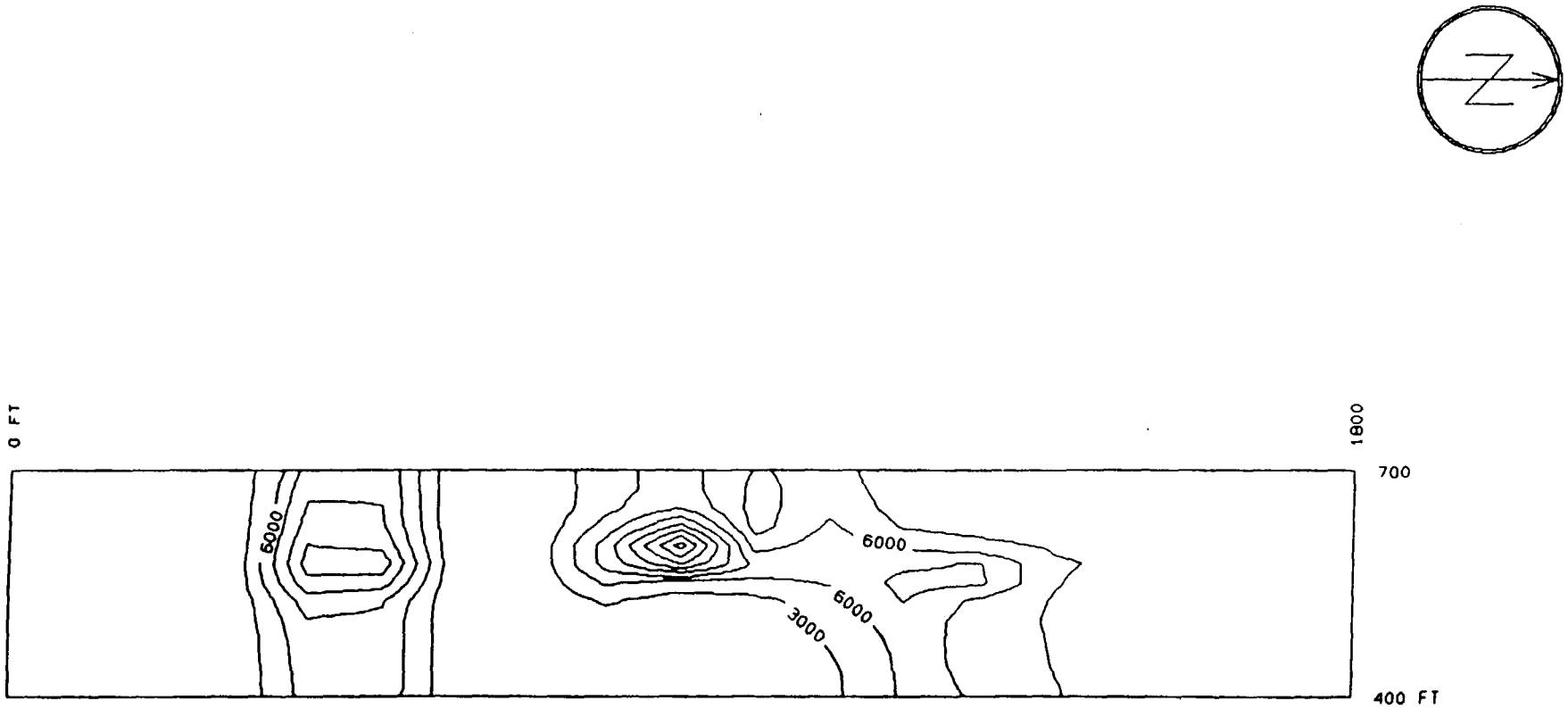
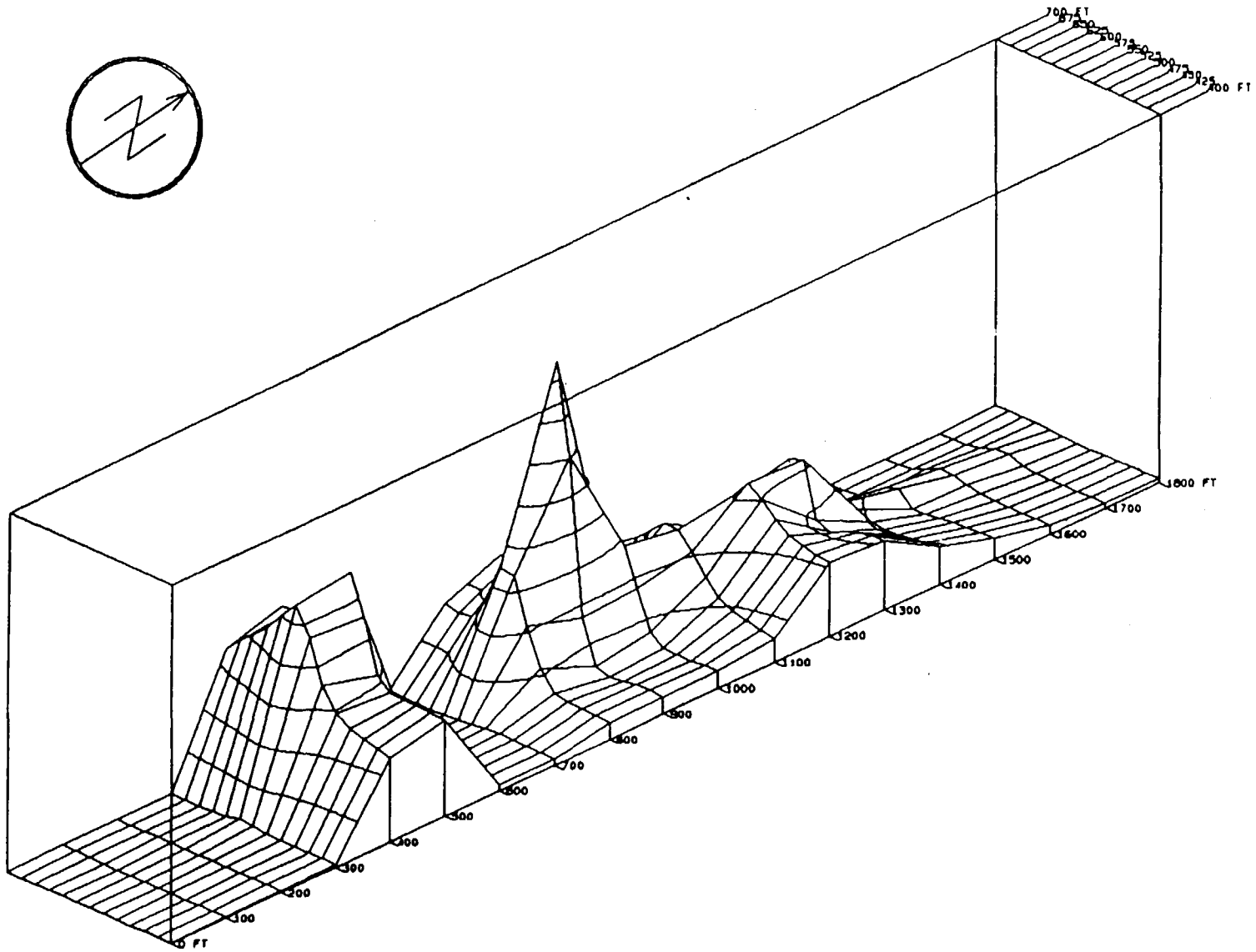
Figure 51



CS - A
Lead Concentrations

THE AVENDT GROUP, INC.

Figure 52



CS - A
Lead Concentrations

X, Y, Z=15: 15, .5

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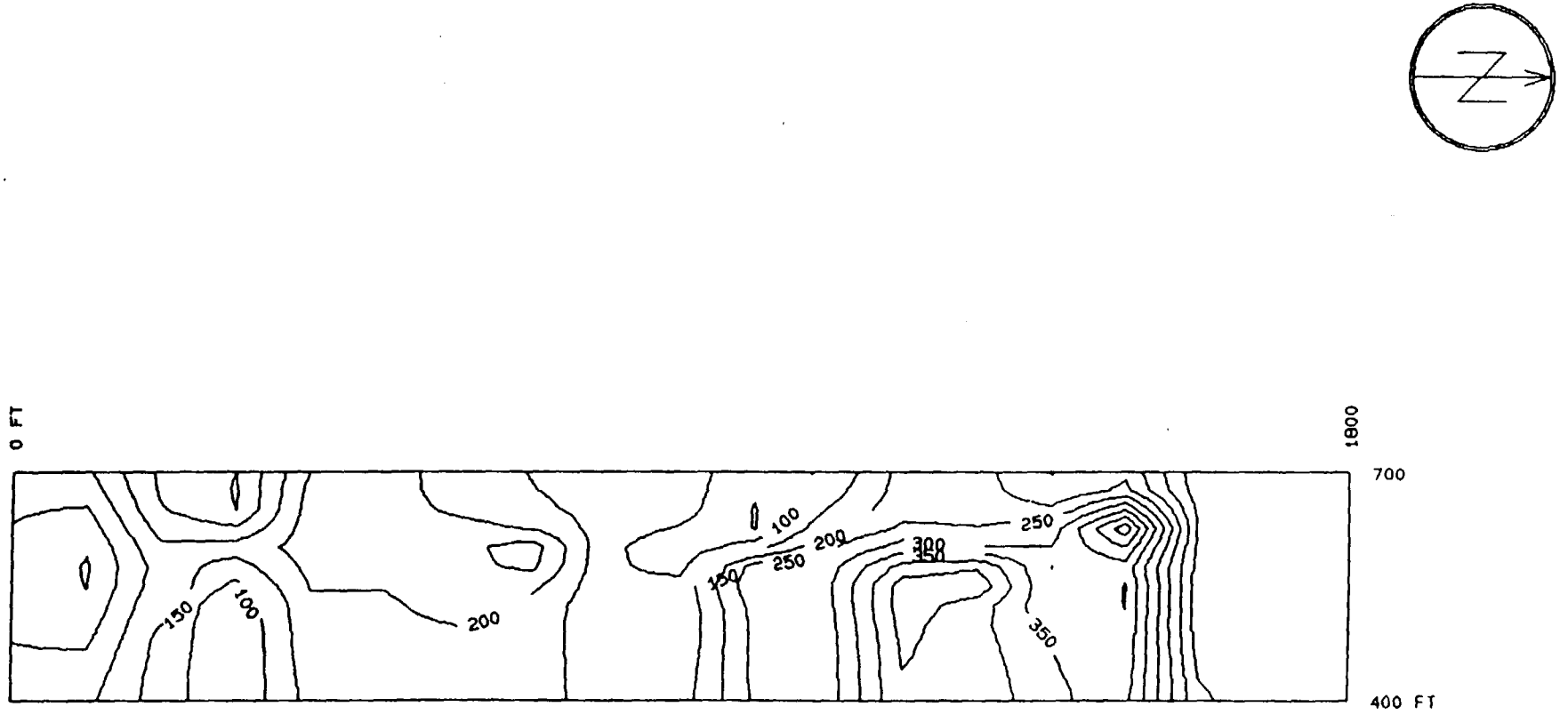
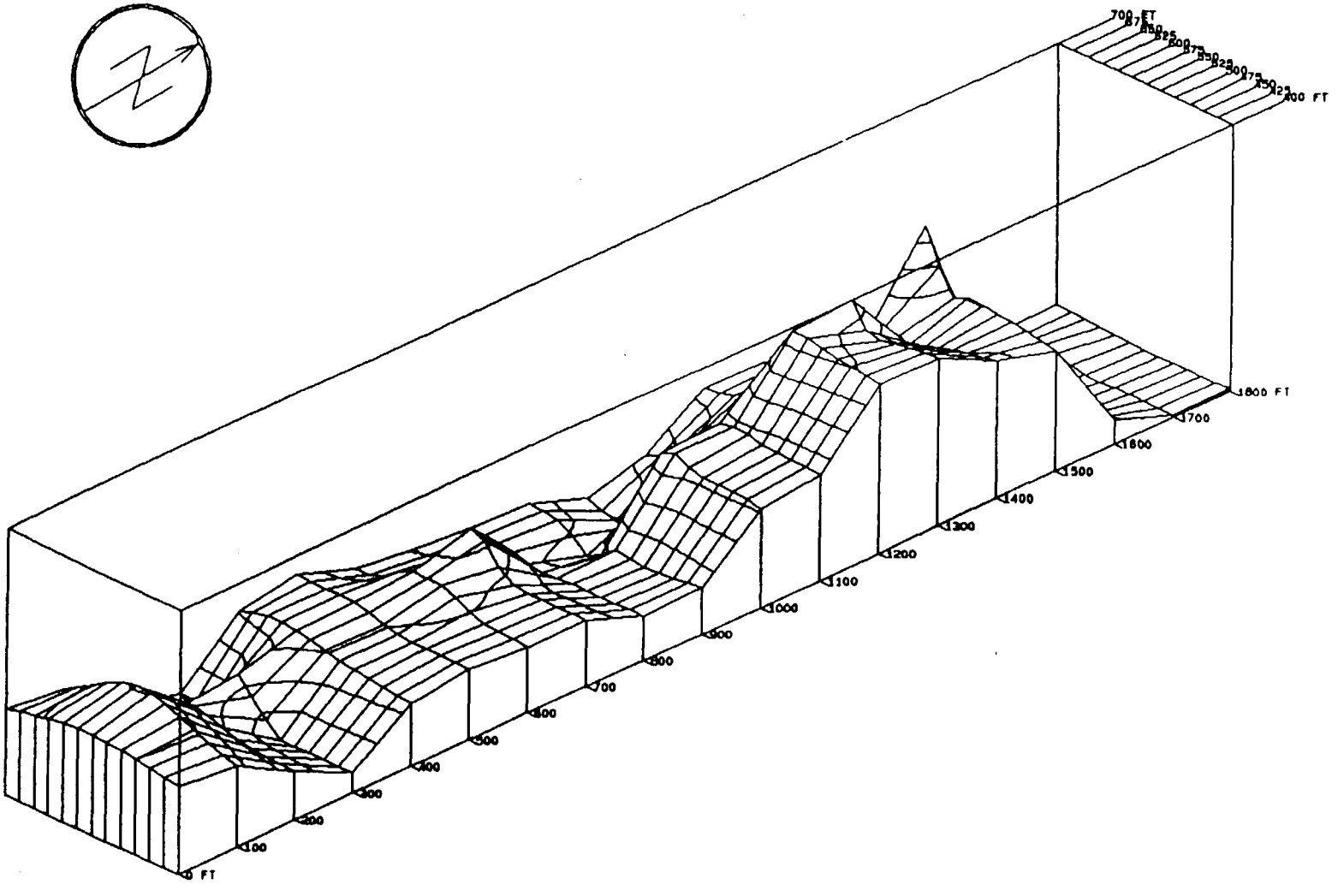
Figure 53



CS - A
Manganese Concentrations

THE AVENOT GROUP, INC.

Figure 56



CS - A
Manganese Concentrations

X: Y: Z=3: 1: 1

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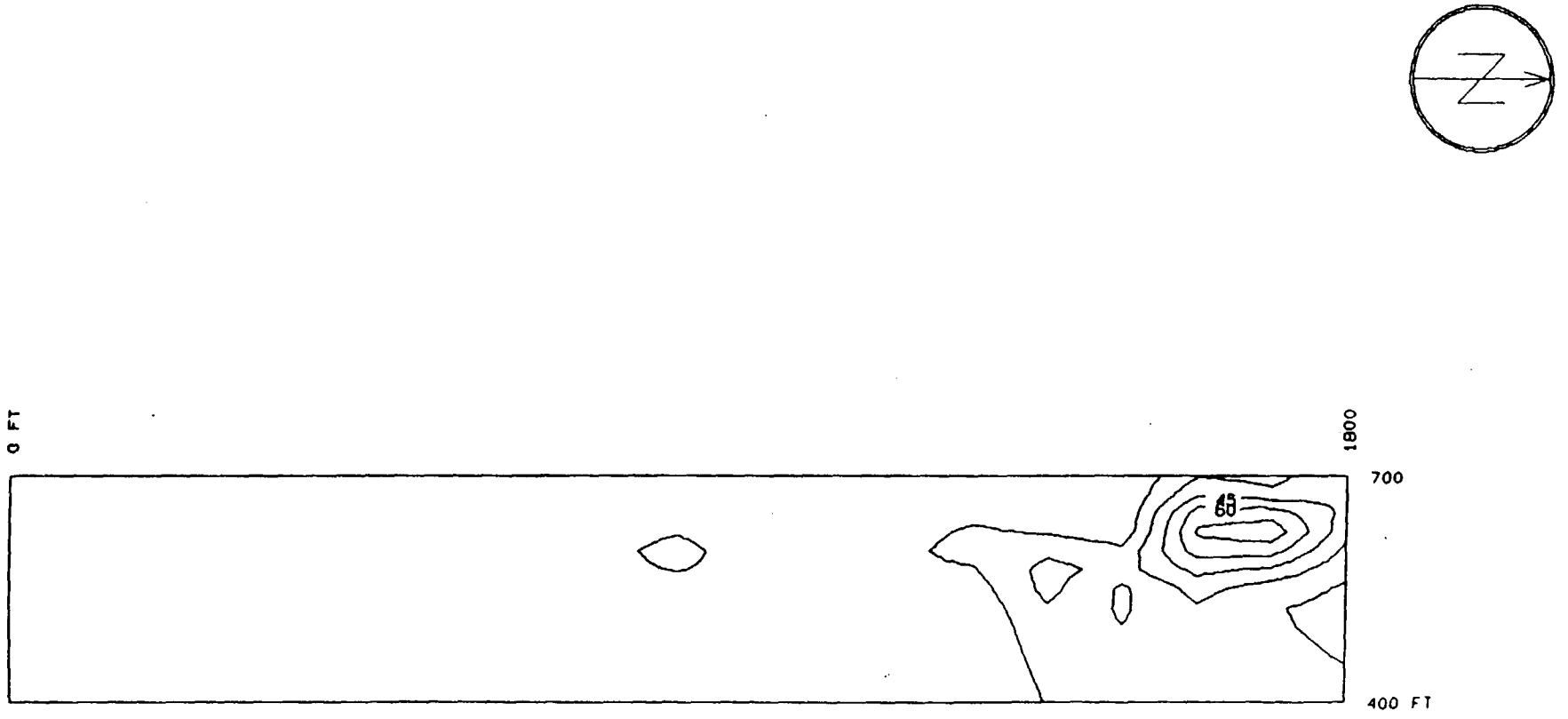
Figure 55



CS - A
Mercury Concentrations

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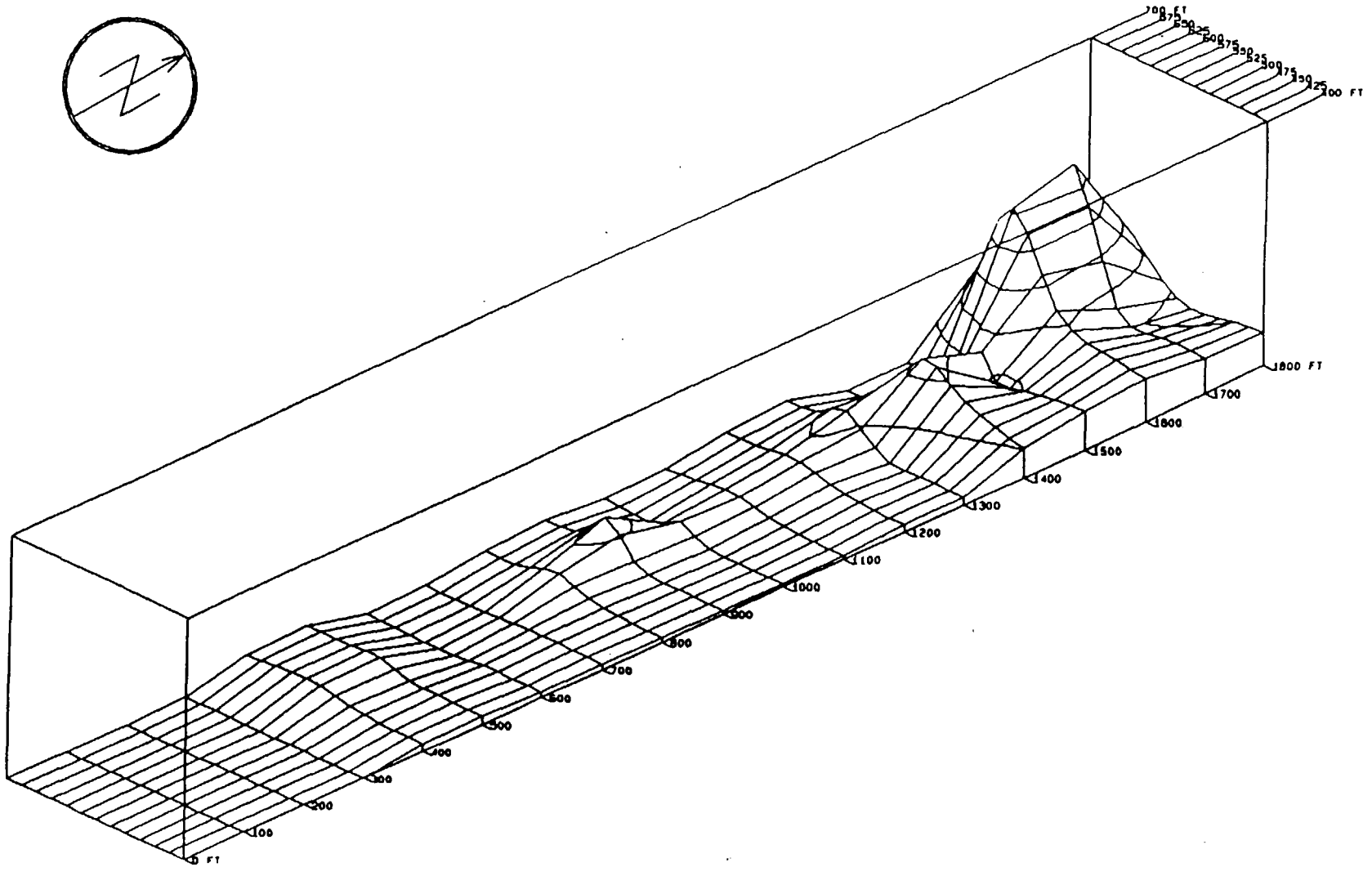
Figure 56



CS - A
Mercury Concentrations

X, Y Z=1, 1, 5

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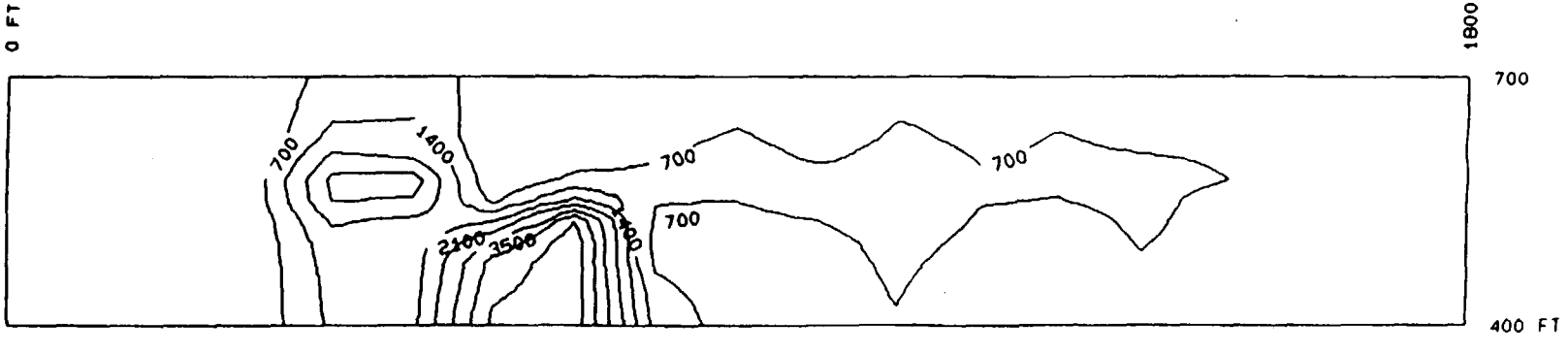
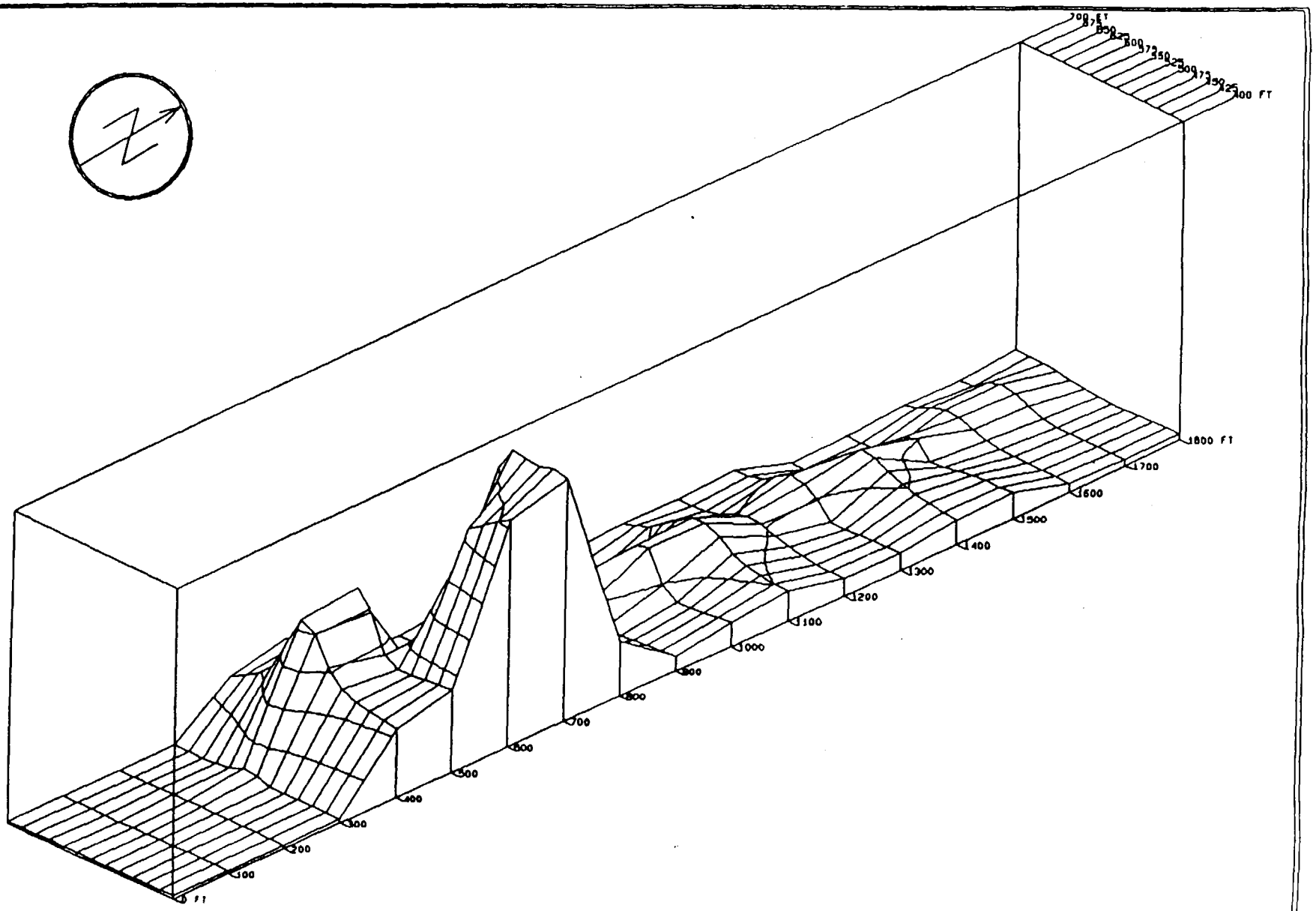
Figure 57



CS - A
Nickel Concentrations

THE AVENOT GROUP, INC.

Figure 58

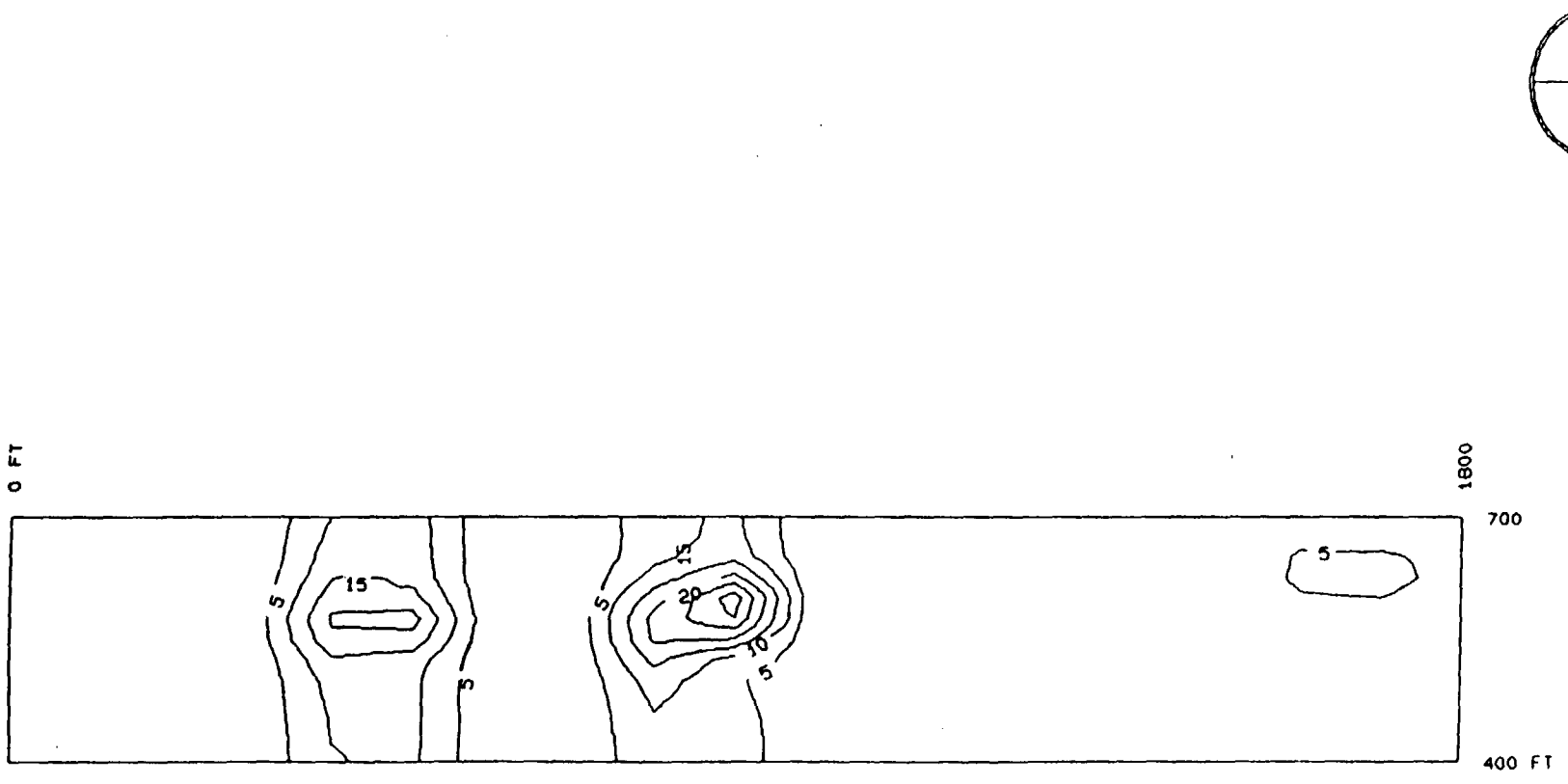


CS - A
Nickel Concentrations

X: Y: Z=4: 4: .5

THE AVENOT GROUP, INC.

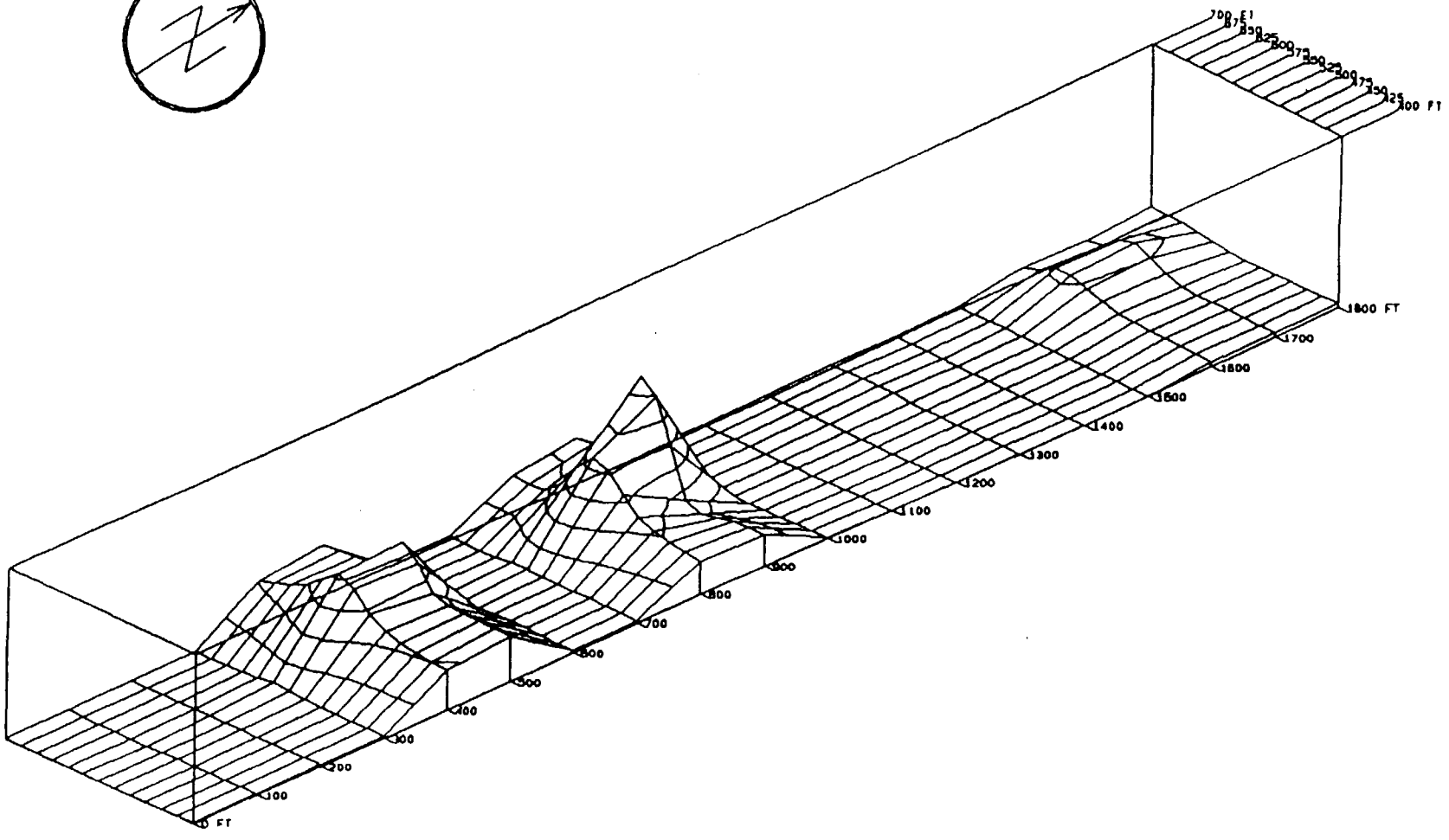
Figure 59



CS - A
Selenium Concentrations

THE AVENDT GROUP, INC.

Figure 60

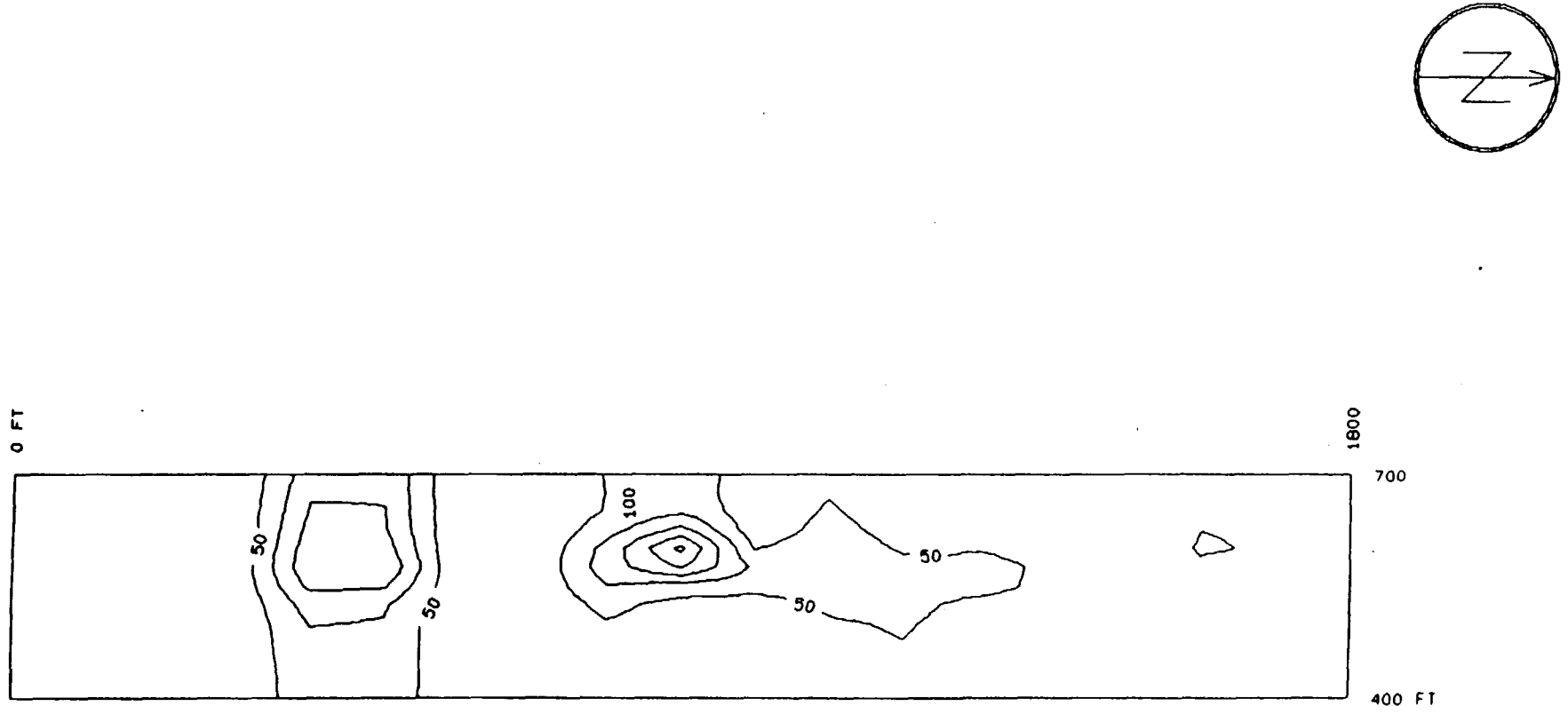


CS - A
Selenium Concentrations

X, Y, Z=1, 1, 10

THE AVENOT GROUP, INC.

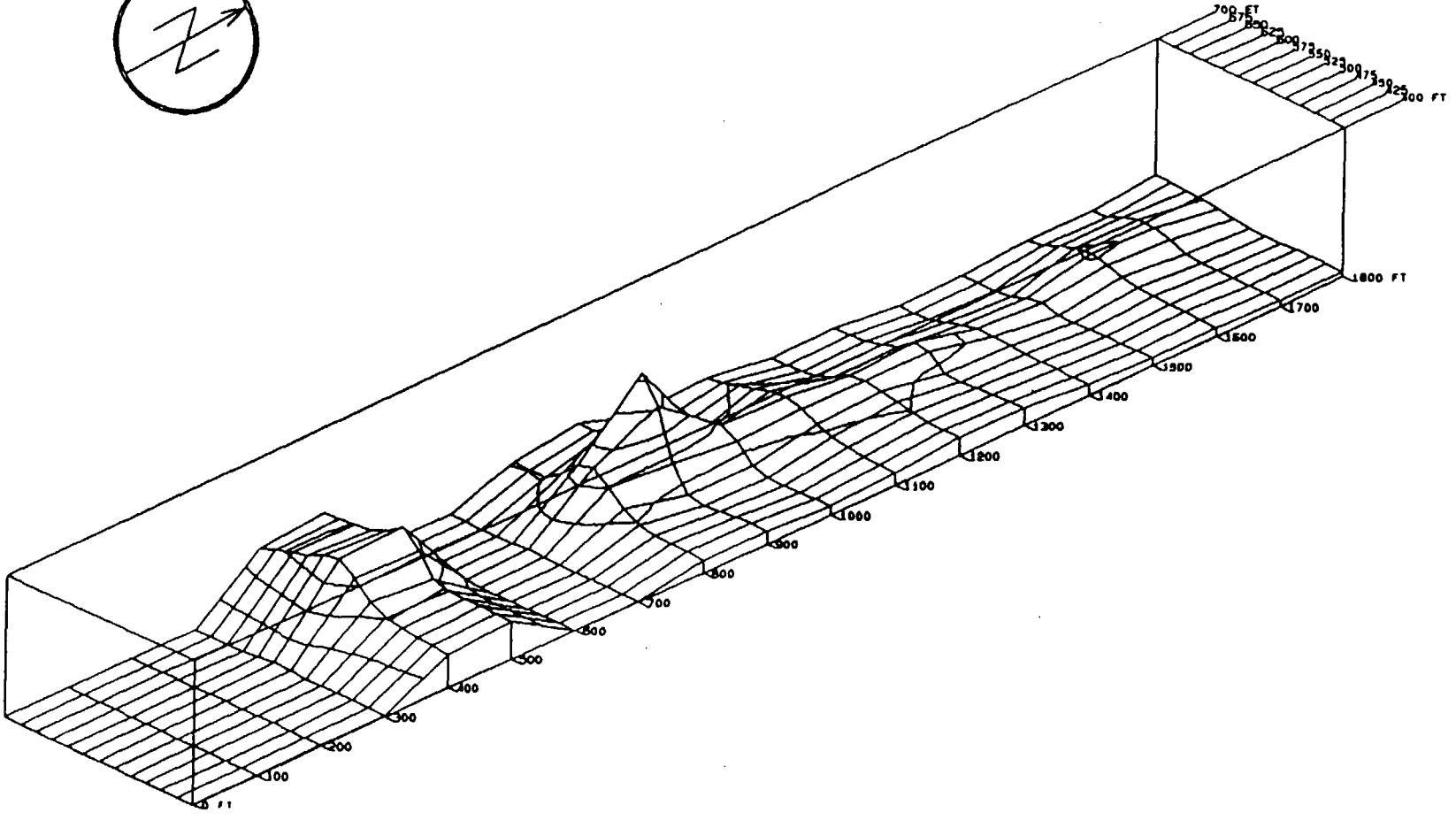
Figure 61



CS - A
Silver Concentrations

THE AVENOT GROUP, INC.

Figure 62

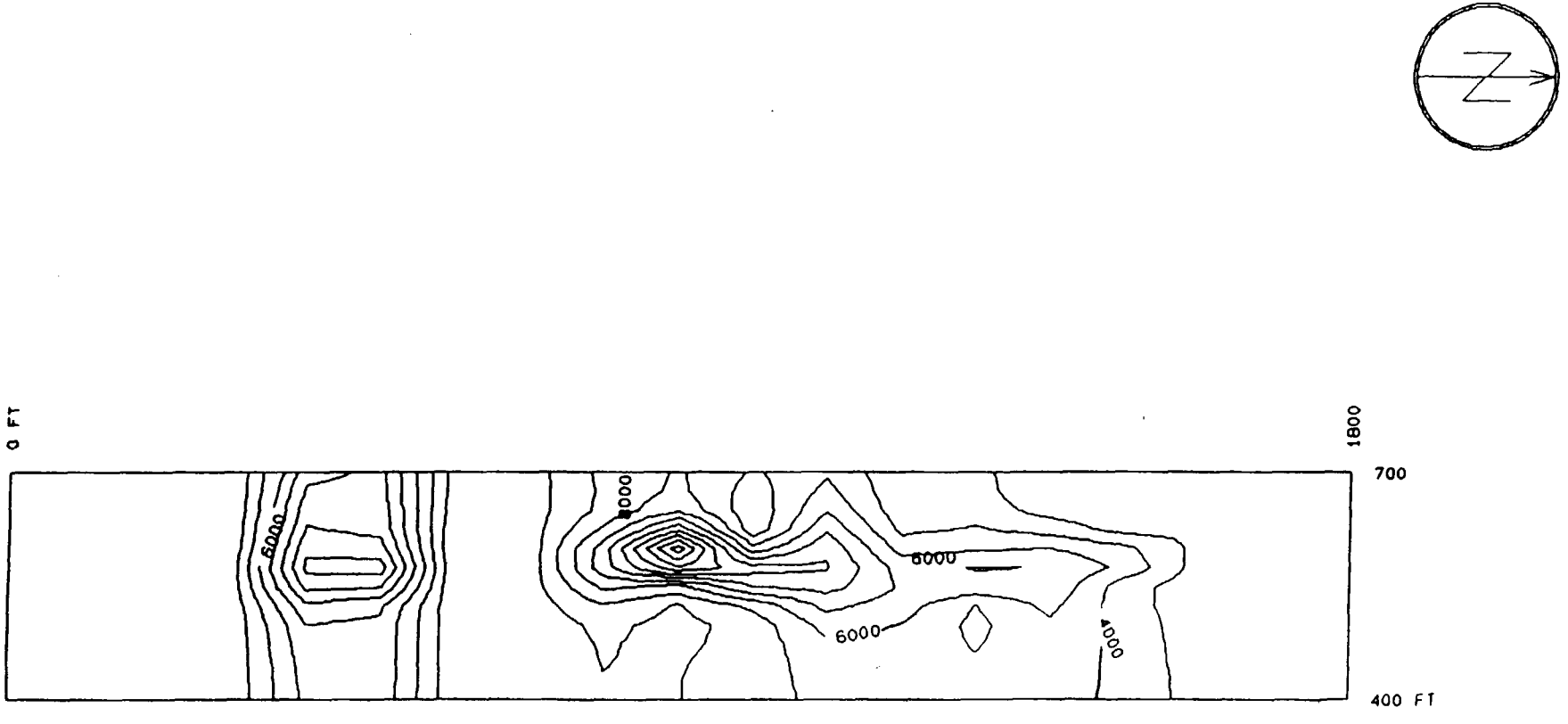


CS - A
Silver Concentrations

X, Y, Z=1: 1: 1

THE AVENDT GROUP, INC.

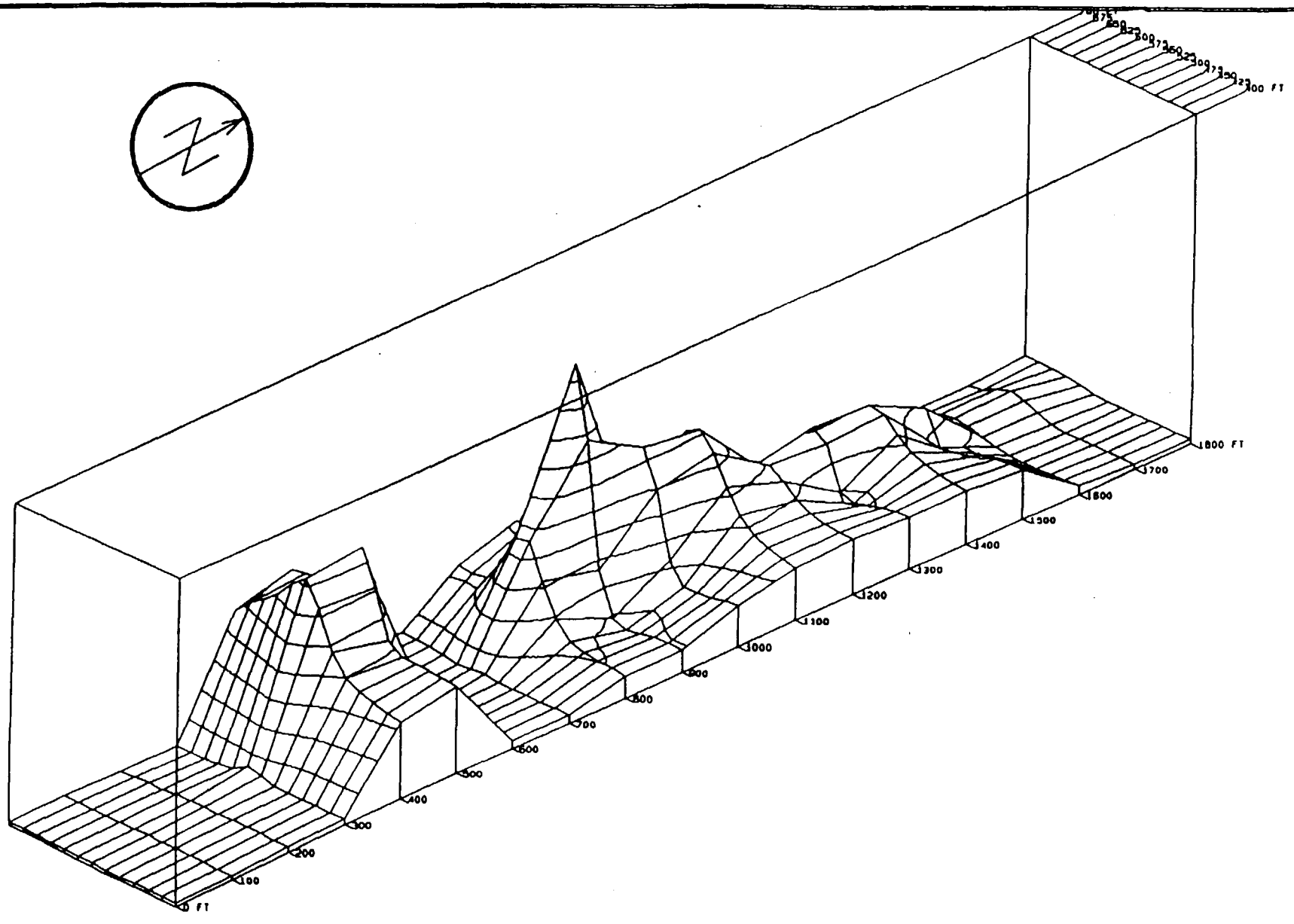
Figure 63



CS - A
Zinc Concentrations

THE AVENDT GROUP, INC.

Figure 64



CS - A
Zinc Concentrations

X Y Z=15. 15 . 5

THE AVENOT GROUP, INC.

Figure 65

4.5 Organic Analysis

4.5.1 Volatile Organic Compounds

The results of the Appendix IX compound search indicate that nine volatile organic compounds are present in the creek channel sediments (Table 8). The volatile organic compounds were tested using SW-846, Method 8240. The compounds methylene chloride, acetone, 1,2-dichloroethene (total), trichloroethene, toluene, chlorobenzene, ethylbezene, xylene (total), and dichlorodifluoromethane were detected. Review of these compounds indicates that the highest values of each of these compounds occur on the A16 transverse, the northernmost sampling point (Plate 2).

4.5.2 Semi-Volatile Compounds

The Appendix IX compound search indicated that 16 semi-volatile compounds are present in the creek bottom sediments of CS-A (Table 9). The semi-volatile organic compounds were tested using SW-846, Method 8270. The compounds phenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, benzyl alcohol, 1,2-dichlorobenzene, 4-methylphenol, 2,4-dimethylphenol, benzoic acid, 1,2,4-trichlorobenzene, 4-chloroaniline, 3-methylphenol, acetophenone, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were detected (Table 9). Review of the semi-volatile data indicates that the highest concentrations also occur along transverse A16 (Table 9) (Plate 2).

4.6 Hazardous Waste Characteristics

4.6.1 Characteristic of Ignitability

Twenty-four of the sediment/soil samples collected from the CS-A project site were analyzed for the characteristics of ignitability using SW-846, Method 1010. Only sample A13C, at the 4-8.5 depth exhibited the characteristics of ignitability having a flash point of 98 degrees Fahrenheit (Table 10).

Table 8

CS - A

Volatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-20
PARAMETERS														
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	580 J	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	1600 B	1500 B	1700 B	25000 B	5400 B	4400 B	2500 B	2300 B	3800 B	20000 B	30000 B	5800 B	3100 B	2100
Acetone	ND	1000 JB	690 JB	22600 JB	4500 JB	2400 JB	1300 JB	2300 B	6300 B	16000 B	23000 JB	4100 JB	2000 JB	2400
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	1600	ND	6400 J	ND	260 J	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	15000	ND	ND	1400	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600 J	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	740 J	ND	ND	ND	ND	ND	ND	ND	870 J	100000	14000 J	ND	690 J	2100
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	440 J	2600 J	8800 J	ND	ND	ND
Trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	380 J	680 J	ND	ND	4600 J	11000 J	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	330 J	ND	ND	ND	ND	ND
Toluene	ND	ND	170 J	ND	690 J	ND	ND	ND	ND	7200 J	ND	ND	ND	5700
Chlorobenzene	650	240 J	530 J	5200 J	4600	2100	590 J	420 J	1100 J	31000	24000	6100	620 J	18000
Ethylbenzene	1100	2900	ND	3600 J	ND	1400 J	ND	ND	1400 J	80000	50000	ND	560 J	330 J
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene(total)	ND	360	3800	ND	ND	460 J	ND	ND	5200	500000	240000	ND	ND	ND
Acrolein	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	170 J	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	6900	ND	ND	ND	ND	ND	ND	ND	ND
Acetonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iodomethane	460 J	630 J	ND	ND	1700 J	1800 J	1300 J	1000 J	ND	ND	ND	3000 J	1000 J	ND
Propionitrile (Ethyl Cyanide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 8
(Cont.)

Volatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-20
PARAMETERS														
Methacrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isobutyl alcohol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachlorethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-Butadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 9

CS - A

Semivolatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-2(
PARAMETERS														
Phenol	ND	720 JB	ND	ND	ND	1300 J	ND	ND	ND	610000 B	21000 JB	ND	ND	3800(
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	3200 JB	ND	5100	ND	120 J	4900 J	32000 J	23000 J	ND	ND	ND
1,4-Dichlorobenzene	210 J	ND	3600 J	58000	18000 J	39000	730	1100	64000	390000 B	260000 B	13000 J	34000 J	2900
Benzyl Alcohol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8200(
1,2-Dichlorobenzene	58 J	ND	840 J	6100 JB	ND	12000	210 J	1100	74000	650000 B	360000 B	ND	ND	6100
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200(
N-Nitroso-Di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	1600 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5500(
Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	ND	28000(
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	8600	12000 J	31000 J	47000	ND	490	46000	160000 B	12000 JB	6000 J	ND	9500
Naphthalene	130 J	ND	850 J	ND	ND	ND	ND	ND	ND	ND	5600 J	ND	ND	1500
4-Chloroaniline	140 J	17000	9400	13000 J	ND	ND	ND	ND	ND	ND	14000 J	ND	ND	7300(
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	600 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Picoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3600
Pentachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200
N-Nitrosopyrrolidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	150 J	ND	1300 JB	ND	ND	24000	320 J	140 J	8100 J	ND	4300 JB	ND	ND	2900
N-Nitrosomorpholine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
a,a-Dimethylphenethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 9
(Cont.)

Semivolatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-20
PARAMETERS														
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Phenylenediamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-butylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	ND	ND	19000	3100 J	8000 J	28000	ND	140 J	10000 J	19000 J	ND	ND	ND	ND
Isoafrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	ND	ND	13000	4400 J	18000 J	19000	260 J	380 J	28000	37000 J	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	800 J	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (1)	110 J	ND	ND	ND	ND	ND	ND	49 J	2500 J	ND	4200 J	ND	ND	ND
4-Bromophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	1700 J	ND	ND	ND	ND	59 J	4300 J	ND	ND	ND	ND	ND
Pentachlorophenol	800 J	ND	ND	ND	ND	ND	ND	88 J	ND	ND	ND	ND	ND	ND
Phenanthrene	66 J	ND	670 J	3000 J	ND	1800 J	ND	ND	1800 J	ND	5400 J	4900 J	14000 J	790 J
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-Butylphthalate	55 JB	1100 JB	1100 JB	ND	4400 J	ND	ND	56 J	ND	ND	ND	ND	ND	2900 J
Fluoranthene	ND	ND	540 J	3900 J	6700 J	1400 J	ND	ND	ND	ND	3600 J	8100 J	ND	ND
Pyrene	ND	ND	540 J	4900 J	ND	1500 J	ND	ND	ND	ND	4200 J	8300 J	10000 J	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	1100 J	ND	160 J	11000 J	70000 JB	100000 B	ND	ND	620 J
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5700 J	4800 J	ND	1000 J
bis(2-Ethylhexyl)phthalate	75 J	ND	ND	3400 J	8600 J	6200 B	190 JB	240 JB	11000 JB	26000 JB	ND	6700 J	ND	20000
Di-n-octyl phthalate	ND	ND	ND	ND	3800 J	ND	ND	ND	ND	ND	18000 JB	7300 J	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 9
(Cont.)

Semivolatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-2
PARAMETERS														
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	10000 J	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diallate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenylamine	110 J	ND	ND	ND	ND	ND	ND	42 J	2500 J	ND	4200 J	ND	ND	ND
5-Notro-o-toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinityophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroquinoline-1-oxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aramite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzilate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Aacetylaminofluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

** Units: Ug/Kg **

Table 10

CS - A

Characteristics of Hazardous Waste

Sample I.D.		Date	Ash (%)	Solids (%)	Alkalinity (%)	Cyanide Reactive (mg/kg)	Cyanide Total (mg/kg)	Flash Point (deg F)	pH	Sulfide (mg/kg)	Sulfide Reactive (mg/kg)	Total PCBs	Observed Creek Sediment
A10	6-7	08/22		85.9									
A10	9-10	08/22		64.4								0	
A10	15-17	08/22	96.8	76.3	0.87	ND	ND	>200	7.9	ND	ND	0	
A10	20-22	08/22		70.6								.48	
A10	24-29	08/22		79.2								1.4	
A10	37-38	08/22		81.0								14.3	
A11A	8-13	07/19		71.9								3.88	
A11A	13-18	07/19		65.8								0	
A11B	4-8	07/18	96.8	72.6	0.12	ND	ND	>200	7.7	86.0	ND	0	
A11B	8.1-10.6	07/18		57.3								.53	
A11B	12-17	07/18		76.9								.21	
A11C	2-6.5	07/18	99.7	72.6	ND	ND	ND	>200	7.6	ND	ND	.92	
A11C	6.5-10.5	07/18		78.0								55	
A11C	12.5-16.5	07/18		83.7								13	
A11D	8-10	07/18	80.8	72.9	0.13	ND	2.5	>200	8.8	ND	ND	1.3	
A11D	18.5-23.5	07/18	98.5	82.2	0.13	ND	ND	>200	8.0	ND	ND	0	
A12A	8-11	07/19		74.2								38	
A12A	11-20.5	07/19		79.4								0	
A12B	3-7	08/22	89.0	12.2	6.3	ND	1.6	>200	6.9	ND	ND	.067	
A12B	9-12	08/22		75.3								32	*
A12B	14-17	08/22		80.6								13.83	
A12B	17-19	08/22		78.6								0	
A12C	4-9	07/12	91.7	55.8	1.0	ND	ND	>200	6.2	ND	ND	.27	
A12C	10-13	07/12		78.5								0	*
A12C	14-16	07/12		82.8								0	
A12D	6-13	07/18		76.2								0	
A12D	17-20	07/18	98.6	74.1	0.17	ND	ND	>200	7.9	ND	ND	530	
A12D	20-25	07/18		81.3								101	
A13A	9-14	07/20										15.8	
A13A	14-19	07/20										0	
A13A	19-20.5	07/20										0	
A13B	4.5-6	07/11	86.1	32.9	2.2	ND	5.8	>180	6.6	ND	ND	0	
A13B	6-9.5	07/11		74.9								440	*
A13B	9.5-12	07/11		81.6								50	
A13C	4-8.5	07/12	91.3	41.0	1.5	ND	ND	98	6.2	ND	ND	2.25	
A13C	6-13	07/12		77.5								910	*
A13C	13-16	07/12		83.1								25.5	
A13D	18-23	07/19	99.2	76.0	0.14	ND	ND	>200	7.7	ND	ND	0	
A14A	4-9	07/20										1.3	
A14A	13.5-23.5	07/20										.099	
A14A	23.5-28.5	07/20										.062	
A14B	4-8.5	07/11	94.3	59.9	1.1	ND	ND	>200	6.6	ND	ND	0	
A14B	8.5-13	07/11		84.1								114	*
A14C	4-8.5	07/11	87.2	23.1	2.7	ND	2.9	>180	6.0	ND	ND	6.3	
A14C	8.5-10.5	07/11		59.1								540	*
A14C	13.5-16.5	07/11		84.0								2.22	
A14D	10-14	07/12	95.8	79.9	0.68	ND	ND	>200	8.0	ND	ND	6.2	
A14D	15-19	07/12		77.1								0	
A14D	24-29	07/12		84.5								0	
												0	

Table 10
(Cont.)

Characteristics of Hazardous Waste

Sample I.D.	Date	Ash (%)	Solids (%)	Alkalinity (%)	Cyanide Reactive (mg/kg)	Cyanide Total (mg/kg)	Flash Point (deg F)	pH	Sulfide (mg/kg)	Sulfide Reactive (mg/kg)	Total PCBs	Observed Creek Sediment
A15A 9-14	07/20										0	
A15A 14-19	07/20										0	
A15A 19-24	07/20										0	
A15B 6-9	07/07	95.1	59.0	1.1	ND	ND	>200	7.9	ND	ND	3.7	
A15B 13-16	07/07		83.8								9	
A15B 16-19	07/07		79.6								0	
A15C 4.5-9	07/10	85.4	26.0	0.97	ND	1.8	>200	7.4	ND	ND	980	*
A15C 9.5-14.5	07/10		79.9								1.66	
A15C 14.5-17.5	07/10		82.3								17.3	
A15D 4-9	07/12	96.6	83.0	0.64	ND	ND	>200	8.5	ND	ND	0	
A15D 12-14	07/12		85.9								0	
A15D 19-24	07/12		81.2								0	
A15D 24-29	07/12		75.0								0	
A16A 9-14	07/20										0	
A16A 14-19	07/20										2.96	
A16A 24-29	07/20										0	
A16B 9-12	07/18	75.3	23.5	0.56	ND	19.2	>200	6.8	ND	ND	1600	*
A16B 14-19	07/18		74.7								5.4	
A16C 2-5	07/18	84.6	20.2	0.14	ND	5.8	>200	6.8	ND	ND	0	*
A16C 7-12	07/18		69.2								13	
A16C 12-17	07/18		79.7								1.55	
A16D 13-18	07/20										0	
A16D 18-23	07/20										.09	
A16D 23-31	07/20										0	
A16E 13-18	07/20										.81	
A16E 18-23	07/20										1.99	
A16E 25.5-28	07/20										.95	
A21B 1-6	08/22	80.6	40.3	2.1	ND	6.0	>200	7.0	1.7	ND	27	*
A21B 6-10	08/22		54.4								.2	
A21B 10-13	08/22		79.4								0	
A21C 4-8	07/14	87.7	23.2	4.2	ND	5.0	>200	7.2	ND	ND	30	*
A21C 8-11	07/14		72.9								0	
A21C 13-14.5	07/14		85.8								0	
A21D 4-9	07/10		82.8								.09	
A21D 9-14	07/10		78.1								.15	
A21D 14-19	07/10		69.6								0	
A22A 9-14	07/11		71.4								0	
A22A 19-22	07/11		79.4								0	
A22A 24-28	07/11		77.4								0	
A22B 0-7	08/22	97.4	72.9	0.88	ND	ND	>200	7.8	ND	ND	120	*
A22B 7-13	08/22		77.2								0	
A22C 3-9	08/22	94.9	70.4	1.1	ND	ND	>200	7.9	41.7	6.6	19	*
A22C 10-15	08/22		79.8								0	
A22D 4-9	07/11		80.7								12	
A22D 9-14	07/11		74.1								0	
A22D 24-27	07/11		84.8								0	
A23A 12-13	07/14		87.6								3.99	
A23A 13-19	07/14		74.0								6.9	
A23A 19-20	07/14	94.7	66.1	1.3	ND	ND	>200	8.6	9.4	ND	150	
A23A 21-23	07/14		83.8								1.6	

4.6.2 Characteristic for Reactivity

Twenty-four samples were collected and analyzed for the hazardous characteristic of reactivity using SW-846, Method 7332 and Method 7342. Review of the analysis results indicate that none of the twenty-four samples collected exhibited the characteristic of reactivity (Table 10).

4.6.3 Characteristic for Corrosivity

Twenty-four samples were analyzed for the hazardous characteristic of corrosivity using SW-846, Method 9045. The pH of the twenty-four samples analyzed by this method ranged from 6.0 to 8.8 pH units. Based on these results, none of the samples exhibited the characteristics of corrosivity as outlined in 40 CFR 261.22 (Table 10).

5.0 CONCLUSIONS - AVENDT WORK

5.1 Site Investigation

The site investigation performed by AGI at CS-A identified five (5) unconsolidated stratigraphic units; fill material, fluidized creek sediments, the Cahokia Unit, a discontinuous clay layer and the Henry Formation. Fill material, which is the uppermost unit encountered outside of the creek channel ranged in thickness from one to 15 feet. The fluidized creek bottom sediments ranged in thickness from one-half foot to 11 feet thick. This unit was the uppermost unit encountered within the creek channel. The Cahokia Unit, which is situated on top of the Henry Formation, ranges in thickness from one (1) to 20 feet thick. The Cahokia Unit consists of sediments of the upper Henry Formation which were reworked by the Mississippi River. The Henry Formation is the lowermost unit encountered at the study area. This unit is 98 to 103 feet thick and extends to the bedrock surface which is approximately 110 feet below the surface.

CS-A was characterized through a network of 34 soil borings. The results of the boring program indicate that there is approximately 19,500 cubic yards of contaminated creek bottom sediments within CS-A. This estimate was derived by subdividing the creek into eight discrete zones, measuring the width and length of each zone, determining the average depth of creek bottom sediments in each zone, and calculating the volume of sediment in each zone. The eight zone volumes were added together to determine the total volume of sediments within the creek channel. The creek sediment analysis statistics are presented in Table 11.

5.2 Chemical Characterization

5.2.1 Manufacturing Process Involved in PCB Synthesis

As part of the investigation performed by The Avendt Group, Inc., a literature search was performed to determine the industrial process used to produce PCBs. Direct chlorination of biphenyl in the presence of a catalyst is the method most commonly used by industry for the production of PCBs (Romo, 1988; Hutzinger, Safe, Zitko, 1983).

TABLE 11
CREEK SEGMENT - A
CREEK SEDIMENT ANALYSIS STATISTICS

PARAMETER	CONCENTRATION RANGE (PPM)	CONCENTRATION ARITHMETIC MEAN	CONCENTRATION GEOMETRIC MEAN
TOTAL PCBs (PPM)	ND - 1,600.00	85.78	27.5423
PCB PRECURSORS (PPM)			
BIPHENYL	0.10 - 24.00	6.60	1.1238
CHLOROBIPHENYL	0.02 - 160.00	33.58	1.2254
DICHLOROBIPHENYL	0.05 - 160.00	47.70	8.7297
TRICHLOROBIPHENYL	0.10 - 24.00	5.69	0.7716
TETRACHLOROBIPHENYL	0.03 - 21.00	5.35	1.0899
PENTACHLOROBIPHENYL	ND - 550.00	144.30	16.3418
HEXACHLOROBIPHENYL	ND - 640.00	270.62	27.8997
DECACHLOROBIPHENYL	ND - 640.00	279.12	68.6119
EPTOX METALS (PPM)			
CADMIUM	0.01 - 4.00	1.47	0.6309
LEAD	0.10 - 35.40	6.80	2.0309
ARSENIC	ND - 0.35	0.04	0.0155
BARIUM	ND - 3.90	1.49	1.3079
CHROMIUM	ND - 0.60	0.07	0.0300
TOTAL METALS (PPM)			
SILVER	2.40 - 348.00	118.42	69.1830
ALUMINUM	1400.00 - 8050.00	4020.77	3715.3523
ARSENIC	ND - 194.00	64.25	33.8844
BARIUM	241.00 - 5200.00	1347.31	933.2543
BERYLLIUM	ND - 44.10	12.28	5.2480
CALCIUM	ND - 17000.00	10433.85	9772.3722
CADMIUM	2.60 - 532.00	217.80	106.6350
COBALT	ND - 78.00	27.35	22.1870
CHROMIUM	62.00 - 695.00	345.67	255.7407
COPPER	1160.00 - 91800.00	32628.46	21081.4270
IRON	10100.00 - 312000.00	113300.00	76225.4500
MERCURY	ND - 124.00	30.52	9.2789
MAGNESIUM	ND - 7800.00	3140.77	2755.4974
MANGANESE	40.10 - 379.00	184.65	148.8332
SODIUM	ND - 7800.00	2626.62	2116.4109
NICKEL	95.20 - 2230.00	1478.78	973.1952
LEAD	145.00 - 32400.00	10069.54	4555.1219
ANTIMONY	ND - 356.00	116.23	72.9625
SELENIUM	ND - 41.60	13.10	6.3899
VANADIUM	ND - 43.00	30.85	25.2638
ZINC	373.00 - 26800.00	10822.54	6254.6066

TABLE 11 (CON'T)
CREEK SEGMENT - A
CREEK SEDIMENT ANALYSIS STATISTICS

PARAMETER	CONCENTRATION RANGE (PPM)	CONCENTRATION ARITHMETIC MEAN	CONCENTRATION GEOMETRIC MEAN
VOLATILES (PPM)			
1,1-DICHLOROETHANE	ND - 13.00	4.38	2.6157
1,2-DICHLOROETHENE	ND - 15.00	6.51	3.9039
TRICHLOROETHENE	ND - 100.00	16.83	4.1610
CHLOROBENZENE	ND - 31.00	8.77	3.7393
ETHYLBENZENE	ND - 80.00	17.62	4.0188
XYLENE(TOTAL)	ND - 500.00	95.55	8.3425
DICHLORO-DIFLUORMETHANE	ND - 31.00	11.68	7.7428
SEMI-VOLATILES (PPM)			
1,3-DICHLOROBENZENE	ND - 73.00	25.90	16.1733
1,4-DICHLOROBENZENE	ND - 99.00	43.88	36.2243
1,2-DICHLOROBENZENE	ND - 99.00	44.51	32.0331
1,2,4-TRICHLOROBENZENE	ND - 99.00	40.75	28.3595
ACETOPHENONE	ND - 99.00	36.68	24.3837
1,2,4,5-TETRACHLORO-BENZENE	ND - 73.00	25.01	17.3620
PENTACHLOROBENZENE	ND - 73.00	29.80	23.6428

NOTES:

- For calculations of mean values, detection limits were substituted for reported 'ND' and 'BDL' data points.
- Geometric Mean calculated according to the method described in *Water & Sewage Works*, June/July: 1976, article titled 'Estimating the Reliability of Advanced Waste Treatment' by Robert B. Dean, Science Advisor, EPA.

5.2.2 Indications of Biphenyl Present with PCBs

Several PCBs were detected in the sediments ranging from non-detect to 1600 mg/kg (Table 12). Chemical analysis shows that the PCB concentrations were highest at the north end of the creek, and decreased further south along the creek (Figure 66). The reported data for the PCB precursor, biphenyl, followed a similar pattern as the PCB concentrations (Figure 67) (Table 13).

5.2.3 Organic Analysis

The results of the Appendix IX compound search indicate that nine volatile organic compounds - methylene chloride, acetone, 1,2-dichloroethene (total), trichloroethene, toluene, chlorobenzene, ethylbenzene, xylene (total), and dichlorodifluoromethane were detected in the creek channel sediments (Table 8). The volatile organic compounds were tested using SW-846, Method 8240. The highest values of each of these compounds occur on the A16 transverse, the northernmost sampling point (Plate 2).

The Appendix IX compound search indicated that 16 semi-volatile compounds - phenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, benzyl alcohol, 1,2-dichlorobenzene, 4-methylphenol, 2,4-dimethylphenol, benzoic acid, 1,2,4-trichlorobenzene, 4-chloroaniline, 3-methylphenol, acetophenone, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were detected in the creek bottom sediments of CS-A (Table 9). The semi-volatile data indicates that the highest concentrations also occur along transverse A16 (Table 9) (Plate 2).

5.2.4 EP Tox Metals

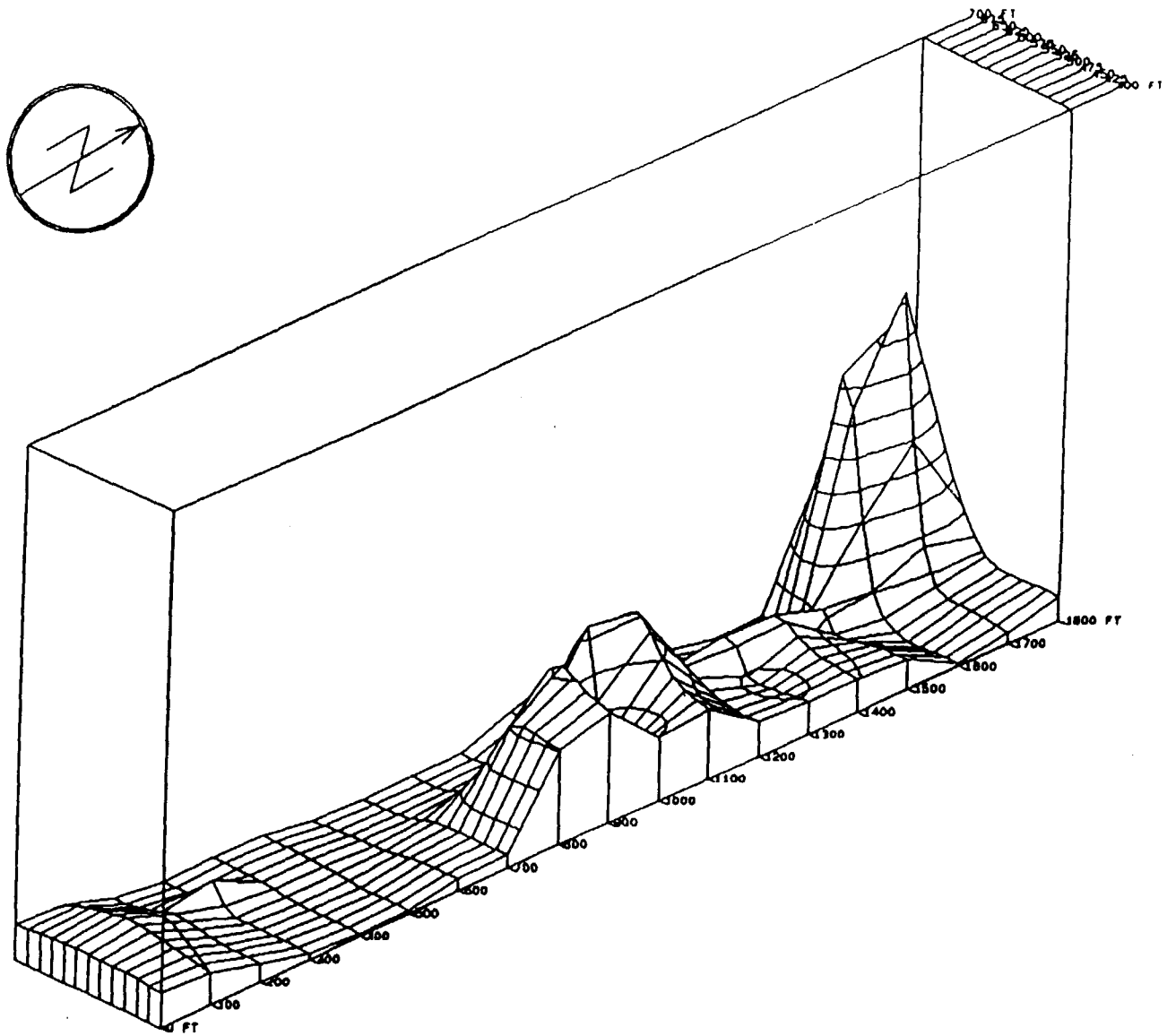
Review of the EP Tox analysis indicates that six EP Tox RCRA metals were within allowable EP Tox limits (Table 6). The creek-bottom sediments contain Cd and Pb above EP Tox limits at some locations (Table 6). The EP Tox limit for Pb and Cd was exceeded in isolated locations in the southern one-third to one-half of CS-A (Plate 2; Figures 35 and 37).

Table 12

CS - A

PCB Concentrations

SAMPLE IDENTIFICATION	PCB	CONCENTRATION(PPM)
A10B 24 - 29	AROCLOR 1221	10
A11B 4 - 8	AROCLOR 1254	.53
A11C 2 - 6.5	AROCLOR 1232	45
A12B 3 - 7	AROCLOR 1232	32
A12C (ALL)	AROCLOR (ALL)	ND
A13B 4.5 - 6	AROCLOR 1232	340
A13C 4 - 8.5	AROCLOR 1221	780
A14B 4 - 8.5	AROCLOR 1221	100
A14C 4 - 8.5	AROCLOR 1254	350
A14D (ALL)	AROCLOR (ALL)	ND
A15B 13 - 16	AROCLOR 1232	7.2
A15C 4.5 - 9	AROCLOR 1232	300
A15D (ALL)	AROCLOR (ALL)	ND
A16B 9 - 12	AROCLOR 1232	1600
A16C 2 - 5	AROCLOR (ALL)	ND
A21C 4 - 8	AROCLOR 1260	30
A21D (ALL)	AROCLOR (ALL)	ND
A22A (ALL)	AROCLOR (ALL)	ND
A22B 0 - 7	AROCLOR 1248	120
A22D 4 - 9	AROCLOR 1260	12
A23B 19 - 20	AROCLOR 1248	150

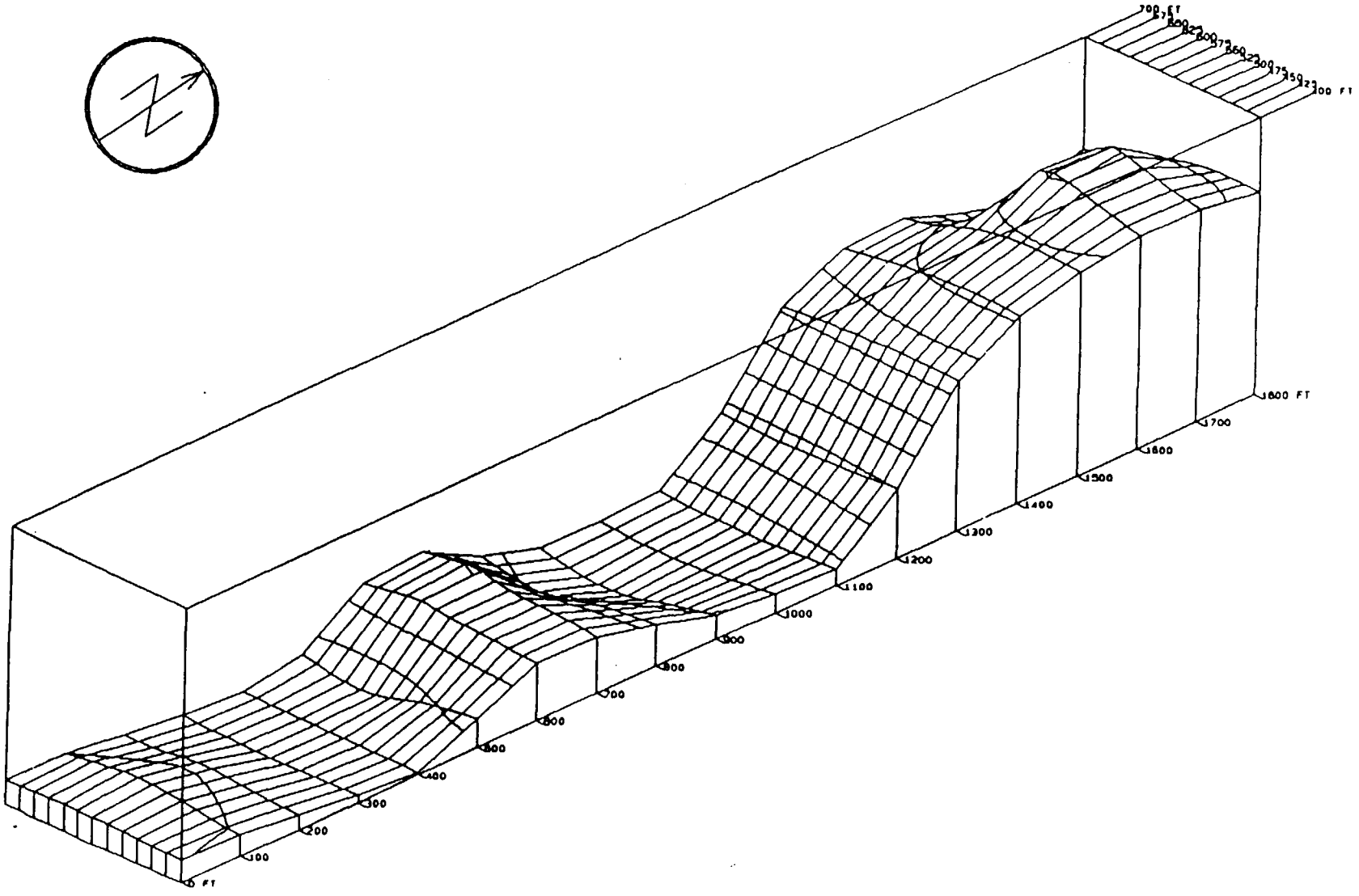


CS - A
PCB's Greatest Concentrations

X, Y, Z=3: 1: 1

THE AVENDT GROUP, INC.

Figure 66



CS - A
Biphenyl Concentrations

X, Y Z=1, 1, 30

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Figure 67

TABLE 13

BIPHENYL CONCENTRATIONS

TABLE 13
CS - A

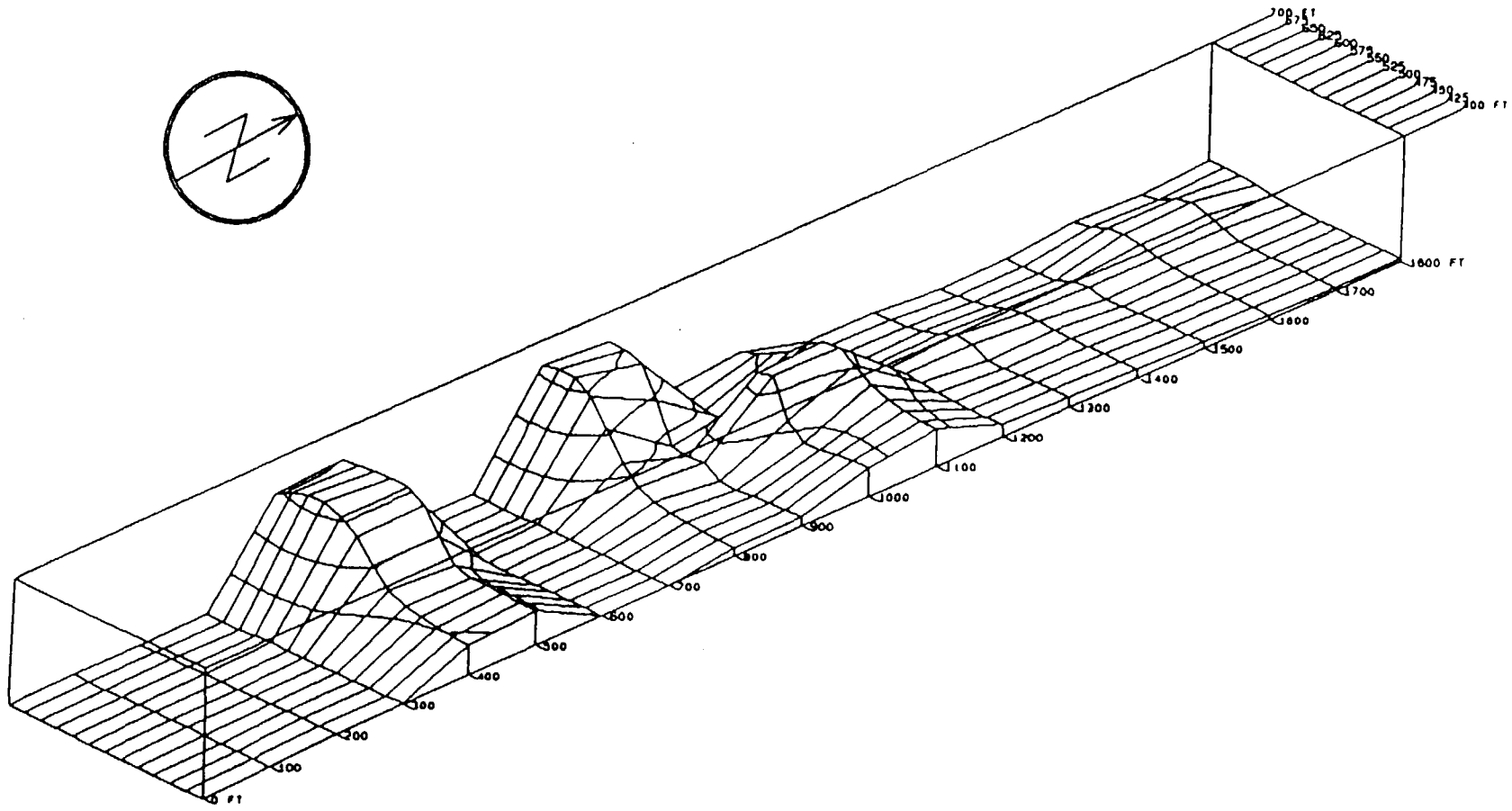
Biphenyl Concentrations

SAMPLE IDENTIFICATION	CONCENTRATION(mg/kg)	
A11B 4 - 8	6.6	J
A11C 2 - 6.5	5.2	J
A12B 9 - 12	0.08	J
A16B 9 - 12	8.3	J
A16C 2 - 5	24.0	J
A21B 1 - 6	0.1	J
A22B 0 - 7	0.3	J
A22C 3 - 9	0.3	J
A23C 21 - 23	2.9	J

» 'J' Indicates an estimated value for or an analyte that meets the identification criteria but the result is less than the specified detection limit.

5.3 Spatial Distribution

The laboratory reports from the Avendt investigation reveal the spatial distribution within CS-A. The laboratory reported values show the PCBs and biphenyl concentrations are highest at the north end of CS-A (Figures 66 & 67). The laboratory reported values show heavy metal concentrations are highest in the southern one-third to one-half of CS-A (Figures 68-73). The laboratory reported values for volatiles and semi-volatiles show the concentrations for these parameters to be highest at the northernmost sampling points within CS-A (Tables 8 and 9).



CS - A
EPTOX: Cadmium

X Y Z=1: 1: 75

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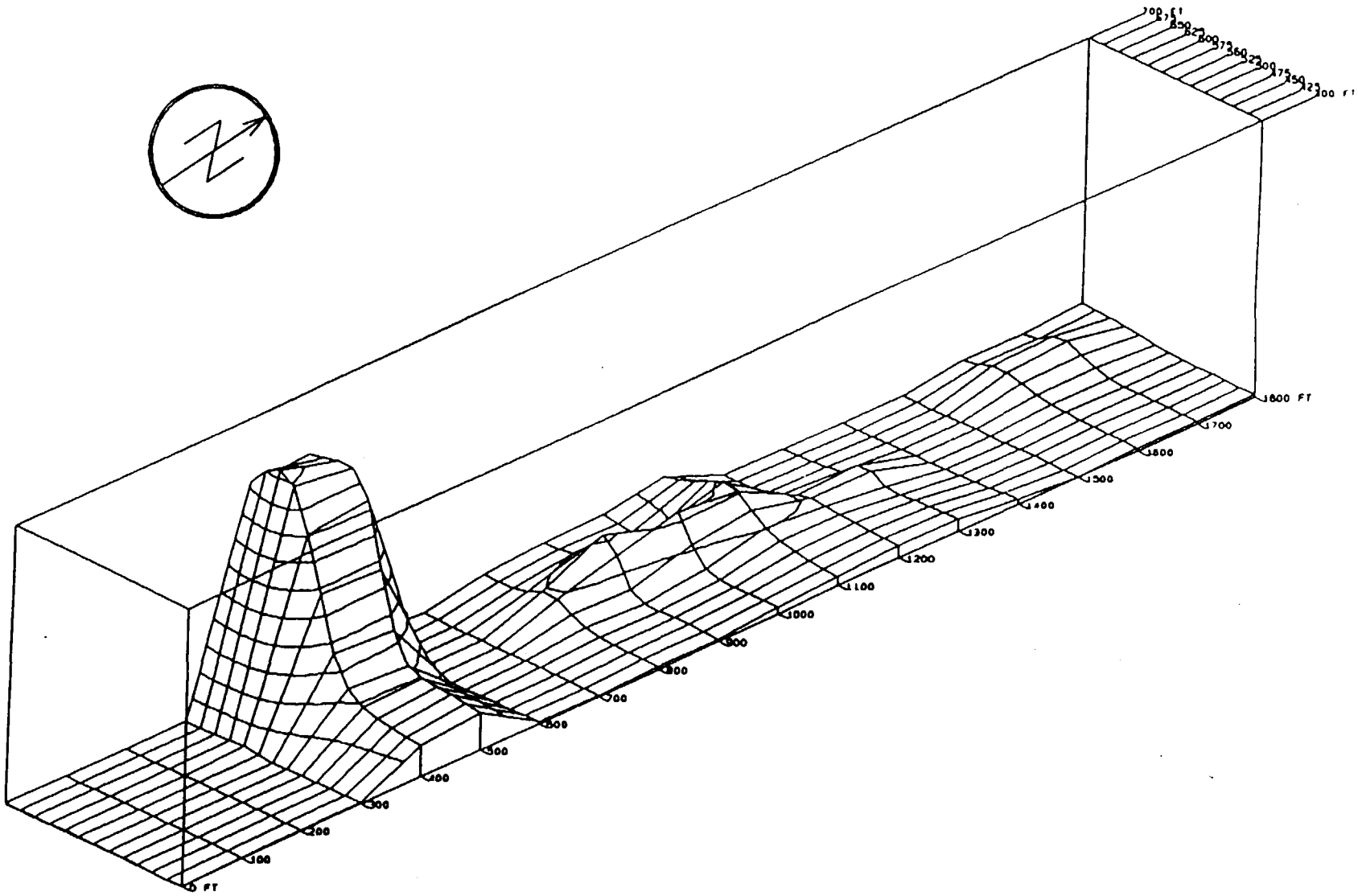
Figure 68



CS - A
EPTOX: Lead

X, Y, Z=1: 1, 20

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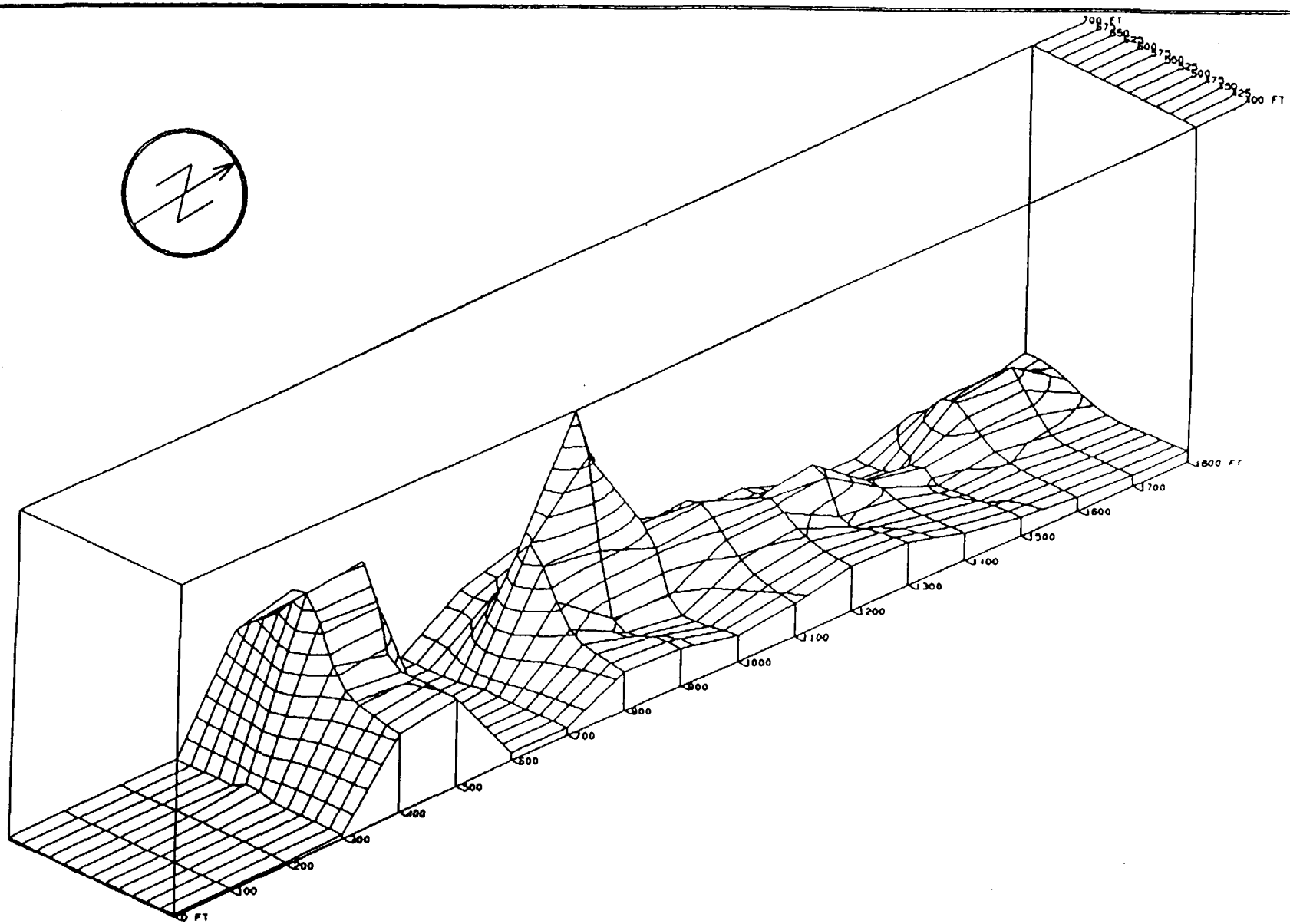
Figure 71

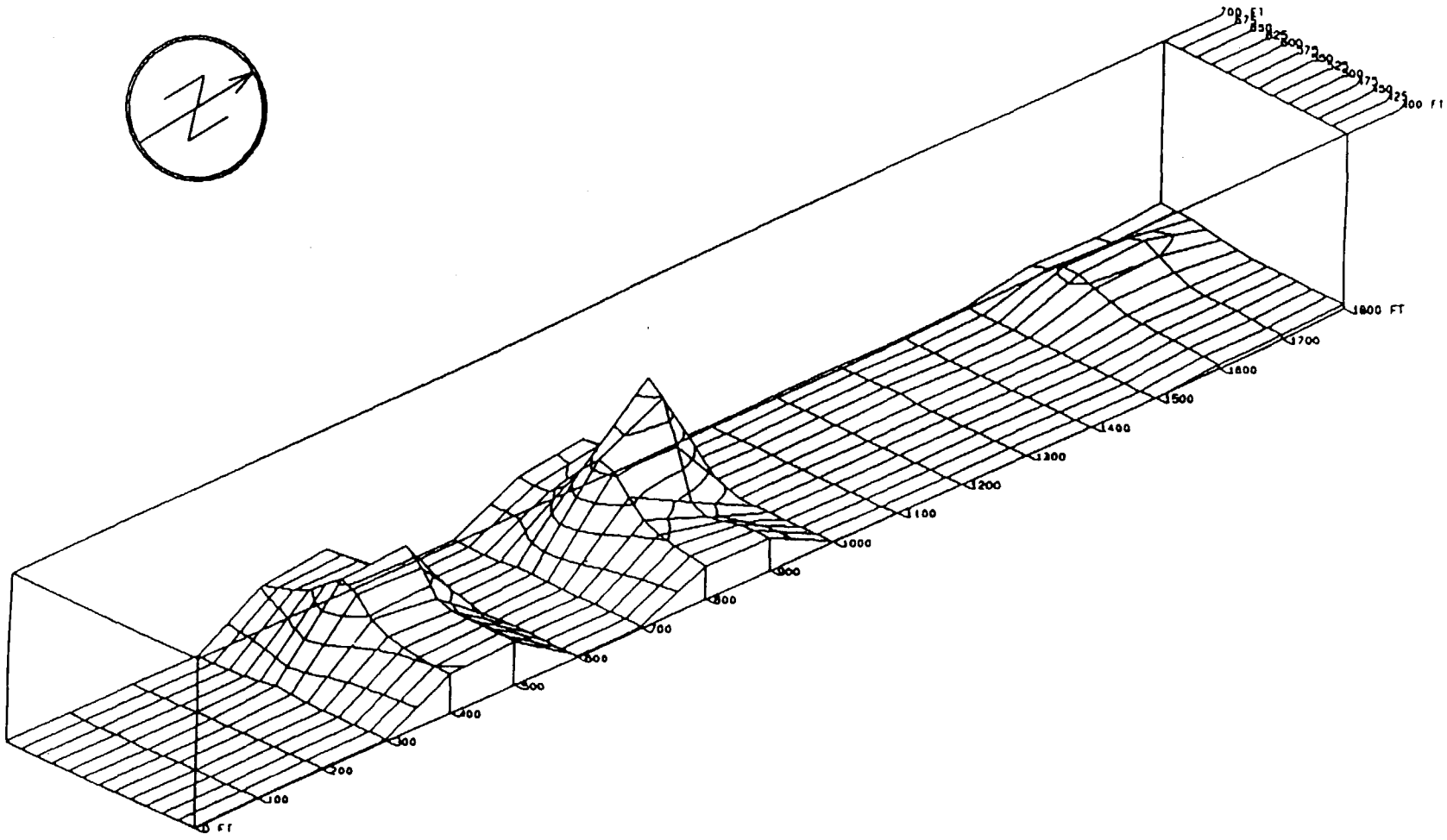


CS - A
Copper Concentrations

X Y Z=50: 50 .5

THE AVENDT GROUP, INC.

Figure 70



CS - A
Selenium Concentrations

X, Y, Z=1, 1, 10

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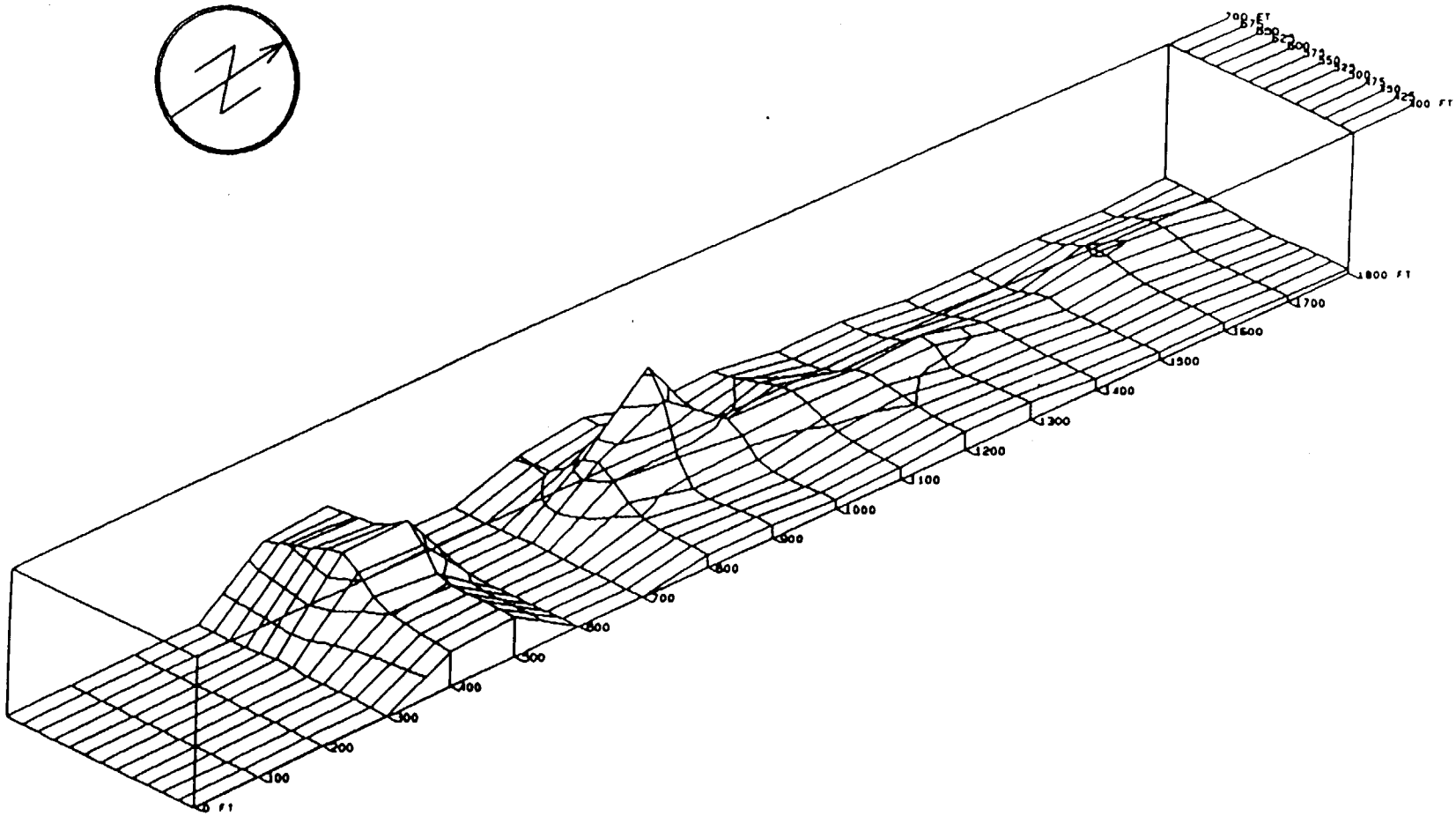
Figure 71

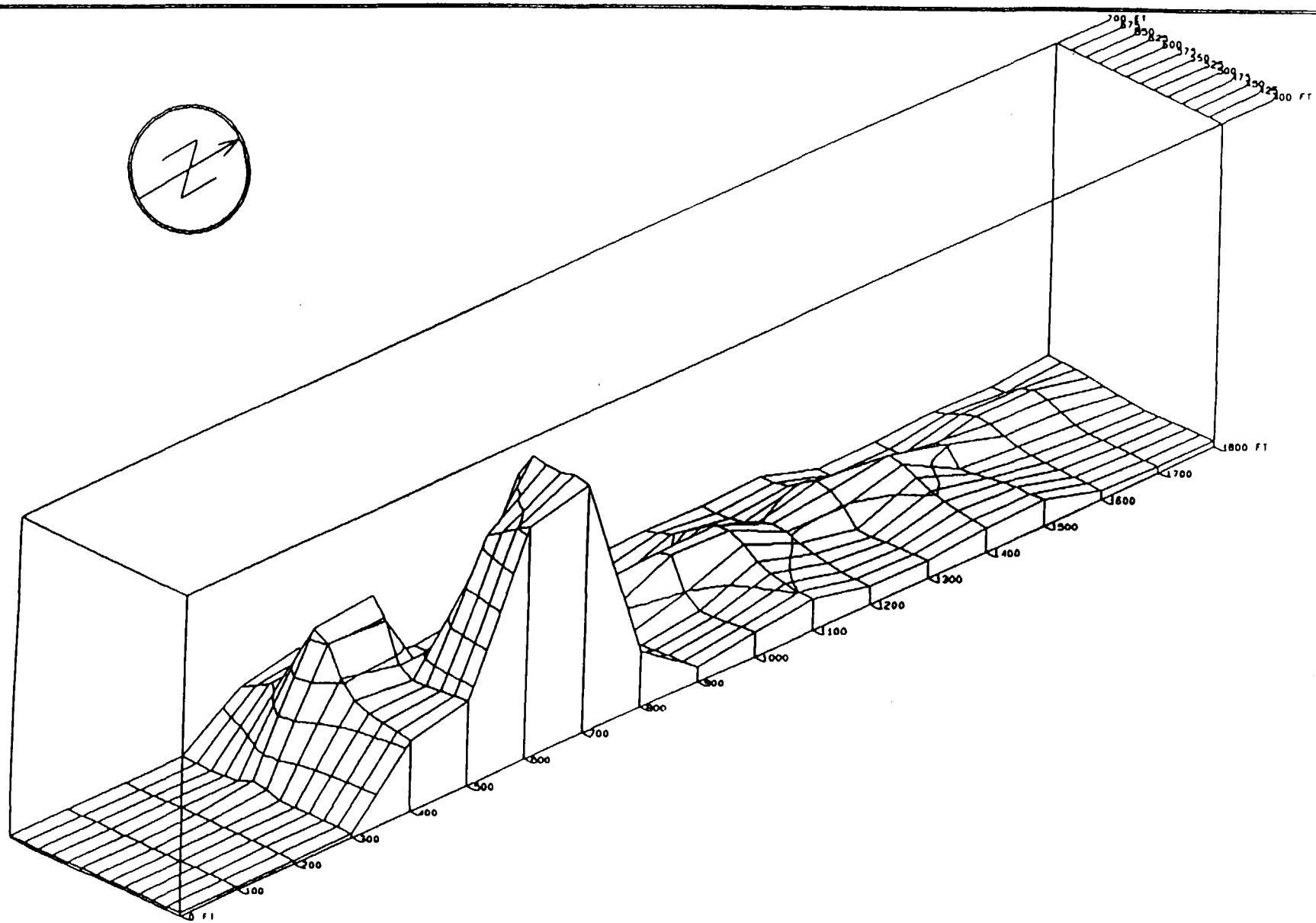


CS - A
Silver Concentrations

X, Y, Z=1, 1, 1

THE AVENOT GROUP, INC

Figure 72



CS - A
Nickel Concentrations

X Y Z=4. 4. 5

THE AVENOT GROUP, INC

Figure 73

APPENDIX A

HEALTH AND SAFETY PLAN

FOR

AT-RISK SAMPLING

ON SAUGET SITES AREA, SECTOR A

CERRO COPPER PRODUCTS COMPANY

SAUGET, ILLINOIS

Prepared by:

The Avendt Group, Inc.
432 North Saginaw Street
Third Floor, Northbank Center
Flint, Michigan 48502

SITE DESCRIPTION:

The Sauget Site Area consists of two creek sectors, CS-A and CS-B. The CS-A portion of Dead Creek will be sampled in this sampling event.

Creek Sector A has two smaller sections which are identified as CS-A1 and CS-A2. CS-A1 is the largest section, and lies on the north-northwest section of the Cerro property. This sector is approximately 1,200 feet long and 80 feet wide. CS-A2 is the smaller portion, and is 400 feet long and 80 feet wide. A lift station is located at the northernmost end of the Creek section, and is used to control the amount of flow emanating from the Creek.

The Cerro Copper Products Company facility, located on the west side of the Creek, has owned this property since 1970. Records indicate that waste discharge into the Creek began in the late 1930's. Environmental impacts, such as discoloration of the Creek prior to 1970 and 1971, is indicated in an aerial photograph. A fence was constructed in 1971, that separated CS-A from the Cerro facility.

CS-A lies on the east side of the Mississippi River along the west side of its flood plain, in the town of Sauget, Illinois. It is bounded on the south by Queeny Avenue, on the north by the Alton Southern railroad tracks, and by the Cerro facility and Site I on the west and east, respectively.

Sectors CS-A1 and CS-A2 of Dead Creek both have steep banks, approximately seven to ten feet high. During heavy rains or seasonal wet periods, the Creek waters rise to as much as four to five feet. Surface water flow is intermittent. The creek bed consists of approximately seven feet of sandy silt over medium-fine sands. The creek bank consists of interbedded silty sand and sandy silts. The aquifer level surrounding Dead Creek is as shallow as ten feet, and this area is subject to possible flooding.

The Cerro Copper Products Company facility is located in a heavily industrialized area. Monsanto Company, located north of the Cerro Copper Products Company facility, is the largest chemical industry in the area. Other smaller industries exist northeast of the facility.

Site: Sauget Site Area **Job Number:** 88001

Site Description: See attached sheet.

Location: Sauget, Illinois **Perimeter Established?** Yes

Performed by: The Avendt Group, Inc.

Proposed Starting Date of Site Activity: July 5, 1989

Anticipated Date of End of Site Activity: September 5, 1989

Plan Prepared by: Jeff Kost

Date: June 29, 1989

Objective of Entry: The objective of entry into Sauget Site Area Sectors CS-A1 and CS-A2 is to sample the subsoils in and around the Creek area by boring methods. Surface soil samples will be collected. Site-specific QA/QC and decontamination techniques will be employed throughout the sampling activities. A laboratory following CLP procedure will be utilized to obtain analytical results. The analytical information will then be evaluated for extent of contamination.

Objective of the Health and Safety Plan (HSP): The objective of writing this Health and Safety Plan for the Cerro Copper Products Company site at Sauget is to:

1) Provide measures that will minimize accidents and injuries that may occur during this particular project;

2) Guide the Avendt Group personnel and any others that may be associated during the work sessions;

3) Remind any working personnel at the site of possible dangers and variable weather conditions as well as to provide guidance for normal site operations. Emergency situations that may be experienced include:

a) variety of hazardous/toxic chemicals;
b) biological agents;
c) heat or other physical stresses;
d) equipment-related accidents;
e) fire or explosion creatable by on-site activities;

4) To meet standards as required by OSHA/NIOSH/EPA as contained in 29CFR-1910.120.

Possible Hazards: Volatile organics, semivolatile organics, pesticides/PCBs, inorganics and heavy metals.

Areas Affected: Surface water in the Creek. Soils and sediments proximate to the Creek. Possibly the groundwater.

Topography: The CS--A site is flat with little topographic relief. The main topographic difference is the Dead Creek Channel.

Weather Condition: Summer, temperatures in range of 75 degrees F up to 100 degrees F at 100% humidity.

Additional Information: Will be announced when received by The Avendt Group, Inc.

On-Site Organization and Coordination: The following functions have been assigned, respectively:

Project Team Leader:	Chris Bade
Scientific Advisor:	Jeff Kost
Site Safety Officer:	Chris Bade
Public Information Officer:	
Security Officer:	Cerro Copper Security
* Record Keeper:	Avendt Group Personnel
Financial Officer:	Cerro Copper Personnel
Field Team Leader:	Chris Bade
Field Team Members:	Chris Bade, Jeff Kost, Mark Keyes
Federal Agency Representatives:	
State Agency Representatives:	
Local Agency Representatives:	
Co-Contractor(s):	

* All personnel arriving or departing the site should log in and out with the Record Keeper.

Out-of-bounds Area: Sectors A and B to nine team workers.

Established Command Post/Staging Area: Shower Trailer.

Prevailing Wind Conditions Are: To be determined (TBD).

Upwind/Downwind: TBD.

Exclusion Zone: TBD.

Personal Protective Equipment: Based on the evaluation of the potential hazards, the following levels of personal protection have been designated for applicable work areas or tasks.

Location	Job Function	Protection
Exclusion Zone	Soil Boring/sampling	A
CS-A11-6 and CS-A22 and CS-A21	Soil Boring/sampling	C[a]
Downwind of surface flowing water	Surface Water/sampling	C[b]
CS-A1s and CS-A2s	Groundwater sampling	C
East/west and north/ south banks of Dead Creek CS-A1 and CS-A2	Surface soil sampling	C

Level C Protection

Requirements for this level of protection include:

- Racal power air purifying respirators (APRs)
- neoprene boots (steel toe and shank)
- Tyvek or Saranax coveralls
- disposable gloves and booties; safety glasses required
- hard hats and neoprene gloves

C[a] Ear plugs might be needed during boring activities.
C[b] Gloves worn during surface water sampling should be taped at the wrist.

Based on past records, chlorobenzene is one of the volatile organics found in high concentration in Site I. Photoionization detector (PID) will be used to monitor general volatile organic vapor. Bases for level "D" protection using chlorobenzene as a marker, is 75ppm PID reading. 75ppm is the time waited average (TWA)[1] exposure for chlorobenzene vapor. That is the concentration that does not require respiratory apparatus. If PID of VOC[2] reads between 76ppm to 999ppm, Level D protection is required. For PID of VOC 1000ppm and up, Level C protection is required.

Although Level A and B protections are not expected on this job site, Level B respiratory protection level and other protections applicable to B will be needed for a PID above 1875ppm. If PID of VOC reads 2400ppm or above, all protective equipment for Level A must be employed. This is because the immediate danger to life and health (IDLH) level for chlorobenzene is 2400ppm.

In the event of a change in hazardous conditions, the above protection Level will be upgraded to Level B or A or downgraded to protection Level D.

Level A Protection

This level of protection will be required when vapor and gas concentration becomes higher than Level C or B at specific job locations. At such conditions, it will be assumed that there is a potential danger to continue with Level C protection. The following protective equipment is recommended:

- encapsulated suit (for emergency)
- cascade system
- spare air tank
- out-work gloves
- self-contained breathing apparatus (SCBA), in addition to that equipment under Level C protection.

[1] Time waited average based on eight-hour period.
[2] Volatile organic chemicals.

Level B Protection

This level of protection will be used at job functions where Level C protection becomes unsatisfactory. At this event, the following protective equipment will be required in addition to that assigned for Level C protection. They are:

- SCBA
- spare air tank
- booties
- cascade system
- manifold system
- air compressor

Level D Protection

This is the lowest protection level. It is employed where there is not possible potential for exposure to chemical hazards. However, Level D protection is required for safety reasons. The Level D protection will only require the following equipment:

- ultra-twin respirator
- cartridges (types GMC-H, GM-P)
- chemical-resistant overalls
- neoprene safety boots
- booties (latex)
- work gloves
- hard hat and safety glasses

The safety officer and the project team leader are the only personnel authorized to make changes on the recommended level of protection (especially downgrading it) for this job site. This is because they are the ones who possess the expertise on the safety requirements and conditions on related job activities. They are also assigned complete safety control and overseeing of this project activity.

Decontamination Procedure:

Personal: All disposable protective clothing will be bagged, labeled and drummed. Boots and gloves to be washed with Alconox detergent and rinsed three or more times with deionized water.

Equipment: A hollow steam auger with a hand-held high-pressure steam cleaner should be used. The continuous core sampler will be decontaminated between each boring with Acetone, and rinsed three or more times with deionized water.

Site Entry: Depending on daily based weather conditions,

Procedure: Decontamination station is subject to change.

Emergency Medical Care: It is necessary that all the crew members be aware of the following in case of emergency.

First-aid Equipment is available on-site at the following locations:

First-Aid Kit: Shower Trailer.
Emergency Eye Wash: Shower Trailer
Emergency Shower: Shower Trailer
Other: TBA

List of Emergency Phone Numbers

Agency/Facility	Phone Number	Contact
Police (local, County Sheriff, or State)	(618) 277-3500 (618) 332-6500	County Police Sauget Police
Police, Explosive Unit	(618) 346-3600	State Police
Fire	(618) 332-6600	Sauget Fire Department
Ambulance	(618) 332-6793	Braun's Ambulance
Hospital Emergency Room	(618) 874-7076	Gateway Community Hospital
Airport	(618) 337-6060	Bi-State Park Airport Cahokia
Poison Control Center OR	(618) 233-1935 (618) 233-1938	Memorial Hospital
Agency Contact (EPA, State, Local, USCG)	(217) 524-4827	Paul Takacs, IEPA, Hazardous Waste Dept.
Local Medical Laboratory	(618) 235-1780	St. Clair Medical Lab.
Federal Express	(314) 367-8278	6181 Aviation Drive St. Louis Airport
Client Contact	N/A	N/A
Others IEPA Emergency Unit	(217) 782-3637	N/A

Emergency Routes:

Directions to Hospital (include map):

Monsanto Avenue east to Monsanto Road (19th Street in East St. Louis) north on 19th Street to Bond Avenue, west on Bond Avenue to 15th Street, north on 15th Street to King Drive. East on King Drive to Gateway Community Hospital. Routes to be driven by designated site personnel prior to initiating on-site operations.

Directions to BI State Airport: State Route 50 south to Judith Lane. East on Judith Lane to Cahokia Road, south on Cahokia Road to Julian Avenue, east on Julian Avenue to Airport Road.

QA/QC Precaution

To maintain quality assurance and quality control measures, all boring equipment (i.e., augers, drilling rods, etc.) should be steam-cleaned after an acetone rinse between borings. Avendt Group personnel will observe the decontamination operation. All dirt and materials must be removed from the auger flights. All rinse and waste water during the boring activities should be disposed per state and federal regulations.* Also to monitor possible contamination, a trip blank prepared from distilled deionized water should be carried throughout the sampling, storage and shipment process. Sample pouring and collection near to exhaust fumes must be avoided.

*Disposal of On-site Generated Waste

All small amounts of decontamination and rinse solutions must be stored in 55-gallon drums. Larger drums of 110 gallons, 1,000 gallons, etc., will be employed according to the volume of waste rinse solution generated. These could be either associated with personal contamination station or large equipment rinse that must be done in an area that will collect all the spent fluids. The waste rinse containers that can be sealed until ultimate disposal is arranged.

Decontamination and rinse solutions cannot be allowed to drain back on site.

Proper labeling is required on each decontamination rinse solution drums and mud pits. The maximum duration for storing the on-site generated waste is 90 days. Beyond this period, permit and interim status will be required. Details of applicable waste storage, management and disposal of contaminated materials is an RCRA requirement and is found in 40CFR262 entitled "Standard Applicable to Generators of Hazardous Wastes."

IEPA will be contacted at (217) 782-3397 for the applicable state requirements when such a condition arises.

<u>Equipment Check List, Level C:</u>

Ultra-Twin Respirator:	_____
Racal power air purifier:	_____
Racal cartridge (type GMC-H AEP-3) HEPA filters:	_____
Robert Shaw escape mask:	_____
Chemical-resistant coveralls:	_____

Protective coveralls: _____
Type Saranac hooded: _____
Rain suits: _____
Butyl apron: _____
Gloves (type viton-neoprene): _____
Outer work gloves: _____
Neoprene safety boots: _____
Hard hat with face shield: _____
Hard hat without face shield: _____
Latex disposable booties: _____
Safety glasses: _____

Decon Equipment Check List:

Wash tubs: _____
Buckets: _____
Scrub brushes: _____
Pressurized sprayer: _____
Detergent (type tsp Alconex): _____
Solvent (type, acetone): _____
Plastic sheets: _____
Tarps: _____
Trash bags: _____
Trash cans: _____
Masking tape: _____
Duct tape: _____
Paper towels: _____
Face mask: _____
Face mask sanitizer: _____
Folding chairs: _____
Step ladder: _____

First-Aid Equipment Check List:

First-aid kit: _____
Oxygen administrator: _____
Stretcher: _____
Portable eye wash: _____
Blood pressure monitor: _____
Radiation badges: _____
Fire extinguisher: _____
Thermometers (oval): _____
Walkie-talkie: _____

Van Equipment Checklist:

Tool kit: _____
Hydraulic jack: _____
Gas: _____
Oil: _____
Anti-freeze/coolant: _____
Battery: _____
Windshield wash: _____
Tire pressure: _____
Lug wrench: _____
Tow chain: _____
Van checkout: _____

Instrument Check List:

OVA: _____
Thermal desorber: _____
O_2/explosimeter: _____
Explosimeter calibration kit: _____
HNu W/10-2 EV lamp: _____
RAD mini: _____
Magnetometer: _____
Pipe locator: _____
Weather station: _____
Drager pump: _____
Brunton compass: _____
HNu calibration kit: _____
Monitox CN meter: _____
GCA/MDA particulate monitor: _____

Miscellaneous Check List:

Pitcher pump: _____
Surveyor's tape: _____
100' fiberglass tape: _____
300' nylon rope: _____
Nylon string: _____
Surveying flags: _____
Film: _____
Wheelbarrow: _____
Bung wrench: _____
Soil auger: _____
Pick: _____
Shovel: _____
Catalytic heater: _____
Propane gas: _____
Banner tape: _____

Surveying meter stick: _____
Chaining pins and ring: _____
Tables: _____
Weather radio: _____
Binoculars: _____
Megaphone: _____

Emergency Information

Since there has been background information regarding both volatile and semivolatile organics in the site, the following emergency precautions should be adopted:

	In Case of This (Acute Exposure Symptoms)	Do This (First Aid)
1)	Severe irritation of skin -	Wash irritated areas.
2)	Severe irritation of respiratory system -	Get medical aid.
3)	Accidental ingestion of unknown liquid -	Immediately induce vomiting.
4)	Dust/vapor/liquid contact irritation -	Wash affected areas with suspected and contaminant and skin in soap and water.

Site Resources:

Water Supply: 5-gallon collapsible containers will be used.

Telephone: New Queeny Avenue and Falling Spring Road. Also Route 3 via Cerro Plant Road, and Monsanto Avenue.

Radio: TBA

Other: TBA

Emergency Contacts:

Chris Bade, Regional Safety Coordinator,
(301) 261-1177 office, (313) 658-2048, Home.

MEDTOX Hotline: In case of emergencies that require hotline action:

1) The following should be contacted: Drs. Raymond Harbison, Glenn Milner or Robert James at (501) 370-8263 (24-hour answering services).

2) What to state:

   a) "This is an emergency;"
   b) Your name, region and site;
   c) Telephone number to reach you;
   d) Location of emergency;
   e) Name of person injured or exposed;
   f) Nature of emergency; and
   g) Action taken.

Special Site Precaution:

1) Before any boring is attempted, local utility and surrounding industries (chemical or others) should be contacted to identify (if any) their subsurface transmission lines, cables or pipes. (These have been confirmed.)

2) Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat and cold stress symptoms should/will be monitored and recorded in the site security log book.

3) Attempts to open drums of unknown contents must be avoided. This is important as to eliminate such explosion hazards.

4) Work will be conducted during daylight hours only.

5) Pre-employment and post-employment physicals are recommended for all personnel to be involved with the on-site job. The physicals must be completed a few days prior to start of work, and upon termination of work. Exposure logs will be maintained as to supplement facts on the subsequent medical checkups.

Site/Waste Characterization:

Waste type(s): Liquid, solid, sludge, corrosive, ignitable, volatile, toxic, reactive, and unknowns have been characterized and associated with the Site I/Creek Sector A subsurface soil samples.

Some specific waste types:

1) Volatile organics to a total of 10 (ten) with chlorobenzene as highest.

2) Total of 25 semivolatile organic chemicals. Those in high concentrations are:

   a) 1,2,4-trichlorobenzene @ 8,300ppm
   b) Hexachlorobenzene @ 1,300ppm
   c) 1,4-dichlorobenzene @ 1,800ppm
   d) Naphthalene @ 10ppm

   Also found were fluoroethene, anthracene, dichlorobenzene, n-nitrosodiphenylamine, etc.

Pesticides/PCBs: Three pesticides and PCBs at the following levels were found:

1) 4,4'DDD @ a concentration of 30ppm
2) 4,4'DDT @ a concentration of 4.3ppm
3) Toxaphene @ a concentration of 490ppm
4) One PCB congener (i.e., arochlor)

Inorganics: Found at high concentrations were chromium, mercury, cyanide, nickel, lead, vanadium and antimony.

Principal Disposal Method: Landfill (area filling), wastepiles, surface impoundments, and open drumming.

- Type and location:

  1) Two disposal pits were identified at Site I, Section CS-A containing waste materials such as oily sand, clay, wood and cinders. Occasional refuse such as cardboard, rubber and cloth were identified.

  2) At Sector B, rubbery wastes and sponge-like materials were found on surface soils. Stagnate water at surface depressions and shallow channels were evidenced at northern half of CSB.

Past investigations detected contaminants in the following media: soils, groundwater, surface water, sediments and air. Primary source of contamination is the soil from waste disposal.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

FOR

DEAD CREEK SECTOR A

Prepared by:

The Avendt Group, Inc.
432 North Saginaw Street
Third Floor, Northbank Center
Flint, Michigan 48502

October, 1989

QUALITY ASSURANCE PROJECT PLAN

for

DEAD CREEK, SECTOR A

SAUGET, ILLINOIS

APPROVAL PAGE:

Raymond J. Avendt, Ph.D., P.E. Project Manager	Date
Christopher Bade, M.S. Assistant Project Manager	Date

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Appendix A - Sample and Analysis Plan

Appendix B - Weston/Gulf Coast Laboratories, Inc. Quality Assurance Plan

Appendix C - Health and Safety Plan

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the policies, objectives, functions, and specific Quality Assurance (QA) and Quality Control (QC) measures taken for the Avendt Group, Inc.'s (AGI) Dead Creek Sector A project, located on the property of Cerro Copper Products, Inc., Sauget, Illinois. The purpose of this QAPP is to ensure the validity and integrity of the technical data generated for this project.

The QC activities provide a system of checks to provide information on quality of field sampling and laboratory analysis. This includes documentation of sample movement, chain-of-custody records, etc.

The QA activities are used to certify that QC procedures are implemented during the course of the project.

This QAPP incorporates the following:

- Sample collection, chain-of-custody, and analysis;
- Document control;
- Laboratory instrumentation, analysis and control.

2.0 PROJECT DESCRIPTION

This QAPP was prepared by AGI for conducting the Remedial Investigation/ Feasibility Study (RI/FS) on the Dead Creek Sector A site located on the property of Cerro Copper Products in Sauget, St. Clair County, Illinois.

A previous RI/FS by Ecology and Environment, Inc. (E & E) was performed on the entire Dead Creek area. This investigation encompassed six sectors of Dead Creek and 12 sites that were used as landfills for municipal and industrial wastes. Of these sections designated by E & E, this project only covers creek sector A. These sections are further limited to those portions lying within the property boundaries of Cerro Copper Products, Inc.

Samples to be taken for this project include:

- Subsurface soil samples (from borings);
- Creek bottom sediment samples;

Air quality will be monitored during on-site work to assure that all safety precautions necessary are taken.

Information pertaining to sample collection is included in Appendix I - Sample and Analysis Plan.

All laboratory QA procedures are listed in Appendix II - Weston/Gulf Coast Laboratories, Inc. Quality Assurance Plan for Environmental Analyses. Since Weston is the only laboratory to be employed, their QA information is specific to this project.

Air quality monitoring and other safety precautions are listed in Appendix III - Health and Safety Plan.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

3.1 Management Overview

This QAPP provides for designated QA personnel to review products and provide guidance on QA/QC matters, and outlines the approach to be followed to assure that products of sufficient quality are obtained. The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The various QA functions are described below.

3.1.1 Project Management

The project management staff consists of AGI president, Dr. Raymond J. Avendt, Project Manager; and Mr. Christopher Bade, Assistant Project Manager. They are responsible for implementing the project, and will have the authority to commit the resources necessary to meet project objectives and requirements. Primary functions are to insure that technical, financial, and scheduling objectives are achieved successfully. With full responsibility and authority for project performance, they will:

- Define project objectives and develop a detailed work plan and schedule;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical, corporate, and/or subcontractor resources as needed to insure performance within budget and schedule constraints;
- Orient support staff concerning the project objectives;
- Develop and meet on-going project and/or task staffing requirements;
- Review the work performed on each task to insure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;

- Approve all Dead Creek Sector A reports before their distribution;
- Ultimately be responsible for the preparation and quality of interim and final project reports; and,
- Represent the project team at meetings and hearings.

3.1.2 Field Team Leader

For this project, the Assistant Project Manager is also the Field Team Leader. He is responsible for leading and coordinating the day-to-day activities of the technical staff and subcontractors. Mr. Christopher Bade is the Team Leader. Specific responsibilities for this position include:

- Provision of day-to-day coordination with the Project Manager;
- Liaison between subcontractors, clients and technical staff;
- Development and implementation of team-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordination and management of team staff;
- Implementation of QC for technical data provided by the team staff;
- Adherence to work schedules provided by the Project Manager;
- Authorship, review, and approval of text and graphics required for team efforts;
- Coordination of technical efforts of subcontractors assisting the team;
- Identification of problems at the team level, discussion of resolutions with the Project Manager, and provision of communications between team and upper-management; and,
- Participation in the preparation of the final report.

APPENDIX I

SAMPLE AND ANALYSIS PLAN

SAMPLE AND ANALYSIS PLAN

for

CREEK BOTTOM SEDIMENT
and
SOIL CHARACTERIZATION PROJECT

DEAD CREEK SECTOR A

CERRO COPPER PRODUCTS COMPANY

SAUGET, ILLINOIS

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1.0 Site Description

1.1 Current Situation

The project area is located in the small town of Sauget, St. Clair County, Illinois. The site is situated on Cerro Copper Products Company property and consists of Dead Creek Section A (DCS-A) and associated creek banks. The Dead Creek Section A project site is bounded on the north by Alton and Southern Railroad and the Monsanto Company, the east by Site I of the Dead Creek project area, the south by Queeny Avenue, and the west by the Cerro Copper Products facility. This portion of Dead Creek was once the head waters of Dead Creek which drained this area of St. Clair County to the Mississippi River. However, this portion of the creek was isolated from the creek by blocking the drainage culverts in the late 1960's, and converted into a holding pond for the stormwater run-off from the Cerro Copper facility.

1.2 Site Physiography

1.2.1 Area Topography

The project area is located in the southwest portion of the Springfield Plain within the Till Plain portion of the Central Lowland Province of Illinois. The Springfield Plain is a flat till plain which consists of glaciated till material from the Illinoian ice age period. The till plain consists of morainic and flood plain features which include broad and flat swampy areas, terraces, curved ridges and swales, and oxbow lakes.

The site is situated in an area known as the American Bottoms, which is the flood plain, or valley bottom of the Mississippi River. The physiographic features in the area are controlled by bedrock structures. The Mississippi River flood plain is defined by the high bluffs located on the east and west sides of the river.

1.2.2 Surface Drainage

Regional surface drainage around the site is primarily toward the Mississippi River. However, local drainage around the site is toward and into Dead Creek.

Drainage within the site is into DCS-A. DCS-A has been disconnected from Dead Creek by blocking the culverts under Queeny Avenue. Water within DCS-A drains into an interceptor and is carried to the Sauget POTW.

1.2.3 Land Use

The land around the site is primarily used for industrial purposes. However, a small residential subdivision, commercial, and agricultural properties are also located within close proximity of the site. The property immediately north-northwest of the site is owned by Monsanto. Cerro Copper Products Company owns the land which encompasses the DCS-A site. Metro Construction Company occupies the land immediately south of the project area.

1.2.4 Regional Geology

The geologic formations within the region around the project area consist of unconsolidated alluvium and glacial outwash, underlain by Mississippian and older bedrock layers. These rock layers are underlain by crystalline granite rock of Precambrian age. The project area, the American Bottoms, and the Mississippi River and associated tributaries are situated in a large, deeply cut bedrock valley highlighted by high bluffs on both sides. The Mississippi River has been the dominant factor which has controlled the formation of geology and hydrogeology within the region surrounding the site. However, a glaciation during the Quaternary ice age has also played a role in the geological developments in the area.

Unconsolidated material within the Mississippi River cut valley ranges in thickness from 70 to 120 feet in the project area. The unconsolidated material consists of three formations: 1) the Cahokia Alluvium, 2) Henry Formation, and 3) The Peyton Collisvium. The Cahokia Alluvium consists of silty sands and sandy silts. The Henry Formation is composed of sand and gravel from glacial outwash. The Peyton Collisvium consists of fine-grained silts and clays.

1.2.5 Hydrogeology

Groundwater in the area exists in the unconsolidated material and underlying bedrock. Large quantities of water are available in both unconsolidated and bedrock units. The majority of domestic and industrial wells pump water from the unconsolidated material aquifers. Groundwater flow generally follows the land surface on a locate scale. However, regional groundwater flow is toward the Mississippi River. Groundwater is primarily recharged through infiltration from the ground surface, however, river beds will also act as a recharge zone where pumpage has lowered the water table below the stream beds.

1.2.6 Climatological Information

The regional climate in the site area is continental, with hot, humid summers and mild winters, occasionally interrupted with extremely cold periods of short duration. The project area is located in an area where cold fronts converge from the north and warm moist fronts converge from the south. This zone of frontal convergence produces a variety of rapid changes in weather conditions.

The average precipitation in the project area is 35.4 inches per year. June is normally the wettest month. The average annual temperature is 56 degrees fahrenheit with a January mean temperature of 32 degrees F and a July mean temperature of 79 degrees F.

2.0 SITE INVESTIGATION

2.1 Site Boring Plan

The boring plan is based on a preliminary review of existing information on the geologic/hydrogeologic and surface physiographic conditions which exist at the Dead Creek site. Dead Creek consists of two sections, DCS-A1 and DCS-A2.

2.1.1 Purpose

The purpose of this boring plan is to characterize the depth of sediment in Dead Creek on the Cerro Copper Products property in Sauget, Illinois. This will be accomplished by collecting continuous core borings in DCS-A. The core borings will be collected to a depth corresponding with the creek sediment/Cahokia Alluvium interface.

2.1.2 Boring Locations

The section of DCS-A to be characterized in this report is located on the east side of Cerro Copper Products property (Figure 1). It is divided into two areas which are bisected by Cerro Plant Road. The width of the creek varies from 35-65 feet wide. The north portion of DCS-A, which is identified as DCS-A1, is approximately 1,200 feet long. The south portion of DCS-A, which is identified as DCS-A2, is approximately 400 feet long.

DCS-A will be divided into eight traverses oriented in an east-west direction. Locations of the traverses are shown in Figure 1 and described below:

DCS-A1

A11 - 50 feet from the south end of DCS-A1.

A12 - 250 feet from the south end of DCS-A1.

A13 - 450 feet from the south end of DCS-A1.

A14 - 650 feet from the south end of DCS-A1.

A15 - 850 feet from the south end of DCS-A1.

A16 - 1050 feet from the south end of DCS-A1.

DCS-A2

A21 - 100 feet from the south end of DCS-A2.

A22 - 100 feet from the north end of DCS-A2.

The sediment/soil borings will be identified by letter from west to east. Creek traverses A11, A12, A13, A21, and A22 will contain four sediment/soil borings. The borings located on the west bank of the creek will be approximately five feet from the edge of the creek. Two borings will be performed within the creek channel. These borings will be located five feet from the west and east creek banks respectively. The borings located on the east side of the creek along these traverses will be placed approximately five feet from the edge of the creek.

Traverses A14, A15, and A16 will contain five sediment/soil borings. As with the other borings, these will also be identified by a letter from west to east. The borings will be performed the same way as previously discussed except one additional boring will be performed 20 feet east of the creek bank along these traverses. The additional borings are necessary because of the larger area at the north end of DCS-A1.

2.1.3 Boring Method

Two boring methods will be employed for the characterization of sediments/soils in Creek Section A. Characterization of bottom sediments, when working within the creek channel, will be accomplished with a small drilling rig utilizing five feet long hollow stem augers.

The drilling rig will be mounted on a 28 feet long, eight feet wide reinforced aluminum pontoon. The pontoon will be anchored to the creek channel bank with cables and metal stakes.

Prior to beginning boring operations at each boring location, an outer casing will be hydraulically pushed three to five feet into the creek bottom sediments. The area inside the outer casing will be de-watered to enhance core recovery. After the outer casing is set and de-watered, boring operations will begin.

Boring operations on the creek banks will be performed with a truck mounted drilling rig utilizing five feet long hollow stem augers.

The five feet long hollow stem augers will produce a six-inch outer diameter borehole. The inner diameter of the hollow stem auger is 4 1/4 inches. During core sample classification and sampling, the hollow stem augers will be decontaminated with a hand-held, high-pressure steam cleaner.

A continuous core sample will be collected for each boring. The core sample will be collected by utilizing a 4 1/4 inch diameter, five feet long continuous split spoon sample core. The split spoon sampler will be advanced into the sediments approximately two to four inches ahead of the auger flights. The continuous core sampler will be decontaminated between each boring with Alconox detergent and a steam-cleaning rinse.

2.1.4 Borehole Abandonment

All boreholes will be plugged after making strata observations and collection of sediment/soil samples. The shallow boreholes will be plugged with "Holeplug" 100% granular bentonite. When bridging occurs, identified by breakthrough when tamping the holeplug pellets, a bentonite slurry will be trimmied into the borehole. The borehole will be filled to within one foot of the ground surface. The remaining foot or so will be filled with clean top soil and re-vegetated.

2.1.5 Borehole Depth and Core Log

The depth of each borehole will vary according to the location of the boring within the creek section. Sediment borings will be advanced to the Dead Creek sediment/Mississippi River flood plain strata interface, and will include the upper few

inches of the Mississippi River flood plain sediments. The thickness of the creek bottom sediments is estimated to be no more than 11 feet thick. However, it is anticipated that the sediment thickness of three to five feet is more realistic. Soil borings performed on the banks of the creek will be advanced to a depth which shows a continuous strata across the entire creek traverse.

The borehole cores will be logged by a Geologist or Engineer of the Avendt Group, Inc. Bottom sediments will be described in accordance with the Unified Soil Classification System. The borehole log information will include:

1) Boring number;
2) Project number;
3) Site Location;
4) Time
   a) beginning
   b) end;
5) Total Depth (feet);
6) Hole Diameter (inches);
7) Type of Sampling/Coring Device;
8) Length and Diameter of Coring Device;
9) Sampling Interval;
10) Boring Method;
11) Boring Contractor;
12) Driller;
13) Hammer Weight and Drop (if applicable).

In addition to the items outlined above, all related observations about boring rate, equipment operation or unusual conditions will be noted. This information may include:

1) Rig reactions such as chatter, auger drops, and bouncing;
2) Boring rate changes;
3) Material changes;
4) Grouting material (if necessary).

2.1.6 Decontamination

All boring equipment (i.e. augers, drilling rods, etc.) will be steam-cleaned between borings. Avendt Group personnel will observe the steam-cleaning operations to maintain QA/QC. All dirt and material will be removed from the auger flights. The five feet continuous core sampler will be decontaminated with Alconox detergent and rinsed with deionized water.

3.0 Sampling Plan

3.1 Purpose

The purpose of this sampling plan is to characterize the depth and the contamination characteristics of the sediment in Dead Creek and to characterize the depth and the contamination characteristics of the creek bank soils near Dead Creek on the Cerro Copper Products property in Sauget, Illinois. This will be accomplished by taking continuous soil borings in Dead Creek and on the creek banks to record the depth of sediment/soils and by chemically analyzing the sediment/soil samples from these borings.

3.2 Sample Location

3.2.1 Horizontal and Vertical Extent of Sampling

The section of Dead Creek to be characterized (Figure 1) in this report is located on the east side of Cerro Copper Products property. It is divided into two areas which are bisected by Cerro Plant Road. The width of the creek varies from approximately 35 feet to 65 feet. The north portion (Dead Creek Section A1) of the creek is approximately 1200 feet long, and the south portion (Dead Creek Section A2) of the creek is approximately 400 feet long.

Horizontal Locations

Dead Creek will be divided into eight traverses oriented in an east-west direction. Locations of the traverses are shown in Figure 1, and described below:

A10 - South edge of Cerro Plant Road

A11 - 50 feet from the south end of DCS-A1.

A12 - 250 feet from the south end of DCS-A1.

A13 - 450 feet from the south end of DCS-A1.

A14 - 650 feet from the south end of DCS-A1.

A15 - 850 feet from the south end of DCS-A1.

A16 - 1050 feet from the south end of DCS A1.

A21 - 100 feet from the south end of DCS-A2.

A22 - 100 feet from the north end of DCS-A2.

A23 - 450 feet from the north end of DCS-A2.

Four sample points will be located along each of these traverses. These sample points will be identified by the labels A, B, C, and D. Sample points A and D will be on top of the bank and sample points B and C will be in the creek bed. The sample points are shown in Figure 1, and described below:

A - This sample point will be located approximately five feet from the top of the west bank.

B - This sample point will be located approximately five feet from the bottom of the west bank.

C - This sample point will be located approximately five feet from the bottom of the east bank.

D - This sample point will be located approximately five feet from the top of the east bank.

The A16 traverse will have a fifth sampling point located on the east bank. This sampling point will be labeled A16E. This sample point will be located approximately twenty feet from the top of the east bank. Locations of sample points may vary depending upon field conditions.

Vertical Locations

A five feet continuous split spoon sampler will be used to characterize the depth of sediment and Mississippi River flood plain strata which is contaminated from waste disposal practices. Vertical locations of samples will be taken of the upper one to two feet of sediments/soils and at strata interfaces. Final depth will be located by the limits of the sediment contamination. Generally, if there are no strata interfaces, three samples will be taken. These will be located at the upper one to two feet of sediments/soils, at the middle of the sediments/soils total depth, and below the bottom of the sediment/soil strata. The vertical interval of the sample will be indicated in the sample number as the last two digits. For example, a sample taken in Dead Creek Section A2, second cross-section to the north, on the west bank and three to five feet in depth would be labeled A22a35.

Sample collection and type of analysis to be performed on each sample will be determined in the field. Field observations of stained soils, sediment characteristics, and boring depths followed by a scan for volatile organic contamination with a photoionization detector will be the field methods employed for collecting samples and selecting the analytical process for each sample.

3.3 Analytical Procedures

3.3.1 Parameters

Parameters to be analyzed for in the sediments/soils include:

Parameter	Frequency
1) RCRA Appendix IX Constituents (not including dioxins and furans.)	One per traverse.
(The following two parameters are included with the above when a RCRA Appendix IX scan is performed.)	
a) Polychlorinated Biphenyls (PCBs)	Analyze on all samples
b) Polychlorinated Biphenyl Precursors	Analyze on all samples
c) Total Metals	At strata changes. One per boring.
2) Extraction Procedure Toxicity Test (EP Toxic)	At strata changes. One per boring.

3.3.2 Methods

All laboratory analytical methods will follow U.S. EPA's SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods." A listing of SW-846 Test Methods is included in Appendix B.

3.3.3 Sampling Methods and Equipment

The sediment/soil samples will be collected by utilizing a five-foot long, three-inch diameter continuous split spoon sampling unit. The procedures for sediment/soil sampling are described below.

Procedures for Sediment/Soil Sampling

1. Wash hands prior to and between samples to avoid cross-contamination of samples.

2. Wear protective clothing and equipment as outlined in the Health and Safety Plan.

3. All split spoon samplers will be cleaned with an Alconox solution and steam-cleaned prior to sampling.

4. Record location of sampling point.

5. Wear clean gloves for each sample to avoid cross contamination.

6. Split spoon samples are taken during boring operations, and are removed from the drill rig for sediment/soil depth classification and sediment/soil characterization.

7. The sediment/soil sample will be collected directly from the five-foot continuous split spoon sampler.

8. Cap container and apply seal. Place sample location ID number, date and time on sample label (in indelible ink) and cover with transparent tape. Dispose of used tin in a plastic bag.

9. Brush excess debris from container, place in plastic bag and store in cooler with ice.

10. Record sample location, ID number and other pertinent information in daily field log notebook, and fill out laboratory analysis request form.

11. Deliver samples to laboratory personnel at the end of the day, and obtain signature on transfer custody form.

The order of samples taken and specifics of each analysis are presented below.

(1) VOLATILE ORGANICS

Standard 40ml glass screw cap VOA vials with Teflon-faced silicone septum may be used for both liquid and solid matrices. When collecting the samples, liquids and solids should be introduced into the vials gently to reduce agitation which might drive off volatile compounds. Liquid samples should be poured into the vial without introducing any air bubbles within the vial refilled. Each VOA vial should be filled until there is a meniscus over the lip of the vial. The screw-top lid with the septum (Teflon side toward the sample) should then be tightened onto the vial. After tightening the lid, the vial should be inverted and tapped to check for air bubbles. If there are any air bubbles present, the sample must be retaken. Two VOA vials should be filled per sample location.

VOA sample containers for solid or semi-solid (sludges) matrices should be completely filled as best as possible. The containers should be tapped slightly as they are filled to try and eliminate as much free air space as possible.

VOA vials should be filled and labeled immediately at the point at which the sample is collected. They should not be filled near a running motor or any type of exhaust system because discharged fumes and vapors may contaminate the samples. The two vials from each sampling location should then be sealed in separate plastic bags to prevent cross-contamination between samples particularly if the sampled waste is suspected of containing high levels of volatile organics. (Activated carbon may also be included in the bags to prevent cross-contamination from highly-contaminated samples.) VOA samples may also be contaminated by diffusion of volatile organics through the septum during shipment and storage. To monitor possible contamination, a trip blank prepared from the distilled deionized water should be carried throughout the sampling, storage, and shipping process.

(2) PCBs

The sample containers should be amber glass, one liter or one quart volume. Caps should be threaded to screw onto the sample bottles, and must be lined with Teflon. Apply tape around cap to completely seal cap to bottom. Conventional sampling practices must be followed. The bottles must not be pre-washed with sample before collection. Sampling equipment must be free of tygon, rubber tubing, and other potential sources of contamination which may absorb the target analytes.

(3) SEMI-VOLATILE ORGANICS (This includes Pesticides and Herbicides.)

The sample containers should be of glass or Teflon and have screw top covers with Teflon liners. Plastic containers or lids may not be used for the storage of samples due to the possibility of sample contamination from the phthalate esters and other hydrocarbons within the plastic. Sample containers should be filled with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus causing contamination. Samples should not be collected or stored in the presence of exhaust fumes.

(4) METALS

Metals

Samples should be collected in a one quart/liter amber glass jar with Teflon-lined screw cap. Samples shall be refrigerated upon collection.

EP Toxic

Sample should be collected in a one quart/liter glass jar with Teflon-lined screw cap. Need at least 100 grams. Nonaqueous samples shall be refrigerated and analyzed as soon as possible.

3.4 Sample Preservation and Handling

Sample preservation and handling will consist of the following:

Parameter	Container	Preservative
Volatile Organics	2-40ml glass vials with Teflon Liner cap	Cool, 4'C
Semi-volatile Organics	1-quart glass jar with Teflon-lined threaded screw-on lid	Cool, 4'C
PCBs	1-quart glass jar with Teflon-lined threaded screw-on lid	Cool, 4'C
Metals		
Toxic Metals	1-quart glass jar with Teflon-lined threaded screw-on lid	Cool, 4'C
EP Toxic	1-quart glass jar with with Teflon-lined threaded screw-on lid	Cool, 4'C

3.5 Chain of Custody

Chain of Custody will be kept on all samples during the course of this project. The Weston/Gulf Coast Chain of Custody form (Appendix D) will be used during the project. The chain of custody form contains the following information:

a) Company and Facility Name
b) Sampler's Name;
c) Sample Number;
d) Date;
e) Time;
f) Matrix;
g) Number of Containers;
h) Analysis Required;
i) General Remarks;
j) Preservation.

3.6 Field and Laboratory Quality Assurance/Quality Control

3.6.1 Field Quality Assurance/Quality Control

Several critical QA/QC procedures are associated with this sampling program. These include:

- Chain of Custody;
- Daily Field Log Notes;
- Sample/Core Log Notes;
- Sample Analysis Request Documentation
- Quality Assurance/Quality Control Blanks

3.6.1.1 Chain of Custody

The chain of custody control is documented by the use of chain of custody seals and forms, which identify the persons in possession of and responsible for the samples from the time they are collected until the time they are analyzed. After collecting samples, the containers will be marked immediately with all appropriate information and placed inside a shipping container; the label will be covered with transparent tape. This container will remain in the view and possession of the designated sampler at all times. The samples will be secured, locked in a vehicle to which no one else will have any access to during any breaks. At the end of field sampling, the samples will be delivered to the lab.

3.6.1.2 Daily Field Log

The daily log is completed to record an individual's daily sampling activities and to note any unusual conditions should they be encountered. Notations will be made daily in a field log kept by the designated sampler. The field log will contain the following information:

- Sample Date;
- Weather Observations;
- Time samples are collected;
- Documentation of field equipment cleaning procedures;
- Any unusual sampling circumstances;
- Field diagram of sample locations.

The field log will be archived as permanent documentation of field sampling procedures performed as a portion of the soil sampling program.

3.6.1.3 Sample/Core Log Notes

The sample/core log notes are used to document the conditions of the sample boreholes and the soil stratification. These are filled out as each sample borehole is drilled. Information contained in the sample/core log notes includes the following:

- Boring Number;
- Drilling Times;
- Total Depth Drilled;
- Hole Diameter;
- Drilling Method;
- Drillers;
- Sampling Device;
- Sample/Core Description.

3.6.1.4 Sample Analysis Request Form

Sample analysis request forms will be completed for each delivery of samples to the laboratory. The request form permanently documents the date of delivery to the lab and the analyses requested to be performed for each of the samples. The form contains the following information:

1. Name of sampler and company affiliation, including address and phone number.

2. Date and time of sampling.

3. Location of sampling site.
4. Sample location ID number and laboratory ID number (to be added by designated laboratory personnel.)

5. Type of sample.

6. Pertinent field information (if any).

7. Analysis requested for each sample.

3.6.1.5 Quality Control/Quality Assurance Blanks

A blank is an artificial sample designated to monitor the introduction of artifacts into the process. For aqueous samples, reagent water is used as a blank matrix; however, a universal blank matrix does not exist for solid samples, and therefore, no matrix is used. The blank is taken through the appropriate steps of the process.

Field blanks are aliquots of analyte-free water or solvents brought to the field in sealed containers and transported back to the laboratory with the sample containers.

Trip blanks and equipment blanks are two specific types of field blanks.

To monitor possible contamination, a trip blank prepared from distilled deionized water should be carried throughout the sampling, storage and shipping process. Trip blanks are not opened in the field. They are a check on sample contamination originating from sample transport and shipping from site conditions.

Equipment blanks are opened in the field and the contents are poured appropriately over or through the sample collection device, collected in a sample container, and returned to the laboratory as a sample. Equipment blanks are a check on sampling device cleanliness.

Replicate Sample is a sample prepared by dividing a sample into two or more separate aliquots. Duplicate samples are considered to be two replicates. Replicate samples will be analyzed by the lab.

3.6.2 Laboratory Quality Assurance/Quality Control

The Laboratory's Quality Assurance and Quality Control Document will be included in this sampling plan to document internal laboratory quality assurance and quality control.

4.0 Data Summary

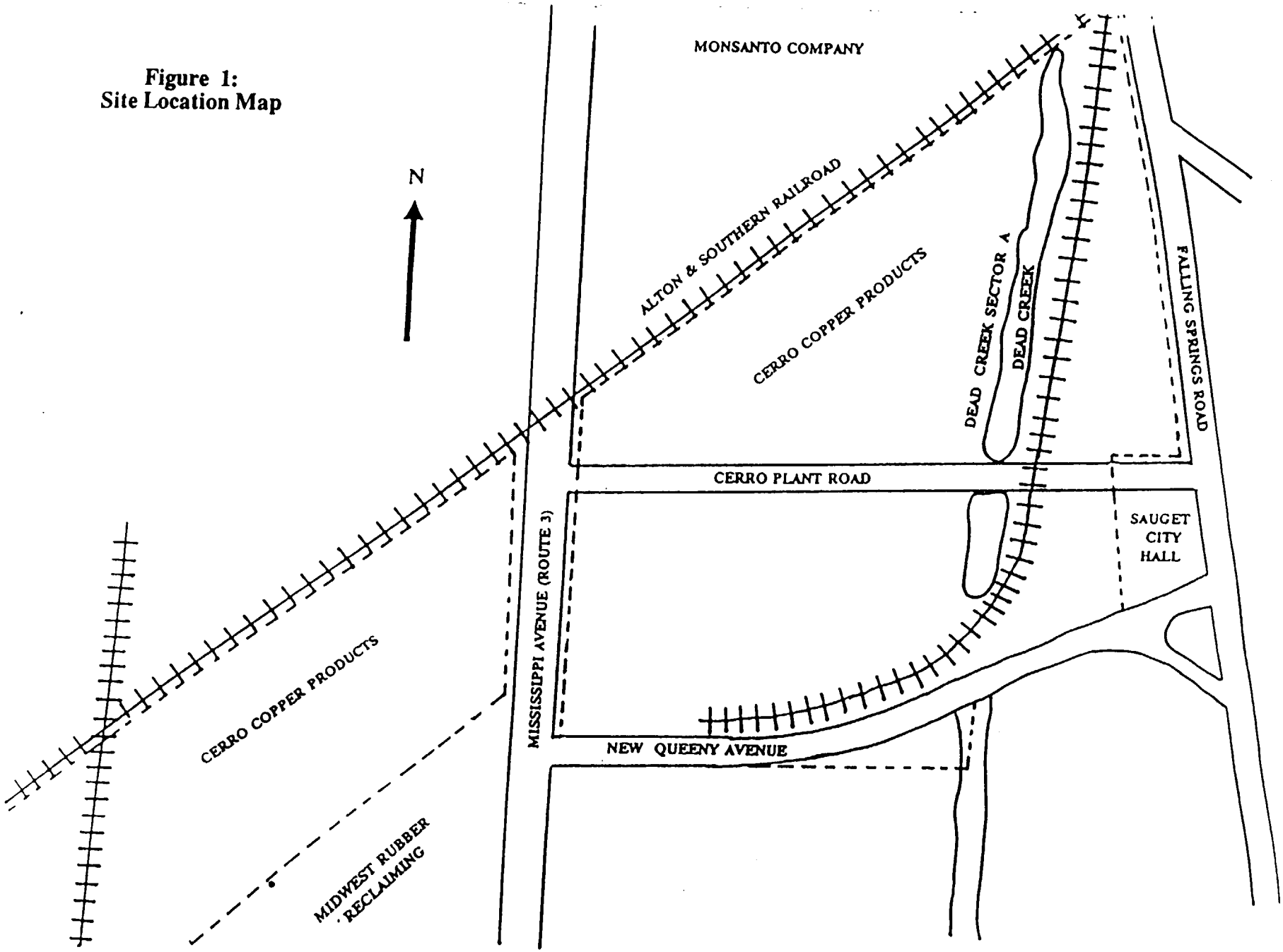
Avendt Group personnel will thoroughly summarize the data generated during the investigation. The objective of the summary is to ensure that the investigation data are sufficient in quality and quantity to adequately describe the nature and extent of contamination. The results and data from the investigation will be organized and presented logically so that the information will be readily available for the final report.

5.0 Final Report

The final report will discuss the individual tasks performed during the sampling and analysis program. This report will also discuss the characteristics of the site, summarize data collected during the site investigation, and draw conclusions based on site data.

APPENDIX A

Figure 1:
Site Location Map



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APPENDIX B

3.1 Sampling Considerations
3.2 Sample Preparation Methods

Method 3005:	Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by Flame; Atomic Absorption Spectroscopy; or Inductively Coupled Plasma Spectroscopy
Method 3010:	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Flame; Atomic Absorption Spectroscopy; or Inductively Coupled Plasma Spectroscopy
Method 3020:	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Furnace; Atomic Absorption Spectroscopy
Method 3040:	Dissolution Procedure for Oils, Greases, or Waxes
Method 3050:	Acid Digestion of Sediments, Sludges, and Soils

3.3 Methods for Determination of Metals

Method 6010:	Inductively Coupled Plasma Atomic Emission Spectroscopy
Method 7000:	Atomic Absorption Methods
Method 7020:	Aluminum (AA, Direct Aspiration)
Method 7040:	Antimony (AA, Direct Aspiration)
Method 7041:	Antimony (AA, Furnace Technique)
Method 7060:	Arsenic (AA, Furnace Technique)
Method 7061:	Arsenic (AA, Gaseous Hydride)
Method 7080:	Barium (AA, Direct Aspiration)
Method 7090:	Beryllium (AA, Direct Aspiration)
Method 7091:	Beryllium (AA, Furnace Technique)
Method 7130:	Cadmium (AA, Direct Aspiration)
Method 7131:	Cadmium (AA, Furnace Technique)
Method 7140:	Calcium (AA, Direct Aspiration)
Method 7190:	Chromium (AA, Direct Aspiration)
Method 7191:	Chromium (AA, Furnace Technique)
Method 7195:	Chromium, Hexavalent (Coprecipitation)
Method 7196:	Chromium, Hexavalent (Colorimetric)
Method 7197:	Chromium, Hexavalent (Chelation/Extraction)
Method 7198:	Chromium, Hexavalent (Differential Pulse Polarography)
Method 7200:	Cobalt (AA, Direct Aspiration)
Method 7201:	Cobalt (AA, Furnace Technique)
Method 7210:	Copper (AA, Direct Aspiration)
Method 7380:	Iron (AA, Direct Aspiration)
Method 7420:	Lead (AA, Direct Aspiration)

4.3 Determination of Organic Analytes

4.3.1 Gas Chromatographic Methods

Method 8000: Gas Chromatography
Method 8010: Halogenated Volatile Organics
Method 8015: Non-halogenated Volatile Organics
Method 8020: Aromatic Volatile Organics
Method 8030: Acrolein, Acrylonitrile, Acetonitrile
Method 8040: Phenols
Method 8060: Phthalate Esters
Method 8080: Organochlorine Pesticides and PCBs
Method 8090: Nitroaromatics and Cyclic Ketones
Method 8100: Polynuclear Aromatic Hydrocarbons
Method 8120: Chlorinated Hydrocarbons
Method 8140: Organophosphorus Pesticides
Method 8150: Chlorinated Herbicides

4.3.2 Gas Chromatographic/Mass Spectroscopic Methods

Method 8240: Gas Chromatography/Mass Spectrometry for Volatile Organics
Method 8250: Gas Chromatography/Mass Spectrometry for Semi-volatile Organics: Packed Column Technique
Method 8270: Gas Chromatography/Mass Spectrometry for Semi-volatile Organics: Capillary Column Technique
Method 8280: The Analysis of Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans

Appendix A: Signal-to-Noise Determination Methods
Appendix B: Recommended Safety and Handling Procedures for PCDDs/PCDFs.

4.3.3 High Performance Liquid Chromatographic Methods

Method 8310: Polynuclear Aromatic Hydrocarbons

4.4 Miscellaneous Screening Methods

Method 3810: Polynuclear Aromatic Hydrocarbons
Method 3820: Hexadecane Extraction and Screening of Purgeable Organics

5.0 Miscellaneous Test Methods

Method 9010: Total and Amenable Cyanicde (Colorimetric, Manual)

Method 9100: Saturated Hydraulic Conductivity, Saturated Leachate Conductivity, and Intrinsic Permeability
Method 9310: Gross Alpha and Gross Beta
Method 9315: Alpha-Emitting Radium Isotopes

7.0 INTRODUCTION AND REGULATORY DEFINITIONS

7.1 Test Method to Determine Hydrogen Cyanide Released from Wastes

7.2 Test Method to Determine Hydrogen Sulfide Released from Wastes

7.3 Extraction Procedure Toxicity

8.0 METHODS FOR DETERMINING CHARACTERISTICS

Method 1010: Pensky-Martens Closed-Cup Method for Determining Ignitability
Method 1020: Setaflash Closed-Cup Method for Determining Ignitability
Method 1110: Corrosivity Toward Steel

8.1 Reactivity

8.2 Toxicity

Method 1310: Extraction Procedure (EP) Toxicity Test Method and Structural Integrity Test

APPENDIX C

TABLE 2-16. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Name	Container[1]	Preservation	Maximum holding time
Sulfate	P, G	Cool, 4°C	28 days
Sulfide	P, G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
Sulfite	P, G	None required	Analyze immediately
Surfactants	P, G	Cool, 4°C	48 hours
Temperature	P, G	None required	Analyze
Turbidity	P, G	Cool, 4°C	48 hours
Organic Tests:			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$	14 days
Purgeable aromatic hydrocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH2	14 days
Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, Adjust pH to 4-5	14 days
Phenols	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction
Phthalate esters	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
Nitrosamines	G, Teflon-lined cap	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$	40 days after extraction
PCBs, acrylonitrile	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Haloethers	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
TCDD	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Total organic halogens	G, Teflon-lined cap	Cool, 4°C; H_2SO_4 to pH<2	7 days
Pesticides Tests:			
Pesticides	G, Teflon-lined cap	Cool, 4°C, pH 5-9	40 days after extraction
Radiological Tests:			
Alpha, beta and radium	P, G	HNO_3 to pH<2	6 months

[1]Polyethylene (P) or Glass (G)

APPENDIX D

ORIGINAL

WESTON/GULF COAST

CHAIN OF CUSTODY FORM

Seal # _____ GCL # _____

Date Sealed: _____ By _____

Company: _____

Facility Name: _____ Contact: _____

Address: _____ Phone: ( ) _____

_____

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME

CONTAINER				ANALYSIS	FILTERING		
No.	Code	Size	Preservative		(Y/N)	Date	Time

CHAIN OF CUSTODY CHRONICLE

Opened By: (print) _____ Signature: _____

Date: _____ Time: _____ Seal #: _____

Received By: (print) _____ Signature: _____

Date: _____ Time: _____ Comments: _____

Received By: (print) _____ Signature: _____

Date: _____ Time: _____ Comments: _____

Sealed By: (print) _____ Signature: _____

Date: _____ Time: _____ Seal #: _____

Opened By: (print) _____ Signature: _____

Date: _____ Time: _____ Seal #: _____

Condition: _____

APPENDIX E

AVENDT GROUP, INC.
432 North Saginaw Street
3rd Floor
Flint, Michigan 48502
(313)233-6270

SAMPLE/CORE LOG

Boring/Well _____ Project/No. _____ Page _____ of _____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ (feet)

Hole Diameter _____ (inches) Type of Sample/ Coring Device _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Drilling Fluid Used _____ Drilling Method _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ Hammer Drop _____ Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description

APPENDIX F

REQUEST FOR LABORATORY ANALYSIS

Laboratory: _____

Location: _____

JOB NUMBER: _____

Date of Request: _____

Approximate Response Time: _____

APPENDIX II

WESTON/GULF COAST LABORATORIES, INC.

QUALITY ASSURANCE PLAN

QUALITY ASSURANCE PLAN FOR ENVIRONMENTAL ANALYSES

PREPARED FOR:

Generic Client

Prepared by:

Weston/Gulf Coast Laboratories, Inc.

A Wholly Owned Subsidiary of Roy F. Weston, Inc.

WESTON

MANAGERS DESIGNERS/CONSULTANTS

G E N R I C L A B O R A T O R Y

Q U A L I T Y A S S U R A N C E P L A N

Prepared by: WESTON/GULF COAST LABORATORIES, INC.

Approval Page:

John Boudreau — 24 Jan 89
John Boudreau Laboratory Manager — Date

Raymond Frederici — 1-24-89
Raymond Frederici Quality Assurance Director — Date

January 1989

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1.0 Quality Assurance Policy

It is the policy and objective of WESTON to provide and to be acknowledged as an organization that provides high quality services.

2.0 Discussion

WESTON provides high quality services because it takes pride in its work and because providing high quality service is a sound business practice.

Quality is the most significant criteria influencing the viability and well being of WESTON. It is the criteria that distinguishes the best organization from the others.

WESTON is a professional services company and as such the quality of its services and deliverables is dependent in large measure upon their reception by the client. The Quality objective is mutually defined between WESTON and the client and is an inherent part of the quality assurance program.

Within relatively narrow limits, the level of excellence required may vary from project to project and from work element to work element with in a project depending on the technological and the financial risk to either the client or WESTON. However, there shall be a WESTON "standard of quality" established at a level of excellence sufficiently high to assure attaining a reputation as a quality organization.

The attainment of a reputation as a quality organization does not just happen. It results from a successful concerted effort over a long period of time. Therefore, the effort must be well planned and is supported both organizationally and individually.

4.0 ORGANIZATION

It is the objective of WESTON to provide an organizational structure that can enhance the attainment of the Corporate goals of quality services, cost competiveness, client satisfaction, employee gratification and profitable operations.

Weston Gulf Coast Laboratories has many available engineering, design, construction, and field operation links through its relationship with its parent company Roy F. Weston, Corporation.

Since each environmental situation which results in laboratory analysis is unique and specific to the site, the organizational structure for the engineering, design, construction, and field operations will be detailed in project specific plans.

4.1 Laboratory Oganization Chart
(refer to next page)

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4.1 DESCRIPTION OF LABORATORY PERSONNEL RESPONSIBILITIES

4.1.1. LABORATORY MANAGER

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Manager. The Laboratory Manager is vested with the authority to effect those policies and procedures to ensure that only data of the highest attainable caliber are produced.

4.1.2. SECTION MANAGERS

To assist the Laboratory Manager in achieving his goals, the Organic Section Manager, Inorganic Section Manager, and Unit Leaders, as well as the Laboratory Quality Assurance/ Quality Control Coordinator and analytical Project Managers, are responsible for the implementation of the established policies and procedures. They possess the authorities commensurate with their responsibilities for the day-to-day enforcement and monitoring of laboratory activities.

Section Managers have the responsibility for ensuring that their personnel are adequately trained to perform analyses, that equipment and instrumentation under their control are calibrated and functioning properly, and that system audits are performed on a periodic basis. These system audits will include the analysis of external check samples to determine the analyst/instrument capability to identify and quantify routine analytes.

4.1.3. QUALITY ASSURANCE/QUALITY CONTROL COORDINATOR

The Quality Assurance/Quality Control Coordinator has the responsibility for the conduct of and evaluation of results from system audits. In addition, the preparation of standard operating procedures and quality assurance documentation for the laboratory is a function of the Quality Assurance/Quality Control Coordinator. The Quality Assurance/Quality Control Coordinator will review program plans for consistency with organizational and contractual requirements and will advise appropriate personnel.

4.1.4. LABORATORY PERSONNEL

Any effective quality assurance and quality control program depends not only on organization and management but also on the efforts of each and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must be constantly aware for indications of perturbations from the norm and be ready to verify that the system is in control before continuing analyses or reporting results.

4.2 LABORATORY PERSONNEL INFORMATION

TABLE 4.2
WESTON/GULF COAST LABORATORY PERSONNEL INFORMATION

Employee	Title	Academics HS	AA	BS	MS	Field of Study Major/Minor	Function 1	2	3	4	Performed 5	6	A	B	C	Lab Experience
Boudreau, John	Lab Manager	X		X	X	Environmental/Chemistry	X	X	X		X		X	X	X	18
Gipple, Donald	Project Director	X		X	X	Chemistry	X	X	X		X		X	X		18
Healy, Mike	Op.Manager/Data Mgmt.	X		X		Biology/Botany	X		X		X		X	X		5
DiCosola, Paul	Personnel Director	X		X	X	Business Administration		X								2
Frederici, Ray	QC/QA Director	X		X		Biology/Geology	X	X	X		X		X			7
Harper, Diane	Group Leader	X		X	X	Biology			X		X			X		8
Kaczinski, Jeff	Group Leader	X		X		Medical Technology					X			X		4
Lang, Eric	Group Leader	X		X		Biology/Chemistry			X		X		X			4
Mackley, Linda	Group Leader	X		X		Envir. Biology/Botany			X		X		X	X	X	7
Maw, Charles	System Manager	X		X		Chemistry/Biology			X		X			X		5
Preston, Bill	Project Scientist	X		X	X	Environmental Science										8
Shaffer, Claudia	Client Services/Marketing															
Barnes, Curtis	Analyst	X		X		Chemistry					X				X	3
Blair, Jodi	Analyst	X		X		Biology					X		X	X		3
Brenner, Jeff	Analyst/Night	X		X		Microbiology					X		X			3
Chestnut, Corene	Analyst	X		X		Chemistry					X		X			1
Cote, Bill	Analyst/Night	X	X	X		Biological Sciences			X			X				4
Culver, Kevin	Analyst	X		X		Biology/Chemistry					X		X			5
Farlow, David	Analyst	X		X		Chemistry										
Fox, Janet	Analyst	X		X		Biology/Chemistry					X		X			2
Hibler, Diane	Analyst	X		X		Ecology										
Holmgren, Jeff	Analyst	X		X		Chemistry/Math					X		X	X		5
Krebel, Cheryl	Analyst	X		X		Biology										
Ivanyo, Donna	Analyst	X	X			Technical Chem					X		X			2
Jackinoski, Janet	Analyst/Night	X		X		Biology					X		X			2
Jagodzinski, Donna	Analyst	X		X		Biology										
Kay, Nora	Analyst	X		X		Chemistry										
Kienzynski, Robert	Analyst/Night	X		X		Chemistry					X		X	X		3
Koehlert, Donna	Analyst	X		X	X	Chemistry					X			X		2
Krueding, M.	Analyst	X		X	X	Environmental Biology					X			X		5
Kyrousc, J.	Analyst	X		X		Chemistry					X			X		2
Letterer, Pat	Analyst	X		X		Biology					X			X		3
Lesniak, Karen	Analyst/Bethlehem	X		X		Chemistry					X		X			2
Miller, Pat	Analyst/Night	X		X		Environmental Science					X			X		3
Miller, Rich	Analyst/Night	X		X		Natural Science					X		X			2

Functions - 1) General Manager 2) Director 3) Technical Supervisor 4) Engineer 5) Technical Staff 6) Support
Analyses Performed - A) Inorganic B) Organic C) Microbiology

TABLE 4.2
WESTON/GULF COAST LABORATORY PERSONNEL INFORMATION

Employee	Title	Academics HS	AA	BS	MS	Field of Study Major/Minor	Function 1	2	3	4	5	6	Performed A	B	C	Lab Experienc
Murphy, Kevin	Analyst	X		X		Biology					X		X			1
Murphy, Moiya	Analyst	X		X		Microbiology					X			X		2
Ollo, Chris	Analyst	X		X		Chemistry/Ind. Mgt.					X		X			3
Oppman, Kim	Analyst/Bethlehem	X		X		Medical Technology					X		X			2
Riechman, Susan	Analyst/Night	X		X		Biological Sciences					X					2
Rynkar, Gary	Analyst	X		X		Biology					X		X			1
Schleppenbach, P.	Analyst/Bethlehem	X		X		Soil Science					X		X			3
Sharkitt, John	Analyst	X		X	X	Chemistry					X		X			2
Smega, Dan	Analyst	X		X		Biology/Chemistry					X		X			3
Tavitas, Nancy	Analyst	X		X		Chemistry					X		X	X		3
Terrell, Karen	Analyst	X		X		Chemistry					X			X		2
Thompson, Brenda	Analyst	X		X		Biology/Chemistry					X		X	X		3
Walker, Phil	Analyst	X		X		Chemistry					X		X			1
Woltman, Denise	Analyst	X		X		Biomedical Communications										
Host, Bryan	Technician	X									X					
McCarthy, Paul	Technician	X									X	X	X	X		4
Middleton, Mary Ann	Technician	X	X								X	X	X			3
Miller, Kathy	Technician															
Smith, Pat	Technician	X				Nursing (Inc.)					X	X	X			7
Holtz, June	Dishwasher (temporary)															
Tolbeck, Al	Maintenance															
Baro, Kathy	Bottle Project	X		X		Biology										1
Lang, John	Bottle Project	X														
Schultz, Kay	Data Processing	X														
Ward, Bill	Bottle Project	X		X												
Bus, Tim	Field Technician															
Ciastko, Charles	Field Technician															
Curtis, Jan	Field Technician	X		X		Geology										
Estes, Bill	Field Technician	X		X	X	Botany					X					
Grazioli, Mike	Field Technician	X				Env. Biology (Inc.)					X					
Hinrichs, Leonard	Field Technician	X		X		Geology					X					
Houser, Andy	Field Technician	X									X					
Martinez, Gerise	Field Data Clerical	X									X					
Matthies, Dale	Field/Sample Pick up	X									X					
O'Malley, Jim	Field Technician	X		X		Biology/Chemistry					X		X			2
Sass, Bill	Field Technician	X		X	X	Biological Sciences					X					
Witt, Tommy	Field/Sample Pick up	X														
Wright, Richard	Field Coordinator	X		X	X	Environmental Science					X					3

-Functions - 1) General Manager 2) Director 3) Technical Supervisor 4) Engineer 5) Technical Staff 6) Support
Analyses Performed - A) Inorganic B) Organic C) Microbiology

TABLE 4.2
WESTON/GULF COAST LABORATORY PERSONNEL INFORMATION

Employee	Title	Academics HS	AA	BS	MS	Field of Study Major/Minor	Function 1	2	3	4	Performed 5	6	Lab A	B	C	Experienc
Bracken, Jodie	Data Processing	X										X				1
Gifford, Lynn	Data Processing/Analyst	X		X		Biology					X	X		X	X	3
Johnson, Sheryl	Data Processing	X										X				3
Kroesch, Rita	Department Secretary	X														
LeClair, Karen	Data Processing	X										X				
McAnarney, Tammy	Accounts Receivable	X										X				
Minter, RaeAnn	File Clerk	X														
Schaefer, Regina	Receptionist	X														
Scott, Sherri	Data Processing	X										X				
Siders, Cathy	Data Processing	X		X	X	Chemistry/Exercise Phy.										
Slaga, Terese	QA/QC Coordinator	X		X		Biology/Chemistry										4
Straub, Donna	Accounts Payable	X									X		X	X		5

Functions- 1) General Manager 2) Director 3) Technical Supervisor 4) Engineer 5) Technical Staff 6) Support
Analyses Performed - A) Inorganic B) Organic C) Microbiology

5.0 QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The overall objective of the laboratory analyses, is to provide data that is accurate, precise, comparable between laboratories and representative of the site.

The definition of each term is given below. How compliance with these objectives is assessed is detailed in Section 14, and the routine procedural protocols are detailed in Section 5.6 and Table 5.5 summarizes the Quality Control data objectives.

5.1 PRECISION

Precision is defined as the measure of the mutual agreement among individual measurements of the same parameter of a sample, secured under the same analytical protocols. Field and lab precision will be expressed as relative percent difference (RPD).

The goals for precision are related to the proximity of the sample result to contract required detection limit (CRDL). In sample duplicate analysis a control limit listed in Tables 5.5 and 5.6 are used for values greater than five times the CRDL. A control limit of U+V the CRDL is used for samples values less than five times the CRDL. When one result is above the CRDL and the other is below, the U+V CRDL criteria is followed. Refer to Section 14.3.

5.2 ACCURACY

Accuracy is defined as the degree to which the analytical measurement reflects the true concentration present. Accuracy is measured by percent recovery of matrix spikes for organics, and matrix spikes plus laboratory control samples for inorganics. Refer to Tables 5.5 and 5.6 for objectives.

5.3 COMPLETENESS

Completeness is defined as the percentage of valid data obtained as judged by objectives in Tables 5.5 and 5.6 compared to the total amount of data collected.

5.4 REPRESENTATIVENESS

Representativeness is dependent on the sampling plan on a project specific basis and therefore is not covered in this laboratory plan. Assessment of site and collection representativeness is performed by the field engineer.

TABLE 5.5

INORGANICS

ACCURACY, PRECISION, COMPLETENESS - OBJECTIVES

PARAMETER	ACCURACY WATER/SOIL/SED RANGE	PRECISION WATER/SOIL/SED LIMIT	COMPLETENESS
pH		20 %	+/- 0.1 Unit
Conductivity	90 - 110%	20 %	95 %
Cyanide	90 - 110%	20 %	95 %
Total Organic Halogens	90 - 110%	20 %	95 %
Total Organic Carbon	90 - 110%	20 %	95 %
Metals	90 - 110%	20 %	95 %
Chloride	90 - 110%	20 %	95 %
Fluoride	90 - 110%	20 %	95 %
Nitrogen Nitrate	90 - 110%	20 %	95 %
Sulfate	90 - 110%	20 %	95 %
Phenol	90 - 110%	20 %	95 %
Nitrogen Ammonia	90 - 110%	20 %	95 %
Chemical Oxygen Demand	90 - 110%	20 %	95 %
Hardness	90 - 110%	20 %	95 %
Nitrogen Nitrite	90 - 110%	20 %	95 %
Total Kjeldahl Nitrogen	90 - 110%	20 %	95 %
Fats, Oil and Grease	90 - 110%	20 %	95 %
Phosphorous	90 - 110%	20 %	95 %
Ortho-Phosphate	90 - 110%	20 %	95 %
Total Suspended Solids	90 - 110%	20 %	95 %
Total Dissolved Solids	90 - 110%	20 %	95 %
Biochemical Oxygen Demand	90 - 110%	20 %	95 %
Total Solids	90 - 110%	20 %	95 %
Sulfide	90 - 110%	20 %	95 %
Mercury	80 - 120%	20 %	95 %

TABLE 5.6

ORGANICS
ACCURACY, PRECISION, COMPLETENESS, OBJECTIVES

	PARAMETER	% RECOVERY ACCURACY WATER/	SOIL/SED	% RPD PRECISION WATER/	SOIL/SED	COMPLETENESS
VOA	1,1-Dichloroethane	61-145	59-172	14	22	95 %
VOA	Trichloroethene	71-120	62-137	14	24	95 %
VOA	Chlorobenzene	75-130	60-133	13	21	95 %
VOA	Toluene	76-125	59-139	13	21	95 %
VOA	Benzene	76-127	66-142	11	21	95 %
BN	1,2,4-trichlorobenzene	39- 98	38-107	28	23	95 %
BN	Acenaphthalene	46-118	31-137	31	19	95 %
BN	2,4-Dinitrotoluene	24- 96	28- 89	38	47	95 %
BN	Pyrene	26-127	35-142	31	36	95 %
BN	N-nitroso-di-n-propylamine	41-116	41-126	38	38	95 %
BN	1,4-Dichlorobenzene	36- 97	28-104	28	27	95 %
Acid	Pentachlorophenol	9- 103	17-109	50	47	95 %
Acid	Phenol	12- 89	26- 90	42	35	95 %
Acid	2-Chlorophenol	27-123	25-102	40	50	95 %
Acid	4-Chloro-3-methylphenol	23- 97	26-103	42	33	95 %
Acid	4-Nitrophenol	10- 89	11-114	50	50	95 %
Pesticide	Lindane	56-123	46-127	15	50	95 %
Pesticide	Heptachlor	40-131	35-130	20	31	95 %
Pesticide	Aldrin	40-120	34-132	22	43	95 %
Pesticide	Dieldrin	52-126	31-134	18	38	95 %
Pesticide	Endrin	56-121	42-139	21	45	95 %
Pesticide	4,4-DDT	38-127	23-134	27	50	95 %
PCB	Aroclor 1254	*	*	30	50	95 %

*Recovery limits will be developed as data becomes available.

6.0 SAMPLING PROCEDURES

Field sampling is a critically important operation since the analytical results and subsequent decision based upon the analytical data are virtually dependent upon the validity of the samples obtained. Field sampling plans will be developed on a project specific basis. All sampling procedures will be in accordance to "USEPA Region IV - Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual", April, 1986, Section 4.

6.1 FIELD SAMPLING PREPARATION

WESTON/GULF COAST Laboratories takes great efforts to carefully plan and conduct a sampling operation. Sampling, protocol preparation, cost, and time are carefully considered by a dedicated field staff to save on expenses incurred by prior planning. Field personnel are experienced, full time samplers, and are well aware of the importance of proper sampling protocol, and are also aware that field data must be well documented. All sampling plans and objectives are clearly defined before personnel take to the field.

6.2 FIELD DOCUMENTATION

Proper documentation is an essential part of any sampling event. Details of the sampling episode are recorded on "Field Survey Forms". These field notes are often crucial in supporting potential enforcement actions resulting from the sample data. All documentation is recorded in triplicate; the original is supplied to the client, and copies are provided for the laboratory file and the sampler (originator).

The other piece of essential documentation is the sample "Chain of Custody Form", which is intended as a legal record of the possession of the sample. The form is initiated with bottle preparation, and remains with the sample at all times. This form bears the name of the person assuming responsibility of the sample custody and fully documents any chance in custody and sample accountability. (Refer to Section 7.)

6.3 FIELD QUALITY ASSURANCE - CONTROLLING SAMPLE CONTAMINATION

Applying field sampling techniques provides many paths for sample contamination. Field contamination is anything inadvertently added to the sample during collection and transportation. Contamination sources include sampling equipment, preservatives, ambient air contaminates, sample containers, and sample handling. Cross-contamination often results from improper cleaning of non-dedicated sampling equipment. Regardless of the contamination source, the effect is inaccurate analytical results, most often "False Positive" errors.

Sample contamination is best controlled by blanks. Two types of

blanks are used to control field contamination. The first one is a "Field Blank", also called equipment blanks, which determine contaminants introduced through sample equipment contact. These are prepared by collecting the matrix used to clean/rinse sampling equipment. The second type of blank is used to control for contamination introduced during transportation and storage of samples, called "Trip Blanks".

6.3.1 GROUNDWATER SAMPLING

The physical and chemical integrity of the sample must be maintained from the time of sampling to the time of testing in order to keep any CHANGES at a minimum. The time between sampling and testing should be kept at the absolute minimum.

Whenever sampling requirements call for a trip blank, one will be prepared from documented analyte free matrix. The trip blank will accompany the sample bottles to the field and will return, with the samples, to the laboratory. A trip blank will always be used when sample for volatile organics.

6.4.2 SAMPLING EQUIPMENT

For the most practical applications, a PVC bailer with non-glued joints is suitable for groundwater sampling when dedicated to the well. Teflon or stainless steel bailers may be preferable when monitoring organics. Non-dedicated bailers are triple-rinsed with deionized water between samplings. During non sampling periods dedicated bailers will be kept in the locked wells suspended above the water line.

6.4.3 FIELD DOCUMENTATION

Field measurements, along with proper documentation, are integral parts of any monitoring program. At a minimum, six tests need to be performed in the field prior to or immediately upon sample collection: Stick-up, Water Level, Total Depth, Temperature, pH, and Specific Conductance. All observations made during the entire sampling event are properly documented on field forms. Pertinent information should include sample appearance, weather conditions, well integrity, etc.

6.4.4 STATIC WATER LEVEL AND TOTAL DEPTH MEASUREMENTS

The static water level and total depth measurements are obtained using a slope indicator. This instrument consists of a spool of cable, which is marked in one foot increments, ending with a stainless steel conductance sensor. With the sensitivity dial in the "on" position, a red light and buzzer are simultaneously activated when the probe comes in contact with the water, giving the static water level in the well. The total depth measurement is obtained by feeling the slack and/or tension in the cable line

as it is lowered to the bottom of the well. All measurements are recorded to the 0.01 foot on field form. The slope indicator is rinsed with distilled water prior to and after each usage.

To calculate the volume:

1 Casing Volume (gallons) = r squared X h(7.48)
= 3.14
r = radius of well casing in feet
h = height of water column in feet
7.48 = conversion factor

OR SIMPLY

2" diameter well casing: 1 volume = h x 0.1632

4" diameter well casing: 1 volume = h x 0.6529

Total depth - water level = h (height of water column)

6.4.5 PURGING

Monitoring wells should be purged of stagnant water prior to sampling, in order to ensure that representative groundwater has entered the well. A minimum of three casing volumes should be purged whenever possible.

In situations involving low yield wells, it may be possible to purge the well to dryness. In this case, purge the well dry and sample as the well is recovering, within a 24 hour period. The single most important objective while purging a well is minimizing contamination.

Equipment should never touch the ground or any other possible contamination sources. This is best accomplished by using a fiber drum lined with a new plastic bag to collect the rope. The water being purged from the well will be collected in a 5 gallon bucket or a known volume container. This enables the sampler to accurately measure the volume of water that has been purged from the well. The volume of water removed will be recorded on the field form.

6.4.6 FILLING SAMPLE BOTTLES

All sample bottles must be filled directly from the bailer, with a minimal amount of air contact. TOX bottles and VOA vials should be headspace free and filled first. Bottle caps should be removed carefully so that the inside of the cap is not touched. Caps should never be placed on the ground or any other possible contamination source. Caps for VOA vials contain a teflon lined septum. The teflon side of the septum must be facing the sample in order to prevent contamination. Samples that need to be filtered may be placed in pre-filtration bottles until they are filtered and divided into their respective containers. Plastic

prefiltration bottles may be used for inorganic parameters; however, any organic parameters that need to be filtered must be placed in glass prefiltration bottles.

6.4.7 FILTRATION

All samples requiring filtering will be done using a stainless steel pressure filter through a 0.45 micron membrane filter paper. It is generally best to filter at the well head if possible. Refer to Florida Administrative Code, Chapter 17-4.

6.4.8 PRESERVATION

Samples must be preserved immediately after filtering or immediately upon collection at the well if the sample does not require filtering. Appropriate preservatives should always be added to the sample bottle after the bottle has been filled, however, for VOC's, the HCL may be added to the 40 ml vial prior to filling the container with sample.

6.4.9 SAMPLE SHIPMENT AND STORAGE

Samples will be stored at 4 degrees C in an enclosed cooler or darkened refrigerator prior to transport to the laboratory.

6.4.10 BLANKS

Trip and field blanks are used as control or external QA/QC samples to detect contamination that may be introduced during bottle preparation, in the field (from sampling equipment), in transit to and from the site, during log-in, or in sample storage. The blanks may also reflect contamination that may occur during the analytical process.

6.4.11 CALIBRATION AND USE OF FIELD METERS

Prior to any actual field measurements being taken, all meters must be properly calibrated. Additionally, these calibration results must be entered into a hard bound logbook to be kept with the meters at all times. This logbook will include information about the meters being used, such as name, model, serial number, and year purchased. Calibration of the pH meter consists of a 2 point standardization using the 7 and 10 buffers, as well as, a check on the 4 buffer. The specific conductance meter should be calibrated at two standards - 707 and 1413 umhos. Calibration limits should be within +/- 0.1 pH units and +/- 5% umhos. After the initial calibration, meters must be checked every 4 hours to verify that the standards still fall within the acceptable calibration limits. If they do not, the meter(s) must be recalibrated.

6.5 LIQUID AND SOLID AND WASTE SAMPLING

Sampling of liquid waste must be conducted to adequately characterize waste which may exhibit wide variability in chemical composition. To obtain representative characterization of the sample media, an appropriate sampling plan and methods must be chosen.

Gulf Coast Laboratories uses both grab and composite sampling techniques consistent with "Test Methods for Evaluating Solid Waste", SW-846, 1986, Vol. II, Part III.

6.5.1 OBJECTIVES

Proper sample custody procedures assure the sample integrity from the moment the sample is taken by field personnel; when received by the laboratory, and continues throughout the entire analytical scheme until the sample is returned or commercially disposed. As few people as possible should handle the sample.

6.5.2 SPLIT SAMPLING

Special procedures are required when split samples or duplicate samples are to be obtained. Aliquots of the sample must be alternated between sampling teams and/or sample bottles, in order to provide samples to each group which will be as representative as possible.

6.5.3 BOTTLES AND PRESERVATIVES

All samples are collected in new, certifiably clean containers. Preservatives are color coded and individually sealed in glass ampules. A specifications listing of bottles and preservatives can be found on the following pages.

6.6.0 SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

PARAMETERS	CONTAINER TYPE	PRESERVATION	HOLDING TIME
TABLE 6A - BACTERIAL TESTS:			
1-4. Coliform, Fecal and Total		Cool, 4 C, 0.008% $Na_2S_2O_3$	6 Hours
5. Fecal Streptococci			
TABLE 4B - INORGANIC TESTS:			
1. Acidity	3,5	Cool 4 C	14 Days
2. Alkalinity	3,5	Cool 4 C	
4. Ammonia	3,5	Cool 4 C, H_2SO_4 to pH <2	28 Days
9. Biochemical Oxygen Demand	3,5	Cool 4 C	48 Hours
11. Bromide		Cool 4 C	28 Days
14. Biochemical Oxygen Demand Carbonaceous	3,5	Cool 4 C	48 Hours
15. Chemical Oxygen Demand	3,5	Cool 4 C, H_2SO_4 to pH <2	28 Days
16. Chloride	3,5	Cool 4 C	
17. Chlorine, Total Residual	3,5	Cool 4 C	Analyze Immediately
21. Color	3,5	Cool 4 C	48 Hours
23-24. Cyanide, Total & Amenable to Chlorination	3,5	Cool 4 C, NaOH to pH>12, 0.6g ascorbic acid	14 Days
25. Fluoride	3	Cool 4 C	28 Days
27. Hardness	3,5	HNO_3 to pH<2, H_2SO_4 to pH<2	6 Months
28. Hydrogen ion (pH)	3,5	Cool 4 C	Analyze Immediately
31,43. Kjeldahl and Organic Nitrogen	3,5	Cool 4 C, H_2SO_4 to pH<2	28 Days
METALS:			
18. Chromium VI	3,5	Cool 4 C	24 Hours
35. Mercury	5,10	HNO_3 to pH<2	14 Days
3, 5-8, 10, 12, 13, 19, 20, 22, 26, 29, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75	3,5	Cool 4 C, HNO_3 to pH<2	6 Months
38. Nitrate	3,5	Cool 4 C	48 Hours
39. Nitrate-Nitrite	3,5	Cool 4 C, H_2SO_4 to pH<2	14 Days
40. Nitrite	3,5	Cool 4 C	48 Hours
41. Oil and Grease	5	Cool 4 C, H_2SO_4 to pH<2	28 Days
42. Organic Carbon	3,5	Cool 4 C, H_2SO_4 to pH<2 or HCL	
44. Orthophosphate	3,5	Filter Immediately, Cool 4 C	48 Hours
46. Oxygen, Dissolved Probe and Cap	G Bottle	Cool 4 C	Analyze Immediately
47. Winkler		Fix on site and store in dark	8 Hours
48. Phenols		Cool 4 C, H_2SO_4 to pH<2	28 Days
49. Phosphorus (elemental)	5	Cool 4 C	48 Hours
50. Phosphorus, Total	3,5	Cool 4 C, H_2SO_4 to pH<2	28 Days
53. Residue, Total	3,5	Cool 4 C	7 Days
54. Residue, Filterable	3,5	Cool 4 C	7 Days
55. Residue, Nonfilterable (TSS)	3,5	Cool 4 C	7 Days

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES CONTINUED

	PARAMETERS	CONTAINER TYPE	PRESERVATION	HOLDING TIME
56.	Residue, Settleable	3,5	Cool 4 C	48 Hours
57.	Residue, Volatile	3,5	Cool 4 C	7 Days
61.	Silica	3	Cool 4 C	28 Days
64.	Specific Conductance	3,5	Cool 4 C	
65.	Sulfate	3,5	Cool 4 C	
66.	Sulfide	3,5	Cool 4 C, Add Zinc acetate and sodium hydroxide to pH>9	7 Days
67.	Sulfite	3,5	Cool 4 C	Analyze Immediately
68.	Surfactants	3,5	Cool 4 C	48 Hours Immediately
69.	Temperature	3,5	None Required	Analyze
73.	Turbidity	3,5	Cool 4 C	48 Hours
TABLE 6C - ORGANIC TESTS:				
13, 18-20, 22, 24-28, 34-37, 37-43, 45-47, 56, 66, 88, 92-95, 97 Purgeable Halocarbons		8,12	Cool 4 C, 0.008%, Na2S2O3	14 Days
6, 57, 90 Purgeable Hydrocarbons			Cool 4 C, 0.008% NaS2O3, HCl to pH 2	
3, 4 Acrolein and Acrylonitrile			Cool 4 C, 0.008% NaS2O3, Adjust pH to 4-5	
23, 30, 44, 49, 53, 67, 70, 71, 83, 85, 96 Phenols	lined cap	1,5,9	Cool 4 C, 0.008% NaS2O3,	7 Days Extraction 40 Days after
7, 38 Benzidines				7 Days Extraction
14, 17, 48, 50-52 Phthalate esters			Cool 4 C	7 Days Extraction 40 Days After
72-74 Nitrosamines			Cool 4 C, Store in dark 0.008% NaS2O3,	
76-82 PCBs Acrylonitrile			Cool 4 C	
54, 55, 65, 69 Nitroaromatics and Isophorone			Cool 4 C, 0.008% NaS2O3 Store in Dark	
1, 2, 5, 8-12, 32, 33, 58, 59, 64, 68, 84, 86 Polynuclear Aromatic Hydrocarbons				
15, 16, 21, 31, 75 Haloethers			Cool 4 C, 0.008% NaS2O3,	
29, 35-37, 60-63, 91 Chlorinated Hydrocarbons			Cool 4 C	
87.	TCDD		Cool 4 C, 0.008% NaS2O3,	
TABLE 6D - PESTICIDES TESTS:				
1-70	Pesticides		Cool 4 C, pH 5-9	
RADIOLOGICAL TESTS:				
1-5	Alpha, Beta and Radium	3,5	HNO3 to pH<2	6 Months

FIGURE A-1
MATRIX OF CONTAINER REQUIREMENTS

Parameter and	Container Type(s)	Cleaning Procedures	Color Code
Extractable Organics	1, 5, 9	I	Red
Oil/Grease	5	V	Brown
Phenols	5	IV	Pink
Cyanide	3, 5	III	Black
Metals	3, 5	III	Green
THM/VOA	8, 12	II	Blue
Mercury	5, 10	III	Silver
Nutrients	3, 5	IV	Yellow
Prefiltration	11	IV	White
General	3, 5	IV	Orange
Radioactivity	3, 5	III	Green
Sulfide	3, 5	IV	Purple

FIGURE A-2
REAGENT REQUIREMENTS

Reagents	Amount	Color Code	Preservative Code	Diluted Volume
50% HS2TSOS4T	4 ml	Yellow	Yel	1000 ml
50% HS2TSOS4T	4 ml	Brown	Bro	1000 ml
NAS2TSS2TOS8T	10 mg	Blue	Blu	40 ml
6 N NaOH	5 ml	Black	Bla	1000 ml
50% HNOS3T	5 ml	Green	Grn	1000 ml
10% CuSOS4T, HS3TPOS4T	10 ml	Pink	Pin	1000 ml
25% HNOS3T, 2.5% K2Cr2O7	10 ml	Gray	Gry	500 ml
2 N Zinc Acetate	4 ml	Purple	Plp	1000 ml

Reagents are to be packaged in color-coded, contaminant-free, sealed ampules or linerless glass containers in the amounts specified.

Acids, bases, sodium chiosulfate, copper sulfate, and nitric acid/ potassium dichromate, must not produce any measurable quantity of any of the compounds listed in Figures D-3, D-4 and D-, when diluted with ASTM Type I water to the volumes stated above.

F I G U R E B - 1

Container Type	Parameter & Container and Material Specification	Sample Type
1	Container: 1 liter* amber, Boston round, glass bottle, 33 mm pour-out neck finish. Closure: white polypropylene cap, 33-400 size, .015 mm teflon liner	Extractable Organics
3	Container: 1 liter* natural high-density polyethylene cylinder round bottle, 52g weight, 28 mm neck finish. Closure: baked polyethylene, white ribbed, 28-400 or 28-410 size; unlined lid.	Metals, Cyanide Radioactivity General Nutrients, Sulfide
5	Container: 32 oz. tall, wide-mouth straight-sided paragon, flint glass jar, 89 mm neck finish. Closure: white polypropylene cap, 89-400 size, .015 mm teflon liner .	Extractable Organics, Oil/Grease, Metals, Mercury, Cyanide, Nutrients, Phenols General, Sulfide
8	Container: 40 ml borosilicate glass vial, Type 1 glass, 24 mm neck finish. Closure: black phenolic, open-top, screw cap, 15 cm opening, 24-400 size. Septum: 22 mm disc of 2 mil teflon bonded to silicon for total thickness of 125 mil.	THM/VOA
9	Container: 1/2 gallon amber glass, ring handle bottle/jug, 38 mm neck finish. Closure: teflon-lined white propylene cap, 38-400 size.	Extractable Organics
10	Container: 500 ml natural high density polyethylene, oblong bottle, 43 mm neck finish. Closure: white propylene unlined cap, 43-400 size (or 43mm)	Mercury
11	1 gallon plastic	Prefiltration
12	Container: 2 oz. wide-mouth straight-sided paragon, flint glass jar, 53mm neck Closure: white polypropylene cap, 53-400 size, 0.015 mm teflon liner.	THM/VOA

*These bottles must have sufficient overfill to accommodate an actual capacity of 1 liter of liquid. Bottle manufacturers refer to the bottles as 32 ounce bottles, however all 32 ounce bottles do not have sufficient overfill to meet the requirement.

NOTE: Containers and component material specifications different than, but equivalent to, the manufacturer's specifications cited here may be acceptable. The bidder shall be required to demonstrate equivalence prior to Government approval of use of alternate material The Government shall determine acceptability as part of bidder preaward confirmations (see Pre-Award Bid Confirmations).

6.6.1 CONTAINER PREPARATION AND CLEANING PROCEDURES

The bottle supplies shall clean and prepare containers and component materials according to the following procedures specified for each container type.

A. EXTRACTABLE ORGANICS

Container Types: 1 - 1 liter amber glass
5 - 32 oz glass jar
9 - 1/2 gallon amber glass

1. The containers, teflon liners and caps are to be washed in hot tap water with laboratory-grade non-phosphate detergent.

2. Rinse three times with tap water.

3. Rinse three times with ASTM Type I organic-free water.

4. Dry in oven @ 105WoTC for one hour.

5. Rinse inside and outside of container with pesticide grade acetone or methylene chloride.

6. Dry containers, liners, and caps in an oven at 105 C for one hour.

7. Allow containers to cool and seal with teflon lined caps.

8. Label each container with color coded labels with lot number and pack in a sealable carton.

9. Place identical labels on exterior of carton and store in a designated contaminant-free area.

B. PURGEABLE ORGANICS

Container Types: 8 - 40 ml glass vial
12 - 2 oz glass jar

1. Containers, teflon-backed septa and caps are washed in hot tap water with laboratory-grade non-phosphate detergent.

2. Rinse three times with tap water.

3. Rinse three times with ASTM Type I organic-free water.

4. Oven dry vials, containers, caps, septa, and teflon-lined lids at 105 C for one hour.

5. Cool in a contaminant-free area.

7.0 FIELD CUSTODY

Definition of custody - A sample is in one's custody if:

A. It is in one's physical possession.

B. It is in one's view, after being in one's physical possession.

C. It is in one's physical possession and secured so that no one can tamper with it.

D. It is kept in a secured area restricted to authorized personnel only.

7.1 CUSTODY PROCEDURES

All custody records shall originate by field personnel and should be attached to the sample container at the time it is collected. The sample record should contain the following information.

A. Sample I.D.

B. Date and time taken

C. Source of the sample (include sample type and name of firm)

D. Preservative

E. Analysis required

F. Name of person collecting sample

The shipping container should then be sealed so that the sample tag cannot be removed and the container opened without breaking the seal. The tags and seals should be filled out in legible handwriting.

When transferring the possession of samples, the transferee should sign and record the date and time the transfer took place.

The responsibility of transporting to Gulf Coast Laboratories will be defined for each project. The chain of custody forms will be stored securely by GCL personnel with the samples.

The log-in personnel shall receive and verify the integrity of the samples. Samples not properly passed are not to be received until the client is notified of the specific problems and client approved action is specified.

7.2 LABORATORY CUSTODY PROCEDURES

Gulf Coast Laboratories assumes the responsibility for the integrity and security of the samples upon receipt once the transfer is complete.

A. Gulf Coast Laboratories' building is securely locked between 5:30 p.m. and 7:30 a.m. The laboratory is securely locked 24 hours/day and entrance to the lab by the front door is monitored by the receptionist using a sign in book. Only authorized people may gain entrance to the laboratory by the front door and then they must be supervised by lab personnel.

B. Log-in personnel under the supervision of the Laboratory Director receive the samples and provide the GCL number for each sample bottle on the chain of custody record and log sample in sample log book filling out the necessary information to identify the sample.

C. Log-in personnel check samples to insure that the samples are properly coordinated with log book information, chain of custody records, and all other pertinent information.

D. Persons designated by the laboratory supervisor are responsible for securing the samples in the appropriate refrigerator or walk in cooler within the secured laboratory area.

All sample manipulation/preparation will be documented by the analyst/technician in the sample extraction log, sample digestion log, sample distillation log or the technician's personal log book.

E. Internal chain-of-custody for samples is maintained by the Sample Custodian on the custody record. Internal chain-of-custody for sample extracts is maintained in the Extraction Laboratory on the Sample Extraction Record. Internal chain-of-custody for digestates is maintained in the Metals Section on the sample digestion record. All samples and extracts must be signed for by the person retaining custody of these items. On completion of all analyses, these custody sheets will be placed in the client file.

When a sample is obtained from the Sample Custodian, the transfer is documented in the custody block of the custody transfer record/laboratory work request form. When the sample is returned to the walk-in cooler after extraction, the Sample Custodian will re-take custody of the samples and again document the transfer on the custody transfer record.

When a sample is extracted or digested for analysis, a sample extraction record or sample digestion record will be initiated and maintained as a custody transfer document.

When the extracts are transferred to the GC or GC/MS laboratories for analysis, the custody section of the sample extraction record is signed by the person accepting custody of the extracts. Any additional transfers of these extracts are also documented in the custody section which is maintained in the extraction laboratory. The signed sample extraction record is placed in the file on completion of the project.

When the digestates are transferred to the metals laboratory for analysis, the custody section of the sample digestion record is signed by the person accepting custody of the digestates. Any additional transfers of these digestates is also documented in the custody section of this form, which is maintained in the Metals Laboratory. The signed sample digestion record is placed in the client file on completion of the project.

F. All samples will be held until all the results have been reported and accepted; or until litigation has been completed, or unless otherwise requested. All hazardous samples will be disposed of commercially.

G. When samples are transferred from the lab to any other destination the appropriate custody protocol will be used.

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8.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the basic protocols used for calibration of AA metals, ICP metals, other inorganic parameters and organics. These protocols are followed to provide assurance of optimization of each procedure prior to the analysis of samples. Continuing calibration verification is discussed in Section 11 "Internal Quality Control Checks".

8.1 METALS

The H.C. lamp and flame position are adjusted for maximum optimization. A standard calibration curve consisting of a calibration blank and three standards are analyzed and absorbance readings are recorded. The standard curve must show a 0.995 - 1.000 correlation coefficient and a slope consistent with previous curves. An initial calibration verification sample will be analyzed and be within 90 - 110% of the true value. (Mercury range = 80 -120.) A continuing calibration standard will be analyzed every ten samples to verify the continual instrument optimization. If the standard does not fall within 10% of original curve, the instrument will be recalibrated and the samples in the previous set reanalyzed.

An initial calibration verification (ICV) is performed at the beginning of the analysis of samples by analyzing an independent standard. The ICV must be 90 - 110% recovery of the known concentration.

A continuing calibration verification (CCV) sample is analyzed every ten samples during an analytical run. The CCV must be 90 - 110% recovery of the known concentration.

8.2 ICP METALS

Calibration using a calibration blank and a standard is performed after a period of time sufficiently to warm up the instrument. A 50% and 20% standards are analyzed to verify linearity of standard curve by calculation of the correlation coefficient, (0.995-1.000) acceptance range. A standard is analyzed to identify the upper limit of the linear range and all samples above the ICP linear range are diluted and analyzed.

ICP Interference Check Sample: For ICP Interference Check Sample obtained from USEPA (EMSL/LV) the control limit is +/- 20% of the true value for analytes included in the ICS. For elements contained in the ICS, yet for which no true value was supplied the control limit will be +/- 20% of the determined mean value. If the ICP Interference Check Sample is not available from USEPA, an independent ICP Check Sample shall be prepared with the interferent and analyte concentrations at the levels specified in USEPA SOW 787. Results for the independent ICP Check Sample shall be within the contract limits of +/- 20% of the determined mean value. The

mean will be determined initially by analyzing the sample at least five times repetitively for the particular analytes. The mean determination must be made during an analytical run that meets all contract specifications. If results for the check sample does not fall within the control limit, terminate the analysis, correct the problem, recalibrate, reverify the calibration, and reanalyze the samples. Results from the Interference Check Sample analyses is recorded on Form III for all ICP parameters.

8.3 INORGANIC COLORIMETRIC METHODS

Standard calibration curves are prepared for all analyses on a daily basis or a standard curve is analyzed whenever new reagents are used, or when changes in the procedure are introduced. For each batch of analyses a mid-range and high range standard will be analyzed and must be within 10% of the original curve. If it is not within 10% of the original curve, a new curve will be developed or reanalysis of the standards will be done to verify they do not fit the curve. The standard curve is composed of a reagent blank, three to five standards and must have a correlation coefficient of 0.995 - 1.000.

For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pretreated standard is within 10% of the standard curve the curve will be used. If the pretreated sample is not within 10% of the curve the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment.

8.4 ORGANICS

WESTON/GULF COAST Laboratories will analyze for all of the pesticide and PCB target compounds by gas chromatography with an electron capture detector. WESTON/GULF COAST Laboratories will tentatively identify the pesticide/PCB parameters by retention time on a primary GC column and confirm the identification on a confirmatory column of a dissimilar polarity.

Before samples may be analyzed for Pesticides/PCBs, retention time windows must be calculated for each GC/ECD instrument used for the analysis. The retention time for identification of a target compound in a sample will be the retention time of that compound in the initial daily standard plus or minus the retention time window. Determine retention time windows for each of the Pesticide/PCB target compounds as follows:

A. Inject each target compound on three consecutive days. Single response analytes may be combined into one or two mixtures. The surrogate spike compound, dibutylchlorendate, must be included in each standard. Resolution between any two compounds in a mixture

must be greater than 25%. The concentration of each compound must be sufficient to produce approximately half scale response.

B. Calculate the standard deviation of the absolute retention time for each target compound. For multi-response pesticides and PCBs, the calculation need only be performed for one of the major peaks which is characteristic of the pesticide or PCB mixture.

C. Calculate the percent change in the absolute retention time of dibutylchlorendate. The retention time of dibutylchlorendate must not vary more than two percent over the three days. If the retention time of dibutylchlorendate does vary by more than two percent, then repeat the analysis of all standards until the criteria is met.

When GC/MS work is performed, all of the compounds listed in the target compound lists will be identified by an analyst competent in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. Two criteria will be satisfied to verify the identifications:

A. Elution of the sample component will be at the same GC relative retention time (RRT) as the standard of that component. For establishing correspondence of the RRT, the sample component RRT must compare within +/- 0.06 RRT units of the RRT of the standard component. For reference, the standard must be run on the same shift as the sample. If coelution of interfering components prohibits accurate assignment of the sample component RRT from the total ion chromatogram, the RRT should be assigned by using extracted ion current profiles for ions unique to the component of interest.

B. Correspondence of the sample component mass spectrum and the standard component mass spectrum must be established. For comparison of standard and sample component mass spectra, mass spectra obtained on the GC/MS are required. Once obtained, these standard spectra may be used only if the GC/MS meets the daily tuning requirements for the analysis being performed. The standard spectra may be obtained from the run used to obtain reference RRTs. All ions present in the standard mass spectrum at a relative intensity greater than 10 percent must be present in the sample spectrum and their relative intensities must agree within +/- 20 percent. Ions present in the sample spectrum, at greater than 10 percent relative abundance, which are not present in the sample spectrum must be considered and accounted for by the analyst.

WESTON/GULF COAST Laboratories will perform forward search routines of the most recent available EPA/NIH mass spectral library and report tentative identifications and estimated concentrations of the ten most significant not listed GC peaks in samples run for volatile analyses and the twenty most significant not listed GC peaks in semi-volatile analyses. Substances with response of less than 10% of the nearest internal standard are not required to be searched in this manner.

A. Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

B. The relative intensities of the major ions should agree within +/- 20%. (Example: For an ion with an abundance of 50% of the standard spectra, the corresponding sample ion abundance must be between 30% and 70%.)

C. Molecular ions present in reference spectrum should be present in sample spectrum.

D. Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

E. Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible background subtraction from the sample spectrum because of background contamination or co-eluting compounds. Data system library reduction programs can sometimes create these discrepancies.

If, in the opinion of the mass spectral specialist, no valid tentative identification can be made, the compound will be reported as unknown. The mass spectral specialist should give additional classification of the unknown compound, if possible (i.e., unknown aromatic, unknown hydrocarbon, unknown acid type, unknown chlorinated compound). If probable molecular weights can be distinguished, include them.

All sample results will be reported to the "Customer" in the same chronological order that they were analyzed, along with the standards, spikes, blanks, duplicates and/or surrogates. The GC chromatograms and/or GC/MS spectra and computer printouts (or legible photocopies) will be submitted to support all the results upon request. The samples must be analyzed within the appropriate holding time specified in the standard operating procedures.

8.5 VOLATILE ORGANICS AND ACID BASE/NEUTRALS BY GC/MS.

Initial demonstration of acceptable precision and accuracy will be accomplished by analyzing four replicate spiked samples according to the applicable wastewater method. The average concentration and standard deviation for each component must meet quality control acceptance criteria in the applicable wastewater method. Alternatively, historical data generated with USEPA CLP protocols may be submitted. Data from spiked blanks, USEPA quality control samples, or USEPA performance evaluation samples is acceptable.

When using capillary columns, Gulf Coast Laboratories obtains less than 6% relative standard deviation (RSD) between replicate injections and less than 15% RSD between replicate purges for each instrument. RSD of surrogate response, calculated by internal standard technique, is measured in blank samples or standards.

Initial calibration curves are generated for each compound on the

attached target lists for the method being calibrated. The standards used to generate the curves must start at or near the contract required detection limit (CRDL) and cover the entire working range of the instrument. Any sample concentrate must be diluted or concentrated so that all components present above the

contract required detection level fall within the range of the initial calibration curve. When dilution of a sample or sample extract is necessary, the analyst will quantify the lower level components from the initial undiluted analysis.

For GC/MS analyses, calibration is performed on five points by the internal standard technique. Calculate Response Factors (RF) according to:

RF = Ax/Ais X Cis/Cx

Ax = Area of the characteristic ion of compound to be measured

Ais = Area of the characteristic ion of the specific internal standard used to calculate the compound to be measured.

Cis = Concentration of the internal standard (ng/uL).

Cx = Concentration of the compound to be measured (ng/uL).

Response factor and average response factor must be calculated for each component.

The minimum acceptable average RF for the volatile compounds; chloromethane, 1,1-dichloroethane, 1,1,2,2,-tetrachloroethane and chlorobenzene is 0.300.
The minimum acceptable average RF for bromoform is 0.250.

The minimum acceptable average RF for the semivolatile compounds; N-nitroso-di-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitrophenol and 4-nitrophenol is 0.050.

The Percent Relative Standard Deviation (% RSD) must be calculated for all target compounds.

For the following Calibration Check Compounds (CCC), (%RSD) criteria apply:

Base / Neutral CCC	Acid / CCC	Volatile CCC
Acenaphthene	4-Chloro-3-Methylphenol	1,1-Dichloroethene
1,4-Dichlorobenzene	2,4-Dichlorophenol	Chloroform
Hexachlorobutadiene	2-Nitrophenol	1,2-Dichloropropane
N-Nitrosodiphenylamine	Phenol	Toluene
Di-n-Octylphthalate	Pentachlorophenol	Ethylbenzene
Fluoranthene	2,4,6-Trichlorophenol	Vinyl Chloride
Benzo(a)pyrene		

Calculate percent RSD by: %RSD = (SD / average RF) X 100

SD = Standard Deviation of initial 5 response factors (per compound)

For the initial calibration to be valid, the percent RSD for these compounds must be less than 30%.

For each 12-hour period, before any samples or standards are run on the GC/MS, the tuning must be verified by comparing the spectrum of BFB (p-bromo-fluorobenzene) for volatile analysis or DFTPP (decafluoro-triphenylphosphine) for base/neutral or acid extractable (BNA) analysis to the ion abundance criteria in Table 8.1 or(BFB) or Table 8.2 (DFTPP). For each tuning verification compound, the mass labeled as the base peak in the appropriate table must be 100% relative abundance.

Table 8.1
Bromofluorobenzene
(BFB) Tuning Verification Limits

Mass	Ion Abundance Criteria
50	15.0 - 40.0% of the base peak
75	30.0 - 60.0% of the base peak
95	Base peak, 100% relative abundance
96	5.0 - 9.0% of the base peak
173	Less than 1.0% of the base peak
174	Greater than 50.0% of the base peak
175	5.0 - 9.0% of mass 174
176	Greater than 95.0% but less than 101.0% of mass 174
177	5.0 - 9.0% of mass 176

Table 8.2
Decafluorotriphenylphosphine
(DFTPP) Tuning Verification Limits

Mass	Ion Abundance Criteria
51	30.0 - 60.0% of mass 198
68	Less than 2.0% of mass 69
70	Less than 2.0% of mass 69
127	40.0 - 60.0% of mass 198
197	Less than 1.0% of mass 198
198	Base peak, 100% relative abundance
199	5.0 - 9.0% of mass 198
275	10.0 - 30.0% of mass 198
365	Greater than 1.0% of mass 198
441	Present but less than mass 443
442	Greater than 40.0% of mass 198
443	17.0 - 23.0% of mass 442

8.6 PESTICIDES AND PCBS BY GC/ECD

Calibration of the GC/ECD instrument for Pesticides/PCB analysis will be performed as required in the Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, USEPA CLP, 7/87.

TABLE 8.3
VOLATILE TARGET COMPOUNDS

Compound	Water Detection Level	Soil/Solid Detection Level
Chloromethane	10 ug/l	10 ug/kg
Bromomethane	10 ug/l	10 ug/kg
Vinyl Chloride	10 ug/l	10 ug/kg
Chloroethane	10 ug/l	10 ug/kg
Methylene Chloride	5 ug/l	5 ug/kg
Acetone	10 ug/l	10 ug/kg
Carbon Disulfide	5 ug/l	5 ug/kg
1,1-Dichloroethene	5 ug/l	5 ug/kg
1,1-Dichloroethane	5 ug/l	5 ug/kg
t-1.2-Dichloroethene	5 ug/l	5 ug/kg
c.-1,2-dichloroethene	5 ug/l	5 ug/kg
Chloroform	5 ug/l	5 ug/kg
1,2-Dichloroethane	5 ug/l	5 ug/kg
2-Butanone	10 ug/l	10 ug/kg
1,1,1-trichloroethane	5 ug/l	5 ug/kg
Carbon Tetrachloride	5 ug/l	5 ug/kg
Vinyl Acetate	10 ug/l	10 ug/kg
Dichlorobromomethane	5 ug/l	5 ug/kg
c-1,3-dichloropropene	5 ug/l	5 ug/kg
Trichloroethene	5 ug/l	5 ug/kg
Benzene	5 ug/l	5 ug/kg
Chlorodibromomethane	5 ug/l	5 ug/kg
1,1,2-trichloroethane	5 ug/l	5 ug/kg
t-1,3-Dichloropropene	5 ug/l	5 ug/kg
2-Chloroethyl Vinyl Ether	10 ug/l	10 ug/kg
Bromoform	5 ug/l	5 ug/kg
2-Hexanone	10 ug/l	10 ug/kg
4-Methyl-2-pentanone	10 ug/l	10 ug/kg
1,1,2,2-tetrachloroethane	5 ug/l	5 ug/kg
Tetrachloroethene	5 ug/l	5 ug/kg
Toluene	5 ug/l	5 ug/kg
Chlorobenzene	5 ug/l	5 ug/kg
Ethylbenzene	5 ug/l	5 ug/kg
Styrene	5 ug/l	5 ug/kg
Total Xylenes	15 ug/l	15 ug/kg

TABLE 8.5
ACID TARGET COMPOUNDS

Compound	Water Detection Level	Soil/Solid Detection Level
Benzoic Acid	50 ug/l	1600 ug/kg
Phenol	10 ug/l	330 ug/kg
2-Chlorophenol	10 ug/l	330 ug/kg
2-Nitrophenol	50 ug/l	1600 ug/kg
2-Methylphenol	10 ug/l	330 ug/kg
2,4-Dimethylphenol	10 ug/l	330 ug/kg
4-Methylphenol	10 ug/l	330 ug/kg
2,4-Dichlorophenol	10 ug/l	330 ug/kg
2,4,6-Trichlorophenol	10 ug/l	330 ug/kg
2,4,5-Trichlorophenol	50 ug/l	1600 ug/kg
4-Chloro-3-methylphenol	10 ug/l	330 ug/kg
2,4-Dinitrophenol	50 ug/l	1600 ug/kg
2-Methyl-4,6-dinitrophenol	50 ug/l	1600 ug/kg
Pentachlorophenol	50 ug/l	1600 ug/kg
4-Nitrophenol	50 ug/l	1600 ug/kg

TABLE 8.5
PESTICIDE TARGET COMPOUNDS

Compound	Contract Required Detection Level
a-BHC	0.05 ug/l
b-BHC	0.05 ug/l
d-BHC	0.05 ug/l
Lindane	0.05 ug/l
Heptachlor	0.05 ug/l
Aldrin	0.05 ug/l
Heptachlor Epoxide	0.05 ug/l
Endosulfan I	0.05 ug/l
p,p'-DDD	0.10 ug/l
Dieldrin	0.10 ug/l
Endrin	0.10 ug/l
pp'-DDE	0.10 ug/l
Endosulfan II	0.10 ug/l
p,p'-DDT	0.10 ug/l
Endrin Aldehyde	0.10 ug/l
Endosulfan Sulfate	0.10 ug/l
Mirex	0.10 ug/l
Methoxychlor	0.50 ug/l
Chlordane	0.50 ug/l
Toxaphene	0.50 ug/l
Aroclor-1016	0.50 ug/l
Aroclor-1221	0.50 ug/l
Aroclor-1232	0.50 ug/l
Aroclor-1242	0.50 ug/l
Aroclor-1248	0.50 ug/l
Aroclor-1254	1.0 ug/l
Aroclor-1260	1.0 ug/l

9.0 ANALYTICAL PROCEDURES

The tables in this section indicate the methods generally utilized by Weston/Gulf Coast Laboratories. Because numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Weston/Gulf Coast Laboratories analytical capabilities are not limited to the procedures listed in Section 9.0, therefore, please contact us with questions concerning procedures not specified.

1. Methods for Chemical Analysis of Water and Waste, EPA 600/4-79-020, EMSL, Cincinnati, Revision March, 1983.

2. Manual of Analytical Methods prepared by Pesticides and Toxic Substances Effects Laboratory. Analysis of Pesticide Residues in Human and Environmental Samples. December, 1974.

3. The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oils, Physical and Chemical Methods Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. April,1981.

4. Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol, and Pesticides in Water and Wastewater, EMSL, U.S.EPA, Cincinnati, Ohio, September, 1978.

5. Standard Methods for the Examination of Water and Wastewater, 15th edition, APHA, 1980, and 16th Edition, APHA, 1985.

6. SW-846 Test Methods for Evaluating Solid Waste, Physical Chemical Methods, Waste Characterization Branch, Office of Solid Waste. U.S.EPA, Washington, D.C., July 1982 2nd Ed., and September, 1986, 3rd Edition.

7. Federal Register, 40 CFR 136H. December 3, 1979, U.S.EPA EMSL Cincinnati, OH 45268.

8. Annual Book of ASTM Standards, Part 31, Water, 1980.

9. Methods for Chemical Analysis of Water and Wastes, EMSL, Cincinnati, March 1979, EPA 600/4-79-020.

10. Federal Register, 40 CFR 136H, October 26, 1984 U.S.EPA EMSL Cincinnati, Ohio 43243.

11. IFB Statement of Work for Organics Analysis Multi-Media Multi-concentration Attachment A, 7/87, U.S.EPA Contract Laboratory Program.

The exact procedures to be used may be found on the following pages. Sample bottles and preservatives for each parameter can be found in Section 6.0.

TABLE 9A. BIOLOGICAL TEST PROCEDURES

	PARAMETER AND UNITS	METHOD	Reference (Method Number or Page) EPA	Standard Methods 16th Ed.	USGS
1.	Coliform (fecal) in number per 100 ml. membrane filter (MF 4) single step	MPN, 5 tube, 3 dilution; or	p. 132	908C	
2.	Coliform (fecal) in presence of chlorine number per 100 ml	MPN, 5 tube, 3 dilution	p. 124	909	B-0050-77F
3.	Coliform (total) number per 100 ml (4) single step or two step	MPN, 5 tube, dilution; or MF	p. 114 p. 108	908A 909A	B-0025-77
4.	Coliform (total) in presence of chlorine number per 100 ml	MPN, 5 tube, dilution; or MF (4) with enrichment	p. 114 p. 111	908A 909	
5.	Fecal streptococci, number per 100	MPN, 5 tube, 3 dilution; MF (4) or plate count	p. 139 p. 136 p. 143	910A 910B 910C	B-0055-77

TABLE 9B
INORGANIC TEST PROCEDURES

	PARAMETER, UNITS, AND METHOD	EPA 1979	STANDARD METHODS 16th ED.	FEDERAL REGISTER	SW846
1.	Acidity as CaCO3 mg/L: Electrometric end point	305.1	402(4.d)		
2.	Alkalinity as CaCO3, mg/L: Electormetric or				
	Colorimetric Titration to pH 4.5, manual	310.	403		
	Automated	310.2			
3.	Aluminum-Total mg/L: Digestion followed by				
	Inductively coupled plasma			200.7	6010
4.	Ammonia (as N) mg/L: Manual distillation at				
	pH 9.5) followed by	350.2	417A		
	Nesselerization	350.2	417B		
	Titration	350.2	417D		
	Electrode	350.3			
5.	Antimony-Total, mg/L: Digestion followed by				
	AA Furnace	204.2	304		7041
	Inductively coupled plasma			200.7	6010
6.	Arsenic-Total, mg/L: Digestion followed by	206.5			
	Hydride	206.3	303E		
	AA Furnace	206.2	304		7060
	Colorimetric (SDDC)	206.4	307B		
7.	Barium-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	208.1/208.2			7080
	Inductively coupled plasma			200.7	6010
8.	Beryllium-Total, mg/L Digestion followed by			200.7	6010
	Inductively coupled plasma				
9.	Biochemical oxygen demand (BOD), mg/L:				
	Winkler (Azide modification)	405.1	507		
	Electrode Method				
10.	Boron-Total, mg/L				
	Inductively coupled plasma			200.7	6010
11.	Bromide, mg/L: Titrimetric	320.1			
12.	Cadmium-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	213.1	303A/303B		7130
	AA Furnace	213.2	304		7131
	Inductively coupled plasma			200.7	6010
13.	Calcium-Total, mg/L: Digestion followed by				
	Atomic Absorption	215.1	303A		7140
	Inductively coupled plasma			200.7	6010
	EDTA Titration	215.2	311C		
14.	Carbonaceous Biochemical Oxygen Demand (CBOD), mg/L, Winkler (Azide modification) or Electrode Method with Nitrification Inhibitor		507(5.e.6)		

TABLE 9B
INORGANIC TEST PROCEDURES CONTINUED

	PARAMETER, UNITS, AND METHOD	EPA 1979	STANDARD METHODS 16th ED.	FEDERAL REGISTER	SW846
15.	Chemical Oxygen Demand (COD), mg/L				
	Titrimetric Colorimetric	410.1	508A		
	Manual	410.2/410.3			
	Automated	410.4			
	Spectrophotometric				
16.	Chloride, mg/L				
	Titrimetric (silver nitrate)		407A		
	Mercuric Nitrate	325.3	407B		
	Colorimetric (ferricyanide) Manual				
	Automated	325.1/325.2	407D		
17.	Chlorine-Total Residual, mg/L				
	Titrimetric amperometric	330.1	408C		
	Starch Endpoint	330.2	408B		
	Iodometric	330.3	408A		
	DPD-FAS	330.4	408D		
	Electrode				
18.	Chromium VI dissolved, mg/L: 0.45 micron filtration Colorimetric (Diphenylcarbazide)	218.4			
19.	Chromium-Total, mg/L: Digestion (optional extraction) followed by	218.3			
	AA Direct Aspiration	218.1	303A/303B		7190
	AA Furnace	218.2	304		7191
	Inductively coupled plasma			200.7	6010
20.	Cobalt-Total, mg/L: Digestion followed by				
	AA Furnace	219.2	304		
	Inductively coupled plasma			200.7	6010
21.	Color, Platinum Cobalt units or dominant wavelength hue, luminance purity				
	Colorimetric, ADMI	110.1	204D		
22.	Copper-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	220.1	303A/303B		7210
	AA Furnace	220.2	304		6010
	Inductively coupled plasma			200.7	
23.	Cyanide-Total, mg/L				
	Manual Distillation with MgCl2	335.2	412D		
	Followed by Titrimetric	335.2	412B		9010
	Manual	335.2	412C		
	Automated Spectrophotometric	325.3	412D		
24.	Cyanide Amenable to Chlorination, mg/L: Manual distillation with MgCl2: Followed by titrimetric, manual or automated spectrophotometric	335.1	412F		9010
25.	Fluoride-Total, mg/L	340.2	413B		
26.	Gold-Total, mg/L: Digestion followed by:				
	AA Direct Aspiration	231.1	303A		
	AA Furnace	231.2	304		

TABLE 9B
INORGANIC TEST PROCEDURES CONTINUED

	PARAMETER, UNITS, AND METHOD	EPA 1979	STANDARD METHODS 16th ED.	FEDERAL REGISTER	SW846
27.	Hardness-Total as CaCo3, mg/L				
	Automated Colorimetric	130.1			
	EDTA Titration	130.2	314B		
	Inductively Coupled Plasma				
	Atomic Absorption	215.1	303A		
	Sum of Ca and Mg as their respective carbonates	242.1			
28.	Hydrogen ion (pH) units				
	Electrometric	150.1	423		
30.	Iron-Total, mg/L: Digestion followed by		303A/303B		
	AA Direct Aspiration	236.1	303B		
	Inductively Coupled Plasma			200.7	6010
31.	Kjeldahl Nitrogen-Total (as N), mg/L:				
	Digestion and Distillation	351.3	420A/420B		
	Followed by Titration	351.3	417D		
	Nesslerization	351.3	417B		
	Electrode	351.3	417E		
	Automated Phenate	351.1			
	Semi-automated Block Digester	351.2			
	Potentiometric	351.4			
32.	Lead-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	239.1	303A/303B		7420
	AA Furnace	239.2	304		7421
	Inductively Coupled Plasma			200.7	6010
33.	Magnesium-Total, mg/L: Digestion followed by				
	Atomic Absorption	242.1	303A		
	Inductively Coupled Plasma			200.7	6010
34.	Manganese-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	243.1	303A/303B		
	Inductively Coupled Plasma			200.7	6010
35.	Mercury-Total, mg/L				
	Cold Vapor Manual	245.1	303F		7471
36.	Molybdenum-Total, mg/L: Digestion followed by				
	Inductively Coupled Plasma			200.7	6010
37.	Nickel-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	249.1	303A/303B		7520
	Inductively Coupled Plasma			200.7	6010
38.	Nitrate (as N), mg/L	Parameter			
	Nitrate-Nitrite N minus Nitrite N	39 & 40	See 39/40		
39.	Nitrate-Nitrite (as N), mg/L				
	Cadmium Reduction Manual	353.3	418C		
	Automated Hydrazine	353.1			
40.	Nitrite (as N), mg/L				
	Spectrophotometric Manual	354.1	419		
	Automated (Diazotization)				

TABLE 9B
INORGANIC TEST PROCEDURES CONTINUED

PARAMETER, UNITS, AND METHOD	EPA 1979	STANDARD METHODS 16th ED.	FEDERAL REGISTER	SW846
41. Oil and Grease-Total recoverable, mg/L				
Gravimetric Extraction	413.1	503A		
42. Organic Carbon-Total (TOC) mg/L				
Combustion or Oxidation	415.1	505		
43. Organic Nitrogen (as N), mg/L Parameter				
Total Kjeldahl N minus Ammonia N	31 & 4	420A		
44. Orthophosphate (as P), mg/L				
Ascorbic Acid Method Automated	365.1	424G		
Manual Single Reagent	365.2	424E		
46. Oxygen, Dissolved, mg/L				
Winkler (Azide Modification)	360.2	421B		
Electrode	360.1	421F		
48. Phenols, mg/L				
Manual Distillation	420.1			
Followed by Manual or	420.1			
Automated Colorimetric (4AAP)	420.2			
50. Phosphorus-Total, mg/L				
Persulfate Digestion	365.2	424C (111)		
Followed by Manual or	365.2/365.3	424F		
Automated Ascorbic Acid	365.1	424G		
Reduction or Semi-automated Block Digester	365.4			
51. Platinum-Total, mg/L: Digestion followed by				
AA Direct Aspiration	255.1	303A		
AA Furnace	255.2	304		
52. Potassium-Total, mg/L: Digestion followed by				
Atomic Absorption	258.1	303A		7610
Inductively Coupled Plasma			200.7	6010
Flame Photometric	322B			
53. Residue-Total, mg/L: Gravimetric 103-105 degrees C	160.3	209A		
54. Residue-Filterable, mg/L: Gravimetric 180 degrees C	160.1	209B		
55. Residue-Nonfilterable, (TSS), mg/L: Gravimetric 103-105 degrees C post washing of residue	160.2	209C		
56. Residue-Settleable, mg/L: Volumetric (Imhoff Cone) or Gravimetric	160.5	209E		
57. Residue-Volatile, mg/L: Gravimetric 550 degrees C	160.4	209D		
60. Selenium-Total, mg/L: Digestion followed by				
AA Furnace	270.2	304		7740
Inductively Coupled Plasma			200.7	6010
Hydride	270.3	303E		
61. Silica-Dissolved, mg/L: 0.45 micron filtration				
Followed by Manual or	370.1	425C		
Automated Colorimetric (Molybdosilicate)				
Inductively Coupled Plasma			200.7	6010

TABLE 9B
INORGANIC TEST PROCEDURES CONTINUED

	PARAMETER, UNITS, AND METHOD	EPA 1979	STANDARD METHODS 16th ED.	FEDERAL REGISTER	SW846
62.	Silver-Total, mg/L: Digestion followed by				
	AA Direct Aspiration 272.1		303A/303B		7760
	AA Furnace	272.2	304		7761
	Inductively Coupled Plasma			200.7	6010
63.	Sodium-Total, mg/L: Digestion followed by				
	Atomic Absorption	273.1	303A		
	Inductively Coupled Plasma			200.7	6010
	Flame Photometric	120.1	205		
64.	Specific Conductance, mhos/cm: Wheatstone Bridge	120.1	205		
65.	Sulfate (as SO4), mg/L				
	Automated Barium Chloanilate	375.1			
	Gravimetric	375.3	426A/426B		
	Turbidimetric	375.4	426C		
66.	Sulfide (as S), mg/L				
	Titrimetric (Iodine)	376.1	427D		9030
	Colorimetric (Methylene Blue)	376.2	427C		
67.	Sulfite (as SO4), mg/L: Titrimetric (Iodine Iodate)	377.1	428A		
68.	Surfactants, mg/L: Colorimetric (Methylene Blue)	425.1	512B		
69.	Temperature, degrees C: Thermometric	170.1	212		
70.	Thallium-Total, mg/L: Digestion followed by				
	AA Furnace	279.2	304		7841
	Inductively Coupled Plasma			200.7	6010
71.	Tin-Total, mg/L: Digestion followed by				
	AA Furnace	282.2	304		
72.	Titanium-Total, mg/L: Digestion followed by				
	AA Furnace	283.2	304		
73.	Turbidity, NTU: Nephelometric	180.1	214A		
74.	Vanadium-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	286.1	303C		7910
	AA Furnace	286.2	304		
	Inductively Coupled Plasma			200.7	6010
75.	Zinc-Total, mg/L: Digestion followed by				
	AA Direct Aspiration	289.1	303A/303B		7950
	AA Furnace	289.2	304		
	Inductively Coupled Plasma			200.7	6010
76.	Strontium, mg/L				
	Inductively Coupled Plasma			200.7	6010
77.	Total Organic Halogen, mg/L		506		9020

TABLE 9C.
PROCEDURES FOR NON-PESTICIDE ORGANIC COMPOUNDS

	PARAMETER	EPA METHOD NUMBER GC	GC/MS	HPLC
1.	Acenaphthene	610	625	610
2.	Acenaphthylene	610	625	610
3.	Acrolein	603	624	
4.	Acrylonitrile	603	624	
5.	Anthracene	610	625	610
6.	Benzene	602	624	
8.	Benzo(a)anthracene	610	625	610
9.	Benzo(a)pyrene	610	625	610
10.	Benzo(b)fluoranthene	610	625	610
11.	Benzo(ghi)perylene	610	625	610
12.	Benzo(k)fluoranthene	610	625	610
13.	Benzyl Chloride			
14.	Benzyl Butyl Phthalate	606	625	
15.	Bis(2-chloroethoxy)methane	611	625	610
16.	Bis(2-chloroethyl)ether	611	625	
17.	Bis(2-ethythexyl)phthalate	606	625	
18.	Bromodichloromethate	601	624	
19.	Bromoform	601	624	
20.	Bromomethane	601	624	
21.	4-Bromophenylphenyl ether	611	625	
22.	Carbon tetrachloride	601	624	
23.	4-Chloro-3-methylphenol	604	625	
24.	Chlorobenzene	601, 602	624	
25.	Chloroethane	601	624	
26.	2-Chloroethylvinyl ether	601	624	
27.	Chloroform	601	624	
28.	Chloromethane	601	624	
29.	2-Chloronapthalene	612	625	
30.	2-Chlorophenol	604	625	
31.	4-Chlorophenylphenyl ether	611	625	
32.	Chrysene	610	625	610
33.	Bibenzo(a,h)anthracene	610	625	610
34.	Dibromochloromethane	601	624	
35.	1,2-Dichlorobenzene	601, 602, 612	624, 625	
36.	1,3-Dichlorobenzene	601, 602, 612	624, 625	
37.	1,4-Dichlorobenzene	601, 602, 612	625	
38.	3,3-Dichlorobenzidine		625	605
39.	Dichlorodifluoromethane	601		
40.	1,1-Dichloroethane	601	624	
41.	1,2-Dichloroethane	601	624	
42.	1,1-Dichloroethane	601	624	
43.	trans-1,2-Dichloroethane	601	624	
44.	2,4-Dichlorophenol	604	625	

TABLE 9C
PROCEDURES FOR NON-PESTICIDE ORGANIC COMPOUNDS CONTINUED

	PARAMETER	EPA METHOD NUMBER GC	GC/MS	HPLC
45.	1,2-Dichloropropane	601	624	
46.	cis-1,3-Dichloropropene	601	624	
47.	Trans-1,3-Dichloropropene	601	624	
48.	Diethyl phthalate	606	625	
49.	2,4-Dimethylphenol	604	625	
50.	Dimethyl phthalate	606	625	
51.	Di-n-butyl phthalate	606	625	
52.	Di-n-octyl phthalate	606	625	
53.	2,4-Dinitrophenol	604	625	
54.	2,4-Dinitrotoluene	609	625	
55.	2,6-Dinitrotoluene	609	625	
56.	Epichlorophydrin			
57.	Ethylbenzene	602	624	
58.	Fluoranthene	610	625	610
59.	Fluorene	610	625	610
60.	Hexachlorobenzene	612	625	
61.	Hexachlorobutadiene	612	625	
62.	Hexachlorocyclopentadiene	612	625	
63.	Hexachloroethane	612	625	
64.	Ideno(1,2,3-cd)pyrene	610	625	610
65.	Isophorone	609	625	
66.	Methylene Chloride	601	624	
67.	2-Methyl-4,6-Dinitrophenol	604	625	
68.	Naphthalene	610	625	
69.	Nitrobenezene	609	625	
70.	2-Nitrophenol	604	625	
71.	4-Nitrophenol	604	625	
72.	N-Nitrosodimethylamine	607	625	
73.	N-Nitrosodi-n-propylamine	607	625	
74.	N-Nitrosodiphenylamine	607	625	
75.	2,2-oxybis(1-chloropropane)	611	625	
76.	PCB-1016	608	625	
77.	PCB-1221	608	625	
78.	PCB-1232	608	625	
79.	PCB-1242	608	625	
80.	PCB-1248	608	625	
81.	PCB-1254	608	625	
82.	PCB-1260	608	625	
83.	Pentachlorophenol	604	625	
84.	Phenanthrene	610	625	610
85.	Phenol	604	625	
86.	Pyrene	610	625	610
88.	1,1,2,2-Tetrachloroethane	601	624	
89.	Tetrachloroethene	601	624	
90.	Toluene	602	624	
91.	1,2,4-Trichlorobenzene	612	625	
92.	1,1,1-Trichloroethane	601	624	
93.	1,1,2-Trichloroethane	601	624	
94.	Trichloroethene	601	624	
95.	Trichlorofluoromethane	601	624	
96.	2,4,6-Trichlorophenol	604	625	
97.	Vinyl Chloride	601	624	

TABLE 9D - PROCEDURES FOR PESTICIDES

PARAMETERS	STANDARD METHODS METHOD	EPA	15th Ed.	ASTM
1. Aldrin	GC	608	509A	D3086
	GC/MS	625		
5. Atrazine	GC			
6. Azinphos methyl	GC			
8. a-BHC	GC	608	509A	D3086
	GC/MS	625		
9. b-BHC	GC	608		D3086
	GC/MS	625		
10. d-BHC	GC	608		D3086
	GC/MS	625		
11. y-BHC (Lindane)	GC	608	509A	D3086
	GC/MS	625		
12. Captan	GC		509A	
14. Carbophenothion	GC			
15. Chlordane	GC	608	509A	D3086
17. 2,4-D	GC		509B	
18. 4,4'-DDD	GC	608	509A	D3086
	GC/MS	625		
19. 4,4'-DDE	GC	608	509A	D3086
	GC/MS	625		
20. 4,4'-DDT	GC	608	509A	D3086
	GC/MS	625		
23. Diazinon	GC			
24. Dicamba	GC			
28. Dieldrin	GC	608	509A	
	GC/MS	625		
35. Endrin	GC	608	509A	D3086
	GC/MS	625		
37. Ethion	GC			
40. Heptachlor	GC	608	509A	D3086
	GC/MS	625		
41. Heptachlor epoxide	GC	608	509A	D3086
44. Malathion	GC		509A	
46. Methoxychlor	GC		509A	D3086
48. Mirex	GC		509A	
49. Monuron	TLC			
50. Monuron-TCA	TLC			
52. Parathion methyl	GC		509A	
53. Parathion ethyl	GC		509A	
64. Strobane	GC		509A	
66. 2,4,5-T	GC		509B	
67. 2,4,5-TP (Silvex)	GC		509B	
69. Toxaphene	GC	608	509A	D3086
	GC/MS	625		
70. Trifluralin	GC		509A	

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 SIGNIFICANT FIGURES

A significant figure is a digit that denotes the amount of the quantity reported. Analytical values must contain only significant figures. A value is made up of significant figures when it contains all digits known to be true and one last digit in doubt. For example, if a value is reported as 18.8 mg/L the 18 must be firm while the 0.8 is somewhat uncertain, but presumably better than one of the values 0.7 or 0.9. The number zero (0) may or may not be a significant figure depending on the situation. Final zeros after a decimal point are always meant to be significant figures. Zeros before a decimal point with non-zero digits preceding them are significant. With no preceding non-zero digits, a zero before the decimal point is not significant. If there are no non-zero digits preceding a decimal point, the zeros after the decimal point, but preceding other non-zero digits are not significant. These zeros only indicate the position of the decimal point. Final zeros in a whole number may or may not be significant.

Significant figures reflect the limits in accuracy of the particular method of analysis. It must be decided whether the number of significant digits obtained for resulting values is sufficient for interpretation purposes. If not, there is little that can be done within the limits of the given laboratory operations to improve these values. If more significant figures are needed, a further improvement in method or selection of another method will be required.

Once the number of significant figures obtainable from a type of analysis is established, data resulting from such analyses are reduced according to set rules for rounding off.

10.2 ROUNDING OFF NUMBERS

Rounding off of numbers is a necessary operation in all analytical areas. It is automatically applied by the limits of measurements of every instrument and all glassware. Rounding off should be applied only as described in the following sections.

A. If the figures following those to be retained is less than 5, the figure is dropped and the retained figures are kept unchanged.

B. If the figure following those to be retained is greater than 5, the figure is dropped and the last retained figure is raised by 1.

C. If the figures following those to be retained is 5 and if there are no figures other than zeros beyond the 5, the figure 5 is dropped and the last place figure retained is increased by 1 if it is an odd number, and it is kept unchanged if it is an even number.

D. When an arithmetic operation with a series of numbers is performed, the result should be rounded off to the same number of decimal places as the figure with the smallest number of places after the operation is completed with all decimal places intact.

E. The preceding rules for rounding off are reasonable for most calculations, however, when dealing with two nearly equal numbers, there is a danger of loss of all significance when applied to a series of computations that rely on relatively small differences in two values. The procedure is to carry several extra figures through the calculations and then round off to significant figures.

10.3 DATA REDUCTION

The raw data values are reduced to final form depending on the type of analyses and method used. The following procedures generalize the methods used to convert the raw data to final form.

GRAVIMETRIC PROCEDURES: If a liquid sample, the result is expressed in mg/L, if solid or soil the result is expressed as mg/kg.

$$\frac{A \text{ mgs} - B \text{ mgs}}{C \text{ mgs or ml}} \times 1000 \text{ mg/kg or ml/L} = R \text{ (mg/kg or mg/L)}$$

A = Gross weight of sample with container weight
B = Tare weight of container
C = Size of sample being analyzed
R = Result

COLORIMETRIC PROCEDURES: Sample absorbance readings are plotted on a standard calibration curve which compares concentration vs. absorbance readings of known standard. The calibration curve is developed by calculating a least squares, fit to evaluate the correlation coefficient, slope, and y intercept of the curve. The colorimetric procedures are calculated by one of two methods:

A. Method used when standards are expressed as actual weight (ug's) of parameter of interest.

$$\frac{a \times \text{Dilution}}{\text{Sample size (mg or ml)}} = R \text{ (mg/L or mg/kg)}$$

B. Method used when standards are expressed as weight per volume of parameter of interest when standard and samples are the same volume within the method.

a X Dilution = R (mg/L or mg/kg)

a = The value obtained from the absorbance reading calculated by least squares program of computer.

Dilution = Ratio of sample volume to total working volume of the method.

R = Result expressed as mg/L if sample size was measured as liquid or mg/kg if sample size was measured by weight.

TITRIMETRIC PROCEDURES:

$$\frac{\text{ml titrant} \times \text{normality of titrant} \times \text{factor}}{\text{Sample Size}} = R \text{ (mg/L or mg/kg)}$$

"Factor" is dependent upon the type of analysis. For cyanide, etc. refer directly to referenced procedure.

Alkalinity	50,000
Total Kjeldahl Nitrogen	14,010
Nitrogen Ammonia	14,010
Chlorine	40,000
Chloride	40,000
Sulfite	40,000

INSTRUMENT DIRECT RESULTS: Are results obtained from a direct instrument reading. The instrument analyzes samples of a known concentration and sets up a calibration curve. The sample concentration is proportional to the direct instrument reading multiplied by the dilution factor. In this procedure it is necessary to calculate the results for ICP & AA Metals, Nova NH3, TOC, TOX as follows:

$$\frac{A \times B}{C} = R \text{ (mg/L or mg/kg)}$$

A = Direct instrument reading result
B = Final volume of sample being analyzed
C = Initial weight or volume of samples
R = Result

STRIP CHART MEASUREMENT BY PEAK/HEIGHT: A standard calibration curve is set up for each analysis. The peak/heights of the samples are compared to the standard curve and a value is calculated utilizing a least squares fit. The sample results must then be calculated for dilution.

a X Dilution = result (mg/L or mg/kg)

a = value obtained from the least squares fit calculation or manual comparison of calibration curve graphed.

R = Result expressed as mg/kg if by sample weight or plot mg/L if by sample volume.

Once all the results are calculated to final concentration, they are reviewed by the analyst and then reported on sample parameter sheets.

10.4 VALIDATING RAW DATA

The information present in the raw data is parameter dependent. The following information is used as a general guideline by Gulf Coast Laboratories.

1. Parameter
2. Method
3. Method detection limit
4. Reagent blank
5. Method blank
6. Calibration standards*
7. Duplicate samples
8. Spike blank
9. Matrix spike
10. Correlation coefficient*
11. Slope*
12. Y Intercept*
13. Quality control data calculated
14. Analyst signature and date analyzed
15. General information - instrument used, wavelength, filter setting, cell pathlength, etc.
16. No scratching out
17. No soluble marker
18. No pencil (only black ballpoint pen)
19. No white out
20. "Z" out all unused portions of page

*NOTE: titration procedures will not require raw data indicated by *. However, they must contain the standardization information of the titrant, and/or a concentration verification of the titrant.

Raw data from automated equipment must be dated, initialed and should indicate to what data it belongs. It will then become permanent raw data and filed in a secure place where it can be easily retrieved.

Strip charts must contain identified peaks, the parameter being measured, the analyst's signature and should indicate to what data it belongs. If calculations are not performed on the chart, it must appear on hard copy and be filed in such a manner as to indicate to which charts it belongs.

All raw data must be reviewed and verified by the analyst before the reporting of the results. Once raw data is reviewed by the analyst it must be signed.

10.5 VALIDATING ANALYTICAL PERFORMANCE

All raw data will be examined by the analyst to verify that the documentation is correct.

Control charts are then used by the analyst to evaluate the daily analytical performance and to determine that valid data is being generated.

It is the analyst's responsibility to confirm that the goals for

precision and accuracy on duplicates, spiked samples and reference samples are met using the proper control charts.

The Quality Control/Quality Assurance personnel's responsibility is to review the control charts to assure that deviations from acceptance criteria is noted and audits are performed monthly to assure raw data meets criteria.

10.6 VERIFICATION OF DATA

Analytical data is verified in a three step review process. Initially the analyst reviews the analytical raw data prior to the reporting of results. Precision and accuracy of results are checked to verify they meet quality assurance/quality control limits. If results are not within quality assurance/quality control objectives corrective action is taken. A corrective action report (C.A.R.) is filled out, stating the deviations, the corrective action taken and the outcome of the corrective action.

Prior to shipping of an analytical report the data package is reviewed by quality assurance/quality control personnel. Quality assurance/quality control personnel verify the package is complete and deviations in protocols are accounted for.

The Laboratory Director verifies the final report is printed correctly and that there are not transcription or typographical errors.

10.7 RAW DATA REPORTING

Final results of samples are reported on the parameter search sheets. The parameter search sheet is transferred to Data Management personnel and the results are transferred into the computer for future reference. The Laboratory Director reviews the final report and verifies it with the sample report sheet before the final report is sent. The sample report sheet are then forwarded to the Billing Department. The sample report sheets are then filed alphabetically in a secured area for future reference and kept on file for a minimum period of five years, unless otherwise specified.

10.8 DATA PACKAGING

The data for each project is assembled into separate data packages. The data packages include the final report, chain of custodies, field forms, raw data, a quality assurance narrative and the IEPA CLP report packages for each area (organics and inorganics).

11.0 INTERNAL QUALITY CONTROL CHECKS

Our Quality Control Program is a systematic method to assure the precision and accuracy of analyses meets our quality control objectives listed in Section 5. Our quality control program provides confidence in the accuracy of analytical results and provides information to detect determinant sources of error. Precision is monitored and controlled by replicate analyses. Precision can be estimated by statistical techniques (listed in Section 14) and can control indeterminate errors inherent in a procedure.

11.1 QUALITY CONTROL INORGANICS

The minimum QC requirements of the inorganic program consist of both an initial and ongoing demonstration the Laboratories capability to generate acceptable precision and accuracy, using approved methods in the analysis of samples from various matrices. If any QC measurement fails to meet criteria the analytical measurement may be repeated only once prior to taking the appropriate corrective action. These include, but are not limited to, the following:

A. Calibration Curve and Initial Calibration Verification
B. Calibration Blank
C. Continuing Calibration Verification
D. ICP Interference Check Sample analysis
E. Preparation Blank analysis
F. Sample Spike analysis
G. Sample Duplicate analysis
H. Laboratory Control Sample analysis
I. ICP Serial Dilution analysis

11.2 METALS QC

A. Calibration Curve: For atomic absorption systems, calibration curves are composed of a minimum of a calibration blank and three standards with one calibration standard at or below the CRDL (except for mercury). The calibration curve is prepared fresh each time an analysis is to be performed. If the AA instrument configuration prevents the required 4-point calibration, calibrate according to instrument manufacturer's recommendations, and analyze the remaining required standards. The Method of Standard Addition (MSA) is used for the analysis of all EP extracts and all samples that suffer from matrix interferences. For ICP systems, calibrate the instrument according to instrument manufacturer's recommended procedures.

Initial Calibration Verification: Initial calibration verification for metals is performed at the beginning of the analysis of samples by analyzing an independent standard. The independent standard is prepared from a different stock standard source than that used in the preparation of standards for the calibration curve. The independent standard concentration must fall within the calibration range.

B. Calibration Blank: A calibration blank is analyzed each time the instrument is calibrated, at the beginning of the run, and once every 10 analytical samples during the run.

C. Continuing Calibration Verification: These checks determine that the analytical system is meeting contract-required criteria. A mid-range standard is analyzed every 10 analytical samples or every 2 hours during an analysis run, whichever is more frequent. The standard is also analyzed for each analyte after the last analytical sample. The standard is prepared from a different stock standard source than that used in the preparation of standards for the calibration curve.

D. ICP Interference Check Sample: ICP interference check sample analyses must be performed at the beginning and end of each sample analysis run (or a minimum of twice per eight-hour shift) to verify interelemental and background correction factors.

E. Preparation Blank: Preparation blank analyses must be performed for each batch of samples, or for each set of 20 samples, to ascertain whether sample concentrations reflect contamination. The first 20 samples to preparation blank two, etc.

F. Sample spikes: Spiked sample analyses must be performed for each matrix within a batch of samples or for each set of 10 samples of a similar matrix within a batch. This provided information on analytical accuracy, and the effect of the sample matrix on the digestion and measurement methodology. (See Table "Spiking Levels For Spiked Sample Analysis")

G. Sample duplicates: Duplicate samples must be performed for each matrix within a batch of samples or for each set of 10 samples of a similar matrix within a batch. This provides information concerning sample homogeneity, and analytical precision.

H. Laboratory control sample: The "laboratory control sample" is a standard carried through sample preparation and analytical methods to document the performance of the entire sample process. The laboratory control sample is required for each batch of samples taken through the sample process or for each set of 10 samples. For metals, the control sample is a blank spiked with the appropriate concentration of metals to be determined so that at the time of analysis the final concentration should fall on the calibration curve. Percent recovery is then determined. A LCS is not required for mercury analysis.

I. ICP Serial Dilution Analysis: Prior to reporting concentration data for the analyte elements, the Contractor must analyze and report the results of the ICP Serial Dilution (ISD) analysis. The ISD analysis must be performed on each group of samples of a similar matrix type (i.e., water, soil) or for each batch of samples delivered to the laboratory, whichever is more frequent.

"SPIKING LEVELS FOR SPIKED SAMPLE ANALYSIS"

Element	For ICP/AA (ug/l)		For Furnace AA (ug/l)		Other (ug/l)
	Water	Sediment	Water	Sediment	
Aluminum	2,000	*			
Antimony	500	500	100	100	
Arsenic	2,000	2,000	40	40	
Barium	2,000	2,000			
Beryllium	50	50			
Cadmium	50	50	5	5	
Calcium	*	*			
Chromium	200	200			
Cobalt	500	500			
Copper	250	250			
Iron	1,000	*			
Lead	500	500	20	20	
Magnesium	*	*			
Manganese	500	500			
Mercury					1
Nickel	500	500			
Potassium	*	*			
Selenium	2,000	2,000	10	10	
Silver	50	50			
Sodium	*	*			
Thallium	2,000	2,000	50	50	
Vanadium	500	500			
Zinc	500	500			

1 Amount added prior to digestion/distillation--choose amount appropriate to method of analysis. Elements without spike levels and not designated with an asterisk, should be spiked at appropriate levels.

2 The levels shown indicate concentrations in the digestate of the spiked sample. For example 1 ml X 50 mg/l Pb spiking solution = 50 ug Pb, then 50 ug Pb U ,100 L final digestate volume = 500 ug/L concentration in the digestate of spiked sample.

* No spike required.

Water = sample matrices of the groundwater, surface water, and wastewater type.

Sediment = sample matrices of the solid, soil, and sludge type.

11.3 OTHER INORGANIC PARAMETERS

For all other inorganic parameters the frequency of Q.C. stated below is required.

Preparation Blank: Every 10 samples if distillation or digestion is required by the analytical method.

Sample Duplicate: Every 10 samples.

Sample Spike: Every 10 samples.

Laboratory Control Sample: Every 10 samples. If the method calls for sample preparation (i.e., Distillation, Digestion, etcetera), the lab control sample shall be subject to the entire procedure. The laboratory control sample is being used to validate the calibration curve and determine the level of analytical accuracy. This sample shall be the last sample analyzed each analytical run.

If for an analytical run a previously ran calibration curve is to be verified, it shall be done with the use of a reagent blank and two standards (i.e., one standard at mid-range and one at or near the maximum allowable concentration). Checks must be within +/- 10% of the original curve. The original curve must be comprised of a reagent blank and five standards.

11.4 ORGANICS QC

In order to monitor method precision and accuracy, duplicate matrix spikes will be analyzed every 20 samples, or once per batch of samples of a similar matrix, for each method. Matrix spike compounds for each type of analysis and limits for percent recovery and relative percent difference, are given in Table 5.6.

To monitor method quality control and sample integrity, reagent water blanks and field blanks will be analyzed periodically and surrogate spike compounds will be added to every sample. A reagent water blank will be analyzed every day that semivolatiles or pesticides/PCBs are extracted or with every 20 samples, whichever is more often. A reagent water blank will be analyzed each day before volatile analysis is performed.

LIMITS FOR CONTAMINANTS IN BLANKS ARE AS FOLLOWS:

Pesticides/PCBs and BNAs - any compound, except common phthalate esters, on the attached target compounds list present in a blank must be below the Contract Required Detection Limit (CRDL). Common phthalate esters must be below five times the CRDL. Any tentatively identified compound present in the blank must be less than 50% of the amount of that compound in any of the associated samples.

VOA - all contaminants except the common laboratory solvents, methylene chloride, acetone and toluene, in the daily reagent water blank must be below the CRDL before analysis of samples may proceed. Target compounds, except common laboratory solvents, in the field blank must be below the CRDL. Common laboratory solvents in the field blank must be below five times CRDL. Tentatively identified compounds in a field blank must be less than 50% of that component in any of the associated samples.

If the limits for contaminants are exceeded in a blank and any of the associated samples contain that compound at reportable levels, corrective action must be taken and documented. The samples associated with the suspect blank must be re-analyzed if sufficient sample volume is available. If sufficient sample volume is not available, the problem and corrective actions taken must be discussed in the Quality Assurance summary narrative.

Surrogate spike compounds will be added to each sample analyzed for acid and base/neutral extractables, pesticides and PCBs or volatile organics. Surrogate spike compounds and recovery limits are given in the following chart:

TABLE 11.2

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM% WATER	LOW/MEDIUM% SOIL/SEDIMENT
VOA	Toluene-d8	88-110	81-117
VOA	1,2-Dichloroethane-d4	86-115	74-121
VOA	4-Bromofluorobenzene	76-114	70-121
BN	Nitrobenzene-d5	35-114	23-120
BN	2-Fluorobiphenyl	43-116	30-115
BN	p-Terphenyl-d14	33-141	18-137
BN	Phenol-d5	10- 94	24-113
BN	2-Fluorophenol	21-100	25-121
BN	2,4,6-Tribromophenol	10-123	19-122
Pest	Dibutyl Chlorendate	24-154*	20-150*

*At present Dibutyl Chlorendate limits are advisory only. They are not used to determine if a sample should be reanalyzed. When sufficient data is
available recovery limits will be set.
Surrogate recovery limits are referenced from EPA CLP SOW 2/88.B

At present, Dibutylchlorendate limits are advisory only. They are not used to determine if a sample should be reanalyzed.

If the percent recovery of any one surrogate in a volatile (VOA) or base-neutral/acid (BNA) contract required reagent water blank sample is outside the above criteria, the contractor MUST investigate the cause of the error, correct the problem, reanalyze the blank sample AND reanalyze the samples associated with the blank at no additional cost to the Agency. Report to the Agency only results of samples associated with blanks which met the above surrogate percent recovery criteria.

If the percent recovery of any one surrogate in a VOA sample is outside the above criteria the contractor MUST reanalyze the sample. If the percent recovery of any two surrogate in a BNA sample is outside the above criteria the contractor MUST reanalyze the sample. If the percent recovery of any one surrogate in a BNA sample is below ten percent the contractor MUST reanalyze the sample. If the reanalyzed sample is also outside the limits, then report the results of both analyses and document the problem in the Case Narrative; the Agency will pay for both analyses. If the reanalysis is within the limits, then report only the results of the reanalysis; the Agency will pay only for the reanalysis. If the sample with surrogate recoveries outside the limits is the sample used for the matrix spike and matrix spike duplicate, and the surrogate recoveries of the matrix spike and matrix spike duplicate show the same pattern (i.e., outside the limits), then the sample, matrix spike, and matrix spike duplicate do not require reanalysis. Document in the narrative the similarity in surrogate recoveries.

12.0 INTERNAL PERFORMANCE AND SYSTEM AUDITS

All quality control results will be reviewed by both the analyst and the Quality Control personnel of WESTON/GULF COAST Laboratories before reports are submitted to the Chemical Supervisor.

Quarterly evaluations of all quality control data will be reviewed to examine any long term trends in the quality control data. An example would be continual low recoveries with a certain procedure or parameter.

System audits are being made to assure all quality control evaluations are performed and corrective action followed. At this time the analyst's raw data lab books are reviewed. This continued evaluation of quality control data will ensure continually high quality data.

At a minimum, quarterly external reference samples are used to provide performance evaluation of wet chemical analyses, metals and extraction procedures.

The results of the reference sample are used to evaluate the accuracy of the procedures and to determine if the quality control objectives are being met.

12.1 RAW DATA AUDIT

All lab notebooks are recorded in a lab book reference book. The date issued, date completed, analyst's name, and/or the description of the lab book will be noted in the reference. After each working day, all lab books will be placed on the active lab book shelf. This will make it possible to retrieve raw data at any time without an extensive search for such data.

In developing a working data validation system, all active laboratory lab books and quality control files are subject to periodic audits. The evaluation will be based on the following.

INFORMATION: The following information should be present where applicable. The parameter testing, method used, instrument used, date, analyst signature, wavelength, filter setting, cell path length, and all other pertinent data which will authenticate the analytical results.

STANDARD EVALUATION: A blank and three to five levels of standards shall be used. The unit of measure of the standards should be shown. All samples must fall within the working range of the standards. The percent goodness of fit or correlation coefficient, and any other such data showing the linearity of the standard curve should be recorded. Correlation coefficient of standard curves must be between 0.995 and 1.00.

QUALITY CONTROL EVALUATION: All quality assurance/quality control data with the amount spiked, percent recovery and all calculation, etc. must be reported in lab books. Duplicates, method blanks, matrix spikes, spike blanks, known quality control should be present at a specified frequency. The quality control data should also be reported in the quality control data file on a DAILY basis.

NEATNESS AND EASE OF DATA INTERPRETATION: A good format should be used and should be kept neat. No scratching out, no soluble marker, no pencil, and no "white out" should appear. All unused portions of the page should be "Z" out and the page signed by the analyst after the data has been reviewed by the analyst.

FOLLOW UP ON EVALUATION: Improvement or regression in the quality of lab data will be noted.

12.1 EXTERNAL PERFORMANCE AND SYSTEMS AUDIT

As part of Weston's effort to assure project compliance is satisfied, on-site systems audits by D.E.R. or its designate are permitted. Full cooperation, by Weston staff, with D.E.R. during the on-site visit will be provided.

A response to all deficiencies determined during the on-site will be addressed within a timely manner designated by D.E.R.

13.0 PREVENTIVE MAINTENANCE

Maintenance of equipment is an important part of every laboratory operation. The responsibility of routine care lies with the analysts using the instruments. Every manufacturer furnishes an instrument maintenance manual. These are kept on file for reference. Each instrument has a logbook in which daily preventive maintenance is recorded. Repairs which can be performed are contracted to the manufacturer's servicemen or yearly maintenance agreements. The analytical balances are checked annually under service contracts.

Table 13.1 is a synopsis of the minimum equipment quality control and Table 13.2 is a calendar of equipment maintenance schedule.

TABLE 13.1
A SYNOPSIS OF EQUIPMENT QUALITY CONTROL FOR GCL

Balances	Monthly	Use Class "S" weights	If sensitivity is lesser than 0.1 mg service representative must be called
Top Loader or Pan Balances	Monthly	Use Class "S" weights	Adjust balance by using Class "S" weights or call service r representative
Conductivity Bridge	Daily	Check both the 1.0 cm and 0.1 cm cell using a molar 0.0100 KCL solution	Report any deviation in readings to supervisor
pH Calibration	Daily or with each use	Check the meter for linearity by using 2 different buffers	If linearity is out of control the electrode must be replaced
BOD Incubator	Shelf Thermometers check daily	Checked against an NBS or equivalent thermometer	Temperature corrections are attached to the shelf thermometers
Walk in Refrigerator	Chart checked daily replaced monthly	Chart observation daily	If temperature is erratic call service representative
Water Deionizer	Checked	Monitor trace metals and other toxic compounds monthly	Replace cartridge as indicated by manufacture or as indicated by analytical results
Drying Ovens	Daily	Check oven thermometers against an NBS or equivalent	Temperature corrections are attached to the oven thermometer
Freezer	Daily	Check freezer thermometer against an NBS or equivalent freezer thermometer	Alarm system built in, temperature corrections are attached to freezer thermometer
Centrifuge	Monthly	Check brushes and bearings for wear every six months	Replace as needed
Water Baths	Daily	Check bath thermometers against an NBS or equivalent Water replaced monthly	Temperature corrections are attached to the bath thermometer
Pure Water Tests			
pH	Twice a week	pH Meter	If any of the pure water tests are outside the recommended limit the problem must be identified and corrected. Until this is done another source of water must be used.
Conductivity	Twice a week	Wheatstone Bridge	
Standard Plate Count	Annually	16th Edition Standard Methods	
Suitability Test	Annually	16th Edition Standard Methods	
Trace Metals *	Annually	Atomic Absorption	

TABLE 13.2
CALENDAR OF EQUIPMENT MAINTENANCE

INSTRUMENT	PROCEDURE	FREQUENCY
1. Balances	Calibration	Every time a standard is prepared or at least monthly
Top Loader	Calibration	Monthly
Triple Beam Balances	Calibration	Monthly
All Balances	Field service	Annually
All Balances	Reference weight check	Annually
2. Conductivity Meter	Calibration with Standard KCL solution	Weekly
	Conductivity cell cleaning	As required
3. Deionized/Distilled Water	Conductivity	Weekly
	Deionizer light	Daily
	Monitoring organic test	Weekly
	System cleaning	As required
	Replace cartridge & large mixed bed resins	As required
4. Drying Ovens	Temperature monitoring	Daily
	Temperature calibration	Monthly
5. Refrigerators/Freezers	Temperature monitoring	Daily
	Warning system checked	Monthly
	Temperature adjustment	As required
	Defrosting	As required
6. Vacuum Pumps/Air Compressor	Drained	Weekly
	Belts checked	Monthly
	Lubricated	Semi-annually
7. pH Meter	pH calibration	Each time pH meter is used
	pH electrode maintenance	As required
	Specific ion reference electrode electrode maintenance	As required
8. Gas Chromatograph	Check response with standard mixture, compare to previous day, & file chromatograph	Daily
	Check recorder electrometer zero and noise level at operating attenuation	Daily
	Check carrier gas flow through column with bubble flow-meter, document in instrument log	Daily
	Check temperature of detector, inlet, column oven and document in instrument log	Daily
	Verify linearity	Daily
	Septum replacement	Every 2 days
	Change carrier gas drier assembly	After every 2 gas cylinders
	Visually check for shifting of column packing material resulting in forward movement beyond the bottom of the column exit or settling in excess of 1/2" from the glass wool plug at the column inlet	Weekly
	Glass wool replacement	As required
	Check glass flow system for leaks using "SNOOP"	Monthly and with carrier gas cylinder change
	Evaluate performance of each column with special standard mixture	Monthly

TABLE 13.2
CALENDAR OF EQUIPMENT MAINTENANCE (continued)

INSTRUMENT	PROCEDURE	FREQUENCY
	Check entire instrument for loose connections and frayed wire insulation	Monthly
	Check all rotometers and flow controllers for proper float action.	Monthly
	Column temperature verification	Monthly
9. Electron Capture Detector	Detector wipe test (N-63)	Semi-annually
	Detector cleaning	As required
10. Flame Ionization Detector	Detector cleaning	As required
11. Hall 700A Detector	Electrolyte change	Monthly or as required by noise
	Reactor tube/teflon connecting tube change	Semi-annually or as required
12. Newlett Packard GC/MS	Ion gauge tube degassing	Weekly
	High vacuum meter calibration	After degassing
	Preamplifier fine zero	Monthly
	Pump oil-level check	Monthly
	Pump purging	Monthly
	Pump oil changing	Semi-annually
	Mechanical pump turbo	Semi-annually or when bakeout does
	not adequately reduce background	
	Preamplifier coarse zero	Semi-annually
	Analyzer cleaning	If background is too high after bakeout. Dirty or contaminated analyzer components may also produce poor peak shape and re require excessive ion energy to obtain reasonable sensitivity

TABLE 13.2
CALENDAR OF EQUIPMENT MAINTENANCE (Continued)

INSTRUMENT	PROCEDURE	FREQUENCY
	Resolution adjustment	When peak shape and resolution becomes unsatisfactory or after cleaning the analyzer assembly
	Analyzer bakeout	When background becomes excessive
	Air filter cleaning	Every 3 months
	Data system air filter	Semi-annually
	Floppy disk	Every 40 hours of use
	Printer - Head carriage lubrication	Every 3 months
	Paper sprocket cleaning	Semi-annually
	Drive belt lubrication	Yearly
13. AA Spectrophotometer	Check or clean windows	Daily
	Aspirate D.I. water 2 min.	Daily
	Check & drain compressor manifold	Daily
	Remove accumulated dry residue	Weekly
14. Furnace AA Spectrophotometer	Check or clean windows	Daily
	Check optical mask alignment	Daily
	Check water flow	Daily
	Check & drain compressor drain	Daily
	Atomizer cell cleaned	Weekly
	Cell door cylinder cleaned	Semi-annually
	Nebulizer	Monthly
15. UV-Vis Spectrophotometer	Clean sample compartment	Daily
	Clean sample cell	Daily
	Wavelength calibration	Semi-annually
	Clean air filter	Semi-annually
16. ICP-Plasma Maintenance	Check condition of pump winding	Daily
	Check liquid argon supply	Weekly
	Replace sediment filter on cooling line	Weekly
	Clean tape head on cassette compartment	Weekly
	Replace inline sample filter, if necessary	Weekly
	Check condition of torch	Weekly
	Check carbon ignition tip	Weekly
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Clean or replace air filters	Monthly
	Change printer ribbon	As required

14.0 QUALITY CONTROL DATA ASSESSMENT

14.1 For each parameter tested a quality control data file exists. Each parameter file consists of a Gulf Coast Laboratories Quality Assurance/Quality Control Data Report.

14.2 The in-house quality control results, matrix spike percent recovery results, and the blank spike results are computer analyzed. Each test's information is stored in the computer by department and test name.

When entering quality control data on the computer, the cumulative number of tests and the cumulative upper and lower control limits (based on two standard deviations from the mean) are displayed on the screen. Also, the mean, coefficient of variation, number of tests, and upper and lower control limits (based on two standard deviations from the mean) for the most current 31 values are displayed and available for editing. Because the cumulative data and most current 31 point data are displayed on the screen, trends in the data can be noted. Also, the program will indicate current trends to the operator so immediate action can be taken.

The program also warns the operator of possible errors in data entry and does not allow out of control data to be entered without being manually overridden.

The data for each parameter may be printed in Levey-Jennings plots, internal reports or external reports. The internal report lists trends, the mean, number of values, standard deviation and coefficient of variation for the following: the cumulative data, the most current 31 data values, the current period and the previous period. The external report lists each parameter in the computer, the method used, the number of results the data is based on, the mean, and the standard deviation.

14.3 The following calculations are used for the quality control assessment by the computer. These calculations were verified manually.

The mean of a series of replicate measurements of a known quantity calculation:

$$\text{mean} = \frac{\text{Sum of sample measurements}}{\text{Number of sample measurements}}$$

The standard deviation S of a series of measurements to set control limits.

$$S = \text{The square root of } \frac{\text{The sum of squared results} - (\text{sum of results squared/number of results})}{\text{Number of results minus one}}$$

$$\text{Recovery Percent} = \frac{\text{Total analyte found} - \text{analyte originally present}}{\text{Analyte added}} \times 100\%$$

Coefficient of variation c.v:

$$\text{c.v.} = \frac{s}{x}$$

s = standard deviation
x = mean of result

Precision in the laboratory is analyzed by performing duplicates at a 10% frequency and analyzing the duplicate data by one of the following method: Acceptance protocol for precision as stated in USEPA CLP SOW for Inorganics 787.

A. For samples with concentrations less than five times the CRDL +/- the CRDL is the level of precision acceptable.

B. For samples greater than five times the CRDL, precision is calculated by relative percent difference (RPD) between the duplicate samples.

15.0 CORRECTIVE ACTION

All problems associated with an analytical data package will be documented on a Corrective Action Report (CAR). The analyst describes the problem in detail on the CAR and reports the corrective action which was followed. The Unit Leader will review the action, assuring it is sufficient to meet contract requirements.

15.1 DATA VALIDATION & CORRECTIVE ACTIONS

ANALYST

REAGENT (Method Blank): The quality control blank cannot show the presence of the parameter of interest. Analysis of the batch must not continue until the source of the problem has been corrected. Any samples associated with a blank which does not meet the criteria specified in Section 11 must be reanalyzed after the problem has been corrected.

INTERNAL QUALITY CONTROL (Lab Control): Must fall within the quality control limits. If the lab control is outside limits (refer to Section 5) the following corrective actions must be taken:

- Check the data and recovery calculations
- Check the EPA reference standard for standard verification
- If above is acceptable repeat analyses
- All samples associated with a laboratory control sample which does not meet criteria in Section 5 must be reanalyzed

SPIKE BLANK: Must fall within the quality control limits, if the spike blank is outside the limits +/- standard deviations from the mean of results, the following corrective actions must be taken:

- Check the data and recovery calculations
- Check the EPA reference standard for standard verification
- If above is okay repeat analyses

QUALITY CONTROL MATRIX SPIKE: Must fall within the quality control limits (refer to Section 5) established for each methodology. The corrective actions should be as follows:

- Check the data and recovery calculations

- Check if the blank spike and reference are within range

- If the matrix spike is out, check other analytes present for possible sample matrix interference. If sample matrix is identified as the problem this must be footnoted. If the matrix spikes are consistently outside for a particular

parameter another methodology may have to be suggested for sample analyses.

- If matrix spike is out, check for presence of that parameter at a high value which may be greater than the amount of spike, causing invalid spike recovery.

REPLICATES: Replicates must be within the range specified by the quality control limits. If reproducibility can not be achieved, and sample matrix interferences are not apparent, batch re-analyses should occur. Calculations, dilutions, etc. should be checked prior to re-analyses.

GENERAL QUALITY CONTROL: Borderline cases or problems with quality control should be brought to the attention of a supervisor for appropriate corrective action.

- All samples should be diluted within working range of standards.

SUPERVISOR

- Should follow all of the guidelines above checking for completeness, as well as, quality control limits.

- Also available will be raw data to spot check calculations, correct dilution factors and standard curve.

- Historical data may be used here as another check on calculations, dilutions or possible sample mishandling or analysis.

DATA CHALLENGES: All data challenges directed to the lab should be handled in the following fashion:

- Check historical data.

- Check raw data for dilution or transcription errors.

- Check quality control for the batch it was in for anomalies.

- Sample re-analyses are necessary if none of the above procedures resolve the problem. If the re-analysis is also outside of acceptance limits and the quality control data is in control the "Customer" will bear the cost of the re-analysis. If the quality control data is out of control the appropriate corrective action will be taken to correct the problem, and the lab will bear the cost of reanalysis.

15.2 QUALITY CONTROL DATA RESPONSIBILITY

- Method blank acceptance (analyst).

- Spiked blank acceptance (analyst) by control limits to be maintained and updated by Quality Assurance Director personnel.

- Precision of method evaluated by R charts maintained and updated, possibility of several concentration levels (QC/QA personnel).

- Accuracy evaluated by:

  A. EPA reference within EPA acceptance criteria (metals daily, conventionals quarterly).

  B. Percent recovery control charts maintained and updated (QC charts, QA/QC personnel).

- Final review of data submitted for checks:

  A. Completions
  B. Accuracy of reporting
  C. Calculations
  D. Historical review of data

15.3 Calibration curve does not have a 0.995-1.00 correlation coefficient:

- Plot curve to verify values were plotted correctly.

- Replot curve if necessary to check data entry error.

- If curve range still does not fit acceptance limits, batch re-analysis must occur.

When initial instrument calibration verification is out of control limits:

- Check instrument maintenance log and note if any changes have been made which would affect calibration verification.

- Check reagent reference log to verify that reagents have been properly prepared and/or meet specifications.

- Rerun new standards if above have not changed.

- If continued out of control, tune instrument according to manufacturer's specified procedure.

- Call for service if problem can not be resolved.

When initial instrument standard verification is out of control limits:

- Check reagent reference log to verify that reagents have been properly prepared and/or meet specification.
- Rerun new standard if above have not changed.
- If continued out of control prepare new reagents.

When initial GC/MS tuning standard is out of control limits:

- Check instrument maintenance log and note if any changes have been made which would affect calibration verification.
- Check reagent reference log to verify that reagents have been properly prepared and/or meet specifications.
- Rerun new standards if above have not changed.
- If continued out of control, tune instrument according to manufacturer's specified procedure.
- Call for service if problem can not be resolved.

When Method of Standard Additions slope is not acceptable:

- If for EP toxicity continue and note.
- If for sample not for EP toxicity rerun and note.

When continued verification standard is outside control limits (refer to Section 8):

- Rerun standard to verify outside control
- If continued out of control recalibrate and rerun previous set
- Continue

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Quality Assurance Manager is responsible for providing the Laboratory Manager, Project Director with a quarterly Quality Assurance report. The report will consist of the following:

* Performance evaluation summary (PES) - Includes a summary of performance evaluation results and corrective actions to any not acceptable results.

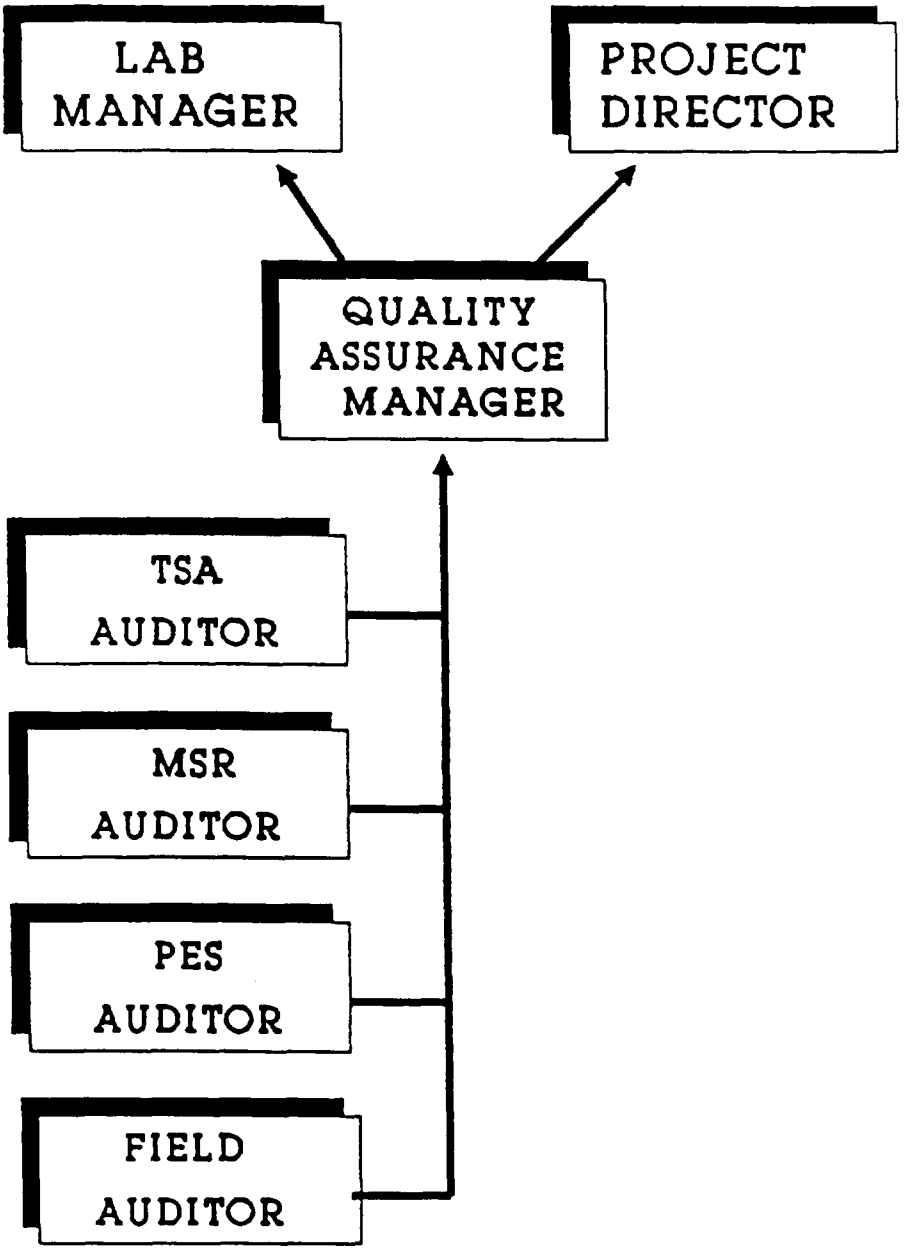
* Technical Systems Audit (TSA) - Quarterly assessment of deliverables for completeness, data accuracy, and data precision.

* Management Systems Review (MSR) - Assessment of operation procedures and systems, which assure a quality analytical product.

* Field Assessment Survey (FAS) - Compliance assessment of field operations, protocols, and methods.

All corrective actions and recommendations to problems or deficiencies will be noted in the quarterly report. All outcomes of previous corrective actions will be reviewed and reported.

16.1 Quality Assurance report flow chart



APPENDIX III

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

for

CREEK BOTTOM SEDIMENT
and
SOIL CHARACTERIZATION PROJECT

DEAD CREEK SECTOR A

CERRO COPPER PRODUCTS COMPANY

SAUGET, ILLINOIS

SITE DESCRIPTION

The Dead Creek site consists of two creek sectors, CS-A and CS-B (see attached Figure A-1). The CS-A portion of Dead Creek will be sampled in this sampling event.

Dead Creek Sector A has two smaller sections which are identified as CS-A1 and CS-A2. CS-A1 is the largest section, and lies on the north section of the Cerro property. This sector is approximately 1,000 feet long and 75 feet wide. CS-A2 is the smaller portion, and is 400 feet long and 75 feet wide. A lift station is located at the northernmost end of the Creek section, and is used to control the amount of flow emanating from the Creek.

The Cerro Copper Products Company facility, located on the west side of the Creek, has owned this property since 1970. Records indicate that waste discharge into the Creek began in the late 1930's. Environmental impacts, such as discoloration of the Creek prior to 1970 and 1971, is indicated in an aerial photograph. A fence was constructed around CS-A in 1971.

CS-A lies on the east of the Mississippi River flood plain in the town of Sauget, Illinois. It is bounded on the south by Queeny Avenue, on the north by railroad tracks, and by the Cerro facility and Site I on the west and east, respectively.

Sectors CS-A1 and CS-A2 of Dead Creek both have steep banks, approximately seven to ten feet high. During heavy rains or seasonal wet periods, the Creek waters rise to as much as four to five feet. Surface water flow is intermittent. The creek bed lithography consists of approximately seven feet of sandy silt over median-fine sands. The creek bank consists of interbedded silty sand and sandy silts. The aquifer level surrounding Dead Creek is as shallow as ten feet, and this area is subject to possible flooding.

The Cerro Copper Products Company facility is located in a heavily industrialized area. Monsanto Company, located northwest of the Cerro Copper Products Company facility, is the largest chemical industry in the area. Other smaller industries exist northeast of the facility.

Site: Dead Creek **Job Number:** 88001

Site Description: See attached sheet.

Location: Sauget, Illinois **Perimeter Established?** Yes (see map/sketch attached)

Performed by: The Avendt Group, Inc.

Proposed Starting Date of Site Activity: July 5, 1989

Anticipated Date of End of Site Activity: September 5, 1989

Plan Prepared by: Chuks Iregbu **Approved by:** _____

Date: June 29, 1989 **Date:** _____

Objective of Entry: The objective of entry into Dead Creek site Sectors CS-A1 and CS-A2 is to sample the subsoils around the Creek area by boring methods. Surface soil samples, surface water samples and groundwater samples will also be collected. Site-specific QA/QC and decontamination techniques will be employed throughout the sampling activities. A laboratory following CLP procedure will be utilized to obtain analytical results. The analytical information will then be evaluated to determine the extent of contamination.

Objective of the Health and Safety Plan (HSP): The aim of this Health and Safety Plan for the Cerro Copper Products Company site at Sauget is to:

1) Provide measures that will minimize accidents and injuries that could occur during this particular project;

2) Guide the Avendt Group personnel and any others associated with the project during the work sessions;

3) Inform all working personnel at the site of possible dangers as well as to provide guidance for normal site operations. Emergency situations that may be experienced include:

   a) variety of hazardous/toxic chemicals;
   b) biological agents;
   c) heat or other physical stresses;
   d) equipment-related accidents;
   e) fire or explosion creatable by on-site activities;

4) To meet standards as required by OSHA/NIOSH/EPA as contained in 29CFR-1910.120.

Possible Hazards: Volatile organics, semivolatile organics, pesticides/PCBs, inorganics and heavy metals.

Areas Affected: Surface water flowing through the Creek. Soils and sediments proximate to the Creek. Possibly the groundwater.

Topography: Some soil discoloration was detected in aerial photography.

Weather Conditions: Summer temperatures range from 75 degrees F up to 100 degrees F at 100% humidity.

Additional Information: Will be announced when received by The Avendt Group.

On-Site Organization and Coordination: The following functions have been assigned, respectively:

Project Team Leader: _____
Scientific Advisor: _____
Site Safety Officer: _____
Public Information Officer: _____
Security Officer: _____
*Record Keeper: _____
Financial Officer: _____
Field Team Leader: _____
Field Team Members: _____
Federal Agency Representatives: _____
State Agency Representatives: _____
Local Agency Representatives: _____
Co-Contractor(s): _____

* All personnel arriving or departing the site should log in and out with the Record Keeper.

Out-of-bounds Area: Sector A to nine team workers.

Established Command Post/Staging Area: Shower Trailer.

Prevailing Wind Conditions Are: To be determined (TBD).

Upwind/Downwind: TBD.

Exclusion Zone: TBD.

Personal Protective Equipment (PPE):

When air monitoring levels are at background levels or below, PPE will be minimized to hard hats, safety glasses, steel-toed work boots, and work gloves. If air monitoring registers a reading above background levels, then more equipment must be employed by personnel, as listed below.

Level B: This level or protection is required when air monitoring levels exceed 400 ppm above background, but are less than 1500 ppm above background. The PPE list for this level is the following:

1. Self-Contained Breathing Apparatus (SCBA) - this includes bottled air; a fifteen-minute emergency-air supply pack; and full face respirators.

2. Polycoat/Saranex Coveralls.

3. One pair of surgical gloves, covered by one pair of chemical-resistant gloves, covered by one pair of PVC work gloves.

4. Steel-toed work boots covered by neoprene overboots.

5. Hard hats.

6. Hearing protection (when deemed necessary).

Level C: This level of protection is required when air monitoring levels exceed 40 ppm above background, but are less than 401 ppm above background. The PPE list for this level is the following:

1. Full-face respirators with organic vapor cartridges (type GMC-H)

2. Polycoat/Saranex Coveralls.

3. One (1) pair of surgical gloves, covered by one pair of chemical-resistant gloves, covered by one pair of PVC work gloves.

4. Steel-toed work boots covered by neoprene overboots.

5. Hard hats.

6. Hearing protection (when deemed necessary).

Level D: This is the lowest protection level, and is employed when air monitoring levels are measured at 40 parts per million (ppm) above background readings, or less. Level D will require the following PPE:

1. Polycoat/Saranex Coveralls.

2. Two (2) pairs of surgical gloves covered by one (1) pair of PVC work gloves.

3. Steel-toed boots covered by neoprene overboots.

4. Hard hats.

5. Safety glasses.

6. Hearing protection (when deemed necessary).

If air monitoring levels exceed 1500 ppm above background, then the work site will be evacuated.

Equipment: A hollow steam auger with a hand-held high-pressure steam cleaner should be used. The continuous core sampler will be decontaminated between each boring with Alconox detergent.

Site Entry Procedure: Depending on daily based weather conditions, decontamination station is subject to change.

Emergency Medical Care: It is necessary that all the crew members be aware of the following in case of emergency.

First-aid Equipment is available on-site at the following locations:

First-Aid Kit: Shower Trailer.
Emergency Eye Wash: Shower Trailer
Emergency Shower: Shower Trailer
Other: TBA

List of Emergency Phone Numbers

Agency/Facility	Phone Number	Contact
Police (local, County Sheriff, or State	(618) 277-3500 (618) 332-6500	County Police Sauget Police
Police, Explosive Unit	(618) 346-3600	State Police
Fire	(618) 332-6600	Sauget Fire Department
Ambulance	(618) 332-6793	Braun's Ambulance
Hospital Emergency Room	(618) 874-7076	Gateway Comm. Hospital
Airport	(618) 337-6060	Bi-State Park Airport Cahokia
Poison Control Center	(618) 233-1935 OR (618) 233-1938	Memorial Hospital
Agency Contact (EPA, State, Local, USCG)	(217) 524-4827	Paul Takacs, IEPA, Hazardous Waste Dept.
Local Medical Laboratory	(618) 235-1780	St. Clair Medical Lab.
Federal Express	(314) 367-8278)	6181 Aviation Drive St. Louis Airport
Client Contact	N/A	N/A
Others IEPA Emergency Unit	(217) 782-3637	N/A

Emergency Routes:

Directions to Hospital (include map):

Monsanto Avenue east to Monsanto Road (19th Street in East St. Louis) north on 19th Street to Bond Avenue, west on Bond Avenue to 15th Street, north on 15th Street to King Drive. East on King Drive to Gateway Community Hospital. Routes to be driven by designated site personnel prior to initiating on-site operations.

Directions to BI State Airport: State Route 50 south to Judith Lane. East on Judith Lane to Cahokia Road, south on Cahokia Road to Julian Avenue, east on Julian Avenue to Airport Road.

QA/QC Precaution: To maintain quality assurance and quality control measures, all boring equipment (i.e., augers, drilling rods, etc.) should be washed with Alkanox detergent solution and steam-cleaned between borings. Avendt Group personnel will observe the decontamination operation. All dirt and materials must be removed from the auger flights. All rinse water generated during the boring activities shall be allowed to drain back into the Creek.

Disposal of On-site Generated Waste: All waste generated on site must be stored in 55-gallon drums.

Proper labeling of drums is required. The maximum duration for storing the on-site generated waste is 90 days. Beyond this period, permit and interim status will be required. Details of applicable waste storage, management and disposal of contaminated materials is an RCRA requirement and is found in 40CFR262 entitled "Standard Applicable to Generators of Hazardous Wastes."

IEPA will be contacted at (217) 782-3397 for the applicable state requirements when such a condition arises.

Equipment Check List, Level C:

Chemical-resistant coveralls: _____
Protective coveralls: _____
Type Saranex hooded: _____
Rain suits: _____
Gloves (type viton-neoprene): _____
Outer work gloves: _____
Neoprene safety boots: _____
Hard hat without face shield: _____
Safety glasses: _____

Decon Equipment Check List:

Wash tubs: _____
Buckets: _____
Scrub brushes: _____
Pressurized sprayer: _____
Detergent (type tsp Alconex): _____
Plastic sheets: _____
Tarps: _____
Trash bags: _____
Trash cans: _____
Duct tape: _____
Paper towels: _____
Face mask: _____
Face mask sanitizer: _____
Folding chairs: _____
Step ladder: _____

First-Aid Equipment Check List:

First-aid kit: _____
Portable eye wash: _____
Fire extinguisher: _____
Thermometers (oval): _____
Walkie-talkie: _____

Van Equipment Checklist:

Tool kit: _____
Hydraulic jack: _____
Gas: _____
Oil: _____
Anti-freeze/coolant: _____
Battery: _____
Windshield wash: _____
Tire pressure: _____
Lug wrench: _____
Tow chain: _____
Van checkout: _____

Instrument Check List:

PID: _____
HNu W/10-2 EV lamp: _____
HNu calibration kit: _____

Miscellaneous Check List:

Surveyor's tape:	_____
100 fiberglass tape:	_____
300 nylon rope:	_____
Nylon string:	_____
Surveying flags:	_____
Film:	_____
Soil auger:	_____
Banner tape:	_____
Surveying meter stick:	_____
Tables:	_____
Weather radio:	_____
Binoculars:	_____

Emergency Information: Since there has been background information regarding both volatile and semivolatile organics in the site, the following emergency precautions should be adopted:

In Case of This (Acute Exposure Symptoms)	Do This (First Aid)
1) Severe irritation of skin -	Wash irritated areas.
2) Severe irritation of respiratory system -	Get medical aid.
3) Accidental ingestion of unknown liquid -	Immediately induce vomiting.
4) Dust/vapor/liquid contact of suspected contaminant on skin and irritation -	Wash affected areas with soap and water.

Site Resources:

Water Supply: 5-gallon collapsible containers will be used.

Telephone: New Queeny Avenue and Falling Spring Road. Also Route 3 via Cerro Plant Road, and Monsanto Avenue.

Radio: TBA

Other: TBA

Emergency Contacts:

1) _____, Regional Safety Coordinator,
(313) 233-6270 office, ( ) - , Home.

2) _____ , Corporate Safety Director,
( ) - office, ( ) - , Home.

MEDTOX Hotline: In case of emergencies that require hotline action:

1) The following should be contacted: Drs. Raymond Harbison, Glenn Milner or Robert James at (501) 370-8263 (24-hour answering services).

2) What to state:

   a) "This is an emergency;"
   b) Your name, region and site;
   c) Telephone number to reach you;
   d) Location of emergency;
   e) Name of person injured or exposed;
   f) Nature of emergency; and
   g) Action taken.

Special Site Precaution:

1) Before any boring is attempted, local utility and surrounding industries (chemical or others) should be contacted to identify (if any) their subsurface transmission lines, cables or pipes. (These have been confirmed.)

2) Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat and cold stress symptoms should/will be monitored and recorded in the site security log book.

3) Attempts to open drums of unknown contents must be avoided. This is important as to eliminate such explosion hazards.

4) Work will be conducted during daylight hours only.

5) Pre-employment and post-employment physicals are recommended for all personnel to be involved with the on-site job. The physicals must be completed a few days prior to start of work, and upon termination of work. Exposure logs will be maintained as to supplement facts on the subsequent medical checkups.

Site/Waste Characterization:

Waste type(s): Liquid, solid, sludge, corrosive, ignitable, volatile, toxic, reactive, and unknowns have been characterized and associated with the Site I/Creek Sector A subsurface soil samples.

Some specific waste types:

1) Volatile organics to a total of 10 (ten) with chlorobenzene as highest.

2) Total of 25 semivolatile organic chemicals. Those in high concentrations are:

   a) 1,2,4-trichlorobenzene @ 8,300ppm
   b) Hexachlorobenzene @ 1,300ppm
   c) 1,4-dichlorobenzene @ 1,800ppm
   d) Naphthalene @ 10ppm

   Also found were fluoroethene, anthracene, dichlorobenzene, n-nitrosodiphenylamine, etc.

Pesticides/PCBs: Three pesticides at the following levels were found:

1) 4,4'DDD @ a concentration of 30ppm
2) 4,4'DDT @ a concentration of 4.3ppm
3) Toxaphene @ a concentration of 490ppm
4) One PCB congener (i.e., arochlor)

Inorganics: Found at high concentrations were chromium, mercury, cyanide, nickel, lead, vanadium and antimony.

Principal Disposal Method: Landfill (area filling), wastepiles, surface impoundments, and open drumming).

o Type and location:

Two disposal pits were identified at Site I, Section CS-A containing waste materials such as oily sand, clay, wood and cinders. Occasional refuse such as cardboard, rubber and cloth were characterized.

Past investigations detected contaminants in the following media: soils, groundwater, surface water, sediments and air. Primary source of contamination is the soil from waste disposal.

APPENDIX C

1906 Forest Drive
Annapolis, MD 21401
(301) 261-1177

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SAMPLE/CORE LOG

Boring/Well A10B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 10:00 a.m. Drilling Completed 5:30 p.m.

Total Depth Drilled 39 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 18" - 5' Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Helper

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	4 1/2	0		Rubble & fill
4 1/2	9 1/2	3'		0 ppm dry brown silt
9 1/2	10	4'		0 ppm at hole, dry brown silt, high organic odor
10	13			Grey wet silt
13	14 1/2			Black clay 3" black org. mtl. above clay
				below silt , odor!
14 1/2	15	4'		Grey clay-mottled silty clay to clayey silt
15	15 1/2			Clayey silt
15	17			Grey silt, HNO=22 ppm , strong odor
17	19 1/2			Silt grey with minor clay - odor
19 1/2	24 1/2	2'		Dark grey silt, odor with some clay,
				mottled , 10 ppm, spikes to 70 ppm
24 1/2	29 1/2	2'		Grey brown fine sand - 14 ppm
29 1/2	34		170 bl.	For 29 1/2 - 30 1/2 grey silt, very wet
34	38			Lost blown out
38	39		135 bl.	Almost like refusal, grey silt - have
				4 ppm, strong odor

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SAMPLE/CORE LOG

Boring/Well A11B Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 10:30 Drilling Completed 11:50

Total Depth Drilled 17 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" Continuous core; 5' Long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	1.5			Brown, black, yellow moist silt. Slightly
				fluidized. PID = 0.8 ppm
1.5	6.0			Gray, mottled with black streaks silty
				clay/clayey silt. Some organic matter,
				moist, plastic PID = 1.8 ppm
				(Blackground @ 1.8)
6.0	8.0			Gray, more moist, mottled, orange, black
				yellow silty clay/clayey silt
				PID = 5.8 ppm @ 6.5 ft. level
				Some organic matter; Rainbow sheen in
				silty clay
8.0	8.1			Encountered a 1 in. sand seam stained
				orange, gray, yellow. Sand is wet. It
				is between the gray silty clay/clayey silt
				and gray minor silt clay

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SAMPLE/CORE LOG

Boring/Well A11B Project/No. 88001 Page 2 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 10:30 Drilling Completed 11:50

Total Depth Drilled _____ (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device _____ Sampling Interval Variable feet

Drilling Fluid Used - None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller _____ Helper _____

Prepared By _____ Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
8.1	10.6			Gray, moist, plastic, very minor silt clay
				with some black streaks. Look to be
				approx. 10-6 or 10-8 K. PID = 2.5 ppm
10.6	11.6			Gray, minor silt, course sand, PID = 2.8 ppm
11.6	12.0			Gray, silty sand, slight green tint to
				larger not extremely wet, moist
12.0	17			Course gray minor silt sand, relatively
				clean, GW @ 12 ft. Some black specks.
				PID = 1.8 @ 12 ft.
				= 2.1 @ 14 ft.
				= 17.6 @ 16 ft.
				= 3.2 @ 17 ft.

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SAMPLE/CORE LOG

Boring/Well A11C Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 8:00 Drilling Completed 9:10

Total Depth Drilled 17 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	.5			Brown, orange, black mottled moist creek
				sed. PID = .7 ppm Some organic matter.
.5	2.0			Gray, mottled with black streaks; minor
				silt clay, organic matter. PID = 1.7 ppm
				Slightly moist
2.0	2.5			Gray mottled with black streaks; silty clay,
				moist to wet organic matter
2.5	5.0			Gray mottled with black streaks; silty clay,
				(less silt) Slightly moist very little
				organic matter. PID = 1.0 ppm
5.0	8.0			Gray, yellow, orange, black clayey silt/
				silty clay with black specks, moist but
				slightly wet @ 6.0 ft. level PID=7.3 ppm

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SAMPLE/CORE LOG

Boring/Well A11C Project/No. 88001 Page 2 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 9:00 Drilling Completed

Total Depth Drilled (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Helper

Prepared By Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
8	17			Gray minor silty sand (Henry) In GW.
				PID = 18.3 @ 10ft. level
				But average PID = 17.4 Some minor
				clay pockets the size of a quarter, and
				clay streaks.

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SAMPLE/CORE LOG

Boring/Well A11D Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 7/18 Drilling Completed 7/18

Total Depth Drilled 23.5 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 2" Split Spoon 18" Long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper Don Brewington

Prepared By R.L.A. Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	13.5			Rubble concrete debris, bricks, slag, rags,
				and black oily stained soil & pellet
				material very strong odor PID = 30 ppm
				Tan sandy clay @ surface of road
13.5	18.5			Gray silty clay with some sand @ base of
				road file; clean contact; PID = 7.0 ppm
				(Cahokia)
18.5	20.0			Brown-gray silty sand; this beds (maybe
				creek bottom) of silt/sand alternate;
				PID = 4.0 ppm (Henry)
20.0	23.5			Green to tan-medium sand (clean) with some
				some heavy minerals (Henry)

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SAMPLE/CORE LOG

Boring/Well A12A Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 7/19 Drilling Completed 7/19

Total Depth Drilled 20.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 2" split spoon 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper Don Brewington

Prepared By R.L.A. Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0.0	4.5			Black silty clay; plastic with minor sand;
				top 1-foot roadfill, gravel and sandy silt
4.5	10.5			Gray clayey sand/sandy clay with some clay
				(CH) horizons. Lense of silty sand with
				mineral segregation noted @ 10';
				PID = 2 - 4 ppm (Cahokia)
10.5	11.0			Gray clay; highly plastic; moist & soft;
				PID = 10 ppm
11.0	20.5			Green f-m sand with trace silt; heavy
				minerals observed PID = 4.0 ppm (Henry)

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SAMPLE/CORE LOG

Boring/Well A12b Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 10:10 Drilling Completed 4:00

Total Depth Drilled 18 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	8	4-9 ft.		Brown/orange/black mottled fluidized silt
				PID = 0.7
8	8.5			Gray silty clay some sweet smell
8.5	9.0			Gray sandy silt with good clay present
9.0	12	5		Gray silty sand with black specks, very
		9-14 ft.		moist. Small odor; some twigs
12	13			Gray silty clay (took sample to Maths for
				Porosity test)
13	14			Gray, streaky; mottled minor silt sand
				unit, some sweet smell to the sand unit
				black and white streaks

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Boring/Well A12b Project/No. 88001 Page 2 of 2

Site Location Cerro, Sauget; CS-A Drilling Started _____ Drilling Completed 5:00

Total Depth Drilled 18 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper _____

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
14	17			Gray streaky sand. Black streaks ; strong
				odor. Wearing Level "C" protected mask.
17	18			Grayish brown sand with minor silt
				PID = 12.7 some clay seams
18				Gray sediments with minor silt
				with some clay seams '14 thick

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SAMPLE/CORE LOG

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Site Location Cerro, Sauget; CS-A Drilling Started 3:45 Drilling Completed 5:25

Total Depth Drilled 15 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	6	4		Brown to light brown yellowish fluidized
				sediment. PID = 0.3 ppm . Some parts of
				vegitation
6	8			Silty clay, brownish-yellow mottled some
				gray color
8	8.5			Gray silt with minor clay mottled brown
				streaks
8.5	10.0			Brown mottled with gray streaks; silt
				with minor clay.
10.0	12.0	4		Mottled gray & brown silt w/ minor clay
12.0	15.0			Brown, mottled with gray streaks; silt
				with minor clay. Gray colored seds
				and coarser than the brown. Brown is
				stain rust color.
15.0				Gray silty sand with minor clay.

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SAMPLE/CORE LOG

Boring/Well A12D Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 7/18 Drilling Completed 7/18

Total Depth Drilled 25' (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper Don Brewington

Prepared By R.L.A. Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	6.0			Tan sandy clay with some silt; roadfill
				with assorted debris, brick, and stones;
				Dry; PID = 0.0 ppm
6.0	13.0			Rubble concrete debris with strong organic
				odor (PID = 1.0 to 5 ppm); debris consist
				of rags, bricks, glass, wood, slag and some
				oil staining
13.0	20.0			Gray-green sandy silt with clay; moderately
				plastic; slightly mottled sand; lense (3")
				in bottom at spoon PID = 0.0 ppm (Cahokia)
				GW @ 18'

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SAMPLE/CORE LOG

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Site Location Cerro, Sauget; CS-A Drilling Started _____ Drilling Completed _____

Total Depth Drilled 25 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper Don Brewington

Prepared By R.L.A. Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
20.0	25.0			Green f-m sand with trace silt
				PID = 0.0 ppm (Henry)

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SAMPLE/CORE LOG

Boring/Well A13A Project/No. 88001 Page 1 of 1

Site Location Cerro. Sauget; CS-A Drilling Started 7:15 Drilling Completed 8:30

Total Depth Drilled 20.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Helper

Prepared By C. Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	1			Road fill, crushed stone sand and gravel
1	5.0			Brown to dark brown clayey silt to silty
				clay, minor sand. PID = 0 ppm
5.0	18			Gray to greenish-gray silty clay, slightly
				plastic, moist. Approx. 15 - 30% silt,
				black streaks (Cahokia Fm.)
18	20.5			Gray-brown to greenish fine sand, minor
				silt, relatively clean, can see quartz
				grains without hand lens. (Henry Fm.)

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SAMPLE/CORE LOG

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Site Location Cerro, Sauget: CS-A Drilling Started 4:50 Drilling Completed 5:10

Total Depth Drilled 16 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	6	5		Brown to black wet, fluidized silt, some
				organic matter, some organic streaks,
				strong odor
6	9.5	5		Gray to slightly brownish gray clay, moist,
				some black streaks
9.5	12			Gray moist sand, with black specks. Can
				identify quartz grains with naked eye.
12	16	3" split spoon		Gray wet sand with black specks. Can
				identify quartz grains with naked eye.

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SAMPLE/CORE LOG

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Site Location Cerro, Sauget: CS-A Drilling Started 11:00 Drilling Completed 12:00

Total Depth Drilled 8.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	6	4		Mottled dark brown to rust silt, fluidized
6	7			Rusty to brown silty clay
7	8			Gray clay with minor silt, not fluid
8	8.5			Brownish-gray silt with minor clay-less wet
8.5				Gray/brownish-gray course minor silt sand

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SAMPLE/CORE LOG

Boring/Well A13D Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 7/19 Drilling Completed

Total Depth Drilled 23 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 2" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper Don Brewington

Prepared By R.L.A. Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	8.0(?)			Tan silty clay/clayey silt; dry with
				trace moisture at surface
				PID = 0.0 ppm
8.0(?)	16.0(?)			Gray-green sandy silt with trace clay;
				PID = 0.0 ppm (Cahokia)
16.0(?)	23.0			Gray-green silty sand with trace heavy
				minerals; bedding structures observed
				PID = 0.0 ppm (Henry)
				GW @ 16'

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SAMPLE/CORE LOG

Boring/Well A14A Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 9:30 a.m. Drilling Completed 11:00 a.m.

Total Depth Drilled 28.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	1.5			Road fill, crushed stone, sand and gravel
1.5	23.5			Brown to brownish gray silty sand
				(approx. 40% silt) poorly sorted ,fine
				brown streaks (Cahokia Fm.)
23.5	28.5			Fine to medium gray sand with minor silt.
				Relatively clean. PID = 0 ppm
				(Henry Fm.)

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SAMPLE/CORE LOG

Boring/Well A14B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 1:25 Drilling Completed 2:00

Total Depth Drilled 18 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	6	4		Brown to blackish brown, mottled with
				orange streaks, fluidized silt. Some
				organic matter. Strong odor.
6	6.5			Gray, moist, clay with minor silt, some
				black streaks
6.5	18	4		Moist to wet gray medium to course sand
				with some black specks. (Henry Fmt.)

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SAMPLE/CORE LOG

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Site Location Cerro, Sauget; CS-A Drilling Started 8:30 Drilling Completed 9:30

Total Depth Drilled 16.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	4			Brown to blackish brown fluidized silt with
				orange streaks. Some organic matter.
				Strong odor.
4	7.5	4		Moist medium gray sand with some black
				specks
7.5	10.5			Gray moist, plastic, clay with black
				streaks
10.5	16.5			Gray wet coarse sand with black specks
				(Henry Fmt.)

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SAMPLE/CORE LOG

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Site Location Cerro. Sauget: CS-A Drilling Started 3:00 Drilling Completed 5:20

Total Depth Drilled 30.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Daryl Davenport

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	1 1/2	-	core	Fill
1 1/2	4 1/2	3	core	Fill - silt, brn.-gray mottled rust; No odor
4 1/2	9 1/2	3	core	Sandy silt, light-med. tan, mottled,
				striations with tan/black small layers
9 1/2	12	2 1/2	core	Silt
12	14	2	core	Silty clay to clayey silt dark brown
14	14 1/2	1/2	core	Fine sand - silt light brown
14 1/2	19 1/2	3	core	Wet silt with minor sand med. brown
19 1/2	24 1/2	2	core	Med. brown silty sand to med. grained sand
24 1/2	25	8	spoon	Fine sand to silty sand brown
25	25 1/2	6	spoon	
25 1/2	26	8	spoon	Coarse sand / gray
26	26 1/2	3	spoon	Gray-blue with black striations
26 1/2	27	5	spoon	clayey with black flecks & wood specks-
27	27 1/2	12	spoon	organics ?
27 1/2	28	8	spoon	Dark gray silt with coarse
28	28 1/2	11	spoon	grained sand

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SAMPLE/CORE LOG

Boring/Well A14D Project/No. 88001 Page 2 of 2

Site Location Cerro. Sauget: CS-A Drilling Started 3:00 Drilling Completed 5:20

Total Depth Drilled 30.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Helper

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
28 1/2	29	22	spoon	Dark gray coarse sand
29	29.5	35	spoon	"
29.5	30	35	spoon	"
30	30.5	35	spoon	"
				"

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SAMPLE/CORE LOG

Boring/Well A15A Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 1:30 Drilling Completed 2:45

Total Depth Drilled 24.0 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By Chris Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	1			(Road Fill) crushed stone, sand & gravel
1	16.5			Brown to brownish gray silty sandy clay/
				silty sand (moist); Some coarse sand grains
				Some minor Dark brown to black streaks.
				PID = 0 ppm (Cahokia Fm.)
16.5	17.0			Gray, moist minor silt clay layer, some
				thin black streaks, seems to be approx.10-6
17.0	24.0			Fine to medium gray sand, can see quartz
				grains, poor to fair sorting; minor
				silt PID = 0.0 ppm (Henry Fm.)

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SAMPLE/CORE LOG

Boring/Well A15B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 9:15 Drilling Completed 3:30

Total Depth Drilled 19 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5'long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	6	3		Brown to blackish brown fluidized silt with
				some orange streaks. Some organic matter.
				Strong odor.
6	10			Gray, moist, medium sand with black speacks
10	13			Gray moist, plastic, clay with black streaks
13	19			Gray to brownish gray, moist to wet sand
				with minor silt. Some black specks.

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SAMPLE/CORE LOG

Boring/Well A15C Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 11:00 Drilling Completed 2:00

Total Depth Drilled 17 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	8	5		Brown to blackish brown, fluidized silt.
				Some orange streaks; some organic matter.
				Strong odor.
8	9			Gray, moist, plastic clay with black streaks
9	11.5			Gray, moist medium sand with minor silt.
				Some black specks.
11.5	14.5			Gray, moist, plastic clay with black streaks
14.5	17			Gray, course, wet sand with black specks

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SAMPLE/CORE LOG

Boring/Well A15D Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 9:40 (7/12/89) Drilling Completed 12:20 p.m.

Total Depth Drilled 29 1/2 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Daryl Davenport

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	1 1/2		cont.	Fill-silt brown-black, some clay
1 1/2	4 1/2	2	core	Fill-silt, medium brown
4 1/2	6 1/2	4		Silt-clayey silt medium brown
6 1/2	9 1/2	4		Silty clay medium brown, mottled, sl. odor
9 1/2	11	4		Silt/clayey silt
11	12 1/2	4		Silty-brown with dark brown clay mottled
12 1/2	13	4		Silt very light brown, wet
13	14	4		Gray clay with minor silt
14	14 1/2	4		Very wet silt with minor clay
14 1/2	17	3		Brown silt; no odor
17	19 1/2	3		Brown sand medium coarse
19 1/2	24	2 1/2		Medium brown sand
24	24 1/2	2 1/2		Brown silty sand
24 1/2	29 1/2			Silty dark gray; scummy water

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SAMPLE/CORE LOG

Boring/Well A16A Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 3:15 Drilling Completed 3:45

Total Depth Drilled 29 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Ed Clark Helper

Prepared By C. Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	2			Road fill, crushed stone, sand and gravel
2	24			Brown to grayish brown clayey silt to
				silty sand with minor black streaks. Some
				thin (approx. .5 in. thick) clay layers
				encountered between the 14 to 15 foot
				depths. PID = 0.0 ppm (Cahokia Fm.)
24	29			Gray sand with minor silt; can see quartz
				grains without hand lens. Very moist.
				PID = 0 ppm

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SAMPLE/CORE LOG

Boring/Well A16B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 6:00 Drilling Completed 6:30

Total Depth Drilled 24 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
9	10			Brown, orange, black ,yellow fluidized
				creek silt PID = 8 to 18 ppm. Some
				organic matter.
10	11.5			Gray, moist plastic clay with minor silt.
				Some black streaks.
11.5	12			Gray, silty sand, clayey silt. Which is
				sandwiched between a large clay layer and
				a 1/2 in. thick clay layer. Clay is gray
				& plastic with black streaks.
12	24			Gray, minor sandy silt with small clay
				lenses PID = 18 - 36 ppm .
				Some black specks.
				GW at 16 ft.

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SAMPLE/CORE LOG

Boring/Well A16C Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 3:30 Drilling Completed 4:30

Total Depth Drilled 17 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
2	6			Brown, orange, yellow, black mottled,
				fluidized creek silt with organic matter
				PID = 7.6 to 24.9 ppm between 2 and 6 ft.
6	7	1		Gray, minor silt clay with black streaks
				through clay. PID = 1.3 ppm.
7	9			Gray, coarse, pebbly sand with some organic
				material. Some black specks. Some clay
				lenses. PID = 5.9 ppm
9	9.5			Gray, silty clay with organic matter.
				Black streaks in a moist, plastic texture.
				PID = 3.0 ppm
9.5	17			Gray silty clay, clayey silt with black streaks. Groundwater at 11.5 ft.
				PID = 10.3 ppm Trade into a uniform gray silty sand PID = 4 - 8 ppm

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SAMPLE/CORE LOG

Boring/Well A16D Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 7:30 Drilling Completed 10:50

Total Depth Drilled 31 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	2			Lt. brown to dk. brown silt to clayey silt.
				Some organic matter, roots, wood.
2	6			Lt. brown silt to clayey silt, slightly
				moist, mottled
6	13			Silty clay to clayey silt. Lt. brown,
				mottled appearance with a slight odor.
				PID = 1.5 to 2.0 ppm (Cahokia)
13	18			Gray to brownish gray fine to medium sand
				with silt. Moist, slightly plastic
18	23			Lt. brown to a fine medium sand with a
				1.5 in. thick bluish gray clay layer at
				21.0 ft. below clay. A medium silt with
				mottled gray, orange and brown color.
				PID =0.0 ppm

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SAMPLE/CORE LOG

Boring/Well A16D Project/No. 88001 Page 2 of 2

Site Location Cerro, Sauget; CS-A Drilling Started _____ Drilling Completed _____

Total Depth Drilled 31 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper _____

Prepared By C. Bade & M. Jefferson; Mathis Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
23	31			Gray sand with minor silt, moist and
				plastic. A 4 inch thick clay layer
				encountered at 30 ft. Clay was gray to
				blueish gray color. Below clay layer a
				medium gray sand with minor silt. Wet unit.
				(Henry Fm)

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SAMPLE/CORE LOG

Boring/Well A16E Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 1:50 Drilling Completed 3:55

Total Depth Drilled 28 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	8			Brown (clayey silt) to silty clay with
				organic matter, wood, roots, etc.
8	13			Gray to brownish-gray silty clay, mottled
				appearance. PID = 0.0 ppm (Cohokia)
13	18			Light gray silty sand, mottled with black
				streaks.
18	23			Gray medium sand with 3 inch silty clay
				layer. Moist and plastic.
23	28			Gray medium sand with minor silt. Can see
				quartz grains without hand lens.
				PID = 0.0 ppm, Wet. (Henry Fm)

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Boring/Well A21B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 9:30 Drilling Completed 11:00

Total Depth Drilled 12.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	4	5		Mottled brown, yellow, orange fluidized
				silty clay, clayey silt. Stream sediment
				PID = 2.4 ppm
4	4.5			Gray, streaky, black speckled silt, wet
4.5	7.5	5		Gray, moists minor silt clay, plastic
				texture, some black specks, some
				decom. vegitation.(less silt at bottom of
				unit)
7.5	12			Gray, wet minor silt, black specks, clean
				sand, uniform sand grains (Henry)
				PID = 0.0 ppm maybe 3 ft. clay above seems
				to be doing a good job of aquiclude.
12	12.5	4		Gray, silty clay PID = 0.0 ppm
12.5	down			Gray, wet, minor silt sand
				Groundwater looks good.

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SAMPLE/CORE LOG

Boring/Well A21C Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 11:36 Drilling Completed 2:12

Total Depth Drilled 13 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	5			Brownish, orange, black fluidized silt,
				No PID reading (dead vegitation)
5	6			Brownish gray silty clay, plastic texture,
				moist
6	8			Gray clayey silt, nearly 1 to 1 ratio clay
				to silt
8	11			Gray clayey silt, nearly 1 to 1 clay
				silt ratio , sweet smell, gray color,
				black specks.
11	12			Gray, minor silt clay, very plastic, moist
12	13			Gray, clean, meaning uniform minor silt,
				sand layer. Definitly ground water.
				Some black streaks.

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SAMPLE/CORE LOG

Boring/Well CSA21d Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 11:24 a.m. Drilling Completed 5:00 p.m. (7-10-89)

Total Depth Drilled 31 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Dave Julius

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	4			Brown to light brown silty sand fill
				material with stones, pebbles, and organic
				matter, intermixed
4	19			Light brown to gray sandy silt with minor
				clay seams ranging from 1 inch to 6 inches
				in thickness
19	31			Gray to dark gray medium to coarse sand.
				Unit is moist to wet and contains a slight
				odor.

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SAMPLE/CORE LOG

Boring/Well A22a Project/No. 88001 Page 1 of P

Site Location Cerro, Sauget; CS-A Drilling Started 2:15 p.m. Drilling Completed 5:30 p.m.

Total Depth Drilled 28.5 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Daryl Davenport

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	6.0			Boulders, rocks, slag, copper fill
				HNU = 0, medium brown, sandy silt, mottled
				with rust flakes, dry
6.0	19.5			Bottom dark to medium brown silty clayey,
				wet, fine grained sand, dark brown silty
				clayey sand same as above
19.5	28.5			Some mottled dark brown clayey sand with
				pockets of clay interbedded with medium
				brown coarse sand with rust flakes,
				grade into gray medium to coarse sand.

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SAMPLE/CORE LOG

Boring/Well A22B Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 1:35 Drilling Completed 2:20

Total Depth Drilled 15 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0.0	4	3		Brown, mottled yellow, orange, black
				fluidized silty clayey silt, PID = 3.0 ppm
				Some organic matter, twigs, leaves, roots
4	6			Gray to brownish-gray silty clay, some
				organics, PID = 0.0 ppm. Clay is moist
				with plastic texture
6	6.5			Gray, wet silty sand seam with black
				specks and streaks.
6.5	7.0			Gray, streaky sand clay. PID = 0.0 ppm
				Some organic matter.
7.0	15			Gray, very wet, minor silt sand (Henry)
				PID = 0.0 ppm. Some organic matter
				PID @ 13 feet was 12.3 ppm

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SAMPLE/CORE LOG

Boring/Well A22C Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget; CS-A Drilling Started 4:30 Drilling Completed 5:15

Total Depth Drilled 13 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" continuous core; 5' long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Kent Helper

Prepared By C. Bade Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	4	1		Possible 4 ft. of fluidized creek sediment.
				Only recovered 3 in. of silt. Silt was
				black and mottled with organic matter.
4	10			Gray, silty clay to gray minor silt clay,
				looks to be tight. Some organic material
				found at the 8 ft. level. Also at the 8 ft.
				level found a 1/2 in. sand seam. Sand was
				gray & uniform. Sand was wet. Clay is
				moist and slightly plastic. Some black
				streaks .
10	11.75			Black specks, gray silty sand, wet no Bid
				reading
11.75	12			Gray minor silt clay
12	13			Gray, minor silty sand, wet, black specks

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SAMPLE/CORE LOG

Boring/Well A22d Project/No. 88001 Page 1 of 1

Site Location Cerro, Sauget: CS-A Drilling Started 8:30 a.m. Drilling Completed 12:00 noon

Total Depth Drilled 27 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Helper Daryl Davenport

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
0	9			Brown to dark brown fill material consisting
				of wood, bricks, roots, etc. PID = 0.0 ppm
9	19			Medium gray to dark gray silty sand with
				trace of clay. Grades to a medium gray
				sand. Groundwater @ 10 feet. PID=2.0 ppm
19	27			Gray to dark gray, medium to coarse sand.
				Moist to wet. PID ranged from 0.2 to 3.2
				ppm.

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SAMPLE/CORE LOG

Boring/Well A23C Project/No. 88001 Page 1 of 2

Site Location Cerro, Sauget: CS-A Drilling Started 10:45 Drilling Completed 2:30

Total Depth Drilled 25 (feet)

Hole Diameter 6" (inches) Type of Sample/Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Quintin Nowak

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0	8.5			Road fill, black oily, stones, sand, silt.
				Lots of stones. Some red sandstone pieces.
				Still in roadfill.
8.5	15			White, limestone fill material, very little
				recovery with split spoon.
				Ground water @ 10'
15	20.5			Black to brownish black silt with some
				organic material. Some minor clay seams
				approximately 1 to 6 inches thick.
				PID ranged from 5 to 300 ppm inside augers.
				Still very wet to moist.
20.5	22			Gray moist, plastic clay with minor silt.

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Boring/Well A23C Project/No. 88001 Page 2 of 2

Site Location Cerro, Sauget; CS-A Drilling Started 10:45 Drilling Completed 2:30

Total Depth Drilled 25 (feet)

Hole Diameter 6" (inches) Type of Sample/ Coring Device Continuous Core/Split Spoon

Length and Diameter of Coring Device 3" split spoon; 18" long Sampling Interval Variable feet

Drilling Fluid Used None Drilling Method Hollow stem auger

Drilling Contractor Mathis Driller Jerry Bignall Helper Quintin Nowak

Prepared By Ivan Cooper Hammer Weight 140# Hammer Drop 30 Inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
22	25			Gray,wet medium coarse sand with minor
				silt. Relatively clean unit.

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DATE OF ITEM(S)			
NO. OF ITEMS	3		
PHASE	SAS		
PRP			
PHASE (AR DOCUMENTS ONLY)	___ Remedial ___ Removal ___ Deletion Docket ___ AR ____ Original ____ Update # ____ Volume ____ of ___		
O.U.			
LOCATION	Box # ____ Folder # ___ Subsection _____		
COMMENT(S)			
OVERSIZED SITE MAP(S)			

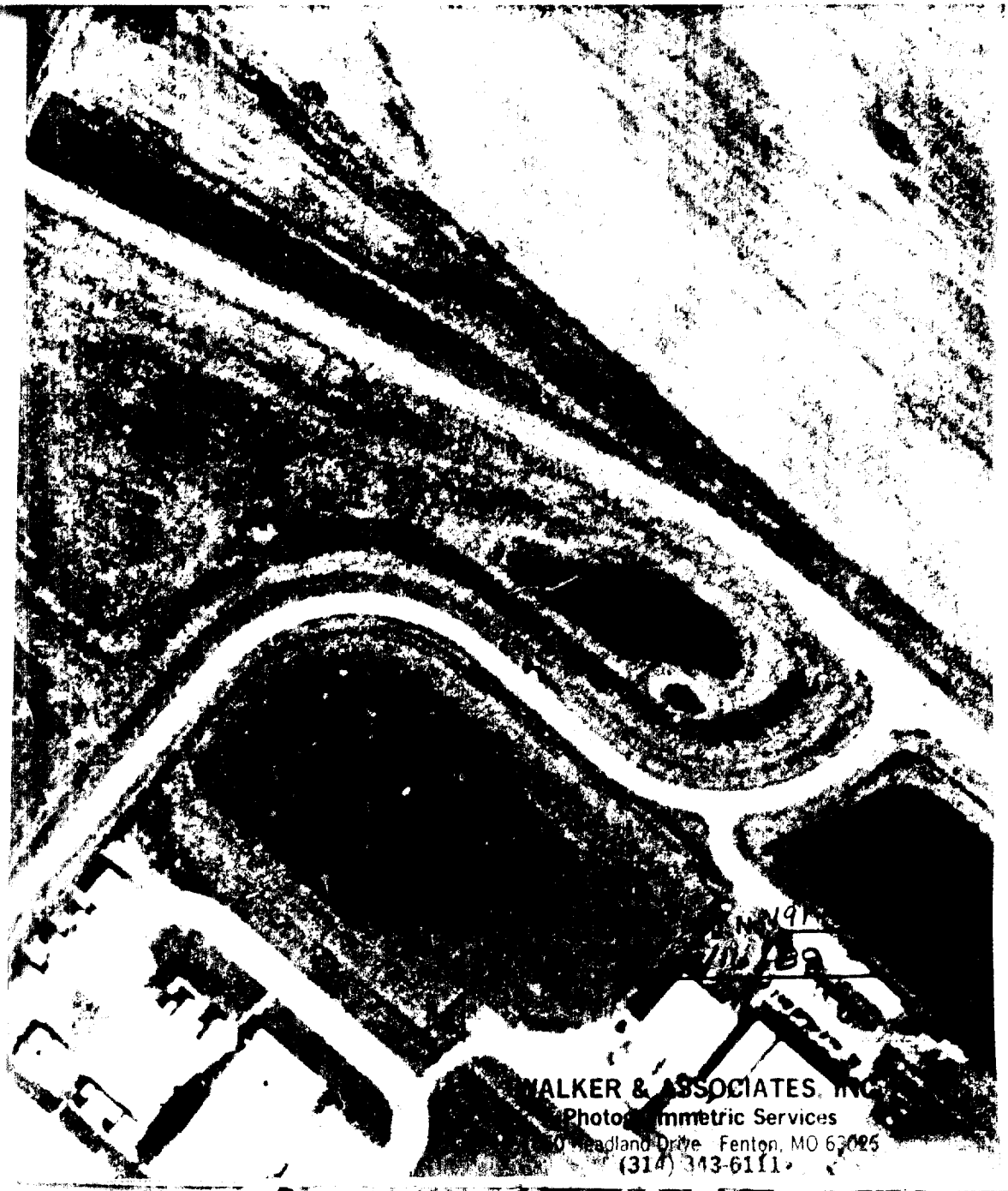
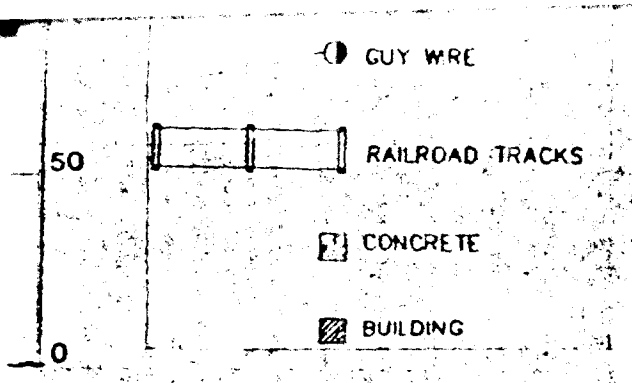

WALKER & ASSOCIATES, INC.
Photogrammetric Services
Meadland Drive Fenton, MO 63026
(314) 343-6111

PLATE 1



AUTHENTICATION

ility for professional engineering liability is hereby limited to the set of plans y the seal, signature and date hereunder onsibility is disclaimed for all other s involved in this project or specifically ns after this date unless reauthenticated.

Date

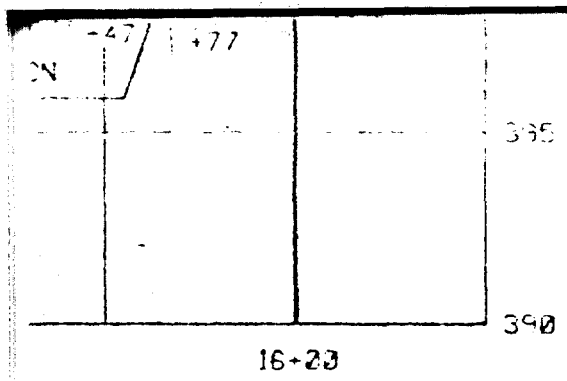
THE AVENDT GROUP, INC.

ENGINEERS & SCIENTISTS

TOPOGRAPHIC SURVEY

DRAWN CDT/PJO	DATE 7/12/89		1 / 1
CHECKED	DATE		
FIELD BOOK	PROJECT # 89-112		
	JOB ORDER # 4050		

PLATE 2



MK	DATE	REVISION

STORMWATER COLLECTION FACILITY
SITE PLAN AND PROFILE
OPTION 1
(COMBINED PROCESS AND STORM SEWER SYSTEM)

The Chester Engineers
Engineers Scientists Architects

CERRO COPPER PRODUCTS CO.
A Member of THE MARMON GROUP

DWG NO. 3890-1A	SCALE AS SHOWN	DRAWN BY CAD	DRAWING NO. SK-1A
DATE 25 Aug 1989 /10:20	DATE AUG 89	CHECKED BY WRS	

PLATE 3