

**SITE SOIL AND GROUNDWATER
INVESTIGATION REPORT
REEVES BROTHERS, INC.
BESSEMER CITY, NORTH CAROLINA**

Prepared for:

**Parker, Poe, Adams & Bernstein, L.L.P.
on behalf of
Reeves Brothers, Inc.
Spartanburg, South Carolina**

Prepared by:

**AWARE Environmental Inc.^o
9305-J Monroe Road
Charlotte, North Carolina 28270**

AEI Project No. N156-33

June 1996

June 25, 1996

Reeves Brothers, Inc.
c/o Parker, Poe, Adams & Bernstein, L.L.P.
2500 Charlotte Plaza
Charlotte, North Carolina 28244

Attn: Mr. Max Justice, Esquire

Re: Site Soil and Groundwater Investigation Report
Reeves Brothers, Inc. Osage Plant
Bessemer City, North Carolina
AEI Project No. N156-33

Dear Mr. Justice:

AWARE Environmental Inc.® (AEI) was retained to assess site soil and groundwater conditions at the Reeves Brothers, Inc. (RBI) Osage Plant located in Bessemer City, North Carolina (Figure 1). The environmental assessment was conducted at the textile manufacturing facility to provide RBI with data regarding present site subsurface conditions to be used for the purpose of a potential real estate transaction involving the sale of the Osage Plant property. Site assessment methods, field data, and soil and groundwater sample analytical results are discussed in this report.

EXECUTIVE SUMMARY

AWARE Environmental Inc.® (AEI) conducted an assessment of site soil and groundwater conditions at the Reeves Brothers, Inc. (RBI) Osage Plant in Bessemer City, North Carolina to provide data for the purpose of a potential real estate transaction involving the subject property. Prior to the site assessment, areas of potential environmental concern at the subject site were identified by AEI as based on site observations and historical operations conducted at the facility. Soil and groundwater conditions were investigated in these areas of potential environmental concern.

No semi-volatile organic compounds or total petroleum hydrocarbons were detected above the respective method detection limits in the soil samples that were analyzed. Metals concentrations detected in the soil samples were consistent with background levels and/or fall within the range of naturally occurring concentrations suggesting that the respective metals concentrations are naturally occurring. An evaluation of the metals analytical data does not indicate any adverse environmental impact to the site soils.

Analyses for volatile organic compounds (VOCs) detected 83 µg/kg acetone, 7.2 µg/kg carbon disulfide, 7.9 µg/kg tetrachloroethene and 92 µg/kg toluene in surficial grab sediment samples (OF-Grab and SWO-1 Surface) collected from below an off-site stormwater sewer outfall located to the south of the RBI site across Alabama Avenue.

Groundwater samples were collected from temporary assessment wells constructed within six (6) of the soil borings. Well screens were placed to intersect the local water table. Analyses of these groundwater samples did not detect any semi-volatile organic compounds. RCRA metals were either not detected or were detected in the groundwater samples at concentrations well below the 15A NCAC 2L Class GA groundwater quality standards. Petroleum hydrocarbons (i.e., benzene, toluene and xylenes) and chlorinated organic compounds (i.e., tetrachloroethene, trichloroethene, chloroform, carbon disulfide and cis-1,2-dichloroethene) were detected in a groundwater sample (W-2) collected from temporary well W-2 installed along the central-southern boundary of the property to investigate petroleum USTs and a stormwater drain located in the general area. Tetrachloroethene was also detected in a groundwater sample (OF-W) collected from temporary well OF installed in the immediate vicinity of an off-site stormwater sewer outfall situated downgradient and to the south of the site.

Based upon the recently acquired site assessment data, a limited groundwater impact has been identified in an area located in the vicinity of a former and several existing petroleum USTs and also located adjacent to a stormwater sewer which originates from an upgradient off-site

location and channels flow through the RBI site. Benzene, toluene and xylenes (BTX) were detected in groundwater sample W-2 suggesting a petroleum release. Because neither TPH nor individual aromatic hydrocarbons were detected in soil sample W-2(20), these soil analytical data do not suggest that a petroleum UST release has occurred in this locality. A potential exists that the petroleum hydrocabons were discharged into the stormwater sewer and leaked into the site soils at a remote on-site location. An off-site upstream discharge of petroleum substances has been documented.

The sampling data suggest a possible relationship between the occurrence of tetrachloroethene and toluene in the on-site and off-site samples. A common source would appear to be the stormwater sewer. The only discharge, other than surface water runoff, from the RBI facility to the city stormwater system is reportedly rainwater which is removed by roof drains that are connected to the stormwater sewer. Historical off-site discharges of waste crankcase oil into the stormwater sewer from an upgradient adjacent garage operator have been documented. No evidence of the use of tetrachloroethene at the Osage Plant has been identified by Reeves Brothers, Inc. Based upon available data, the constituents detected in the grab groundwater sample W-2 collected in the vicinity of the stormwater sewer may have been affected by materials originating from an upstream off-site location that were released into the stormwater sewer.

Site Soil and Groundwater Investigation Report

Reeves Brothers, Inc. Osage Plant Bessemer City, North Carolina

Background

Prior to conducting a site subsurface environmental assessment, AEI identified potential areas of environmental concern based upon site observations and historical plant operations. Areas of concern identified by AEI included: 1) the former storage of coal on the ground surface in the vicinity of the boiler room; 2) empty drum storage; 3) storage of products in the Paint Room; 4) petroleum underground storage tanks (USTs); and 5) sanitary and stormwater drains and sewers (Figure 2).

Soil and Groundwater Sampling and Analytical Methods

On March 13, 1996, a total of six (6) soil borings [B-1, B-2, B-3, W-1, W-2, BW-3] were mechanically advanced at the site with 2.25-inch I.D. hollow-stem augers using a CME 45 drill rig (Figure 2). All borings were initially advanced to a depth of 20 feet below grade. Soil samples were collected with a 2.0-inch split-spoon sampler at five-foot intervals (i.e., 5-7, 10-12, 15-17, and 20-22 feet) as the borings were advanced. Soil boring logs are provided in Attachment A. Soil sampling methods are discussed in further detail in AEI's Standard Procedures/Technical Methods included in Attachment B. Following sample collection, soil borings which were not further advanced to install temporary monitoring wells were abandoned by backfilling and compacting the soil cuttings removed from the borehole.

Soil samples collected at each sampling interval were visually classified and field-screened with a HNu Systems Inc. Model 101 photoionization detector (HNu) for the relative absence/presence of volatile organic vapors. A portion of each soil sample was placed in a ziplock plastic bag and then disaggregated. The probe of the HNu was used to pierce the sealed bag and the headspace soil vapor concentration was measured with the field detector. Elevated readings were observed in soil samples collected at the subject site. Because organic

vapors were not suspected in the samples and considerable moisture was present, sample headspace vapors were confirmed using a Foxboro Century 128 Organic Vapor Analyzer (OVA) back at the office. In general, elevated readings were not observed as a result of the confirmatory OVA screenings. OVA readings are shown on the boring logs included in Attachment A. Soil headspace vapor measurement methods are discussed in further detail in AEI's Standard Procedures/Technical Methods included in Attachment B.

Soil samples were collected from each sampling interval and placed in laboratory-supplied sample containers for the target analytes. Containers were labeled and then placed in an insulated cooler with ice. Samples collected from each boring at a depth interval of 20-22 feet below grade were selected for laboratory analyses of target constituents.

Three (3) borings [W-1, W-2, and BW-3] were further advanced to depths below the local water table in order to install temporary wells to collect shallow groundwater samples for target analyses (Figure 2). Boring logs and temporary well construction schematics are included in Attachment A. Each temporary well was constructed of 2-inch-diameter Schedule 40 PVC riser and a 10-foot length of 0.01-inch slot size well screen. The boring annulus for the entire screen length was filled with sand to provide a filter pack. The boring was then sealed at the surface to prevent the entry of unwanted soils or debris. Each temporary well was allowed to recharge and then was developed by purging with a Teflon bailer until sediment in the bailer was minimized. Time was allowed for further settling of fines in the water column in each well before groundwater samples were collected. Temporary well construction and well development, purging and sampling methods are discussed in further detail in AEI's Standard Procedures/Technical Methods included in Attachment B. Following sample collection, all temporary well materials were removed from the boreholes and the boreholes were then filled with cement grout.

On April 25, 1996, three (3) additional soil borings [BW-4, BW-5 and OF] were mechanically advanced at the site and at one off-site location with 2.25-inch I.D. hollow-stem augers using a CME 750 drill rig (Figure 2). All borings were initially advanced to a depth of 20 feet below grade. Soil samples were collected with a 2.0-inch split-spoon sampler at five-foot intervals (i.e., 5-7, 10-12, 15-17, and 20-22 feet) as the borings were advanced. Soil boring logs are provided in Attachment A. One surficial sediment sample [OF-Grab] was collected with a stainless steel hand auger from the area immediately beneath an off-site stormwater sewer outfall located to the south of the facility across Alabama Avenue (Figure 2). Samples collected at the off-site stormwater sewer outfall were analyzed for target compounds to evaluate the potential for off-site contamination to impact the RBI facility as a result of leaks or discharges from the stormwater drain which crosses the RBI site.

Soil samples collected at each sampling interval were visually classified and field-screened with a HNu photoionization detector for the relative absence/presence of volatile organic vapors. A portion of each soil sample was placed in a ziplock plastic bag and then disaggregated. The probe of the HNu was used to pierce the sealed bag and the headspace soil vapor concentration was measured with the field detector. Again elevated soil vapor measurements were observed in several soil samples collected during this additional site investigation. To confirm the elevated soil vapor measurements observed in the field, samples were screened again with an OVA after they were brought back to the office. In general, elevated readings were not observed as a result of the confirmatory OVA screenings. OVA readings are shown on the boring logs included in Attachment A. Soil sampling and screening methods are discussed in further detail in AEI's Standard Procedures/Technical Methods included in Attachment B.

Soil samples were collected from each sampling interval and placed in laboratory-supplied sample containers for the target analytes. Containers were labeled and then placed in an insulated cooler with ice. Samples collected from each boring at a depth interval of 20-22 feet below grade were selected for laboratory analyses of target constituents.

B-2(15) which was analyzed for total lead only, these samples were analyzed for the following analytes:

| Analyte | Analytical Method |
|---------------------------------|--------------------------------|
| Volatile organic compounds | EPA Method 8240 |
| Semi-volatile organic compounds | EPA Method 8270 |
| Total petroleum hydrocarbons | EPA Method 8015M/3550 and 5030 |
| Total RCRA metals | Appropriate EPA Methods |

Soil samples collected for organic analyses were sent to Hydrologic, Inc. in Frankfort, Kentucky, and soil samples collected for metals analyses were sent to Hydrologic, Inc. in Asheville, North Carolina. All sample transfers were conducted under chain-of-custody protocol. Chain-of-custody records are included with the laboratory analytical reports in Attachment C.

A summary of initial soil analytical data is provided Table 1(a). The sample concentrations for each metal analyte are compared with the background sample BW-3(20) concentrations, naturally-occurring concentration ranges, USEPA Office of Solid Waste and Emergency Response (OSWER) Soil Screening Levels (SSLs), and USEPA Region III Risk-Based Concentrations (RBCs). EPA OSWER SSLs are chemical concentrations in soil that represent a level of contamination below which there is no concern under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as "Superfund"), provided conditions associated with the SSLs are met. SSLs estimate an acceptable concentration for which a risk of migration of a particular chemical constitute from soil to groundwater would not likely occur. USEPA Region III RBCs are concentrations which constitute an acceptable risk to exposure to soil ingestion in a residential land use setting.

Soil Metals Analytical Results

Mercury, selenium and silver were not generally detected above the method detection limits within the site soil samples, with the exception of selenium being detected at low concentrations of 0.57 mg/kg and 0.68 mg/kg in background samples BW-3(20) and BW-3(40), respectively.

All arsenic levels in the soil samples are well below the OSWER SSL which evaluate a risk for migration of the respective analyte from soil to groundwater. Site soil arsenic concentrations occur at the extreme lower end of the naturally-occurring concentration range and are generally less than or essentially comparable to background sample arsenic levels. Artificially elevated levels of arsenic are not indicated by the analytical data.

With the exception of samples collected from boring B-2, lead concentrations detected in the site soil samples are less than the site background sample concentrations. Lead levels of 34.7 mg/kg and 35.28 mg/kg detected in samples B-2(15) and B-2(20), respectively, fall at the lower end of the naturally-occurring soil lead range of 2.0 - 200 mg/kg. Significantly elevated levels of lead in the site soils are not indicated by the analytical data.

Cadmium and chromium were not detected above method detection limits in background soil samples; yet were detected in trace to low concentrations in other site soil samples. Both soil cadmium and chromium levels were well below the respective OSWER SSLs which evaluate a risk for migration of the respective analyte from soil to groundwater. Artificially elevated levels of cadmium and chromium are not indicated by the analytical data.

Barium levels in the site soils appear to be generally consistent with background sample concentrations. All detected barium levels occur at the extreme lower end of the naturally-occurring concentration range. Artificially elevated levels of barium are not indicated by the analytical data.

Soil Organics Analytical Results

With the exception of the surficial sediment samples collected at the off-site stormwater sewer outfall, no volatile or semi-volatile organic compounds were detected above the respective method detection limits in any site soil sample as a result of analyses by EPA Methods 8240 and 8270 nor total petroleum hydrocarbons as a result of analyses by EPA Method 8015M with sample preparations by SW-846 Methods 3550 and 5030. These data suggest materials have been discharged to the stormwater sewer from an upstream location and have flowed across the RBI site to the off-site outfall. Laboratory analytical data reports are provided in Attachment C.

Groundwater Sampling Results

Grab groundwater samples (W-1, W-2 and BW-3) were collected from each initial temporary well for laboratory analyses. These samples were analyzed for the following analytes:

| Analyte | Analytical Method |
|---------------------------------|--|
| Volatile organic compounds | EPA Methods 601 and 602 |
| Semi-volatile organic compounds | EPA Method 625 |
| Total RCRA Metals | EPA Methods 6010 and 7470/7471 (mercury) |

Groundwater samples collected for organic analyses were sent to Hydrologic, Inc. in Frankfort, Kentucky, and groundwater samples collected for metals analyses were sent to Hydrologic, Inc. in Asheville, North Carolina. All sample transfers were conducted under chain-of-custody protocol. Chain-of-custody records are included with the laboratory analytical reports in Attachment C.

Groundwater Metals Analytical Results

A summary of groundwater analytical data is provided in Table 1(b). The sample concentrations for each metal analyte are compared with the background sample BW-3

concentrations and the 15A North Carolina Administrative Code Subchapter 2L .0202 groundwater quality standards (2L standards). Groundwater samples were collected for total RCRA metals analysis as unfiltered and acid-preserved.

Total concentrations of arsenic, chromium, lead and silver were not detected above method detection limits in the site groundwater samples. Barium, cadmium and mercury were detected in the groundwater samples at concentrations below their respective 2L groundwater quality standards (Table 1(b)). Selenium was detected at a trace level of 0.008 mg/l in well sample W-1 which is below its 2L standard of 0.05 mg/l. Artificially elevated levels of RCRA metals are not indicated by the site groundwater analytical data.

Groundwater Organic Analytical Results

No semi-volatile organic compounds were detected above the respective method detection limits in any site groundwater sample as a result of analyses by EPA Method 625.

Volatile organic compounds were detected in only initial site assessment well W-2, which is located near the stormwater sewer which runs through the RBI site. Both purgeable halocarbon and aromatic compounds were identified in well sample W-2. The sample analyses detected 167 µg/l tetrachloroethene, 2.1 µg/l trichloroethene, 62.1 µg/l benzene, 14.9 µg/l toluene, and 27.6 µg/l xylenes. A duplicate sample was analyzed to confirm the initially detected VOC levels. Duplicate sample results were similar to the initial results with the exception that 5.4 µg/l chloroform and 2.1 µg/l cis-1,2-dichloroethene were also detected by the latter sample analyses. Tetrachloroethene, trichloroethene, chloroform and benzene were detected in well sample W-2 at concentrations which exceed their respective 2L groundwater standards.

Follow-Up Site Subsurface Assessment Results

Based on the findings of the initial site soil and groundwater assessment, a source of the identified petroleum and chlorinated VOCs was suspected to be a release from a nearby stormwater sewer located along the southern boundary of the site. The stormwater sewer crosses the site in the southwestern quadrant and exits the site near the midpoint of the southern property boundary along Alabama Avenue (Figure 2). The stormwater sewer drain enters the site from an off-site location along the western property boundary and channels stormwater through the RBI site. The only discharge, other than surface water runoff, from the RBI facility to the city stormwater system is reportedly rainwater which is removed by roof drains that are connected to the stormwater sewer. No evidence of the use of tetrachloroethene at the Osage Plant has been identified by Reeves Brothers, Inc. Historical off-site discharges of waste crankcase oil into the stormwater sewer from an upgradient adjacent garage operator have been documented.

To further investigate the potential for discharges of regulated constituents into the stormwater sewer, additional soil and groundwater samples were collected in the immediate vicinity of the stormwater sewer outfall located approximately 20 feet to the south side of Alabama Avenue at an off-site location.

Outfall Soil Organics Analytical Results

A summary of outfall soil sample analytical data is provided in Table 1(c). Two (2) surface sediment samples [OF-Grab and SOW-1 (Surface)] were collected from a small ponded area located immediately below the off-site stormwater sewer outfall. Analyses for VOCs detected 83 µg/kg acetone, 7.2 µg/kg carbon disulfide, 7.9 µg/kg tetrachloroethene in sample OF-Grab, and 92 µg/kg toluene in sample SOW-1 (Surface). In addition, petroleum odors indicative of a relatively heavy oil were suspected in sample SOW-1 (Surface) and the presence of high boiling point petroleum hydrocarbons were confirmed by the chromatogram. VOC analyses of subsurface soil samples [OF-5', OF-10', OF-15', OF-20', SWO-1 (5')]

collected to a depth of 20 feet near the outfall did not detect any target VOCs above the method detection limits.

Outfall Groundwater Organics Analytical Results

Groundwater sample OF-W was collected from temporary assessment well OF installed along the west bank of the drainage ditch which carries stormwater away from the stormwater outfall. The well was situated approximately 15 feet from the outfall. Sample analyses for VOCs detected 60 µg/l tetrachloroethene. All other target (EPA Methods 601 and 602) analytes were not detected above the method detection limits.

Evaluation of Site Groundwater Flow

Water levels in the temporary wells were allowed to equilibrate for approximately two (2) hours following the temporary well installations. Prior to collecting groundwater samples from the wells, the well water levels were measured with reference to the adjacent ground surface. The topographic elevations at the well locations were approximated from an area topographic quadrangle (USGS 7.5-Minute Topographic Quadrangle, Bessemer City, NC, 1973). These interpolated site elevations were later field-checked for relative accuracy. Well elevation and water level data are summarized below. Based on these elevation data, a site potentiometric surface (water table contour) map was generated to evaluate the general groundwater flow gradient and direction (Figure 3). The average hydraulic gradient across the site was approximately 0.036 feet/foot. The general groundwater flow direction was to the south in the western half of the site and to the south-southeast in the eastern half of the site.

Well Elevation and Water Level Data

| Temporary Well ID | Well Water Level (feet below grade) | Approximate Ground Surface Elevation (MSL)* | Approximate Water Table Elevation (MSL)* |
|-------------------|-------------------------------------|---|--|
| W-1 | 27.20 | 893 | 865.8 |
| W-2 | 23.10 | 887 | 863.9 |
| BW-3 | 29.92 | 900 | 870.1 |
| BW-4 | 27.70 | 895 | 867.3 |
| BW-5 | 27.00 | 893.5 | 866.5 |
| OF | 21.10 | 880 | 858.9 |

Table Notes:

- 1) Ground surface elevations interpolated from USGS topographic quadrangle with subsequent field-checking to improve accuracy.
- 2) * Error margin is estimated at ± 1.0 foot.
- 3) Water levels in wells W-1, W-2, and BW-2 were measured on March 13, 1996.
- 4) Water levels in wells BW-4, BW-5 and OF were measured on April 25, 1996.

Conclusions

Based upon the recently acquired site assessment data, a limited groundwater impact has been identified in an area situated along the central-southern boundary of the property. A former 500-gallon gasoline UST and two (2) existing No. 5 fuel oil USTs, and a stormwater sewer (which originates from an off-site location and exits the subject site along the central-southern boundary) are situated in this general area.

Benzene, toluene and xylenes (BTX) were detected in an area groundwater sample (W-2). In addition, tetrachloroethene and its degradation products were also identified in groundwater sample W-2. However, petroleum hydrocarbons and chlorinated organic compounds were not detected in a soil sample (W-2(20)) collected from a depth of 20 feet below grade from the well boring. The absence of these constituents in the overlying unsaturated soil does not indicate a nearby source for the environmental impact to the underlying site groundwater. A

remote release possibly due to a leaking stormwater drain is thought to be a likely source of the detected dissolved-phase constituents.

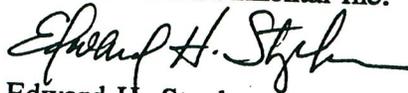
Further investigation at a stormwater sewer outfall occurring at an off-site location across Alabama Avenue identified the presence of tetrachloroethene in a groundwater sample and toluene in a surficial sediment sample. These data suggest a possible relationship between the occurrence of tetrachloroethene and toluene in the on-site and off-site samples. The common source appears to be the stormwater sewer. Historical off-site discharges of waste crankcase oil into the stormwater from an upgradient adjacent garage operator have been documented. No evidence of the use of tetrachloroethene at the Osage Plant has been identified by Reeves Brothers, Inc. The only discharge, other than surface water runoff, from the RBI facility to the city stormwater system is reportedly rainwater which is removed by roof drains that are connected to the stormwater sewer.

Because VOCs were not detected in soil samples collected at the RBI site, it is suspected the constituents detected at the off-site stormwater outfall originated upstream of the RBI facility. Based on available data, the constituents detected in the grab groundwater sample W-2 collected in the vicinity of the stormwater sewer may have been affected by materials originating from an upstream off-site location that were released into the stormwater drain.

AWARE Environmental Inc. appreciates this opportunity to provide continuing environmental consulting services to Parker, Poe, Adams and Bernstein, L.L.P. Should you have any questions concerning this report, please do not hesitate to contact Michael Smith or me at (704) 845-1697.

Sincerely,

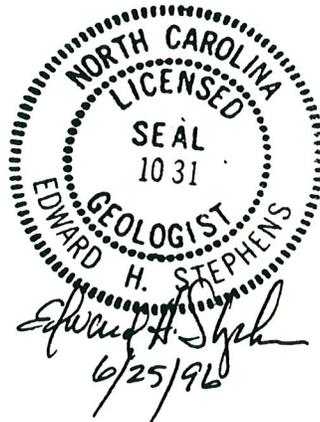
AWARE Environmental Inc.

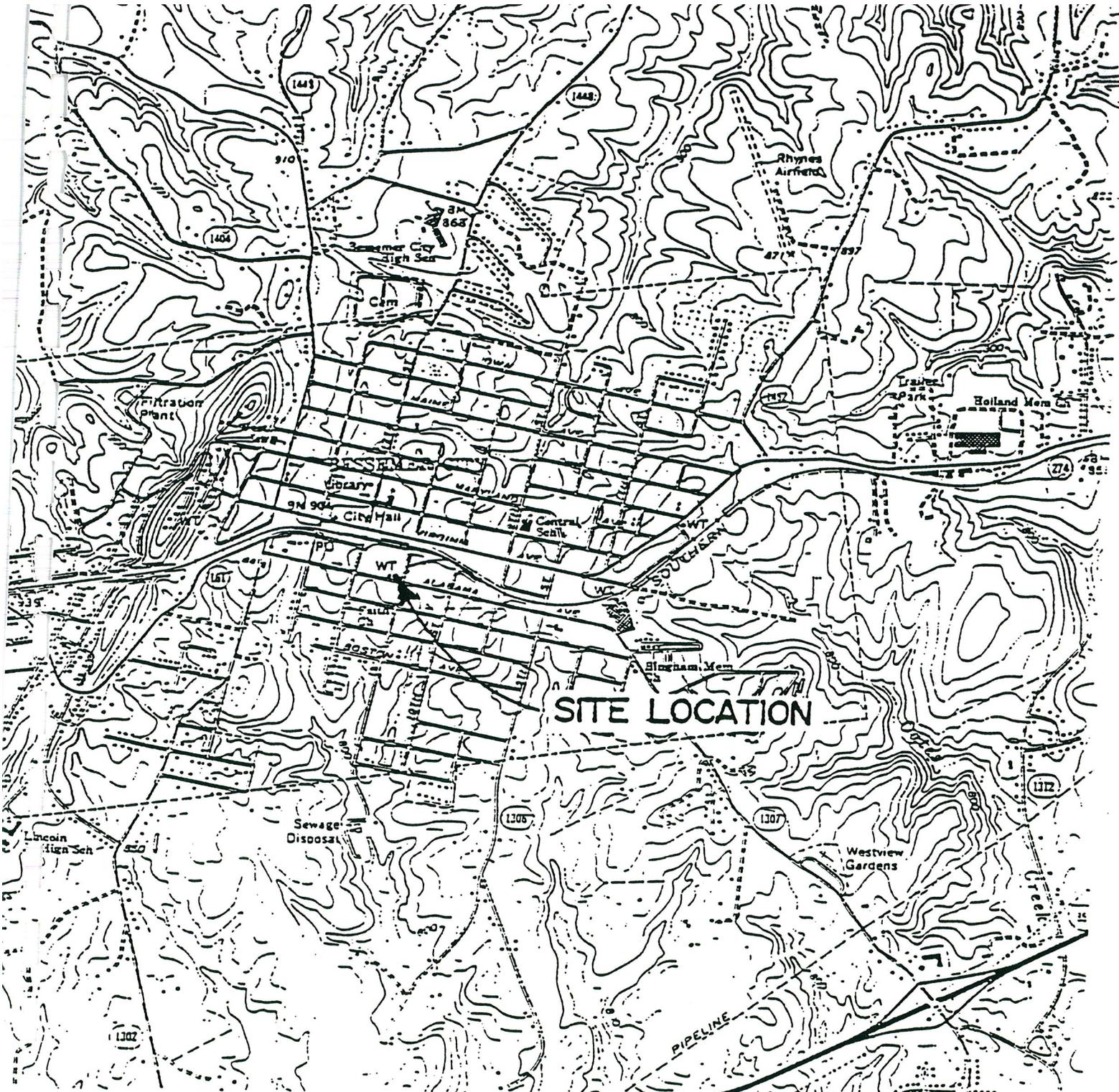


Edward H. Stephens
Senior Hydrogeologist

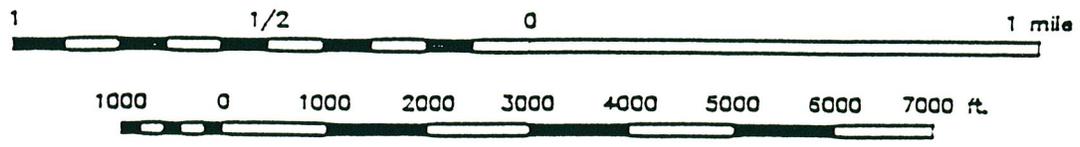
Attachments

cc: File
M. Smith, AEI





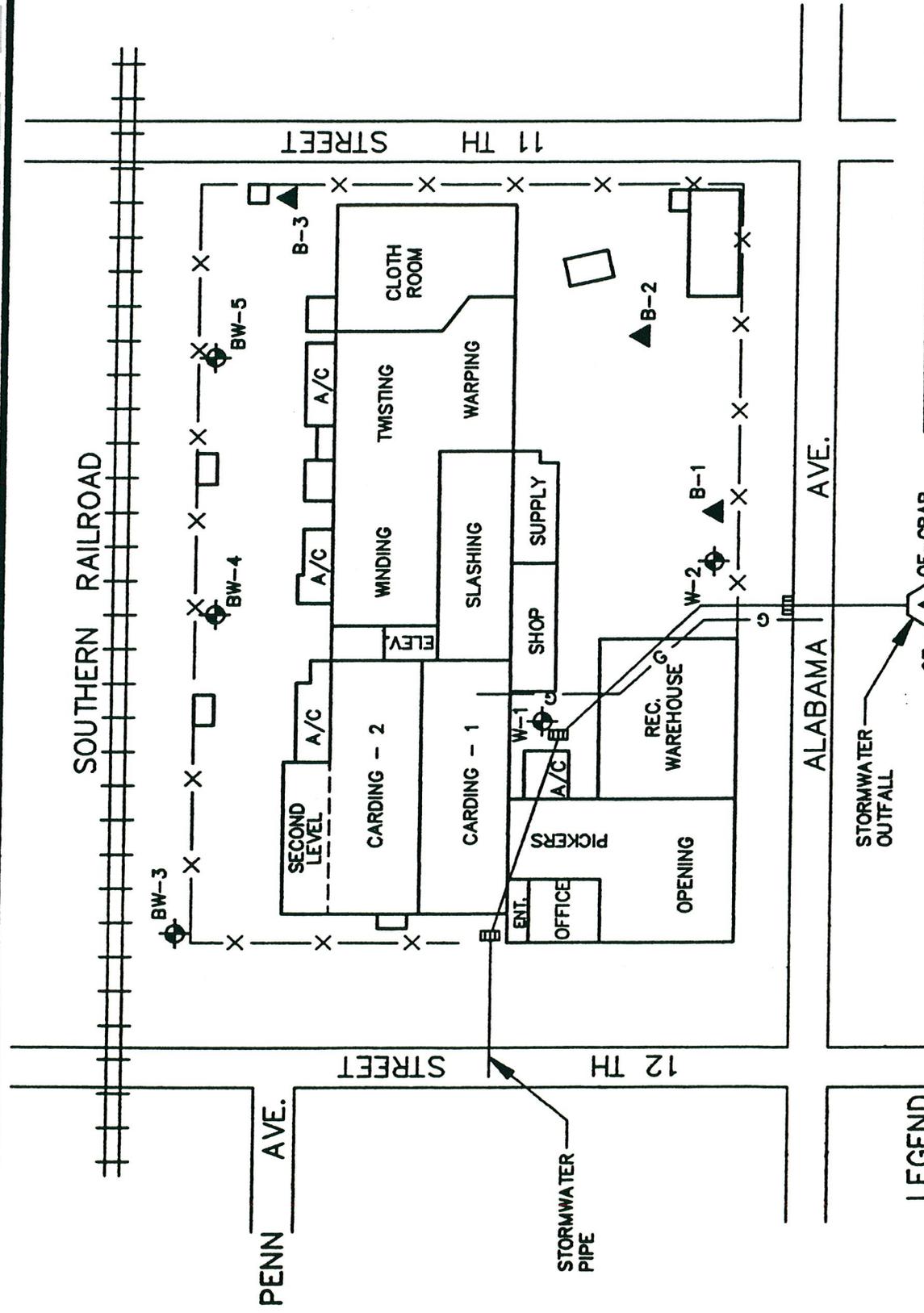
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Source:
 USGS, Bessemer City, NC
 Quadrangle Map, 1973

Figure 1
 SITE LOCATION MAP

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LEGEND

- ⊕ TEMPORARY MONITORING WELL
- ▲ TEMPORARY SOIL BORING
- ▤ STORMWATER CATCH BASIN
- X- FENCE
- C- NATURAL GAS LINE

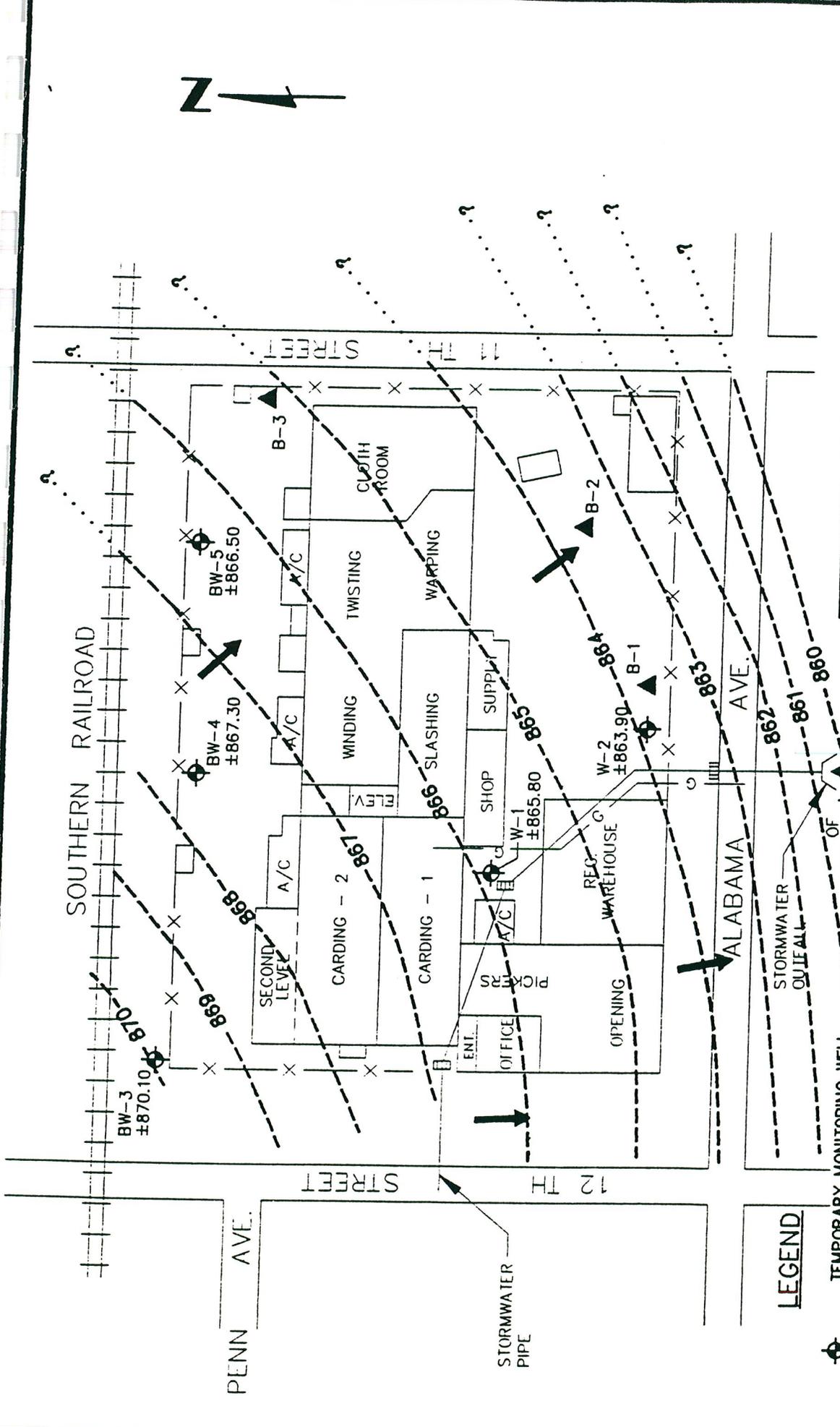
NOTE:
 TEMPORARY WELL AND SOIL BORING
 LOCATIONS ARE APPROXIMATE.

SITE MAP

REEVES BROTHERS, INC.
BESSEMER CITY, NORTH CAROLINA

| | |
|-------------------------|----------------------|
| SCALE NOT TO SCALE | APPROVED BY: J.K.S. |
| DATE: JUNE 1996 | REVISED |
| PROJECT NUMBER: N156-33 | DRAWING NO. FIGURE 2 |

AWARE
 ENVIRONMENTAL INC.



WATER TABLE CONTOUR MAP

REEVES BROTHERS, INC.
 BESSEMER CITY, NORTH CAROLINA

SCALE NOT TO SCALE
 DATE: JUNE 1996
 PROJECT NUMBER: N156-33

ALVARE INC.
 DRAWN BY: J.K.S.
 REVISED
 DRAWING NO. JUNE 24, 1996 3:54:00 p.m.
 Drawing: D:\5633503.DWG

FIGURE 3

LEGEND

- TEMPORARY MONITORING WELL
- TEMPORARY SOIL BORING
- STORMWATER CATCH BASIN
- FENCE
- NATURAL GAS LINE
- WATERTABLE CONTOUR LINE
- GENERAL GROUNDWATER FLOW DIRECTION

REFERENCE NOTE:

WATER TABLE ELEVATIONS HAVE BEEN ESTIMATED FROM WELL WATER LEVEL DATA AND APPROXIMATE GROUND SURFACE ELEVATIONS TAKEN FROM TOPOGRAPHIC MAP AND FIELD CHECKED.

NOTE:

TEMPORARY WELL AND SOIL BORING LOCATIONS ARE APPROXIMATE.

Table 1(a) Reeves Brothers, Inc. Bessemer City, NC Soil Sample Analytical Summary

| Sample I.D. | BW-3(20) | BW-3(40) | W-1 (20) | W-2 (20) | B-1 (20) | B-2 (15) | B-2 (20) | B-3 (20) | Nat.-Occ. Range | OSWER SSL | EPA RBC |
|--------------------------|----------|----------|----------|----------|----------|----------|--------------------------|----------|-----------------|-----------|---------|
| Analyte (mg/kg) | | | | | | | | | | | |
| Total RCRA Metals | | | | | | | | | | | |
| Arsenic | 0.71 | 0.85 | 0.85 | 0.37 | 0.29 | NA | 0.28 | 0.31 | 1.0 - 40 | 15 | 23 |
| Lead | 7.63 | 12.5 | 7.5 | 3.69 | 4.33 | 34.7 | 35.28/33.40 ¹ | 4.75 | 2.0 - 200 | NS | 400 |
| Mercury | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | NA | <0.02 | <0.02 | 0.01 - 0.08 | 3 | 23 |
| Selenium | 0.57 | 0.68 | <0.15 | <0.15 | <0.15 | NA | <0.15 | <0.15 | 0.1 - 2.0 | 3 | 390 |
| Silver | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | NA | <0.05 | <0.05 | 0.1 - 5.0 | NS | 390 |
| Barium | 12.14 | 19.68 | 39.46 | 27.08 | 12.03 | NA | 8.4 | 11.68 | 100 - 3500 | 32 | 5500 |
| Cadmium | <0.05 | <0.05 | 1.03 | 1.67 | 1.34 | NA | 1.27 | 2.33 | 0.01 - 7.0 | 6 | 39 |
| Chromium | <0.25 | <0.25 | 0.98 | 5.43 | 4.83 | NA | 2.78 | 11.09 | 5.0 - 3000 | 19* | 390* |
| EPA 8240 | all BDL | NA | all BDL | all BDL | | | |
| EPA 8270 | all BDL | NA | all BDL | all BDL | NCDEM AL | | |
| EPA 8015M/3550 | all BDL | NA | all BDL | all BDL | 40 | | |
| EPA 8015M/5030 | all BDL | NA | all BDL | all BDL | 10 | | |

All units in milligrams/kilogram (mg/kg).

BDL = Below Method Detection Limit.

Nat.-Occ. Range = Naturally occurring concentrations of metals in soils (J. Dragun, The Soil Chemistry of Hazardous Materials, HMCRI, 1988).

OSWER SSL = USEPA Office of Solid Waste and Emergency Response Soil Screening Level for migration pathway to groundwater.

EPA RBC = USEPA Region III Risk-Based Concentrations for soil ingestion in residential land use setting.

NS = Not Specified.

NA = Not Analyzed.

* = Values given for Cr 6+ (hexavalent Cr only).

¹ Sample reanalyzed for confirmation.

All samples collected by AEI personnel on 3/13/96.

Table 1(b) Reeves Brothers, Inc. Bessemer City, NC Groundwater Sample Analytical Summary

| Sample I.D. | BW-3 | BW4-W | BW5-W | W-1 | W-2 | W-2 ^R | OF-W | NCDEM |
|--------------------------|---------|---------|---------|---------|---------|------------------|---------|---------|
| Sample Date | 3/13/96 | 4/25/96 | 4/25/96 | 3/13/96 | 3/13/96 | 3/13/96 | 5/25/96 | 2L STD. |
| Analyte | | | | | | | | |
| Total RCRA Metals | | | | | | | | |
| Arsenic | (mg/l) | NA | NA | <0.003 | <0.003 | NA | NA | 0.05 |
| Lead | <0.01 | NA | NA | <0.01 | <0.01 | NA | NA | 0.015 |
| Mercury | 0.0003 | NA | NA | 0.0002 | 0.0008 | NA | NA | 0.0011 |
| Selenium | <0.003 | NA | NA | 0.008 | <0.003 | NA | NA | 0.05 |
| Silver | <0.001 | NA | NA | <0.001 | <0.001 | NA | NA | 0.018 |
| Barium | 0.151 | NA | NA | 0.087 | 0.065 | NA | NA | 2 |
| Cadmium | 0.002 | NA | NA | 0.001 | 0.001 | NA | NA | 0.005 |
| Chromium | <0.005 | NA | NA | <0.005 | <0.005 | NA | NA | 0.05 |
| EPA 625 | all BDL | NA | NA | all BDL | all BDL | NA | NA | |
| EPA 601 | (ug/l) | | | | | | | |
| Tetrachloroethene | BDL | BDL | BDL | BDL | 167 | 143 | 60 | 0.7 |
| Trichloroethene | BDL | BDL | BDL | BDL | 2.1 | 3.5 | BDL | 2.8 |
| Chloroform | BDL | BDL | BDL | BDL | BDL | 5.4 | BDL | 0.19 |
| Cis-1,2-Dichloroethene | BDL | BDL | BDL | BDL | BDL | 2.1 | BDL | 70 |
| EPA 602 | (ug/l) | | | | | | | |
| Benzene | BDL | BDL | BDL | BDL | 62.1 | 55.8 | BDL | 1 |
| Toluene | BDL | BDL | BDL | BDL | 14.9 | 11.4 | BDL | 1000 |
| Xylene (Total) | BDL | BDL | BDL | BDL | 27.6 | 10.8 | BDL | 530 |

R = Sample Reanalyzed.

BDL = Below Method Detection Limit.

NS = Not Specified.

NA = Not Analyzed.

NCDEM 2L STD. = Class GA groundwater quality standards specified in 15A NCAC Subchapter 2L .0202. Samples collected by AEI personnel on indicated dates.

Table 1(c) Outfall Soil Sample Analytical Summary

| Sample I.D. | OF-Grab | OF-5' | OF-10' | OF-15' | OF-20' | SWO-1(Surface) | SWO-1 (5') |
|-------------------|---------|---------|---------|---------|--------|----------------|------------|
| Sample Date | 4/25/96 | 4/25/96 | 4/25/96 | 4/25/96 | 5/3/96 | 5/3/96 | 5/3/96 |
| Analyte | (ug/kg) | | | | | | |
| EPA 8240 | | | | | | | |
| Acetone | 83 | BDL | BDL | BDL | BDL | BDL | BDL |
| Carbon Disulfide | 7.2 | BDL | BDL | BDL | BDL | BDL | BDL |
| Tetrachloroethene | 7.9 | BDL | BDL | BDL | BDL | BDL | BDL |
| Toluene | BDL | BDL | BDL | BDL | BDL | 92 | BDL |

All units in ug/kg.

BDL = Below Method Detection Limit.

Samples collected by AEI personnel on indicated dates.

ATTACHMENT A

SOIL BORING LOGS

AND

TEMPORARY WELL CONSTRUCTION SCHEMATICS

AWARE Environmental Inc.

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PROJECT NO: N156-33 BORING NO: B-2 PROJECT NAME: Reeves, Bessemer City, NC
 DRILLER: Chris Bender DATE FINISHED: 3/13/96 FIELD PERSONNEL: Ed Stephens
 T.O.C. ELEV.: NA
 GROUND-SURFACE-ELEV.: NA GWL-DATE/TIME: NA GWL-ELEV.: NA
 DRILLING METHOD: Hollow Stem Auger DRILL-EQUIP: GE-45
 CONTRACTOR: Environmental Construction Services CHECKED BY: Roger Smith

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | PROFILE | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|-------------------|--|-------------------------------|------|---|
| | | | | BKG | MEAS | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7 eV PROBE |
| 5.00 | | [Hatched Profile] | SILT: TAN WITH SLIGHT BURGUNDY; WITH WHITE MOTTLING; CLAYEY SILT (ML) | 1.7 | 6.8 | |
| 10.00 | | [Hatched Profile] | SILT: RESIDUAL; TAN/BURGUNDY; STRATIFIED WITH WHITE AND BLACK; LITTLE OR NO MICA VERY FINE SANDY SILT (ML) | 1.7 | 5.3 | |
| 15.00 | | [Hatched Profile] | SILT: RESIDUAL; TAN/BURGUNDY; STRATIFIED WITH WHITE AND BLACK; LITTLE OR NO MICA VERY FINE SANDY SILT (ML) | 1.7 | 4.7 | |
| 20.00 | | [Hatched Profile] | SILT: RESIDUAL; BURGUNDY AND WHITE; STRATIFIED WITH WHITE AND BLACK; LITTLE OR NO MICA VERY FINE SANDY SILT (ML) | 1.8 | 3.5 | BORING TERMINATED AT 22 FEET BELOW GRADE |
| 25.00 | | | | | | |

AWARE Environmental Inc.

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PROJECT NO: N156-33 BORING NO: B-3 PROJECT NAME: Reeves, Bessemer City, NC
 DRILLER: Chris Bender DATE FINISHED: 3/13/96 FIELD PERSONNEL: Ed Stephens
 T.O.C. ELEV.: NA
 GROUND-SURFACE-ELEV.: NA GWL-DATE/TIME: NA GWL-ELEV.: NA
 DRILLING METHOD: Hollow Stem Auger DRILL-EQUIP: CM-45
 CONTRACTOR: Environmental Construction Services CHECKED BY: Roger Smith

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | PROFILE | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|-------------------------|---|-------------------------------|------|---|
| | | | | BG | MEIS | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7 eV PROBE |
| 5.00 | | [Hatched Pattern] | CLAY: TAN/YELLOW; SILTY CLAY (CL) | 1.9/4.2 | | |
| 10.00 | | [Cross-hatched Pattern] | SILT: RESIDUAL; BROWN; STRATIFIED WITH BLACK; VERY FINE SANDY CLAYEY SILT (ML) | 1.9/3.7 | | |
| 15.00 | | [Cross-hatched Pattern] | SILT: RESIDUAL; DARK BROWN; STRATIFIED WITH BLACK; VERY FINE SANDY CLAYEY SILT (ML) | 2.0/4.0 | | |
| 20.00 | | [Cross-hatched Pattern] | SILT: RESIDUAL; WHITE/YELLOW; STRATIFIED CLAYEY SILT (ML) | | | |
| 25.00 | | | | | | BORING TERMINATED AT 22 FEET BELOW GRADE |

AWARE Environmental Inc.

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PROJECT NO: N156-33

BORING NO: W-1

PROJECT NAME: Reeves, Bessemer City, NC

DRILLER: Chris Bender

DATE FINISHED: 3/13/96

FIELD PERSONNEL: Ed Stephens

T.O.C. ELEV.: NA

GROUND-SURFACE-ELEV.: NA

GWL-DATE/TIME: NA

GWL-ELEV.: NA

DRILLING METHOD: Hollow Stem Auger

DRILL-EQUIP: CME-45

CONTRACTOR: Environmental Construction Services

CHECKED BY: Roger Smith

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | PROFILE | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|---|---|-------------------------------|------|--|
| | | | | BKG | MEAS | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7 eV PROBE |
| 5.00 | |  | CLAY: TAN/BROWN; SILTY CLAY (CL) | 1.5 | 5.5 | |
| 10.00 | |  | SILT: RESIDUAL; YELLOW/TAN; STRATIFIED CLAYEY SILT (ML) | 1.5 | 15.0 | |
| 15.00 | |  | SILT: RESIDUAL; OLIVE GREEN/TAN; STRATIFIED WITH WHITE MOTTLING; VERY FINE SANDY SILT (ML) | 1.8 | 10.0 | |
| 20.00 | |  | SILT: RESIDUAL; YELLOW/TAN; STRATIFIED WITH WHITE AND BLACK MOTTLING; VERY FINE SANDY SILT (ML) | 1.5 | 3.5 | |
| 25.00 | | | | | | BORING TERMINATED AT 40 FEET BELOW GRADE AS A TEMPORARY WELL WATER LEVEL AT 27.20 FT BELOW GRADE |

AWARE Environmental Inc.

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PROJECT NO: N156-33 BORING NO: 4-3 PROJECT NAME: Reeves, Bessemer City, NC
 DRILLER: Chris Bender DATE FINISHED: 3/13/96 FIELD PERSONNEL: Ed Stephens
 T.O.C. ELEV.: NA
 GROUND-SURFACE-ELEV.: NA GWL-DATE/TIME: NA GWL-ELEV.: NA
 DRILLING METHOD: Hollow Stem Auger DRILL-EQUIP: DM-45
 CONTRACTOR: Environmental Construction Services CHECKED BY: Roger Smith

| DEPTH (FT) | PENETRATION RESISTANCE (blows/Ft) | DEPTH | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|-------|---|-------------------------------|------|--|
| | | | | BKG | MEAS | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7 eV PROBE |
| 5.00 | | 5.00 | CLAY: TAN/YELLOW SILTY CLAY (CL) | -7 | 16.0 | |
| 10.00 | | 10.00 | SILT: RESIDUAL; WHITE SLIGHTLY TAN; STRATIFIED; VERY FINE SANDY SILT (ML) | -7 | 4.0 | |
| 15.00 | | 15.00 | SILT: RESIDUAL; TAN/YELLOW & WHITE; STRATIFIED; VERY FINE SANDY SILT (ML) | -7 | 5.0 | |
| 20.00 | | 20.00 | SILT: RESIDUAL; TAN/YELLOW & WHITE; STRATIFIED; VERY FINE SANDY SILT (ML) | 1.4 | 18.0 | |
| 25.00 | | 25.00 | | | | |
| 30.00 | | 30.00 | SILT: TAN CLAYEY SILT (ML) | 1.2 | 18.1 | |
| 35.00 | | 35.00 | | | | |
| 40.00 | | 40.00 | SILT: YELLOW/TAN CLAYEY SILT (ML) | 1.2 | 16.4 | BORING TERMINATED AT 40 FT BELOW GRADE AS A TEMPORARY WELL WATER LEVEL AT 29.92 FT BELOW GRADE |
| 45.00 | | 45.00 | | | | |

AWARE Environmental Inc.

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PROJECT NO: N156-33
 DRILLER: NA

BORING NO: SW0-1
 DATE FINISHED: 5/3/96

PROJECT NAME: Reeves, Bessemer City, NC
 FIELD PERSONNEL: Randy Smith

T.O.C. ELEV.: NA

GROUND-SURFACE-ELEV.: NA

GWL-DATE/TIME: NA

GWL-ELEV.: NA

DRILLING METHOD: Hand Auger

DRILL-EQUIP: NA

CONTRACTOR: NA

CHECKED BY: Sally Hartness

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | PROLITHIUM | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|------------|---|-------------------------------|--------|---|
| | | | | BKG | MEAS | |
| 0.00 | 0 20 40 60 80 100 | | SAND: WET; BLACK ORGANIC RICH SAND; W/LEAVES, STICKS, ETC.; STRONG PETROLEUM ODOR DETECTED (SM) | 1/ | >1000 | VOLATILE ORGANIC VAPORS MEASURED WITH FOXBORO 128 OVA |
| | | | CLAY: SLIGHTLY MOIST; YELLOW-TAN CLAY (CL) | | | |
| | | | CLAY: DRY; RED CLAY W/YELLOW MOTTLING (CL) | | | |
| 5.00 | | | BORING TERMINATED AT 5 FEET BELOW GRADE | 1/18 | ** 1/9 | ** MEASURED FOR METHANE USING CARBON FILTER PROBE |

AWARE Environmental Inc.

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PROJECT NO: N156-33 BORING NO: 0F PROJECT NAME: Reeves, Bessemer City, NC

DRILLER: Chris Bender DATE FINISHED: 4/25/96 FIELD PERSONNEL: Ed Stephens

T.O.C. ELEV.: NA

GROUND-SURFACE-ELEV.: NA GWL-DATE/TIME: NA GWL-ELEV.: NA

DRILLING METHOD: Hollow Stem Auger DRILL-EQUIP: ME-45

CONTRACTOR: Environmental Construction Services CHECKED BY: Sally Hartness

| DEPTH (FT) | PENETRATION RESISTANCE (blows/Ft) | PROFILE | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|---------|--|-------------------------------|------|--|
| | | | | BKG | HEX | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7eV PROBE AND A FOXBORO 128 OVA ** MEASURED WITH OVA |
| 5.00 | | | CLAY: WET; RED/BROWN TO TAN SLIGHTLY SANDY SILTY CLAY; W/GRAVEL AND ROOTS; FILL MATERIAL, (CL) | -0.2 | 10.1 | ** 0.8/0.5 |
| 10.00 | | | SILT: MOSTLY DRY; RED AND WHITE SPECKLED SILT; HIGHLY WEATHERED SAPROLITE; MICACEOUS (ML) | -0.2 | 10.8 | ** 0.5/0.5 |
| 15.00 | | | SILT: SLIGHTLY MOIST; RED AND WHITE SILT; FOLIATED SAPROLITE; SCHISTOSE LAYERING (ML) | 0.2 | 11.3 | ** 0.8/0.5 |
| 20.00 | | | SILT: WET; RED AND TAN SILT; SOFT SAPROLITE W/MANGANESE OXIDE STREAKS (ML) | 0.2 | 9.6 | ** 0.6/0.5 |
| 25.00 | | | BORING TERMINATED AT 25 FEET BELOW GRADE | | | BORING TERMINATED AT 25 FEET BELOW GRADE AS A TEMPORARY WELL; WATER LEVEL AT 21.1 FEET BELOW GRADE |

AWARE Environmental Inc.

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PROJECT NO: N156-33

BORING NO: BW-4

PROJECT NAME: Reeves, Bessemer City, NC

DRILLER: Chris Bender

DATE FINISHED: 4/25/96

FIELD PERSONNEL: Ed Stephens

T.O.C. ELEV.: NA

GROUND-SURFACE-ELEV.: NA

GWL-DATE/TIME: NA

GWL-ELEV.: NA

DRILLING METHOD: Hollow Stem Auger

DRILL-EQUIP: CME-45

CONTRACTOR: Environmental Construction Services

CHECKED BY: Sally Hartness

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | PROFIT | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|-----------|--|-------------------------------|------|---|
| | | | | BGS | MEAS | |
| 0.00 | 0 20 40 60 80 100 | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOCINOIZATION DETECTOR WITH A 11.7eV PROBE AND WITH A FOXBORO 128 OVA ** - OVA MEASUREMENTS |
| 5.00 | | [Pattern] | SILT: DRY; TIGHT; RED/BROWN CLAYEY SILT; HIGHLY WEATHERED, NO STRUCTURE (ML) | 0.2/10.0 | | ** 1.0/0.5 |
| 10.00 | | [Pattern] | SILT: DRY; HARD; SLIGHTLY SANDY SILT; MICACEOUS; W/MANGANESE OXIDE VEINS; SCHISTOSE STRUCTURE (ML) | 0.2/7.0 | | ** 0.8/0.5 |
| 15.00 | | [Pattern] | SILT: DRY; GREEN/TAN SILT; SAPROLITE; HIGHLY MICACEOUS; SCHISTOSE STRUCTURE (ML) | -0.2/10.0 | | ** 0.6/0.5 |
| 20.00 | | [Pattern] | PARTIALLY WEATHERED ROCK: VERY DRY; DENSE; ROCK FRAGMENTS W/SILT | -0.2/11.0 | | ** 0.6/0.5 |
| 25.00 | | [Pattern] | PARTIALLY WEATHERED ROCK: SATURATED SAPROLITE W/SILT; MICACEOUS; SCHISTOSE STRUCTURE | 0.2/9.3 | | ** 0.7/0.5 |
| 30.00 | | | COMPETENT ROCK | | | BORING TERMINATED AT 30 FEET BELOW GRADE AS A TEMPORARY WELL; WATER LEVEL AT 27.7 FEET BELOW GRADE |

AWARE Environmental Inc.

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PROJECT NO: N156-33

BORING NO: BW-5

PROJECT NAME: Reeves, Bessemer City, NC

DRILLER: Chris Bender

DATE FINISHED: 4/25/96

FIELD PERSONNEL: Ed Stephens

T.O.C. ELEV.: NA

GROUND-SURFACE-ELEV.: NA

GWL-DATE/TIME: NA

GWL-ELEV.: NA

DRILLING METHOD: Hollow Stem Auger

DRILL-EQUIP: CME-45

CONTRACTOR: Environmental Construction Services

CHECKED BY: Sally Hartness

| DEPTH (FT) | PENETRATION RESISTANCE (blows/ft) | | | | | PROFILE | DESCRIPTION | VOLATILE ORGANIC VAPORS (ppm) | | REMARKS |
|------------|-----------------------------------|----|----|----|----|---|---|-------------------------------|------------|--|
| | 0 | 20 | 40 | 60 | 80 | | | 100 | BGS | |
| 0.00 | | | | | | | | | | VOLATILE ORGANIC VAPORS MEASURED WITH PHOTOIONIZATION DETECTOR WITH A 11.7eV PROBE AND FOXBORO 128 OVA ** MEASURED WITH OVA |
| 5.00 | | | | | |  | SILT: DRY; FIRM; RED SILT; MICACEOUS; HIGHLY WEATHERED AND LEACHED (ML) | 0.2/8.6 | ** 1.5/0.5 | |
| 10.00 | | | | | |  | SILT: DRY; VERY SOFT; PINK TO TAN SILT; MICACEOUS SAPROLITE (ML) | 0.2/11.5 | ** 0.5/0.5 | |
| 15.00 | | | | | |  | SILT: DRY; SOFT; PINK/TAN/WHITE SILT; MICACEOUS SAPROLITE (ML) | 0.2/10.9 | ** 0.5/0.5 | |
| 20.00 | | | | | |  | SILT: SLIGHTLY WET; FIRM; PINK/TAN/WHITE SILT; MICACEOUS SAPROLITE (ML) | 0.2/10.4 | ** 0.8/0.5 | |
| 25.00 | | | | | |  | SILT: WET; FIRM; PINK/TAN/WHITE SILT; MICACEOUS SAPROLITE (ML) | 0.2/5.9 | ** 0.6/0.5 | |
| 30.00 | | | | | | | BORING TERMINATED AT 30 FEET BELOW GRADE | | | BORING TERMINATED AT 30 FEET BELOW GRADE AS A TEMPORARY WELL; WATER LEVEL AT 27.0 FEET BELOW GRADE |

ATTACHMENT B

**AEI
STANDARD PROCEDURES
AND
TECHNICAL METHODS**

AEI's STANDARD PROCEDURES/TECHNICAL METHODS

AWARE Environmental Inc. has conducted the reported site investigation in accordance with the following standard procedures and technical methods:

SOIL SAMPLING

Hand-Augered Borings

Shallow soil borings are manually-advanced with a clean 3.25" O.D. stainless steel auger bucket connected to extendible rods with a "T" handle. Relatively undisturbed soil cores approximately 6" - 8" in length are retrieved from target depths and brought to the surface for soil classification and environmental testing. The boreholes are decommissioned after use by adding lean cement grout or bentonite to the borehole and capping with clean stable soils.

The auger bucket is decontaminated between sample collection events by scrubbing the exterior and interior of the bucket with a stiff bristle brush using Alconox or other phosphate-free detergent and potable water. The bucket is then rinsed with distilled water. All decontamination rinsate is initially collected in a five-gallon plastic bucket and later transferred to a 55-gallon drum stored on site for later approved disposal by the client.

Mechanically-Advanced Borings

Soil borings are constructed with a drill rig by mechanically-advancing continuous-flight rotary hollow-stem steel augers of various diameters. The augers are advanced to a target sampling depth where a 2.0-inch-diameter stainless steel split-barrel sampler connected onto drill rods is inserted into the hollow center of the augers. The sampler is lowered to the bottom of the borehole and then marked in six-inch increments to measure penetration resistance. The sampler is advanced into undisturbed soil materials by allowing a 140-pound steel cylinder (hammer) to free-fall from a height of 30 inches. The number of hammer blows (DN) are recorded for each six-inch-increment (generally three or four intervals). The first six inches of penetration is considered a seating drive. The average blowcount (N) is an average of the total number of blows recorded for each increment ignoring the initial six inches of penetration. This procedure for driving a split-barrel sampler to obtain a representative soil sample and measure the resistance of the soil to penetration of the sampler is generally known as the Standard Penetration Test (SPT) and is specified in ASTM D 1586-84 Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

As the sampler penetrates the formation, a sample is collected in the interior of the cylinder. The split-barrel sampler connected to the drill rod assembly is lifted from the augers using a winch and steel cable and the sampler is disconnected from the lead rod.

A threaded drive shoe is twisted off the sampler assembly allowing the split barrel to be parted exposing the sample core. Sample cores are generally 1.5 inches in diameter and will have a maximum length of 18 inches. The percent recovery and/or length of the recovered sample is recorded. Relatively undisturbed soil cores are retrieved from target depths and brought to the surface for soil classification and environmental testing.

Hollow-stem augers, drill rods, tools and other downhole drilling equipment are steam-cleaned by using a high pressure-high temperature washer prior to site drilling, between each boring, and before leaving the site. Containment areas are established for equipment decontamination. The split-barrel sampler is decontaminated between sample collection events by scrubbing the individual parts which comprise the assembly with a stiff bristle brush using Alconox or other phosphate-free detergent and potable water. This cleaning is generally conducted in a five-gallon plastic bucket. The vigorous cleaning is followed by a distilled water rinse. Between borings and occasionally more often, the sampler is steam-cleaned with a high pressure-high temperature washer. All decontamination rinsate is initially collected in a five-gallon bucket or plastic-lined decontamination dike and later transferred 55-gallon drums stored on site for later approved disposal by the client.

The boreholes are decommissioned after sampling unless they are used for subsequent monitoring well installations (see below). Borings are abandoned by backfilling and compacting the soil cuttings removed from the borehole unless the boring penetrated the local water table in which case lean cement grout or a cement/bentonite mixture is used to backfill the hole..

Soil Headspace Vapor Screening

As a preliminary field screening method to determine the relative presence of volatile organic vapors in soils, a portable flame-ionization or photo-ionization vapor detection instrument is used to measure the headspace vapor emitted from a soil sample. Field instruments are frequently calibrated with known concentrations of recommended gases such as methane and isobutane by the instrument supplier or by AEI personnel.

Portions of soil samples collected with a hand auger or with a split-barrel sampler are placed in a sealable plastic baggie. The bag is then sealed with the "zip-lock" closure and the sample disaggregated and agitated. Soil vapors are allowed to equilibrate in the sealed bag. After a few minutes, the tip of the probe of the vapor detector is used to pierce the bag and to pull under vacuum a sample of the headspace gas into the instrument for measurement. This protocol may be repeated to verify the initial vapor content reading.

The ambient background vapor level is recorded in the sampling area and this data is always presented with the actual headspace vapor measurement for comparison. Soil vapor content readings are recorded on the soil boring logs. They are used as a aid in

the selection of representative environmental samples for confirmatory laboratory analytical testing.

GROUNDWATER SAMPLING

Temporary Monitoring Well Installation

Temporary monitoring wells are generally constructed within hollow-stem augers advanced into the shallow saturated zones of low- to semi-cohesive soils. The augers may be removed from saturated cohesive soils to allow well construction. The most typical temporary well installation consists of 2" diameter flush-threaded Schedule 40 polyvinylchloride (PVC) riser pipe and a short section of 0.01" machine-slotted well screen. A PVC cap, also serving as a sediment trap, is attached to the end of the screen. In turn, the flush-threaded screen section is attached to a section of riser pipe. Additional riser sections are attached to the previous sections to bring the entire PVC assembly to the surface. If necessary, centralizers may be used to keep the well assembly aligned in the borehole.

Clean coarse filter sand is poured slowly into the annular space between the PVC pipe and the borehole wall until the sand column reaches a height approximately two feet above the top of the well screen. This sand column serves as a filter for the well intake area. The surface entry to the well annulus is then sealed to exclude the inadvertent entry of soil cuttings or other foreign matter.

Following groundwater sampling, the temporary well is abandoned by removing the PVC well materials and backfilling the borehole with cement grout.

Well Development

Following the construction of monitoring wells, they are developed to restore the natural hydraulic conductivity of the formation and to remove foreign sediment to ensure turbid-free groundwater samples. Well development is either conducted by the driller or by AEI personnel. Groundwater is evacuated from the well with a bailer or pump until the presence of sediment is minimal. Air is never used to develop wells. All evacuated water resulting from well development is temporarily placed in 5-gallon plastic buckets and stored on site for appropriate disposal.

When monitoring wells are installed with minimal sediment build-up resulting from drilling or well construction activities, such wells are developed and purged simultaneously (see Well Purging below).

Water Level Measurements

Prior to each purging and sampling event, static water levels in each monitoring well are collected. Initially, each well is vented to the atmosphere to allow the water surface in the well casing to reach a static equilibrium with the local water-table. Measurements are then taken with a conductive water level probe attached to a plastic measuring tape graduated in tenths of an foot.

Water level indicators are decontaminated by washing with Alconox or other phosphate-free detergent and water using a brush. The equipment is then rinsed with distilled water. Cleaning and rinsate fluids are collected and poured in a 5-gallon plastic bucket for appropriate disposal.

Groundwater Sampling

Groundwater samples are collected from shallow wells with clean dedicated bottom-loading Teflon bailers. The sampler ties an appropriate length of new nylon cord to the top of the bailer. The bailer is slowly lowered into the standing water in the well and is allowed to fill. The bailer is then slowly retrieved from the well. While wearing latex or other protective gloves, the sampler slowly tilts the bailer to allow a slow pouring of its contents into the laboratory-supplied sample containers. Once a sample container is full, eliminating any headspace, the cap is secured and the sample container visually inspected for air bubbles. If bubbles are found in the container, the sample is discarded and the process repeated. The entire process is repeated until all required sample containers are collected.

Samples are collected and containerized in the order of the volatilization sensitivity of the targeted analytical parameters. The preferred collection order for some common groundwater analytical parameters is as follows:

- Volatile organics (VOC)
- Purgeable organic carbon (POC)
- Purgeable organic halogens (POX)
- Total organic halogens (TOX)
- Total organic carbon (TOC)
- Extractable organics (semi-volatiles)
- Total metals
- Dissolved metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

When temperature, pH and specific conductance measurements are taken, they are made in the field before and after sample collection. All field instruments are thoroughly rinsed with distilled or deionized water between measurement events.

All sample containers are properly labeled with an adhesive-backed label. Labeling information includes sample identification number, date, time, sampler's name, analytical parameter, and type of preservative. Samples are immediately placed in an insulated cooler with frozen "blue ice" or with ice securely wrapped in a durable plastic bag to prevent leakage. Samples are never left unattended during the sampling event. Sampling personnel lock the sample cooler in a field vehicle when immediate sample custody is not practical. All samples are prepared for shipment by common carrier by carefully surrounding the sample containers with soft foam packing materials and by placing fresh frozen "blue ice" packs in the insulated cooler.

Chain-of-Custody

Sample custody protocol is followed to adequately handled and trace the possession of individual samples from the time of field collection through laboratory analysis. The chain-of-custody protocol includes: 1) sample labels to properly identify each sample; individual sample and/or shipping container seals to preserve the integrity of the samples; and chain-of-custody records to establish the documentation necessary to trace sample possession from the time of sample collection to analysis. In addition, information regarding sample collection is documented in an up-to-date field logbook. Pertinent sampling information (i.e., static water level, purge volume, and other field observations) which is not included on the sample label or chain-of-custody report is recorded in the logbook.