Carmen Johnson 2/2/12
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BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

SITE HYDROGEOLOGIC REPORT

JMN/CLEVELAND CONTAINER INDUSTRIAL LANDFILL
CLEVELAND COUNTY, NORTH CAROLINA

NORTH CAROLINA LICENSED SEAL 1043 GEOLOGIST MARK S. PREDDY 10/2/00

Prepared For:

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October 2, 2000

BLE Project Number J99-1307-04

BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

October 2, 2000

Hodges, Harbin, Newberry, & Tribble, Inc.
484 Mulberry Street, Suite 265
Macon, Georgia 31201

Attention: Mr. William F. Hodges, P.E.

Subject: **Site Hydrogeologic Report**
JMN/Cleveland Container Industrial Landfill
Cleveland County, North Carolina
BLE Project Number J99-1307-04

Gentlemen:

Bunnell-Lammons Engineering, Inc. (BLE) has completed the Site Hydrogeologic Study for the JMN/Cleveland Container Industrial Landfill. This report addresses the relevant geologic and hydrogeologic site application requirements as outlined in the North Carolina Rules for Solid Waste Management, 15A NCAC 13B .0503(2)(d) and .0504(1)(c). The attached report describes the work performed and presents the results obtained.

We appreciate the opportunity to serve as your geological, hydrogeological, and geotechnical consultant on this project and look forward to continue working with you at the JMN/Cleveland Container Industrial Landfill. If you have any questions, please contact us at (864) 288-1265.

Sincerely,

BUNNELL-LAMMONS ENGINEERING, INC.

Mark S. Preddy, P.G.
Senior Hydrogeologist
Registered, North Carolina #1043

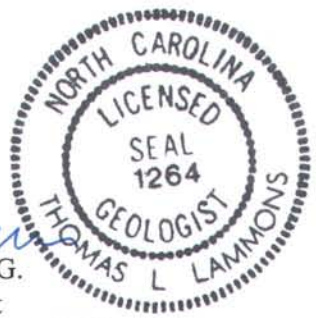

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TABLE OF CONTENTS

TABLE OF CONTENTS–Continued

LIST OF TABLES

Table

LIST OF FIGURES

Figure

EXECUTIVE SUMMARY

The North Carolina Department of Environment and Natural Resources (NCDENR) has evaluated the compliance status of the existing facility with regards to solid waste management Rule 15A NCAC 13B .0503 pertaining to site and design requirements for disposal sites. The NCDENR specified deficiencies in the existing landfill design plan pertaining to compliance with current ground-water standards, and hydrogeologic information of the site. This *Site Hydrogeologic Report* addresses the deficiencies specified by the NCDENR for the existing landfill and provides the required site suitability demonstrations for a proposed ±40-acre Phase 2 expansion. The suitability criteria and applicable geologic/hydrogeologic requirements for prospective industrial waste landfill sites are outlined in the North Carolina Rules for Solid Waste Management, Title 15A NCAC 13B .0503(2)(d) and .0504(1)(c). The evaluation methodology for this study was developed to satisfy these requirements.

The entire site covers approximately 110 acres located within rolling piedmont terrain of Cleveland County, North Carolina and consists of an existing landfill and the referenced 40-acre Phase 2 expansion area. The existing landfill occupies the western portion of the site. The eastern portion of the site consists of the Phase 2 area, where topography is characterized by a central high ridge, which drops off radially to the east, west, and south. A centrally located intermittent stream that flows south to Buffalo Creek separates the existing landfill area and the Phase 2 area.

The surface drainage pattern in Phase 2 is radial from the central ridge to the topographic ravine located between Phase 2 and the existing landfill, and to Buffalo Creek south of the site. The topographic ravine between Phase 2 and the existing site serves as a southward flowing wet season conveyance for surface water to Buffalo Creek. Buffalo Creek flows southwest from the site and ultimately converges with the Broad River four miles southwest of the site.

The site is located within the Inner Piedmont Belt of the Piedmont Physiographic Province. The crystalline rocks of the Inner Piedmont Belt occur in generally northeast-southwest trending geologic belts in the Carolinas, and consist of a stack of highly metamorphosed thrust sheets bound on the northwest by the Brevard Shear Zone and to the southeast by the Kings Mountain Shear Zone. The Inner Piedmont includes high-grade metamorphosed sedimentary and igneous rocks that have been exposed to multiple deformations. Rock types that resulted from the multiple metamorphisms include gneiss, schist and amphibolite with northeast/southwest trending foliation with varying degrees of dip. Quaternary-age sediments consisting of sand and gravel fill the stream valleys. Holocene and younger age faults were not found on site or within 200 feet of the site from the literature review or from the field reconnaissance.

Five soil borings and two rock corings were performed on the Phase 2 area and two soil borings were performed on the existing landfill site. At eight of these nine locations, ground water was encountered. The soil and rock borings ranged in depth from 17.5 to 52 feet below ground surface. Clayey/silty soils were encountered near the ground surface and grade with increasing depth into micaceous sandy silts, silty sands, and then partially weathered rock. Residual soil and partially weathered rock overly the basement bedrock. The overburden thickness varies from 29 to 52 feet, averaging 38 feet over most areas. The upper bedrock was cored at two locations. The rock cores generally exhibited moderate to severe fracturing with rock quality designation (RQD) values from 0 to 100 percent with an average of 48 percent.

Nine ground-water piezometers were installed in selected locations to measure seasonally high ground-water elevations and characterize the site hydrogeology. Water level measurements were recorded from the piezometers and existing monitoring wells during January through July 2000, and the highest ground-water levels recorded were in May.

Ground water is present above the bedrock surface over much of the site, with the exception of PZ-3, which is located in an upland location in the Phase 2 area. The saprolite and bedrock units are hydraulically connected, comprising a single unconfined aquifer where recharge rates, flow rates and storativity differ between the units. Generally, shallow ground water flows to the south from recharge areas in the north-central upland locations, and discharges to Buffalo Creek along the southern site boundary.

Based on slug tests, the hydraulic conductivity in the residual soil zone ranges from 5.5×10^{-4} cm/sec to 3.8×10^{-5} cm/sec. Hydraulic conductivity in the bedrock piezometers ranges from 7.6×10^{-4} cm/sec to 7.0×10^{-4} cm/sec. The ground-water seepage velocity ranges from 0.012 to 0.88 ft/day in the residual soil zone, and 0.69 to 4.6 ft/day in the bedrock zone.

The residual soils, partially weathered rock, and rock at the site provide a stable foundation for the landfill waste placement and the associated earthwork cut and fill slopes. Settlement of the subsurface profile due to waste placement will be minimal. Residual soils consisting of red-brown silty clay (CL) and sandy clayey silt (ML and MH) were found to depths of 3 to 5.5 feet below ground surface. These soils would readily achieve a remolded hydraulic conductivity (permeability, k) $\leq 1 \times 10^{-5}$ cm/sec acceptable for use as a soil base liner or low permeability soil cap. Soils capable of achieving a permeability $k \leq 1 \times 10^{-7}$ cm/sec were found in limited quantity. The remaining residual soils are acceptable for use as structural fill for embankments and final or daily cover.

Based on the results of field and laboratory testing, field observations, and data from published literature, the study area meets the North Carolina geological, hydrogeological, and geotechnical suitability criteria for siting of an industrial waste landfill.

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1.0 PROJECT INFORMATION

The subject industrial waste landfill is located in Cleveland County, North Carolina near the town of Shelby (Figure 1). The site consists of approximately 110 acres, which includes an existing landfill, soil borrow areas, and a proposed Phase 2 expansion area (approximately 40 acres). The existing landfill is unlined and has been receiving limited industrial and construction and demolition (C&D) waste since the 1970's. Since the facility continued to receive waste after January 1, 1998 and has plans for expansion (the Phase 2 area), the landfill must obtain a permit modification, or new permit, under applicable solid waste regulations 15A NCAC 13B.

The North Carolina Department of Environment and Natural Resources (NCDENR) has evaluated the compliance status of the existing facility with regards to solid waste management Rule 15A NCAC 13B .0503. Camp, Dresser, and McKee (CDM) prepared a *Landfill Design Plan*, dated December 1, 1997. The Division of Waste Management, Solid Waste Section (Section) reviewed the Plan and determined that the information submitted does not meet the requirements of Rule .0503(2)(d)(ii). This rule pertains to the design of the landfill such that the ground-water standards under 15A NCAC 2L will not be exceeded in the uppermost aquifer at the compliance boundary. As stated in a letter dated January 25, 1999 from Mr. James C. Coffey of the Section to Republic Services, Inc.:

> "Specifically, the submitted ground water monitoring information does not demonstrate current compliance with the ground water standards in the upper most aquifer at the compliance boundary; the modeling information submitted does not provide adequate hydrogeologic characterization of the site to demonstrate future compliance with ground water standards in the upper most aquifer at the compliance boundary; and the information provided concerning previously disposed waste does not provide accurate physical and chemical characteristics of the leachate."

BLE prepared a proposed scope of work to address the requirements of Rule .0503(2)(d)(ii) (*Work Plan for Site Hydrogeologic Characterization, JMN/Cleveland Container Industrial Landfill*, dated March 3, 1999, BLE Job Number J99-1307-02), herein referred to as the "Work Plan". Additionally, the Work Plan provided a scope of work to address the geologic/hydrogeologic characteristic of the Phase 2 area under Rules .0503(2)(d) and .0504(1)(c). The Work Plan includes opportunities for the Section to be notified of project progress as tasks are completed.

BLE prepared a *Status Report of Site Hydrogeologic Characterization, JMN/Cleveland Container Industrial Landfill* dated October 4, 1999 (BLE Job Number J99-1307-04). The Status Report included the results of the residential water well inventory and the fracture trace analysis. The Status Report also provided recommendations for drilling/piezometer installation on the existing landfill site and the Phase 2 area. This report includes the results of the aforementioned tasks discussed in the Status Report.

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2.0 FIELD INVESTIGATION

The North Carolina Division of Solid Waste Management (NCDSWM) requires that Site Hydrogeologic Studies include the performance of one boring per 10-acres of permitted site area. The acreage of the Phase 2 area is approximately 40 acres. Seven piezometers were performed on the Phase 2 area during this Site Hydrogeologic Study. Additionally, two piezometers were installed on the existing landfill site. These nine new piezometers supplement the previous nine monitoring wells at the site.

A discussion of the drilling and soil laboratory testing methodology used in the site evaluation is provided below. The field activities reported below were performed under the direction of a North Carolina licensed geologist. A North Carolina-licensed driller (Superior Drilling, Inc. of Raleigh, North Carolina; No. 1769) performed drilling and piezometer installation services. A North Carolina registered land surveyor (Tommy Fields of Troy, North Carolina; RLS-2906) surveyed the horizontal and vertical coordinates of the final boring and piezometer locations.

2.1 AREA AND FIELD RECONNAISSANCE

The study area was traversed by foot to map rock outcrops and surface drainage features. A reconnaissance of private and residential water-supply wells was conducted within a 2-mile radius surrounding the site. Well locations were identified by field observation, review of published topographic maps, and aerial photographs.

2.2 FRACTURE TRACE ANALYSIS

The fracture trace analysis consisted of evaluating exposed rock outcrops and topographic fracture traces and lineaments.

The orientations of bedrock fractures (open joints, open foliation, and open bedding planes) were measured using a Brunton-style compass. The orientation information was collected from exposed rock and saprolite outcrops at the site as well as along nearby roads within about two miles of the site. The field measurements were plotted on Schmidt lower hemisphere equal-area stereonets and Rose diagrams.

Topographic fracture traces and lineaments were evaluated using topographic maps. Regionally, pronounced depressions typically develop along zones of weakness in the bedrock where fractures induce preferential weathering. This preferential weathering along bedrock fractures is ultimately expressed topographically as linear valleys. The trend of fracture traces and lineaments greater than 1,000 feet in length within a 2-mile radius of the site were measured from USGS topographic maps and plotted on a Rose diagram.

2.3 SOIL TEST BORING AND ROCK CORING

Five soil test borings and two rock corings were performed on the Phase 2 area and two soil test borings were performed on the existing landfill site to study the subsurface geology. Soil samples were obtained from the borings at 2.5-foot intervals within the upper ten feet below the ground surface, and at five-foot intervals deeper than ten feet below the ground surface. Drilling

techniques consisted of hollow-stem augering and rock coring. Refer to Appendix A for discussion of the various standard drilling techniques.

Copies of boring logs produced in the field are attached in Appendix B. Soil descriptions on the field logs were based on visual examination and grain-size estimations in accordance with the Unified Soil Classification System (USCS). Upon completion of laboratory grain-size and Atterberg Limit analyses, the preliminary field classifications were adjusted accordingly as reported on the final boring logs. Soil Test Boring/Rock Coring Records showing visual descriptions of the soil and rock strata encountered are included in Appendix C.

The soil test boring locations and depths were selected to comply with the applicable NCSWS rules.

2.4 LABORATORY TESTING

Laboratory tests were conducted to confirm the field classifications and quantify pertinent engineering soil properties. Soil samples were collected using split-spoon samplers, Shelby tubes (undisturbed), and from the auger cuttings (bulk samples). The laboratory tests were performed in general accordance with applicable ASTM specifications, where available. Brief descriptions of the test procedures are included in Appendix D and the laboratory results are included in Appendix E.

2.5 GROUND-WATER INVESTIGATION

Nine piezometers were installed to monitor water table elevations and further characterize the study area hydrogeology. At two locations on the Phase 2 area, piezometer pairs were installed to measure vertical hydraulic gradients. Additionally, two deeper piezometers were installed next to existing monitoring wells on the existing landfill property to measure vertical hydraulic gradients. Piezometer installation records are included with the boring logs in Appendix C, and field procedures are described in Appendix F. Survey information is presented on Table 1 and piezometer construction details are summarized on Table 2.

Ground-water elevations were measured in the piezometers at the time of boring and after 24 hours. Additionally, measurements were taken in the piezometers on site during the period from January to July 2000.

Field permeability (slug) tests were performed in four piezometers to measure the *in situ* hydraulic conductivity of different units of the water table aquifer. Slug test field procedures and data plots are presented in Appendix G.

The piezometers are intended only for investigation use, were not constructed as permanent monitoring wells, and will not be part of the permanent ground-water monitoring system. Prior to landfill construction activities, the piezometers will be abandoned in accordance with 15A NCAC 2C, Rule .0113(a)(2) by over-drilling and backfilling the resulting boreholes from the bottom to the ground surface with neat cement.

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3.0 RESULTS OF INVESTIGATION

3.1 RESIDENTIAL WELL RECONNAISSANCE

The locations of private and public water supply wells within two miles of the site were identified in the field during our reconnaissance in April 1999 and September 2000. The regional Division of Environmental Management office in Mooresville, North Carolina was visited to obtain private well installation records. Additionally, the extent of the public water system in the vicinity of the site was determined and documented.

The reconnaissance identified 534 habitable residences within two miles of the site, which have, or most likely have, a private water supply well. Of these residences:

- 356 residences are on roads serviced by the public water system; and
- 178 residences are on roads not serviced by the public water system.

The Cleveland County Regional Water System supplies most of the residences near the site with potable water, although many of the residences have private wells. The source of the public water is from the First Broad River. No government-owned public water supply wells were identified within 2 miles of the site.

Figure 2 shows the locations of the 516 residences identified in the field. Areas serviced by the Cleveland County Regional Water System are also shown.

Well installation records at the Mooresville Regional Office were sparse, and only six private water well records were obtained for locations within two miles of the site. Appendix C includes copies of the well records and locations of the wells are indicated on the Figure 2. These wells were dug, range in depth from 45 to 60 feet, and constructed with 24-inch diameter concrete casing.

A detailed reconnaissance was performed in the vicinity of the landfill to locate residences still using private drinking water wells. The area of the detailed reconnaissance is indicated on Figure 2. This reconnaissance included obtaining a list of property owners (county tax maps), a list of residences connected to the county water department (Cleveland County Regional Water System), and a door-to-door inquiry. In summary, there are 47 residences and two churches in the limited study area. Of these, 33 residences are connected to the water system, and 14 residences and the two churches are not connected to the public water system, which instead use private well water. Additionally, most of the residences connected to the public water system also have private wells on their property. A summary of the property owners in the limited study area is included in Appendix H.

The reconnaissance also identified a Superfund site about 7000 feet upgradient of the site. The site is known as the Kosa Plant (former Hearst-Celanese Plant), which is located along highway NC-198, north of the town of Earl. The nature of contamination at the site is chlorinated solvents and glycols in an on-site landfill. The site has been in remediation since 1986 and recent monitoring data show that contaminants are not migrating off site.

3.2 REGIONAL GEOLOGY

The subject site is located within the Inner Piedmont Belt of the Piedmont Physiographic Province (Figure 3). The crystalline rocks of the Inner Piedmont Belt occur in generally northeast-southwest trending geologic belts in the Carolinas, and consist of a stack of highly metamorphosed thrust sheets bound on the northwest by the Brevard Shear Zone and to the southeast by the Kings Mountain Shear Zone.

The Inner Piedmont includes high-grade metamorphosed sedimentary and igneous rocks that have been exposed to multiple deformations Horton and Zullo (1991). Rock types that resulted from the multiple metamorphisms include gneiss, schist and amphibolite with northeast/southwest trending foliation with varying degrees of dip. Quaternary-age sediments consisting of sand and gravel fill the stream valleys.

Holocene and younger age faults were not indicated on site or within 200 feet of the site from the literature review or from the field reconnaissance.

The typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by micaceous sandy silts and silty sands. Residual soil zones develop by the *in situ* chemical weathering of bedrock, and are commonly referred to as "saprolite." Saprolite usually consists of micaceous sand with lessor amounts of clay, silt and large rock fragments. The thickness of the saprolite in the Piedmont ranges from a few feet to more than 100 feet. The boundary between soil and rock is not sharply defined.

A transitional zone of partially weathered rock is normally found overlying the parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance in excess of 100 blows per foot (bpf). Fractures, joints, and the presence of less resistant rock types facilitate weathering. Consequently, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

3.3 REGIONAL HYDROGEOLOGY

Ground water in the Piedmont usually occurs as unconfined, water table aquifers in three primary geologic zones: 1) residual soil; 2) partially weathered rock; and 3) fractured bedrock. These zones are typically interconnected through open fractures and pore spaces. The configuration of the water table aquifer generally resembles the local topography.

In the residual soil and partially weathered rock zone, ground water is stored within the pore spaces and is released to the underlying bedrock through gravity drainage. Ground water within the bedrock zones occurs primarily in fracture voids. Generally, fractures within the bedrock are very small but may extend to several hundred feet.

Infiltration of precipitation to recharge the water table aquifer is primarily affected by rainfall intensity and duration, pre-existing soil moisture conditions, temperature (evaporation), and plant uptake (transpiration). Seasonal high-water tables are typically observed during the late winter

and early spring months of the year when maximum infiltration efficiency occurs due to lower temperatures and less plant uptake (i.e., many plants are dormant). Seasonal low-water tables are typically observed during the summer and fall months when minimum infiltration efficiency occurs due to higher temperatures and greater plant uptake of water.

3.4 STUDY AREA PHYSIOGRAPHY AND TOPOGRAPHY

The site is located in Cleveland County, North Carolina, as shown in Figure 1. The Phase 2 area is currently comprised of undeveloped densely wooded young timber (hardwood and pine) with paths throughout the tract. The existing landfill area is occupied by the landfill disposal area, soil borrow areas, a landfill office, and a scale house.

The Phase 2 topography is characterized by a central high ridge, which drops off radially to the east, west, and south. Phase 2 is bordered by a wet season stream and the existing landfill area to the west, and Buffalo Creek to the south. The highest elevations (approximately 688 ft above mean sea level [msl]) occur at the northeastern site boundary with the lower elevations (approximately 600 ft above msl) occurring along Buffalo Creek at the southern site boundary. The relief across Phase 2 is approximately 88 feet from north to south.

Bedrock and saprolitic outcrops in the study area consist of a few boulders at the higher elevations and a few locations along streambeds in lower elevations. Cobble size float rock at the ground surface is common across the site. Rock outcrops used for the fracture trace analysis were located on site and within two miles of the site.

The preliminary soil survey of Cleveland County, prepared by the US Department of Agriculture (USDA), indicates that soil types in the upland elevations in the expansion area include the Pacolet-Saw complex on 15 to 25 percent slopes and the Pacolet sandy clay loam on 8-15 percent slopes. Soil types in the lower elevations include the Taccoa sandy loam on 0-2 percent slopes, which is occasionally flooded (USDA, unpublished).

The surface drainage pattern in Phase 2 is radial from the central ridge to the topographic ravine located between Phase 2 and the existing landfill, and to Buffalo Creek south of the site. The topographic ravine between Phase 2 and the existing landfill serves as a southward flowing wet season conveyance for surface water and ground water to Buffalo Creek. Buffalo Creek flows southwest from the site and ultimately converges with the Broad River four miles southwest of the site. A topographic map/site plan is provided as Figure 4.

No monitoring wells, piezometers, or water supply wells were on the Phase 2 area prior to this investigation based on our field reconnaissance. However, nine ground-water monitoring wells were present prior to our field work at the existing landfill.

3.5 STUDY AREA SUBSURFACE CONDITIONS

Five soil borings and two rock corings were performed on the Phase 2 area and two soil tests borings were performed on the existing landfill site during December 1999 and January 2000. The geologic conditions encountered while drilling were variable with boulders and seams of partially weathered rock occurring throughout the subsurface soil overburden profile. In general, three zones

were encountered: 1) the residual soils from weathered gneiss and schist, 2) the partially weathered rock, and 3) the fractured gneiss and schist bedrock. Subsurface geology at the site is shown on three cross sections designated A-A', B-B', and C-C' (Figure 5). A description of the subsurface materials encountered is provided below.

3.5.1 Geologic Unit Description

3.5.1.1 Residual Soil (Saprolite)

The residual soils are the result of the in-place weathering of the gneiss and schist bedrock. The residual soil profile below the topsoil consists of two identifiable components based on the USCS.

An upper soil component consists of reddish-brown, micaceous silty clay (CL) and sandy clayey silt (ML, MH). This soil component was encountered in six of the seven soil borings, generally ranging from 3 to 5.5 feet below ground surface. N-values range from 6 to 17 with an average value of 9, indicating a stiff average consistency.

The upper soil component grades with depth into a coarser grained, less plastic, brown, gray, and white micaceous sandy silt and silty sand which extends to the depth of the partially weathered rock and/or auger refusal. This soil component was encountered in each of the seven soil borings, generally ranging in thickness from 11.5 to 39 feet. USCS classifications of these soils are ML and SM. N-values range from 5 to 100 with an average of 18, indicating a firm average consistency.

3.5.1.2 Partially Weathered Rock

The transition between soil and rock at the site is irregular and consists of partially weathered rock overlying the parent bedrock. This zone was encountered in each of the seven borings and ranges in thickness from 2 to 17 feet. Auger refusal depths represent competent bedrock or possibly boulders of hard rock within the residual soil unit. A map of the bedrock surface (represented by auger refusal) is shown as Figure 6.

3.5.1.3 Fractured Bedrock

At the following selected test boring locations, core samples were obtained of the upper bedrock:

BORING	ROCK CORE SECTIONS (FT)	RECOVERY (%)	RQD (%)	GENERAL DESCRIPTION
PZ-1c	29 – 30.5	100	100	sl. weathered q-f-b GNEISS
	30.5 – 35.5	92	100	fresh q-f-g ORTHOGNEISS
	35.5 – 40.5	100	80	sl. weathered to fresh q-f-b-g GNEISS
	40.5 – 45.5	100	68	sl. weathered to fresh q-f-b-g GNEISS
PZ-4c	30 – 35	0	0	partially weathered rock (no recovery)
	35 – 40	50	0	mod. sev. weathered f-b-q GNEISS
	40 – 45	64	0	mod. sev. weathered f-b-q GNEISS
	45 – 50	68	34	mod. sev. to sl. weathered f-b-q GNEISS

Notes: "q" = quartz; "f" = feldspar; "b" = biotite; "g" = garnet; "mod." = moderately; "sev." = severely; "sl." = slightly; RQD = rock quality designation

The upper bedrock profile at the PZ-1c location is generally more competent and less weathered than at the PZ-4c location. The rock core at the PZ-1c location is slightly weathered to fresh biotite-quartz-feldspar-garnet gneiss, with moderately close to widely spaced fractures. The rock core at the PZ-4c location is severely to slightly weathered biotite-quartz-feldspar gneiss, with very close to moderately closely spaced fractures. At both locations, the metamorphic foliation is horizontal to shallow dipping and the bedrock fractures are shallow dipping.

The bedrock core from the two locations had generally "fair" recovery (range of 0 to 100 percent; average of 72 percent) and "poor" RQD (range of 0 to 100 percent; average of 48 percent).

3.5.2 Fracture Trace Analysis

A fracture trace analysis was performed for this phase of work. The data plots for the fracture trace analysis are in Appendix I and a summary of the fracture trace analysis is provided below.

The trend of 126 topographic fracture traces and lineaments within two miles of the site were measured and plotted on a Rose diagram utilizing a 10° interval. Two primary fracture trace trends were observed: N31°-60°W and N11°-20°E. Additionally, three secondary trends were observed: N31°-50°E, N0°-30°W, and N61°-90°W.

The orientations and trends of 16 open joint surfaces and 18 bedrock foliation planes were measured in the field from rock and saprolite outcrops, then plotted on Schmidt equal area projections and Rose diagrams. The plots consist of one Schmidt net for plotting poles to the joints and foliation, one Rose diagram utilizing a 10° interval for joint trends, and one Rose diagram utilizing a 10° interval for foliation trends. One primary joint orientation was observed: N71°-90°W, dipping 70°-90°S; and two secondary trends were observed: N71°-N80°E, near vertical, and N41°-50°W, dipping 80°-90°NE. The metamorphic foliation orientation is N21°-40°W, dipping 32°NE-25°SW.

Our analysis of the local fracture trends, bedrock joint orientations, and foliation orientations indicate that the prevailing fracture trend is northwest. Additionally, a west-northwest trend is present as indicated from local fracture traces and joint trends. Other less prominent trends include north-northeast (primary fracture trace trend), and north-northwest (secondary fracture trace trend), and east-northeast (secondary joint trend).

3.5.3 Laboratory Testing Results

A list of the soil laboratory tests performed in the Phase 2 area is provided in the table below. The laboratory test results are summarized in Table 3. Laboratory data sheets are in Appendix E.

SAMPLE ANALYSES	SPLIT SPOON SAMPLES TESTED	REMOLDED BAG SAMPLES TESTED	SHELBY TUBE SAMPLES TESTED
Grain-Size Analysis	4	1	1
Natural Moisture Content	4	1	1
Atterberg Limits	1	1	-
Total Porosity	-	-	1
In Situ Saturated permeability*	-	-	1
Standard Proctor	-	1	-
Remolded permeability	-	1	-

* Hydraulic Conductivity

3.5.3.1 Undisturbed Samples

One undisturbed Shelby Tube sample and four split spoon samples were collected and tested in the laboratory to measure natural soil conditions in the study area. The hydraulic conductivity value of the sample in the Phase 2 area was 3.5×10^{-4} centimeters per second (cm/sec). Total porosity in the sample analyzed was 46.5 percent. Specific yield values were estimated from grain-size analyses (Fetter, 1988), and values ranged from 3.5 percent in the silty/clayey sand near the ground surface to 30 percent in the micaceous silty sand.

3.5.3.2 Remolded Samples

One bulk soil sample (bag sample) was collected from boring B-3 (PZ-3) of the upper 5 feet below ground surface to evaluate potential landfill daily cover and clay liner materials. The sample was analyzed in the laboratory for plasticity characteristics, natural moisture, and grain size. The Atterberg limit test indicated a Liquid Limit (LL) of 51 with a Plasticity Index (PI) of 18. The amount of sand, silt, and clay in the sample tested was 40, 25, and 35 percent, respectively.

A standard Proctor compaction test was performed on the bulk sample, then it was tested for permeability (hydraulic conductivity) after remolding. The sample was remolded to 95 percent of the standard Proctor maximum dry density, and approximately 5 percent wetter than the Proctor optimum moisture. The results of the remolded permeability tests (hydraulic conductivity) yielded a value of 7.3×10^{-8} cm/sec.

3.6 STUDY AREA HYDROGEOLOGY

Nine ground-water piezometers were installed at the site during December 1999 to January 2000, at locations shown on Figure 4. Ground water is present above the bedrock surface in the lower elevation areas in the study area, and below the bedrock surface in higher elevation areas. The water-table aquifer consists of the residual soil, partially weathered rock, and fractured gneissic bedrock. These three units are hydraulically connected and thus comprise a single unconfined aquifer. Recharge rates, flow rates and storativity differ between the units based on the unique geologic conditions of each zone. The configuration of the water table surface is a subdued replica of the ground surface. Generally, shallow ground water flows to the south from recharge areas in the north-central upland locations, and discharges to Buffalo Creek in the southern portion of the site. A description of the hydrogeologic conditions in the study area is provided below.

3.6.1 Piezometer Construction and Nomenclature

Piezometer identification numbers were designated with the letters "a," "b," or "c" depending on the location of the screened interval in the piezometer. Piezometers with a screened interval that brackets the water table and is above the depth of auger refusal were designated with the letter "a". Piezometers with a screened interval at the depth of auger refusal (top of bedrock surface) and below the water table were designated with the letter "b." In cases where the water table was near the depth of auger refusal, the piezometer identification number was designated using "ab". Bedrock piezometers were designated with the letter "c". Piezometers that are dry do not have a letter designation. A typical schematic diagram of piezometer construction and nomenclature is provided in Appendix C. A description of the piezometer construction procedures is provided in Appendix F.

3.6.1.1 Auger Refusal Piezometers

Four piezometers ("b" and "ab") in the Phase 2 area were installed with screened intervals at the depth of auger refusal in the residual soil and/or the partially weathered rock zones with the screened interval at or near the water table. These piezometers include PZ-1ab, PZ-2ab, PZ-4ab, and PZ-5ab. Additionally, two piezometers, PZ-6b and PZ-7b, were installed at the depth of auger refusal with the screened interval below the water table.

One piezometer, PZ-3, was installed with the screened interval at the depth of auger refusal, but did not intersect ground water.

3.6.1.2 Bedrock Piezometers

Two piezometers ("c") in the Phase 2 area were installed as open boreholes in the bedrock zone at locations to address vertical hydraulic gradients (PZ-1c and PZ-4c).

3.6.1.3 Piezometer Pairs

There are two well clusters in the Phase 2 area: PZ-1ab/PZ-1c and PZ-4ab/PZ-4c. These piezometer pairs are used to measure the vertical hydraulic gradients in at the upper and lower ends of Phase 2.

In order to evaluate vertical hydraulic gradients at the lower end of the existing landfill, deeper piezometers were installed next to existing monitoring wells. Piezometer PZ-6b was installed near monitoring well MW-4, and PZ-7b was installed near MW-7.

3.6.2 Precipitation and Seasonal Ground-Water Level Trends

Historical NOAA monthly precipitation data were obtained from Division 2, North Carolina for the period of January 1980 through August 2000. The data are summarized seasonally in Appendix J such that January-March represents *winter*, April-June represents *spring*, July-September represents *summer*, and October-December represents *fall*.

Historically in the Cleveland County area, the winter and summer months will experience the most amounts of precipitation, with less precipitation in the fall and spring. In the summer months, the effects of evapotranspiration offset the contribution of this precipitation to recharge of the uppermost aquifer. Because of these natural trends, the amount of ground-water recharge, and subsequent increase in water table level is typically greatest during winter and spring seasons.

Monthly water level measurements were obtained on-site during January to July 2000. These measurements were collected from the existing piezometer and monitoring well on site, including those installed during previous phases of work at the JMN/Cleveland Container Industrial Landfill.

3.6.3 Water Table Elevation and Ground-Water Flow Direction

Ground-water level elevations were measured in the piezometers on site at the time of boring and after 24 hours. Additionally, monthly water level measurements were collected between January and July 2000. Table 4 provides a summary of the water level measurements collected. A water-table surface contour map was prepared for the February 14, 2000 data (Figure 7).

Generally, ground-water flows to the south beneath the site. However, beneath the existing landfill, flow is radial around the upland areas with a similar configuration as the topography and auger refusal. The higher elevations located in the central and northern portion of the site serve as recharge areas and influence the ground-water flow directions. Flow is convergent towards the central drainage feature, then flows southward to Buffalo Creek. Ground water flow is through the soil matrix, the weathered fracture openings in the saprolite, and the bedrock fractures.

On February 14, 2000, the depth to ground water varied across the site from about 3 feet below ground surface (PZ-6b) in low elevation areas to about 46 feet below ground surface (MW-1A) in high elevation areas.

3.6.4 Man-made Influences to Ground-Water Levels

The existing landfill is being developed in the upland area west of the proposed Phase 2 area. As cell construction proceeds to Phase 2, ground water infiltration and recharge of the water table will be limited, resulting in lower ground-water levels. Additionally, ground water in the seasonal discharge area between the existing landfill and Phase 2 may dry up after future cell development takes place in the upgradient recharge area.

3.6.5 Hydraulic Coefficients and Ground-Water Flow Velocity

3.6.5.1 Hydraulic Conductivity

Hydraulic conductivity is defined as the ability of the aquifer material to conduct water under a hydraulic gradient. Five slug tests were performed in the study area during January 2000 to measure the *in situ* hydraulic conductivity of the different zones of the water-table aquifer. The slug test results were evaluated using the Bouwer and Rice Method for partially-penetrating wells in an unconfined aquifer.

Three slug test were performed in piezometers installed in the residual soil zone (PZ-2ab, PZ-4ab, and PZ-7b); and two slug tests were performed in the open bedrock piezometers (PZ-1c and PZ-4c). The results of the tests are provided in Appendix G and summarized on Table 5. The hydraulic conductivity in the residual soil zone ranged from 5.5 x 10^{-4} cm/sec in piezometer PZ-4ab to 3.8 x 10^{-5} cm/sec in piezometer PZ-7b. Hydraulic conductivity values in the fractured bedrock zone ranged from 7.6 x 10^{-4} cm/sec in piezometer PZ-1c to 7.0 x 10^{-4} cm/sec in piezometer PZ-4c.

3.6.5.2 Hydraulic Gradient

The hydraulic gradient is determined by dividing the difference in ground-water elevations at two locations by the horizontal distance between those locations along the direction of ground-water flow. The steepest hydraulic gradient at the site is about 0.11, which is located in the northern area near MW-1 and PZ-1ab/PZ-1c. The shallowest gradient at the site is about 0.035, which is located in the southern area near MW-4 and MW-5.

3.6.5.3 Effective Porosity and Specific Yield

Effective porosity is the volume of void spaces through which water or other fluids can travel in a rock or sediment divided by the total volume of the rock or sediment. Effective porosity can be assumed to be approximately equal to specific yield for unconfined (water-table) aquifers. Specific yield is defined as the ratio of the volume of water that drains from a saturated rock owing to the attraction of gravity to the total volume of rock.

Specific yield measurements in the study area within the water bearing zone range from about 19 to 30 percent in the micaceous silty sands. The effective porosity can be expected to range from about 5 to 10 percent for fractured crystalline bedrock (Kruseman and deRidder, 1989).

3.6.5.4 Ground-Water Flow Velocity

The velocity of ground-water movement (V) is a function of existing hydraulic gradient (i), the hydraulic conductivity (K) and the effective porosity (n), in the equation $V = Ki/n$.

Based on these parameters and the data provided above, the horizontal movement of ground-water ranges from approximately 0.012 to 0.88 feet/day in the residual soil zone, and 0.69 to 4.6 feet/day in the bedrock zone. Table 6 summarizes the ground-water flow velocity calculations.

3.6.6 Vertical Flow Gradients

Vertical flow gradients were evaluated at the site by installing piezometer pairs. There are two vertical well pairs in the Phase 2 area: PZ-1ab/PZ-1c and PZ-4ab/PZ-4c. There are two vertical well pairs on the existing landfill site: MW-4/PZ-6b and MW-7/PZ-7b. Based on ground-water level measurements in the well pairs on February 14, 2000, the following vertical gradients were observed:

PIEZOMETER PAIR	SITE LOCATION DESCRIPTION	RECHARGE GRADIENT	DISCHARGE GRADIENT	NEARLY FLAT GRADIENT
PZ-1ab/PZ-1c	Upper end of drainage feature between existing landfill and Phase 2	✓		
PZ-4ab/PZ-4c	Southern portion of Phase 2 area near Buffalo Creek			✓
MW-4/PZ-6b	Lower end of drainage feature between existing landfill and Phase 2		✓	
MW-7/PZ-7b	South of existing landfill			✓

Based on the site topography, the vertical gradients observed in the study area are typical for unconfined aquifers in the Piedmont. Ground-water recharge occurs in the upland areas. Ground-water discharge occurs to the drainage feature between the existing landfill and Phase 2, and to Buffalo Creek on the southern site boundary. Table 7 summarizes the vertical gradient calculations.

3.7 GEOTECHNICAL CONSIDERATIONS

An evaluation of the potential impact from faults, seismic zones and unstable areas, as required by 15A NCAC13B.1622 is briefly presented below to provide a background for the geotechnical evaluation. Geotechnical related topics evaluated for the Phase 2 area include the stability of the planned cut and fill slopes, stability of the base liner system, and settlement of the subgrade and fill soils resulting from the planned waste placement. Construction considerations include surface water control, excavation, site subgrade preparation, and engineered fill placement. Each of these topics is reviewed in the following paragraphs.

3.7.1 Fault Areas

No Holocene faults are located within 200 feet of the subject site (Horton and Zullo, 1991).

3.7.2 Seismic Impact Zones

According to the definition of seismic impact zones in 15A NCAC 13B .1622 (5), this site is in a seismic impact zone. The maximum horizontal acceleration expressed as a percentage of the earth's gravity (g), in rock is about 0.14g with a 10 percent probability of being exceeded in 250 years (Algermissen, and others, 1990; partial reproduction attached as Figure 8). The landfill should be designed to resist the maximum horizontal acceleration in lithified earth material at the site. This magnitude of bedrock acceleration should not present any unusual design constraints and conventional design slopes will be appropriate.

3.7.3 Unstable Areas

An unstable area according to 15A NCAC 13B.1622 (5) is defined as a location that is susceptible to natural or human induced events or forces capable of impairing the integrity of some or all of

the landfill structural components responsible for preventing releases from a landfill. Unstable areas could include poor foundation conditions, areas susceptible to mass movements, and karst terrains. Site and subsurface data obtained were evaluated to determine if unstable site areas exist. Settlement and slope stability were evaluated utilizing data obtained from soil test borings, the test pits, and from field observations. The results and conclusions of the evaluation are included below.

3.7.3.1 Subgrade Settlement

Site grading plans for construction of the landfill cells have not yet been prepared; however, we anticipate a combination of earthwork cut and fill will be made to establish the cell areas. Foundation support conditions for the landfill liner system will consist of either: 1) dense residual soils overlying partially weathered rock at shallow depths, 2) loose to dense residual soils with thicknesses of up to 40 feet over weathered rock, or 3) engineered fill with thicknesses of up to 15 feet to 20 feet overlying residual soils. Soil elastic modulus values for settlement analyses were based on previously developed correlations with standard penetration resistance values in similar soils. To simplify the analyses, we assumed the stress increase within the residual soil layer was equal to the full surcharge pressure of the refuse mound. The surcharge pressures were estimated based on an assumed unit weight of 60 pounds per cubic foot (pcf) of stored waste.

The rock and partially weathered rock underlying the site are relatively incompressible and will not realize appreciable settlements under the anticipated landfill loading. The residual soils are typically firm to very firm sandy clayey silts grading coarser with depth into dense silty sands with some gravel. Modest settlements will be realized from compression of the upper zones of residual soils and the anticipated fills. The subgrade settlement at a given location and differential settlements realized will be a function of the actual refuse and structural fill heights at a given point and the corresponding foundation materials. Maximum settlements on the order of 0.5 feet or less could be expected when placing the full height of refuse over the maximum height of structural fill and deepest thickness of residual soil. This situation could occur in the vicinity of borings PZ-2ab and PZ-3. Correspondingly, subsurface soil settlements due to even the full height of the landfill would result in insignificant soil settlements when bearing on dense residual soils overlying rock of a shallow depth.

Settlement near the edge of the landfill should be minimal. Residual soil settlement should occur rapidly as the cells are filled. Total and differential settlements are expected to be well within acceptable limits of the structural components at a municipal solid waste landfill and leachate collection system.

3.7.3.2 Slope Stability

The soil test borings and laboratory test results indicate that the on site residual soils may be used for construction of earthwork cut and engineered fill slopes. Slope angles of 2.5 horizontal to 1 vertical or flatter are acceptable in the construction of the landfill cells and cut and fill slopes are appropriate. The existing natural slope areas observed by a geologist showed no signs of slope instability.

3.7.3.3 Conclusion

Our settlement and slope stability evaluation did not indicate areas of potential mass movement exist. This site is not karst and is not subject to sinkhole activity or caves. Based on the above considerations, it is our opinion that this site is stable; no unstable areas were identified at the site.

3.7.4 Excavation

Excavation of the residual soils can be accomplished using conventional earth moving equipment. An estimated top of rock (auger refusal) contour map was developed as Figure 6 which is based on auger refusal depths in the soil borings drilled at this site. Materials sufficiently hard to cause refusal to the mechanical drill augers may result from continuous bedrock, boulders, lenses, ledges, or layers of relatively hard rock. Coring was performed at two locations (PZ-1c and PZ-4c) where refusal to augering occurred. Continuous rock was found with varying recovery and RQD as discussed above in Section 3.5.1.3. Due to its typically varying surface, the actual occurrence of hard rock during site grading may vary somewhat from that presented in Figure 6.

3.7.5 Permeability of Potential On-Site Soils for Clay Liner and Cover Construction

The permeability of selected potential on-site borrow soils were determined as indicated in Section 3.5.3 titled Laboratory Testing Results and compared with prior site laboratory test results presented by CDM. The samples were generally compacted to 95 percent of the standard Proctor maximum dry density at 3-5 percent over optimum moisture content. Hydraulic conductivities of 1.4×10^{-7} to 7.3×10^{-8} cm/sec were obtained for the selected (CL, MH, and ML).

Residual soils consisting of red-brown silty clay (CL) and sandy clayey silt (ML and MH) were found to depths of 3 to 5.5 feet below ground surface. These soils would readily achieve a remolded hydraulic conductivity (permeability, k) $\leq 1.0 \times 10^{-5}$ cm/sec acceptable for use as a soil base liner or low permeability soil cap. Soils capable of achieving a permeability $k \leq 1.0 \times 10^{-7}$ cm/sec were found in limited quantity. The remaining residual soils are acceptable for use as structural fill for embankments and final or daily cover.

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4.0 MODIFICATION TO THE WATER QUALITY MONITORING SYSTEM FOR EXISTING LANDFILL

As an addition to this Site Hydrogeologic Report, modifications to the monitoring plan for the existing site are submitted herein. These revisions to the existing monitoring system are needed to better address requirements in Rule 15A NCAC 13B .0503. Currently, nine ground-water monitoring wells are present at the existing landfill as follows:

- Background: MW-1A;
- Compliance: MW-4, MW-5, MW-6, MW-7, and MW-8; and
- Unused wells: MW-1, MW-2, and MW-3.

Additionally, two surface water sampling locations are used:

- Upgradient: SW-3; and
- Downgradient: SW-4.

The five compliance wells are located about 0 to 100 feet from the waste boundary. The background well is located about 200 feet from the waste boundary. The monitoring wells located adjacent to the edge of the waste can capture only a narrow segment of the ground water flow regime. Therefore, the compliance well locations should be moved further downgradient (100 to 150 feet from the waste boundary) to better use the effects of dispersivity, which will result in a larger monitoring area for each well. Additionally, areas of convergent ground-water flow should be targeted.

4.1 GROUND-WATER MONITORING PLAN

4.1.1 Subsurface Considerations

Site specific factors were considered in redesigning this ground-water detection monitoring system, including the locations and construction details of each proposed monitoring well. In addition, environmental factors were considered, such as seasonal variations of the water table, the horizontal and vertical flow regimes, and lithology characteristics.

The residual soils and bedrock comprise the unsaturated and saturated zones of the uppermost water table aquifer.

4.1.2 Relevant Point of Compliance

The relevant point of compliance is less than 250 feet from the boundary of the existing waste boundary. This relevant point of compliance is also more than 50 feet from the facility property boundary.

4.1.3 Monitoring Well Locations

Existing background monitoring well MW-1A is located on the west side of Roseborough Road, which is not located between the landfill and the closest upgradient residence. Therefore, a new upgradient location has been selected, which will consist of a well-pair: MW-1B and MW-1C. The proposed well pair location is approximately 95 feet from the waste boundary (Figure 4). MW-1B will be screened at the first occurrence of ground water in the residual soil. MW-1C will be screened at a similar depth as the nearby private drinking water wells, which is approximately 20-30 feet below the water table in the residual soil. Unused well MW-1 is located at the waste boundary and is therefore unusable.

Existing compliance monitoring wells MW-4 and MW-5 are in locations of convergent ground-water flow approximately 35 and 100 feet from the waste boundary, respectively. The southward flowing drainage feature in the center of the site restricts their distance from the waste boundary.

Existing compliance monitoring well MW-8 is in a side-gradient location on the west side of the landfill. This well is located about 30 feet from the waste boundary between the landfill and two residences with private drinking water wells, which are located on the west side of Roseborough Road. The property boundary and Roseborough Road restrict the distance of MW-8 from the waste boundary. Although MW-8 is located closer than 150 feet from the limits of waste and closer than 50 feet from the property boundary, the well should remain part of the monitoring system since it is located between the landfill and the residences using private drinking water wells.

Existing compliance monitoring wells MW-6 and MW-7 are located on the south side of the landfill approximately 50 and 0 feet from the waste boundary, respectively. The area of the landfill being monitored by these wells is not restricted by property boundaries or ground water divides. Therefore, two new replacement wells (MW-6A and MW-7A) should be installed further downgradient of the existing wells to better use the effects of dispersivity within the relevant zone of compliance. The new locations were selected based on the direction of ground-water flow shown on Figure 7. Monitoring wells MW-6 and MW-7 should be abandoned.

4.1.4 Monitoring Well Depths and Screened Intervals

The depth of the proposed monitoring wells (MW-1B, MW-6A and MW-7A) will be designed to monitor the uppermost aquifer present at the site. The wells will be constructed with 15-foot long screened intervals. The proposed well depths will be determined by either:

- the depth to ground water in the soil and partially weathered rock units, if a sufficient saturated thickness of the aquifer exists above the depth of auger refusal. The screened interval will be set to bracket the water table surface; or
- by the depth of water-bearing fractures in the bedrock unit. The screened interval will be set to intersect the water-bearing fractures.

The depth of MW-1C will be designed to be at a similar depth as private drinking water wells in the vicinity of the landfill. Area private wells are typically dug wells to a depth of about 20 to 30

feet below the water table. Therefore, MW-1C should be installed to approximately 25 feet below the water table (or to the depth of auger refusal if the 25-foot water column is not attainable)

The proposed depths for wells MW-1B, MW-1C, MW-6A and MW-7A are based on the subsurface geology and water table elevations encountered in the nearby borings (Table 8). The actual well depths may be adjusted during well installation based on field conditions (i.e., depth to water, depth to bedrock). The anticipated well depth for MW-1B is 50 feet, MW-1C is 68 feet, MW-6A is 33 feet, and for MW-7A is 40 feet below ground surface.

4.1.5 Proposed Monitoring Well Construction

The anticipated lithology at the new proposed well locations has been estimated based on the closest available boring/coring data and from cross-sections and plan view geologic maps. The proposed monitoring well construction details are presented on Table 8.

It is proposed that each of the new wells be constructed of 2-inch diameter PVC casing and 10 to 15-foot long screened interval, with a sand pack, bentonite seal and grout column in the annular space between the borehole and PVC casing. A lockable standup steel cover should be secured over each well along with a concrete pad at the cover's base.

4.2 SURFACE WATER MONITORING PLAN

There are two existing surface water sampling locations associated with landfill. These two locations are sufficient to monitor the upgradient (SW-3) and downgradient (SW-4) surface water for the site.

4.3 WATER QUALITY MONITORING SYSTEM

The revised water quality monitoring system for the existing landfill is shown on Figure 4. Once constructed, the monitoring system will include seven ground-water monitoring wells and two surface water sampling locations. The water quality monitoring system for the site will include:

- two upgradient monitoring well (MW-1B and MW-1C);
- five downgradient monitoring wells (MW-4, MW-5, MW-6A, MW-7A, and MW-8,);
- one upgradient surface water location (SW-3); and
- one downgradient surface water location (SW-4).

The remaining six unused monitoring wells (MW-1A, MW-1, MW-2, MW-3, MW-6, and MW-7) should be abandoned in accordance with 15A NCAC 2C, Rule .0113(a)(2) by drilling them out and filling the resulting boreholes with a grout mixture of cement, bentonite, and water.

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5.0 CONCLUSIONS

The purpose of this evaluation was to provide supplemental hydrogeologic information for the existing landfill site, and to determine if the Phase 2 area meets North Carolina Department of Solid Waste suitability criteria for site permitting of an industrial waste landfill. The scope of the investigation and the criteria for site suitability are defined by 15A NCAC 13B, Rule .0503(2)(d) and .0504(1)(c).

Existing Landfill Area

Hydraulic gradients at the base of the existing landfill were measured to be nearly flat (MW-7 area) and discharging (MW-4 area).

Existing background monitoring well MW-1A is located on the west side of Roseborough Road, which is not located between the landfill and the closest upgradient residence. Therefore, a new upgradient location has been selected, which will consist of a well-pair: MW-1B and MW-1C. The proposed well pair location is approximately 95 feet from the waste boundary. MW-1B will be screened at the first occurrence of ground water in the residual soil. MW-1C will be screened at a similar depth as the nearby private drinking water wells, which is approximately 20-30 feet below the water table in the residual soil.

Existing monitoring wells MW-6 and MW-7 are currently located about 50 to 0 feet from the waste boundary, respectively. Since the general monitoring areas of these two wells are not restricted by property boundaries or hydraulic divides, they should be abandoned and replaced downgradient. The replacement monitoring wells (MW-6A and MW-7A) should be installed approximately 150 feet from the waste boundary. By adding these wells to the monitoring network, dispersion of contaminants downgradient from the landfill could be observed. This will result in a more effective monitoring system.

Phase 2 Area

No Holocene-age, or younger, faults or unstable areas were identified on site. The site is in a seismic impact zone and the design should include consideration of a maximum horizontal acceleration (g) in the bedrock of 0.14, however, conventional landfill design slopes and structural components should be appropriate.

An unconfined water table aquifer underlies the Phase 2 area. A detection monitoring system can be designed based on the characteristics of the site aquifer. Ground-water monitoring would be effective in areas of convergent ground-water flow such as near the linear drainage features.

Based on the results of field and laboratory testing, it is our professional opinion that the study area meets the minimum standards required for industrial waste landfill development.

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6.0 ANNOTATED BIBLIOGRAPHY

Algermissen, S.T., Perkins, D.M., Thenhaus, P.C., Hanson, S.L., and Bender, B.L., 1990, *Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico*: USGS Miscellaneous Field Studies Map MF-2120.
- Seismic impact zones.

Bouwer, H. and Rice, R.C., 1976, "A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells," Water Resources Research, Vol. 12, No. 3, pp. 423-428.
- Slug testing data reduction procedures.

Brown, M.B., and others (compilers), 1985, *Geologic Map of North Carolina*: NCDNRCD, scale 1:500,000.
- General geologic setting, and fault locations.

Fetter, C.W., 1988, *Applied Hydrogeology*: Merrill Publishing Company, Columbus, Ohio.
- Basic hydrogeologic principles and estimates of effective porosity in soils.

Horton, J.W. and Zullo, V.A., 1991, *The Geology of the Carolinas: Carolina Geological Society fifteenth anniversary volume*: The University of Tennessee Press, Knoxville, TN.
- General geologic setting.

Kruseman, G.P., and deRidder, N.A., 1989, *Analysis and Evaluation of Pumping Test Data*: *Publication 47*, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.
- Estimates of effective porosity in fractured bedrock.

U.S. Department of Agriculture (USDA), unpublished, Soil Survey of Cleveland County, North Carolina. Cleveland County Soil Conservation Service.
- Soil survey of the area around the site.

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TABLES

TABLE 1

PIEZOMETER/BORING SURVEY INFORMATION
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Piezometers & Monitoring Wells	Ground Elevation	TOC Elevation	Northing	Easting
MW-1	773.99	777.14	536,817.75	1,252,569.79
MW-1A	777.28	780.33	536,906.57	1,252,420.17
MW-2	606.15	607.76	---	---
MW-3	605.96	607.75	---	---
MW-4	630.13	632.83	535,688.76	1,253,452.56
MW-5	622.45	625.32	535,058.12	1,253,423.02
MW-6	636.27	639.29	534,699.46	1,252,992.43
MW-7	657.19	660.09	535,037.64	1,252,499.85
MW-8	736.21	739.39	536,063.99	1,252,455.73
PZ-1ab	677.48	680.14	536,687.28	1,253,386.60
PZ-1c	677.83	679.54	536,676.06	1,253,403.35
PZ-2ab	648.93	651.37	536,000.89	1,254,116.97
PZ-3	669.21	670.53	535,778.21	1,253,829.19
PZ-4ab	617.68	620.13	535,180.88	1,254,292.47
PZ-4c	618.15	619.48	535,186.18	1,254,289.67
PZ-5ab	646.50	648.44	535,384.12	1,253,774.27
PZ-6b	630.01	632.79	535,681.47	1,253,453.90
PZ-7b	656.96	659.86	534,990.11	1,252,474.33

NOTES:

1. Measurements are in feet; elevations are relative to mean sea level
2. TOC = Top of Casing
3. Surveying was performed by Wright & Fields (RLS) of Troy, NC

TABLE 2

PIEZOMETER CONSTRUCTION DETAILS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Piezometers & Monitoring Wells	Ground Elev.	TOC Elev.	Auger Refusal Depth	Auger Refusal Elev.	Bedrock Drilling Depth	Screened Interval Depth	Screened Interval Elvation
MW-1	773.99	777.14	Info Not Available	---	---	39.0 - 54.0	735.0 - 720.0
MW-1A	777.28	780.33	Not Reported	---	---	35.0 - 50.0	742.3 - 727.3
MW-2	606.15	607.76	Info Not Available	---	---	4.0 - 19.0	602.2 - 587.2
MW-3	605.96	607.75	Info Not Available	---	---	5.0 - 15.0	601.0 - 591.0
MW-4	630.13	632.83	Not Reported	---	---	4.5 - 14.5	625.6 - 615.6
MW-5	622.45	625.32	Not Reported	---	---	6.0 - 21.0	616.5 - 601.5
MW-6	636.27	639.29	Not Reported	---	---	12.0 - 27.0	624.3 - 609.3
MW-7	657.19	660.09	Not Reported	---	---	13.0 - 28.0	644.2 - 629.2
MW-8	736.21	739.39	Not Reported	---	---	35.0 - 50.0	701.2 - 686.2
PZ-1ab	677.48	680.14	17.5	660.0	---	12.2 - 17.2	665.3 - 660.3
PZ-1c	677.83	679.54	29.0	648.8	29.0 - 45.5	29.0 - 45.5	648.8 - 632.3
PZ-2ab	648.93	651.37	39.0	609.9	---	28.7 - 38.7	620.2 - 610.2
PZ-3	669.21	670.53	45.5	623.7	---	33.2 - 43.2	636.0 - 626.0
PZ-4ab	617.68	620.13	25.5	592.2	---	15.2 - 25.2	602.5 - 592.5
PZ-4c	618.15	619.48	30.0	588.2	30.0 - 50.0	30.0 - 50.0	588.2 - 568.2
PZ-5ab	646.50	648.44	38.0	608.5	---	27.7 - 37.7	618.8 - 608.8
PZ-6b	630.01	632.79	30.0	600.0	---	24.7 - 29.7	605.3 - 600.3
PZ-7b	656.96	659.86	52.0	605.0	---	41.7 - 51.7	615.3 - 605.3

NOTES:

1. Measurements are in feet; elevations are relative to mean sea level
2. TOC = Top of Casing
3. Surveying was performed by Wright & Fields (RLS) of Troy, NC
4. PZ-1c and PZ-4c are open bedrock piezometers with no well screen.

TABLE 3

SUMMARY OF LABORATORY RESULTS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Boring	Split-Spoon Depth (ft)	Shelby Tube Depth (ft)	Bag Sample Depth (ft)	Nat. Moisture Content (%)	Standard Proctor Opt. Moisture Content (%)	Standard Proctor Max. Dry Density (pcf)	Hydraulic Conductivity (cm/sec) Remolded	Hydraulic Conductivity (cm/sec) In-Situ	Total Unit Weight (pcf)	Porosity (%) Effective	Porosity (%) Total	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Grain Size (% by wt) Gravel	Grain Size (% by wt) Sand	Grain Size (% by wt) Silt	Grain Size (% by wt) Clay	% Pass 200 Sieve	USCS
PZ-1c	23.5 - 25.0	-	-	44.4%	-	-	-	-	-	19%	-	-	-	-	0.0%	61.8%	27.2%	11.0%	38.2%	SM
PZ-2ab	28.5 - 30.0	-	-	35.1%	-	-	-	-	-	24%	-	-	-	-	0.0%	69.0%	24.0%	7.0%	31.0%	SM
PZ-3	-	-	1.0 - 5.0	33.7%	21.0%	100.5	7.3E-08	-	-	3.5%	-	51	33	18	0.0%	40.4%	24.5%	35.1%	59.6%	MH
PZ-3	-	23.0 - 25.0	-	10.1%	-	-	-	3.5E-04	100.6	25%	46.5%	-	-	-	2.0%	73.2%	18.2%	6.6%	24.8%	SM
PZ-4ab	18.5 - 20.0	-	-	13.8%	-	-	-	-	-	30%	-	-	-	-	0.8%	84.2%	11.9%	3.1%	15.0%	SM
PZ-5ab	1.0 - 2.5	-	-	31.0%	-	-	-	-	-	-	-	59	46	13	-	-	-	-	60.3%	MH

NOTES:
Moisture Content % = (Weight of water/Weight of soil) * 100
Effective Porosity (specific yield) is based on grain size analyses and Figure 4.11 (Fetter, 1988)
pcf = pounds per cubic foot
USCS = Unified Soil Classification System

Prepared By: MSP
Checked By: AWA

TABLE 4

GROUND-WATER ELEVATION MEASUREMENTS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Wells	Ground Elev.	TOC Elev.	DGW TOB	Water Elev.	DGW 24-HR	Water Elev.	DGW 1/11/00	Water Elev.	DGW 1/19/00	Water Elev.	DGW 2/14/00	Water Elev.	DGW 3/28/00	Water Elev.	DGW 5/2/00	Water Elev.	DGW 6/9/00	Water Elev.	DGW 7/14/00	Water Elev.	Maximum Water Elev.	Minimum Water Elev.	Difference
MW-1	773.99	777.14	NA		NA		NM		46.30	**727.69**	46.55	727.44	46.85	727.14	46.99	727.00	46.93	727.06	46.90	727.09	727.69	727.00	0.69
MW-1A	777.28	780.33	NA		NA		NM		43.70	733.58	43.90	733.38	43.98	733.30	43.65	733.63	43.25	**734.03**	43.49	733.79	734.03	733.30	0.73
MW-2	606.15	607.76	NA		NA		NM		NM		NM		NM		NM		NM		NM		-	-	-
MW-3	605.96	607.75	NA		NA		NM		NM		NM		NM		NM		NM		NM		-	-	-
MW-4	630.13	632.83	NA		NA		NM		5.21	624.92	5.01	625.12	4.95	625.18	4.92	**625.21**	5.11	625.02	5.05	625.08	625.21	624.92	0.29
MW-5	622.45	625.32	NA		NA		NM		10.20	612.25	9.76	612.69	9.39	613.06	9.30	**613.15**	10.13	612.32	10.55	611.90	613.15	611.90	1.25
MW-6	636.27	639.29	NA		NA		NM		23.57	612.70	21.75	614.52	21.06	615.21	20.58	**615.69**	21.69	614.58	23.04	613.23	615.69	612.70	2.99
MW-7	657.19	660.09	NA		NA		NM		20.28	636.91	20.09	637.10	18.43	**638.76**	20.25	636.94	20.55	636.64	20.70	636.49	638.76	636.49	2.27
MW-8	736.21	739.39	NA		NA		NM		43.47	**692.74**	43.74	692.47	44.02	692.19	44.03	692.18	43.80	692.41	43.73	692.48	692.74	692.18	0.56
PZ-1ab	677.48	680.14	Dry		15.92	661.56	15.92	661.56	16.59	660.89	14.65	662.83	12.94	664.54	12.39	**665.09**	15.49	661.99	16.13	661.35	665.09	660.89	4.20
PZ-1c	677.83	679.54	NS		17.91	659.92	17.91	659.92	17.98	659.85	17.62	660.21	17.00	660.83	16.50	**661.33**	16.79	661.04	17.41	660.42	661.33	659.85	1.48
PZ-2ab	648.93	651.37	35.0	613.9	29.96	618.97	29.96	618.97	29.99	618.94	29.97	618.96	29.77	619.16	29.29	619.64	29.28	**619.65**	29.79	619.14	619.65	618.94	0.71
PZ-3	669.21	670.53	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	>43.98	<625.23	-	-	-
PZ-4ab	617.68	620.13	18.0	599.7	16.49	601.19	16.49	601.19	16.54	601.14	15.84	601.84	15.77	601.91	15.75	**601.93**	18.30	599.38	18.35	599.33	601.93	599.33	2.60
PZ-4c	618.15	619.48	NS		17.16	600.99	17.16	600.99	17.21	600.94	16.58	601.57	16.44	601.71	16.40	**601.75**	18.80	599.35	18.96	599.19	601.75	599.19	2.56
PZ-5ab	646.50	648.44	36.0	610.5	30.56	615.94	30.56	615.94	30.56	615.94	30.52	615.98	30.34	616.16	30.10	616.40	30.02	**616.48**	30.31	616.19	616.48	615.94	0.54
PZ-6b	630.01	632.79	NS		3.27	626.74	NS		3.27	626.74	2.95	627.06	2.70	627.31	2.64	**627.37**	3.10	626.91	3.24	626.77	627.37	626.74	0.63
PZ-7b	656.96	659.86	NS		20.94	636.02	20.94	636.02	20.71	636.25	20.50	636.46	20.28	**636.68**	20.32	636.64	20.54	636.42	20.69	636.27	636.68	636.02	0.66

	DGW 1/11/00	DGW 1/19/00	DGW 2/14/00	DGW 3/28/00	DGW 5/2/00	DGW 6/9/00	DGW 7/14/00
Average Depth to Water	21.28	23.04	22.63	22.26	22.21	22.92	23.22
Maximum Depths to Water	30.56	46.30	46.55	46.85	46.99	46.93	46.90
Minimum Depths to Water	15.92	3.27	2.95	2.70	2.64	3.10	3.24

NOTES:
Measurements are in feet; elevations are relative to mean sea level
TOB = Time of Boring
DGW = Depth to Ground Water below ground surface
TOC = Top of Casing
NA = Not Available
NM = Not Measured
NS = Not Stabilized at the time of measurement
Bold elevations represent highest observed elevations between 1/11/00 to 7/14/00.

A Is this well dry? explain

Prepared By: MSP
Checked By: AWA

TABLE 5

SUMMARY OF IN-SITU HYDRAULIC CONDUCTIVITY TESTING - SLUG TEST RESULTS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Well	Method	Data Type	Aquifer Unit	K(ft/min)	K(cm/sec)	K(ft/day)
PZ-1c	Bouwer-Rice	Falling Head	Bedrock	1.5E-03	7.6E-04	2.1E+00
PZ-2ab	Bouwer-Rice	Rising Head	Saprolite	5.9E-04	3.0E-04	8.4E-01
PZ-4ab	Bouwer-Rice	Rising Head	Saprolite	1.1E-03	5.5E-04	1.5E+00
PZ-4c	Bouwer-Rice	Falling Head	Bedrock	1.4E-03	7.0E-04	2.0E+00
PZ-7b	Bouwer-Rice	Falling Head	Saprolite	7.4E-05	3.8E-05	1.1E-01
Saproilite Only	Maximum Hydraulic Conductivity			1.1E-03	5.5E-04	1.5E+00
	Median Hydraulic Conductivity			5.9E-04	3.0E-04	8.4E-01
	Mean Hydraulic Conductivity			5.8E-04	2.9E-04	8.3E-01
	Geometric Mean Hydraulic Conductivity			3.6E-04	1.8E-04	5.2E-01
	Minimum Hydraulic Conductivity			7.4E-05	3.8E-05	1.1E-01
Rock Only	Maximum Hydraulic Conductivity			1.5E-03	7.6E-04	2.1E+00
	Mean Hydraulic Conductivity			1.4E-03	7.3E-04	2.1E+00
	Minimum Hydraulic Conductivity			1.4E-03	7.0E-04	2.0E+00
Both Units	Maximum Hydraulic Conductivity			1.5E-03	7.6E-04	2.1E+00
	Median Hydraulic Conductivity			1.1E-03	5.5E-04	1.5E+00
	Mean Hydraulic Conductivity			9.2E-04	4.7E-04	1.3E+00
	Geometric Mean Hydraulic Conductivity			6.3E-04	3.2E-04	9.0E-01
	Minimum Hydraulic Conductivity			7.4E-05	3.8E-05	1.1E-01

NOTES:
K = Hydraulic Conductivity
The data was reduced and the hydraulic conductivities calculated using SuperSlug Version 3.0.

TABLE 6

INTERSTITIAL GROUND-WATER FLOW VELOCITY CALCULATIONS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Geologic Unit	Hydraulic Conductivity (K) (feet per day)	Hydraulic Gradient (i) (unitless)	Effective Porosity (n) (unitless)	Ground-Water Velocity (V) (feet per day)
Saprolite (high velocity)	1.5	0.11	0.19	0.88
Saprolite (mean velocity)	0.83	0.071	0.25	**0.24**
Saprolite (low velocity)	0.11	0.035	0.30	0.012
Rock (high velocity)	2.1	0.11	0.05	4.6
Rock (mean velocity)	2.1	0.071	0.075	**2.0**
Rock (low velocity)	2.0	0.035	0.10	0.69
Both Units (high velocity)	2.1	0.11	0.05	4.6
Both Units (mean velocity)	1.3	0.071	0.18	**0.54**
Both Units (low velocity)	0.11	0.035	0.30	0.012

Notes:

1. Hydraulic conductivity values are from slug test data (Table 5).
2. The flow calculations for "Both Units" combines the hydraulic properties of the different units and represents a range of flow velocities across the site.
3. Hydraulic gradient information is from the February 14, 2000 Water Table Contour Map (Figure 7).
4. The *high velocity* hydraulic gradient is from the northern area near MW-1 and PZ-1ab/PZ-1c (maximum calculated hydraulic gradient of 0.11).
5. The *low velocity* hydraulic gradient in from the southern area near MW-4 and MW-5 (minimum calculated hydraulic gradient of 0.035).
6. Effective porosity is estimated from specific yield as described by Fetter (1988) and Kruseman and deRidder (1989).

Prepared by: MSP
Checked by: AWA

TABLE 7

VERTICAL HYDRAULIC GRADIENTS AND FLOW RATES
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Well Pairs	Ground Elev. (ft)	TOC Elev. (ft)	Ground Elevation Difference (ft)	Horizontal Distance Between Wells (ft)	Midpoint Screen Elev. (ft)	Vertical Separation Between Screen Midpoints (ft)	Water Level Information			Vertical Hydraulic Gradient (i)	Average Hydraulic Conductivity (ft/day)	Average Effective Porosity (n)	Vertical Flow Velocity (ft/day)	Flow Direction
							Date	Water Elev. (ft)	Head Difference (ft)					
PZ-1ab	677.48	680.14	0.35	17	661.56	20.98	2/14/00	662.83	2.62	0.12	1.5	0.18	1.0	Downward
PZ-1c	677.83	679.54			640.58			660.21						
PZ-4ab	617.68	620.13	0.47	13	597.16	19.01	2/14/00	601.84	0.27	0.014	1.5	0.18	0.12	Slightly Downward
PZ-4c	618.15	619.48			578.15			601.57						
MW-4	630.13	632.83	0.12	10	620.38	17.57	2/14/00	625.12	-1.94	-0.11	0.83	0.25	-0.38	Upward
PZ-6b	630.01	632.79			602.81			627.06						
MW-7	657.19	660.09	0.23	45	633.15	22.89	2/14/00	637.10	0.64	0.028	0.83	0.25	0.095	Slightly Downward
PZ-7b	656.96	659.86			610.26			636.46						

Notes:

1. PZ-1ab/PZ-1c is a well pair between the soil and bedrock units, respectively. They are located in an upland area along the central drainage feature.
2. PZ-4ab/PZ-4c is a well pair between the soil and bedrock units, respectively. They are located in a lowland area on the expansion site near Buffalo Creek.
3. MW-4/PZ-6b is a well pair between piezometers screened in the soil at the water table and top of bedrock, respectively. They are located in a lowland area along the central drainage feature.
4. MW-7/PZ-7b is a well pair between piezometers screened in the soil at the water table and top of bedrock, respectively. They are located at the base of the existing landfill area.
5. Negative values for head difference, vertical hydraulic gradients, and flow gradients represent an upward flow gradient.
6. If the water elevation was below the top of the screen elevation, the "Midpoint" elevation of the water column was used.

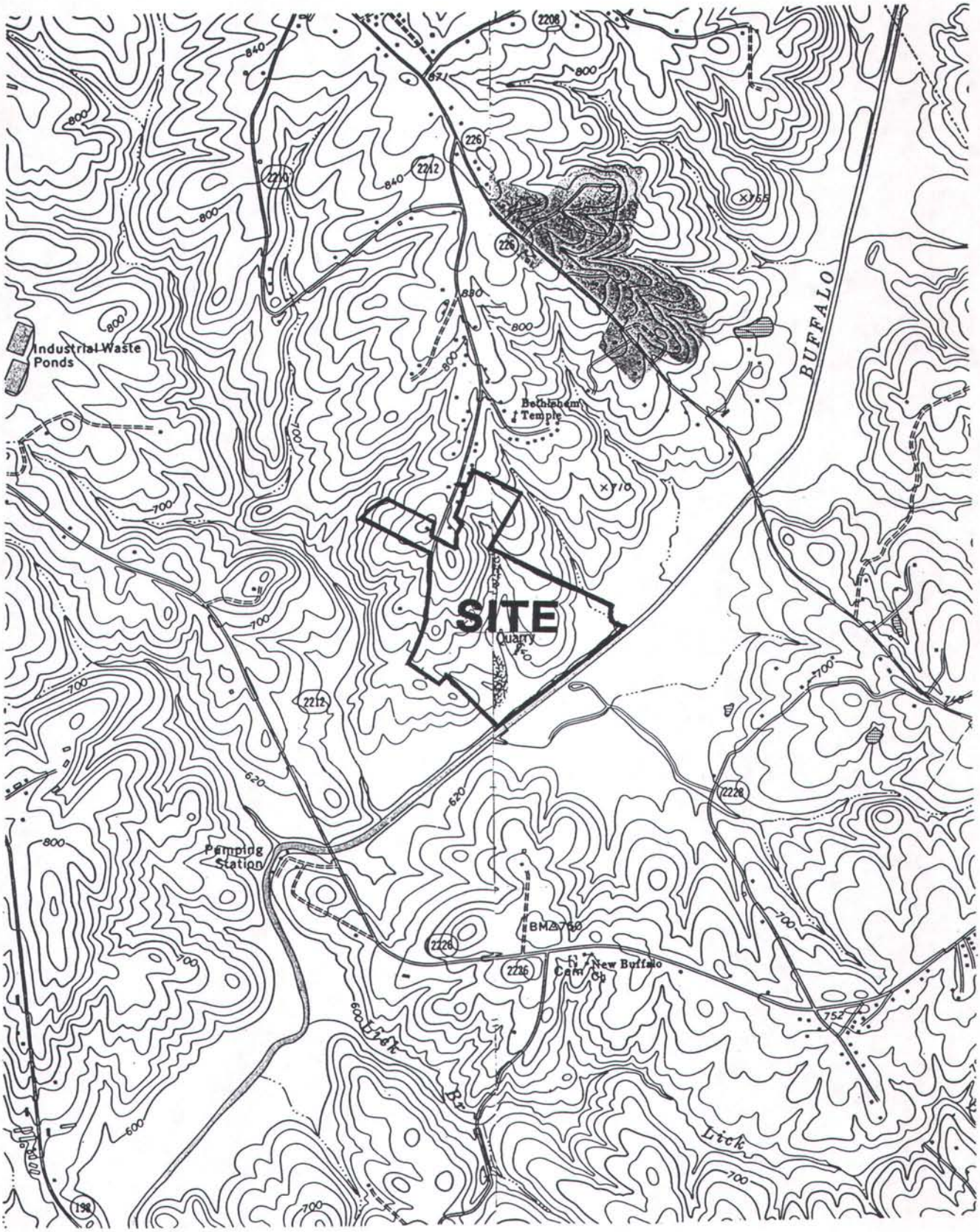
TABLE 8

SUMMARY OF PROPOSED MONITORING WELL CONSTRUCTION DETAILS
JMN/Cleveland Container Industrial Landfill
Cleveland County, NC
BLE Project Number J99-1307-04

Proposed Well	Aquifer Unit Monitored	GS Elev.	Ground Water Elevation	AR Elev.	DTW	DTR	Water Column Above Rock	Top Screen Elev.	Bot. Screen Elev.	Screen Length	Well TD
MW-1B	Saprolitic Soil	768	728	700	40	68	28	733	718	15	50
MW-1C	Saprolitic Soil	768	728	700	40	68	28	710	700	10	68
MW-6A	Saprolitic Soil	634	611	590	23	44	21	616	601	15	33
MW-7A	Saprolitic Soil	657	627	605	30	52	22	632	617	15	40

Notes:
GS = Ground Surface
WT = Water Table
AR = Auger Refusal
DTW = Depth to Water
DTR = Depth to Rock (auger refusal)
TD = Total Depth
Measurements are in feet
Elevations are in feet above MSL
Proposed details estimated from known conditions near the proposed well locations. Actual subsurface conditions may vary.

FIGURES 2, 4, 5, 6 and 7 under Seperate Cover



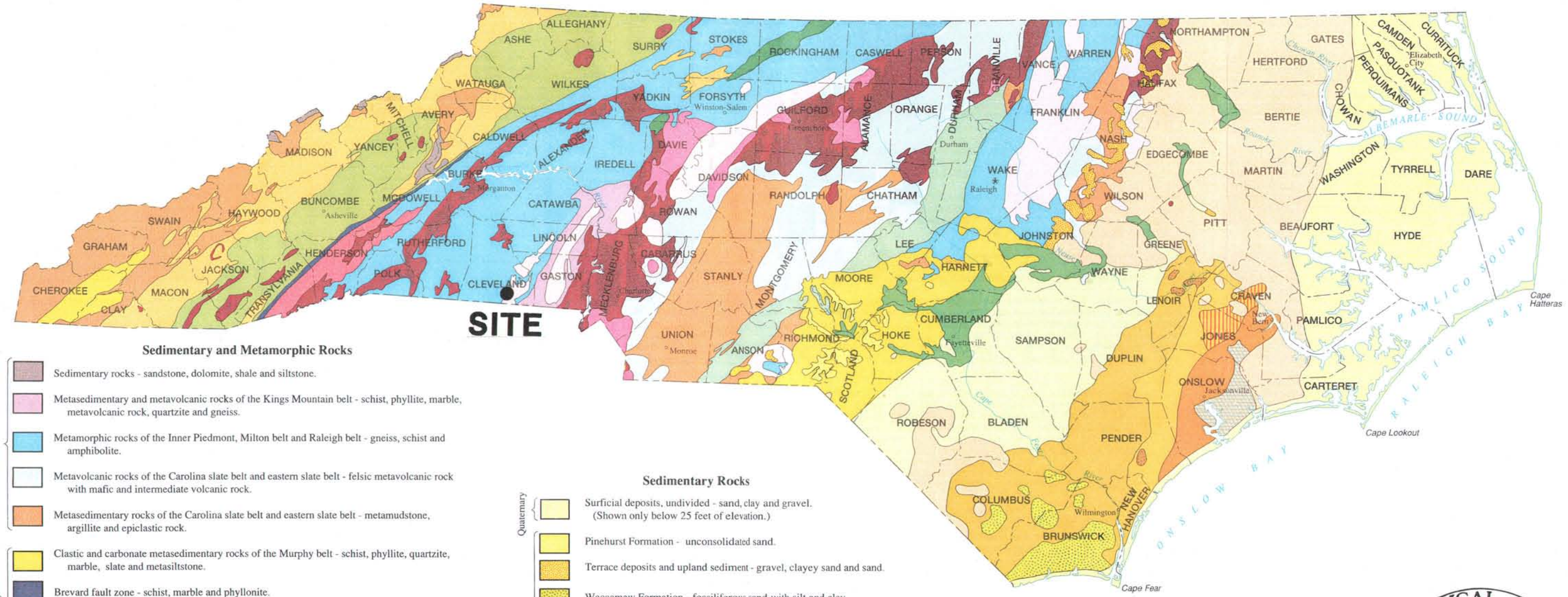
2000 1000 0 2000 4000

APPROXIMATE SCALE IN FEET

REFERENCE:
USGS TOPOGRAPHIC MAP, 7.5 MINUTE SERIES,
BLACKSBURG NORTH AND GROVER, N.C.-S.C. QUADRANGLES, 1971 AND 1993.

DRAWN: AEH	DATE: 02-24-99	BLE INC. BUNNELL-LAMMONS ENGINEERING, INC. 1200 WOODRUFF ROAD, SUITE B-7 GREENVILLE, SOUTH CAROLINA 29607 PHONE: (864)288-1265 FAX: (864)288-4430	SITE LOCATION MAP CLEVELAND CONTAINER LANDFILL SHELBY, NORTH CAROLINA
CHECKED: MSP	CAD: CCLF-SLM		FIGURE 1
APPROVED:	JOB NO: J99-1307-02		

GENERALIZED GEOLOGIC MAP OF NORTH CAROLINA



Sedimentary and Metamorphic Rocks

Late Proterozoic to Early Paleozoic

- Sedimentary rocks - sandstone, dolomite, shale and siltstone.
- Metasedimentary and metavolcanic rocks of the Kings Mountain belt - schist, phyllite, marble, metavolcanic rock, quartzite and gneiss.
- Metamorphic rocks of the Inner Piedmont, Milton belt and Raleigh belt - gneiss, schist and amphibolite.
- Metavolcanic rocks of the Carolina slate belt and eastern slate belt - felsic metavolcanic rock with mafic and intermediate volcanic rock.
- Metasedimentary rocks of the Carolina slate belt and eastern slate belt - metamudstone, argillite and epiclastic rock.

Late Proterozoic

- Clastic and carbonate metasedimentary rocks of the Murphy belt - schist, phyllite, quartzite, marble, slate and metasiltstone.
- Brevard fault zone - schist, marble and phyllonite.
- Clastic metasedimentary and metavolcanic rocks of the Ocoee Supergroup, Grandfather Mountain Formation, Mount Rogers Formation and quartzite of the Sauratown Mountains anticlinorium - slate, metasiltstone, schist, metagraywacke, calc-silicate granofels, quartzite and felsic metavolcanic rock.
- Clastic metasedimentary rock and mafic and felsic metavolcanic rock of the Ashe Metamorphic Suite, Tallulah Falls Formation and Alligator Back Formation - gneiss, schist, metagraywacke, amphibolite and calc-silicate granofels.

Middle Proterozoic

- Felsic gneiss derived from sedimentary and igneous rocks in the northern outcrop area; biotite gneiss in the southern outcrop area; locally migmatitic and mylonitic. Locally and variably interlayered with amphibolite, calc-silicate granofels and rare marble. Intruded by Late Proterozoic mafic and felsic plutons.

Intrusive Rocks

Middle Paleozoic to Late Paleozoic

- Granitic rocks - unfoliated to weakly foliated.
- Syenite - Concord ring dike.

Late Proterozoic to Middle Paleozoic

- Metamorphosed gabbro and diorite - foliated to weakly foliated.
- Metamorphosed granitic rocks - foliated to weakly foliated; locally migmatitic.
- Henderson Gneiss - uneven-grained monzonitic to granodioritic.
- Meta-ultramafic rocks.

Sedimentary Rocks

Quaternary

- Surficial deposits, undivided - sand, clay and gravel. (Shown only below 25 feet of elevation.)

Tertiary

- Pinehurst Formation - unconsolidated sand.
- Terrace deposits and upland sediment - gravel, clayey sand and sand.
- Waccamaw Formation - fossiliferous sand with silt and clay.
- Yorktown Formation and Duplin Formation, undivided -
  Yorktown Formation- fossiliferous clay and sand.
  Duplin Formation- shelly sand, sandy marl and limestone.
- Belgrade Formation, undivided -
  Pollocksville Member- oyster-shell mounds in sand matrix.
  Haywood Landing Member- fossiliferous clayey sand.
- River Bend Formation - sandy, molluscan-mold limestone.
- Castle Hayne Formation -
  Spring Garden Member- molluscan-mold limestone.
- Comfort Member and New Hanover Member, undivided -
  Comfort Member - limestone with bryozoan and echinoid skeletons.
  New Hanover Member - phosphate-pebble conglomerate.
- Beaufort Formation, undivided -
  Unnamed upper member - glauconitic, fossiliferous sand and silty clay.
  Jericho Run Member - siliceous mudstone with sandstone lenses.

Cretaceous

- Peedee Formation - marine sand, clayey sand and clay.
- Black Creek Formation - lignitic sand and clay.
- Middendorf Formation - sand, sandstone and clay.
- Cape Fear Formation - sandstone and sandy mudstone.

Triassic

- Dan River Group, undivided -
  Stoneville Formation - conglomerate, sandstone and mudstone.
  Cow Branch Formation - mudstone.
  Pine Hall Formation - sandstone, mudstone and conglomerate.
- Chatham Group, undivided -
  Sanford Formation - conglomerate, sandstone and mudstone.
  Cumnock Formation,- sandstone and mudstone.
  Pekin Formation - conglomerate, sandstone and mudstone.

50 Miles

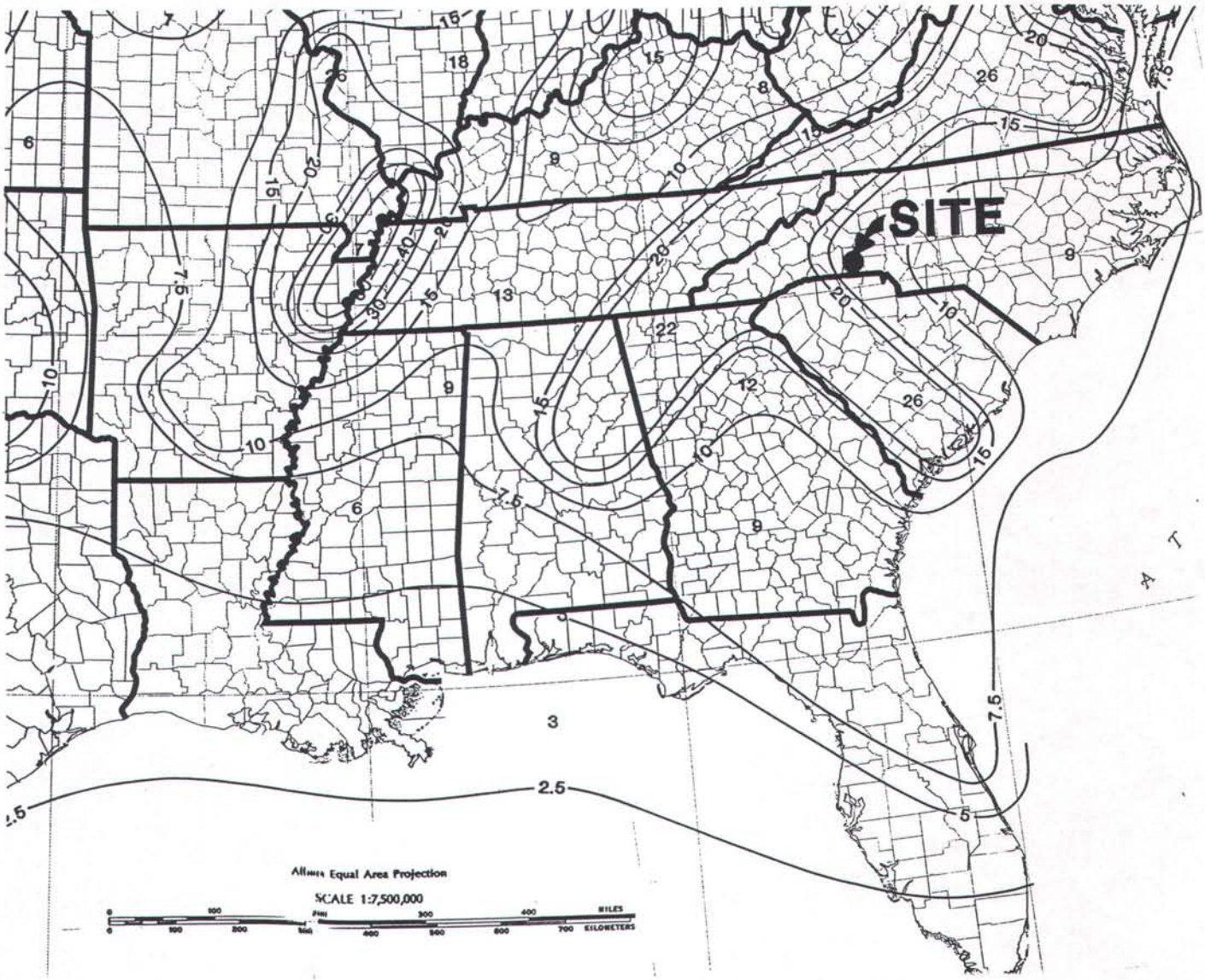
GEOLOGICAL SURVEY N.C. 1823

1991

FIGURE 3

PROBABILISTIC EARTHQUAKE ACCELERATION AND VELOCITY MAPS FOR THE UNITED STATES AND PUERTO RICO

By S.T. Algermissen, D.M. Perkins, P.C. Thenhaus, S.L. Hanson, and B.L. Bender



MAP C.-HORIZONTAL ACCELERATION (90 PERCENT PROBABILITY OF NOT BEING EXCEEDED IN 250 YEARS)
(EXPRESSED IN PERCENT)

MISCELLANEOUS FIELD STUDIES MAP
Published by the U.S. Geological Survey, 1990
Reprinted 1991
(PARTIAL REPRODUCTION)

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DRAWN: AEH	DATE: 02-23-00	BLE INC. BUNNELL-LAMMONS ENGINEERING, INC. 1200 WOODRUFF ROAD, SUITE B-7 GREENVILLE, SOUTH CAROLINA 29607 PHONE: (864)288-1265 FAX: (864)288-4430	SEISMIC IMPACT ZONES MAP JMN/CLEVELAND CONTAINER INDUSTRIAL LANDFILL CLEVELAND COUNTY, NORTH CAROLINA	FIGURE 8
CHECKED: MSP	CAD: CCLF04-SIZM			
APPROVED:	JOB NO: J99-1307-04			

APPENDICES

APPENDIX A

DRILLING AND SAMPLING PROCEDURES

APPENDIX A

DRILLING AND SAMPLING PROCEDURES

SOIL TEST BORINGS

Soil test borings were advanced by mechanically twisting a continuous flight steel auger into the soil. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586. At regular intervals, soil samples were obtained with a standard 1.4-inch ID, 2-inch OD, split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and designated the "penetration resistance."

CORE DRILLING

Core drilling procedures were required to determine the character and vertical continuity of refusal materials. Refusal to soil drilling equipment may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of solid continuous rock.

Prior to coring, a 3-inch diameter PVC pipe was seated in the refusal material and grouted into place with a cement-bentonite mixture. Refusal materials were then cored according to the ASTM D 2113 using a diamond-studded bit fastened to the end of a hollow, double-tube core barrel. The NQ size designate bits that obtain rock cores 1-7/8 inches in diameter. Upon completion of each drill run, the core inner barrel was brought to the surface, the core recovered was measured, and the core samples were removed and placed in boxes for storage.

The core samples were returned to our laboratory where the refusal material was identified and the percent core recovery and rock quality designation (RQD) was determined by a geologist. The percent core recovery is the ratio of the core length obtained to the length cored, expressed as a percent. The RQD is obtained by summing only those pieces of recovered core which are 4 inches or longer and are at least moderately hard, and dividing by the total length cored. The percent core recovery and the RQD are related to soundness and continuity of the refusal material. Refusal-material descriptions, recoveries and the bit size are shown on a Test Boring Record (see Appendix C).

APPENDIX B

FIELD LOGS OF SOIL TEST BORINGS

TEST BORING REPORT

BORING NO. PZ-16

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 1
LOCATION:
ELEVATION:
DATE START: 12/2/99
DATE FINISH: 12/2/99
DRILLER: S. Gower
PREPARED BY: MSP

GROUND WATER DATE	GROUND WATER HRS AFT COMP	DEPTH TO: WATER	DEPTH TO: BOT. OF CASING	DEPTH TO: BOT. OF HOLE

	CASING	SAMPLER	CORE BARREL
TYPE	HSA	SS	—
SIZE ID/OD	8 1/2"	2"	—
HAMMER WT	XXX	140 lb	XXX
HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS
					Topsoil
		3 3 5	S-1	ML/CL	F. sdy SI CLAY - residuum
5		7 9 11	S-2	ML	v. stiff lt. gray & lt. br. sli. moist sli. mic. F. sdy SILT
		7 8 10	S-3	ML	as above
10		5 6 10	S-4	ML	as above moist
15		3 3 2	S-5	SM	loose brown moist mic. SI F. SAND
		hard			
20			S-6		AR = 17.5'

WELL

Backfill 0 – 1.0
Soil Backfill 1.0 – 7.3
Bent 7.3 – 5.3
Sand 5.3 – 12.2
12.2 – 17.2
17.5

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND = 9.3'
TOP BENT. = 7.3'
SCREEN = 12.2 – 17.2
SCREEN LENGTH = 5'
END CAP = 6.3'
WELL TD = 17.5

Sand = 3 bags
Bent = 1 bag

TEST BORING REPORT

BORING NO. PZ-1c

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 3
LOCATION:
ELEVATION:
DATE START: 12/2/99
DATE FINISH: 12/7/99
DRILLER: S. Gower
PREPARED BY: MSP

GROUND WATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	TYPE	HSA	SS	—
					SIZE ID/(OD)	8¼"	2"	—
					HAMMER WT	XXX	140 lb	XXX
					HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
5			S-1		Same as PZ-1ab	2" PVC casing
			S-2			Grout
10			S-3			
			S-4			
15			S-5		hard drilling	
20		50/3" —	S-6	PWR	PWR sampled as brown sli moist sli. mic. sl. F-C SAND	

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND =
TOP BENT. =
SCREEN =
SCREEN LENGTH =
END CAP =
WELL TD =

TEST BORING REPORT

BORING NO. PZ-1C

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 3

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
						Grout; 3" PVC casing
		6				
		8	S-7	SM	M. Firm gray & brown moist	
25		19			V. mic. si F-M SAND (schist)	
					v. hard @ 28'	
		50/0	S-8			29,0
30					AR @ 29'	
					Set 3" PVC casing w/ grout	
			S-9			
35						
			S-10			
40						
			S-11			
45						

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND =

BENTONITE =

GROUT =

WELL O.D. =

WELL TYPE =

CORE BORING REPORT

BORING NO. PZ-1C

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 3 of 3
LOCATION:
ELEVATION:
DATE START: 12/7/99
DATE FINISH: 12/7/99
DRILLER: Ficox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:			ORIENTATION	CORE BARREL	
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	X VERTICAL	TYPE	NQ
					HORIZONTAL	TYPE	
					INCLINED	Bit (ft)	
					BEARING	Barrel (ft)	
					ANG. FROM VERT.	Total (ft)	

DEPTH IN FEET	DRILL RATE MIN/FT	CORE NO. DEPTH RANGE	SAMPLE NUMBER	RECOVERY FT	RECOVERY %	RQD	FIELD CLASSIFICATION AND REMARKS	WELL
								3" PVC
30			R-1	1.5	100	100	v. hard, slightly weathered, black and white, medium grained, quartz, feldspar, biotite GNEISS; with horizontal to shallow dipping foliations and moderately closely spaced, shallow dipping fractures	
			R-2	4.6	92	100	v. hard, fresh, white, med-coarse grained, quartz, mica, garnet MYLONITE, with shallow dipping foliation; and mod. close to widely spaced, shallow dipping fractures	
35								
			R-3	5.0	100	80	v. hard, slightly weathered to fresh, black and white, medium grained, quartz, feldspar, biotite, garnet GNEISS; with shallow dipping foliation; and close to moderately closely spaced, shallow dipping fractures.	
40								
			R-4	5.0	100	68	as above	
45								

29.0

45.5

FIELD HARDNESS		BEDDING		ATTITUDE AND ANGLE	JOINTS / SHEAR / FRACTURE		WEATHERING
V. HARD	- KNIFE CANT SCRATCH	V. THIN	<2"	HORIZONTAL (0-5)	V. CLOSE	<2"	FRESH
HARD	- SCRATCHES DIFFICULTLY	THIN	2"-12"	SHALLOW OR LOW ANGLE (5-35)	CLOSE	2"-12"	V. SLIGHT
MOD. HARD	- SCRATCHES EASILY	MEDIUM	12"-36"	MODERATELY DIPPING (35-55)	MOD CLOSE	12"-36"	SLIGHT
SOFT	- GROVES	THICK	36"-120"	STEEP OR HIGH ANGLE (55-85)	WIDE	36"-120"	MODERATE
V. SOFT	- CARVES	V. THICK	>120"	VERTICAL (85-90)	V. WIDE	>120"	MOD. SEVERE
							V. SEVERE
							COMPLETE

ORDER FOR CORE DESCRIPTION: FIELD HARDNESS, WEATHERING, COLOR, GRAIN SIZE/TEXTURE, LITHOLOGY, FRACTURE CHARACTERISTICS, BEDDING AND FOLIATION, COMMENTS

Changes
Rod on
GS to TOR
Depth to bit
Run

WELL DESCRIPTION	
SCREEN DEPTH =	STICKUP =
SCREEN LENGTH =	TOP SAND =
END CAP =	TOP BENT. =
WELL TD =	BOT. CASING =

Open Bedrock

TEST BORING REPORT

BORING NO. PZ-2ab

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 2
LOCATION:
ELEVATION:
DATE START: 12/3/99
DATE FINISH: 12/3/99
DRILLER: F. Cox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	TYPE	HSA	SS	—
					SIZE ID/OD	8 1/4"	2"	—
					HAMMER WT	XXX	140 lb	XXX
					HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS
					TOPSOIL
		3 3 3	S-1	CL	Firm brown moist F. sdy si CLAY - residuum
5		5 6 6	S-2	ML	stiff brown moist mic sdy F. sdy SILT
		5 6 7	S-3	SM	Firm brown moist V. Mic. sdy si F. SAND
10		5 7 7	S-4	SM	as above
15		5 7 7	S-5	SM	Firm gray/white moist V. Mic si F-M SAND
20		5 8 9	S-6	SM	Firm brown moist V. Mic si F-M SAND

WELL: Bentonite; 2" PVC

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION	
STICKUP =	
TOP SAND =	27.0
TOP BENT. =	0
SCREEN =	28.7-38.7
SCREEN LENGTH =	10
END CAP =	0.3
WELL TD =	39.0

TEST BORING REPORT

BORING NO. PZ-2ab

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 2

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
25		10 8 11	S-7	SM	Firm gray/black moist v. mic si F-m SAND	Bentonite
30		3 5 5	S-8	SM	loose gray/br/white moist v. mic si F-m SAND	27 28
35		5 7 8	S-9	SM	Firm gray/white moist v. mic. si F-m SAND	Bentonite
40		17 50/4"	S-10	PWR	PWR sampled as black/white moist v. mic. si F-m SAND AR = 39.0'	38.7 39.0
45			S-11			

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND =

BENTONITE =

GROUT =

WELL O.D. = 2"

WELL TYPE = PVC

TEST BORING REPORT

BORING NO. PZ-3

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 2
LOCATION:
ELEVATION:
DATE START: 12/6/99
DATE FINISH: 12/6/99
DRILLER: F. Cox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	TYPE	HSA	SS	—
					SIZE ID/(OD)	8¼"	2"	—
					HAMMER WT	XXX	140 lb	XXX
					HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
					Topsoil	
		3 5 6	S-1	ML	stiff red-br moist mic. F. sdy cly SILT - residuum	
		4 7 8	S-2	SM	Film brown sli moist v. mic. cly si F-M SAND	
5						
		3 5 6	S-3	SM	as above	
		4 4 5	S-4	SM	as above	Bentonite
10						
		4 4 5	S-5	SM	loose gray/brown moist v. mic si F-M SAND	2" PVC
15						
		5 7 6	S-6	SM	Film as above	
20						

BLOWS/FT	DENSITY	BLOWS/FT	CONSISTANCY	SAMPLE ID		WELL DESCRIPTION
0-4	VERY LOOSE	0-2	VERY SOFT	SS	SPLIT SPOON	STICKUP =
5-10	LOOSE	3-4	SOFT	HP	HYDROPUNCH	TOP SAND =
11-20	FIRM	5-8	FIRM	UD	UNDISTURBED TUBE	TOP BENT. =
21-30	VERY FIRM	9-15	STIFF	G	GRAB	SCREEN = 33.2 - 43.2
31-50	DENSE	16-30	VERY STIFF	C	COMPOSITE	SCREEN LENGTH = 10
51+	VERY DENSE	31-50	HARD	B	BAG	END CAP = 0.3
		51+	VERY HARD	NR	NO RECOVERY	WELL TD = 43.5

TEST BORING REPORT

BORING NO. P2-3

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 2

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
25		UD	S-7		UD 23'-25'	Bentonite
30		4 5 5	S-8	SM	loose gray/brown/white moist V. Mic. Si F-M SAND	31.0
35		7 7 8	S-9	SM	Firm as above	33.2
40		6 9 11	S-10	SM	Firm as above	SAND
45		50/5" — —	S-11	PwR	PWR sampled as gray/white moist V. Mic Si F-M SAND	43.2 43.5 SOIL 45.5

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND =

BENTONITE =

GROUT =

WELL O.D. = 2"

WELL TYPE = PVC

TEST BORING REPORT

BORING NO. PZ-4ab

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 2
LOCATION:
ELEVATION:
DATE START: 12/6/99
DATE FINISH: 12/16/99
DRILLER: F. Cox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	TYPE	HSA	SS	—
					SIZE ID/OD	8 1/4"	2"	—
					HAMMER WT	XXX	140 lb	XXX
					HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS
		5 3 3	S-1	ML	Firm red-br moist F. sdy cly SLT - residuum
		3 3 3	S-2	ML	Firm red-br sli moist sl. cly F. sdy SILT
5					
		33 50 —	S-3	PWR	PWR sampled as gray/white sl. moist mic si F-C SAND
		38 31 9	S-4	SM	v. dense gray/white sli moist mica si F-C SAND
10					
		6 9 10	S-5	SM	Firm brown/white moist mic. si F-M SAND
15					
		31 50/5"	S-6	PWR	PWR as below
20					

WELL: Bentonite; 2" PVC; Sand; 15.2

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND = 14.0
TOP BENT. = 0
SCREEN = 15.2-25.2
SCREEN LENGTH = 10
END CAP = 0.3
WELL TD = 25.5

TEST BORING REPORT

BORING NO. PZ-4ab

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 2

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
25		50/5"	S-7	PWR	PWR sampled as brown/white wet si F-M SAND	sand 25.3 25.5
					AR = 25.5'	
30			S-8			
35			S-9			
40			S-10			
45			S-11			

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND =

BENTONITE =

GROUT =

WELL O.D. = 2"

WELL TYPE = PVC

TEST BORING REPORT

BORING NO. PZ-4C

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 3
LOCATION:
ELEVATION:
DATE START: 12/2/99
DATE FINISH: 12/7/99
DRILLER: T. Cox
PREPARED BY: MSP

GROUND WATER DATE	GROUND WATER HRS AFT COMP	DEPTH TO: WATER	DEPTH TO: BOT. OF CASING	DEPTH TO: BOT. OF HOLE

	CASING	SAMPLER	CORE BARREL
TYPE	HSA	SS	—
SIZE ID/OD	8¼"	2"	—
HAMMER WT	XXX	140 lb	XXX
HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
					Same as PZ-4ab	grout; 3" PVC
			S-1			
			S-2			
5						
			S-3			
			S-4			
10						
			S-5			
15						
			S-6			
20						

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

SAMPLE ID	
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND =
TOP BENT. =
SCREEN =
SCREEN LENGTH =
END CAP =
WELL TD =

TEST BORING REPORT

BORING NO. P2-4c

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 3

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
25			S-7			grout / 3" PVC
30		19 50/5"	S-8	PWR	PWR sampled as brown/white moist si F-M SAND	
					Auger refusal at 30.0' set 3" PVC casing w/ grout	
35			S-9			
40			S-10			
45			S-11			

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS
SAND =
BENTONITE =
GROUT =
WELL O.D. =
WELL TYPE =

CORE BORING REPORT

BORING NO. PZ-4c

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 3 of 3
LOCATION:
ELEVATION:
DATE START: 12/7/99
DATE FINISH: 12/7/99
DRILLER: E. Cox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:			ORIENTATION		CORE BARREL	
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	X	VERTICAL	TYPE	NQ
						HORIZONTAL	TYPE	
						INCLINED	Bit (ft)	
						BEARING	Barrel (ft)	
						ANG. FROM VERT.	Total (ft)	

DEPTH IN FEET	DRILL RATE MIN/FT	CORE NO. DEPTH RANGE	SAMPLE NUMBER	RECOVERY FT	RECOVERY %	RQD	FIELD CLASSIFICATION AND REMARKS
			R-1	0	0	0	PWR (no recovery)
35			R-2	2.5	50	0	PWR moderately hard to soft, mod. severely weathered, brown, white, and gray, medium grained, feldspar, biotite, quartz GNEISS; with horizontal to shallow dipping foliation, and v. close to closely spaced, horizontal to shallow dipping fractures
40			R-3	3.2	64	0	
45			R-4	4.3	68	34	soft to hard, mod. severe to slightly weathered, black, white, and brown, medium grained, biotite, feldspar quartz GNEISS; with shallow dipping foliation; and v. close to mod. closely spaced, shallow dipping fractures
50							

grout

WELL: 3' PVC; 30.0; open bedrock; 50.0

FIELD HARDNESS		BEDDING		ATTITUDE AND ANGLE	JOINTS / SHEAR / FRACTURE		WEATHERING
V. HARD	- KNIFE CANT SCRATCH	V. THIN	<2"	HORIZONTAL (0-5)	V. CLOSE	<2"	FRESH
HARD	- SCRATCHES DIFFICULTLY	THIN	2"-12"	SHALLOW OR LOW ANGLE (5-35)	CLOSE	2"-12"	V. SLIGHT
MOD. HARD	- SCRATCHES EASILY	MEDIUM	12"-36"	MODERATELY DIPPING (35-55)	MOD CLOSE	12"-36"	SLIGHT
SOFT	- GROVES	THICK	36"-120"	STEEP OR HIGH ANGLE (55-85)	WIDE	36"-120"	MODERATE
V. SOFT	- CARVES	V. THICK	>120"	VERTICAL (85-90)	V. WIDE	>120"	MOD. SEVERE
							V. SEVERE
							COMPLETE

ORDER FOR CORE DESCRIPTION: FIELD HARDNESS, WEATHERING, COLOR, GRAIN SIZE/TEXTURE, LITHOLOGY, FRACTURE CHARACTERISTICS, BEDDING AND FOLIATION, COMMENTS

Changes
Rod on
GS to TOR
Depth to bit
Run

WELL DESCRIPTION	
SCREEN DEPTH =	STICKUP =
SCREEN LENGTH =	TOP SAND =
END CAP =	TOP BENT. =
WELL TD =	BOT. CASING =

TEST BORING REPORT

BORING NO. PZ-5ab

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 2
LOCATION:
ELEVATION:
DATE START: 12/7/99
DATE FINISH: 12/7/99
DRILLER: E. Cox
PREPARED BY: MSP

GROUND WATER DATE	GROUND WATER HRS AFT COMP	DEPTH TO: WATER	DEPTH TO: BOT. OF CASING	DEPTH TO: BOT. OF HOLE

	CASING	SAMPLER	CORE BARREL
TYPE	HSA	SS	—
SIZE ID (OD)	8 1/4"	2"	—
HAMMER WT	XXX	140 lb	XXX
HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS
		4	S-1	ML-CL	V. stiff red-br moist sli. mic. F. sdy cly SILT - residuum
		7			
		10			
		5	S-2	SM	Firm brown/gray/white moist v. mic. si F-M SAND
5		6			
		7			
		5	S-3	SM	loose as above
		4			
		6			
		5	S-4	SM	Firm as above
		6			
10		7			
		5	S-5	SM	Firm as above
		5			
15		7			
		6	S-6	SM	loose as above
		4			
20		5			

WELL: Bentonite; 2" PVC

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND = 26.0
TOP BENT. = 0
SCREEN = 27.7-37.7
SCREEN LENGTH = 10
END CAP = 0.3
WELL TD = 38.0

TEST BORING REPORT

BORING NO. PZ-Sab

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 2

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
						Bentonite
		8				
		8	S-7	SM	Firm as above	
25		10				
						26.0
						27.1
		15				Sand
		13	S-8	SM	Dense gray/white Moist	
30		26			v. mic si F-M SAND	
		50/5"	S-9	PwR	PWR sampled as gray/white	
35		—			Moist v. mic si F-M SAND	
						37.1
						38.0
			S-10		AR = 38.0'	
40						
			S-11			
45						

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND =

BENTONITE =

GROUT =

WELL O.D. = 2"

WELL TYPE = PVC

TEST BORING REPORT

BORING NO. PZ-66

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 2
LOCATION:
ELEVATION:
DATE START: 1/11/00
DATE FINISH: 1/11/00
DRILLER: E. Cox
PREPARED BY: MSP

GROUND WATER DATE	GROUND WATER HRS AFT COMP	DEPTH TO: WATER	DEPTH TO: BOT. OF CASING	DEPTH TO: BOT. OF HOLE

	CASING	SAMPLER	CORE BARREL
TYPE	HSA	SS	—
SIZE ID/OD	8 1/4"	2"	—
HAMMER WT	XXX	140 lb	XXX
HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS
					Top Soil
			S1	SM	loose to firm red-br moist mic. cly si F. SAND
5			S2		
			S3		
10		4 5 7	S-4	SM	Firm brown/white moist mic. si F-M SAND
15			S5		
					Hard @ 16'
20		50/4.5"	S-6	PWR	PWR SAMPLED as brown/white moist mic. si F-M SAND

PZ-66 WELL

Grout

2" PVC

Bentonite

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND = 24.0
TOP BENT. = 14.0
SCREEN = 29.7-29.7
SCREEN LENGTH = 10
END CAP = 0.3
WELL TD = 30.0

TEST BORING REPORT

BORING NO. PZ-6 b

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 2

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
						Bentonite
25						Sand 24.7
		50/0.5"	S-8	PWR	as above	29.7
30		—				30.0
					Auger refusal 30.0'	
			S-9			
35						
			S-10			
40						
			S-11			
45						

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND = 2.5 bags

BENTONITE = 10'

GROUT = yes

WELL O.D. = 2"

WELL TYPE = pvc

TEST BORING REPORT

BORING NO. PZ-7b

PROJECT: Cleveland Container LF - Shelby, NC
CLIENT: HHNT
CONTRACTOR: Superior Drilling, Inc.
EQUIPMENT USED: CME 550 ATV

BLE JOB NO. J99-1307-04
PAGE NO. 1 of 3
LOCATION:
ELEVATION:
DATE START: 1/10/00
DATE FINISH: 1/10/00
DRILLER: F. Cox
PREPARED BY: MSP

GROUND WATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFT COMP	WATER	BOT. OF CASING	BOT. OF HOLE	TYPE	HSA	SS	—
					SIZE ID/OD	8¼OD	2"OD	—
					HAMMER WT	XXX	140 lb	XXX
					HAMMER FALL	XXX	30"	XXX

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
					no top soil	
			S-1	ML	soft to Firm red br mic moist clay & sdy SILT	
5			S-2			
			S-3			
		4 5 6	S-4	SM	Firm brown moist v. mic. si F-m SAND	
10						
			S-5			
15						
		3 3 3	S-6	SM	loose gray/wht/br wet v. mic. si F-m SAND	
20						

WELL: Grout; 2" PVC

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL DESCRIPTION
STICKUP =
TOP SAND = 40
TOP BENT. = 30
SCREEN = 41.7 - 51.7
SCREEN LENGTH = 10
END CAP = 0.3
WELL TD = 52.0

TEST BORING REPORT

BORING NO. PZ-76

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 2 OF 3

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
25			S-7			Grout
				SM	loose brown/gray wet, v. mic si F-C SAND	
		5				
		3	S-8			
30		10		ML	v. stiff white wet F. sdy SILT (kaolinite, weathered Feldspar in pegmatite)	30.0
				SM	Firm brown/gray wet v. mic si F-C SAND	Bentonite
35			S-9			
		50/2	S-10	PWR	PWR sampled as black/white wet F-C SAND (gneiss)	
40						40.0
					HARD	41.7
					softer	Sand
45			S-11		Hard	

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS
SAND =
BENTONITE =
GROUT =
WELL O.D. =
WELL TYPE =

TEST BORING REPORT

BORING NO. PZ-76

Cleveland Container LF - Shelby, NC — J99-1307-04 — PAGE 3 OF 3

DEPTH IN FEET	CASING BLOWS PER FT	SAMPLER BLOWS PER 6"	SAMPLE NUMBER	USCS	FIELD CLASSIFICATION AND REMARKS	WELL
50		50/2	S-12	PWR	PWR sampled as brown moist mic si F-m SAND	Sand
						51.7
					Auger refusal @ 52.0'	52.0
55			S-13			
60			S-14			
65			S-15			
70			S-16			

BLOWS/FT	DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-20	FIRM
21-30	VERY FIRM
31-50	DENSE
51+	VERY DENSE

BLOWS/FT	CONSISTANCY
0-2	VERY SOFT
3-4	SOFT
5-8	FIRM
9-15	STIFF
16-30	VERY STIFF
31-50	HARD
51+	VERY HARD

	SAMPLE ID
SS	SPLIT SPOON
HP	HYDROPUNCH
UD	UNDISTURBED TUBE
G	GRAB
C	COMPOSITE
B	BAG
NR	NO RECOVERY

WELL MATERIALS

SAND = 4 bags

BENTONITE = 10'

GROUT = yes

WELL O.D. = 2"

WELL TYPE = PVC

0.5 Slot

Bottom of Well

APPENDIX C

SOIL TEST BORING/ROCK CORING RECORDS AND PIEZOMETER DIAGRAMS

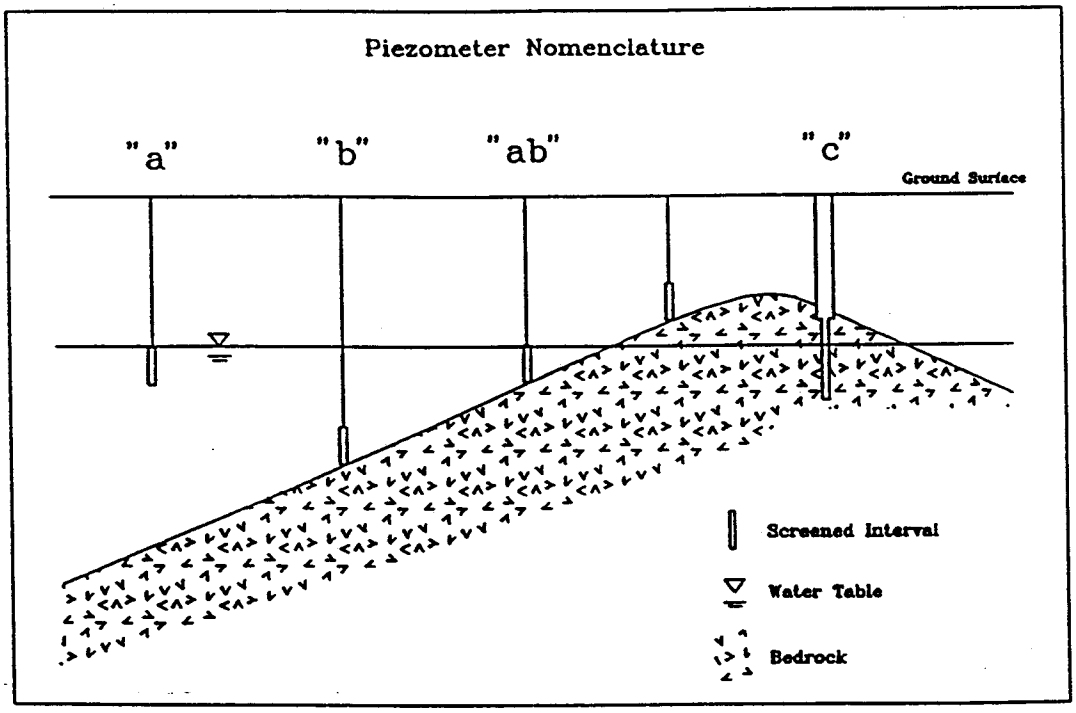
APPENDIX C

SOIL TEST BORING/ROCK CORING RECORDS AND PIEZOMETER DIAGRAMS

Piezometer Construction and Nomenclature

Piezometer identification numbers were designated with the letters "a," "b," or "c" depending on the location of the screened interval in the piezometer. Piezometers with a screened interval which brackets the water table and is above the depth of auger refusal, were designated with the letter "a." Piezometers with a screened interval at the depth of auger refusal (top of bedrock surface) and below the water table were designated with the letter "b." In cases where the water table was near the depth of auger refusal, the piezometer identification number was designated using "ab." Bedrock piezometers were designated with the letter "c". Piezometers that are dry do not have a letter designation.

A typical schematic diagram of piezometer construction and nomenclature is shown below.



KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

BUNNELL-LAMMONS ENGINEERING, INC.
GREENVILLE, SOUTH CAROLINA

Penetration Resistance* Blows per Foot	Relative Density
SANDS	
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

Penetration Resistance* Blows per Foot	Consistency
SILTS and CLAYS	
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

*ASTM D 1586

Particle Size Identification

Boulder: Greater than 300 mm
Cobble: 75 to 300 mm
Gravel:
Coarse - 19 to 75 mm
Fine - 4.75 to 19 mm
Sand:
Coarse - 2 to 4.75 mm
Medium - 0.425 to 2 mm
Fine - 0.075 to 0.425 mm
Silt & Clay: Less than 0.075 mm

KEY TO DRILLING SYMBOLS

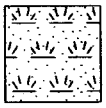

Split Spoon Sample

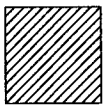

Undisturbed Sample


Groundwater Table at Time of Drilling


Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

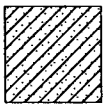

Topsoil

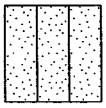

Low Plasticity Silty Clay


High Plasticity Silty Clay


Low Plasticity Silt


High Plasticity Clayey Silt


Clayey Sand

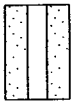

Silty Sand


Partially Weathered Rock


Bedrock, Gneiss

KEY TO PIEZOMETER DESCRIPTIONS


Bentonite


Filter pack, Sand


Well Screen

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-1ab

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 12-2-99 END: 12-2-99

LOCATION: Shelby, North Carolina — ELEVATION: 677.48

DRILLER: Superior Drilling, Inc., S. Gower — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ dry AFTER 24 HOURS: ▼ 15.92 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
675 / 2	6-inches of TOPSOIL Firm, reddish-brown, moist, slightly micaceous, fine sandy, clayey SILT - (residuum)			8	Bentonite seal, 0 to 1 foot
4	Very stiff, light gray and light brown, slightly moist to moist, slightly micaceous, fine sandy SILT			20	Soil backfill, 1 to 7.3 feet
670 / 6				18	Bentonite seal, 7.3 to 9.3 feet
8				16	
10					
665 / 12	Loose, brown, moist, micaceous, silty, fine SAND			5	Filter pack, sand 9.3 to 17.5 feet
14					.010-inch slotted Schedule 40 PVC well screen, 12.2 to 17.2 feet
16 ▼					Pipe cap
660 / 18	Auger refusal at 17.5 feet. No ground water encountered at time of drilling.				Total well depth, 17.5 feet
20					
655 / 22					
24					
26					
650 / 28					
30					
645 / 32					
34					
36					
640 / 38					

GEOT_WELL 1307-04.GPJ 1/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-1c

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 12-2-99 END: 12-7-99

LOCATION: Shelby, North Carolina — ELEVATION: 677.83

DRILLER: Superior Drilling, Inc., S. Gower/F. Cox — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ ____ AFTER 24 HOURS: ▼ 17.91 CAVING> ____

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
675 / 2	6-inches of TOPSOIL Firm, reddish-brown, moist, slightly micaceous, fine sandy, clayey SILT - (residuum)			8	
4	Very stiff, light gray and light brown, slightly moist to moist, slightly micaceous, fine sandy SILT			20	
670 / 6				18	how is PVC anchored
8					
10				16	
665 / 12	Loose, brown, moist, micaceous, silty, fine SAND			5	3-inch PVC casing set to 29 feet by grouting
14					
16	PARTIALLY WEATHERED ROCK which sampled as brown, slightly moist, slightly micaceous, silty, fine to coarse SAND				
660 / 18 ▼				50/3"	50/3"
20					
22	Very firm, gray and brown, moist, very micaceous, silty, fine to medium SAND (schist)				
655 / 24				27	
26					
650 / 28	PARTIALLY WEATHERED ROCK Very hard at 28 feet			50/0"	50/0"
30	Very hard, slightly weathered, black and white, medium grained, quartz, feldspar, biotite GNEISS; with horizontal to shallow dipping foliations and moderately closely spaced, shallow dipping fractures.(R-1 recovery = 100%, RQD = 100), (R-2 recovery = 92%, RQD = 100)			R-1	
32					
645 / 34				R-2	
36					
640 / 38	Very hard, fresh, white, red-coarse grained, quartz, mica, garnet MYLONITE,			R-3	3-inch open bedrock well from 29 to 45.5 feet

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-1c

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04

CLIENT: HHNT | DATE START: 12-2-99 END: 12-7-99

LOCATION: Shelby, North Carolina | ELEVATION: 677.83

DRILLER: Superior Drilling, Inc., S. Gower/F. Cox | LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ AFTER 24 HOURS: ▼ 17.91 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
635 / 42	with shallow dipping foliation; and moderately close to widely spaced, shallow dipping fractures. (R-2 recovery = 92%, RQD = 100)				
44			R-4		
46	Very hard, slightly weathered to fresh, black and white, medium grained, quartz, feldspar, biotite, garnet GNEISS; with shallow dipping foliation; and close to moderately closely spaced, shallow dipping fractures. (R-3 recovery = 100%, RQD = 80), (R-4 recovery = 100%, RQD = 68)				
630 / 48					
50					
52					
625 / 54	Auger refusal at 29 feet. Set 3-inch PVC casing with grout.				
56					
620 / 58					
60					
62					
615 / 64					
66					
610 / 68					
70					
72					
605 / 74					
76					
600 / 78					

GEOT_WELL 1307-04.GPJ 7/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-2ab

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 12-3-99 END: 12-3-99

LOCATION: Shelby, North Carolina — ELEVATION: 648.93

DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ 35 AFTER 24 HOURS: ▼ 29.96 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
0	6-inches of TOPSOIL				
2	Firm, brown, moist, fine sandy, silty CLAY - (residuum)			6	
645 4	Stiff, brown, moist, micaceous, clayey, fine sandy SILT			12	
6	Firm, brown, moist, very micaceous, clayey, silty, fine SAND			13	
8 640					
10				14	
12	Firm, gray and white, moist, very micaceous, silty, fine to medium SAND				Bentonite seal, 0 to 27 feet
635 14				14	
16					
18	Firm, brown, moist, very micaceous, silty, fine to medium SAND				
630				17	
20					
22	Firm and loose, gray, black and white, moist, very micaceous, silty, fine to medium SAND				
625 24				19	
26					
28					
620				10	
30					Filter pack, sand 27 to 39 feet
32					
615 34				15	.010-inch slotted Schedule 40 PVC well screen, 28.7 to 38.7 feet
36					
38	PARTIALLY WEATHERED ROCK which sampled as black and white, moist,			50/4"	Pipe cap
610				50/4"	

GEOT_WELL 1307-04.GPJ 2/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-2ab

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04

CLIENT: HHNT | DATE START: 12-3-99 END: 12-3-99

LOCATION: Shelby, North Carolina | ELEVATION: 648.93

DRILLER: Superior Drilling, Inc., F. Cox | LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ 35 AFTER 24 HOURS: ▼ 29.96 CAVING> ▨

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
42	very micaceous, silty, fine to medium SAND				Total well depth, 39 feet
605 — 44	Auger refusal at 39 feet. No ground water encountered at time of drilling.				
46					
48					
600 — 50					
52					
595 — 54					
56					
58					
590 — 60					
62					
585 — 64					
66					
68					
580 — 70					
72					
575 — 74					
76					
78					
570					

GEOT_WELL 1307-04.GPJ 2/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-3

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 12-6-99 END: 12-6-99

LOCATION: Shelby, North Carolina — ELEVATION: 669.21

DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ dry AFTER 24 HOURS: ▼ dry CAVING> ▨

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
665 / 2	6-inches of TOPSOIL Stiff, reddish-brown, moist, micaceous, fine sandy, clayey SILT - (residuum)			11	
4 / 6	Firm, brown, slightly moist, very micaceous, clayey, silty, fine to medium SAND			15 11	
660 / 8 / 10				9	
12	Loose to firm, gray and brown, moist, very micaceous, silty, fine to medium SAND				
655 / 14 / 16				9	Bentonite seal, 0 to 31 feet
18					
650 / 20				13	
22					
645 / 24	UD tube pushed from 23 to 25 feet				
26					
28	Loose to firm, gray, brown and white, moist, very micaceous, silty, fine to medium SAND				
640 / 30				10	
32					Filter pack, sand 31 to 43.5 feet
635 / 34				15	
36					
38					.010-inch slotted Schedule 40 PVC well screen, 33.2 to 43.2 feet
630				20	

GEOT WELL 1307-04.GPJ 000

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-3

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04
CLIENT: HHNT | DATE START: 12-6-99 END: 12-6-99
LOCATION: Shelby, North Carolina | ELEVATION: 669.21
DRILLER: Superior Drilling, Inc., F. Cox | LOGGED BY: MSP
DRILLING METHOD: CME 550 ATV Hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ dry AFTER 24 HOURS: ▼ dry CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
42 / 625	PARTIALLY WEATHERED ROCK which sampled as gray and white, moist, very micaceous, silty, fine to medium SAND		50/5"	50/5"	Pipe cap
44 / 625					Soil 43.5 to 45.5 feet
46					
48 / 620					Total well depth, 43.5 feet
50	Auger refusal at 45.5 feet. No ground water encountered at time of drilling.				
52					
54 / 615					
56					
58					
60 / 610					
62					
64 / 605					
66					
68					
70 / 600					
72					
74 / 595					
76					
78 / 590					

GEOT_WELL 1307-04.G 4/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-4ab

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04

CLIENT: HHNT | DATE START: 12-6-99 END: 12-6-99

LOCATION: Shelby, North Carolina | ELEVATION: 617.68

DRILLER: Superior Drilling, Inc., F. Cox | LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ 18 AFTER 24 HOURS: ▼ 16.49 CAVING> ▨

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
615 / 2	Firm, reddish-brown, moist, fine sandy, clayey SILT - (residuum)			6	
4	Firm, reddish-brown, slightly moist, slightly clayey, fine sandy SILT			6	
610 / 6	PARTIALLY WEATHERED ROCK which sampled as gray and white, slightly moist, micaceous, silty, fine to coarse SAND			50	Bentonite seal, 0 to 14 feet
8	Very dense, gray and white, slightly moist, micaceous, silty, fine to coarse SAND			40	
605 / 12	Firm, brown and white, moist, micaceous, silty, fine to medium SAND				
14				19	Filter pack, sand 14 to 25.5 feet
16 ▼					
600 / 18 ▽	PARTIALLY WEATHERED ROCK which sampled as brown and white, wet, silty, fine to medium SAND			50/5"	50/5"
20					.010-inch slotted Schedule 40 PVC well screen, 15.2 to 25.2 feet
595 / 22					
24				50/5"	50/5"
26	Auger refusal at 25.5 feet. No ground water encountered at time of drilling.				Pipe cap
590 / 28					Total well depth, 25.5 feet
30					
585 / 32					
34					
36					
580 / 38					

GEOT_WELL 1307-04.GPJ 1/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-4c

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04

CLIENT: HHNT | DATE START: 12-2-99 END: 12-7-99

LOCATION: Shelby, North Carolina | ELEVATION: 618.15

DRILLER: Superior Drilling, Inc., F. Cox | LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ AFTER 24 HOURS: ▼ 17.16 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
615 / 2	Firm, reddish-brown, moist, fine sandy, clayey SILT - (residuum)			6	
4	Firm, reddish-brown, slightly moist, slightly clayey, fine sandy SILT			6	
610 / 6	PARTIALLY WEATHERED ROCK which sampled as gray and white, slightly moist, micaceous, silty, fine to coarse SAND			50	
8	Very dense, gray and white, slightly moist, micaceous, silty, fine to coarse SAND			40	
10					
12	Firm, brown and white, moist, micaceous, silty, fine to medium SAND				
605 / 14				19	
16					
600 / 18	PARTIALLY WEATHERED ROCK which sampled as brown and white, wet, silty, fine to medium SAND			50/5"	50/5"
20					
22					
595 / 24				50/5"	50/5"
26					
590 / 28				50/5"	50/5"
30					
32					
585 / 34	PARTIALLY WEATHERED ROCK No recovery				
36					
580 / 38	Moderately hard to soft, moderately severely weathered, brown, white				

3-inch PVC casing set to 30 feet by grouting

GEOT_WELL 1307-04.G

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-4c

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04
CLIENT: HHNT — DATE START: 12-2-99 END: 12-7-99
LOCATION: Shelby, North Carolina — ELEVATION: 618.15
DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP
DRILLING METHOD: CME 550 ATV Hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ _____ AFTER 24 HOURS: ▼ 17.16 CAVING> _____

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
575 / 42	and gray, medium grained, feldspar, biotite, quartz GNEISS; with horizontal to shallow dipping foliation; and very close to closely spaced, horizontal to shallow dipping fractures. (R-2 recovery = 50%, RQD = 0), (R-3 recovery = 64%, RQD = 0)				3-inch open bedrock well from 30 to 50 feet
570 / 48	Soft to hard, moderately severe to slightly weathered, black, white and brown, medium grained, biotite, feldspar quartz GNEISS; with shallow dipping foliation and very close to moderately closely spaced, shallow dipping fractures. (R-4 recovery = 68%, RQD = 34)				
565 / 54	Auger refusal at 30 feet. Set 3-inch PVC casing with grout. No ground water encountered at time of drilling.				
560 / 58					
555 / 64					
550 / 68					
545 / 74					
540 / 78					

GEOT_WELL 1307-04 3/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-5ab

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04
CLIENT: HHNT — DATE START: 12-7-99 END: 12-7-99
LOCATION: Shelby, North Carolina — ELEVATION: 646.50
DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP
DRILLING METHOD: CME 550 ATV Hollow stem auger
DEPTH TO - WATER> INITIAL: ▽ 36 AFTER 24 HOURS: ▼ 30.56 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
645 / 2	Very stiff, reddish-brown, moist, slightly micaceous, fine sandy, clayey SILT - (residuum)		17		
4	Firm and loose, brown, gray and white, moist, very micaceous, silty, fine to medium SAND		13		
640 / 6			10		
8			13		
635 / 10					
12			12		Bentonite seal, 0 to 26 feet
630 / 14					
16					
18			9		
625 / 20					
22					
620 / 24			18		
26	Dense, gray and white, moist, very micaceous, silty, fine to medium SAND				
28			39		Filter pack, sand 26 to 38 feet
615 / 30					
32	PARTIALLY WEATHERED ROCK which sampled as gray and white, moist, very micaceous, silty, fine to medium SAND		50/5"	50/5"	.010-inch slotted Schedule 40 PVC well screen, 27.7 to 37.7 feet
34					
610 / 36 ▽					
38	Auger refusal at 38 feet. No ground water encountered at time of drilling.				Pipe cap
605 / 40					Total well depth, 38 feet

GEOT_WELL 1307-04 3/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-6b

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 1-11-00 END: 1-11-00

LOCATION: Shelby, North Carolina — ELEVATION: 630.01

DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ — AFTER 24 HOURS: ▼ 3.27 — CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
625 / 2	6-inches of TOPSOIL Loose to firm, reddish-brown, moist, micaceous, clayey, silty, fine SAND				
4	Firm, brown and white, moist, micaceous, silty, fine to medium SAND				
6					Neat cement, 0 to 14 feet
8					
620 / 10			12		
12					
14					
615 / 16	PARTIALLY WEATHERED ROCK which sampled as brown and white, moist, micaceous, silty, fine to medium SAND				
18			50/4.5"	50/4.5"	Bentonite seal, 14 to 24 feet
610 / 20					
22					
24					
605 / 26					Filter pack, sand 24 to 30 feet
28			50/.5"	50/.5"	.010-inch slotted Schedule 40 PVC well screen, 24.7 to 29.7 feet Pipe cap
600 / 30	Auger refusal at 30 feet. No ground water encountered at time of drilling.				Total well depth, 30 feet
32					
34					
595 / 36					
38					

GEOT_WELL 1307-04.2/00

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-7b

PROJECT: Cleveland Container Landfill — PROJECT NO.: J99-1307-04

CLIENT: HHNT — DATE START: 1-10-00 END: 1-10-00

LOCATION: Shelby, North Carolina — ELEVATION: 656.96

DRILLER: Superior Drilling, Inc., F. Cox — LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ ____ AFTER 24 HOURS: ▼ 20.94 CAVING> ____

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
655 / 2	No topsoil Soft to firm, reddish-brown, micaceous, moist, clayey, fine sandy SILT				
4	Firm, brown, moist, very micaceous, silty, fine to medium SAND				
650 / 6					
8					
10				11	
645 / 12					
14					
16	Loose, gray, white and brown, wet, very micaceous, silty, fine to medium SAND				Neat cement, 0 to 30 feet
640 / 18					
20	▼			6	
635 / 22					
24					
26					
630 / 28					
30	Very stiff, white, wet, fine sandy SILT (kaolinite, weathered feldspar in pegmatite)			13	
625 / 32					
34	Firm, brown and gray, wet, very micaceous, silty, fine to coarse SAND				
36	PARTIALLY WEATHERED ROCK which sampled as black and white, wet, fine to coarse SAND (gneiss)				Bentonite seal, 30 to 40 feet
620 / 38				50/2"	50/2"

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PIEZOMETER NO. PZ-7b

PROJECT: Cleveland Container Landfill | PROJECT NO.: J99-1307-04

CLIENT: HHNT | DATE START: 1-10-00 END: 1-10-00

LOCATION: Shelby, North Carolina | ELEVATION: 656.96

DRILLER: Superior Drilling, Inc., F. Cox | LOGGED BY: MSP

DRILLING METHOD: CME 550 ATV Hollow stem auger

DEPTH TO - WATER> INITIAL: ▽ AFTER 24 HOURS: ▼ 20.94 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)	MONITOR WELL INSTALLATION DETAILS
615 — 42					Filter pack, sand 40 to 52 feet
44					
	PARTIALLY WEATHERED ROCK which sampled as brown, moist, micaceous, silty, fine to medium SAND				
610 — 46					.010-inch slotted Schedule 40 PVC well screen, 41.7 to 51.7 feet
48				50/2"	
			50/2"		
50					
605 — 52					Pipe cap
	Auger refusal at 52 feet. No ground water encountered at time of drilling.				Total well depth, 52 feet
54					
56					
600 — 58					
60					
595 — 62					
64					
66					
590 — 68					
70					
585 — 72					
74					
76					
580 — 78					

GEOT_WELL 1307-04 2/00

R-1

NC DEHNR
DEM - GW SECTION
P.O. BOX 29535
RALEIGH, NC 27626-0535
(919) 733-3221

QUAD NO._____ SER. NO._____
LAT _____ LONG_____
BASIN CODE_____
HEADER ENT._____GW-1 ENT._____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: PITTMAN WELL BORING

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

DRILLER REGISTRATION #: 946

==========

1. **WELL LOCATION:** (SHOW SKETCH OF THE LOCATION BELOW)
   NEAREST TOWN: EARL **COUNTY:** CLEV
   HWY. #198
   (ROAD, COMM., OR SUBDV. & LOT NO.)
2. **OWNER** WYLIE LEE
   ADDRESS HWY. #198
   EARL NC 28038
   CITY OR TOWN **STATE** **ZIP CODE**
3. **DATE DRILLED:** 06-13-96 **USE OF WELL:** HOUSE
4. **TOTAL DEPTH:** 45'
5. **CUTTINGS COLLECTED:** YES NO XX
6. **DOES WELL REPLACE EXISTING WELL?** YES NO XX
7. **STAT. WAT. LEVL.** BEL.TOP OF CASING 25 '
   (USE "+" IF ABOVE TOP)
8. **TOP OF CASING IS** 18" ' **ABOVE LAND SURF.***
9. **YIELD (GPM):** 20' **METHOD OF TEST** STEEL TAPE
10. **WATER ZONES (DEPTH):** _____
11. **CHLORINATION: TYPE** CLOROX **AMOUNT** 1/2 GAL
12. **CASING:**

	DEPTH		DIA	W. THICK. OR WT/FT.	MTL
FROM	0	TO 45 FT.	24"		CONC
FROM		TO FT.			

13. **GROUT:**

	DEPTH		MATERIAL	METHOD
FROM	0	TO 20 FT.	CEMENT	POURED
FROM		TO FT.		

14.

	DEPTH		DIA	SLOT SIZE	MTL
FROM		TO FT.		IN.	IN.
FROM		TO FT.		IN.	IN.
FROM		TO FT.		IN.	IN.

15. **SAND/GRAVEL PACK:**

	DEPTH		SIZE	MATERIAL
FROM	25	TO 45 FT.	#6 M	STONE

16. **REMARKS:** _____

==========

LOCATION SKETCH

GO DOWN HWY. #198 FROM EARL. HOUSE ON RT. JUST BEFORE CROSSING BUFFALO CREEK.

N.C. DEPT. OF ENVIRONMENT, HEALTH & NATURAL RESOURCES
OCT 10 1996
DIVISION OF ENVIRONMENTAL MANAGEMENT
MOORESVILLE REGIONAL OFFICE

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

RECEIVED
OCT - 7 1996
Groundwater Section
Asheville

Dennis K. Pittman 9-16-96
SIGNATURE OF CONTRACTOR OR AGENT **DATE**

R-2

NC DEHNR
DEM - GW SECTION
P.O. BOX 29535
RALEIGH, NC 27626-0535
(919) 733-3221

QUAD NO._____ SER. NO._____
LAT _____ LONG_____
BASIN CODE_____
HEADER ENT._____GW-1 ENT._____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: PITTMAN WELL BORING

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

DRILLER REGISTRATION #: 946

1. WELL LOCATION: (SHOW SKETCH OF THE LOCATION BELOW)
   NEAREST TOWN: GROVER COUNTY: CLEV

   (ROAD, COMM., OR SUBDV. & LOT NO.)
2. OWNER DAVID ADAMS
   ADDRESS 1237 LAVENDER RD.
   GROVER NC 28073
   CITY OR TOWN STATE ZIP CODE
3. DATE DRILLED: 05-27-96 USE OF WELL: HOUSE
4. TOTAL DEPTH: 60'
5. CUTTINGS COLLECTED: YES NO XX
6. DOES WELL REPLACE EXISTING WELL? YES NO XX
7. STAT. WAT. LEVL. BEL.TOP OF CASING 40 '
   (USE "+" IF ABOVE TOP)
8. TOP OF CASING IS 18" ' ABOVE LAND SURF.*
9. YIELD (GPM): 20' METHOD OF TEST STEEL TAPE
10. WATER ZONES (DEPTH):_____
11. CHLORINATION: TYPE CLOROX AMOUNT 1/2 GAL
12. CASING:

	DEPTH		DIA	W. THICK. OR WT/FT.	MTL
FROM	0	TO 60 FT.	24"		CONC
FROM		TO FT.			

13. GROUT:

	DEPTH		MATERIAL	METHOD
FROM	0	TO 20 FT.	CEMENT	POURED
FROM		TO FT.		

14.

	DEPTH		DIA	SLOT SIZE	MTL
FROM		TO FT.	IN.	IN.	
FROM		TO FT.	IN.	IN.	
FROM		TO FT.	IN.	IN.	

15. SAND/GRAVEL PACK:

	DEPTH		SIZE	MATERIAL
FROM	40	TO 60 FT.	#6 M	STONE

DEPTH FROM	DEPTH TO	DRILLING LOG FORM.	DRILLING LOG DESC.

LOCATION SKETCH

HWY. #226 S. FROM SHELBY. 1 MILE THIS SIDE OF GROVER RT. ON LAVENDER RD. 1/4 MILE ON RT. (1237 ON MAILBOX)

N.C. DEPT. OF ENVIRONMENT, HEALTH, & NATURAL RESOURCES

JUN 19 1996

DIVISION OF ENVIRONMENTAL MANAGEMENT
MOORESVILLE REGIONAL OFFICE

16. REMARKS:_____

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

RECEIVED
JUN 14 1996
Groundwater Section
Asheville Regional Office

Donna A. Pittman 6/11/96
SIGNATURE OF CONTRACTOR OR AGENT DATE

R-3

North Carolina Department of Environment, Health and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 Raleigh, NC 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY 175251
Quad. No. _____ Ser. No. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Bnt. _____ GW-1 Bnt. _____

DEPT. OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
JAN 12 1997
DIVISION OF ENVIRONMENTAL MANAGEMENT
ASHEVILLE REGIONAL OFFICE

WELL CONSTRUCTION RECORD

Drilling Contractor CAMP'S WELL & PUMP CO., INC.

Driller Registration Number 215

State Well Construction Permit Number

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town GROVER

(Road, Community or Subdivision and Lot No.)

2. OWNER ROXANNA BEYERSDORFER
ADDRESS 128 GARDEN LANE GROVER, NC 28073

3. DATE DRILLED 03/25/94 USE OF WELL DOMESTIC
4. TOTAL DEPTH 54
5. CUTTINGS COLLECTED? NO
6. DOES WELL REPLACE EXISTING WELL? NO
7. STATIC WATER LEVEL Below Top of Casing: 34 FT.
8. TOP OF CASING IS 1 FT. Above Land Surface.
9. YIELD (gpm) 20 METHOD OF TEST BAILER
10. WATER ZONES (depth) 34
11. CHLORINATION: Type CHLORINE Amount 2 CUPS
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0.	To 54	ft.	24		CONCRETE
From	To	ft.			
From	To	ft.			

13. GROUT:

	Depth		Material	Method
From 0.	To 20	ft.	NEAT CEMENT	HAND METHOD
From	To	ft.		

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From	To	ft.	in.		in.
From	To	ft.	in.		in.
From	To	ft.	in.		in.

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From	To	ft.		
From	To	ft.		

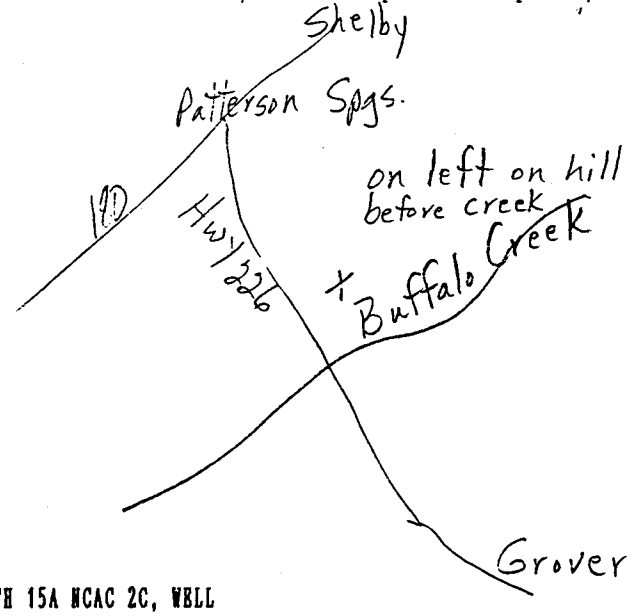
16. REMARKS:

County CLEVELAND

Depth From	Depth To	DRILLING LOG Formation Description
0	54	DIRT

RECEIVED/GW
97 JAN 29 PM 1:05
GW. REGIONAL SUPERVISOR

(Show direction and distance from at least two State Roads, or other map reference points)



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Jimmy Camp
SIGNATURE OF CONTRACTOR OR AGENT

03/25/94
DATE

GW-1 REV 6/91

Submit original to Division of Environmental Management

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT

WELL RECORD R-4

DIVISION OF ENVIRONMENTAL MANAGEMENT, GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611

CL 2494

DRILLING CONTRACTOR Weather Well Boring REG. NO. 35 WELL CONSTRUCTION PERMIT NO.

(1)

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: _____ County: Cleveland
   (Road, Community or Subdivision and Lot No.) Quadrangle No. R-74
2. OWNER: Ricky Gordon
3. ADDRESS: P.O. Box 274 East N.C.
4. TOPOGRAPHY: draw, valley, slope, hilltop, flat (circle one)
5. USE OF WELL: Home DATE: 9-15-78
6. DOES THIS WELL REPLACE AN EXISTING WELL? —
7. TOTAL DEPTH: 56 RIG TYPE OR METHOD: Sand
8. FORMATION SAMPLES COLLECTED: YES ____ NO ____
9. CASING:

From	to	ft	Depth	Inside Dia.	Wall thick. or weight/ft.	type
0	56	ft	24"	1/2"		Concrete

10. GROUT:

From	to	ft	Depth	Material	Method
0	2	ft		Cement and mixture	

11. SCREEN:

From	to	ft	Depth	Dia.	Type & Opening

12. GRAVEL:

From	to	ft	Depth	Size	Material
20	56	ft		3/4	round stone

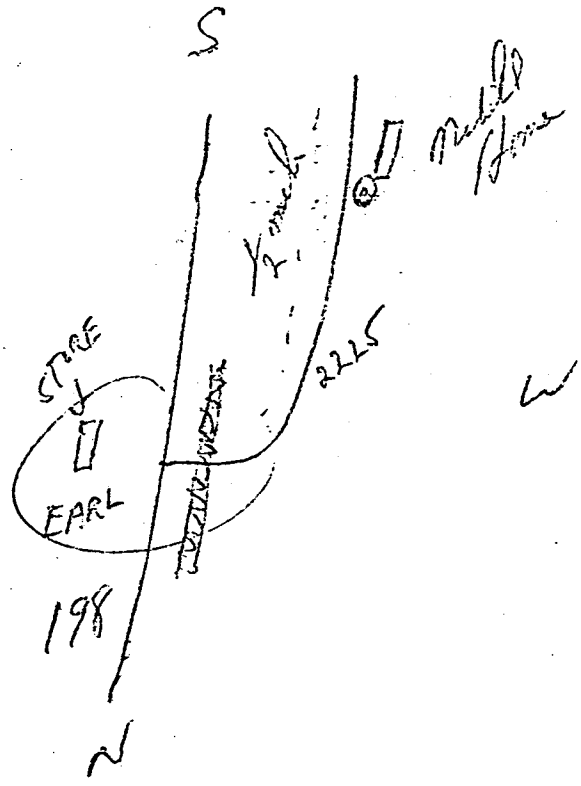
13. WATER ZONES (depth): 26
14. STATIC WATER LEVEL: 26 ft. ~~above~~ below top of casing
    Casing is 1 ft. above land surface ELEV: ____
15. YIELD (gpm): ____ METHOD OF TESTING: ____
16. PUMPING WATER LEVEL: ____ ft.
    after ____ hours at ____ gpm.
17. CHLORINATION: Type LITE Amount 1 bags
18. WATER QUALITY: ____ TEMPERATURE (°F) ____
19. PERMANENT PUMP: Date Installed ____
    Type ____ Capacity ____ (gpm) HP ____
    Make ____ Intake Depth ____
    Airline Depth ____
20. HAS THE OWNER BEEN PROVIDED A COPY OF THIS RECORD AND INFORMED OF THE DEPARTMENTS REQUIREMENTS AND RECOMMENDATIONS? ____
21. REMARKS ____

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION

If additional space is needed, use back of form

LOCATION SKETCH
(Show distance to numbered roads, or other map reference points)



I do hereby certify that this well was constructed in accordance with N.C. Well Construction Regulations and Standards and that this well record is true and exact.

SIGNATURE OF CONTRACTOR OF AGENT DATE 1-2-79

Form GW-1 Revised 11/1/77

Submit original to Groundwater Section and copy to well owner.

CV0015

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT
P.O. Box 27687 — RALEIGH, N.C. 27611 919-733-2020

WELL RECORD

DRILLING CONTRACTOR Arnolds Well Drilling REG. NO. 65 WELL CONSTRUCTION PERMIT NO.

R-5

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: EAST County: Cleveland
   EAST Wood Rd Dead End. Quadrangle No. B74
   (Road, Community or Subdivision and Lot No.)
2. OWNER: Eugene foster
3. ADDRESS:
4. TOPOGRAPHY: draw, valley, slope, hilltop, flat (circle one)
5. USE OF WELL: trailer DATE: 4-15-82
6. DOES THIS WELL REPLACE AN EXISTING WELL? No
7. TOTAL DEPTH: 45 RIG TYPE OR METHOD: 90S peck
8. FORMATION SAMPLES COLLECTED: YES ____ NO ____
9. CASING:

	Depth		Inside Dia.	Wall thick. or weight/ft.	type
From	1	to 45 ft	24		Cement

10. GROUT:

	Depth		Material	Method
From	1	to 20 ft	Sand & Cement	

11. SCREEN:

	Depth		Dia.	Type & Opening
From		to ft		

12. GRAVEL:

	Depth		Size	Material
From		to ft		

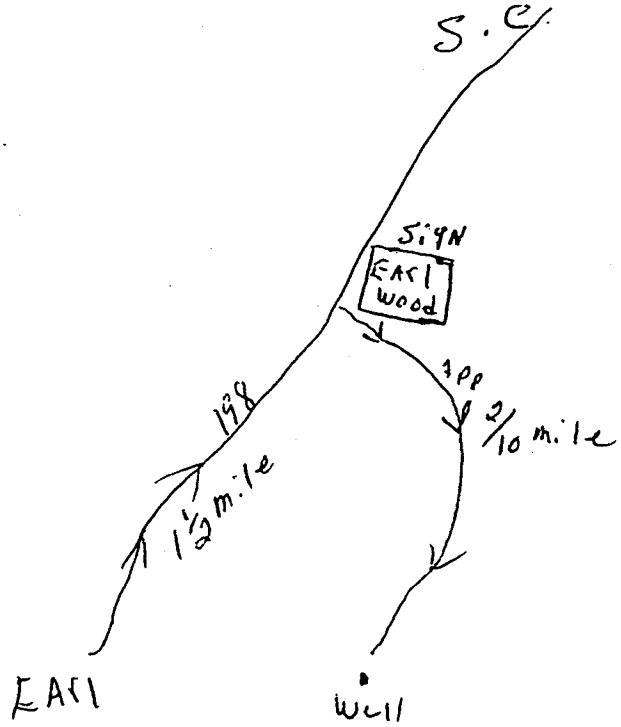
13. WATER ZONES (depth): 24
14. STATIC WATER LEVEL: 24 ft. above / below top of casing
    Casing is 1 ft. above land surface ELEV: ____
15. YIELD (gpm): 2 METHOD OF TESTING: Bailing
16. PUMPING WATER LEVEL: ____ ft.
    after ____ hours at ____ gpm.
17. CHLORINATION: Type H+H Amount ____
18. WATER QUALITY: Good TEMPERATURE (°F) ____
19. PERMANENT PUMP: Date Installed ____
    Type ____ Capacity ____ (gpm) HP ____
    Make ____ Intake Depth ____
    Airline Depth ____
20. HAS THE OWNER BEEN PROVIDED A COPY OF THIS RECORD AND INFORMED OF THE DEPARTMENTS REQUIREMENTS AND RECOMMENDATIONS? Yes
21. REMARKS

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
1	45	CLAY

If additional space is needed, use back of form

LOCATION SKETCH
(Show distance to numbered roads, or other map reference points)



I do hereby certify that this well was constructed in accordance with N.C. Well Construction Regulations and Standards and that this well record is true and exact.

Arnold Philpott 4-15-82
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 10/1/80 Submit original to Division of Environmental Management and copy to well owner

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. R7391 Serial No. _____
Lat. 35°11'48" Long. 81°28'56" Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR Junior Setzer Well Boring
DRILLER REGISTRATION NUMBER 322
STATE WELL CONSTRUCTION PERMIT NUMBER: _____

WELL LOCATION: (Show sketch of the location below)
Nearest Town: Patterson Springs
NC 226 (3½ mi South of Patt. Spgs on 226)
(Road, Community, or Subdivision and Lot No.)
County: Cleveland

1. OWNER Mike Boone
ADDRESS NC. 226 (Street or Route No.)
Patterson Springs N.C. (City or Town / State / Zip Code)
2. DATE DRILLED 5/11/86 USE OF WELL Home supply
3. TOTAL DEPTH 531 CUTTINGS COLLECTED ☐ Yes ☐ No
4. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
5. STATIC WATER LEVEL: _____ FT. ☐ above ☐ below TOP OF CASING,
TOP OF CASING IS 1 FT. ABOVE LAND SURFACE.
6. YIELD (gpm): _____ METHOD OF TEST _____
7. WATER ZONES (depth): _____
8. CHLORINATION: Type _____ Amount _____
9. CASING:

	Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	53 Ft.	24"	1 1/4	
		Ft.			
		Ft.			

10. GROUT:

	Depth From	To	Material	Method
	0	20 Ft.	sand cement	
		Ft.		

11. SCREEN:

	Depth From	To	Diameter	Slot Size	Material
	N/A	Ft.	in.	in.	
		Ft.	in.	in.	
		Ft.	in.	in.	

12. GRAVEL PACK:

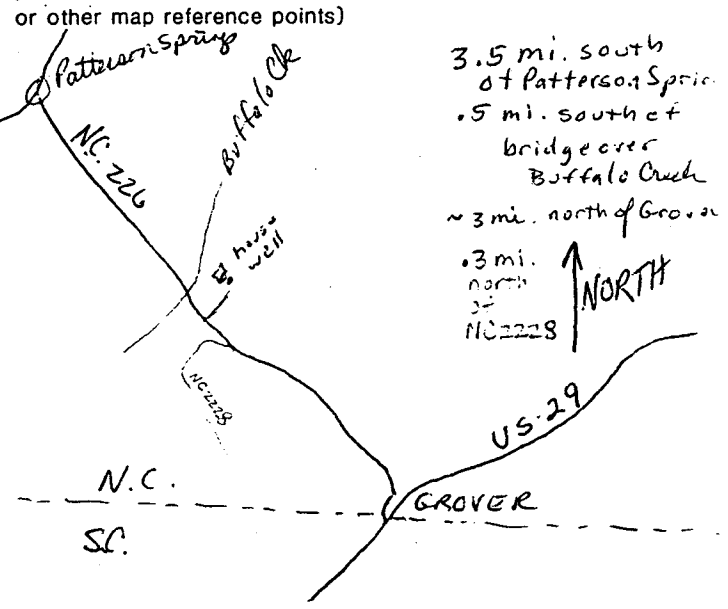
	Depth From	To	Size	Material
		Ft.		
		Ft.		

13. REMARKS: _____

Depth From	To	DRILLING LOG Formation Description

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT DATE

APPENDIX D

SOIL LABORATORY TEST PROCEDURES

APPENDIX D

SOIL LABORATORY TEST PROCEDURES

MOISTURE CONTENT AND UNIT WEIGHT

An undisturbed sample is trimmed in the laboratory into a right circular cylinder approximately three to six inches long. The dimensions and weight of the specimen are determined and the total unit weight calculated. Moisture contents are determined from representative portions of the specimen. The soil is dried to a constant weight in an oven at 100 degrees C and the loss of moisture during the drying process is measured. From this data, the moisture content and dry unit weight are computed.

ATTERBERG LIMITS

The Atterberg Limits Tests, Liquid Limit (LL), and Plastic Limit (PL), are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the materials. The Liquid Limit is the minimum moisture content at which a soil will flow as a heavy viscous fluid. The Plastic Limit is the minimum moisture content at which the solid behaves as a plastic material. The Plasticity Index (PI) is the numeric difference of Liquid Limit and the Plastic Limit and indicates the range of moisture content over which a soil remains plastic. These tests are performed in accordance with ASTM D 4318.

PARTICLE SIZE DISTRIBUTION

The distribution of soils coarser than the No. 200 (75-um) sieve is determined by passing a representative specimen through a standard set of nested sieves. The weight of material retained on each sieve is determined and the percentage retained (or passing) is calculated. A specimen may be washed through only the No. 200 sieve, if the full range of particle sizes is not required. The percentage of material passing the No. 200 sieve is reported. The distribution of materials finer than No. 200 sieve is determined by use of the hydrometer. The particle sizes and distribution are computed from the time rate of settlement of the different size particles while suspended in water. These tests are performed in accordance with ASTM D 421, D 422, and D 1140.

HYDRAULIC CONDUCTIVITY

The ease with which water flows through a soil is characterized by its hydraulic conductivity. Two general test methods are employed depending on the soil type.

The **Constant Head** method is used for coarse-grained materials (sands and gravels). The sample is confined in permeameter chamber while water is allowed to flow through it from a constant head level. The quantity of water flowing through the specimen in a given time period is used to calculate the hydraulic conductivity. See ASTM D 2434 for a complete description of this test.

Fine-grained materials (silts and clays) require the use of a **Flexible Wall Permeameter**. The sample is prepared in a similar manner as in the triaxial compression test. It is encased in a rubber membrane and placed inside a permeameter chamber. The specimen is back-pressure saturated

and allowed to consolidate under a specified effective stress. Water is then forced through the specimen under a controlled hydraulic gradient. The quantity of water flowing into the sample in a given time period is used to calculate the hydraulic conductivity. This test is performed in general accordance with ASTM D 5084.

APPENDIX E

SOIL LABORATORY TEST RESULTS

BLE INC.

HYDRAULIC CONDUCTIVITY TEST REPORT

CONSTANT VOLUME APPARATUS (ASTM D 5084)

CLEVELAND

PROJECT: CONTAINER LANDFILL
PROJECT NO.: J99-1307-04
DATE RECEIVED:

TESTED BY: DAVID WILLIAMS
CHECKED BY: PAUL YARBER

SAMPLE NO. B-3
TYPE UNDISTURBED
SAMPLE LOCATION: 23.0-25.0
SAMPLE DESCRIPTION: GREENISH GREY FI.-MED. SANDY SILT

SAMPLE DIMENSIONS AND PROPERTIES

ITEM	INITIAL		FINAL	
	inches	centimeters	inches	centimeters
Sample Length	2.212	5.618	2.193	5.570
Sample Diameter	2.817	7.155	2.827	7.181
Length/Diameter Ratio		0.79		
Moisture Content (%)	WW= 205.2 DW= 180.3	13.8	WW= 160.2 DW= 118.8	34.8
Sample Wet Weight (grams)	364.0		420.3	
Wet Density (pcf)	100.6		116.3	
Dry Density (pcf)	88.4		86.3	
Saturation (%) ASSUMED SG= 2.65	42		101	

HYDRAULIC CONDUCTIVITY TESTING MEASUREMENT

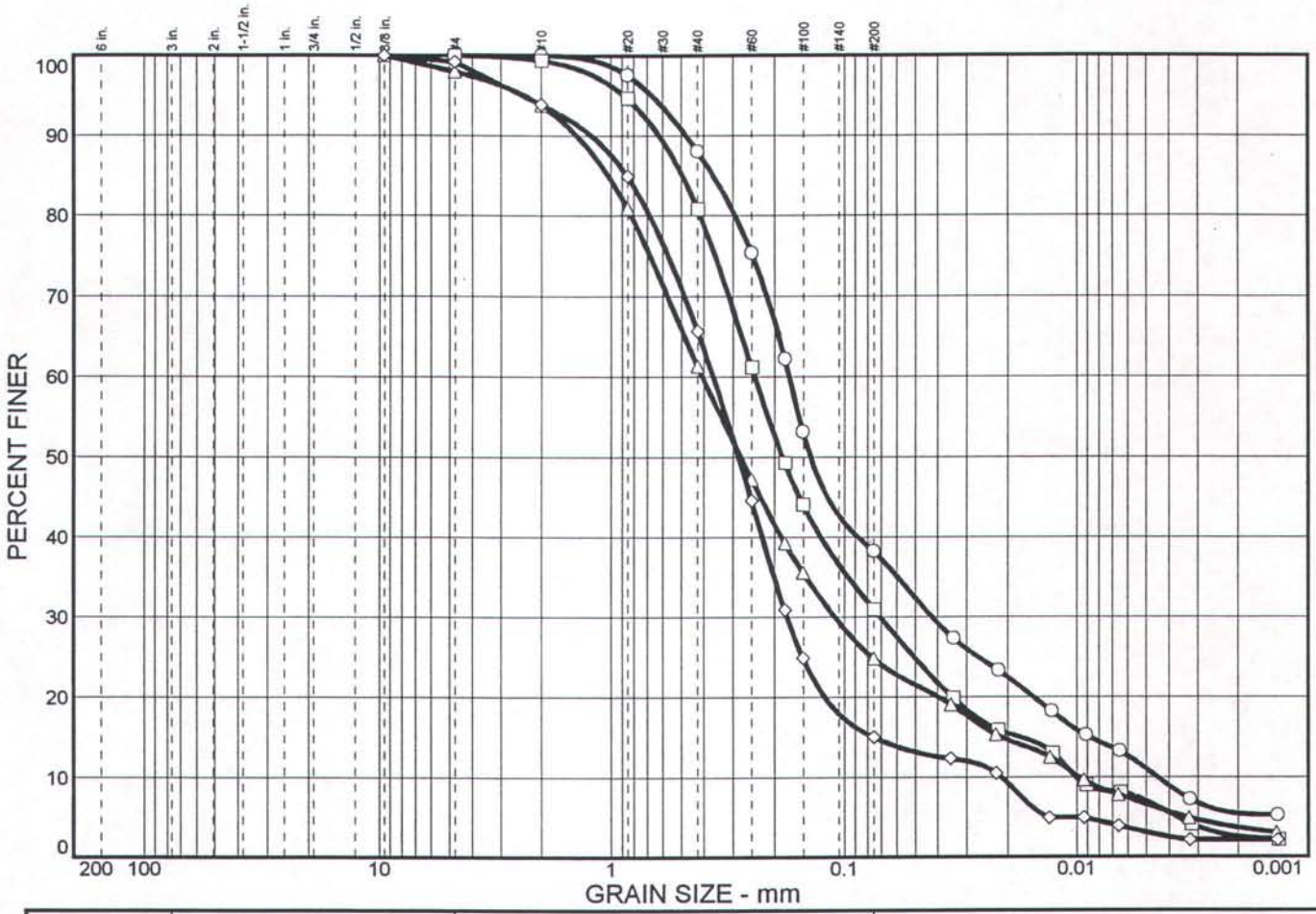
FALLING HEAD TEST

Confining Pressure (psi) 99.5 | Influent Pressure (psi) 85.5 | Effluent Pressure (psi) 85

Date	Clock Time		Elapsed Time	Pipet Readings				Head		Temp	Gradient	K	Temp	K_{20}
				Initial		Final		Initial	Final					
	Start	End	seconds	in	out	in	out	cm	cm	°C		(cm/sec)	Correction	(cm/sec)
1-19-00	3:50:00	3:50:24	24	13.0	11.0	15.0	9.0	32.868	28.265	24.00	5	3.82E-04	0.910	3.47E-04
	3:51:30	3:51:58	28	15.0	9.0	17.0	7.0	28.265	23.662	24.00	5	3.85E-04	0.910	3.51E-04
	3:53:00	3:53:33	33	17.0	7.0	19.0	5.0	23.662	19.058	24.00	4	3.98E-04	0.910	3.62E-04
	3:55:00	3:55:43	43	19.0	5.0	21.0	3.0	19.058	14.455	24.00	3	3.90E-04	0.910	3.55E-04
		Pipet Length, cm		27.620	27.620									
		Pipet Volume, cc		24	24									
		Cross-sectional Area of Pipet, cm^2		0.8689	0.8689									

HYDRAULIC CONDUCTIVITY (k) 3.5E-04 cm/sec

Particle Size Distribution Report



	% COBBLES	% GRAVEL		% SAND			% FINES		
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT		CLAY
○	0.0	0.0	0.0	0.0	12.0	49.8 61.8	27.2	38.2	11.0
□	0.0	0.0	0.0	0.6	18.6	49.8 69	24.0	31	7.0
△	0.0	0.0	2.0	4.2	32.5	36.5 73.2	18.2	24.8	6.6
◇	0.0	0.0	0.8	5.3	28.3	50.6 84.2	11.9	15	3.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	Borrow	B-1	23.5-25.0	Dark grey silty fi.-med. SAND	SM
□	Borrow	B-2	28.5-30.0	Dark grey silty fi.-med. SAND	SM
△	Borrow	B-3(3)	23.0-25.0	Light to dark brown silty fi.-med. SAND	SM
◇	Borrow	B-4	18.5-20.0	Brownish white silty fi.-med. SAND	SM

Particle Size Distribution Report

BUNNELL-LAMMONS ENGINEERING, INC.

Client: Hodges, Harbin, Newberry & Tribble Inc.

Project: Cleveland Container Landfill

Project No.: J99-1307-04

Plate

LABORATORY MOISTURE CONTENT DETERMINATION

LABORATORY ASSIGNMENT NO. 0416

SAMPLE NO.	WET WEIGHT	DRY WEIGHT	MOISTURE CONTENT %
B-1, 23.5-25.0	192.0	133.0	44.4
B-2, 28.5-30.0	196.6	145.5	35.1
B-3, 23.0-25.0	186.9	169.8	10.1
B-4, 18.5-20.0	205.2	180.3	13.8

JOB NAME: Cleveland Container Landfill
JOB NO.: J99-1307-04

CHECKED BY: PAUL YARBER
DATE: 1/27/00

BLE INC.

HYDRAULIC CONDUCTIVITY TEST REPORT

CONSTANT VOLUME APPARATUS (ASTM D 5084)

PROJECT:	CLEVELAND CONTAINER LANDFILL	TESTED BY:	JAMAL SALEEM
PROJECT NO.:	J99-1307-04	CHECKED BY:	PAUL YARBER
DATE RECEIVED:	1-17-00		

SAMPLE NO.	B-3	SAMPLE LOCATION:	1.0-5.0'
TYPE	REMOLDED	SAMPLE DESCRIPTION:	BROWN CLAYEY FI.-MED. SANDY SILT

SAMPLE DIMENSIONS AND PROPERTIES

ITEM	INITIAL		FINAL	
	inches	centimeters	inches	centimeters
Sample Length	3.000	7.620	2.968	7.539
Sample Diameter	2.850	7.239	2.861	7.267
Length/Diameter Ratio		1.05		
Moisture Content (%)	WW= 98.6 DW= 78.4	25.8	WW= 262.4 DW= 207.9	26.2
Sample Wet Weight (grams)	604.5		610.5	
Wet Density (pcf)	120.3		121.9	
Dry Density (pcf)	95.7		96.6	
Saturation (%) TESTED SG= 2.63	95		99	

HYDRAULIC CONDUCTIVITY TESTING MEASUREMENT

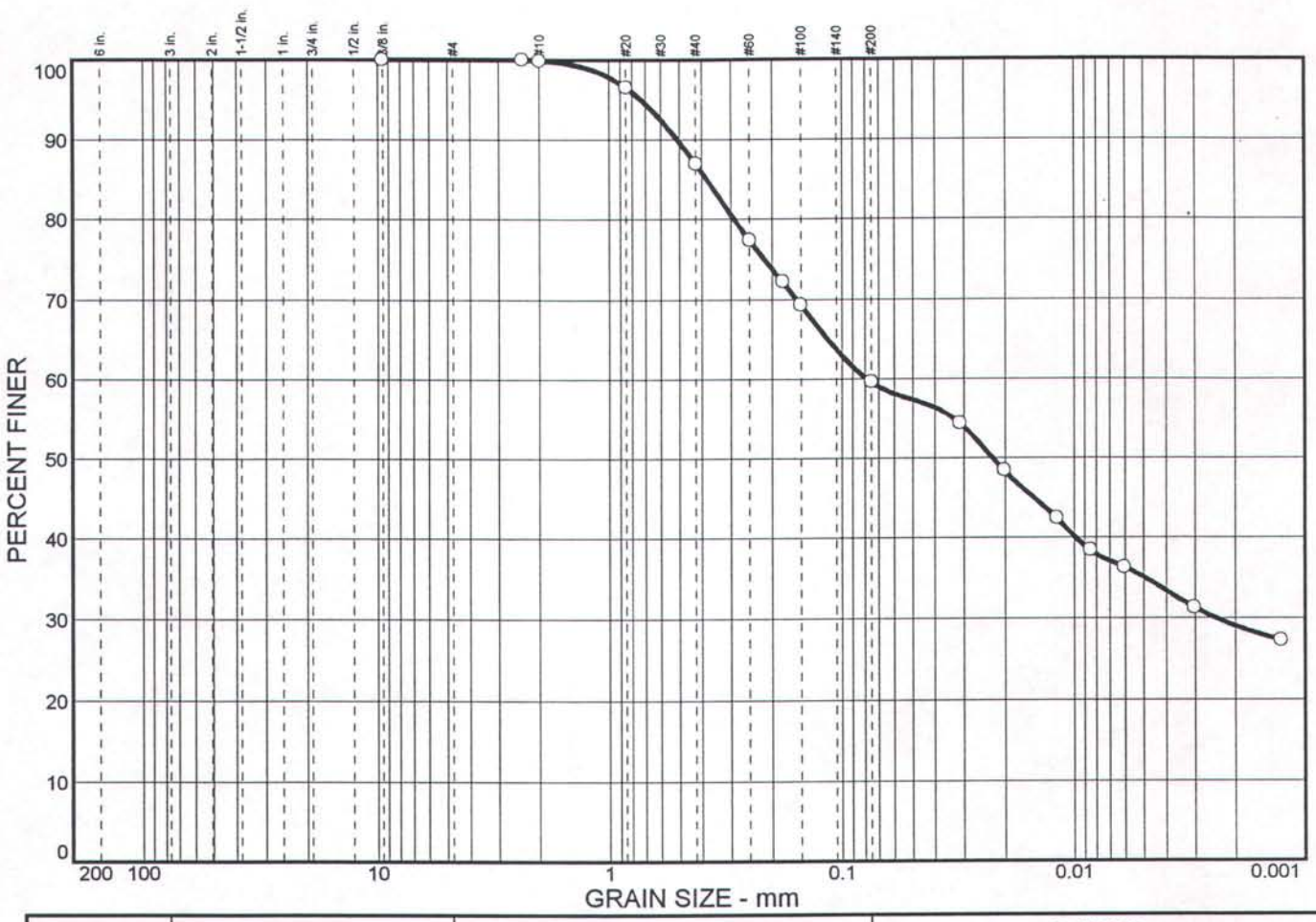
(PERMOMETER)

Confining Pressure (psi) 100 | Influent Pressure (psi) 90 | Effluent Pressure (psi) 90

Reset (Y/N)	Date	Clock Time	Elapsed Time	HA_{OUT} (cm)	HA_{IN} (cm)	Temp °C	Gradient	K (cm/sec)	Temp Correction	K_{20} (cm/sec)
Y	1-28-00	8:41:45		13.2	1.33	23	20			
		8:47:39	0:05:54	12.5	1.36	23	19	7.97E-08	0.931	7.42E-08
		8:49:25	0:07:40	12.3	1.37	23	18	7.96E-08	0.931	7.41E-08
		8:52:18	0:10:33	12.0	1.38	23	18	7.82E-08	0.931	7.28E-08
		8:53:16	0:11:31	11.9	1.39	23	18	7.80E-08	0.931	7.26E-08

HYDRAULIC CONDUCTIVITY (k) 7.3E-08 cm/sec

Particle Size Distribution Report



	% COBBLES	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.1	12.9	27.4 40.4	24.5 59.6	35.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	DESCRIPTION	USCS
○	Borrow	B-3(2)	1-5'	Brown clayey fi.-med. sandy SILT	MH

Particle Size Distribution Report

BUNNELL-LAMMONS ENGINEERING, INC.

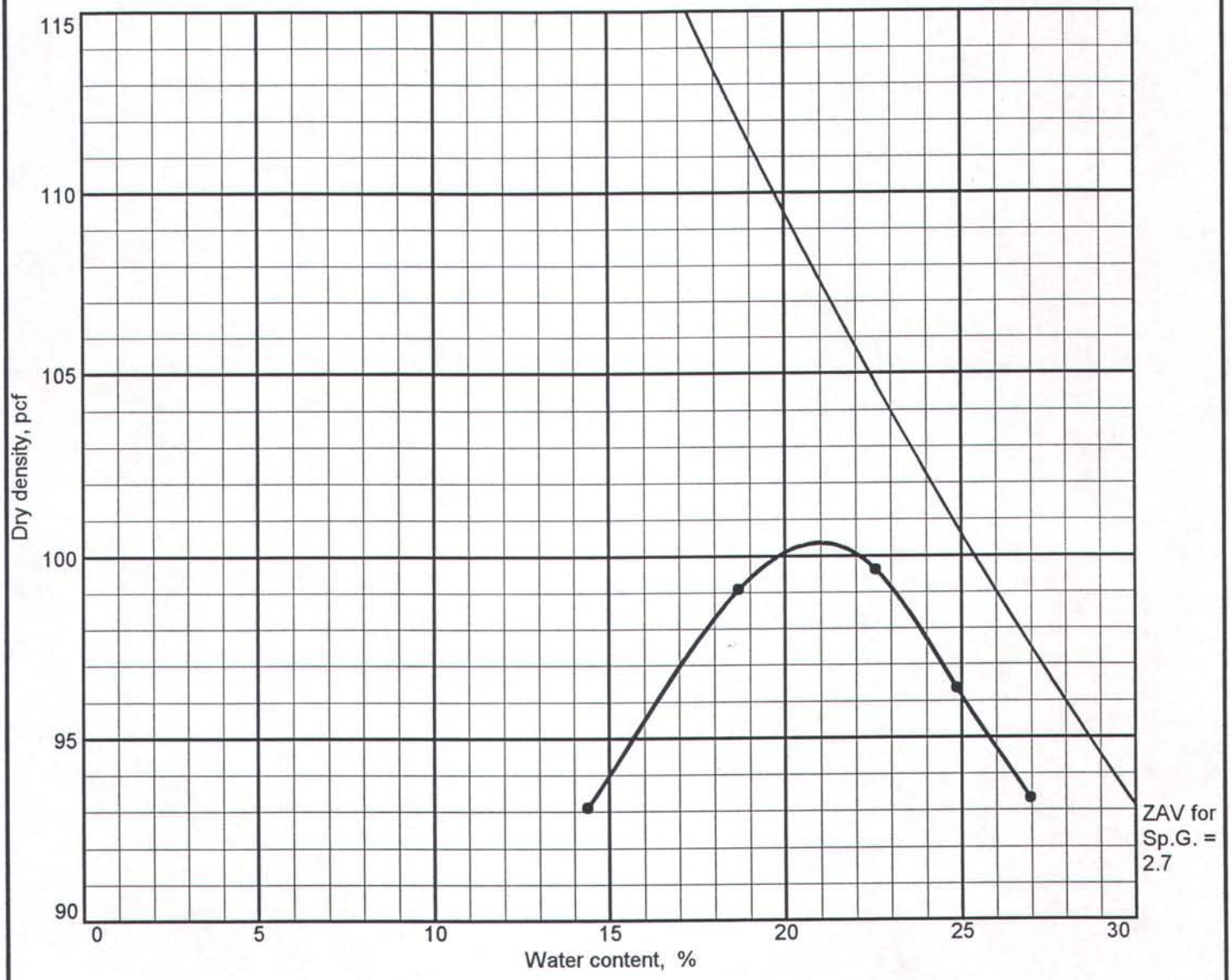
Client: Hodges, Harbin, Newberry & Tribble Inc.

Project: Cleveland Container Landfill

Project No.: J99-1307-04

Plate

MOISTURE DENSITY RELATIONSHIP



Test specification: ASTM D 698-99 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1-5'	MH				51	18	0.0	59.6

TEST RESULTS

Maximum dry density = 100.5 pcf

Optimum moisture = 21 %

MATERIAL DESCRIPTION

Brown clayey fi.-med. sandy SILT

Project No. J99-1307-04 **Client:** Hodges, Harbin, Newberry & Tribble Inc.

Project: Cleveland Container Landfill

● **Source:** Borrow **Sample No.:** B-3(2) **Elev./Depth:** 1-5'

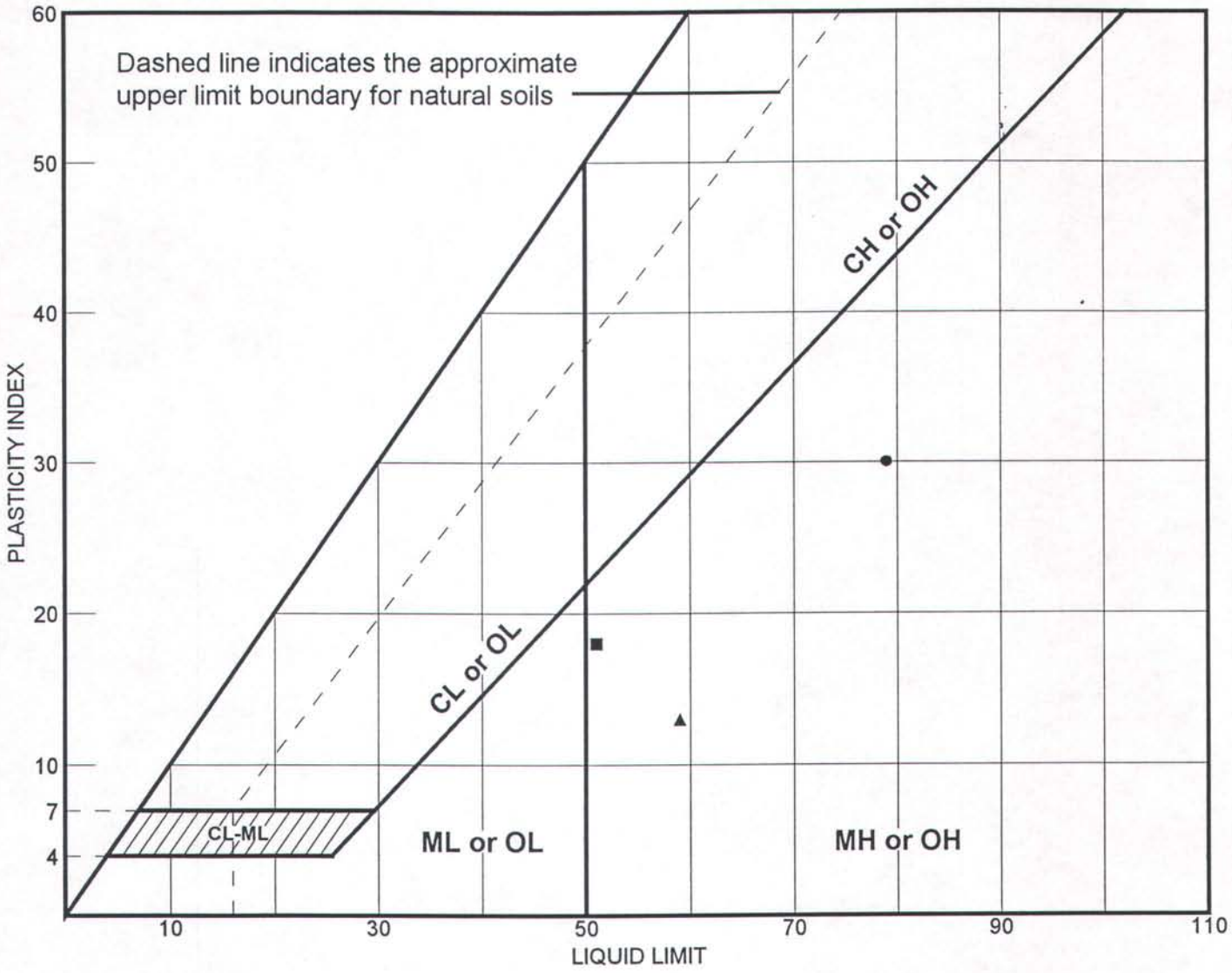
Remarks:

MOISTURE DENSITY RELATIONSHIP

BUNNELL-LAMMONS ENGINEERING, INC.

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Borrow	B-3(1)	1.0-2.5	33.7	49	79	30	MH
■	Borrow	B-3(2)	1-5'		33	51	18	MH
▲	Borrow	B-5	1.0-2.5	31.0	46	59	13	MH

LIQUID AND PLASTIC LIMITS TEST REPORT

BUNNELL-LAMMONS ENGINEERING, INC.

Client: Hodges, Harbin, Newberry & Tribble Inc.

Project: Cleveland Container Landfill

Project No.: J99-1307-04

Plate

LABORATORY % FINER THAN #2OO DETERMINATION

LABORATORY ASSIGNMENT NO. 0414

SAMPLE NO.	TOTAL WT. (g)	WT. RETAINED #200 (g)	% PASSING #200
B-3, 1.0-2.5'	65.0	25.6	60.6
B-5, 1.0-2.5'	63.6	25.3	60.3

JOB NAME: Cleveland Container Landfill
JOB NO.: J99-1307-04

CHECKED BY: PAUL YARBER
DATE: 1/27/00

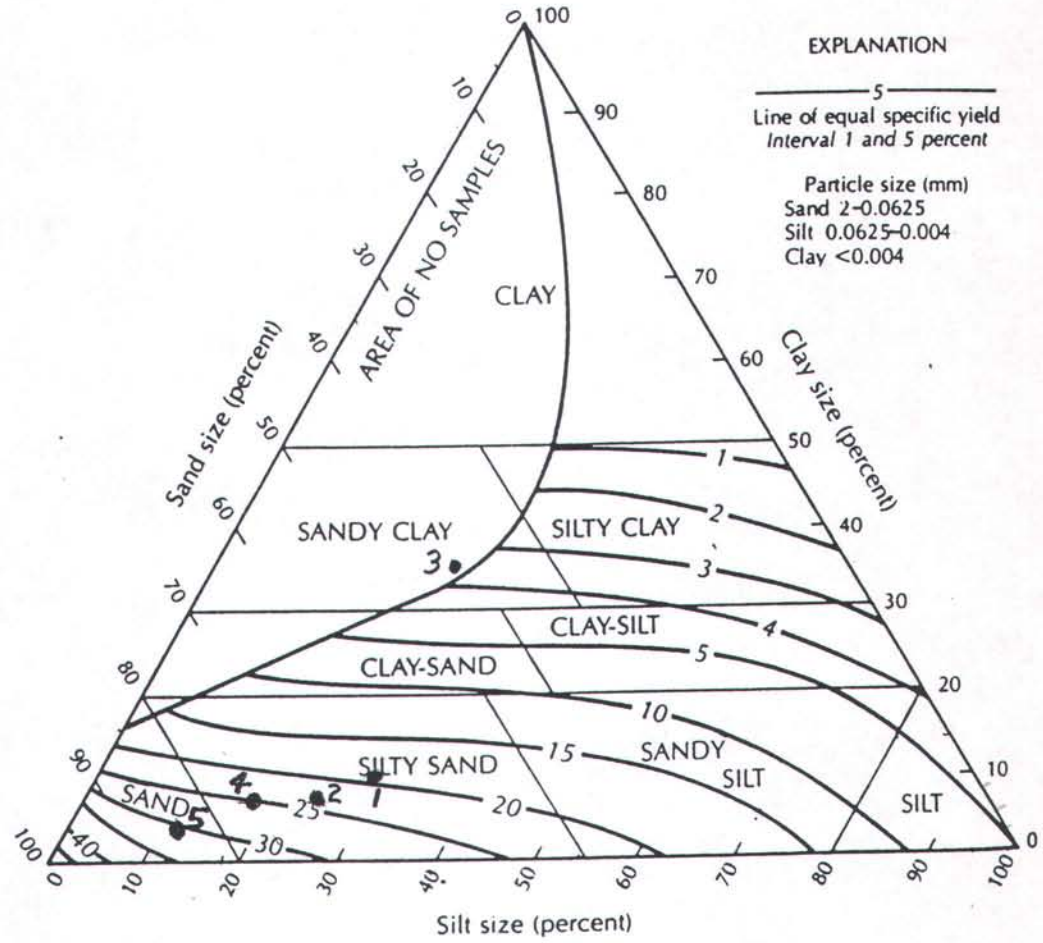


FIGURE 4.11 Textural classification triangle for unconsolidated materials showing the relation between particle size and specific yield. Source: A.I. Johnson, U.S. Geological Survey Water-Supply Paper 1662-D, 1967.

1 PZ-1ab (23.5-25.0)
2 PZ-2ab (28.5-30.0)
3 PZ-3 (1.0-5.0)
4 PZ-3 (23.0-25.0)
5 PZ-4ab (18.5-20.0)

JMM/Cleveland Container LF
Cleveland Co., NC
BLE Job No. J99-1307-04

APPENDIX F

PIEZOMETER INSTALLATION PROCEDURES

APPENDIX F

PIEZOMETER INSTALLATION PROCEDURES

Ground-water piezometers were installed in the boreholes resulting from the drilling process. Approximate well locations are shown on the attached Piezometer/Boring Location Plan (Figure 4).

The piezometer consists of 2-inch diameter PVC pipe (Schedule 40 with flush-threaded joints) inserted into an 8.25-inch diameter augured borehole. The bottom 5 to 10-foot section of each peizometer was a manufactured screen with 0.010-inch slots. Washed sand backfill was placed around the outside of the pipe to at least 1 to 2 feet above the top of the well screen. The sand backfill is used to stabilize the formation and to help yield a less turbid ground-water sample.

A bentonite seal (minimum 2-foot thick) was installed on top of the sand backfill up to the ground surface. A PVC cap was placed over the PVC well stickup on each piezometer. Piezometer construction records are attached in Appendix C.

APPENDIX G

SLUG TEST PROCEDURES AND RESULTS

APPENDIX G

SLUG TEST PROCEDURES AND RESULTS

Slug tests were performed in the field to estimate the average hydraulic conductivity of the upper formation material. Hydraulic conductivity is a constant of proportionality relating to the ease with which a fluid passes through a porous medium. These data were used to estimate the ground-water flow velocities of ground water beneath the site. The field procedure was as follows:

- Measure the static ground-water elevation in the well to be tested.
- Affect an instantaneous change to the static water level in the well by removing a known volume of water.
- Measure the rate at which the water level recovers to its original level (see attachments).

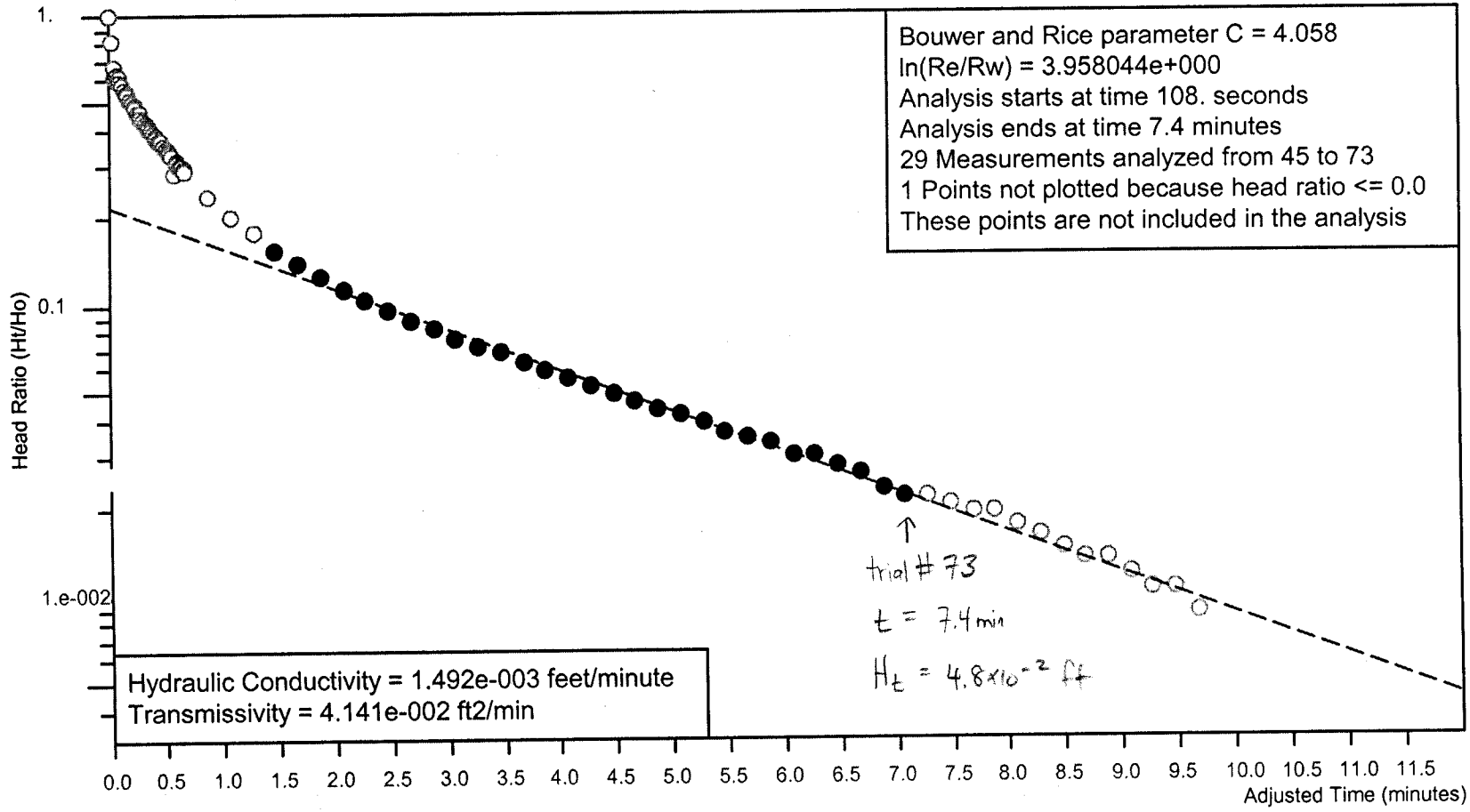
The resulting slug test data (time versus water level) was reduced and hydraulic conductivities were calculated using the Bouwer and Rice Method for partially penetrating wells in unconfined aquifers.

JMN/Cleveland Container Industrial Landfill

Cleveland Co., NC 1/19/00

Bouwer and Rice Graph

PZ-1c



Ho is 2.212 feet at 19.2 seconds

Project Number J99-1307-04 for HHNT

Analysis by Bunnell-Lammons Engineering, Inc.

Site Name:	JMN/Cleveland Container Industrial Landfill
Location:	Cleveland Co., NC
Test Date:	1/19/00
Client:	HHNT
Project Number:	J99-1307-04
Import File:	C:\Public\MLT Folder\Projects\Cleveland Container\Slug Input Data\PZ-1c.txt

Well Label:	PZ-1c
Aquifer Thickness:	27.75 feet
Screen Length:	16. feet
Casing Radius:	0.1575 feet
Effective Radius:	0.1575 feet
Static Water Level:	0. feet
Water Table to Screen Bottom:	27.75 feet
Anisotropy Ratio:	1.
Time Adjustment:	19.2 Seconds

Test starts with trial 0
There are 87 time and drawdown measurements
Maximum head is 2.212 feet
Minimum head is 0. feet

Trial	Time (minutes)	Adjusted Time (minutes)	Drawdown (feet)	Head (feet)	Head Ratio
1	0.32	0.	2.212	2.212	1.
2	0.35	3.e-002	1.806	1.806	0.8165
3	0.3666	4.66e-002	1.488	1.488	0.6727
4	0.3833	6.33e-002	1.357	1.357	0.6135
5	0.4	8.e-002	1.399	1.399	0.6325
6	0.4166	9.66e-002	1.354	1.354	0.6121
7	0.4333	0.1133	1.313	1.313	0.5936
8	0.45	0.13	1.278	1.278	0.5778
9	0.4666	0.1466	1.243	1.243	0.5619
10	0.4833	0.1633	1.208	1.208	0.5461
11	0.5	0.18	1.176	1.176	0.5316
12	0.5166	0.1966	1.138	1.138	0.5145
13	0.5333	0.2133	1.116	1.116	0.5045
14	0.55	0.23	1.09	1.09	0.4928
15	0.5666	0.2466	1.059	1.059	0.4788
16	0.5833	0.2633	1.014	1.014	0.4584
17	0.6	0.28	1.014	1.014	0.4584
18	0.6166	0.2966	0.976	0.976	0.4412
19	0.6333	0.3133	0.966	0.966	0.4367
20	0.65	0.33	0.947	0.947	0.4281
21	0.6666	0.3466	0.925	0.925	0.4182
22	0.6833	0.3633	0.909	0.909	0.4109
23	0.7	0.38	0.887	0.887	0.401
24	0.7166	0.3966	0.868	0.868	0.3924
25	0.7333	0.4133	0.858	0.858	0.3879
26	0.75	0.43	0.836	0.836	0.3779
27	0.7666	0.4466	0.817	0.817	0.3693
28	0.7833	0.4633	0.808	0.808	0.3653
29	0.8	0.48	0.785	0.785	0.3549
30	0.8166	0.4966	0.776	0.776	0.3508
31	0.8333	0.5133	0.763	0.763	0.3449
32	0.85	0.53	0.747	0.747	0.3377
33	0.8666	0.5466	0.734	0.734	0.3318
34	0.8833	0.5633	0.722	0.722	0.3264

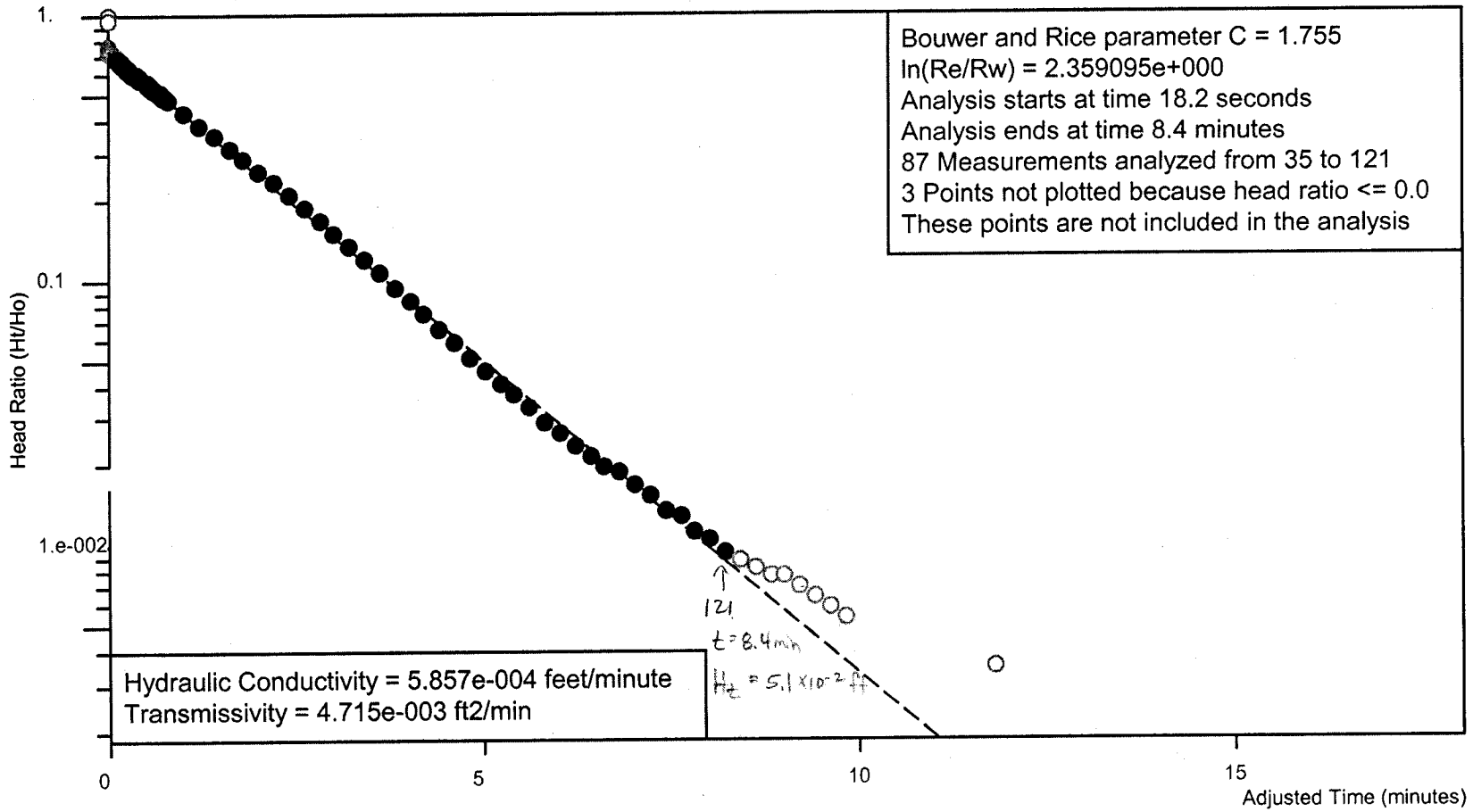
35	0.9	0.58	0.63	0.63	0.2848
36	0.9166	0.5966	0.696	0.696	0.3146
37	0.9333	0.6133	0.684	0.684	0.3092
38	0.95	0.63	0.661	0.661	0.2988
39	0.9666	0.6466	0.661	0.661	0.2988
40	0.9833	0.6633	0.652	0.652	0.2948
41	1.	0.68	0.642	0.642	0.2902
42	1.2	0.88	0.522	0.522	0.236
43	1.4	1.08	0.445	0.445	0.2012
44	1.6	1.28	0.388	0.388	0.1754
45	1.8	1.48	0.34	0.34	0.1537
46	2.	1.68	0.302	0.302	0.1365
47	2.2	1.88	0.274	0.274	0.1239
48	2.4	2.08	0.248	0.248	0.1121
49	2.6	2.28	0.226	0.226	0.1022
50	2.8	2.48	0.21	0.21	9.494e-002
51	3.	2.68	0.194	0.194	8.77e-002
52	3.2	2.88	0.181	0.181	8.183e-002
53	3.4	3.08	0.166	0.166	7.505e-002
54	3.6	3.28	0.159	0.159	7.188e-002
55	3.8	3.48	0.15	0.15	6.781e-002
56	4.	3.68	0.14	0.14	6.329e-002
57	4.2	3.88	0.131	0.131	5.922e-002
58	4.4	4.08	0.124	0.124	5.606e-002
59	4.6	4.28	0.115	0.115	5.199e-002
60	4.8	4.48	0.108	0.108	4.882e-002
61	5.	4.68	0.102	0.102	4.611e-002
62	5.2	4.88	9.6e-002	9.6e-002	4.34e-002
63	5.4	5.08	9.2e-002	9.2e-002	4.159e-002
64	5.6	5.28	8.6e-002	8.6e-002	3.888e-002
65	5.8	5.48	8.e-002	8.e-002	3.617e-002
66	6.	5.68	7.7e-002	7.7e-002	3.481e-002
67	6.2	5.88	7.3e-002	7.3e-002	3.3e-002
68	6.4	6.08	6.7e-002	6.7e-002	3.029e-002
69	6.6	6.28	6.7e-002	6.7e-002	3.029e-002
70	6.8	6.48	6.1e-002	6.1e-002	2.758e-002
71	7.	6.68	5.8e-002	5.8e-002	2.622e-002
72	7.2	6.88	5.1e-002	5.1e-002	2.306e-002
73	7.4	7.08	4.8e-002	4.8e-002	2.17e-002
74	7.6	7.28	4.8e-002	4.8e-002	2.17e-002
75	7.8	7.48	4.5e-002	4.5e-002	2.034e-002
76	8.	7.68	4.2e-002	4.2e-002	1.899e-002
77	8.2	7.88	4.2e-002	4.2e-002	1.899e-002
78	8.4	8.08	3.8e-002	3.8e-002	1.718e-002
79	8.6	8.28	3.5e-002	3.5e-002	1.582e-002
80	8.8	8.48	3.2e-002	3.2e-002	1.447e-002
81	9.	8.68	2.9e-002	2.9e-002	1.311e-002
82	9.2	8.88	2.9e-002	2.9e-002	1.311e-002
83	9.4	9.08	2.6e-002	2.6e-002	1.175e-002
84	9.6	9.28	2.3e-002	2.3e-002	1.04e-002
85	9.8	9.48	2.3e-002	2.3e-002	1.04e-002
86	10.	9.68	1.9e-002	1.9e-002	8.59e-003
87	12.	11.68	7.e-003	7.e-003	3.165e-003

JMN/Cleveland Container Industrial Landfill

Cleveland Co., NC 1/19/00

Bouwer and Rice Graph

PZ-2ab



Ho is 5.433 feet at 11. seconds

Project Number J99-1307-04 for HHNT

Analysis by Bunnell-Lammons Engineering, Inc.

Site Name:	JMN/Cleveland Container Industrial Landfill
Location:	Cleveland Co., NC
Test Date:	1/19/00
Client:	HHNT
Project Number:	J99-1307-04
Import File:	C:\Public\MLT Folder\Projects\Cleveland Container\Slug Input Data\PZ-2ab.txt

Well Label:	PZ-2ab
Aquifer Thickness:	8.05 feet
Screen Length:	8.05 feet
Casing Radius:	8.3e-002 feet
Effective Radius:	0.344 feet
Static Water Level:	0. feet
Water Table to Screen Bottom:	8.05 feet
Anisotropy Ratio:	1.
Time Adjustment:	11. Seconds

Test starts with trial 0
There are 133 time and drawdown measurements
Maximum head is 5.433 feet
Minimum head is 0. feet

Trial	Time (minutes)	Adjusted Time (minutes)	Drawdown (feet)	Head (feet)	Head Ratio
1	0.1833	0.	5.433	5.433	1.
2	0.1866	3.3e-003	5.227	5.227	0.9621
3	0.1933	1.e-002	4.174	4.174	0.7683
4	0.1966	1.33e-002	4.146	4.146	0.7631
5	0.2	1.67e-002	4.12	4.12	0.7583
6	0.2033	2.e-002	4.082	4.082	0.7513
7	0.2066	2.33e-002	4.063	4.063	0.7478
8	0.21	2.67e-002	4.035	4.035	0.7427
9	0.2133	3.e-002	4.022	4.022	0.7403
10	0.2166	3.33e-002	4.003	4.003	0.7368
11	0.22	3.67e-002	3.984	3.984	0.7333
12	0.2233	4.e-002	3.981	3.981	0.7327
13	0.2266	4.33e-002	3.965	3.965	0.7298
14	0.2333	5.e-002	3.949	3.949	0.7269
15	0.2366	5.33e-002	3.939	3.939	0.725
16	0.24	5.67e-002	3.933	3.933	0.7239
17	0.2433	6.e-002	3.905	3.905	0.7188
18	0.2466	6.33e-002	3.886	3.886	0.7153
19	0.25	6.67e-002	3.889	3.889	0.7158
20	0.2533	7.e-002	3.876	3.876	0.7134
21	0.2566	7.33e-002	3.87	3.87	0.7123
22	0.26	7.67e-002	3.854	3.854	0.7094
23	0.2633	8.e-002	3.851	3.851	0.7088
24	0.2666	8.33e-002	3.851	3.851	0.7088
25	0.27	8.67e-002	3.841	3.841	0.707
26	0.2733	9.e-002	3.832	3.832	0.7053
27	0.2766	9.33e-002	3.822	3.822	0.7035
28	0.28	9.67e-002	3.806	3.806	0.7005
29	0.2833	1.e-001	3.803	3.803	0.7
30	0.2866	0.1033	3.8	3.8	0.6994
31	0.29	0.1067	3.79	3.79	0.6976
32	0.2933	0.11	3.771	3.771	0.6941
33	0.2966	0.1133	3.784	3.784	0.6965
34	0.3	0.1167	3.781	3.781	0.6959

35	0.3033	0.12	3.762	3.762	0.6924
36	0.3066	0.1233	3.759	3.759	0.6919
37	0.31	0.1267	3.74	3.74	0.6884
38	0.3133	0.13	3.73	3.73	0.6865
39	0.3166	0.1333	3.73	3.73	0.6865
40	0.32	0.1367	3.724	3.724	0.6854
41	0.3233	0.14	3.717	3.717	0.6842
42	0.3266	0.1433	3.698	3.698	0.6807
43	0.33	0.1467	3.702	3.702	0.6814
44	0.3333	0.15	3.698	3.698	0.6807
45	0.35	0.1667	3.657	3.657	0.6731
46	0.3666	0.1833	3.626	3.626	0.6674
47	0.3833	0.2	3.594	3.594	0.6615
48	0.4	0.2167	3.562	3.562	0.6556
49	0.4166	0.2333	3.524	3.524	0.6486
50	0.4333	0.25	3.508	3.508	0.6457
51	0.45	0.2667	3.464	3.464	0.6376
52	0.4666	0.2833	3.435	3.435	0.6322
53	0.4833	0.3	3.413	3.413	0.6282
54	0.5	0.3167	3.381	3.381	0.6223
55	0.5166	0.3333	3.267	3.267	0.6013
56	0.5333	0.35	3.302	3.302	0.6078
57	0.55	0.3667	3.27	3.27	0.6019
58	0.5666	0.3833	3.245	3.245	0.5973
59	0.5833	0.4	3.217	3.217	0.5921
60	0.6	0.4167	3.188	3.188	0.5868
61	0.6166	0.4333	3.163	3.163	0.5822
62	0.6333	0.45	3.137	3.137	0.5774
63	0.65	0.4667	3.109	3.109	0.5722
64	0.6666	0.4833	3.083	3.083	0.5675
65	0.6833	0.5	3.058	3.058	0.5629
66	0.7	0.5167	3.036	3.036	0.5588
67	0.7166	0.5333	3.007	3.007	0.5535
68	0.7333	0.55	2.985	2.985	0.5494
69	0.75	0.5667	2.96	2.96	0.5448
70	0.7666	0.5833	2.934	2.934	0.54
71	0.7833	0.6	2.912	2.912	0.536
72	0.8	0.6167	2.887	2.887	0.5314
73	0.8166	0.6333	2.861	2.861	0.5266
74	0.8333	0.65	2.839	2.839	0.5225
75	0.85	0.6667	2.817	2.817	0.5185
76	0.8666	0.6833	2.792	2.792	0.5139
77	0.8833	0.7	2.769	2.769	0.5097
78	0.9	0.7167	2.747	2.747	0.5056
79	0.9166	0.7333	2.722	2.722	0.501
80	0.9333	0.75	2.7	2.7	0.497
81	0.95	0.7667	2.677	2.677	0.4927
82	0.9666	0.7833	2.658	2.658	0.4892
83	0.9833	0.8	2.636	2.636	0.4852
84	1.	0.8167	2.614	2.614	0.4811
85	1.2	1.017	2.325	2.325	0.4279
86	1.4	1.217	2.1	2.1	0.3865
87	1.6	1.417	1.9	1.9	0.3497
88	1.8	1.617	1.716	1.716	0.3158
89	2.	1.817	1.552	1.552	0.2857
90	2.2	2.017	1.399	1.399	0.2575
91	2.4	2.217	1.26	1.26	0.2319

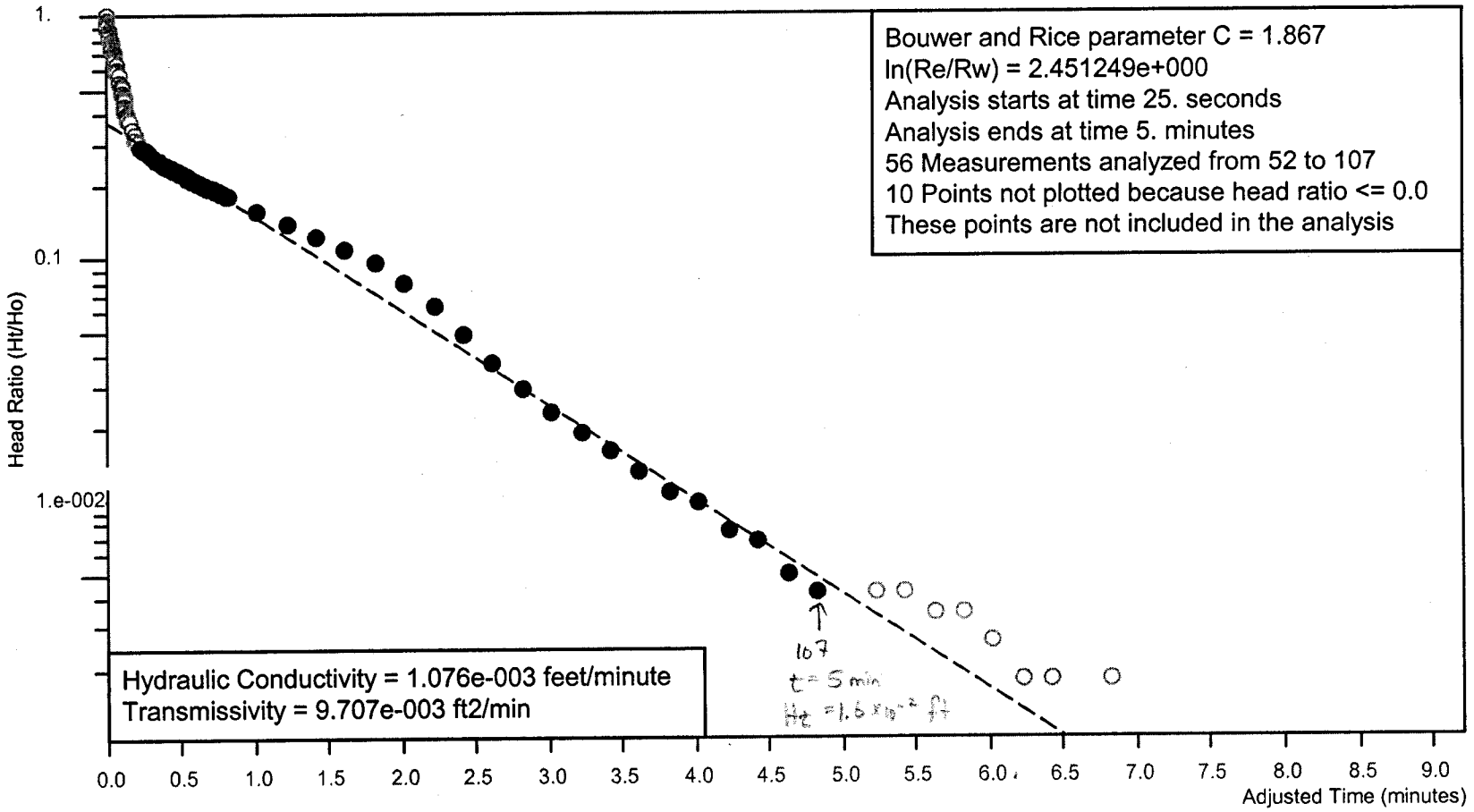
92	2.6	2.417	1.133	1.133	0.2085
93	2.8	2.617	1.019	1.019	0.1876
94	3.	2.817	0.911	0.911	0.1677
95	3.2	3.017	0.809	0.809	0.1489
96	3.4	3.217	0.727	0.727	0.1338
97	3.6	3.417	0.648	0.648	0.1193
98	3.8	3.617	0.575	0.575	0.1058
99	4.	3.817	0.508	0.508	9.35e-002
100	4.2	4.017	0.451	0.451	8.301e-002
101	4.4	4.217	0.4	0.4	7.362e-002
102	4.6	4.417	0.353	0.353	6.497e-002
103	4.8	4.617	0.314	0.314	5.779e-002
104	5.	4.817	0.276	0.276	5.08e-002
105	5.2	5.017	0.248	0.248	4.565e-002
106	5.4	5.217	0.219	0.219	4.031e-002
107	5.6	5.417	0.2	0.2	3.681e-002
108	5.8	5.617	0.178	0.178	3.276e-002
109	6.	5.817	0.159	0.159	2.927e-002
110	6.2	6.017	0.143	0.143	2.632e-002
111	6.4	6.217	0.127	0.127	2.338e-002
112	6.6	6.417	0.118	0.118	2.172e-002
113	6.8	6.617	0.108	0.108	1.988e-002
114	7.	6.817	0.102	0.102	1.877e-002
115	7.2	7.017	9.2e-002	9.2e-002	1.693e-002
116	7.4	7.217	8.3e-002	8.3e-002	1.528e-002
117	7.6	7.417	7.3e-002	7.3e-002	1.344e-002
118	7.8	7.617	7.e-002	7.e-002	1.288e-002
119	8.	7.817	6.1e-002	6.1e-002	1.123e-002
120	8.2	8.017	5.7e-002	5.7e-002	1.049e-002
121	8.4	8.217	5.1e-002	5.1e-002	9.387e-003
122	8.6	8.417	4.8e-002	4.8e-002	8.835e-003
123	8.8	8.617	4.5e-002	4.5e-002	8.283e-003
124	9.	8.817	4.2e-002	4.2e-002	7.731e-003
125	9.2	9.017	4.2e-002	4.2e-002	7.731e-003
126	9.4	9.217	3.8e-002	3.8e-002	6.994e-003
127	9.6	9.417	3.5e-002	3.5e-002	6.442e-003
128	9.8	9.617	3.2e-002	3.2e-002	5.89e-003
129	10.	9.817	2.9e-002	2.9e-002	5.338e-003
130	12.	11.82	1.9e-002	1.9e-002	3.497e-003
131	14.	13.82	1.e-002	1.e-002	1.841e-003
132	16.	15.82	0.	0.	0.
133	18.	17.82	0.	0.	0.

JMN/Cleveland Container Industrial Landfill

Cleveland Co., NC 1/19/00

Bouwer and Rice Graph

PZ-4ab



Project Number J99-1307-04 for HHNT

Analysis by Bunnell-Lammons Engineering, Inc.

Ho is 3.829 feet at 10.4 seconds

Site Name:	JMN/Cleveland Container Industrial Landfill
Location:	Cleveland Co., NC
Test Date:	1/19/00
Client:	HHNT
Project Number:	J99-1307-04
Import File:	C:\Public\MLT Folder\Projects\Cleveland Container\Slug Input Data\PZ-4ab.txt

Well Label:	PZ-4ab
Aquifer Thickness:	9.02 feet
Screen Length:	9.02 feet
Casing Radius:	8.3e-002 feet
Effective Radius:	0.344 feet
Static Water Level:	0. feet
Water Table to Screen Bottom:	9.02 feet
Anisotropy Ratio:	1.
Time Adjustment:	10.4 Seconds

Test starts with trial 0
There are 125 time and drawdown measurements
Maximum head is 3.829 feet
Minimum head is 0. feet

Trial	Time (minutes)	Adjusted Time (minutes)	Drawdown (feet)	Head (feet)	Head Ratio
1	0.1733	0.	3.829	3.829	1.
2	0.1766	3.3e-003	3.689	3.689	0.9634
3	0.18	6.7e-003	3.635	3.635	0.9493
4	0.1833	1.e-002	3.597	3.597	0.9394
5	0.1866	1.33e-002	3.508	3.508	0.9162
6	0.19	1.67e-002	3.442	3.442	0.8989
7	0.1933	2.e-002	3.375	3.375	0.8814
8	0.1966	2.33e-002	3.315	3.315	0.8658
9	0.2	2.67e-002	3.261	3.261	0.8517
10	0.2033	3.e-002	3.191	3.191	0.8334
11	0.2066	3.33e-002	3.122	3.122	0.8154
12	0.21	3.67e-002	3.055	3.055	0.7979
13	0.2133	4.e-002	3.017	3.017	0.7879
14	0.2166	4.33e-002	2.947	2.947	0.7697
15	0.22	4.67e-002	2.868	2.868	0.749
16	0.2233	5.e-002	2.823	2.823	0.7373
17	0.2266	5.33e-002	2.754	2.754	0.7192
18	0.23	5.67e-002	2.709	2.709	0.7075
19	0.2333	6.e-002	2.652	2.652	0.6926
20	0.2366	6.33e-002	2.595	2.595	0.6777
21	0.24	6.67e-002	2.535	2.535	0.6621
22	0.2433	7.e-002	2.497	2.497	0.6521
23	0.2466	7.33e-002	2.449	2.449	0.6396
24	0.25	7.67e-002	2.345	2.345	0.6124
25	0.2533	8.e-002	2.322	2.322	0.6064
26	0.2566	8.33e-002	2.272	2.272	0.5934
27	0.26	8.67e-002	2.237	2.237	0.5842
28	0.2633	9.e-002	2.215	2.215	0.5785
29	0.2733	0.1	2.069	2.069	0.5403
30	0.2766	0.1033	2.043	2.043	0.5336
31	0.28	0.1067	2.005	2.005	0.5236
32	0.2833	0.11	1.961	1.961	0.5121
33	0.2866	0.1133	1.916	1.916	0.5004
34	0.29	0.1167	1.945	1.945	0.508

35	0.2933	0.12	1.843	1.843	0.4813
36	0.2966	0.1233	1.793	1.793	0.4683
37	0.3	0.1267	1.761	1.761	0.4599
38	0.3033	0.13	1.729	1.729	0.4516
39	0.3066	0.1333	1.634	1.634	0.4267
40	0.31	0.1367	1.593	1.593	0.416
41	0.3133	0.14	1.561	1.561	0.4077
42	0.3166	0.1433	1.542	1.542	0.4027
43	0.32	0.1467	1.514	1.514	0.3954
44	0.3233	0.15	1.51	1.51	0.3944
45	0.3266	0.1533	1.488	1.488	0.3886
46	0.33	0.1567	1.437	1.437	0.3753
47	0.3333	0.16	1.415	1.415	0.3695
48	0.35	0.1767	1.326	1.326	0.3463
49	0.3666	0.1933	1.257	1.257	0.3283
50	0.3833	0.21	1.2	1.2	0.3134
51	0.4	0.2267	1.158	1.158	0.3024
52	0.4166	0.2433	1.123	1.123	0.2933
53	0.4333	0.26	1.095	1.095	0.286
54	0.45	0.2767	1.073	1.073	0.2802
55	0.4666	0.2933	1.047	1.047	0.2734
56	0.4833	0.31	1.025	1.025	0.2677
57	0.5	0.3267	1.006	1.006	0.2627
58	0.5166	0.3433	0.99	0.99	0.2586
59	0.5333	0.36	0.974	0.974	0.2544
60	0.55	0.3767	0.958	0.958	0.2502
61	0.5666	0.3933	0.943	0.943	0.2463
62	0.5833	0.41	0.93	0.93	0.2429
63	0.6	0.4267	0.92	0.92	0.2403
64	0.6166	0.4433	0.905	0.905	0.2364
65	0.6333	0.46	0.892	0.892	0.233
66	0.65	0.4767	0.882	0.882	0.2303
67	0.6666	0.4933	0.873	0.873	0.228
68	0.6833	0.51	0.86	0.86	0.2246
69	0.7	0.5267	0.854	0.854	0.223
70	0.7166	0.5433	0.841	0.841	0.2196
71	0.7333	0.56	0.832	0.832	0.2173
72	0.75	0.5767	0.822	0.822	0.2147
73	0.7666	0.5933	0.813	0.813	0.2123
74	0.7833	0.61	0.803	0.803	0.2097
75	0.8	0.6267	0.794	0.794	0.2074
76	0.8166	0.6433	0.784	0.784	0.2048
77	0.8333	0.66	0.774	0.774	0.2021
78	0.85	0.6767	0.765	0.765	0.1998
79	0.8666	0.6933	0.759	0.759	0.1982
80	0.8833	0.71	0.749	0.749	0.1956
81	0.9	0.7267	0.743	0.743	0.194
82	0.9166	0.7433	0.736	0.736	0.1922
83	0.9333	0.76	0.727	0.727	0.1899
84	0.95	0.7767	0.721	0.721	0.1883
85	0.9666	0.7933	0.714	0.714	0.1865
86	0.9833	0.81	0.705	0.705	0.1841
87	1.	0.8267	0.698	0.698	0.1823
88	1.2	1.027	0.6	0.6	0.1567
89	1.4	1.227	0.527	0.527	0.1376
90	1.6	1.427	0.467	0.467	0.122
91	1.8	1.627	0.416	0.416	0.1086

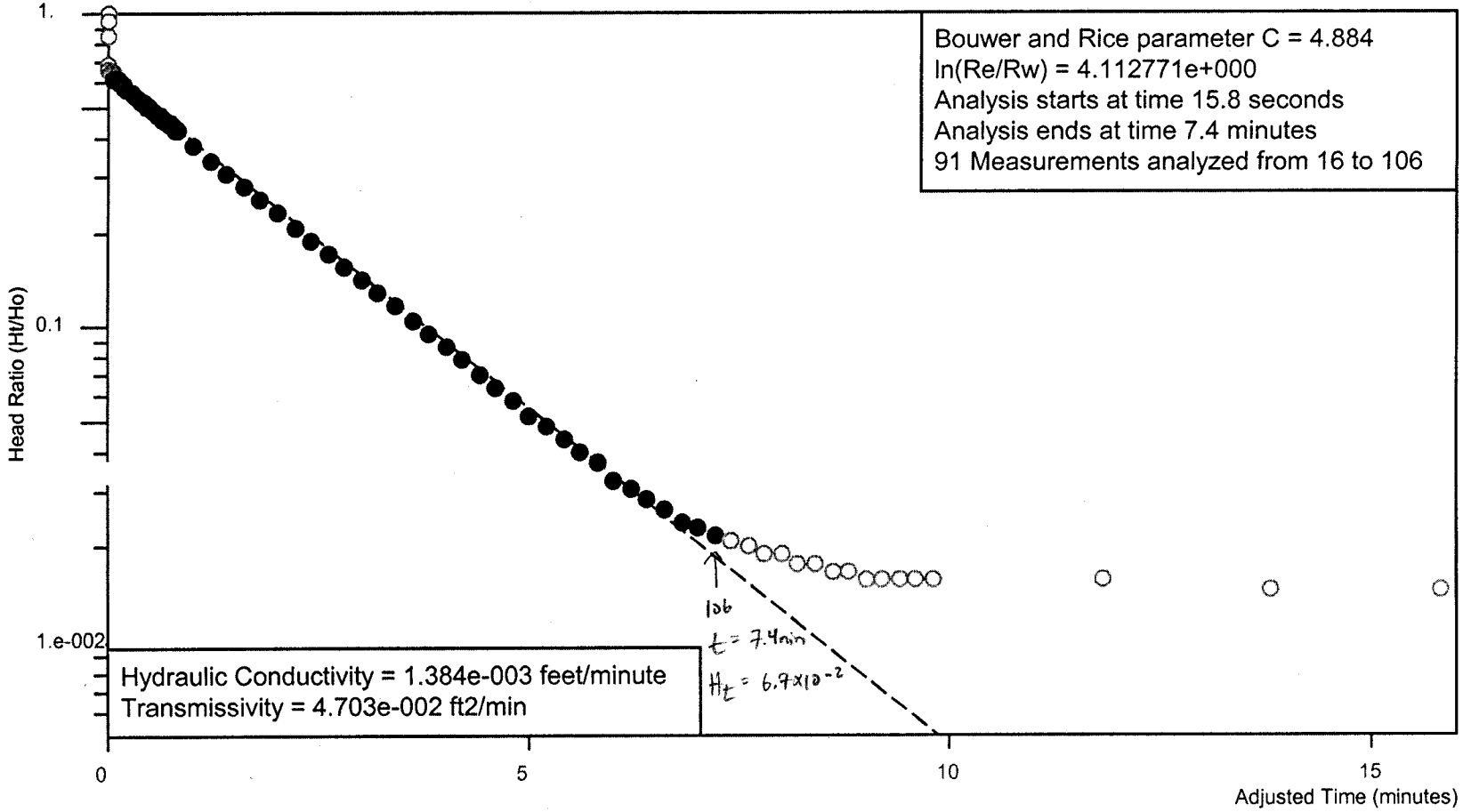
92	2.	1.827	0.368	0.368	9.611e-002
93	2.2	2.027	0.305	0.305	7.966e-002
94	2.4	2.227	0.241	0.241	6.294e-002
95	2.6	2.427	0.184	0.184	4.805e-002
96	2.8	2.627	0.14	0.14	3.656e-002
97	3.	2.827	0.111	0.111	2.899e-002
98	3.2	3.027	8.9e-002	8.9e-002	2.324e-002
99	3.4	3.227	7.3e-002	7.3e-002	1.907e-002
100	3.6	3.427	6.1e-002	6.1e-002	1.593e-002
101	3.8	3.627	5.1e-002	5.1e-002	1.332e-002
102	4.	3.827	4.2e-002	4.2e-002	1.097e-002
103	4.2	4.027	3.8e-002	3.8e-002	9.924e-003
104	4.4	4.227	2.9e-002	2.9e-002	7.574e-003
105	4.6	4.427	2.6e-002	2.6e-002	6.79e-003
106	4.8	4.627	1.9e-002	1.9e-002	4.962e-003
107	5.	4.827	1.6e-002	1.6e-002	4.179e-003
108	5.4	5.227	1.6e-002	1.6e-002	4.179e-003
109	5.6	5.427	1.6e-002	1.6e-002	4.179e-003
110	5.8	5.627	1.3e-002	1.3e-002	3.395e-003
111	6.	5.827	1.3e-002	1.3e-002	3.395e-003
112	6.2	6.027	1.e-002	1.e-002	2.612e-003
113	6.4	6.227	7.e-003	7.e-003	1.828e-003
114	6.6	6.427	7.e-003	7.e-003	1.828e-003
115	7.	6.827	7.e-003	7.e-003	1.828e-003
116	7.2	7.027	4.e-003	4.e-003	1.045e-003
117	7.4	7.227	4.e-003	4.e-003	1.045e-003
118	7.6	7.427	4.e-003	4.e-003	1.045e-003
119	8.	7.827	4.e-003	4.e-003	1.045e-003
120	8.2	8.027	4.e-003	4.e-003	1.045e-003
121	8.4	8.227	4.e-003	4.e-003	1.045e-003
122	8.6	8.427	4.e-003	4.e-003	1.045e-003
123	8.8	8.627	4.e-003	4.e-003	1.045e-003
124	9.	8.827	0.	0.	0.
125	9.2	9.027	0.	0.	0.

JMN/Cleveland Container Industrial Landfill

Bouwer and Rice Graph

Cleveland Co., NC 1/19/00

PZ-4c



Project Number J99-1307-04 for HHNT

Analysis by Bunnell-Lammons Engineering, Inc.

Ho is 3.063 feet at 10.4 seconds

Site Name:	JMN/Cleveland Container Industrial Landfill
Location:	Cleveland Co., NC
Test Date:	1/19/00
Client:	HHNT
Project Number:	J99-1307-04
Import File:	C:\Public\MLT Folder\Projects\Cleveland Container\Slug Input Data\PZ-4c.txt

Well Label:	PZ-4c
Aquifer Thickness:	33.98 feet
Screen Length:	20. feet
Casing Radius:	0.1575 feet
Effective Radius:	0.1575 feet
Static Water Level:	0. feet
Water Table to Screen Bottom:	33.98 feet
Anisotropy Ratio:	1.
Time Adjustment:	10.4 Seconds

Test starts with trial 0
There are 122 time and drawdown measurements
Maximum head is 3.063 feet
Minimum head is 0. feet

Trial	Time (minutes)	Adjusted Time (minutes)	Drawdown (feet)	Head (feet)	Head Ratio
1	0.1733	0.	3.063	3.063	1.
2	0.1766	3.3e-003	2.919	2.919	0.953
3	0.18	6.7e-003	2.617	2.617	0.8544
4	0.1833	1.e-002	2.137	2.137	0.6977
5	0.19	1.67e-002	2.045	2.045	0.6676
6	0.23	5.67e-002	2.003	2.003	0.6539
7	0.2333	6.e-002	2.003	2.003	0.6539
8	0.2366	6.33e-002	2.003	2.003	0.6539
9	0.24	6.67e-002	1.997	1.997	0.652
10	0.2433	7.e-002	1.981	1.981	0.6468
11	0.2466	7.33e-002	1.968	1.968	0.6425
12	0.25	7.67e-002	1.953	1.953	0.6376
13	0.2533	8.e-002	1.937	1.937	0.6324
14	0.2566	8.33e-002	1.924	1.924	0.6281
15	0.26	8.67e-002	1.911	1.911	0.6239
16	0.2633	9.e-002	1.902	1.902	0.621
17	0.2666	9.33e-002	1.902	1.902	0.621
18	0.27	9.67e-002	1.902	1.902	0.621
19	0.2733	0.1	1.902	1.902	0.621
20	0.2766	0.1033	1.902	1.902	0.621
21	0.28	0.1067	1.905	1.905	0.6219
22	0.2833	0.11	1.908	1.908	0.6229
23	0.2866	0.1133	1.908	1.908	0.6229
24	0.29	0.1167	1.908	1.908	0.6229
25	0.2933	0.12	1.905	1.905	0.6219
26	0.2966	0.1233	1.902	1.902	0.621
27	0.3	0.1267	1.898	1.898	0.6197
28	0.3033	0.13	1.892	1.892	0.6177
29	0.3066	0.1333	1.886	1.886	0.6157
30	0.31	0.1367	1.879	1.879	0.6135
31	0.3133	0.14	1.873	1.873	0.6115
32	0.3166	0.1433	1.863	1.863	0.6082
33	0.32	0.1467	1.863	1.863	0.6082
34	0.3233	0.15	1.857	1.857	0.6063

35	0.3266	0.1533	1.848	1.848	0.6033
36	0.33	0.1567	1.848	1.848	0.6033
37	0.3333	0.16	1.848	1.848	0.6033
38	0.35	0.1767	1.838	1.838	0.6001
39	0.3666	0.1933	1.819	1.819	0.5939
40	0.3833	0.21	1.797	1.797	0.5867
41	0.4166	0.2433	1.768	1.768	0.5772
42	0.45	0.2767	1.736	1.736	0.5668
43	0.4666	0.2933	1.708	1.708	0.5576
44	0.4833	0.31	1.698	1.698	0.5544
45	0.5	0.3267	1.685	1.685	0.5501
46	0.5166	0.3433	1.666	1.666	0.5439
47	0.5333	0.36	1.651	1.651	0.539
48	0.55	0.3767	1.625	1.625	0.5305
49	0.5833	0.41	1.606	1.606	0.5243
50	0.6	0.4267	1.58	1.58	0.5158
51	0.6166	0.4433	1.58	1.58	0.5158
52	0.6333	0.46	1.571	1.571	0.5129
53	0.65	0.4767	1.549	1.549	0.5057
54	0.6666	0.4933	1.539	1.539	0.5024
55	0.6833	0.51	1.53	1.53	0.4995
56	0.7	0.5267	1.514	1.514	0.4943
57	0.7166	0.5433	1.498	1.498	0.4891
58	0.7333	0.56	1.485	1.485	0.4848
59	0.75	0.5767	1.472	1.472	0.4806
60	0.7666	0.5933	1.46	1.46	0.4767
61	0.7833	0.61	1.45	1.45	0.4734
62	0.8	0.6267	1.437	1.437	0.4691
63	0.8166	0.6433	1.421	1.421	0.4639
64	0.8333	0.66	1.409	1.409	0.46
65	0.85	0.6767	1.399	1.399	0.4567
66	0.8666	0.6933	1.387	1.387	0.4528
67	0.8833	0.71	1.374	1.374	0.4486
68	0.9	0.7267	1.361	1.361	0.4443
69	0.9166	0.7433	1.348	1.348	0.4401
70	0.9333	0.76	1.367	1.367	0.4463
71	0.95	0.7767	1.336	1.336	0.4362
72	0.9666	0.7933	1.313	1.313	0.4287
73	0.9833	0.81	1.304	1.304	0.4257
74	1.	0.8267	1.298	1.298	0.4238
75	1.2	1.027	1.151	1.151	0.3758
76	1.4	1.227	1.04	1.04	0.3395
77	1.6	1.427	0.945	0.945	0.3085
78	1.8	1.627	0.856	0.856	0.2795
79	2.	1.827	0.773	0.773	0.2524
80	2.2	2.027	0.706	0.706	0.2305
81	2.4	2.227	0.636	0.636	0.2076
82	2.6	2.427	0.579	0.579	0.189
83	2.8	2.627	0.525	0.525	0.1714
84	3.	2.827	0.477	0.477	0.1557
85	3.2	3.027	0.433	0.433	0.1414
86	3.4	3.227	0.391	0.391	0.1277
87	3.6	3.427	0.356	0.356	0.1162
88	3.8	3.627	0.321	0.321	0.1048
89	4.	3.827	0.293	0.293	9.566e-002
90	4.2	4.027	0.264	0.264	8.619e-002
91	4.4	4.227	0.239	0.239	7.803e-002

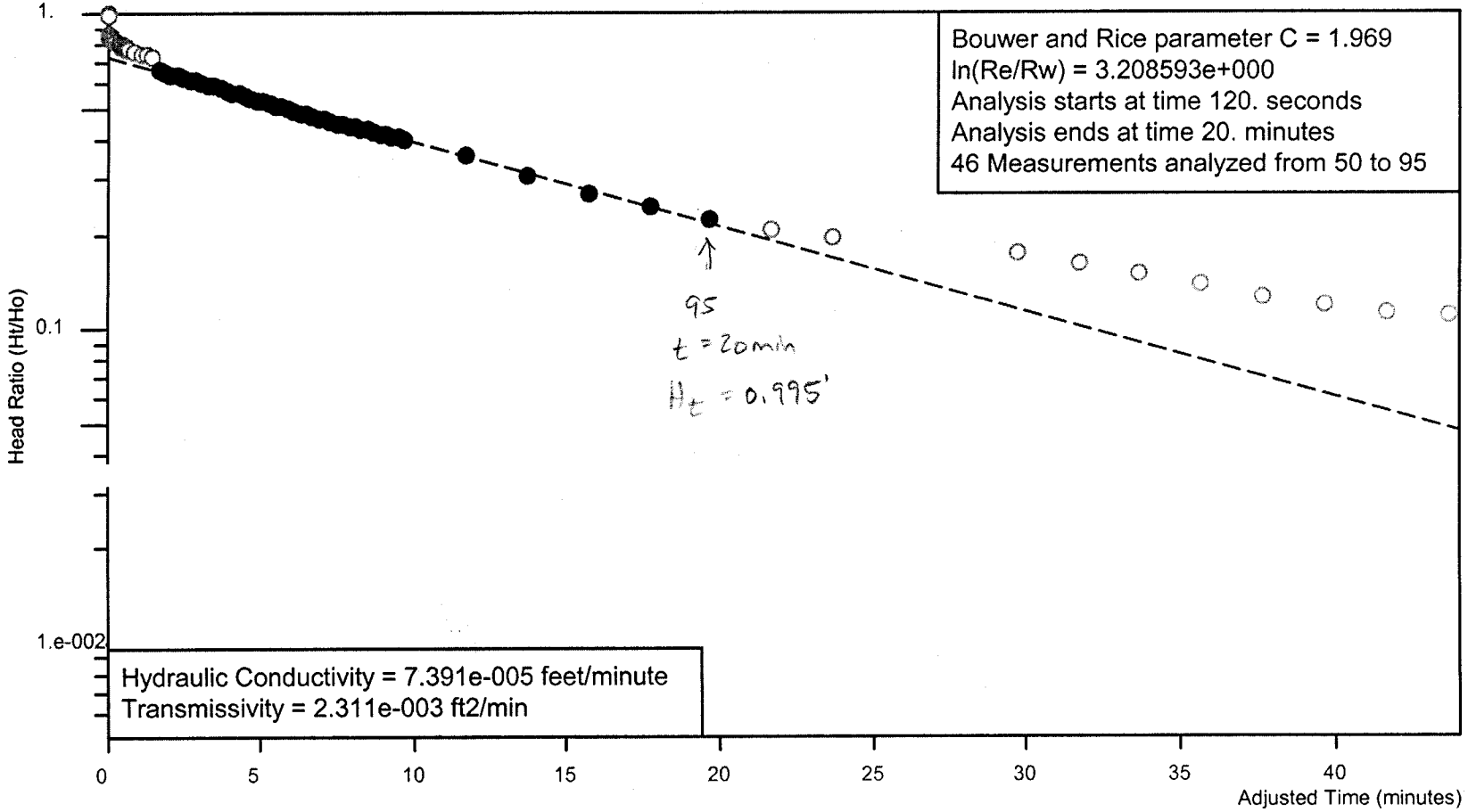
92	4.6	4.427	0.216	0.216	7.052e-002
93	4.8	4.627	0.197	0.197	6.432e-002
94	5.	4.827	0.178	0.178	5.811e-002
95	5.2	5.027	0.159	0.159	5.191e-002
96	5.4	5.227	0.147	0.147	4.799e-002
97	5.6	5.427	0.134	0.134	4.375e-002
98	5.8	5.627	0.121	0.121	3.95e-002
99	6.	5.827	0.112	0.112	3.657e-002
100	6.2	6.027	9.9e-002	9.9e-002	3.232e-002
101	6.4	6.227	9.3e-002	9.3e-002	3.036e-002
102	6.6	6.427	8.6e-002	8.6e-002	2.808e-002
103	6.8	6.627	8.e-002	8.e-002	2.612e-002
104	7.	6.827	7.3e-002	7.3e-002	2.383e-002
105	7.2	7.027	7.e-002	7.e-002	2.285e-002
106	7.4	7.227	6.7e-002	6.7e-002	2.187e-002
107	7.6	7.427	6.4e-002	6.4e-002	2.089e-002
108	7.8	7.627	6.1e-002	6.1e-002	1.992e-002
109	8.	7.827	5.8e-002	5.8e-002	1.894e-002
110	8.2	8.027	5.8e-002	5.8e-002	1.894e-002
111	8.4	8.227	5.4e-002	5.4e-002	1.763e-002
112	8.6	8.427	5.4e-002	5.4e-002	1.763e-002
113	8.8	8.627	5.1e-002	5.1e-002	1.665e-002
114	9.	8.827	5.1e-002	5.1e-002	1.665e-002
115	9.2	9.027	4.8e-002	4.8e-002	1.567e-002
116	9.4	9.227	4.8e-002	4.8e-002	1.567e-002
117	9.6	9.427	4.8e-002	4.8e-002	1.567e-002
118	9.8	9.627	4.8e-002	4.8e-002	1.567e-002
119	10.	9.827	4.8e-002	4.8e-002	1.567e-002
120	12.	11.83	4.8e-002	4.8e-002	1.567e-002
121	14.	13.83	4.5e-002	4.5e-002	1.469e-002
122	16.	15.83	4.5e-002	4.5e-002	1.469e-002

JMN/Cleveland Container Industrial Landfill

Cleveland Co., NC 1/19/00

Bouwer and Rice Graph

PZ-7b



Project Number J99-1307-04 for HHNT

Analysis by Bunnell-Lammons Engineering, Inc.

Ho is 4.454 feet at 18.6 seconds

Site Name:	JMN/Cleveland Container Industrial Landfill
Location:	Cleveland Co., NC
Test Date:	1/19/00
Client:	HHNT
Project Number:	J99-1307-04
Import File:	C:\Public\MLT Folder\Projects\Cleveland Container\Slug Input Data\PZ-7b.txt

Well Label:	PZ-7b
Aquifer Thickness:	31.26 feet
Screen Length:	10. feet
Casing Radius:	8.3e-002 feet
Effective Radius:	0.344 feet
Static Water Level:	0. feet
Water Table to Screen Bottom:	31.26 feet
Anisotropy Ratio:	1.
Time Adjustment:	18.6 Seconds

Test starts with trial 0
There are 105 time and drawdown measurements
Maximum head is 4.454 feet
Minimum head is 0. feet

Trial	Time (minutes)	Adjusted Time (minutes)	Drawdown (feet)	Head (feet)	Head Ratio
1	0.31	0.	4.454	4.454	1.
2	0.3166	6.6e-003	4.375	4.375	0.9823
3	0.3266	1.66e-002	3.856	3.856	0.8657
4	0.33	2.e-002	3.831	3.831	0.8601
5	0.3333	2.33e-002	3.79	3.79	0.8509
6	0.35	4.e-002	3.783	3.783	0.8493
7	0.3666	5.66e-002	3.777	3.777	0.848
8	0.3833	7.33e-002	3.764	3.764	0.8451
9	0.4	9.e-002	3.758	3.758	0.8437
10	0.4166	0.1066	3.751	3.751	0.8422
11	0.4333	0.1233	3.739	3.739	0.8395
12	0.45	0.14	3.729	3.729	0.8372
13	0.4666	0.1566	3.723	3.723	0.8359
14	0.4833	0.1733	3.71	3.71	0.833
15	0.5	0.19	3.7	3.7	0.8307
16	0.5166	0.2066	3.691	3.691	0.8287
17	0.5333	0.2233	3.678	3.678	0.8258
18	0.55	0.24	3.669	3.669	0.8238
19	0.5666	0.2566	3.659	3.659	0.8215
20	0.5833	0.2733	3.65	3.65	0.8195
21	0.6	0.29	3.64	3.64	0.8172
22	0.6166	0.3066	3.631	3.631	0.8152
23	0.6333	0.3233	3.624	3.624	0.8137
24	0.65	0.34	3.611	3.611	0.8107
25	0.6666	0.3566	3.602	3.602	0.8087
26	0.6833	0.3733	3.592	3.592	0.8065
27	0.7	0.39	3.586	3.586	0.8051
28	0.7166	0.4066	3.58	3.58	0.8038
29	0.7333	0.4233	3.57	3.57	0.8015
30	0.75	0.44	3.564	3.564	0.8002
31	0.7666	0.4566	3.554	3.554	0.7979
32	0.7833	0.4733	3.551	3.551	0.7973
33	0.8	0.49	3.545	3.545	0.7959
34	0.8166	0.5066	3.542	3.542	0.7952

35	0.8333	0.5233	3.535	3.535	0.7937
36	0.85	0.54	3.532	3.532	0.793
37	0.8666	0.5566	3.529	3.529	0.7923
38	0.8833	0.5733	3.519	3.519	0.7901
39	0.9	0.59	3.516	3.516	0.7894
40	0.9166	0.6066	3.5	3.5	0.7858
41	0.9333	0.6233	3.487	3.487	0.7829
42	0.95	0.64	3.484	3.484	0.7822
43	0.9666	0.6566	3.481	3.481	0.7815
44	0.9833	0.6733	3.478	3.478	0.7809
45	1.	0.69	3.472	3.472	0.7795
46	1.2	0.89	3.408	3.408	0.7652
47	1.4	1.09	3.347	3.347	0.7515
48	1.6	1.29	3.297	3.297	0.7402
49	1.8	1.49	3.243	3.243	0.7281
50	2.	1.69	2.988	2.988	0.6709
51	2.2	1.89	2.931	2.931	0.6581
52	2.4	2.09	2.88	2.88	0.6466
53	2.6	2.29	2.845	2.845	0.6388
54	2.8	2.49	2.81	2.81	0.6309
55	3.	2.69	2.775	2.775	0.623
56	3.2	2.89	2.737	2.737	0.6145
57	3.4	3.09	2.699	2.699	0.606
58	3.6	3.29	2.664	2.664	0.5981
59	3.8	3.49	2.626	2.626	0.5896
60	4.	3.69	2.591	2.591	0.5817
61	4.2	3.89	2.556	2.556	0.5739
62	4.4	4.09	2.518	2.518	0.5653
63	4.6	4.29	2.479	2.479	0.5566
64	4.8	4.49	2.451	2.451	0.5503
65	5.	4.69	2.416	2.416	0.5424
66	5.2	4.89	2.384	2.384	0.5352
67	5.4	5.09	2.349	2.349	0.5274
68	5.6	5.29	2.317	2.317	0.5202
69	5.8	5.49	2.285	2.285	0.513
70	6.	5.69	2.254	2.254	0.5061
71	6.2	5.89	2.219	2.219	0.4982
72	6.4	6.09	2.19	2.19	0.4917
73	6.6	6.29	2.162	2.162	0.4854
74	6.8	6.49	2.136	2.136	0.4796
75	7.	6.69	2.107	2.107	0.4731
76	7.2	6.89	2.079	2.079	0.4668
77	7.4	7.09	2.053	2.053	0.4609
78	7.6	7.29	2.031	2.031	0.456
79	7.8	7.49	2.006	2.006	0.4504
80	8.	7.69	1.984	1.984	0.4454
81	8.2	7.89	1.961	1.961	0.4403
82	8.4	8.09	1.939	1.939	0.4353
83	8.6	8.29	1.917	1.917	0.4304
84	8.8	8.49	1.901	1.901	0.4268
85	9.	8.69	1.879	1.879	0.4219
86	9.2	8.89	1.856	1.856	0.4167
87	9.4	9.09	1.84	1.84	0.4131
88	9.6	9.29	1.825	1.825	0.4097
89	9.8	9.49	1.809	1.809	0.4062
90	10.	9.69	1.786	1.786	0.401
91	12.	11.69	1.586	1.586	0.3561

92	14.	13.69	1.367	1.367	0.3069
93	16.	15.69	1.205	1.205	0.2705
94	18.	17.69	1.087	1.087	0.2441
95	20.	19.69	0.995	0.995	0.2234
96	22.	21.69	0.925	0.925	0.2077
97	24.	23.69	0.865	0.865	0.1942
98	30.	29.69	0.779	0.779	0.1749
99	32.	31.69	0.718	0.718	0.1612
100	34.	33.69	0.664	0.664	0.1491
101	36.	35.69	0.62	0.62	0.1392
102	38.	37.69	0.563	0.563	0.1264
103	40.	39.69	0.531	0.531	0.1192
104	42.	41.69	0.505	0.505	0.1134
105	44.	43.69	0.493	0.493	0.1107

APPENDIX H

LIST OF RESIDENCES CLOSE TO THE LANDFILL

List of Residences in the Limited Study Area Close to the JMN/Cleveland Container Landfill
BLE Project Number J99-1307-04

Name	Address		Acres	Water Well Present	Connected to County Water System
Watkins Elaine Keller	106	Kitty Ct	8.35	Yes	No
Lesieur Michel Raoul	107	Kitty Ct	8.39	Yes	Yes
Meeks Thomas S & Sunday H	231	Roseborough Road	1.06	Yes	No
Unknown	232	Roseborough Road		Probably*	Yes
Davis Elizabeth A	233	Roseborough Road	0.6	Yes	Yes
Unknown	234	Roseborough Road		Probably*	Yes
Brooks Shirley	235	Roseborough Road		Yes	No
Jefferies Robert & Annie	236	Roseborough Road	0.5	Probably*	Yes
Roseboro Robert & Linda	237	Roseborough Road	0.52	Yes	Yes
Brooks Isabell Hartgrove	238	Roseborough Road	0.5	Probably*	Yes
Hartgrove Jay Lewis	239	Roseborough Road	0.53	Probably*	Yes
Dawkins Francine Brooks	240	Roseborough Road	1	Yes	No
Smith Benny & Gwendolyn	241	Roseborough Road	0.53	Yes	Yes
Feaster Margaret H	243	Roseborough Road	0.53	Probably*	Yes
Dawkins Martha Lee	244	Roseborough Road	2	Probably*	Yes
Parker Rufus Douglas & Ru	247	Roseborough Road	0.56	Probably*	Yes
Evans Nathaniel H & Joyce	249	Roseborough Road		Probably*	Yes
Unknown	256	Roseborough Road		Probably*	Yes
Unknown	257	Roseborough Road		Probably*	Yes
Unknown	257-1	Roseborough Road		No	Yes
Moses L. A.	258	Roseborough Road		Yes	No
Feaster Joe Wilson & Addi	259	Roseborough Road		Yes	Yes
Gingles Bobbie M	262	Roseborough Road		Yes	No
Cooke Geraldine	266	Roseborough Road		Yes	No
Mt. Olive Holiness Church	267	Roseborough Road	0.91	Yes	No
Walls James Floyd & Nelli	301	Roseborough Road	1	Yes	Yes
Prior Landfill Address	303	Roseborough Road		No	Yes
Unknown	322	Roseborough Road		Probably*	Yes
Meek John Robert	326	Roseborough Road	0.653	Yes	No
Abandoned Property	346	Roseborough Road		Yes	Yes
Morgan Winfred Andrew	351	Roseborough Road	2	Yes	No
Unknown	354	Roseborough Road		No	Yes
Carroll Debbie	355	Roseborough Road		Probably*	Yes
Martin David	356	Roseborough Road		No	Yes
Gist Silas Jr. & Ruby H	361	Roseborough Road	2.072	Probably*	Yes
Styles Sharon Barnes	363	Roseborough Road	2.545	Probably*	Yes
Unknown	107	Temple Drive		Probably*	Yes
Dawkins Ruby	109	Temple Drive		No (well abandoned)	Yes
Bethlehem Temple Church	115	Temple Drive		Yes	No
Meeks Louise	116	Temple Drive	0.86	Yes	No
Brintley OB & Rube	117	Temple Drive	1.25	Yes	No
Brooks Alfred Lee	118	Temple Drive	1	Probably*	Yes
Unknown	120	Temple Drive		Yes	No
Meeks Brenda Jean	122	Temple Drive	1	Yes	Yes
Unknown	124	Temple Drive		Probably*	Yes
Unknown	126	Temple Drive		Yes	Yes
Smith Elvira M & James W	127	Temple Drive	2.33	Yes	Yes
Unknown	128	Temple Drive		Probably*	No
Unknown	129	Temple Drive		Probably*	No

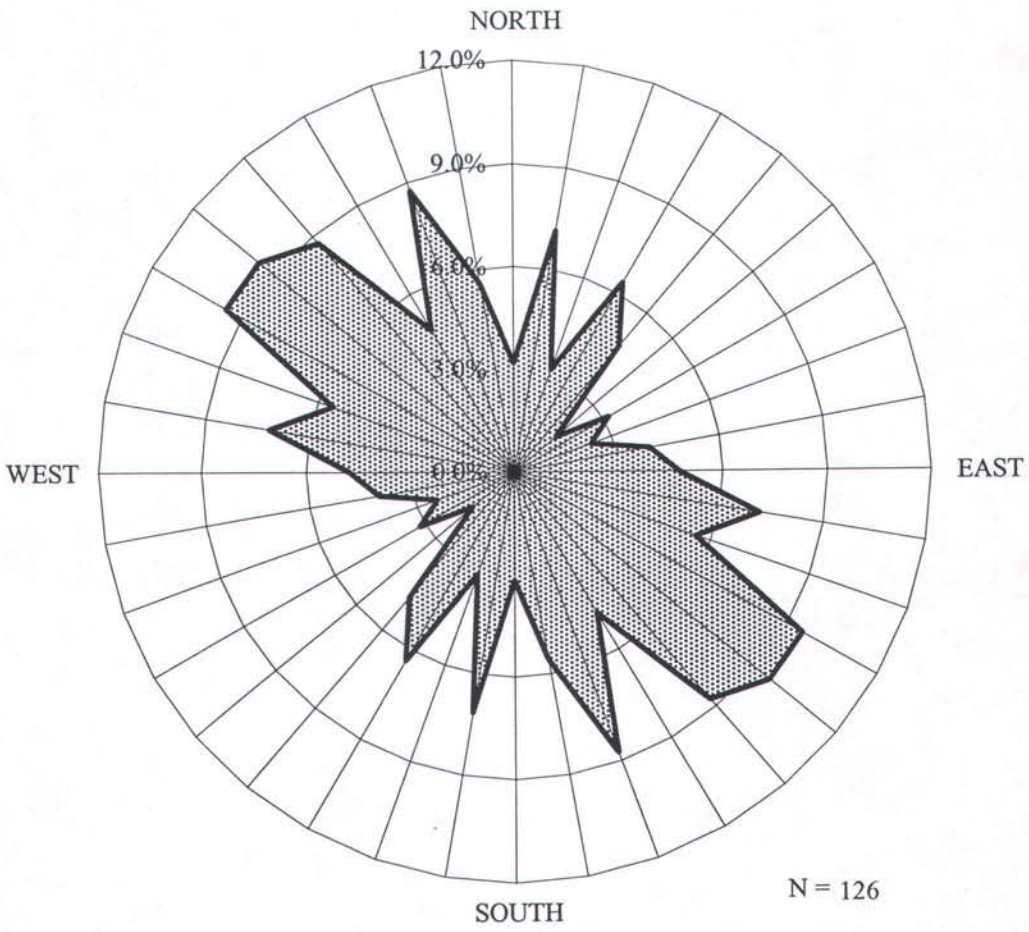
Notes:

1. * = No well readily visible; however, other residences of similar ages in the area have private water wells
2. Refer to Figure 2 for the extent of the limited study area

APPENDIX I

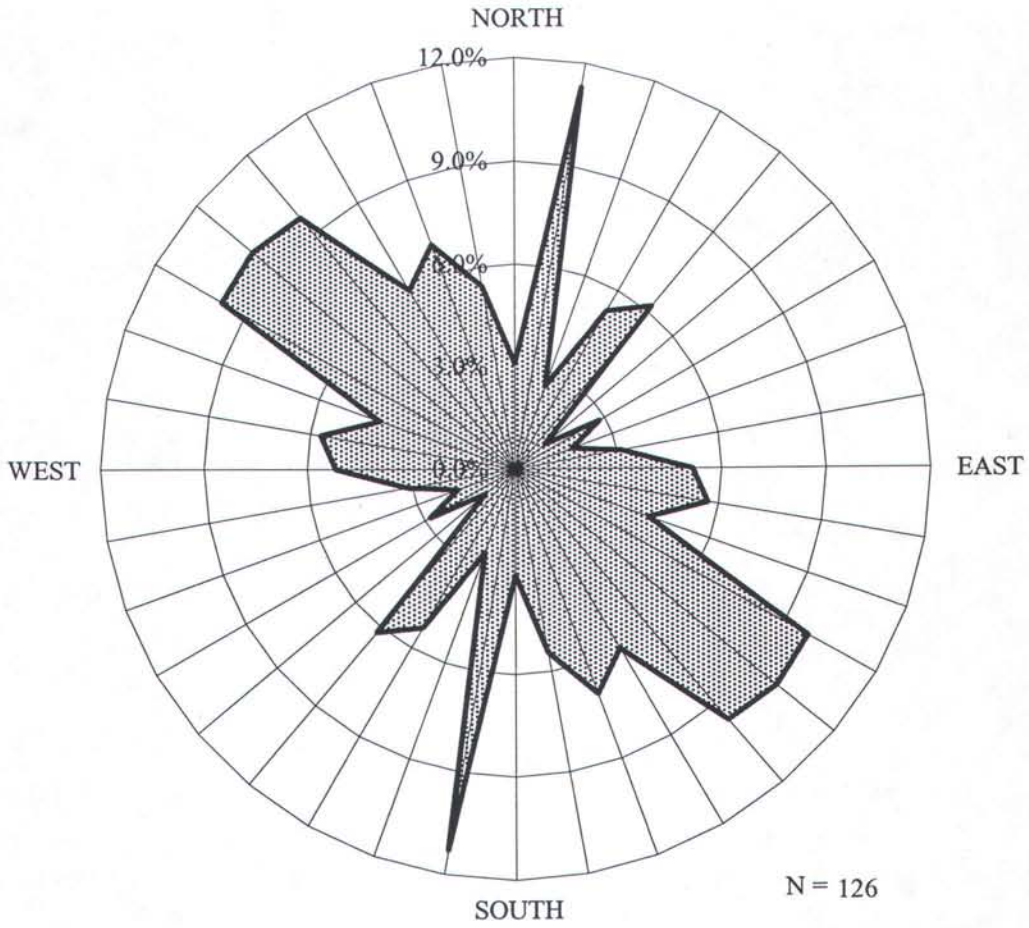
FRACTURE TRACE ANALYSIS DATA AND RESULTS

ROSE DIAGRAM OF FRACTURE TRACE AND LINEAMENT TRENDS
Percentage Expressed as Number of Fracture Traces/Lineaments
Data Collected within 2-Mile Radius of the JMN/Cleveland Container Landfill, Shelby, NC
BLE Job J99-1307-04

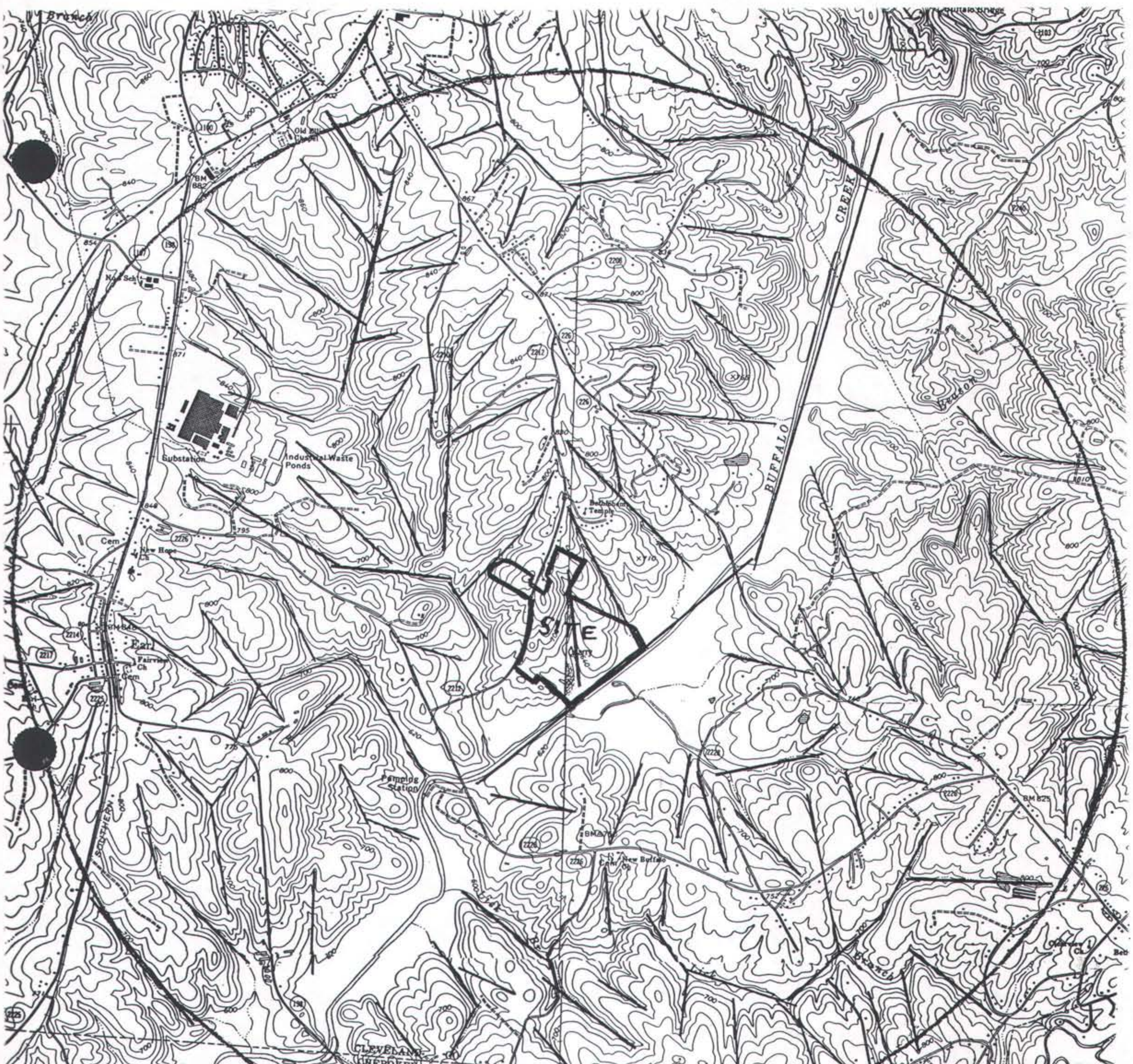


Clev Cont LF FTA-Area.xls
Rose Diagram (Lineament Trends)

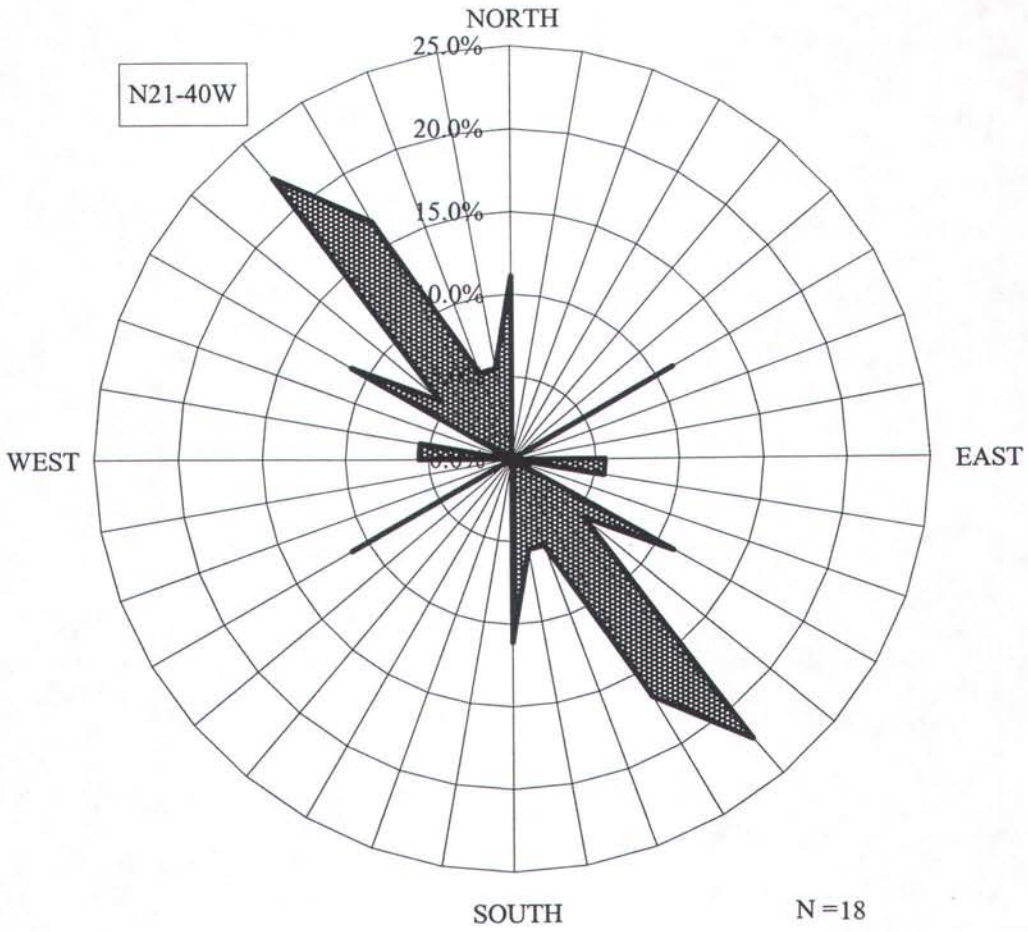
ROSE DIAGRAM OF FRACTURE TRACE AND LINEAMENT TRENDS
Percentage Expressed as Length of Fracture Traces/Lineaments
Data Collected within 2-Mile Radius of the JMN/Cleveland Container Landfill, Shelby, NC
BLE Job J99-1307-04



Clev Cont LF FTA-Area.xls
Rose Diagram (Lineament Length)

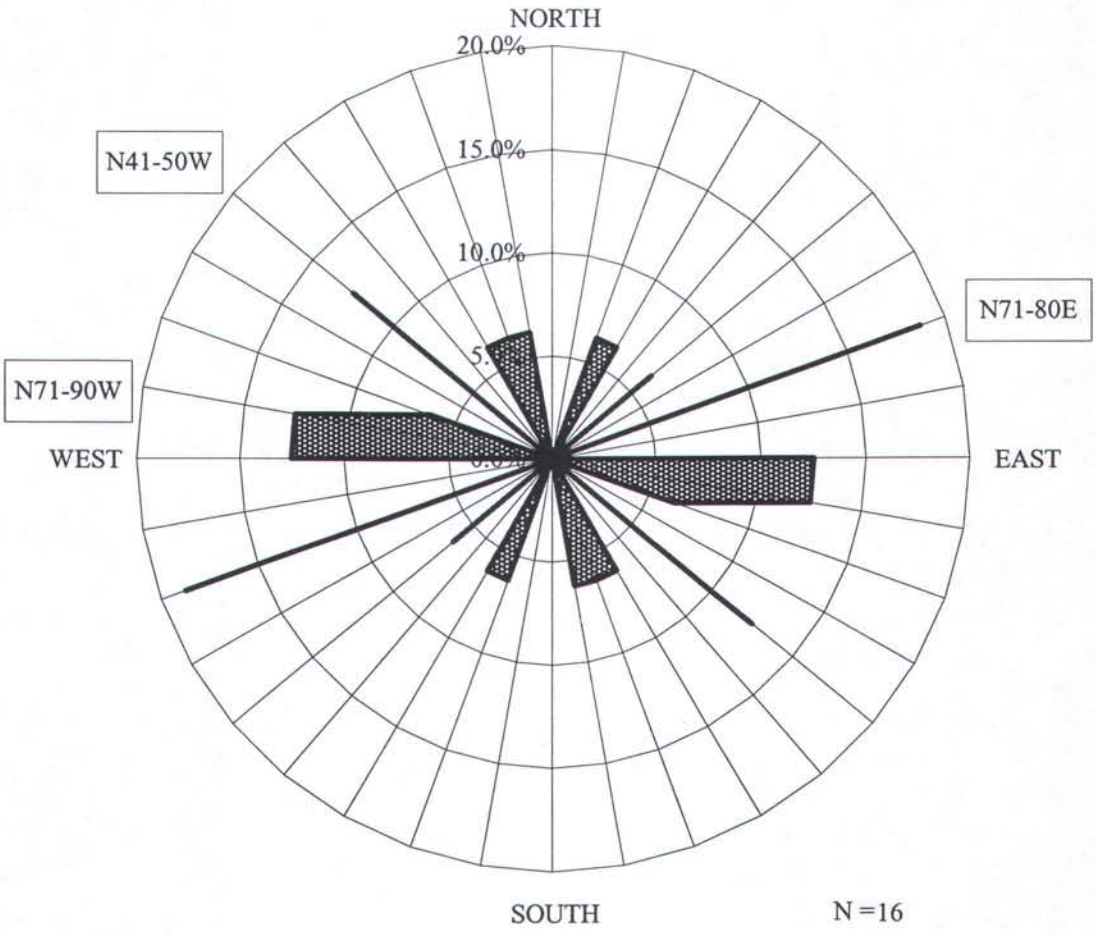

SITE
BUFFALO
CREEK
Substation
Industrial Waste Ponds
Pumping Station
New Hope Ch
Cem
Earl
Fairview Ch
New Buffalo Ch
CLEVELAND CO
CHEROKEE CO
INTERCHANGE 104
Industrial Waste Pond
Bee
Branch

Rose Diagram of Foliation Trends Measured at and near the Cleveland Container Industrial Landfill, Shelby, NC
BLE Job Number J99-1307-04



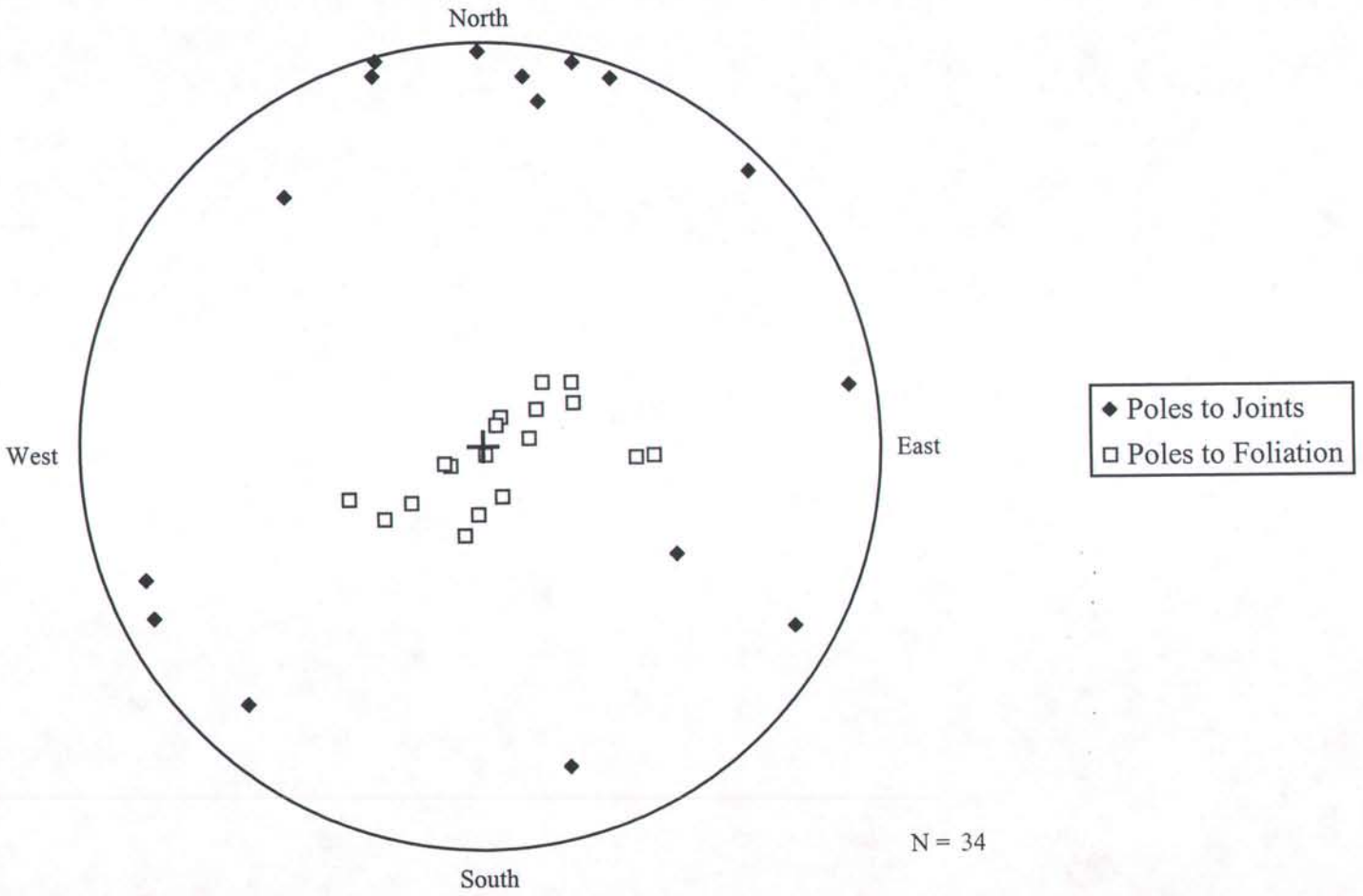
CCLF STR-DIP Foliation.xls
rose diagram

Rose Diagram of Joint Trends Measured at and near the Cleveland Container Industrial Landfill, Shelby, NC
BLE Job Number J99-1307-04



CCLF STR-DIP Joints.xls
rose diagram

PLOT OF POLES TO JOINTS & FOLIATION
Cleveland Container Industrial Landfill, Shelby, NC
BLE Job Number J99-1307-04



CCLF STR-DIP Joints and Foliation.xls
Stereo 2

Stereo Projection
Equal Angle

APPENDIX J

PRECIPITATION DATA

MONTHLY PRECIPITATION DATA - 1980 TO 2000

North Carolina Division 5
JMN/Cleveland Container Industrial Landfill
Cleveland Co., North Carolina
BLE Job Number J99-1307-04

	YEAR																					
MONTH	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**20-Yr Monthly Avg.**
January	4.92	0.59	5.42	2.77	4.54	4.23	1.34	6.12	3.83	1.87	3.89	5.71	2.51	6.32	4.55	5.53	4.28	3.86	8.04	4.86	5.5	4.32
February	1.43	3.47	5.41	5.64	5.83	4.59	1.31	4.85	1.63	4.9	5.3	1.77	3.68	2.95	3.17	5.42	2.65	4.25	5.08	2.44	2.28	3.72
March	8.65	2.07	1.9	6.98	5.73	1.06	2.87	4.79	2.63	5.69	3.81	6.94	3.92	8.26	5.66	2.51	5.1	3.51	4.92	2.49	3.16	4.41
April	2.56	0.79	3.83	4.02	4.4	1.56	0.69	2.75	2.33	3.81	2.89	5.36	3.46	4.31	2.04	0.89	3.54	5.51	5.47	4.16	4.66	3.29
May	4.36	3.82	4.36	2.41	6.42	4.12	2.03	1.46	2.29	5.05	5.96	2.83	4.05	3.09	2.03	4.18	2.19	1.77	3.53	1.6	1.75	3.30
June	3.23	3.53	6.24	3.01	2.84	4.91	0.76	4.43	2.33	5.53	0.78	3.83	7.48	2.66	6.47	8.01	3.02	3.87	2.44	4.51	2.92	3.94
July	3.05	7.43	4.6	1.16	9.76	5.51	2.69	2.83	3.42	6.12	3.65	6.42	1.93	3.11	6	5.2	4.48	9.09	4.33	2.85	4.59	4.68
August	2.22	3.62	2.82	3.5	2.93	8.95	8.51	3.14	5.73	4.14	2.97	7	5.27	3.84	5.15	6.78	5.53	0.71	3.82	2.65	3.29	4.41
September	6.85	3.6	2.09	2.61	0.87	0.2	1.5	7	4.65	6.65	1.38	1.97	3.66	3.09	3.94	3.34	6.11	3.99	5.11	8.31		3.85
October	3.54	3.52	4.73	2.5	2.47	5.54	3.43	1.37	3.73	4.59	13.21	0.69	6.7	2.96	3.43	8.14	3.38	4.57	2.57	4.61		4.28
November	3.36	0.82	2.82	4.46	1.58	7.07	4.97	4.2	3.6	2.96	2.47	1.78	7.17	3.19	2.89	5	3.5	3.81	1.82	1.79		3.46
December	1.21	6.15	4.52	7.57	2.26	1.1	3.8	3.46	1.28	3.62	3.05	2.99	3.09	3.69	2.35	1.55	3.19	4.28	3.67	1.9		3.24
SEASON																						**20-Yr Seasonal Avg.**
Winter	15	6.13	12.73	15.39	16.1	9.88	5.52	15.76	8.09	12.46	13	14.42	10.11	17.53	13.38	13.46	12.03	11.62	18.04	9.79	10.94	12.45
Spring	10.15	8.14	14.43	9.44	13.66	10.59	3.48	8.64	6.95	14.39	9.63	12.02	14.99	10.06	10.54	13.08	8.75	11.15	11.44	10.27	9.33	10.53
Summer	12.12	14.65	9.51	7.27	13.56	14.66	12.7	12.97	13.8	16.91	8	15.39	10.86	10.04	15.09	15.32	16.12	13.79	13.26	13.81		12.99
Fall	8.11	10.49	12.07	14.53	6.31	13.71	12.2	9.03	8.61	11.17	18.73	5.46	16.96	9.84	8.67	14.69	10.07	12.66	8.06	8.3		10.98
Yearly Totals	45.38	39.41	48.74	46.63	49.63	48.84	33.90	46.40	37.45	54.93	49.36	47.29	52.92	47.47	47.68	56.55	46.97	49.22	50.80	42.17		**Yearly Avg.** 46.89
Rank from 1980 to 1999	16	18	9	14	5	8	20	15	19	2	6	12	3	11	10	1	13	7	4	17		

Data Source: NOAA, public information

APPENDIX K

INFORMATION FROM CAMP DRESSER & MCKEE'S *LANDFILL DESIGN PLAN*, DATED DECEMBER 1997

CDM Camp Dresser & McKee

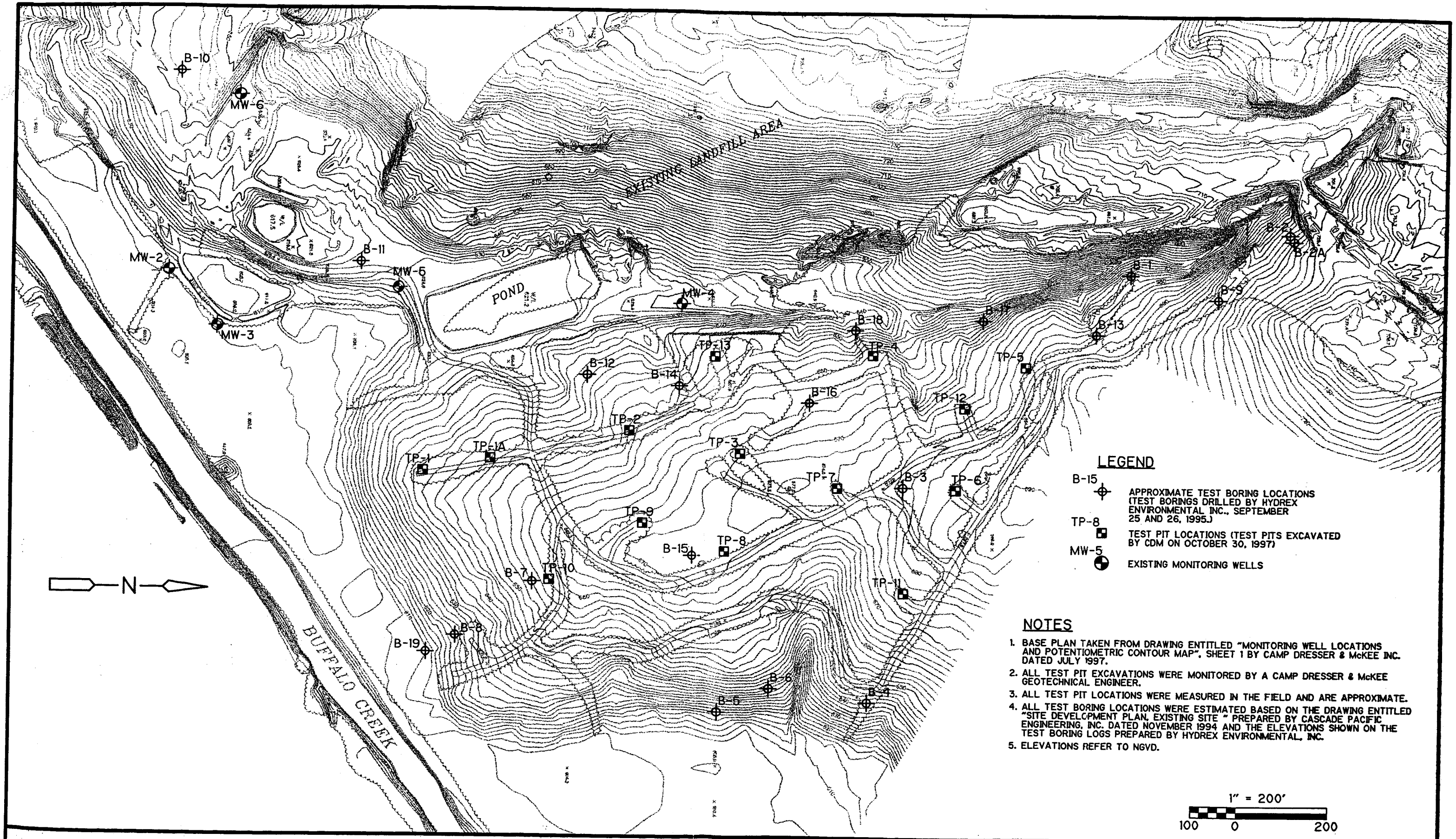
Report

Cleveland Container, Services, Inc.

JMN/Cleveland Container Industrial Landfill Shelby, North Carolina

Landfill Design Plan

December 1997



CLEVELAND CONTAINER SERVICES

JMN LANDFILL

TEST PIT AND EXPLORATIONS LOCATION PLAN

Figure No. 3-1

CDM
environmental engineers, scientists, planners, & management consultants

G:\1038437\GRAP\FIG-1.DWG

Table 3-1
JMN Industrial Landfill
Test Pit and Sample Summary

Test Pit I.D. Number	Approximate G.Surface Elevation	Test Pit Depth (ft. bgs)	Sample Type (1)	Sample Depth (ft. bgs)	USCS (2) (ASTM D2488)	"Red Silt" Layer Thickness (ft. bgs)
TP-1	641	6.5	S.Bag S.Bag	0.5-1.0 5.0-6.0	MH ML	1.0
TP-1A	646	11.5	L.Bag S.Bag	1.0-2.0 11.5	CL ML	2.5
TP-2	654	8.5	Pail	1.0-3.0	CL	2.5
TP-3	669	9.5	S.Bag Pail S.Bag	1.0-2.0 3.0-4.0 7.0	CL MH MH	4.5
TP-4	661	8.5	L.Bag	1.0-2.0	CL	2.0
TP-5	681	6.0	L.Bag S.Bag	1.0-2.0 5.0-6.0	CL Rock (3)	1.5
TP-6	685	11.0	Pail S.Bag	1.0-2.5 5.0-6.0	MH (4) ML	4.0
TP-7	674	10.5	Pail S.Bag	2.0-3.0 6.0	MH / SM (4) ML	4.5
TP-8	671	11.5	L.Bag S.Bag	3.0-4.0 5.0-6.0	MH MH (3)	4.5
TP-9	669	12.5	Pail S.Bag S.Bag	1.0-2.0 5.0 7.0	CH (4) MH (4) ML / SM (4)	5.5
TP-10	657	11.5	Pail L.Bag	2.0-4.0 9.0-10.0	MH (4) ML	3.5
TP-11	676	11.0	L.Bag L.Bag S.Bag	1.0-2.0 2.5-3.0 11.0	ML ML ML	4.5
TP-12	675	12.0	L.Bag S.Bag	1.0-2.0 5.0	ML ML	4.0
TP-13	651	10.0	L.Bag	1.0-2.0	MH	3.5

Notes :

1. Sample Type : Pail = 5gallon Bucket; L.Bag= 1gallon Zip-Lock Bag; S.Bag= 1quart Zip-Lock Bag
2. Visual USCS classification conducted on sample portion passing No. 40 sieve.
3. Detailed description provided on test pit log.
4. Samples submitted for geotechnical laboratory testing (see Table 3-2).

Table 3-2

JMN Industrial Landfill

Summary of Geotechnical Laboratory Test Results

	ASTM	As received	D 854	D 422	D 4318			D 2488	D6 98		D 5084	D 47 67	
Sample Number	Depth Below G. Surface	Water Content	Specific Gravity	Passing No. 200	Atterberg Limits Test: Liquid Limit	Plastic Limit	Plasticity Index	USCS classification	Standard Proctor: Max. Dry Density	Opt. Moisture Content	Flex. Wall Permeability	Triaxial C. c'	Undrained ϕ'
	(ft.)	(%)		(%)	(LL)	(PL)	(PI)		(pcf)	(%)	(cm/sec)	(psi)	(degrees)
TP-6	1.0 - 2.5	29.0	2.64	59.1	62.0	52.0	10.0	MH	91.0	27.6	1.4×10^{-7}	0.0	38.5
TP-7	2.0 - 3.0	21.8	*	47.5	61.0	36.0	25.0	SM	93.9	26.4	2.2×10^{-7}	*	*
TP-9	1.0 - 2.0	17.4	*	65.0	71.0	33.0	38.0	CH	89.7	28.3	9.9×10^{-8}	*	*
TP-9	5.0	30.3	*	*	NP	NP	NP	*	*	*	*	*	*
TP-9	7.0	17.4	*	28.6	*	*	*	SM	*	*	*	*	*
TP-10	2.0 - 4.0	22.1	2.60	57.2	54.0	43.0	11.0	MH	100.5	21.7	1.4×10^{-7}	5.1	27.3

Notes :

1. The associated test data sheets should be attached with this summary table
2. Indicates test was not requested (*)

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-1
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 641
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry, reddish brown, SILT, trace - some mica, trace fine sand	1.5 ft.	Moderate to Hard
3	Dry, light brown/gray, medium to fine SAND, some mica, trace-some silt		Easy
4			
5			
6		6.5 ft.	
7	**Bottom of TP-1 at 6.5 ft. bgs**		
8			
9			
10			
11			
12			
13			

T.P. DIMENSIONS

Width (ft):	3
Length (ft):	11
Depth (ft):	6.5
VOL. (ft^3)	**214.5**

REMARKS

1 S.Bag sample between 0.5 - 1ft. depth
1 S.Bag sample between 5 - 6 ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-1A
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 646
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry-moist, reddish brown, elastic SILT, trace mica	3.0 ft.	Moderate to Hard
3			
4	Dry, brown, fine SAND, trace-some silt, trace-some mica	6.0 ft.	Easy to Moderate
5			
6			
7	Dry, light brown/gray, fine SAND and mica, some silt	11.5 ft.	Easy to Moderate
8			
9			
10			
11			
12	**Bottom of TP-1A at 11.5 ft. bgs**		
13			

T.P. DIMENSIONS

Width (ft):	3
Length (ft):	12
Depth (ft):	11.5
VOL. (ft^3)	414

REMARKS

1 L.Bag sample between 1 - 2ft. depth
1 S.Bag sample at 11.5ft. depth

BOUNDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-2
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 654
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry, reddish brown, SILT, trace-some mica	3.5 ft.	Moderate
4	Dry, light brown/gray, fine SAND and mica, trace-some silt	8.5 ft.	Easy to Moderate
9	**Bottom of TP-2 at 8.5 ft. bgs**		

T.P. DIMENSIONS	
Width (ft):	4
Length (ft):	13
Depth (ft):	8.5
VOL. (ft^3)	442

REMARKS

1 Pail sample between 1 - 3ft. depth (5gal)

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-3
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 669
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
0	Topsoil and roots	0.5 ft.	Easy
1–2	Dry, reddish brown, elastic SILT, trace mica	2.0 ft.	Moderate
3–5	Dry, reddish brown/brown, SILT, trace mica some fine sand	5.0 ft.	Moderate
6–9	Dry, light brown/gray, fine SAND and mica, trace-some silt	9.5 ft.	Easy to Moderate
10	**Bottom of TP-3 at 9.5 ft. bgs**		
11–13			

T.P. DIMENSIONS

Width (ft):	3
Length (ft):	16
Depth (ft):	9.5
VOL. (ft^3) :	456

REMARKS

1 S.Bag sample between 1 - 2ft. depth
1 Pail sample between 3 - 4ft. depth (5gal)
1 S.Bag sample at 7ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-4
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 661
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
0	Topsoil and roots	0.5 ft.	Easy
1–2	Dry, reddish brown, elastic SILT, trace mica (Black weathered rock with magnesium oxide staining and gravel at 2 ft. depth)	2.5 ft.	Moderate
3–8	Dry, light brown, fine SAND, some mica, trace-some silt	8.5 ft.	Easy to Moderate
9	**Bottom of TP-4 at 8.5 ft. bgs**		
10–13			

T.P. DIMENSIONS		REMARKS	BOULDER COUNT	
Width (ft):	3	1 L.Bag sample between 1 - 2ft. depth	6 in - 12 in :	0
Length (ft):	10		12 in - 18 in :	0
Depth (ft):	8.5		18 in - 24 in :	0
VOL. (ft^3)	**255**		24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-5
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 681
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry-moist, reddish brown, SILT, some sand trace clay, mica, gravel	2.0 ft.	Easy
3	Dry-moist, reddish to light brown, SILT, some mica, some, sand, trace weathered rock, clay, gravel	5.0 ft.	Easy to Moderate
6	Bedrock : Dry, reddish brown to grey, medium to coarse grained GNEISS. Heavily foliated/planar horizontal surfaces. Crystalline and platy texture, micaceous and quartzitic. Primary minerals, muscovite, quartz, feldspar. Sheet silicates, thin rectangular arrangement oriented in one direction. Platy cleavage with fissility, microfractures along cleavage and minor fractures across cleavage. Easily broken. Heavy chemical weathering, limonitic staining and magnesium oxides on fracture surfaces and cleavage planes. Decomposed-degraded mineralogy.	6.0 ft.	Hard
11	**Bottom of TP-5 at 6.0 ft. bgs**		

T.P. DIMENSIONS	
Width (ft):	3
Length (ft):	11
Depth (ft):	6
VOL. (ft^3)	198

REMARKS

1 L.Bag sample between 1 - 2ft. depth
1 S.Bag sample between 5 - 6ft. depth

BOULDER COUNT	
6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-6
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 685
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots, trace coarse gravel and small cobbles	1.0 ft.	Easy
2–5	Dry, reddish brown, elastic SILT, trace-some mica	5.0 ft.	Moderate to Hard
6–11	Distinct layering/transition between silt and sand layer between 5 - 6ft. depth Dry, light brown/gray, fine SAND some mica, trace-some silt	11.0 ft.	Easy to Moderate
12	**Bottom of TP-6 at 11.0 ft. bgs**		

T.P. DIMENSIONS

Width (ft):	4
Length (ft):	16
Depth (ft):	11
VOL. (ft^3):	704

REMARKS

1 Pail sample between 1 - 2.5ft. depth (5gal)
1 S.Bag sample between 5 - 6ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-7
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 674
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	1.0 ft.	Easy
2	Dry, reddish brown, elastic SILT, trace mica	2.0 ft.	Moderate
3	Dry, reddish brown, SILT, some mica some fine sand		Moderate
4			
5		5.5 ft.	
6	Dry, light brown/gray, fine SAND and mica, trace-some silt		Easy to Moderate
7			
8			
9			
10	Crushed, compacted mica layer at approximately 10 ft. depth	10 10.5 ft.	Hard
11	**Bottom of TP-7 at 10.5 ft. bgs**		
12			
13			

T.P. DIMENSIONS	
Width (ft):	4
Length (ft):	16
Depth (ft):	10.5
VOL. (ft^3)	672

REMARKS

1 Pail sample between 2 - 3ft. depth (5gal)
1 S.Bag sample at 6ft. depth

BOULDER COUNT	
6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-8
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 671
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry, reddish brown, elastic SILT, trace mica trace fine sand	3.5 ft.	Moderate
3			
4	Dry, reddish brown, SILT, some mica some fine sand	5.0 ft.	Moderate
5			
6	Coarse gravel and mica flakes	6.0 ft.	Hard
7	Dry, light brown/gray, fine SAND, some mica	5.0 ft.	Easy
8			
9	Crushed coarse gravel between 9 -10 ft. depth	9.0 ft.	Hard
10			
11		11.5 ft.	
12	**Bottom of TP-8 at 11.5 ft. bgs**		
13			

T.P. DIMENSIONS

Width (ft):	4
Length (ft):	16
Depth (ft):	11.5
VOL. (ft^3) :	736

REMARKS

1 L.Bag sample between 3 - 4ft. depth
1 S.Bag sample between 5 - 6ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-9
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 669
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry, reddish brown, elastic SILT, trace mica	3.0 ft.	Easy to Moderate
4	Dry, reddish brown, SILT and fine sand, some mica		Moderate
6	Distinct mica/weathered rock and gravel layer	6.0 ft.	Hard
7	Dry, light brown/gray, fine SAND and mica flakes, trace silt	12.5 ft.	Easy to Moderate
13	**Bottom of TP-9 at 12.5 ft. bgs**		

T.P. DIMENSIONS	
Width (ft):	4
Length (ft):	14
Depth (ft):	12.5
VOL. (ft^3)	700

REMARKS

1 Pail sample between 1 - 2ft. depth (5gal)
1 S.Bag sample at 5ft. depth
1 S.Bag sample at 7ft. depth

BOULDER COUNT	
6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-10
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 657
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	0.5 ft.	Easy
2	Dry-moist, reddish brown, SILT, trace-some fine sand, trace-some mica	4.0 ft.	Moderate to Hard
3			
4			
5	Dry, light brown/gray, medium - fine SAND some mica flakes, trace silt	11.5 ft.	Easy to Moderate
6			
7			
8			
9			
10			
11			
12	**Bottom of TP-10 at 11.5 ft. bgs**		
13			

T.P. DIMENSIONS

Width (ft):	6
Length (ft):	11
Depth (ft):	11.5
VOL. (ft^3)	759

REMARKS

1 Pail sample between 2 - 4ft. depth (5gal)
1 L.Bag sample at 9 - 10ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-11
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 676
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots, trace cobbles and small boulders	0.5 ft.	Easy
2	Dry, reddish brown, elastic SILT, trace-some mica	2.5 ft.	Moderate to Hard
3	Dry, reddish brown, SILT and some mica	5.0 ft.	Easy to Moderate
6	Dry, light brown/gray, fine SAND some mica, trace-some silt	11.0 ft.	Easy to Moderate
12	**Bottom of TP-11 at 11.0 ft. bgs**		

T.P. DIMENSIONS	
Width (ft):	4
Length (ft):	17
Depth (ft):	11
VOL. (ft^3)	748

REMARKS

1 L.Bag sample between 1 - 2ft. depth
1 L.Bag sample between 2.5 - 3ft. depth
1 S.Bag sample at 11ft. depth

BOULDER COUNT	
6 in - 12 in :	0
12 in - 18 in :	1
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-12
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina

DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 675
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
1	Topsoil and roots	1.0 ft.	Easy
2–5	Dry, reddish brown, elastic SILT, trace fine sand and mica	5.0 ft.	Easy to Moderate
6–12	Dry, light brown/gray, fine SAND and mica, trace-some silt, with white mica streaks/thin layers	12.0 ft.	Moderate to Hard
13	**Bottom of TP-12 at 12.0 ft. bgs**		

T.P. DIMENSIONS

Width (ft):	4
Length (ft):	16
Depth (ft):	12
VOL. (ft^3)	**768**

REMARKS

1 L.Bag sample between 1 - 2ft. depth
1 S.Bag sample at 5ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

TEST PIT FIELD LOG

CAMP DRESSER & MCKEE INC.

TP-13
Sheet 1 of 1

PROJECT : JMN Landfill
SITE : Shelby, N.Carolina
DEPTH TO GROUNDWATER : Dry on completion
LOG PREPARED BY : S.Ratnam

APPROX. G.S. : El. 651
DATE : 11/30/97
CONTRACTOR : Cleveland Container Service
EQUIPMENT: Excavator (Komatsu PC180LC)

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
0	Sand and gravel (Fill)	0.5 ft.	Easy
1–4	Dry, reddish brown, elastic SILT, trace mica	4.0 ft.	Easy to Moderate
5–10	Dry, light brown/gray, fine SAND and mica, trace silt, white mica streaks	10.0 ft.	Easy
11–13	**Bottom of TP-13 at 10.0 ft. bgs**		

T.P. DIMENSIONS

Width (ft):	4
Length (ft):	13
Depth (ft):	10
VOL. (ft^3)	520

REMARKS

1 L.Bag sample between 1 - 2ft. depth

BOULDER COUNT

6 in - 12 in :	0
12 in - 18 in :	0
18 in - 24 in :	0
24 in - 30 in :	0

Camp Dresser & McKee Inc.
Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D 5084)

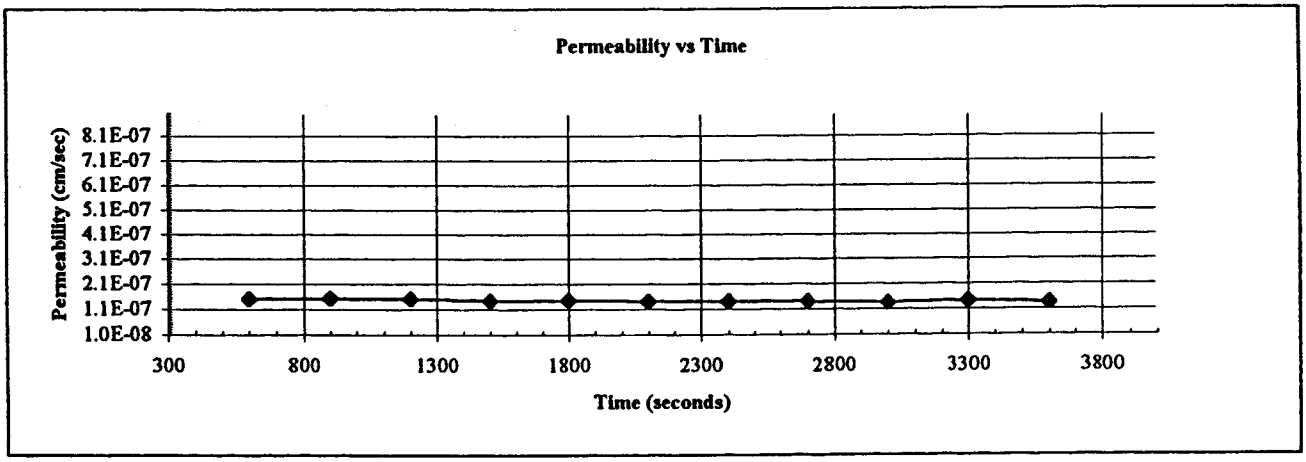
Client:	Cleveland Container Srevice Inc.	Tested by:	JM
Project Name:	JMN Landfill	Checked by:	PGB
Project Location:	Shelby, N.C.	Start Test Date:	11/18/97
Project Number:	10388-22437-RT.GEO	Permeant Fluid:	De-aired water
Sample Number:	TP-6		
Lab I.D. Number:	1810	Sample Preparation	
Boring Number:	-	Procedures:	Sample as requested was compacted at 86.5 pcf dry density and 33.5% moisture content.
Depth (ft):	1-2.5		
Sample Description:	Sandy Elastic Silt (MH)		
Test Type:	Falling head (Method C)		

Sample Characteristics	Initial	Final
Avg. length of specimen (in):	3.03	3.03
Avg. dia. of specimen (in):	2.83	2.83
Area (sq in):	6.29	6.29
Volume (cubic in):	19.05	19.05
Moist mass (g):	580.3	498.4
Moist unit weight (pcf):	116.1	99.7
Moisture content (%):	**32.9**	**33.9**
Dry unit weight (pcf):	**87.3**	**74.5**
Specific gravity (assumed)	2.65	2.65
Void Ratio	0.90	0.89

Test Specifications	
B-Value (%):	95.0
Consolidation stress (psi):	10.0
Maximum gradient (in/in):	26.3
Minimum gradient (in/in):	10.3
Cell pressure (psi):	28.0
Back pressure (psi):	23.0

Comments: Sample was divided vertically in quarters.
No observed anomalies (ie. rocks, voids, etc.).

Permeability at 20 °C = 1.4 x 10^{-7} cm/sec



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Phone: (617) 252-8137 Fax: (617) 577-9492

Camp Dresser & McKee Inc.
Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D 5084)

Client:	Cleveland Container Srevice Inc.
Project Name:	JMN Landfill
Project Location:	Shelby, N.C.
Project Number:	10388-22437-RT.GEO
Sample Number:	TP-7
Lab I.D. Number:	1811
Boring Number:	-
Depth (ft):	2-3
Sample Description:	Silty sand (SM)
Test Type:	Falling head (Method C)

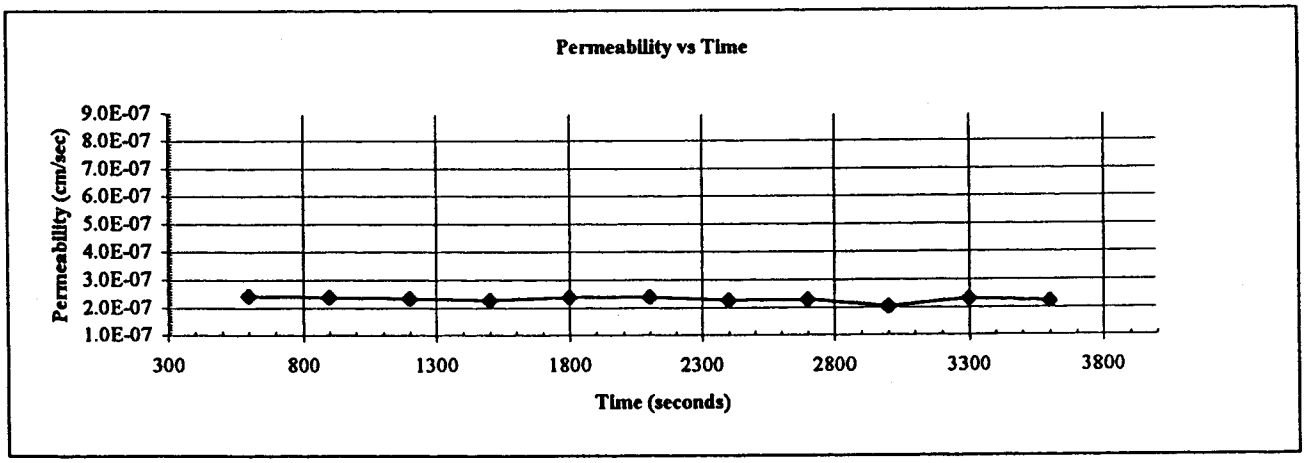
Tested by:	AS
Checked by:	PGB
Start Test Date:	11/18/97
Permeant Fluid:	De-aired water
Sample Preparation Procedures:	Sample as requested was compacted at 89.2 pcf dry density and 30.5% moisture content.

Sample Characteristics	Initial	Final
Avg. length of specimen (in):	3.11	3.11
Avg. dia. of specimen (in):	2.84	2.84
Area (sq in):	6.33	6.33
Volume (cubic in):	19.69	19.69
Moist mass (g):	585.0	498.4
Moist unit weight (pcf):	113.2	96.4
Moisture content (%):	**30.1**	**32.2**
Dry unit weight (pcf):	**87.0**	**73.0**
Specific gravity (assumed)	2.65	2.65
Void Ratio	0.90	0.90

Test Specifications	
B-Value (%):	96.0
Consolidation stress (psi):	10.0
Maximum gradient (in/in):	23.4
Minimum gradient (in/in):	5.4
Cell pressure (psi):	43.0
Back pressure (psi):	38.0

Comments: Sample was divided vertically in quarters.
No observed anomalies (ie. rocks, voids, etc.).

Permeability at 20 °C = 2.2 x 10^{-7} cm/sec



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Camp Dresser & McKee Inc.
Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D 5084)

Client:	Cleveland Container Srevice Inc.
Project Name:	JMN Landfill
Project Location:	Shelby, N.C.
Project Number:	10388-22437-RT.GEO
Sample Number:	TP-9
Lab I.D. Number:	1812
Boring Number:	-
Depth (ft):	1-2
Sample Description:	Sandy fat clay (CH)
Test Type:	Falling head (Method C)

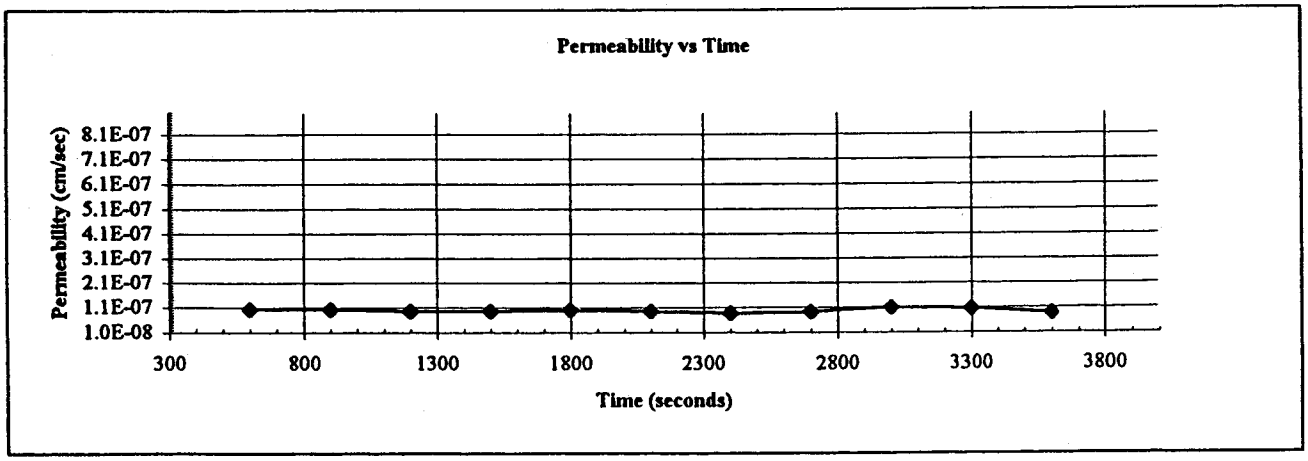
Tested by:	AS
Checked by:	PGB
Start Test Date:	11/14/97
Permeant Fluid:	De-aired water
Sample Preparation Procedures:	Sample as requested was compacted at 85.2 pcf dry density and 33.5% moisture content.

Sample Characteristics	Initial	Final
Avg. length of specimen (in):	3.06	3.06
Avg. dia. of specimen (in):	2.83	2.83
Area (sq in):	6.29	6.29
Volume (cubic in):	19.24	19.24
Moist mass (g):	572.1	498.4
Moist unit weight (pcf):	113.3	98.7
Moisture content (%):	**32.2**	**34.6**
Dry unit weight (pcf):	**85.7**	**73.3**
Specific gravity (assumed)	2.65	2.65
Void Ratio	0.93	0.95

Test Specifications	
B-Value (%):	97.0
Consolidation stress (psi):	10.0
Maximum gradient (in/in):	29.3
Minimum gradient (in/in):	15.6
Cell pressure (psi):	43.0
Back pressure (psi):	38.0

Comments: Sample was divided vertically in quarters.
No observed anomalies (ie. rocks, voids, etc.).

Permeability at 20 °C = 9.9 x 10^{-8} cm/sec



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Camp Dresser & McKee Inc.
Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D 5084)

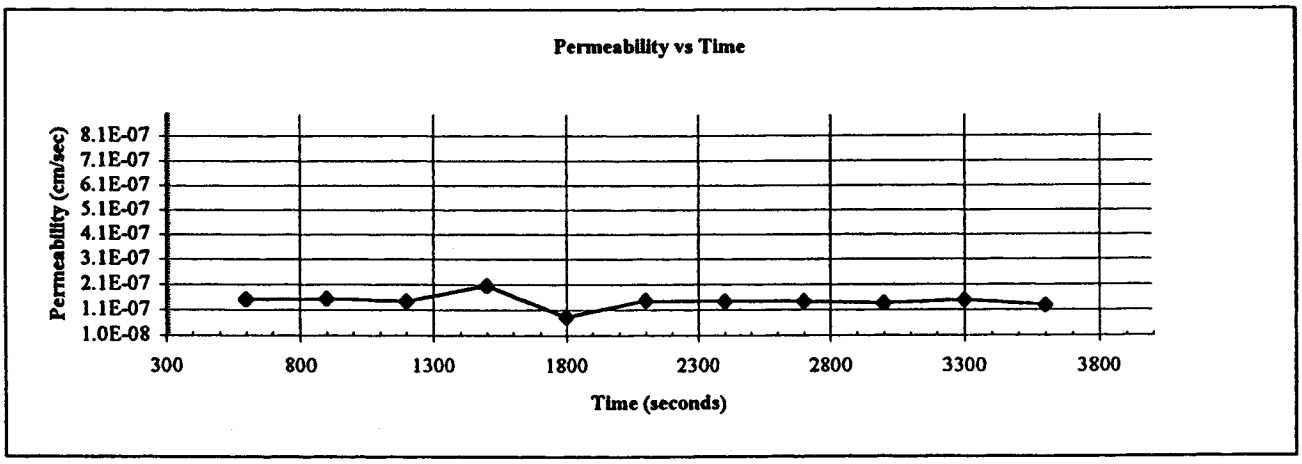
Client:	Cleveland Container Srevice Inc.	Tested by:	JM
Project Name:	JMN Landfill	Checked by:	PGB
Project Location:	Shelby, N.C.	Start Test Date:	11/18/97
Project Number:	10388-22437-RT.GEO	Permeant Fluid:	De-aired water
Sample Number:	TP-10		
Lab I.D. Number:	1813	Sample Preparation	
Boring Number:	-	Procedures:	Sample as requested was compacted at 95.5 pcf dry density and 26.0% moisture content.
Depth (ft):	2-4		
Sample Description:	Sandy Elastic Silt (MH)		
Test Type:	Falling head (Method C)		

Sample Characteristics	Initial	Final
Avg. length of specimen (in):	3.01	3.03
Avg. dia. of specimen (in):	2.82	2.82
Area (sq in):	6.24	6.24
Volume (cubic in):	18.79	18.92
Moist mass (g):	605.4	498.4
Moist unit weight (pcf):	122.7	100.4
Moisture content (%):	**25.9**	**26.7**
Dry unit weight (pcf):	**97.5**	**79.2**
Specific gravity (assumed)	2.65	2.65
Void Ratio	0.70	0.71

Test Specifications	
B-Value (%):	95.0
Consolidation stress (psi):	10.0
Maximum gradient (in/in):	27.3
Minimum gradient (in/in):	10.7
Cell pressure (psi):	28.0
Back pressure (psi):	23.0

Comments: Sample was divided vertically in quarters.
No observed anomalies (ie. rocks, voids, etc.).

Permeability at 20 °C = 1.4 x 10^{-7} cm/sec



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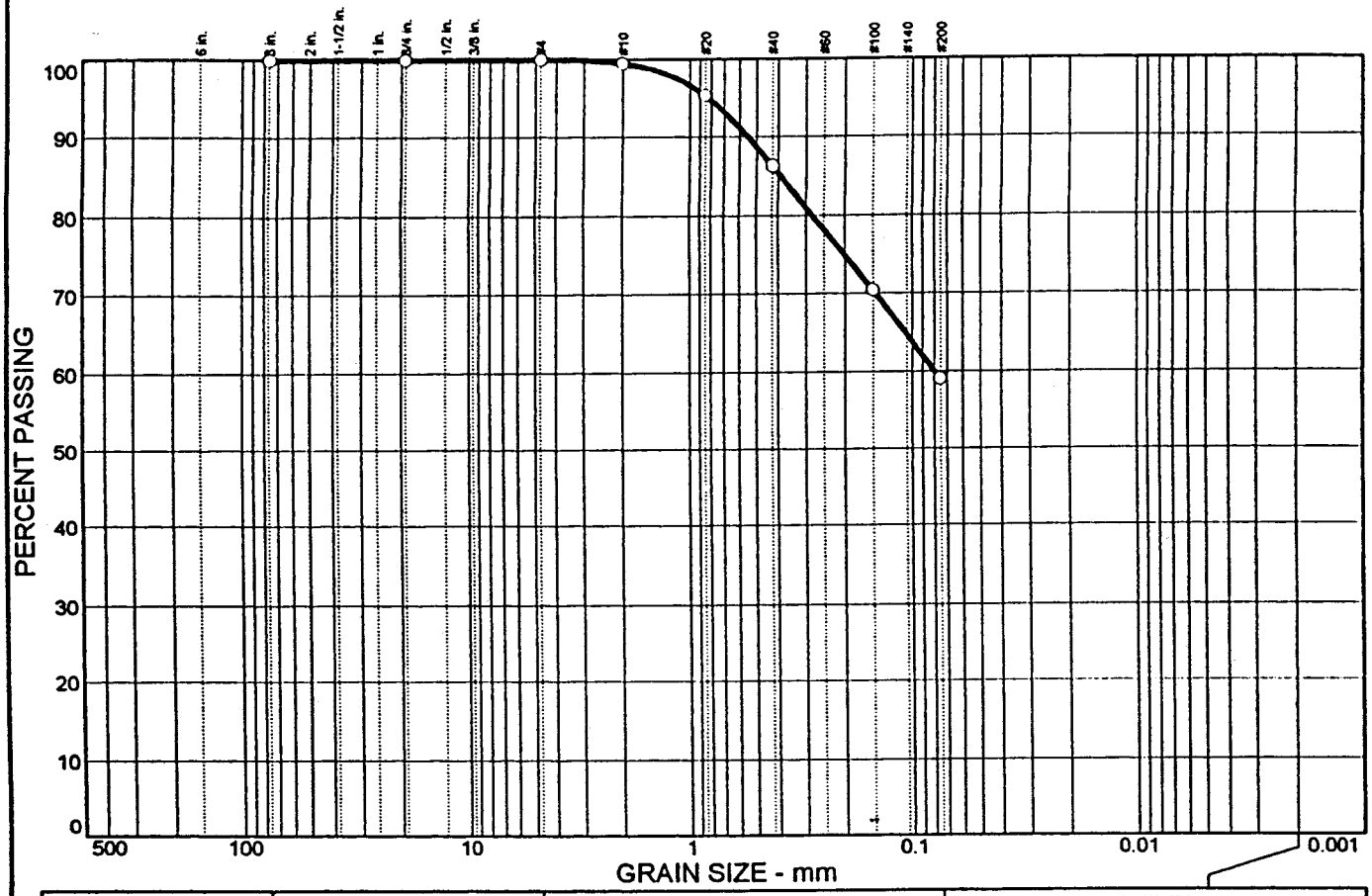
PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.5	13.2	27.2	59.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
3/4"	100.0		
#4	100.0		
#10	99.5		
#20	95.3		
#40	86.3		
#100	70.4		
#200	59.1		

* (no specification provided)

Soil Description

Sandy elastic silt (MH)

Atterberg Limits

PL= 52 LL= 62 PI= 10

Coefficients

D_{85}= 0.389 D_{60}= 0.0792 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO= A-5(7)

Remarks

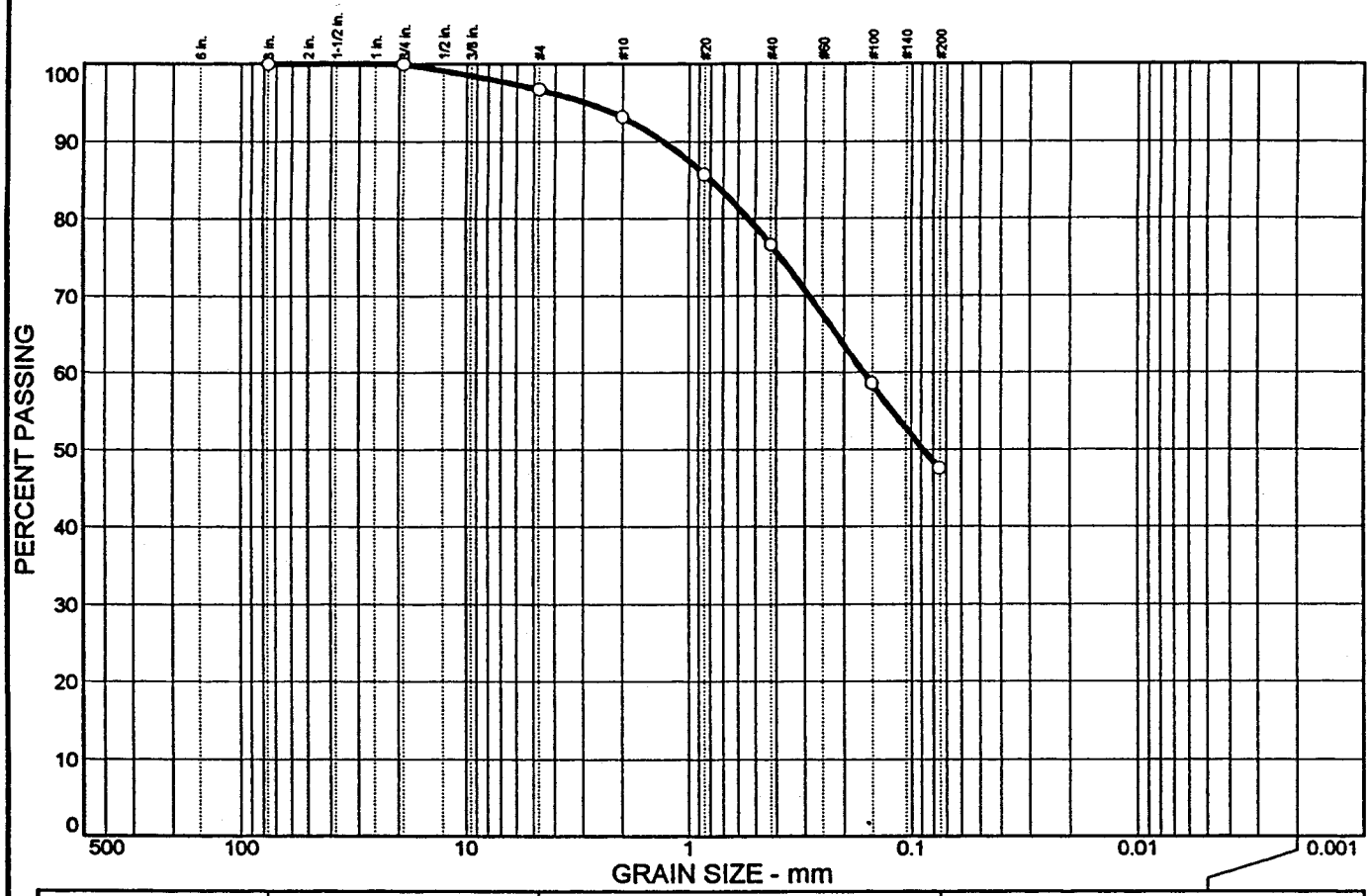
As Receive Moisture Content = 29.0%

Sample No.: TP-6 **Source of Sample:** **Test Date:** 11/7/97

Location: Shelby, N.C. **Elev./Depth:** 1 - 2.5 ft

Camp Dresser & McKee Inc. **Geotechnical Engineering Laboratory**	**Client:** Cleveland Container Service Inc. **Project:** JMN Landfill **Project No:** 10388-22437-RT.GEO

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	3.3	3.6	16.5	29.1	47.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
3/4	100.0		
#4	96.7		
#10	93.1		
#20	85.8		
#40	76.6		
#100	58.6		
#200	47.5		

* (no specification provided)

Soil Description

Silty sand (SM)

Atterberg Limits

PL= 36 LL= 63 PI= 27

Coefficients

D_{85}= 0.792 D_{60}= 0.163 D_{50}= 0.0881
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-7-5(10)

Remarks

As Receive Moisture Content = 21.8%

Sample No.: TP-7 **Source of Sample:** **Test Date:** 11/7/97

Location: Shelby, N.C. **Elev./Depth:** 2 - 3 ft

Camp Dresser & McKee Inc.

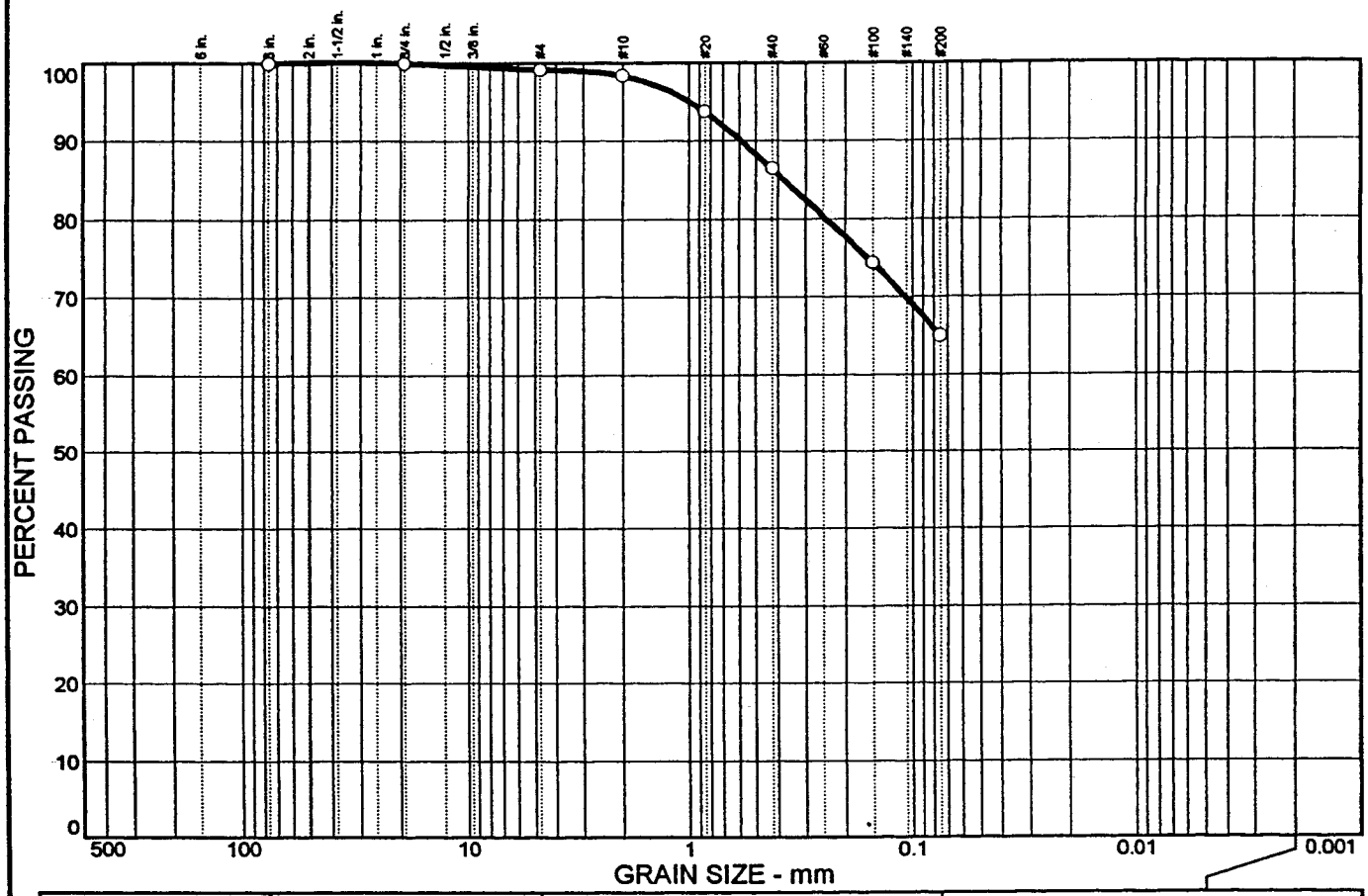
Geotechnical Engineering Laboratory

Client: Cleveland Container Service Inc.

Project: JMN Landfill

Project No: 10388-22437-RT.GEO

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.8	0.8	12.0	21.4	65.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
3/4	100.0		
#4	99.2		
#10	98.4		
#20	93.8		
#40	86.4		
#100	74.4		
#200	65.0		

* (no specification provided)

Soil Description

Sandy fat clay (CH)

Atterberg Limits

PL= 33 LL= 71 PI= 38

Coefficients

D_{85}= 0.375 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-5(25)

Remarks

As Receive Moisture Content = 30.3%

Sample No.: TP - 9 **Source of Sample:** **Test Date:** 11/7/97
Location: Shelby, N.C. **Elev./Depth:** 1 - 2 ft

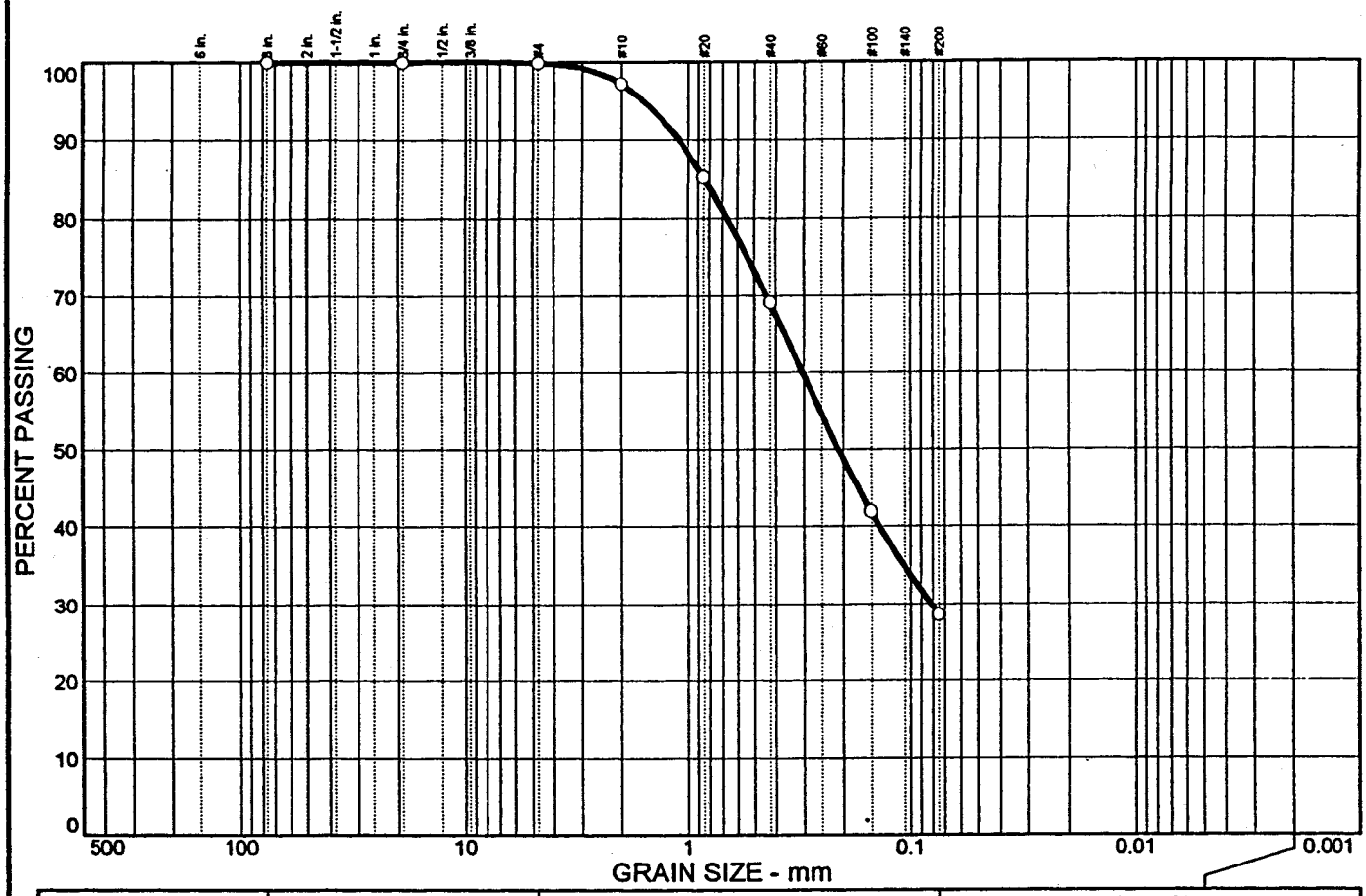
Camp Dresser & McKee Inc.

Geotechnical Engineering Laboratory

Client: Cleveland Container Service Inc.
Project: JMN Landfill

Project No: 10388-22437-RT.GEO

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.1	2.7	28.1	40.5	28.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
3/4	100.0		
#4	99.9		
#10	97.2		
#20	85.2		
#40	69.1		
#100	41.9		
#200	28.6		

* (no specification provided)

Soil Description

Silty sand (SM)

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.841 D_{60}= 0.303 D_{50}= 0.209
D_{30}= 0.0812 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

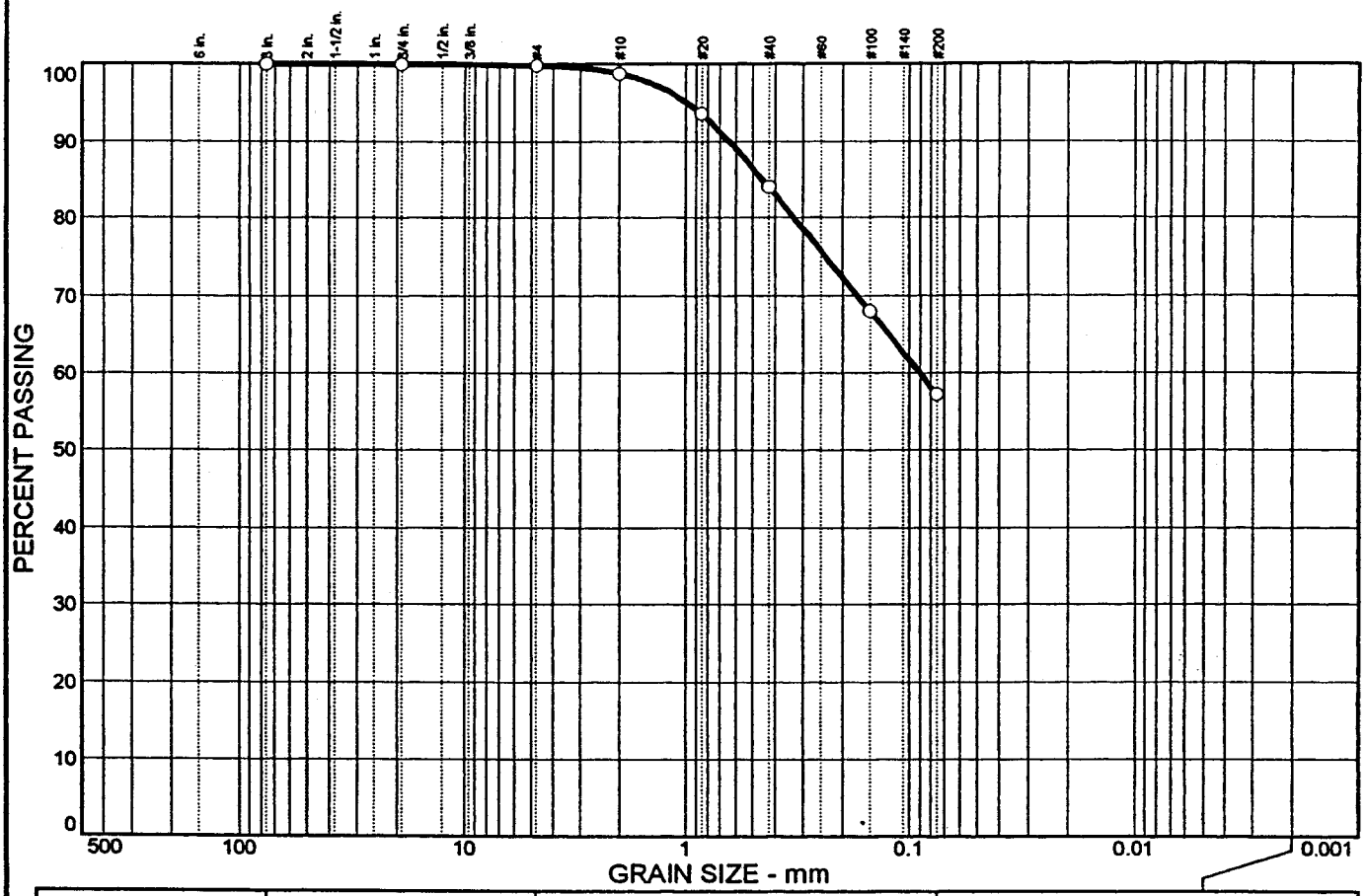
Remarks

As Received Moisture Content = 17.4%

Sample No.: TP-9 **Source of Sample:** **Test Date:** 11/7/97
Location: Shelby, N.C. **Elev./Depth:** 7 ft

Camp Dresser & McKee Inc. **Geotechnical Engineering Laboratory**	**Client:** Cleveland Container Service Inc. **Project:** JMN Landfill **Project No:** 10388-22437-RT.GEO

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.2	1.0	14.8	26.8	57.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
3/4"	100.0		
#4	99.8		
#10	98.8		
#20	93.6		
#40	84.0		
#100	68.0		
#200	57.2		

* (no specification provided)

Soil Description

Sandy elastic silt (MH)

Atterberg Limits

PL= 43 LL= 54 PI= 11

Coefficients

D_{85}= 0.454 D_{60}= 0.0897 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO= A-7-5(6)

Remarks

As Receive Moisture Content = 22.1%

Sample No.: TP-10 **Source of Sample:** **Test Date:** 11/7/97
Location: Shelby, N.C. **Elev./Depth:** 2 - 4 ft

Camp Dresser & McKee Inc.

Geotechnical Engineering Laboratory

Client: Cleveland Container Service Inc.
Project: JMN Landfill

Project No: 10388-22437-RT.GEO

Camp Dresser & McKee Inc.
Geotechnical Engineering Laboratory

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

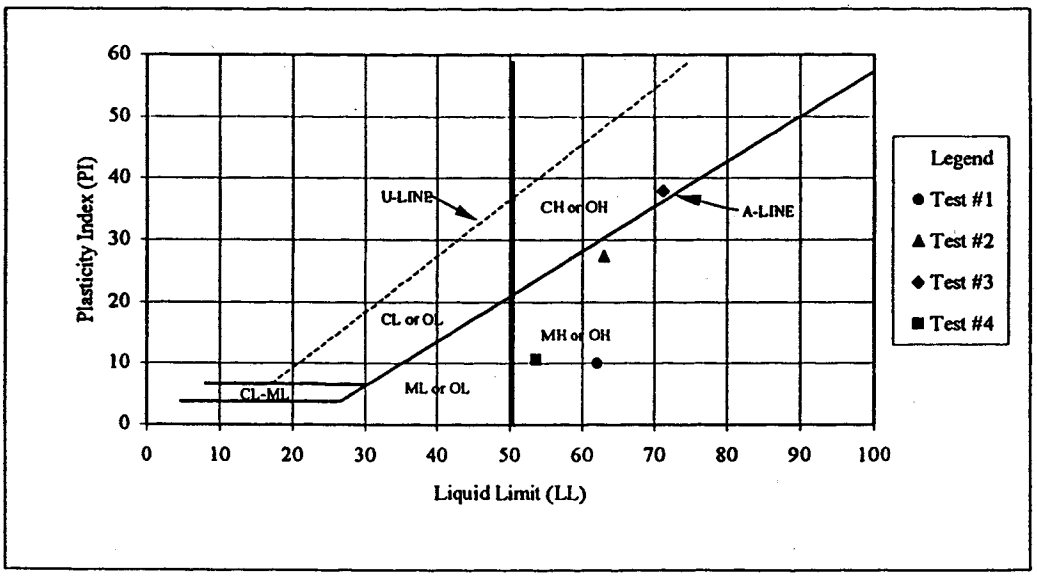
Client:	Cleveland Container	Checked By:	S.R.
Project Name:	JMN Landfill		
Project Location:	Shelby, NC		
Project Number:	10388-22437-RT.GEO		

Results

Test Number:	1	2	3	4	5
Sample Number:	TP-6	TP-7	TP-9	TP-10	TP-9
Lab ID Number:	1810	1811	1812	1813	1814
Tested By:	JM	AS	JM	JM	JM
Test Date:	11/7/97	11/7/97	11/7/97	11/7/97	11/7/97
Sample Depth (ft):	1-2.5	2-3	1-2	2-4	7.0
As Rec'd Water Cont. (%):	29.0	21.8	30.3	22.1	17.4
Liquid Limit (LL)	62	63	71	54	NP
Plastic Limit (PL)	52	36	33	43	NP
Plasticity Index (PI)	10	27	38	11	NP

Plasticity Chart

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils.



Reference: ASTM D 2487

60 Rogers St., Cambridge, MA
Phone: (617) 252-8207 Fax: (617) 577-9492

Camp Dresser McKee Inc.
Geotechnical Engineering Laboratory

Specific Gravity of Soils (ASTM D 854)

Client:	Cleveland Container Service Inc.
Project Name:	JMN Landfill
Project Number:	10388-22437-RT.GEO
Project Location:	Shelby, N.C.
Sample ID:	TP-6
Depth(ft)	1 - 2.5

Temperature, (°C)	20
Procedure:	A
Mass of pycnometer, (g)	108.1
Mass of pycnometer and oven-dry soil, (g)	226.3
Mass of oven-dry soil, (g)	118.2
Mass of pycnometer filled with water, (g)	357.0
Mass of pycnometer filled with water and soil, (g)	430.5

Specific Gravity
2.64

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Phone: (617) 252-8137 Fax: (617) 577-9492

Camp Dresser McKee Inc.
Geotechnical Engineering Laboratory

Specific Gravity of Soils (ASTM D 854)

Client:	Cleveland Container Service Inc.
Project Name:	JMN Landfill
Project Number:	10388-22437-RT.GEO
Project Location:	Shelby, N.C.
Sample ID:	TP-10
Depth(ft)	2 - 4

Temperature, (°C)	20
Procedure:	A
Mass of pycnometer, (g)	105.8
Mass of pycnometer and oven-dry soil, (g)	201.6
Mass of oven-dry soil, (g)	95.8
Mass of pycnometer filled with water, (g)	355.2
Mass of pycnometer filled with water and soil, (g)	414.2

Specific Gravity
2.60

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Phone: (617) 252-8137 Fax: (617) 577-9492

PROCTOR TEST REPORT

Curve No.:

Project No.: 10388-22437-RT.GEO Date: 11-12-1997

Project: JMN Landfill

Location: Shelby N.C.

Elev/Depth: 1-2.5'

Remarks:

Sample Number = TP-6

MATERIAL DESCRIPTION

Description: As Received Moisture Content = 29.0%

Classifications: USCS: MH AASHTO: A-5(7)

Nat. Moist. = -% Sp.G. = 2.64

Liquid Limit = 62 Plasticity Index = 10

TEST RESULTS
Maximum dry density = 91.0 pcf
Optimum moisture = 27.6 %

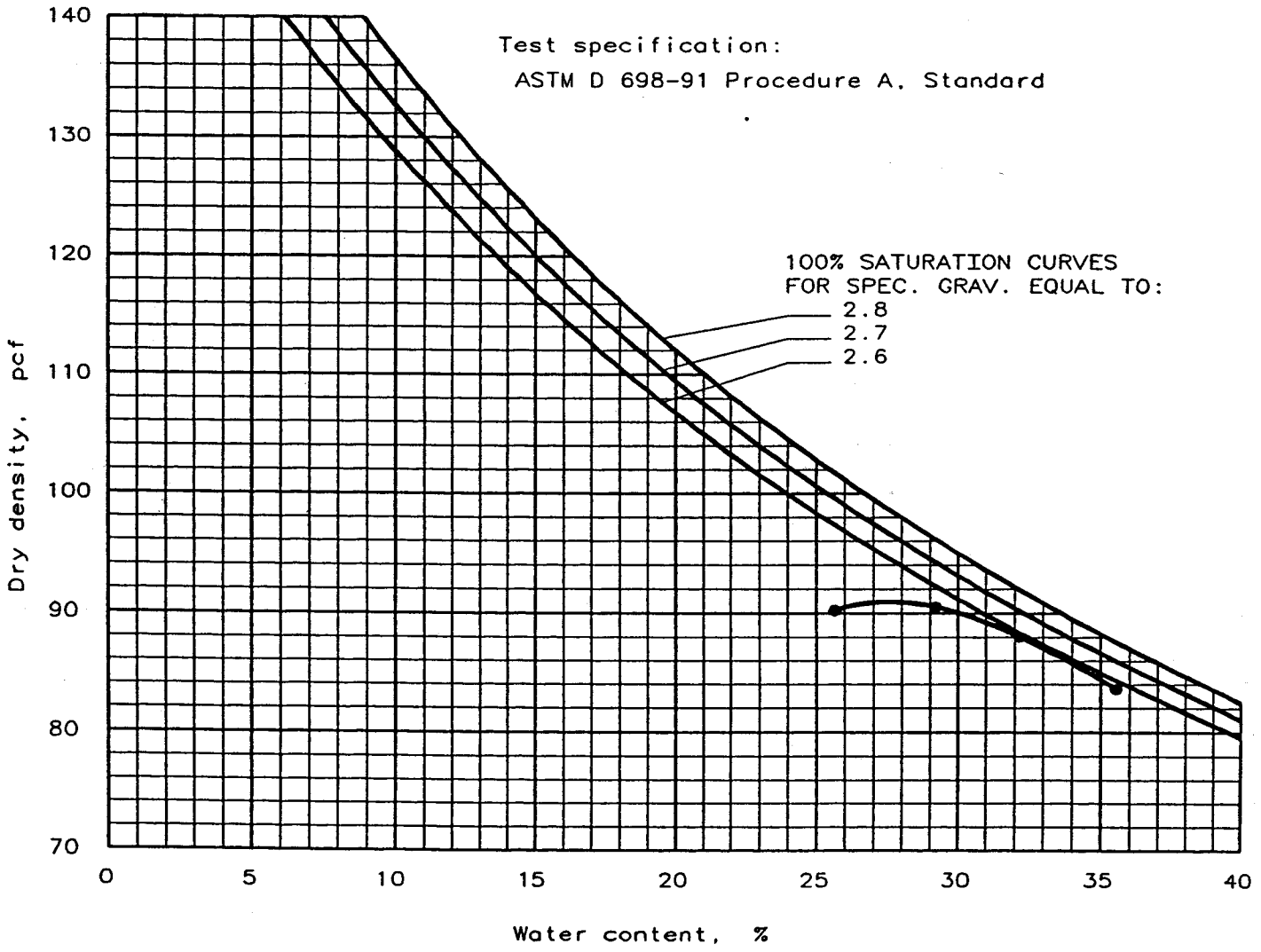


Plate No.

Camp Dresser & McKee Inc. / Geotechnical Engineering Laboratory

PROCTOR TEST REPORT

Curve No.:

Project No.: 10388-22437-RT.GEO

Date: 11-12-1997

Project: JMN Landfill

Location: Shelby, N.C.

Elev/Depth: 2'-3'

Remarks:

1) Sample Number = TP-7 2) Specific Gravity = assumed

MATERIAL DESCRIPTION

Description: As Received Moisture Content = 21.8%

Classifications: USCS: SM AASHTO: A-7-5(10)

Nat. Moist. = -% Sp.G. = 2.65

Liquid Limit = 63 Plasticity Index = 27

%> No.4 = 1.0%

TEST RESULTS
Maximum dry density = 93.9 pcf
Optimum moisture = 26.4 %

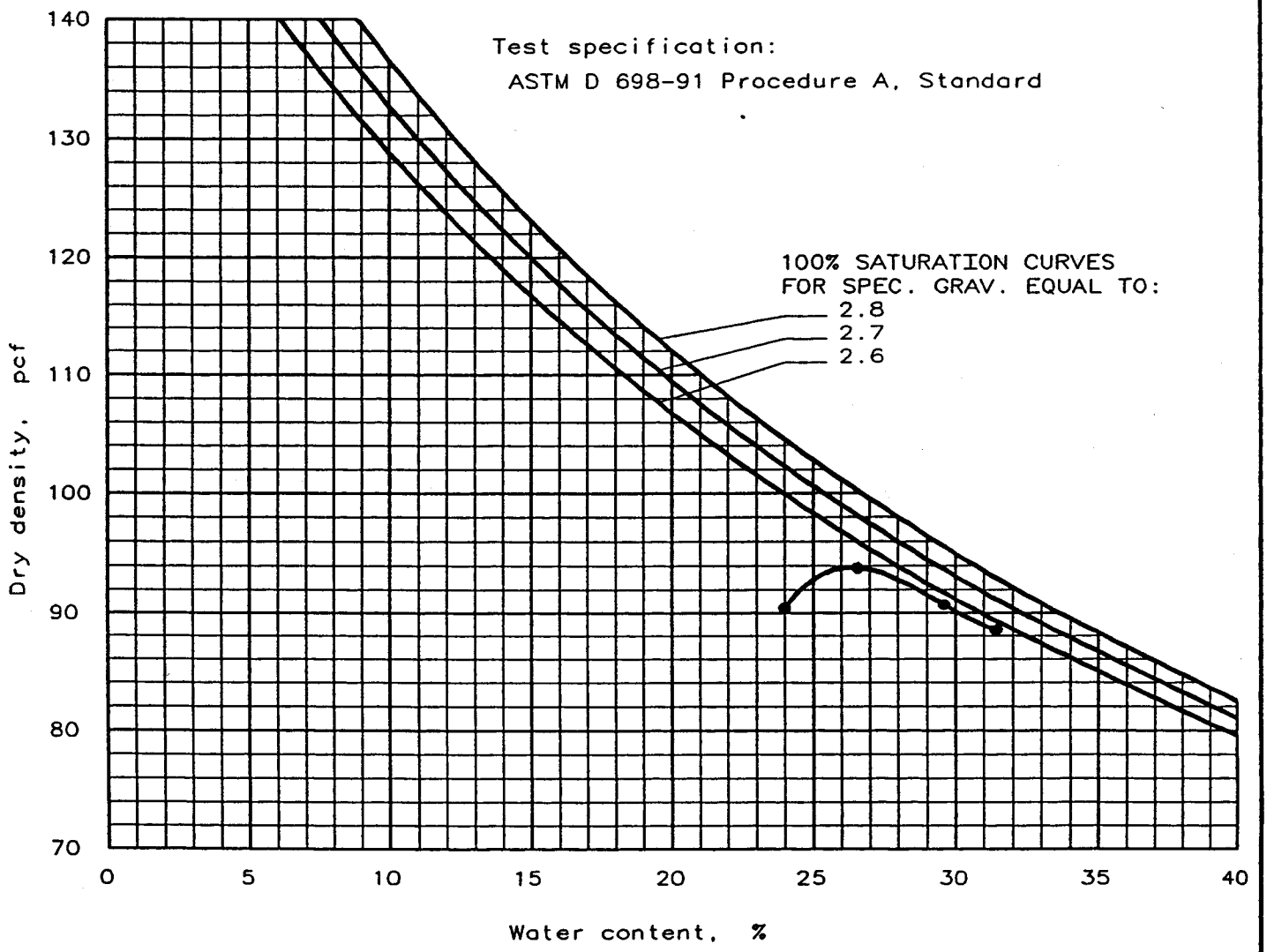


Plate No.

Camp Dresser & McKee Inc. / Geotechnical Engineering Laboratory

PROCTOR TEST REPORT

Curve No.:

Project No.: 10388-224737-RT.GEO Date: 11-11-1997

Project: JMN Landfill

Location: Shelby, N.C.

Elev/Depth: 1'-2'

Remarks:

1) Sample Number = TP-9 2) Specific Gravity = assumed

MATERIAL DESCRIPTION

Description: As Received Moisture Content = 30.3%

Classifications: USCS: CH AASHTO: A-7-5(25)

Nat. Moist. = -% Sp.G. = 2.65

Liquid Limit = 71 Plasticity Index = 38

%> No.4 = 1.3%

TEST RESULTS
Maximum dry density = 89.7 pcf
Optimum moisture = 28.3 %

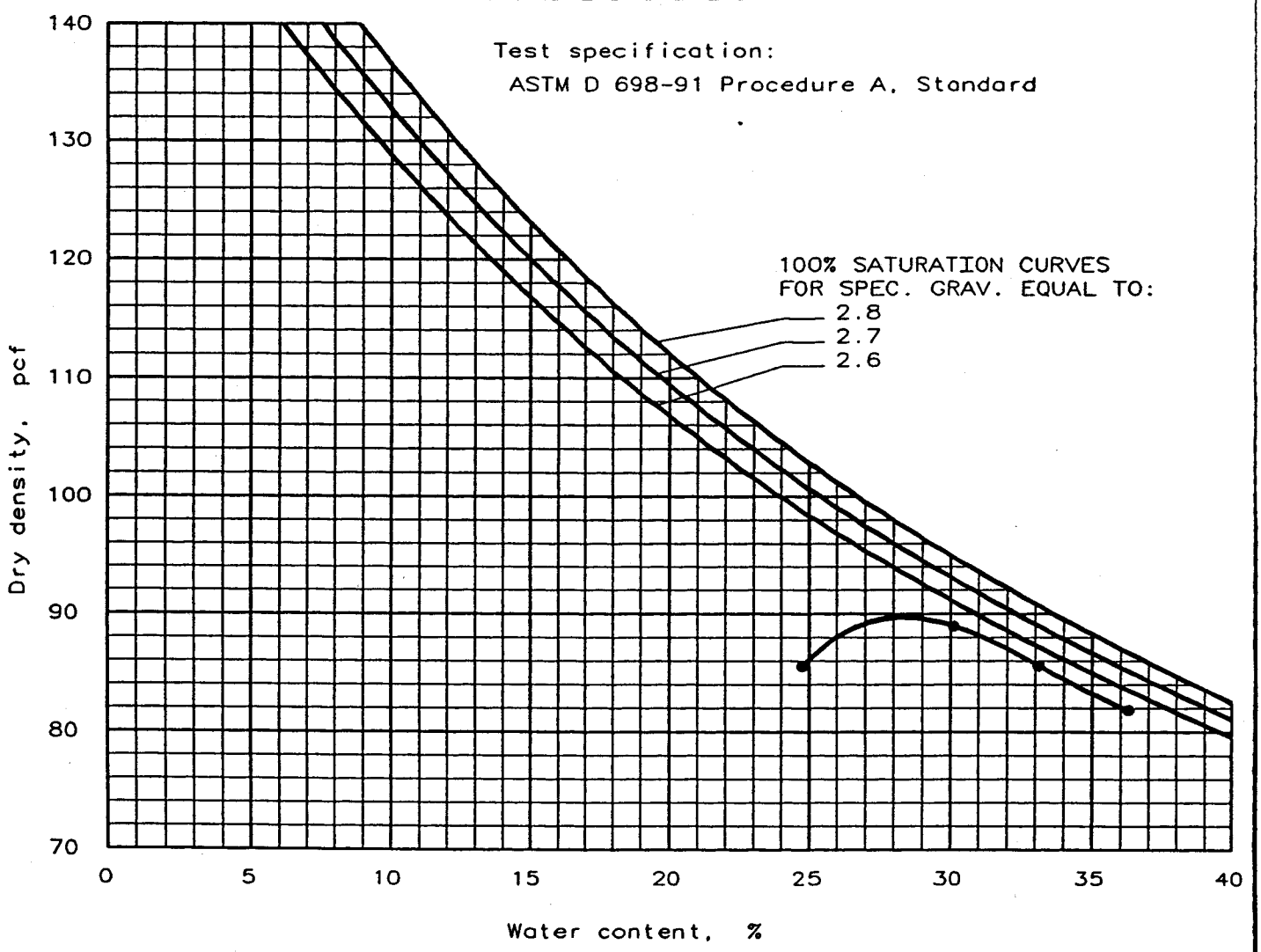


Plate No.

Camp Dresser & McKee Inc. / Geotechnical Engineering Laboratory

PROCTOR TEST REPORT

Curve No.:

Project No.: 10388-22437-RT.GEO Date: 11-12-1997

Project: JMN Landfill

Location: Shelby, N.C.

Elev/Depth: 2'-4'

Remarks:

1) Sample Number = TP-10

MATERIAL DESCRIPTION

Description: As Received Moisture Content = 22.1%

Classifications: USCS: MH AASHTO: A-7-5(6)

Nat. Moist. = -% Sp.G. = 2.60

Liquid Limit = 54 Plasticity Index = 11

TEST RESULTS
Maximum dry density = 100.5 pcf
Optimum moisture = 21.7 %

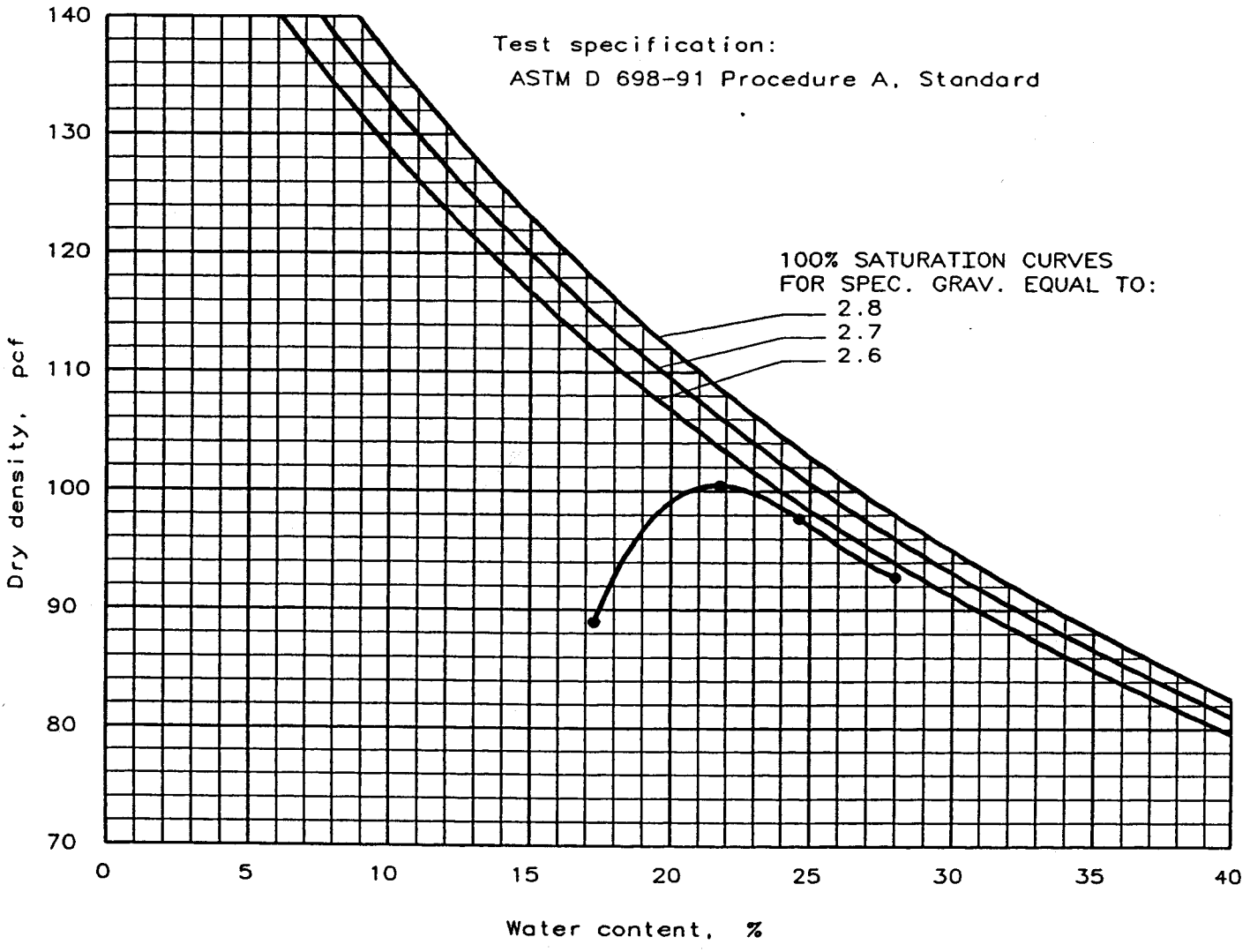
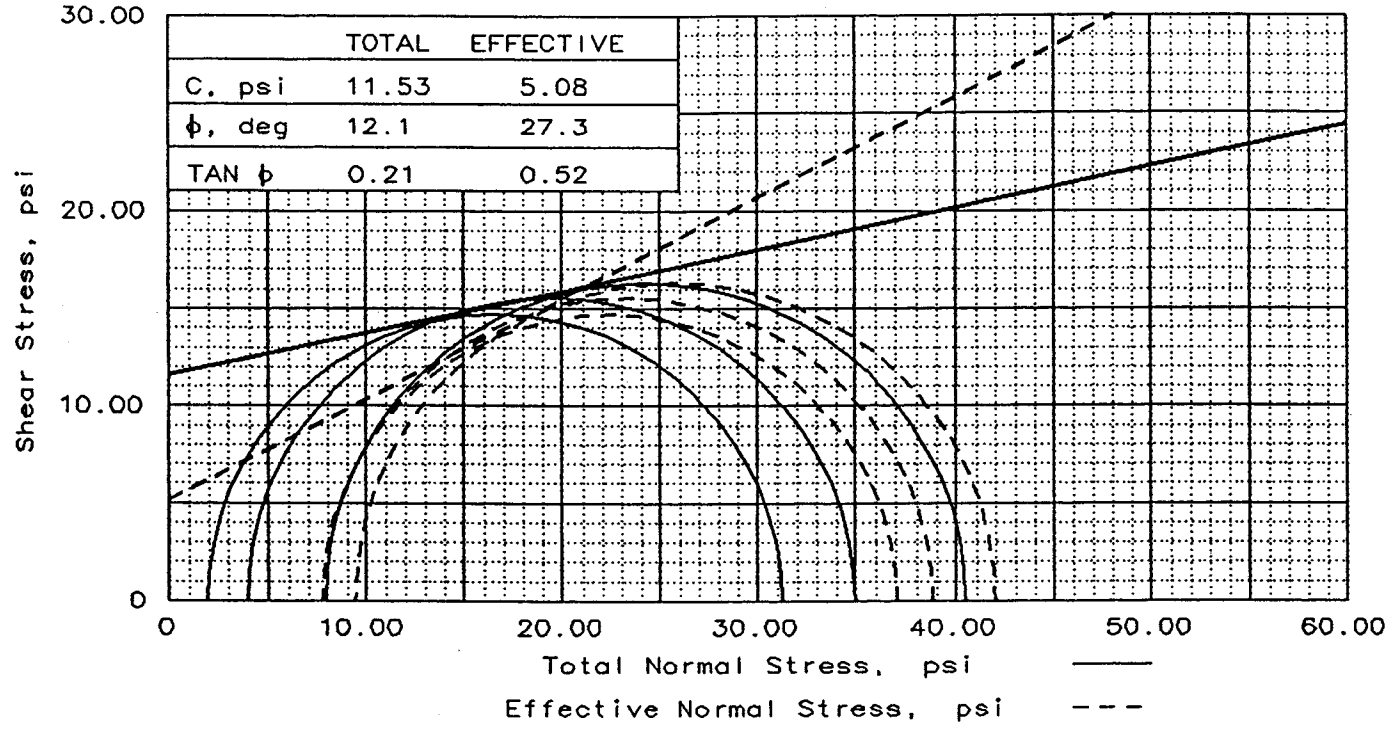
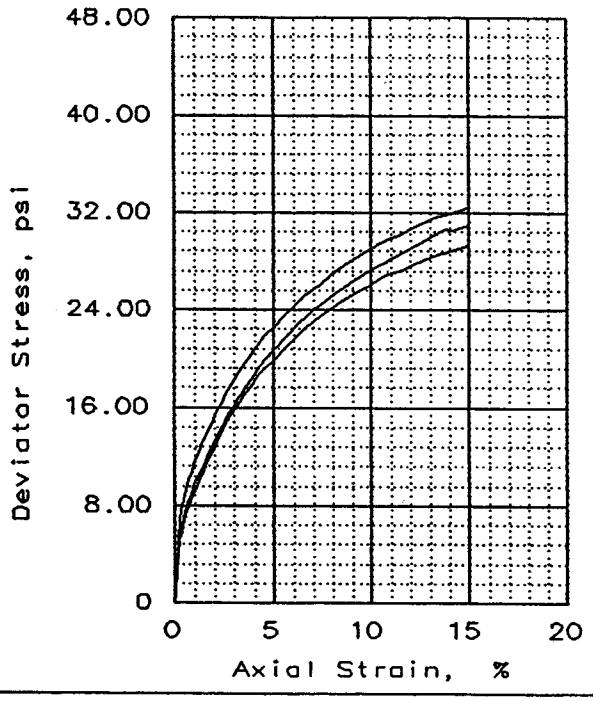


Plate No.

Camp Dresser & McKee Inc. / Geotechnical Engineering Laboratory





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	26.0	26.0	26.0
	DRY DENSITY, pcf	95.5	95.5	95.5
	SATURATION, %	94.2	94.2	94.2
	VOID RATIO	0.731	0.731	0.731
	DIAMETER, in	2.80	2.80	2.80
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	27.5	27.4	27.2
	DRY DENSITY, pcf	95.6	95.7	96.0
	SATURATION, %	99.8	99.7	99.8
	VOID RATIO	0.730	0.728	0.723
	DIAMETER, in	2.80	2.80	2.80
	HEIGHT, in	6.00	6.00	5.99
Strain rate, in/min		0.002	0.002	0.001
BACK PRESSURE, psi		53.00	53.00	53.00
CELL PRESSURE, psi		55.00	57.00	61.00
FAILURE STRESS, psi		29.31	31.02	32.58
PORE PRESSURE, psi		47.20	49.10	51.50
ULTIMATE STRESS, psi		29.31	31.02	32.58
PORE PRESSURE, psi		47.20	49.10	51.50
$\bar{\sigma}_1$ FAILURE, psi		37.11	38.92	42.08
$\bar{\sigma}_3$ FAILURE, psi		7.8	7.9	9.5

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: COMPACTED
DESCRIPTION: CLAY

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: SAMPLES COMPACTED TO 95% SPMDD AT 26.0% WATER CONTENT

FIG. NO. CDM-4

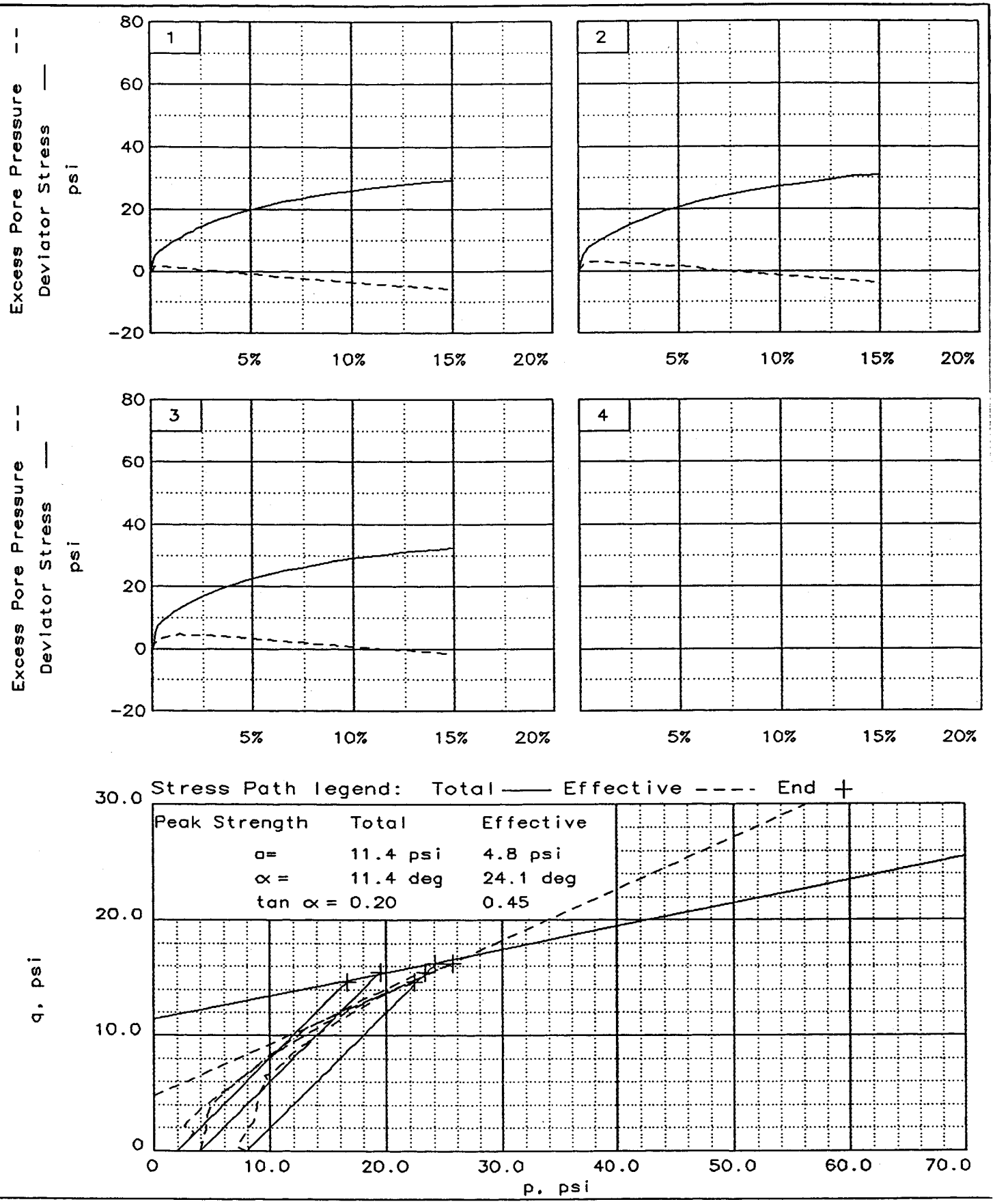
CLIENT: CAMP DRESSER & McKEE

PROJECT: JMN LANDFILL
SHELBY NORTH CAROLINA
SAMPLE LOCATION: JMN LANDFILL
TP-10 (2'-4')

PROJ. NO.: 97S2238-01 DATE: 11-19-97

TRIAXIAL SHEAR TEST REPORT

J & L TESTING CO., INC.

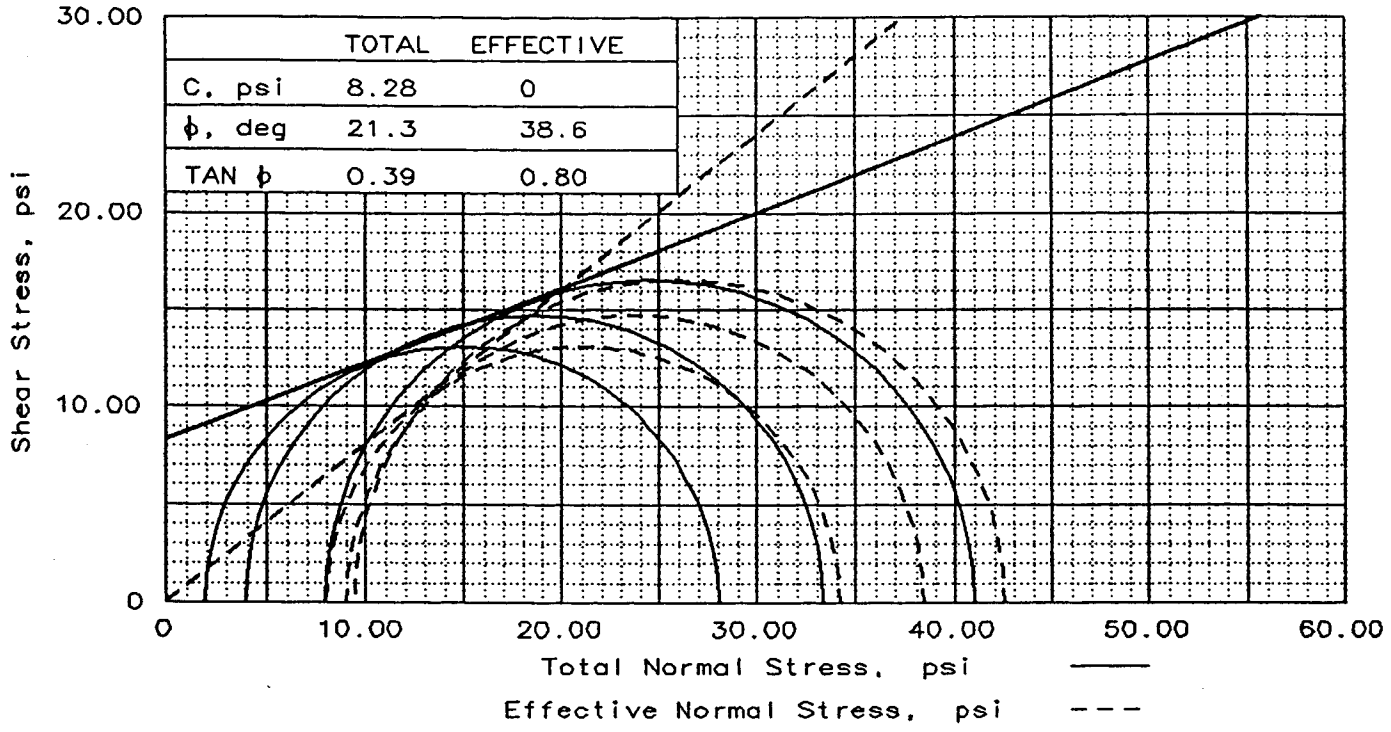


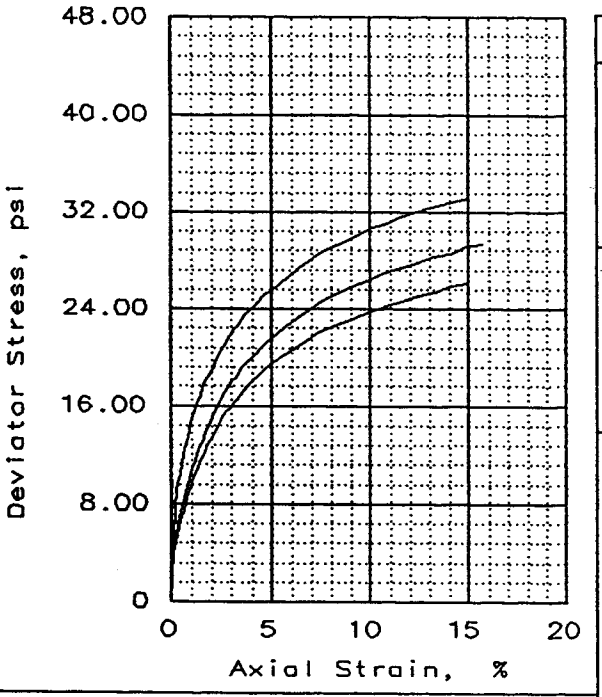
Client: CAMP DRESSER & McKEE

Project: JMN LANDFILL SHELBY NORTH CAROLINA

Location: JMN LANDFILL TP-10 (2'-4')

File: CDM-4 Project No.: 97S2238-01 Page 2/2 Fig. No. CDM-4





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	33.5	33.5	33.5
	DRY DENSITY, pcf	86.6	86.6	86.6
	SATURATION, %	97.5	97.5	97.5
	VOID RATIO	0.911	0.911	0.911
	DIAMETER, in	2.80	2.80	2.80
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	34.3	34.0	33.5
	DRY DENSITY, pcf	86.7	87.0	87.6
	SATURATION, %	100.0	100.0	99.9
	VOID RATIO	0.909	0.901	0.888
	DIAMETER, in	2.80	2.80	2.79
	HEIGHT, in	6.00	5.99	5.98
Strain rate, in/min		0.002	0.002	0.001
BACK PRESSURE, psi		53.00	53.00	53.00
CELL PRESSURE, psi		55.00	57.00	61.00
FAILURE STRESS, psi		26.12	29.38	33.10
PORE PRESSURE, psi		46.90	47.90	51.50
ULTIMATE STRESS, psi		26.12	29.38	33.10
PORE PRESSURE, psi		46.90	47.90	51.50
$\bar{\sigma}_1$ FAILURE, psi		34.22	38.48	42.60
$\bar{\sigma}_3$ FAILURE, psi		8.1	9.1	9.5

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: COMPACTED
DESCRIPTION: CLAY

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: SAMPLES COMPACTED TO 95% SPMDD AT 33.5% WATER CONTENT

FIG. NO. CDM-3

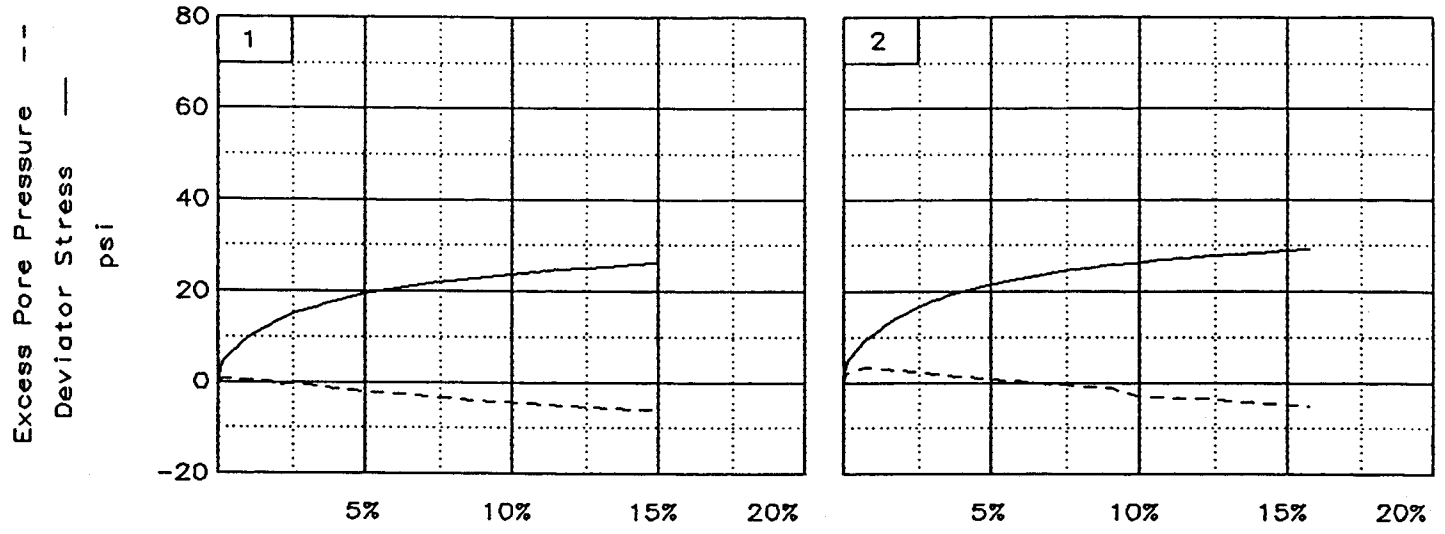
CLIENT: CAMP DRESSER & McKEE

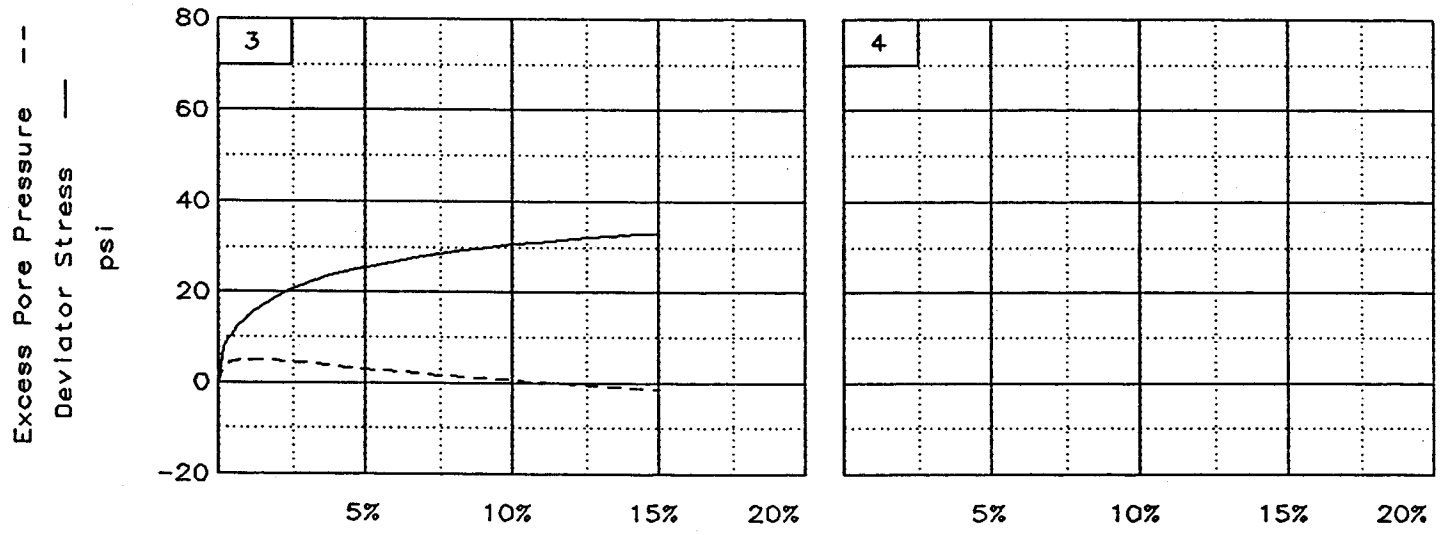
PROJECT: JMN LANDFILL
SHELBY NORTH CAROLINA
SAMPLE LOCATION: JMN LANDFILL
TP-6 (1'-2.5')

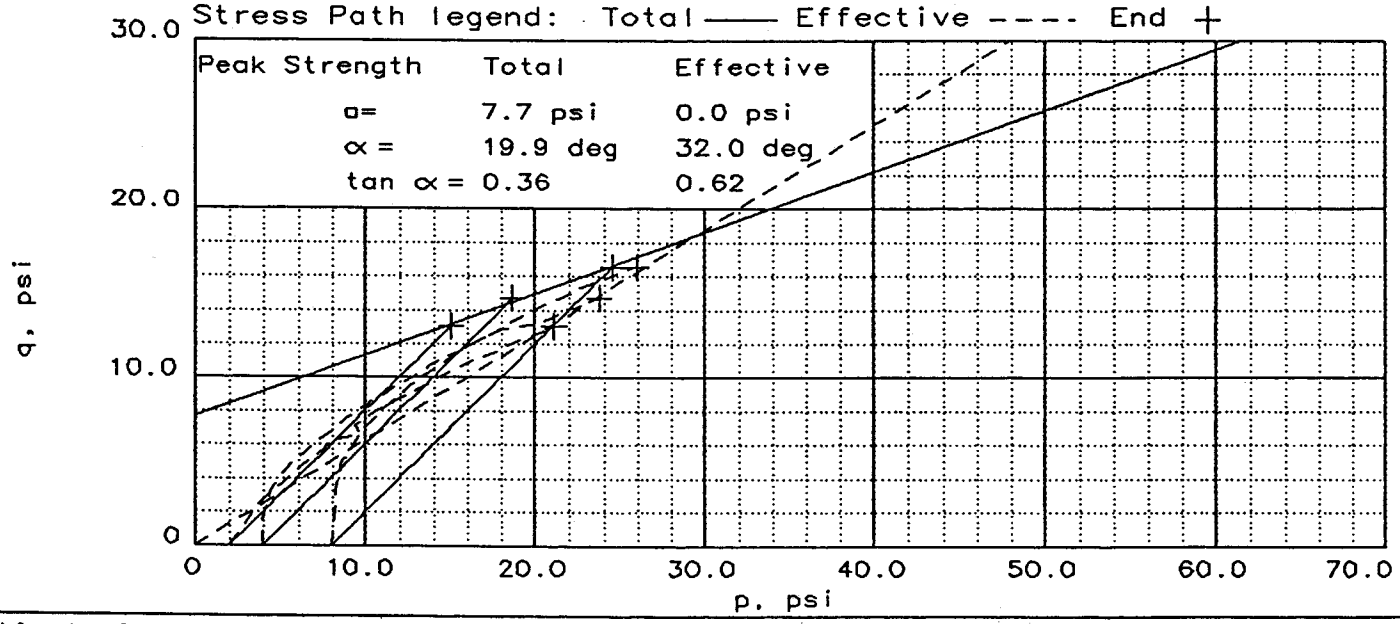
PROJ. NO.: 97S2238-01 DATE: 11-18-97

TRIAXIAL SHEAR TEST REPORT

J & L TESTING CO., INC.







Client: CAMP DRESSER & McKEE
Project: JMN LANDFILL SHELBY NORTH CAROLINA
Location: JMN LANDFILL TP-6 (1'-2.5')
File: CDM-3 Project No.: 97S2238-01 Page 2/2 Fig. No. CDM-3