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TRANSMITTAL OF GEOTECHNICAL INVESTIGATION REPORT FOR THE ON-SITE DISPOSAL FACILITY

01/17/96

DOE-0430-96
DOE-FN EPAS
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REPORT

Department of Energy
Fernald Environmental Management Project
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JAN 17 1996
DOE-0430-96

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401 East 5th Street
Dayton, OH 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF GEOTECHNICAL INVESTIGATION REPORT FOR THE ON-SITE DISPOSAL FACILITY

The Department of Energy, Fernald Area Office (DOE-FN) is pleased to submit the enclosed Geotechnical Investigation Report, On-Site Disposal Facility document for your reference during the On-Site Disposal Facility design review.

This report presents the results of geotechnical testing on samples gathered in accordance with the Fernald Environmental Restoration Management Corporation's (FERMCO) Geotechnical Sampling and Testing Plan for Phase III of the Site-Wide Disposal Facility Field Investigation. All geotechnical data from previous work in the site vicinity is included in the data bases presented therein.

If you have any questions, please contact Rod Warner at (513) 648-3156.

Sincerely,

Johnny Reising

Johnny Reising
Fernald Remedial Action
Project Manager

FN:Warner

Enclosure: As Stated

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Geotechnical Investigation Report
On-Site Disposal Facility

Operable Unit 2
Project Order 140

December 1995
Revision 0

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

PARSONS

25 Merchant Street
Cincinnati, OH 45246

207

Geotechnical Investigation Report
On-Site Disposal Facility

Operable Unit 2
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Environmental Remedial Action Project
Fernald Environmental Management Project
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Geotechnical Investigation Report
On-Site Disposal Facility
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LIST OF ACRONYMS AND ABBREVIATIONS

3-D	Three-Dimensional
AASHTO	American Association of State Highway and Transportation Officials
AFAP	Active Fly Ash Pile
ASTM	American Society for Testing and Materials
ATT	Advanced Terra Testing, Inc.
CBR	California Bearing Ratio
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
CPT	Cone Penetrometer Testing
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CSF	Central Storage Facility
CSR	Cyclic Stress Ratio
CU	Consolidated, Undrained
DOE	United States Department of Energy
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FML	Flexible Membrane Liner
FOS	Factor of Safety
GCL	Geosynthetic Clay Liner
GDB	Geotechnical Data Base
GIS	Geographic Information System
HDPE	High-Density Polyethylene
LL	Liquid Limit
MDD	Maximum Dry Density
MMI	Modified Mercalli Intensity
OCR	Overconsolidation Ratio
ODOT	Ohio Department of Transportation
OMC	Optimum Moisture Content
OU	Operable Unit
PC	Performance Category
pcf	pounds per cubic foot
PGA	Peak Horizontal Ground Acceleration
PI	Plasticity Index
PL	Plastic Limit
PO	Project Order
psf	pounds per square foot
psi	pounds per square inch

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SAIC	Science Applications International Corporation
sec	second
SPT	Standard Penetration Test
STD	Standard (DOE)
TI	Traffic Index
tsf	tons per square foot
UCS	Unconfined Compressive Strength
USCS	Unified Soil Classification System
UU	Unconsolidated, Undrained

A

SECTION 1

INTRODUCTION

This report summarizes the results of a geotechnical investigation performed at the proposed site of the On-Site Disposal Facility at the Fernald Environmental Management Project (FEMP), Fernald, Ohio. Figure 1-1 shows the proposed disposal facility footprint. The geotechnical investigation was performed to provide subsurface soil properties and parameters to support development of design criteria, and parameters for the design of an aboveground waste containment structure with a soil/geosynthetic liner and cap. The report summarizes the data from geotechnical field and laboratory tests, and provides recommendations based on the analysis of these data.

1.1 Scope and Objectives

PARSONS was tasked by the Fernald Environmental Restoration Management Corporation (FERMCO) under Project Order 140 (PO-140) (PARSONS 1995a) to provide geotechnical engineering services for a geotechnical design investigation at the proposed disposal facility site. Specifically, PARSONS' scope was to:

1) Provide geotechnical sampling oversight during field activities

2) Provide geotechnical laboratory testing services

3) Perform preliminary geotechnical engineering evaluations and analyses based on field and laboratory data

4) Prepare a report that summarizes the field and laboratory data, and provide specific geotechnical recommendations

The overall objective of the evaluations and analyses is to provide preliminary geotechnical recommendations for the following general aspects of the proposed disposal facility design:

1) Earthwork and site preparation
2) Facility foundation
3) Facility structure (berms, liner, cap)
4) Roadways

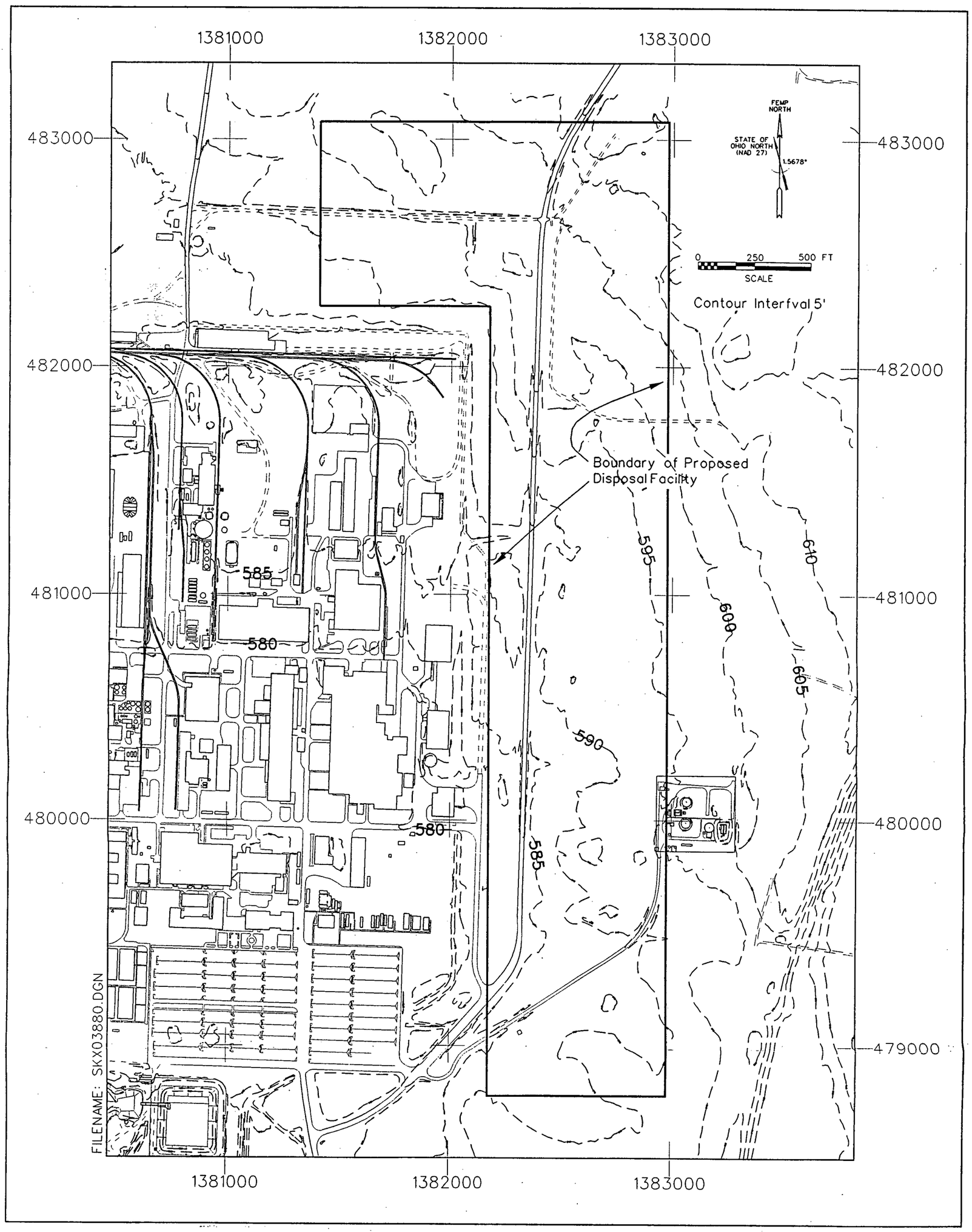

Figure 1-1 - Topographical Base Map Showing Boundary of Proposed Disposal Facility

Section 5 summarizes the geotechnical evaluations and analyses performed; Section 6 contains specific geotechnical and civil engineering design recommendations for the proposed disposal facility.

1.2 Background

The field and geotechnical laboratory activities of the geotechnical design investigation at the proposed disposal facility site were conducted from March through August, 1995. The design investigation was the third phase of a phased investigation conducted by FERMCO at the proposed site. This third phase included geotechnical test borings and shallow boring/excavations, Cone Penetrometer Testing (CPT), and geotechnical laboratory testing to provide data for the analyses, evaluations, and recommendations contained in this report. The activities of the third phase investigation, including geotechnical testing and sampling activities, are described in *Geotechnical Sampling and Testing Plan for the Phase III Site-Wide Disposal Facility Field Investigation* (FERMCO 1995a).

Prior to the Phase III investigation, the first and second phases of the investigation were conducted by FERMCO in late 1994 and early 1995 to define a location for the disposal facility on the east side of the FEMP. This area, based on the Remedial Investigations/Feasibility Studies for Operable Units (OUs) 2 and 5, is located on the east side of the FEMP and measures approximately 2,000 feet from east to west and 5,300 feet from north to south. The first phase included preliminary CPT and water level measurements. The second phase included preliminary geotechnical sampling and testing. The activities of the first and second phases, including the geotechnical sampling and testing activities, are described in the *Project Specific Plan for Phases I and II of the Operable Unit 2 Pre-design Field Investigation*, Revision 0 (FERMCO 1994). Geotechnical laboratory testing results from soil samples collected during Phase II are summarized in *Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report Summary Document* (PARSONS 1995b). Geotechnical data from this summary document were also used to support the analyses, evaluations, and recommendations contained in this report.

It should be noted that FERMCO conducted other data collection activities during the recent three-phase investigation. These activities included monitoring-well installation, lysimeter installation, slug testing, water level measurements, and environmental laboratory testing. The results of these activities are reported in other documents by FERMCO. PARSONS was provided geologic cross sections prepared from a three-dimensional (3-D) geologic model, and water level data from FERMCO to support preparation of this report.

From 1991 though 1993, PARSONS and the H. C. Nutting Company conducted geotechnical investigations in or peripheral to the proposed disposal facility footprint. These reports are:

1) *Technical Report 5.1A, Engineering Evaluation Report for On-Site Disposal* (Draft) (DOE 1993a)
2) *Central Storage Facility Subsurface Exploration* (PARSONS 1993)
3) *On-Site Disposal Cell Pre-Design Activities Engineering Report* (PARSONS 1994a)

4) *On-Site Disposal Cell Pre-Design Activities Engineering Supplemental Report* (PARSONS 1994b)

Reports of these investigations were reviewed, and applicable data from these investigations were used to support this report.

SECTION 2

PROPOSED DISPOSAL FACILITY

This section provides a conceptual description of the proposed disposal facility and a description of conditions at the proposed site.

2.1 Conceptual Description of Facility

The preferred remedial alternative for OU-2 includes on-site disposal of remediation material. The design of a disposal facility is required as part of OU-2 remedial action plans. Also, the design will include accepting waste materials generated from other on-site remediation. The proposed disposal facility involves an essentially aboveground waste containment structure with a soil/geosynthetic composite liner and cap.

Figure 2-1 conceptually shows a typical cross section of the proposed disposal facility. Figure 2-2 shows the tentative details of the composite cap and liner. This conceptual facility formed the basis for the analyses and evaluations presented in this report. Appendix A provides additional tentative details of the disposal facility.

2.2 Site Description

The site of the proposed disposal facility is the grassy pasture land located east of the former production area. Figure 1-1 shows the topography of the proposed site. Figure 2-3 shows the locations of geotechnical test borings, shallow borings/excavations, and CPT soundings in the vicinity of the footprint and a proposed haul road located west of the former production area. Figure 2-4 shows the locations of geotechnical test boring from a prior investigation immediately south of the proposed footprint (PARSONS 1994a). Field testing and/or geotechnical laboratory testing of soil samples collected at these locations provided the geotechnical data used to support the analyses and evaluations described in Section 5. Table 2-1 provides a cross-reference for the geotechnical borings, shallow borings, and CPTs. The table shows the investigation during which the CPT, geotechnical test boring, or shallow boring/excavation was completed. Also shown are the reference documents for investigations other than the FERMCO Phase I and III investigations, geotechnical data from which is described and presented in Sections 3 and 4. Appendix B provides a list of coordinates and elevations for the borings and CPTs.

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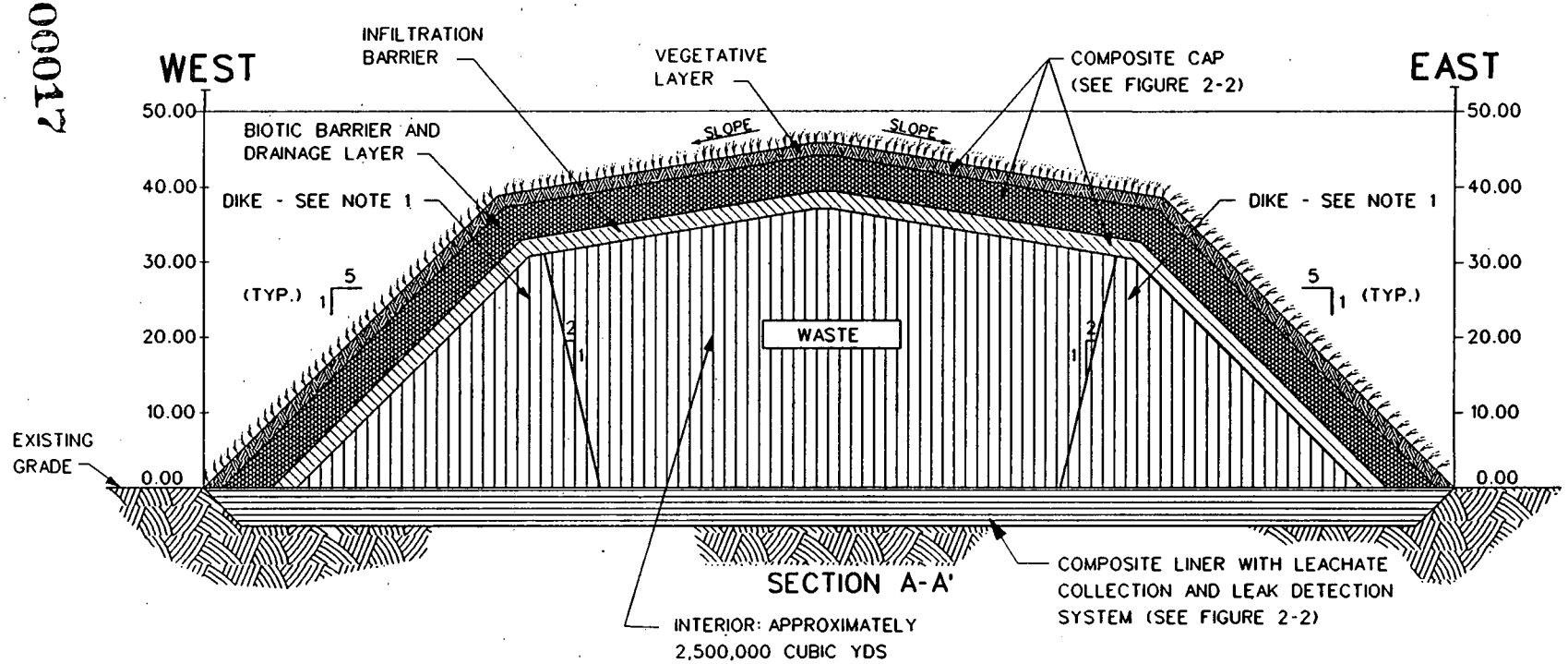

NOTE:

1. Dike shall be constructed of suitable fill and till material excavated from the waste units.

HORIZONTAL SCALE: 0 50' 100' 200'
VERTICAL 0 10' 20' 40'

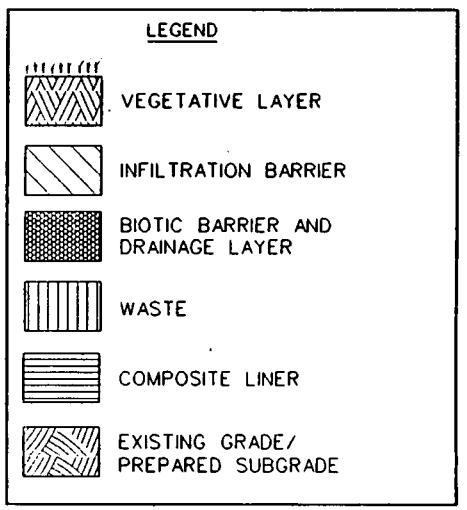

Figure 2-1 - Typical Cross Section of the Disposal Facility

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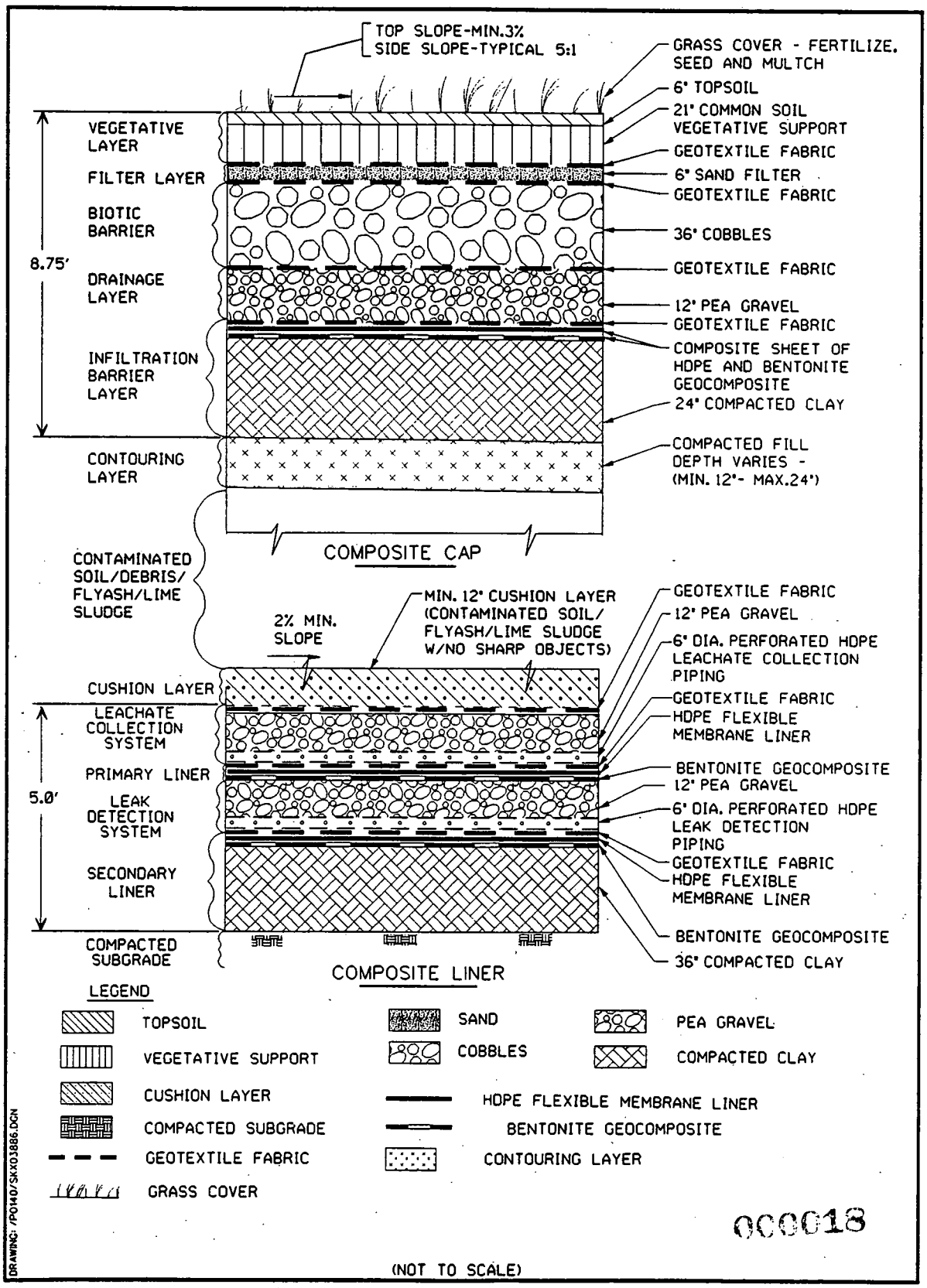


Figure 2-2 - Composite Cap and Liner Details

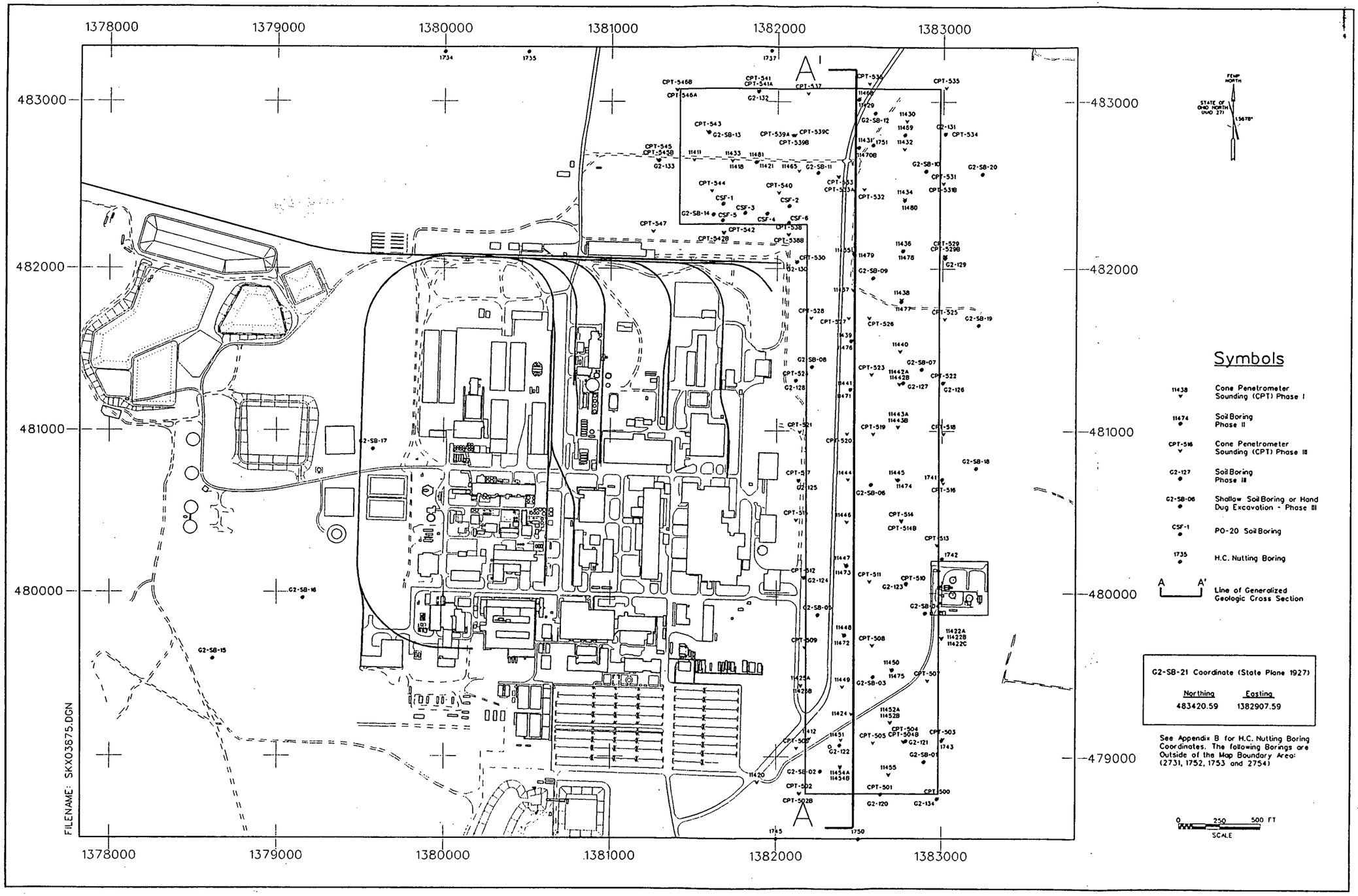
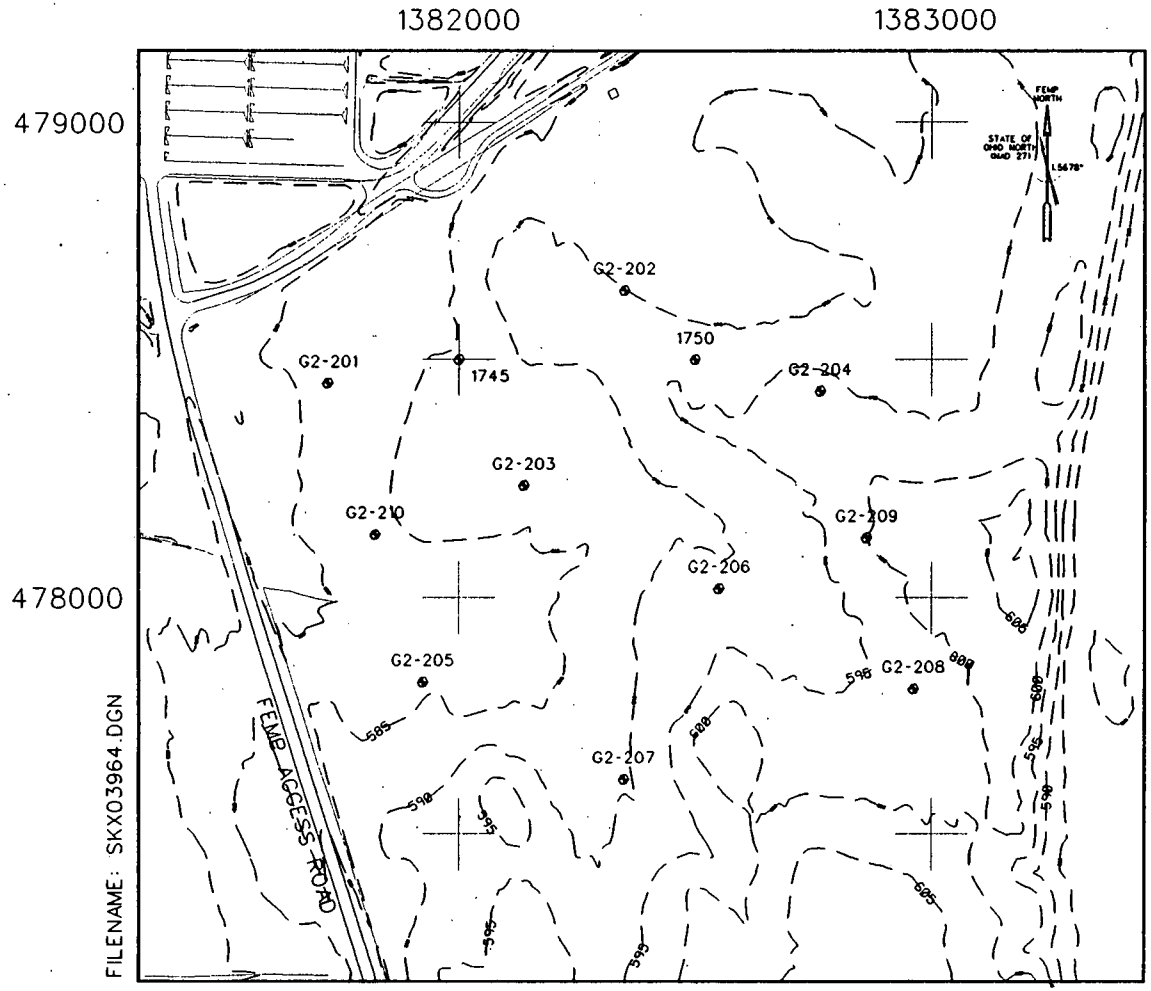


Figure 2-3 - Soil Boring, Shallow Excavation, CPT, and Generalized Geotechnical Cross-Section Location Map



Symbols

G2-201 — PO-101 Soil Boring

1746 — H.C. Nutting Soil Boring

Borings Completed During PO-101 Investigations			
Boring ID	Northing	Easting	Elev.
G2-201	478449.83	1381723.93	580.57
G2-202	478646.65	1382349.97	590.10
G2-203	478234.86	1382136.51	587.60
G2-204	478433.71	1381764.52	596.15
G2-205	477822.93	1381923.79	583.49
G2-206	478019.24	1382550.41	591.43
G2-207	477617.08	1382349.42	589.00
G2-208	477808.73	1382961.93	596.27
G2-209	478125.60	1382863.29	598.78
G2-210	478132.27	1381824.28	583.18

H.C. Nutting Borings			
Boring ID	Northing	Easting	Elev.
1745	478500.00	1382000.00	586.0
1750	478500.00	1382500.00	593.0

Coordinates are NAD 1927, elevations in feet

0 250 500 FT
SCALE

Figure 2-4 - Soil Boring Location Map for Prior Investigation South of Proposed Disposal Facility Footprint (PARSONS 1994a)

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Table 2-1 - Geotechnical Boring, Excavation, and CPT Cross Reference for Disposal Facility Footprint Area and Haul Roads

Type	Identification	Investigation	Reference Report
CPT	11411 through 11466	FERMCO Pre-Design Phase I	*
CPT	G2-CPT-500 through G2-CPT-547	FERMCO Design Phase III	*
Geotechnical Test Boring	1734, 1735, 1737, 1741-1743, 1745, 1750-1753, 2731, and 2754	Engineering Evaluation for On-Site Disposal (H.C. Nutting)	(DOE 1993a)
Geotechnical Test Boring	CSF-1 through CSF-6	Central Storage Facility (PARSONS PO-20)	(PARSONS 1993)
Geotechnical Test Boring	G2-201 through G2-210	On-Site Disposal Cell Pre-Design Activities (PARSONS PO-101)	(PARSONS 1994 a,b)
Geotechnical Test Boring	11468 through 11481	FERMCO Pre-Design Phase II	(PARSONS 1995b)
Geotechnical Test Boring	G2-120 through G2-134	FERMCO Design Phase III	*
Shallow Boring/Excavation	G2-SB-01 through G2-SB-21	FERMCO Design Phase III	*

Notes:

1. See Section 7 for reference list
2. * - indicates that results of data are first presented in this report
3. PARSONS PO Number for FERMCO Phase II Investigation: PO-132
4. PARSONS PO Number for FERMCO Phase III Investigation: PO-140

2.2.1 Subsurface Conditions

Figure 2-5 shows a typical generalized geological cross section. Figure 2-3 shows in plan view the location of the cross section relative to the proposed disposal facility footprint. The cross section is based on a 3-D geologic model developed and interpreted by FERMCO. Unified Soil Classification System (USCS) group names and symbols have been added as notes by PARSONS to the cross sections based on geotechnical laboratory test data from borings near the section line.

Underlying materials investigated and sampled broadly consist of varying mixtures of fine-grained and coarse-grained soils typical of glacial till deposits. Fine-grained soils within the brown and gray till units are predominantly lean clay, with sand contents ranging between values that result in the materials being classified as sandy lean clay or lean clay with sand. The consistency of the lean clay generally increases with depth (through both the brown and gray till layers) from stiff to very stiff and hard; however, the plasticity tends to decrease with depth. It should be noted that layers of coarse-grained materials were encountered in borings in the brown till as well as the gray till, and locally displayed perched water conditions. These coarse-grained materials range from poorly graded to well-graded sand with scattered gravel, and are typically dense. Also present in the till deposits are units of silty sand and clayey sand that are typically medium dense. Directly below the till are sands and gravels of the Great Miami Aquifer. Borings G2-124, G2-126, G2-127, and G2-130 encountered the sands and gravels of the Great Miami Aquifer at depths of approximately 30 to 40 feet. Shale bedrock lies at about elevation 370-375 beneath much of the proposed facility site (DOE 1993b)).

Within the sand and gravel of the Great Miami Aquifer is a layer of clay, referred to as blue clay. The blue clay lies at an elevation of approximately 448 feet in the area of the facility footprint. Information regarding the blue clay layer comes from prior investigations summarized in the *Remedial Investigation Report for OU-1*. Although borings from the most recent FERMCO phased geotechnical investigation were not advanced to depths that would encounter this layer, maps from previous investigations indicate that near the western edge of the proposed facility site, about midway between the north and south boundaries, the layer is present and varies in thickness from 0 to about 15 feet.

For purposes of description, in this report the glacial till at the proposed site is discussed in two broad categories: (1) brown till and (2) gray till. As shown in the cross sections, the brown till overlies the gray till. The sands and gravels underlying the gray till are referred to as the Great Miami Aquifer formation.

Figure 2-6 shows typical groundwater elevations in the sand and gravel of the Great Miami Aquifer formation. Regional groundwater maps and hydrographs constructed from comprehensive water elevation surveys conducted between August 1982 and May 1988 demonstrate that " . . . the entire Great Miami Aquifer responds to seasonal water level changes . . ." (DOE 1994a). In the specific area of the proposed on-site disposal cell, the water levels show a seasonal fluctuation ranging from about 2 to 3 feet.

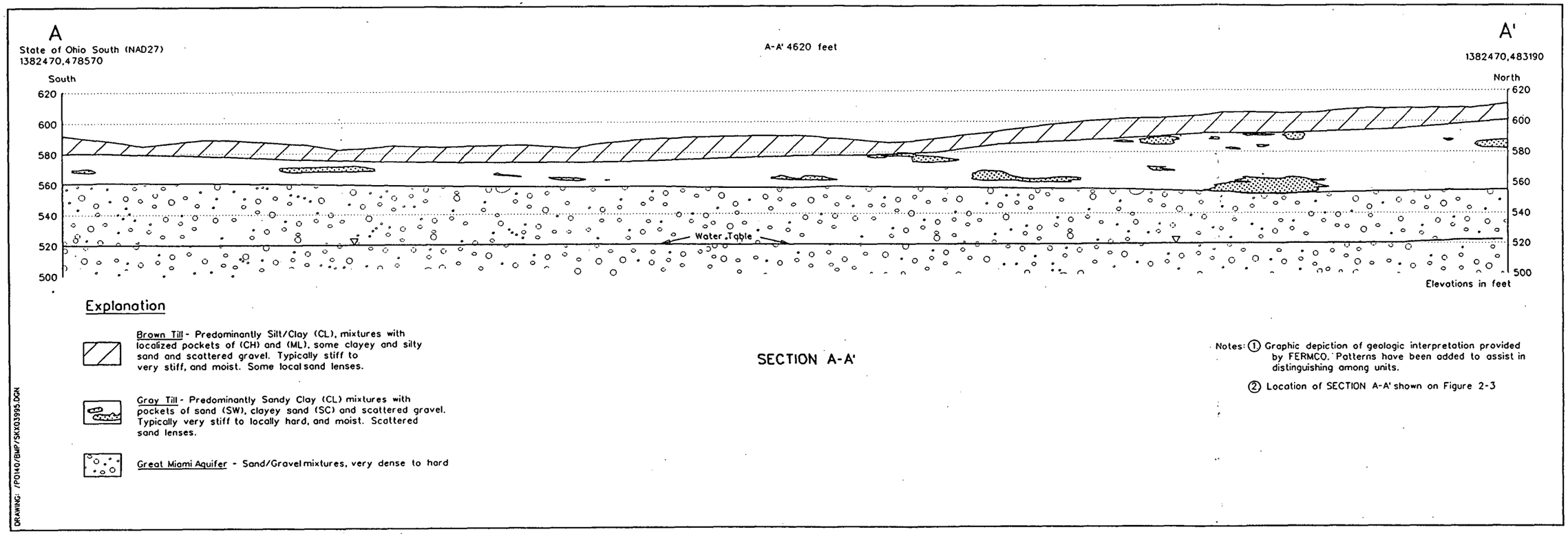


Figure 2-5 - Generalized Geologic Cross Section A-A'

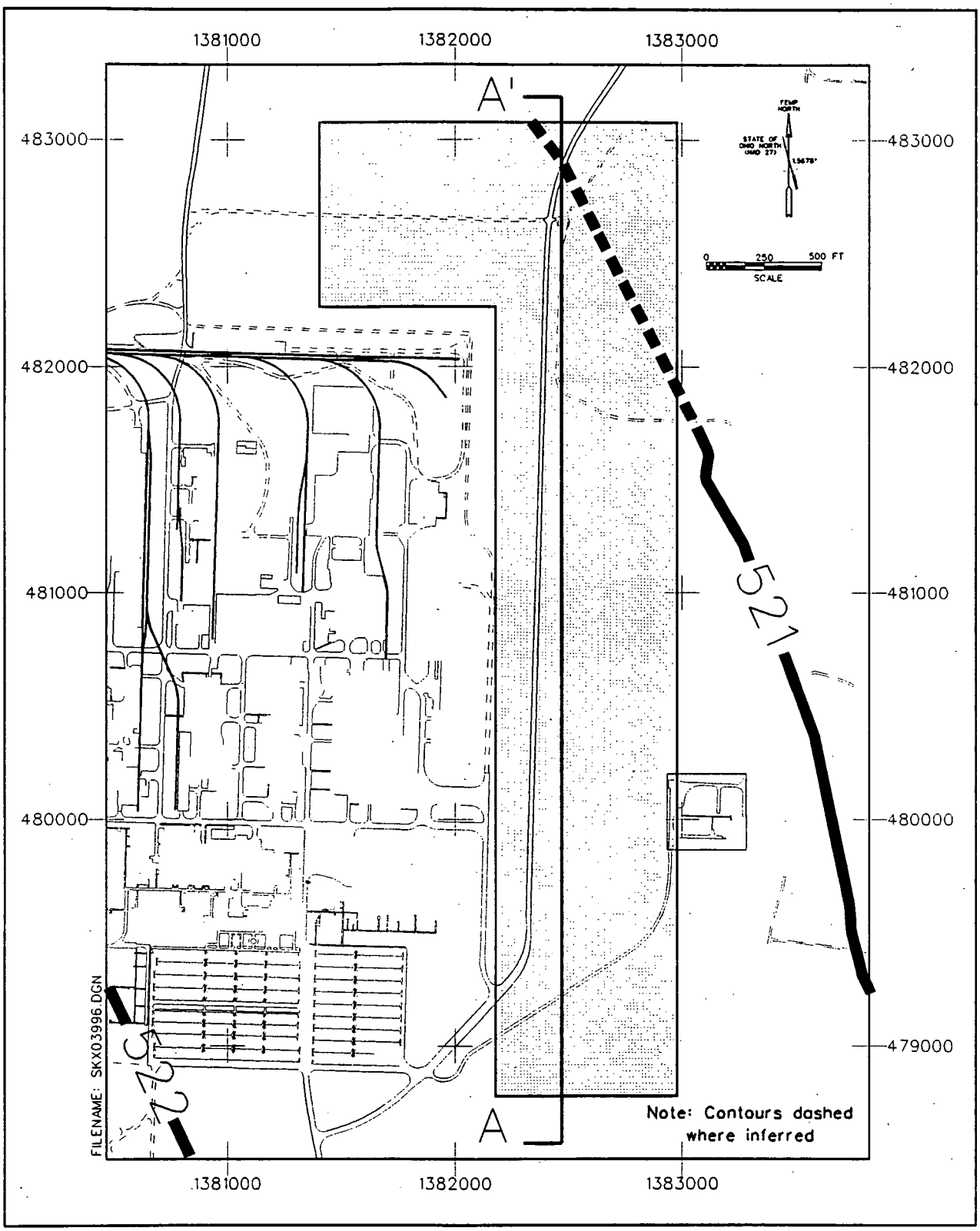


Figure 2-6 - Typical Groundwater Elevations in the Great Miami Aquifer Formation

Figure 2-7 shows typical elevations of groundwater perched in silty and clayey sands within the till. These groundwater elevations were developed and provided to PARSONS by FERMCO. It should be noted that the perched groundwater contours shown in Figure 2-7 come from water level readings taken in the silty and clayey sands within the clayey brown and gray till strata. These silty and clayey sand deposits can often not be correlated in adjacent borings, are thought to be the remnants of braided stream channels deposited during glacial events; thus the groundwater contours represent a perched water condition that displays seasonal variations in elevation, as well as a wide range (an order of magnitude) of calculated vertical gradients indicative of a unit that is not well connected hydraulically (DOE 1995).

2.2.2 Seismic Conditions

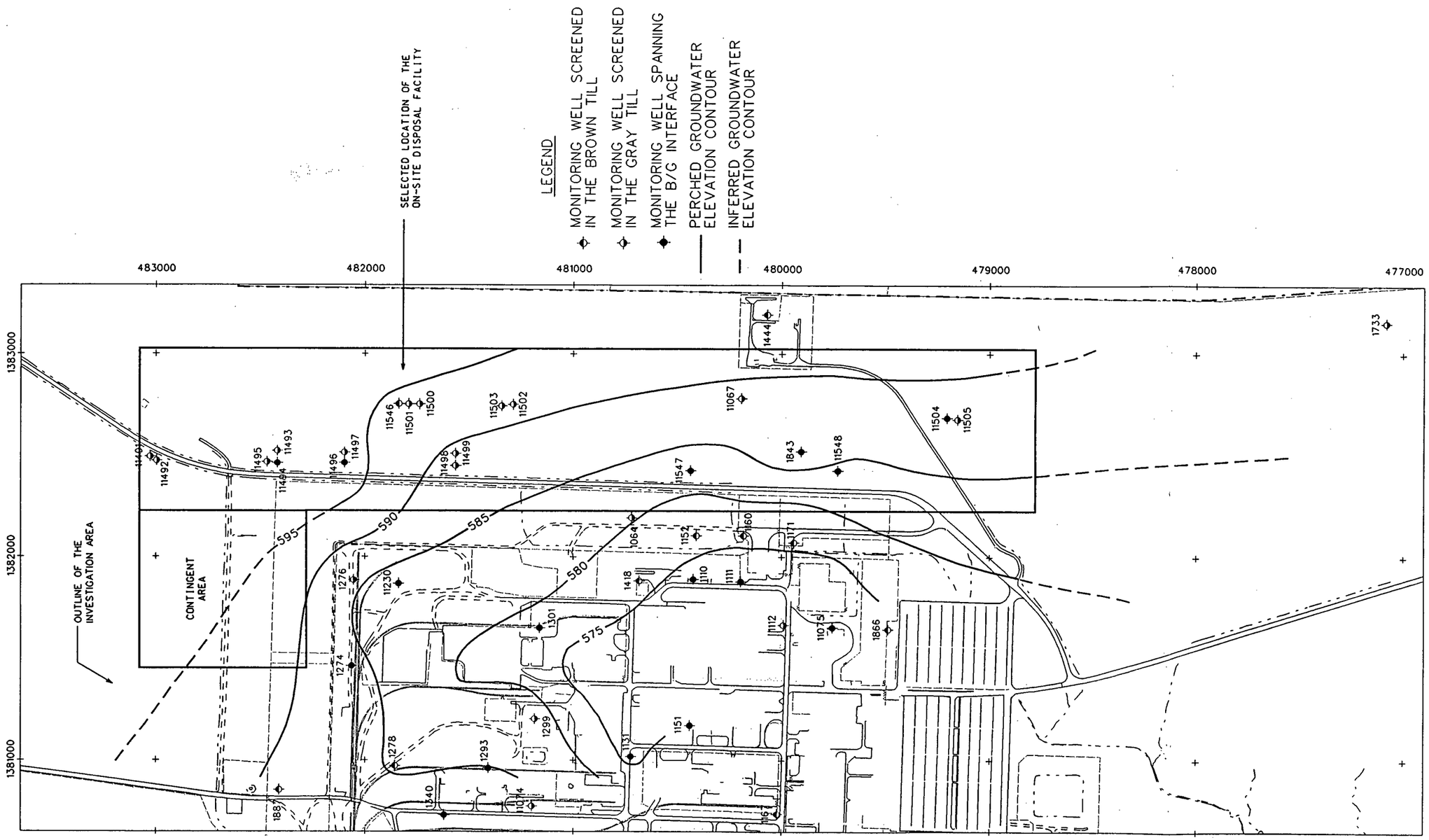
The FEMP site is located on the eastern edge of the central stable physiographic province. The central stable region represents the interior of the American tectonic plate, an area which has been relatively undisturbed since Precambrian time. Two distinct geologic features exist in the central stable region near the FEMP site:

1) The Cincinnati Arch, which extends northward from Tennessee to the western border of Ohio and Kentucky.

2) The Findlay Arch, which extends northeastward in the northwest corner of Ohio and intersects the Bowling Green Fault zone. Faulting in the area of the FEMP site is limited. The Bowling Green Fault lies approximately 120 miles to the north of the FEMP site, and an unnamed fault zone extends from Kentucky to about midway between Cincinnati and Porstmouth, Ohio. Outside Ohio, the active New Madrid fault zone lies approximately 300 miles from the FEMP site.

The largest known earthquake to have occurred in Ohio was in the Anna, Ohio, area on March 9, 1937, and has been listed as Modified Mercalli Intensity (MMI) of VII to VIII. The corresponding MMI at the FEMP site would have been IV to V. There have been four earthquakes in the Anna, Ohio, area having MMIs of VII, and these would probably have resulted in intensities of IV to V at Fernald. However, it appears that based on historical activity, the New Madrid seismic zone can be a greater seismic threat to the FEMP site than the Anna, Ohio, seismic zone. The MMI at the FEMP site for the 1811 to 1812 New Madrid series earthquake is VII based upon an isoseismal map of the December 16, 1811, earthquake (DOE 1993).

The United States Department of Energy (DOE) has established natural phenomena design and evaluation criteria for its facilities. These criteria are found in DOE-STD-1020-94, "Natural Phenomena Design and Evaluation Criteria for Department of Energy Facilities" (DOE 1994b). Requirements for the design and evaluation of structures comprising DOE facilities, including the FEMP, for earthquake ground shaking is part of DOE-STD-1020-94.



NOTE: COORDINATES ARE STATE PLANAR NAD 1927

Figure 2-7 - Typical Perched Groundwater Elevations

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

TYPICAL PERCHED GROUNDWATER ELEVATION

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DATE 5-02-95
DRAWN DEG

FILE NAME: /2ccs1/dgn/map/hor/dpth/ph20037.dgn

For the seismic analyses and evaluations of this report, the proposed disposal facility is assumed to be categorized as a Performance Category 2 (PC2) (moderate hazard) facility. Classification as a PC2 facility corresponds to an earthquake hazard annual probability of an exceedance of 1×10^{-3}. The corresponding peak horizontal ground acceleration (PGA) for the FEMP site is 0.13 acceleration due to gravity (g) per Table C-5a of DOE-STD-1020-94. The corresponding Richter magnitude was taken as 6 (USGS 1980, Cain 1983).

SECTION 3

SUMMARY OF PHASE III GEOTECHNICAL INVESTIGATION

This section describes the geotechnical field and laboratory test program implemented per the *Geotechnical Sampling and Testing Plan for the Phase III Site-Wide Disposal Facility Field Investigation* (FERMCO 1995a). Sixty-three CPT soundings were performed at 48 different locations at the proposed site in March 1995. Geotechnical test borings were advanced at 15 locations, and 17 shallow borings (or excavations) were performed at the proposed disposal facility site during April through June, 1995. Additionally, during this period, three shallow excavations were performed along a proposed haul road west of the former production area, and aggregate and riprap samples were collected at stockpiles near the site's fly ash waste units. Geotechnical laboratory testing was performed by Advanced Terra Testing, Inc. (ATT), Lakewood, Colorado, and by Aguirre Engineers, Englewood, Colorado, during April through August, 1995. Additionally, during this period, chloride and sulfate tests were performed on soil samples at ACCU-Labs Research Inc., Golden, Colorado. The laboratory data sheets from this testing are compiled in a seven-volume data report entitled *Geotechnical Investigation On-Site Disposal Facility, Soil Investigation Data Report* (SAIC 1995). Geotechnical field and laboratory activities were conducted following the guidelines of the *Sitewide CERCLA Quality Assurance Project Plan* (DOE 1994c).

3.1 Cone Penetrometer Testing

Piezo-electric cone penetrometer testing was conducted in March 1995 as part of the Phase III geotechnical investigation. Sixty-three CPT soundings were performed at 48 different locations at the proposed site using a penetrometer truck with an overall push capacity of 45,000 pounds. The penetrometer truck was owned by the DOE and operated by Applied Research Associates, Inc., under contract with the DOE. Figure 2-3 shows the CPT locations, designated as G2-CPT-500 through G2-CPT 547. The Phase III soundings were advanced from 19 to 96 feet in depth. In general, the CPT soundings confirmed the overall understanding of shallow subsurface conditions at the proposed disposal facility site.

Testing was performed in accordance with American Society for Testing and Materials (ASTM) D 3441. A penetrometer probe of standard dimensions was used and advanced at a constant rate. Inside the probe, two load cells independently measure the vertical resistance against the conical tip and the side friction along the sleeve. Forces are sensed by the load cells and the data are transmitted from the probe assembly via a cable within the push tubes. Penetration pore pressures are measured with a pore pressure transducer located behind the tip in the lower end of the probe. Typically a set of data is recorded each second, for a minimum resolution of one data point every 0.8 inches of cone advance. The depth of penetration is measured using a string potentiometer mounted on the push frame.

Electronic data acquisition is accomplished using a computer with graphics monitor and a rack of signal conditioners mounted within the truck. Upon completion of the test, penetration data are plotted (hard copy) and stored on hard disk.

Electronic disks of the data were also provided to FERMCO, and subsequently to PARSONS. The electronic CPT files were loaded on an Intergraph Geographic Information System (GIS) work station at PARSONS' Fairfield office to allow for future data manipulation, analysis, and plotting, as required.

For reference, data from 47 CPT soundings conducted during the Phase I investigation are also included. Phase I CPT soundings (designated as 11411 through 11466) extended from about 10 feet to 40 feet in depth at the various locations shown in Figure 2-3.

The electronic CPT files have been correlated for various geotechnical parameters by the CPT contractor. These parameters include overburden pressures, wet density, relative density, friction angle, undrained shear strength, synthesized Standard Penetration Test (SPT) blow counts, and classification by CPT correlation.

For evaluating California Bearing Ratio (CBR) of shallow soils in the vicinity of the proposed haul roads, the undrained shear strength value provided by CPT correlation was averaged for the top 5 feet for various areas along the proposed roads. Appendix C contains these values and the corresponding CBR values from literature.

3.2 Geotechnical Test Borings

Fifteen geotechnical test borings (G2-120 through G2-134) were advanced by FERMCO's drilling subcontractor, Alliance Environmental, Inc., at the locations shown on Figure 2-3. The boring locations were established and staked by FERMCO. Upon completion of the geotechnical test borings, the location and elevation of each were surveyed by FERMCO.

The test borings were advanced with 4-1/4-inch, inside-diameter, hollow-stem augers to depths ranging from 14 to 82 feet. During drilling, a PARSONS geotechnical engineer or geologist was at the drill rig to visually classify the soil samples, log the borings, and record water levels if groundwater was encountered. During sampling activities, FERMCO sampling technicians screened the soil samples and drill cuttings, using hand-held instruments for volatile organics and radiation.

Soil samples were recovered in the undisturbed material below the bottom of the augers using either the Standard Method for Penetration Resistance and Split-Barrel Sampling (ASTM D 1586), 3-inch-diameter Shelby Tubes (ASTM D 1587), or a Denison sampler. Samples were collected following the sample plan described in the Geotechnical Sampling and Testing Plan (FERMCO 1995). Variations in the sample

plan due to conditions encountered in the field were documented on Field Change Notice/Variance documents provided to FERMCO.

Upon completion of each boring, the soil test borings were backfilled throughout the entire length of the boring with an expansive grout using C150 Type K Portland Cement (ASTM D 5299). A FERMCO geologist oversaw the grouting operations.

Appendix D contains a field boring log and a Geotechnical Logging Report for each of the geotechnical test borings from the Phase III investigation. The Geotechnical Logging Report updates the soil classification based on the results of laboratory classification tests. Appendix B summarizes the Ohio State Plane Coordinates and ground surface elevations for test borings.

3.3 Shallow Boring/Excavations

Fourteen shallow borings (G2-SB-1 through G2-SB-14) were conducted during the Phase III investigation at the proposed disposal facility site. A hydraulic hand auger was used to collect bulk samples of soil to depths of about 5 feet for remolded laboratory tests. A Geoprobe core sample was taken at each shallow boring location to provide for visual logging. The Geoprobe core sampler was also used at eight of the locations to collect samples for chloride and sulphate tests. Figure 2-3 shows the locations of the shallow borings.

Four shallow excavations (G2-SB-18 through G2-SB-21) were dug along a proposed access road centerline with a hand shovel, to depths of about 2 feet. A bulk sample of soil was collected at each location for R-value testing using a Hveem Stabilometer. Figure 2-3 shows the locations of these shallow excavations.

Three shallow excavations (G2-SB-15 through G2-SB-17) were dug along the centerline of a proposed haul road located to the west of the former production area, to depths of about 2 feet. Figure 2-3 shows the locations of these shallow excavations. A bulk sample was collected at each location for CBR tests.

Appendix E contains a field boring log and a Geotechnical Logging Report for each of the geotechnical shallow borings/excavations from the Phase III investigation. The Geotechnical Logging Report updates the soil classification based on the results of laboratory classification tests. Appendix B summarizes the Ohio State Plane Coordinates and ground surface elevations for the shallow boring/excavations.

3.4 Aggregate and Riprap Sampling

Samples of limestone coarse aggregate and riprap were collected from stockpiles located near the fly ash pile waste units at the FEMP site and tested for bulk specific gravity and soundness.

3.5 Laboratory Test Program

Geotechnical laboratory testing of soil and rock samples was performed at three laboratories. ATT performed all of the geotechnical laboratory soil tests, with the exception of the R-value tests, which were performed by Aguirre Engineers, and the chloride and sulphate tests, which were performed by ACCU-Labs Research, Inc. Aguirre Engineers performed bulk specific gravity and soundness tests on the aggregate and riprap samples. Additionally, ATT performed three large-scale interface, direct shear tests on select geosynthetics and FEMP soils.

The laboratory testing program was directed toward classifying of the in situ and remolded soils and determining their engineering properties. A variety of index tests were performed on selected samples to aid in soil classification and to extend the utility of the more sophisticated strength and permeability tests. Table 3-1 lists the number of tests performed and the laboratory test methods. The soil testing was performed on split-spoon samples (disturbed samples), bulk samples (collected from auger cuttings, shallow hand-dug excavations, and Geoprobe core samples), and Shelby and Denison Tube samples (relatively undisturbed samples) obtained during the field investigation. A PARSONS geotechnical engineer assigned laboratory tasks after reviewing the test plan, field boring logs, and sample recovery. Appendix F contains a matrix which summarizes the geotechnical tests completed by location.

3.5.1 Undisturbed Sample Test Conditions

Consolidation, triaxial compression, and vertical permeability tests were performed on undisturbed Shelby Tube and Denison samples. Table 3-2 lists test conditions for undisturbed samples.

3.5.2 Test Conditions for Remolded Specimens

Consolidation, triaxial compression, and permeability tests were performed on test specimens remolded from soils from bulk (auger cuttings from shallow borings), Shelby, and Denison samples. Table 3-3 lists test conditions for remolded specimens from the bulk samples. Maximum Dry Densities (MDDs) and Optimum Moisture Contents (OMCs) for remolding of test specimens from bulk samples of auger cuttings, and hand-dug excavations came from Standard Proctor Compaction tests of soils from the bulk samples. Remolded tests were also performed on soil from Shelby Tube and Denison samples. For these tests, MDD and OMC for remolding was based on Standard Compaction test data for FEMP soils obtained in the Phase II Investigation (PARSONS 1995b). Table 3-4 summarizes the MDD and OMC data that the laboratory used for remolding Phase III investigation test specimens obtained from Shelby Tube and Denison samples.

Table 3-1 - Summary of Geotechnical Laboratory Program

Test Method	Title	Number Performed
ASTM D 2216	Method for Laboratory Determination of Water Content of Soil and Rock (oven method)	73[1]
ASTM D 4643	Test Method for Determination of Water Content of Soil (microwave method)	18
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	66
ASTM D 422	Test Method for Particle-Size Analysis of Soils	96
ASTM D 854	Test Method for Specific Gravity of Soils	110[2]
ASTM D 2974	Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils	42
ASTM D 698	Test Method for Laboratory Compaction of Soil Using Standard Effort	16
ASTM D 5084	Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	22[3]
ASTM D 4767	Test Method for Consolidated-Undrained Triaxial Compression Test on Cohesive Soils	20[4]
ASTM D 2850	Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soils	25[5]
ASTM D 2435	Test Method for One-Dimensional Consolidation Properties of Soils	30[6]
ASTM D 2844	Test Method for R-value and Expansion Pressure of Compacted Soils	4
ASTM D 1883	Test Method for California Bearing Ratio of Laboratory Compacted Soils	3
ASTM C 127	Test Method for Specific Gravity and Absorption of Coarse Aggregate	5
ASTM D 5321	Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method	3
ASTM D 5240	Test Method for Testing Rock Slabs to Evaluate the Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate	2

Table 3-1 - Summary of Geotechnical Laboratory Program (Continued)

Test Method	Title	Number Performed
ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	3
EPA 9038	Sulfate (turbidimetric method)	8
EPA 9251	Chloride (ferricyanide method)	8

Notes:

1 Additional moisture contents were determined in conjunction with organic content, permeability, consolidation, unconfined compressive strength, triaxial compression tests, and compaction tests.

2 Specific gravity tests were performed in conjunction with hydrometer (i.e., grain-size analyses).

3 Eight vertical permeability tests on undisturbed samples; 14 permeability tests on remolded test specimens.

4 Thirteen consolidated, undrained triaxial compression tests on undisturbed samples; seven consolidated, undrained triaxial compression tests on remolded test specimens.

5 Seventeen unconsolidated, undrained triaxial compression tests on undisturbed samples; eight unconsolidated, undrained triaxial compression tests on remolded test specimens.

6 Seven consolidation tests on undisturbed samples at saturated conditions; seven consolidation tests at field moisture conditions; 16 consolidation tests on remolded test specimens.

Table 3-2 - Undisturbed Sample Test Conditions

	Consolidation Test, In situ, Nat. Moist (ASTM D 2435)	Consolidation Test, In situ, Saturated (ASTM D 2435)	Triaxial Compression, Unconsolidated, Undrained (TX-UU), In Situ (ASTM D 2850)	Triaxial Compression, Consolidated, Undrained w/Pore Pressure (TX-CUw/pp), In situ (ASTM D 4767)	Triaxial Permeability, In situ, (ASTM D 5084)
Test Code	CON	CON_s	UU	CU	P
Confining Pressure			Existing overburden pressure at sample depth (use 1 psi per foot of depth) Perform test at saturated condition	<u>If sample depth is 5 - 15 feet:</u> 1st Specimen: 1 psi per foot of sample depth 2nd Specimen: 30 psi 3rd Specimen: 70 psi <u>If sample depth is >15 feet:</u> 1st Specimen: 1 psi per foot of sample depth 2nd Specimen: 40 psi 3rd Specimen: 80 psi	Existing overburden pressure at sample depth (use 1 psi per foot of depth at sample depths greater than 3 feet)
Consolidation Test Conditions	at natural moisture	at saturated condition			
Constant Head					2 psi

Notes:

CON = Consolidation with time readings, ASTM D2435, undisturbed sample at natural moisture.

CON_s Consolidation with time readings, ASTM D2435, undisturbed sample at saturated condition.

UU = Unconsolidated, undrained triaxial compression, ASTM D2850, undisturbed sample.

CU = Consolidated undrained triaxial compression with pore pressure measurements, ASTM D4767, undisturbed sample. Three samples to be used at three different confining pressures. If three samples were not available, a staged test was performed on one sample.

P = Permeability, ASTM D5084, undisturbed sample.

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Table 3-3 - Remolded Specimen Test Conditions

	Consolidation Test, Remolded, 95 percent r.c., (ASTM D 2435)	Consolidation Test, Remolded, 85 percent r.c., (ASTM D 2435)	Triaxial Compression Test, Unconsolidated, Undrained, (TX-UU), Remolded, 95 percent r.c., (ASTM D 2850)	Triaxial Compression Test, Unconsolidated, Undrained, (TX-UU), Remolded, 85 percent r.c., (ASTM D 2850)	Triaxial Compression Test, Consolidated, Undrained, (TX-CUw/pp), Remolded, 95 percent r.c., (ASTM D 4767)	Triaxial Compression Test, Consolidated, Undrained, (TX-CUw/pp), Remolded, 85 percent r.c., (ASTM D 4767)	Triaxial Permeability, Remolded, 95 percent r.c., (ASTM D 5084)
Test Code	CON_r	CON_{r85}	UU_r	UU_{r85}	CU_r	CU_{r85}	P_r
Specimen Remolding Requirements	Minimum Dry Density: 95 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near 4 percent wet of optimum	Dry Density: 85 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near optimum	Minimum Dry Density: 95 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near 4 percent wet of optimum	Dry Density: 85 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near optimum	Minimum Dry Density: 95 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near 4 percent wet of optimum	Dry Density: 85 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near optimum	Minimum Dry Density: 95 percent of the maximum Standard Proctor Dry Density Moisture Content: at or near 4 percent wet of optimum
Confining Pressure			Existing overburden pressure at sample depth (use 1 psi per foot of depth) Perform test at saturated condition	Existing overburden pressure at sample depth (use 1 psi per foot of depth) Perform test at saturated condition	10 psi 25 psi 50 psi	10 psi 25 psi 50 psi	4 psi
Consolidation Test Conditions	at saturated condition	at saturated condition					
Constant Head							2 psi

Table 3-3 - Remolded Specimen Test Conditions (Continued)

	Consolidation Test, Remolded, 95 percent r.c., (ASTM D 2435)	Consolidation Test, Remolded, 85 percent r.c., (ASTM D 2435)	Triaxial Compression Test, Unconsolidated, Undrained, (TX-UU), Remolded, 95 percent r.c., (ASTM D 2850)	Triaxial Compression Test, Unconsolidated, Undrained, (TX-UU), Remolded, 85 percent r.c., (ASTM D 2850)	Triaxial Compression Test, Consolidated, Undrained, (TX-CUw/pp), Remolded, 95 percent r.c., (ASTM D 4767)	Triaxial Compression Test, Consolidated, Undrained, (TX-CUw/pp), Remolded, 85 percent r.c., (ASTM D 4767)	Triaxial Permeability, Remolded, 95 percent r.c., (ASTM D 5084)
Standard Compaction Data to Use for Remolding Specimens	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	See Table 3-4 for Maximum dry density and OMC to use for material from tube samples	Use Max. dry density and OMC from Standard Compaction Test of material from same bulk sample

Notes:

CON_r = Consolidation with time readings, ASTM D 2435, remolded sample with 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D 698.

CON_{r85} = Consolidation with time readings, ASTM D 2435, remolded sample with 85 percent relative compaction at optimum moisture content in accordance with ASTM D 698.

UU_r = Unconsolidated, undrained triaxial compression, ASTM D 2850, remolded sample with 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D 698.

UU_{r85} = Unconsolidated, undrained triaxial compression, ASTM D 2850, remolded sample with 85 percent relative compaction at optimum moisture content in accordance with ASTM D 698.

CU_r = Consolidated, undrained triaxial compression with pore pressure measurements, ASTM D 4767, remolded sample with 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D 698. Three samples to be used at three different confining pressures. If three samples were not available, a staged test was performed on one sample.

CU_{r85} = Consolidated, undrained triaxial compression with pore pressure measurements, ASTM D 4767, remolded sample with 85 percent relative compaction at optimum moisture content in accordance with ASTM D 698. Three samples to be used at three different confining pressures. If three samples were not available, a staged test was performed on one sample.

P_r = Permeability, ASTM D 5084, remolded sample with 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D 698.

r.c. = relative compaction (i.e., relative to standard MDD).

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Table 3-4 - Standard Proctor Maximum Dry Density and OMC Criteria for Remolded Tests of Material From Tube Samples

Material	Approximate Sample Depth (feet)	Maximum Standard Proctor Dry Density (pcf)	Optimum Moisture Content (percent)
Brown CL	2 - 7.5	118	14.5
Brown CL	7.5 - 13	123	12.6
Gray CL	(see Note 3)	125	11.3
Brown CH	(see Note 3)	106	19.3
Brown ML	(see Note 3)	125	11.3

Notes:

1. This table applies to remolded tests of material from Shelby or Denison Tubes where compaction test data is not available.
2. These data are derived from Phase II (PO-132) Standard Compaction Test (ASTM D 698, Method A) results of FEMP Soils.
3. In general for till above the sand and gravel stratum, the "brown" colored soil material comes from depths less than about 10 - 15 feet; the "gray" colored soil material comes from depths of greater than about 10 -15 feet.

3.6 Laboratory Test Results - Disturbed and Undisturbed Soil Samples

This subsection summarizes the results of the geotechnical testing of disturbed (split-spoon) and undisturbed (Shelby Tube or Denison Tube) samples. These data are presented in a series of tables found in Appendix G that incorporate the sample's identifier as well as the sample's color, USCS group symbol, and USCS group name.

3.6.1 Index/Classification Tests

Moisture content tests (ASTM D 2216, ASTM D 4643) were performed on selected samples to provide soil moisture profiles of the borings. Moisture content was also determined as a routine part of test procedures for strength, consolidation, and permeability. Plasticity tests (ASTM D 4318) and grain size analyses (ASTM D 422) were conducted for soil classification (ASTM D 2487). Table G-1 presents a summary of the moisture content test results along with the Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI), grain size, and specific gravity of the soil. Table G-1A compares the oven-dried moisture content (ASTM D 2216) with the microwave moisture content (ASTM D 4643).

Total weight and dry unit weight of the soils were determined in conjunction with other laboratory tests (i.e., consolidation, permeability, unconfined compressive strength, and triaxial compression tests) and are presented in Table G-2.

3.6.2 Consolidation Tests

Sixteen consolidation tests (ASTM 2435) were performed on specimens from undisturbed samples. Eleven of the tests were performed at field (as-received) moisture content and were not saturated during the test. Test specimens from these tests compressed with little rebound upon unloading. The data sheets for these tests can be found in the Soils Investigation Data Report (SAIC 1995). The five other consolidation tests were performed under saturated conditions and evaluated for consolidation parameters to be used in evaluating settlements. Table G-3 summarizes the results of the saturated consolidation tests.

3.6.3 Unconsolidated, Undrained Triaxial Compression Tests

Seventeen unconsolidated, undrained triaxial compression tests (ASTM D 2850) were performed on specimens from undisturbed samples. Table G-4 summarizes the results of the tests.

3.6.4 Consolidated, Undrained Triaxial Compression Tests

Thirteen consolidated, undrained compressive strength tests (with pore pressure measurements) (ASTM D 4767) were performed on specimens from undisturbed samples. For each test, three specimens from a Shelby Tube or Denison sample were tested under varying confining pressures to determine the effective and total shear strength parameters. When three specimens could not be obtained, a staged test was performed on a single specimen. Table G-5 summarizes the cohesion and friction angles from Mohr circle constructions. Appendix H contains the Mohr strength envelopes.

3.6.5 Permeability Tests

Laboratory permeability tests (ASTM D 5084) were performed on eight undisturbed specimens. Table G-6 summarizes the results of the tests.

3.7 Laboratory Test Results - Bulk Sample and Remolded Specimens

This section summarizes results of tests performed on remolded test specimens of soils from the bulk samples (from shallow auger borings/excavations), Shelby Tubes, and Denison samples collected during the Phase III Investigation.

3.7.1 Index/Classification Tests

Table G-7 lists index property tests performed on the 14 bulk samples of auger cuttings collected during the Phase III investigation. Grain-size distribution, LL, PL, PI, and specific gravity of the samples are summarized.

3.7.2 Compaction Tests

Seventeen Standard Proctor compaction tests (ASTM D 698) were performed on bulk samples or from shallow borings/excavations to determine the maximum dry density and the optimum moisture content of the proposed site's shallow (0 to 5 foot depth) soils. Samples G2-SB-2,3,4,6 and G2-SB-8,9,10,11 were composite samples of topsoil from 0 to 1.5 feet. The amount of compaction and degree of wetting/drying operations required during earthwork operations can be estimated from the compaction test results. Table G-7 summarizes the optimum moisture contents and maximum dry densities. Appendix I contains compaction curves for the samples tested.

3.7.3 Remolded Consolidation Tests

Sixteen consolidation tests (ASTM D 2435) were performed on remolded specimens. Soil materials for remolding came from bulk samples from shallow/borings excavations, Shelby Tubes, or Denison samples. For bulk samples, the MDD and OMC for remolding were based on the results of standard compaction tests performed on material from the bulk sample. For specimens from Shelby Tube and Denison samples, the MDD and OMC for remolding were based on results of compaction tests performed on similar FEMP soils during the Phase II investigation (see Table 3-4). The specimens were remolded at the laboratory to maximum target dry densities of either 85 percent at or near OMC or 95 percent of Standard MDD, wet of optimum moisture content. Table G-8 summarizes the results of the tests.

3.7.4 Remolded Unconsolidated, Undrained Triaxial Compression Tests

Eight unconsolidated, undrained triaxial compression tests (ASTM D 2850) were performed on specimens remolded from Shelby Tube and Denison samples. The test specimens were remolded at the laboratory to minimum target dry densities of either 95 percent MDD, wet of OMC; or 85 percent MDD, at or near OMC. The MDD and OMC for remolding were based on results of compaction tests performed on similar FEMP soils during the Phase II Investigation (see Table 3-4). Table G-9 summarizes the test results. Appendix H contains the Mohr strength envelopes.

3.7.5 Remolded Consolidated, Undrained Triaxial Compression Tests

Seven consolidated, undrained compressive strength tests (with pore pressure measurements) (ASTM D 4767) were performed on specimens remolded from Shelby Tube and Denison samples. For each test, three specimens were tested under varying confining pressures to determine the effective and total shear strength parameters. Where three specimens could not be obtained, a staged test was performed on a single specimen. The MDD and OMC for remolding were based on results of compaction tests performed on similar FEMP soils during the Phase II Investigation (see Table 3-4). Specimens were remolded to conditions listed in Table 3-3. Table G-10 summarizes the cohesion and friction angles from Mohr circle constructions. Appendix H contains the Mohr strength envelopes.

3.7.6 Remolded Permeability Tests

Laboratory permeability tests (ASTM D 5084) were performed on 14 remolded specimens from bulk samples. The test specimens were remolded at the laboratory to minimum target dry densities of 95 percent of the Standard Proctor maximum dry density, at or near 4 percent wet of optimum moisture content. Table G-11 summarizes the results of the tests.

3.7.7 California Bearing Ratio Tests

Laboratory CBR tests (ASTM D 1883) were performed on bulk soil samples collected from 1 to 2 feet below ground surface at shallow excavations G2-SB-15, G2-SB-16, and G2-SB-17. Table G-12 presents the results of these tests.

3.7.8 R-Value Tests

R-Value tests (ASTM D 2844) were performed on bulk soil samples collected from 1 to 2 feet below ground surface at shallow excavations G2-SB-18 through G2-SB-21. Table G-13 presents the results of the tests.

3.7.9 Organic Content Tests

A Geoprobe core sampler was used to collect topsoil samples at shallow boring locations for organic content tests (ASTM D 2974). Three intervals were sampled and tested: ground surface to 6 inches, 6 to 12 inches, and 12 to 18 inches. Table G-14 contains the results of the organic content tests.

3.7.10 Chloride and Sulfate Tests

A Geoprobe core sampler was used to collect samples of brown till for chloride (EPA 9251) and sulfate (EPA 9038) Tests. Eight samples were taken at depths of 4.5 to 5 feet and tested at ACCU-Labs Research, Inc. Table G-15 summarizes the results. The tests provide scoping information concerning the chemical reactivity potential of soils with any concrete structures of the proposed disposal facility.

3.8 Laboratory Test Results - Aggregate and Riprap Testing

To assess the quality of some readily available rock materials for use as aggregate and riprap, a total of 10 bulk samples were taken at two separate on-site locations. Four samples were collected from stockpiles in the area of the Inactive Fly Ash Pile, and six samples were collected from rock materials placed along the toe of the Active Fly Ash Pile (AFAP).

Samples from the stockpiles were placed in 10-gallon cans, three cans per sample. Samples from the toe of the AFAP were placed in 10-gallon cans, one can per sample. The three-can samples were necessary to accommodate the large size of the rock, typically about 10 to 12 inches.

Tests performed consisted of bulk specific gravity and absorption (ASTM C 127) and soundness (ASTM C 88). The large rock was tested for soundness per ASTM D 5240. Table G-16 contains the results of these tests.

3.9 Large-Scale Geosynthetic and Soils Direct Shear Tests

Three large-scale interface, direct shear test series were performed in accordance with ASTM D 5321 on select geosynthetic/soil interfaces supplied to ATT by PARSONS. The purpose of the testing was to provide worst case scoping values for interface friction for stability analysis of the proposed cap.

The laboratory testing conditions and materials tested were chosen to simulate worst case field conditions. This strategy was used to establish a lower bound for the range of strength parameters that can be expected from the candidate materials and their interfaces with the other materials. These worst-case conditions included testing geosynthetic materials without friction enhancing or reinforcing features (i.e., a smooth HDPE and a non-reinforced GCL) under saturated conditions. Using the measured shear strength values determined in this stage of testing and the proposed configuration of the disposal facility, the requirements for further testing of candidate materials was established (see Subsection 6.4.3).

The testing was conducted with a large direct shear box which used a 12-inch by 12-inch upper (stationary) box and a 12-inch by 16-inch lower (traveling) box. In general, the types of interface tested were:

1) Series A - Geosynthetic Clay Liner (GCL) to Compacted Clay
2) Series B - High Density Polyethylene (HDPE) to Compacted Clay
3) Series C - Geotextile to HDPE Membrane

Each test series was run at three normal stress levels ranging from 360 to 1,440 pounds per square foot (psf). The soil material for Series A and B was a FEMP brown clay (CL). The results of these tests are described in Subsection 4.7.

SECTION 4

SUMMARY OF GEOTECHNICAL CONDITIONS AND DESIGN PARAMETERS

This section summarizes the geotechnical conditions and parameters from the geotechnical investigation of the proposed disposal facility site. The soil and material parameters described herein are based on PARSONS review of data from the Phase III investigation and the prior geotechnical investigations of the proposed site listed in Subsection 1.2. A Geotechnical Data Base (GDB) has been developed by PARSONS using ORACLE data base software (see Appendix K). A GIS platform is used to query the data, perform mathematical functions, and provide for graphical output. The GDB was used to assist in preparing several of the summaries presented below. The GDB draws primarily from the geotechnical data collected during the Phase II (PARSONS PO-132) and Phase III (PARSONS PO-140) investigations.

4.1 Summary of Soil Index Properties

Table 4-1 provides a general summary of index properties for FEMP soils investigated. The data come from the Phase III investigation, the Phase II investigation (PARSONS 1995), and prior investigations, at or peripheral to (ranging from 500 to 1,400 feet from the proposed footprint boundary) the proposed disposal facility footprint. For reference, in situ laboratory permeability and strength parameters are also shown. The GDB was used to develop the table. Appendix G, Tables G-1 and G-2, summarizes index properties for individual samples tested during the Phase II, Phase III, and prior investigations.

Table 4-1 - Summary of Index Properties, Permeability, and Strength Parameters, FEMP Soils

General Stratum	USCS Group Symbol	Moisture Content (percent dry wgt)		Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Specific Gravity		Permeability (cm/sec)	Strength Parameters (CU Test)			
														Total Friction ϕ (degrees)	Total Cohesion c (psf)	Eff. Friction ϕ' (degrees)	Eff. Cohesion c' (psf)
		(range)	(avg)	(range)	(range)	(range)	(range)	(range)	(range)	(range)	(range)	(avg)	(range)	(range)	(range)	(range)	(range)
Brown Till (0 - 5 ft)	CL	11-30	21	95-125	21-50	7-32	0-12	1-43	35-63	18-48	2.63-2.84	2.72	9.0×10^{-9} - 6.4×10^{-6}	12-22	250-600	24-30	300-500
Brown Till (5 - 10 ft)	CL	3-26	16	91-130	22-49	7-28	0-23	1-33	30-64	21-59	2.69-2.83	2.75	9.4×10^{-9} - 2.3×10^{-8}	15-28	0-500	20-36	50-425
Brown Till (10 - 15 ft)	CL	10-25	15	107-131	19-43	4-23	0-25	1-41	29-65	18-58	2.69-2.86	2.78	1.0×10^{-8} - 2.7×10^{-8}	17-24	400-725	27-34	125-625
Gray Till	CL	9-24	14	113-139	19-33	5-17	0-31	1-39	28-79	18-38	2.67-2.84	2.74	6.8×10^{-9} - 8.4×10^{-8}	16-26	0-1125	27-44	0-575
Brown or Gray Till	CL-ML	11-20	15	113-130	17-23	4-7	0-16	15-42	36-55	18-30	2.69-2.85	2.78	-	24	350	900	29
Brown Till	CH	20-25	23	102-105	50-57	23-38	0-2	3-14	38-61	34-48	2.67-2.74	2.70	1.0×10^{-8}	-	-	-	-
Brown or Gray Till	GC	12-22	15	114-135	28	13	26	25	27	22	-	2.73	-	20-26	0-400	34-42	0-400
Gray Till	GM	-	-	-	-	-	40	38	17	5	-	2.80	-	-	-	-	-
Brown or Gray Till	ML	11-24	17	100-135	16-23	0-4	0-7	3-38	41-84	10-18	2.70-2.79	2.75	-	25-32	0	35	0
Brown or Gray Till	SM	9-24	15	113	NP-13	NP-1	0-15	43-71	13-42	4-20	2.70-2.78	2.73	1.0×10^{-5}	-	-	-	-
Brown or Gray Till	SC	8-11	9	131	19-25	8-12	18-26	29-55	13-27	8-18	2.69-2.74	2.72	-	-	-	-	-
Brown or Gray Till	SC-SM	11-20	15	98-135	18-24	5-8	0-25	37-56	26-35	12-18	2.70-2.80	2.74	2.0×10^{-8}	21	300-400	29-38	0-1150
Brown Till	GC-GM	15-36	23	85-124	24	7	43	22	23	12		2.79	-	-	-	-	-
Great Miami Aquifer	SM	2-15	8	-	-	-	0-32	53-84	10-36	1-5	2.67-2.79	2.75	-	-	-	-	-
Great Miami Aquifer	SW-SM	3-9	5	-	-	-	16-37	54-76	4-10	1-3	2.68-2.79	2.74	-	-	-	-	-
Great Miami Aquifer	SP-SM	2-12	6	-	-	-	0-35	57-91	4-10	0-3	2.69-2.77	2.73	-	-	-	-	-

Data Sources: Phase II Investigation (PO-132), Phase III Investigation (PO-140), Central Storage Facility (CSF) Investigation (PO-20), Pre-Design Activities Investigation (PO-101), and H.C. Nutting Investigation (DOE 1993a) Data

Notes:

1. Percent clay defined as those particles finer than (0.005 mm) (Reference ASTM D 422)
2. Moisture, density, permeability, and strength properties and parameters shown are for in situ soils
3. NP is non plastic

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Figures 4-1 through 4-6 are plasticity charts for fine-grained samples from the Phase II and III investigations. Figure 4-1 shows a plasticity chart for the brown and gray fine-grained till samples. Figure 4-2 is a plasticity chart for the brown fine-grained till samples, and Figure 4-3 is plasticity chart for the gray fine-grained till samples. Figures 4-4 through 4-6 present data for the fine-grained brown samples in approximate increments of 5-foot depth. From review of the plasticity charts, the gray clay (CL) samples show remarkably consistent PIs and LLs (see Figure 4-3). The brown clay ranges in behavior from low plasticity (CL) to high plasticity (CH) (see Figure 4-2). This behavior appears to depend on depth, with the brown clay having the lower plasticity characteristics of the gray clay at depths approaching about 10 to 15 feet (see Figures 4-3 through 4-6).

4.2 Summary of Standard Penetration Test Data

Standard penetration tests (ASTM D 1586) were performed during the Phase II and Phase III investigations of the proposed site. Blow count data from these tests are found on the field boring logs for these investigations. For the Phase III investigation, blow count data are also found on the Geotechnical Logging Reports contained in Appendix D.

4.3 Summary of Soil Consolidation Parameters

Table 4-2 provides a general summary of one-dimensional consolidation parameters from consolidation tests of FEMP soil samples collected and tested during the Phase III investigation, the Phase II investigation, the CSF investigation (PARSONS 1993), the Pre-Design Activities Investigation (PARSONS 1994a), and the H. C. Nutting investigation (DOE 1993a). Appendix G, Table G-3, summarizes consolidation test results for undisturbed samples from the Phase II, Phase III, and prior investigations. Appendix G, Table G-8, summarizes the results of consolidation tests of remolded specimens conducted during the Phase II and Phase III investigations. From tests of undisturbed samples, the brown till was found to be slightly over consolidated, while the gray till was typically normally consolidated to slightly over consolidated.

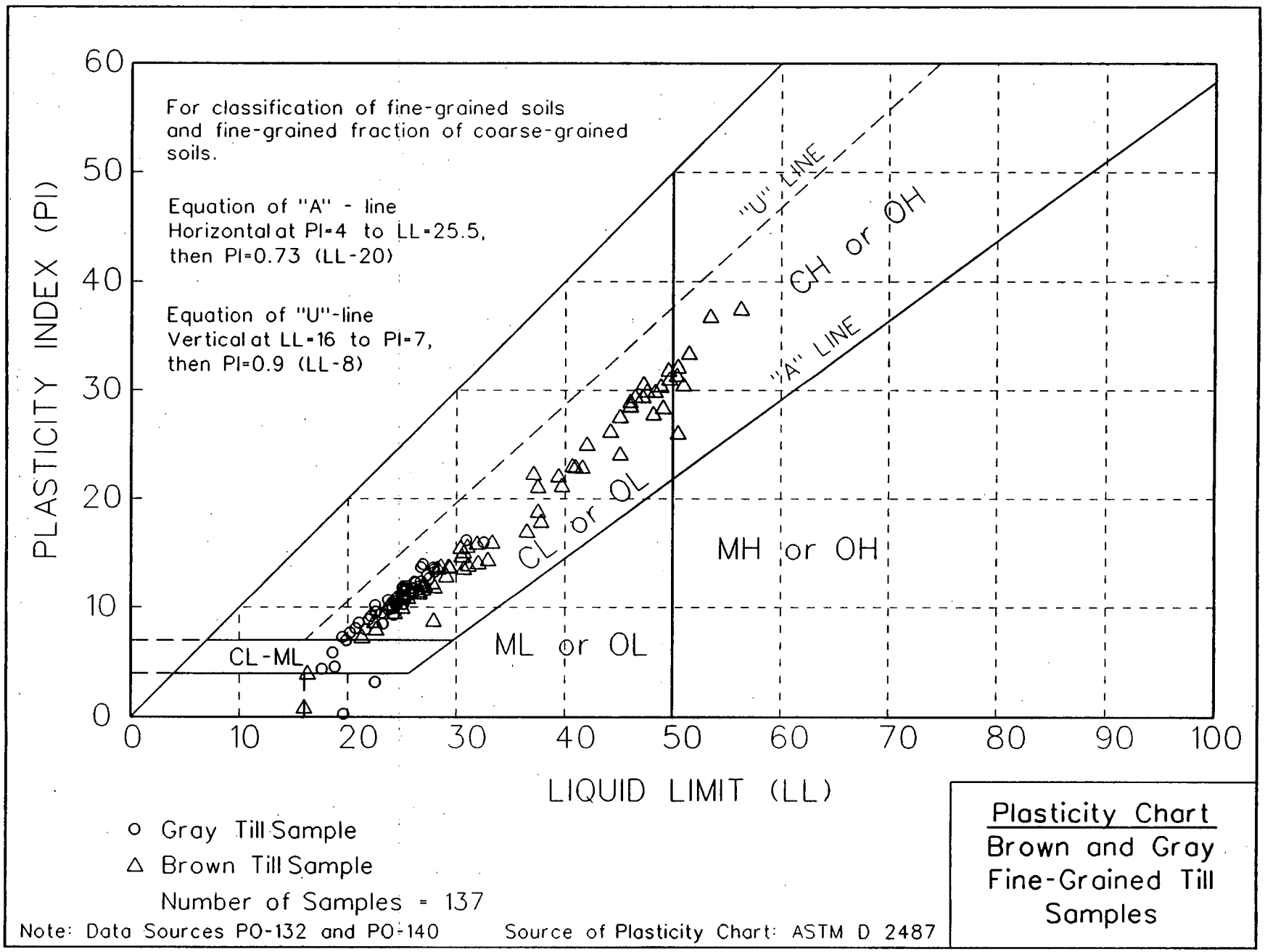

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Figure 4-1 - Plasticity Chart, Brown and Gray Fine-Grained Till Samples

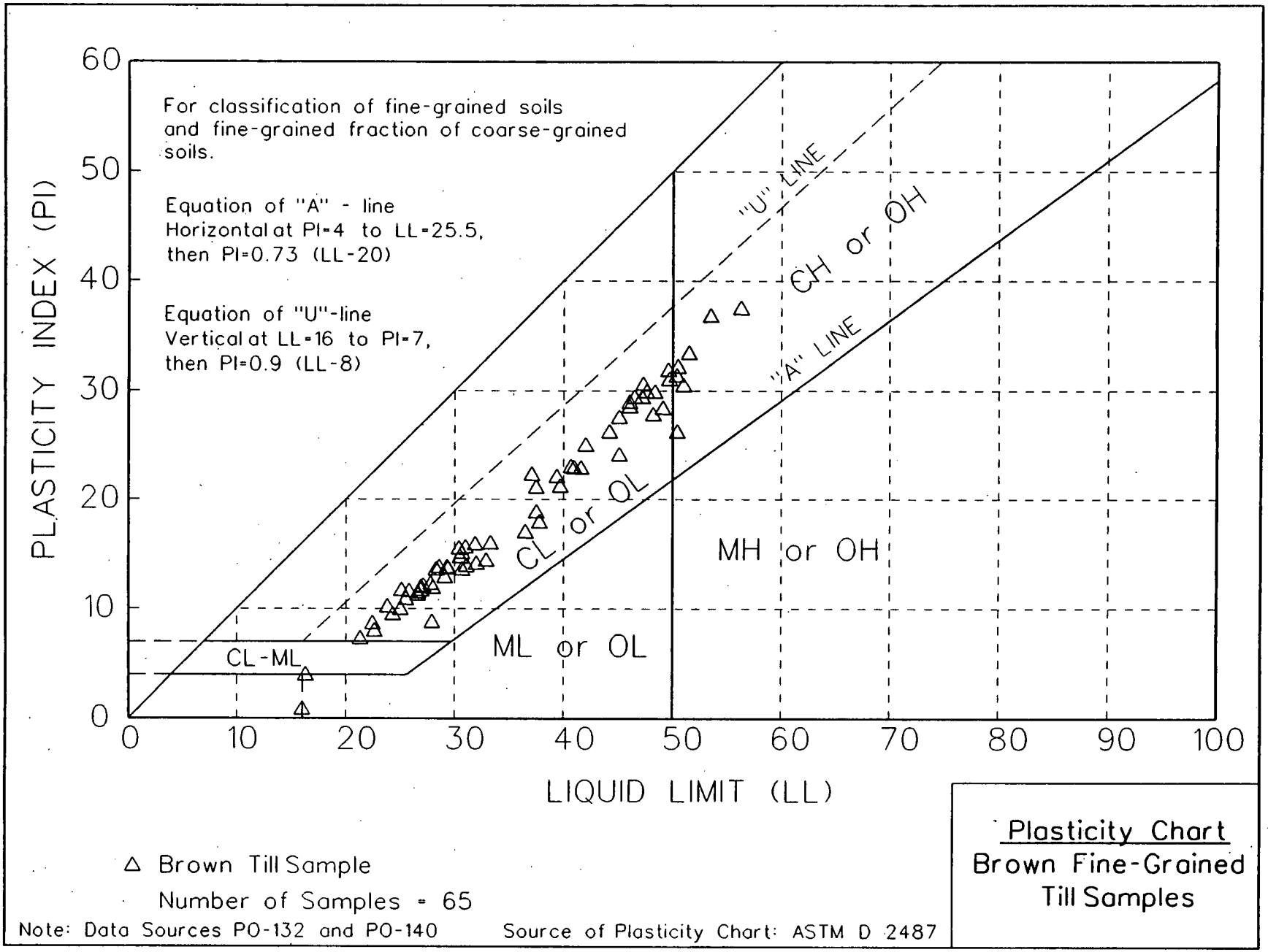

Figure 4-2 - Plasticity Chart, Brown Fine-Grained Till Samples

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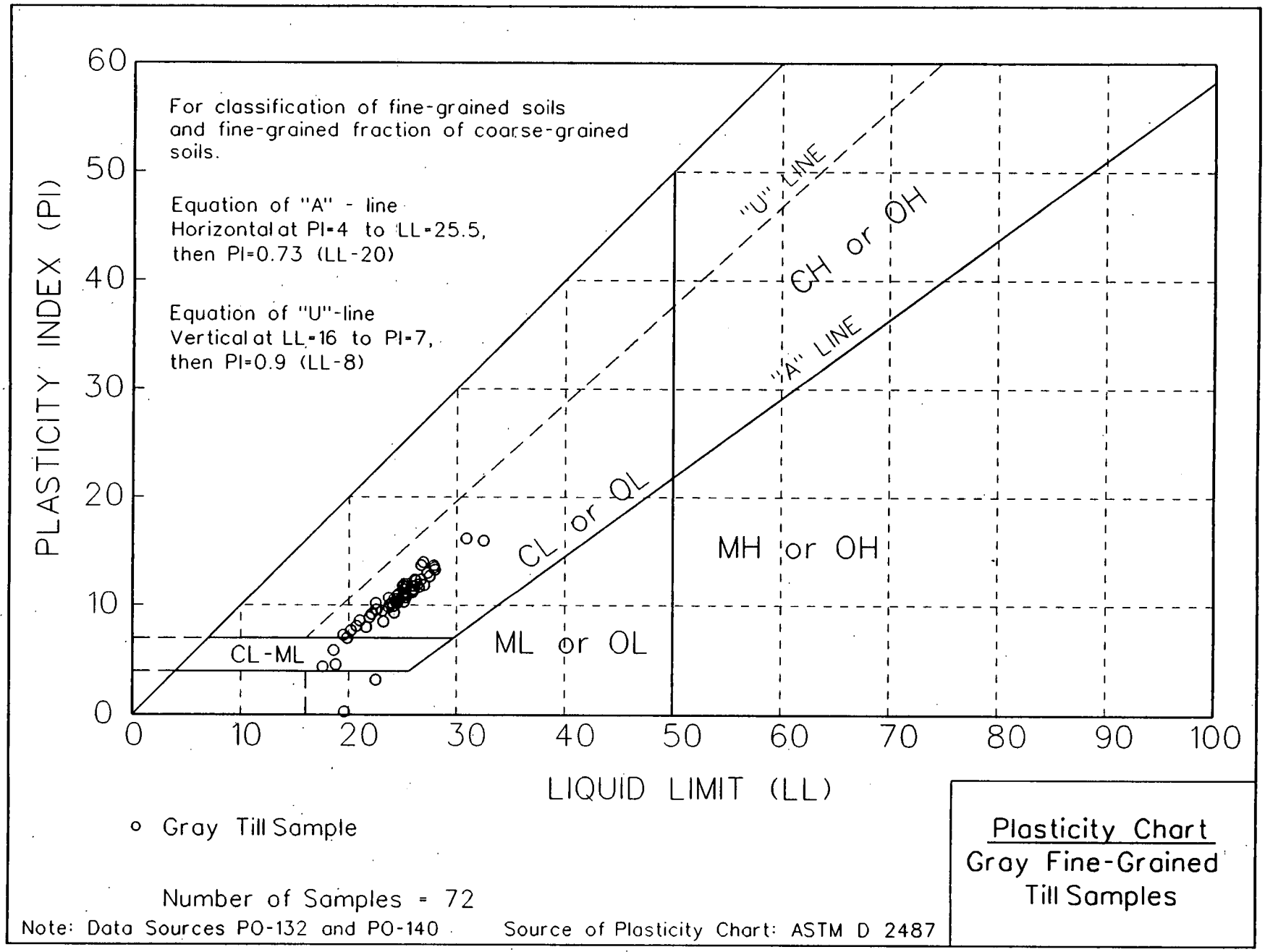

Figure 4-3 - Plasticity Chart, Gray Fine-Grained Till Samples

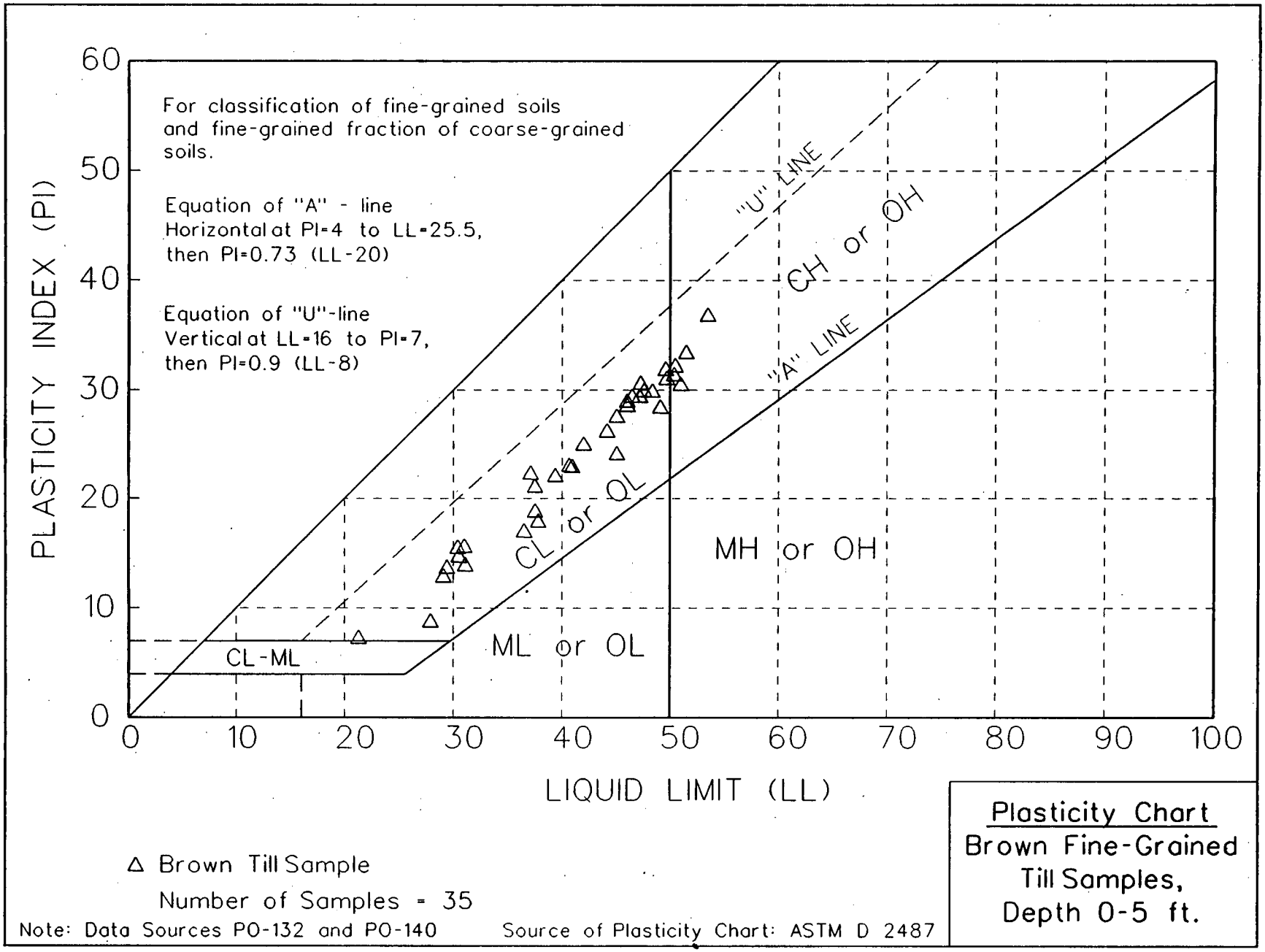

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Figure 4-4 - Plasticity Chart, Brown Fine-Grained Till Samples, Depth 0 - 5 Feet

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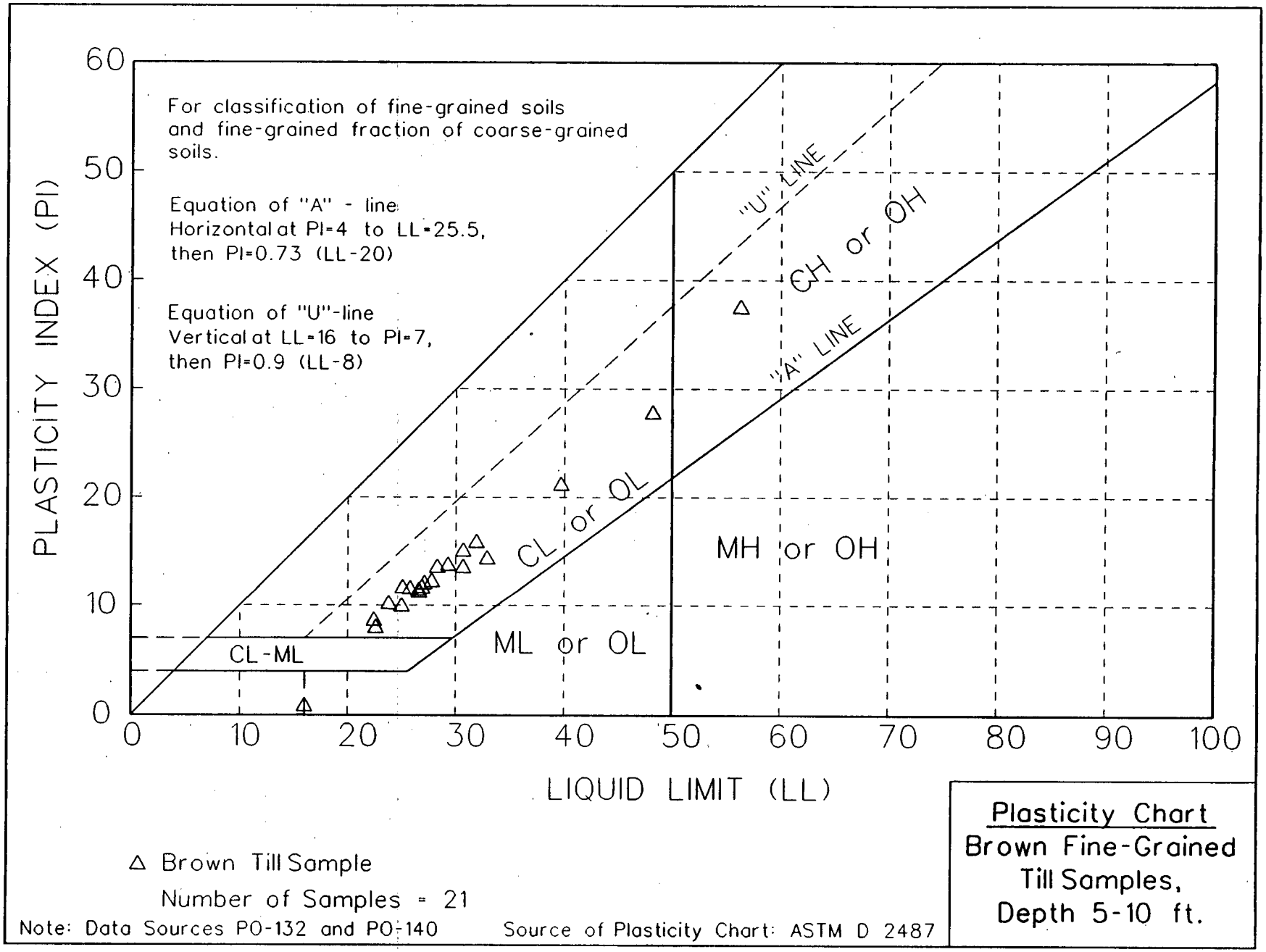

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Figure 4-5 - Plasticity Chart, Brown Fine-Grained Till Samples, Depth 5 - 10 Feet

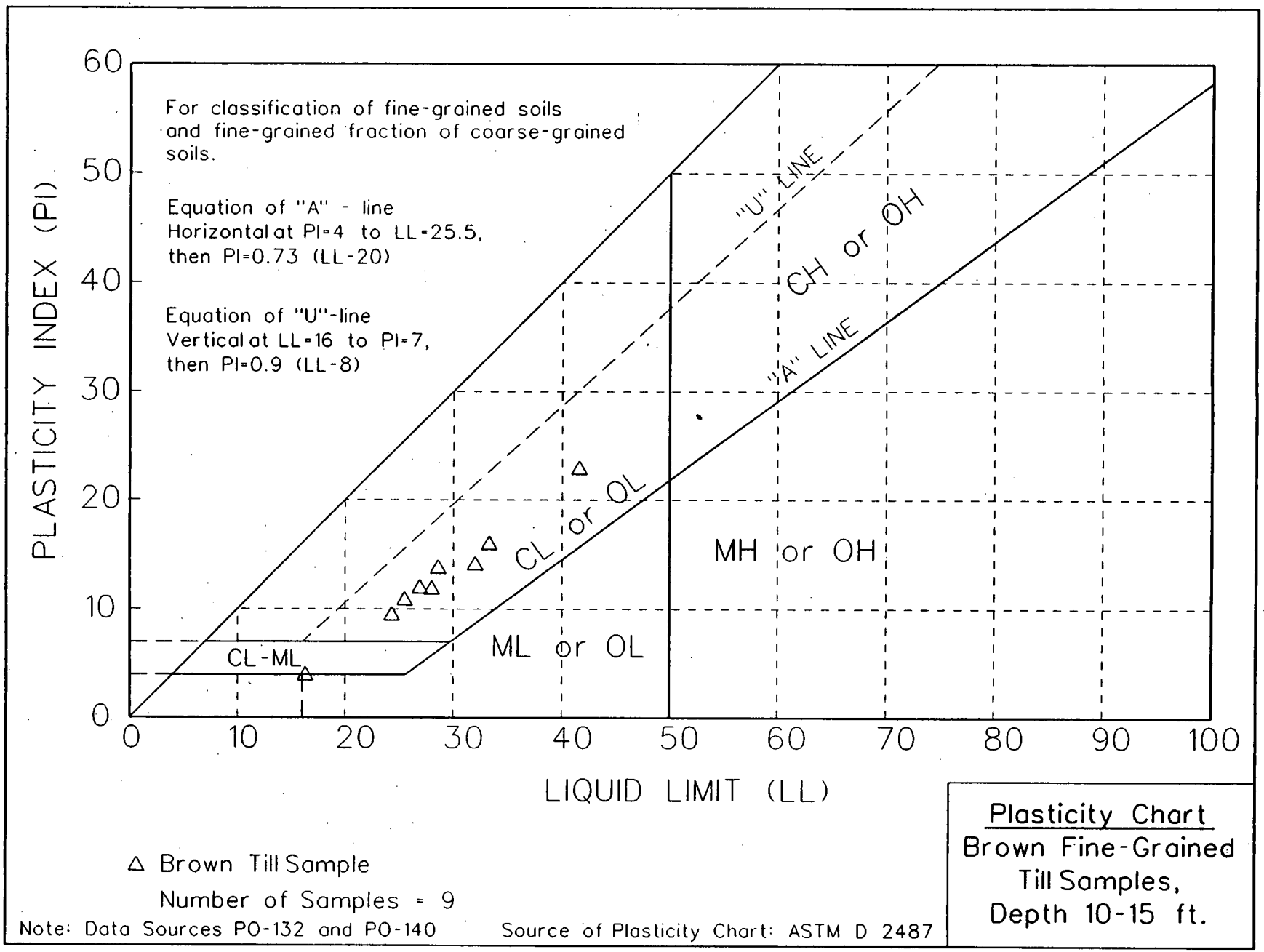

Figure 4-6 - Plasticity Chart, Brown Fine-Grained Till Samples, Depth 10 - 15 Feet

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Table 4-2 - Summary of Consolidation Parameters, FEMP Soils

General Stratum	USCS Classification	Sample Condition	Compression Index C_c	Recompression Index C_r	Initial Void Ratio e_o	Overconsolidation Ratio
Brown Till	CL	Undisturbed	0.057-0.141	0.014-0.038	0.359-0.563	1.7-3.5
Gray Till	CL	Undisturbed	0.050-0.139	0.010-0.028	0.233-0.490	<1-2.2
Brown Till	CL	Remolded to 95 percent Max. Dry Density	0.107-0.211	0.032-0.037	0.450-0.655	not applicable
Gray Till	CL	Remolded to 95 percent Max. Dry Density	0.096-0.112	0.007-0.010	0.404-0.444	not applicable
Brown Till	CL	Remolded to 85 percent Max. Dry Density	0.102-0.277	0.007-0.047	0.621-0.904	not applicable
Gray Till	CL	Remolded to 85 percent Max. Dry Density	0.128-0.164	0.016-0.018	0.561-0.608	not applicable

Data Sources: Phase II (PO-132), Phase III (PO-140), CSF (PO-20), Pre-Design Activities (PO-101) and H.C. Nutting Investigations

4.4 Summary of Soil Strength Parameters

Three types of laboratory strength tests of FEMP soils were conducted on cohesive soil samples from the proposed site. In general, these tests were:

1) Unconfined Compressive Strength (UCS) tests
2) Unconsolidated, Undrained (UU) triaxial compression tests
3) Consolidated, Undrained (CU) triaxial compression tests (with pore pressure measurements)

Each of the tests provides soil strength parameters that can be used in geotechnical analysis and design. The engineer or designer selects the appropriate test parameters to be used based on the loads, drainage conditions, and construction sequence for the particular analysis.

Table 4-3 provides a general summary of undrained shear strength from UCS tests of undisturbed samples collected and tested during the Phase II investigation. Appendix G, Table G-4A, summarizes unconfined compressive strength test data for individual samples.

Table 4-3 - Summary of Undrained Shear Strength from UCS Tests, FEMP Soils

General Stratum	USCS Classification	Undrained Shear Strength (psf)
Brown Till	CL	652-4458
Gray Till	CL	1974-4848

Data Source: Phase II Investigation (PO-132)

Table 4-4 provides a general summary of undrained shear strength from UU tests of samples collected during the Phase III and CSF investigations. Appendix G, Table G-4, summarizes individual test results for undisturbed samples. Appendix G, Table G-9, summarizes test results for remolded specimens.

Table 4-4 - Summary of Undrained Shear Strength from UU Triaxial Tests, FEMP Soils

General Stratum	USCS Classification	Undrained Shear Strength (psf)			
		Undisturbed at Field Moisture	Undisturbed Saturated	Remolded 95 percent Max. Dry Density	Remolded 85 percent Max. Dry Density
Brown Till	CL	2200-7660	513-8076	754-981	194-202
Gray Till	CL	1986-3600	1557-3090	647-864	188

Data Source: Phase III Investigation (PO-140) and CSF investigation (PO-20)

Table 4-5 provides a general summary of shear strength parameters from CU tests of samples collected during the Phase II, Phase III, and prior investigations. Table G-5 of Appendix G summarizes individual test results for undisturbed samples. Table G-10 summarizes individual test results for remolded specimens.

Table 4-5 - Summary of Strength Parameters from CU Triaxial Shear Tests, FEMP Soils

Soil Description	USCS Classification	Consolidated Undrained Shear Strength Parameters							
		Undisturbed Samples				Remolded Samples to 95 percent Max. Dry Density			
		Total		Effective		Total		Effective	
		c (psf)	ϕ (°)	c′ (psf)	ϕ' (°)	c (psf)	ϕ (°)	c′ (psf)	ϕ' (°)
Brown Till	CL	0-725	12-28	50-625	20-36	0-450	13-27	100-400	20-31
Brown Till	ML	0	25-32	0	35	-	-	-	-
Gray Till	CL	0-1125	16-26	0-575	27-44	0	19-22	0-100	32

Data sources: Phase II (PO-132), Phase III (PO-140), Engineering Evaluation for On-Site Disposal (H.C. Nutting), and Predesign Activities (PO-101) investigations

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4.5 Summary of Soil Compaction Properties

Standard compaction tests were performed on bulk samples collected during the Phase II and Phase III investigations. Samples were collected primarily in the brown till. A few compaction tests were performed on samples of the gray till. For presentation of the compaction test results, the brown till has been divided into three categories based upon 3-foot depth intervals below the topsoil. These approximate depths are:

1) 1.5 - 4.5 feet
2) 4.5 - 7.5 feet
3) 7.5 - 10.5 feet

Bulk soil samples were collected for compaction tests at various depth intervals within the brown till. The intervals sampled ranged from 2.7 to 4.5 feet in thickness. The midpoint of the sample interval was used to establish the appropriate depth category in which to present the compaction curve (i.e., either 1.5 - 4.5, 4.5 - 7.5, or 7.5 - 10.5 feet).

Compaction tests for the gray till were performed on bulk samples collected from depths of about 12 to 18 feet. Two compaction curves for topsoil collected from 0 to 1.5 feet depth are contained in Appendix I. Figures 4-7 through 4-10 present the family of compaction curves for the brown and gray CL samples. Figure 4-11 shows the compaction curves for brown CH Samples from about depths 1.5 to 7.5 feet. Table G-7 of Appendix G summarizes the index properties and results of the compaction tests. Table G-7A presents the results of a Modified Proctor Compaction test from prior investigation (PARSONS 1994a).

4.6 Summary of Soil Laboratory Permeability

This subsection summarizes the results of laboratory permeability tests on FEMP soils.

4.6.1 In Situ Permeability

Table 4-6 summarizes the vertical coefficient of permeability from testing of undisturbed clay samples at the geotechnical laboratory. Table 4-1 presents the coefficient of permeability within approximate 5-foot depth intervals within the brown till. Table G-6 presents the results of the laboratory permeability tests for individual samples.

Depth: 1.5-4.5 ft (See Note 2)

Description: Brown CL

Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc.

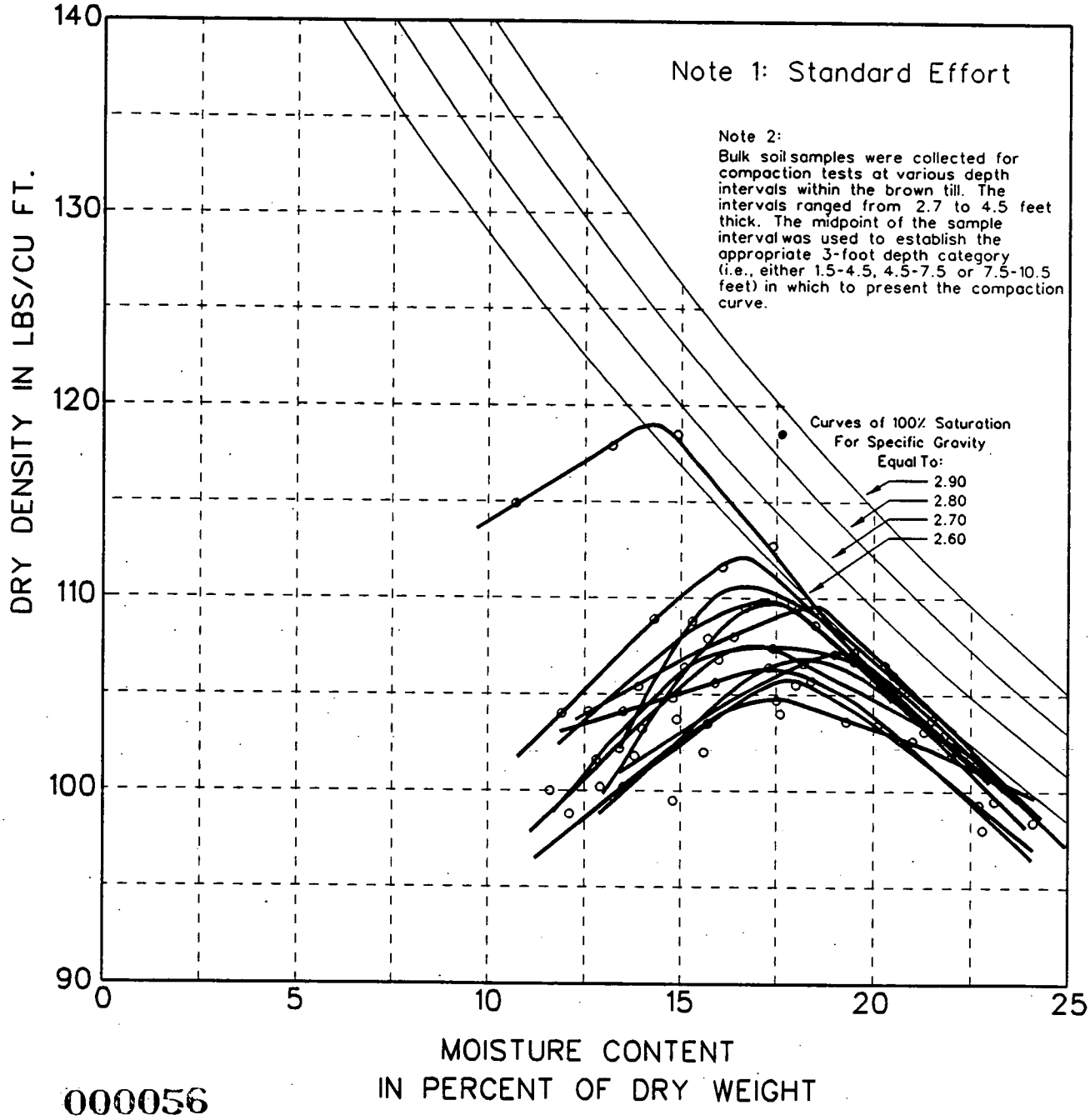

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Figure 4-7 - Summary of Standard Proctor Compaction Curves, Brown CL Bulk Samples, Depth 1.5 - 4.5 Feet

Depth: 4.5-7.5 ft (See Note 2)

Description: Brown CL

Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc.

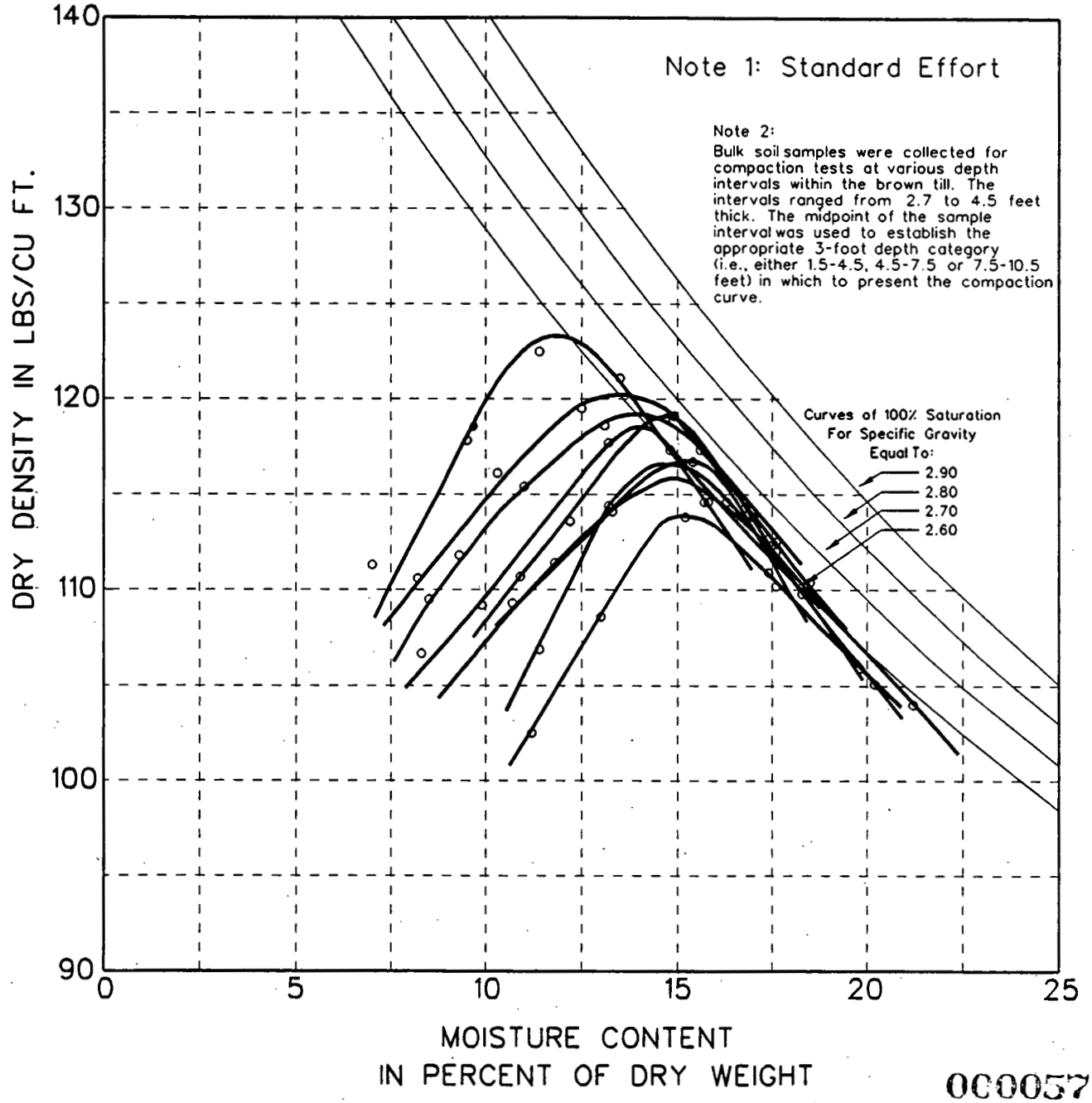

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Figure 4-8 - Summary of Standard Proctor Compaction Curves, Brown CL Bulk Samples, Depth 4.5 - 7.5 Feet

Depth: 7.5-10.5 ft (See Note 2)

Description: Brown CL

Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc.

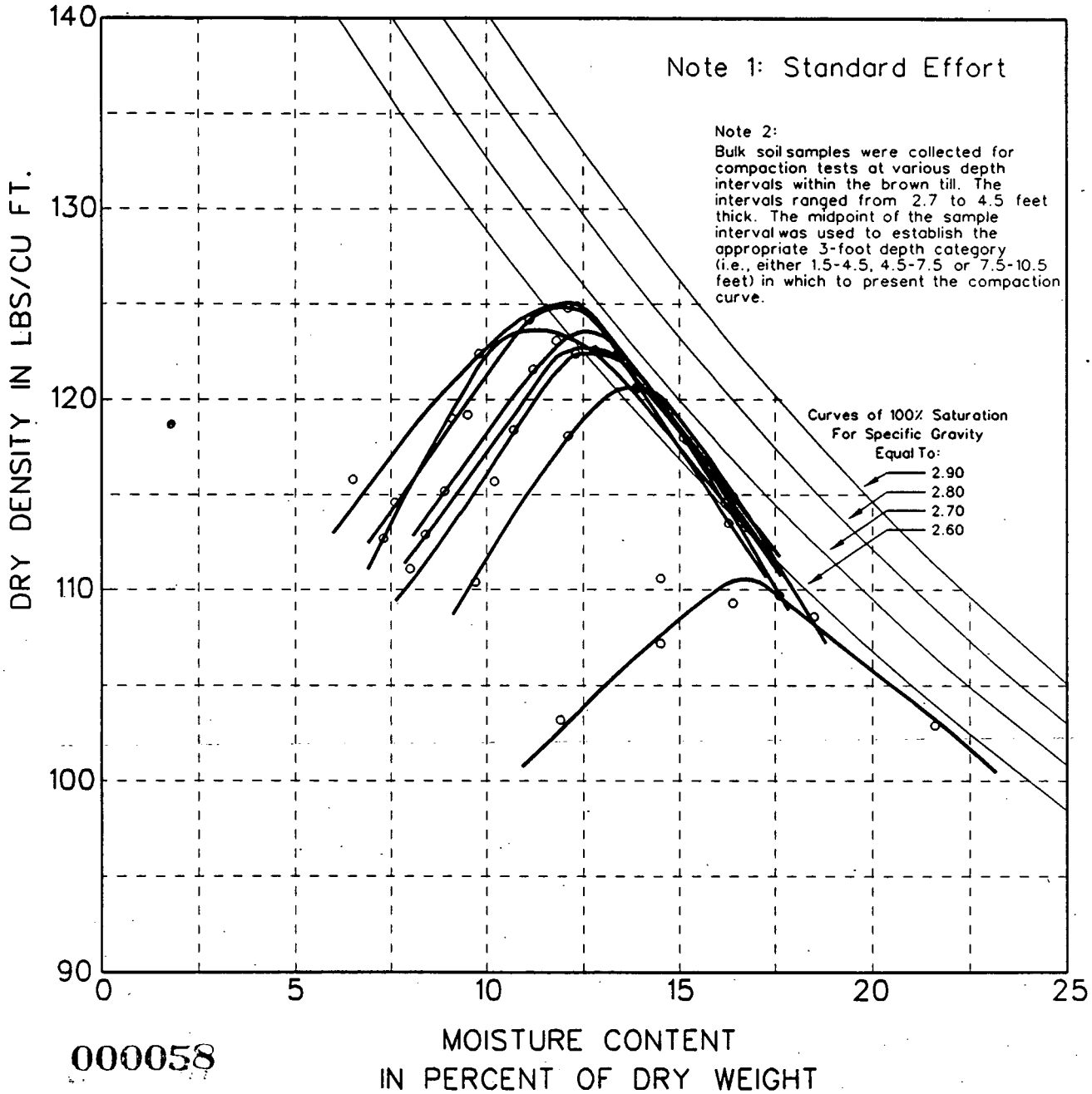

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Figure 4-9 - Summary of Standard Proctor Compaction Curves, Brown CL Bulk Samples, Depth 7.5 - 10.5 Feet

Depth: 12.0-18.5 ft

Description: Gray CL

Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc.

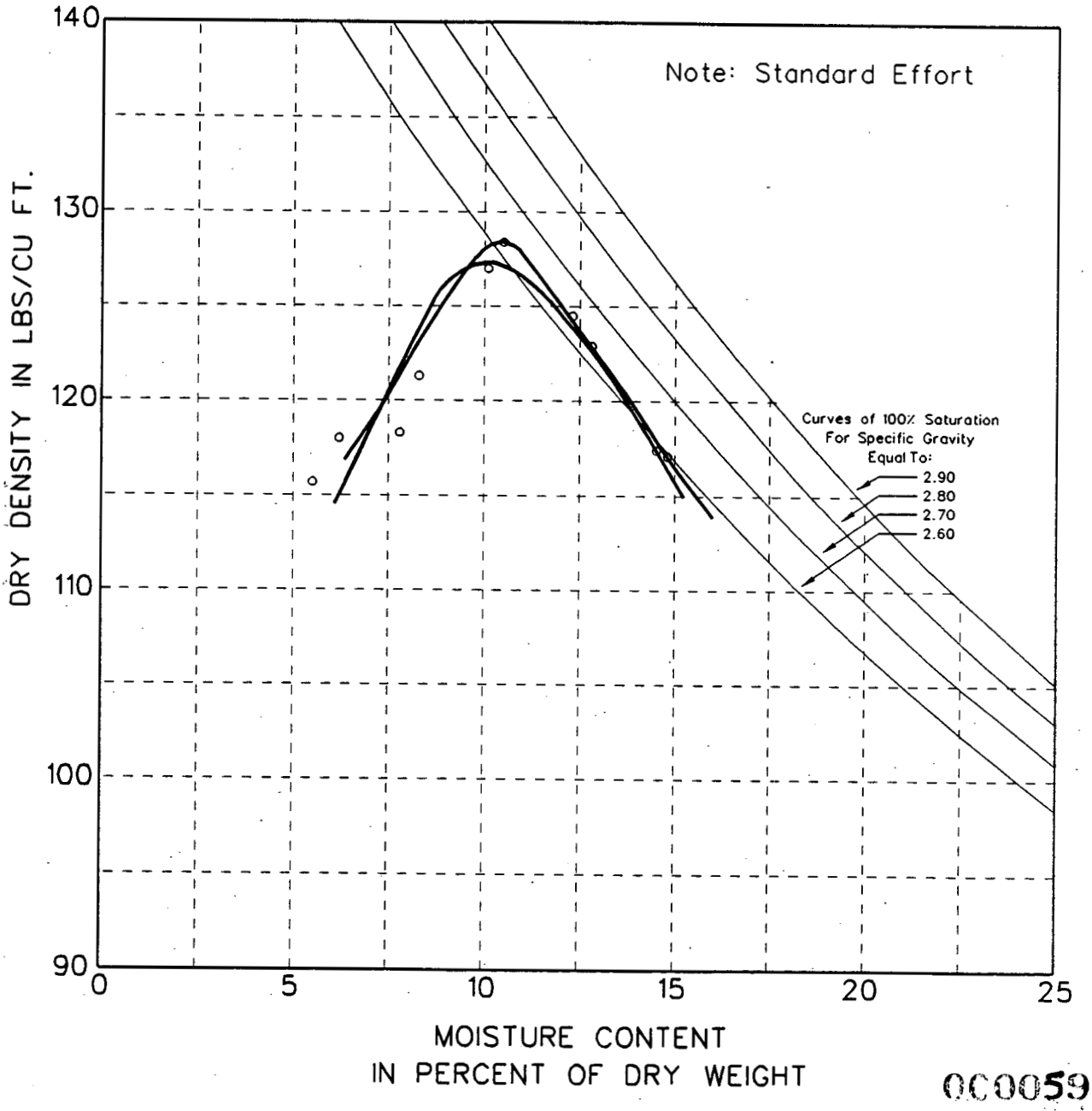

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Figure 4-10 - Summary of Standard Proctor Compaction Curves, Gray CL Bulk Samples, Depth 12 - 18.5 Feet

Depth: 1.5-7.5 ft

Description: Brown CH

Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc.

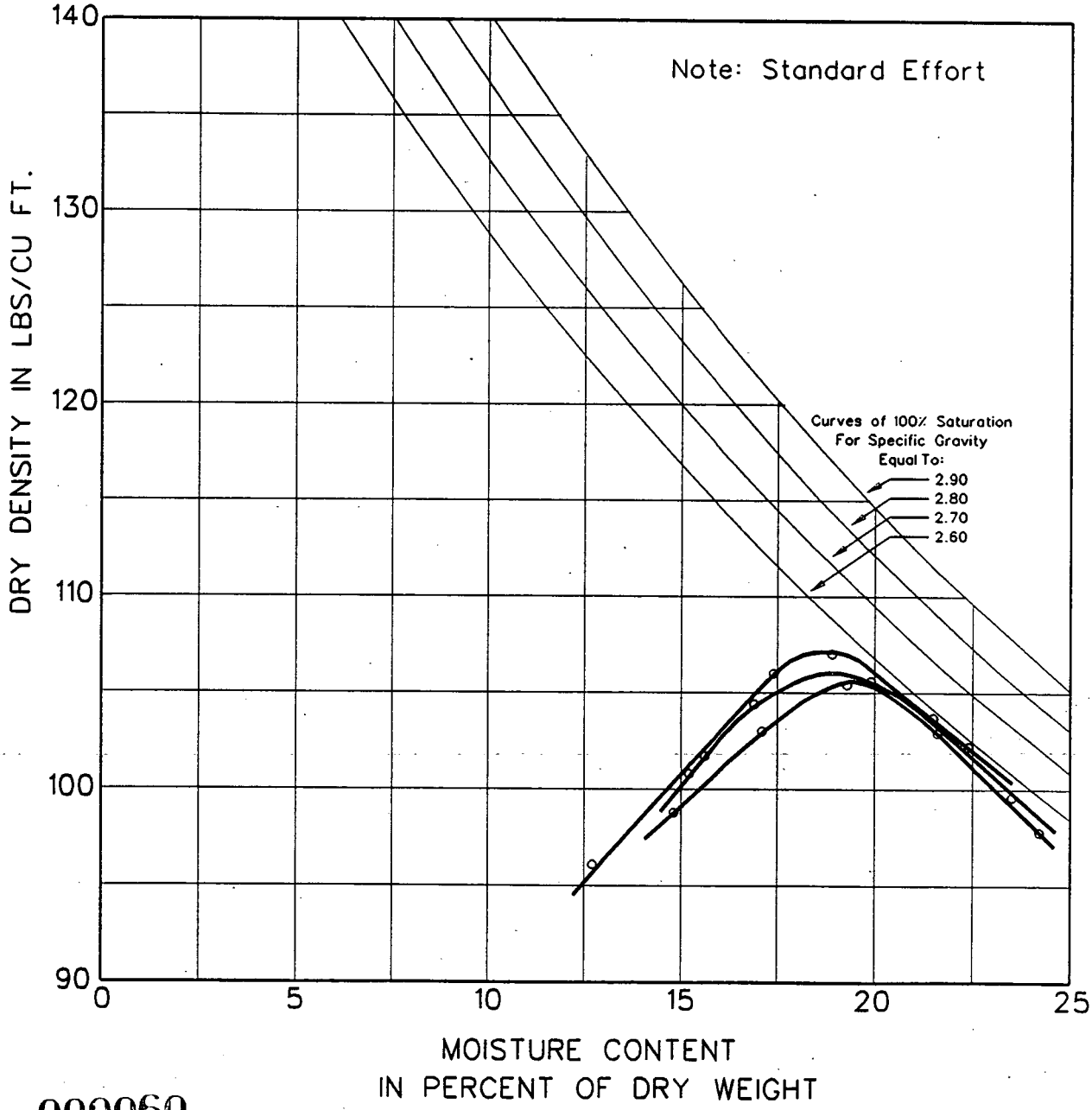

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Figure 4-11 - Summary of Standard Proctor Compaction Curves, Brown CH Bulk Samples, Depth 1.5 - 7.5 Feet

Table 4-6 - Summary of Coefficient of Permeability from Laboratory Tests of Undisturbed Samples, FEMP Clay

General Stratum	USCS Classification	Pre-Test Moisture Content (percent)	Pre-Test Dry Density (pcf)	Percent Saturation	Vertical Coefficient of Permeability (cm/sec)	Number of Tests
Brown Till	CL	11.3-22.1	103.0-125.1	80-100	9.0E-9 to 6.4E-6	15
Brown Till	CH	24.8	102.0	100	1.0E-8	1
Gray Till	CL	10.7-18.8	115.5-131.2	82-100	6.8E-9 to 8.4E-8	21

Data Source: Phase II (PO 132), Phase III (PO140), and Predesign Activities (PO-101) Investigations

4.6.2 Remolded Permeability

As part or the Phase II and Phase III investigations, laboratory permeability tests (ASTM D 5084) were performed on remolded test specimens of brown clay collected from within the proposed disposal facility footprint. The test specimens were remolded at the laboratory at target conditions of 95 percent of Standard MDD and wet of optimum, with a target of at or near 4 percent wet of optimum. Table 4-7 summarizes the results of these remolded permeability tests. Table G-11 of Appendix G provides data for the individual tests. Table G-7 provides a summary of index properties and compaction test results for the bulk samples that underwent remolded permeability testing.

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Table 4-7 - Summary of Coefficient of Permeability from Phase II and III Laboratory Tests of Remolded Samples, FEMP Clay

General Stratum	Sample Depth (feet)	USCS Class.	Natural Moisture Content (%)	Effective Confining Pressure	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Pre-Test Moisture Content (%)	Pre-Test Dry Density (pcf)	Percent Relative Compaction	Percent Wet of OMC	Remolded Coefficient of Permeability (cm/sec)	Number of Tests	Inv. Phase
Brown Till	1.5-5	CL	15.1-29.3	576 (4 psi)	14.3-19.2	104.8-119.0	18.1-23.2	100.0-112.6	94.4-96.2	2.8-4.0	3.4E-6 to 1.3E-8	12	III
Brown Till	2-7.5	CL	14.4-21.3	1440 (10 psi)	11.8-16.7	110.5-123.3	13.9-19.9	106.3-119.6	94.6-97.0	2.1-3.9	4.2E-8 to 1.0E-8	11	II
Brown Till	1.5-5	CH	20.9-21.0	576 (4 psi)	18.1-18.7	106.1-107.1	21.8-22.7	101.2-101.4	94.5-95.6	3.7-4.0	4.8E-8 to 2.6E-8	2	III
Brown Till	3.0-7.5	CH	24.9	1440 (10 psi)	19.3	105.6	22.6	101.4	96.0	3.3	2.5E-8	1	II

Data Source: Phase II (PO 132) and Phase III (PO 140) Investigations

Notes:

1. Optimum Moisture Content and Maximum Dry Density are from Standard Proctor Compaction Tests (ASTM D 698)
2. Coefficient of permeability is the average of the last four determinations from the laboratory permeability test
3. Percent Relative Compaction = (Pre-Test Dry Density/Maximum Dry Density) x 100

Phase II Remolded Permeability Tests

During the Phase II investigation, bulk samples of brown clay auger cutting were collected at the geotechnical test boring locations using 4-1/4 inch (inner diameter) hollow stem augers and sent to the ATT Geotechnical Laboratory for testing. The target sample depth for this investigation was approximately 5 feet. The clays augered to the surface for the bulk samples came from depth intervals of about 2 to 7.5 feet. Grain size and plasticity tests were performed on each bulk sample and to allow for classification. A standard compaction test (ASTM D 698) was performed on each bulk sample to establish the moisture-density relationship (compaction curve). Specimens for permeability testing were then remolded to a target condition of 95 percent of Standard MDD and wet of optimum, with a target of at or near 4 percent optimum based on the compaction curve. These target conditions were based on results of remolded permeability tests conducted in April and May 1994, described in *On-Site Disposal Cell Pre-Design Activities Engineering Supplemental Report* (PARSONS 1994b). Table 4-8 summarizes the results of these prior permeability tests. These tests were performed on a composite sample of brown and gray clay from 0 to 25 feet at boring G2-210, which is located approximately 600 feet south of the southern boundary of the proposed disposal facility foot print. Test specimens were remolded using standard effort at target water contents of optimum, +2 percent wet of OMC, and +5 percent wet of OMC. These test data, though not conclusive, indicated that for samples remolded to densities corresponding to a standard compaction curve, the laboratory permeability (k) decreases from the 10^{-6} to 10^{-5} range at approximately optimum moisture content to an approximate 10^{-8} to 10^{-7} range at 5 percent wet of optimum (PARSONS 1994b). These tests were performed at an effective confining pressure of 720 psf (5 pounds per square inch [psi]) which approximately simulates the confining pressure at the top of the compacted clay layer of the proposed cap.

The Phase II investigation permeability tests concerned the preliminary evaluation of the permeability of compacted clays within the proposed footprint for use as compacted clay basal liner and berm materials. To evaluate the permeability of the compacted native clays for use in a compacted clay liner beneath the proposed facility, an effective confining pressure of 1,440 psf (10 psi) was chosen to simulate the typical overburden pressure acting upon the compacted liner due to the weight of the disposal facility structure above. Table 4-7 summarizes the results of Phase II permeability tests. The laboratory coefficients of permeability for the brown low plasticity clay (CL) tested ranged from 4.2×10^{-8} to 1.0×10^{-8} cm/sec for test specimens remolded at 94.6 to 97.0 percent of the Standard MDD and 2.1 to 3.9 wet of OMC.

Phase III Remolded Permeability Tests

During the Phase III investigation, bulk samples of brown clay auger cuttings were collected at the shallow test boring locations using a 4-inch (outer diameter) auger powered by a hydraulic, hand-operated motor. The samples were sent to the ATT Geotechnical Laboratory for testing. The clays augered to the surface for the bulk samples came from depth intervals of 1.5 to 5 feet. Grain size and plasticity tests were

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Table 4-8 - Summary of Prior Laboratory Permeability Results for Test Specimens Compacted Using Standard Proctor Compactive Effort

Boring No./Sample No.	Depth (feet)	Specimen[1] Identification	Effective Confining Pressure (psf)	Specimen Preparation[2]	Pre-Test Moisture Content (%)	Pre-Test Dry Density (pcf)	Percent Relative Compaction[6]	Percent Wet of OMC	Coefficient of Permeability (cm/sec)[5]
G2-210/Bulk	0-25	bulk	1440 (10 psi)	Compacted to 95% Standard Proctor max. dry density	11.8	116.5	95.3	-0.6	2.2×10^{-6}
G2-210/Bulk	0-25	120 pcf @ 12.4%	720 (5 psi)	Compacted at or near optimum moisture content[3] and dry density within a band about ± 4 pcf from compaction curve dry density	12.0	120.0	98.1	-0.4	1.9×10^{-6}
G2-210/Bulk	0-25	118 pcf @ 14.4%	720 (5 psi)	Compacted 2% wet of optimum moisture content[4] and dry density within a band about ± 4 pcf from compaction curve dry density	13.8	118.0	96.5	1.4	6.5×10^{-6}
G2-210/Bulk	0-25	112 pcf @ 17.4%	720 (5psi)	Compacted 5% wet of optimum moisture content[4] and dry density within a band about ± 4 pcf from compaction curve dry density	16.9	113.5	92.8	4.5	3.6×10^{-8}

Notes:

(1) Soil description and classification: Brown and gray Lean Clay with Sand (CL)

(2) Standard Proctor compaction data: Sample G2-210/Bulk: maximum dry density = 122.3 pcf, optimum moisture content = 12.4%

(3) Tolerance for moisture content: -0.5%, +1.5%

(4) Tolerance for moisture content: ±1.0%

(5) Average of last four coefficient of permeability determinations from the laboratory test

(6) Percent Relative Compaction = (Pre-Test Dry Density/Maximum Dry Density) x 100

performed on each bulk sample and to allow for classification. A standard compaction test (ASTM D 698) was performed on each bulk sample to establish the moisture-density relationship (compaction curve) for the sample. Specimens for permeability testing were then remolded to a target condition of 95 percent of Standard MDD and wet of optimum, with a target at or near 4 percent wet of optimum based on the compaction curve.

The Phase III investigation permeability tests concerned the preliminary evaluation of the permeability of the on-site clays for use as compacted clay in the proposed cap. The brown clay samples tested were collected from locations within the proposed footprint. The clays within the footprint were assumed to be similar to other potential nearby borrow sources (i.e., the proposed borrow area to the south of the proposed footprint). An effective confining pressure of 576 psf (4 psi) was chosen to allow for evaluation of the sensitivity of the coefficient of permeability to confining pressure.

Table 4-7 summarizes the results of Phase III permeability tests. The laboratory coefficients of permeability for the brown low plasticity clay (CL) tested ranged from 3.4×10^{-6} to 1.3×10^{-8} cm/sec for test specimens remolded at 94.4 to 96.2 percent of the Standard MDD and 2.8 to 4.0 percent wet of OMC.

Remolded specimens from five of 12 tests of the Brown CL collected from 1.5 to 5 feet during the Phase III investigation had laboratory coefficients of permeability greater than 1×10^{-7} cm/sec. For these five tests the percent relative compaction based on standard compaction tests ranged from 95.0 to 95.5 percent, and the test specimens were remolded 3.6 to 3.9 percent wet of optimum.

The higher permeability of the Phase III remolded may be attributed to the characteristics of the low-plasticity clays. From Table 4-7 it can be seen that the clays tested in Phase II had slightly different compaction characteristics than those tested in Phase III. The MDD from standard compaction tests of the clay tested during Phase III was about 4 to 5 pcf less than the clays tested during Phase II. This may be attributed to brown clay variability with sample depth (i.e., the Phase III samples came from an interval of about 1.5 to 5 feet, and the Phase II samples came from depths of about 2 to 7.5 feet [see Subsection 4.1]). Thus, the specimens from Phase II were tested at slightly higher densities. Preliminary remolded permeability tests on a composite sample (0 to 25 feet) of brown and gray till from boring G2-209 (about 700 feet south of the footprint) provide some insight into the permeability characteristics of the clay remolded to higher densities. Table 4-9 presents the coefficients of permeability of the composite sandy clay sample (G2-209/Bulk) remolded at densities based on a Modified Proctor compaction test (PARSONS 1994b).

Additionally, due to these differences in compaction characteristics and confining pressures between the clay samples tested in the Phase II and the Phase III programs, conclusions regarding the sensitivity of the coefficient of permeability to confining pressure are uncertain. Additional testing described below will provide additional data for this evaluation.

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Table 4-9 - Summary of Prior Laboratory Permeability Results for Test Specimens Compacted Using Modified Proctor Compactive Effort

Boring No./Sample No.	Depth (feet)	Specimen[1][2]	Effective Confining Pressure (psf)	Specimen Preparation[3]	Pre-Test Moisture Content (%)	Pre-Test Dry Density (pcf)	Percent Relative Compaction[7]	Percent Wet of OMC	Coefficient of Permeability (cm/sec)[6]
G2-209/Bulk	0-25	3 at OMC	720 (5 psi)	Compacted at or near optimum moisture content[4] and dry density within a band about ± 4 pcf from compaction curve dry density	10.0	131.8	98.7	-0.3	2.5×10^{-8}
G2-209/Bulk	0-25	4 +2% OMC	720 (5 psi)	Compacted 2% wet of optimum moisture content[5] and dry density within a band about ± 4 pcf from compaction curve dry density	12.1	128.4	96.1	1.8	8.3×10^{-9}
G2-209/Bulk	0-25	5 @ +5% OMC	720 (5psi)	Compacted 5% wet of optimum moisture content[5] and dry density within a band about ± 4 pcf from compaction curve dry density	14.9	120.9	90.5	4.6	1.9×10^{-8}

Notes:

(1) Soil description and classification: Brown and gray Sandy Lean Clay (CL)

(2) Standard Proctor compaction data: Sample G2-209/Bulk: maximum dry density = 122.3 pcf, optimum moisture content = 12.3%

(3) Modified Proctor compaction data: Sample G2-209/Bulk: maximum dry density = 133.6 pcf, optimum moisture content = 10.3%

(4) Tolerance for moisture content: -0.5%, +1.5%

(5) Tolerance for moisture content: ±1.0%

(6) Average of last four coefficient of permeability determinations from the laboratory permeability test

(7) Percent Relative Compaction = (Pre-Test Dry Density/Maximum Dry Density) x 100

Recommendations for Additional Testing

The following general recommendations are suggested to provide additional data to evaluate the permeability of remolded on-site clays:

1) Test materials from proposed locations and depths of on-site clay borrow materials

2) Evaluate the laboratory coefficient of permeability of proposed on-site clay borrow materials over a range of densities, moisture contents, and confining pressures. Staged permeability tests performed on the same specimen at confining pressures of 2 and 5 psi are suggested to allow for evaluation of the effect of confining pressure on the coefficient of permeability, and to allow for correlation of laboratory permeability test results with field scale permeability tests at a test pad.

3) Based on results of laboratory permeability tests, construct a field scale test pad and perform field permeability tests

4.7 Soil to Geosynthetic Friction Summary

Scoping soil to geosynthetic, and geosynthetic to geosynthetic tests were performed at ATT to provide parameters for preliminary interface stability analysis. Three large-scale interface, direct shear tests (ASTM D 5321) were performed. The results of these tests are contained in Appendix J. Figure 4-12 illustrates the general test configurations for this series of tests. The general test configurations for the three tests were based on providing friction parameters of preliminary stability analysis of critical layers within the layered conceptual cap section shown in Figure 2-2. Table 4-10 summarizes the test configurations for each series.

The laboratory testing conditions and materials tested were chosen to simulate worst-case field conditions. This strategy was used in order to establish a lower bound for the range of strength parameters that can be expected from the candidate materials and their interfaces with the other materials. Using the measured shear strength values determined in this stage of testing and the proposed configuration of the disposal facility, the requirements for further testing of candidate materials was established (see Section 6.4.3).

The flexible membrane liner (FML) chosen for testing was a 60-mil thick, non-textured, HDPE liner manufactured by Gundle Lining Systems, Inc. The GCL chosen for testing was a Gundle Gundseal HD 20, which consists of an FML coated on one side with a layer of bentonite. The geotextile used was a 10 ounce per square yard, non-woven, needlepunched fabric manufactured by Nicolon and designated as Nicolon S1000.

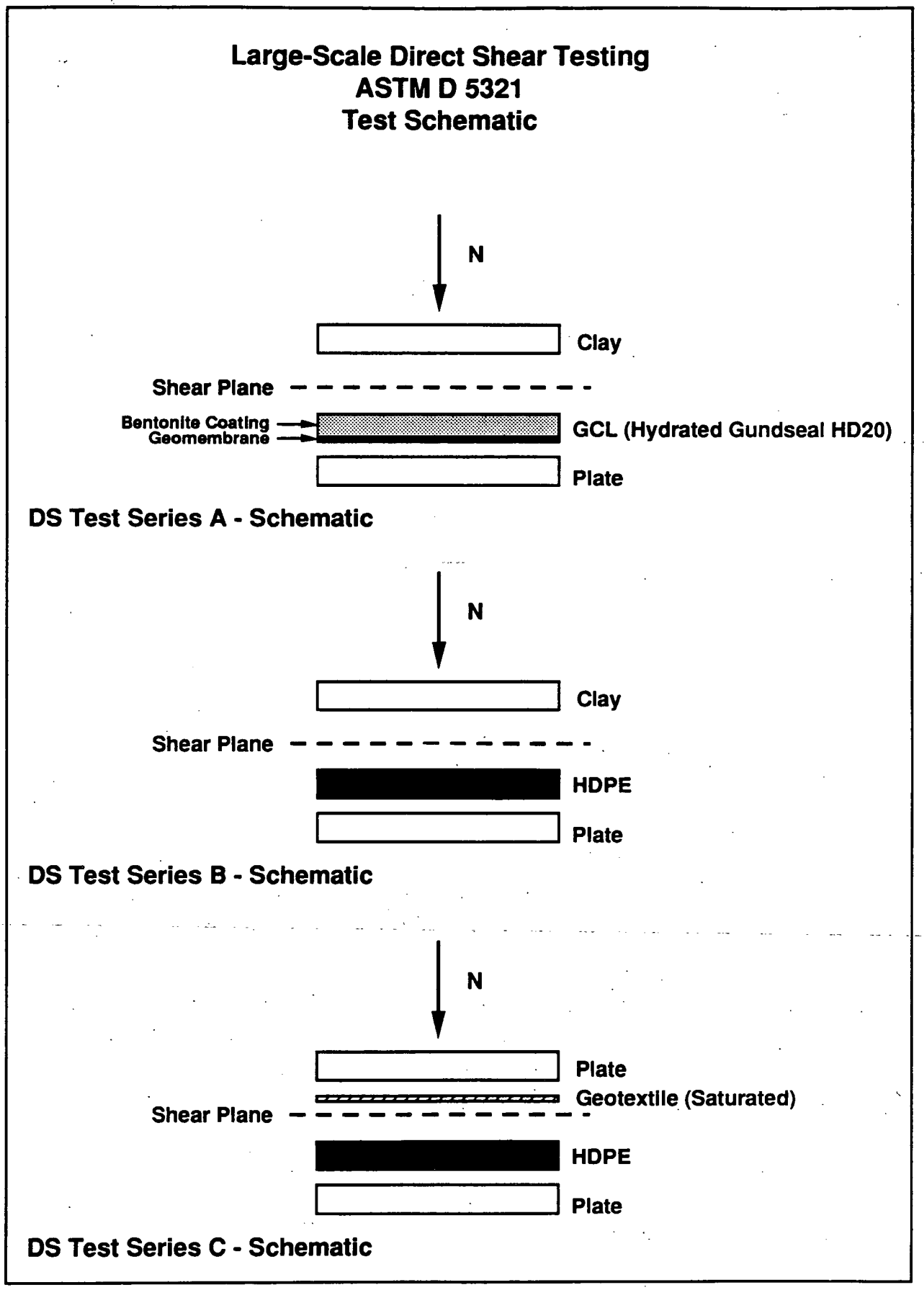

Figure 4-12 - Large-Scale Direct Shear Testing, ASTM D 5321 Test Schematic

All shear tests were performed under saturated conditions. All shear tests involving the GCL were performed after hydration and consolidation for 2 hours under a normal load of 360 psf, which represents approximately 3 feet of overburden soils. It should be noted that actual field conditions are unlikely to result in a complete saturation of the GCL layers. In addition, consolidation pressures for the cover system GCL will be caused by an overburden thickness of approximately 6.75 feet. The liner system GCLs will be subjected to overburden loads up to an equivalent of approximately 50 feet of soil. It is recommended that additional testing, to more closely simulate field behavior, and geosynthetics to be used in the design, be performed in conjunction with design. These conditions should include simulation of long term loading at low rates of strain. Documented friction angles for textured FML/geotextile interfaces tested under expected conditions for the proposed disposal cell range from 15 to 33 degrees (Sharma and Lewis 1994).

Table 4-11 summarizes the results of the large-scale interface, direct shear tests. For all tests incorporating geosynthetics, flat plates were used as the supporting surface, thus the normal loading does not simulate overburden deformation characteristics. Of particular note in Test Series A by the laboratory is the fact that the bentonite gel was fully exposed to the clay surface during shearing. Bentonite was observed to adhere to the surface of the clay immediately after shearing. This contributed to a low peak/residual friction angle against the clay at these low normal loads and may actually reflect shear within the bentonite immediately below the interface.

4.8 Summary of Soil Bearing Parameters (Road Design)

CBR and R-Value test results from the Phase III investigation are summarized in Appendix G, Tables G-12 and G-13, respectively.

4.9 Summary of Aggregate and Riprap Properties

A limited amount of riprap and aggregate testing was performed during the Phase III investigation, on limestone stockpiled at the FEMP. These tests were bulk specific gravity and soundness tests. Appendix G, Table G-16, presents the sampling locations and the results of these tests. Additional rock testing is planned for an off-site borrow study.

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Table 4-10 - Summary of Large-Scale Direct Shear Test Configurations

Direct Shear Test Series	Type of Interface	Material on Top	Material on Bottom	Normal Load (3-point test)	Hydrating Conditions	Shear Rate	Other Test Conditions
A	GCL to Compacted Clay	FEMP Brown Compacted Clay (CL) (1.5-5 feet), 95 percent Standard MDD, +2 percent wet of OMC	GCL - Gundle Gundseal HD 20	360, 720, 1440 psf	Free swell under 360 psf for 24 hours	0.04 in/min	Consolidation for 2 hours under 360 psf for each point before shear
B	HDPE Geomembrane to Compacted Clay	FEMP Brown Compacted Clay (CL) (1.5-5 feet), 95 percent Standard MDD, +2 percent wet of OMC	HDPE Geomembrane, smooth - 60 mil thickness	360, 720, 1440 psf	N/A	0.04 in/min	-
C	Geotextile to HDPE Geomembrane	Non-Woven Geotextile, 10oz/yd^2	HDPE Geomembrane, smooth - 60 mil thickness	360, 720, 1440 psf	N/A	0.2 in/min	Saturated interface

Table 4-11 - Interface Direct Shear Results

Test Series Number	Normal Stress Range (psf)	Peak Strength		Residual Strength	
		Friction Angle (δ)	Adhesion (psf)	Fiction Angle (δ)	Adhesion (psf)
DS Series A	360-1440	5.4	0.5	5.4	0.5
DS Series B	360-1440	13.1	126	10.3	88
DS Series C	360-1440	10.1	8.0	8.4	7.5

Notes:

1. The adhesion value may not be the "true adhesion" of the interface
2. DS Series A contained a fully hydrated Gundseal HD GCL
3. DS Series C was run with a saturated geotextile/HDPE Geomembrane interface

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SECTION 5

EVALUATION AND ANALYSIS

This section describes the engineering evaluations and analyses performed to support the disposal facility design recommendations found in Section 6. The evaluations and analyses are based on site-specific data from the geotechnical investigations described previously, and on supplemental technical data and methodologies, as required, from engineering literature.

5.1 Site Materials Evaluation

This section provides a preliminary evaluation of site materials for use in construction of the proposed facility. Additional data for this evaluation will come from a Borrow Study currently being undertaken by FERMCO.

5.1.1 Compacted Fills

The source of the select borrow material for the Disposal Facility compacted clay liners has not yet been established. An on-site borrow study by FERMCO will provide data to assess the use of on-site clay materials from proposed borrow areas for use in low-permeability liner and cap layers. Design recommendations of use of FEMP soils for select liner and cap materials should be based on the results of these planned field and laboratory testing activities.

Permeability Characteristics

Laboratory permeability testing of remolded test specimens during the Phase II and Phase III investigations provides insight into the expected behavior of recompacted brown clayey tills underlying the disposal facility footprint (see Subsection 4.6.2). In general, the predominant clay material in the Brown Till stratum is a low-plasticity clay, classified CL per USCS, ranging from a lean clay to a sandy lean clay. High-plasticity, or fat, clay (CH) was also encountered at some borehole locations, within the brown till, generally at shallow depths. Laboratory plasticity tests of the brown CL material suggest that the PI and LL decrease with increasing depth within the brown till stratum (i.e., the material has lower plasticity with depth [See Figures 4-4 through 4-6]).

Subsection 4.6.2 provides the details of laboratory permeability tests performed on remolded specimens of clay. In general, the density of the CL material that can be achieved using a standard compactive effort increases with depth within the brown till stratum (see Figures 4-7 through 4-10). This increase in density is probably a contributing factor to the lower coefficients of permeability of remolded CL samples from deeper in the brown till stratum. Additionally due to the difference in compaction

characteristics and confining pressures between clay samples tested in the Phase II and Phase III programs, conclusions regarding the sensitivity of the coefficient of permeability to confining pressure are uncertain. It is recommended that the laboratory coefficient of permeability of proposed on-site clay borrow material be evaluated over a range of densities, moisture contents, and confining pressures (see Subsection 4.6.2). These additional tests to be conducted during the on-site Borrow Study will provide additional data for evaluation of the permeability characteristics of the recompacted clay.

In situ soils have moisture contents very near complete saturation, exceeding 95 percent in almost all cases and being 100 percent in more than half the samples. The in situ moisture contents generally range from optimum to 5 percent wet of optimum moisture for standard effort compaction. These existing soil moistures are conducive to clay liner placement. The ability to obtain 95 percent compaction at a higher moisture content by additional compactive effort needs to be field verified. The extent of this additional compactive effort, the permeability at selected moistures and compaction, and the feasibility of obtaining all this is usually determined by the field test pads.

Compaction Characteristics

The compaction characteristics of the till are a potential concern. The compaction curves are relatively steep on the wet side of optimum moisture. This suggests that for a target moisture content at 4 percent wet of optimum, the average density is less than 95 percent of the maximum using Standard Proctor compactive effort.

Since the strength is sensitive to disturbance and recompaction, it appears that required compaction should be held to 95 percent Standard Proctor, minimum. Also, for hydraulic conductivity, 95 percent Standard Proctor compaction may be required as a minimum.

5.1.2 Topsoil and Organic Content

In the grassy field at the proposed facility site, the majority of the visible vegetative root system and associated organic matter were encountered in the top 12 inches of soil. Fine rootlets were encountered at the grassy disposal facility site to depths of approximately 3 feet below the ground surface. In isolated areas, hair rootlets, having diameters of approximately 1/32 inches, were discovered at depths up to 5 feet below the ground surface.

Organics comprise 4 to 8 percent of the soil in the uppermost 6 inches for about 70 percent of the areas sampled, dropping to 2.5 to 3 percent below 6 inches depth. In the other 30 percent of the areas sampled, organic contents of 4.5 to 5 percent extended to depths of 18 inches. Typically, from review of various classification charts, classification systems for organic soils consider the material to be an organic soil (verses, a mineral, or inorganic soil) if the organic content is more than about 20 to 30 percent (Fang 1991). Thus the FEMP topsoil, in general, may be considered an inorganic topsoil with organic content.

Because the majority of the organic materials visually encountered in the test boring at the proposed site consisted predominantly of fine hair roots of grass and tree root less the 1/4-inch in diameter, these materials are normally not considered sufficiently detrimental to justify wasting material containing minor amounts of these materials (USBR 1974).

An average stripped depth of 12 inches should be sufficient to provide either suitable base for engineered fill or to expose borrow material to be used as liner compacted clay road fill, or other compacted fill (provided that permeability criteria can be met). Standard construction practice also includes stockpiling of topsoil for later use in revegetating disturbed areas.

5.1.3 Potentially Unsuitable Fill and Rubble

Fill materials were encountered in G2-SB-17, consisting of very stiff, moist clayey silt, with brick fragments, wire, and metal fragments. The hand-dug excavation was 2 feet deep and remained in fill materials throughout the entire interval. These fill materials were very stiff and moist. Although the soil materials encountered would be suitable for re-use as fill material, the overall rubble nature of the materials would require that they be cleaned and made free of such things as wire and metal fragments.

Boring 11475 encountered several feet of materials that had organic characteristics. These organic materials were observed in samples retrieved from depths of about 10 feet. Such deposits would need to be removed and are considered unsuitable for use in the proposed disposal facility design.

5.1.4 Excavation and Construction Operations

Excavation operations for the disposal facility should not prove unusually difficult, provided that schedules do not necessitate work during the winter. However, considerable care and effort may be required to suitably segregate and stockpile differing materials for later re-use. Recommendations for handling, stockpiling, and protecting excavated materials are discussed elsewhere herein.

Pockets and lenses of sand or gravel, many times combined with perched or trapped water, were encountered during exploration and should be anticipated during construction.

Till Strength

The site's predominantly silty clay glacial till materials are moderately stiff to very stiff and possess good in situ shear strength. However, the clays are relatively sensitive to weathering and tend to soften and become slippery and difficult to handle after wetting. Triaxial compression strengths of remolded samples, compacted to 95 percent density, at moisture contents wet of optimum, showed strength parameter reduction compared to in situ strengths. Samples compacted to only 85 percent density at optimum moisture showed a greater reduction in strength.

5.2 Bearing Capacity

The allowable bearing capacity of the disposal facility subsurface soils was determined to be 40,800 psf if the water table remains within the Great Miami Aquifer, or 23,500 psf if the water table is perched at a depth of 15 feet below the ground surface. This bearing capacity assumes that the entire width of the facility will behave as a large mat foundation. Consideration should be given to smaller areas (e.g., a 1-year cell, shallow footing, etc.). The allowable bearing capacity was calculated using a safety factor of 3. A cohesion value of 250 psf and an internal friction angle of 19 degrees, which are the average total shear strength parameters, were used in calculating the allowable bearing capacity of the glacial tills below the disposal facility. Other factors that were assumed for the allowable bearing capacity determination were a glacial till moist unit weight of 135.7 pounds per cubic foot, a disposal facility base depth of 5 feet below the existing ground surface, and a disposal facility base that would behave similarly to a large mat foundation.

The non-uniform load produced by the On-Site Disposal Facility due to its sloping sides and gradually sloping top was converted to an average uniform load of 5,200 psf. The average uniform load was calculated by simplifying the cross section of the disposal facility to a trapezoid, a uniform load bounded on both sides with a linearly decreasing load having a slope of 5H:1V. The linearly decreasing loads on each end of the trapezoid were further simplified by replacing them with equivalent uniform loads. The average uniform load was then determined by using the weighted average of the two uniform side loads and the uniform middle load.

Recommendations regarding bearing capacity are found in Subsection 6.2.

5.3 Settlement

This section provides an evaluation of the consolidation settlement of soils underlying the disposal facility, as well as settlement of the disposal facility earthen structure and wastes. The rate of consolidation is also evaluated. Figure 5-1 provides a graphical summary of estimated settlements for the proposed disposal facility. Recommendations regarding settlement are found in Subsection 6.3.

5.3.1 Settlement of the Underlying Soils

Settlement predictions of soils underlying the proposed disposal facility were performed at eight locations across the proposed site using data presented in Table 5-1. Four cross sections were evaluated along the north-south axis of the proposed facility. Settlement predictions were performed at the center and edge of the facility along each cross section. Determining the settlement at these locations allows the determination of differential settlement along the length of the center and edge of the facility and across the width of the facility, as well as maximum differential settlement over the entire facility.

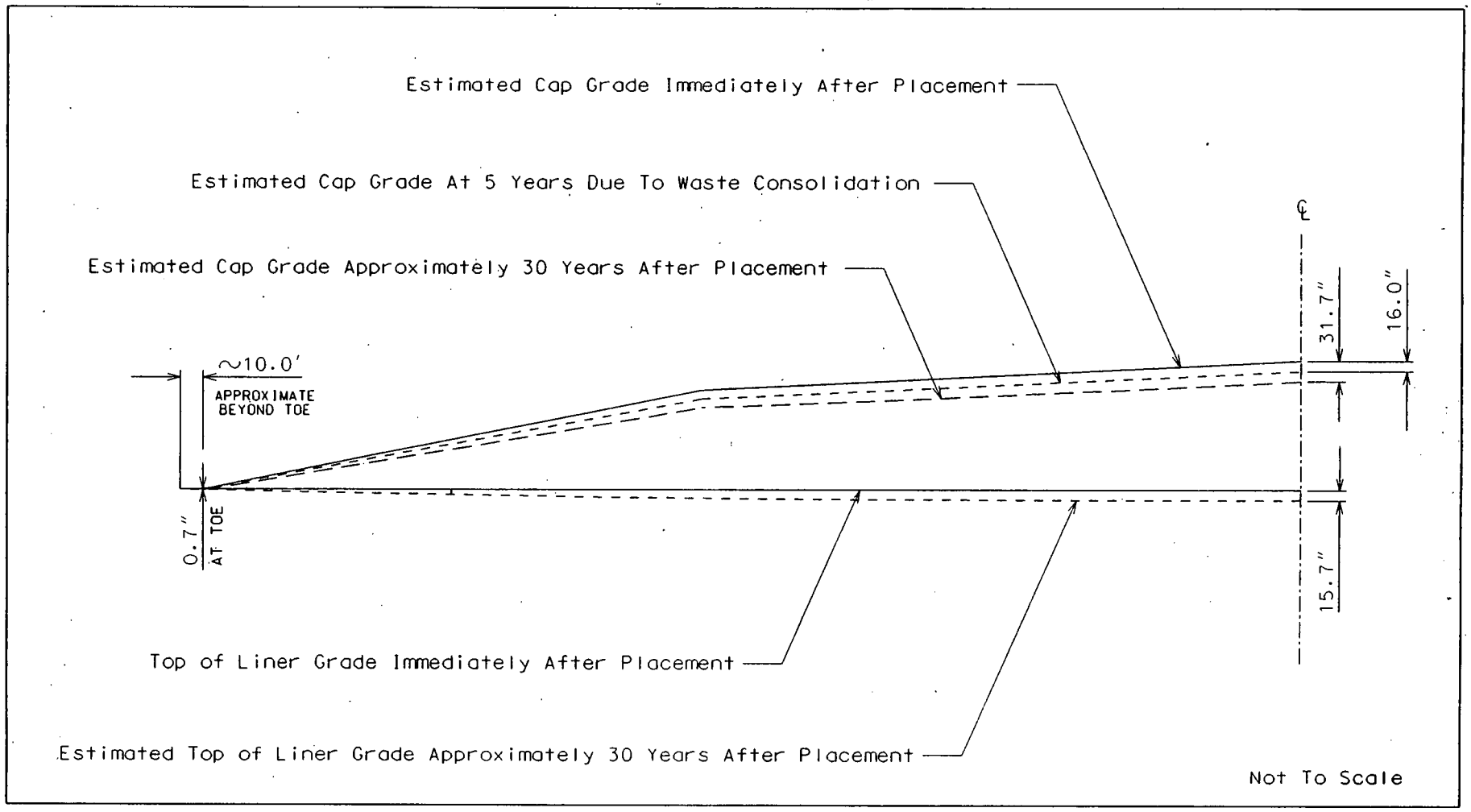

Figure 5-1 - Summary of Proposed Disposal Facility Estimated Settlements Based on Instantaneous Loading

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Table 5-1 - Input Data for Settlement Analysis of Foundation Soils

Cross-Section No.	Depth (ft)	General Soil Description	Compression Index, C_c	Recompression Index, C_r	Initial Void Ratio, e_o	Preconsolidation Pressure, σ_p (psf)	Overconsolidation Ratio, OCR
2	2.0-5.0	Clay Liner	0.2038	0.0348	0.6450	---	---
2	5.0-11.8	Brown Till	0.088	0.017	0.3682	3980	3.2
2	11.8-15.0	Gray Till	0.070	0.015	0.2811	2510	1.7
2	15.0-17.5	Gray Till	0.077	0.016	0.380	2344	1.0
2	17.5-25.0	Gray Till	0.101	0.0134	0.3804	5500	2.15
2	25.0-56.0	Gray Till	0.057	0.005	0.2333	6310	1.8
3	2.0-5.0	Clay Liner	0.2038	0.0348	0.6450	---	---
3	5.0-9.5	Brown Till	0.070	0.019	0.280	2649	2.3
3	9.5-11.6	Brown Till	0.066	0.010	0.400	1445	1.0
3	11.6-17.0	Gray Till	0.114	0.016	0.490	2089	1.0
3	17.0-20.0	Gray Till	0.050	0.010	0.280	2455	1.0
3	20.0-38.0	Gray Till	0.062	0.016	0.3517	6918	1.4
4	2.0-5.0	Clay Liner	0.2038	0.0348	0.6450	---	---
4	5.0-14.0	Brown Till	0.0925	0.0213	0.4313	3357	3.3
4	14.0-18.0	Gray Till	0.07	0.013	0.350	2630	1.3
4	18.0-20.0	Gray Till	0.099	0.018	0.4004	5234	2.0
4	20.0-30.0	Gray Till	0.139	0.028	0.4411	4250	1.4
5	2.0-5.0	Clay Liner	0.2038	0.0348	0.6450	---	---
5	5.0-15.0	Brown Till	0.115	0.017	0.5073	5167	5.1
5	15.0-30.0	Gray Till	0.078	0.028	0.4234	3950	1.2

Note: East-west Cross-section 2 located at North 482584 (NAD 1927)
East-west Cross-section 3 located at North 481296 (NAD 1927)
East-west Cross-section 4 located at North 480095 (NAD 1927)
East-west Cross-section 5 located at North 479097 (NAD 1927)

The settlement predictions were based on consolidation test data from subsurface borings located within and near the proposed footprint of the disposal facility and vertical stress increases in the subsurface soils produced by construction of the disposal facility. Using the boring logs and geologic cross sections provided by FERMCO, simplified cross sections were developed of the subsurface stratigraphy below the proposed disposal facility. The simplified cross sections were then further divided according to the available consolidation data from nearby borings.

The consolidation due to the vertical stress increase in each soil layer was determined using soil consolidation theory. Once the consolidation of each soil layer within each cross section was determined, the total settlement was determined for each cross section by summing the settlements of each individual layer.

Total and Differential Settlement

Due to the geometry of the proposed On-Site Disposal Facility, the vertical stress increase within the subsurface soils is much greater at the center of the facility than at the edge of the facility. As a result, the predicted settlements along the center of the facility were much greater than the predicted settlements along the edge. Predicted settlements along the center of the facility range between 11.6 and 15.7 inches, while the settlements along the edge range between 0.2 and 0.7 inches. As a result of the magnitude of the settlements along the center and edge of the facility, the maximum differential settlement across the facility is 15.5 inches.

Rate of Settlement

Using time rate of consolidation data from the laboratory consolidation tests, expected settlement having occurred at different times were estimated. The time rates were estimated assuming one-way drainage within the compressible soil strata would occur and that the facility load would occur immediately. Due to the massive size of the disposal facility and the design of the facility's clay liner, pore water within the compressible glacial tills can only drain downward toward the unsaturated portion of the Great Miami Aquifer. Any continuous or discontinuous sand seams within the compressible glacial till were ignored in the time rate determination. Sand seams would act as additional drainage layers and would reduce the amount of time for the consolidation of the compressible soils to occur by reducing the drainage path length. Therefore, ignoring the sand seams provides a conservative estimate of the time rate of settlement.

Assuming the load of the facility is placed immediately on the foundation soils, the time to achieve 95 percent of the total settlement in the foundation soil ranges between 5 and 30 years. From the calculations performed, it appears the facility will settle more rapidly toward the south end of the proposed facility than toward the north end. The glacial till layer is thinner at the south end of the facility (30 feet at the south end versus 56 feet at the north end). As a result, pore water near the south

end of the facility has less distance to travel to relieve the excess pore pressures developed in the foundation soils due to the facility load.

Assuming that the disposal facility load is placed immediately for the time rate of settlement is not how the site will actually be loaded. In reality, the facility will be built in compacted lifts and covered at the end of each work day. In addition, the facility will be built in cells. Therefore, the load increase due to the facility will be applied gradually and will not be uniform over the entire site. As a result, the actual time to achieve 95 percent of the expected total settlement will be longer due to gradual loading, and the differential settlements may be magnified by building the facility cell by cell.

5.3.2 Settlement of the Compacted Waste and Clay Berms

Consolidation settlements of the compacted waste fill and the compacted clay berms due to the addition of the composite cap were also estimated. The settlement was estimated at the center of the facility, where the waste fill is the deepest, and at the deepest portion of the berms. Since there is no waste or compacted clay at the edge of the facility, no settlement calculations were performed.

The settlement predictions of the compacted waste and clay berms assumed that the waste and clay would be placed in thin enough lifts and slow enough that little to no settlement would occur due to the waste's and berms' own weight. As a result, any settlement that would occur in the waste and berms results from the additional load of the proposed composite cap.

Total Settlement

The predicted consolidation settlements of the compacted waste and compacted clay berms are 16.0 and 13.5 inches, respectively. These predicted settlements assume that the waste material would have consolidation properties similar to those of brown till samples compacted to 85 percent of maximum dry density as determined by Standard Proctor, and that the berms would have consolidation properties similar to those of the brown till samples compacted to 95 percent of maximum dry density as determined by Standard Proctor.

Rate of Settlement

The time rate of settlement was also predicted for the compacted waste and compacted clay berms, using data from the laboratory consolidation tests performed on soil samples compacted to 85 percent and 95 percent of maximum dry density as determined by Standard Proctor. Due to the design of the proposed composite cap and composite liner, the excess pore pressures developed due to the cap load can only dissipate downward toward the leachate collection system. Therefore, the time rate of settlement predictions assume one-way drainage within the compressible waste and berms.

It was predicted that 95 percent of the total predicted settlement within the compacted waste and clay berms would occur within 6 and 5 years, respectively. If the design of the clay cap would happen to change and a drainage layer would be placed between the clay cap and the waste, the time to achieve 95 percent of the total settlement in the waste and the berms would be 1.5 and 1 year, respectively.

5.3.3 Settlement Summary

Table 5-2 is a summary of the predicted consolidation settlements for the On-Site Disposal Facility. Considering the settlement of the foundation soils and the settlements within the facility, the predicted settlements across the facility range from 0.2 to 31.7 inches, and 95 percent of the consolidation settlement would be achieved between 5 and 30 years after construction.

Table 5-2 - Summary of Predicted On-Site Disposal Facility Consolidation Settlement

	Foundation Soils				
	Center of Facility	Edge of Facility	Compacted Waste Fill	Compacted Clay Berms	Total Facility
Min. Settlement	11.6 in.	0.2 in.	NA	NA	0.2 in.
Max. Settlement	15.7 in.	0.7 in.	16.0 in.	13.5 in.	31.7 in.
Max. Differential Settlement	4.1 in.	0.50 in.	NA	NA	31.5 in.
Min. Time for 95% Settlement	5 yr	5 yr	NA	NA	5 yr
Max. Time for 95% Settlement	15 yr	30 yr	6 yr	5 yr	30 yr

5.3.4 Liquefaction Settlement and Lateral Spreading

Referring to the liquefaction potential analysis (see Subsection 5.5), it is unlikely that liquefaction would occur for an earthquake having a Richter scale magnitude 6 and a maximum horizontal ground surface acceleration of 0.13 g. As a result, liquefaction settlement would not occur unless the design earthquake was exceeded, and this liquefaction would occur only in the isolated sand zones having low factors of safety against liquefaction.

Using methods outlined in Sharma and Lewis (1994) the amount of settlement that would occur if the saturated cohesionless soil strata would liquefy was estimated. Sharma and Lewis propose using several

different properties of the saturated cohesionless soils to estimate the volumetric strain that would occur within the soil during liquefaction. Liquefaction settlement was analyzed using three different properties of the cohesionless soils: N_1, q_{cl}, and CSR (where N_1 is the SPT N-value normalized to 1 TSF of overburden, q_{cl} is the tip resistance from the CPT and CSR is the cyclic stress ratio, τ_{av}/σ_o').

Once the volumetric strain was estimated using each property, it was assumed that all of the volumetric strain would occur vertically due to the lateral confinement of the adjacent soils. This is a conservative assumption, since it attributes all of the volumetric strain to vertical strain. The settlement due to liquefaction of each cohesionless soil layer was then determined by multiplying the vertical strain by the thickness of the corresponding soil stratum.

The method using the CSR values consistently estimated the largest liquefaction settlements, thus producing the most conservative estimates. According to the liquefaction settlement analysis, the maximum estimated liquefaction settlement is 0.71 inches. This settlement would occur in the vicinity of Boring No. 11479 which is located in the northern portion of the facility footprint.

The 0.71 inches of liquefaction settlement includes 0.13 inches of liquefaction settlement that could possibly occur within the Great Miami Aquifer. The estimated amount of liquefaction settlement that could occur in the Great Miami Aquifer was determined using data from Boring No. G2-124. Boring No. G2-124 was used since the SPT N-values within the Great Miami Aquifer were lower than the N-values of any other boring that penetrated the Great Miami Aquifer. As a result of the lower N-values, the liquefaction potential and the liquefaction settlement would be the greatest at Boring No. G2-124.

In addition to one-dimensional liquefaction settlement, lateral spreading due to liquefaction was also investigated. Using a method to estimate liquefaction-induced lateral spreading was discussed in US EPA 1995. Horizontal deformations resulting from liquefaction were estimated for four granular soil deposits exhibiting the lowest factors of safety against liquefaction.

The method only takes into account the ground slope and thickness of the liquefiable layer. This method does not consider the depth or density of the liquefiable layer and, therefore, the method may be overly conservative. Estimated lateral spreading deformations range between 2.6 and 4.5 inches. Though evaluated, for lateral spreading to occur the soils would first have to liquefy which is unlikely, referring to the liquefaction potential analysis (see Subsection 5.5.1). Additionally, lateral spreading estimates of this magnitude are minute in comparison to the facilities dimensions and would have little or no impact on structural integrity.

5.4 Slope Stability

This section summarizes the analyses performed to evaluate the stability of various aspects of the proposed disposal facility. For each stability evaluation, the technical approach used is discussed and the results presented. Recommendations for design based on the results for the evaluations are presented in Subsection 6.4. Subsection 5.4.1 presents the methodology and results of the analyses performed for the overall stability against slope failure for the proposed disposal facility configuration and the subgrade soils. The stability of the side berm slopes is discussed in Subsection 5.4.2. The potential for veneer sliding of the cover slopes and along the bottom liner system is evaluated and discussed in Subsection 5.4.3.

5.4.1 Evaluation of Overall Stability of Disposal Facility and Subgrade Soils

Technical Approach

The stability of the proposed disposal facility and subgrade soils was analyzed for the following four loading scenarios:

1) Immediately post-construction, undrained conditions
2) Long-term drained conditions
3) Long-term drained conditions with seismic loading
4) Undrained conditions with seismic loading

Each of these loading scenarios represents possible conditions that might arise during the design life of the disposal facility.

The analyses were performed using the XSTABL slope stability computer model, developed by Interactive Software Designs, Moscow, Idaho. This model performs two-dimensional limit equilibrium analyses and incorporates a random surface generator for searching out the critical failure surface for a given slope. The static analyses were performed using Bishop's Simplified Method, and the seismic analyses were performed using Spencer's Method on the critical failure surfaces determined during the static analyses.

The Corps of Engineers (U.S. COE 1970) consider the following minimum factors of safety to be acceptable for typical loading conditions of earthen dams:

Long-term, drained conditions:	F.S. = 1.5
Short-term, undrained conditions:	F.S. = 1.3
Seismic loading conditions:	F.S. = 1.0

These values were used for comparison with the calculated factors of safety for the overall stability of the proposed disposal facility, the stability of the side berms, and the veneer stability of the cover and liner systems.

Analysis Cross-Section

The section chosen for analysis is a typical east-west cross section through the proposed facility. A geologic cross section provided by FERMCO was used for the cross section below the disposal facility. The profile of the liner, waste, berms, and cover system was developed from Figures 2-1 and 2-2, which show the proposed cross section through the cover and liner systems, and the general configuration of the disposal facility. Figure 5-2 shows the cross-section used to analyze slope stability. The drainage sand, cobbles, and gravel in the cover system were assumed to be one homogeneous layer. Potential failures along the geosynthetic layers incorporated in the cover and liner systems were not considered in these analyses.

Material Properties

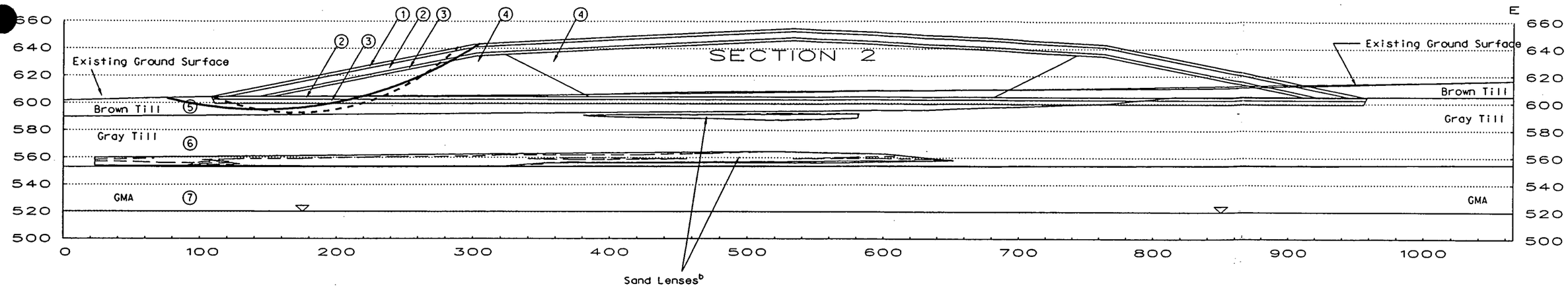
The material properties used for the slope stability modeling are presented in a table on Figure 5-2. These values were based on laboratory results from the Phase II and III investigations, and literature values. Laboratory analyses on remolded samples of the brown till were used to estimate unit weight and shear strength properties of the compacted clay liners, the side berms, and the waste materials. Literature sources for unit weight values used are summarized in Appendix L. The values chosen for use in the modeling are considered to be conservative values based on PARSONS' experience with similar materials. For the seismic analyses, shear strength values were assumed to be equivalent to 80 percent of the static values, per standard engineering practice (US EPA 1995).

Design Earthquake

The design basis earthquake used for the modeling has a maximum horizontal acceleration of 0.13g. This value is based on DOE-STD-1020-94 (DOE 1994b). The seismic coefficient used in the XSTABL modeling was assumed to be equivalent to one-half the maximum horizontal acceleration (US EPA 1995).

Results

Table 5-3 summarizes the factors of safety calculated using XSTABL for the scenarios described above. The factors of safety for each of the four scenarios are acceptable in comparison to the minimum recommended values (U.S. COE 1970).



Legend

Critical Failure Surface for Drained Conditions
F.S. static = 3.49 F.S. seismic = 2.05

Critical Failure Surface for Undrained Conditions
F.S. static = 2.62 F.S. seismic = 1.56

SOIL PARAMETERS

SOIL LAYER NUMBER	SOIL TYPE	MOIST UNIT WEIGHT (PCF)	SATURATED UNIT WEIGHT (PCF)	TOTAL STRESS		EFFECTIVE STRESS	
				COHESION (PSF)	FRICTION ANGLE (DEG.)	COHESION (PSF)	FRICTION ANGLE (DEG.)
1	Vegetative Soil	100.0	112.3	0	26	0	26
2	Drainage Layers	125.0	134.2	0	30	0	30
3	Compacted Clay at 95%	133.1	145.0 [a]	200	15	200	24
4	Waste/Berm Materials	112.2	125.0 [a]	200	15	200	24
5	Brown Till	135.7	145.0 [a]	300	19	200	28
6	Gray Till	143.0	150.0 [a]	250	21	200	29
7	GMA	140.0	149.8	0	33	0	33

a) Saturated unit weights assumed. Because layers are above water table, values do not impact stability analyses.

b) Sand lenses within Gray Till were not incorporated into stability analyses. Based on laboratory testing, the sand has higher shear strength properties than the Gray Till.

Figure 5-2 - Cross Section of Proposed Disposal Facility Used for Stability Analysis with Drained and Undrained Failure Surfaces

Table 5-3 - Disposal Facility Overall Slope Stability Summary

Scenario Number	Loading and Drainage Conditions	Factor of Safety
1	Immediately post-construction, undrained conditions	2.62
2	Long-term drained conditions	3.49
3	Long-term drained conditions with seismic loading	2.05
4	Undrained conditions with seismic loading	1.56

5.4.2 Stability of Side Berm Slopes

The stability of the side berms was analyzed for the following two loading scenarios:

1) Immediately post-construction, undrained conditions
2) Long-term drained conditions

No seismic loading was considered because of the limited duration that the side berms will be exposed during construction of the disposal facility. The XSTABL slope stability model, described in Subsection 5.4.1, was used for the analyses of the side berms.

Analysis Cross-Section

The section chosen for analysis is a cross-section through a simple triangular berm with a 2H:1V slope face and a 5H:1V slope face. Based on the configuration of the disposal facility presented in Figure 2-1, the maximum berm height chosen for analysis was 25 feet. Analysis of this assumed berm configuration is considered to be conservative because construction sequencing is likely to involve placement of waste materials at the toe of the berm prior to reaching a berm height of 25 feet.

The foundation of the berm is assumed to be native brown till. No liner materials such as drainage sand, compacted clay, or geosynthetics were included in the cross-section.

Material Properties

The material properties used for the berm and the foundation soil were based on laboratory results from the Phase II and III investigations and literature. Unit weights and shear strengths found for samples of

the brown till remolded to 85 percent of Standard Proctor maximum dry density (per ASTM D698) were used to determine appropriate values for the berm material.

Results

The technical approach, material properties, design earthquake, and sections used are essentially identical to those used in Subsection 5.4.1. except for the exposed slope section of the berm.

Table 5-4 summarizes the factors of safety calculated using XSTABL for the scenarios described above. These values are adequate in comparison to the accepted factors of safety for earthen embankments discussed in Subsection 5.4.1.

Table 5-4 - Side Berm Slope Stability Summary

Scenario Number	Loading and Drainage Conditions	Factor of Safety
1	Immediately post-construction, undrained conditions	1.51
2	Long-term static, drained conditions	1.95

5.4.3 Veneer Sliding of the Cover and Liner Systems

Calculations were performed to analyze the potential for planar sliding along the components of the cover and liner systems. This type of analysis is critical for evaluation of candidate geosynthetics and their interaction with the soil components of the cover and liner systems.

Technical Approach

The following slope failure scenarios were evaluated:

1) Veneer sliding of 5 percent cover slope, static and seismic conditions
2) Veneer sliding of 5H:1V side slope, static and seismic conditions
3) Sliding along components of the liner system, static and seismic conditions

The methodology used for these evaluations consisted of (1) identification of the critical sliding surface by estimation of the interface strength properties, and (2) calculation of the factor of safety against sliding along the critical interface.

The design configurations of the cover and liner systems used in the calculations was the same as that described in Subsection 5.4.1. The analyses for both static and seismic loading were performed assuming infinite slope conditions. This is considered a conservative assumption for the 5H:1V side slope because of buttressing effects at the toe of the slope which will increase the factor of safety against sliding. No buttressing effects are expected for the 5 percent cover slopes due to the break in grade to the 5H:1V side slopes.

The factors of safety considered acceptable for veneer stability are the same as those presented in Subsection 5.4.1 for the overall stability of the proposed disposal facility (U.S.COE 1970).

Material Properties

Laboratory direct shear testing was performed using candidate geosynthetics and FEMP earthen materials in order to evaluate potentially critical interfaces. As mentioned in Subsection 4.7, the direct shear testing conditions and the materials chosen for testing represent worst-case field conditions for the given configuration. Interface shear strength properties of materials not tested were assumed using literature values (Sharma and Lewis 1994). Unit weights of materials were estimated as described in Subsection 5.4.1.

Results

For the proposed cover configuration, the critical interface was determined to be within the GCL. The laboratory-determined friction angle for the worst case GCL was 5.4 degrees, implying that to be stable under static conditions, the slope should not be significantly steeper than 5.4 degrees. The factor of safety for an infinite 5 percent slope under static conditions with a critical interface friction angle of 5.4 degrees was calculated to be approximately 1.9. Taking into account the design earthquake loading, the factor of safety for an infinite 5 percent slope is less than 1.0, implying unstable conditions. For an infinite 5H:1V slope, the factors of safety under static conditions and seismic loading conditions were calculated to be less than 1.0.

Additional analysis indicates that the minimum friction angle required for stability (F.S.= 1.0) under seismic loading conditions for the 5H:1V slope is approximately 15 degrees.

Evaluation of the liner system revealed that, similar to the 5 percent cover slopes, the critical interface involves the GCL. The bottom liner is currently designed at a minimum slope of 2 percent. Calculations were performed for an infinite slope of 3 percent. Under static conditions, the liner was calculated to have a factor of safety greater than 3.0. For seismic loading conditions, the factor of safety against sliding was calculated to be approximately 1.0. These results are conservative because of the configuration of the liner system and the overall disposal facility (i.e., the loads above the liner system

are restrained against movement). Subsection 6.4.3 provides additional discussion of cover and liner stability and provides recommendations for additional interface friction testing.

5.5 Liquefaction

This subsection summarizes the results of a soil liquefaction potential analysis performed for the disposal facility. Subsection 6.5 contains recommendations regarding liquefaction. During earthquakes, the shaking of ground may cause a loss of strength or stiffness due to increase in pore pressure that results in settlement of buildings, landslides, the failure of earth dams, or other hazards. The process leading to such loss of strength is called soil liquefaction. It is a phenomenon associated primarily with saturated, cohesionless soils. The analysis determines the factor of safety (FOS) against liquefaction for the On-Site Disposal Facility site using established empirical correlations relating the occurrence or nonoccurrence of liquefaction to the intensity of ground shaking and the principal characteristics of cohesionless soils.

According to the *Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* (US EPA 1995a) there are several quick initial checks that can be made to determine if soils are potentially liquefiable. The first check involves the age of the deposit. This document (US EPA 1995) says generally pre-Holocene soils do not liquefy, but liquefaction has been observed in some Pleistocene soils. The soils investigated below the proposed disposal facility are of Pleistocene origin and, therefore, liquefaction is unlikely but possible.

The second screening check for liquefaction listed in *Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* (US EPA 1995a) is soils having greater than 15 percent clay fines by dry weight, liquid limits greater than 35 percent, and in situ water contents less than 0.9 times the liquid limit. These do not generally liquify. Looking at Table 5-4, most of the granular soils below the disposal facility do not meet the above criteria. As a result, it is possible that liquefaction may occur within the granular soils below the proposed disposal facility.

The third criteria listed in *Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* (US EPA 1995a) is that soils having degrees of saturation less than 80 to 85 percent do not generally liquefy. Saturation data is not readily available on the interbedded sand seams and the upper portions of the Great Miami Aquifer, but the boring logs indicate that most of the granular soils below the proposed disposal facility are wet (see Appendix D). Generally, wet soils can be interpreted as saturated soils. Therefore, most of the granular soils beneath the proposed disposal facility meet this requirement for liquefaction.

Seismic Design Guidance for Municipal Solid Waste Landfill Facilities (US EPA 1995a) states that liquefaction does not generally occur at depths below 50 feet, see Table 5-4. All of the soils investigated for liquefaction are at depths above 50 feet and are possibly liquefiable according to this criteria.

Finally the document (US EPA 1995a) gives several guidelines for normalized SPT blowcount (N_{160}). It states that generally soils with N_{160} above 22 do not generally liquefy but reports that some research has suggested that liquefaction can occur in soils having normalized blowcounts as high as 40. Again looking at Table 5-4, approximately half of the soils investigated had N_{160} values under 22, and all but one of the soils have N_{160} values below 40.

Considering the above criteria, two soil strata have the potential for liquefaction during an earthquake and were evaluated. These strata are the till stratum that has thin seams of sand located randomly throughout and the saturated portion of the Great Miami Aquifer.

5.5.1 Design Earthquake

The disposal facility was assumed to be categorized as PC2 for Natural Phenomena Hazards. This corresponds to an earthquake hazard annual probability of exceedance of 1×10^{-3} per DOE-STD-1020 (DOE 1994b). The corresponding PGA for the FEMP site is 0.13 acceleration due to gravity (g) per Table C-5a of DOE-STD-1020-94.

For the soil liquefaction analysis, a Design/Evaluation Basis Earthquake with 0.13g PGA was used. The corresponding Richter magnitude was taken as 6 (USGS 1980, Cain 1983).

5.5.2 Technical Approach

Seed, et al., proposed a method of determining the liquefaction potential of saturated, cohesionless soils using modified SPT N values (blow count). The procedure corrects the actual N values for various equipment and procedural variations of the SPT using a standard size sampler (ASTM D 1586). In the procedure, a measured N value is corrected for four variables:

1) Energy effect
2) Length of drill rod
3) Sampling barrel effect
4) Overburden

Using the corrected N values and the amount of fines present in the cohesionless soil, an estimate of the average cyclic shear stress induced by the design ground motion to effective overburden ratio (cyclic stress ratio [CSR]) that causes liquefaction can be estimated using plots. The CSR value increases with increasing fines within the cohesionless soil. The actual CSR for the soil is calculated using an equation that was proposed by Seed et al. The CSR that causes liquefaction is divided by the actual CSR to determine the FOS against liquefaction.

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The liquefaction analysis evaluated liquefaction potential based on the blow counts of individual SPT samples. This allowed for a conservative analysis which based the FOS on the blow counts of an individual sample. Individual SPT samples from borings that encountered sands within the glacial overburden were evaluated, as were individual SPT samples from the Great Miami Aquifer formation. All sand seams and the Great Miami Aquifer were assumed to be saturated to provide a conservative analysis for the site.

For the saturated sands within the glacial overburden, the SPT blow counts from individual split-barrel samples from the geotechnical investigation were used as the measured blow counts. Water levels were assumed to be at the existing ground surface for the analysis. Assuming that the water table is at the ground surface is conservative, since it allows all the sand layers to be liquefiable. Unit weight data for the clay came from the averaged laboratory data, and unit weights for the sands were obtained from literature.

5.5.3 Results

The method described above was used to estimate FOS against liquefaction for the individual sample. Table 5-5 presents information about the SPT samples analyzed and gives the estimated FOS based on the blow count of the individual sample.

Till Overburden

The minimum FOS against liquefaction in the saturated sands of the glacial overburden within the facility footprint for the design earthquake is estimated to be 1.49. The SPT sample that resulted in this FOS came from a clayey sand encountered in Boring 11479. The analysis allowed credit for any liquefaction resistance provided by the minus 200 sieve fines within the silty-clayey sand. If minus 200 sieve fines data was not available for the investigated soils, the minimum value of fines from the same soil type was used.

Great Miami Aquifer Sands and Gravel

For the saturated sands within the Great Miami Aquifer formation, the SPT blow counts from individual split-barrel samples from Boring G2-124 were used as the measured blow counts. Boring G2-124 had the lowest blow counts within the Great Miami Aquifer of any of the borings, and it was assumed that the lowest blow counts would result in the lowest FOS. Again the water table was assumed to be at the ground surface. Unit weights for the sands were obtained from literature. The minimum FOS against liquefaction in the saturated sands of the Great Miami Aquifer formation at the On-Site Disposal Facility site for the design earthquake was estimated to be 2.46.

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Table 5-5 - Description of Soils Evaluated for Liquefaction Potential and Estimated FOS Against Liquefaction During a Design Earthquake

Boring No.	Sample Depth (feet)	USCS Symbol	FOS Against Liquefaction	Normalized SPT N-value (N_{160})	Percent Minus 200 Sieve Fines	Liquid Limit	Plasticity Index
G2-124	30.0-31.5	SM	2.97	19.5	24.9	ND	ND
G2-124	35.0-36.5	SM	2.46	15.7	21.7	ND	ND
G2-124	40.0-41.5	SM	4.20	23.9	14.2	ND	ND
11468	11.8-13.0	SC	5.14	41.7	ND	ND	ND
11468	21.5-23.0	SC	5.35	23.1	ND	ND	ND
11468	31.0-33.0	SC	5.63	25.5	ND	ND	ND
11468	34.5-35.5	SC	5.67	24.4	ND	ND	ND
11468	41.5-42.0	SC	1.62	9.6	ND	ND	ND
11471	9.0-11.5	SM	1.95	12.7	37.9	NP	NP
11472	18.5-19.5	SC	5.23	54.7	21.6	19.4	8.2
11476	16.5-18.0	SC	5.16	25.4	48.0	18.1	5.8
11477	6.5-7.5	SM	1.92	13.6	39.6	NP	NP
11477	8.0-9.0	SM	2.64	19.6	39.6	NP	NP
11477	22.5-23.5	SM	5.31	22.0	40.3	NP	NP
11478	30.8-32.0	SM	3.37	19.1	42.6	NP	NP
11479	6.5-7.5	SC	5.08	26.9	ND	ND	ND
11479	16.5-17.5	SM	1.96	15.2	21.1	NP	NP
11479	32.0-33.0	SC-SM	1.49	8.2	44.1	19.6	7.2

Notes: ND = No data available NP = Nonplastic

5.6 Pavement Evaluation

This subsection presents methods for flexible pavement design of anticipated roadways that will support Disposal Facility construction and operations. Design and performance of existing roads at the FEMP site are discussed. The required thicknesses for both full-depth asphalt and asphalt pavement with granular base are presented for CBR = 3 (consistent with the average test value) and for CBR = 6 (Ohio Department of Transportation [ODOT] estimate) for a full range of Traffic Indices (TIs).

5.6.1 Design Methods

As described in the PO Plan, recommendations are presented for asphalt paved roads and parking areas for TIs 4 though 10. Several methods are available for the design of flexible (asphalt) pavements. They generally are based on either an empirical (experience) approach or a mechanistic (theoretical) approach. The empirical method used by ODOT, with minor exceptions as noted in the body of the text, has been used as the basis for preliminary thickness determination.

5.6.2 Subgrade

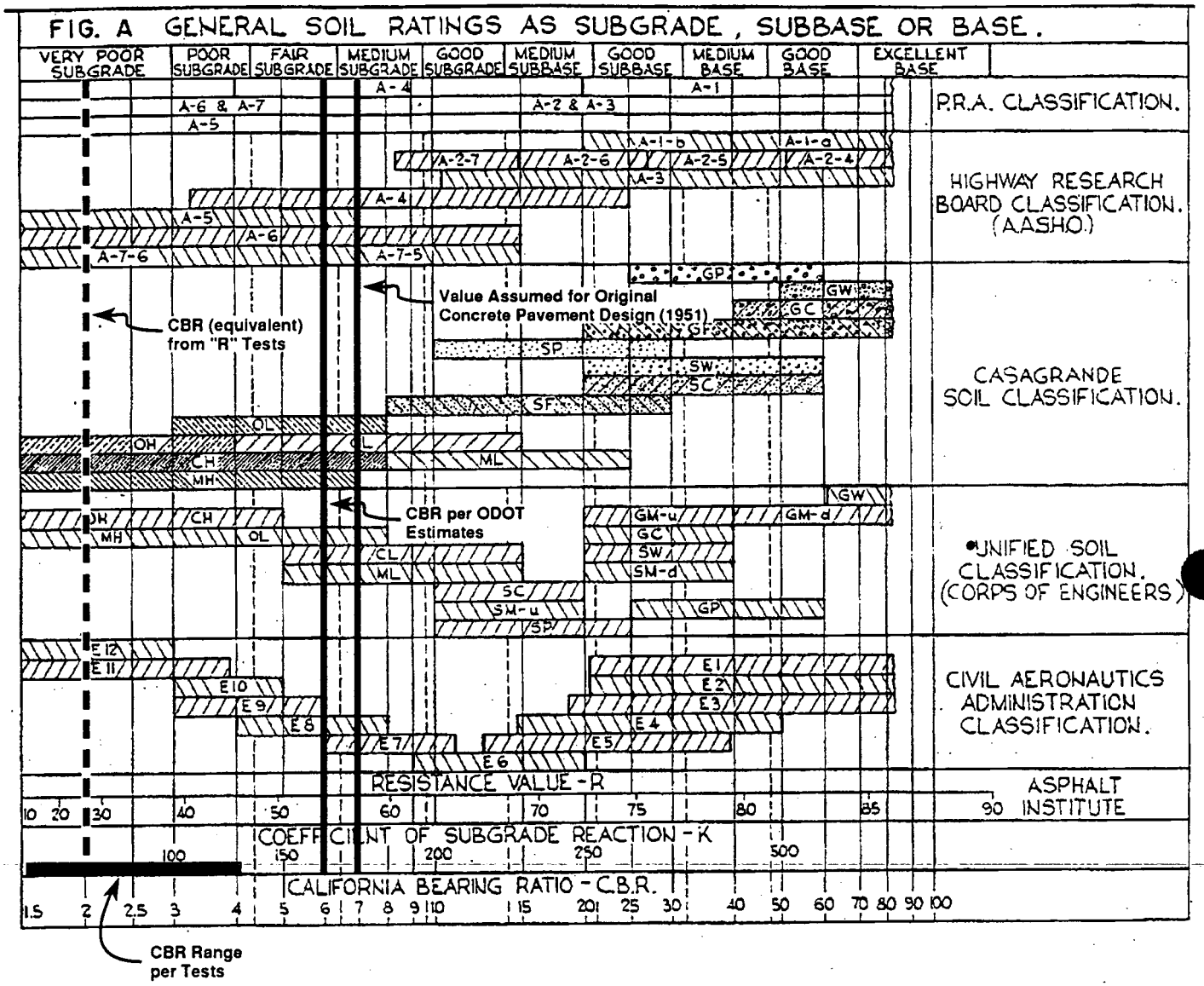
Subgrade preparation and strength is probably the greatest single factor governing performance of flexible (asphalt) pavement design. Subgrade strengths appear to be somewhat unclear and are a concern. Testing for CBR values indicates that the subgrade soils range from poor to very poor (see Figure 5-3). The CBR values ranged from 1.5 to 4.25. This compares with an ODOT estimate of CBR = 6. Earlier Caltrans R tests showed extremely low values but were disregarded because they were only for very shallow soils (see Figure 5-4).

CBR results presented in Table G-12 of Appendix G are for remolded (compacted to 95 percent standard MDD) samples. The test values are quite low and would probably lead to over-conservatism if used for in situ subgrade conditions. To provide additional information regarding CBR of natural subgrade material CPT data previously obtained were evaluated to estimate equivalent CBR values.

Appendix C contains information regarding a preliminary evaluation of CBR in the general vicinity of proposed haul roads using CPT data. This evaluation estimated the CBR of the natural subgrade to be in a range of about 4 to 5.

Additional relevant information can be found in archives. This source is a U.S. Army Corps of Engineers Report dated February 1952, and entitled *Report of Foundation Investigation, Feed Materials Production Center, Fernald, Ohio* (COE 1952) and hereinafter referred to as "1952 Report."

Roads and Airfields - General Soil Ratings



* From *Design-Data Book for Civil Engineers*, E.E. Seeyle, 3rd Ed.

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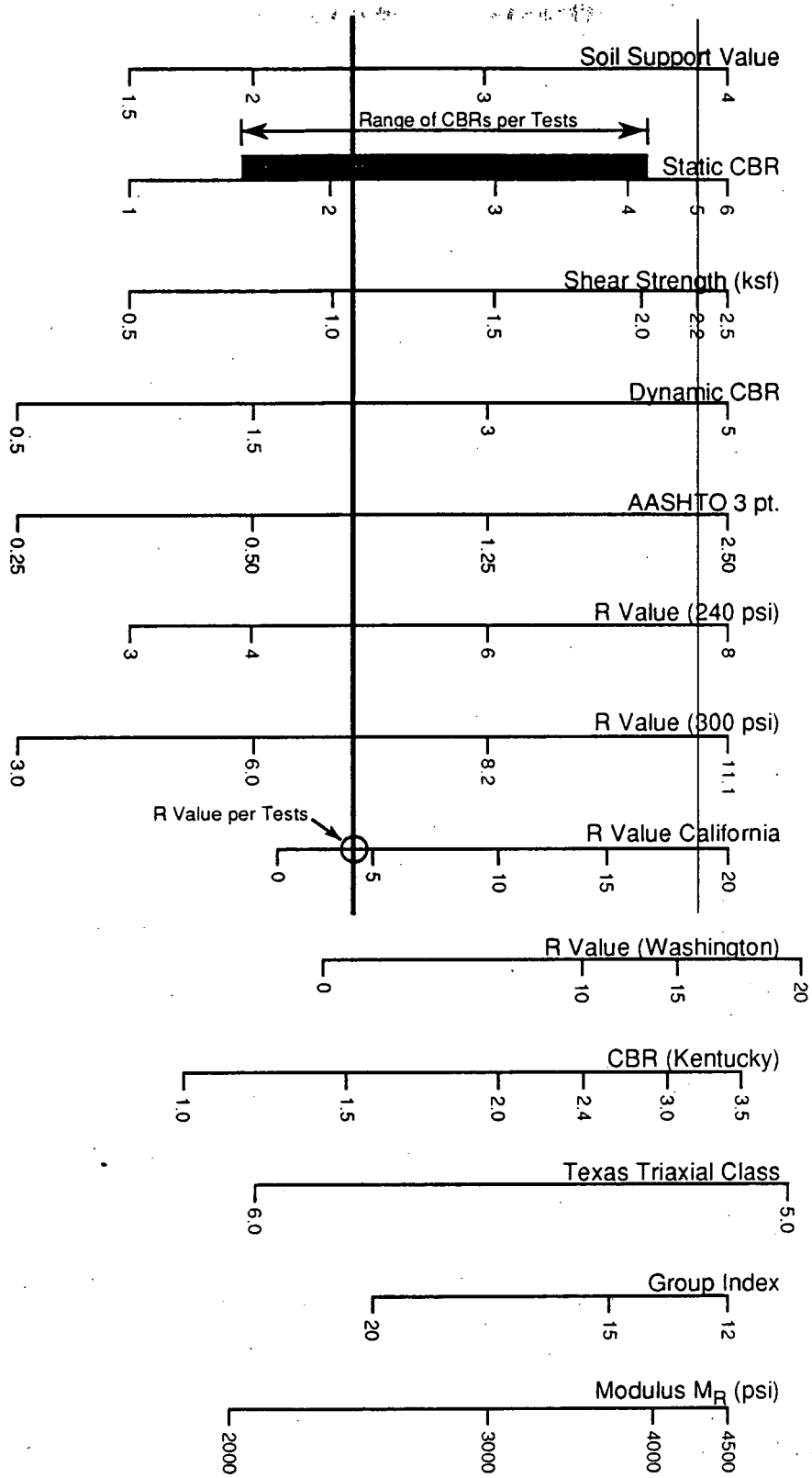
Figure 5-3 - Subgrade Strength Versus CBR Value



* From *Evaluation of AASHTO Interim Guides for Design of Pavement Structures*, NCHRP 128, Van Til, D.J., et al., 1972.

"I:\US\OU-2\PO-140\SOIL STRENGTH/SUPPORT.EPS

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Figure 5-4 - Typical Relationship Between Several Measures of Soil Strength and Soil Support Value

For the South Access Road the 1952 Report reports the CBR value of 4.8 for natural subgrade with no compaction. With rigorous compaction (e.g., 100 percent Standard Association of State Highway and Transportation Officials [AASHTO] or 90 percent modified AASHTO) the CBR rises to 8.0.

For flexible pavement design the 1952 Report recommends that the top 6 inches of the subgrade in either cut or fill sections should be compacted to 95 percent of Modified AASHTO and further that deeper zones of all fill sections should be compacted to 90 percent Modified AASHTO density.

For concrete pavement design, actually incorporated in the construction, the 1952 Report requires no compaction of subgrade cut sections and 90 percent Modified AASHTO for fill sections.

To construct a quality asphalt pavement, it is imperative to have a solid, unyielding subgrade at the time of construction. Considering the information available thus far, it may prove necessary to enhance subgrade strength by adding a subbase consisting of 4 to 6 inches of locally available crushed gravel over a geotextile fabric, followed by wheeled traffic pre-rutting to mobilize the fabric prior to final smoothing and paving. (In some cases it may be beneficial to excavate down to the higher strength material.)

5.6.3 Existing Road Design and Performance

An examination of the design and construction records for the existing roads reveals that, except for the North Access Road, the roads were built in 1951 of concrete 7½ inches thick, placed on clay subgrade. The subgrade modules used for design was 175 psi which is equivalent to a CBR of 7.

No indication of generalized poor subgrade performance has been reported, although the records show that 29 road repair or overlay projects have been performed. Reportedly, nearly all roads were resurfaced with 3 inches of asphalt in the mid-1980s. It should be noted that for concrete pavements, uniformity of the subgrade, rather than its strength, is of the greatest importance.

The North Access Road was constructed in 1955 with 2 inches of asphalt concrete over 5 inches of Macadam (asphalt) base. Apparently, no roads with granular bases have been constructed on site, although the main parking area was constructed with 3 inches of asphalt over 4 inches of stone.

No indication of unsatisfactory performance is known for the North Access Road. It is understood, however, that the bulk of heavy-load traffic used the South Access Road.

5.6.4 Thickness Design

For the full range of TIs, 4 through 10, required thicknesses for both full-depth asphalt and asphalt pavement with granular base were calculated for CBR = 3 (consistent with the average test value) and

for CBR = 6 (ODOT estimate). The range of preliminary thicknesses for both designs for each TI are shown in Table 5-6.

ODOT design methodologies were used to determine the preliminary thicknesses, with the following exceptions:

1) Subgrade resilient modules was determined by multiplying CBR by 1,500 (used by AASHTO and the Asphalt Institute) instead of the more conservative value of 1,200 used by ODOT.

2) Structural number coefficient used for asphalt concrete is 0.40 (AASHTO) per inch thickness instead of the more conservative value of 0.35 used by ODOT.

It appears that, in general, the required full-depth asphalt thickness required is reduced by approximately 20 to 25 percent for CBR = 6 compared with CBR = 3. It is evident from this that considerable savings will accrue if the subgrade strengths are, in fact, higher than now indicated or else can be improved or stabilized in a cost-effective manner.

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Table 5-6 - Total Thickness of Asphalt Required

		CBR = 3			CBR = 6		
TI	EAL(18^k)[1]	$SN_{REQ'D}$ [2]	t_{FDA} [3 5]	t_{asph} [4 5 6] (+6"stone)	$SN_{req'd}$ [2]	t_{FDA} [3 4]	t_{asph} [4 5 6] (+6"stone)
10	2,400,000	4.57	11.42" (11-1/2")	10.02" (10")	3.58	8.95" (9")	7.55"(7-1/2")
9	1,000,000	4.00	10.0" (10")	8.75" (9")	3.08	7.70" (8")	6.30"(6-1/2")
8	372,000	3.50	8.75" (9")	7.35" (7-1/2")	2.65	6.63" (7")	5.23"(5-1/2")
7	121,000	2.90	7.25" (7-1/2")	5.85" (6")	2.20	5.50" (6")	4.10"(4-1/2")
6	33,000	2.42	6.05" (6-1/4")	4.65" (5")	1.80	4.50" (5")	3.10"(3-1/2")
5	7,000	2.22	5.55" (5-3/4")	4.15" (4-1/2")	1.70	4.25" (4-1/2")	2.85"(3")
4	1,000	2.18	5.45" (5-1/2")	4.05" (4-1/4")	1.65	4.13" (4-1/4")	2.65"(3")
Parking Areas	____	2.5±	(6")	(5")	2.0±	(5")	(3-1/2")

Notes:

1. See Calculation Table 603.4A for EAL (Equiv. Axle Loads - 18 KIPS).
2. See Calculation Charts 701-13 for $SN_{req'd}$ (Structure No.).
3. FDA (Full-Depth Asphalt) coefficient is 0.4 per inch thickness. ODOT coefficient is more conservative @ 0.35 per inch.
4. Stone value is 0.14 per inch thickness (per ODOT). Only 4" is assumed to contribute (per Asphalt Institute)
5. Values in parentheses indicate design asphalt thickness. Asphalt includes upper 1-3/4" to 2" of asphalt concrete, Spec 402 (ODOT) and remainder of bituminous aggregate base, Spec 301 (ODOT). The only wearing surface asphalt, Spec 404 (ODOT) will be 1-1/4" for relocated North Access Road.
6. Stone is crushed limestone, aggregate base, Spec 304 (ODOT).

SECTION 6

DESIGN RECOMMENDATIONS

This section presents PARSONS' recommendations regarding specific preliminary geotechnical and civil engineering design aspects of the proposed disposal facility tasked by FERMCO under PO-140 (PARSONS 1995a). These design recommendations are general in nature and the actual design and construction details will be defined during the disposal facility design.

6.1 Earthwork and Site Preparation

6.1.1 Removal of Organic Soils

Organic soils should be removed by stripping the site to an average depth of 12 inches and stockpiling the materials for re-use as topsoil or as cap vegetative soil. The stripped depth probably can be reduced to just 6 inches for much of the site, but, in a few locations, may be required to depths of approximately 18 inches. Planning for long-term stockpiling of these materials is required.

Small roots and minor amounts of other organics are acceptable in general construction fill and care should be taken to minimize the amount of organic materials for the compacted clays in the liner and cap.

6.1.2 Excavation

Within the limits of proposed excavation and filling, vegetation and topsoil should be stripped. For estimating purposes, 12 inches of topsoil stripping should be assumed. The topsoil may be stockpiled outside the construction limits for use during final grading.

Fill may be required in some areas to achieve proposed grades. Within existing swale areas it may be necessary to undercut soft sediments. Field evaluations will be required to determine the depth and lateral extent of undercutting. It is anticipated that undercut sediments will be wet. The materials should either be wasted or stockpiled according to future use.

Stockpiles

It is recommended that clearly defined stockpile areas be identified on the plans. During excavation, qualified geotechnical personnel should be present to observe materials being excavated and direct operators to the appropriate stockpiles.

The waste pile would be for wet sandy materials within the perched water table zone and wet sediments from undercutting swale areas. This material could be used for general embankment construction if needed. However, moisture contents will probably be higher than optimum moisture for best compaction.

To facilitate optimum re-use of excavated materials, consideration should be given to selectively excavating, insofar as practical, and segregating in separate stockpiles different classes of material, as follows:

1) Class A - Clay suitable for compacted clay layer in bottom liner or future cap.

2) Class B - Clay with significant inclusions of sand or other materials and unsuitable for liner (re-use in berms, miscellaneous fills, cushion layer, etc.).

3) Class C - Sands, gravels, and excessively wet soils (re-use in berms or miscellaneous fills).

Proper stockpiling of materials should be considered in the overall project development and sequencing plan.

Moisture Adjustment

It is recommended that moisture adjustments be made in stockpile areas for the materials used for general embankments and especially for soil liner materials. Adjusting moisture in the stockpile will expedite fill placement. Moisture adjustment required will depend on seasonal conditions at the time of earthwork. Stockpiles should be graded to drains and sealed at the end of the working day if precipitation is predicted.

Material Handling

Recognizing the characteristic of the till materials to become very slippery and difficult to handle when wet, the stockpiled materials should be, as a minimum, "walked in" with bulldozers to compact the surface, and should be sloped to drain freely. The final lift in each area should be thoroughly "walked in." Lift thickness should not be more than approximately 12 inches for proper compaction.

Erosion control and dust suppression are to be considered. Vegetation should be established early and supplemented with other measures, such as plastic covers, if and when necessary. To minimize maintenance problems associated with silt fences as primary control, consideration should be given to using stockpile perimeter interceptor ditches along the low side with controlled outlets and utilizing silt fences as supplemental or temporary measures. Runoff would then flow by gravity to the sedimentation pond(s).

6.1.3 Surface Preparation and Treatment of Unsuitable Soils

After excavating to subgrade level for the compacted clay layer for the composite liner, wet pockets should be drained and stabilized sufficiently to support equipment without pumping, rutting, or heaving. These areas, plus predominantly silt areas or other suspicious zones should then be proofrolled. Materials that do not firm up after draining and/or rolling should be undercut and backfilled with suitable material. Where it is impractical to protect excavated or stockpiled areas and the soils become wet, major problems are possible and could result in construction delays. Further evaluation of the severity of this problem, particularly relating to schedule impacts, should be undertaken prior to beginning full-scale construction.

There is no indication from the soils investigation that other problem soils, such as expansive, collapsible, or highly compressible soils, will be encountered.

6.1.4 Shrinkage/Bulking Factors

Shrinkage and bulking factors will be calculated from test results as needed for design.

6.1.5 Slopes (Cut/Fill) and Slope Protection

As discussed in Subsection 5.1, the till is apparently sensitive to disturbance and recompaction as well as to exposure and wetting. These issues, as well as freeze/thaw behavior will need to be considered during design.

6.1.6 Compacted Fills

General Fill Placement

Following stripping and vegetation of topsoil, and undercutting of swale sediments, the top 6 inches in areas to receive fill should be scarified and recompacted in place to a minimum of 95 percent Standard Proctor density (ASTM 698). Any soft areas not stabilized by repeated compaction should be further undercut.

Compacted Soil Liner

Locating and evaluating clay borrow material for the compacted soil liners of the proposed facility is a major step in the construction process. FERMCO is currently conducting a borrow study which investigates sources of potential clay borrow on site. A description of the field and laboratory activities can be found in *Draft Geotechnical Sampling and Tests Plan for On-Site Borrow Areas, Off-Site Material Sources and Operable 2 Unit Waste Units* (FERMCO 1995b). Borrow study activities include laboratory

classification of clay materials, compaction tests, and remolded laboratory permeability testing. Design and construction criteria for the compacted clay liners should be based in part on the results of the borrow study. Additionally, as part of the design process, it is recommended that a test pad be constructed to allow for analysis of the critical liner and/or cap components (See Subsection 6.1.7).

Compacted soil should be constructed in a series of thin lifts. It is anticipated that lifts for liner will be placed in horizontal layers. However, when liners are constructed on side slopes, the lifts can be placed either parallel to the slopes (for slopes up to 2.5H:1V, due to limitations of compaction equipment) or in horizontal lifts. Horizontal lifts require at least the width of one piece of construction equipment (about 12 feet). Generally, the lift thickness of the clay layers is 8 to 9 inches before compaction, and 6 inches after compaction. Care should be taken to ensure that each lift of the clay liner is properly bonded to the underlying and overlying lifts. Scarification of the underlying lift surface prior to new lift placement is recommended. Mechanical kneading type compactors are best suited for compacting clay liners, and should be used. In place density tests should be performed to confirm the degree of compaction being obtained.

Embankment Fill

Embankment fill should be spread in near-horizontal lifts, about 8 to 9 inches before compaction, and 6 inches after compaction. Scarification of the underlying lift surface prior to new lift placement is also recommended. Each lift should be compacted to a minimum of 95 percent Standard Proctor MDD prior to placement of additional lifts. In place density tests should be performed to confirm the degree of compaction being obtained.

Construction Materials

The brown till CL from depths below about 3 feet appears to be better material for use as compacted clay than the CL material at shallower depths, however, the permeability and constuctability of field scale liner from this material should be demonstrated and is recommended to be part of the design process. From the standard compaction test data, increasing the water content to greater than about 2 percent to 4 percent wet of optimum will most likely result in relative compaction of less than 95 percent standard MDD. Compacting the clay materials using a greater compactive effort may result in additional decreases in the coefficient of permeability.

Freeze-Thaw Factor

The final design thickness of the cap should consider protecting the compacted clay material from potential freeze-thaw cycles. The design frost penetration depth for southwest Ohio is 30 inches. Construction and exposure of the liner and cap to freeze-thaw conditions should be avoided to reduce the potential for cracking and avoid difficulties in meeting field compaction requirements.

6.1.7 Geotechnical Monitoring and Testing for Construction

As part of the design process it is recommended that a test pad be constructed and tested to allow the performance and constructability of critical liner/and or cap components to be evaluated. Unlike laboratory tests, field hydraulic conductivity tests performed on a test pad allow flow through features such as macropores and fissures. Also, larger, more representative field samples provide more realistic permeabilities during field testing. PARSONS, therefore, recommends the use of a fill test and field hydraulic conductivity testing as part of the preconstruction quality assurance program for compacted soil liners. Categories of field permeability tests applicable to low permeability soils are:

1) Borehole tests
2) Porous probes
3) Infiltrometers
4) Lysimeters

As part of the preconstruction quality assurance testing, tests from these categories should be considered for field hydraulic conductivity testing of a compacted clay test pad liner. Often a Sealed Double-Ring Infiltometer is suitable for fine-grained clayey or low-permeability soils of a compacted liner.

Two important aspects of liner construction are:

1) Construction quality control (CQC)
2) Construction quality assurance (CQA)

CQC is designed to ensure that the materials used meet specifications and refers to tests and observations performed by the contractor. CQA refers to observations and tests performed by an organization independent of the contractor to verify that the constructed facility meets the requirements set forth in the plans and specifications. Technical guidance for preparation of site-specific CQC and CQA plans is found in a recently published US EPA document entitled *Quality Assurance and Quality Control for Waste Containment Facilities* (US EPA 1995b).

In general, CQA testing for clay liners concerns:

1) Clay borrow source testing
2) Clay liner testing during construction
3) Granular drainage blanket testing

The frequency of testing should be specified in CQA plans or specifications.

Clay borrow source testing should include index properties testing, moisture-density curve development, and laboratory permeability testing of remolded samples.

Clay liner testing during construction should include in place density (nuclear or sand cone) and index properties tests. Undisturbed samples are collected for dry density and permeability tests. Moisture-density tests are also conducted.

Granular drainage blanket testing should include grain size, permeability, and carbonate content tests.

For the disposal facility, a CQA program should be prepared. The CQA program should present observations to be made, tests to be performed, and reporting methods for each major component of the construction, including liners, berms, cap, and waste placement. The appropriate field and laboratory tests, testing frequency, and material acceptability criteria, and other inspections should be a part of the CQA program. Qualified personnel should be present during construction to make the observations and perform the tests outlined in the CQA documents. Personnel qualified in the area of geotechnical engineering should be present during construction activities, excavation, embankment construction, and clay liner construction, including waste placement. Personnel qualified to work with synthetic liner placement should be present during installation to observe the contractors performance and monitor their methods.

6.2 Bearing Capacity

As evaluated in Subsection 5.2, the average uniform load for the disposal facility (5,200 psf) is much less than the bearing capacity of the underlying glacial till (40,800 and 23,500 psf). As a result, the existing subgrade soils will adequately support the On-Site Disposal Facility.

6.3 Settlements

The estimated differential settlements described in Subsection 5.3 occurring across the On-Site Disposal Facility should not cause any problems with the facility's proposed cap and liner. The differential settlement across the top of the facility amounts to less than 1 percent of the distance between the centerline of the facility and the break in slope between the 5H:1V side slope and the 5 percent top slope. As a result, positive drainage will remain once the facility completely settles.

The differential settlement across the liner is less than 1 percent of the distance between the centerline and edge of the facility. This is an extremely small amount of differential settlement and should have little to no impact with regards to the integrity of the proposed composite liner.

Applying the maximum practical (95 percent standard or above desirable) compactive effort during construction of the compacted waste fill and compacted clay berms is recommended to reduce the amount of settlement. Increasing the compactive effort reduces the initial void ratio of both the waste and the clay berms, resulting in smaller consolidation settlements.

One method that should be considered to further reduce the settlement of the disposal facility is to excavate the existing subsurface soils to a depth of 10 to 12 feet below the existing ground surface and found the facility at that elevation. Placing the base of the facility at a lower elevation would reduce the effective overburden pressure in the compressible layer, and thus reduce the total vertical stress acting within the compressible strata. In addition, placing the base of the facility at a lower elevation would also reduce the thickness of the compressible layer. Reducing the vertical stress and the thickness of the compressible strata would result in a reduction of the consolidation settlement of the disposal facility.

Due to the actual loading conditions of the disposal facility, a more detailed time rate of consolidation analysis should be performed before the facility is actually designed. The analysis of time rate of consolidation typically requires the use of computer software due to the complicated loading sequence.

6.4 Slope Stability

This section provides recommendations concerning overall stability of the disposal facility and subgrade soils, stability of the side berms and base, and the stability along the cap and liner system and its interfaces. These recommendations are based on the results of analyses described in Subsection 5.4.

6.4.1 Overall Stability of Disposal Facility and Subgrade Soils

The factors of safety considered acceptable for the disposal facility are 1.5 for permanent or sustained loading conditions, 1.3 for short-term loading conditions such as immediately post-construction, and 1.0 for transient loads such as earthquakes (U.S. COE 1970). Comparing these acceptable factors of safety with the values from analysis using XSTABL described in Subsection 5.4.1, it is apparent that the disposal facility appears to be stable for the four loading and drainage scenarios considered. No changes to the proposed overall configuration are recommended.

6.4.2 Stability of Side Berm Slopes

The stability analyses performed for the side berms resulted in acceptable factors of safety against slope failure for both short-term (undrained) and long-term (drained) conditions. The berm configuration analyzed consisted of a 25-foot high simple triangular berm with a 2H:1V face and a 5H:1V face. The analyses focused on failures within the berm material, which was assumed to have the properties of the local brown till compacted to 85 percent of Standard Proctor maximum density (ASTM D698). No consideration was given to failure along the geosynthetic interface at the bottom of the berm. This

potential failure mechanism, along with the maximum berm height expected during construction, should be investigated during the detailed design.

It should be noted that construction sequencing of the berms and the waste material is likely to preclude the necessity for berms as high as 25 feet (as were considered in the stability analysis), and at the same time allow for a maximization of the volume within the cells for waste materials.

6.4.3 Veneer Sliding of Cover and Liner Systems

Evaluation of the veneer stability of the cover and liner systems revealed that the critical failure surfaces are within the GCL layers and at the FML/geotextile interfaces. Based on laboratory direct shear testing using candidate materials, the friction angles determined for these surfaces were 5.4 degrees and 10.1 degrees, respectively (see Subsection 4.7). Infinite slope analyses using either of these friction angles under seismic loading conditions results in slope failure of the cover system. The calculations show that a minimum friction angle of approximately 15 degrees is required for long-term stability of the cover system. In contrast, the liner system is expected to be stable for the conditions assumed in the analyses (see Subsection 5.4.3).

As noted in Subsection 4.7, the laboratory direct shear testing modeled worst-case field conditions. Documented friction angles for GCLs measured under conditions that more closely model the expected field conditions range from 16 to 43 degrees (Sharma and Lewis 1994). Documented friction angles for textured FML/geotextile interfaces tested under the expected conditions range from 15 to 33 degrees (Sharma and Lewis 1994). Based on these documented values, it is expected that the currently proposed configuration and material types of the cover system are acceptable with respect to veneer stability. Confirmation of this conclusion will be required during the detailed design.

It is recommended that further laboratory testing be performed to evaluate candidate materials under conditions that closely model the loading conditions expected in the field. This should include direct shear testing of the geosynthetics and cover soils following consolidation under the overburden pressures expected in the cover system. Testing should consider long term tests at low rates of strain. Candidate materials should include textured FMLs and reinforced GCLs. Analyses performed during the detailed design should incorporate the updated laboratory data on interface shear strengths and, if necessary, consider the effects of toe buttressing under the design seismic loading conditions. The analyses should also evaluate the stability of the liner system geosynthetics due to loading from the side berms and interim placement of the waste materials.

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6.5 Liquefaction Potential

The minimum FOS against liquefaction from the liquefaction potential analysis was estimated to be 1.49. According to Sharma and Lewis (1994) soil elements having low FOS ($FOS \leq 1.1$) would achieve conditions wherein soil liquefaction failure should be considered (Sharma 1994). The minimum FOS against liquefaction is well above the minimum FOS suggested by Sharma and Lewis, indicating that liquefaction of the foundation soils will not occur during the design earthquake.

The granular soil having the FOS against liquefaction of 1.49 is located at a depth of 32 to 33 feet, which results in a significant confining pressure. This high confining pressure provides an additional margin of safety against liquefaction. In addition, the majority of the soil overlying the granular soil deposit with the minimum FOS against liquefaction value is a lean clay. The lean clay is liquefaction-resistant. According to Das (1993) overlying liquefaction-resistant stratum reduces the liquefaction potential of the underlying soil.

6.6 Roadway Design

This subsection presents design recommendations for roadways with respect to drainage, subbase preparation, and pavement design.

6.6.1 Drainage

Since drainage is also of major importance in asphalt pavement performance, it is justifiable to add subdrains at sag points in road profiles or in other situations where wet conditions are evident. This becomes a greater necessity if a granular base course is used, possibly trapping water against the subgrade. The general satisfactory performance of the existing road pavements indicates that subgrade drainage has not been a major problem. To facilitate drainage, roadway subgrade cross-slopes should be a minimum of 3 percent, with 5 percent desired for shoulders. Subgrades under parking areas should be sloped a minimum of 2 percent for positive drainage, and collector underdrains provided as necessary.

6.6.2 Preparation

Soils with silt contents above 50 percent should be undercut to a minimum depth of 2 feet below subgrade for frost protection. This is consistent with ODOT practice except that the undercut is reduced from 3 to 2 feet. Only a small percentage of soils sampled were this silty, requiring removal.

Geotextiles are proposed for use over the subgrade. Their primary function is separation by preventing the clay soils from intruding into either the granular base or the asphalt. See "Separation in Pavements: a Valuable Geosynthetic Function," by S. DeBeradino, Geotechnical Fabrics Report, February 1995, and

"Separation: Perhaps the Most Underestimated Geotextile Function," by R. Koerner and G. Koerner, Geotechnical Fabrics Report, January 1994.

6.6.3 Pavement Design Recommendations

Pavement construction is recommended to be full-depth asphalt without the use of a granular base course (Spec 304-ODOT). This is the prevailing practice in the Cincinnati area. The City of Sharonville, for instance, has a high percentage of industrial traffic and prefers this method exclusively. Several advantages of full-depth asphalt include the following:

1) The constructed cost of full-depth asphalt is approximately the same as for pavement with granular bases, and in many instances is less.

2) The closest source for crushed stone is approximately 60 miles away. The locally available crushed gravel is suitable as aggregate for asphalt or concrete, but questionable for use as granular base. The percent fines is quite high, apparently often exceeding the ODOT Specification 304 limit of 13 percent. The generally recommended upper limit is 8 to 9 percent fines in high quality granular bases.

3) Full-depth asphalt pavements are less likely to trap water and less conducive to a wet subgrade.

4) Total overall pavement depth of full-depth asphalt is less by 2-1/2 to 4 inches. In cut areas, this reduces the amount of required excavation and consequent disposal.

5) The cost for removing the pavement structure, if required because of contamination at final closure, will be reduced, as will the disposal cell volume occupied.

To improve surface stability against deformation or damage and achieve modest cost savings, the pavement is not recommended to include the ODOT Specification 404 smooth-wearing surface, except possibly for the relocated North Access Road to be used by the general public. Elsewhere, the wearing surface should be asphalt concrete, ODOT Specification 402.

Planned service lives of the haul road sections fall into the following three classes:

1) 4 years
2) 7 years
3) 10 years

The service life of the relocated North Access Road is more than 20 years.

CBR values adopted for subgrade strength should be as provided under Subsection 5.6.2. Requirements for subgrade preparation should consider the recommendations included in the 1952 Report as summarized herein in Subsection 5.6.2. However, consideration should also be given to whether rigorous compaction control is necessary to meet pavement service life requirements and are practical, considering influences of schedule, cost, and weather.

SECTION 7

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APPENDIX A

TENTATIVE DETAILS OF DISPOSAL FACILITY

Site Wide Disposal Facility
PRELIMINARY DESIGN ASSUMPTIONS

(As on November 30, 1994)

Disposal Facility Design Data

Capacity: 2,500,000 cubic Yards

Size: Foot Print Area - 1,290' X 2,390' (71 Acres)

Height: Average 51' (Max. 62.25', Min. 39.75')

Liner Area: 342,567 Square Yards (For Typical Liner Detail, refer to Appendix E-6 OU-2 FS)

Cap Area: 345,491 Square Yards (For Typical Cap Detail, refer to Appendix E-6 OU-2 FS)

Side Slope: 5-Horizontal to 1-Vertical (5:1)

Slope Top of Disposal Facility: Min. 3-percent, Max. 5-percent

Disposal Facility Construction Data

Start Construction: February 1997

Start Accepting waste: August 1997

No. of Cells: 5

Cell Capacity: 500,000 Cubic Yards Each

Cell Size: 1,290' X 480' (14.25 Acres) Each

Cell Construction: 2 Phases each cell

Phase size: 645' X 480' (7.1 Acres) Each

Intermediate Cover: As Required

Staging Area (concrete): 160' X 160'

Storage Area (Asphaltic Concrete): 200' X 200'

Equipment and Personnel Decon. Facilities: 1-Each

Service Road: 15'-Wide with crushed rock surfacing

Fencing: 6'-High chain link fence

No. of Monitoring Wells: 50 Pairs

B

APPENDIX B

BORING AND CPT COORDINATES

Pre–Design (Phase II) Investigation – Geotechnical Boring Location and Depth

Boring ID	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft–MSL)	B/G Interface	Depth (feet)
11468	483010.93	1382488.59	609.78	13.50	46.0
11469	482802.15	1382766.11	610.04	12.00	45.0
11470	482724.36	1382489.67	605.90	9.25	45.5
11471	481255.59	1382445.05	589.01	11.50	35.0
11472	479737.00	1382411.82	584.65	17.75	25.5
11473	480168.48	1382424.10	585.61	13.50	25.0
11474	480697.37	1382732.62	591.58	11.80	25.0
11475	479526.63	1382699.70	591.84	16.75	21.0
11476	481556.97	1382449.66	593.95	10.50	27.3
11477	481800.66	1382750.24	597.88	11.50	35.5
11478	482105.96	1382757.45	601.24	16.00	35.0
11479	482091.12	1382463.63	602.25	10.00	39.0
11480	482409.77	1382766.66	606.21	12.50	31.5
11481	482636.25	1381865.58	599.52	12.50	40.0

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Design (Phase III) Investigation – Boring Location and Depth

Boring ID	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft–MSL)	Depth (feet)
G2–120	478773.12	1382633.71	588.08	21.5
G2–121	479097.13	1382783.04	588.41	21.5
G2–122	479068.99	1382384.60	587.52	19.0
G2–123	480059.08	1382781.31	592.02	25.0
G2–124	480094.62	1382164.34	582.44	82.0
G2–125	480692.34	1382131.94	588.17	25.0
G2–126	481296.31	1383002.59	598.88	81.5
G2–127	481296.90	1382762.16	593.78	30.0
G2–128	481310.19	1382113.74	588.90	25.0
G2–129	482063.46	1383014.99	605.18	42.0
G2–130	482039.04	1382117.68	591.22	81.5
G2–131	482806.83	1383012.54	612.23	82.3
G2–132	483058.03	1381878.78	603.41	45.0
G2–133	482648.59	1381282.46	595.19	37.0
G2–134	478745.89	1382973.17	590.00	14.0
G2–SB–01	478970.28	1382892.77	589.13	5.0
G2–SB–02	478911.73	1382267.56	587.61	5.0
G2–SB–03	479484.02	1382584.44	586.35	5.0
G2–SB–04	479875.17	1382897.85	594.56	5.0
G2–SB–05	479863.64	1382249.11	584.12	5.0
G2–SB–06	480668.22	1382569.99	589.98	5.0
G2–SB–07	481381.10	1382873.39	596.16	5.0
G2–SB–08	481396.18	1382211.79	590.92	5.0
G2–SB–09	481943.14	1382579.18	600.24	5.0
G2–SB–10	482584.29	1382894.65	608.69	5.1
G2–SB–11	482573.22	1382243.36	604.32	5.0
G2–SB–12	482930.69	1382587.33	612.95	4.2
G2–SB–13	482813.99	1381582.40	600.16	5.0
G2–SB–14	482321.87	1381611.01	593.34	5.0
G2–SB–15	479589.89	1378616.23	571.54	2.0
G2–SB–16	479963.96	1379160.06	572.19	2.0
G2–SB–17	480884.53	1379581.08	578.47	2.0
G2–SB–18	480768.44	1383207.68	598.90	2.0
G2–SB–19	481654.97	1383220.99	607.37	2.0
G2–SB–20	482567.17	1383239.35	612.79	2.0
G2–SB–21	483420.59	1382907.59	616.48	2.0

Engineering Evaluation for On–Site Disposal Investigation – Boring Location and Depth

Boring ID	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft–MSL)	Depth (feet)
1734	483300.00	1380000.00	592.00	25.0
1735	483300.00	1380500.00	594.00	13.0
1737	483306.00	1381957.00	606.50	15.0
1741	480700.00	1383000.00	595.50	30.0
1742	480213.00	1383000.00	594.00	29.0
1743	479100.00	1383000.00	589.50	24.0
1745	478500.00	1382000.00	586.00	27.0
1750	478500.00	1382500.00	593.00	30.0
1751	482740.00	1382575.00	607.00	28.0
1752	483620.00	1381480.00	618.00	30.0
1753	483630.00	1380000.00	610.00	8.0
2731	484155.00	1382895.00	620.00	29.0
2754	484149.05	1383465.72	608.30	120.0

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Central Storage Facility Investigation – Boring Location and Depth[1]

Boring ID	*Northing Coordinate (NAD 1927)*	*Easting Coordinate (NAD 1927)*	*Ground Surface Elevation (ft–MSL)*	*Depth (feet)*
CSF–1	482386.14	1381668.50	595.05	45.0
CSF–2	482375.20	1382068.34	599.54	45.0
CSF–3	482332.51	1381800.41	596.05	45.0
CSF–4	482328.86	1381933.70	596.53	45.0
CSF–5	482286.18	1381665.76	594.60	45.0
CSF–6	482275.23	1382065.61	594.52	45.0

[1] Coordinates and elevations estimated from ground features

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On-Site Disposal Cell Pre-Design Activities Investigation - Boring Location and Depth

Boring ID	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft-MSL)	Depth (feet)
G2-201	478449.83	1381723.93	580.57	24.5
G2-202	478646.65	1382349.97	590.10	75.0
G2-203	478234.86	1382136.51	587.60	24.5
G2-204	478433.71	1382764.52	596.15	24.2
G2-205	477822.93	1381923.79	583.49	23.7
G2-206	478019.24	1382550.42	591.43	24.5
G2-207	477617.08	1382348.42	588.99	77.0
G2-208	477808.73	1382961.93	596.27	24.2
G2-209	478125.60	1382863.29	598.78	25.0
G2-210	478132.27	1381824.28	583.18	25.0

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Pre–Design (Phase I) Investigation – Cone Penetrometer Location and Depth

CPT ID	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft–MSL)	Depth (feet)[1]
11411	482650.07	1381494.75	597.56	37
11412	479110.08	1382201.01	587.00	25
11418	482642.92	1381723.51	599.64	40
11420	478845.38	1381882.57	579.74	25
11421	482636.49	1381873.82	600.97	40
11422A	479722.64	1382999.26	592.58	10
11422B	479719.55	1382998.44	592.68	10
11422C	479717.94	1382998.03	592.59	25
11424	479258.26	1382455.52	587.09	25
11425A	479432.70	1382147.38	579.88	25
11425B	479429.66	1382146.87	580.09	25
11428	478430.83	1382669.98	595.11	25
11429	483017.93	1382491.39	610.26	40
11430	482882.84	1382778.56	611.92	40
11431	482725.22	1382482.57	605.56	40
11432	482715.99	1382764.62	608.70	40
11433	482642.12	1381723.46	599.31	40
11434	482415.14	1382767.34	606.25	40
11435	482097.80	1382465.54	602.20	35
11436	482106.34	1382758.76	601.03	40
11437	481870.92	1382458.85	600.24	35
11438	481811.06	1382751.78	598.63	40
11439	481558.86	1382451.33	594.13	30
11440	481492.28	1382744.08	594.61	35
11441	481257.68	1382445.28	588.95	30
11442A	481289.99	1382739.68	593.28	35
11442B	481287.09	1382739.66	593.21	35
11443A	481024.83	1382733.21	592.67	21
11443B	481021.70	1382732.97	592.69	30
11444	480698.66	1382432.61	589.91	25
11445	480698.66	1382724.97	591.62	25
11446	480438.18	1382425.81	587.98	25
11447	480174.70	1382419.09	585.44	25
11448	479741.99	1382408.68	585.14	25
11449	479421.95	1382401.21	584.58	25
11450	479527.70	1382697.28	591.71	25
11451	479100.87	1382393.55	587.58	25
11452A	479208.95	1382689.41	589.78	25
11452B	479205.19	1382689.32	589.93	25
11454A	478940.57	1382389.48	587.50	25
11454B	478935.00	1382389.57	587.46	25
11455	478891.96	1382681.27	592.65	25
11456	478492.47	1382380.88	593.26	25
11457	478139.01	1382372.06	586.48	25
11458	477877.06	1382364.82	589.60	25
11465	482584.73	1382127.41	601.76	
11466	477984.50	1382661.46	592.20	

[1] Depth rounded to nearest foot

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Design (Phase III) Investigation – Cone Penetrometer Location and Depth

CPT ID	New CPT No	Northing Coordinate (NAD 1927)	Easting Coordinate (NAD 1927)	Ground Surface Elevation (ft-MSL)	Depth (feet)(1)
CPT-500	11664	478746.66	1382975.92	590.61	21
CPT-501	11663	478770.99	1382629.26	587.76	54
CPT-502	11662	478778.36	1382142.85	590.56	20
CPT-502B	11662	478775.93	1382137.87	590.78	20
CPT-503	11660	479107.45	1383008.67	590.92	57
CPT-504	11661	479091.64	1382768.61	588.75	22
CPT-504B	11661	479091.75	1382771.87	588.57	22
CPT-505	11669	479083.06	1382587.01	589.82	21
CPT-506	11670	479052.05	1382121.48	584.95	55
CPT-507	11616	479461.34	1382913.75	590.44	23
CPT-508	11659	479675.08	1382580.16	587.72	25
CPT-509	11623	479663.90	1382169.54	582.38	24
CPT-510	11655	480052.35	1382784.12	592.02	25
CPT-511	11653	480070.86	1382563.26	588.47	25
CPT-512	11647	480094.62	1382162.01	582.74	95
CPT-513	11656	480296.90	1382970.34	593.46	57
CPT-514	11651	480442.01	1382754.58	591.69	24
CPT-514B	11651	480448.95	1382754.21	592.02	25
CPT-515	11638	480449.63	1382117.71	585.27	51
CPT-516	11650	480676.05	1383006.61	595.23	29
CPT-517	11635	480694.83	1382130.95	588.17	54
CPT-518	11644	480981.16	1383009.61	596.93	30
CPT-519	11646	480980.07	1382584.16	590.77	28
CPT-520	11649	480980.44	1382426.15	590.20	27
CPT-521	11634	480992.28	1382137.91	588.20	26
CPT-522	11645	481297.17	1383008.05	598.87	67
CPT-523	11641	481347.73	1382572.56	591.10	29
CPT-524	11633	481309.17	1382113.54	588.86	58
CPT-525	11640	481692.45	1383014.29	602.43	38
CPT-526	11637	481698.65	1382558.87	596.61	35
CPT-527	11639	481697.82	1382434.52	597.97	35
CPT-528	11632	481698.39	1382206.56	593.06	30
CPT-529	11636	482071.34	1383014.49	605.18	67
CPT-529B	11636	482074.29	1383014.51	605.18	67
CPT-530	11631	482040.42	1382116.56	591.01	54
CPT-531	11635	482508.05	1383001.57	609.38	48
CPT-531B	11635	482509.50	1383000.69	609.24	48
CPT-532	11612	482473.56	1382523.96	603.27	43
CPT-533	11629	482547.20	1382369.12	603.34	16
CPT-533A	11629	482550.06	1382365.77	603.46	43
CPT-534	11610	482806.98	1383014.90	612.54	73
CPT-535	11611	483083.47	1383015.27	612.79	48
CPT-536	11613	483107.06	1382551.47	613.51	40
CPT-537	11614	483046.64	1382182.42	605.83	40
CPT-538	11630	482202.98	1382066.32	591.28	37
CPT-538B	11630	482203.76	1382064.07	591.46	37
CPT-539A	11619	482798.52	1382090.07	604.33	37
CPT-539B	11619	482799.06	1382099.29	604.33	37
CPT-539C	11619	482799.31	1382103.24	604.32	37
CPT-540	11628	482452.90	1382006.64	598.53	38
CPT-541	11621	483058.97	1381880.74	603.41	
CPT-541A	11621	483059.12	1381877.16	603.42	
CPT-542	11627	482212.33	1381675.62	590.24	51
CPT-542B	11627	482212.70	1381670.51	590.37	51
CPT-543	11617	482817.11	1381574.44	600.56	40
CPT-544	11626	482463.31	1381601.72	595.84	37
CPT-545	11615	482649.73	1381274.06	595.48	45
CPT-545B	11615	482649.43	1381277.67	595.62	55
CPT-546A	11624	483072.52	1381394.40	600.74	38
CPT-546B	11624	483072.13	1381387.98	600.37	38
CPT-547	11625	482222.21	1381249.76	589.68	34

(1) Depth rounded to nearest foot

C

APPENDIX C

CONE PENETROMETER/CBR CORRELATIONS

CONE PENETROMETER CBR CORRELATIONS

Introduction

To provide a preliminary estimate of California Bearing Ratio (CBR) for proposed haul road design, Cone Penetrometer Test (CPT) data in the vicinity of the roads were used to develop an estimate of the CBR values for natural subgrade soils.

Method of Analysis

FERMCO provided PARSONS with electronic data files from the Phase I and Phase III investigations at the proposed disposal facility site. Additionally, files for CPT tests performed in Operable Unit 1 (OU-1) (west of the former production area) were provided. The files contained various strength correlations provided by the CPT Contractor, Applied Research Associates, Inc. These data files included correlated values for undrained shear strength (S_u) with depth for each sounding. Figure C-1 shows the location of the CPTs relative to the proposed haul road.

To perform the analysis, the digital S_u values in the top 5 feet of the soil profile were used to obtain an average value for the 5 foot interval. An Intergraph GIS work station was used to manipulate the data to obtain maximum, minimum, and average values for the top 5 feet of S_u CPT data. A chart (see Figure C-2) from *Evaluation of AASHTO Interim Guides for Design of Pavement Structures* (Van Til, et al. 1972) was then used to estimate the CBR value of the natural subgrade at each CPT location. Figure C-1 presents all CPT locations used to develop averages for each area shown.

Results

Table C-1 lists the minimum, maximum, and average S_u values and the associated correlated CBR value from Figure C-2. Table C-2 summarizes the CBR values for the seven areas in the vicinity of the haul road.

The estimated CBRs for the natural subgrade for Areas 1 through 4 ranged from about 3.2 to 4.2, while the CBRs for Areas 5 through 7 were greater than 6. On review of the CBR values from the individual CPTs for Areas 5 though 7, it can be seen that all individual CBR values from CPTs in these areas are not necessarily greater than 6. Furthermore, the CPT values that are greater than 6 predominantly came from soundings performed during the Phase I (114XX series) or the OU-1 (C6-X series) investigation. This suggests that possibly different equipment or test setup was used during the various investigations, or possibly that different ground-saturation conditions existed when the CPT soundings were performed. For the Phase III CPTs (CPT-XXX series), which were conducted at the end of March 1995, the ground was wet, sometimes resulting in the need to use a bulldozer to tow the CPT truck to test locations.

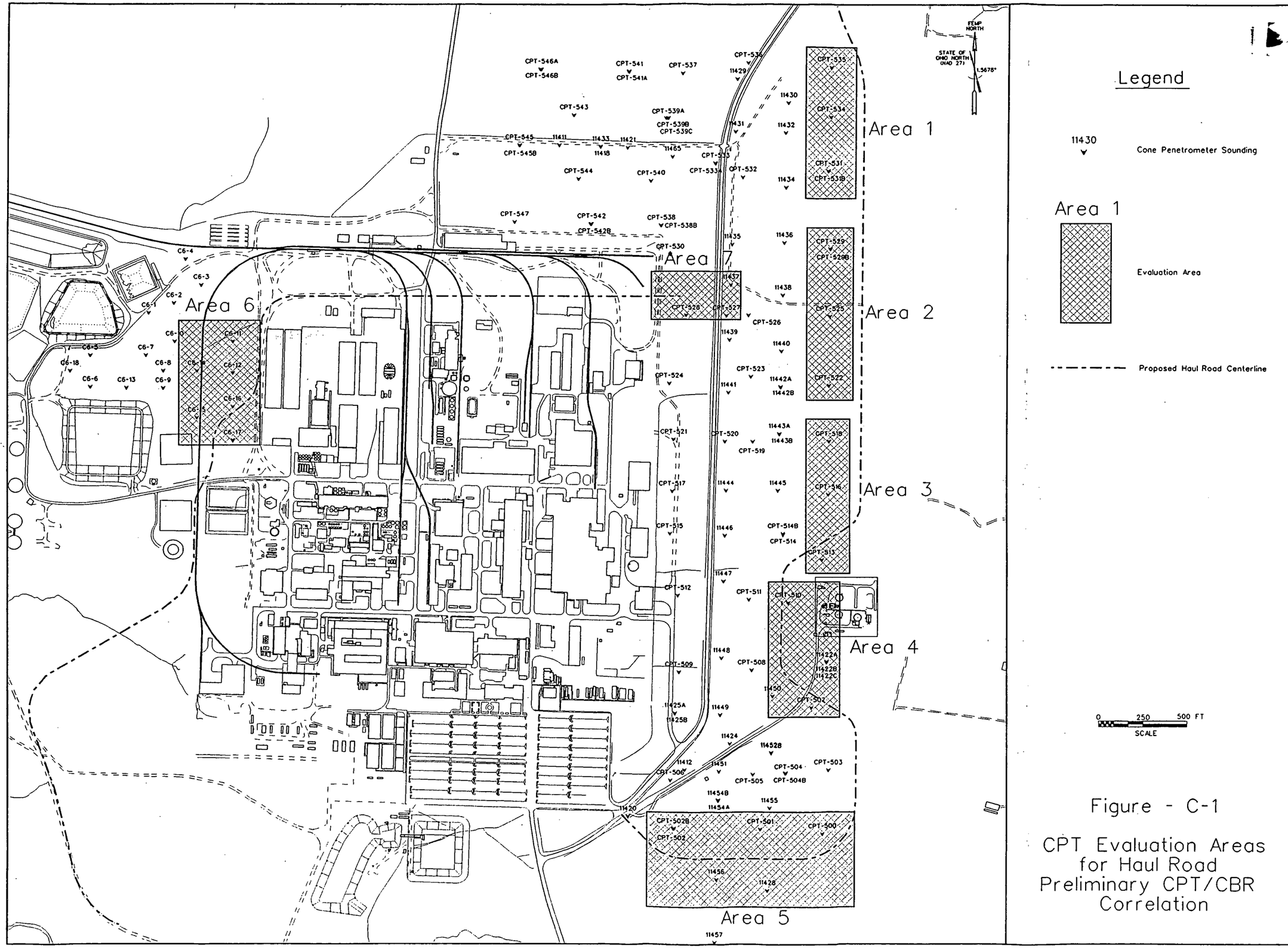

Figure C-1 - CPT Evaluation Areas for Haul Road Preliminary CPT/CBR Correlation

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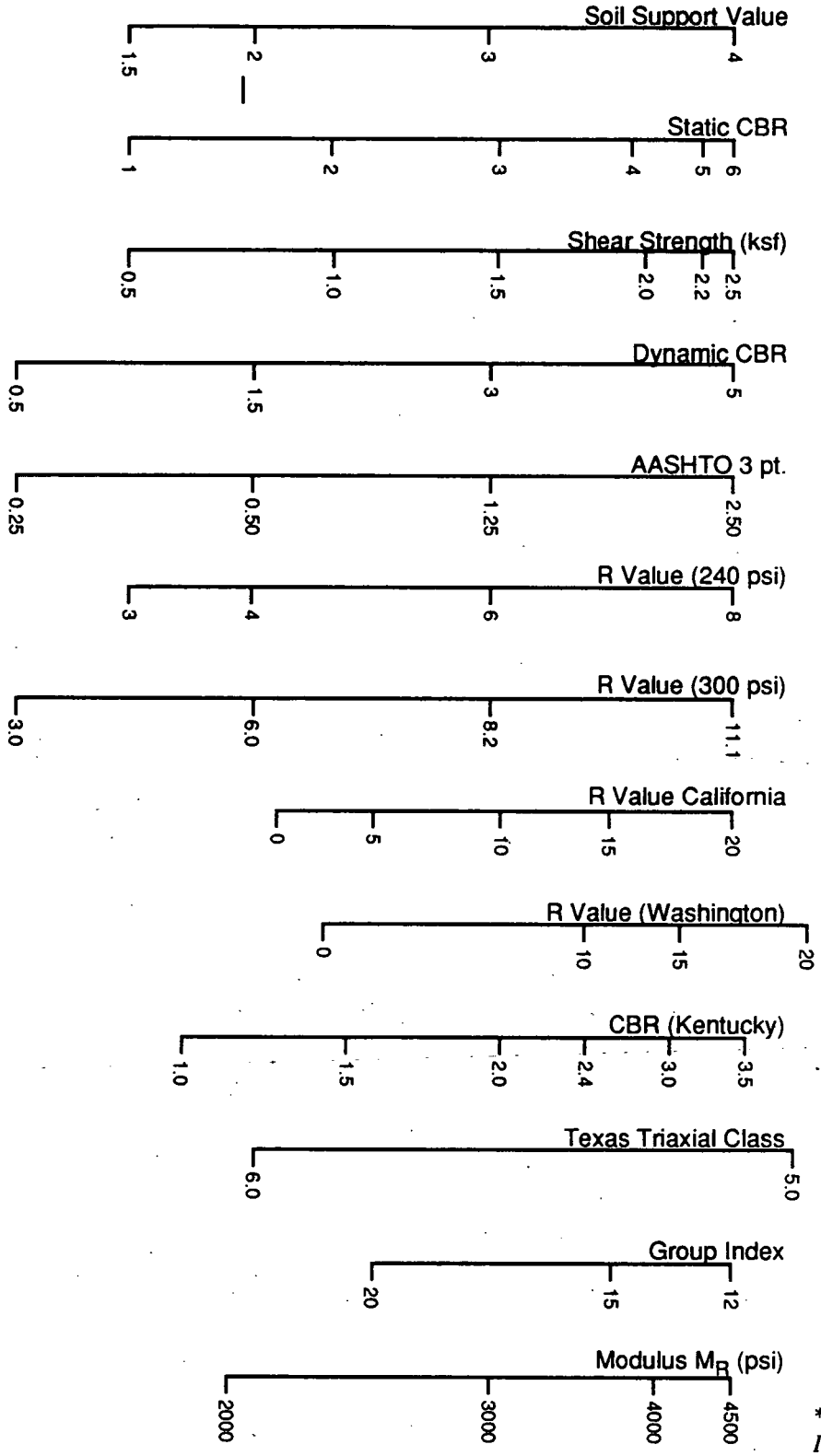
Table C-1
Minimum, Maximum, and Average S_u Values and Correlated CBR for Individual CPTs from Surface to 5 Feet Below Surface

CPT ID	Minimum Su (psi)	Maximum Su (psi)	Average Su (psi)	Average Su (ksf)	Num. Points from 0 to 5 feet	Corr. CBR (Fig. C-2)
11428	6.85	63.23	52.02	7.5	43	>6
11437	7.16	60.40	46.14	6.6	29	>6
11450	2.10	23.53	15.47	2.2	21	5
11456	3.29	39.40	27.85	4.0	22	>6
C6-11	5.49	205.82	58.91	8.5	38	>6
C6-12	1.76	39.90	21.87	3.1	58	>6
C6-14	5.96	147.03	66.73	9.6	92	>6
C6-15	3.17	93.34	36.34	5.2	87	>6
C6-16	11.79	136.33	59.61	8.6	68	>6
C6-17	7.41	220.91	103.19	14.9	67	>6
CPT-500	1.51	38.76	16.08	2.3	94	5.5
CPT-501	1.01	17.87	8.83	1.3	178	2.5
CPT-502	1.05	32.38	17.16	2.5	62	6
CPT-502B	4.28	33.08	17.58	2.5	20	6
CPT-504	3.97	15.39	9.99	1.4	42	2.7
CPT-507	2.48	50.77	9.03	1.3	99	2.5
CPT-510	0.64	27.95	13.25	1.9	95	4
CPT-513	2.06	28.03	15.45	2.2	99	5
CPT-516	3.14	34.89	15.90	2.3	82	5.3
CPT-518	0.84	36.03	9.83	1.4	53	2.7
CPT-522	1.53	23.39	11.56	1.7	56	3.5
CPT-525	2.79	47.40	12.13	1.7	22	3.5
CPT-527	3.62	13.17	9.31	1.3	36	2.5
CPT-528	1.81	26.32	14.15	2.0	83	4.2
CPT-529	0.94	16.76	9.99	1.4	130	2.7
CPT-529B	0.00	16.88	9.64	1.4	88	2.7
CPT-531	2.06	43.70	10.71	1.5	69	3
CPT-531B	1.36	25.72	11.69	1.7	42	3.5
CPT-534	3.49	44.64	18.34	2.6	30	>6
CPT-535	1.51	38.76	16.08	2.3	94	5.3



* From *Evaluation of AASHTO Interim Guides for Design of Pavement Structures*, NCHRP 128, Van Til, D.J., et al., 1972.

Figure C-2 - Typical Relationship Between Several Measures of Soil Strength and Soil Support Value

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Table C-2
Minimum, Maximum, and Average S_u Values and Correlated CBR for Haul Road Areas From Surface to 5 Feet Below Surface

Area ID	Minimum Su (psi)	Maximum Su (psi)	Average Su (psi)	Average Su (ksf)	Num. Points from 0 to 5 feet	Corr. CBR (Fig. C-2)
Area 1	2.30	38.02	13.58	2.0	141	4.2
Area 2	1.32	26.11	10.83	1.6	296	3.2
Area 3	1.73	35.58	12.58	1.8	293	3.7
Area 4	1.74	34.08	12.58	1.8	215	3.7
Area 5	3.00	37.45	23.25	3.3	419	>6
Area 6	5.93	140.56	57.78	8.3	410	>6
Area 7	4.20	33.30	23.20	3.3	148	>6

Notes:
Su = Undraind Shear Strength from CPT Correlation from ARA, Inc. CPT data file
Area 1 = CPT-531, CPT-531B, CPT-534, CPT-535
Area 2 = CPT-522, CPT-525, CPT-529, CPT-529B
Area 3 = CPT-513, CPT-516, CPT-518
Area 4 = 11450, CPT-507, CPT-510
Area 5 = 11428, 11456, CPT-500, CPT-501, CPT-502, CPT-502B
Area 6 = C6-11, C6-12, C6-14, C6-15, C6-16, C6-17
Area 7 = 11437, CPT-527, CPT-528

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Considering only the individual CPTs from the Phase III investigation, the average correlated CBR value for the natural subgrade was about 4.

Conclusions

A typical CBR value for the natural subgrade material along the proposed haul road, estimated from the CPT data, is about 4 to 5. This is corroborated by a "soaked CBR test" result of 4.8 for natural subgrade soil along the South Access Road described in the *Report of Foundation Investigation, Feed Materials Production Center, Fernald Ohio* (COE 1952).

It should be noted that the CPT locations were not located along the center of the proposed road and were used to develop CBR values through correlations and charts.

An alternative approach for estimating CBR can be found in *Foundation Engineering* (Fang 1991). Figure C-3 is a chart for approximate interrelationships between soil classification, bearing values, and some in situ parameters (Fang 1991). The chart presents a correlation that uses parameters from the CPT test directly (i.e., cone tip bearing and friction ratio). Further evaluation of the CPT could be conducted using this correlation for comparison with the results of the analysis above. The utility of these correlations could be enhanced by performing additional CPT soundings along the centerline of proposed roads.

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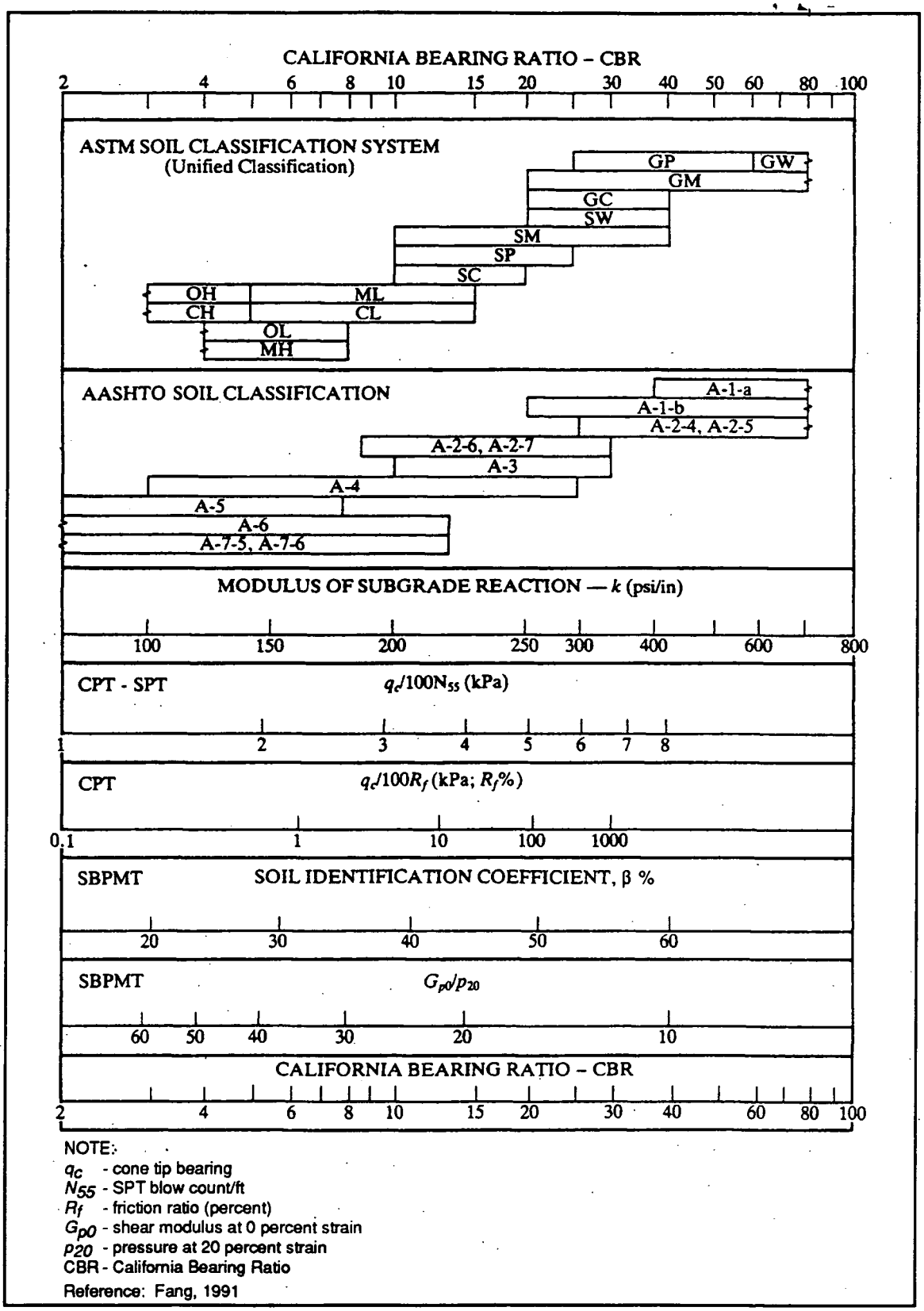

NOTE:
q_c - cone tip bearing
N_{55} - SPT blow count/ft
R_f - friction ratio (percent)
G_{p0} - shear modulus at 0 percent strain
p_{20} - pressure at 20 percent strain
CBR - California Bearing Ratio
Reference: Fang, 1991

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Figure C-3 - Chart for Approximate Interrelations Between Soil Classification, Bearing Values, and Some In Situ Parameters

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D

APPENDIX D

PHASE III INVESTIGATION - GEOTECHNICAL FIELD BORING LOGS AND GEOTECHNICAL LOGGING REPORTS

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-120	Drilling Method: Mobile B-61 HSA	Date Started: 5/2/95
Coordinates:	Geologist: R. Nicks	Date Completed: 5/2/95
Ground Surface Elevation:	GWL/DATE: 16.6 BGS/5-2-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Fat clay, olive brown with trace of sand, medium stiff, wet (CH)	405123	2.5-4.0	SS	3-2-5	18	
6	Sandy lean clay, olive brown with scattered gravel to 1 inch, very stiff, moist CL	405124	5.0-7.0	ST	NA	19	MC, MC_M, UW, GS, CON_{RS}, AL
		405125	7.5-9.0	SS	8-9-11	17	
10.5	Sandy lean clay, with scattered gravel, dark greenish-gray, very stiff to hard, moist (CL)	405126	10.0-10.5	SS	NA	6	
		405127	11.0-13.0	D	NA	2	
		405128	13.5-15.0	SS	6-10-22	15	
		405129	17.5-19.0	SS	4-9-30	15	
		405130	20.0-21.5	SS	8-11-14	18	
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-G2120-003

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation				PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-120	COORDINATES:	RELATED FAL NOs.:		
SURFACE ELEVATION:	GROUNDWATER LEVEL: 17'3" BGL	DATE: 5/2/95	TIME: 1048	DATE STARTED: 5/2/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: 16.6 BGL	DATE: 5/2/95	TIME: 1300	DATE COMPLETED: 5/2/95
WATER USED DURING DRILLING: 130 gal.	DRILLING CONTRACTOR: Alliance Environmental Svc	DRILLING EQUIPMENT: Mobile B-61 HSA		DRILLER/HELPER: Marty, Proctor, Barry, Rick

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Fat CLAY 2.5Y 4/4 olive brn., w/ trace of sand (m-c) rounded, and scattered carbonaceous/organic pellets to 1/8" soft to stiff, wet	CH		
	0847 5/2/95 405123	3 2 5	18"			<.5 to 1.5	<.5 @ 3-3.5'
5							
	0902 5/2/95 405124	Sh cl by	19"	LEAN CLAY with SAND, trace gravel to 1" 2.5Y 4/4 v. stiff, moist	CL		Tip crumpled 600 lbs down pressure
	0911 5/2/95 405125	8 11 19	17"	Gravelly CLAY with SAND 2.5Y 5/4 lt. oliv. brn. v. stiff, moist	CL	>4.5	
10	Archive 405126		6"				0925 - Archive 405126, 30 gal H2O Tried Denison h.b cobble in 1st 6 inches try Sample 11'-13' w/Denison
	0950 5/2/95 ~~405127~~ 405127	Den Sa n	2"	10Y 4/1, dk. grn. gray LEAN CLAY with SAND, trace gravel to 1½", v. stiff to hard, moist	CL	>4.5	
				GRAVELLY SAND 10YR 4/4, dk. yel. brn. with silt, v. dense, wet	SW		50 gal H2O for sample attempt
	1000 5/2/95 405128	6 10 22	15"	LEAN CLAY with GRAVEL, trace sand 10Y 4/1 dk. grn. gray, v. stiff, moist. m-f sand stringers to 1/8". gravels to 1"	CL		~~No sam~~
15	1012 5/2/95 No sample	Den Sam	0"				50 gal H2O for sample attempt
	1032 5/2/95 405129	4 9 30	15"	trace gravel to ½" 10Y 4/1 dk grn gr. stiff to v. stiff, moist	CL	2.25	
20							

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5-17-95

200308-G2120-004

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
PHASE III GEOTECHNICAL INVESTIGATION	20.03.08	G2-120

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1041 5/2/95 405130	8 11 14	18"	LEAN CLAY with sand and trace gravel to ½", 10Y 4/1 ~~dkgrn~~ dk. grn. gray	CL	2.25 to >4.5	
				TOTAL DEPTH 21½ ft.			

000132

NOTES:

WELL NUMBER: 11695 G2-120

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308-G2120-006

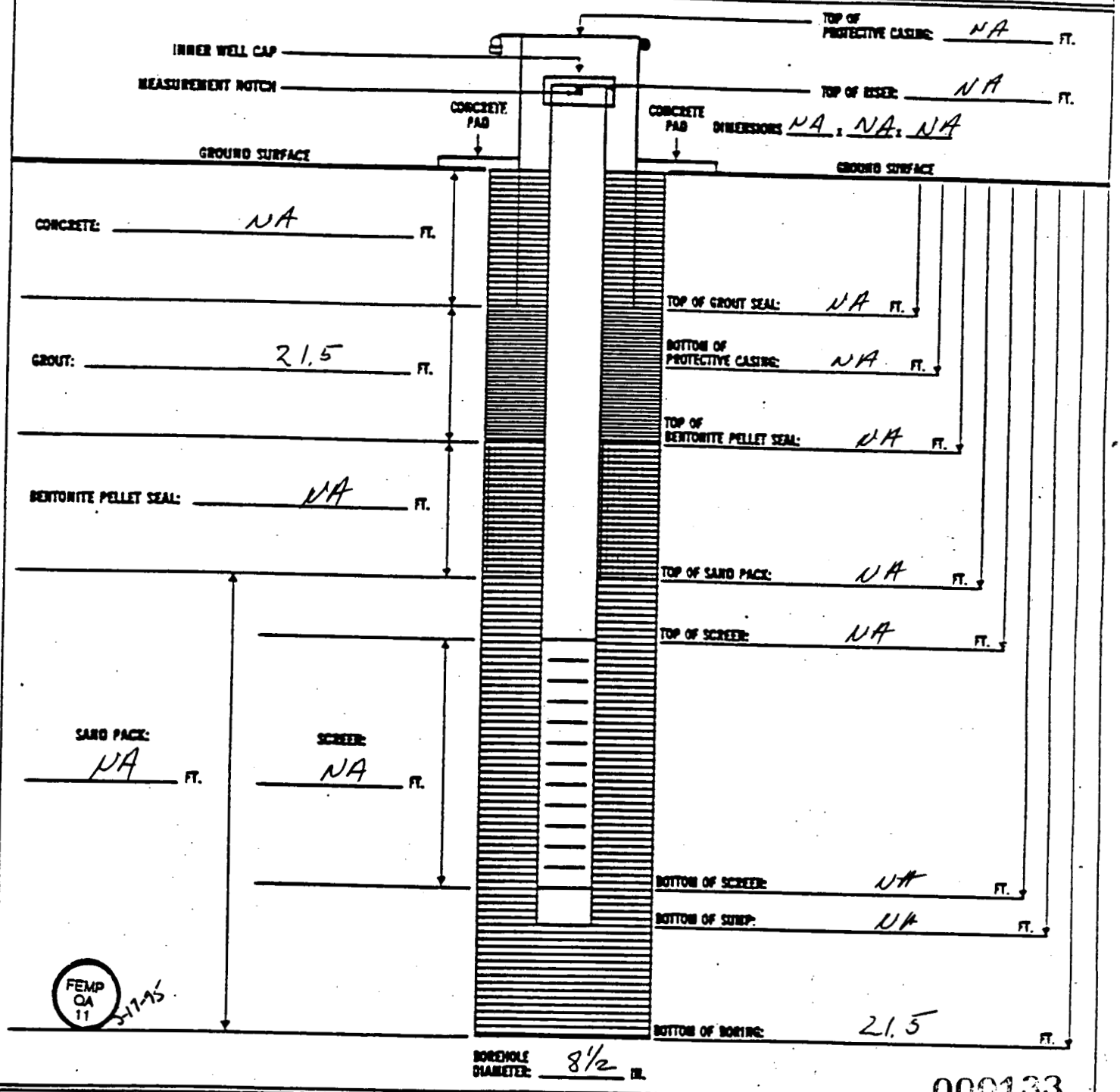
PROJECT NAME: Phase III Disposal Facility

PROJECT NUMBER: 20.03.08

GEOLOGIST: Ken Coleman

DRILLING METHOD: Hollow Stem Auger

DATES OF INSTALLATION	WATER LEVEL (R.L.)	DATE	RELATED FAL NUMBERS	CHECKED BY
5/2/95	16.65	5/2/95		



000133

TYPE AND AMOUNT OF GROUT USED	BENTONITE PELLETS (5-GALLON BUCKETS)	DEEPEST TEMPORARY DRILLING CASING PENETRATION
K Grout 6 Bags	NA	NA FT.
VOLUME OF WATER USED DURING DRILLING	**RISER MATERIAL**	**VOLUME OF WATER USED FOR GROUT HYDRATION**
NA GAL	NA	42.0 GAL

RISER WALL THICKNESS	TYPE OF SAND PACK	SCREEN MATERIAL	DRILLING CASING DIAMETER
NA	NA	NA	NA IN.
RISER/SCREEN DIAMETER	**SCREEN SLOT SIZE**	**SCREEN TYPE**	**DEPTH OF CENTRALIZER(S)**
NA IN.	NA IN	NA	NA FT.

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-121	Drilling Method: Mobile B-61 HSA	Date Started: 4-27-95
Coordinates:	Geologist: J. Erjavec	Date Completed: 5-1-95
Ground Surface Elevation:	GWL/DATE: 1.5 BGS / 5-1-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay with sand, light olive brown, moist, stiff (CL)	404808	2.5-4.5	ST	NA	15	Hold
		404810	5.0-6.5	SS	2-5-6	11.5	
7.5	Sand with gravel, light olive brown, medium dense, wet (SW)	404811	7.5-9.5	ST	NA	5	
9.5	Sandy lean clay, light olive brown to greenish-gray, with trace of gravel, stiff moist to very moist CL	404812	10.0-11.7	ST	NA	18	UW, GS, AL, CU
		404814	12.5-14.5	ST	NA	21	MC, MC_m, UW, GS, AL, P
		404816	15.0-16.5	SS	5-20-21	18	
		404817	17.5-19.5	ST	NA	19	MC, UW, GS, AL, P
		404819	20.0-21.5	SS	12-14-15	1	
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-G2121-004

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-121	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 13.4 bls	DATE: 4/27/95	TIME: 1557	DATE STARTED: 4/27/95
GEOLOGIST: J. Erjavec	GROUNDWATER LEVEL: (2) 1.5 bls	DATE: 5/1/95	TIME: 0740	DATE COMPLETED: ~~4/27/95~~ 5/1/95 JE
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Env., Inc	DRILLING EQUIPMENT: Mobile Drill B-61 HSA	DRILLER/HELPER: B. Erickson / B. Babcock	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1							Augered to 2.5' from cuttings
2							2.5-4.5' ST 2 13/16" ID
3	1358 4/27/95		15"	~~Very moist~~ light olive brown clay with sand (fg-mg, angular) with organic material (black), clay-med plasticity moist (2.5Y 5/6) Iron staining	CL		Push 24" max 300 psi (1)
4	404808						404808 = ARCHIVE from end of ST
5							Augered
6	14:13 4/27/95 404810	-2 -5 -6	11.5"	light olive brown clay (2.5Y, 5/4) trace sand of gravel (subangular-rounded), clay-med plasticity, moist, Gravel ~1/8" or less (fine) Iron staining, med. stiff JE	CL	1.0	SS-2" OD 5-6.5' JE
7							Augered
8	14:30 4/27/95		JE 3.5"	med-coarse dark brown sand with gravel (up to 2" angular, granitic-metamorphic). ~~Clay~~ Sand-dirty, ~~well~~ poorly graded, large # of metric minerals-black	~~CL~~ ~~SP~~ JE SW		7.5-9.5 ST push 24" 250/800/300 psi max last 6"
9	404811 Archived Sample		above 4"	Clay, light olive brown (2.5Y 5/6) wet, low plasticity			Tube crimped - slight recovery ~~Sampled archived only~~ Project
10	14:43 4/27/95 404812		JE 18" 18"	clay, light olive brown (2.5Y 5/3) mottled with grayish gray clay (10Y 6/1), low plasticity, moist, trace organics (reddish-black)	CL		push 18" 300/450/800 1-6" 2-6" 1-7" ST 11-11.7 (Tube wet) 404813 Archived
1.7							
	15:03 4/27/95 404814		20"	clay, greenish gray (10Y, 5/1) moist, low plasticity, with gravel (subrounded-subangular, .5-1") trace sand (fg to vfg) gray.	CL		Push 18" 300/400 1-12" last 6" ST 12.5-14.5 404815 Archived
15							Augered
	15:15 4/27/95 404816	-5 -20 -21	18"	silty clay, greenish gray (10Y, 5/1) moist, low plastic. with sand, gray, vfg-fg. Sand interbedded in clay. ~~Trace gravel~~, hard (3)	CL		SS - 15-16.5'
							Augered
	15:35 4/27/95 404817		19"	silty clay, dark grayish gray (10Y, 4/1) with ~~sand~~ trace ~~sand~~ JE gravel (fine). Low plasticity. v. moist.	CL		18" push 450 psi max 404818 - Archived ST 17.5-19.5 Tube wet
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: HSA = Hollow Stem Auger
G2-121 loc. approx. 1.5' W of CPT-304
(1) Described samples from top of ST
bls = below land surface
(2) Level misc may be partially due to Rainwater
Weekend of 4/29-4/30

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5/7/95

4/95

200308-G2121-005

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
PHASE III Geotech. Investig.	20.63.08	G2-121

	DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20		15:45 4/27/95 404819	-12 -14 -15	1"	Silty clay, greenish gray (10Y, 5/1) with sand, moist-wet, med-plastricity, v. stiff (3)	CL		SS 20-21.5' Sample wet
22					Bottom of boring = 21.5' KE KE			

000136

NOTES: (3) consistency based on SPT blow-count, otherwise, consistency assigned based on pocket penetrometer reading KE

FEMP OA 11 6-14-95

G2-121

E. 207

WELL NUMBER: 11697

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308-G2121-008

PROJECT NAME: CRAZ PHASE II DISPOSAL FACILITY GEOTECHNICAL FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

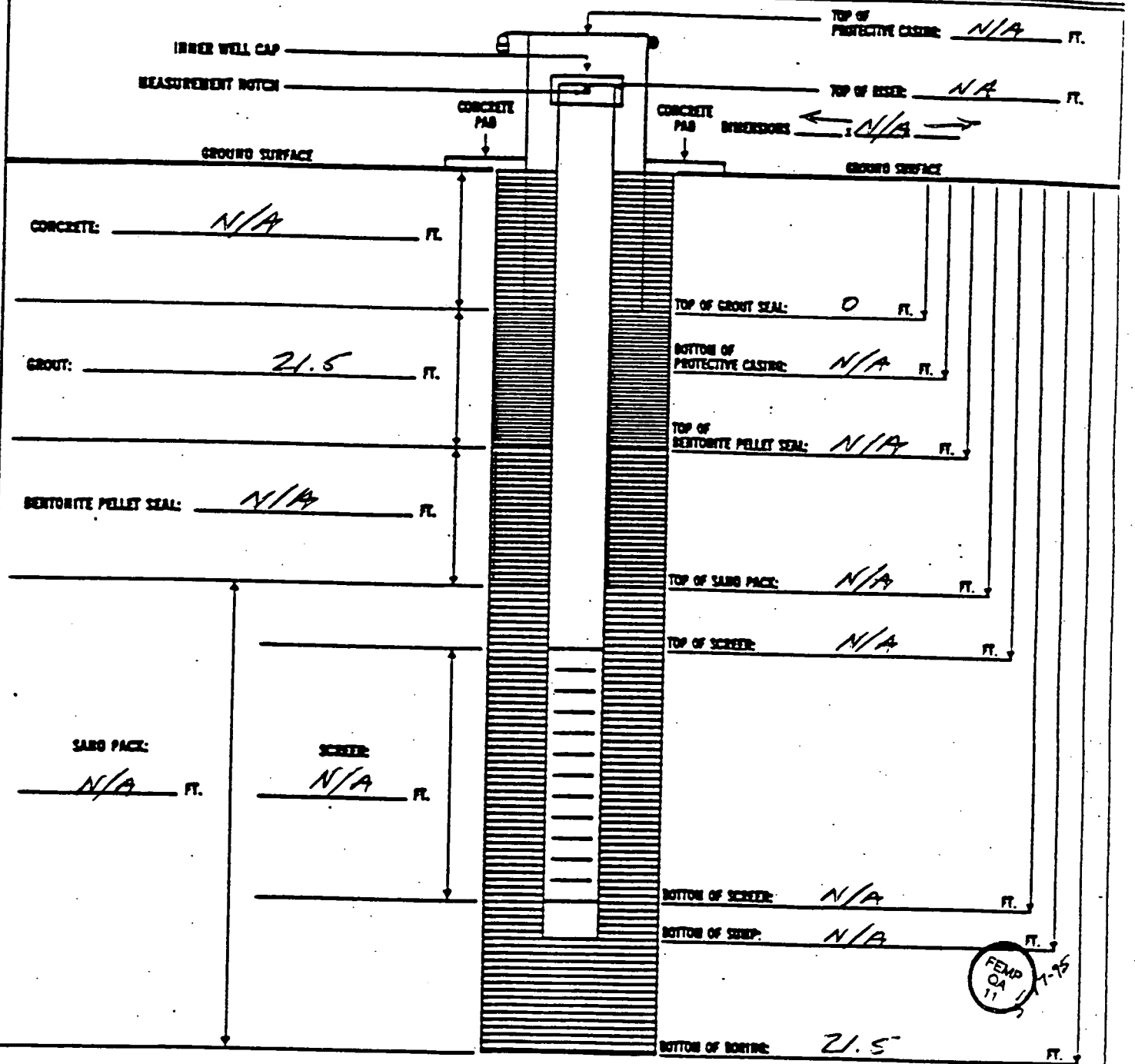
DATES OF INSTALLATION: 4/27 - 5/1/95

WATER LEVEL (ft): 13.4' BGL 1.5' BGL

DATE: 4/27/95 5/1/95

RELATED FAL NUMBERS: N/A

CHECKED BY:



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TYPE AND AMOUNT OF GROUT USED: TYPE E-I-K EXPANSIVE CMT. 6 - 94 lb. BAGS	BENTONITE PELLETS (5-GALLON BUCKETS): N/A	DEEPEST TEMPORARY DRILLING CASING PENETRATION: N/A FT.
VOLUME OF WATER USED DURING DRILLING: N/A GAL	RISER MATERIAL: N/A	VOLUME OF WATER USED FOR GROUT HYDRATION: 30 GAL

RISER WALL THICKNESS: N/A	TYPE OF SAND PACK: N/A	SCREEN MATERIAL: N/A	DRILLING CASING DIAMETER: N/A IN.
RISER/SCREEN DIAMETER: N/A IN.	SCREEN SLOT SIZE: N/A IN	SCREEN TYPE: N/A	DEPTH OF CENTRALIZER(S): N/A

Geotechnical Logging Report

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Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-122	Drilling Method: Mobile B-61 HSA	Date Started: 5-1-95
Coordinates:	Geologist: J. Erjavec	Date Completed: 5-1-95
Ground Surface Elevation:	GWL/DATE: Dry / 5-1-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, dark yellow brown to light olive brown with trace of sand, very stiff to hard, moist CL	404820	2.5-4.0	SS	3-8-12	13	
		404821	5.0-7.0	ST	NA	24	MC_m, UW, GS, AL, CON, CU
		404823	7.5-9.0	SS	19-14-20	19	
		404824	10.0-12.0	ST	NA	22	MC, MC_m, UW,GS,AL, UU, UU', UU_{r85}
		404826	12.5-14.0	SS	9-14-20	20	
		404827	15.0-17.0	ST	NA	24	MC, UW, GS AL, CU_{r85}
17	Lean clay, greenish-gray, with fossils and wood fragments, stiff, moist (CL)	404829	17.5-19.0	SS •	5-8-11	16	
	• Note: ASTM symbols in parentheses indicate visual classification						

5-29-95

FEMP QA 18

B- 207

FEMP
LITHOLOGIC LOG

CONTROL NO: 200308G2122-003

Page 1 of 1

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-122	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: DRY	DATE: 5/1/95	TIME: 13:45 5/1/95	DATE STARTED: 5/1/95
GEOLOGIST: J. Eriavec	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 5/1/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: Alliance Env. Inc.	DRILLING EQUIPMENT: Mobile Drill B-61 HSA	DRILLER/HELPER: B. Erickson / B. Belcock

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1, 2							Augered to 2.5' 12:30 brown cuttings = clay
2.5, 3	12:39 5/1/95 404820	-3 -8 -12	1.1' (13")	clay, dark yellowish brown (10YR 4/4) with organics (reddish brown), trace iron staining, trace silt, moist, low plasticity ~~clay and very stiff~~ JE very stiff 5/1/95	CL	2.5	SS-2" OD 2.5-4' 120 cpm
4.0, 4							
5.0, 5							Augered
6	12:50 5/1/95 404822 404821		24"	clay, light olive brown (2.5Y, 5/4), low plasticity, moist, mottled with yellowish brown clay, trace gravel, trace organics.	CL		ST 2 1/16" ID 5.0-7.0' (1) Push 24" 300/400/625 psi 1.5' 404822 (archived)
7.5, 7							Augered
8	13:02 5/1/95 404823	-9 -14 -20	19"	clay, light olive brown (2.5Y, 5/4), low plasticity, moist, with gravel to 1" diameter, subrounded to subangular, with organics, trace iron staining.	CL	4.0	SS 7.5-9'
9.0, 9				Gravel - granitic in native clay, very stiff to hard			Augered
10.0, 10	13:09 5/1/95 404825 404824		22"	clay, light olive brown (2.5Y, 5/4) low plast., moist, with gravel to 1" diam. (subangular to subrounded - granitic). Trace organics.	CL		ST 10.0-12.0' Push 24" 425/1100 psi 1-12" (10" last) 404825 (archived)
12.0, 12.5							Augered
14.0	13:19 5/1/95 404826	-9 -14 -20	20"	clay, light olive brown (2.5Y, 5/4), low plastic, moist, homogenous appearance, trace gravel, trace sand, trace iron staining, trace organics, clay - hard	CL	7.5	SS 12.5-14.0'
15.0, 15							Augered
17.0	13:30 5/1/95 404827		24"	clay, (top sample in brown clay; bottom - gray clay), greenish gray (10Y, 5/1), med. plasticity, moist, trace gravel to 1/2" diam. with some silt (greenish gray) JE 5/1/95	CL		ST 15.0-17.0' 300 psi / 550 max last 6" 404828 - archived, push 24"
17.5							Augered
19.0	13:45 5/1/95 404829	-5 -8 -11	16"	clay, greenish gray (10Y, 5/1), med. plastic, moist, trace to some gravel (angular/subrounded, including reworked fossil debris from Ordovician. Trace organics - wood or root material, well preserved, some silt, gray (greenish). Fossil is - bryozoan clay - stiff	CL	2.0	SS 17.5-19.0' 5/1/95 JE 5/1/95
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA	SEE FAL		
BETA/GAMMA			

NOTES: HSA = Hollow Stem Auger
(1) ST samples from bottom ST 1"

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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000139 495

G2-122

WELL NUMBER: 11696

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308G2122-005

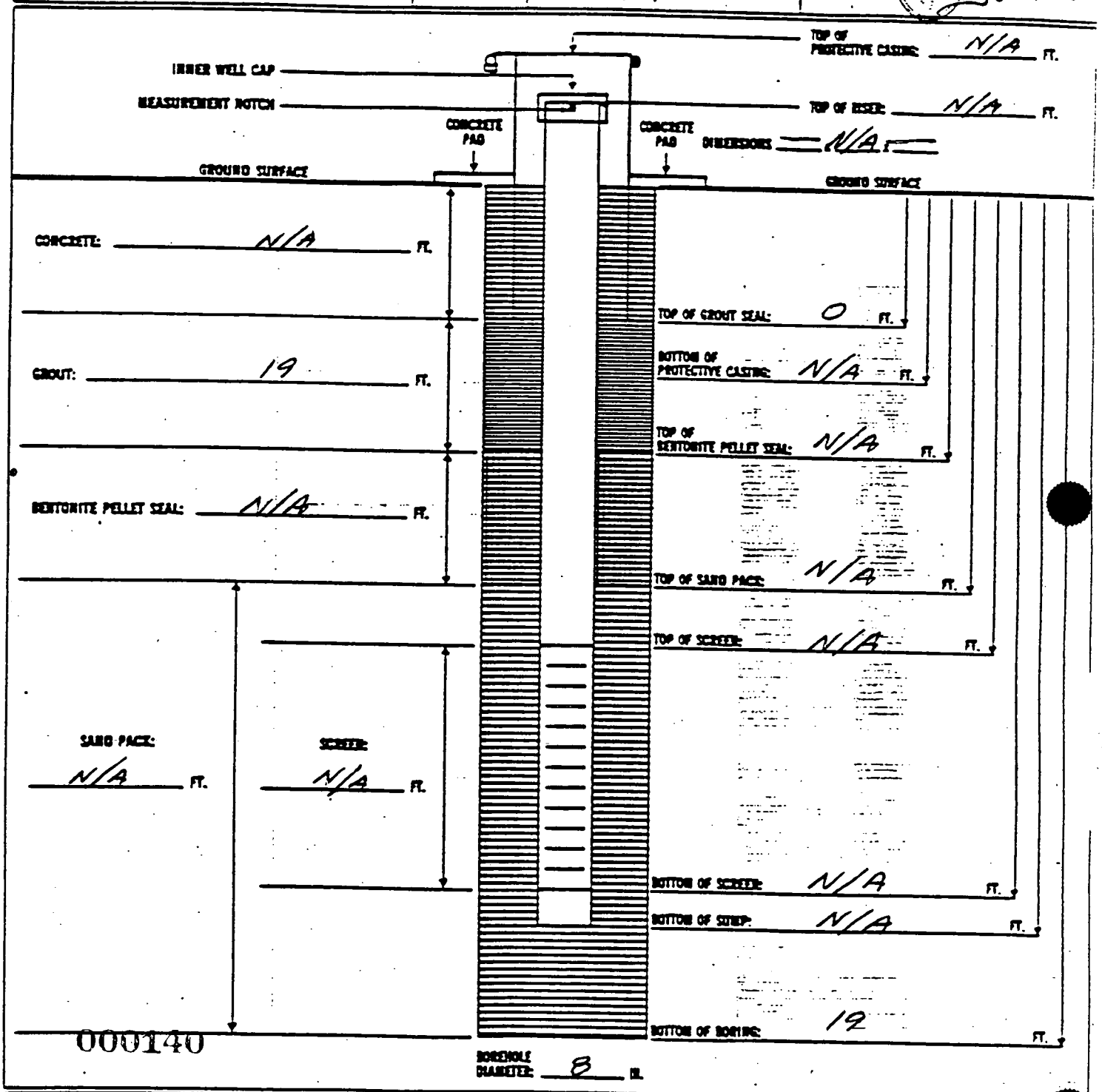
PROJECT NAME: CAU 2 PHASE III DISPOSAL FACILITY GEOTECHNICAL FIELD INVESTIGATION

PROJECT NUMBER: 20-03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

DATES OF INSTALLATION:	WATER LEVEL (ft.):	DATE:	RELATED FAL NUMBERS:	CHECKED BY:
5/1/95	NONE	N/A	N/A	5-24-95



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TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION:
TYPE E-I-K EXPANSIVE CMT. 6 94 LB. BAGS	N/A	N/A FT.

VOLUME OF WATER USED DURING DRILLING:	RISER MATERIAL:	VOLUME OF WATER USED FOR GROUT HYDRATION:
NONE GAL	N/A	30 GAL

RISER WALL THICKNESS:	TYPE OF SAND PACK:	SCREEN MATERIAL:	DRILLING CASING DIAMETER:
N/A	N/A	N/A	N/A IN.

RISER/SCREEN DIAMETER:	SCREEN SLOT SIZE:	SCREEN TYPE:	DEPTH OF CENTRALIZER(S):
N/A IN.	N/A IN.	N/A	N/A

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-123	Drilling Method: Mobile B-61 HSA	Date Started: 4-26-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-26-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Sandy lean clay, light olive brown to dark yellow brown, with scattered gravel, very stiff to hard, moist CL	404794	2.5-4.5	ST	NA	24	Hold
		404796	5.0-6.5	SS	5-10-13	18	
		404797	7.5-9.5	ST	NA	22	UW, GS, AL, CU
		404799	10.0-11.5	SS	12-19-26	17	
13	Sandy lean clay, dark greenish gray with alternating traces of sand and gravel, very stiff to hard, moist CL	404800	12.5-14.5	ST	NA	22	MC, MC_m, UW, GS, AL, P
		404802	15.0-16.5	SS	8-11-15	15	
		404803	17.5-19.5	ST	NA	13	
		404804	20.0-21.2	ST	NA	11	UW, GS, AL, CU
		404806	21.5-23.0	SS	16-19-30	11	
		404807	23.5-25.0	SS	5-21-21	7	
	* Note: ASTM symbols in parentheses indicate visual classification						

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CONTROL NO: 200308G2123-0004 ~~002~~ 5/1/95

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: 62-123	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME:		DATE STARTED: 4-26-95
GEOLOGIST: D. Creek	GROUNDWATER LEVEL: / DATE: / TIME:		DATE COMPLETED: 4-26-95
WATER USED DURING DRILLING: no water used	DRILLING CONTRACTOR: Alliance Environmental	DRILLING EQUIPMENT: Mobile Drill B-61 / HSA	DRILLER/HELPER: B. Erickson / B. Babcock

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1							
2							
3	4-26-95 #404794,	NA	DC ~~1.8~~ 24"+	CLAY, trace sand (fine), (2.5Y, 5/4) light olive brown, caliche, mottled, slt. iron staining, dry to moist, low to med. plasticity	CL	NA	Shelby Tube, (2") Slet DC KB push 300 psi: 6" 375 psi: 18" 600 psi: last 4" wet at bottom
4	#404795						#404795 Archive
5							auger to 5'
6	1424 4-26-95 #404796	5 10 13	18"	CLAY, with gravel (fine to med, subang. to ang. max. ½"), ~~trace~~ few sand (coarse), (10YR, 4/6) dark yellowish brown, DC moist, Fe staining, black nodules, stiff, slight mottled, low plasticity	CL / ~~ML~~ DC	1.75	Split spoon, 18" drive
7							auger to 7.5'
8	1438 4-26-95 #404797,	NA	22"	CLAY, few sand (fine to coarse, subang to ang.), DC ~~sil~~ silty, (10YR, 4/6) dark yellowish brown, moist, low plasticity	CL / ML	NA	Shelby Tube, 2' push 300 psi 1st 6" 450 psi 2nd 3" 900-1000 max next 3" 5" bottom crimp 36" shelby tube
9	#404798						#404798 Archive
10							auger to 10'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Shelby tubes collected per ASTM D1587

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. (ASTM D1586)

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FEMP QA 11 5/17/95

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200308G2123-~~005~~ 88 5/1/95

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-123

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10							
11	1455 4-26-95 #404799	12 19 26	DC ~~15~~ 17"	CLAY, with gravel (fine to coarse, rnd to ang DC max 3/4"), with sand (coarse, rndd to subrndd), silty, low plasticity, hard, Coarse gravel (1" max) at 10.2'-10.4', vert. fracture with Fe staining from 10.4 to ~11.2' (2.5Y, 5/4) lt olive brown, Fe stains throughout, dry to moist	CL	>30	Split spoon, 1.5' drive 2" od
12				* interface - assumed 13' *			auger to 12.5'
13 14	1515 4-26-95 #404800 #404801	NA	22"	CLAY, few Sand (fine to ~~med~~ coarse, subrndd DC), (10Y, 4/1) dark greenish gray, low to med plasticity, stf. silty, fractures (dessicated) w/ iron staining, dry to moist classified at bottom of tube	CL	NA	Shelby Tube, 2' push 300 psi 12" 850 psi max top of sample - brn clay bottom - gray clay #404801 Archive
15							auger to 15'
16	1530 4-26-95 #404802	8 11 15	15"	CLAY, trace Sand (med., ang), few gravel (fine to coarse, subang. to ang), (5GY, 4/1) dark greenish gray, fossiliferous gravel at 15.5', moist, med. plasticity, very stiff	CL	2.5	Split spoon, 18" drive
17							auger to 17.5'
18 19	1545 4-26-95 #404803, ~~#404804~~ DC	NA	13"	CLAY, few Sand (fine to med), (5GY, 4/1) dark greenish gray, moist, low to medium plasticity (Sandy at and wet bottom of tube). DC (very poor recovery - discard tube)	CL	NA	Shelby Tube, 2' push 300 psi first 12" 900 psi max. 8" Crimp, v. poor tube #404803 DC Archive
20							auger to 20'
21 21.2	1615 4-26-95 #404804 #404805	NA	11"	CLAY, few Sand (fine to med), (10Y, 4/1) dark greenish gray, moist, low plasticity stage-triaxial	CL	NA	Shelby Tube 2' push crimp on bottom 1" wet tube #404805 Archive
21.5							auger to 21.5'
DC ~~22~~	DC			Skip to next page			DC
DC 22.5							

NOTES:

007
200308G2123-004 885/1/95

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation
PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-123

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
21.5							
22	1635 4-26-95 #404806	16 19 30	11"	CLAY, trace gravel (fine to coarse, subang.), few sand (med to coarse, rndd to subrndd), (10Y, 4/1) dark greenish gray, moist to wet, med. plasticity, hard	CL	NM	Split spoon, 18" drive - not measured clayey sand (wet) on outside barrel wet on inside, possibly from water in hole
23							auger to 23.5'
24	1648 4-26-95 #404807	5 21 21	7"	CLAY, trace gravel (fine to med. subrndd), few sand (med. to coarse, subang. to ang.); (10Y, 4/1) dark greenish gray, moist, med. plasticity, very stiff	CL	>3.0	Split spoon, 18" drive wet clayey sand on outside
25				Total Depth 25'			

NOTES:

FEMP QA 11 5/17/95

WELL NUMBER: 11693

G2-123

FEMP

WELL COMPLETION LOG

CONTROL NUMBER: 200308G2123-007 008

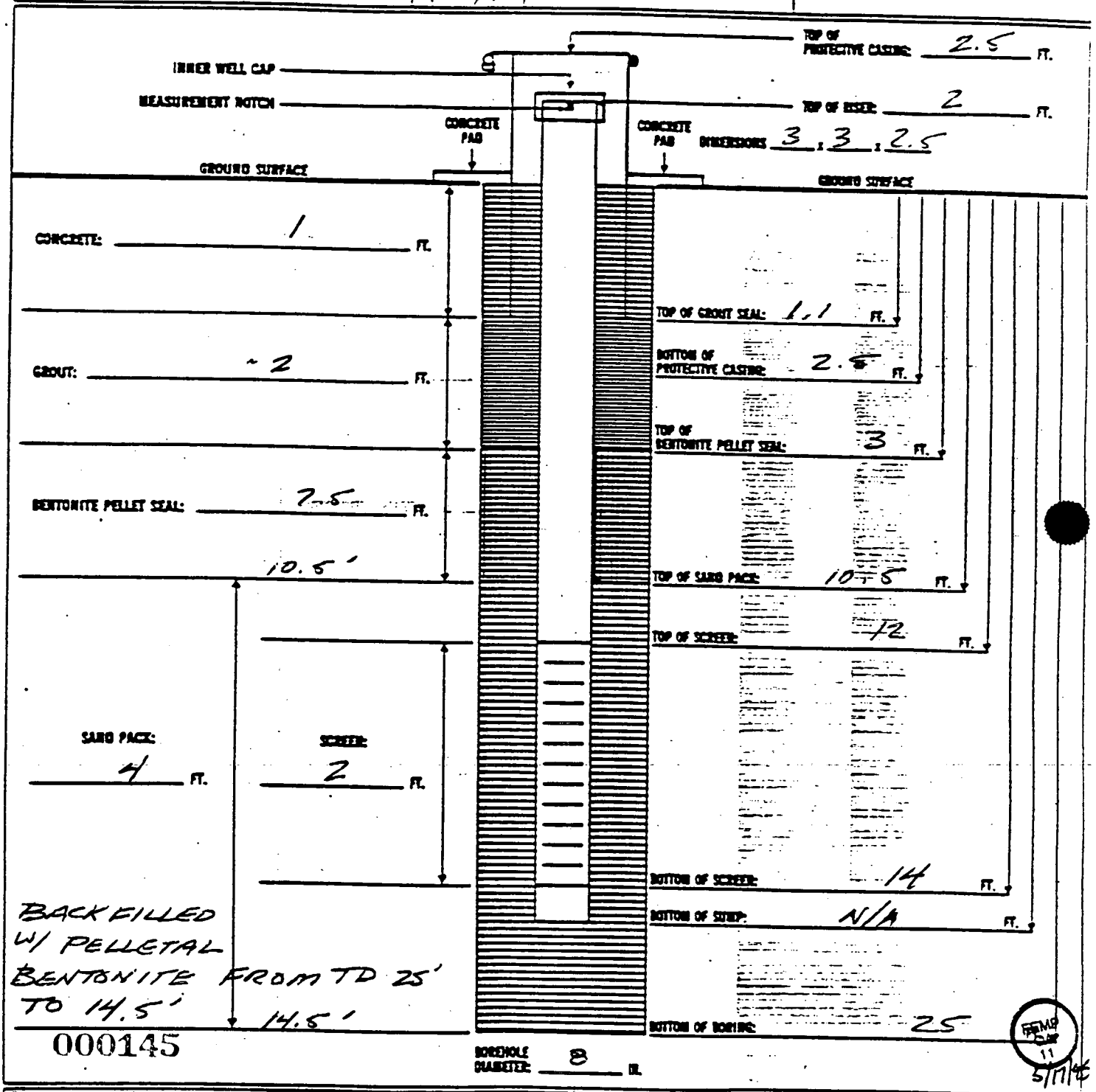
PROJECT NAME: CRUZ PHASE III DISPOSAL FACILITY GEOTECHNICAL FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

DATES OF INSTALLATION	WATER LEVEL (ft.)	DATE	RELATED FAL NUMBERS	CHECKED BY:
4/26 - 27/95	4.3' BGL	4/27/95	N/A	



TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION:
BENTONITE FLOUR 1.4 LB.	6 1/2 BUCKETS	N/A
VOLUME OF WATER USED DURING DRILLING:	**RISER MATERIAL:** 3/16"	**VOLUME OF WATER USED FOR GROUT HYDRATION:**
NONE USED - FM. WATER AFTER DRLG. GAL	STAINLESS STEEL	3 GAL
RISER WALL THICKNESS:	**TYPE OF SAND PACK:**	**SCREEN MATERIAL:**	**DRILLING CASING DIAMETER:**
3/16"	#5	3/16" STAINLESS STEEL	N/A IN.
RISER/SCREEN DIAMETER:	**SCREEN SLOT SIZE:**	**SCREEN TYPE:**	**DEPTH OF CENTRALIZER(S):**
2 IN.	10-SLOT / IN	3/16" STAINLESS STEEL	N/A FT.

FEMP DOE 11 5/17/96

Geotechnical Logging Report

E 207

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-124	Drilling Method: Mobile B-61 HSA	Date Started: 4-12-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-13-95
Ground Surface Elevation:	GWL/DATE: 35.8 BGS / 4-13-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, greenish black, very stiff, moist (CH)	405001	2.5-4.0	SS	6-10-12	18	
5	Fat clay, greenish black, very stiff, moist CH	405002	5.0-7.0	ST	NA	18	UW, GS, AL, UU
7	Lean clay, olive brown, very stiff to hard, moist CL carbonaceous pellets to 9 feet with scattered gravel and a trace of sand, gravels to 2 inches at 18 feet	405003	7.5-9.0	SS	5-9-12	15.5	
		405004	10.0-12.0	ST	NA	21.5	UW, GS, SG, AL, CON, CON_{r}, CON_{r85}, CU
		405006	12.5-14.0	SS	5-9-14	18	
		405007	15.0-17.0	ST	NA	24	
		405008	17.5-19.0	SS	7-22-20	14	
20	Lean clay, dark greenish gray, with scattered gravel and cobbles to 3 inches. Very stiff, moist (CL)	405009	20.0-22.0	ST	NA	6	
		405010	22.0-24.0	ST	NA	11.5	
25	Lean clay, greenish gray, with fine sand, and silt layers to 1/2 inch, very stiff, wet (CL)	405011	25.0-26.5	SS	6-8-22	18	MC, GS
30	Sand, dark greenish gray to yellowish brown, medium dense to dense, some gravel to ¼ inch, wet (SM)	405012	30.0-31.5	SS	9-9-12	18	MC, GS
		405013	35.0-36.5	SS	6-9-9	15	MC, GS
		405014	40.0-41.5	SS	10-14-15	16	MC, GS
		405015	45.0-46.5	SS	15-20-29	18	MC, GS
50	Gravely sand, brown, very dense, wet, well graded, well rounded (SW)	405016	50.0-51.5	SS	26-34-36	15	MC, GS
		405017	55.0-56.5	SS	29-43-51	17	MC, GS
		405018	60.0-61.5	SS	27-51-__	10	MC, GS
		405019	65.0-66.5	SS	15-27-32	15	MC, GS
		405020	70.0-71.5	SS	8-28-29	13	MC, GS
		405021	80.0-82.0	SS	9-18-28-34	6	MC, GS
	* Note: ASTM symbols in parentheses indicate visual classification						

E 207

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-124	COORDINATES: 2' SE of CPT-512	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER ~~LEVEL~~: depth 43'-10"	DATE: 4/13/95	TIME: 0800	DATE STARTED: 4/12/95
GEOLOGIST: R. Nicks	GROUNDWATER ~~LEVEL~~: depth 35'-9.5"	DATE: 4/13/95	TIME: 1327	DATE COMPLETED: 4/13/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Environmental Inc	DRILLING EQUIPMENT: Mobile B-61	DRILLER/HELPER: Marty, Berry, Rick	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	Qa	6 10 12		Silty Clay 2.5/10Y greenish black, v.st. moist - rootlets to 1/32", highly plastic	CH		Top 12" is fill - sand/silt/gravel, wet
	1410 4/12/95 ① 405001	6 10 12	18"	Silty Clay 2.5/10Y greenish black, v.st., moist highly plastic	CH	3.25	
5	14:20 4/12/95 ② 405002	Shelby	11"				Pushed 24" 350 lbs - smooth push Top at 4 1/2" from top of tube. Bottom 10" up from bottom of tube - could not
	Qa 1438 4/12/95 ③ 405003	5 9 12	15 1/2"	Silty Clay 2.5Y 4/4 olive brn. f. to st, moist w/ carbonaceous pellets to 1/4" iron stained. medium plasticity	CL	1.75	300 lbs push Each 400 lbs ≈ 11 tb.
10	Qa 1445 4/12/95 ④ 405004	Shelby	21 1/2"				Push 24" Sample #5 Archive 11 12 405005
	1456 4/12/95 ⑤ ⑥ 405006	6 9 14	18"	Silty Clay, olive brn. 2.5Y 4/3 w/ sand pockets (f-m) ≈ 1/2" sub scattered sand sub angular to subrounded. Trace gravel 1/4 Medium plasticity	CL	>4.5	Refusing
15	Qa 1507 4/12/95 ⑦ 405007	Shelby	24"				400 lbs push
	Qa 1513 4/12/95 ⑧ 405008	7 22 20	14"	Silty Clay, 10YR 4/4 dark yel. brn. v.st. moist w/ scat. gravel to 2" and trace sand f-c - subangular to subrounded Medium plasticity	CL	>4.5	
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Rod being used for SPT sampler is not A-Rod, check ASTM standard or conversion. Rods appear to standard N rod.

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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4/95

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation				PROJECT NUMBER: 20.03.08
BORING NUMBER: CPT-512 62-124	COORDINATES:	RELATED FAL NOs.:		
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1535 4/12/95 ⑨ 405009	Shelby	6"	Silty Clay, 10y 4/1 dark grn. Gr. V.ST, moist scattered gravel: cobbles to 3", ~~mois~~ medium plasticity	CL	>4.5	Push 1200 lbs. - Refusal @ 20'6". Crushed shelby only 6" recovery disturbed by 3"+ rock. Pushed 22 - 24, Recovered 11½" crushed tube - Lg. Cobble in side of hole.
	1605 4/12/95 ⑩ 405010	Shelby	0"				
25	1610 4/12/95 ⑪ 405011	6 8 22	18"	~~Clayey Silt~~ Silty Clay, 10y 5/1 Grn. Gr. wet @ 25' w/ fine sand and silt layers to ½", med. plasticity	CL	3.0	
30	1620 4/12/95 ⑫ 405012	9 9 12	18"	Silty Sand @ 30 - 31 10YR 4/6 M.D. wet, dense	SM		
				Sand 31 - 31½ 10 YR 4/6 M.D. to D wet, well graded, some gravel to ¼" dk. yel. brn.	SW		
35	1629 4/12/95 ⑬ 405013	6 9 9	15"	Sand, dk. grn gr., M.D. to D, some gravel to ¼", well graded. wet dk. yel. brn.	SW		
40							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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FEMP
LITHOLOGIC LOG

CONTROL NO:	
PROJECT NAME:	Phase III Geotechnical Investigation
PROJECT NUMBER:	20.02.08
BORING NUMBER:	G2-124
COORDINATES:	
RELATED FAL NOs.:	
SURFACE ELEVATION:	
GROUNDWATER LEVEL:	—
DATE:	
TIME:	
DATE STARTED:	
GEOLOGIST:	R. Nicks
GROUNDWATER LEVEL:	
DATE:	
TIME:	
DATE COMPLETED:	
WATER USED DURING DRILLING:	
DRILLING CONTRACTOR:	
DRILLING EQUIPMENT:	
DRILLER/HELPER:	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
40	1640 4/12/94 (14) 405014	10 14 15	16"	Sand 10yr 6/4 light yellowish brn. Dense, wet, poorly graded, f-m, w/scat. Gravel to 1/4"	SP		
45	1652 4/12/94 (15) 405015	15 20 29	18"	w/c sand to 1/2" gravel in a 6" layer 45 1/2 - 46 - subangular to subrounded, dense to v. dense	SP		4/12/95 1700 - end of day's drilling 4/13/95 - water level measured @ 42'10" thru auger after 15 hrs.
4/12/95 4/13/95							
50	0839 4/13/95 405016	26 34 36	15"	Gravelly Sand 10yr 5/3 brn., v. dense wet, well graded, well rounded gravel to 1/2"	SW		
55	0905 4/13/95 405017	29 43 51	17"	7.5yr 5/3 brn. v. dense, moist well graded, subrounded to well rounded	SW		
60							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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4/95

CONTROL NO:

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-124	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED:
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: / DATE: / TIME: / DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: / DRILLING EQUIPMENT: / DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
60	0930 4/13/95 405018	27 51 –	10"	Gravelly Sand 3YR 5/1 Gray, v. dense, moist, well graded, subrounded to well rounded. Maby gravel to 1"	SW		27-51 for 11" total then refusal
65	0951 4/13/95 405019	15 27 32	15"	10BG 4/1 dk. grn. gray, v. dense, wet, well graded, sub angular to sub rounded gravel to ½"	SW		
70	1014 4/13/95 405020	8 28 29	13"	5G 5/1 Grn. Gray, v. dense, wet, well graded, subrounded	SW		≈ 1 ft. of heave in bottom of auger
75	1050 4/13/95 NA	1 4 12	0" NA				≈ 18" of heave in auger - sample all slough.
80							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: NA = Not applicable because all recovered material was slough.

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation					PROJECT NUMBER: 20.03.08
BORING NUMBER: C2-124	COORDINATES:	RELATED FAL NOs.:			
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED:	
WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:		

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
80	1127 4/13/95	9 18 28	16 18	Sandy Gravel, 10Y 4/1, dk grn. gray, v. dense, wet, subangular to rounded	GW		Sand heaving, making it difficult to add auger. About 30" heave when re-entering for 80 ft. sample interval. Overdrive 6" to try and capture some natural. 1st "top", rods dropped ≈ 18".
	405021	34	34				
				Total Depth 82 feet			Water level @ 1327 ~~35'9.5~~ Gn, 35'9.5" after 2 Hours

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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4/95

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-125	Drilling Method: Mobile B-61 HSA	Date Started: 4-17-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-17-95
Ground Surface Elevation:	GWL/DATE: 22.2 BGS / 4-17-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, yellowish brown, with trace of sand, and scattered gravel, very stiff, moist CL	405023	2.5-4.5	ST	NA	21	MC, MC_m, UW, GS, AL, CU,
		405025	5.0-6.5	SS	7-14-18	15	
		405026	7.5-9.5	ST	NA	24	MC, UW, GS, AL, UU
	stiff and wet at 11.0	405028	10.0-11.5	SS	5-7-12	18	
14	Sandy lean clay, gray to dark gray, stiff, wet, with sand layers to 6 inches thick CL	405029	12.5-14.5	ST	NA	24	MC, UW, GS, AL
		405031	15.0-16.5	SS	5-7-8	18	
		405033	17.5-19.5	ST	NA	24	MC, UW, GS, AL, UU
		405035	20.0-21.5	SS	4-5-8	18	
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-GS125-004

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.08.08
BORING NUMBER: G2-125	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE: / TIME:	DATE STARTED: 4/17/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE: / TIME:	DATE COMPLETED: 4/17/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Environmental Inc	DRILLING EQUIPMENT: Mobile B-61	DRILLER/HELPER: Marty, Barry, Rick

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Silty Clay - dk. yellowish brn. 10yr 4/4, stiff, moist	CL		30" S/O CPT 517
	1325 4/17/95 405023	shelby	21"	Clayey Silt - dk. yel. brn. 10yr 4/4, v. st, moist, iron stain w/trace f. sand.	ML		400# pressure let shelby set 10 min. before withdrawing from hole - bottom few inches? Loose from rest of sample Archive 405024
5	1320 4/17/95 405025	7 14 18	18"	Clayey Silt - 10yr 5/4 yel. brn v. st., moist w/trace of sand subangular, and scattered gravel to 1/4" - rounded	ML	7.45	
	1355 4/17/95 405026	shelby	24"	Silty Clay with sand 10yr/5/4 yel brn. v. st., moist w/trace sand m-f, subangular, and scat. gravel to 1/4"	CL		500# pressure Archive # 405027
10	1402 4/17/95 405028	5 7 12	18"	Clayel Silt - 10yr 5/4 yel. brn. stiff, wet @ 11' w/trace sand m-f. subang. to sub rounded	ML	3.5	
	1420 4/17/95 405029	shelby	24"	Silty Clay 5Y/5/1 in tip @ 14' and 10yr-5/4 in top. gray, and yel. brn. stiff, moist-wet, with sand f-m,	CL		300# pressure Archive # 405030
15	1423 4/17/95 405031	5 7 8	18"	Sandy Silt stiff, wet, greenish gray sand m-f @ 15' 9" - 6" layer dense, wet, 10y 5/1 greenish gray w/some clay, low plasticity	ML	3.0	15'9" - 16'3" Sand - m-f.
	1500 4/17/95 405032	shelby	24"	Silty Clay 2.5y 4/1 dark gr. stiff, wet, w/sand m-f	CL		300# pressure water in top of shelby tube, ~~Archive #~~ Not #'d. cuttings - bulk in bucket #405034 Archive
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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FEMP QA 11 5-17-95

200308-GS125-005

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-125

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1510 4/17/95 405035	4 5 8	18"	Clayey Silt w/sand, 2.5y 4/1 dk. gray, firm to stiff, 6" sand (m-f) lens @ 20-20.5	ML	1.5	
				Silty Clay @ 21.5 2.5y 4/1 dk. gray firm to stiff, wet, med. to high plasticity	CL		
	1530 4/17/95 405036 (Archive)	shelby	see remarks	~~dk.grn.gray~~ dk. grn. gray 10y 4/1, v. stiff, moist, w/trace of sand m-f, and scattered gravel to 1/4"			Shelby crimped and folded - archive sample only # 405036
25				Total Depth 25.0 feet.			

NOTES:

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4/95

FEMP QA 11 5-17-95

FEMP QA 11

207

WELL NUMBER: G2-125 11695

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308G2125-008

PROJECT NAME: Phase III Sitewide Disposal Facility

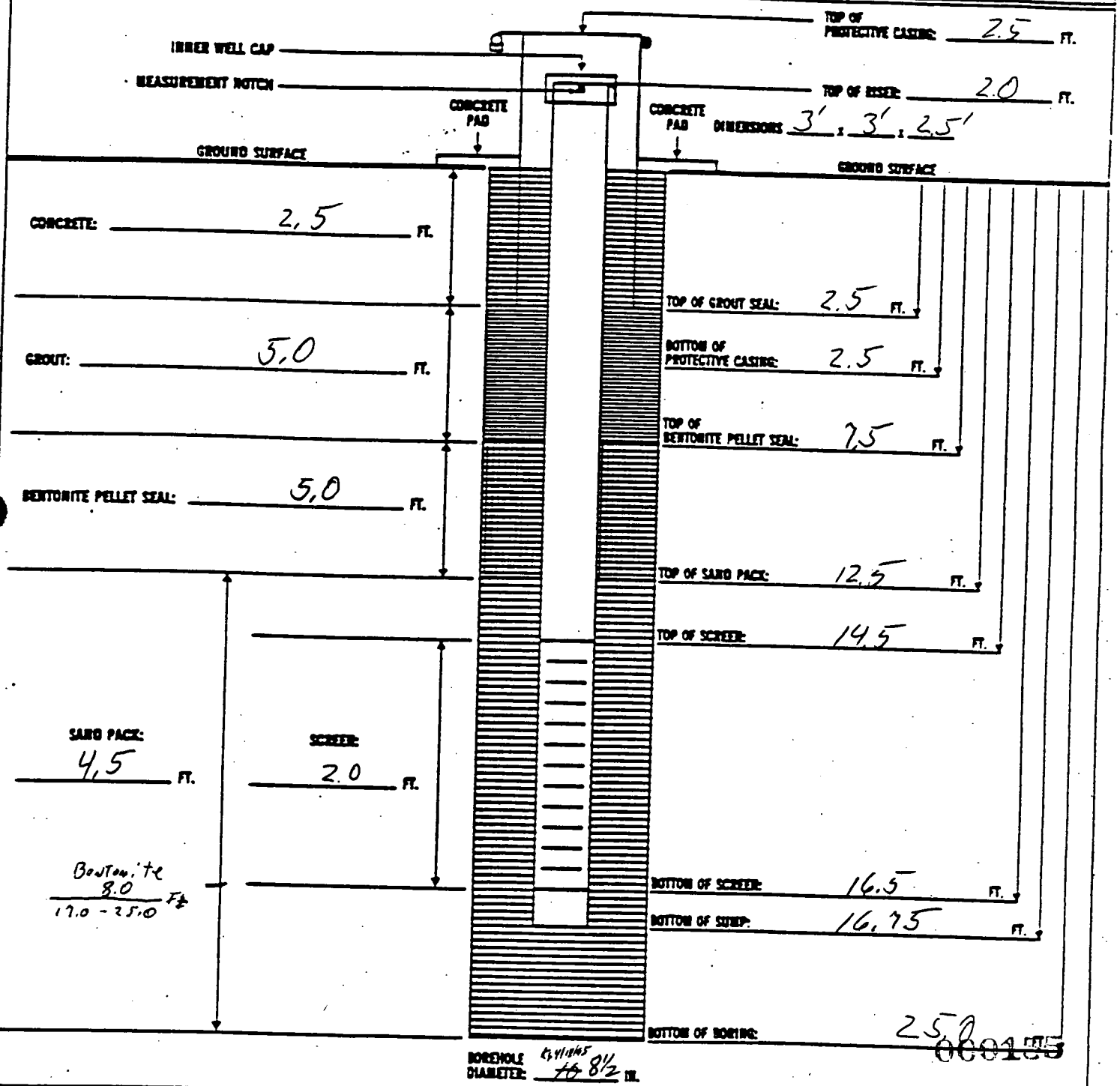
PROJECT NUMBER: 20.03.08

GEOLOGIST: Ken Geiger / Keith Payne

DRILLING METHOD: Hollow Stem Auger

DATES OF INSTALLATION: 4/17/95 4/18/95

WATER LEVEL (ft.): | DATE: | RELATED FAL NUMBERS: | CHECKED BY:



TYPE AND AMOUNT OF GROUT USED: Volclay 50lbs	BENTONITE PELLETS (5-GALLON BUCKETS): 3 Buckets		DEEPEST TEMPORARY DRILLING CASING PENETRATION: NA FT.
VOLUME OF WATER USED DURING DRILLING: NA GAL	RISER MATERIAL: 316 Stainless Steel		VOLUME OF WATER USED FOR GROUT HYDRATION: 20.0 GAL
RISER WALL THICKNESS: 316 Stainless	TYPE OF SAND PACK: Global #5	SCREEN MATERIAL: 316 Stainless Steel	DRILLING CASING DIAMETER: NA IN.
RISER/SCREEN DIAMETER: 2.0 IN.	SCREEN SLOT SIZE: .010 IN	SCREEN TYPE: 316 Stainless Steel	DEPTH OF CENTRALIZER(S): NA

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-126	Drilling Method: Mobile B-61 HSA	Date Started: 4-24-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-25-95
Ground Surface Elevation:	GWL/DATE: 2.75 BGS/4-25-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Sandy lean clay, light olive brown, with trace of sand and gravel, stiff, moist to wet, becoming very stiff at 11.5 CL	404765	2.5-4.5	ST	NA	27	Hold
		404767	5.0-6.5	SS	4-9-14	15	
		404768	7.5-9.0	ST	NA	16	UW, GS, AL, CU
		404770	10.0-11.5	SS	14-19-18	18	
11.5	Sandy lean clay, dark greenish gray with trace of sand and scattered gravel, very stiff to hard, moist CL	404771	12.5-14.5	ST	NA	23	MC, UW, GS, AL, CU,
		404773	15.0-17.0	ST	NA	23	UW, GS, SG, AL, CON, CON_r, CON_{r85}, UU
	wood fragment 18.5	404775	17.5-19.0	SS	10-11-15	15	
		404776	20.0-21.5	SS	20-16-18	20	
		404777	22.5-24.0	SS	7-14-17	16	
		404778	25.0-27.0	ST	NA	25	MC, MC_m, UW, GS, AL, P
		404780	27.5-29.0	SS	7-10-17	16	
		404781	30.0-31.5	SS	6-10-14	16	
		404782	32.5-34.0	SS	11-19-41	14	
		404783	35.0-37.0	ST	NA	22	MC_m, GS, SG, AL, CON, CON_s
40	Silty sand, dark yellowish brown to dark greenish gray, wet, very dense (SM)	404785	40.0-41.5	SS	15-24-50/.4	16	MC, GS
		404786	45.0-46.5	SS	34-44-41	16	MC, GS
		404787	50.0-51.5	SS	40-40-40	17	MC, GS
		404788	55.0-56.5	SS	40-50-61	18	MC, GS
		404789	60.0-61.5	SS	30-80	12	MC, GS
		404790	65.0-66.5	SS	35-38-50/.4	14	MC, GS
70	Well graded sand with silt and gravel, light olive gray, very dense, dry to wet, SW-SM	404791	70.0-71.5	SS	50/.4	6	MC, GS
		404792	75.0-76.5	SS	50/.4	7	MC, GS
		404793	80.0-81.5	SS	25-41-41	15	MC, GS
	• Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-G2126-006

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-126	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 2.75' bgs (see note below)*	DATE: 4-25-95	TIME: 0826	DATE STARTED: 4-24-95
GEOLOGIST: D. Creek	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4-25-95
WATER USED DURING DRILLING: no water used	DRILLING CONTRACTOR: Alliance Environmental	DRILLING EQUIPMENT: MobileDrill B-61 / HSA	DRILLER/HELPER: B. Erickson / B. Babcock	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1, 2							auger to 2.5'
3, 4	1138 4-24-95 #404765, #404766	Nt	27"	CLAY, few Sand (fine to coarse, ang.) (2.5Y, 5/4) lt olive brown, mottled, some Fe staining, low plasticity, dry to moist,	CL	NA	Shelby Tube 2' push 250 psi first 18" 400 psi last 6" stt. crimping #404766 Archive
5							auger to 5'
6	1150 4-24-95 #404767	4 9 14	15"	CLAY, Sandy (fine to coarse, ang), few gravel (fine, angular, to 3/4"), (2.5Y, 5/6) lt. olive brn, mottled, low to med. plasticity, moist to wet, med-stiff (lenses of silty CLAY, fatter CLAY)	CL	1.0	Split spoon 1.5' drive 2" od
7							auger to 7.5'
8, 9	1310 4-24-95 #404768, #404769	NA	16"	CLAY, few Sand (fine to coarse, ang), trace gravel (fine, 1/2", ang.), (2.5Y, 5/6) lt. olive brown, Fe stains, black nodules, moist to wet, med. plasticity, wet on outside of tube	CL	NA	Shelby Tube, 18" push 300 psi first 6" 450 psi next 6" 850 psi last 6" Crimped #404769 Archive
	DG 4/25/95						DC 4-25-95
10							auger to 10'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:
* High groundwater level likely due to inflow from surface water overnight.
Shelby tubes collected per ASTM D1587

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. (ASTM D1586)

200308-G2126-007

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-126

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10	1323 4-24-95 #404770	14 19 18	18"	CLAY, sandy (fine to coarse, subang to rndd) (2.5Y, 5/4) lt. olive brn, extreme Fe staining (vert & horiz fractures) black nodules, moist, very stiff, low plasticity	CL	>30	Split spoon, 18" drive brn → grey @ 10.7'
11				CLAY, few sand (fine to coarse, ang), (10Y, 4/1) dark greenish gray, mottled, trace gravel (fine, rndd, 3/8") moist, extreme Fe staining near interface, v. stiff.. low to med plasticity (fossiliferrous gravel)	CL		
12							auger to 12.5
13	1345 4-24-95 #404771, #404772	NA	23"	CLAY, few sand (fine to coarse, ang to subrounded), few gravel (fine, 3/4", subangular), (10Y, 4/1) dk greenish gray, moist, med plasticity	CL	NA	Shelby Tube, 2' push 100 psi first 6" 250 psi next 12" 400 psi last 6" minor bottom crimp
14				classified at tube bottom			#404772 Archive
15							auger to 15'
16	1400 4-24-95 #404773, #404774	NA	23"	CLAY, trace sand (fine to med, ang), trace gravel (fine, ang, 3/8"), (10Y, 4/1) dk greenish gray, moist, med plasticity, gravel to 1.5"	CL	NA	Shelby Tube 2' push 250 psi first 18" 450 psi last 6" Slight crimp bottom 1"
17				classified at tube bottom			#404774 Archive
							auger to 17.5'
18	1415 4-24-95 #404775	10 11 15	15"	CLAY, trace sand (fine to med), trace gravel (fine, ang, 3/8"), (10Y, 4/1) dk greenish gray, moist, med. plasticity, wood stick at 18.5', stiff	CL	1.5	Split spoon, 18" drive 2" od
19							
							auger to 20'
20	1425 4-24-95 #404776	20 16 18	20"	CLAY, trace sand (fine to coarse, subrndd to rndd), trace gravel (fine to coarse, subangular), (10Y, 4/1) dk greenish grey, moist, med plasticity, stiff	CL	1.75	Split spoon, 18" drive 2" od
21							
22							auger to 22.5
22.5							

NOTES:

200308-G2126-008

FEMP LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-126

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
22.5							
23	1445 4-24-95 #404777	7 14 17	16"	CLAY, trace sand (fine to coarse, ang), ~~some~~ few gravel (fine to coarse, 1.5" max, rounded to subrounded) stick at 23', moist, (10Y, 4/1) dk greenish gray, very stiff, black nodules	CL	2.25	Split spoon, 18" drive 2" od
24				wood pc			auger to 25'
25	1505 4-24-95 #404778, #404779	NA	25"	CLAY, trace gravel (fine, rounded to subrounded) (10Y, 4/1) dk greenish gray, moist to wet, med to high plasticity	CL	NA	Shelby tube, 2' push 200 psi: 18" 450 psi: 6" #404779 Archive
27							auger to 27.5'
28	1525 4-24-95 #404780	7 10 17	16"	CLAY, few gravel (fine, rounded to subrounded), few sand (fine to coarse, ang), (10Y, 4/1) dk greenish gray, moist, med. plasticity, very stiff	CL	2.0	Split spoon, 18" drive
29							auger to 30'
30	1540 4-24-95 #404781	6 10 14	16"	CLAY, trace sand (fine to coarse, ang), trace gravel (fine, rndd to subrounded), (10Y, 4/1) dk greenish gray, moist, med. plasticity, stiff	CL	1.75	split spoon, 18" drive
32							auger to 32.5'
33	1600 4-24-95 #404782	11 19 41	14"	CLAY, trace sand (fine to med, ang), few gravel (fine to coarse, subrndd to rndd, 1" max), (10Y, 4/1) dk. greenish gray, moist, med to high plasticity, stiff	CL	1.5	Split spoon, 18" drive
34							auger to 35'
35							

NOTES:

200308-G2126-009

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-126

35

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
36	1627 4-24-95 #404783 #404784	NA	22"	CLAY, trace sand (fine to coarse, ang), trace gravel (fine, subangular, ½"), (10Y, 4/1) dark greenish gray, moist, med. plasticity	CL	NA	Shelby Tube, 2' push 250 12" 300 6" 400 last 6" Slightly crimped @ bottom #404784 Archive
37							Auger to 40'
38							
39							
40	0850 4-25-95 #404785	15 24 50/.4	16"	SAND, (fine to med), clayey, extreme Fe staining at 41', [Clay layer 40.3'-41' (highly plastic), 1.25 tsf pocket pen (10Y, 4/1) gray clay], wet, (10Y, 4/1) dark greenish grey, ~~medium~~ dense (to 41.5')	SC	NA	Split spoon, 18" drive wet on outside of spoon
41							
42							Auger to 45'
43							
44							
45	0937 4-25-95 #404786	34 44 41	16"	SAND, (fine to coarse, subang), few gravel (fine, rndd), (10YR, 4/6) dark yellowish brn, wet, very dense, clean	SP	NA	Split spoon 18" drive
46							
47							Auger to 50'
				Change scale on next sheet			

NOTES:

200308-G2126-010

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-126

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
47							auger to 50'
48							
49							
50	1017 4-25-95 #404787	40 40 40	17"	SAND, clean (fine to coarse, grading to finer downward, subang.), few gravel (fine, rndd, 3/8" max), clay stringer at 51.3', wet to moist at bottom (10YR, 4/6) dark yellowish brn., very dense	SP/SW	NA	Split spoon 18" drive wet on outside
51.5							
							auger to 55'
55	1045 4-25-95 #404788	40 50 61	18"	SAND, clean (fine to coarse, rndd to subrndd), trace gravel (rndd, 3/8" max, fine), dry, very dense (2.5Y, 5/6) lt. olive brn	SP	NA	Split spoon, 18" drive wet on outside
56.5				Clayey Sand (55'-55.5'), (fine sand), moist, med. plasticity clay, (10YR, 4/4), dark yellowish brown, SC	DC 4/25/95		auger to 60'
60	1110 4-25-95 #404789	30, 80/6"	12"	SAND (fine to coarse, rndd to ang), with gravel (fine to med, subrounded, 3/4" max), dry, (2.5Y, 5/4) lt. olive brown,	SP	NA	Split spoon, ~~18"~~ DC 4/25/95 drive 12" (refusal)
61.5				SAND, ~~slightly clayey~~ DC with 4/25/95 (60-61.5'), moist, fine to med sand, (10YR, 4/6) dk yellowish brn, very dense			
							auger to 65'
65	1238 4-25-95 #404790	35 38 50/0.4'	14"	SAND (fine to coarse, rndd to ang), trace gravel (fine, rndd to subang), dry, (DC 4/25/95 5Y, 6/2) light olive ~~brown~~ gray, very dense, clean	SW	NA	Split spoon, 1.4' drive (refusal)
66.5							
							auger to 70'
70	1300 4-25-95 #404791	50/.4'	6"	GRAVEL (fine to med, rndd to subang, 1/2" max), sandy (fine to coarse), slt. silty, (5Y, 6/2) light olive gray, very dense, dry	GP	NA	Split spoon, 0.5' drive (refusal)
71.5							
72'							

NOTES:

200308-G2126-011

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-126

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
72'							auger to 75'
75'	1328 4-25-95 #404792	50/.4'	7"	GRAVEL (fine to coarse, mdd to subrdd, 3/4" max), Sandy (fine to coarse, mdd to ang), clean, (5Y, 6/2) lt olive gray, very dense, dry	GP	NA	Split spoon, 0.8' drive (refusal)
76.5'							
							auger to 80'
80'	1400 4-25-95 #404793	25 41 41	15"	SAND (fine to coarse, mdd to ang), gravelly (fine to med, mdd to subang, max 3/4"), clean, (5Y, 6/2) lt olive gray, very dense, dry	SW	NA	Split spoon, 18" drive
81.5'							
85'				Total Depth 81.5'			

NOTES:

207

WELL NUMBER: 11689 G2-126

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308-G2126-015

PROJECT NAME: CRU 2 PHASE III DISPOSAL FACILITY GEOTECH. FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

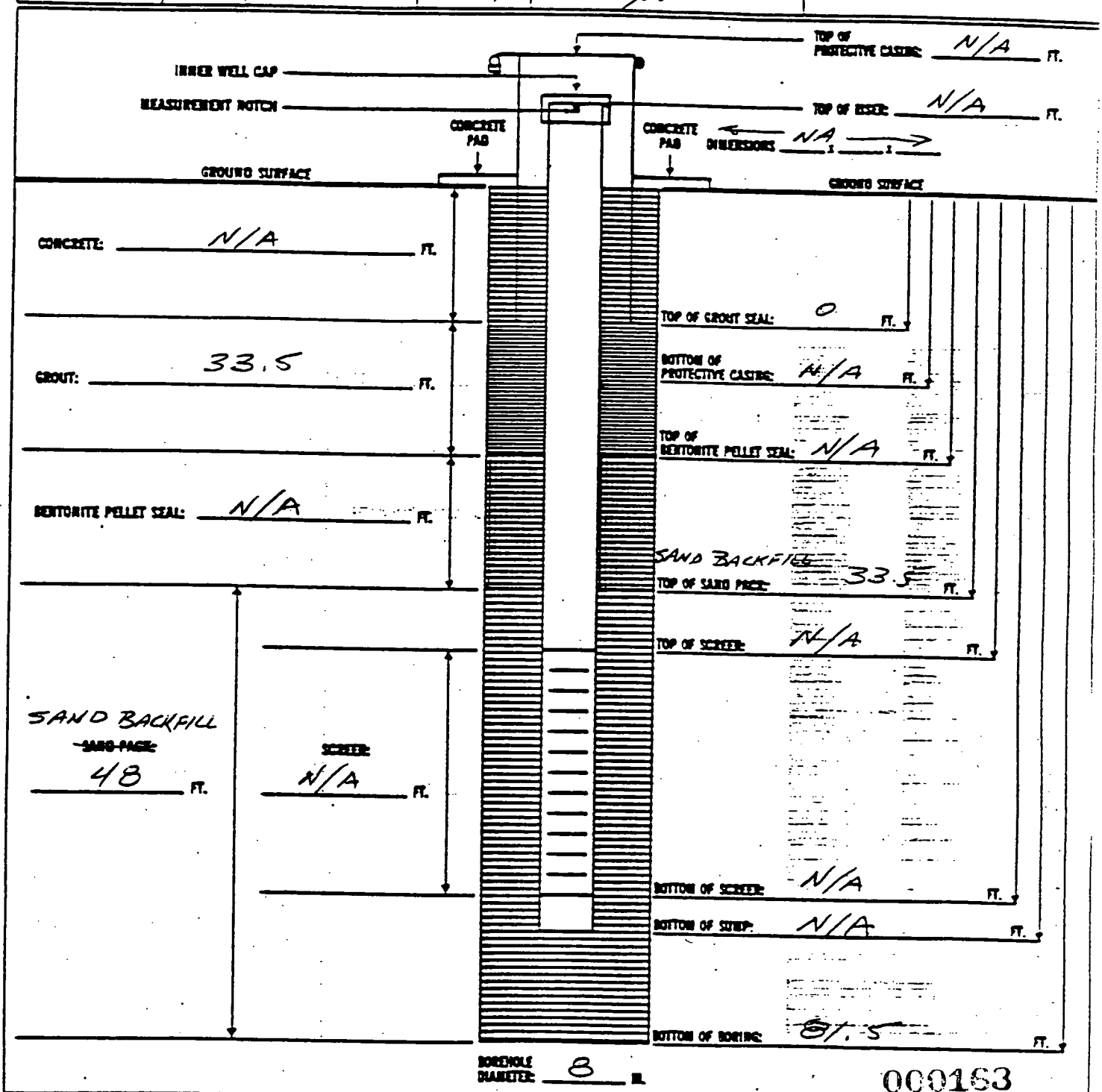
DATES OF INSTALLATION: 4/24-26/95

WATER LEVEL (ft): 2.75' BGL

DATE: 4/25/95

RELATED FAL NUMBERS: N/A

CHECKED BY:



000163

TYPE AND AMOUNT OF GROUT USED: TYPE E-I-K EXPANSIVE CEMENT (9 BAGS)

BENTONITE PELLETS (5-GALLON BUCKETS): N/A

DEEPEST TEMPORARY DRILLING CASING PENETRATION: N/A FT.

VOLUME OF WATER USED DURING DRILLING: NONE GAL.

RISER MATERIAL: N/A

VOLUME OF WATER USED FOR GROUT HYDRATION: 45 GAL.

RISER WALL THICKNESS: N/A

TYPE OF SAND PACK: BACKFILL #5 MED. SAND

SCREEN MATERIAL: N/A

DRILLING CASING DIAMETER: N/A IN.

RISER/SCREEN DIAMETER: N/A IN.

SCREEN SLOT SIZE: N/A IN

SCREEN TYPE: N/A

DEPTH OF CENTRALIZER(S): N/A FT.

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-127	Drilling Method: Mobile B-61 HSA	Date Started: 4-21-95
Coordinates:	Geologist: D. Creek	Date Completed:
Ground Surface Elevation:	GWL/DATE: Dry / 4-21-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay with sand, light olive brown, very stiff, moist CL	404748	2.5-4.0	SS	6-8-10	12	
		404749	5.0-7.0	ST	NA	17	Hold
		404751	7.5-9.5	ST	NA	23	UW, GS, SG, AL, CON, CON_s, UU, UU_r, UU_{r85}
10	Lean clay with sand, light olive brown, with trace of sand, very stiff, moist (CL)	404753	10.0-12.0	ST	NA	24	Hold
		404755	12.5-14.0	SS	9-13-16	18	
12.9	Sandy lean clay, dark greenish gray, very stiff, moist CL	404756	15.0-17.0	ST	NA	23	UW, GS, AL, CU
		404758	17.5-19.0	SS	6-11-13	16	
	with trace of gravel	404759	20.0-22.0	ST	NA	16	Hold
	wood fragments at 23.5	404761	22.5-24.0	SS	10-14-18	17	
		404762	25.0-26.5	SS	5-10-11	15	
		404763	28.0-30.0	ST	NA	21	MC, UW, GS, AL, P
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G2127.003

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-127	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: no water	DATE:	TIME:	DATE STARTED: 4-21-95
GEOLOGIST: D. Creek	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4-21-95
WATER USED DURING DRILLING: none	DRILLING CONTRACTOR: Alliance Environmental	DRILLING EQUIPMENT: Mobil Drill B-61 / HSA	DRILLER/HELPER: B. Erickson / B. Babcock

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1, 2							auger to 2.5'
3, 4	1000 4/21/95 #404748	6 8 10	12"	CLAY, silty, trace Sand (fine). (2.5Y, 5/6) lt. olive brown, some Fe stains, roots at ~ 3' (dk. brn), moist, med. stiff to stiff, mottled, ~~low to~~ med plasticity DC KL 5/18/95	CL	1.5	Split spoon 18" drive 2" od
5							auger to 5'
6, 7	1025 4/21/95 #404749, #404750	NA	17"	CLAY, silty, ~~some~~ few Sand (fine to med angular), (2.5Y, 5/6) lt. olive brown, moist, mottled, low to med plasticity DC 4/21/95	CL/ML	NA	first 12" 250 psi last 12" 600-800 psi Shelby tube 24" push Crimped on bottom 6" #404750 Archive
							auger to 7.5'
8, 9	1054 4/21/95 #404751, #404752	NA	23"	CLAY, silty, ~~some~~ few Sand (fine to coarse, ang.), (2.5Y, 5/6) lt. olive brown, moist, low to med. plasticity, some Fe staining DC 4/21/95	CL	NA	Shelby tube 24" ~~24"~~ ~~18"~~ push DC 4/21/95 DC 4/21/95 first 12" 300-400 psi last 6" 800 psi #404752 Archive
10							auger to 10'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Shelby tubes collected per ASTM D1587

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. (ASTM D1586)

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

200308G2127-004

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-127

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10							
11	1115 4/21/95 #404753 DC 4/21/95 #404754	NA	24"	CLAY, trace Sand (fine), ~~Some~~ few DC 4/21/95 gravel (fine, 1/4"-3/4", angular), (2.5Y, 5/4) lt olive brown, moist, med. plasticity, mottled, some gray clay mottles (interface at ~12' likely)	CL	NA	Shelby tube 24" push 200 psi 6" 400 psi 12" 900 psi 6" slt. crimped at end #404754 Archive
12				* Interface @ 12.9' (brown to grey) *			auger to 12.5'
13	1135 4/21/95 #404755	9 13 16	18"	SAA to 12.9' CLAY, trace Sand (fine to coarse), ~~Some~~ few DC 4/21/95 gravel (fine, angular, to 1/2"), (10Y, 4/1) dk greenish gray, moist, med. plasticity, some Fe staining, stiff	CL	1.75	Split spoon 18" drive 2" od
14							auger to 15'
15	1150 4/21/95 #404756 #404757	NA	23"	CLAY, trace sand (med to coarse, angular), trace gravel (fine, angular, up to 1.25"), (10Y, 4/1) dk greenish gray, moist, med. to high plasticity,	CL	NA	Shelby tube 24" push 250 psi 18" 400 psi 6" slt. crimp at bottom #404757 Archive
17							auger to 17.5'
18	1249 4/21/95 #404758	6 11 13	16"	CLAY, trace Sand (fine to coarse), ~~Some~~ few DC 4/21/95 gravel (fine, ang., to 3/4"), (10Y, 4/1) dk greenish gray, moist, med to high plasticity, stiff	CL	1.5	Split spoon, 18" drive 2" od
19							auger to 20'
20	1300 4/21/95 #404759, #404760	NA	16"	CLAY, trace sand (med to coarse, ang), trace gravel (fine, angular), (10Y, 4/1) dk greenish gray, moist, med. to high plasticity, some caliche nodules, slt. Fe staining	CL	NA	Shelby tube, 24" push Crimped on side (bot 21") 250 psi 18" 600 psi 6" #404760 Archive
21							
22							auger to 22.5'

000166

NOTES:

200308G2127-005

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
22.5							
23	1323 4/21/95 #404761	10 14 18	17"	CLAY, trace Sand (fine to coarse, ang. to rounded), ~~some~~ few gravel (fine to coarse, ang. to subrounded, to 1" diam), (5GY, 4/1) dk greenish grey, sticks at ~23.5', wood, stiff, moist	CL	1.5	Split spoon, 18" drive 2" od
24							auger to 25'
25	1335 4/21/95 #404762	5 10 11	15"	CLAY, trace Sand (fine to coarse, ang. to rounded), trace gravel (fine, ang to subang; 0.5" max), (10Y, 4/1) dk. greenish gray, moist, stiff	CL	1.5	Split spoon, 18" drive 2" od
27							auger to 28'
28	1418 4/21/95 #404763, #404764	NA	21"	SAND (fine to coarse, ang to rounded), few gravel (fine, to ½ inch, subang), clayey, pockets of CLAY (sandy), (10Y, 4/1) dk greenish gray, moist to wet	SC	NA	Shelby tube, 2" push 18" 250 psi: 12" 800 psi: 6" Slt. crimped at bottom Classified at bottom #404764 Archive
29				(This interval classified only @ bottom)			
30				Total Depth 30'			
31							

000167

NOTES:

WELL NUMBER: #688

G2-127

FEMP

WELL COMPLETION LOG

CONTROL NUMBER: 200308G2127-008

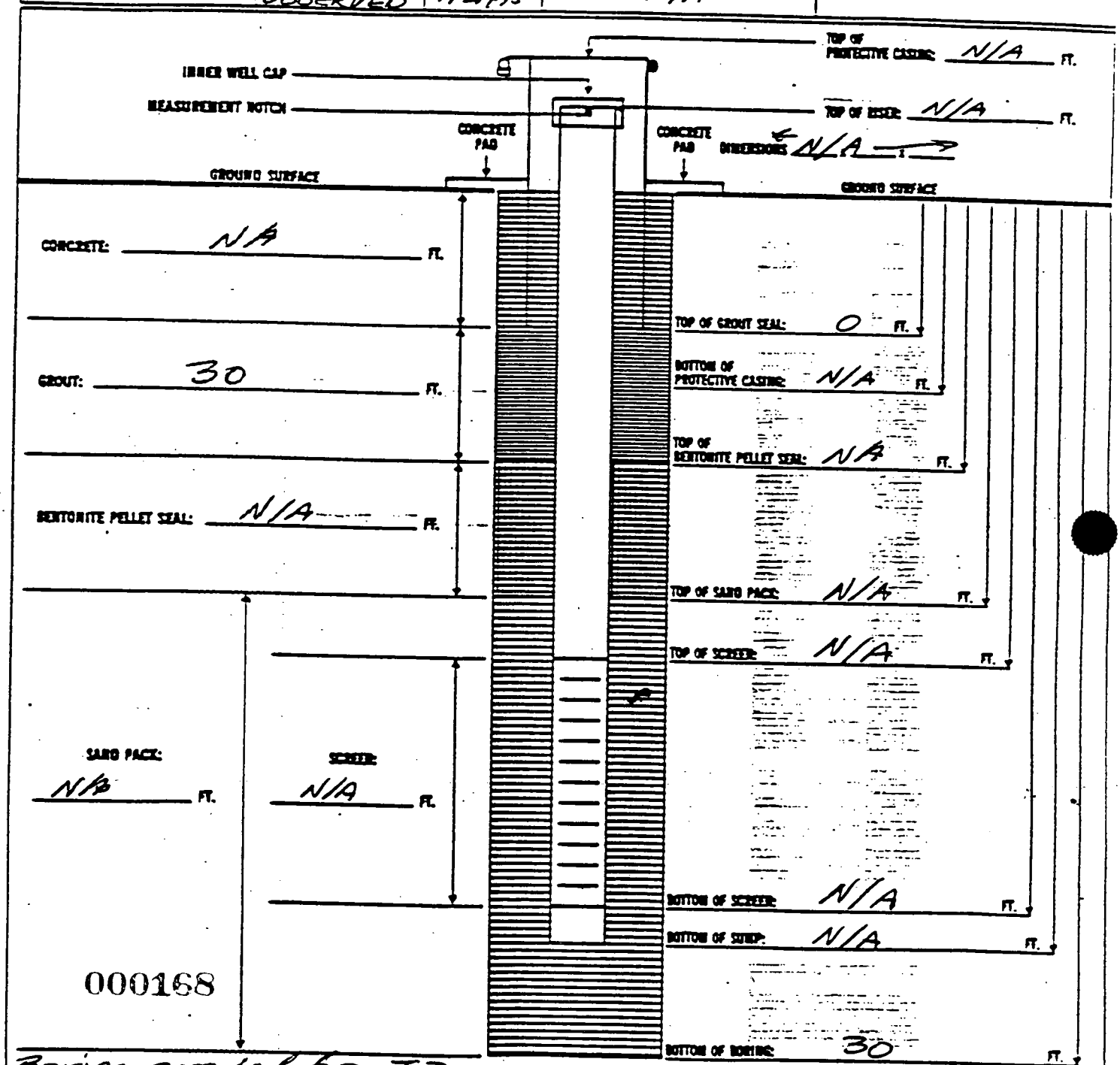
PROJECT NAME: CRU2 PHASE III DISPOSAL FACILITY FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

DATES OF INSTALLATION:	WATER LEVEL (ft):	DATE:	RELATED FAL NUMBERS:	CHECKED BY:
N/A	NONE OBSERVED	4/21/95	N/A	



000168

Boring grouted from TD 30 to surface

TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION:
TYPE E-I-K EXPANSIVE CMT. BAGS	N/A	N/A FT

VOLUME OF WATER USED DURING DRILLING:	RISER MATERIAL:	VOLUME OF WATER USED FOR GROUT HYDRATION:
N/A GAL	N/A	45 GAL

RISER WALL THICKNESS:	TYPE OF SAND PACK:	SCREEN MATERIAL:	DRILLING CASING DIAMETER:
N/A	N/A	N/A	N/A IN.

RISER/SCREEN DIAMETER:	SCREEN SLOT SIZE:	SCREEN TYPE:	DEPTH OF CENTRALIZER(S):
N/A IN.	N/A IN	N/A	N/A FT

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-128	Drilling Method: Mobile B-61 HSA	Date Started: 4-19-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-19-95
Ground Surface Elevation:	GWL/DATE: 19.5 BGS / 4-19-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, dark yellow brown to light olive brown, firm, wet, becoming sandy at 5.0 and hard with trace of gravel CL	405040	2.5-4.5	ST	NA	13	MC, GS, AL, UU
		405042	5.0-6.5	SS	5-14-19	17	
7.5	Sandy lean clay with gravel, light olive brown, hard, moist CL	405043	7.5-9.5	D	NA	24	MC, UW, GS, AL, CU,
		405045	10.0-11.5	SS	12-21-36	12	
12	Clayey gravel with sand, light olive brown, very stiff, moist GC	405046	12.5-14.5	D	NA	15	UW, GS, SG, AL, CON, CON_{r85}
15.0	Sandy lean clay with gravel, dark gray, very stiff, moist (CL)	405048	15.0-16.5	SS	8-10-14	12	
17.5	Sandy lean clay with gravel, gray, very stiff, wet, with cobbles to 3 inches (CL)	405049	17.5-19.5	D	NA	24	MC, UW, GS, AL
		405051	20.0-21.5	SS	8-12-15	19	
23	Lean clay with sand, dark greenish gray, very stiff and wet (CL)	405052	23.0-25.0	SS	15-12-10	18	
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G2128-005

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-128	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 2.0'	DATE: 4/19/95	TIME: 0800	DATE STARTED: 4/18/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: 19.5'	DATE: 4/19/95	TIME: NOON	DATE COMPLETED: 4/19/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Environmental Inc	DRILLING EQUIPMENT: Mobile B-61	DRILLER/HELPER: Marty, Berry, Rick	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Lean CLAY. dk. yel. brn. 10YR 4/4 firm, wet	CL		2' N/O CPT 524
	1450 4/18/95 405040	Shelby	13"	Lt. olive brn 2.5Y 5/4, wet firm to stiff, moist, iron stained, scattered gravel to 1/2" subangular	CL		Difficult to push straight - soft ground and scattered gravel to 1/2" #405041 Archive
5	1500 4/18/95 405042	5 14 19	17"	SANDY LEAN CLAY with GRAVEL 10YR 7/3 brn, 10YR 7/1 light gray. v.stiff to hard, moist, gravel subangular to 1/2", trace to 1"	CL	>4.5	
	1650 4/18/95 405043	Dennison	24"	GRAVELLY LEAN CLAY with Sand 2.5Y 5/3 light olive brown, hard, w/ gravel to 1"	CL		Drilled Dennison w/water - used ≈50 gal. Archive # 405044 0837 4/19/95 X 2
1/18/95 1/19/95 10	0845 4/19/95 405045	12 21 36	12"	2.5Y 4/3 olive brown, v.stiff to hard w/gravel to 2"	CL	4.5	
	0945 4/19/95 405046	Dennison	15"	2.5Y 5/3 light olive brn. v.stiff, moist w/gravel (cobbles) to 3"	CL		≈75 gal. used to drill Dennison - No advance past ≈13'9" Sample disturbed - hitting shoe with hammer to loosen
15	1000 4/19/95 405048	8 10 14	12"	2.5Y 4/1 dark gray, v.stiff		4.5	Archive #405047
	1030 4/19/95 405049	Dennison	24"	Sandy Lean CLAY with GRAVEL 2.5Y 5/1 gray v.stiff, wet, w/cobbles to 3"	CL		≈25 gal. used sample disturbed
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:
* Clays 3.5 - 4.0 but high gravel/sand tends to give somewhat misleading high values. (penetrometer) clays actually about 1.75 to 2.75
Shelby per ASTM D 1587

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. D1586

*TLL/US/MISC/GEOTECH/LITHO LOG.EPS

200308G2128-006

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-128

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1040 4/19/95 405051	8 12 15	19"	SANDY LEAN CLAY WITH GRAVEL 2.5 y 5/1 gray, firm-stiff, wet	CL	2.75	
	1050 4/19/95	Shelby	0"	Lean CLAY w/sand m-f and scat. gravel 10y 4/1 - dk. grn. gray, firm-stiff, moist	CL	1.75	Shelby only pushed 3" then refusal. Drive SPT 15, 12, 10 23½-25
25	SPT sample # 405052 23½-25 4/19/95 1100	15 12 10	18"	Total Depth 25'			

000171

NOTES:

E. 207

WELL NUMBER: G2 128 11684

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 20030862128-009

PROJECT NAME: Phase III Disposal Facility

PROJECT NUMBER: 20.03.08

GEOLOGIST: Ken Geiger

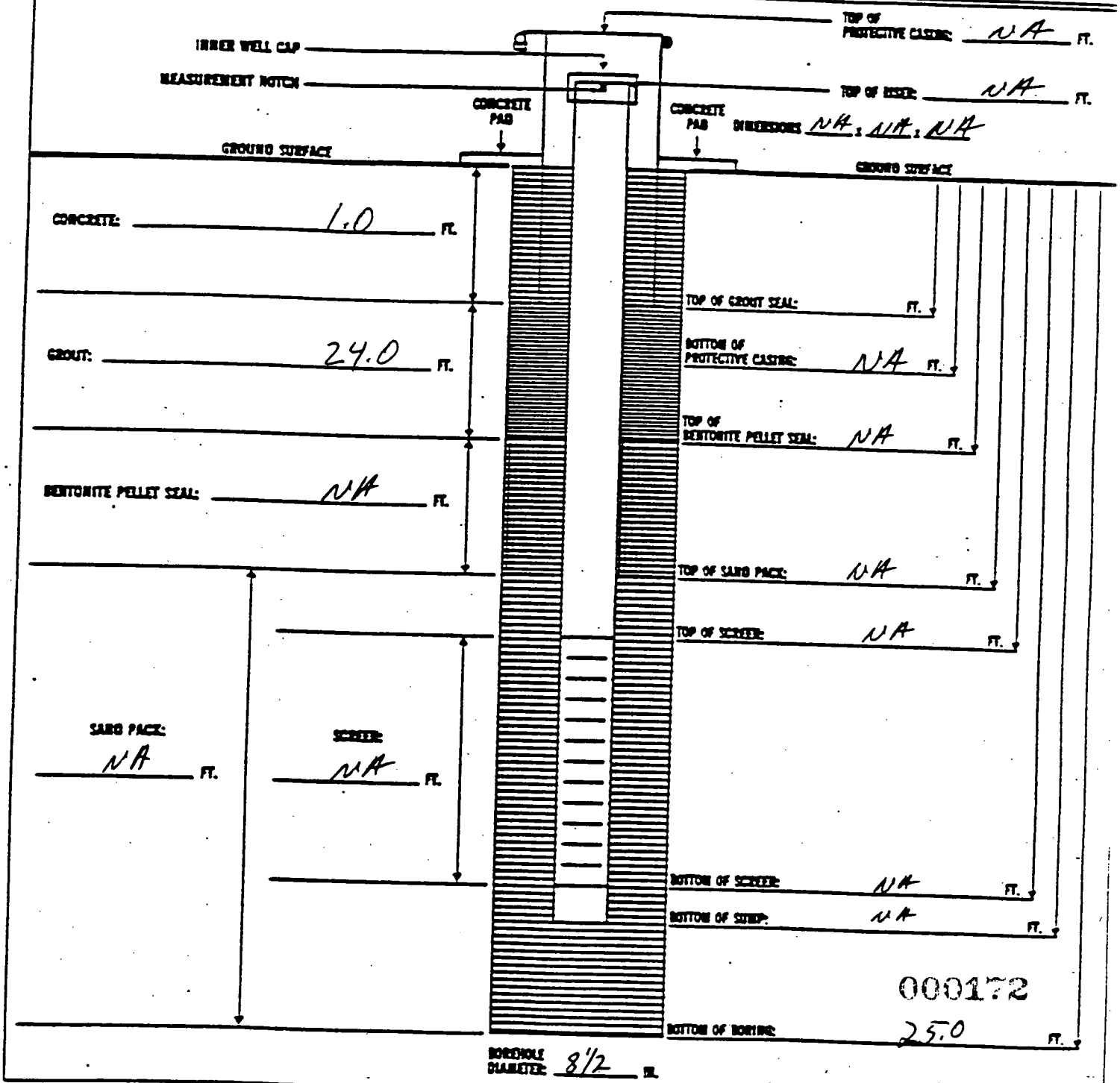
DRILLING METHOD: Hollow Stem Auger

DATES OF INSTALLATION: 4/18/95 4/19/95

WATER LEVEL (ft.): 19.50 DATE: 4/19/95

RELATED FAL NUMBERS:

CHECKED BY:



000172

TYPE AND AMOUNT OF GROUT USED: K Grout 6 Bags 50 lb each	BENTONITE PELLETS (5-GALLON BUCKETS): NA	DEEPEST TEMPORARY DRILLING CASING PENETRATION: NA FT.
VOLUME OF WATER USED DURING DRILLING: NA GAL	RISER MATERIAL: NA	VOLUME OF WATER USED FOR GROUT HYDRATION: 42.0 ~~35.0~~ 4/19/95 GAL
RISER WALL THICKNESS: NA	TYPE OF SAND PACK: NA	SCREEN MATERIAL: NA
DRILLING CASING DIAMETER: NA IN.	RISER/SCREEN DIAMETER: NA IN.	SCREEN SLOT SIZE: NA
SCREEN TYPE: NA	DEPTH OF CENTRALIZER(S):	

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-129	Drilling Method: Mobile B-61 HSA	Date Started: 4-18-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-19-95
Ground Surface Elevation:	GWL/DATE: 10.95 BGS / 4-19-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, yellowish brown, stiff to very stiff, moist CL	404728	2.5-4.0	SS	4-5-7	17	
		404729	5.0-7.5	ST	NA	30	MC, MC_m, UW, GS, AL UU
		404731	7.5-9.0	SS	7-11-15	21	
	with sand from 10.2	404732	10.0-12.5	ST	NA	15	MC, MC_m, UW, GS, AL
12.5	Sandy lean clay, dark greenish gray, very stiff to hard, moist CL	404734	12.5-14.0	SS	7-13-19	15	
		404735	15.0-17.5	ST	NA	30	
		404737	17.5-19.0	SS	10-22-37	20	
	with trace of gravel 22.5 - 42.0	404739	22.5-24.0	SS	6-12-20	10	
		404740	24.0-26.5	ST	NA	24	UW, GS, AL, CU
		404742	30.0-31.5	SS	8-15-19	17	
	wet at 32.5	404743	32.5-34.0	SS	7-9-12	17	
		404744	35.0-36.5	SS	6-13-20	23	
		404745	37.5-39.0	SS	21-50-49	23	
		404746	40.0-42.0	D	NA	24	Hold
	* Note: ASTM symbols in parentheses indicate visual classification						

5-22-95 FEMP QA 18 207

CONTROL NO: 200308G2129-006

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation					PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-129	COORDINATES:	RELATED FAL NOs.:			
SURFACE ELEVATION:	GROUNDWATER LEVEL: 10'11.5" bgs	DATE: 4-19-95	TIME: 0835	DATE STARTED: 4-18-95	
GEOLOGIST: D. Creek (by L. Love 4-20-95 @ 0850)	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4-19-95	
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Environmental	DRILLING EQUIPMENT: Mobil Drill B-61 / HSA	DRILLER/HELPER: B. Erickson / B. Babcock		

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1, 2							augered to 2.5'
3, 4	1234 4/18/95 #404728	4 5 7	17"	CLAY, silty, (10YR, 5/6) yellowish brown, iron staining, dk brn/organic @ 2.5', moist, rel. homogeneous, stiff, medium plasticity	CL	1.5	Split Spoon, 18" drive 2" od
5							augered to 5'
6, 7	1305 4/18/95 #404729, #404730	NA	30"	CLAY, v. silty, (10YR, 5/8), yellowish brown, iron staining at 7.5', dry to moist, low to med. plasticity, mottled	CL/ML		Shelby tube 30" push first 24" 250-300 psi last 6" 600 psi free water on outside of tube classified at bottom #404730 Archive
8, 9	1320 4/18/95 #404731	7 11 15	21"	CLAY, v. silty, (10YR, 5/6) yellowish brown, horiz. iron staining at 8' & 9', dry to moist, low to med. plasticity, very stiff, mottled	CL/ML	3.0	Split Spoon, 18" drive 2" od
10							000174

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Shelby tubes collected per ASTM D1587

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. (ASTM D1586)

200308G2129-007

FEMP QA 19 5-23-95

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER: 62-129

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10 11 12	1345 4/18/95 #404732, #404733	NA	15"	CLAY, w. sand (fine to coarse, angular) gravelly (coarse, 3" cobble @ ~~12.5'~~ 11.25' subang.) (10YR, 5/8), brownish yellow, moist (some free water @ top of tube), low to med. plasticity see note	CL/SC		Shelby tube 30" push first 12" 400 psi last 18" 625 psi classified at bottom of tube 3" o.d. #404733 · Archive
13 14	1400 4/18/95 #404734	7, 13, 19	15"	CLAY, sandy (med. to coarse, ang.), few gravel (fine, angular), (5GY, 3/1) dk greenish gray, moist, med to high plasticity very stiff	CL	2.5	Split spoon 18" drive 2" od free water on sampler
							auger to 15'
15 16 17	1415 4/18/95 #404735, #404736	NA	30"	CLAY, w/ sand (fine), (5GY, 3/1) dk greenish gray, moist, med. plasticity, moist to dry see note	CL		Shelby tube, 30" push, 3" od first 6" 300 psi next 18" 450 psi last 6" 900 psi tube crimped at end, sl. crushed along ~~end sides~~ side #404736 Archive ream to 17.5'
18 19	1434 4/18/95 #404737	10, 22, 33	20"	CLAY, sandy (fine to coarse, angular), (10Y, 4/1) dk greenish gray, moist, med. to high plasticity, very stiff, homogeneous	CL	4.0	split spoon, 18" drive 2" od
20 21 22	0904 4/19/95 #404738, ~~#404739~~	NA	0" (3" in Bbo)	CLAY, sandy (fine to coarse, subrounded) trace gravel (coarse), 3" cobble in shoe, (10Y, 4/1) dk greenish gray, v. moist, med to high plasticity	CL		Denison Sample using ~14 gal water Cobble stuck in shoe, #404738 Archive

22.5

NOTES: Sample 404732 from 10'-11¼' (cobble pit at ~11¼', pushed down)
Sample 404735 tube damage, no structural testing or unit weight, sample tube appears to have been pushed along gravel

200308G2129-008

FEMP
LITHOLOGIC LOG

FEMP QA 13

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-129

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
22.5							
23	0920 4/19/95 #404739	6 12 20	10"	CLAY, sandy (fine to coarse), few gravel (fine), (10Y, 4/1) dk greenish gray, v. moist, med. plasticity, med. stiff.	CL	.75	Split spoon, 18" drive 2" od free water in tube archive
24	0955 4/19/95 #404740 (tube)	NA	24"	CLAY, w/sand (med to coarse, angular), trace gravel (fine, angular), (10Y, 4/1) dk greenish gray, v. moist, med plasticity	CL		Shelby tube, 2½" push 250 psi 1.5' 500 psi next 6" 250 psi last 6"
25							
26	#404741						#404741 Archive
27							auger down to 30'
28							
29							
30	1015 4/19/95 #404742	8 15 19	17"	CLAY, w/sand (fine to med), few gravel (fine to coarse, 1" max, ang.), (10Y, 4/1) dk greenish gray, moist to wet, med plasticity, slt Fe staining, med. stiff @ 30.2', 1" SC/OC zone (med to coarse sand)	CL	1.0	Split spoon, 18" drive 2" od
31							archive
32							auger to 32.5'
33	1032 4/19/95 #404743	7 9 12	17"	CLAY, few sand (fine to coarse, ang), trace gravel (fine, angular) (½" max), (10Y, 4/1) dk greenish gray, moist to wet, med plasticity, medium stiff	CL	0.5	Split spoon, 18" drive 2" od
34							archive
35							auger to 35'

NOTES:

200308G2129-009

FEMP
LITHOLOGIC LOG

FEMP QA 13

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
Phase III Geotechnical Investigation	20.03.08	G2-129

35

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
36	1049 4/19/95 #404744	6 13 20	23"	CLAY, few sand (fine to coarse ang), trace gravel (fine, ang., ½"), (10Y, 4/1) dark greenish gray, moist to wet, med plasticity, med. stiff SAA	CL	0.5	Split spoon, 18" drive 2" od archive
37							auger to 37.5'
38	1110 4/19/95 #404745	21 50 49	23"	CLAY, with sand (fine to coarse, ang), trace gravel (fine, ¼-½", ang), (10Y, 4/1) dark greenish gray, moist to wet, low to med plasticity, very stiff	CL	2.0	split spoon, 18" drive 2" od Sampler hit cobble but no recovery of cobble archive #404745
39							
40							
41	1203 4/19/95 #404746, #404747	NA	24"	CLAY, with sand (fine to coarse, ang), trace gravel (fine ¼", ang), (10Y, 4/1) dark greenish gray, wet, med plasticity.	CL	-	Dennison Sample, 2" tube ~70 gal water used Full recovery #404747 Archive
42							
43				Total Depth 42' bgs			
44							

000177

NOTES:

WELL NUMBER: 11687

GZ-129

FEMP

WELL COMPLETION LOG

CONTROL NUMBER: 200308G2129-012

PROJECT NAME: CRU 2. PHASE III DISPOSAL FACILITY GEOTECHNICAL FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: CLIFF LEE

DRILLING METHOD: AUGER

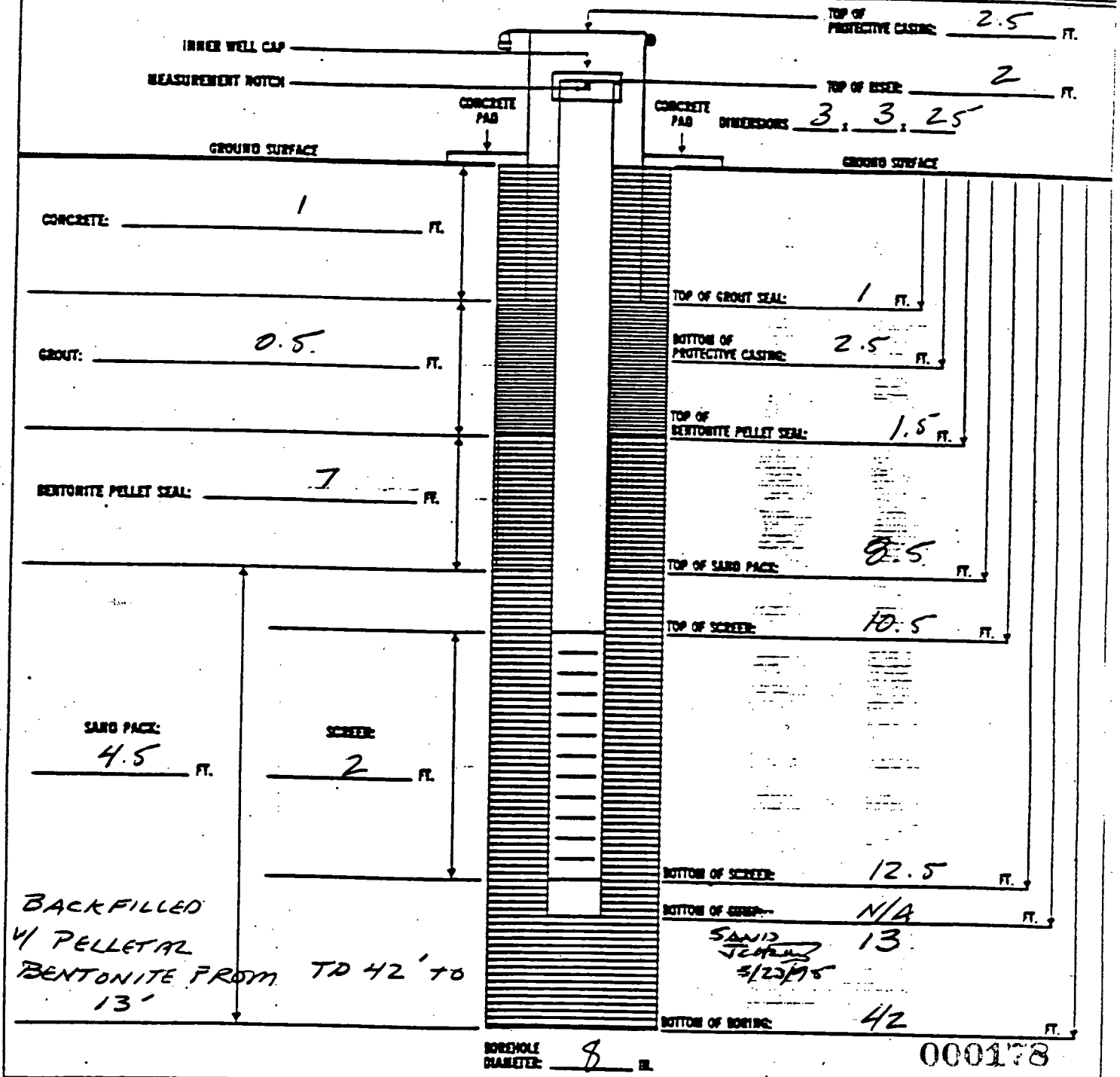
DATES OF INSTALLATION: 4/19/95

WATER LEVEL (ft.): 10' 11 1/2"

DATE: 4/19/95

RELATED FAL NUMBERS: N/A

CHECKED BY: CA 13 5-23-95



000178

TYPE AND AMOUNT OF GROUT USED: VOLCLAY 0.25 BAGS	BENTONITE PELLETS (5-GALLON BUCKETS): 11.5 BUCKETS	DEEPEST TEMPORARY DRILLING CASING PENETRATION: N/A FT.
VOLUME OF WATER USED DURING DRILLING: 84 gal - USED W/ DENISON SAMPLER GAL	RISER MATERIAL: 3/16" STAINLESS STEEL	VOLUME OF WATER USED FOR GROUT HYDRATION: 2 GAL.
RISER WALL THICKNESS: 3/16"	TYPE OF SAND PACK: #5 & #7	SCREEN MATERIAL: 3/16" STAINLESS STEEL
DRILLING CASING DIAMETER: N/A IN.	RISER/SCREEN DIAMETER: 2 IN.	SCREEN SLOT SIZE: 10-SLOT / IN
SCREEN TYPE: 3/16" STAINLESS STEEL	DEPTH OF CENTRALIZER(S): N/A	

Geotechnical Logging Report

Project No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-130	Drilling Method: Mobile B-61 HSA	Date Started: 4-25-95
Coordinates:	Geologist: R. Nicke	Date Completed: 4-26-95
Ground Surface Elevation:	GWL/DATE: 73.0 BGS / 4-26-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay with sand, light olive brown, very stiff, moist, with scattered gravel to 1 inch, greenish gray at 5.0 CL	405074	2.5-4.0	SS	10-14-20	18	MC, MC_m, UW, GS, AL, UU
		405075	5.0-7.0	D	NA	22	
7.5		405076	7.5-9.0	SS	8-11-14	14	
10	Lean clay, dark gray, very stiff, moist CL	405077	10.0-12.0	D	NA	24	UW, GS, AL, CU
		405079	12.5-14.0	SS	6-8-12	18	
15	Sandy lean clay, dark gray, very stiff, moist, with scattered gravel to 1/2 inch CL	405080	15.0-17.0	ST	NA	24	UW, GS, SG, AL, CON, CON_r, CON_{rs}, UU
		405082	17.5-19.0	SS	5-12-16	18	
		405083	20.0-22.0	ST	NA	24	MC, UW, GS, AL, CU,
		405085	22.5-24.0	SS	5-9-12	18	
		405086	25.0-26.5	SS	6-9-17	18	
		405087	27.5-29.0	SS	6-12-18	18	
30	Sandy lean clay with scattered gravel, dark greenish gray, very stiff, moist CL	405088	30.0-32.0	D	NA	24	UW, GS, AL, CU
		405089	32.5-34.0	SS	9-15-23	18	
35	Silt, greenish gray, very stiff, moist to wet (ML)	405090	35.0-36.5	SS	7-9-26	18	
40	Sand, gray, dense to very dense, moist (SM)	405091	40.0-41.5	SS	22-30-31	18	MC, GS
		405092	45.0-46.5	SS	15-21-18		MC, GS
		405093	50.0-51.5	SS	50	5	
55	Gravelly sand, gray, dense to very dense, moist (SW)	405094	55.0-56.5	SS	35-32-41	16	MC, GS
		405095	60.0-61.5	SS	32-50	9	
		405096	65.0-66.5	SS	21-21-24	16	MC, GS
65	Poorly graded sand with silt, gray, very dense, moist, with scattered gravel to 3/4 inch, wet at 75.0 (SP-SM)	405097	70.0-71.5	SS	14-20-22	18	MC, GS
		405098	75.0-76.5	SS	22-32-35	16	MC, GS
		405099	80.0-81.5	SS	15-25-49	10	MC, GS
	• Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G2130-007

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation				PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-130-0	COORDINATES:	RELATED FAL NOs.:		
SURFACE ELEVATION:	GROUNDWATER LEVEL: 73' BGL	DATE: 4/26/95	TIME: 1027	DATE STARTED: 4/25/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4/26/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: Alliance Environmental Inc	DRILLING EQUIPMENT: Mobile B-61 HSA	DRILLER/HELPER: Proctor Marty, Barry, Rick	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				LEAN CLAY with SAND 2.5y 5/3 lt. olive brown, v. stiff, moist, gravel to 1" scattered	CL		
	0907 4/25/94 405074	10 14 20	18"	SANDY LEAN CLAY with GRAVEL TO 1" 2.5y 5/3 lt olive brown, v. stiff, moist sand m-f, gravel rounded	CL	3.5	
5	1030 4/25/94 405075	Dennison	22"	10y 5/1 grn. gray	CL		30 gal. H_2O to drill/Dennison nothing in tip
	1036 ~~405~~ 4/25/94 405076	8 11 14	14"	5y 4/1 dark gray, v. stiff, moist	CL	3.0	
10	1050 4/25/94 405077	Dennison	24"	Fat CLAY 5y 4/1 dark gray, v. stiff, moist,	CH		40 gal. H_2O
	1100 4/25/95 405079	6 8 12	18"	5y 4/2 olive gray, stiff to v. stiff, moist trace of sand (fine)	CH	2.75	archive # 405078
15	1110 4/25/95 405080	Shelby	24"	LEAN CLAY with Sand and Scat. gravel to 1/2" 5y 4/1 dk. gray v. stiff, moist.	CL		600 lbs down pressure last 6" gravelly. 405081 archive
	1240 4/25/95 405082	5 12 16	18"	5y 4/1 dk. gr. v. stiff, moist with trace sand medium plastic		2.5	
20							

5-23-95

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST. (D 1586)

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200308G2130-008

FEMP
LITHOLOGIC LOG

PROJECT NAME:	PROJECT NUMBER:	BORING NUMBER:
PHASE III GEOTECHNICAL INVESTIGATION	20.03.08	G2-130

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1302 4/25/95 405083	Shelby	24"	LEAN CLAY with SAND 5Y 4/1 dark gray stiff to v.stiff, moist, with scat. gravel to 3/4"	CL		300# lbs down pressure Archive# 405084 gravel @ tip bolted end.
	1312 4/25/95 405085	5 9 12	18"	5Y 4/1 dk. gr. stiff to, moist, w/scat. gravel to 3/4"	CL	2.0	
25	1318 4/25/95 405086	6 9 17	18"	5Y 4/1, dk. gr., stiff, moist, w/scat. gravel to 1/4"	CL	2.5	
	1324 4/25/95 405087	6 12 18	18"	5Y 4/1, dk. gr. v.stiff, moist, w/scat. gravel to 1/2"		2.5 / 3.5	@ 28
30	1348 4/25/95 405088	Denison	24"	SANDY LEAN CLAY with GRAVEL 5Y 4/1 v.stiff, moist, gravel to 1", sand m-f	CL		70 gal H2O to Drill
	1415 4/25/95 405089	9 15 23	18"	5Y 4/2 olive gray, v. stiff to hard, moist sand m-f, scattered gravel to 1/4"	CL	4.0	
35	1428 4/25/95 405090	7 9 26	18"	10Y 4/1 dark grn. gr. v.stiff, moist		2.0	
				PLASTIC SILT 10Y 5/1 grn. gr., firm to stiff moist to wet, with trace sand fine, and scat. gravel to 1/4"	ML	2.0	
40	1446 4/25/95 405091	22 30 31	18"	SAND 5Y 5/1 gray, m-f, dense, ~~moist~~ to v. dense, moist	SP		
	000181						

45

FEMP QA 5-23-98

NOTES:

2003086 2130-009

FEMP LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-130

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
45	1510 4/25/95 405092	15 21 18		SAND 5Y 5/1, rare gravel to 1/4", dense, moist gray, fine grained	SP		
				SILT 5Y 5/1, stiff, moist	ML		3" layer of silt
50	1530 4/25/95 405093	50 for 5"	5"	with gravel to 2"	SP		
55	1600 4/25/95 405094	35 32 41	16"	GRAVELLY SAND, gray, v. dense, moist gravel - 1½", rounded, sand m-f, subrounded, some coarse	SW		
60	1615 4/25/95 405095	32 50 for 3"	9"	gravels platy - 1", sand m-f, some coarse	SW		rock in tip
65	1645 4/25/95 405096	21 21 24	16"	SAND, gray, v. dense, moist, with scattered gravel to 3/4"	SP		
4/25/95 4/26/95	*①						
70							

5-23 GS

FEMP QA 13

NOTES: ① Pull up 20' of auger to avoid being "stuck" in the sand.

200308G2130-010

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-130

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
70	0925 4/26/95 405097	14 20 22	18"	SAND, gray, lt. gray 2.5Y 7/1, dense to v. dense, moist, rare gravel to 1/2" well rounded. Sand angular to well rounded. Predominant qtz-Feldspar, trace olivine.	SP		Hole collapsed back to 53'. H_2O @ 28.3
75	0945 4/26/95 405098	22 32 35	16"	wet SANDY GRAVEL, —?—	GW —?—		
80	1015 4/26/95 405099	15 25 49	10"	w/gravel to 2" rounded	SW		8" ? sloff in hole Rock in bip
				TOTAL DEPTH 81'			

5-23-95

FEMP QA 13

000183

NOTES:

207

WELL NUMBER: G2 130 11683

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308G2130-014

PROJECT NAME: Phase III Disposal Facility

PROJECT NUMBER: 20.03.08

GEOLOGIST: Kim Geiger

DRILLING METHOD: Hollow Stem Auger

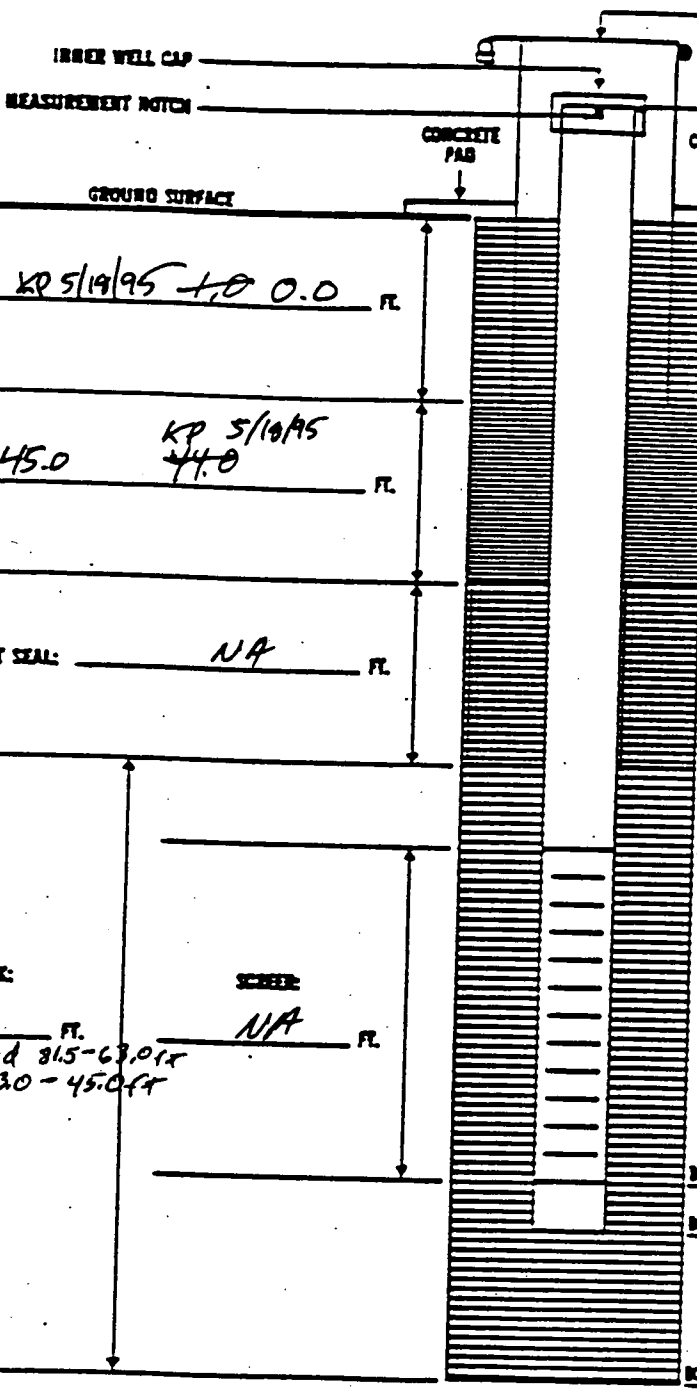
DATES OF INSTALLATION: 4/25/95 4/26/95

WATER LEVEL (ft): 73.00

DATE: 4/26/95

RELATED FAL NUMBERS:

CHECKED BY: FEMP CA 5-23



TOP OF PROTECTIVE CASING: NA FT.

TOP OF RISER: NA FT.

DIMENSIONS NA x NA x NA

CONCRETE: KP 5/19/95 ~~1.0~~ 0.0 FT.

GROUT: 45.0 KP 5/19/95 ~~44.0~~ FT.

BENTONITE PELLET SEAL: NA FT.

SAND PACK: 34.5 FT.
Natural Sand 81.5-63.0 ft
Global #5 63.0 - 45.0 ft

SCREEN: NA FT.

TOP OF GROUT SEAL: 0.0 KP 5/19/95 ~~1.0~~ FT.

BOTTOM OF PROTECTIVE CASING: NA FT.

TOP OF BENTONITE PELLET SEAL: NA FT.

TOP OF SAND PACK: 45.0 FT.

TOP OF SCREEN: NA FT.

BOTTOM OF SCREEN: NA FT.

BOTTOM OF SUMP: NA FT.

BOTTOM OF BORING: 81.5 FT.

BOREHOLE DIAMETER: 8 1/2 IN.

000184

TYPE AND AMOUNT OF GROUT USED: K Grout 18 Bags

BENTONITE PELLETS (5-GALLON BUCKETS): NA

DEEPEST TEMPORARY DRILLING CASING PENETRATION: NA FT.

VOLUME OF WATER USED DURING DRILLING: NA GAL

RISER MATERIAL: NA

VOLUME OF WATER USED FOR GROUT HYDRATION: 126.0 GAL

RISER WALL THICKNESS: NA

TYPE OF SAND PACK: Global #5 13 Bags

SCREEN MATERIAL: NA

DRILLING CASING DIAMETER: NA IN.

RISER/SCREEN DIAMETER: NA IN

SCREEN SLOT SIZE: NA

SCREEN TYPE: NA

DEPTH OF CENTRALIZER(S): NA

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-131	Drilling Method: Mobile B-61 HSA	Date Started: 4-12-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-17-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-17-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silty clay, brownish yellow, very stiff, moist (CL)	404701	2.5-4.5	ST	NA	23	Hold
		404703	5.0-6.5	SS	7-13-15	15	
7.5	Lean clay with sand, yellowish brown, few gravel, very stiff to hard, dry to moist CL	404704	7.5-9.5	ST	NA	22	MC, MC_m, UW, GS, AL, UU, UU,
		404706	10.0-11.5	SS	11-23-23	18	
11.5	Lean clay with sand, dark greenish gray, very stiff, moist, with scattered gravel CL	404707	12.5-14.5	ST	NA		
		404708	15.0-16.5	SS	7-15-16	15	
		404709	17.5-19.5	D	NA	24	UW,GS, SG, AL, CON, CON_s
		404711	20.0-21.5	SS	11-10-11	16.5	
		404712	25.0-27.0	ST	NA		
		404713	27.5-29.5	D	NA	23.5	UW, GS, SG, AL, CON, UU
	stiff at 30.0	404715	30.0-31.5	SS	4-8-12	18	
		404716	35.0-37.0	D	NA	24	Hold
	becoming very stiff at 40.0	404718	40.0-41.5	SS	7-12-18	18	
		404719	45.0-47.0	D	NA	14	MC_m, UW, GS, SG, AL, CON, CON_s, UU
		404721	50.0-51.5	SS	8-12-16	18	
		404722	55.0-56.5	SS	8-11-19	22	
60.0	Silt, very dense, moist (ML)	404723	60.0-61.5	SS	16-34-50	19	MC, GS, AL
65.0	Silty sand, pale brown, dense to very dense, moist, well graded	404724	65.0-66.5	SS	18-21-30	17	MC, GS
	Becoming silty sand with gravel, pale brown, very stiff, dry to moist (SM)	404725	70.0-71.5	SS	22-26-27	17.5	MC, GS
		404726	75.0-76.5	SS	39-50	14.5	MC, GS
		404727	81.0-82.5	SS	26-50	13.5	MC, GS
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-G2131-007

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 58.5 bls	DATE: 4/17/95	TIME: 0841	DATE STARTED: 4/12/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL: -Dry-	DATE: 4/17/95	TIME: 1227	DATE COMPLETED: 4/17/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: Alliance Envir., Inc.	DRILLING EQUIPMENT: Mobile Drill B-61; HSA	DRILLER/HELPER: B. Ericksons/B. Clough/B. Babcock

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1.0, 2.0							Augered to 2.5'. Cuttings - brown clay
3.0, 4.0	1355, 4/12/95, #404702 KE, #404702 KE		23"	(10 YR 6/6) Brownish yellow silty Clay with Sand (Sand is fine to medium), low plasticity, moist, (trace fine gravel, subangular [1/8" max] gravel)	CL		3" O.D. Shelby tube 24 inch push @ 300 psi for first 21", 400 psi for last 1" #404701 is Shelby Tube #404702 is Archive from bottom tube. Description is from bottom of Shelby Tube.
5.0							Augered to 5'
6.0	1408, 4/12/95, #404703	4 KE 7 - 13 - 15	15"	Hard, (10 YR 6/6) Brownish Yellow and (2.5 Y 6/3) light yellowish brown (mottled) silty clay with sand (Sand fine to med) low plasticity, trace fine subround to subangular gravel (3/8" max) dry to moist, trace iron staining trace black organic material	CL	4.5	Split Spoon 2" O.D. #404703 is Archive sample
7.0							Augered to 7.5' Cuttings - brown clay
8.0, 9.0	1443, 4/12/95, #404704, #404705	11 - 23 KE	22"	(10 YR 5/6) yellowish brown sandy clay, few subround to subangular fine gravel (3/4" max) (sand is fine to medium), moist, low plasticity, trace red iron staining	CL		3" O.D. Shelby Tube 24" Push @ 600 psi #404704 is Shelby Tube #404705 is Jar archive from bottom of tube. Bottom of tube slightly crimped in at bottom 1/8" in. Description is from bottom of shelby tube
10.0							Augered to 10'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Colors described using Munsell ® soil color charts (1994 revised edition). Split-barrel sampling and standard penetration testing per ASTM D 1586. Thin-walled sampling using Shelby tube per ASTM D 1587. Consistency of fine-grained soils based on

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP CA 11 5-17-95

CONTROL NO: 200308-G2131-008

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL: see Page 1 / DATE: / TIME: / DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: / DRILLING EQUIPMENT: / DRILLER/HELPER: 4/13/95 B. Erickson / B. Babcock

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10.0 – 11.0	1452, 4/12/95, #404706	11-23-23	18"	Hard, (10 YR 5/4) yellowish brown Sandy clay, few gravel (subrounded to subangular), fine to coarse (1 1/4" max) low plasticity, dry to moist, (Sand is fine) Bottom 2": contained 1 1/4" coarse gravel piece, clay at very bottom of spoon gray	CL	74.5	Split-Spoon 2" O.D. #404706 is archive sample
12.0							Augered to 12.5' Color Change brown → gray D = 11.5'
13.0 – 14.0	1512, 4/12/95, #404707		—	(10 G 4/1) dark greenish gray Sandy clay with gravel (gravel is subrounded to subangular fine (1/2" max) low plasticity, moist (sand is fine to coarse)	CL		Shelby Tube 3" O.D. Tube badly crushed up entire length of approx 20" 24" push @ ~ 1000 psi - Tube not kept - 16 oz jar. Description from bottom of tube (#404707)
15.0							Augered to 15'
16.0	1520, 4/12/95 #404708	7-15-16	15"	V. Stiff, (10 Y 4/1) dark greenish gray Sandy clay, trace fine subrounded to subangular gravel (3/4" max.), low plasticity, moist (sand is fine to coarse), moist. 1/4" by 1/8" piece of wood at depth = 16'	CL	3.5	Split-Spoon 2" O.D. #40478 is archive sample
17.0							
18.0 – 19.0	0920 4/13/95 #404709 #404710		24"	(10 Y 4/1) Dark greenish gray Sandy clay, few fine subrounded to subangular gravel (3/4" max), (Sand is fine to coarse), low plasticity, moist	CL		Denison Sample 2 13/16" liner I.D., 24" Long Description is from bottom "plug" from Denison Sampler shoe #404709 is Den. Tube #404710 is jar archive
20.0							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: (Cont'd) Pocket penetrometer. Density of coarse-grained soils based on SPT blow count

bls = below land surface
D = Depth

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP 5-17-95

4/95

CONTROL NO: 200308-G213-009

FEMP LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL: see gas / DATE: / TIME: / DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: / DRILLING EQUIPMENT: / DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20.0	0935 4/13/95, #404711	11-10-11	16.5"	Medium stiff, (10Y 5/1) greenish gray sandy clay, trace fine ~~gravel~~ to coarse gravel (1" max) (gravel is subrounded to subangular), (sand is fine to coarse), medium plasticity, moist	CL	0.75	Split-spoon 2" OD 1" piece of gravel at ~20.5' #404711 is Archive Sample
21.0							
22.0							Augered to 25'
23.0							
24.0							
25.0							
26.0	1005, 4/13/95, #404712		—	(10Y 4/1) dark greenish gray sandy clay with gravel (fine, subrounded to subangular (1/2" max.)) (Sand is fine to medium) low plasticity, moist (Description is from soil taken from bottom of tube)	CL		Shelby Tube, 3" O.D 24" push @ 400 psi first, 600 psi next 6", 400 psi rest of push Tube badly crimped - 16" of length. Tube not kept. #404712 is Jar Archive
27.0							Augered to 27.5'
28.0	1255, 4/13/95, #404713, #404714		23.5" 29"	(10Y 4/1) dark greenish gray sandy clay with gravel (gravel fine to coarse, -1 5/8" (max) gravel fragments at bottom of shoe), (sand is fine to coarse), low to medium plasticity, moist	CL		Denison Sample 2 13/16" Liner I.D, 24" long Description from material taken from sampler inner barrel shoe (#404714)
29.0							Augered to 30'
30.0							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: O.D. = outer diameter
I.D. = inner diameter

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5-17-95

CONTROL NO: 200308-G2131-010

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL: See Page 1 / DATE: / TIME: / DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: / DRILLING EQUIPMENT: / DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
30.0 – 31.0	1310, 4/13/95, #404715	4-8-12	18"	Medium stiff (10Y 4/1) dark greenish gray Sandy Clay, few fine (5/8" max. subrounded to subangular gravel), sand is fine to medium, low plasticity, moist ((10Y 4/1) - dark greenish gray)		1.0	Split-spoon 2" O.D. #404715 is TEMP Archive
32.0 – 35.0							Augered to 35' Drilling was slightly "gravelly" while augering
36.0 – 37.0	1350, 4/13/95, #404716, #404717	–	24"	(10Y 4/1) dark greenish gray Sandy clay, few fine (1/2" max. subrounded to subangular) gravel, sand is fine to ~~medium~~ coarse, low plasticity, moist.			Denison Sample 2 13/16" liner, 24" long (liner provides 2 13/16" sample) Description is from soil material from sample shoe (#404717)
38.0 – 40.0							Augered to 40'

000189

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5-17-95

4/95

FEMP LITHOLOGIC LOG

CONTROL NO: 200308-G2131-011

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-131

COORDINATES:

RELATED FAL NOs.:

SURFACE ELEVATION:

GROUNDWATER LEVEL: DATE: TIME: DATE STARTED:

GEOLOGIST:

GROUNDWATER LEVEL: see page DATE: TIME: DATE COMPLETED:

WATER USED DURING DRILLING:

DRILLING CONTRACTOR:

DRILLING EQUIPMENT:

DRILLER/HELPER:

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
40.0	1425, 4/13/95, #404718	7-12-18	18"	Stiff, (10Y 4/1) dark greenish gray sandy clay, trace fine subrounded to subangular gravel (1/2" max.), sand is fine to coarse, low plasticity, moist	CL	1.25	Split spoon - 2" OD. Thin 1/8" sand seam at 40.75' (fine to med)
41.0				sandy clay V. Stiff, dark greenish gray (10Y 4/1), A trace fine to coarse subrounded gravel (1 3/4" max), sand is fine to coarse, low plasticity, moist	CL	2.0	Thin 1/8-1/4" sand seam at 41' (fine to coarse) #404718 is Archive Sample
42.0							Augered to 45'
43.0							
44.0							
45.0							
46.0	1517, 4/13/95, #404719, #404720	-	~~18~~ 14"	(10Y 4/1) dark greenish gray sandy clay with gravel (fine subrounded to subangular, 3/4" max), sand is fine to coarse, low plasticity, moist	CL		Denison Sample 2 15/16" I.D. liner. Upper 10" of sample is disturbed. Description is from material from inner sampler shoe (#404720)
47.0							
48.0							Augered to 50'
49.0							
50.0							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5-17-95

000190

CONTROL NO: 200308-G2131-0A

FEMF
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: GZ-131	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL: see Page 1	DATE:	TIME:	DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
50.0	1546, 4/13/95, #404721	8-12-16	18"	Stiff, (10 Y 4/1) dark greenish gray sandy clay, trace fine to coarse subangular to subrounded gravel (1" max), low plasticity, moist, (sand is fine to coarse)	CL	1.25	Split spoon, 2" O.D. #404721 is archive sample ← 1" piece of gravel at 51.2
51.0							
52.0							Augered to 55'
53.0							
54.0							
55.0	1614, 4/13/95, #404722	8-11-19	22"	Stiff, (10 Y 4/1) dark greenish gray sandy clay, few fine to coarse subrounded to subangular gravel (1½" max), sand is fine to coarse, low plasticity, moist	CL	1.25	Split-spoon, 2" O.D. #404722 is Archive sample
56.0							
57.0							Augered to 60'
58.0							
59.0							
60.0							

000191

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

5-17-95

CONTROL NO: 200308-G2131-013

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES:	RELATED FAL NOs:	
SURFACE ELEVATION: see page 1	GROUNDWATER LEVEL: 58.5' bls	DATE: 4/17/95	TIME: 0841	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: see page 1
WATER USED DURING DRILLING: See page 1	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER: 4/17/95 E. Miller/B. Clough	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
60.0 – 61.0	0922, 4-17-95 #404723	16-34-~~54~~ 50/6"	19"	Top 2": (10 YR ~~4/1~~ 4/1) dark greenish gray sandy clay, trace fine subrounded gravel (¼" max), moist, low plasticity; very dense, 10 YR 5/6 yellowish brown clayey sand, (fine sand), moist, low to no plasticity	CL / SC		Split-Spoon, 2" O.D. #404723 is jar sample of sand
62.0 – 65.0							Augered to 65'
66.0	0957, 4-17-95, #404724	18-21-30	17"	V. dense, (10 YR 6/3) pale brown fine to medium sand, well graded, subrounded to subangular sand grains, moist, iron staining	SW		Split-Spoon 2" O.D.
67.0 – 70.0							Augered to 70'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

5-17-95

4/95

CONTROL NO: 200308-G2131-014

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-131

COORDINATES:

RELATED FAL NOs.:

SURFACE ELEVATION:

GROUNDWATER LEVEL: DATE: TIME: DATE STARTED:

GEOLOGIST:

GROUNDWATER LEVEL: See Page 1 DATE: TIME: DATE COMPLETED:

WATER USED DURING DRILLING:

DRILLING CONTRACTOR:

DRILLING EQUIPMENT:

DRILLER/HELPER: 4/17/95 E. Miller/B. Clough

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
70.0	1025, 4/17/95, #404725	22-26-27	17.5"	V. dense, (10YR 6/3) pale brown fine to medium, subround to subangular sand, well graded, trace fine subangular to subround gravel (1/8-3/16" max.), moist, iron staining	SW		2" O.D. split spoon
71.0							
72.0							Augered to 75'
73.0							
74.0							
75.0	1058, 4/17/95 #404726	39-50/5 3/4"	14.5"	V. dense, (10YR 6/3) pale brown fine to ~~medi~~ KE coarse, subrounded to subangular sand, (well graded sand) with fine to coarse gravel, subrounded to subangular (1 1/2" max), dry KE to moist	SW		2" O.D split spoon Drove spoon to 18" with 69 additional blows to collect sample material for lab testing
76.0							
77.0							Augered to 81'
78.0							
79.0							
80.0							

000193

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

FEMP QA 11 5-17-95

4/95

207

CONTROL NO: 200308-G2131-015

FEMP
LITHOLOGIC LOG

Page 89 of 89

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-131	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: see page 2	DATE:	TIME:	DATE STARTED:
GEOLOGIST:	GROUNDWATER LEVEL: — Dry —	DATE: 4/17/95	TIME: 1227	DATE COMPLETED:
WATER USED DURING DRILLING:	DRILLING CONTRACTOR:	DRILLING EQUIPMENT:	DRILLER/HELPER:	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
80.0							
81.0							
82.0	1222, 4/17/95, #404727	26 50/5"	13.5"	V. dense, (10YR 5/6) pale brown fine to coarse, subangular to subrounded sand, well graded, with fine to coarse, subrounded to subangular gravel (1" max.), dry to moist	SW		Split-Spoon, 2" O.D. - Drove ~~[illegible]~~ sampler a total of 15" to collect sample for lab testing
				Total Depth = 82.3'			
83.0							Time: 1158 - 4/17/95 Helper: B. Babcock
84.0							
85.0							
86.0							
87.0							
88.0							
89.0							
90.0							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

OC0194

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

WELL NUMBER: G2-131

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 200308-G2131-017

PROJECT NAME: CRUZ PHASE III DISPOSAL FACILITY FIELD INVESTIGATION

PROJECT NUMBER: 20.03.08

GEOLOGIST: KEN GEIGER, CLIFF LEE

DRILLING METHOD: AUGER

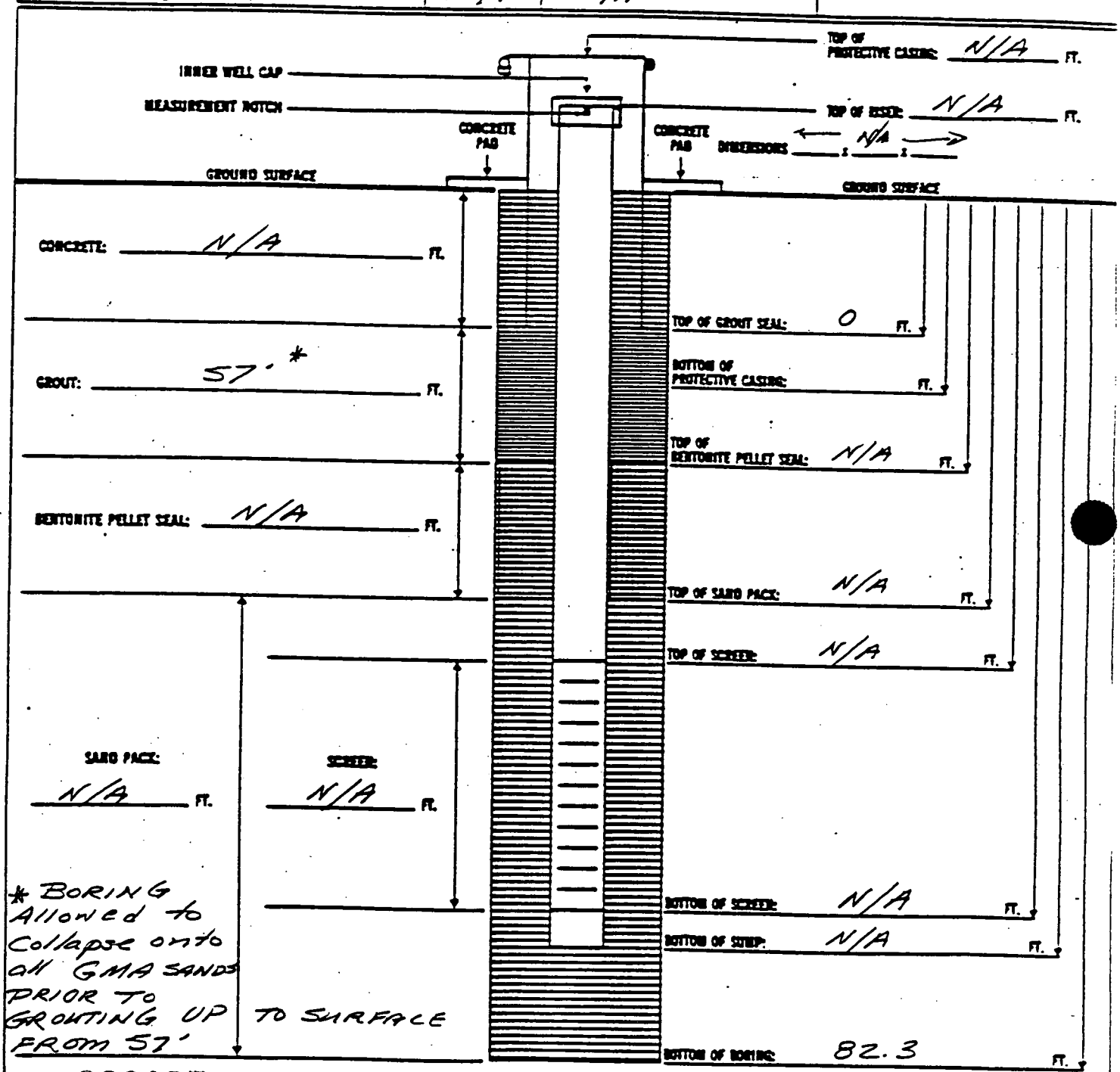
DATES OF INSTALLATION: 4/12,13,17/95

WATER LEVEL (FL): DRY

DATE: 4/17/95

RELATED FAL NUMBERS: N/A

CHECKED BY:



* BORING Allowed to Collapse onto all GMA SANDS PRIOR TO GROUTING UP FROM 57'

000195

BOREHOLE DIAMETER: 8 IN. MAX.

TYPE AND AMOUNT OF GROUT USED: TYPE E-I-K 15-94lb. bags	BENTONITE PELLETS (5-GALLON BUCKETS): N/A	DEEPEST TEMPORARY DRILLING CASING PENETRATION: N/A FT.
VOLUME OF WATER USED ~~DURING DRILLING~~ FOR GROUTING 5 BATCHES 75 GAL	RISER MATERIAL: N/A	VOLUME OF WATER USED FOR GROUT HYDRATION: (15GAL/BATCH) 75 GAL
RISER WALL THICKNESS: N/A	TYPE OF SAND PACK: N/A	SCREEN MATERIAL: N/A
DRILLING CASING DIAMETER: N/A IN.	RISER/SCREEN DIAMETER: N/A IN.	SCREEN SLOT SIZE: N/A IN
SCREEN TYPE: N/A	DEPTH OF CENTRALIZER(S): N/A FT.	

FEMP 04 11 5-17-95

Geotechnical Logging Report

207

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-132	Drilling Method: Mobile B-61 HSA	Date Started: 4-27-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-27-95
Ground Surface Elevation:	GWL/DATE: 7.2 BGS / 4-27-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, olive brown, stiff to very stiff, wet at 5.0, soft to stiff at 5.0 CL	405101	2.5-4.0	SS	3-4-5	14	
		405102	5.0-7.0	ST	NA	24	MC, MC_m, UW, GS, AL, UU, CU,
		405104	7.5-9.0	SS	8-12-24	18	
11	Lean clay with sand, gray to dark greenish gray, very stiff, moist, with scattered gravel to 3-1/2 inches CL	405105	10.0-12.0	D	NA	24	MC, MC_m, UW, GS, AL, UU, UU,
		405107	12.5-14.0	SS	7-9-11	18	
15	Sandy lean clay, gray to dark greenish gray, stiff to very stiff, moist, with scattered gravel CL	405108	15.0-17.0	ST	NA	22	UW, GS, AL, CU
		405110	17.5-19.0	SS	5-6-10	17	
	•	405111	20.0-22.0	ST	NA	24	MC, MC_m, UW, GS, AL, P
		405113	22.5-24.0	SS	5-6-7	15	
		405114	25.0-26.5	SS	4-50	8	
		405115	27.5-29.0	SS	5-6-11	12	
		405116	30.0-32.0	ST	NA	10	
		405118	32.5-34.0	SS	4-5-10	18	
		405119	35.0-36.5	SS	5-6-8	26	
	wood fragments and twigs at 37.5	405120	37.5-39.0	SS	3-5-8	22	
		405121	43.5-45.0	SS	5-9-15	18	
	• Note: ASTM symbols in parentheses indicate visual classification						

22
5/2/95

E 207

CONTROL NO: 200308-G2132-004 005

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-132	COORDINATES:
RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 7.2' BGL
DATE: 4/27/95	TIME: 1625
DATE STARTED: 4/27/95	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: 2.1 BGL
DATE: 5/1/95	TIME: 0800
DATE COMPLETED: 5/1/95	
WATER USED DURING DRILLING: 40 gallons	DRILLING CONTRACTOR: Alliance Environmental Inc.
DRILLING EQUIPMENT: Mobile B-61 HSA	DRILLER/HELPER: Marty Proctor, Barry, Rick

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				LEAN CLAY with trace SAND 2.5Y 4/4 olive brown, Firm to stiff	CL		
	1042 4/27/95 4050101 LW 4/27/95	3 4 5	14"	2.5Y 4/4 olive brown	CL	2.0	
5	1100 4/27/95 4050102 LW 4/27/95	Shelby	24"	soft to firm, wet 2.5Y 3/2 dk. oliv. brn in pockets with 2.5Y 4/4 oliv. brn. matrix.	CL	<0.5	300 lbs. down pressure on the push Archive # 4050103
	1110 4/27/95 4050104 LW 4/27/95	8 12 24	18"	LEAN CLAY WITH SAND 2.5Y 5/4 lt. olive brn., v. stiff, wet, w/scat. gravel to 1/4."	CL	>4.5	
10	1127 4/27/95 4050105 LW 4/27/95	Dennison	24"	LEAN CLAY with SAND 5Y 5/1, gray v. stiff, moist, w/scat. gravel to 3 1/2" subrounded.	CL		Had to bap barrel w/ hammer to lower bit on Dennison. 3 1/2" gravel in Tip. Archive # 4050106 ≈ 40 gal H_2O to drill Dennison
	1315 4/27/95 4050107 LW 4/27/95	7 9 11	18"	10Y 4/1 dk. grn. gray, scattered gravel to 1/4"	CL	3.0	
15	1334 4/27/95 ~~456~~ 4050108 4/27/95	Shelby	22"	5Y 5/1 gray, v. stiff, moist, w/trace gravel to 1."	CL	3.25	250 lbs - 400 lbs down pressure on push Bottom 5" may be disturbed. Tip slightly folded. 1" grav. in tip. Archive # 4050109
	1341 4/27/95 4050110 LW 4/27/95	5 6 10	17"	LEAN CLAY with trace SAND, 10Y 4/1 dk. grn. gray, firm to stiff, moist	CL	2.25	
20							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:
(1.) All sample numbers are sequential starting with 4050101 and ending with 4050121. The extra '0' is to be deleted as shown. Nicks

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

5-25 FEMP CA

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28/5/8/95

200308-G2132-~~006~~ 006

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-132

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	1400 4/27/95 4050111 KW4/27/95	Shelby	24"	LEAN CLAY with trace SAND 5Y 4/1 dk. gray firm to stiff, moist, scat. gravel to 1/4"	CL	2.0	200 lbs down pressure Archive #4050112
	1410 4/27/95 4050113 KW4/27/95	5 6 7	15"	5Y 4/1 dk. gray, firm, locally soft	CL	1.25	
25	1420 4/27/95 4050114 KW4/27/95	4 50 for 4"	8"	firm, moist 10Y 4/1 dk. grn. gray with scattered gravel to 1/4"	CL	1.0	Rock in tip
	1430 4/27/95 4050115 KW4/27/95	5 6 11	12"	firm, moist 10Y 4/1, dk. grn. gray with trace gravel to 1/2"	CL	1.5	
30	1440 4/27/95 4050116 KW4/27/95	Shelby	10"	firm to stiff, moist 10Y 4/1 dk. grn. gray with trace gravel to 1/2"	CL		300 lbs down pressure for 18" then bottom 6" 600 lbs. Bottom 3" of tube edge folded in on one side. Archive # 4050117
	1503 4/27/95 4050118 KW4/27/95	4 5 10	18"	firm, moist, 10Y 5/1 greenish gray	CL	1.25	
35	1515 4/27/95 4050119 KW4/27/95	5 6 8	26"	5Y 4/1 dk. grn. gray medium plastic w/scat grav. to 3/4"	CL	1.25 TO 1.5	spoon settled x 6" when set on bottom with just rod weight. wood frag. (≈ 1" long 1/8" sq)
	1532 4/27/95 4050120 KW4/27/95	3 5 8	22"	10Y 5/1 grn. gray soft to firm, w/scat gravel to 1", subangular to subrounded. Wood frags - twig 1" long 1/8" wide	CL	1.25	spoon settled x 4" with rod weight
40	1555 4/27/95 Qn. ~~4050121~~ KW4/27/95	Shelby	0"				shelby crushed over 1/2 its length. No sample
	1612 4/27/95 4050121 KW4/27/95	5 9 15	18"	5GY 4/1 dk. grn. gray, v. stiff, moist, w/scat gravel to 1/2"	CL	2.0	TOTAL DEPTH 45'
45							

NOTES:

000198

5-25-95

TILLUS\MISC\GEOTECH\LITHO LOG-PG 2.EPS

FEMP CL

4/95

WELL NUMBER: 1/6-51 62-132

FEMP
WELL COMPLETION LOG

CONTROL NUMBER: 207 200308-G2132-089 010

PROJECT NAME: Phase III Disposal Facility

PROJECT NUMBER: 20.03.08 5-895

GEOLOGIST: Ken Geiger

DRILLING METHOD: Hollow Stem Auger

DATES OF INSTALLATION: 4/27/95 - 5/1/95

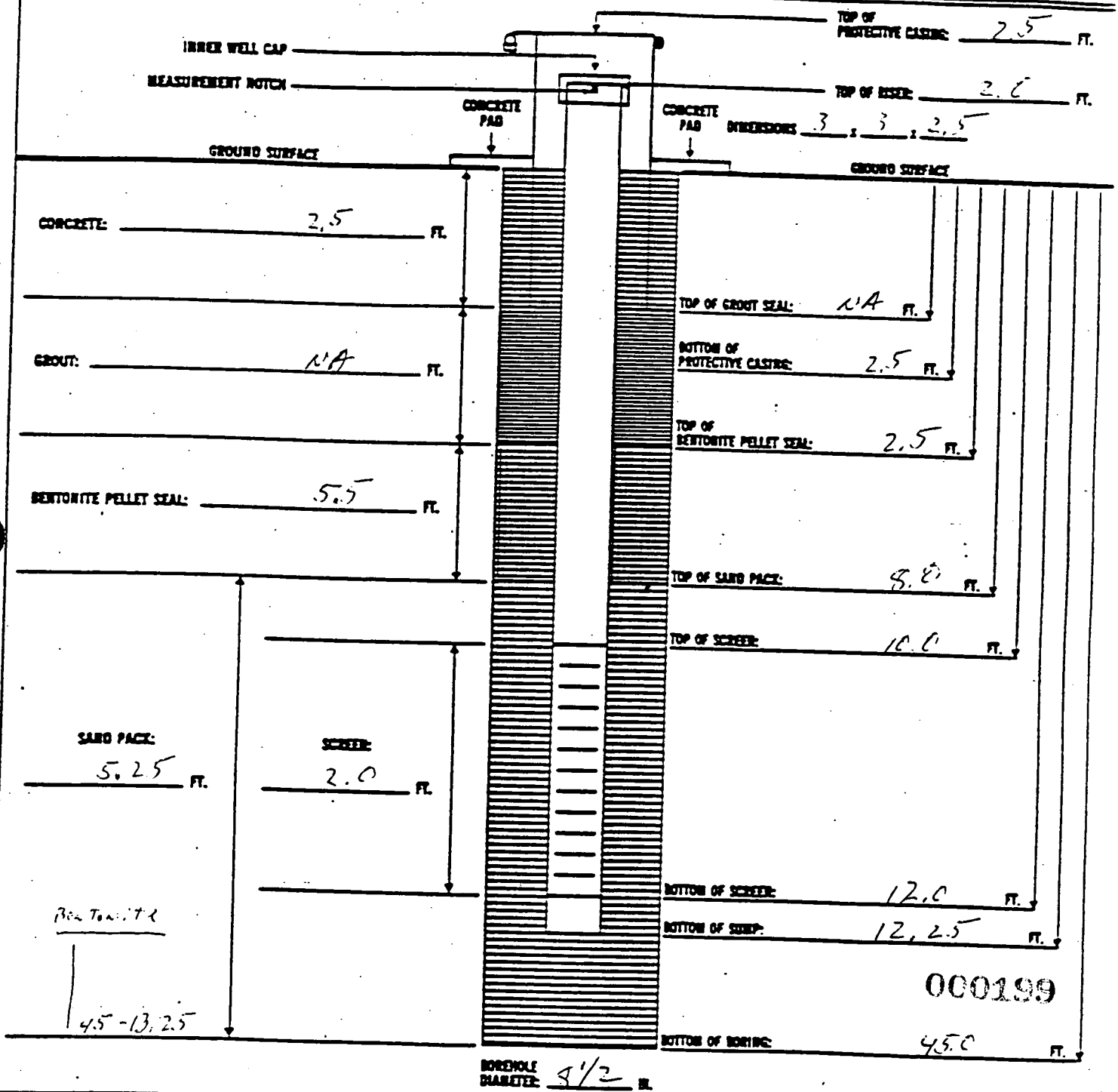
WATER LEVEL (R.I.): N/A

DATE: N/A

RELATED FAL NUMBERS:

CHECKED BY:

FEMP QA 13 5-219



000199

TYPE AND AMOUNT OF GROUT USED: N/A	BENTONITE PELLETS (5-GALLON BUCKETS): 9 Buckets		DEEPEST TEMPORARY DRILLING CASING PENETRATION: N/A FT.
VOLUME OF WATER USED DURING DRILLING: ~~N/A~~ KO 5/1/95 40.0 GAL	RISER MATERIAL: 316 Stainless Steel		VOLUME OF WATER USED FOR GROUT HYDRATION: N/A GAL
RISER WALL THICKNESS: 316 Stainless	TYPE OF SAND PACK: Global #5 4 Bags	SCREEN MATERIAL: Stainless Steel	DRILLING CASING DIAMETER: N/A IN.
RISER/SCREEN DIAMETER: 2.0 IN.	SCREEN SLOT SIZE: .010 IN	SCREEN TYPE: Stainless Steel	DEPTH OF CENTRALIZER(S): N/A

Geotechnical Logging Report

Project No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-133	Drilling Method: Mobile B-61 HSA	Date Started: 4-21-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-24-95
Ground Surface Elevation:	GWL/DATE: 33.5 BGS / 4-24-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, dark gray brown, medium stiff to stiff, moist, trace of sand (CL)	405053	2.5-4.5	ST	NA	8	
5	Sandy lean clay, light olive brown, stiff, moist (CL)	405054	5.0-6.5	SS	6-7-7	15	MC, UW, GS, AL, CU_{res}
		405055	7.5-9.5	ST	NA	23	UW, GS, SG, AL, CON, CON_s, UU
11	Sandy lean clay, gray, very stiff to hard, moist CL	405057	10.0-11.5	SS	11-17-21	18	
		405058	12.5-14.5	ST	NA	15	Hold
15	Sandy lean clay, dark gray, very stiff, moist, scattered gravel to 1-1/2 inches CL	405059	15.0-17.0	D	NA	24	UW, GS, AL, CU
		405061	17.5-19.5	D	NA	24	MC, UW, GS, AL, P
	becoming wet at 21.0	405063	20.0-21.5	SS	17-16-19	2	
22.5	Sandy lean clay, dark greenish gray, very stiff, moist to wet CL	405064	22.5-24.0	SS	6-10-24	7	
		405065	25.0-27.0	D	NA	24	MC, UW, GS, AL, P
		405067	27.5-29.0	SS	6-9-12	17	
		405068	30.0-31.5	SS	5-11-12	18	
		405069	32.5-34.0	SS	5-9-15	17	
		405070	35.0-37.0	ST	NA	24	
	* Note: ASTM symbols in parentheses indicate visual classification						

207

CONTROL NO: 200308 G2 133-006

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION					PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-133	COORDINATES:	RELATED FAL NOs.:			
SURFACE ELEVATION:	GROUNDWATER LEVEL: Ground surface	DATE: 4/24/95	TIME: 0800	DATE STARTED: 4/21/95	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: 33.5	DATE: 4/24/95	TIME: NOON	DATE COMPLETED: 4/24/95	
WATER USED DURING DRILLING: 140 gal total for 3 Dennisons	DRILLING CONTRACTOR: Alliance Environmental Inc.	DRILLING EQUIPMENT: MOBILE B-61 HSA		DRILLER/HELPER: Monty Proctor, Rick, Barry	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				LEAN CLAY, 10YR 4/2 dk. gr. brown firm-stiff, moist, trace sand M-F	CL		
	0945 4/21/95 405053	Shelby	8"	10YR 4/2 dark gr. brown some mottling w/streaks of lighter brn.		Q 4/21/95 ~~4.0~~	
5	0951 4/21/95 405054	6 7 7	15"	Sandy LEAN CLAY, 2.5Y 5/4 lt. olive brown, stiff to v. stiff, moist, w/gravel angular to 1/4"	CL	4.0	
	1015 4/21/95 405055	Shelby	23"	2.5Y 5/4 light olive brown			Archive 405056 Tube crimped
10	1020 4/21/95 405057	11 17 21	18"	2.5Y 4/3 olive brown v. stiff to hard, moist, w/gravel to 1". — gray @ 11'±	CL	>4.5	
	1045 4/21/95 405058	Shelby	15"	10Y 4/1, dk. grn. gray, v. stiff to hard, moist	CL		Shelby crushed - Too hard
15	1139 4/21/95 405059	Dennison	24"	LEAN CLAY with SAND 5Y 4/1 dk. gray, v. stiff, moist, scat. gravel to 1/2" rounded		3.25	50 gal. water to drill Dennison - 100% return Archive 405060
	~~405059~~ 1144 4/21/95						
	1155 4/21/95 405061	Dennison	24"	10Y 4/1, dk. grn. gray	CL	2.5	50 gal. water to drill/Dennison 100% return Archive Q 4/21/95 405062

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA	See FAL			
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

200308G2133-~~006~~ 007 4/25/95

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION

PROJECT NUMBER: 20.03.08

BORING NUMBER: G2-133 ~~A~~

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
20	0835 4/24/95 405063	17 16 19	2"	Lean CLAY with sand m-f, 5y 4/2 olive gray, st. to v. stiff, moist-wet, w/scat grav. to 1/2" med. plastic	CL		Only recovery was in the tip.
	0847 4/24/95 405064	6 10 24	7"	Lean CLAY, 10y 4/1, dk. grn. gray, stiff to v. stiff, w/trace sand m-f, and scat. gravel to 1/4" subangular medium plastic.	CL	3.0	
25	0905 4/24/95 405065	Dennison	24"	10y 4/1 dark greenish gray	CL	3.0	40 gal. H_2O to drill Dennison, Part disturbed only 1/2 long, bulging lower ≈ 10" Archive # 405066
	0918 4/24/95 405067	6 9 12	17"	10y 5/1 greenish gray, no gravel in sample	CL	2.75	
30	0926 4/24/95 405068	5 11 12	18"	3" Silty sand lens @ 30'6", with clay, fine grained, dense 10y 4/1 dk. grn. gray	SP	2.50	
	0946 4/24/95 405069	5 9 15	17"	10y 5/1 grn. gray.		2.50	
35	1010 4/24/95 405070	Shelby	24"	10y 5/1 grn. gray, w/scat. gravel to 1/2"	CL		Last 6" of push hit some gravel. 1/2" gravel in tip Archive 405071
				Total depth 37'			
40							

000202

5-25-95

NOTES: Water level @ ground surface in auger @ 0800 4/24/95

200308G2133-009 010

207 010

FEMP
WELL COMPLETION LOG

WELL NUMBER: 62133 11682

CONTROL NUMBER: 200308G2133-009

PROJECT NAME: Phase III Disposal Facility

PROJECT NUMBER: 20.03.08

GEOLOGIST: Ken Geiger

DRILLING METHOD: Hollow Stem Auger

DATES OF INSTALLATION: 4/19/95 – 4/24/95

WATER LEVEL (ft.): 27.80

DATE: 4/24/95

RELATED FAL NUMBERS:

CHECKED BY: 5-25-95

TOP OF PROTECTIVE CASING: NA FT.

INNER WELL CAP

MEASUREMENT NOTCH

TOP OF RISER: NA FT.

CONCRETE PAD

CONCRETE PAD

DIMENSIONS NA x NA x NA

GROUND SURFACE

GROUND SURFACE

CONCRETE: 0.0 FT.

TOP OF GROUT SEAL: 0.0 FT.

GROUT: 37.0 ~~36.0~~ KG 4/24/95 FT.

BOTTOM OF PROTECTIVE CASING: NA FT.

TOP OF BENTONITE PELLET SEAL: NA FT.

BENTONITE PELLET SEAL: NA FT.

TOP OF SAND PACK: NA FT.

TOP OF SCREEN: NA FT.

SAND PACK: NA FT.

SCREEN: NA FT.

BOTTOM OF SCREEN: NA FT.

BOTTOM OF SUMP: NA FT.

BOTTOM OF BORING: 37.0 FT.

BOREHOLE DIAMETER: 8 1/2 IN.

000203

TYPE AND AMOUNT OF GROUT USED: K Grout 6 Bags	BENTONITE PELLETS (5-GALLON BUCKETS): NA	DEEPEST TEMPORARY DRILLING CASING PENETRATION: NA FT.
VOLUME OF WATER USED DURING DRILLING: 140 ~~NA~~ KG 4/24/95 GAL	RISER MATERIAL: NA	VOLUME OF WATER USED FOR GROUT HYDRATION: 42.0 GAL
RISER WALL THICKNESS: NA	TYPE OF SAND PACK: NA / SCREEN MATERIAL: NA	DRILLING CASING DIAMETER: NA IN.
RISER/SCREEN DIAMETER: NA IN	SCREEN SLOT SIZE: NA / SCREEN TYPE: NA	DEPTH OF CENTRALIZER(S): NA

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-134	Drilling Method: Mobile B-61 HSA	Date Started: 5-3-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-3-95
Ground Surface Elevation:	GWL/DATE: 4.0 BGS / 5-3-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample D = Denison Sampler

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Fat clay, dark yellow brown, medium stiff, moist to wet (CH)	405132	0.0-1.5	SS	2-2-5	15	
		405133	1.5-3.0	SS	2-3-4	13	
3.5	Lean clay with sand, light olive brown to yellow brown, stiff to very stiff, moist (CL)	405134	3.0-4.5	SS	3-5-8	18	
		405135	4.5-6.0	SS	6-9-14	18	
		405136	6.0-7.5	SS	5-9-12	18	
	Silty sand, brown, very dense, wet at 8 - 8.5 (SM)	405137	7.5-9.0	SS	6-19-20	18	
		405138	9.0-10.5	SS	8-14-22	18	
11	Sandy lean clay, dark greenish gray, very stiff, moist CL	405139	10.5-12.0	SS	10-12-17	18	
		405140	12.0-14.0	D	NA	24	MC, UW, GS, AL, UU, UU,, UU_{r85}
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP LITHOLOGIC LOG

CONTROL NO: 200308G2134-002

Page 1 of 1

PROJECT NAME: PHASE III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-134	COORDINATES:	RELATED FAL NOs.: 200308G2134-001	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 4ft BGL	DATE: 5/3/95	TIME: 16.36	DATE STARTED: 5/3/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 5/3/95
WATER USED DURING DRILLING: 30 gallons	DRILLING CONTRACTOR: Alliance Environmental Inc	DRILLING EQUIPMENT: At Mobile B-61 HSA	DRILLER/HELPER: Marty, Proctor, Barry, Rick	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1500 5/3/95 405132	2 2 5	15"	FAT CLAY 10yR 4/4, dk. yel. brn. w/ trace sand, organic pods to 1/8", hair roots Firm to stiff, moist to wet. plastic	CH	2.0	3'wsw of CPT500
	1507 5/3/95 405133	2 3 4	13"	10yR 5/4 yel. brn.	CH	2.5	
	1512 5/3/95 405134	3 5 8	18"	5y 5/4 olive w/some gray mottling LEAN CLAY with Sand, scat. gravel to 1/4" stiff, moist	CL	3.0	
5	1521 5/3/95 405135	6 9 14	18"	10 yR 5/6 yel. brn, stiff to v. stiff	CL	3.5	
	1532 5/3/95 405136	5 9 12	18"	2.5y 5/4 lt. olive brn., some dk brn. Mn? staining. v. stiff, moist, scattered 1/2" grav.	CL	3.5	
	1540 5/3/95 405137	6 19 20	18"	SiltySAND 10YR 4/2 brn. V. Dense. wet w/1" grav	SP	3.0	and stks. of lean clay. Sand. fine, gravel rounded
10	1549 5/3/95 405138	8 14 22	18"	LEAN CLAY with SAND, scattered gravel to 3/4", v. stiff, moist, numerous iron stains	CL	>4.5	
	1558 5/3/95 405139	10 12 17	18"	2.5y 4/4 olive brn. transition to 10y 4/1 dk. grn. gr. iron stained fracture open ≈ 1/32" in gr. clay	CL	3.25 / >4.5	in brn / in gray
	1625 5/3/95 405140	Denison	24"	10y 4/1, v. stiff w/scat grav. to 1/2" dk. grn. gray	CL	3.75	Add ≈ 30 gal. H_2O to take Denison Sample
15				TOTAL DEPTH 14'			

NR 5-19-95

FEMP QA 18

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

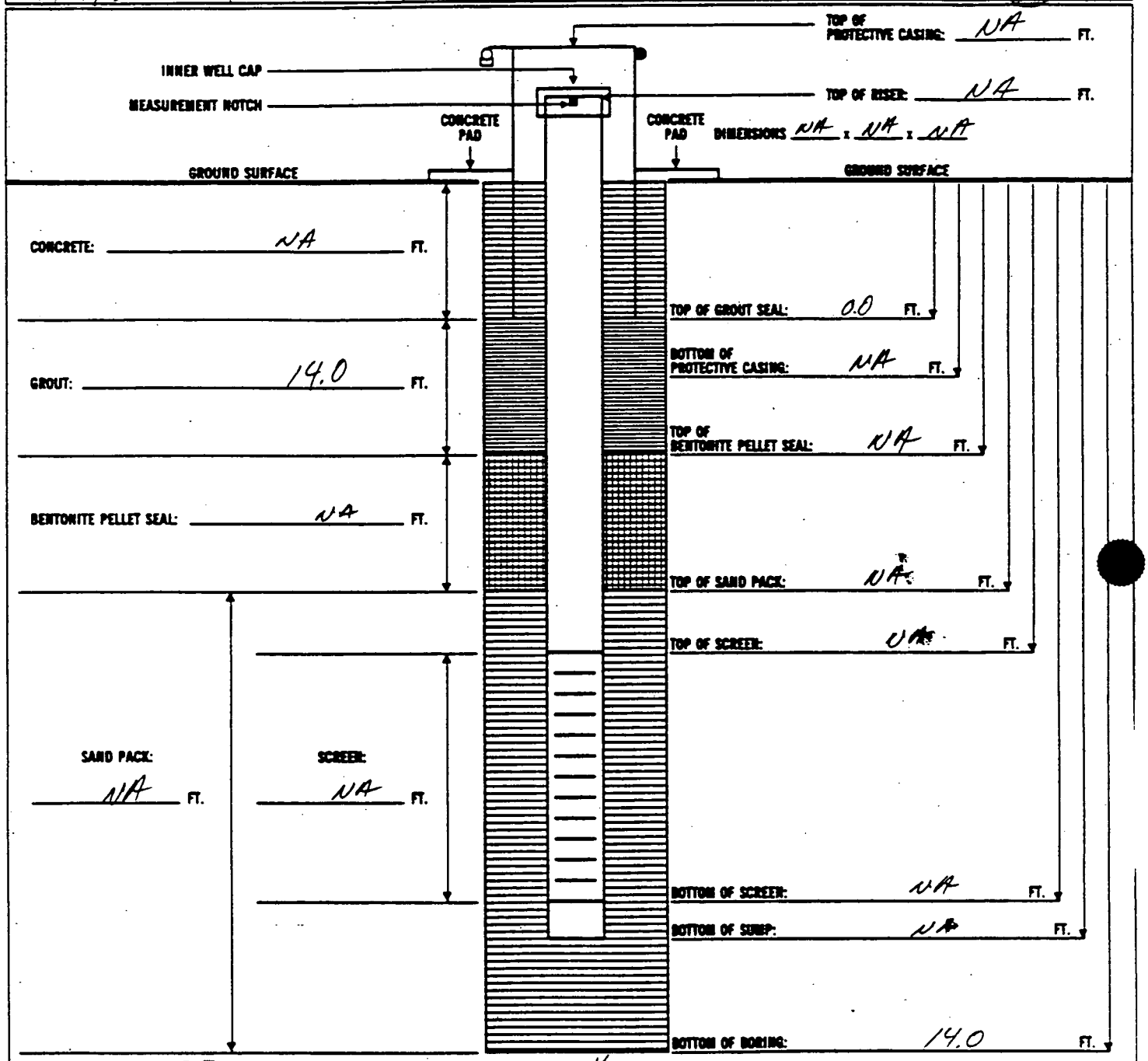
*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

WELL NUMBER:	FEMP WELL COMPLETION LOG	CONTROL NUMBER:
6.2 134		200308-G2134-004

PROJECT NAME:	PROJECT NUMBER:
Phase III Disposal Fac. 1.79	20.03.08

GEOLOGIST:	DRILLING METHOD:
Ky Geiger	Hollow Stem Auger

DATES OF INSTALLATION:	WATER LEVEL (ft.):	DATE:	RELATED FAL NUMBERS:	CHECKED BY:
5/3/95				NC 5-14-95 FEMP CA



000206

TYPE AND AMOUNT OF GROUT USED:	BENTONITE PELLETS (5-GALLON BUCKETS):	DEEPEST TEMPORARY DRILLING CASING PENETRATION:
K Grout 3 Bags	NA	NA FT.
VOLUME OF WATER USED DURING DRILLING:	**RISER MATERIAL:**	**VOLUME OF WATER USED FOR GROUT HYDRATION:**
NA GAL	NA	210 G

RISER WALL THICKNESS:	TYPE OF SAND PACK:	SCREEN MATERIAL:	DRILLING CASING DIAMETER:
NA	NA	NA	NA IN.
RISER/SCREEN DIAMETER:	**SCREEN SLOT SIZE:**	**SCREEN TYPE:**	**DEPTH OF CENTRALIZER(S):**
NA IN.	NA IN.	NA	NA FT.

FS-F-3684 (9/10/93)

E

APPENDIX E

PHASE III INVESTIGATION - SHALLOW BORING/EXCAVATION FIELD BORING LOGS AND GEOTECHNICAL LOGGING REPORTS

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-1	Drilling Method: Geoprobe Van	Date Started: 4-24-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-24-95
Ground Surface Elevation:	GWL/DATE: 0.4 BGS / 4-24-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silt, brown, moist (ML)	404605	0.0-0.5	B	NA	6	OC
		404606	0.5-1.0	B	NA	6	OC
		404607	1.0-1.5	B	NA	6	OC
1.5	Silty clay, brown to yellow brown, moist to wet, with trace of sand (CL)	404608	1.5-5.0	B	NA	12	MC, GS, SG, AL, SP, P_r, CON_{r85}
		404609	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G2SB1-002

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-1	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 0.4' bls (1)	DATE: 4/24/95	TIME: 1536	DATE STARTED: 4/24/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4/24/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van/Little Beaver Hyd. Auger	DRILLER/HELPER: B. Neyer/J. Cappanari	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1435, 4/24/95, #404605	Push	6" / 6"	Silt, brown, grass and vegetation, root strands, low plasticity, moist (topsoil)	ML		18" push of Geoprobe Macrocore 1.5" dia sampler at two locations 10" apart @ G2-SB-1. The 0-0.5', 0.5-1.0' and 1.0-1.5' intervals from the sampler were combined (i.e, 0-0.5' interval from the first push was combined with the 0-0.5' interval from the second push.)
0.5							
	1440, 4/24/95, #404606	Push	6" / 6"	Silt, brown, root strands, low plasticity, moist, (topsoil), nodules of organic material,	ML		
1.0							
	1443, 4/24/95, #404607	Push	6" / 6"	SAA, (topsoil)	ML		
1.5							
	1520, 4/24/95 #404608 (auger cuttings)			Cuttings 1.5-2.0 silty clay, brown low plasticity, moist	CL		#404608 is 3-gal can of auger cuttings
2.0				cuttings ~~1.5-2.0~~ 2.0-2.5: lean clay, yellowish brown, low plasticity, moist	CL		
				cuttings 2.5-3.5 - SAA -	CL		
				cuttings 3.5-5': lean clay, yellowish brown, low to medium plasticity, wet, trace sand	CL		Depth ~ 3.5' cuttings wet; Geoprobe used to sample 3.5-5.0 at Location 1.5' east of auger hole
3.0							
	3.5'						3.5' Geoprobe van lifts while sampling; sample advanced by push/weight
			17"	From Geoprobe sample 1.5' east of auger hole: Lean clay, trace sand, yellowish brown, iron staining (sand is fine to coarse), low plasticity, moist	CL		
4.0		Push (2)					4.2'-5.0 Percussion hammer used to advance sampler
	1555, 4/24/95 #404609	High (2)	6"	Lean clay, trace fine to coarse sand, yellowish brown, iron staining, few gravel, fine to coarse (1/8 to 1 1/2" max.), low plasticity, wet	CL		#404609 is 4.5-5.0' interval from geoprobe sample for Environmental Lab. (Chloride and Sulfate)
5.0							

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: (1) Puddles of water on the ground surface
(2) Geoprobe used to sample 3.5-5.0 at location 1.5' east of auger hole location

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

TLLUS\MISC\GEOTECH\LITHO LOG.EPS

8-8-95

4/95

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-2	Drilling Method: Geoprobe Van	Date Started: 4-24-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-24-95
Ground Surface Elevation:	GWL/DATE: 1.0 BGS / 4-24-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, brown to yellow brown, medium stiff to stiff, moist to wet CL	404600	0.0-0.5	B	NA	6	OC
		404601	0.5-1.0	B	NA	6	OC
		404602	1.0-1.5	B	NA	6	OC
		404603	1.5-5.0	B	NA		MC, GS, AL, SP, P,
		404604	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

200308G2SB2-002

CONTROL NO: G2SB2 5-1295

FEMP
LITHOLOGIC LOG

Page 1 of 1

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2 - SB - 2	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: 1.0' bls (2)	DATE: 4/24/95	TIME: 1140	DATE STARTED: 4/24/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4/24/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van/Little Beaver Hyd Auger	DRILLER/HELPER: B. Meyer/J. Capannari	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	4/24/95, 1020, #404600	Push	6"/6"	Silty clay, brown changing to yellowish-brown, grass with roots, low plasticity, moist, trace organic nodules (black).	CL/ML		0-1.5 18" push using Geoprobe 1.5" dia Macrocore sampler. Two pushes @ location G2-SB-2, ~ 8" apart 0-0.5, 0.5-1.0, and 1.0-1.5' intervals recovered combined in a jar for each 6" interval
1.0	4/24/95, 1025, #404601	Push	6"/6"	Silty clay, yellowish-brown, mottled, stringy rootlets, fewer than above, trace fine to coarse gravel (limestone, subangular), trace sand, low plasticity, moist, iron staining	CL		
1.5	4/24/95, 1030 #404602	Push	4"/6"	Silty clay, (yellowish brown) with dark brown to black organic material, mottled, trace stringy rootlets, moist, iron staining,	CL		
2.0	4/24/95, 1130 #404603 (Auger Cuttings)			Cuttings 1.5-2.5: yellowish brown to brown lean clay, low to medium plasticity, moist	CL		- Auger cuttings from 0-1.5' placed in 5-gal can (Composite sample SB-2,3,4 & 6) (Time 1055)
3.0				Cuttings 2.5-5': yellowish brown lean clay, trace sand (fine) wet, medium plasticity			
4.0							
5.0	4/24/95, 1201 #404604 (Macrocore Sample)	push	6"	(1) Geoprobe Macrocore sample: yellowish brown lean clay, low to medium plasticity, iron staining, moist, stiff	CL		#404604 is for Environmental Lab for Chloride and Sulfate tests,
				Bottom of boring = 5'			
							#404603 is a 5-gal, plastic lined can of auger cuttings 1.5-5'

8-8-95

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: (1) Geoprobe Macrocore sampler used to collect core at depth 4.5 - 5.0 The location of the probe was 1.5' south of the auger hole where bulk sample of cuttings was collected.
(2) Ground surface in vicinity of G2-SB-2 is wet, with puddles

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS/MISC/GEOTECH/LITHO LOG.EPS

4/95

000211

Geotechnical Logging Report

ect No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-3	Drilling Method: Geoprobe Van	Date Started: 4-21-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-21-95
Ground Surface Elevation:	GWL/DATE: Dry	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silt, brown, firm to stiff, moist (ML)	404588	0.0-0.5	B	NA	6	OC
		404589	0.5-1.0	B	NA	6	OC
		404590	1.0-1.5	B	NA	6	OC
2	Lean clay, light brown to brown, wet at 2.0 CL	404591	1.5-5.0	B	NA		MC, GS, AL, SP, P,
	• Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G25B3-003

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-03	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: NA / DATE: — / TIME: — / DATE STARTED: 4/21/95
GEOLOGIST: K. Ernst & R. Nicks	GROUNDWATER LEVEL: NA / DATE: — / TIME: — / DATE COMPLETED: 4/21/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Geoprobe van/Hand, Hand Auger / DRILLER/HELPER: B. Meyer/S. Capannari

BULK SAMPLE / COMPOSITE

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NOON 4/21/95 404588	P_{w_n}		brown silt, grass, roots, trace gravel, wet, low plasticity	ML		*3 hole 0-18" were pushed with the Geoprobe, and samples were divided 0-0.5, 0.5-1.0, and 1.0-1.5, then combined by depths with similar samples from each push. The reason for 3 holes is that the 2nd push gave a full 18" length, but a rock evidently prevented half of the sample (longitudinally) from being recovered.
0.5	1215 4/21/95 404589	P_{v_s} h		LT. Brn to brn firm, moist, firm-stiff		—	
1.0	1230 4/21/95 404590	P_{v_s} h		stiff		NA	
1.5	1400						
2.0	Bulk sample (Composite) 0-1.5 ~~1.0~~-5' 4/21/95 404591	NA	5 gal. bucket	Lean Clay, lt. brn to brn., wet medium plasticity to high plasticity locally.	CL	NA	
3.0							
4.0							
5.0				TOTAL DEPTH 5'			

8-8-95

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

Geotechnical Logging Report

ct No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-4	Drilling Method: Geoprobe Van	Date Started: 4-25-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-25-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-25-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Clay/silt mixtures (fill?), dark yellow brown, medium stiff, moist (CL)	404612	0.0-0.5	B	NA	6	OC
		404613	0.5-1.0	B	NA	6	OC
		404614	1.0-1.5	B	NA	6	OC
1.5	Lean clay with sand, yellowish brown to olive brown, scattered gravel, medium stiff to stiff, moist CL	404615	1.5-5.0	B	NA		MC, GS, SG, AL, CON,, CON_{res}, SP, P,
		404616	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-04	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE: / TIME:	DATE STARTED: 4/25/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL: Dry	DATE: 4/25/95 / TIME: 1222	DATE COMPLETED: 4/25/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van/Little Beaver Hyd. Auger	DRILLER/HELPER: B Neyer/J. Cappannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	Geoprobe RECOVERY (feet)	DESCRIPTION ~~(Colors identified per Munsell Color Chart)~~ From Geoprobe push/hammer 1.5" Ø sampler	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	1142, 4/25/95 #404612 ①		0.7'	Dark yellowish brown clayey silt trace fine gravel 1/8" - 1/4" subrounded, low to non plasticity, moist, iron staining, grass, roots, trace sand	ML		Geoprobe push 0-0.7'
1.0	1143 4/25/95, #404613 ①		0.3'	0.7' Coarse gravel fragments, (fill)? 1.5" max, dry	GP		Geoprobe-hammered ~~0.7-1.0'~~ ~~Gravel~~ Geoprobe hammered 1.0-1.5'
1.5	1145 4/25/95 #404614 ①		0.5'	1.3' yellowish brown Dark brown, clay, low plasticity moist, trace iron staining 1.5'	CL		
2.0	1210 4/25/95 #404615 (5-gal can of auger cuttings collected with hyd. hand auger)		0.3'	yellowish brown lean clay, low plasticity, moist, trace, iron staining trace black organic material, medium stiff	CL		Geoprobe push 1.5-2.5' #404617 Composite sample SB-2,3,4,6 Depth 0-1.5 (topsoil)
3.0			0.5'	2.5' SAA	CL		Geoprobe push and hammer (last 0.3') 2.5-3.0'
4.0			1.2'	3.0' yellowish brown lean clay trace fine subangular gravel (1/8" max), med stiff to stiff, low plasticity, moist, iron staining, trace black organic nodules (material), trace sand	CL		Geoprobe push and hammer (last 0.3') → 3.0-4.1'
4.5	1132 4/25/95 #404616 Bottom of boring 5.0'		0.9'	4.1' olive brown lean clay, few fine to coarse gravel, subangular to subrounded (3/4" max), med. stiff to stiff, iron staining, low plasticity, moist, less trace organic material than above, trace fine to coarse sand	CL		Geoprobe hammered 4.1 to 5.0' ③ 3/4" piece of gravel subangular @ 4.9'
5.0							

Auger cuttings 1.5 (3') — Auger cuttings from this boring (SB-04) combined with SB-2,3,6 cuttings and stored

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Initial Geoprobe push/hammer 0-5' time 1045 to 1132. From 1135 to 1142 pushed/hammered second geoprobe sampler 0-1.5' to provide additional sample material for 0-0.5', 0.5-1.0' and 1.0-1.5' samples.
① Combined soil from two adjacent Geoprobe pushes/drives for samples for 0-0.5' and 0.5-1.0 and 1.0-1.5' sample intervals
② Location of second geoprobe push is 0.3' south of first 0-5' push/drive. Second location augered with Little Beaver to collect auger cuttings
③ Augering into gravelly zone @ 4.9-5.0'. Coarse gravel 3/4"-1 1/2" max. augered to surface, subangular to subrounded.

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS/MISC/GEOTECH/LITHO LOG.EPS

4/95

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-5	Drilling Method: Geoprobe Van	Date Started: 4-26-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-26-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-26-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silt/clay mixtures, brown to gray, stiff to very stiff, moist (CL)	404624	0.0-0.5	B	NA	6	OC
		404625	0.5-1.0	B	NA	6	OC
		404626	1.0-1.5	B	NA	6	OC
3.5	Lean clay, olive brown to dark yellowish brown, with trace of sand, stiff, moist CL	404627	1.5-5.0	B	NA		MC, GS, AL, SP, P,
		404628	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308-G2SB5-005

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-05	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: dry hole	DATE:	TIME:	DATE STARTED: 4-26-95
GEOLOGIST: D. Creek	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4-26-95
WATER USED DURING DRILLING: no water used	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van / Little Bear Hyd. Auger	DRILLER/HELPER: B. Neyer / J. Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1005 4-26-95 #404624	NA		Grass, weeds at surface. CLAY, silty, (10YR, 4/4) dark yellowish brown, thick grass roots, trace sand (fine), moist, low plasticity, stiff	CL	1.75	3.0' Geoprobe push 1.5" diameter core
0.5	1006 4-26-95 #404625			0.6' SILT, clayey, (2.5Y, 3/2) v. dark grayish brown, mottled, ~~trace~~ few gravel (fine, angular), trace sand (rnd to subang., coarse), fine thin roots, moist, caliche, low plasticity, max. gravel (0.5"), very stiff	ML	>3.0	
1.0	1007 4-26-95 #404626		2.9'/3.0'	grading to more clayey			
1.5	1017 4-26-95 #404627 (5-gal can of auger cuttings plus extra geoprobe sample)			1.7' CLAY, silty (2.5Y, 4/4) olive brown, mottled, black organic nodules, trace sand (fine), trace gravel (fine, ang to rndd), fine roots, slight Fe staining, ~~few fine roots (thin), moist~~,	CL/ML	*	broke apart w/ pocket pen
2.0							
2.5			Geoprobe Push				
3.0				3.3'			2.0' Geoprobe push 1.5" diameter core
3.5			1.9'/2.0'	CLAY, trace sand (fine), (10YR, 4/4) dark yellowish brown, mottled, blocky, black nodules throughout, olive brown mottles, med. plasticity, very few roots (thin), moist, Fe staining, stiff	CL	2.0	
4.0							
4.5	1019 4-26-95 #404628		Geoprobe Push Driven last 6"	fine roots to 5.0' Total Depth = 5.0'			dry at bottom of hole
5.0							

Auger cuttings for Bulk sample #404627 1017

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Visual descriptions from Geoprobe macrocore
Borehole grouted with expansive K-grout (Type E-I-K Expansive Cement)
Auger hole placed ~0.5' south of 1st geoprobe hole
Second geoprobe hole ~0.5' east of 1st geoprobe hole

~~SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.~~ DC

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

8-10-95

4/95

000217

Geotechnical Logging Report

ct No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-6	Drilling Method: Geoprobe Van	Date Started: 4-21-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-21-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-21-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silt, light brown, medium stiff to stiff, moist (ML)	404592	0.0-0.5	B	NA	6	OC
		404593	0.5-1.0	B	NA	6	OC
		404594	1.0-1.5	B	NA	6	OC
2	Lean clay, brown, with trace of sand, moist CL	404595	1.5-5.0	B	NA		MC, GS, AL, SP, P,
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO: 200308G2SB6-003

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-06	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: NA / DATE: / TIME: / DATE STARTED: 4/21/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: NA / DATE: / TIME: / DATE COMPLETED: 4/21/95
WATER USED DURING DRILLING: NONE	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Little Beaver Auger / DRILLER/HELPER: Neyer

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1430 4/21/95 404592	Push	6"/6"	SILT, lt. brn., firm-stiff, moist, rootlets to 1/32" diam.	ML		
1	1440 4/21/95 404593	Push	6"/6"	w/sand (fine) streaks or stringers to 1/4"			
	1445 4/21/95 404594	Push	6"/6"				using air hammer to advance last 4" i.e. 1'2" to 1'6"
2	1515			LEAN CLAY, brown-lt. brn., moist w/trace sand (fine), medium plasticity	CL	NA	
3	BULK SAMPLE (COMPOSITE) 1.5 ft-5 ft, @ 4/21/95 404595	NA	5 gal. can				
4							
5				Total Depth 5 ft.			* For the top 18", 2 holes were pushed with the geoprobe and samples were divided 0-6", 6"-12", and 12"-18", then combined with like depth samples from the 2nd 18" deep hole.

COMPOSITE BULK SAMPLE

8-10-95

FEMP QA 18

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

000219

4/95

Geotechnical Logging Report

ect No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-7	Drilling Method: Geoprobe Van	Date Started: 4-26-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-26-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-26-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silty clay, olive brown, with trace of sand, moist, medium stiff (CL)	404629	0.0-0.5	B	NA	6	OC
		404630	0.5-1.0	B	NA	6	OC
1.0	Lean clay, dark yellowish brown, with trace of sand, stiff, moist, becoming olive brown at 2.0 CL	404631	1.0-1.5	B	NA	6	OC
		404632	1.5-5.0	B	NA		MC, GS, SG, AL, CON,, CON_{res}, SP, P,
		404633	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME:	Phase III Geotechnical Investigation
PROJECT NUMBER:	20.03.08
BORING NUMBER:	G2-SB-7
COORDINATES:	
RELATED FAL NOs.:	
SURFACE ELEVATION:	
GROUNDWATER LEVEL:	dry hole
DATE:	
TIME:	
DATE STARTED:	4-26-95
GEOLOGIST:	D. Creek
GROUNDWATER LEVEL:	
DATE:	
TIME:	
DATE COMPLETED:	4-26-95
WATER USED DURING DRILLING:	no water used
DRILLING CONTRACTOR:	FERMCO
DRILLING EQUIPMENT:	Geoprobe Van / Little Bear Hyd. Auger
DRILLER/HELPER:	B. Neyer / J. Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1150 4-26-95 #404629	NA		grass & weeds at surface CLAY, silty, trace sand (fine to med), (2.5Y, 4/4) olive brown, low plasticity, numerous fine roots, dry to moist, med. stiff	CL / ML	1.0	3.0' Geoprobe push and drive 1.5" diam. core
0.5	1151 4-26-95 #404630			0.9'			
1.0	1152 4-26-95 #404631		2.8'/3.0'	CLAY, trace sand (fine), (10YR, 4/6) dark yellowish brown, mottled, Fe staining throughout, fine roots throughout, black nodules 1.6'-2.0', low to med. plasticity, moist, blocky, stiff	CL	1.5	
1.5				2.0'			
2.0	1200 • 4-26-95 #404632 (5-gal can of auger cuttings)		Geoprobe Push hammer last 8"	CLAY, trace sand (fine to coarse, rndd to subang), (2.5Y, 4/4) olive brown, mottled, dark brown and orange mottles throughout, blocky, black nodules, medium plasticity, fine roots, Fe staining, very stiff, moist	CL	2.75	
2.5				roots to ~ 3' DC ~~Cobbly~~ DC extreme Fe staining (precip.) at 2.8'		DC	
3.0			2.0/2.0				2.0' Geoprobe push and drive 1.5" diam. core
3.5				CLAY, gravelly (fine to coarse, subrndd to ang, max 3/4"), few sand (coarse), (2.5Y, 4/3) olive brown, mottled with orange (Fe stains?) caliche, low plasticity, dry to moist, very stiff, fossiliferous gravel at 3.8'	CL	>30	
4.0			Geoprobe Drive				
4.5	1210 4-26-95 #404633						dry at bottom of hole
5.0							

auger cuttings for DWK sample # 1-12

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Visual description from geoprobe macrocore
Second geoprobe hole ~ 8" south of 1st geoprobe hole.
Auger hole 2 6" south of 1st geoprobe hole.
Borehole grouted with Type P-I-K Expansive Cement.

~~SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.~~ CC

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/93

000221

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-8	Drilling Method: Geoprobe Van	Date Started: 4-25-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-25-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-25-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Clayey silt, brown, moist to wet, with trace of gravel (ML)	404618	0.0-0.5	B	NA	6	OC
		404619	0.5-1.0	B	NA	6	OC
		404620	1.0-1.5	B	NA	6	OC
2	Lean clay, yellowish brown to olive brown, moist CL	404621	1.5-5.0	B	NA		MC, GS, AL, SP, P,
		404622	4.5-5.0	B	NA	6	SU, CL
	• Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: GZ-SB-8	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: ~4.9 (est.) ②	DATE: 4/25/95	TIME: 1505	DATE STARTED: 4/25/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL: Dry	DATE: 4/25/95	TIME: 1500	DATE COMPLETED: 4/25/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van/Little Beaver Hyd Auger	DRILLER/HELPER: B. Neyer/J. Capannari	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION ~~(Colors identified per Munsell Color Chart)~~	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	1430, 4/25/95, 404618 ①		2.9'	Clayey Silt, brown, grass roots, iron staining, trace fine to coarse gravel (3/4" max) subangular, black organic material, moist, low plasticity	ML		Geoprobe, 1.5" ϕ sampler – pushed 0 – 3.0'
1.0	1432, 4/25/95, 404619 ①						Auger cuttings of top soil from 0 – 1.5' placed in 5-gal drum that will contain similar soils (i.e., 0 – 1.5') from boring, SB-8, SB-9, SB-10 & SB-11 (i.e., composite topsoil sample)
1.5	1434 4/25/95 404620 ①			roots become less with depth, finer, stringy roots			
2.0	1456, 4/25/95, 404621 (5-gal can of auger cuttings 1.5 – 5.0'		Geoprobe push	1.5' Silt, brown, trace roots, vertical iron staining, trace fine stringy roots, moist to wet, low plasticity	ML		
				2.1' Lean Clay, yellowish brown, iron staining, low plasticity, moist, trace black organic material, rootlets, to depths of ~3'	CL		
3.0			2.0'				Geoprobe, 1.5" ϕ sampler – pushed 3.0 – 4.5, driven (hammered w/ Geoprobe) 4.5 – 5.0'
			Geoprobe push	3.5' Lean Clay, yellowish brown, iron staining, low plasticity, moist, trace black organic material, trace sand, fine to coarse	CL		
4.0				4.0' Lean Clay, olive brown, iron staining, few sand, fine to coarse, low plasticity moist, trace black organic material	CL		
5.0	1436, 4/25/95, 404622		Geoprobe Drive	4.5' Lean Clay with few fine to coarse sand, few fine to coarse gravel, olive brown iron staining, moist, low plasticity,	CL		Max gravel ~1" subangular

Composite Sample from GZ-SB-8, -9, -10, -11

Bulk sample # 404621

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: Visual Description from Geoprobe Macrocore – Sample 1.5" ϕ pushed or driven from 0 – 5' (First Geoprobe)
① A second geoprobe core sample was pushed 0 – 1.5' to provide additional soil for samples 0 – 0.5, 0.5 – 1.0 and 1 – 1.5'. Location of 2nd Geoprobe sample 0.6' west of first sample @ GZ-SB-8. Little Beaver Hyd. Auger used to collect auger cuttings at location of 2nd geoprobe sample
② Water observed at bottom of borehole just prior to grouting. Ripples on water surface → [illegible] estimated

~~*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST~~

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

Geotechnical Logging Report

ect No: P0140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-9	Drilling Method: Geoprobe Van	Date Started: 4-20-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-20-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay, light brown, medium stiff to stiff, moist CL	404584	0.0-0.5	B	NA	6	OC
		404585	0.5-1.0	B	NA	6	OC
	Very moist to wet at 3.0	404586	1.0-1.5	B	NA	6	OC
5		404587	1.5-5.0	B	NA		MC, GS, AL, SP, P,
	* Note: ASTM symbols in parentheses indicate visual classification						

003

CONTROL NO: 200308G2SB9-0004 4/24/95

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-09	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED: 4/20/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 4/20/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe/Little Beaver	DRILLER/HELPER:	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
*	1555 4/20/95 404584	Push	6"/6"	LEAN CLAY, lt. brown, firm-stiff, moist medium plastic w/hair rootlets	CL	NA	* For the top 18", 2 holes were pushed with the Geoprobe and samples were divided 0-6", 6"-12" and 12-18" then combined with like depth samples from the 2nd 18" deep hole.
1	1600 4/20/95 404585	Push	6"/6"				
	1605 4/20/95 404586	Push	5"/6"	Light yel. brown @ 1½'			
2	1645 4/20/95 K BUL	NA	NA 5gal bucket	Becoming v. moist to wet @ 3 higher silt content			
4							
5	404587			Trace of sand m-f @ 4½			
				Total depth 5'			

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-10	Drilling Method: Geoprobe Van	Date Started: 4-26-95
Coordinates:	Geologist: D. Creek	Date Completed: 4-26-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-26-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Clayey silt, dark yellowish brown, soft, moist (ML)	404634	0.0-0.5	B	NA	6	OC
		404635	0.5-1.0	B	NA	6	OC
0.8	Lean clay, light olive brown, stiff, moist (CL)	404636	1.0-1.5	B	NA	6	OC
2.5	Lean clay with sand, light olive brown, very stiff, moist CL	404637	1.5-5.0	B	NA		MC, GS, AL, SP, P,
		404638	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: Phase III Geotechnical Investigation			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-10	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE: / TIME:	DATE STARTED: 4-26-95
GEOLOGIST: D. Creek/K. Ernst	GROUNDWATER LEVEL: Dry	DATE: 4/26/95 / TIME: 1520	DATE COMPLETED: 4-26-95
WATER USED DURING DRILLING: no water used	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Geoprobe Van/Little Bear Hyd. Auger	DRILLER/HELPER: B. Neyer/J. Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1440, 4-26-95, #404634	Push	3.0/3.0	Clayey Silt, grass (top), roots, low plasticity, moist, (10YR 4/4) dark yellowish brown, (topsoil), iron staining, soft	ML	0.25	Geoprobe core sample, 1.5" dia, pushed 0-3.0'
0.5	1443 4-26-95 #404635			0.8'			
1.0	1445 4-26-95 #404636			Lean clay, roots, stringy, iron staining, low plasticity, moist (2.5 Y 5/6) light olive brown, black organic nodules, scattered, stiff	CL	1.5	Collected topsoil from auger cuttings 0-1.5' for composite sample
1.5							
2.0							
2.5	1515, 4-26-95 #404637 (5-gal can of auger cuttings)			2.5' Lean clay with sand, few to trace fine to coarse gravel (scattered), 2" max) subangular, moist, (sand is fine to med.)	CL	2.5	Gravel fragment @ 3.3'
3.0		Driven	2.1/2.1	← roots (stringy) to 3.1' low plasticity, iron staining (vertical) (2.5 5/4) light olive brown very stiff			Geoprobe core sample dia 1.5" Driven 3.0-5.1'
3.5							
4.0						3.0	Hard augering at 3.1 feet. piece of root augered to surface 3/8" ⌀ 2" long (Tree ~25' north of G2-SB-10)
4.5	1500 4-26-95 #404638			Bottom of boring = 5.1'			2" Gravel fragments @ 4.4

G2-SB-8, -9, -10 and -11

Bulk Sample

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: First geoprobe at G2-SB-10 pushed/driven 0-5' for visual logging and sampler. Second geoprobe pushed 0-1.5', 1-foot south of inital geoprobe for additional soil for 0-0.5, 0.5-1, and 1-1.5 Jar sampler. Hand Auger boring performed at location of 2nd Geoprobe. to depth = 5.0'

~~SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST~~ KE

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000227

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-11	Drilling Method: Geoprobe Van	Date Started: 4-27-95
Coordinates:	Geologist: J. Erjavec	Date Completed: 4-27-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-27-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Lean clay with sand, brown to olive brown, very stiff to hard, moist CL	404639	0.0-0.5	B	NA	6	OC
		404640	0.5-1.0	B	NA	6	OC
		404641	1.0-1.5	B	NA	6	OC
		404642	1.5-5.0	B	NA		MC, GS, SG, AL, CON_{r85}, P_r, SP
5.0		404643	4.5-5.0	B	NA	6	SU, CL
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO:

FEMP
LITHOLOGIC LOG

Page 1 of 1

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-11	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: DRY	DATE: 4/27/95 TIME: 11:40	DATE STARTED: 4/27/95
GEOLOGIST: JIM ERJAVEC	GROUNDWATER LEVEL:	DATE: TIME:	DATE COMPLETED: 4/27/95
WATER USED DURING DRILLING: NONE	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: GEOPROBE VAN	DRILLER/HELPER: B. Neyer, J. Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
.9' below surface	16:50 4/27/95 404639		3'	9/10' ft interface (1) Brown silty clay with gravel angular, unconsolid. low plasticity, roots trace			Hammered geoprobe (1.5" diam core) from 0.5 to 3' below 0.5.
0.5	10:53 4/27/95 404640		6"	gravel brown to brown clay with trace gravel & organic material. Brown clay - mottled, gravel brown clay med. plasticity, moist (10YR 5/8 yellowish brown) very stiff	CL	4.0	
1.0	10:55 4/27/95 404641		6-12"	Brown clay, trace roots, med plasticity (10YR 5/8 yellowish brown) very stiff trace rootlets & iron staining, moist	CL	2.5	
1.5			12-18"	Brown clay, trace roots & trace gravel low-med plasticity (10YR 5/6 yellowish brown)	CL	2.0	very stiff
2.0 2.1				brown clay, trace roots & gravel, cobble moist, low plasticity (10YR 5/6 yellowish brown)	CL	3.0	very stiff
			2.9'	Brown clay, trace gravel, low plasticity trace silt very stiff moist (2.5Y 5/6 light olive brown)	CL	3.0	Hammered (1.5" diam core from 3' to 6' lost bottom .1 ft.
				Brown clay, trace silt, low plasticity, trace gravel, moist (2.5Y 5/6 light olive brown), very stiff	CL	3.0	
3.0	Bulk of Auger 11:35, 4/27/95 404643			Brown clay with silt, low plasticity, trace gravel moist (2.5Y 5/6 light olive brown), very stiff	CL	2.5	
				Brown clay with silt, low plasticity moist (2.5Y 5/6 light olive brown), hard	CL	>4.5	
4.0				Brown clay, lean, trace sand, moist, low plasticity, trace fine gravel (2.5 5/6 light olive brown), hard	CL	>4.5	
5.0	11:10 4/27/95 404642			Brown clay with silt, trace sand & gravel, low plasticity (2.5 5/6 light olive brown), hard	CL	>4.5	

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: 3' - hammered most of way. 1st push 3', 2nd push
(1) Top 9/10' stone above sample interval 3' constructed below this interval

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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Augured 2.4' to 5.4'. Bulk sample in 404643 (composite). (1.5' - 5.0' Bottom on log) 2 Kgs

2nd geoprobe pushed 2.4', offset 12" W of initial push. Samples went into 404639-640, -641. Augured at 2nd location to 2.4'. Material from 0.0 to 2.4' combined with SB-8, 9, 10) Composite sample # 404644

000229

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-12	Drilling Method: Geoprobe Van	Date Started: 4-21-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-21-95
Ground Surface Elevation:	GWL/DATE: Dry / 4-21-95	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silt, brown, medium stiff to stiff, moist (ML)	404596	0.0-0.5	B	NA	6	OC
		404597	0.5-1.0	B	NA	6	OC
		404598	1.0-1.5	B	NA	6	OC
2.0	Fat clay, brown to light brown, moist CH	404599	1.5-4.2	B	NA		MC, GS, AL, SP, P,
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-12	COORDINATES:	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: NA	DATE: — / TIME: —	DATE STARTED: 4/21/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: NA	DATE: — / TIME: —	DATE COMPLETED: 4/21/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Little Beaver Auger	DRILLER/HELPER: NEYER

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1545 404596	$P_{US_{12}}$		SILT, brown, firm-stiff, moist	ML		*3 holes 0-18" were Pushed with the Geoprobe, and samples were divided 0-0.5, 0.5-1.0 and 1.0-1.5. Then combined by depths with similar samples from each push. The reason for 3 holes is that the 2nd push gave a full 18" length but a rock evidently prevented half of the sample (longitudinally) from being recovered.
	1548 404597	$P_{US_{12}}$		Lt.brn. w/trace of sand (fine) and scattered gravel to 1" rounded slightly porous (pinhole size) and rootlets to 1/32" - most hair roots			
1	1551 404598	$P_{US_{12}}$					
2	1615						
	4/21/95 Bulk 404599	NA	5gal can	LEAN CLAY, Brown to Lt. Brn., moist, w/trace of sand m-f, and scattered gravel well rounded to 1", medium plastic	CL		
3							
4							
	Qh.			TOTAL DEPTH 4.2 feet — Pist size cobble @ 4.2'			
5				TOTAL DEPTH ~~5~~ 4.2 ft. Qh.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-13	Drilling Method: Geoprobe Van	Date Started: 4-20-95
Coordinates:	Geologist: R. Nicks	Date Completed: 4-20-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Clayey silt, brown, firm to stiff, moist, some sand (ML)	404580	0.0-0.5	B	NA	6	OC
		404581	0.5-1.0	B	NA	6	OC
		404582	1.0-1.5	B	NA	6	OC
1.5	Lean clay, brown to dark brown, stiff, wet CL	404583	1.5-5.0	B	NA		MC, GS, AL, SP, P,
	* Note: ASTM symbols in parentheses indicate visual classification						

003

CONTROL NO: 200308G2SB13-~~002~~ 003 RP 4/25/95

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-13	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED: 4/20/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: / DATE: / TIME: / DATE COMPLETED: 4/20/95
WATER USED DURING DRILLING:	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Geoprobe and Little Beaver / DRILLER/HELPER: Meyer, Jim

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
*	1400 4/20/95 404580	PUSH	6"/6"	Clayey silt - brown, firm - stiff, moist, some sand M-F	ML	NA	* For the top 18", 2 holes were pushed with the Geoprobe and samples were divided 0-6", 6"-12", and 12-18", then combined with like depth samples from the 2nd 18" deep hole
1	1405 4/20/95 404581	PUSH	6"/6"				
	1410 4/20/95 404582	PUSH	6"/6"				
2	1430 4/20/95			Silty Clay - brown : dk. brown - stiff, wet porous, with pores to 1/32" size, color mottled to 2½	CL		
3	BULK	NA	5gal Bucket	- brown to light brown @ 2.5 plastic - Light brown @ 3.0 w/scattered gravel to ½"	CH		
4							
5	404583			Gravelly Lean Clay, light brown, moist	CL		
				Total Depth 5'			

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

* -SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

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4/95

000233

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-14	Drilling Method: Geoprobe Van	Date Started: 4-19-95
Coordinates:	Geologist: K. Ernst	Date Completed: 4-19-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Silty clay, brown, moist (CL)	404575	0.0-0.5	B	NA	6	OC
		404576	0.5-1.0	B	NA	6	OC
		404577	1.0-1.5	B	NA	6	OC
3.0	Fat clay, yellowish brown, moist CH	404578	1.5-5.0	B	NA		MC, GS, AL, SP, P,
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO:

FEMP
LITHOLOGIC LOG

PROJECT NAME: Phase III Geotechnical Investigation	PROJECT NUMBER: 20.03.08
BORING NUMBER: GZ-SB-14	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME: / DATE STARTED: 4/19/95
GEOLOGIST: K. Ernst	GROUNDWATER LEVEL: / DATE: / TIME: / DATE COMPLETED: 4/19/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Geoprobe Van / DRILLER/HELPER: B. Neyer/S. Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch) Note:	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	1345, 4/19/95, #404575 ②		6"/8"	Brown silty clay, grass, roots, moist, low plasticity	CL/ML		6" push on sampler x 2 pushes Note ①
1.0	1346 4/19/95 #404576 ②		4"/5"	Brown silty clay, trace roots, moist, low plasticity	CL/ML		6" push on sampler x 2 pushes Note ①
1.5	1347, 4/19/95, ② #404577		6"/6"	Brown silty clay, trace roots, moist, low plasticity	CL/ML		6" push on sampler x 2 pushes Note ①
2.0	1550 4/19/95 #404578			1.5-2.5' cuttings: Brown silty clay, low plasticity, moist	CL		4" ⌀ hyd. hand auger used to collect auger cutting for bulk sample #404578, 5-gal steel bucket, plastic lined
3.0				2.5 - 3.0' cuttings: cuttings becoming yellowish brown in color, lean clay, trace fine sand, low plasticity, moist			
4.0				3 - 4.5 cuttings: yellowish brown clay with sand, low to medium plasticity, moist			
5.0				4.5-5.0 cuttings: yellowish brown clay with sand, ~~few~~ trace fine to coarse gravel (1/2" max.) low plasticity, moist ①			Bottom of boring = 5.0'

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES: 0-1.5' samples collected with Geoprobe Macrocore core sampler w/ 1.5" I.D. teflon liner, hydraulically pushed at 2 locations at SB-14, 3" apart.
② Composite sample of 2, 1.5" diameter cores of soil

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-15	Drilling Method: Hand/Shovel	Date Started: 5-12-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-12-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
	Silt/clay mixtures, yellowish brown, stiff, moist (CL)	404649	1.0-2.0	B	NA		CBR
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-15	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: — / DATE: — / TIME: — / DATE STARTED: 5/12/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: — / DATE: — / TIME: — / DATE COMPLETED: 5/12/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Shovel-hand dug / DRILLER/HELPER: Neyer, Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NA	—	—	CLAYEY SILT 10 YR 5/4 yel. brn stiff, moist	ML	3.5	
				LEAN CLAY 10 YR 5/4 yel. brn. stiff, moist, with trace sand (f)	CL	3.5	
1	0915 5/12/95 404649	BULK	10 991			3.0 3.5	
2				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME	NOTES:
PID				
ALPHA				
BETA/GAMMA				

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\TMO.USG\EPS

4/95

000237

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-16	Drilling Method: Hand/Shovel	Date Started: 5-10-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-10-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0	Clayey silt, brown, firm to stiff, moist with trace of sand, scattered gravel to 1/4 inch.		0.0-0.75		NA	NA	
1	Lean clay, dark yellowish brown, stiff to very stiff, moist (CL)	404650	0.75-2.0	B	NA	NA	MC_m CBR

CONTROL NO:

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-16	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: NA / DATE: — / TIME: — / DATE STARTED: 5/10/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: NA / DATE: — / TIME: — / DATE COMPLETED: 5/10/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Shovel - Hand dug / DRILLER/HELPER: Neyer, Capommori

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CLAYEY SILT 10YR 4/3 brown, firm-stiff moist, w/trace sand(f), scat gravel to 1/4"	ML	2.5	A/B screen 405367 1140
1	1155 5/10/95 4046650	BV V L K	10 gal.	LEAN CLAY - 10YR 4/6, dk. yel. brn. stiff to v. stiff, moist	CL	3.25	
2				TOTAL DEPTH 2ft			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

000239

Geotechnical Logging Report

ct No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-17	Drilling Method: Hand/Shovel	Date Started: 5-10-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-10-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0 2.0	Silt to 1.0 becoming clayey 1.0 - 2.0 brown, very stiff, moist (ML)	405366	1.0-2.0	B	NA		MC_M, CBR
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

Page 1 of 1

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-JB-17	COORDINATES: / RELATED FAL NOs.:
SURFACE ELEVATION:	GROUNDWATER LEVEL: — DATE: — TIME: — DATE STARTED: 5/10/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: — DATE: — TIME: — DATE COMPLETED:
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO / DRILLING EQUIPMENT: Shovel - hand dug / DRILLER/HELPER: Neyer, Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				FILL - CLAYEY SILT - 10YR 4/4 dk. yel. brn., v.stiff, moist, with gravel to 4". 10YR 5/4 @ 6", yel. brn	ML	>4.5	#405368 A/B screen Rusty wire @ 4" 4" cobble @ 9" brick. frags @ 9"
1						>4.5	
	1045 5/10/95 405364	BULK	10 gal.	Lean CLAY pods to 8" @ 1.5' - 10YR 4/2 dk gr. brn., v.stiff, moist 2.5Y 5/4 lt. oliv. brn. pods and stringers mixed w/dk. gr. brn. v.stiff to hd.	CL	>4.5 >4.5	
2				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

000241

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-18	Drilling Method: Hand/Shovel	Date Started: 5-5-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-5-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0 2.0	Lean clay, dark yellowish brown, trace sand, very stiff, moist (CL)	404648	1.0-2.0	B	NA		R
	* Note: ASTM symbols in parentheses indicate visual classification						

CONTROL NO:

FEMP
LITHOLOGIC LOG

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-18	COORDINATES: 1351738.39 400797.87
RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME:
DATE STARTED: 5/5/95	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: / DATE: / TIME:
DATE COMPLETED: 5/5/95	
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO
DRILLING EQUIPMENT: shovel-hand dug	DRILLER/HELPER: Neyer, Copannori

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NA	NA	NA	LEAN CLAY 10YR 4/3 brn. stiff, moist	CL		
1	1130 5/5/25 404648	BULK	10 gal.	LEAN CLAY 10YR 4/4 dk.yel. brn., stiff, moist, with trace sand	CL	2.5	
2				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

ILLUS\MISC\GEOTECH\LITHO LOG.EPS

000243

4/95

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-19	Drilling Method: Hand/Shovel	Date Started: 5-5-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-5-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0 2.0	Lean clay, brown to dark yellowish brown, stiff, moist (CL)	404647	1.0-2.0	B	NA		R
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

Page 1 of 1

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION			PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-19	COORDINATES: 481684.76 1351751.63	RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL:	DATE:	TIME:	DATE STARTED: 5/5/95
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL:	DATE:	TIME:	DATE COMPLETED: 5/5/95
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO	DRILLING EQUIPMENT: Shovel - hand dug	DRILLER/HELPER: Neyer, Copenmeri	

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NA	NA	NA	LEAN CLAY 10YR 4/3 brown, firm, moist 1/16" rootlets, trace sand (f), scat. grav. to 1/4"	CL		
1				10 YR 4/4 dk. yel. brn. stiff, moist	CL		
	1100 5/5/95	B U L K	10 gal.			2.0 to 2.5	
2	404647						
				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

000245

Geotechnical Logging Report

Project No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-20	Drilling Method: Hand/Shovel	Date Started: 5-5-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-5-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0 2.0	Clayey silt to 1.0 then lean clay, brown to dark yellowish brown, stiff, moist (CL)	404646	1.0-2.0	B	NA		R
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

Page 1 of 1

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: G2-SB-20	COORDINATES: 1351767.53 482598.16
RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME:
DATE STARTED: 5/5/95	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: / DATE: / TIME:
DATE COMPLETED: 5/5/95	
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO
DRILLING EQUIPMENT: shovel - hand dug	DRILLER/HELPER: Noyer, ~~Espinosa~~ Capannari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NA	NA	NA	CLAYEY SILT 10YR 5/3 brown, firm, moist trace of sand f. Rootlets to 1/16" diam	ML		
1	1030 5/5/95 404646	BULK	10 gal.	LEAN CLAY 10 YR 4/4 dk. yel. brn. firm-stiff, moist	CL		
2				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

000247

Geotechnical Logging Report

ect No: PO140	Project Title: Phase III Geotechnical Investigation	
Boring No. G2-SB-21	Drilling Method: Hand/Shovel	Date Started: 5-5-95
Coordinates:	Geologist: R. Nicks	Date Completed: 5-5-95
Ground Surface Elevation:	GWL/DATE:	Page 1 of 1

Notes: Samples collected per ASTM D 1586 and ASTM D 1587. Colors identified using Munsell Color Chart. Consistency based on Standard Penetration Resistance Value. Soils visual description per ASTM D 2488 and soil classification per ASTM D 2487. Soil descriptions interpreted from field logs and laboratory results.
SS = Split-spoon Sample ST = Shelby Tube Sample B = Bulk Sample

Depth (ft)	Description [ASTM Symbol]	Sample No.	Sample Depth (ft)	Sample Type	Blows per 6"	Recovery (in)	Laboratory Tests
0 2.0	Silt to 1.0, gray brown, firm, moist; then lean clay olive brown, firm to stiff, moist (CL)	404645	1.0-2.0	B	NA		R
	* Note: ASTM symbols in parentheses indicate visual classification						

FEMP
LITHOLOGIC LOG

CONTROL NO:

PROJECT NAME: PHASE III GEOTECHNICAL INVESTIGATION	PROJECT NUMBER: 20.03.08
BORING NUMBER: 4a E2-SB-21	COORDINATES: 4234[illegible]8.59 1351439.02
RELATED FAL NOs.:	
SURFACE ELEVATION:	GROUNDWATER LEVEL: / DATE: / TIME:
DATE STARTED: 5/5/95	
GEOLOGIST: R. Nicks	GROUNDWATER LEVEL: / DATE: / TIME:
DATE COMPLETED: 5/5/95	
WATER USED DURING DRILLING: None	DRILLING CONTRACTOR: FERMCO
DRILLING EQUIPMENT: shovel- hand dug	DRILLER/HELPER: Neyer, Caponari

DEPTH (FEET)	SAMPLE TIME, DATE, AND NUMBER	BLOWS (per 6 inch)	RECOVERY (inches)	DESCRIPTION (Colors identified per Munsell Color Chart)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
		NA	NA	SILT 10YR 5/2 gr. brn. firm, moist (Topsoil). Root to 1/8" diam	ML		
1	0940 5/5/95 404645	BULK	10 gal.	LEAN CLAY w/trace sand, 2.5Y 4/4 olive brn. firm-stiff, moist	CL	1.5 2.0	
2				TOTAL DEPTH 2 ft.			

INSTRUMENT	BACKGROUND	DATE	TIME
PID			
ALPHA			
BETA/GAMMA			

NOTES:

*SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST.

*ILLUS\MISC\GEOTECH\LITHO LOG.EPS

4/95

000249

APPENDIX F

PHASE III INVESTIGATION - GEOTECHNICAL LABORATORY TESTING SUMMARY BY LOCATION

PO 140
Geotechnical Testing Status Report

12/08/95

	D2216 MC		D4643 MCm		D2937 UW		D422 GS		D854 SG		D4318 AL		D2435 CON		D2435 CONs		D2435 CONr		D2435 CONr85		D2850 UU		D2850 UUr		D2850 UUr85		D4767 CU		D4767 CUr		D4767 CUr85		D698 SP		D5084 P		D5084 Pr		D2974 OC		D2844 R		D4230, CSR S		C127 BSG		EPA 9038 SU		EPA 9251 CL		D1883 CBR	
	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C
PARSONS POP (Rev. 1) Totals:																																																			
Total Requested	73		18		48		97		14		66		11		7		5		11		17		5		3		13		5		2		16		8		14		42		4		5		5		8		8		3	
Total Completed	73		18		48		96		14		66		11		7		5		11		17		5		3		13		5		2		16		8		14		42		4		5		5		8		8		3	
Total Remaining	0		0		0		(1) 1		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0	

Notes:

R - Indicates Requested Test
C - Indicates Completed Test

ST - Shelby Tube Sample
SS - Split Spoon Sample
D - Denison Sample
B - Bulk Sample

(1) - Request for test cancelled, insufficient sample material.
(2) - Total reflects two tests on sample 404746, boring G2-129.

Testing of Hold Samples Not Requested, Samples Returned to FEMP

Geotechnical Testing Status Report Summary by Location

12/08/95

	Boring	Sample No.	Type	Top Depth ft	Bot. Depth ft	Status	D2216 MC R	D2216 MC C	D4643 MCm R	D4643 MCm C	D2937 UW R	D2937 UW C	D422 GS R	D422 GS C	D854 SG R	D854 SG C	D4318 AL R	D4318 AL C	D2435 CON R	D2435 CON C	D2435 CONs R	D2435 CONs C	D2435 CONr R	D2435 CONr C	D2435 CONr85 R	D2435 CONr85 C	D2850 UU R	D2850 UU C	D2850 UUr R	D2850 UUr C	D2850 UUr85 R	D2850 UUr85 C	D4767 CU R	D4767 CU C	D4767 CUr R	D4767 CUr C	D4767 CUr85 R	D4767 CUr85 C	D698 SP R	D698 SP C	D5084 P R	D5084 P C	D5084 Pr R	D5084 Pr C	D2974 OC R	D2974 OC C	D2844 R R	D2844 R C	D4320/C84 S R	D4320/C84 S C	C127 BSG R	C127 BSG C	EPA 9038 SU R	EPA 9038 SU C	EPA 9251 CL R	EPA 9251 CL C	D1883 CBR R	D1883 CBR C
1	G2-SB-1	404605	Bulk	0.0	0.5																																								X	X												
2	G2-SB-1	404606	Bulk	0.5	1.0																																								X	X												
3	G2-SB-1	404607	Bulk	1.0	1.5																																								X	X												
4	G2-SB-1	404608	Bulk	1.5	5.0		X	X					X	X	X	X	X	X							X	X													X	X			X	X												
5	G2-SB-1	404609	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
6	G2-SB-2	404600	Bulk	0.0	0.5																																								X	X												
7	G2-SB-2	404601	Bulk	0.5	1.0																																								X	X												
8	G2-SB-2	404602	Bulk	1.0	1.5																																								X	X												
9	G2-SB-2	404603	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
10	G2-SB-2	404604	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
11	G2-SB-3	404588	Bulk	0.0	0.5																																								X	X												
12	G2-SB-3	404589	Bulk	0.5	1.0																																								X	X												
13	G2-SB-3	404590	Bulk	1.0	1.5																																								X	X												
14	G2-SB-3	404591	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
15	G2-SB-4	404612	Bulk	0.0	0.5																																								X	X												
16	G2-SB-4	404613	Bulk	0.5	1.0																																								X	X												
17	G2-SB-4	404614	Bulk	1.0	1.5																																								X	X												
18	G2-SB-4	404615	Bulk	1.5	5.0		X	X					X	X	X	X	X	X					X	X	X	X													X	X			X	X												
19	G2-SB-2,3,4,6	404617	Bulk	0.0	1.5																				X	X													X	X																		
20	G2-SB-4	404616	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
21	G2-SB-5	404624	Bulk	0.0	0.5																																								X	X												
22	G2-SB-5	404625	Bulk	0.5	1.0																																								X	X												
23	G2-SB-5	404626	Bulk	1.0	1.5																																								X	X												
24	G2-SB-5	404627	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
25	G2-SB-5	404628	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
26	G2-SB-6	404592	Bulk	0.0	0.5																																								X	X												
27	G2-SB-6	404593	Bulk	0.5	1.0																																								X	X												
28	G2-SB-6	404594	Bulk	1.0	1.5																																								X	X												
29	G2-SB-6	404595	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
30	G2-SB-7	404629	Bulk	0.0	0.5																																								X	X												
31	G2-SB-7	404630	Bulk	0.5	1.0																																								X	X												
32	G2-SB-7	404631	Bulk	1.0	1.5																																								X	X												
33	G2-SB-7	404632	Bulk	1.5	5.0		X	X					X	X	X	X	X	X					X	X	X	X													X	X			X	X												
34	G2-SB-7	404633	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
35	G2-SB-8	404618	Bulk	0.0	0.5																																								X	X												
36	G2-SB-8	404619	Bulk	0.5	1.0																																								X	X												
37	G2-SB-8	404620	Bulk	1.0	1.5																																								X	X												
38	G2-SB-8	404621	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
39	G2-SB-8	404622	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
40	G2-SB-9	404584	Bulk	0.0	0.5																																								X	X												
41	G2-SB-9	404585	Bulk	0.5	1.0																																								X	X												
42	G2-SB-9	404586	Bulk	1.0	1.5																																								X	X												
43	G2-SB-9	404587	Bulk	1.5	5.0		X	X					X	X			X	X																					X	X			X	X												
					Total		1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
44	G2-SB-10	404634	Bulk	0.0	0.5																																								X	X												
45	G2-SB-10	404635	Bulk	0.5	1.0																																								X	X												
46	G2-SB-10	404636	Bulk	1.0	1.5																																								X	X												
47	G2-SB-10	404637	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												

Geotechnical Testing Status Report Summary by Location

12/08/95

	Boring	Sample No.	Type	Top Depth ft	Bot. Depth ft	Status	D2216 MC		D4643 MCm		D2937 UW		D422 GS		D854 SG		D4318 AL		D2435 CON		D2435 CONs		D2435 CONr		D2435 CONr85		D2850 UU		D2850 UUr		D2850 UUr85		D4767 CU		D4767 CUr		D4767 CUr85		D698 SP		D5084 P		D5084 Pr		D2974 OC		D2844 R		D4250, C88 S		C127 BSG		EPA 9038 SU		EPA 9251 CL		D1883 CBR	
							R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C
48	G2-SB-10	404638	Bulk	4.5	5.0																																																							
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
49	G2-SB-11	404639	Bulk	0.0	0.5																																																							
50	G2-SB-11	404640	Bulk	0.5	1.0																																								X	X												
51	G2-SB-11	404641	Bulk	1.0	1.5																																								X	X												
52	G2-SB-11	404642	Bulk	1.5	5.0		X	X					X	X	X	X	X	X							X	X													X	X			X	X	X	X												
53	G2-SB-11	404643	Bulk	4.5	5.0																																																X	X	X	X		
					Total		1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	1	1	1	1	0	0
54	G2-SB-8,9,10,11	404644	Bulk	0.0	1.5																				X	X													X	X																				
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	G2-SB-12	404596	Bulk	0.0	0.5																																								X	X												
56	G2-SB-12	404597	Bulk	0.5	1.0																																								X	X												
57	G2-SB-12	404598	Bulk	1.0	1.5																																								X	X												
58	G2-SB-12	404599	Bulk	1.5	4.2		X	X	X				X	X			X	X																					X	X			X	X												
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
59	G2-SB-13	404580	Bulk	0.0	0.5																																								X	X												
60	G2-SB-13	404581	Bulk	0.5	1.0																																								X	X												
61	G2-SB-13	404582	Bulk	1.0	1.5																																								X	X												
62	G2-SB-13	404583	Bulk	1.5	5.0		X	X					X	X			X	X																					X	X			X	X												
					Total		1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
63	G2-SB-14	404575	Bulk	0.0	0.5																																								X	X												
64	G2-SB-14	404576	Bulk	0.5	1.0																																								X	X												
65	G2-SB-14	404577	Bulk	1.0	1.5																																								X	X												
66	G2-SB-14	404578	Bulk	1.5	5.0		X	X	X				X	X			X	X																					X	X			X	X												
					Total		1	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
67	G2-SB-15	404649	Bulk	1.0	2.0																																																		X	X		
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
68	G2-SB-16	404650	Bulk	1.0	2.0					X																																												X	X		
					Total		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
69	G2-SB-17	405366	Bulk	1.0	2.0					X																																												X	X		
					Total		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
70	G2-SB-18	404648	Bulk	1.0	2.0																																										X	X										
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
71	G2-SB-19	404647	Bulk	1.0	2.0																																										X	X										
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
72	G2-SB-20	404646	Bulk	1.0	2.0																																										X	X										
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
73	G2-SB-21	404645	Bulk	1.0	2.0																																										X	X										
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
74	G2-120	405124	ST	5.0	7.0		X	X	X	X	X	X	X	X			X	X							X	X																																
					Total		1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	G2-121	404808	ST	2.5	4.5	Hold																																																					
76	G2-121	404812	ST	10.0	11.7						X	X	X	X			X	X															X	X																								
77	G2-121	404814	ST	12.5	14.5		X	X	X	X	X	X	X	X			X	X																							X	X																
78	G2-121	404817	ST	17.5	19.5		X	X			X	X	X	X			X	X																							X	X																
					Total		2	2	1	1	3	3	3	3	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Geotechnical Testing Status Report Summary by Location

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	Boring	Sample No.	Type	Top Depth ft	Bot. Depth ft	Status	D2216 MC		D4643 MCm		D2937 UW		D422 GS		D854 SG		D4318 AL		D2435 CON		D2435 CONs		D2435 CONr		D2435 CONr85		D2850 UU		D2850 UUr		D2850 UUr85		D4767 CU		D4767 CUr		D4767 CUr85		D698 SP		D5084 P		D5084 Pr		D2974 OC		D2844 R		D4250, C88 S		C127 BSG		EPA 9038 SU		EPA 9251 CL		D1883 CBR	
							R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C	R	C
79	G2-122	404821	ST	5.0	7.0					X	X	X	X	X			X	X	X	X													X	X																									
80	G2-122	404824	ST	10.0	12.0		X	X	X	X	X	X	X	X			X	X									X	X	X	X	X	X																											
81	G2-122	404827	ST	15.0	17.0		X	X			X	X	X	X			X	X																			X	X																					
					Total		2	2	1	2	3	3	3	3	0	0	3	3	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	G2-123	404794	ST	2.5	4.5	Hold																																																						
83	G2-123	404797	ST	7.5	9.5						X	X	X	X			X	X															X	X																									
84	G2-123	404800	ST	12.5	14.5		X	X	X	X	X	X	X	X			X	X																							X	X																	
85	G2-123	404804	ST	20.0	21.2						X	X	X	X			X	X															X	X																									
					Total		1	1	1	1	3	3	3	3	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	G2-124	405002	ST	5.0	7.0						X	X	X	X			X	X									X	X																															
87	G2-124	405004	ST	10.0	12.0						X	X	X	X	X	X	X	X	X	X			X	X	X	X							X	X																									
88	G2-124	405011	SS	25.0	26.5		X	X					X	X																																													
89	G2-124	405012	SS	30.0	31.5		X	X					X	X																																													
90	G2-124	405013	SS	35.0	36.5		X	X					X	X																																													
91	G2-124	405014	SS	40.0	41.5		X	X					X	X																																													
92	G2-124	405015	SS	45.0	46.5		X	X					X	X																																													
93	G2-124	405016	SS	50.0	51.5		X	X					X	X																																													
94	G2-124	405017	SS	55.0	56.5		X	X					X	X																																													
95	G2-124	405018	SS	60.0	61.5		X	X					X	X																																													
96	G2-124	405019	SS	65.0	66.5		X	X					X	X																																													
97	G2-124	405020	SS	70.0	71.5		X	X					X	X																																													
98	G2-124	405021	SS	80.0	81.5		X	X					X	(1)																																													
99	G2-124	405007	ST	15.0	17.0	Hold																																																						
100	G2-124	405009	ST	20.0	20.5	Hold																																																						
					Total		11	11	0	0	2	2	13	12	1	1	2	2	1	1	0	0	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	G2-125	405023	ST	2.5	4.5		X	X	X	X	X	X	X	X			X	X																	X	X																							
102	G2-125	405026	ST	7.5	9.5		X	X			X	X	X	X			X	X									X	X																															
103	G2-125	405029	ST	12.5	14.5						X	X	X	X			X	X															X	X																									
104	G2-125	405033	ST	17.5	19.5		X	X			X	X	X	X			X	X									X	X																															
					Total		3	3	1	1	4	4	4	4	0	0	4	4	0	0	0	0	0	0	0	0	2	2	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	G2-126	404765	ST	2.5	4.5	Hold																																																						
106	G2-126	404768	ST	7.5	9.5						X	X	X	X			X	X															X	X																									
107	G2-126	404771	ST	12.5	14.5		X	X			X	X	X	X			X	X																	X	X																							
108	G2-126	404773	ST	15.0	17.0						X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X																															
109	G2-126	404778	ST	25.0	27.0		X	X		X	X	X	X	X			X	X																							X	X																	
110	G2-126	404783	ST	35.0	37.0					X			X	X	X	X	X	X	X	X	X	X																																					
111	G2-126	404785	SS	40.0	41.5		X	X					X	X																																													
112	G2-126	404786	SS	45.0	46.5		X	X					X	X																																													
113	G2-126	404787	SS	50.0	51.5		X	X					X	X																																													
114	G2-126	404788	SS	55.0	56.5		X	X					X	X																																													
115	G2-126	404789	SS	60.0	61.5		X	X					X	X																																													
116	G2-126	404790	SS	65.0	66.5		X	X					X	X																																													
117	G2-126	404791	SS	70.0	71.5		X	X					X	X																																													
118	G2-126	404792	SS	75.0	76.5		X	X					X	X																																													
119	G2-126	404793	SS	80.0	81.5		X	X					X	X																																													
					Total		11	11	0	2	4	4	14	14	2	2	5	5	2	2	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	G2-127	404749	ST	5.0	7.0	Hold																																																						
121	G2-127	404751	ST	7.5	9.5						X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X																											
122	G2-127	404753	ST	10.0	12.0	Hold																																																					
123	G2-127	404756	ST	15.0	17.0						X	X	X	X			X	X															X	X																									
124	G2-127	404759	ST	20.0	22.0	Hold																																																					
125	G2-127	404763	ST	28.0	30.0		X	X	X		X	X	X	X			X	X																							X	X																	
					Total		1	1	1	0	3	3	3	3	1	1	3	3	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	G2-128	405040	ST	2.5	4.5		X	X					X	X			X	X									X	X																															
127	G2-128	405043	DEN	7.5	9.5		X	X			X	X	X	X			X	X																	X	X																							
128	G2-128	405046	DEN	12.5	14.5						X	X	X	X	X	X	X	X	X	X					X	X																																	
129	G2-128	405049	DEN	17.5	19.5		X	X			X	X	X	X			X	X																																									
					Total		3	3	0	0	3	3	4	4	1	1	4	4	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Geotechnical Testing Status Report Summary by Location
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	Boring	Sample No.	Type	Top Depth ft	Bot. Depth ft	Status	D2216 MC R	D2216 MC C	D4643 MCm R	D4643 MCm C	D2937 UW R	D2937 UW C	D422 GS R	D422 GS C	D854 SG R	D854 SG C	D4318 AL R	D4318 AL C	D2435 CON R	D2435 CON C	D2435 CONs R	D2435 CONs C	D2435 CONr R	D2435 CONr C	D2435 CONr85 R	D2435 CONr85 C	D2850 UU R	D2850 UU C	D2850 UUr R	D2850 UUr C	D2850 UUr85 R	D2850 UUr85 C	D4767 CU R	D4767 CU C	D4767 CUr R	D4767 CUr C	D4767 CUr85 R	D4767 CUr85 C	D698 SP R	D698 SP C	D5084 P R	D5084 P C	D5084 Pr R	D5084 Pr C	D2974 OC R	D2974 OC C	D2844 R R	D2844 R C	D4250 CSS S R	D4250 CSS S C	C127 BSG R	C127 BSG C	EPA 9038 SU R	EPA 9038 SU C	EPA 9251 CL R	EPA 9251 CL C	D1883 CBR R	D1883 CBR C
130	G2-129	404729	ST	5.0	7.5		X	X	X	X	X	X	X	X			X	X									X	X																														
131	G2-129	404732	ST	10.0	12.5		X	X		X	X	X	X	X			X	X																																								
132	G2-129	404740	ST	24.0	26.5						X	X	X	X			X	X															X	X																								
133	G2-129	404746	DEN	40.0	42.0								X	X			X	X			X	X																																				
					Total		2	2	1	2	3	3	4	4	0	0	4	4	0	0	2 (2)	2 (2)	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
134	G2-130	405075	DEN	5.0	7.0		X	X	X	X	X	X	X	X			X	X									X	X																														
135	G2-130	405077	DEN	10.0	12.0						X	X	X	X			X	X															X	X																								
136	G2-130	405080	ST	15.0	17.0						X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X																														
137	G2-130	405083	ST	20.0	22.0		X	X			X	X	X	X			X	X																	X	X																						
138	G2-130	405088	DEN	30.0	32.0						X	X	X	X			X	X															X	X																								
139	G2-130	405091	SS	40.0	41.5		X	X					X	X																																												
140	G2-130	405092	SS	45.0	46.5		X	X					X	X																																												
141	G2-130	405094	SS	55.0	56.5		X	X					X	X																																												
142	G2-130	405096	SS	65.0	66.5		X	X					X	X																																												
143	G2-130	405097	SS	70.0	71.5		X	X					X	X																																												
144	G2-130	405098	SS	75.0	76.5		X	X					X	X																																												
145	G2-130	405099	SS	80.0	81.5		X	X					X	X																																												
					Total		9	9	1	1	5	5	12	12	1	1	5	5	1	1	0	0	1	1	1	1	2	2	0	0	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	G2-131	404701	ST	2.5	4.5	Hold																																																					
147	G2-131	404704	ST	7.5	9.5		X	X	X	X	X	X	X	X			X	X									X	X	X	X																												
148	G2-131	404709	DEN	17.5	19.5						X	X	X	X	X	X	X	X	X	X	X	X																																				
149	G2-131	404713	DEN	27.5	29.5						X	X	X	X	X	X	X	X	X	X							X	X																														
150	G2-131	404716	DEN	35.0	37.0	Hold																																																				
151	G2-131	404719	DEN	45.0	47.0					X	X	X	X	X	X	X	X	X	X	X	X	X					X	X																														
152	G2-131	404723	SS	60.0	61.5		X	X					X	X			X	X																																								
153	G2-131	404724	SS	65.0	66.5		X	X					X	X																																												
154	G2-131	404725	SS	70.0	71.5		X	X					X	X																																												
155	G2-131	404726	SS	75.0	76.5		X	X					X	X																																												
156	G2-131	404727	SS	81.0	82.3		X	X					X	X																																												
					Total		6	6	1	2	4	4	9	9	3	3	5	5	3	3	2	2	0	0	0	0	3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157	G2-132	405102	ST	5.0	7.0		X	X		X	X	X	X	X			X	X									X	X							X	X																						
158	G2-132	405105	DEN	10.0	12.0		X	X	X	X	X	X	X	X			X	X									X	X	X	X																												
159	G2-132	405108	ST	15.0	17.0						X	X	X	X			X	X															X	X																								
160	G2-132	405111	ST	20.0	22.0		X	X		X	X	X	X	X			X	X																							X	X																
					Total		3	3	1	3	4	4	4	4	0	0	4	4	0	0	0	0	0	0	0	0	2	2	1	1	0	0	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161	G2-133	405053	ST	2.5	4.5		X	X			X	X	X	X			X	X																			X	X																				
162	G2-133	405055	ST	7.5	9.5						X	X	X	X	X	X	X	X	X	X	X	X					X	X																														
163	G2-133	405058	ST	12.5	14.5	Hold																																																				
164	G2-133	405059	DEN	15.0	17.0						X	X	X	X			X	X															X	X																								
165	G2-133	405061	DEN	17.5	19.5		X	X			X	X	X	X			X	X																							X	X																
166	G2-133	405065	DEN	25.0	27.0		X	X			X	X	X	X			X	X																							X	X																
167	G2-133	405070	ST	35.0	37.0	Hold																																																				
					Total		3	3	0	0	5	5	5	5	1	1	5	5	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
168	G2-134	405140	DEN	12.0	14.0		X	X			X	X	X	X			X	X									X	X	X	X	X	X																										
					Total		1	1	0	0	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169	IFAP	405377	Bulk surf		surf																																												X	X							
170	IFAP	405378	Bulk surf		surf																																																				
171	IFAP	405379	Bulk surf		surf																																												X	X							
172	IFAP	405380	Bulk surf		surf																																														X	X						
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	0	0	0	0
173	AFAP	405381	Bulk surf		surf																																														X	X							
174	AFAP	405382	Bulk surf		surf																																														X	X							
175	AFAP	405383	Bulk surf		surf																																														X	X							
176	AFAP	405384	Bulk surf		surf																																												X	X							
177	AFAP	405385	Bulk surf		surf																																												X	X							
178	AFAP	405386	Bulk surf		surf																																												X	X							
					Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0

APPENDIX G

SUMMARY OF GEOTECHNICAL LABORATORY TESTING RESULTS

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Table G-1 - Summary of Index Properties, Disturbed and Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel %	Grain Size Sand %	Grain Size Silt %	Grain Size Clay %	Specific Gravity (5)	Data Source
11468	403071	ST	2.0	4.5	Olive brown	Brown Till	Lean Clay with Sand	CL	17.5	47.2	17.9	29.3	3.7	18.9	37.4	40.0	2.72	PO 132
11468	403074	SS	4.5	6.0	Light olive brown	Brown Till	Sandy Lean Clay	CL	14.0	31.9	16.1	15.8	6.5	27.6	37.9	28.0	2.70	PO 132
11468	403077	ST	9.0	11.5	Light olive brown	Brown Till	Sandy Lean Clay	CL	14.1	25.5	14.7	10.8	2.7	41.0	34.3	22.0	2.74	PO 132
11468	403081	ST	15.0	17.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	14.0	28.0	14.7	13.3	10.3	24.2	37.5	28.0	2.73	PO 132
11468	403084	ST	19.5	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	12.4	24.1	14.2	9.9	13.0	25.9	38.1	23.0	2.76	PO 132
11468	403089	SS	25.0	26.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	15.5	25.3	13.6	11.7	6.2	27.8	39.0	27.0	2.70	PO 132
11469	402820	SS	1.5	3.0	Brown	Brown Till	Lean Clay	CL	27.7	45.1	21.1	24.0	0.0	3.9	59.1	37.0	2.67	PO 132
11469	402821	ST	3.0	5.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	17.2	37.1	14.9	22.2	2.5	18.0	47.5	32.0	2.70	PO 132
11469	402826	SS	9.0	10.5	Brown	Brown Till	Sandy Lean Clay	CL	13.1	25.8	14.3	11.5	7.6	24.8	40.6	27.0	2.69	PO 132
11469	402831	ST	15.5	18.0	Dark gray	Gray Till	Lean Clay with Sand	CL	14.2	25.2	13.7	11.5	4.1	18.9	46.0	31.0	2.73	PO 132
11469	402835	ST	20.0	21.5	Gray	Gray Till	Sandy Lean Clay	CL	12.8	25.3	14.6	10.7	7.2	26.5	38.3	28.0	2.72	PO 132
11469	402838	SS	24.0	25.5	Gray	Gray Till	Sandy Lean Clay	CL	15.2	21.6	13.6	8.0	10.4	32.1	32.5	25.0	2.73	PO 132
11469	402842	SS	30.0	31.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	14.4	24.5	14.3	10.2	12.2	27.9	36.9	23.0	2.68	PO 132
11470B	403131-1	SS	1.5	3.0	Yellowish brown	Brown Till	Silty, Clayey Sand	SC-SM	19.4	19.8	14.3	5.5	12.2	43.6	32.2	12.0	2.71	PO 132
11470B	403132-1	ST	3.5	6.0	Brownish yellow	Brown Till	Silty Sand	SM	14.4	NP	NP	NP	7.0	43.6	41.4	8.0	2.70	PO 132
11470B	403137-1	ST	8.0	10.5	Brownish yellow	Brown Till	Sandy Silt	ML	13.7	16.0	15.2	0.8	1.2	36.1	47.7	15.0	2.72	PO 132
11470B	403141-1	SS	13.5	15.0	Dark greenish gray	Gray Till	Lean Clay with Sand	CL	15.7	26.5	14.8	11.7	3.2	25.5	39.3	32.0	2.69	PO 132
11470B	403144-1	SS	18.0	19.5	Dark greenish gray	Gray Till	Lean Clay with Sand	CL	15.9	23.7	13.9	9.8	8.3	17.9	48.8	25.0	2.75	PO 132
11470B	403150-1	SS	23.5	25.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.6	22.5	12.3	10.2	9.5	31.1	37.4	22.0	2.75	PO 132
11470B	403154-1	DEN	30.0	32.0	Dark greenish gray	Gray Till	Sandy Lean Clay with Gravel	CL	20.6	27.5	14.8	12.7	15.7	32.9	33.4	18.0	2.73	PO 132
11471	(9) 402962	SS	1.5	3.0	Dark brown	Brown Till	Fat Clay	CH	24.4	51.9	28.0	23.9	0.0	5.9	60.1	34.0	2.67	PO 132
11471	402963	ST	3.5	6.0	Yellowish brown	Brown Till	Fat Clay	CH	24.9	50.5	18.4	32.1	0.0	3.8	55.2	41.0	2.72	PO 132
11471	402969	SS	10.5	11.5	Yellowish brown	Brown Till	Silty Sand	SM	24.0	NP	NP	NP	2.4	59.7	25.9	12.0	2.70	PO 132
11471	402973	SS	15.0	16.5	Gray	Gray Till	Silt	ML	17.2	22.5	19.3	3.2	0.0	3.9	78.1	18.0	2.73	PO 132
11471	402974	ST	17.0	19.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	9.4	21.0	12.4	8.6	10.7	36.0	34.3	19.0	2.77	PO 132
11471	402979	SS	27.5	29.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	13.0	25.9	14.7	11.2	11.8	27.2	36.0	25.0	2.69	PO 132
11472	402939	SS	1.5	3.0	Yellowish brown	Brown Till	Lean Clay	CL	26.1	49.1	20.8	28.3	0.0	3.2	48.8	48.0	2.65	PO 132
11472	402940	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	15.7	29.4	15.8	13.6	2.7	21.4	40.9	35.0	2.74	PO 132
11472	402945	ST	9.5	11.5	Yellowish brown	Brown Till	Clayey Sand with Gravel	SC	10.5	24.5	13.1	11.4	25.8	29.3	26.9	18.0	2.69	PO 132
11472	402953	SS	18.5	19.5	Yellowish brown	Brown Till	Clayey Sand with Gravel	SC	9.5	19.4	11.2	8.2	24.2	54.2	13.6	8.0	2.74	PO 132
11472	402956	ST	23.0	25.5	Dark bluish gray	Gray Till	Sandy Lean Clay	CL	12.7	25.0	13.1	11.9	7.1	28.4	39.5	25.0	2.69	PO 132
11473	402918	ST	3.5	6.0	Light olive brown	Brown Till	Lean Clay with Sand	CL	14.9	31.1	17.3	13.8	5.6	17.2	44.2	33.0	2.70	PO 132
11473	402920	ST	6.5	8.5	Light yellowish brown	Brown Till	Lean Clay with Sand	CL	13.2	29.3	15.6	13.7	7.3	20.8	36.9	35.0	2.74	PO 132
11473	402922	SS	9.0	10.5	Light yellowish brown	Brown Till	Sandy Lean Clay	CL	13.4	25.0	15.1	9.9	5.9	29.2	37.9	27.0	2.70	PO 132
11473	402928	ST	15.5	18.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	12.8	27.3	14.3	13.0	8.9	24.8	36.3	30.0	2.77	PO 132
11473	402931	ST	20.0	22.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	14.1	30.9	14.7	16.2	5.5	24.9	35.6	34.0	2.71	PO 132
11473	402934	SS	23.5	25.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	11.5	24.2	14.9	9.3	6.9	28.6	36.5	28.0	2.70	PO 132
11474	402891	SS	1.5	3.0	Brown	Brown Till	Lean Clay with Sand	CL	29.5	44.2	18.1	26.1	7.7	8.5	45.8	38.0	2.63	PO 132
11474	402892	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	16.5	27.9	19.2	8.7	0.8	16.6	55.6	27.0	2.79	PO 132
11474	402898	SS	9.0	10.5	Yellowish brown	Brown Till	Sandy Lean Clay	CL	12.6	25.1	13.5	11.6	5.1	26.1	40.8	28.0	2.76	PO 132
11474	402904	ST	14.0	16.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	13.0	24.2	13.6	10.6	10.8	27.5	36.7	25.0	2.75	PO 132
11474	402907	ST	18.5	21.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	13.7	27.9	14.2	13.7	8.4	24.9	34.7	32.0	2.70	PO 132
11474	402911	SS	23.5	25.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	13.1	25.4	13.4	12.0	8.5	24.4	41.1	26.0	2.70	PO 132
11475	403251	ST	2.0	4.5	Mottled yellowish and pale brown	Fill	Lean Clay	CL	23.2	48.5	16.2	32.3	0.8	9.7	44.5	45.0	2.62	PO 132
11475	403254	ST	6.5	9.0	Mottled olive gray	Fill	Lean Clay	CL	23.1	49.2	26.0	23.2	1.6	11.5	42.9	44.0	2.66	PO 132
11475	403258	ST	11.0	13.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	14.1	33.3	17.4	15.9	1.8	25.6	37.6	35.0	2.74	PO 132
11475	403260	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.2	26.9	12.9	14.0	6.9	25.3	37.8	30.0	2.71	PO 132
11475	403263	SS	19.5	21.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	15.0	26.7	14.3	12.4	14.5	23.4	35.1	27.0	2.72	PO 132
11476	402988	SS	1.5	3.0	Olive brown	Brown Till	Lean Clay with Sand	CL	21.9	40.7	17.8	22.9	11.5	16.4	38.1	34.0	2.70	PO 132
11476	402989	ST	3.5	6.0	Light Olive brown	Brown Till	Lean Clay with Sand	CL	14.8	30.5	15.9	14.6	2.1	13.2	44.7	40.0	2.64	PO 132
11476	402995	ST	9.5	12.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	12.9	18.8	14.2	4.6	0.1	30.5	48.4	21.0	2.77	PO 132
11476	402998	ST	14.0	16.5	Gray	Gray Till	Silty, Clayey Sand	SC-SM	11.1	18.1	12.3	5.8	10.3	41.7	35.0	13.0	2.75	PO 132
11476	403002	ST	18.5	21.0	Greenish gray	Gray Till	Lean Clay with Sand	CL	14.4	20.2	12.5	7.7	2.3	26.6	44.1	27.0	2.70	PO 132
11476	403006	SS	24.0	25.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	15.0	25.1	14.2	10.9	5.2	25.0	37.8	32.0	2.68	PO 132
11477	402863	SS	1.5	3.0	Brown	Brown Till	Lean Clay	CL	22.8	37.8	20.0	17.8	0.0	6.9	56.1	37.0	2.72	PO 132
11477	402864	ST	3.5	6.0	Brownish yellow	Brown Till	Lean Clay with Sand	CL	19.4	30.4	15.0	15.4	1.4	26.9	43.7	28.0	2.73	PO 132
11477	402868	SS	8.0	9.0	Yellowish brown	Brown Till	Silty Sand	SM	21.3	NP	NP	NP	6.6	53.8	35.6	4.0	2.75	PO 132
11477	402873	ST	14.0	16.5	Dark gray	Gray Till	Sandy Lean Clay	CL	15.1	25.1	13.1	12.0	5.2	27.8	41.0	26.0	2.72	PO 132
11477	402878	SS	22.0	22.5	Dark gray	Gray Till	Sandy Lean Clay	CL	13.9	21.9	13.0	8.9	4.2	34.8	37.0	24.0	2.70	PO 132
11477	402879	SS	22.5	23.5	Dark gray	Gray Till	Silty Sand	SM	13.6	NP	NP	NP	6.5	53.2	33.3	7.0	2.75	PO 132
11477	402887	SS	34.0	35.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	12.1	25.1	13.3	11.8	10.0	26.2	39.8	24.0	2.73	PO 132
11478	402790	SS	1.5	3.0	Yellowish brown	Brown Till	Fat Clay	CH	24.3	51.0	20.6	30.4	0.0	5.1	50.9	44.0	2.69	PO 132
11478	402792	ST	3.5	6.0	Light olive brown	Brown Till	Lean Clay with Sand	CL	20.3	37.5	16.5	21.0	3.4	17.7	39.9	39.0	2.71	PO 132
11478	402798	SS	10.5	12.0	Dark yellowish brown	Brown Till	Lean Clay with Sand	CL	14.1	28.0	16.2	11.8	4.5	25.0	40.5	30.0	2.71	PO 132
11478	402805	SS	21.5	23.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	10.8	24.3	13.9	10.4	7.3	32.1	35.6	25.0	2.67	PO 132
11478	402807	SS	24.5	26.0	Dark greenish gray	Gray Till	Sandy Silty Clay	CL-ML	11.1	18.6	12.7	5.9	3.9	41.3	36.8	18.0	2.72	PO 132
11478	402810	SS	30.5	32.0	Dark grayish brown	Gray Till	Silty Sand	SM	12.0	NP	NP	NP	0.0	57.4	22.6	20.0	2.70	PO 132

Table G-1 - Summary of Index Properties, Disturbed and Undisturbed Samples (continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel %	Grain Size Sand %	Grain Size Silt %	Grain Size Clay %	Specific Gravity (5)	Data Source
11478	402812	SS	33.5	35.0	Dark gray	Gray Till	Silty, Clayey Sand	SC-SM	16.1	23.2	16.5	6.7	0.0	55.2	26.8	18.0	2.72	PO 132
11479	403021	SS	1.5	3.0	Yellowish brown	Brown Till	Fat Clay	CH	25.0	53.5	16.8	36.7	0.6	13.1	38.3	48.0	2.67	PO 132
11479	403022	ST	3.5	6.0	Yellowish brown	Brown Till	Sandy Lean Clay	CL	12.5	21.3	14.1	7.2	3.9	42.8	35.3	18.0	2.74	PO 132
11479	403032	SS	16.5	17.5	Dark greenish gray	Gray Till	Silty Sand	SM	14.6	NP	NP	NP	14.2	64.7	13.1	8.0	2.71	PO 132
11479	403034	ST	18.5	21.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	12.5	25.2	14.2	11.0	13.5	26.4	35.1	25.0	2.69	PO 132
11479	403037	ST	23.0	25.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.9	24.5	13.9	10.6	2.0	28.3	41.7	28.0	2.70	PO 132
11479	403043	SS	31.5	33.0	Dark greenish gray	Gray Till	Silty, Clayey Sand with Gravel	SC-SM	17.1	19.6	12.4	7.2	17.2	38.7	31.1	13.0	2.70	PO 132
11479	403045	SS	34.5	36.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.0	24.1	14.2	9.9	8.6	31.0	36.4	24.0	2.71	PO 132
11480	402768	ST	0.5	3.0	Brown	Brown Till	Lean Clay	CL	22.5	49.6	17.8	31.8	2.9	10.2	41.9	45.0	2.71	PO 132
11480	402770	ST	5.0	7.5	Light yellowish brown	Brown Till	Lean Clay	CL	20.6	39.7	18.6	21.1	1.0	11.2	51.8	36.0	2.78	PO 132
11480	402773	ST	9.5	12.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	14.8	32.0	18.0	14.0	0.4	20.0	44.6	35.0	2.76	PO 132
11480	402777	ST	14.0	16.5	Gray	Gray Till	Lean Clay with Sand	CL	13.0	23.1	13.6	9.5	4.7	24.2	45.1	26.0	2.73	PO 132
11480	402779	SS	18.0	20.0	Gray	Gray Till	Sandy Lean Clay	CL	13.8	25.1	13.9	11.2	4.9	25.5	41.6	28.0	2.69	PO 132
11480	402784	ST	24.5	27.0	Dark gray	Gray Till	Sandy Lean Clay	CL	12.5	26.2	13.9	12.3	8.8	27.9	36.3	27.0	2.71	PO 132
11480	402787	ST	29.0	31.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	14.4	25.9	14.5	11.4	7.1	26.7	38.2	28.0	2.72	PO 132
11481	403202	ST	3.5	6.0	Yellowish brown	Brown Till	Sandy Lean Clay	CL	14.7	31.0	15.5	15.5	8.9	24.9	38.2	28.0	2.74	PO 132
11481	403204	ST	6.5	9.0	Yellowish brown	Brown Till	Gravelly Lean Clay with Sand	CL	14.3	26.6	15.4	11.2	22.9	21.0	33.1	23.0	2.72	PO 132
11481	403211	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	11.8	23.7	13.0	10.7	6.5	29.8	37.7	26.0	2.73	PO 132
11481	403214	ST	20.0	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.2	22.6	13.0	9.6	7.7	28.2	39.1	25.0	2.73	PO 132
11481	403219	SS	26.5	28.0	Greenish gray	Gray Till	Sandy Silty Clay	CL-ML	16.2	17.6	13.2	4.4	7.2	27.4	43.4	22.0	2.69	PO 132
11481	403223	SS	32.5	34.0	Greenish gray	Gray Till	Lean Clay with Sand	CL	14.9	26.0	14.5	11.5	5.5	23.7	40.8	30.0	2.73	PO 132
11481	403227	SS	37.0	38.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	13.1	26.1	13.7	12.4	13.1	26.3	35.6	25.0	2.73	PO 132
G2-120	405124	ST	5.0	7.0	Olive Brown	Brown Till	Sandy Lean Clay	CL	16.6	30.7	15.7	15.0	8.3	25.0	32.7	34.0	2.71	PO 140
G2-121	404812	ST	10.0	11.7	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	(6) 11.1	26.9	15.0	11.9	6.1	27.9	38.0	28.0	2.74	PO 140
G2-121	404814	ST	12.5	14.5	Greenish Gray	Gray Till	Sandy Lean Clay	CL	11.9	26.4	14.4	11.9	13.1	25.7	35.2	26.0	2.77	PO 140
G2-121	404817	ST	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	12.0	25.0	13.1	11.9	13.9	26.1	36.0	24.0	2.74	PO 140
G2-122	404821	ST	5.0	7.0	Light Olive Brown	Brown Till	Lean Clay	CL	20.0	30.7	17.2	13.5	0.0	3.4	59.6	37.0	2.74	PO 140
G2-122	404824	ST	10.0	12.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	13.2	28.6	14.9	13.7	7.3	22.7	37.0	33.0	2.73	PO 140
G2-122	404827	ST	15.0	17.0	Greenish Gray	Gray Till	Lean Clay with Sand	CL	12.9	26.3	14.0	12.3	4.5	24.2	39.3	32.0	2.70	PO 140
G2-123	404797	ST	7.5	9.5	Dark Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 13.6	26.6	15.2	11.4	6.5	27.1	37.4	29.0	2.80	PO 140
G2-123	404800	ST	12.5	14.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	12.6	28.0	14.4	13.5	7.3	24.4	37.3	31.0	2.79	PO 140
G2-123	404804	ST	20.0	21.2	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.7	26.7	13.0	13.7	6.9	27.8	37.3	28.0	2.74	PO 140
G2-124	405002	ST	5.0	7.0	Greenish Black	Brown Till	Fat Clay	CH	(6) 21.7	56.3	18.9	37.4	0.0	3.8	49.2	47.0	2.74	PO 140
G2-124	405004	ST	10.0	12.0	Olive Brown	Brown Till	Lean Clay	CL	(6) 21.6	41.6	18.8	22.8	0.3	13.5	43.2	43.0	2.72	PO 140
G2-124	405011	SS	25.0	26.5	Greenish Gray	Gray Till	Sandy Lean Clay (4)	CL (4)	16.6	NA	NA	NA	4.6	27.0	43.4	25.0	2.73	PO 140
G2-124	405012	SS	30.0	31.5	Dark Yellowish Brown	Gray Till	Silty Sand (8)	SM (8)	9.3	NA	NA	NA	4.6	70.5	20.9	4.0	2.74	PO 140
G2-124	405013	SS	35.0	36.5	Dark Greenish Gray	GMA	Silty Sand (8)	SM (8)	10.3	NA	NA	NA	10.8	67.5	16.7	5.0	2.76	PO 140
G2-124	405014	SS	40.0	41.5	Light Yellowish Brown	GMA	Silty Sand (8)	SM (8)	8.2	NA	NA	NA	1.8	84.0	11.2	3.0	2.72	PO 140
G2-124	405015	SS	45.0	46.5	Light Yellowish Brown	GMA	Silty Sand (8)	SM (8)	8.3	NA	NA	NA	9.5	77.4	10.1	3.0	2.73	PO 140
G2-124	405016	SS	50.0	51.5	Brown	GMA	Silty Sand with Gravel (8)	SM (8)	6.5	NA	NA	NA	21.2	64.3	12.5	2.0	2.79	PO 140
G2-124	405017	SS	55.0	56.5	Brown	GMA	Well-graded Sand with Silt and Gravel	SW-SM	2.9	NA	NA	NA	29.5	59.0	8.5	3.0	2.71	PO 140
G2-124	405018	SS	60.0	61.5	Gray	GMA	Poorly-graded Sand with Silt and Gravel	SP-SM	5.6	NA	NA	NA	27.6	60.5	8.9	3.0	2.69	PO 140
G2-124	405019	SS	65.0	66.5	Dark Greenish Gray	GMA	Well-graded Sand with Silt and Gravel	SW-SM	7.6	NA	NA	NA	27.1	66.2	4.7	2.0	2.76	PO 140
G2-124	405020	SS	70.0	71.5	Greenish Gray	GMA	Well-graded Sand with Silt and Gravel	SW-SM	8.3	NA	NA	NA	16.1	75.4	5.5	3.0	2.75	PO 140
G2-125	405023	ST	2.5	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	20.0	37.5	18.8	18.7	1.1	7.9	55.0	36.0	2.71	PO 140
G2-125	405026	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	12.1	22.4	13.9	8.6	2.9	31.5	41.6	24.0	2.78	PO 140
G2-125	405029	ST	12.5	14.5	Gray, Yellowish Brown	Brown Till	Sandy Silt	ML	(6) 11.0	16.3	12.4	3.9	3.6	35.9	42.5	18.0	2.77	PO 140
G2-125	405033	ST	17.5	19.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	12.9	19.9	12.8	7.0	3.2	27.4	49.4	20.0	2.71	PO 140
G2-126	404768	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	(6) 13.5	22.6	14.7	7.9	3.4	29.2	43.4	24.0	2.78	PO 140
G2-126	404771	ST	12.5	14.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	11.2	23.8	13.7	10.1	8.5	27.4	39.1	25.0	2.76	PO 140
G2-126	404773	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay with Gravel	CL	(6) 12.6	24.0	13.9	10.2	16.8	23.8	36.4	23.0	2.69	PO 140
G2-126	404778	ST	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	14.0	27.0	15.0	11.9	11.4	24.6	37.0	27.0	2.74	PO 140
G2-126	404783	ST	35.0	37.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	13.2	25.3	14.4	10.9	6.8	26.8	38.4	28.0	2.74	PO 140
G2-126	404785	SS	40.0	41.5	Dark Greenish Gray	Gray Till	Lean Clay with Sand (4)	CL (4)	20.3	NA	NA	NA	1.3	14.3	62.4	22.0	2.73	PO 140
G2-126	404786	SS	45.0	46.5	Dark Yellowish Brown	GMA	Silty Sand (8)	SM (8)	13.3	NA	NA	NA	4.4	72.9	18.7	4.0	2.75	PO 140
G2-126	404787	SS	50.0	51.5	Dark Yellowish Brown	GMA	Silty Sand (8)	SM (8)	7.7	NA	NA	NA	3.0	76.7	17.3	3.0	2.74	PO 140
G2-126	404788	SS	55.0	56.5	Light Olive Brown	GMA	Silty Sand (8)	SM (8)	6.7	NA	NA	NA	2.7	73.7	18.6	5.0	2.76	PO 140
G2-126	404789	SS	60.0	61.5	Light Olive Brown	GMA	Silty Sand (8)	SM (8)	7.6	NA	NA	NA	5.3	79.9	12.8	2.0	2.73	PO 140
G2-126	404790	SS	65.0	66.5	Light Olive Gray	GMA	Silty Sand (8)	SM (8)	3.4	NA	NA	NA	1.1	82.0	14.9	2.0	2.75	PO 140
G2-126	404791	SS	70.0	71.5	Light Olive Gray	GMA	Well-graded Sand with Silt and Gravel	SW-SM	4.4	NA	NA	NA	36.5	54.2	7.3	2.0	2.68	PO 140
G2-126	404792	SS	75.0	76.5	Light Olive Gray	GMA	Well-graded Sand with Silt and Gravel	SW-SM	3.1	NA	NA	NA	28.6	59.6	9.8	2.0	2.79	PO 140
G2-126	404793	SS	80.0	81.5	Light Olive Gray	GMA	Well-graded Sand with Silt and Gravel	SW-SM	4.1	NA	NA	NA	21.8	68.9	8.3	1.0	2.76	PO 140
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	(6) 12.9	28.3	14.8	13.5	3.7	21.0	42.3	33.0	2.74	PO 140
G2-127	404756	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.0	26.1	14.3	11.8	11.1	25.1	36.8	27.0	2.73	PO 140
G2-127	404763	ST	28.0	30.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	15.6	20.7	12.6	8.1	9.0	38.8	32.2	20.0	2.74	PO 140
G2-128	405040	ST	2.5	4.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	18.8	39.4	17.3	22.0	1.3	18.7	38.0	42.0	2.76	PO 140

Table G-1 - Summary of Index Properties, Disturbed and Undisturbed Samples (continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel %	Grain Size Sand %	Grain Size Silt %	Grain Size Clay %	Specific Gravity (5)	Data Source
G2-128	405043	DEN	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay with Gravel	CL	12.1	27.8	15.5	12.2	15.4	26.0	30.6	28.0	2.78	PO 140
G2-128	405046	DEN	12.5	14.5	Light Olive Brown	Brown Till	Clayey Gravel with Sand	GC	(6) 15.7	28.3	15.5	12.7	26.3	25.0	26.7	22.0	2.73	PO 140
G2-128	405049	DEN	17.5	19.5	Gray	Gray Till	Sandy Lean Clay	CL	12.1	22.6	13.3	9.3	13.6	31.7	33.7	21.0	2.77	PO 140
G2-129	404729	ST	5.0	7.5	Yellowish Brown	Brown Till	Lean Clay	CL	19.6	32.9	18.6	14.3	0.0	1.5	58.5	40.0	2.72	PO 140
G2-129	404732	ST	10.0	12.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	14.1	24.3	14.9	9.4	9.1	31.6	35.3	24.0	2.78	PO 140
G2-129	404740	ST	24.0	26.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.0	22.5	12.9	9.6	6.6	33.2	37.2	23.0	2.73	PO 140
G2-129	404746	DEN	40.0	42.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	(6) 11.6	23.8	13.9	9.9	8.6	34.5	33.4	23.5	2.73	PO 140
G2-130	405075	DEN	5.0	7.0	Greenish Gray	Brown Till	Lean Clay with Sand	CL	12.9	23.8	13.7	10.1	5.6	21.9	47.5	25.0	2.75	PO 140
G2-130	405077	DEN	10.0	12.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	(6) 14.6	25.2	14.1	11.1	3.8	19.3	46.9	30.0	2.75	PO 140
G2-130	405080	ST	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	(6) 11.3	19.5	12.2	7.3	9.7	33.6	38.7	18.0	2.79	PO 140
G2-130	405083	ST	20.0	22.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	14.8	26.0	14.6	11.4	5.3	24.3	43.4	27.0	2.79	PO 140
G2-130	405088	DEN	30.0	32.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	(6) 11.3	24.5	13.6	10.9	8.9	28.3	39.8	23.0	2.74	PO 140
G2-130	405091	SS	40.0	41.5	Gray	GMA	Silty Sand	SM	14.3	NA	NA	NA	0.2	74.6	23.2	2.0	2.76	PO 140
G2-130	405092	SS	45.0	46.5	Gray	GMA	Silty Sand	SM	12.4	NA	NA	NA	0.3	70.1	28.6	1.0	2.77	PO 140
G2-130	405094	SS	55.0	56.5	Gray	GMA	Poorly-graded Sand with Silt and Gravel	SP-SM	2.4	NA	NA	NA	34.8	57.2	7.5	0.5	2.76	PO 140
G2-130	405096	SS	65.0	66.5	Gray	GMA	Poorly-graded Sand with Silt	SP-SM	3.2	NA	NA	NA	2.9	88.2	8.9	0.0	2.77	PO 140
G2-130	405097	SS	70.0	71.5	Light Gray	GMA	Poorly-graded Sand with Silt	SP-SM	2.3	NA	NA	NA	0.8	90.1	9.1	0.0	2.69	PO 140
G2-130	405098	SS	75.0	76.5	Light Gray	GMA	Poorly-graded Sand with Silt and Gravel	SP-SM	11.9	NA	NA	NA	16.3	76.2	7.0	0.5	2.73	PO 140
G2-130	405099	SS	80.0	81.5	Light Gray	GMA	Poorly-graded Sand with Silt and Gravel	SP-SM	8.5	NA	NA	NA	24.5	70.2	4.3	1.0	2.73	PO 140
G2-131	404704	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	15.1	27.1	15.1	12.0	4.4	25.4	36.2	34.0	2.69	PO 140
G2-131	404709	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	(6) 14.0	25.2	13.6	11.7	6.4	22.4	36.2	35.0	2.73	PO 140
G2-131	404713	DEN	27.5	29.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.5	24.5	13.5	11.0	7.5	25.3	38.2	29.0	2.78	PO 140
G2-131	404719	DEN	45.0	47.0	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	14.1	32.5	16.5	16.0	4.2	15.8	42.0	38.0	2.72	PO 140
G2-131	404723	SS	60.0	61.5	Dark Greenish Gray	Gray Till	Silt	ML	23.8	NP	NP	NP	0.1	3.5	83.4	13.0	2.79	PO 140
G2-131	404724	SS	65.0	66.5	Pale Brown	GMA	Silty Sand	SM	8.5	NA	NA	NA	0.0	59.5	35.5	5.0	2.78	PO 140
G2-131	404725	SS	70.0	71.5	Pale Brown	GMA	Silty Sand	SM	3.9	NA	NA	NA	0.1	81.0	14.9	4.0	2.67	PO 140
G2-131	404726	SS	75.0	76.5	Pale Brown	GMA	Silty Sand with Gravel	SM	3.4	NA	NA	NA	31.3	53.3	12.4	3.0	2.77	PO 140
G2-131	404727	SS	81.0	82.3	Pale Brown	GMA	Silty Sand with Gravel	SM	2.6	NA	NA	NA	19.5	66.4	12.1	2.0	2.79	PO 140
G2-132	405102	ST	5.0	7.0	Dark Olive Brown	Brown Till	Lean Clay	CL	3.0	48.2	20.6	27.7	0.0	7.1	46.9	46.0	2.71	PO 140
G2-132	405105	DEN	10.0	12.0	Gray	Gray Till	Lean Clay with Sand	CL	15.0	25.1	14.8	10.3	4.6	20.6	47.8	27.0	2.75	PO 140
G2-132	405108	ST	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.0	24.5	14.2	10.3	6.6	24.1	46.3	23.0	2.75	PO 140
G2-132	405111	ST	20.0	22.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	14.1	23.2	14.7	8.5	8.9	22.8	47.3	21.0	2.76	PO 140
G2-133	405053	ST	2.5	4.5	Dark Grayish Brown	Brown Till	Lean Clay	CL	28.4	47.3	16.8	30.5	0.0	2.2	56.8	41.0	2.73	PO 140
G2-133	405055	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	(6) 13.0	26.9	15.3	11.6	5.4	26.4	43.2	25.0	2.77	PO 140
G2-133	405059	DEN	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	12.2	22.1	12.9	9.2	8.6	28.5	39.9	23.0	2.75	PO 140
G2-133	405061	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	13.1	24.4	14.2	10.2	3.6	27.2	39.2	30.0	2.78	PO 140
G2-133	405065	DEN	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	15.9	25.8	14.1	11.8	12.6	23.7	35.7	28.0	2.70	PO 140
G2-134	405140	DEN	12.0	14.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	13.7	24.6	13.5	11.1	7.8	30.6	38.6	23.0	2.72	PO 140
CSF-1	CSF-1 / 4	ST	6.0	8.0	Very Dark Grayish Brown	Brown Till	Lean Clay with Sand	CL	(6) 19.3	33.1	14.6	18.5	3.0	21.0	43.0	33.0	2.75	PO 20
CSF-1	CSF-1 / 5	ST	8.0	10.0	Dark Yellowish Brown	Brown Till	Lean Clay with Sand	CL	(6) 14.3	24.8	15.1	9.7	8.0	26.0	42.0	24.0	2.78	PO 20
CSF-2	CSF-2 / 6	ST	13.0	15.0	Gray	Gray Till	Lean Clay with Sand	CL	(6) 11.9	22.1	14.6	7.5	9.0	24.0	44.0	23.0	2.77	PO 20
CSF-3	CSF-3 / 6	ST	10.0	12.0	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	(6) 15.5	21.5	17.7	3.8	6.0	11.0	65.0	18.0	2.81	PO 20
CSF-4	CSF-4 / 6	ST	13.0	15.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	12.6	21.6	14.8	6.8	6.0	24.0	48.0	22.0	2.74	PO 20
CSF-5	CSF-5 / 14	SS	38.0	40.0	Gray	Gray Till	Lean Clay with Sand	CL	17.9	23.4	17.8	5.6	0.0	1.0	79.0	20.0	2.77	PO 20
CSF-6	CSF-6 / 8	ST	20.0	22.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	(6) 14.4	23.0	13.8	9.2	0.0	14.0	59.0	27.0	2.75	PO 20
1735	(7) 1750	SS	0.0	4.0	Dark Brown	Brown Till	Lean Clay	CL	27.2	47.0	23.0	24.0	0.0	6.0	57.0	37.0	2.69	Nutting
1735	(7) 1749	SS	0.0	4.0	Dark Brown	Brown Till	Lean Clay	CL	23.6	48.0	24.0	24.0	0.0	7.0	62.0	31.0	2.75	Nutting
1735	(7) 1748	SS	0.0	4.0	Dark Brown	Brown Till	Lean Clay	CL	29.3	45.0	22.0	23.0	0.0	6.0	54.0	40.0	2.75	Nutting
1735	3247	ST	8.0	11.0	Yellowish Brown	Brown Till	Sandy Silt	ML	20.8	NP	NP	NP	0.0	36.0	47.0	17.0	2.76	Nutting
1737	(7) 2319	SS	6.0	9.0	Yellowish Brown	Brown Till	Sandy Silt	ML	14.3	NP	NP	NP	0.0	38.0	41.0	11.0	2.78	Nutting
1737	(7) 2318	SS	6.0	9.0	Yellowish Brown	Brown Till	Silt with Sand	ML	16.7	NP	NP	NP	2.0	27.0	55.0	16.0	2.78	Nutting
1737	(7) 2321	SS	10.5	12.0	Olive	Brown Till	Sandy Lean Clay with Gravel	CL	10.0	27.0	16.0	11.0	20.0	26.0	34.0	20.0	2.79	Nutting
1737	(7) 2320	SS	10.5	12.0	Olive	Brown Till	Gravelly Lean Clay with Sand	CL	16.5	19.0	16.0	13.0	25.0	23.0	31.0	21.0	2.80	Nutting
1737	(7) 2323	SS	15.0	19.0	Dark Gray	GrayTill	Sandy Lean Clay	CL	17.9	25.0	15.0	10.0	6.0	30.0	39.0	25.0	2.80	Nutting
1737	(7) 2324	SS	15.0	19.0	Dark Gray	GrayTill	Sandy Lean Clay with Gravel	CL	13.5	28.0	16.0	12.0	17.0	24.0	34.0	25.0	2.79	Nutting
1737	(7) 2322	SS	15.0	19.0	Dark Gray	GrayTill	Silt with Sand	ML	18.7	NP	NP	NP	0.0	17.0	68.0	15.0	2.79	Nutting
1737	(7) 2325	SS	26.0	27.5	Dark Gray	GrayTill	Sandy Silty Clay	CL-ML	19.1	21.0	15.0	6.0	5.0	30.0	44.0	21.0	2.79	Nutting
1737	(7) 2326	SS	26.0	27.5	Dark Gray	GrayTill	Sandy Lean Clay	CL	16.2	23.0	13.0	10.0	12.0	30.0	38.0	20.0	2.80	Nutting
1739	1751	SS	13.0	15.0	Gray	GrayTill	Sandy Lean Clay with Gravel	CL	13.6	26.0	15.0	11.0	23.0	24.0	32.0	21.0	2.78	Nutting
1739	1752	SS	17.0	19.0	Gray	GrayTill	Sandy Lean Clay	CL	16.0	31.0	16.0	15.0	7.0	28.0	35.0	30.0	2.78	Nutting
1741	1737	SS	6.0	8.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	12.1	25.0	15.0	10.0	14.0	27.0	35.0	24.0	2.79	Nutting
1741	1738	SS	8.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	11.9	24.0	15.0	9.0	14.0	29.0	36.0	21.0	2.79	Nutting
1741	1739	SS	12.0	14.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	13.1	25.0	16.0	9.0	12.0	30.0	34.0	24.0	2.79	Nutting
1741	3249	ST	20.0	23.0	Gray	Gray Till	Sandy Lean Clay	CL	11.4	26.0	16.0	10.0	9.0	28.0	37.0	26.0	2.79	Nutting
1741	(7) 1741	SS	23.0	28.0	Gray	GrayTill	Sandy Lean Clay with Gravel	CL	18.6	25.0	16.0	9.0	19.0	22.0	34.0	25.0	2.79	Nutting

Table G-1 - Summary of Index Properties, Disturbed and Undisturbed Samples (continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel %	Grain Size Sand %	Grain Size Silt %	Grain Size Clay %	Specific Gravity (5)	Data Source
1741	(7) 1742	SS	23.0	28.0	Gray	GrayTill	Sandy Lean Clay with Gravel	CL	14.7	24.0	15.0	9.0	22.0	26.0	32.0	20.0	2.75	Nutting
1741	(7) 1740	SS	23.0	28.0	Gray	GrayTill	Sandy Lean Clay	CL	13.9	26.0	15.0	11.0	5.0	27.0	40.0	28.0	2.79	Nutting
1742	(7) 1735	SS	11.0	13.0	Olive Brown	Brown Till	Sandy Lean Clay	CL	12.3	25.0	16.0	9.0	12.0	27.0	36.0	25.0	2.80	Nutting
1742	(7) 1736	SS	11.0	13.0	Olive Brown	Brown Till	Sandy Lean Clay	CL	13.3	25.0	16.0	9.0	8.0	29.0	39.0	24.0	2.81	Nutting
1742	3248	ST	18.0	21.0	Gray	Gray Till	Sandy Lean Clay	CL	13.3	23.0	15.0	8.0	9.0	29.0	39.0	23.0	2.77	Nutting
1743	(7) 1754	SS	9.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	13.4	27.0	16.0	11.0	0.0	30.0	43.0	27.0	2.79	Nutting
1743	(7) 1753	SS	9.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	12.8	26.0	17.0	9.0	3.0	31.0	37.0	29.0	2.79	Nutting
1745	3250	ST	6.0	9.0	Brown	Brown Till	Silty Clay with Sand	CL-ML	17.9	21.0	15.0	6.0	0.0	15.0	55.0	30.0	2.80	Nutting
1745	(7) 1755	SS	9.0	13.0	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	17.5	25.0	17.0	8.0	0.0	15.0	50.0	35.0	2.85	Nutting
1745	(7) 1756	SS	9.0	13.0	Olive	Brown Till	Lean Clay with Sand	CL	19.9	26.0	16.0	10.0	5.0	21.0	42.0	32.0	2.82	Nutting
1750	(7) 2508	SS	4.0	8.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	15.9	24.0	16.0	8.0	1.0	32.0	44.0	23.0	2.80	Nutting
1750	(7) 2506	SS	4.0	8.0	Light Olive Brown	Brown Till	Silty Clay with Sand	CL-ML	15.9	23.0	16.0	7.0	0.0	26.0	50.0	24.0	2.84	Nutting
1750	(7) 2507	SS	4.0	8.0	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	13.4	31.0	19.0	12.0	13.0	16.0	43.0	28.0	2.80	Nutting
1750	(7) 2509	SS	24.0	28.0	Gray	GrayTill	Sandy Lean Clay	CL	13.9	25.0	15.0	10.0	14.0	30.0	34.0	21.0	2.81	Nutting
1750	(7) 2510	SS	24.0	28.0	Gray	GrayTill	Sandy Lean Clay	CL	14.2	23.0	14.0	9.0	12.0	33.0	34.0	21.0	2.79	Nutting
1750	(7) 2511	SS	24.0	28.0	Gray	GrayTill	Sandy Lean Clay	CL	14.4	23.0	15.0	8.0	5.0	36.0	36.0	23.0	2.77	Nutting
1751	(7) 2515	SS	4.0	8.0	Olive Yellow	Brown Till	Sandy Lean Clay	CL	15.2	25.0	17.0	8.0	8.0	27.0	42.0	23.0	2.79	Nutting
1751	(7) 2514	SS	4.0	8.0	Olive Yellow	Brown Till	Sandy Lean Clay with Gravel	CL	19.3	29.0	16.0	13.0	16.0	25.0	33.0	26.0	2.79	Nutting
1751	(7) 2512	SS	4.0	8.0	Olive Yellow	Brown Till	Sandy Lean Clay	CL	14.7	26.0	16.0	10.0	5.0	30.0	40.0	25.0	2.80	Nutting
1751	(7) 2513	SS	4.0	8.0	Olive Yellow	Brown Till	Sandy Lean Clay	CL	15.8	25.0	16.0	9.0	10.0	29.0	37.0	24.0	2.78	Nutting
1751	3253	ST	8.0	11.0	Brown	Brown Till	Silty, Clayey Sand with Gravel	SC-SM	11.2	20.0	15.0	5.0	25.0	37.0	26.0	12.0	2.80	Nutting
1752	(7) 2519	SS	6.0	17.0	Light Yellowish Brown	Brown Till	Lean Clay with Sand	CL	12.7	31.0	17.0	14.0	4.0	24.0	40.0	32.0	2.76	Nutting
1752	(7) 2520	SS	6.0	17.0	Light Yellowish Brown	Brown Till	Lean Clay	CL	18.0	43.0	22.0	21.0	0.0	3.0	39.0	58.0	2.80	Nutting
1752	(7) 2518	SS	6.0	17.0	Light Yellowish Brown	Brown Till	Sandy Lean Clay with Gravel	CL	10.5	30.0	19.0	21.0	16.0	22.0	34.0	28.0	2.86	Nutting
1752	(7) 2517	SS	6.0	17.0	Light Yellowish Brown	Brown Till	Sandy Lean Clay with Gravel	CL	13.6	31.0	16.0	15.0	22.0	23.0	29.0	26.0	2.81	Nutting
1752	(7) 2516	SS	6.0	17.0	Light Yellowish Brown	Brown Till	Lean Clay	CL	16.9	38.0	20.0	18.0	4.0	9.0	38.0	49.0	2.83	Nutting
1752	(7) 2521	SS	25.3	27.5	Light Yellowish Brown	Brown Till	Lean Clay with Sand	CL	22.6	35.0	20.0	15.0	7.0	21.0	43.0	29.0	2.75	Nutting
1752	(7) 2522	SS	25.3	27.5	Light Yellowish Brown	Brown Till	Lean Clay with Sand	CL	37.2	34.0	19.0	15.0	12.0	13.0	39.0	36.0	2.78	Nutting
1752	(7) 2523	SS	25.3	27.5	Light Yellowish Brown	Brown Till	Lean Clay with Sand	CL	37.1	35.0	20.0	15.0	6.0	15.0	42.0	37.0	2.79	Nutting
1753	(7) 2525	SS	4.0	8.0	Light Yellowish Brown	Brown Till	Lean Clay	CL	15.1	43.0	22.0	21.0	1.0	8.0	32.0	59.0	2.77	Nutting
1753	(7) 2524	SS	4.0	8.0	Light Yellowish Brown	Brown Till	Lean Clay with Sand	CL	20.6	44.0	21.0	23.0	12.0	13.0	32.0	43.0	2.77	Nutting
1753	(7) 2526	SS	4.0	8.0	Light Yellowish Brown	Brown Till	Lean Clay	CL	16.4	42.0	21.0	21.0	2.0	7.0	39.0	52.0	2.81	Nutting
2731	(7) 2313	SS	0.0	4.5	Dark Brown	Brown Till	Lean Clay	CL	26.0	45.0	23.0	22.0	0.0	1.0	54.0	45.0	2.78	Nutting
2731	(7) 2312	SS	0.0	4.5	Dark Brown	Brown Till	Lean Clay	CL	18.6	41.0	23.0	18.0	0.0	1.0	55.0	44.0	2.82	Nutting
2731	(7) 2314	SS	0.0	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	26.0	45.0	24.0	21.0	0.0	3.0	51.0	46.0	2.84	Nutting
2731	3255	ST	8.0	11.0	Yellowish Brown	Brown Till	Silty, Clayey Gravel with Sand	GC-GM	14.5	24.0	17.0	7.0	43.0	22.0	23.0	12.0	2.79	Nutting
2731	(7) 2315	SS	22.0	29.0	Dark Grayish Brown	GrayTill	Sandy Lean Clay with Gravel	CL	18.6	32.0	19.0	13.0	16.0	22.0	33.0	29.0	2.79	Nutting
2731	(7) 2316	SS	22.0	29.0	Dark Grayish Brown	GrayTill	Sandy Lean Clay	CL	23.6	30.0	17.0	13.0	8.0	26.0	34.0	32.0	2.84	Nutting
2731	(7) 2317	SS	22.0	29.0	Olive	GrayTill	Gravelly Lean Clay with Sand	CL	16.7	32.0	17.0	15.0	31.0	17.0	28.0	24.0	2.82	Nutting
2754	3256	CJ	4.0	8.0	Olive Yellow	Brown Till	Lean Clay	CL	23.4	39.0	21.0	18.0	0.0	2.0	39.0	59.0	2.83	Nutting
2754	3257	CJ	11.0	14.0	Pale Brown	Brown Till	Lean Clay	CL	25.0	32.0	20.0	12.0	0.0	1.0	44.0	55.0	2.80	Nutting
2754	3258	CJ	22.0	28.0	Dark Gray	GrayTill	Sandy Lean Clay	CL	15.6	26.0	16.0	10.0	3.0	27.0	42.0	28.0	2.78	Nutting
G2-201	G2-201 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	(6) 19.0	49.0	18.0	31.0	0.0	3.0	49.0	48.0	2.70	PO 101
G2-201	G2-201 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay	CL	16.0	30.0	17.0	13.0	2.0	10.0	46.0	42.0	2.73	PO 101
G2-201	G2-201 / 7	SS	15.0	17.0	Gray	Gray Till	Sandy Lean Clay (10)	CL (10)	13.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-201	G2-201 / 9	SS	20.0	22.0	Gray	Gray Till	Sandy Lean Clay (10)	CL (10)	14.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-201	G2-201 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	(6) 13.0	24.0	14.0	10.0	8.0	29.0	39.0	24.0	2.75	PO 101
G2-202	G2-202 / 1	SS	0.0	2.0	Brown	Brown Till	Sandy Lean Clay (10)	CL (10)	25.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-202	G2-202 / 3	SS	5.0	7.0	Yellowish Brown	Brown Till	Sandy Silty Clay	CL-ML	13.0	20.0	14.0	6.0	10.0	29.0	43.0	18.0	2.85	PO 101
G2-202	G2-202 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 14.0	27.0	15.0	12.0	10.0	25.0	38.0	27.0	2.81	PO 101
G2-202	G2-202 / 5	SS	10.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	12.0	25.0	14.0	11.0	7.0	24.0	42.0	27.0	2.84	PO 101
G2-202	G2-202 / 7	SS	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	14.0	25.0	14.0	11.0	10.0	25.0	39.0	26.0	2.81	PO 101
G2-202	G2-202 / 9	SS	20.0	22.0	Gray	Gray Till	Silty Gravel with Sand (4)	GM (4)	NA	NA	NA	NA	40.0	38.0	17.0	5.0	2.80	PO 101
G2-203	G2-203 / 5	SS	10.0	12.0	Yellowish Brown	Brown Till	Clayey Sand with Gravel	SC	8.0	21.0	13.0	8.0	18.0	41.0	26.0	15.0	2.74	PO 101
G2-203	G2-203 / 7	SS	15.0	17.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	17.0	28.0	16.0	12.0	7.0	27.0	39.0	27.0	2.76	PO 101
G2-203	G2-203 / 8	ST	17.5	19.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 17.0	27.0	16.0	11.0	7.0	31.0	32.0	30.0	2.74	PO 101
G2-203	G2-203 / 9	SS	20.0	22.0	Gray	Gray Till	Sandy Lean Clay	CL	12.0	21.0	13.0	8.0	5.0	35.0	39.0	21.0	2.77	PO 101
G2-203	G2-203 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	(6) 14.0	23.0	14.0	9.0	7.0	28.0	40.0	25.0	2.79	PO 101
G2-204	G2-204 / 1	SS	0.0	2.0	Brown	Brown Till	Sandy Lean Clay (10)	CL (10)	19.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-204	G2-204 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 14.0	27.0	15.0	12.0	6.0	26.0	39.0	29.0	2.74	PO 101
G2-204	G2-204 / 6	ST	12.5	14.5	Gray	Gray Till	Lean Clay with Sand	CL	(6) 13.0	24.0	14.0	10.0	4.0	25.0	44.0	27.0	2.76	PO 101
G2-204	G2-204 / 7	SS	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	10.0	25.0	14.0	11.0	4.0	26.0	45.0	25.0	2.74	PO 101
G2-204	G2-204 / 8	ST	17.5	19.5	Gray	Gray Till	Silty Sand	SM	9.0	13.0	12.0	1.0	8.0	51.0	32.0	9.0	2.78	PO 101
G2-204	G2-204 / 9	SS	20.0	22.0	Gray	Gray Till	Sandy Lean Clay (10)	CL (10)	12.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-204	G2-204 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	(6) 12.0	24.0	14.0	10.0	7.0	29.0	38.0	26.0	2.78	PO 101
G2-205	G2-205 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	(6) 11.0	41.0	23.0	18.0	1.0	12.0	51.0	36.0	2.68	PO 101

Table G-1 - Summary of Index Properties, Disturbed and Undisturbed Samples (continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel %	Grain Size Sand %	Grain Size Silt %	Grain Size Clay %	Specific Gravity (5)	Data Source
G2-205	G2-205 / 3	SS	5.0	7.0	Yellowish Brown	Brown Till	Lean Clay (10)	CL (10)	12.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-205	G2-205 / 5	SS	10.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	14.0	28.0	16.0	12.0	10.0	25.0	38.0	27.0	2.79	PO 101
G2-205	G2-205 / 8	ST	17.5	19.5	Gray	Gray Till	Sandy Lean Clay	CL	(6) 13.0	23.0	14.0	9.0	16.0	27.0	37.0	20.0	2.77	PO 101
G2-206	G2-206 / 1	SS	0.0	2.0	Grayish Brown	Brown Till	Lean Clay with Sand (10)	CL (10)	20.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-206	G2-206 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	(6) 11.0	35.0	17.0	18.0	5.0	19.0	41.0	35.0	2.76	PO 101
G2-206	G2-206 / 3	SS	5.0	7.0	Yellowish Brown	Brown Till	Lean Clay with Sand (4)	CL (4)	13.0	NA	NA	NA	10.0	18.0	35.0	37.0	2.76	PO 101
G2-206	G2-206 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 14.0	28.0	15.0	13.0	9.0	23.0	38.0	30.0	2.75	PO 101
G2-206	G2-206 / 5	SS	10.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	14.0	26.0	15.0	11.0	8.0	28.0	38.0	26.0	2.76	PO 101
G2-206	G2-206 / 6	ST	12.5	14.5	Yellowish Brown	Brown Till	Lean Clay with Sand (10)	CL (10)	12.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-206	G2-206 / 7	SS	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	12.0	22.0	13.0	9.0	6.0	33.0	39.0	22.0	2.73	PO 101
G2-206	G2-206 / 8	ST	17.5	19.5	Gray	Gray Till	Silty Sand (10)	SM (10)	13.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-206	G2-206 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	(6) 13.0	25.0	15.0	10.0	7.0	28.0	41.0	24.0	2.73	PO 101
G2-207	G2-207 / 1	SS	0.0	2.0	Brown	Brown Till	Sandy Lean Clay (10)	CL (10)	25.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-207	G2-207 / 5	SS	10.0	12.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	13.0	26.0	16.0	10.0	6.0	27.0	40.0	27.0	2.83	PO 101
G2-207	G2-207 / 11	SS	25.0	27.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	14.0	19.0	13.0	6.0	16.0	32.0	38.0	14.0	2.81	PO 101
G2-208	G2-208 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	(6) 23.0	44.0	20.0	24.0	0.0	2.0	63.0	35.0	2.76	PO 101
G2-208	G2-208 / 3	SS	5.0	7.0	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	26.0	40.0	17.0	23.0	1.0	29.0	39.0	31.0	2.74	PO 101
G2-208	G2-208 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	(6) 17.0	31.0	15.0	16.0	1.0	30.0	42.0	27.0	2.76	PO 101
G2-208	G2-208 / 5	SS	10.0	12.0	Gray	Gray Till	Sandy Lean Clay (10)	CL (10)	13.0	NA	NA	NA	NA	NA	NA	NA	NA	PO 101
G2-208	G2-208 / 9	SS	20.0	22.0	Gray	Gray Till	Sandy Lean Clay	CL	13.0	24.0	14.0	10.0	6.0	33.0	39.0	22.0	2.80	PO 101

Notes

1. Sample Type
   - ST Shelby Tube Sample (ASTM D 1587)
   - DEN Denison Core Barrel Sample
   - CJ Combined Jar Sample of Split Spoon Samples

2. Moisture Content determined by ASTM D 2216

3. NP - Reported as non plastic from laboratory plasticity test (ASTM D 4318)
   NA - Not Analyzed

(4) Classification determined by grain size analysis and visual classification
(5) Specific gravity test performed on minus #10 seive portion of soil sample
(6) Moisture content from CU, CON, CON_S, UU testing, or P test. Value is average if more than one specimen in the sample interval was tested.
(7) Data represents subsamples of reported depth interval
(8) Classification of fines portion determined from grain size anlaysis
(9) Liquid Limit and Plasitic Limit test (ASTM D 4318) results shown for Sample 11471, #402962 (1.5-3') were performed on composite of archive samples: 11471, #402984 (1.5-3') and #402961 (0-1.5')
(10) Visual classification

11. Data Source:
   - PO 132 Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
   - PO 20 Central Storage Facility Subsurface Exploration, PARSONS Project Order 20, September 1993; borings located within the proposed disposal facility footprint.
   - Nutting Engineered Waste Management Facility (EWMF) Investigation; DOE Technical Report 5.1A, June 1993; Geotechnical Laboratory Testing by The H.C. Nutting Co., Cincinnati, Ohio; borings located within or near the perimeter of the proposed disposal faclilty foot print.
   - PO 101 On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-1A - Comparison of Moisture Content Results, Oven verses Microwave Methods

Boring No.	Sample No.	MC D2216	MC Microwave D4643
G2-SB-16	404650	24.7	23.8
G2-SB-17	405366	17.3	17.7
G2-120	405124	16.6	15.6
G2-121	404814	11.9	11.5
G2-122	404821	20.0	19.5
G2-122	404824	13.2	12.4
G2-123	404800	12.6	12.3
G2-125	405023	20.0	21.6
G2-126	404778	14.0	14.5
G2-126	404783	13.2	13.1
G2-129	404729	19.6	19.4
G2-129	404732	14.1	20.8
G2-130	405075	12.9	13.8
G2-131	404704	15.1	15.2
G2-131	404719	14.1	15.1
G2-132	405105	15.0	15.5
G2-132	405111	14.1	15.8

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Table G-2 - Summary of Unit Weight and Percent Saturation, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content Specimen (%)	Moisture Content Average (%)	Wet Density Specimen (pcf)	Wet Density Average (pcf)	Dry Density Specimen (pcf)	Dry Density Average (pcf)	Percent Saturation Specimen (%)	Percent Saturation Average (%)	Specific Gravity	Data Source
11468	403071	ST	2.0	4.5	Olive brown	Brown Till	Lean Clay with Sand	CL	403071A	P	20.5		124.1		103.0		86		2.72	PO 132
11468	403077	ST	9.0	11.5	Light olive brown	Brown Till	Sandy Lean Clay	CL	403077A	CU	13.8		136.7		120.1		89		2.74	PO 132
									403077B	CU	16.8		136.5		116.9		99		2.74	PO 132
									403077C	CU	14.8		140.7		122.6		100		2.74	PO 132
												15.1		138.0		119.9		96		Average
11468	403081	ST	15.0	17.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403081B	UCS	12.9		144.2		127.7		100		2.73	PO 132
11468	403084	ST	19.5	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403084	P	13.7		141.8		124.8		99		2.76	PO 132
11469	402821	ST	3.0	5.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402821B	P	12.7		134.8		119.7		84		2.70	PO 132
									402821C	CU	14.7		130.8		114.1		83		2.70	PO 132
									402821D	CU	17.2		124.4		106.1		79		2.70	PO 132
									402821E	CU	19.1		122.2		102.6		80		2.70	PO 132
												15.9		128.1		110.6		82		Average
11469	402831	ST	15.5	18.0	Dark gray	Gray Till	Lean Clay with Sand	CL	402831	CON	14.1		141.7		124.1		100		2.73	PO 132
									402831A	P	14.6		140.7		122.7		100		2.73	PO 132
									402831B	UCS	13.8		143.2		125.9		100		2.73	PO 132
												14.2		141.9		124.2		100		Average
11470B	403132-1	ST	3.5	6.0	Brownish yellow	Brown Till	Silty Sand	SM	403132-1A	P	19.2		134.5		112.9		100		2.70	PO 132
11470B	403137-1	ST	8.0	10.5	Brownish yellow	Brown Till	Sandy Silt	ML	403137-1B	UCS	14.1		135.9		119.1		90		2.72	PO 132
									403137-1C	CU	15.7		137.8		119.1		100		2.72	PO 132
									403137-1D	CU	18.7		131.9		111.1		96		2.72	PO 132
									403137-1E	CU	17.0		135.0		115.3		98		2.72	PO 132
												16.4		135.2		116.1		96		Average
11470B	403154-1	DEN	30.0	32.0	Dark greenish gray	Gray Till	Sandy Lean Clay with Gravel	CL	403154-1C	P	16.8		136.8		117.2		100		2.73	PO 132
11471	402963	ST	3.5	6.0	Yellowish brown	Brown Till	Fat Clay	CH	402963A	P	24.8		127.3		102.0		100		2.72	PO 132
11471	402974	ST	17.0	19.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	402974	CON	10.3		149.4		135.4		100		2.77	PO 132
									402974B	UCS	10.5		145.9		132.0		94		2.77	PO 132
									402974C	P	18.0		137.4		116.4		100		2.77	PO 132
												12.9		144.2		127.9		98		Average
11472	402940	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402940A	UCS	14.0		138.9		121.8		95		2.74	PO 132
									402940B	P	16.7		135.6		116.2		97		2.74	PO 132
												15.4		137.3		119.0		96		Average
11472	402945	ST	9.5	11.5	Yellowish brown	Brown Till	Clayey Sand with Gravel	SC	402945	CON	10.8		145.0		130.8		100		2.69	PO 132
11472	402956	ST	23.0	25.5	Dark bluish gray	Gray Till	Sandy Lean Clay	CL	402956A	CU	12.7		144.3		128.0		100		2.69	PO 132
									402956B	CU	12.3		144.4		128.6		100		2.69	PO 132
									402956C	CU	12.7		144.1		127.8		100		2.69	PO 132
									402956D	P	13.5		140.6		123.9		100		2.69	PO 132
												12.8		143.4		127.1		100		Average
11473	402920	ST	6.5	8.5	Light yellowish brown	Brown Till	Lean Clay with Sand	CL	402920A	UCS	15.0		140.1		121.8		100		2.74	PO 132
									402920B	P	14.9		140.7		122.5		100		2.74	PO 132
												15.0		140.4		122.1		100		Average
11473	402928	ST	15.5	18.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	402928A	P	12.6		143.0		127.0		97		2.77	PO 132
									402928B	UCS	12.9		143.9		127.4		100		2.77	PO 132
												12.8		143.5		127.2		99		Average
11474	402892	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402892A	P	17.8		135.8		115.3		97		2.79	PO 132
11474	402904	ST	14.0	16.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	402904	CON	12.2		142.9		127.4		96		2.75	PO 132
									402904A	P	12.3		144.3		128.5		100		2.75	PO 132
									402904B	UCS	12.0		144.7		129.1		100		2.75	PO 132
												12.2		144.0		128.3		99		Average
11475	403258	ST	11.0	13.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	403258A	CU	12.7		141.6		125.6		96		2.74	PO 132
									403258B	CU	16.8		137.5		117.7		100		2.74	PO 132
									403258C	CU	20.1		133.1		110.9		100		2.74	PO 132
									403258D	P	20.9		130.2		107.7		97		2.74	PO 132
												17.6		135.6		115.5		98		Average
11475	403260	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403260A	P	12.4		142.3		126.6		100		2.71	PO 132
									403260B	UCS	12.1		143.7		128.2		100		2.71	PO 132
												12.3		143.0		127.4		100		Average
11476	402989	ST	3.5	6.0	Light Olive brown	Brown Till	Lean Clay with Sand	CL	402989A	P	14.5		140.8		123.0		100		2.64	PO 132
11476	402995	ST	9.5	12.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	402995	CON	13.8		140.5		123.5		95		2.77	PO 132
									402995B	UCS	12.4		144.8		128.9		100		2.77	PO 132
												13.1		142.7		126.2		98		Average
11476	402998	ST	14.0	16.5	Gray	Gray Till	Silty, Clayey Sand	SC-SM	402998A	CU	8.7		146.2		134.4		87		2.75	PO 132
									402998B	CU	8.4		144.4		133.2		80		2.75	PO 132
									402998C	CU	10.0		146.1		132.8		94		2.75	PO 132
									402998D	P	13.7		142.9		125.7		100		2.75	PO 132
												10.2		144.9		131.5		90		Average

Table G-2 - Summary of Unit Weight and Percent Saturation, Undisturbed Samples (Continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content Specimen (%)	Moisture Content Average (%)	Wet Density Specimen (pcf)	Wet Density Average (pcf)	Dry Density Specimen (pcf)	Dry Density Average (pcf)	Percent Saturation Specimen (%)	Percent Saturation Average (%)	Specific Gravity	Data Source
11477	402864	ST	3.5	6.0	Brownish yellow	Brown Till	Lean Clay with Sand	CL	402864A	P	20.1		130.8		108.9		97		2.73	PO 132
									402864B	UCS	24.4		124.3		100.1		94		2.73	PO 132
												22.3		127.6		104.5		96		Average
11477	402873	ST	14.0	16.5	Dark gray	Gray Till	Sandy Lean Clay	CL	402873	CON	17.7		134.5		114.3		99		2.72	PO 132
									402873A	CU	13.1		142.3		125.9		100		2.72	PO 132
									402873B	CU	11.8		144.1		128.9		100		2.72	PO 132
									402873C	CU	13.2		140.9		124.4		98		2.72	PO 132
									402873D	P	18.0		136.3		115.5		100		2.72	PO 132
												14.8		139.6		121.8		99		Average
11478	402792	ST	3.5	6.0	Light olive brown	Brown Till	Lean Clay with Sand	CL	402792A	CU	17.5		134.9		114.8		100		2.71	PO 132
									402792B	CU	19.4		126.8		106.2		89		2.71	PO 132
									402792C	CU	25.3		120.1		95.8		90		2.71	PO 132
									402792D	P	22.1		126.6		103.6		95		2.71	PO 132
												21.1		127.1		105.1		94		Average
11479	403022	ST	3.5	6.0	Yellowish brown	Brown Till	Sandy Lean Clay	CL	403022A	P	16.3		134.4		115.6		93		2.74	PO 132
11479	403034	ST	18.5	21.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	403034A	UCS	12.7		144.7		128.4		100		2.69	PO 132
									403034C	P	15.4		136.1		117.9		98		2.69	PO 132
												14.1		140.4		123.2		99		Average
11480	402768	ST	0.5	3.0	Brown	Brown Till	Lean Clay	CL	402768A	UCS	20.7		128.3		106.3		95		2.71	PO 132
11480	402773	ST	9.5	12.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402773A	P	12.2		135.8		121.1		80		2.76	PO 132
11480	402777	ST	14.0	16.5	Gray	Gray Till	Lean Clay with Sand	CL	402777A	P	12.9		143.3		127.0		100		2.73	PO 132
11481	403204	ST	6.5	9.0	Yellowish brown	Brown Till	Gravelly Lean Clay with Sand	CL	403204A	UCS	12.8		143.4		127.1		100		2.72	PO 132
									403204B	P	12.8		141.1		125.1		97		2.72	PO 132
												12.8		142.3		126.1		99		Average
11481	403211	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403211A	CU	11.2		147.9		133.0		100		2.73	PO 132
									403211B	CU	12.3		144.7		128.8		100		2.73	PO 132
									403211C	CU	11.9		144.3		129.0		100		2.73	PO 132
												11.8		145.6		130.3		100		Average
11481	403214	ST	20.0	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403214A	P	12.9		144.1		127.6		100		2.73	PO 132
G2-121	404812	ST	10.0	11.7	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	404812A	CU-Stg	11.1		144.7		130.2		97		2.74	PO 140
G2-121	404814	ST	12.5	14.5	Greenish Gray	Gray Till	Sandy Lean Clay	CL	404814A	P	11.0		145.5		131.1		96		2.77	PO 140
G2-121	404817	ST	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404817B	P	11.1		145.1		130.6		87		2.74	PO 140
G2-122	404821	ST	5.0	7.0	Light Olive Brown	Brown Till	Lean Clay	CL	404821A	CU-Stg	15.4		138.0		119.5		98		2.74	PO 140
									404821B	CON	16.6		132.4		113.5		90		2.74	PO 140
												16.0		135.2		116.5		94		Average
G2-122	404824	ST	10.0	12.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	404824A	UU	13.5		141.3		124.5		100		2.73	PO 140
G2-122	404827	ST	15.0	17.0	Greenish Gray	Gray Till	Lean Clay with Sand	CL	404827A	UW	11.8		145.7		130.3		100		2.70	PO 140
G2-123	404797	ST	7.5	9.5	Dark Yellowish Brown	Brown Till	Sandy Lean Clay	CL	404797A	CU-Stg	13.6		139.6		122.9		90		2.80	PO 140
G2-123	404800	ST	12.5	14.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404800B	P	10.7		141.5		127.7		82		2.79	PO 140
G2-123	404804	ST	20.0	21.2	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404804A	CU	12.7		143.7		127.5		100		2.74	PO 140
G2-124	405002	ST	5.0	7.0	Greenish Black	Brown Till	Fat Clay	CH	405002A	UU	21.7		127.7		105.0		94		2.74	PO 140
G2-124	405004	ST	10.0	12.0	Olive Brown	Brown Till	Lean Clay	CL	405004A	CON	22.1		131.5		107.7		100		2.72	PO 140
									404004B	CU-Stg	21.1		131.0		108.2		100		2.72	PO 140
												21.6		131.3		108.0		100		Average
G2-125	405023	ST	2.5	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	405023A	UW	18.9		129.3		108.8		92		2.71	PO 140
G2-125	405026	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	405026A	UU	14.0		140.9		123.6		97		2.78	PO 140
G2-125	405029	ST	12.5	14.5	Gray, Yellowish Brown	Brown Till	Sandy Silt	ML	405026A	CU-Stg	9.9		148.5		135.2		96		2.77	PO 140
G2-125	405033	ST	17.5	19.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	405026A	UU	12.7		144.9		128.6		100		2.71	PO 140
G2-126	404768	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	404768B	CU-Stg	13.5		142.4		125.5		98		2.78	PO 140
G2-126	404771	ST	12.5	14.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404771A	UW	11.0		135.3		121.9		73		2.76	PO 140
G2-126	404773	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay with Gravel	CL	404773B	CON	12.4		146.6		130.5		100		2.69	PO 140
									404773A	UU	12.9		143.6		127.2		100		2.69	PO 140
												12.6		145.1		128.9		100		Average
G2-126	404778	ST	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404778B	P	13.0		142.1		125.8		99		2.74	PO 140
G2-126	404783	ST	35.0	37.0	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	404783C	CON	12.3		143.5		127.8		99		2.74	PO 140
									404783B	CON_S	12.6		141.9		126.0		97		2.74	PO 140
												12.5		142.7		126.9		98		Average
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	404751D	CON	13.3		140.2		123.7		95		2.74	PO 140
									404751E	CON_S	13.5		140.0		123.3		96		2.74	PO 140
									404751A	UU	11.8		141.8		126.9		93		2.74	PO 140
												12.9		140.7		124.6		94		Average
G2-127	404756	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404756A	CU	12.4		144.7		128.7		100		2.73	PO 140
									404756B	CU	12.7		143.6		127.4		100		2.73	PO 140
									404756C	CU	11.0		142.7		128.6		92		2.73	PO 140
												12.0		143.7		128.2		97		Average

Table G-2 - Summary of Unit Weight and Percent Saturation, Undisturbed Samples (Continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content Specimen (%)	Moisture Content Average (%)	Wet Density Specimen (pcf)	Wet Density Average (pcf)	Dry Density Specimen (pcf)	Dry Density Average (pcf)	Percent Saturation Specimen (%)	Percent Saturation Average (%)	Specific Gravity	Data Source
G2-127	404763	ST	28.0	30.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404763B	P	13.2		142.1		125.5		100		2.74	PO 140
G2-128	405040	ST	2.5	4.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	405040A	UU	13.2		140.4		124.1		94		2.76	PO 140
G2-128	405043	DEN	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay with Gravel	CL	405043A	UW	12.1		143.2		127.8		94		2.78	PO 140
G2-128	405046	DEN	12.5	14.5	Light Olive Brown	Brown Till	Clayey Gravel with Sand	GC	405046A	CON	15.7		138.3		119.5		100		2.73	PO 140
G2-128	405049	DEN	17.5	19.5	Gray	Gray Till	Sandy Lean Clay	CL	405049A	UW	11.2		154.1		138.5		100		2.77	PO 140
G2-129	404729	ST	5.0	7.5	Yellowish Brown	Brown Till	Lean Clay	CL	404729B	UU	18.7		133.0		112.1		99		2.72	PO 140
G2-129	404732	ST	10.0	12.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	404732A	UW	18.8		132.5		111.5		94		2.78	PO 140
G2-129	404740	ST	24.0	26.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404740A	CU	12.9		144.7		128.2		100		2.73	PO 140
									404740B	CU	12.6		141.7		125.8		97		2.73	PO 140
									404740C	CU	10.6		144.1		130.3		94		2.73	PO 140
												12.0		143.5		128.1		97		Average
G2-129	404746	DEN	40.0	42.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404746A	CON_S	13.7		139.9		123.1		97		2.73	PO 140
									404746B	CON_S	9.5		139.8		127.7		77		2.73	PO 140
												11.6		139.9		125.4		87		Average
G2-130	405075	DEN	5.0	7.0	Greenish Gray	Brown Till	Lean Clay with Sand	CL	405075A	UU	12.4		144.8		128.8		100		2.75	PO 140
G2-130	405077	DEN	10.0	12.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	405077A	CU	14.0		144.9		127.1		100		2.75	PO 140
									405077B	CU	19.2		134.8		113.0		100		2.75	PO 140
									405077C	CU	10.5		146.9		132.9		99		2.75	PO 140
												14.6		142.2		124.3		100		Average
G2-130	405080	ST	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	405080B	CON	11.6		145.2		130.1		96		2.79	PO 140
									405080A	UU	11.0		146.1		131.7		95		2.79	PO 140
												11.3		145.7		130.9		95		Average
G2-130	405083	ST	20.0	22.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	405083A	UW	13.3		144.0		127.1		100		2.79	PO 140
G2-130	405088	DEN	30.0	32.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	405088A	CU	11.2		146.0		131.3		100		2.74	PO 140
									405088B	CU	11.1		146.8		132.2		100		2.74	PO 140
									405088C	CU	11.7		144.7		129.5		100		2.74	PO 140
												11.3		145.8		131.0		100		Average
G2-131	404704	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	404704A	UU	11.9		144.4		129.0		100		2.69	PO 140
G2-131	404709	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	404709B	CON	13.6		142.3		125.3		100		2.73	PO 140
									404709A	CON_S	14.4		141.2		123.5		100		2.73	PO 140
												14.0		141.8		124.4		100		Average
G2-131	404713	DEN	27.5	29.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404713C	CON	12.9		142.5		126.2		95		2.78	PO 140
									404713A	UU	12.0		144.4		128.9		96		2.78	PO 140
												12.5		143.5		127.6		96		Average
G2-131	404719	DEN	45.0	47.0	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	404719B	CON	17.5		133.4		113.5		96		2.72	PO 140
									404719C	CON_S	16.5		137.6		118.1		100		2.72	PO 140
									404719A	UU	19.0		135.1		113.6		100		2.72	PO 140
												17.6		135.4		115.1		99		Average
G2-132	405102	ST	5.0	7.0	Dark Olive Brown	Brown Till	Lean Clay	CL	405102A	UU	30.2		118.9		91.3		96		2.71	PO 140
G2-132	405105	DEN	10.0	12.0	Gray	Gray Till	Lean Clay with Sand	CL	405105A	UU	14.2		140.7		123.2		99		2.75	PO 140
G2-132	405108	ST	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	405108A	CU	11.9		145.8		130.3		100		2.75	PO 140
									405108B	CU	12.4		145.3		129.3		100		2.75	PO 140
									405108C	CU	11.7		145.2		130.0		100		2.75	PO 140
												12.0		145.4		129.9		100		Average
G2-132	405111	ST	20.0	22.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	405111A	P	13.9		141.2		124.0		99		2.75	PO 140
G2-133	405053	ST	2.5	4.5	Dark Grayish Brown	Brown Till	Lean Clay	CL	405053A	UW	23.5		128.3		103.9		100		2.73	PO 140
G2-133	405055	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	405055C	CON	12.5		146.1		129.9		100		2.77	PO 140
									405055B	CON_S	13.7		144.7		127.2		100		2.77	PO 140
									405055A	UU	12.7		143.0		126.9		97		2.77	PO 140
												13.0		144.6		128.0		99		Average
G2-133	405059	DEN	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	405059A	CU	10.7		146.5		132.4		99		2.75	PO 140
									405059B	CU	11.3		146.8		131.9		100		2.75	PO 140
									405059C	CU	9.0		149.3		137.0		98		2.75	PO 140
												10.3		147.5		133.8		99		Average
G2-133	405061	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	405061A	P	13.3		143.0		126.2		98		2.78	PO 140
G2-133	405065	DEN	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	405065A	P	14.4		141.5		123.7		100		2.70	PO 140
G2-134	405140	DEN	12.0	14.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	405140A	UU	12.6		143.7		127.6		100		2.72	PO 140
CSF-1	CSF-1 / 4	ST	6.0	8.0	Very Dark Grayish Brown	Brown Till	Lean Clay with Sand	CL	C1/4B	UU	28.3		124.4		96.9		100		2.78	PO 20
									C1/4A	UU	15.2		139.4		121.0		97		2.78	PO 20
									C1/5	CON_S	14.3		144.8		120.9		91		2.78	PO 20
												19.3		136.2		112.9		96		Average
CSF-3	CSF-3 / 6	ST	10.0	12.0	Light Olive Brown	Brown Till	Silt with Sand	ML	C3/6C	UU	14.8		140.2		122.1		95		2.81	PO 20
									C3/6B	UU	18.9		133.7		112.5		95		2.81	PO 20
												16.9		137.0		117.3		95		Average

Table G-2 - Summary of Unit Weight and Percent Saturation, Undisturbed Samples (Continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content Specimen (%)	Moisture Content Average (%)	Wet Density Specimen (pcf)	Wet Density Average (pcf)	Dry Density Specimen (pcf)	Dry Density Average (pcf)	Percent Saturation Specimen (%)	Percent Saturation Average (%)	Specific Gravity	Data Source
CSF-6	CSF-6 / 8	ST	20.0	22.0	Dark Gray	Gray Till	Lean clay	CL	C6/8C	UU	14.7		141.5		123.3		100		2.75	PO 20
									C6/8B	UU	14.7		141.1		123.0		100		2.75	PO 20
									C6/8A	UU	13.8		142.8		125.4		100		2.75	PO 20
												14.4		141.8		123.9		100		Average
CSF-2	CSF-2 / 6	ST	13.0	15.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	C2/6	CON_S	11.9		144.5		129.1		97		2.77	PO 20
CSF-3	CSF-3 / 10	ST	25.0	27.0	Dark Gray	Gray Till	Sandy Silt	ML	C3/10	CON_S	10.7		148.4		134.1		97		2.81	PO 20
1735	3247	ST	8.0	11.0	Yellowish Brown	Brown Till	Sandy Silt	ML		CU	20.8		132.4		109.6		100		2.76	Nutting
										CU	18.1		132.2		111.9		95		2.76	Nutting
										CU	18.1		132.2		111.9		95		2.76	Nutting
										CON_S	28.5		129.4		100.7		100		2.76	Nutting
										P_C	17.2		125.6		107.2		81		2.76	Nutting
												20.5		130.4		108.3		94		Average
1742	3248	ST	18.0	21.0	Dark Gray	Gray Till	Sandy Lean Clay	CL		CU	13.3		144.1		127.2		100		2.77	Nutting
										CU	13.4		144.4		127.3		100		2.77	Nutting
										CU	15.1		148.4		128.9		100		2.77	Nutting
										CON_S	13.1		139.7		123.5		90		2.77	Nutting
										P_C	16.1		134.7		116.0		96		2.77	Nutting
												14.2		142.3		124.6		97		Average
1741	3249	ST	20.0	23.0	Gray	Gray Till	Sandy Lean Clay	CL		CU	11.4		142.4		127.8		95		2.79	Nutting
										CU	14.2		142.6		124.9		100		2.79	Nutting
										CU	13.9		142.6		125.2		100		2.79	Nutting
										CON_S	13.5		137.2		120.9		85		2.79	Nutting
										P_C	13.5		136.4		120.2		91		2.79	Nutting
												13.3		140.2		123.8		94		Average
1745	3250	ST	6.0	9.0	Yellowish Brown	Brown Till	Silty Clay with Sand	CL-ML		CU	17.9		138.3		117.3		100		2.80	Nutting
										CU	14.4		140.8		123.1		100		2.80	Nutting
										CU	14.1		143.4		125.7		100		2.80	Nutting
										CON_S	15.8		134.3		116.0		87		2.80	Nutting
										P_C	15.1		131.0		113.8		86		2.80	Nutting
												15.5		137.6		119.2		95		Average
1748	3251	ST	9.0	12.0	Brown	Brown Till	Clayey Gravel with Sand	GC		CU	9.7		143.6		134.9		100		2.79	Nutting
										CU	11.2		146.2		131.5		100		2.79	Nutting
										CU	12.0		144.6		129.1		100		2.79	Nutting
										CON_S	11.1		136.8		123.1		75		2.79	Nutting
										P_C	11.1		142.4		128.2		96		2.79	Nutting
												11.0		142.7		129.4		94		Average
1747	3252	ST	12.0	14.5	Yellowish Brown	Gray Till	Clayey Gravel with Sand	GC		CU	13.4		142.2		125.4		100		2.74	Nutting
										CU	13.6		143.5		126.3		100		2.74	Nutting
										CU	12.4		143.9		128.0		100		2.74	Nutting
										CON_S	13.7		134.5		118.3		84		2.74	Nutting
										P_C	21.4		138.8		114.3		100		2.74	Nutting
												14.9		140.6		122.5		97		Average
1751	3253	ST	8.0	11.0	Olive Yellow	Brown Till	Silty Clayey Sand with Gravel	SC-SM		CU	11.2		147.3		132.5		100		2.74	Nutting
										CU	12.0		144.0		128.6		100		2.74	Nutting
										CU	12.2		142.6		127.1		98		2.74	Nutting
										CON_S	22.5		123.6		100.9		86		2.80	Nutting
										P_C	17.6		116.1		98.7		100		2.74	Nutting
												15.1		134.7		117.6		97		Average
2731	3255	ST	8.0	11.0	Yellowish Brown	Brown Till	Silty Clayey Gravel with Sand	GC-GM		CU	14.5		142.0		124.0		100		2.79	Nutting
										CU	18.8		137.9		116.3		100		2.79	Nutting
										CU	29.8		122.1		94.1		100		2.79	Nutting
										CON_S	14.9		137.1		119.3		90		2.79	Nutting
										P_C	36.3		116.5		85.5		100		2.79	Nutting
												22.9		131.1		107.8		98		Average
G2-201	G2-201 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay	CL	4A	UW	15.5		136.5		118.2		96		2.73	PO 101
G2-201	G2-201 / 2	ST	2.5	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	2A	CU	20.4		130.2		108.5		99		2.70	PO 101
									2B	CU	17.7		120.9		102.8		75		2.70	PO 101
									2C	CU	18.2		119.4		101.1		74		2.70	PO 101
												18.8		123.5		104.1		83		Average
G2-201	G2-201 / 10	ST	22.5	24.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	10A	CU	12.6		143.7		127.6		100		2.75	PO 101
									10B	CU	13.0		143.4		126.9		100		2.75	PO 101
									10C	CU	13.8		142.4		125.2		100		2.75	PO 101
												13.1		143.2		126.6		100		Average

Table G-2 - Summary of Unit Weight and Percent Saturation, Undisturbed Samples (Continued)

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content Specimen (%)	Moisture Content Average (%)	Wet Density Specimen (pcf)	Wet Density Average (pcf)	Dry Density Specimen (pcf)	Dry Density Average (pcf)	Percent Saturation Specimen (%)	Percent Saturation Average (%)	Specific Gravity	Data Source
G2-202	G2-202 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	4A	CU	14.2		139.6		122.3		98		2.81	PO 101
									4B	CU	14.1		142.4		124.8		92		2.81	PO 101
												14.2		141.0		123.6		95		Average
G2-204	G2-204 / 6	ST	12.5	14.5	Dark Gray	Gray Till	Lean Clay with Sand	CL	6C	CU	12.5		142.9		127.0		100		2.76	PO 101
									6B	CU	12.9		144.0		127.6		100		2.76	PO 101
									6A	CU	12.7		145.9		129.5		97		2.76	PO 101
												12.7		144.3		128.0		99		Average
G2-203	G2-203 / 8	ST	17.5	19.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	8B	P	16.7		138.6		118.8		100		2.74	PO 101
G2-203	G2-203 / 10	ST	22.5	24.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	10A	CON_S	14.0		139.5		122.4		93		2.79	PO 101
G2-204	G2-204 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	4A	CON_S	14.2		139.2		122.0		96		2.74	PO 101
G2-204	G2-204 / 10	ST	22.5	24.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	10B	P	12.1		144.3		128.7		96		2.78	PO 101
G2-205	G2-205 / 2	ST	2.5	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	2B	P	11.3		138.3		124.2		87		2.68	PO 101
G2-205	G2-205 / 8	ST	17.5	19.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	8A	CU	12.6		144.4		128.2		100		2.77	PO 101
									8B	CU	13.0		143.1		126.6		99		2.77	PO 101
									8C	CU	12.2		143.3		127.7		95		2.77	PO 101
												12.6		143.6		127.5		98		Average
G2-206	G2-206 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	2A	CON_S	11.4		122.8		110.2		56		2.76	PO 101
G2-206	G2-206 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	4A	P	13.7		138.5		121.8		92		2.75	PO 101
G2-206	G2-206 / 6	ST	12.5	14.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	6A	UW	11.5		146.0		130.9		100		2.76	PO 101
G2-206	G2-206 / 10	ST	22.5	24.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	10A	CU	12.7		144.4		128.1		100		2.73	PO 101
									10B	CU	12.7		144.2		128.0		100		2.73	PO 101
									10C	CU	12.8		143.5		127.2		100		2.73	PO 101
												12.7		144.0		127.8		100		Average
G2-208	G2-208 / 2	ST	2.5	4.5	Dark Yellowish Brown	Brown Till	Lean Clay	CL	2A	CU	25.4		123.0		98.1		93		2.76	PO 101
									2B	CU	21.8		120.7		99.1		81		2.76	PO 101
									2C	CU	22.9		122.6		99.7		87		2.76	PO 101
												23.4		122.1		99.0		87		Average
G2-208	G2-208 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	4A	CU	23.4		126.6		102.6		95		2.76	PO 101
									4B	CU	14.3		143.4		125.4		100		2.76	PO 101
									4C	CU	13.5		140.0		123.4		94		2.76	PO 101
												17.1		136.7		117.1		96		Average

Notes:

1. Sample Type:
   - ST — Shelby Tube Sample (ASTM D 1587)
   - DEN — Denison Core Barrel Sample

2. Test Type:
   - CON — Consolidation with time readings, (ASTM D 2435), specimen at natural moisture
   - CON_S — Consolidation with time readings, (ASTM D 2435), specimen at saturated conditions
   - CU — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767)
   - CU-Stg — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767), Staged Test
   - P — Triaxial, Back-Pressure Permeability (ASTM D 5084)
   - P_C — Rigid Wall, Constant Head Permeability (ASTM D 2434)
   - UU — Triaxial Shear, Unconsolidated, Undrained ASTM D 2850
   - UW — Unit Weight (ASTM D 2937)
   - UCS — Unconfined Compressive Strength (ASTM D 2166)

3. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads
   - PO 20 — Central Storage Facility Subsurface Exploration, PARSONS Project Order 20, September 1993; borings located within the proposed disposal facility footprint.
   - Nutting — Engineered Waste Management Facility (EWMF) Investigation; DOE Technical Report 5.1A, June 1993; Geotechnical Laboratory Testing by The H.C. Nutting Co., Cincinnati, Ohio; borings located within or near the perimeter of the proposed disposal
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-3 - Summary of Consolidation Tests, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Test Type	Initial Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Percent Saturation (%)	Coefficient of Consolidation (Cv) Square inch/minute, @ t90 Loading 0.8 (tsf)	1.6 (tsf)	3.2 (tsf)	6.4 (tsf)	Average Overburden Pressure (psf)	Maximum Past Pressure (psf)	Initial Void Ratio	Compression Index (Cc)	Recompression Index (Cr)	Overconsolidation Ratio (OCR)	Data Source
11469	402831	ST	15.5	18.0	Dark gray	Gray Till	Lean Clay with Sand	CL	CONs	14.2	141.7	124.1	100	0.036	0.015	0.014	0.027	2296	2344	0.38	0.077	0.016	1.4	PO 132
11471	402974	ST	17.0	19.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	CONs	10.3	149.4	135.4	100	0.028	0.035	0.035	0.041	2514	2455	0.28	0.050	0.010	1.0	PO 132
11472	402945	ST	9.5	11.5	Yellowish brown	Brown Till	Clayey Sand with Gravel	SC	CONs	10.8	145.0	130.8	100	0.093	0.092	0.104	0.117	1414	2399	0.28	0.061	0.008	1.7	PO 132
11474	402904	ST	14.0	16.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	CONs	12.2	142.9	127.4	96	0.081	0.033	0.035	0.029	2085	2630	0.35	0.070	0.013	1.3	PO 132
11476	402995	ST	9.5	12.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	CONs	13.8	140.5	123.5	95	0.042	0.069	0.064	0.132	1448	1445	0.40	0.066	0.010	1.0	PO 132
11477	402873	ST	14.0	16.5	Dark gray	Gray Till	Sandy Lean Clay	CL	CONs	17.7	134.5	114.3	99	0.016	0.022	0.018	0.032	2085	2089	0.49	0.114	0.016	1.0	PO 132
G2-126	404783	ST	35.0	37.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CONs	12.6	141.9	126.0	97	0.010	0.025	0.045	0.039	5059	6918	0.36	0.062	0.016	1.4	PO 140
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	CONs	13.5	140.0	123.3	96	0.048	0.039	0.020	0.020	1145	2649	0.39	0.070	0.019	2.3	PO 140
G2-129	404746 Top	DEN	40.0	42.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CONs	13.7	139.9	123.1	97	0.183	0.113	0.103	0.091	5759	8483	0.39	0.062	0.010	1.5	PO 140
G2-129	404746 Bot	DEN	40.0	42.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CONs	9.5	139.8	127.7	77	0.081	0.194	0.053	0.153	5759	5500	0.34	0.078	0.018	1.0	PO 140
G2-131	404709	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	CONs	14.4	141.2	123.5	100	0.052	0.015	0.032	0.035	5500	8157	0.38	0.101	0.013	2.2	PO 140
G2-131	404719	DEN	45.0	47.0	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	CONs	16.5	137.6	118.1	100	0.035	0.027	0.027	0.017	6483	2238	0.44	0.085	0.028	<1.0	PO 140
G2-133	405055	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	CONs	13.7	144.7	127.2	100	0.100	0.051	0.038	0.040	1145	1933	0.36	0.057	0.014	1.7	PO 140
CSF-1	CSF-1 / 4	ST	6.0	8.0	Very Dark Grayish Brown	Brown Till	Lean Clay with Sand	CL	CONs	14.3	144.8	120.9	91	0.073	0.091	0.089	0.116	1250	3980	0.37	0.088	0.017	3.2	PO 20
CSF-2	CSF-2 / 6	ST	13.0	15.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	CONs	11.9	144.5	129.1	97	0.026	0.050	0.077	0.054	1520	2510	0.28	0.070	0.015	1.7	PO 20
CSF-3	CSF-3 / 10	ST	25.0	27.0	Dark Gray	Gray Till	Sandy Silt	ML	CONs	10.7	148.4	134.1	97	0.051	0.140	0.138	0.161	3600	6310	0.23	0.057	0.005	1.8	PO 20
1735	3247	ST	8.0	11.0	Yellowish Brown	Brown Till	Sandy Silt	ML	CONs	28.5	129.4	100.7	100	(3) 0.027	(3) 0.034	(3) 0.036	(3) 0.058	1280	5450	0.71	0.141	0.026	4.3	Nutting
1742	3248	ST	18.0	21.0	Gray	Gray Till	Sandy Lean Clay	CL	CONs	13.1	139.7	123.5	90	(3) 0.010	(3) 0.014	(3) 0.025	(3) 0.028	2668	5234	0.40	0.099	0.018	2.0	Nutting
1741	3249	ST	20.0	23.0	Gray	Gray Till	Sandy Lean Clay	CL	CONs	13.5	137.2	120.9	85	(3) 0.011	(3) 0.012	(3) 0.017	(3) 0.021	2958	4250	0.44	0.139	0.028	1.4	Nutting
1745	3250	ST	6.0	9.0	Brown	Brown Till	Silty Clay with Sand	CL-ML	CONs	15.8	134.3	116.0	87	(3) 0.039	(3) 0.044	(3) 0.041	(3) 0.044	1010	5167	0.51	0.115	0.017	5.1	Nutting
1748	3251	ST	9.0	12.0	Brown and Gray	Brown Till	Clayey Gravel with Sand	GC	CONs	11.1	136.8	123.1	75	(3) 0.051	(3) 0.063	(3) 0.048	(3) 0.024	1414	5167	0.41	0.134	0.030	3.7	Nutting
1747	3252	ST	12.0	14.5	Gray and Brown	Gray Till	Gravelly Lean Clay with Sand	CL	CONs	13.7	134.5	118.3	84	(3) 0.037	(3) 0.049	(3) 0.027	(3) 0.018	1785	5500	0.45	0.142	0.026	3.1	Nutting
1751	3253	ST	8.0	11.0	Brown	Brown Till	Silty, Clayey Sand with Gravel	SC-SM	CONs	22.5	123.6	100.9	86	(3) 0.006	(3) 0.006	(3) 0.004	(3) 0.003	1280	3925	0.73	0.219	0.040	3.1	Nutting
2731	3255	ST	8.0	11.0	Yellowish Brown	Brown Till	Silty, Clayey Gravel with Sand	GC-GM	CONs	14.9	137.1	119.3	90	(3) 0.008	(3) 0.018	(3) 0.024	(3) 0.029	1280	3300	0.46	0.103	0.016	2.6	Nutting
G2-203	203/10A	ST	22.5	24.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	CONs	14.0	139.5	122.4	93	0.131	0.145	0.135	0.160	3332	3950	0.23	0.078	0.028	1.2	PO 101
G2-204	204/4A	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	CONs	14.2	139.2	122.0	96	0.150	0.183	0.181	0.146	1184	4898	0.40	0.084	0.023	1.7	PO 101
G2-206	206/2A	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	CONs	11.4	122.8	110.2	56	0.212	0.217	0.208	0.197	429	1514	0.56	0.141	0.038	3.5	PO 101

Notes:

1. Sample Type: ST Shelby Tube Sample (ASTM D 1587)
   DEN Denison Core Barrel Sample

2. Test Type: CONs Consolidation with time readings. ASTM D2435, undisturbed specimen at saturated conditions

3. Cv values are t50 values with loadings of 2, 4, 6, and 8 tsf respectively

4. Data Source:
   PO 132 Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   PO 140 Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads
   PO 20 Central Storage Facility Subsurface Exploration, PARSONS Project Order 20, September 1993; borings located within the proposed disposal facility footprint.
   Nutting Engineered Waste Management Facility (EWMF) Investigation; DOE Technical Report 5.1A, June 1993; Geotechnical Laboratory Testing by The H.C. Nutting Co., Cincinnati, Ohio; borings located within or near the perimeter of the proposed disposal facility foot print.
   PO 101 On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-4 - Summary of Unconsolidated, Undrained Triaxial Compression Tests, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Test Type	Confining Pressure (psf)	Total Cohesion (psf)	Total Friction Angle (degrees)	Testing Condition	Percent Saturation	Data Source
G2-122	404824	ST	10.0	12.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	UU	1728	7660	0	Field Moisture	100	PO 140
G2-124	405002	ST	5.0	7.0	Greenish Black	Brown Till	Fat Clay	CH	UU	1008	3565	0	Field Moisture	94	PO 140
G2-125	405026	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	UU	1368	2419	0	Field Moisture	97	PO 140
G2-125	405033	ST	17.5	19.5	Dark Gray	Gray Till	Sandy Lean Clay	CL	UU	2808	1986	0	Field Moisture	100	PO 140
G2-126	404773	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay with Gravel	CL	UU	2448	2056	0	Field Moisture	100	PO 140
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	UU	1368	8076	0	Saturated	93	PO 140
G2-128	405040	ST	2.5	4.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	UU	648	3519	0	Saturated	94	PO 140
G2-129	404729	ST	5.0	7.5	Yellowish Brown	Brown Till	Lean Clay	CL	UU	1080	3347	0	Saturated	99	PO 140
G2-130	405075	DEN	5.0	7.0	Greenish Gray	Brown Till	Lean Clay with Sand	CL	UU	1008	2093	0	Saturated	100	PO 140
G2-130	405080	ST	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	UU	2448	3062	0	Saturated	95	PO 140
G2-131	404704	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	UU	1368	4630	0	Saturated	100	PO 140
G2-131	404713	DEN	27.5	29.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	UU	4248	3090	0	Saturated	96	PO 140
G2-131	404719	DEN	45.0	47.0	Dark Greenish Gray	Gray Till	Lean Clay with Sand	CL	UU	6768	2085	0	Saturated	100	PO 140
G2-132	405102	ST	5.0	7.0	Dark Olive Brown	Brown Till	Lean Clay	CL	UU	1008	513	0	Saturated	96	PO 140
G2-132	405105	DEN	10.0	12.0	Gray	Gray Till	Lean Clay with Sand	CL	UU	1728	2173	0	Saturated	99	PO 140
G2-133	405055	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	UU	1368	5534	0	Saturated	97	PO 140
G2-134	405140	DEN	12.0	14.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	UU	2016	1557	0	Saturated	98	PO 140
CSF-1	CSF-1 / 4	ST	6	8	Dark Grayish Brown	Brown Till	Lean Clay with Sand	CL	UU	4000	2200	0	Field Moisture	99	PO 20
CSF-3	CSF-3 / 6	ST	10	12	Light Olive Brown	Brown Till	Silt with Sand	ML	UU	8000	2900	0	Field Moisture	95	PO 20
CSF-6	CSF-6 / 8	ST	20	22	Dark Gray	Gray Till	Lean Clay	CL	UU	4000	3600	0	Field Moisture	100	PO 20

Notes:

1. Sample Type
   - ST — Shelby Tube
   - DEN — Denison Core Barrel Sample
2. Test Type
   - UU — Unconsolidated, Undrained Triaxial Compression, ASTM D 2850, undisturbed specimen, single point test
3. Data Source:
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
   - PO 20 — Central Storage Facility Subsurface Exploration, PARSONS Project Order 20, September 1993; borings located within the proposed disposal facility footprint.

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Table G-4A - Summary of Unconfined Compressive Strength Tests, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Munsell Color (from field log)	General Stratum	USCS Group Name	USCS Symbol	Test Type	Moisture Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Unconfined Compressive Strength (psf)	Undrained Shear Strength (psf)
11468	403081B	ST	15.0	17.5	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	12.9	144.2	127.7	15	5475	2738
11469	402831B	ST	15.5	18.0	Dark gray	Gray Till	Lean Clay with Sand	CL	UCS	13.8	143.2	125.9	15	5300	2650
11470B	403137-1B	ST	8.0	10.5	Brownish yellow	Brown Till	Sandy Silt	ML	UCS	14.1	135.9	119.1	7.07	1560	780
11471	402974B	ST	17.0	19.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	10.5	145.9	132.0	14.57	7465	3733
11472	402940A	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	UCS	14.0	138.9	121.8	12.86	8800	4400
11473	402920A	ST	6.5	8.5	Light yellowish brown	Brown Till	Lean Clay with Sand	CL	UCS	15.0	140.1	121.8	10.39	8116	4058
11473	402928B	ST	15.5	18.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	12.9	143.9	127.4	15	5950	2975
11474	402904B	ST	14.0	16.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	12.0	144.7	129.1	11.57	7293	3647
11475	403260B	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	12.1	143.7	128.2	10.07	9696	4848
11476	402995B	ST	9.5	12.0	Gray	Gray Till	Sandy Silty Clay	CL-ML	UCS	12.4	144.8	128.9	15	5270	2635
11477	402864B	ST	3.5	6.0	Brownish yellow	Brown Till	Lean Clay with Sand	CL	UCS	24.2	124.3	100.1	7.69	1303	652
11479	403034B	ST	18.5	21.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	UCS	12.7	144.7	128.4	15	3947	1974
11480	402768A	ST	0.5	3.0	Brown	Brown Till	Lean Clay	CL	UCS	20.7	128.3	106.3	4.32	4254	2127
11481	403204A	ST	6.5	9.0	Yellowish brown	Brown Till	Gravelly Lean Clay with Sand	CL	UCS	12.8	143.4	127.1	11.65	8915	4458

Notes:

1. Sample Type:
   ST = Shelby Tube Sample (ASTM D 1587)

2. Test Type:
   UCS = Unconfined Compressive Strength (ASTM D 2166)

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Table G-5 - Summary of Mohr Circle Constructions from Consolidated, Undrained Triaxial Compression Tests, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Test Type	Effective Cohesion (psf)	Effective Friction Angle (degrees)	Total Cohesion (psf)	Total Friction Angle (degrees)	Data Source
11468	403077	ST	9.0	11.5	Light olive brown	Brown Till	Sandy Lean Clay	CL	CU	525	28	725	19	PO 132
11469	402821	ST	3.0	5.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	CU	500	25	600	12	PO 132
11470B	403137-1	ST	8.0	10.5	Brownish yellow	Brown Till	Sandy Silt	ML	CU	0	35	0	32	PO 132
11472	402956	ST	23.0	25.5	Dark bluish gray	Gray Till	Sandy Lean Clay	CL	CU	150	30	300	20	PO 132
11475	403258	ST	11.0	13.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	CU	125	34	525	19	PO 132
11476	402998	ST	14.0	16.5	Gray	Gray Till	Silty, Clayey Sand	SC-SM	CU	0	38	400	21	PO 132
11477	402873	ST	14.0	16.5	Dark gray	Gray Till	Sandy Lean Clay	CL	CU	180	32	250	20	PO 132
11478	402792	ST	3.5	6.0	Light olive brown	Brown Till	Lean Clay with Sand	CL	CU	325	26	350	15	PO 132
11481	403211	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	CU	250	32	400	22	PO 132
G2-121	404812	ST	10.0	11.7	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	CU-Stg	625	28	675	24	PO 140
G2-122	404821	ST	5.0	7.0	Light Olive Brown	Brown Till	Lean Clay	CL	CU-Stg	425	20	500	16	PO 140
G2-123	404797	ST	7.5	9.5	Dark Yellowish Brown	Brown Till	Sandy Lean Clay	CL	CU-Stg	50	36	100	28	PO 140
G2-123	404804	ST	20.0	21.2	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CU-Stg	0	31	0	22	PO 140
G2-124	405004	ST	10.0	12.0	Olive Brown	Brown Till	Lean Clay	CL	CU-Stg	450	27	400	17	PO 140
G2-125	405029	ST	12.5	14.5	Gray, Yellowish Brown	Brown Till	Sandy Silt	ML	CU-Stg	0	35	0	25	PO 140
G2-126	404768	ST	7.5	9.5	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	CU-Stg	225	33	175	25	PO 140
G2-127	404756	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CU	550	29	1125	16	PO 140
G2-129	404740	ST	24.0	26.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	CU	425	27	550	18	PO 140
G2-130	405077	DEN	10.0	12.0	Dark Gray	Gray Till	Lean Clay with Sand	CL	CU	50	29	200	19	PO 140
G2-130	405088	DEN	30.0	32.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	CU	400	32	425	23	PO 140
G2-132	405108	ST	15.0	17.0	Gray	Gray Till	Sandy Lean Clay	CL	CU	575	30	550	20	PO 140
G2-133	405059	DEN	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	CU	175	34	0	25	PO 140
1742	3248	ST	18.0	21.0	Gray	Gray Till	Sandy Lean Clay	CL	CU	350	40	200	20	Nutting
1741	3249	ST	20.0	23.0	Gray	Gray Till	Sandy Lean Clay	CL	CU	0	44	200	21	Nutting
1745	3250	ST	6.0	9.0	Brown	Brown Till	Silty Clay with Sand	CL-ML	CU	900	29	350	24	Nutting
1748	3251	ST	9.0	12.0	Brown and Gray	Brown Till	Clayey Gravel with Sand	GC	CU	0	42	0	26	Nutting
1747	3252	ST	12.0	14.5	Gray and Brown	Gray Till	Gravelly Lean Clay with Sand	CL	CU	400	34	400	20	Nutting
1751	3253	ST	8.0	11.0	Brown	Brown Till	Silty, Clayey Sand with Gravel	SC-SM	CU	1150	29	300	21	Nutting
G2-201	G2-201 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	CU	500	24	300	22	PO 101
G2-202	G2-202 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	CU	200	26	450	15	PO 101
G2-208	G2-208 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	CU	300	30	250	22	PO 101
G2-208	G2-208 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	CU	150	31	300	16	PO 101
G2-201	G2-201 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	CU	400	28	250	24	PO 101
G2-204	G2-204 / 6	ST	12.5	14.5	Gray	Gray Till	Lean Clay with Sand	CL	CU	450	27	600	20	PO 101
G2-205	G2-205 / 8	ST	17.5	19.5	Gray	Gray Till	Sandy Lean Clay	CL	CU	200	32	300	23	PO 101
G2-206	G2-206 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	CU	250	31	200	26	PO 101

Notes:

1. Sample Type:
   - ST — Shelby Tube Sample (ASTM D 1587)
   - DEN — Denison Core Barrel Sample
2. Test Type:
   - CU — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767)
   - Stg — Staged test on one test specimen
3. Values reported for Nutting Tests are from Parsons Evaluation of H.C. Nutting Test Data (PARSONS Calculation Package 140-16-4).
4. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
   - Nutting — Engineered Waste Management Facility (EWMF) Investigation; DOE Technical Report 5.1A, June 1993; Geotechnical Laboratory Testing by The H.C. Nutting Co., Cincinnati, Ohio; borings located within or near the perimeter of the proposed disposal facility foot print.
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

Table G-6 - Summary of Laboratory Permeability Tests, Undisturbed Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Specimen ID	Test Type	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Coeff. of Perm. (last 4 determinations) k1 (cm/sec)	k2 (cm/sec)	k3 (cm/sec)	k4 (cm/sec)	Average Coeff. of Permeability (cm/sec)	Percent Saturation (%)	Confining Pressure (psf)	Data Source
11468	403071	ST	2.0	4.5	Olive brown	Brown Till	Lean Clay with Sand	CL	403071A	P	20.5	124.1	103.0	4.3E-06	5.1E-06	6.4E-06	9.6E-06	6.4E-06	86	619	PO 132
11468	403084	ST	19.5	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403084	P	13.7	141.8	124.8	8.8E-09	1.1E-08	1.2E-08	1.0E-08	1.0E-08	99	3010	PO 132
11469	402821	ST	3.0	5.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402821B	P	12.7	134.8	119.7	9.9E-08	9.0E-08	8.6E-08	8.6E-08	9.0E-08	84	749	PO 132
11469	402831	ST	15.5	18.0	Dark gray	Gray Till	Lean Clay with Sand	CL	402831A	P	14.6	140.7	122.7	9.2E-09	9.2E-09	7.0E-09	9.3E-09	8.7E-09	100	2462	PO 132
11470B	403132-1	ST	3.5	6.0	Brownish yellow	Brown Till	Silty Sand	SM	403132-1A	P	19.2	134.5	112.9	9.8E-06	1.0E-05	1.0E-05	1.0E-05	1.0E-05	100	821	PO 132
11470B	403154-1	DEN	30.0	32.0	Dark greenish gray	Gray Till	Sandy Lean Clay with Gravel	CL	403154-1C	P	16.8	136.8	117.2	8.6E-08	8.2E-08	8.4E-08	8.5E-08	8.4E-08	100	4378	PO 132
11471	402963	ST	3.5	6.0	Yellowish brown	Brown Till	Fat Clay	CH	402963A	P	24.8	127.3	102.0	1.1E-08	1.1E-08	9.5E-09	9.9E-09	1.0E-08	100	821	PO 132
11471	402974	ST	17.0	19.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	402974C	P	18.0	137.4	116.4	3.2E-08	2.8E-08	3.1E-08	2.8E-08	3.0E-08	100	2668	PO 132
11472	402940	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402940B	P	16.7	135.6	116.2	4.2E-08	4.0E-08	4.2E-08	4.1E-08	4.1E-08	97	821	PO 132
11472	402956	ST	23.0	25.5	Dark bluish gray	Gray Till	Sandy Lean Clay	CL	402956D	P	13.5	140.6	123.9	1.3E-08	1.4E-08	1.4E-08	1.6E-08	1.4E-08	100	3485	PO 132
11473	402920	ST	6.5	8.5	Light yellowish brown	Brown Till	Lean Clay with Sand	CL	402920B	P	14.9	140.7	122.5	2.2E-08	2.2E-08	2.3E-08	2.3E-08	2.3E-08	100	1166	PO 132
11473	402928	ST	15.5	18.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	402928A	P	12.6	143.0	127.0	8.3E-09	9.6E-09	8.4E-09	8.4E-09	8.7E-09	97	2462	PO 132
11474	402892	ST	3.5	6.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402892A	P	17.8	135.8	115.3	9.9E-08	9.7E-08	9.7E-08	9.6E-08	9.7E-08	97	821	PO 132
11474	402904	ST	14.0	16.5	Greenish gray	Gray Till	Sandy Lean Clay	CL	402904A	P	12.3	144.3	128.5	1.4E-08	1.4E-08	1.5E-08	1.3E-08	1.4E-08	100	2261	PO 132
11475	403258	ST	11.0	13.5	Yellowish brown	Brown Till	Lean Clay with Sand	CL	403258D	P	20.9	130.2	107.7	1.1E-08	1.1E-08	8.2E-09	1.1E-08	1.0E-08	97	1843	PO 132
11475	403260	ST	15.5	18.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403260A	P	12.4	142.3	126.6	7.5E-09	1.0E-08	8.8E-09	8.7E-09	8.8E-09	100	2462	PO 132
11476	402989	ST	3.5	6.0	Light Olive brown	Brown Till	Lean Clay with Sand	CL	402989A	P	14.5	140.8	123.0	1.1E-08	1.1E-08	1.3E-08	1.1E-08	1.2E-08	100	821	PO 132
11476	402998	ST	14.0	16.5	Gray	Gray Till	Silty, Clayey Sand	SC-SM	402998D	P	13.7	142.9	125.7	2.0E-08	1.5E-08	2.4E-08	2.0E-08	2.0E-08	100	2260	PO 132
11477	402864	ST	3.5	6.0	Brownish yellow	Brown Till	Lean Clay with Sand	CL	402864A	P	20.1	130.8	108.9	1.7E-07	1.7E-07	1.8E-07	1.8E-07	1.8E-07	97	821	PO 132
11477	402873	ST	14.0	16.5	Dark gray	Gray Till	Sandy Lean Clay	CL	402873D	P	18.0	136.3	115.5	5.7E-08	5.5E-08	5.6E-08	5.6E-08	5.6E-08	100	2260	PO 132
11478	402792	ST	3.5	6.0	Light olive brown	Brown Till	Lean Clay with Sand	CL	402792D	P	22.1	126.6	103.6	7.9E-09	1.0E-08	9.2E-09	8.7E-09	9.0E-09	95	821	PO 132
11479	403022	ST	3.5	6.0	Yellowish brown	Brown Till	Sandy Lean Clay	CL	403022A	P	16.6	134.4	115.6	3.1E-07	2.9E-07	3.2E-07	3.3E-07	3.1E-07	93	749	PO 132
11479	403034	ST	18.5	21.0	Greenish gray	Gray Till	Sandy Lean Clay	CL	403034C	P	15.4	136.1	117.9	1.2E-08	1.3E-08	1.3E-08	1.3E-08	1.3E-08	98	2880	PO 132
11480	402773	ST	9.5	12.0	Yellowish brown	Brown Till	Lean Clay with Sand	CL	402773A	P	12.2	135.8	121.1	2.5E-08	2.9E-08	2.7E-08	2.8E-08	2.7E-08	80	1642	PO 132
11480	402777	ST	14.0	16.5	Gray	Gray Till	Lean Clay with Sand	CL	402777A	P	12.9	143.3	127.0	1.7E-08	1.8E-08	1.7E-08	1.7E-08	1.7E-08	100	2260	PO 132
11481	403204	ST	6.5	9.0	Yellowish brown	Brown Till	Gravelly Lean Clay with Sand	CL	403204B	P	12.8	141.1	125.1	1.7E-08	1.8E-08	1.6E-08	1.6E-08	1.7E-08	97	1238	PO 132
11481	403214	ST	20.0	22.0	Dark greenish gray	Gray Till	Sandy Lean Clay	CL	403214A	P	12.9	144.1	127.6	2.4E-08	2.6E-08	2.3E-08	2.2E-08	2.4E-08	100	3010	PO 132
G2-121	404814	ST	12.5	14.5	Greenish Gray	Gray Till	Sandy Lean Clay	CL	404814A	P	11.0	145.5	131.1	7.7E-09	7.7E-09	7.7E-09	7.7E-09	7.7E-09	96	2088	PO 140
G2-121	404817	ST	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404817B	P	11.1	145.1	130.6	1.0E-08	8.3E-09	1.0E-08	1.0E-08	9.6E-09	87	2808	PO 140
G2-123	404800	ST	12.5	14.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404800B	P	10.7	141.5	127.7	3.5E-08	3.5E-08	3.4E-08	3.6E-08	3.5E-08	82	2088	PO 140
G2-126	404778	ST	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404778B	P	13.0	142.1	125.8	1.2E-08	1.1E-08	1.2E-08	1.2E-08	1.2E-08	99	3888	PO 140
G2-127	404763	ST	28.0	30.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	404763B	P	13.2	142.1	125.5	8.3E-09	9.5E-09	9.5E-09	9.6E-09	9.2E-09	100	4320	PO 140
G2-132	405111	ST	20.0	22.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	405111A	P	13.9	141.2	124.0	2.5E-08	2.3E-08	2.7E-08	2.5E-08	2.5E-08	99	3168	PO 140
G2-133	405061	DEN	17.5	19.5	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	405061A	P	13.3	143.0	126.2	1.8E-08	1.7E-08	1.7E-08	1.7E-08	1.7E-08	98	2808	PO 140
G2-133	405065	DEN	25.0	27.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	405065A	P	14.4	141.5	123.7	1.2E-08	1.3E-08	1.3E-08	1.2E-08	1.3E-08	100	3888	PO 140
G2-203	G2-203 / 8	ST	17.5	19.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	8 B	P	16.7	138.6	118.8	1.6E-08	1.6E-08	1.5E-08	1.6E-08	1.6E-08	100	2275	PO 101
G2-204	G2-204 / 10	ST	22.5	24.5	Gray	Gray Till	Sandy Lean Clay	CL	10 B	P	12.1	144.3	128.7	8.3E-09	6.2E-09	6.3E-09	6.3E-09	6.8E-09	96	2825	PO 101
G2-205	G2-205 / 2	ST	2.5	4.5	Yellowish Brown	Brown Till	Lean Clay	CL	2 B	P	11.3	138.3	124.2	7.4E-08	7.4E-08	7.3E-08	7.8E-08	7.5E-08	87	576	PO 101
G2-206	G2-206 / 4	ST	7.5	9.5	Yellowish Brown	Brown Till	Sandy Lean Clay	CL	4 A	P	13.7	138.5	121.8	9.2E-09	9.5E-09	9.3E-09	9.4E-09	9.4E-09	92	1235	PO 101

Notes:

1. Sample Type:
   - ST — Shelby Tube Sample (ASTM D 1587)
   - DEN — Denison Core Barrel Sample
2. Test Type:
   - P — Triaxial, Back-Pressure Permeability (ASTM D 5084)
3. Confining Pressure: Approximately 1 psi per foot of bottom depth was used to calculate the appropriate confining pressure.
4. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-7 - Summary of Index Properties and Standard Compaction Tests of Bulk Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	General Stratum	USCS Group Name	USCS Group Symbol	Natural Moisture Content	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size: Gravel (%)	Sand (%)	Silt (.002mm) (%)	Clay (.002mm) (%)	Silt (%)	Clay (%)	Specific Gravity	Compaction Method	Opt. Moisture Content (%)	Maximum Dry Density (pcf)	Data Source
11468	403103	Bulk	2.0	6.5	Brown Till	Lean clay with sand	CL	19.0	45.3	16.2	29.1	9.5	14.3	46.2	30.0	39.2	37.0	2.75	Standard	16.7	110.5	PO 132
11468	403104	Bulk	9.0	13.0	Brown Till	Lean clay with sand	CL	14.1	30.8	14.1	16.7	0.0	29.3	47.7	23.0	41.7	29.0	2.78	Standard	11.6	125.0	PO 132
11469	402824	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	15.9	36.1	15.1	21.0	5.6	21.6	46.8	26.0	37.8	35.0	2.70	Standard	13.9	118.5	PO 132
11469	402828	Bulk	7.5	12.0	Brown Till	Lean clay with sand	CL	13.1	29.4	13.0	16.4	3.6	24.8	46.6	25.0	39.6	32.0	2.69	Standard	11.3	123.7	PO 132
11470B	403169-1	Bulk	3.5	7.5	Brown Till	Sandy silt	ML	16.8	17.7	15.7	2.0	6.9	37.2	47.9	8.0	45.9	10.0	2.70	Standard	11.1	125.0	PO 132
11470B	403170-1	Bulk	7.5	12.0	Brown Till	Sandy silt	ML	13.7	17.3	16.7	0.6	1.5	32.5	57.0	9.0	54.0	12.0	2.72	Standard	11.4	124.0	PO 132
11471	402966	Bulk	3.0	7.5	Brown Till	Fat clay	CH	24.9	50.5	19.3	31.2	0.0	3.9	65.1	31.0	57.1	39.0	2.72	Standard	19.3	105.6	PO 132
11471	402978	Bulk	7.5	10.5	Brown Till	Lean clay	CL	24.0	43.0	21.8	21.2	0.0	4.0	69.0	27.0	64.0	32.0	2.71	Standard	17.4	110.6	PO 132
11472	402958	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	15.5	30.9	14.0	16.9	3.1	20.1	48.8	28.0	39.8	37.0	2.74	Standard	14.4	119.0	PO 132
11472	402959	Bulk	9.0	12.0	Brown Till	Sandy lean clay	CL	10.5	28.7	13.8	14.9	5.8	33.6	37.6	23.0	31.6	29.0	2.69	Standard	12.0	124.9	PO 132
11473	402923	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	14.9	35.4	15.8	19.6	0.9	16.2	53.9	29.0	45.9	37.0	2.76	Standard	15.1	116.7	PO 132
11473	402925	Bulk	7.5	12.0	Brown Till	Lean clay with sand	CL	13.3	31.0	14.8	16.2	2.1	21.0	48.9	28.0	38.9	38.0	2.76	Standard	13.7	120.6	PO 132
11474	402896	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	17.2	28.1	16.2	11.9	1.1	17.4	58.5	23.0	53.5	28.0	2.79	Standard	13.7	119.2	PO 132
11474	402901	Bulk	7.5	12.0	Brown Till	Lean clay with sand	CL	12.6	26.2	13.8	12.4	2.4	21.4	54.2	22.0	47.2	29.0	2.76	Standard	12.8	122.6	PO 132
11475	403264	Bulk	4.5	8.5	Fill	Lean clay with sand	CL	23.1	42.8	15.8	27.0	0.4	15.1	54.5	30.0	46.5	38.0	2.71	Standard	18.1	108.3	PO 132
11476	402993	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	14.7	33.0	14.8	18.2	5.0	17.6	48.4	29.0	40.4	37.0	2.72	Half Std.	15.2	113.3	PO 132
11476	402993	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	14.7	33.0	14.8	18.2	5.0	17.6	48.4	29.0	40.4	37.0	2.72	Standard	14.6	117.4	PO 132
11476	403010	Bulk	12.0	15.0	Gray Till	Lean clay with sand	CL	14.1	20.7	12.7	8.0	0.3	26.7	53.0	20.0	43.0	30.0	2.75	Standard	10.5	127.3	PO 132
11477	402866	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	21.3	42.2	16.6	25.6	0.4	19.3	49.3	31.0	41.3	39.0	2.79	Standard	14.6	116.0	PO 132
11477	402874	Bulk	14.0	18.0	Gray Till	Sandy lean clay	CL	15.1	22.7	14.5	8.2	2.7	39.0	44.3	14.0	40.3	18.0	2.72	Standard	10.5	128.4	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	20.9	35.3	16.6	18.7	3.5	22.1	46.4	28.0	39.4	35.0	2.71	Standard	14.7	116.5	PO 132
11478	402813	Bulk	7.5	10.0	Brown Till	Sandy lean clay	CL	14.1	26.6	14.8	11.8	3.6	27.7	45.7	23.0	38.7	30.0	2.71	Standard	12.7	122.6	PO 132
11479	403048	Bulk	3.5	7.5	Brown Till	Sandy lean clay	CL	14.4	28.8	14.1	14.7	3.2	32.8	44.0	20.0	37.0	27.0	2.75	Standard	11.8	123.3	PO 132
11479	403049	Bulk	7.5	10.5	Brown Till	Sandy lean clay	CL	NA	25.2	14.9	10.3	7.1	28.7	43.2	21.0	36.2	28.0	2.75	Half Std.	13.0	119.5	PO 132
11480	402771	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	21.3	38.5	15.8	22.7	1.5	15.7	51.8	31.0	43.8	39.0	2.78	Standard	15.2	113.8	PO 132
11480	402774	Bulk	7.5	12.0	Brown Till	Lean clay with sand	CL	14.8	27.2	14.4	12.8	0.5	20.7	54.8	24.0	48.8	30.0	2.76	Standard	12.5	123.5	PO 132
11481	403230	Bulk	3.5	7.5	Brown Till	Sandy lean clay with gravel	CL	14.7	30.7	14.5	16.2	16.6	21.6	40.8	21.0	33.8	28.0	2.74	Standard	13.4	120.2	PO 132
11481	403231	Bulk	13.5	18.5	Gray Till	Lean clay with sand	CL	11.8	24.9	12.8	12.1	1.3	28.1	48.6	22.0	40.6	30.0	2.69	Half Std.	12.5	122.2	PO 132
G2-SB-1	404608	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	29.3	48.9	18.6	30.3	1.0	6.9	60.1	32.0	50.1	42.0	2.73	Standard	17.5	104.8	PO 140
G2-SB-2	404603	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	28.6	41.0	18.1	22.8	0.1	7.7	63.2	29.0	54.2	38.0	2.69	Standard	17.0	107.5	PO 140
G2-SB-3	404591	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	27.1	46.1	17.6	28.5	0.0	4.4	65.6	30.0	57.6	38.0	2.67	Standard	17.8	105.8	PO 140
G2-SB-4	404615	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	21.0	47.6	17.8	29.8	5.5	10.3	52.2	32.0	44.2	40.0	2.70	Standard	17.2	107.5	PO 140
G2-SB-2,3,4,6	404617	Bulk	0.0	1.5	Top Soil	Lean Clay	CL	23.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.61	Standard	17.7	105.6	PO 140
G2-SB-5	404627	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	21.0	49.7	18.8	30.9	1.3	8.8	55.9	34.0	47.9	42.0	2.71	Standard	18.2	106.8	PO 140
G2-SB-6	404595	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.0	36.5	19.6	16.9	0.0	6.8	70.2	23.0	61.2	32.0	2.66	Standard	17.3	106.3	PO 140
G2-SB-7	404632	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	20.6	45.1	17.6	27.5	2.1	9.9	56.0	32.0	47.0	41.0	2.72	Standard	18.5	109.6	PO 140
G2-SB-8	404621	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	23.5	42.0	17.1	24.9	0.3	9.4	59.3	31.0	50.3	40.0	2.74	Standard	17.5	109.7	PO 140
G2-SB-9	404587	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.3	48.4	18.6	29.8	0.4	8.1	58.5	33.0	49.5	42.0	NA	Standard	19.2	107.2	PO 140
G2-SB-10	404637	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	19.1	46.5	17.2	29.3	3.0	12.4	51.6	33.0	42.6	42.0	2.77	Standard	17.1	109.9	PO 140
G2-SB-11	404642	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	15.1	29.1	16.3	12.8	5.8	16.6	57.6	20.0	47.6	30.0	2.77	Standard	14.3	119.0	PO 140
G2-SB-8,9,10,11	404644	Bulk	0.0	1.5	Top Soil	Lean Clay	CL	33.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.67	Standard	19.3	105.3	PO 140
G2-SB-12	404599	Bulk	1.5	4.2	Brown Till	Fat Clay	CH	21.0	50.4	19.1	31.3	0.4	10.4	51.2	38.0	42.2	47.0	2.73	Standard	18.1	106.1	PO 140
G2-SB-13	404583	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	24.0	46.0	17.2	28.9	1.5	11.9	52.6	34.0	44.6	42.0	NA	Standard	16.6	112.1	PO 140
G2-SB-14	404578	Bulk	1.5	5.0	Brown Till	Fat Clay	CH	20.9	51.5	18.2	33.3	1.2	10.5	52.3	36.0	44.3	44.0	NA	Standard	18.7	107.1	PO 140
G2-SB-15	404649	Bulk	1.0	2.0	Brown Till	Lean Clay	CL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Standard	21.4	101.0	PO 140
G2-SB-16	404650	Bulk	1.0	2.0	Brown Till	Lean Clay	CL	24.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Standard	20.9	103.9	PO 140
G2-SB-17	405366	Bulk	1.0	2.0	Brown Till	Lean Clay	CL	17.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Standard	19.3	109.1	PO 140
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	NA	27.7	13.2	14.5	3.0	27.0			40.0	30.0	2.80	Standard	12.3	122.3	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	NA	27.6	14.1	13.5	3.0	22.0			44.0	31.0	2.76	Standard	12.4	122.3	PO 101
G2-201-204	G2-201-204	Bulk	0.0	24.5	Br and Gr Till	Lean Clay with Sand	CL	NA	27.0	15.0	12.0	3.0	25.0			44.0	28.0	2.79	Standard	12.0	122.7	PO 101
G2-205-208	G2-205-208	Bulk	0.0	24.5	Br and Gr Till	Sandy Lean Clay	CL	NA	27.0	14.0	13.0	3.0	27.0			42.0	28.0	2.81	Standard	12.3	122.5	PO 101

Notes:

1. Sample Type: Bulk — Bulk sample
2. Compaction Method: Standard — Standard Proctor Compactive Effort (ASTM D 698, Method A)
3. Clay size particles defined as those smaller than 0.005 mm (Reference: ASTM D 422)
4. Natural Moisture Content: Moisture contents shown for PO-132 bulk samples are average values from tests on shelby tubes taken at or near the bulk sample depth interval. Moisture contents shown for PO-140 bulk sample are moisture contents of the sample.
5. NA — Not available
6. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

Table G-7A - Summary of Index Properties and Modified Compaction Tests of Bulk Samples

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	General Stratum	USCS Group Name	USCS Group Symbol	Natural Moisture Content	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Grain Size Gravel (%)	Grain Size Sand (%)	Grain Size Silt (%)	Grain Size Clay (%)	Specific Gravity	Compaction Method	Opt. Moisture Content (%)	Maximum Dry Density (pcf)	Data Source
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	NA	27.7	13.2	14.5	3.0	27.0	40.0	30.0	2.80	Modified	10.3	133.6	PO 101

Notes:

1. Sample Type: Bulk — Bulk sample
2. Compaction Method: Modified — Modified Proctor Compactive Effort (ASTM D 1557, Method A)
3. Clay size particles defined as those smaller than 0.005 mm (Reference: ASTM D 422)
4. NA — Not available
5. Data Source: PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-8 - Summary of Consolidation Tests, Remolded Specimens

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Test Type	Initial Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	Percent Saturation (%)	Coefficient of Consolidation (Cv) Square inch/minute, @ t90 Loading 0.8 (tsf)	1.6 (tsf)	3.2 (tsf)	6.4 (tsf)	Initial Void Ratio	Compression Index (Cc)	Recompression Index (Cr)	Data Source
G2-SB-4	404615	Bulk	1.5	5.0	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	CONr	21.5	123.8	101.9	89	0.06	0.06	0.06	* 0.01	0.65	0.211	0.032	PO 140
G2-SB-7	404632	Bulk	1.5	5.0	Olive Brown	Brown Till	Lean Clay	CL	CONr	22.7	127.4	103.8	97	0.08	0.05	0.05	0.03	0.64	0.197	0.037	PO 140
G2-124	405004	ST	10.0	12.0	Olive Brown	Brown Till	Lean Clay	CL	CONr	16.2	136.1	117.1	98	0.14	0.10	0.23	0.20	0.45	0.107	0.036	PO 140
G2-126	404773	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay with Gravel	CL	CONr	14.3	136.7	119.6	95	0.14	0.09	0.12	0.08	0.40	0.112	0.007	PO 140
G2-130	405080	ST	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	CONr	12.9	136.2	120.6	81	0.04	0.08	0.02	0.02	0.44	0.096	0.010	PO 140
G2-SB-1	404608	Bulk	1.5	5.0	Brown, Yellowish Brown	Brown Till	Lean Clay	CL	$CONr_{85}$	16.9	104.6	89.5	51	0.06	0.04	0.04	0.03	0.90	0.277	0.039	PO 140
G2-SB-4	404615	Bulk	1.5	5.0	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	$CONr_{85}$	17.6	107.0	91.0	56	0.15	0.07	0.03	* 0.02	0.85	0.218	0.032	PO 140
G2-SB-2,3,4,6	404617	Bulk	0.0	1.5	Dark Yellowish Brown	Top Soil	NA	NA	$CONr_{85}$	17.4	105.6	89.9	56	0.04	0.09	0.06	0.06	0.81	0.217	0.030	PO 140
G2-SB-7	404632	Bulk	1.5	5.0	Olive Brown	Brown Till	Lean Clay	CL	$CONr_{85}$	18.5	110.2	93.0	61	0.09	0.05	0.03	0.01	0.83	0.216	0.047	PO 140
G2-SB-11	404642	Bulk	1.5	5.0	Brown	Brown Till	Lean Clay with Sand	CL	$CONr_{85}$	14.0	115.5	101.3	55	0.07	0.07	0.04	0.03	0.71	0.156	0.023	PO 140
G2-SB-8,9,10,11	404644	Bulk	0.0	1.5	Dark Yellowish Brown	Top Soil	NA	NA	$CONr_{85}$	19.6	106.8	89.3	60	0.12	0.04	0.03	0.01	0.87	0.233	0.040	PO 140
G2-120	405124	ST	5.0	7.0	Olive Brown	Brown Till	Sandy Lean Clay	CL	$CONr_{85}$	13.3	115.1	101.6	54	0.07	0.05	0.05	0.06	0.67	0.666	0.007	PO 140
G2-124	405004	ST	10.0	12.0	Olive Brown	Brown Till	Lean Clay	CL	$CONr_{85}$	12.3	117.6	104.8	54	0.08	0.08	0.05	0.04	0.62	0.175	0.038	PO 140
G2-126	404773	ST	15.0	17.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay with Gravel	CL	$CONr_{85}$	10.0	118.4	107.6	48	0.04	0.03	0.07	0.02	0.56	0.164	0.018	PO 140
G2-128	405046	DEN	12.5	14.5	Light Olive Brown	Brown Till	Clayey Gravel with Sand	GC	$CONr_{85}$	12.5	117.5	104.5	54	0.05	0.04	0.02	0.02	0.63	0.152	0.024	PO 140
G2-130	405080	ST	15.0	17.0	Dark Gray	Gray Till	Sandy Lean Clay	CL	$CONr_{85}$	9.3	118.3	108.3	42	0.05	0.04	0.05	0.04	0.61	0.128	0.016	PO 140

Notes:

1. Sample Type: ST Shelby Tube Sample (ASTM D 1587)
   DEN Dennison Core Barrel Sample
   Bulk Bulk samples dug from test excavation by shovel

2. Test Type: CONr Consolidation with time readings. ASTM D2435, remolded specimen with 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D698
   $CONr_{85}$ Consolidation with time readings. ASTM D2435, remolded specimen with 85 percent relative compaction at moisture content at or near optimum in accordance with ASTM D698

3. * Indicates loading of 9.6 tsf

4. NA - Not Available

5. Data Source: PO 140 Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads

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Table G-9 - Summary of Mohr Circle Constructions from Unconsolidated, Undrained Triaxial Compression Tests, Remolded Specimens

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Test Type	Confining Pressure (psf)	Total Cohesion (psf)	Total Friction Angle (degrees)	Testing Condition	Data Source
G2-122	404824	ST	10.0	12.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	UU_r	1728	755	0	Saturated	PO 140
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	UU_r	1368	981	0	Saturated	PO 140
G2-131	404704	ST	7.5	9.5	Yellowish Brown	Brown Till	Lean Clay with Sand	CL	UU_r	1368	754	0	Saturated	PO 140
G2-132	405105	DEN	10.0	12.0	Gray	Gray Till	Lean Clay with Sand	CL	UU_r	1728	864	0	Saturated	PO 140
G2-134	405140	DEN	12.0	14.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	UU_r	2016	647	0	Saturated	PO 140
G2-122	404824	ST	10.0	12.0	Light Olive Brown	Brown Till	Sandy Lean Clay	CL	UU_{r85}	1728	194	0	Saturated	PO 140
G2-127	404751	ST	7.5	9.5	Light Olive Brown	Brown Till	Lean Clay with Sand	CL	UU_{r85}	1368	202	0	Saturated	PO 140
G2-134	405140	DEN	12.0	14.0	Dark Greenish Gray	Gray Till	Sandy Lean Clay	CL	UU_{r85}	2016	188	0	Saturated	PO 140

Notes:

1. Sample Type
   - ST — Shelby Tube
   - DEN — Denison Core Barrel Sample

2. Test Type
   - UU_r — Unconsolidated, Undrained Triaxial Compression, ASTM D 2850, remolded specimen with 95 percent relative compaction at moisture content wet of optimum
   - UU_{r85} — Unconsolidated, Undrained Triaxial Compression, ASTM D 2850, remolded specimen with 85 percent relative compaction at or near optimum moisture content

3. Data Source: PO 140 Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.

Table G-10 - Summary of Mohr Circle Constructions from Consolidated, Undrained Triaxial Compression Tests, Remolded Specimens

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	General Stratum	USCS Group Name	USCS Group Symbol	Compaction Method	Opt. Moisture Content (%)	Maximum Dry Density (pcf)	Type Test	Average Pre-Test Moisture (%)	Average Pre-Test Dry Density (pcf)	Effective Cohesion (psf)	Effective Friction Angle (degrees)	Total Cohesion (psf)	Total Friction Angle (degrees)	Data Source
11468	403103	Bulk	2.0	6.5	Brown Till	Lean clay with sand	CL	Standard	16.7	110.5	$CU_{r\text{-}opt}$	16.0	106.0	325	29	300	16	PO 132
11472	402959	Bulk	9.0	12.0	Brown Till	Sandy lean clay	CL	Standard	12.0	124.9	$CU_{r\text{-}opt}$	11.6	118.8	100	29	0	17	PO 132
11474	402896	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	Standard	13.7	119.2	$CU_{r\text{-}opt}$	12.8	113.6	200	30	0	19	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	Standard	14.7	116.5	$CU_{r\text{-}opt}$	13.9	111.3	400	23	300	15	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	Standard	14.7	116.5	$CU_{r\text{-}dry}$	11.2	110.7	175	28	125	16	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	Standard	14.7	116.5	CU_{r}	18.0	110.9	250	25	325	15	PO 132
G2-125	405023	ST	2.5	4.5	Brown Till	Lean Clay	CL	Standard	14.5 (5)	118.0 (5)	CU_{r}-Stg	18.2	111.6	250	30	125	27	PO 140
G2-126	404771	ST	12.5	14.5	Gray Till	Sandy Lean Clay	CL	Standard	11.3 (5)	125.0 (5)	CU_{r}-Stg	15.1	118.1	0	32	0	19	PO 140
G2-128	405043	DEN	7.5	9.5	Brown Till	Sandy Lean Clay with Gravel	CL	Standard	12.6 (5)	123.0 (5)	CU_{r}	15.1	119.5	200	31	450	17	PO 140
G2-130	405083	ST	20.0	22.0	Gray Till	Lean Clay with Sand	CL	Standard	11.3 (5)	125.0 (5)	CU_{r}-Stg	14.9	119.4	100	32	0	22	PO 140
G2-132	405102	ST	5.0	7.0	Brown Till	Lean Clay	CL	Standard	14.5 (5)	118.0 (5)	CU_{r}-Stg	16.8	113.1	150	20	300	13	PO 140
G2-122	404827	ST	15.0	17.0	Gray Till	Lean Clay with Sand	CL	Standard	11.3 (5)	125.0 (5)	CU_{r85}	11.2	107.3	225	25	50	18	PO 140
G2-133	405053	ST	2.5	4.5	Brown Till	Lean Clay	CL	Standard	14.5 (5)	118.0 (5)	CU_{r85}-Stg	15.8	98.5	350	29	300	17	PO 140
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	Standard	12.3	122.3	$CU_{r\text{-}opt}$	12.1	117.1	150	25	100	15	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	Standard	12.4	122.3	$CU_{r\text{-}opt}$	12.0	118.4	300	21	250	13	PO 101

Notes:

1. Sample Type:
   - ST — Shelby Tube Sample (ASTM D 1587)
   - DEN — Denison Core Barrel Sample
   - Bulk — Bulk Sample of Auger Cuttings

2. Compaction Method:
   - Standard — Standard Proctor Compactive Effort (ASTM D 698, Method A)

3. Type Test:
   - $CU_{r\text{-}opt}$ — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767), 95 percent relative compaction at moisture content at or near optimum in accordance with ASTM D 698
   - $CU_{r\text{-}dry}$ — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767), 95 percent relative compaction at moisture content dry of optimum in accordance with ASTM D 698
   - CU_{r} — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767), 95 percent relative compaction at moisture content wet of optimum in accordance with ASTM D 698
   - CU_{r85} — Triaxial Shear, Consolidated, Undrained with Pore Pressure Measurements (ASTM D 4767), 85 percent relative compaction at moisture content at or near optimum in accordance with ASTM D 698
   - Stg — Staged test on one test specimen

4. Average Pre-test Moisture Content and Dry Density are average values of three test specimens, except for staged tests.

5. Optimum moisture content and maximum dry density data listed are based on compaction data for FEMP soils from prior testing (PO 132). Compaction tests were not performed directly on soil from these samples.

6. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-11 - Summary of Laboratory Permeability Tests, Remolded Specimens

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	General Stratum	USCS Group Name	USCS Group Symbol	Natural Moisture Content	Compaction Method	Opt. Moisture Content (%)	Maximum Dry Density (pcf)	Test Type	Confining Pressure (psf)	Target Remold Conditions	Pre-Test Moisture (%)	Pre-Test Dry Density (pcf)	Percent Wet of Optimum	Percent Compaction	Coeff. of Perm (last 4 determinations) k1 (cm/sec)	k2 (cm/sec)	k3 (cm/sec)	k4 (cm/sec)	Average Coeff. of Permeability (cm/sec)	Data Source
11468	403103	Bulk	2.0	6.5	Brown Till	Lean clay with sand	CL	19.0	Standard	16.7	110.5	P_r	1440	Note 4a.	19.9	106.3	3.2	96.2	2.8E-08	3.5E-08	3.3E-08	3.3E-08	3.2E-08	PO 132
11469	402824	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	15.9	Standard	13.9	118.5	P_r	1440	Note 4a.	17.1	113.2	3.2	95.5	2.6E-08	2.7E-08	2.4E-08	2.4E-08	2.5E-08	PO 132
11470B	403169-1	Bulk	3.5	7.5	Brown Till	Sandy silt	ML	16.8	Standard	11.1	125.0	P_r	1440	Note 4a.	14.5	119.5	3.4	95.6	4.6E-07	4.2E-07	4.2E-07	4.6E-07	4.4E-07	PO 132
11471	402966	Bulk	3.0	7.5	Brown Till	Fat clay	CH	24.9	Standard	19.3	105.6	P_r	1440	Note 4a.	22.6	101.4	3.3	96.0	2.5E-08	2.3E-08	2.3E-08	2.3E-08	2.4E-08	PO 132
11472	402958	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	15.5	Standard	14.4	119.0	P_r	1440	Note 4a.	17.8	112.9	3.4	94.9	1.5E-08	1.7E-08	1.7E-08	1.6E-08	1.6E-08	PO 132
11473	402923	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	14.9	Standard	15.1	116.7	P_r	1440	Note 4a.	18.2	111.3	3.1	95.4	1.2E-08	1.5E-08	1.5E-08	1.5E-08	1.4E-08	PO 132
11474	402896	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	17.2	Standard	13.7	119.2	P_r	1440	Note 4a.	16.5	114.3	2.8	95.9	3.5E-08	3.6E-08	3.7E-08	3.5E-08	3.6E-08	PO 132
11475	403264	Bulk	4.5	8.5	Fill	Lean clay with sand	CL	23.1	Standard	18.1	108.3	P_r	1440	Note 4a.	21.3	103.8	3.2	95.8	3.1E-08	2.9E-08	2.9E-08	2.9E-08	3.0E-08	PO 132
11476	402993	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	14.7	Standard	14.6	117.4	P_r	1440	Note 4a.	17.5	112.6	2.9	95.9	1.2E-08	1.2E-08	1.2E-08	1.2E-08	1.2E-08	PO 132
11477	402866	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	21.3	Standard	14.6	116.0	P_r	1440	Note 4a.	18.5	109.7	3.9	94.6	1.8E-08	2.2E-08	2.1E-08	2.0E-08	2.0E-08	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	20.9	Standard	14.7	116.5	P_r	1440	Note 4a.	17.8	112.0	3.1	96.1	1.1E-08	9.8E-09	9.8E-09	9.9E-09	1.0E-08	PO 132
11479	403048	Bulk	3.5	7.5	Brown Till	Sandy lean clay	CL	14.4	Standard	11.8	123.3	P_r	1440	Note 4a.	13.9	119.6	2.1	97.0	4.2E-08	4.3E-08	4.1E-08	4.2E-08	4.2E-08	PO 132
11480	402771	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	21.3	Standard	15.2	113.8	P_r	1440	Note 4a.	17.8	108.8	2.6	95.6	3.0E-08	2.7E-08	2.7E-08	2.7E-08	2.8E-08	PO 132
11481	403230	Bulk	3.5	7.5	Brown Till	Sandy lean clay with gravel	CL	14.7	Standard	13.4	120.2	P_r	1440	Note 4a.	16.5	115.2	3.1	95.8	1.2E-08	1.5E-08	1.3E-08	1.3E-08	1.3E-08	PO 132
G2-SB-1	404608	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	29.3	Standard	17.5	104.8	P_r	576	Note 4a.	21.3	100.0	3.8	95.4	3.9E-07	4.1E-07	4.1E-07	4.1E-07	4.1E-07	PO 140
G2-SB-2	404603	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	28.6	Standard	17.0	107.5	P_r	576	Note 4a.	20.8	102.5	3.8	95.3	2.9E-07	2.7E-07	2.6E-07	2.5E-07	2.7E-07	PO 140
G2-SB-3	404591	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	27.1	Standard	17.8	105.8	P_r	576	Note 4a.	21.4	101.0	3.6	95.5	1.2E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07	PO 140
G2-SB-4	404615	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	21.0	Standard	17.2	107.5	P_r	576	Note 4a.	21.1	102.4	3.9	95.3	3.5E-06	3.3E-06	3.4E-06	3.4E-06	3.4E-06	PO 140
G2-SB-5	404627	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	21.0	Standard	18.2	106.8	P_r	576	Note 4a.	22.1	101.2	3.9	94.8	5.9E-08	5.5E-08	5.3E-08	5.4E-08	5.5E-08	PO 140
G2-SB-6	404595	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.0	Standard	17.3	106.3	P_r	576	Note 4a.	21.2	101.0	3.9	95.0	4.4E-07	4.8E-07	4.2E-07	4.3E-07	4.4E-07	PO 140
G2-SB-7	404632	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	20.6	Standard	18.5	109.6	P_r	576	Note 4a.	22.3	104.4	3.8	95.3	1.4E-08	1.2E-08	1.3E-08	1.2E-08	1.3E-08	PO 140
G2-SB-8	404621	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	23.5	Standard	17.5	109.7	P_r	576	Note 4a.	21.3	104.4	3.8	95.2	2.9E-08	2.8E-08	2.6E-08	2.6E-08	2.7E-08	PO 140
G2-SB-9	404587	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.3	Standard	19.2	107.2	P_r	576	Note 4a.	23.2	101.2	4.0	94.4	2.5E-08	2.3E-08	2.3E-08	2.5E-08	2.4E-08	PO 140
G2-SB-10	404637	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	19.1	Standard	17.1	109.9	P_r	576	Note 4a.	19.9	105.7	2.8	96.2	5.9E-08	5.4E-08	5.4E-08	5.3E-08	5.5E-08	PO 140
G2-SB-11	404642	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	15.1	Standard	14.3	119.0	P_r	576	Note 4a.	18.1	112.6	3.8	94.6	4.7E-08	4.5E-08	4.8E-08	4.7E-08	4.7E-08	PO 140
G2-SB-12	404599	Bulk	1.5	4.2	Brown Till	Fat Clay	CH	21.0	Standard	18.1	106.1	P_r	576	Note 4a.	21.8	101.4	3.7	95.6	5.0E-08	4.6E-08	4.7E-08	4.8E-08	4.8E-08	PO 140
G2-SB-13	404583	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	24.0	Standard	16.6	112.1	P_r	576	Note 4a.	20.3	106.7	3.7	95.2	2.8E-08	2.3E-08	2.5E-08	2.5E-08	2.5E-08	PO 140
G2-SB-14	404578	Bulk	1.5	5.0	Brown Till	Fat Clay	CH	20.9	Standard	18.7	107.1	P_r	576	Note 4a.	22.7	101.2	4.0	94.5	2.9E-08	2.5E-08	2.6E-08	2.4E-08	2.6E-08	PO 140
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	---	Standard	12.3	122.3	P_r	1440	Note 4b.	11.7	116.3	-0.6	95.1	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.5E-06	PO 101
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	---	Modified	10.3	133.6	P_r	720	Note 4c.	10.0	131.8	-0.3	98.7	2.6E-08	2.4E-08	2.5E-08	2.5E-08	2.5E-08	PO 101
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	---	Modified	10.3	133.6	P_r	720	Note 4d.	12.1	128.4	1.8	96.1	8.6E-09	7.4E-09	8.6E-09	8.7E-09	8.3E-09	PO 101
G2-209	G2-209 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Sandy Lean Clay	CL	---	Modified	10.3	133.6	P_r	720	Note 4e.	14.9	120.9	4.6	90.5	2.0E-08	2.0E-08	1.8E-08	1.9E-08	1.9E-08	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	---	Standard	12.4	122.3	P_r	1440	Note 4b.	11.8	116.5	-0.6	95.3	2.3E-06	2.2E-06	2.1E-06	2.1E-06	2.2E-06	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	---	Standard	12.4	122.3	P_r	720	Note 4c.	12.0	120.0	-0.4	98.1	1.8E-06	1.9E-06	1.8E-06	1.9E-06	1.9E-06	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	---	Standard	12.4	122.3	P_r	720	Note 4d.	13.8	118.0	1.4	96.5	7.1E-06	6.6E-06	6.2E-06	6.1E-06	6.5E-06	PO 101
G2-210	G2-210 / Bulk	Bulk	0.0	25.0	Br and Gr Till	Lean Clay with Sand	CL	---	Standard	12.4	122.3	P_r	720	Note 4e.	16.9	113.5	4.5	92.8	3.8E-08	3.5E-08	3.5E-08	3.5E-08	3.6E-08	PO 101

Notes:

1. Sample Type: Bulk — Bulk sample

2. Compaction Method:
   - Standard — Standard Proctor Compactive Effort (ASTM D 698, Method A)
   - Modified — Modified Proctor Compactive Effort (ASTM D 1557, Method A)

3. Test Type: P_r — Triaxial, Remolded, Back-Pressure Permeability (ASTM D 5084)

4. Target Remold Conditions:
   - 4a. Minimum dry density: 95 % of the maximum Standard Proctor Dry Density; Moisture content: at or near 4 % wet of optimum moisture content
   - 4b. 95% of the maximum Standard Proctor Dry Density; Moisture content: at or near optimum moisture content
   - 4c. At or near optimum moisture content (-0.5%, +1.5%) at dry density in a band about +/-4 pcf from compaction curve dry density
   - 4d. +2% wet of optimum (+/-1%) at dry density in a band about +/-4 pcf from compaction curve dry density
   - 4e. +5% wet of optimum (+/-1%) at dry density in a band about +/-4 pcf from compaction curve dry density

5. Natural Moisture Content: Moisture contents shown for PO-132 bulk samples are average values from tests on shelby tubes taken at or near the bulk sample depth interval. Moisture contents shown for PO-140 bulk sample are moisture contents of the sample.

6. Data Source:
   - PO 132 — Disposal Facility Pre-Design Geotechnical Investigation, PARSONS Project Order 132, July 1995; corresponds to FERMCO Phase II Investigation; borings located within the proposed disposal facility foot print.
   - PO 140 — Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads
   - PO 101 — On-Site Disposal Cell, Pre-Design Activities Investigation, PARSONS Project Order 101, April and July 1994; borings located outside of proposed disposal facility footprint (south).

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Table G-11A - Summary Statistics - Remolded CL Permeability Tests

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	General Stratum	USCS Group Name	USCS Group Symbol	Natural Moisture Content	Compaction Method	Opt. Moisture Content (%)	Maximum Dry Density (pcf)	Test Type	Confining Pressure (psf)	Target Remold Conditions	Pre-Test Moisture (%)	Pre-Test Dry Density (pcf)	Percent Wet of Optimum	Percent Compaction	Coeff. of Perm (last 4 determinations) k1 (cm/sec)	k2 (cm/sec)	k3 (cm/sec)	k4 (cm/sec)	Average Coeff. of Permeability (cm/sec)	Data Source
11468	403103	Bulk	2.0	6.5	Brown Till	Lean clay with sand	CL	19.0	Standard	16.7	110.5	P_r	1440	Note 4a.	19.9	106.3	3.2	96.2	2.8E-08	3.5E-08	3.3E-08	3.3E-08	3.2E-08	PO 132
11469	402824	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	15.9	Standard	13.9	118.5	P_r	1440	Note 4a.	17.1	113.2	3.2	95.5	2.6E-08	2.7E-08	2.4E-08	2.4E-08	2.5E-08	PO 132
11480	402771	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	21.3	Standard	15.2	113.8	P_r	1440	Note 4a.	17.8	108.8	2.6	95.6	3.0E-08	2.7E-08	2.7E-08	2.7E-08	2.8E-08	PO 132
11474	402896	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	17.2	Standard	13.7	119.2	P_r	1440	Note 4a.	16.5	114.3	2.8	95.9	3.5E-08	3.6E-08	3.7E-08	3.5E-08	3.6E-08	PO 132
11473	402923	Bulk	3.0	7.5	Brown Till	Lean clay with sand	CL	14.9	Standard	15.1	116.7	P_r	1440	Note 4a.	18.2	111.3	3.1	95.4	1.2E-08	1.5E-08	1.5E-08	1.5E-08	1.4E-08	PO 132
11472	402958	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	15.5	Standard	14.4	119.0	P_r	1440	Note 4a.	17.8	112.9	3.4	94.9	1.5E-08	1.7E-08	1.7E-08	1.6E-08	1.6E-08	PO 132
11476	402993	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	14.7	Standard	14.6	117.4	P_r	1440	Note 4a.	17.5	112.6	2.9	95.9	1.2E-08	1.2E-08	1.2E-08	1.2E-08	1.2E-08	PO 132
11477	402866	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	21.3	Standard	14.6	116.0	P_r	1440	Note 4a.	18.5	109.7	3.9	94.6	1.8E-08	2.2E-08	2.1E-08	2.0E-08	2.0E-08	PO 132
11478	402796	Bulk	3.5	7.5	Brown Till	Lean clay with sand	CL	20.9	Standard	14.7	116.5	P_r	1440	Note 4a.	17.8	112.0	3.1	96.1	1.1E-08	9.8E-09	9.8E-09	9.9E-09	1.0E-08	PO 132
11479	403048	Bulk	3.5	7.5	Brown Till	Sandy lean clay	CL	14.4	Standard	11.8	123.3	P_r	1440	Note 4a.	13.9	119.6	2.1	97.0	4.2E-08	4.3E-08	4.1E-08	4.2E-08	4.2E-08	PO 132
11481	403230	Bulk	3.5	7.5	Brown Till	Sandy lean clay with gravel	CL	14.7	Standard	13.4	120.2	P_r	1440	Note 4a.	16.5	115.2	3.1	95.8	1.2E-08	1.5E-08	1.3E-08	1.3E-08	1.3E-08	PO 132
						Statistics for:	Max:	21.3		16.7	123.3				19.9	119.6	3.9	97.0					4.2E-08	
						Brown Till, CL	Min:	14.4		11.8	110.5				13.9	106.3	2.1	94.6					1.0E-08	
						Conf. Press. = 1440	Avg:	17.2		14.4	117.4				17.4	112.4	3.0	95.7					2.3E-08	
						Depth = 2 - 7.5 ft	Std. Dev.	2.8		1.2	3.4				1.5	3.5	0.5	0.7					1.1E-08	
G2-SB-8	404621	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	23.5	Standard	17.5	109.7	P_r	576	Note 4a.	21.3	104.4	3.8	95.2	2.9E-08	2.8E-08	2.6E-08	2.6E-08	2.7E-08	PO 140
G2-SB-13	404583	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	24.0	Standard	16.6	112.1	P_r	576	Note 4a.	20.3	106.7	3.7	95.2	2.8E-08	2.3E-08	2.5E-08	2.5E-08	2.5E-08	PO 140
G2-SB-9	404587	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.3	Standard	19.2	107.2	P_r	576	Note 4a.	23.2	101.2	4.0	94.4	2.5E-08	2.3E-08	2.3E-08	2.5E-08	2.4E-08	PO 140
G2-SB-1	404608	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	29.3	Standard	17.5	104.8	P_r	576	Note 4a.	21.3	100.0	3.8	95.4	3.9E-07	4.1E-07	4.1E-07	4.1E-07	4.1E-07	PO 140
G2-SB-2	404603	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	28.6	Standard	17.0	107.5	P_r	576	Note 4a.	20.8	102.5	3.8	95.3	2.9E-07	2.7E-07	2.6E-07	2.5E-07	2.7E-07	PO 140
G2-SB-6	404595	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	22.0	Standard	17.3	106.3	P_r	576	Note 4a.	21.2	101.0	3.9	95.0	4.4E-07	4.8E-07	4.2E-07	4.3E-07	4.4E-07	PO 140
G2-SB-5	404627	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	21.0	Standard	18.2	106.8	P_r	576	Note 4a.	22.1	101.2	3.9	94.8	5.9E-08	5.5E-08	5.3E-08	5.4E-08	5.5E-08	PO 140
G2-SB-3	404591	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	27.1	Standard	17.8	105.8	P_r	576	Note 4a.	21.4	101.0	3.6	95.5	1.2E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07	PO 140
G2-SB-7	404632	Bulk	1.5	5.0	Brown Till	Lean Clay	CL	20.6	Standard	18.5	109.6	P_r	576	Note 4a.	22.3	104.4	3.8	95.3	1.4E-08	1.2E-08	1.3E-08	1.2E-08	1.3E-08	PO 140
G2-SB-10	404637	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	19.1	Standard	17.1	109.9	P_r	576	Note 4a.	19.9	105.7	2.8	96.2	5.9E-08	5.4E-08	5.4E-08	5.3E-08	5.5E-08	PO 140
G2-SB-11	404642	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	15.1	Standard	14.3	119.0	P_r	576	Note 4a.	18.1	112.6	3.8	94.6	4.7E-08	4.5E-08	4.8E-08	4.7E-08	4.7E-08	PO 140
G2-SB-4	404615	Bulk	1.5	5.0	Brown Till	Lean Clay with Sand	CL	21.0	Standard	17.2	107.5	P_r	576	Note 4a.	21.1	102.4	3.9	95.3	3.5E-06	3.3E-06	3.4E-06	3.4E-06	3.4E-06	PO 140
						Statistics for:	Max:	29.3		19.2	119.0				23.2	112.6	4.0	96.2					3.4E-06	
						Brown Till, CL	Min:	15.1		14.3	104.8				18.1	100.0	2.8	94.4					1.3E-08	
						Conf. Press. = 576	Avg:	22.8		17.4	108.9				21.1	103.6	3.7	95.2					4.1E-07	
						Depth = 1.5 - 5 ft	Std. Dev.	4.1		1.2	3.8				1.3	3.5	0.3	0.5					9.6E-07	

Notes:

1. Sample Type: Bulk — Bulk sample
2. Compaction Method: Standard — Standard Proctor Compactive Effort (ASTM D 698, Method A)
3. Test Type: P_r — Triaxial, Remolded, Back-Pressure Permeability (ASTM D 5084)
4. Target Remold Conditions: 4a. Minimum dry density: 95 % of the maximum Standard Proctor Dry Density; Moisture content: at or near 4 % wet of optimum moisture content
5. Natural Moisture Content: Moisture contents shown for PO-132 bulk samples are average values from tests on shelby tubes taken at or near the bulk sample depth interval. Moisture contents shown for PO-140 bulk sample are moisture contents of the sample.

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Table G-12 - Summary of Laboratory California Bearing Ratio Test Results

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color and Description (from field log)	General Stratum	Initial Dry Density (pcf)	% Maximum SP Dry Density	Initial Moisture (%)	Relation to OMC	% Swell After Soaking	Bearing Ratio Penetration 0.1 inches	Bearing Ratio Penetration 0.2 inches	Data Source
G2-SB-15	404649	Bulk	1.0	2.0	Yellowish Brown Lean Clay	Brown Till	96.0	95.0	18.5	-2.9%	3.1	2.08	2.11	PO 140
							95.6	94.7	21.9	+0.5%	1.4	3.13	3.25	PO 140
							95.8	94.9	24.7	+3.3%	0.7	3.80	3.20	PO 140
G2-SB-16	404650	Bulk	1.0	2.0	Dark Yellowish Brown Lean Clay	Brown Till	99.1	95.4	17.5	-3.4%	2.1	2.70	2.60	PO 140
							98.7	95.0	20.9	0.0%	0.8	4.40	4.10	PO 140
							98.2	94.5	24.5	+3.6%	0.3	3.30	2.80	PO 140
G2-SB-17	405366	Bulk	1.0	2.0	Dark Yellowish Brown, Yellowish Brown, Dark Grayish Brown, Light Olive Brown Lean Clay	Brown Till	104.3	95.6	15.7	-3.6%	3.1	2.25	2.25	PO 140
							104.1	95.4	18.8	-0.5%	1.0	3.80	3.70	PO 140
							104.2	95.5	21.7	+2.4%	0.9	1.95	2.11	PO 140

Notes:

1. Bearing Ratios determined by ASTM D 1883

2. SP Standard Proctor (ASTM D 698)
   OMC Optimum Moisture Content
   Bulk Bulk sample dug from test excavation by shovel

3. Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.

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Table G-13 - Summary of Corrected R - Values of Compacted Soils

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	Visual Description (from field log)	General Stratum	Corrected R-Value	Data Source
G2-SB-18	404648	Bulk	1.0	2.0	Dark Yellowish Brown	Lean Clay	Brown Till	< 5	PO 140
G2-SB-19	404647	Bulk	1.0	2.0	Dark Yellowish Brown	Lean Clay	Brown Till	< 5	PO 140
G2-SB-20	404646	Bulk	1.0	2.0	Dark Yellowish Brown	Lean Clay	Brown Till	< 5	PO 140
G2-SB-21	404645	Bulk	1.0	2.0	Olive Brown	Lean Clay	Brown Till	3	PO 140

Notes:

1. Resistance R-Value determined by "Resistance R-Value and Expansion Pressure of Compacted Soils", (ASTM D 2844-89)

2. Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.

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Boring	Sample Number	Top Depth (feet)	Bottom Depth (feet)	Moisture Content (% dry wgt.)	Total Organic Content (% dry wgt.)	Data Source
G2-SB-1	404605	0.0	0.5	42.9	7.2	PO 140
G2-SB-1	404606	0.5	1.0	28.4	4.9	PO 140
G2-SB-1	404607	1.0	1.5	24.8	5.0	PO 140
G2-SB-2	404600	0.0	0.5	41.4	7.4	PO 140
G2-SB-2	404601	0.5	1.0	16.9	2.2	PO 140
G2-SB-2	404602	1.0	1.5	19.3	4.5	PO 140
G2-SB-3	404588	0.0	0.5	31.8	5.0	PO 140
G2-SB-3	404589	0.5	1.0	20.6	2.7	PO 140
G2-SB-3	404590	1.0	1.5	21.3	2.2	PO 140
G2-SB-4	404612	0.0	0.5	21.5	4.2	PO 140
G2-SB-4	404613	0.5	1.0	18.4	3.6	PO 140
G2-SB-4	404614	1.0	1.5	19.6	2.6	PO 140
G2-SB-5	404624	0.0	0.5	23.5	4.3	PO 140
G2-SB-5	404625	0.5	1.0	21.2	4.2	PO 140
G2-SB-5	404626	1.0	1.5	21.0	4.5	PO 140
G2-SB-6	404592	0.0	0.5	26.5	4.5	PO 140
G2-SB-6	404593	0.5	1.0	18.8	2.7	PO 140
G2-SB-6	404594	1.0	1.5	19.3	2.8	PO 140
G2-SB-7	404629	0.0	0.5	33.9	4.7	PO 140
G2-SB-7	404630	0.5	1.0	23.4	2.5	PO 140
G2-SB-7	404631	1.0	1.5	24.8	3.6	PO 140
G2-SB-8	404618	0.0	0.5	23.8	4.1	PO 140
G2-SB-8	404619	0.5	1.0	21.1	2.6	PO 140
G2-SB-8	404620	1.0	1.5	21.1	4.0	PO 140
G2-SB-9	404584	0.0	0.5	22.6	5.7	PO 140
G2-SB-9	404585	0.5	1.0	19.1	2.3	PO 140
G2-SB-9	404586	1.0	1.5	19.3	2.4	PO 140
G2-SB-10	404634	0.0	0.5	31.6	5.1	PO 140
G2-SB-10	404635	0.5	1.0	24.4	2.5	PO 140
G2-SB-10	404636	1.0	1.5	25.4	3.3	PO 140
G2-SB-11	404639	0.0	0.5	20.9	2.3	PO 140
G2-SB-11	404640	0.5	1.0	24.8	2.9	PO 140
G2-SB-11	404641	1.0	1.5	23.6	2.9	PO 140
G2-SB-12	404596	0.0	0.5	23.5	3.9	PO 140
G2-SB-12	404597	0.5	1.0	17.2	2.3	PO 140
G2-SB-12	404598	1.0	1.5	17.0	1.7	PO 140
G2-SB-13	404580	0.0	0.5	29.4	5.0	PO 140
G2-SB-13	404581	0.5	1.0	24.8	3.2	PO 140
G2-SB-13	404582	1.0	1.5	26.6	5.0	PO 140
G2-SB-14	404575	0.0	0.5	22.6	4.7	PO 140
G2-SB-14	404576	0.5	1.0	18.1	4.1	PO 140
G2-SB-14	404577	1.0	1.5	22.6	5.3	PO 140

Notes:

1. Total organic content determined by ASTM D 2974.
2. Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.

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Table G-14 - Summary of Organic Content Tests

Table G-15 - Summary of Chloride and Sulfate Concentrations

Boring No.	Sample No.	Sample Type	Top Depth (feet)	Bottom Depth (feet)	Color (from field log)	General Stratum	USCS Group Name	USCS Group Symbol	Chloride (mg/Kg Dry)	Sulfate (mg/Kg Dry)	Data Source
G2-SB-1	404609	Bulk	4.5	5.0	Yellowish Brown	Brown Till	Lean Clay (4)	CL (4)	16	45	PO 140
G2-SB-2	404604	Bulk	4.5	5.0	Yellowish Brown	Brown Till	Lean Clay (4)	CL (4)	<6	40	PO 140
G2-SB-4	404616	Bulk	4.5	5.0	Olive Brown	Brown Till	Lean Clay (4)	CL (4)	16	66	PO 140
G2-SB-5	404628	Bulk	4.5	5.0	Olive Brown, Dark Yellowish Brown	Brown Till	Lean Clay (4)	CL (4)	8	100	PO 140
G2-SB-7	404633	Bulk	4.5	5.0	Olive Brown	Brown Till	Lean Clay (4)	CL (4)	16	36	PO 140
G2-SB-8	404622	Bulk	4.5	5.0	Olive Brown	Brown Till	Lean Clay (4)	CL (4)	24	45	PO 140
G2-SB-10	404638	Bulk	4.5	5.0	Light Olive Brown	Brown Till	Lean Clay with Sand (4)	CL (4)	50	150	PO 140
G2-SB-11	404643	Bulk	4.5	5.0	Brown	Brown Till	Lean Clay (4)	CL (4)	25	33	PO 140

Notes:

1. Chloride concentrations determined by EPA 9251
2. Sulfate concentrations determined by EPA 9038
3. Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.
4. Visual descriptions from boring logs

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Boring No.	Sample No.	Visual Description (from field notes)	Average Bulk Specific Gravity	Average Adsorption (%)	Data Source
IFAP	405377	12" Limestone, Angular	2.70	0.7	PO 140
IFAP	405379	12" Limestone, Angular	2.83	0.3	PO 140
AFAP	405381	3" Limestone, Angular	2.68	1.0	PO 140
AFAP	405382	3" Limestone, Angular	2.75	1.2	PO 140
AFAP	405383	3" Limestone, Angular	2.67	1.1	PO 140

Notes:

Specific gravity and average absorption determined by: Specific Gravity and Absorption of Coarse Aggregate (ASTM C 127-88)

Boring No.	Sample No.	Visual Description (from field notes)	Particle Size Fraction	Weighted Percent Loss	Observed Degradation	Data Source
AFAP	405384	3" Limestone, Angular	+3 "	0	Splitting	PO 140
			+2 "	3	Splitting	PO 140
			Total	3		
AFAP	405385	3" Limestone, Angular	+3 "	1	Splitting	PO 140
			+2 1/2 "	2	Splitting	PO 140
			+1 1/2 "	1	Splitting	PO 140
			Total	4		
AFAP	405386	3" Limestone, Angular	+2 1/2 "	4	Splitting	PO 140
			+1 1/2 "	1	Splitting	PO 140
			Total	5		

Notes:

Weighted % Loss determined by: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate (ASTM C 88-90)

Boring No.	Sample No.	Visual Description (from field notes)	Average % Soundness Loss	Observed Degradation	Data Source
IFAP	405378	12" Limestone, Angular	6.7	Flaking, splitting, crumbling	PO 140
IFAP	405380	12" Limestone, Angular	32.8	Flaking, splitting, crumbling	PO 140

Notes:

Average % Soundness Loss determined by: Soundness of Rip Rap by Use of Sodium Sulfate or Magnesium Sulfate (ASTM D 5240-92)

Data Source: PO 140

Disposal Facility Geotechnical Investigation, PARSONS Project Order 140, November 1995; corresponds to FERMCO Phase III Investigation; borings/excavations located within the proposed disposal facility foot print and along proposed haul roads.

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Table G-16 - Summary of Aggregate and Riprap Testing

FEMP

FIELD ACTIVITY LOG

20.03.08

[redacted]

BADGE NO.:	DATE:
9412	5/12/95

FIELD ACTIVITY SUBJECT:	GENERAL LOCATION / FACILITY DESCRIPTION:
Stockpiled rock sampling	Near Inactive Fly Ash pile berm

207

WEATHER CONDITIONS:	AIR TEMPERATURE:	BAROMETRIC PRESSURE (in Hg):
Fair, Calm	75°F	

TIME	DESCRIPTION OF ACTIVITY
1345	Begin collecting large rock (12"±) from stockpile #1 (see sketch
	on reverse side of this page). Rock placed in 3-10gallon cans to
	produce 30 gallons of sample per sampling location.
1400	Collect sample #2 as above
1415	Collect sample #3 as above
1430	Collect sample #4 as above
1445	Load samples into Jeep
	3-10gallons cans persample for 4 samples for a total of
	12 cans.
	NOTE:
	Sample # schedule on reverse side of this page

METER CALIBRATION

WATER QUALITY METER

MFR. NAME:	SERIAL NO.:	INITIALS:	DATE:	TIME:	STD. SOLN. MFR.:	STD. SOLN. LOT NO.:	STD. SOLN. EXP. DATE:

PHOTOIONIZATION DETECTOR

MFR. NAME:	SERIAL NO.:	INITIALS:	DATE:	TIME:	CAL. GAS MFR.:	CAL. GAS TYPE:	CAL. GAS CONC.:	ppm:	PROBE eV:

ALPHA METER		BETA GAMMA METER		CALIBRATION PROBLEMS:
MFR. NAME:	SERIAL NO.:	MFR. NAME:	SERIAL NO.:	

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	DEPARTED

FS-F-3682 (11-08-94)

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000286

Table G-16 Attachment - Riprap Sampling Field Notes

FIELD ACTIVITY LOG
(CONTINUATION PAGE)

[redacted]

BADGE NO.: 9412

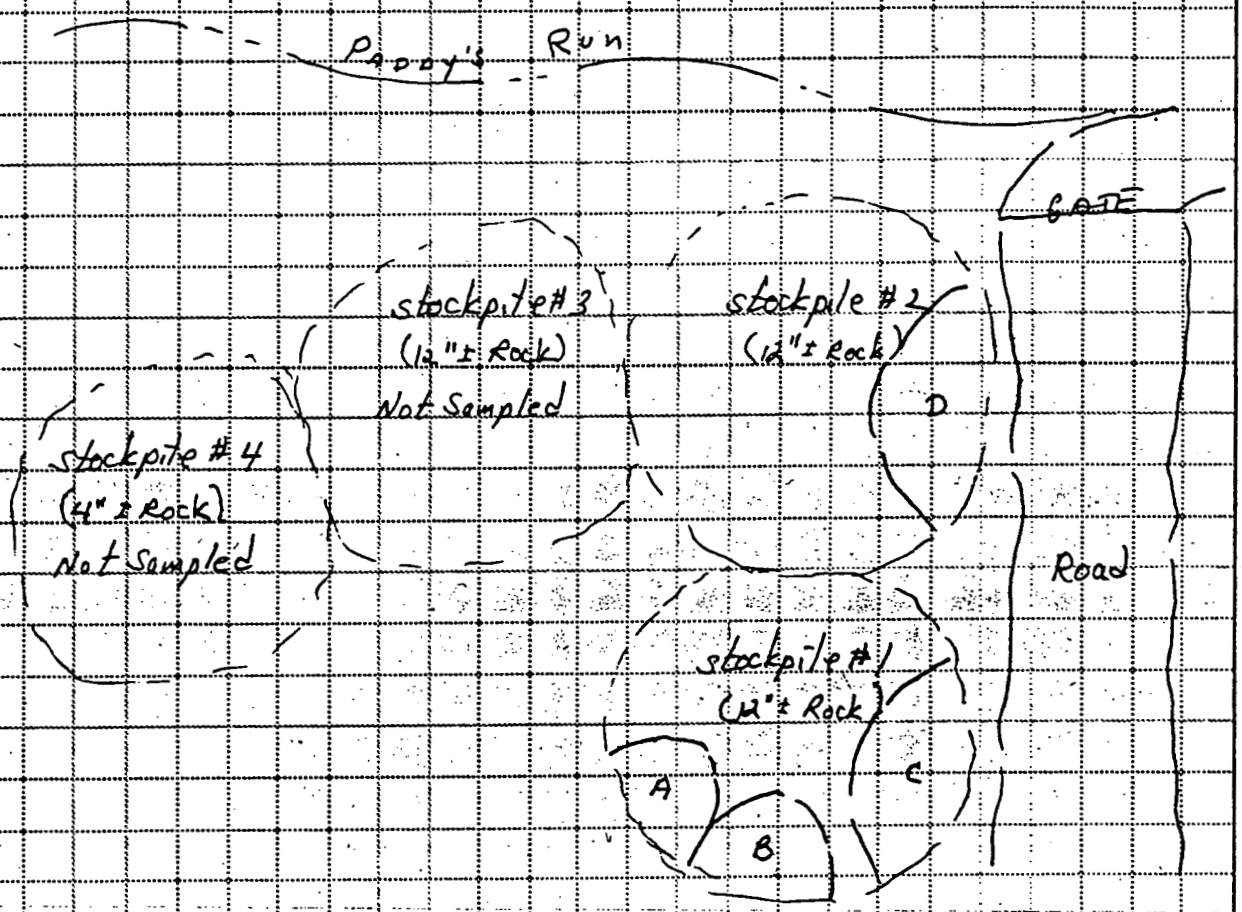
DATE: 5/12/95

FIELD ACTIVITY SUBJECT: stockpiled rock sampling

GENERAL LOCATION / FACILITY DESCRIPTION: Near inactive fly ash pile berm

TIME	DESCRIPTION OF ACTIVITY

NO SCALE SKETCH



A,B,C,D = General area of sample collection

Sample area and sample # schedule

A = 405377
B = 405378
C = 405379
D = 405380

000287

FS-F-3682-1 (11-08-94)

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Table G-16 Attachment - Riprap Sampling Field Notes (Continued)

FEMP

FIELD ACTIVITY LOG

BADGE NO.:	DATE:
9412	5/12/95

FIELD ACTIVITY SUBJECT:	GENERAL LOCATION / FACILITY DESCRIPTION:
Rock Riprap sampling	South Base of Active Fly Ash Pile

207

WEATHER CONDITIONS:	AIR TEMPERATURE:	BAROMETRIC PRESSURE (in Hg):
Fair, Calm	75°F	

TIME	DESCRIPTION OF ACTIVITY
1450	Begin sampling Rock riprap at areas A&B (see attached sketch)
1500	Begin Sampling Rock riprap at area C
	2-10gallon cans per sampling area for a total of 6 cans
	NOTE:
	Sample # schedule on reverse side of this page

METER CALIBRATION

WATER QUALITY METER

MFR. NAME:	SERIAL NO.:	INITIALS:	DATE:	TIME:	STD. SOLN. MFR.:	STD. SOLN. LOT NO.:	STD. SOLN. EXP. DATE:

PHOTOIONIZATION DETECTOR

MFR. NAME:	SERIAL NO.:	INITIALS:	DATE:	TIME:	CAL. GAS MFR.:	CAL. GAS TYPE:	CAL. GAS CONC.:	ppm:	PROBE eV:

ALPHA METER		BETA GAMMA METER		CALIBRATION PROBLEMS:
MFR. NAME:	SERIAL NO.:	MFR. NAME:	SERIAL NO.:	

VISITORS		TIME	
NAME(S)	ORGANIZATION(S)	ARRIVED	DEPARTED

000288

FS-F-3682 (11-08-94)

G:\WPSC\94-364.DRW

Table G-16 Attachment - Riprap Sampling Field Notes (Continued)

FIELD ACTIVITY LOG
(CONTINUATION PAGE)

[redacted]

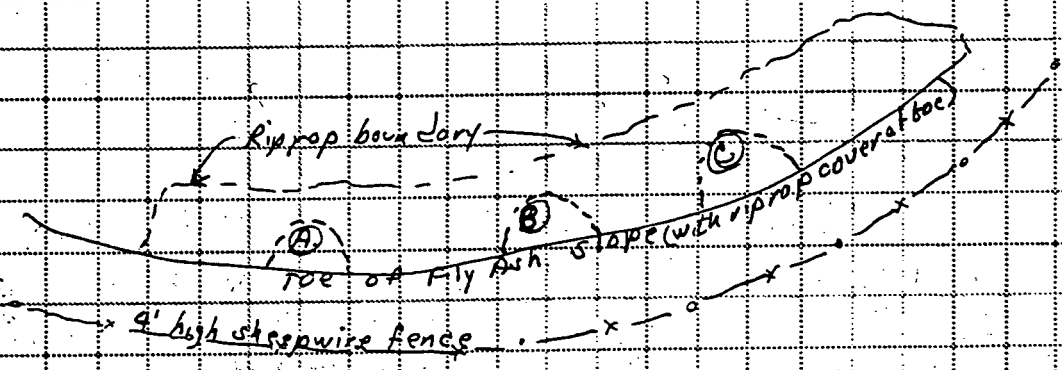
BADGE NO.: 9412

DATE: 5/12/95

FIELD ACTIVITY SUBJECT: Rock Riprap Sampling

GENERAL LOCATION / FACILITY DESCRIPTION: South Base of Active Fly Ash Pile

TIME	DESCRIPTION OF ACTIVITY
44	NO SCALE SKETCH



Sample area and sample # schedule

A = 405381, 405384

B = 405382, 405385

C = 405383, 405386

FS-F-3682-1 (11-08-94)

G:\WPSC\94-365.DRW

000289

Table G-16 Attachment - Riprap Sampling Field Notes (Continued)

H

APPENDIX H

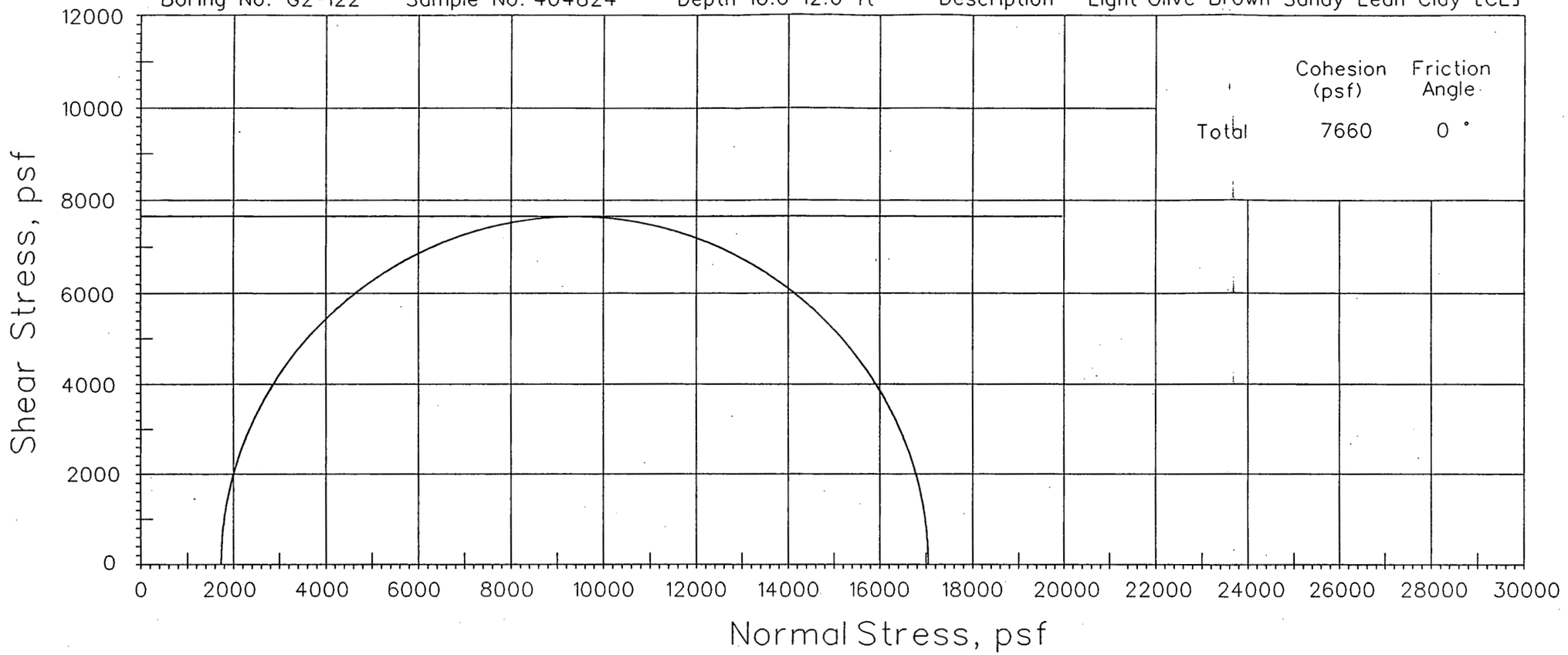
MOHR CIRCLES

UNCONSOLIDATED UNDRAINED (UU) TRIAXIAL COMPRESSION TESTS

UNDISTURBED SAMPLES

Triaxial Compression Test Report

Boring No. G2-122 Sample No. 404824 Depth 10.0-12.0 ft Description - Light Olive Brown Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

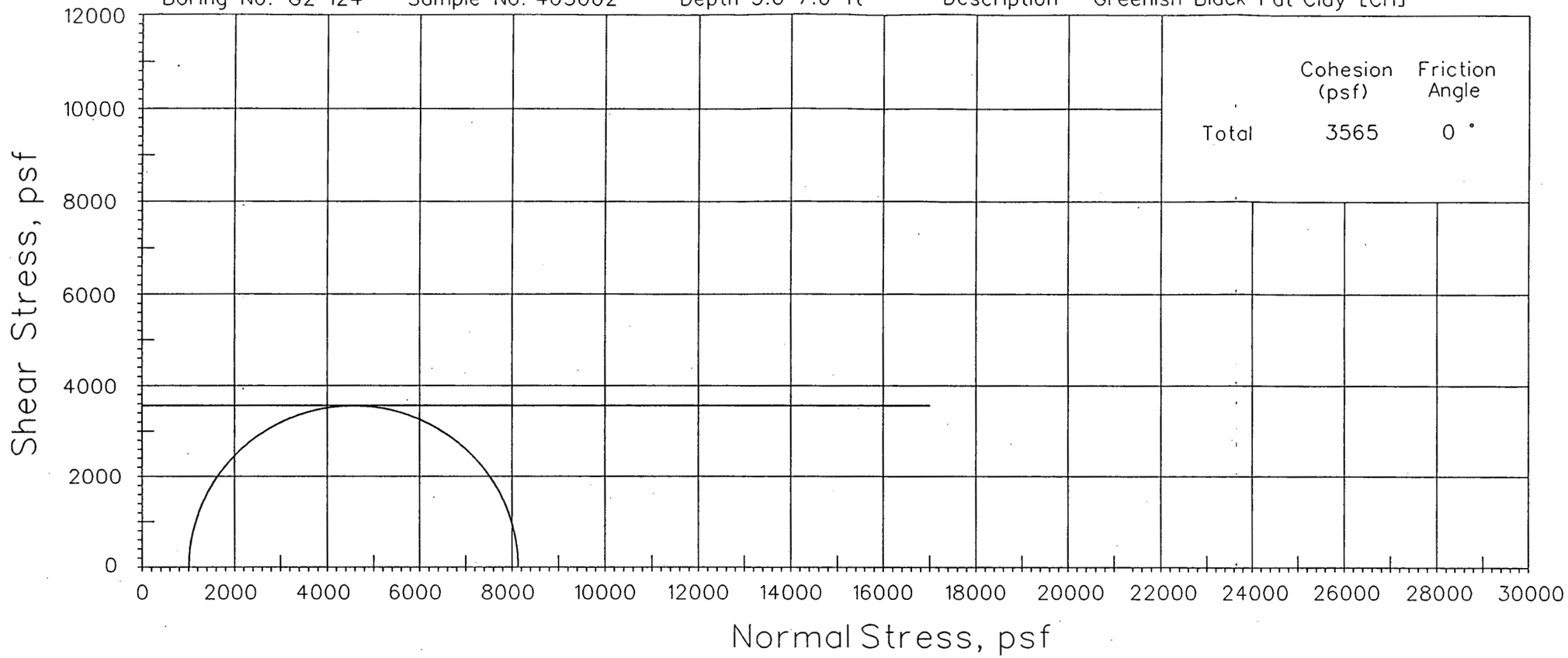
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-122	10.0-12.0	404824	13.5		141.4	124.6	15.16	15319	N/A	1728	17047	9.87

1. At Field Moisture.
2. N/A = Not Applicable

CAD FILE: SKX03816.DGN

Triaxial Compression Test Report

Boring No. G2-124 Sample No. 405002 Depth 5.0-7.0 ft Description - Greenish Black Fat Clay [CH]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

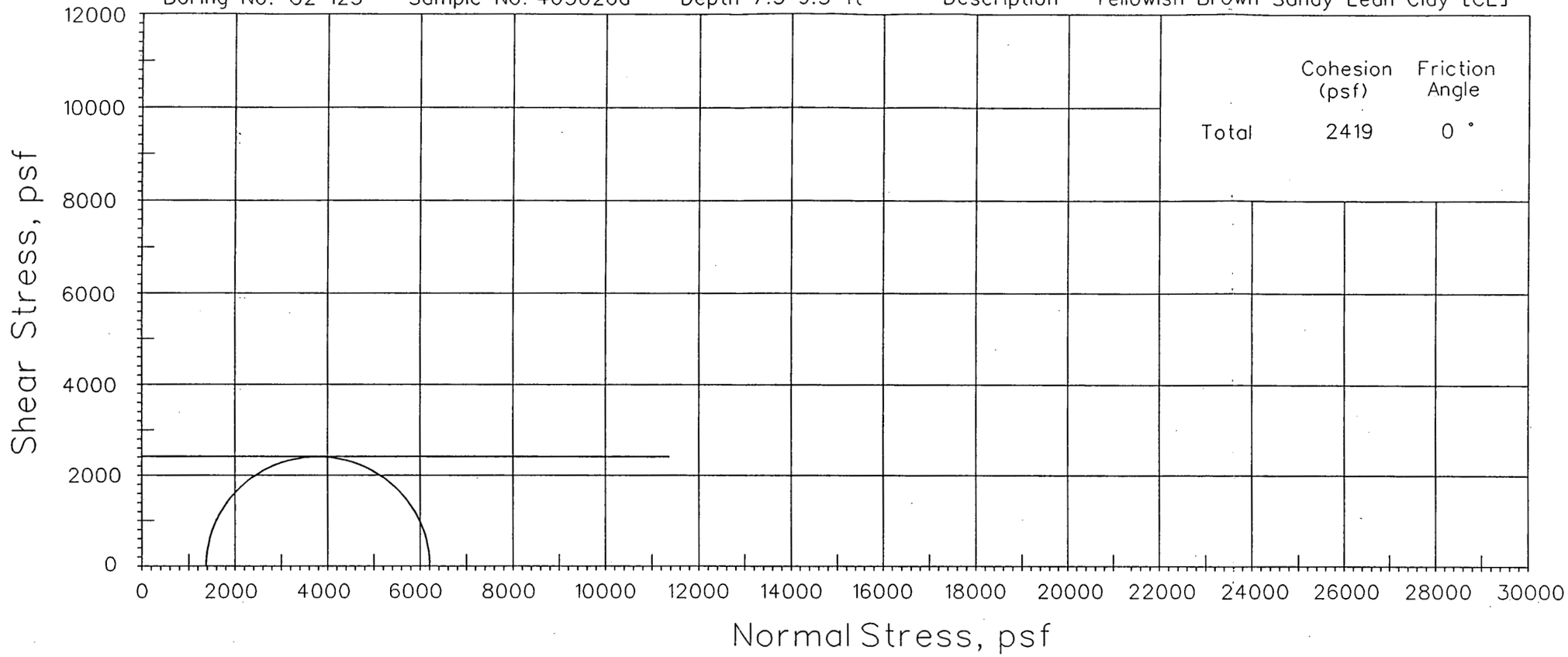
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-124	5.0-7.0	405002	21.7		127.8	105.1	13.57	7130	N/A	1008	8138	8.07

1. At Field Moisture.
2. N/A = Not Applicable

CAD FILE: SKX03817.DGN

Triaxial Compression Test Report

Boring No. G2-125 Sample No. 405026a Depth 7.5-9.5 ft Description - Yellowish Brown Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

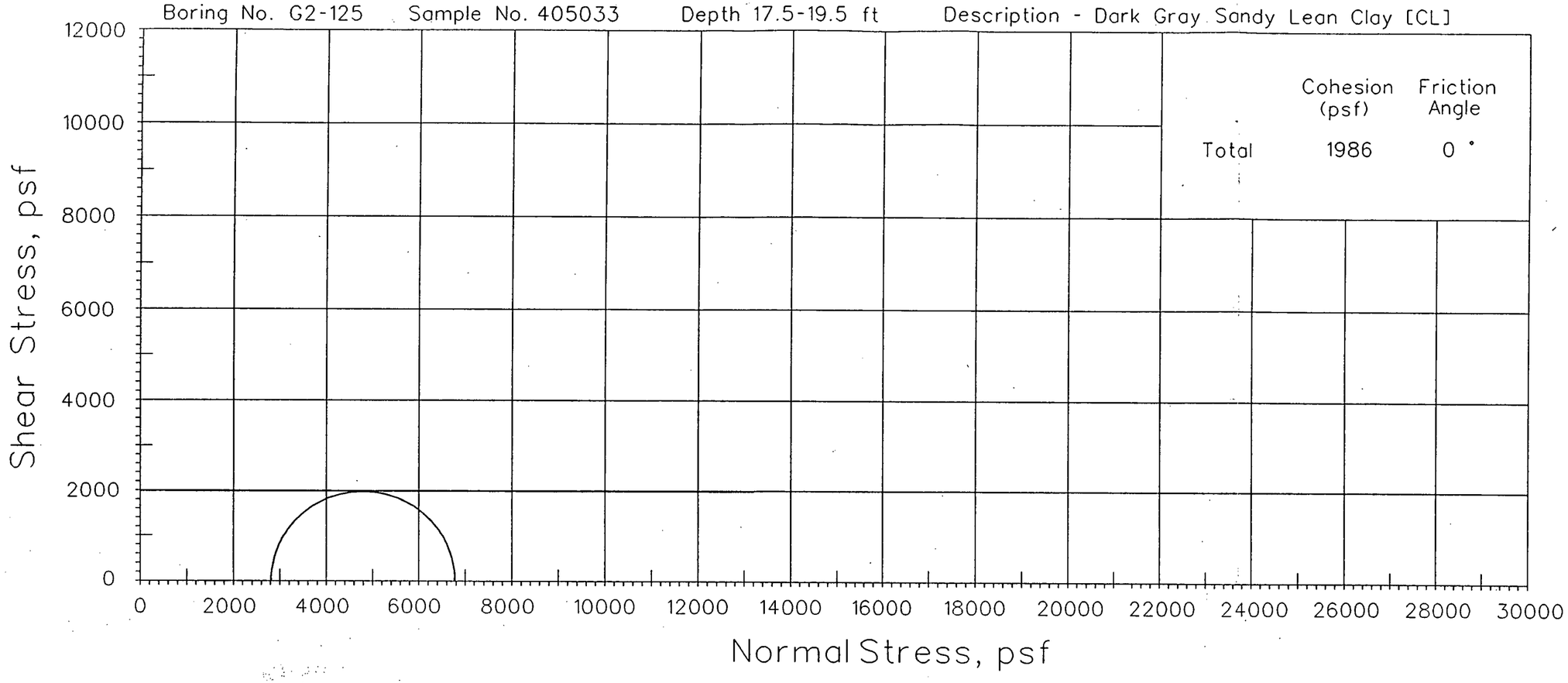
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-125	7.5-9.5	405026a	14.0		141.0	123.7	13.33	4837	N/A	1368	6205	4.54

1. At Field Moisture.
2. N/A = Not Applicable

CAD FILE: SKX03818.DGN

Triaxial Compression Test Report

Boring No. G2-125 Sample No. 405033 Depth 17.5-19.5 ft Description - Dark Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

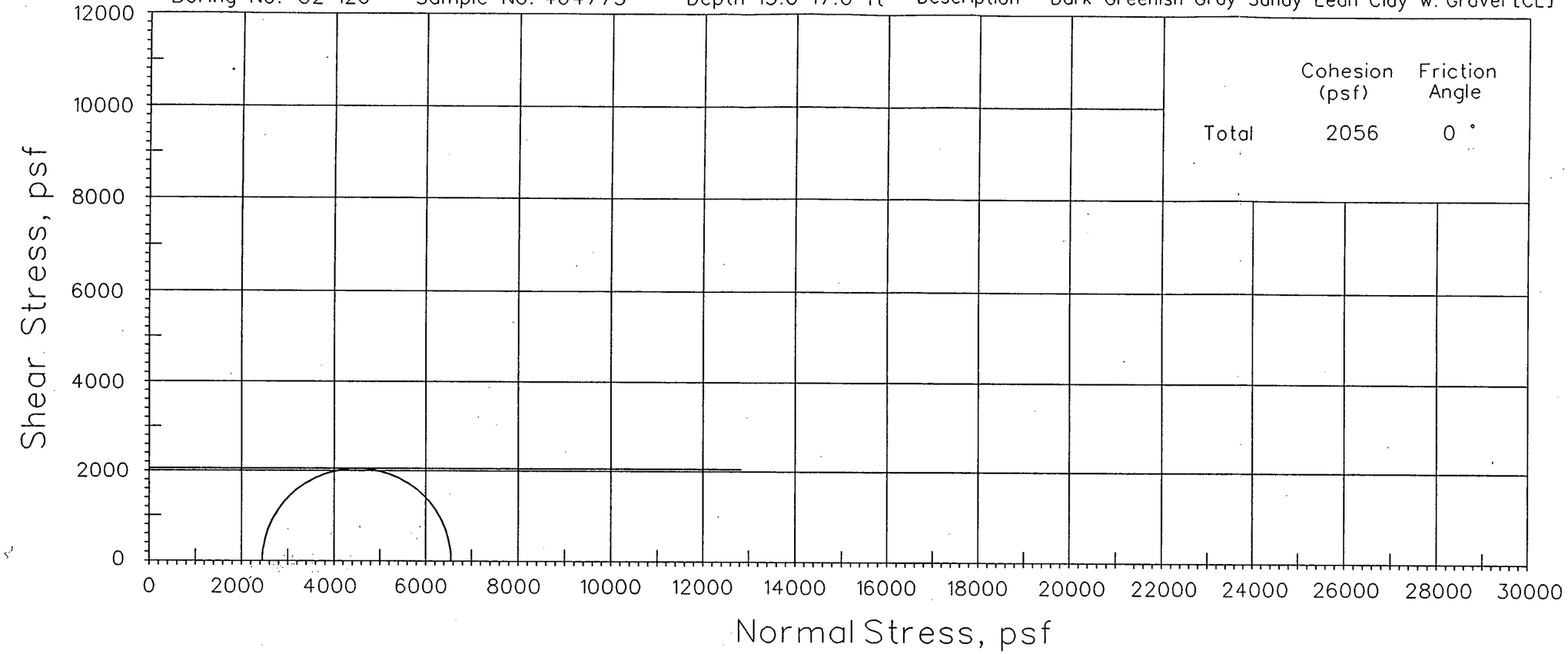
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-125	17.5-19.5	405033	12.7		145.0	128.7	15.21	3972	N/A	2808	6780	2.41

1. At Field Moisture.
2. N/A = Not Applicable

CAD FILE: SKX03819.DGN

Triaxial Compression Test Report

Boring No. G2-126 Sample No. 404773 Depth 15.0-17.0 ft Description - Dark Greenish Gray Sandy Lean Clay w. Gravel [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

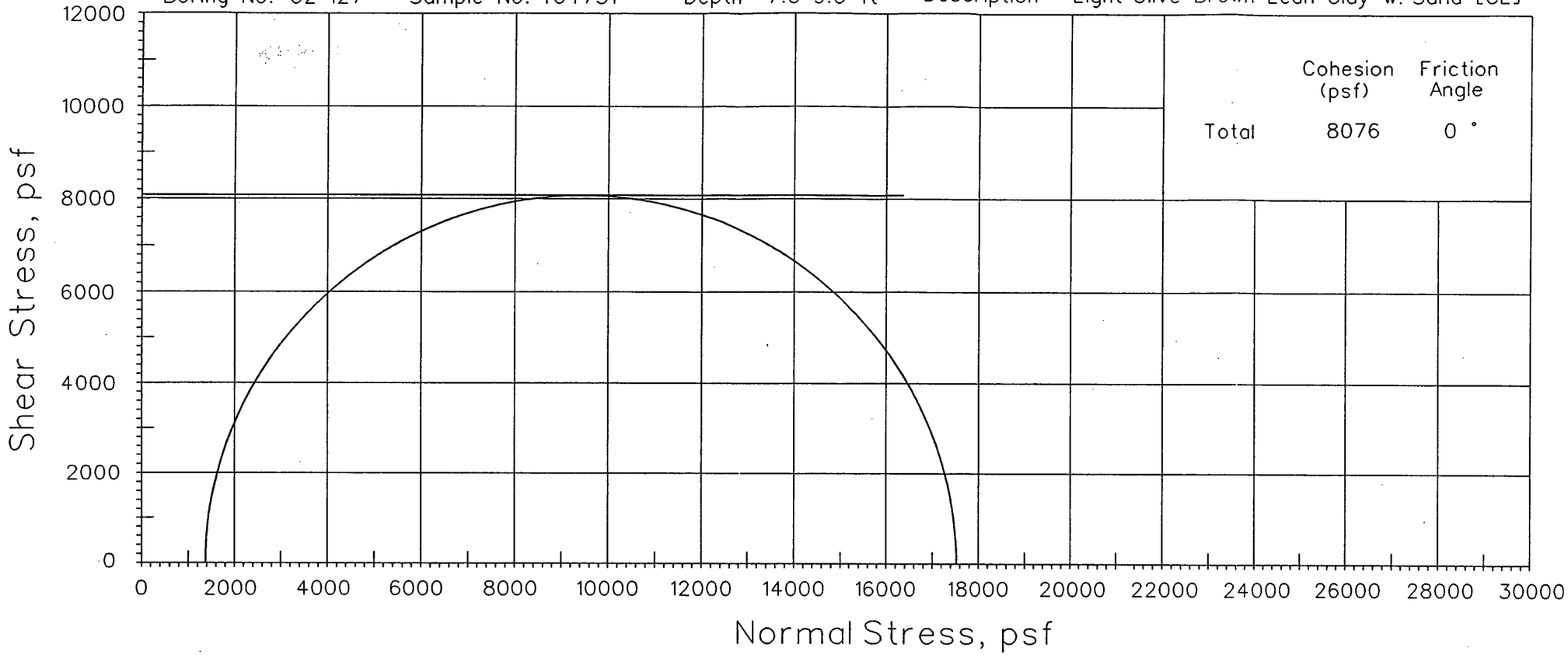
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-126	15.0-17.0	404773	12.9		143.7	127.3	15.0	4112	N/A	2448	6560	2.68

1. At Field Moisture.
2. N/A = Not Applicable

CAD FILE: SKX03820.DGN

Triaxial Compression Test Report

Boring No. G2-127 Sample No. 404751 Depth 7.5-9.5 ft Description - Light Olive Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

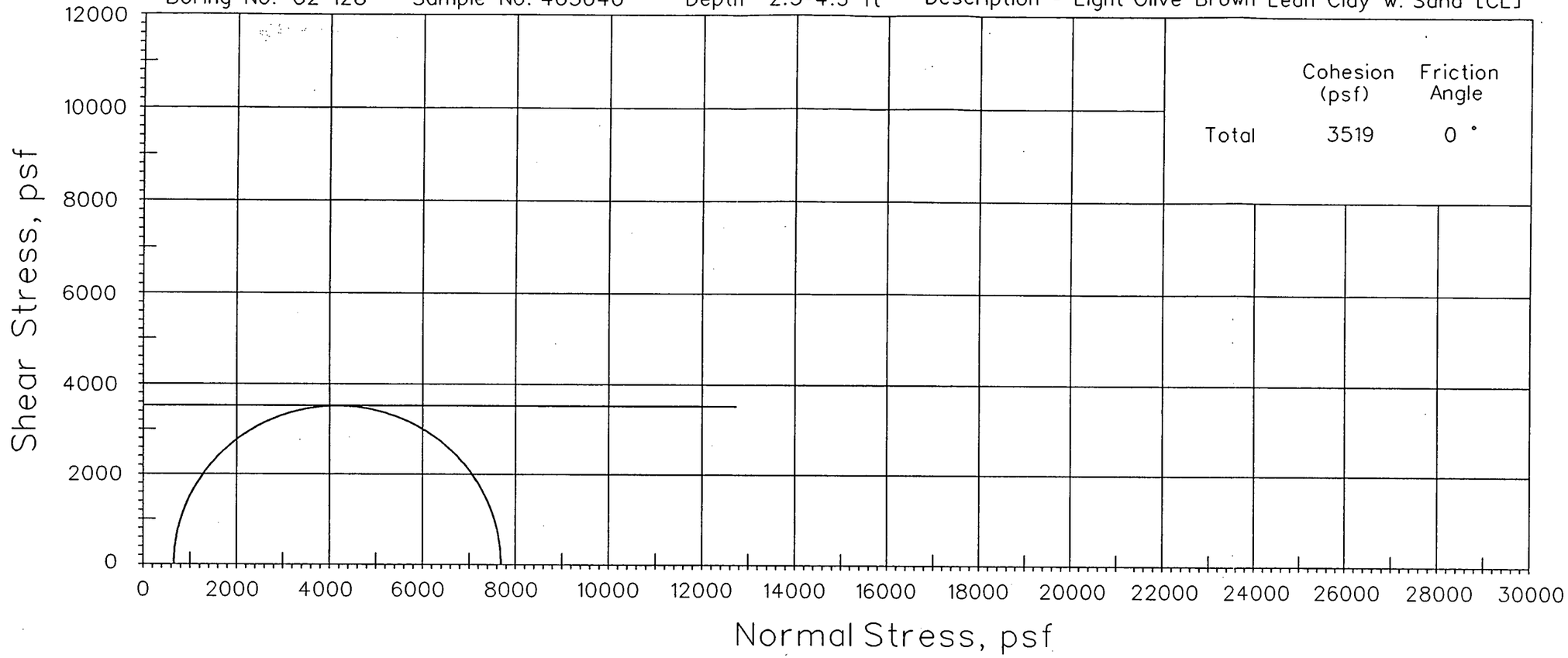
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-127	7.5-9.5	404751	11.8	13.8	141.8	126.9	15.21	16153	N/A	1368	17521	12.81

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03840.DGN

Triaxial Compression Test Report

Boring No. G2-128 Sample No. 405040 Depth 2.5-4.5 ft Description - Light Olive Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

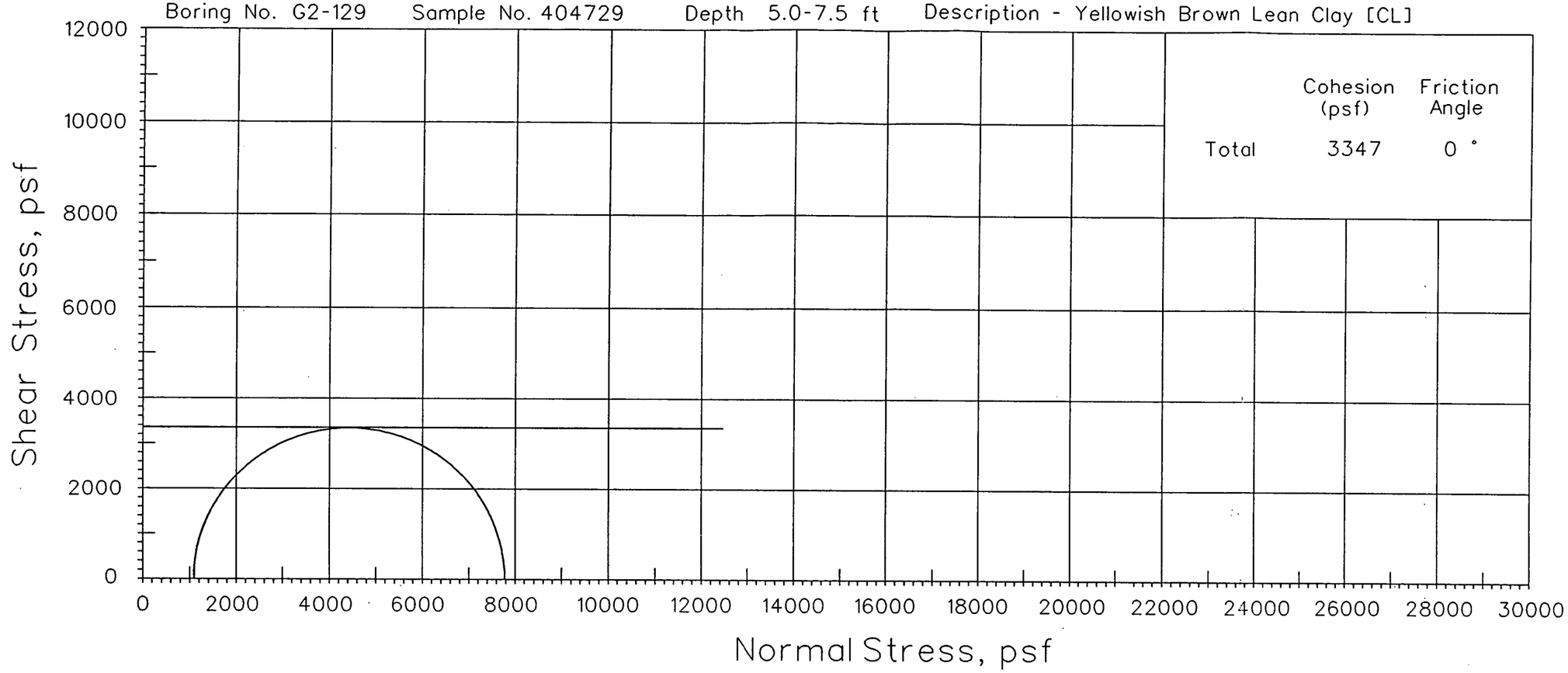
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-128	2.5-4.5	405040	13.2	15.3	140.4	124.1	13.34	7038	N/A	648	7686	11.86

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03841.DGN

Triaxial Compression Test Report

Boring No. G2-129 Sample No. 404729 Depth 5.0-7.5 ft Description - Yellowish Brown Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-129	5.0-7.5	404729	18.7	20.0	133.0	112.1	13.38	6694	N/A	1080	7774	7.2

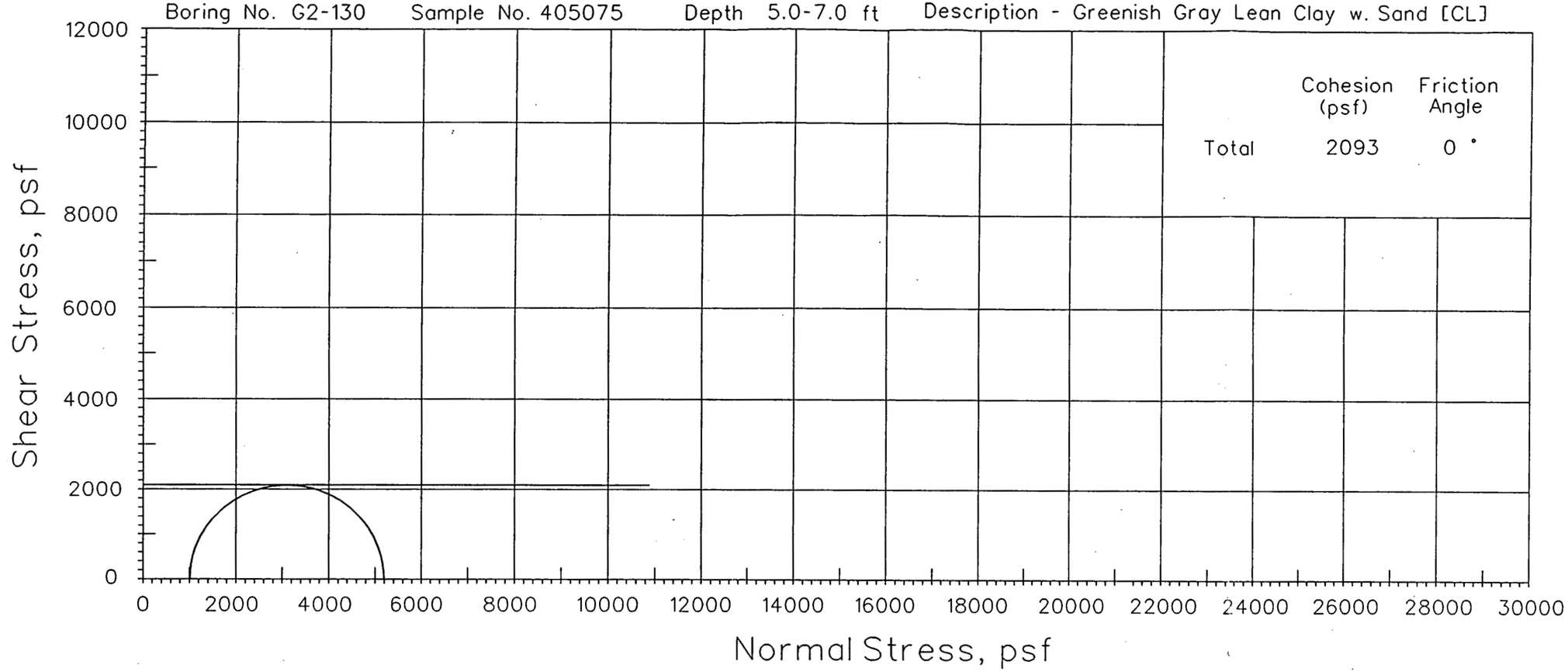
1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03842.DGN

R405075mo.m(2334.ws415) po140@ws415. Fri Oct 27 12:43:20 CDT 1995

Triaxial Compression Test Report

Boring No. G2-130 Sample No. 405075 Depth 5.0-7.0 ft Description - Greenish Gray Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

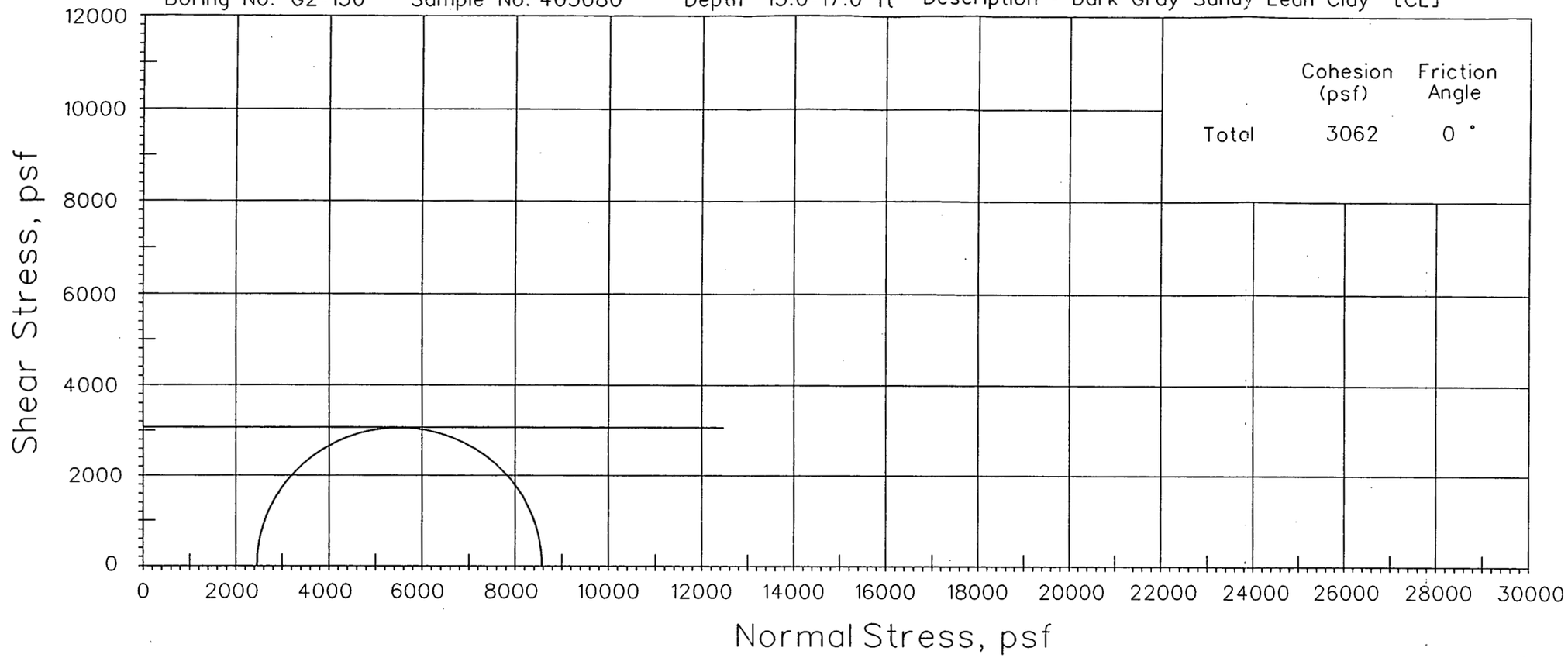
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-130	5.0-7.0	405075	12.4	12.4	144.8	128.8	15.03	4186	N/A	1008	5194	5.15

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03843.DGN

Triaxial Compression Test Report

Boring No. G2-130 Sample No. 405080 Depth 15.0-17.0 ft Description - Dark Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

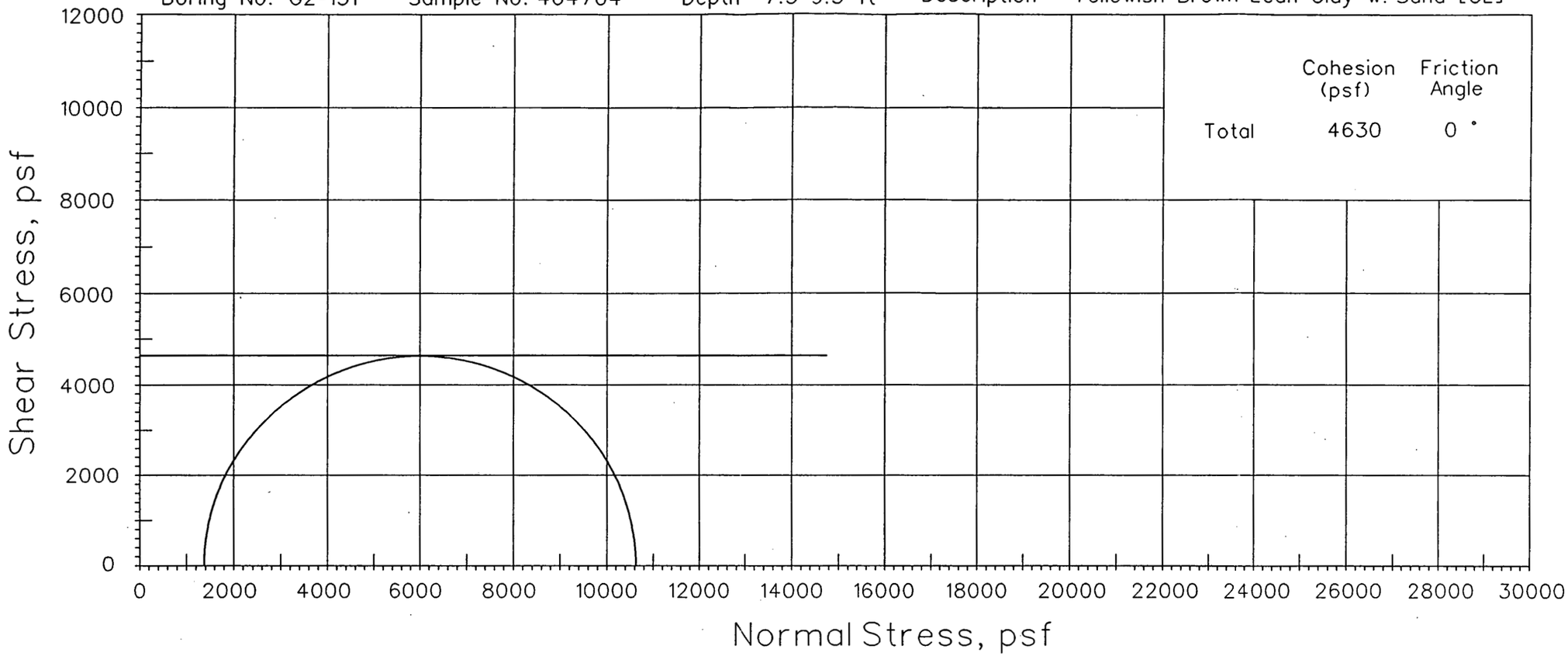
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-130	15.0-17.0	405080	11.0	10.6	146.1	131.7	15.07	6125	N/A	2448	8573	3.50

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03844.DGN

Triaxial Compression Test Report

Boring No. G2-131 Sample No. 404704 Depth 7.5-9.5 ft Description - Yellowish Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-131	7.5-9.5	404704	11.9	12.5	144.4	129.0	14.99	9260	N/A	1368	10628	7.77

1. Saturated Test.
2. N/A = Not Applicable

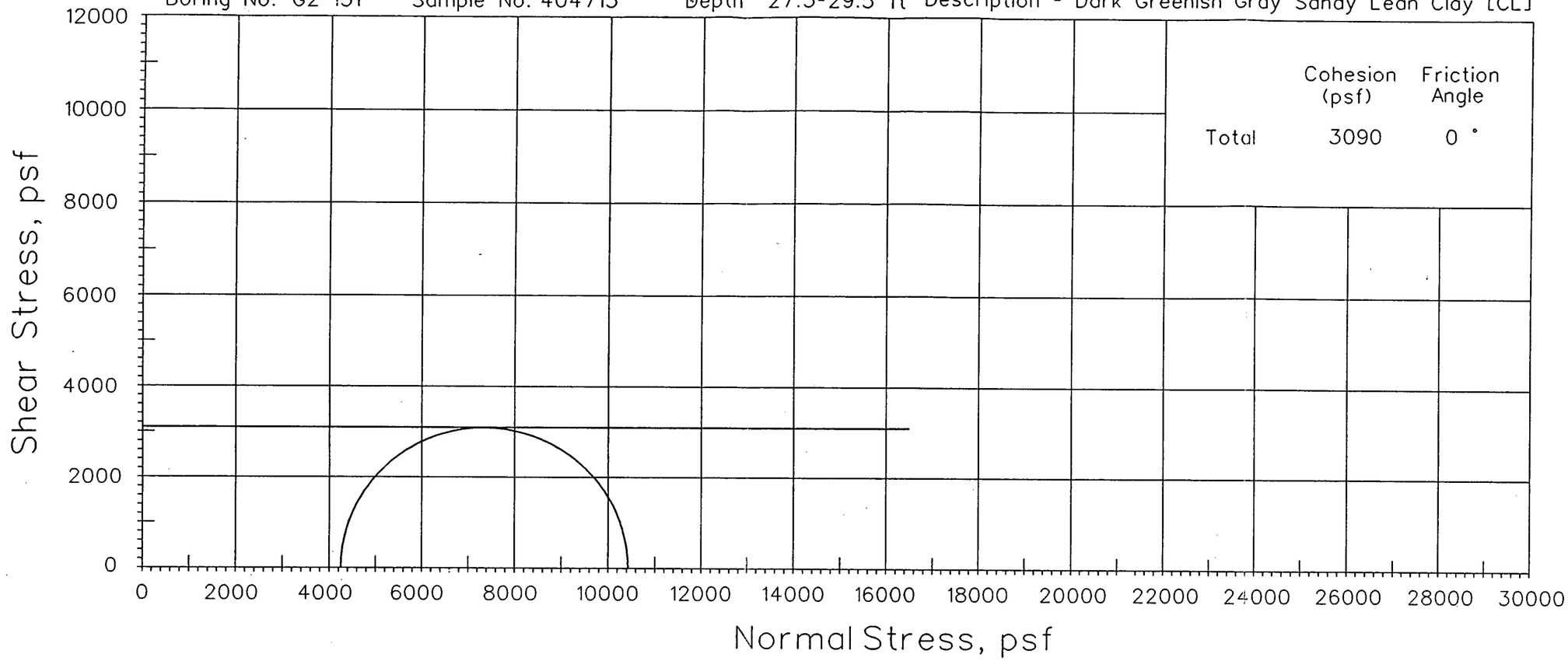
CAD FILE: SKX03845.DGN

000302

R404704a_mo.m(2338.ws415) po140@ws415. Fri Oct 27 13:03:44 CDT 1995

Triaxial Compression Test Report

Boring No. G2-131 Sample No. 404713 Depth 27.5-29.5 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

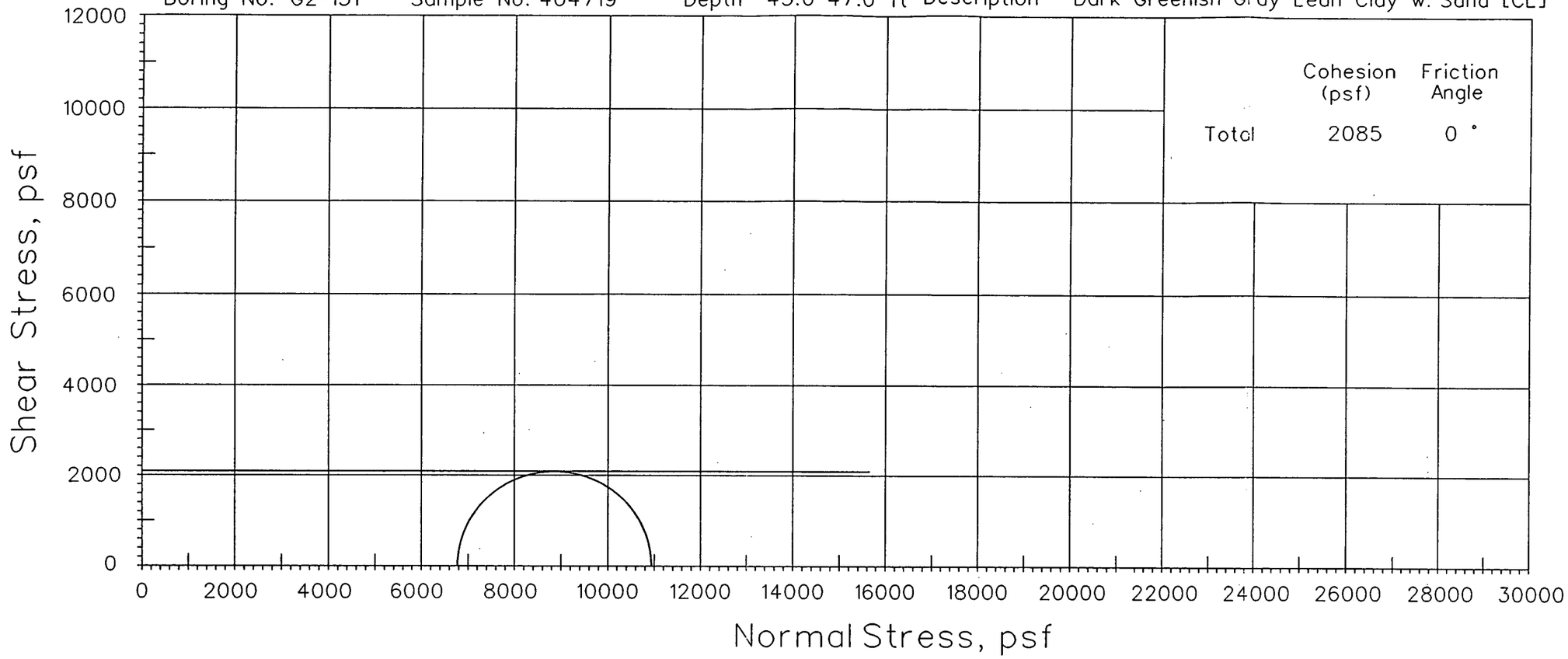
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-131	27.5-29.5	404713	12.0	12.0	144.4	128.9	15.09	6181	N/A	4248	10429	2.45

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03846.DGN

Triaxial Compression Test Report

Boring No. G2-131 Sample No. 404719 Depth 45.0-47.0 ft Description - Dark Greenish Gray Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

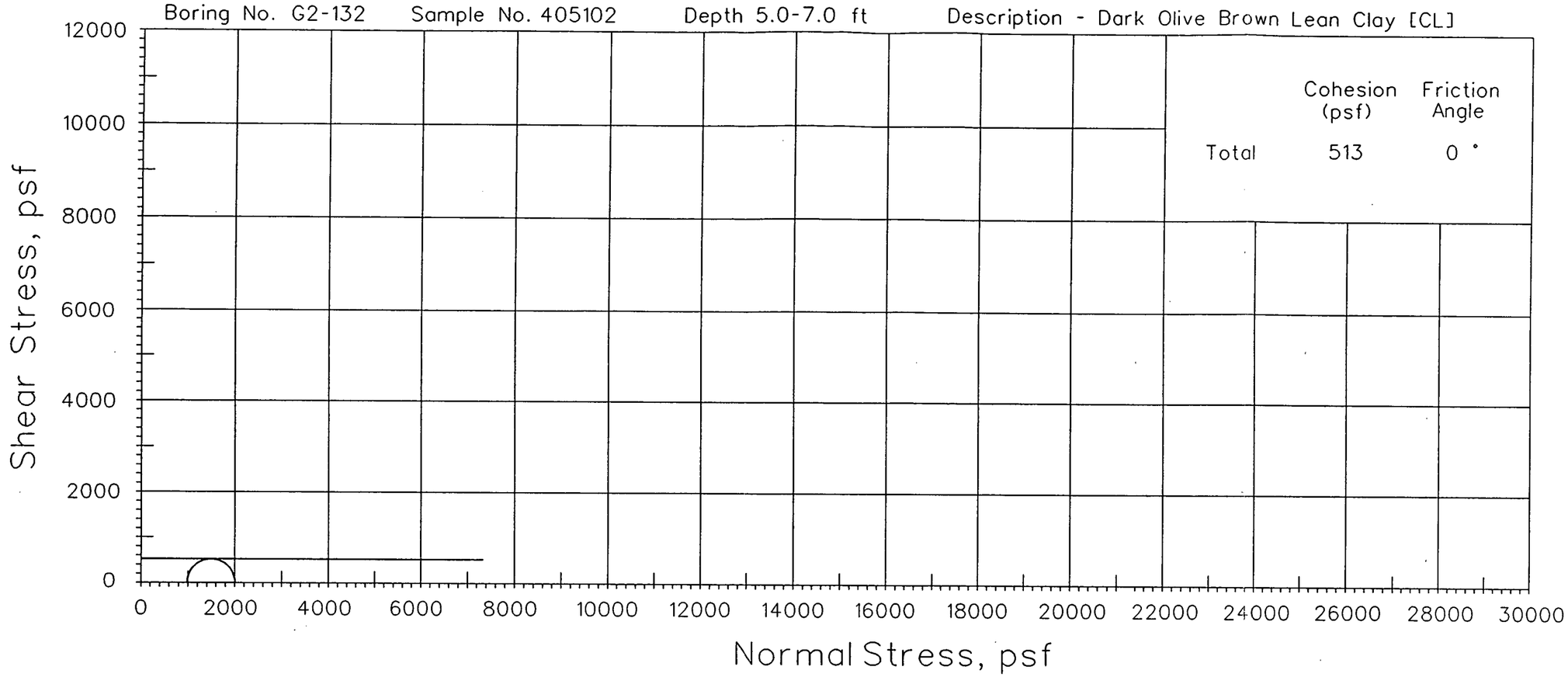
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-131	45.0-47.0	404719	19.0	19.9	135.1	113.6	14.92	4171	N/A	6768	10939	1.62

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03847.DGN

Triaxial Compression Test Report

Boring No. G2-132 Sample No. 405102 Depth 5.0-7.0 ft Description - Dark Olive Brown Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

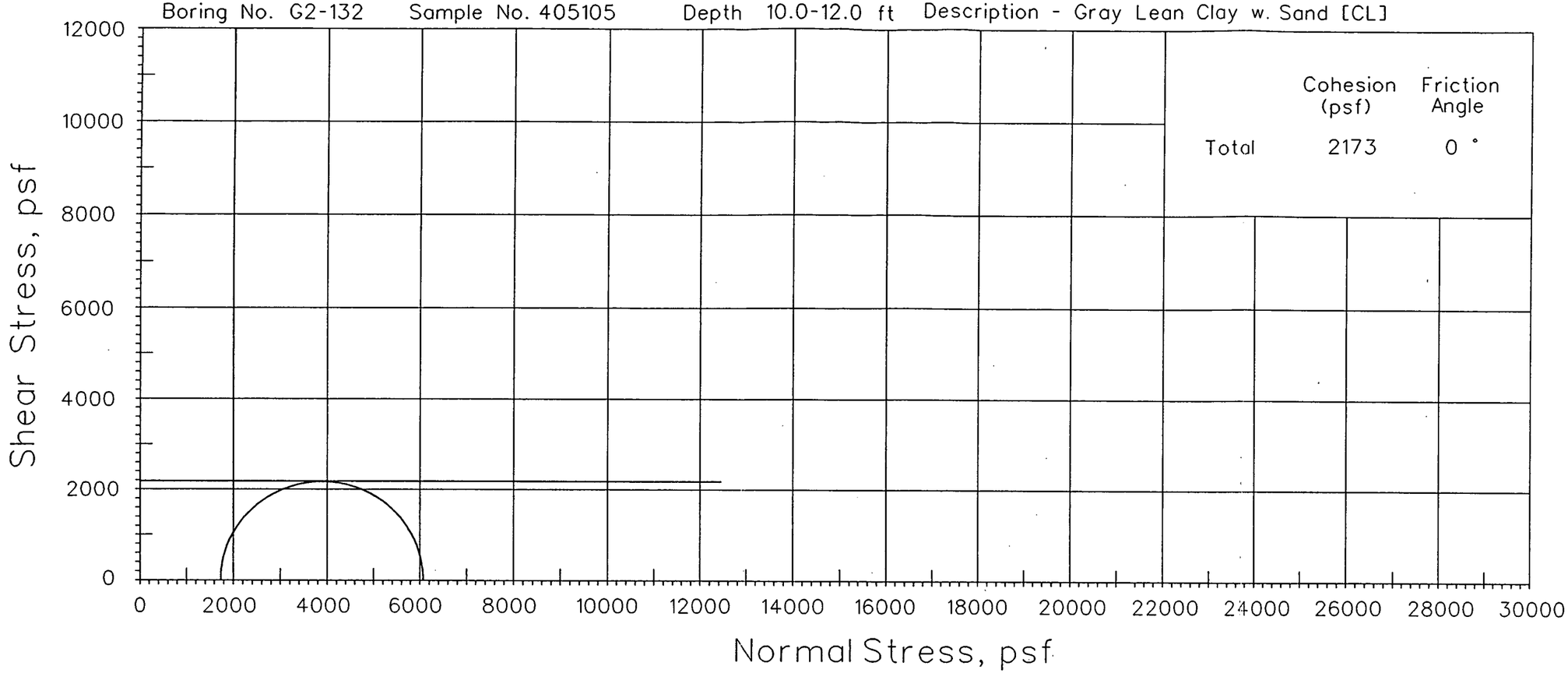
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-132	5.0-7.0	405102	30.2	30.1	118.9	91.3	15.26	1026	N/A	1008	2034	2.02

1. Saturated Test.

CAD FILE: SKX03884.DGN

Triaxial Compression Test Report

Boring No. G2-132 Sample No. 405105 Depth 10.0-12.0 ft Description - Gray Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

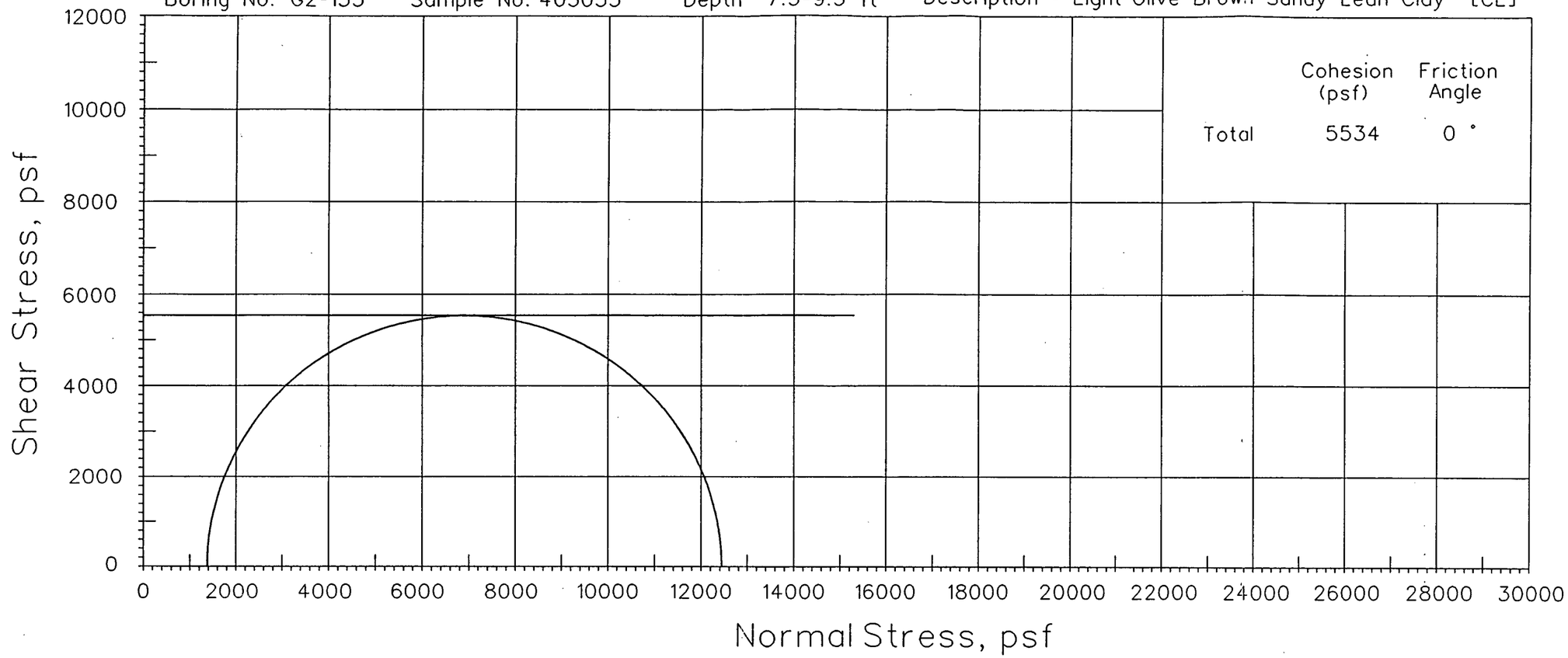
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-132	10.0-12.0	405105	14.2	13.5	140.7	123.2	14.98	4346	N/A	1728	6074	3.52

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03848.DGN

Triaxial Compression Test Report

Boring No. G2-133 Sample No. 405055 Depth 7.5-9.5 ft Description - Light Olive Brown Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

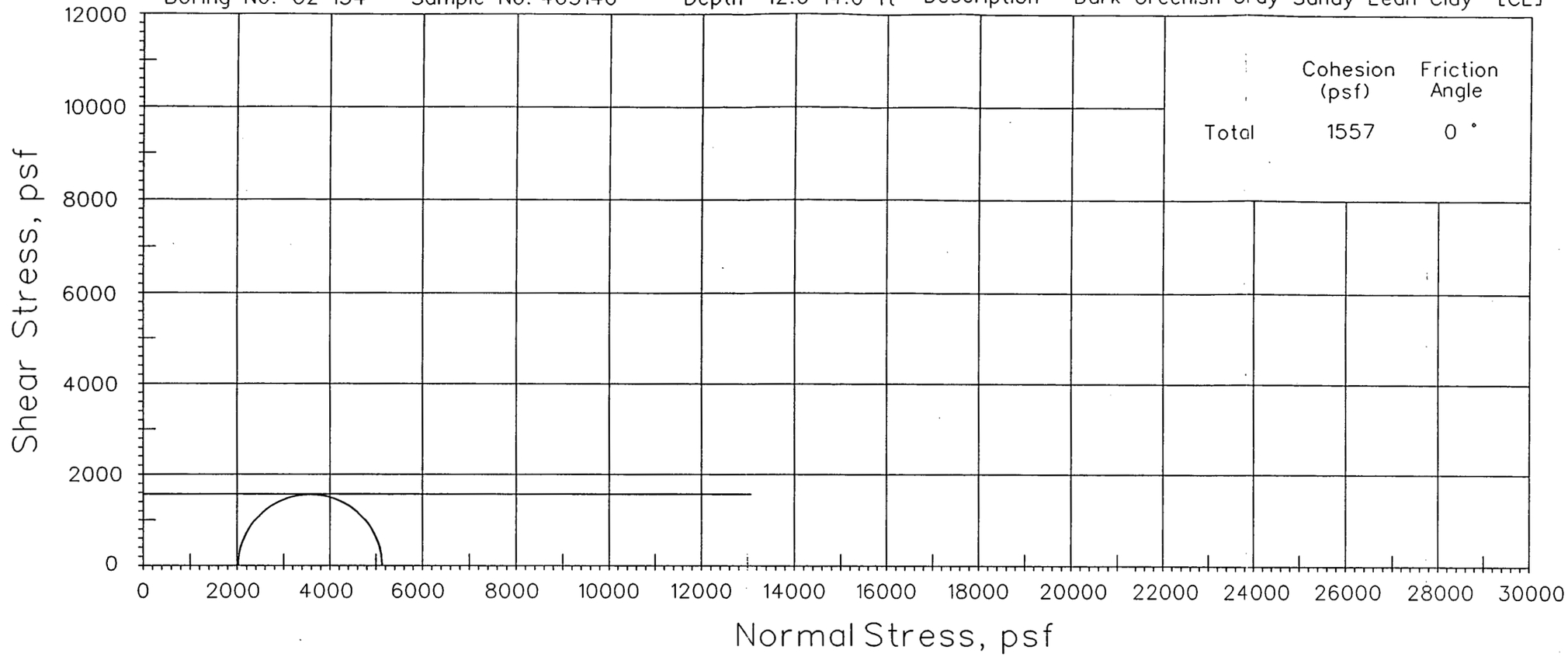
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-133	7.5-9.5	405055	12.7	12.5	143.0	126.9	15.05	11068	N/A	1368	12436	9.09

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03849.DGN

Triaxial Compression Test Report

Boring No. G2-134 Sample No. 405140 Depth 12.0-14.0 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: In Situ Failure Criteria: 15% Axial Strain

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-134	12.0-14.0	405140	12.6	12.1	143.7	127.6	15.14	3115	N/A	2016	5131	2.55

1. Saturated Test.
2. N/A = Not Applicable

CAD FILE: SKX03850.DGN

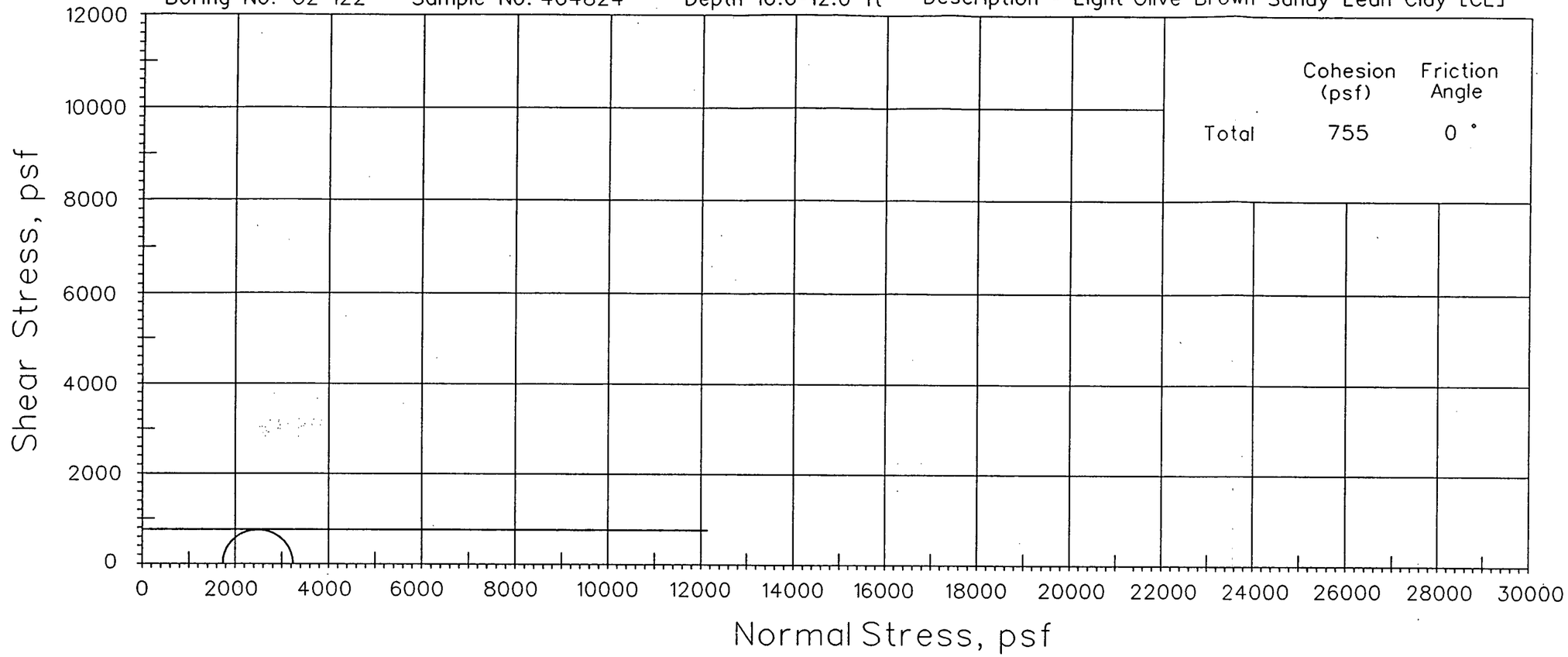
UU TRIAXIAL COMPRESSION TESTS - REMOLDED 95% MDD

WET OF OPTIMUM MOISTURE CONTENT (ASTM D698)

R404824a_mo.m(2336.ws415) po140@ws415. Fri Oct 27 12:53:34 CDT 1995

Triaxial Compression Test Report

Boring No. G2-122 Sample No. 404824 Depth 10.0-12.0 ft Description - Light Olive Brown Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: Remolded 95% MDD[3] Failure Criteria: 15% Axial Strain

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-122	10.0-12.0	404824	14.9	15.1	136.3	118.5	15.01	1510	N/A	1728	3238	1.87

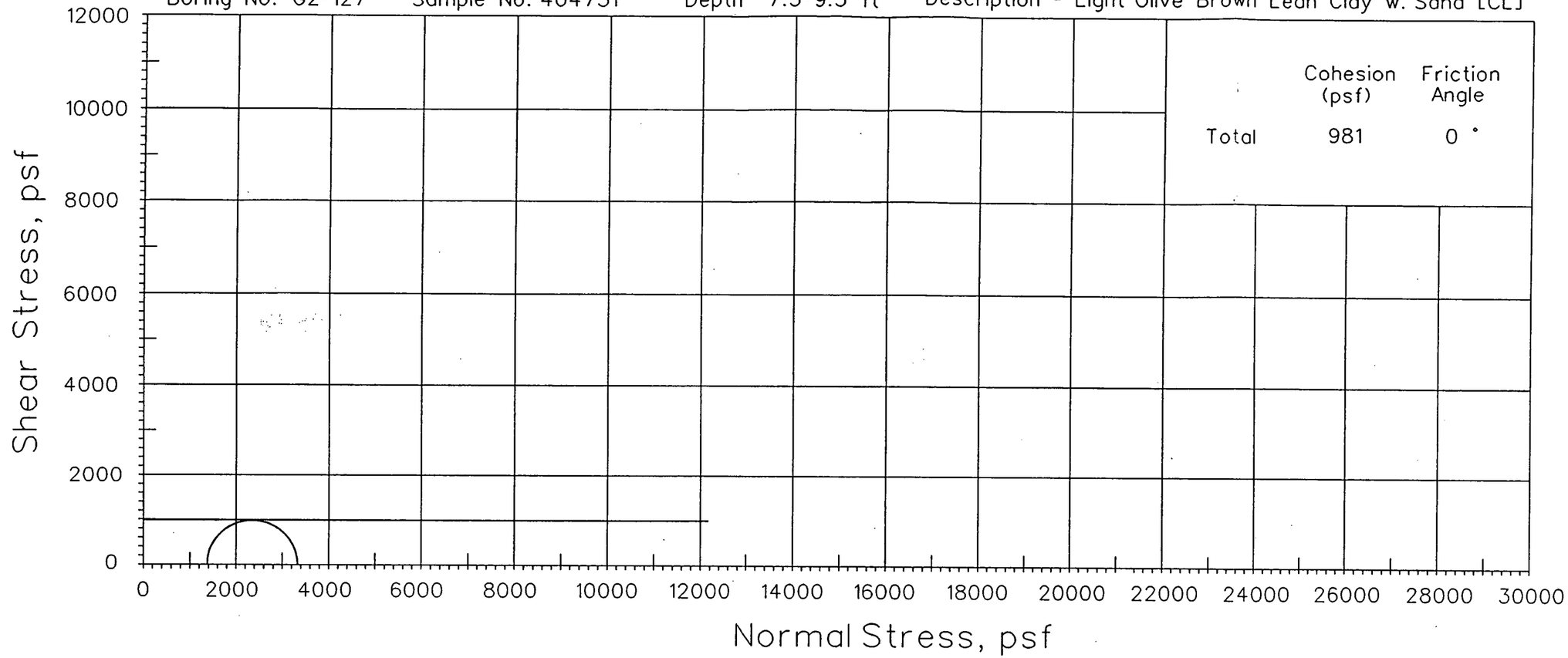
1. Saturated Test.
2. N/A = Not Applicable
3. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03832.DGN

R404751a_mo.m(2337.ws415) po140@ws415. Fri Oct 27 13:01:23 CDT 1995

Triaxial Compression Test Report

Boring No. G2-127 Sample No. 404751 Depth 7.5-9.5 ft Description - Light Olive Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: Remolded 95% MDD[3] Failure Criteria: 15% Axial Strain

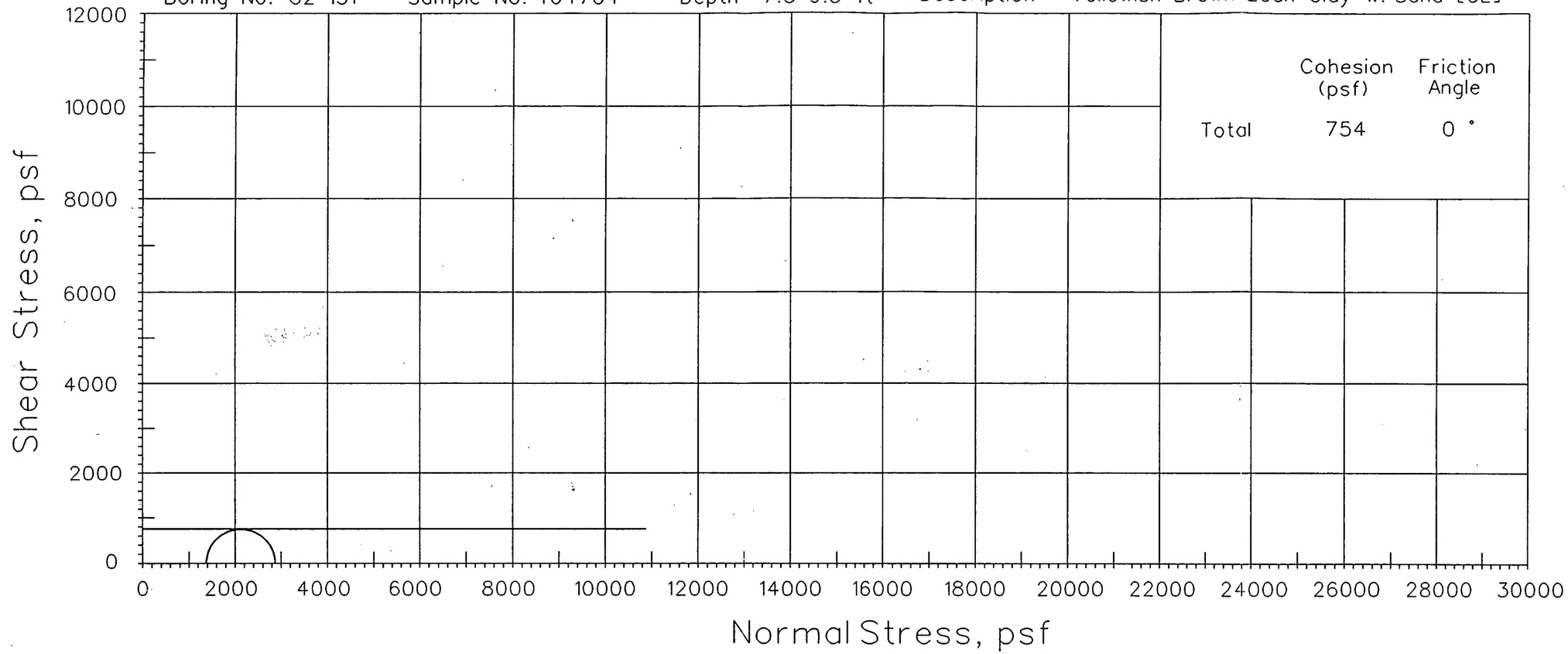
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-127	7.5-9.5	404751	15.9	16.4	135.9	117.3	14.92	1963	N/A	1368	3331	2.44

1. Saturated Test.
2. N/A = Not Applicable
3. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03833.DGN

Triaxial Compression Test Report

Boring No. G2-131 Sample No. 404704 Depth 7.5-9.5 ft Description - Yellowish Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: 95% MDD[3] Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-131	7.5-9.5	404704	16.8	16.5	136.9	117.2	11.71	1507	N/A	1368	2875	2.10

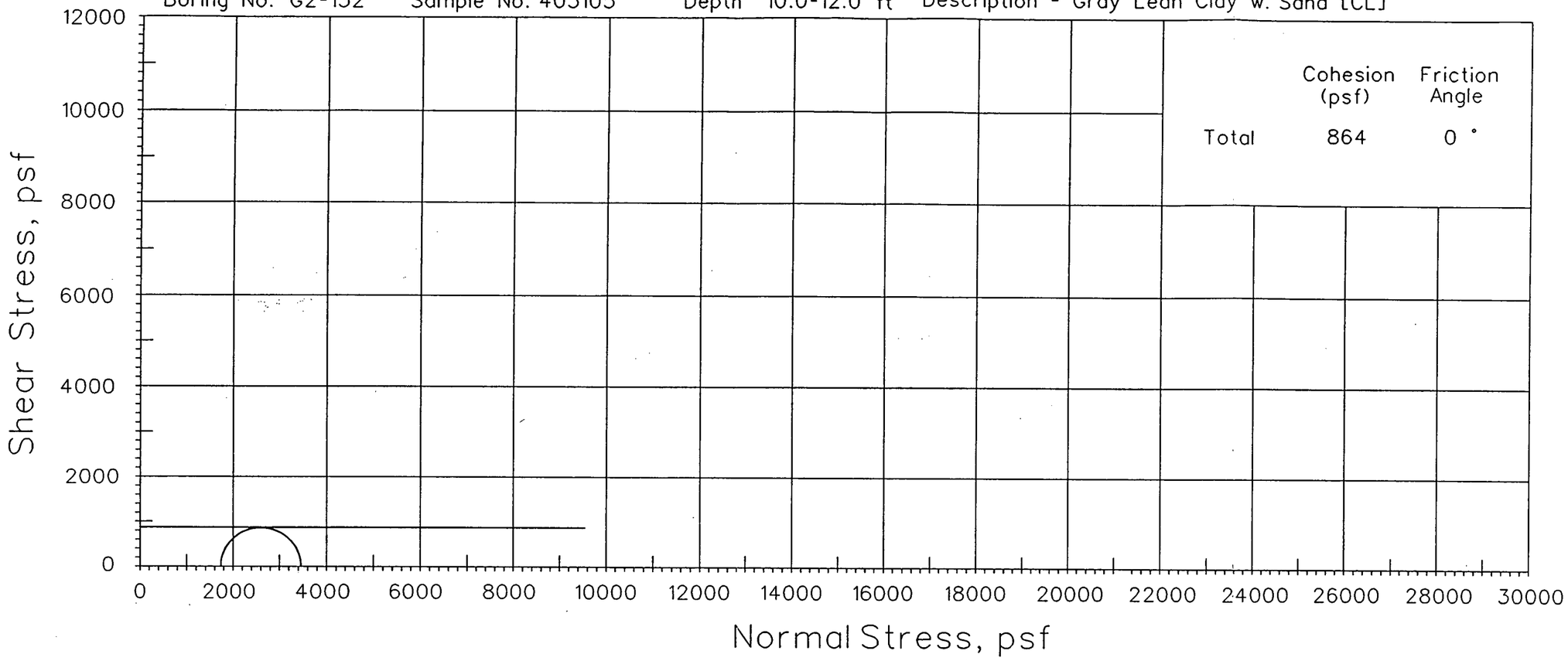
1. Saturated Test.
2. N/A = Not Applicable
3. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03835.DGN

R405105b_mo.m(2339.ws415) po140@ws415. Fri Oct 27 13:05:45 CDT 1995

Triaxial Compression Test Report

Boring No. G2-132 Sample No. 405105 Depth 10.0-12.0 ft Description - Gray Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: 95% MDD [3] Failure Criteria: 15% Axial Strain

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-132	10.0-12.0	405105	14.3	14.7	136.8	119.7	14.99	1729	N/A	1728	3457	2.00

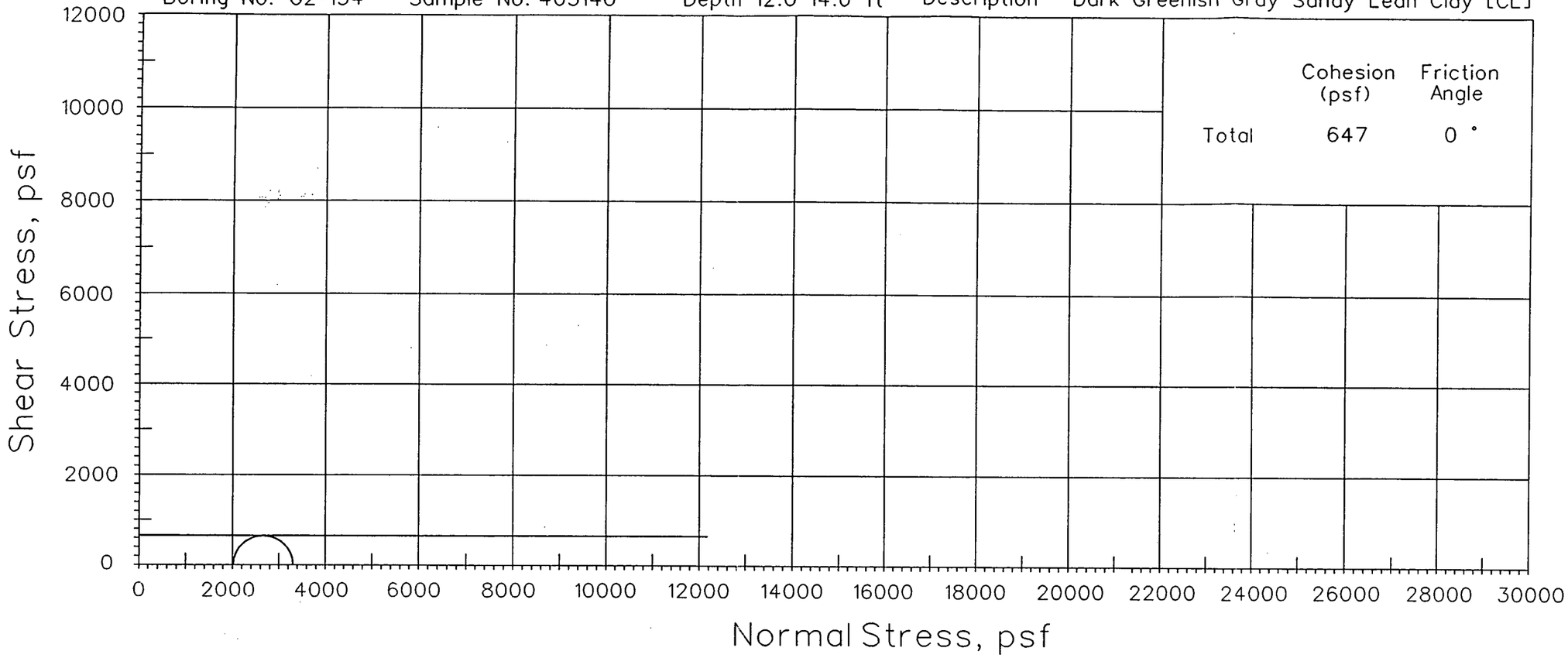
1. Saturated Test.
2. N/A = Not Applicable
3. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03834.DGN

R405140a_mo.m(2340.ws415) po140@ws415. Fri Oct 27 13:07:57 CDT 1995

Triaxial Compression Test Report

Boring No. G2-134 Sample No. 405140 Depth 12.0-14.0 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: Remolded 95% MDD[3] Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-134	12.0-14.0	405140	14.5	14.6	136.8	119.5	11.64	1294	N/A	2016	3310	1.64

1. Saturated Test.
2. N/A = Not Applicable
3. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03836.DGN

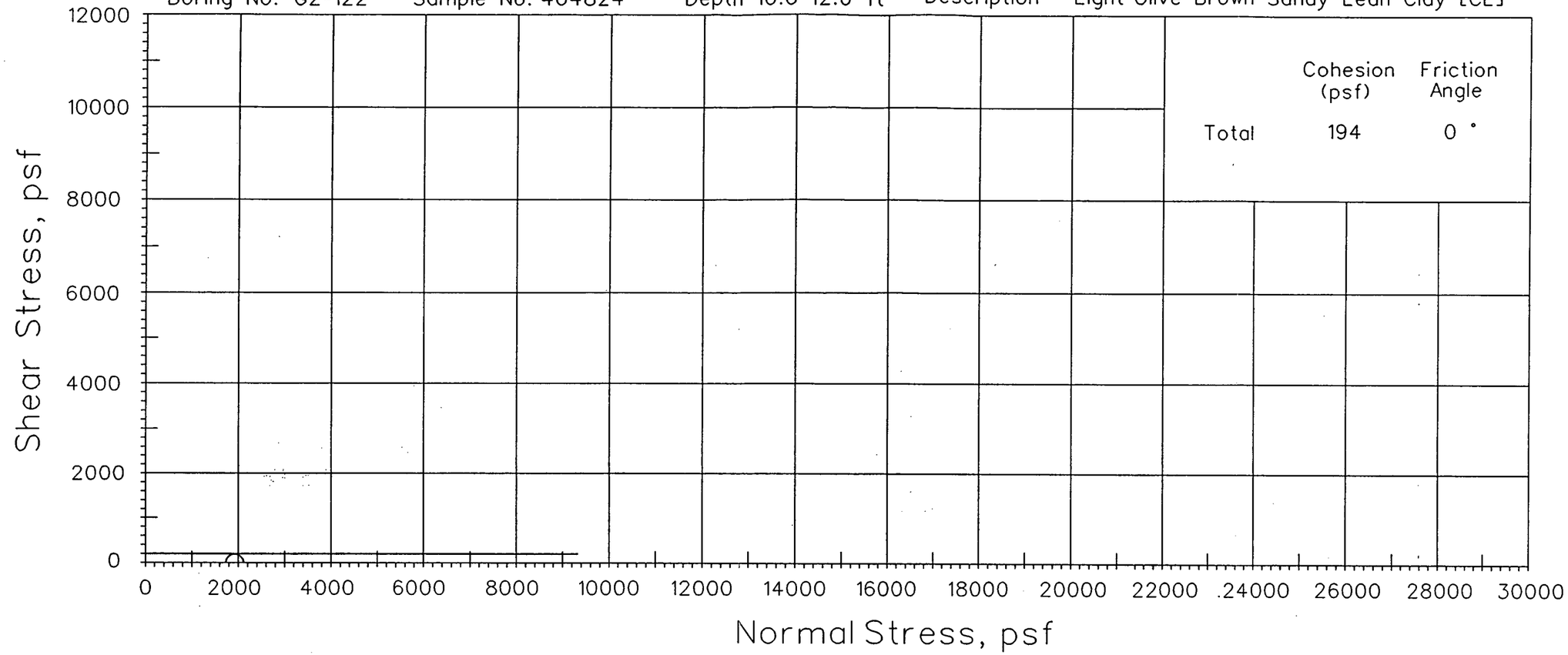
UU TRIAXIAL COMPRESSION TESTS - REMOLDED 85% MDD

AT OR NEAR OPTIMUM MOISTURE CONTENT (ASTM D698)

R404824b_mo.m(2342.ws415) po140@ws415. Fri Oct 27 14:05:47 CDT 1995

Triaxial Compression Test Report

Boring No. G2-122 Sample No. 404824 Depth 10.0-12.0 ft Description - Light Olive Brown Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: Remolded 85% MDD[3] Failure Criteria: 15% Axial Strain

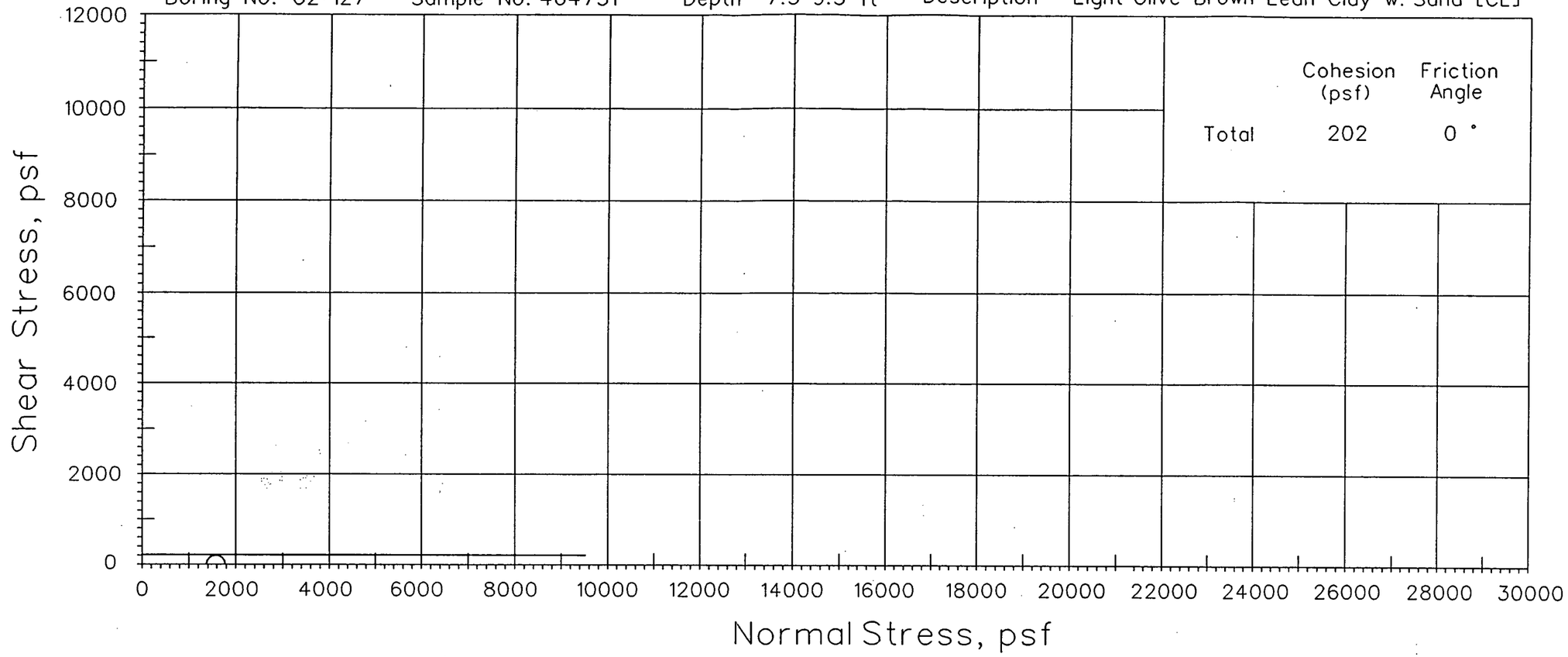
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-122	10.0-12.0	404824	11.7	17.2	117.7	105.4	14.96	388	N/A	1728	2116	1.22

1. Saturated Test.
2. N/A = Not Applicable
3. Remolded At or Near Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03837.DGN

Triaxial Compression Test Report

Boring No. G2-127 Sample No. 404751 Depth 7.5-9.5 ft Description - Light Olive Brown Lean Clay w. Sand [CL]



Type of Test: UU - Single Point Sample Type: Remolded 85% MDD[3] Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-127	7.5-9.5	404751	12.5	19.4	117.2	104.1	14.99	405	N/A	1368	1773	1.30

1. Saturated Test.
2. N/A = Not Applicable
3. Remolded At or Near Optimum Moisture Content In Accordance with ASTM D698

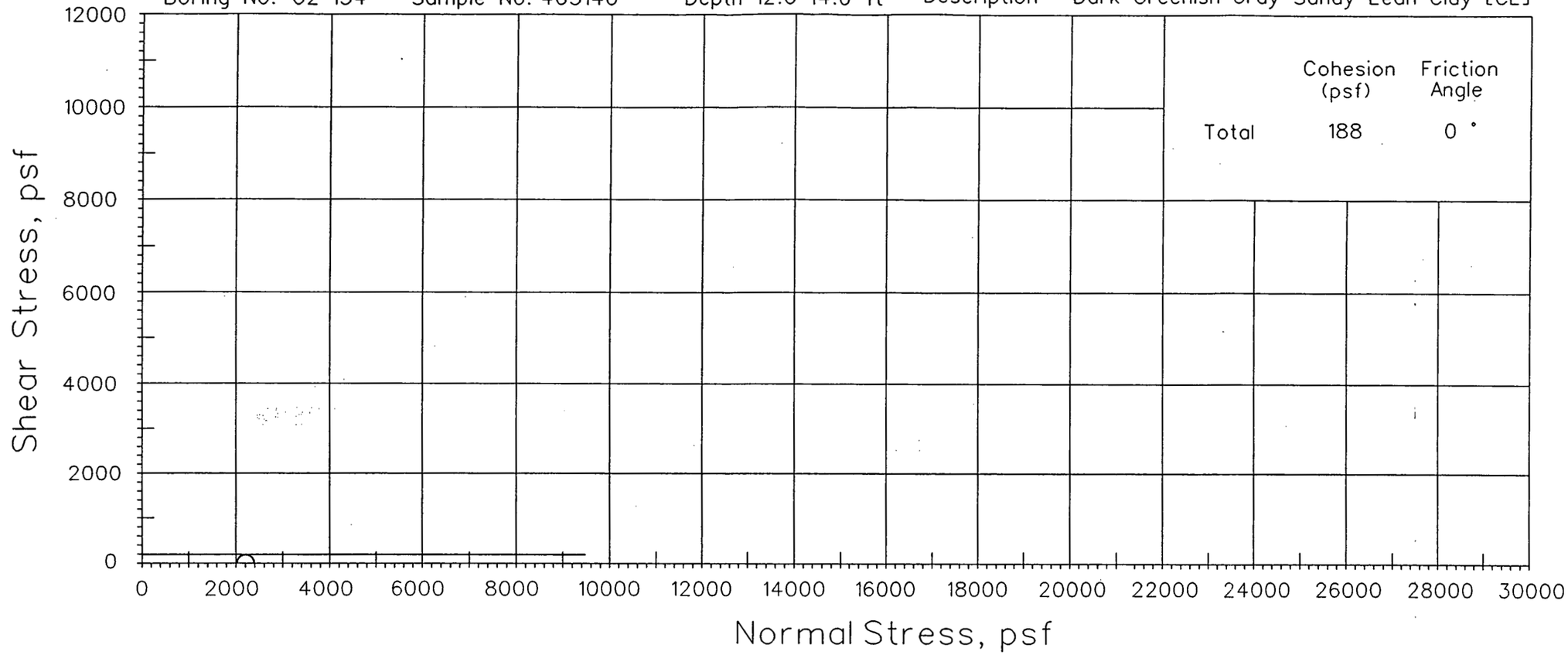
CAD FILE: SKX03838.DGN

000217

R404751b_mo.m(2343.ws415) po140@ws415. Fri Oct 27 14:06:18 CDT 1995

Triaxial Compression Test Report

Boring No. G2-134 Sample No. 405140 Depth 12.0-14.0 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



Type of Test: UU - Single Point Sample Type: Remolded 85% MDD[3] Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Total Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-134	12.0-14.0	405140	10.9	16.5	117.3	105.8	14.96	377	N/A	2016	2393	1.19

1. Saturated Test.
3. Remolded At or Near Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03839.DGN

R405140b_mo.m(2344.ws415) po140@ws415. Fri Oct 27 14:06:49 CDT 1995

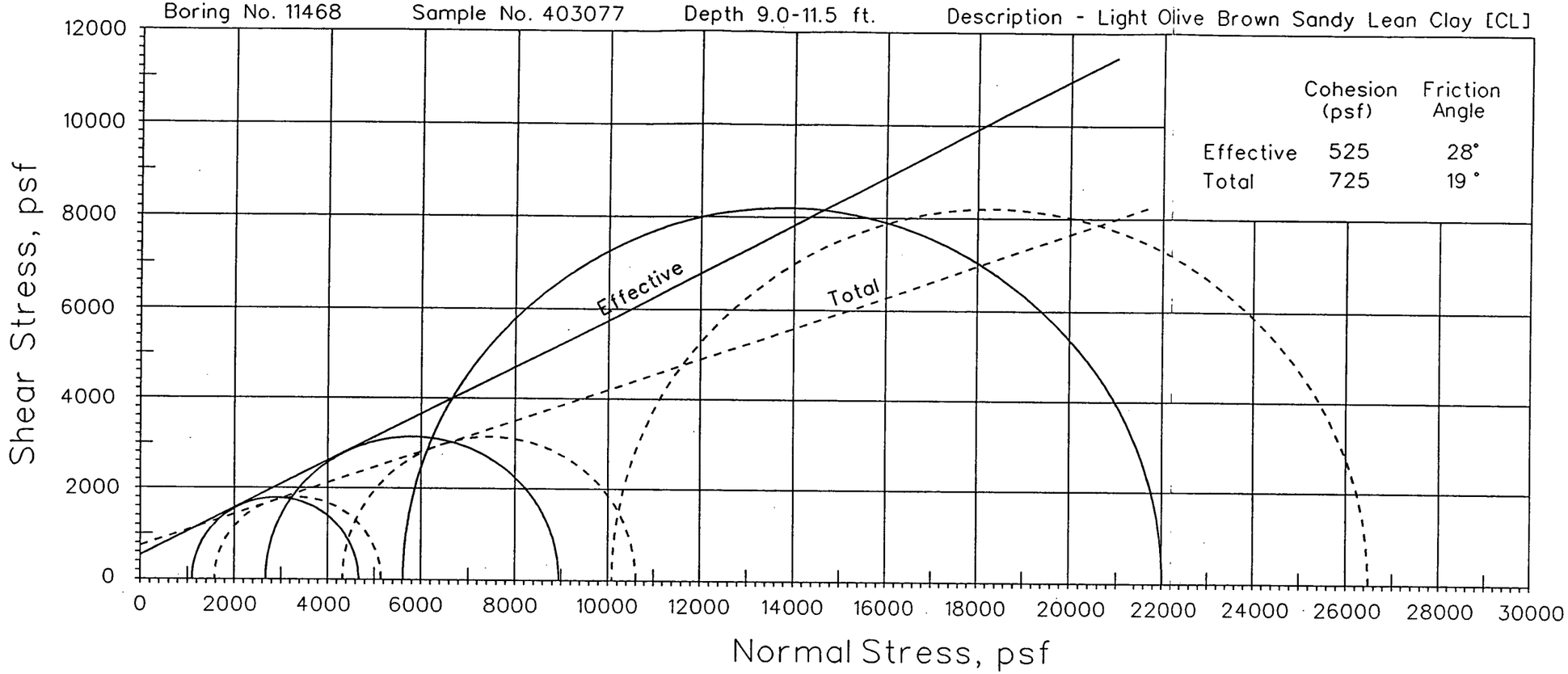
CONSOLIDATED UNDRAINED (CU) TRIAXIAL COMPRESSION TESTS

UNDISTURBED SAMPLES

R11468mo.m(2427.ws415) po140@ws415. Mon Oct 30 15:15:10 CST 1995

Triaxial Compression Test Report

Boring No. 11468 Sample No. 403077 Depth 9.0-11.5 ft. Description - Light Olive Brown Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

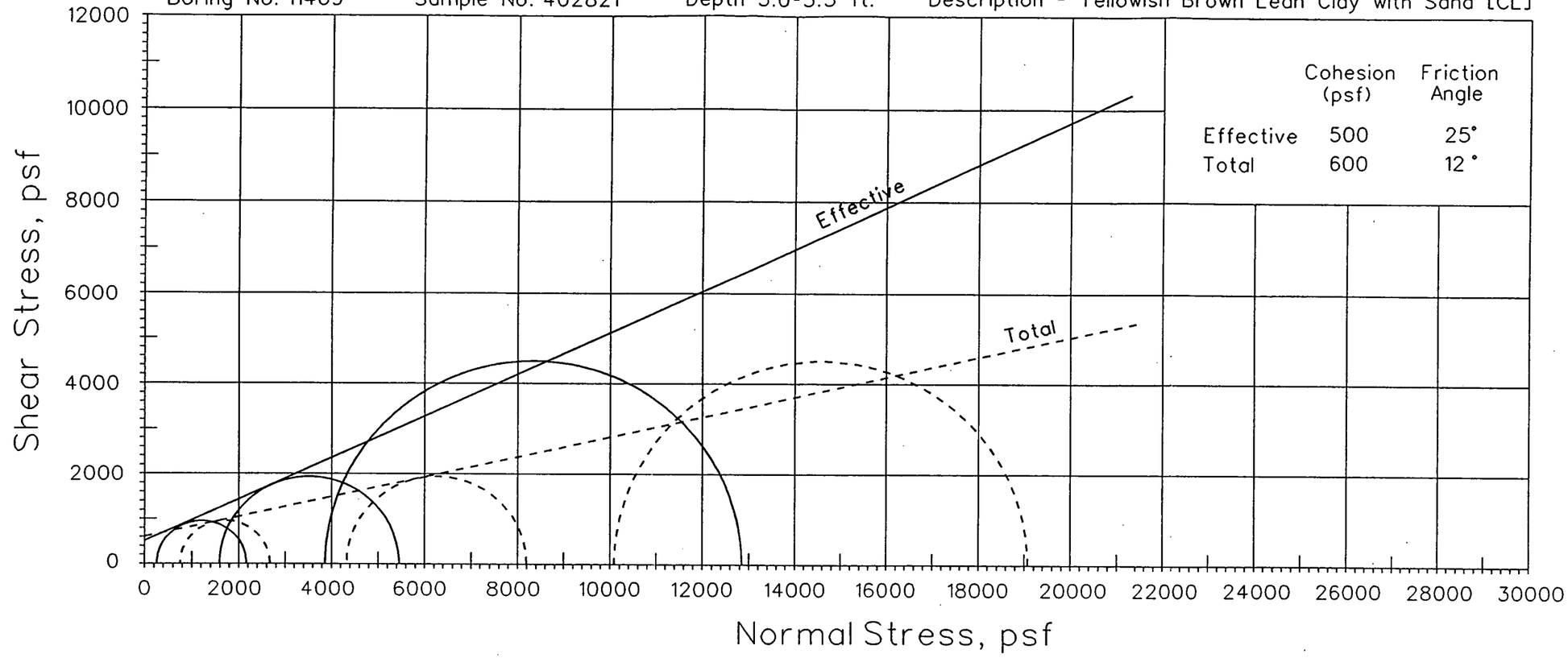
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11468	9.0-11.5	A	13.8	13.9	136.7	120.1	7.09	16397	4464	5616	22013	3.92
		B	16.8	16.5	136.5	116.9	5.90	6285	1656	2664	8949	3.36
		C	14.8	15.1	140.7	122.6	3.68	3574	475	1095	4669	4.26

CAD FILE: skx03565.dgn

R11469mo.m(2420.ws415) po140@ws415. Mon Oct 30 13:46:39 CST 1995

Triaxial Compression Test Report

Boring No. 11469 Sample No. 402821 Depth 3.0-5.5 ft. Description - Yellowish Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

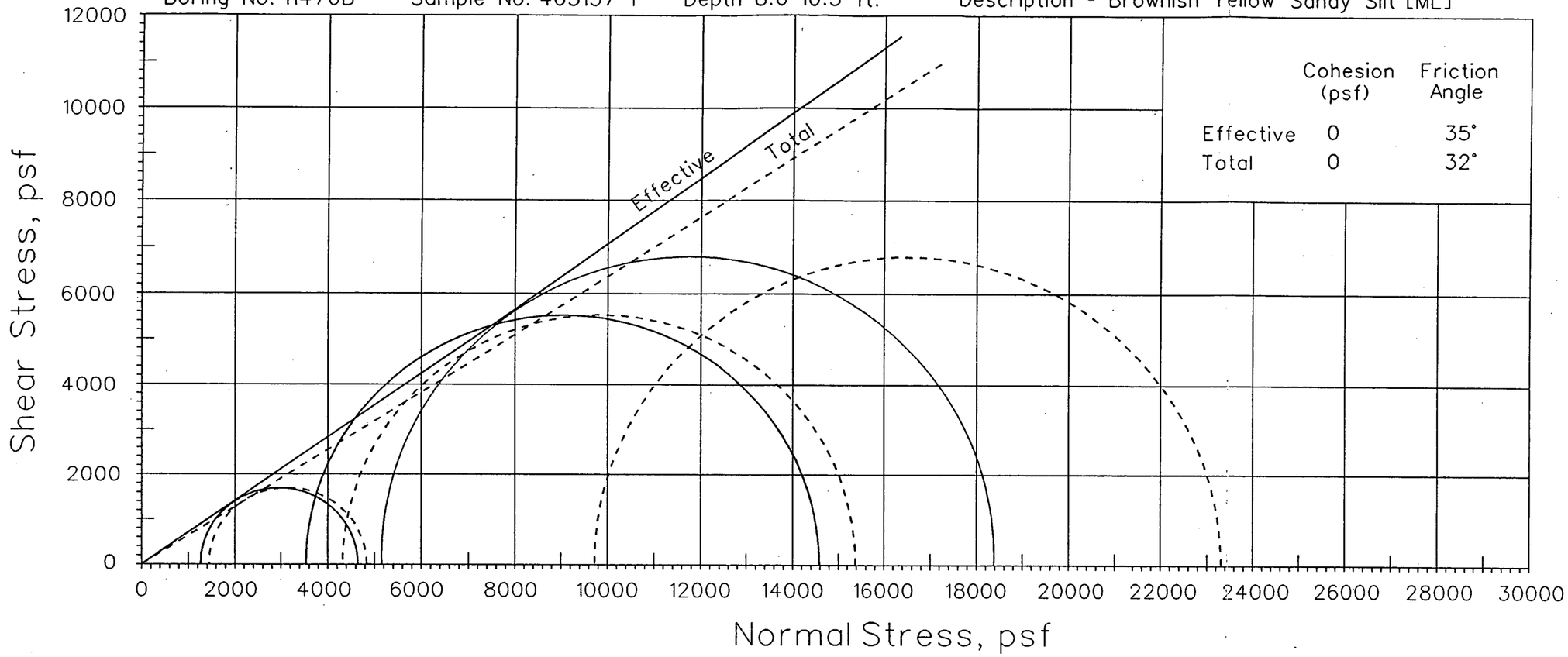
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11469	3.0-5.5	C	14.7	16.2	130.8	114.1	5.89	8987	6221	3859	12846	3.33
		D	17.2	21.4	124.4	106.1	8.11	3873	2736	1584	5457	3.45
		E	19.1	24.9	122.2	102.6	1.90	1908	490	259	2167	8.35

CAD FILE: skx03566.dgn

R11470bmo.m(2383.ws415) po140@ws415. Mon Oct 30 10:14:34 CST 1995

Triaxial Compression Test Report

Boring No. 11470B Sample No. 403137-1 Depth 8.0-10.5 ft. Description - Brownish Yellow Sandy Silt [ML]



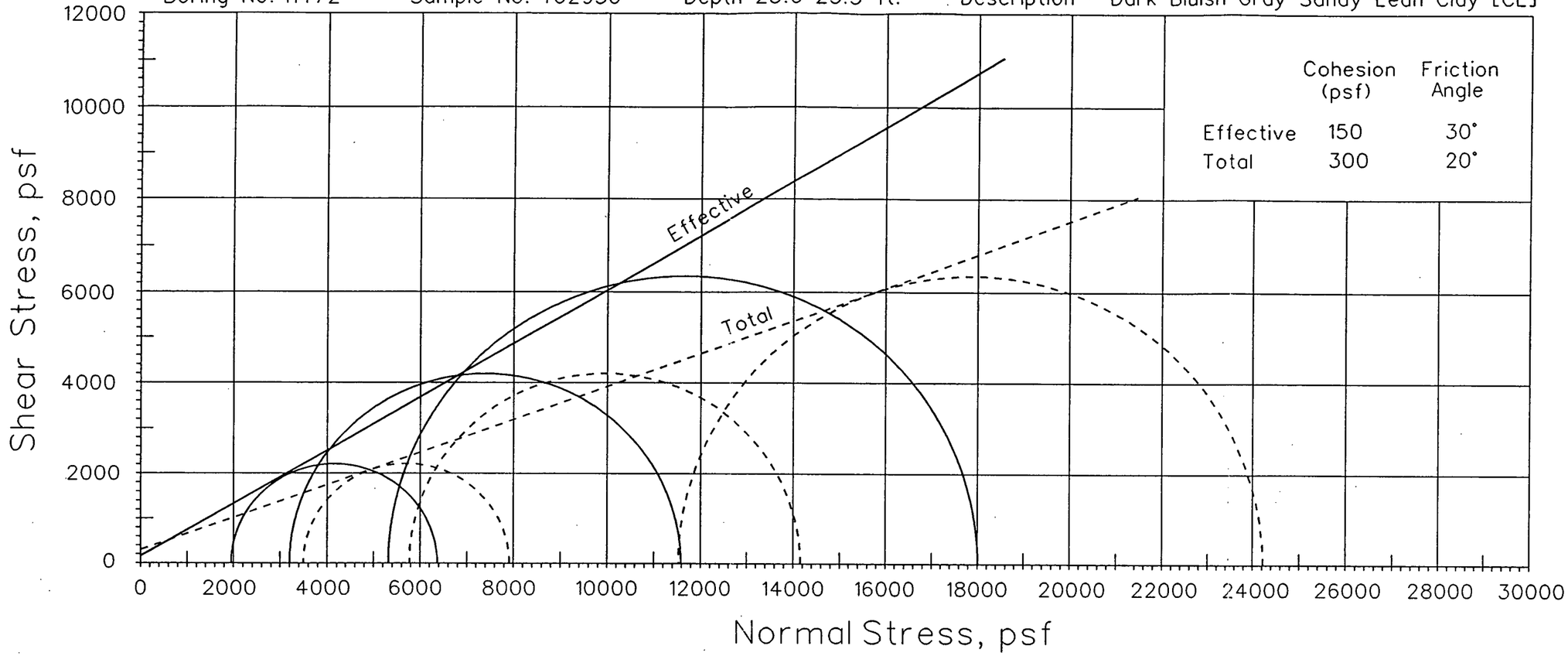
Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11470B	8.0-10.5	C	15.7	14.7	137.8	119.1	5.09	13224	4925	5155	18379	3.57
		D	18.7	17.4	131.9	111.1	4.61	11052	792	3528	14580	4.13
		E	17.0	16.1	135.0	115.3	6.14	3392	187	1253	4645	3.71

CAD FILE: skx03567.dgn

Triaxial Compression Test Report

Boring No. 11472 Sample No. 402956 Depth 23.0-25.5 ft. Description - Dark Bluish Gray Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

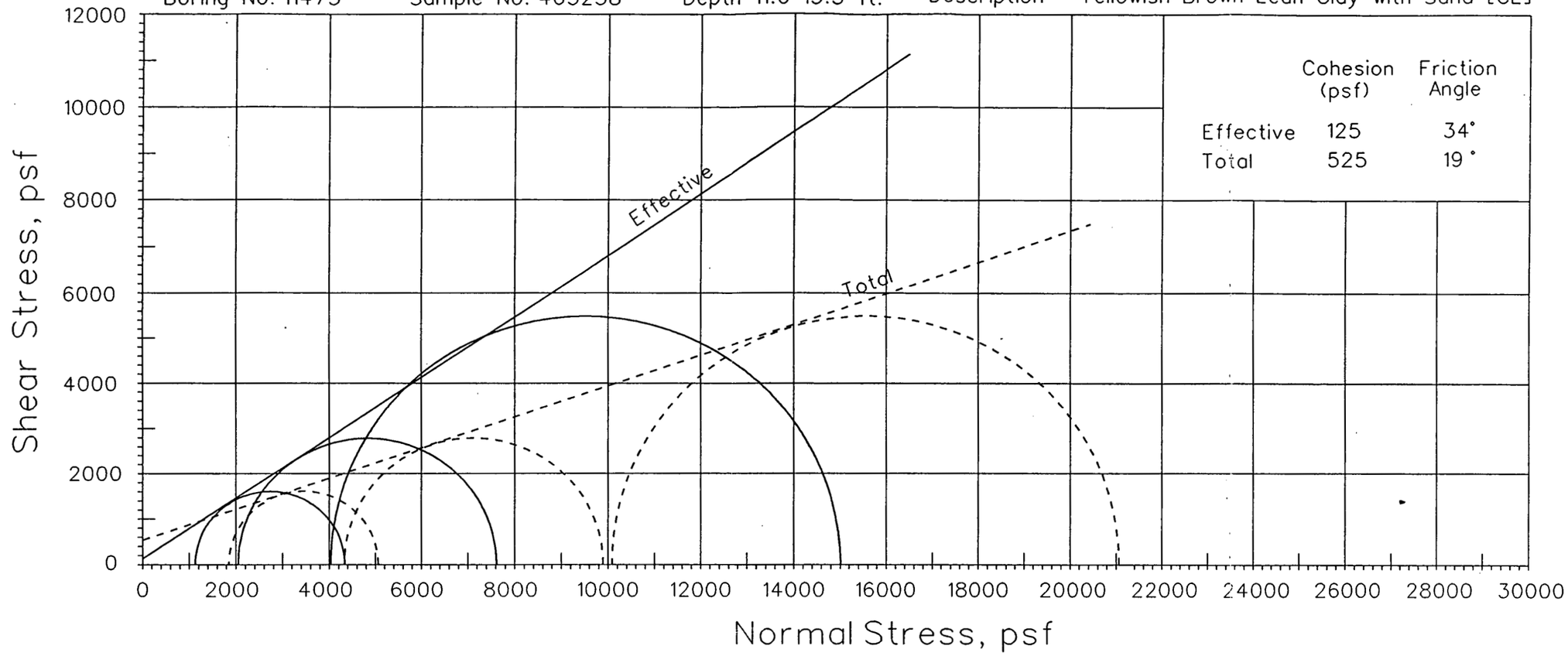
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11472	23.0-25.5	A	12.7	10.9	144.3	128.0	6.19	12695	6206	5314	18009	3.39
		B	12.3	11.0	144.4	128.6	10.43	8391	2563	3197	11588	3.62
		C	12.7	12.0	144.1	127.8	4.34	4423	1541	1944	6367	3.28

CAD FILE: skx03568.dgn

R11472mo.m(2385.ws415) po140@ws415. Mon Oct 30 10:15:30 CST 1995

Triaxial Compression Test Report

Boring No. 11475 Sample No. 403258 Depth 11.0-13.5 ft. Description - Yellowish Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

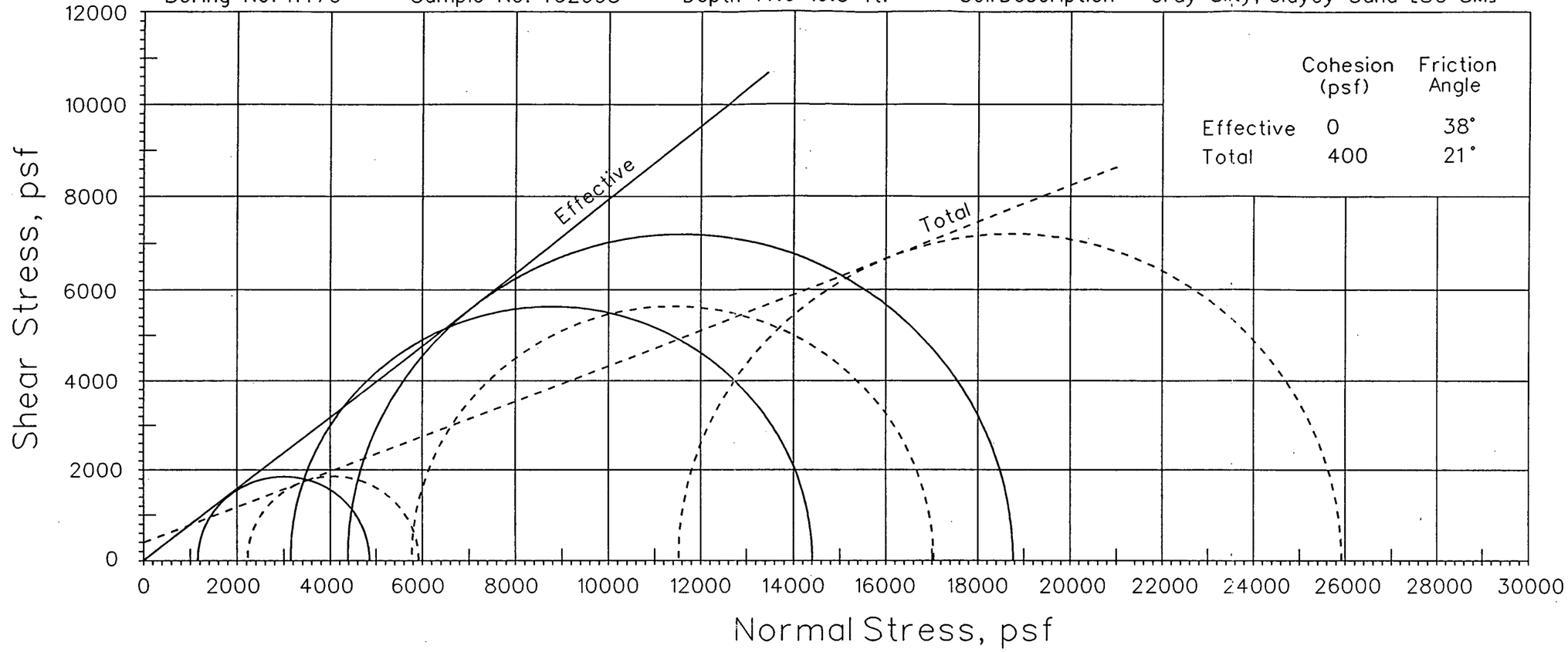
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11475	11.0-13.5	A	12.7	11.8	141.6	125.6	5.31	10976	6048	4032	15008	3.72
		B	16.8	15.2	137.5	117.7	7.15	5571	2275	2045	7616	3.72
		C	20.1	19.7	133.1	110.9	5.89	3211	720	1123	4334	3.86

CAD FILE: skx03569.dgn

R11475mo.m(2386.ws415) po140@ws415. Mon Oct 30 10:16:27 CST 1995

Triaxial Compression Test Report

Boring No. 11476 Sample No. 402998 Depth 14.0-16.5 ft. Soil Description - Gray Silty, Clayey Sand [SC-SM]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

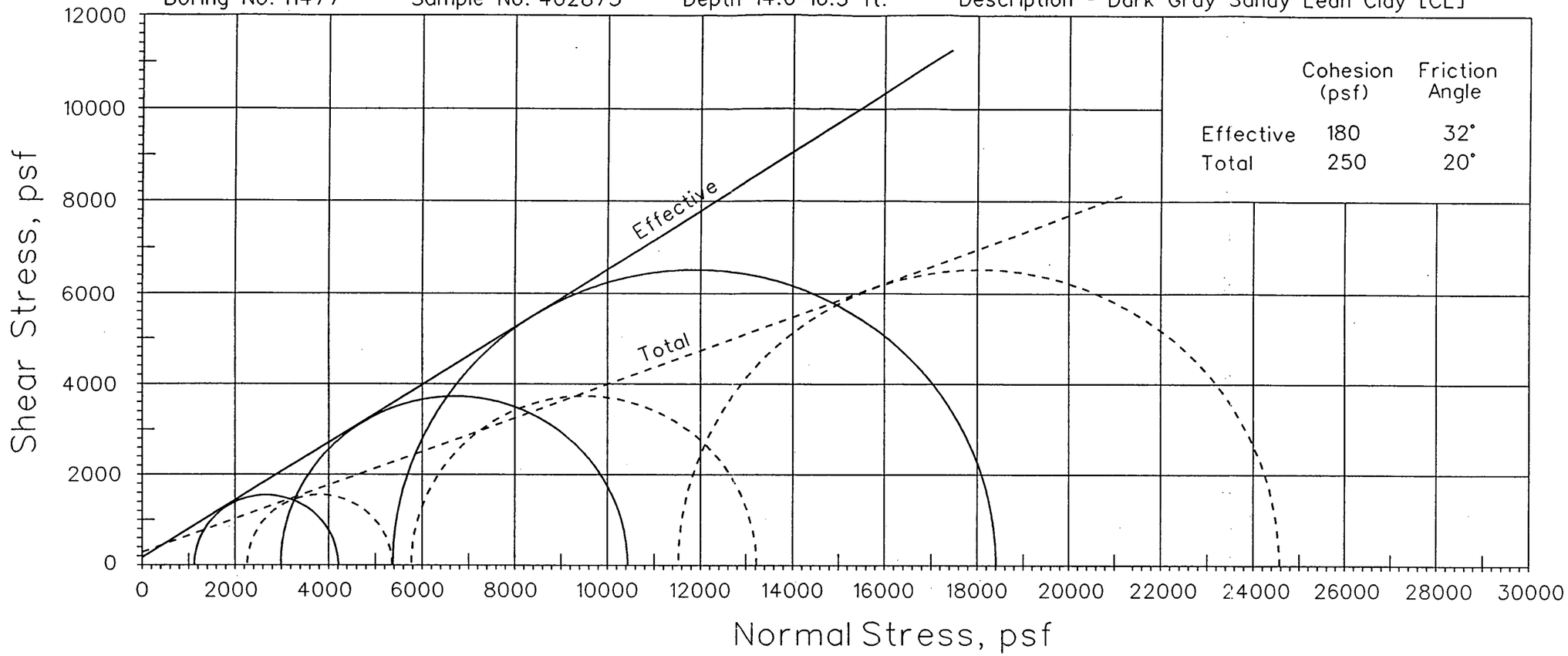
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11476	14.0-16.5	A	8.7	7.7	146.2	134.4	5.93	14391	7142	4378	18768	4.29
		B	8.4	8.0	144.4	133.2	19.75	11268	2621	3139	14408	4.59
		C	10.0	9.4	146.1	132.8	2.53	3663	1066	1191	4854	4.07

CAD FILE: skx03570.dgn

R11476mo.m(2388.ws415) po140@ws415. Mon Oct 30 10:17:10 CST 1995

Triaxial Compression Test Report

Boring No. 11477 Sample No. 402873 Depth 14.0-16.5 ft. Description - Dark Gray Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11477	14.0-16.5	A	13.1	11.7	142.3	125.9	8.26	13042	6149	5371	18413	3.43
		B	11.8	10.9	144.1	128.9	6.20	7456	2779	2981	10437	3.50
		C	13.2	12.5	140.9	124.4	5.12	3095	1138	1122	4217	3.76

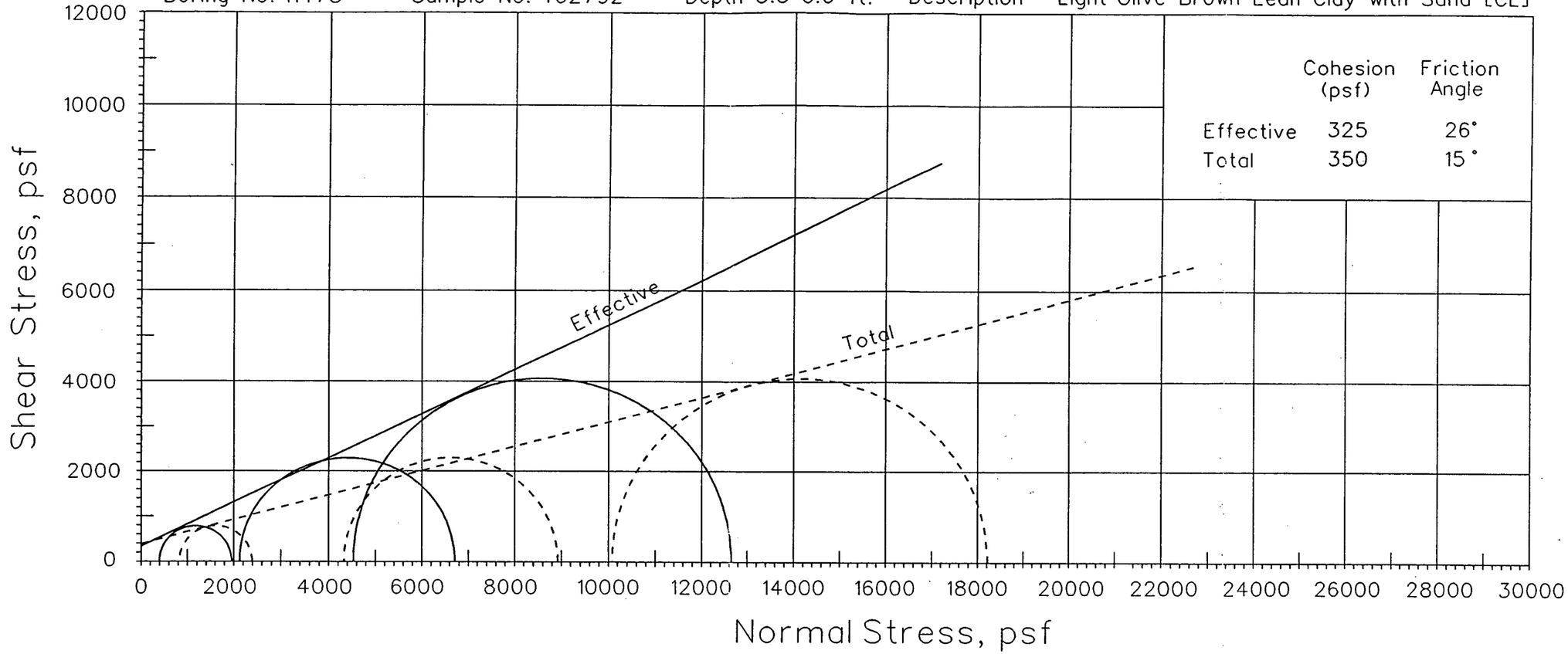
CAD FILE: skx03571.dgn

R11477mo.m(2389.ws415) po140@ws415. Mon Oct 30 10:17:44 CST 1995

R11478mo.m(2390.ws415) po140@ws415. Mon Oct 30 10:18:17 CST 1995

Triaxial Compression Test Report

Boring No. 11478 Sample No. 402792 Depth 3.5-6.0 ft. Description - Light Olive Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

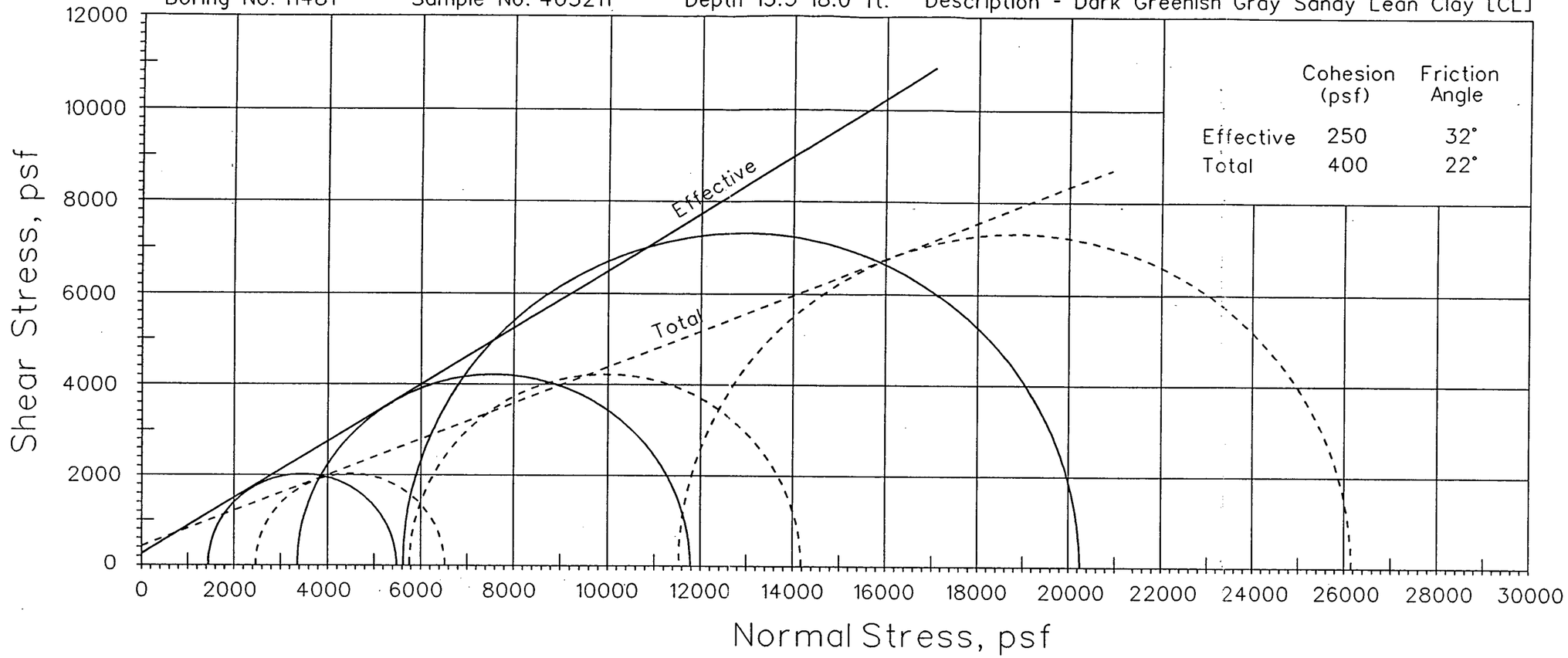
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11478	3.5-6.0	A	17.5	15.8	134.9	114.8	7.31	8133	5558	4522	12654	2.80
		B	19.4	19.9	126.8	106.2	7.22	4596	2203	2117	6712	3.17
		C	25.3	29.0	120.1	95.8	2.24	1570	432	389	1959	5.04

CAD FILE: skx03572.dgn

R11481mo.m(2391.ws415) po140@ws415. Mon Oct 30 10:18:51 CST 1995

Triaxial Compression Test Report

Boring No. 11481 Sample No. 403211 Depth 15.5-18.0 ft. Description - Dark Greenish Gray Sandy Lean Clay [CL]



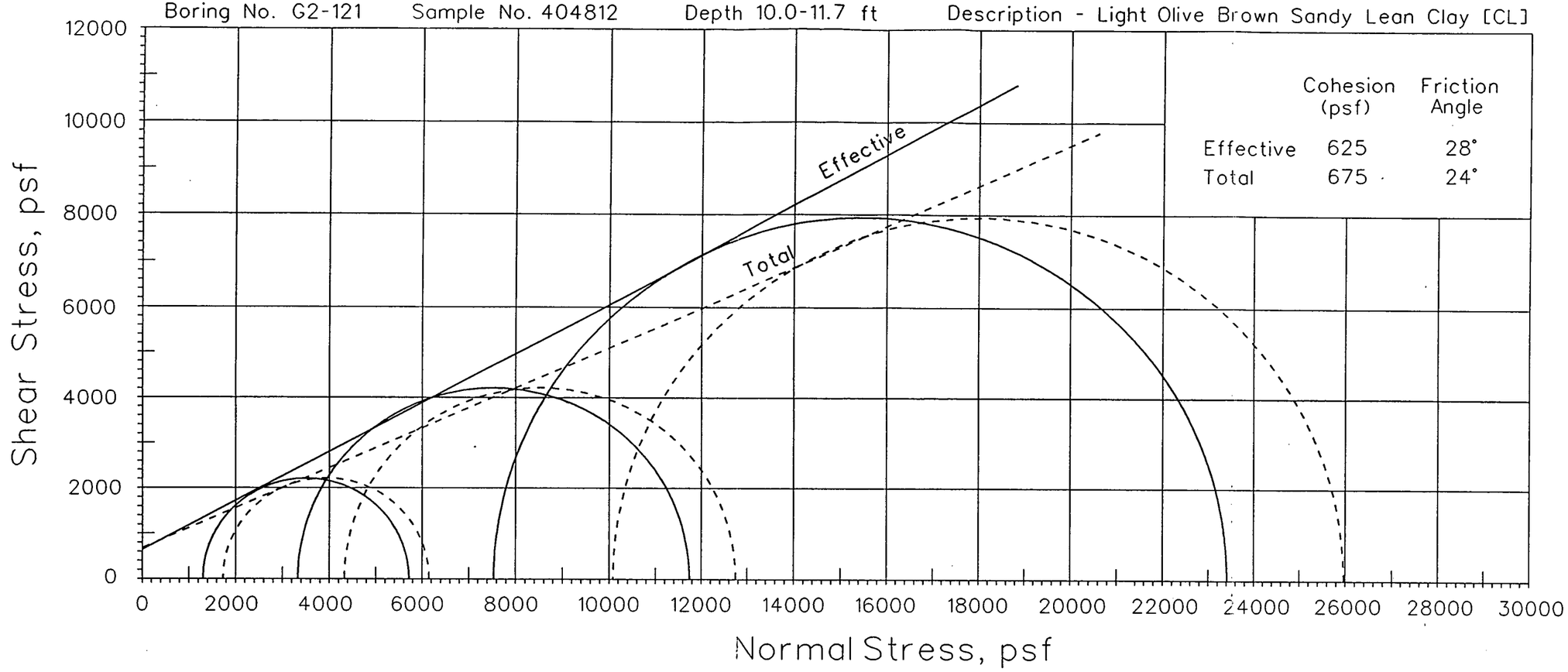
Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11481	15.5-18.0	A	11.2	9.6	147.9	133.0	5.94	14632	5904	5616	20248	3.61
		B	12.3	11.3	144.7	128.8	8.8	8427	2405	3355	11782	3.51
		C	11.9	11.7	144.3	129.0	4.32	4047	1022	1440	5487	3.81

CAD FILE: skx03573.dgn

Triaxial Compression Test Report

Boring No. G2-121 Sample No. 404812 Depth 10.0-11.7 ft Description - Light Olive Brown Sandy Lean Clay [CL]



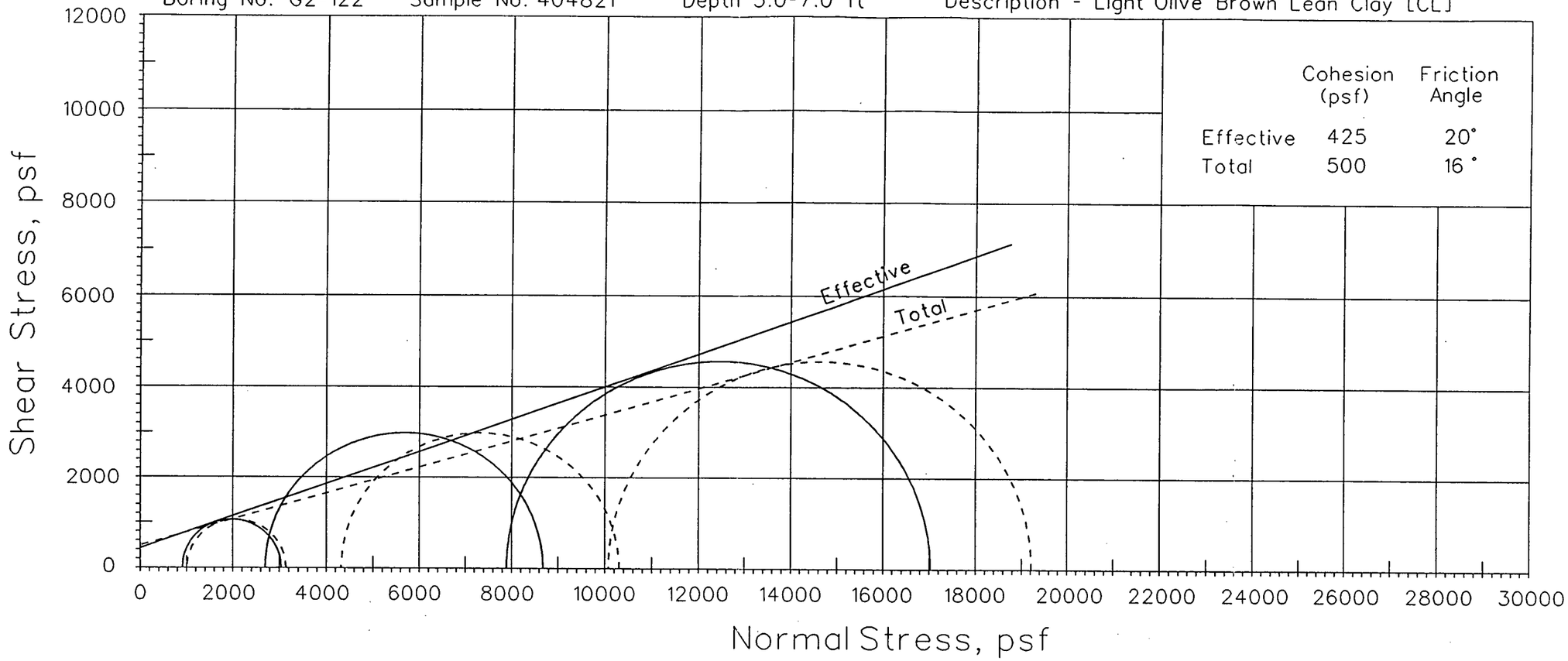
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-121	10.0-11.7	A-STG1	11.1	12.0	144.7	130.2	1.88	4421	432	1296	5717	4.41
		A-STG2	11.1	12.0	145.0	130.5	2.14	8419	994	3326	11746	3.53
		A-STG3	11.1	12.0	146.4	131.8	4.74	15878	2549	7531	23409	3.11

CAD FILE: SKX03795.DGN

Triaxial Compression Test Report

Boring No. G2-122 Sample No. 404821 Depth 5.0-7.0 ft Description - Light Olive Brown Lean Clay [CL]



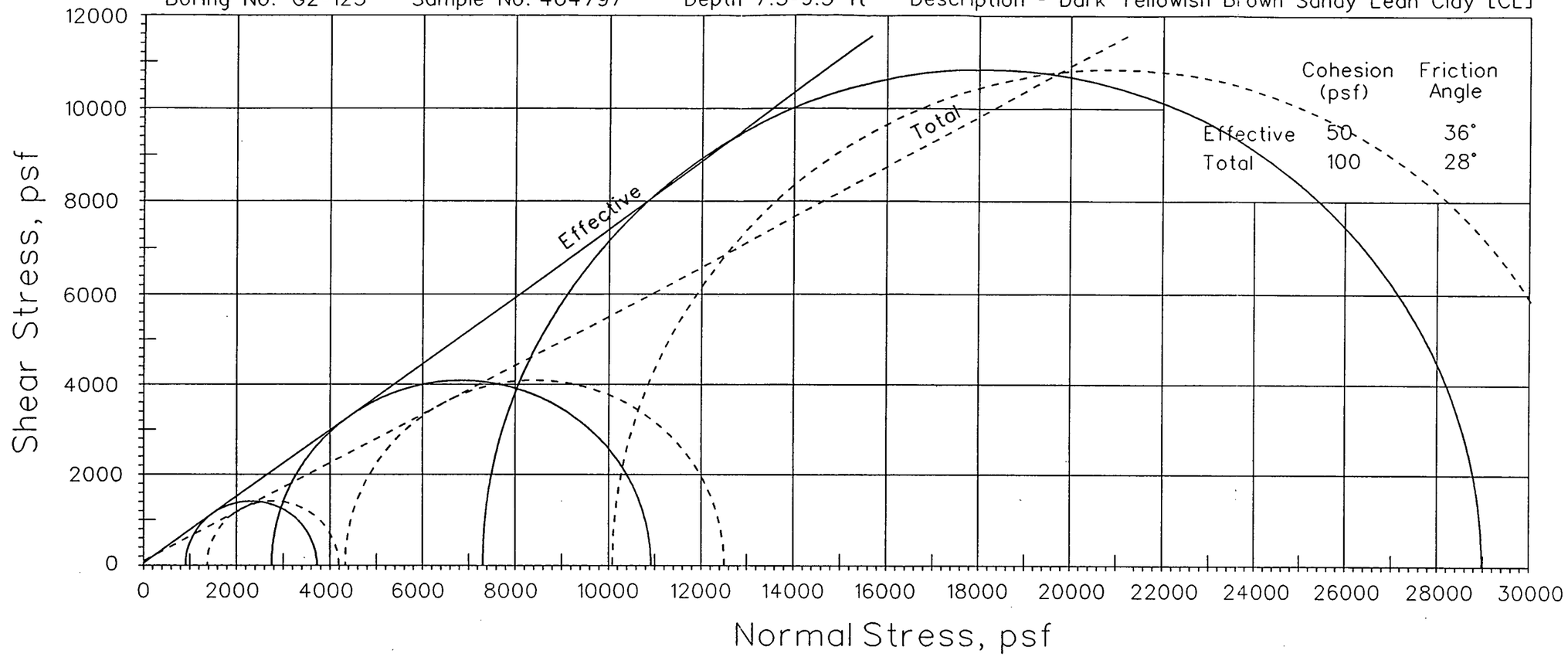
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Maximum Pore Pressure

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-122	5.0-7.0	A-STG1	15.4	15.4	138.0	119.5	1.53	2136	101	907	3043	3.35
		A-STG2	15.4	15.4	139.9	121.2	1.57	5985	1627	2693	8678	3.22
		A-STG3	15.4	15.4	142.4	123.3	4.52	9141	2189	7891	17032	2.16

CAD FILE: SKX03803.DGN

Triaxial Compression Test Report

Boring No. G2-123 Sample No. 404797 Depth 7.5-9.5 ft Description - Dark Yellowish Brown Sandy Lean Clay [CL]



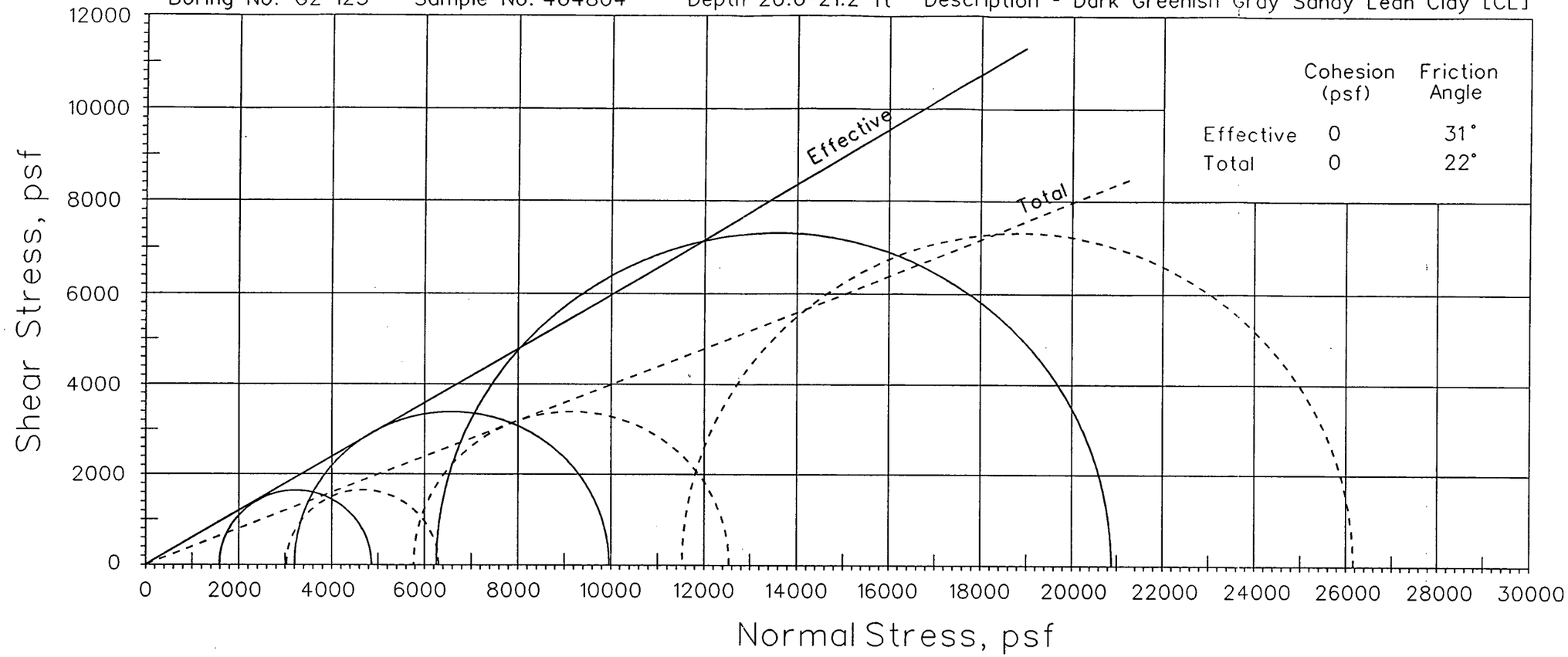
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-123	7.5-9.5	A-STG1	13.6	12.9	139.6	122.9	2.41	2819	461	907	3726	4.11
		A-STG2	13.6	12.9	142.9	125.8	2.47	8171	1570	2750	10922	3.97
		A-STG3	13.6	12.9	145.1	127.8	4.59	21670	2779	7301	28971	3.97

CAD FILE: SKX03798.DGN

Triaxial Compression Test Report

Boring No. G2-123 Sample No. 404804 Depth 20.0-21.2 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



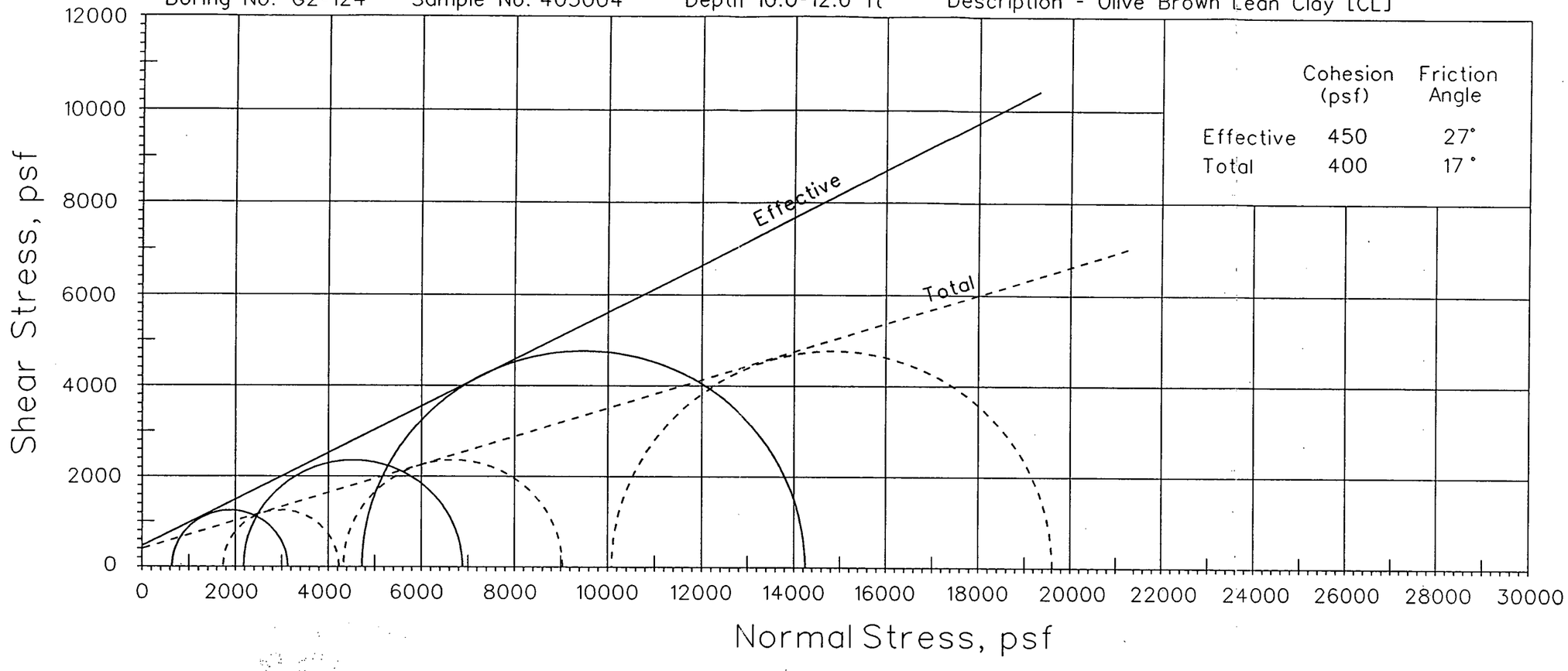
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-123	20.0-21.2	A-STG1	12.7	12.2	143.7	127.5	2.17	3279	1440	1584	4863	3.07
		A-STG2	12.7	12.2	144.7	128.5	2.73	6770	2563	3197	9967	3.12
		A-STG3	12.7	12.2	146.1	129.7	4.41	14634	5270	6250	20883	3.34

CAD FILE: SKX03804.DGN

Triaxial Compression Test Report

Boring No. G2-124 Sample No. 405004 Depth 10.0-12.0 ft Description - Olive Brown Lean Clay [CL]



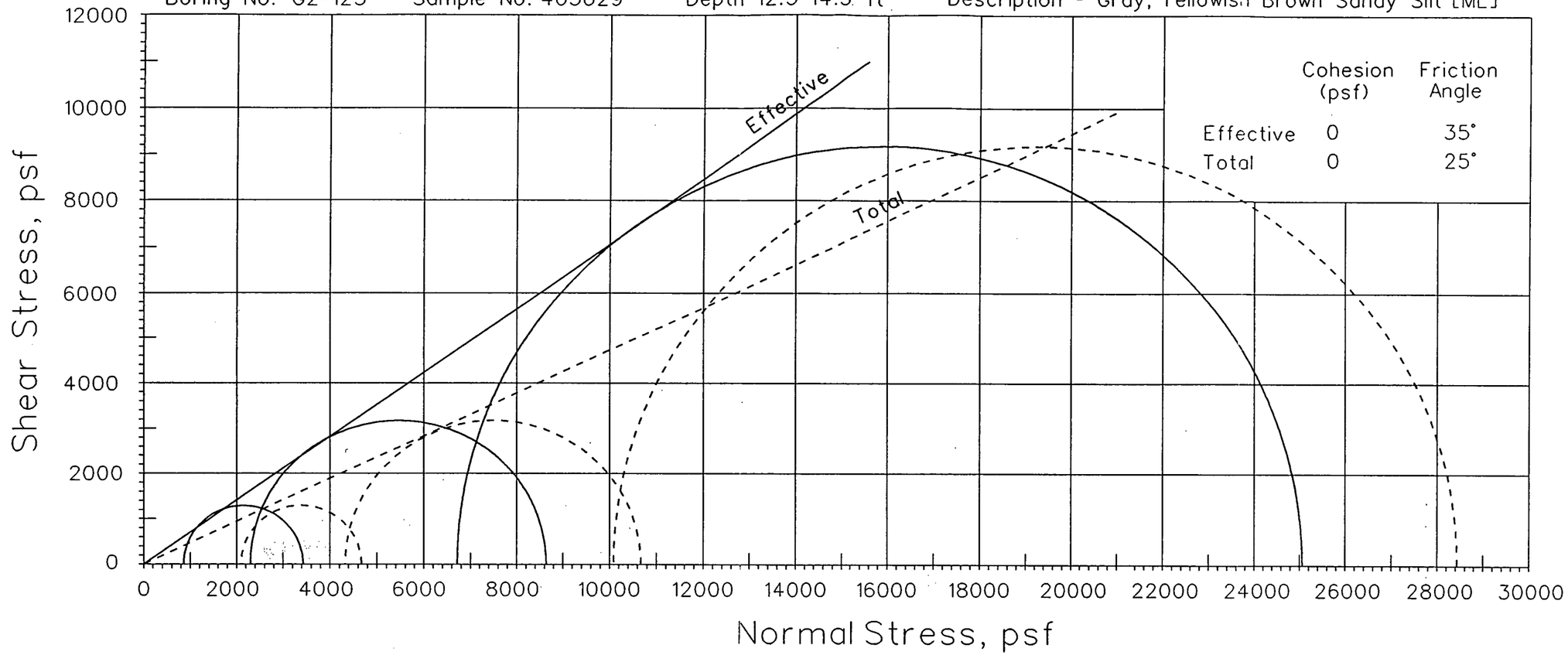
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-124	10.0-12.0	A-STG1	21.1	19.8	131.0	108.2	3.04	2496	1094	634	3130	4.94
		A-STG2	21.1	19.8	132.4	109.3	2.48	4712	2146	2174	6886	3.17
		A-STG3	21.1	19.8	134.2	110.9	3.66	9524	5357	4723	14248	3.02

CAD FILE: SKX03799.DGN

Triaxial Compression Test Report

Boring No. G2-125 Sample No. 405029 Depth 12.5-14.5 ft Description - Gray, Yellowish Brown Sandy Silt [ML]



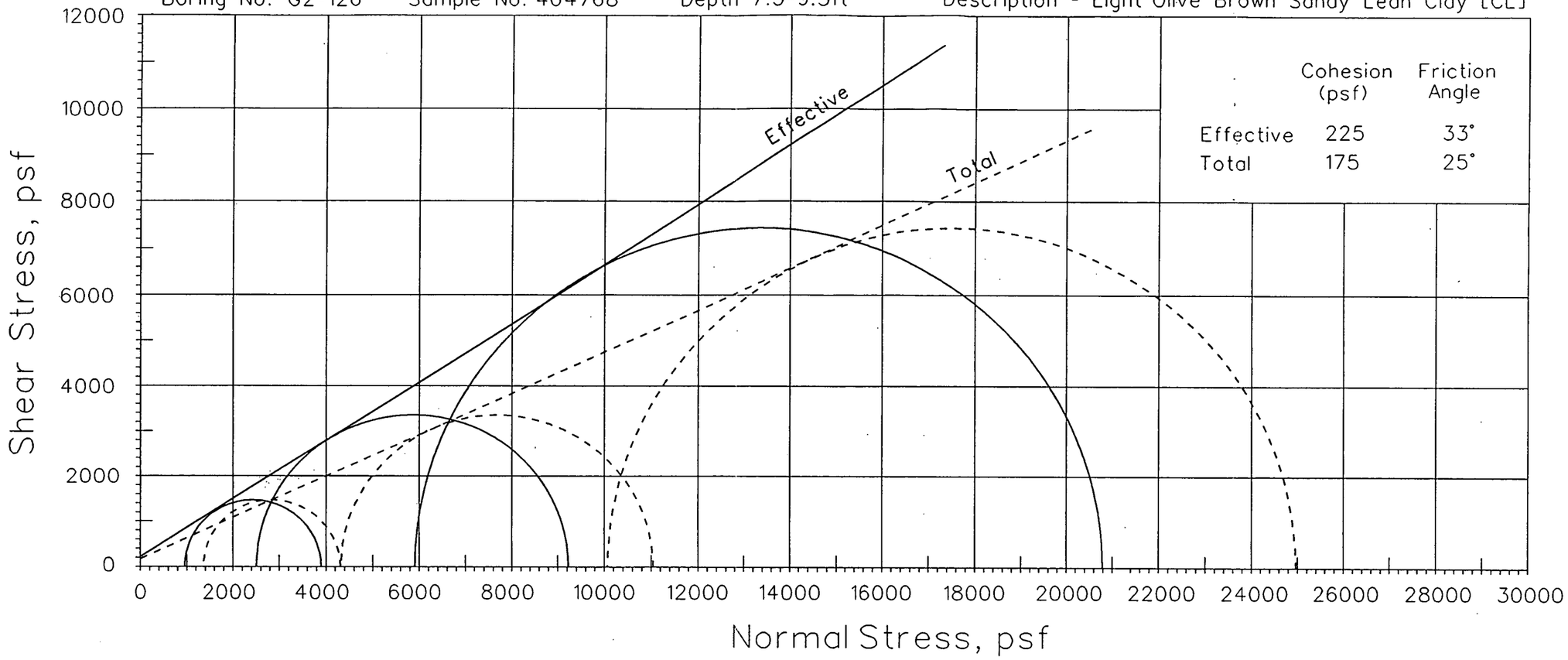
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-125	12.5-14.5	A-STG1	9.9	8.7	148.5	135.2	1.36	2579	1238	850	3428	4.03
		A-STG2	9.9	8.7	149.7	136.3	1.55	6349	2030	2290	8639	3.77
		A-STG3	9.9	8.7	150.7	137.1	6.15	18349	3370	6710	25059	3.73

CAD FILE: SKX03802.DGN

Triaxial Compression Test Report

Boring No. G2-126 Sample No. 404768 Depth 7.5-9.5ft Description - Light Olive Brown Sandy Lean Clay [CL]



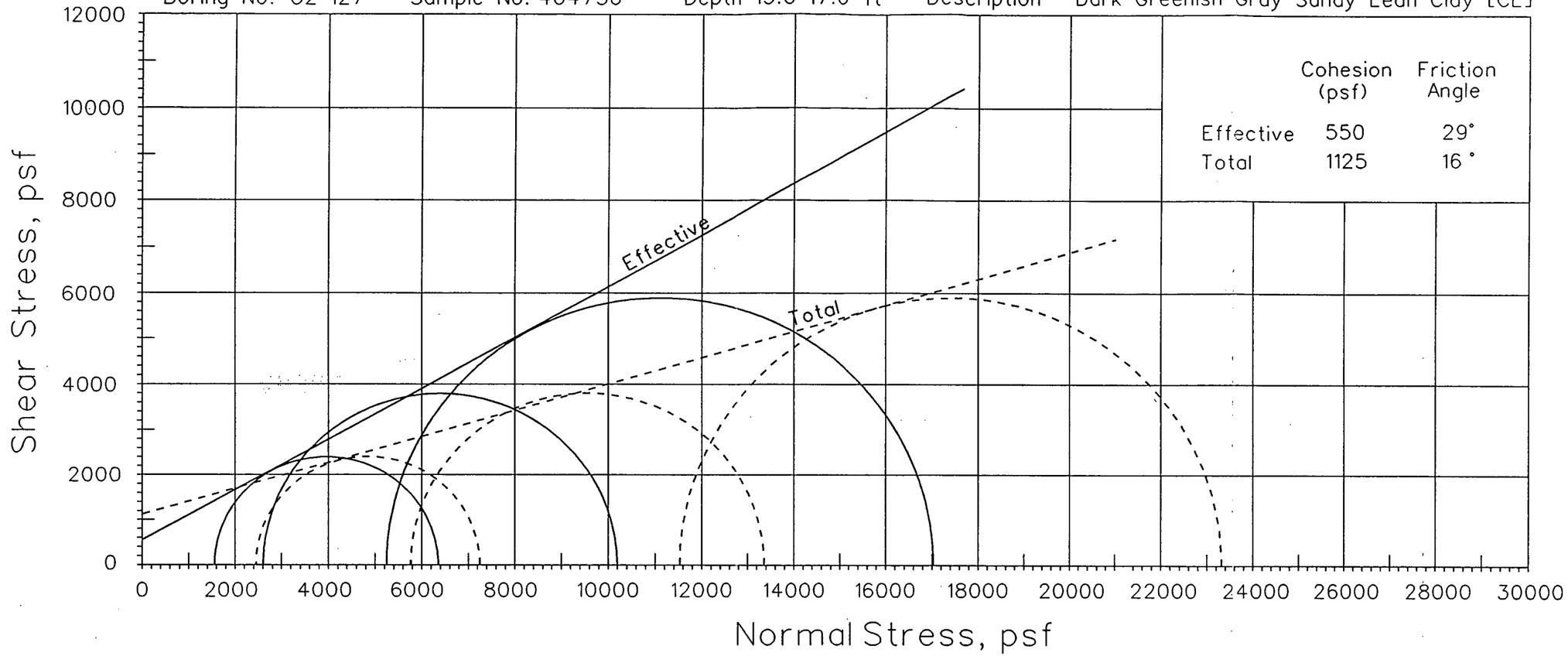
Type of Test: CU w/pp - STAGED Sample Type: In Situ Failure Criteria: Maximum Pore Pressure

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-126	7.5-9.5	A-STG1	13.5	12.3	142.4	125.5	2.02	2931	403	965	3896	4.04
		A-STG2	13.5	12.3	145.0	127.8	1.75	6713	1814	2506	9219	3.68
		A-STG3	13.5	12.3	147.0	129.6	4.45	14887	4176	5904	20791	3.52

CAD FILE: SKX03801.DGN

Triaxial Compression Test Report

Boring No. G2-127 Sample No. 404756 Depth 15.0-17.0 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



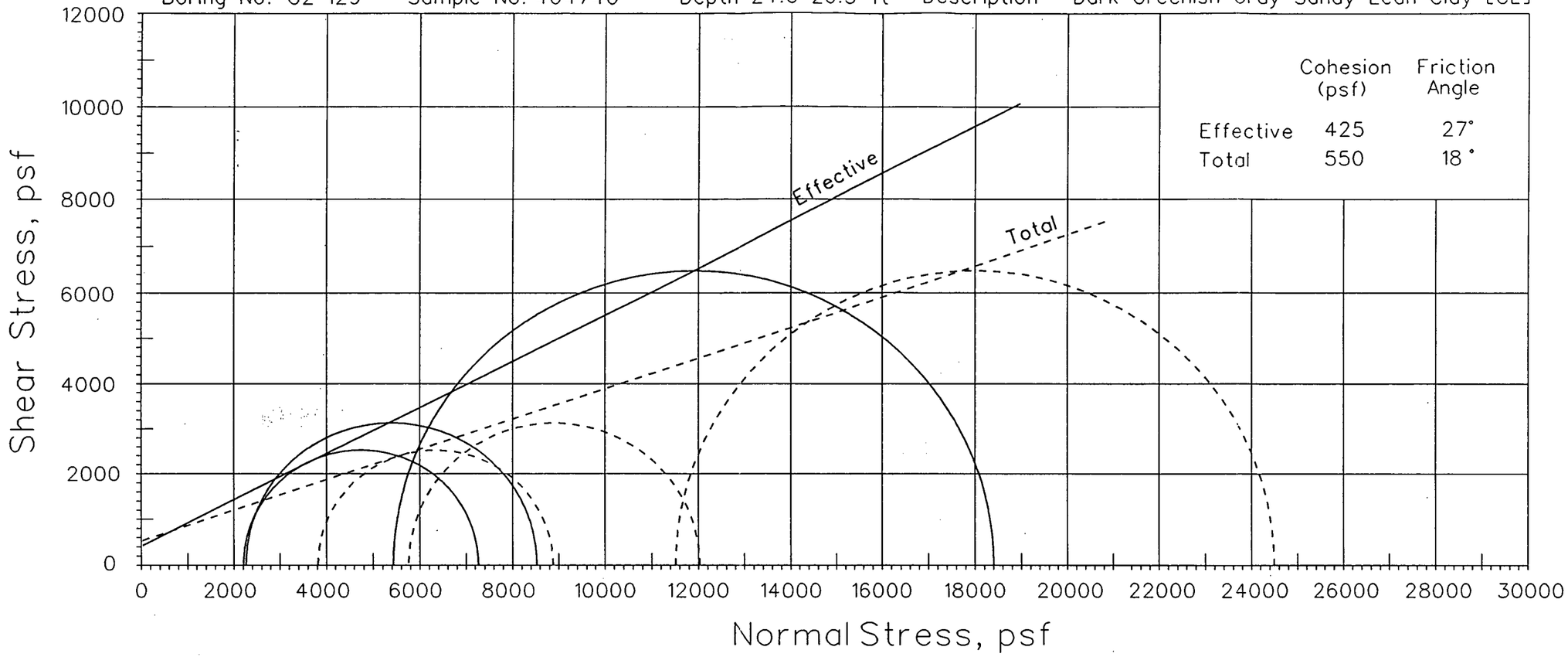
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-127	15.0-17.0	A	12.4	12.0	144.7	128.7	4.20	4797	893	1555	6352	4.08
		B	12.7	12.2	143.6	127.4	4.22	7592	3154	2606	10198	3.91
		C	11.0	11.0	142.7	128.6	5.08	11789	6278	5242	17030	3.25

CAD FILE: SKX03794.DGN

Triaxial Compression Test Report

Boring No. G2-129 Sample No. 404740 Depth 24.0-26.5 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



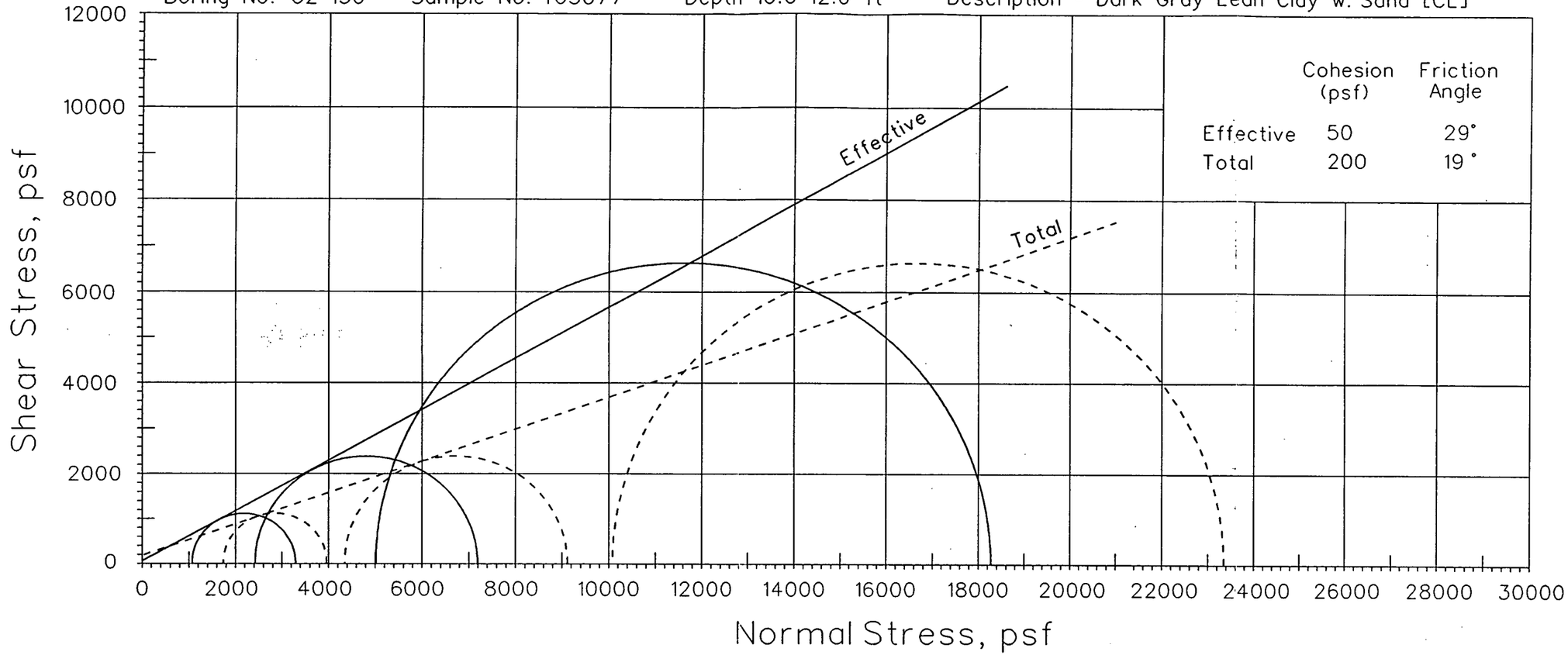
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Maximum Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-129	24.0-26.5	A	12.9	11.7	144.7	128.2	5.05	5063	1613	2203	7266	3.30
		B	12.6	12.4	141.7	125.8	4.20	6272	3499	2261	8533	3.77
		C	10.6	10.2	144.1	130.3	6.97	12972	6091	5429	18401	3.39

CAD FILE: SKX03829.DGN

Triaxial Compression Test Report

Boring No. G2-130 Sample No. 405077 Depth 10.0-12.0 ft Description - Dark Gray Lean Clay w. Sand [CL]



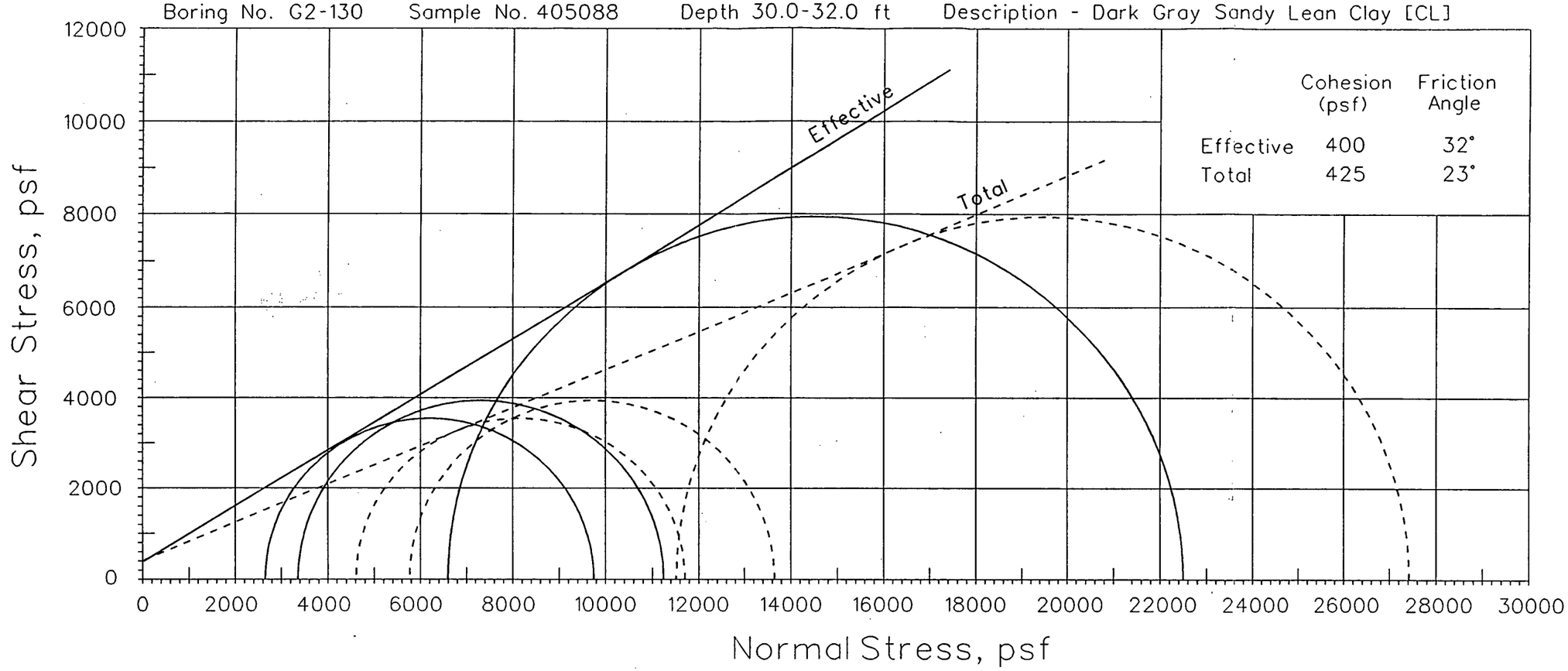
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Maximum Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-130	10.0-12.0	A	14.0	13.1	144.9	127.1	4.30	2235	662	1066	3301	3.10
		B	19.2	17.9	134.8	113.0	6.92	4776	1901	2419	7195	2.97
		C	10.5	9.9	146.9	132.9	7.71	13265	5069	5011	18277	3.65

CAD FILE: SKX03830.DGN

Triaxial Compression Test Report

Boring No. G2-130 Sample No. 405088 Depth 30.0-32.0 ft Description - Dark Gray Sandy Lean Clay [CL]



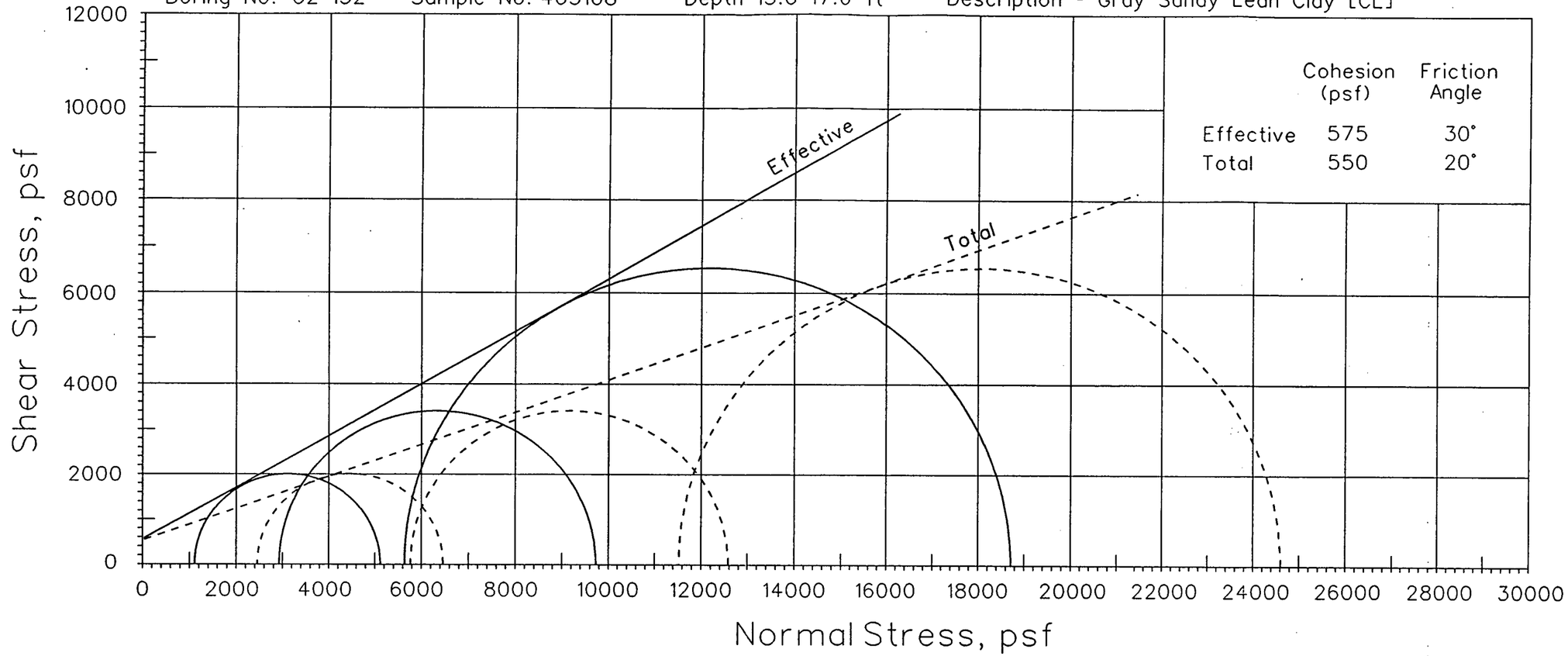
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Maximum Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-130	30.0-32.0	A	11.2	11.0	146.0	131.3	3.37	7100	1958	2650	9750	3.68
		B	11.1	10.7	146.8	132.2	4.21	7890	2405	3355	11245	3.35
		C	11.7	11.1	144.7	129.5	8.42	15901	4925	6595	22496	3.41

CAD FILE: SKX03831.DGN

Triaxial Compression Test Report

Boring No. G2-132 Sample No. 405108 Depth 15.0-17.0 ft Description - Gray Sandy Lean Clay [CL]



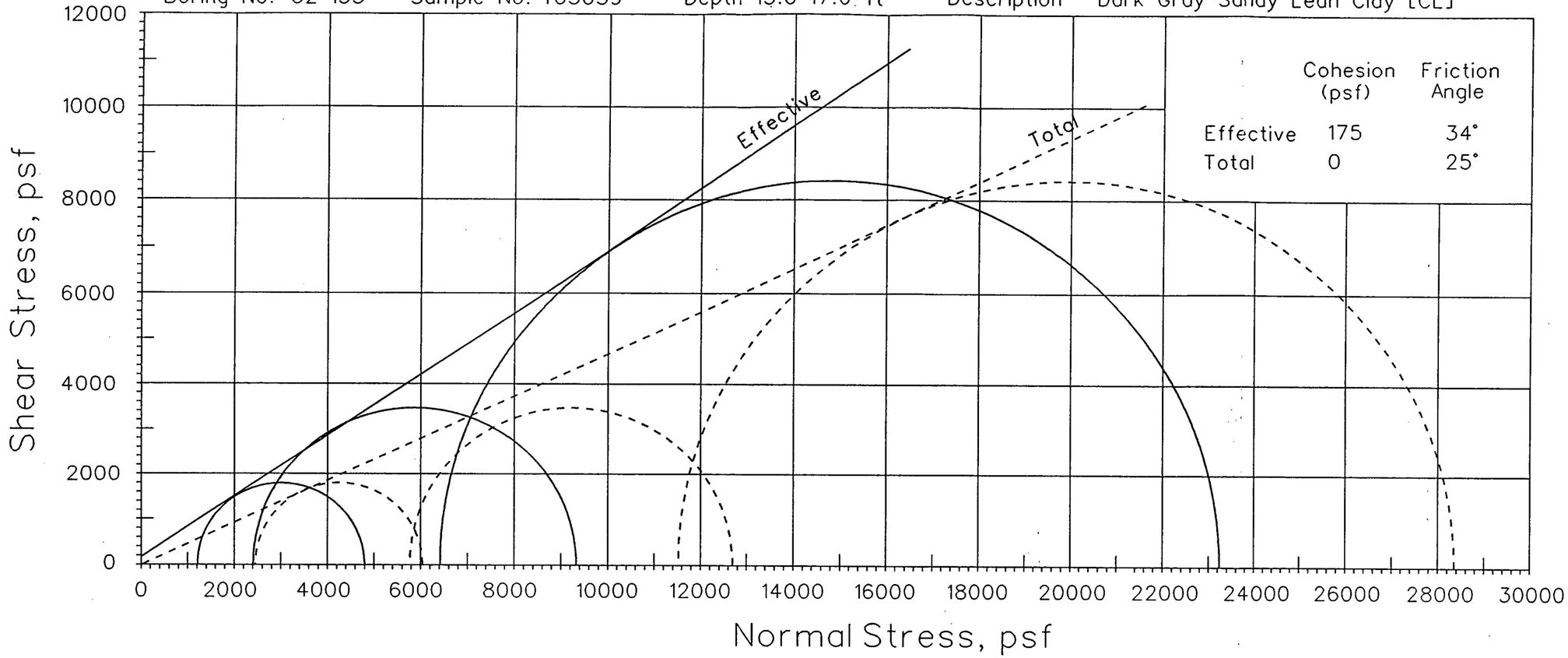
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-132	15.0-17.0	A	11.9	11.7	145.8	130.3	2.52	4016	1339	1109	5124	4.62
		B	12.4	11.8	145.3	129.3	5.07	6814	2837	2923	9737	3.33
		C	11.7	11.7	145.2	130.0	8.53	13082	5890	5630	18712	3.32

CAD FILE: SKX03827.DGN

Triaxial Compression Test Report

Boring No. G2-133 Sample No. 405059 Depth 15.0-17.0 ft Description - Dark Gray Sandy Lean Clay [CL]



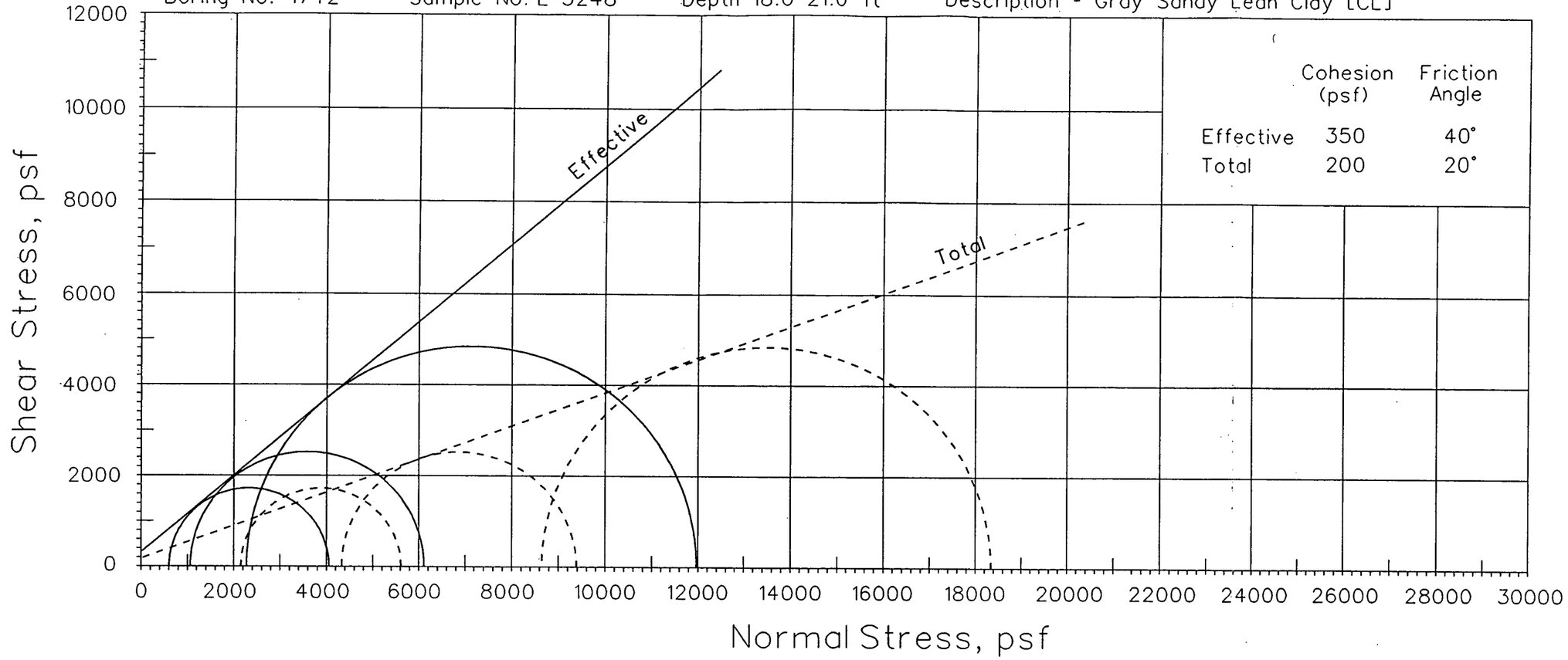
Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-133	15.0-17.0	A	10.7	10.2	146.5	132.4	2.52	3588	1238	1210	4797	3.97
		B	11.3	10.6	146.8	131.9	3.36	6929	3355	2405	9334	3.88
		C	9.0	9.5	149.3	137.0	6.76	16829	5112	6408	23237	3.63

CAD FILE: SKX03828.DGN

Triaxial Compression Test Report

Boring No. 1742 Sample No. L-3248 Depth 18.0-21.0 ft Description - Gray Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

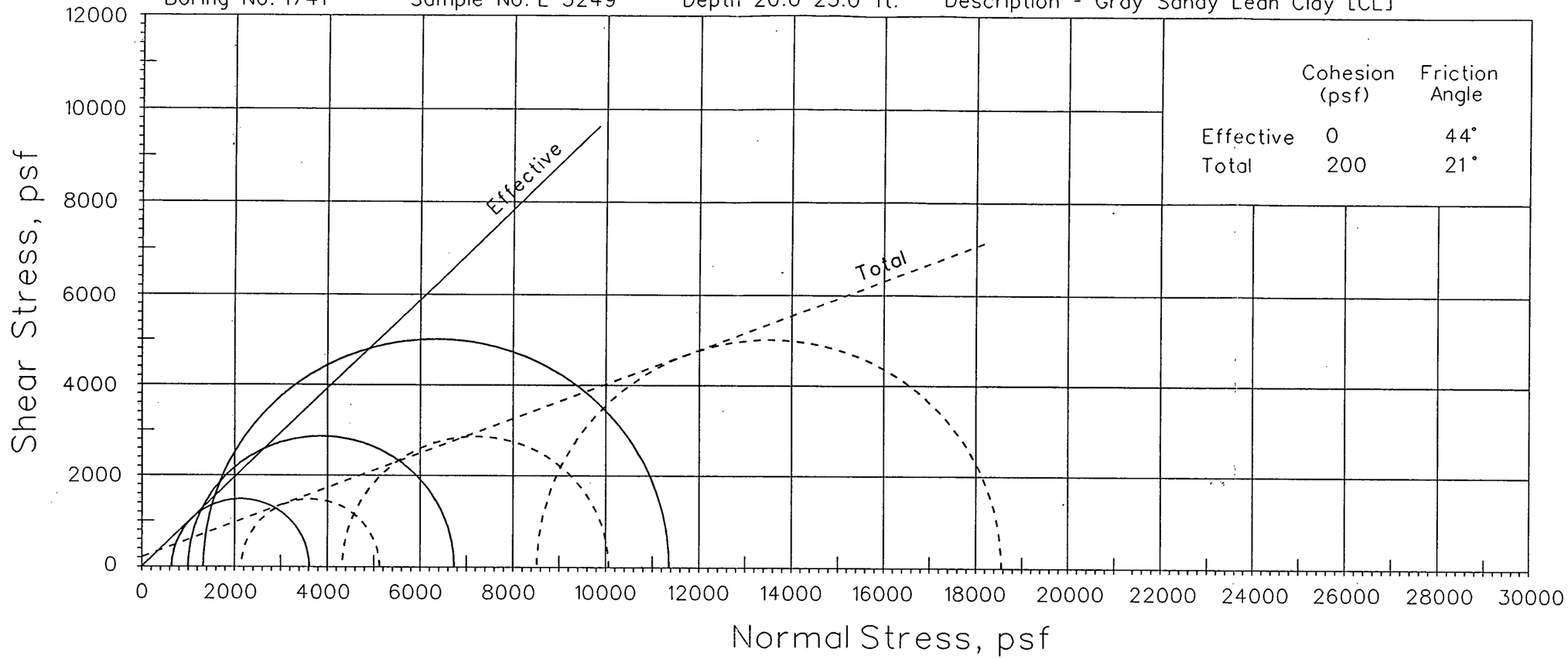
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1742	18.0-21.0	1	13.3	12.5	144.1	127.2	5.8	3460	1556	600	4060	6.77
		2	13.4	12.0	144.4	127.3	5.3	5060	3269	1060	6120	5.77
		3	15.1	9.6	148.4	128.9	5.8	9700	6365	2280	11980	5.25

Data Source: H.C. Nutting Co., data file: 3248, 6/1/92.

CAD FILE: SKX03811.DGN

Triaxial Compression Test Report

Boring No. 1741 Sample No. L-3249 Depth 20.0-23.0 ft. Description - Gray Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: Insitu Failure Criteria: Max. Principal Stress Ratio

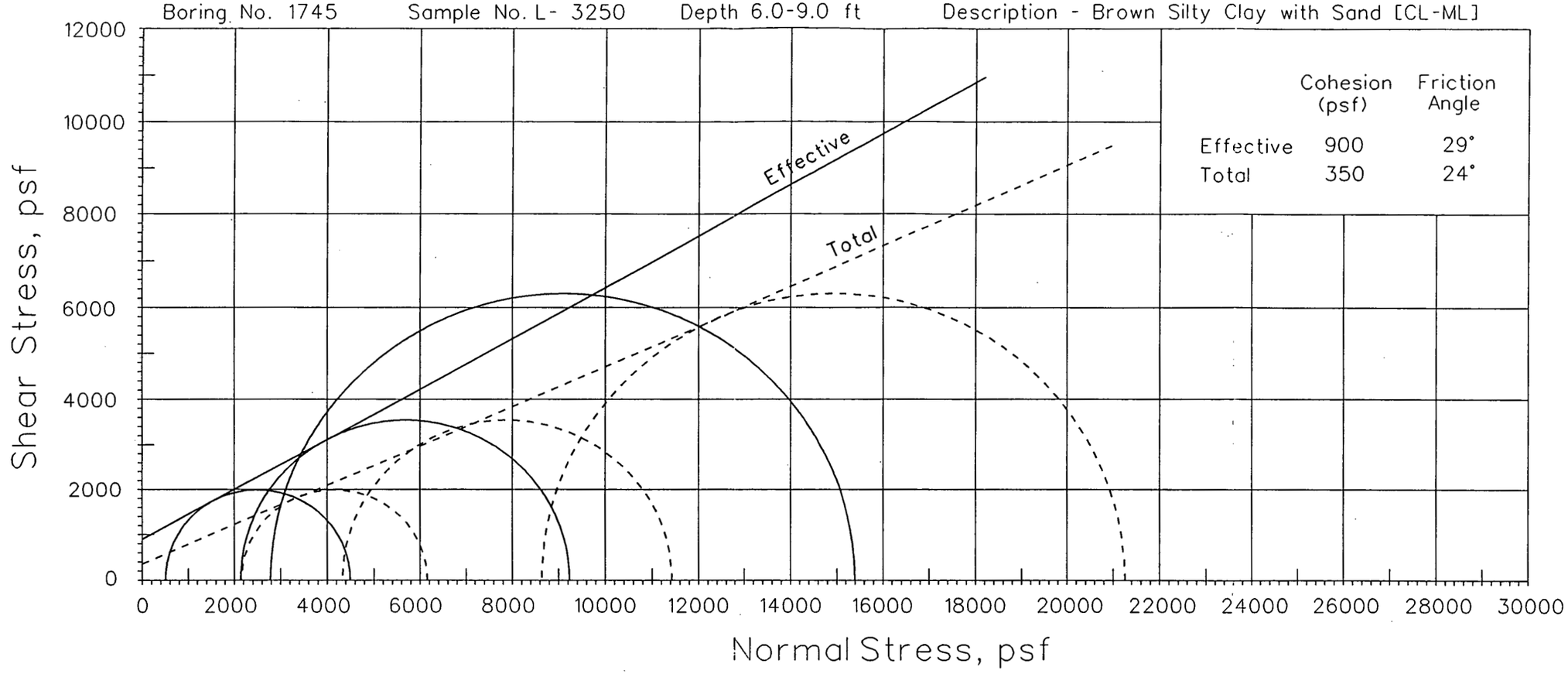
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1741	20.0-23.0	1	11.4	14.1	142.4	127.8	4.7	2980	1512	640	3620	5.66
		2	14.2	13.5	142.6	124.9	4.3	5740	3326	1000	6740	6.74
		3	13.9	12.5	142.6	125.2	5.7	10040	7330	1320	11360	8.61

Data Source: H.C. Nutting Co., data file: 3250, 5/18/92.

CAD FILE: SKX03810.DGN

Triaxial Compression Test Report

Boring No. 1745 Sample No. L- 3250 Depth 6.0-9.0 ft Description - Brown Silty Clay with Sand [CL-ML]



Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

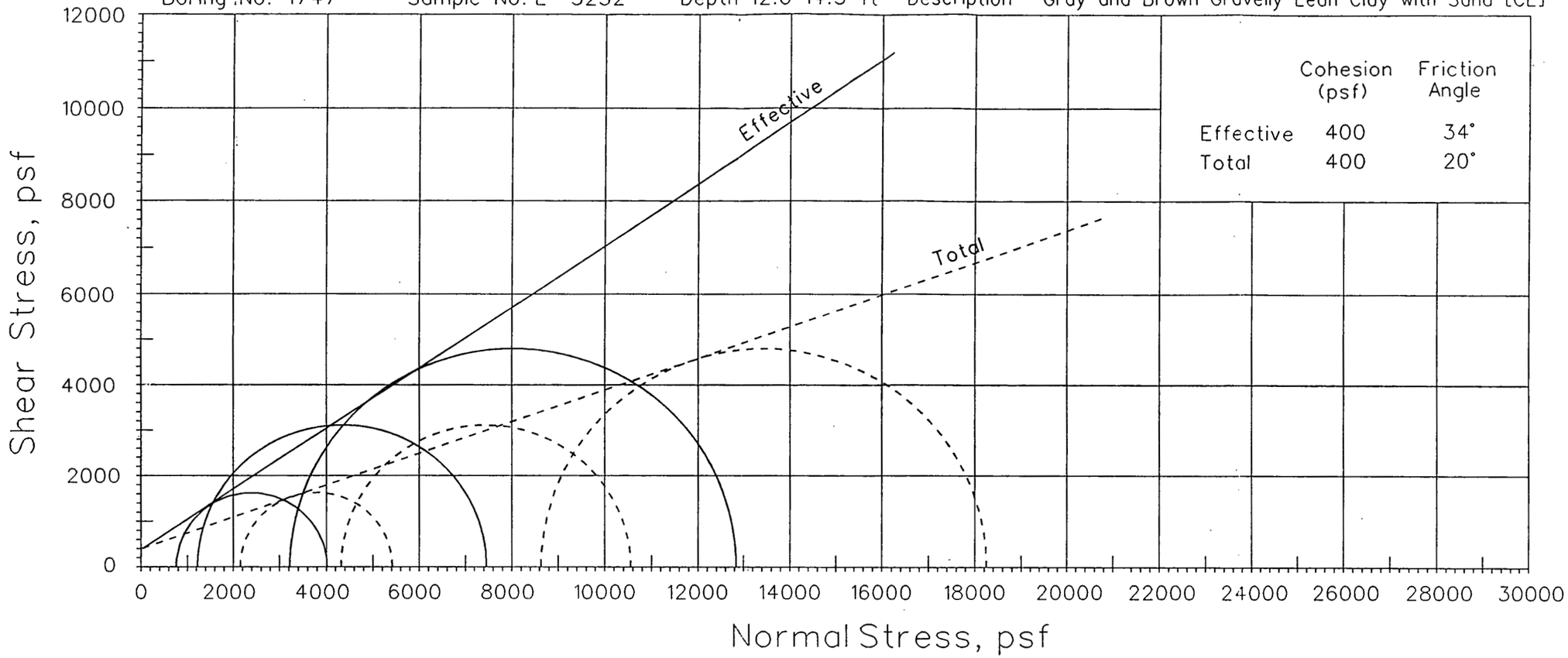
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1745	6.0-9.0	1	17.9	16.7	138.3	117.3	3.7	4000	1656	500	4500	9.00
		2	14.4	15.4	140.8	123.1	4.8	7100	2189	2140	9240	4.32
		3	14.1	11.0	143.4	125.7	4.7	12620	5861	2780	15400	5.54

Data Source: H.C. Nutting Co., data file: 3250, 5/20/92.

CAD FILE: SKX03805.DGN

Triaxial Compression Test Report

Boring .No. 1747 Sample No. L- 3252 Depth 12.0-14.5 ft Description - Gray and Brown Gravelly Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1747	12.0-14.5	1	13.4	12.1	142.2	125.4	3.6	3260	1397	760	4020	5.29
		2	13.6	12.9	143.5	126.3	7.1	6240	3096	1220	7460	6.11
		3	12.4	11.2	143.9	128.0	6.2	9620	5414	3220	12840	3.99

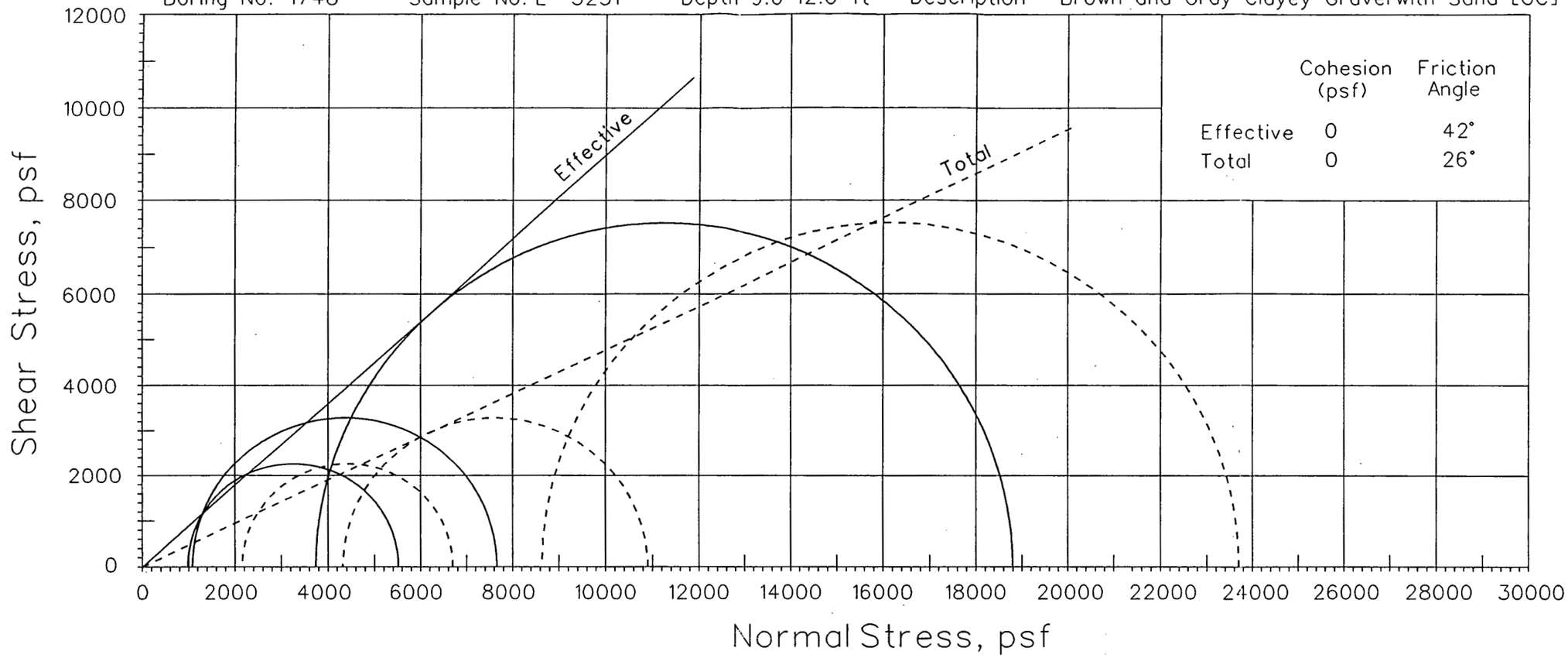
Data Source: H.C. Nutting Co., data file: 3252, 5/26/92.

CAD FILE: SKX03807.DGN

1. CU Test Data Sheet Describes Test Specimens as Gray and Brown Sandy Lean Clay with Gravel and Rock

Triaxial Compression Test Report

Boring No. 1748 Sample No. L- 3251 Depth 9.0-12.0 ft Description - Brown and Gray Clayey Gravel with Sand [GC]



Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1748	9.0-12.0	1	9.7	10.8	148.0	134.9	3.1	4540	1181	980	5520	5.63
		2	11.2	11.7	146.2	131.5	3.2	6580	3240	1080	7660	7.09
		3	12.0	10.9	144.6	129.1	4.5	15060	4896	3740	18800	5.03

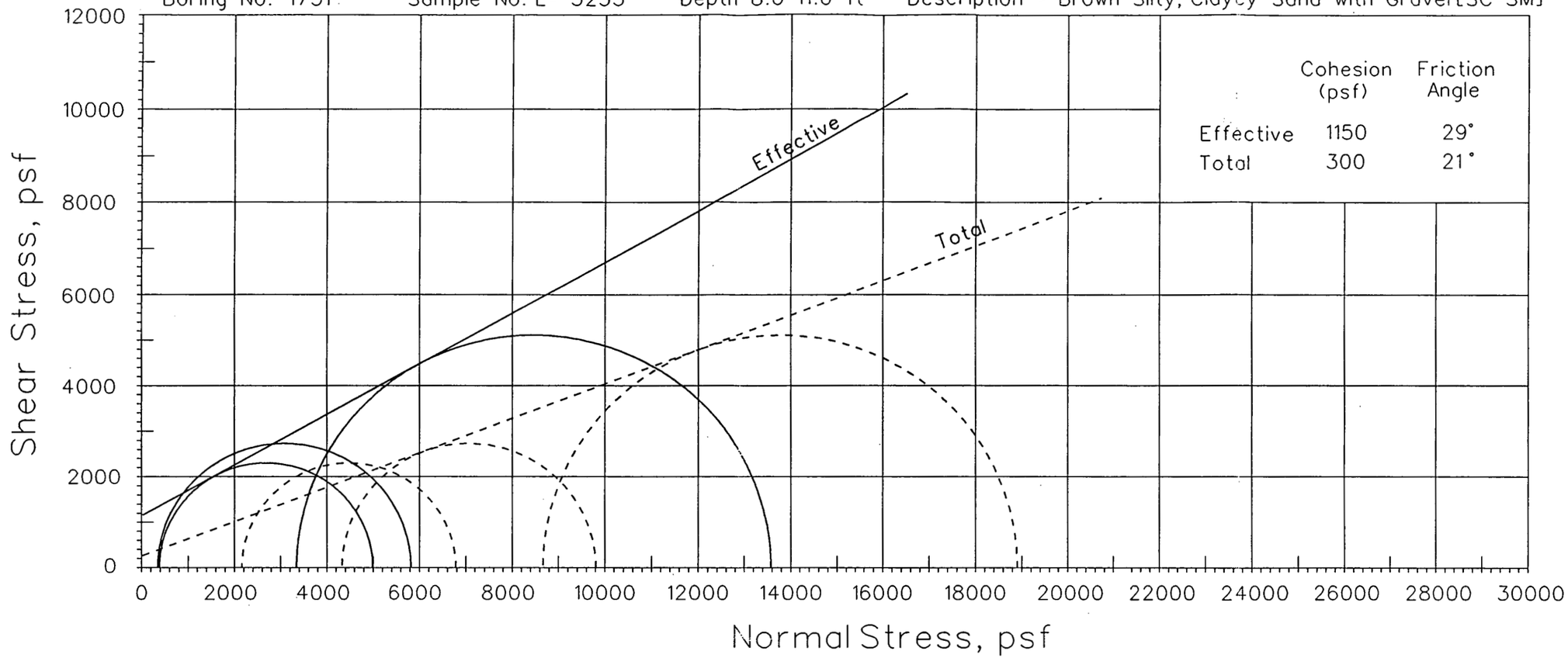
Data Source: H.C. Nutting Co., data file: 3251, 5/18/92.

CAD FILE: SKX03806.DGN

1. CU Test Data Sheet Describes Test Specimens as Brown and Gray Sandy Lean Clay with Gravel and Rock

Triaxial Compression Test Report

Boring No. 1751 Sample No. L- 3253 Depth 8.0-11.0 ft Description - Brown Silty, Clayey Sand with Gravel [SC-SM]



Type of Test: CU w/pp Sample Type: In Situ Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
1751	8.0-11.0	1	11.2	11.0	147.3	132.5	3.6	4620	1786	380	5000	13.15
		2	12.0	10.9	144.0	128.6	3.0	5480	3989	340	5820	17.12
		3	12.2	12.1	142.6	127.1	5.1	10260	5328	3320	13580	4.09

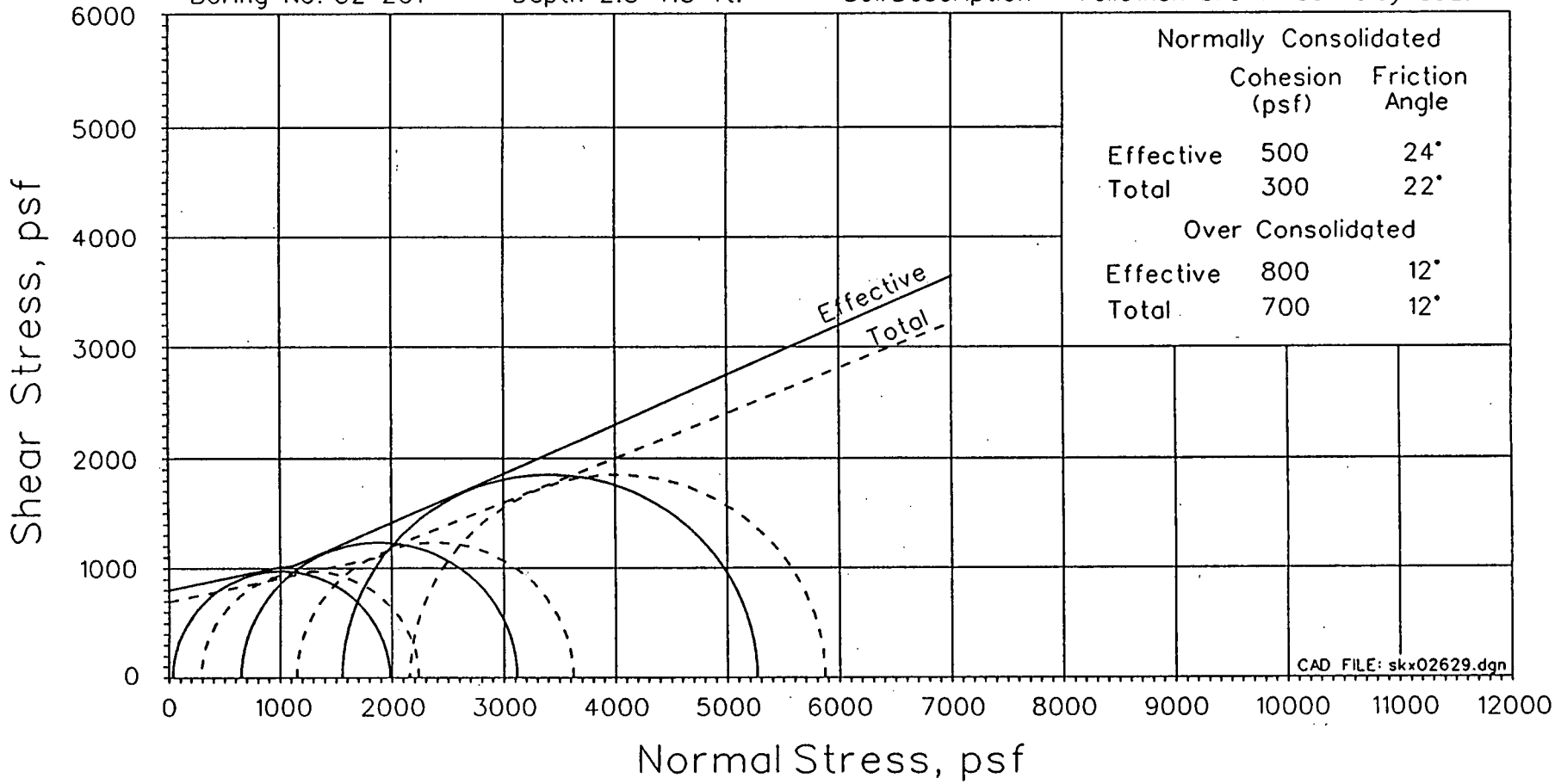
Data Source: H.C. Nutting Co., data file: 3253, 5/27/92.

CAD FILE: SKX03809.DGN

1. CU Test Data Sheet Describes Test Specimens as Brown Sandy Lean Clay with Silt Lenses, Gravel and Rock.

Triaxial Compression Test Report

Boring No. G2-201 Depth 2.5-4.5 ft. Soil Description - Yellowish brown lean clay [CL]



Type of Test: CU w/pp Sample Type: Insitu

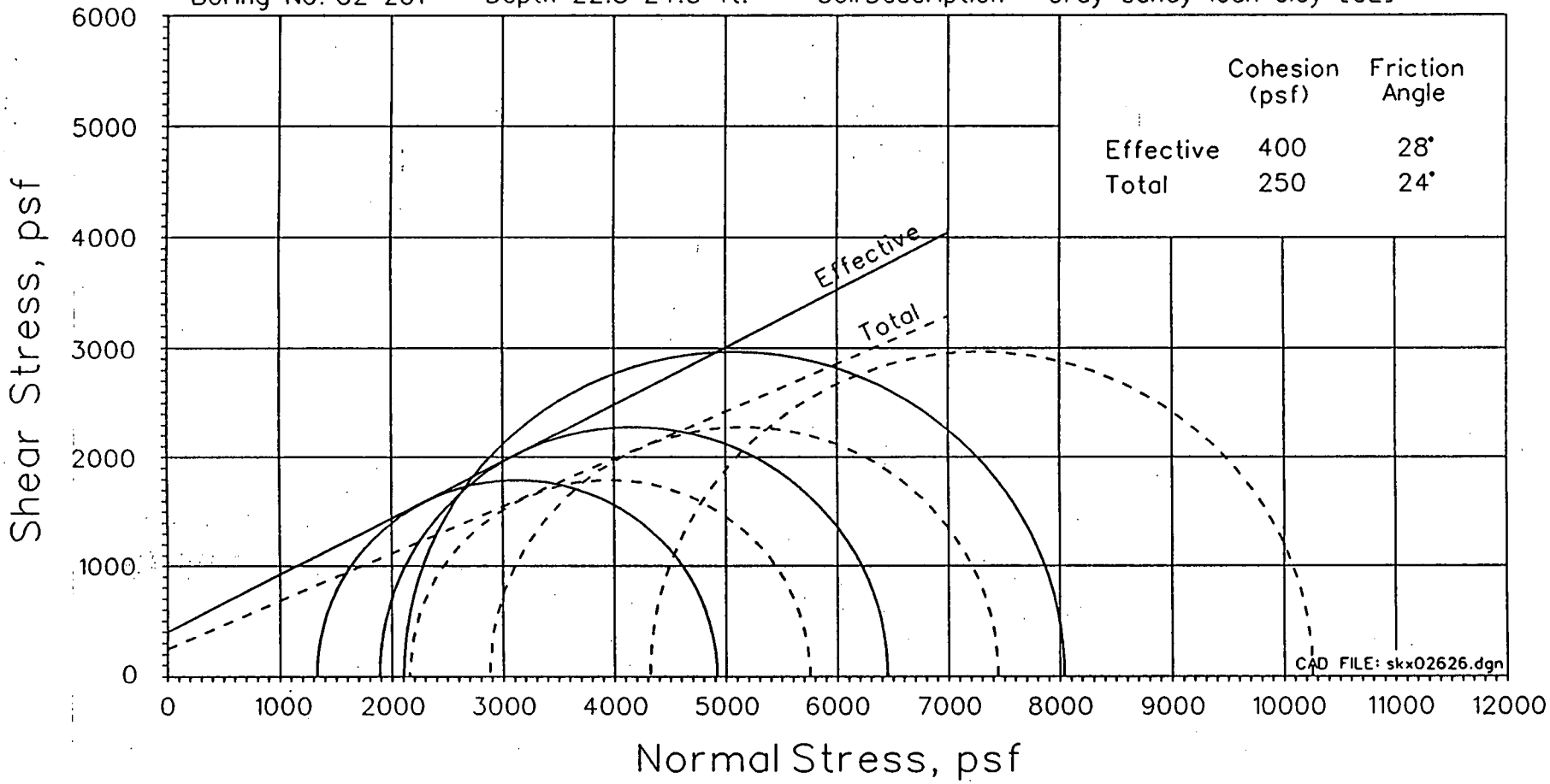
Boring No.	Depth (feet)	Stage	Moisture Content (%) Initial	Moisture Content (%) Final	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
G2-201	2.5-4.5	1	18.2	27.5	119.4	101.1	0.33	1953	259	29	1982	68.82
		2	17.7	25.7	120.9	102.8	1.37	2472	504	648	3120	4.82
		3	20.4	24.7	130.2	108.2	3.33	3711	605	1555	5266	3.39

000348

207

Triaxial Compression Test Report

Boring No. G2-201 Depth 22.5-24.5 ft. Soil Description - Gray sandy lean clay [CL]



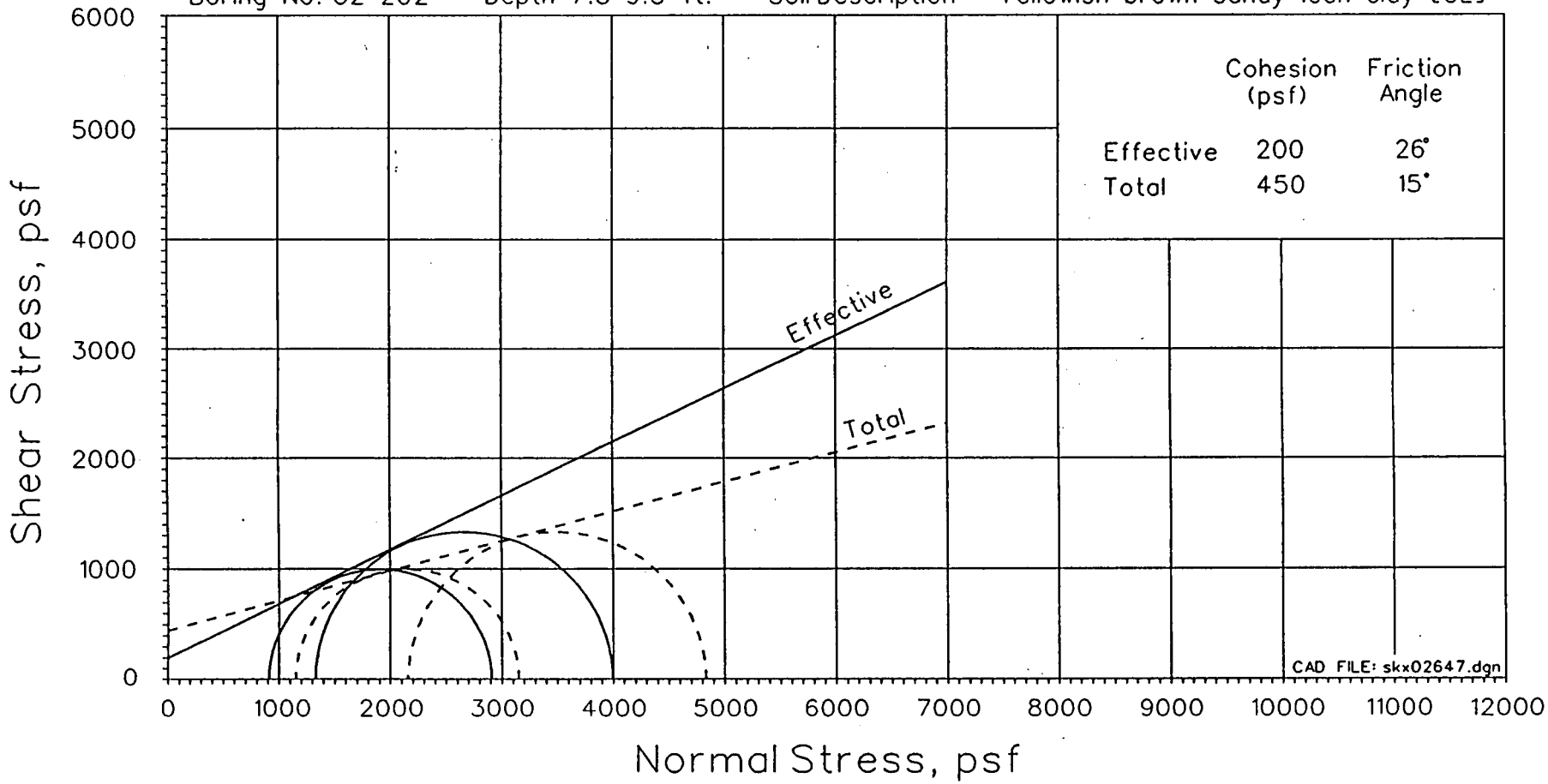
Type of Test: CU w/pp Sample Type: Insitu

Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-201	22.5-24.5	1	12.6	12.2	143.7	127.6	6.17	3595	835	1325	4919	3.71
		2	13.0	12.1	143.4	126.9	5.14	4566	994	1886	6453	3.42
		3	13.8	12.5	142.4	125.2	6.06	5938	2218	2102	8041	3.82

000346

Triaxial Compression Test Report

Boring No. G2-202 Depth 7.5-9.5 ft. Soil Description - Yellowish brown sandy lean clay [CL]



Type of Test: CU w/pp Sample Type: Insitu

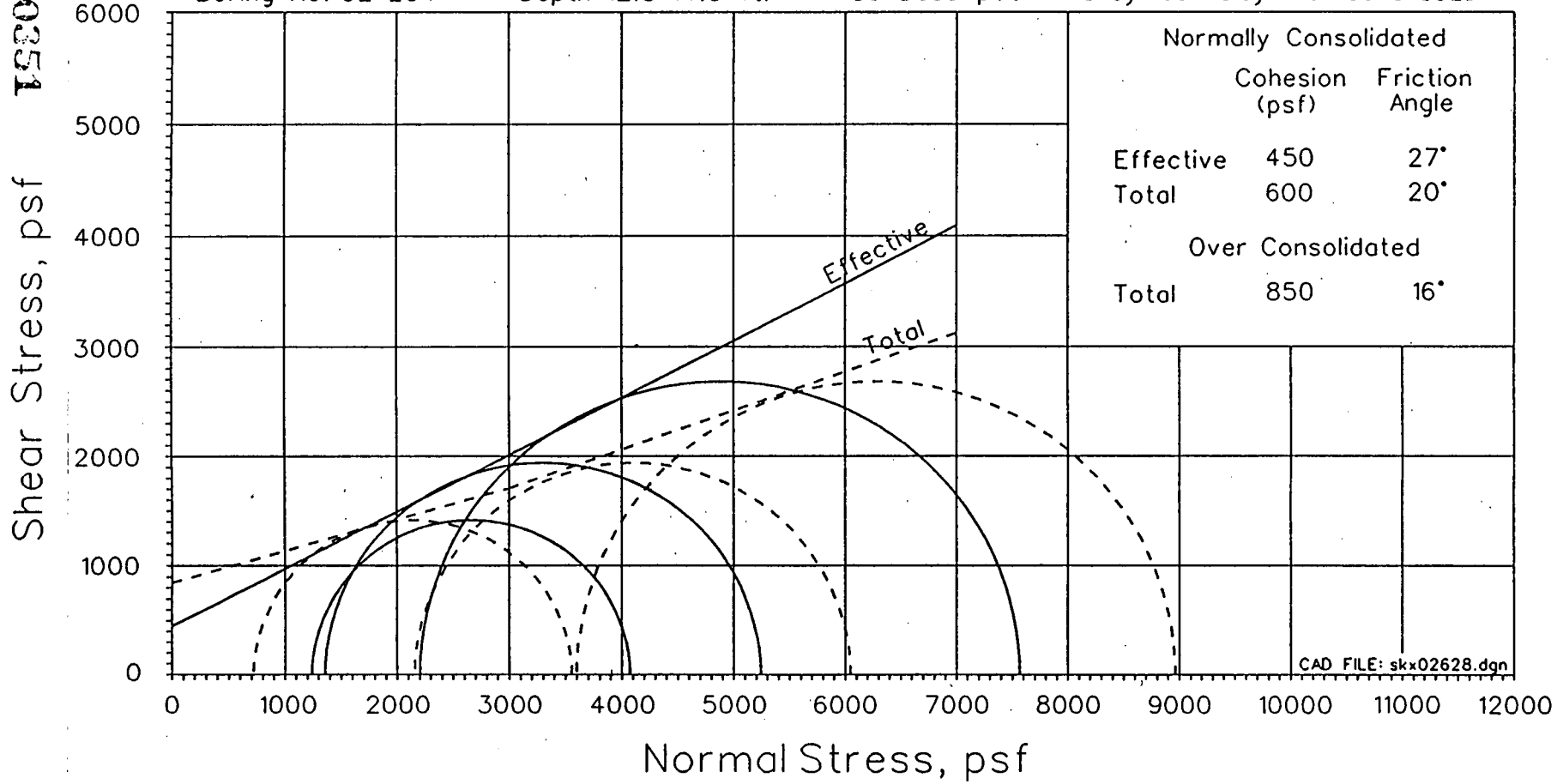
Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-202	7.5-9.5	1	14.2	14.4	139.6	122.3	3.60	2673	835	1325	3997	3.02
		2	14.1	14.7	142.4	124.8	0.96	2001	245	907	2908	3.21

000356

207

Triaxial Compression Test Report

Boring No. G2-204 Depth 12.5-14.5 ft. Soil Description - Gray lean clay with sand [CL]



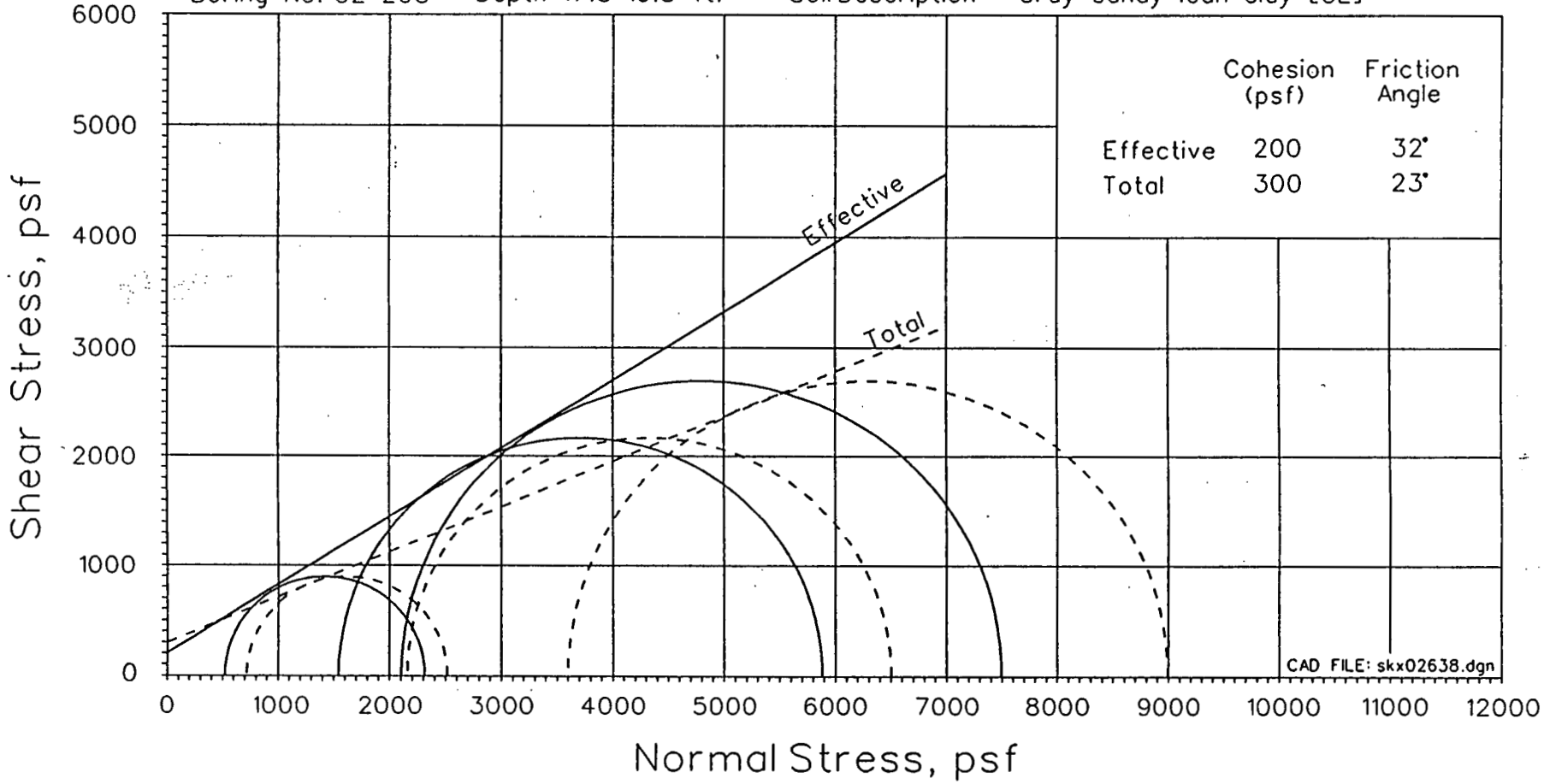
Type of Test: CU w/pp Sample Type: Insitu

Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-204	12.5-14.5	1	12.5	13.2	142.9	127.0	6.18	2838	-518	1238	4076	3.29
		2	12.9	12.8	144.0	127.6	3.56	3888	806	1354	5242	3.87
		3	12.7	12.1	145.9	129.5	4.43	5366	1397	2203	7569	3.44

000351

Triaxial Compression Test Report

Boring No. G2-205 Depth 17.5-19.5 ft. Soil Description - Gray sandy lean clay [CL]



Type of Test: CU w/pp Sample Type: Insitu

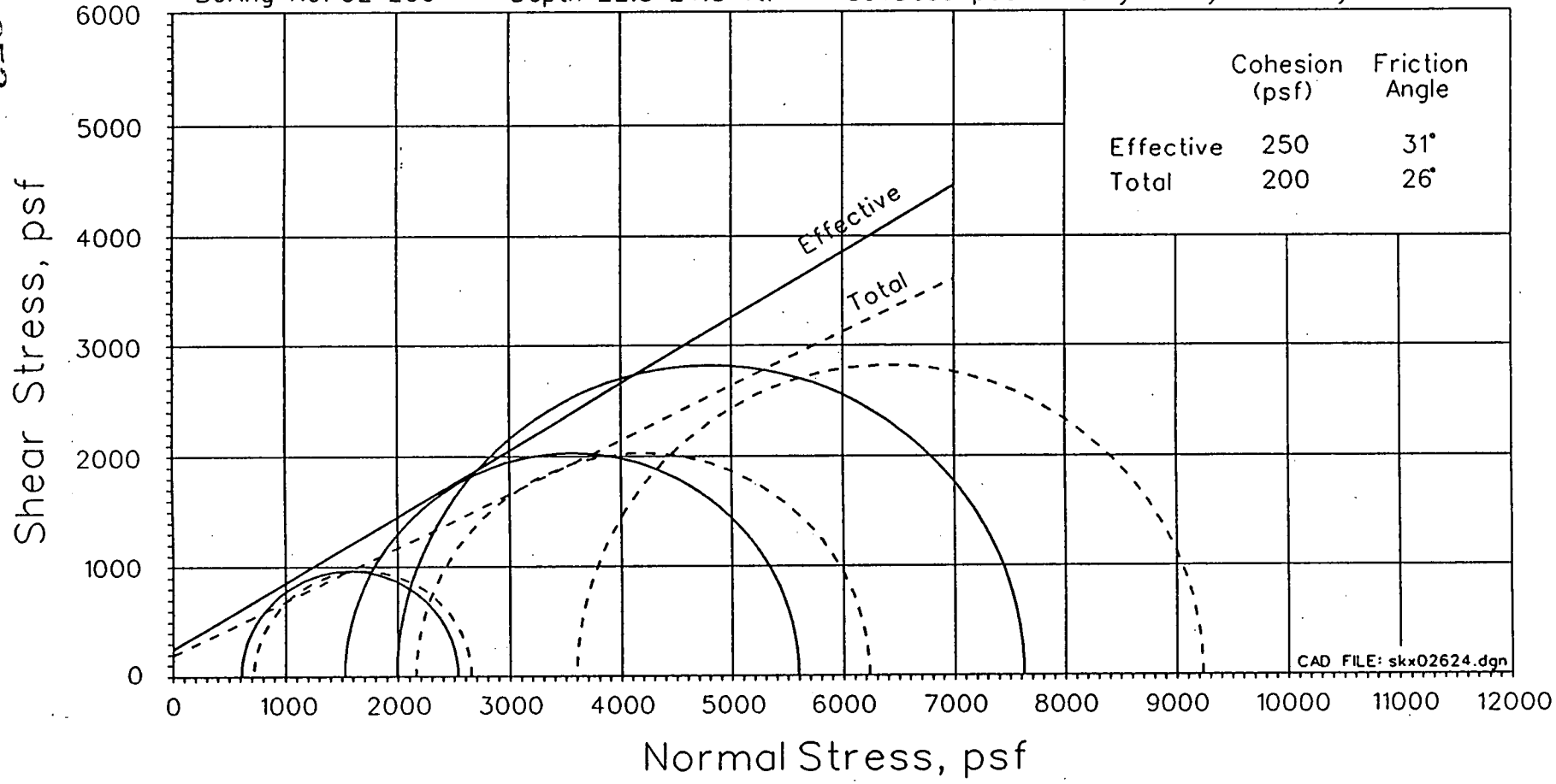
Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-205	17.5-19.5	1	12.2	12.6	143.3	127.7	2.68	1797	202	518	2316	4.47
		2	13.0	12.5	143.1	126.6	6.75	4344	619	1541	5885	3.82
		3	12.6	12.6	144.4	128.2	5.97	5395	1498	2102	7498	3.57

000352

202

Triaxial Compression Test Report

Boring No. G2-206 Depth 22.5-24.5 ft. Soil Description - Gray sandy lean clay [CL]



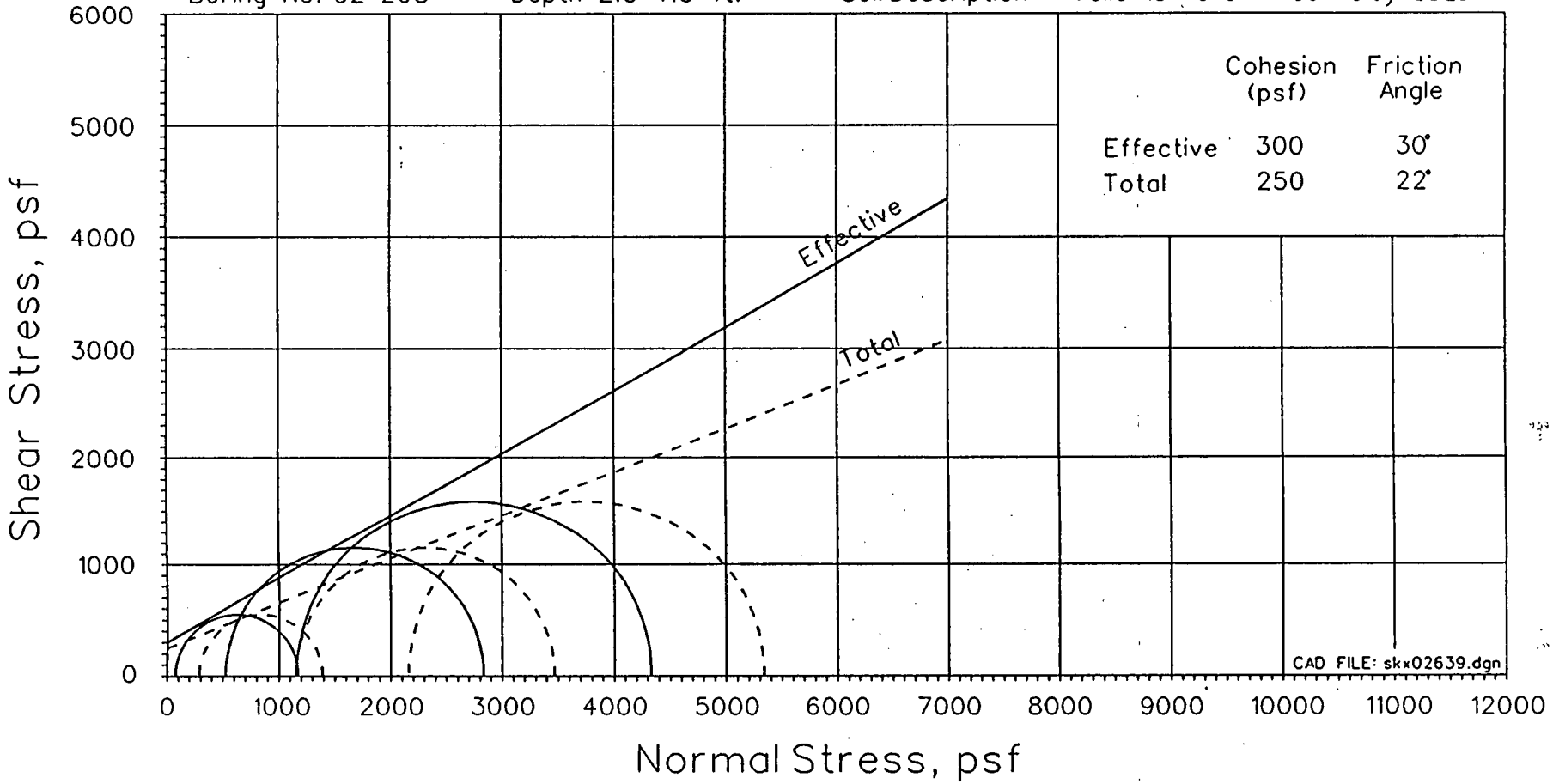
Type of Test: CU w/pp Sample Type: Insitu

Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-206	22.5-24.5	1	12.8	13.0	143.5	127.2	2.51	1932	115	605	2537	4.20
		2	12.7	12.4	144.2	128.0	5.87	4072	634	1526	5598	3.67
		3	12.7	12.1	144.4	128.1	6.92	5638	1613	1987	7625	3.84

000353

Triaxial Compression Test Report

Boring No. G2-208 Depth 2.5-4.5 ft. Soil Description - Yellowish brown lean clay [CL]



Type of Test: CU w/pp Sample Type: Insitu

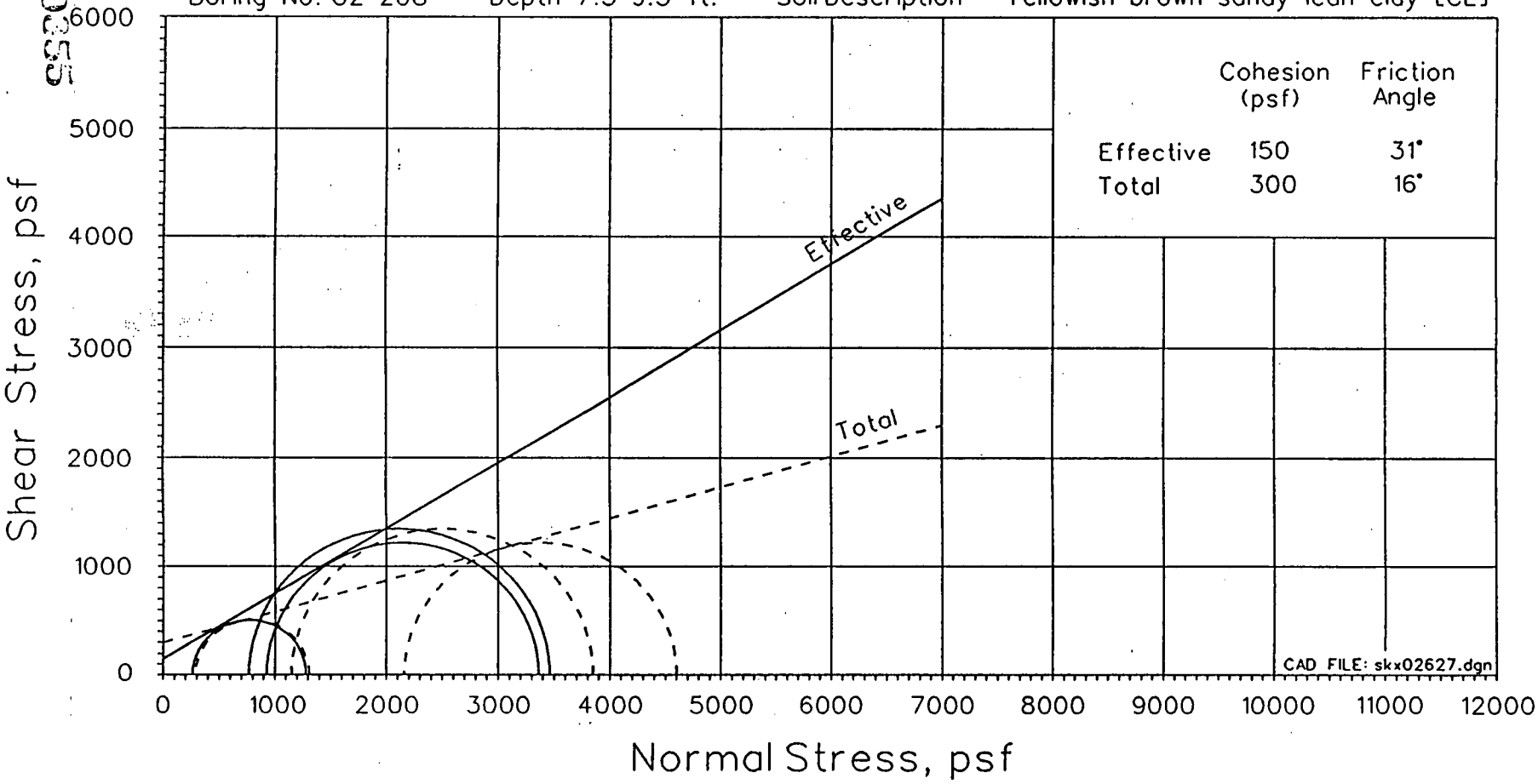
Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-208	2.5-4.5	1	22.9	27.3	122.6	99.7	0.70	1103	216	72	1175	16.31
		2	21.8	28.8	120.7	99.1	2.01	2317	634	518	2835	5.47
		3	25.4	27.2	123.0	98.1	5.09	3182	1008	1152	4334	3.76

000354

F-207

Triaxial Compression Test Report

Boring No. G2-208 Depth 7.5-9.5 ft. Soil Description - Yellowish brown sandy lean clay [CL]



Type of Test: CU w/pp Sample Type: Insitu

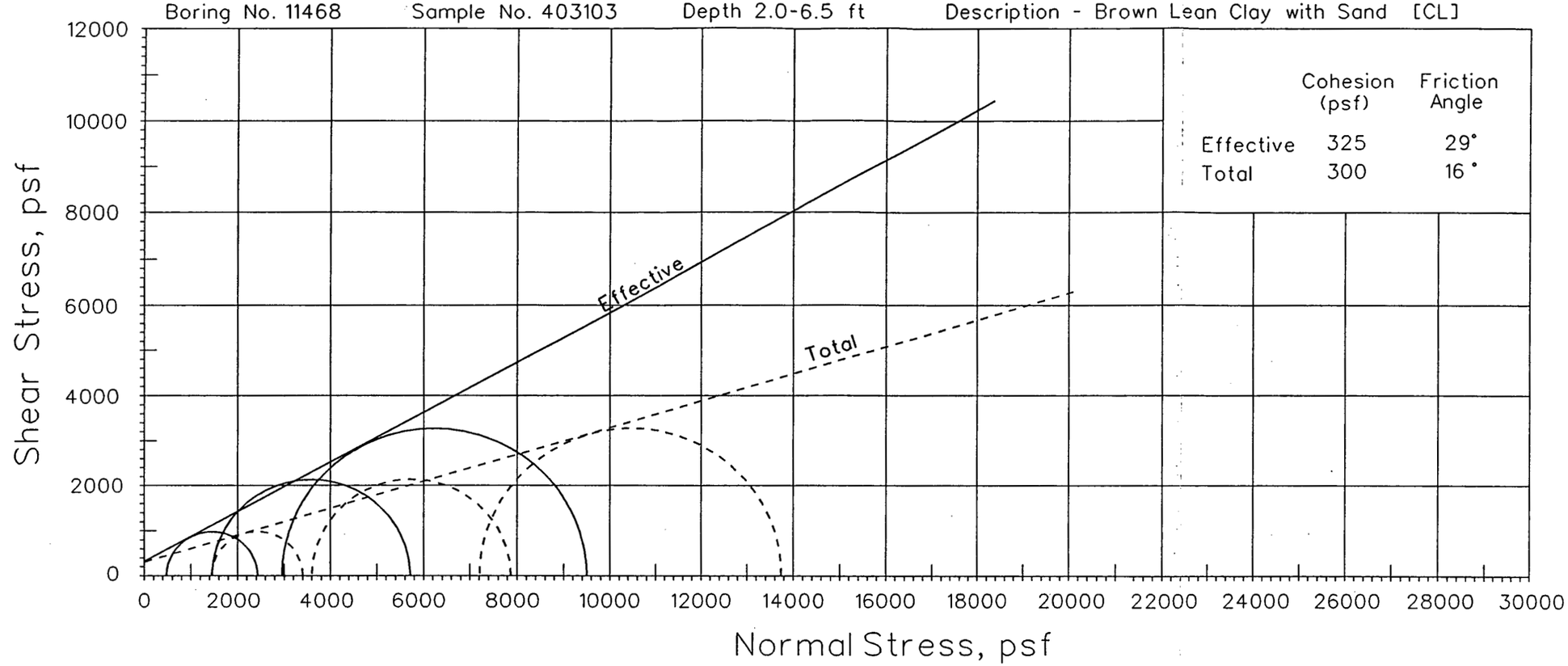
Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-208	7.5-9.5	1	13.5	14.5	140.0	123.4	1.00	1024	29	259	1283	4.95
		2	14.3	13.7	143.4	125.4	2.55	2700	389	763	3463	4.54
		3	23.4	23.0	126.6	102.6	5.10	2444	1238	922	3365	3.65

CU TRIAXIAL COMPRESSION TESTS - REMOLDED 95% MDD

AT OR NEAR OPTIMUM MOISTURE CONTENT

Triaxial Compression Test Report

Boring No. 11468 Sample No. 403103 Depth 2.0-6.5 ft Description - Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11468	2.0-6.5	A	16.3	22.7	123.3	106.0	8.37	1957	965	475	2432	5.12
		B	16.0	20.3	123.2	106.2	15.27	4264	2146	1454	5718	3.93
		C	15.8	19.0	122.7	105.9	10.20	6544	4248	2952	9496	3.22

1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near optimum moisture content (OMC)
2. Bulk Sample 403103 Std. Proc. Compaction Data: Max. Dry Density = 110.5 pcf, OMC = 16.7%

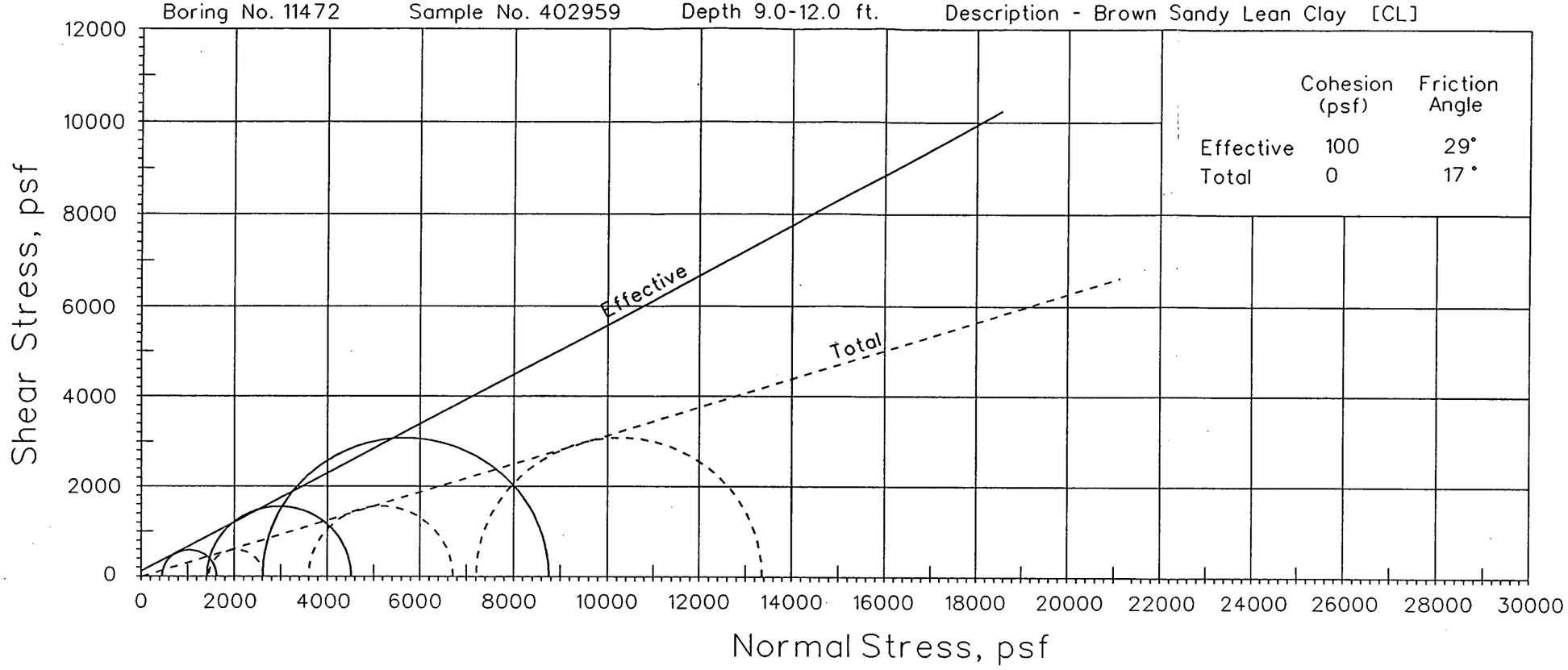
CAD FILE: skx03658.dgn

R403103mo.m(2421.ws415) po140@ws415. Mon Oct 30 14:14:53 CST 1995

R402959mo.m(2422.ws415) po140@ws415. Mon Oct 30 14:16:29 CST 1995

Triaxial Compression Test Report

Boring No. 11472 Sample No. 402959 Depth 9.0-12.0 ft. Description - Brown Sandy Lean Clay [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11472	9.0-12.0	A	11.4	13.3	132.5	118.9	10.13	6154	4594	2606	8760	3.36
		B	11.5	14.1	132.6	119.0	10.21	3108	2189	1411	4519	3.20
		C	11.9	15.5	132.6	118.5	6.73	1177	994	446	1624	3.64

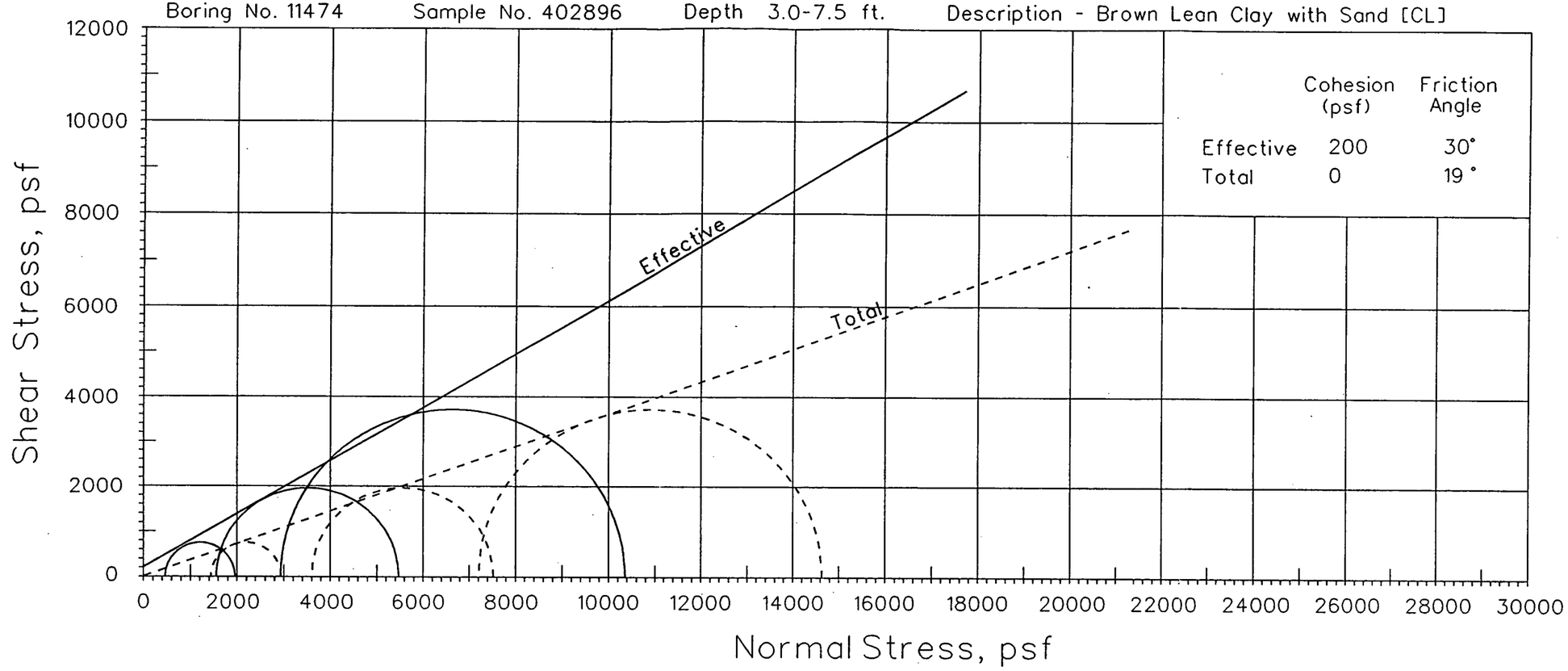
1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near optimum moisture content (OMC)
2. Bulk Sample 402959 Std. Proc. Compaction Data: Max. Dry Density = 124.9 pcf, OMC = 12.0%

CAD FILE: skx03659.dgn

R402896mo.m(2423.ws415) po140@ws415. Mon Oct 30 14:18:51 CST 1995

Triaxial Compression Test Report

Boring No. 11474 Sample No. 402896 Depth 3.0-7.5 ft. Description - Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

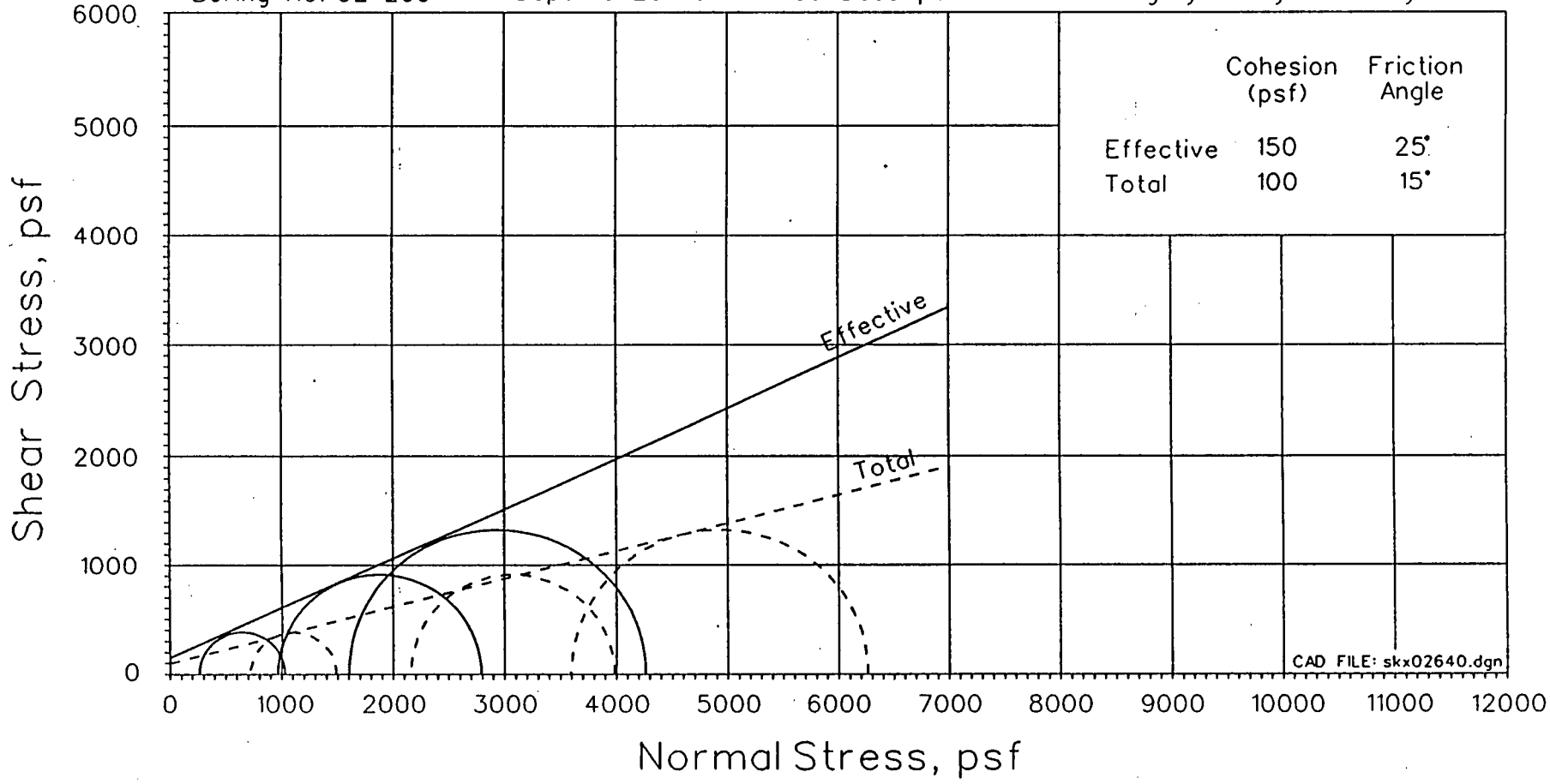
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11474	3.0-7.5	A	13.2	15.7	128.7	113.7	11.88	7430	4277	2923	10354	3.54
		B	12.6	16.2	128.0	113.7	10.05	3923	2045	1555	5478	3.52
		C	12.7	18.3	127.9	113.5	6.66	1500	979	461	1961	4.26

1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near optimum moisture content (OMC)
2. Bulk Sample 402896 Std. Proc. Compaction Data: Max. Dry Density = 119.2 pcf, OMC = 13.7%

CAD FILE: skx03660.dgn

Triaxial Compression Test Report

Boring No. G2-209 Depth 0-25 ft. Soil Description - Brown & gray sandy lean clay [CL]

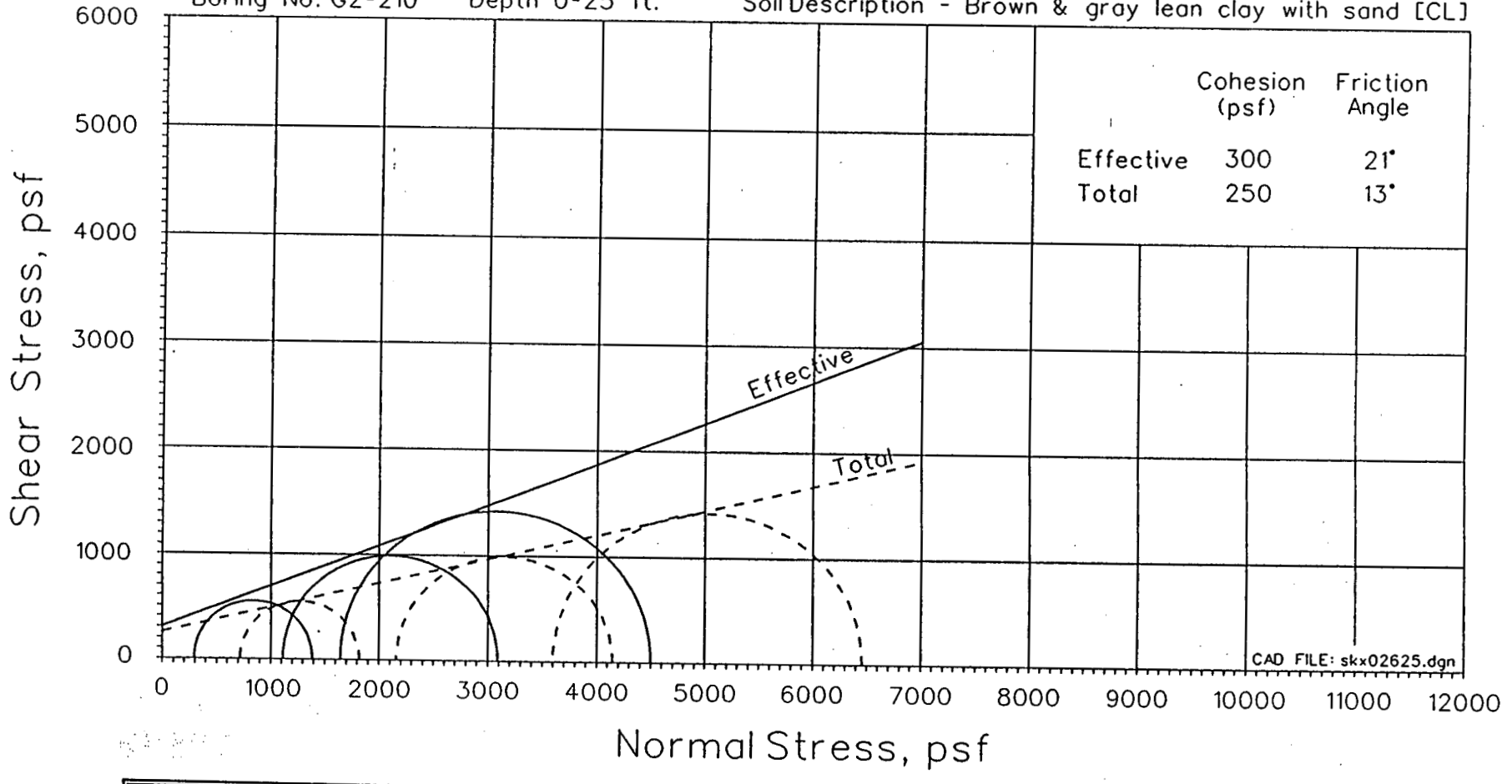


Type of Test: CU w/pp Sample Type: Remold

Boring No.	Depth (feet)	Stage	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-209	0-25	1	12.0	17.6	131.4	117.3	3.36	770	461	259	1030	3.97
		2	12.1	16.0	131.6	117.4	9.33	1827	1195	965	2791	2.89
		3	12.1	15.2	130.6	116.5	10.12	2665	2002	1598	4263	2.67

Triaxial Compression Test Report

Boring No. G2-210 Depth 0-25 ft. Soil Description - Brown & gray lean clay with sand [CL]



Type of Test: CU w/pp Sample Type: Remold

Boring No.	Depth (feet)	Stage	Moisture Content (%) Initial	Moisture Content (%) Final	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
G2-210	0-25	1	12.0	18.1	131.4	117.3	1.67	1102	432	288	1390	4.83
		2	12.0	16.1	133.1	118.9	10.28	1986	1051	1109	3095	2.79
		3	11.9	14.8	133.2	119.1	6.86	2861	1958	1642	4503	2.74

130000

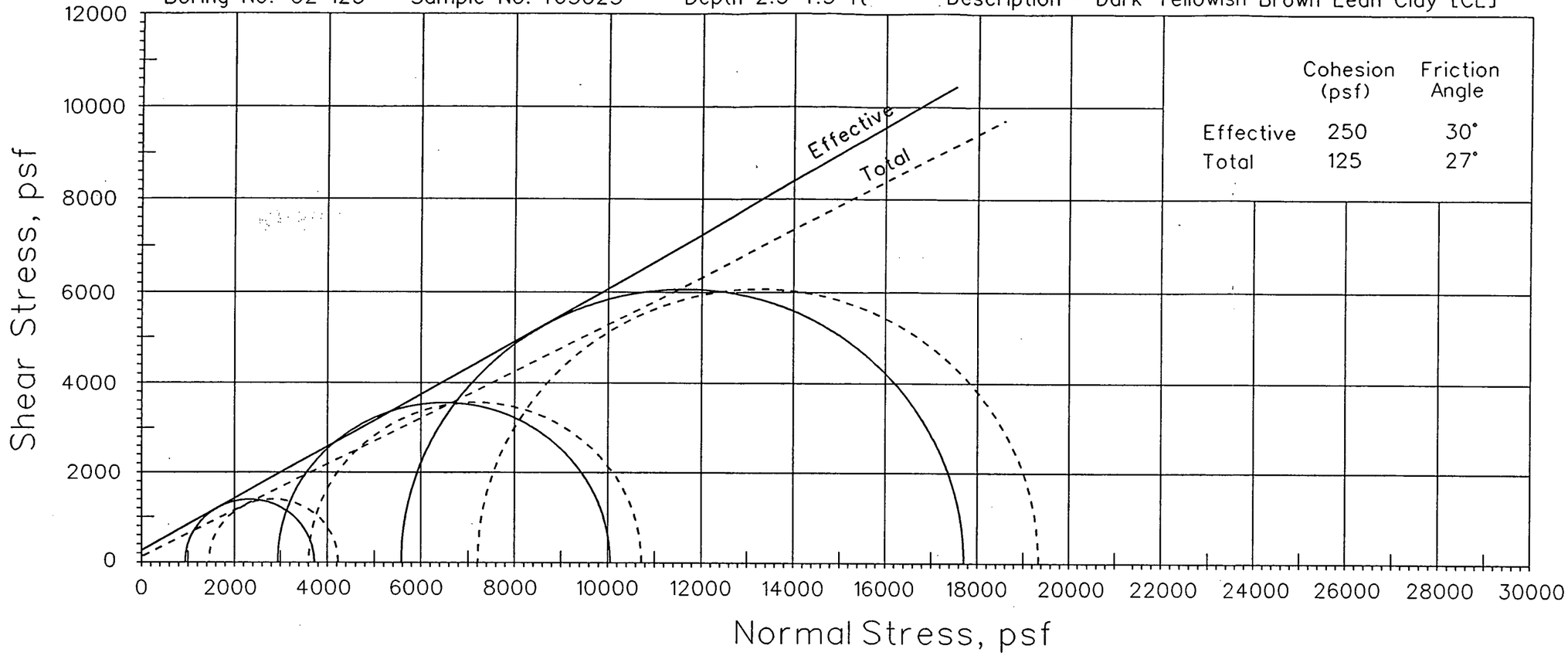
CU TRIAXIAL COMPRESSION TESTS - REMOLDED 95% MDD

WET OF OPTIMUM MOISTURE CONTENT (ASTM D698)

R405023mo.m(2348.ws415) po140@ws415. Fri Oct 27 14:11:07 CDT 1995

Triaxial Compression Test Report

Boring No. G2-125 Sample No. 405023 Depth 2.5-4.5 ft Description - Dark Yellowish Brown Lean Clay [CL]



Type of Test: CU w/pp - STAGED Sample Type: 95% MDD [1] Failure Criteria: Max. Principle Stress Ratio

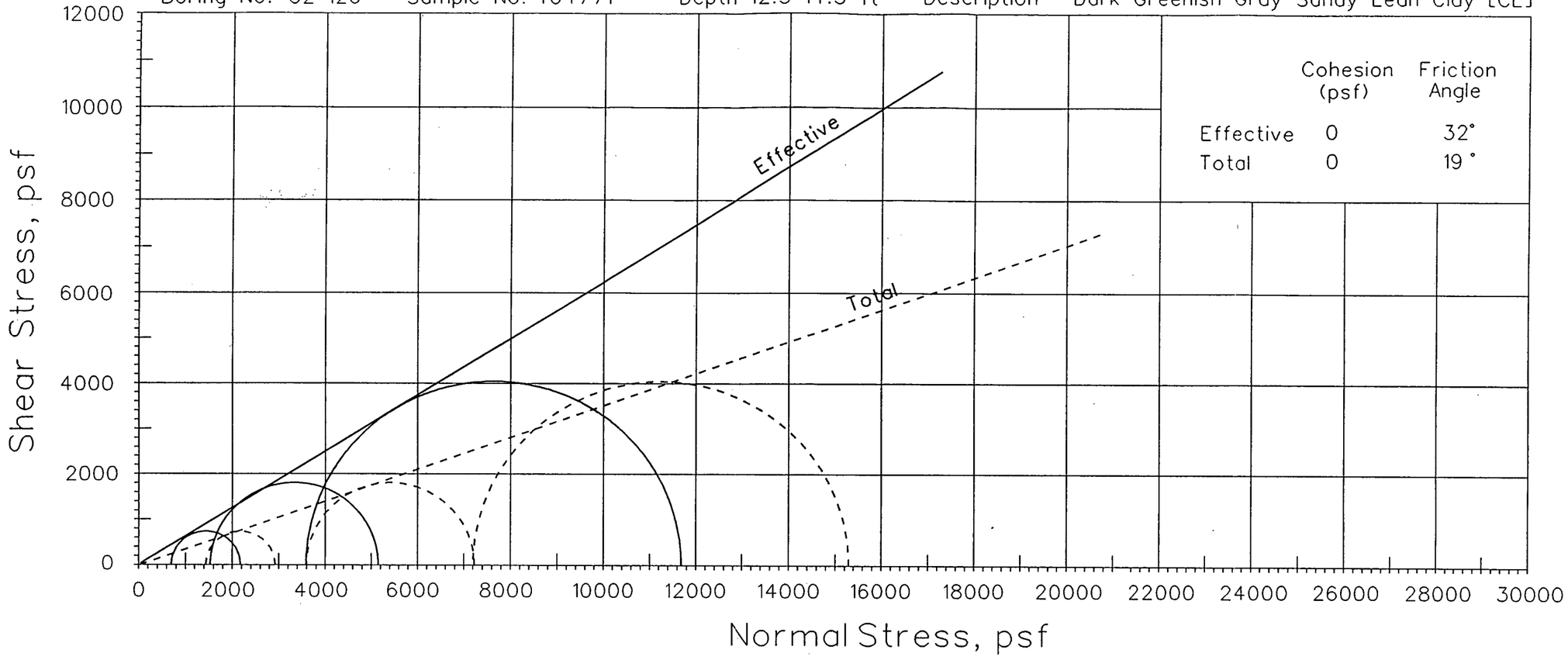
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-125	2.5-4.5	A-STG1	18.2	19.5	131.9	111.6	1.51	2790	504	936	3726	3.98
		A-STG2	18.2	19.5	133.5	112.9	3.05	7118	662	2938	10056	3.42
		A-STG3	18.2	19.5	135.0	114.2	3.66	12137	1627	5573	17710	3.18

1. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03858.DGN

Triaxial Compression Test Report

Boring No. G2-126 Sample No. 404771 Depth 12.5-14.5 ft Description - Dark Greenish Gray Sandy Lean Clay [CL]



Type of Test: CU w/pp - STAGED Sample Type: Remolded 95% MDD[1] Failure Criteria: Max. Principle Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-126	12.5-14.5	STG1	15.1	11.3	135.9	118.1	4.22	1487	749	691	2179	3.15
		STG2	15.1	11.3	141.8	123.2	3.53	3626	2074	1526	5153	3.38
		STG3	15.1	11.3	144.2	125.3	4.62	8103	3614	3586	11689	3.26

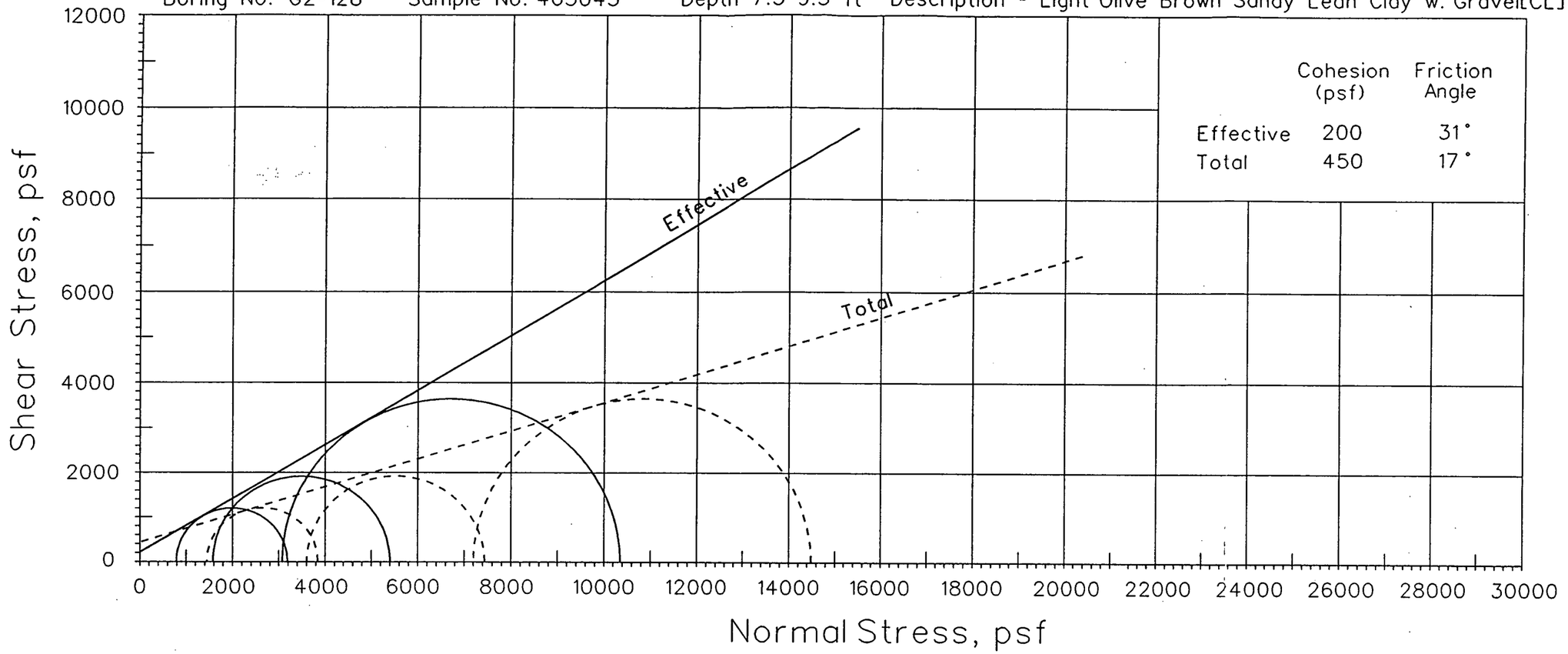
1. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03822.DGN

R405043mo.m(2345.ws415) po140@ws415. Fri Oct 27 14:07:20 CDT 1995

Triaxial Compression Test Report

Boring No. G2-128 Sample No. 405043 Depth 7.5-9.5 ft Description - Light Olive Brown Sandy Lean Clay w. Gravel[CL]



Type of Test: CU w/pp Sample Type: Remolded 95% MDD[1] Failure Criteria: Max. Principle Stress Ratio

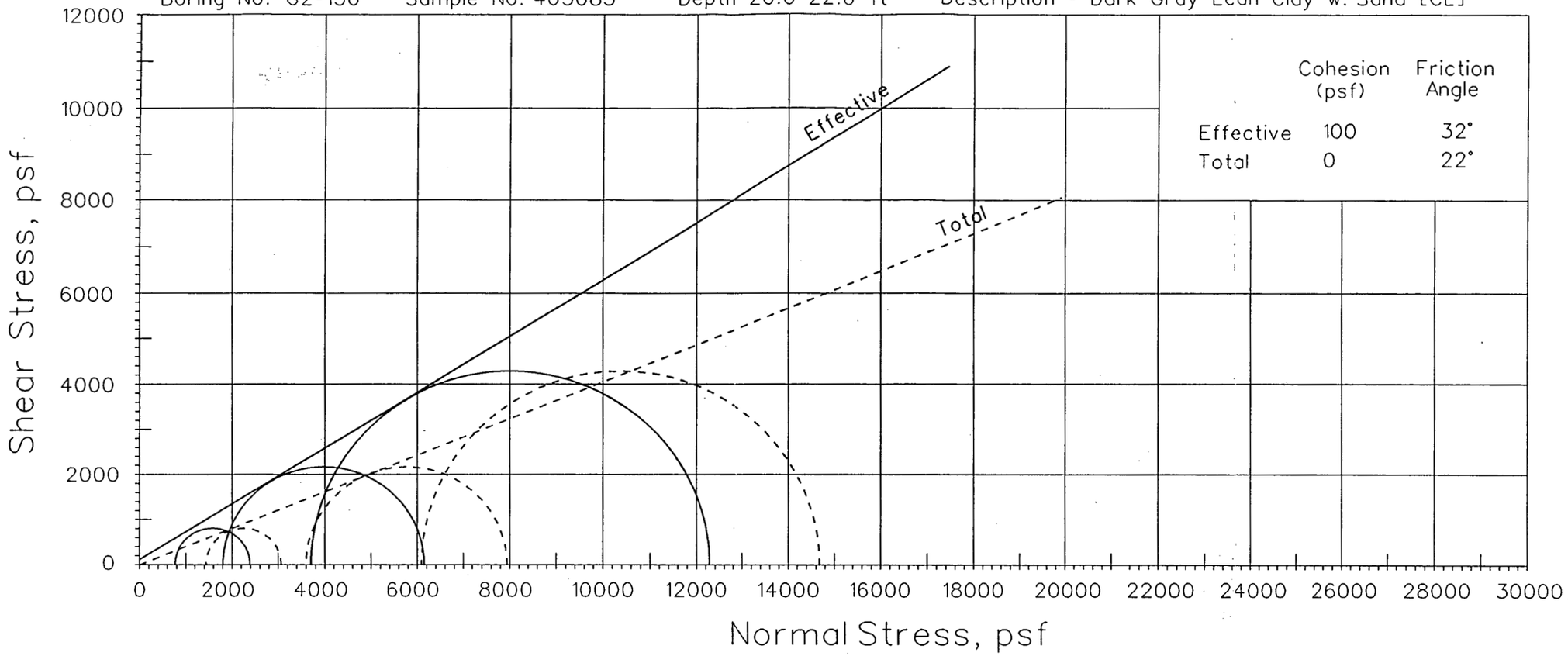
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-128	7.5-9.5	A	14.7	11.8	137.1	119.5	12.04	7281	4133	3067	10349	3.37
		B	15.4	12.7	136.3	118.1	8.54	3835	2030	1570	5404	3.44
		C	15.1	13.6	136.1	118.2	13.55	2404	657	783	3187	4.07

1. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03821.DGN

Triaxial Compression Test Report

Boring No. G2-130 Sample No. 405083 Depth 20.0-22.0 ft Description - Dark Gray Lean Clay w. Sand [CL]



Type of Test: CU w/pp - STAGED Sample Type: Remolded 95% MDD[1] Failure Criteria: Max. Principle Stress Ratio

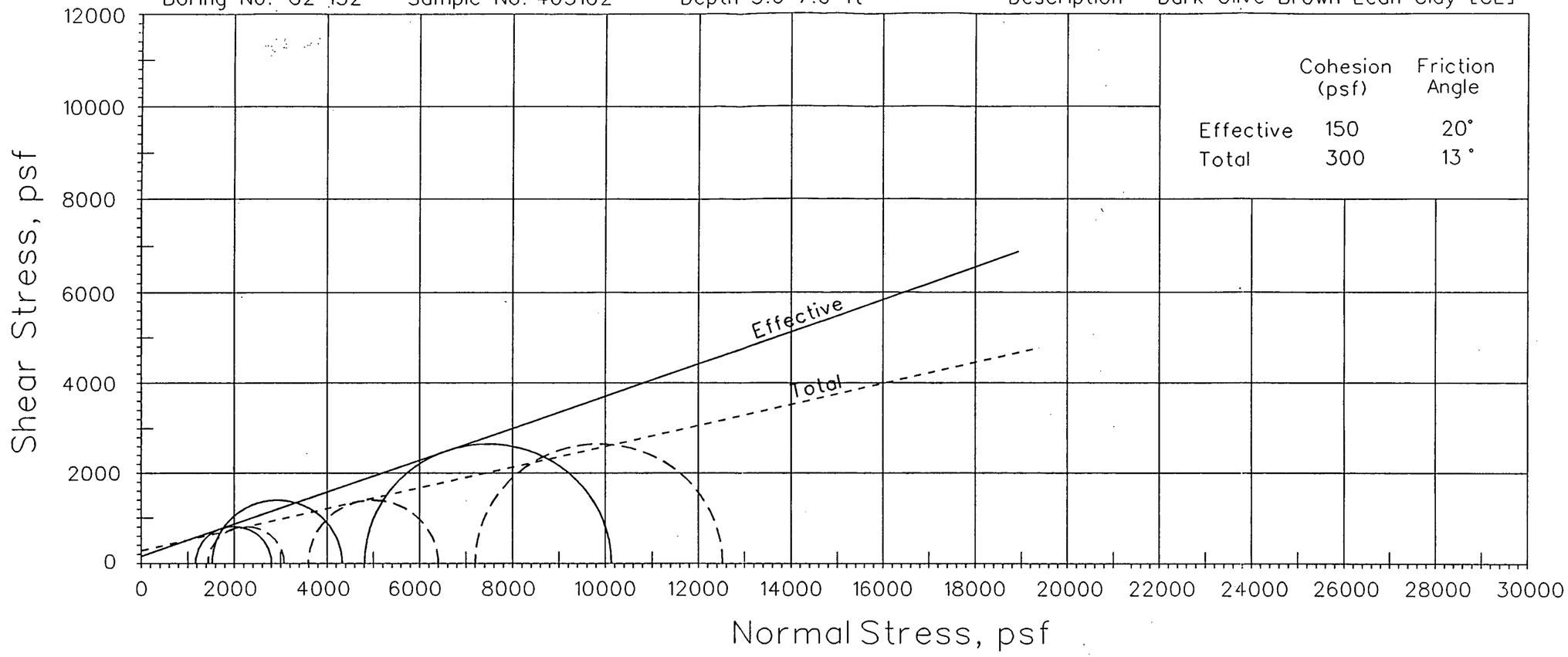
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-130	20.0-22.0	STG1	14.9	12.1	137.1	119.4	4.19	1630	677	763	2393	3.14
		STG2	14.9	12.1	140.9	122.6	4.75	4350	1800	1800	6150	3.42
		STG3	14.9	12.1	143.6	125.0	3.69	8586	3499	3701	12287	3.32

1. Remolded Wet of Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03823.DGN

Triaxial Compression Test Report

Boring No. G2-132 Sample No. 405102 Depth 5.0-7.0 ft Description - Dark Olive Brown Lean Clay [CL]



Type of Test: CU w/pp - STAGED Sample Type: Remolded 95% MDD[1] Failure Criteria: Princ. Stress Ratio = 2.5

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-132	5.0-7.0	STG1	16.8	21.1	132.2	113.1	0.08	1636	274	1166	2803	2.40
		STG2	16.9	21.1	136.5	116.8	0.17	2807	2074	1526	4333	2.84
		STG3	16.8	21.1	142.4	121.9	5.29	5321	2390	4810	10131	2.11

1. Saturated Test

CAD FILE: SKX03824.DGN

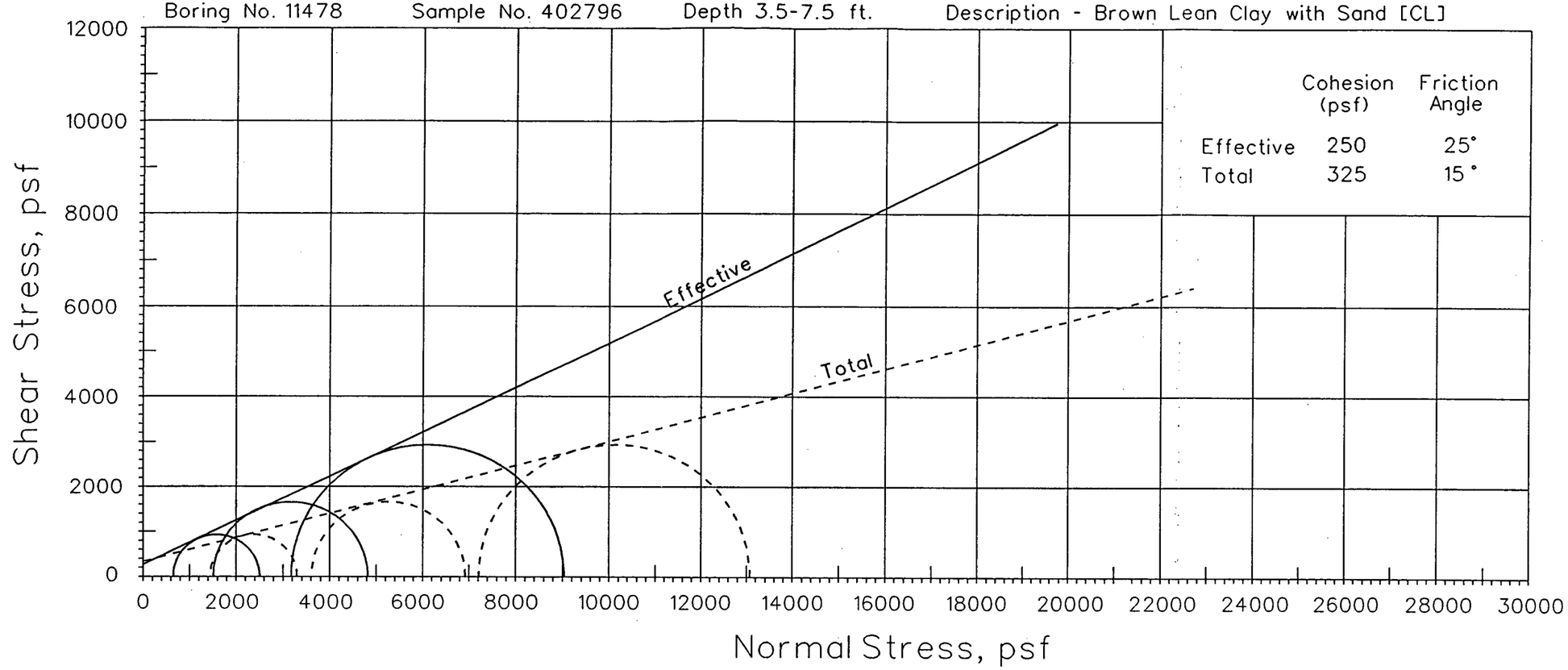
CU TRIAXIAL COMPRESSION TESTS - REMOLDED 85% MDD

AT OR NEAR OPTIMUM MOISTURE CONTENT (ASTM D698)

R402796_2mo.m(2426.ws415) po140@ws415. Mon Oct 30 14:23:31 CST 1995

Triaxial Compression Test Report

Boring No. 11478 Sample No. 402796 Depth 3.5-7.5 ft. Description - Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11478	3.5-7.5	A-2	17.9	16.8	130.9	111.1	8.44	5866	4032	3168	9034	2.85
		B-2	18.3	18.5	130.9	110.7	5.03	3311	2088	1512	4823	3.19
		C-2	17.9	19.1	130.6	110.8	3.35	1858	792	648	2506	3.87

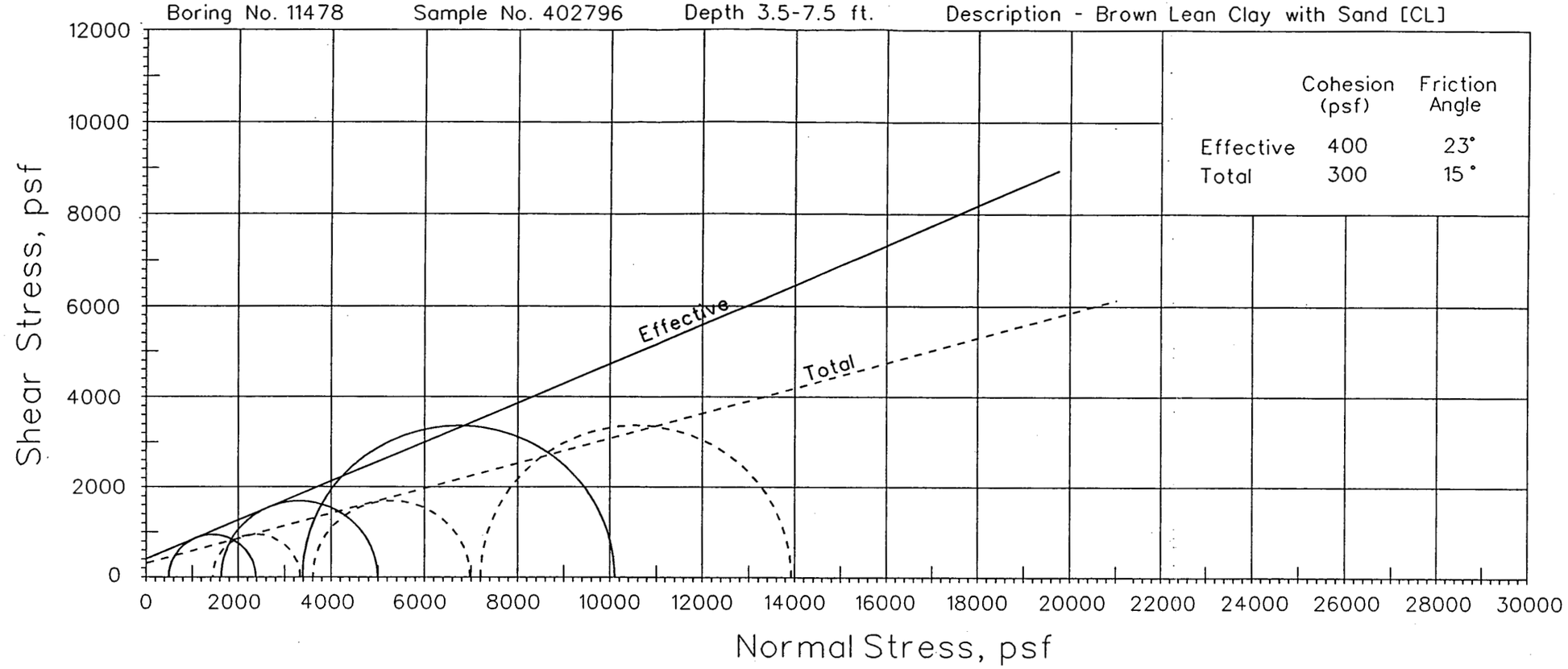
1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near 4% wet of OMC
2. Bulk Sample 402796 Std. Proc. Compaction Data: Max. Dry Density = 116.5 pcf, OMC = 14.7%

CAD FILE: skx03663.dgn

R402796mo.m(2424.ws415) po140@ws415. Mon Oct 30 14:20:46 CST 1995

Triaxial Compression Test Report

Boring No. 11478 Sample No. 402796 Depth 3.5-7.5 ft. Description - Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11478	3.5-7.5	A	14.4	17.7	126.5	110.6	15.28	6725	3816	3384	10109	2.99
		B	13.5	17.8	127.1	112.1	10.18	3373	1973	1627	5000	3.07
		C	13.7	19.8	126.3	111.2	8.33	1885	950	490	2374	4.85

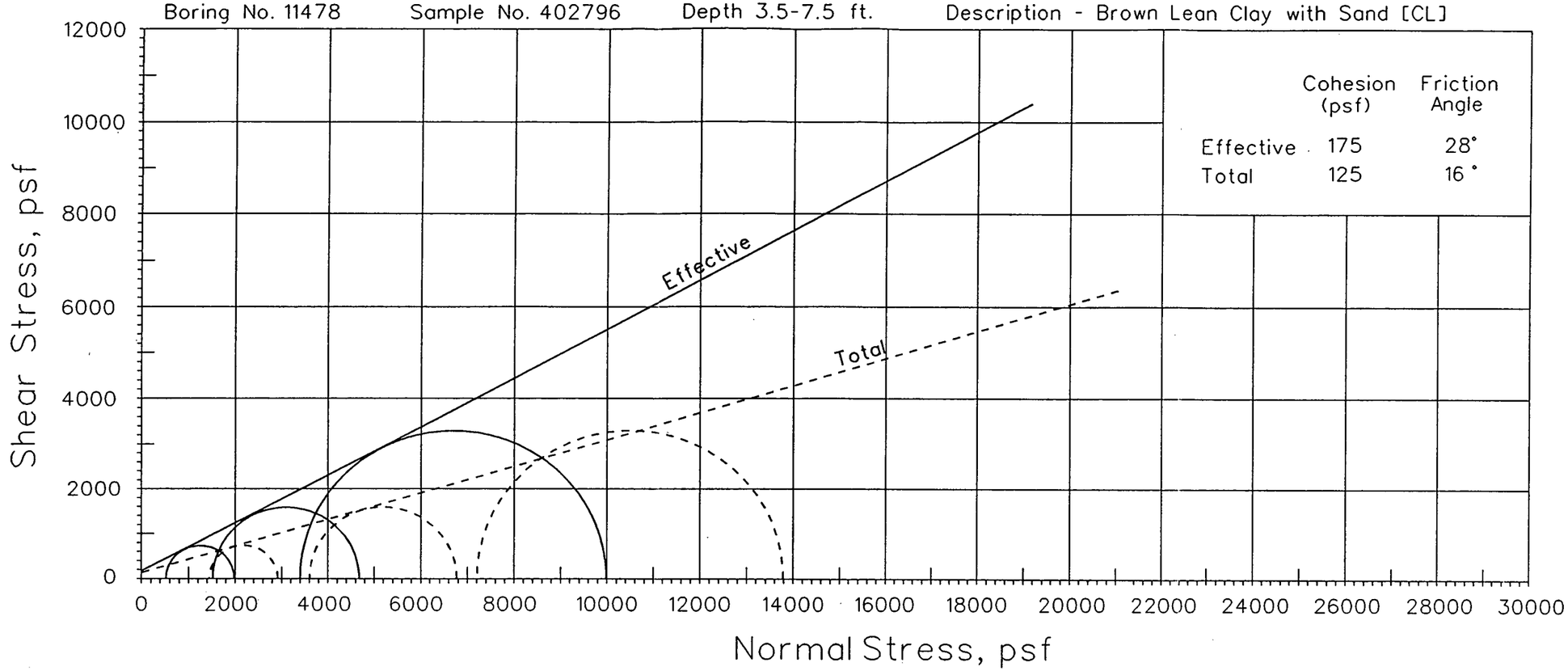
1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near optimum moisture content (OMC)
2. Bulk Sample 402796 Std. Proc. Compaction Data: Max. Dry Density = 116.5 pcf, OMC = 14.7%

CAD FILE: skx03661.dgn

R402796_1mo.m(2425.ws415) po140@ws415. Mon Oct 30 14:21:30 CST 1995

Triaxial Compression Test Report

Boring No. 11478 Sample No. 402796 Depth 3.5-7.5 ft. Description - Brown Lean Clay with Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded Failure Criteria: Max. Principal Stress Ratio

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
11478	3.5-7.5	A-1	11.3	15.9	123.1	110.7	11.87	6588	3802	3398	9986	2.94
		B-1	11.1	17.7	123.0	110.7	10.11	3168	2088	1512	4680	3.10
		C-1	11.2	20.1	123.0	110.7	14.95	1470	922	518	1988	3.83

1. Target Conditions for Remolded Test Specimens
   Minimum Dry Density: 95% of max. Std. Proc. Dry Density; Moisture Content: at or near 3% dry of OMC
2. Bulk Sample 402796 Std. Proc. Compaction Data: Max. Dry Density = 116.5 pcf, OMC = 14.7%

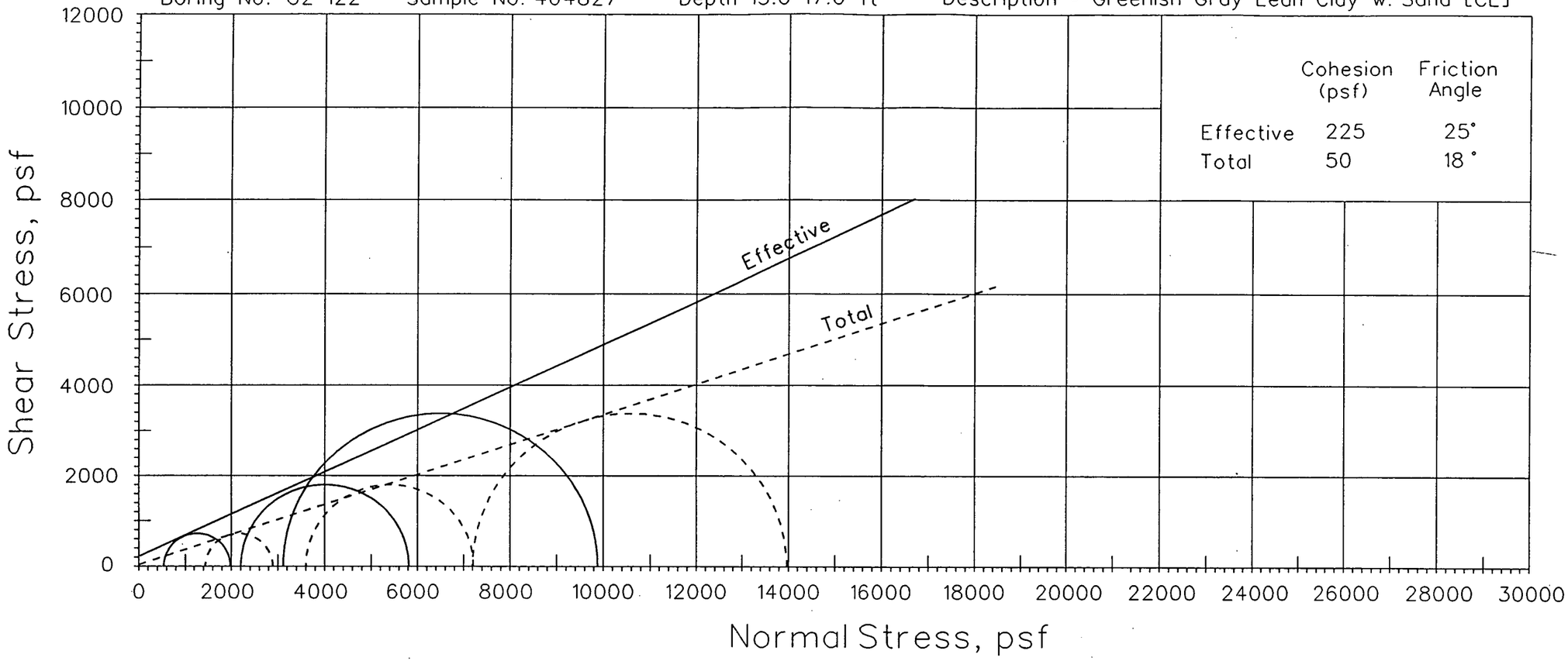
CAD FILE: skx03662.dgn

CU TRIAXIAL COMPRESSION TEST SERIES - REMOLDED 95% MDD

WET, AT OR NEAR, AND DRY OF OMC

Triaxial Compression Test Report

Boring No. G2-122 Sample No. 404827 Depth 15.0-17.0 ft Description - Greenish Gray Lean Clay w. Sand [CL]



Type of Test: CU w/pp Sample Type: Remolded 85% MDD[1] Failure Criteria: 15% Axial Strain

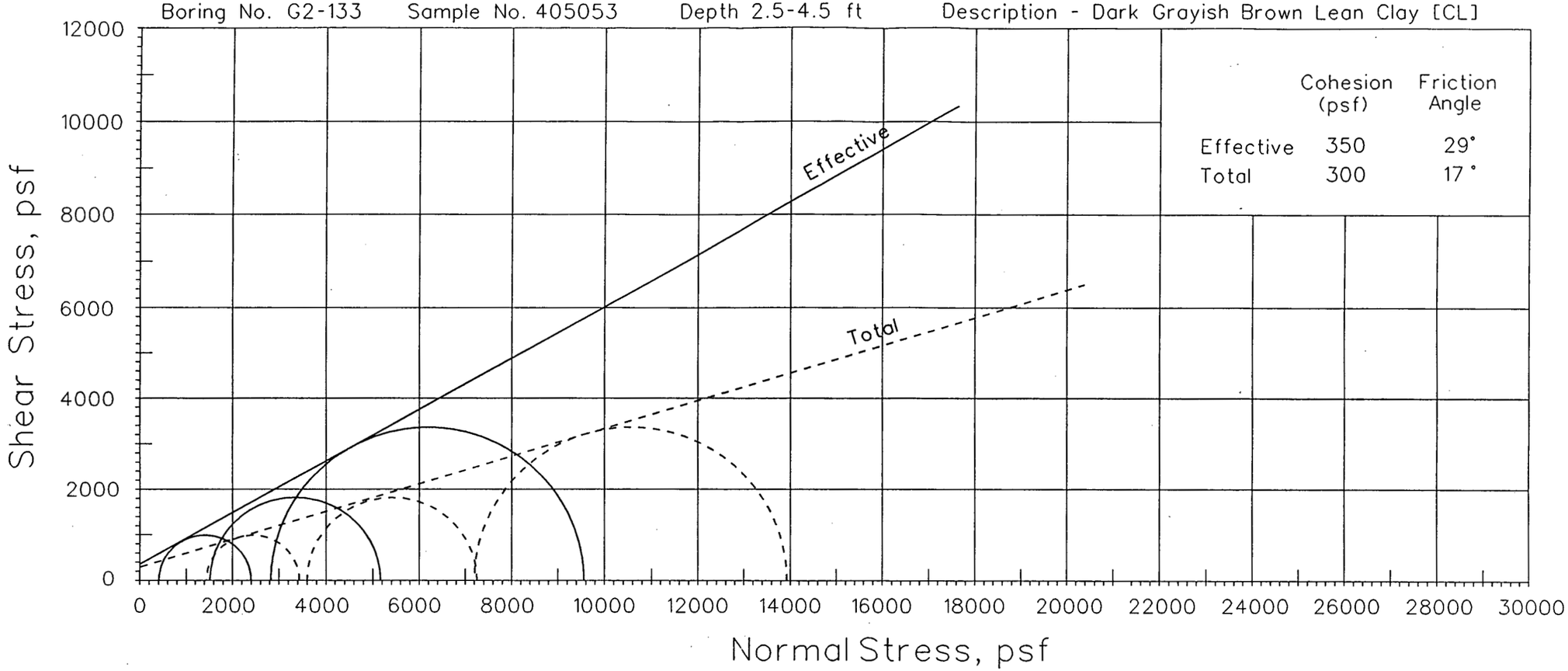
Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-122	15.0-17.0	A	10.4	11.7	118.5	107.3	7.01	6773	4090	3110	9883	3.18
		B	11.7	14.2	117.5	105.2	15.66	3613	1397	2203	5817	2.64
		C	11.5	16.3	118.0	105.9	13.73	1453	907	533	1986	3.73

1. Remolded At or Near Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03826.DGN

Triaxial Compression Test Report

Boring No. G2-133 Sample No. 405053 Depth 2.5-4.5 ft Description - Dark Grayish Brown Lean Clay [CL]



Type of Test: CU w/pp - STAGED Sample Type: Remolded 85% MDD[1] Failure Criteria: Maximum Pore Pressure

Boring No.	Depth (feet)	Spec. No.	Moisture Content (%)		Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Axial Strain (%)	Deviator Stress (psf)	Pore Pressure (psf)	Effective Confining Pressure ($sigma_3$) (psf)	Major Principal Stress ($sigma_1$) (psf)	Principal Stress Ratio
			Initial	Final								
G2-133	2.5-4.5	STG1	15.8	22.6	114.0	98.5	3.76	1998	1037	403	2401	5.95
		STG2	15.8	22.6	112.0	96.7	4.36	3654	2088	1512	5166	3.42
		STG3	15.8	22.6	116.6	100.8	8.24	6740	4378	2822	9562	3.39

1. Remolded At or Near Optimum Moisture Content In Accordance with ASTM D698

CAD FILE: SKX03825.DGN

APPENDIX I

COMPACTION CURVES

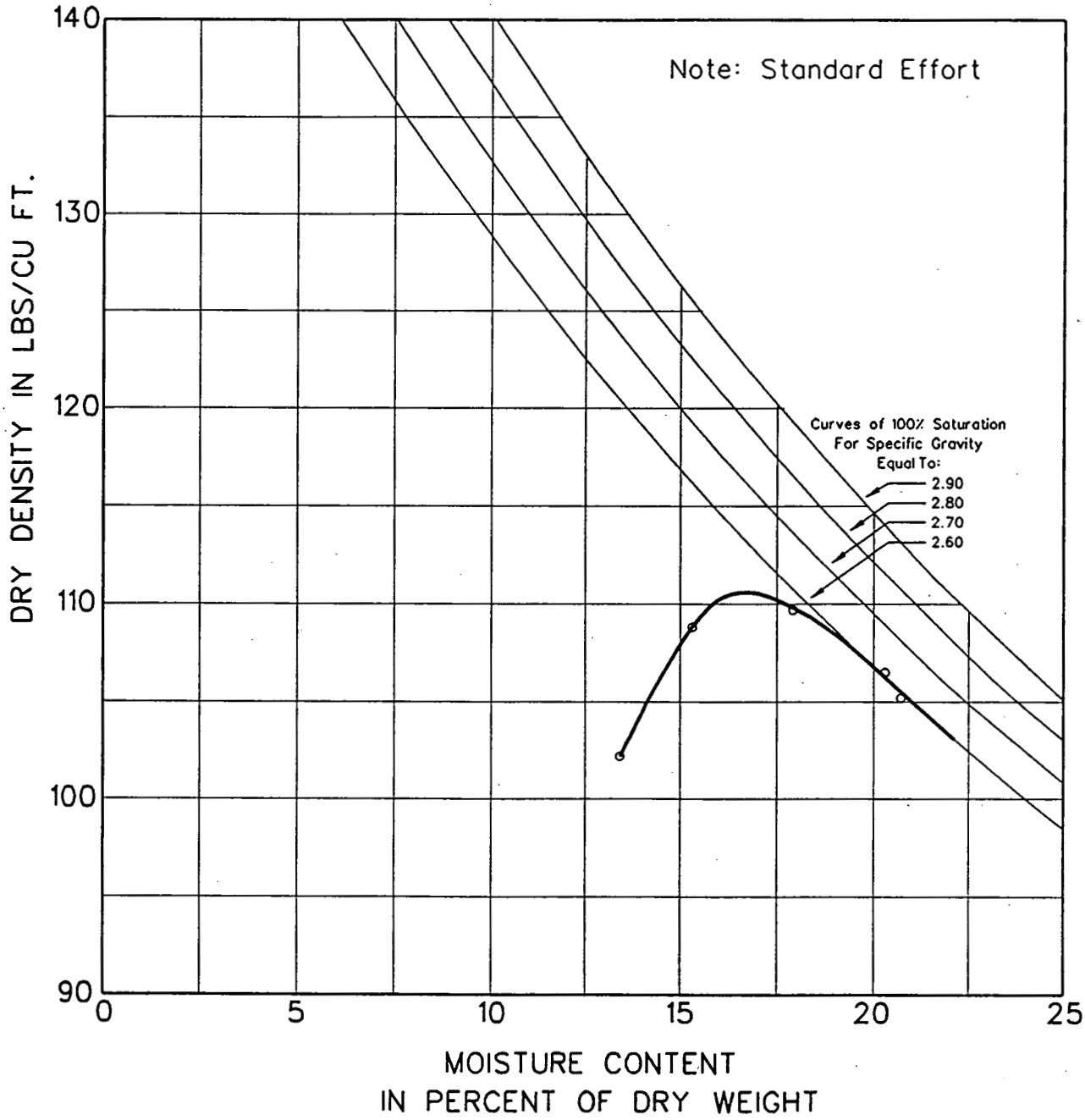
Boring: 11468 Sample Number: 403103 Depth: 2.0-6.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 16.7% Maximum Dry Density: 110.5 lbs/ft^3

Specific Gravity: 2.75 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/03/95



FILENAME: SKX03656.DGN

R403103c.m(2473.ws415) po140@ws415. Tue Oct 31 13:00:59 CST 1995

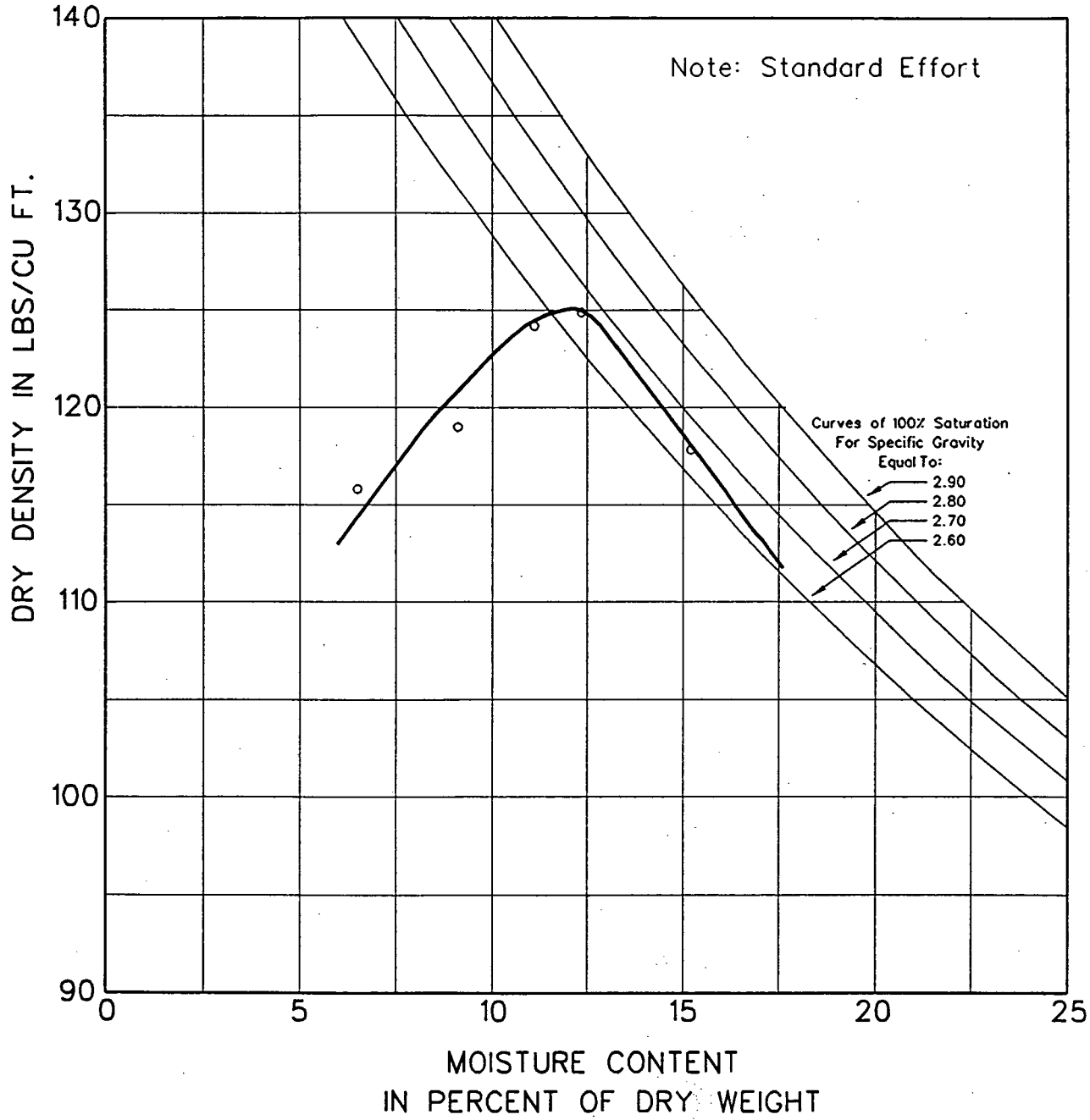
Boring: 11468 Sample Number: 403104 Depth: 9.0-13.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 11.6% Maximum Dry Density: 125.0 lbs/ft^3

Specific Gravity: 2.78 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 2/28/95



FILENAME: SKX03639.DGN

R403104c.m(2456.ws415) po140@ws415. Tue Oct 31 12:47:13 CST 1995

000077

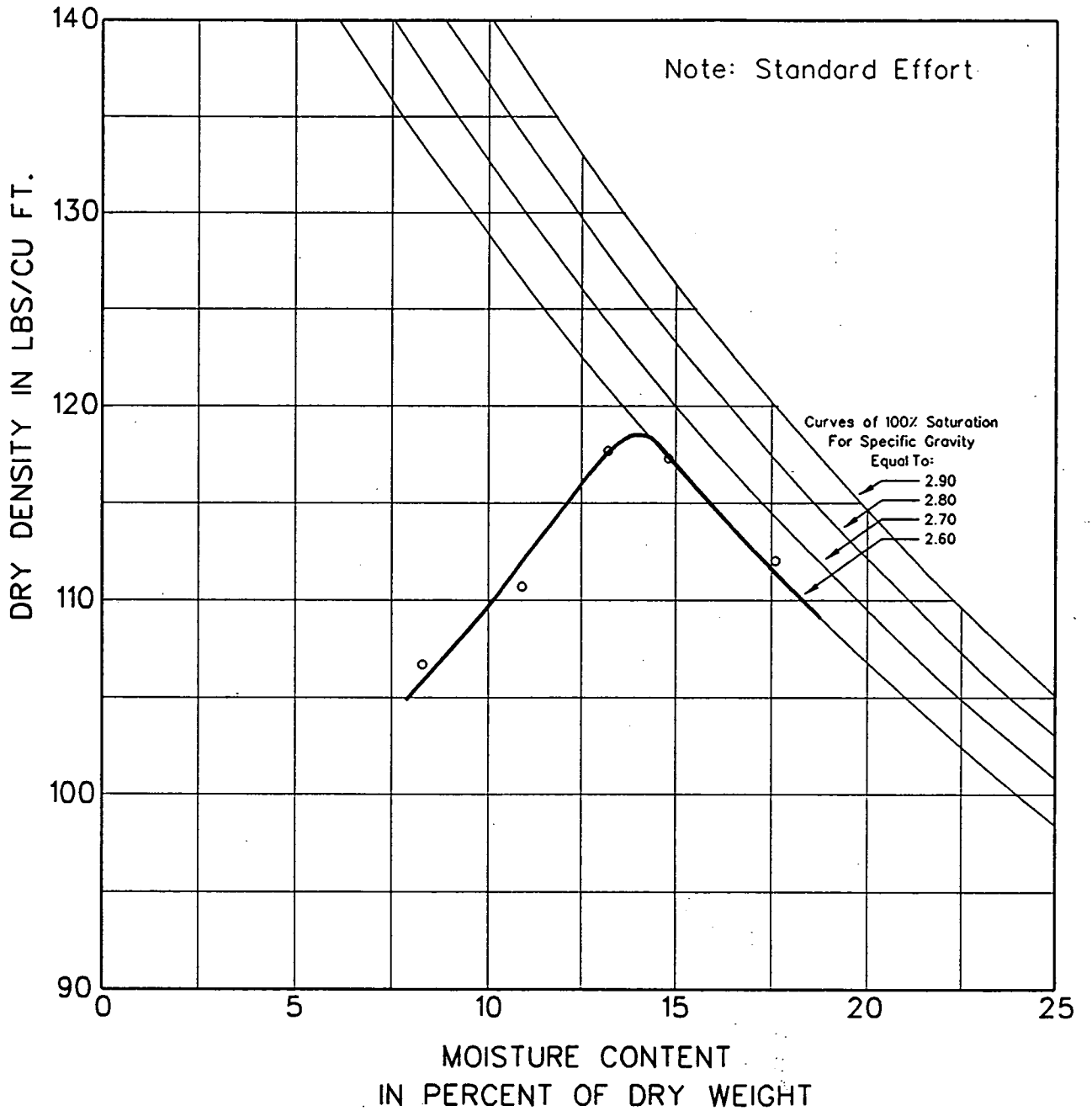
Boring: 11469 Sample Number: 402824 Depth: 3.0-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 13.9% Maximum Dry Density: 118.5 lbs/ft^3

Specific Gravity: 2.70 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/14/95



FILENAME: SKX03655.DGN

R402824c.m(2472.ws415) po140@ws415. Tue Oct 31 13:00:32 CST 1995

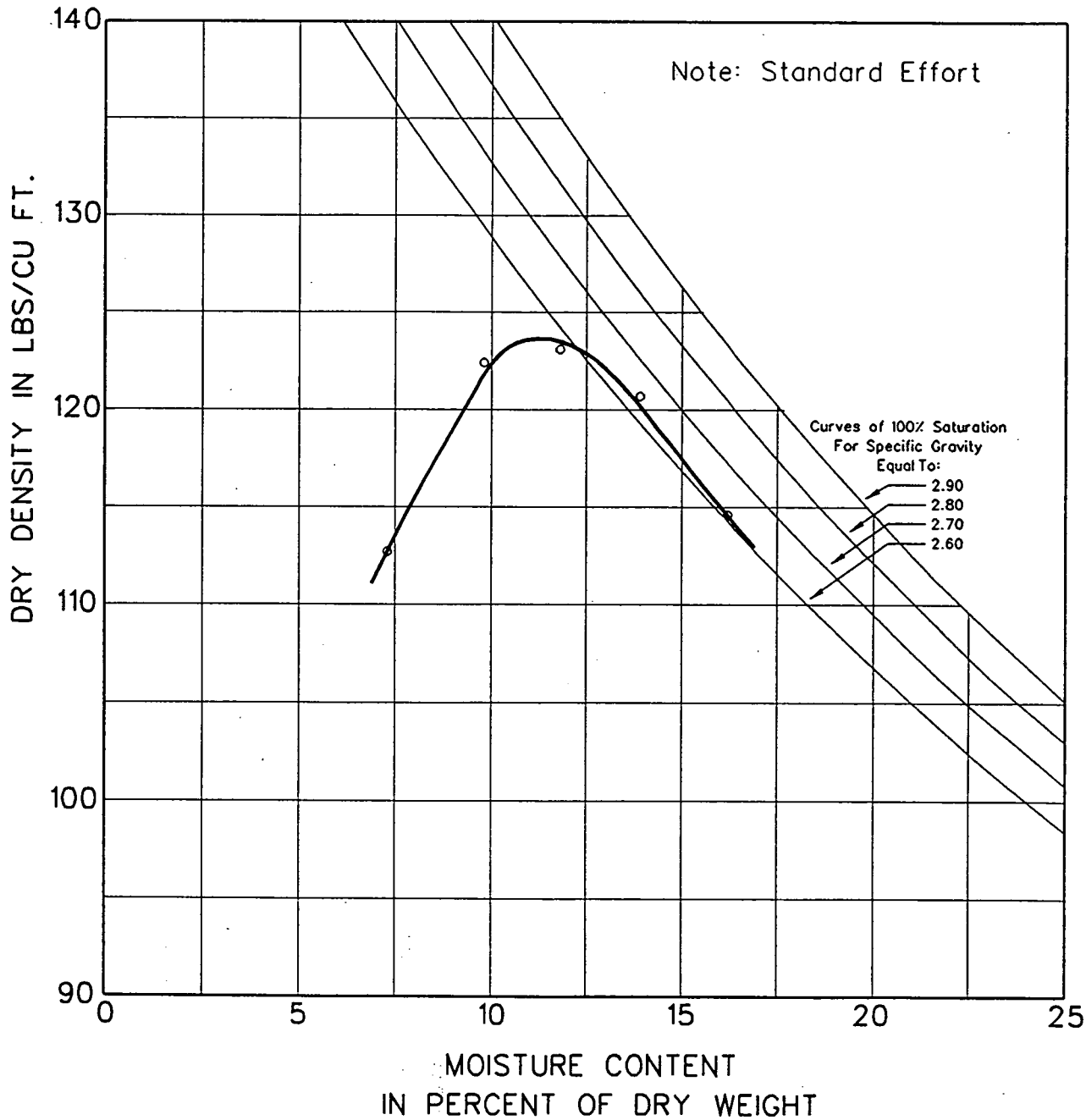
Boring: 11469 Sample Number: 402828 Depth: 7.5-12.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 11.3% Maximum Dry Density: 123.7 lbs/ft^3

Specific Gravity: 2.69 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/15/95



FILENAME: SKX03657.DGN

R402828c.m(2474.ws415) po140@ws415. Tue Oct 31 13:01:27 CST 1995

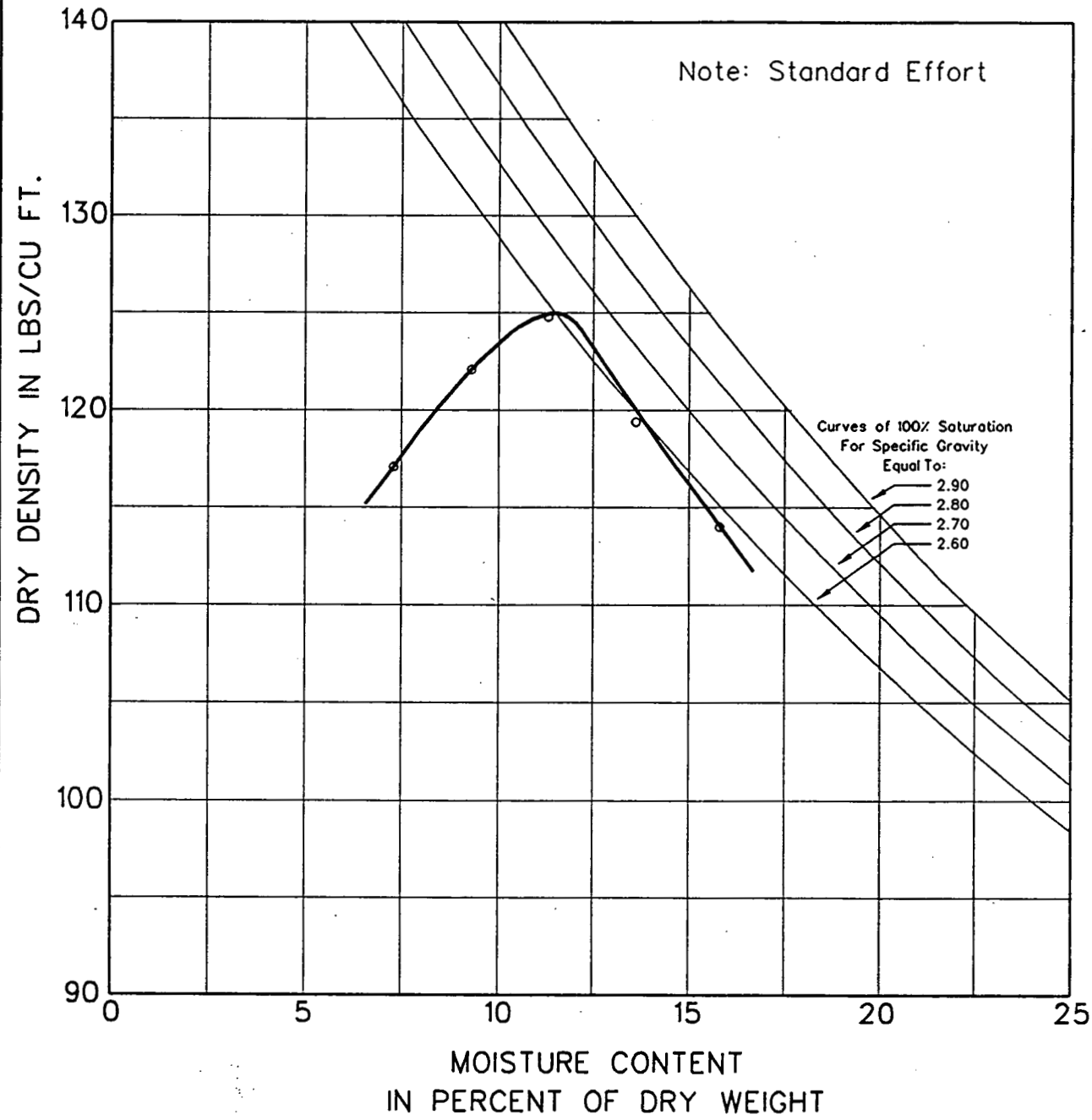
Boring: 11470B Sample Number: 403169-1 Depth: 3.5-7.5 ft

Description: Brown Sandy Silt (ML)

Optimum Moisture Content: 11.1% Maximum Dry Density: 125.0 lbs/ft^3

Specific Gravity: 2.70 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/03/95



FILENAME: SKX03638.DGN

R403169c.m(2455.ws415) po140@ws415. Tue Oct 31 12:45:09 CST 1995

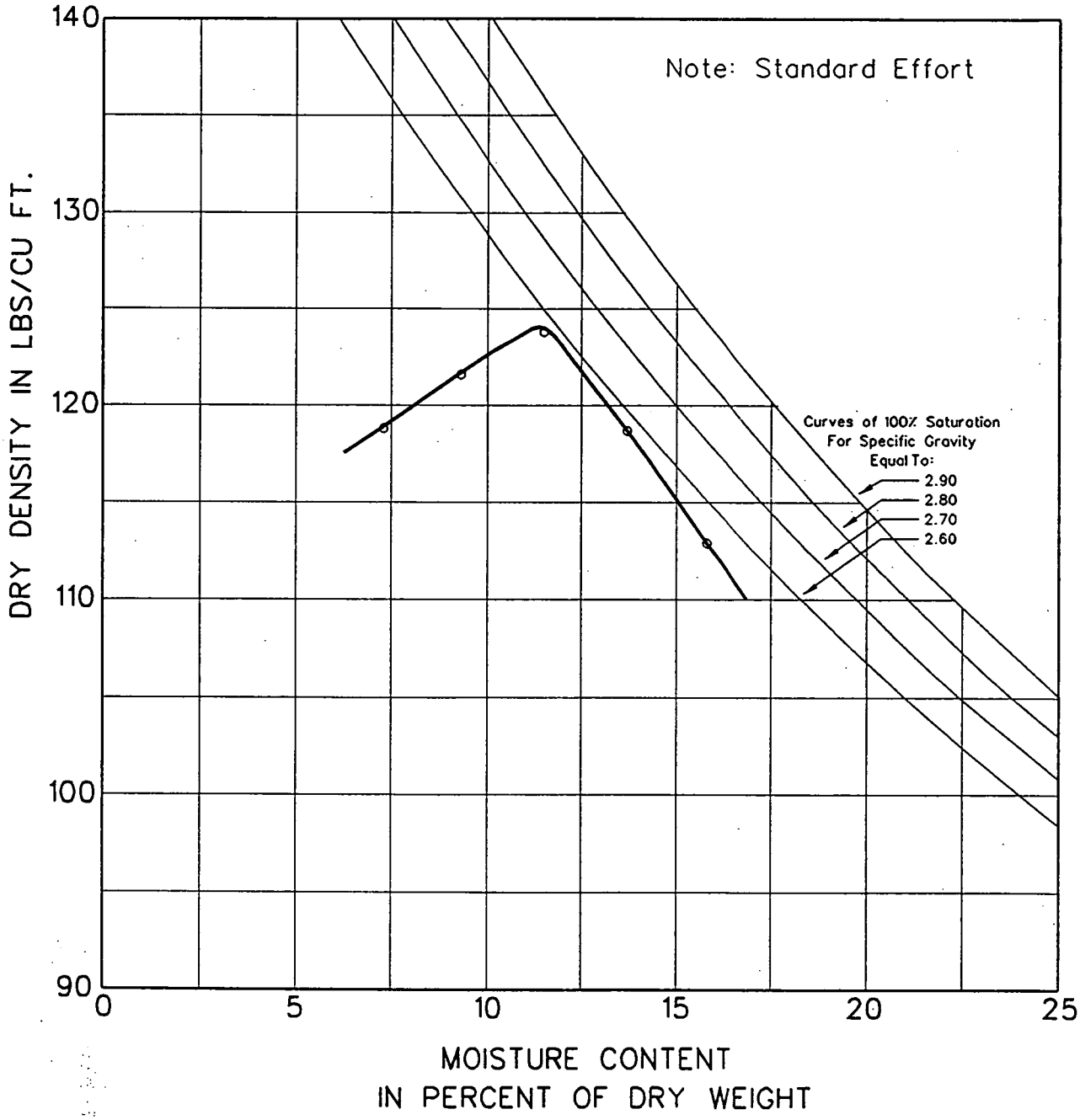
Boring: 11470B Sample Number: 403170-1 Depth: 7.5-12.0 ft

Description: Brown Sandy Silt (ML)

Optimum Moisture Content: 11.4% Maximum Dry Density: 124.0 lbs/ft^3

Specific Gravity: 2.72 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/09/95



FILENAME: SKX03637.DGN

R403170c.m(2454.ws415) po140@ws415. Tue Oct 31 12:44:23 CST 1995

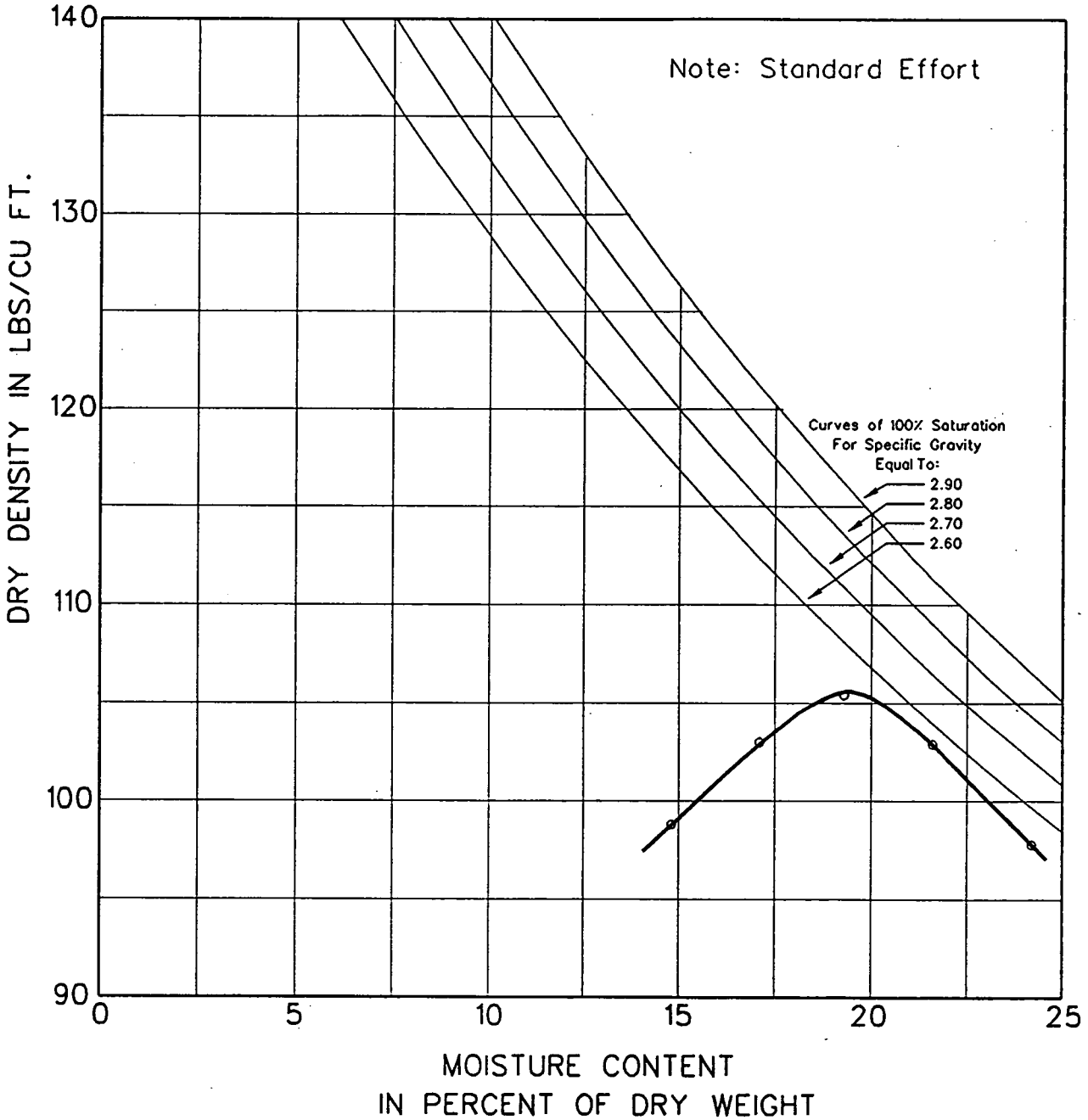
Boring: 11471 Sample Number: 402966 Depth: 3.0-7.5 ft

Description: Brown Fat Clay (CH)

Optimum Moisture Content: 19.3% Maximum Dry Density: 105.6 lbs/ft^3

Specific Gravity: 2.72 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/03/95



FILENAME: SKX03654.DGN

R402966c.m(2471.ws415) po140@ws415. Tue Oct 31 13:00:04 CST 1995

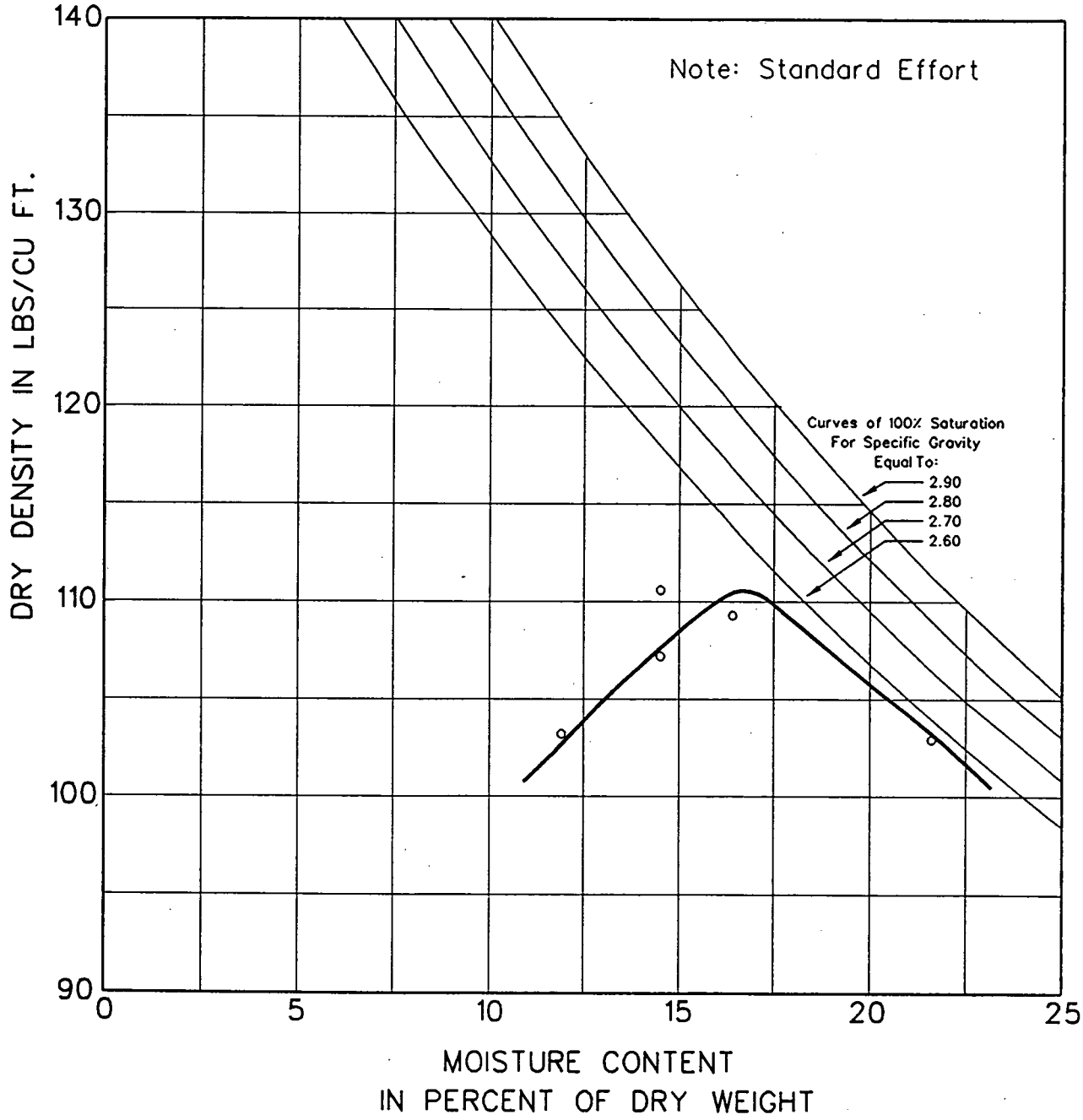
Boring: 11471 Sample Number: 402978 Depth: 7.5-10.5 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.4% Maximum Dry Density: 110.6 lbs/ft^3

Specific Gravity: 2.71 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/01/95



FILENAME: SKX03653.DGN

R402978c.m(2470.ws415) po140@ws415. Tue Oct 31 12:59:37 CST 1995

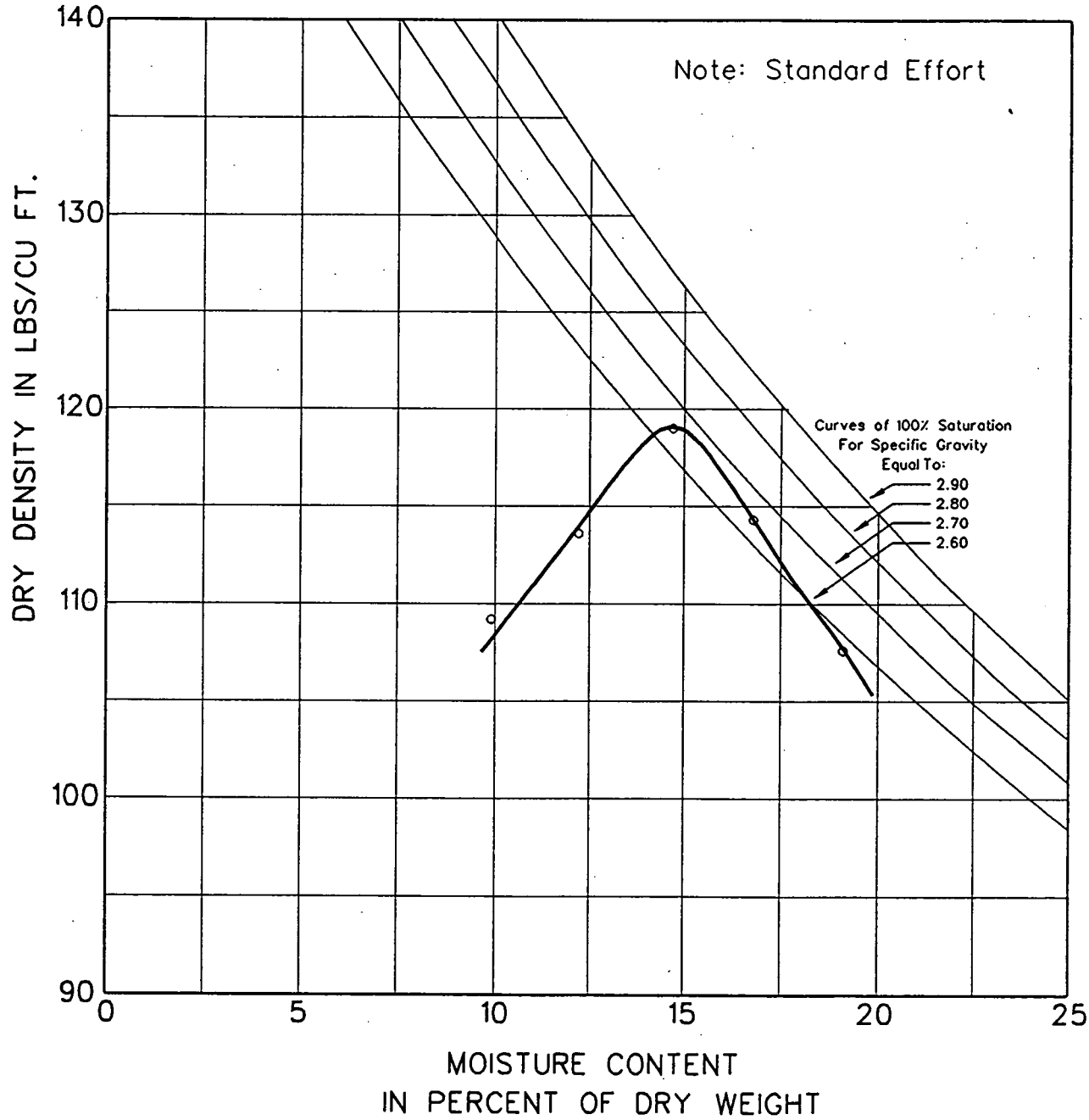
Boring: 11472 Sample Number: 402958 Depth: 3.5-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 14.4% Maximum Dry Density: 119.0 lbs/ft^3

Specific Gravity: 2.74 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/13/95



FILENAME: SKX03636.DGN

R402958c.m(2453.ws415) po140@ws415. Tue Oct 31 12:42:59 CST 1995

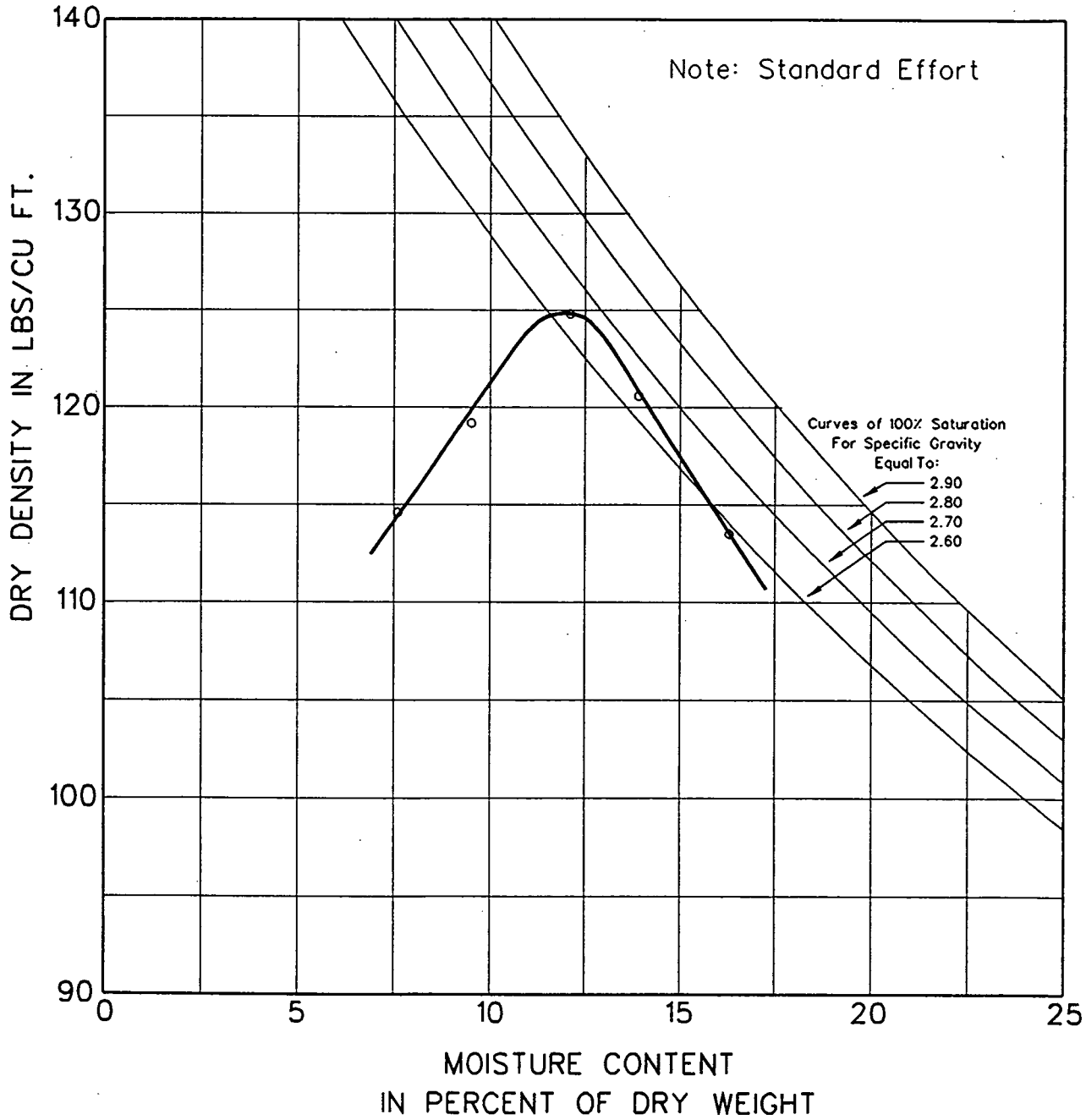
Boring: 11472 Sample Number: 402959 Depth: 9.0-12.0 ft

Description: Brown Sandy Lean Clay (CL)

Optimum Moisture Content: 12.0% Maximum Dry Density: 124.9 lbs/ft^3

Specific Gravity: 2.69 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/18/95



FILENAME: SKX03652.DGN

R402959c.m(2469.ws415) po140@ws415. Tue Oct 31 12:59:08 CST 1995

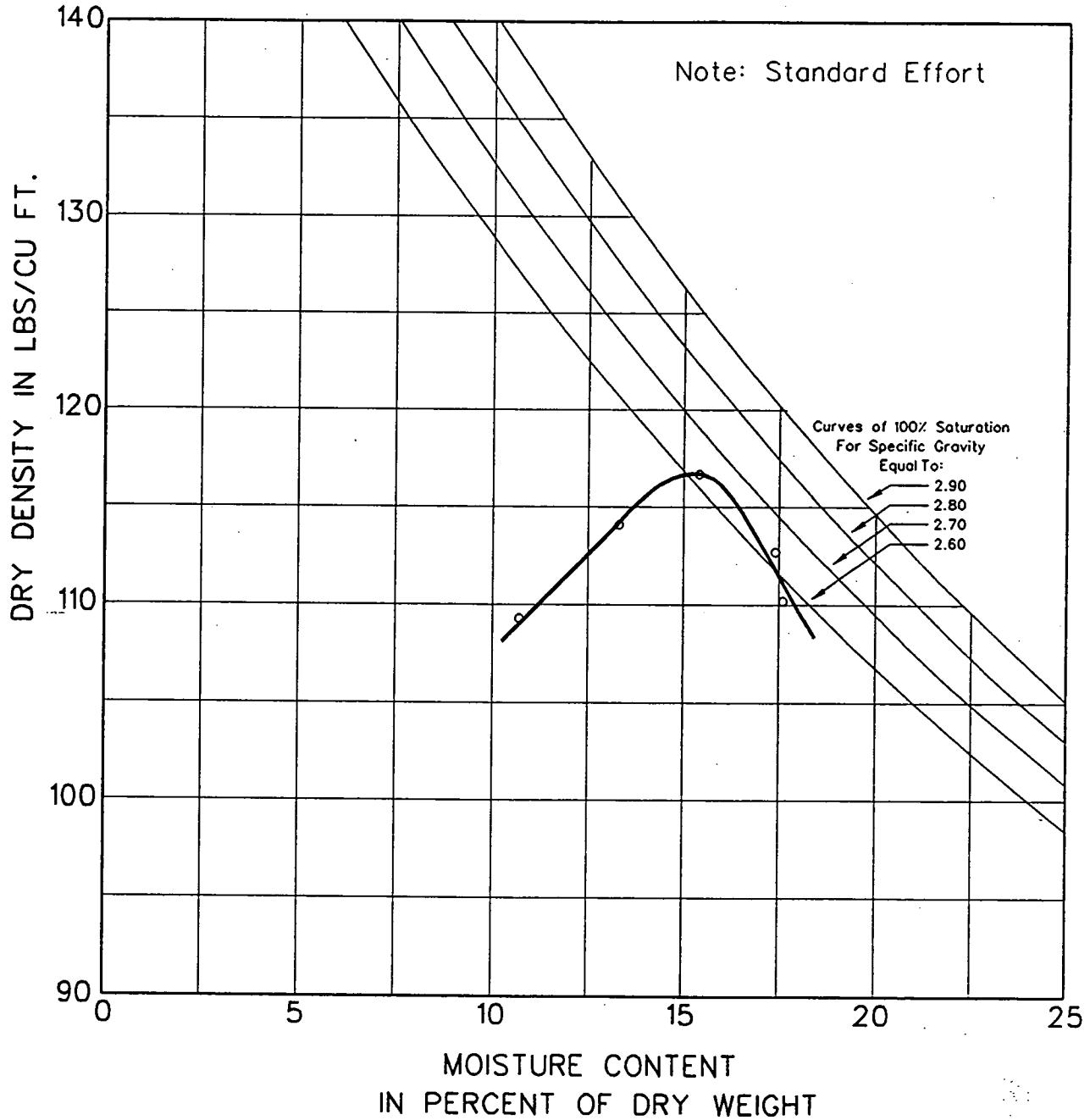
Boring: 11473 Sample Number: 402923 Depth: 3.0-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 15.1% Maximum Dry Density: 116.7 lbs/ft^3

Specific Gravity: 2.76 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/14/95



FILENAME: SKX03651.DGN

R402923c.m(2468.ws415) po140@ws415. Tue Oct 31 12:58:38 CST 1995

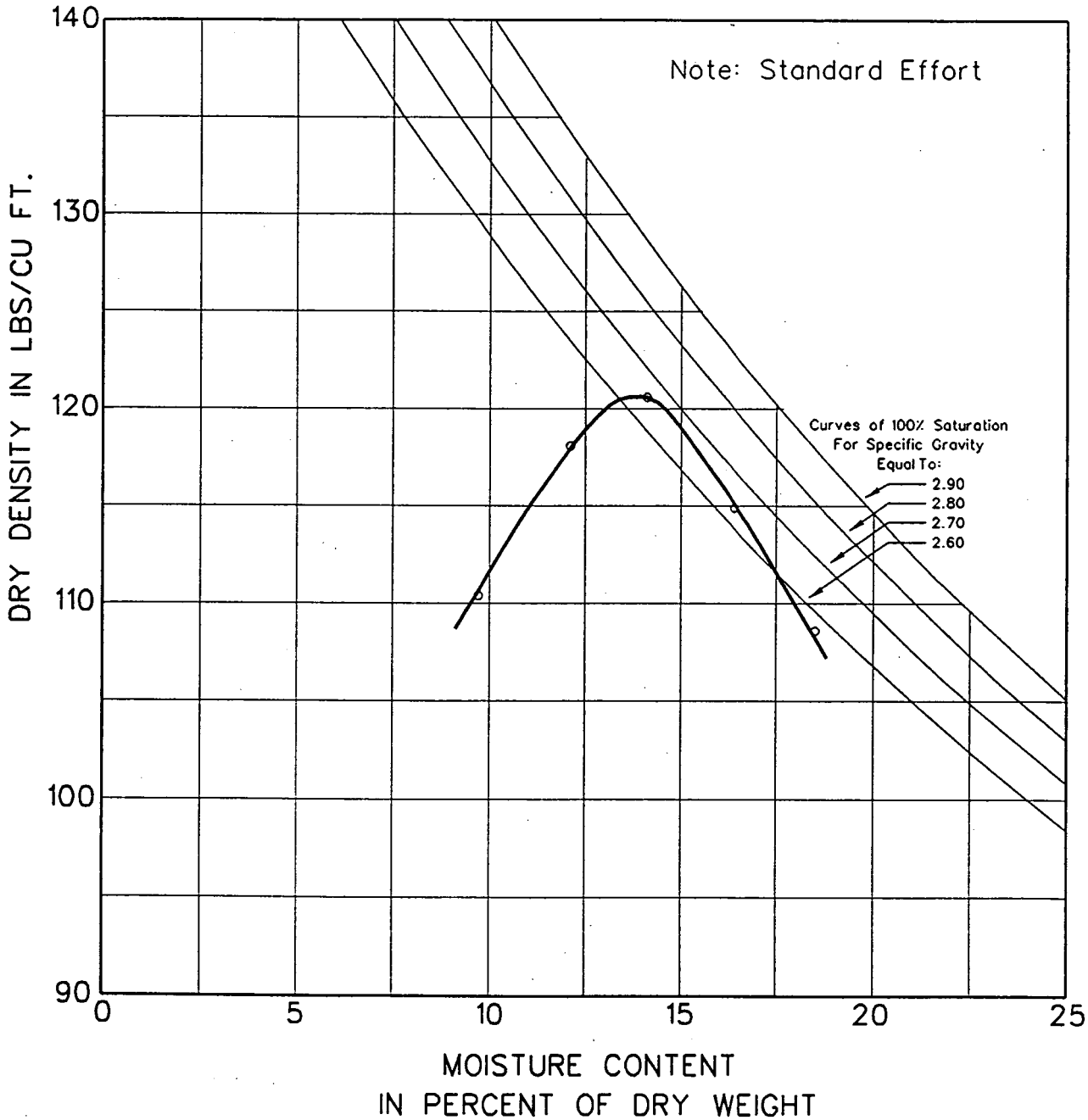
Boring: 11473 Sample Number: 402925 Depth: 7.5-12.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 13.7% Maximum Dry Density: 120.6 lbs/ft^3

Specific Gravity: 2.76 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/16/95



FILENAME: SKX03635.DGN

R402925c.m(2452.ws415) po140@ws415. Tue Oct 31 12:42:32 CST 1995

000287

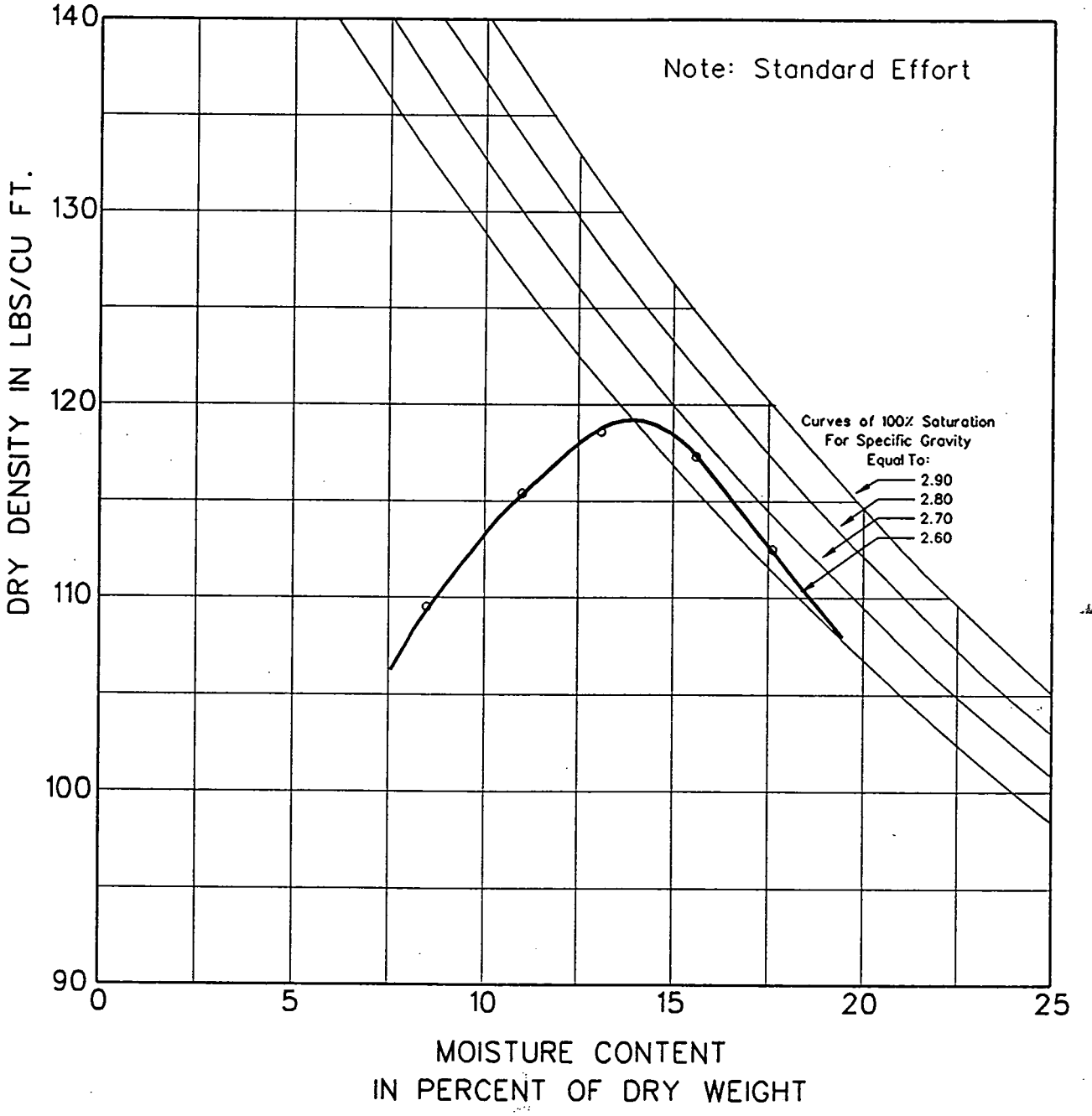
Boring: 11474 Sample Number: 402896 Depth: 3.0-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 13.7% Maximum Dry Density: 119.2 lbs/ft^3

Specific Gravity: 2.79 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/14/95



FILENAME: SKX03650.DGN

R402896c.m(2467.ws415) po140@ws415. Tue Oct 31 12:52:18 CST 1995

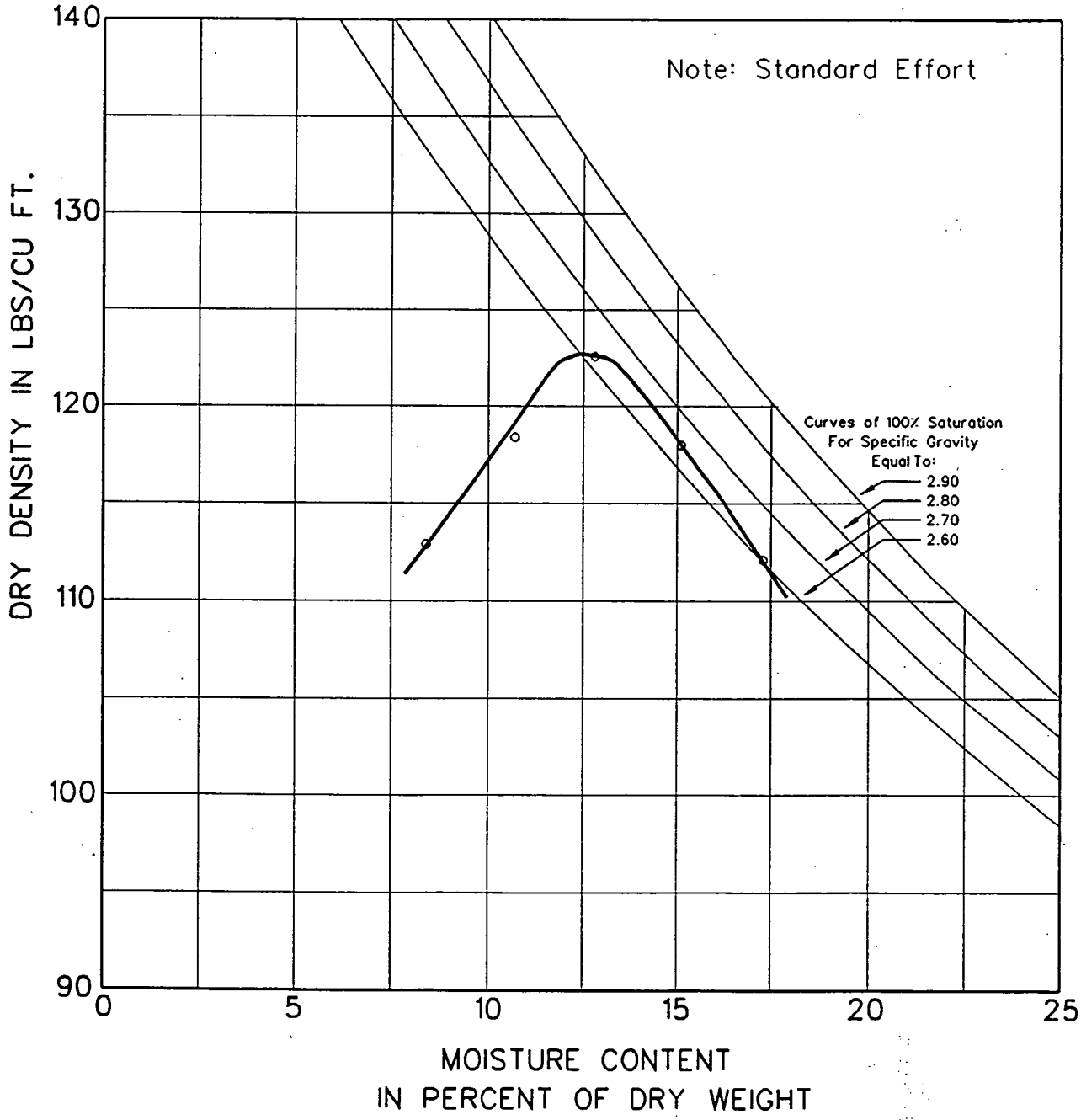
Boring: 11474 Sample Number: 402901 Depth: 9.7.5-12.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 12.8% Maximum Dry Density: 122.6 lbs/ft^3

Specific Gravity: 2.76 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/16/95



FILENAME: SKX03649.DGN

R402901c.m(2466.ws415) po140@ws415. Tue Oct 31 12:51:51 CST 1995

000089

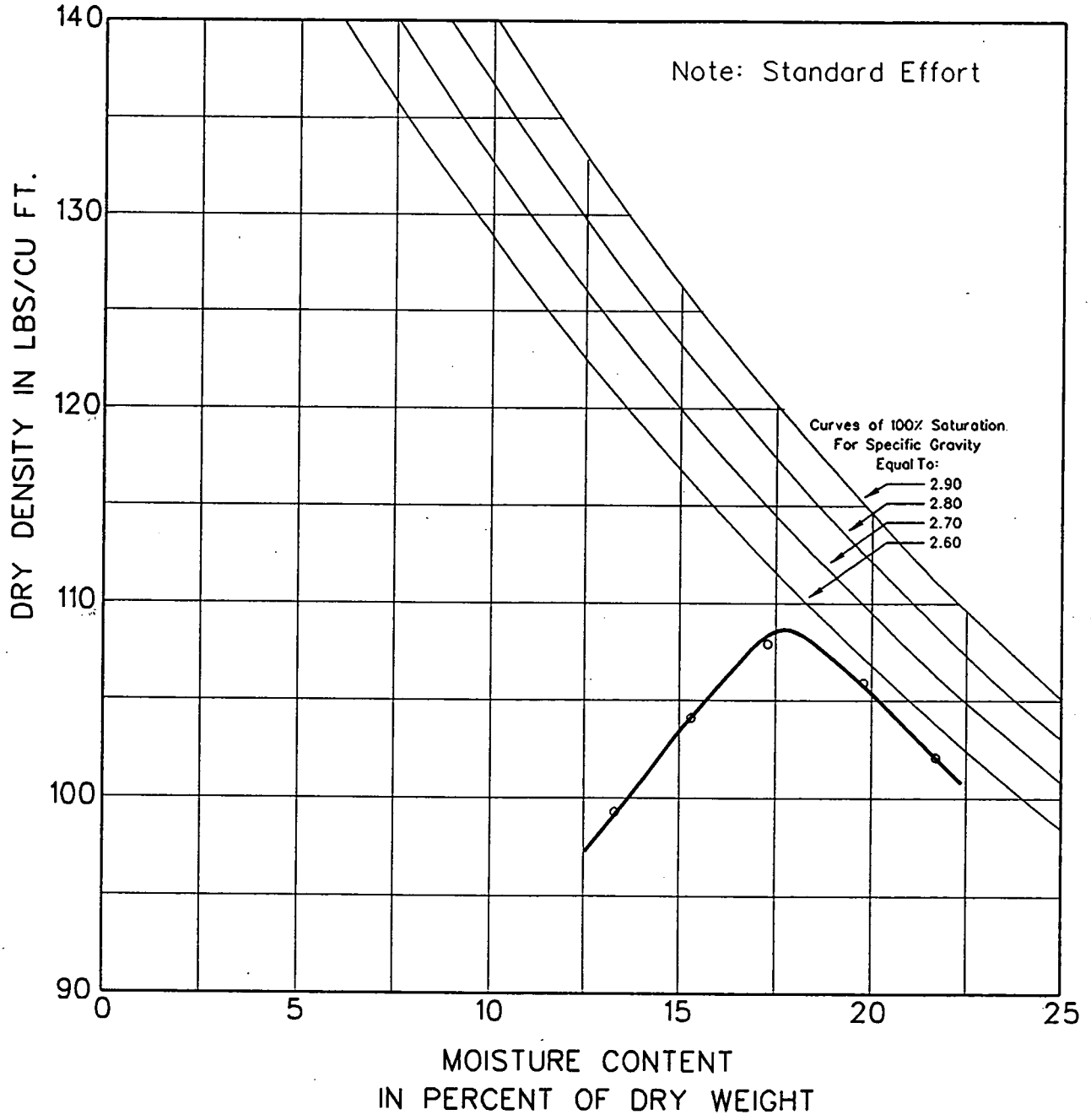
Boring: 11475 Sample Number: 403264 Depth: 4.5-8.5 ft

Description: Brown Lean Clay with Sand (Fill) (CL)

Optimum Moisture Content: 18.1% Maximum Dry Density: 108.3 lbs/ft^3

Specific Gravity: 2.71 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/06/95



FILENAME: SKX03648.DGN

R403264c.m(2465.ws415) po140@ws415. Tue Oct 31 12:51:24 CST 1995

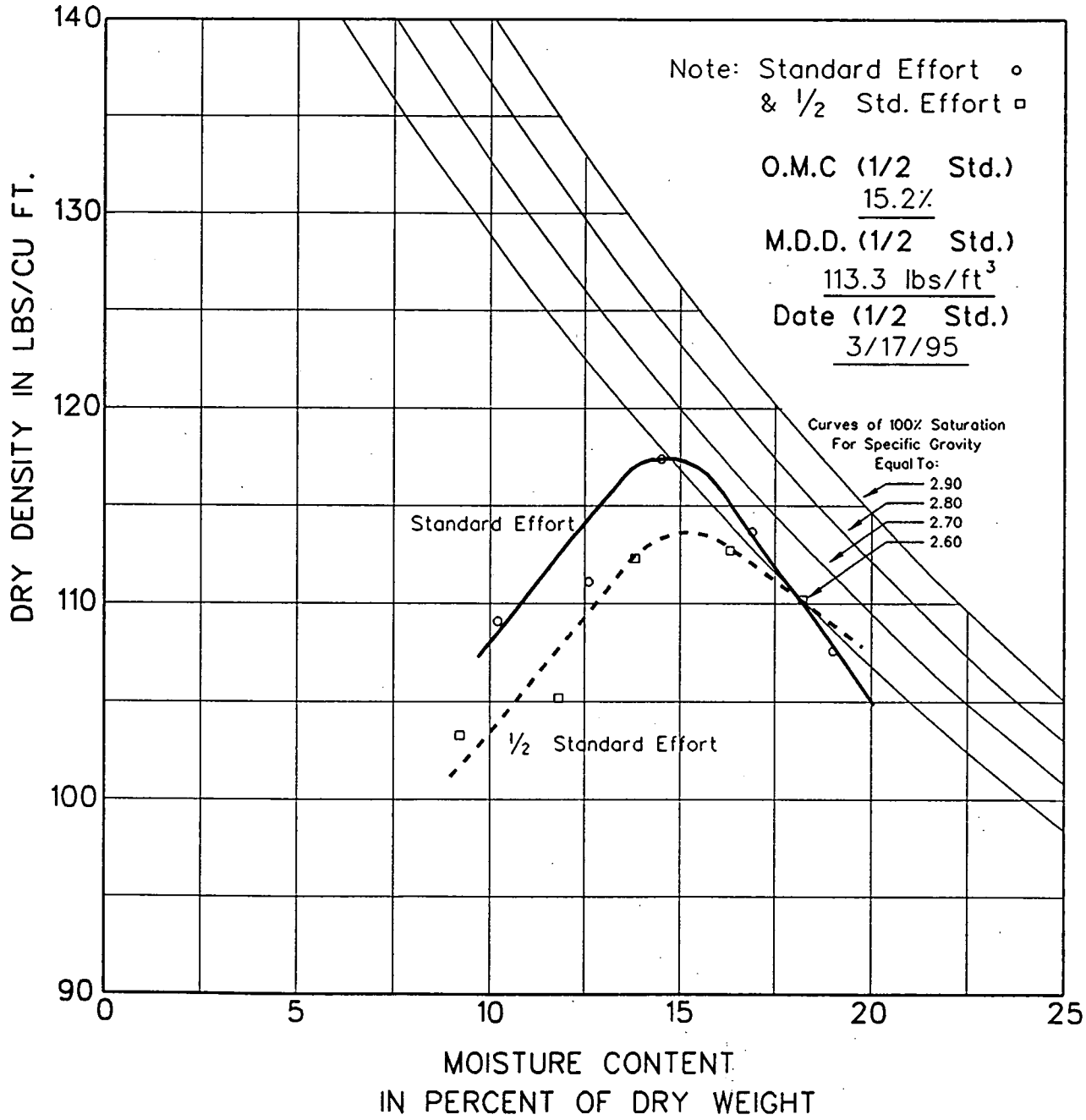
Boring: 11476 Sample Number: 402993 Depth: 3.5-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 14.6% Maximum Dry Density: 117.4 lbs/ft^3

Specific Gravity: 2.72 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/09/95



FILENAME: SKX03631.DGN

R402993c.m(2448.ws415) po140@ws415. Tue Oct 31 12:37:41 CST 1995

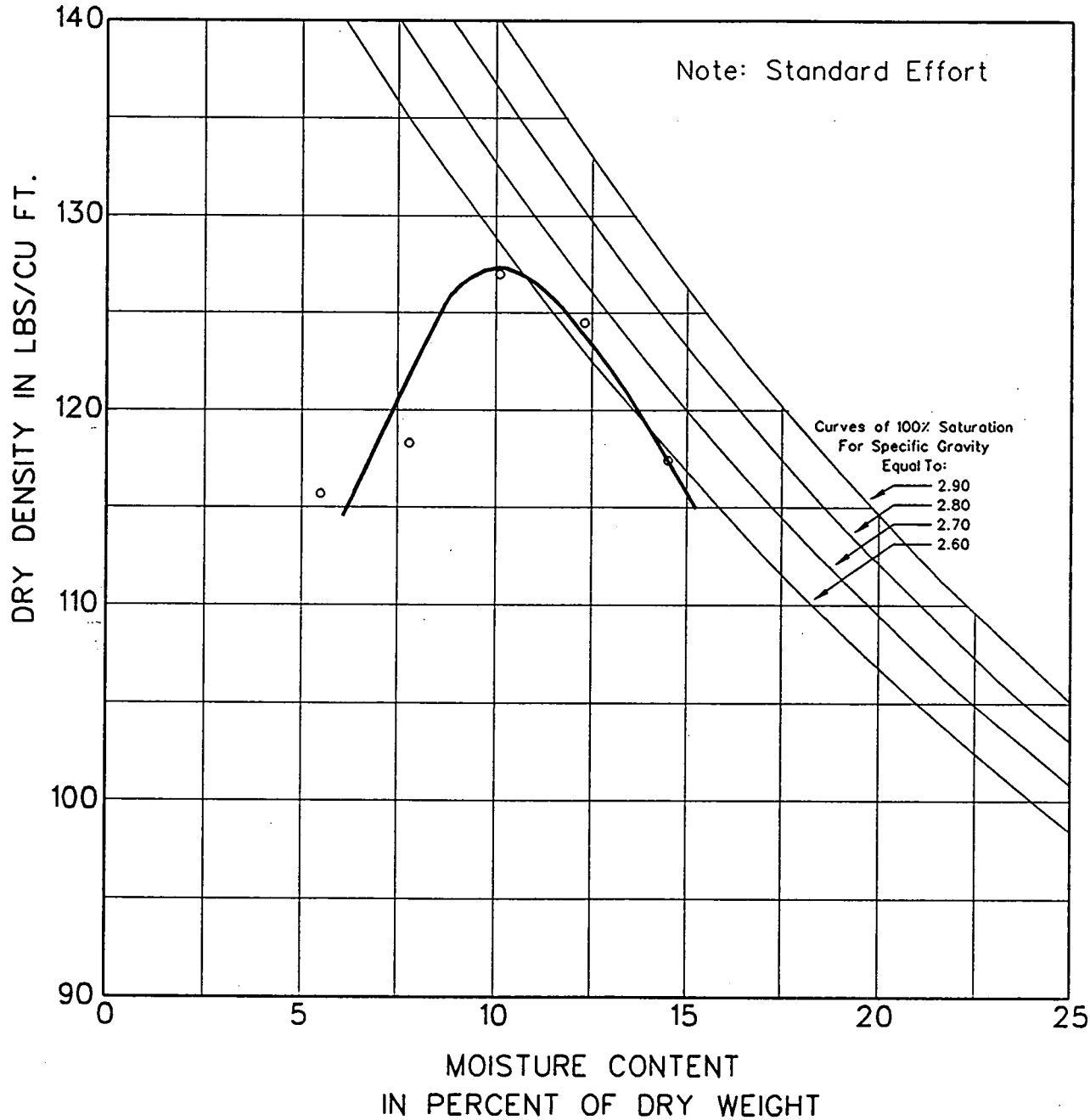
Boring: 11476 Sample Number: 403010 Depth: 12.0-15.0 ft

Description: Gray Lean Clay with Sand (CL)

Optimum Moisture Content: 10.5% Maximum Dry Density: 127.3 lbs/ft^3

Specific Gravity: 2.75 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/09/95



FILENAME: SKX03634.DGN

R403010c.m(2451.ws415) po140@ws415. Tue Oct 31 12:41:43 CST 1995

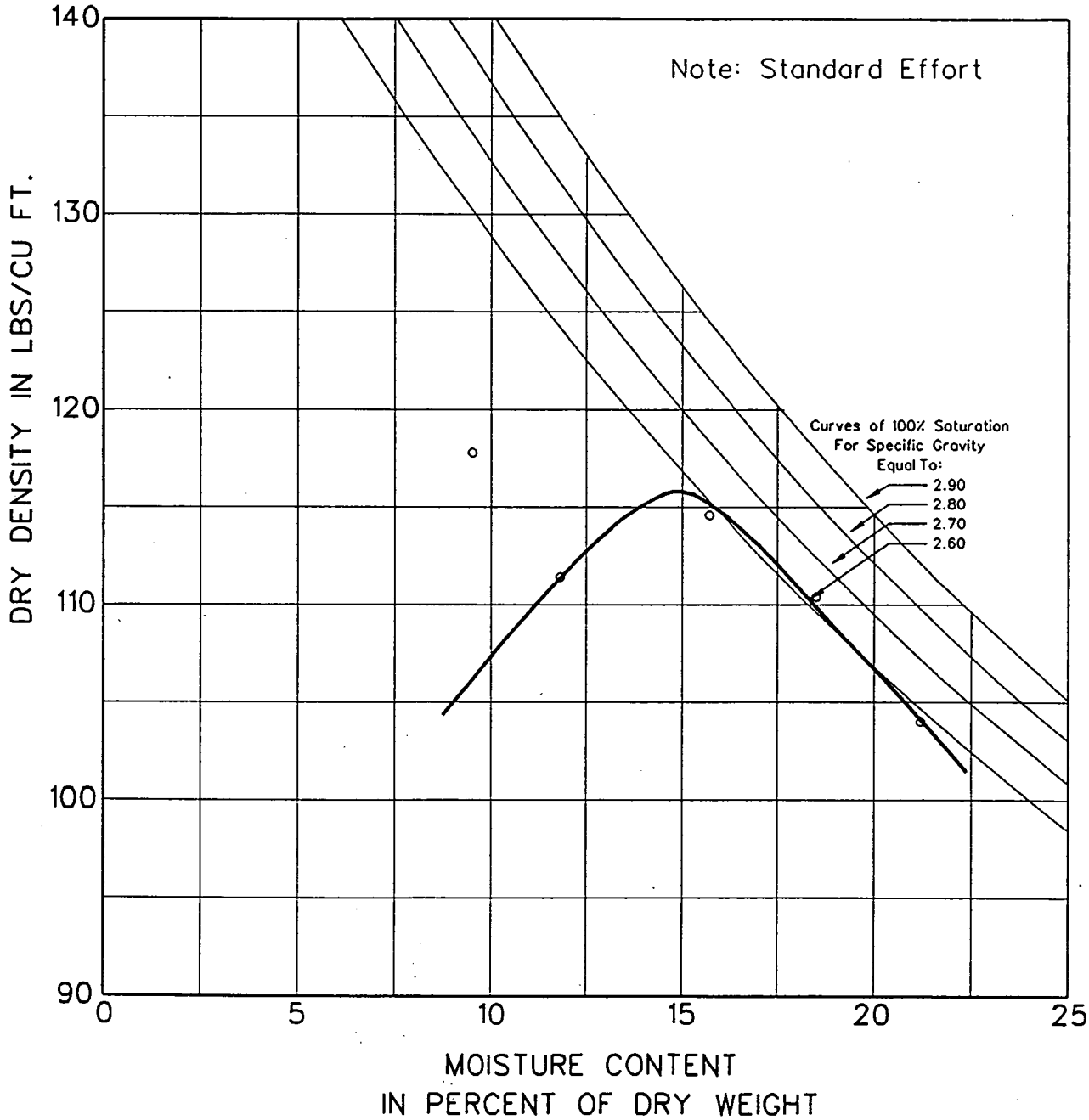
Boring: 11477 Sample Number: 402866 Depth: 3.5-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 14.6% Maximum Dry Density: 116.0 lbs/ft^3

Specific Gravity: 2.79 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 2/28/95



FILENAME: SKX03632.DGN

R402866c.m(2449.ws415) po140@ws415. Tue Oct 31 12:38:52 CST 1995

000293

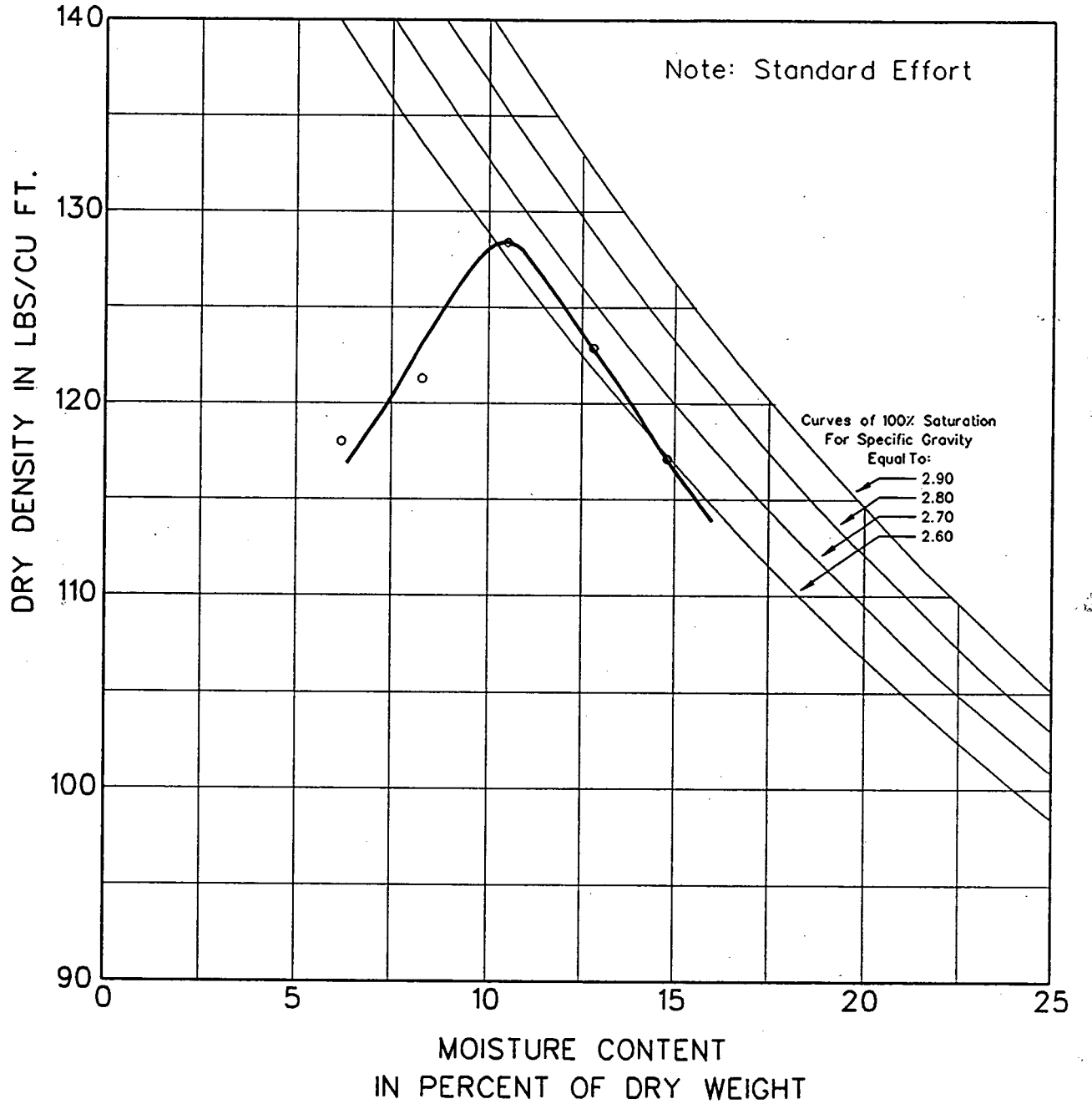
Boring: 11477 Sample Number: 402874 Depth: 14.0-18.0 ft

Description: Gray Sandy Lean Clay (CL)

Optimum Moisture Content: 10.5% Maximum Dry Density: 128.4 lbs/ft^3

Specific Gravity: 2.72 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/14/95



FILENAME: SKX03647.DGN

R402874c.m(2464.ws415) po140@ws415. Tue Oct 31 12:50:57 CST 1995

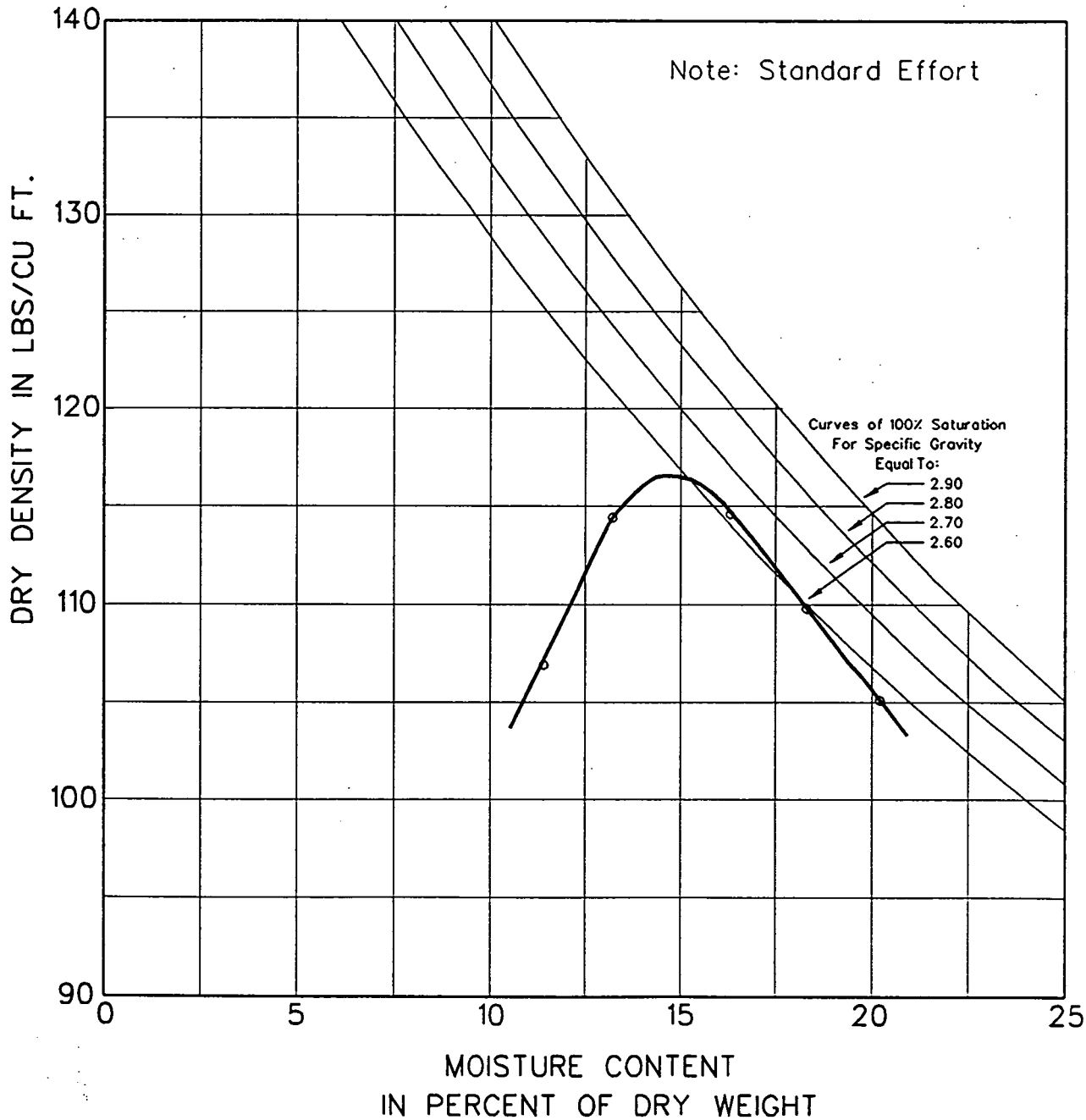
Boring: 11478 Sample Number: 402796 Depth: 3.5-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 14.7% Maximum Dry Density: 116.5 lbs/ft^3

Specific Gravity: 2.71 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/09/95



FILENAME: SKX03646.DGN

R402796c.m(2463.ws415) po140@ws415. Tue Oct 31 12:50:30 CST 1995

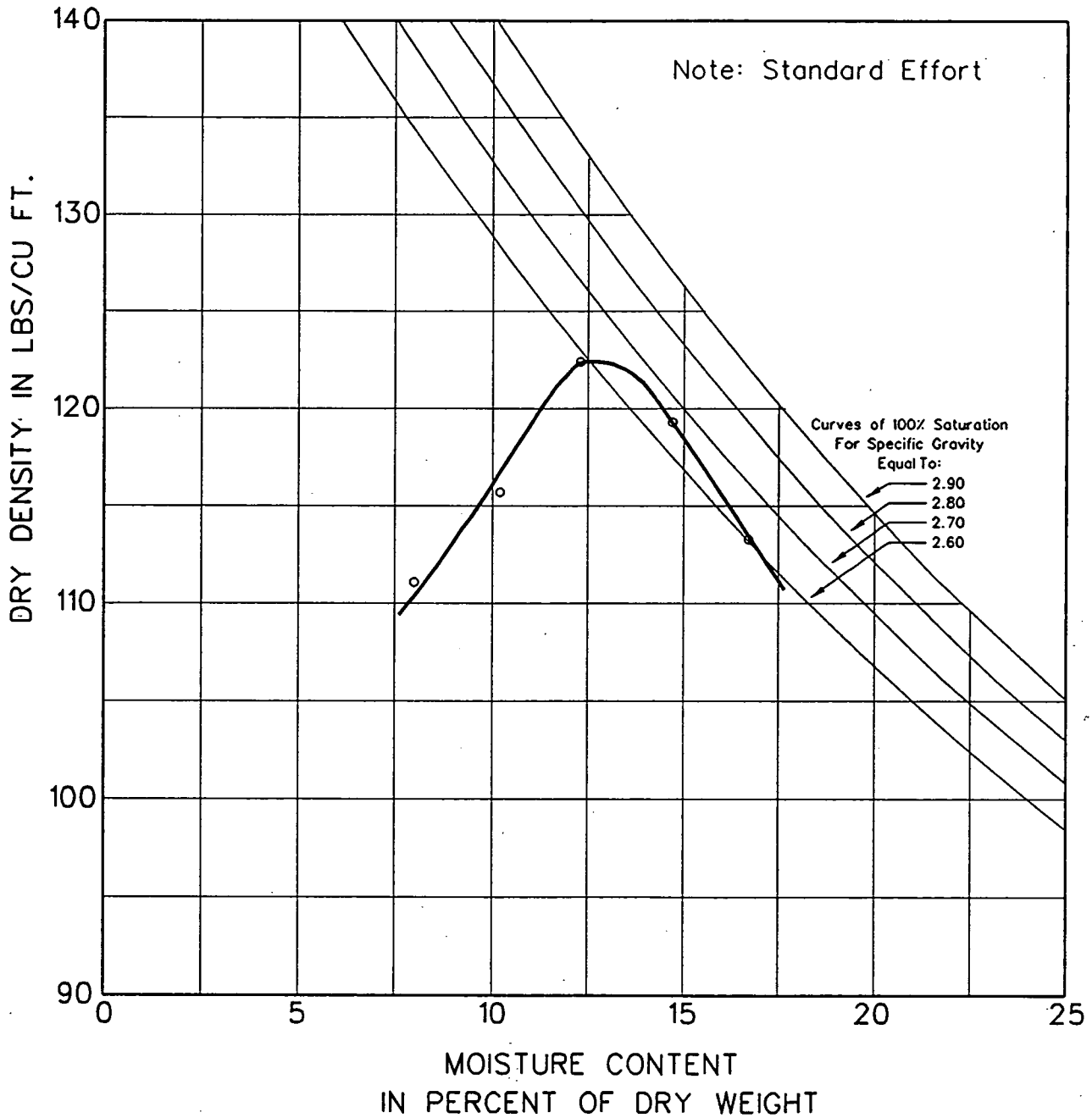
Boring: 11478 Sample Number: 402813 Depth: 7.5-10.0 ft

Description: Brown Sandy Lean Clay (CL)

Optimum Moisture Content: 12.7% Maximum Dry Density: 122.6 lbs/ft^3

Specific Gravity: 2.71 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/16/95



FILENAME: SKX03645.DGN

R402813c.m(2462.ws415) po140@ws415. Tue Oct 31 12:50:03 CST 1995

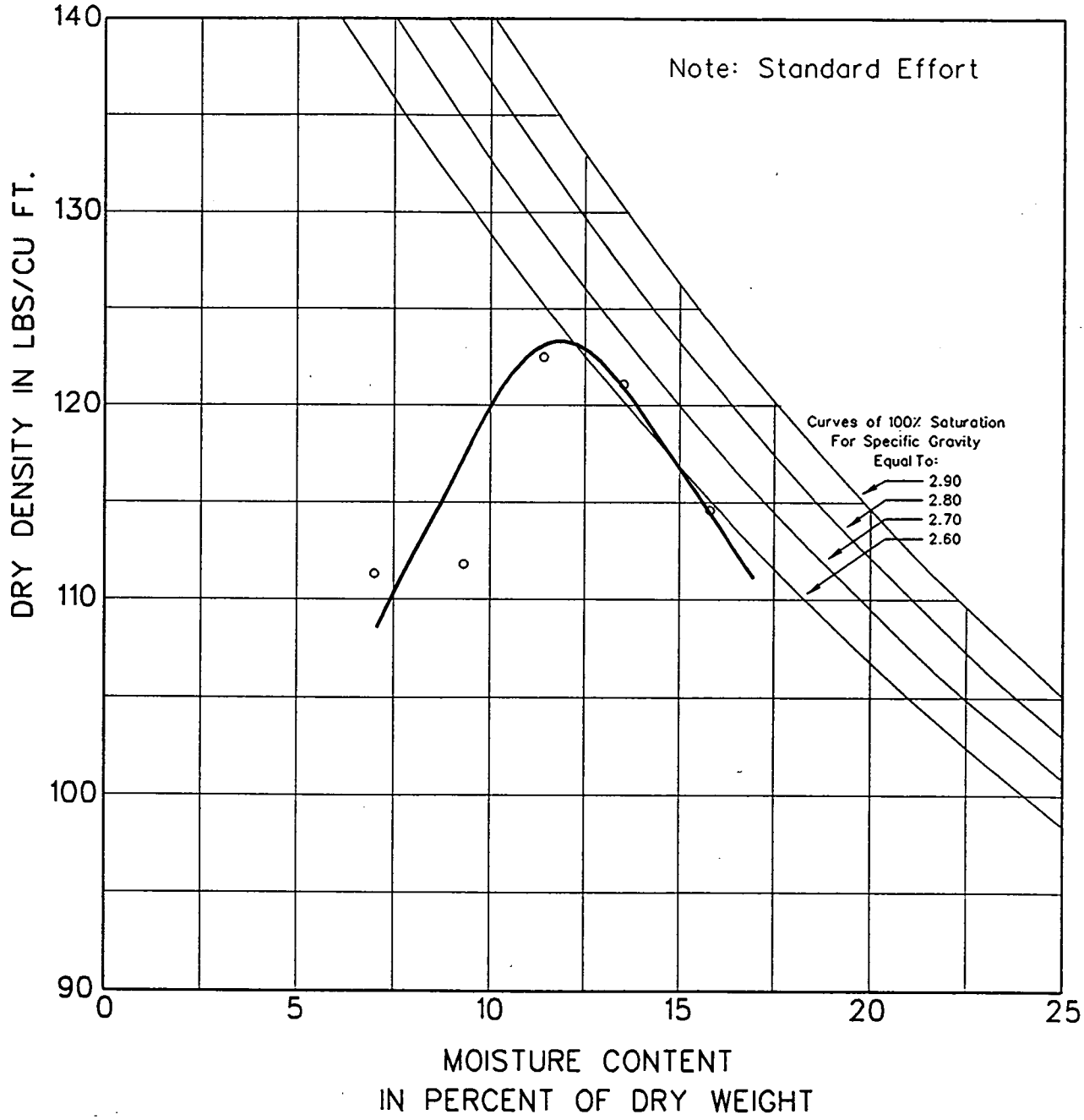
Boring: 11479 Sample Number: 403048 Depth: 3.5-7.5 ft

Description: Brown Sandy Lean Clay (CL)

Optimum Moisture Content: 11.8% Maximum Dry Density: 123.3 lbs/ft^3

Specific Gravity: 2.75 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/06/95



FILENAME: SKX03644.DGN

R403048c.m(2461.ws415) po140@ws415. Tue Oct 31 12:49:36 CST 1995

000097

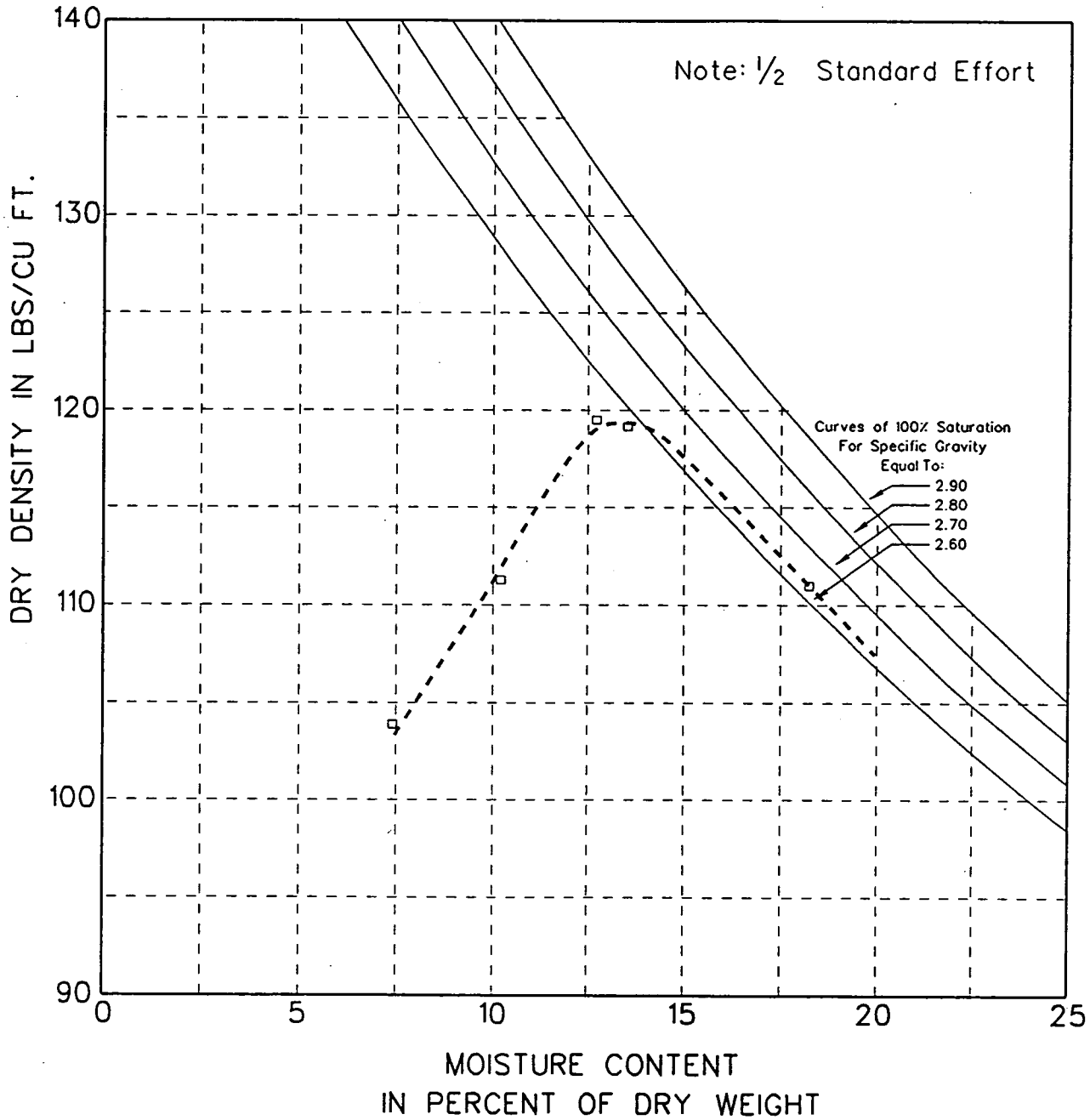
Boring: 11479 Sample Number: 403049 Depth: 7.5-10.5 ft

Description: Brown Sandy Lean Clay (CL)

Optimum Moisture Content: 13.0% Maximum Dry Density: 119.5 lbs/ft^3

Specific Gravity: 2.75 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/27/95



FILENAME: SKX03643.DGN

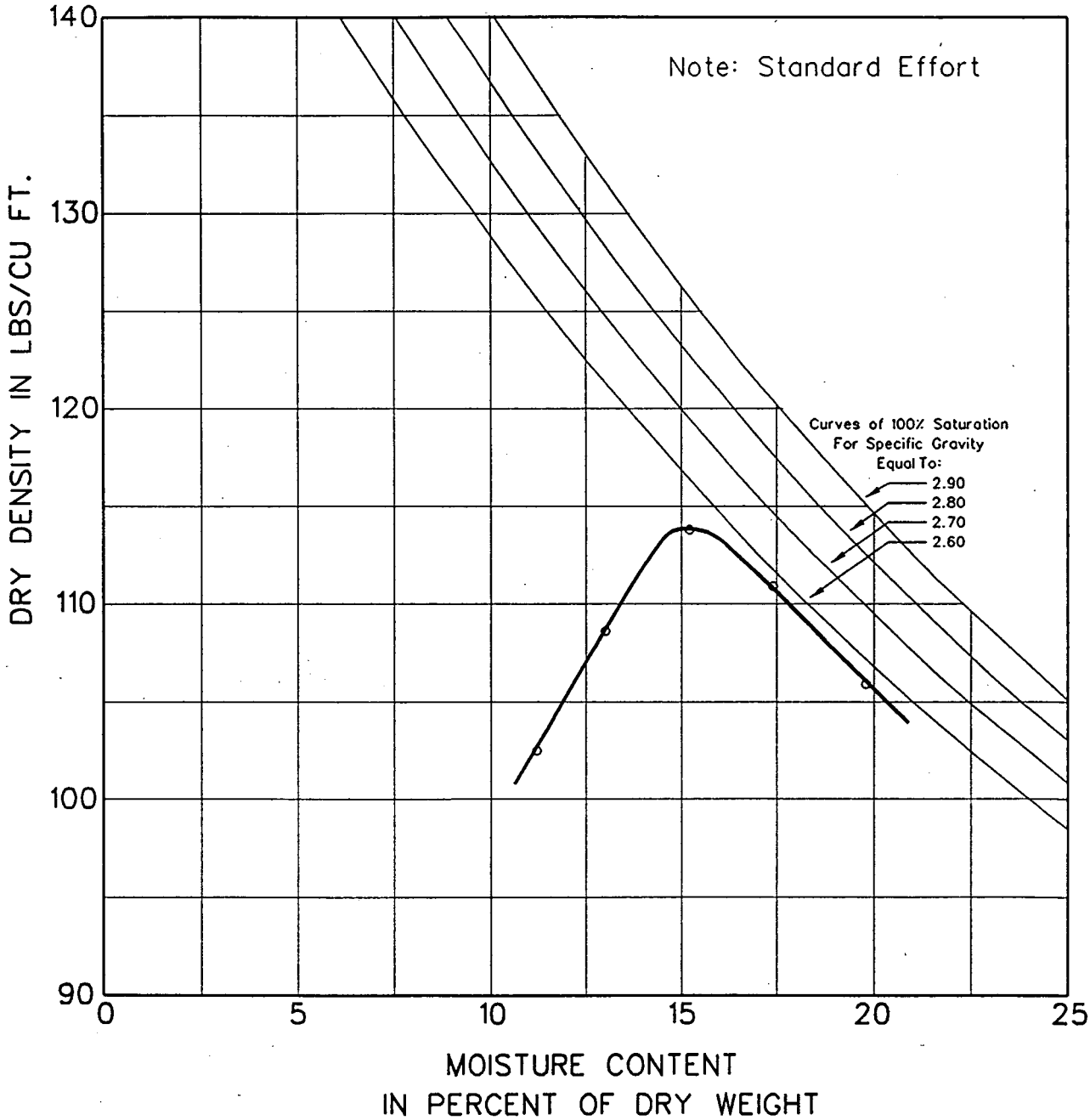
Boring: 11480 Sample Number: 402771 Depth: 3.0-7.5 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 15.2% Maximum Dry Density: 113.8 lbs/ft^3

Specific Gravity: 2.78 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/17/95



FILENAME: SKX03633.DGN

R402771c.m(2450.ws415) po140@ws415. Tue Oct 31 12:39:22 CST 1995

000299

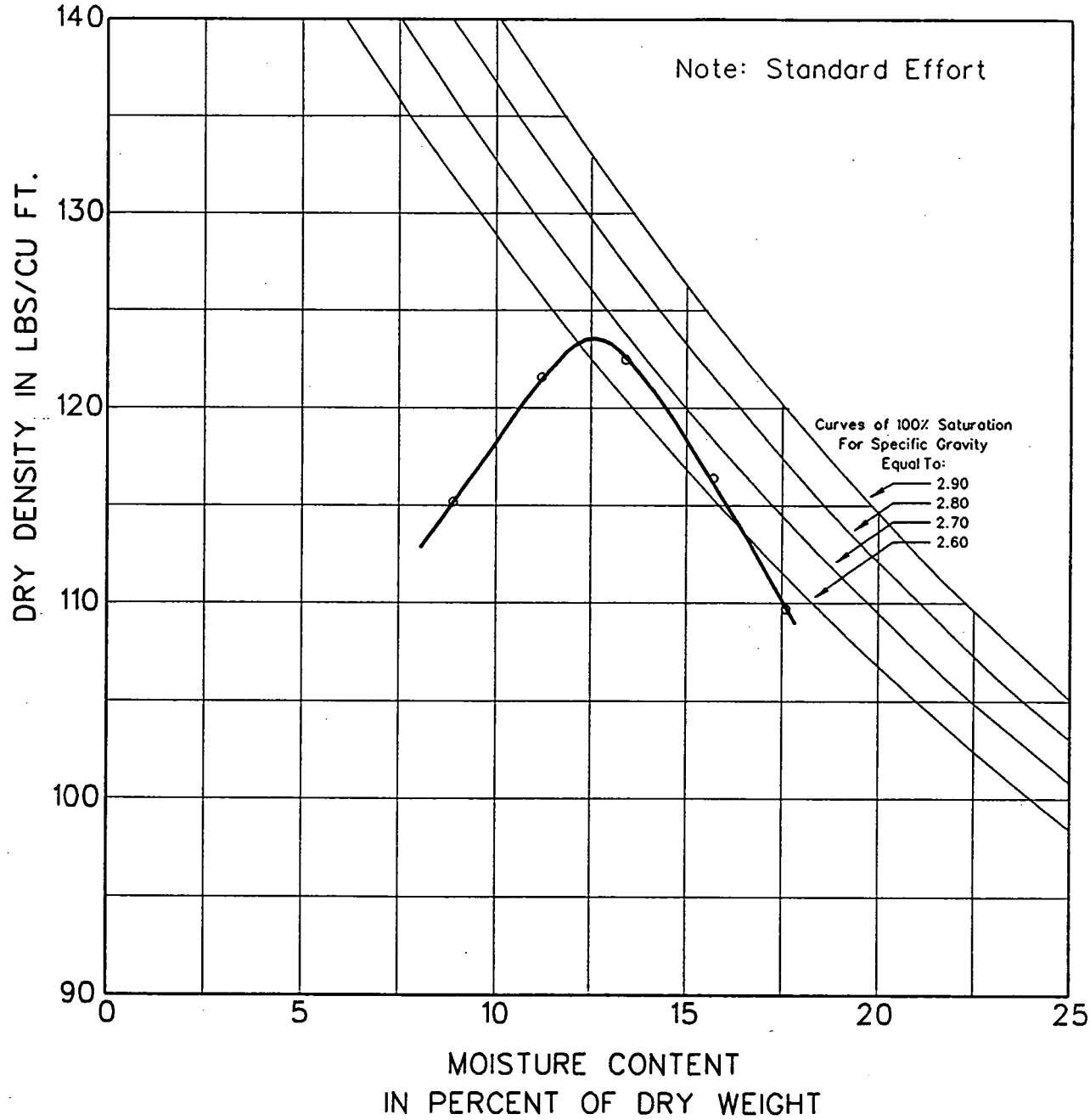
Boring: 11480 Sample Number: 402774 Depth: 7.5-12.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 12.5% Maximum Dry Density: 123.5 lbs/ft^3

Specific Gravity: 2.76 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/16/95



FILENAME: SKX03642.DGN

R402774c.m(2459.ws415) po140@ws415. Tue Oct 31 12:48:41 CST 1995

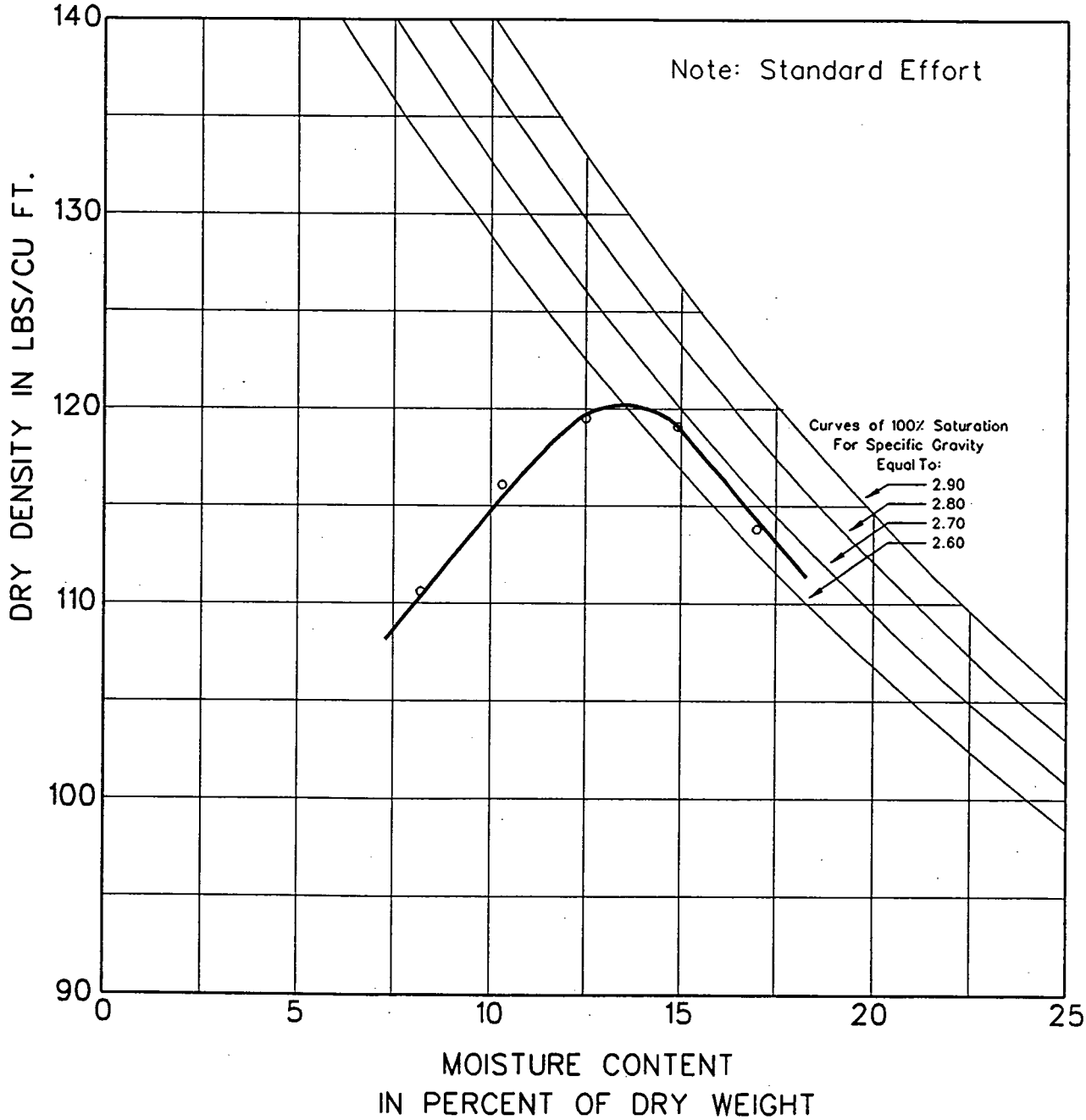
Boring: 11481 Sample Number: 403230 Depth: 3.5-7.5 ft

Description: Brown Sandy Lean Clay with Gravel (CL)

Optimum Moisture Content: 13.4% Maximum Dry Density: 120.2 lbs/ft^3

Specific Gravity: 2.74 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/16/95



FILENAME: SKX03641.DGN

R403230c.m(2458.ws415) po140@ws415. Tue Oct 31 12:48:12 CST 1995

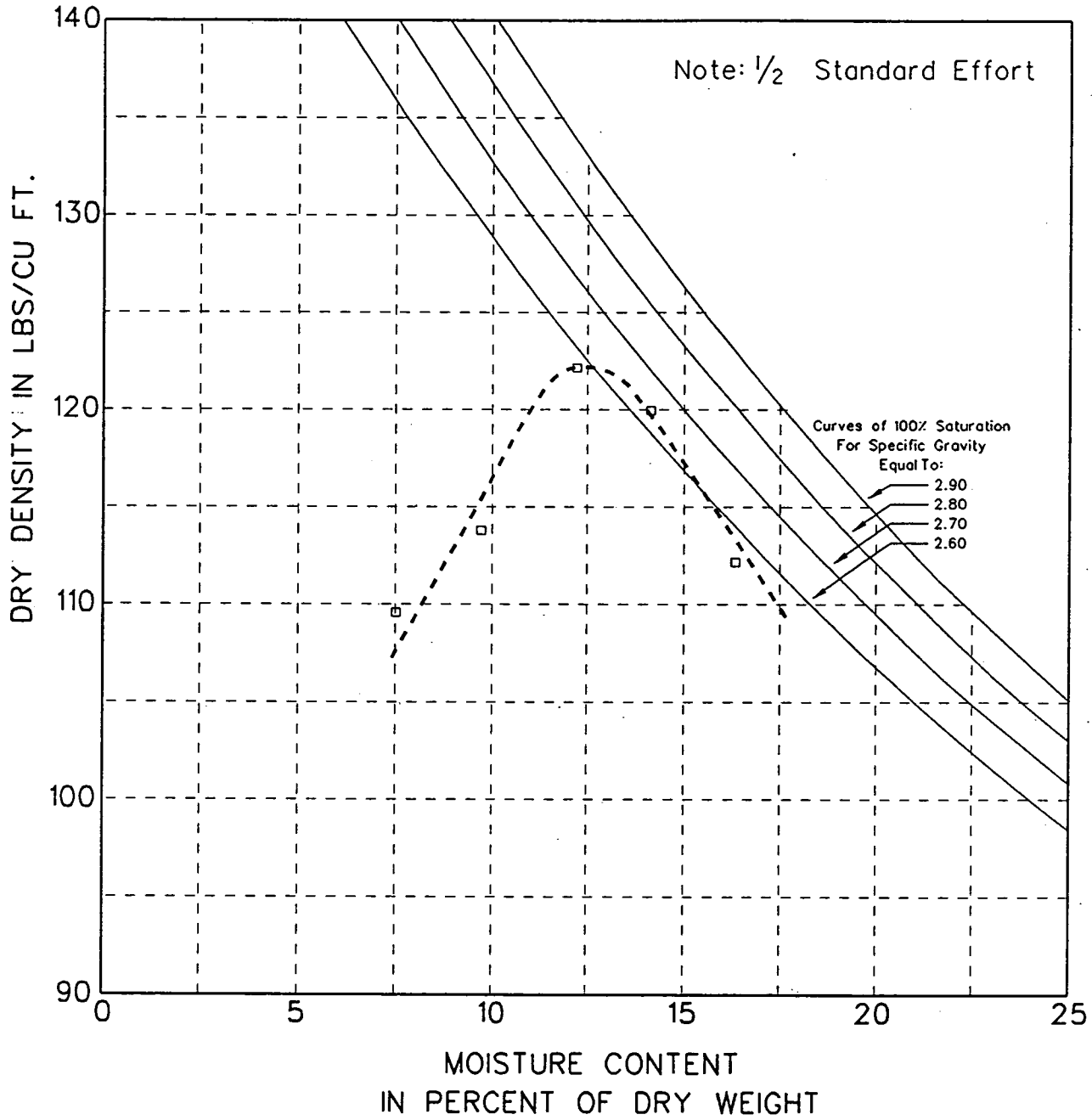
Boring: 11481 Sample Number: 403231 Depth: 13.5-18.5 ft

Description: Gray Lean Clay with Sand (CL)

Optimum Moisture Content: 12.5% Maximum Dry Density: 122.2 lbs/ft^3

Specific Gravity: 2.69 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 3/14/95



FILENAME: SKX03640.DGN

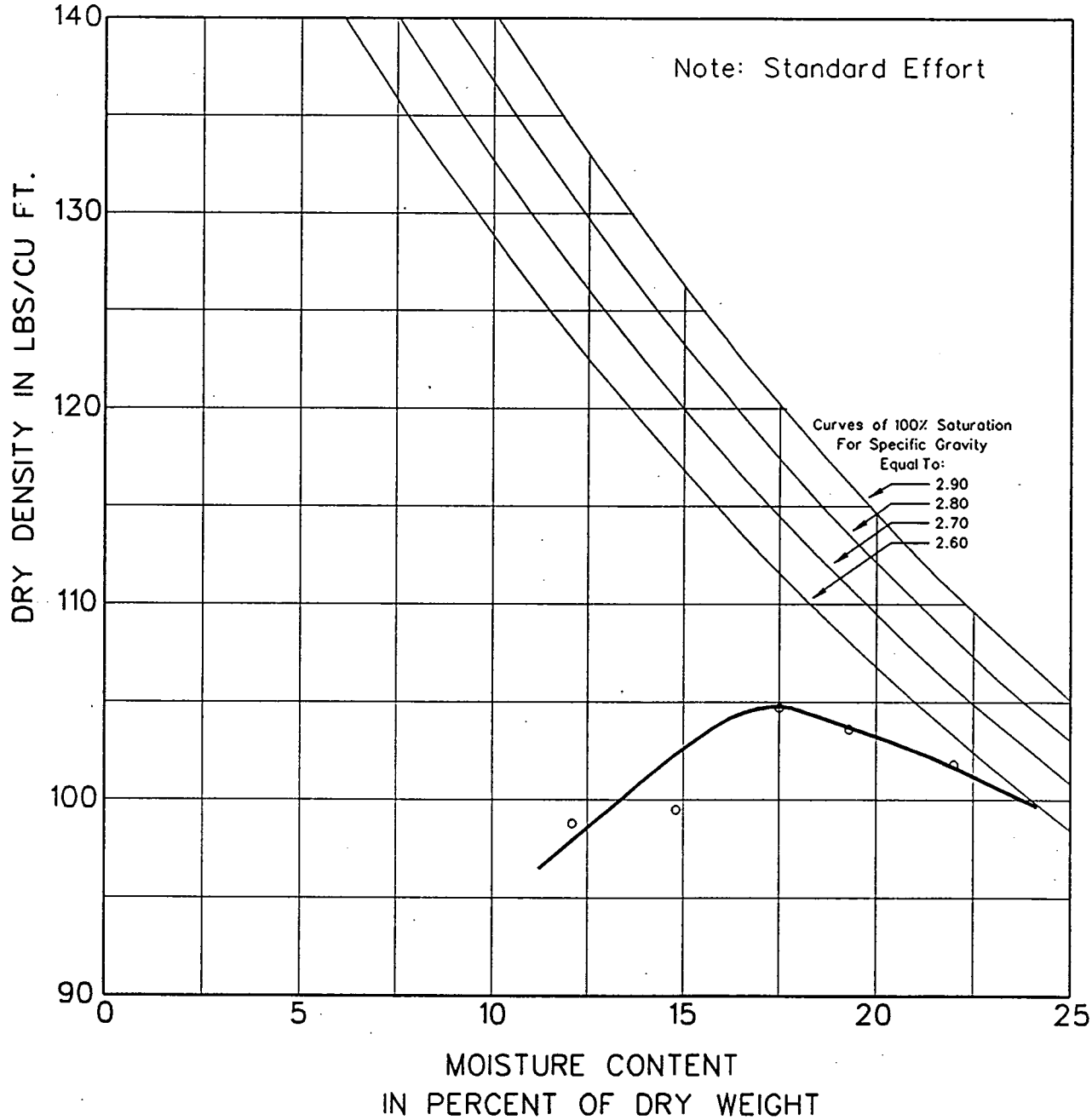
Boring: G2-SB-1 Sample Number: 404608 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.5% Maximum Dry Density: 104.8 lbs/ft^3

Specific Gravity: 2.73 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/18/95



FILENAME: SKX03761.DGN

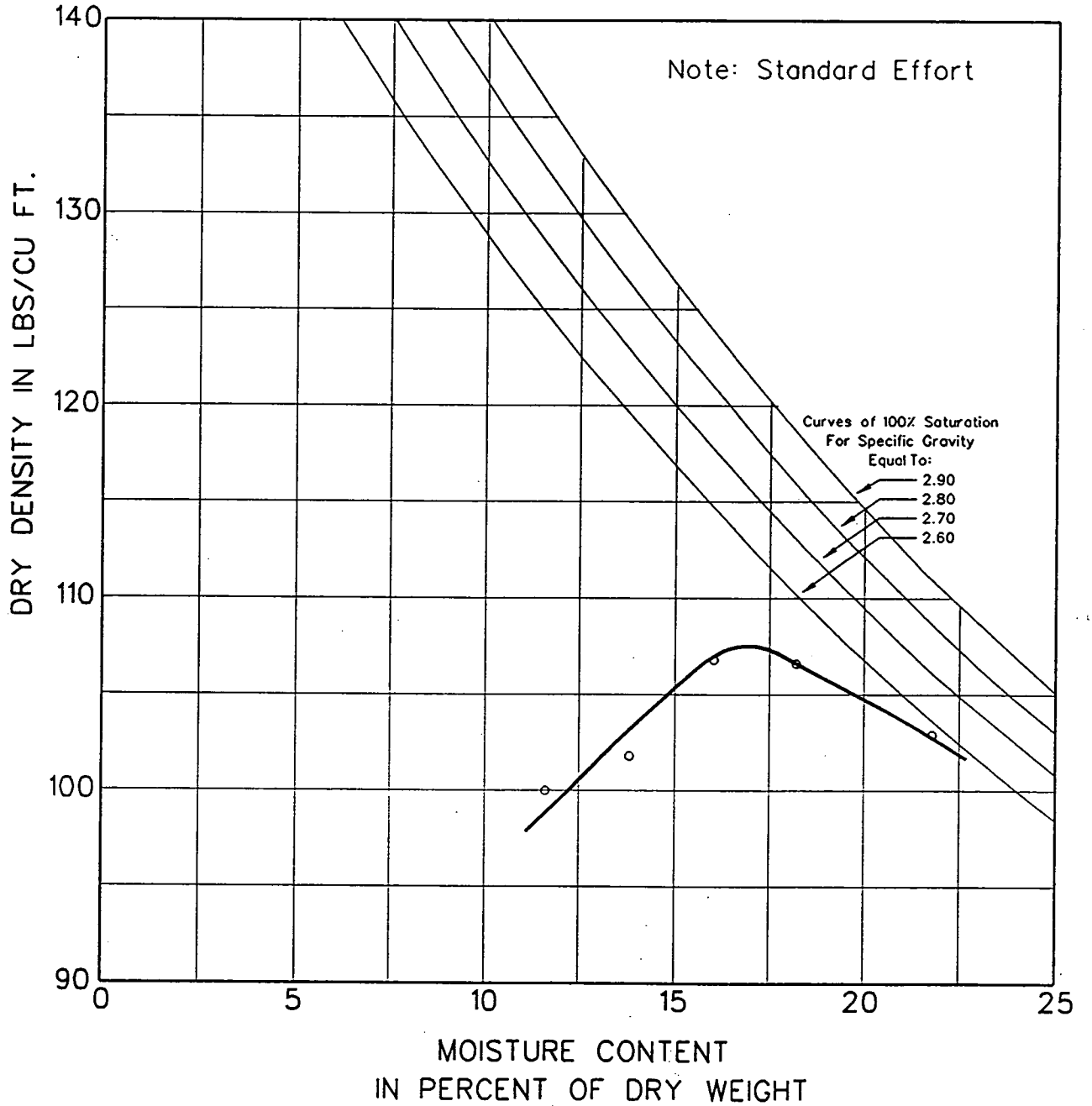
Boring: G2-SB-2 Sample Number: 404603 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.0% Maximum Dry Density: 107.5 lbs/ft^3

Specific Gravity: 2.69 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/23/95



FILENAME: SKX03762.DGN

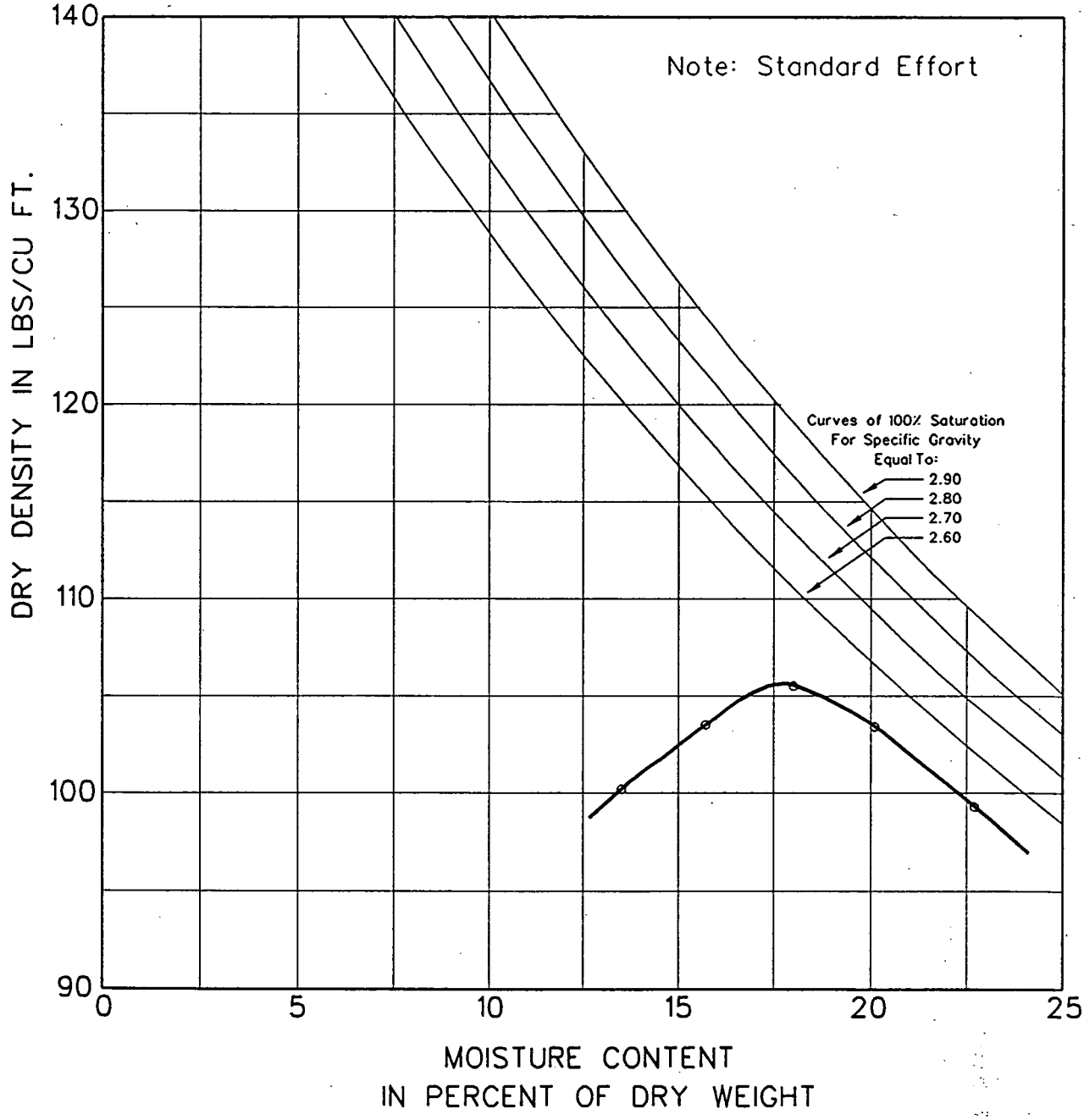
Boring: G2-SB-2, 3,4,6 Sample Number: 404617 Depth: 0-1.5 ft

Description: Top Soil

Optimum Moisture Content: 17.7% Maximum Dry Density: 105.6 lbs/ft^3

Specific Gravity: 2.61 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/02/95



FILENAME: SKX03763.DGN

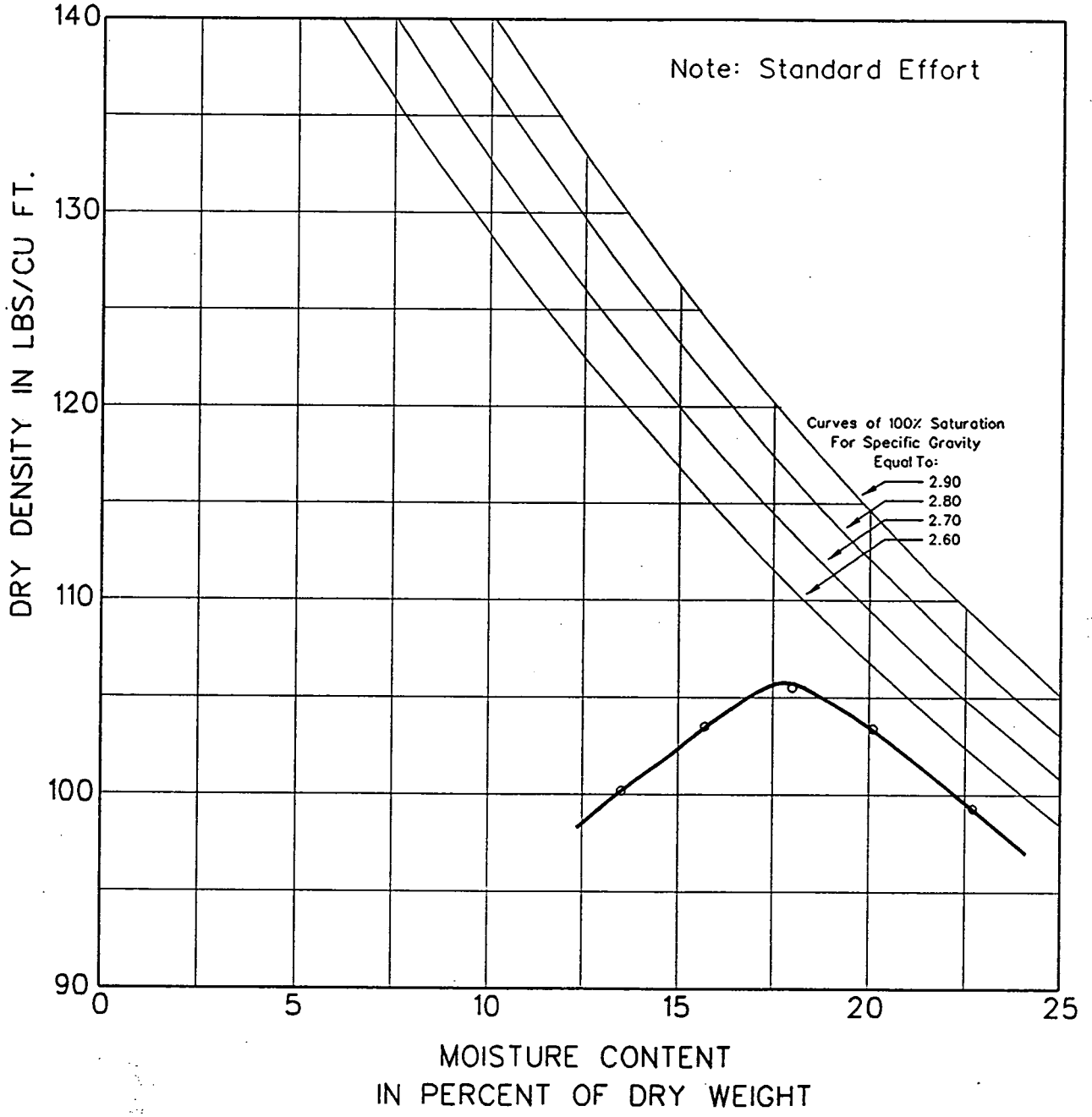
Boring: G2-SB-3 Sample Number: 404591 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.8% Maximum Dry Density: 105.8 lbs/ft^3

Specific Gravity: 2.67 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/25/95



FILENAME: SKX03764.DGN

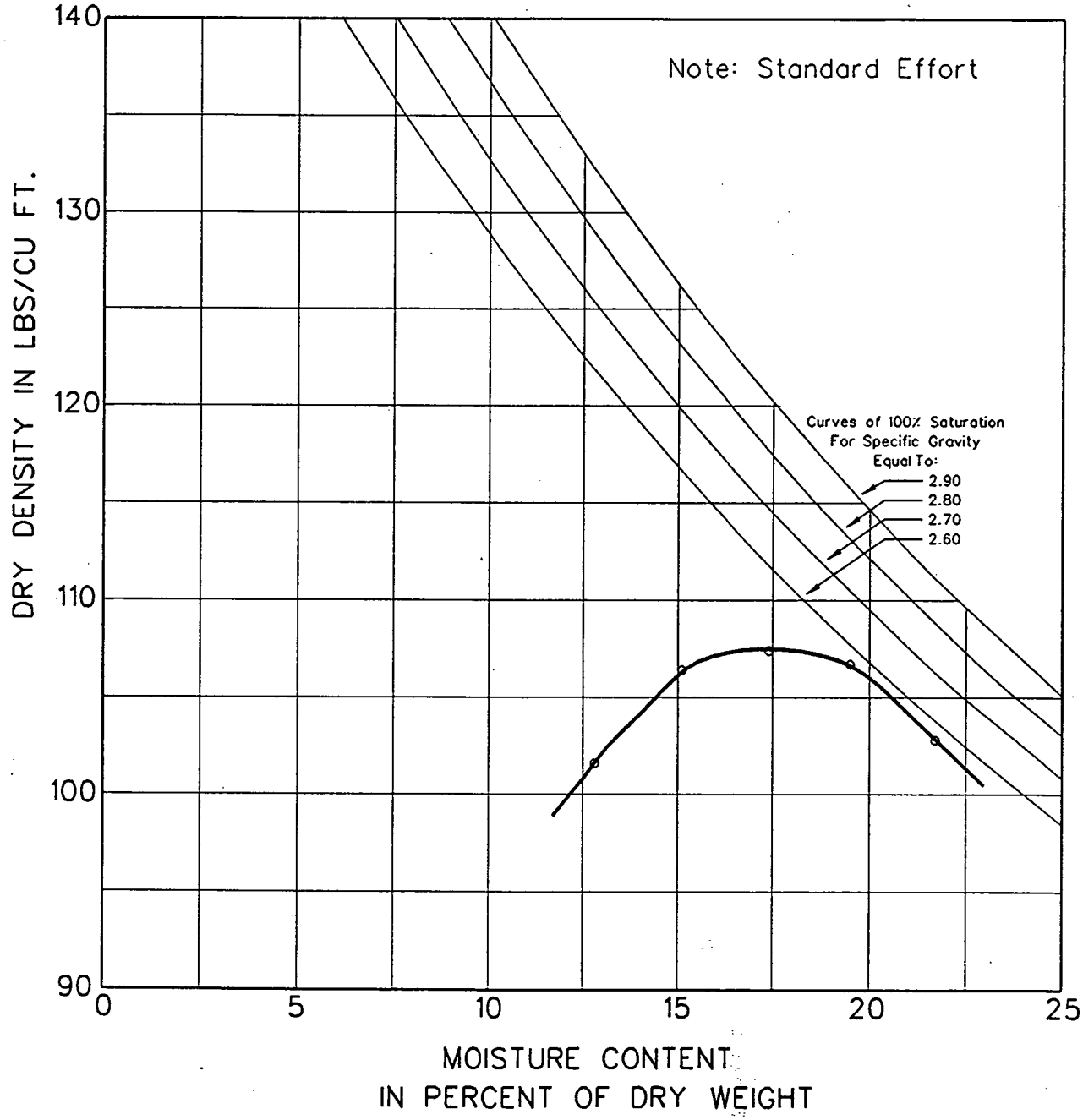
Boring: G2-SB-4 Sample Number: 404615 Depth: 1.5-5.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 17.2% Maximum Dry Density: 107.5 lbs/ft^3

Specific Gravity: 2.70 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/18/95



FILENAME: SKX03765.DGN

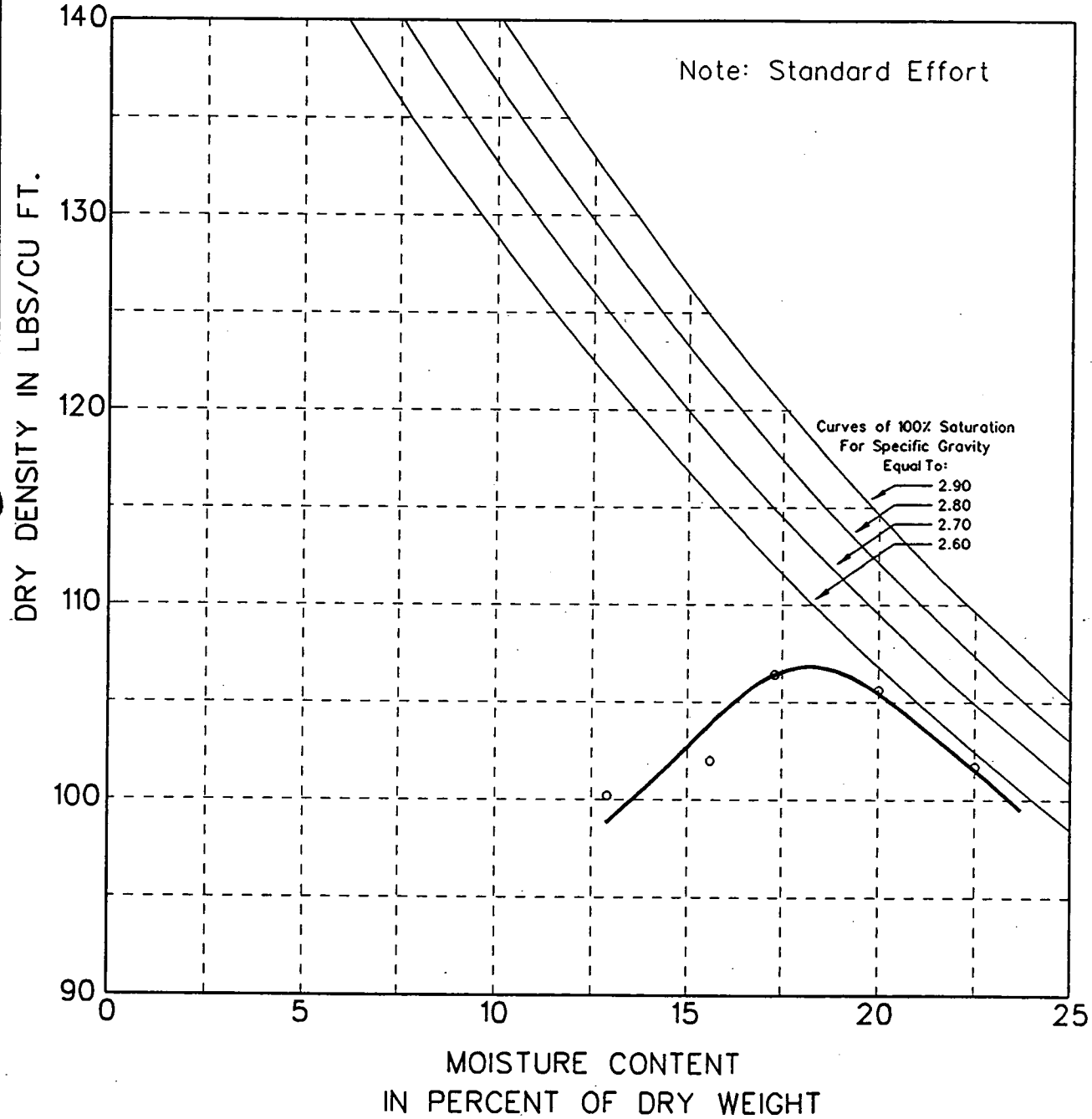
Boring: G2-SB-5 Sample Number: 404627 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 18.2% Maximum Dry Density: 106.8 lbs/ft^3

Specific Gravity: 2.71 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/28/95



ENAME: SKX03767.DGN

R404627c.m(2476.ws415) po140@ws415. Tue Oct 31 13:44:38 CST 1995

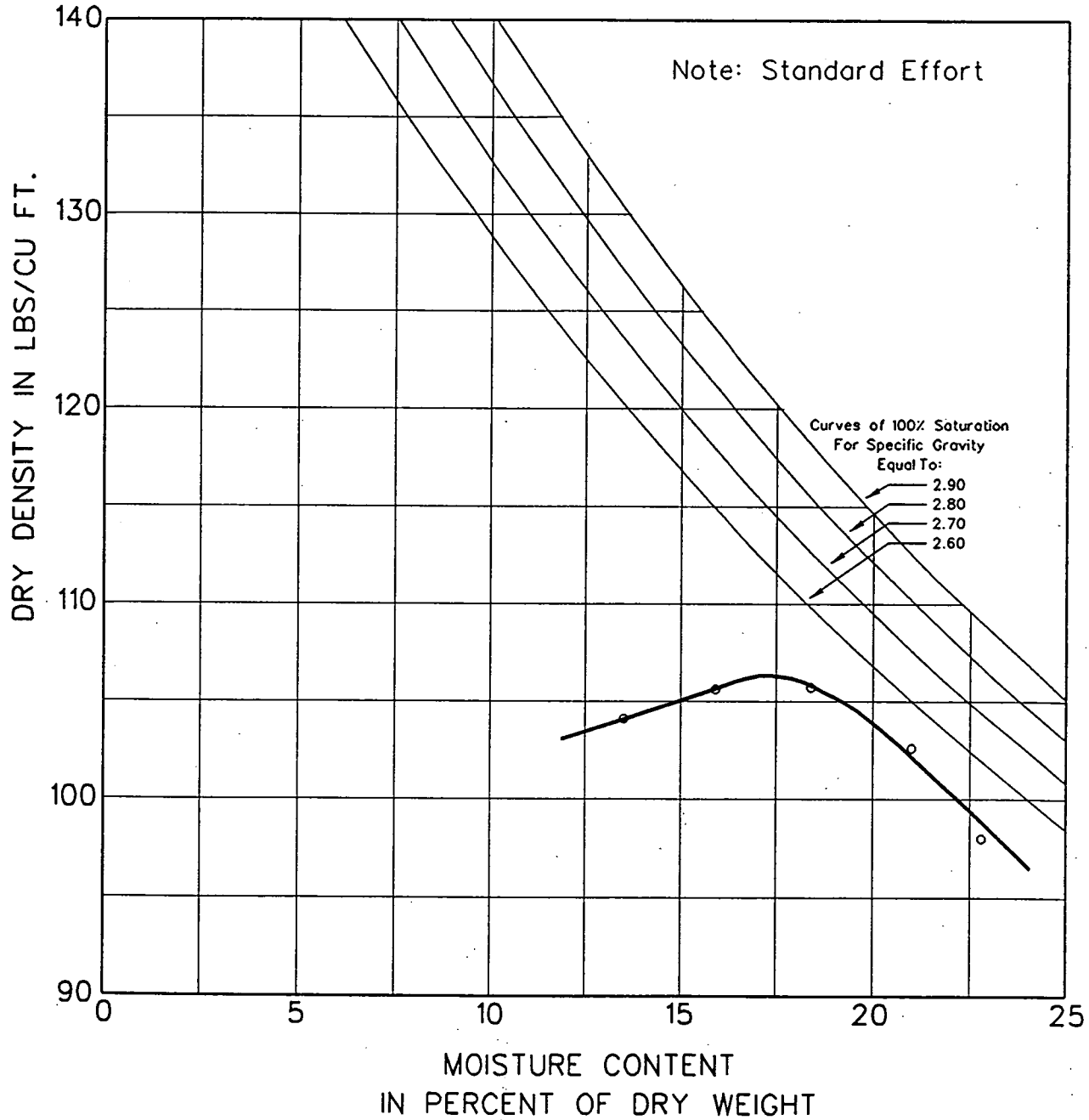
Boring: G2-SB-6 Sample Number: 404595 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.3% Maximum Dry Density: 106.3 lbs/ft^3

Specific Gravity: 2.66 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/31/95



FILENAME: SKX03768.DGN

000409

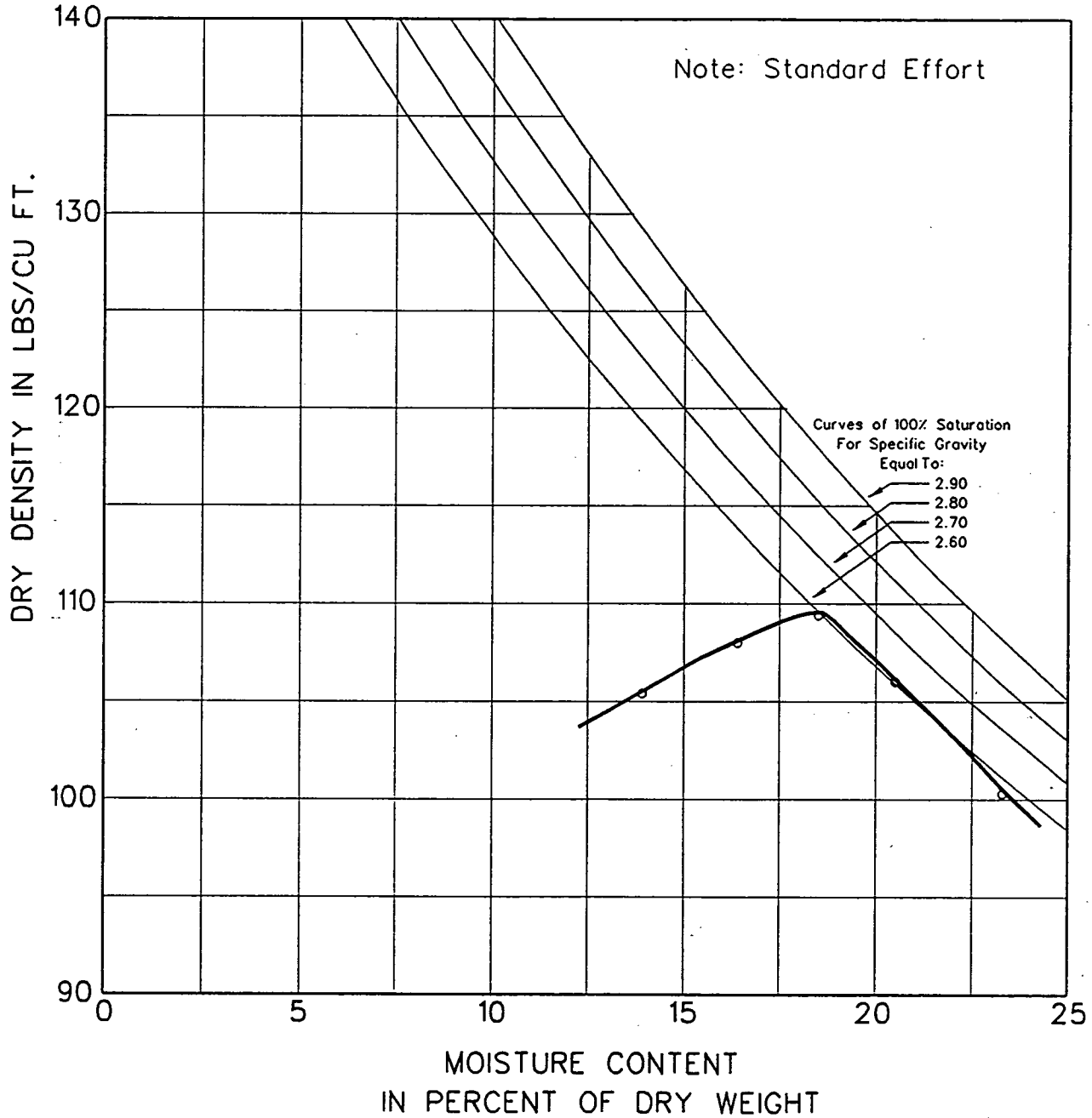
Boring: G2-SB-7 Sample Number: 404632 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 18.5% Maximum Dry Density: 109.6 lbs/ft^3

Specific Gravity: 2.72 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/18/95



FILENAME: SKX03769.DGN

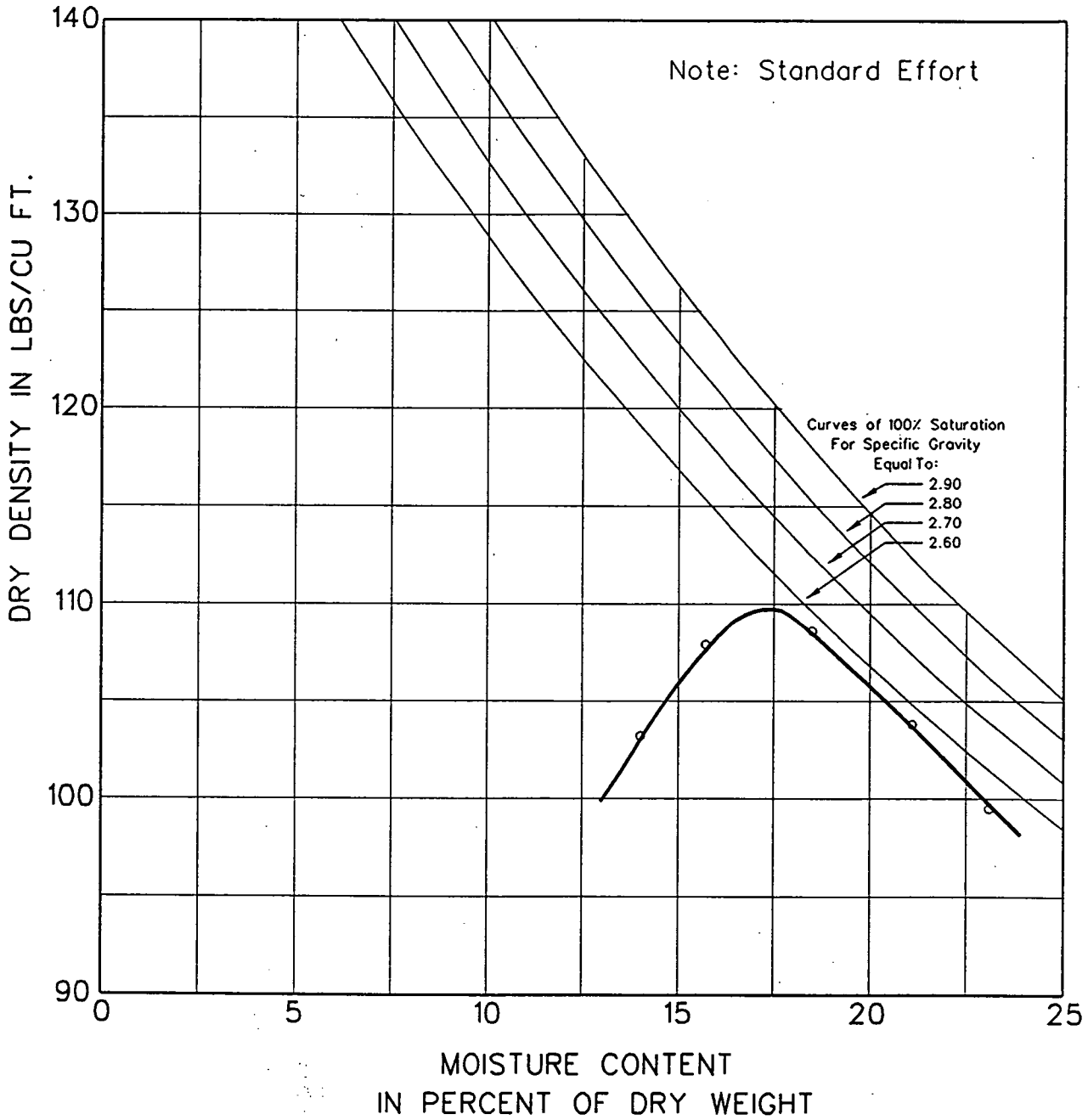
Boring: G2-SB-8 Sample Number: 404621 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 17.5% Maximum Dry Density: 109.7 lbs/ft^3

Specific Gravity: 2.74 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/31/95



FILENAME: SKX03770.DGN

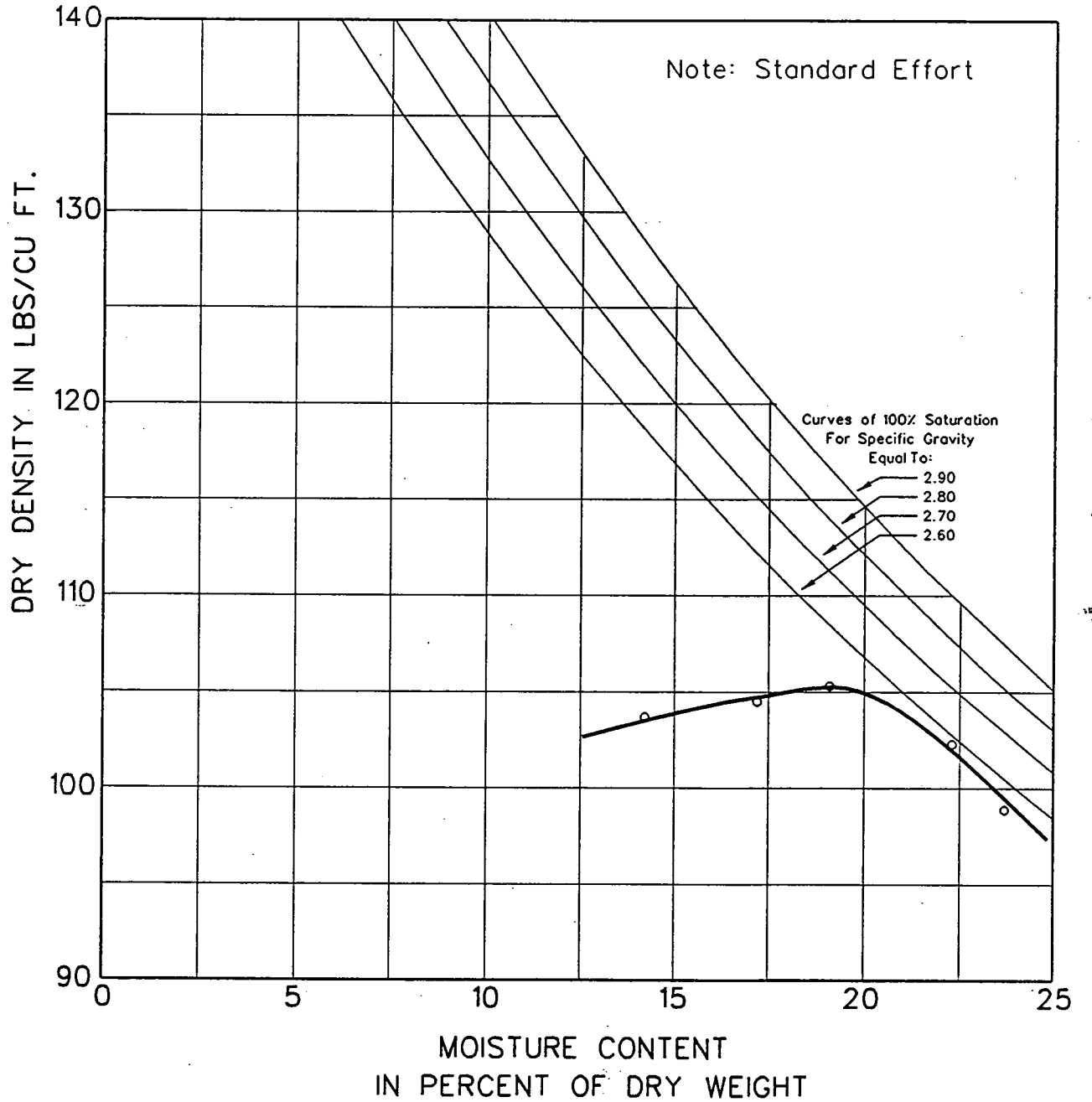
Boring: G2-SB-8, 9,10,11 Sample Number: 404644 Depth: 0-1.5 ft

Description: Topsoil

Optimum Moisture Content: 19.3% Maximum Dry Density: 105.3 lbs/ft^3

Specific Gravity: 2.67 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/07/95



ILENAME: SKX03771.DGN

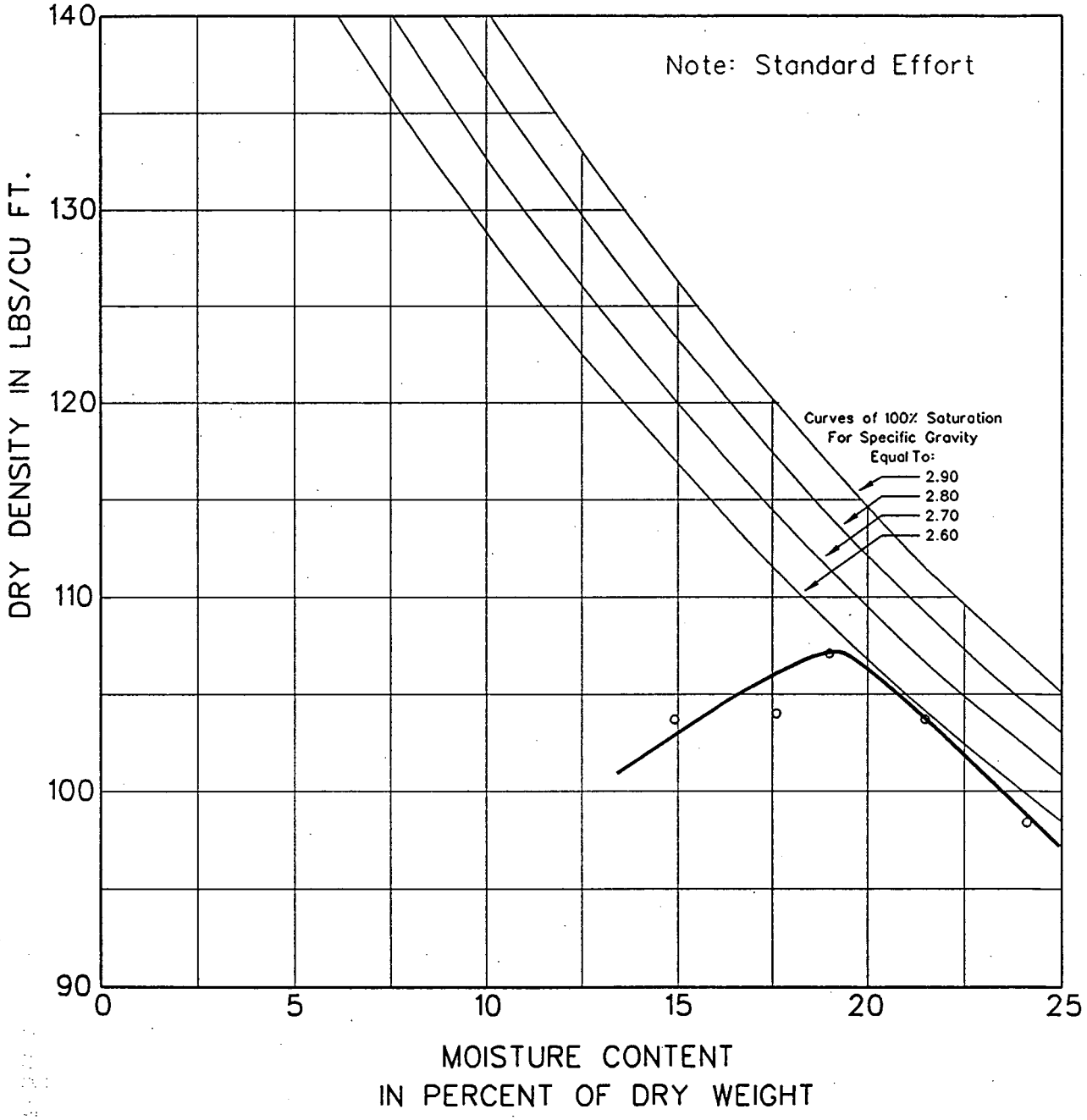
Boring: G2-SB-9 Sample Number: 404587 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 19.2% Maximum Dry Density: 107.2 lbs/ft^3

Specific Gravity: 2.69 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/31/95



FILENAME: SKX03772.DGN

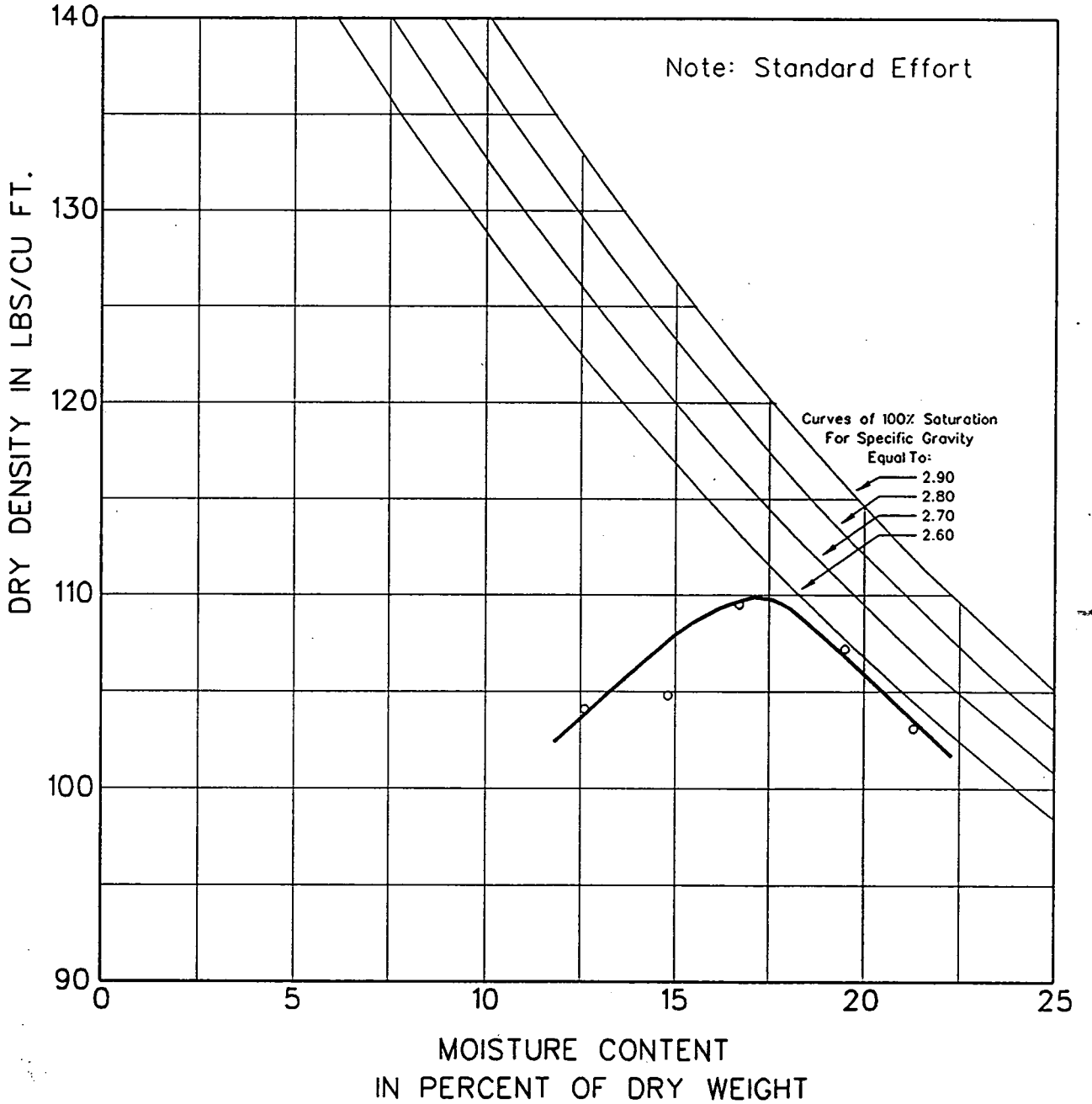
Boring: G2-SB-10 Sample Number: 404637 Depth: 1.5-5.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 17.1% Maximum Dry Density: 109.9 lbs/ft^3

Specific Gravity: 2.77 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/02/95



FILENAME: SKX03773.DGN

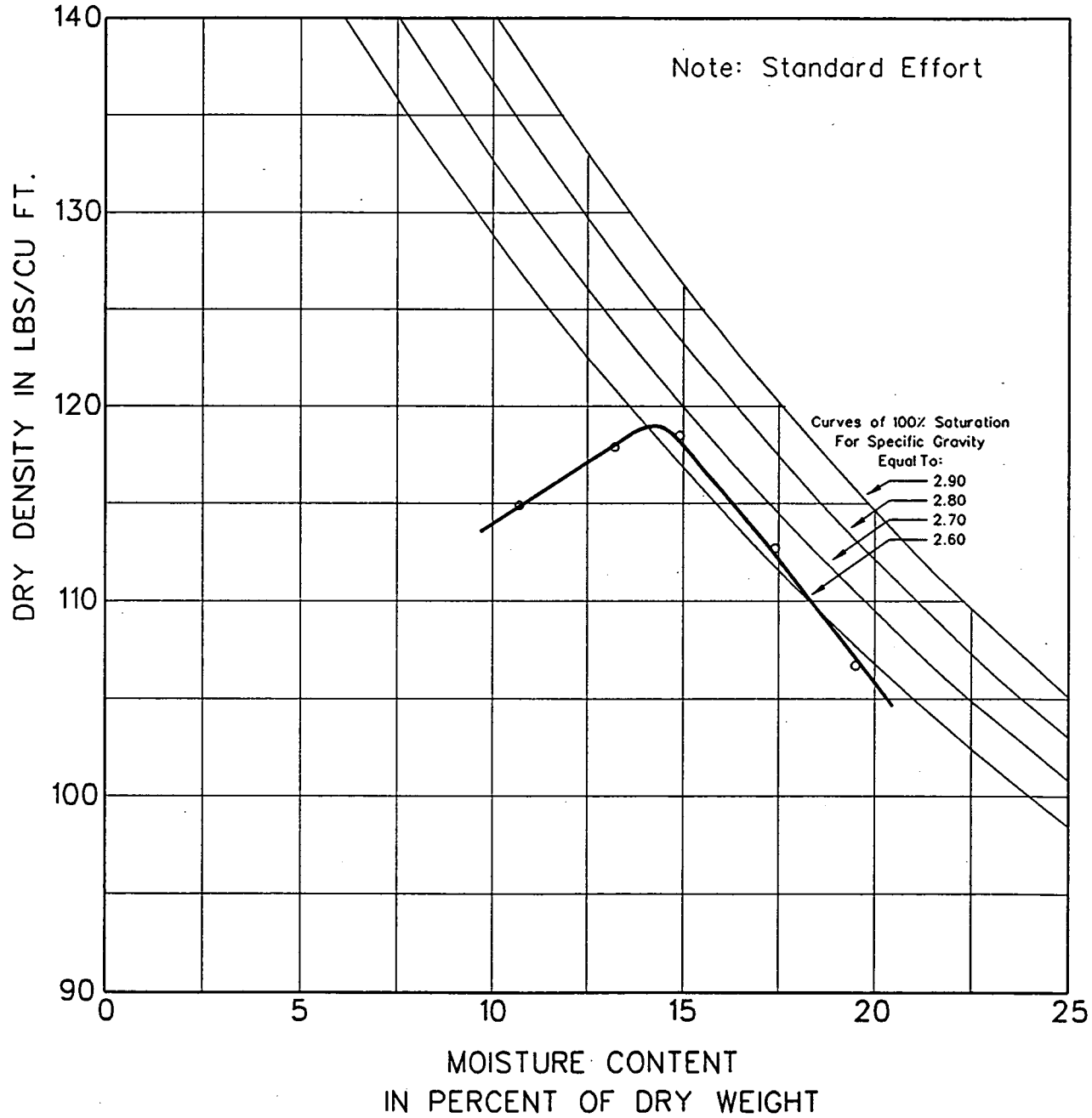
Boring: G2-SB-11 Sample Number: 404642 Depth: 1.5-5.0 ft

Description: Brown Lean Clay with Sand (CL)

Optimum Moisture Content: 14.3% Maximum Dry Density: 119.0 lbs/ft^3

Specific Gravity: 2.77 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 5/25/95



FILENAME: SKX03774.DGN

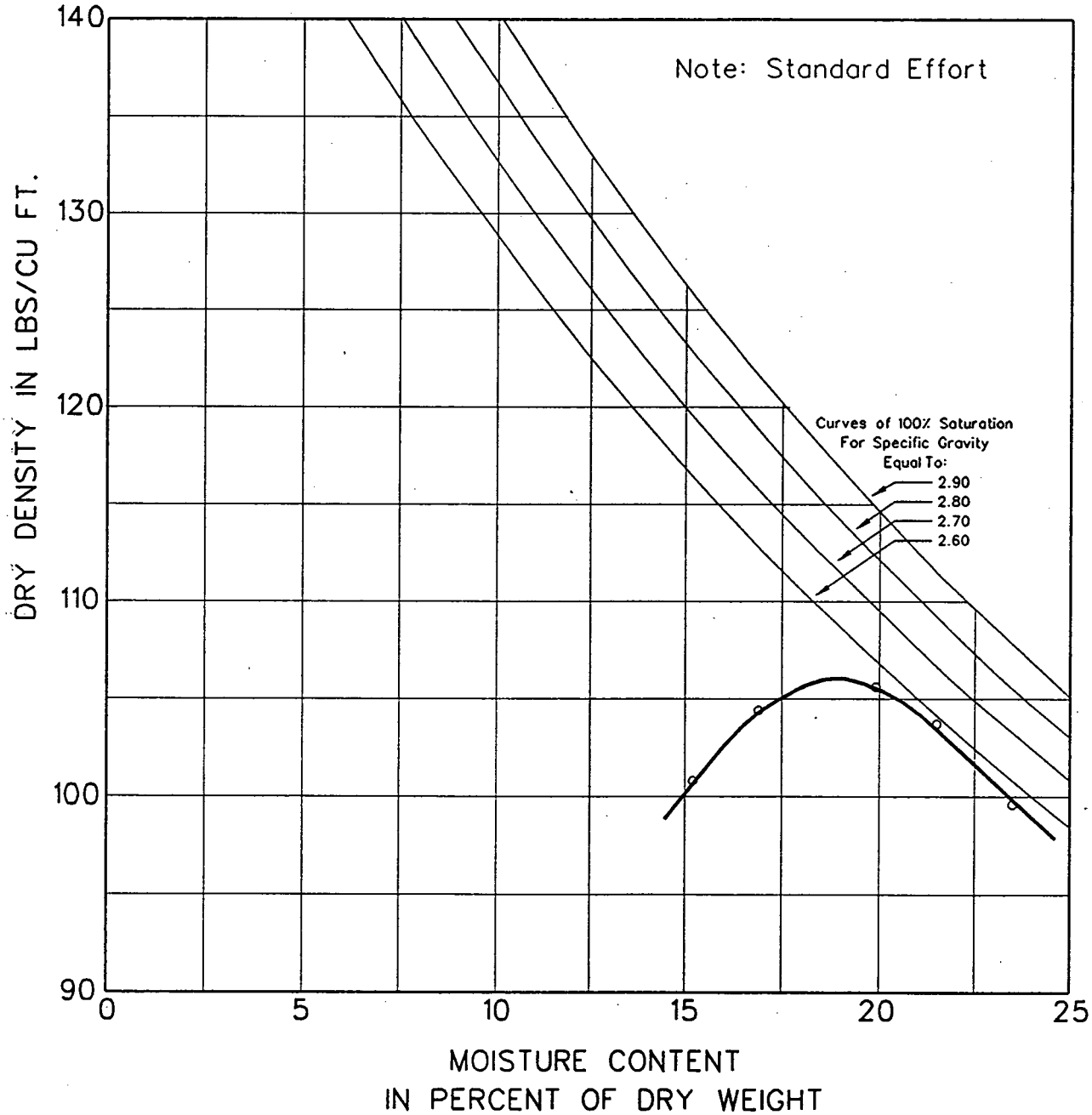
Boring: G2-SB-12 Sample Number: 404599 Depth: 1.5-4.2 ft

Description: Brown Fat Clay (CH)

Optimum Moisture Content: 18.1% Maximum Dry Density: 106.1 lbs/ft^3

Specific Gravity: 2.73 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/08/95



FILENAME: SKX03775.DGN

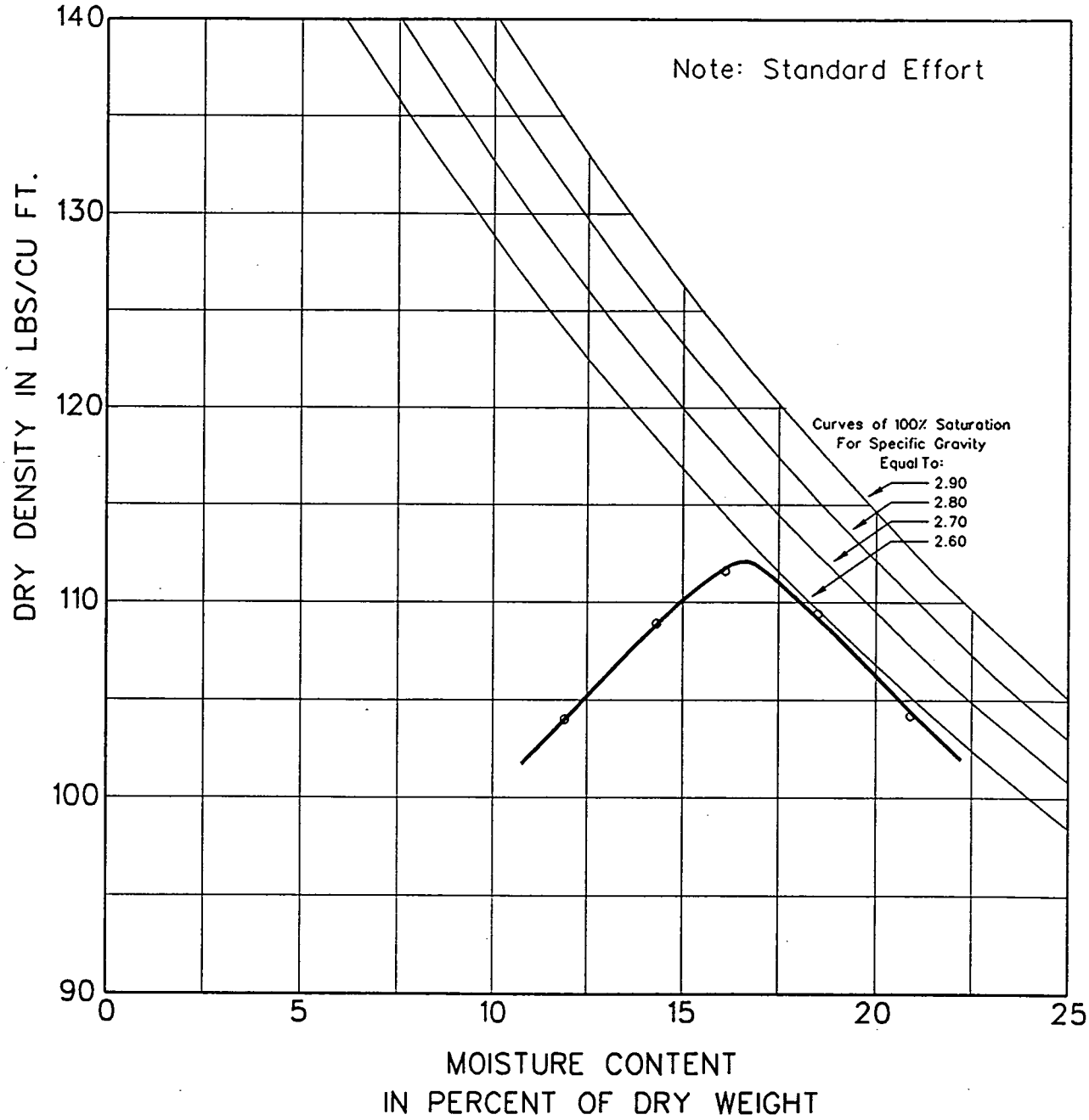
Boring: G2-SB-13 Sample Number: 404583 Depth: 1.5-5.0 ft

Description: Brown Lean Clay (CL)

Optimum Moisture Content: 16.6% Maximum Dry Density: 112.1 lbs/ft^3

Specific Gravity: 2.68 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/02/95



FILENAME: SKX03776.DGN

000417

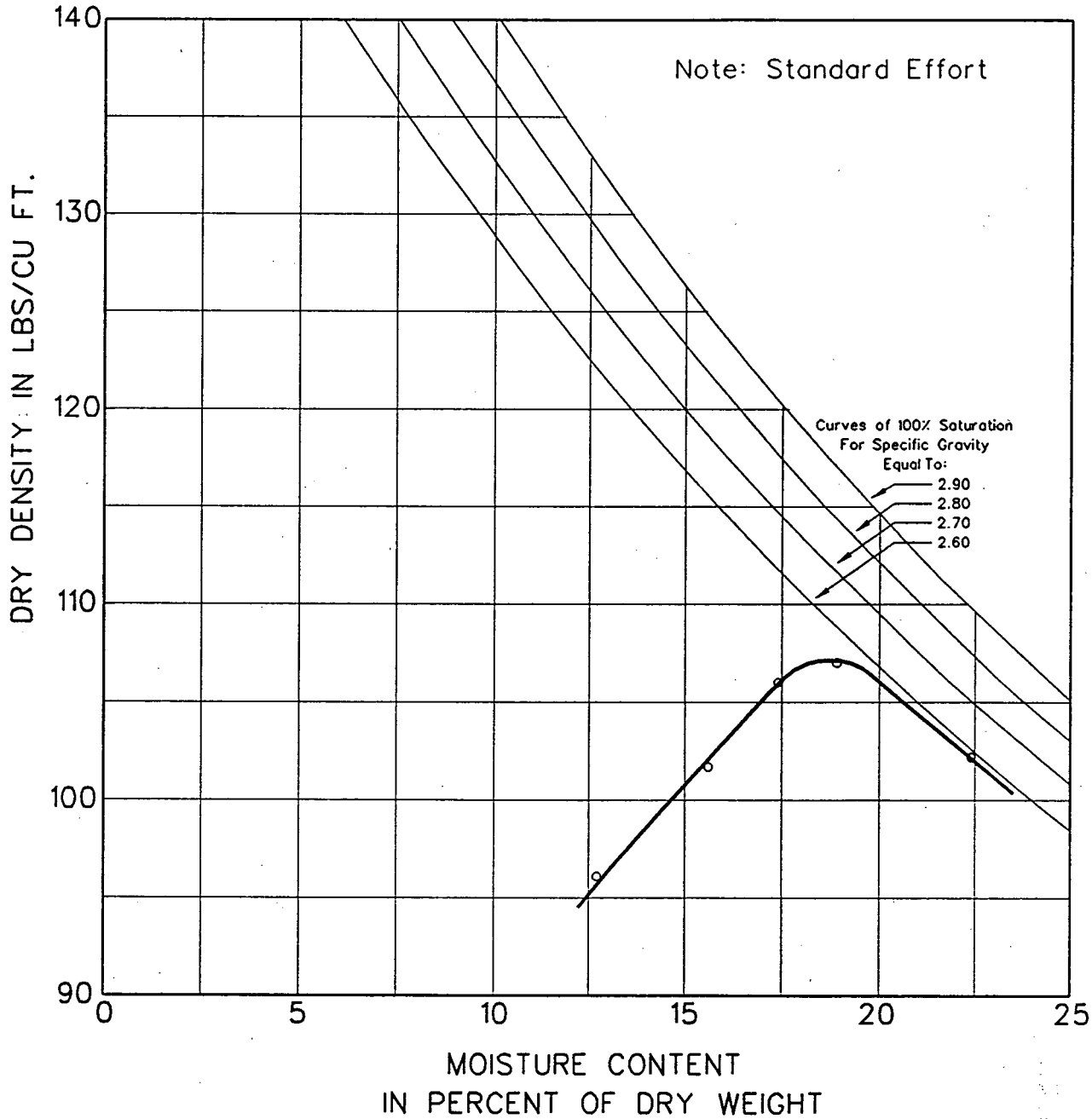
Boring: G2-SB-14 Sample Number: 404578 Depth: 1.5-5.0 ft

Description: Brown Fat Clay (CH)

Optimum Moisture Content: 18.7% Maximum Dry Density: 107.1 lbs/ft^3

Specific Gravity: 2.78 Compaction Method: ASTM D 698 Method A

Lab: Advanced Terra Testing, Inc. Date Tested: 6/07/95



FILENAME: SKX03766.DGN

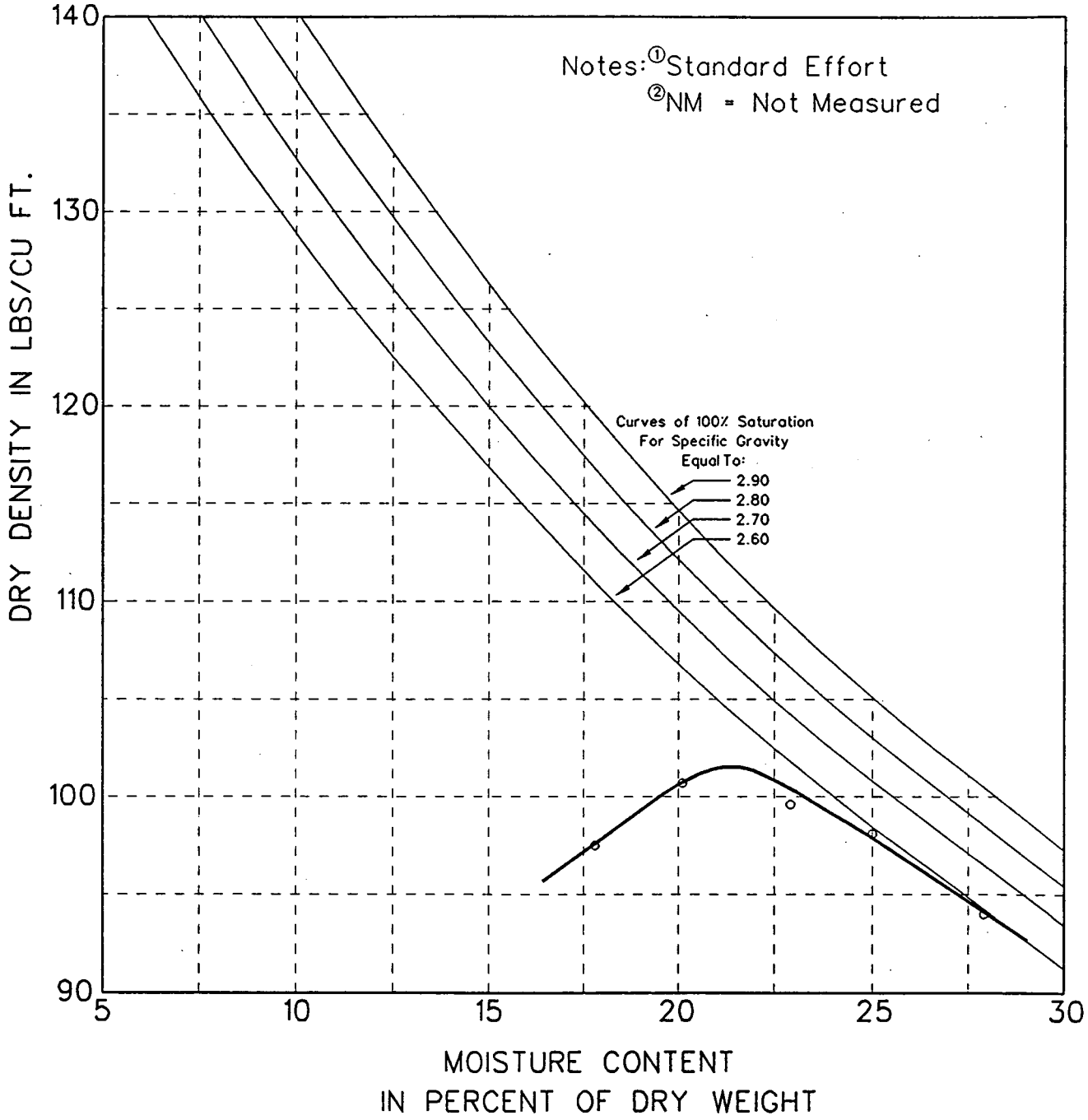
Boring: G2-SB-15 Sample Number: 404649 Depth: 1.0-2.0 ft

Description: Brown Lean Clay with trace Sand (Visual Description)

Optimum Moisture Content: 21.4% Maximum Dry Density: 101.0 lbs/ft^3

Specific Gravity: NM② Compaction Method: ASTM D 698 Method A①

Lab: Advanced Terra Testing, Inc. Date Tested: 6/30/95



FILENAME: SKX03759.DGN

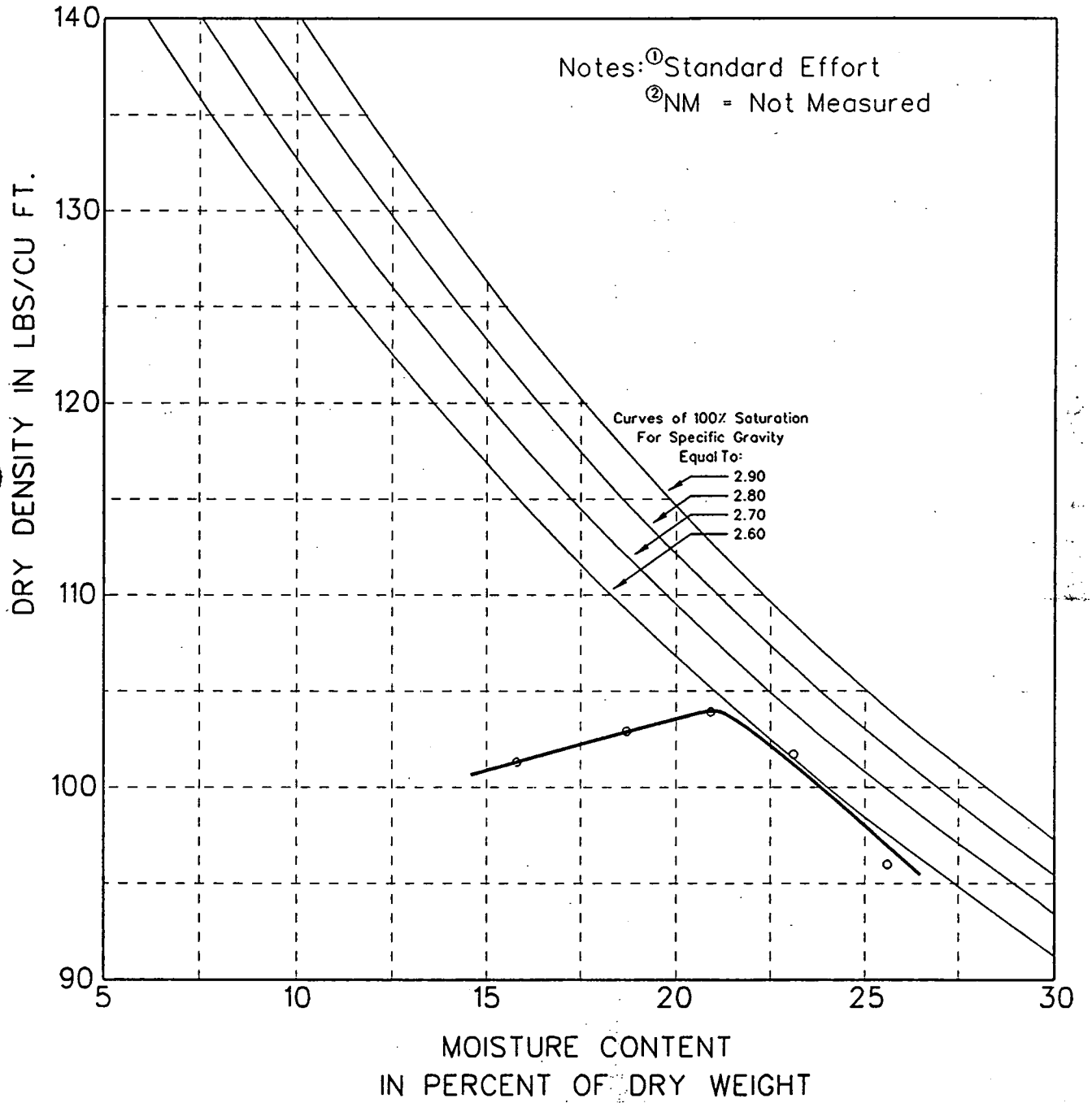
Boring: G2-SB-16 Sample Number: 404650 Depth: 1.0-2.0 ft

Description: Brown Lean Clay (Visual Description)

Optimum Moisture Content: 20.9% Maximum Dry Density: 103.9 lbs/ft^3

Specific Gravity: NM② Compaction Method: ASTM D 698 Method A①

Lab: Advanced Terra Testing, Inc. Date Tested: 6/29/95



ME: SKX03758.DGN

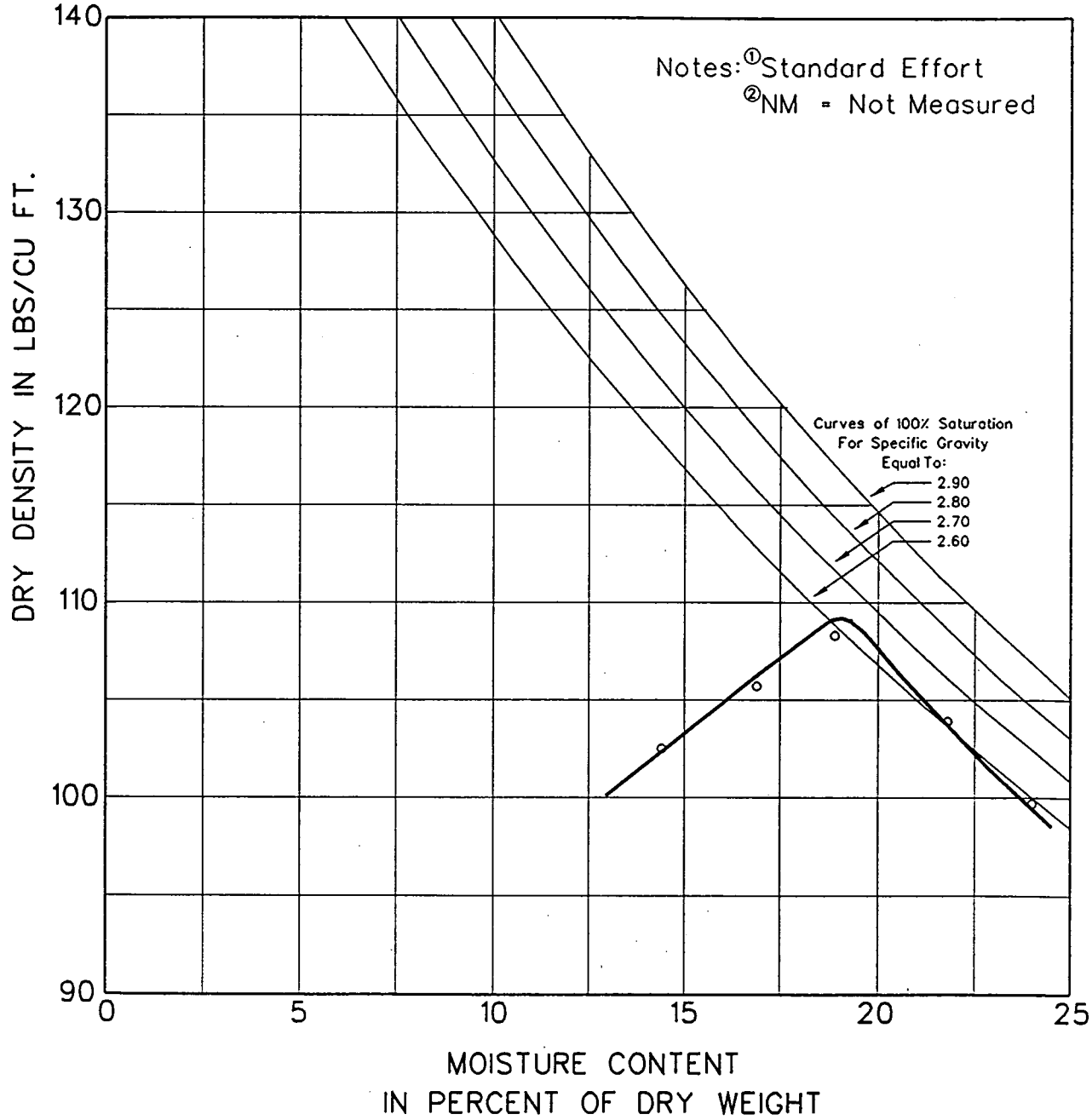
Boring: G2-SB-17 Sample Number: 405366 Depth: 1.0-2.0 ft

Description: Clayey Silt (Visual Description)

Optimum Moisture Content: 19.3% Maximum Dry Density: 109.1 lbs/ft^3

Specific Gravity: NM② Compaction Method: ASTM D 698 Method A①

Lab: Advanced Terra Testing, Inc. Date Tested: 6/29/95



FILENAME: SKX03757.DGN

Sample No. G2-201-204 Depth 0 - 24.5 Elevation _____ 207

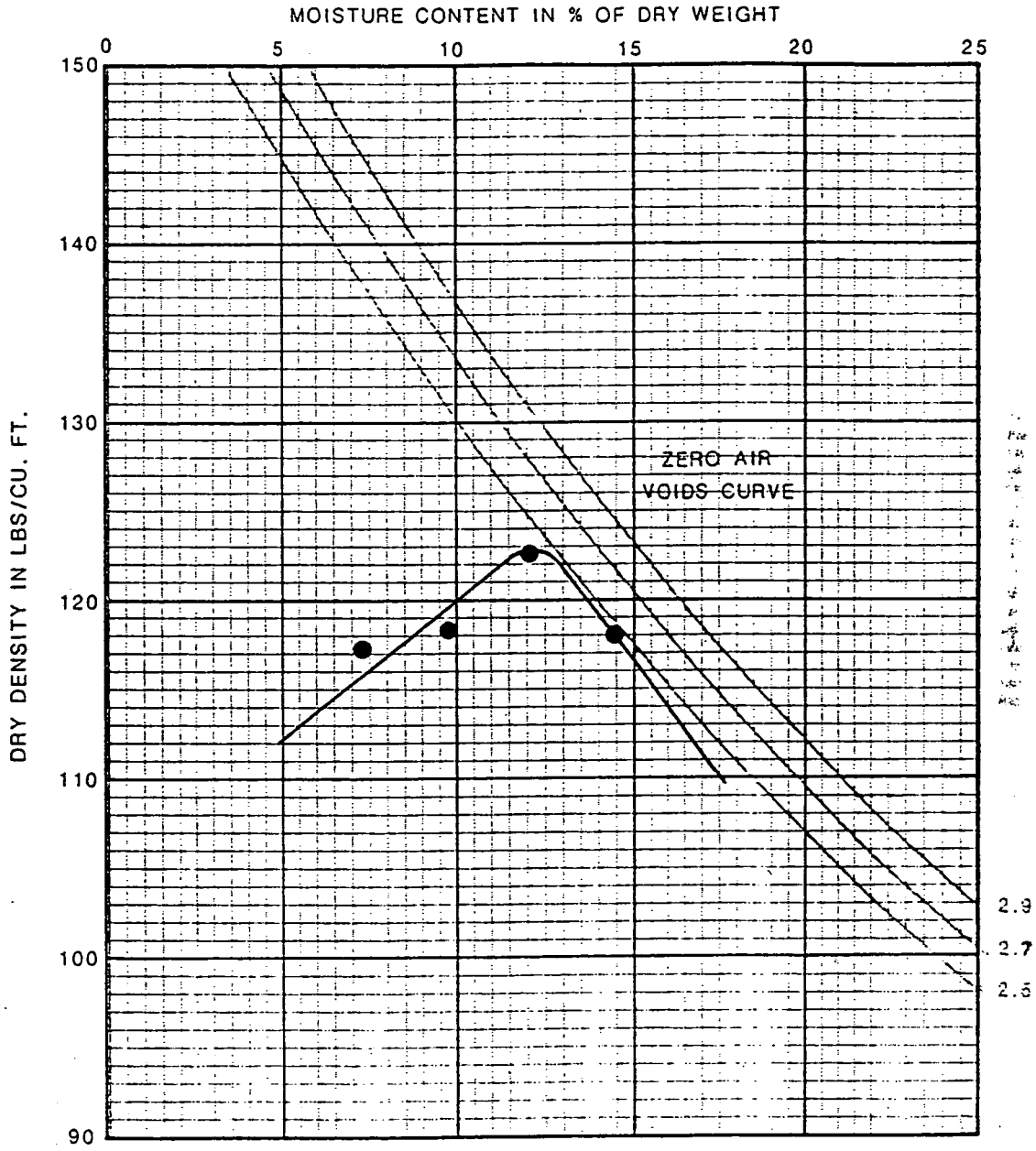
Soil Composite 201, 202, 203, 204

Location Proposed On-Site Disposal Cell (PO-101)

Optimum Moisture Content 12.0%

Maximum Dry Density 122.7 pcf

Method of Compaction ASTM D 698, Method A



File

COMPACTION TEST DATA

ADVANCED TERRA TESTING

Sample No. G2-205-208 Depth 0 - 24.5 Elevation _____

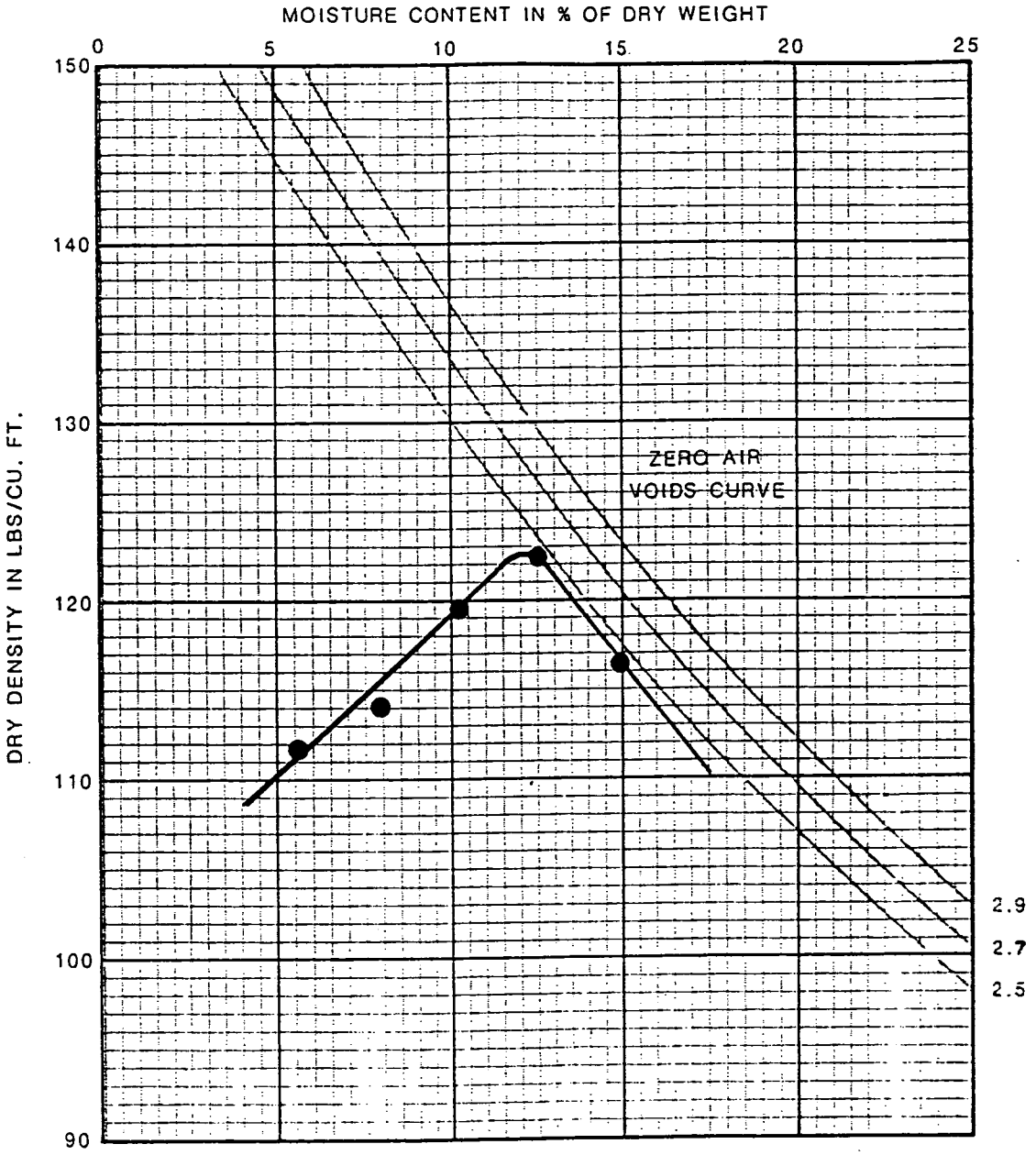
Soil Composite 205, 206, 207, 208

Location Proposed On-Site Disposal Cell (PO-101)

Optimum Moisture Content 12.3%

Maximum Dry Density 122.5 pcf

Method of Compaction ASTM D 698, Method A



File _____

COMPACTION TEST DATA

ADVANCED TERRA TESTING

000423

Sample No. G2-209 Depth 0 - 25 Elevation

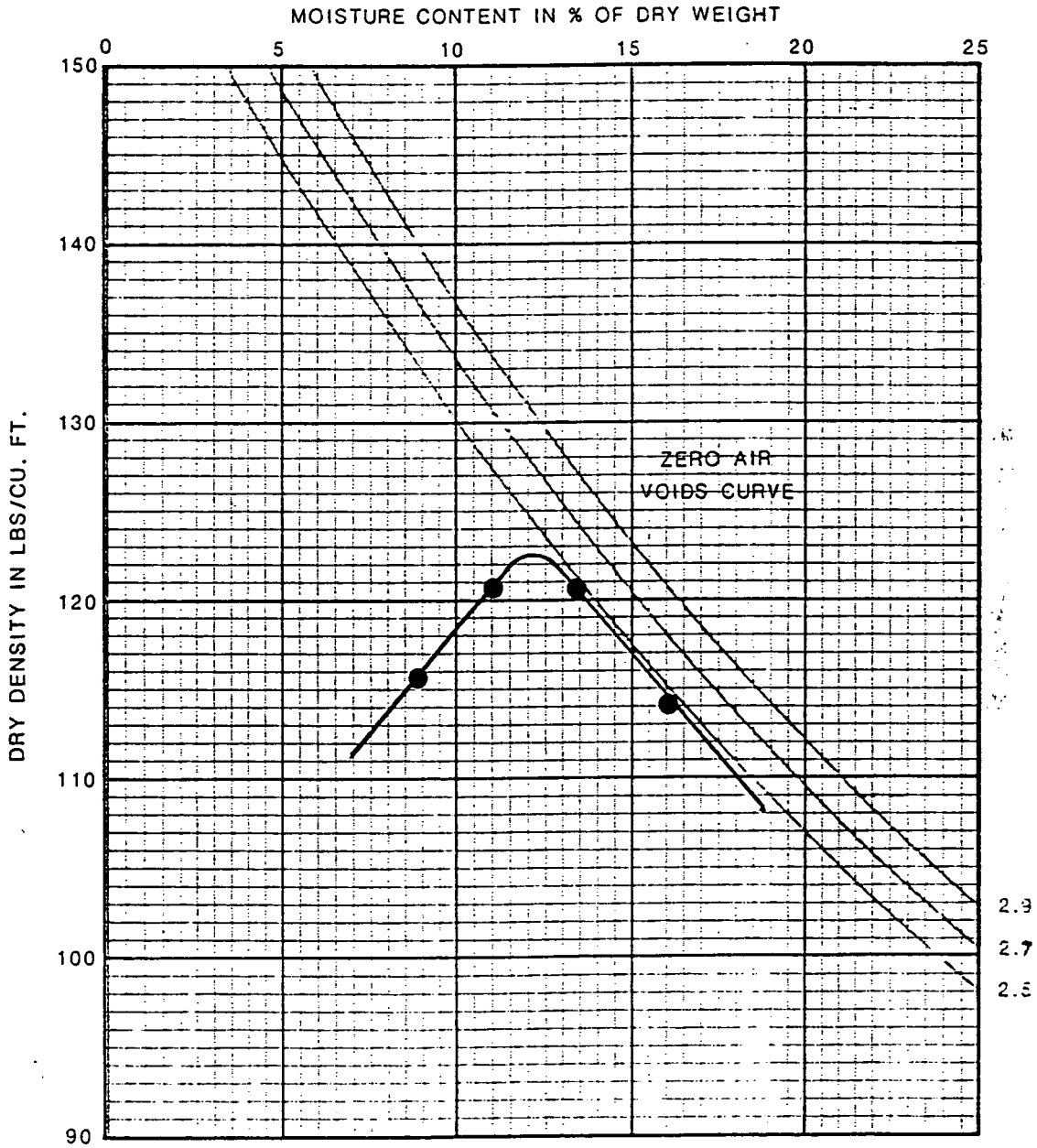
Soil Brown and Gray Sandy Lean Clay (CL)

Location Proposed On-Site Disposal Cell (PO-101)

Optimum Moisture Content 12.3%

Maximum Dry Density 122.3 pcf

Method of Compaction ASTM D 698, Method A



File

COMPACTION TEST DATA

ADVANCED TERRA TESTING

Sample No. G2-209 Depth 0-24.5' Elevation _____

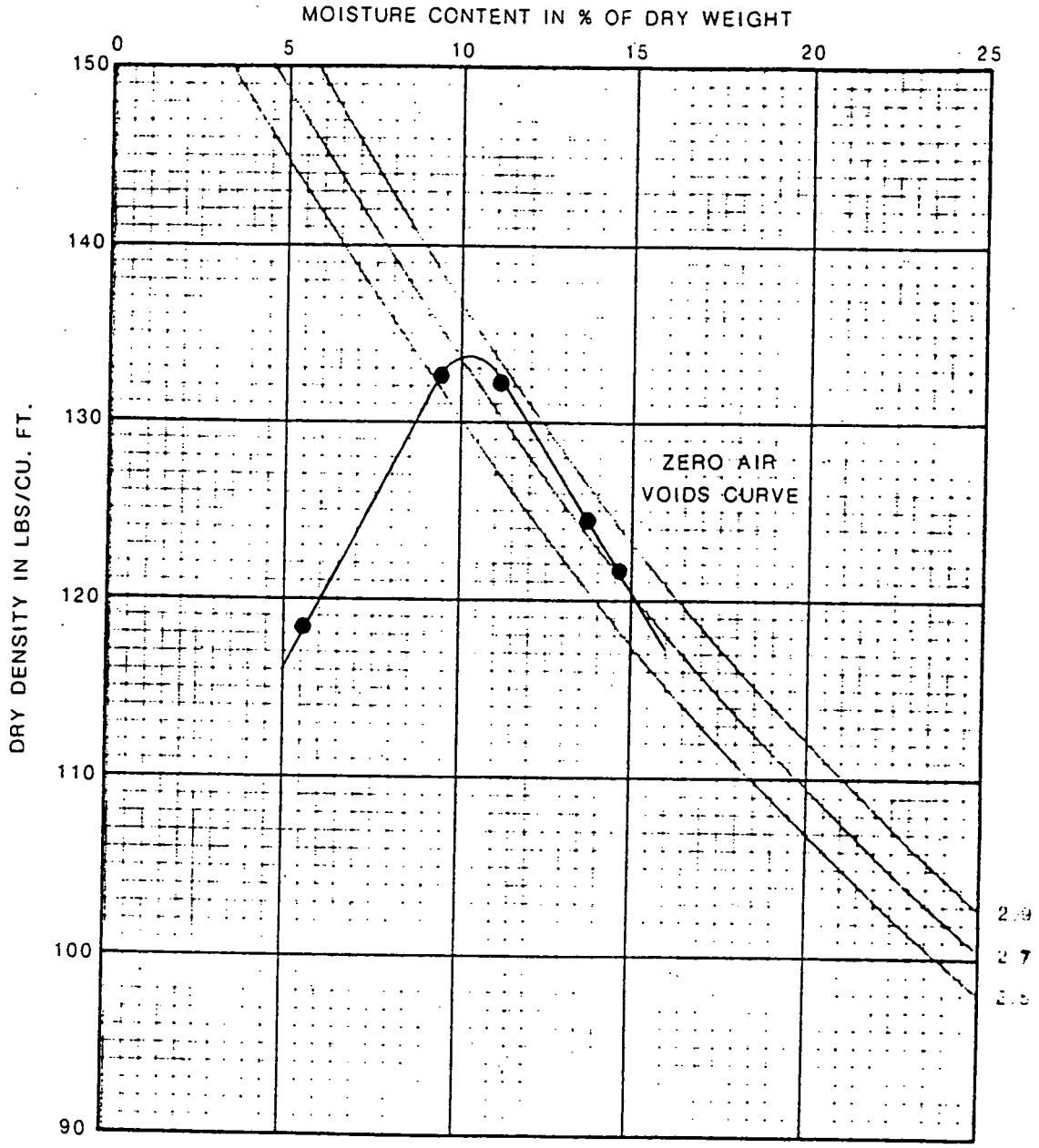
Soil Bulk

Location Onsite Waste Disposal Cell

Optimum Moisture Content 10.3 %

Maximum Dry Density 133.6 pcf

Method of Compaction ASTM D 1557 A



File Parsons PO 101
2059-10

COMPACTION TEST DATA

ADVANCED TERRA TESTING

Sample No. G2-210 Depth 0 - 25 Elevation _____ B- 207

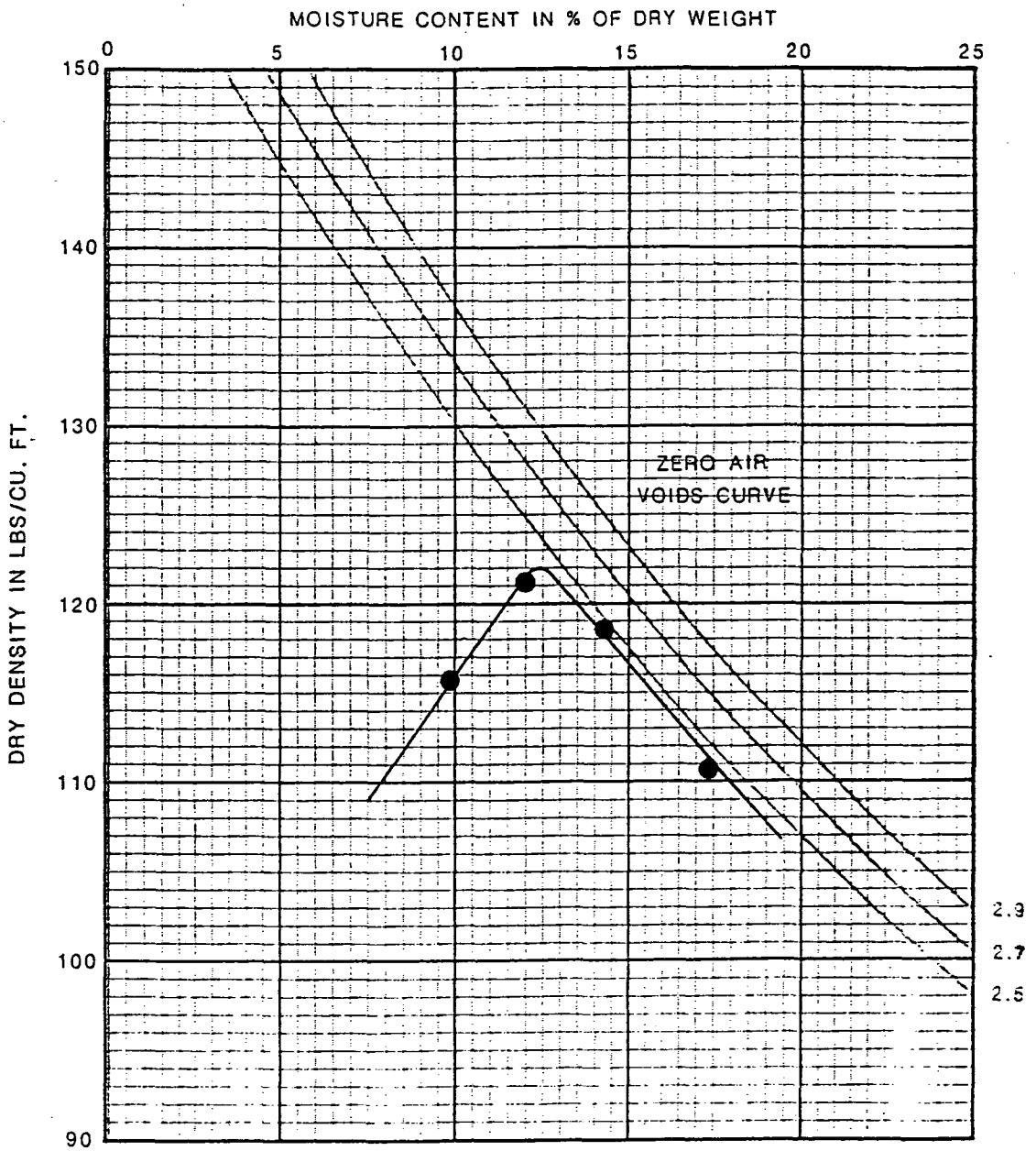
Soil Brown and Gray Lean Clay with Sand (CL)

Location Proposed On-Site Disposal Cell (PO-101)

Optimum Moisture Content 12.4%

Maximum Dry Density 122.3 pcf

Method of Compaction ASTM D 698, Method A



COMPACTION TEST DATA

ADVANCED TERRA TESTING

File

APPENDIX J

LARGE-SCALE INTERFACE, DIRECT SHEAR TEST RESULTS

FINAL REPORT
LARGE SCALE INTERFACE DIRECT SHEAR TESTING
SELECT GEOSYNTHETICS AND SOILS
PARSONS - ERA PROJECT NO. P.O. 140

Prepared for:

SCIENCE APPLICATIONS INTERNATIONAL CORP.
14142 Denver West Parkway, Suite 100
Golden, CO 80402

Prepared by:

ADVANCED TERRA TESTING, Inc.
833 Parfet Street, Unit A
Lakewood, CO 80215

Project No. PO 140

August 7, 1995

INTRODUCTION

This laboratory test program report is for the exclusive use of SAIC/Parsons ERA and consists of three large scale interface direct shear test series performed on select geosynthetic interfaces supplied to ATT by Parsons ERA. Each test series was run at three normal stress levels ranging from 360 to 1440 psf.

The large scale direct shear tests were run in accordance with ASTM D 5321 "Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction By the Direct Shear Method". The testing was carried out on ATT's large direct shear box which utilized a 12 in x 12 in (300 mm x 300 mm) upper (stationary) box and a 12 in x 16 in (300 mm x 400 mm) lower (traveling) box. Figure 1 presented at the end of this report illustrates the ATT shear box and some general test configurations for this series of tests.

GEOSYNTHETICS AND SOIL MATERIAL

Three geosynthetic materials were supplied by Parsons ERA for use in the test program:

* A 60 mil (1.5 mm) thick smooth high density polyethylene (HDPE) geomembrane manufactured by Gundle Lining Systems, Inc.
* A geosynthetic clay liner (GCL) manufactured by Gundle Lining Systems, Inc. and designated as Gundle Gundseal HD20.
* A 10 oz./yd^2 non-woven needle punched geotextile (GT) manufactured by Nicolon and designated as Nicolon S1000.

The soil material was a FEMP brown clay (CL) supplied to ATT by Parsons ERA in 11 sample numbers. As requested by Parsons ERA, the following sample numbers were combined into one compacted clay sample for DS Test Series A and B:

DS Test Series A - FEMP Sample Numbers 404608, 404591, 404627, 404632, 404587.

DS Test Series B - FEMP Sample Numbers 404603, 404615, 404595, 404621, 404637, 404583

All FEMP clay samples were compacted to 95% MDD and +2% OMC in the upper (stationary) box away from the direct shear machine.

TEST PROGRAM AND GENERAL PROCEDURES

The interface direct shear tests, as requested by Parsons ERA, were configured as shown in figure 1.

As requested by Parsons ERA, for all test series incorporating geosynthetics, flat plates were used as the supporting surface. Thus, normal loading does not simulate overburden deformation characteristics. Geosynthetics were fixed to either the top (stationary) or bottom (traveling) box.

For DS Test Series A, the Gundseal HD20 GCL was hydrated and consolidated under 360 psf for each point before applying desired normal load and shearing.

Fresh geosynthetics were used for each test point in all DS Test Series and all specimens were cut and prepared so that direction of shear was in the manufactured machine direction of the geosynthetics.

The ATT large scale direct shear box design includes a lower (traveling) box with a larger surface area than the upper (stationary) box, and thus all tests are performed using a constant effective sample area requiring no area correction when computing normal and shear stresses.

For all DS Test Series, fresh geosynthetics and soils were prepared for each normal stress condition and each specimen was sheared at a constant displacement rate immediately after application of the desired normal load. The shear constant displacement rate for the HDPE geomembrane to geotextile test series was 0.2 in/min (5mm/min) and the HDPE to Clay and Clay to GCL hydrated test series were run at 0.04 in/min (1 mm/min). Normal stress levels ranged from 360 to 1440 psf as directed by Parsons ERA in order to model required loading conditions.

<u>DS TEST SERIES A</u>

Type of Interface:	Geosynthetic Clay Liner (GCL) to Compacted Clay
Material on Top:	FEMP Brown Compacted Clay (CL), 95% Standard MDD, @ OMC +2% (FEMP Sample Nos. 404608, 404591, 404627, 404632, 404587)
Material on Bottom:	Geosynthetic Clay Liner (GCL) - Gundle Gundseal HD20
Manufacturer:	Gundle Lining System, Inc.
Number of Tests:	3 (points)
Normal Load:	360, 720, 1440 psf

Hydrating Conditions:	Free swell under 360 psf for 24 hours
Other Test Conditions:	Shear Rate - 0.04 in/min
	Consolidation for 2 hours under 360 psf for each point before shear

DS TEST SERIES B

Type of Interface:	HDPE Geomembrane to Compacted Clay
Material on Top:	FEMP Brown Compacted Clay (CL), 95% Standard MDD, @ OMC +2% (FEMP Sample Nos. 404603, 404615, 404595, 404621, 404637, 404583)
Material on Bottom:	HDPE Geomembrane, smooth - 60 mil thickness
Manufacturer:	Gundle Lining Systems, Inc.
Number of Tests:	3 (points)
Normal Load:	360, 720, 1440 psf
Other Test Conditions:	Shear Rate - 0.04 in/min

DS TEST SERIES C

Type of Interface:	Geotextile to HDPE Geomembrane
Material on Top:	Non-Woven Geotextile, 10 oz/yd^2
Material on Bottom:	HDPE Geomembrane, smooth - 60 mil thickness
Manufacturer:	Nicolon (Geotextile)
	Gundle (Geomembrane)
Number of Tests:	3 (points)
Normal Load:	360, 720, 1440 psf
Other Test Conditions:	Shear Rate - 0.2 in/min
	Saturated Interface

TEST RESULTS - INTERFACE DIRECT SHEAR

The direct shear resistance of the three test series were evaluated for each applied normal stress. the actual test data are shown in Appendix A. The test data were plotted on a graph of shear force versus shear displacement. The peak value of shear force and the residual value of shear force were used to calculate peak and residual shear strengths for each DS test series. The total stress peak and residual shear strengths were plotted on a graph of shear stress versus corresponding normal stress. The total stress peak and residual interface friction angle is obtained by a best fit straight line drawn through three data points. The summary plots of shear stress versus applied normal stress are also presented in Appendix A. A summary of the interface friction angles and apparent adhesions are summarized in Table 1.

Table 1
Interface Direct Shear Test Results
SAIC/Parsons ERA
P.O. 140

Test Series Number	Normal Stress Range (PSF)	Peak Strength		Residual Strength	
		Friction Angle (δ)	Adhesion (PSF)	Friction Angle (δ)	Adhesion (PSF)
DS Series A	360-1440	5.4	0.5	5.4	0.5
DS Series B	360-1440	13.1	126	10.3	88
DS Series C	360-1440	10.1	8.0	8.4	7.5

Notes:
1) The adhesion value may not be "true adhesion" of the interface.
2) DS Series A contained a fully hydrated Gundseal HD20 GCL.
3) DS Series C was run with a saturated geotextile/HDPE Geomembrane interface.

Of particular note in DS Test Series A is the fact that the bentonite gel was fully exposed to the clay surface during shearing. Bentonite was observed to adhere to the surface of the clay immediately after shearing. This obviously contributed to a low Peak/Residual friction angle against the clay at these low normal loads and may actually reflect shear in the bentonite immediately below the interface.

This concludes our report for large scale interface direct shear testing performed on three interfaces as requested by SAIC/Parsons ERA. The results reported apply only to the materials tested and do not apply to other materials or test conditions.

INTERFACE DIRECT SHEAR TEST DATA

DIRECT SHEAR DATA TEST SERIES
12X12 inch Box
Geotextile vs. HDPE Test C

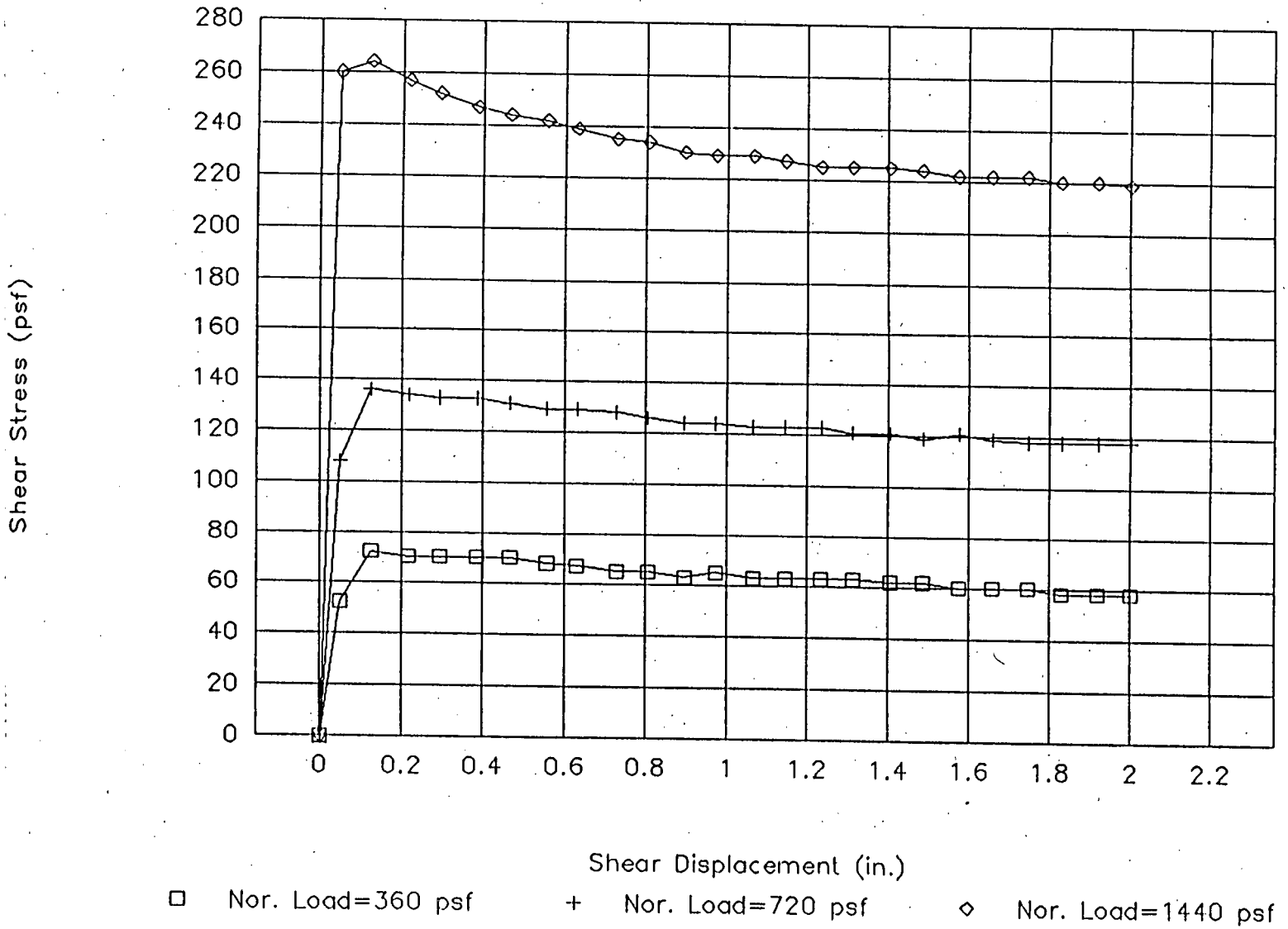
CLIENT: Saic/Parsons PO 140
PROJECT NO: 2059-13N
PROJECT: Fernald

Date: 8-8-95
Date Tested: 8-8-95

Displacement (inches)	Normal Force=360 psf Shear Stress (psf)	Normal Force=720 psf Shear Stress (psf)	Normal Force=1440 psf Shear Stress (psf)
0.001	0	0	0
0.05	52	108	260
0.126	72	136	264
0.218	70	134	257
0.295	70	133	252
0.386	70	133	247
0.467	70	131	244
0.556	68	129	242
0.63	67	129	239
0.727	65	128	235
0.805	65	126	234
0.896	63	124	230
0.973	65	124	229
1.065	63	123	229
1.145	63	123	227
1.234	63	123	225
1.313	63	121	225
1.406	62	121	225
1.486	62	119	224
1.577	60	121	222
1.659	60	119	222
1.747	60	118	222
1.83	58	118	220
1.92	58	118	220
2.002	58	118	219

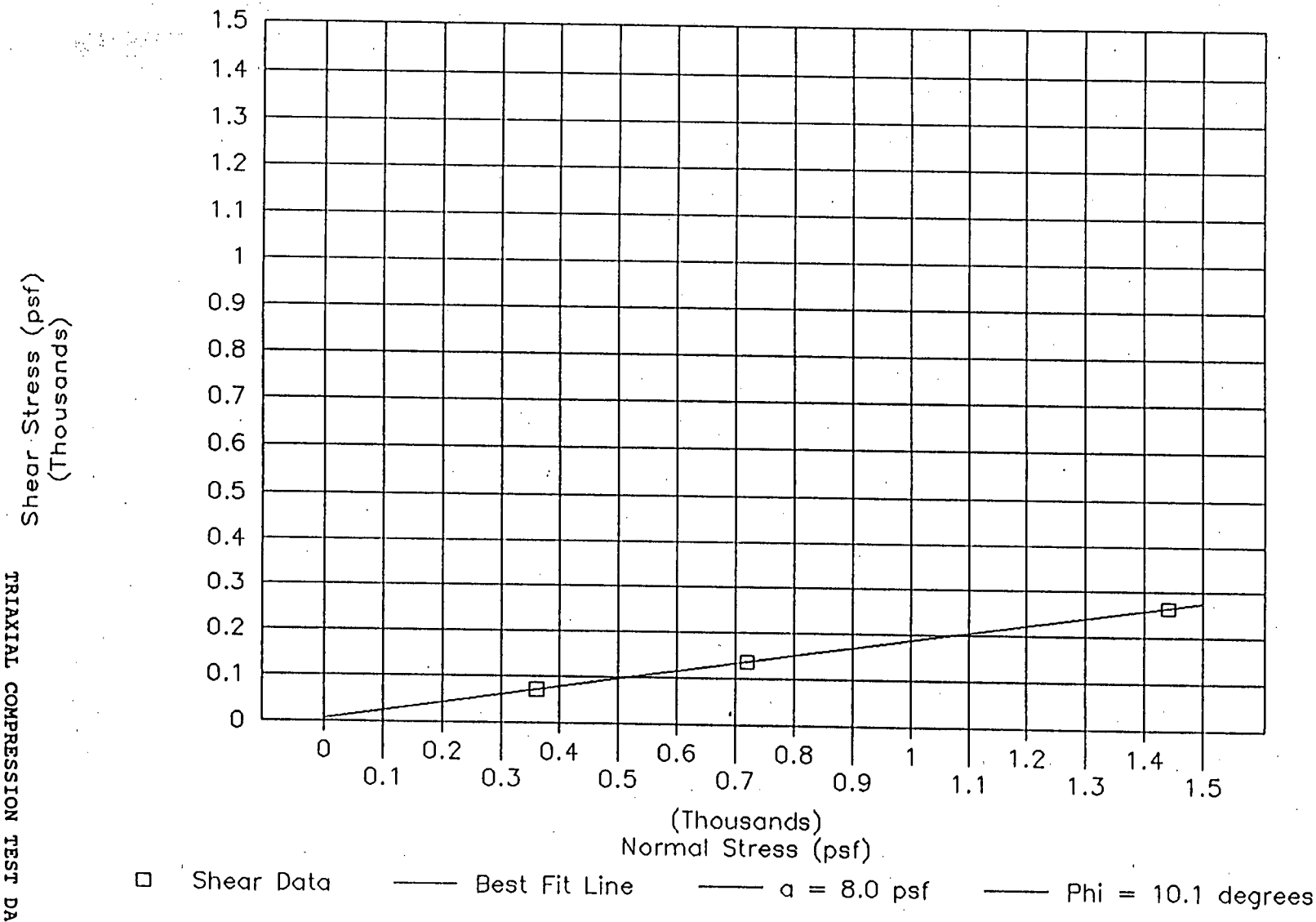
Shear Stress vs. Displacement

Geotextile vs. HDPE



Normal Stress vs. Peak Shear Stress

Geotextile vs. HDPE



TRIAXIAL COMPRESSION TEST DATA

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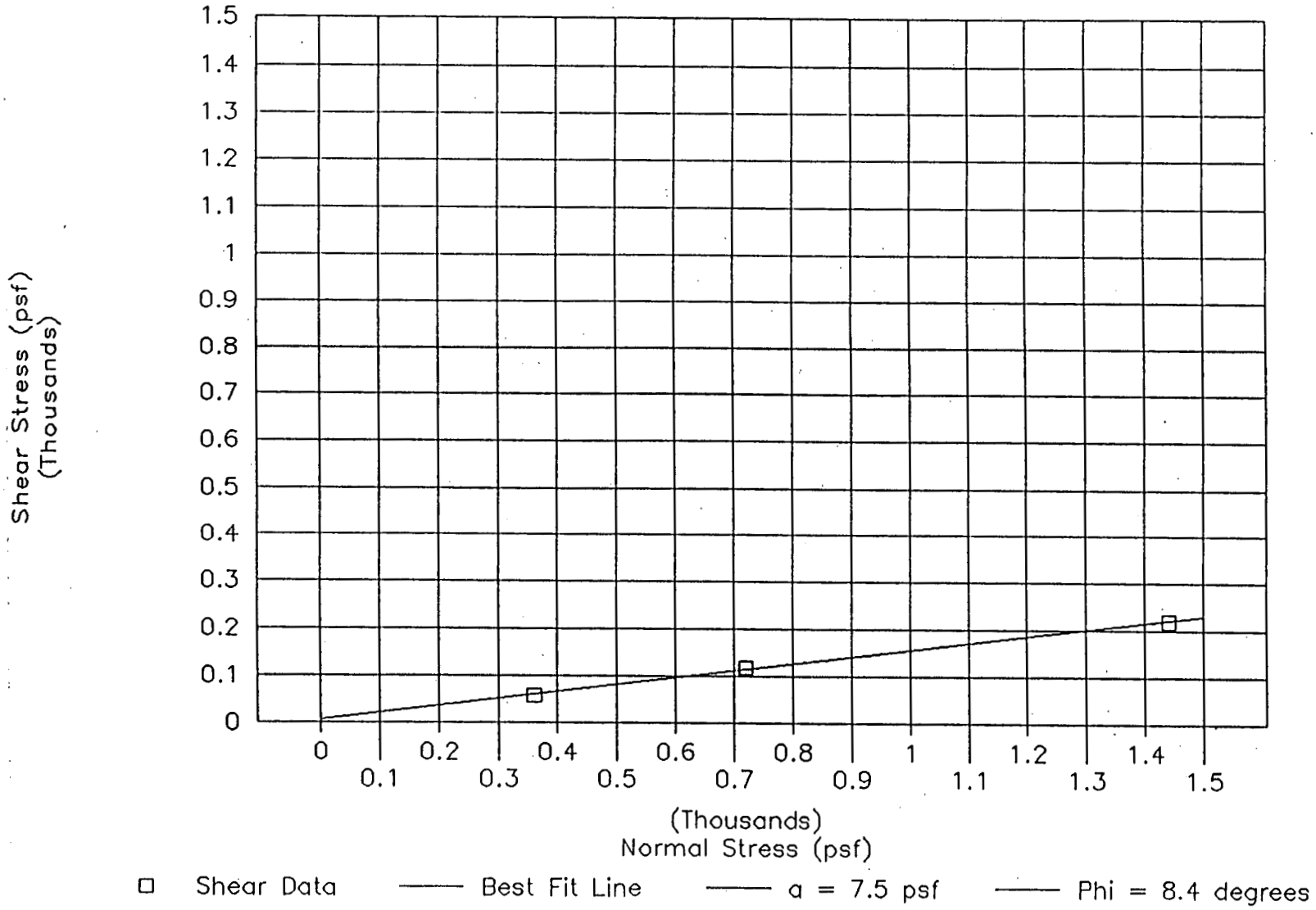
Normal Stress vs. Residual Shear Stress

Geotextile vs. HDPE



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DIRECT SHEAR DATA TEST SERIES
12X12 inch Box
Clay vs. Hydrated GCL Test A

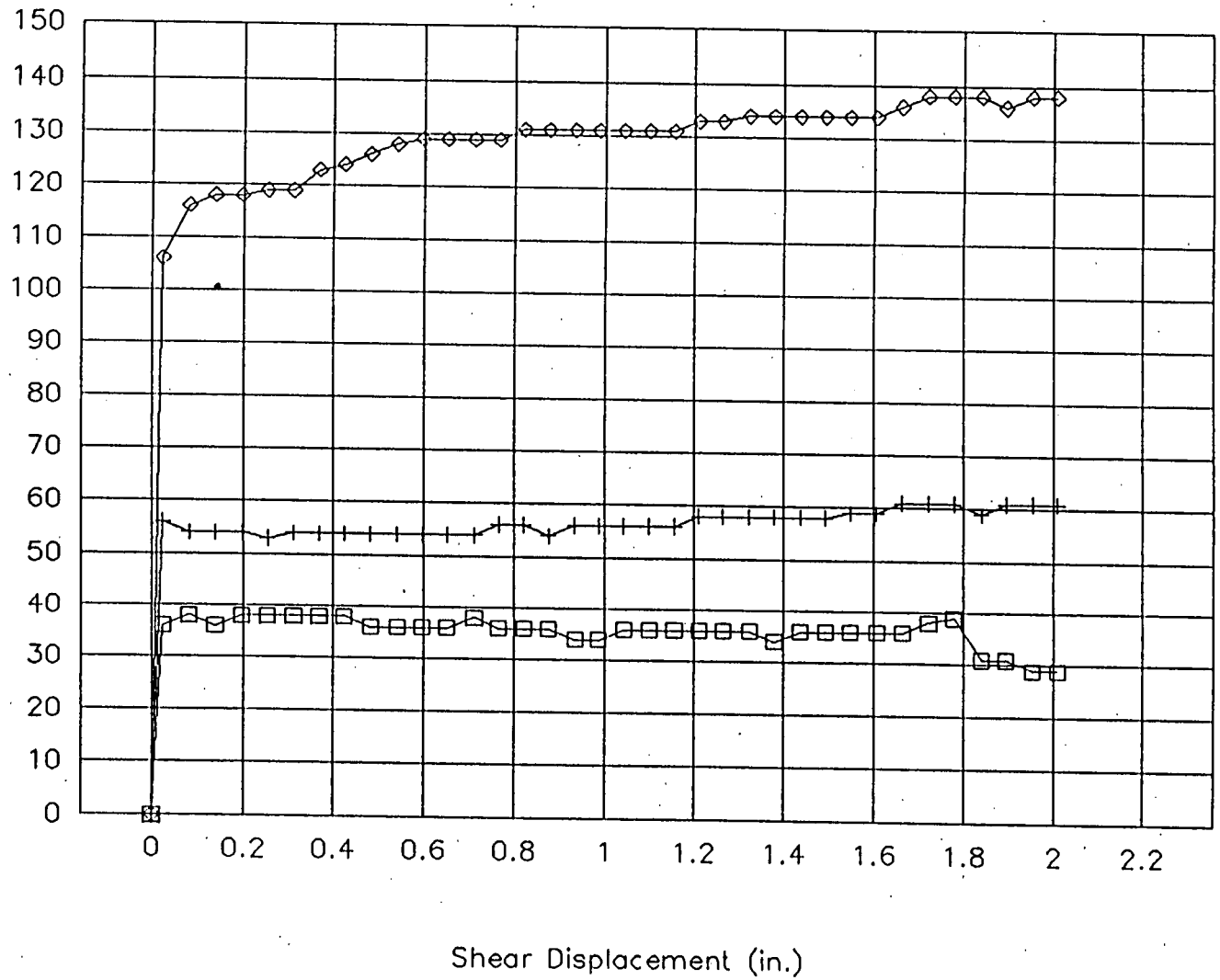
CLIENT: Saic/Parsons PO 140
PROJECT NO: 2059-13N
PROJECT: Fernald

Date: 8-7-95
Date Tested: 8-3-95

Displacement (inches)	Normal Force=360 psf Shear Stress (psf)	Normal Force=720 psf Shear Stress (psf)	Normal Force=1440 psf Shear Stress (psf)
0	0	0	0
0.024	36	56	106
0.082	38	54	116
0.139	36	54	118
0.198	38	54	118
0.254	38	53	119
0.312	38	54	119
0.369	38	54	123
0.425	38	54	124
0.483	36	54	126
0.542	36	54	128
0.597	36	54	129
0.651	36	54	129
0.711	38	54	129
0.765	36	56	129
0.821	36	56	131
0.875	36	54	131
0.934	34	56	131
0.987	34	56	131
1.042	36	56	131
1.099	36	56	131
1.155	36	56	131
1.21	36	58	133
1.265	36	58	133
1.324	36	58	134
1.379	34	58	134
1.438	36	58	134
1.493	36	58	134
1.549	36	59	134
1.607	36	59	134
1.664	36	61	136
1.722	38	61	138
1.778	39	61	138
1.84	31	59	138
1.894	31	61	136
1.953	29	61	138
2.009	29	61	138

Shear Stress vs. Displacement

Clay vs. Hydrated GCL



□ Nor. Load=360 psf + Nor. Load=720 psf ◇ Nor. Load=1440 psf

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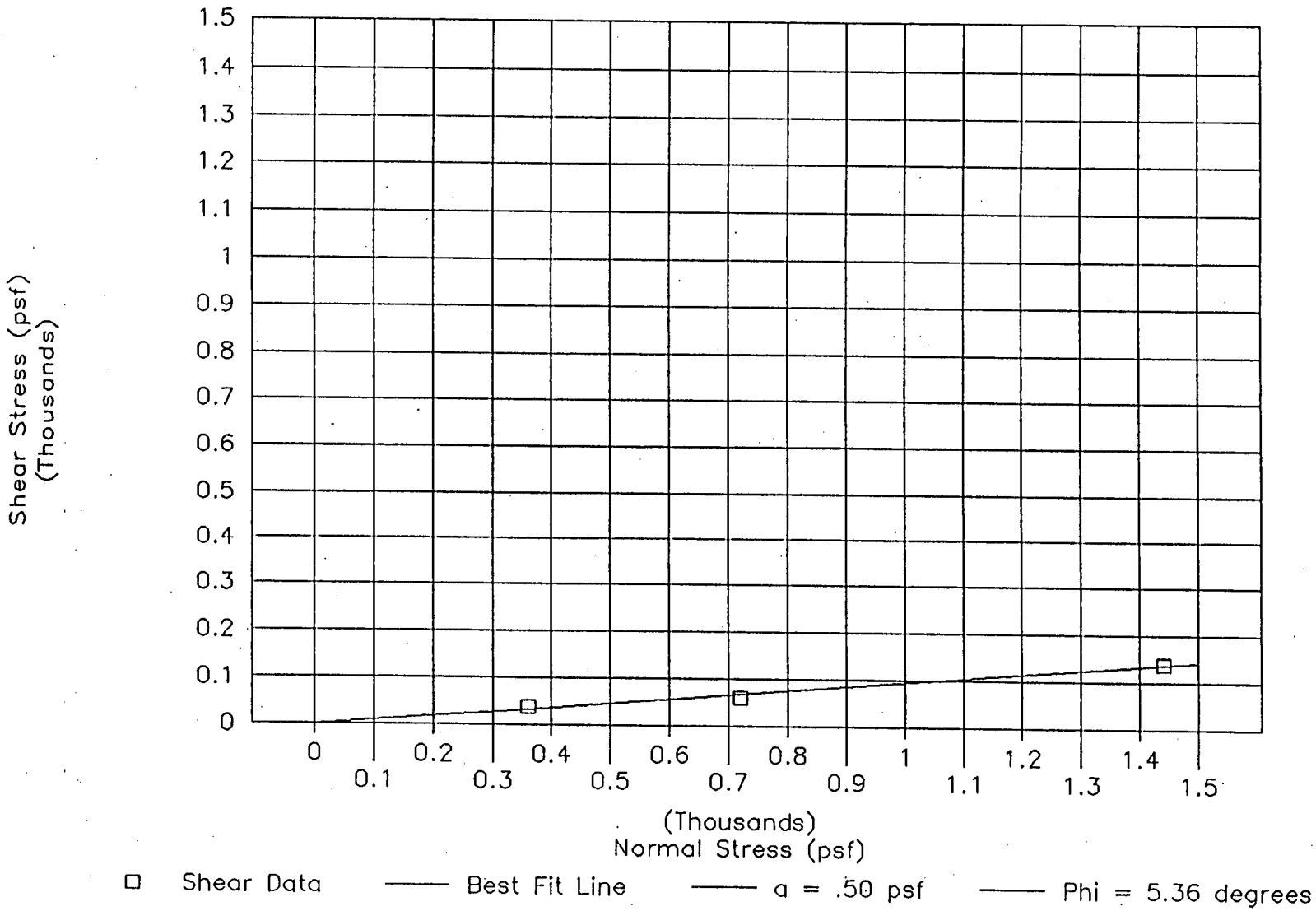
Ultimate Shear Stress

Clay vs. Hydrated GCL



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DIRECT SHEAR DATA TEST SERIES
12X12 inch Box
Clay vs. 60 mil HDPE Test B

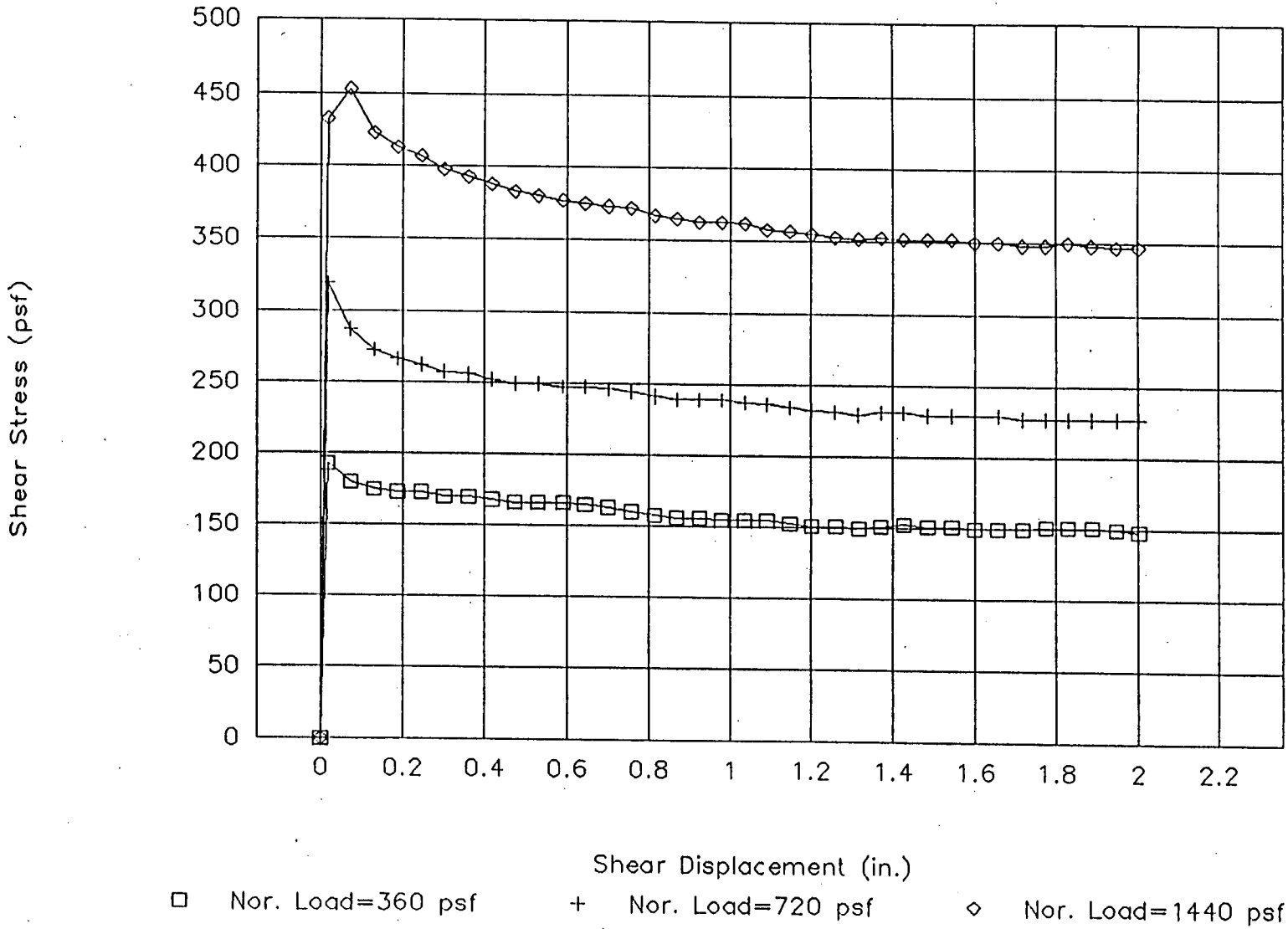
CLIENT: Saic/Parsons PO 140
PROJECT NO: 2059-13N
PROJECT: Fernald

Date: 8-2-95
Date Tested: 8-1-95

Displacement (inches)	Normal Force=360 psf Shear Stress (psf)	Normal Force=720 psf Shear Stress (psf)	Normal Force=1440 psf Shear Stress (psf)
0	0	0	0
0.017	193	319	433
0.073	180	287	453
0.131	175	272	423
0.188	173	266	413
0.247	173	262	407
0.302	170	257	398
0.361	170	256	393
0.418	168	252	388
0.474	166	249	383
0.53	166	249	380
0.591	166	247	377
0.644	165	247	375
0.7	163	246	373
0.756	160	244	372
0.814	158	241	367
0.868	156	239	365
0.924	156	239	363
0.979	155	239	363
1.036	155	237	362
1.09	155	236	358
1.147	153	234	357
1.201	151	232	355
1.259	151	231	353
1.316	150	229	352
1.37	151	231	353
1.426	153	231	352
1.485	151	229	352
1.545	151	229	352
1.6	150	229	350
1.657	150	229	350
1.717	150	227	348
1.774	151	227	348
1.83	151	227	350
1.888	151	227	348
1.948	150	227	347
2.003	148	227	347

Shear Stress vs. Displacement

Clay vs. HDpe 60



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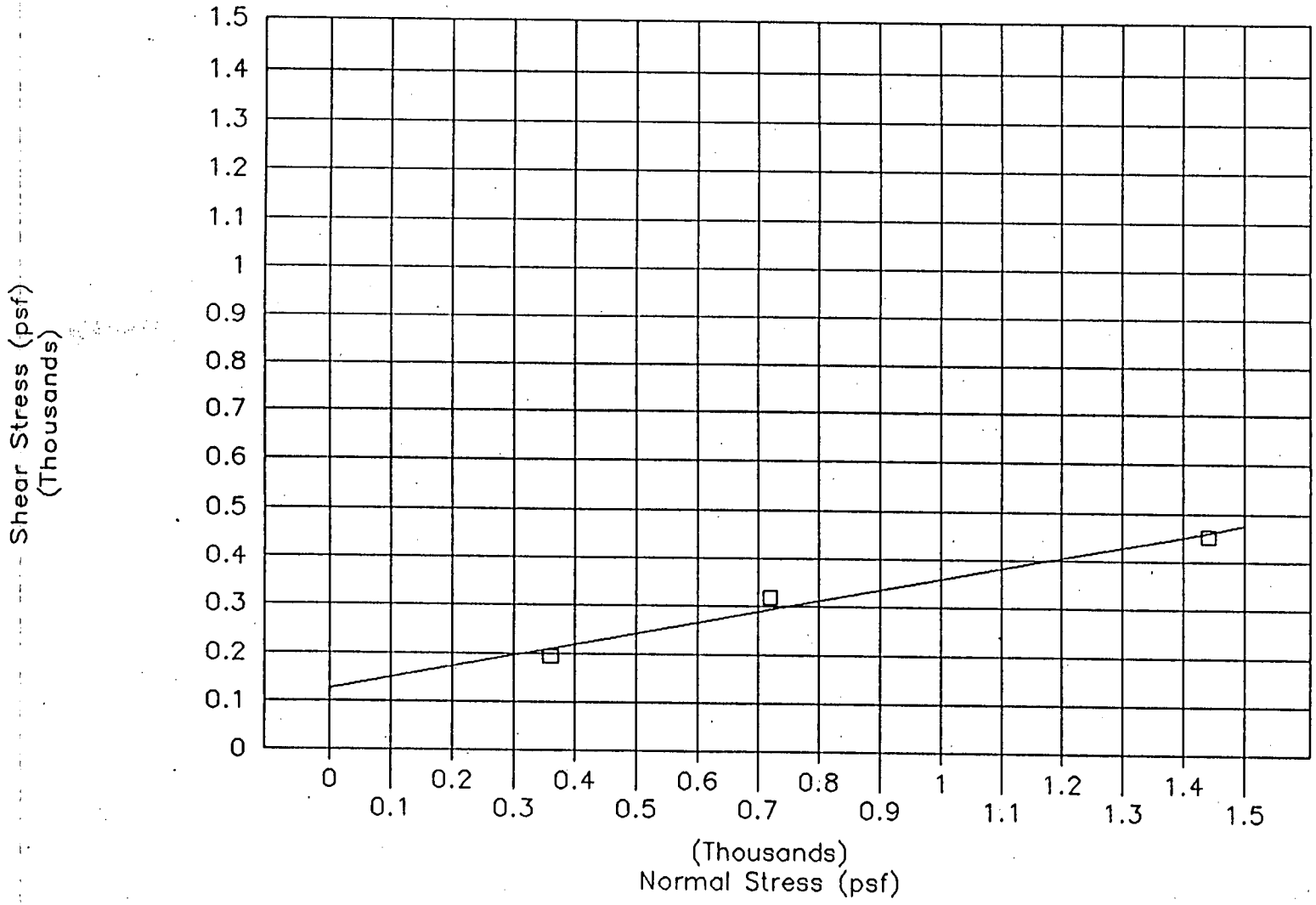
Normal Stress vs. Peak Shear Stress

Clay vs. 60 mil HDPE



□ Shear Data —— Best Fit Line —— a = 126 psf —— Phi = 13.1 degrees

Normal Stress vs. Residual Shear Stress

Clay vs. 60 mil HDPE

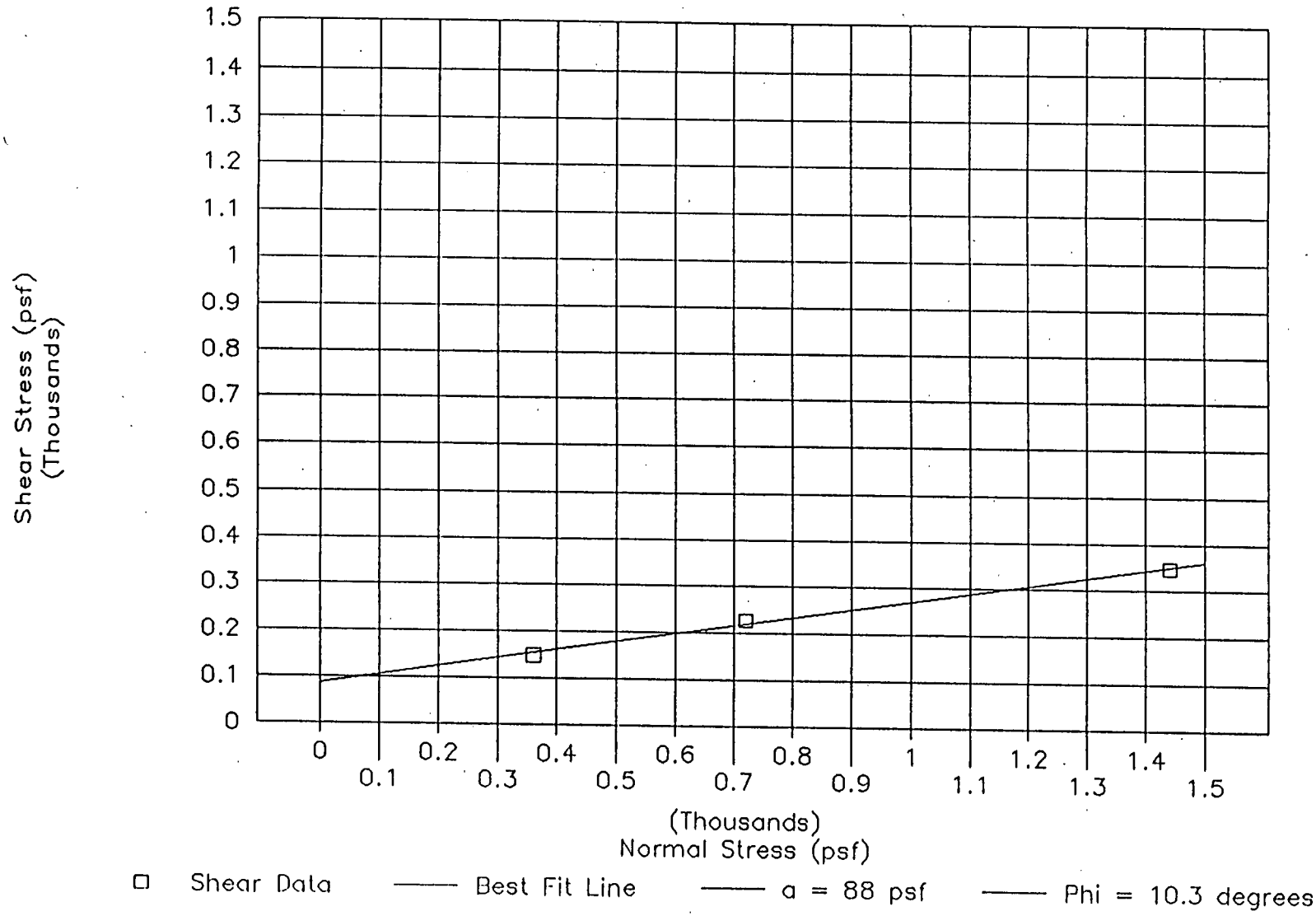


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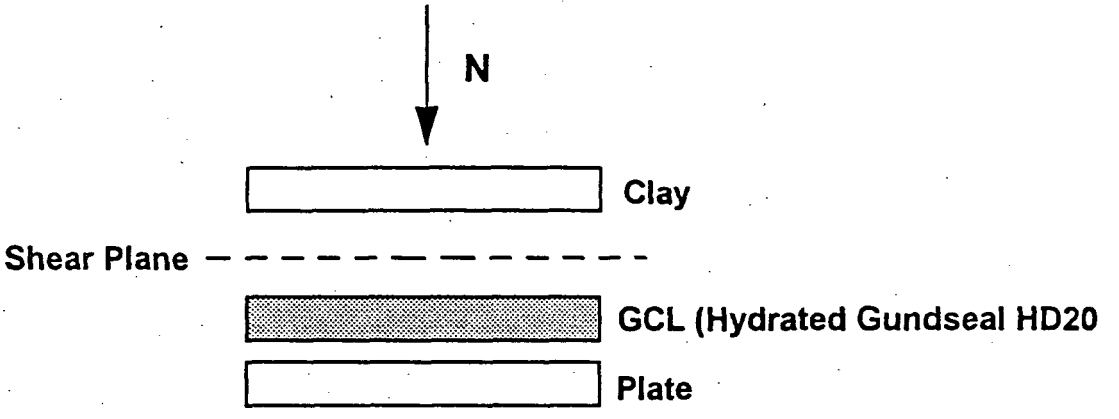
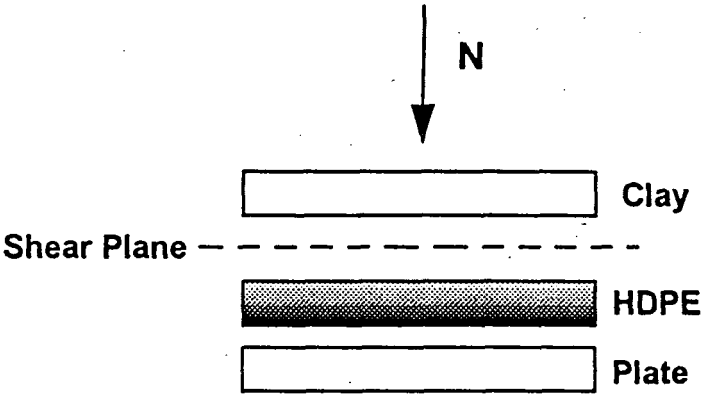
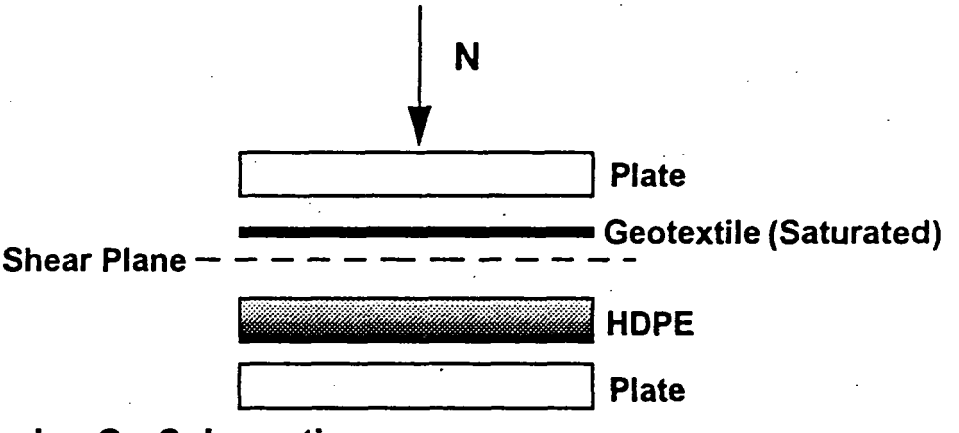
Figure 1
Large Scale Direct Shear Testing
ASTM D 5321
Test Schematic



DS Test Series A - Schematic



DS Test Series B - Schematic



DS Test Series C - Schematic

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APPENDIX K

DESCRIPTION OF GEOTECHNICAL DATA BASE

GEOTECHNICAL DATA BASE

The Geotechnical Data Base is comprised of a collection of soil boring and Cone Penetrometer Test (CPT) data that were obtained during tasks completed under PO's 20, 101, 132, 140 and from the H.C. Nutting Report. The Geotechnical Data Base has been tailored to a data-specific format and resides on an Oracle Data Base system that is integrated with the Intergraph Modular GIS Environment (MGE) and Environmental Resource Management Application's (ERMA) software platform. The bulk of the data base functionality is governed by the Relational Interface System (RIS) which serves as the software link between the data base and the geological/mapping application's programs.

Overview of Soil Boring Data Base Attributes

The Geotechnical Data Base contains ten attribute tables for the soil borings. These tables are part of the data regiment that represents the geotechnical and soil boring results of the above-mentioned tasks.

Table Name	*Brief Description*
log_hdr	Log Header Information: including State Plane coordinates, ground surface elevation, depth intervals, dates and other appropriate header information.
log_lith	Log Lithology Data: Sample number, intervals and type, ground surface elevation, SPT blow count data and a unique lithology flag.
consol	Consolidation Properties: Moisture content, wet density and dry density before and after testing. Test type and other observed consolidation test properties of the soil sample dataset.
density	Soil Density Properties: Includes test method, wet density, dry density and percent saturation values.
index_prop	Index Properties: Moisture content, Liquid Limit, Plastic Limit, Plasticity Index, UCSC designations and soil sample visual qualifiers. Also includes lithology percentages, specific gravity and compaction test method.
compaction	Compaction Data: Moisture content and dry density values for five-point compaction curve plots as well as test method utilized.

hyd_con	Hydraulic Conductivity: Test method, moisture contents and density values. Permeability data.
ucs	UCS: Moisture content, wet and dry density values. Strain, maximum deviation and undrained shear strength values.
tx_uu	TX_UU (Triaxial Compression, Unconsolidated, Undrained) test data: dataset populated with moisture contents, wet densities, dry densities, confining pressure data, strain and failure parameters associated with the compression tests. Information output in Mohr Circle plots.
tx_cupp	TX_CUPP (Triaxial Compression, Consolidated, Undrained) test data: dataset populated with moisture contents, wet densities, dry densities, confining pressure data, strain and failure parameters associated with the compression tests. Information output in Mohr Circle plots.

Status of Geotechnical Data Base CPTs

Because of the application-specific format required for the loading of CPT data, those data have not been directly entered into the geotechnical data base. Rather, CPT data have been archived into flat ASCII files for storage. Loading of CPT data is not covered under the scope of this task.

Loading Procedure for the Geotechnical Data Base

Approximately 98 percent of the geotechnical data were loaded into the geotechnical data base from two main sources - hard copy output and digital file formats (Lotus 1-2-3 Rel.3 and flat ASCII). The remainder of the data (approx. 2 percent) were directly loaded into the data base through key-in.

Data from hard copy sources were compiled into Lotus spreadsheets, then validated for accuracy. After validation, the data were loaded through the Well Data Translator (WDT) Software (an ASCII format data loader). After loading, hard copy printouts of tables were created and cross-checked for data integrity and quality assurance.

A similar procedure was used for the loading of digital format file data without the added step of compiling data into Lotus spreadsheets. The process first entailed the proper formatting of the digital data for subsequent transfer into the data base through the WDT Software. ASCII Files were directly fed into the WDT Software. Lotus files were first dumped into an ASCII file format, then processed using WDT. As a final step for quality assurance, **all** data base records were output into hard copy format and back-checked for data integrity and quality assurance.

Data that were keyed directly into the data base were flagged as key-in using a data identifier field in the particular record being loaded. Records were then output into hard copy format and back-checked for quality assurance.

Data Base Structure

The tables within the data base are linked by two fields which are present in all tables - the *bor_id* and *sample_no* (Boring Identifier and Sample Number) attribute columns. The use of these key fields was necessary to permit the creation of joined tables and the subsequent development of table views (tables which contain criteria-defined unique attributes from two or more tables).

It was determined that one table (*log_hdr*) would be required to provide the links necessary to develop an adequate graphical point data/record interface that would be used to post data points within graphics files (design files). Since the *log_hdr* table is linked to graphical point data, it can be accessed through the Modular GIS Environment (MGE) data base interface as well as through the ERMA Data Manager interface.

The graphical links embedded in the data base records provide the means for a single record or series of records to be queried and the linked graphic data element to be located within a specific design file. Conversely, a graphic element can be queried within the design file to retrieve the corresponding table and/or table views which are linked to the graphic element. Once a graphic element is chosen, the data base record for that element will be displayed (as well as any table views that have been created). Because of this functionality, the *log_hdr* table can be used to plot well symbols representing soil borings and CPTs in various basemap and subsurface map and cross-section formats.

Both the MGE Geologic Mapper (MGLM) software and the MGE Geologic Analyst (MGLA) software rely on the *log_hdr* table for accurate posting of soil borings and CPTs in map and cross-section format.

Access to the Geotechnical Data Base

Typical access to the geotechnical data base for the geotechnical user will be accomplished using Intergraph's DB Access software in conjunction with the ERMA Data Base Access Menus. At its most basic level, this interface will permit the user to perform criteria-based queries directly on the data base using a series of forms-driven Structured Query Language (SQL) templates. Output can either be to the screen or to ASCII data base reports (formatted or unformatted).

Since the power of the DB Access menus also provides a means of modifying and updating the data base, it is at the discretion of the Data Base Administrator (DBA) to grant such access to individual users. Because of the possibilities for data corruption, the DBA will have control over permissions granted to users for general geotechnical data base access.

To assist the general user, data base queries that are used repeatedly can be stored into a Query Library for subsequent retrieval and use. Queries within a library can be recalled for use on a particular dataset or series of datasets.

In Review Mode, a distinct number of attributes can be highlighted for data base review allowing for a comparison of a number of similar records within a table structure. These reviews can subsequently be output to an ASCII text file.

Reports

The ERMA Data Manager allows for the development of specific report forms through the use of the RIS Report Writer. Individual forms can be generated using the Report Writer Interface. A wide variety of report formats are available. Data base reports that are generated through RIS Report Writer should be stored in a designated data base report library as specified by the DBA. Output from reports can be used as subsequent input for analysis packages, text reports, or as flat ASCII files to be archived. Access to the RIS Report Writer will be limited to those authorized by the DBA and Lead Discipline Engineer (LDE).

Security

Access to the Geotechnical Data Base *will not be granted* to any user *without the approval* of the Data Base Administrator. Strict guidelines have been adopted to maintain a controlled environment that will ensure the continued integrity of the data base and will restrict unauthorized access to the data base or any of its components.

Brief Description of Access to the Data Base

Once authorized, the user will access the Geotechnical Data Base using the following procedure:

1) Log into the PO-140 Account on a Unix (MGE specified) workstation using the Workstation User Menu (Figure K-1)

Account name[1] *PO140*[2]
Password (from System Manager)

2) Log into the PO-140 Window using the pulldown menu.

Username po140
Password (from System Manager)

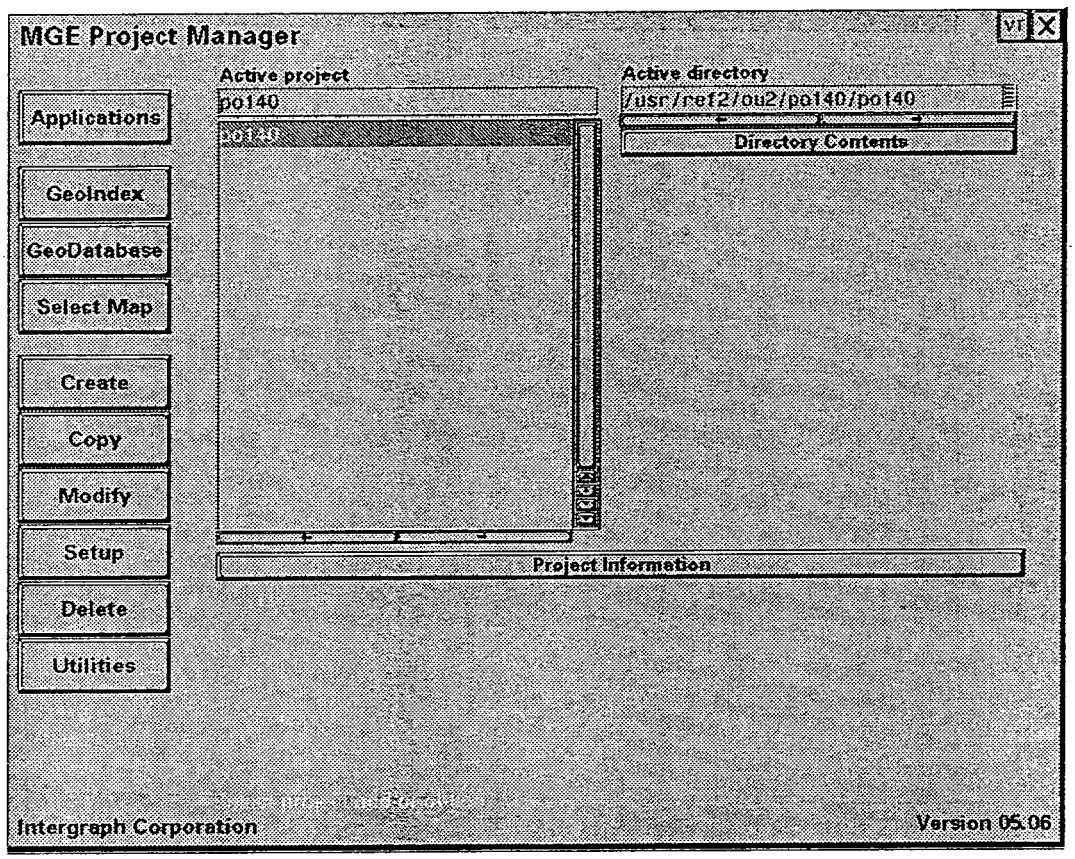

Figure K-1 - MGE Project Manager Form

3) Unix $ prompt: *mge*

4) MGE Project Manager Form - Access the *Application Button* (Figure K-2)

5) Applications Form - Choose *MGE Environmental Manager* (Figure K-3)

6) Applications Form 2 - Choose *DBMenus - ERMA Data Base Menus* (Figure K-4)

7) ERMA Data Base Access Main Menu - Key-in one of the below "table names" in the Existing Tables or choose it from the Pulldown Menu (Figure K-5)

compaction
consol
density
hyd_con
index_prop
log_hdr
log_lith
tx_cupp
tx_uu
ucs

8) "table name" TABLE FORM (Figure K-6)
Enter *query item* (9a) directly into data base form or choose *Edit SQL Query* Button to enter the **Build SQL Query** Form (9b).

9a) Choose *Execute Query* Button.

or

9b) Enter Query using the Build SQL Query Form Interface (Figure K-7)
Accept the Query (hit **Accept** button)
Check out of the Form (upper right of form)

[1] System prompts in bold for clarity.
[2] User key-ins italicized for clarity.

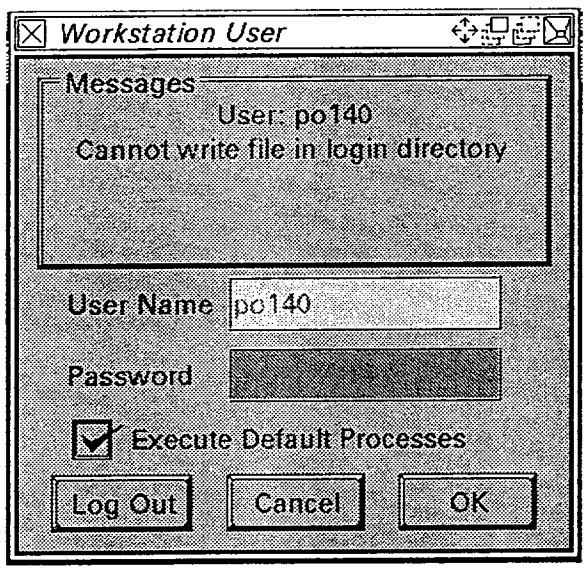

Figure K-2 - Workstation User Form

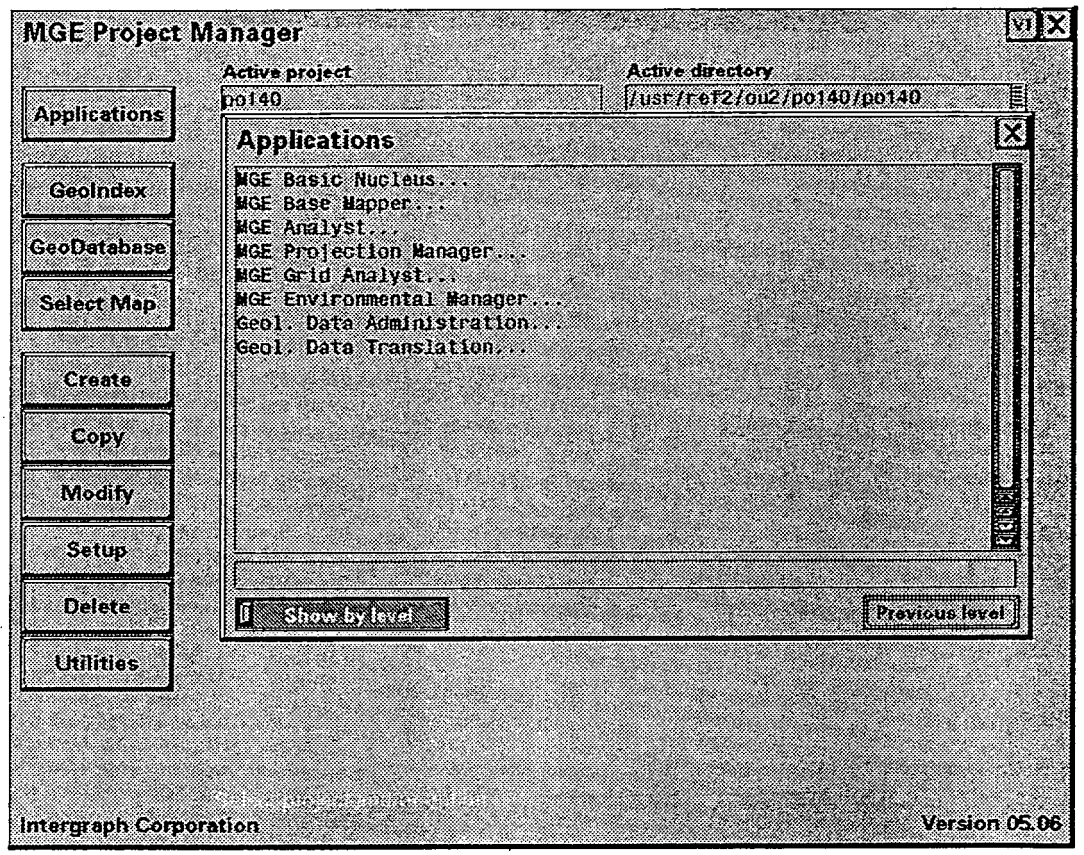

Figure K-3 - MGE Applications Form

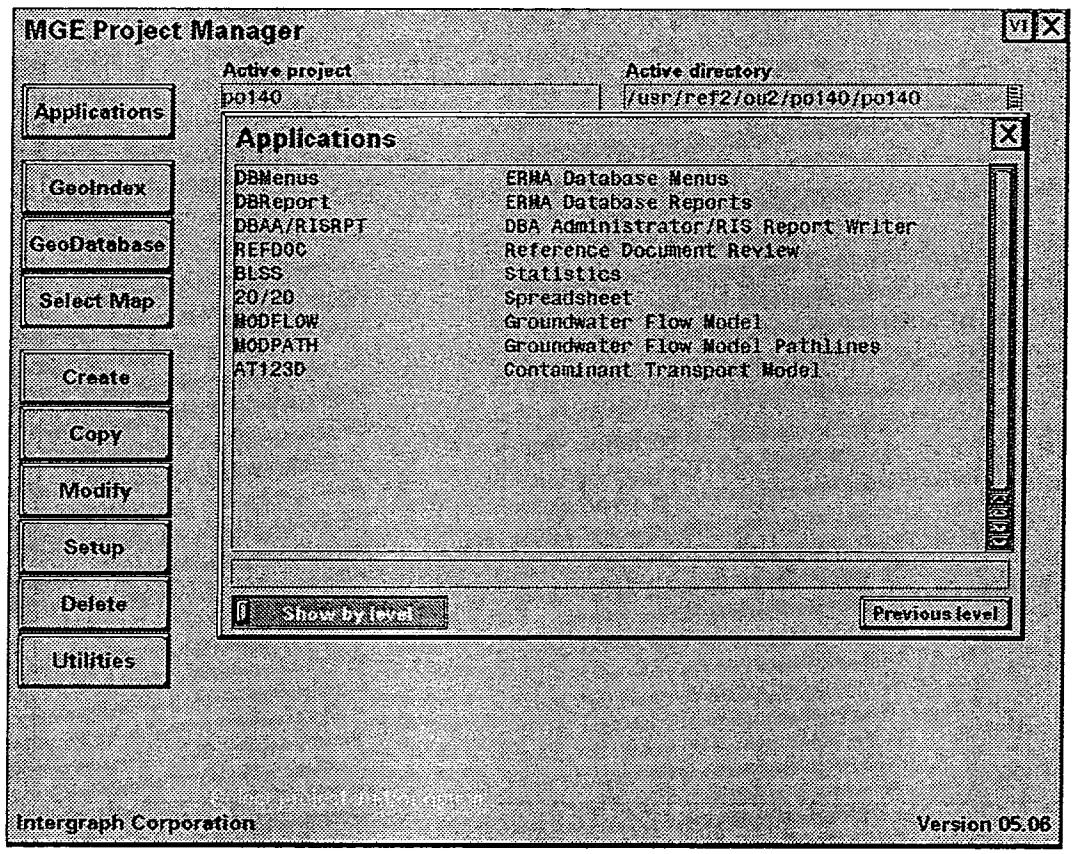

Figure K-4 - MGE Applications Level 2 Form

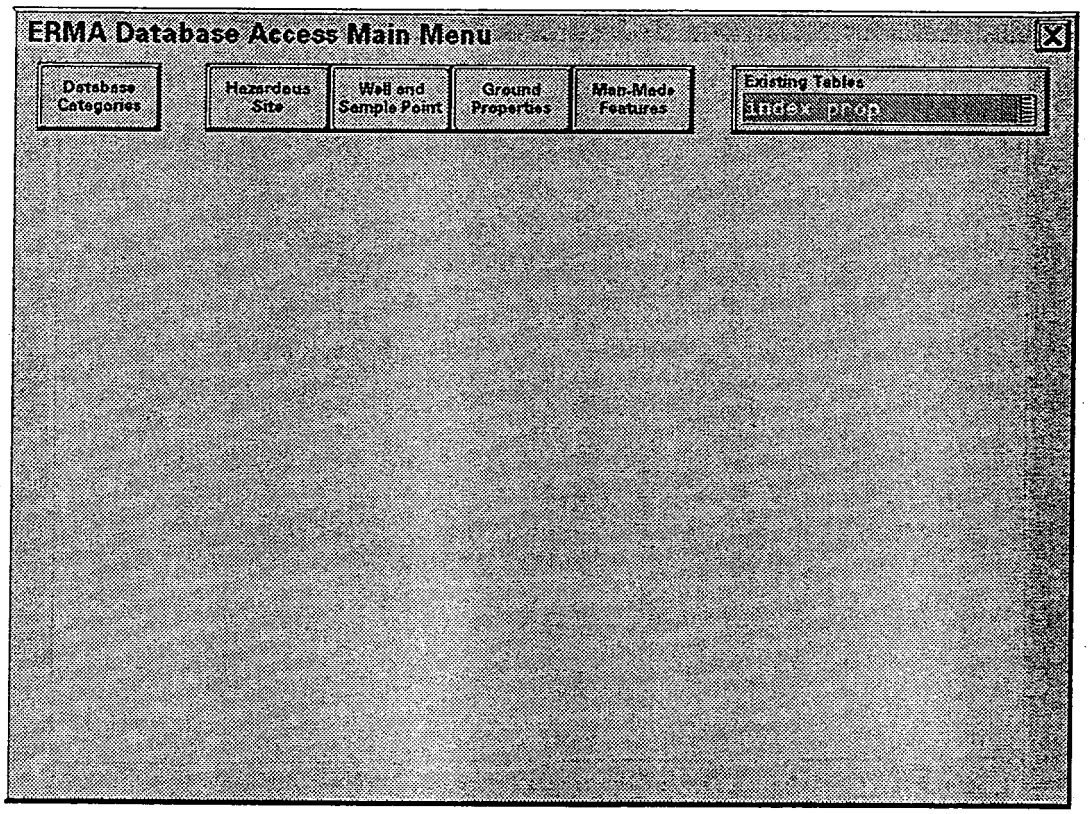

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Figure K-5 - ERMA Data Base Access Main Menu Form

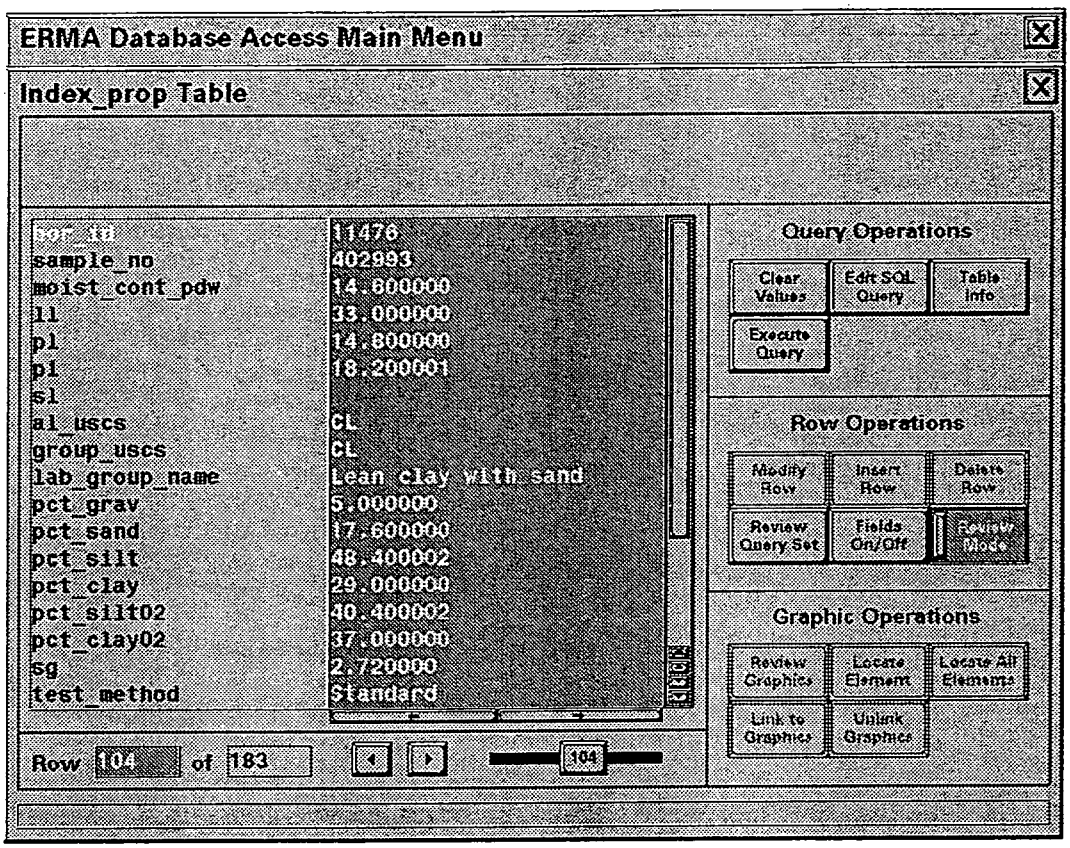

Figure K-6 - Index Properties Table

000457

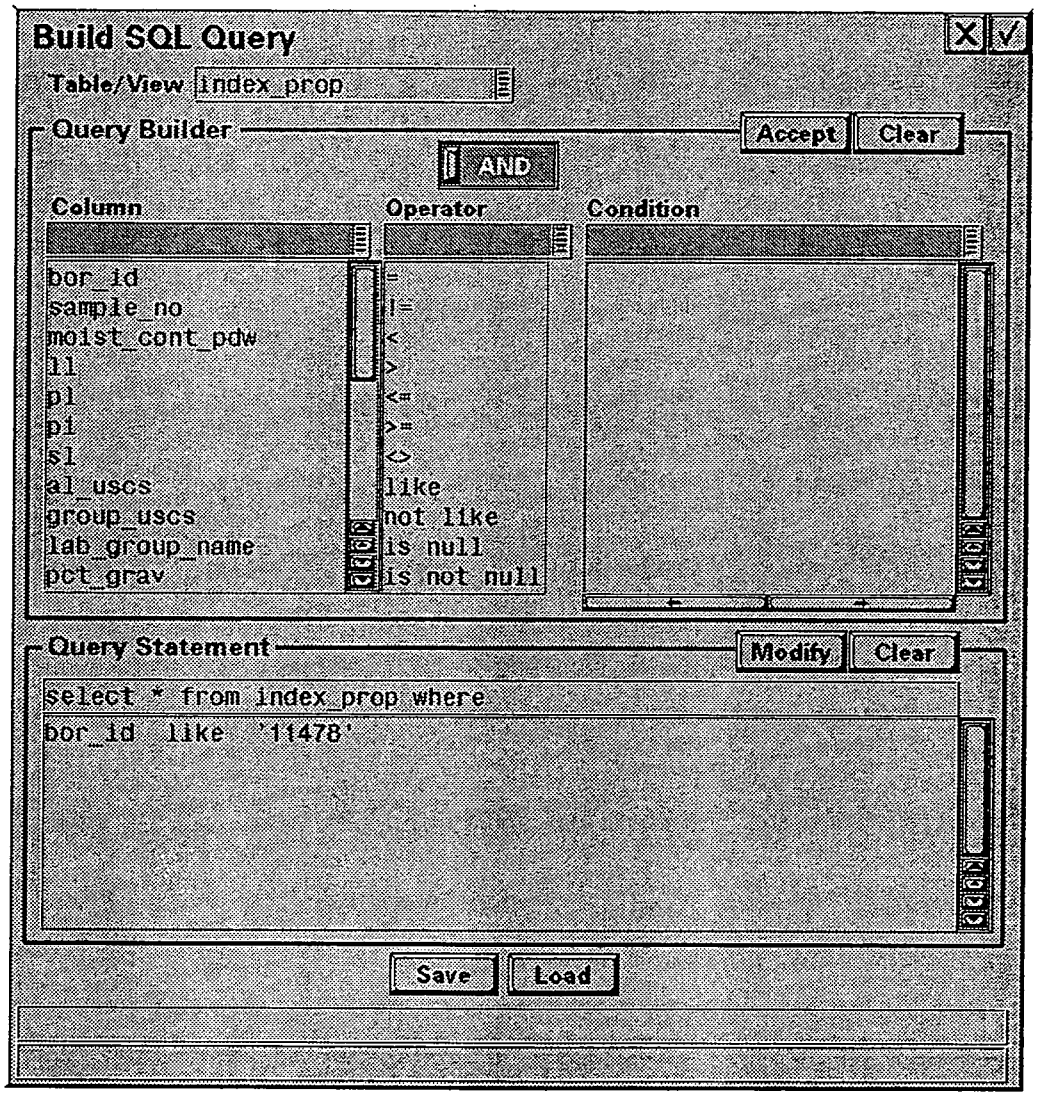

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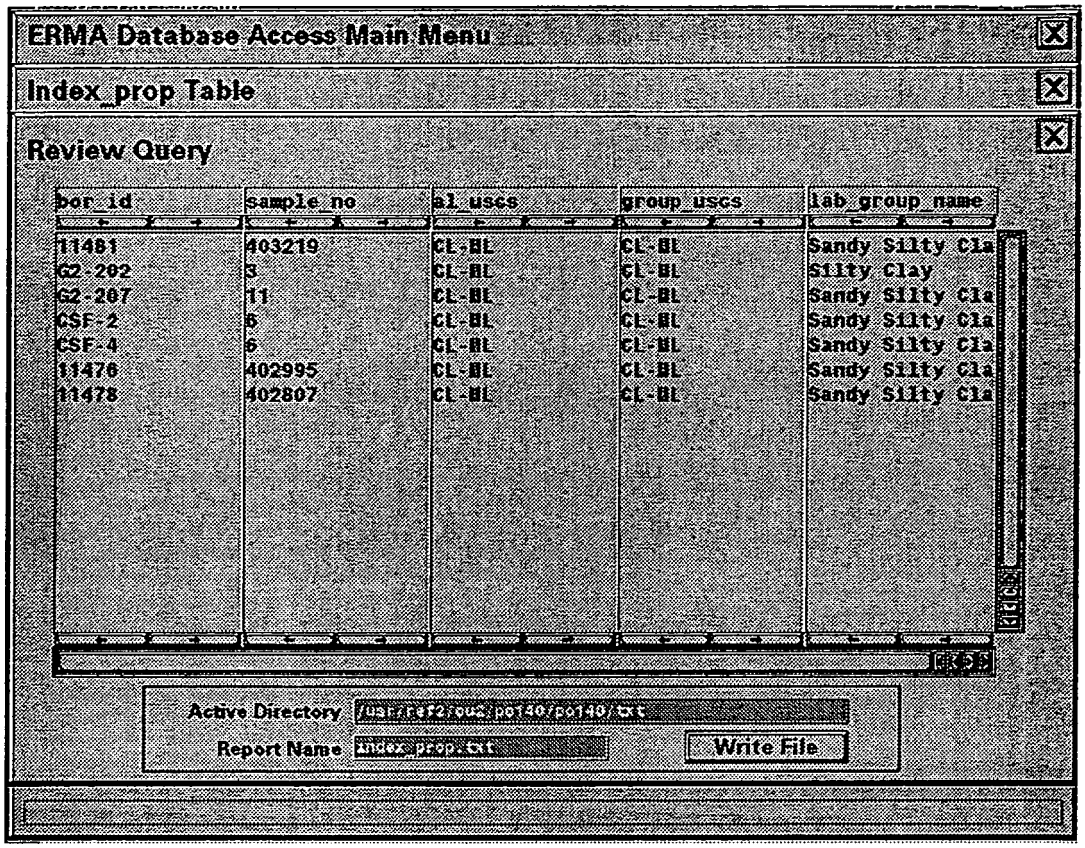
Figure K-7 - SQL Query Form

Some Examples of Data Base Queries for the Geotechnical Data Base

1) All samples from *index_prop* table that have both al_uscs and group_uscs attributes that are CL-ML (results in Figure K-8)

2) All samples from the *log_lith* table that have a sample top depth > = 5.0 ft and a sample bottom depth < = 10.0 ft (results in Figure K-9)



ERMA Database Access Main Menu

Index_prop Table

Review Query

bor_id	sample_no	al_uscs	group_uscs	lab_group_name
11481	403219	CL-BL	CL-BL	Sandy Silty Cla
G2-202	3	CL-BL	CL-BL	Silty Clay
G2-207	11	CL-BL	CL-BL	Sandy Silty Cla
CSF-2	6	CL-BL	CL-BL	Sandy Silty Cla
CSF-4	6	CL-BL	CL-BL	Sandy Silty Cla
11476	402995	CL-BL	CL-BL	Sandy Silty Cla
11478	402807	CL-BL	CL-BL	Sandy Silty Cla

Active Directory /usr/rrd2/ous/po140/po140/ctx

Report Name Index_prop.ctx

Write File

OC0460

Figure K-8 - Query Review Form

Review Query

bor_id	sample_no	samp_top_depth	samp_bot_depth	samp_type
CSF-1	C1/4	6.000000	8.000000	ST
CSF-2	C2/4	6.000000	8.000000	SS
CSF-2	C2/5	8.000000	10.000000	SS
CSF-3	C3/4	6.000000	8.000000	SS
CSF-3	C3/5	8.000000	10.000000	SS
CSF-4	C4/4	6.000000	8.000000	SS
CSF-4	C4/5	8.000000	10.000000	SS
CSF-5	C5/4	6.000000	8.000000	SS
CSF-5	C5/5	8.000000	10.000000	SS
CSF-6	C6/4	6.000000	8.000000	SS
CSF-6	C6/5	8.000000	10.000000	ST
11468	403075	6.500000	9.000000	ST
11469	402823	6.000000	7.500000	SS
11469	402825	7.500000	9.000000	SS
11470B	403135	6.000000	7.500000	SS
11471	402967	7.500000	9.000000	SS

Active Directory /usr/rsf2/ou2/po140/po140y.rsa

Report Name Top_Extract

Write File

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Figure K-9 - Example Query

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes

Field Name	Description	Units	Codes/Example/Comments
Table: log_hdr (boring log header information)			
bor_id	boring identification		
oh_n27	Ohio North coordinate (NAD 1927)		
oh_e27	Ohio East coordinate (NAD 1927)		
oh_n83	Ohio North coordinate (NAD 1983)		
oh_e83	Ohio East coordinate (NAD 1983)		
gs_elev_ft	ground surface elevation	feet-MSL	
bor_st_dt	date boring started		
bor_end_dt	date boring completed		
bor_end_dt_q	date boring comp (query)		
bor_botd_ft	boring depth	feet	
comp_type	boring completion code		GROUT=grouted WELL=well installed
proj_ord	PARSONS Proj. Order No.		PO132 (ex)
work_plan	title of assoc. work plan		
work_pl_no	ident. no. of work plan		
work_pl_dt	date of work plan		
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
alt_id	alternative boring id		

Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: log_lith (lithologic data from boring log)			
bor_id	boring identification		
sample_no	sample number		
sample_date	date sampled		
gs_elev	ground surface elevation	feet-MSL	
samp_top_depth	depth to top of sample	feet	
samp_bot_depth	depth to bottom of sample	feet	
samp_type	sample type		SS=split spoon sample ST=shelby tube sample DEN=denison sample GP_CORE=geoprobe core BULK_CUT=bulk-auger cuttings BULK_EXC=bulk-excavated
n_spt	SPT N value		
refusal	flag for sampler refusal		Y
uniq_lith	unique lithology identifier		Brown Till=brown till Gray Till=gray till Great Miami Aquifer=Great Miami Aquifer Form. Fill=fill
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		
intnv_avg	midpoint of interval		

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: compaction (laboratory compaction test data)			
bor_id	boring identification		
sample_no	sample number		
opt_mc_pdw	optimum moisture content	percent	
max_drden_pcf	maximum dry density	pcf	
mc_1	moisture content-point #1	percent	
dden_1	dry density-point #1	pcf	
mc_2	moisture content-point #2	percent	
dden_2	dry density-point #2	pcf	
mc_3	moisture content-point #3	percent	
dden_3	dry density-point #3	pcf	
mc_4	moisture content-point #4	percent	
dden_4	dry density-point #4	pcf	
mc_5	moisture content-point #5	percent	
dden_5	dry density-point #5	pcf	
com_effort	compactive effort for test		Standard = standard effort Modified = modified effort Half Std. = half standard eff.
test_method	test method		ASTM D 698, Method A (typ) ASTM D 1557, Method A (typ)
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
qual_level	identifier		

Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: index_prop (laboratory index properties test data)			
bor_id	boring identification		
sample_no	sample number		
moist_cont_pdw	moisture content (oven method)	percent	
ll	liquid limit		
pl	plastic limit		
pi	plasticity index		
al_uscs	USCS symbol from Atterberg tests		
group_uscs	USCS group symbol		
lab_group	USCS group name		
pct_grav	percent gravel	percent	
pct_sand	percent sand	percent	
pct_silt	percent silt (0.05mm clay size)	percent	
pct_clay	percent clay (0.05mm clay size)	percent	
pct_silt02	percent silt (0.02mm clay size)	percent	
pct_clay02	percent clay (0.02mm clay size)	percent	
sg	specific gravity		
test_method	test method(s)		ASTM D 2216,4318,422,854(typ)
source	source of data		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		
uniq_lith	unique lithology identifier		
C140_132	combination project identifier		

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: density (in situ density data from various laboratory tests)			
bor_id	boring identification		
sample_no	sample number		
spec_no	specimen number		
wet_den_pcf	wet density	pcf	
dry_den_pcf	dry density	pcf	
pct_sat	percent saturation	percent	
from_test	test providing density data		ASTM D 2435 (if consol) ASTM D 5084 (typ, if perm) ASTM D 2166 (if UCS) ASTM D 2850 (if TX-UU) ASTM D 4767 (if TX-CU)
test_method	test method		
source	source of data		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		

Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: hyd_con (Laboratory hydraulic conductivity data)			
bor_id	boring identification		
sample_no	sample number		
spec_no	specimen number		
type_test	type of test, in situ or remolded		IN_SITU REMOLDED
rm_comp_tar	target relative compaction, remolded tests		95% std. MDD, 85% std. MDD (ex)
rm_mc_tar	target moisture content, remolded tests		@OMC, @OMC+2%, @OMC-2% (ex)
conf_pr_psf	confining pressure	psf	
head_pr_psi	head pressure (constant head test)	psi	
mc_before_per	before test moisture content	percent	
mc_after_per	after test moisture content	percent	
wden_bef_pcf	before test wet density	pcf	
wden_aft_pcf	after test wet density	pcf	
dden_bef_pcf	before test dry density	pcf	
dden_aft_pcf	after test dry density	pcf	
k1_cps	coeff. of permeability (reading #1)	cm/sec	
k2_cps	coeff. of permeability (reading #2)	cm/sec	
k3_cps	coeff. of permeability (reading #3)	cm/sec	
k4_cps	coeff. of permeability (reading #4)	cm/sec	
k5_cps	coeff. of permeability (reading #5)	cm/sec	
k6_cps	coeff. of permeability (reading #6)	cm/sec	
k7_cps	coeff. of permeability (reading #7)	cm/sec	
k8_cps	coeff. of permeability (reading #8)	cm/sec	
k9_cps	coeff. of permeability (reading #9)	cm/sec	
k10_cps	coeff. of permeability (reading #10)	cm/sec	
k11_cps	coeff. of permeability (reading #11)	cm/sec	
k12_cps	coeff. of permeability (reading #12)	cm/sec	
k13_cps	coeff. of permeability (reading #13)	cm/sec	
k14_cps	coeff. of permeability (reading #14)	cm/sec	
k15_cps:	coeff. of permeability (reading #15)	cm/sec	
k_avg_cps	coeff. of permeability (last 4 readings)	cm/sec	
test_method	test method		ASTM D 5084 (typ)
qual_lever	qa identifier		PO132 (ex)
source	source of data (code)		
initials	initials of person entering data		

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: consol (Consolidation test data)			
bor_id	boring identification		
sample_no	sample number		
sat_test	saturated test identifier		Y or N
spec_no	specimen number		
type_test	type of test, in situ or remolded		IN SITU
mc_before_per	before test moisture content		REMOLDED
rm_comp_tar	target relative compaction, remolded tests		95% std. MDD, 85% std. MDD (ex)
rm_mc_tar	target moisture content, remolded tests	percent	@OMC, @OMC+2%, @OMC-2% (ex)
mc_after_per	after test moisture content		
wden_bef_pcf	before test wet density	percent	
wden_aft_pcf	after test wet density	pcf	
dden_bef_pcf	before test dry density	pcf	
dden_aft_pcf	after test dry density	pcf	
c_sub_c	compression index	pcf	
c_sub_r	recompression index		
e_o	initial void ratio		
p_p_psf	maximum past pressure		
p_vo_psf	overburden pressure	psf	
ocr	overconsolidation ratio	psf	
units_area	units area (for cv)		
units_t	units time (for cv)	sq in	
units_cv	units of coeff. of consolidation	min	
load_1_psf	1st load increment	sq in/min	
t50_1	1st load, time to 50% consolidation	psf	
cv50_1	1st load, cv, 50% consolidation	min	
t90_1	1st load, time to 90% consolidation	sq in/min	
cv90_1	1st load, cv, 90% consolidation	min	
load_2_psf	2nd load increment	sq in/min	
t50_2	2nd load, time to 50% consolidation	psf	
cv50_2	2nd load, cv, 50% consolidation	min	
t90_2	2nd load, time to 90% consolidation	sq in/min	
cv90_2	2nd load, cv, 90% consolidation	min	
load_3psf	3rd load increment	sq in/min	
t50_3	3rd load, time to 50% consolidation	psf	
cv50_3	3rd load, cv, 50% consolidation	min	
t90_3	3rd load, time to 90% consolidation	sq in/min	
cv90_3	3rd load, cv, 90% consolidation	min	
load_4_psf	4th load increment	sq in/min	
t50_4	4th load, time to 50% consolidation	psf	
cv50_4	4th load, cv, 50% consolidation	min	
t90_4	4th load, time to 90% consolidation	sq in/min	
cv90_4	4th load, cv, 90% consolidation	min	
		sq in/min	

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: consol (Consolidation test data) [continued]			
load_5_psf	5th load increment	psf	
t50_5	5th load, time to 50% consolidation	min	
cv50_5	5th load, cv, 50% consolidation	sq in/min	
t90_5	5th load, time to 90% consolidation	min	
cv90_5	5th load, cv, 90% consolidation	sq in/min	
load_6_psf	6th load increment	psf	
t50_6	6th load, time to 50% consolidation	min	
cv50_6	6th load, cv, 50% consolidation	sq in/min	
t90_6	6th load, time to 90% consolidation	min	
cv90_6	6th load, cv, 90% consolidation	sq in/min	
load_7_psf	7th load increment	psf	
t50_7	7th load, time to 50% consolidation	min	
cv50_7	7th load, cv, 50% consolidation	sq in/min	
t90_7	7th load, time to 90% consolidation	min	
cv90_7	7th load, cv, 90% consolidation	sq in/min	
load_8_psf	8th load increment	psf	
t50_8	8th load, time to 50% consolidation	min	
cv50_8	8th load, cv, 50% consolidation	sq in/min	
t90_8	8th load, time to 90% consolidation	min	
cv90_8	8th load, cv, 90% consolidation	sq in/min	
test_method	test method		ASTM D 2435 (typ)
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: ucs (Unconfined compressive strength test data)			
bor_id	boring identification		
sample_no	sample number		
sat_test	saturated test identifier		Y or N
spec_no	specimen number		
type_test	type of test, in situ or remolded		IN_SITU REMOLDED
rm_comp_tar	target relative compaction, remolded tests		95% std. MDD, 85% std. MDD (ex)
rm_mc_tar	target moisture content, remolded tests		@OMC, @OMC+2%, @OMC-2% (ex)
mc_percent	moisture content	percent	
wdensity_pcf	wet density	pcf	
ddensity_pcf	dry density	pcf	
strain_f	stain at failure	percent	
max_dev_f_psf	max. deviator stress at failure	psf	
und_sh_st_psf	undrained shear strength	psf	
test_method	test method		ASTM D 2166 (typ)
source	source of data (code)		PO132 (ex)
initials	initials of person		
qual_level	qa identifier		

Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: tx_uu (Triaxial compression, unconsolidated, undrained test data)			
bor_id	boring identification		
sample_no	sample number		
sat_test	saturated test identifier		Y or N
type_test	type of test, in situ or remolded		IN_SITU REMOLDED
rm_comp_tar	target relative compaction, remolded tests		95% std. MDD, 85% std. MDD (ex)
rm_mc_tar	target moisture content, remolded tests		@OMC, @OMC+2%, @OMC-2% (ex)
at_fld_mc	at field moisture content		Y
spec1_no	specimen number, specimen #1		
conf_pr_1_psf	confining pressure, specimen #1	psf	
mc_before1	before test moisture content, specimen #1	percent	
mc_after1_per	after test moisture content, specimen #1	percent	
wden_bef1_pcf	before test wet density, specimen #1	pcf	
wden_aft1_pcf	after test wet density, specimen #1	pcf	
dden_bef1_pcf	before test dry density, specimen #1	pcf	
dden_aft1_pcf	after test dry density, specimen #1	pcf	
strain_f1	strain at failure, specimen #1	percent	
sig3_f_tl1_psf	sigma 3, total, failure, specimen #1	psf	
sig1_f_tl1_psf	sigma 1, total, failure, specimen #1	psf	
spec2_no	specimen number, specimen #2		
conf_pr_2_psf	confining pressure, specimen #2	psf	
mc_before2_per	before test moisture content, specimen #2	percent	
mc_after2_per	after test moisture content, specimen #2	percent	
wden_bef2_pcf	before test wet density, specimen #2	pcf	
wden_aft2_pcf	after test wet density, specimen #2	pcf	
dden_bef2_pcf	before test dry density, specimen #2	pcf	
dden_aft2_pcf:	after test dry density, specimen #2	pcf	
strain_f2	strain at failure, specimen #2	percent	
sig3_f_tl2_psf	sigma 3, total, failure, specimen #2	psf	
sig1_f_tl2_psf	sigma 1, total, failure, specimen #2	psf	
spec3_no	specimen number, specimen #3		
conf_pr_3_psf	confining pressure, specimen #3	psf	
mc_before3_per	before test moisture content, specimen #3	percent	
mc_after3_per	after test moisture content, specimen #3	percent	
wden_bef3_pcf	before test wet density, specimen #3	pcf	
wden_aft3_pcf	after test wet density, specimen #3	pcf	
dden_bef3_pcf	before test dry density, specimen #3	pcf	
dden_aft3_pcf	after test dry density, specimen #3	pcf	
strain_f3	strain at failure, specimen #3	percent	
sig3_f_tl3_psf	sigma 3, total, failure, specimen #3	psf	
sig1_f_tl3_psf	sigma 1, total, failure, specimen #3	psf	
c_phieq_0_deg	cohesion, phi = 0 degrees case	psf	
test_method	test method		ASTM D 2850 (typ)
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: tx_cu pp (Triaxial compression, consolidated, undrained)			
bor_id	boring identification		
sample_no	sample number		
sat_test	saturated test identifier		Y or N
type-test	type of test, in situ or remolded		IN_SITU REMOLDED
rm_comp_tar	target relative compaction, remolded tests		95% std. MDD, 85% std. MDD (ex)
rm_mc_tar	target moisture content, remolded tests		@OMC, @OMC+2%, @OMC-2% (ex)
spec1_no	specimen number, specimen #1		
conf_pr_1_psf	confining pressure, specimen #1	psf	
mc_before1_per	before test moisture content, specimen #1	percent	
mc_after1_per	after test moisture content, specimen #1	percent	
wden_bef1_pcf	before test wet density, specimen #1	pcf	
wden_aft1_pcf	after test wet density, specimen #1	pcf	
dden_bef1_pcf	before test dry density, specimen #1	pcf	
dden_aft1_pcf	after test dry density, specimen #1	pcf	
strain_f1	strain at failure, specimen #1	percent	
sig3_f_tl1_psf	sigma 3, total, failure, specimen #1	psf	
sig1_f_tl1_psf	sigma 1, total, failure, specimen #1	psf	
sig3_f_ef1_psf	sigma 3, effective, failure, specimen #1	psf	
sig1_f_ef1_psf	sigma 3, effective, failure, specimen #1	psf	
del_u_f_1_psf	delta pore pressure, failure, specimen #1	psf	
spec2_no	specimen number, specimen #2		
conf_pr_2_psf	confining pressure, specimen #2	psf	
mc_before2_per	before test moisture content, specimen #2	percent	
mc_after2_per	after test moisture content, specimen #2	percent	
wden_bef2_pcf	before test wet density, specimen #2	pcf	
wden_aft2_pcf	after test wet density, specimen #2	pcf	
dden_bef2_pcf	before test dry density, specimen #2	pcf	
dden_aft2_pcf	after test dry density, specimen #2	pcf	
strain_f2	strain at failure, specimen #2	percent	
sig3_f_tl2_psf	sigma 3, total, failure, specimen #2	psf	
sig1_f_tl2_psf	sigma 1, total, failure, specimen #2	psf	
sig3_f_ef2_psf	sigma 3, effective, failure, specimen #2	psf	
sig1_f_ef2_psf	sigma 3, effective, failure, specimen #2	psf	
del_u_f_2_psf	delta pore pressure, failure, specimen #2	psf	

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Table K-1 - Geotechnical Data Base, Fields, Units and Codes (Continued)

Field Name	Description	Units	Codes/Example/Comments
Table: tx_cu (Triaxial compression, consolidated, undrained) [continued]			
spec3_no	specimen number, specimen #3		
conf_pr_3_psf	confining pressure, specimen #3	psf	
mc_before3_per	before test moisture content, specimen #3	percent	
mc_after3_per	after test moisture content, specimen #3	percent	
wden_bef3_pcf	before test wet density, specimen #3	pcf	
wden_aft3_pcf	after test wet density, specimen #3	pcf	
dden_bef3_pcf	before test dry density, specimen #3	pcf	
dden_aft3_pcf	after test dry density, specimen #3	pcf	
strain_f3	strain at failure, specimen #3	percent	
sig3_f_tl3_psf	sigma 3, total, failure, specimen #3	psf	
sig1_f_tl3_psf	sigma 1, total, failure, specimen #3	psf	
sig3_f_ef3_psf	sigma 3, effective, failure, specimen #3	psf	
sig1_f_ef3_psf	sigma 3, effective, failure, specimen #3	psf	
del_u_f_3_psf	delta pore pressure, failure, specimen #3	psf	
oc_behave	over consolidated behavior flag		
c_eff_psf	cohesion, effective	psf	
phi_eff_deg	friction angle, effective	degrees	
c_tot_psf	cohesion, total	psf	
phi_tot_deg	friction angle, effective	degrees	
test_method	test method		ASTM D 4767 (typ)
source	source of data (code)		PO132 (ex)
initials	initials of person entering data		
qual_level	qa identifier		

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APPENDIX L

UNIT WEIGHTS USED FOR SLOPE STABILITY, CONSOLIDATION SETTELEMENT, AND LIQUEFACTION ANALYSIS

Unit Weights Used for Slope Stability, Consolidation Settlement and Liquefaction Analyses

Soil Type	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Reference / Comments
vegetative soil	100.0	112.3	(Holtz and Kovacs 1981) / saturated value is the maximum of the given range, moist value assumed
sand	125.0	134.2	(Holtz and Kovacs 1981) / saturated value is an average of the range given for sands and gravels, moist value assumed
cobbles	125.0	134.2	(Holtz and Kovacs 1981) / saturated value is an average of the range given for sands and gravels, moist value assumed
pea gravel	125.0	134.2	(Holtz and Kovacs 1981) / saturated value is an average of the range given for sands and gravels, moist value assumed
compacted clay	133.1	145.0	(SAIC 1995) / moist value for average of tests performed on compacted samples, saturated value assummed
brown till	135.7	145.0	(PARSONS 1995b) and (SAIC 1995) / moist value an average from data, saturated value assumed
gray till	143.0	150.0	(PARSONS 1995b) and (SAIC 1995) / moist value an average from data, saturated value assumed
sand and gravel (GMA)	140.0	149.8	(Holtz and Kovacs 1981) / saturated value is the maximum of the given range, moist value assumed
waste materials	112.2-115.0	125.0	(SAIC 1995) / moist value for average of tests performed on compacted samples, saturated value assummed or 85% of the maximum dry density multiplied by one plus the optimum moisture content, saturated value assumed

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