# APPENDIX E
# CLAY LINER TEST PAD DATA

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# APPENDIX E.1
# PHASES I AND II TEST PAD REPORT

89-977

# TEST FILL AND INFILTROMETER TEST RESULTS

## LANDFILL UNIT B-18
## PHASES I AND II AND FINAL CLOSURE

Prepared For:

CHEMICAL WASTE MANAGEMENT, INC. (CWMI)

January 23, 1992

ENVIRONMENTAL SOLUTIONS, INC.

# ENVIRONMENTAL SOLUTIONS, INC.

January 23, 1992

Project No. 89-977

Mr. Robert Henry
Project Manager
Chemical Waste Management, Inc.
35251 Old Skyline Road
Kettleman City, California 93239

Transmittal
Test Fill and Infiltrometer Test Results Report
Landfill Unit B-18
Phases I and II and Final Closure
Kettleman Hills Facility
Kings County, California

Dear Mr. Henry:

Enclosed are 15 copies of the report entitled *Test Fill and Infiltrometer Test Results, Landfill Unit B-18, Phases I and II and Final Closure.*

Field measured permeabilities coupled with laboratory permeability tests indicate that the claystone used for the test fill and proposed for use as the liner/cap provides an adequate low permeability soil layer for the B-18 Landfill, Phases I and II and Final Closure.

We will be pleased to provide any clarifications necessary in response to reviews by the agencies or your staff.

Very truly yours,

Kerry K. Parkinson, P.E.
Civil Engineer (License No. 41021)

KKP:hs
Enclosures

cc: Dick Ellison
Ken Floom
Julio Badel

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# 1.0 INTRODUCTION

1. This report presents the Sealed Double Ring Infiltrometer (SDRI) test results and the geotechnical data associated with the construction of the test fill at the Kettleman Hills Facility (see Figure 1). The purposes of the test fill were to model placement and compaction procedures for the construction of the B-18 Landfill clay liner/cap and to verify that these procedures will achieve the specified compaction and permeability criteria.

2. The objective of the SDRI test is to evaluate the saturated, vertical permeability of the clay liner material to verify that it meets the specification for permeability of less than or equal to $1 \times 10^{-7}$ cm/sec and to assess if laboratory permeability values are comparable to field permeabilities. In this report, the terms permeability and hydraulic conductivity are used interchangeably.

3. The methods used to construct the test fill including field and laboratory testing, are presented in Chapter 2.0. The design and installation of the infiltrometer are described in Chapter 3.0. The theory and data analyses are presented in Chapter 4.0. The results of the test, analyses and conclusions are presented in Chapter 5.0. References are included in Chapter 6.0.

# 2.0 CONSTRUCTION OF THE TEST FILL

1. The test fill was constructed between January 22 and February 1, 1991, at the location shown in Figure 2. The test fill plan, cross section, and detail are presented in Figure 3.

2. Material used as fill consisted of onsite clay hauled from the B-18 Clay Processing Area. Moisture conditioning in conjunction with weathering and particle size reduction were performed in the Clay Processing Area prior to hauling and placement. The procedures used for processing and construction of the test fill are considered similar to those that would be used for the B-18 Landfill.

3. The clay was originally derived from the Stratum 18-8 (claystone) previously characterized during the design phase (see Section 3.5 of the *Engineering and Design Report, Landfill Unit B-18,* August, 1990 [Environmental Solutions, Inc., 1990a]) as a suitable clay source for clay liner construction.

## 2.1 SUBGRADE PREPARATION

1. The area within the test fill was initially cleared of vegetation and loose soil. The surface soils were then graded to form a smooth, firm subgrade surface. Finally, a drainage system consisting of geonet (Polynet 3000) and a layer of geotextile (Trevira 1155) was placed over the subgrade as shown in Figure 3.

## 2.2 EQUIPMENT

1. In order to simulate clay liner/cap construction conditions for Phases I and II and Final Closure, the test fill was constructed using equipment similar to that which would be used during the B-18 Landfill bottom and final closure liner/cap construction. The equipment used and their respective functions are listed in Table 1.

## 2.3 CONSTRUCTION SEQUENCE

1. Initially, a 1-foot thick base lift of clay was placed and compacted to provide protection for the geonet/geotextile drainage system. Then, each of the five lifts comprising the test fill was constructed according to the following steps:

    - Moisture conditioning, weathering, and particle size reduction were performed in the B-18 Clay Processing Area to meet the revised specification from the *Construction Specifications and Quality Assurance Plan, Landfill Unit B-18, Phases I and II, and Final Closure*, which specifies the following:
        - Moisture Content: Within the range defined by the area formed by connecting the following points for the Modified Proctor Compaction curve:
            - 2 to 5 percent above the optimum moisture content for a density equal to 90 percent of the maximum Modified Proctor density.
            - 3 percent above the optimum moisture content at 97 percent of the maximum Modified Proctor density.
            - 1 percent above the optimum moisture content at 98 percent of the maximum Modified Proctor density.
    - This criterion, which allows a lower water content for higher compactive efforts, was established to: (1) assure that both the required strength and permeability characteristics are realized; and (2) provide flexibility for the contractor and CQA engineer to work with a range of water contents without having a clay which is either too wet or dry. This flexibility is desirable in hot, dry areas where exact water content is difficult to control. This specification is represented by the area designated as "Specified Window" in Figure 4.

- The moisture conditioned clay was hauled to the test fill area by a scraper and unloaded in loose lifts approximately 8 inches thick. A motor grader was utilized to smooth the uneven lifts and to maintain a 2 percent slope in the longitudinal direction.
- After the entire test fill area was covered with a loose lift of clay, a Caterpillar 825C compactor made four passes for each lift. Compacted lift thicknesses were approximately 6 inches. Four passes were determined during the initial testing to achieve approximately the minimum specified density of 90 percent of Modified Proctor maximum dry density. The infiltrometer test was performed on a fill compacted near the lower, acceptable dry density to assure that the permeability criteria ($\approx 10^{-7}$ cm/sec) could be achieved for the more conservative, lower density.
- Each lift was tested to verify the as-built moisture content and density.

## 2.4 FIELD AND LABORATORY TESTING

1. Field and laboratory tests were conducted on the test fill to evaluate if the construction equipment and procedures would meet the specifications for compaction and permeability of the clay liner.

2. These tests were performed in accordance with the procedures and frequencies outlined in the following documents:
   - Appendix E (Test Fill and Infiltrometer Test Plan) of the *Engineering and Design Report, Landfill Unit B-18, Phases I and II, and Final Closure* (Environmental Solutions, Inc., 1990a).
   - *Construction Specifications and Quality Assurance Plan, Landfill Unit B-18*, Phases I and II, and Final Closure (Environmental Solutions, Inc., 1990b).

### 2.4.1 FIELD TESTS

1. Initially, the first lift had to be constructed several times until the procedure to achieve the required water content and density was developed. After the appropriate procedure was developed, the moisture density specifications were achieved for the majority of tests.

2. Field density (compaction) tests, consisting of a minimum of two nuclear density tests and one sand cone density test for each lift, were conducted at the locations shown in Figure 3. The compaction test results within the tested zone are shown in Figure 4.

3. The majority of the density tests fall within the lower portion of the specified moisture-density window. Also, except for point 18(5) the tests are within or very close to the specified range. Because point 18(5) has a lower density, its effects on the results, if any, would be in the conservative direction.

2.4.2 LABORATORY TESTS

1. Laboratory tests were conducted on soil samples recovered in six thin-walled Shelby tube samplers collected after the construction of the test fill. These tests include:
   - Atterberg Limits
   - Grain Size Analyses
   - One-Dimensional Swell Test
   - Permeability

   The Shelby Tube sample locations are shown in Figure 3.

2. Atterberg Limits test results are presented in Figure 5. The material consistently had a plasticity in the CH (highly plastic clay) range with liquid limits varying between 65 and 79 percent, and a plasticity index between 44 and 55 percent.

3. Figure 6 shows the grain size distribution determined from the hydrometer tests for the six samples. These data show the relative uniformity of the clay with 80 percent or greater of the soil by weight passing the No. 200 sieve.

4. Appendix A provides a summary table of the One-Dimensional Swell tests. These results indicate that the compacted clay has a high potential to swell with an average swell of 16.5 percent under low confining pressure (70 psf, average value).

5. Laboratory permeability test results are shown in Figure 7 as a function of the initial moisture content. These tests indicate that under laboratory conditions (with applied consolidation pressures from 2.2 ksf to 6.2 ksf to prevent swelling) measured permeability values varied from $1.5 \times 10^{-8}$ cm/sec to $2.8 \times 10^{-10}$ cm/sec. These values, in conjunction with the infiltrometer test results discussed below, provide the basis to conclude that the clay used for the construction of the test fill adequately meets the permeability criterion of $10^{-7}$ cm/sec or less.

# 3.0 INFILTROMETER (SDRI) TEST

1. An SDRI, developed by Trautwein Soil Testing Equipment of Houston, Texas, was used to assess the in situ permeability of the test fill constructed with onsite clay which is to be used for the B-18 Landfill clay liner. Eight tensiometer probes were installed around the inner ring to measure the soil suction. The SDRI test layout is shown in Figure 3. The schematic of the infiltrometer test model is presented in Figure 8. The theory and analysis of the test are described in Section 4.0. A summary of the SDRI system installation and data collection is presented in the following sections.

## 3.1 SDRI DESCRIPTION

1. The SDRI consists of two rings: a fiberglass, 5-feet by 5-feet ring (inner ring) which is positioned in the center of a second aluminum 12-feet by 12-feet ring (outer ring) as shown in Figure 8. The inner ring is sealed over the top to avoid evaporation losses. Both rings are filled with water, and the loss of water from the inner ring is measured periodically. This water loss is the sum of the flow due to infiltration (Qi), filling of pore space due to swelling of the clay (Qs), and volumetric changes of water within the inner ring due to temperature variations. The water head in the inner and outer ring is maintained at a constant level slightly above the top of the inner ring.

## 3.2 SITE PREPARATION AND INSTALLATION

1. The surface of the test fill was prepared for the installation of the SDRI by using a motor grader and a smooth drum roller to level and smooth the upper lift. The entire test fill area was lightly sprayed with water and covered with a black plastic tarp to prevent cracking.

2. The outer ring was positioned on the tarp and its outline was marked on the tarp to locate the trenches for the ring. The outer ring trench was cut with a Ditch Witch Series 1420 to a depth of 18 inches. The inner ring was positioned in the center of the outer ring and its outline was marked. The 5-inch-deep trench for the inner ring was cut by hand using small tools.

3. The outer ring trench was sealed with bentonite pellets surrounding the ring at the bottom and vertical sides. The trench for the inner ring was grouted with viscous Volclay grout.

4. After the installation of both rings was completed, a topographic survey was made to establish the original horizontal and vertical positions of the test fill surface including selected points on and around the inner ring. The primary purpose of the survey was to monitor the amount of swelling during the test.

5. The outer ring was flooded until the inner ring was slightly submerged, then the inner ring was partially filled through one plastic tube while air was removed through a second tube connected to the highest point of the cover. Then, the outer ring was filled to its final depth and the inner ring was topped off. Finally, plastic bags for measuring water flow within the inner ring were installed, and the test commenced.

### 3.3 DATA COLLECTION

1. The volume change of water within the flexible bag (shown in Figure 3) was indicative of the volume of water infiltrating through (the volume of water lost) the inner ring. The volume change was determined by calculating the change in the weight of the bag over a known time period (usually once per day). During the early days of the test, several bags of water were needed to account for higher flow rates due to minor surface desiccation cracking. The infiltration flow rates stabilized after several days. SDRI field data sheets are presented in Appendix B.

## 4.0 THEORY

1. The objective of the infiltrometer test is to measure the saturated permeability of the clay material for the B-18 Landfill under very low confining stresses. The test is performed by measuring the seepage of water through saturated soil.

2. In addition to being driven by the hydraulic gradient caused by the ponded water, seepage of water into the test fill also occurs due to high capillary suction of the partially saturated clay, as opposed to fully saturated conditions associated with laboratory tests. Performance of the field tests must also account for swelling of the clay at low confining stresses, which decreases the compacted density and increases permeability, as opposed to laboratory testing when higher confining stresses preclude swelling of the clay.

3. The saturated permeability is computed using a form of Darcy's Law which includes terms for the total hydraulic gradient. The governing equation that describes the infiltration of water through the compacted clay is developed below, based on the terms and sign convention shown in Figure 8[1]:

$$q = -K\frac{\Delta h}{\Delta L} \quad (1)$$

where:

$q$ = Infiltration rate per unit area and time (L/T)

$K$ = Saturated permeability (L/T)

$\frac{\Delta h}{\Delta L}$ = Total hydraulic gradient (L/L)

$\Delta h = h_1 - h_2$

$\Delta L = z_1 - z_2$

$h$ = Total head

$h = z + \bar{\phi}$

$z$ = Elevation head

$\bar{\phi}$ = Pressure head (due to hydraulic head or soil suction/tension)

In Figure 8, substituting for $\Delta h$ and $\Delta L$, yields the equation:

$$q = -K\left[\frac{(z_1 + \bar{\phi}_1) - (z_2 + \bar{\phi}_2)}{(z_1 - z_2)}\right] \quad (2)$$

For any given wetting front, $L_f = z_1 - z_2$. Substituting this into Equation (2), the infiltration rate at any wetting front is calculated as:

$$q = -K\left[\frac{\bar{\phi}_1}{L_f} - \frac{\bar{\phi}_2}{L_f} + 1\right] \quad (3)$$

4. As shown in Figure 8, at Point 1 the pressure head is equal to the depth of water in the outer ring, $D_f$, with soil suction/tension equal to zero, i.e., the soil is saturated. At this point, the pressure head, $Df = \bar{\phi}_1$. Also, since the clay fill is unsaturated below the wetting front, the in situ pressure head at Point 2 will be equal to the soil suction and negative in sign convention, and can be designated simply as $\bar{\phi}$, i.e., $\bar{\phi} = -\bar{\phi}_2$. Substituting into Equation 3:

$$q = -K\left[\frac{D_f}{L_f} + \frac{\bar{\phi}}{L_f} + 1\right] \quad (4)$$

5. Equation 4 is time dependent. That is, the infiltration flow rate per unit area (q) and the depth of the wetting front ($L_f$) are interrelated and vary with time. As the wetting front advances,

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[1] The minus sign indicates that the flow is in the negative Z-direction (downward).

Equation 4 can be rearranged to calculate permeability at various wetting front depths, determined by tensiometer measurements, as follows:

$$K = -\frac{q}{1 + \frac{D_f}{L_f} + \frac{\bar{\varphi}}{L_f}} \quad (5)$$

The length of the wetting front ($L_f$) is known by noting the depth to which tensiometers indicate moisture content increases. The depth of flooding ($D_f$) is taken as an average value of readings measured during the test. The soil suction ($\bar{\varphi}$) is set equal to the stabilized or weighted soil tension value, measured prior to the passage of the wetting front, and is dependent on the shape of the suction versus time plot. The infiltration rate (q) is determined by weighing the flexible bag periodically to determine the volume of water lost.

6. The measured volume of water lost is corrected to account for swelling of the soil and temperature changes. The total water lost is the sum of the following:

- $Q = Q_i + Q_s + Q_t$ (6)
- $Q$ = measured water loss
- $Q_i$ = flow due to infiltration
- $Q_s$ = flow due to swell
- $Q_t$ = flow due to temperature changes (considered to be insignificant)

7. The infiltration rate per unit area (q) is:

$$q = \frac{Q_i}{A} = \frac{Q - Q_s - Q_t}{A} = \frac{Q - Q_s}{A} \quad (7)$$

A close estimate of $Q_s$ can be obtained by assuming that any volume change that occurs is due to vertical swelling and that the additional volume generated by the swelling is water filling the soil pores. Based on these two assumptions:

$$Q_s = \Delta s \times A \quad (8)$$

where:

$\Delta s$ = amount of swelling (as surveyed) at the time the water front passes a given tensiometer

$A$ = area of inner ring

A plot of total water lost versus time is used to determine the total flow (Q) at the time the wetting front passes the tensiometer.

8. The test procedure and analysis methodology described above is based on the following assumptions:
   - Darcy's Law applies.
   - A sharp wetting front exists between the saturated soil and the unsaturated soil.
   - The measured water loss from the flexible bag represents the water lost due primarily to infiltration through the inner ring, and soil swelling. Changes due to temperature variations are not significant.
   - The test fill is homogeneous and isotropic.
   - Flow through the inner ring is vertically downward.
   - Any volume change that occurs is vertical.
   - The wetting front under the outer ring reaches a given depth $L_f$ at the same time as the wetting front under the inner ring.

9. The first assumption that Darcy's Law applies is valid due to the fact that the ground water flow is laminar when the wetting front reaches the tensiometer tip. The second assumption of a sharp wetting front is valid early during the test. At later times a transition zone between the saturated and partially-saturated soil is likely to exist.

10. The assumption concerning the measured water loss is based on the fact that the inner ring is completely purged of air; additional volume generated by swelling is water filling the soil pores, and water temperature variations are relatively small due to measuring flow volumes at similar times each day of the test. Considering that the fill was placed under controlled conditions, the assumptions that the test fill is homogeneous and isotropic is appropriate.

11. The assumption that any volume change that occurs is vertical is based on the very low magnitude of the confining stresses in the upper 18 inches of the test fill. There are practically no constraints for vertical swelling.

12. The assumption of vertical flow through the inner ring is based on the fact that an equal head is maintained between the inner and outer ring, and as a result the only driving force is vertically downward. This basis, in effect, also assumes that the wetting fronts for the inner and outer rings advance at the same rate, which would eliminate the possibility of soil suction causing lateral movement.

13. The last assumption is necessary due to the fact that the sealed inner ring apparatus precludes the installation of soil tensiometers under the inner ring to monitor the advance of the wetting front within the inner ring.

# 5.0 SDRI TEST RESULTS AND CONCLUSIONS

1. The infiltrometer test was conducted over a period of approximately two months to evaluate the permeability of the upper 18 inches of test fill. Based on the tensiometer readings (Figures 9 and 10), the wetting front (zone of saturation) reached depths of 12 and 18 inches in about 18 and 53 days, respectively. The tensiometers installed at a depth of 6 inches were damaged by wind and consequently no readings were taken at this depth as originally intended.

2. Figure 11 presents the accumulated total water flow, Q, as a function of time. The initial flow rate over the time interval of 0 to 5,000 minutes was about two times the average flow rate that occurred during saturation of the top 12 inches. This higher flow rate was likely due to water filling small surface cracks/voids. This condition was accounted for in determining the rate of flow.

3. Table 2 summarizes the survey data indicating the swell of the test fill soil, when the wetting front had reached 12 and 18 inches, respectively. Table 2 also shows the calculated flow due to swell (Qs) for these periods.

4. The suction pressure for both sets of tensiometers (Figures 9 and 10) was approximately 70 centibars, or 280 inches of water pressure.

5. The results of the infiltrometer test using Equation 5 are summarized in Table 3. The field measured permeabilities for both the 0- to 12-inches and 0- to 18-inches increments are less than $1 \times 10^{-7}$ cm/sec. Based on these results, coupled with the laboratory permeability tests, it is concluded that the claystone, used for the test fill and proposed for use as the liner/cap, provides an adequate low permeability soil layer for the B-18 Landfill.

6. The test fill results are one to two orders of magnitude higher than laboratory permeabilities. These differences are expected and are primarily due to the unrestrained swelling of the clay which occurs during field testing (Chen and Yamamoto, 1987). The low hydraulic conductivity measured in the laboratory is a function of the consolidation pressure used in the test to prevent swelling. This consolidation pressure simulates the effect of the waste fill overburden on the clay liner. The SDRI test is more indicative of the stress condition for the cover system (very low confining stresses).

# 6.0 REFERENCES

Chen, Hsien W. and Leonard O. Yamamoto. *Permeability Tests for Hazardous Waste Management Unit Clay Liners, Proceedings of Geotechnical and Geohydrologic Aspects of Waste Management;* 1987.

Environmental Solutions, Inc., 1990a. *Engineering and Design Report, Landfill Unit B-18, Phases I and II and Final Closure, Kettleman Hills Facility, Kings County, California,* August 1990.

Environmental Solutions, Inc., 1990b. *Construction Specifications and Quality Assurance Plan, Landfill Unit B-18, Phases I and II and Final Closure, Kettleman Hills Facility, Kings County, California*, September 24, 1990.

Golder Associates. *Test Fill and Infiltrometer Test Results, Landfill B-19, Phase IA, Kettleman Hills Facility, Kettleman City, California*, January 1987.

Trautwein Soil Testing Equipment. *Installation and Operating Instruction for the Sealed-Double Ring Infiltrometer,* March 1989.

# TABLE 1

## EQUIPMENT UTILIZED IN THE TEST FILL CONSTRUCTION

| EQUIPMENT | FUNCTION |
|---|---|
| Caterpillar D8N Dozer | Grading test fill |
| Caterpillar 14G Motor Grader | Grading test fill; scarifying previous lifts |
| Caterpillar 631E Scraper | Hauling clay from B-18 Clay Processing Area |
| Caterpillar 825C Compactor | Compacting lifts; |
| Ingersoll-Rand SP-56 Smooth Drum Roller | Dressing test fill |
| Water Truck | Moisture conditioning |

89-977 (1/23/92/hs)

# TABLE 2

## ESTIMATE OF SWELL FLOW VOLUME

| TEST INTERVAL | AVERAGE SURVEYED VERTICAL SWELLING (ft) | AREA OF TEST ($ft^2$) | SWELL FLOW VOLUME (cc) |
|---|---|---|---|
| 0 to 12 inches | 0.17 | 25 | 120,300 |
| 0 to 18 inches | 0.20 | 25 | 141,600 |

89-977 (1/9/92/mg)

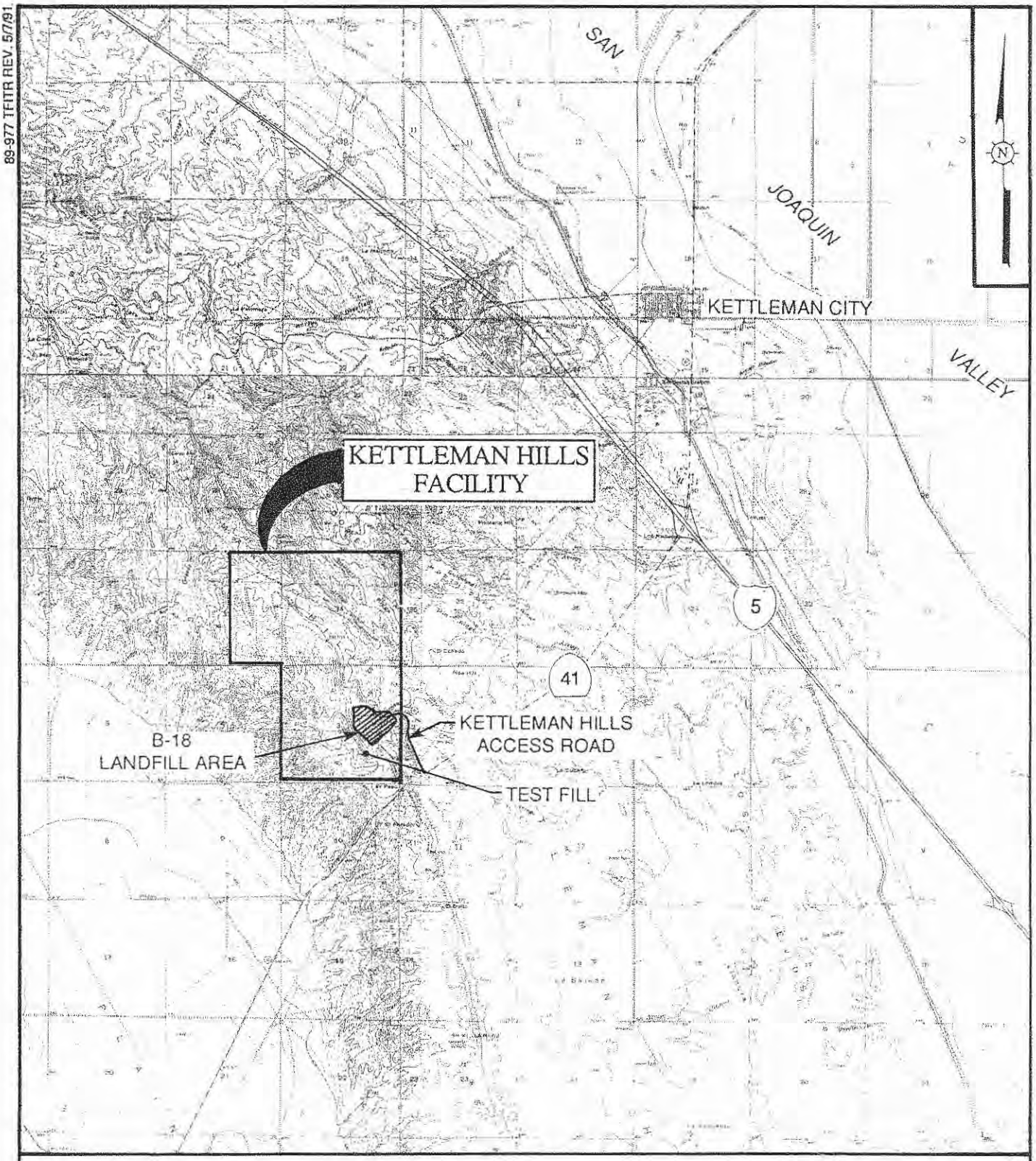
# TABLE 3

# INFILTROMETER TEST RESULTS

| TEST INTERVAL | CUMULATIVE WATER LOSS Q (cc) | FLOW DUE TO SWELL $Q_s$ (cc) | FLOW DUE TO INFILTRATION $Q_i$ (cc) | INFILTRATION RATE PER UNIT AREA q (cm/sec) | DEPTH OF WATER IN OUTSIDE RING $D_f$ (in) | DEPTH OF WETTED FRONT $L_f$ (in) | SUCTION PRESSURE $\phi$ (in of $H_2O$) | $K = -\frac{q}{1 + \frac{D_f}{L_f} + \frac{\phi}{L_f}}$ (cm/sec) |
|---|---|---|---|---|---|---|---|---|
| **DEPTH: 0 to 12 INCHES**<br>Tensiometers: TN-2, TN-3, TN-6, TN-7<br>Total Swelling: 1.98 inches<br>% of Swelling - Field: 17.0<br>% of Swelling - Lab: 16.5 | 180,000 | 120,300 | 59,700 | $1.3 \times 10^{-6}$ | 15 | 12 | 280 | $5.1 \times 10^{-8}$ |
| **DEPTH: 0 to 18 INCHES**<br>Tensiometers: TN-4, TN-5<br>Total Swelling: 2.40 inches<br>% of Swelling - Field: 13.3<br>% of Swelling - Lab: 16.5 | 280,000 | 141,600 | 140,400 | $1.20 \times 10^{-6}$ | 15 | 18 | 280 | $6.9 \times 10^{-8}$ |

89-977 (1/9/92/mg)

89-977 TFITR REV. 5/7/91




0 4000 8000 FEET

SCALE

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP OF LA CIMA, DATED 1963, PHOTOREVISED 1971, LOS VIEJOS, DATED 1954, PHOTOREVISED 1981, KETTLEMAN CITY, DATED 1963, PHOTOREVISED 1981, AND KETTLEMAN PLAIN, CALIFORNIA, DATED 1953, PHOTOINSPECTED 1978.

FIGURE 1

## SITE VICINITY MAP

LANDFILL UNIT B-18
KETTLEMAN HILLLS FACILITY

**ENVIRONMENTAL SOLUTIONS, INC.**

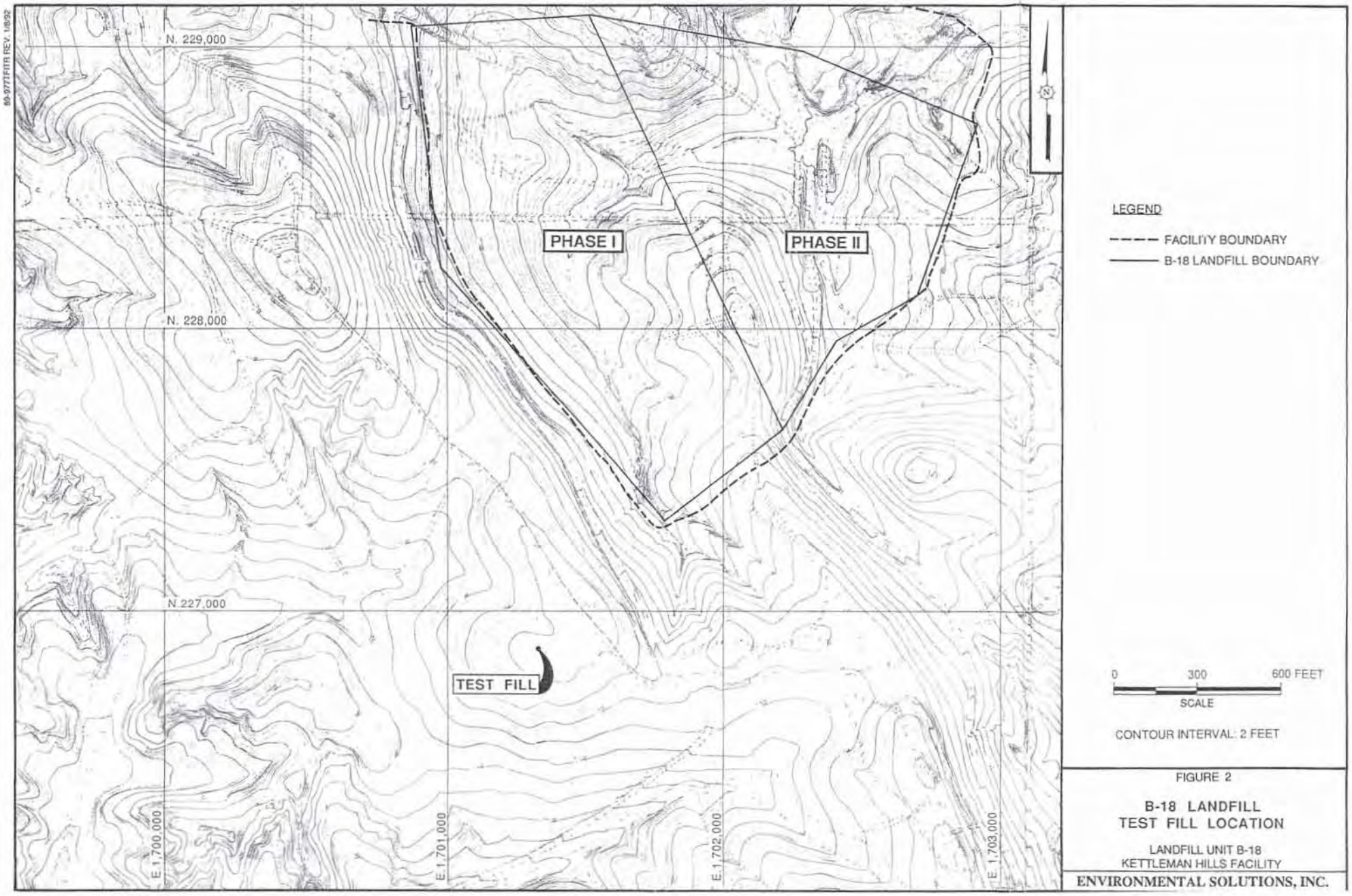



FIGURE 2

**B-18 LANDFILL**
**TEST FILL LOCATION**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.

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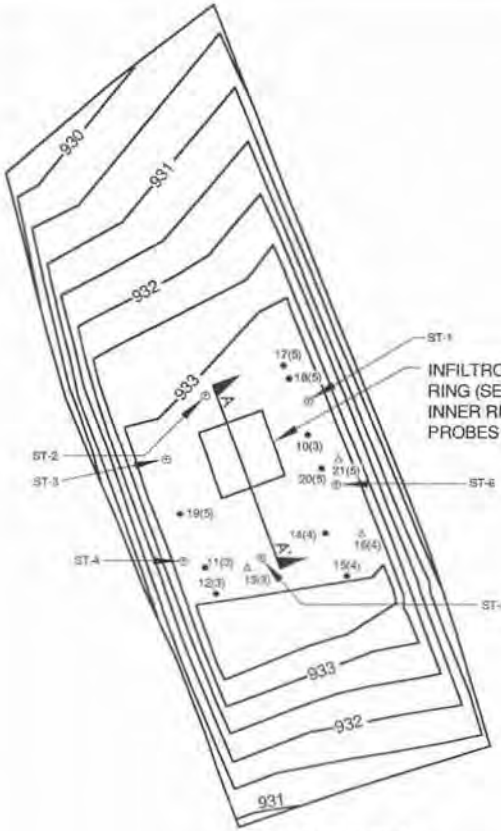



**TEST FILL PLAN**

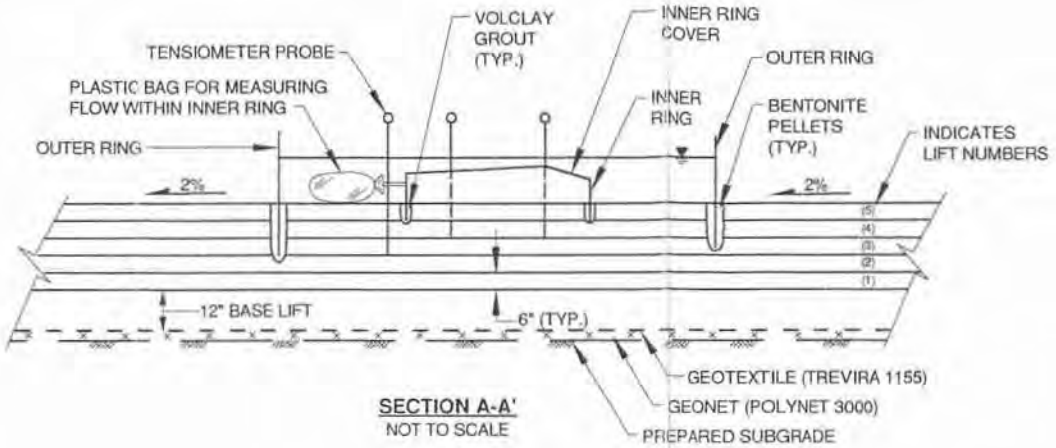
0 20 40 FEET
SCALE

LEGEND

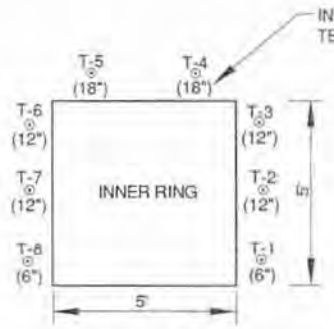
4(5) • NUCLEAR DENSITY TEST LOCATION
- LIFT NUMBER
- TEST NUMBER

7(3) △ SAND CONE DENSITY TEST LOCATION
- LIFT NUMBER
- TEST NUMBER

ST-6 ⊙ SHELBY TUBE SAMPLE LOCATION AND NUMBER




**SECTION A-A'**
NOT TO SCALE



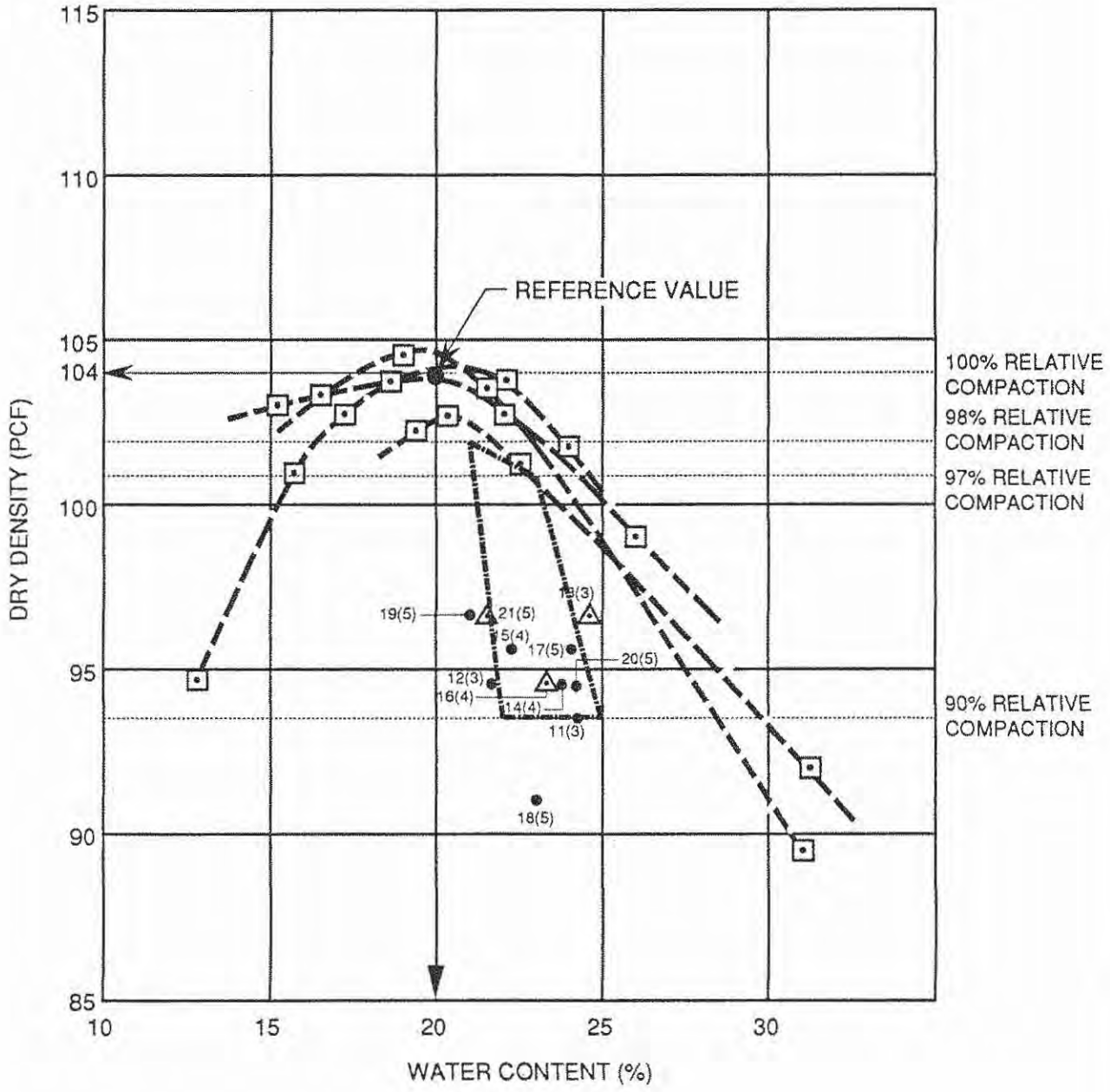

**DETAIL 1**
TENSIOMETER PROBES LAYOUT

FIGURE 3

**TEST FILL PLAN, CROSS SECTION AND DETAIL**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.




LEGEND

18(5) — NUCLEAR DENSITY TEST
LIFT NUMBER
TEST NUMBER

16(4) — SAND CONE TEST
LIFT NUMBER
TEST NUMBER

MODIFIED PROCTOR (ASTM DI557-78) COMPACTION POINTS

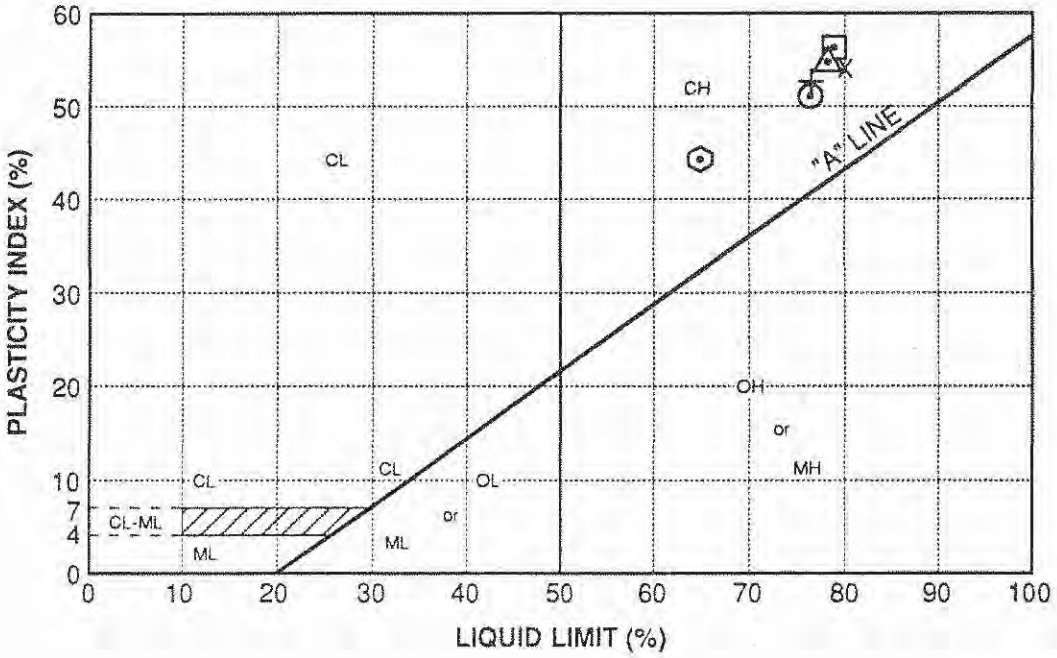
SPECIFIED MOISTURE-DENSITY WINDOW USED FOR CONSTRUCTION CONTROL

FIGURE 4

**COMPACTION DATA**
**TEST FILL**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.




| SYMBOL | SHELBY TUBE NO. | LIQUID LIMIT(%) | PLASTICITY INDEX (%) | SOIL TYPE (USCS SOIL CLASSIFICATION) |
|---|---|---|---|---|
| △ | ST-1 | 78 | 54 | OLIVE CLAY (CH) |
| ⊙ | ST-2 | 76 | 51 | OLIVE CLAY (CH) |
| X | ST-3 | 79 | 54 | OLIVE CLAY (CH) |
| ⊡ | ST-4 | 79 | 55 | OLIVE CLAY (CH) |
| + | ST-5 | 76 | 52 | OLIVE CLAY (CH) |
| ⬡ | ST-6 | 65 | 44 | OLIVE CLAY (CH) |

FIGURE 5

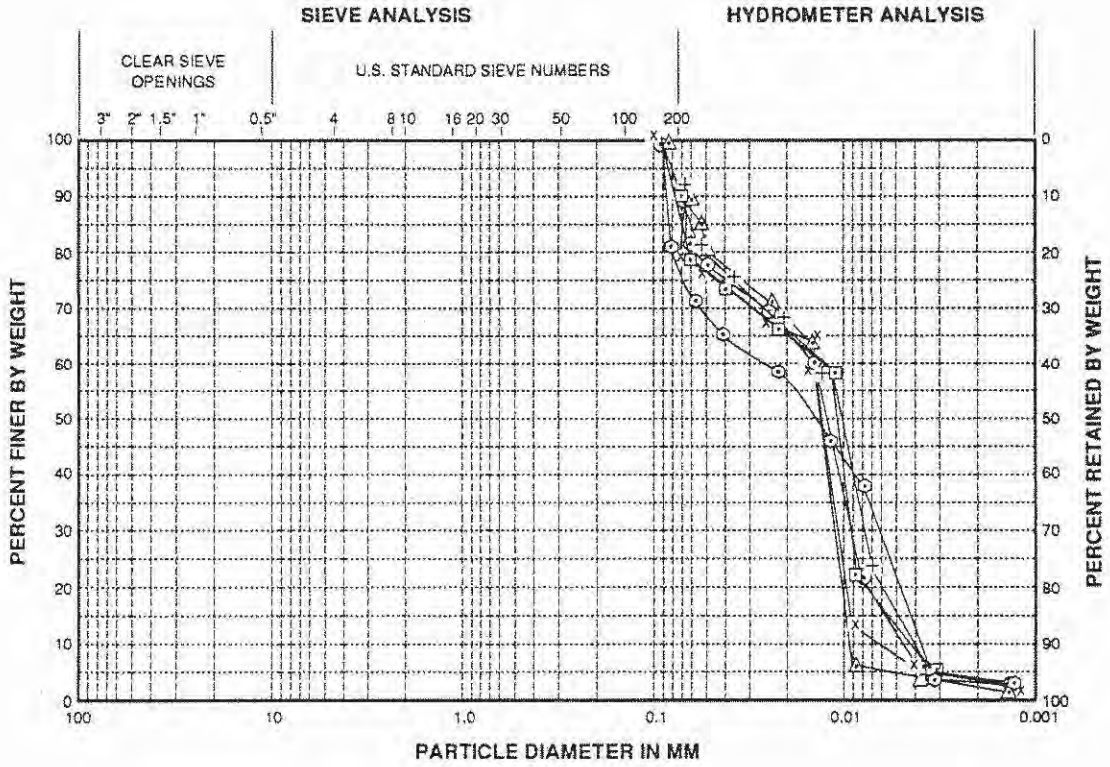
**ATTERBERG LIMIT TEST FILL SOIL**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.

89-977/TFITR-09 REV. 1/8/92

| SYMBOL | SAMPLE NO. | LIQUID LIMIT(%) | PLASTICITY INDEX (%) | SOIL TYPE |
|---|---|---|---|---|
| △ | ST-1 | 78 | 54 | OLIVE CLAY (CH) |
| ⊙ | ST-2 | 76 | 51 | OLIVE CLAY (CH) |
| X | ST-3 | 79 | 54 | OLIVE CLAY (CH) |
| ⊡ | ST-4 | 79 | 55 | OLIVE CLAY (CH) |
| + | ST-5 | 76 | 52 | OLIVE CLAY (CH) |
| ⬡ | ST-6 | 65 | 44 | OLIVE CLAY (CH) |



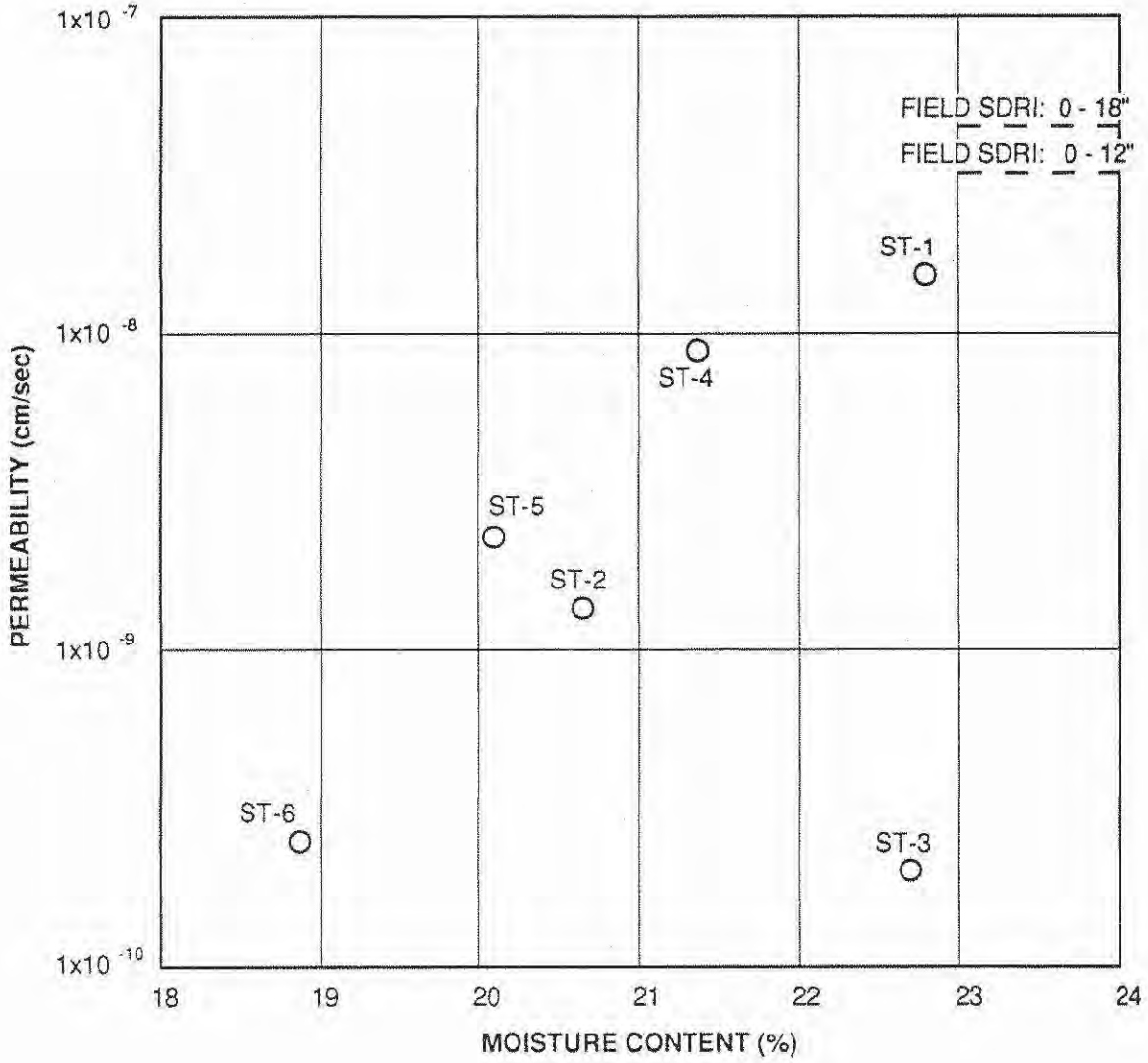

| COBBLES | GRAVEL | | SAND | | | SILT AND CLAY FRACTION |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

FIGURE 6

**GRAIN SIZE DISTRIBUTION**
**TEST FILL SOIL**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.




LEGEND

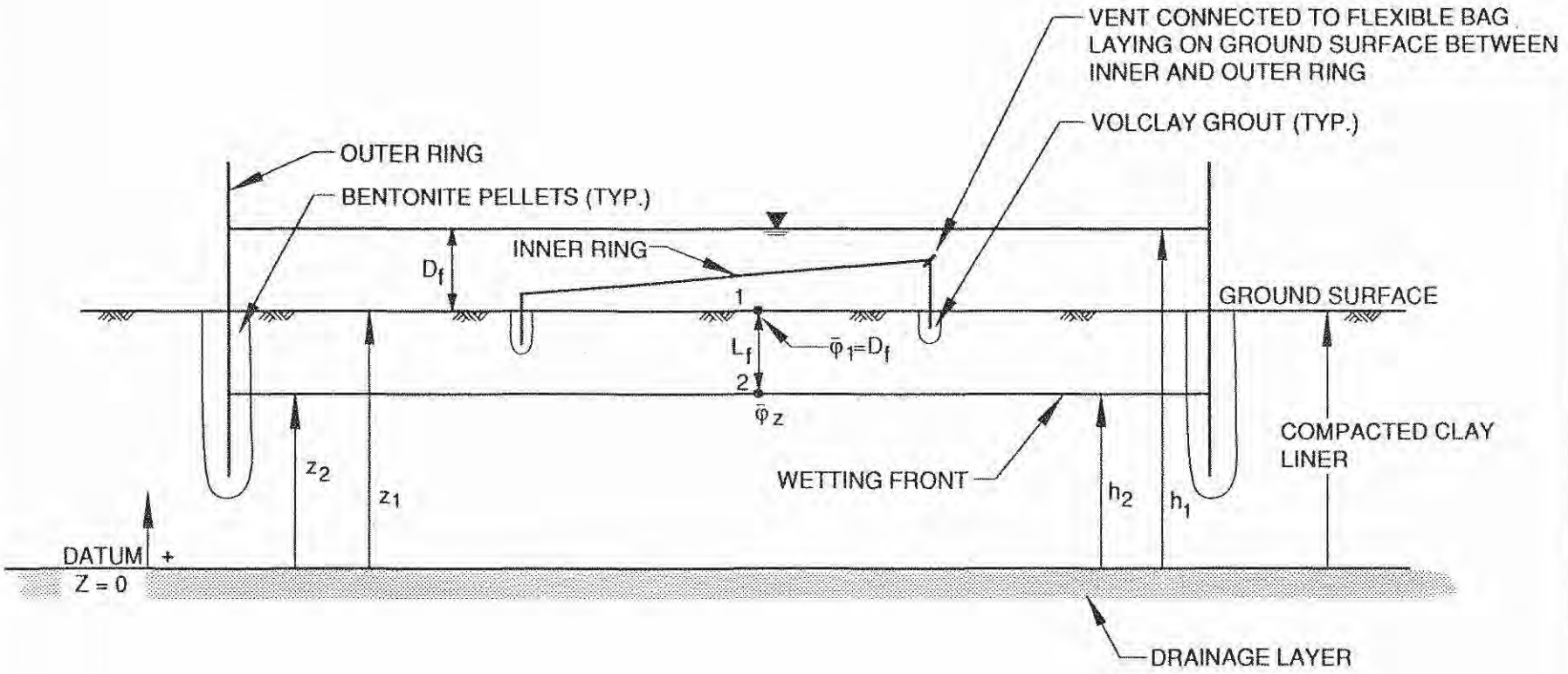
ST-2 ○ LABORATORY PERMEABILITY AND SAMPLE NUMBER

FIGURE 7

**LABORATORY PERMEABILITY VERSUS WATER CONTENT**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.



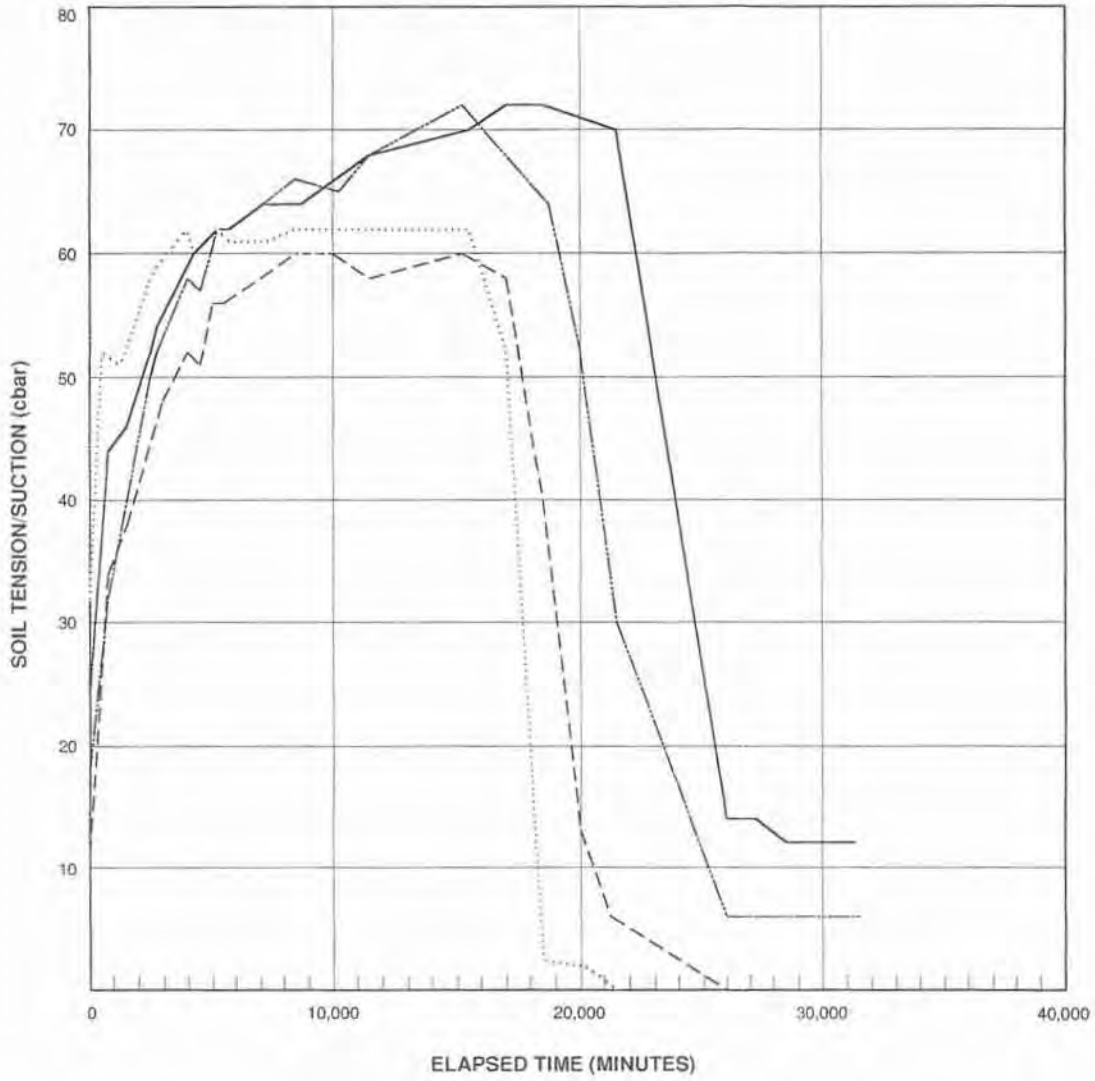

NOT TO SCALE

FIGURE 8

**SCHEMATIC OF INFILTROMETER TEST MODEL**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

**ENVIRONMENTAL SOLUTIONS, INC.**




LEGEND

TN-2

TN-3

TN-6

TN-7

FIGURE 9

12-INCH SOIL TENSION/SUCTION VERSUS TIME

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.

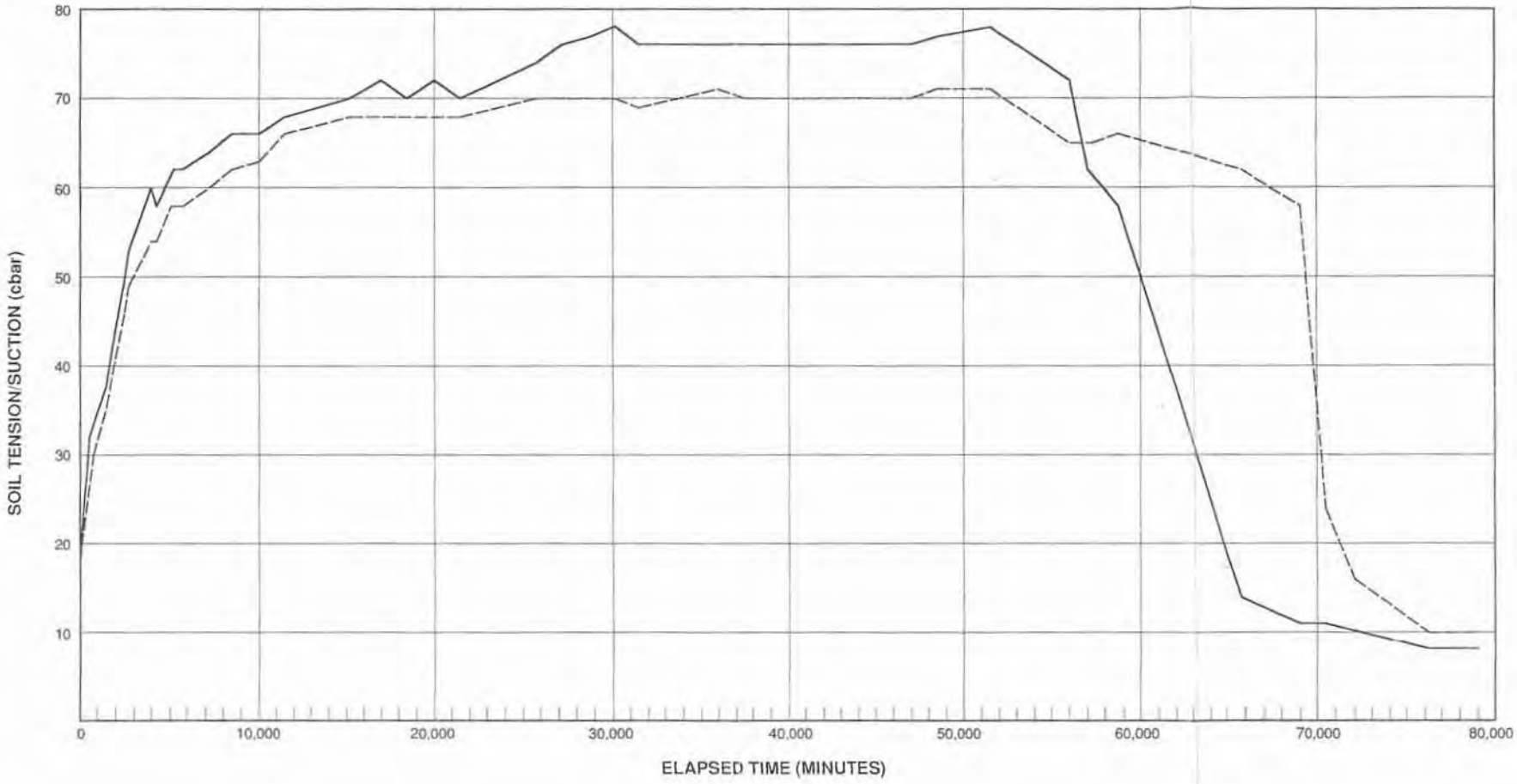
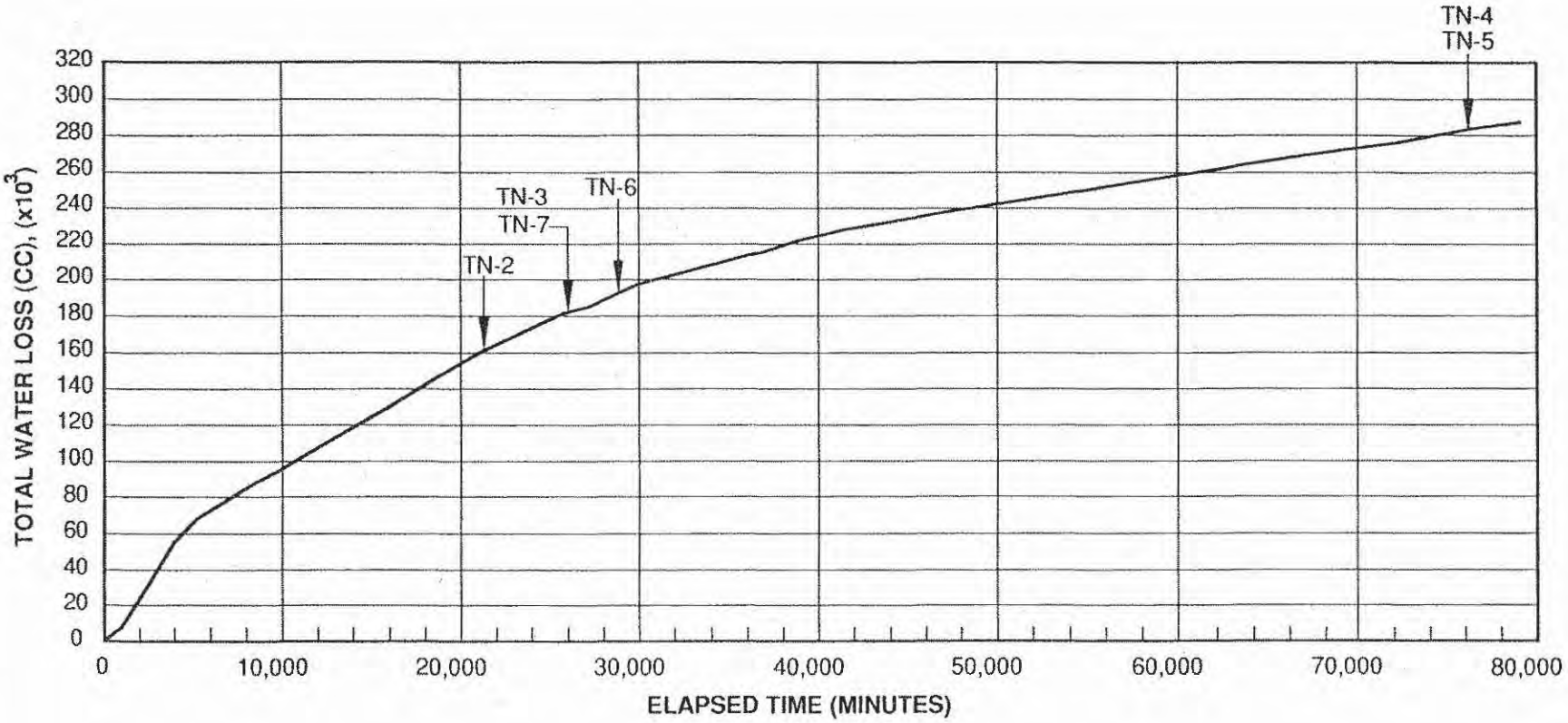



FIGURE 10

**18-INCH SOIL TENSION/SUCTION VERSUS TIME**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

ENVIRONMENTAL SOLUTIONS, INC.




LEGEND

TN-2 ↓ THE TIME WHEN THE TENSIOMETER INDICATED A SATURATED SOIL CONDITION EXISTED.

FIGURE 11

**INFILTRATION VERSUS TIME**

LANDFILL UNIT B-18
KETTLEMAN HILLS FACILITY

**ENVIRONMENTAL SOLUTIONS, INC.**

# APPENDIX A

# ONE-DIMENSIONAL SWELL TEST RESULTS

# ONE DIMENTIONAL SWELL TEST

ASTM 4546-85

Project Name: B-18 Landfill
Project No.: 89-977H
Tested By: GH Date: 03/08/91
Input Checked By: GH Date: 03/13/91
Reviewed By: [illegible] Date: 4/5/91

| | | | | | | |
|---|---|---|---|---|---|---|
| Vertical Stress (psi): | 0.470 | 0.467 | 0.467 | 0.468 | 0.465 | 0.464 |
| Frame No.: | 1 | 2 | 3 | 4 | 5 | 6 |
| Sample No.: | ST-1 | ST-2 | ST-3 | ST-4 | ST-5 | ST-6 |
| Depth (ft): | --- | --- | --- | --- | --- | --- |
| Liquid Limit (LL): | 78 | 76 | 79 | 79 | 76 | 65 |
| Plasticity Index (PI): | 54 | 51 | 54 | 55 | 52 | 44 |

| WATER CONTENT | Trim | Final | Trim | Final | Trim | Final | Trim | Final | Trim | Final | Trim | Final |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wet Wt.+Tare (gm): | 219.35 | 309.43 | 284.96 | 316.34 | 175.14 | 264.93 | 150.53 | 294.07 | 143.39 | 271.65 | 208.92 | 315.20 |
| Dry Wt.+Tare (gm): | 194.56 | 253.75 | 248.23 | 261.60 | 158.94 | 211.22 | 140.33 | 238.76 | 133.51 | 219.52 | 187.15 | 262.55 |
| Wt. of Tare (gm): | 92.08 | 114.49 | 91.99 | 126.32 | 89.76 | 76.62 | 90.16 | 105.23 | 92.18 | 81.31 | 89.82 | 115.62 |
| Moisture Content (%): | 24.19 | 39.98 | 23.51 | 40.46 | 23.42 | 39.90 | 20.33 | 41.42 | 23.91 | 37.72 | 22.37 | 35.83 |

| DENSITY AND SATURATION | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wet Soil+Tare (gm): | 1141.40 | 309.43 | 1130.70 | 316.34 | 1132.40 | 264.93 | 1131.00 | 294.07 | 1140.20 | 271.65 | 1148.70 | 315.20 |
| Ring/Tare (gm): | 967.30 | 114.49 | 962.60 | 126.32 | 966.20 | 76.62 | 969.00 | 105.23 | 969.30 | 81.31 | 970.80 | 115.62 |
| Wet Soil (gm): | 174.10 | 194.94 | 168.10 | 190.02 | 166.20 | 188.31 | 162.00 | 188.84 | 170.90 | 190.34 | 177.90 | 199.58 |
| Moisture Content (%): | 25.02 | 39.98 | 24.26 | 40.46 | 23.48 | 39.90 | 21.32 | 41.42 | 23.65 | 37.72 | 21.08 | 35.83 |
| Dry Soil (gm): | 139.26 | 139.26 | 135.28 | 135.28 | 134.60 | 134.60 | 133.53 | 133.53 | 138.21 | 138.21 | 146.93 | 146.93 |
| Length of Sample (in): | 0.8750 | 1.0323 | 0.8750 | 1.0270 | 0.8750 | 1.0035 | 0.8750 | 1.0291 | 0.8750 | 0.9995 | 0.8750 | 1.0243 |
| Diameter of Sample (in): | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 | 2.870 |
| Volume of Sample (c.c.): | 92.760 | 109.436 | 92.760 | 108.874 | 92.760 | 106.383 | 92.760 | 109.097 | 92.760 | 105.959 | 92.760 | 108.588 |
| Wet Density (PCF): | 117.1 | 111.2 | 113.1 | 108.9 | 111.8 | 110.5 | 109.0 | 108.0 | 115.0 | 112.1 | 119.7 | 114.7 |
| Dry Density (PCF): | 93.7 | 79.4 | 91.0 | 77.5 | 90.5 | 79.0 | 89.8 | 76.4 | 93.0 | 81.4 | 98.8 | 84.4 |
| Specific Gravity : | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 |
| Volume of Solids (%): | 55.60 | 47.13 | 54.01 | 46.02 | 53.74 | 46.86 | 53.32 | 45.33 | 55.18 | 48.31 | 58.67 | 50.11 |
| Volume of Liquid (%): | 37.56 | 50.88 | 35.38 | 50.28 | 34.07 | 50.49 | 30.69 | 50.70 | 35.24 | 49.20 | 33.39 | 48.49 |
| Volume of Air (%): | 6.84 | 1.99 | 10.60 | 3.70 | 12.19 | 2.65 | 15.99 | 3.97 | 9.57 | 2.49 | 7.95 | 1.40 |
| Deg.of Saturation (%): | 84.60 | 96.24 | 76.94 | 93.14 | 73.65 | 95.01 | 65.74 | 92.74 | 78.64 | 95.18 | 80.77 | 97.20 |

| SUMMARY | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moisture Content (%): | 25.02 | 39.98 | 24.26 | 40.46 | 23.48 | 39.90 | 21.32 | 41.42 | 23.65 | 37.72 | 21.08 | 35.83 |
| Dry Density (PCF): | 93.7 | 79.4 | 91.0 | 77.5 | 90.5 | 79.0 | 89.8 | 76.4 | 93.0 | 81.4 | 98.8 | 84.4 |
| Deg.of Saturation (%): | 84.60 | 96.24 | 76.94 | 93.14 | 73.65 | 95.01 | 65.74 | 92.74 | 78.64 | 95.18 | 80.77 | 97.20 |
| Final Swell (%): | | 17.98 | | 17.37 | | 14.69 | | 17.61 | | 14.23 | | 17.06 |

Note: 1. Specific gravity is assumed. 2. Demineralized water used.

APPENDIX B

SDRI FIELD DATA SHEETS

**Chemical Waste Management, Inc.**
Post Office Box 471
Kettleman City, California 93239
209 386-9711

# TRANSMITTAL LETTER

To Environmental Solutions, Inc
21 Technology Drive
Irvine, CA 92718
ATTN: Julio Badel

Date 3/28/91
Project No. 89-03

Sent by

- ☒ Mail
- ☐ Air Freight
- ☐ Hand Carried
- ☐ Under Separate Cover
- ☐ Enclosed

| Quantity | Item | Description |
|---|---|---|
| 4 | B-18 Test Cell Field Data Sheets | (2) Originals<br>(2) Copies |

Remarks

Per Vien Perez

Initial 3'

| | STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| TH | 1/31/91 | VOP/JB | 13°C | 15' | 1637 | (2/1) 0745 | 15.1 | 3711 *5 | 133 | | 3.0 | 3.0 | 3.0 | 3.0 |
| | | | | | | | | 3758 *2 | 137 | 7199 | | | | |
| FQ | 2/1/91 | VOP/JB | 11°C | 15" | 0745 | (2/1) 1615 | 8.5 | 3749 *6 | 103 | | 3.5 | 3.0 | 3.5 | 3.6 |
| | | | | | | | | 3923 *4 | 132 | 7437 | | | | |
| FQ | 2/1/91 | VOP/RAG | 13° | 15" | 1615 | (2/2) 0845 | 16.6 | 4237 *12 | 151 | | | | | |
| | | | | | | | | 4269 *11 | 155 | | | | | |
| | | | | | | | | 3842 *1 | 120 | | | | | |
| | | | | | | | | 3937 *3 | 125 | 15733 | | | | |
| SAT | 2/2/91 | VOP | 11°C | 15" | 0850 | 1540 | 6.9 | 1300 *9 | 129 | | 2.9 | 2.94 | 2.98 | 2.9 |
| | | | | | | | | 1315 *10 | 120 | | | | | |
| | | | | | | | | 3950 *7 | 212 | | | | | |
| | | | | | | | | 3943 *5 | 170 | 9877 | | | | |
| SAT | 2/2/91 | VOP | 11°C | 15" | 1545 | (2/3) 0945 | 18.1 | 4198 *6 | 345 | | 2.9 | 2.94 | 2.98 | 2.9 |
| | | | | | | | | 4201 *4 | 265 | | | | | |
| | | | | | | | | 4246 *3 | 321 | | | | | |
| | | | | | | | | 4086 *1 | 314 | 15486 | | | | |
| SUN | 2/3/91 | VOP | | 15" | 0950 | (2/3) 1535 | 5.9 | 1421 *8 | 1243 | | 2.89 | 2.92 | 2.97 | 2.9 |
| | | | | | | | | 1362 *10 | 1116 | | | | | |
| | | | | | | | | 4164 *11 | 2480 | | | | | |
| | | | | | | | | 4339 *12 | 2512 | 3935 | | | | |

JOB NO. 89-03 PROJECT B-18 Infiltrometer

# INFILTROMETER FIELD DATA

Condux P...
932.94

②

| STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| SUN 2/3/91 | VOP | 13°C | 15" | 1540 | (2/4) 0705 | 15.5 | 45006 #3 | 22000 | | 936.03 | 936.11 | 936.38 | 936.28 |
| | | | | | | | 4161 #5 | 1935 | | | | | |
| | | | | | | | 4158 #2 | 2890 | | | | | |
| | | | | | | | 4202 #6 | 1754 | 8248 | | | | |
| MON 2/4/91 | VOP | 11°C | 15" | 0710 | (2/4) 1640 | 9.5 | 1421 #8 | 1217 | | 2.88 | 2.92 | 2.96 | 2.9 |
| | | | | | | | 1400 #9 | 1119 | | | | | |
| | | | | | | | 4377 #1 | 2218 | | | | | |
| | | | | | | | 4113 #4 | 2384 | 4343 | | | | |
| MON 2/4/91 | VOP | 14°C | 15" | 1643 | (2/5) 1550 | 23.2 | 4160 #5 | 1912 | | 2.88 | 2.92 | 2.96 | 2.9 |
| | | | | | | | 4421 #6 | 2292 | | | | | |
| | | | | | | | 4308 #11 | 1295 | | | | | |
| | | | | | | | 4084 #12 | 1949 | 7448 | | | | |
| TUE 2/5/91 | VOP | 15°C | 15" | 1555 | (2/6) 1430 | 22.7 | 1377 #9 | 677 | | | | | |
| | | | | | | | 1367 #0 | 947 | | | | | |
| | | | | | | | 3993 #2 | 924 | | | | | |
| | | | | | | | 4694 #3 | 1155 | 7730 | | | | |
| WED 2/6/91 | VOP | 14°C | 15" | 1435 | (2/7) 1600 | 25.4 | 1416 #8 | 1167 | | 2.74 | 2.81 | 2.75 | 2.75 |
| | | | | | 1600 | | 4372 #1 | 2510 | | | | | |
| | | | | | 1600 | | 4263 #4 | 1623 | | | | | |
| | | | | | 1600 | | 4195 #6 | 1463 | 7483 | | | | |

JOB NO. 89-03 PROJECT B-18 Infiltrometer

# INFILTROMETER FIELD DATA

| | STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| TH | 2/7/91 | VOP | 19.6°C | 15" | 1600 | (2-8) 1625 | 24.5 | 1402 *9 | 1049 | | | | | |
| | | | | | 1600 | | | 4288 *12 | 1337 | | | | | |
| | | | | | 1600 | | | 4589 *15 | 2059 | | | | | |
| | | | | | 1600 | | | 4826 *11 | 1490 | 9175 | | | | |
| FR | 2/8/91 | VOP | 16.0°C | 14.9" | 1630 | (2-11) 0827 | 64.1 | 4269 *2 | 456 | | 2.74 | 2.73 | 2.78 | 2.76 |
| | | | | | | | | 4571 *4 | 387 | | | | | |
| | | | | | | | | 4437 *1 | 459 | | | | | |
| | | | | | | | | 4725 *3 | 457 | | | | | |
| | | | | | | | | 4224 *6 | 401 | | | | | |
| | | | | | | | | 1492 *8 | 252 | 21308 | | | | |
| MO | 2/11/91 | VOP | 12°C | 14.9" | 0834 | 2-12 1145 | 27.2 | 1311 *10 | 1068 | | 2.74 | 2.73 | 2.79 | 2.76 |
| | | | | | | | | 4421 *12 | 762 | | | | | |
| | | | | | | | | 4627 *11 | 1083 | | | | | |
| | | | | | | | | 4370 *5 | 903 | 10913 | 2.84 | 2.73 | 2.88 | 2.75 |
| TUE | 2/12/91 | VOP | 19.4°C | 14.8" | 1150 | (2-13) 1407 | 26.3 | 4363 *1 | 1030 | | | | | |
| | | | | | | | | 4327 *6 | 1048 | | | | | |
| | | | | | | | | 4100 *2 | 1587 | | | | | |
| | | | | | | | | 1418 *8 | 1077 | 9466 | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

JOB NO. 89-03 PROJECT B-18 Infiltrometer

INFILTROMETER FIELD DATA

| STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| WED 2/13/91 | VOP | 16°C | 14.8" | ~~1407~~ | (2-14) 1442 | 24.6 | 1366 #9 | 951 | | 2.72 | 2.73 | 2.8 | 2.73 |
| | | | | | | | 4304 #11 | 9004 | | | | | |
| | | | | | | | 4722 #4 | 1981 | | | | | |
| | | | | | | | 4973 #3 | 29000 | 8626 | | | | |
| TH 2/14/91 | VOP | 16.5°C | 14.75" | 1442 | (2-15) 1430 | 23.8 | 4367 #1 | 1338 | | 2.71 | 2.73 | 2.82 | 2.69 |
| | | | | | | | 4725 #5 | 1536 | | | | | |
| | | | | | | | 1398 #8 | 1124 | | | | | |
| | | | | | | | 1347 #10 | 1123 | 6716 | | | | |
| FR 2/15/91 | VOP | 16°C | 14.75" | 1430 | (2-18) 1450 | 72.3 | 4803 #4 | 1189 | | 2.64 | 2.6 | 2.79 | 2.57 |
| | | | | | | | 4617 #3 | 1874 | | | | | |
| | | | | | | | 5060 #11 | 10416 | | | | | |
| | | | | | | | 5481 #12 | 1246 | | | | | |
| | | | | | | | 4531 #6 | 2100 | | | | | |
| | | | | | | | 4504 #2 | 2115 | 9,426 | | | | |
| MON * 2/18/91 | VOP | 14°C | 13.8" | 1450 | (2-19) 1510 | 24.4 | 1414 #8 | 212 | | - | - | - | - |
| | | | | | | | 1386 #10 | 1109 | | | | | |
| | | | | | | | 4771 #5 | 2476 | | | | | |
| | | | | | | | 4747 #1 | 1622 | 5899 | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Wind pull down wires, unable to measure swell data

JOB NO. 89-03 PROJECT ~~B-18~~ Landfill Infiltrometer

INFILTROMETER FIELD DATA

| STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| TUE 2/19/91 | VOP | 16°C | 13.8" | 1510 | (2-20) 1351 | 22.6 | 4537 *6 | 2997 | | - | - | - | - |
| | | | | | | | 5056 *11 | 1264 | 5332 | | | | |
| WED 2/20/91 | VOP | 16°C | 14.8" | 1351 | (2-21) 1450 | 25.0 | 4734 *5 | 2535 | | - | - | - | - |
| | | | | | | | 4586 *1 | 1911 | 4874 | | | | |
| TH 2/21/91 | VOP | 16°C | 14.75" | 1450 | (2-22) 1425 | 23.6 | 4940 *11 | 1736 | | | | | |
| | | | | | | | 4561 *6 | 2881 | 4884 | 1.44 | 1.48 | 1.45 | 1.42 |
| FQ 2/22/91 | VOP | 16°C | 14.5" | 1425 | (2-25) 1700 | 74.6 | 4523 *1 | 1371 | | | | | |
| | | | | | | | 4920 *5 | 2104 | | 1.44 | 1.48 | 1.45 | 1.42 |
| | | | | | | | 4679 *4 | 1984 | | | | | |
| | | | | | | | 4912 *3 | 2251 | | | | | |
| | | | | | | | 1459 *8 | 1075 | | | | | |
| | | | | | | | 1442 *9 | 1151 | 12029 | | | | |
| MON 2/25/91 | VOP | 15°C | 14.0" | 1700 | (2-26) 1555 | 22.9 | 4713 *12 | 1808 | | 1.43 | 1.46 | 1.45 | 1.40 |
| | | | | | | | 4351 *2 | 3384 | 3878 | | | | |
| TUE 2/26/91 | VOP | 15°C | 16.0" | 1555 | (2-27) 1515 | 23.3 | 1312 *10 | 1174 | | 1.42 | 1.46 | 1.45 | 1.40 |
| | | | | | | | 4520 *6 | 1996 | 3346 | | | | |
| WED 2/27/91 | VOP | 13°C | 16.0" | 1515 | (3-1) 1100 | 43.8 | 4814 *4 | 1500 | | 1.42 | 1.46 | 1.45 | 1.40 |
| | | | | | | | 4567 *1 | 1536 | 6345 | | | | |

JOB NO. 89-03 PROJECT B-18 INFILTROMETER

INFILTROMETER FIELD DATA

| STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| 3/1/91 | VOP | 13°C | 16.0" | 1100 | (2-5) 1010 | 95.2 | 4368 #6 | 1010 | | 1.42 | 1.46 | 1.45 | 1.40 |
| | | | | | | | 4982 #3 | 993 | | | | | |
| | | | | | | | 5012 #2 | 797 | | | | | |
| | | | | | | | 1376 #10 | 930 | 12008 | | | | |
| 3/5/91 | VOP | 12°C | 16.0" | 1010 | (3-6) 1041 | 24.5 | 4511 #2 | 3299 | | 1.41 | 1.46 | 1.45 | 1.40 |
| | | | | | | | 5166 #11 | 2525 | 3853 | | | | |
| 3/6/91 | VOP | 12°C | 15.0" | 1041 | (3-8) 900 | 46.3 | 4565 #5 | 869 | | 1.41 | 1.44 | 1.43 | 1.39 |
| | | | | | | | 1425 #9 | 987 | 4134 | | | | |
| 3/8/91 | VOP | 11°C | 14.9" | 900 | (3-8) 1536 | 78.5 | 1457 #8 | 671 | | 1.40 | 1.42 | 1.41 | 1.39 |
| | | | | | 1530 | | 4511 #4 | 705 | | | | | |
| | | | | | | | 4136 #1 | 772 | 7956 | | | | |
| 3/11/91 | RA | 11°C | 14.2" | 1530 | (3-13) 1105 | 43.6 | 4474 2 | 1840 | | 16.2 | 15.8 | 15.4 | 16.0 |
| | | | | | | | 4569 11 | 2330 | 4873 | | | | |
| 3/13/91 | RA | 11°C | 14.2" | 1105 | (3-18) 1330 | 122.4 | 4000 4 | 570 | | wires broke | | | |
| | | | | | | | 3848 1 | 581 | 6697 | | | | |
| 3/18/91 | RA | 10°C | 14.3" | 1330 | (3-20) 1405 | 48.6 | 4459 11 | 1196 | | wires broke | | | |
| | | | | 1330 | | | 3937 2 | 2091 | 5109 | swell data measured | | | |
| 3/22/91 | RA/VP | 11°C | 15" | 1405 | (3-22) 1540 | 49.6 | 4167 #6 | 1811 #6 | | by topographic | | | |
| | | | | | | | 4989 #12 | 1322 #6 | 6023 | survey | | | |
| | | | | | | | | | | | | | |

JOB NO. 89-003 PROJECT B-18 Testfill

INFILTROMETER FIELD DATA

(7)

| STATION I-1 | | INFILTROMETER READINGS | | | | | | | | SWELL DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | FIELD ENGR | WATER TEMP. | WATER DEPTH | INITIAL TIME | FINAL TIME | TIME INTERVAL | INITIAL WT OF BAG (GRAMS) | FINAL WT OF BAG (GRAMS) | CHANGE IN WT (GRAMS) | NW CORNER Δh | NE CORNER Δh | SE CORNER Δh | SW CORNER Δh |
| 3/22/91 | TC/VP | 13°C | 15" | 5:40 | (3-25) 16:15 | 72.5 | 4504 #5 | 1107 #5 | | | | | |
| | | | | | | | 4504 #3 | 1413 #3 | 6487 | WIDES BROKE | | | |
| 3/25/91 | TC/VP | 13°C | 15" | 16:15 | (3-27) 1435 | 46.4 | 4398 #1 | 941 #1 | | | | | |
| | | | | | | | 4417 #2 | 954 #2 | 3914 | Swell DATA measured | | | |
| 3/27/91 | TC/VP | 12°C | 14.5" | 1435 | | | 4451 #5 | | | by Topographic survey | | | |
| | | | | | | | 4379 #3 | | | | | | |

JOB NO. 89-03 PROJECT B-18 INFILTROMETER

INFILTROMETER FIELD DATA

STATION I-1

| DATE | TIME | FIELD ENGR | ATM. PRESSURE (IN. Hg) | TENSIOMETER READINGS (CENTIBARS) 6" 1 | 12" 2 | 12" 3 | 18" 4 | 18" 5 | 12" 6 | 12" 7 | 6" 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/31/91 | 1641 | VOP/JB | | 34 | 30 | 18 | 18 | 18 | 24 | 11 | 16 |
| 2/1/91 | 0750 | VOP/JB | | 45 | 54 | 32 | 32 | 30 | 44 | 34 | 20 |
| 2/1/91 | 1617 | VOP/RAG | | 45 | 51 | 40 | 38 | 36 | 46 | 38 | 15 |
| 2/2/91 | 0855 | VOP | 29.41 | 50 | 58 | 50 | 50 | 46 | 52 | 46 | -* |
| 2/2/91 | 1350 | VOP | | 51 | 59 | 52 | 53 | 49 | 54 | 48 | - |
| 2/3/91 | 1000 | VOP | | 4 | 62 | 58 | 60 | 54 | 59 | 52 | - |
| 2/3/91 | 1550 | VOP | | 4 | 60 | 57 | 58 | 54 | 60 | 51 | - |
| 2/4/91 | 0717 | VOP | | 2 | 62 | 62 | 62 | 58 | 62 | 56 | - |
| 2/4/91 | 1645 | VOP | | 3 | 61 | 62 | 62 | 58 | 62 | 56 | - |
| 2/5/91 | 1605 | VOP | | 4 | 61 | 64 | 64 | 60 | 64 | 58 | |
| 2/6/91 | 1442 | VOP | | 4 | 62 | 66 | 66 | 62 | 64 | 60 | |
| 2/7/91 | 1611 | RG/RA | | 4 | 62 | 66 | 66 | 63 | 66 | 60 | |
| 2/8/91 | 1640 | VOP | | 4 | 62 | 68 | 68 | 66 | 68 | 58 | |
| 2/11/91 | 0836 | VOP | | 2 | 62 | 72 | 70 | 68 | 70 | 60 | |
| 2-12-91 | 1150 | RG | | 4 | 52 | 68 | 72 | 68 | 72 | 58 | |
| 2/13/91 | 1429 | VOP | | 3 | 2 | 64 | 70 | 68 | 72 | 40 | |
| 2/14/91 | 1453 | VOP | | 4 | 2 | 52 | 72 | 68 | 71 | 13 | |
| ⊛ 2/15/91 | 1448 | VOP | | + | 0 | 30 | 70 | 68 | 70 | 6 | |
| 2/18/91 | 1455 | VOP | | -* | 0 | 6 | 74 | 70 | 14 | 0 | |
| 2/19/91 | 1528 | VOP | | - | 0 | 6 | 76 | 70 | 14 | 0 | |
| 2/20/91 | 1351 | VOP | | - | 0 | 6 | 77 | 70 | 12 | 0 | |
| 2/21/91 | 1500 | VOP | | - | 0 | 6 | 78 | 70 | 12 | 0 | |
| 2/22/91 | 1458 | VOP | | - | 0 | 6 | 76 | 69 | 12 | 0 | |
| 2/25/91 | 1705 | VOP | | - | 0 | 6 | 76 | 71 | 10 | 0 | |
| 2/26/91 | 1602 | VOP | | - | 0 | 6 | 76 | 70 | 10 | 0 | |
| 2/27/91 | 1520 | VOP | | - | 0 | 6 | 76 | 70 | 10 | 0 | |
| 3/1/91 | 1105 | VOP | | - | 0 | 6 | 76 | 70 | 10 | 0 | |
| 3/5/91 | 1012 | VOP | | - | 0 | 6 | 76 | 70 | 9 | 0 | |
| 3/6/91 | 1051 | VOP | | - | 0 | 4 | 77 | 71 | 8 | 0 | |
| 3/8/91 | 914 | VOP | | - | 0 | 2 | 78 | 71 | 8 | 0 | |

⊛ Refilled

JOB NO. 89-03 PROJECT B-18 Infiltrometer

TENSIOMETER FIELD DATA

| STATION I-1 | | | | TENSIOMETER READINGS (CENTIBARS) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | TIME | FIELD ENGR | ATM. PRESSURE (IN. Hg) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3/11/91 | 1155 | RA | 29.45 | — | 0 | > | 72 | 65 | 6 | 8 | 0 |
| 3/12/91 | 1050 | RA | 29.52 | — | 0 | 6 | 62 | 65 | 7 | 6 | 0 |
| 3/13/91 | 1100 | RA | 29.27 | — | 0 | 2 | 58 | 66 | 5 | 4 | 0 |
| 3/18/91 | 0930 | RA | 29.21 | — | 0 | 2 | 14 | 62 | 4 | 2 | 0 |
| 3/20/91 | 1400 | RA/NP | | — | Ø | 2 | 11 | 58 | 4 | 2 | Ø |
| 3/21/91 | 1345 | RA/NP | | — | Ø | 2 | 11 | 24 | 4 | 2 | Ø |
| 3/22/91 | 15:24 | NP/TC | | - | Ø | 2 | 10 | 16 | 4 | 2 | Ø |
| 3/26/91 | 16:00 | TC/NP | | - | Ø | 2 | 8 | 10 | 4 | 2 | Ø |
| 3/27/91 | 1435 | TC/NP | | - | Ø | 2 | 8 | 10 | 4 | 2 | Ø |

JOB NO. 89-Ø3 PROJECT B-18 Testfill

# TENSIOMETER FIELD DATA

# APPENDIX E.2
# PHASE III CLAY SOURCE TESTING REPORT

Geosyntec consultants

3990 Old Town Avenue
Suite B-101
San Diego, CA 92110

PH 619.297.1530
FAX 619.297.1532

www.geosyntec.com

11 February 2008

Rodney Walter
Waste Management, Inc.
5903 Spring Blossom Street
Bakersfield, California 93313

Subject: Clay Source Testing: Summary of Field and Laboratory Test Results
Kettleman Hills Facility
Kettleman City, California

Dear Rodney:

Geosyntec Consultants (Geosyntec) is pleased to provide Waste Management, Inc. (WMI) with the results of our recent investigation of a proposed clay source at the Kettleman Hills Facility (KHF), located in Kings County, California. The Pecten Claystone, a clay layer located in the San Joaquin Formation on the eastern boundary of Landfill B-17 has been identified as a potential clay source for use in the liner system of the proposed Class I/II (hazardous waste) Landfill B-18 expansion (see Figure 1). Clay from this clay layer has been used for clay liners on site successfully in the past. Based on discussions with you and a review of preliminary designs for the expansion of Landfill B-18, we understand approximately 35,000 cubic yards (cy) of clay material will be needed for the first phase of the Landfill B-18 expansion.

## PROJECT DESCRIPTION

The Code of Federal Regulations Part 264 (Subtitle C) and the California Code of Regulations (CCR) Titles 23 and 22 have the following requirements for the clay liner component of a hazardous waste landfill:

- The compacted soil material shall have a hydraulic conductivity of no more than $1 \times 10^{-7}$ centimeters per second (cm/s),

- The clay liner shall consist of materials with at least 30 percent of the material, by weight, passing a No. 200 U.S. Standard sieve, and
- The materials shall be fine-grained soils with a significant clay content and without organic matter, in the "SC" (clayey sand), "CL" (clay, sandy or silty clay), or "CH" (clay, sandy clay) classes of the Unified Soil Classification System.

The purpose of our investigation was to evaluate whether the earthen material in the proposed clay source meets the requirements stated above and to determine the geographic extent of these materials. Our scope for this phase of work included performing a field investigation to evaluate the limit of the claystone material and collect samples, laboratory testing, and preparation of this letter report. We have also prepared plans, specifications and construction quality assurance recommendations for construction of a test pad; these documents have been provided under separate cover.

**REVIEW OF EXISTING DOCUMENTATION**

We have reviewed existing borings performed by others in the general vicinity of the proposed clay source. Copies of relevant and available borings in the vicinity are included in Attachment 1. We have also reviewed the following documents summarizing laboratory and field testing of clay materials used at the site in the past:

- Environmental Construction Services, Inc.., 1991, "Clay Source Report, Landfill B-18, Phase IA and IB, Kettleman Hills Faciltiy, Kettleman City, California," dated 25 November 1991.
- Environmental Solutions, Inc., 1990 "Engineering and Design Report, Landfill Unit B-18, Phases I and II and Final Closure, Kettleman Hills Facility, Kings County, California," dated August 1990.
- Environmental Solutions, Inc., 1992, "Test Fill and Infiltrometer Test Results, Landfill Unit B-18, Phases I and II and Final Closure," dated 23 January 1992.
- Golder Construction Services, 1993, "Construction Reports for Landfill B-18, Phase IIA and IIB, Volume I – Clay Source Report, Kettleman Hills Facility, Kettleman City, California," dated May 1993.

Geosyntec consultants

## FIELD INVESTIGATION

Our field investigation was performed at the site by Layne Christensen Company on 27 November and 28 November 2008. Three borings (CS-1, CS-1A, and CS-2) were advanced to depths ranging from 21 feet to 91 feet using the hollow stem auger (HSA) drilling method. The borings were sampled at approximately 5 foot intervals with a California sampler; bulk samples of soil cuttings were also collected. Locations of the borings are shown on Figure 1. Four test pits were also excavated to depths ranging from 10 to 12 feet by KHF staff. The borings and test pits were sampled and logged in accordance with the Unified Soil Classification System by an engineer from our firm. Boring and test pit logs are provided in Attachment 2.

## LABORATORY TESTING

Samples from the borings and test pits were collected and returned to our office for review. Based on a review of the boring logs and samples, laboratory tests were assigned and select soil samples were delivered to Excel Geotechnical Testing, Inc. for laboratory testing. Potential clay source material was tested for the plasticity characteristics, grain size analyses, compaction, and permeability. Results of these tests are summarized in Table 1 and are presented in Attachment 3. Laboratory testing was performed in general accordance with American Society for Testing and Materials (ASTM) standards. Hydraulic conductivity tests performed on samples collected with a California sampler were based on maximum dry density results of similar clay materials from the test pad construction for Landfill B-18 Phase I/II (Environmental Construction Services, Inc., 1991); the actual degree of relative compaction may vary for these samples. During hydraulic conductivity testing of these samples, under a confinement of 5 pounds per square inch (psi), significant swelling was noted. This suggests that the Pecten claystone materials may be considered highly expansive.

## CONCLUSIONS

Based on our field investigation and a review of previous work at the site, the Pecten Claystone ranges in depth from a few feet (at the northeastern boundary) to more than 90 feet deep at the western boundary of the clay layer. The clay layer is estimated to dip to the southwest at approximately 32 degrees. The surface of this clay layer may be expected to be weathered and may contain some disturbance due to previous grading at the site in some areas.

Based on a review of the available data and the results of our field and laboratory tests, the proposed clay source is generally classified as fat clay (CH) with approximately 90 percent of

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consultants

material passing the No. 200 sieve. Based on preliminary laboratory testing, the laboratory hydraulic conductivity of the compacted clay is on the order of $5x10^{-9}$ cm/s to $1x10^{-8}$ cm/s when compacted to a minimum relative compaction of approximately 92 percent and at least two percent wet of the optimum moisture content. The proposed material is anticipated to generally meet the state and federal requirements for a compacted clay liner and to be suitable for use in the construction of the expansion of Landfill B-18. However, field hydraulic conductivity and laboratory hydraulic conductivity can often vary by more than an order of magnitude. Results of the test pad Sealed Double Ring Infiltrometer test, which will be performed during construction of landfill B-17 Phase A1 on material excavated from the Pecten Claystone, will provide more conclusive results on the in-situ hydraulic conductivity of the proposed material. Specifications, drawings, and construction quality assurance testing recommendations for the test pad construction have been provided under separate cover.

We appreciate the opportunity to work on this project. If you have any questions, please call Jane Soule at 619.297.1530 x 208.

Sincerely,

Jane W. Soule

Jane W. Soule, R.C.E. 59815
Project Engineer

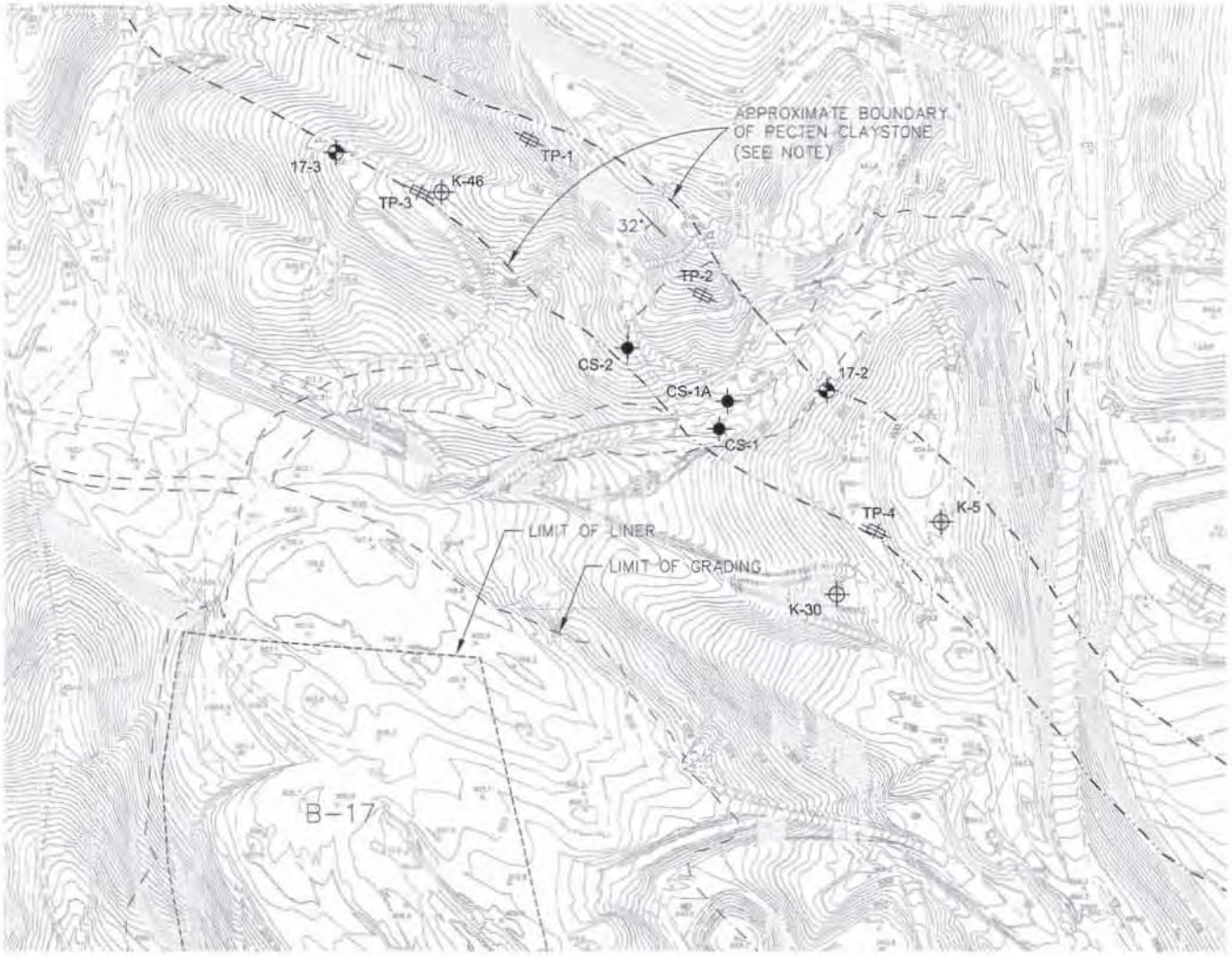

Attachments:

Table 1: Summary of Geotechnical Laboratory Test Results
Figure 1: Site Plan
Attachment 1: Previous Investigations
Attachment 2: Current Field Investigation
Attachment 3: Laboratory Test Results

TABLE 1
SUMMARY OF GEOTECHNICAL LABORATORY TEST RESULTS
CLAY SOURCE EVALUATION - PECTEN CLAYSTONE
KETTLEMAN HILLS FACILITY, KETTLEMAN CITY, CALIFORNIA

| Boring ID | Sample ID | Depth (ft) | | USCS | As-Received Conditions | | Sieve | Atterberg Limits | | | Laboratory Compaction | | Hydraulic Conductivity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | | Moisture Content (D2216) (%) | Dry Density (pcf) | Fines (%) | LL (%) | PL (%) | PI (%) | Maximum Dry Density (pcf) | Optimum Moisture (%) | (cm/s) | Test Conditions (MC, RC) |
| CS-1 | 1-2 | 10.5 | 12 | CH - Fat Clay | 16.0 | | 92.2 | 100 | 35 | 65 | | | 7.0E-08 | +2, 90%* |
| CS-1 | 1-3 | 15 | 16.5 | | | | | | | | | | | |
| CS-1 | 1-4 | 20 | 21.5 | CH - Fat Clay | 18.5 | 100.6 | 96.0 | 88 | 32 | 56 | | | | |
| CA-1A | Bulk 1A-1 | 0 | 5 | CH - Fat Clay with Sand | 12.4 | | 76.0 | 55 | 21 | 34 | 122 | 12.5 | 7.4E-09, 9.2E-09 | +3, 92%, +3, 89% |
| CA-1A | 1A-2 | 10.5 | 12 | | 19.3 | 100.3 | | | | | | | | |
| CA-1A | 1A-3 | 16 | 16.5 | MH - Elastic Silt | 20.3 | | 98.1 | 97 | 44 | 53 | | | | |
| CA-1A | 1A-5 | 25 | 26.5 | CH - Fat Clay | 20.9 | 98.6 | 93.3 | 105 | 41 | 64 | | | 6.2E-08 | +2, 90%* |
| CA-1A | 1A-6 | 30 | 31.5 | MH - Elastic Silt | 23.1 | | | | | | | | 9.6E-08 | +2, 90%* |
| CA-1A | 1A-7 | 35 | 36.5 | | | | 89.6 | 89 | 39 | 50 | | | | |
| CA-1A | 1A-8 | 40 | 41.5 | CH - Fat Clay | 21.2 | | 89.5 | 78 | 31 | 47 | | | | |
| CA-1A | 1A-9 | 45 | 46.5 | CH - Fat Clay | 24.4 | 98.2 | 87.7 | 82 | 35 | 47 | | | | |
| CA-1A | 1A-11 | 55 | 56.5 | CH - Fat Clay with Sand | 18.6 | 95.8 | 84.2 | 58 | 29 | 29 | | | | |
| CA-1A | 1A-13 | 65 | 66 | SC - Clayey Sand | 3.4 | | 17.4 | | | | | | | |
| CS-2 | Bulk 2-1 | 0 | 5 | CH - Fat Clay | 14.1 | | 96.3 | 104 | 36 | 68 | 113.1 | 15.6 | 3.7E-09 | +3, 92% |
| CS-2 | Bulk 2-2 | 6.5 | 10.5 | | | | | | | | | | | |
| CS-2 | 2-2 | 10.5 | 12 | CH - Fat Clay | 16.5 | 106.4 | 95.2 | 100 | 34 | 66 | | | | |
| CS-2 | 2-4 | 20 | 21.5 | CH - Fat Clay | 21.0 | | 95.3 | 92 | 39 | 53 | | | 8.6E-08 | +2, 90%* |
| CS-2 | 2-7 | 35 | 36.5 | CH - Fat Clay | 21.0 | 100.6 | 89.8 | 93 | 33 | 60 | | | | |
| CS-2 | 2-9 | 45 | 46.5 | CH - Fat Clay | 24.7 | 99.7 | 98.6 | 104 | 37 | 67 | | | | |
| CS-2 | 2-11 | 55 | 56.5 | CH - Fat Clay | 24.0 | | 96.7 | 82 | 33 | 49 | | | 8.2E-08 | +2, 90%* |
| CS-2 | 2-13 | 65 | 66 | CH - Fat Clay | 25.1 | | 98.4 | 112 | 40 | 72 | | | 1.7E-08 | +2, 90%* |
| CS-2 | 2-14 | 70 | 71.5 | | | 97.7 | | | | | | | | |
| CS-2 | 2-16 | 80 | 81.5 | CH - Fat Clay | 25.4 | | 91.1 | 129 | 41 | 88 | | | 5.3E-08 | +2, 90%* |
| CS-2 | 2-17 | 85 | 86.5 | | | | | | | | | | | |
| TP-1 | TP1-1 | 9 | 10 | CH - Fat Clay | 20.8 | | 93.0 | 100 | 37 | 63 | 109.9 | 17.8 | 1.1E-08 | +3, 92% |
| TP-2 | TP2-1 | 0 | 8 | CH - Fat Clay | 14.6 | | 97.8 | 92 | 31 | 61 | 111.7 | 16.2 | 5.0E-09 | +3, 92% |
| TP-3 | TP3-1 | 11 | 12 | CH - Fat Clay | 21.9 | | 91.1 | 102 | 35 | 67 | 108.2 | 17.4 | 6.5E-09 | +3, 92% |
| TP-4 | TP4-1 | 9 | 10 | CH - Fat Clay | 17.0 | | 88.5 | 93 | 34 | 59 | 105.5 | 20.1 | 1.4E-08<br>4.5E-08 | +3, 92% |

Note: *Samples collected with a California type sampler tested for hydraulic conductivity were compacted at 90% relative compaction of the maximum dry density of similar materials from the test pad construction of Landfill B-18 Phases 1A/1B (Environmental Construction Services, 1991).




LEGEND:

- BORING, CURRENT INVESTIGATION
- TEST PIT, CURRENT INVESTIGATION
- BORING, URS (2003)
- BORING EMCON (1985)
- APPROXIMATE LIMITS OF PECTEN CLAYSTONE
- B-17 LIMIT OF GRADING
- B-17 LIMIT OF LINER

N

200 100 0 200

SCALE IN FEET

NOTE:

PECTEN CLAYSTONE LIMITS BASED ON MAPPING BY URS (2003).

SITE PLAN
LANDFILL B-17
KETTLEMAN HILLS FACILITY

Geosyntec consultants

DATE: JAN 08

PROJECT NO. SC0478

FIGURE 1

P:\CAD\SC0396 KMAN B-17 CQA\figures\location of pecten claystone.dwg

# Attachment 1: Previous Investigations

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84

SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Finer (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft) | | | | |
| | | | | | | | | | Interlayered Light olive-brown (2.5Y 5/4) clayey SILTSTONE and silty CLAYSTONE; lithified<br><br>(gypsum layers in top 20 feet) |
| | | | | | | 5 | | | |
| | | | | | | 10 | | | |
| | | | | | | 15 | | | |
| | | | | | | 20 | | | |

REMARKS

emcon

PLATE A-18

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 25 | | | interlayered light olive-brown (2.5Y 5/4) clayey SILTSTONE and silty CLAYSTONE; lithified |
| | | | | | | 30 | | | |
| | | | | | | 35 | | | |
| | | | | | | 40 | | | |

REMARKS

emcon

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (#-No.200) | Liquid Limit | Plasticity Index | Core Re-Covery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | 4' | | | | | 1 | Light olive-brown (2.5Y 5/4) CLAYSTONE with reddish-yellow (7.5YR 6/8) 1/4-inch claystone layers; occasional light gray (10YR 7/1) fine sandstone lenses cemented with gypsum |
| | | | | | | 45 | | | |
| | | | 2' | | | | | 2 | Light olive-brown (2.5Y 5/4) very fine, silty SANDSTONE<br>Light olive-brown (2.5Y 5/4) silty CLAYSTONE<br>Light olive-brown (2.5Y 5/4) very fine, silty SANDSTONE; loose |
| | | | | | | 50 | | | |
| | | | | | | 55 | | | (olive-yellow (2.5Y 6/6))<br>Light olive-brown, (2.5Y 5/4) silty CLAYSTONE |
| | | | | | | 60 | | | |

REMARKS:

EMCON

PLATE A-20

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No 200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | | | | Olive-brown (2.5Y 5/4) clayey - sandy SILTSTONE |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) CLAYSTONE |
| | | | | | | 65 | | | |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) silty SANDSTONE |
| | | | | | | 70 | | | |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) CLAYSTONE |
| | | | | | | 75 | | | |
| | | | | | | | | | Olive-brown (2.5Y 5/4) clayey-silty, very fine SANDSTONE |
| | | | | | | 80 | | | |

REMARKS

EMCON

PLATE A-21

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5

SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Level | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 85 | | | (gypsum at 83 feet)<br>Grayish-brown (2.5Y 5/2) CLAYSTONE |
| | | | | | | 90 | | | Thinly interlayered grayish-brown (2.5Y 5/2) CLAYSTONE and light olive-brown (2.5Y 5/4) SILTSTONE |
| | | | 5' | | | | | 3 | Grayish-brown (2.5Y 5/2) to light olive-brown (2.5Y 5/4) CLAYSTONE with silty partings<br>Thinly interlayered grayish-brown (2.5Y 5/2) CLAYSTONE and light olive-brown (2.5Y 5/4) SILTSTONE |
| | | | | | | 95 | | | Light olive-brown (2.5Y 5/4) clayey SILTSTONE; woody fossils |
| | | | 2' C | | | | | 4 | Light olive-brown (2.5Y 5/4) CLAYSTONE with occasional silty partings |
| | | | | | | 100 | | | Light olive-brown (2.5Y 5/4) silty, fine SANDSTONE; loose |

REMARKS

emcon

PLATE A-22

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5

SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Stength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 105 | | | Gray (N5) CLAYSTONE |
| | | | | | | 110 | | | Light olive-brown (2.5Y 5/4) very fine silty SANDSTONE |
| | | | | | | | | | Interlayered light olive-brown (2.5Y 5/4) SILTSTONE and gray (N5) CLAYSTONE |
| | | | | | | 115 | | | Light olive-brown (2.5Y 5/4) very fine silty SANDSTONE |
| | | | | | | 120 | | | |

REMARKS:

EMCON

PLATE A-23

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5

SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Gray (N5) CLAYSTONE |
| | | | | | | 125 | | | Light olive-brown (2.5Y 5/4) very fine silty SANDSTONE |
| | | | | | | 130 | | | Interlyered light olive-brown (2.5Y 5/4) SILTSTONE and gray (N5) CLAYSTONE<br>Light olive-brown (2.5Y 5/4) fine SANDSTONE; poorly graded |
| | | | | | | | | | Gray (N6) CLAYSTONE |
| | | | | | | 135 | | | Light olive-gray (2.5Y 5/4) sandy SILTSTONE |
| | | | | | | | | | Gray (N5) CLAYSTONE |
| | | | | | | 140 | | | |

REMARKS:

EMCON

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.35 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | 4' | | | | | B | Gray (N6)CLAYSTONE<br>Interlayered light olive-brown (2.5Y 5/4) CLAYSTONE and very fine SANDSTONE<br>Light olive-brown (2.5Y 5/6) silty, fine SANDSTONE<br>Light olive-brown (2.5Y 5/4) CLAYSTONE<br>Light olive-brown (2.5Y 5/4) slightly silty, fine SANDSTONE; poorly graded<br>(woody fossils at 145 feet)<br>(loose from 145 feet to 148 1/2 feet) |
| | | | 1'6" | | | 145 | | B | |
| | | | | | | 150 | | | Interlayered light olive-brown (2.5Y 5/4) very fine sandy SILTSTONE and CLAYSTONE |
| | | | | | | 155 | | | Light olive-brown (2.5Y 5/4) slightly silty, fine to medium SANDSTONE; well sorted |
| | | | | | | 160 | | | |

REMARKS:

EMCON

PLATE A-25

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) slightly silty, fine to medium SANDSTONE |
| | | | | | | 165 | | | Light olive-brown (2.5Y 5/4) sandy SILTSTONE |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) silty, fine to medium SANDSTONE |
| | | | | | | 170 | | | Light olive-brown (2.5Y 5/4) CLAYSTONE |
| | | | | | | | | | Light olive-brown (2.5Y 5/4) very silty, very fine SANDSTONE |
| | | | | | | 175 | | | Interlayered light olive-brown (2.5Y 5/4) very fine, silty SANDSTONE and sandy SILTSTONE |
| | | | | | | 180 | | | |

REMARKS

EMCON ASSOCIATES

PLATE A-26

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36
BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5
SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | | | | Interlayered light olive-brown (2.5Y 5/4) very fine, silty SANDSTONE and sandy SILTSTONE |
| | | | | | | 185 | | | (light olive brown (2.5Y 5/6)) |
| | | | | | | 190 | | | Light olive-brown (2.5Y 5/4)very fine, silty SANDSTONE; very well graded (1-inch clay stringer at 190.5 feet) |
| | | | 5' | | | | | 7 | Interlayered light olive-brown (2.5Y 5/4) SILTSTONE and grayish-brown (2.5Y 5/2) CLAYSTONE |
| | | | | | | 195 | | | Grayish-brown (2.5Y 5/2) CLAYSTONE with silty partings; iron staining present (olive-gray (5Y 4/2); woody fragments at 196 feet) (dark olive-gray (N4); no silty partings) |
| | | | 5' | | | | | 8 | |
| | | | | | | 200 | | | (olive-gray (5Y 4/2) with silty partings) |

REMARKS

emcon

PLATE A-27

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 205 | | | Light olive-gray (5Y 6/2) silty SANDSTONE with occasional dark gray (N4) claystone stringers |
| | | | | | | 210 | | | Dark gray (N4) CLAYSTONE |
| | | | | | | 215 | | | |
| | | | | | | 220 | | | Interlayered light olive-gray (5Y 6/2) silty, fine to medium SANDSTONE and SILTSTONE |

REMARKS:

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PLATE A-28

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Interlayered light olive-gray (5Y 6/2) silty, fine to medium SANDSTONE and SILTSTONE |
| | | | | | | 225 | | | |
| | | | | | | 230 | | | Blue gray (N8) CLAYSTONE with silty partings |
| | | | | | | 235 | | | |
| | | | | | | | | | Tan to light gray silty, very fine SANDSTONE |
| | | | | | | 240 | | | |

REMARKS:

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Re-Covery | Compressive Stength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | | | | Tan to light gray silty, fine SANDSTONE |
| | | | 5' | | | | | 9 | Olive-brown (2.5Y 5/4) CLAYSTONE with orange and dark gray (N5) bands; silty to very fine sandy partings; black organics present (dark gray (N5)) |
| | | | | | | 245 | | | |
| | | | | | | | | | Tan to buff SILTSTONE |
| | | | 5' | | | | | 10 | Medium gray (N6) CLAYSTONE with occasional limonite staining |
| | | | | | | | | | (slickensides at 249.5 feet) |
| | | | | | | 250 | | | Olive-gray (5Y 5/2) silty, very fine SANDSTONE with silty layers |
| | | | | | | 255 | | | |
| | | | | | | 260 | | | |

REMARKS:

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PLATE A-30

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84- 6/14/84 SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (- No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 265 | | | Blue gray (N6) silty CLAYSTONE with silty partings |
| | | | | | | 270 | | | |
| | | | | | | 275 | | | |
| | | | | | | 280 | | | |

REMARKS

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PLATE A-31

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| e | | | | | | | | | Olive-gray (5Y 6/2) silty, very fine SANDSTONE with blue gray (N6) claystone stringers |
| | | | | | | 285 | | | Olive-gray (5Y 6/2) SILTSTONE |
| | | | | | | 290 | | | Light gray to tan silty, fine to medium SANDSTONE |
| | | | 5' | | | | | 11 | Brown gray (2.5Y 5/2) CLAYSTONE with occasional orange and drk gray (N4) thin beds; very fine sandy silt partings present |
| | | | | | | 295 | | | (medium gray (N5), very silty) |
| | | 8' | | | | | | 12 | (very silty with abundant silt partings) |
| | | | | | | | | | (fine sandy partings) |
| | | | | | | 300 | | | |

REMARKS.

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PLATE A-32

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | | | | Blue gray (N6) silty CLAYSTONE |
| | | | | | | 305 | | | (decrease of silt) |
| | | | | | | 310 | | | |
| | | | | | | 315 | | | Light olive (5Y 6/2) slightly silty, fine SANDSTONE with thin blue gray (N6) claystone layers |
| | | | | | | 320 | | | |

REMARKS:

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PLATE A-33

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5

SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 325 | | | Light olive (5Y 6/2) slightly silty, fine SANDSTONE with thin blue gray (N5) claystone layers |
| | | | | | | 330 | | | |
| | | | | | | 335 | | | (very silty) |
| | | | | | | 340 | | | (fine to medium grained and light gray (5Y 6/1)) |

REMARKS:

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PLATE A-34

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Finer (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Stength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | 5' | | | | | 13 | Orange-brown (7.5YR 7/8) sandy CLAYSTONE<br>Tan to light gray (10YR 5/6) silty, fine to medium SANDSTONE<br><br>(1/2-inch clayey layer) |
| | | | | | | 345 | | | |
| | | | 4' | | | | | 18 | (1/2-inch clayey layer)<br>(orange brown (7.5YR 7/8), clayey stringers from 348 feet to 349 feet) |
| | | | | | | 350 | | 15 | |
| | | | | | | | | | (olive-gray (5y 5/2) with occasional siltstone lenses) |
| | | | | | | 355 | | | |
| | | | | | | 360 | | | (orange brown (7.5YR 7/8)) |

REMARKS

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PLATE A-35

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84

SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Orange brown (7.5YR 7/8) slightly silty, fine to medium SANDSTONE |
| | | | | | | 365 | | | |
| | | | | | | 370 | | | |
| | | | | | | 375 | | | |
| | | | | | | 380 | | | |

REMARKS:

EMCON ASSOCIATES

PLATE A-36

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | | | | 385 | | | Gray to tan slightly silty, fine to medium SANDSTONE |
| | | | | | | 390 | | | Olive-gray (2.5Y 5/2) fine sandy SILTSTONE |
| | | | 4'6" | | | | | 16 | Gray to tan slightly silty, fine to medium SANDSTONE |
| | | | | | | | | | Banded light olive-gray, black and orange clayey SILTSTONE with very fine sandy partings |
| | | | | | | 395 | | | Dark gray (N5) CLAYSTONE with abundant very fine sandy silt partings |
| | | | 3'0" | | | | | 17 | |
| | | | | | | 400 | | | |

REMARKS

EMCON

PLATE A-37

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 244-01.36

BORING NO.K-5

BY JK/SW DATE 6/1/84 - 6/14/84

SURFACE ELEV.900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Stength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Blue gray (N6) fine sandy SILTSTONE |
| | | | | | | | | | (very sandy) |
| | | | | | | 405 | | | Blue gray (N6) silty fine to medium SANDSTONE |
| | | | | | | | | | Blue gray (N6) CLAYSTONE |
| | | | | | | 410 | | | |
| | | | | | | 415 | | | (very sandy) |
| | | | | | | 420 | | | |

REMARKS

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PLATE A-38

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 244-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Blue gray (N6) sandy CLAYSTONE |
| | | | | | | 425 | | | (decrease of sand |
| | | | | | | | | | (increase of sand) |
| | | | | | | 430 | | | |
| | | | | | | 435 | | | (very silty) |
| | | | | | | 440 | | | |

REMARKS.

emcon ASSOCIATES

PLATE A-39

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 — BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 — SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | Depth in Ft. | Ground Water Levels | Samples | |
| | | | | | | | | | Dark to medium gray (N5) CLAYSTONE with tight gray very fine sandy - silty partings; black organics present |
| | | | 5' | | | | | 18 | (very silty partings) |
| | | | | | | | | | (1-inch sandy layer) (very silty) |
| | | | | | | 445 | ▼ | | (blue gray (N6)) |
| | | | | | | | | | Blue gray (N6) silty, fine SANDSTONE with shell fragments |
| | | | 5' | | | | | 19 | Blue gray (N6) sandy-clayey SILTSTONE; very moist |
| | | | | | | | | | Blue gray (N6) silty CLAYSTONE with very fine sandy-silty partings |
| | | | | | | 450 | | | |
| | | | | | | | | | Blue gray (N6) very fine sandy SILTSTONE |
| | | | | | | 455 | | | |
| | | | | | | | | | Dark gray (N6) silty CLAYSTONE with light gray (N7) very fine sandy - silty partings |
| | | | | | | 460 | | | |

REMARKS

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PLATE A-40

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36

BY JK/SW DATE 6/1/84 - 6/14/84

BORING NO. K-5

SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| < | | | | | | | | | Dark gray (N6) silty CLAYSTONE with light gray (N7) very fine sandy - silty partings |
| | | | | | | 465 | | | Interlayered dark gray (N6) CLAYSTONE and SILTSTONE |
| | | | | | | 470 | | | Dark gray (N6) silty CLAYSTONE with light gray (N7) very fine sandy-silty partings |
| | | | | | | 475 | | | |
| | | | | | | 480 | | | |

REMARKS

EMCON

PLATE A-41

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900' MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines No.200 | Liquid Limit | Plasticity Index | Core Recovery | Compressive Stength (TSF) | Penetration (Blows/Ft.) | Depth in Ft. | Ground Water Levels | Samples | |
| | | | | | | | | | Dark gary (N6) silty CLAYSTONE with light gray (N7) very fine sandy - silty partings |
| | | | | | | 485 ▽ | | | Dark gray (N4) very silty - clayey very fine SANDSTONE; black organics at 485 1/4 feet |
| | | | 2'8" | | | | | 20 | |
| | | | | | | | | | (black organics at 488 1/4 feet |
| | | | | | | 490 | | | |
| | | | 0' | | | | | 21 | |
| | | | | | | 495 | | | |
| | | | 2' | | | | | 22 | Dark gray (N4) very fine, silty SANDSTONE with very thin organic stringers |
| | | | 1'3" | | | 500 | | 23 | |

REMARKS

EMCON

PLATE A-4

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK/SW DATE 6/1/84 - 6/14/84 SURFACE ELEV. 900'MSL

| CLASSIFICATION DATA | | | FIELD DATA | | | Depth in Ft. | Ground Water Levels | Samples | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | | | | |
| | | | 1'3" | | | | | 23 | Dark gray (5Y 4/1) CLAYSTONE with very fine, very silty sandy stringers |
| | | | 3' | | | 505 | | 24 | Dark gray (N4) slightly silty, fine SANDSTONE with occasional claystone stringers |
| | | | 1' | | | 510 | | | Log below a depth of 508 feet obtained from adjacent borehole. Claystone at 495 feet on column below corresponds to claystone at 503 feet on above column. |
| | | | | | | 515 | | | |
| | | | | | | 520 | | | |

REMARKS.

EMCON

PLATE A-43

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK DATE 6/12/84 SURFACE ELEV. -

| CLASSIFICATION DATA | | | FIELD DATA | | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | Depth in Ft. | Ground Water Levels | Samples | |
| < | | | 2' | | | | | 25 | Dark gray (5Y 4/1) CLAYSTONE with occasional sandy stringers |
| | | | 0' | | | | | 26 | |
| | | | | | | 500 | | | Dark gray (5Y 4/1) CLAYSTONE with very fine silty sandstone stringers |
| | | | 1' | | | | | 27 | Dark gray (5Y 4/1) fine silty SANDSTONE with occasional clay stringers; very loose |
| | | | | | | | | | Dark gray (5Y 4/1) CLAYSTONE with 1/4-inch stringers |
| | | | 2' | | | 505 | | 28 | |
| | | | | | | | | | Dark gray (5Y 4/1) silty, very fine SANDSTONE with clay stringers |
| | | | 4' | | | 510 | | 29 | (3-inches with very hard caliche cement) |
| | | | | | | | | | (fine grained) |
| | | | 3' | | | 515 | | 30 | Interlayered dark gray clayey - silty, fine SANDSTONE and CLAYSTONE with abundant organics and shell fragments |

REMARKS

emcon

PLATE A-44

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-01.36 BORING NO. K-5

BY JK DATE 6/12/84 SURFACE ELEV. -

| CLASSIFICATION DATA | | | FIELD DATA | | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| % Fines (-No.200) | Liquid Limit | Plasticity Index | Core Recovery | Compressive Strength (TSF) | Penetration (Blows/Ft.) | Depth in Ft. | Ground Water Levels | Samples | |
| | | | 5' | | | | | 30 | Dark gray (5Y 4/1) very fine, very silty SANDSTONE with frequent claystone stringers |
| | | | | | | | | | Dark gray (5Y 4/1) CLAYSTONE with occasional sandy partings |
| | | | 5' | | | 520 | | 31 | |
| | | | | | | | | | BOTTOM OF BORING |
| | | | | | | 525 | | | |

REMARKS:

emcon

PLATE A-6

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 1 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 0 | ML | | SANDY SILTSTONE, fill. |
| | | | | 5 | | | |
| | | | | | SS | | SILTY SANDSTONE; yellowish gray (5Y, 7/2); 40% silt; very fine grained; moderately graded; minor siltstone laminae; calcareously cemented; moderately indurated; dry. |
| | | | | 10 | Ⓑ | | |
| | | | | 15 | | | |
| | | | | 20 | | | |

REMARKS Well K-30 was drilled with air-rotary drilling equipment to a total depth of 480 feet. The borehole was converted to a groundwater monitoring well (see Completion Diagram).

Ⓑ denotes a bag sample.

EMKON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 2 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 20 | B | SS | SILTY SANDSTONE (continued). 20% disseminated silt. |
| | | | | 25 | | | |
| | | | | 30 | B | SS/SLST | change of color to dusky yellow (5Y,6/4); <15% silt; very fine- to fine-grained: arkosic(?); poorly graded. |
| | | | | 35 | | | SANDSTONE and SILTSTONE interbedded, 2:1. sandstone: dusky yellow (5Y, 6/4). siltstone: light olive-gray (5Y, 5/2); poorly developed bedding. |
| | | | | 40 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
PAGE 3 OF 24
SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 40 | B | SS/ SLST | SANDSTONE and SILTSTONE interbedded (continued). |
| | | | | | | SS | |
| | | | | 45 | | | SANDSTONE. |
| | | | | 50 | B | | |
| | | | | 55 | | CLST | SILTY CLAYSTONE; light olive-gray (5Y, 5/2); 20-30% silt; limonitic partings; poorly indurated; slightly damp. |
| | | | | 60 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 4 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 60 | Ⓑ | CLST | SILTY CLAYSTONE (continued). |
| | | | | 65 | | | change of color to dark gray (N3). |
| | | | | 70 | Ⓑ | | 15% disseminated silt; massive. |
| | | | | 75 | | | gypsum viens. |
| | | | | 80 | | | |

REMARKS Began water injection at 80 feet.

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PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 5 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 80 | Ⓑ | CLST | SILTY CLAYSTONE (continued). change of color to medium dark gray (N4); <10% silt. |
| | | | | 85 | | | |
| | | | | 90 | Ⓑ | | 0.5"-thick beds; slightly fissile; black organic material to 100'. |
| | | | | 95 | | | |
| | | | | 100 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 6 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 100 | Ⓑ | CLST | SILTY CLAYSTONE (continued). |
| | | | | 105 | | | |
| | | | | 110 | Ⓑ | | minor yellowish gray (5Y, 7/2) siltstone stringers. |
| | | | | 115 | | | |
| | | | | 120 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 7 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 120 | B | CLST | SILTY CLAYSTONE (continued). |
| | | | | 125 | | | |
| | | | | 130 | B | | Pecten (?) shell fragments. |
| | | | | 135 | | | |
| | | | | 140 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
PAGE 8 OF
SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 140 | Ⓑ | CLST | SILTY CLAYSTONE (continued). minor organic material; 1 shell fragment. |
| | | | | 145 | | | |
| | | | | 150 | Ⓑ | | fine sandstone partings; organic rich. |
| | | | | 155 | | | change of color to light olive-gray (5Y, 5/2); 20% fine disseminated sand; moderately fissile; gypsum stringers; minor fossils; minor limonitic sandstone pebbles; poorly indurated. |
| | | | | 160 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 9 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 160 | Ⓑ | CLST | SILTY CLAYSTONE (continued). |
| | | | | 165 | | | |
| | | | | 170 | Ⓑ | | |
| | | | | | | CLST /SLST | |
| | | | | 175 | | | CLAYSTONE and SANDY SILTSTONE interbedded, 2:1. claystone: medium dark gray (N4); sandstone partings. siltstone: light olive-gray (5Y, 6/2); 20-30% very fine sand; minor very limonitic, moderately indurated, fine sandstone laminae. |
| | | | | 180 | | | |

REMARKS

EMCON ASSOCIATES

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 180 | Ⓑ | CLST/ SLST | CLAYSTONE and SANDY SILTSTONE interbedded (continued). |
| | | | | 185 | | | very poor cuttings return. |
| | | | | 190 | Ⓑ | | |
| | | | | 195 | | | |
| | | | | 200 | | | |

REMARKS

EMCON ASSOCIATES

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 200 | B | CLST /SLST | CLAYSTONE and SANDY SILTSTONE interbedded (continued). CLST:SLST = 1:1. |
| | | | | | | | increase of disseminated sand within the siltstone portion. |
| | | | | | SS | | |
| | | | | 205 | | | |
| | | | | | | | SILTY SANDSTONE; dusky yellow (5Y, 6/4); very fine- to fine-grained; quartzose; moderately graded; claystone laminae; limonitic staining. |
| | | | | 210 | B | | |
| | | | | | | | change of color to dark yellowish orange (10YR, 6/6); 40% silt; fine grained; quartzose; iron-oxide cement; abundant organics; poorly indurated. |
| | | | | 215 | | | |
| | | | | 220 | | | |

REMARKS

EMCON ASSOCIATES

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 12 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 220 | Ⓡ | SS | SILTY SANDSTONE (continued). |
| | | | | 225 | | SLST /SS | SILTSTONE and SANDSTONE interbedded, 2:1.<br>siltstone: light olive-gray (5Y, 5/2); <½"-thick beds; fissile; limonitic partings.<br>sandstone: dark yellowish orange (10YR, 6/6). |
| | | | | 230 | Ⓡ | | |
| | | | | 235 | | | |
| | | | | 240 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
PAGE 13 OF 24
SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 240 | B | SLST /SS | SILTSTONE and SANDSTONE interbedded (continued). |
| | | | | 245 | | | |
| | | | | 250 | B | | |
| | | | | 255 | | | |
| | | | | 260 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 14 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 260 | Ⓑ | SLST /SS | SILTSTONE AND SANDSTONE interbedded (continued). @ 260': organic interbeds(?). |
| | | | | | | SS | |
| | | | | 265 | | | SANDSTONE; dusky yellow (5Y, 6/4); 20% silt; fine grained; quartzose; moderately graded; gypsum stringers; organics; moderately indurated; harder drilling. |
| | | | | 270 | Ⓑ | | |
| | | | | 275 | | | |
| | | | | 280 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 15 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 280 | Ⓡ | SS | SANDSTONE (continued). |
| | | | | 285 | | | 30% siltstone interbeds. |
| | | | | 290 | Ⓡ | | |
| | | | | 295 | | SS/ SLST | SILTY SANDSTONE and SILTSTONE interbedded (continued on next page). |
| | | | | 300 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 300 | B | SS/ SLST | SILTY SANDSTONE and SILTSTONE interbedded.<br>silty sandstone: light olive-brown (5Y, 5/6); very fine grained; quartzose.<br>siltstone: light olive-brown (5Y, 5/6); thinly bedded; sandstone partings; fissile. |
| | | | | 305 | | | |
| | | | | 310 | B | CLST /SLST | CLAYSTONE and SILTSTONE interbedded, 1:1.<br>claystone: medium dark gray (N4); fissile; poorly indurated.<br>siltstone: light olive-brown (5Y, 5/6); fine to very fine sandstone partings; fissile; poorly indurated. |
| | | | | 315 | | | |
| | | | | 320 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
PAGE 17 OF 24
SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 320 | B | CLST /SLST | CLAYSTONE and SILTSTONE interbedded (continued). |
| | | | | 325 | | | |
| | | | | 330 | B | | siltstone portion becomes sandy; limonitic staining. |
| | | | | 335 | | | gypsum stringers. |
| | | | | 340 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 18 OF

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 340 | B | CLST /SLST | CLAYSTONE and SILTSTONE interbedded (continued). CLST:SLST = 7:3. |
| | | | | 345 | | | |
| | | | | 350 | B | | |
| | | | | | | CLST | SILTY CLAYSTONE; medium dark gray (N4); 15-20% light olive-brown (5Y, 5/6) siltstone interbeds; moderately fissile; poorly indurated. |
| | | | | 355 | | | |
| | | | | 360 | | | |

REMARKS

EMKON ASSOCIATES

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 360 | B | CLST | SILTY CLAYSTONE (continued). |
| | | | | 365 | | SS | SILTY SANDSTONE; moderate yellowish brown (10YR, 5/4); 30-40% silt; very fine- to fine-grained; arkosic; limonitic cementation; moderately indurated. |
| | | | | 370 | B | | |
| | | | | 375 | | CLST | CLAYSTONE (continued on next page). |
| | | | | 380 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 20 OF --

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 380 | Ⓡ | CLST | CLAYSTONE; medium dark gray (N4); no siltstone beds; organic material. |
| | | | | 385 | | | |
| | | | | 390 | Ⓡ | | occasional moderate yellowish brown (10YR, 5/4); limonitic, very fine, silty sandstone interbeds. |
| | | | | 395 | | | |
| | | | | 400 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17 BORING NO. K-30

PROJECT NAME Kettleman Hills PAGE 21 OF 24

BY CW DATE 7/21 - 7/24/85 SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 400 | (B) | CLST | CLAYSTONE (continued). 10% moderate yellowish brown (10YR, 5/4) siltstone interbeds. |
| | | | | 405 | | | |
| | | | | | | CLST /SS | SILTY CLAYSTONE and SANDSTONE interbedded. silty claystone: medium dark gray (N4). sandstone: moderate yellowish brown (10YR, 5/4); very fine grained; limonitic staining. |
| | | | | 410 | (B) | | |
| | | | | | | CLST | CLAYSTONE; dark greenish gray (5GY, 4/1); slightly fissile; slickensides(?); shell fragments; minor organic material. |
| | | | | 415 | | | |
| | | | | 420 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 420 | Ⓡ | CLST | CLAYSTONE (continued). |
| | | | | 425 | | | minor very silty claystone interbeds; abundant organic material. |
| | | | | 430 | Ⓡ | | |
| | | | | 435 | | | |
| | | | | 440 | | | |

REMARKS

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
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SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 440 | SS | | SANDSTONE; dark gray (N3); no clay or silt; fine- to medium-grained; quartzose; mafics; poorly graded; subrounded to well rounded; friable; wet(?). |
| | | | | | | | Rec. 0.0' |
| | | | | 445 | | | |
| | | | | | | | Rec. 0.0' |
| | | | | 450 | | | |
| | | | | | | | Rec. 0.0' |
| | | | | 455 | | | @ 455': color change to medium dark gray to dark gray (N4 to N3); <5% silt; quartzose; 10% lithics; rounded; massive; moderately to poorly indurated. |
| | | | | | | | CORE BOX 1 |
| | | | | | | | Rec. 5.0' |
| | | | | 460 | | | |

REMARKS The borehole was continuously cored from 440- to 480-feet.

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# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224-56.17
PROJECT NAME Kettleman Hills
BY CW DATE 7/21 - 7/24/85

BORING NO. K-30
PAGE 24 OF
SURFACE ELEV. 878.0' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 460 | SS | | SANDSTONE (continued).<br>@ 461': <10% disseminated silt. |
| | | | | CORE BOX 2 | | | |
| | | | | Rec. 4.5' | | | @ 464'-465': friable. |
| | | | | 465 | | | @ 466': 42° dip.<br>@ 466.5': change of grain size to fine. |
| | | | | CORE BOX 3 | | | @ 469'-469.5': 0.5"-thick siltstone interbeds deposited every 0.5". |
| | | | | Rec. 5.0' | | | @ 472': <5% disseminated silt and cl fine- to medium-grained; quartzose; 20% lithics; siltstone laminae deposited every 0.5'; poorly indurated.<br>@ 474.5'-475': friable.<br>@ 475': change of grain size to medium to very fine; moderately to poorly graded; massive.<br>@ 476'-477.5': unit becomes a silty sandstone to a sandy siltstone with 50% disseminated silt; very fine grained SILTSTONE; medium dark gray (N4); 10-20% sandstone interbeds; 0.25"- to 0.5"-thick beds; organic laminae; poorly indurated.<br>@ 477.5'-478.5': no sand; massive.<br>@ 478.5': <25% very fine sandstone laminae; <30° dip. |
| | | | | 470 | | | |
| | | | | CORE BOX 4 | | | |
| | | | | Rec. 5.0' | | | |
| | | | | 475 | | | |
| | | | | CORE BOX 5 | | | |
| | | | | | SLST | | |
| | | | | Rec. 5.0' | | | TERMINATED BORING AT 480 FEET. |
| | | | | 480 | | | |

REMARKS

EMKON ASSOCIATES

PLATE

KETTLEMAN HILLS MONITORING WELL SUMMARY

## MONITORING WELL K-30

LOKI 2

NORTHING: 230115.9
EASTING: 1700113.4

| Well Construction Data[2] | | | Date Measured |
|---|---|---|---|
| TOC (TOSP) Elevation[3]: | 878.83 | ft. MSL | 96-Apr-01 |
| Ground Surface Elevation | 877.7 | ft. MSL | 87-Nov-22 |
| TOTAL WELL DEPTH: | 465 | ft. BGS. | 87-Nov-22 |
| TOTAL BOREHOLE DEPTH: | 480 | ft. BGS | 87-Nov-22 |
| easured Depth to Top of Sand Pack: | 421 | ft. BGS. | 87-Nov-22 #57.83 |
| Measured Depth to Top of Screen: | 435 | ft. BGS. | 87-Nov-22 1145.23 |
| Measured Depth to Pump Intake[4]: | 457.8 | ft. BGS. | 87-Nov-22 |
| Measured Depth to Water: | 433.40 | ft. BTOC | 96-Dec-01 |

| Well Deviation Calculations[1] | | | | |
|---|---|---|---|---|
| Measurement | True Vertical Depth | Ref. | True Vertical Elevation | Ref. |
| WELL TD: | 463.45 | ft. BGS. | 414.20 | ft. MSL |
| Top of Sand : | 419.92 | ft. BGS. | 457.73 | ft. MSL |
| Top of Screen : | 433.61 | ft. BGS. | 444.04 | ft. MSL |
| Pump Intake : | 455.66 | ft. BGS. | 421.99 | ft. MSL |
| GW Measurement: | 432.03 | ft. BTOC | 446.80 | ft. MSL |

**Well Deviation Survey Results**

| Measured Depth (ft.) | Course Length (ft.) | Drift/Deviation Angle (°) | Vertical Course (ft.) | True Vertical Depth (ft.) | True Elevation (MSL) |
|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 0 | 0 | 877.65 |
| 25 | 25 | 0.2 | 25.0 | 25.0 | 852.65 |
| 50 | 25 | 0.6 | 25.0 | 50.0 | 827.65 |
| 75 | 25 | 1.1 | 25.0 | 75.0 | 802.66 |
| 100 | 25 | 1.8 | 25.0 | 100.0 | 777.67 |
| 125 | 25 | 2.6 | 25.0 | 125.0 | 752.69 |
| 150 | 25 | 3.6 | 25.0 | 149.9 | 727.74 |
| 175 | 25 | 3.2 | 25.0 | 174.9 | 702.78 |
| 200 | 25 | 2.9 | 25.0 | 199.8 | 677.81 |
| 225 | 25 | 3.4 | 25.0 | 224.8 | 652.86 |
| 250 | 25 | 3.9 | 24.9 | 249.7 | 627.92 |
| 275 | 25 | 4.9 | 24.9 | 274.6 | 603.01 |
| 300 | 25 | 4.2 | 24.9 | 299.6 | 578.07 |
| 325 | 25 | 5.7 | 24.9 | 324.5 | 553.20 |
| 350 | 25 | 6.0 | 24.9 | 349.3 | 528.34 |
| 375 | 25 | 6.4 | 24.8 | 374.2 | 503.49 |
| 400 | 25 | 5.9 | 24.9 | 399.0 | 478.62 |
| 425 | 25 | 8.8 | 24.7 | 423.7 | 453.92 |
| 450 | 25 | 6.7 | 24.8 | 448.6 | 429.09 |
| 462 | 12 | 5.1 | 12.0 | 460.5 | 417.14 |

Date Installed: 85-Jul-24
Well Deviation Survey Date: 85-Jul-29

Notes: 1. True Vertical Depth and True Vertical Elevation calculations based on closest previous deviation measurement (i.e. for 460', use deviation measured at 450')
2. Well Construction Data from Emcon, (1985) and site records.
3. TOC elevations & GW Measurements provided by R. Reed, CWMI
4. Pump Intake Depth = Pump depth-(TOC-GSE).

WELENCO, INC. 4817 DISTRICT BLVD. BAKERSFIELD, CA 93309

JOB # 10474
PAGE # 1 OF 2

SURVEY DATA SHEET

COMPANY EMCON ASSOCIATES ADDRESS 90 ARCHER ST., SAN JOSE, CA 95112 7-29-85

WELL #K-30 (CASED HOLE) FIELD KETTLEMAN HILLS COUNTY KINGS STATE CA

| ASURED PTH | COURSE LENGTH | DEVIATION ANGLE | VERTICAL DEPTH COURSE | VERTICAL DEPTH TOTAL | COURSE DEVIA-TION | DIRECTION OF DEVIATION | COURSE LATITUDE NORTH | COURSE LATITUDE SOUTH | COURSE DEPARTURE EAST | COURSE DEPARTURE WEST | TOTAL LATITUDE NORTH | TOTAL LATITUDE SOUTH | TOTAL DEPARTURE EAST | TOTAL DEPARTURE WEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | N 36 E | - | - | - | - | - | - | - | - |
| 25.0 | 25.0 | 0.2 | 25.0 | 25.0 | 0.1 | N 54 E | 0.1 | - | 0.1 | - | 0.1 | - | 0.1 | - |
| 50.0 | 25.0 | 0.6 | 25.0 | 50.0 | 0.3 | N 61 E | 0.1 | - | 0.2 | - | 0.2 | - | 0.3 | - |
| 75.0 | 25.0 | 1.1 | 25.0 | 75.0 | 0.5 | N 66 E | 0.2 | - | 0.4 | - | 0.4 | - | 0.7 | - |
| 00.0 | 25.0 | 1.8 | 25.0 | 100.0 | 0.8 | N 76 E | 0.2 | - | 0.8 | - | 0.6 | - | 1.5 | - |
| 25.0 | 25.0 | 2.6 | 25.0 | 125.0 | 1.1 | N 68 E | 0.4 | - | 1.1 | - | 1.0 | - | 2.6 | - |
| 50.0 | 25.0 | 3.6 | 25.0 | 149.9 | 1.6 | N 72 E | 0.5 | - | 1.5 | - | 1.5 | - | 4.0 | - |
| 75.0 | 25.0 | 3.2 | 25.0 | 174.9 | 1.4 | N 71 E | 0.5 | - | 1.3 | - | 1.9 | - | 5.4 | - |
| 00.0 | 25.0 | 2.9 | 25.0 | 199.8 | 1.3 | N 71 E | 0.4 | - | 1.2 | - | 2.3 | - | 6.6 | - |
| 25.0 | 25.0 | 3.4 | 25.0 | 224.8 | 1.5 | N 69 E | 0.5 | - | 1.4 | - | 2.9 | - | 7.9 | - |
| 50.0 | 25.0 | 3.9 | 24.9 | 249.7 | 1.7 | N 70 E | 0.6 | - | 1.6 | - | 3.5 | - | 9.5 | - |
| 75.0 | 25.0 | 4.9 | 24.9 | 274.6 | 2.1 | N 68 E | 0.8 | - | 2.0 | - | 4.3 | - | 11.5 | - |
| 00.0 | 25.0 | 4.2 | 24.9 | 299.6 | 1.8 | N 74 E | 0.5 | - | 1.8 | - | 4.8 | - | 13.3 | - |
| 25.0 | 25.0 | 5.7 | 24.9 | 324.5 | 2.5 | N 73 E | 0.7 | - | 2.4 | - | 5.5 | - | 15.7 | - |
| 50.0 | 25.0 | 6.0 | 24.9 | 349.3 | 2.6 | N 72 E | 0.8 | - | 2.5 | - | 6.3 | - | 18.1 | - |
| 75.0 | 25.0 | 6.4 | 24.9 | 374.2 | 2.8 | N 73 E | 0.8 | - | 2.7 | - | 7.1 | - | 20.8 | - |
| 00.0 | 25.0 | 5.9 | 24.9 | 399.0 | 2.6 | N 71 E | 0.8 | - | 2.4 | - | 7.9 | - | 23.2 | - |
| 25.0 | 25.0 | 8.8 | 24.7 | 423.7 | 3.8 | N 72 E | 1.2 | - | 3.6 | - | 9.1 | - | 26.9 | - |
| 50.0 | 25.0 | 6.7 | 24.8 | 448.6 | 2.9 | N 72 E | 0.9 | - | 2.8 | - | 10.0 | - | 29.6 | - |
| 62.0 | 12.0 | 5.1 | 12.0 | 460.5 | 1.1 | N 70 E | 0.4 | - | 1.0 | - | 10.4 | - | 30.7 | - |
| | | | | CLOSURE: | | | 32.4 | FT. | N 70° | E | | | | |
| | | | | TOTAL VERTICAL DEPTH: | | | 460.5 | FT. | | | | | | |
| | | | | BEARING: | | | 70° | | | | | | | |

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2)
PAGE 1 OF
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 0 | | CLST | SILTY CLAYSTONE; grayish olive (10Y,4/2); 30% silt; 10% very fine sandstone laminae with limonitic staining. 10' with gypsum viening ; very poorly indurated. |
| | | | | 5 | | | |
| | | | | 10 | (B) | | |
| | | | | 15 | | | |
| | | | | 20 | | | |

REMARKS Borings K-46 and K-46(RD-1) were plugged and abandoned as a result of swollen claystone beds blocking the passage of PVC casing. Well K-46(RD-2) was located 65 feet east of K-46(RD-1). K-46(RD-2) was drilled with air-rotary drilling equipment to a total depth of 461 feet. During the completion procedures mud-rotary drilling methods were employed. The borehole was converted to a ground-water monitoring well (see Completion Diagram).

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 2 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 20 | (B) | CLST | SILTY CLAYSTONE (Continued). 20% disseminated silt. |
| | | | | 25 | | | |
| | | | | 30 | (B) | | occasional gypsum stringers. |
| | | | | 35 | | | |
| | | | | 40 | | | |

REMARKS (B) denotes bag sample.
Began water injection at 32 feet.

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 3 OF
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 40 | (B) | CLST | SILTY CLAYSTONE (Continued). |
| | | | | | SS | | |
| | | | | 45 | | | SANDSTONE; moderate olive-brown (5Y,4/4); 5% silt; very fine-to fine-grained; quartzose; lithic; minor cementatio friable to poorly indurated. |
| | | | | 50 | (B) | | |
| | | | | 55 | | | |
| | | | | 60 | | | increase of black mica content. |

REMARKS

EMCON ASSOCIATES

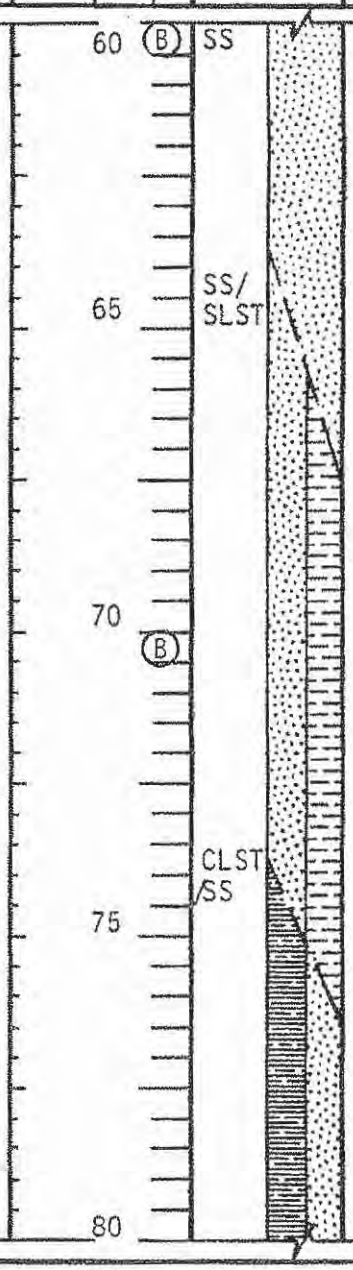
PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD.2
PAGE 4 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|




SANDSTONE (Continued).

SANDSTONE and SILTSTONE interbedded, 3:2.
sandstone: light olive-brown (5Y, 5/6).
siltstone: light olive-brown (5Y, 5/6).

CLAYSTONE and SANDSTONE interbedded, 13:7.
claystone: light olive-brown (5Y, 5/6).
sandstone: light olive-brown (5Y, 5/6).
very fine grained.

REMARKS

EMKON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD.1
PAGE 5 OF 2
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 80 | (B) | CLST/SS | CLAYSTONE and SANDSTONE interbedded (Continued). |
| | | | | 85 | | | |
| | | | | 90 | (B) | CLST | CLAYSTONE, light olive-gray (5Y, 5/2). |
| | | | | 95 | | SS | SANDSTONE (Continued on next page). |
| | | | | 100 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD.2
PAGE 6 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 100 | (B) | SS | SANDSTONE; light olive-brown (5Y, 5/6); 10% silt; fine grained; 15% medium and coarse; 15-20% claystone laminae; minor medium to coarse, dark lithics. |
| | | | | 105 | | | |
| | | | | 110 | (B) | | 20% disseminated silt; 5-10% claystone. |
| | | | | 115 | | SS/ SLST | SANDSTONE and SILTSTONE interbedded, 7:3. sandstone: light olive-brown (5Y, 5/6) fine-to medium-grained; quartzose; abundant pelecypod(?) shell fragments; bone(?) fragments. siltstone: olive (10Y, 5/2). |
| | | | | 120 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 7 OF -
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 120 | B | SS/SLST | SANDSTONE and SILTSTONE interbedded (Continued). |
| | | | | | | | siltstone comprises the major portion of the unit. |
| | | | | 125 | | CLST | |
| | | | | | | | CLAYSTONE; moderate olive-brown (5Y, 4/ |
| | | | | 130 | B | | |
| | | | | 135 | | | |
| | | | | 140 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 56.33 — BORING NO. K-46(RD-1

PROJECT NAME Kettleman Hills — PAGE 8 OF 24

BY MAC, BB DATE 10/9 - 10/10/85 — SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 140 | B | CLST | CLAYSTONE (Continued). |
| | | | | 145 | | | |
| | | | | 150 | B | | |
| | | | | 155 | | SLST | SILTSTONE; olive (10Y, 5/2). |
| | | | | 160 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 9 OF .
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|

160 (B) SLST — SILTSTONE (Continued).

165

170 (B)

SLST/SS — 175

SILTSTONE and SANDSTONE interbedded.
siltstone: olive (10Y, 5/2).
sandstone: olive (10Y, 5/2); fine-to medium-grained.

180

REMARKS

emcon ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 10 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 180 | B | SLST /SS | SILTSTONE and SANDSTONE interbedded (Continued). |
| | | | | 185 | | SLST | SANDY SILTSTONE; olive (10Y, 5/2). |
| | | | | 190 | B | | |
| | | | | 195 | | | |
| | | | | 200 | | | |

REMARKS

EMKON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RP
PAGE 11 OF 2
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 200 | B | SLST | SANDY SILTSTONE (Continued). |
| | | | | 205 | | | |
| | | | | 210 | B | | |
| | | | | 215 | | | |
| | | | | 220 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 12 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 220 | B | SLST | SANDY SILTSTONE (Continued). |
| | | | | 225 | SS | | SILTY SANDSTONE; light olive-brown (5Y, 5/6); 20% silt; fine-to medium-grained; quartzose; lithic; poorly graded. |
| | | | | 230 | B | | |
| | | | | 235 | | SLST | SILTSTONE; grayish olive (10Y, 4/2); ≤5% very fine sand; occasional limonitic staining. |
| | | | | 240 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 13 OF
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 240 | (B) | SLST | SILTSTONE (Continued). |
| | | | | 245 | | CLST/SLST | CLAYSTONE and SILTSTONE interbedded. 10% limonitic, very fine sandstone laminae. |
| | | | | 250 | (B) | | |
| | | | | 255 | | | |
| | | | | 260 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33 BORING NO. K-46(RD-2

PROJECT NAME Kettleman Hills PAGE 14 OF 24

BY MAC, BB DATE 10/9 - 10/10/85 SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 260 | B | CLST /SLST | CLAYSTONE and SILTSTONE interbedded (Continued). |
| | | | | | | CLST /SS | |
| | | | | 265 | | | CLAYSTONE and SANDSTONE interbedded. |
| | | | | 270 | B | | |
| | | | | | | SS/ SLST | |
| | | | | 275 | | | SANDSTONE and SILTSTONE interbedded, 3:2. sandstone: light olive-brown (5Y, 5/6); fine-to medium- grained; quartzose; lithic. siltstone: grayish olive (10Y, 4/2). |
| | | | | 280 | | | |

REMARKS

EMCON ASSOCIATES

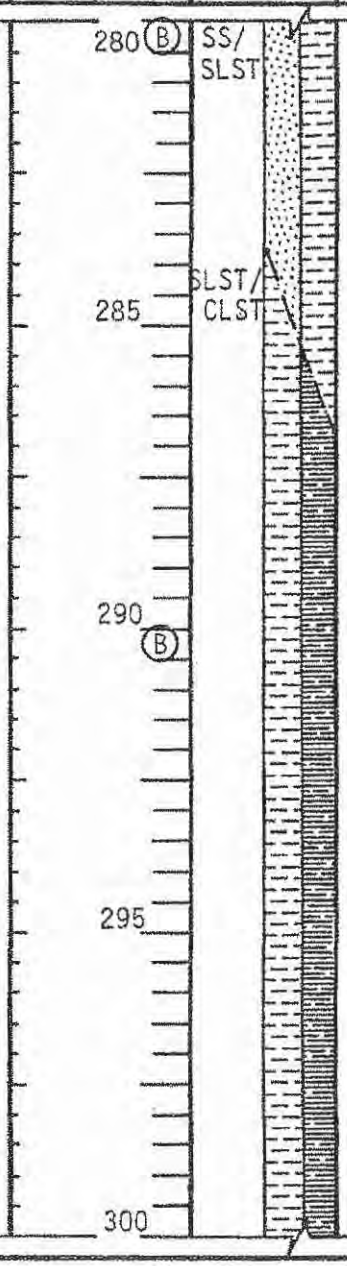
PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 15 OF .
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|




SANDSTONE and SILTSTONE interbedded (Continued).

SILTSTONE and CLAYSTONE interbedded, 3:2.
siltstone: light olive-gray (5Y, 5/2).
claystone: greenish black (5GY, 2/1).

harder drilling.

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 16 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 300 | B | SLST/CLST | SILTSTONE and CLAYSTONE interbedded (Continued). |
| | | | | 305 | | SS | CLAYEY SANDSTONE; light olive-brown (5Y, 5/6); 20-25% clay; very fine grained; quartzose; poorly graded. |
| | | | | 310 | B | | |
| | | | | 315 | | SS/CLST | SANDSTONE and CLAYSTONE interbedded. sandstone: light olive-brown (5Y, 5/6). |
| | | | | 320 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224. 56.33 — BORING NO. K-46(RD-

PROJECT NAME Kettleman Hills — PAGE 17 OF .

BY MAC, BB DATE 10/9 - 10/10/85 — SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 320 | B | SS/CLST | SANDSTONE and CLAYSTONE interbedded (Continued). |
| | | | | | | CLST | CLAYSTONE; greenish black (5G, 2/1); 10-15% siltstone laminae; 5% very fine sandstone laminae. |
| | | | | 325 | | | |
| | | | | 330 | B | | |
| | | | | 335 | | | |
| | | | | 340 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224- 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 18 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 340 | B | CLST | CLAYSTONE (Continued). |
| | | | | | | SS | CLAYEY SANDSTONE; light olive-brown (5Y, 4/4); 15% clay; very fine grained; poorly graded; 10% claystone laminae. |
| | | | | | | CLST | |
| | | | | 345 | | | |
| | | | | | | | CLAYSTONE; dark greenish gray (5G, 4/1); 15-20% grayish olive (10Y, 4/2) and yellowish brown (5Y, 5/4) siltstone interbeds. |
| | | | | 350 | B | | |
| | | | | 355 | | | |
| | | | | 360 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 56.33
PROJECT NAME Kettleman Hills
BY MAC,BB DATE 10/9 - 10/85

BORING NO. K-46(RD-2
PAGE 19 OF 2.
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 360 | B | CLST | CLAYSTONE (Continued). |
| | | | | 365 | | | |
| | | | | 370 | B | | |
| | | | | 375 | | SS/CLST | SANDSTONE and CLAYSTONE interbedded, 1:1.<br>sandstone: light olive-brown (5Y,5/4); very fine-to fine-grained; micaceous; poorly graded.<br>claystone: dark greenish gray (5G, 4/1). |
| | | | | 380 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 20 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 380 | B | SS/CLST | SANDSTONE and CLAYSTONE interbedded (Continued). |
| | | | | | | CLST | |
| | | | | 385 | | | CLAYSTONE; dark greenish gray (5G, 4/1); 5% sand; 10% sandstone laminae; 15-20% siltstone laminae; black organic laminae; pyrite nodules; occasional gypsum veins. |
| | | | | 390 | B | | harder drilling. |
| | | | | 395 | | | |
| | | | | 400 | | | |

REMARKS

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.3.3
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 21 OF
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 400 | B | CLST | CLAYSTONE (Continued). |
| | | | | 405 | | | harder drilling. |
| | | | | 410 | B | | harder drilling. |
| | | | | 415 | | | harder drilling. |
| | | | | 420 | | | |

REMARKS

EMCON ASSOCIATES

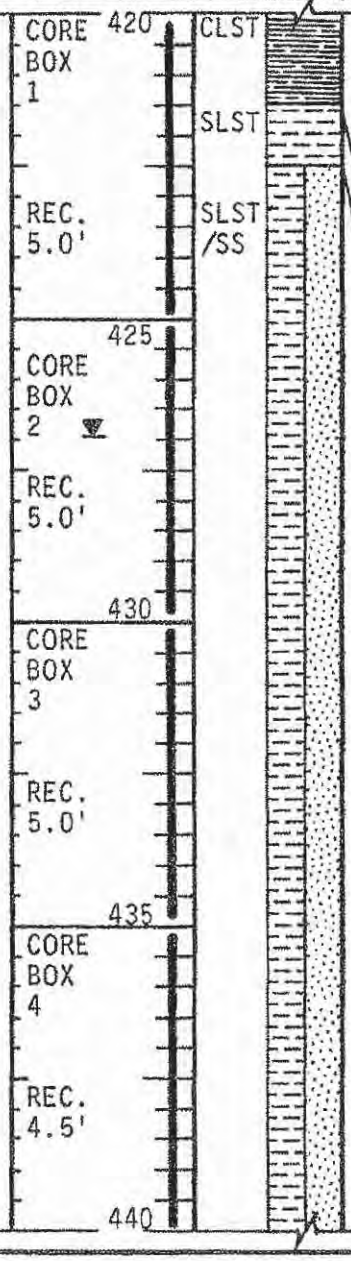
PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC,BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 22 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|




CLAYSTONE (Continued).
@ 420': color change to greenish black (5GY, 2/1); 40% fine to medium, quartzose, 50% lithics, moderate to well graded, angular to subangular sand. moderately bioturbated; minor slickensides; abundant Mya; poorly indurated; damp.

SANDY SILTSTONE; dark greenish gray (5G, 4/1); 20% very fine sand.

SILTSTONE and SANDSTONE interbedded, 1:1.
siltstone: dark greenish gray (5G, 4/1) very thinly laminated; well indurated.
sandstone: medium light gray (N6); very fine grained; very thinly laminated.

@ 431.5': SLST:SS = 7:3.
siltstone: medium dark gray (N4); poorly indurated.
sandstone: medium gray (N5); occasional oraganic fragments; rare pyrite nodules.
@ 433', brownish black (5YR, 2/1) to black (N1) organic laminae.

@ 440'-442': low degree of slumping.

REMARKS The borehole was continuously cored from 420 - to 461 - feet.

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

BORING NO. K-46(RD-2
PAGE 23 OF .
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 440 | | SLST/SS | SILTSTONE and SANDSTONE interbedded (Continued).<br>@ 441': decrease of sandstone portion. |
| | | | | | | | CLAYEY SANDSTONE; dark greenish gray (5GY, 4/1); ≤20% clay; medium-to coarse-grained; quartzose; moderate to well graded; subangular to subrounded; massive; occasional cement, calcareous; poorly indurated; moist.<br>@ 445': harder drilling. |
| | | | | 445 | | SS | |
| | | | | | P | | @ 449'-450': minor sandy claystone interbeds. |
| | | | | 450 | | | @ 451'-452' occasional organic laminae and fragments.<br>@ 452.5': change of grain size to fine to medium. |
| | | | | 455 | P | | @ 455': very poorly indurated; minor friable sandstone.<br>@ 456': 1.0"-thick siltstone interbeds. |
| | | | | | P | SLST | SILTSTONE; dark greenish gray (5GY, 4/1). very fine silty sandstone to sandy siltstone interbeds with 60% silt and clay; organic laminae.<br>@ 459.5': 10% silty sandstone to sandy siltstone interbeds. |
| | | | | 460 | P | | |

CORE BOX 5 — REC. 5.0'
CORE BOX 6 — REC. 5.0'
CORE BOX 7 — REC. 5.0'
CORE BOX 8 — REC. 5.0'

REMARKS (P) denotes a 5-to 6-inch preserved sample.

EMCON ASSOCIATES

PLATE

# LOG OF EXPLORATORY BORING

PROJECT NUMBER 224 - 56.33
PROJECT NAME Kettleman Hills
BY MAC, BB DATE 10/9 - 10/10/85

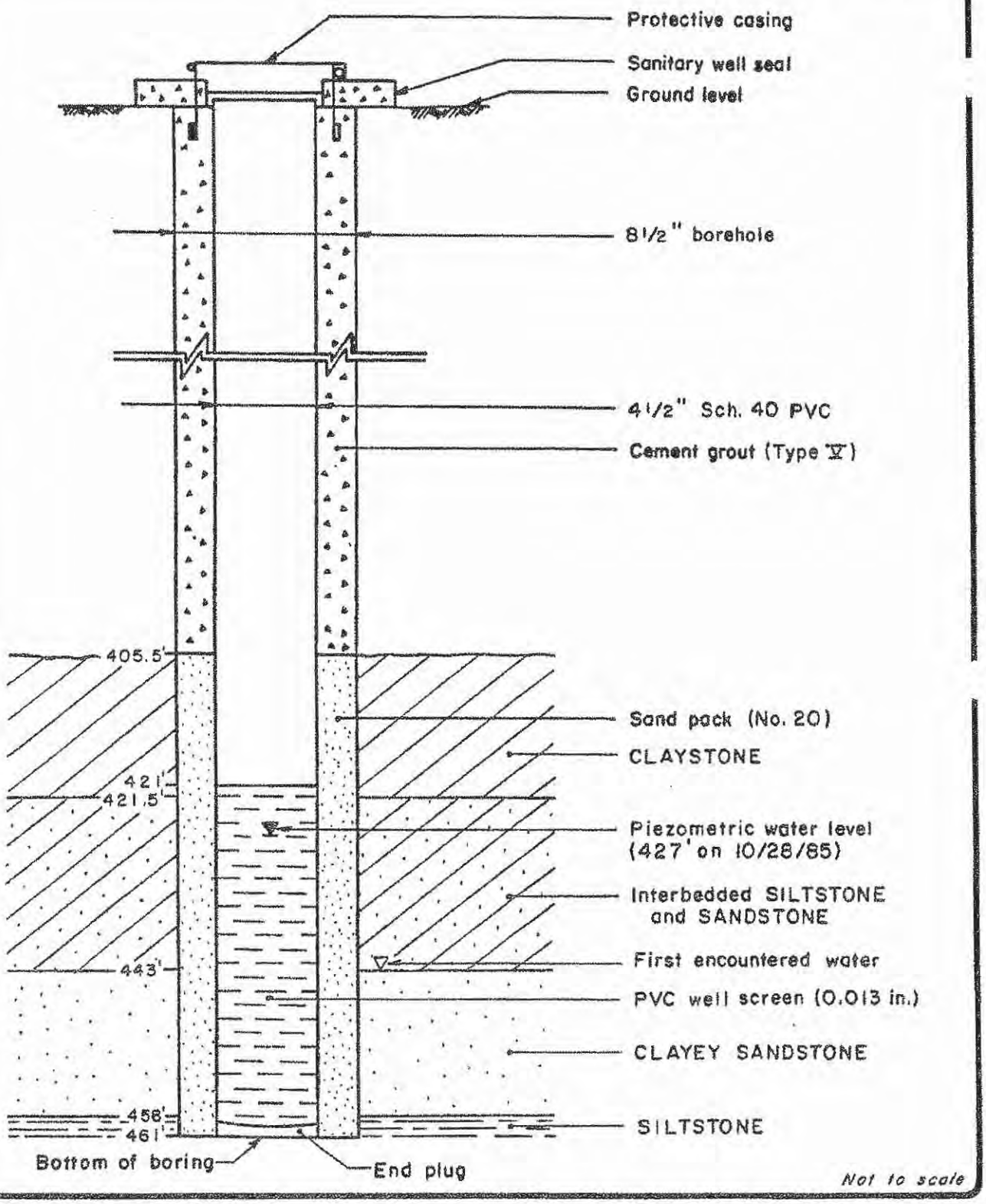
BORING NO. K-46(RD-2)
PAGE 24 OF 24
SURFACE ELEV. 871.30' M.S.L.

| TORVANE (TSF) | POCKET PENETROMETER (TSF) | PENETRATION (Blows/Ft.) | GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHOGRAPHIC COLUMN | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | | | | 460 | SLST | | SILTSTONE (Continued). |
| | | | | | | | TERMINATED BORING AT 461'. |
| | | | | 465 | | | |
| | | | | 470 | | | |
| | | | | 475 | | | |
| | | | | 480 | | | |

REMARKS

EMCON ASSOCIATES

PLATE




EMCON Associates
San Jose, California

CHEMICAL WASTE MANAGEMENT, INC.
KETTLEMAN HILLS FACILITY
KINGS COUNTY, CALIFORNIA

K-46 (RD-2) WELL COMPLETION DIAGRAM

FIGURE

PROJECT NO.
224-56.33

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-2



| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 10/30/02 - 11/4/02 | Logged By | M. McKenzie | Checked By (Date) | M. Hatch |
| Drilling Method | Air Rotary | Drill Bit Size/Type | 5" cutting bit | Total Depth Drilled (feet) | 150.0 |
| Drill Rig Type | TH-60 | Drilling Contractor | PC Exploration | Approximate Surface Elevation | 868 |
| Groundwater Level | Not encountered | Location | | Inclination from Horizontal/Bearing | 90° |
| Borehole Completion | Bentonite grout | | | Hammer Data | NA |

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTE AND LAB TES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 868 | 0 | | | | | | | | HIGHLY SAN JOAQUIN FORMATION<br>Dense, moist, light brown becoming brown, sandy SILT (ML), highly weathered | | | | | | |
| | 1 | | | | | | | | | | | | | | |
| 866 | 2 | | | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 864 | 4 | | | | | | | | | | | | | | |
| | 5 | | | | | | | | | | 1 | | | 1640 | MC=14, SA(90) |
| 862 | 6 | | | | | | | | | | | 34 | | | |
| | 7 | | | | | | | | | | | | | | |
| 860 | 8 | | | | | | | | SAN JOAQUIN FORMATION<br>Silty CLAYSTONE (CH), olive brown, soft, highly to moderately weathered grading to clayey SILTSTONE (ML) locally | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 858 | 10 | | | | | | | | | | 2 | | | 1648 | MC=16 |
| | 11 | | | | | | | | | | | 65 | | | |
| 856 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |

Report: GEO_CO; .OIL_178; File: 2764461.GPJ; 1/22/2003 17-2

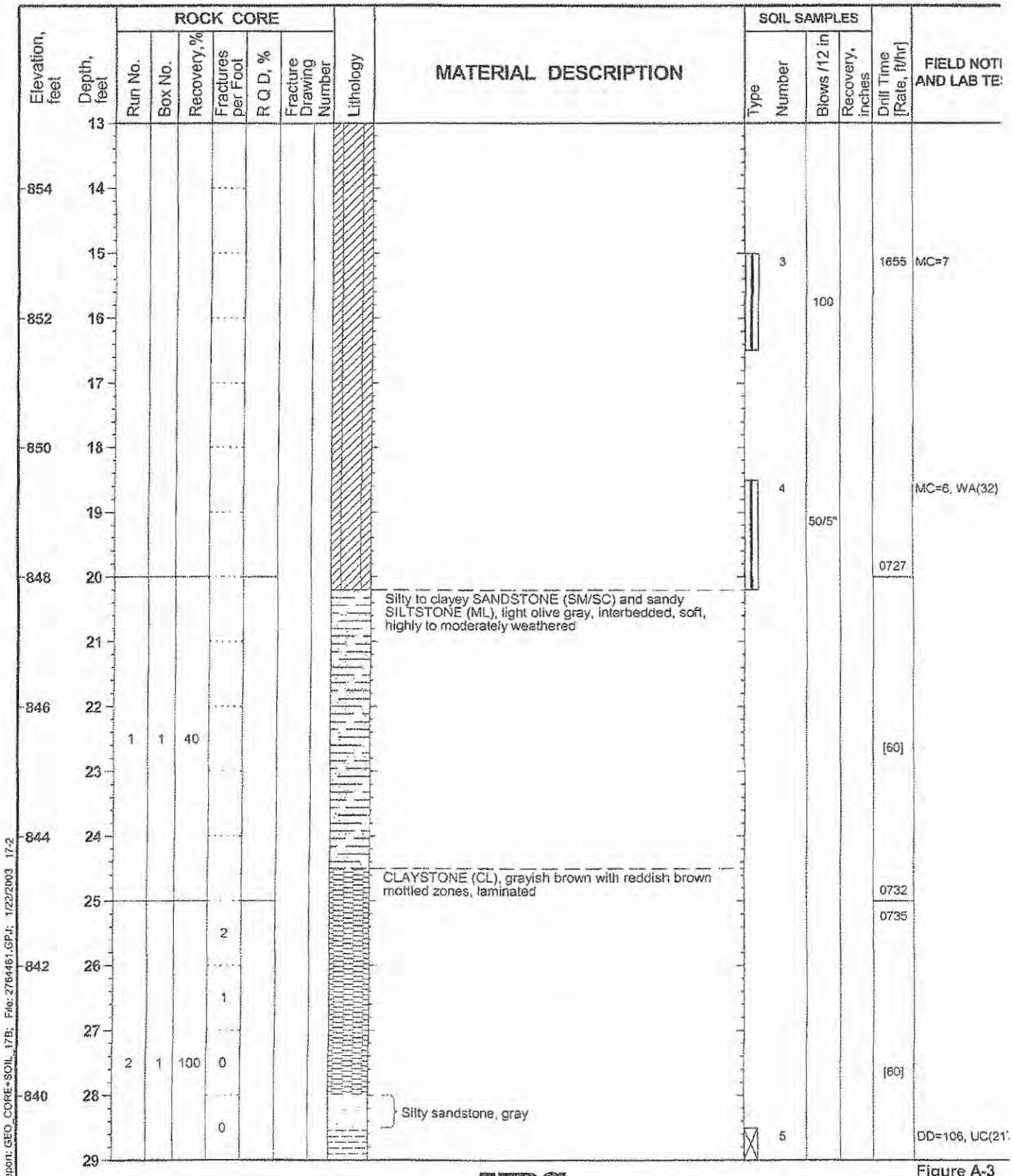
URS

Figure A-3

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-2

Sheet 2 of 10




Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-2

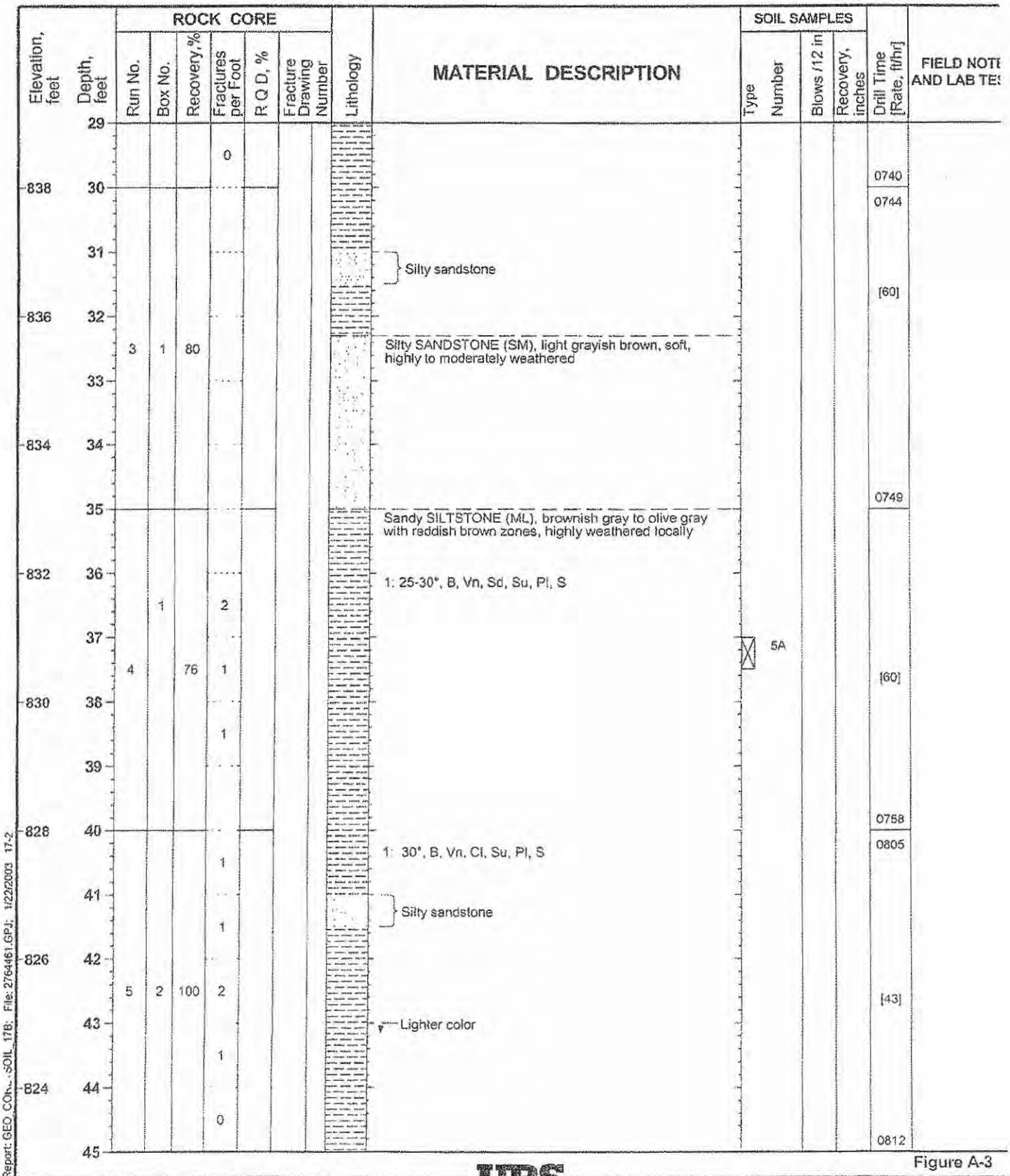
URS

Figure A-3

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-2

Sheet 3 of 10




Report: GEO_COn...SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-2

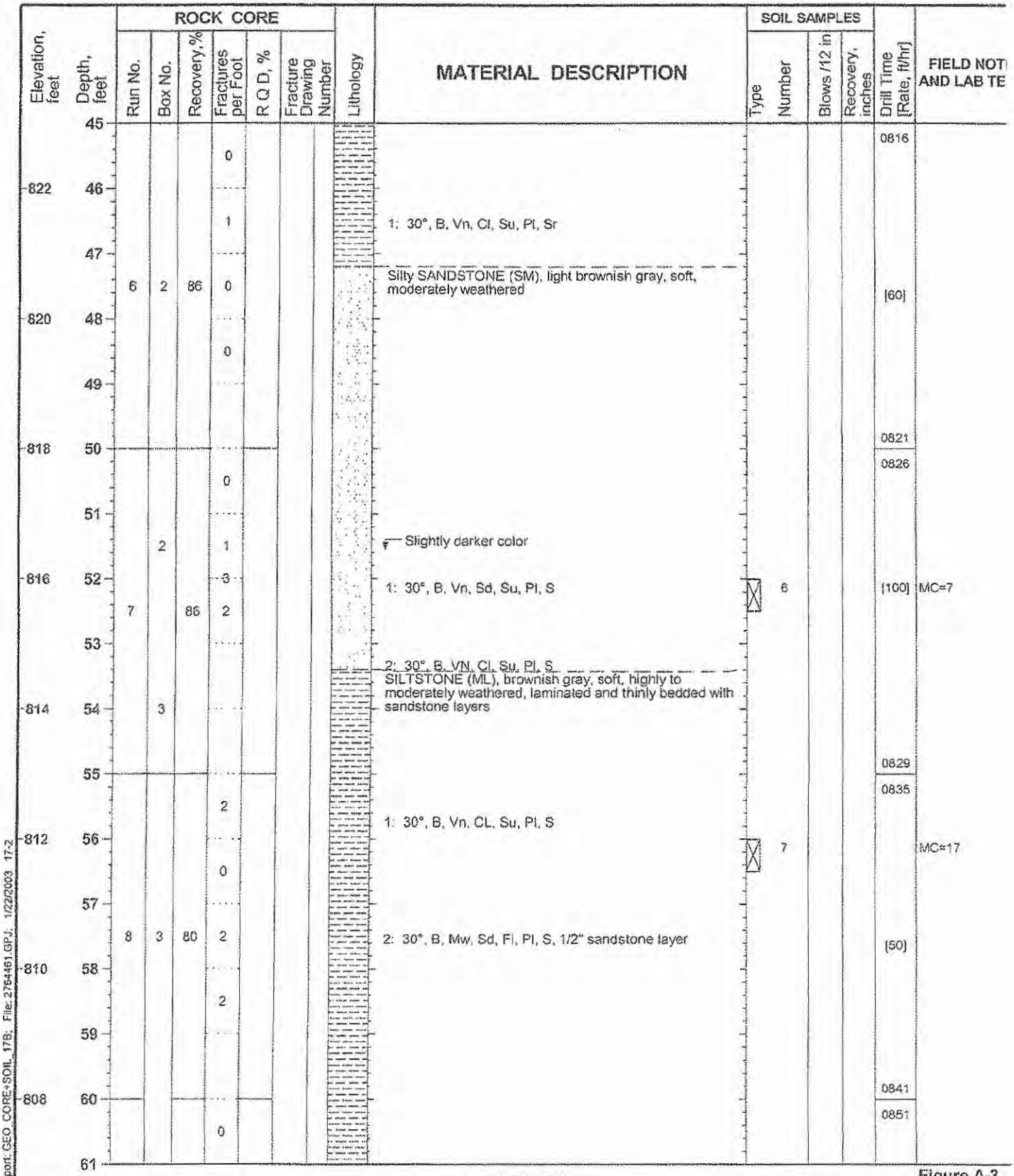
URS

Figure A-3

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-2

Sheet 4 of 10




Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-2

URS

Figure A-3

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-2

Sheet 5 of 10

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery,% | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTI AND LAB TE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 61 | | | | 0 | | | | | | | | | |
| 806 | 62 | 9 | 3 | 76 | 0 | | | | | | | | [100] | |
| | 63 | | | | 0 | | | | Silty SANDSTONE (SM), olive gray, soft, highly weathered | | | | | |
| 804 | 64 | | | | | | | | | | | | | |
| | 65 | | | | | | | | | | | | 0854 | |
| | | | | | 0 | | | | Silty SANDSTONE (SM), light brownish gray, soft, moderately weathered | | | | 0859 | |
| 802 | 66 | | | | | | | | | | | | | |
| | 67 | 10 | 3 | 16 | | | NR | | | | | | [100] | |
| 800 | 68 | | | | | | | | | | | | | |
| | 69 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | 0902 | |
| 798 | 70 | | | | | | | | | | | | 0907 | |
| | | | | | 0 | | | | | | | | | |
| | 71 | | 3 | | 0 | | | | | | | | | |
| 796 | 72 | 11 | | 50 | 0 | | | | | | | | [100] | |
| | 73 | | | | | | NR | | | | | | | |
| 794 | 74 | | | | | | | | | | | | | |
| | 75 | | | | | | | | | | | | 0910 | |
| | | | | | 0 | | | | | | | | 0913 | |
| 792 | 76 | | | | | | | | CLAYSTONE (CL), brownish gray, soft, laminated with lesser sandstone<br>1: 30°, B, Vn, Sd, Su, Pl, Sr | | | | | |
| | 77 | | | | 1 | | | | | | | | | |

Report: GEO_COrc+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17:2

URS

Figure A-3

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-2



| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOT AND LAB TE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 77 | | | | | | | | | | | | | | |
| | | 12 | | 90 | 2 | | | | | | | | | [43] | |
| 790 | 78 | | 3 | | | | | | | | | | | | |
| | | | | | 2 | | | | | | | | | | |
| | 79 | | 4 | | | | | | | | 8 | | | | SA(93) |
| | | | | | 1 | | | | | | | | | 0920 | |
| 788 | 80 | | | | | | | | Silty SANDSTONE (SM), gray, soft, moderately weathered | | | | | 0929 | |
| | | | | | 0 | | | | | | | | | | |
| | 81 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | | | | | | | |
| 786 | 82 | | 4 | | | | | | | | | | | | |
| | | 13 | | 100 | 0 | | | | | | | | | [50] | |
| | 83 | | | | | | | | | | | | | | |
| | | | | | 1 | | | | 1: 30°, B, Vn, Sd, Su, Pl, S | | | | | | |
| 784 | 84 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | | | | | | | |
| | 85 | | | | | | | | | | | | | 0935 | |
| | | | | | 0 | | | | | | | | | 0941 | |
| 782 | 86 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | | | | | | | |
| | 87 | | 4 | | | | | | | | | | | | |
| | | 14 | | 80 | 0 | | | | | | | | | [43] | |
| 780 | 88 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | | | | | | | |
| | 89 | | | | | | NR | | | | | | | | |
| 778 | 90 | | | | | | | | | | | | | 0948 | |
| | | | | | 0 | | | | | | | | | 0952 | |
| | 91 | | | | | | | | Sandy SILTSTONE (ML), gray, moderately soft to soft, moderately weathered | | | | | | |
| | | | 4 | | 0 | | | | | | | | | | |
| 776 | 92 | | | | | | | | | | | | | | |
| | | 15 | | 60 | 0 | | | | | | | | | [43] | |
| | 93 | | | | | | | | | | | | | | |

Report: GEO_CORE+SOIL_17B; File: 27644618.GPJ; 1/22/2003 17-2

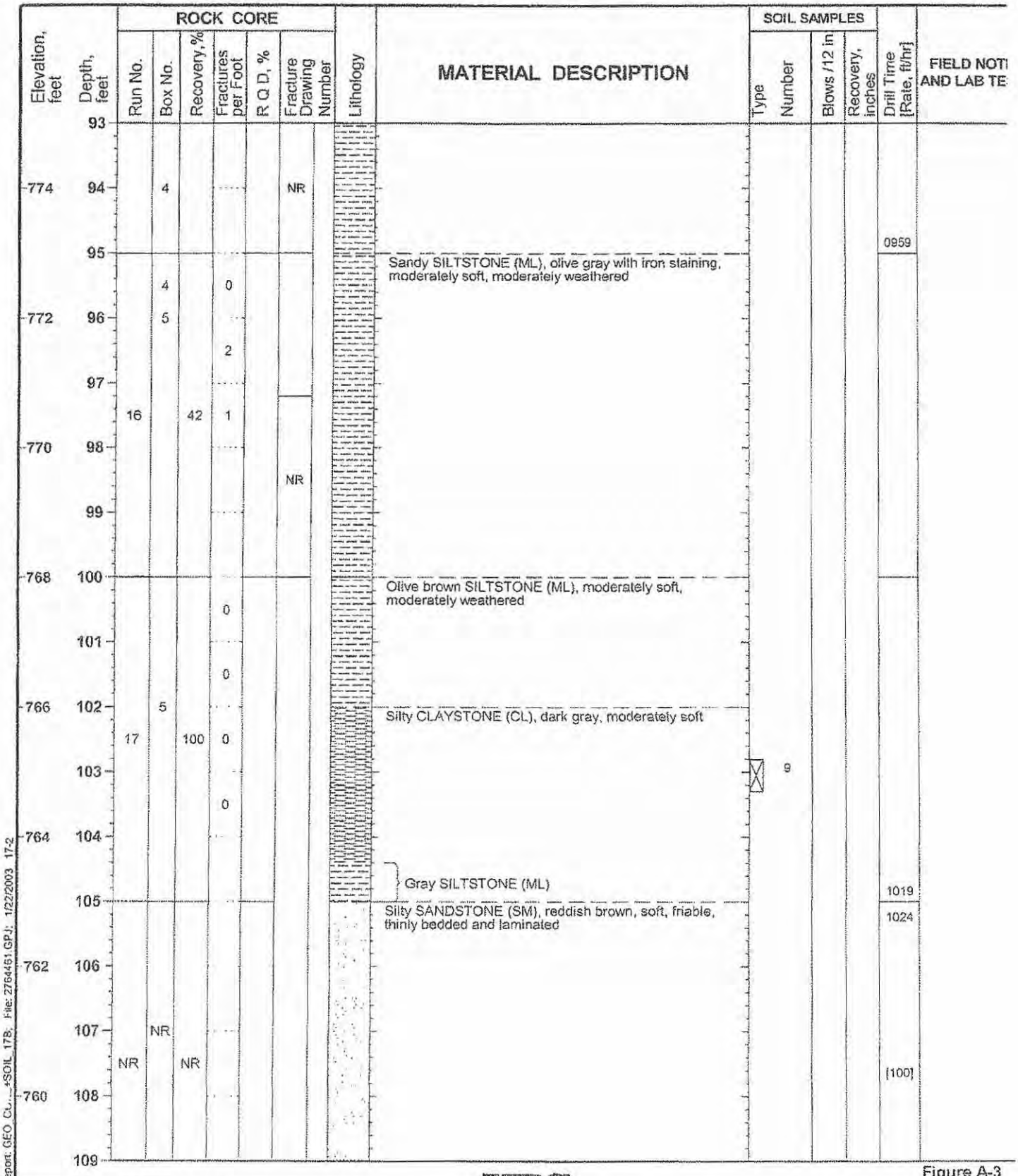
URS

Figure A-3

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-2

Sheet 7 of 10




Report: GEO Cu...+SOIL_178; File: 2764451.GPJ; 1/22/2003 17-2

URS

Figure A-3

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-2



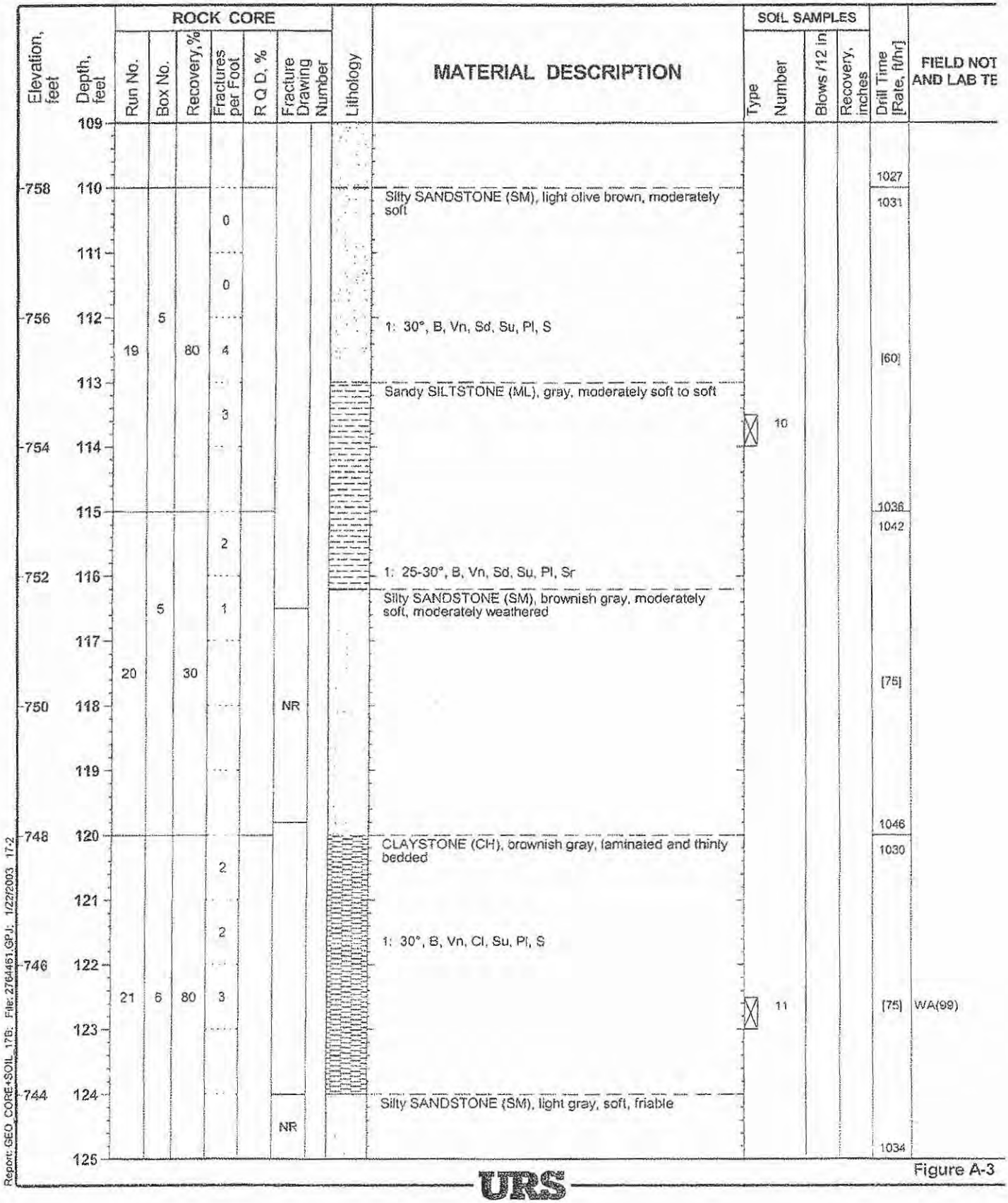


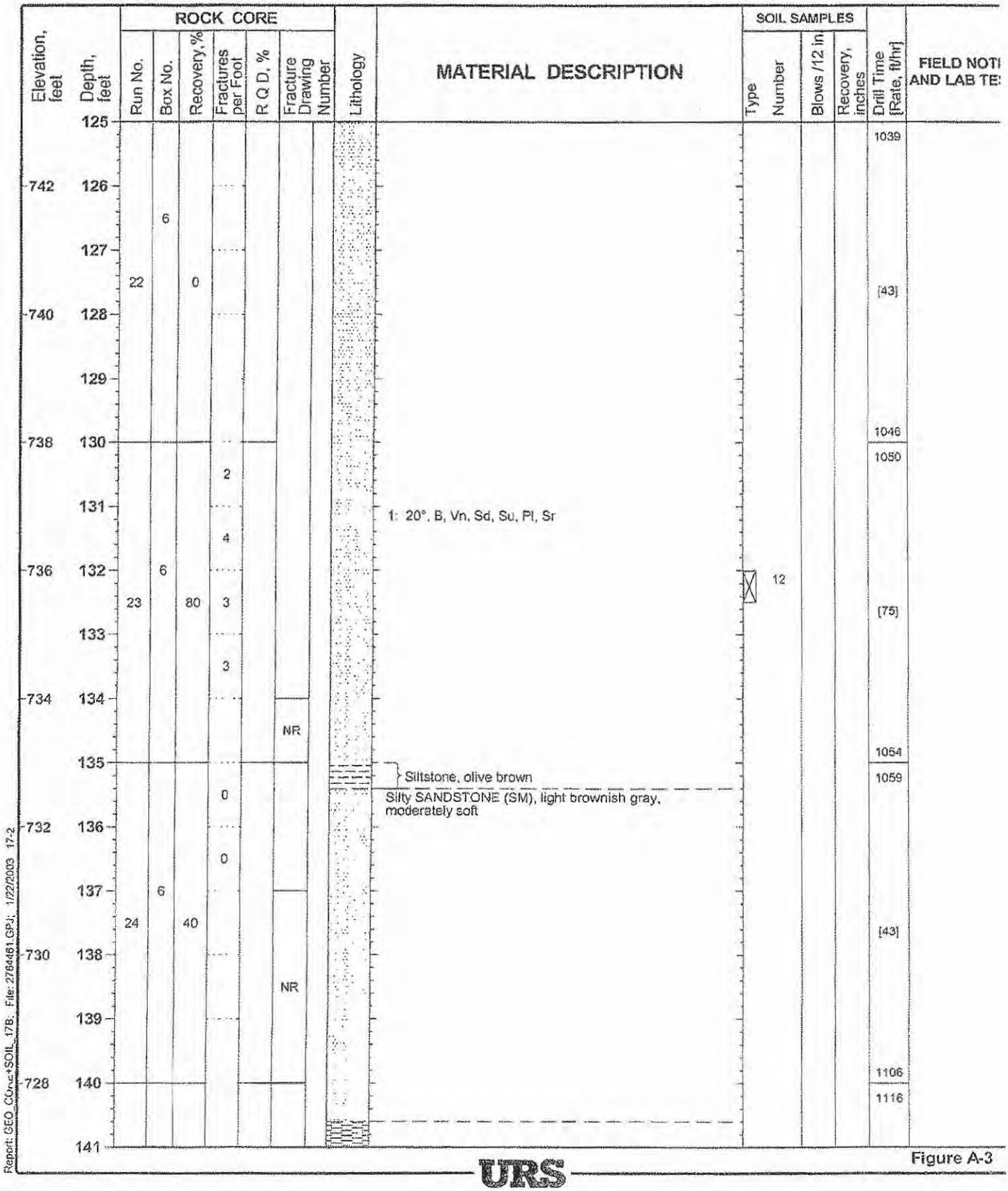



Figure A-3

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-2

Sheet 9 of 10




Report: GEO_COnc+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-2

URS

Figure A-3

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-2

Sheet 10 of 10

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOT AND LAB TE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 141 | | | | | | | | | | | | | |
| 726 | 142 | 25 | 6 | 70 | | | | | CLAYSTONE (CL), olive brown, moderately soft, moderately to slightly weathered | | | | [50] | |
| | 143 | | | | | | | | | | | | | |
| 724 | 144 | | | | | | NR | | Silty SANDSTONE (SM), light grayish brown, moderately soft, slightly weathered | | | | | |
| | 145 | | | | | | | | | | | | 1122 | |
| | | | | | | | | | | | | | 1131 | |
| 722 | 146 | | | | | | | | | | | | | |
| | 147 | | | | | | | | | | | | | |
| | | 26 | | 0 | | | | | | | | | [75] | |
| 720 | 148 | | | | | | | | | | | | | |
| | 149 | | | | | | | | | | | | | |
| 718 | 150 | | | | | | | | | | | | 1135 | |
| | | | | | | | | | Bottom of Boring at 150 feet | | | | | |
| | 151 | | | | | | | | | | | | | |
| 716 | 152 | | | | | | | | | | | | | |
| | 153 | | | | | | | | | | | | | |
| 714 | 154 | | | | | | | | | | | | | |
| | 155 | | | | | | | | | | | | | |
| 712 | 156 | | | | | | | | | | | | | |
| | 157 | | | | | | | | | | | | | |

Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17:2

URS

Figure A-3

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-3

Sheet 1 of 9

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 10/29/02 | Logged By | M. McKenzie | Checked By (Date) | M. Hatch |
| Drilling Method | Air Rotary | Drill Bit Size/Type | 5" cutting bit | Total Depth Drilled (feet) | 140.0 |
| Drill Rig Type | TH-60 | Drilling Contractor | PC Exploration | Approximate Surface Elevation | 852 |
| Groundwater Level | Not encountered | Location | | Inclination from Horizontal/Bearing | 90° |
| Borehole Completion | Bentonite grout | | | Hammer Data | NA |

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTE AND LAB TES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 852 | 0 | | | | | | | | HIGHLY WEATHERED SAN JOAQUIN FORMATION<br>Silty SANDSTONE (SM), dense, moist, light brown | | | | | | |
| | 1 | | | | | | | | | | | | | | |
| 850 | 2 | | | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 848 | 4 | | | | | | | | | | | | | | |
| | 5 | | | | | | | | | | 1 | | | | |
| 846 | 6 | | | | | | | | | | | 33 | | | |
| | 7 | | | | | | | | | | | | | | |
| 844 | 8 | | | | | | | | | | | | | | |
| | 9 | | | | | | | | SAN JOAQUIN FORMATION<br>CLAYSTONE (CH), gray, laminated and thinly bedded with siltstone and sandstone layers | | | | | | |
| 842 | 10 | | | | | | | | | | 2 | | | | MC=22, WA(77) |
| | 11 | | | | | | | | | | | 48 | | | |
| 840 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |

Report: GEO_CO1...\SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

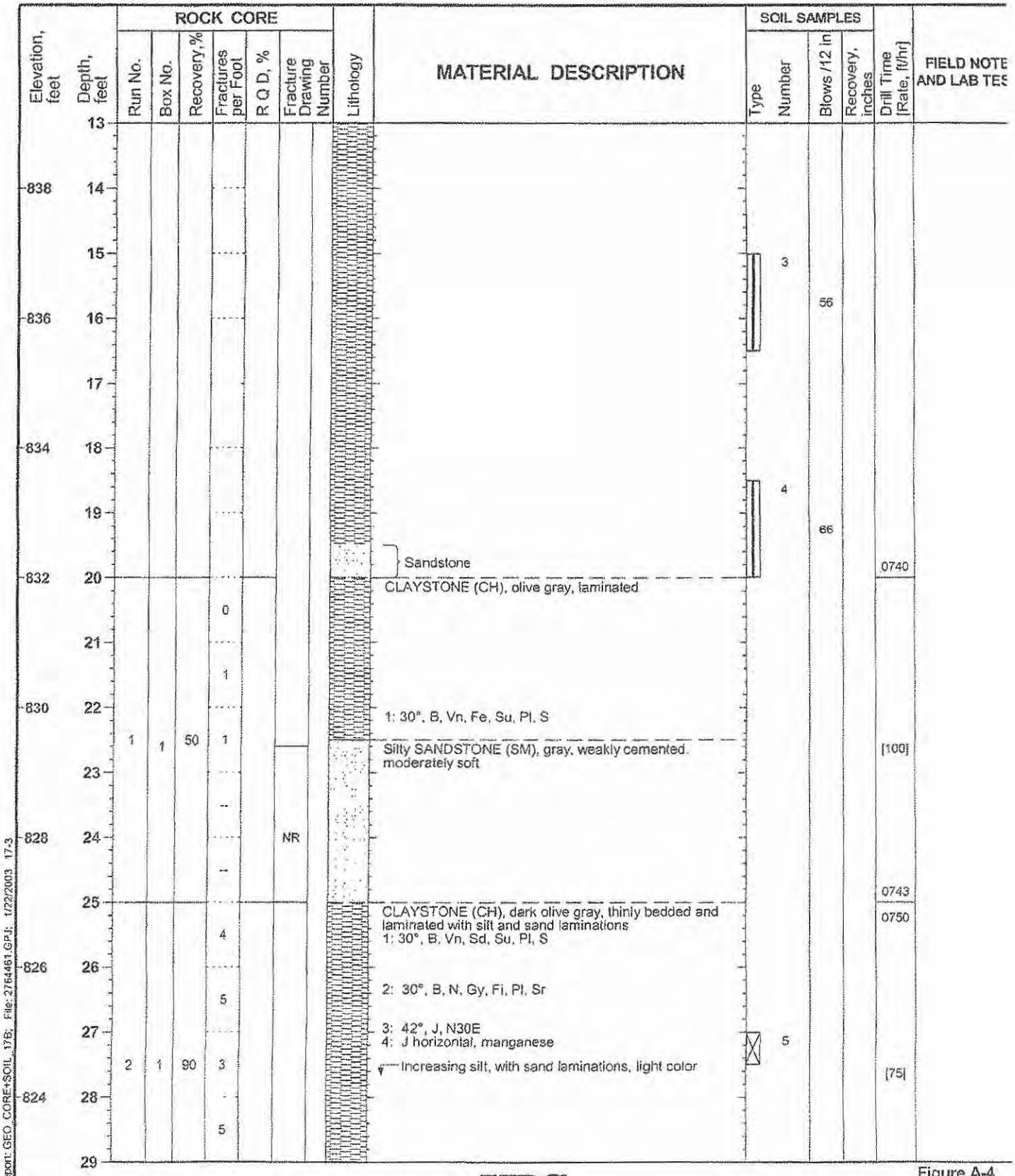
URS

Figure A-4

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-3

Sheet 2 of 9




Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

URS

Figure A-4

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-3

Sheet 3 of 9

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in. | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTE AND LAB TES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 29 | | | | 5 | | | | Silty CLAYSTONE (CH) grading to SILTSTONE (ML), light olive gray<br>3: 30°, B, Vn, Cl, Su, Pl, S | | | | | 0754 | |
| 822 | 30 | | | | 6 | | | | 1: 60°, Jn, Vn, Cl, Su, Pl, S | | | | | 0758 | |
| | 31 | | | | 6 | | | | 2: 30°, B, Vn, Cl, Su, Pl, S | X | 6 | | | | WA(98), LL=83, PI=49 |
| 820 | 32 | 3 | 1 | 98 | 3 | | | | | | | | | [43] | |
| | 33 | | | | 1 | | | | 3: 30°, B, Vn, Sd, Su, Pl, R<br>Silty sandstone, brown, moderately soft | | | | | | |
| 818 | 34 | | | | 1 | | | | 4: 30°, B, N, Gy, Fi, Pl, R<br>Claystone, dark gray | | | | | 0805 | |
| | 35 | | | | | | | | 1: 30°, B, N, Gy, Fe, Pl, R<br>CLAYSTONE (CH), dark olive gray, thinly bedded and laminated, sandstone laminations, decreased silt | | | | | 0815 | |
| | 36 | | | | 5 | | | | 2: 30°, B, Vn, Fc, Su, Pl, S | | | | | | |
| 816 | 37 | | | | 6 | | | | 3: 60°, Sh, Vn, Fe, Su, Pl, S | | | | | | |
| | 38 | 4 | 2 | 95 | 5 | | | | | X | 7 | | | [43] | |
| 814 | 39 | | | | 6 | | | | Increased sand laminations<br>4: 30°, B, Vn, Sd, Su, Pl, Sr | | | | | | |
| | 40 | | | | 7 | | NR | | | | | | | 0822 | |
| 812 | 41 | | | | >15 | | | | Darker color, waxy claystone<br>1: 20-25°, B, Vn, Cl, Su, Pl, Sr<br>2: 25-30°, B, N, Gy, Fi, Pl, R | | | | | 0831 | |
| | 42 | | | | 6 | | | | | | | | | | |
| 810 | 43 | 5 | 2 | 100 | 5 | | | | | X | 8 | | | [43] | WA(99), LL=78, PI=48 |
| | 44 | | | | 3 | | | | | | | | | | |
| 808 | 45 | | | | 7 | | | | | | | | | 0838 | |

Report: GEO_CO_OIL_178; File: 2764461.GPJ; 1/22/2003 17-3

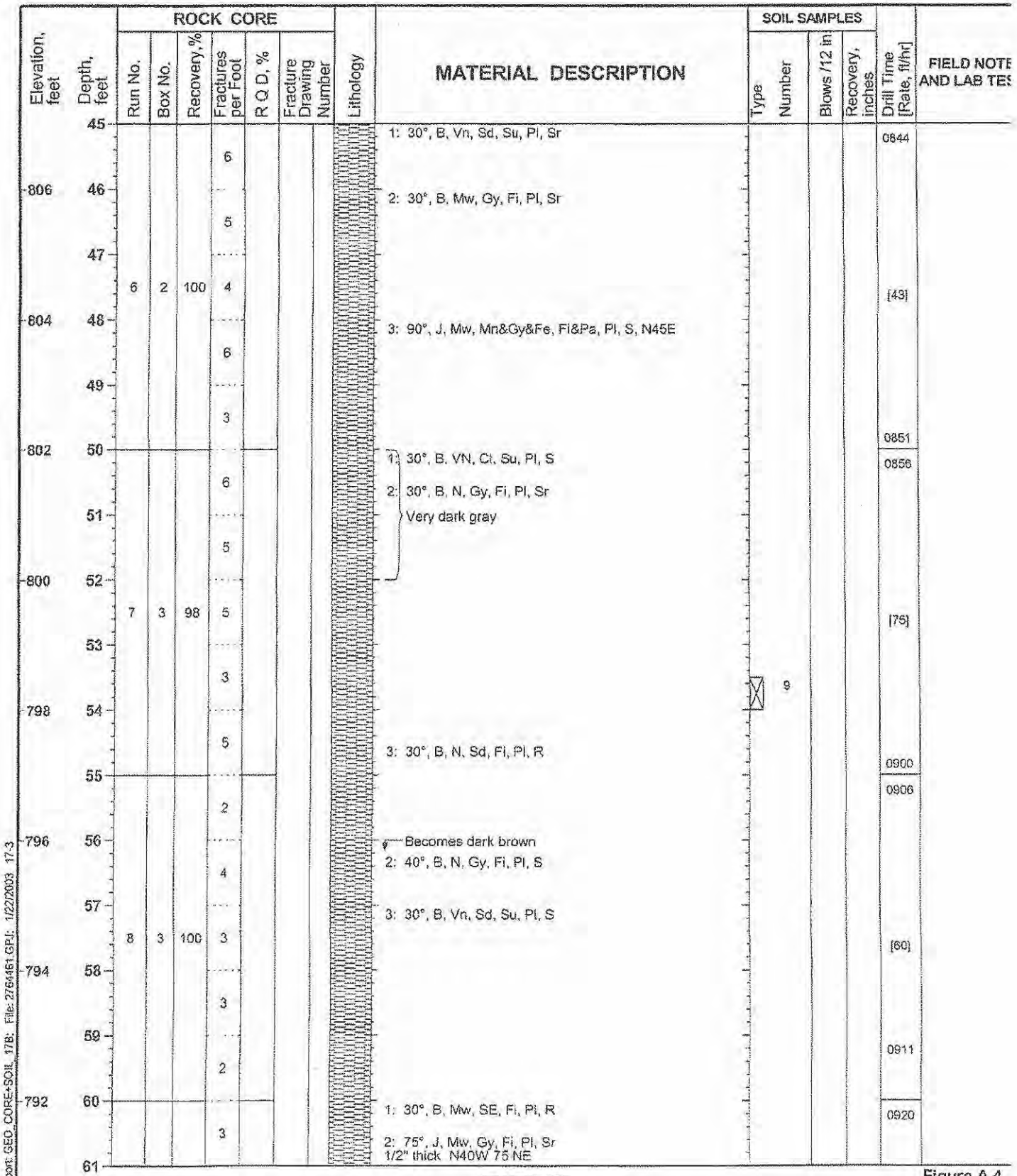
URS

Figure A-4

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-3

Sheet 4 of 9




Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

URS

Figure A-4

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-3

Sheet 5 of 9

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTES AND LAB TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 61 | | | | 3 | | | | Becomes dark gray | | | | | | |
| 790 | 62 | 9 | 3 | 100 | 2 | | | | | X | 10 | | | | WA(94) |
| | 63 | | | | 2 | | | | 3: 30°, B, Mw, Gy, Fi, Pl, S | | | | | [75] | |
| 788 | 64 | | 4 | | 0 | | | | | | | | | 0924 | |
| | 65 | | | | 0 | | | | | | | | | 0931 | |
| 786 | 66 | | | | 3 | | | | 1: 30°, B, N, Gy, Fi, Pl, S<br>2: 30°, B, Vn, Cl, Su, Pl, S | | | | | | |
| | 67 | 10 | 4 | 100 | 1 | | | | Increased waxy claystone | | | | | [60] | |
| 784 | 68 | | | | 2 | | | | 3: 60°, J/Sh, waxy surface, clay gypsum, iron 1/32" thick<br>Increased sandstone laminations and thin layers, and waxy clay layers | X | 11 | | | | |
| | 69 | | | | 7 | | | | | | | | | 0936 | |
| 782 | 70 | | | | 1 | | | | Silty CLAYSTONE (CL), gray<br>1: 30°, B, Vn, Cl, Su, Pl, S | | | | | 0944 | |
| | 71 | | | | 3 | | | | 2: 30°, B, N, Gy, Fi, Pl, S | | | | | | |
| 780 | 72 | 11 | 4 | 100 | 3 | | | | With sandstone layers to 1/2" thick | | | | | [100] | |
| | 73 | | | | 1 | | | | | | | | | | |
| 778 | 74 | | | | 1 | | | | | | | | | 0947 | |
| | 75 | | | | 2 | | | | Siltstone | | | | | 0952 | |
| 776 | 76 | | | | 0 | | | | 1: 30°, B,Vn, Sd, Su, Pl, Sr | X | 12 | | | | |
| | 77 | | | | | | | | | | | | | | |

Report: GEO_CORE+sOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

URS

Figure A-4

**Project:** Kettleman Hills Facility Expansion
**Project Location:** Kettleman City, California
**Project Number:** 27644618.10006

# Log of Boring 17-3

Sheet 7 of 9

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTES AND LAB TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93 | | | | 1 | | | | Grades to silty SANDSTONE (SM) | | | | | | |
| 758 | 94 | | | | | | | | | | | | | | |
| | 95 | | | | | | | | | | | | | 1050 | |
| | | | | | | | | | | | | | | 1058 | |
| 756 | 96 | | | | | | | | | | 15 | | | | |
| | 97 | | | | | | | | | | | | | | |
| | | 16 | 5 | 80 | | | | | | | | | | [60] | |
| 754 | 98 | | | | | | | | | | | | | | |
| | 99 | | | | | | NR | | | | | | | | |
| 752 | 100 | | | | | | | | | | | | | 1100 | |
| | | | | | | | | | Sandy SILTSTONE (ML), light olive gray, moderately soft | | | | | 1110 | |
| | 101 | | 5 | | | | | | | | | | | | |
| | | | | | 7 | | | | 1: 30°, B, Vn, Cl, Su, Pl, S | | | | | | |
| | | | | | | | | | 2: 60°, B,N, Gy, Fl, Wa, Sr | | | | | | |
| 750 | 102 | | | | | | | | 3: 40°, N, N, Gy, Fi, Pl, Sr | | | | | | |
| | | 17 | 6 | | 1 | | | | | | | | | | |
| | 103 | | | | | | | | | | 16 | | | [75] | UC(151), DD=103 |
| | | | | | 4 | | | | | | | | | | |
| 748 | 104 | | | | | | | | | | | | | | |
| | | | | | 1 | | | | | | | | | | |
| | 105 | | | | | | | | Sandy CLAYSTONE (CL)< gray, moist, moderately soft | | | | | 1114 | |
| | | | | | | | | | | | | | | 1122 | |
| | | | | | 0 | | | | | | | | | | |
| 746 | 106 | | | | | | | | | | 17 | | | | WA(75) |
| | | | | | 0 | | | | | | | | | | |
| | 107 | | | | | | | | | | | | | | |
| | | 18 | 6 | 76 | 0 | | | | | | | | | [75] | |
| 744 | 108 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | Silty SANDSTONE (SM), light gray to light brown, moderately soft, moderately weathered | | | | | | |
| | 109 | | | | | | | | | | | | | | |

Report GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

URS

Figure A-4

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-3



| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in | Recovery, inches | Drill Time (Rate, ft/hr) | FIELD NOTES AND LAB TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 109 | | | | 0 | | | | | | | | | | |
| 742 | 110 | | | | | | | | | | | | | 1126 | |
| | | | | | | | | | | | | | | 1132 | |
| | 111 | | | | | | | | | | | | | | |
| 740 | 112 | | | | | | | | | | | | | | |
| | | 19 | 6 | 24 | | | | | | | | | | [43] | |
| | 113 | | | | | | NR | | | | | | | | |
| 738 | 114 | | | | | | | | | | | | | | |
| | 115 | | | | | | | | CLAYSTONE (CH), gray, moderately soft, moderately to slightly weathered | | | | | 1139 | |
| | | | | | 1 | | | | | | | | | 1143 | |
| 736 | 116 | | | | | | | | 1: 30°, B, Vn, Cl, Su, Pl, Sr | X | 18 | | | | |
| | | | | | 4 | | | | ▼ Dark gray color | | | | | | |
| | 117 | | | | | | | | | | | | | | |
| | | 20 | 6 | 80 | 0 | | | | | | | | | [60] | |
| 734 | 118 | | | | | | | | ▼ Olive gray, silty CLAYSTONE (CH) | | | | | | |
| | | | | | 2 | | | | | | | | | | |
| | 119 | | | | | | | | | | | | | | |
| | | | | | | | NR | | | | | | | 1148 | |
| 732 | 120 | | | | | | | | | | | | | 1152 | |
| | | | 6 | | 0 | | | | | | | | | | |
| | 121 | | | | | | | | | | | | | | |
| | | | | | 2 | | | | 1: 30°, B, W, Fe, Fi, Pl, Sr | | | | | | |
| 730 | 122 | | | | | | | | 2: 30°, B, Vn, Cl, Su, Pl, S | | | | | | |
| | | 21 | 7 | 80 | 4 | | | | | X | 19 | | | [50] | |
| | 123 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | Silty SANDSTONE (SM), olive gray, moderately soft | | | | | | |
| 728 | 124 | | | | | | | | | | | | | | |
| | | | | | | | NR | | | | | | | 1158 | |
| | 125 | | | | | | | | | | | | | | |

Report GEO CORE ...it, 17B, File: 2764481.GPJ; 1/22/2003 17-3

Figure A-4

URS

Project: Kettleman Hills Facility Expansion
Project Location: Kettleman City, California
Project Number: 27644618.10006

# Log of Boring 17-3

Sheet 9 of 9

| Elevation, feet | Depth, feet | ROCK CORE: Run No. | Box No. | Recovery, % | Fractures per Foot | R Q D, % | Fracture Drawing Number | Lithology | MATERIAL DESCRIPTION | SOIL SAMPLES: Type | Number | Blows /12 in. | Recovery, inches | Drill Time [Rate, ft/hr] | FIELD NOTES AND LAB TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 125 | | | | 0 | | | | | | | | | 1203 | |
| 726 | 126 | | | | | | | | Silty fine SANDSTONE (SM) with fine sandy siltstone layers | | | | | | |
| | | | | | 2 | | | | 1: 30°, B, Vn, Sd, Su, Pl, Sr | | | | | | |
| | 127 | | | | | | | | | | | | | | |
| | | 22 | 7 | 60 | 1 | | | | Silty SANDSTONE (SM), olive gray, friable | X | 20 | | | [75] | |
| 724 | 128 | | | | | | | | | | | | | | |
| | 129 | | | | | | NR | | | | | | | | |
| 722 | 130 | | | | | | | | | | | | | 1207 | |
| | | | | | 0 | | | | Silty CLAYSTONE (CH), dark gray, moderately soft, slightly weathered | | | | | 1210 | |
| | 131 | | | | | | | | | | | | | | |
| | | | | | 0 | | | | | X | 21 | | | | |
| 720 | 132 | | | | | | | | 1: 30°, B, Vn, Cl, Su, Pl, Sr | | | | | | |
| | | 23 | 7 | 50 | 1 | | | | Silty SANDSTONE (SM), light olive gray, slightly weathered | | | | | [37] | |
| | 133 | | | | | | NR | | | | | | | | |
| 718 | 134 | | | | | | | | | | | | | | |
| | 135 | | | | | | | | | | | | | 1218 | |
| | | | | | 0 | | | | | | | | | 1223 | |
| 716 | 136 | | | | | | | | 1: 20°, B, Vn, Sd, Su, Pl, Sr | | | | | | |
| | | | | | 2 | | | | | | | | | | |
| | 137 | | | | | | | | | | | | | | |
| | | 24 | 7 | 48 | | | | | Fine SANDSTONE (SP), light olive gray | | | | | [60] | |
| 714 | 138 | | | | | | | | | | | | | | |
| | | | | | | | NR | | | | | | | | |
| | 139 | | | | | | | | | | | | | | |
| 712 | 140 | | | | | | | | | | | | | 1228 | |
| | | | | | | | | | Bottom of Boring at 140 feet | | | | | | |
| | 141 | | | | | | | | | | | | | | |

Report: GEO_CORE+SOIL_17B; File: 2764461.GPJ; 1/22/2003 17-3

Figure A-4

URS

Geosyntec consultants

# Attachment 2: Current Field Investigation

Geosyntec consultants
10875 Rancho Bernardo Rd, Suite 200
San Diego, CA 92127
Tel: (858) 674-6559
Fax: (858) 674-6586

**PROJECT** Kettleman Hills Facility
**PROJECT LOCATION** Kettleman City
**PROJECT NUMBER** SC0458-01

# KEY SHEET - CLASSIFICATIONS AND SYMBOLS

GS FORM: KEY 09/99

## EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES *

| | N VALUE * (BLOWS/FT) | CONSISTENCY | UNCONFINED COMPRESSIVE STRENGTH (TONS/SQ FT) |
|---|---|---|---|
| FINE GRAINED SOILS | 0 - 2 | VERY SOFT | <0.25 |
| | 3 - 4 | SOFT | 0.25 - 0.50 |
| | 5 - 8 | FIRM | 0.50 - 1.00 |
| | 9 - 15 | STIFF | 1.00 - 2.00 |
| | 16 - 30 | VERY STIFF | 2.00 - 4.00 |
| | 31 - 50 | HARD | >4.00 |
| | >50 | VERY HARD | |

| | N VALUE * (BLOWS/FT) | RELATIVE DENSITY |
|---|---|---|
| COARSE GRAINED SOILS | 0 - 4 | VERY LOOSE |
| | 5 - 10 | LOOSE |
| | 11 - 30 | MEDIUM DENSE |
| | 31 - 50 | DENSE |
| | >50 | VERY DENSE |

* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1.4 IN. I.D. SAMPLER ONE FOOT.

## UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

| MAJOR DIVISIONS | | | SYMBOLS | DESCRIPTIONS |
|---|---|---|---|---|
| COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL COARSER THAN NO. 200 SIEVE SIZE | GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE | CLEAN GRAVELS — LITTLE OR NO FINES | GW | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES |
| | | | GP | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES |
| | | GRAVELS WITH FINES — APPRECIABLE AMOUNT OF FINES | GM | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES |
| | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES |
| | SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO.4 SIEVE | CLEAN SANDS — LITTLE OR NO FINES | SW | WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| | | | SP | POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| | | SANDS WITH FINES — APPRECIABLE AMOUNT OF FINES | SM | SILTY SANDS, SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS, SAND-CLAY MIXTURES |
| FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL FINER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| HIGHLY ORGANIC SOILS | | | PT | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT |

NOTE: DUAL SYMBOLS USED FOR BORDERLINE CLASSIFICATIONS

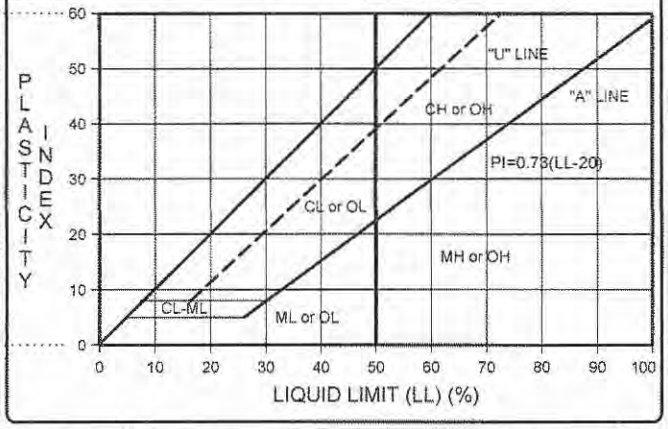
## PARTICLE SIZE IDENTIFICATION

| | |
|---|---|
| BOULDERS | >300 mm |
| COBBLES | 75 - 300 mm |
| GRAVEL: COARSE | 19.0 - 75 mm |
| GRAVEL: FINE | 4.75 - 19 mm |
| SAND: COARSE | 2.00 - 4.75 mm |
| SAND: MEDIUM | 0.425 - 2.00 mm |
| SAND: FINE | 0.075 - 0.425 mm |
| SILT | 0.075 - 0.002 mm |
| CLAY | <0.002 mm |

WELL GRADED - HAVING WIDE RANGE OF GRAIN SIZES AND APPRECIABLE AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES

POORLY GRADED - PREDOMINANTLY ONE GRAIN SIZE, OR HAVING A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING

## PLASTICITY CHART




## OTHER MATERIAL SYMBOLS

- Siltstone
- Sandstone
- Siltstone/Claystone
- Claystone
- Shale
- Siltstone/Sandstone
- Conglomerate
- Granitic
- Sand
- Silt
- Silty Sand
- Evaporite
- Artificial Fill
- Debris Fill
- Asphalt
- Concrete

## WELL SYMBOLS

- HYDRATED BENTONITE CHIPS
- BENTONITE CEMENT GROUT
- FILTER PACK
- CONCRETE
- NATIVE/ SLOUGH
- CENTRAL-IZER

## SAMPLER AND OTHER SYMBOLS

- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- HAND AUGER
- DRIVE SAMPLE
- GROUNDWATER SAMPLE

- Water Level at Time Drilling, or as Shown
- Static Water Level
- MSL: Mean Sea Level
- AGS: Above Ground Surface
- BGS: Below Ground Surface
- BTOC: Below Top of Casing
- HSA: Hollow Stem Auger

KEY SC0458.GPJ GEOSNTEC.GDT 1/30/08

Geosyntec consultants
10875 Rancho Bernardo Rd, Suite 200
San Diego, CA 92127
Tel: (858) 674-6559
Fax: (858) 674-6586

GS FORM: BORE 1/99

# BOREHOLE RECORD

**BORING** CS-1A **SHEET** 1 OF 3
**START DATE** Nov 26, 07 **ELEVATION** 855 FT MSL
**FINISH DATE** Nov 27, 07
**PROJECT** Kettleman Hills Facility
**LOCATION** Kettleman City
**PROJECT NUMBER** SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **SAN JOAQUIN FORMATION** Dense, moist, light yellowish brown (2.5Y 6/4), FAT CLAY (CH) with fine to very fine sand | | 854 | BULK 1A-1 | | | | | | Bulk Sample from 0-5' |
| 2 | | | 853 | | | | | | | |
| 3 | | | 852 | | | | | | | |
| 4 | | | 851 | | | | | | | |
| 5 | | | 850 | | | | | | | |
| 6 | | | 849 | 1A-1 | | 8/11/20 | | | | |
| 7 | | | 848 | BULK 1A-2 | | | | | | |
| 8 | Hard, moist, light gray (2.5Y 7/1) to very dark grayish brown (2.5Y 3/2), mottled coloring, FAT CLAY [CH], with thin interbedded laminations of very fine sand, contains iron oxide stain and is cemented locally. | | 847 | | | | | | | |
| 9 | | | 846 | | | | | | | |
| 10 | | | 845 | | | | | | | Bulk Sample from 5-10' |
| 11 | | | 844 | 1A-2 | | 10/31/43 | | | | |
| 12 | | | 843 | | | | | | | |
| 13 | | | 842 | | | | | | | |
| 14 | | | 841 | | | | | | | |
| 15 | Becomes SILTY CLAY | | 840 | 1A-3 | | 25/50/50 | | | | |
| 16 | | | 839 | | | | | | | |
| 17 | | | 838 | | | | | | | |
| 18 | | | 837 | | | | | | | |
| 19 | | | 836 | | | | | | | |
| 20 | | | 835 | 1A-4 | | 22/50/5" | | | | |
| 21 | | | 834 | | | | | | | |
| 22 | | | 833 | | | | | | | |
| 23 | | | 832 | | | | | | | |
| 24 | | | 831 | | | | | | | |
| 25 | Calcite infilling, increase in silt and fine sand [ML], becomes pale yellow (2.5Y 7/4) | | 830 | 1A-5 | | 16/34/39 | | | | |
| 26 | | | 829 | | | | | | | |
| 27 | | | 828 | | | | | | | |
| 28 | | | 827 | | | | | | | |
| 29 | | | 826 | | | | | | | |
| 30 | | | 825 | 1A-6 | | 61/50/5" | | | | |
| 31 | Hard, moist, dark gray (2.5Y 4/1), FAT CLAY [CH], with thin laminations of iron oxide stained silty fine sand. | | 824 | | | | | | | |
| 32 | | | 823 | | | | | | | |

**CONTRACTOR** Layne Christensen **NORTHING**
**EQUIPMENT** CME-95 **EASTING**
**DRILL MTHD** Hollow Stem Auger **ANGLE** Vertical
**DIAMETER** 8" **BEARING** ------
**LOGGER** K. Botelho **REVIEWER** A. Greene **PRINTED** Jan 30, 08

**REMARKS:** Located about 50' south and 10' west of K-25

**COORDINATE SYSTEM:**
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

Geosyntec consultants

10875 Rancho Bernardo Rd, Suite 200
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GS FORM: BORE 1/99

# BOREHOLE RECORD

**BORING** CS-1A **SHEET** 2 OF 3
**START DATE** Nov 26, 07 **ELEVATION** 855 FT MSL
**FINISH DATE** Nov 27, 07
**PROJECT** Kettleman Hills Facility
**LOCATION** Kettleman City
**PROJECT NUMBER** SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | | | 822 | | | | | | | |
| 34 | | | 821 | | | | | | | |
| 35 | Contains manganese staining locally | | 820 | 1A-7 | | 12/26/50/5" | | | | |
| 36 | | | 819 | | | | | | | |
| 37 | | | 818 | | | | | | | |
| 38 | | | 817 | | | | | | | |
| 39 | | | 816 | | | | | | | |
| 40 | | | 815 | 1A-8 | | 17/46/50/4" | | | | |
| 41 | | | 814 | | | | | | | |
| 42 | | | 813 | | | | | | | |
| 43 | | | 812 | | | | | | | |
| 44 | | | 811 | | | | | | | |
| 45 | Decease in sandy interbeds | | 810 | 1A-9 | | 12/38/50/4" | | | | |
| 46 | | | 809 | | | | | | | |
| 47 | | | 808 | | | | | | | End for the day @16:30 resume drilling following day 11/27/2007 @ 6:30 |
| 48 | | | 807 | | | | | | | |
| 49 | | | 806 | | | | | | | |
| 50 | | | 805 | 1A-10 | | 22/56/50/3" | | | | |
| 51 | | | 804 | | | | | | | |
| 52 | | | 803 | | | | | | | |
| 53 | | | 802 | | | | | | | |
| 54 | | | 801 | | | | | | | |
| 55 | Becomes yellowish brown (2.5Y 6/2), FAT CLAY [CH] with sand | | 800 | 1A-11 | | 32/50/5" | | | | |
| 56 | | | 799 | | | | | | | |
| 57 | | | 798 | | | | | | | |
| 58 | Very dense, moist, light yellowish brown (2.5Y 6/2), clayey fine SAND [SC] | | 797 | | | | | | | Drilling indicates change at 58' |
| 59 | | | 796 | | | | | | | |
| 60 | | | 795 | 1A-12 | | 50/50/1" | | | | |
| 61 | | | 794 | | | | | | | |
| 62 | Decrease in silt | | 793 | | | | | | | |
| 63 | | | 792 | | | | | | | |
| 64 | | | 791 | | | | | | | |

**CONTRACTOR** Layne Christensen **NORTHING**
**EQUIPMENT** CME-95 **EASTING**
**DRILL MTHD** Hollow Stem Auger **ANGLE** Vertical
**DIAMETER** 8" **BEARING** -----
**LOGGER** K. Botelho **REVIEWER** A. Greene **PRINTED** Jan 30, 08

**REMARKS:** Located about 50' south and 10' west of K-25

**COORDINATE SYSTEM:**
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING CS-1A SHEET 3 OF 3
START DATE Nov 26, 07 ELEVATION 855 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 65 | Very dense, moist, light yellowish brown (2.5Y 6/2), fine poorly graded SAND [SP] with trace silt | | 790 | 1A-13 | | 44/120/4" | | | | Poor recovery added sand catcher to sampler |
| 66 | | | 789 | | | 110/5" | | | | |
| | Total Depth = 66.5 ft bgs. | | | | | | | | | |

CONTRACTOR Layne Christensen NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Hollow Stem Auger ANGLE Vertical
DIAMETER 8" BEARING -----
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 50' south and 10' west of K-25

COORDINATE SYSTEM:
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BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING CS-1 SHEET 1 OF 1
START DATE Nov 26, 07 ELEVATION 845 FT MSL
FINISH DATE Nov 26, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **SAN JOAQUIN FORMATION** Soft, moist, light yelowish brown (2.5Y 6/4), FAT CLAY [CH] with trace very fine sand, medium plastic. | | 844 | BULK 1-1 | | | | | | Bulk Sample from 0-5' |
| 2 | | | 843 | | | | | | | |
| 3 | | | 842 | | | | | | | |
| 4 | | | 841 | | | | | | | |
| 5 | Becomes hard | | 840 | 1-1 | | 20/14/24 | | | | |
| 6 | | | 839 | | | | | | | |
| 7 | | | 838 | BULK 1-2 | | | | | | |
| 8 | | | 837 | | | | | | | |
| 9 | Becomes pale yellow to grayish brown (2.5Y 7/3-5/2), with iron oxide stain and calcite locally, contains fine poorly graded sand laminations. | | 836 | | | | | | | |
| 10 | | | 835 | | | | | | | Bulk Sample from 5-10' |
| 11 | | | 834 | 1-2 | | 17/44/50/5" | | | | |
| 12 | Increase in moisture and slight color change to light olive brown (2.5Y 5/4) Becomes cemented | | 833 | | | | | | | |
| 13 | | | 832 | | | | | | | |
| 14 | | | 831 | | | | | | | |
| 15 | | | 830 | 1-3 | | 6/38/50/5" | | | | |
| 16 | | | 829 | | | | | | | |
| 17 | | | 828 | | | | | | | |
| 18 | | | 827 | | | | | | | |
| 19 | | | 826 | | | | | | | |
| 20 | | | 825 | 1-4 | | 8/40/50/5" | | | | |
| 21 | | | 824 | | | | | | | |
| | Total Depth = 21.5 ft bgs. | | | | | | | | | |

CONTRACTOR Layne Christensen NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Hollow Stem Auger ANGLE Vertical
DIAMETER 8" BEARING -----
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 85' south and 15' west of K-25

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING CS-2 SHEET 1 OF 3
START DATE Nov 27, 07 ELEVATION 875 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **SAN JOAQUIN FORMATION** Hard, moist, grayish brown (2.5Y 5/2), and bluish black (GLEY2 2.5/10B), FAT CLAY [CH], medium to high plasticity, mottled, iron oxide staining. | | 874 | BULK 2-1 | | | | | | Highly cemented for the first foot of drilling Bulk Sample from 0-5' |
| 2 | | | 873 | | | | | | | |
| 3 | | | 872 | | | | | | | |
| 4 | | | 871 | | | | | | | |
| 5 | | | 870 | | | | | | | |
| 6 | | | 869 | 2-1 | | 22/42/20 | | | | |
| 7 | | | 868 | BULK 2-2 | | | | | | |
| 8 | | | 867 | | | | | | | |
| 9 | | | 866 | | | | | | | |
| 10 | | | 865 | | | | | | | Bulk Sample from 5-10' |
| 11 | Contains very thin layers of pale yellow (2.5Y 7/3), fine sandy silt layers, cemented, laminations apprear to be at angles of about 30° | | 864 | 2-2 | | 20/35/40 | | | | |
| 12 | | | 863 | | | | | | | |
| 13 | | | 862 | | | | | | | |
| 14 | | | 861 | | | | | | | |
| 15 | | | 860 | | | | | | | |
| 16 | | | 859 | 2-3 | | 17/28/50 | | | | |
| 17 | | | 858 | | | | | | | |
| 18 | | | 857 | | | | | | | |
| 19 | | | 856 | | | | | | | |
| 20 | | | 855 | | | | | | | |
| 21 | Becomes very dark gray (2.5Y 3/1), decrease in laminations | | 854 | 2-4 | | 16/27/50/4" | | | | |
| 22 | | | 853 | | | | | | | |
| 23 | | | 852 | | | | | | | |
| 24 | | | 851 | | | | | | | |
| 25 | | | 850 | | | | | | | |
| 26 | | | 849 | 2-5 | | 17/35/50/2" | | | | |
| 27 | | | 848 | | | | | | | |
| 28 | | | 847 | | | | | | | |
| 29 | | | 846 | | | | | | | |
| 30 | | | 845 | | | | | | | |
| 31 | Contains calcite infilling locally | | 844 | 2-6 | | 24/50/5" | | | | |
| 32 | | | 843 | | | | | | | |

CONTRACTOR Layne Christensen NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Hollow Stem Auger ANGLE Vertical
DIAMETER 8" BEARING -----
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 10' east and 160' south of K-25

COORDINATE SYSTEM:
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# BOREHOLE RECORD

BORING CS-2 SHEET 2 OF 3
START DATE Nov 27, 07 ELEVATION 875 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 33 | | | 842 | | | | | | | |
| 34 | | | 841 | | | | | | | |
| 35 | | | 840 | 2-7 | | 27/50/50/4" | | | | |
| 36 | | | 839 | | | | | | | |
| 37 | | | 838 | | | | | | | |
| 38 | | | 837 | | | | | | | |
| 39 | | | 836 | | | | | | | |
| 40 | | | 835 | | | | | | | |
| 41 | Increase in laminations, conatins interbedded silt lenses [CH/MH] | | 834 | 2-8 | | 38/50/5" | | | | |
| 42 | | | 833 | | | | | | | |
| 43 | | | 832 | | | | | | | |
| 44 | | | 831 | | | | | | | |
| 45 | Hard, moist, very dark grayish brown (2.5Y 3/2), FAT CLAY [CH], medium to high plasticity, with pale yellow silty laminations, contains calcite infilling and both managnese and | | 830 | | | | | | | |
| 46 | iron oxide staining locally. | | 829 | 2-9 | | 13/37/50/4" | | | | |
| 47 | | | 828 | | | | | | | |
| 48 | | | 827 | | | | | | | |
| 49 | | | 826 | | | | | | | |
| 50 | Increasing laminations of pale yellow sandy silt and occasionally fine silty sand. | | 825 | | | | | | | |
| 51 | | | 824 | 2-10 | | 19/50/5" | | | | |
| 52 | | | 823 | | | | | | | |
| 53 | | | 822 | | | | | | | |
| 54 | | | 821 | | | | | | | |
| 55 | | | 820 | | | | | | | |
| 56 | | | 819 | 2-11 | | 11/33/50/4" | | | | |
| 57 | | | 818 | | | | | | | |
| 58 | | | 817 | | | | | | | |
| 59 | Becomes dark gray (GLEY1 4/N) | | 816 | | | | | | | |
| 60 | | | 815 | | | | | | | |
| 61 | | | 814 | 2-12 | | 26/50/4" | | | | |
| 62 | | | 813 | | | | | | | |
| 63 | | | 812 | | | | | | | |
| 64 | | | 811 | | | | | | | |

CONTRACTOR Layne Christensen NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Hollow Stem Auger ANGLE Vertical
DIAMETER 8" BEARING ------
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 10' east and 160' south of K-25

COORDINATE SYSTEM:
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BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING CS-2 SHEET 3 OF 3
START DATE Nov 27, 07 ELEVATION 875 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 65 | Decrease in laminations | | 810 | 2-13 | | 23/37/50/4" | | | | |
| 66 | | | 809 | | | | | | | |
| 67 | | | 808 | | | | | | | |
| 68 | | | 807 | | | | | | | |
| 69 | | | 806 | | | | | | | |
| 70 | | | 805 | | | | | | | |
| 71 | Becomes moist, dark gray (GLEY1 4/N), CLAY [CH], medium to high plasticity, laminated with light gray (GLEY1 2/N) fine sandy silt. | | 804 | 2-14 | | 8/20/50/5" | | | | |
| 72 | | | 803 | | | | | | | |
| 73 | | | 802 | | | | | | | |
| 74 | | | 801 | | | | | | | |
| 75 | Contains trace pale yellow silty sand laminations | | 800 | 2-15 | | 27/40/50/2" | | | | |
| 76 | | | 799 | | | | | | | |
| 77 | | | 798 | | | | | | | |
| 78 | | | 797 | | | | | | | |
| 79 | | | 796 | | | | | | | |
| 80 | | | 795 | | | | | | | |
| 81 | Becomes dark grayish brown (2.5Y 4/2) to olive yellow (2.5Y 6/6), FAT CLAY [CH], fissured. | | 794 | 2-16 | | 15/50/50/4" | | | | |
| 82 | | | 793 | | | | | | | |
| 83 | | | 792 | | | | | | | |
| 84 | | | 791 | | | | | | | |
| 85 | Returns to dark gray (2.5Y 4/1), FAT CLAY [CH] | | 790 | 2-17 | | 28/50/5" | | | | |
| 86 | | | 789 | | | | | | | |
| 87 | | | 788 | | | | | | | |
| 88 | | | 787 | | | | | | | |
| 89 | | | 786 | | | | | | | |
| 90 | | | 785 | | | | | | | |
| 91 | Very dense, moist, light gray (2.5Y 7/1), fine clayey SAND [SC]. | | 784 | 2-18 | | 34/50/1" | | | | |
| | Total Depth = 91 ft bgs. | | | | | | | | | |

CONTRACTOR Layne Christensen NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Hollow Stem Auger ANGLE Vertical
DIAMETER 8" BEARING ------
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 10' east and 160' south of K-25

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING TP-1 SHEET 1 OF 1
START DATE Nov 27, 07 ELEVATION 900 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **SAN JOAQUIN FORMATION** Hard, moist, light yellowish brown (2.5Y 6/4), with occasional orange coloring, FAT CLAY(CH), medium plasticity | | 900 | BULK TP1-1 | | | | | | |
| 1 | | | 899 | | | | | | | |
| 2 | | | 898 | | | | | | | |
| 3 | Becomes pale yellow to orange, cemented | | 897 | | | | | | | |
| 4 | | | 896 | | | | | | | |
| 5 | Becomes dark gray | | 895 | | | | | | | |
| 6 | | | 894 | | | | | | | |
| 7 | | | 893 | | | | | | | |
| 8 | Dense, moist, light to dark gray, fine clayey sand with silt (SC) | | 892 | | | | | | | Excavation indicates soil becomes harder |
| 9 | | | 891 | BULK TP1-2 | | | | | | |
| 10 | Total Depth = 10 ft bgs. | | 890 | | | | | | | |

CONTRACTOR Waste Management
EQUIPMENT CME-95
DRILL MTHD Back Hoe Test Pit
DIAMETER 3' x 8'
LOGGER K. Botelho REVIEWER A. Greene

NORTHING
EASTING
ANGLE Vertical
BEARING ------
PRINTED Jan 30, 08

REMARKS: Located about 50' east of K-46 and 120' north of K-46

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING TP-2 SHEET 1 OF 1
START DATE Nov 27, 07 ELEVATION 900 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOW COUNTS | SAMPLES % RECOVERY | SAMPLES PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **SAN JOAQUIN FORMATION** Hard, moist, light yellowish brown (2.5Y 6/4), FAT CLAY(CH), medium plasticity | | | | | | | | | |
| 1 | | | 899 | | | | | | | Fissured from 1 to 5 feet |
| 2 | with pale yellow to orange colorations | | 898 | | | | | | | |
| 3 | Becomes cemented | | 897 | | | | | | | |
| 4 | | | 896 | | | | | | | |
| 5 | Appearance of white mineral occasionally along side walls of test pit | | 895 | | | | | | | |
| 6 | | | 894 | | | | | | | |
| 7 | | | 893 | | | | | | | |
| 8 | | | 892 | | | | | | | |
| 9 | Becomes light gray, highly cemented | | 891 | BULK TP2-1 | | | | | | |
| 10 | Total Depth = 10 ft bgs. | | 890 | | | | | | | |

CONTRACTOR Waste Management NORTHING
EQUIPMENT CME-95 EASTING
DRILL MTHD Back Hoe Test Pit ANGLE Vertical
DIAMETER 3' x 10' BEARING -----
LOGGER K. Botelho REVIEWER A. Greene PRINTED Jan 30, 08

REMARKS: Located about 150' east of K-50 and 20' north

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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# BOREHOLE RECORD

BORING TP-3 SHEET 1 OF 1
START DATE Nov 27, 07 ELEVATION 870 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOW COUNTS | SAMPLES: % RECOVERY | SAMPLES: PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **SAN JOAQUIN FORMATION** Hard, moist, light yellowish brown (2.5Y 6/4), FAT CLAY (CH), medium to high plasticity | | 870 | | | | | | | |
| 1 | | | 869 | | | | | | | |
| 2 | | | 868 | | | | | | | |
| 3 | | | 867 | | | | | | | |
| 4 | Orange coloration | | 866 | | | | | | | |
| 5 | | | 865 | | | | | | | |
| 6 | | | 864 | | | | | | | |
| 7 | | | 863 | | | | | | | |
| 8 | Becomes more cemented | | 862 | | | | | | | |
| 9 | | | 861 | | | | | | | |
| 10 | | | 860 | | | | | | | |
| 11 | | | 859 | BULK TP3-1 | | | | | | |
| 12 | Total Depth = 12 ft bgs. | | 858 | | | | | | | |

CONTRACTOR Waste Management
EQUIPMENT CME-95
DRILL MTHD Back Hoe Test Pit
DIAMETER 3' x 8'
LOGGER K. Botelho REVIEWER A. Greene

NORTHING
EASTING
ANGLE Vertical
BEARING ------
PRINTED Jan 30, 08

REMARKS: Located about 30' west of K-46 and 20' north

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

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GS FORM: BORE 1/99

# BOREHOLE RECORD

BORING TP-4 SHEET 1 OF 1
START DATE Nov 27, 07 ELEVATION 895 FT MSL
FINISH DATE Nov 27, 07
PROJECT Kettleman Hills Facility
LOCATION Kettleman City
PROJECT NUMBER SC0458-01

| DEPTH (ft) | MATERIAL DESCRIPTION | SYMBOLIC LOG | ELEVATION (ft) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOW COUNTS | SAMPLES: % RECOVERY | SAMPLES: PID READING | TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **SAN JOAQUIN FORMATION** Hard, moist, light yellowish brown (2.5Y 6/4), FAT CLAY (CH) with yellowish to brown discolorations, highly cemented | | | | | | | | | |
| 1 | | | 894 | | | | | | | side walls appear fissured |
| 2 | | | 893 | | | | | | | |
| 3 | | | 892 | | | | | | | |
| 4 | | | 891 | | | | | | | |
| 5 | Becomes light grayish brown | | 890 | | | | | | | |
| 6 | | | 889 | | | | | | | |
| 7 | | | 888 | | | | | | | |
| 8 | | | 887 | | | | | | | |
| 9 | | | 886 | BULK TP4-1 | | | | | | |
| 10 | Total Depth = 10 ft bgs. | | 885 | | | | | | | |

CONTRACTOR Waste Management
EQUIPMENT CME-95
DRILL MTHD Back Hoe Test Pit
DIAMETER 3' x 10'
LOGGER K. Botelho REVIEWER A. Greene

NORTHING
EASTING
ANGLE Vertical
BEARING -----
PRINTED Jan 30, 08

REMARKS:

COORDINATE SYSTEM:
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG NO WELL (STEVE) NO SIG SC0458.GPJ GEOSNTEC.GDT 1/30/08

Geosyntec consultants

# Attachment 3: Laboratory Test Results

Excel Geotechnical Testing, Inc.
"Excellence in Testing"
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

# Test Results Summary

Project Name: KHF Clay Source Evaluation
Client Name: Geosyntec

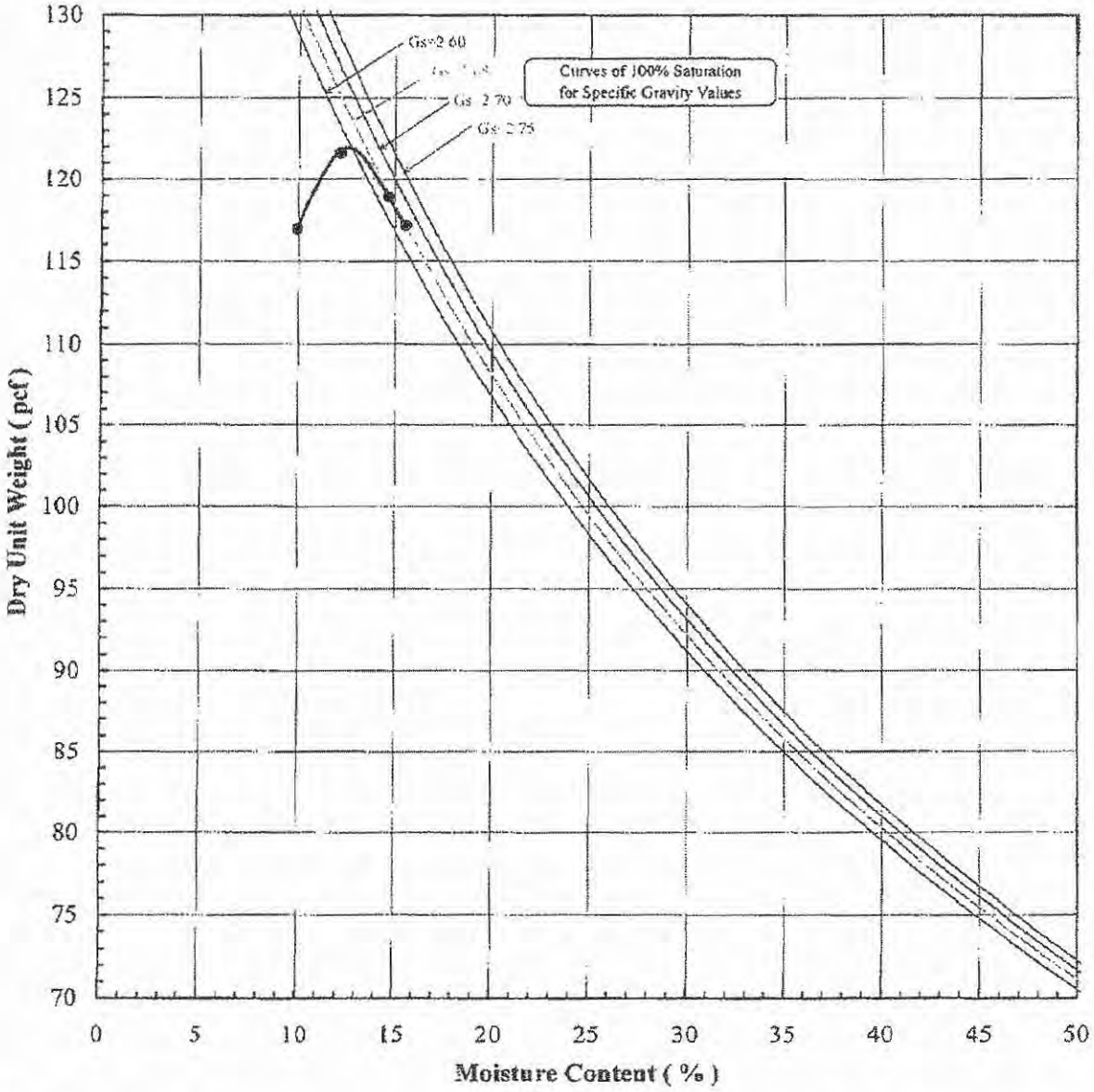
## Index Test Results

| Sample Information | | Test Information | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Site ID | Lab. No. | As Rec. Moisture Content | As Rec. Dry Unit Weight | Grain Size Analyses | | | Engineering Classification | Remarks |
| | | | | Gravel Content | Sand Content | Fines Content | | |
| (-) | (-) | (%) | (PCF) | (%) | (%) | (%) | (-) | |
| CS-1-4 | L072 | 18.5 | 100.6 | | | | | |
| CS-1A-2 | L074 | 19.3 | 100.3 | | | | | |
| CS-1A-5 | L077 | 20.9 | 98.6 | | | | | |
| CS-1A-9 | L081 | 24.4 | 98.2 | | | | | |
| CS-1A-11 | L083 | 18.6 | 95.8 | | | | | |
| CS-2-2 | L087 | 16.5 | 106.4 | | | | | |
| CS-2-7 | L092 | 21.0 | 100.6 | | | | | |
| CS-2-9 | L094 | 24.7 | 99.7 | | | | | |
| CS-2-14 | L098 | 25.1 | 97.7 | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A - |
| Lab Sample No: | L103 - |

ASTM D 1557 **COMPACTION MOISTURE-DENSITY RELATIONSHIP** Modified - Method B



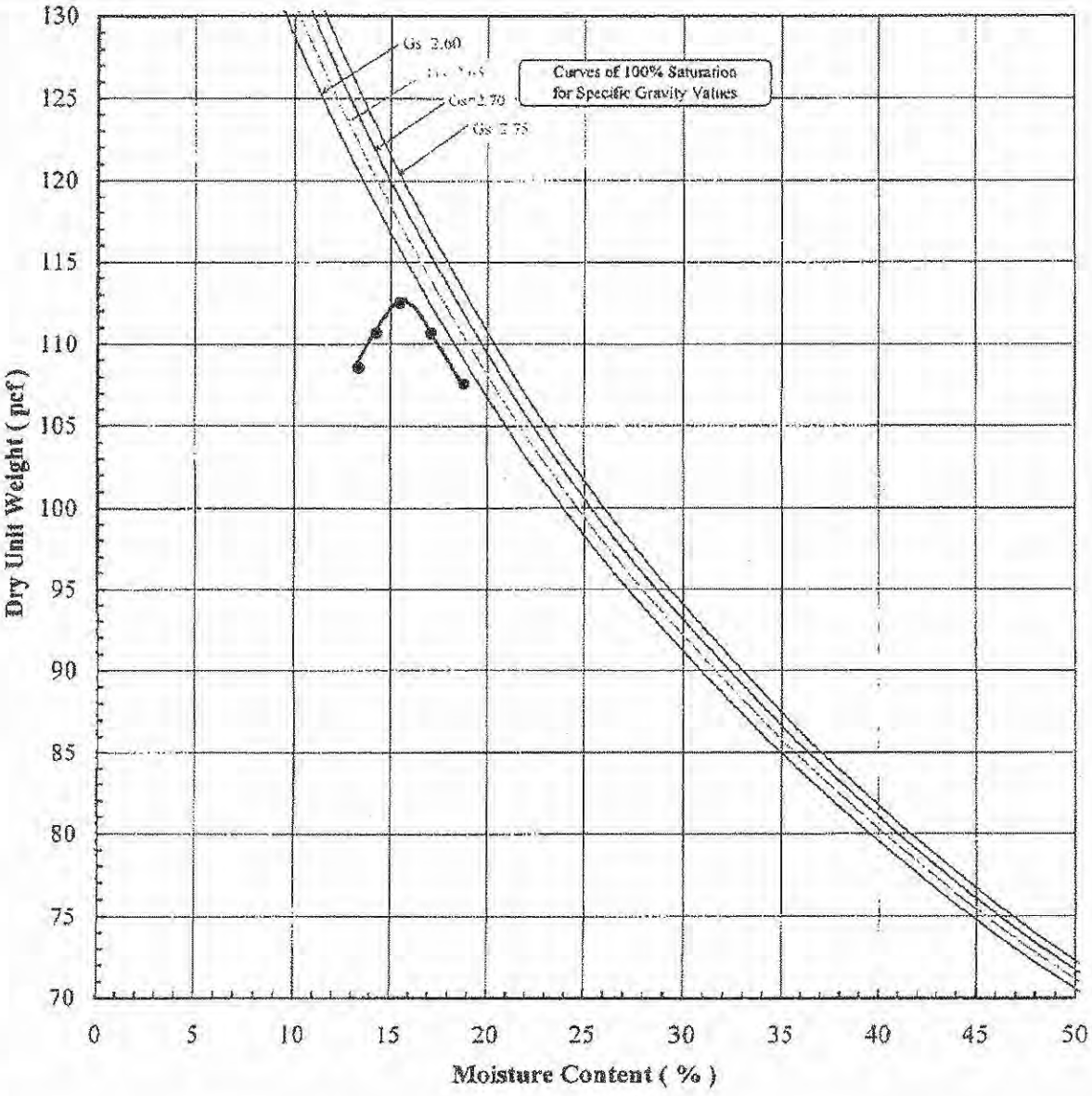

| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| CS-1A | L103 | 122.0 | 12.5 | |

Note(s):

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2 |
| Lab Sample No: | L104 |

ASTM D 1557 **COMPACTION MOISTURE-DENSITY RELATIONSHIP** Modified - Method B




| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| CS-2 | L104 | 113.1 | 15.6 | |

Note(s):

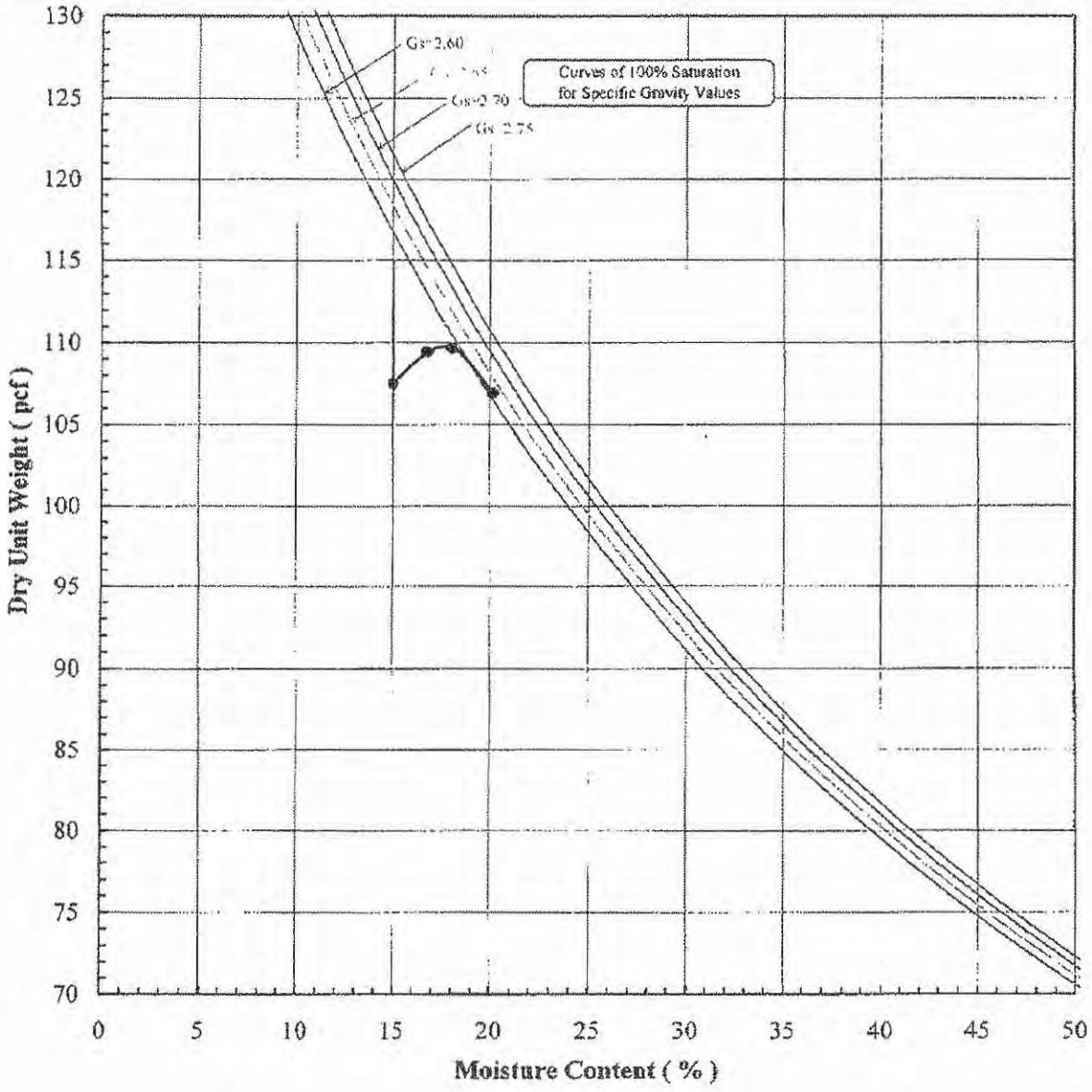
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | TP-1 |
| **Lab Sample No:** | L105 |

ASTM D 1557

## COMPACTION MOISTURE-DENSITY RELATIONSHIP

Modified - Method B



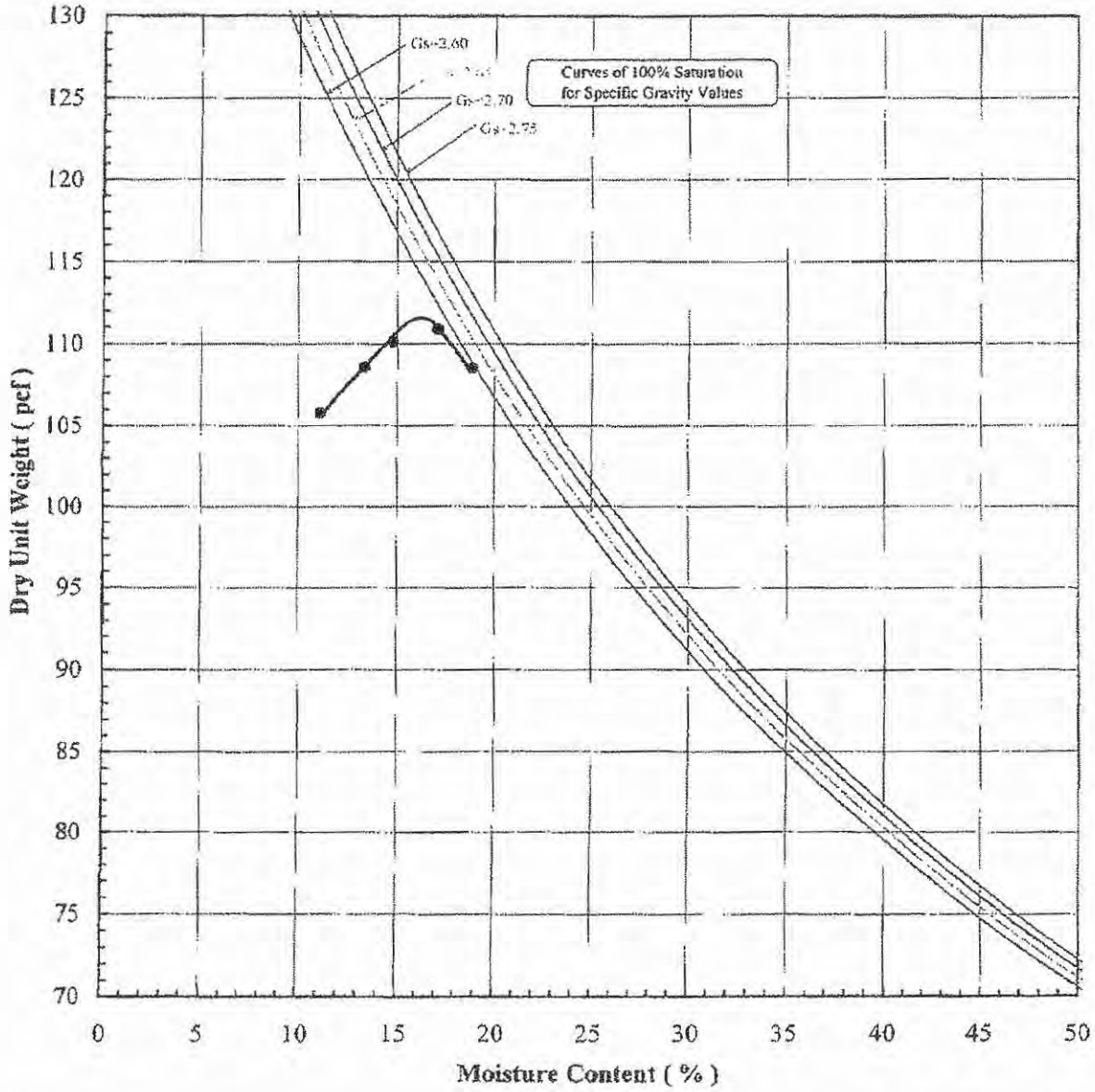

| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| TP-1 | L105 | 109.9 | 17.8 | |

Note(s)

Excel Geotechnical Testing, inc.
"Excellence in Testing"
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | TP-2 |
| Lab Sample No: | L106 |

ASTM D 1557 **COMPACTION MOISTURE-DENSITY RELATIONSHIP** Modified - Method B



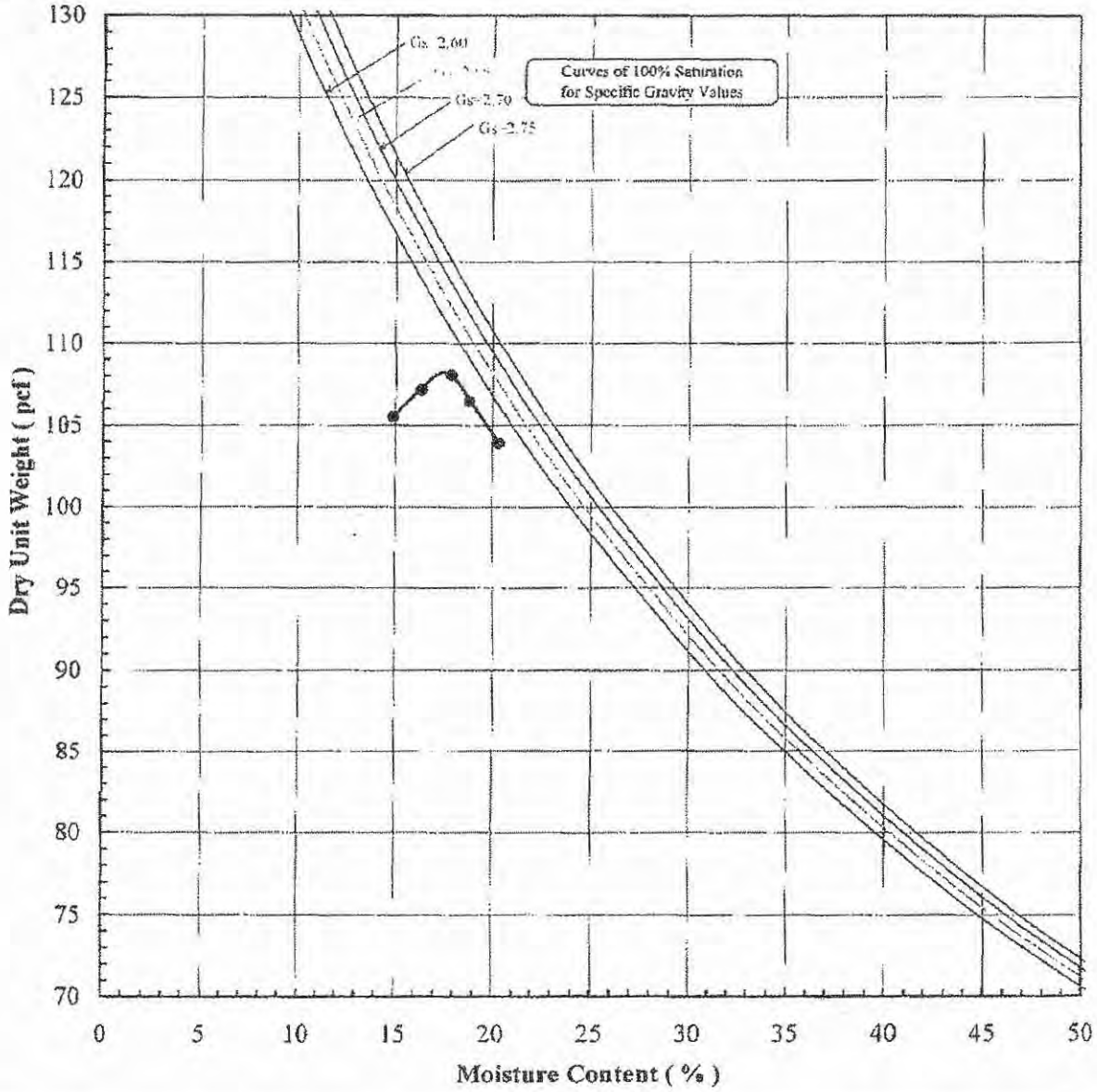

| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| TP-2 | L106 | 111.7 | 16.2 | |

Note(s):

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | TP-3 |
| **Lab Sample No:** | L107 |

ASTM D 1557 **COMPACTION MOISTURE-DENSITY RELATIONSHIP** Modified - Method B



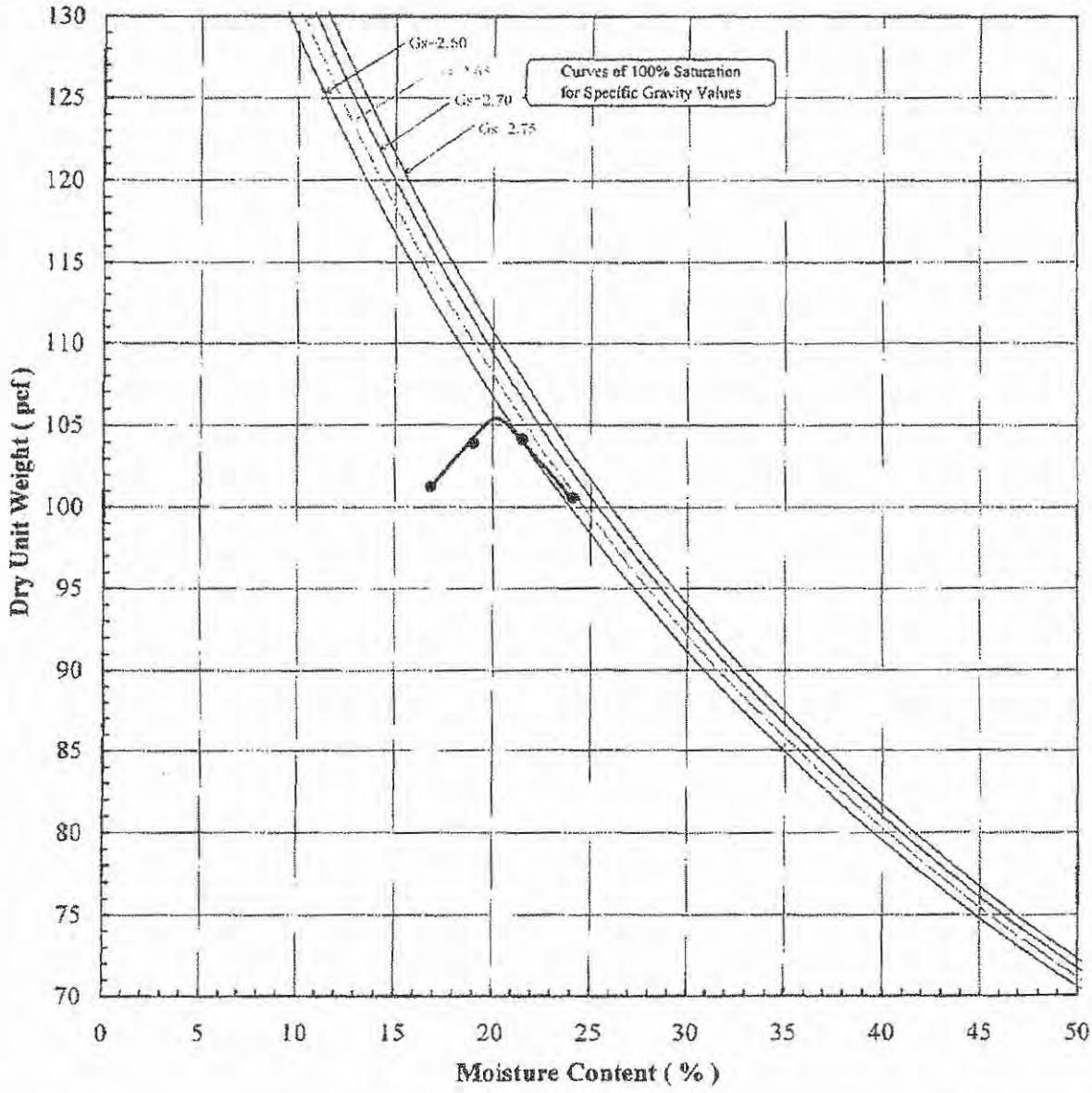

| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| TP-3 | L107 | 108.2 | 17.4 | |

Note(s):

**Excel Geotechnical Testing, Inc.**
*"Excellence In Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | TP-4 |
| Lab Sample No: | L108 |

ASTM D 1557 **COMPACTION MOISTURE-DENSITY RELATIONSHIP** Modified - Method B




| Client/Site Sample ID. | Lab Sample No: | Maximum Dry Unit Weight ( pcf ) | Optimum Moisture Content ( % ) | Remarks |
|---|---|---|---|---|
| TP-4 | L108 | 105.5 | 20.1 | |

Note(s):

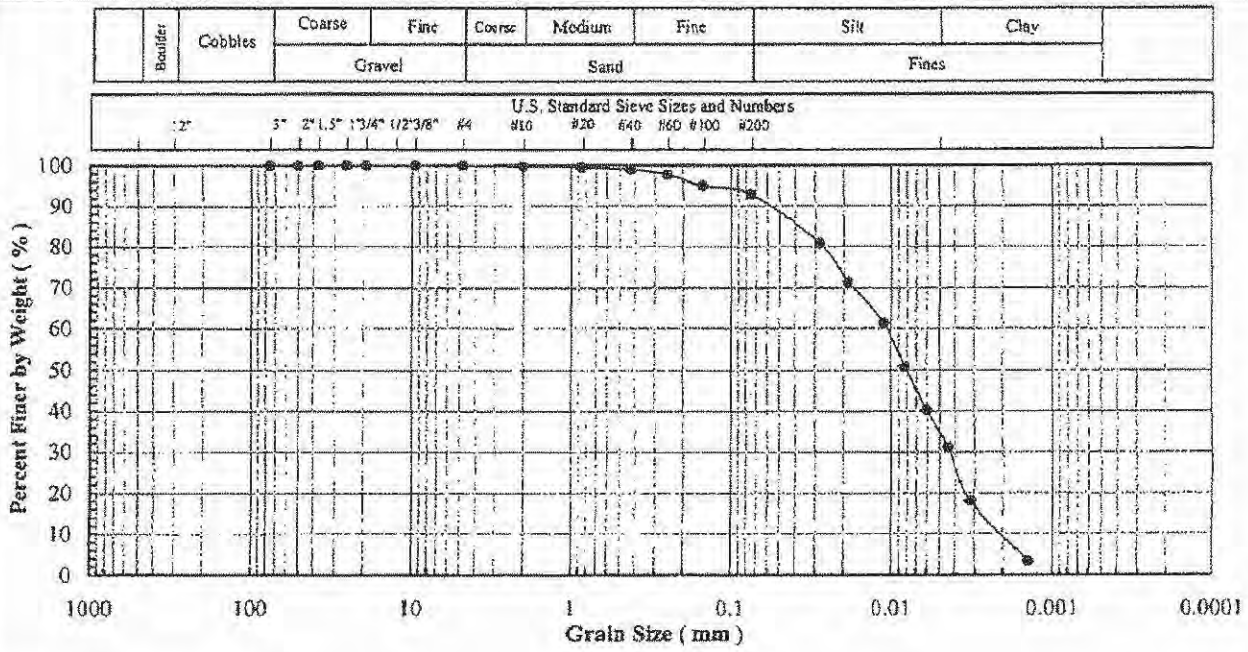
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | TP-1- |
| Lab Sample No: | L105 |

ASTM C136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont. Eng. Classification, Atterberg Limits



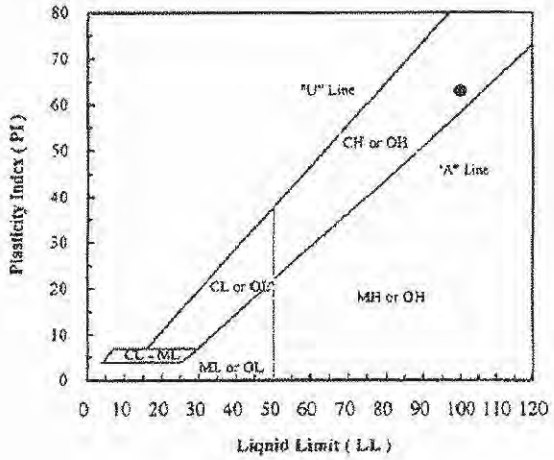

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.8 |
| #20 | 0.850 | 99.6 |
| #40 | 0.425 | 99.1 |
| #60 | 0.250 | 97.8 |
| #100 | 0.150 | 95.1 |
| #200 | 0.075 | 93.0 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0282 | 80.8 |
| 0.0111 | 61.4 |
| 0.0060 | 40.2 |
| 0.0032 | 18.0 |
| 0.0014 | 3.5 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 7.0 |
| Fines (%): | 93.0 |
| Silt (%): | 58.5 |
| Clay (%): | 34.5 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| TP-1 | L105 | 20.8 | 93.0 | 100 | 37 | 63 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen coagulated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

**Excel Geotechnical Testing, Inc.**
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941 Forrest Street, Roswell, Georgia 30075
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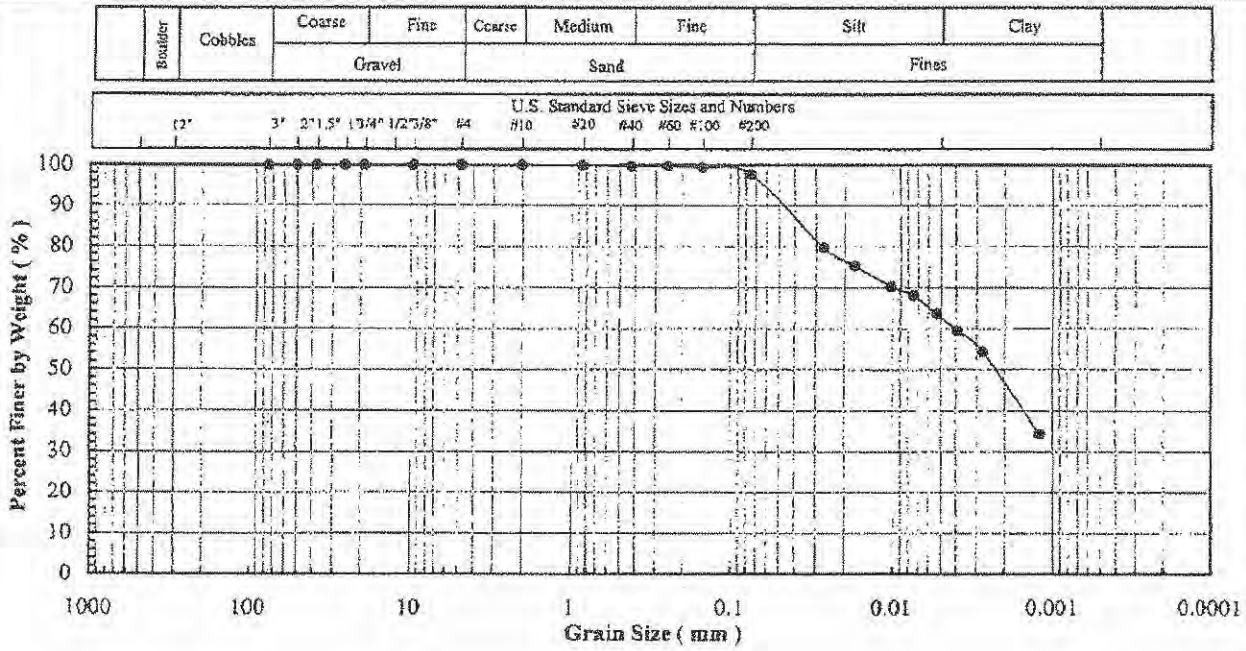
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | TP-2 |
| Lab Sample No: | L106 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits



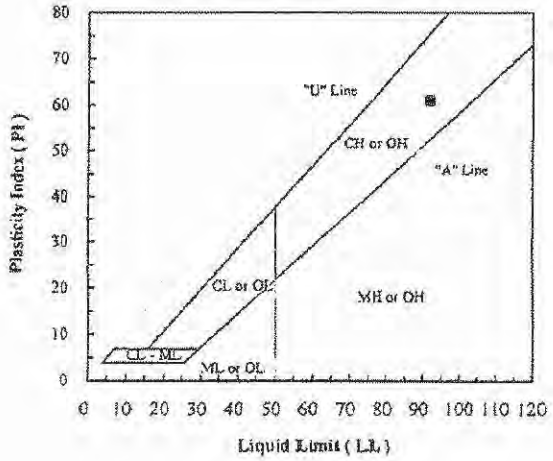

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.9 |
| #40 | 0.425 | 99.8 |
| #60 | 0.250 | 99.8 |
| #100 | 0.150 | 99.4 |
| #200 | 0.075 | 97.8 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0268 | 79.7 |
| 0.0102 | 70.3 |
| 0.0053 | 63.7 |
| 0.0027 | 54.3 |
| 0.0012 | 34.4 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 2.2 |
| Fines (%): | 97.8 |
| Silt (%): | 35.0 |
| Clay (%): | 62.8 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| TP-2 | L106 | 14.6 | 97.8 | 92 | 31 | 61 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

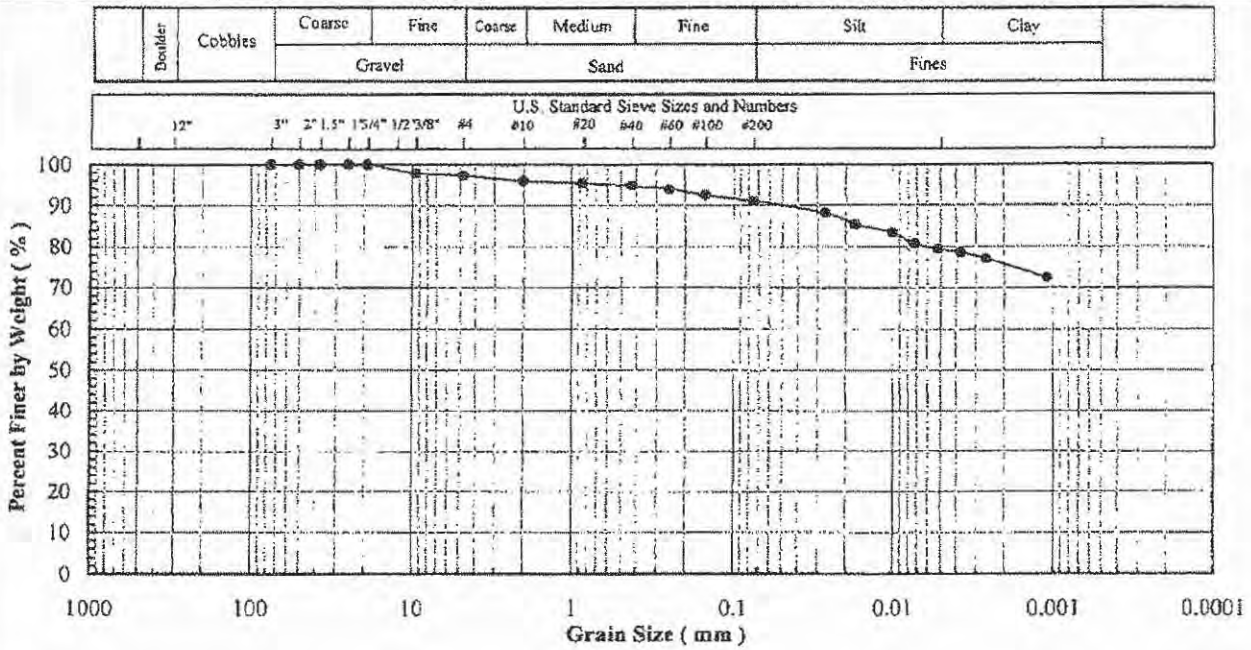
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | TP-3 |
| **Lab Sample No:** | L107 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



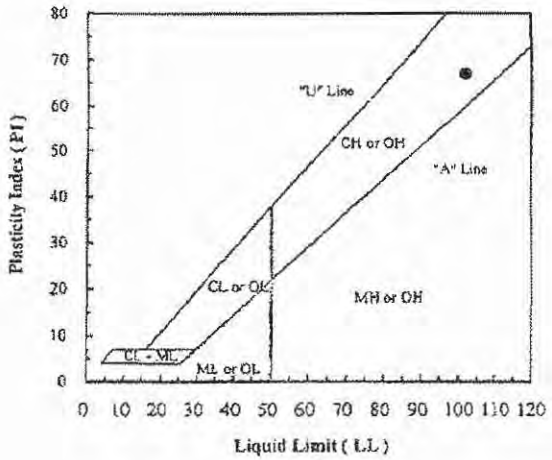

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 97.9 |
| #4 | 4.75 | 97.3 |
| #10 | 2.00 | 96.0 |
| #20 | 0.850 | 95.4 |
| #40 | 0.425 | 94.8 |
| #60 | 0.250 | 93.9 |
| #100 | 0.150 | 92.5 |
| #200 | 0.075 | 91.1 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0270 | 88.2 |
| 0.0101 | 83.5 |
| 0.0052 | 79.5 |
| 0.0026 | 77.1 |
| 0.0011 | 72.4 |

| | |
|---|---|
| Gravel (%): | 2.7 |
| Sand (%): | 6.2 |
| Fines (%): | 91.1 |
| Silt (%): | 11.7 |
| Clay (%): | 79.4 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| TP-3 | L107 | 21.9 | 91.1 | 102 | 35 | 67 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

**Excel Geotechnical Testing, Inc.**
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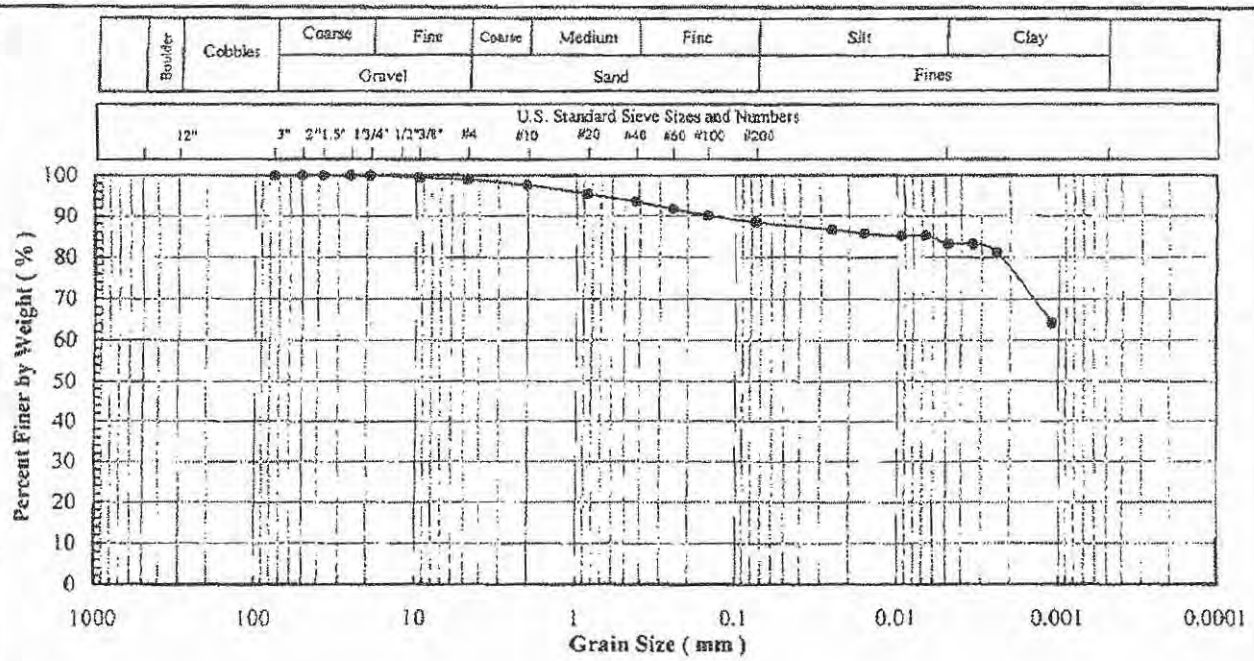
| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | TP-4 |
| **Lab Sample No:** | L108 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits



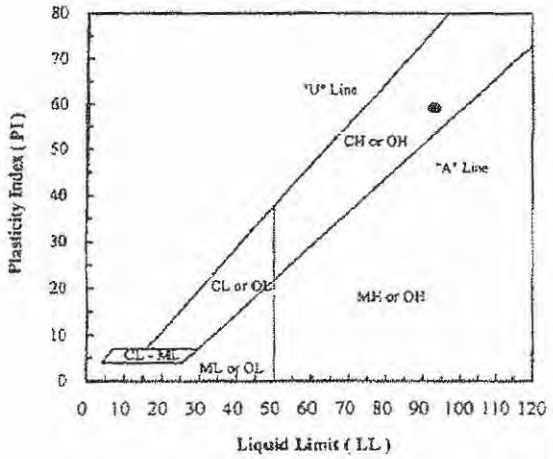

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 99.4 |
| #4 | 4.75 | 99.0 |
| #10 | 2.00 | 97.6 |
| #20 | 0.850 | 95.4 |
| #40 | 0.425 | 93.6 |
| #60 | 0.250 | 91.7 |
| #100 | 0.150 | 90.1 |
| #200 | 0.075 | 88.5 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0256 | 86.6 |
| 0.0095 | 85.1 |
| 0.0048 | 83.2 |
| 0.0024 | 81.2 |
| 0.0011 | 64.1 |

| | |
|---|---|
| Gravel (%): | 1.0 |
| Sand (%): | 10.5 |
| Fines (%): | 88.5 |
| Silt (%): | 5.3 |
| Clay (%): | 83.2 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| TP-4 | L108 | 17.0 | 88.5 | 93 | 34 | 59 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

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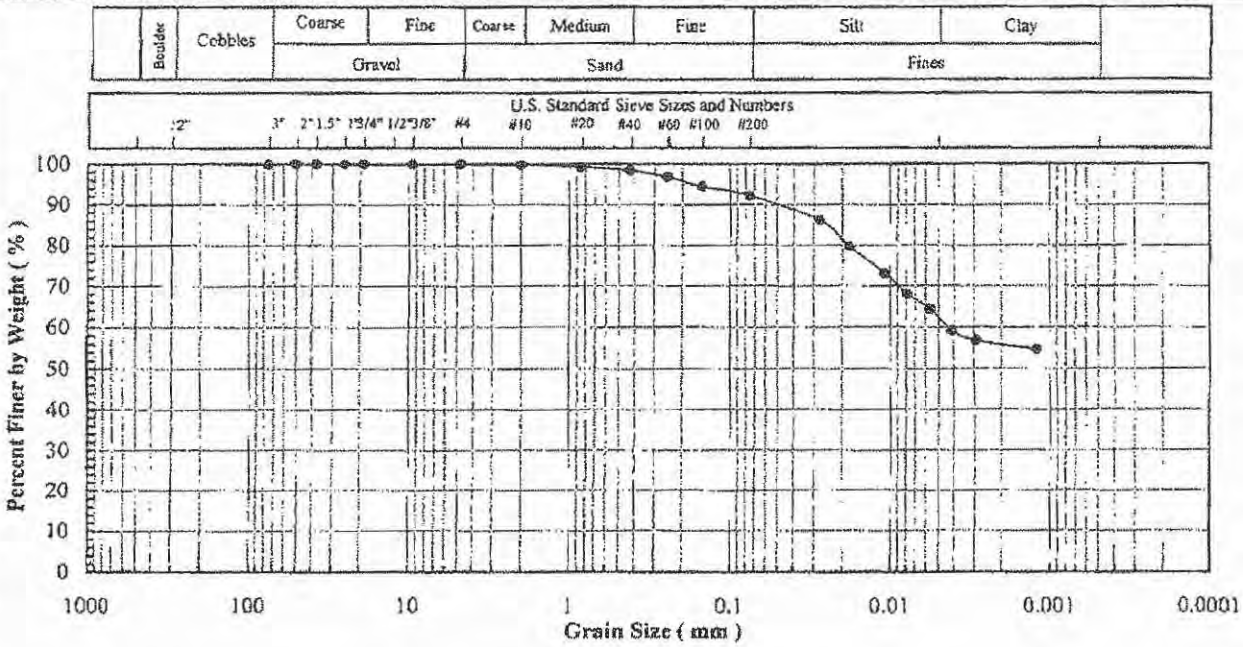
| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | CS-1-2 & CS-1-3 |
| **Lab Sample No:** | L070 & L071 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits



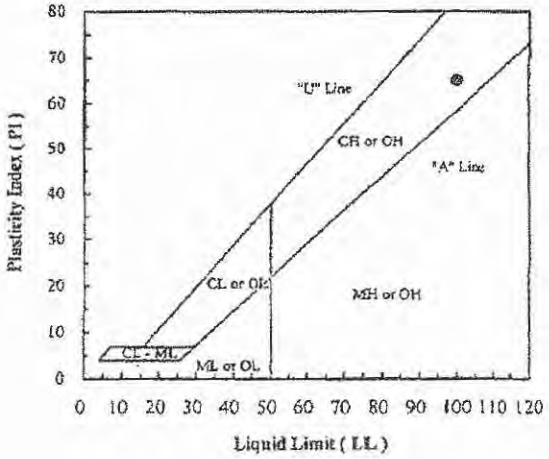

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.7 |
| #20 | 0.850 | 99.3 |
| #40 | 0.425 | 98.4 |
| #60 | 0.250 | 96.8 |
| #100 | 0.150 | 94.5 |
| #200 | 0.075 | 92.2 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0275 | 86.2 |
| 0.0108 | 73.1 |
| 0.0056 | 64.4 |
| 0.0029 | 56.9 |
| 0.0012 | 54.7 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 7.8 |
| Fines (%): | 92.2 |
| Silt (%): | 29.9 |
| Clay (%): | 62.3 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1-2 & CS-1-3 | L070 & L071 | 16.0 | 92.2 | 100 | 35 | 65 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

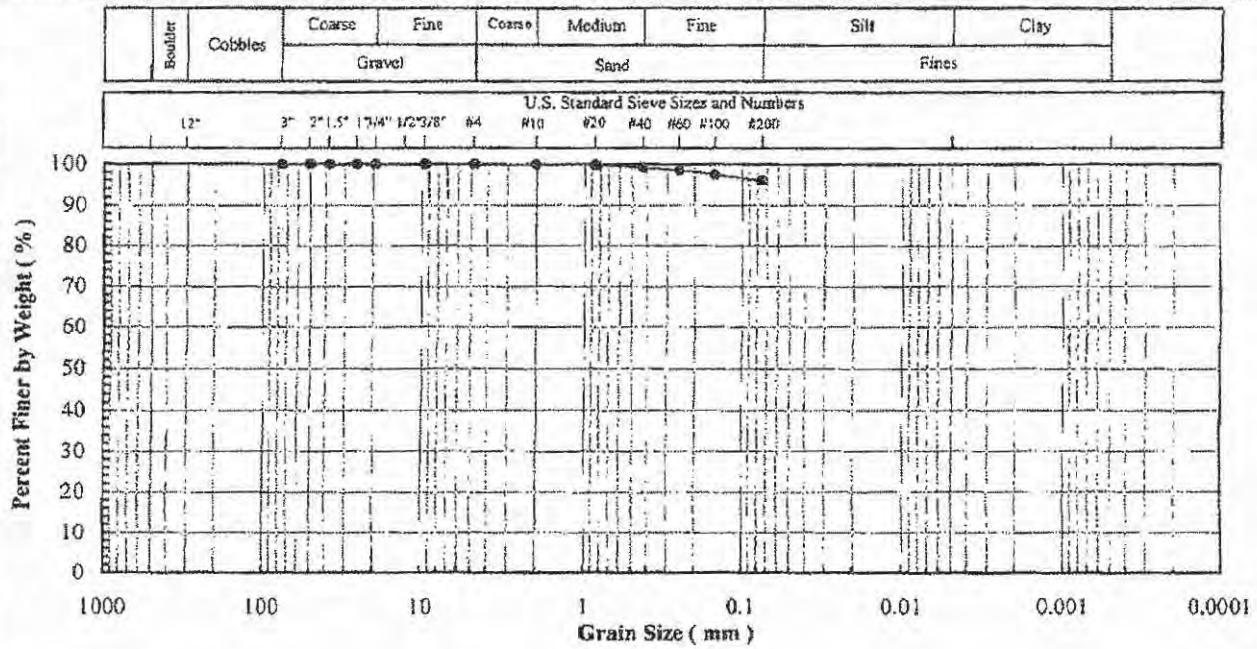
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1-4 |
| Lab Sample No: | L072 |

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



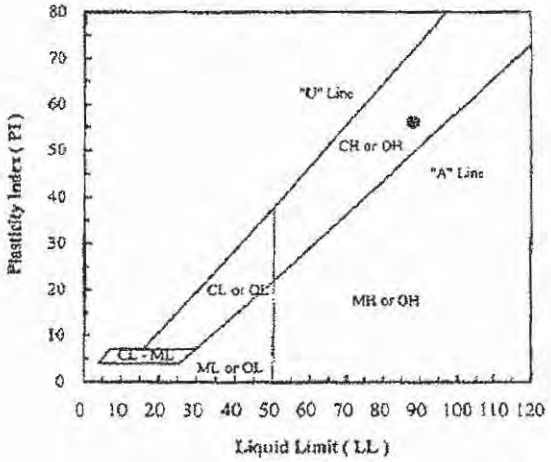

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.9 |
| #20 | 0.850 | 99.8 |
| #40 | 0.425 | 99.2 |
| #60 | 0.250 | 98.5 |
| #100 | 0.150 | 97.5 |
| #200 | 0.075 | 96.0 |

| Specific Gravity ( - ): | |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 4.0 |
| Fines (%): | 96.0 |
| Silt (%): | |
| Clay (%): | |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1-4 | L072 | 18.5 | 96.0 | 88 | 32 | 56 | CH - Fat clay |

Note(s):

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

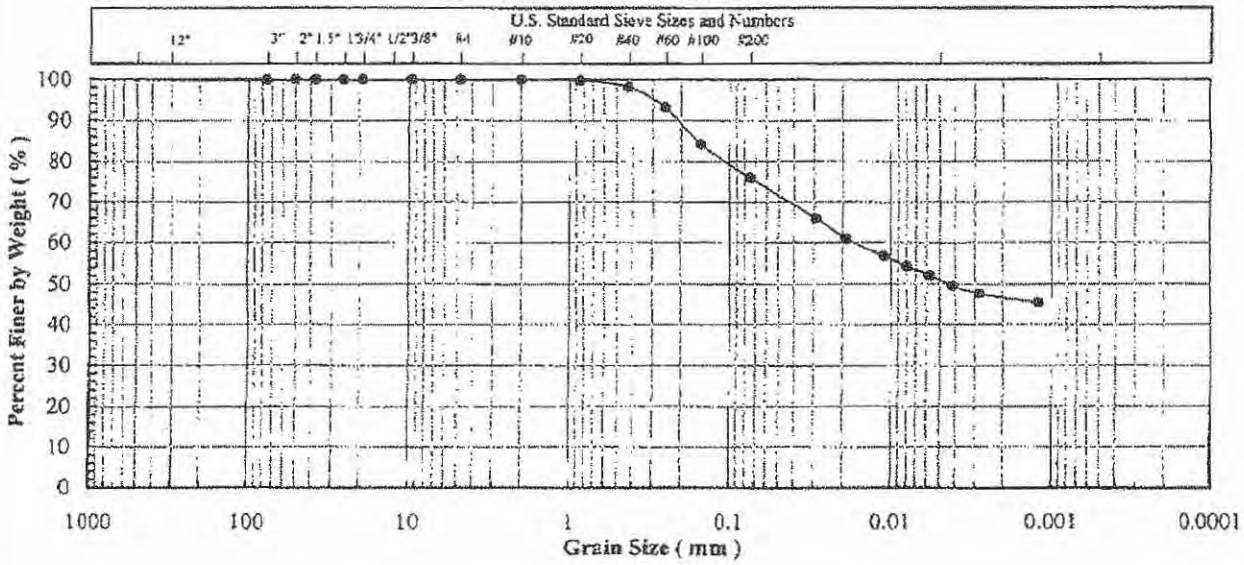
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A |
| Lab Sample No: | L103 |

ASTM C136, D422, D854, D1140, D2216, D2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Reg. Classification, Atterberg Limits

| Boulder | Cobbles | Gravel: Coarse | Gravel: Fine | Sand: Coarse | Sand: Medium | Sand: Fine | Fines: Silt | Fines: Clay |
|---|---|---|---|---|---|---|---|---|



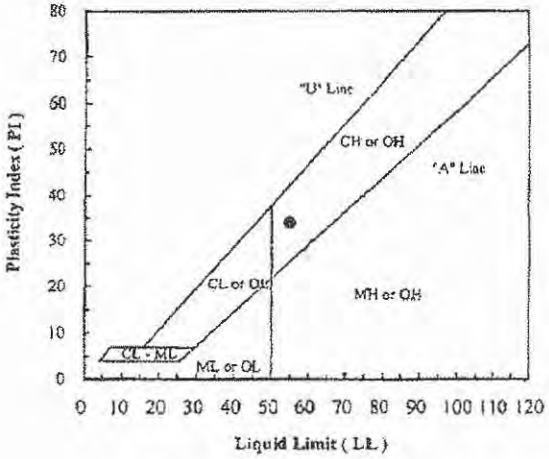

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.7 |
| #40 | 0.425 | 98.2 |
| #60 | 0.250 | 93.2 |
| #100 | 0.150 | 84.2 |
| #200 | 0.075 | 76.0 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0292 | 65.9 |
| 0.0130 | 56.8 |
| 0.0057 | 52.1 |
| 0.0028 | 47.6 |
| 0.0012 | 45.4 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 24.0 |
| Fines (%): | 76.0 |
| Silt (%): | 25.0 |
| Clay (%): | 51.0 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | Atterberg Limits PL ( - ) | Atterberg Limits PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A | L103 | 12.4 | 76.0 | 55 | 21 | 34 | *CH - Fat clay with sand* |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

**Excel Geotechnical Testing, Inc.**
*"Excellence In Testing"*
941 Forrest Street, Roswell, Georgia 30075
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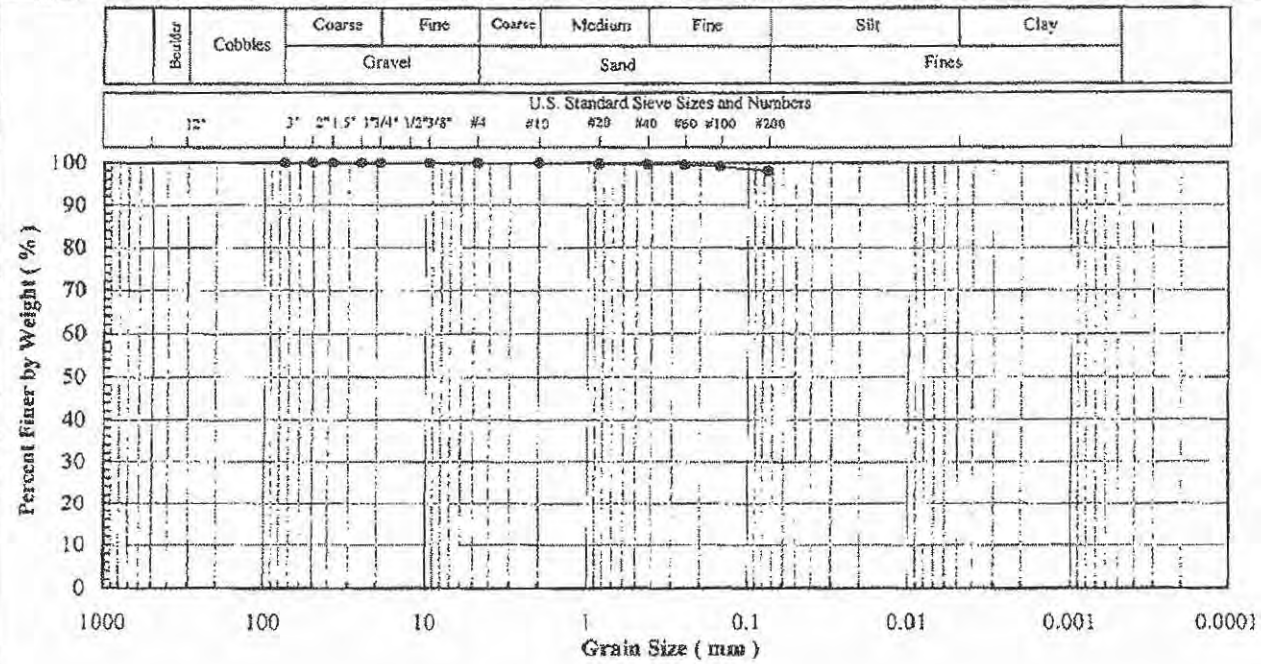
| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | CS-1A-3 |
| **Lab Sample No:** | L075 |

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Exp. Classification, Atterberg Limits



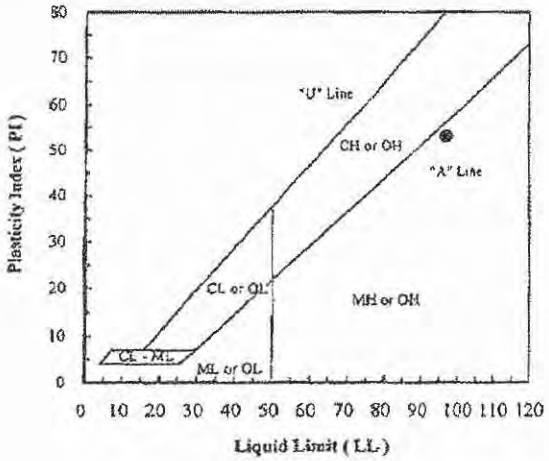

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.8 |
| #40 | 0.425 | 99.6 |
| #60 | 0.250 | 99.5 |
| #100 | 0.150 | 99.2 |
| #200 | 0.075 | 98.1 |

| Specific Gravity ( - ): | |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 1.9 |
| Fines (%): | 98.1 |
| Silt (%): | |
| Clay (%): | |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-3 | L075 | 20.3 | 98.1 | 97 | 44 | 53 | MH - Elastic silt |

Note(s):

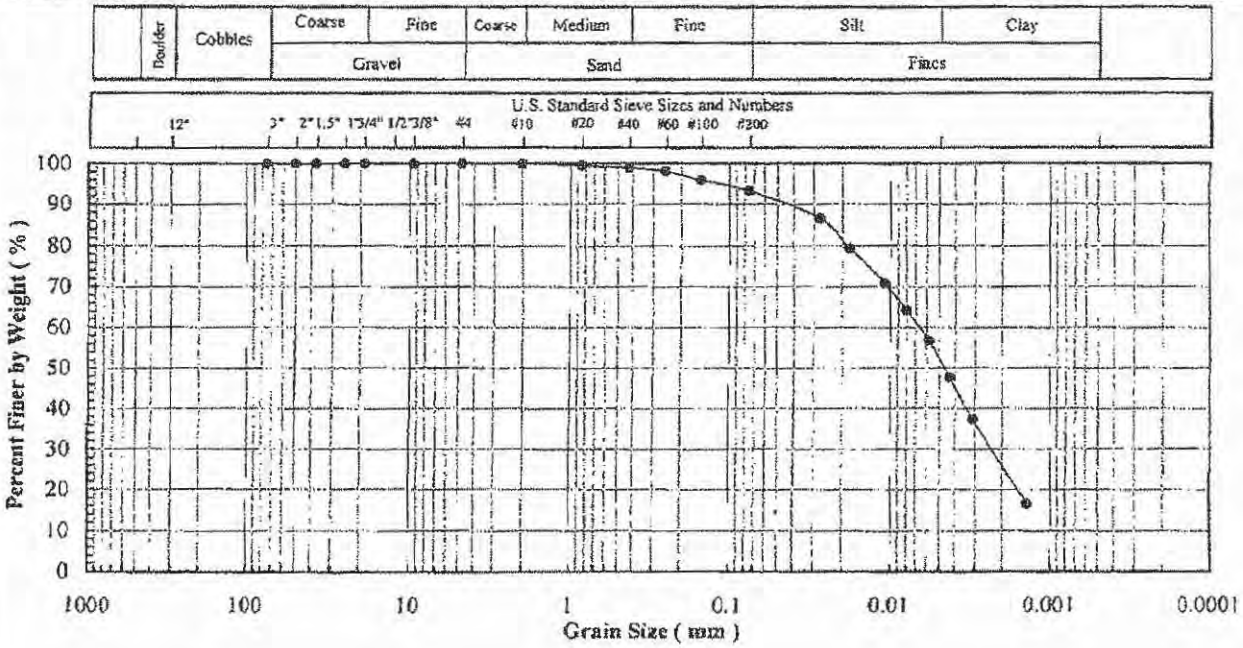
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A-5 |
| Lab Sample No: | L077 |

ASTM C136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont. Eng. Classification, Atterberg Limits



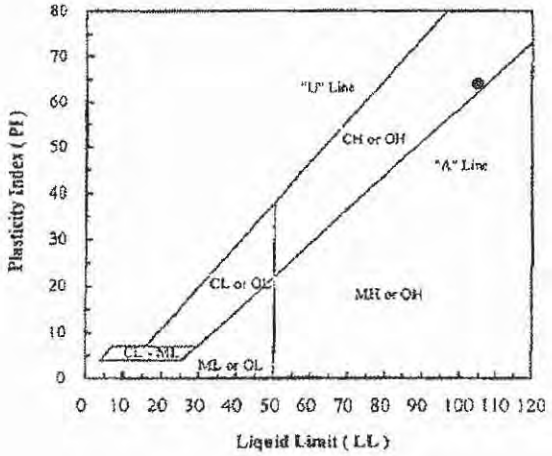

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.5 |
| #40 | 0.425 | 98.9 |
| #60 | 0.250 | 98.1 |
| #100 | 0.150 | 95.9 |
| #200 | 0.075 | 93.3 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0275 | 86.6 |
| 0.0109 | 70.9 |
| 0.0058 | 56.8 |
| 0.0031 | 37.3 |
| 0.0014 | 16.6 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 6.7 |
| Fines (%): | 93.3 |
| Silt (%): | 41.3 |
| Clay (%): | 52.0 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | Atterberg Limits PL ( - ) | Atterberg Limits PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-5 | L077 | 20.9 | 93.3 | 105 | 41 | 64 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

**Excel Geotechnical Testing, Inc.**
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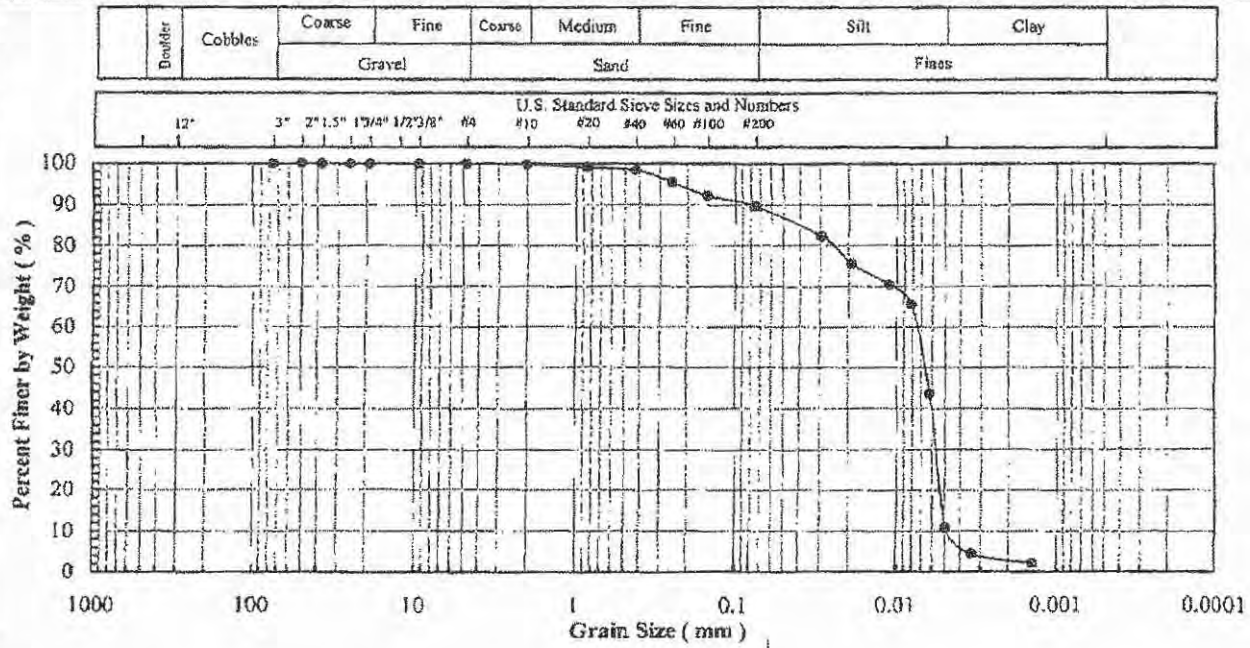
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A-6 & CS-1A-7 |
| Lab Sample No: | L078 & L079 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits



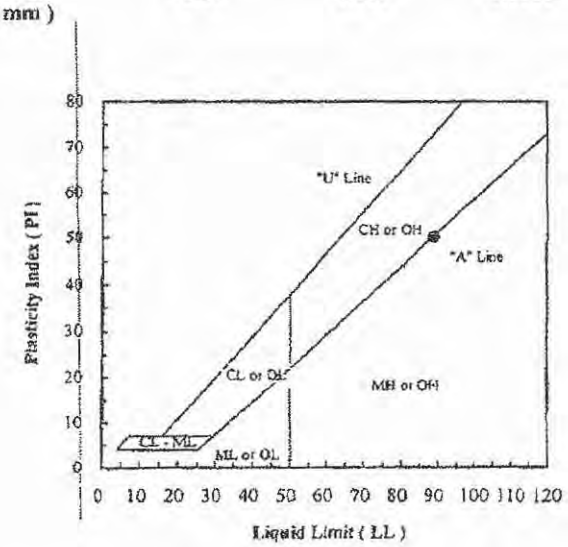

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.8 |
| #20 | 0.850 | 99.2 |
| #40 | 0.425 | 98.4 |
| #60 | 0.250 | 95.6 |
| #100 | 0.150 | 92.3 |
| #200 | 0.075 | 89.6 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0293 | 82.2 |
| 0.0112 | 70.4 |
| 0.0062 | 43.7 |
| 0.0034 | 4.5 |
| 0.0014 | 2.1 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 10.4 |
| Fines (%): | 89.6 |
| Silt (%): | 76.3 |
| Clay (%): | 13.3 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-6 & CS-1A-7 | L078 & L079 | 23.1 | 89.6 | 89 | 39 | 50 | MH - Elastic silt |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

**Excel Geotechnical Testing, Inc.**
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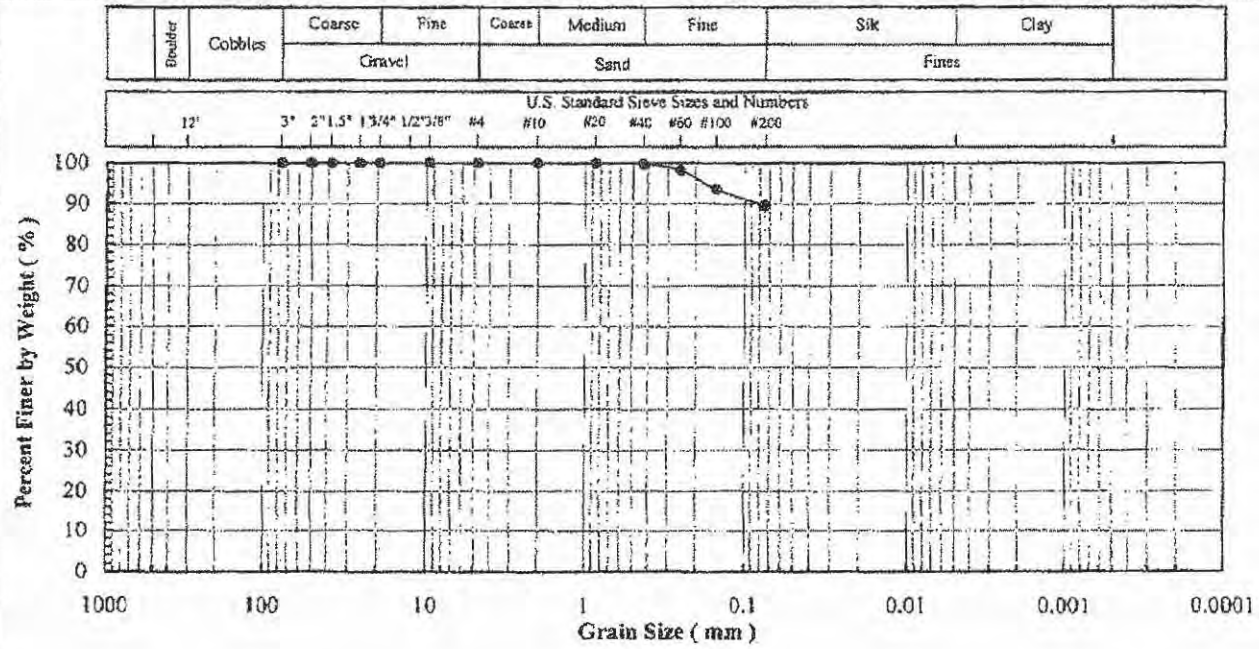
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A-8 |
| Lab Sample No: | L080 |

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



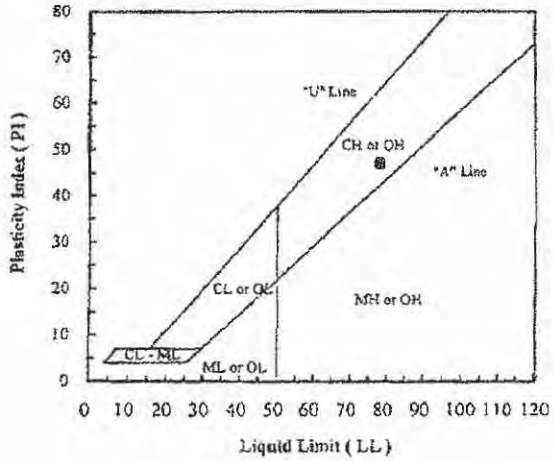

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 100.0 |
| #40 | 0.425 | 99.8 |
| #60 | 0.250 | 98.3 |
| #100 | 0.150 | 93.5 |
| #200 | 0.075 | 89.5 |

| Specific Gravity ( - ): | |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 10.5 |
| Fines (%): | 89.5 |
| Silt (%): | |
| Clay (%): | |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-8 | L080 | 21.2 | 89.5 | 78 | 31 | 47 | CH - Fat clay |

Note(s):

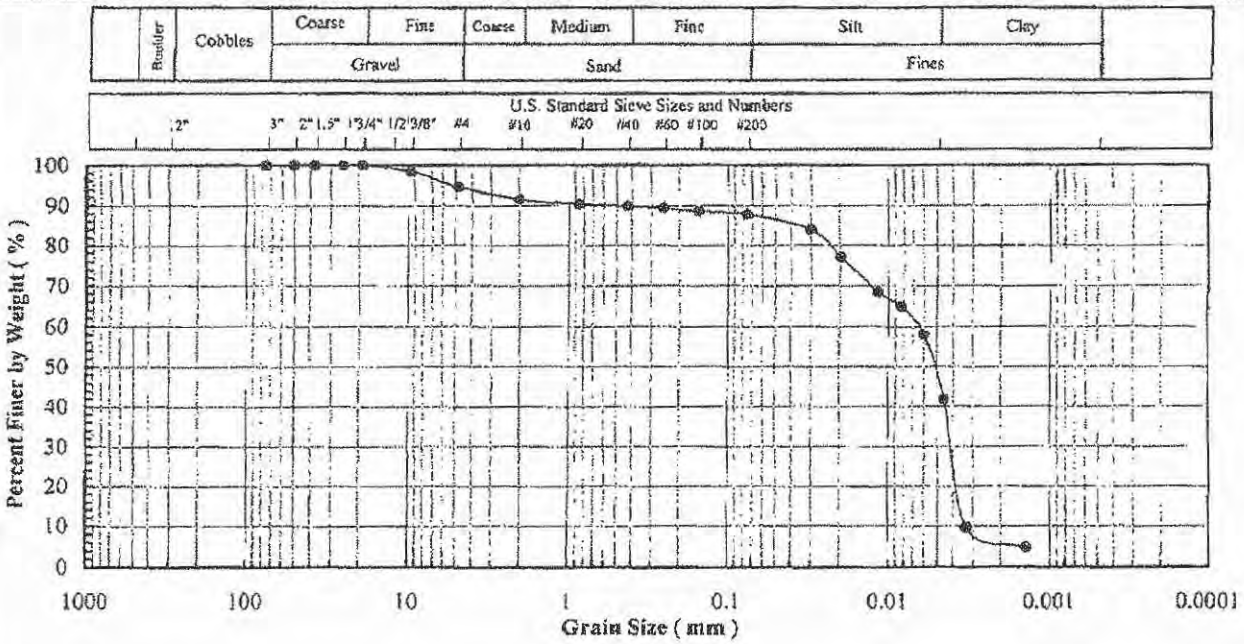
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | CS-1A-9 |
| **Lab Sample No:** | L081 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont. Reg. Classification, Atterberg Limits



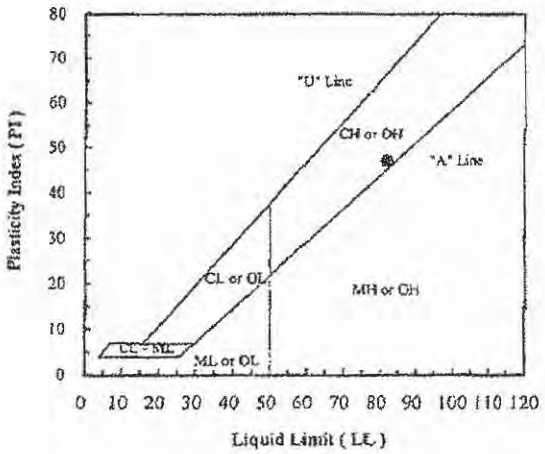

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 98.5 |
| #4 | 4.75 | 94.6 |
| #10 | 2.00 | 91.5 |
| #20 | 0.850 | 90.4 |
| #40 | 0.425 | 89.9 |
| #60 | 0.250 | 89.4 |
| #100 | 0.150 | 88.6 |
| #200 | 0.075 | 87.7 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0302 | 84.0 |
| 0.0116 | 68.5 |
| 0.0060 | 58.0 |
| 0.0033 | 9.7 |
| 0.0014 | 4.9 |

| | |
|---|---|
| Gravel (%): | 5.4 |
| Sand (%): | 6.9 |
| Fines (%): | 87.7 |
| Silt (%): | 40.5 |
| Clay (%): | 47.2 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-9 | L081 | 24.4 | 87.7 | 82 | 35 | 47 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

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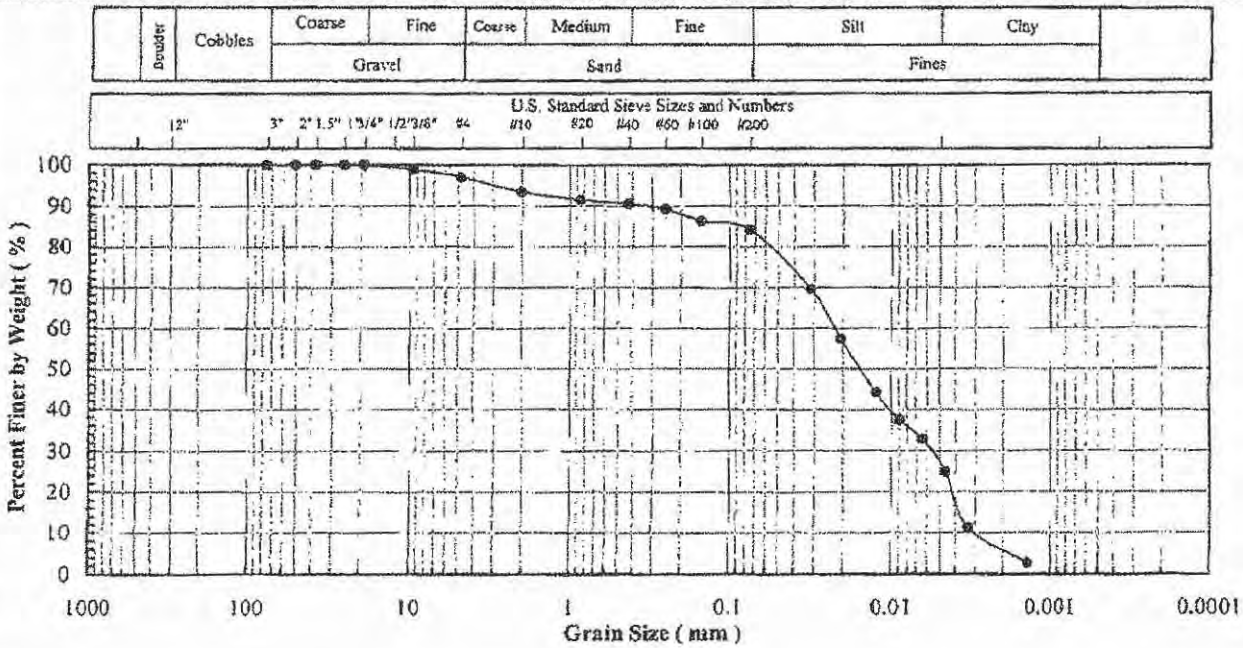
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A-11 |
| Lab Sample No: | L083 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



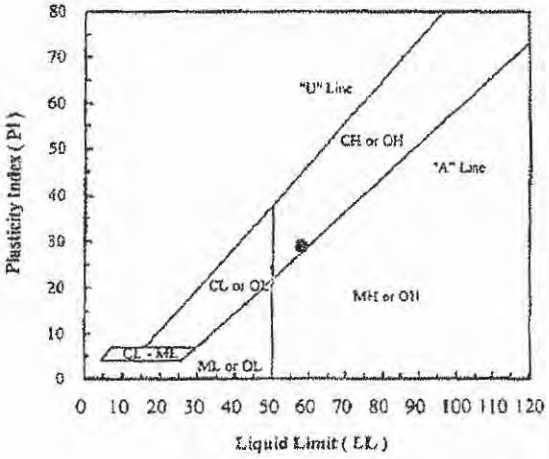

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 98.9 |
| #4 | 4.75 | 96.9 |
| #10 | 2.00 | 93.5 |
| #20 | 0.850 | 91.5 |
| #40 | 0.425 | 90.5 |
| #60 | 0.250 | 89.2 |
| #100 | 0.150 | 86.3 |
| #200 | 0.075 | 84.2 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0314 | 69.5 |
| 0.0124 | 44.2 |
| 0.0064 | 32.9 |
| 0.0033 | 11.2 |
| 0.0014 | 2.8 |

| | |
|---|---|
| Gravel (%): | 3.1 |
| Sand (%): | 12.7 |
| Fines (%): | 84.2 |
| Silt (%): | 57.5 |
| Clay (%): | 26.7 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-11 | L083 | 18.6 | 84.2 | 58 | 29 | 29 | CH - Fat clay with sand |

Note(s)

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

**Excel Geotechnical Testing, Inc.**
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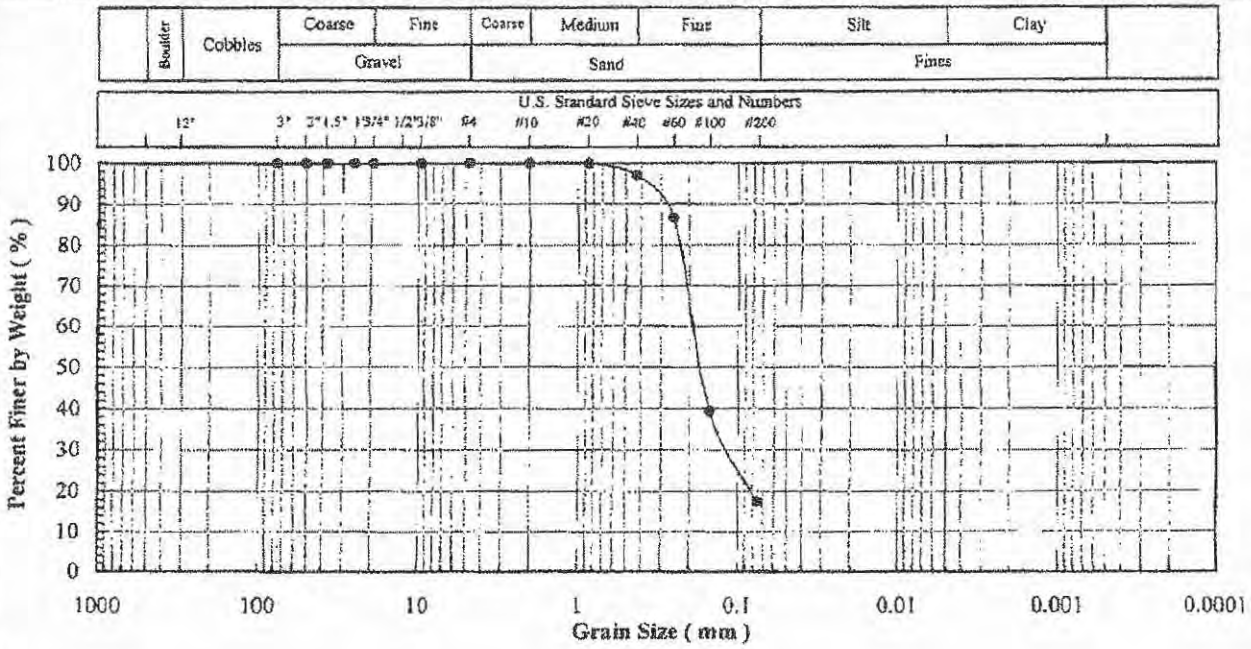
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-1A-13 |
| Lab Sample No: | L085 |

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



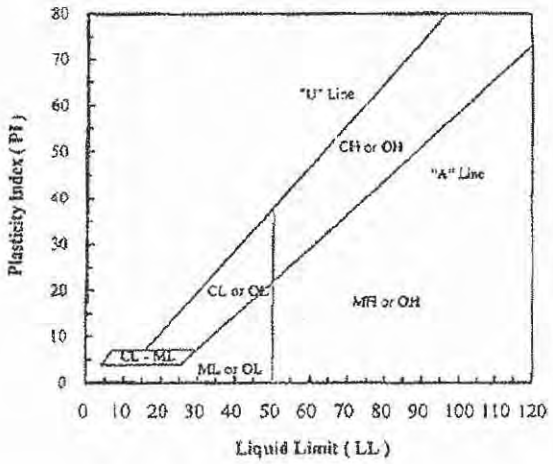

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.9 |
| #40 | 0.425 | 97.1 |
| #60 | 0.250 | 86.7 |
| #100 | 0.150 | 39.4 |
| #200 | 0.075 | 17.4 |

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 82.6 |
| Fines (%): | 17.4 |
| Silt (%): | |
| Clay (%): | |

| | |
|---|---|
| Specific Gravity ( - ): | |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-1A-13 | L085 | 3.4 | 17.4 | | | | |

Note(s):

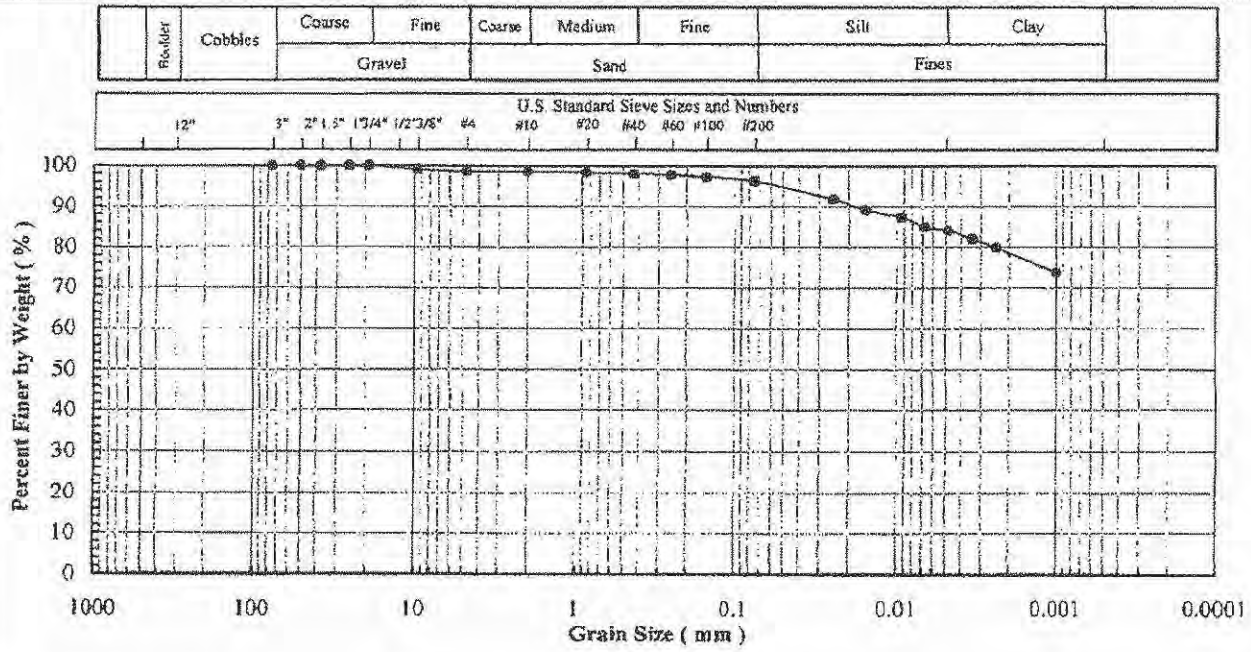
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2 |
| Lab Sample No: | L104 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits



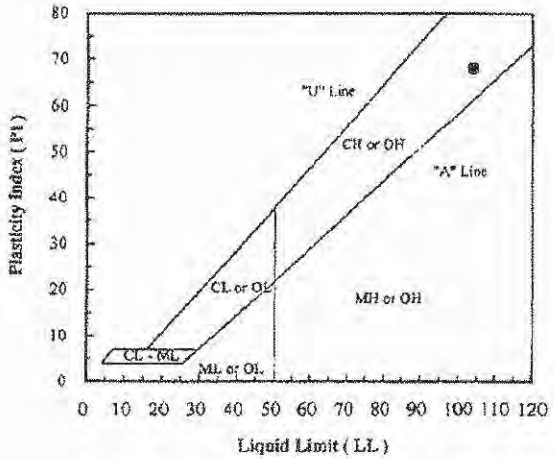

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 99.1 |
| #4 | 4.75 | 98.6 |
| #10 | 2.00 | 98.6 |
| #20 | 0.850 | 98.4 |
| #40 | 0.425 | 98.1 |
| #60 | 0.250 | 97.8 |
| #100 | 0.150 | 97.3 |
| #200 | 0.075 | 96.3 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0247 | 91.8 |
| 0.0093 | 87.4 |
| 0.0048 | 84.1 |
| 0.0024 | 80.0 |
| 0.0010 | 73.8 |

| | |
|---|---|
| Gravel (%): | 1.4 |
| Sand (%): | 2.3 |
| Fines (%): | 96.3 |
| Silt (%): | 11.9 |
| Clay (%): | 84.4 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2 | L104 | 14.1 | 96.3 | 104 | 36 | 68 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

**Excel Geotechnical Testing, Inc.**
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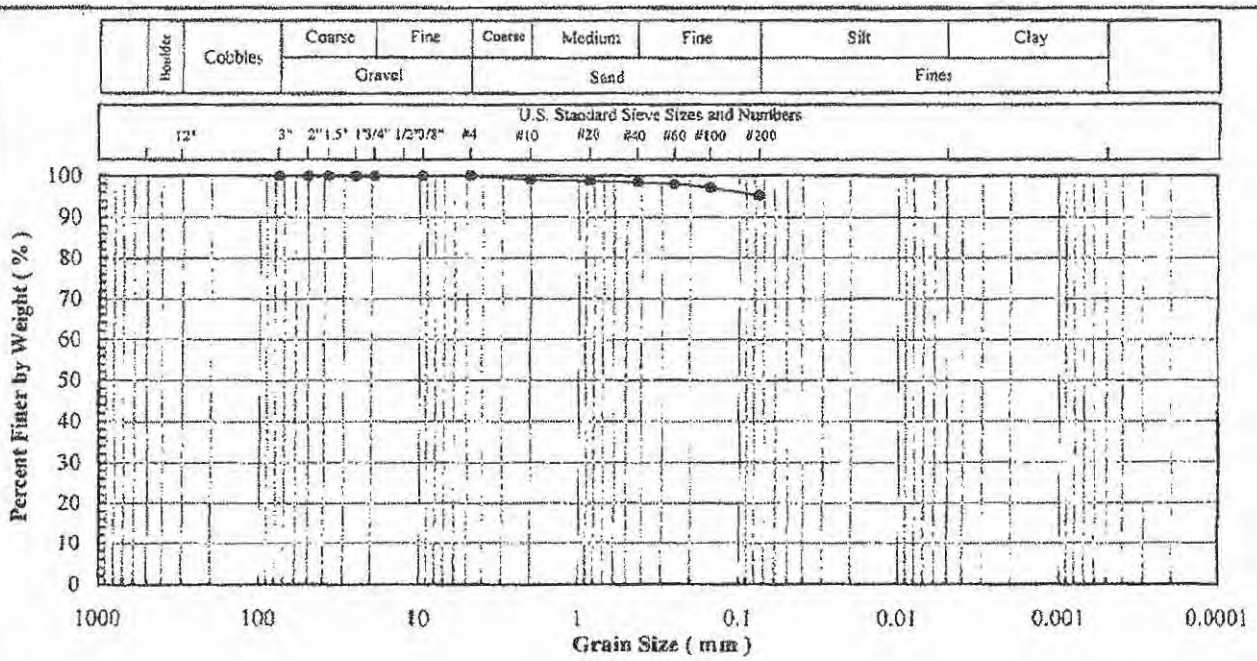
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-2 |
| Lab Sample No: | L087 |

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



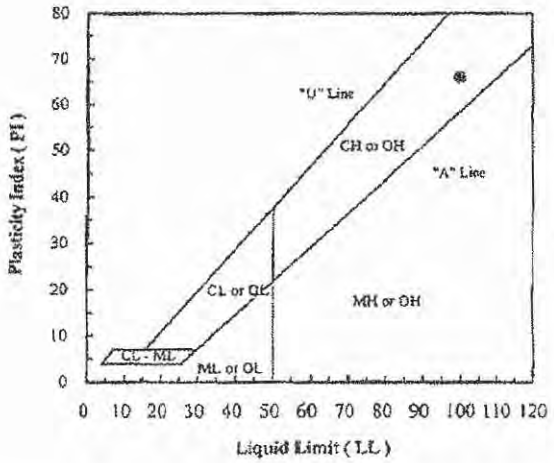

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.1 |
| #20 | 0.850 | 98.8 |
| #40 | 0.425 | 98.4 |
| #60 | 0.250 | 98.0 |
| #100 | 0.150 | 97.1 |
| #200 | 0.075 | 95.2 |

| Specific Gravity ( - ): | |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 4.8 |
| Fines (%): | 95.2 |
| Silt (%): | |
| Clay (%): | |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-2 | L087 | 16.5 | 95.2 | 100 | 34 | 66 | CH - Fat clay |

Note(s):

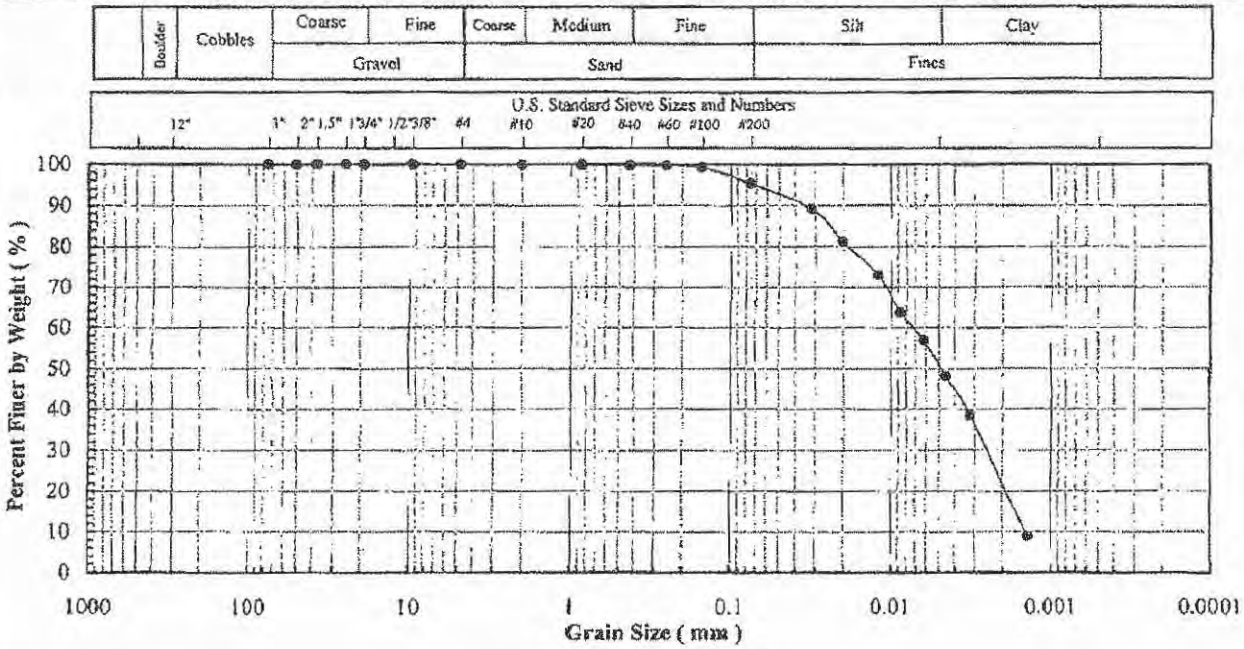
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-4 |
| Lab Sample No: | L089 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Engr. Classification, Atterberg Limits



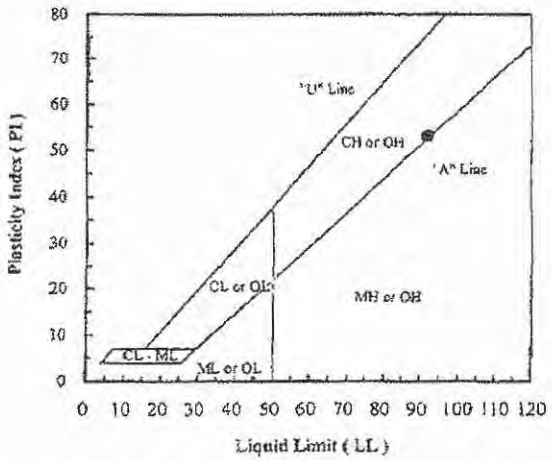

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.9 |
| #20 | 0.850 | 99.9 |
| #40 | 0.425 | 99.8 |
| #60 | 0.250 | 99.7 |
| #100 | 0.150 | 99.3 |
| #200 | 0.075 | 95.3 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0316 | 89.2 |
| 0.0120 | 73.0 |
| 0.0062 | 56.8 |
| 0.0032 | 38.6 |
| 0.0014 | 8.9 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 4.7 |
| Fines (%): | 95.3 |
| Silt (%): | 44.7 |
| Clay (%): | 50.6 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-4 | L089 | 21.0 | 95.3 | 92 | 39 | 53 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

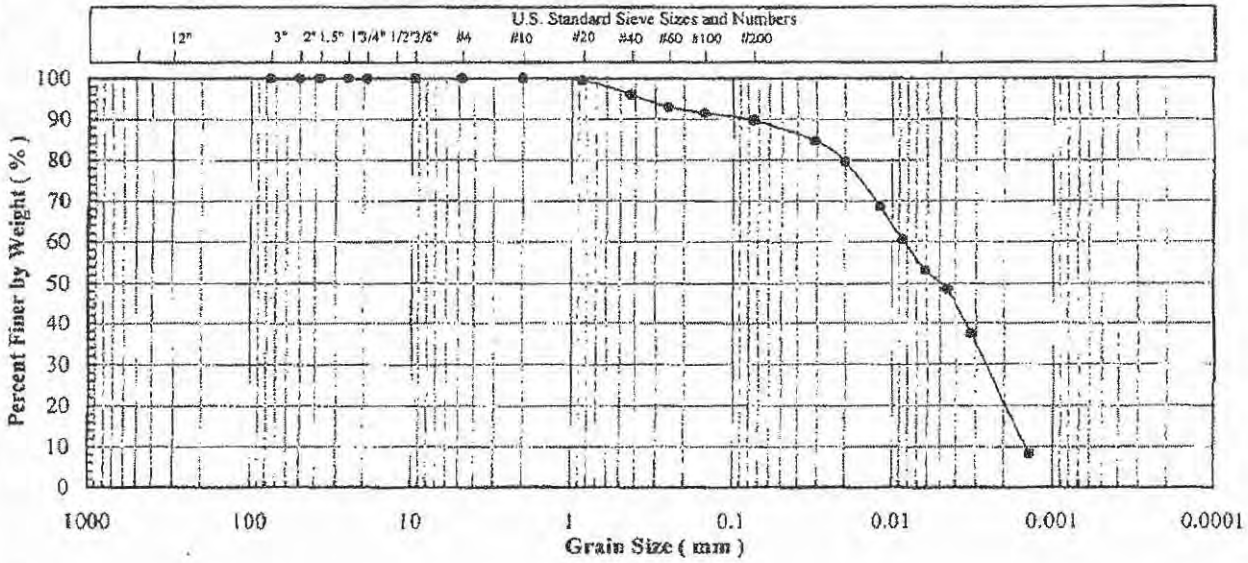
| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project No:** | 289 |
| **Client Sample ID:** | CS-2-7 |
| **Lab Sample No:** | L092 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Eng. Classification, Atterberg Limits

| Boulder | Cobbles | Gravel: Coarse | Gravel: Fine | Sand: Coarse | Sand: Medium | Sand: Fine | Silt | Clay |
|---|---|---|---|---|---|---|---|---|
| | | Gravel | | Sand | | | Fines | |



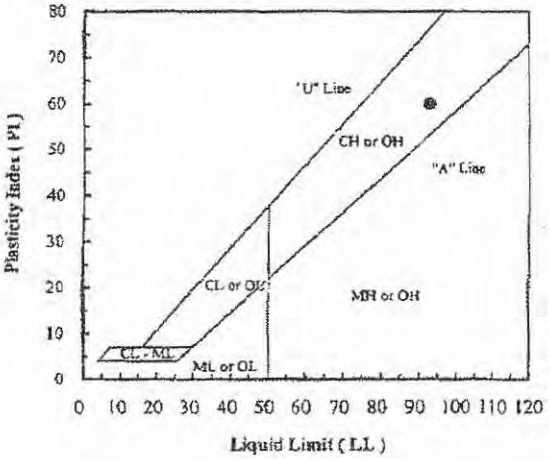

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.9 |
| #20 | 0.850 | 99.4 |
| #40 | 0.425 | 95.9 |
| #60 | 0.250 | 92.9 |
| #100 | 0.150 | 91.5 |
| #200 | 0.075 | 89.8 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0311 | 84.7 |
| 0.0119 | 68.5 |
| 0.0062 | 53.2 |
| 0.0032 | 37.5 |
| 0.0014 | 8.3 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 10.2 |
| Fines (%): | 89.8 |
| Silt (%): | 39.8 |
| Clay (%): | 50.0 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-7 | L092 | 21.0 | 89.8 | 93 | 33 | 60 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable)

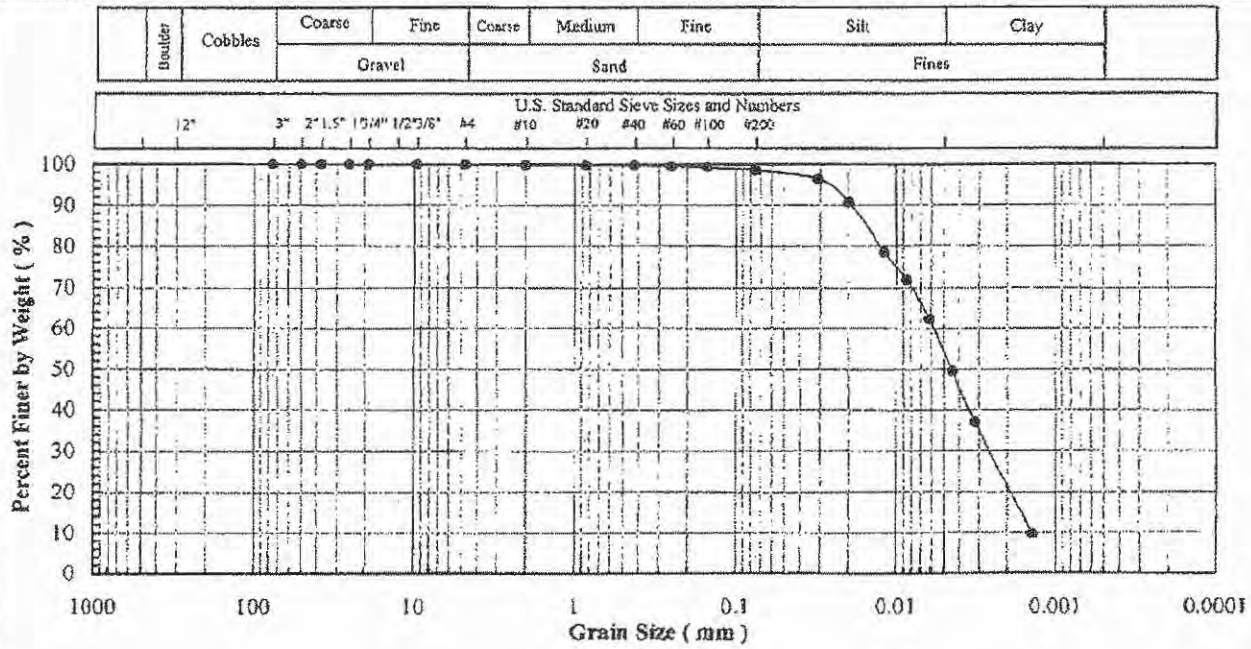
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHP Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-9 |
| Lab Sample No: | L094 |

ASTM C 136, D 422, D 854, D 3740, D 2216, D 2487, D 4318

## SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Sep. Classification, Atterberg Limits



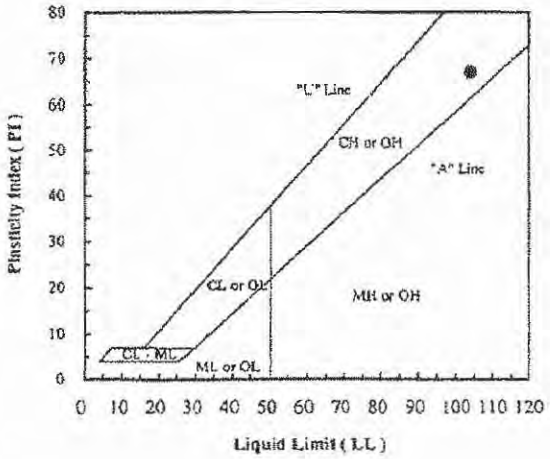

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 99.9 |
| #10 | 2.00 | 99.8 |
| #20 | 0.850 | 99.7 |
| #40 | 0.425 | 99.7 |
| #60 | 0.250 | 99.5 |
| #100 | 0.150 | 99.3 |
| #200 | 0.075 | 98.6 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0309 | 96.4 |
| 0.0118 | 78.5 |
| 0.0061 | 62.2 |
| 0.0032 | 37.2 |
| 0.0014 | 9.7 |

| | |
|---|---|
| Gravel (%): | 0.1 |
| Sand (%): | 1.3 |
| Fines (%): | 98.6 |
| Silt (%): | 44.6 |
| Clay (%): | 54.0 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-9 | L094 | 24.7 | 98.6 | 104 | 37 | 67 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable).

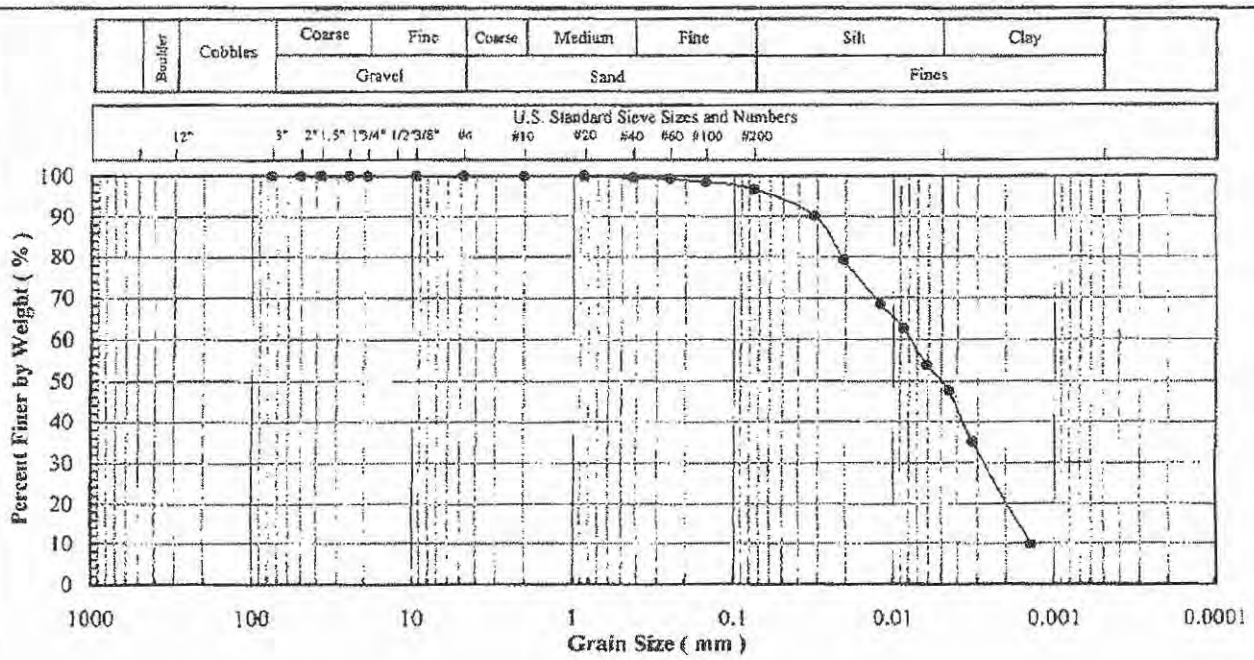
**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
941 Forrest Street, Roswell, Georgia 30075
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-11 |
| Lab Sample No: | L095 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont., Reg. Classification, Atterberg Limits



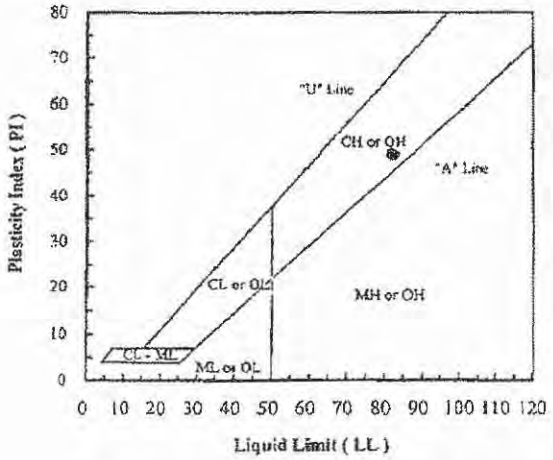

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.9 |
| #20 | 0.850 | 99.9 |
| #40 | 0.425 | 99.6 |
| #60 | 0.250 | 99.2 |
| #100 | 0.150 | 98.5 |
| #200 | 0.075 | 96.7 |

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0315 | 90.1 |
| 0.0121 | 68.4 |
| 0.0062 | 53.9 |
| 0.0032 | 35.2 |
| 0.0014 | 9.8 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 3.3 |
| Fines (%): | 96.7 |
| Silt (%): | 47.2 |
| Clay (%): | 49.5 |

| | |
|---|---|
| Specific Gravity (-): | 2.65 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-11 | L095 | 24.0 | 96.7 | 82 | 33 | 49 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

**Excel Geotechnical Testing, Inc.**
*"Excellence in Testing"*
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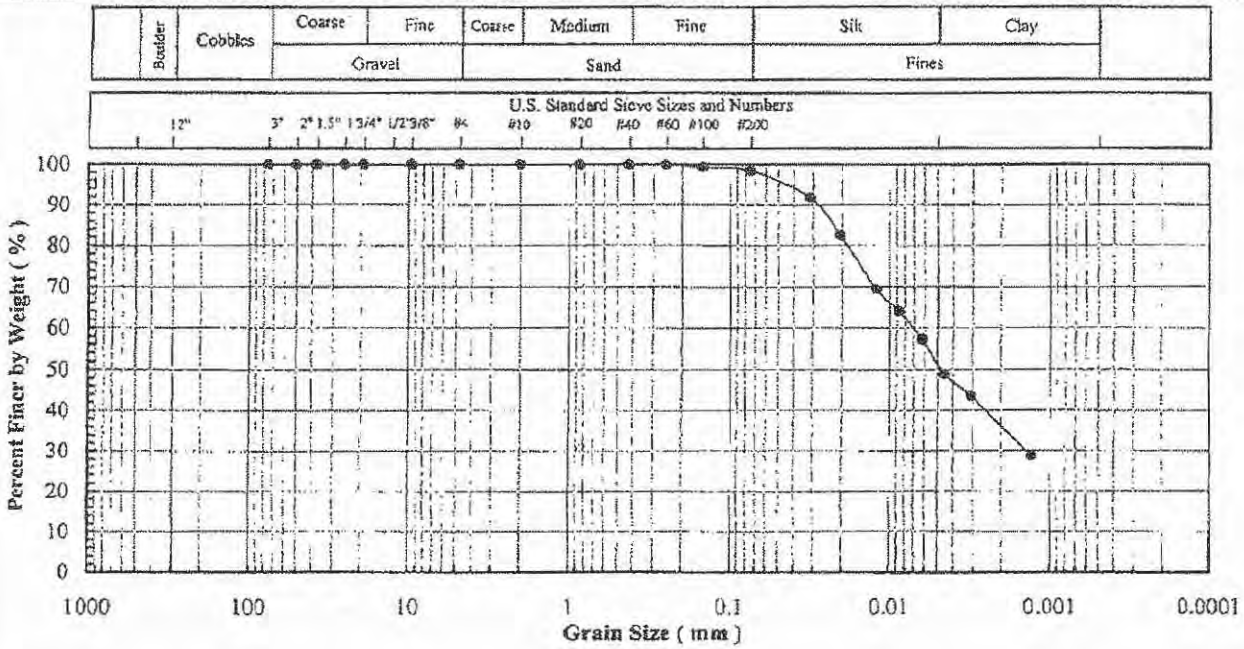
| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-13 & CS-2-14 |
| Lab Sample No: | L097 & L098 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



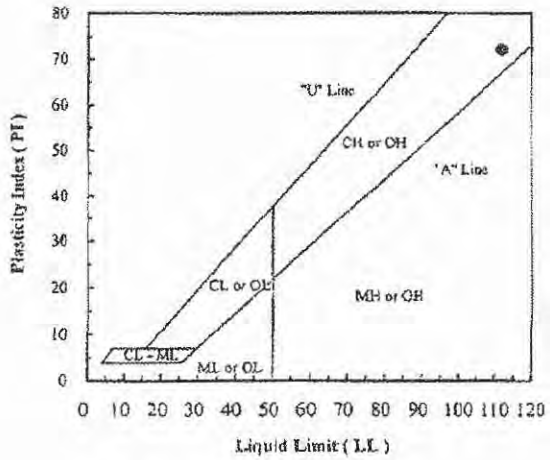

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 100.0 |
| #20 | 0.850 | 99.9 |
| #40 | 0.425 | 99.9 |
| #60 | 0.250 | 99.9 |
| #100 | 0.150 | 99.3 |
| #200 | 0.075 | 98.4 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0315 | 91.8 |
| 0.0121 | 69.3 |
| 0.0062 | 57.2 |
| 0.0031 | 43.6 |
| 0.0013 | 28.9 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 1.6 |
| Fines (%): | 98.4 |
| Silt (%): | 47.1 |
| Clay (%): | 51.3 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-13 & CS-2-14 | L097 & L098 | 25.1 | 98.4 | 112 | 40 | 72 | CH - Fat clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

Hydrometer soil specimen conglomerated and formed a cloudy substance which settled to the lower portion of the test tube (i.e., the test results may be questionable)

**Excel Geotechnical Testing, Inc.**
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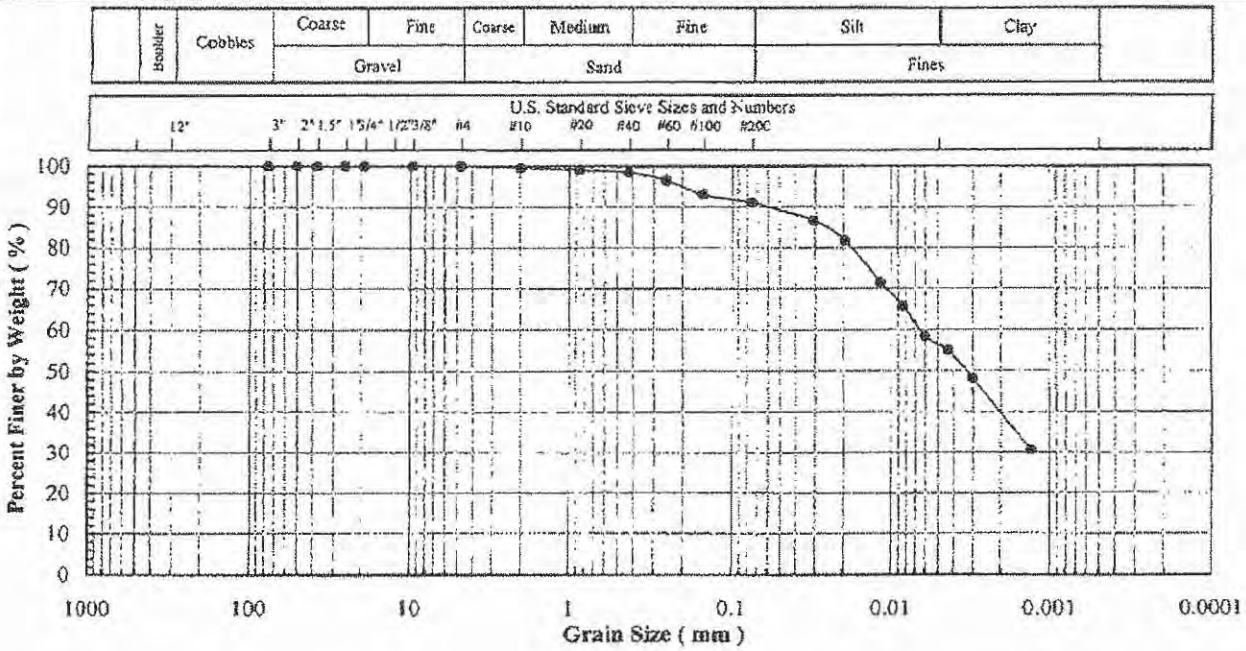
Tel: (770) 650 1666 Fax: (770) 650 5786

| | |
|---|---|
| Project Name: | KHF Clay Source Evaluation |
| Project No: | 289 |
| Client Sample ID: | CS-2-16 & CS-2-17 |
| Lab Sample No: | L100 & L101 |

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

# SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



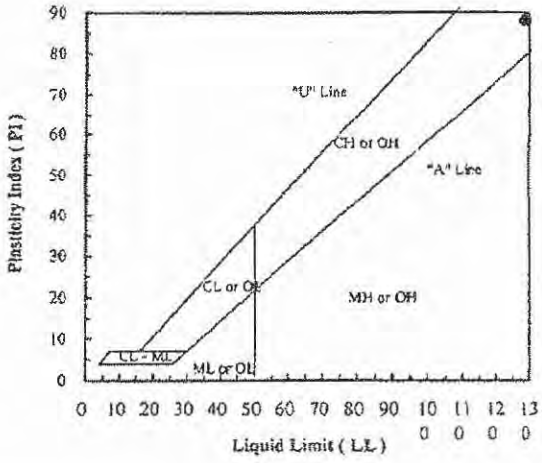

| Sieve No. | Size (mm) | % Finer |
|---|---|---|
| 3" | 75 | 100.0 |
| 2" | 50 | 100.0 |
| 1.5" | 37.5 | 100.0 |
| 1" | 25 | 100.0 |
| 3/4" | 19 | 100.0 |
| 3/8" | 9.5 | 100.0 |
| #4 | 4.75 | 100.0 |
| #10 | 2.00 | 99.6 |
| #20 | 0.850 | 99.1 |
| #40 | 0.425 | 98.4 |
| #60 | 0.250 | 96.4 |
| #100 | 0.150 | 93.1 |
| #200 | 0.075 | 91.1 |

| Specific Gravity (-): | 2.65 |
|---|---|

| Hydrometer Particle Diameter (mm) | % Finer |
|---|---|
| 0.0307 | 86.6 |
| 0.0116 | 71.5 |
| 0.0060 | 58.4 |
| 0.0030 | 48.2 |
| 0.0013 | 30.7 |

| | |
|---|---|
| Gravel (%): | |
| Sand (%): | 8.9 |
| Fines (%): | 91.1 |
| Silt (%): | 34.7 |
| Clay (%): | 56.4 |

| | |
|---|---|
| Coeff. Unif. (Cu): | |
| Coeff. Curv. (Cc): | |




| Client Sample ID. | Lab Sample No: | Moisture Content ( % ) | Fines Content < No. 200 ( % ) | Atterberg Limits LL ( - ) | PL ( - ) | PI ( - ) | Engineering Classification |
|---|---|---|---|---|---|---|---|
| CS-2-16 & CS-2-17 | L100 & L101 | 25.4 | 91.1 | 129 | 41 | 88 | CH - Fat Clay |

Note(s):

An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS-1A |
| **Lab Sample Number:** | L103 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 122.0 | 12.5 | 108.0 | 15.4 | 75.0 | 70.0 | 5.0 | DTW | 6 | 9.2E-9 |

88.5%

Notes:

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 89% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS-1A |
| **Lab Sample Number:** | L103 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 122.0 | 12.5 | 112.4 | 15.4 | 75.0 | 70.0 | 5.0 | DTW | 6 | 7.4E-9 |

92.1%

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations

Laboratory temperature at 22±3 °C.

Test specimen final conditions are not presented

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS-2 |
| **Lab Sample Number:** | L104 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 113.1 | 15.6 | 104.0 | 18.5 | 75.0 | 70.0 | 5.0 | DTW | 12 | 3.7E-9 |

92%

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | TP-1 |
| **Lab Sample Number:** | L105 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 109.9 | 17.8 | 101.0 | 20.7 | 75.0 | 70.0 | 5.0 | DTW | 4 | 1.1E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | TP-2 |
| **Lab Sample Number:** | L106 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 111.7 | 16.2 | 102.8 | 19.1 | 75.0 | 70.0 | 5.0 | DTW | 9 | 5.0E-9 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | TP-3 |
| **Lab Sample Number:** | L107 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 108.2 | 17.4 | 99.0 | 20.2 | 75.0 | 70.0 | 5.0 | DTW | 8 | 6.5E-9 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | TP-4 |
| **Lab Sample Number:** | L108 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 12/21/2007 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 105.5 | 20.1 | 97.1 | 22.9 | 75.0 | 70.0 | 5.0 | DTW | 4 | 1.4E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 92% of the maximum dry unit weight and the optimum moisture content plus 3%.
7. Type of permeant liquid: DTW = Desired Tap Water, DDI = Desired Deionized Water

* Deviations:
Laboratory temperature at 22±3 °C
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS1-2 & CS1-3 |
| **Lab Sample Number:** | L070 & L071 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/23/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.6 | 21.9 | 75.0 | 70.0 | 5.0 | DTW | 14 | 7.0E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS1A-5 |
| **Lab Sample Number:** | L077 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/23/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.4 | 21.9 | 75.0 | 70.0 | 5.0 | DTW | 18 | 6.2E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:
Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS1A-6 & CS1A-7 |
| **Lab Sample Number:** | L078 & L079 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/22/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.5 | 21.9 | 75.0 | 70.0 | 5.0 | DTW | 15 | 9.6E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS2-4 |
| **Lab Sample Number:** | L089 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/22/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.6 | 21.9 | 75.0 | 70.0 | 5.0 | DTW | 16 | 8.6E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS2-11 |
| **Lab Sample Number:** | L095 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/22/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.5 | 21.8 | 75.0 | 70.0 | 5.0 | DTW | 18 | 8.2E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS2-13 & CS2-14 |
| **Lab Sample Number:** | L097 & L098 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/22/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.4 | 22.0 | 75.0 | 70.0 | 5.0 | DTW | 16 | 1.7E-8 |

**Notes:**

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height.
5. Assumed Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Modified Proctor Compaction Test (ASTM D 1557).
6. Based on the target values of 90% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.

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# FLEXIBLE WALL PERMEABILITY TEST [1]

## ASTM D5084 *

| | |
|---|---|
| **Project Name:** | KHF Clay Source Evaluation |
| **Project Number:** | 289 |
| **Client Name:** | Geosyntec Consultants |
| **Site Sample ID:** | CS2-16 & CS2-17 |
| **Lab Sample Number:** | L100 & L101 |
| **Material Type:** | Soil |
| **Specified Value (cm/sec):** | NA |
| **Date Test Started:** | 1/22/2008 |

| Remolded Specimen | Proctor [5] Compaction | | Specimen Initial Conditions [6] | | Test Conditions | | | | | Hydraulic Conductivity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Max. DUW | Opt. MC | Dry Unit Weight | Moisture Content | Cell Press. | Back Press. | Consolid. Press. | Permeant Liquid [7] | Average Gradient | |
| ( - ) | ( pcf ) | ( % ) | ( pcf ) | ( % ) | ( psi ) | ( psi ) | ( psi ) | ( - ) | ( - ) | ( cm/s ) |
| Notes 2 , 3 & 4 | 104.0 | 20.0 | 93.5 | 21.9 | 75.0 | 70.0 | 5.0 | DTW | 15 | 5.3E-8 |

Notes:

1. Method C, "Falling-Head, Increasing-Tailwater" test procedures were followed during the testing.
2. All particles larger than 3/8 inch, if any, were discarded when forming the remolded specimen.
3. Remolded specimen was formed by tamping the soil in one-centimeter-thick layers.
4. Remolded specimen approximately 2.87 inches in diameter and 2.36 inches in height. Modified 1537
5. Maximum Dry Unit Weight (DUW) and Optimum Moisture Content (MC) based on Standard Proctor Compaction Test (ASTM D:698).
6. Based on the target values of 95% of the maximum dry unit weight and the optimum moisture content plus 2%.
7. Type of permeant liquid: DTW = Deaired Tap Water, DDI = Deaired Deionized Water 90

* Deviations:

Laboratory temperature at 22±3 °C.
Test specimen final conditions are not presented.