GEOTECHNICAL REPORT

REPORT

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED PANOCHE ENERGY CENTER PROJECT
WEST PANOCHE ROAD
FRESNO COUNTY, CALIFORNIA

JULY 14, 2006

URS JOB NO. 28906975-000040

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation performed by URS Corporation (URS) for the proposed Panoche Energy Center Project (Project) in Fresno County, California. The Project site covers approximately 12.8 acres, located on the south side of West Panoche Road, approximately 2 miles east of the intersection of Panoche Road and Interstate Highway 5. The location of the site relative to existing topographic features is shown in the Vicinity Map, Figure 1.

This report includes our geotechnical recommendations for design and construction of the proposed Project. Conclusions and recommendations presented in this report are based on subsurface conditions encountered at the locations of our explorations and our experience on similar projects. Soil and groundwater data obtained during our field explorations were observed and interpreted at our boring locations only. Conditions may vary between boring locations, and should not be extrapolated to other areas without our prior review.

2.0 PROJECT DESCRIPTION

2.1 PROPOSED EQUIPMENT

We understand that it is proposed to install a 400 megawatt electrical generating facility at the site. The generating facility will consist of four (4) General Electric LMS100 natural gas-fired combustion turbine generators (CTGs), a selective catalytic reduction (SCR) and an oxidation catalyst. Auxiliary equipment will include inlet air filters with evaporative coolers, turbine compressor section inter-cooler, mechanical draft cooling tower, circulating water pumps, water treatment equipment, natural gas compressors, generator step-up and auxiliary transformers, and water storage tanks.

2.2 WEIGHTS AND FOUNDATION DIMENSIONS

We understand that concrete mat foundations will be used primarily to facilitate efficient interaction between critical equipment components. Weights and dimensions of major components as provided by the project civil/structural engineer (Bibb & Associates) are as follows:

Description	Length (Feet)	Width (Feet)	Weight (Pounds)
Main Unit	60	15	365,000
Generator	30	14	365,085
Intercooler Heat Exchanger	44	15	237,739
Auxiliary Skid	34	13	177,988
Hot SCR	70	25	503,100
Wet Cooling Tower	151	42	N/A
LMS100, Generator, IHE, Aux Skid	125	90	8,653,846
Hot SCR Foundation	70	25	1,346,154
Exhaust Stack	90 [a]	14.5[b]	N/A
Raw water storage tank (500,000 gallons)	44[a]	44[b]	450,000
Generator Step-Up Transformers	N/A	N/A	280,000

[a] Height of equipment in feet.

[b] Diameter of equipment in feet.

N/A indicates data was not available and would be provided later.

2.3 OTHER PROJECT CONSIDERATIONS

Based on the above component weights and foundation dimensions, soil contact pressures under the mats are expected to be on the order of 300 psf to 900 psf. The desired maximum differential settlement between adjacent mats is ½ inch upon application of the component loading.

As part of the proposed site development, we understand that it is also desired to raise the existing site grade by about 3 feet in order to facilitate adequate site surface drainage. The existing average surface elevation is currently at approximately +415 feet above Mean Sea Level (MSL).

A layout of the site showing locations of the proposed new units is shown in Figure 2.

3.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our investigation was to explore and evaluate the subsurface conditions at the Project site and develop preliminary foundation options and geotechnical

recommendations for design and construction of the Project. The scope of our services included performing the following tasks:

- Review of previous geotechnical and geologic data pertinent to the project site;
- Site reconnaissance to review existing site features and proposed boring locations;
- A field exploration program involving drilling and sampling of twenty (20) borings;
- Laboratory testing of selected soil samples obtained from the borings to evaluate in-situ moisture/density, index properties, shear strength, and other pertinent properties of the soils;
- Provide the zone factor, Z, and soil profile type, S, and near-surface factors per the 2001 California Building Code (CBC);
- Evaluate the potential for liquefaction and seismic-induced settlements;
- Engineering analyses to develop geotechnical recommendations for design and construction of the project; and
- Preparation of this engineering report.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

4.1 SITE RECONNAISSANCE

Prior to initiating any fieldwork URS personnel performed a reconnaissance on May 31, 2006 to observe the existing site conditions. In accordance with State regulations, URS contacted Underground Service Alert (USA) of Northern California regarding subsurface utility clearance at the site. USA responded by notifying various agencies who identified known underground utilities and subsurface obstructions on the property by marking the ground surface with color-coded paint.

Boring locations were established at the site by URS land surveyors on June 12, 2006. Borings were located primarily within the footprints of proposed major units and equipment. As necessary, borings were relocated in the field depending upon access conditions. Coordinates of the final boring locations are shown on the logs of borings.

4.2 FIELD EXPLORATION

A field exploration program was initiated on June 12 and completed on June 16, 2006 under the technical supervision of a representative from our Los Angeles office. Exploratory borings were drilled using a truck-mounted drilling rig equipped with 8-inch diameter hollow stem augers.

Twenty (20) borings (Borings SB-1 through SB-20) were advanced to depths ranging between 30 feet and 65 feet below existing ground surface. Relatively undisturbed soil samples were obtained using a California Type-U Sampler. Standard Penetration Tests (per ASTM D-1586) were performed at selected depths for seismic-induced settlement evaluation. Upon completion of the drilling activities, the boreholes were backfilled with soil cuttings generated during drilling. The locations of the borings are shown in Figure 2.

A detailed description of the field exploration program, including boring logs, key to the logs of borings and other pertinent information, is presented in Appendix A.

4.3 LABORATORY TESTING

Soil samples obtained from the borings were packaged and sealed in the field to prevent moisture loss and disturbance and transported to our Los Angeles laboratory where they were further examined and classified. Index and strength tests were performed on selected soil samples in accordance with ASTM standards. A detailed description of the laboratory testing program is presented in Appendix B.

5.0 SITE GEOLOGY

5.1 REGIONAL GEOLOGY

The Project site is located in the western San Joaquin Valley, which is part of the Central Valley, also referred to as the Great Valley geomorphic province. The Central Valley comprises about 20,000 square miles and extends from near Red Bluff on the north to near Bakersfield on the south. The most extensive geomorphic units in the province include dissected uplands, low alluvial plains and fans, river flood plains and channels, and overflow lands and lake bottoms. The valley represents the alluvial, flood, and delta plains of two major rivers (the Sacramento and San Joaquin Rivers) and their tributaries.

5.2 GEOLOGIC SOIL CONDITIONS

The Project site is located southeast of Panoche Creek on the Panoche Creek alluvial fan at an elevation of about +415 feet MSL. Published geologic mapping of the site indicates that geologic materials exposed within a two-mile radius of the site comprise primarily of surficial sediments. The site is located within an area mapped as Quaternary age alluvium composed of clays, silts and sands.

As observed in our exploratory borings, the underlying site materials consist of a thin blanket of possible artificial fill overlying recent alluvium. These alluvial deposits primarily comprise clays and silts.

5.3 GROUNDWATER CONDITIONS

The Project Site is located in the Westside Subbasin of the San Joaquin Valley Groundwater Basin. The Westside Subbasin consists mainly of the lands in the Westlands Water District. Groundwater was not encountered in any of the borings drilled during our subsurface investigation to the maximum depths explored, 65 feet. Depth to groundwater in the vicinity of the site is estimated to occur at a depth of about 195 feet ground surface.

5.4 GEOLOGIC AND SEISMIC HAZARDS

Geologic and seismic hazards are those hazards that could impact a site due to the surrounding geologic and seismic conditions. Geologic hazards include landsliding, erosion, subsidence, volcanic eruptions, and poor soil conditions. Seismic hazards include phenomena that occur during an earthquake such as ground shaking, ground rupture, and liquefaction. Our assessment of these hazards was based on guidelines established by the California Geological Survey (1997) and as outlined in CDMG Special Publication 117 (1999).

5.4.1 Primary Ground Rupture

Primary ground rupture is defined as the surface displacement which occurs along the surface trace of the causative fault during an earthquake. According to the California Geological Survey, the site is not currently located within an Alquist-Priolo Earthquake Fault Zone. Based on our review of available geologic data, no other surface traces of active

faults pass through the site. Therefore, the potential for primary ground rupture within the project site during a seismic event is low.

5.4.2 Ground Shaking

The site may experience strong seismic shaking in the future. The California Geological Survey (CGS) defines an active fault as one which has experienced surface rupture within the last 11,000 years (Holocene time). Potentially active faults have shown displacement within the last 1.6 million years (Quaternary age). "Inactive faults" show no evidence of movement in historic or recent geologic time, suggesting that the faults are dormant (Fresno County, 2000). The nearest potential sources of strong seismic shaking (as designated by the State of California) include:

- Ortigalita Fault Zone: The Ortigalita fault zone is approximately 50 miles long, originating near Crow Creek in western Stanislaus County and extending southeast to a few miles north of Panoche in western Fresno County. Most of the fault is considered active due to displacement during Holocene time (Fresno County, 2000). The Ortigalita Fault is a major Holocene dextral strike-slip fault in the central Coast Ranges that is an eastern part of the larger San Andreas fault system. The Ortigalita fault zone is about 19.4 miles from the site at its closest point.

- The San Andreas Fault Zone: The San Andreas Fault is considered active and is of primary concern in evaluating seismic hazards throughout western Fresno County (Fresno County, 2000). The 1,100 kilometer long San Andreas fault zone is the principal element of the San Andreas fault system, a network of faults with predominantly dextral strike-slip displacement that collectively accommodates the majority of relative north-south motion between the North American and Pacific plates. The closest segment of the San Andreas Fault is located approximately 28.2 km west and southwest of the site.

- Nunez Fault: The Nunez Fault is located approximately six to seven miles northwest of Coalinga and is about 30 miles from the site at its closest point. The fault is about 4.2 kilometers long and is considered active based on surface rupture associated with the 1983 Coalinga earthquake.

- The Great Valley Thrust Faults: The Great Valley Thrust Faults have been divided into at least 14 segments extending over 300 miles in cumulative length based on

geomorphic interpretation of the range front (USGS, 2006a). The closest Great Valley thrust fault is about 5.3 miles from the site at its closest point.

5.4.3 Liquefaction and Seismic-Induced Settlement

Liquefaction is a phenomenon whereby loose, saturated, granular soils lose their inherent shear strength due to excess pore water pressure build-up such as that generated during repeated cyclic loading from an earthquake. A low relative density of the granular materials, shallow ground-water table, long duration and high acceleration of seismic shaking are some of the factors favorable to cause liquefaction. Presence of predominantly cohesive or fine-grained materials and/or absence of saturated conditions can preclude liquefaction. Due to absence of groundwater at the site, the potential for liquefaction to occur and impact the site is low.

Although liquefaction is not expected to pose a hazard to the site, the presence of loose, unsaturated granular soil layers could result in some seismic-induced settlement that would need to be taken into account during foundation design. The potential for seismic-induced settlement was evaluated using the SPT data from our current exploratory borings and the results of the laboratory tests. The analysis was performed using the LIQUEFY program based on the simplified procedure outlined in Youd and Idriss (2001). A peak ground acceleration of 0.48g was used in the analysis (see Section 7.13 of this report)

Based on the results of the analyses, some seismic-induced settlement could occur within the loose to medium dense sandy and silty layers in the upper 40 feet based on a DLE event, resulting in settlement of about 2 inches within the susceptible soil layers.

5.4.4 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. By the mid-1960's withdrawal of groundwater for agriculture is known to have caused up to 26 feet of subsidence in some areas within the San Joaquin Valley. Subsidence rates reportedly increased until the mid-1950's when the maximum observed rate was 1.8 feet per year (Bull, 1975). Beginning in mid-1960's, surface water imported via the California Aqueduct began to replace groundwater as the primary source of irrigation supply in the area south of Mendota (Gilliom et al., 1989; Belitz and Heimes, 1990). By 1983, land subsidence due to groundwater withdrawal appeared to have slowed considerably or stopped in most of the San Joaquin Valley (Ireland, 1986).

5.4.5 Other Geologic and Seismic Hazards

The CGS has not developed any landslide hazard maps for Fresno County. However, the existing topography at the site does not provide sufficient relief that would cause concern from landslides. Therefore, landsliding is not anticipated to pose a hazard to the site. Also, by being relatively flat, the proposed site should not be readily susceptible to erosion. No centers of potential volcanic activity occur within hundreds of miles of the site. Volcanic hazards, such as lava flows and ash falls, are therefore not anticipated to present a hazard to the proposed site.

Other seismic hazards include tsunamis, seiches, and differential soil settlement. A tsunami is a great sea wave (commonly called a tidal wave) produced by a significant undersea disturbance such as tectonic displacement of the sea floor associated with large, shallow earthquakes. A seiche is an oscillation of a body of water in an enclosed or semi-enclosed basin (such as a reservoir, harbor, lake or storage tank) resulting from earthquakes or other large environmental disturbances. The potential for tsunamis and seiches at the Project Site is nil to low due to the absence of oceans, lakes, or large bodies of water in the immediate area.

Differential soil settlement occurs when significantly different densities and strengths of soil abut each other and seismic shaking causes one type of soil to settle more than the other. Based on our current field explorations, the site appears to be underlain by relatively uniform soil conditions that should not be prone to significant differential settlement under earthquake loading conditions.

6.0 SURFACE AND SUBSURFACE CONDITIONS

6.1 SURFACE CONDITIONS

The proposed Project site occupies approximately 12.8 acres, and is generally flat at an average elevation of approximately +415 feet MSL. The site currently in agricultural production with numerous rows of pomegranate trees.

Surrounding areas are predominantly used for agriculture with two existing power generation facilities nearby. Anticipated subsurface utilities present below the surface consist mainly of irrigation and water supply lines for agricultural purposes. Overhead power lines are present in the vicinity but do not cross over the site boundaries.

6.2 SUBSURFACE CONDITIONS

The subsurface soils at the site generally consist of interbedded clays, silts and sands to the maximum depth explored of 65 feet below the existing ground surface. In the upper 40 feet, the granular (sandy) soils were generally loose to medium dense in consistency and the fine-grained soils (clays and silts) were generally medium stiff to stiff. Below 40 feet, the soils dense soils were encountered, grading denser to the maximum depth explored in the borings (65 feet).

The fine-grained soils are relatively compressible and moderately expansive.

6.3 DESIGN GROUNDWATER LEVELS

Groundwater was not encountered in any of the borings drilled during the current investigation. As discussed in Section 5.3, depth to groundwater is expected to be about 195 feet below existing ground surface at the site. Therefore, groundwater is not expected to have a significant impact to the design and construction of this project.

7.0 DISCUSSION AND RECOMMENDATIONS

7.1 FOUNDATION CONSIDERATIONS

7.1.1 Key Geotechnical Issues

The upper 40 feet of the site consists of loose to medium dense granular soils and compressible fine-grained soils, which are in turn underlain by dense to very dense soils to the maximum depth explored of 65 feet.

Due to the loose and compressible consistency of the upper soils, equipment supported on shallow (mat) foundations are expected to experience significant static settlements. In addition, the loose sandy deposits are susceptible to seismic-induced settlement from a design earthquake.

7.1.2 Site Improvement Options for Mat Foundations

We understand that mat foundations are being considered for support the major units. However, in order to limit total and differential settlements of the mat foundations, improvement of the upper loose and compressible soils will be necessary. A common

method of improvement would be direct overexcavation and recompaction of the unsuitable soils. This is discussed in more detail in Section 7.5.

In lieu of soil removal and recompaction, selective replacement or in-situ improvement of the loose to medium dense soils using gravel or stone columns, or deep soil-cement mixing, may be viable alternatives for providing improvement under the mats. This site improvement is discussed further in Section 7.6 of this report.

7.1.3 Alternative Deep Foundation Schemes

Alternatively, deep foundations established in the underlying dense alluvial deposits should also provide adequate support for the different individual equipment units and mitigation for both static and seismic induced settlements. The use of deep foundations would preclude the need for improvement of the on-site soils.

Conventional driven, pre-cast concrete piles may be considered for support of the major, heavy units. Other deep foundation options such as cast-in-drilled-hole (CIDH) piles and auger-cast piles may be considered and recommendations can be provided if needed. Preliminary design criteria for the driven piles are provided in Section 7.9 of this report.

Specific recommendations for site earthwork, pavement, foundation design, and construction monitoring are provided below.

7.2 EARTHWORK

7.2.1 Compaction Criteria

The compaction criteria will depend on the specific loading conditions anticipated. In general, all fills and backfills should be compacted to the minimum requirements of the California Building Code unless specifically recommended.

Fills and backfills should be placed in loose lifts not exceeding 8 inches in thickness and moisture conditioned as required to achieve near-optimum or above moisture content. All fills and backfills should be compacted using mechanical compaction equipment. All fills and backfills providing structural support should be compacted to at least 95 percent of the maximum dry density per ASTM D-1557. This should include all areal fills placed to raise the site grade and fills and backfills providing passive resistance for footings and pile caps, as well as support for pavements and slabs-on-grade.

Secondary and non-structural fills may be compacted to at least 90 percent per ASTM D1557.

7.2.2 On-Site Sources and Import Materials Criteria

Most of the materials to be excavated in order to satisfy any one of the above described foundation options would comprise predominantly sandy and clayey soils, depending upon the site locations. The sandy soils may be reused as engineered fill from a geotechnical stand-point. Predominately clayey soils should be blended with the sandy soils in order to enhance the soil compaction characteristics. The geotechnical engineer should be present to review the types of materials encountered in the excavations in order to confirm their re-usability.

All imported fill and backfill soils should be predominantly granular, non-expansive, less than 3 inches in any dimension and be free of organic and inorganic debris. All fill and backfill materials should be observed and tested by the geotechnical engineer prior to their use in order to evaluate their suitability. Fill materials with any appreciable amount of fines (greater than 35 percent passing the #200 sieve) should be observed and tested by the geotechnical engineer prior to their use.

7.2.3 Temporary Excavations

All excavations should comply with the current California and Federal OSHA requirements, as applicable. All cuts greater than 5 feet in depth should be sloped and/or shored. Temporary excavations should be no steeper than 1(h):1(v), up to a maximum depth of 10 feet below surrounding grade. Flatter slopes will be required if clean and/or loose sandy soils are encountered along the slope face. Steeper cuts may be utilized for cuts less than 5 feet deep depending on the strength and homogeneity of the soils as observed in the field. The following table summarizes the excavation slopes for various excavation depths.

Excavation Depth (Feet)	Required Excavation Support
Less than 5	Vertical
5 to 10	1:1 slopes
Over 10	Shoring Required

No excavation is allowed within the influence zone of existing footings unless the footings are properly underpinned. The influence zone of the existing footings may be

assumed to be below a 45-degree line projected down from the bottom edge of the footing.

If removal of unsuitable soils within the influence zone described above becomes necessary, existing footings will need to be underpinned. Specific recommendation for underpinning can be provided on a case-by-case basis, if needed.

During wet weather, runoff water should be prevented from entering the excavation, and collected and disposed of outside the construction limits. To prevent runoff from adjacent areas from entering the excavation, a perimeter berm should be constructed at the top of the slope. Heavy construction equipment, building materials, excavated soil stockpiles and vehicle traffic should not be allowed near the top of the slope within a horizontal distance equal to the depth of the excavation.

7.2.4 Permanent Cut and Fill Slopes

All permanent fill and cut slopes should be constructed at 2(h): 1(v) or flatter. Benching should be performed during construction of all fill slopes for existing ground surface that is at 5(h): 1(v) or steeper. All fill slopes should be compacted to 95 percent of the maximum dry density and in accordance with applicable grading codes.

7.3 TEMPORARY SHORING

If the available space will not permit sloping or benching of the excavations, a temporary shoring system will be required. It is assumed that the temporary shoring will be in place for a few weeks only. Shoring systems typically consist of a soldier pile and lagging retention system; either tied-back, internally braced, or cantilevered.

On a preliminary basis, typical soldier piles consist of steel H-sections installed in predrilled holes. The holes should be backfilled below the planned bottom of the excavation with structural concrete and with lean concrete above. Horizontal spacing between soldier piles should be limited to about 8 feet. Treated timber lagging may be required in sandy zones. Any space between the lagging and excavation should be filled with lean concrete with provisions for weepholes to reduce the potential for buildup of hydrostatic pressure.

The temporary shoring system should be designed to resist lateral earth pressures plus additional horizontal pressures imposed by foundations of adjacent structures.

Temporary cantilevered shoring should be designed for a triangular load distribution equivalent to the pressure exerted by a fluid weighing 35 pounds per cubic foot (pcf). For an areal surcharge placed adjacent to the shoring, an equivalent, horizontal (rectangular) pressure equivalent to thirty (30) percent of the surcharge may be assumed to act along the entire length of the shoring.

Soldier piles must extend below the excavation bottom to provide lateral resistance by passive soil pressure. Allowable passive pressures may be taken as equivalent to the pressure exerted by a fluid weighing 250 pcf in alluvium to a maximum value of 2,500 psf. To account for three-dimensional effects, the lateral pressure may be assumed to act on an area twice the pile width. The above values for passive pressure incorporate a factor of safety of at least 1.5.

For lagging design, it is customary to account for about fifty percent of the basic earth pressure for temporary conditions. For this purpose a uniform horizontal pressure (rectangular distribution) of 10***H*** psf may be assumed for lagging design. The above design recommendations do not include any hydrostatic pressure. It is assumed that drainage will be provided through cracks in the lagging.

7.4 LATERAL EARTH PRESSURES

Walls should be designed to resist the earth pressure exerted by the retained soils, plus any additional lateral forces that will be applied to the walls due to surface loads placed at, or near the top, those due to potential ground water build-up and seismic loads. Adequate provisions are required to counteract the effects of hydrostatic pressure, as recommended previously. Free-draining backfill should be used behind portions of walls above the design ground-water level. Provisions should be made to collect and dispose of water that may accumulate behind the walls.

The at-rest earth pressure against walls with a level-backfill that are restrained at the top can be taken as equivalent to the pressure exerted by a fluid weighing 60 pcf. Fifty percent of any uniform areal surcharge placed at the top of a restrained wall will act as a uniform horizontal pressure over the entire height of the wall.

Walls that are not restrained at the top may be designed for an active earth pressure developed by an equivalent fluid weighing 35 pcf. Thirty percent of any uniform surcharge will act as a uniform horizontal pressure over the entire height of the wall.

The above lateral earth pressures do not include any hydrostatic pressure. Therefore, wall backfill should be free draining and provisions should be made to collect and dispose of water that may accumulate behind the walls. Light equipment should be used during backfill compaction to avoid possible overstressing of walls.

7.5 MAT FOUNDATIONS WITH ENGINEERED FILL

7.5.1 Overexcavation and Recompaction

Mat foundations established in engineered fill prepared in accordance with the preceding recommendations may be considered for support for the project, provided the estimated settlements can be tolerated. Conventional removal and recompaction of the upper soils may be performed for this purpose.

On a preliminary basis, and for estimating purposes, we have performed engineering analysis to provide design and construction recommendations for a nominal 10 feet of removal and recompaction under the mat foundations. The proposed site grading (additional 3 feet of fill) may be taken into account in the nominal fill thickness. The engineered fill should extend a minimum 10 feet beyond the edge of the mat, or equal to the thickness of fill under the mat whichever is greater.
Mats should be embedded a minimum of 12 inches below the lowest finished adjacent grade.

7.5.2 Bearing Pressures and Anticipated Settlements

The allowable bearing pressure for the mat foundation will be governed by the allowable settlement. The following table presents the bearing pressures versus predicted settlements (static) for a mat foundation based on the above nominal site preparation constraints (ie. 10 feet of improvement).

Soil Bearing Pressure (psf)	Predicted Static Settlement (inches)
500	2
1000	4

A one-third increase to the above bearing values may be assumed when considering the effects of temporary wind or seismic loads. The bearing values given above are net values.

The predicted settlements indicated above are total static settlements. In addition to the anticipated settlements, seismic-induced settlements as discussed in Section 5.4.3 should be accounted for. Maximum differential settlement between adjacent, similarly loaded mats is expected to be about half of the total predicted settlement.

As discussed above, maximum settlement of mat foundations when supported on a minimum 10 feet of engineered fill is estimated to be on the order of 4 inches. In order to reduce the magnitude of settlement, it follows that additional overexcavation and recompaction beyond 10 feet would be required.

7.5.3 Structural Design of Mat Foundation

For further analysis of a mat foundation scheme, the preceding bearing values and predicted settlements can be used in the rigid mat method, a conventional method for structural design of a mat foundation. Another common design method is the approximate flexible method (American Concrete Institute Committee 336) in which the foundation soil is modeled as an infinite number of elastic springs. The elastic spring constant is referred to as the modulus of subgrade reaction (k). For large foundations such as a mat, the k value is also a function of the size of the foundation.

The following equation may be used to estimate the **k** value (in units of pounds per cubic inch, pci) for a mat with dimensions of B (width) by L (length):

$$\mathbf{k} = k_s \frac{(m + 0.5)}{1.5m}$$

where:

k_s = 5 to 10 pci

m = ratio of L/B

For a more refined analysis/structural design of mat foundations, there are other more rigorous discrete-element methods such as the finite-difference and the finite-element methods. These methods utilize advanced numerical modeling techniques by dividing the mat into grid elements and predicting the behavior of the soil and structure under loading (soil-structure-interaction, SSI) for each element. URS has these capabilities and upon request by the owner, can assist the structural engineer to rapidly evaluate the sensitivity of a design to extreme soil or loading conditions.

7.6 MAT FOUNDATIONS WITH IN-SITU SOIL IMPROVEMENT

If the overexcavation and recompaction option discussed in Section 7.5 proves to be unfeasible, in-situ improvement of the unsuitable soils may be considered.

One technique, known as vibro-replacement or vibro-compaction (or stone columns), involves use of specially designed vibratory equipment to direct compactive energy at the required improvement depths. As the vibratory device is withdrawn from the ground, the resulting void is filled with sand, gravel or stone, and then re-vibrated to ensure densification effort throughout the penetration depth.

Another similar technique involves deep soil-cement mixing, where in-situ mixed soil-cement columns are installed by approximately 4 to 5 foot diameter blades which are inserted into the ground to blend the in-situ materials. The disturbed cylinder of soil is mixed with cement and water to create a homogenous column of soil-cement.

In both cases, the stone or soil-cement columns are typically installed in a grid pattern directly under the footprint of the mat. For these types of in-situ improvement, it is customary to leave specific equipment and procedural specifications to a specialty contractor to achieve the specified project criteria in a performance specification.

7.7 SPREAD FOOTINGS (LIGHTY LOADED STRUCTURES)

Lightly-loaded (about 10 to 25 kips), non-settlement sensitive (i.e., not sensitive to the magnitudes of static and seismic-induced settlements), and isolated units may be supported on conventional spread footings established on a minimum 3 feet of compacted engineered fill. The final thickness of engineered fill would depend upon the actual depths of removal of uncertified fills during site preparation. The limits of engineered fill should extend at least 3 feet beyond the edges of the footings or equal to the depth of improvement under the footing, whichever is greater.

Footings should be a minimum of 2 feet wide and established at a minimum depth of 2 feet below the lowest adjacent final grade. An allowable bearing pressure of 1,500 pounds per square foot (psf) may be used for spread footings with the above minimum dimensions. The allowable bearing pressure is a net value. Therefore, the weight of the foundation and the backfill over the footing may be neglected when computing dead loads. The bearing pressure applies to dead plus live loads and includes a calculated

factor of safety of at least 3. The allowable bearing pressure value may be increased by one-third for short-term loading due to wind or seismic forces.

Total static settlements of individual, lightly loaded spread footings will vary depending on the width of the footing and the actual load supported. Total static settlements of footings, designed and constructed in accordance with the preceding recommendations are estimated to be on the order of 1 inch or less.

7.8 RESISTANCE TO LATERAL LOADS

Resistance to lateral loads may be provided by frictional resistance between concrete mats and the underlying soils and by passive soil pressure against the sides of the mats. The coefficient of friction between the concrete foundations and the underlying soils may be taken as 0.4. Passive pressure available in compacted backfill may be taken as equivalent to the pressure exerted by a fluid weighing 250 pounds per cubic foot (pcf) to a maximum 2,500 psf. A one-third increase in the passive value may be used for temporary wind or seismic loads. The above-recommended values include a factor of safety of at least 1.5; therefore, frictional and passive resistances may be used in combination without reduction.

7.9 DRIVEN PILES

7.9.1 General

Pre-stressed, concrete piles (12-inch or 14-inch square) may be considered for support of the heavy, settlement sensitive equipment, as appropriate. The piles should be driven through the upper loose to medium dense soils into the underlying dense to very dense sands to obtain the required load-bearing capacities. It is anticipated that the piles would need to be driven to depths of about 50 to 65 feet below the pile cap in order to achieve adequate axial capacities.

7.9.2 Axial Capacities

The piles should be driven with a hammer delivering, at a minimum, energy on the order of 50,000 foot-pounds per blow. For preliminary estimating purposes only, piles should be driven to a refusal criterion of at least 40 continuous blows for the last 3-foot of penetration. The above refusal criterion is intended to result in allowable downward and upward axial pile capacities as shown in the table below.

Pile Width (Inches)	Allowable Downward Capacity	Allowable Upward Capacity
12	100 kips	30 kips
14	150 kips	40 kips

The above estimates of axial capacities are based on conventional analyses performed using the methods outlined in Chapter 5 of the Design Manual 7.02 prepared by Naval Facilities Engineering Command (NavFac) for displacement piles. The allowable downward and upward capacities include a factor of safety of at least 2.0. The allowable downward capacities have considered the anticipated effects of some down-drag generated from seismically-induced settlement of the upper strata, including the identified liquefiable layer. The allowable downward and upward capacities may be increased by 33 percent to account for temporary loads such as those from wind or earthquakes.

To avoid interference with adjacent piles, and to minimize group effects we recommend that the piles be spaced a minimum of 3 pile widths, center-to-center. For this minimum spacing, it will not be necessary to reduce axial capacities for group action. Settlements of the piles are expected to be less than one inch, including elastic compression of the piles under the design loads.

The pile-driving rig should be equipped with a drill motor to facilitate pre-drilling, if requested by the geotechnical engineer. Pre-drilling may be necessary in order to advance the piles to the desired tip elevation. Prior to commencement of pile driving, the contractor should be required to submit equipment specifications to assist in wave equation evaluation of the actual refusal criteria and induced stresses on the pile.

We recommend that several indicator piles be driven at the site prior to driving production piles in order to evaluate driveability, hammer efficiency and other conditions. The indicator piles should be monitored using a Pile Driving Analyzer (PDA) in order to evaluate the actual driving stresses in the piles and capacities achieved during driving.

7.9.3 Lateral Capacities

Resistance to lateral loads will be provided by the resistance of the soil against the pile, pile caps, grade beams, and by the bending strength of the pile itself. The lateral capacity

and maximum induced bending moments for 12- and 14-inch square, pre-stressed concrete piles with the top of the pile in a fixed-head condition are presented in the table below.

Pile Width (Inches)	Lateral Load (Kips)	Deflection (Inches)	Maximum Induced Bending Moment (Ft-Kips)	Depth To Zero Moment (Feet)
12	13	¼	46	5
14	27	¼	108	5

The above lateral pile capacities and maximum induced bending moments correspond to a pile head deflection of ¼-inch. At full fixity, the maximum induced bending moment occurs at the pile cap connection. For pile head deflections up to ½ inch, lateral capacities and moments may be assumed directly proportional to the deflection. The group reduction in lateral capacity is about 50 percent for center-to-center spacing of at least 3 pile widths.

If needed, grade beams/tie beams may be provided between piles to provide additional lateral resistance and to maintain foundation alignment and integrity.

7.10 CAST-IN-DRILLED-HOLE PILES FOR LIGHT POLES

Cast-in-drilled-hole piles (CIDH piles) with a minimum diameter of 24 inches may be used for support of light poles around the project site. The following parameters may be used for design of the light poles.

Design Parameters	
Allowable Bearing Capacity	1,500 psf
Lateral Bearing Capacity (for Light Poles)	250 psf/ft, Maximum lateral resistance is limited to 2,500 psf.
Lateral Sliding Resistance	0.25

Concrete should be placed after completion of the drilling of each pile. Excavations should not be allowed to stand open overnight. A minimum of 8 hours should be allowed between concrete placement in one shaft before drilling an adjacent shaft within 5 diameters center-to-center. Loose soils and water at the bottom of the drilled holes

should be removed to the extent possible. All drilled pile construction should be performed in accordance with the latest edition of ACI 336.1, "Standard Specifications for Construction of Drilled Piles".

7.11 PAVEMENTS AND SIDEWALKS

To provide uniform and adequate support, general surfaces to be paved with either Portland cement concrete or asphaltic concrete should be underlain by at least 24 inches of granular fill compacted to 95 percent relative density.

In areas to be provided with settlement-sensitive coverings such as decorative tile or stone, we recommend providing a minimum 5 feet of engineered fill under the pavement. The actual thickness of the engineered fill will vary depending on the thickness of existing uncertified fills to be removed.

A moisture barrier is recommended under all floor slabs to be overlain by moisture-sensitive floor covering. A plastic or vinyl membrane may be used for this purpose and should be placed between two layers of moist sand, each at least 2 inches thick, to promote uniform curing of the concrete and to protect the membrane during construction. For design of slabs and rigid pavements and for estimating their deflections, a modulus of subgrade reaction (k) of 250 pounds per square inch per inch deflection (pci) may be used.

7.12 PAVEMENT STRUCTURAL SECTIONS

Pavement subgrades at the project site are anticipated to expose loose surficial soils. Because of the unpredictability of traffic use, we have recommended pavement structural sections based on our experience with similar projects and subsurface materials. The intention is to keep the initial costs minimal, while additional asphalt concrete surfacing may be added later, if needed. R-value testing may be necessary during construction for verification purposes so as to consider any need for modifications. Recommended minimum thickness of flexible pavements for Traffic Index (TI) values of 4.0, 5.0 and 7.0 are provided below:

Pavement Description	Traffic Index (TI)	Pavement Thickness (Inches)	
		Asphaltic Concrete	Aggregate Base
Truck Drive Areas	7	4	10
Car Drive Areas	5 to 5½	4	7
Parking Areas	4	3	6

To provide uniform support, all pavement areas should be provided with at least 24 inches of engineered fill compacted to 95 percent of the maximum dry density per ASTM D-1557. We recommend that the areas to receive pavements be prepared in accordance with the applicable preceding recommendations. Adequate grade or drainage should be provided to prevent ponding of water on the pavement.

Alternatively, all areas subject to future truck traffic (fire trucks, trucks with 5 axles or greater) may be overlain by a minimum of 7½ inches of reinforced concrete over 6 inches aggregate base.

All concrete pavements should be provided with nominal reinforcement. Pavements may be reinforced using minimum No. 3 bars at 12-inch on-center, each way. Aggregate base should satisfy Caltrans Class 2 gradation requirements and should have a minimum R-value of 78. All gradation and R-value should be confirmed by the geotechnical engineer during construction. All base materials should be compacted to a minimum of 95 percent of the maximum dry density per ASTM D-1557.

7.13 SEISMIC PARAMETERS

7.13.1 Probabilistic Seismic Hazard Assessment

A probabilistic seismic hazard analysis (PSHA) was performed using the computer program FRISKSP (Blake, 2000) to estimate the Peak Horizontal Ground Accelerations (PHGA) that could occur at the site. The site latitude and longitude inputs were 36.6512 degrees 120.5845 degrees, respectively. Various probabilistic density functions were used in the analysis to assess the uncertainty inherent in the calculations with respect to magnitude, distance, and ground motion. An average of three attenuation relationships (Abrahamson and Silva, 1977, Boore et al., 1997, and Sadigh et al, 1997) were used to estimate ground motions for the site underlain by deep alluvial deposits.

The results of the analysis suggest that the estimated PHGA with a 10 percent probability of exceedance in 50 years is approximately **0.48g** (recurrence interval of 475 years). This level of ground motion is considered the Design Basis Earthquake (DBE).

7.13.2 California Building Code (2001 CBC)

For determination of the site coefficient, a subsurface soil profile corresponding to a site profile type S_D, in accordance with Table No. 16-J of the 2001 California Building Code may be used. The project site may be assumed to be located within Seismic Zone 4.

According to the Maps of Known Active Fault Source Zone, prepared by the California Department of Conservation Division of Mines and Geology (1998), the proposed Project site is located greater than 10 kilometers from the Ortigalita Fault Zone. A seismic source Type B should be used for the site when selecting a near source factor from Tables 16-S and 16-T of the 2001 CBC. In summary, based on URS' review of the available geotechnical and geological data, the seismic parameters for the site, according to 2001 CBC, are presented in the table below.

Seismic Design Parameters	
Assumed Site Profile Type	S_D
Fault Type	B
Distance to Fault	> 10 km
Seismic Zone Factor (Z)	0.40
Seismic Coefficient (C_a)	0.44
Seismic Coefficient (C_v)	0.64
Near-Source Factor (N_a)	1.0
Near-Source Factor (N_v)	1.0

7.14 SURFACE DRAINAGE

The ground surface of the site should be adequately sloped to direct water away from the foundations. Areas where water could pond should be eliminated by the use of area drains. Area drains should not be placed next to or in contact with the foundations. The ground surface should be adequately sloped away from structures toward the area drains.

8.0 DESIGN REVIEW

We recommend that the geotechnical aspects of the project be reviewed by the geotechnical engineer during the design process. The scope of services may include

assistance to the design team in providing specific recommendations for special cases, reviewing the foundation design and evaluating the overall applicability of the recommendations presented in this report, reviewing the geotechnical portions of the project for possible cost savings through alternative approaches and reviewing the proposed construction techniques to evaluate if they satisfy the intent of the recommendations presented in this report.

9.0 CONSTRUCTION MONITORING

As required under Section 3317 of the 2001 CBC, all earthwork and foundation construction should be monitored by a qualified engineer/technician under the supervision of the geotechnical engineer-of-record. Such monitoring should include, but not be limited to, the following:

- Site preparation -- site stripping, overexcavation, and recompaction;
- Foundation excavation subgrades (prior to placing steel and concrete);
- Placement of structural fills and backfills; and
- All stone column or pile installations.

We recommend that URS be present to observe the soil conditions encountered during construction, to evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and to recommend appropriate changes in design or construction if conditions differ from those described herein.

10.0 LIMITATIONS

URS warrants that our services are performed within the limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. No other warranty or representation, express or implied, is included or intended in this report.

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The following are attached and complete this report:

Figure 1	Vicinity Map
Figure 2	Plot Plan
Appendix A	Exploration Borings
Appendix B	Geotechnical Laboratory Testing

It has been a pleasure to assist you with this project. We look forward to being of further assistance as the project develops. Should you have any questions, please contact us.

Respectfully submitted,

URS CORPORATION

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Senior Project Engineer

Arnel Bicol, P.E., G.E.
Principal Engineer

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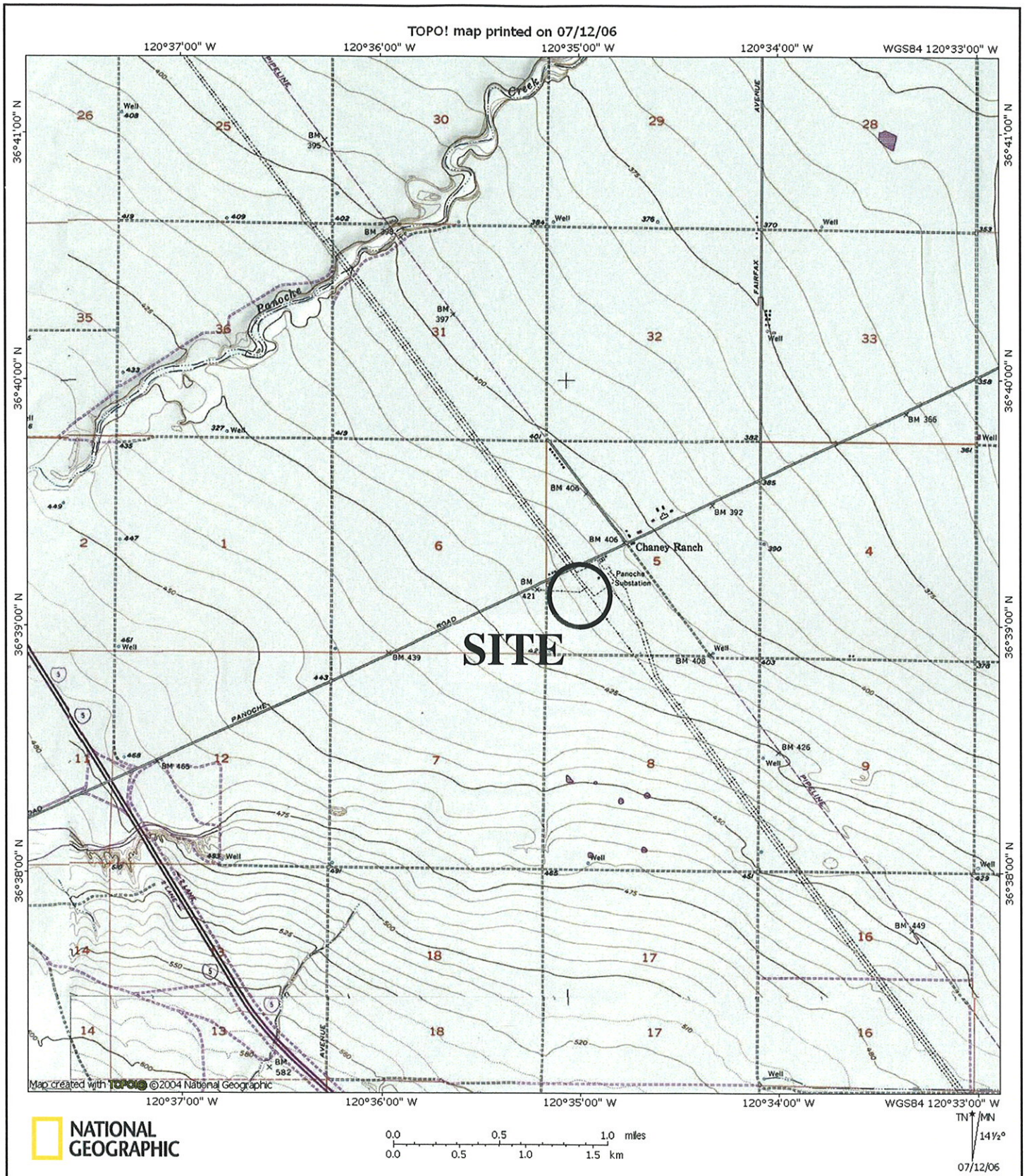
FIGURES



NATIONAL GEOGRAPHIC

VICINITY MAP

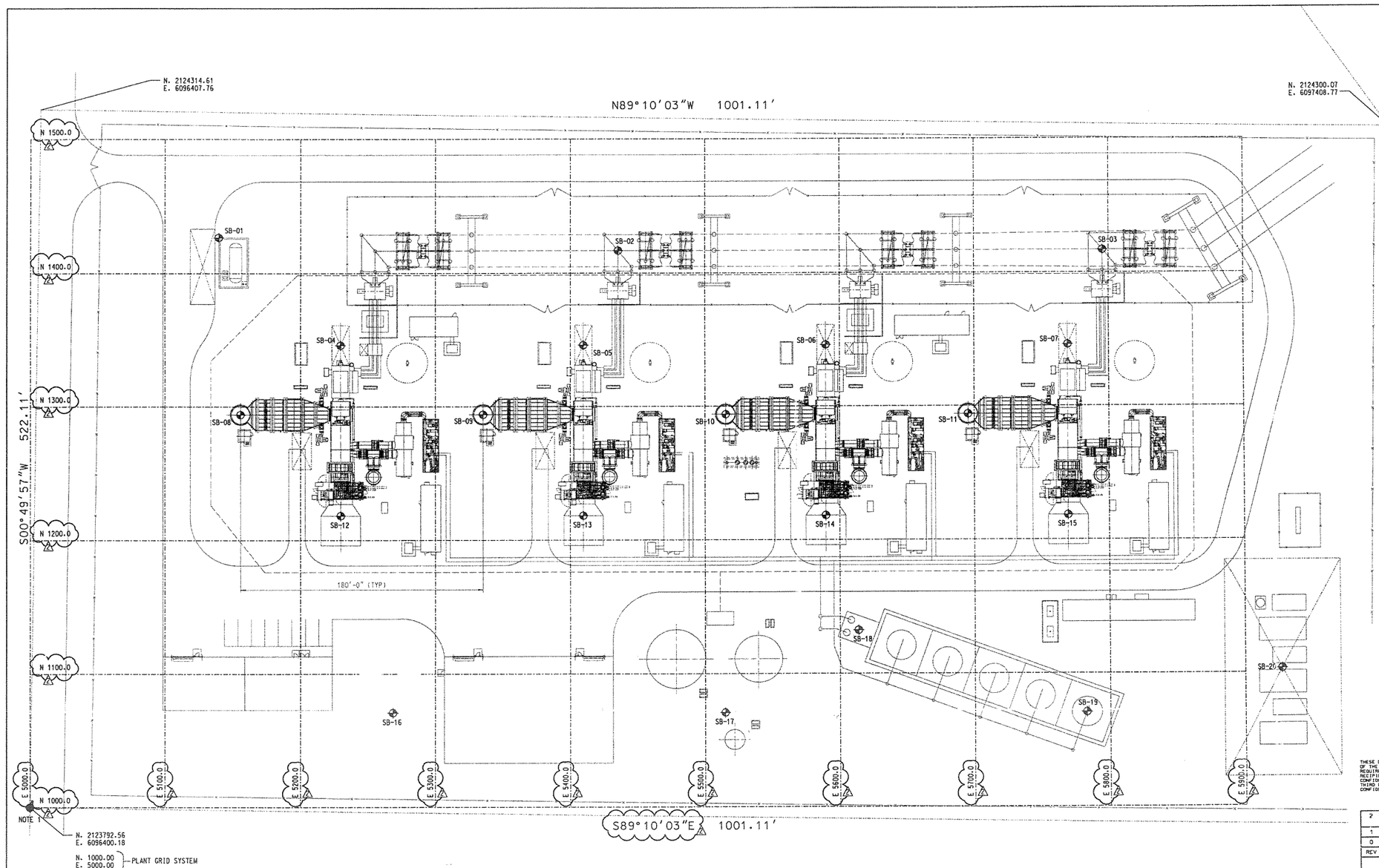
PROPOSED PANOCHE ENERGY CENTER

FRESNO COUNTY, CALIFORNIA

FOR: PANOCHE ENERGY CENTER, LLC.

URS

FIGURE 1



SOIL BORING LOCATION COORDINATES		
SB NO.	NORTHING (FEET)	EASTING (FEET)
SB-01	N 1426.78	E 5139.36
SB-02	N 1416.87	E 5435.58
SB-03	N 1416.87	E 5795.58
SB-04	N 1346.15	E 5229.88
SB-05	N 1346.15	E 5409.88
SB-06	N 1346.15	E 5589.88
SB-07	N 1346.15	E 5769.88
SB-08	N 1294.07	E 5155.57
SB-09	N 1294.07	E 5335.57
SB-10	N 1294.07	E 5515.57
SB-11	N 1294.07	E 5695.57
SB-12	N 1218.28	E 5229.88
SB-13	N 1218.28	E 5409.88
SB-14	N 1218.28	E 5589.88
SB-15	N 1218.28	E 5769.88
SB-16	N 1070.91	E 5268.66
SB-17	N 1070.91	E 5514.93
SB-18	N 1132.48	E 5613.73
SB-19	N 1070.92	E 5782.88
SB-20	N 1103.20	E 5927.90

NOTES

1. PLANT GRID REFERENCE LOCATION OF N. 1000.00, E. 5000.00 IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE 4, NAD 1983. N. 2123792.56, E. 6096400.18.

⊕ DENOTES - SOIL BORING LOCATIONS

— PRELIMINARY —
NOT FOR CONSTRUCTION

CONFIDENTIAL

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REV.	DESCRIPTION	DWN	CHK	APP	DATE
2	REVISED GRID SYSTEM, REVISED PROPERTY BOUNDARY BEARING. ISSUED FOR GEOTECHNICAL SURVEY	BMB	JDT	FGA	06-01-06
1	ISSUED FOR GEOTECHNICAL SURVEY	BMB	JDT	FGA	05-30-06
0	ISSUED FOR CONSTRUCTION	JOY	CDH		05-10-06

KIEWIT INDUSTRIAL CO.
A Kiewit Company

PANOCHE ENERGY CENTER
4x0 LMS100
FIREBAUGH, CA

Bibb and associates
8455 Lenexa Drive
Lenexa, Kansas 66214

SOIL BORING LOCATION PLAN

	by	date
DESIGNED	CAH	05-09-06
DRAWN	JOY	05-10-06
CHECKED	CDH	05-10-06
APPROVED		

DRAWING NUMBER
P-2006-027-SC-001

FIGURE 2

APPENDIX A

EXPLORATION BORINGS

EXPLORATION BORINGS

This appendix describes the exploration program conducted by URS for the proposed electrical generating facility in Fresno County, California. The exploratory locations for soil borings were first marked in the field, and then checked through USA for clearance of potential conflicts with the underground utilities.

Subsurface exploration included drilling and sampling 20 borings (Borings SB-1 through SB-20) to depths ranging between 30 feet and 65 feet below the existing ground surface using a truck-mounted hollow stem-auger drill rig. The approximate locations of the borings are shown in Figure 2.

A URS representative from our Los Angeles office maintained a log for each boring in the field, recording sampler blow counts, soil characteristics, observations, sample locations, and other pertinent drilling and sampling information. The subsurface materials were characterized by visual inspection of the samples and soil cuttings returned to the surface during the drilling operation. The behavior of the drill rig, such as variations in penetration rate, was also considered in material characterization. Soils were classified according to the Unified Soil Classification System (ASTM D 2488). The boring logs were modified to reflect the results of laboratory observations and testing of the samples. A key to notations on the boring logs is presented in Figure A-1. The Logs of Borings are presented in Figures A-2 through A-21, respectively.

Relatively undisturbed samples were obtained using a Dames & Moore Type U sampler (2.42-inches I.D.) driven 18-inches using a 140-pound hammer with a 30-inch drop. The number of blows required to drive the sampler was recorded for each 6-inch interval of penetration. The first 6-inch increment of penetration is considered to be a "seating interval" in potentially highly disturbed soils at the base of the borehole, and is therefore not included in the final log notation unless refusal was met within the seating interval. The total number of blows for the 12 inches of penetration beyond the seating interval, or the distance driven before refusal, is normally recorded on the log.

Relatively undisturbed and disturbed samples from the sampling activities were placed in plastic bags to preserve the water content of the soil and transported to our geotechnical laboratory in Los Angeles for testing.

Standard penetration tests (SPT) were also performed at selected depths per ASTM D-1586. The blow count for the final 12 inches of sampler penetration is commonly referred to as the "N-value". This value generally reflects the resistance to penetration of the soil at the sample depth. The degree of relative density of granular soils and the degree of consistency of cohesive soils are generally described on the boring logs according to the conventional correlation presented below:

Granular Soils			**Cohesive Soils**	
SPT Blow Count	Description		SPT Blow Count	Description
< 4	Very Loose		< 2	Very Soft
4 - 10	Loose		2 – 4	Soft
10 - 30	Medium Dense		4 – 8	Medium Stiff
30 - 50	Dense		8 – 15	Stiff
> 50	Very Dense		15 – 30	Very Stiff
			> 30	Hard

The relative density and consistency descriptions on the attached boring logs are based on adjusted blow counts recorded in the field. These numbers are considered to be useful in providing an estimate of the soils relative density or consistency. The relative density and consistency descriptions on the logs may deviate from the correlation for a number of reasons, including reliance on other test results or the engineer's judgment based on manual manipulation of the sample.

It is widely accepted that the above-listed SPT blow count correlation is overly simplistic. For most applications in non-gravelly soils, the blow count is usually adjusted for the effective vertical pressure at the sampling depth and for other sampling system parameters such as the efficiency of the sampling system and sampling techniques used. In gravelly soil, it is recognized that the blow counts are higher than would be expected in non-gravelly soil of similar density or consistency. This occurs because the sampler tends to push larger gravel clasts ahead of it. The area of the gravel clasts may be significantly greater than that of the sampler, causing increased resistance and higher blow counts.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER 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 IS SMALLER 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 SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Rock Material Symbols (examples)

Asphalt

Sampler and Symbol Descriptions

- California sample
- Standard Penetration Test
- No Recovery
- Bk Bulk sample
- Disturbed Type-U Sample
- Pitcher Tube Sample
- Shelby Tube Sample
- Rock Core Sample
- Approximate depth of perched water or groundwater

Note: Number of blows required to advance driven sample 12" (or length noted) is recorded; blow count recorded for seating interval (initial 6" of drive) is indicated by an asterisk.

Laboratory and Field Test Abbreviations

CBR	California Bearing Ratio(result in parentheses)
COMP	Compaction test
CORR	Corrosivity test
CON	Consolidation Test
DSCD	Consolidated drained direct shear test (normal pressure and shear strength results shown)
EI	Expansion Index(result in parentheses)
LL=29	Liquid limit (Atterberg limits test)
PERM	Permeability test
PI=11	Plasticity Index (Atterberg limits test)
R-value	R-Value Test(result in parentheses)
SA	Sieve Analysis (-200 result in parentheses)
SA/HA	Sieve and Hydrometer Analysis(-200 result in parentheses)
UC	Unconfined Compressive Strength test
(0,21.4,0,0)	(Methane/LEL in %,O2 in %,CO in ppm, H2S in ppm)
-200	Percent passing #200 sieve (test result in parentheses)

KEY TO LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-1

URS

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1426.78 feet, E 5144.36 feet (Plant Grid System)		

Boring SB-1

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	Silty SAND yellowish-brown, loose, moist, fine to medium			
	5	■	1	17				22	83	
						SM-ML	Silty SAND to Sandy SILT yellowish-brown, loose, moist, fine to medium			
	10	◪	2	8				12		
						SM	Silty SAND yellowish-brown, medium dense, moist, fine to medium			
	15	■	3	45				6	92	DSCD
	20	◪	4	14			Grades with coarse sand	11		
						SP	SAND light olive gray, medium dense, slightly moist, fine to medium, trace coarse sand			
	25	■	5	27				3	94	
	30	◪	6	19			Grades fine to coarse with fine weathered gravel	3		
	35									
	40									

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

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FIGURE A-2

URS

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DML A.GDT Printed: 7/16/06

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1416.87 feet, E 5430.58 feet (Plant Grid System)		

Boring SB-2

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			ML	SILT with sand light olive gray, medium stiff, moist, fine	13		-200(80); COMP
	5		1	12				6	94	
						CL	CLAY light gray, stiff, moist, with brown oxidation stains and caliche			
	10		2	20				13	89	-200(98)
						SP-SM	SAND with silt light olive brown to olive gray, medium dense, slightly moist, fine to medium, with some fine gravel			
	15		3	21				3	100	COL=1% -200(6); DSCD
	20		4	14			Grades loose, interlayered with some fine sandy silt beds	3	90	COL=1%
						SM	Silty SAND light olive gray, medium dense, moist, fine			
	25		5	16				12		
						CL	CLAY with sand olive brown, stiff, moist, trace fine sand			
	30		6	30				24	97	-200(84)
						SP	SAND light olive gray, medium dense, slightly moist, fine to medium, with some gravel			
	35		7	16				5		
	40									

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FIGURE A-3

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

Boring SB-2
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	36		CL	Sandy CLAY olive brown, very stiff, moist, fine to coarse	16	106	-200(50)
	45		9	18			Grades with more silt	13		
	50		10	37			Grades yellowish-brown, with less sand	21	106	-200(90)
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-3

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1416.87 feet, E 5791.83 feet (Plant Grid System)		

Boring SB-3

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					ML	SILT light olive brown, medium stiff, slightly moist, with fine sand			
	5	■	1	14				9	88	COL=1%
	10	■	2	23			Grades with silty fine sand layer	7	92	-200(72); CON
						ML	Sandy SILT light olive brown, medium dense, slightly moist, fine			
	15	■	3	23		ML	Sandy SILT light olive brown, stiff, moist, fine	14	96	COL=1% DSCD
	20	■	4	31			Grades dark olive brown, interbedded with clay and silty sand	14	97	-200(59)
	25	◪	5	14			Grades olive brown, layered	23		
	30	■	6	23			Grades dark brown, moist, with more clay Grades with some fine gravel	13	106	COL=1%
	35	◪	7	25		SP-SM	SAND with Silt light olive gray, medium dense, slightly moist, fine to coarse, with trace fine gravel	3		-200(8)
	40					ML	Sandy SILT			

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-4

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FRESNO COUNTY, CALIFORNIA

FOR: PANOCHE ENERGY CENTER LLC

Boring SB-3

Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	43			olive brown, medium dense, moist, fine to medium	6	107	
	45		9	26			Grades interbedded with silty fine sand and clay	17		
						CL	CLAY with sand dark olive brown, very stiff, moist, fine			
	50		10	55				20	107	-200(83)
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-4

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1346.15 feet, E 5231.88 feet (Plant Grid System)		

Boring SB-4

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					CL	CLAY light olive brown, medium stiff, moist			
	5		1	4				19		-200(96)
	10		2	29			Grades stiff, with silt	20	92	DSCD; CON
						SM	Silty SAND light olive brown, loose, slightly moist, fine			
	15		3	5				7		-200(45)
						SM	Silty SAND light olive brown, medium dense, moist, fine to medium, with minor interbeds of clay			
	20		4	35				8	102	
	25		5	9			Grades olive brown, loose, without clay	14		
						CL	Sandy CLAY olive brown, stiff, moist, fine, with trace fine gravel			
	30		6	30				19	98	
	35									
	40									

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LOG OF BORING

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FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-5

URS

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1346.15 feet, E 5412.88 feet (Plant Grid System)		

Boring SB-5

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					CL	CLAY light olive gray, stiff, moist, with fine sand			
	5		1	31				15	91	
	10		2	22			Grades silty, with some roots	7	92	CON
						SM	Silty SAND olive brown, medium dense, slightly moist, fine to medium			
	15		3	21				4	102	
	20		4	15			Grades loose, with more silt and some clay	13	95	COL=2% DSCD
	25		5	8			Grades with a sandy silt layer	9		
	30		6	29			Grades medium dense with some clay	21	98	
	35									
	40									

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FIGURE A-6

URS

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Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1346.15 feet, E 5589.88 feet (Plant Grid System)		

Boring SB-6

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	36.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					CL	CLAY light olive gray, medium stiff, moist, with some fine sand and roots			
	5	■	1	8				9	91	
	10	■	2	23			Grades stiff, interbedded with some clayey silt beds	11	82	-200(96)
						SM	Silty SAND light olive brown, medium dense, moist, fine			
	15	■	3	21				8	94	
						ML	Sandy SILT light olive brown, loose, moist, fine, with clay			
	20	■	4	16				8	89	-200(56); CON
	25	◪	5	6				15		
	30	■	6	28			Grades medium dense with layer of light olive brown fine to medium sand	5	108	
						CL	CLAY light olive brown, stiff, moist			
						SP-SM	SAND with Silt light olive brown, medium dense, slightly moist, fine to medium			
	35	◪	7	28				4		-200(7)
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-7

URS

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

Date(s) Drilled	06/15/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1346.15 feet, E 5769.88 feet (Plant Grid System)		

Boring SB-7

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	41.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY light brown, medium stiff, moist, with some fine sand			
	5		1	11				10	90	
	10		2	29			Grades stiff with abundant hard caliche, without sand	15	101	
						CL	Sandy CLAY light olive brown, medium stiff, moist, fine			
	15		3	22				11	95	COL=0 DSCD
	20		4	28				11	97	
						CL	CLAY dark olive brown, stiff, moist			
						ML	SILT dark olive brown, very stiff, moist, with trace fine sand			
	25		5	15				19		
	30		6	23				24	99	CON
							Grades medium dense, sandy			
	35		7	14		SP	SAND light gray, medium dense, moist, fine to coarse, trace fine gravel	6		
						ML	Sandy SILT olive brown, medium dense, moist, fine			
	40									

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

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FIGURE A-8

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Boring SB-7

Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	21				7		
	45									
	50									
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

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FIGURE A-8

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1294.07 feet, E 5160.57 feet (Plant Grid System)		

Boring SB-8

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY light olive brown, stiff, moist, with some fine sand			EI(86)
	5		1	20				19	92	-200(89)
						ML	SILT light olive brown, stiff, moist, fine			
	10		2	18				9	86	-200(95)
						SM	Silty SAND light olive brown, medium dense, slightly moist, fine to medium, trace coarse sand			
	15		3	21				5	95	CON
	20		4	21			Grades olive brown	4	94	DSCD
	25		5	16		SP-SM	Sand with Silt light olive brown, medium dense, slightly moist, fine to coarse	4		-200(11)
	30		6	25				4	101	
						SP	SAND olive gray, medium dense, slightly moist, fine to coarse, with some fine gravel			
	35		7	28						
	40									

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LOG OF BORING

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FIGURE A-9

URS

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Boring SB-8
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	33			Grades yellowish-brown, with some clay interbeds and abundant fine gravel			
						CL	CLAY with sand yellowish-brown, hard, moist, fine			
	45		9	32				21		-200(80)
	50		10	44			Grades very stiff with more fine sand			
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

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FIGURE A-9

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1294.07 feet, E 5337.57 feet (Plant Grid System)		

Boring SB-9

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	Silty SAND light brown, loose, moist, fine			
	5	■	1	12				13	87	
	10	■	2	17			Grades with some clay	9	89	
						SP-SM	SAND with Silt light grayish-brown, medium dense, slightly moist, fine			
	15	■	3	28				3	96	COL=1%
						SM	Silty SAND light brown, medium dense, moist, fine to medium, with abundant caliche			
	20	■	4	24				16	91	-200(18); DSCD
	25	■	5	22			Grades slightly moist, interbedded, with trace of light gray fine to coarse sand and yellowish-brown fine sandy silt	5	107	
	30	◪	6	5			Grades loose	10		
	35	■	7	24			Grades yellowish-brown, medium dense, fine to medium, trace clay	11	97	
						ML	Sandy SILT yellowish-brown, dense, moist, fine, with some gravel			
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-10

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FOR: PANOCHE ENERGY CENTER LLC

Boring SB-9
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	36				10		
	45		9	32			Grades dark yellowish-brown, medium dense, slightly moist, trace clay layers, without gravel	6	110	-200(23)
						ML	SILT yellowish-brown, dense, moist, trace fine sand			
	50		10	32				16		
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-10

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1294.07 feet, E 5519.57 feet (Plant Grid System)		

Boring SB-10

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			ML	Sandy SILT light brown, loose, moist, fine			COMP
	5		1	12				9	88	-200(64)
	10		2	15			Grades with interbedded light gray fine to coarse sand layers	8	91	
						SP	SAND light olive brown, medium dense, dry, fine to medium			
	15		3	33				2	101	COL=1
						ML	SILT yellowish-brown, stiff, moist, trace roots ansd caliche			
	20		4	24				17	102	DSCD
	25		5	10				14		LL=37; PI=21 -200(57)
						CL	CLAY light brown, stiff, moist, with abundant caliche, interbedded with fine sand layer			
	30		6	46				8	100	
						SP	SAND light olive brown, medium dense, moist, fine to coarse			
	35		7	17			Grades with coarse gravel to 1-inch	5		
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
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FIGURE A-11

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FRESNO COUNTY, CALIFORNIA
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Boring SB-10
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	50/6"			Grades dense, with more silt and less gravel	5	106	-200(13)
						ML	SILT yellowish-brown, very stiff, moist, with some fine sand			
	45		9	19				10		
						CL	CLAY light brown, hard, slightly moist, with abundant light gray caliche			
	50		10	45				16	108	
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-11

Date(s) Drilled	06/15/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1294.07 feet, E 5704.07 feet (Plant Grid System)		

Boring SB-11

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					CL	CLAY with sand light gray, medium stiff, moist, fine, roots			
	5	■	1	14				12	91	LL=31; PI=14 -200(80)
	10	■	2	25			Grades stiff, silty, without roots	18	98	
						CH	CLAY light gray, stiff, moist			
	15	■	3	21				23	83	LL=59; PI=36 CON
	20	■	4	30			Grades with less silt, laminated	12	98	DSCD
						ML/CL	Clayey SILT to Silty CLAY olive brown, stiff, moist, trace fine sand and caliche			
	25	◪	5	11				18		-200(59)
						ML	SILT olive brown, stiff, moist, with fine gravel, caliche, trace fine sand			
	30	■	6	25				13	108	COL=1%
						SP-SM	SAND with silt light olive gray, medium dense, moist, fine to coarse			
	35	◪	7	24				4		-200(8)
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-12

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FRESNO COUNTY, CALIFORNIA

FOR: PANOCHE ENERGY CENTER LLC

Boring SB-11

Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	33		ML	Sandy SILT olive brown, medium dense, moist, fine, trace fine gravel and caliche	8	108	LL=NA; PI=NA
	45		9	27				19		-200(73)
						ML	SILT olive brown, very stiff, moist, with some fine sand			
	50		10	33		CL	CLAY olive brown, very stiff to hard, moist, with some fine sand	23	97	
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-12

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1218.28 feet, E 5232.88 feet (Plant Grid System)		

Boring SB-12

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	61.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY light grayish brown, stiff, moist, with silt interbeds			
	5		1	15				11	89	
						SM	Silty SAND light brown, loose, moist, fine			
	10		2	8				7		
	15		3	25			Grades medium dense with some clay, trace caliche	8	90	CON
	20		4	11			Grades with light brown silty clay interbeds	14		
	25		5	32			Grades olive brown, moist, fine to medium	9	98	DSCD
	30		6	46				9		
							Grades with gravel			
						SP/GP	SAND to GRAVEL light grayish-brown, medium dense, moist, fine to coarse sand and gravel up to 2-inches			
	35		7	36				14	101	
						SP	SAND light olive gray, medium dense, moist, fine to coarse			
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-13

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

Boring SB-12
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	25				4		
						CL	Sandy CLAY yellowish-brown, very stiff, moist, fine, with silt			
	45		9	51				13	108	
						CL	CLAY light yellowish-brown, very stiff, moist, with abundant white caliche			
	50		10	30				21		
	55		11	15			Grades yellowish-brown, trace fine sand, sticky			
						SM	Silty SAND olive brown, dense, moist, fine to medium, trace clay			
	60		12	63		SP	SAND light olive gray, very dense, moist, fine to coarse			
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-13

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1218.28 feet, E 5411.38 feet (Plant Grid System)		

Boring SB-13

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	61.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY light olive gray, medium stiff, moist, with some fine sand and roots			EI(78)
	5		1	12				11	92	LL=31; PI=16
						ML	Sandy SILT light olive brown, loose, dry, fine			
	10		2	6				7		-200(72)
	15		3	25				5	95	COL=1% DSCD
						SM	Silty SAND light olive brown, medium dense, slightly moist, fine to medium			
						CL	CLAY light olive brown, very stiff, dry, with silty sand seam			
	20		4	18				24		-200(99)
						SM	Silty SAND olive brown, medium dense, moist, fine to medium, with some clay, trace gravel			
	25		5	23				5	100	
						SC	Clayey SAND olive brown, medium dense, moist, fine to medium, with some clay, trace gravel			
	30		6	12				13		
						SP	SAND dark olive brown, medium dense, moist, fine to coarse, with abundant gravel			
	35		7	21				4	116	DSCD
						SC	Clayey SAND			
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-14

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

Boring SB-13
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	18			olive brown, medium dense, moist, fine to medium	10		
						ML	SILT olive brown, very stiff, moist, with abundant caliche			
	45		9	36				10	108	
						CL	CLAY olive brown, hard, moist, sticky			
	50		10	36				20		
						ML	SILT olive brown, very stiff, moist, sticky			
	55		11	26						
						SP-SM	SAND with Silt olive gray, very dense, moist, fine to medium, trace gravel			
	60		12	69						
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-14

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1218.28 feet, E 5590.38 feet (Plant Grid System)		

Boring SB-14

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	66.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	Silty SAND light olive brown, loose, dry, fine, trace clay			
	5		1	3				7		
	10		2	28			Grades silty, with more clay	8	88	-200(75)
	15		3	7			Grades with layer of coarse sand, less clay	9		
						CL	CLAY olive gray, stiff, slightly moist, with caliche, fine sand, and gravel			
	20		4	36				23	89	-200(91); DSCD
	25		5	9			Grades dark olive gray, medium stiff, moist	21		
						ML	SILT dark olive brown, stiff, moist, with caliche, trace fine sand			
	30		6	27				15	110	
						SM	Silty SAND gray, medium dense, slightly moist, fine to coarse, with some gravel			
	35		7	19				9		-200(22)
						ML	Sandy SILT olive brown, medium dense, moist, fine			
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
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FIGURE A-15

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Boring SB-14
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	54				7	108	
	45		9	25				12		
	50		10	53		ML	SILT olive brown, very stiff, slightly moist, trace fine sand	24	96	-200(91)
	55		11	22			Grades with more clay	17		
	60		12	45		SM	Silty SAND olive brown, dense, moist, fine to medium with some gravel	12		
	65		13	53		SP	SAND light grayish-brown, dense, moist, fine to coarse, with some gravel	5		
	70									
	75									
	80									
	85									
	90									

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FIGURE A-15

Date(s) Drilled	06/15/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1218.28 feet, E 5771.13 feet (Plant Grid System)		

Boring SB-15

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					CL	CLAY light grayish-brown, stiff, moist, with some fine sand			
	5	■	1	18				13	96	
						CH	CLAY light grayish-brown, stiff, moist			
	10	◪	2	12			Grades with abundant caliche	18		LL=55; PI=34
	15	■	3	22			Grades with more silt and fine sand	6	93	COL=1%
	20	◪	4	17			Grades dark olive gray, moist, laminated	21		LL=45; PI=25
						ML	SILT olive gray, very stiff, slightly moist, with some fine sand			
	25	■	5	25			Grades stiff, moist, with abundant caliche	22	96	
	30	◪	6	10			Grades dark olive gray, interbedded with fine sandy silt	14		
						SM	Silty SAND grayish-brown, loose to medium dense, moist, fine to medium			
	35	■	7	19			Grades with coarse sand	7	102	
	40									

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LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
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FIGURE A-16

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Boring SB-15

Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	18			Grades olive brown, medium dense, with more silt	9		
	45		9	42		CL	CLAY olive brown, very stiff, moist, with some caliche	28	94	
	50		10	37			Grades hard with trace fine sand	22		
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-16

Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1068.91 feet, E 5272.66 feet (Plant Grid System)		

Boring SB-16

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	Silty SAND light brown, loose, moist, fine			
	5		1	6				11		
						SM	Silty SAND light brown, medium dense, moist, fine, with some gray clay			
	10		2	22				7	88	-200(46); PERM
						SM	Silty SAND brown, loose, moist, fine			
	15		3	7				8		
						ML	SILT with sand light brown, loose, moist, fine			
	20		4	18				14	88	-200(73); PERM
						SM	Silty SAND light brown, medium dense, moist, fine			
	25		5	11				12		
	30		6	33		SP-SM	SAND with Silt light brown, medium dense, moist, fine to medium	11	100	PERM
	35									
	40									

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PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-17

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Date(s) Drilled	06/13/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1070.91 feet, E 5515.93 feet (Plant Grid System)		

Boring SB-17

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					ML	Sandy SILT light olive brown, loose, moist, fine, with some roots			
	5		1	4				9		
						ML	SILT light olive gray, stiff, moist, with some roots			
	10		2	33				11	91	-200(89)
						SM	Silty SAND light olive gray, medium dense, moist, fine to medium			
	15		3	14				7		
						ML	Sandy SILT olive gray, medium dense, slightly moist, with some roots and caliche			
	20		4	24				11	91	-200(61)
	25		5	11				6		
						SP	SAND olive gray, medium dense, moist, fine to medium			
	30		6	34				6	97	
	35									
	40									

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-18

URS

Report: DMG4; Project File: G:\WESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DML A.GDT Printed: 7/16/06

Date(s) Drilled	06/14/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1132.48 feet, E 5607.23 feet (Plant Grid System)		

Boring SB-18

Sheet 1 of 1

Job Number	
Total Depth Drilled (ft)	31.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	Sandy CLAY light olive gray, medium stiff, moist, fine, with caliche layers			
	5		1	11				8	96	-200(55)
	10		2	35			Grades stiff with some roots	22	84	DSCD
						ML	SILT light olive brown, medium stiff, moist, with some fine sand, caliche, and iron oxide stains			
	15		3	21				16	90	-200(89)
	20		4	20			Grades laminated	11	102	
	25		5	7			Grades medium stiff, interbedded with fine to medium sandy silt layers	13		-200(47)
						ML	Sandy SILT olive brown, loose, moist, fine to medium with clay, caliche, and gravel fragments			
	30		6	17				11	106	COL=1%
	35									
	40									

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-19

URS

Report: DMG4; Project File: G:\WESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

Date(s) Drilled	06/15/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1070.92 feet, E 5785.88 feet (Plant Grid System)		

Boring SB-19

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY mottled light gray and brown, stiff, dry, with some roots			
	5		1	20				24	83	-200(97)
	10		2	23			Grades very stiff with more silt and caliche	18		
						ML	SILT light olive brown, very stiff, moist, with fine sand			
	15		3	48				12	90	-200(90)
	20		4	18			Grades with more sand	9		
						CL	CLAY dark olive brown, very stiff, moist			
	25		5	31				20	104	
						ML	SILT olive brown, stiff, moist, with fine sand			
	30		6	25			Grades dark olive brown, very stiff with more caliche, without sand	15		
						SP-SM	SAND with silt olive brown, dense, moist, fine			
	35		7	67				4	118	-200(6)
	40									

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

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FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-20

URS

Report: DMG4; Project File: G:\MESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DMLA.GDT Printed: 7/16/06

FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

Boring SB-19
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	34				9		
	45		9	65			Grades fine to medium, with clay	11	105	
						CL	CLAY brown, hard, moist, with some fine sand			
	50		10	46				22		
	55									
	60									
	65									
	70									
	75									
	80									
	85									
	90									

Report: DMG4; Project File: G:\NESA\PROJECTS\POWER PLANT\PANOCHE\FRESNO.GPJ; Data Template:DML.AGDT Printed: 7/16/06

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FIGURE A-20

Date(s) Drilled	06/15/06	Logged By	C.Shen
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	
Drill Rig Type	CME-85	Hammer Data	140 lbs, 30-inch drop
Sampling Method(s)	California, SPT, Bulk		
Approximate Groundwater Depth and Date Measured	No Groundwater Encountered		
Comments	N 1103.20 feet, E 5930.90 feet (Plant Grid System)		

Boring SB-20

Sheet 1 of 2

Job Number	
Total Depth Drilled (ft)	56.5
Approximate Ground Surface Elevation(ft)	

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0		BK-1			CL	CLAY with sand light olive gray, stiff, moist, fine, with roots and slightly porous			COMP
	5		1	30				15	93	-200(81)
	10		2	34			Grades hard with caliche and traces of interbedded sand	15		
	15		3	75			Grades without caliche	7	99	-200(86)
	20		4	21			Grades very stiff, olive brown, moist, with minor interbeds of silty fine sand and clayey silt	23		
	25		5	38			Grades brown, interbedded with light olive brown silt	25	98	
						ML	Sandy SILT olive brown to brown, very stiff, moist, fine, with some caliche			
	30		6	23				20		-200(66)
	35		7	40				27	95	
						SP	SAND light gray, medium dense, fine to coarse, trace fine gravel, silty clay seam			
	40					ML	Sandy SILT			

This log is part of the report prepared by URS for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with time. Data presented are a simplification of actual conditions encountered.

LOG OF BORING

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FOR: PANOCHE ENERGY CENTER LLC

FIGURE A-21

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Boring SB-20

Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	40		8	26			olive brown, medium dense, moist, fine to medium, with some clay	7		
	45		9	37			Grades with fine sand	23	98	
						ML	SILT dark olive brown, hard, moist, trace caliche and fine sand			
	50		10	38				18		
	55		11	36			Grades with more fine to medium sand	24		
	60									
	65									
	70									
	75									
	80									
	85									
	90									

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FIGURE A-21

APPENDIX B
LABORATORY TESTING

LABORATORY TESTING

B.1 GENERAL

Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Tests performed are indicated on the Logs of Borings. A description of the laboratory testing program is presented below.

B.2 MOISTURE AND DENSITY TESTS

Moisture content and density tests were performed on a number of samples recovered from the borings. The results of these tests were used to compute existing soil overburden pressures, to correlate strength and compressibility data from tested samples with those not tested, and to aid in evaluating soil properties. The tests were performed in accordance with ASTM Test Methods D-2937 and D-2216, respectively. The results of these tests are shown on the Logs of Borings.

B.3 ATTERBERG LIMTS

Atterberg Limits tests were performed to aid in classification and to evaluate the plasticity characteristics of fine-grained materials encountered at the site. These tests were performed in accordance with ASTM Test Method D-4318. The results of these tests are summarized on the Logs of Borings and summarized in Figure B-1.

B.4 SIEVE ANALYSIS

Percent passing No. 200 sieve and full grain size sieve (2 inch to No. 200 sieve) tests were performed on selected samples of soils encountered at the site. These tests were performed to evaluate the gradation characteristics of the soils and to aid in their classification. The tests were performed in accordance with ASTM Test Methods D-1140 and D-698, respectively. The results are shown on the Logs of Borings.

B.5 DIRECT SHEAR TESTS

Consolidated-drained (saturated) direct shear tests were performed on selected undisturbed samples to evaluate shear strength parameters of the site soils. The direct shear tests were performed in accordance with ASTM Test Method D-3080. The results of these tests are presented in Figures B-2 through B-17.

B.6 PERMEABILITY TESTS

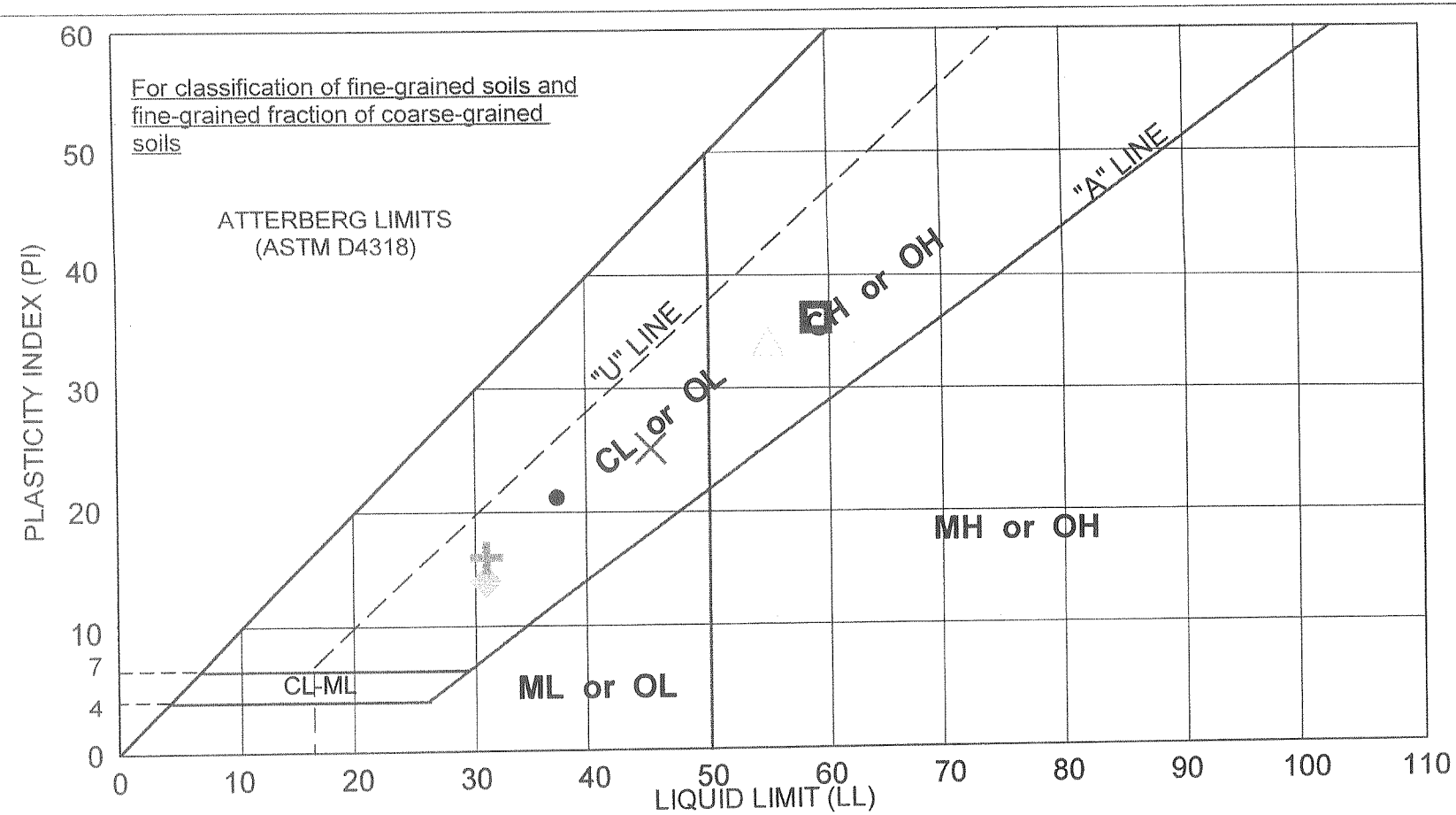
Permeability tests (hydraulic conductivity) were performed to determine the permeability of representative soils within the upper strata of the site. These tests were performed in accordance with ASTM Test Method D-5084. The test results are presented on Figures B-18 through B-20.

B.7 CONSOLIDATION

One-dimensional consolidation tests were performed on representative samples of the fine-grained soils to evaluate the compressibility characteristics of the site soils. These tests were preformed in accordance with ASTM Test Method D-2435. The consolidation test results are presented on Figures B-21 through B-28.

B.8 COMPACTION

Compaction tests were performed on representative bulk samples of the onsite surficial soils to evaluate the maximum dry density and optimum moisture content of the soils. The tests were performed in accordance with ASTM Test Method D-1557. Results of the compaction tests are presented in Figures B-29 through B-31.



SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (ft.)	USCS	LL (%)	PI(%)
●	B-10	5	25	CL	37	21
◇	B-11	1	5	CL	31	14
□	B-11	3	15	CH	59	36
	B-11	8	40	SM	N/A	N/A
+	B-13	1	5	CL	31	16
△	B-15	2	10	CH	55	34
×	B-15	4	20	CL	45	25

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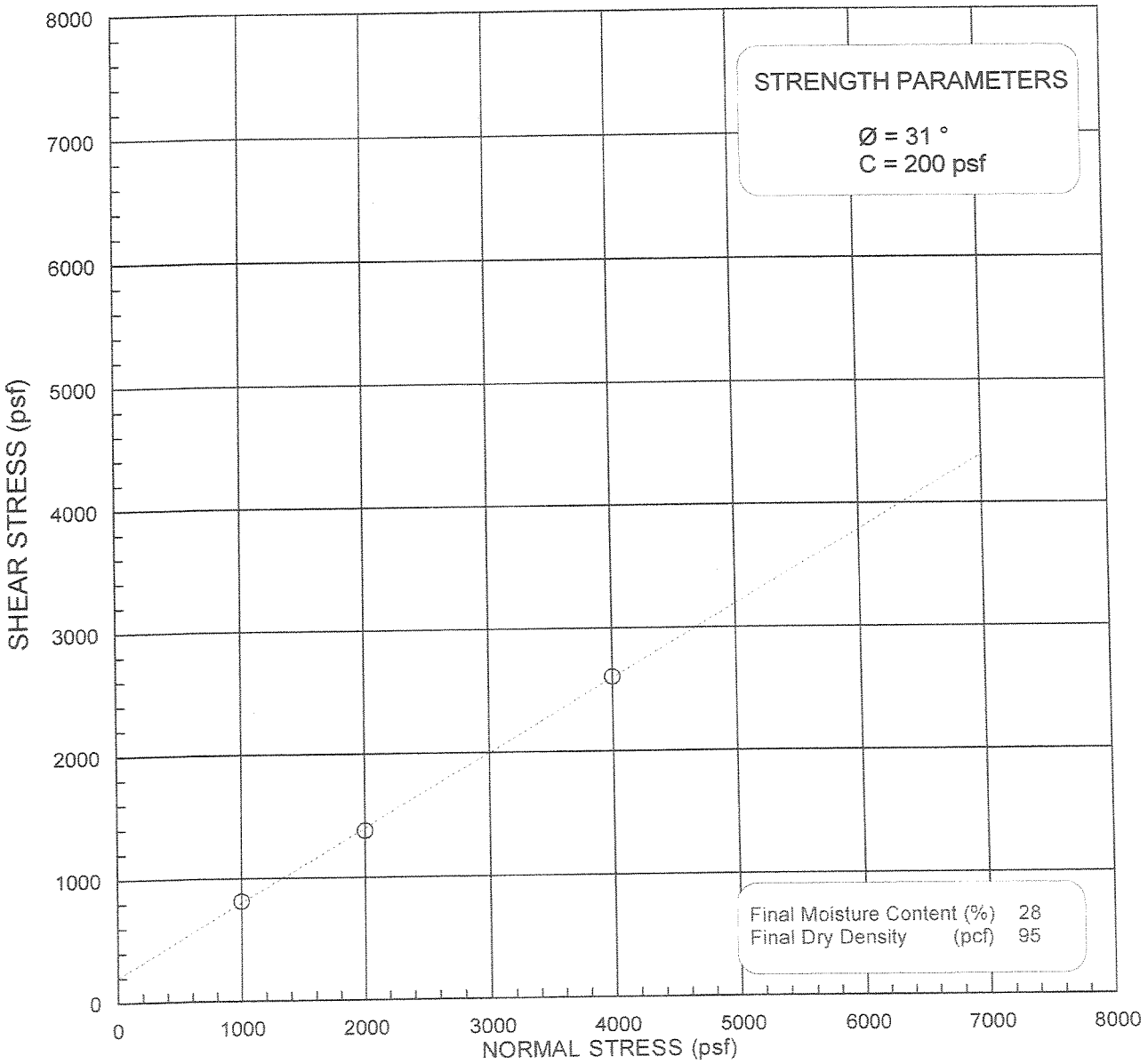
FIGURE B-1



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-1	3	15	0.010	○ 1000	816
				○ 2000	1380
				○ 4000	2604

Sample Description: Yellowish-brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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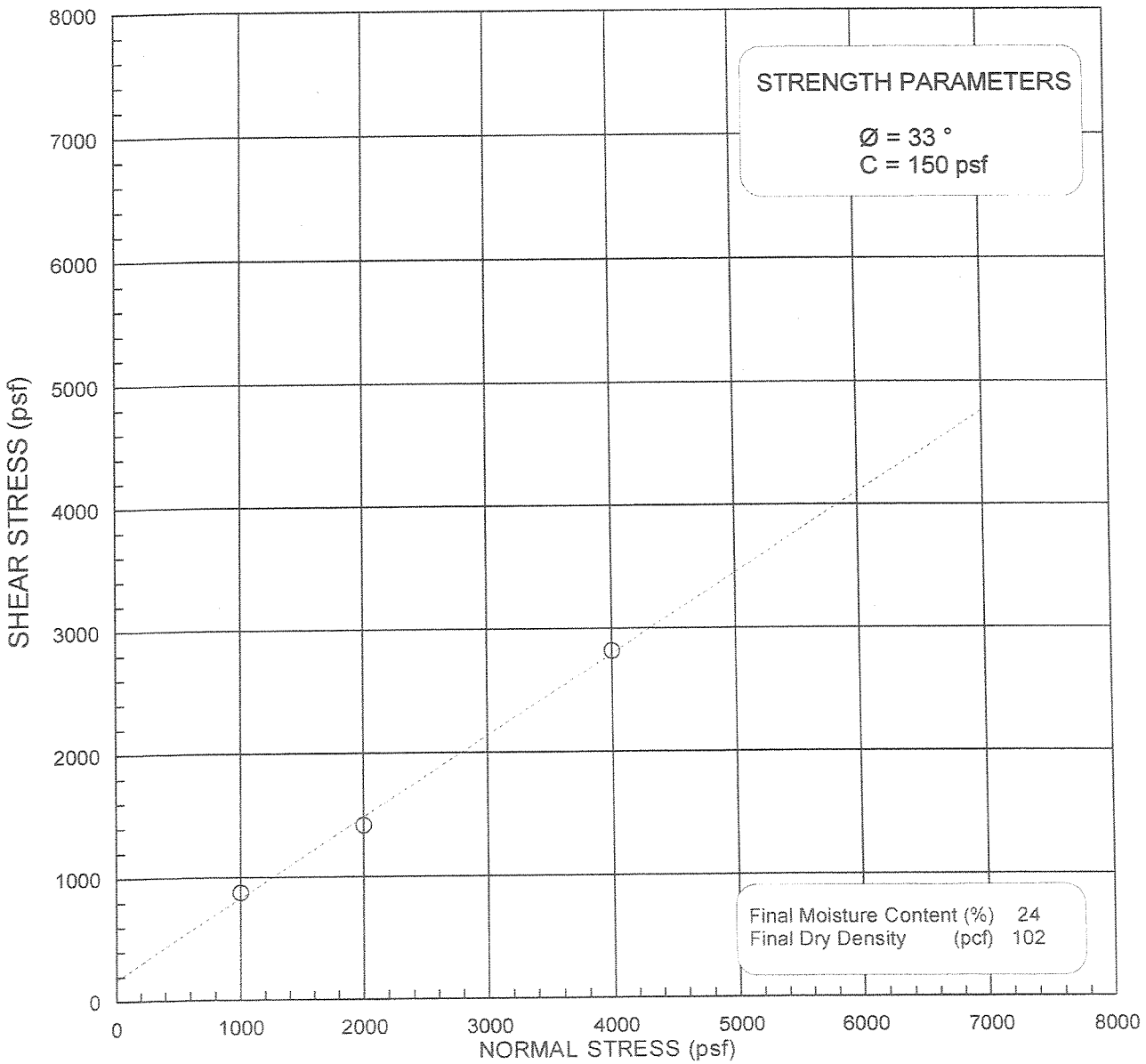
FIGURE B-2



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-2	3	15	0.010	○ 1000	876
				○ 2000	1416
				○ 4000	2820

Sample Description: Light olive brown SAND with silt (SP-SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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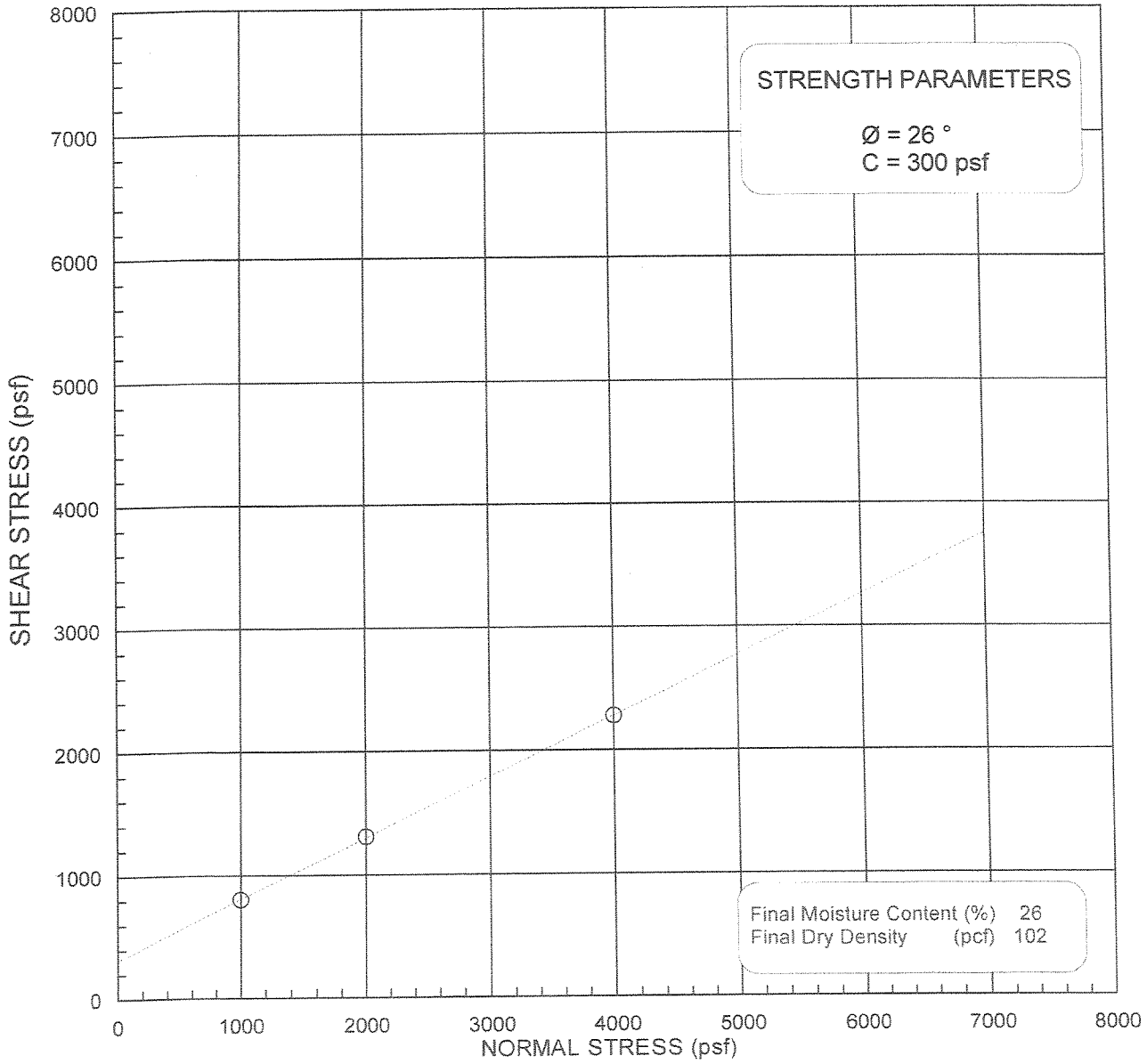
FIGURE B-3



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-3	3	15	0.005	○ 1000	804
				○ 2000	1308
				○ 4000	2280

Sample Description: Light olive brown Sandy SILT (ML)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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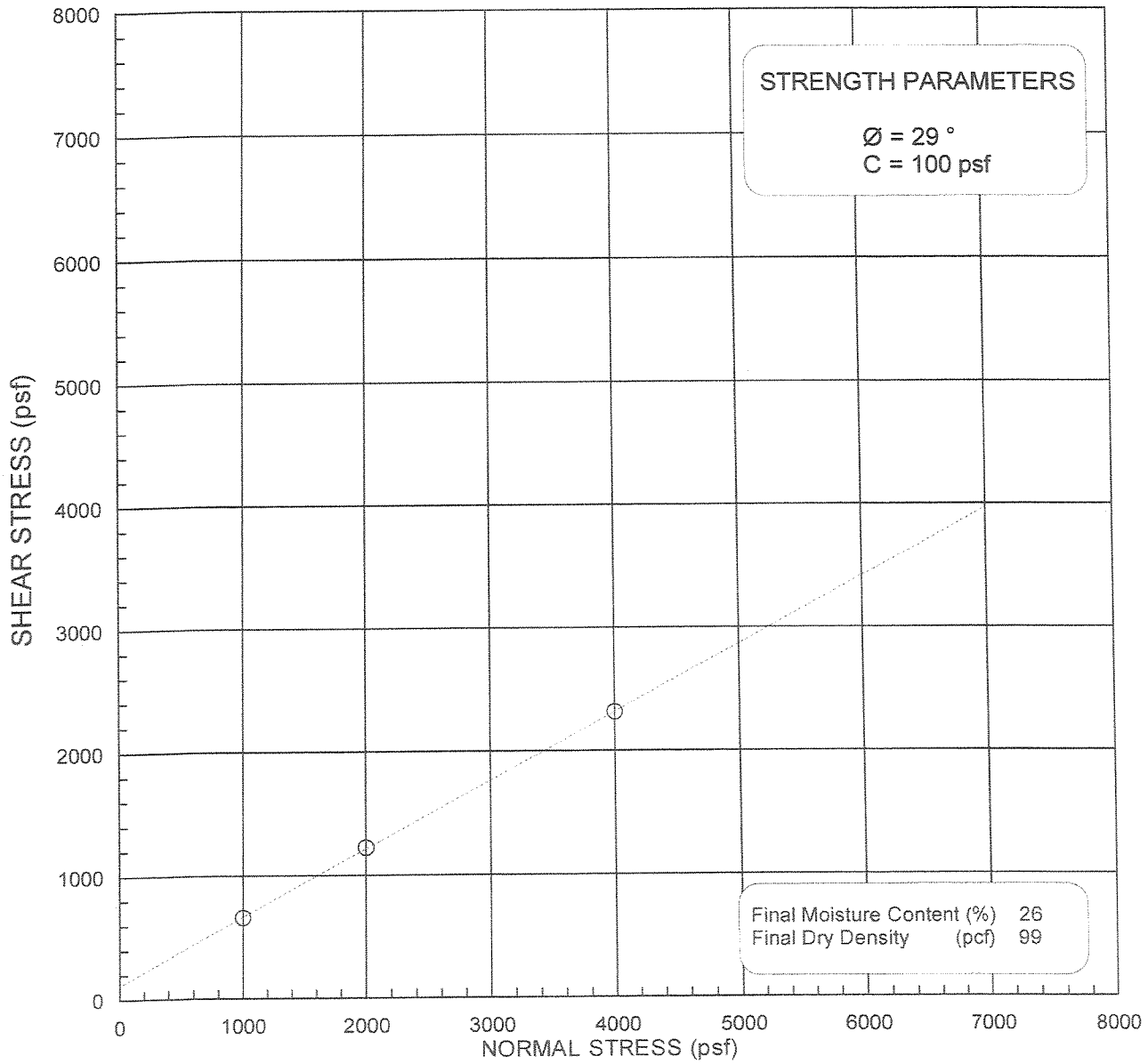
FIGURE B-4



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-4	2	10	0.005	○ 1000	660
				○ 2000	1224
				○ 4000	2316

Sample Description: Light olive brown CLAY (CL)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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FRESNO COUNTY, CALIFORNIA
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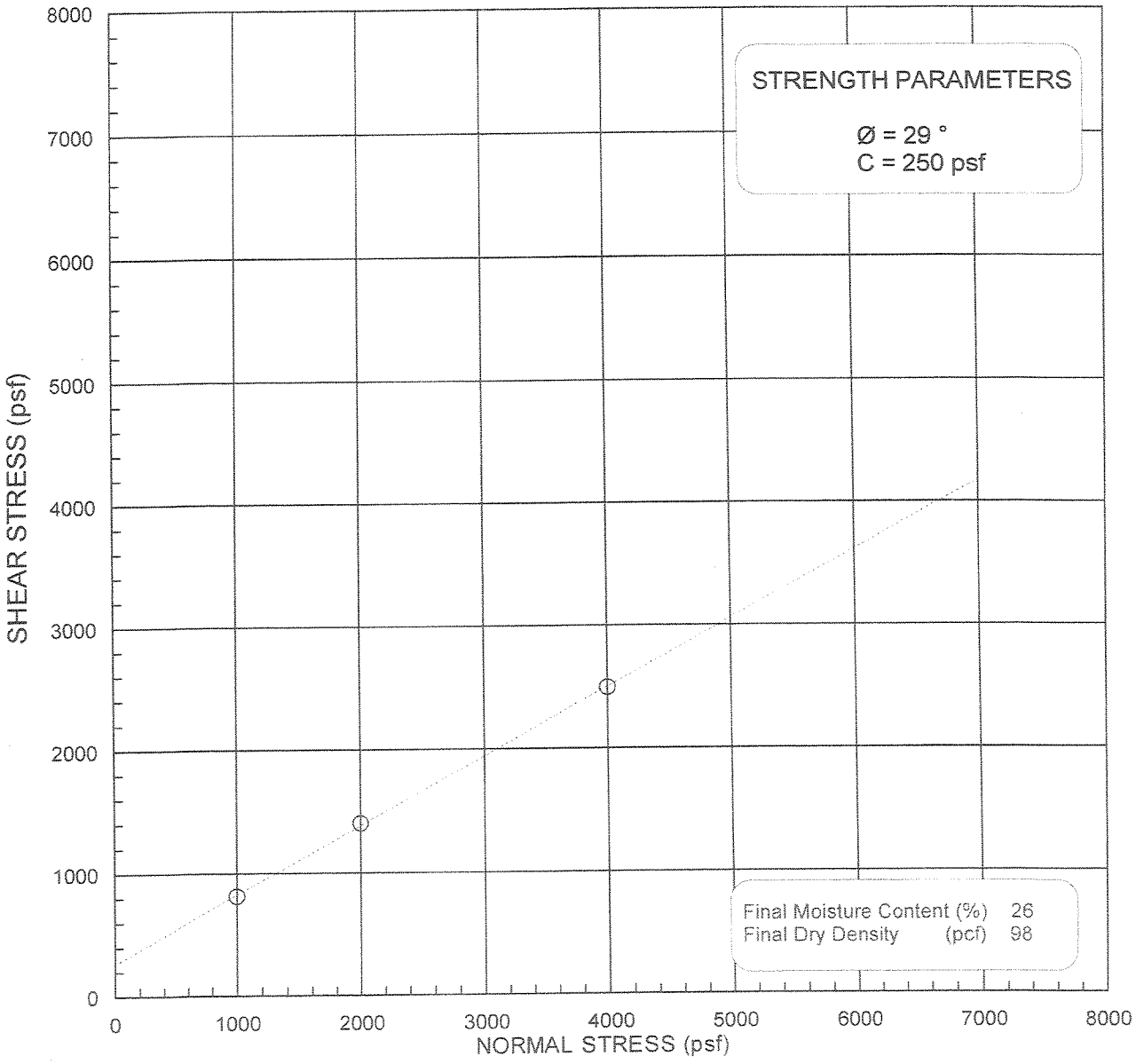
FIGURE B-5



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-5	4	20	0.005	○ 1000	816
				○ 2000	1404
				○ 4000	2496

Sample Description: Olive brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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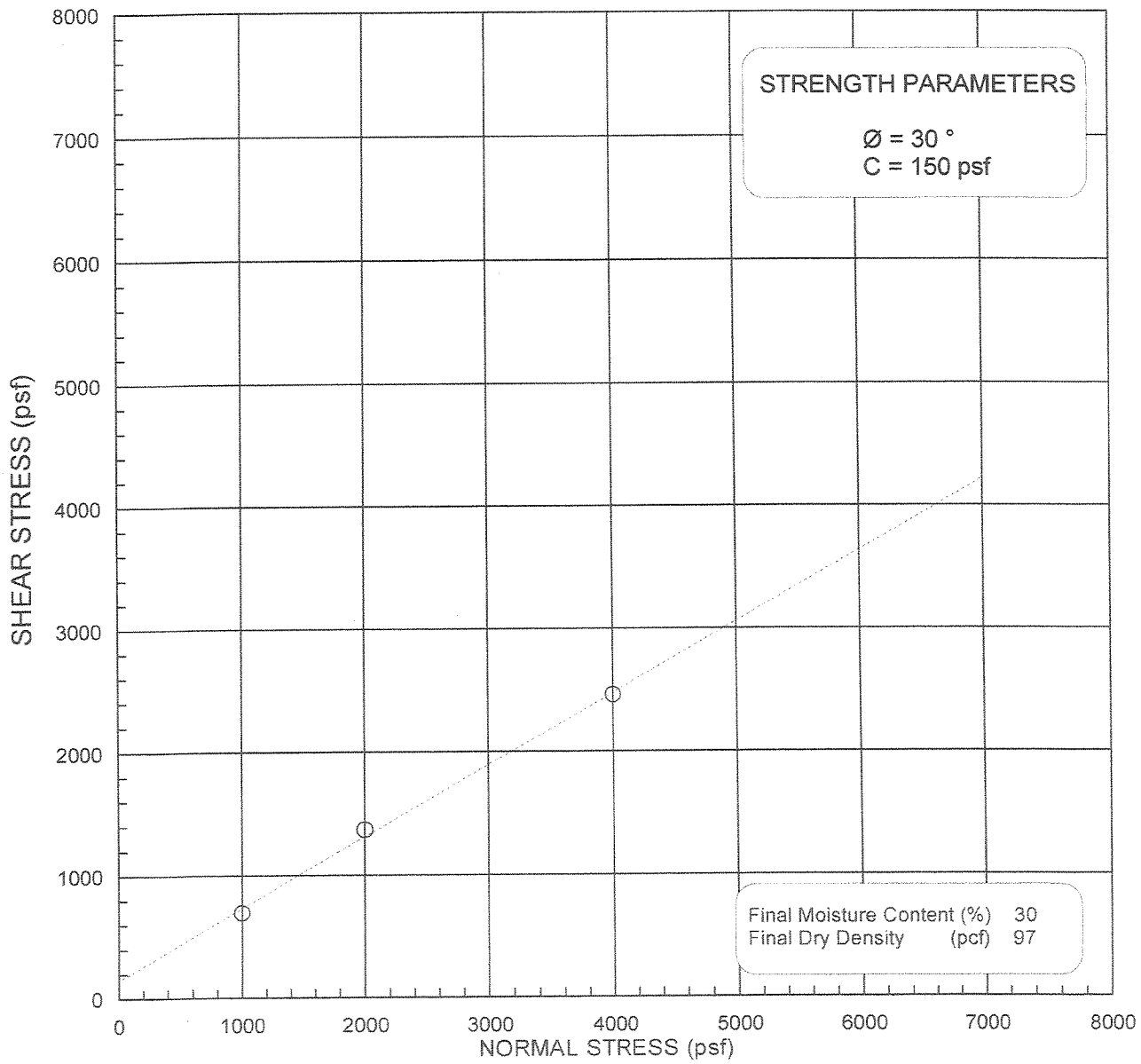
FIGURE B-6



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-7	3	15	0.005	○ 1000	696
				○ 2000	1368
				○ 4000	2460

Sample Description: Light olive brown Sandy CLAY (CL)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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FRESNO COUNTY, CALIFORNIA
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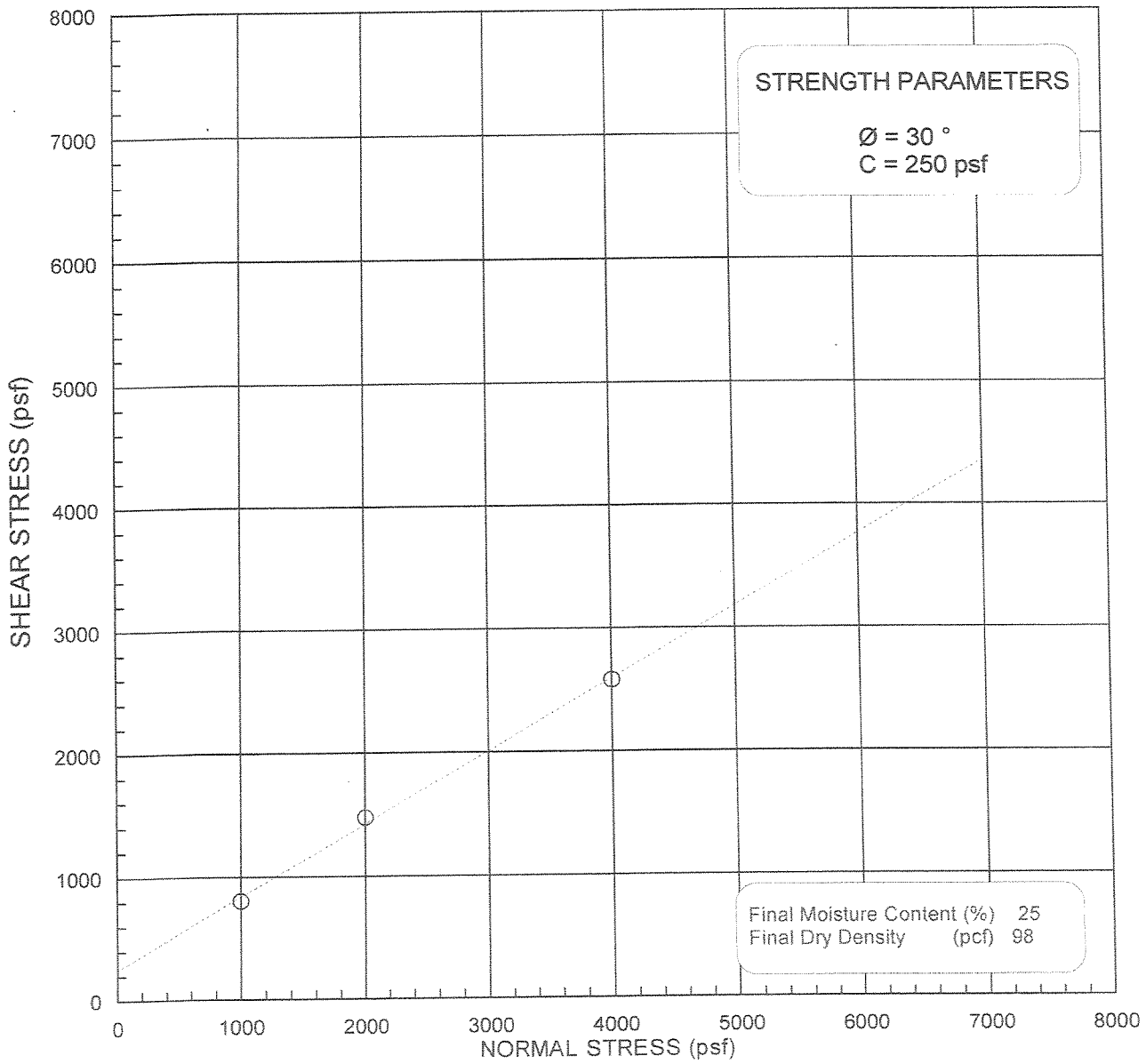
FIGURE B-7



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-8	4	20	0.010	○ 1000	804
				○ 2000	1476
				○ 4000	2580

Sample Description: Olive-brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

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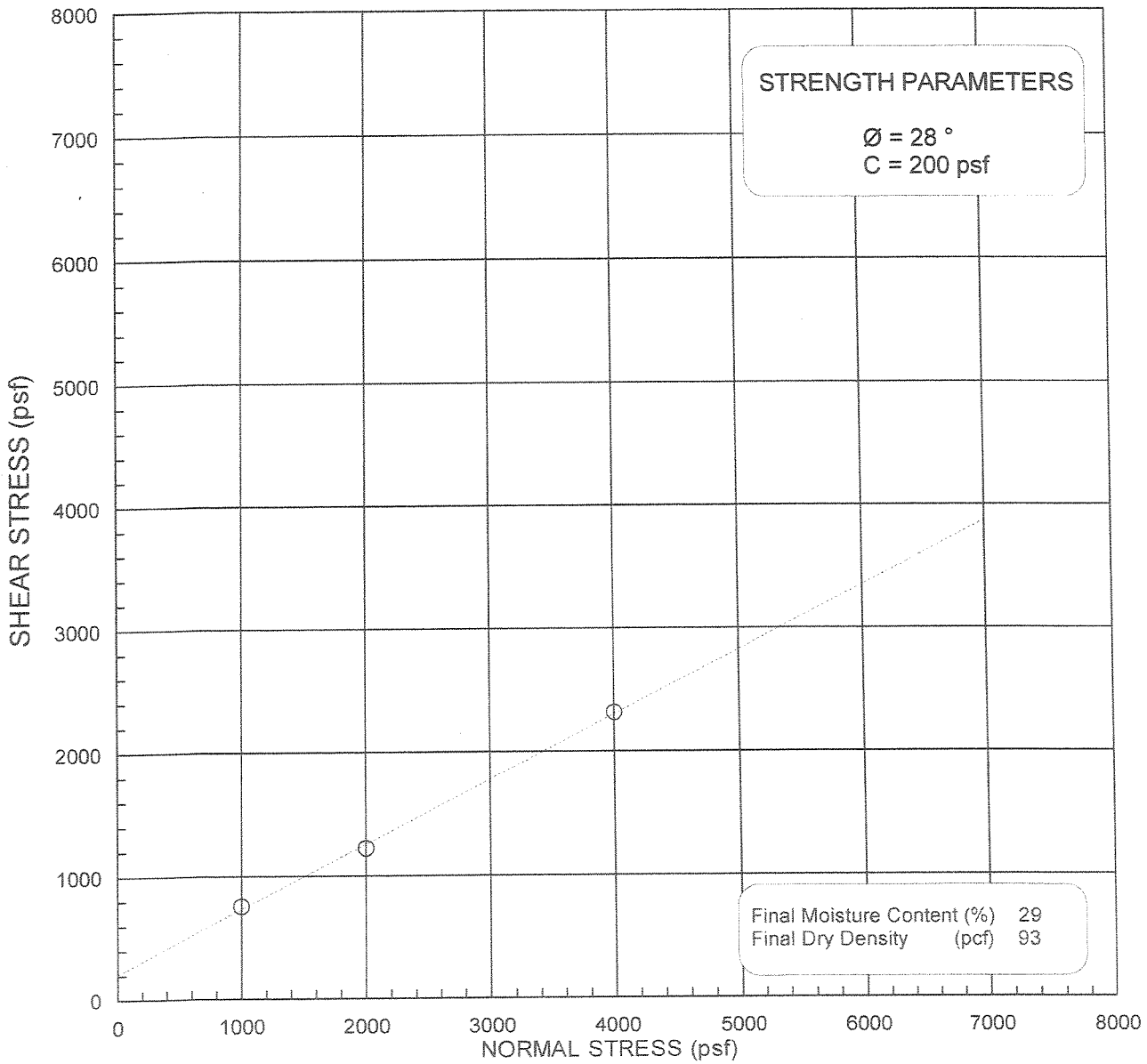
FIGURE B-8



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-9	4	20	0.010	○ 1000	756
				○ 2000	1224
				○ 4000	2316

Sample Description: Light brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED
ASTM D 3080

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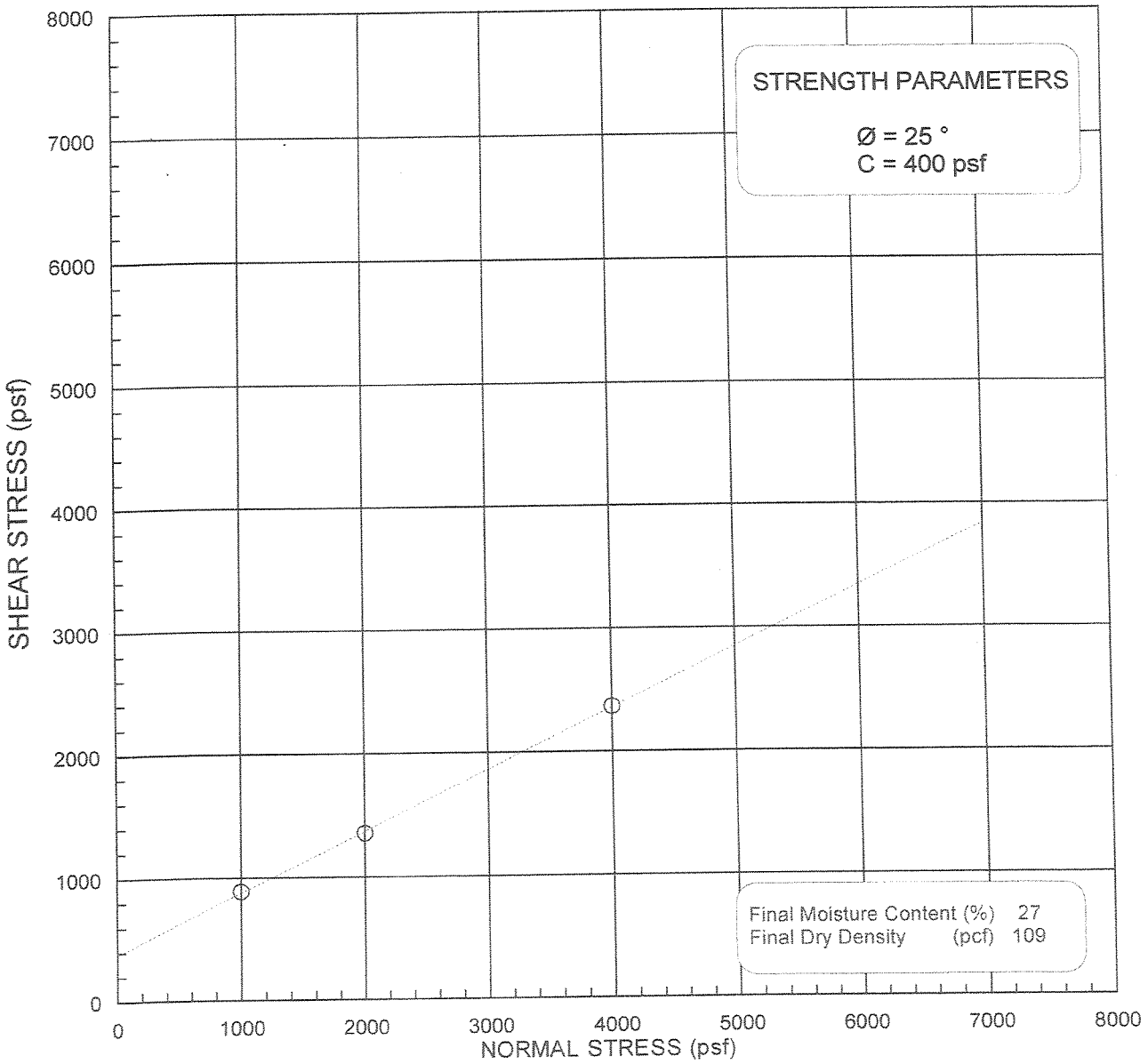
FIGURE B-9



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-10	4	20	0.005	○ 1000	888
				○ 2000	1356
				○ 4000	2364

Sample Description: Yellowish-brown SILT (ML)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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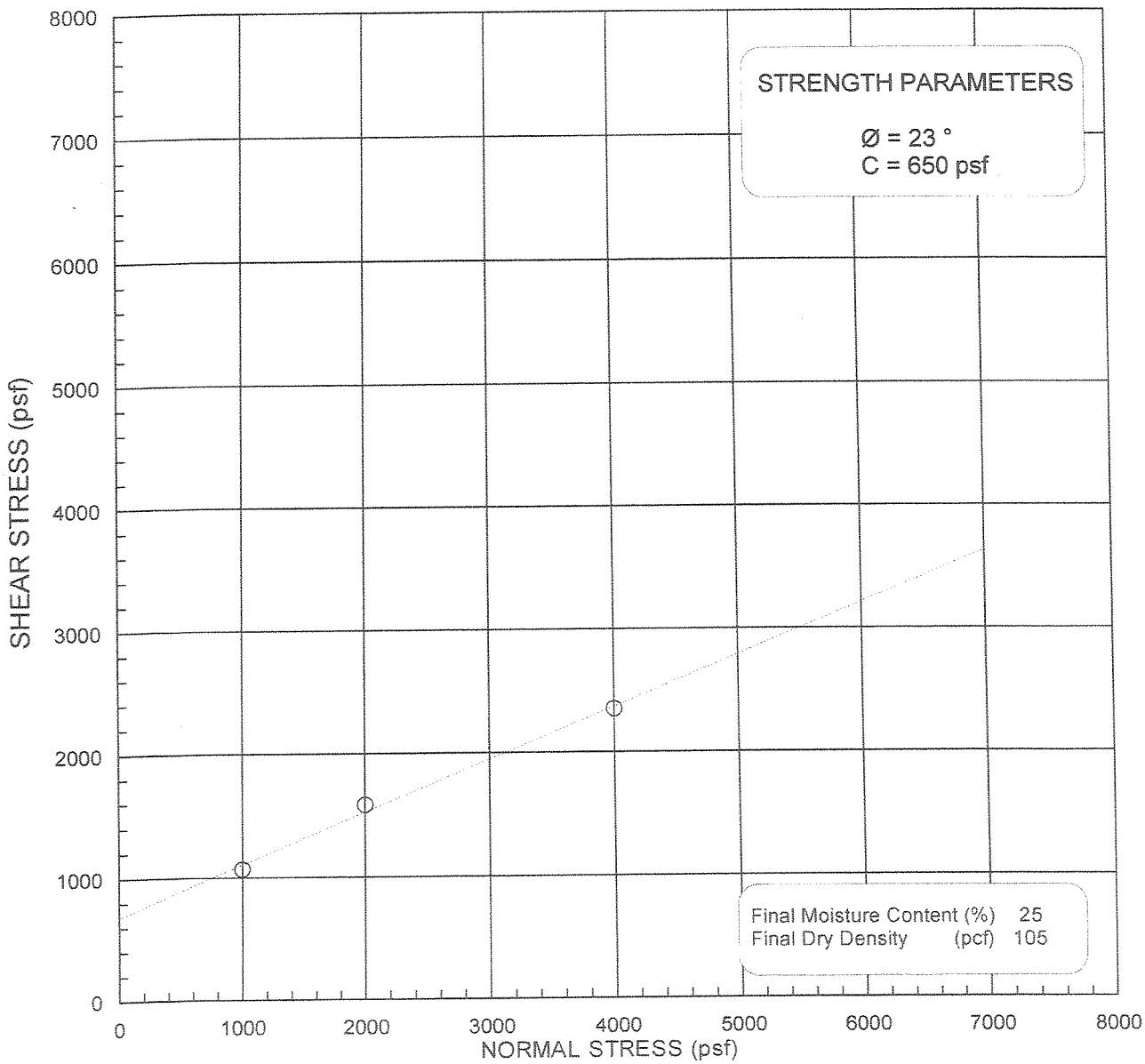
FIGURE B-10



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-11	4	20	0.005	○ 1000	1068
				○ 2000	1584
				○ 4000	2352

Sample Description: Light gray CLAY (CL)

DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED
ASTM D 3080

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FOR: PANOCHE ENERGY CENTER LLC

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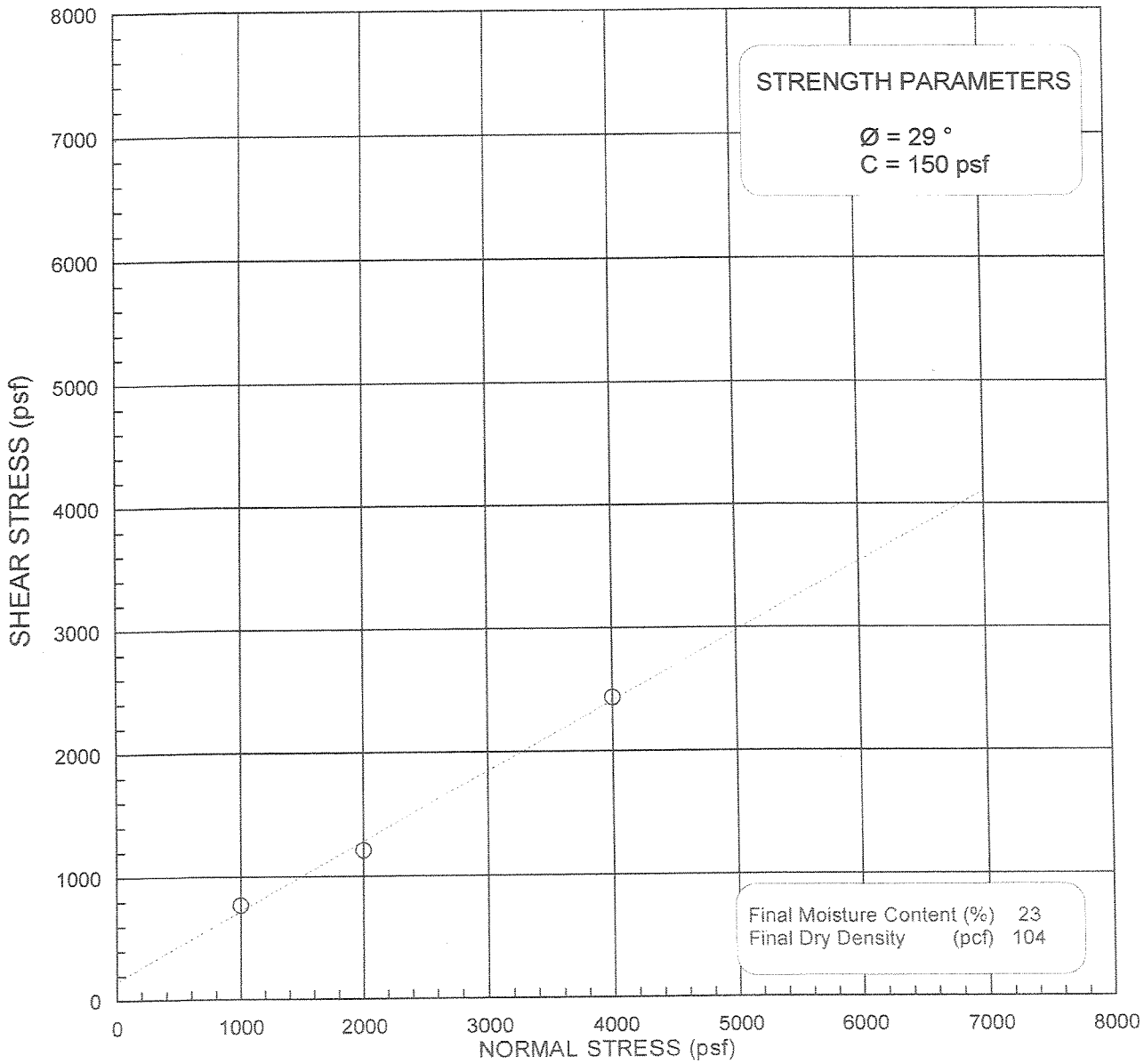
FIGURE B-11



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-12	5	25	0.010	○ 1000	768
				○ 2000	1212
				○ 4000	2436

Sample Description: Olive brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

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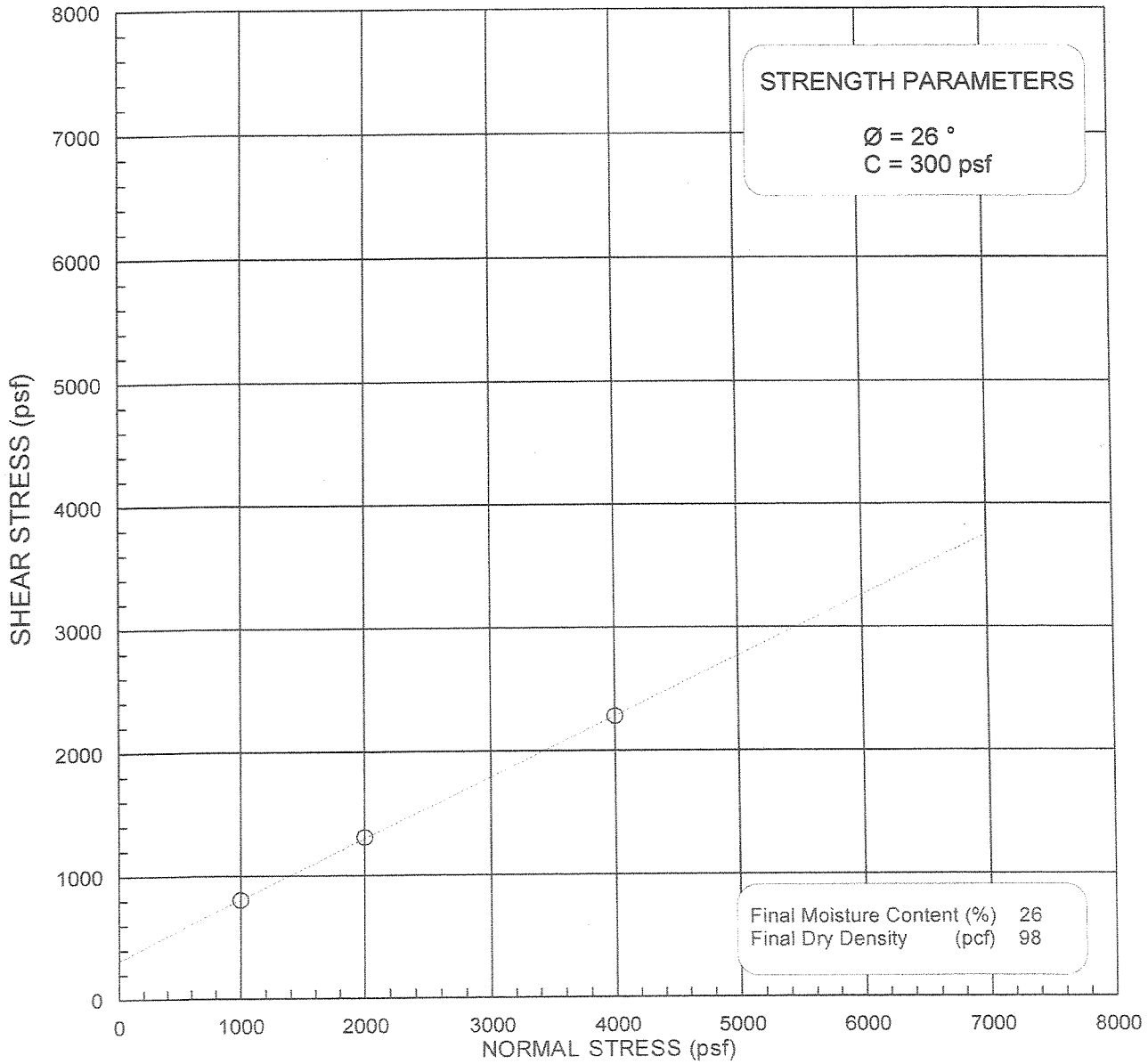
FIGURE B-12



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-13	3	15	0.010	○ 1000	708
				○ 2000	1272
				○ 4000	2352

Sample Description: Light olive brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED
ASTM D 3080

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FOR: PANOCHE ENERGY CENTER LLC

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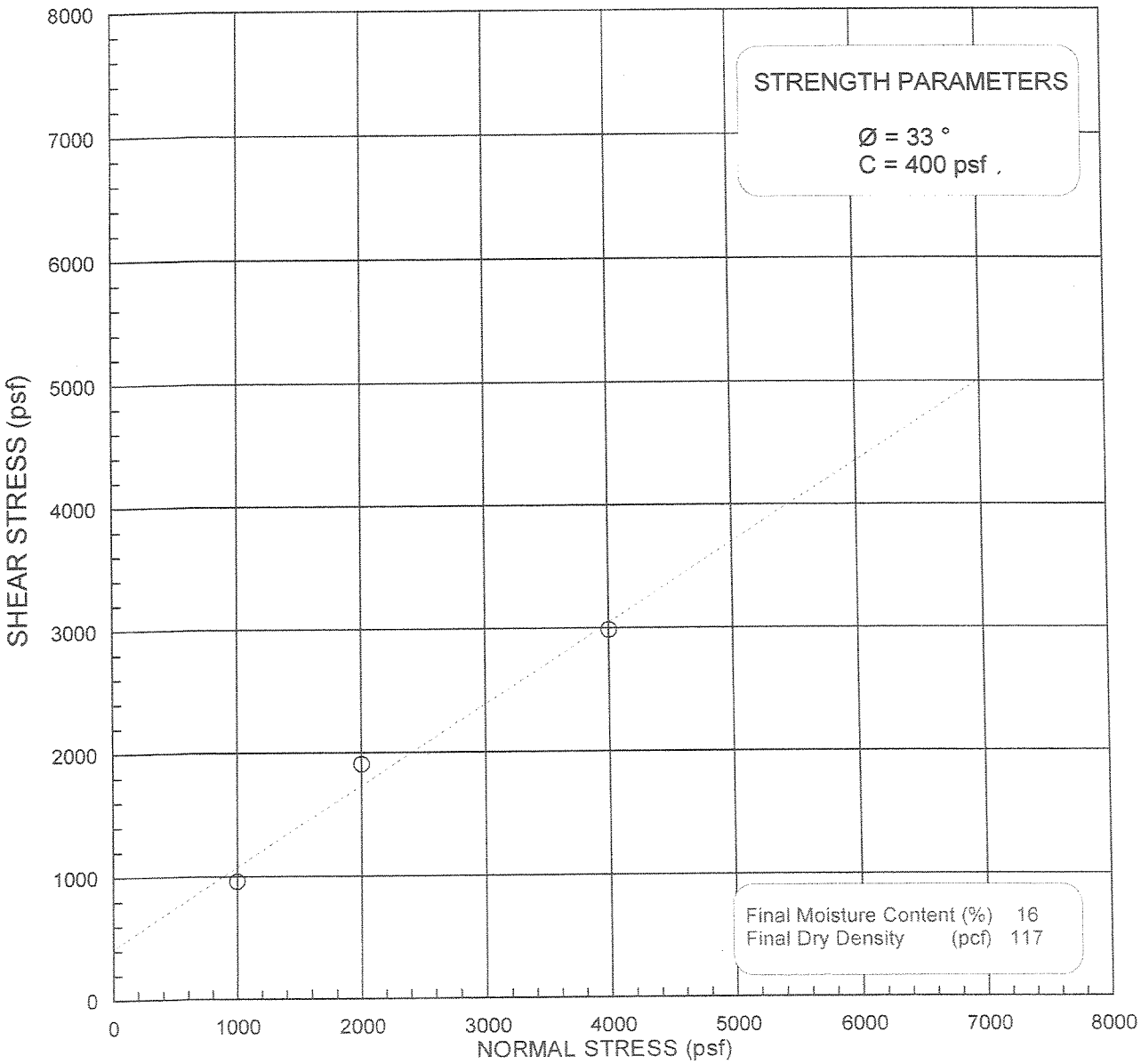
FIGURE B-13



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-13	7	35	0.010	○ 1000	960
				○ 2000	1908
				○ 4000	2988

Sample Description: Dark olive brown SAND (SP)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

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FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

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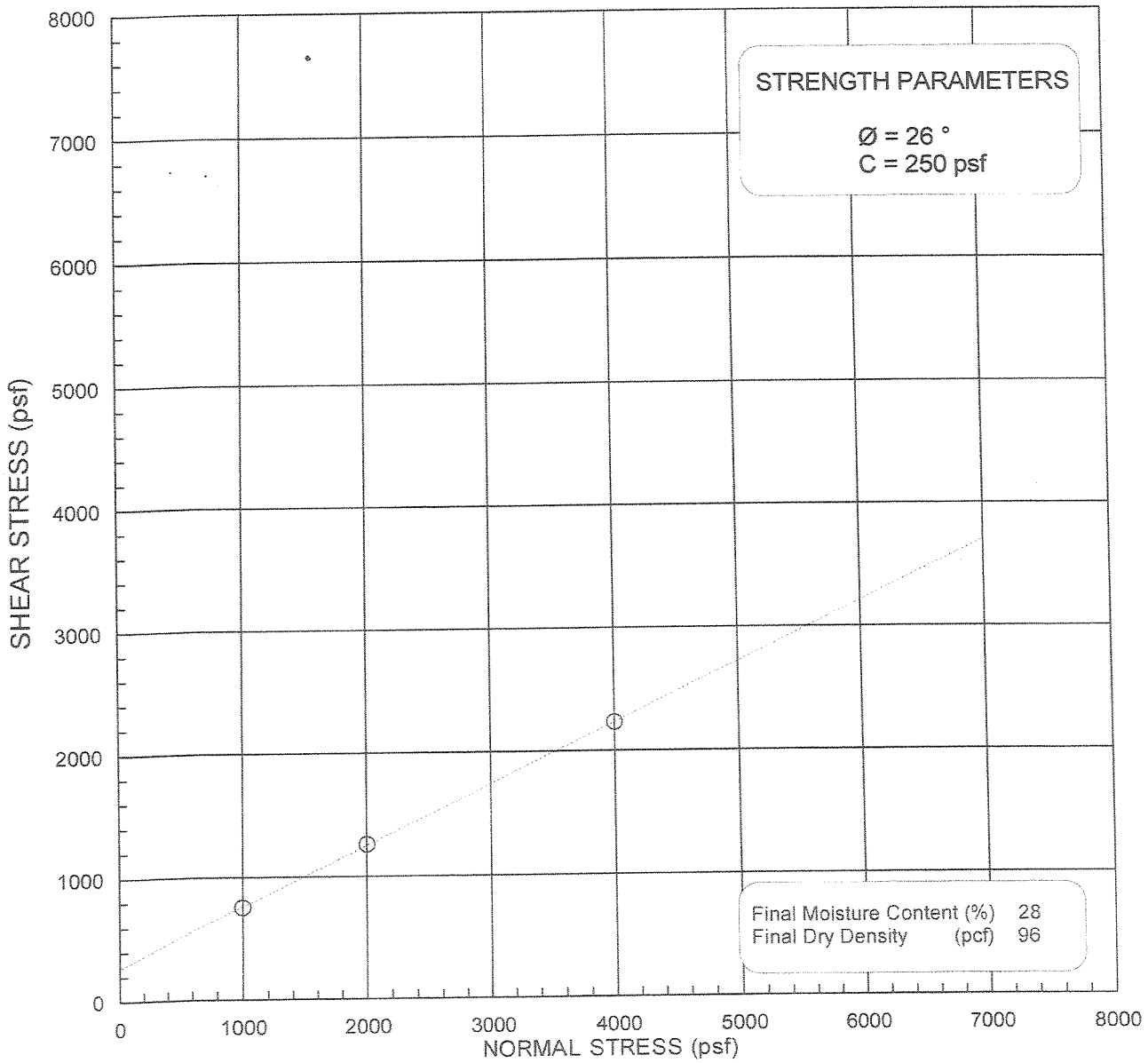
FIGURE B-14



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-14	4	20	0.005	○ 1000	756
				○ 2000	1260
				○ 4000	2232

Sample Description: Olive gray CLAY (CL)

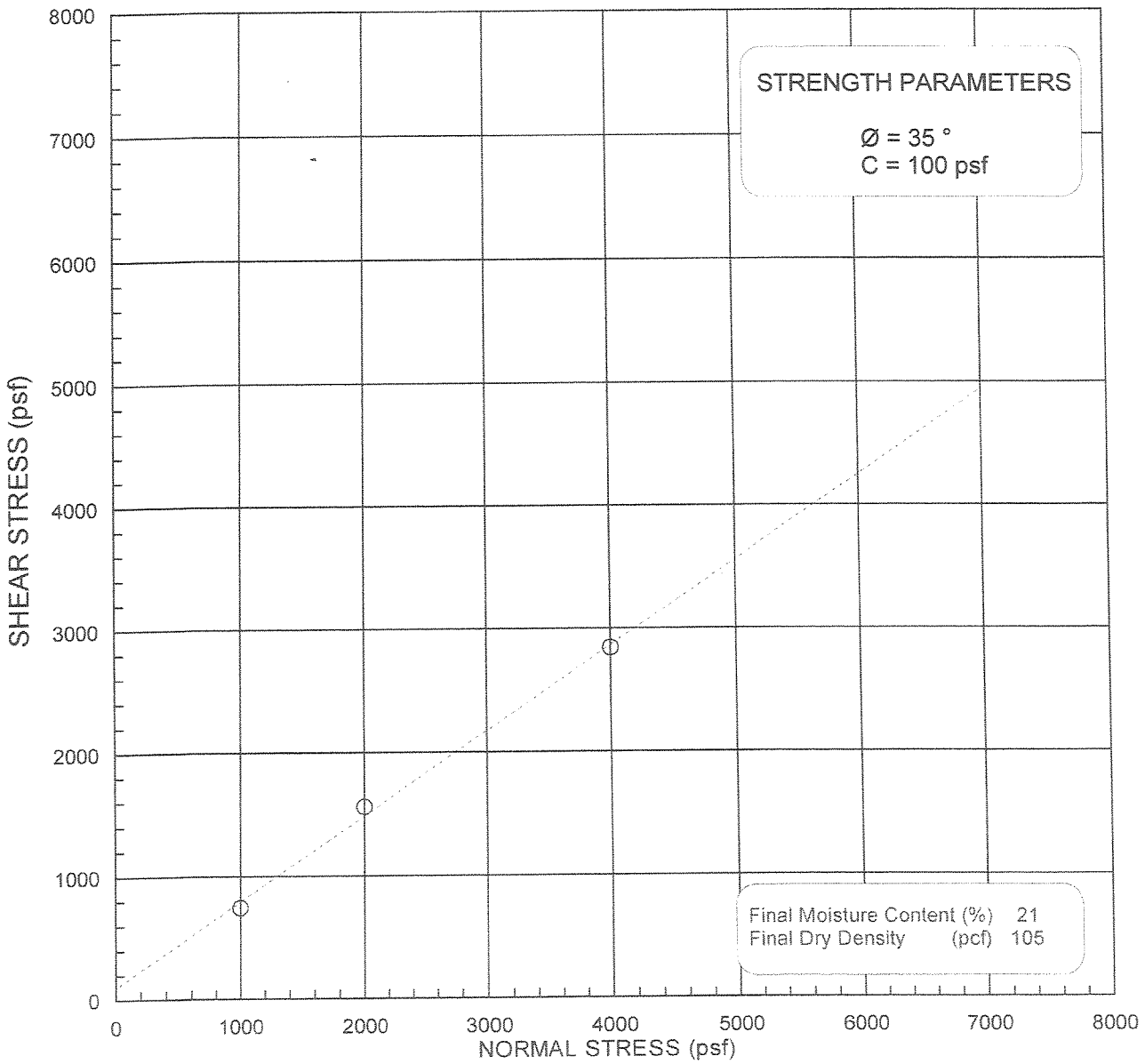
DIRECT SHEAR TEST RESULTS

CONSOLIDATED DRAINED
ASTM D 3080

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-15



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-15	7	35	0.010	○ 1000	744
				○ 2000	1560
				○ 4000	2844

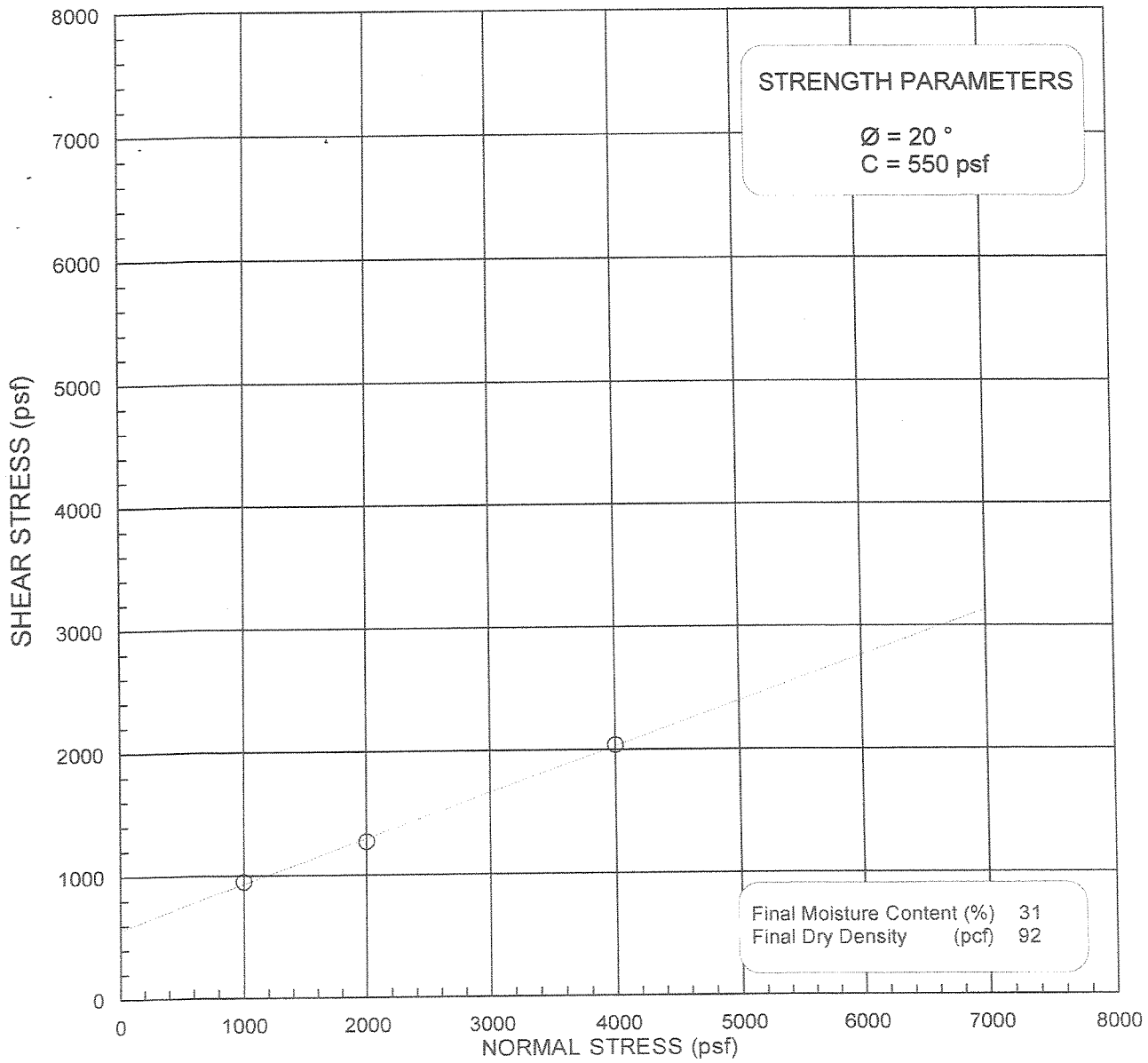
Sample Description: Grayish-brown Silty SAND (SM)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-16



BORING NO.	SAMPLE NO.	DEPTH (ft)	STRAIN RATE (in/min)	NORMAL STRESS (psf)	SHEAR STRESS (psf)
B-18	2	10	0.005	○ 1000	948
				○ 2000	1272
				○ 4000	2040

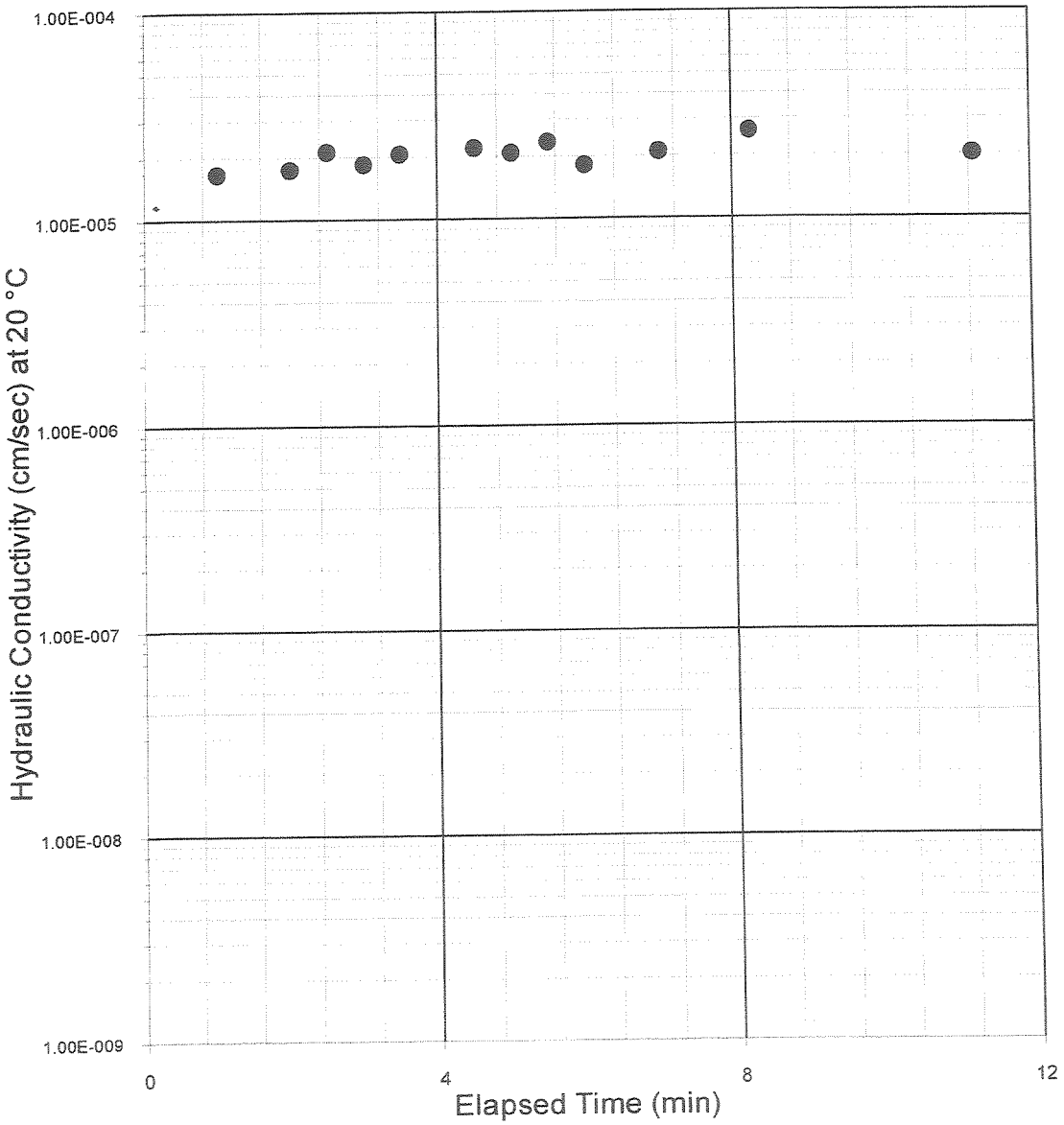
Sample Description: Light olive gray Sandy CLAY (CL)

DIRECT SHEAR TEST RESULTS
CONSOLIDATED DRAINED
ASTM D 3080

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-17



Boring No.	SAMPLE NUMBER	DEPTH (ft.)	SOIL DESCRIPTION	MOISTURE CONTENT/ DRY DENSITY	EFFICTIVE STRESS (psi)	HYDRUALIC CONDUCTIVITY (cm/sec)
B-16	2	10	Light brown Silty SAND (SM)	26/ 99	7	2.1E-05

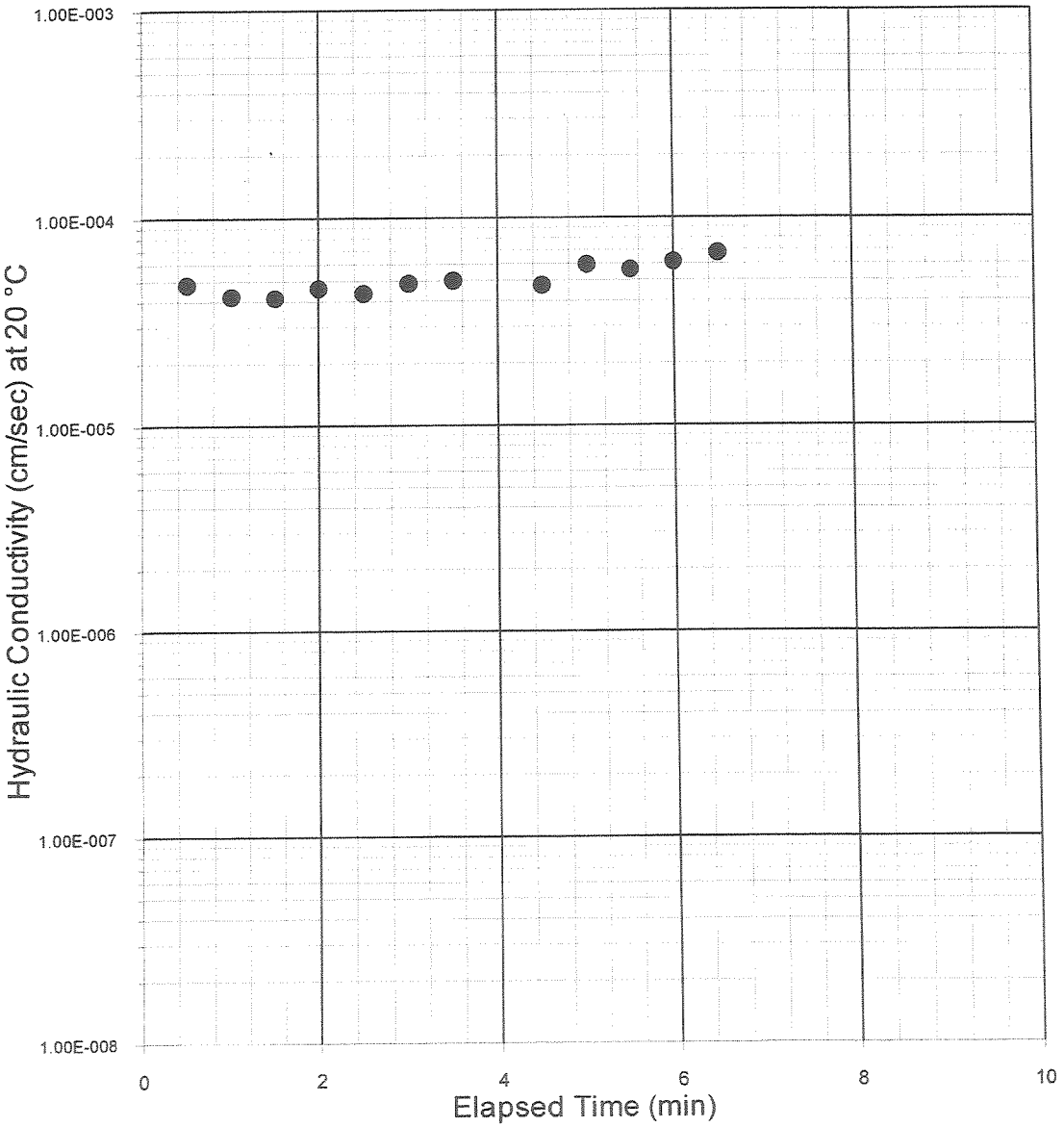
ASTM D 5084

SATURATED HYDRAULIC CONDUCTIVITY

URS

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE B-18



Boring No.	SAMPLE NUMBER	DEPTH (ft.)	SOIL DESCRIPTION	MOISTURE CONTENT/ DRY DENSITY	EFFICTIVE STRESS (psi)	HYDRUALIC CONDUCTIVITY (cm/sec)
B-16	4	20	Light brown SILT with sand (ML)	25/ 100	14	6.1E-05

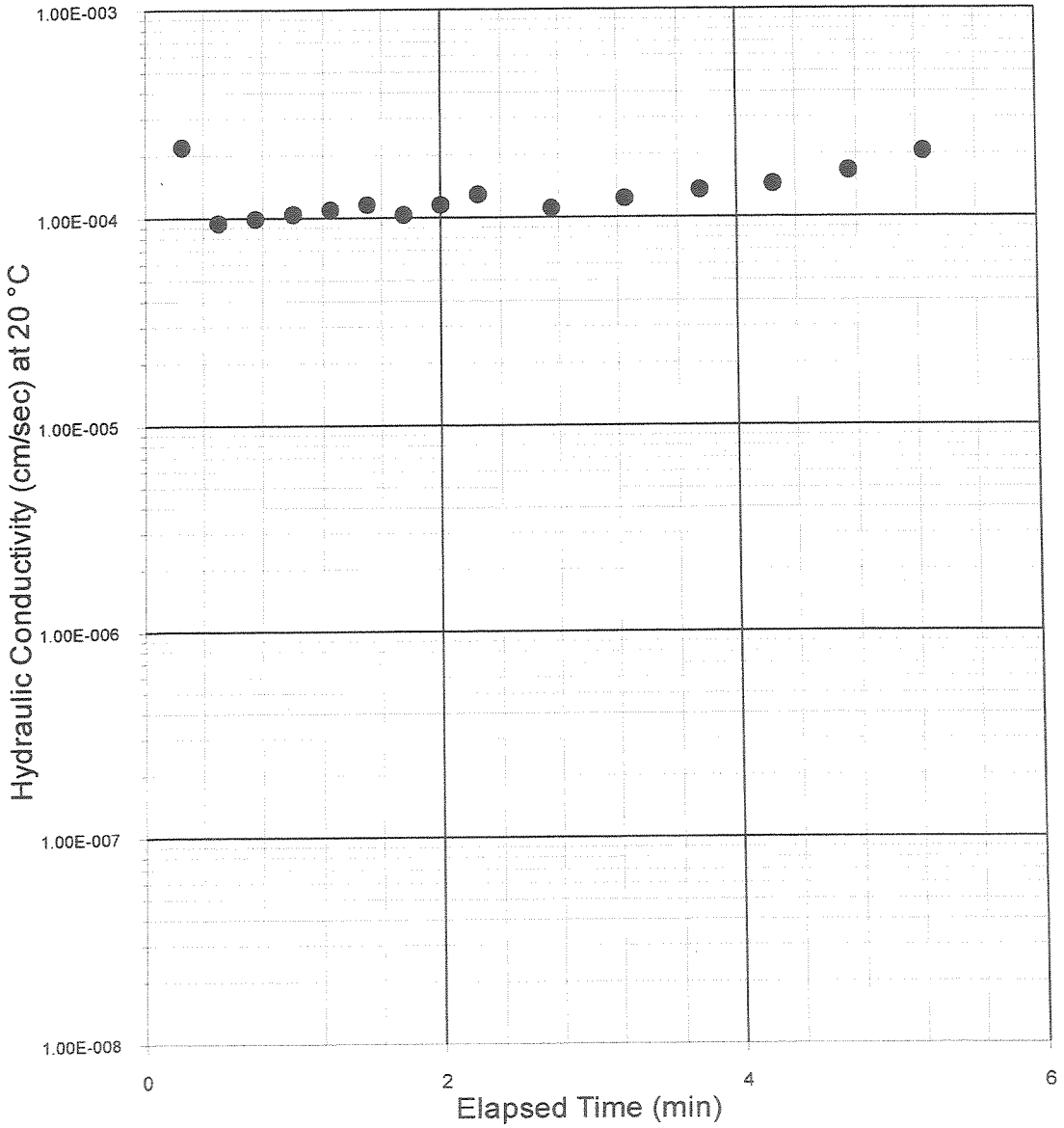
ASTM D 5084

SATURATED HYDRAULIC CONDUCTIVITY

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-19



Boring No.	SAMPLE NUMBER	DEPTH (ft.)	SOIL DESCRIPTION	MOISTURE CONTENT/ DRY DENSITY	EFFICTIVE STRESS (psi)	HYDRUALIC CONDUCTIVITY (cm/sec)
B-16	6	30	Light brown SAND with silt (SP-SM)	25/ 99	23	1.2 E-04

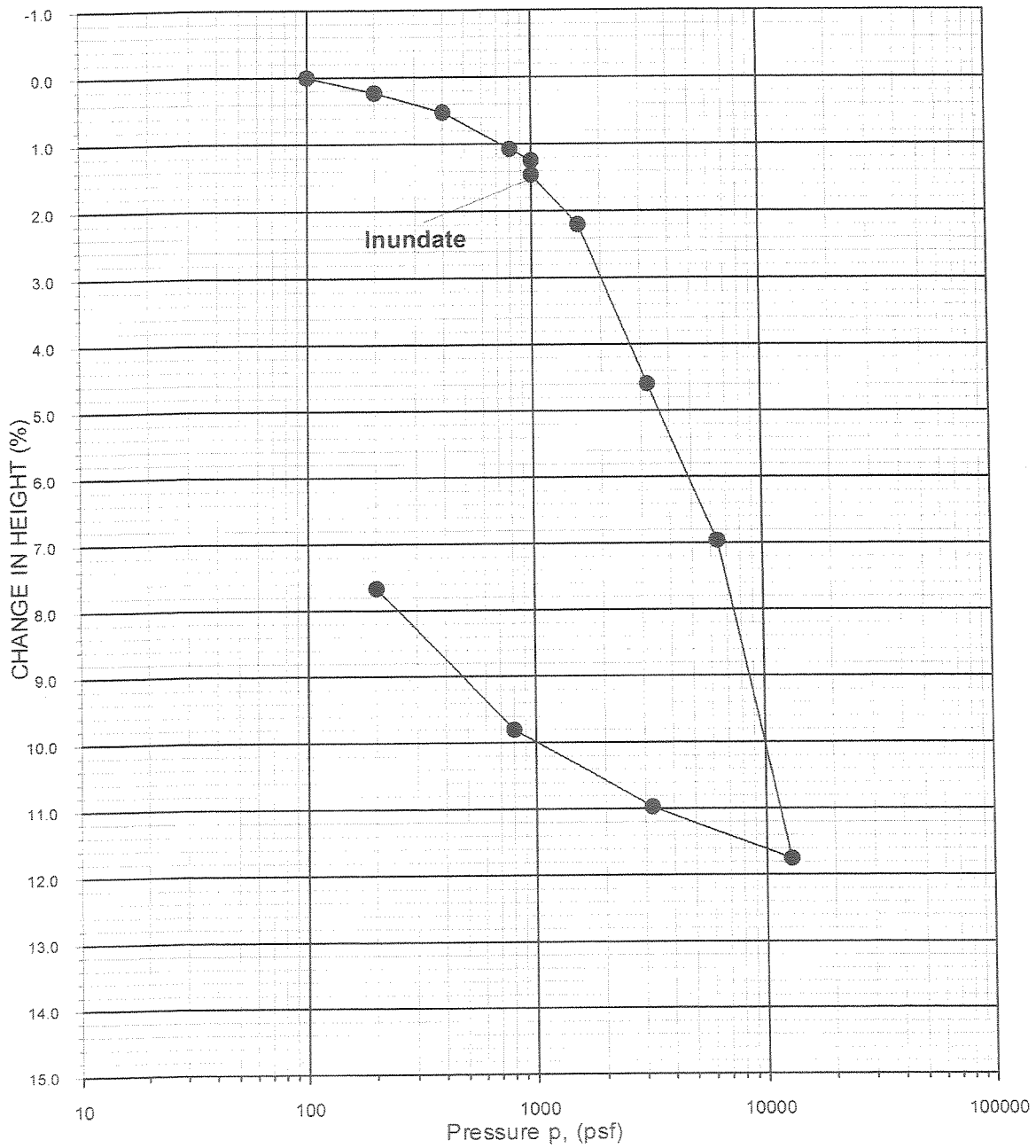
ASTM D 5084

SATURATED HYDRAULIC CONDUCTIVITY

URS

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE B-20



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-3	2	10	12 / 29	90 / 96	37/100

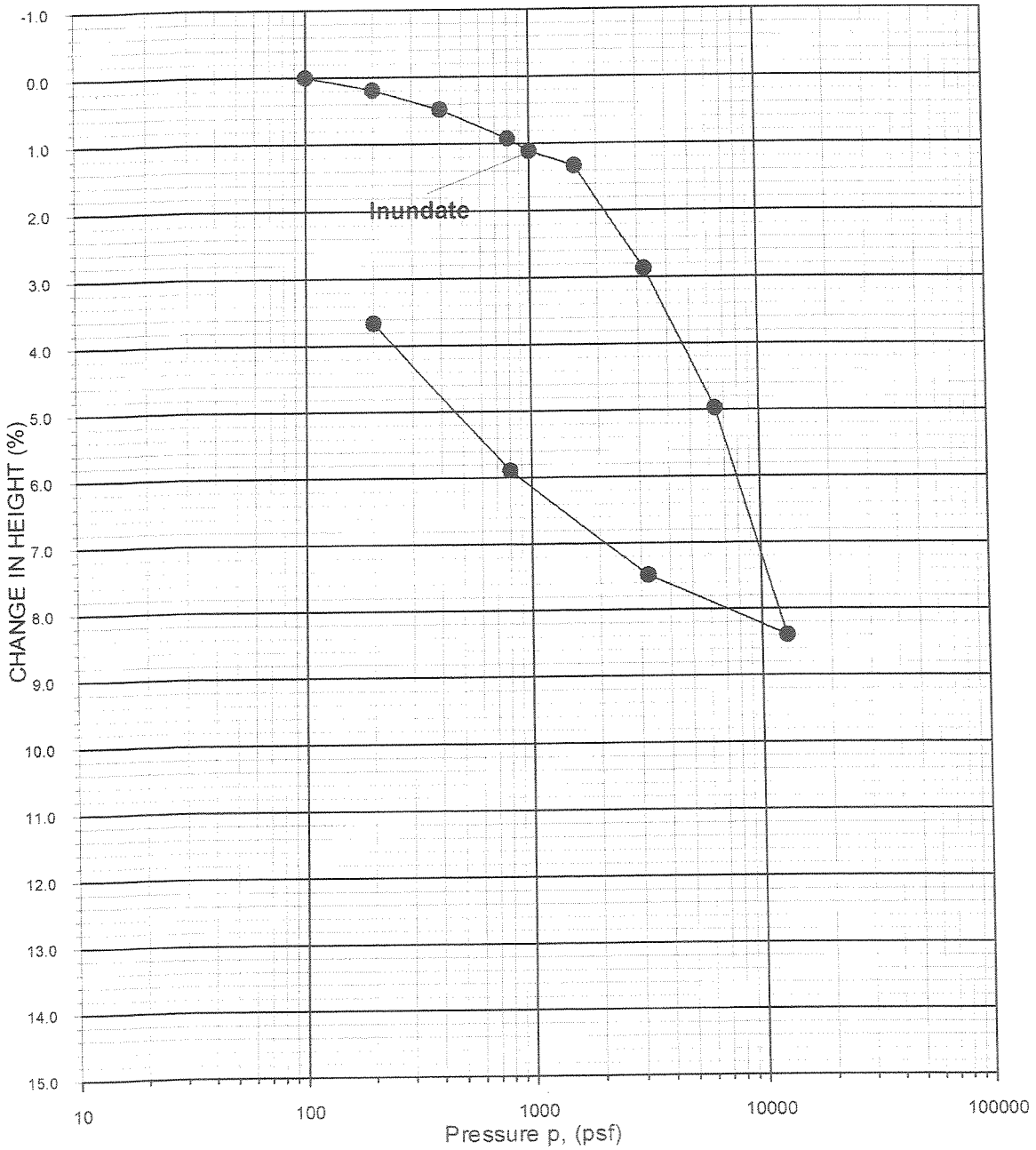
SOIL DESCRIPTION: Light olive brown Sandy SILT (ML)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-21



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-4	2	10	14 / 25	98 / 102	53/100

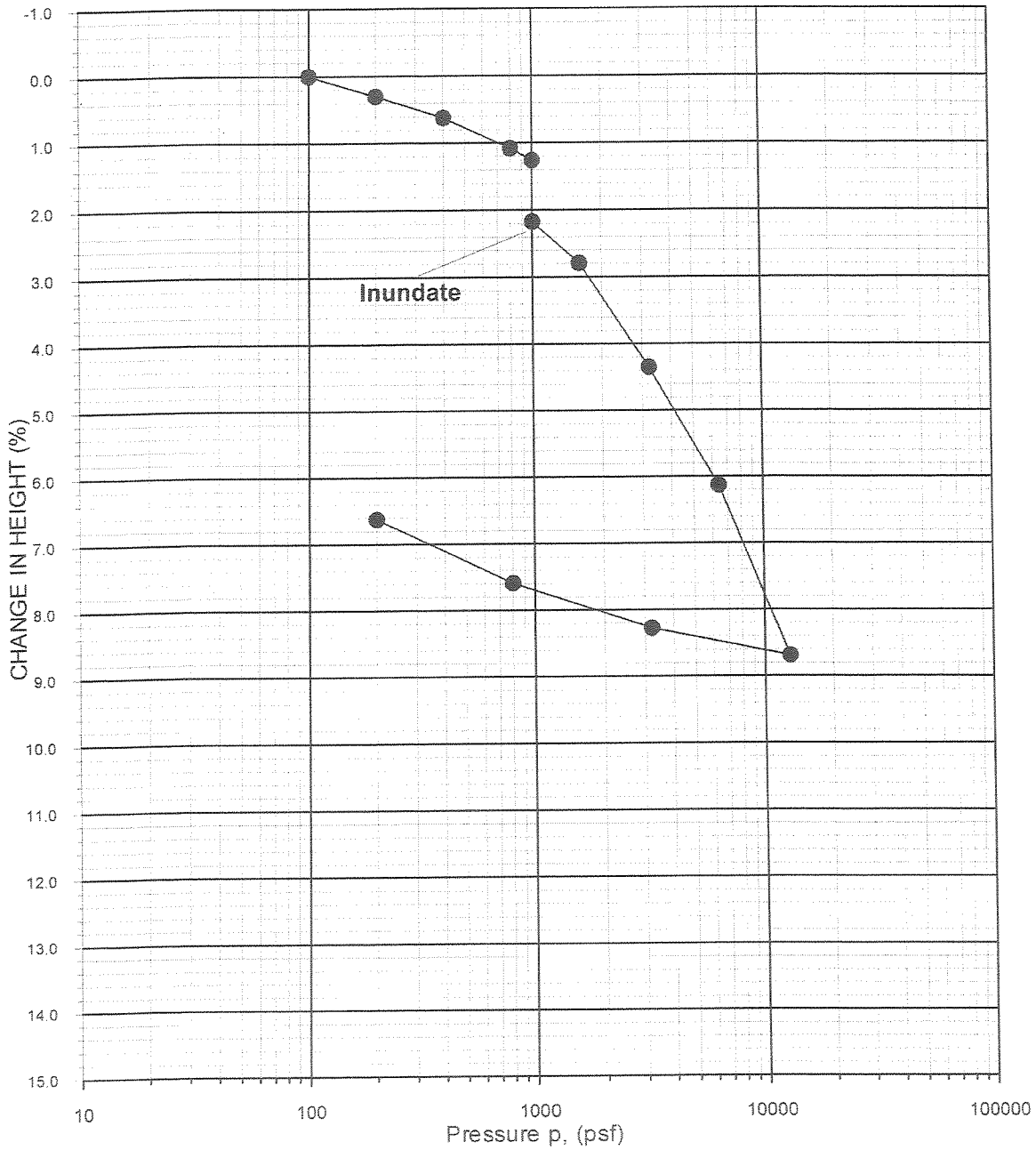
SOIL DESCRIPTION: Light olive brown CLAY (CL)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-22



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-5	2	10	7 / 28	91 / 96	23/100

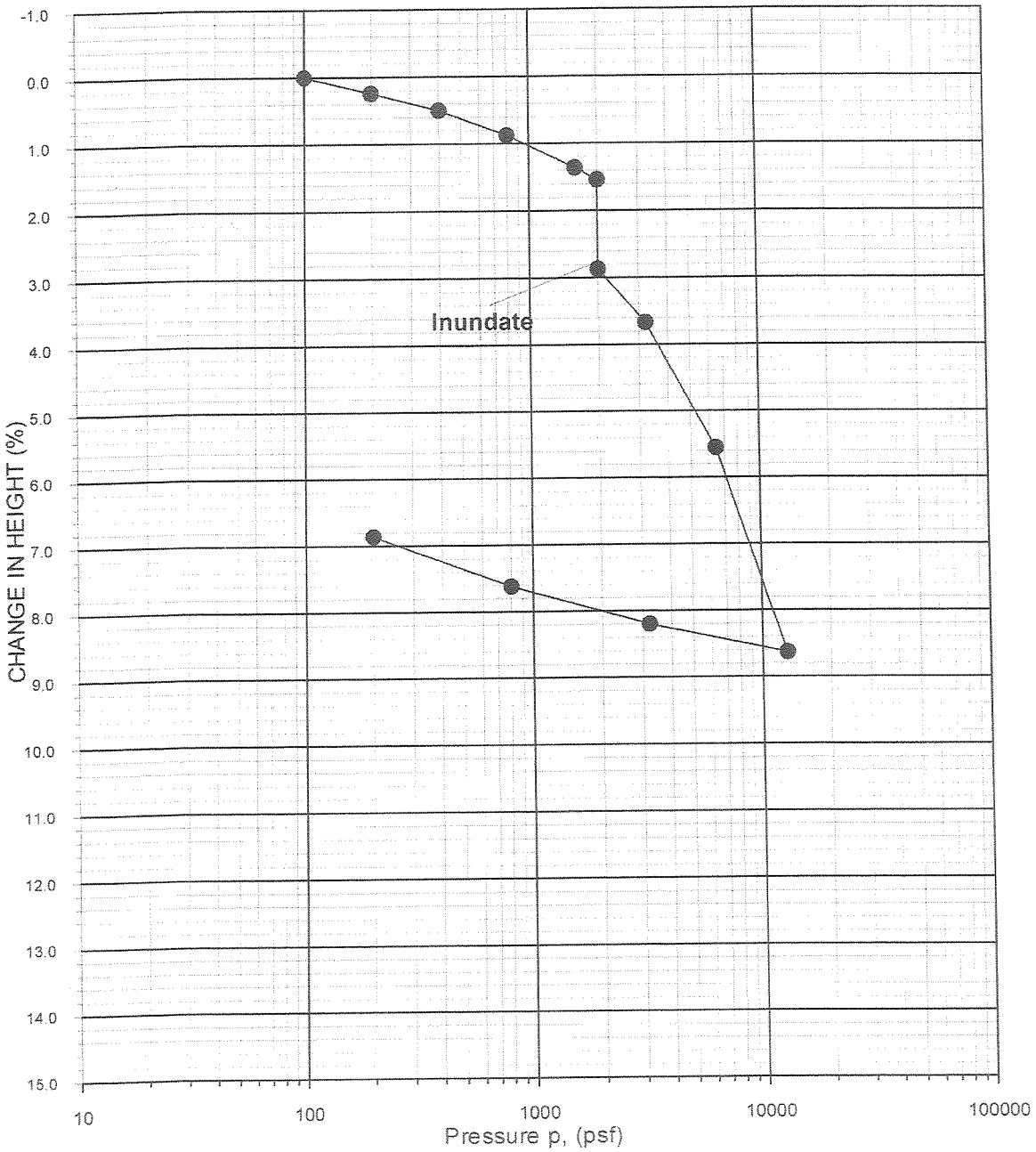
SOIL DESCRIPTION: Light olive gray CLAY (CL)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-23



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-6	4	20	9 / 28	88 / 95	26/100

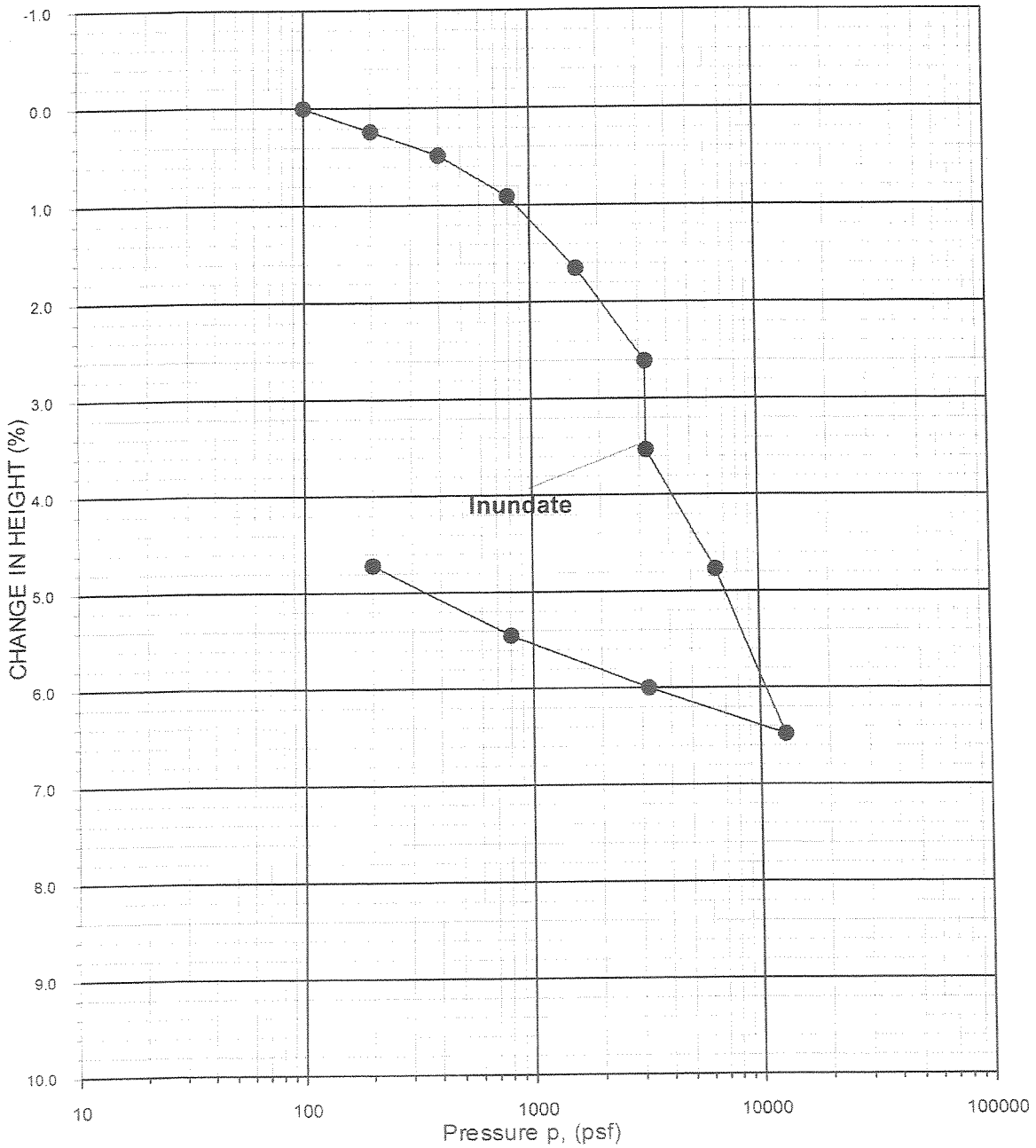
SOIL DESCRIPTION: Light olive brown Sandy SILT (ML)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-24



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-7	6	30	14 / 21	102 / 107	59 /100

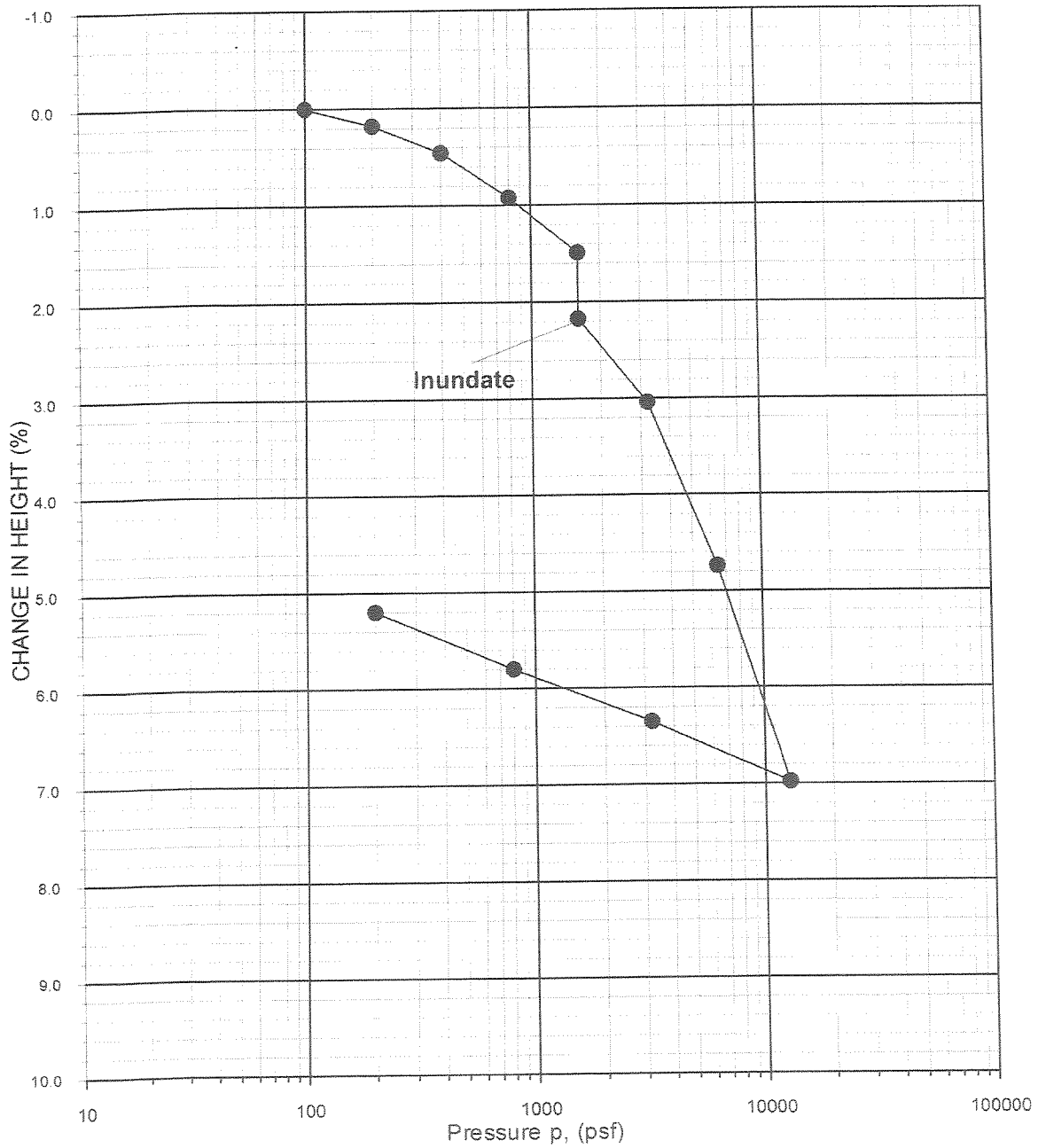
SOIL DESCRIPTION: Dark olive brown SILT (ML)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-25



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-8	3	15	6 / 28	91 / 96	20/100

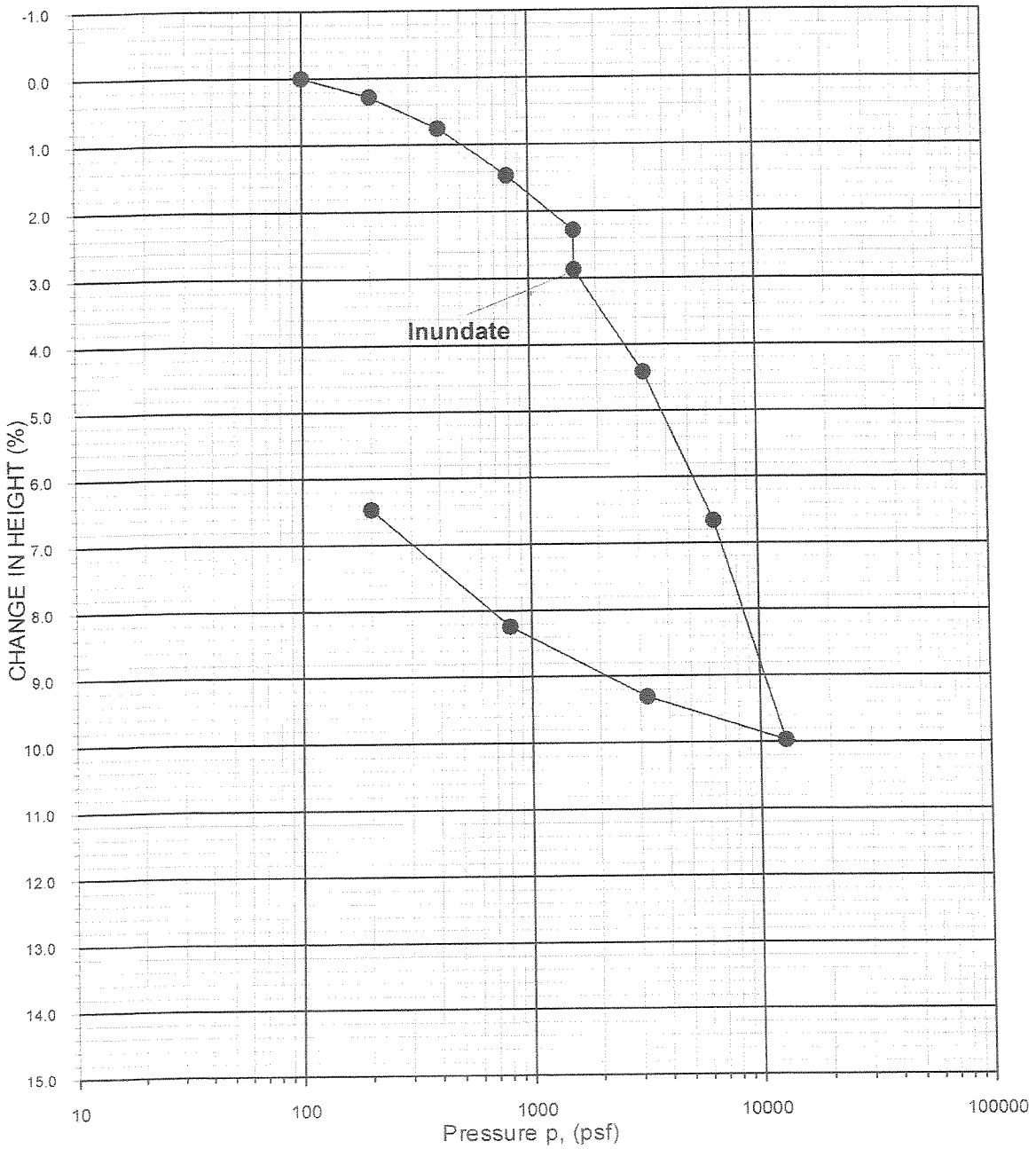
SOIL DESCRIPTION: Light olive brown Silty SAND (SM)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-26



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-11	3	15	13 / 27	92 / 98	42/100

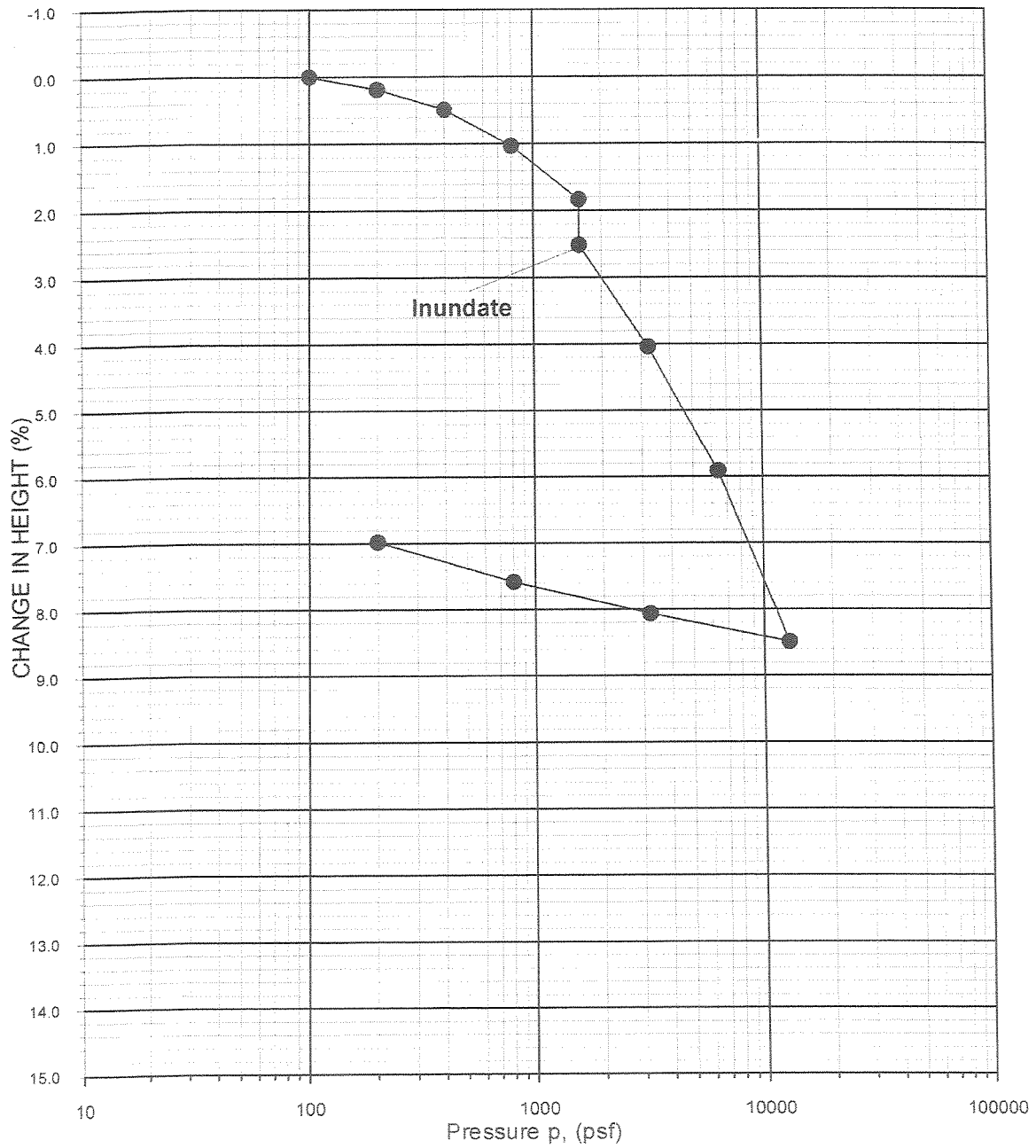
SOIL DESCRIPTION:Light gray CLAY (CH)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-27



BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%) Initial / Final	DRY DENSITY (pcf) Initial / Final	DEGREE OF SATURATION (%) Initial / Final
SB-12	3	15	6 / 27	89 / 96	18/100

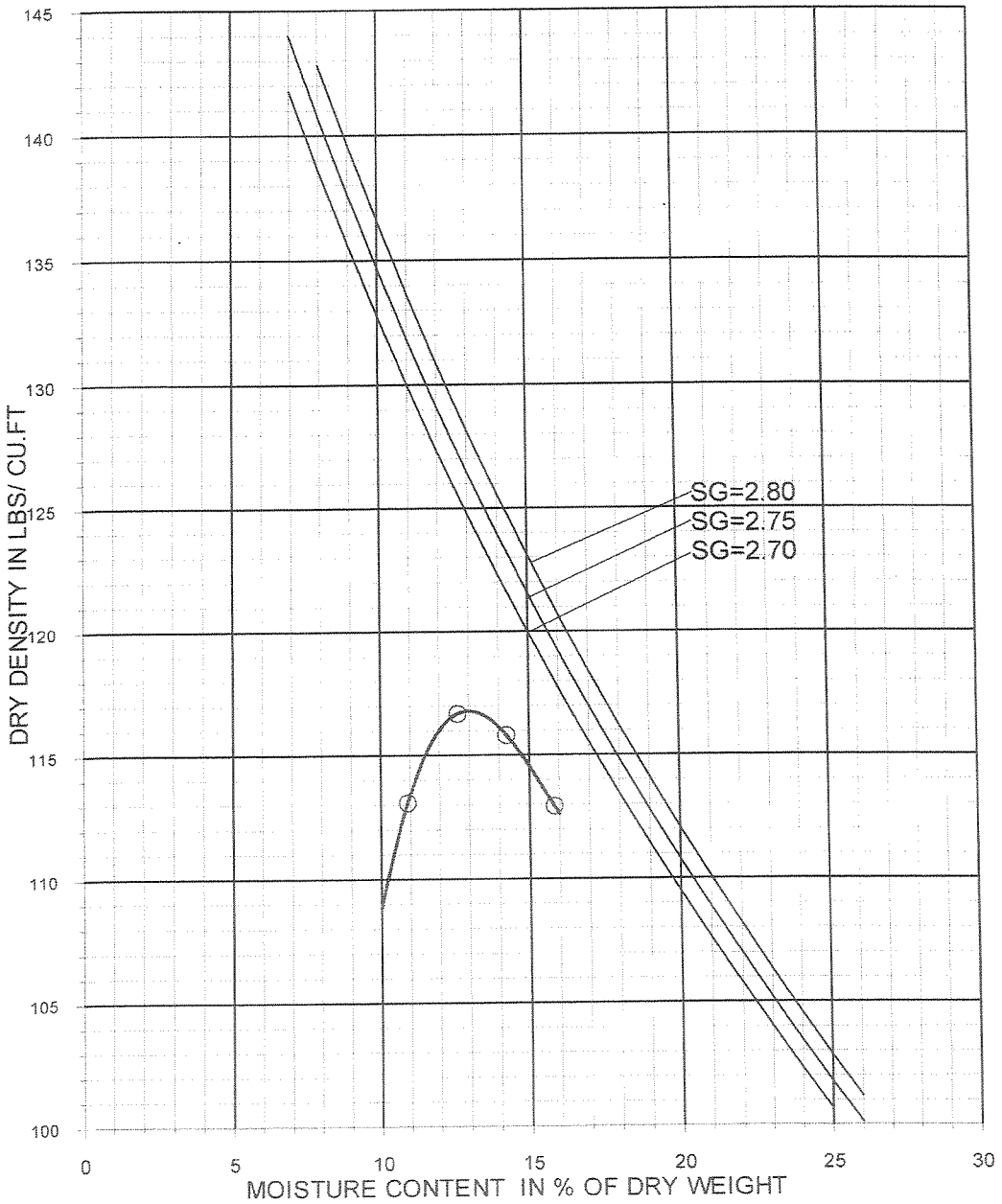
SOIL DESCRIPTION: Light brown Silty SAND (SM)

ONE-DIMENSIONAL CONSOLIDATION
(ASTM D2435)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-28



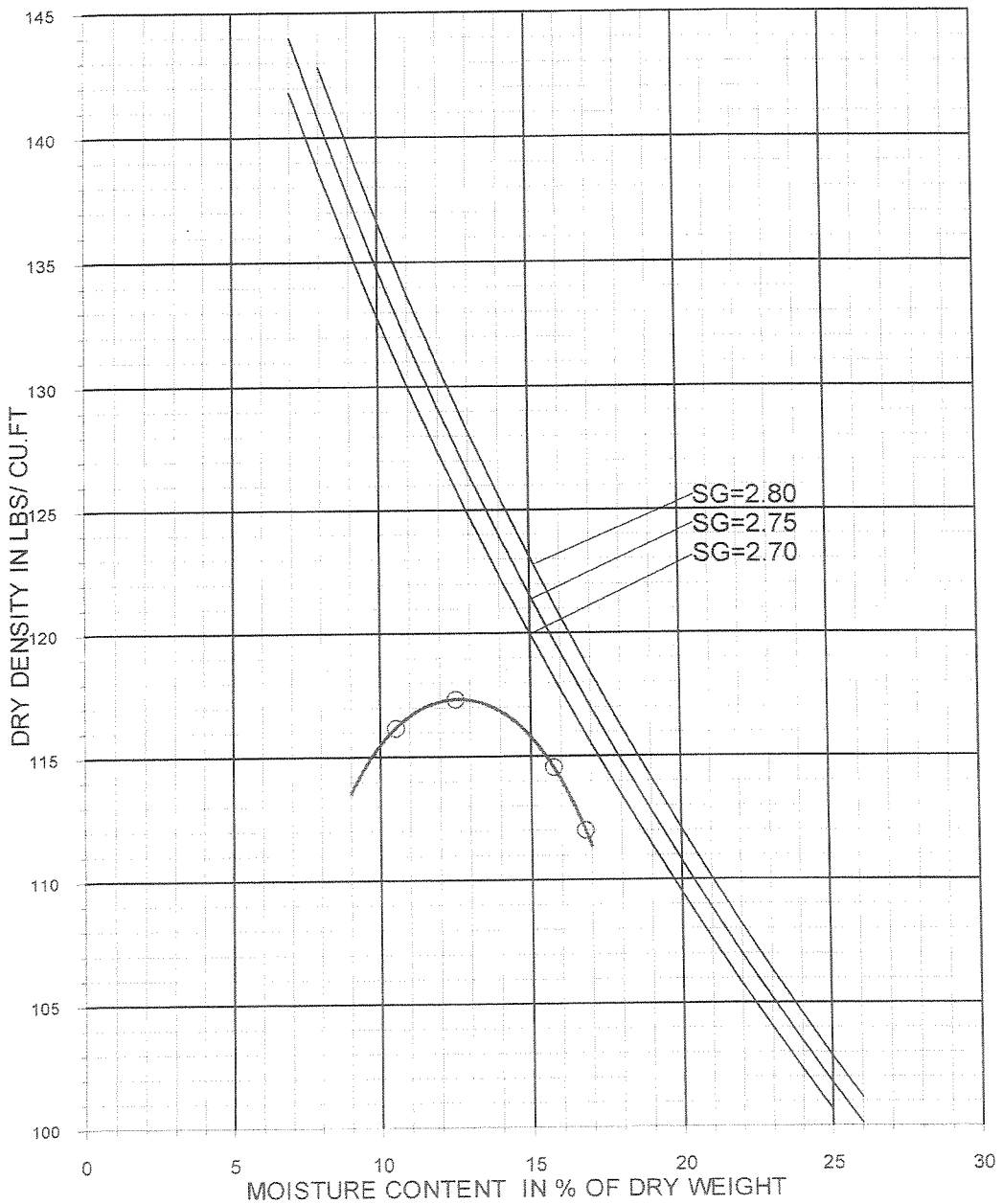
SYMBOL	BORING NUMBER	SAMPLE NUMBER	Depth (ft)	SOIL DESCRIPTION	TEST METHOD	OPT. MOISTURE CONTENT (%)	MAX. DRY DENSITY (pcf)
○	SB-2	BK-1	0 - 5	Light olive gray SILT with sand (ML)	ASTM D1557-B	13.0	117.0

COMPACTION TEST RESULTS
(ASTM D1557-A)

URS

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE B-29



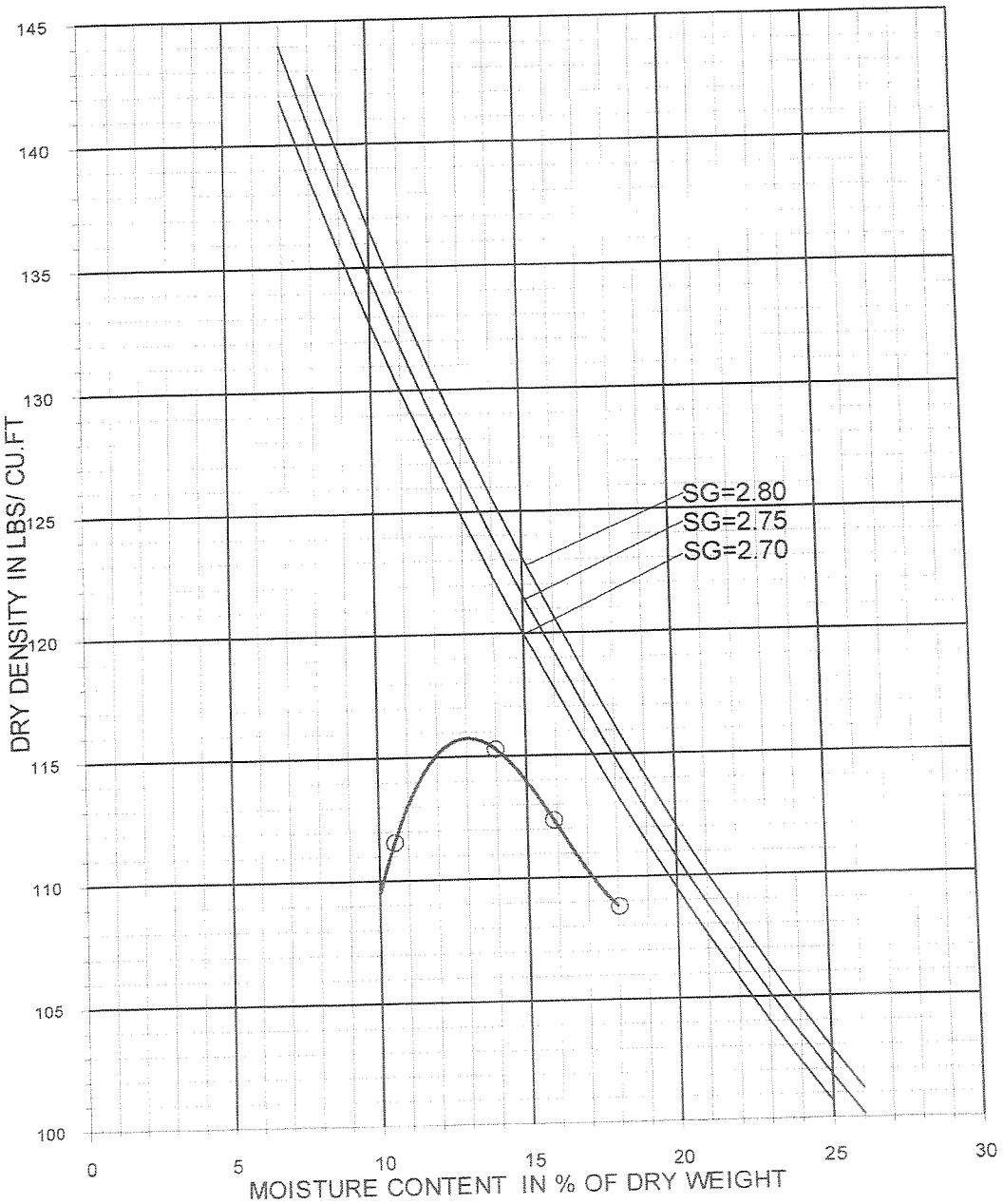
SYMBOL	BORING NUMBER	SAMPLE NUMBER	Depth (ft)	SOIL DESCRIPTION	TEST METHOD	OPT. MOISTURE CONTENT (%)	MAX. DRY DENSITY (pcf)
○	SB-10	BK-1	0 - 5	Light brown Sandy SILT (ML)	ASTM D1557-B	13.0	117.5

COMPACTION TEST RESULTS
(ASTM D1557-A)

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

URS

FIGURE B-30



SYMBOL	BORING NUMBER	SAMPLE NUMBER	Depth (ft)	SOIL DESCRIPTION	TEST METHOD	OPT. MOISTURE CONTENT (%)	MAX. DRY DENSITY (pcf)
○	SB-20	BK-1	0 - 5	Light olive gray CLAY with sand (CL)	ASTM D1557-B	13.0	116

COMPACTION TEST RESULTS
(ASTM D1557-A)

URS

PROPOSED PANOCHE ENERGY CENTER
FRESNO COUNTY, CALIFORNIA
FOR: PANOCHE ENERGY CENTER LLC

FIGURE B-31