GEOTECHNICAL INVESTIGATION REPORT PROPOSED SECURITY TREATMENT FACILITY COALINGA, CA

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

KLEINFELDER

An employee owned company

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Prepared For:
Kaplan-McLaughlin-Diaz
222 Vallejo Street
San Francisco, California 94111

March 16, 2000
Revised July 17, 2000

Prepared For:

Kaplan-McLaughlin-Diaz
222 Vallejo Street
San Francisco, California 94111

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Kleinfelder Job No.: 21-4158-01

Prepared by:

Stephen P. Plauson, E.I.T.
Project Engineer

David L. Pearson, P.E., G.E.
Senior Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
DAVID L. PEARSON
No. 674
Exp. 12/31/01
GEOTECHNICAL
STATE OF CALIFORNIA

Lutz Kunze, P.E., G.E.
Senior Project Manager

KLEINFELDER, INC.
1410 F Street
Fresno, California 93706
(559) 486-0750

March 16, 2000
Revised July 17, 2000

TABLE OF CONTENTS

CHAPTER **PAGE**

APPENDIX A

APPENDIX B

1. INTRODUCTION

1.1 GENERAL

In this report we present the results of our geotechnical investigation for the Proposed Coalinga Secure Treatment Facility to be located in Coalinga, California [Kaplan-McLaughlin-Diaz (KMD) Project No. 869-101]. The purpose of our investigation was to explore and evaluate the subsurface conditions at the site in order to develop geotechnical engineering recommendations to aid in project design and construction. The site location lies on the south side of Jayne Avenue immediately adjacent to the eastern property boundary of the existing Pleasant Valley Prison in Coalinga, California (Vicinity Map, Plate 1).

This report includes our recommendations related to the geotechnical aspects of project design and construction. Conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the locations of our explorations and the provisions and requirements outlined in the "ADDITIONAL SERVICES" and "LIMITATIONS" sections of this report. Recommendations presented herein should not be extrapolated to other areas or used for other projects without our prior review.

1.2 PROPOSED CONSTRUCTION

The proposed project will involve construction of a 1500 bed, maximum security, mental health facility. The completed facility will occupy approximately 60.7 ha (150 acres). On-site improvements are anticipated to include: asphalt concrete parking areas and driveways; underground utilities; facility lighting; security fences; concrete walkways; water storage tanks; a waste water treatment facility; perimeter flood control berms; and one and two-story, concrete masonry buildings with concrete slab-on-grade floors. Based on discussions with the project structural engineer column and wall loads (dead plus live loads) will range range from 510 to 4,380 kN (35 to 300 kips) and 22 to 117 kN/m (1.5 to 8.0 kips/ft), respectively. Building locations are shown on Plate 2. The finished floor elevation of the planned structures is 174 meters (571 feet). The planned crest of the perimeter flood protection berm is 175 meters (574 feet). Two 24-meter (80-foot) diameter water storage tanks will be constructed in the central eastern portion of the site. Wastewater treatment lagoons will be located in the southeastern corner of the site.

Grading plans are not yet developed; however it is our understanding earthwork fills on the order of 1.22 meters (4 feet) are planned across a majority of the site to facilitate pad grade for the main compound and to provide vehicular access and positive surface drainage. Some minor cut may be necessary at the northeast corner of the site to facilitate vehicular access. Therefore, the planned improvements will generally be located entirely on fill. A majority of the planned perimeter flood protection berms will require approximately 2.4 meters (8 feet) of fill to achieve the top of berm grade.

A generalized plot plan indicating the proposed facility layout (as supplied by KMD) is shown on Plate 2.

1.3 PREVIOUS INVESTIGATIONS

Kleinfelder performed a previous investigation for the adjacent Pleasant Valley Prison. Reference has been made to applicable data from that previous study.

1.4 PURPOSE AND SCOPE OF SERVICES

The purpose of the present investigation was to explore and evaluate the subsurface conditions at the facility in order to develop recommendations related to the geotechnical aspects of project design and construction.

The scope of services was outlined in a proposal to KMD dated September 30, 1998 (Kleinfelder Proposal No. 58-YP8-506), and included the following:

- Exploration of the subsurface conditions at various locations within the area of the proposed construction.
- Laboratory testing of representative samples obtained during the field investigation to evaluate relevant engineering parameters of the subsurface soils.

- A description of the proposed project including a vicinity map showing the location of the site and a site plan showing the locations of the exploration points for this study;
- A description of the site surface and subsurface conditions encountered during our field investigation, including boring logs;
- A summary of the field exploration and laboratory testing programs;
- Recommendations for general site earthwork;
- Comments on bulking and/or shrinkage from cut to fill volume;
- Recommended flexible roadway pavement section. Structural pavement sections are presented for various traffic indexes. The ADDT for 2, 3 and 5-axle trucks are presented for the assumed design traffic indexes;
- Recommendations for rigid pavement sections.
- Comments on stability of temporary cuts;
- Recommended E' values for trench backfill and trench side walls for use in flexible pipe design;
- Frictional coefficients at pipe/backfill interface and lateral bearing and associated deformation of thrust blocks for design of pressurized pipelines;
- Comments on the general corrosion potential of on-site soil;
- Comments on the general engineering seismology of the site, including a description of the site geologic setting, possible associated geology-related hazards, potential for liquefaction, seismic parameters associated with the 1998 CBC seismic design criteria, and site specific seismic response spectra;
- Recommendations for vertical and lateral bearing and estimated settlement of structure footing foundations. Settlement data are provided for ranges in foundation loads to allow for flexibility in foundation design;
- Comments on vapor transmission and capillarity for structures with moisture sensitive flooring or contents;
- Comments on expansive potential and preliminary recommendations for building slab design; and,
- Recommendations on modulus of subgrade reaction for structural elastic design of loaded building slabs or grade beams.

2. FIELD AND LABORATORY EXPLORATION

2.1 FIELD EXPLORATION

The subsurface conditions at the site were explored on December 10, 13, and 14, 1999. Exploration was performed by drilling 50 test borings to depths ranging from 1.5 to 15.7 meters (5 to 51.5 feet) below existing grade. Borings were drilled using both CME 75 and CME 85 truck-mounted drill rigs equipped with 152 mm (6 inch) and 203 mm (8 inch) diameter hollow-stem auger, respectively. In addition to the test borings, 12 test pits were excavated to depths ranging from 3.0 to 4.3 meters (10 to 14 feet) below existing grade. Test pits were excavated using a backhoe equipped with a 610 mm (24-inch) wide bucket. The locations of the test borings and test pits performed for this investigation are shown on Plate 2 of this report. All borings and test pits were staked and cleared through Underground Service Alert (USA) prior to drilling.

Kleinfelder engineers maintained a log of the borings and test pits, visually classified soils encountered according to the Unified Soil Classification System, and obtained relatively undisturbed and bulk samples of the subsurface materials. A key to the Logs is presented in Appendix A and Logs of Borings and Logs of Test Pits are presented on Plates A-1 through A-62.

Soil samples were obtained from the borings using either a California or Standard Penetration Sampler driven 457 mm (18 inches) (unless otherwise noted) into undisturbed soil using a 762 mm (30 inch) drop of a 0.62kN (140 pound) hammer. Blow counts were recorded at 152 mm (6 inch) intervals for each sample attempted and are reported on the logs in terms of blows for the last 300 mm (1 foot) of penetration. Soil samples obtained from the excavations were packaged and sealed in the field to reduce moisture loss and disturbance, and returned to our laboratory for further testing. After excavations were completed, they were backfilled with the cuttings.

2.2 FIELD AND LABORATORY TESTS

Sampler penetration rates were used to aid in evaluating the consistency, compression and strength characteristics of the foundation soils. Laboratory tests were performed on selected samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was designed with emphasis on the geotechnical properties of soils to assist in the evaluation of necessary earthwork and foundation design recommendations. Our laboratory testing program included performing the following tests:

- Unit weight (ASTM D-2937)
- Moisture content (ASTM D-2216)
- Direct Shear (ASTM D-3080)
- Resistance Value (California Test Method No. 301)
- Consolidation (ASTM D-2435,without rate data)
- Maximum Density Curve (ASTM D-1557)
- Sieve Analysis (ASTM C-136)
- Hydrometer (ASTM D-422)
- Plasticity Index (ASTM D-4318)
- Expansion Index (ASTM D-4829)
- Soluble Sulfate Content (California Test Method No. 417)
- Soluble Chloride Content (California Test Method No. 422)
- pH and Minimum Resistivity (California Test Method No.532)

Unit weight and moisture content test results are shown on the boring logs in Appendix A. The soil corrosion results are reported in section 5.6 of this report. The results of other laboratory tests are in Appendix B.

3. SITE CONDITIONS

3.1 SURFACE

The proposed prison facility abuts the south side of Jayne Avenue immediately adjacent to the eastern property boundary of the existing Pleasant Valley Prison (Vicinity Map, Plate 1). The site consists of undeveloped land and is generally covered with scattered annual grasses and weeds. The surface of the site is generally flat and generally slopes downward to the north. At the time of our investigation the site was mostly tilled. Overhead utilities were present along the eastern project boundary.

3.2 SUBSURFACE

The following description provides a general summary of the subsurface conditions encountered during our field exploration and further validated by the laboratory testing program. For a more detailed description of the conditions encountered at the test excavation locations, refer to the test boring and test pit logs presented in Appendix A (Plates A-1 through A-62). The data from our test borings and test pits excavated for this study indicate that the soil across the site generally consists of sandy lean and fat clay extending to the depth explored, 15.7 meters (51.5 feet). Laterally discontinuous zones and lenses of silty sand and sandy silt were encountered in some of the borings and test pits. The majority of the soils encountered are stiff to very stiff.

Evidence of groundwater was not observed within the 12 test pits excavated to a maximum depth of 4.3 meters (14 feet), nor was groundwater encountered in the 50 borings drilled to a maximum depth of 15.7 meters (51.5 feet) for this project. Fluctuations of the groundwater level, can occur during and following the rainy season or periods of locally intense rain fall or storm water runoff. However, groundwater is not anticipated to influence the facility design or construction.

Based on information provided by Underground Service Alert, a 305 mm (12-inch) diameter below grade gas pipe line bisects the site in a northwest direction. It is our understanding the line is buried approximately 1.2 meters (4 feet) below existing grade. No other underground utilities were identified on the site through USA notification.

4. ENGINEERING GEOLOGY

4.1 GENERAL

The seismic evaluation associated with this study developed site specific design ground motions, in terms of peak ground accelerations and design response spectra, for the subject project using a seismic source model (proximity to active faults, major historical earthquakes, regional seismicity) and site specific subsurface data. The response spectra is a graphical representation relating the maximum response of a single degree of freedom, damped elastic oscillator with different fundamental periods to dynamic loads. Site-specific spectra for any given return period represents uniform-risk earthquake ground motions consistent with the seismic source model and the local site response. Specifically, our scope of services include the following:

- Discussion of significant faults and assessment of site seismicity;
- Seismic hazard analysis to assess peak ground accelerations for two levels of earthquakes;
- Development of site-specific, uniform-risk elastic horizontal response spectra for the two levels of earthquakes and two levels of damping;
- Identification of seismic parameters associated with 1998 CBC seismic design criteria.

4.2 REGIONAL GEOLOGY

The area of the site lies in the central portion of Pleasant Valley near the border between the Coast Ranges and Great Valley geomorphic provinces in central California. The Central Valley is a large northwestward trending, asymmetric structural trough that has been filled with as much as 10 vertical km (6 vertical miles) of sediment. The trough is situated between the Sierra Nevada Mountains on the east and the Coast Range Mountains on the west. Both of these mountain ranges were initially formed by uplifts that occurred during the Jurassic and Cretaceous periods of geologic time (greater than 65 million years ago). Renewed uplift began in the Sierra Nevada during late Tertiary time, and is continuing today.

4.3 AREA AND SITE GEOLOGY

Using the Guijarral Hills, California 7½-minute quadrangle topographic map (USGS, photorevised 1971), the site lies within the northeast quarter of Section 4, T21S, R16E. Elevation of the site is about 170 meters (560 feet) above Mean Sea Level. Based upon the USGS (1971) map, the site coordinates are:

Latitude: 36.1319° N   Longitude: 120.2422° W

According to the 1998 CBC Figure 16A-2 of Vol. 2 and Figure 16B-2 of Vol. 2B, the site lies within Seismic Zone 4.

The majority of the native sediments in the project area have been mapped (Santa Cruz 2° geologic sheet) by the California Division of Mines and Geology (CDMG) as Pleistocene non-marine sediments (Qc). More detailed mapping by Dibblee (1971) indicate the soils as Recent alluvial sands, gravel, and clay (Qa). The U.S. Department of Agriculture, Soil Conservation Survey (SCS) has mapped the project site as primarily Lethent clay loam with the southwest area including the Excelsior sandy loam. Bedrock beneath the site has been estimated at greater than 150 meters (500 feet) and will not be encountered at the site (Bartow, 1991).

4.4 LOCAL AND REGIONAL FAULTING

Coalinga is located in a region traditionally characterized by few active faults and moderate to high seismic activity. Based on the information provided in Hart and Bryant (1997), the site is not in an Alquist-Priolo Earthquake Fault Zone and no known active faults traverse the site. The project site is located approximately 7 km southwest of the interpreted surface location of the Great Valley fault and approximately 32 km northeast of the San Andreas fault. A major seismic event on these faults could cause significant ground shaking at the site.

Table 4.4-1 lists these faults and their seismic parameters. Locations of the active and potentially active faults in the area with respect to the subject site are shown on Plate 1 in Appendix C. The locations of the faults and associated parameters presented on Table 4.4-1 are based on data presented by Real et. al. (1978), Toppozada et. al. (1978), Hart et al. (1984), Wesnousky (1986), Wong et al. (1988), Wagner (1990), Jennings (1994), Frankel et al. (1996), and Petersen et al. (1996). The maximum earthquake magnitudes presented in this table are based on the moment magnitude scale developed by Kanamori (1977).

TABLE 4.4-1

SIGNIFICANT FAULTS

Fault Name	Fault Length (km)	Closest Distance to Site (km)**	Magnitude of Maximum Earthquake *	Slip Rate (mm/yr)	Values of	
					a	b
Great Valley 14	24	7	6.4	1.5	1.86	0.70
Great Valley 13	30	7	6.5	1.5	1.88	0.70
Great Valley 12	17	26	6.3	1.5	1.79	0.70
San Andreas	345	32	7.8	34	4.62	0.88
Great Valley 11	25	46	6.4	1.5	1.88	0.70
San Juan	68	49	7.0	1	2.47	0.80
Rinconada	189	67	7.3	1	3.32	0.90
Great Valley 10	22	68	6.4	1.5	1.83	0.70

* Moment magnitude
** Distance to the surface trace of the fault

The "a" and "b" values listed in this table below are a measure of the frequency of occurrence of earthquakes of various magnitudes. The general form of this recurrence model is based on the Gutenberg-Richter (Gutenberg and Richter, 1956) exponential frequency-magnitude relationship:

$$\log N(M) = a - bM$$

where N(M) is the cumulative number of earthquakes of magnitude "M" or greater per year, and "a" and "b" are constants based on recurrence analyses.

4.5 HISTORICAL SEISMICITY

The project site and its vicinity are located in an area traditionally characterized by moderate to high seismic activity. Most of the seismic activities at the site are associated with the Great Valley fault system and the San Andreas fault, about 32 km towards the southwest. Some of the significant relatively nearby events (within 100 km of the site) include: the 1983 (M6.5) and (M5.7) Coalinga earthquakes and several after shocks, about 1 to 10 km around the site; the 1881 (M5.8), the 1901 (M6.4), the 1922 (M6.3), the 1934 (M6.0), and the 1966 (M6.0) Parkfield earthquakes, about 30-35 km to the southwest; the 1952 (M6) Bryson earthquake, about 100 km to the southwest; and the 1985 (M5.9) North Kettlemen Hills earthquake, about 1 km away from the site. The Coalinga and North Kettlemen Hills earthquakes were possibly associated with the Great Valley fault system. Epicenters of some significant earthquakes (M>4.0) within the vicinity of the site are shown on Plate 3 in Appendix C.

The earthquake database used in our search contains in excess of 5,500 seismic events and covers the period from 1800 through December 1999. The earthquake database is principally comprised of an earthquake catalog for the State of California prepared by the Division of Mines and Geology (CDMG). The original CDMG catalog (Real, et. al, 1978) is a merger of the University of California at Berkeley and the California Institute of Technology instrumental catalogs (Hileman, et. al, 1973). The combined catalog contains earthquake records from January 1, 1900 through December 31, 1974. Updates prepared by CDMG in 1979 and 1982 extend the coverage through 1982. In addition to the CDMG updates, data for earthquakes, which occurred between 1910 and January 2000, have been obtained from a composite catalog by Council of the National Seismic System (CNSS). The CNSS catalog is a world-wide earthquake catalog, which is created by merging the master earthquake catalogs from contributing CNSS networks and then removing duplicate events, or non-unique solutions from the same event. The CNSS network includes Northern and Southern California Seismic Networks, Pacific Northwest Seismic Network, University of Nevada, Reno Seismic Network, University of Utah Seismographic Stations and US National Earthquake Information Service. The earthquake database also consists of earthquake records between 1800 and 1900. This subset of the earthquake database was derived from Seeburger and Bolt (1976) and Toppozada, et al. (1978, 1981).

The parameters used to define the limits of the historical earthquake search include geographical limits (within 100 km of the site), dates (1800 through December 1999), and magnitudes (M>4). A summary of the results of the historical search is presented below.

Time period (1800 to January 2000)	200 years
Maximum moment magnitude	8.3
Approximate distance to nearest historical M>4 earthquake	<0.2 km
Number of events exceeding magnitude 4 within search area	279

4.6 SITE CHARACTERIZATION

In developing site specific seismic design criteria, the characteristics of the soils underlying the site are an important input to evaluate the site response at a given site. Based on the results of our field investigations at this site, the site is underlain by sandy clay with some interbedded layers of silty sands and sandy silts to the maximum exploration depths. Groundwater table was not encountered in any of the borings. The depth to bedrock is not known but is believed to be well over 150 meters (500 feet) at the site.

Based on the above information, we classify the site soil profile for site response study as site profile type S_D based on Table 16-J of 1997 UBC or Table 16A-J of the 1998 CBC. S_D is defined as a soil profile consisting of stiff soils with shear wave velocity between 180 and 360 m/s or SPT N = 15-50, or Su = 47 – 95 kPa (1000-2000 psf). Alternately, the site can also be classified as S_2 according to Table 16B-J of Vol. 2B of 1998 CBC with *S* Factor of 1.2.

4.7 DESIGN EARTHQUAKE LEVEL

Based on the project design criteria, the site specific response spectra were developed for two levels of seismic events. Lower Level Event (LLE) is defined as ground motion having 50% probability of exceedance in 50 years (return period of about 72 years) and Upper Level Event (ULE) is defined as ground motion having 10% probability of exceedance in 50 years (return period of about 475 years).

Using the seismic risk analysis, we developed peak ground accelerations and uniform-risk elastic design response spectra for damping values of 5- and 10-percent.

4.8 ATTENUATION RELATIONSHIP

Site-specific ground motions can be influenced by the styles of faulting, magnitudes of the earthquakes, and the local soil conditions. The attenuation relationships used to estimate ground motion from an earthquake source at some distance from the site need to consider these effects.

Many attenuation relationships have been developed to estimate the variation of peak ground surface acceleration with earthquake magnitude and distance from the site to the source of an earthquake. Of these relationships, we have selected relationship presented by Boore et. al. (1994, 1997) because of its wide acceptance by seismologists. This relationship has also been used in developing recent National Seismic Hazard Maps (Frankel et. al., 1996) for the State of California. This relationship uses an estimate of average site shear wave velocity in the analyses. Therefore, an average site shear wave velocity of 250 m/s, as recommended by Boore et. al. (1997) for the Soil Profile Type S_D, was used in our analyses. The relationship by Boore et. al. (1994, 1997) does not provide spectral values for periods greater than 2 seconds. Therefore, to develop response spectra for long periods, we have used the relationship presented by Abrahamson and Silva (1993). These predictive relationships were developed from statistical analyses of recorded earthquakes from Western North America, including the records from the 1989 Loma Prieta earthquake and 1992 Landers earthquake. The attenuation relationships provide mean values of ground motions associated with one set of parameters: magnitude, distance, site soil conditions, and mechanism of faulting. The uncertainty in the predicted ground motion is taken into consideration by including a magnitude dependent standard error in the probabilistic analysis.

4.9 PROBABILISTIC ANALYSIS

Probabilistic modeling procedure was used to estimate the peak ground motions corresponding to the design level earthquake. The probabilistic analysis approach is based on the characteristics of the earthquake and of the causative fault associated with the earthquake. These characteristics include such items as magnitude of the earthquake, distance from the site to the causative fault, maximum credible earthquake, length, and activity of the fault. The effects of site soil conditions and mechanism of faulting are accounted for in the attenuation relationship for this site.

The theory behind the seismic risk analysis has been developed over many years (Cornell, 1968, 1971; Merz and Cornell, 1973) and is based on the "total probability theorem" and on the assumption that earthquakes are events that are independent of time and space from one another. According to this approach, the probability of exceeding PE(Z) at a given level of ground motion, Z, at the site within a specified time period, T, is given by

$$PE(Z) = 1 - e^{-\vartheta(Z)T}$$

where $\vartheta(Z)$ is the mean annual rate of exceedance of ground motion level Z. Different probabilities of exceedance may be selected, depending on the level of performance required.

4.10 PEAK GROUND ACCELERATION

Based on the results of our seismic analyses, the calculated peak ground horizontal accelerations (in units of gravity) for both LLE and ULE are presented in Table 4.10-1. The corresponding return period and annual probabilities of occurrence are also shown.

TABLE 4.10-1
PEAK GROUND ACCELERATION

Event	Return Period	Probability of Occurrence	Annual Probability of Exceedance	Peak Horizontal Acceleration (g)
LLE	72	50% in 50 years	0.0139	0.30
ULE	475	10% in 50 years	0.0021	0.55

4.11 ELASTIC RESPONSE SPECTRA

The site-specific elastic response spectra for this project was developed based on a uniform-risk approach. The uniform risk approach assumes that the same level of risk is uniformly applied to the entire response spectra. Response spectral values for the design level earthquake were calculated using the same probabilistic analysis approach described above. Estimated response spectral values were calculated for damping factor of 5 percent of critical. The response spectra for damping factor of 10 percent of critical were developed using methods proposed by

Newmark and Hall (1982). Our recommended elastic site specific response spectra for the LLE and ULE for 5- and 10-percent damping are shown on Plates 4 and 5 in Appendix C. The tripartite plot of the elastic response spectra are shown on Plates 6 and 7 in Appendix C. The spectral acceleration values for both LLE and ULE in terms of g are presented in Table 4.11-1.

TABLE 4.11-1
Site Specific Spectral Acceleration (g)

Period (sec)	Lower Level Event (LLE)		Upper Level Event (ULE)	
	5% Damping	10% Damping	5% Damping	10% Damping
0.010	0.300	0.300	0.550	0.550
0.050	0.300	0.300	0.550	0.550
0.060	0.384	0.349	0.671	0.611
0.080	0.495	0.406	0.806	0.682
0.100	0.571	0.442	0.922	0.741
0.150	0.678	0.495	1.100	0.836
0.200	0.707	0.516	1.236	0.902
0.250	0.697	0.509	1.301	0.943
0.300	0.668	0.491	1.297	0.952
0.400	0.607	0.458	1.229	0.930
0.500	0.549	0.416	1.142	0.869
0.600	0.490	0.381	1.038	0.806
0.800	0.388	0.306	0.835	0.659
1.000	0.316	0.252	0.686	0.549
1.500	0.203	0.162	0.461	0.369
2.000	0.137	0.111	0.317	0.254
2.500	0.095	0.079	0.228	0.186
3.000	0.069	0.057	0.166	0.140
4.000	0.039	0.033	0.099	0.083

4.12 NEAR FAULT ISSUES IN STRUCTURAL DESIGN

In recent years, many modern structures located near the seismic source have been severely damaged or collapsed. The severe damage and/or collapse is attributed to near fault motions that are characterized by energetic unidirectional velocity pulses (Singh 1984, 1985). What makes these motions particularly damaging is the impulse (area under the acceleration time history multiplied by the mass). A structural system that yields during a long duration pulse (impulse loading) may experience very large permanent deformations and/or collapse. The extent of these actions depends on the strength and natural period of the structure and the structure articulation, as well as the amplitude, duration, and shape of the pulse. The near fault pulse type motions can be particularly damaging because they can accumulate inelastic deformations in one direction and their considerations in the near fault conditions should be properly evaluated.

It should be noted that 1998 CBC Vol. 2B, which is the applicable code for hospitals and correctional facilities, does not have any provisions for near fault consideration in the design of the structures. However, the 1998 CBC Vol. 2 requires using near source factors in the design of the structures for any site located within 10 km from a Seismic Source Type B and within 15 km of Seismic Source Type A. The closest fault from the site is the Great Valley fault, which is a Seismic Source Type B. Although, the Great Valley fault is not zoned for near source factors by ICBO (1998), there is potential of damage to the structures associated with the velocity pulse resulting from the seismic activity on that fault. This phenomenon was observed during the 1983 Coalinga earthquakes. Therefore, due to potential near fault motion resulting from seismic activity on the Great Valley fault, near source effects should be considered in the structural design of the proposed facility. Considering the probable site dip, the site is located within the seismogenic zone of the Great Valley fault. Consequently, for near source considerations, the distance from the site to the source should be taken as <2 km, resulting in recommended Near Source Factors, Na and Nv, of 1.3 and 1.6, respectively. Structures with strength discontinuities, soft stories, plan irregularities, discontinuous shear walls and ductile moment frames are particularly vulnerable to these type of motions and should either be avoided or properly evaluated. It should be noted that the above presented site specific design spectra include the near source effects.

4.13 LIQUEFACTION POTENTIAL

In order for liquefaction of soils due to ground shaking to occur, it is generally accepted that four conditions will exist:

- The subsurface soils are in a relatively loose state,

- The soils are saturated,
- The soils are fine, granular, and uniform,
- Ground shaking of sufficient intensity should occur to act as a triggering mechanism.

The site lies in a relatively moderate to high seismic region. Based on the ground shaking which may be expected at this site, our experience with subsurface conditions at the site, and anticipated depths to groundwater, the potential for liquefaction or seismically induced settlement or bearing loss is considered unlikely.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Based on the field investigation, laboratory testing and geotechnical analyses conducted for this study, we believe it is geotechnically feasible to construct the proposed prison facility as planned, provided the recommendations presented in this report are incorporated into the project design and construction.

The investigation has revealed that the soil materials between elevation 170.4 and 172.2 meters (559 to 565 feet) may be subject to excessive total and differential settlement when loaded and wetted. The soils in this zone have been shown to be sensitive to hydrocompaction. Hydrocompactive soil has a loose skeletal structure which is weakly cemented by soluble salts and/or minor amounts of clay. Increases in soil moisture reduce the interparticle cementation (dry strength) of the soil resulting in a significant decrease in the volume of the soil structure. This condition can lead to significant settlement in areas subject to post construction moisture increases. We have presented recommendations for preparation of the site and construction of foundations that will reduce potential impacts of these conditions on the new construction. Proper observation and monitoring, as well as some flexibility, are extremely important during site earthwork operations to provide sound and economical mitigation.

It is our professional opinion the site may be developed for the proposed facility using conventional grading and foundation construction techniques. Groundwater was not encountered in our investigation and should not impact the planned development.

Based on discussions with the civil designer, a significant amount of import soil will be required to facilitate site development. In the interest of decreasing foundation embedment and pavement sections, increasing the ease of earthwork operations, and reducing expansion related concrete reinforcement, Kleinfelder contacted a local aggregate supplier to check the availability of local granular import materials. Kleinfelder contacted Granite Construction (Granite) located in Coalinga regarding the availability of local granular borrow sources. Granite indicated a majority of the local borrow materials come from land leveling operations and the soils typically generated would be similar to the soils at the site of the proposed prison Facility. However, Granite mentioned a land leveling project located in Avenal (approximately 24 km southeast of the project site) beginning in the near future that may produce more granular soil than typically found in the Coalinga area. Granite estimated the R-value of the Avenal soil may be above 20. The R-value of the on-site soil and typical local borrow materials is 5 or less by expansion. Recommendations provided in this report are based on the on-site or similar soil. If compatible with construction scheduling or project economics, consideration could be given to importing select material to reduce some project components, e.g. pavement sections.

Specific comments as well as general recommendations regarding the geotechnical aspects of project design and construction are presented below.

5.2 EARTHWORK

Based on the apparent low availability of local granular borrow sources for the planned import soil, we have presented the following recommendations anticipating the use of on site soils or similar import materials.

5.2.1 Site Preparation

5.2.1.1 Stripping and Grubbing

Prior to general site grading, existing vegetation, surface obstructions, and any debris should be stripped and disposed of outside the construction limits. We estimate the depth of stripping to be approximately 25 to 75 mm (1 to 3 inches) over a majority of the site. Stripped topsoil, less any debris, may be stockpiled and reused for landscape purposes; however, this material should not be incorporated into engineered fill, unless it is possible to sufficiently mix material to produce an organic content less than 0.3 percent by weight.

5.2.1.2 Existing Utilities, Wells, Foundations and Other Obstructions

During site demolition and prior to actual site grading, a reasonable search should be conducted to locate any abandoned underground structures and undocumented fill. Any encountered subsurface obstructions should be removed and disposed of off-site. Stockpiled soil or undocumented fill may be reused provided it meets the applicable requirements provided below (see Section 5.2.3, "ENGINEERED FILL").

Excavations for removal of the above items should be dish-shaped (with sides sloped 1:3, vertical to horizontal, or flatter) and backfilled with engineered fill. Any existing wells should be abandoned in accordance with applicable regulatory requirements.

5.2.1.3 Over-Excavation

5.2.1.3.1 General

In areas to receive fill or where the planned cut is less than 0.6 meters (2.0 feet), the existing surface soil should be over-excavated to a depth of 0.6 meter (2.0 feet) below the existing original ground surface. [For example, if the planned cut is 0.2 meter, the over-excavation would be 0.4 meter below finish grade.] The area of over-excavation should extend laterally beyond the edge of any fill area or site improvement a distance of at least 3 meters (10 feet). With these provisions site differential settlement due to subsurface soil consistency and collapse under loads associated with site grading would be on the order of 13 to 19 mm (0.5 to 0.75 inches). The exposed surface should be processed in accordance with Section 5.2.1.4. This general over-excavation is intended for areas not supporting structures or rigid improvements which could not tolerate the potential differential settlement. Sections below provide for over-excavation requirements in structure areas.

The over-excavated soil may be reused as engineered fill (see Section 5.2.3, "ENGINEERED FILL").

5.2.1.3.2 Building Areas

To reduce the potential post-construction differential settlement due to fill loads and lighter foundation loads to less than 7 mm (0.25 inch), the existing surface soil within building areas should be over-excavated to a minimum depth of 1.3 m (4 feet) below the existing ground surface. Where column and wall loads exceed approximately 225 kN (50 kips) and 2.7 kN/m (2 kips/foot), respectively, additional over-excavation will be required to reduce potential post-construction differential settlement to less than 7 mm (0.25 inch). Guidelines for the required depths of overexcavation for various wall and column load ranges are presented in Table 5.2.1-1. The over-excavation should extend laterally beyond the buildings or foundation perimeters a distance equal to the total thickness of engineered fill.

TABLE 5.2.1-1
OVER-EXCAVTION

Foundation	Load Range	Minimum Required Total Over-Excavation Below Existing Ground Surface
Wall	< 2.7 kN (2 kips/ft)	1.2 m (4 feet)
	> 2.7 kN (2 kips/ft)	2.2 m (7 feet)
Column	< 225 kN (50 kips)	1.2 m (4 feet)
	225 to 355 kN (50 to 80 kips)	1.8 m (6 feet)
	355 to 1555 kN (80 to 350 kips)	2.2 m (7 feet)

The exposed surface should be processed in accordance with Section 5.2.1.4. The over-excavated soil may be reused as engineered fill (see Section 5.2.3, "ENGINEERED FILL").

5.2.1.4 Scarification and Compaction

Following site stripping and any required grubbing and/or overexcavation, we recommend all areas receiving engineered fill or to be used for the future support of structures be scarified to a depth of 200 mm (8 inches), uniformly moisture-conditioned to at least 5 percent above the optimum moisture content, and compacted to at least 90 percent relative compaction.

5.2.2 Temporary Excavations

5.2.2.1 General

All excavations must comply with applicable local, State, and Federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing the following OSHA trench safety information below solely as a service to KMD. Under no circumstances should the information provided be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

5.2.2.2 Excavations and Slopes

The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, State, and/or Federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

Near-surface soils encountered during our field investigation consisted predominately of stiff clay with occasional interlayers of silty sand and silt. All excavations should be constructed and maintained in conformance with current OSHA requirements (29 CFR Part 1926) for Type B soil (cohesive soil). Some localized layers of granular material may be encountered that may require flattening of excavation slopes.

5.2.2.3 Construction Considerations

Heavy construction equipment, building materials, excavated soil, and vehicular traffic should be kept sufficiently away from the top of any excavation to prevent unanticipated surcharging. If it is necessary to encroach upon the top of an excavation, Kleinfelder can provide comment on slope gradients or shoring to address surcharging, if provided with the geometry and loading. Shoring, bracing, or underpinning required for the project (if any), should be designed by a professional engineer registered in the State of California. Lateral pressures presented in Section 5.4.3 of this report can be used in shoring design.

During wet weather, earthen berms or other methods should be used to prevent runoff water from entering all excavations. All runoff should be collected and disposed of outside the construction limits.

5.2.3 Engineered Fill

5.2.3.1 Materials

All engineered fill soils should be nearly-free of organic or other deleterious debris, have a plasticity index and expansion index less than 35 and 70, respectively, and less than 76 mm (3 inches) in maximum dimension. The on-site soil is considered suitable for use as engineered fill. Any imported fill should meet the minimum following guidelines:

a. Plasticity Index should be less than 35 or expansion index of less than 70.
b. All particles should be less than 3 inches in size and free of debris.
c. Organic content should be less than 0.3 percent by weight.

These minimum guidelines will result in import material similar to the on-site soil. Import soil more granular in nature will likely aid in the ease of constructability and may allow for reduced criteria for some site improvements (e.g. paving).

All imported fill materials, to be used for engineered fill should be sampled and tested by the project Geotechnical Engineer prior to being transported to the site.

5.2.3.2 Compaction Criteria

On-site or similar soils used for engineered fill should be uniformly moisture-conditioned to at least 5 percent above optimum moisture, placed in horizontal lifts less than 200 mm (8 inches) in loose thickness, and compacted to at least 88, but not more than 92 percent relative compaction. Disking and/or blending may be required to uniformly moisture-condition soils used for engineered fill. Import soil with a PI less than 12 should be moisture conditioned to at least optimum and compacted to a minimum relative compaction of 90 percent. The upper 150 mm (6 inches) of subgrade soil within pavement areas should have a moisture content above optimum and be compacted to at least 90 percent, but not more than 95 percent relative compaction if the PI is greater than 12 and at least 95 percent relative compaction if the PI is less than 12. Pavement subgrade compaction and moisture should be checked immediately prior to placing pavement sections.

5.2.4 Test Procedures

All necessary compliance testing should be in accordance with the latest ASTM standards. Maximum dry density and optimum moisture content should be determined by ASTM D-1557.

5.2.5 Volume Loss

Based on the in-place densities obtained from the test borings, it is estimated the change from cut to fill volume in the upper 1.2 meters (4 feet) across the site will range from 3% to 22% loss, with the average volume loss about 12%. It is estimated the change from cut to fill volume below 1.2 meters (4 feet) extending to a depth of approximately 2.7 meters (9 feet) will range from 2% to 22% loss, with the average volume loss about 8%. The volume loss associated with the cut to fill was based on an average compaction during construction of 90% of maximum dry density in accordance with test method ASTM D-1557.

The calculations for developing estimates of an earthwork factor are based on very limited data, and caution should be exercised in the application of this factor in cost estimating and volume calculations. The volume of material tested for in-place density is commonly as small as one ten-thousandth of one percent of the total volume of material to be excavated. Subjective assumptions must be made to perform the calculations, which can effect the accuracy of the results. These include the anticipated relative compaction of the material when placed as fill and uniformity of the materials. In addition, volume loss estimates are based only on density assumptions and do not consider other forms of loss (e.g., demolition, grubbing, spillage, wastage or subsidence), which can be substantial.

5.2.6 Trench Backfill

5.2.6.1 Materials

Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of soil compatible with design requirements for the pipe. Material specifications should fulfill local codes and/or bedding requirements for specific types of pipes. We recommend the project Civil Engineer develop the material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study. Trench zone backfill (i.e., material placed between the pipe zone backfill and finished subgrade) may consist of imported or native soil which meets the requirements for engineered fill provided above.

5.2.6.2 Compaction Criteria

All trench backfill should be placed and compacted in accordance with recommendations provided above for engineered fill (Section 5.2.3). Reduced compaction (85% minimum) could be specified for trench zone backfill in non-structural and non-pavement areas. Mechanical compaction is recommended; ponding or jetting should not be used.

5.3 PIPELINE DESIGN

5.3.1 Pipe loading

The upper native soil is generally considered "stable" in relation to Section 7 of ASTM D2321, or compatible with Trench Type 2 of the Bureau of Reclamation guides. The recommended soil modulus, E', for use when design utilizes the Iowa formula for initial deflection analysis is presented in Table 5.3-1. The values for undisturbed native soil include a judgmental consideration of the natural aging cementation.

Table 5.3-1

Relative Compaction (%)	Soil Modulus, E' (Mpa) [psi]		
	Less than 1.5 m Cover	1.5 to 3 m cover	3 to 4.6 m cover
85	5.2 [750]	6.9 [1000]	7.9 [1150]
90	6.9 [1000]	9.7 [1400]	11.0 [1600]
Undisturbed On-site	5.2 [750]	6.9 [1000]	7.9 [1150]

Table 5.3-2 presents the anticipated average unit weight of on-site soil utilized as backfill.

Table 5.3-2

Backfill Compaction %	Average Unit Weight (kN/m^3) [psf]
85	17.1 [109]
90	18.1 [115]
95	19.1 [122]

5.3.2 Resistance to Longitudinal Loading

Loading along the axis of pressurized pipe may be resisted by friction along the pipe and lateral bearing of thrust blocks. Frictional resistance and lateral bearing may be used in combination.

5.3.2.1 Frictional Resistance

Table 5.3-3 presents the allowable frictional resistance between various pipe types and properly compacted pipe zone backfill consisting of on-site or similar soil. Data are presented for reinforced concrete pipe (RCP) or cement coated pipe and uncoated steel and smooth plastic pipe and for sustained longitudinal loading and test condition loading.

Table 5.3-3

Pipe Type	Allowable Frictional Coefficient	
	Sustained Loading	Test Loading
RCP/Cement Coated/Rough Steel	0.33	0.40
Un-coated Steel / Smooth Plastic	0.21	0.25

Should other pipe types be used, appropriate data could be provided consistent with the pipe roughness.

5.3.2.2 Thrust Blocks

The lateral load on shallow thrust blocks (blocks height greater than 70% of depth to center of pipeline) pour against undisturbed soil can be resisted by the passive lateral bearing provided in Section 5.4.4. The comments on estimated horizontal deflection in Section 5.4.4 would be applicable to shallow thrust blocks (D would be depth from ground surface to bottom of thrust block).

Deep thrust blocks (block height less than 70% of the depth to the pipe center) can be designed for the uniform lateral bearing pressure determined from the following expressions. H in the expressions represents the block height in meters (H in feet for US Customary).

Loading	Allowable Lateral Bearing
Sustained	69.7 + 127.3 H kPa (1450 + 810 H psf)
Test	104.6 + 190.9 H kPa (2180 + 1215 H psf)

The estimated horizontal deflection associated with the above lateral bearing is about 7 mm (0.25 inch) per 100 kPa (2000 psf) of lateral bearing.

5.4 SPREAD FOUNDATIONS

5.4.1 General

Grading operations will result in foundations being supported entirely on engineered fill. Vertical bearing pressures and settlements are based on the over–excavation requirements presented in Section 5.2.1.3. The over-excavation requirements presented are considered very important and should be incorporated into the project plans and specifications.

5.4.2 Allowable Vertical Bearing Pressures and Settlements - Buildings

Conventional spread footing foundations can be supported on properly compacted fill. Two geotechnical issues are considered in arriving at the design bearing pressure for conventional footing foundations; (1) shear strength of the foundation soil and (2) tolerable settlement. Footing depths should be consistent with structural considerations and constructability issues. As a minimum, footings should be embedded at least 450 mm (18 inches) below the lowest adjacent final grade.

The bearing capacity, based only on the shear strength of the soil, will be dependent upon the footing geometry. Presented below are the expressions for the allowable bearing capacity (shear strength considerations only) for static loading (D.L. + L.L.) and total combined loading (D.L. + L.L. + transient loading, such as wind or seismic).

TABLE 5.4-1
BEARING CAPACITY

	Allowable Bearing (kPa) [psf]	
	Continuous	**Column**
Static Loading	69.7 + 72.2D + 29.9B [1450 + 460D+ 190B]	69.7 + 72.2D + 23.6B [1450 + 460D+ 150B]
Total Combined Loading	104.6 + 108.6D + 44.9B [2180 + 690D+ 285B]	104.6 + 108.6D + 36.1B [2180 + 690D+ 230B]

Note: B is footing width in meters and D is footing embedment depth in meters (in feet for US Customary)

The design bearing pressures are net values so the weight of embedded concrete does no need to be included in the foundation loading.

Analysis, utilizing laboratory compression data, determined the following estimated settlements based on a range of assumed structural loads. Presented in Table 5.4-2 are estimated settlements for continuous wall foundations and lightly loaded column foundations [columns with loads less than 170 kN (40 kips)]. The estimated settlements in Table 5.4-2 are valid for bearing pressure less than indicated by table 5.4-1. Settlement curves for various design loads and bearing pressures for columns supporting between 170 and 1560 kN (40 to 350 kips) are presented on Figure 5.4-1. The curves present the relation between column load (D.L. + L.L.) and design bearing pressure for settlements of 13 mm (0.5 inch), 19 mm (0.75 inch), 25 mm (1.0 inch), 32 mm (1.25 inch), and 38 mm (1.5 inch). The analysis assumed 80 percent of the total column load was sustained loading.

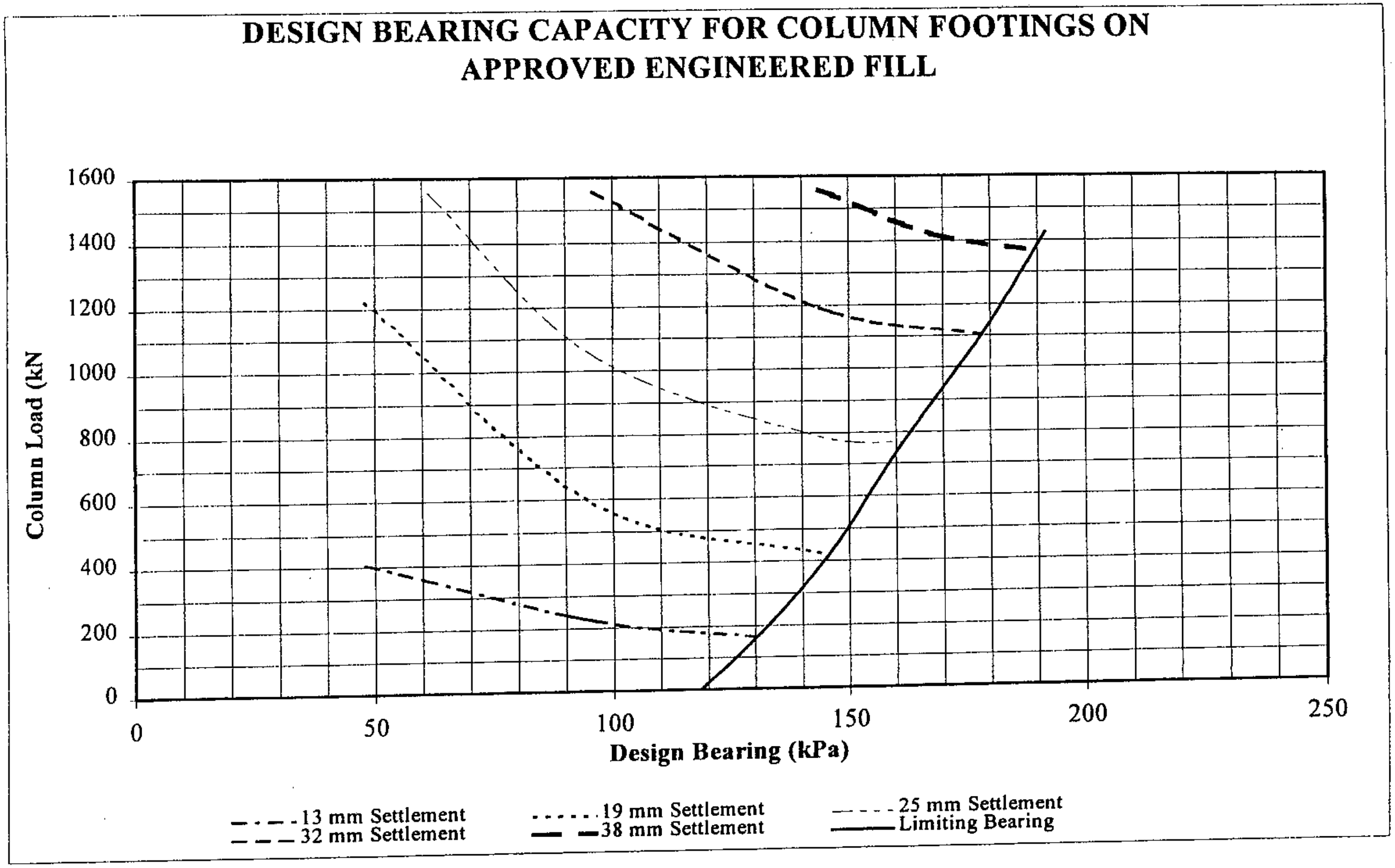
TABLE 5.4-2
ESTIMATED SETTLEMENT

Wall Loading	
Loading (kN/m) [kip/ft]	**Estimated Settlement(1) (mm) [inch]**
Up to 1.4 [1.0]	<7.0 [<0.25]
6.8 [5.0]	13.5 [0.50]
11.0 [8.0]	20.0 [0.75]
Column Loading	
Loading (kN) [kip]	**Estimated Settlement(1) (mm) [inch]**
Up to 45 [10]	<6.5 [<0.25]
45 to 9170 [10 to 40]	<11.0 [<0.50]

Note: (1) Applicable to any design bearing pressure less than determined from Table 5.4-1.

FIGURE 5.4-1

ESTIMATED SETTLEMENT



Differential settlement as a result of variation in soil consistency or collapse between footings designed for equal settlement is estimated to be less than 7 millimeters (0.25 inch). For footings with design bearing pressures associated with differing estimated settlement, the potential differential settlement should be considered as the difference in estimated settlement plus 7mm (0.25 inch).

To economize foundation sizes and to reduce potential differential settlement between columns under various loads, consideration could be given to using large design bearing capacities and placing the footings on select granular material. California Department of Transportation (Caltrans) Class 2, aggregate base or approved equivalent could be used for support of foundations. Each 305 mm (12 inches) of aggregate base placed beneath footings would reduce the estimated settlement in Figure 5.4-1 by about 2.5 mm (0.1 inch).

Settlement analysis has assumed light footing foundations would be placed a minimum of 0.45 meters (1.5 feet) below the lowest adjacent finished grade and the heaviest footings would be 0.9 meters (3 feet) below finished grade.

5.4.3 Allowable Vertical Bearing Pressures and Settlements - Tanks

5.4.3.1 Vertical Bearing Capacity And Settlement

The foundation soil has sufficient strength to support the reservoir tanks. The stress increase from the product load of 65.9 kPa (1375 psf) over the 24.4 meter (80-foot) diameter will influence foundation soil to a depth of approximately 14.6 meters (48 feet). It is estimated the settlement produced by the stress increase will be about 79 mm (3.1 inches) at the tank perimeter and 127 mm (5.0 inches) at the tank center. The foundation soil is considered relatively uniform. Consequently with the recommended site grading (including general over-excavation, Section 5.2.1.3.1) , it is anticipated the differential settlement along the tank perimeter due to the product load will be less than 13 m (0.5 inch). Potential post-construction differential settlement due to saturation of potentially collapsible soils between elevations 171.6 and 171.0 meters (563 and 561 feet) is estimated to be approximately 23 mm (0.9 inch) over a distance of approximately 4.6 m (15 feet). If this differential settlement due to potential collapse is excessive, overexcavation and recompaction of the hydrocompactive soil layer should be performed. For this condition, the soil should be removed 1.2 meters (4 feet) below original grade and the exposed surface processed in accordance with Section 5.2.1.4. The over-excavated soil may be used as engineered fill (see Section 5.2.4, "ENGINEERED FILL").

5.4.3.2 Vertical Bearing Capacity And Settlement - Ringwall Footing

The allowable bearing pressure for the ring footing supporting the tank static wall loads and dynamic loads will be dependent upon the width and depth of the ring footing, the thickness of the sketch plate and the confining effect of the tank product load. The following table presents the allowable bearing capacities for static (D.L. + long-term L.L.) and the total combined load (D.L. + L.L. + dynamic) loading conditions, assuming a sketch plate thickness of 7 mm (0.25) inch and the tank both empty and full.

TABLE 5.4-3

Tank Condition	Allowable Bearing Capacity (kPa) [psf]	
	Static Loads	**Total Combined Loads**
Empty	69.7 + 72.2D + 29.9B [1450 + 460D+ 190B]	69.7 + 72.2D + 23.6B [1450 + 460D+ 150B]
Full	69.7 + 147.6 D + 49.2 B [1450 + 960 D + 400 B]	104.6 + 229.6 D + 65.6 B [2180 + 1450 D + 600 B]

In these expressions, D represents the depth below adjacent grade of the ringwall footing and B represents the width. Both values are in meters (feet for US Customary).

The above bearing capacities consider only the shear strength of the soil. Tolerable settlement may be the factor governing the design bearing pressure. It is estimated the settlement of the ring footing will be about 10 mm (0.4 inch) per 48 kPa (1000 psf) of long-term (static) bearing (excluding product loading), to design pressures of about 287 kPa (6000 psf). The anticipated settlement associated with transient loading is about 8 mm (0.3 inch) per additional 96 kPa (2000 psf) of transient bearing.

5.4.3.3 Tank Seismic Design

The project site is underlain by more than 12.2 meters (40 feet) of soft clay. The site profile would be categorized as "Soil Profile Type D" by AWWA D100-84 (Welded Steel Tanks) or AWWA D103-97 (Bolted Steel Tanks). The recommended site amplification factor, S, associated with this profile would be 2.0. The Seismic Zone Coefficient, Z, would be 0.4 for this site.

5.4.3.4 Pre-loading of Tanks

As mentioned previously, it is estimated the settlement produced by the stress increase from the product load will be about 79 mm (3.1 inches) at the tank perimeter and 127 mm (5.0 inches) at the tank center. If desired, to avoid potential undesired affects on permanent utility connections at the tanks due to tank settlement, the tanks could be pre-loaded (pre-filled) prior to performing permanent connections. Prior to pre-loading, several settlement points should be established around the perimeter of each tank and monitored until movement has sufficiently stabilized. The records of settlement should be reviewed by the geotechnical engineer prior to completing permanent utility connects.

5.4.4 Lateral Earth Pressures

The lateral earth pressure against retaining structures will be dependent upon the ability of the walls to deflect to mobilize available soil strength. Presented in Table 5.4-4 are the active, at-rest, and braced lateral earth pressures associated with on-site soil as backfill. The active soil pressure is applicable to walls capable of 0.0005 radian deflection at the top of the wall. The at-rest pressure should be used for walls fully fixed against rotation or translation. Walls restrained from translation at the top and bottom (e.g. dock-height loading wall), but able to deflect 0.0005 radian between restrained points, should be designed for the braced lateral pressure. These lateral earth pressures assume a drained backfill condition. Use of granular non-expansive backfill to a distance behind the equal to 80 percent of the height would allow for reduced lateral pressures.

TABLE 5.4-4

LATERAL EARTH PRESSURES

Fixity	**Drained Condition** (Static)	**Drained Condition** (Dynamic Incremental Increase)
Active	6.9 kPa/m (44 psf/ft)	3.5 kPa/m (22 psf/ft)
At-Rest	13.5 kPa/m (86 psf/ft)	13.5 kPa/m (14 psf/ft)
Braced	4.4 H kPa (28 H psf)	2.4 H kPa (15 H psf)
Note: H is the height of the wall in meters (feet for US Customary)		

The value for at-rest pressure includes the Jaky solution for normally consolidated material and consideration for the locked-in pressure associated with soil pre-stressing due to backfill compaction.

Lateral loads applied to foundations can be resisted by a combination of passive lateral bearing and base friction. The allowable and ultimate passive pressures and frictional resistance for the footings are presented in Table 5.4-5.

TABLE 5.4-5

PASSIVE PRESSURES AND FRICTIONAL COEFFICIENTS

	Allowable	**Ultimate**
Frictional Resistance	0.31N + 6.4 kPa (0.31N + 135 psf)	0.46N + 9.9 kPa (0.46N + 200 psf)
Static Passive Pressure	29.8D + 14.4 kPa (190D + 300 psf)	59.6 D + 28.7 kPa (380D + 600 psf)
Dynamic Passive Pressure	6.1D + 8.1 kPa (39D + 170 psf)	12.1 D + 16.3 kPa (77D + 340 psf)
Lateral Translation Needed to Develop Static Passive Pressure	0.001 D	0.007 D
Note D is footing depth in meters (feet in US Customary) and N is the normal pressure		

If the deflection resulting from the strain necessary to develop the passive pressure is beyond structural tolerance, additional passive pressure values could be provided based on tolerable deflection. The passive pressure and frictional resistance can be used in combination.

5.4.5 Construction Considerations

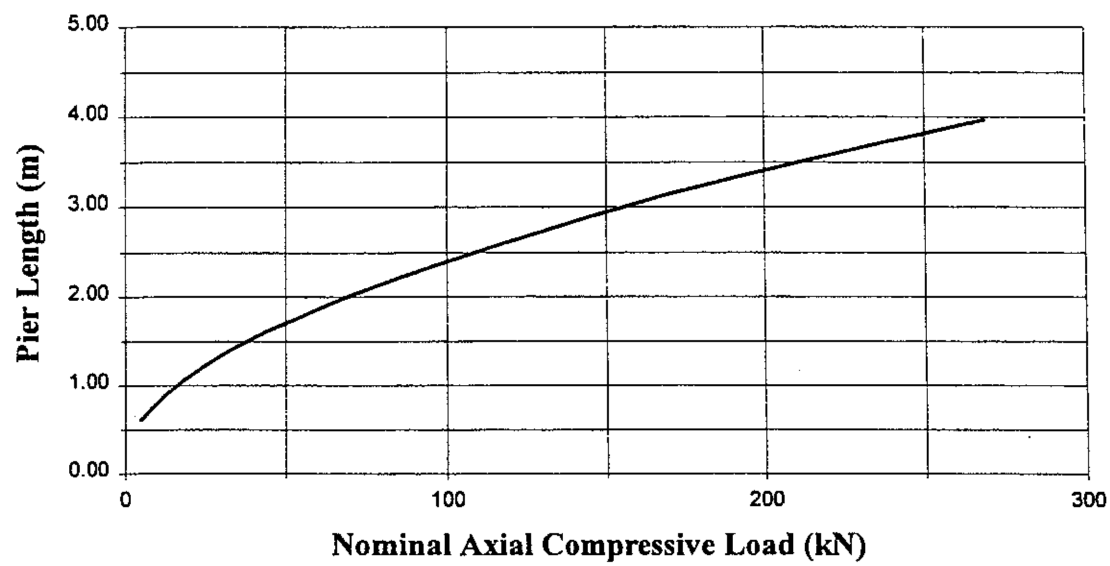
Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. All footing excavations should be observed by the project Geotechnical Engineer just prior to placing steel or concrete to verify the recommendations contained herein are implemented during construction.

5.5 PIER FOUNDATIONS

5.5.1 Vertical Bearing Capacity – Security Lighting and Fencing

CIP concrete piers are considered applicable to support facility security lighting and fencing and resist lateral loads. Axial loads should be supported by the frictional capacity of CIP concrete piers. The allowable frictional capacity verse embedment depth of a 610 mm (24-inch) diameter pier is provided in Figure 5.5-1. The allowable capacity may be increased by one third for the total of all loads, including wind and seismic. The uplift capacity of piers should be taken as 70% of the compressive frictional capacity plus the weight of the pier.

FIGURE 5.5-1



The frictional capacity (compression or uplift) is proportional to the pier diameter at a corresponding depth (e.g., the capacity of a 915 m diameter pier embedded to a depth of 1.8 m will have 1.5 times the capacity of a 610 mm diameter pier with the same embedment). Pier spacing should be at least three pier diameters center-to-center. The total settlement of friction piers designed in accordance with the above recommendations should be less than 7 mm (0.25 inches). The concrete mix and reinforcement for CIP concrete piers should be designed by the project structural engineer.

5.5.2 Resistance to Lateral Loads

For short piers the allowable passive pressure to resist lateral loads may be taken as 63.6 kPa per meter of depth of embedment + 15.5 kPa (405 psf/ft + 325 psf). This value includes arching. Short piers are defined by the following expression: $\mathbf{L(m) = 5.3*D^{0.8}}$ [$\mathbf{L(ft) = 6.6*D^{0.8}}$], where L is the pier length and D is the diameter. Both dimensions are in meters (in feet for US Customary). The passive pressure above may be increased by one-third for the total of all loads, including wind and seismic.

If pier lengths exceed the length determined in the above expression, the passive pressure above may not be appropriate for use in pier design to resist lateral loads. Therefore, Kleinfelder should be contacted for design recommendations to resist lateral loads for long piers. Anticipated loading and associated pier length for 13 mm (0.5-inch) lateral deflection of security lighting and fences are presented below.

TABLE 5.5-1

ANTICIPATED FOUNDATION LOADS

Structure	**Anticipated Maximum Loads Top of Pier**
Security Fencing	Vertical – 2.2 kN (0.5 kips)(1) Shear – 3 kN (.67 kips) Moment – 7.3 kN-m (5.33 kip-ft)
Security Lighting	Vertical – 9.4 kN (2.1 kips) Shear – 23.2 kN (5.2 kips) Moment – 242.7 kN-m (179 kip-ft)

Note: (1) Assumed vertical load

TABLE 5.5-2

ESTIMATED PIER LENGTH

FOR ESTIMATED 12.7 MM HEAD DEFLECTION

Structure	Pier Diameter (mm)	Estimated Pier Length (m)
Security Fencing	305	1.93
	455	1.60
	610	1.42
Security Lighting	1220	6.40
	1525	5.79

The passive pressure values provided in this report consider arching and should not be used in place of the values given in Table No. 18-I-A of the 1998 California Building Code (CBC) if designing pier foundations utilizing the pole formulas in the CBC.

5.5.3 Construction Considerations

Due to the presence of generally cohesive soil extending from the near surface to the maximum depth explored, it is anticipated that CIP concrete pier borings could be uncased. Groundwater was not encountered during our field exploration within the depth of exploration, maximum of 15.7 meters (51.5 feet) below grade. Therefore, groundwater should not impact the construction of CIP concrete piers.

Pier borings should be inspected and approved by the geotechnical engineer prior to installation of reinforcement. Concrete placement by pumping and tremie tube to the bottom of the pier borings is strongly advised. Concrete placement should be addressed in the specifications which should require that sufficient space is provided in the pier reinforcing cage during fabrication to allow the insertion of a tremie tube for concrete placement. The pier reinforcing cage should be installed and the concrete pumped immediately after drilling is completed.

5.6 SOIL CORROSION

Two (2) soil samples obtained from test borings (listed on Table 5.5-1) at depths ranging from 0 to 1.5 meters (0 to 5 feet) were tested to evaluate pH, minimum electrical resistivity, soluble sulfate content, and soluble chloride content. Specific test results are presented on Table 5.6-1.

TABLE 5.6-1
CORROSION RELATED TESTING

Boring No.	Depth (m).	PH	Resistivity at Field Moisture (ohm-cm)	Minimum Resistivity (ohm-cm)	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)
B-10	0.3 – 1.52	7.2	4,200	989.1	3,680	<0.1
B-45	0 – 0.91	7.2	3,000	659.4	6,200	340

The resistivity at field moisture would indicate only a mild corrosive environment. However, as soil moisture increases, the resistivity decreases. The minimum resistivities would indicate a moderate to corrosive environment. Where critical piping is planned or where repair of piping is difficult, a qualified corrosion engineer should be consulted for specific recommendations on pipe materials and protection measures.

Test results generally suggest a high level of soluble sulfates and low to moderate concentration of chlorides are present in on-site soils. The relatively high sulfate content of the on-site soils would normally be considered very severely corrosive to concrete. Therefore, sulfate resistant cement such as Type V with pozzolan (see 1998 California Building Code, Table 19-A-4) should be considered for design.

5.7 CONCRETE SLABS-ON-GRADE

5.7.1 Slab Design

The on-site, near surface soils across the site and anticipated local borrow materials are considered moderately expansive, with the on-site plasticity indexes (P.I.) ranging from 17 to 34 and an Expansion Index (E.I.) of up to 68. Slabs-on-grade should be designed to accommodate the expansive nature of the on-site soils. Based on geotechnical considerations, nominal 100 mm (4-inch) thick slabs should be reinforced with a minimum of #3 bars placed 460 mm (18 inches) on center in both principle direction, or an equivalent. These recommendations are based on engineering judgment and experience associated with expansive soil and is not based on any structural analysis. The slab subgrade should have a moisture content of at least 5 percent over optimum to a depth of at 0.6 meter (2 feet) immediately prior t0 placing the vapor barrier or concrete (in the absence of a vapor barrier).

The thickness and reinforcement of slabs-on-grade associated with structural considerations should be designed by the project structural engineer or building designer. A modulus of subgrade reaction of 54.2 MN/m^3 (200 pci) can be used for elastic analysis of slabs-on-grade. Slabs should be provided with construction or control joints. As a minimum, we recommend the ratio of joint spacing to slab thickness be 25:1. The maximum joint spacing should be 4.5 meters (15 feet). The reinforcing steel in the concrete slab-on-grade should be tied into the perimeter footings. The exterior concrete slabs-on-grade, such as sidewalks and driveways, will also be subjected to the effects of expansive soils. We recommend that frequent crack control joints be constructed to minimize adverse crack patterns. There should be total separation of exterior slabs from structural slabs. Separation of segments should be positive and full depth.

5.7.2 Building Slabs

Building slabs-on-grade should be supported on engineered fill as described in the "Earthwork" Section of this report. In areas to receive moisture-sensitive floor coverings, we recommend that the subgrade be covered by a moisture proofing membrane such as 10 mil PVC, or equivalent, to act as a vapor barrier. The subgrade surface should be smooth and care should be exercised to avoid tearing, ripping, or displacing the membrane during construction. If the membrane becomes torn or disturbed, it should be properly patched, or removed and replaced. The membrane should, in turn, be covered with approximately 25 to 50 mm (1 to 2 inches) of slightly moist clean sand to protect it during construction and aid in curing the concrete. Considering the foundation soil types and depth to water, a capillary break (i.e. gravel layer) is not considered necessary.

5.7.3 Exterior Slabs

Exterior slabs-on-grade should be supported on approved engineered fill. Exterior slabs adjacent to structures should be provided with a gradient away from the structures. Due to differential moisture variations that may occur, isolated exterior slabs may creep or "walk" away from fixed structures. It should be noted that differential slab movement due to heave may also occur. Careful consideration should be made in design details (e.g. smooth dowels) to compensate for this possible movement. Such details may include providing expansion areas between exterior concrete slabs and building elements such as stucco and masonry fascia.

5.7.4 Construction Considerations

Concrete should not be placed if sand overlying the vapor barrier has been allowed to become wet (due to precipitation or excessive moistening) or if standing water is present above the membrane. Excessive water beneath interior floor slabs could result in future significant vapor transmission through the slab, adversely affecting moisture-sensitive floor coverings and could inhibit proper concrete curing.

5.8 SITE DRAINAGE

It is important that drainage away from the improvements be provided to prevent ponding and/or saturation of the soils in the vicinity of foundations, concrete slabs-on-grade, or pavements. We recommend that the site be graded to carry surface water away from the improvements and that positive measures be implemented to carry away roof runoff. Discharge from down spouts should be directed to hardscape or pipe drains. If planted areas are adjacent to the structures, we suggest that care be taken not to overirrigate and to maintain a leak-free sprinkler piping system. In addition, it is recommended that unpaved areas have a minimum of 5 percent positive fall away from building perimeters to a distance of at least 1.5 meters (5 feet). These drainage and landscape watering recommendations are considered very important. Poor perimeter or surface drainage could cause reduced subgrade support.

5.9 PAVEMENTS

5.9.1 Flexible Pavement

5.9.1.1 General

Four (4) resistance value (R-value) tests were performed on representative samples of anticipated pavement subgrade materials encountered at the site. Laboratory R-values ranging from <5 to 34 by exudation were obtained on samples of the onsite clay materials. However, the expansion pressures reduced the design R-values to <5 to 11. A design R-value of 5 has been utilized for design.

5.9.1.2 Pavement Design

The pavement design should consider both the vehicular loading, as well as the environmental factors. The vehicular loading will depend on the amount and type of traffic anticipated for the pavement design life. Environmental factors include the potential for moisture variations beneath the pavement structural section.

Detailed vehicular load and frequency information is not available for this project. However, based on discussions with the civil designer, traffic on the site will vary from light parking for automobiles and light trucks to deliveries from heavy trucks and prison busses. In addition, some improvement to Jayne Avenue may also be necessary. In the absence of specific traffic data, we have provided a range of pavement sections based on Traffic Indexes (T.I.'s) of 4.5, 5.0, 6.0, 7.0 and 8.0. These traffic design assumptions should be reviewed for compatibility with the actual development, and revised pavement sections developed, if necessary. An R-value of 5 was used for design purposes.

The flexible pavement design recommendations presented are based upon the California Department of Transportation (Caltrans) design procedures.

The flexible asphalt concrete pavement sections associated with the assumed T.I.'s are summarized as follows.

TABLE 5.8-2
AVERAGE DAILY TRUCK TRAFFIC

Traffic Index	2-Axle Vehicle	or	3-Axle Vehicle	or	5-Axle Vehicle
5.0	5.2		2.0		0.5
6.0	24.1		9.0		2.4
7.0	88.1		33.0		8.8
8.0	270.6		101.5		27.1

Asphalt concrete, aggregate base (class 2) and aggregate subbase (class 2) should conform to, and be placed in accordance with, current Caltrans Standard Specifications. The aggregate base, aggregate subbase and the upper 150 mm (6 inches) of subgrade if PI is less than 12 should be compacted to a minimum of 95 percent relative compaction as determined by the ASTM D-1557 test procedure. Where subgrade has a PI greater than 12 (e.g. on-site soil), it should be moisture conditioned and compacted to at least 90 percent, but not more than 95 percent relative compaction for a depth of 150 mm (6 inches).

5.9.2 Rigid Pavement

Rigid pavement will be utilized in the loading dock and fueling areas and other locations which might be subject to tight turning vehicles. We recommend rigid pavements consist of at least 150 mm (6 inches) of portland cement concrete (PCC) over 150 mm (6 inches) of AB. It is recommended that the pavements be placed an at least 300 mm (12 inches) of recompacted soil or engineered fill. The aggregate base and top 150 mm (6 inches) of subgrade soils if the PI is less than 12 should be compacted to at least 95 percent relative compaction. Where subgrade has a PI greater than 12 (e.g. on-site soil), it should be moisture conditioned and compacted to at least 90 percent, but not more than 95 percent relative compaction for a depth of 150 mm (6 inches).

We recommend the concrete provide a 28-day compressive strength exceeding 27.5 MPa (4,000 psi). The concrete mix should also be designed for a slump not exceeding 100 mm (4 inches). Thickened edges should be used along outside edges of concrete pavements. Edge thickness should be at least 50 mm (2 inches) greater than the concrete pavement thickness and taper to the actual concrete pavement thickness 900 mm (36 inches) inward from the edge. Integral curbs may be used in lieu of thickened edges.

Continuous sections of PCC pavement should be constructed in an approximately 4 meter (13 feet) square grid system or less. If a square system is impractical, rectangular panels having a maximum dimension of 4 meters (13 feet) can be used. Joints should be located at each grid line location, a maximum of 4 meters (13 feet) apart.

All longitudinal or transverse joints should be constructed by hand forming or by placing pre-molded filler such as zip strips. Longitudinal or transverse construction joints should be keyed or smooth dewelled. Expansion joints should be used to isolate fixed objects abutting or within the pavement area. The expansion joints should extend the full depth of the pavement. Joints should run continuously and extend through integral curbs and thickened edges. We recommend joint layout be adjusted to coincide with the corner of objects and structures.

5.9.3 Unstable Subgrade

In the event unstable (pumping) subgrades are encountered within planned pavement areas, we recommend a heavy, rubber-tired vehicle (typically a loaded water truck) be used to test the load/deflection characteristics of the finished subgrade materials. We recommend this vehicle have a minimum rear axle load (at the time of testing) of 7273 kg (16,000 pounds) with tires inflated to at least 448 kPa (65 psi) pressure. If the tested surface shows a visible deflection extending more than 150 mm (6 inches) from the wheel track at the time of loading, or a visible crack remains after loading, corrective measures should be implemented. Such measures could include disking to aerate, chemical treatment, replacement with drier material, or other methods. We recommend Kleinfelder be retained to assist in developing which method (or methods) would be applicable for this project.

6. ADDITIONAL SERVICES

6.1 PROJECT BID DOCUMENTS

It has been our experience contractors bidding on the project often contact us to discuss the geotechnical aspects of the project. Informal contacts between Kleinfelder and an individual contractor could result in misleading or incomplete information being provided to the contractor. Therefore, we recommend a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project Owner or his designated representative. After consultation with Kleinfelder, the owner or their representative should provide clarifications or additional information to all contractors bidding the job.

6.2 PLANS AND SPECIFICATIONS REVIEW

We recommend Kleinfelder conduct a general review of final plans and specifications to evaluate that our earthwork and foundation recommendations have been properly interpreted and implemented during design. In the event Kleinfelder is not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

6.3 CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork during construction be monitored by a representative from Kleinfelder, including site preparation, placement of all engineered fill and trench backfill, construction of slab and roadway subgrades, and all foundation excavations. The purpose of these services would be to provide Kleinfelder the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

7. LIMITATIONS

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil conditions could vary between or beyond the points explored. If soil conditions are encountered during construction which differ from those described herein, we should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed.

We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by Kleinfelder during the construction phase in order to evaluate compliance with our recommendations.

This report may be used only by the client and their sub-consultants and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

8. REFERENCES

Abrahamson, N.A. and Silva, W.J. (1993), Attenuation of Long Period Strong Ground Motions, Seismic Engineering - Volume 2, ASME, pp. 187-192.

Association of Engineering Geologists, 1993, Preparation and review of engineering geology / seismicity reports for hospital and school sites in California: AEG-CDMG-OSHPD.

Boore, D.M., Joyner W.B., and Fumal T.E., 1994, Estimation of Response Spectra and Peak Acceleration from Western North American Earthquakes: An Interim Report, Part 2, U.S. Geological Survey, Open-File Report 94-127.

Boore, D.M., Joyner W.B., and Fumal T.E. (1997), Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes, *Seismological Research Letters*, Vol. 68, No. 1, January/February.

California Building Code, 1998: California Building Standards Commission.

CDMG, (1986), Guidelines for Preparing Engineering Geologic Reports: California Division of Mines and Geology, CDMG Note 44.

Cornell, C.A. (1968), Engineering Seismic Risk Analysis, Bulletin of the Seismological Society of America, Vol. 58, No. 5.

Cornell, C.A. (1971), Probabilistic Analysis of Damage to Structures Under Seismic Loading, Dynamic Waves in Civil Engineering, London, Interscience.

Frankel, A.D., Mueller, C.S., Barnhard, T., Perkins, D.M., Leyendecker, E.V., Dickman, N., Hanson, S., and Hopper, M., 1996, National Seismic Hazard Maps, June 1996 Documentation, USGS Open File Report 96-532, Denver, CO.: available at web site: http://geohazards.cr.usgs.gov/eq

Greensfelder, R.W., 1975; Maximum Credible Rock Acceleration From Earthquakes in California: California Division of Mines and Geology Map Sheet 23.

Gutenberg, B. and Richter, C.F. (1956), Earthquake Magnitude, Intensity, Energy and Acceleration, Bulletin of the Seismological Society of America, Vol. 46, No. 2.

Hart, E.W. and Bryant, W.A. (1997), Fault-Rupture Hazard Zones in California: California Division of Mines and Geology, Special Publication 42, 1997 revised edition, 38p.

Hileman, J.A., Allen, C.R., and Nordquist, J.M. (1973), Seismicity of Southern California Region, 1 January 1882 to 31 December 1972, California Institute of Technology, Seismological Laboratory Contribution 2385.

Hoose, S,N., (ed.), 1986, The Morgan Hill, California, earthquake of April 24, 1984: U. S. Geological Survey Bulletin 1639.

Jennings, C.W. 1994, Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions, California Division of Mines and Geology.

Kanamori, H., 1977, The Energy Release in Great Earthquakes: Journal of Geophysical Research, Vol. 82, pp. 2981-2987.

Merz, H.L. and Cornell, C.A. (1973), Seismic Risk Analysis Based on a Quadratic Magnitude-Frequency Law, Bulletin of the Seismological Society of America, Vol. 63, No. 6.

Newmark, N.M. and Hall, W.J. (1982), Earthquake Spectra and Design, Earthquake Engineering Reserach Institute, Oakland, CA.

Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P. (1996), Probabilistic Seismic Hazard Assessment for the State of California: Division of Mines and Geology Open File Report 96-08: fault parameters are available at web site: http://www.consrv.ca.gov/dmg/shezp/fltindex.html

Real, C.R., Toppozada, T.R., and Parke, D.L., 1978, Earthquake Catalog of California, January 1, 1900 to December 31, 1974, First Edition: California Division of Mines and Geology, Special Publication 52.

Seeburger, D. A. and Bolt, B. A. (1976), "Earthquakes in California, 1769-1927", Seismicity Listing Prepared for National Oceanic and Atmospheric Administration, University of California, Berkeley.

Singh, J.P. (1984), Characteristics of Near-Field Strong Ground Motion and their Importance in Building Design, Proceedings, Applied Technology Council (ATC) Seminar on Earthquake Ground Motions and Building Damage Potential, San Francisco, March 27, ATC 10-1.

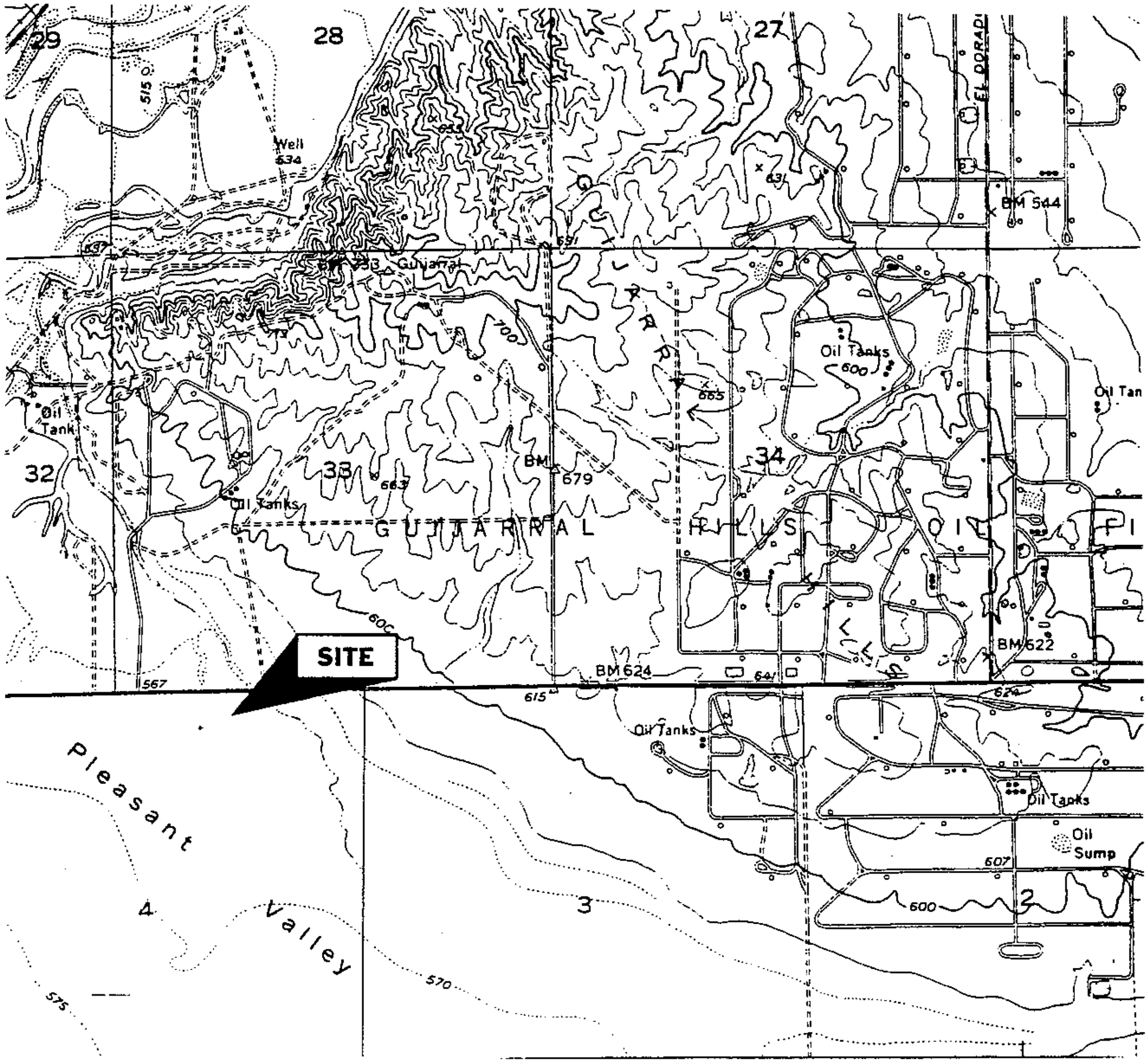
Singh, J.P. (1985), "Earthquake Ground Motions: Implications for Designing Structures and Reconciling Structural Damage", Earthquake Spectra, Vol. 1, No. 3.

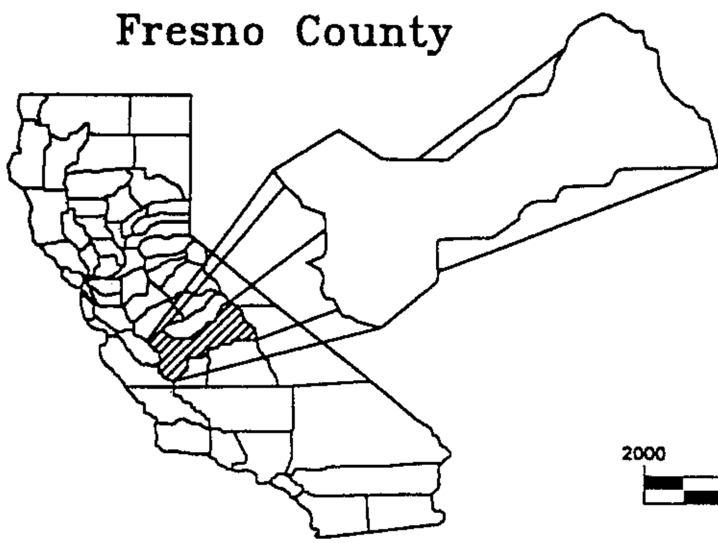
Toppozada, T. R., Parke, D. L., and Higgins, C. T., 1978, Seismicity of California, 1900-1931: California Division of Mines and Geology Special Report 135, pp. 39.

Toppozada, T. R., Real, C. R., and Parke, D. L. (1981), "Preparation of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes", California Division of Mines and Geology Open File Report 81-11 SAC, pp. 182.

Wesnousky, S.G., 1986; Earthquakes, Quaternary Faults, and Seismic Hazard in California: Journal of Geophysical Research, Vol. 91, No. B12, Pages 12,587-12,631, November 10, 1986.

Wong, I.G., Ely, R.W., and Kollman, A.C., (1988), Contemporary Seismic and Tectonics of the Northern and Central Coast Range-Sierra Block Boundary Zone, California: Journal of Geophysical Research, v. 93, pp. 7813-7833.





2000 0 1000 2000 4000

SCALE: 1 inch = 2000 ft.

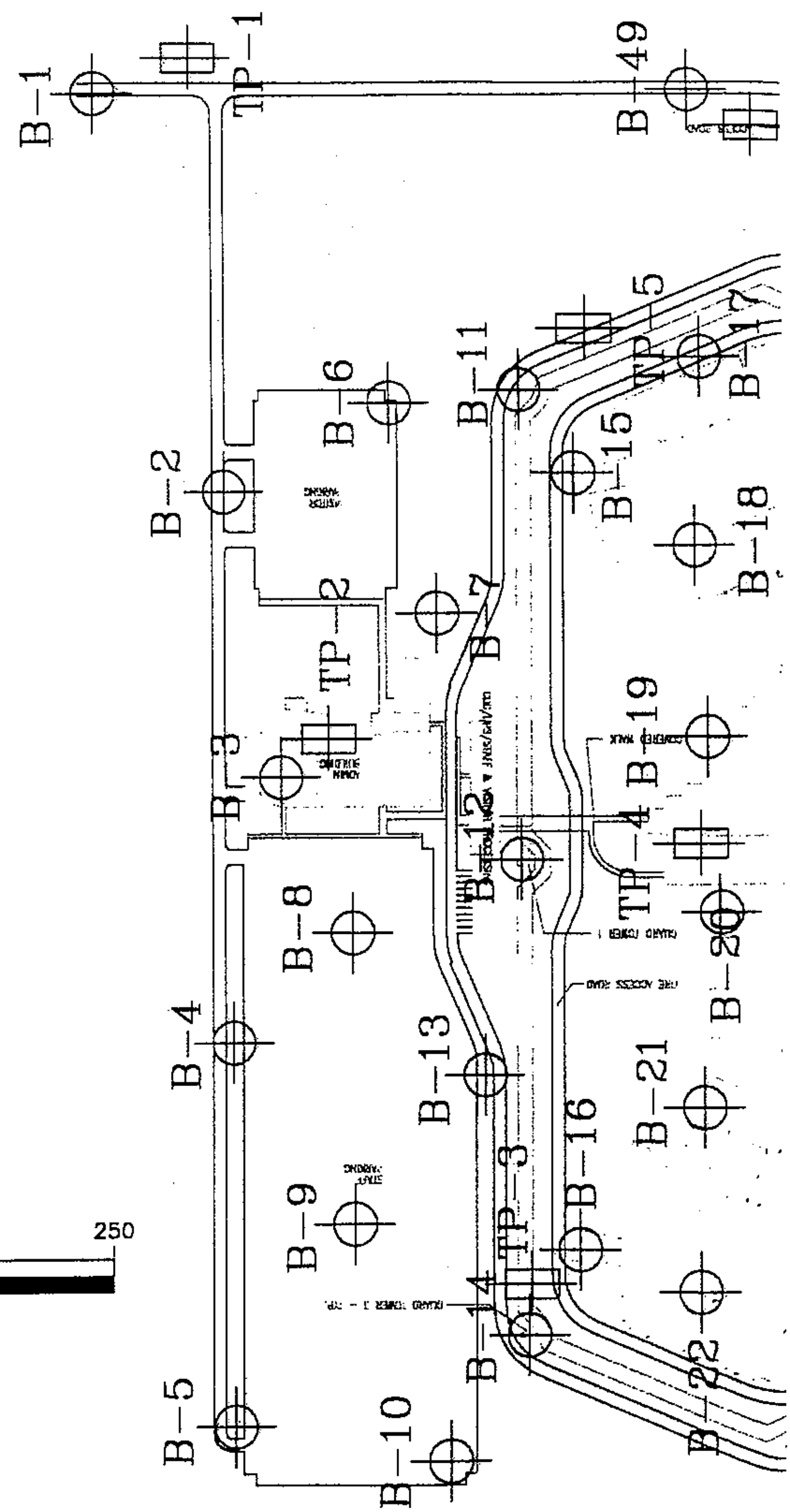
N

KLEINFELDER		SITE VICINITY PROPOSED SECURE TREATMNET FACILITY COALINGA, CALIFORNIA	PLATE 1
DRAWN BY: S. PLAUSON	DATE: 2-28-00		
PROJECT No. 21-4158-01	DWG No. site_vic		

LEGEND

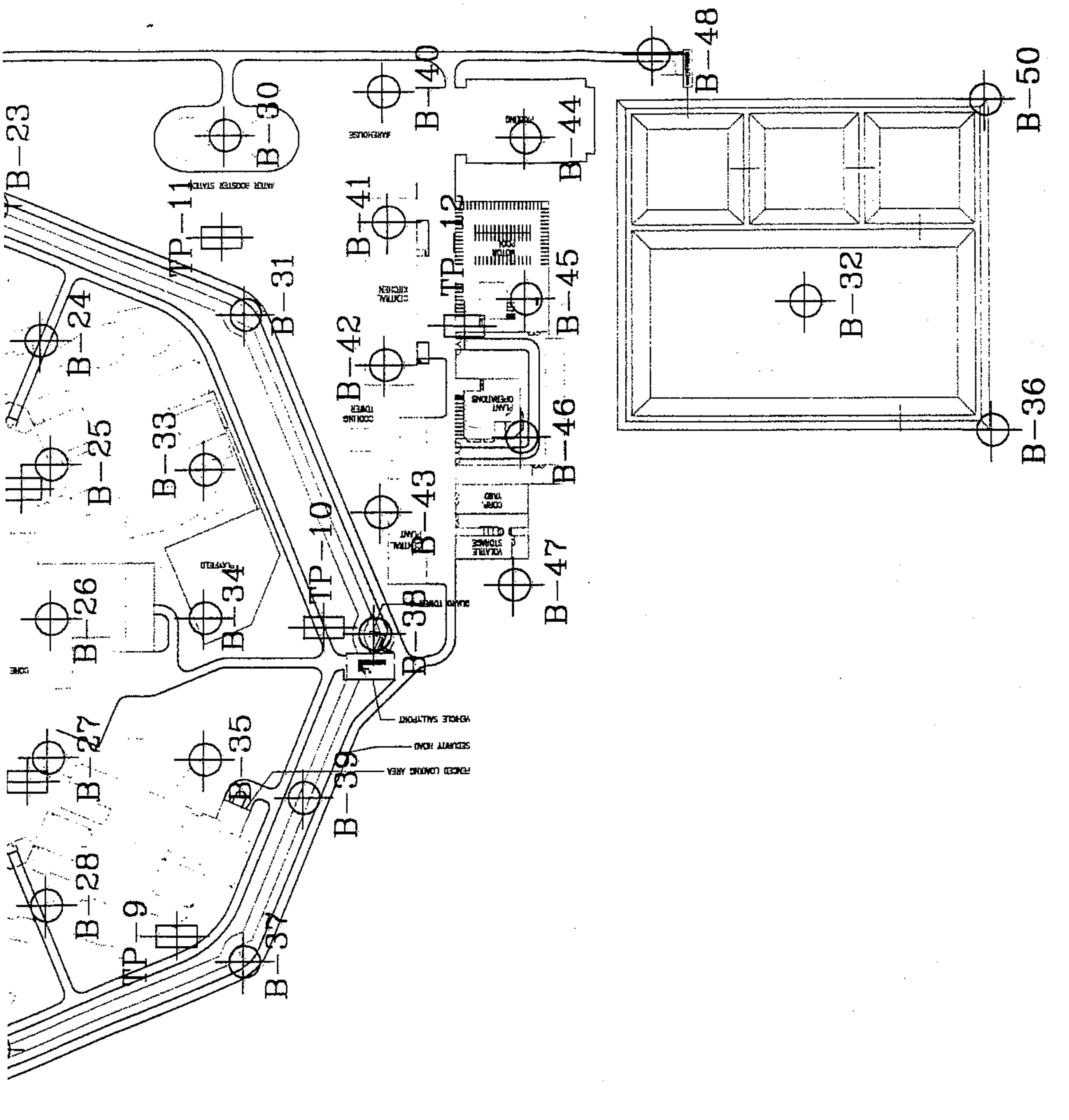
B-1 APPROXIMATE BORING LOCATION

TP-8 APPROXIMATE TEST PIT LOCATION



125 0 62 125 250

SCALE: 1 inch = 125 ft.



KLEINFELDER		SITE PLAN PROPOSED SECURE TREATMENT FACILITY COALINGA, CALIFORNIA	PLATE 2
DRAWN BY: T.NEPHEW	DATE: 02-18-00		
PROJECT No. 21-4158-01	DWG No. SITE_PLAN		

LOG SYMBOLS

Symbol	Description
	BULK/BAG SAMPLE
	MODIFIED CALIFORNIA SAMPLER (2-1/2 inch outside diameter)
	CALIFORNIA SAMPLER (3 inch outside diameter)
	STANDARD PENETRATION SPLIT SPOON SAMPLER (2 inch outside diameter)
	SHELBY TUBE SAMPLER (3 inch outside diameter)
	CONTINUOUS SAMPLER (3 inch outside diameter)
	WATER LEVEL (level after completion)
	WATER LEVEL (level where first encountered)
	SEEPAGE

Abbreviation	Description
-4	PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136)
-200	PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117)
LL	LIQUID LIMIT (ASTM Test Method D 4318)
PI	PLASTICITY INDEX (ASTM Test Method D 4318)
EI	EXPANSION INDEX (ASTM Test Method D 4829)
COL	COLLAPSE POTENTIAL
UC	UNCONFINED COMPRESSION
MC	MOISTURE CONTENT

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transistions may be gradual.

2. No warranty is provided as to the continuity of soil conditions between individual sample locations.

3. Logs represent general soil conditions observed at the point of exploration on the date indicated.

4. In general, Unified Soil Classification designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

5. A temporary benchmark for relative elevation was located at:

KLEINFELDER

Project No.: 21-4158-01

LOG KEY
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE A

KEYLOG 21415801.GPJ 3/15/00

Date Completed: 12/13/99	*Surface Conditions:* Plowed agricultural field
Logged By: S. DEIS	*Groundwater:* NFGWE
Total Depth: 3.5 meters	

Approximate Surface Elevation (m): 172.5

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							SANDY LEAN CLAY (CL) - yellow brown, damp, hard, fine grained, slightly plastic, trace white gypsum lenses
1		45					
							... rootlets
2		32					
							... brown, moist, trace fine gravel
3		50/6"					
4							
5							
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 3.5 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B- 1
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-1

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. DEIS

Groundwater: NFGWE

Total Depth: 2.0 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION — Approximate Surface Elevation (m): 172.5
				3.8				SANDY CLAY (CH) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses
1		9						
2		35	15.9	19.8				... brown, moist
3								
4								
5								
6								
7								
8								
9								
10								
11								

Notes:
1.) Bottom of boring at 2.0 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-2
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-2

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. DEIS

Groundwater: NFGWE

Total Depth: 9.6 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses
1		34	15.7	14.4			
							... gray brown, moist, rootlets
2		14					LEAN CLAY (CL) - gray brown, moist, hard, moderately plastic, some gypsum lenses
3		32					
		10					SANDY LEAN CLAY (CL) - orange brown, moist, very stiff, fine grained, slightly plastic
4							
5		33					
6							
		12					
7							... light brown, with gyspsum seams
8		11					
							... gray brown, trace gyspum lenses
9							
		11					
10							
11							

Notes:
1.) Bottom of boring at 9.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B- 3
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-3

Date Completed: 12/13/99

Logged By: S. DEIS

Total Depth: 2.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
							SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses
1		23	13.9	14.7			
2		11					... gray brown, moist
3							
4							
5							
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 2 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-4
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-4

Date Completed: 12/13/99

Logged By: S. DEIS

Total Depth: 2.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
0							SANDY LEAN CLAY (CL) - yellow brown, damp, medium stiff, fine grained, trace white gypsum lenses
1	◣	8					
2	◣	7					... gray brown, moist
3							
4							
5							
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 2.0 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B- 5
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-5

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. DEIS

Groundwater: NFGWE

Total Depth: 1.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine to medium grained, slightly plastic, trace white gypsum lenses
1								
	▮	36	15.3	21.1				Notes: 1.) Bottom of boring at 5.0 feet. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-6
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-6

Date Completed: 12/13/99

Logged By: S. DEIS

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		15					
2		21	14.5	21.4			... brown, moist, rootlets
3		10					
		18					
4							... orange brown
5		12					
6							... light brown, with white gypsum seams
		23					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 2.0 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-7
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-7

Date Completed: 12/13/99
Logged By: S. DEIS
Total Depth: 2.0 meters

Surface Conditions: Plowed agricultural field
Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses
1		14	13.9	18.0			
2		7					Notes: 1.) Bottom of boring at 2.0 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
3							
4							
5							
6							
7							
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B- 8
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-8

Date Completed:	12/13/99
Logged By:	S. DEIS
Total Depth:	2.0 meters
Surface Conditions:	Plowed agricultural field
Groundwater:	NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - yellow brown, damp, very medium stiff, fine grianed, slightly plastic, trace white gypsum lenses
1		12	15.2	13.4				
								... moist
2		8						Notes: 1.) Bottom of boring at 2.0 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
3								
4								
5								
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B- 9
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-9

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. DEIS

Groundwater: NFGWE

Total Depth: 2.0 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
0–2							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses
1	■	37	16.0	17.9			... moist
2							Notes: 1.) Bottom of boring at 2.0 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
3							
4							
5							
6							
7							
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-10
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-10

Date Completed: 12/13/99

Logged By: S. DEIS

Total Depth: 6.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
		40	15.1	16.0			SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		12					
2							... brown, moist, rootlets
3		16					
4							... red brown, increasing sand
5		23					
6		23					
7							Notes: 1.) Bottom of boring at 6.1 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-11

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-11

Date Completed: 12/13/99		*Surface Conditions:* Plowed agricultural field	
Logged By: S. DEIS		*Groundwater:* NFGWE	
Total Depth: 15.7 meters			

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		27	14.1	15.2			
							... rootlets
2		12					
							... gray brown, moist
3		24	14.5	26.4			
		15					
4							
5		13					
6		12					
7							... orange brown, increasing sand, no gypsum
8		10					
9							... light brown
		31					
10							... moderately plastic
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-12
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 2

A-12

Depth, m	FIELD Sample	Penetration Index	LABORATORY Dry Density kN/m^3	Moisture Content %	FID ppm	Perm. (cm/s)		DESCRIPTION
								(Continued from previous plate)
		19						
12		16						
13								SILTY SAND (SM) - gray moist, dense, fine to coarse grained, trace fine sub-angular gravel
14		50						
15		12						
16								Notes: 1.) Bottom of boring at 15.7 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
17								
18								
19								
20								
21								
22								
23								
24								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-12
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 2.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)
1		18	13.9	20.3		
2		6				
3						
4						
5						
6						
7						
8						
9						
10						
11						

DESCRIPTION

Approximate Surface Elevation (m): 172.5

SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets

... gray brown, moist, rootlets

Notes:
1.) Bottom of boring at 2.0 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-13
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-13

Date Completed: 12/14/99
Logged By: S. DEIS
Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field
Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)
1		20	13.4	11.8		
2		12				
3		9				
		10				
4						
5		12				
6						
		8				
7						
8						
9						
10						
11						

DESCRIPTION

Approximate Surface Elevation (m): 172.5

SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets

... gray brown, rootlets

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-14
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-14

Surface Conditions: **Plowed agricultural field**

Date Completed: **12/13/99**

Logged By: **S. DEIS**

Groundwater: **NFGWE**

Total Depth: **6.5 meters**

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): **172.5**
0							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum seams, rootlets
1		28					
2		25					... gray brown, moist
3		23	14.9	26.9			... stiff
		13					
4							
5		8					
6							
		22					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-15
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-15

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - yellow brown, damp, medium stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		6						... gray brown, moist, stiff
2		24	15.8	24.5				
3		6						
		14						
4								
5		7						
6								
		12						
7								
8								
9								
10								
11								

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

LOG OF BORING B-16
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-16

PROJECT NO. 21-4158-01

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	Sample	Penetration Index	Dry Density kN/m^3	Moisture Content %	FID ppm	Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp,very stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		26					
2		13	15.6	22.1			... gray brown, moist, stiff
3		15					
		18					
4							
5		9					
							SANDY SILT (ML) - light brown, moist, very stiff, fine grained, non-plastic
6							
		28					
7							
8		27					
							Notes: 1.) Bottom of boring at 8.1 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-17

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-17

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 6.5 meters

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)
1		47	14.7	15.9		
2		18				
3		25	14.9	26.5		
3		18				
5		15				
6		30				

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

DESCRIPTION

Approximate Surface Elevation (m): **172.5**

SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets

... gray brown, moist

... yellow brown, increasing sand

SILTY SAND (SM) - yellow brown, moist, medium dense, fine to coarse grained, trace fine sub-angular gravel

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-18
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-18

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Approximate Surface Elevation (m): 172.5

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		9					
2		26	15.0	20.8			... gray brown, moist
3		13					
		29					
4							
5		23					
6							... yellow brown, increasing sand
		8					
7							
8		15					
9							
10							
11							

Notes:
1.) Bottom of boring at 8.1 meters
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-19
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-19

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp, hard, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		30	13.1	17.4			
2		6					... gray brown, moist
3		31	15.6	24.6			
		17					
4							
5		11					
6							... yellow brown, increasing sand
		22					
7							... gray brown, decreasing sand
8		12					
9							
10							
11							

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-20
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Date Completed:	12/14/99	*Surface Conditions:*	Plowed agricultural field
Logged By:	S. DEIS	*Groundwater:*	NFGWE
Total Depth:	6.5 meters		

Approximate Surface Elevation (m): 172.5

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							SANDY LEAN CLAY (CL) - yellow brown, damp, medium stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		6					
2		13	15.4	17.2			... gray brown, moist
3		11					
		18					
4							
5		12					
6							
		7					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-21
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-21

L
L
L
L
L
L
L
L
L
L
L
L
L
L
L
L
L
L

Date Completed: 12/14/99

Logged By: S. DEIS

Total Depth: 7.6 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - yellow brown, damp, medium stiff, fine grained, slightly plastic, trace white gypsum lenses, rootlets
1		6						... silty sand lens
2								... gray brown, moist
3		14	15.1	19.7				
4		6						
5								
6		10						
7		11						
8								Notes: 1.) Bottom of boring at 7.6 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-22
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-22

Surface Conditions: **Plowed agricultural field**

Date Completed: **12/14/99**

Logged By: **S. DEIS**

Groundwater: **NFGWE**

Total Depth: **6.5 meters**

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): **172.5**
0–1							SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum, rootlets
2	■	39	17.0	22.3			... gray brown, moist
3.5	◣	13					
4.5							... yellow brown, increasing sand
5	■	21					
6.5	◣	13					

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-23
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-23

Date Completed:	12/14/99	Surface Conditions: Plowed agricultural field
Logged By:	S. DEIS	Groundwater: NFGWE
Total Depth:	6.5 meters	

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - yellow brown, damp, stiff, fine grained, slightly plastic, trace white gypsum seams, rootlets
1		13					
2		48	15.0	19.7			... gray brown, moist
3		11					
4							
5		26					
6		14					... light brown, with white gypsum seams
7							Notes: 1.) Bottom of boring at 6.6 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-24
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-24

Surface Conditions: Plowed agricultural field

Date Completed: 12/15/99

Logged By: S. PLAUSON

Total Depth: 8.1 meters

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams
		20					... brown
1		29	13.3	18.5			... very stiff ... minor rootlets
2		30	13.0	16.2			... dark brown, no rootlets
3		33					... increasing plasticity
4							
5		16					
6		17					... stiff, decreasing plasticity
7							
8		8					
9							
10							
11							

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/15/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-25
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-25

Date Completed: 12/15/99

Logged By: S. PLAUSON

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	Sample (FIELD)	Penetration Index (FIELD)	Dry Density kN/m^3 (LABORATORY)	Moisture Content % (LABORATORY)	FID ppm (LABORATORY)	Perm. (cm/s) (LABORATORY)		DESCRIPTION (Approximate Surface Elevation (m): 172.5)
		21						SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams
1								
								... very stiff, some rootlets
2		26	14.4	11.6				... increasing plasticity, no rootlets
		28	14.0	25.0				
3		14						... stiff
4								
5		21						
6								... medium stiff to stiff, decreasing plasticity
		8						
7								
8								
9								
10								
11								

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/15/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-26
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-26

Date Completed: 12/15/99

Logged By: S. PLAUSON

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

FIELD		LABORATORY			
Sample	Penetration Index	Dry Density kN/m^3	Moisture Content %	FID ppm	Perm. (cm/s)
	20				
	10	13.9	13.8		
	13				
	9	13.3	10.8		
	3				
	24				
	8				
	6				

Depth, m: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

DESCRIPTION

Approximate Surface Elevation (m): 172.5

SANDY LEAN CLAY (CL) - dark brown, damp, stiff, rootlets, trace white gypsum seams

SILTY SAND (SM) - brown, moist, medium dense, fine grained, some rootlets
... slightly plastic

SANDY LEAN CLAY (CL) - olive brown, moist, stiff, no rootlets
... soft
... stiff

SANDY SILT (ML) - olive brown, moist, medium stiff to stiff, fine grained

LEAN CLAY (CL) - olive brown, moist, soft

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/15/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-27
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-27

Date Completed: 12/15/99

Logged By: S. PLAUSON

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
		25						SANDY LEAN CLAY (CL) - dark brown, moist, very stiff, many rootlets, trace white gypsum seams
1		8	13.3	9.2				SILTY SAND (SM) - brown, moist, medium dense, fine grained
2		13	14.2	31.8				SANDY LEAN CLAY (CL) - olive brown, moist, stiff
		19	14.4	27.7				
3		11						
4								... medium stiff
5		12						
6		17						... stiff, decreasing plasticity, minor rootlets
7								Notes: 1.) Bottom of boring at 6.6 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/15/99.
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-28
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-28

Date Completed: 12/15/99

Logged By: S. PLAUSON

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
		25					SANDY CLAY (CH) - dark brown, damp, very stiff, many rootlets, trace white gypsum seams ... brown
1				6.8			... olive brown, stiff, no rootlets
2		10	14.7	19.4			
3		15					... stiff to very stiff
4							... medium stiff
5		5					
6		5					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/15/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-29
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-29

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Total Depth: 15.7 meters

Groundwater: NFGWE

Approximate Surface Elevation (m): 172.5

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
		26					SANDY LEAN CLAY (CL) - dark brown, damp, very stiff, fine grained, many rootlets, trace white gypsum seams ... brown
1		34	12.2	20.8			... dark brown, minor rootlets
2		43	14.5	22.4			... no rootlets, increasing plasticity
3		28	13.8	26.5			
5		9					... olive brown, stiff, decreasing plasticity
6		19	14.5	20.0			
8		6					... medium stiff
9		18					... very stiff, many rootlets
11							... stiff, increasing sand, minor rootlets

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-30
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 2

A-30

Depth, m	Sample	Penetration Index	Dry Density kN/m^3	Moisture Content %	FID ppm	Perm. (cm/s)			DESCRIPTION
									(Continued from previous plate)
		14							
12		25							... very stiff, decreasing sand, increasing plasticity, moderate rootlets
13									
14		13							... stiff
15		16							
16									Notes: 1.) Bottom of boring at 15.7 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
17									
18									
19									
20									
21									
22									
23									
24									

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-30
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION — Approximate Surface Elevation (m): 172.5
		23						SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
1								... brown
2		27	13.5	17.3				... brown, very stiff, decreasing plasticity, many rootlets
		30	15.0	25.3				... dark brown, no rootlets
3		20						
4								
5		6						... medium stiff
6		10						... stiff, decreasing plasticity, increasing sand
7								Notes: 1.) Bottom of boring at 6.6 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-31
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-31

Date Completed: 12/14/99

Logged By: S. PLAUSON

Total Depth: 5.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
				4.8			SANDY CLAY (CH) - brown, damp, stiff, many rootlets, trace white gypsum seams
		24					
1		20	13.0	20.2			SANDY LEAN CLAY (CL) - dark brown, moist, stiff
				7.2			... brown, rootlets
2		23	13.6	21.0			... dark brown, no rootlets
		21	14.2	25.4			
3		19					
4							
5		—					Notes: 1.) Bottom of boring at 5.0 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
6							
7							
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-32
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-32

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many pinholes, trace white gypsum seams
		21					
1							
			13.0	15.8			... very stiff, many rootlets
2		34	13.7	3.2			... dark brown, no rootlets
		36	14.9	23.8			... olive brown
3							
		27					
4							
5		15					
6							
		17					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-33
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-33

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 8.1 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
		19					SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams
1							
							... dark brown, very stiff, minor rootlets
2		25	13.8	20.8			
		36	15.1	24.4			... no rootlets
3		14					... stiff
4							
5		23					
6		7					... decreasing plasticity
7							
8		5					
9							
10							
11							

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-34
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-34

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
							SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams
		18					... brown
1							
							... sand lens
2		10	13.5	30.4			... dark brown, minor rootlets
		24	15.0	24.5			... olive brown, very stiff, no rootlets
3							... stiff
		13					
4							
							... decreasing plasticity
5		9					
6							
		15					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-35
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-35

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 5.0 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
		23						... light brown, decreasing plasticity, rootlets
1		14	13.0	19.2				
2		19	14.2	12.4				
		24	14.1	12.7				... dark brown, no rootlets
3		16						
4								... olive, decreasing plasticity
5		7						Notes: 1.) Bottom of boring at 5.0 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-36

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-36

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Total Depth: 8.1 meters

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)
		19				
1						
			13.5	22.2		
2		11				
			14.3	27.2		
		16				
3						
		17				
4						
5		9				
6						
		9				
7						
8		9				
9						
10						
11						

DESCRIPTION

Approximate Surface Elevation (m): 172.5

SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams

... brown

... dark brown, medium stiff, minor rootlets

.. olive brown, stiff, no rootlets

... medium stiff

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-37
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-37

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 8.1 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION — Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - brown, damp, stiff, fine grained, rootlets, trace white gypsum seams
		15						
1		20	12.8	12.4				... sand lens
								... rootlets
2		19	14.6	20.2				... dark brown, minor rootlets
3		11						
4								
5		19						
6		7						... very moist
7								... sand lens
8		5						Notes: 1.) Bottom of boring at 8.1 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-38

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-38

Surface Conditions: Plowed agricultural field

Date Completed: 12/14/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 2.0 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - dark brown, damp, stiff, many rootlets, trace white gypsum seams
		23					... brown, moist
1							
							... sand lens
2		11	14.9	22.6			... dark brown, no rootlets
3							
4							
5							
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 2 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-39
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-39

Date Completed: 12/14/99	*Surface Conditions:* Plowed agricultural field
Logged By: S. PLAUSON	*Groundwater:* NFGWE
Total Depth: 8.1 meters	

Approximate Surface Elevation (m): 172.5

Depth, m	Sample (FIELD)	Penetration Index (FIELD)	Dry Density kN/m^3 (LABORATORY)	Moisture Content % (LABORATORY)	FID ppm (LABORATORY)	Perm. (cm/s) (LABORATORY)	DESCRIPTION
		25					SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
1							... brown
		41	14.7	22.6			... olive brown to dark brown, increasing plasticity, no rootlets
2		30	14.6	24.4			... no rootlets
3		28					
4							
5		6					
							SILTY SAND (SM) - brown, moist, medium dense, fine to coarse grained, with fine gravel
6		14					
7							
8		16					
9							
10							
11							

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-40
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-40

Date Completed: 12/14/99

Logged By: S. PLAUSON

Total Depth: 6.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Approximate Surface Elevation (m): 172.5

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
		19					SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
1							
							... many rootlets
2		23	14.0	21.6			... minor rootlets
		26	14.5	21.6			... dark brown, increasing plasticity, very minor rootlets
3							
		14					
4							
							... olive brown
5		13					
6							
		9					
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-41
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-41

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
	■	22					SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
1							
	■	29	15.0	19.1			... brown, very stiff, rootlets ... dark brown, no rootlets
2	■	21	13.9	22.2			... brown, stiff, minor rootlets
3	■	23					... olive, increasing plasticity, no rootlets
4							... medium stiff
5	◣	8					
6	◣	9					... increasing sand, decreasing plasticity
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/14/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-42
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-42

Date Completed: 12/13/99

Logged By: S. PLAUSON

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
		21						
1								... brown
		19	14.1	16.0				
			12.2	16.3				... decreasing rootlets
2		22						... rootlets
		27	15.3	22.3				... dark brown, very stiff, no rootlets
3		18						... olive brown, increasing plasticity
4								
5		22						... stiff
6		14						
7								
8		9						
9								
10								
11								

Notes:
1.) Bottom of boring at 8.1 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-43
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-43

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION (Approximate Surface Elevation (m): 172.5)
							SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, many rootlets, trace white gypsum seams
1		21					... brown, many rootlets
		16	16.8	18.1			
2		25	14.4	24.7			... dark brown, no rootlets
3		13					... olive brown, increasing sand, decreasing plasticity
4							
5		10					
6		11					... increasing plasticity
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-45
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Date Completed: 12/13/99

Logged By: S. PLAUSON

Total Depth: 8.1 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - dark brown, moist, stiff, fine grained, trace white gypsum seams
							... brown
		16					... many rootlets
1		19	12.3	10.4			... dark brown, some rootlets
							... some rootlets
2		34	17.9	22.6			... no rootlets
		28	14.0	26.3			... increasing plasticity
3		16					... olive brown
4							... some rootlets
5		17					
6		11					... increasing sand
7							... decreasing sand
8		8					Notes: 1.) Bottom of boring at 8.1 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/13/99.
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-46

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-46

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 6.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
		20						SANDY LEAN CLAY (CL) - dark brown, moist, fine grained, many rootlets
1		16	14.9	10.8				... brown, many rootlets
2		19	12.3	13.9				... many rootlets
		36	14.9	22.3				... dark brown, some rootlets
3		16						
4								
5		10						
6		36						
7								
8								
9								
10								
11								

Notes:
1.) Bottom of boring at 6.6 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-47

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-47

Surface Conditions: Plowed agricultural field

Date Completed: 12/13/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 3.5 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
	■	21					SANDY LEAN CLAY (CL) - dark brown, damp, stiff, fine grained, rootlets, trace white gypsum seams
1	■	29	13.7	22.0			... brown, many rootlets
2	■	36	13.8	23.6			... dark brown, minor rootlets
	■	25	13.7	29.6			
3	■	16					... olive brown, decreasing plasticity, no rootlets
4							
5							
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 3.5 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-48
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-48

Date Completed: 12/14/99

Logged By: S. Deis

Total Depth: 3.5 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)			DESCRIPTION
									Approximate Surface Elevation (m): 172.5
0–1									SANDY LEAN CLAY (CL) - yellow brown, damp, very stiff, fine grained, slightly plastic, trace white gypsum lenses
1									... gray brown, moist
2		41	15.7	23.4					
3		14							
4									Notes: 1.) Bottom of boring at 3.5 meters. 2.) No free groundwater encountered. 3.) Boring backfilled with soil cuttings 12/14/99.
5									
6									
7									
8									
9									
10									
11									

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-49

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-49

Date Completed: 12/13/09

Logged By: S. PLAUSON

Total Depth: 5.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY LEAN CLAY (CL) - brown, damp, stiff, fine grained, rootlets, trace white gypsum seams
		24					
1							... moist
		25	13.6	18.6			... dark brown
2		36	14.0	25.0			
		19	13.3	20.5			
3							... olive gray, increasing sand, minor rootlets
		11					
4							SILTY SAND (SM) - brown, moist, medium dense, fine to medium grained
5		13					
6							
7							
8							
9							
10							
11							

Notes:
1.) Bottom of boring at 5.0 meters.
2.) No free groundwater encountered.
3.) Boring backfilled with soil cuttings 12/13/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF BORING B-50
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-50

Surface Conditions: Plowed agricultural field

Date Completed: 12/10/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 3.2 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION — Approximate Surface Elevation (m): 172.5
							SANDY CLAY (CL) - brown, moist, fine to coarse grained, many rootlet voids
1							... decreasing voids, trace white gypsum lenses
2							... no visible voids
3							Notes: 1.) Bottom of test pit at 3.2 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
4							
5							
6							
7							
8							
9							
10							
11							

KLEINFELDER

LOG OF TEST PIT TP- 1
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-51

PROJECT NO. 21-4158-01

Date Completed: 12/10/99

Logged By: S. PLAUSON

Total Depth: 3.7 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)			DESCRIPTION
									Approximate Surface Elevation (m): 172.5
									SANDY CLAY (CL) - brown to dark brown, with white gypsum lenses, moist, many rootlets
1									SANDY SILT (ML) - brown, moist, many rootlets
									CLAY (CL) - dark brown, with white gypsum lenses, moist, no rootlets visible
2									
3									
4									Notes: 1.) Bottom of test pit at 3.7 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5									
6									
7									
8									
9									
10									
11									

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 2

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-52

Surface Conditions: Plowed agricultural field

Date Completed: 12/10/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 3.4 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY CLAY (CL) - dark brown, with white gypsum lenses, moist, many rootlets
1							... 8" thick silty sand lense ... brown ... dark brown, rootlets
2							.. rootlets not visible .. wet
3							... stiff clay, with sand
4							Notes: 1.) Bottom of test pit at 3.4 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5							
6							
7							
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 3
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-53

Date Completed: 12/10/99

Logged By: S. PLAUSON

Total Depth: 3.7 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
0–1							SANDY CLAY (CL) - dark brown, with white gypsum lenses, moist, rootlets ... brown, many rootlets
1–2							... dark brown
2–3							... minor rootlets ... brown, no rootlets
3–3.7							... red brown, mottling
4–11							Notes: 1.) Bottom of test pit at 3.7 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 4

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-54

Surface Conditions: Plowed agricultural field

Date Completed: 12/10/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 3.4 meters

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY CLAY (CL) - dark brown, with white gypsum lenses, minor rootlets
1								... no rootlets
2								
3								
4								Notes: 1.) Bottom of test pit at 3.4 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5								
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 5
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE 1 of 1

A-55

Date Completed: 12/10/99	*Surface Conditions:* Plowed agricultural field
Logged By: S. PLAUSON	*Groundwater:* NFGWE
Total Depth: 3.7 meters	

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION — *Approximate Surface Elevation (m):* 172.5
								SANDY CLAY (CL) - dark brown, with white gypsum lenses, moist, minor rootlets
1								... no rootlets
2								... brown, decreasing plasticity, many rootlets
3								... no rootlets
4								Notes: 1.) Bottom of test pit at 3.7 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5								
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 6
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

Date Completed: 12/10/99

Logged By: S. PLAUSON

Total Depth: 3.7 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)	DESCRIPTION
							Approximate Surface Elevation (m): 172.5
							SANDY CLAY (CL) - dark brown, moist, some rootlets
							SANDY SILT (ML) - brown, many rootlets
1							SANDY CLAY (CL) - dark brown, some rootlets
							SANDY SILT (ML) - brown, many rootlets
							SANDY CLAY (CL) - dark brown, minor rootlets
2							
							... some small rootlets
3							
4							Notes: 1.) Bottom of test pit at 3.7 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5							
6							
7							
8							
9							
10							
11							

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP-7

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-57

Date Completed: 12/10/99

Logged By: S. PLAUSON

Total Depth: 4.3 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD Sample	FIELD Penetration Index	LABORATORY Dry Density kN/m^3	LABORATORY Moisture Content %	LABORATORY FID ppm	LABORATORY Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY CLAY (CL) - dark brown, moist, some rootlets
								SANDY SILT (ML) - brown, moist
1								SANDY CLAY (CL) - dark brown, moist, some rootlets ... brown, many rootlets
2								... decreasing clay
								SILTY SAND (SM) - brown, moist, some rootlets
3								... slight plasticity, minor rootlets
								SANDY CLAY (CL) - brown, moist, many rootlets ... nor root voids visible
4								
5								Notes: 1.) Bottom of test pit at 4.3 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 10/12/99.
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 8

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-58

Date Completed: 12/10/99

Logged By: S. PLAUSON

Total Depth: 3.0 meters

Surface Conditions: Plowed agricultural field

Groundwater: NFGWE

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)			DESCRIPTION
									Approximate Surface Elevation (m): 172.5
									SANDY CLAY (CL) - dark brown
									... dark brown, moist, many rootlets
1									
2									... dark brown, minor rootlets ... no root voids visible
3									Notes: 1.) Bottom of test pit at 3.0 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
4									
5									
6									
7									
8									
9									
10									
11									

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP- 9

PROPOSED SECURE TREATMENT FACILITY

COALINGA, CALIFORNIA

PLATE 1 of 1

A-59

Date Completed: 12/10/99	*Surface Conditions:* Plowed agricultural field
Logged By: S. PLAUSON	*Groundwater:* NFGWE
Total Depth: 3.0 meters	

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY CLAY (CL) - dark brown, moist
								... brown, decreasing plasticity, some rootlets
1								... dark brown
								... brown, some rootlets
2								... no root voids visible, increasing plasticity
3								Notes: 1.) Bottom of test pit at 3.0 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
4								
5								
6								
7								
8								
9								
10								
11								

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP-10
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-60

Surface Conditions: Plowed agricultural field

Date Completed: 12/10/99

Logged By: S. PLAUSON

Groundwater: NFGWE

Total Depth: 3.4 meters

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)			DESCRIPTION
									Approximate Surface Elevation (m): 172.5
0–3.4									SANDY CLAY (CL) - dark brown, moist
1									
2									
3									
4									Notes: 1.) Bottom of test pit at 3.4 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
5									
6									
7									
8									
9									
10									
11									

KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP-11
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-61

Date Completed: 12/10/99	*Surface Conditions:* Plowed agricultural field
Logged By: S. PLAUSON	*Groundwater:* NFGWE
Total Depth: 3.4 meters	

Depth, m	FIELD: Sample	FIELD: Penetration Index	LABORATORY: Dry Density kN/m^3	LABORATORY: Moisture Content %	LABORATORY: FID ppm	LABORATORY: Perm. (cm/s)		DESCRIPTION
								Approximate Surface Elevation (m): 172.5
								SANDY CLAY (CL) - dark brown, moist, some rootlets
								... brown, some rootlets
1								... dark brown, minor rootlets
								... brown, some rootlets
								... dark brown, no visible rootlets
2								
								... increasing plasticity
3								
								Notes: 1.) Bottom of test pit at 3.4 meters. 2.) No free groundwater encountered. 3.) Test pit backfilled with soil cuttings 12/10/99.
4								
5								
6								
7								
8								
9								
10								
11								

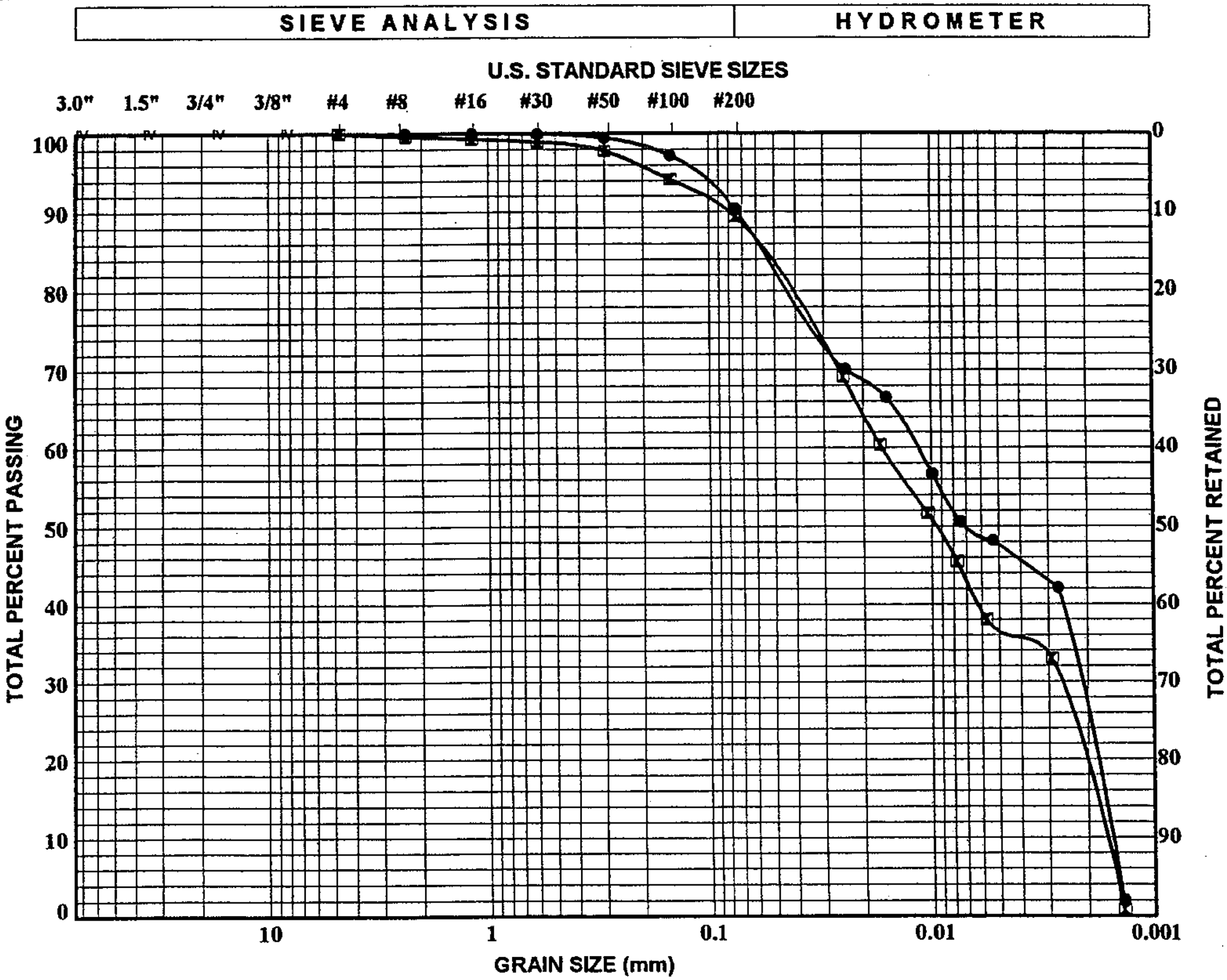
KLEINFELDER

PROJECT NO. 21-4158-01

LOG OF TEST PIT TP-12
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
1 of 1

A-62



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Symbol	Sample	Elevation (m)	Description	Classification
●	B- 2	172.2	Sandy Clay	CH
⊠	B-29	171.6	Sandy Clay	CH

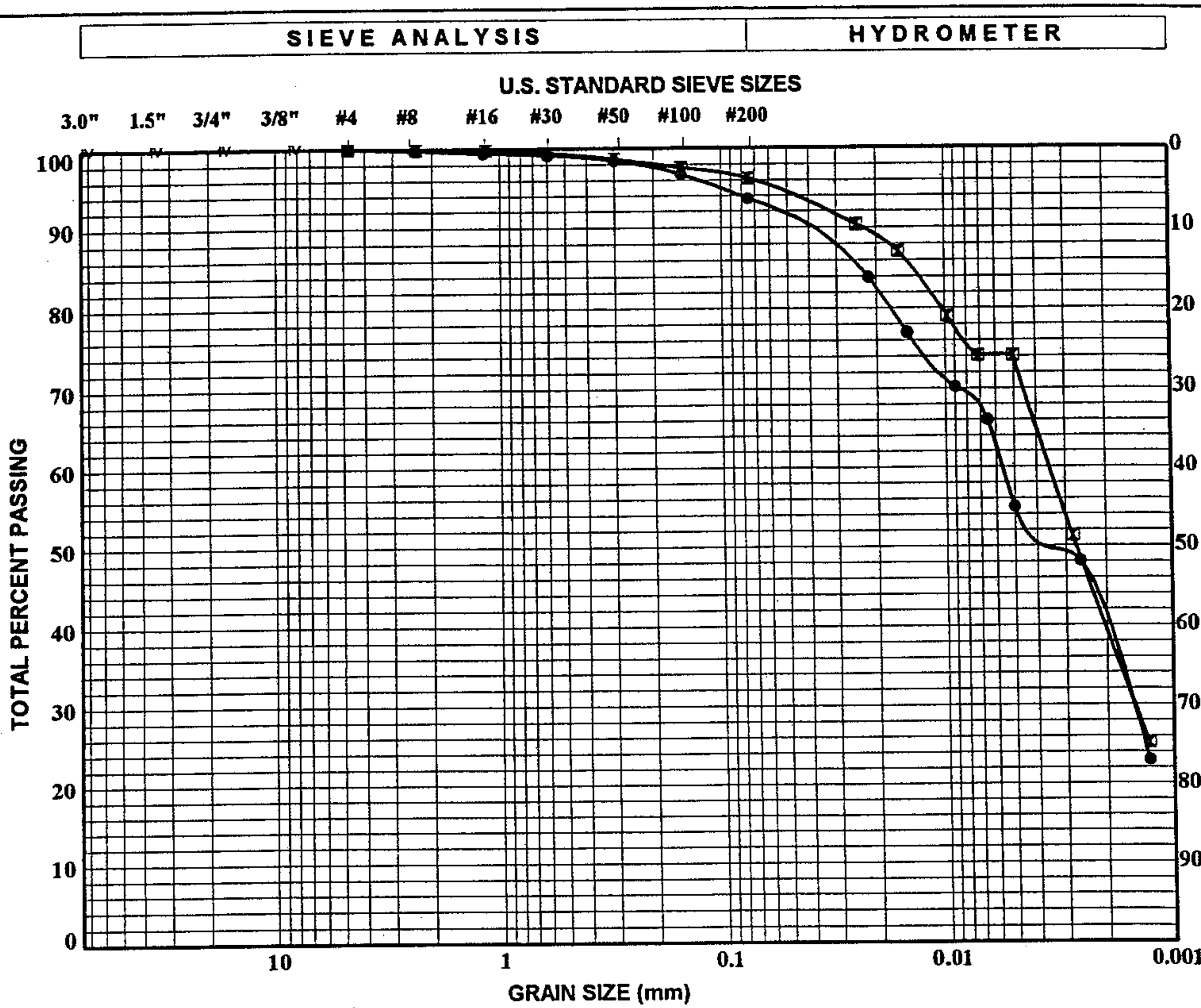
KLEINFELDER

PROJECT NO. 21-4158-01

GRAIN SIZE DISTRIBUTION
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-1



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

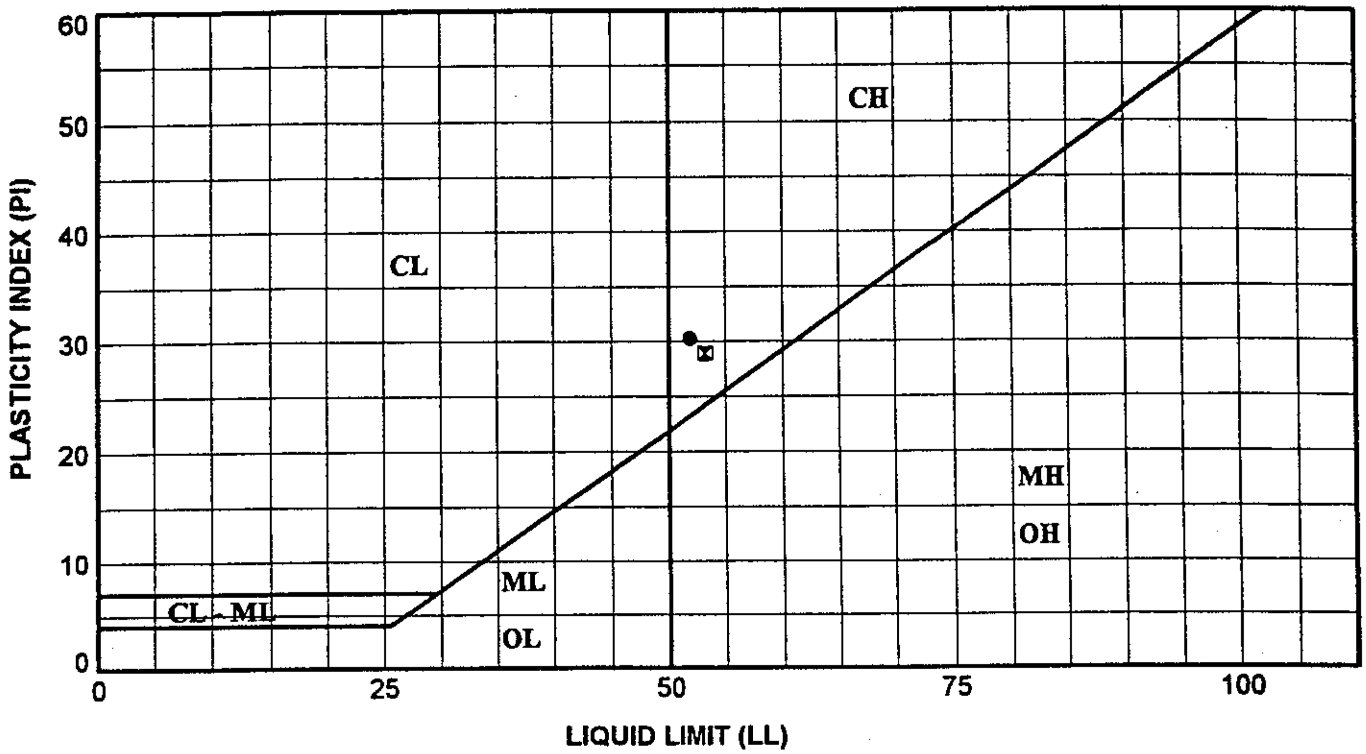
Symbol	Sample	Elevation (m)	Description	Classification
●	B-32	172.2	Sandy Clay	CH
⌧	B-32	171.3	Sandy Lean Clay	CL

KLEINFELDER

GRAIN SIZE DISTRIBUTION
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-2

PROJECT NO. 21-4158-01



	Sample	Elevation (m)	LL (%)	PL (%)	PI (%)	LI (-)	Description
●	B- 2	172.2	51.8	21.6	30.3		Sandy Clay
⊠	B-29	171.6	53.2	24.3	28.9		Sandy Clay

LL - Liquid Limit

PL - Plasticity Limit

PI - Plasticity Index

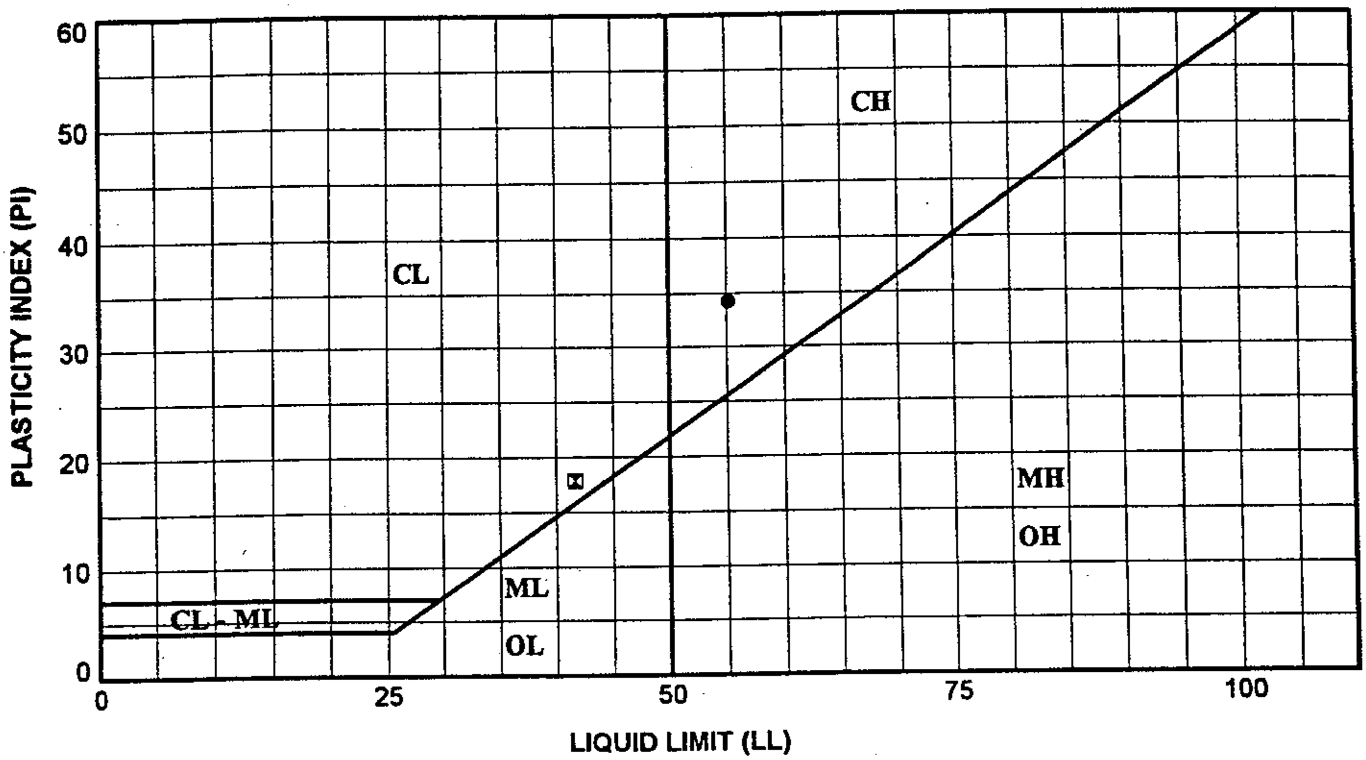
LI - Liquidity Index

Unified Soil Classification
Fine Grained Soil Groups

	LL < 50
ML CL	Inorganic clayey silts to very fine sands of slight plasticity
OL	Inorganic clays of low to medium plasticity
	Organic silts and organic silty clays of low plasticity

	LL > 50
MH	Inorganic silts and clayey silts of high plasticity
CH	Inorganic clays of high plasticity
OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER	ATTERBERG LIMITS PROPOSED SECURE TREATMENT FACILITY COALINGA, CALIFORNIA	FIGURE B-3
PROJECT NO. 21-4158-01		



	Sample	Elevation (m)	LL (%)	PL (%)	PI (%)	LI (-)	Description
●	B-32	172.2	55.1	20.9	34.2		Sandy Clay
⊠	B-32	171.3	41.6	23.8	17.8		Sandy Lean Clay

LL - Liquid Limit

PL - Plasticity Limit

PI - Plasticity Index

LI - Liquidity Index

Unified Soil Classification
Fine Grained Soil Groups

	LL < 50
ML CL	Inorganic clayey silts to very fine sands of slight plasticity
OL	Inorganic clays of low to medium plasticity
	Organic silts and organic silty clays of low plasticity

	LL > 50
MH	Inorganic silts and clayey silts of high plasticity
CH	Inorganic clays of high plasticity
OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER	ATTERBERG LIMITS PROPOSED SECURE TREATMENT FACILITY COALINGA, CALIFORNIA	FIGURE B-4
PROJECT NO. 21-4158-01		

SUMMARY OF
EXPANSION INDEX TESTS

Location	Depth (m) [ft]	Expansion Index
B-29	0.9 to 1.8 [3 to 6]	64
B-32	0 to 1.2 [0 to 4]	68

KLEINFELDER

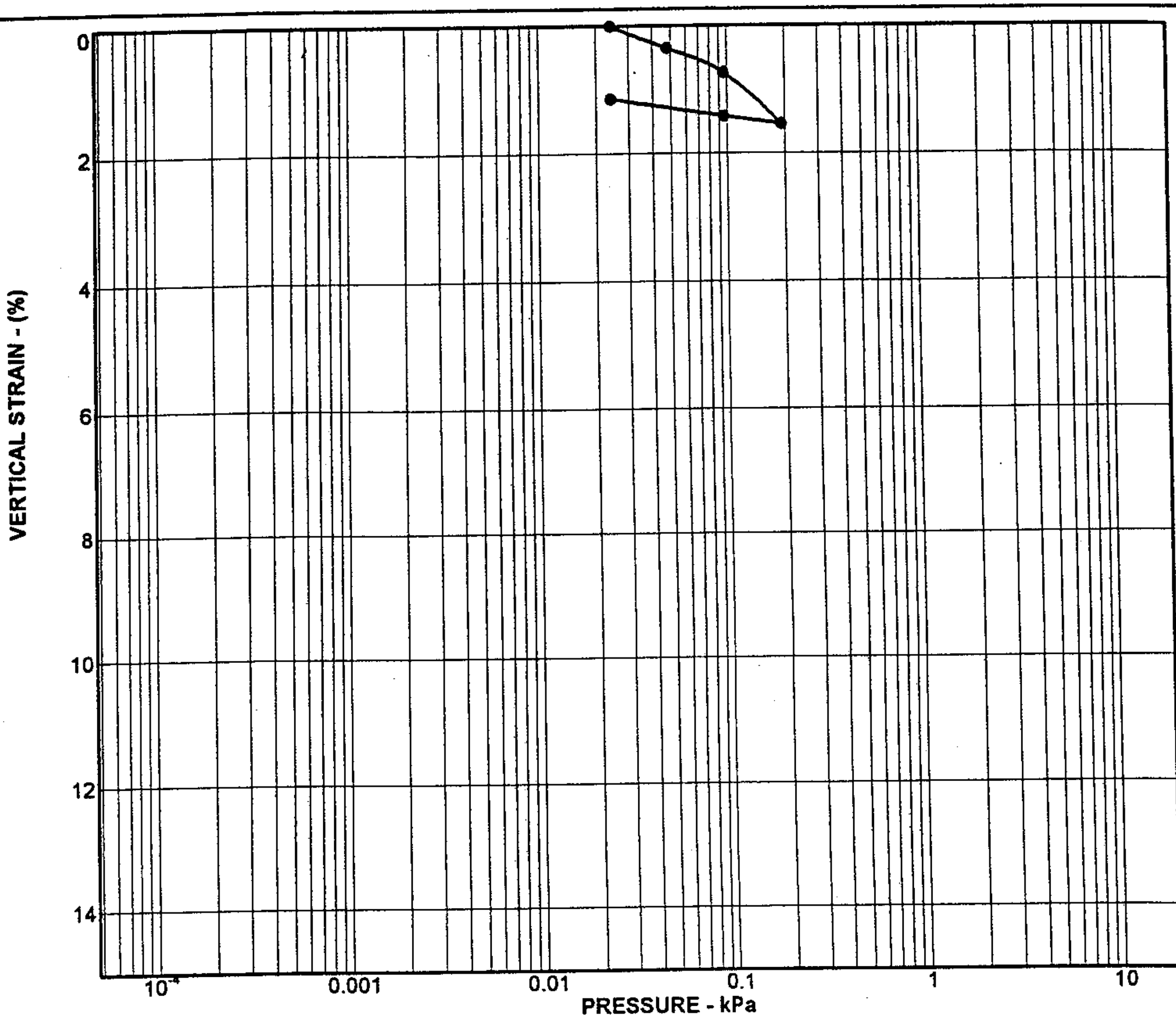
EXPANSION INDEX

PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B5

DRAWN BY: S. PLAUSON
PROJECT No. 21-4158-01

DATE: 2-28-00
DWG No. EXPAN_TEST



Sample	B- 8
Elevation	0.3 m
Description	Sandy Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc		1.64
Water content, %		15.0
Sample height, mm	25.4	24.9

Water added at 96 kPa

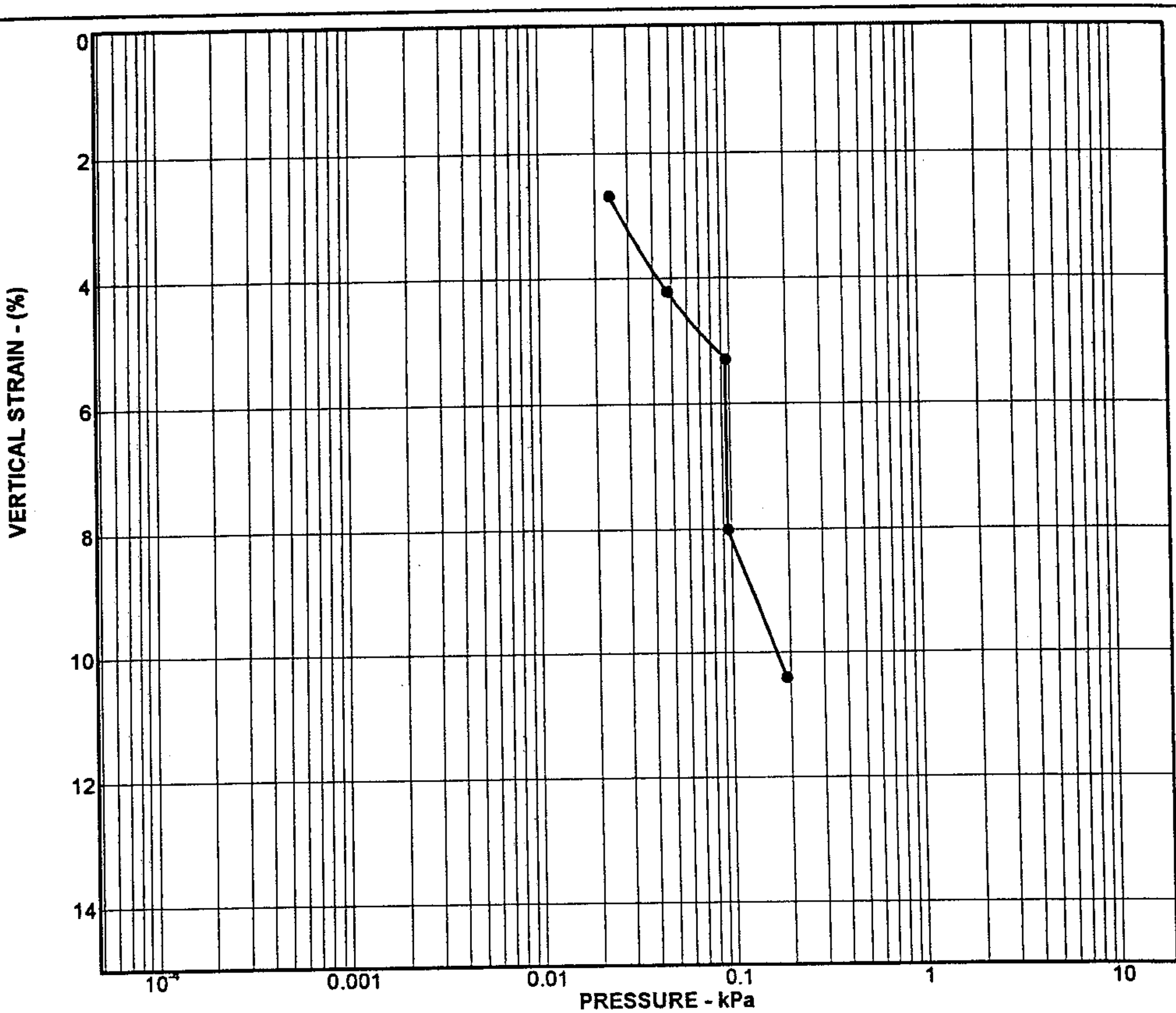
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-6



Sample	B-14
Elevation	0.9 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.36	1.36
Water content, %	11.8	11.8
Sample height, mm	25.4	21.5

Water added at 96 kPa

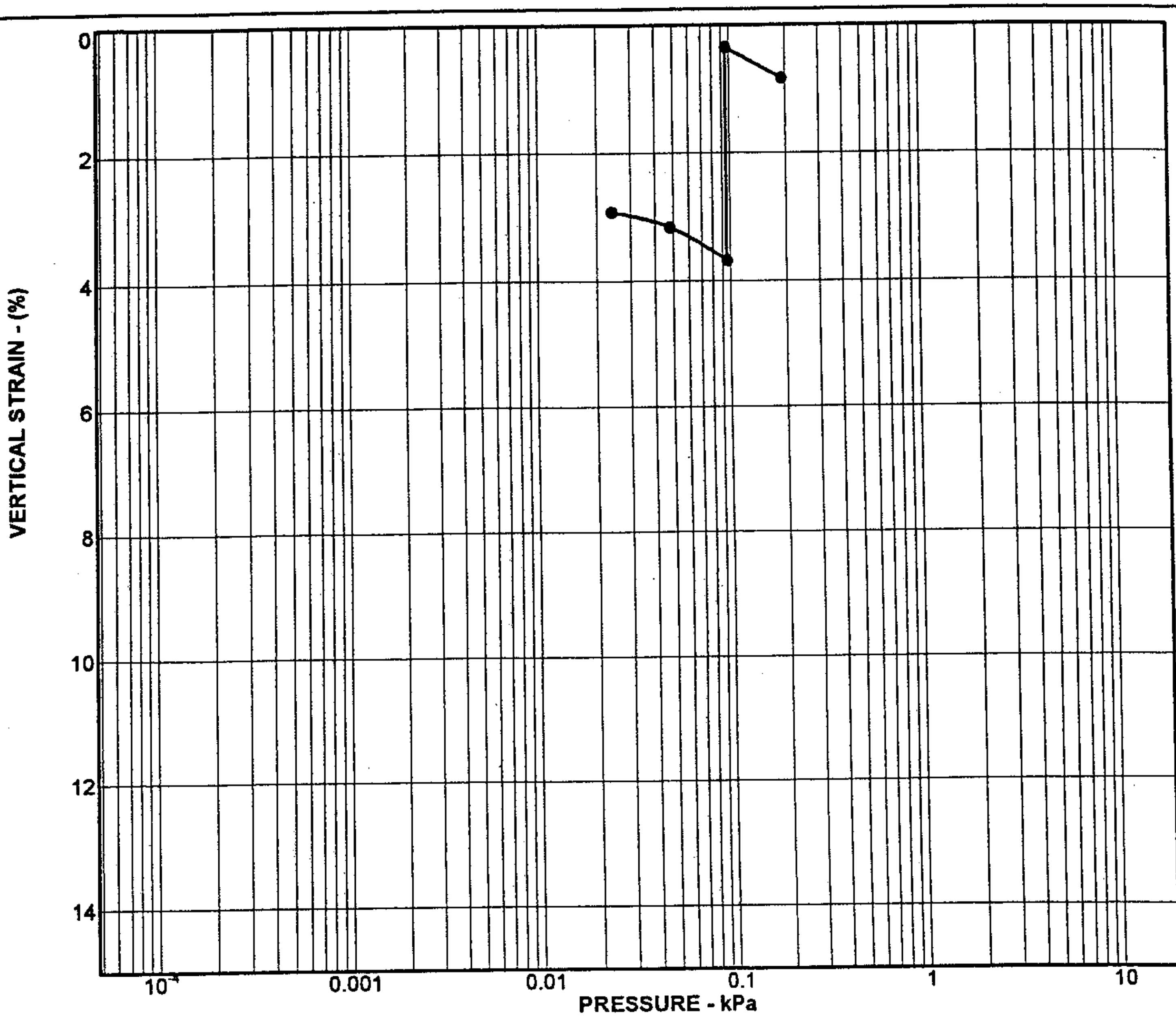
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT
FACILITY
COALINGA, CALIFORNIA

PLATE

B-7



Sample	B-17
Elevation	1.8 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.59	1.73
Water content, %	22.1	14.8
Sample height, mm	25.4	25.2

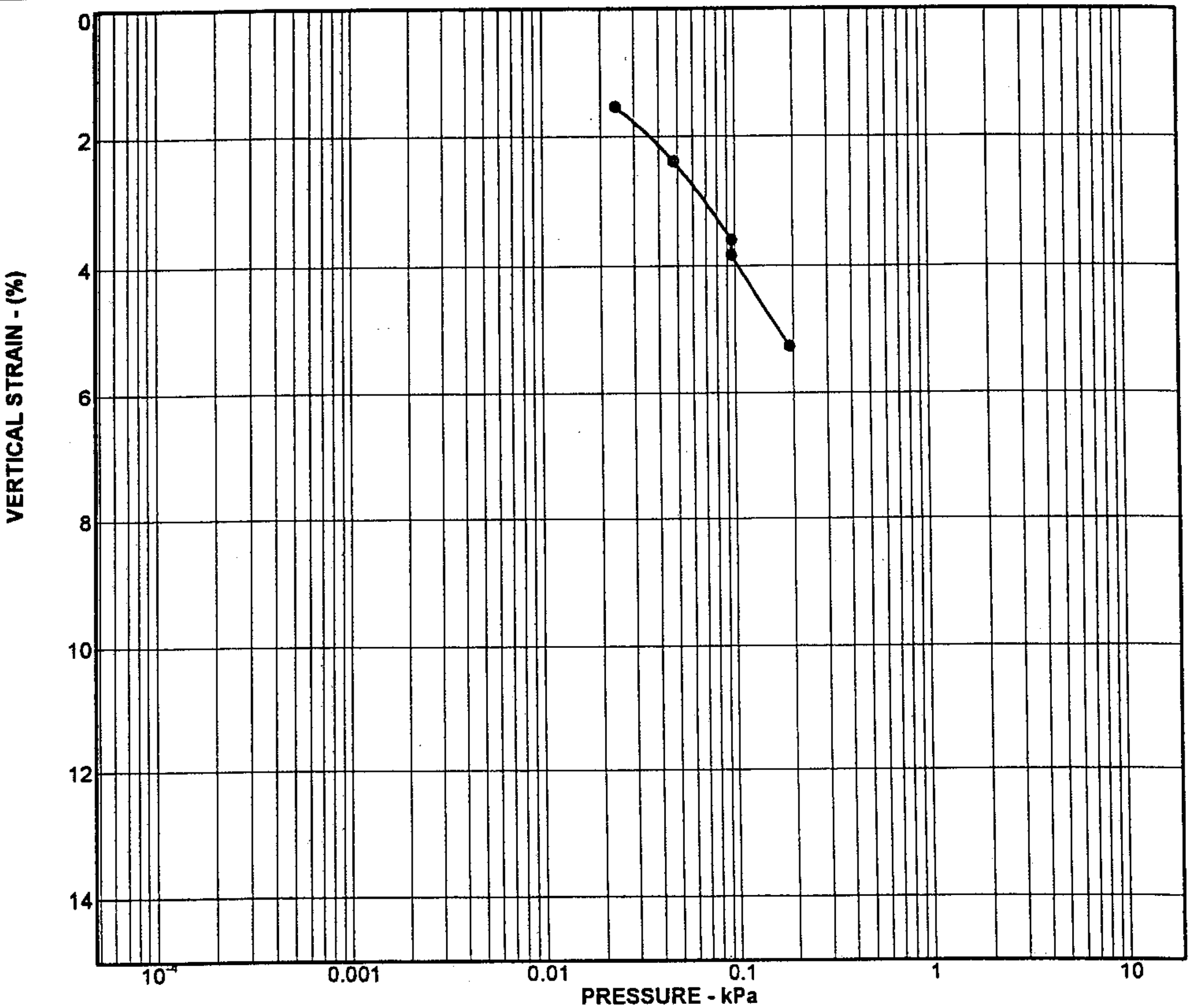
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-8



Sample	B-21
Elevation	1.8 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.57	1.65
Water content, %	17.2	14.8
Sample height, mm	25.4	24.1

Water added at 96 kPa

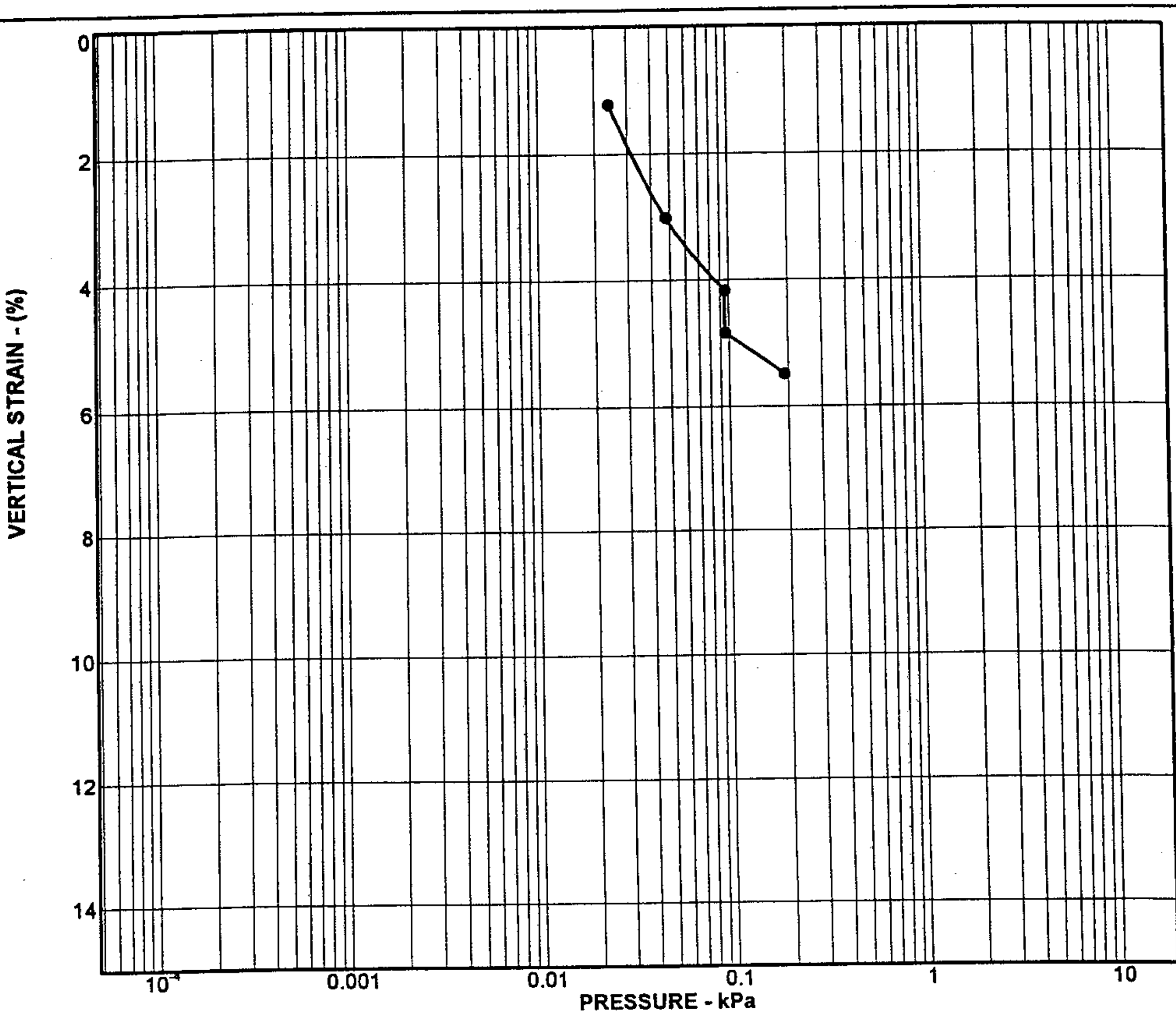
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-9



Sample	B-25
Elevation	1.1 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.35	1.36
Water content, %	18.5	30.6
Sample height, mm	25.4	24.0

Water added at 96 kPa

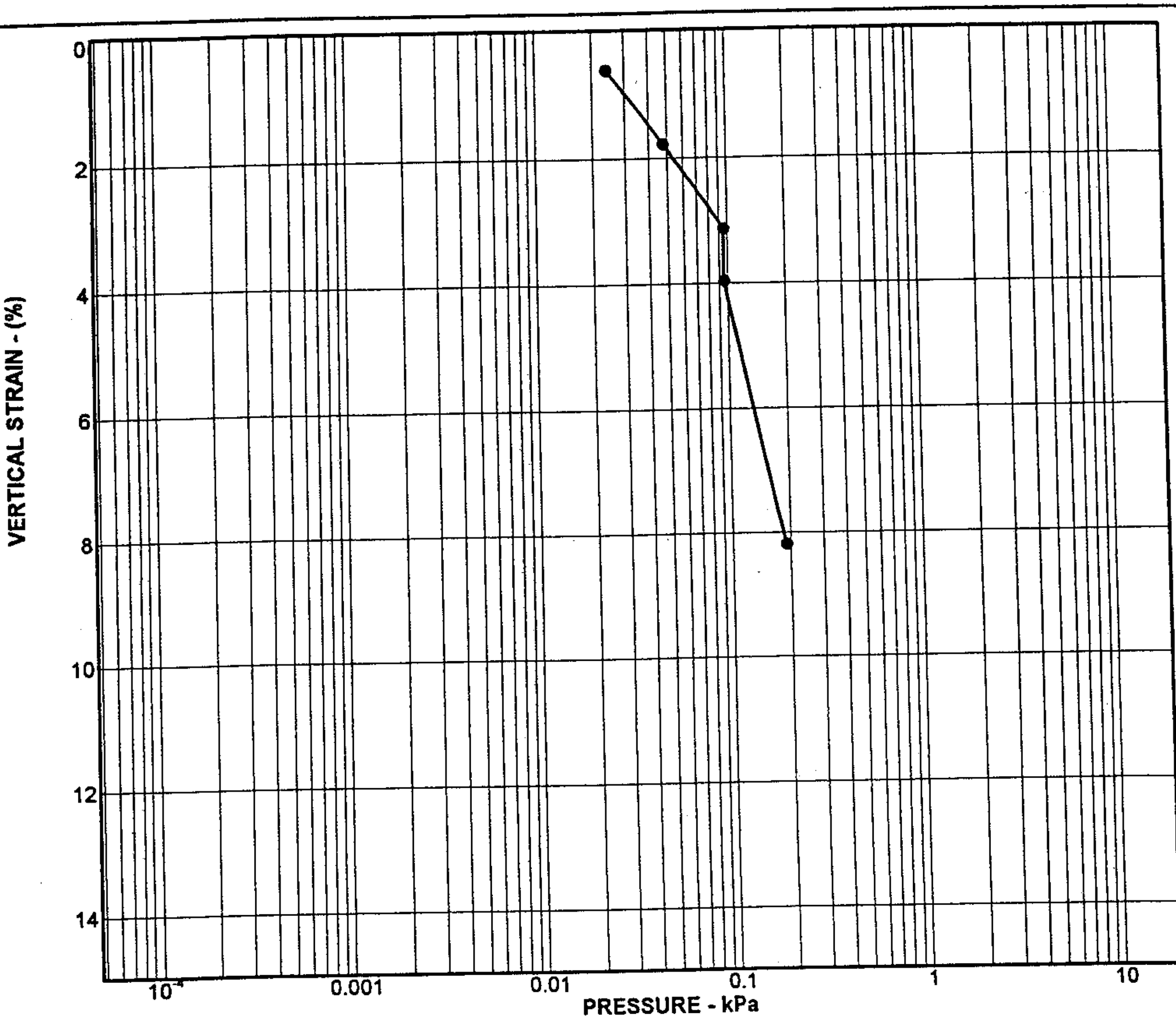
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-10



Sample	B-25
Elevation	1.7 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.32	1.21
Water content, %	16.2	31.6
Sample height, mm	25.4	23.3

Water added at 96 kPa

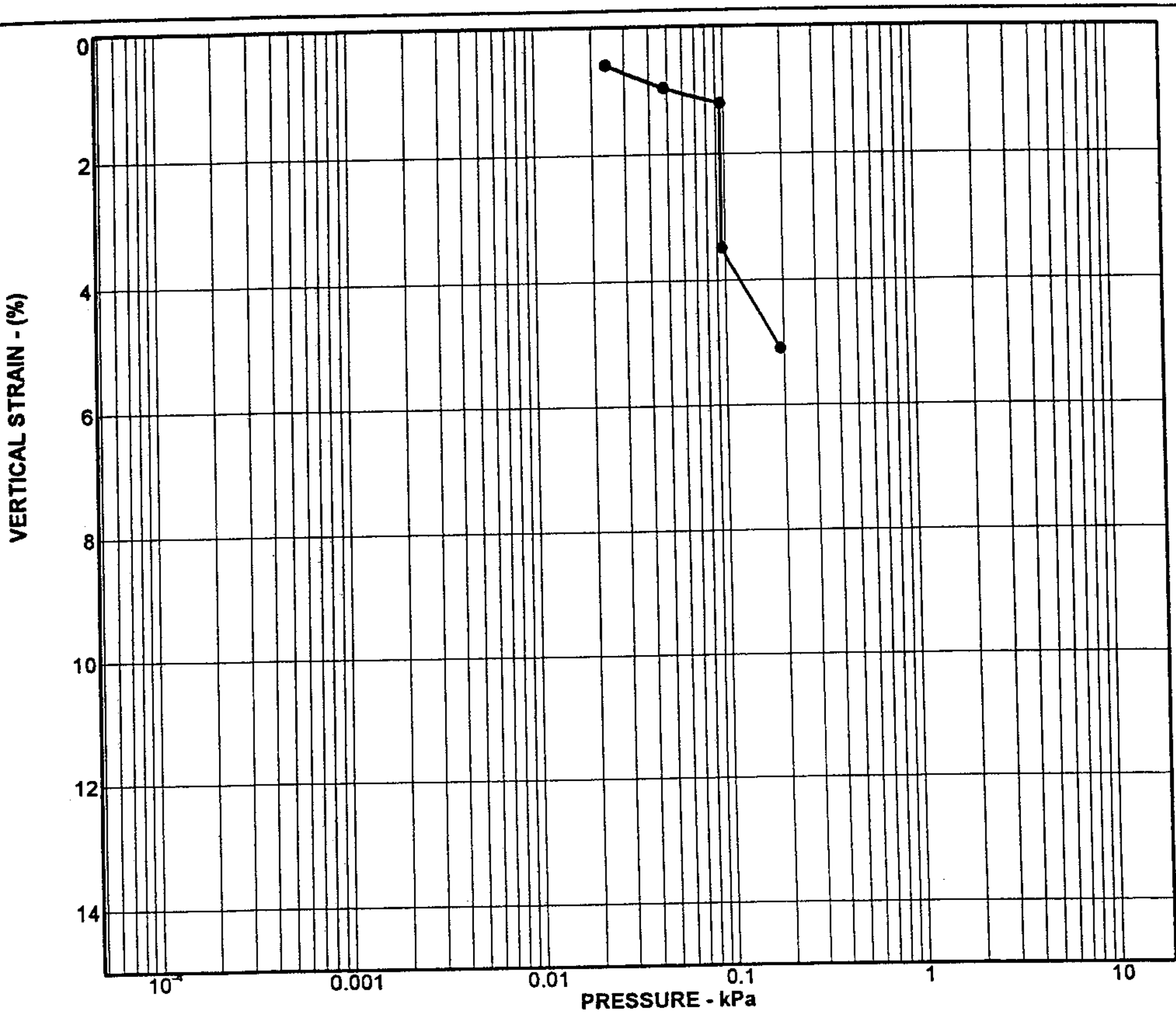
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-11



Sample	B-27
Elevation	2.4 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.35	1.15
Water content, %	10.8	31.8
Sample height, mm	25.4	24.1

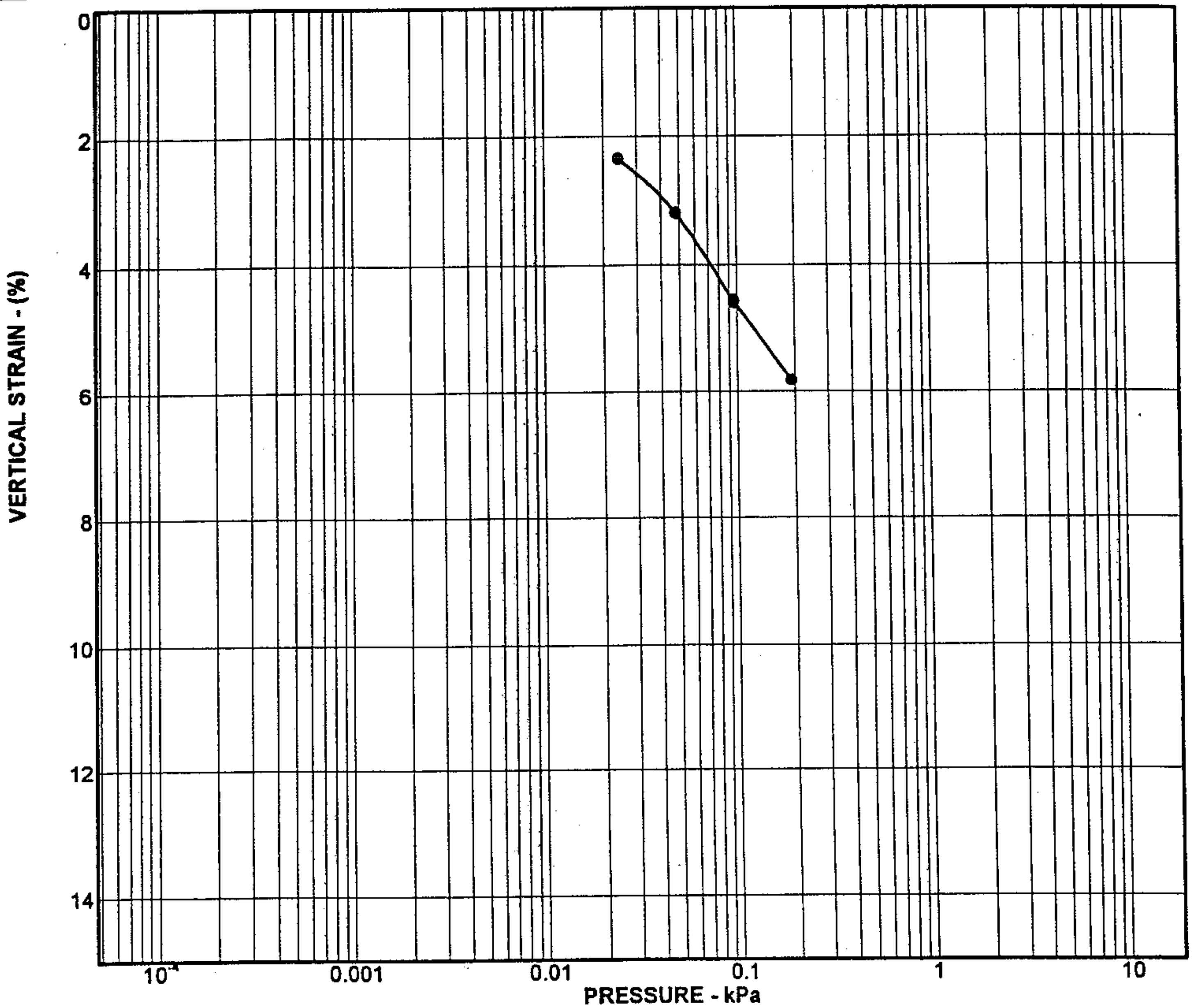
Water added at 96 kPa

KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-12

PROJECT NO. 21-4158-01



Sample	B-28
Elevation	1.8 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.45	1.69
Water content, %	31.8	14.8
Sample height, mm	25.4	23.9

Water added at 96 kPa

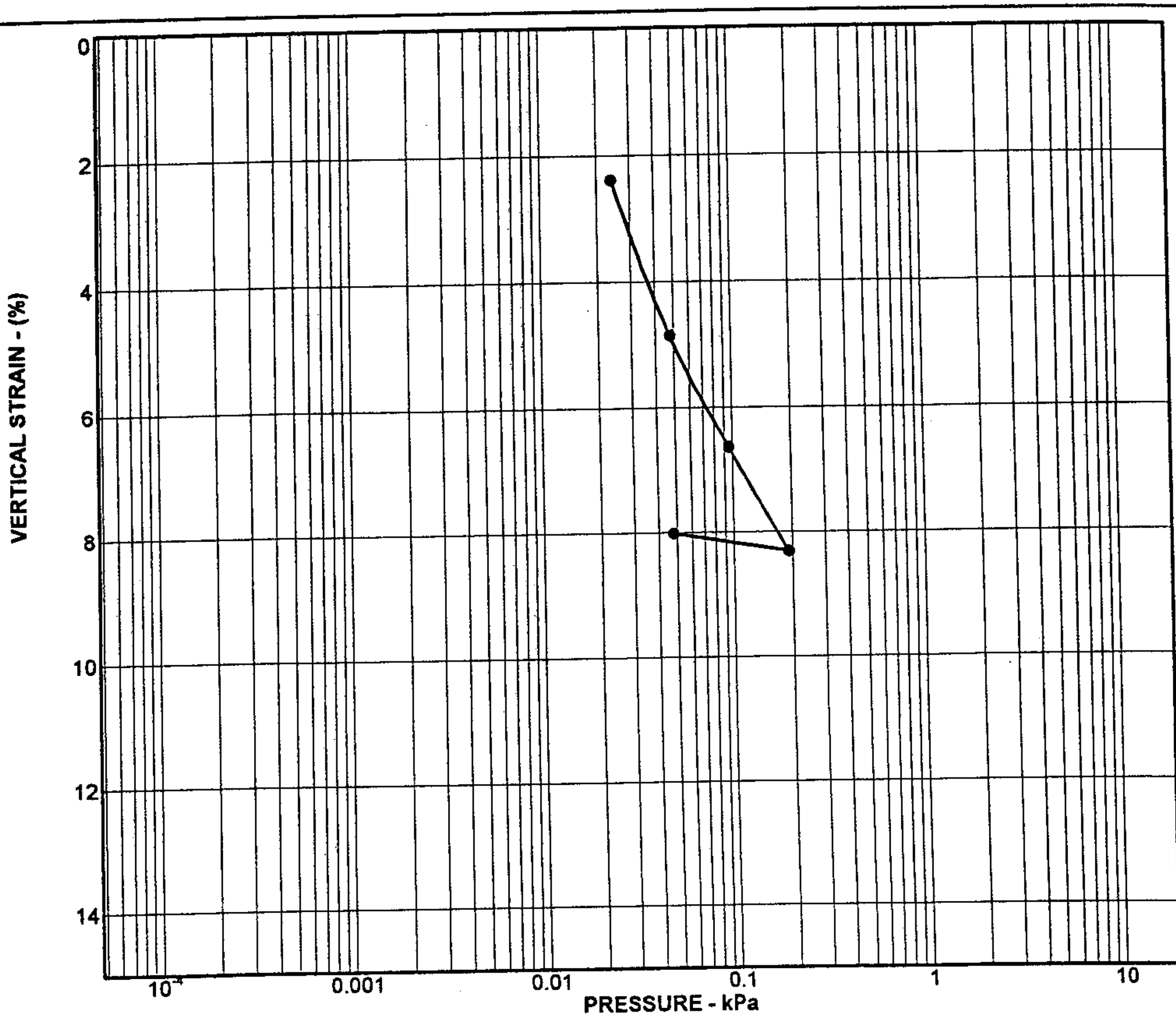
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-13



Sample	B-30
Elevation	3.4 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.41	1.41
Water content, %	26.5	26.5
Sample height, mm	25.4	23.4

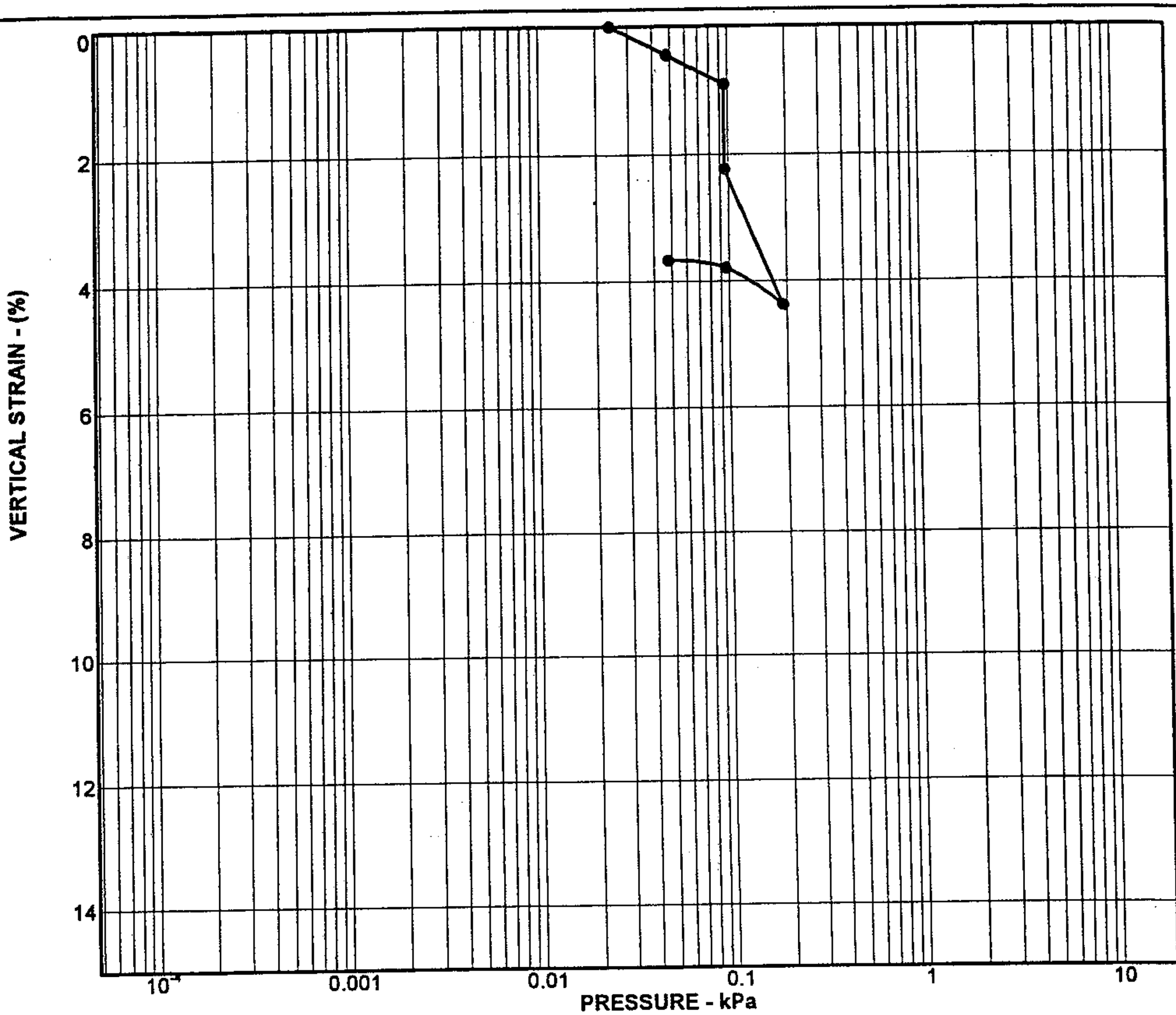
Water added at 96 kPa

KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT
FACILITY
COALINGA, CALIFORNIA

PLATE
B-14

PROJECT NO. 21-4158-01



Sample	B-30
Elevation	6.4 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.48	1.48
Water content, %	20.0	20.0
Sample height, mm	25.4	24.7

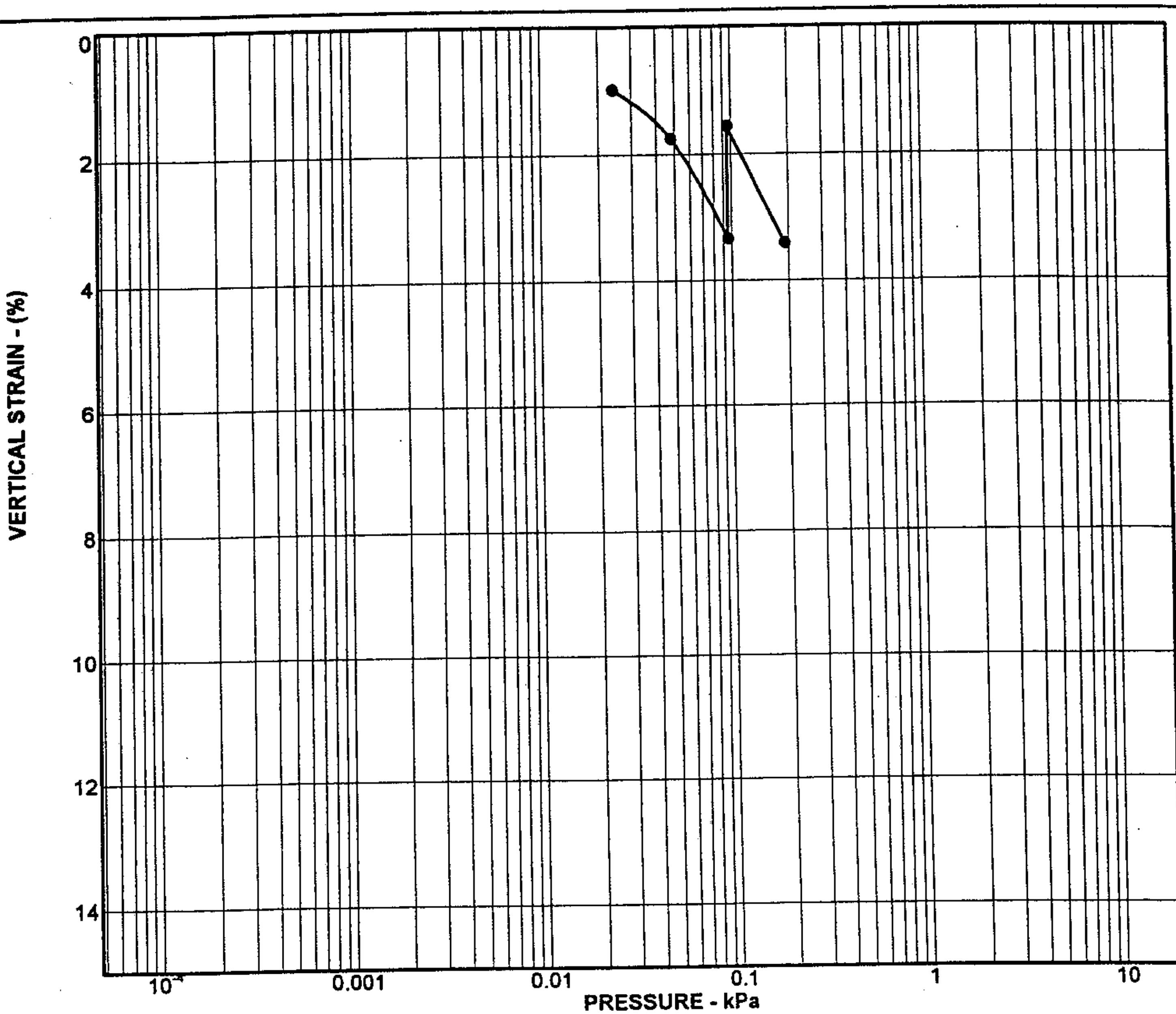
Water added at 96 kPa

KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-15

PROJECT NO. 21-4158-01



Sample	B-34
Elevation	1.8 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.41	1.34
Water content, %	20.8	30.6
Sample height, mm	25.4	24.5

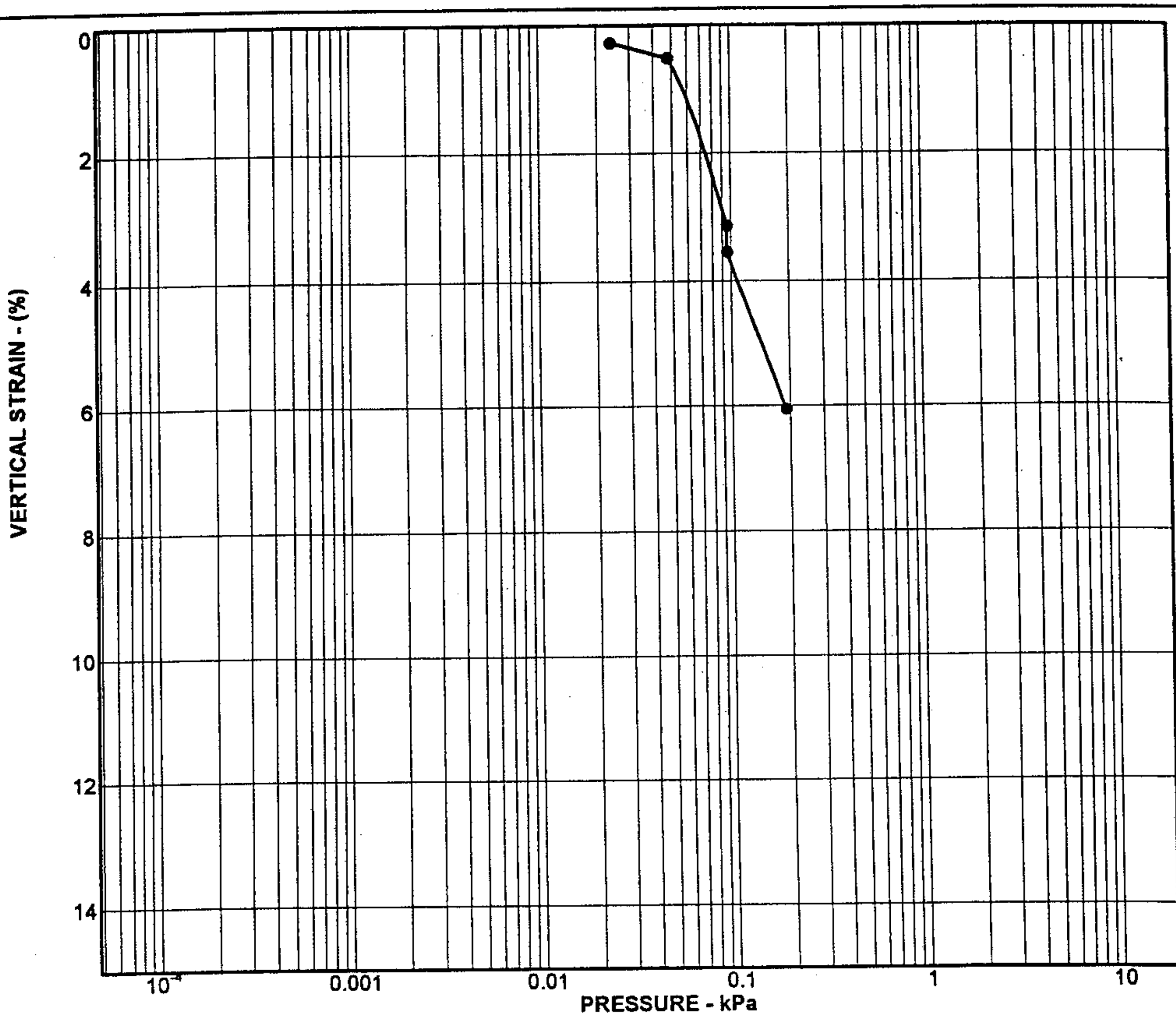
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-16



Sample	B-37
Elevation	1.7 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.38	1.38
Water content, %	22.2	33.8
Sample height, mm	25.4	23.9

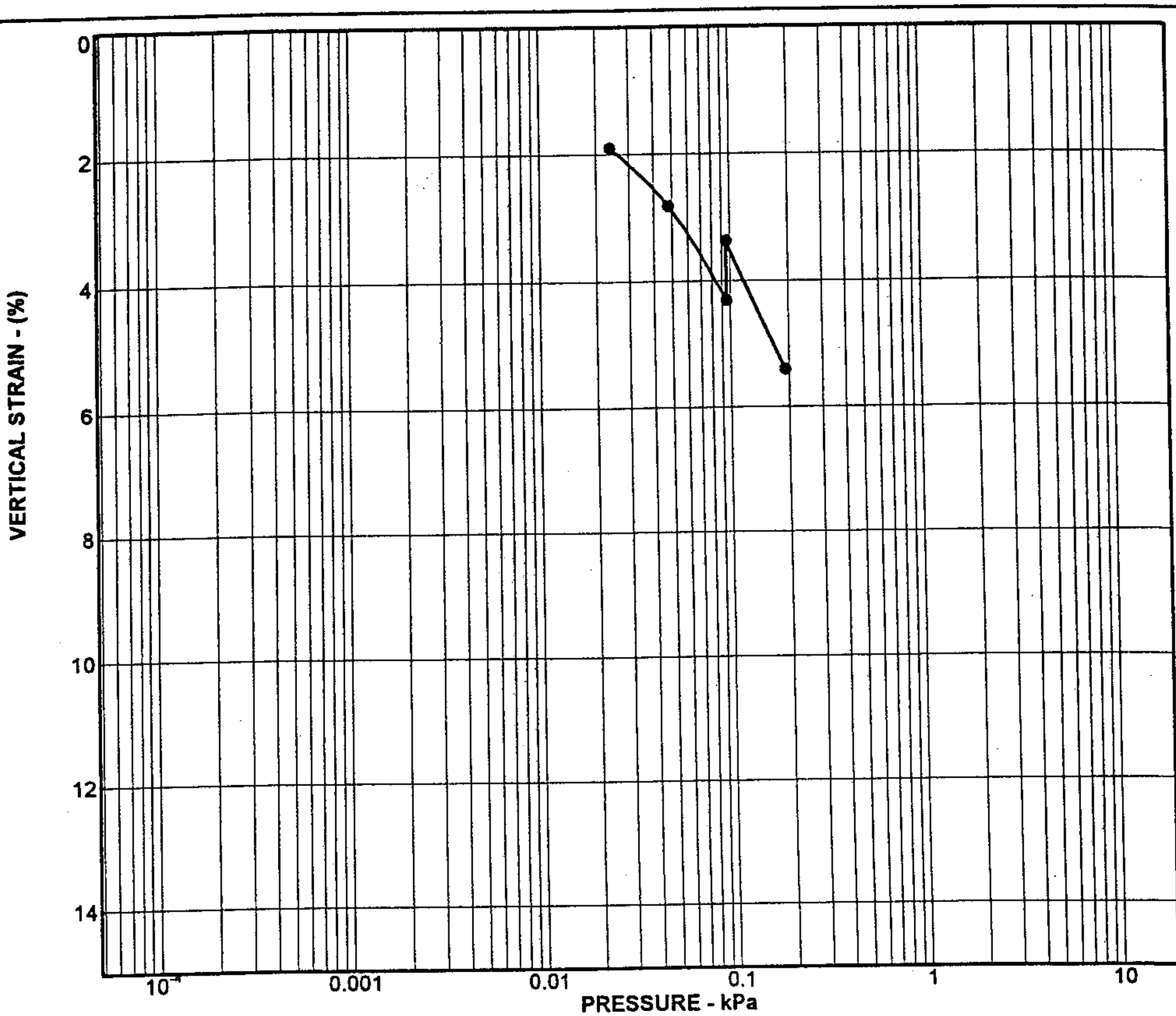
Water added at 96 kPa

KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-17

PROJECT NO. 21-4158-01



Sample	B-37
Elevation	2.3 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.45	1.64
Water content, %	27.2	14.8
Sample height, mm	25.4	24.0

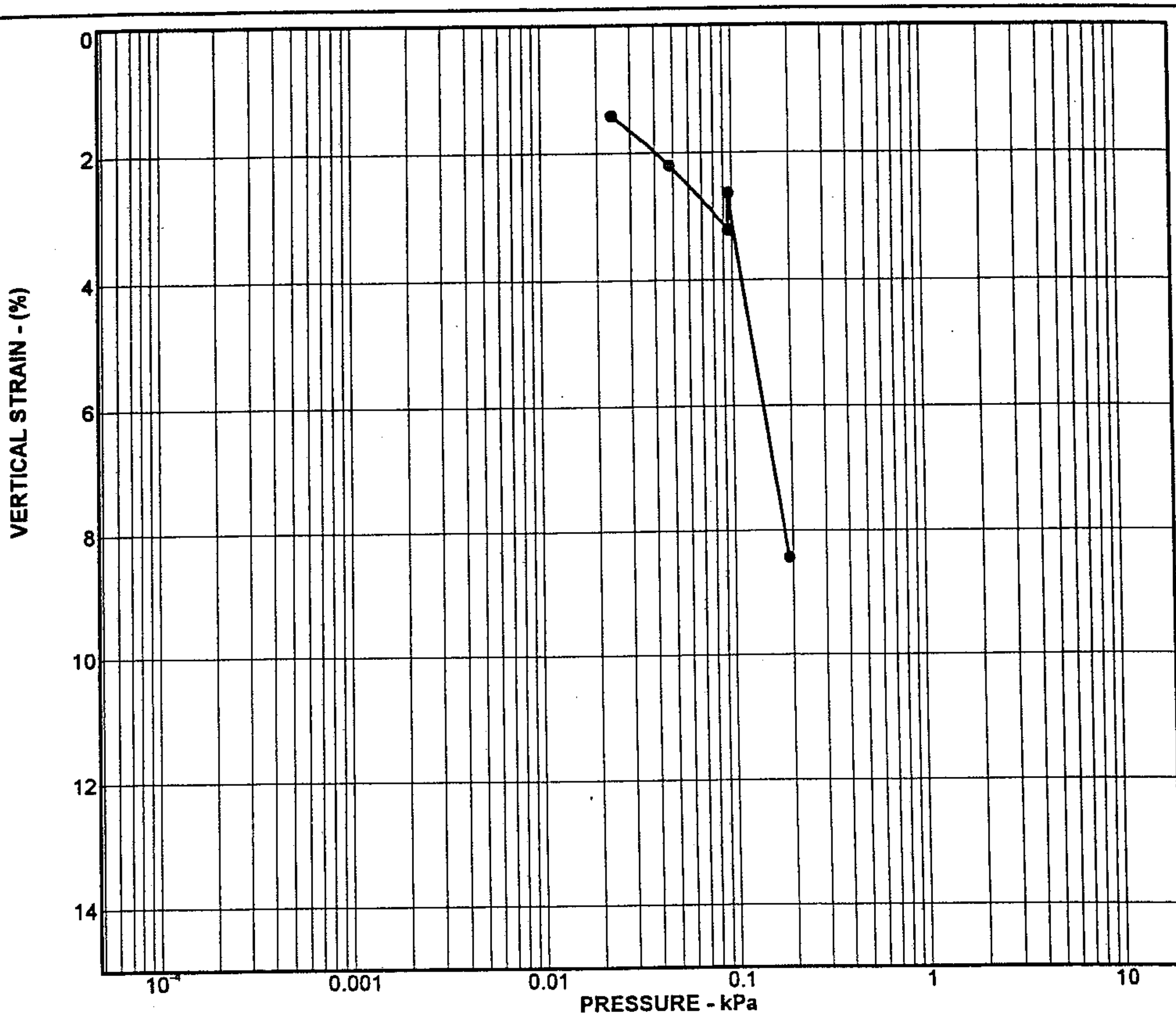
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-18



Sample	B-41
Elevation	1.7 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.42	1.34
Water content, %	21.6	29.8
Sample height, mm	25.4	23.3

Water added at 96 kPa

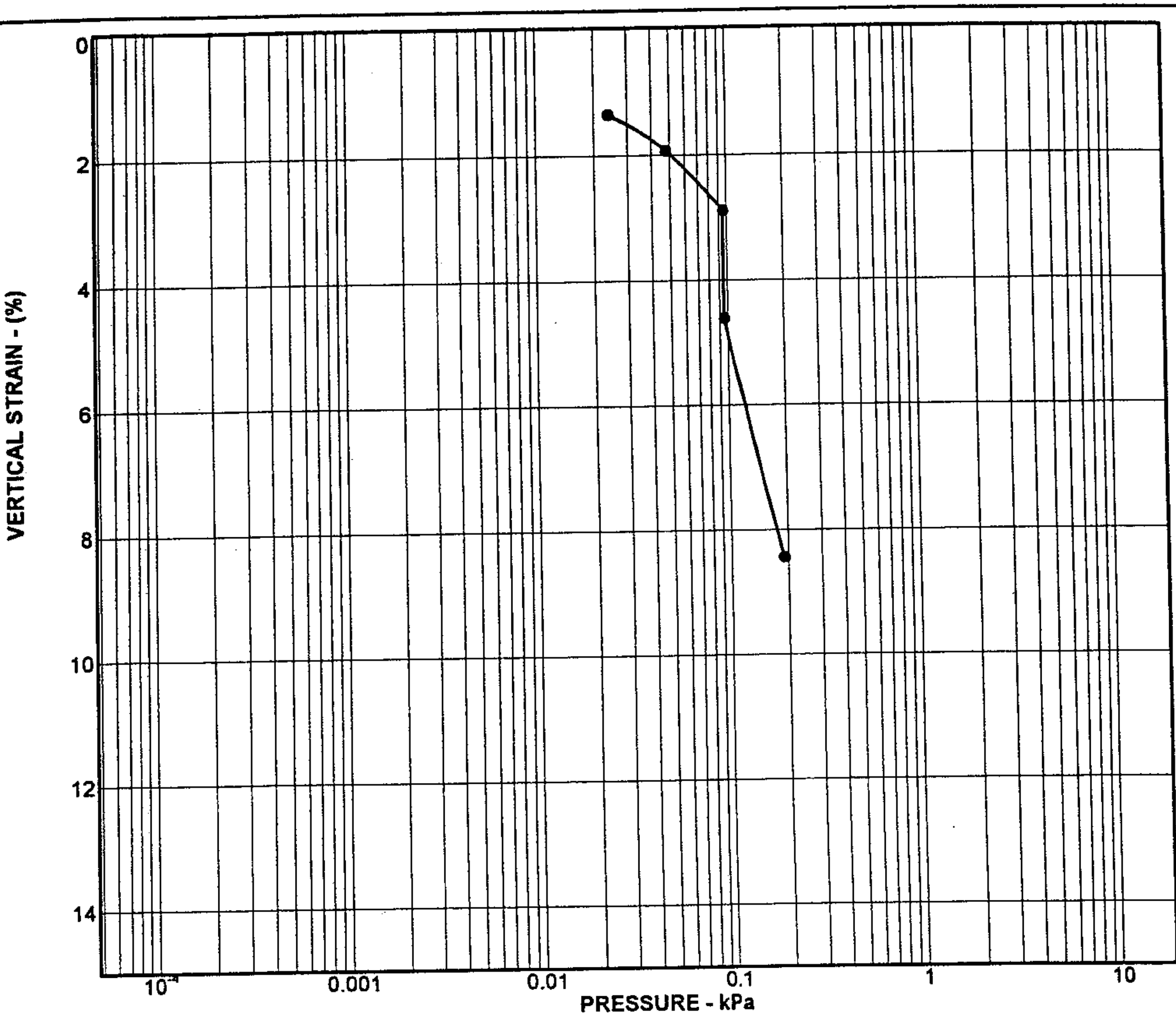
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-19



Sample	B-41
Elevation	2.4 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.47	1.59
Water content, %	21.6	14.8
Sample height, mm	25.4	23.3

Water added at 96 kPa

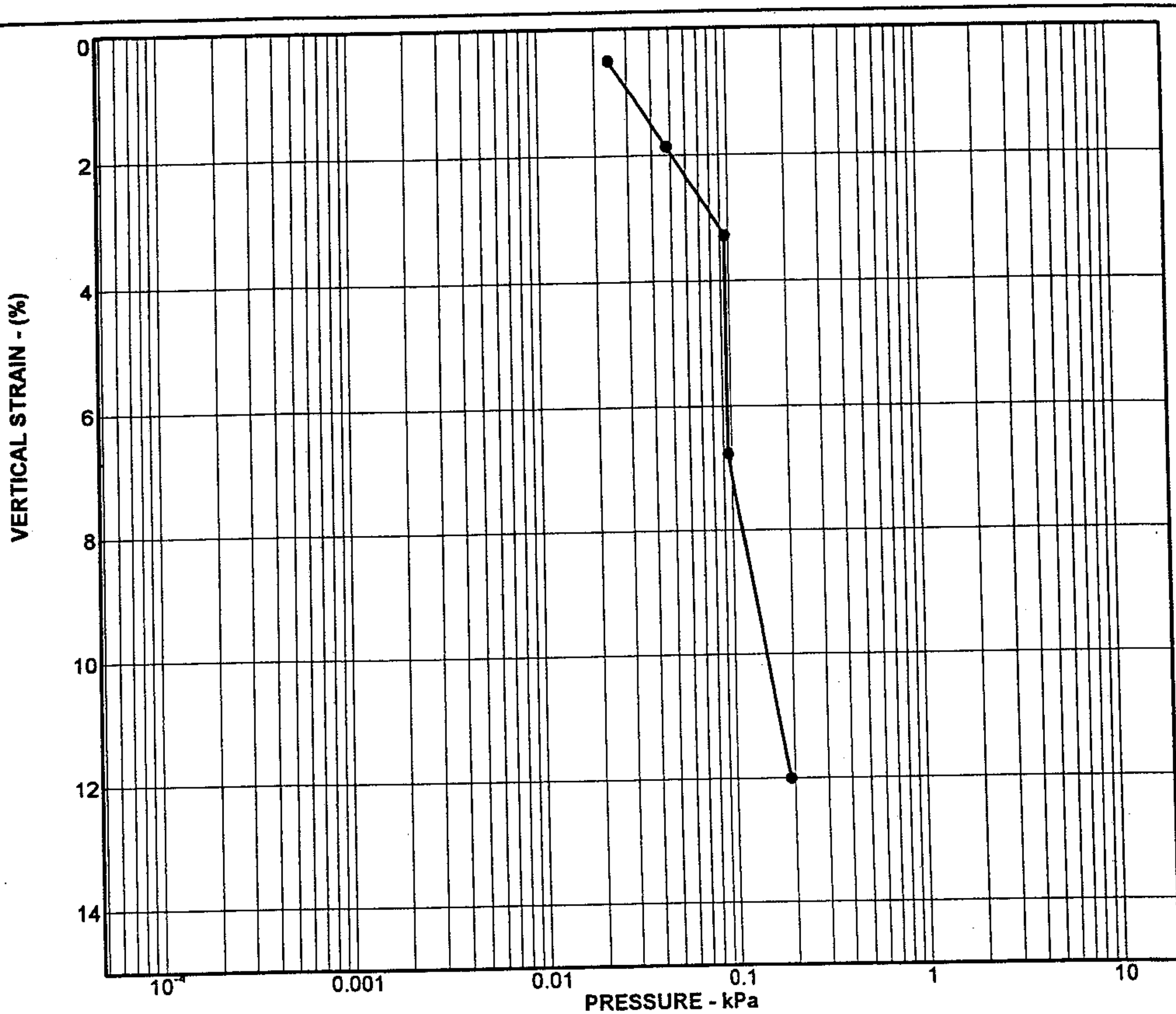
KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT
FACILITY
COALINGA, CALIFORNIA

PLATE

B-20

PROJECT NO. 21-4158-01



Sample	B-43
Elevation	1.1 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.44	1.23
Water content, %	16.0	21.7
Sample height, mm	25.4	22.4

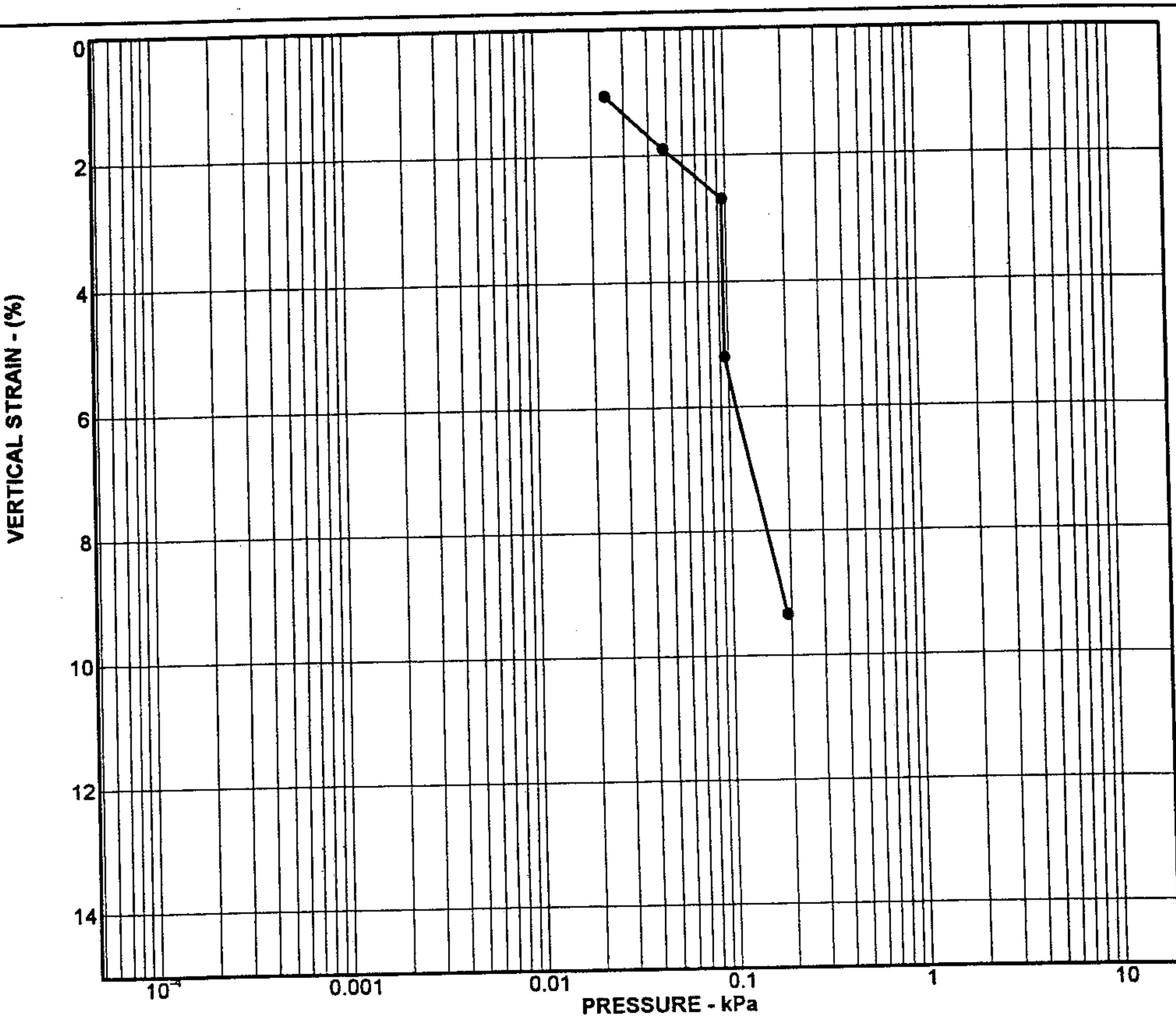
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-21



Sample	B-43
Elevation	1.7 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.24	1.30
Water content, %	16.3	18.3
Sample height, mm	25.4	23.0

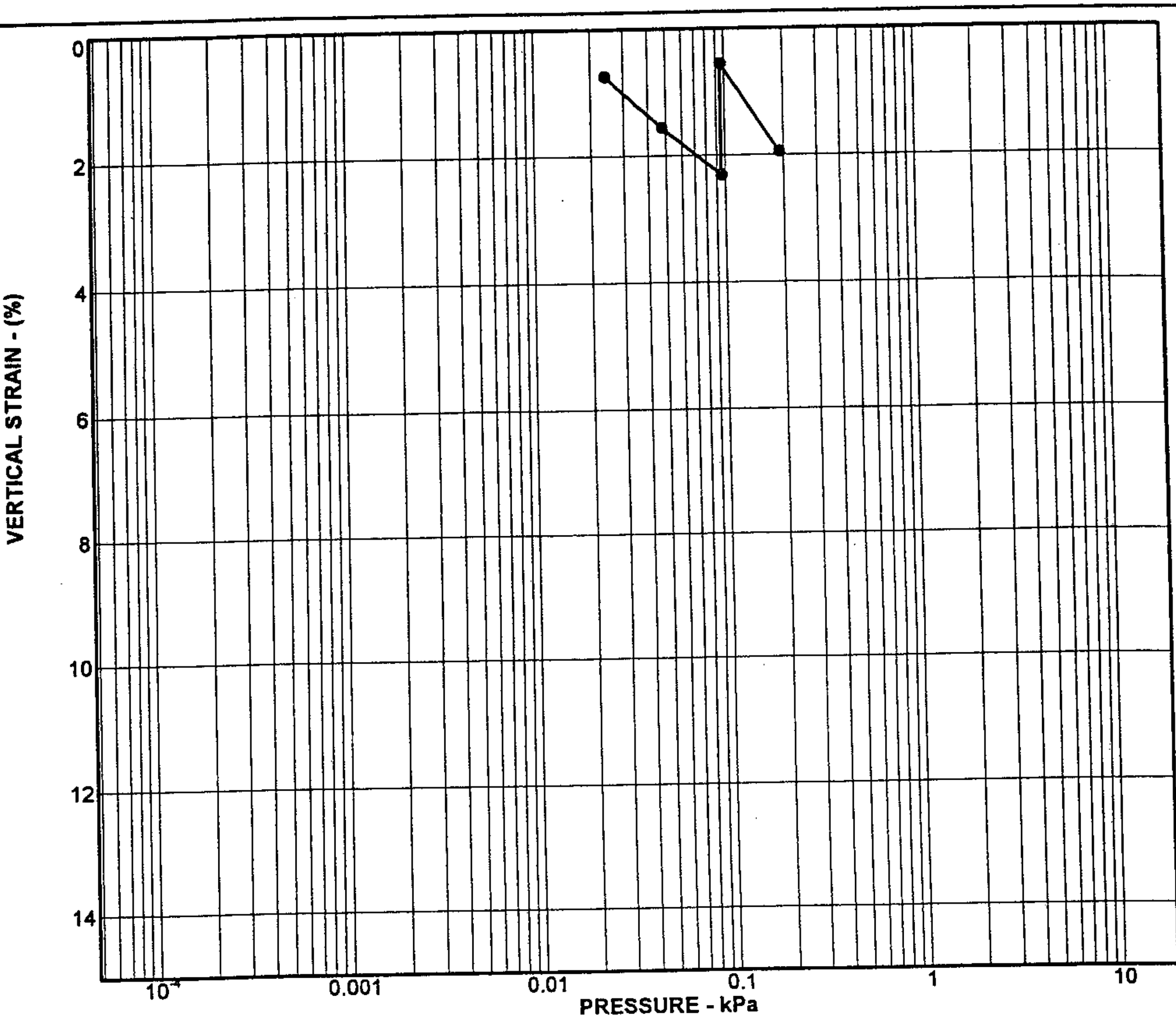
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-22



Sample	B-43
Elevation	2.4 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.56	1.67
Water content, %	22.3	14.8
Sample height, mm	25.4	24.9

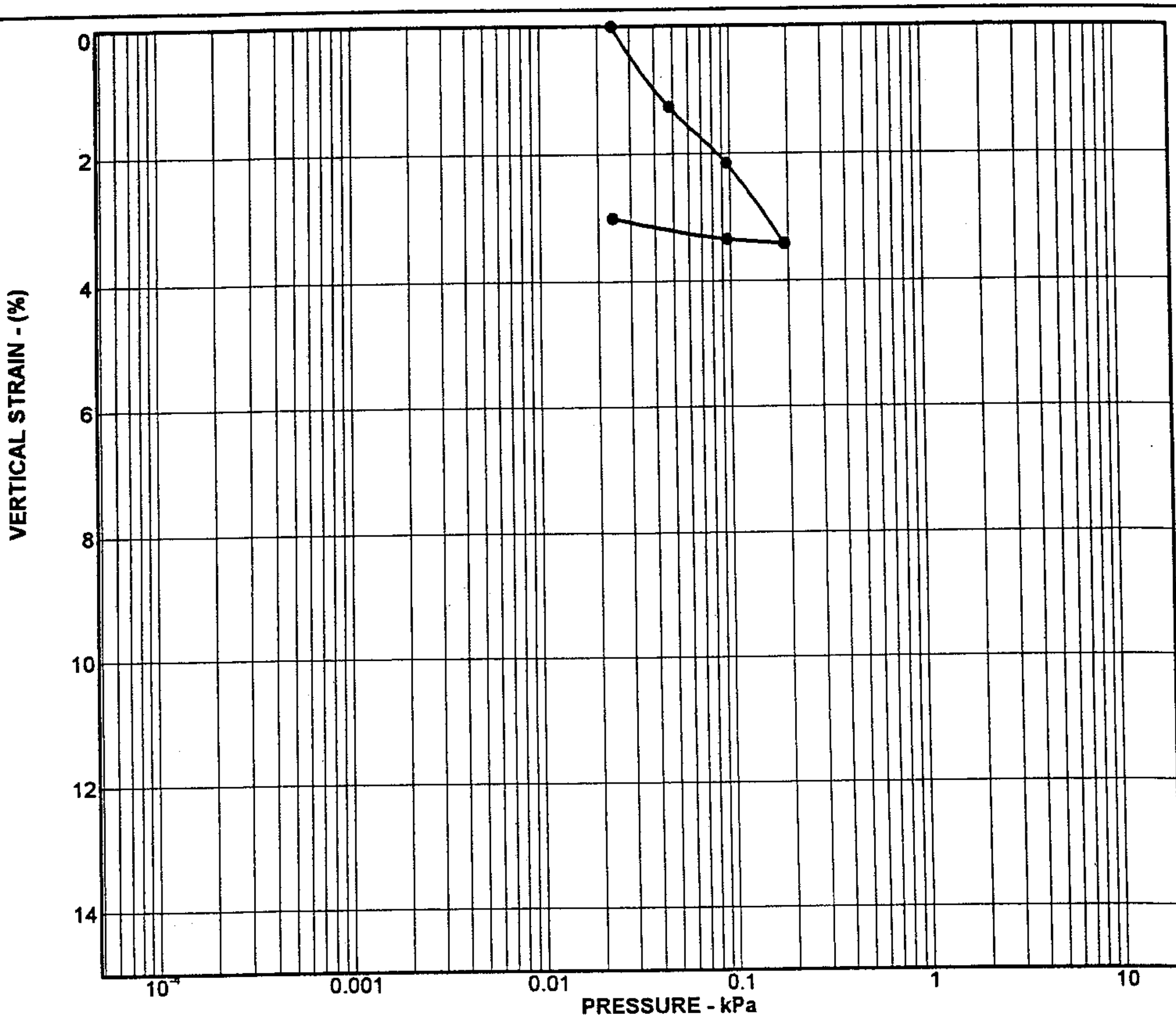
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-23



Sample	B-44
Elevation	0.9 m
Description	Sandy Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc		1.50
Water content, %		21.0
Sample height, mm	25.4	24.5

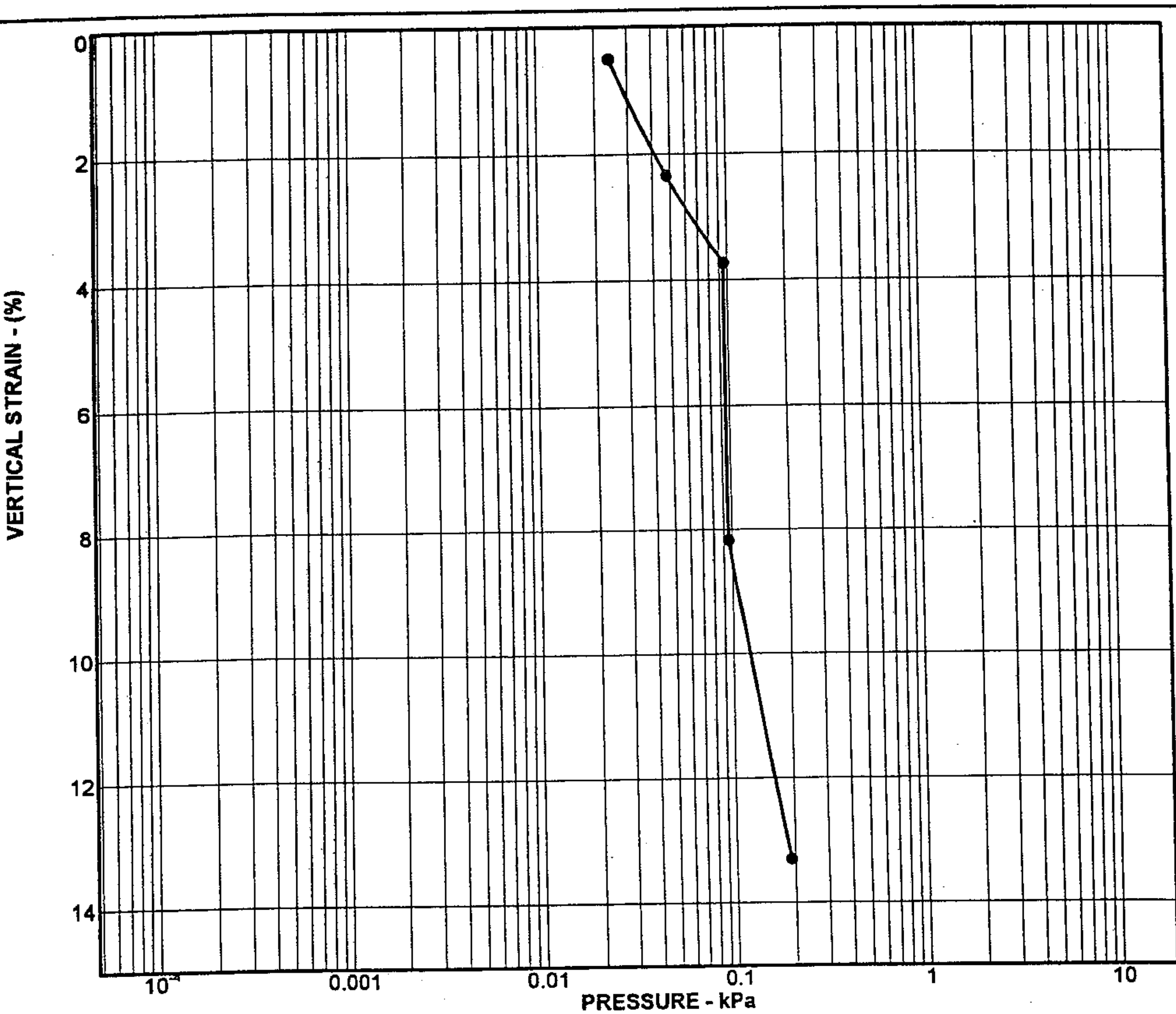
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-24



Sample	B-47
Elevation	1.1 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.52	1.10
Water content, %	10.8	25.1
Sample height, mm	25.4	22.0

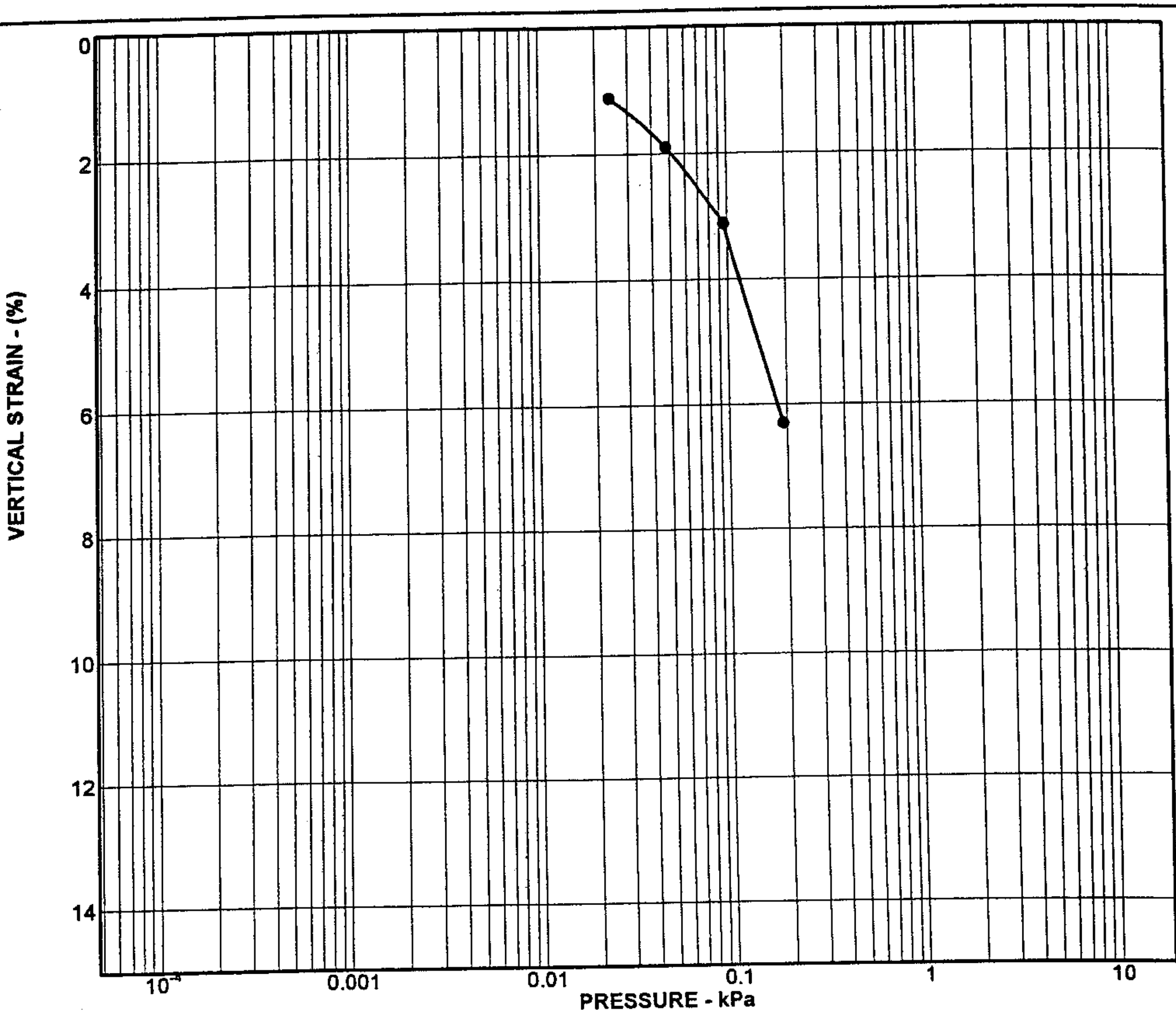
Water added at 96 kPa

KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-25



Sample	B-47
Elevation	1.8 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.25	1.16
Water content, %	13.9	24.6
Sample height, mm	25.4	23.8

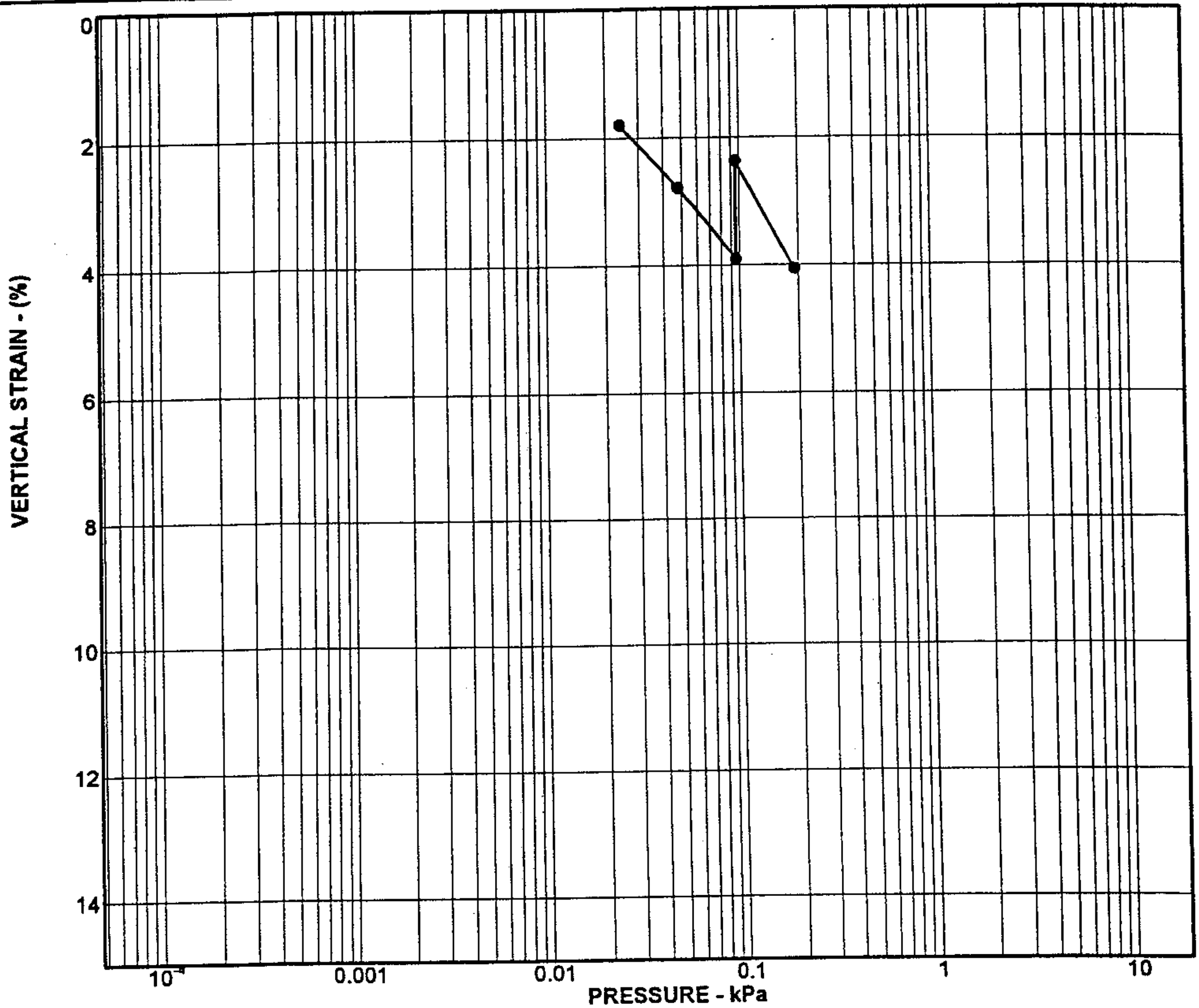
Water added at 96 kPa

KLEINFELDER

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-26

PROJECT NO. 21-4158-01



Sample	B-47
Elevation	2.3 m
Description	Sandy Lean Clay
USCS Classification	CL

	Initial	Final
Dry density, g/cc	1.52	1.69
Water content, %	22.3	14.8
Sample height, mm	25.4	24.4

Water added at 96 kPa

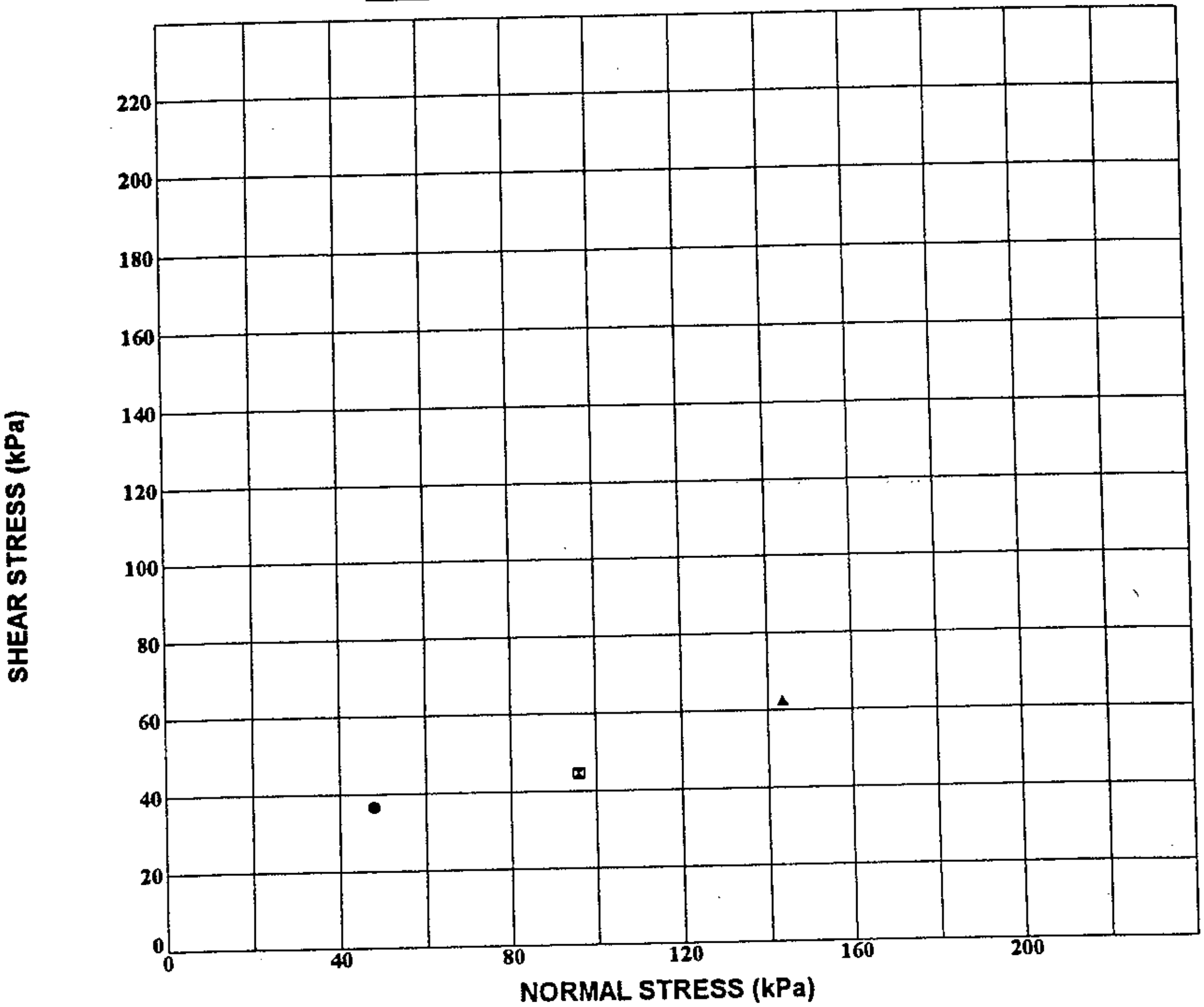
KLEINFELDER

PROJECT NO. 21-4158-01

CONSOLIDATION TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-27

DIRECT SHEAR (Consolidated - Drained)



Source	B-29	B-29	B-29
Elevation (m)	0.9	0.9	0.9
Dry Density (g/cc)	1.58	1.65	1.62
Initial Water Content (%)			
Final Water Content (%)	26.5	20.7	26.5
Normal Stress (kPa)	47.9	95.8	143.6
Peak Shear Stress(kPa)	36.7	44.7	62.4

KLEINFELDER

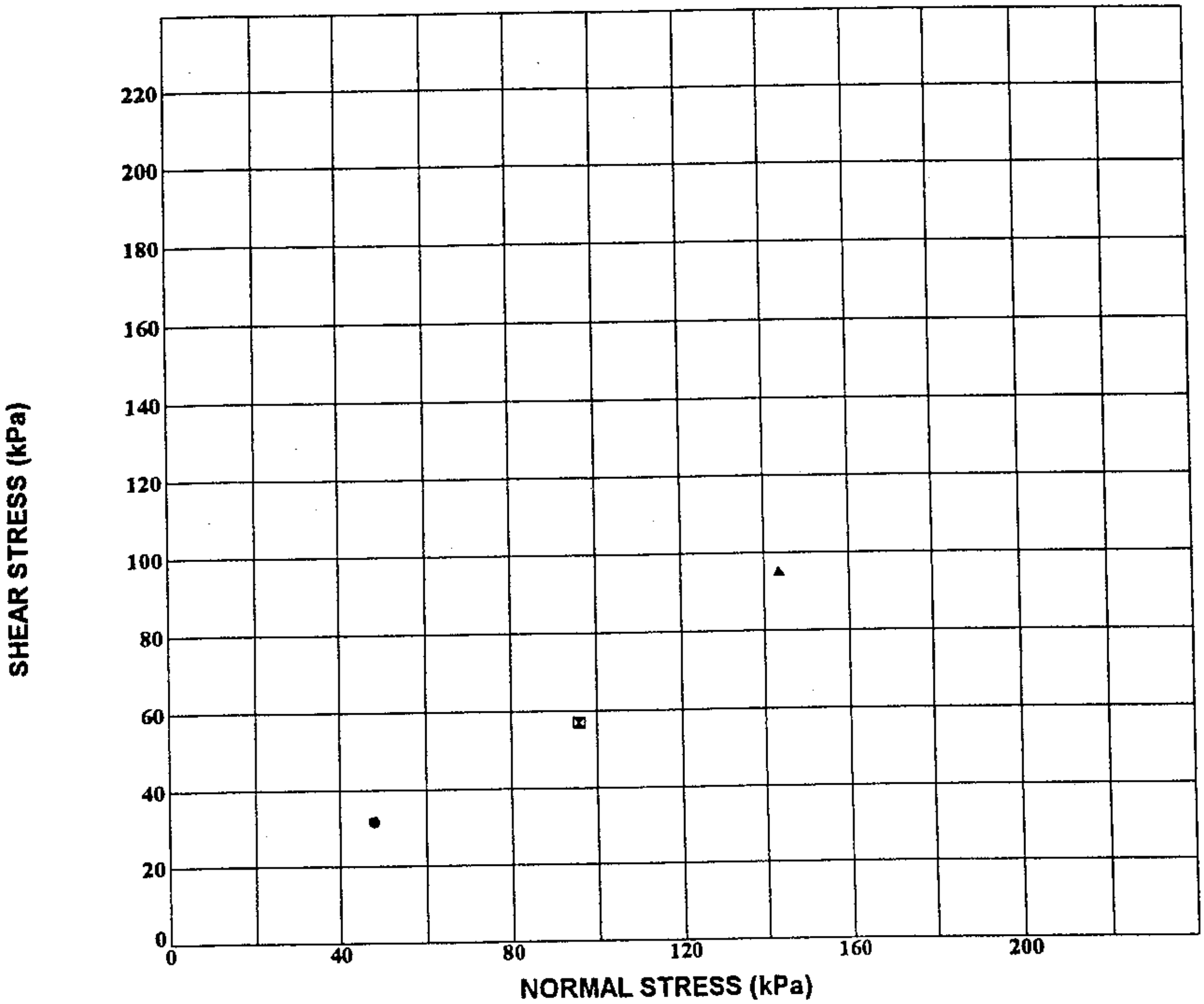
PROJECT NO. 21-4158-01

DIRECT SHEAR TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE

B-28

DIRECT SHEAR (Consolidated - Drained)



Source	B-43	B-43	B-43
Elevation (m)	0.3	0.3	0.3
Dry Density (g/cc)	1.68	1.64	1.60
Initial Water Content (%)			
Final Water Content (%)	25.1	26.2	25.1
Normal Stress (kPa)	47.9	95.8	143.6
Peak Shear Stress(kPa)	31.7	56.9	95.2

KLEINFELDER

PROJECT NO. 21-4158-01

DIRECT SHEAR TEST
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B-29

SUMMARY OF MAXIMUM DENSITY TESTS

Location	Depth (m) [ft]	Soil Description	Optimum Moisture Content (%)	Maximum Dry Density (kN/m^3) [lbs/ft^3]
B-8	0.3 to 1.5 [1 to 5]	Sandy Clay (CL)	15.8	17.6 [112.2]
B-23	0.3 to 1.5 [1 to 5]	Sandy Clay (CL)	14.5	17.5 [111.5]
B-29	0.9 to 1.8 [3 to 6]	Sandy Clay (CL)	19.5	16.7 [106.1]
B-31	0.9 to 1.8 [3 to 6]	Sandy Clay (CL)	19.0	16.4 [104.6]
B-37	0.0 to 0.9 [0 to 3]	Sandy Clay (CL)	14.0	17.8 [113.5]
B-43	0.0 to 0.9 [0 to 3]	Sandy Clay (CL)	13.3	17.8 [113.4]
B-44	0.9 to 1.8 [3 to 6]	Sandy Clay (CL)	20.5	16.4 [104.6]

KLEINFELDER

DRAWN BY: S. PLAUSON
PROJECT No. 21-4158-01

DATE: 2-28-00
DWG No. CURVE_TEST

MAXIMUM DENSITY CURVE

PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE
B30

SUMMARY OF RESISTANCE VALUE TESTS

Location	Depth (m) [ft]	Exudation Pressure (mPa) [psi]	R-Value by Exudation	Expansion Pressure (mPa) [psi]	R-Value by Expansion
B-2	0.3 to 1.5 [1 to 5]	5.21 [756.0]	47	7.52 [1091]	<5
		2.96 [429.7]	36	5.01 [727]	
		1.62 [234.8]	34	2.09 [303]	
B-5	0 to 1.2 [0 to 4]	4.0 [584.9]	21	13.19 [1913]	<5
		2.36[342.2]	16	10.3 [1494]	
		1.18 [171.1]	11	6.27 [909]	
B-5	1.2 to 1.8 [4 to 6]	No lights	8	7.76 [1126]	<5
		Two lights	5	4.48 [650]	
B-29	0.9 to 1.8 [3 to 6]	4.75 [688.4]	21	3.28 [476]	<11
		2.66 [386.0]	14	2.18 [316]	
		1.04 [151.2]	12	0.69 [100]	

KLEINFELDER

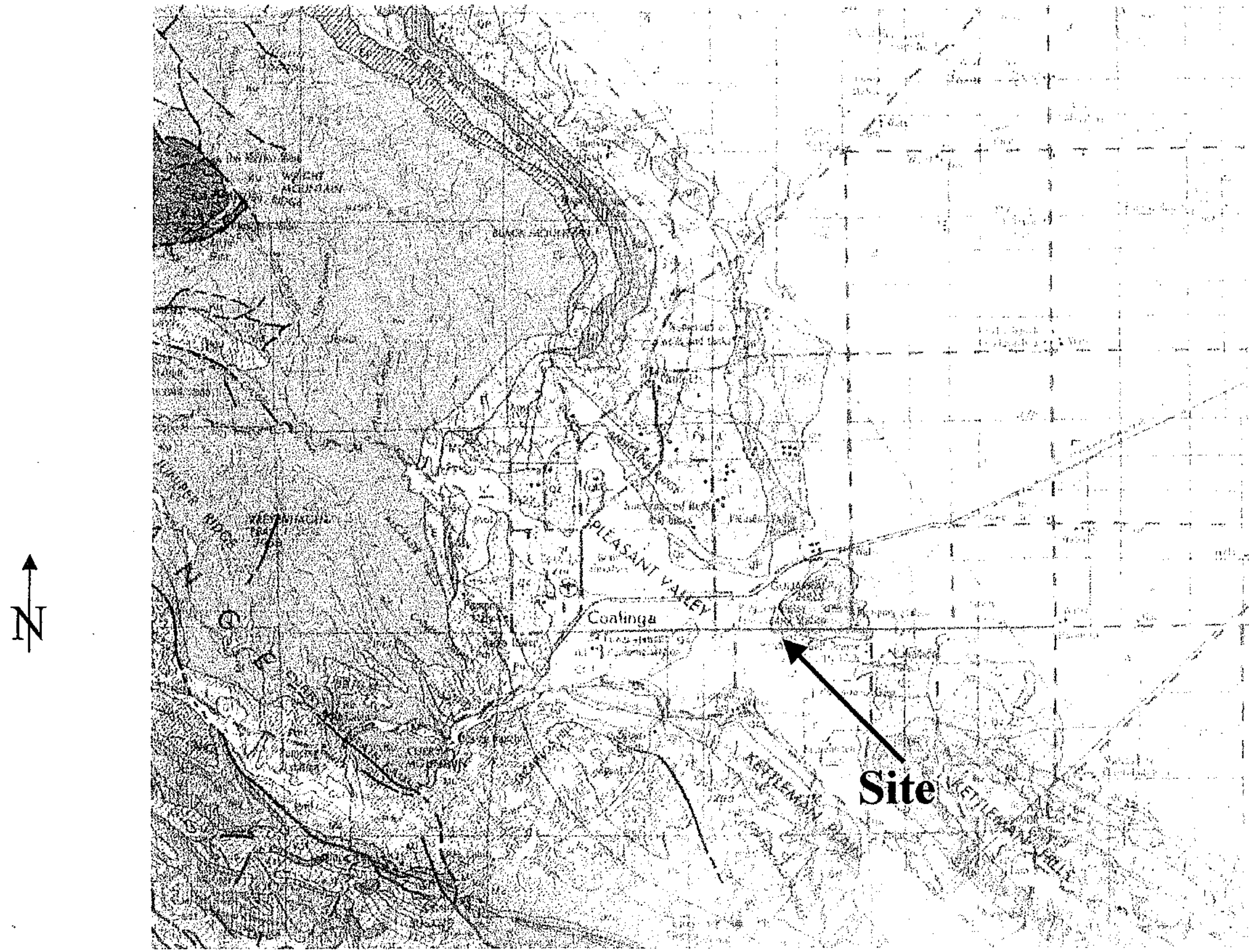
RESISTANCE VALUE

PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE B31

DRAWN BY: S. PLAUSON
PROJECT No. 21-4158-01

DATE: 2-28-00
DWG No. RVAL_TEST



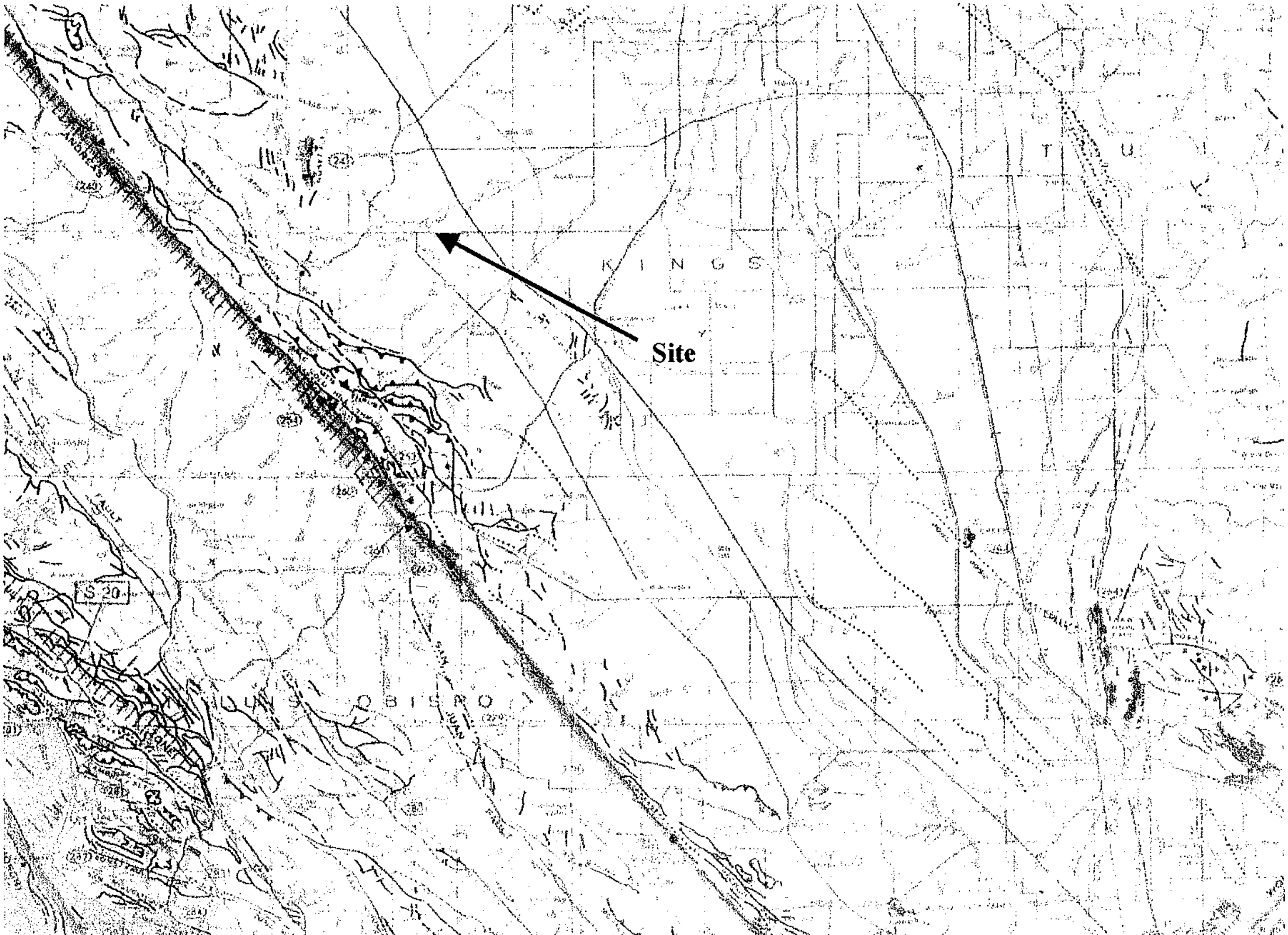
From: Jennings and Strand, 1958

KLEINFELDER

Project Number 21-4158-01

Regional Geologic Map
Proposed SVP Facility
Coalinga, California

PLATE
C1



From Jennings, 1994

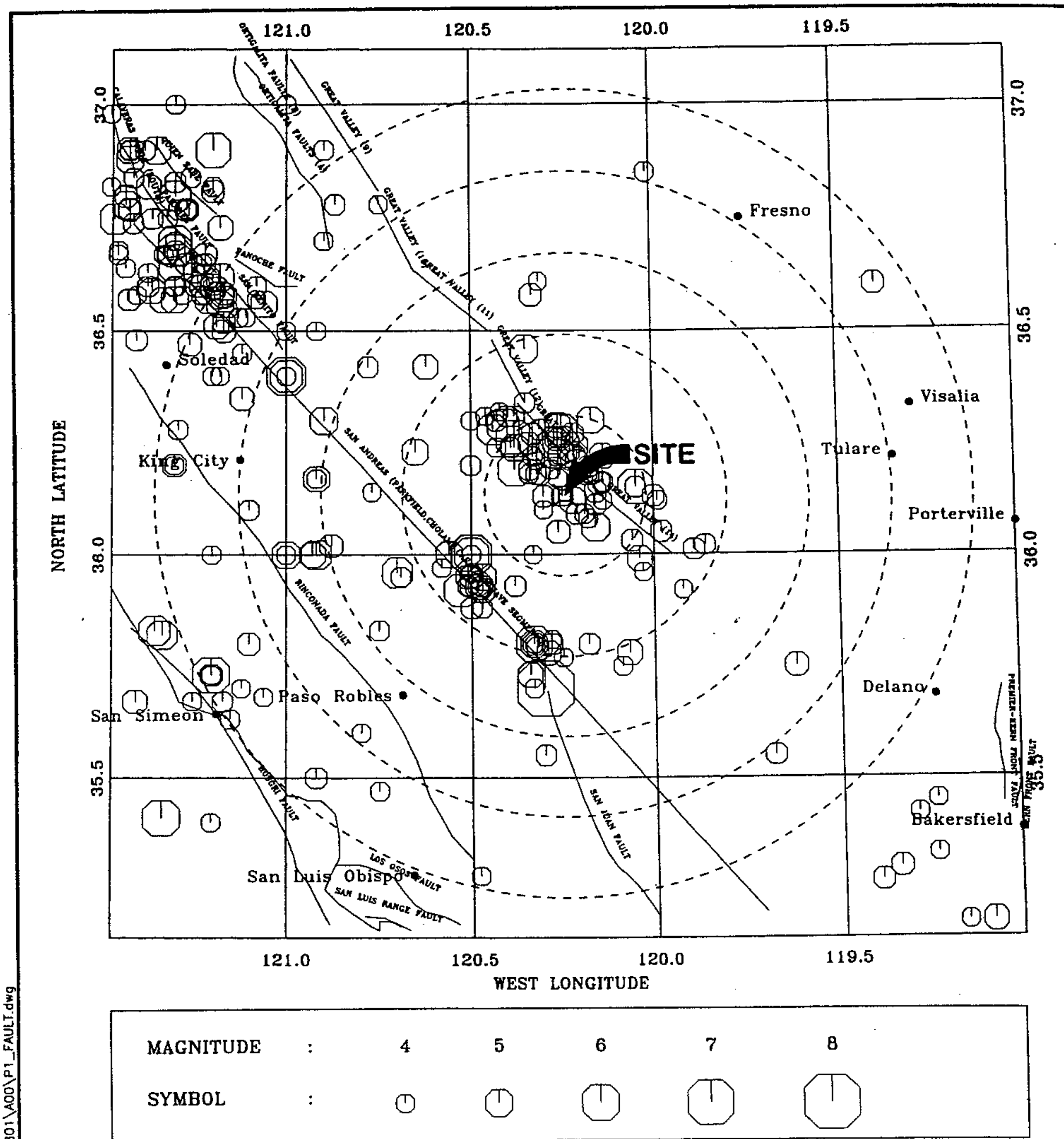
KLEINFELDER

Project Number 21-4158-01

Area Fault Map
Proposed SVP Facility
Coalinga, California

PLATE
C2

M-6A (4/91)



RADIUS OF LARGEST CIRCLE IS 100 KM

KLEINFELDER

REGIONAL FAULT AND SEISMICITY MAP (1800 TO JANUARY 2000)

PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

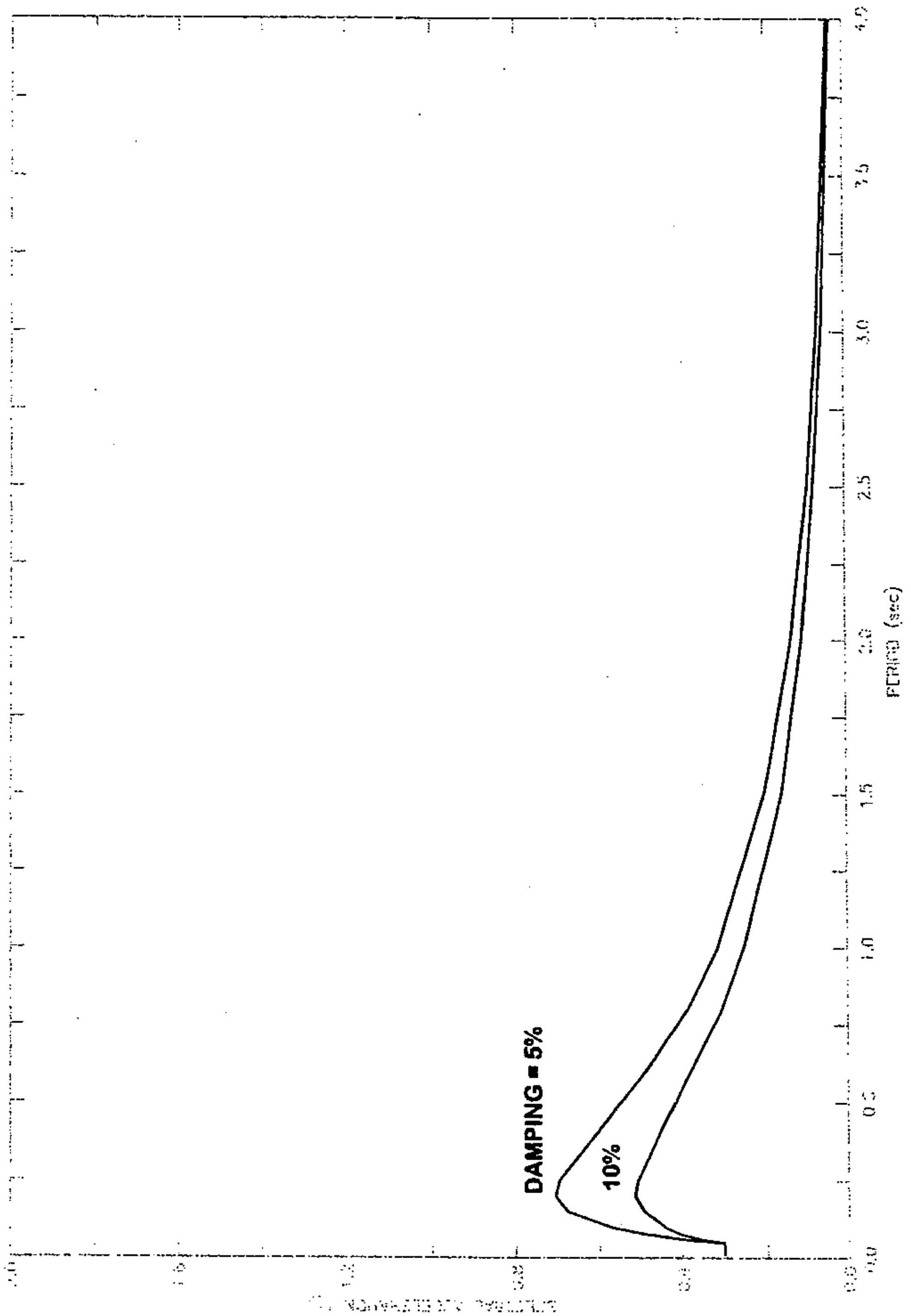
PLATE C3

DRAFTED BY: L. Sue DATE: 2-2-00

CHECKED BY: Z. Zafir DATE: 2-2-00

PROJECT NO. 21-415801-A00

CAD FILE: L:\2000\00PROJECTS\21415801\A00\P1_FAULT.dwg

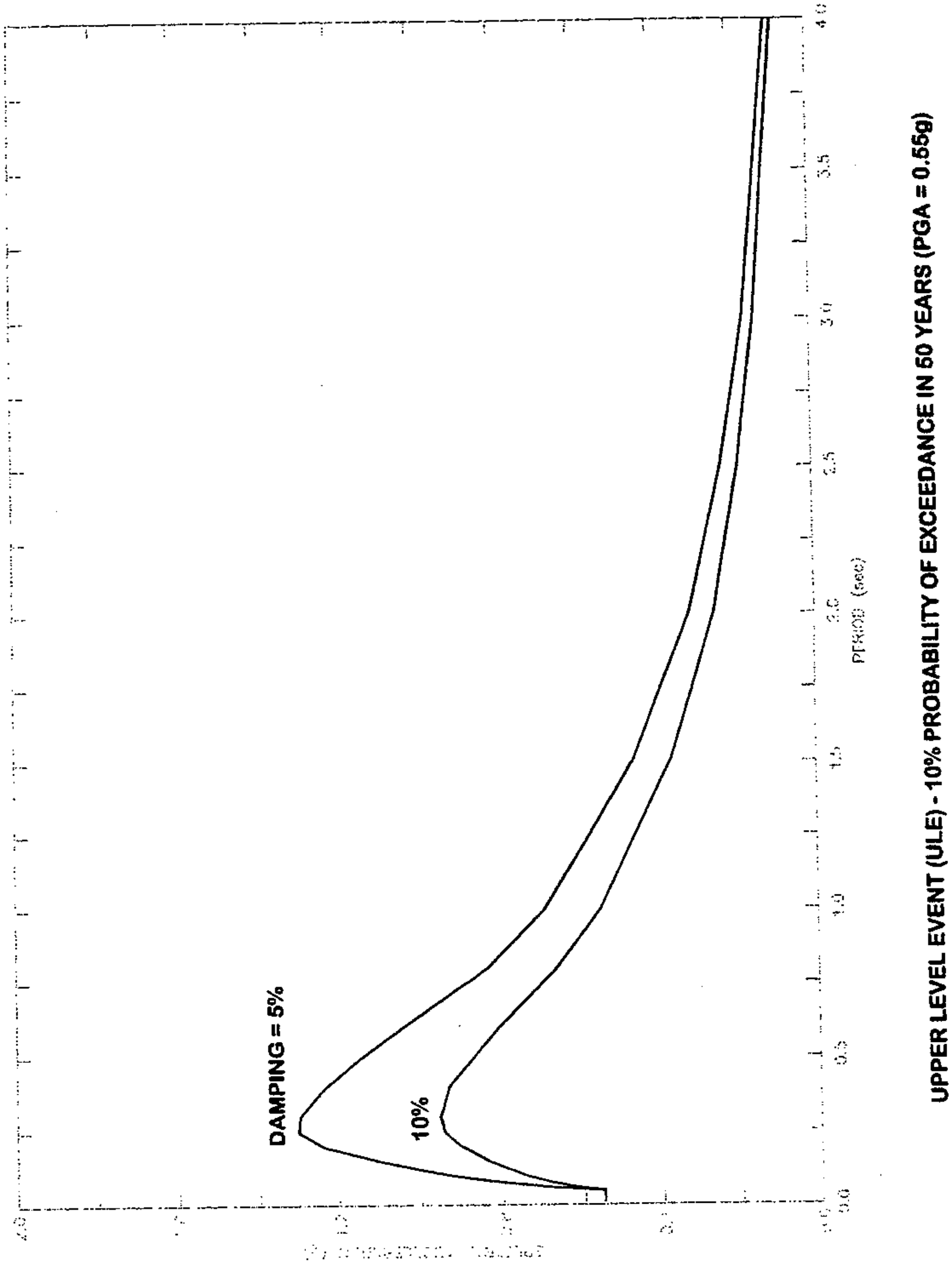


LOWER LEVEL EVENT (LLE) - 50% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.30g)

CAD FILE: L:\2000\00PROJECTS\21415801\A00\P2_LLEHL.dwg

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 2-2-00	SITE-SPECIFIC DESIGN SPECTRA LOWER LEVEL EVENT (LLE) LINEAR PLOT PROPOSED SECURE TREATMENT FACILITY COALINGA, CALIFORNIA	PLATE C4
CHECKED BY: Z. Zafir	DATE: 2-2-00	PROJECT NO. 21-415801-A00	



KLEINFELDER

SITE-SPECIFIC DESIGN SPECTRA
UPPER LEVEL EVENT (ULE)
LINEAR PLOT

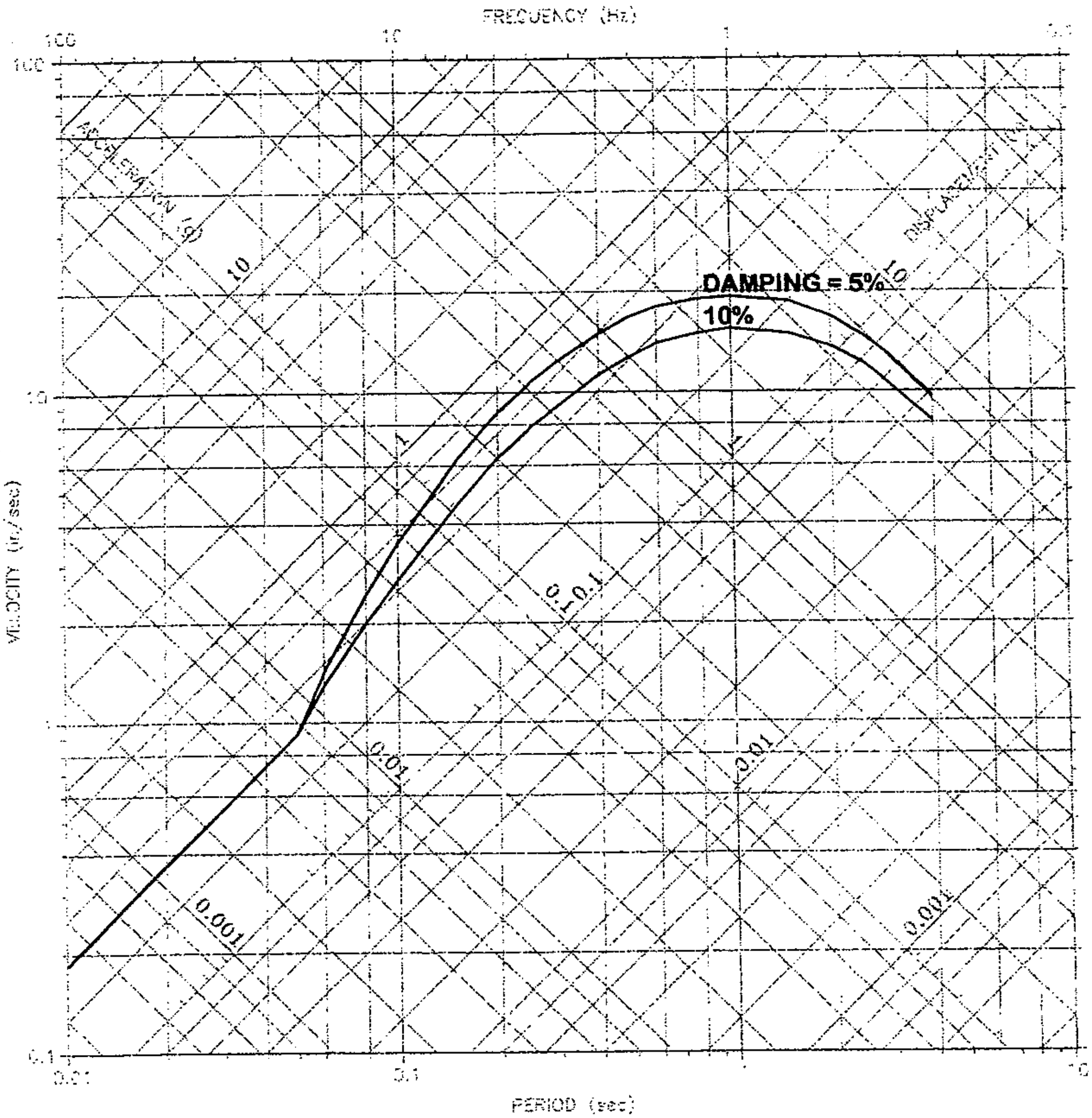
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE C5

DRAFTED BY: L. Sue	DATE: 2-2-00
CHECKED BY: Z. Zafir	DATE: 2-2-00

PROJECT NO. 21-415801-A00

CAD FILE: L:\2000\00PROJECTS\21415801\A00\P3_ULEHL.dwg



LOWER LEVEL EVENT (LLE) = 50% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.30g)

KLEINFELDER

SITE-SPECIFIC DESIGN SPECTRA
LOWER LEVEL EVENT (LLE)
TRIPARTITE PLOT

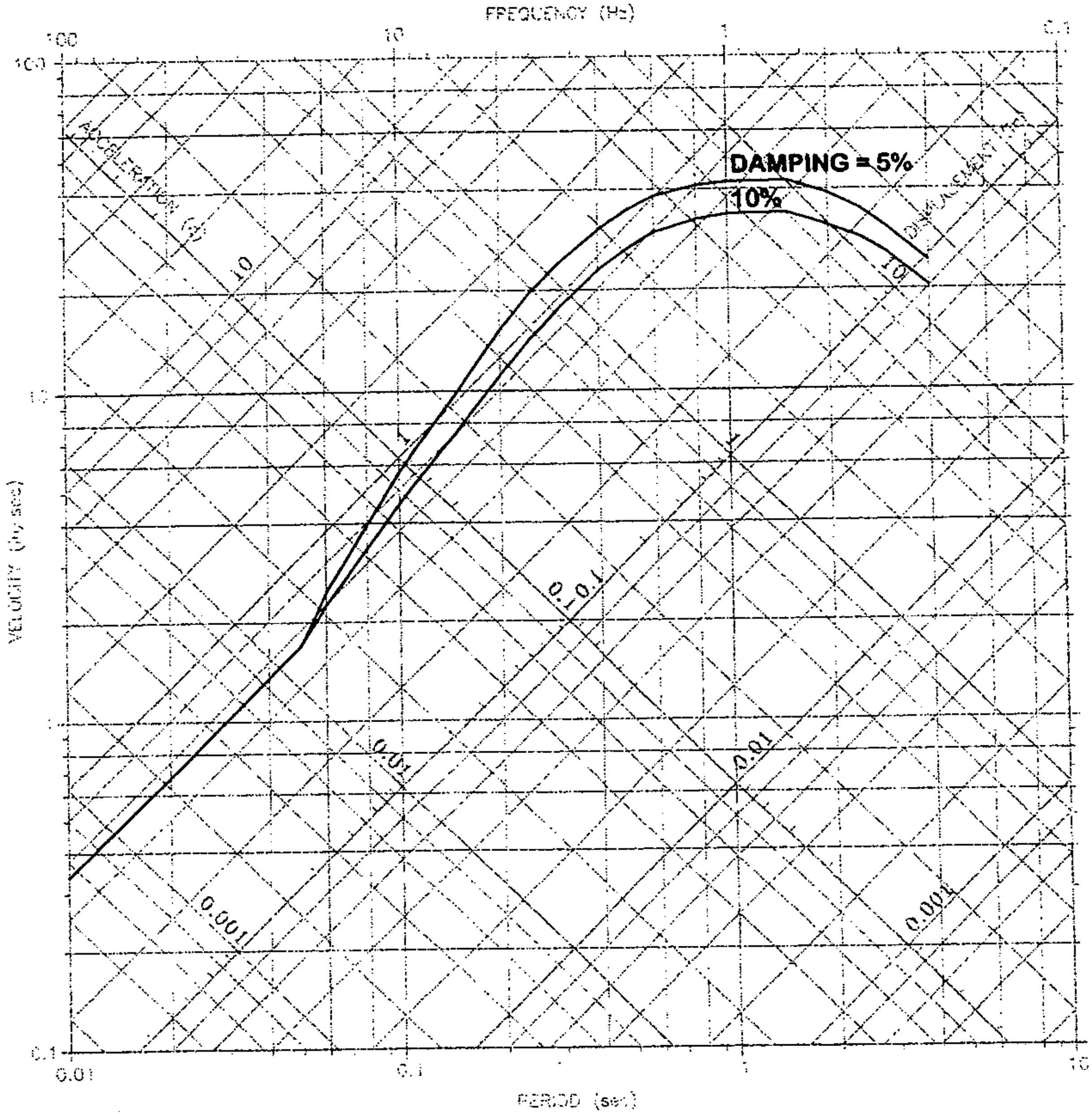
PROPOSED SECURE TREATMENT FACILITY
COALINGA, CALIFORNIA

PLATE C6

DRAFTED BY: L. Sue	DATE: 2-2-00
CHECKED BY: Z. Zafir	DATE: 2-2-00

PROJECT NO. 21-415801-A00

CAD FILE: L:\2000\00PROJECTS\21415801\A00\P4_LLEHT.dwg



UPPER LEVEL EVENT (ULE) = 50% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.55g)

KLEINFELDER	SITE-SPECIFIC DESIGN SPECTRA UPPER LEVEL EVENT (LLE) TRIPARTITE PLOT PROPOSED SECURE TREATMENT FACILITY COALINGA, CALIFORNIA	PLATE C7
DRAFTED BY: L. Sue — DATE: 2-2-00		
CHECKED BY: Z. Zafir — DATE: 2-2-00	PROJECT NO. 21-415801-A00	

CAD FILE: L:\2000\00PROJECTS\21415801\A00\P5_ULEHT.dwg