APPENDIX 8.15A

Preliminary Geotechnical Report

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Vernon Power Plant
5001 Soto Street, Vernon, CA

Prepared for

The City of Vernon

February 21, 2006

CH2MHILL

3 Hutton Centre Drive, Suite 200
Santa Ana, California 92707

Appendix 8.15A
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Vernon Power Plant
5001 Soto Street, Vernon, CA

Submitted to

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February 21, 2006

CH2MHILL

The following individuals have participated in the preparation of this document and/or have completed quality review.

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SECTION 1

Introduction

This report summarizes CH2M HILL'S preliminary geotechnical exploration and data review for design and construction of the proposed Vernon power plant (VPP) located in the City of Vernon, California.

1.1 Purpose and Scope

The proposed project will be located at the southwest corner of Soto Street and 50th Street in the City of Vernon, Los Angeles County, California, on an approximately 5.8-acre parcel zoned for general industrial use. The parcel acquired by the City of Vernon is currently mostly cleared with the surface rough graded. All existing building, structures, and underground utilities within the perimeter of the parcel have been removed and demolished with the exception of a former administration building at 5001 Soto Street remaining to be demolished.

The proposed power plant consists of a power block area containing a steam turbine generator and two power trains each consisting of a combustion turbine generator and a heat recovery steam generator, a switchyard, a cooling tower basin, generator step up transformers, auxiliary cooling units, a reclaimed water storage tank, fire protection systems, an area including an administration building, a control room, and a water treatment building with a parking area, a GIS building, and an access road to the plant.

The purpose of this preliminary exploration is to provide a discussion of geologic and geotechnical issues including subsurface conditions, seismicity, and liquefaction potential of the site. This preliminary geotechnical report will also be used to assist the City of Vernon in the application for certification process for the power plant facility.

The scope of work for the preliminary geotechnical services includes:

- Review existing geotechnical reports on facilities near the proposed VPP
- Field investigation consisting of drilling two hollow-stem auger (HSA) soil borings
- Laboratory testing of selected soil samples to characterize the subsurface materials
- Review existing available seismic and geologic data and summarize the findings
- Development of preliminary geotechnical recommendations for the proposed facility and building foundation design
- Presentation of construction considerations for the proposed facility
- Preparation of this preliminary geotechnical report

1.2 Site Location and Description

The proposed VPP project is located approximately 0.75-mile from the Los Angeles River in the central Los Angeles Basin. The project site is currently mostly cleared with the surface rough graded in an approximately 5.8-acre parcel zoned for general industrial use. The former administration building at 5001 Soto Street remains to be demolished. The location of the proposed project site is shown in Figure 8.15A-1. All figures are located at the end of the sections.

1.3 Pertinent Reports and Investigations

As part of this study, CH2M HILL collected and reviewed existing geotechnical data. The most pertinent documents reviewed include:

- *Preliminary Geotechnical Report: Proposed Power Plant at the former Alcoa Plant Site*. Prepared by CH2M HILL. October, 2005.
- *Report of Geotechnical Investigation: Proposed Generating Units – Malburg Generating Station Facility*. Prepared by Kleinfelder. October 16, 2001.
- *Seismic Hazard Zone Report for the South Gate 7.5-Minute Quadrangle, Los Angeles County, California.* California Department of Conservation, Division of Mines and Geology, 1998

1.4 Limitations

This preliminary report has been prepared for the exclusive use of CH2M HILL, the City of Vernon and its engineers for specific application to the design and construction of the proposed VPP project site as described herein. The work was done in accordance with generally accepted geotechnical engineering practice common to the local area. No other warranty, express or implied, is made.

The content of this report is based on data obtained from the current preliminary investigation and from referenced subsurface explorations. The borings indicate subsurface conditions only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variation in exploration locations. Subsurface conditions and water levels at other locations may differ from those at the indicated locations. Also, the passage of time may result in a change in the conditions at these locations. If variations in subsurface conditions from those described herein are noted during construction, CH2M HILL should be notified immediately; and the recommendations in this report should be re-evaluated.

In the event that any changes in the nature, design, or location of the planned facility occur, the conclusions and recommendations of this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by CH2M HILL. CH2M HILL is not responsible for any claims, damages, or liability associated with interpretation of subsurface data by others or reuse of the subsurface data or engineering analyses without the express written authorization of CH2M HILL.

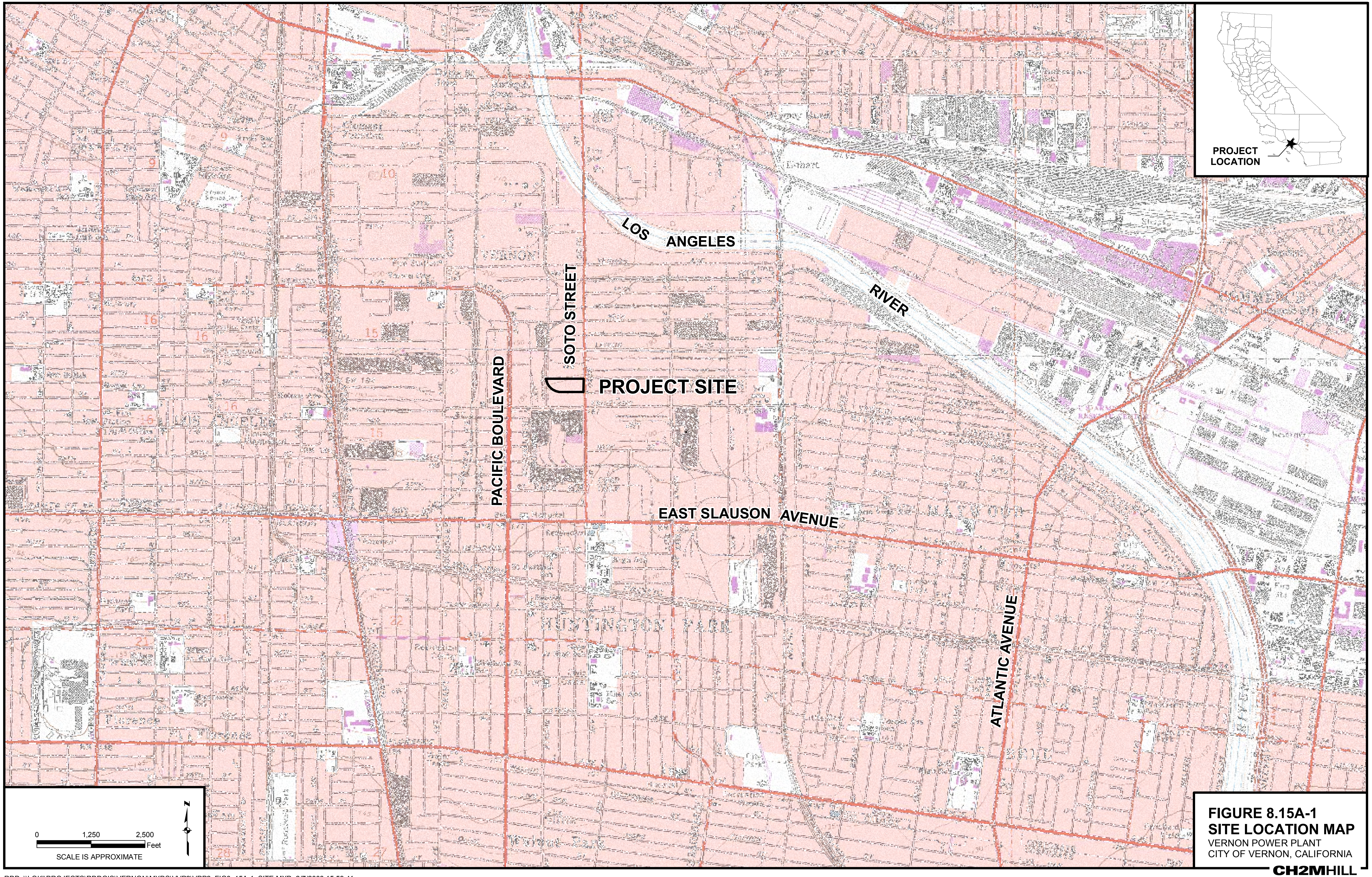

FIGURE 8.15A-1
SITE LOCATION MAP
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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SECTION 2

Technical Data

2.1 Field Exploration

To characterize the subsurface conditions at the proposed VPP site, a geotechnical field exploration was planned and conducted at the project location. The geotechnical field investigation included two HSA borings. Figure 8.15A-2 shows the boring locations relative to the proposed plant site. Table 8.15A-1 summarizes the field exploration.

TABLE 8.15A-1
Summary of Field Exploration

Exploration Number	Performed By	Date Performed	Drilling Method	Depth (feet)	Groundwater Depth (feet)
H-1	2R Drilling	1/24/06	Hollow Stem Auger	81.0	NE
H-2	2R Drilling	1/24/06	Hollow Stem Auger	81.5	NE

NE – Groundwater not encountered during drilling

The two HSA soil borings, H-1 and H-2, were drilled at the project site to depths of 81.0 feet and 81.5 feet, respectively, below ground surface (bgs) in January 2006. The borings were drilled using a truck-mounted, hollow-stem auger drill rig equipped with an 8-inch-diameter hollow-stem auger by 2R Drilling, Inc. under subcontract to CH2M HILL. These HSA borings were logged by a CH2M HILL geotechnical engineer at the time of the drilling.

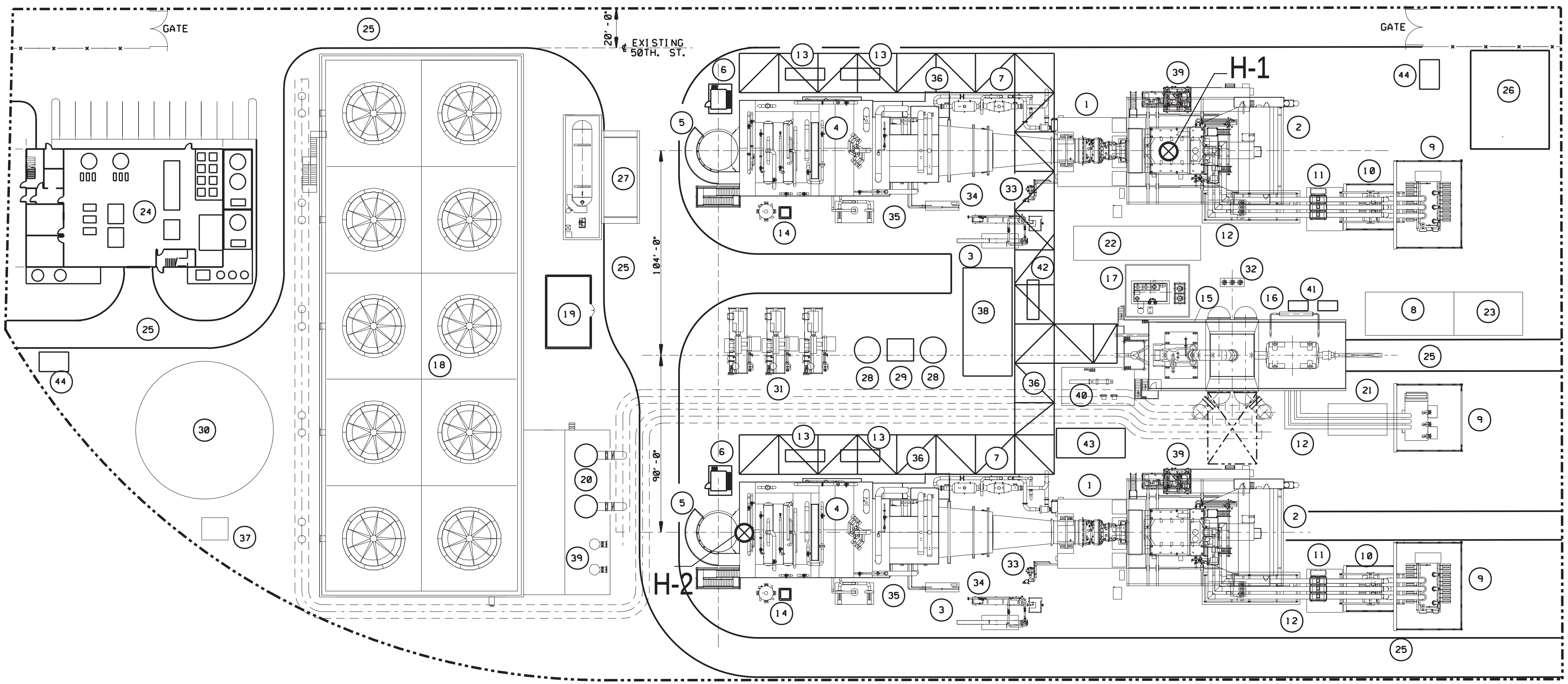
Soil samples were collected at 5-foot intervals using the standard penetration test (SPT) and modified California ring (ring) samplers. The SPT and ring samplers were driven using an automatic trip hammer, 140-pound, free falling from a height of 30 inches, for a total penetration of 18 inches into the ground. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration.

Relatively intact soil samples were collected from the borings using the ring sampler. Sampling procedures generally followed SPT and split-barrel sampling of soils (American Society for Testing and Materials [ASTM] D1586). In addition, representative bulk samples were collected from the borings at shallow depths. Each soil sample collected was examined and classified in accordance with the Unified Soils Classification System (USCS) per ASTM D 2488. Following drilling, sampling, and logging, the borings were backfilled with cement slurry to a depth approximately from 10 to 14 feet from the ground surface to seal the boreholes in accordance with the City's drilling permit requirement. The top portion of the boreholes was subsequently backfilled with native soil cuttings. The soil boring logs are included in Appendix A of this report.

2.2 Laboratory Testing

Laboratory testing was performed on representative soil samples collected during the field explorations. Tests included natural moisture content, in-place density, gradation analysis, Atteberg Limits, direct-shear, consolidation, expansion index, and corrosivity (pH, sulfate content, chloride content, and minimum resistivity). Leighton Consulting, Inc. of Irvine, California, under subcontract to CH2M HILL, conducted the laboratory tests. Testing was completed in accordance with applicable ASTM standards or California Department of Transportation (Caltrans) Test Methods.

CH2M HILL engineers reviewed the laboratory test results for completeness and reasonableness. The laboratory test results are presented in Appendix B of this report.



LEGEND

1 COMBUSTION TURBINE ENCLOSURE
2 TURBINE AIR INLET FILTER
3 FUEL GAS PREHEATER
4 HEAT RECOVERY STEAM GENERATOR
5 HRSG STACK
6 CONTINUOUS EMISSIONS MONITORING ENCLOSURE
7 ROTOR AIR COOLER
8 MV SWITCHGEAR
9 GENERATOR STEP UP TRANSFORMER
10 AUXILIARY TRANSFORMER
11 GENERATOR CIRCUIT BREAKER
12 ISOPHASE BUS DUCT
13 BOILER FEED WATER PUMPS
14 HRSG BLOWDOWN TANK AND WASTE SUMP
15 STEAM TURBINE WITH ENCLOSURE
16 STEAM SURFACE CONDENSER
17 LUBE OIL SKID
18 COOLING TOWER
19 COOLING TOWER POWER DISTRIBUTION CENTER
20 CIRCULATING WATER PUMPS
21 STEAM TURBINE POWER DISTRIBUTION CENTER (PDC)
22 BALANCE OF PLANT POWER DISTRIBUTION CENTER (PDC)
23 BATTERY ROOM, UPS ROOM
24 ADMIN/CONTROL RM/WATER TREATMENT BUILDING
25 ROADS
26 GIS BUILDING
27 AMMONIA UNLOADING/STORAGE AREA (20000 GAL.)
28 CONDENSATE STORAGE TANK
29 CONDENSATE MAKE-UP PUMPS
30 RECLAIMED WATER STORAGE TANK
31 GAS COMPRESSOR
32 CONDENSATE PUMPS
33 CTG FUEL GAS FILTER SEPARATOR
34 HRSG DUCT BURNER
35 AMMONIA DILUTION SKID
36 PIPE RACK
37 RECLAIMED WATER FORWARDING PUMPS
38 CONDENSATE POLISHER (3 SIDED SHELTER)
39 CTG LUBE OIL SKID
40 GLAND STEAM CONDENSER
41 VACUUM PUMPS
42 SAMPLING AND ANALYSIS ENCLOSURE
43 ELECTRIC AUXILIARY BOILER
44 FIRE PROTECTION PUMP HOUSE
⊗ SOIL BORINGS

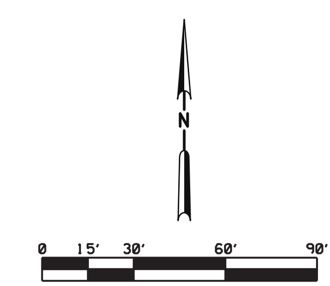


FIGURE 8.15A-2
SOIL BORING LOCATION MAP
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA
CH2MHILL

IS022006001RDD_02 (2/13/06)

SECTION 3

Site Characterization

3.1 Site Geology

The proposed project site is located approximately 0.75-mile from the Los Angeles River in the central Los Angeles Basin. The Los Angeles Basin is located in the northeast corner of the Peninsular Ranges geomorphic province. The Basin is in the area of transition between the Transverse Ranges and Peninsular Ranges geomorphic provinces. The Los Angeles Basin is an active structural depression that is still receiving sediment eroded from surrounding hills. This portion of the Basin is bounded by the Santa Monica Mountains to the northwest, the Puente Hills blind thrust Fault to the northeast, the San Joaquin Hills to the southeast, and the Newport-Inglewood fault zone to the southwest.

The proposed VPP site is a relatively flat site (approximate elevation 180 feet) underlain by Quaternary age alluvial sediments. The geology of the VPP vicinity is relatively complex. The Los Angeles Basin is a structural trough overlying bedrock formations between the Western Shelf and the San Gabriel Mountains. This trough has been filled with marine and alluvial deposits of Quaternary and Tertiary age. Deposits nearly 30,000-feet thick are present near the central part of the basin and rise sharply to the east and to the west. The site, as well as much of southern California, is within an active seismic region.

3.1.1 Stratigraphy

Stratigraphically, the Los Angeles Basin in the area of the VPP is underlain by 100 to 200 feet of unconsolidated alluvium and up to about 12,000 feet of Quaternary age (up to 2 million years old) non-marine gravel and sand (Yerkes, et al, 1965). These materials are underlain by an additional 16,000 feet of sedimentary rocks (Yerkes, et al, 1965; and Dibblee, 1989). The sedimentary rocks that underlie the alluvium in the project area are the marine and non-marine units within the Fernando formation. The non-marine rocks consist of sandstone and conglomerate beds. The marine rocks consist of claystone (Yerkes, et al, 1965; and Dibblee, 1989). These sediments fill a basin or elongated trough of folded basement rock. The basement rock consists of metamorphic bedrock.

3.2 Faulting and Seismicity

The project site is located within Southern California, a seismically active region. Numerous active and potentially active faults considered capable of generating earthquakes have caused and will continue to cause seismic shaking at the site. Over 30 faults have been documented within a 62-mile (100-kilometer) radius of the site as shown on Figure 8.15A-3 attached at the end of the section (Blake, 2004). As shown in Table 8.15A-2, the faults close to the project site include the Puente Hills Blind Thrust, the Upper Elysian Park Blind Thrust, and the Newport-Inglewood Fault. Blind Thrust faults are faults that have not ruptured to the ground surface. The Puente Hills Blind Thrust, approximately 3.1 miles away and capable of generating a maximum credible earthquake (MCE) of magnitude M_w of 7.1, is the controlling fault at the project site. A site-specific deterministic analysis and probabilistic analysis of ground motion were performed for active faults within the region using EQFAULT and FRISKSP published by Thomas Blake (Black, 2004), respectively. The peak bedrock accelerations (PBA) at the project site were estimated to be 0.64 g (rounded up, g = acceleration due to gravity) for the MCE event and 0.47 g for the 500-year event (10 percent exceedance probability in 50 years or 475-year return interval). Fault parameters, such as fault length, fault dip, slip rate, type of fault are also provided in Table 8.15A-2 for the faults close to the project site, based on the data from the Revised 2002 California Probabilistic Seismic Hazard Maps (Cao, et al, 2003).

TABLE 8.15A-2
Summary of Nearby Faults

Fault Name and Type	Distance from Fault (miles)	Maximum Credible Earthquake*	Estimated Peak Bedrock Acceleration*	Fault Length (miles)	Fault Dip	Slip Rate (inch/year)
Puente Hills Blind Thrust (r, 25 N)	3.1	7.1	0.635g	27	25	0.03
Upper Elysian Park Blind Thrust (r, 50 NE)	5.1	6.4	0.403g	12	50	0.05
Newport-Inglewood (rl-ss) (L.A. Basin)	6.5	7.1	0.373g	41	90	0.04

* Blake, 2004
(ss) strike slip; (r) reverse; (rl) right lateral

No faults were found to cross the proposed VPP site. The project site is within Seismic Zone 4, as defined in the California Building Code (CBC), and, for purposes of design, the site Soil Profile Type S_D may be used (CBC, 2001).

3.3 Subsurface Conditions

Based on the soil borings, the subsurface materials at the project site generally consist of dry to slightly moist, loose to dense, unconsolidated alluvial deposits, which classify as silty sand, poorly graded sand, and sandy silt to the depth about 45 feet bgs. The average uncorrected SPT N-value for these materials is about 15. From the depth of 45 feet to about 60 feet bgs, a layer of moist, stiff to hard, low to medium plastic fine grained cohesive soils, classified as silty clay, sandy lean clay, and lean clay, was encountered. The average uncorrected SPT N-value for this cohesive soil layer is about 19. Below this cohesive layer, alternating layers of medium dense to very dense silty sand, poorly graded sand, well-graded sand with silt, and silt with sand were encountered to the final depth of the borings drilled. The uncorrected SPT N-values for these sandy materials range from 23 to greater than 50 for 12 inches of penetration.

Based on the City engineer, the site was recently excavated to a depth about 10 feet from the existing ground surface to remove and demolish underground structures and utilities. After the removal of the underground structures and utilities, the excavation area was backfilled with the onsite soil to the existing ground surface. The backfill was not placed as a controlled engineered fill.

3.4 Groundwater

No free groundwater was encountered during our drilling operation. All borings were immediately backfilled with cement slurry in accordance with the City's drilling permit requirement upon completion of drilling. It should be noted that the borings may not have been left open long enough to establish static groundwater conditions. However, the relatively low moisture content of the soil samples suggests that the local groundwater level was below the bottom of the borings during the time of drilling. According to the State CDMG Seismic Hazard Zone Report for the South Gate 7.5-Minute Quadrangle (CDMG, 1998), the historic high groundwater-level depth in the vicinity of the project site is approximately 35 feet bgs.

It should be noted that the groundwater table might fluctuate due to seasonal variation, variations in rainfall, nearby construction, irrigation, and other man-made and natural influences.

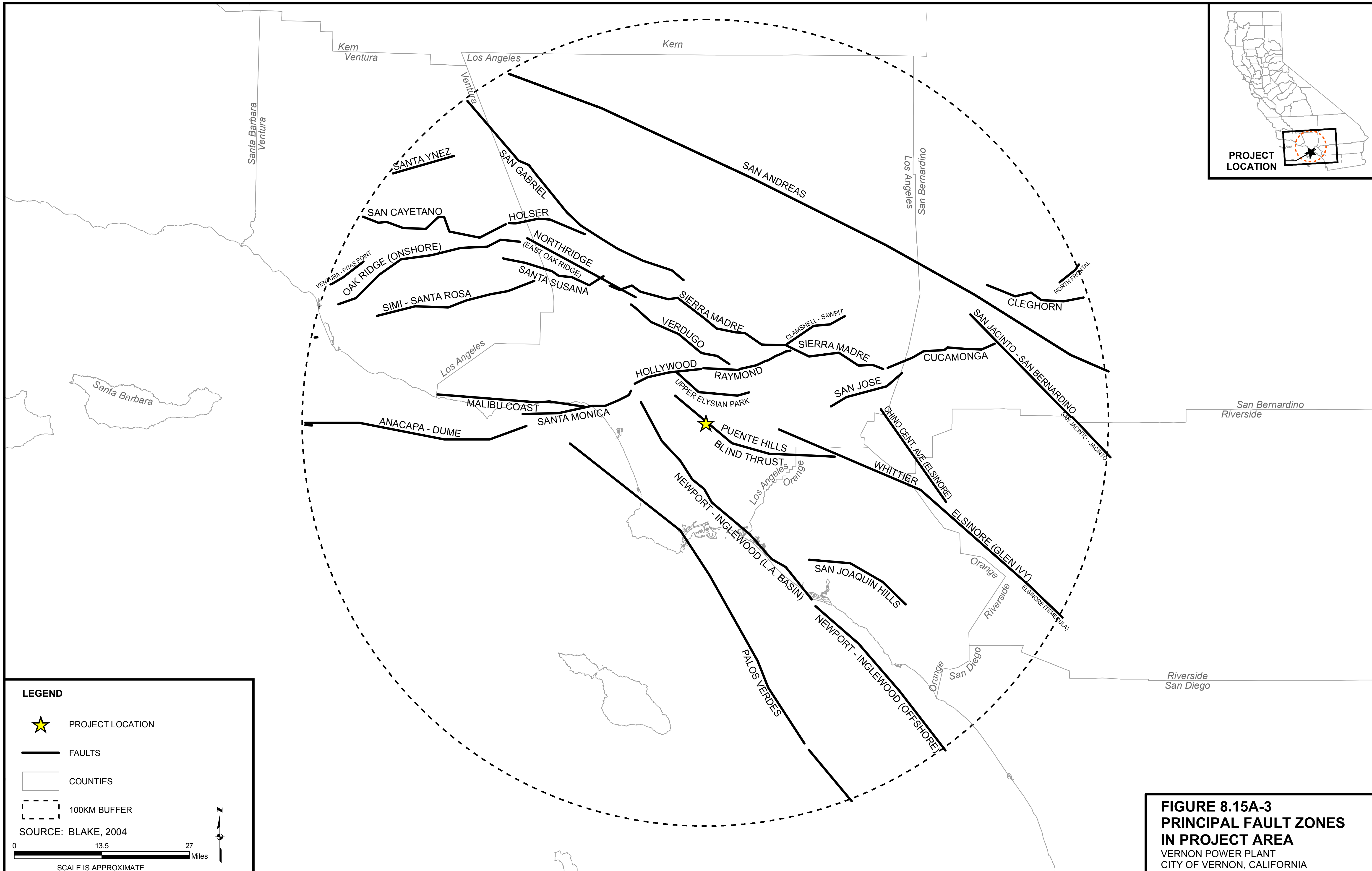


FIGURE 8.15A-3
PRINCIPAL FAULT ZONES IN PROJECT AREA
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

SECTION 4

Discussion and Recommendations

4.1 Seismicity

The VPP project site lies within Seismic Zone 4, as defined in the CBC (CBC, 2001). The following data may be used for the seismic analysis of the proposed facility:

- Causative fault: Puente Hills Blind Thrust
- CBC Seismic Source Type: Type B (CBC, 2001)
- Distance to site: 3.1 miles
- Maximum credible earthquake: 7.1
- Maximum credible earthquake PBA: 0.64 g
- Horizontal PBA (10 percent probability of exceedance in 50 years): 0.47 g
- CBC Site Soil Profile Type: S_D (CBC, 2001)
- CBC Near Source Factors: Na = 1.0; Nv = 1.2 (CBC, 2001)

4.2 Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, cohesionless soils behave like a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: (1) shallow groundwater; (2) low-density sandy soils; and (3) high-intensity ground motion. Studies indicate that saturated, loose and medium-dense, near-surface, cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. Effects of liquefaction on level ground include sand boils, settlement, and bearing-capacity failures below structural foundations.

The soil borings completed at the proposed VPP project site were examined for liquefaction potential. Liquefaction was evaluated using the procedures outlined in "SPT-Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength" by Seed and Harder (1990), as modified by the National Center for Earthquake Engineering Research (NCEER) *Workshop on Evaluation of Liquefaction Resistance of Soils* (NCEER, 2000). The seismically induced settlements were estimated using the methods described in Tokimatsu and Seed (1987).

For the proposed VPP project site, a PBA of 0.64g for the MCE event and a design earthquake magnitude M_w of 7.1 were used in the liquefaction potential analyses. The historic high groundwater level at approximately 35 feet bgs as discussed in Section 3.4 was used in the liquefaction analyses.

Based on the soil boring data, the site generally is underlain by alternating layers of medium dense to dense granular sandy soils and stiff to hard cohesive soils from the depth of 35 feet (historic high groundwater level) to approximately 80 feet bgs. Based on the liquefaction analyses performed and assuming the historic high groundwater level, the site in general has a low to moderate potential for liquefaction on the layer of medium dense granular soils.

The liquefaction induced settlements were examined for borings H-1 and H-2. The total and differential liquefaction induced settlements are estimated about 2.0 and 1.0 inches, respectively, after an MCE event. The magnitude of the liquefaction induced settlement will be verified during the final design phase, when more structure-specific borings are drilled for the project.

If the proposed facility and structures on the project cannot tolerate the liquefaction induced settlement specified above, ground improvement or special foundation design for the facility is needed. Ground improvement methods include deep dynamic compaction or stone columns to increase the relative density of the liquefiable layers. Special foundation designs could include deep foundations bearing within denser soil generally encountered below 60 feet from the ground surface or stiff mat-type foundations to reduce the effects of differential settlements.

The liquefaction potential and the liquefaction-induced settlement are based on our preliminary assessment and will be verified in the final design phase when more structure-specific borings are conducted.

Lateral spreading is not deemed to be a concern due to the depth of the liquefiable soil and the relatively flat ground surface present at the project site.

4.3 Corrosion

Soil laboratory tests for corrosivity assessment were conducted on two samples collected in the borings drilled at the project site. Soil samples were tested for pH, minimum resistivity, soluble chloride content, and soluble sulfate content using the procedures described in Caltrans TMs 417, 422, 532, and 643. The corrosion test results are summarized in Table 8.15A-3.

TABLE 8.15A-3
Summary of Corrosion Laboratory Test Results

Boring	Sample	Depth (ft)	Soil Type	Minimum Resistivity @ Moisture Content (ohm-cm @ %)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
H-1	1-B	0-4.0	SM	742 @ 23.8	7.66	404	76
H-2	1-B	0-4.0	SM	877 @ 38.8	5.23	1092	75

Caltrans Corrosion Guidelines (Caltrans, 1996) defines a corrosive environment as being a site where the soil has electrochemical resistivity of less than 1,000 ohm-centimeters (ohm-cm), a sulfate content greater than 2,000 parts per million (ppm), or chloride content of greater than 500 ppm. Comparison between the laboratory test results and the Caltrans corrosion criteria indicates that the site soils are considered to have a low corrosive potential to common construction materials, include ferrous metals and concrete structures. Based on this criteria, concrete in contact with the soils should be batched using Type II cement. Adequate concrete cover over reinforcing steel should be provided in accordance with good construction practices and design standards. Additional corrosivity testing will be conducted during the final design phase when structure specific borings are conducted. A corrosion engineer should review this data for compatibility with proposed construction materials, including pipes and conduits, at the site.

4.4 Foundation Design and Recommendations

The selection of an appropriate foundation system for the proposed VPP project is based on the anticipated structural loads and settlement. Two potential foundation systems were evaluated based on their geotechnical feasibility. These alternatives include using conventional shallow strip and isolated spread footings with slab-on-grade floors and stiff mat foundations.

Based on the Foundation and Settlement Criteria specified by Siemens Westinghouse Power Corporation (Siemens, 2005), in general, the settlement criteria for foundations for major plant equipment are as follows:

- Total Settlement: less than 1.0 inch
- Differential Settlements:
  - Building: 0.2% slope between adjacent column support points
  - Between equipment within the power train: 0.25 inch
  - Along Centerline of Main Machine Axis: 0.025% slope for operating condition

Estimated foundation dimensions and soil pressures under the foundations for major equipment included in this project are summarized in Table 8.15A-4, per the information provided by Siemens (Siemens, 2005).

TABLE 8.15A-4
Summary of Foundation Dimensions and Soil Pressure under Foundations

Facility	Dimensions (ft x ft)	Load (EQ+Concrete) (Kips)	Soil Pressure (ksf)
Combustion Turbine Generator (CTG)	23 x 95	5,000	2.3
Steam Turbine Generator (STG)	35 x 110	8,900	2.3
Heat Recovery Steam Generator (HRSG) + Stack	50 x 134	16,000	2.4
Generator Step Up Transformer	33 x 46	2,400	1.6
Cooling Tower Basin	60 x 330	25,700	1.3
Water Tank	63 x 63	11,900	3.0

EQ = Equipment

Based on the project site plan, there is a Steam Turbine Generator (STG) and two power trains within the power block area. Each power train consists of a Heat Recovery Steam Generator (HRSG) and Combustion Turbine Generator (CTG). Based on the loads and the settlement criteria specified above, CH2M HILL recommends that the STG and each pair of the HRSG and CTG be founded on single rigid mat foundations. Other facilities and structures can be founded on either conventional shallow strip and isolated spread footings with slab-on-grade floors or stiff mat foundations, depending on the structure loads, estimated differential settlement, and building space required during construction.

4.4.1 Foundation Excavation and Backfill

The proposed administration building, the control room, the water treatment building, the GIS building, the cooling towers, and the water storage tank may be supported on conventional strip and isolated spread footings with slab-on-grade floors bearing on engineered fills. To minimize settlement within the upper 10 feet, we recommend that contact soils beneath the base of footings be over-excavated by at least 10 feet. The base of slab-on-grade floors should be over-excavated by at least 2.0 feet. The foundation over-excavation shall be backfilled with structural fill materials placed and spread in layers, not to exceed 6 inch loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to 95 percent relative compaction (RC) in accordance with ASTM D 1557. The onsite excavated granular material can be used as the structural fill, provided it is free of debris, clay mixtures, and oversized materials greater than 3 inches in diameter.

The over-excavation should extend a minimum of 5 feet beyond footing and 3 feet beyond slab-on-grade limits. The exposed subgrade should be scarified to a depth of 6 inches, moisture conditioned as necessary, and re-compacted to 90 percent RC per ASTM D 1557, prior to the placement of the structural fill. The exposed foundation subgrade should be observed and inspected by a geotechnical engineer to verify that the exposed conditions are adequate for placement of engineered fill.

4.4.2 Bearing Resistance

After completion of the recommended foundation over-excavation and preparation, the site shall be suitable for shallow footing support. CH2M HILL recommends that spread footings should be at least 3.0 feet wide and be embedded at least 2.0 feet below finished grade. For the design of spread footings, CH2M HILL recommends using a net allowable bearing pressure of 2,000 psf. This bearing resistance may be increased to 2,500 psf for transient loads such as seismic and wind loads. The allowable bearing pressures recommended above are net values; therefore, the weight of the footings can be neglected for design purposes.

The friction between soil and the footings provides a portion of resisting force. A coefficient of friction equal to 0.35 may be used for calculating the lateral resistance between the base of footing and the supporting subgrade.

4.4.3 Footing Settlement

Static settlement of individual footings will vary, depending on the depth of engineered fill materials, the plan dimensions of the foundation, and the actual load supported. Based on the anticipated foundation dimensions and loads, we estimate the total settlement of the conventional strip and isolated spread footings designed in accordance with the preceding recommendations should be on the order of 1.0 inch, and the differential settlement should be on the order of 0.5 inches. This corresponds to a differential settlement slope of approximately 0.2 percent between 2 column supports spaced 20 feet apart.

Due to the granular nature of the on site soil materials, the static settlement of the foundations is expected to occur during construction and should be essentially complete shortly after initial application of the loads.

4.4.4 Slab-on-Grade

After completion of the recommended foundation over-excavation and preparation, the site shall be suitable for slab-on-grade floor foundation. Based on the subsurface soil conditions at the site, a modulus of subgrade reaction value of 100 tons per cubic foot can be used for the slab-on-grade design. This modulus will be verified during the final design of the project.

4.4.5 Mat Foundation

Based on the anticipated structure dimensions, foundation loads, and settlement design criteria, CH2M HILL recommends that the HRSG and CTG (within a single power train) and the STG be founded on single rigid mat foundations within the power block area. The intent of using a rigid mat foundation is to distribute the structural load over the entire structure footprint area, resulting in negligible differential settlement in order to meet the power train's foundation settlement design criteria.

CH2M HILL recommends that the mat foundation should be embedded at least 2.0 feet below the finish grade and contact soils below the base of the mat be over-excavated by at least 10 feet. The foundation over-excavation shall be backfilled with structural fill materials placed and spread in layers, not to exceed 6 inch loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to 95 percent RC in accordance with ASTM D 1557. The onsite excavated granular material can be used as the structural fill, provided it is free of debris, clay mixtures, and oversized materials greater than 3 inches in diameter.

The over-excavation should extend at least 5 feet beyond the mat foundation perimeter. The exposed subgrade should be scarified to a depth of 6 inches, moisture conditioned as necessary, and re-compacted to 90 percent RC per ASTM D 1557, prior to the placement of the structural fill. The exposed foundation subgrade should be observed and inspected by a geotechnical engineer to verify that the exposed conditions are adequate for placement of engineered fill.

For the purpose of a mat foundation design, CH2M HILL recommends that the following values be used:

Maximum net allowable bearing pressure: 2,000 psf
Modulus of subgrade reaction for a 1-foot-square plate: 100 tons per cubic foot

The modulus of subgrade reaction recommended above should be adjusted to account for the difference in size between the plate and the actual mat foundation. The following equation provides this adjustment:

$$k_s = k_1 [(B+1)/2B]^2$$

Where:

k_s: Adjusted modulus of subgrade reaction
k_1: Modulus of subgrade reaction for a 1-foot-square plate
B: Least width of mat foundation

The modulus of subgrade reaction presented above is appropriate for mat foundation design considering static loading conditions and elastic settlement. Recommendations considering dynamic machine loads will be presented in the final geotechnical report for the project. The total settlement of a mat foundation designed using the criteria recommended above is expected to be less than 1.0 inch. The American Concrete Institute Committee 436 (ACIC, 1966) suggested a method for calculating the differential settlement of mat foundations. According to this method, if the rigidity factor, Kr, which is defined as the relative rigidity of the structure divided by the relative rigidity of the foundation soil, is greater than or equal to 0.5, the mat foundation designed will be very rigid, and the differential settlement of mat rotation should be less than 10 percent of the total settlement, assuming that structure loads are uniformly distributed over the entire mat footprint area.

4.4.6 Lateral Load Resistance

Resistance to lateral loads can be developed by friction resistance between the bottom of concrete foundations and the underlying subgrade soils. A friction coefficient of 0.35 is considered applicable for calculating the lateral resistance between the foundation bottom and the supporting subgrade. As an alternative, a passive resistance equal to an equivalent fluid pressure weighing 330 pounds per cubic foot acting against the vertical face of the foundation can also be used. If foundations are placed neat against the soil, the friction and passive resistance can be used in combination.

4.5 Expansive Soil Characteristics

Expansive soils are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from rainfall, landscape irrigation, utility leakage, perched groundwater, drought, or other factors, and may cause unacceptable settlement or heave of structures, concrete slabs-on-grade, or pavements supported over these soils. The soils encountered in the borings are predominantly granular, which commonly have a low expansion potential. Based on the soil type encountered, and results of laboratory expansion index testing, the expansion potential of the soil encountered at the site is low. Based on this preliminary data, no special design and specific recommendations are required to mitigate the expansive characterization of the onsite soils.

4.6 Pipeline Design

4.6.1 Design Parameters

Underground pipelines such as storm drains, water mains, and electric conduits will be constructed within the proposed project site. Although the exact pipe size, type of material, and embedment depth are not known at this time, we expect that only flexible pipelines are considered in this project. For flexible pipelines, the aspect of trench, bedding and pipe material, and the interaction of these elements should be considered. The performance of the flexible pipe is highly dependent on the support provided by the soil around it, including the natural soil within which the pipe trench is constructed.

Along with depth, unit weight, and compaction of fills in the trench, the modulus of soil reaction, E′, of the soil surrounding the trench is a parameter used in flexible pipe design, as it controls the lateral support provided by the soil and, therefore, the deformation of the pipe. For the soil encountered in the borings, an E′ value of 1,000 pounds per square inch (psi) is recommended for pipeline design for cover depth less than 10 feet. For the purpose of design, a total unit weight of 120 pounds per cubic foot (pcf) may be used for the fill above the pipeline.

4.6.2 Pipe-Zone Backfill

The material placed as pipe-zone backfill, surrounding the pipe from 6 inches below the invert to 1 foot above the top of pipe, should be composed of sand that is reasonably well graded from coarse to fine and is free from clay, organic material, and deleterious substances. The material also should be noncorrosive. The pipe-zone backfill material should contain a maximum of 8 percent particles passing the No. 200 sieve, and the maximum size should not exceed 1.5 inches. Low-expansive (EI < 50) granular fill should be used as pipe-zone backfill material.

Pipe-zone backfill should be placed and spread in layers, not to exceed 6 inches loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to at least 90 percent RC in accordance with ASTM D 1557. Compaction of the pipe-zone backfill should be increased to 95 percent RC in areas beneath pavements and in areas that are sensitive to surficial settlement. The contractor is responsible for verifying that the pipe strength is adequate to withstand the weight and energy delivered by a roller or compactor during the pipe backfill procedure.

In areas where there is potential for weaker soil (e.g., soft clay or loose sand), the weaker soil should be over-excavated to a minimum depth of 1 foot below the proposed trench bottom and replaced with engineered fill compacted to 95 percent RC.

In lieu of the over-excavation of weaker soils, the use of controlled, low-strength material (CLSM) may be considered. CLSM is a fluid-like mixture of Portland cement, water, and fine aggregate or fly ash, or both. The consistency of the material is that of a slurry or lean grout, and the material is placed like concrete. For use as pipe-zone backfill material, the mixture should be designed for a 28-day strength of 50 to 150 psi.

4.6.3 Trench Backfill

Backfill material around structures and more than 1 foot above the top of the pipe (above the pipe-zone backfill) may consist of excavated onsite soil. However, organic material, rubbish, debris, rocks, broken concrete larger than 6 inches in diameter, and other unsuitable material should be removed prior to use as backfill. Rocks greater than 3 inches in any dimension should not be permitted in backfill placed within 1 foot of the pavement subgrade.

Backfill should be placed and spread in layers, not to exceed 8 inches loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to at least 90 percent RC in accordance with ASTM D 1557. Increased compaction is advised where greater sensitivity to surficial settlements may exist if the compaction does not damage or cause excessive deflections of the pipe.

4.7 Structural Pavement Design

4.7.1 Asphalt Concrete

Preliminary asphalt concrete pavement sections have been designed for the project site for automobile parking areas, automobile driveways, and heavy truck driveways. The pavement sections were designed following the procedures outlined in Chapter 600 of the Caltrans Highway Design Manual (Caltrans, 2004). The proposed pavement structural section consists of dense graded asphalt concrete (AC, Type A) underlain by Class 2 aggregate base (AB). Traffic Index (TI) values of 5.0, 6.0, and 7.0 were assumed for the design of automobile parking areas, automobile driveways, and heavy truck driveways, respectively. The traffic indexes assumed should be reviewed by the Owner and the Civil Engineer of the project to evaluate their suitability for this project. Changes in the traffic indexes will affect the corresponding pavement sections.

The pavement sections presented are based on a minimum subgrade R-value of 40 and an AB R-value of 78 (Class 2). The recommended asphalt pavement sections are presented in Table 8.15A-5.

TABLE 8.15A-5
Summary of Recommended Asphalt Concrete Pavement Sections

Pavement Description	Subgrade R-Value	TI	Pavement Section (inches)
Automobile Parking Area	40	5.0	2.5-inch AC / 5.0-inch AB
Automobile Driveways	40	6.0	3.0-inch AC / 6.0-inch AB
Heavy Truck Driveways	40	7.0	4.0-inch AC / 8.0-inch AB

The pavement sections provided in Table 8.15A-5 are contingent on the following recommendations being implemented during construction.

- The pavement should be placed on at least 12 inches of re-compacted subgrade to at least 95 percent RC. After site preparation and subgrade excavation, the exposed subgrade should be scarified to a depth of 6 inches, moisture conditioned as necessary, and re-compacted to 90 percent RC per ASTM D 1557
- Subgrade soils should be in a stable, non-pumping and yielding condition at the time aggregate base materials are placed and compacted
- Aggregate base materials should meet Caltrans specifications for Class 2 aggregate, placed and spread in layers, not to exceed 6 inch loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to 95 percent RC in accordance with ASTM D 1557
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade and aggregate base materials are not allowed to become wet
- Asphalt concrete paving materials should meet Caltrans specifications for Type A asphalt concrete

The pavement sections provided above are based on the soil conditions encountered during our preliminary field investigation, the assumed final site grades, and the laboratory testing. The actual pavement subgrade materials exposed during grading may be different than those assumed in the design. CH2M HILL recommends that representative subgrade samples be obtained and R-value tests be conducted during final design and construction to verify the pavement sections recommended above. If these test results indicate a significant difference, the design pavement sections may need to be revised.

4.7.2 Portland Cement Concrete

Portland Cement Concrete (PCC) pavement may be desirable in the loading dock, trash collection, and other heavily-traveled areas. The PCC pavement was designed following the Caltrans Highway Design Manual (Caltrans, 2004). The proposed PCC pavement section consists of PCC underlain by Class 2 AB. Based on the assumed design subgrade R-value of 40 and a Traffic Index value of 7.0, CH2M HILL recommends that the PCC pavement section should have a minimum 6 inches of PCC over a minimum 9 inches of AB. The aggregate base materials should be placed and spread in layers, not to exceed 6 inch loose lifts, moisture conditioned within 2 percent of optimum moisture content, and compacted to 95 percent RC in accordance with ASTM D 1557. Control joints should be spaced at every 15 feet. The pavement sections recommended above should be placed on at least 12 inches of engineered fill compacted to at least 95 percent RC per ASTM D 1557. Prior to fill placement, the exposed subgrade should be scarified to a depth of 6 inches, moisture conditioned as necessary, and re-compacted to at least 90 percent RC per ASTM D557.

4.8 Surface Drainage

Ponding of water adjacent to structures should be avoided. During and after construction, positive drainage should be provided to direct surface water away from structures and excavations toward suitable, nonerosive drainage devices. Final grading should slope away from facilities, structures, and pavements.

SECTION 5

Construction Considerations

5.1 Earthwork

5.1.1 Site Preparation

Prior to construction and general grading, any debris and oversized materials (greater than 3 inches in any dimension) should be stripped and disposed outside the construction limits. The stripping operation must expose a firm, non-yielding subgrade that is free of large voids. Excavations resulting from removal of utility lines should be backfilled properly, as described below, with non-expansive fill and compacted to a minimum 90 percent RC per ASTM D 1557.

5.1.2 Over-excavation

Over-excavation is recommended in this project beneath footings, slabs-on-grade, and mat foundations, as discussed in previous sections. The depth of over-excavation is determined based on the borings conducted in the preliminary exploration and will be verified during the final design phase when more structure specific borings are drilled. The depth of over-excavation may be changed during construction depending on the exposed subgrade conditions.

5.1.3 Scarification and Compaction

Following site preparation and any required over-excavation, CH2M HILL recommends that all areas to receive engineered fill or to be used for support of structures or concrete slabs be scarified to a minimum depth of 6 inches, uniformly moisture conditioned to near optimum moisture content, and re-compacted to at least 90 percent RC in accordance with ASTM D 1557.

5.1.4 Fill Placement and Compaction

We expect that most of the onsite soils below the stripped material may be reusable as engineered fill once debris, clay mixtures, and oversized materials greater than 3 inches in diameter are removed. Any imported fill materials to be used for engineered fill should be sampled and tested for approval by the geotechnical engineer prior to transportation to the site. In general, well-graded mixtures of gravel, sand, and non-plastic silt with a sand equivalent value of at least 30 are acceptable for used as import fill.

Structural fill should be placed and spread in layers, not to exceed 6 inch loose lifts, moisture conditioned within 2 percent of optimum moisture content during compaction. Structural fill should be compacted to a minimum 95 percent RC beneath footings, slabs, mat foundations, and around structures, and a minimum 90 percent RC elsewhere per ASTM D 1557.

5.2 Dewatering

Groundwater was not encountered in the soil borings to the depths drilled at the project site. Proposed excavation depths for structure foundation construction are not expected to exceed 12 feet bgs. Based on the available data, the historic high groundwater-level depth in the vicinity of the project site is approximately 35 feet bgs. Therefore, we do not expect encountering groundwater during construction excavation. Control of stormwater, which may necessitate dewatering, will be needed during construction. Diversion berms, ditches, or other means should be employed to reduce stormwater flow into excavations or other construction areas. Best Management Practices should be implemented to reduce erosion and sedimentation during construction.

5.3 Trenching and Temporary Excavations

All temporary excavations should be performed in accordance with the safety requirements of the California Occupational Safety and Health Act and should be the responsibility of the contractor. Soil types may mandate different types/styles of bracing or excavation support; however, regardless of soil type, excavation depth and configuration drive the requirement to brace or not to brace.

Temporary excavation bracing should be designed to protect adjacent traffic, utilities, and construction personnel. Suitable factors of safety should be used in the contractor's sheeting and bracing design. The design of the support system for the excavation walls is the responsibility of the contractor. The contractor should develop means and methods based on experience and availability of materials for constructing the required elements. Performance of the temporary construction must conform to the requirements stated in the contract documents.

5.4 Excavation Requirements

Based on observations during the subsurface investigation and results of laboratory tests, the soils at the site can be excavated with common earth-moving equipment. No field demonstrations have been conducted on the types of earth-moving equipment that can be used to grade the site. However, because of the loose to medium dense surface soils at the project site, it is anticipated that relatively easy excavations will be encountered. All excavations should incorporate applicable safety provisions of city, county, state, and federal regulations.

5.5 Geotechnical Inspection and Testing

All grading and excavation should be performed under the observation and testing of the geotechnical consultant at the following stages:

- Upon completion of site clearing
- During subgrade and foundation excavation and re-compaction
- During structural fill or engineered fill placement
- After completion of foundation excavations and prior to placement of concrete
- When any unusual or unexpected geotechnical conditions are encountered

5.6 Review of Construction Plans and Specifications

The final project plans and specifications should implement the recommendations presented in this report and should be reviewed by the project geotechnical consultant.

SECTION 6

References

American Concrete Institute Committee 436. 1966. *Suggested Design Procedures for Combined Footings and Mats.* Journal of the American Concrete Institute, Vol. 63, No. 10, pp. 1,041-1,077.

American Society for Testing Materials (ASTM). 2003. *Annual Book of Standards. Soil and Rock.* Vol. 04.08.

Blake, T.F. 2004. *A Computer Program for the Estimation of Peak Horizontal Acceleration from 3-D Fault Sources, User's Manuals EQFAULT and FRISKSP ver Windows 95/98*.

California Building Code. 2001. *California Code of Regulations, Title 24, Part 2, Volume 2. California Building Standard Commission.*

California Department of Conservation, Division of Mines and geology, 1998. *Seismic Hazard Zone Report for the South Gate 7.5-Minute Quadrangle, Los Angeles County, California.*

California Department of Transportation (Caltrans). 1996. *California Seismic Hazard Map.*

California Department of Transportation (Caltrans). 2004. *Highway Design Manual*.

Cao, T., Bryant, W.A., B. Rowshandel, D. Branum, and C.J. Wills. 2003. *The Revised 2002 California Probabilistic Seismic Hazard Maps, June 2003*. California Geological Survey, 11 pp.

Dibblee Jr, T.F. 1989. *Geologic Map of the Los Angeles Quadrangle*, Dibblee Foundation Map DF-22.

Kleinfelder. 2001. Report of Geotechnical Investigation: *Proposed Generating Units – Vernon Power Station Facility*. October 16.

Mualchin, L. 1996. Peak Acceleration from Maximum Credible Earthquakes in California, Plate 1. Prepared for California Department of Conservation, Division of Mines and Geology.

National Center for Earthquake Engineering Research (NCEER). 2000. *Workshop on Evaluation of Liquefaction Resistance of Soils*. Technical Report NCEER-97-0022. December.

Siemens Westinghouse Power Corporation. 2005. *Engineering Specification, Geotechnical Investigation for foundation Design*.

Tokimatsu, K. and H.B. Seed. 1987. "Evaluation of Settlements in Sands Due to Earthquake Shaking." *Journal of Geotechnical Engineering*. Vol. 113, No. 8. Pp. 861-878.

U.S. Naval Facilities Engineering Command (NAVFAC). 1986. *Foundations and Earth Structures, NAVFAC DM 7.02*.

Yerkes, R.F., T.H. McCulloh, J.E. Shoellhamer, and J.G. Vedder. 1965. *Geology of the Los Angeles Basin California – An Introduction.* U.S. Geological Survey Professional Paper 420-A. 57 p.

APPENDIX A

Geotechnical Boring Logs

CH2MHILL

PROJECT NUMBER: 338307	BORING NUMBER: SHEET 1 OF 1

BORING LOG EXPLANATION

PROJECT : Vernon Power Plant | LOCATION :

ELEVATION : | DRILLING CONTRACTOR :

DRILLING METHOD AND EQUIPMENT :

WATER LEVELS : --- | START : | END : | LOGGER :

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	1.0					
		1.5				
	2.5					
	3.5					
			1-S			
5	5.0					
10						
15	15.0					
				3-5-6 (11)		
	16.5					
20						
25						
30						

Sample Interval: Top/Bottom (ft. bgs)
Amount of Sample Recovered (ft)

Sample Type - Sample Number

(S) Standard split-spoon drive sampler, 2.0-inch (51-mm) outside diameter, 1.4-inch (35-mm) inside diameter, (without liners)

(D) Modified California split-spoon drive sampler, 3.0-inch (76-mm) outside diameter, 2.4-inch (64-mm) inside diameter (with liners)

(B) Bulk sample collected from drill cuttings

Standard Penetration Test Results

Number of blows required to advance driven sampler over three 6-inch (152-mm) increments. Number in parenthesis is the total number of blows required to advance the sampler 12-inch (305 mm) beyond the first 6-inch (152-mm) interval. Drive samplers advanced using a 140 lb (63.5 kg) Hammer with the 30-inch (762-mm) drop. The blow counts given have not been modified to account for field and/or depth conditions.

General Notes

1) Soil classifications are based on the Unified Soil Classification System. Classifications and descriptions made in the field have been modified based on the results of laboratory testing.

2) Boring logs depict subsurface conditions only at the specific locations and times the boring was made. Logs do not necessarily reflect strata variations that may exist between boring locations.

Comments

Comments and observations regarding drilling or sampling made by the driller or field personnel.

Test

Field and Laboratory tests include the following:

MC	Moisture Content (ASTM D-2216)
γ_d	Dry Unit Weight (ASTM D-2937) in pounds per cubic foot (pcf)
GS	Grain Size analysis (ASTM D-422) with or without hydrometer analysis (See appropriate laboratory data sheets for gradation curve)
AL	Atterberg Limits (ASTM D-4318)
DS	Direct Shear (ASTM D-3080)
γ_{dmax}	Maximum Dry Density (ASTM D-1557)
OMC	Optimum Moisture Content (ASTM D 1557)
CN	Consolidation (ASTM D-2435)
EI	Expansion Index (ASTM D-4829)
CA	Corrosion Suite (California Test Methods 532, 643, 417, 422)

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
338307.TM.GE.PR	H-1 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Vernon Power Plant LOCATION : 11387292 E; 3762612 N (WGS84 UTM)

ELEVATION : 172.0 ft DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE START : 1/24/2006 END : 1/24/2006 LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0 – 4.0		1-B		**SILTY SAND (SM)**, olive brown, slightly moist, medium dense, fine to coarse grained sand, low plastic silt.	CA pH= 7.66 CL= 76 ppm SU= 404 ppm Res.= 742 @ 23.8% γ_{dmax} = 122.0 pcf OMC= 10.5%
5	5.0 – 6.5	1.5	2-S	4-5-6 (11)		
10	10.0 – 11.5	1.0	3-D	8-17-19 (36)		DS= 35° MC= 8.0% γ_d = 106.6 pcf
15	15.0 – 16.5	1.5	4-S	3-3-4 (7)	-- moist, loose, contains fine gravel.	GS= 2:75:23
20	20.0 – 21.5	1.0	5-D	6-11-21 (32)	**POORLY GRADED SAND (SP)**, light olive gray, moist, medium dense, fine to coarse grained sand.	MC= 4.5% γ_d = 100.1 pcf
25	25.0 – 26.5	1.5	6-S	6-9-12 (21)	-- olive brown, contains fine gravels.	
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
338307.TM.GE.PR	H-1 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Vernon Power Plant

LOCATION : 11387292 E; 3762612 N (WGS84 UTM)

ELEVATION : 172.0 ft

DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE

START : 1/24/2006

END : 1/24/2006

LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0 31.5	1.0	7-D	6-11-17 (28)	**SILTY SAND (SM)**, olive, moist, medium dense, fine to medium grained sand, low plastic silt.	MC= 9.0% γ_d = 107.8 pcf GS= 0:79:21
35	35.0 36.5	1.5	8-S	4-5-6 (11)	**SANDY SILT (ML)**, olive, moist, stiff, low to medium plastic, fine to medium grained sand,	GS= 0:47:53
40	40.0 41.5	1.0	9-D	5-8-12 (20)		MC= 25.0% γ_d = 100.6 pcf
45	45.0 46.5	1.5	10-S	4-5-6 (11)	**SILTY CLAY (CL-ML)**, olive brown, moist, stiff, low to medium plastic, fine to medium grained sand,	AL= 20,14,6
50	50.0 51.5	1.0	11-D	10-17-22 (39)	**LEAN CLAY (CL)**, olive brown, moist, very stiff, low to medium plastic.	MC= 19.4% γ_d = 110.5 pcf
55	55.0 56.5	1.5	12-S	10-16-18 (34)	**WELL-GRADED SAND WITH SILT (SW-SM)**, olive brown, moist, dense, fine to medium grained sand, low plastic silt.	GS= 0:88:12
60						

PROJECT NUMBER: 338307.TM.GE.PR	BORING NUMBER: H-1	SHEET 3 OF 3

CH2MHILL

SOIL BORING LOG

PROJECT : Vernon Power Plant

LOCATION : 11387292 E; 3762612 N (WGS84 UTM)

ELEVATION : 172.0 ft

DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE

START : 1/24/2006

END : 1/24/2006

LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0 61.5	1.0	13-D	13-26-40 (66)	**POORLY GRADED SAND (SP),** pale olive, moist, dense, fine to coarse grained sand.	MC= 4.3% γ_d = 103.4 pcf
65	65.0 66.5	1.5	14-S	7-15-14 (29)	**SILTY SAND (SM),** olive, moist, medium dense, fine grained sand, low plastic silt.	GS= 0:59:41
70	70.0 71.5	1.0	15-D	23-33-50/5" (83/11")	**POORLY GRADED SAND (SP),** pale olive, moist, very dense, fine grained sand.	MC= 2.0% γ_d = 98.9 pcf
75	75.0 76.5	1.5	16-S	4-5-8 (13)	**SILT WITH SAND (ML),** olive, moist, stiff, medium plastic, fine grained sand.	GS= 0:17:83
80	80.0 81.5	1.0	17-D	50/5" (50/5")	**POORLY GRADED SAND WITH SILT (SP-SM),** olive, moist, very dense, fine grained sand, low plastic silt.	MC= 6.3% γ_d = 97.9 pcf
85					Total Depth= 81.0 ft. Groundwater was not encountered. Borehole backfilled with cement slurry to 14 ft below ground surface. The top 14 ft backfilled with native soil cuttings. Bottom of Boring at 81.0 ft below ground surface	
90						

PROJECT NUMBER: 338307.TM.GE.PR	BORING NUMBER: H-2 SHEET 1 OF 3

CH2MHILL

SOIL BORING LOG

PROJECT : Vernon Power Plant — LOCATION : 11387222 E; 3762549 N (WGS84 UTM)

ELEVATION : 172.0 ft — DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE — START : 1/24/2006 — END : 1/24/2006 — LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	0.0 – 4.0		1-B		**SILTY SAND (SM),** olive brown, dry, medium dense, fine to coarse grained sand, low plastic silt.	CA pH= 5.23 CL= 75 ppm SU= 1092 ppm Res.= 877 @ 38.8% EI= 0
5	5.0 – 6.5	1.5	2-D	10-20-28 (48)	-- dense.	MC= 11.9% γ_d = 107.3 pcf
10	10.0 – 11.5	1.5	3-S	7-8-11 (19)	**POORLY GRADED SAND (SP),** brown, slightly moist, medium dense, fine to coarse grained sand.	
15	15.0 – 16.5	1.0	4-D	5-9-14 (23)	-- pale olive.	MC= 7.0% γ_d = 104.0 pcf
20	20.0 – 21.5	1.5	5-S	3-3-3 (6)	**SILTY SAND (SM),** olive, slightly moist, loose, fine to medium grained sand, low plastic silt.	GS= 1:56:43
25	25.0 – 26.5	1.0	6-D	6-7-8 (15)	-- olive brown.	DS= 32.8° MC= 19.1% γ_d = 95.0 pcf
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
338307.TM.GE.PR	H-2 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Vernon Power Plant LOCATION : 11387222 E; 3762549 N (WGS84 UTM)

ELEVATION : 172.0 ft DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE START : 1/24/2006 END : 1/24/2006 LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0 31.5	1.5	7-S	4-6-8 (14)	-- olive.	GS= 0:57:43
35	35.0 36.5	1.0	8-D	7-8-10 (18)	-- low to medium plastic silt.	MC= 17.4% γ_d = 105.4 pcf
40	40.0 41.5	1.5	9-S	4-5-6 (11)	-- moist.	GS= 1:56:43
45	45.0 46.5	1.0	10-D	5-7-11 (18)	**SANDY LEAN CLAY (CL),** olive, moist, very stiff, low to medium plastic, fine grained sand.	AL= 31,19,12 CN MC= 22.9% γ_d = 103.2 pcf
50	50.0 51.5	1.5	11-S	3-3-4 (7)	-- wet, stiff, encountered perched water.	GS= 0:37:63
55	55.0 56.5	1.0	12-D	12-25-30 (55)	-- olive brown, moist, hard.	MC= 18.4% γ_d = 112.6 pcf
60						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
338307.TM.GE.PR	H-2 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Vernon Power Plant — LOCATION : 11387222 E; 3762549 N (WGS84 UTM)

ELEVATION : 172.0 ft — DRILLING CONTRACTOR : 2R Drilling, Inc.

DRILLING METHOD AND EQUIPMENT : CME 75, 8" HSA, 140 lb @ 30" Drop Automatic Trip Hammer

WATER LEVELS : NE — START : 1/24/2006 — END : 1/24/2006 — LOGGER : P. Tian

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0 – 61.5	1.5	13-S	8-9-14 (23)	**SILTY SAND (SM),** olive, moist, medium dense, fine to medium grained sand, low plastic silt.	GS= 0:70:30
65	65.0 – 66.5	1.0	14-D	24-43-50 (93)	**POORLY GRADED SAND (SP),** olive brown, moist, very dense, fine to coarse grained sand, trace of fine gravel.	MC= 4.9% γ_d = 115.3 pcf
70	70.0 – 71.5	1.5	15-S	15-23-29 (52)		
75	75.0 – 76.5	1.0	16-D	50/6" (50/6")		MC= 1.9% γ_d = 106.4 pcf
80	80.0 – 81.5	1.5	17-S	7-14-22 (36)	**SILTY SAND (SM),** olive brown, moist, dense, fine grained sand, low plastic silt.	
85					Total Depth= 81.5 ft. Groundwater was not encountered. Borehole backfilled with cement slurry to 10 ft below ground surface. The top 10 ft backfilled with native soil cuttings. Bottom of Boring at 81.5 ft below ground surface	
90						

APPENDIX B

Laboratory Test Results

Project Name: Vernon Power Plant **LCI Proj. ID No.:** 601271001

Project No.: 338307.TM.GE.PR **Tabulated By:** LF

Client: CH2M Hill **Date:** 02/10/06

TABLE 1

SUMMARY of LABORATORY TEST RESULTS

Boring No.	Sample No.	Depth (ft.)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Modified Proctor Compaction (ASTM D 1557) Procedure A: Maximum Dry Density (pcf)	Modified Proctor: Optimum Moisture Content (%)	Expansion Index ASTM D 4829	Corrosion Suite (Soils) DOT CA Test 532/643: Soil pH DOT CA Test 532/643	Chloride Content DOT CA Test 422 (ppm)	Sulfate Content (grav.) DOT CA Test 417 (ppm)	Min. Resistivity @ moist. Cont. DOT CA Test 532/643 (ohm-cm @ %)	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
H-1	1-B	0-4.0					122.0	10.5		7.66	76	404	742 @ 23.8	SM*
	4-S	15-16.5				2:75:23								SM
	5-D	20-21.5	4.5	100.1										SP*
	7-D	30-31.5	9.0	107.8		0:79:21								SM
	8-S	35-36.5				0:47:53								s(ML)
	9-D	40-41.5	25.0	100.6										s(ML)*
	10-S	45-46.5			20,14,6									CL-ML
	11-D	50-51.5	19.4	110.5										CL*
	12-S	55-56.5				0:88:12								SW-SM
	13-D	60-61.5	4.3	103.4										SP*
	14-S	65-66.6				0:59:41								SM
	15-D	70-71.5	2.0	98.9										SP*
	16-S	75-76.5				0:17:83								(ML)s
	17-D	80-81.0	6.3	97.9										SP-SM*

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index

[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

Project Name: Vernon Power Plant **LCI Proj. ID No.:** 601271001

Project No.: 338307.TM.GE.PR **Tabulated By:** LF

Client: CH2M Hill **Date:** 02/10/06

TABLE 1

SUMMARY of LABORATORY TEST RESULTS

Boring No.	Sample No.	Depth (ft.)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Modified Proctor Compaction (ASTM D 1557) Procedure A: Maximum Dry Density (pcf)	Modified Proctor Compaction (ASTM D 1557) Procedure A: Optimum Moisture Content (%)	Expansion Index ASTM D 4829	Corrosion Suite (Soils) DOT CA Test 532/643: Soil pH DOT CA Test 532/643	Corrosion Suite: Chloride Content DOT CA Test 422 (ppm)	Corrosion Suite: Sulfate Content (grav.) DOT CA Test 417 (ppm)	Corrosion Suite: Min. Resistivity @ moist. Cont. DOT CA Test 532/643 (ohm-cm @ %)	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
H-2	1-B	0-4.0							0	5.23	75	1092	877 @ 38.8	SM*
	2-D	5-6.5	11.9	107.3										s(ML)*
	4-D	15-16.5	7.0	104.0										SM/SP*
	5-S	20-21.5				1:56:43								SM
	7-S	30-31.5				0:57:43								SM
	8-D	35-36.5	17.4	105.4										SM*
	9-S	40-41.5				1:56:43								SM
	10-D	45-46.5			31,19,12									CL
	11-S	50-51.5				0:37:63								s(CL)
	12-D	55-56.5	18.4	112.6										CL*
	13-S	60-61.5				0:70:30								SM
	14-D	65-66.5	4.9	115.3										SP*
	16-D	75-76.5	1.9	106.4										SP*

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index

[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

ATTERBERG LIMITS

ASTM D 4318

Leighton

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/09/06
Project No. :	338307.TM.GE.PR	Input By:	LF	Date:	02/10/06
Boring No.:	H-1	Checked By:	LF		
Sample No.:	10-S	Depth (ft.)	45-46.5		
Soil Identification:	Olive brown silty clay (CL-ML)				

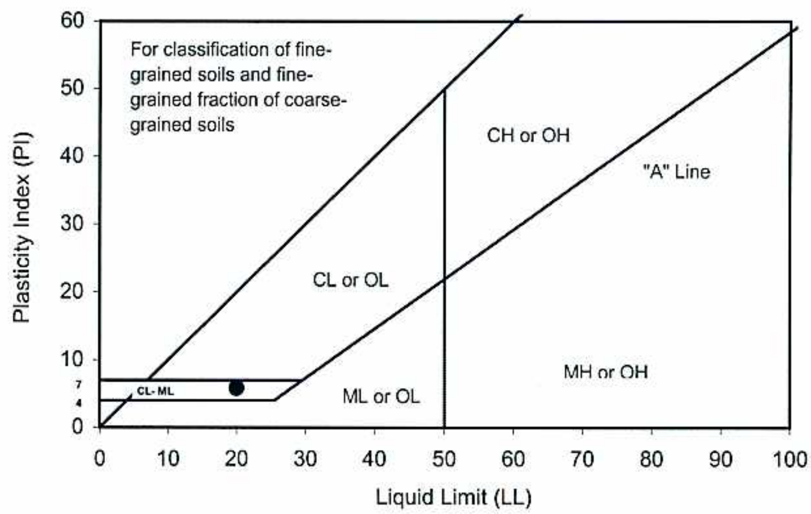
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	22	14	
Wet Wt. of Soil + Cont. (g)	8.93	8.70	21.85	20.24	23.52	
Dry Wt. of Soil + Cont. (g)	7.94	7.75	18.50	17.03	19.63	
Wt. of Container (g)	1.01	1.01	1.09	1.04	1.07	
Moisture Content (%) [Wn]	14.29	14.09	19.24	20.08	20.96	

Liquid Limit	**20**
Plastic Limit	**14**
Plasticity Index	**6**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) | 0

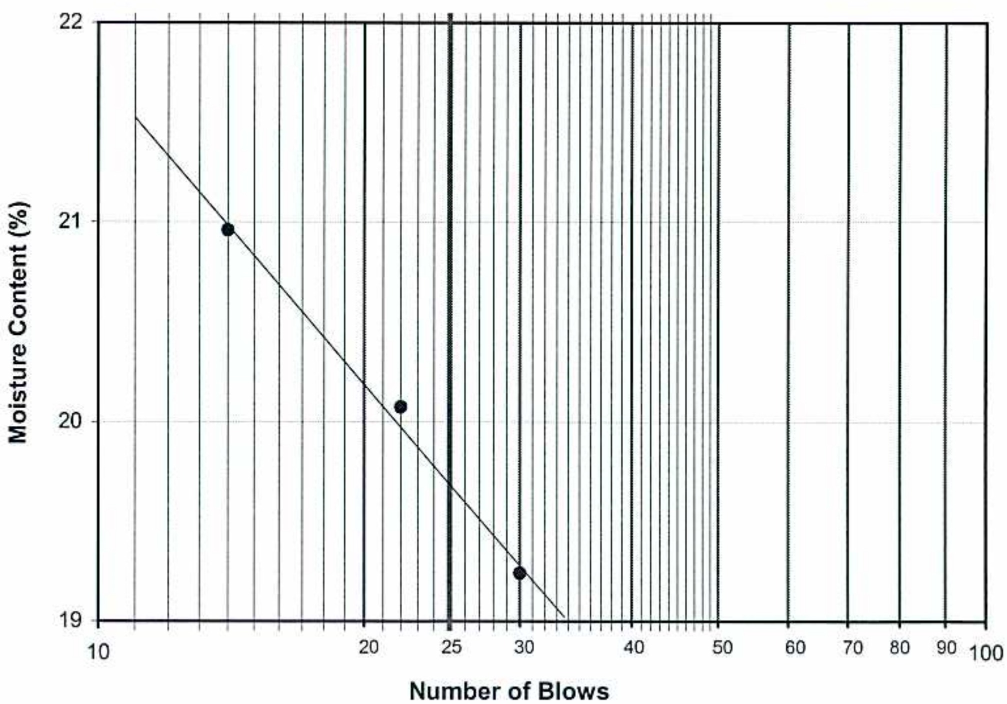
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



ATTERBERG LIMITS

ASTM D 4318

Leighton

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/09/06
Project No. :	338307.TM.GE.PR	Input By:	LF	Date:	02/10/06
Boring No.:	H-2	Checked By:	LF		
Sample No.:	10-D	Depth (ft.)	45-46.5		
Soil Identification:	Olive lean clay (CL)				

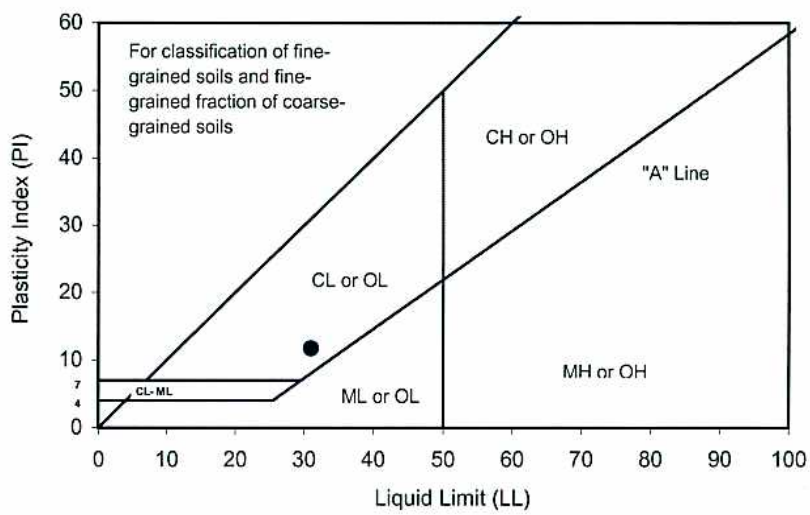
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	17	
Wet Wt. of Soil + Cont. (g)	9.93	9.80	19.59	19.75	19.41	
Dry Wt. of Soil + Cont. (g)	8.48	8.40	15.29	15.33	14.90	
Wt. of Container (g)	1.07	1.04	1.03	1.09	1.04	
Moisture Content (%) [Wn]	19.57	19.02	30.15	31.04	32.54	

Liquid Limit	**31**
Plastic Limit	**19**
Plasticity Index	**12**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) | 8.03

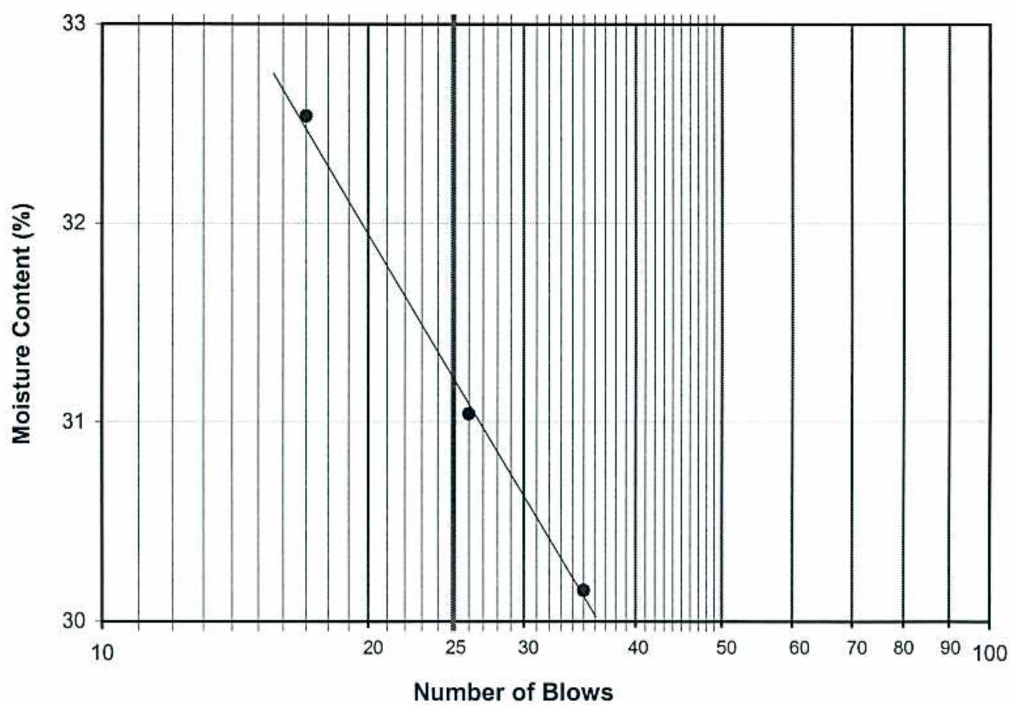
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

- [ ] Wet Preparation — Multipoint - Wet
- [X] Dry Preparation — Multipoint - Dry
- [X] Procedure A — Multipoint Test
- [ ] Procedure B — One-point Test



Boring No.	H-1	H-1	H-1	H-1	H-1	H-1	H-1	
Sample No.	5-D	7-D	9-D	11-D	13-D	15-D	17-D	
Depth (ft.)	20-21.5	30-31.5	40-41.5	50-51.5	60-61.5	70-71.5	80-81.0	
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	
Soil Identification	Light olive gray poorly graded sand (SP) . LOOSE	Olive silty sand (SM)	Olive sandy silt s(ML)	Olive brown lean clay (CL)	Pale olive poorly graded sand (SP)	Pale olive poorly graded sand (SP)	Olive poorly graded sand with silt (SP-SM)	
Pocket Penetrometer (tons/ft^2)	0.75	3.00	3.75	4.00	1.50	0.50	1.00	
Weight Soil + Rings / Tube (g)	996.70	1089.50	957.30	1193.90	1020.00	969.90	827.60	
Weight of Rings / Tube (g)	242.88	242.88	202.40	242.88	242.88	242.88	202.40	
Average Length (in.)	6.000	6.000	5.000	6.000	6.000	6.000	5.000	
Average Diameter (in.)	2.414	2.414	2.414	2.414	2.414	2.414	2.414	
Wet. Wt. of Soil + Cont. (g)	295.20	643.52	364.69	344.56	306.63	300.59	311.08	
Dry Wt. of Soil + Cont. (g)	285.00	596.80	304.90	297.30	295.70	295.80	296.90	
Weight of Container (g)	59.92	76.15	65.49	53.84	39.28	55.88	72.03	
Container No.								
Wet Density	104.6	117.5	125.7	132.0	107.8	100.9	104.1	
Moisture Content (%)	**4.5**	**9.0**	**25.0**	**19.4**	**4.3**	**2.0**	**6.3**	
Dry Density (pcf)	**100.1**	**107.8**	**100.6**	**110.5**	**103.4**	**98.9**	**97.9**	
Degree of Saturation (%)	17.9	43.0	99.7	99.8	18.3	7.7	23.6	

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: Vernon Power Plant
Project No.: 338307.TM.GE.PR
Client Name: CH2M Hill
Tested By: ACS Date: 02/09/06

Boring No.	H-2	H-2	H-2	H-2	H-2	H-2		
Sample No.	2-D	4-D	8-D	12-D	14-D	16-D		
Depth (ft.)	5-6.5	15-16.5	35-36.5	55-56.5	65-66.5	75-76.5		
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive		
Soil Identification	Olive brown sandy silt s(ML)	Pale olive silty / poorly graded sand (SM/SP)	Olive silty sand (SM)	Olive brown lean clay (CL)	Olive brown poorly graded sand (SP)	Olive brown poorly graded sand (SP) / LOOSE		
Pocket Penetrometer (tons/ft^2)	>4	4.0 / 2.0	3.50	>4.5	4.50	N/A		
Weight Soil + Rings / Tube (g)	1107.90	870.70	1134.70	1203.70	1115.20	853.60		
Weight of Rings / Tube (g)	242.88	202.40	242.88	242.88	242.88	202.40		
Average Length (in.)	6.000	5.000	6.000	6.000	6.000	5.000		
Average Diameter (in.)	2.414	2.414	2.414	2.414	2.414	2.414		
Wet. Wt. of Soil + Cont. (g)	335.95	298.14	362.27	249.97	360.96	313.48		
Dry Wt. of Soil + Cont. (g)	306.70	281.10	317.00	216.80	346.30	308.80		
Weight of Container (g)	60.70	37.39	57.06	36.97	49.86	65.71		
Container No.								
Wet Density	120.0	111.3	123.7	133.3	121.0	108.4		
Moisture Content (%)	**11.9**	**7.0**	**17.4**	**18.4**	**4.9**	**1.9**		
Dry Density (pcf)	**107.3**	**104.0**	**105.4**	**112.6**	**115.3**	**106.4**		
Degree of Saturation (%)	56.2	30.4	78.4	100.1	28.9	8.9		

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: Vernon Power Plant
Project No.: 338307.TM.GE.PR
Client Name: CH2M Hill
Tested By: ACS Date: 02/09/06

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Leighton

Project Name:	Vernon Power Plant	Tested By: ACS	Date: 02/07/06
Project No.:	338307.TM.GE.PR	Checked By: LF	Date: 02/10/06
Exploration No.:	H-1	Depth (feet): 15-16.5	
Sample No.:	4-S		
Soil Identification:	Olive silty sand (SM)		

		Moisture Content of Total Air - Dry Soil	
Container No.:	979	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	1019.50	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	110.60	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	908.90	Moisture Content (%)	0.00

After Wet Sieve	Container No.	979
	Wt. of Dry Soil + Container (g)	810.00
	Wt. of Container (g)	110.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	699.40

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	100.0
3/8"	9.500	2.27	99.8
#4	4.750	14.50	98.4
#8	2.360	38.47	95.8
#16	1.180	99.42	89.1
#30	0.600	228.18	74.9
#50	0.300	444.69	51.1
#100	0.150	621.24	31.6
#200	0.075	696.92	23.3
PAN			

GRAVEL: **2 %**

SAND: **75 %**

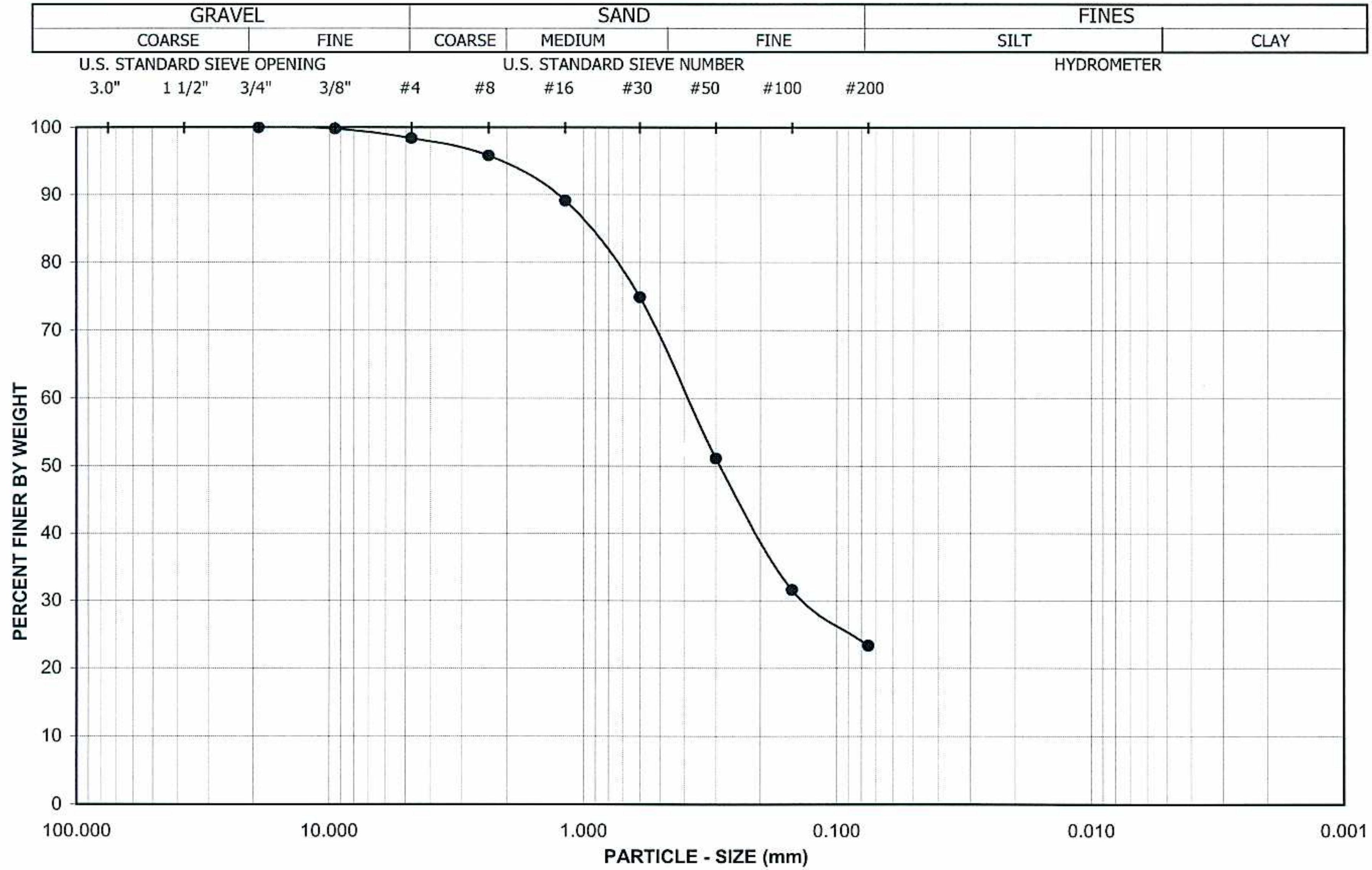
FINES: **23 %**

GROUP SYMBOL: **SM**

$Cu = D60/D10 =$ ______

$Cc = (D30)^2/(D60*D10) =$ ______

Remarks: ______



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-1 Sample No.: 4-S

Depth (feet): 15-16.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 2 : 75 : 23

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Feb-06

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-1	Depth (feet):	30-31.5		
Sample No.:	7-D				
Soil Identification:	Olive silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	748	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	596.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	76.15	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	520.65	Moisture Content (%)	0.00

After Wet Sieve	Container No.	748
	Wt. of Dry Soil + Container (g)	493.80
	Wt. of Container (g)	76.15
	Dry Wt. of Soil Retained on # 200 Sieve (g)	417.65

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.69	99.9
#8	2.360	2.23	99.6
#16	1.180	11.27	97.8
#30	0.600	57.05	89.0
#50	0.300	188.02	63.9
#100	0.150	324.59	37.7
#200	0.075	411.88	20.9
PAN			

GRAVEL: **0 %**

SAND: **79 %**

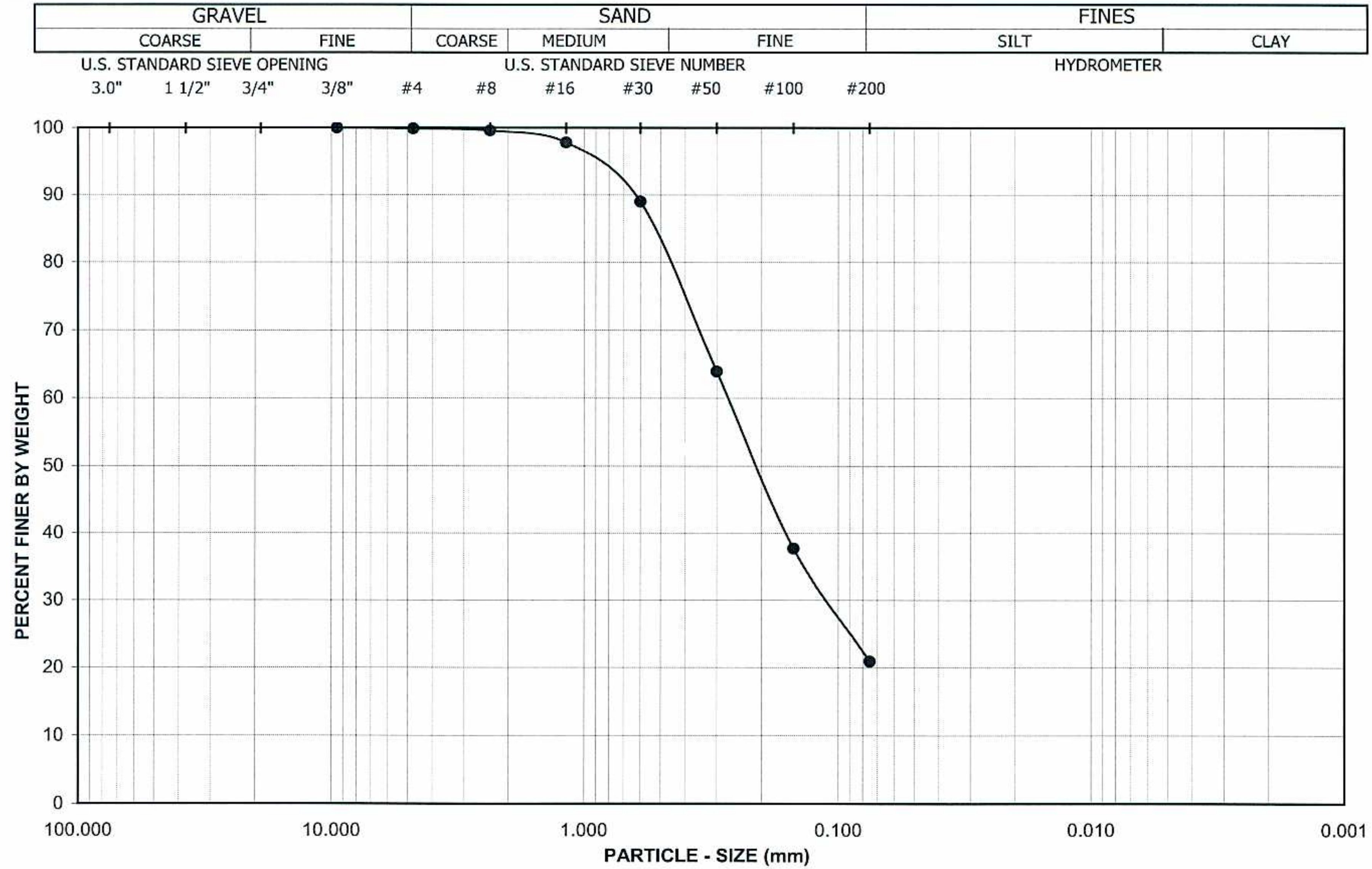
FINES: **21 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = $(D30)^2/(D60*D10)$ = ______

Remarks: ______



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: H-1 Sample No.: 7-D

Depth (feet): 30-31.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 79 : 21

Feb-06

SA H-1 7-D

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-1	Depth (feet):	35-36.5		
Sample No.:	8-S				
Soil Identification:	Olive sandy silt s(ML)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	989	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	842.50	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	109.78	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	732.72	Moisture Content (%)	0.00

After Wet Sieve	Container No.	989
	Wt. of Dry Soil + Container (g)	474.00
	Wt. of Container (g)	109.78
	Dry Wt. of Soil Retained on # 200 Sieve (g)	364.22

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.54	99.9
#8	2.360	3.42	99.5
#16	1.180	12.08	98.4
#30	0.600	25.74	96.5
#50	0.300	57.04	92.2
#100	0.150	168.28	77.0
#200	0.075	346.77	52.7
PAN			

GRAVEL: **0 %**

SAND: **47 %**

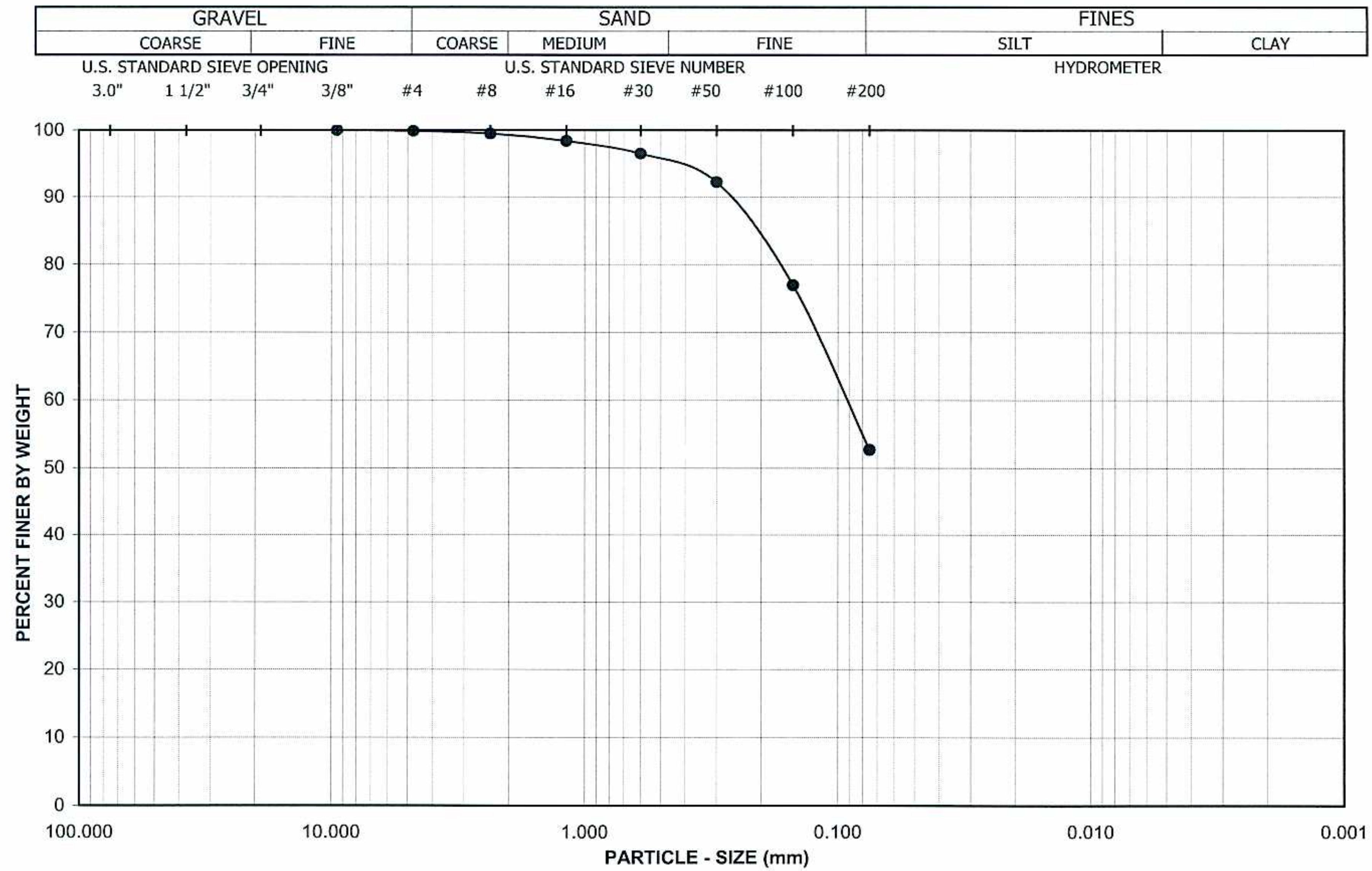
FINES: **53 %**

GROUP SYMBOL: **s(ML)**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-1 | Sample No.: 8-S

Depth (feet): 35-36.5 | Soil Type : s(ML)

Soil Identification: Olive sandy silt s(ML)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 0 : 47 : 53

Feb-06

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-1	Depth (feet):	55-56.5		
Sample No.:	12-S				
Soil Identification:	Olive well-graded sand with silt (SW-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	K-5	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	741.50	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	76.18	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	665.32	Moisture Content (%)	0.00

After Wet Sieve	Container No.	K-5
	Wt. of Dry Soil + Container (g)	665.50
	Wt. of Container (g)	76.18
	Dry Wt. of Soil Retained on # 200 Sieve (g)	589.32

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.92	99.6
#8	2.360	10.14	98.5
#16	1.180	37.05	94.4
#30	0.600	131.77	80.2
#50	0.300	374.16	43.8
#100	0.150	506.51	23.9
#200	0.075	586.14	11.9
PAN			

GRAVEL: **0 %**

SAND: **88 %**

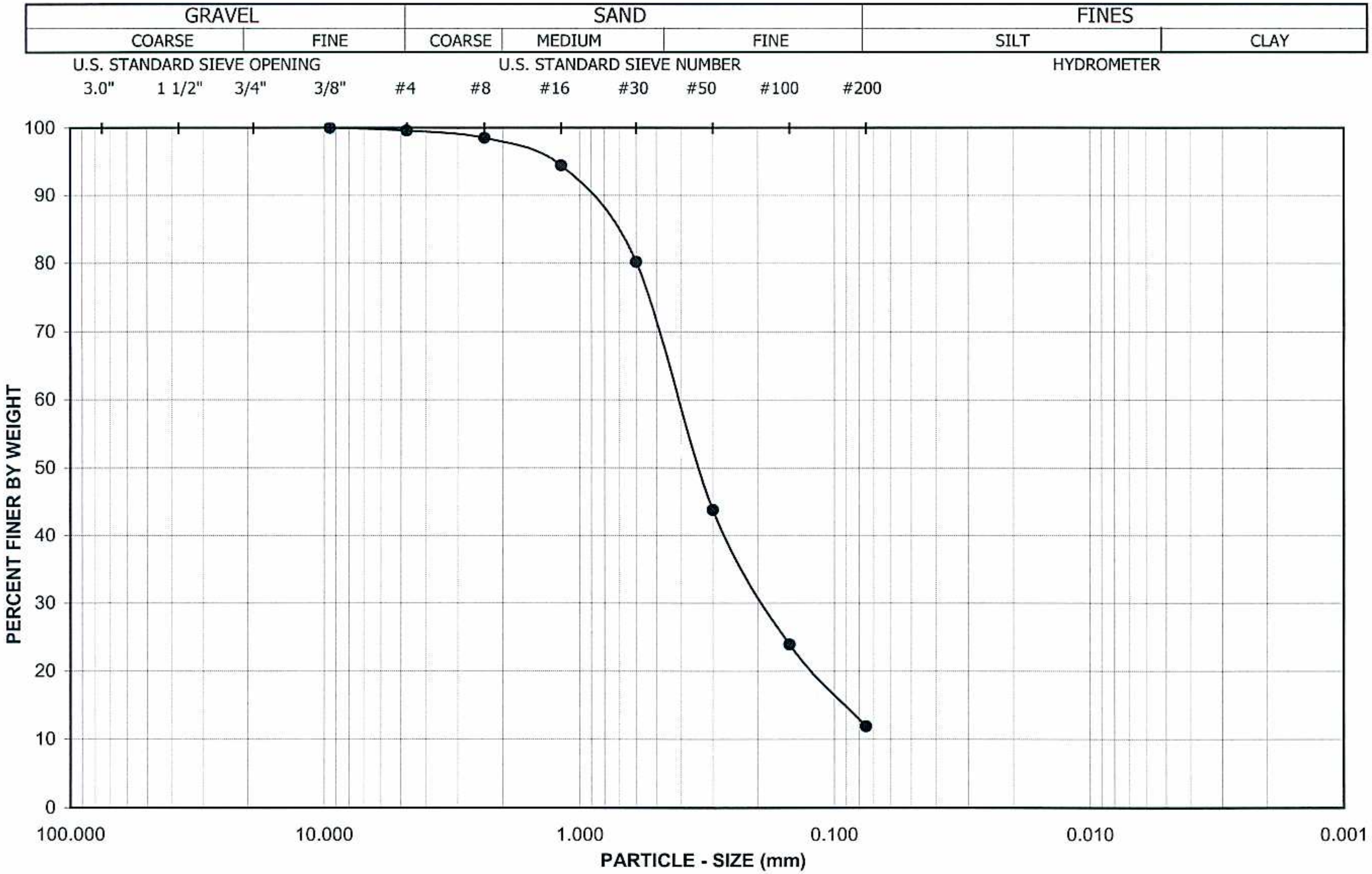
FINES: **12 %**

GROUP SYMBOL: **SW-SM**

Cu = D60/D10 = 6.03

Cc = (D30)²/(D60*D10) = 1.29

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-1 Sample No.: 12-S

Depth (feet): 55-56.5 Soil Type : SW-SM

Soil Identification: Olive well-graded sand with silt (SW-SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 0 : 88 : 12

Feb-06

SA H-1 12-S

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/08/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-1	Depth (feet):	65-66.5		
Sample No.:	14-S				
Soil Identification:	Olive silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	788	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	572.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	75.70	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	497.10	Moisture Content (%)	0.00

After Wet Sieve	Container No.	788
	Wt. of Dry Soil + Container (g)	375.00
	Wt. of Container (g)	75.70
	Dry Wt. of Soil Retained on # 200 Sieve (g)	299.30

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.25	99.9
#8	2.360	0.50	99.9
#16	1.180	4.46	99.1
#30	0.600	19.60	96.1
#50	0.300	73.53	85.2
#100	0.150	200.21	59.7
#200	0.075	295.43	40.6
PAN			

GRAVEL: **0 %**

SAND: **59 %**

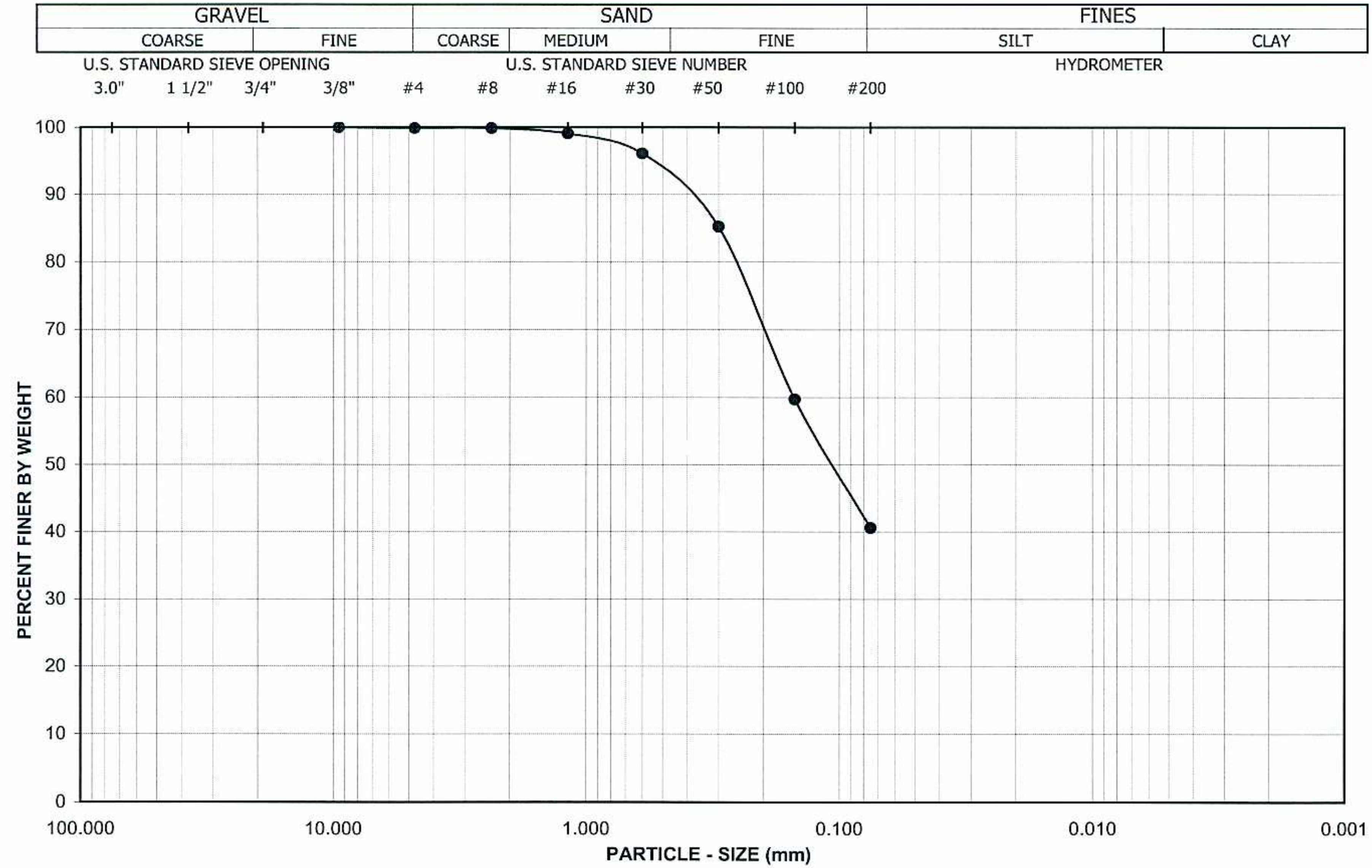
FINES: **41 %**

GROUP SYMBOL: **SM**

$Cu = D60/D10 =$ ______

$Cc = (D30)^2/(D60*D10) =$ ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-1 Sample No.: 14-S

Depth (feet): 65-66.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 59 : 41

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Feb-06

SA H-1 14-S

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By: ACS	Date: 02/08/06
Project No.:	338307.TM.GE.PR	Checked By: LF	Date: 02/10/06
Exploration No.:	H-1	Depth (feet): 75-76.5	
Sample No.:	16-S		
Soil Identification:	Olive silt with sand (ML)s		

		Moisture Content of Total Air - Dry Soil	
Container No.:	790	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	641.00	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	75.76	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	565.24	Moisture Content (%)	0.00

After Wet Sieve	Container No.	790
	Wt. of Dry Soil + Container (g)	175.40
	Wt. of Container (g)	75.76
	Dry Wt. of Soil Retained on # 200 Sieve (g)	99.64

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.96	99.8
#8	2.360	2.31	99.6
#16	1.180	6.06	98.9
#30	0.600	18.31	96.8
#50	0.300	42.39	92.5
#100	0.150	68.75	87.8
#200	0.075	97.18	82.8
PAN			

GRAVEL: **0 %**

SAND: **17 %**

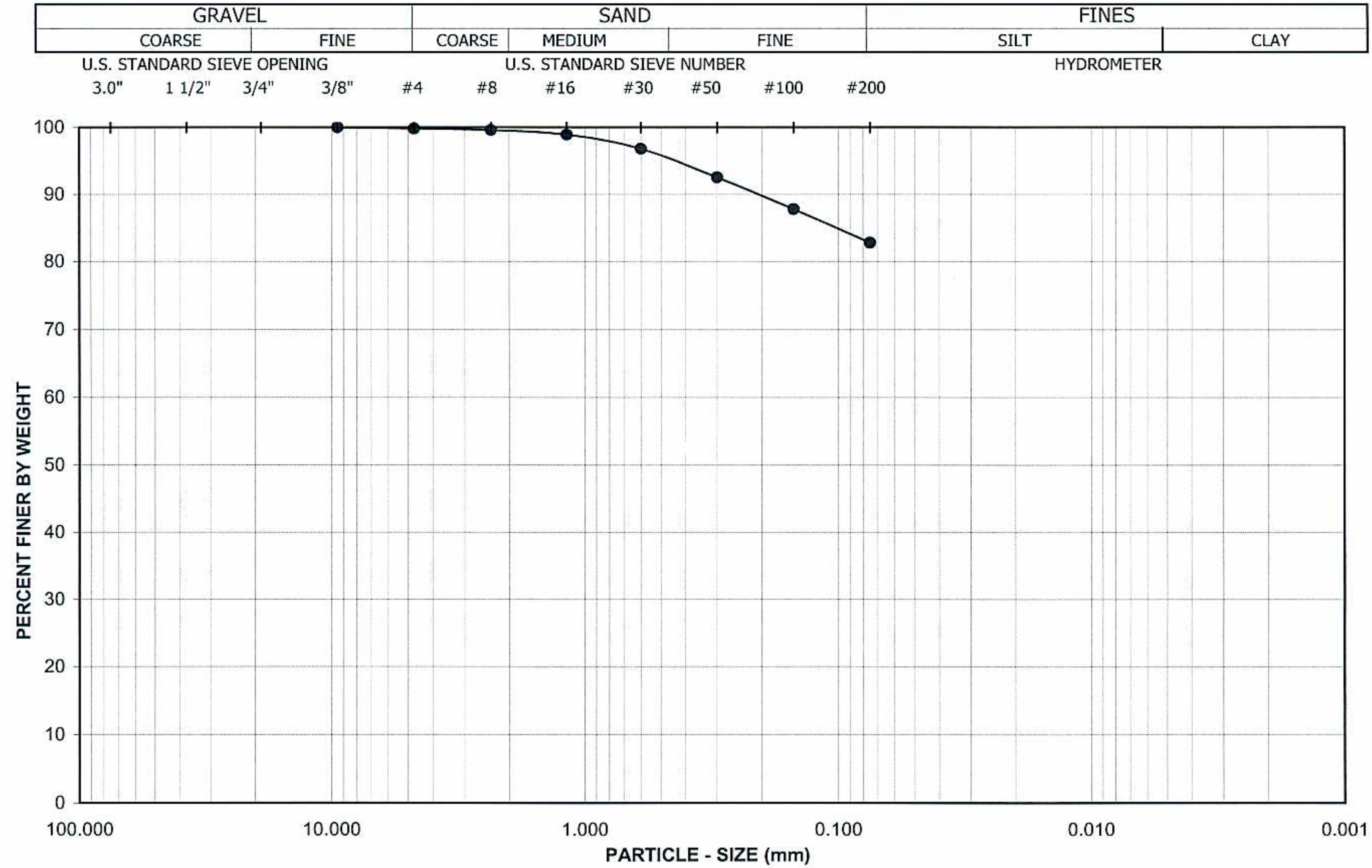
FINES: **83 %**

GROUP SYMBOL: **(ML)s**

$Cu = D60/D10 =$ ______

$Cc = (D30)^2/(D60*D10) =$ ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-1 | Sample No.: 16-S

Depth (feet): 75-76.5 | Soil Type : (ML)s

Soil Identification: Olive silt with sand (ML)s

GR:SA:FI : (%) 0 : 17 : 83

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Feb-06

SA H-1 16-S

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: Vernon Power Plant
Project No.: 338307.TM.GE.PR
Exploration No.: H-2
Sample No.: 5-S
Soil Identification: Olive silty sand (SM)

Tested By: ACS Date: 02/07/06
Checked By: LF Date: 02/10/06
Depth (feet): 20-21.5

		Moisture Content of Total Air - Dry Soil	
Container No.:	969	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	759.60	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	109.87	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	649.73	Moisture Content (%)	0.00

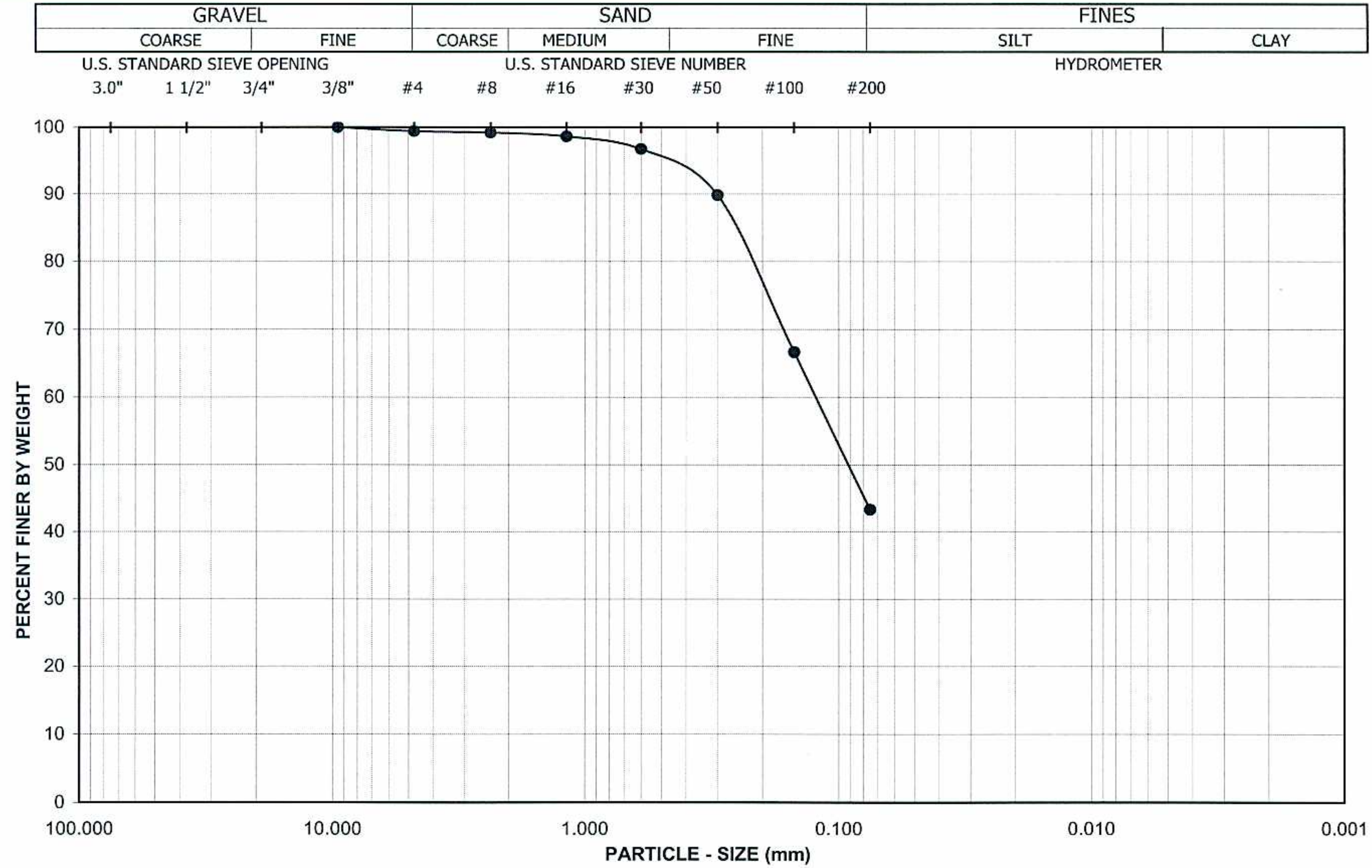
After Wet Sieve	Container No.	969
	Wt. of Dry Soil + Container (g)	487.10
	Wt. of Container (g)	109.87
	Dry Wt. of Soil Retained on # 200 Sieve (g)	377.23

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	3.60	99.4
#8	2.360	5.30	99.2
#16	1.180	9.40	98.6
#30	0.600	21.68	96.7
#50	0.300	66.51	89.8
#100	0.150	216.76	66.6
#200	0.075	368.49	43.3
PAN			

GRAVEL: **1 %**
SAND: **56 %**
FINES: **43 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = ______
Cc = $(D30)^2/(D60*D10)$ = ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-2 Sample No.: 5-S

Depth (feet): 20-21.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 1 : 56 : 43

Feb-06

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By: ACS	Date: 02/08/06
Project No.:	338307.TM.GE.PR	Checked By: LF	Date: 02/10/06
Exploration No.:	H-2	Depth (feet): 30-31.5	
Sample No.:	7-S		
Soil Identification:	Olive silty sand (SM)		

		Moisture Content of Total Air - Dry Soil	
Container No.:	777	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	795.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	75.92	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	719.78	Moisture Content (%)	0.00

After Wet Sieve	Container No.	777
	Wt. of Dry Soil + Container (g)	489.00
	Wt. of Container (g)	75.92
	Dry Wt. of Soil Retained on # 200 Sieve (g)	413.08

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.39	99.9
#8	2.360	1.67	99.8
#16	1.180	6.25	99.1
#30	0.600	23.06	96.8
#50	0.300	98.93	86.3
#100	0.150	269.98	62.5
#200	0.075	409.08	43.2
PAN			

GRAVEL: **0 %**

SAND: **57 %**

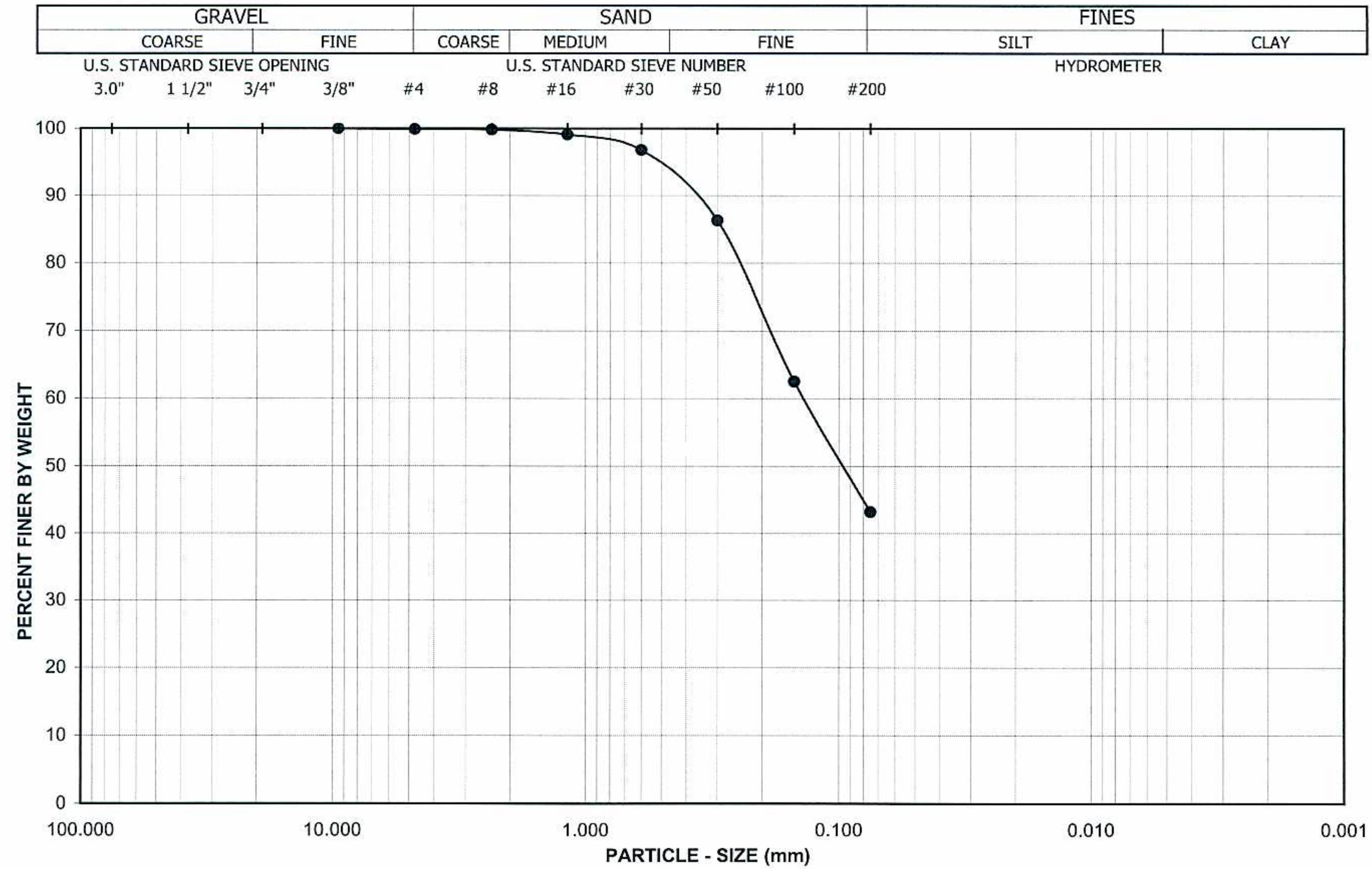
FINES: **43 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = $(D30)^2/(D60*D10)$ = ______

Remarks: ______________________________



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-2 | Sample No.: 7-S

Depth (feet): 30-31.5 | Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 57 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Feb-06

SA H-2 7-S

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-2	Depth (feet):	40-41.5		
Sample No.:	9-S				
Soil Identification:	Olive silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	549	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	709.20	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	77.88	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	631.32	Moisture Content (%)	0.00

After Wet Sieve	Container No.	549
	Wt. of Dry Soil + Container (g)	446.40
	Wt. of Container (g)	77.88
	Dry Wt. of Soil Retained on # 200 Sieve (g)	368.52

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	100.0
3/8"	9.500	4.24	99.3
#4	4.750	5.29	99.2
#8	2.360	8.63	98.6
#16	1.180	17.63	97.2
#30	0.600	35.00	94.5
#50	0.300	94.69	85.0
#100	0.150	224.13	64.5
#200	0.075	361.18	42.8
PAN			

GRAVEL: **1 %**

SAND: **56 %**

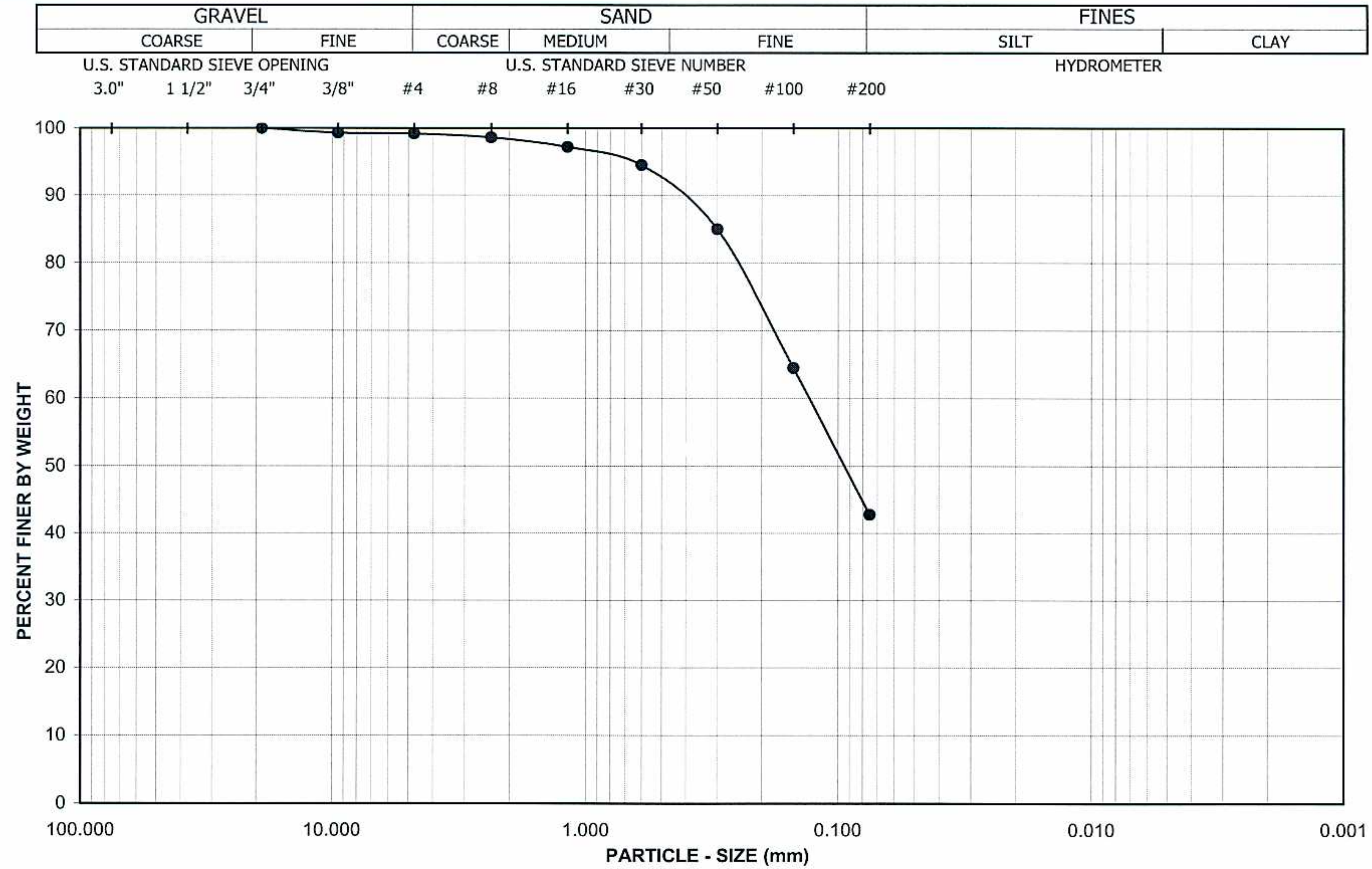
FINES: **43 %**

GROUP SYMBOL: **SM**

$Cu = D60/D10 =$ ______

$Cc = (D30)^2/(D60*D10) =$ ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-2 Sample No.: 9-S

Depth (feet): 40-41.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 1 : 56 : 43

Feb-06

SA H-2 9-S

Leighton

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-2	Depth (feet):	50-51.5		
Sample No.:	11-S				
Soil Identification:	Olive sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	915	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	786.20	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	107.14	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	679.06	Moisture Content (%)	0.00

After Wet Sieve	Container No.	915
	Wt. of Dry Soil + Container (g)	361.80
	Wt. of Container (g)	107.14
	Dry Wt. of Soil Retained on # 200 Sieve (g)	254.66

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.50	99.9
#8	2.360	2.61	99.6
#16	1.180	9.53	98.6
#30	0.600	28.29	95.8
#50	0.300	76.83	88.7
#100	0.150	158.20	76.7
#200	0.075	250.16	63.2
PAN			

GRAVEL: **0 %**

SAND: **37 %**

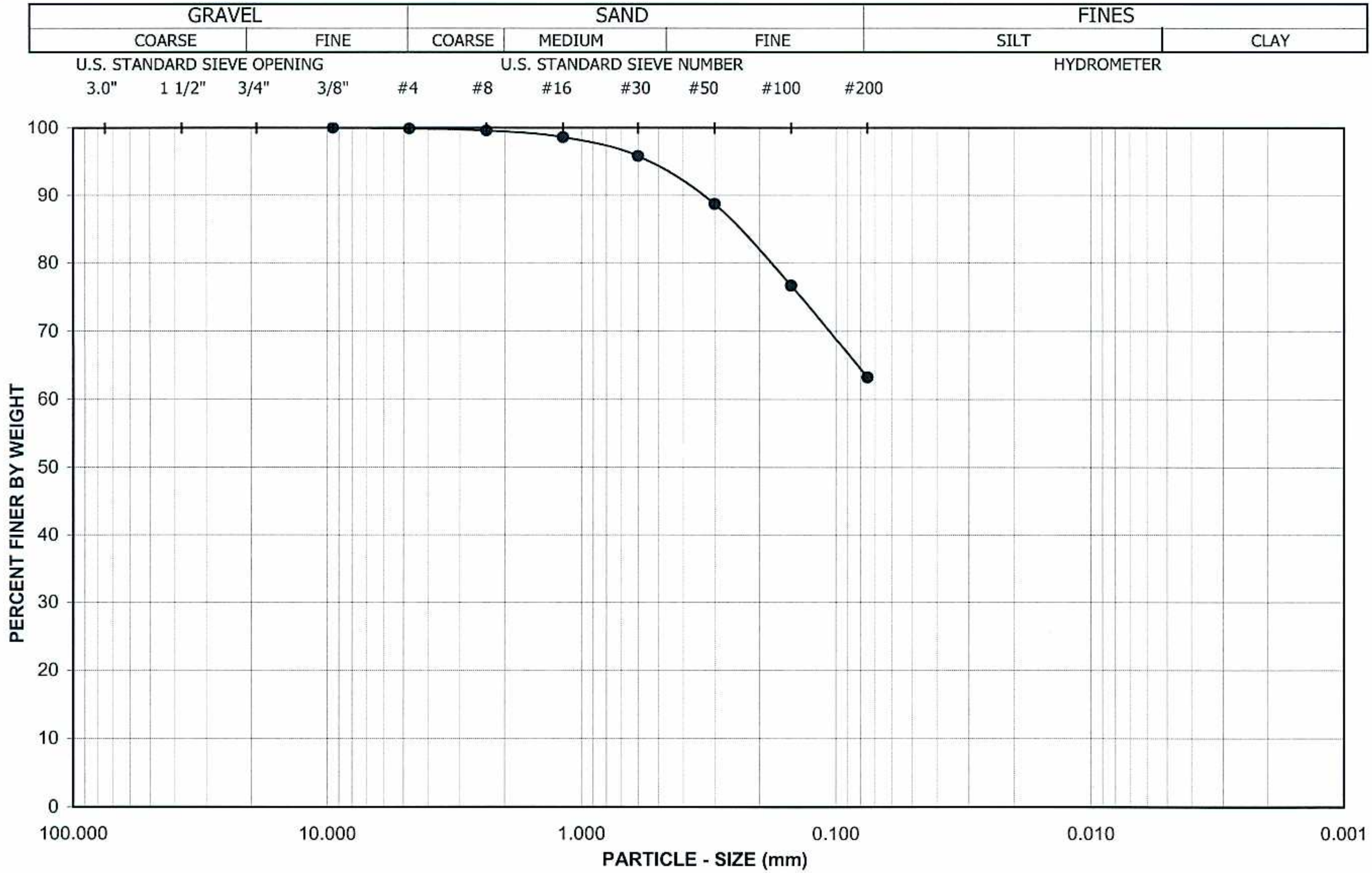
FINES: **63 %**

GROUP SYMBOL: **s(CL)**

$Cu = D60/D10 =$ ______

$Cc = (D30)^2/(D60*D10) =$ ______

Remarks: ______



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-2 Sample No.: 11-S

Depth (feet): 50-51.5 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 0 : 37 : 63

Feb-06

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Leighton

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	02/07/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Exploration No.:	H-2	Depth (feet):	60-61.5		
Sample No.:	13-S				
Soil Identification:	Olive silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	K-14	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	489.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	75.01	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	414.79	Moisture Content (%)	0.00

After Wet Sieve	Container No.	K-14
	Wt. of Dry Soil + Container (g)	370.10
	Wt. of Container (g)	75.01
	Dry Wt. of Soil Retained on # 200 Sieve (g)	295.09

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.37	99.9
#8	2.360	0.82	99.8
#16	1.180	2.80	99.3
#30	0.600	13.25	96.8
#50	0.300	34.21	91.8
#100	0.150	174.28	58.0
#200	0.075	290.43	30.0
PAN			

GRAVEL: **0 %**

SAND: **70 %**

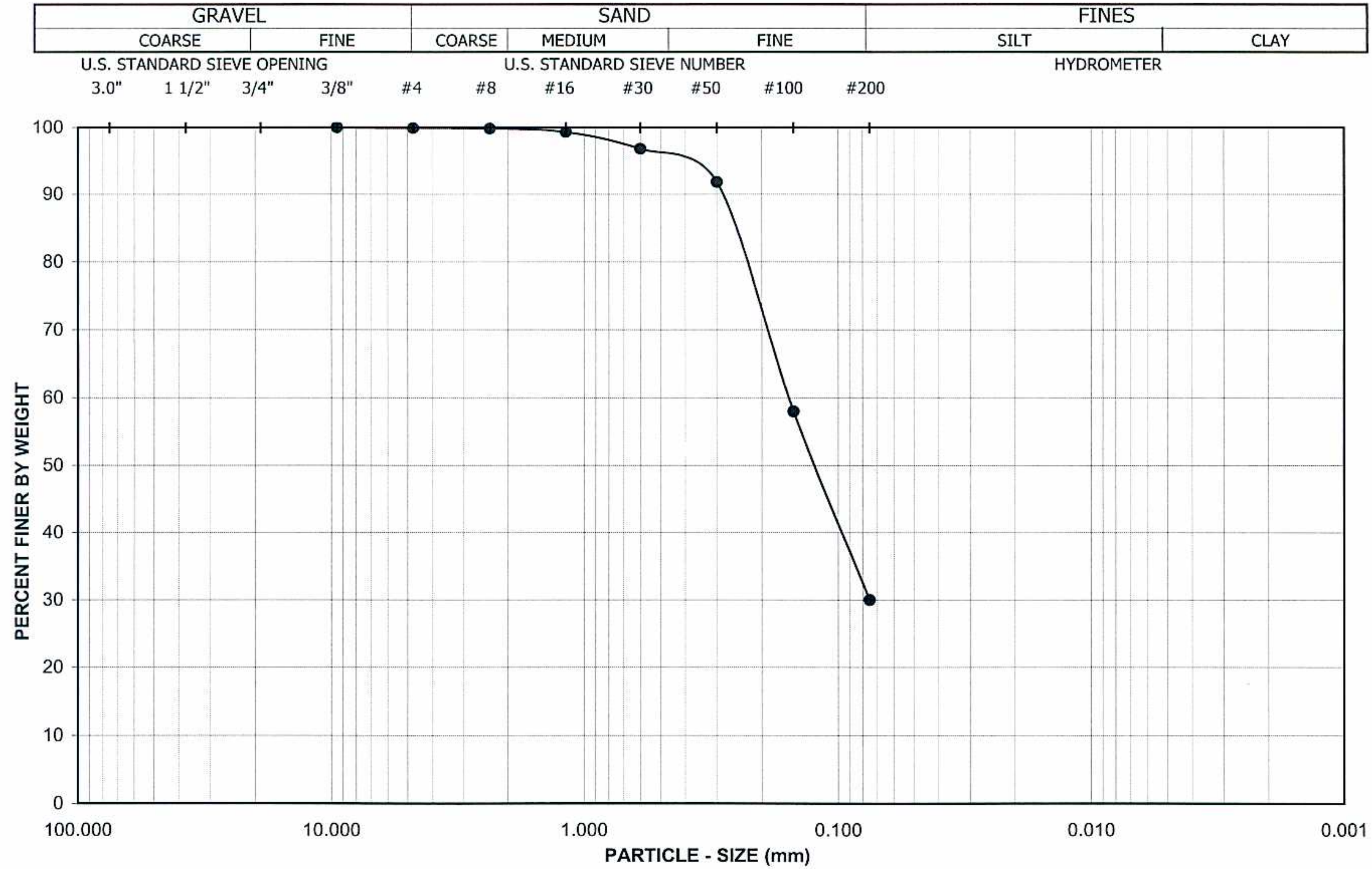
FINES: **30 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks:



Project Name: Vernon Power Plant

Project No.: 338307.TM.GE.PR

Exploration No.: H-2 Sample No.: 13-S

Depth (feet): 60-61.5 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 70 : 30

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

Feb-06

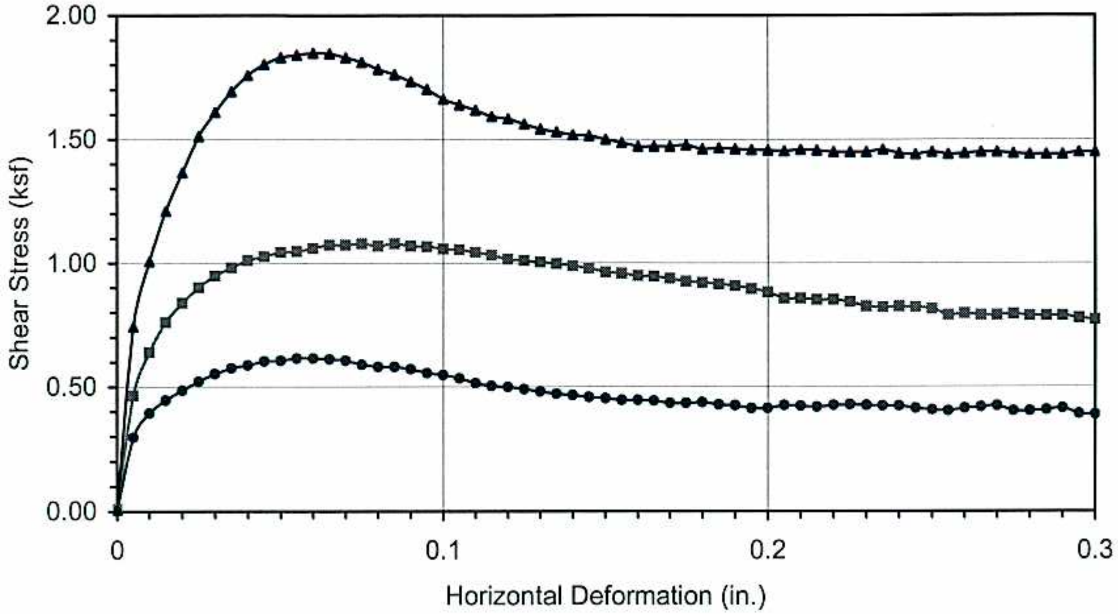
Leighton

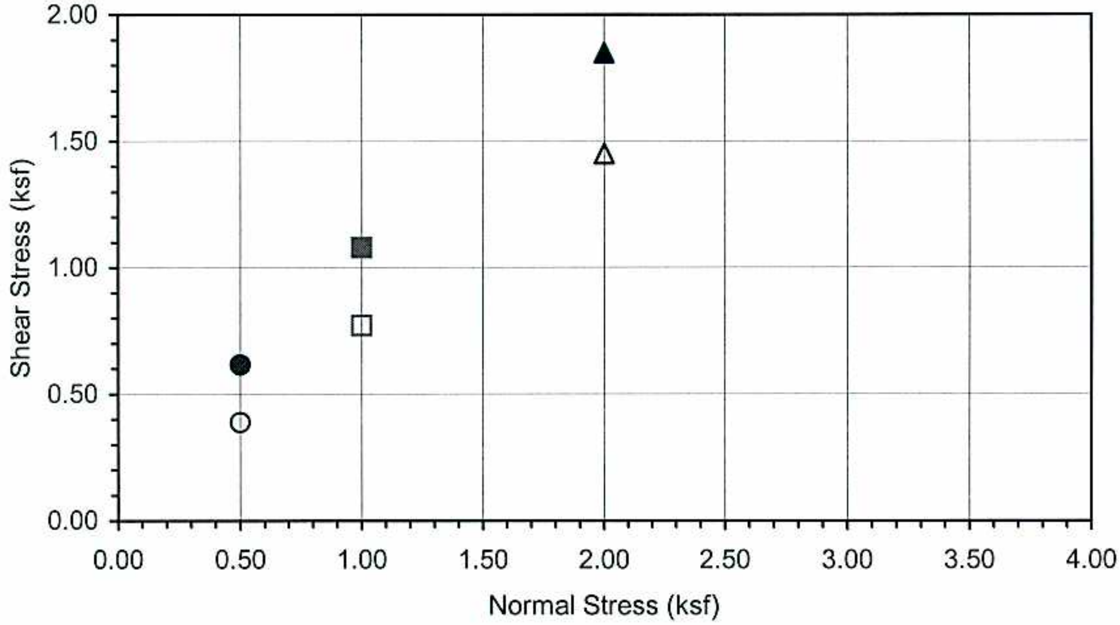
DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name: Vernon Power Plant | Tested By: ACS | Date: 01/30/06
Project No.: 338307.TM.GE.PR | Checked By: LF | Date: 02/10/06
Boring No.: H-1 | Sample Type: Drive
Sample No.: 3-D | Depth (ft.): 10-11.5
Soil Identification: Olive poorly graded sand (SP)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	177.23	177.76	180.98
Weight of Ring(gm):	39.91	40.40	40.45
Before Shearing			
Weight of Wet Sample+Cont.(gm):	218.31	218.31	218.31
Weight of Dry Sample+Cont.(gm):	206.74	206.74	206.74
Weight of Container(gm):	62.17	62.17	62.17
Vertical Rdg.(in): Initial	0.0000	0.3365	0.3401
Vertical Rdg.(in): Final	-0.0034	0.3431	0.3512
After Shearing			
Weight of Wet Sample+Cont.(gm):	208.86	209.72	208.23
Weight of Dry Sample+Cont.(gm):	186.50	188.00	186.80
Weight of Container(gm):	60.05	66.35	58.12
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**H-1**
Sample No.	**3-D**
Depth (ft)	**10-11.5**
Sample Type: Drive	
Soil Identification: Olive poorly graded sand (SP)	

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.614	■ 1.079	▲ 1.849
Shear Stress @ End of Test (ksf)	○ 0.387	□ 0.770	△ 1.450
Deformation Rate (in./min.)	0.0050	0.0050	0.0050
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.00	8.00	8.00
Dry Density (pcf)	105.7	105.8	108.2
Saturation (%)	36.4	36.4	38.7
Soil Height Before Shearing (in.)	0.9966	0.9934	0.9889
Final Moisture Content (%)	17.7	17.9	16.7

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 338307.TM.GE.PR

Vernon Power Plant

01-06

DS H-1 3-D

Leighton

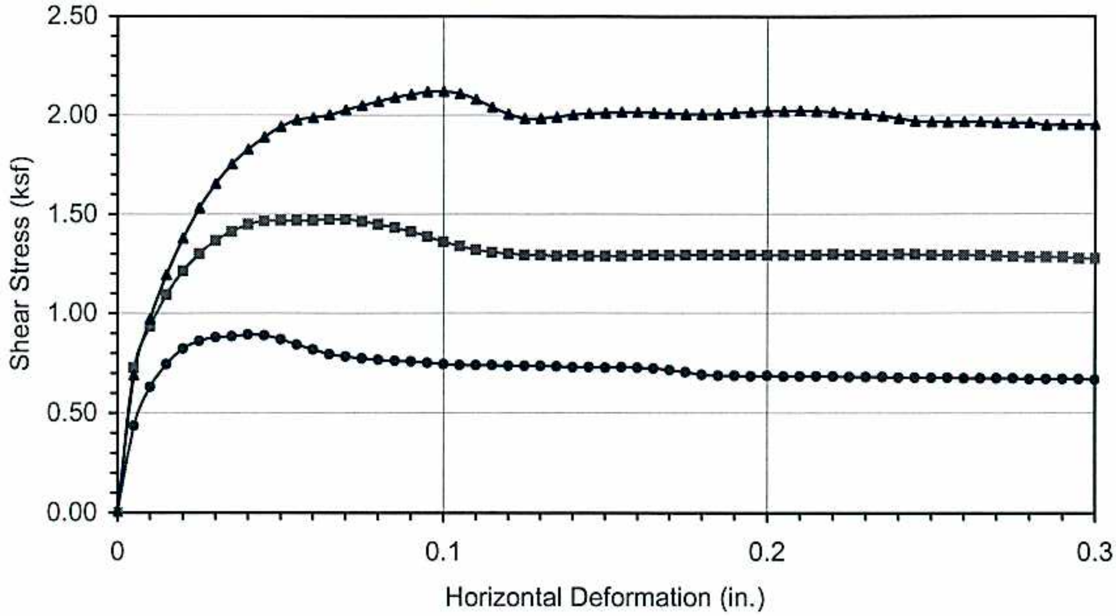
DIRECT SHEAR TEST

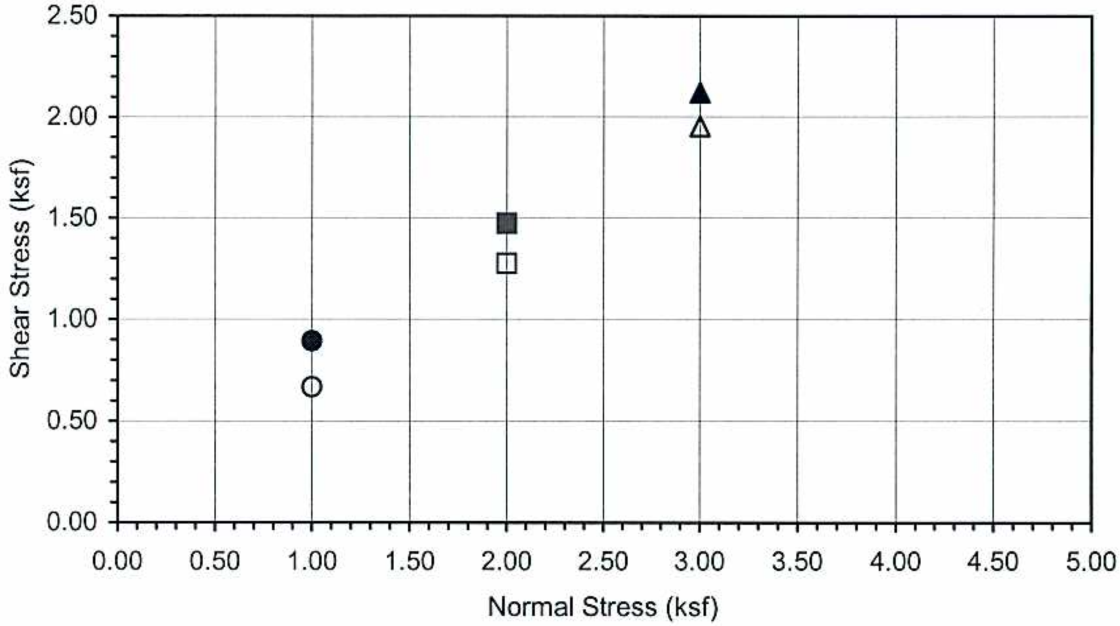
Consolidated Drained - ASTM D 3080

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	01/30/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Boring No.:	H-2	Sample Type:	Drive		
Sample No.:	6-D	Depth (ft.):	25-26.5		

Soil Identification: Olive brown silty sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	174.76	176.81	178.20
Weight of Ring(gm):	40.56	40.58	40.37
Before Shearing			
Weight of Wet Sample+Cont.(gm):	208.87	208.87	208.87
Weight of Dry Sample+Cont.(gm):	184.85	184.85	184.85
Weight of Container(gm):	59.22	59.22	59.22
Vertical Rdg.(in): Initial	0.0000	0.3516	0.3485
Vertical Rdg.(in): Final	-0.0073	0.3671	0.3754
After Shearing			
Weight of Wet Sample+Cont.(gm):	210.28	182.91	206.76
Weight of Dry Sample+Cont.(gm):	179.50	151.90	178.60
Weight of Container(gm):	67.79	40.62	64.06
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**H-2**
Sample No.	**6-D**
Depth (ft)	**25-26.5**
Sample Type: Drive	
Soil Identification: Olive brown silty sand (SM)	

Normal Stress (kip/ft²)	1.000	2.000	3.000
Peak Shear Stress (kip/ft²)	● 0.892	■ 1.472	▲ 2.120
Shear Stress @ End of Test (ksf)	○ 0.667	□ 1.275	△ 1.952
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	19.12	19.12	19.12
Dry Density (pcf)	93.7	95.1	96.2
Saturation (%)	64.6	66.8	68.7
Soil Height Before Shearing (in.)	0.9927	0.9845	0.9731
Final Moisture Content (%)	27.6	27.9	24.6

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 338307.TM.GE.PR

Vernon Power Plant

01-06

DS H-2 6-D

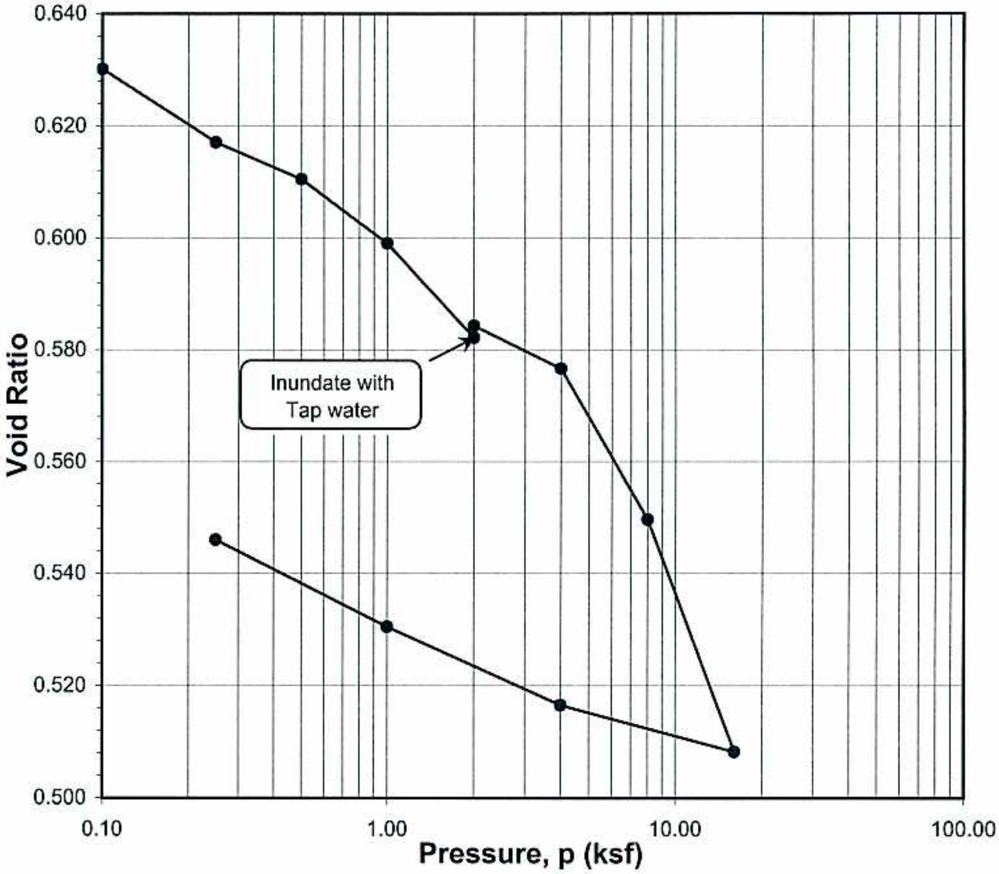
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Leighton

Project Name:	Vernon Power Plant	Tested By:	ACS	Date:	01/25/06
Project No.:	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Boring No.:	H-2	Depth (ft.):	45-46.5		
Sample No.:	10-D	Sample Type:	Drive		
Soil Identification:	Olive lean clay (CL)				

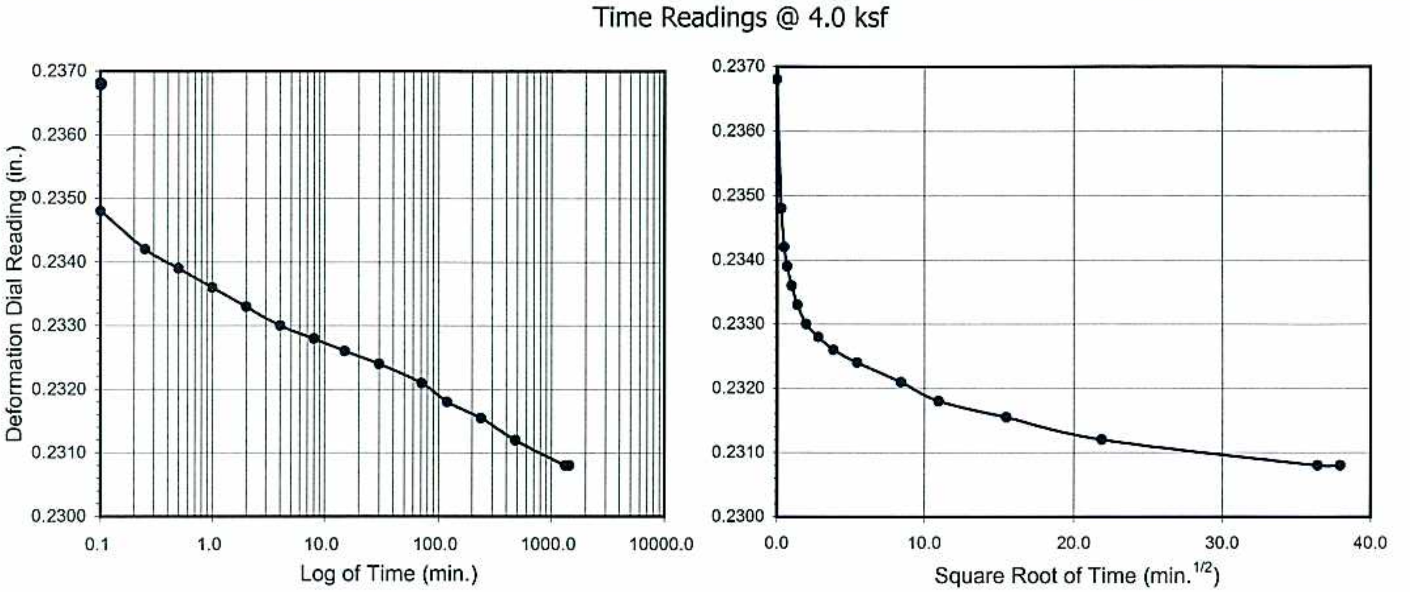
Sample Diameter (in.)	2.414
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	192.57
Weight of Ring (g)	40.25
Height after consol. (in.)	0.9461
Before Test	
Wt.Wet Sample+Cont. (g)	370.51
Wt.of Dry Sample+Cont. (g)	313.89
Weight of Container (g)	66.67
Initial Moisture Content (%)	22.9
Initial Dry Density (pcf)	103.2
Initial Saturation (%)	98
Initial Vertical Reading (in.)	0.2692
After Test	
Wt.of Wet Sample+Cont. (g)	257.82
Wt. of Dry Sample+Cont. (g)	230.39
Weight of Container (g)	68.64
Final Moisture Content (%)	22.58
Final Dry Density (pcf)	106.9
Final Saturation (%)	106
Final Vertical Reading (in.)	0.2129
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

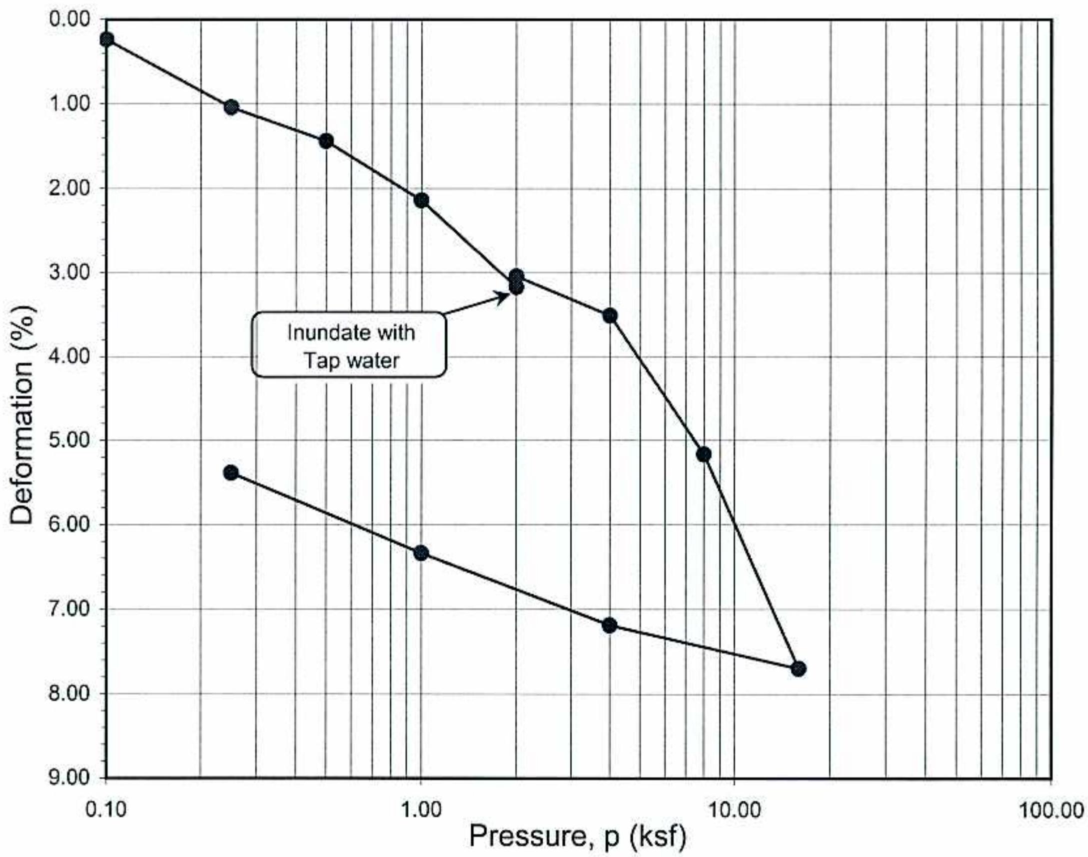


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2668	0.9976	0.00	0.24	0.630	0.24
0.25	0.2584	0.9892	0.04	1.08	0.617	1.04
0.50	0.2540	0.9848	0.08	1.52	0.610	1.44
1.00	0.2465	0.9773	0.13	2.27	0.599	2.14
2.00	0.2355	0.9663	0.20	3.37	0.582	3.17
2.00	0.2368	0.9676	0.20	3.24	0.584	3.04
4.00	0.2308	0.9616	0.33	3.84	0.577	3.51
8.00	0.2126	0.9434	0.49	5.66	0.550	5.17
16.00	0.1855	0.9163	0.67	8.37	0.508	7.70
4.00	0.1927	0.9235	0.46	7.65	0.517	7.19
1.00	0.2026	0.9334	0.32	6.66	0.530	6.34
0.25	0.2129	0.9437	0.24	5.63	0.546	5.39

Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
1/30/06	8:41:00	0.0	0.0	0.2368
1/30/06	8:41:06	0.1	0.3	0.2348
1/30/06	8:41:15	0.2	0.5	0.2342
1/30/06	8:41:30	0.5	0.7	0.2339
1/30/06	8:42:00	1.0	1.0	0.2336
1/30/06	8:43:00	2.0	1.4	0.2333
1/30/06	8:45:00	4.0	2.0	0.2330
1/30/06	8:49:00	8.0	2.8	0.2328
1/30/06	8:56:00	15.0	3.9	0.2326
1/30/06	9:11:00	30.0	5.5	0.2324
1/30/06	9:52:00	71.0	8.4	0.2321
1/30/06	10:41:00	120.0	11.0	0.2318
1/30/06	12:41:00	240.0	15.5	0.2316
1/30/06	16:41:00	480.0	21.9	0.2312
1/31/06	6:48:00	1327.0	36.4	0.2308
1/31/06	8:41:00	1440.0	37.9	0.2308





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
H-2	**10-D**	**45-46.5**	**22.9**	**22.6**	**103.2**	**106.9**	**0.634**	**0.546**	**98**	**100**

Soil Identification: Olive lean clay (CL)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 338307.TM.GE.PR

Vernon Power Plant

02-06

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name: Vernon Power Plant   Tested By : GEB   Date: 01/26/06

Project No.: 338307.TM.GE.   Input By : LF   Date: 02/10/06

Boring No.: H-1   Depth (ft.) 0-4.0

Sample No. : 1-B

Soil Identification: Olive brown silty sand (SM)

Preparation Method: [X] Moist [ ] Dry   [X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03319   *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3720.0	3804.0	3878.0	3856.0		
Weight of Mold (g)	1852.0	1852.0	1852.0	1852.0		
Net Weight of Soil (g)	1868.0	1952.0	2026.0	2004.0		
Wet Weight of Soil + Cont. (g)	529.80	465.80	508.60	546.10		
Dry Weight of Soil + Cont. (g)	503.50	435.10	465.40	489.80		
Weight of Container (g)	54.20	51.10	51.60	54.00		
Moisture Content (%)	5.85	7.99	10.44	12.92		
Wet Density (pcf)	124.1	129.7	134.6	133.1		
Dry Density (pcf)	117.2	120.1	121.9	117.9		

Maximum Dry Density (pcf) **122.0**   **Optimum Moisture Content (%)** **10.5**

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

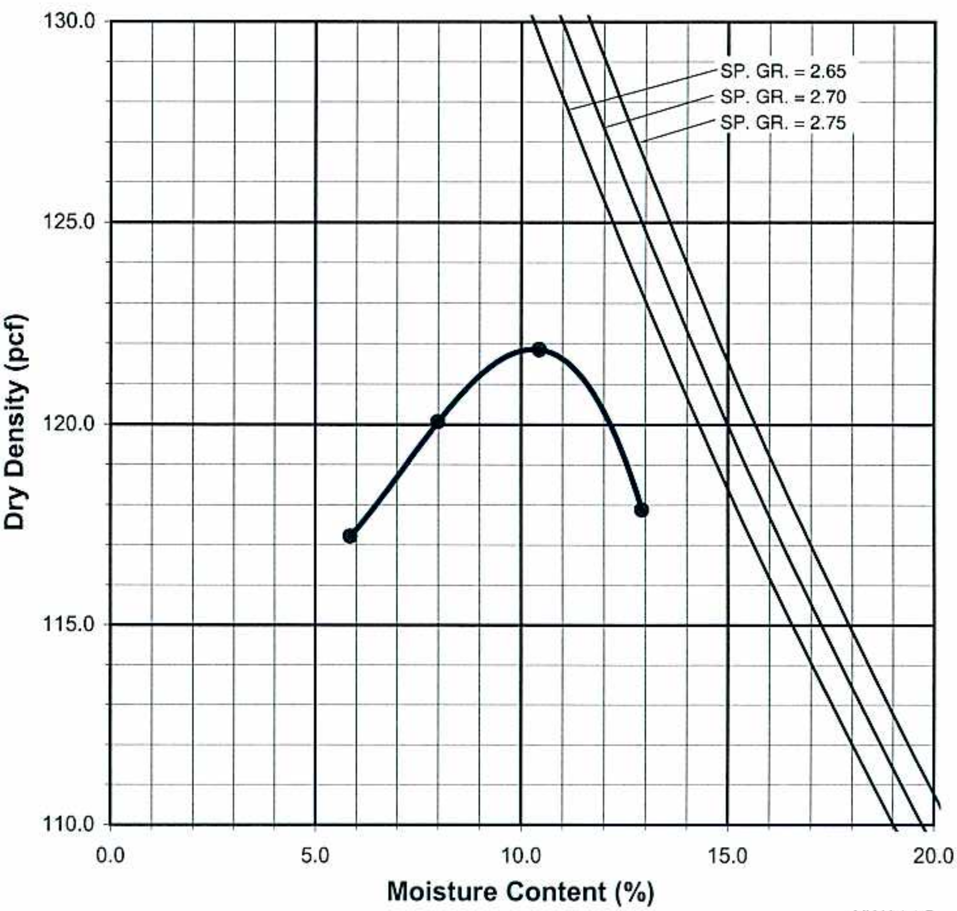
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MX H-1 1-B

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Vernon Power Plant	Tested By:	CMC	Date:	02/02/06
Project No. :	338307.TM.GE.PR	Checked By:	LF	Date:	02/10/06
Boring No.:	H-2	Depth (ft.)	0-4.0		
Sample No. :	1-B				
Soil Identification:	Olive brown silty sand (SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0000
Wt. Comp. Soil + Mold	(g)	597.60	421.20
Wt. of Mold	(g)	207.60	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	803.90	628.80
Dry Wt. of Soil + Cont.	(g)	732.80	563.30
Wt. of Container	(g)	0.00	207.60
Moisture Content	(%)	9.70	18.41
Wet Density	(pcf)	117.6	127.1
Dry Density	(pcf)	107.2	107.3
Void Ratio		0.572	0.571
Total Porosity		0.364	0.364
Pore Volume	(cc)	75.3	75.3
Degree of Saturation (%) [S_{meas}]		**45.8**	87.0

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
02/02/06	16:24	1.0	0	0.1170
02/02/06	16:34	1.0	10	0.1160
Add Distilled Water to the Specimen				
02/03/06	8:05	1.0	931	0.1170
02/03/06	9:05	1.0	991	0.1170

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	1.0
Expansion Index (EI_{50}) = EI_{meas} - (50 - S_{meas})x((65+EI_{meas}) / (220-S_{meas}))	**0**

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TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

Project Name: Vernon Power Plant | Tested By : GB | Date: 01/30/06

Project No. : 338307.TM.GE.PR | Data Input By: LF | Date: 02/10/06

Boring No.	H-1	H-2		
Sample No.	1-B	1-B		
Sample Depth (ft)	0-4.0	0-4.0		
Soil Identification:	SM	SM		
Wet Weight of Soil + Container (g)	212.80	266.21		
Dry Weight of Soil + Container (g)	202.53	255.14		
Weight of Container (g)	61.56	75.53		
Moisture Content (%)	7.29	6.16		
Weight of Soaked Soil (g)	100.20	100.06		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	12	19		
Crucible No.	16	27		
Furnace Temperature (°C)	840	840		
Time In / Time Out	8:40 / 9:25	8:40 / 9:25		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	20.1998	17.6513		
Wt. of Crucible (g)	20.1907	17.6264		
Wt. of Residue (g) (A)	0.0091	0.0249		
PPM of Sulfate (A) x 41150	374.47	1024.63		
PPM of Sulfate, Dry Weight Basis	**404**	**1092**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.9	0.9		
PPM of Chloride (C -0.2) * 100 * 30 / B	70	70		
PPM of Chloride, Dry Wt. Basis	**76**	**75**		

pH TEST, DOT California Test 532/643

pH Value	**7.66**	**5.23**		
Temperature °C	20.5	22.0		

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SOIL RESISTIVITY TEST

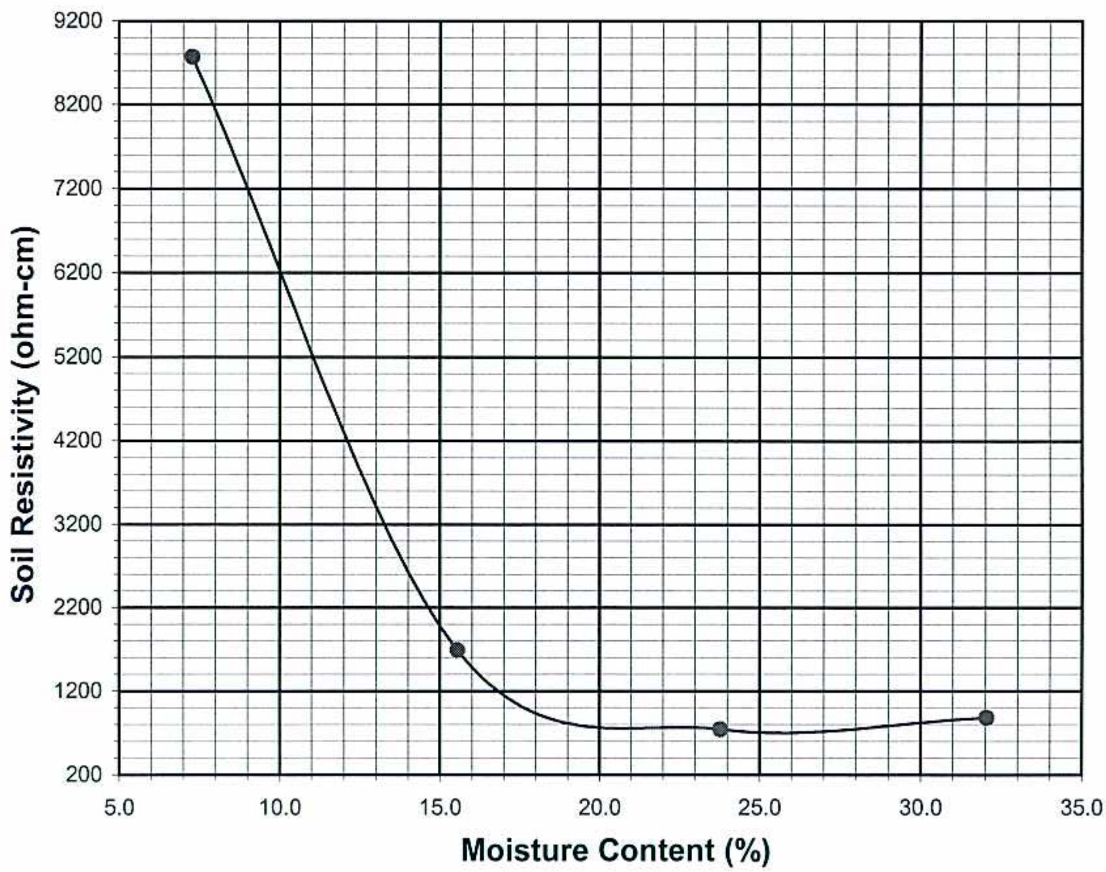
DOT CA TEST 532 / 643

Project Name:	Vernon Power Plant	Tested By :	GB	Date:	01/30/06
Project No. :	338307.TM.GE.PR	Data Input By:	LF	Date:	02/10/06
Boring No.:	H-1	Depth (ft.) :	0-4.0		
Sample No. :	1-B				
Soil Identification:	SM				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	0	7.29	1300	8770
2	100	15.54	250	1687
3	200	23.79	110	742
4	300	32.04	130	877
5				

Moisture Content (%) (MCi)	7.29
Wet Wt. of Soil + Cont. (g)	212.80
Dry Wt. of Soil + Cont. (g)	202.53
Wt. of Container (g)	61.56
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
742	**23.8**	**404**	**76**	**7.66**	**20.5**



SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

Project Name:	Vernon Power Plant	Tested By :	GB	Date:	01/30/06
Project No. :	338307.TM.GE.PR	Data Input By:	LF	Date:	02/10/06
Boring No.:	H-2	Depth (ft.) :	0-4.0		
Sample No. :	1-B				
Soil Identification:	SM				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	14.33	380	2563
2	200	22.50	180	1214
3	300	30.66	150	1012
4	400	38.83	130	877
5	500	47.00	130	877

Moisture Content (%) (MCi)	6.16
Wet Wt. of Soil + Cont. (g)	266.21
Dry Wt. of Soil + Cont. (g)	255.14
Wt. of Container (g)	75.53
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
877	**38.8**	**1092**	**75**	**5.23**	**22.0**