ATTACHMENT 4.6-A: INTERIM GEOTECHNICAL INVESTIGATION

INTERIM GEOTECHNICAL INVESTIGATION

EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC COMPANY
JACUMBA, CALIFORNIA

PREPARED FOR:
SAN DIEGO GAS & ELECTRIC COMPANY

URS PROJECT NO. 27667021.00030

JUNE 10, 2008

REPORT

INTERIM GEOTECHNICAL INVESTIGATION EAST COUNTY SUBSTATION SAN DIEGO GAS & ELECTRIC COMPANY JACUMBA, CALIFORNIA

San Diego Gas & Electric Company

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8365 Century Park Court, CP 52G
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URS Project No. 27667021.00030

June 10, 2008

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June 10, 2008

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Subject: Interim Geotechnical Investigation
East County Substation
San Diego Gas & Electric Company
Jacumba, California
URS Project No. 27667021.00030

Dear Mr. Huber:

URS Corporation (URS) is pleased to present this interim geotechnical investigation report for development of the proposed East County Substation near Jacumba in southeastern San Diego County, California. This report is intended to provide preliminary geotechnical information to assist the San Diego Gas & Electric Company (SDG&E) and their consultants with site development and design of the substation and associated facilities. Our services were performed in accordance with our proposal dated January 27, 2008.

The site location and layout was modified after our field work was completed. An additional geotechnical field exploration program is planned to address the changes in site location and layout. We understand that SDG&E is planning to use the Engineer, Procure, and Construct process to develop this project. SDG&E plans to provide this interim geotechnical report to potential bidders which could propose different designs which may require additional geotechnical investigation or recommendations.

This report provides an interpretation of the geologic conditions encountered and geotechnical information to help bidders prepare a bid design and corresponding cost estimate. The bidders should not view this report as a contractual statement of geotechnical conditions.

The results of our investigation indicate that the site is suitable for development from a geotechnical standpoint. Due to the significant earthwork planned for the project, incorporation of the geotechnical considerations discussed in this report will be important in the site development and design. Anyone relying upon the conclusions and recommendations presented in this report should read it in its entirety.

If you have any questions regarding this report, please contact us.

Sincerely,

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ASTM	American Society for Testing and Materials
bgs	below ground surface
Cal/OSHA	California OSHA
CBC	California Building Code
CUFAD	Compression Uplift Foundation Analysis and Design
EI	Expansion Index
EPC	Engineer, Procure, Construct
EPRI	Electric Power Research Institute
Epmt	Modulus of deformation from a Pressuremeter Test
fps	feet per second
ft	feet
g	units of gravity
H:V	horizontal:vertical
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers, Inc.
Kgr	Granitic rock
ksi	kips per square inch
kV	kilovolt
Kv	Modulus of vertical subgrade reaction
MCE	Maximum Considered Ground Motion
MFAD	Moment Foundation Analysis and Design
MSL	Mean Sea Level
ND	Not detected
ohm-cm	Ohm-centimeters
PCC	Portland Cement Concrete
pcf	pounds per cubic foot
pci	pounds per cubic inch
PGA	peak ground acceleration
ppm	parts per million
psf	pounds per square foot
PSHA	probabilistic seismic hazard analyses
Qal	Alluvium
Qfg	Post-lava fanglomerate
Qoal	Older alluvium
R-Value	Resistance Value (for pavement design)
SDG&E	San Diego Gas & Electric Company
SPT N	Standard Penetration Test N (blowcount)
TI	Traffic Index
Tp	Jacumba Volcanics
Ts	Older sedimentary rocks
URS	URS Corporation
USCS	Unified Soil Classification System
V_P	P-wave velocity
V_S	Shear-wave velocity

SECTION 1 INTRODUCTION

This interim report presents the results of URS Corporation Americas (URS) first phase of subsurface investigation and preliminary geotechnical recommendations for the proposed San Diego Gas & Electric Company (SDG&E) East County Substation, in southeastern San Diego County, California. The proposed substation is located on an approximately 100-acre parcel just south of Old Highway 80 near Jacumba as shown in Vicinity Map, Figure 1. The main project features and proposed site grades are shown on the Site Plan and Geologic Map, Figure 2. Note that Figure 2 shows the currently proposed project grading and site layout. The subsurface investigation was completed on the originally proposed site located approximately 500 feet to the east of the current site.

1.1 PROJECT DESCRIPTION

This site lies within the central portion of the Peninsular Ranges at elevations ranging from approximately 3,165 to 3125 feet above Mean Sea Level (MSL). The original proposed site layout and grading plans provided by SDG&E were titled "Site Arrangement", and dated August 24, 2007. The site layout was modified by SDG&E and a revised Site Arrangement plan dated April 18, 2008 was provided to URS. The revised plan moved the substation site by about 500 feet west of the original location.

The proposed project includes an upper pad approximately 1,100 by 1,300 feet in plan dimensions and a lower pad approximately 1,050 by 1,050 feet in plan dimensions. The proposed pad elevations of the upper and lower pads are approximately 3,263 and 3,190 feet MSL, respectively. The upper pad will house the 500 kilovolt (kV) yard and the lower pad will house the 230 kV yard. Three transmission line towers are also planned east of the site; their locations have not been finalized. An access road will connect the pads to the highway.

Since the topography gently slopes to the west, cuts along the eastern and southern edges, on the order of 20 to 55 feet for the upper pad and 20 to 35 feet for the lower pad, will be required to create the substation pads. Similarly, fills along the western edges on the order of 15 and 40 feet for the upper pad, and 20 to 25 feet for the lower pad will be required. Smaller cuts and fills will be required for the access roads. Preliminary estimates of grading volumes are in excess of 958,000 cubic yards.

Facilities within the substation are likely to include transformers, racks, "A" frames, steel cable poles and a control building. Foundation types typically include drilled piers, strip and spread footings, and mats. Foundation layouts and structural loads are not available at this time.

1.2 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of the geotechnical investigation was to explore the subsurface conditions at the site and provide geotechnical recommendations to support design, cost estimation and construction planning for the proposed substation and ancillary facilities. The field investigation was based on an earlier site location and layout and will be supplemented by additional explorations to investigate the current layout.

Primary tasks for this investigation included mobilization and coordination, field investigation, laboratory testing, engineering analyses and reporting. The field investigation included field mapping, air photo

interpretation, seismic refraction and electrical resistivity surveys, geotechnical borings, test pits, and installation of a groundwater monitoring well.

We understand that SDG&E is planning to use the Engineer, Procure, and Construct process to develop this project. SDG&E plans to provide this interim geotechnical report to potential bidders which could propose different designs which may require additional geotechnical investigation or recommendations.

This report provides an interpretation of the geologic conditions encountered and geotechnical information to help bidders prepare a bid design and corresponding cost estimate. The bidders should not view this report as a contractual statement of geotechnical conditions.

This report specifically presents discussions and recommendations regarding:

- Geologic and seismic setting;
- Potential geologic hazards;
- Site surface and subsurface conditions;
- Groundwater conditions;
- Recommendations for site earthwork;
- Appropriate foundation types;
- Allowable soil bearing pressures;
- Allowable lateral soil resistance;
- Estimated total and differential settlements;
- Parameters for deep foundation design;
- Slab-on-grade floors;
- Flexible pavements;
- Corrosion potential; and
- Construction considerations.

Detailed results of the field explorations, seismic refraction surveys, electrical resistivity survey and geotechnical laboratory testing are provided in the appendices of this report.

SECTION 2 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 FIELD INVESTIGATION

The field investigation included site reconnaissance, subsurface explorations, seismic refraction surveys, electrical resistivity surveys, and geologic mapping. The subsurface explorations consisted of twenty seven hollow stem auger borings and twenty three backhoe excavated test pits. The explorations were completed within the original footprint of the proposed pads in both cut and fill areas, at the proposed tower locations, and along the proposed access roads. Field activities were supervised by a California Certified Engineering Geologist and monitored by a biologist and a cultural representative, which included cultural resource specialists.

The field investigation is discussed further in Appendix A through Appendix C. Approximate locations of the subsurface explorations, seismic refraction surveys, and electrical resistivity surveys are shown on the Site Plan and Geologic Map, Figure 2. Logs of the borings and test pits are presented in Appendix A. The descriptions on the boring and test pit logs are based on field observations, sample inspection, and laboratory test results. Seismic refraction surveys and the electrical resistivity survey are presented in Appendices B and C, respectively.

2.1.1 Borings

Twenty seven borings were advanced between March 27 and April 10, 2008 using hollow stem auger drilling methods. The depths of the borings ranged from 19 to 85 feet below the ground surface (bgs). The materials were logged and classified in accordance with the Unified Soil Classification System (USCS). Disturbed and relatively undisturbed soil samples were typically collected at five-foot depth intervals or at changes in stratigraphy, classified in the field, and subsequently returned to our laboratory for further examination and testing. A Key to Logs is presented in Appendix A as Figure A-1 and logs of the borings are presented as Figures A-2 through A-28.

Boring B-25 was completed as a temporary groundwater monitoring well. Monitoring well installation details are shown on the corresponding boring log in Appendix A.

2.1.2 Test Pits

Twenty three test pits were excavated between April 15 and 17, 2008 to depths ranging from about 4 to 13 feet bgs with a Komatsu WB140 backhoe. Test pits typically encountered refusal to continued excavation in the older alluvial deposits. Disturbed bulk and grab soil samples were collected from the test pits. The test pits were backfilled with excavated material that was nominally compacted using the backhoe bucket. The upper 1.5 to 2 feet of material was removed and placed to the side of the excavation for observation by the environmental monitors. This upper material was then placed on the surface of the nominally compacted backfilled excavation. Logs of the test pits are provided in Appendix A as Figures A-29 through A-51.

2.1.3 Seismic Refraction Survey

Eight seismic refraction traverses were performed in the eastern portion of the site to evaluate subsurface conditions. The seismic refraction data was used to assess the depth and properties of the subsurface layers and their variability within the proposed site. The seismic refraction surveys were performed by a URS geophysicist using a 24-channel seismograph and arrays intended to develop a characterization of the subsurface to sufficient depths considering the proposed pad elevations. The locations of the seismic lines are shown on Figure 2, Site Plan and Geologic Map.

Details of the seismic refraction methodology and results of the seismic refraction surveys are presented in Appendix B.

2.1.4 Electrical Resistivity Survey

Electrical resistivity surveys were performed on March 19 and 20, 2008 by GeoVision Geophysical Services of Corona, California. The surveys were performed in accordance with American Society of Testing and Materials (ASTM) Standard G57. These arrays spanned the width and length of the original layout of the upper and lower pads. The survey methodology and results are presented in Appendix C.

2.1.5 Geologic Mapping

Geologic mapping was performed across the site by URS geologists as part of the field investigation during April, 2008. Data collected from the mapping is included on the Site Plan and Geologic Map, Figure 2.

2.2 LABORATORY TESTING

Laboratory testing was completed on representative soil samples to further evaluate the field classifications and to interpret the engineering characteristics of the subsurface materials. Representative samples were selected for moisture content, dry unit weight, Atterberg limits (plasticity), grain size analyses, compaction, expansion index, Resistance Value (R-value), and corrosivity tests. Testing was performed in general accordance with ASTM standards.

Results of the laboratory tests are summarized at the corresponding sample locations on the logs in Appendix A. Details and graphical results of the laboratory test program are presented in Appendix D.

SECTION 3 SITE CONDITIONS

Knowledge of the site conditions was developed from a review of published geologic information, site reconnaissance, and the results of this study.

3.1 GEOLOGIC SETTING

The proposed East County Substation is within the Peninsular Ranges Physiographic Province. This province is characterized by northwesterly trending mountains and intervening valleys. The site is situated in the southeastern portion of San Diego County east of Jacumba Valley. The proposed substation is located south of a volcanic knob known as Jade Peak and west of the granitic terrain Jacumba Mountains. The general area west of the Jacumba Mountains is noted for distinctive volcanic deposits and associated terrain, including Table Mountain (basalt flows) to the north of the site and Round Mountain (volcanic plug) to the west. These physiographic elements are all associated with the Tertiary-age volcanic activity.

Granitic rock of the Peninsular Ranges Batholith rises to the east of the site and is the most likely source of the surficial layer of alluvial material encountered on site. The alluvium, comprised of brown to light brown silty sands that thins to the west and farther away from the source rock. A lighter colored fine grained older alluvium underlies a majority of the site and is distinguished by increased relative density and significant carbonate cementation. These two alluvial layers overlie older sedimentary rocks of Tertiary-age volcaniclastic origin. The older sedimentary rocks have weathered to an irregular surface that outcrops within the low lying ridges within the site that trend approximately east to west. A Regional Geologic Map is presented in Figure 3.

3.2 TECTONIC SETTING

The tectonic setting of the San Diego area is influenced by plate boundary interaction between the Pacific and North American lithospheric plates. This crustal interaction occurs along a broad zone of northwest-striking, predominantly right-slip faults that span the width of the Peninsular Ranges and extend offshore into the California Continental Borderland Province. At the latitude of San Diego, this zone extends from the San Clemente fault zone, located approximately 60 miles offshore of the San Diego coastline to the San Andreas fault, located about 70 miles east of San Diego and 43 miles east of the project site (see Figure 4, Regional Fault Map).

Geologic, geodetic, and seismic data indicate that the faults along the eastern margin of the plate boundary, including the San Andreas, San Jacinto, and Imperial faults, including their associated branches, are currently the most active and appear dominant in accommodating the majority of the motion between the two adjacent plates. A smaller portion of the relative plate motion is being accommodated by northwest-striking faults to the west, including the Elsinore, Rose Canyon, San Miguel, and Aqua Blanca fault zones, and offshore faults, including the Coronado Bank, San Diego Trough, and San Clemente fault zones. Many of these faults have experienced historic seismic activity.

3.2.1 Regional Faults

The site lies between the Elsinore-Laguna Salada fault zone to the east and the Rose Canyon-Descanso fault zone to the west, at distances of approximately 12 miles and 59 miles, respectively. There are no known active faults in the southeastern portion of San Diego County. The nearest State of California Earthquake Fault Zones are located to the west on the Rose Canyon fault in downtown San Diego or to the northeast on the Elsinore fault zone along the Coyote Mountains. Older faults associated with ancient tectonic regimes have been mapped in the area, and are generally associated with intrusive volcanic events of the Miocene-age, approximately 18 million years ago.

3.2.2 Local Faults

Bedrock faults have been mapped in the area based on published sources (Figure 5). Inactive bedrock faults are anticipated in this area given the Miocene-age intrusive events that resulted in volcanic peaks, cones, and vents. In addition, there is a linear escarpment along the west side of the Jacumba Mountains that has been mapped as a fault and which may be associated with a series of microseismic events. A previous, preliminary investigation of the microseismicity and bedrock fault suggests the structure may be a left-lateral cross fault. The geomorphic expression along the fault suggests limited Quaternary-age fault rupture activity and no evidence of active fault rupture.

3.2.3 Historical Seismicity

Figure 5 presents the locations of regional historical earthquake epicenters. To the east of the site is the Salton Trough, a very active seismic zone that contains high slip rate faults including the southern San Andreas, Imperial and San Jacinto faults. The Imperial fault has ruptured twice in the last 70 years and the San Jacinto has displayed the highest activity level of any fault in the State.

Closer to the site, the Elsinore fault zone has displayed a much lower rate of activity. There have been few historical surface-rupturing earthquakes on segments of the Elsinore fault zone. The 1910 M6 Temescal Valley earthquake ruptured the surface along about 9.3 miles of the Glen Ivy segment (north of Lake Elsinore), and the Laguna Salada fault (considered the southern end of the Elsinore fault zone, located in Mexico) may have produced an M7.8 earthquake in 1892 south of the International Border (Rockwell, 1989; Mueller and Rockwell, 1995). Paleoseismic studies have shown prehistoric fault rupture on the Temecula, Julian, and Coyote Mountain segments of the Elsinore fault zone.

To the west, the Rose Canyon fault has been relatively quiet seismically. Some microseismicity occurred in San Diego Bay in the 1980's, but no major events have occurred in historic time. Paleoseismic studies suggest that the last large event on the Rose Canyon may have occurred on the order of 300 years ago.

3.3 SURFACE CONDITIONS

The project site is about 4.5 miles east of Jacumba, and lies south of Old Highway 80, which intersects Interstate 8 northeast of the site. The site is bounded to the north by an inactive volcanic mound (Jade Peak). The site and adjoining areas are primarily undeveloped. An existing 500 kV transmission line runs along the northern margins of the site. A series of dirt roads are present, with access roads servicing the transmission line and other roads accessing the mountains to the east and the valley to the south. Isolated

parcels in the area have modest developments, consisting of trailers or small outbuildings. There are no other significant developments in the immediate site area. There are a few existing dirt roads around the perimeter of the site. These roads are not maintained and a four wheel drive vehicle is required to access many areas on site.

The ground surface at the proposed substation pads descends about 150 feet from east to west, with an approximate elevation of 3,325 feet MSL near the southeast corner to about elevation 3,165 feet MSL near the northwest corner. The ground surface at the access roads ranges from 3,195 to 3,225 feet MSL.

3.4 SUBSURFACE CONDITIONS

The paragraphs below describe the geologic materials observed during surface mapping or in the subsurface explorations. Geologic cress sections are presented on Figures 6 through 10. The locations of the cross sections are presented on Figure 2.

3.4.1 Alluvium (Qal)

The alluvium (Qal) within the study area is composed of primarily brown to light reddish brown fine to coarse grained silty sands. These deposits appear to range in relative density from loose to medium dense. The alluvial deposits are derived primarily from the granitic rocks of the Jacumba Mountains located just east of the proposed substation. The alluvium thins to the west as it blankets older deposits and is either a thin veneer or not present in the western portion of the site.

3.4.2 Post-Lava Fanglomerate (Qfg)

The Quaternary-age post-lava fanglomerate (Qfg) is composed of sands and gravels derived from the Jacumba Volcanics and local sediments. The fanglomerate is locally exposed surrounding Jade Peak, and is thinly covered with talus from Jade Peak. Based on subsurface investigation performed to date, it should not be present in the proposed substation pads but is present along the access road from Old Highway 80.

3.4.3 Older Alluvium (Qoal)

Older alluvium (Qoal) underlies the majority of the proposed substation. It is either expressed at the surface or covered with a thin veneer of alluvium that is typically less than 10 feet thick. It is composed of light colored fine grained sands, silts, and clays. It is typically very dense. In various borings, water was added to facilitate augering in this material, and a few of the borings were terminated due to auger refusal (the inability to penetrate further with a standard carbide drill bit).

3.4.4 Older Sedimentary Rocks (Ts)

Tertiary-age sedimentary rocks comprised of volcanic conglomerates, volcaniclastic sandstone, and andesite breccias and flows. These rocks were subsequently differentially eroded to ridges and valleys. Alluvial deposits have overlain, infilled, and covered these rocks leaving limited surface exposures. Within the proposed substation they are expressed as portions of the east to west trending low lying

ridges. They generally appear as light colored, very dense silty sandstones with gravel and moderate carbonate cementation.

3.4.5 Jacumba Volcanics (Tp)

The Jacumba Volcanics are the result of volcanic activity in the Miocene period that occurred in the southeastern portion of San Diego County and surrounding area. They range from basalt to andesite. They are the expression of volcanic material that rose to the surface in the Tertiary through the local rocks and are expressed as steep mounds that steeply rise above the local topography. Jade Peak, which rises to the north above the alluvial low land of the proposed substation is a local representation of these rocks. Talus from Jade peak thinly covers the Fanglomerate and Older Alluvium (Qfg) surrounding the base of the mound.

3.4.6 Granitic Rock (Kgr)

Granitic rock (Kgr) of the Peninsular Ranges Batholith rises to the east of the site approximately 1,175 feet to above 4500 feet above sea level at Blue Angels Peak. Regional geologic mapping characterizes this granitic unit as a quartz diorite to granodiorite (Rogers, 1965). Locally the rocks are medium to coarse grained and relatively homogeneous with regards to grain size and composition. Weathering as well as gravitational effects erode these rocks down into the low-lying areas as alluvial fans. Exposures of these rocks are also evident approximately 2,000 feet east of the proposed substation.

3.5 GROUNDWATER CONDITIONS

Groundwater was not encountered in the subsurface explorations performed for this investigation. Boring B-26 was completed as a groundwater monitoring well to a depth of 50 feet bgs and as of June 2008, the monitoring well is dry.

SECTION 4 DISCUSSIONS AND CONCLUSIONS

4.1 SEISMIC HAZARDS

4.1.1 Fault Rupture

There are no active or potentially active faults underlying the proposed substation site. Based on our site investigation, the fault rupture hazard for the substation is considered low to very low.

4.1.2 Seismic Shaking

The site could be subject to moderate to strong ground shaking from a local or more distant, large magnitude earthquake occurring during the expected life of the project. The site lies near seismic sources associated with the Elsinore fault zone, as discussed in Section 3.2. A site-specific Probabilistic Seismic Hazard Analysis (PSHA) for the site is underway. Preliminarily, the peak ground acceleration (PGA) with a probability of 10% exceedance in 50 years (return period of 475 years) is estimated to be 0.3g.

It is expected that various elements of the project will be designed using different seismic loading standards depending on their use and/or governing code. Parameters developed from site-specific seismic evaluation, the 2007 California Building Code (CBC) and IEEE (Institute of Electrical and Electronics Engineers, Inc.) are presented in Section 5 of this report.

Seismic parameters for use in geotechnical analyses were evaluated by reviewing the results code-based design methods (presented in Section 5).

4.1.3 Liquefaction and Seismic Settlement

Liquefaction is a phenomenon where loose, saturated coarse-grained soils lose their strength and acquire some mobility from strong ground motion induced by earthquakes. The secondary effects of liquefaction include sand boils, settlement, reduced strength, lateral spreading and global instability. Loose granular material above groundwater can also experience settlement during an earthquake (seismic compaction).

Localized zones of loose granular material are present at the site, primarily within the alluvium near the ground surface. Groundwater was not observed within these deposits, and therefore the potential for liquefaction to occur at the site is extremely low. However, the loose alluvial material above the groundwater table could experience seismic settlement where this material is not removed during grading (see Section 5).

Seismic settlement was evaluated using the Tokimatsu and Seed (1987) method. If alluvium is left in place below access roads or other developed portions of the site, it is estimated that settlement on the order of 1 inch per 10 feet of loose material could occur during a major seismic event.

4.2 GEOLOGIC HAZARDS

4.2.1 Landslides

Based on aerial photograph interpretation and geologic field mapping, no previous landslides have been identified within the proposed site. Based on the existing topography and knowledge of the subsurface conditions, the potential for future landslides at the site is very low.

4.2.2 Expansive Soils

Soil samples from Boring B-13 and Boring B-15 were tested for expansion potential and indicated a low potential for expansion. Additional expansion index testing will be performed during subsequent phase of field exploration. However, based our investigation to date and on the geology of the area, expansive soils are not expected to pose a constraint to site development.

4.2.3 Collapsible Soils

The potential for collapse settlement due to wetting should be low, considering the relative density and porosity observed in the older alluvium. The potential for collapse settlement will be further evaluated during future study of the site.

4.3 EARTHWORK CONSIDERATIONS

To provide level pads for the substation, significant cuts and fills are planned. It is planned to use the material excavated from the cuts as properly compacted engineered fill. Mass excavation of the alluvium and older alluvium should be the predominant source of fill. If the grading results in excess material, it may be removed from the site for use elsewhere by SDG&E.

4.3.1 Excavation Characteristics

Materials requiring excavation are expected to include alluvium, older alluvium and, to a lesser extent, older sedimentary rocks. This section provides a preliminary assessment of mass excavation and trench excavation characteristics. Assessment of augering characteristics is presented in Section 5.3.6. These assessments assume that the excavating equipment is well maintained and operating at factory-specified efficiencies. The choice of excavation method is often a function of economics, level of desired effort, logistics, quality and size of machinery used, permit conditions, owner preference and/or contractor convenience.

Excavation within the alluvium and older alluvium should encounter moderate difficulty using conventional earth moving equipment (bulldozers, scrapers, etc.). Seismic velocities observed east of the site in the types of geologic materials to be excavated ranged from 2,100 to 3,200 feet per second (fps) in the alluvium and from 3,300 to 4,400 fps in the older alluvium and older sedimentary rocks. These velocities suggest rippable conditions based on Caterpillar Handbook (Caterpillar, 2003) correlations to excavation using a D-9 dozer. Localized zones of cementation may require additional effort.

Trenching machines or backhoes may experience difficult excavation characteristics in the older alluvium and older sedimentary rocks. Refusal was encountered during drilling and during backhoe excavations.

4.3.2 Selective Grading and Stockpiling

The contractor should consider separating excavated materials into separate stockpiles for soils that have different engineering characteristics. It may be possible to use the coarse-grained alluvium and older alluvium as a wearing surface, and clayey materials must be placed at depths greater than 5 feet below finish pad elevation. Test cuts early in the grading program would provide valuable characterization of the materials generated from excavations at the site and help to establish the need for selective grading.

4.3.3 Preliminary Evaluation of Engineering Characteristics

The physical properties of the in-situ and compacted materials were interpreted to evaluate engineering characteristics of the fill material, as well as to provide engineering parameters for analyses. The table below summarizes an interpretation of the basic geotechnical engineering properties of in-situ materials and fill derived from these materials. The properties were interpreted based on field data and laboratory testing.

Design Material Parameters

Geotechnical Property	Fill [a, b]	Undisturbed Alluvium	Undisturbed Older Alluvium
Moist Unit Weight, γ (pcf)	125	110	110
Effective Cohesion, c' (psf)	0	0	0
Effective Friction Angle, ϕ' (degrees)	33	34	35

Notes:

a. Assumes fill material derived from the onsite alluvium and older alluvium.

b. Compacted to 90 percent relative compaction per ASTM D 1557.

c. Neglects the apparent cohesion from carbonate cementation.

These materials and their engineering characteristics are further discussed below.

4.3.3.1 Alluvium

The alluvium typically ranges in relative density from medium dense to dense and locally loose or very dense and is primarily comprised of silty sand to clayey sand. Lesser amounts of clay were encountered in this material. When recompacted as fill, this material should possess characteristics of high quality fill, with moderate strength, high R-values and a low expansion potential. R-Values in coarse-grained samples of this material (USCS classifications of SM and SW) were found to range from 68 to 86. The alluvium observed in the explorations would be suitable for use as a wearing surface. Additional discussion of fill and wearing surface evaluation is presented in Section 5.1.4.

4.3.3.2 Older Alluvium

The older alluvium ranges in relative density from medium dense to very dense and are locally and variable cemented with calcium carbonate. The older alluvium is primarily comprised of fine grained sand, silt, and clay. When recompacted as fill, this material should possess characteristics of high quality fill, with moderate to high strength, moderate to relatively high R-values and a low expansion potential. The granular portions of the alluvial deposits may be suitable for use as wearing surface fill material, however careful selective grading and stockpiling would be required to segregate the material and avoid the clayey, less appropriate portion of the older alluvium.

4.3.3.3 Older Sedimentary Rocks

The older sedimentary rocks are very dense and moderately cemented. Fill derived from these materials should be silty sand with gravel. When recompacted, this material should possess characteristics of high quality fill, with relatively high strengths and R-values and a low expansion potential.

4.3.4 Settlement Evaluation of Deep Fill

Some post-grading settlement is a normal occurrence in deep fills. This settlement is a function of the type of compacted soil, fill placement conditions, underlying fill/bedrock geometry, long-term moisture fluctuations and other factors. The short-term, primary settlement of properly processed and compacted fill due to its own weight should be substantially complete within a few months following the completion of earthwork. Long-term settlement of fill can result in large, often adverse vertical deformation where there is poor cut-fill geometry and/or a significant source of infiltration (*e.g.*, seepage or excessive irrigation). Local experience from long-term monitoring of compacted fill embankments indicates that the total settlement can range from 0.2% to 0.5% of the initial fill thickness at the point under consideration. Based on this range, the total settlement of a 50-foot deep fill could range from one to three inches. The majority of this settlement should occur in the first several months after fill placement.

Construction of the substation components should not begin until the majority of the settlement due to the self weight of the fill is completed. Settlement monuments should be installed where there will be deep fill to monitor the progression of the settlement. Detailed evaluation of expected settlement should be performed after the grading plan is finalized.

Differential settlement is influenced by the underlying fill depth geometry, the contrast in stiffness between fill and cut, the uniformity of relative compaction and other factors. If the depth of fill at one end of a 100-foot-long structure is 40 feet and the depth of fill at the other end of the structure is less than 20 feet, the differential settlement could be about 1½ inches, or about an angular distortion of 1:500. An angular distortion of 1:500 is a common limit before the onset of visible damage, depending on the type of structure and foundation. As a general rule to mitigate the potential for adverse long-term differential settlement, the difference in fill depth below each end of a structure on a shallow foundation (along each axis of the structure) should be less than 15 to 25%, unless site-specific analyses of differential settlement indicates otherwise.

4.4 SLOPE STABILITY

The stability of the preliminary cut and fill slopes was evaluated based on anticipated subsurface conditions. Representative slopes were analyzed using a Mohr-Coulomb strength model in the SLOPE/W computer program using the Spencer Method of limit equilibrium for the analyses. The soil parameters presented in Section 4.3.3 were used for design. The horizontal yield acceleration for slope stability analyses was estimated as one-third of the PGA (Caltrans, 2004), or 0.1g.

Considering the significant height of proposed cut and fill slopes and the potential for relatively high PGA expected at the site, additional analyses of the slopes should be performed using deformation-type methods during design development.

4.4.1 Fill Slopes

The maximum height of proposed fill slopes should be about 45 feet. The grading plan indicates these slopes will be formed at 2:1 (horizontal:vertical) inclinations. Stability analyses indicate that these slopes should be grossly stable under normal conditions and proper maintenance. The calculations indicate factors of safety in excess of 1.5 for static and 1.1 for pseudostatic conditions (using a seismic coefficient of 0.1g). Depending upon the material used to construct the slope face (relatively low cohesion of processed alluvium) surficial instability or "sloughing" and erosion may occur. Constructing the slopes at 2:1 or flatter should allow for revegetation to reduce the potential for surficial instability and to reduce maintenance.

4.4.2 Cut Slopes

The maximum height of the proposed cut slopes will be about 55 feet. It is currently planned to design these slopes at 2:1 inclinations. Stability analyses indicate that these slopes should be grossly stable under normal conditions and proper maintenance. The calculations indicate factors of safety in excess of 1.5 for static conditions and 1.1 for pseudostatic conditions (using a seismic coefficient of 0.1g). The slope face may be subject to surficial erosion, as discussed for fill slopes.

SECTION 5 RECOMMENDATIONS

5.1 EARTHWORK

5.1.1 Grading Plan Design

The geologic cross sections presented on Figures 6 through 9 illustrate an interpretation of the materials that should be present at the face of the cuts. Cut and fill slopes should be designed at a 2:1 inclination.

A Geotechnical Engineer should re-evaluate as necessary the final fill and cut slope configuration adopted for the final grading design. Slope design should include drainage benches in accordance with local grading codes. Surface drainage should be directed away from the top of slopes. Ponded water at the top of slopes and sheet flow over slope surfaces should not be allowed.

Mass grading should be performed in accordance with SDG&E standard specifications and the most recent editions of applicable sections of the County of San Diego Grading Codes, the California Building Code, and the Standard Specifications for Public Works Construction (*i.e.,* Greenbook). The following sections provide further recommendations for general earthwork, which may be used to develop earthwork specifications specific to the earthwork planned to form the site.

5.1.2 Site Preparation

Weeds, grass, trees, shrubs and other debris within areas to be graded should be cleared and properly disposed of off-site. Roots and other vegetative matter should be removed and disposed either offsite or stockpiled for reuse in landscape areas.

Following the clearing of vegetation and debris, the surface within areas to receive fill should be scarified, moisture conditioned as necessary, and compacted prior to fill placement. Localized areas of loose alluvium may require removal and recompaction. Areas temporarily vacated during earthwork should be similarly scarified, moisture conditioned and reworked to the satisfaction of a Geotechnical Engineer before placing additional fill to avoid drying out and lamination along the fill interface.

5.1.3 Overexcavation

Overexcavation of cut areas is recommended to provide uniform support of shallow foundations where they will straddle a transition from cut to fill. The engineering characteristics of materials in cut and fill may result in a contrast in stiffness that could cause shallow foundations to crack and display other forms of distress, depending on the type and rigidity of the foundation. Overexcavation also allows for easier installation of underground utilities and other below-grade elements. A minimum overexcavation of 5 feet below finished pad grades is recommended in cut areas. The depth of overexcavation may be reduced subject to review by the project Geotechnical Engineer during grading, but should be considered 5 feet for bidding purposes.

The overexcavated areas should be replaced with properly compacted fill. Additional localized overexcavation 5 feet below foundations may also be required where fill thicknesses vary significantly within the structure footprint; this should be reevaluated once foundation locations are known.

Overexcavation should extend at least five feet horizontally outside the foundation footprint and any structurally connected facilities. A minimum uniform overexcavation of one foot below the bottom level of pipe bedding is also recommended.

5.1.4 Fill Materials

5.1.4.1 General Fill

Except for surficial organic materials, the onsite materials (alluvium, older alluvium and older sedimentary rocks) are suitable for use as engineered fill. It is recommended that the coarse-grained alluvium be selectively stockpiled for use in the upper portion of the substation pad. Clayey soils should be placed in deeper fills at least five feet below finished grade.

5.1.4.2 Wearing Surface Fill Evaluation

Due to the remote location of the site, it may be cost prohibitive to construct the SDG&E standard wearing surface consisting of 12 inches of Class 2 aggregate base. We understand that SGD&E has approved alternate wearing surface materials (e.g., decomposed granite) at other substations and have experienced suitable long-term performance. We evaluated the native soils at the site for this issue considering R-value and gradation test results.

The table below presents the results of the R-value testing performed to date. Class 2 aggregate base has a specified minimum R-value of 78.

Summary of R-Value Test Results

Exploration No.	Depth (ft)	Geologic Unit	USCS Classification	Percentage of Fines	R-Value
B-24	25	Alluvium	SM	16	76
TP-2	3.5	Alluvium	SM	25	71
TP-3	3	Alluvium	SM	13	71
TP-6	3	Older Alluvium	SM	29	68
TP-19	9.5	Alluvium	SW	12	86

The following table summarizes the average gradations of alluvium and older alluvium based on the sieve analyses performed to date and the specifications for Class 2 Aggregate Base.

Summary of Grain Size Distribution Results

Sieve Size	Percent Passing			
	Gradation Criteria for Class 2 Aggregate Base [a]		Alluvium [b]	Older Alluvium [c]
	Low	High		
1" (25.4 mm)	-	100	99	100
3/4" (19 mm)	87	100	99	100
No. 4 (4.75 mm)	30	65	94	96
No. 30 (0.6 mm)	5	35	49	70
No. 200 (0.075 mm)	0	12	15	38

Notes:

a. Caltrans specification for contract compliance for ¾-inch maximum Class 2 Aggregate base.
b. Average percent passing for 19 samples tested.
c. Average percent passing for 13 samples tested.

As indicated by the specified gradation range, Class 2 aggregate base is a manufactured gravel and sand product with relatively low fines content. The alluvium and older alluvium at the site did not have an appreciable quantity of gravel, and the average fines content was higher than specified for Class 2 aggregate base. However, the summarized results indicate that the alluvium's composition is more similar to the gradation of Class 2 Aggregate Base due to the lower fines content.

Based on the gradation and R-value characteristics, it is our opinion that the alluvium and the coarse-grained portion of the older alluvium may be a suitable as a wearing surface, although not as high quality as compacted Class 2 Aggregate Base. The R-values indicate high quality subgrade. It should also be noted that variable material characteristics were encountered in these deposits, particularly in the older alluvium. It will be necessary to monitor and test materials during grading to stockpile the most suitable material for use as the wearing surface. We understand that the wearing surface should be able to resist the pressures that develop from maintenance truck leveling/stabilization pads.

5.1.5 Import Materials

A Geotechnical Engineer should review and test all import sources before their transport to the site. Import soils should meet the following criteria unless otherwise approved by the Geotechnical Engineer:

- No oversize materials greater than 100 mm in maximum dimension.
- An Expansion Index (EI) less than 20 or a Plasticity Index less than 15%.
- A relatively well-graded particle size distribution with a fines content (percent, by weight, passing the No. 200 sieve) not exceeding 35 percent.

These soils should not have any perishable, spongy, deleterious, or otherwise unsuitable material.

5.1.6 Fill Placement and Compaction

Fill material should be moisture conditioned to achieve a uniform moisture above the optimum moisture content at the time of compaction. Fill should be placed in loose lifts of 8 inches, or thinner as needed to achieve the specified relative compaction. Each lift of general fill should be compacted to not less than 90% relative compaction, using the latest version of ASTM D1557 as the compaction standard. Each lift should be compacted before the next lift is placed, except where specifically designated by the Geotechnical Engineer to facilitate mixing of materials.

The substation pad should be brought to a rough subgrade elevation of 1 foot below finish grade. The upper 12 inches of rough subgrade material should be compacted to 95% relative compaction. A minimum of 12 inches of Class 2 Aggregate Base or suitable alternative wearing surface material as designated by SDG&E should be placed and compacted to 95% relative compaction to achieve finished grade elevations.

5.1.7 Fill Slope Construction

It is preferable to horizontally overfill (about 3 to 6 feet) and trim back fill slopes. After the engineered fill is brought to finish pad grade, the slopes should be trimmed back with a slope board, exposing the compacted inner core at finished slope grade. Alternatively, the slope face may be compacted by backrolling with a sheepsfoot roller after each four-foot increase in slope height. When pad grade is achieved, the slope face should be rolled with a cable-lowered sheepsfoot, and finally grid-rolled.

Where fill is to be placed on slopes where the original grade is steeper than 5:1, or where specified by the Geotechnical Engineer, the slope on which fill is to be placed should be benched or keyed. The benches should extend into competent materials, as approved by the Geotechnical Engineer. A schematic of the recommended benching is shown on Figure 10.

5.1.8 Temporary Support Systems and Slopes

The design and construction of temporary shoring or slopes, as well as the maintenance and monitoring of these works during construction, is the responsibility of the contractor. The contractor should have a geotechnical or geological professional evaluate the soil conditions encountered during excavation to determine permissible temporary slope inclinations and other measures as required by California Occupational Safety and Health Administration (Cal/OSHA). The contractor's geotechnical or geological professional may use the factual information provided in this report, as well as any additional data they may need to acquire, to assess the stability of temporary slopes and prepare a specific temporary slope analysis and/or develop parameters to design temporary support systems.

Based on the existing data interpreted from the borings and test pits, the design of temporary slopes and benches for planning purposes may assume Cal/OSHA Soil Type C. The assessment of Cal/OSHA soil type for temporary excavations is based on preliminary engineering classifications of material encountered in widely spaced explorations. The contractor's geotechnical or geological professional should observe and map mass excavations and temporary slopes at regular intervals during excavation and re-assess the stability of temporary slopes, as necessary.

5.1.9 Erosion, Sediment & Surface Drainage Control

Erosion control measures such as stair-stepping, terraces or benches and/or landscaping should be considered for all cut and fill slopes steeper than 4:1. Stair-stepping of final cut and fill slopes is not required from a geotechnical perspective, but may be desirable for planting or erosion control purposes. Runoff should be directed away from the tops of all slopes. Terraces or benches should be used to keep the uninterrupted slope heights to less than 30 feet. The benches should be at least 5 feet wide. If landscaping is desired as an erosion control measure, slope surfaces should be left rough to improve seed germination and plant growth. It is recommended that all fill slopes, and cut slopes with soil–like characteristics, be planted shortly after completion of the slope construction.

Positive measures should be taken to properly finish grade improved areas to direct drainage waters away from foundations, ground bearing slabs, pavements and the crest of slopes. All runoff water should be directed to proper drainage areas and not be allowed to pond. A minimum ground slope of two percent is recommended; paved areas should have a minimum slope of one percent.

To further reduce the possibility of moisture related problems, all landscaping and irrigation should be kept as far away from structures as possible. Irrigation water, especially close to structures, should be kept to the minimum required level. Concrete curbs bordering landscape areas should have a deepened edge to provide a cutoff for moisture flow beneath the pavement. Generally, the edge of the curb can be extended an additional twelve inches below the base of the curb. The deepened edge should have a thickness of approximately six inches. Even when these measures have been taken, experience has shown that a shallow groundwater or surface water condition can develop in areas where no such water condition existed prior to site development; this is particularly true where a substantial increase in surface water infiltration results from landscaping irrigation.

5.2 SEISMIC DESIGN

Seismic design parameters developed from the 2007 California Building Code (CBC) and IEEE are presented in this section. A PSHA will be performed as part of further studies at the site.

5.2.1 California Building Code Design

The following table provides seismic coefficients from the 2007 California Building Code (CBC). Site Class D (stiff soil profile) was used to develop the coefficients.

2007 California Building Code Seismic Coefficients

Parameter	Value	2007 CBC Reference
Site Class	D	Table 1613.5.2
Mapped Spectral Acceleration - Short Period, S_s (g)	1.215	Figure 1613.5[1]
Mapped Spectral Acceleration - 1 Sec. Period, S_1 (g)	0.423	Figure 1613.5[1]
Site Coefficient - Short Period, F_a	1.014	Table 1613.5.3(1)[1]
Site Coefficient - 1 Sec. Period, F_v	1.577	Table 1613.5.3(2)[1]
MCE Spectral Response Acceleration - Short Period, S_{MS} (g)	1.232	Equation 16-37, $S_{MS}=F_aS_S$
MCE Spectral Response Acceleration - 1 Sec. Period, S_{M1} (g)	0.667	Equation 16-38, $S_{M1}=F_vS_1$
Design Spectral Response Acceleration - Short Period, S_{DS} (g)	0.821	Equation 16-39, $S_{DS}=2/3*S_{MS}$
Design Spectral Response Acceleration - 1 Sec. Period, S_{D1} (g)	0.445	Equation 16-40, $S_{D1}=2/3*S_{M1}$

Notes:

1. Calculated using USGS program "Earthquake Ground Motion Parameters" Version 5.0.8.
2. Site coordinates 32.629795°N; 116.118056°W were obtained from Google.

5.2.2 Substation Equipment Seismic Qualification Level

The selection of the seismic qualification level for the performance evaluation of substation equipment is based on IEEE Standard 693-2005. For the East County Substation site, the moderate performance level is recommended based on methodologies presented in Section 8.6 of the IEEE Standard (IEEE, 2006).

The earthquake hazard method is the preferred approach to select the qualification level, as discussed in Section 8.6.1 of the IEEE Standard. A site-specific probabilistic seismic hazard analysis was not available at the time of report preparation. Using the results of the USGS Ground Motion Parameter calculator, the site is categorized at the moderate performance level because the 2% probability of exceedance in 50-year (2,475-year return period) peak ground acceleration is 0.5g.

The qualification level can also be selected using the seismic exposure map methodology presented in Section 8.6.2.1 of the IEEE Standard. This method results in a moderate qualification level based on a calculated peak ground acceleration of 0.49g. The table below presents the selected and calculated values following the procedures outlined in IEEE 693-2005 and based on the 2006 International Building Code (IBC) and the Maximum Considered Ground Motion (MCE) maps (IBC, 2006). Site Soil Class D was used for the evaluation in the table below.

Seismic Qualification Level Calculation

Parameter	Value	Reference
Site Soil Class	D	IBC Table 1615.1.1
MCE Ground Motion 0.2s Spectral Response Acceleration, S_s	1.215*g*	IBC Figure 1615 (3)
Site Coefficient, F_a	1.014	IBC Table 1615.1.2 (1)
Adjusted MCE Spectral Response Acceleration -short period, S_{ms} ($=S_sF_a$)	1.232*g*	IEEE 8.6.2.1 (d) ; IBC Equation 16-38
Peak Ground Acceleration for seismic qualification selection ($S_{ms}/2.5$)	0.49*g*	IEEE 8.6.2.1 (e)
Selected Seismic Qualification Level	Moderate	IEEE 8.6.2.1 (f)

5.3 FOUNDATIONS

It is expected that various elements of the substation will be supported on strip and spread footings, mat foundations and deep foundations.

5.3.1 Strip and Spread Footings

5.3.1.1 Allowable Bearing Pressure

Shallow foundations are likely to be supported on compacted fill placed due to the pad construction and/or pad overexcavation. The recommended minimum footing embedment depth is 12 inches below the lowest adjacent grade and the recommended minimum footing width is 12 inches. Strip and spread footings designed as described above, founded entirely on properly compacted fill may be designed a vertical allowable bearing pressure of 2,500 pounds per square foot (psf). The allowable bearing values can be increased by 1,000 psf for each additional foot of depth and 500 psf for each additional foor of width beyond the minimum dimensions to a maximum allowable bearing value of 5,000 psf.

Allowable bearing pressures may be increased by 33 percent for short term wind or seismic loads. Footings should not transition between compacted fill and competent native materials unless a Geotechnical Engineer evaluates and approves such placement. The Structural Engineer should determine the footing embedment, size and reinforcement based on anticipated loads and estimated differential settlements.

5.3.1.2 Allowable Lateral Bearing

Resistance to lateral loads on the shallow foundations may be provided by passive resistance along the outside face of the footing and frictional resistance along the bottom of the footing. An allowable passive resistance, modeled as an equivalent fluid weight of 250 pounds per cubic foot (pcf) may be used for the design of footings poured neat against properly compacted fill.

An allowable friction coefficient of 0.35 may be used with the dead load to compute the frictional resistance of footings. If frictional and passive resistance is combined, the friction coefficient should be reduced to 0.3.

The upper 12 inches of soil should be neglected in passive pressure calculations in areas where there will be no hardscape that extends from the outside edge of the footing to a horizontal distance equal to three times the footing depth. The resistance from passive pressure should be neglected where utilities or similar excavations may occur in the future. Where the ground in front of a retaining wall descends, the upper 36 inches of soil should be neglected in consideration of disturbance by surface creep and other factors.

5.3.1.3 Footing Settlement

Footing settlement for a given bearing pressure will depend upon the footing size, shape, embedment depth, relative compaction and the stiffness of the fill and/or underlying native materials. A total settlement of less than one inch has been preliminarily estimated for the allowable bearing pressures provided in this report using the minimum embedment depth. An increase in settlement up to 50 percent has been estimated using the maximum allowable bearing pressures provided for increased embedment. This estimate only considers elastic settlement due to structural loads. The majority of the settlement due to structural loads should occur during construction or shortly after the application of large live loads.

The maximum differential settlement between adjacent footings with identical plan dimensions and embedment of supporting similar loads should not exceed ½ inch, when only structural loads are considered.

The long term total and differential settlement should be re-evaluated by a Geotechnical Engineer when building locations are finalized, the structure design and foundation layout is complete and the underlying cut/fill geometry can be assessed.

5.3.1.4 Footing Location

Adjacent footings founded at different elevations should be located such that the slope from bearing level to bearing level is flatter than 1:1. Where footings are located adjacent to the top of descending slopes they should be founded to the depth necessary to provide a minimum of 8 feet of horizontal distance from the lower outside edge of the footing to the slope face for slopes less than 20 feet high. For higher slopes, this distance should be at least 10 feet. Location-specific assessment of bearing pressure, deformation and surficial stability may allow for closer embedment to the slope face.

5.3.2 Mat Foundations

Mat foundations consist of a thick section of heavily reinforced concrete extending under the entire footprint of the structure. Mat foundations are likely to be supported on compacted fill. An allowable bearing pressure of 4,000 psf is recommended for mat foundations with a minimum embedment of 12 inches and a minimum width of 5 feet. A one-third increase in the allowable bearing value may be used for loads that include wind and seismic forces. Resistance to sliding may be assessed as recommended in the Allowable Lateral Bearing section of this report.

Deflections of mat foundations may be estimated by the Structural Engineer using the subgrade reaction (beam on elastic foundation) method of analysis. For preliminary design, we recommend the modulus of vertical subgrade reaction (Kv) of 250 pounds per cubic inch (pci) for compacted fill. During design

development, the Geotechnical Engineer should review the mat deflections and contact pressures developed from structural engineering analyses that have used the recommended parameters, and evaluate settlement and reassess the modulus as necessary to finalize the design.

5.3.3 Deep Foundations

Deep foundations consisting of Cast-In-Drilled Hole (CIDH) piles are expected to be used for support of racks, "A" or "H" frames and steel cable poles.

5.3.3.1 MFAD Parameters

We understand drilled shaft foundations subject to high overturning moment loading will be evaluated in lateral loading using the Electric Power Research Institute (EPRI) computer program, Moment Foundation Analysis and Design (MFAD). The design soil parameters required to use the MFAD program include:

- Soil Layer Depths;
- Groundwater Depth;
- Total Unit Weight;
- Internal Friction Angle;
- Cohesion;
- Elastic Pressuremeter Modulus; and
- Strength Reduction Factor.

Estimates of the required parameters were developed based on the results of our site observations, subsurface explorations, laboratory testing, engineering evaluation and analysis, empirical correlation, literature research, and professional judgment. The estimated design parameters are presented in the table below. It should be noted that the design parameters presented in the table are intended for use in the MFAD computer program and may not reflect actual strengths. Pressure meter testing was not performed as a part of this project.

Recommended MFAD Design Parameters

Material	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	E_{pmt} [a] (ksi)	Shear Strength Reduction Factor
Engineered Fill	125	32	0	1.0	0.9
Alluvium	110	33	0	1.0	1.0
Older Alluvium	110	35	0	1.5	0.9

Notes:

a. Epmt = Modulus of deformation as would be determined from a pressure-meter test.

The design should neglect the upper 2 feet of soil for CIDH foundations outside of the substation where there is a potential for erosion. Inside the substation, no discount of surficial materials is required. The thicknesses of the material types provided in the table above will vary significantly across the site; the depths at a specific foundation location can be estimated based on the planned grading (considering cuts, fills, and overexcavation). Material depths used for design should be confirmed by the Geotechnical Engineer. Groundwater will likely be deeper than the bottom of the deep foundations and should not need to be considered in the analyses.

5.3.3.2 Vertical Capacity

We understand CIDH piles subject to large axial loads will be evaluated using the Electric Power Research Institute (EPRI) computer program, Compression Uplift Foundation Analysis and Design (CUFAD). For single pole foundations where lateral loads control the design, the vertical capacity of the pile should also be checked. Vertical capacity will depend upon the material type present along the shaft, which will vary depending upon the location at the site. The shafts will gain support in friction along the sides of the shaft and end bearing on the bottom of the shaft.

The MFAD design parameters presented above are also appropriate for use in CUFAD. The parameters in the following table may also be used to preliminarily evaluate the vertical capacity of each shaft using skin friction and end bearing. These estimates consider common bearing capacity methods of analyses and correlations to Standard Penetration Test blowcount (SPT N) in granular soils provided by Xanthakos (1995).

Once the foundation layout is finalized, the Geotechnical Engineer should check the vertical capacity of individual shafts considering subsurface conditions, pile diameter, pile size and applied load.

Preliminary Soil Resistance for Deep Foundations

Material	Average SPT N (blows per foot)	Ultimate End-Bearing Resistance (ksf)	Ultimate Shaft Resistance (ksf)
Engineered Fill	17 [a]	0.4	11
Alluvium	35	0.7	23
Older Alluvium	45	1.0	32

Notes:
a. Estimated for properly placed and compacted fill.

The ultimate capacity of CIDH piles that derive resistance solely from shaft friction may be estimated using the following ultimate unit resistances for embedment that begins at least 10 feet below the pile cap. These estimates consider correlations to SPT N for shaft resistance in granular soils (Xanthakos, 1995).

Allowable axial load capacities for single CIDH piles can be developed using a factor of safety of 3 for end bearing and 2 for shaft resistance. Load capacities may be increased by one-third for short-term wind and seismic loads. The structural capacity of the pile shaft should be checked to ensure that the maximum permissible compressive stress is not exceeded.

5.3.4 Uplift Resistance

The ultimate uplift resistance of straight shafted CIDH piles may be estimated by reducing the axial ultimate unit resistance by 30%. The calculation for uplift capacity may add the weight of pile. Allowable uplift capacities for single CIDH piles can be developed using a factor of safety of 3. Uplift resistance developed from concrete and soil unit weights may be unfactored.

5.3.5 Group Effects and Pile Spacing

The axial group reduction factor for a CIDH pile group can be preliminarily taken as 0.7. Once the foundation layout is determined, group effects should be re-evaluated.

5.3.6 Shaft Excavation

Shaft excavation through alluvium may require temporary casing. Shaft excavation within properly compacted fill typically does not require casing for temporary support.

To evaluate shaft excavation characteristics, we considered the seismic velocities obtained from refraction surveys and compared this data with published correlations of seismic velocities versus actual shaft excavations conditions. Wight and Schug (1985) developed these correlations during construction of SDG&E's Southwest Power Link. Wight and Schug define shaft excavation in terms of "augerability" using Watson 2000 and 3000 drill rigs as follows:

Easy to moderate: A 3-foot-diameter hole can be excavated to a 15-foot depth in less than one hour using standard digging teeth or possibly carbide bullet teeth. Rock fragments up to 10 inches in maximum dimension may be encountered but will not cause significant delay.

Difficult: A similar-sized hole could be excavated using carbide bullet teeth, but greater operator skill is required. The hole can generally be completed within four hours. Some rock excavation payment may be required.

Refusal: No progress is generally made without the assistance of blasting, rock coring or use of more powerful drilling equipment. Significant excavation time is required to complete the hole. Rock excavation payment is typically authorized for this situation.

Wight and Schug developed the following correlation of augerability to seismic velocity, in feet per second (fps), for variably weathered granite.

Augerability	Seismic Velocity For Watson 2000 (fps)	Seismic Velocity for Watson 3000 (fps)
Easy to Moderate [a]	< 3,000	< 3,500
Difficult [b]	3,000 to 3,500	3,500 to 4,400
Refusal	> 3,500	> 4,400

Notes:
a. Augering may become difficult if a large number of cobbles or boulders are encountered.
b. May require core barrel drilling or blasting.

Velocities interpreted from the seismic refraction surveys ranged from 2,100 to 3,200 feet per second (fps) in the alluvium and from 3,300 to 4,400 fps in the older alluvium. These surveys were completed to evaluate the mass excavation characteristics within the depth of proposed cuts.

5.3.7 Shaft Construction

Groundwater is not expected to occur in quantities that could require "wet" construction methods or influence temporary support conditions, considering observations from the fieldwork for this study. Groundwater, if encountered, should be in quantities that allow the shaft to be dewatered.

CIDH pile shafts should have a minimum diameter necessary to allow for cleaning and inspection; typically 30 inches for CIDH piles that use end bearing. The founding level of CIDH piles where the design relies on high contact pressures should be cleaned of all loose or softened material, debris, or other substances that may cause settlement or affect the concrete strength. The bottom of the shaft and the excavation should be dry.

Concrete should be placed in excavations in a manner that precludes segregation of particles and any other occurrence that may decrease the strength of the concrete. Caving soils should not be allowed to mix with the fresh concrete.

CIDH pile shafts may become irregular if caving or sloughing occurs in uncased holes and cause actual concrete volumes to exceed theoretical volumes. Estimates and specifications, along with contract provisions for concrete payment should consider this potential enlargement of shaft excavation, which is incidental to construction.

5.4 CONCRETE SLABS-ON-GRADE

Slab-on-grade concrete floors for control buildings or similar facilities should be at least four inches thick. The Structural Engineer should design the thickness and reinforcement of concrete slab-on-grade floor slabs to accommodate concentrated loads and heavy distributed loads. Expansion joints and crack control sawcuts should be included at regular intervals.

A vapor barrier (e.g., 10 mil Visqueen) with sand or gravel bedding should be used where moisture-sensitive floor coverings (such as carpets or tile) are used. The Contractor should be careful not to puncture the membrane during construction. It may be prudent to specify a membrane thicker than needed for a vapor barrier. The Project Architect should review vapor barrier requirements relative to

desired functionality of the space and floor coverings, construction considerations and recommendations of the American Concrete Institute (ACI).

5.5 PAVEMENT

5.5.1 Structural Section

The structural design of flexible pavement depends primarily on anticipated traffic conditions, subgrade soils, and construction materials. For preliminary evaluation purposes, we have used a Traffic Index (TI) of 5.0. The project civil engineer should confirm the traffic index prior to final design.

Five R-Value tests indicate that R-Value ranges from 68 to 86. An R-Value of 65 was used for preliminary design. Considering the relatively high R-Value of the subgrade and the remote site location, it may be practical to consider a full depth asphalt pavement structural section rather than the combined asphalt and Class 2 Aggregate Base section.

We recommend that the pavement structural section consist of 3 inches of asphalt over 4.5 inches of Class 2 Aggregate Base. If a full lift asphalt section is used, the asphalt should be a minimum of 4 inches thick. An evaluation should be performed to select the most cost effective pavement design. We understand that the SDG&E standard structural section is 4 inches of asphalt over 8 inches of Class 2 Aggregate Base, and typically performs well under vehicular loading typical at substations where subsurface conditions are average.

The sections assume properly prepared subgrade consisting of at least 12 inches of soil compacted to a minimum of 95% relative compaction. The aggregate base materials should be placed at a minimum relative compaction of 95%. Construction materials (asphalt and aggregate base) should conform to the current Standard Specifications for Public Works Construction (Green Book).

The design development should consider PCC pavements in areas where dumpsters will be stored and picked up or in areas of anticipated heavy-truck traffic. Our experience indicates that heavy truck-traffic can shorten the useful life of AC sections. For preliminary evaluation purposes, seven inches of PCC can be used over the prepared select subgrade surface. The concrete pavements should be provided with expansion joints at regular intervals (not exceeding every 15 feet each way).

If unpaved roads are used, the upper 12 inches of material should be compacted to a minimum of 95 percent relative compaction.

5.6 CORROSION POTENTIAL

The results of pH, resistivity, and water-soluble sulfate tests are summarized in the following table.

Summary of Soil Corrosivity Test Results

Exploration No.	Depth (ft)	Material Type	USCS Symbol	pH	Minimum Resistivity (ohm-cm)	Sulfate Content (ppm)	Chloride Content (ppm)
B-1	5	Alluvium	SW/SM	8.8	4,950	6	45
B-7	20	Alluvium	SW-SM/SP	8.0	10,000	3	300
B-8	20	Alluvium	SW	9.3	11,000	69	30
B-13	2.5	Alluvium	SC	8.4	2,000	ND	75
B-15	25	Alluvium	SW-SM/SM	7.7	740	27	525
B-17	5	Alluvium	SC	8.1	1,400	81	120
B-26	5	Older Alluvium	SM	7.3	350	336	555
B-26	15	Older Alluvium	SM	7.5	500	456	705
B-26	35	Older Alluvium	SM	7.5	495	420	510
B-27	5	Older Alluvium	SM	7.9	2,550	432	285
B-27	25	Older Alluvium	SM	7.4	645	468	555

Notes:

a. ND = Not detected at laboratory detection limits.
b. ppm = parts per million

Five of the eleven soil samples tested in the laboratory possessed saturated resistivity values less than 500 ohms-centimeter (ohm-cm), which indicates very corrosive conditions based on our experience with local Corrosion Engineers. Three of the eleven soil samples tested in laboratory possessed saturated resistivity values above 4,000 ohm-cm which indicates mild to non-corrosive conditions. The remaining three samples tested had saturated resistivity values between 500 and 2,500 ohm-cm, which may be considered corrosive to moderately corrosive to metallic utility piping and conduits.

Additional corrosivity testing will be performed as part of further site investigation. However, the results of the testing performed to date indicate highly variable corrosion potential. A Corrosion Engineer should be consulted for additional design information.

The results of these tests indicate that the potential for sulfate attack to concrete should be negligible. Table 19A-4 of the 1997 Uniform Building Code, Requirements for Concrete Exposed to Sulfate Containing Solutions, considers that sulfate exposure from concentrations less than 0.10% is negligible. The majority of samples tested had chloride concentrations above about 200 ppm indicating a possibility for chloride attack.

SECTION 6 ADDITIONAL SERVICES

6.1 ADDITIONAL FIELD INVESTIGATION

Additional field investigation is planned to evaluate subsurface conditions in the western pad and to supplement subsurface information in the eastern pad. Additional explorations may also be warranted for specific deep foundations in and adjacent to the substation. This investigation did not provide specific subsurface information for transmission line structures.

If requested, URS can perform laboratory and/or in-situ testing to provide estimates of permeability of in-situ and compacted materials for design of stormwater management features such as infiltration basins.

6.2 DESIGN DEVELOPMENT SERVICES

We anticipate that the following services may be required during design development.

- Once information on foundation types, sizes and locations is available, URS should review expected subsurface conditions and foundation locations to evaluate whether the design recommendations provided in this report are appropriate.

- URS should review the foundation and grading plans for the improvements to verify that the intent of the recommendations presented herein has been properly interpreted and incorporated into the construction documents.

6.3 CONSTRUCTION OBSERVATION AND TESTING

Earthwork and placement of engineered fill should be performed under the observation and testing services of a geotechnical professional supervised by a California-registered Geotechnical Engineer. Tests should be taken to determine the in-place moisture and relative compaction of engineered fill.

Removal excavations should be observed and mapped by a geologic or geotechnical professional during earthwork. Cut slopes and other temporary excavations should be geologically mapped during construction to evaluate the orientation of geologic structures and the presence of seeps and other sources of groundwater.

All footing and slab subgrade soils should be observed by a geotechnical or geologic professional prior to placement of steel and concrete to observe that the subgrade is satisfactory. Excavations should be free of soft fill or loose and disturbed soils.

A California-registered Geotechnical Engineer should prepare a final report of earthwork testing and observation.

SECTION 7 UNCERTAINTIES AND LIMITATIONS

We have observed only a very small portion of the pertinent subsurface conditions. The recommendations made herein are based on the assumption that soil conditions do not deviate appreciably from those found during our field investigation. Specific details for the proposed project are not available at this time. The recommendations presented in this report are intended to assist SDG&E and its subconsultants in the planning and design of the project. The professional judgments and interpretations presented in this report are based on our current knowledge of the proposed improvements, our interpretations of the subsurface conditions in the project area, and our understanding of the geologic and tectonic setting of the project site. This knowledge is based on the information provided to us, published literature, and our investigations.

Geotechnical engineering and the geologic sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our understanding of the proposed construction, and partly on our general experience. Our engineering work and judgments rendered meet current professional standards; we do not guarantee the performance of the project in any respect.

SECTION 8 REFERENCES

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SOURCE: GoogleEarth

VICINITY MAP
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS	NOT TO SCALE	CHECKED BY: PB	DATE: 06-10-08	FIG. NO: 1
		PM: MEH	PROJ. NO: 27667021.00030	

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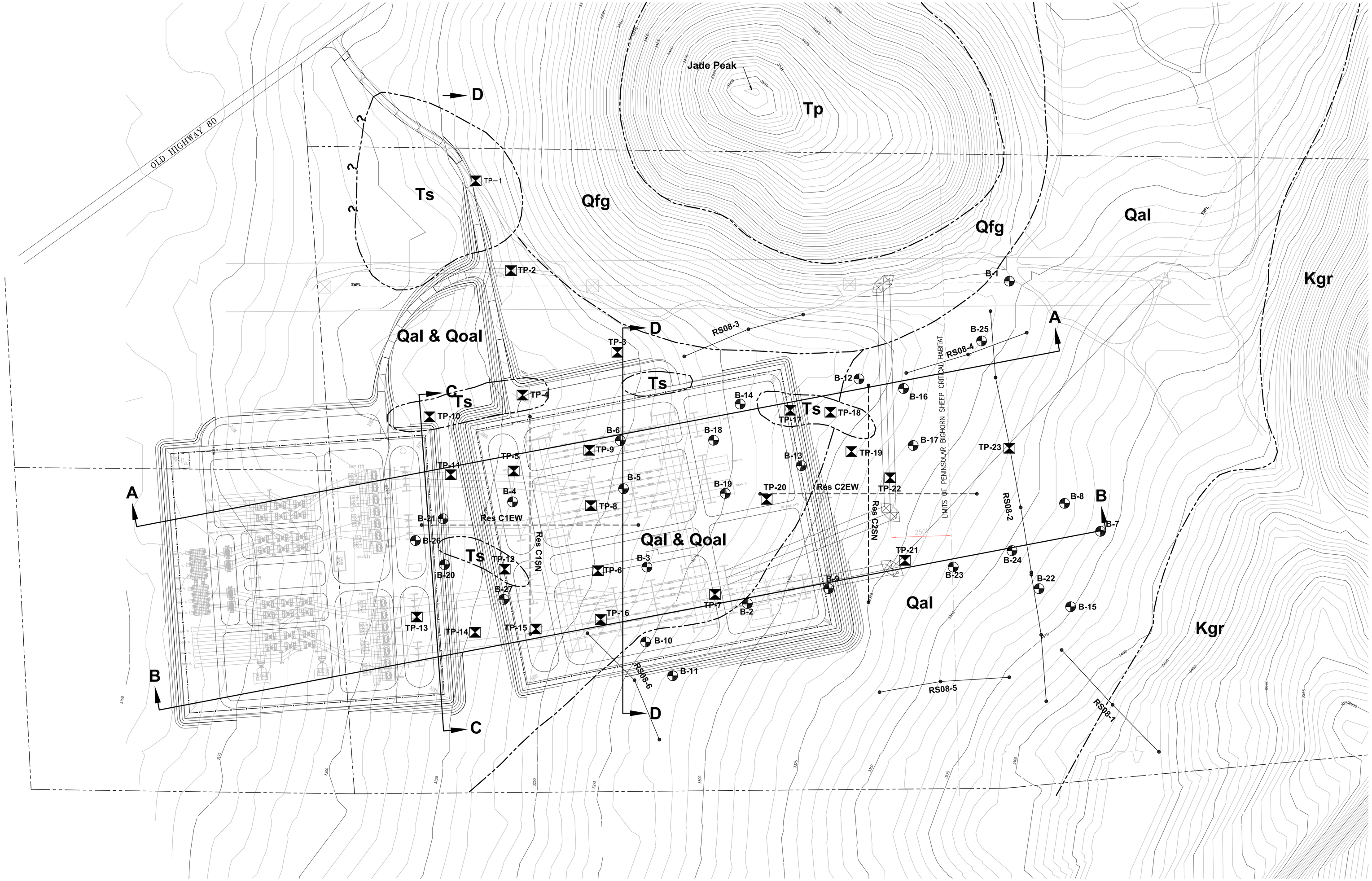

LEGEND

- Approximate location of test boring
- Approximate location of test pit
- Approximate location of seismic line
- Resistivity survey locations
- Geologic contact
- A — Geologic cross section
- Geologic contact

Qal Alluvium – Primarily of Kgr origin, medium sand with silt and gravel

Qfg Post-Lava Fanglomerate – Sands and gravels of older alluvium

Qal & Qoal Older alluvium with a variable veneer of Younger Alluvium (0'–10' thick) – Fine grained alluvium, moderately cemented with carbonate

Ts Older Sedimentary Rocks (Tertiary–age) – Volcanic conglomerates, volcaniclastic sandstone, andesite breccias and flows (undifferentiated)

Tp Jacumba Volcanics (Tertiary–age) – Hyperstene andesite plugs

Kgr Peninsular Ranges Batholith (Cretaceous–age) Granitic rocks primarily quartz diorite and granodiorite

REFERENCE:
"Site Arrangement, East County Substation",
San Diego Gas & Electric Company,
dated 04–18–08.

SITE PLAN AND GEOLOGIC MAP
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

100 0 100 200 Feet
SCALE: 1"= 200'

CHECKED BY: DR | DATE: 06–10–08 | FIG. NO: 2
PM: MEH | PROJ. NO: 27667021.00030

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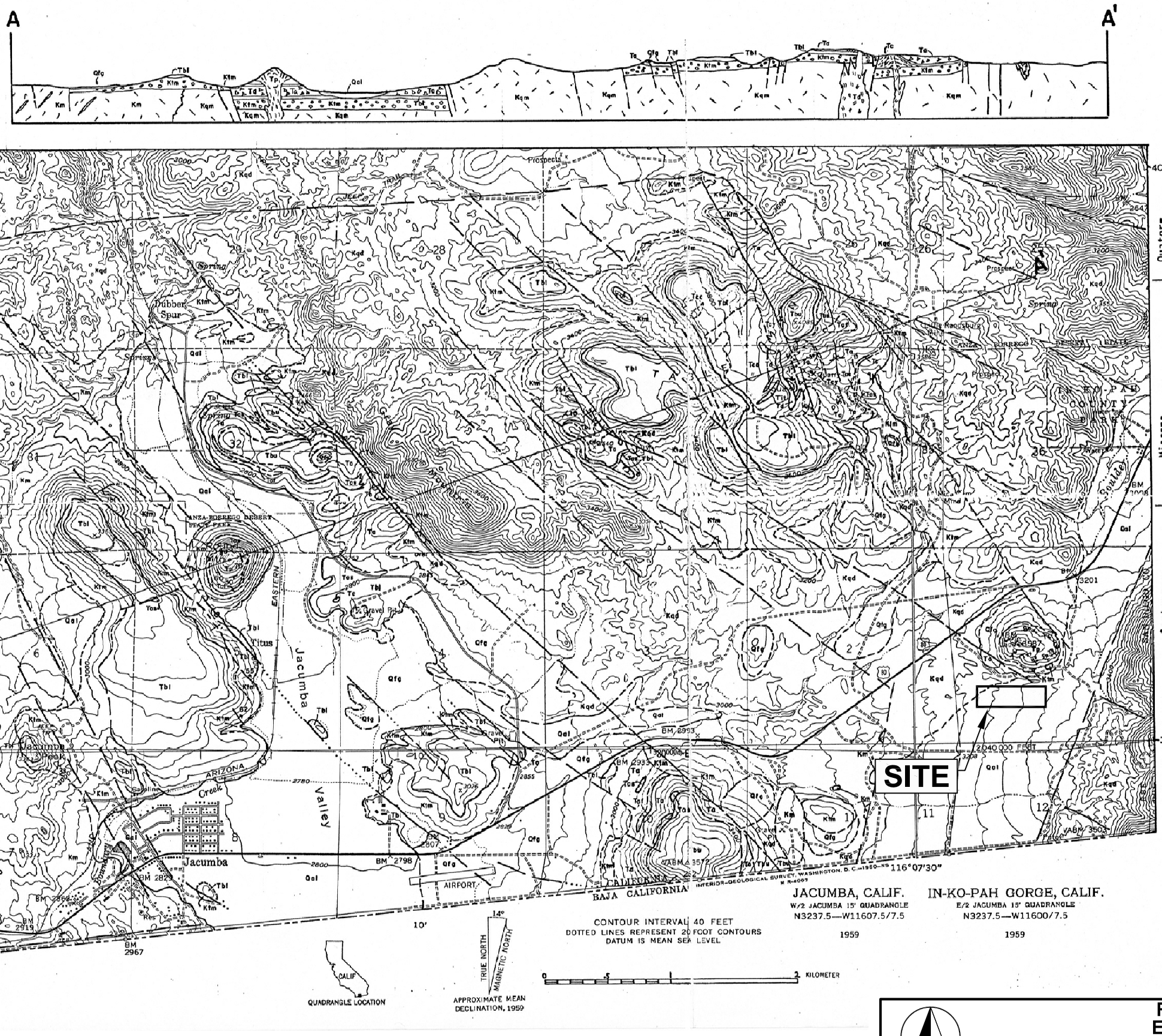

EXPLANATION

Quaternary	Qal	Recent alluvium
	Qfg	Older alluvium and fanglomerate
Miocene		Jacumba Volcanics
	Tp	Hypersthene andesite plugs
	Tbu	Upper basalt flows
	Td	Basalt dikes
	Tca	Cinder agglomerate
	Ta	Andesite breccias, flows, lahar deposits and volcanic conglomerates
	Tas	Volcaniclastic sandstones
	Taf	Andesite flows
	Tat	Tuffs
	Tbl	Lower basalt flows
	Tc	Cinder cones and associated carpets
	Tcy	Yellow cinder bed
		Table Mountain Formation
	Ktm	Sandstone and conglomeratic sandstone
Cretaceous		Southern California Batholith
	Kqd	Quartz diorite and granodiorite
		Julian Schist and leucocratic plutonic rocks
	Km	Schist, quartz diorite, gneiss, quartzite and pegmatites

FAULT — Known — Inferred — Concealed

CONTACT — Definite — Inferred

FOLD

DIP & STRIKE 60

REGIONAL GEOLOGIC MAP
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

1500 0 1500 3000 Feet
SCALE: 1"= 3000'

CHECKED BY: PB | DATE: 06-10-08 | FIG. NO: 3

PM: MEH | PROJ. NO: 27667021.00030

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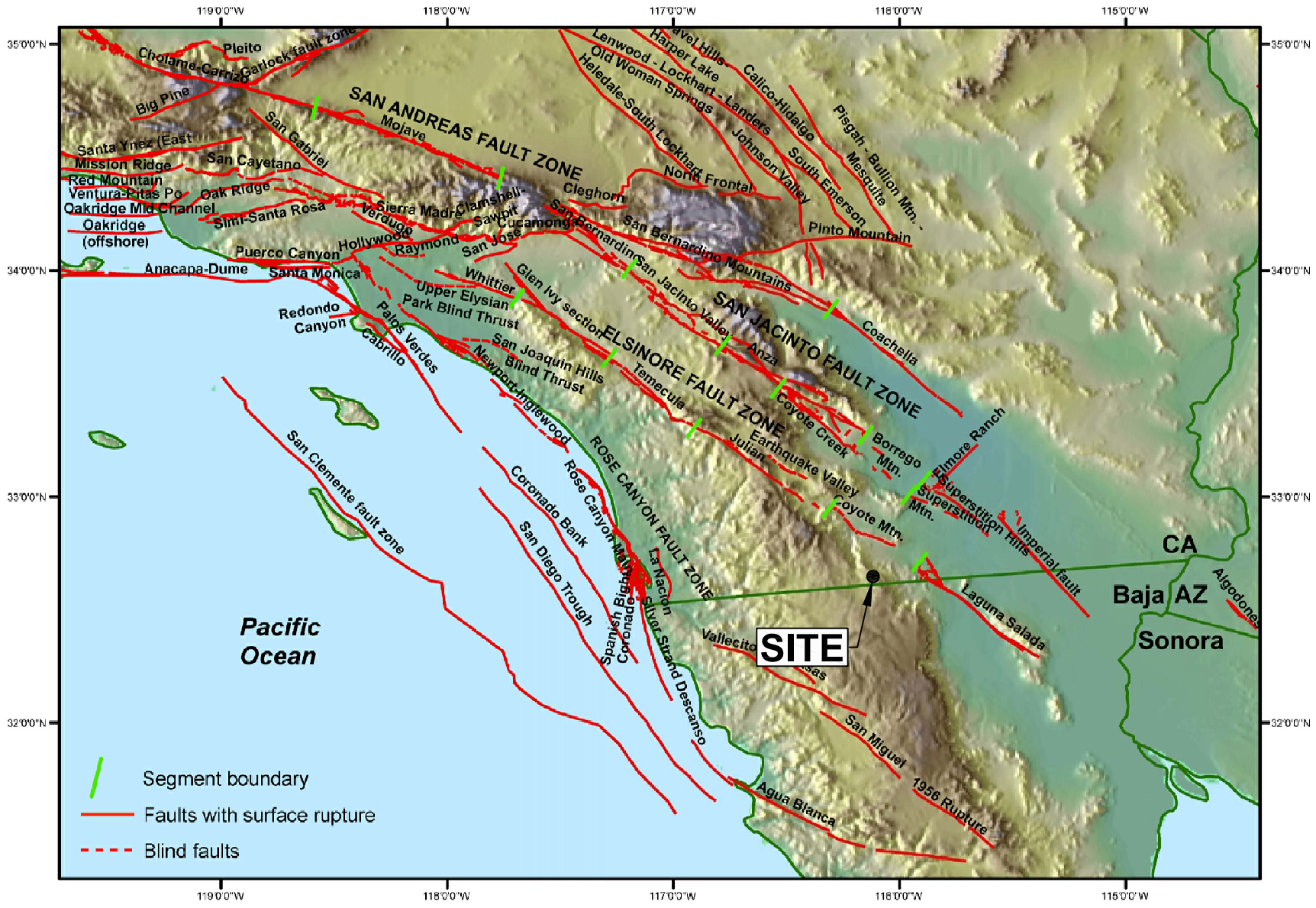

REGIONAL FAULT MAP
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

N

URS

25 12.5 0 25 Miles

CHECKED BY: PB	DATE: 06-10-08	FIG. NO: 4
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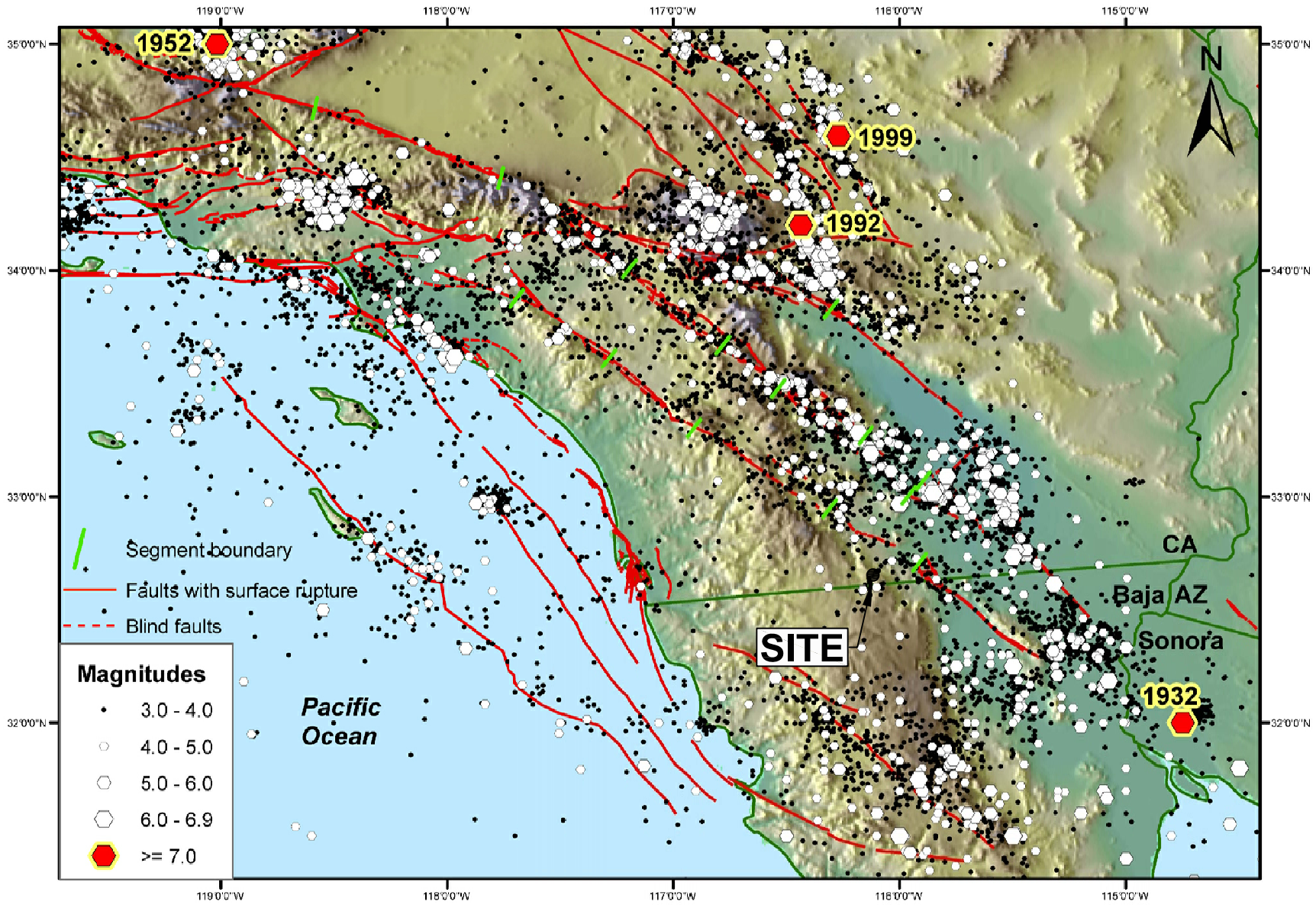

HISTORICAL SEISMICITY MAP
EAST COUNTY SUBSTATION
SAN DIEGO GAS AND ELECTRIC
JACUMBA, CALIFORNIA

URS

25 12.5 0 25 Miles

CHECKED BY: PB	DATE: 06-10-08	FIG. NO: 5
PM: MEH	PROJ. NO: 27667021.00030	

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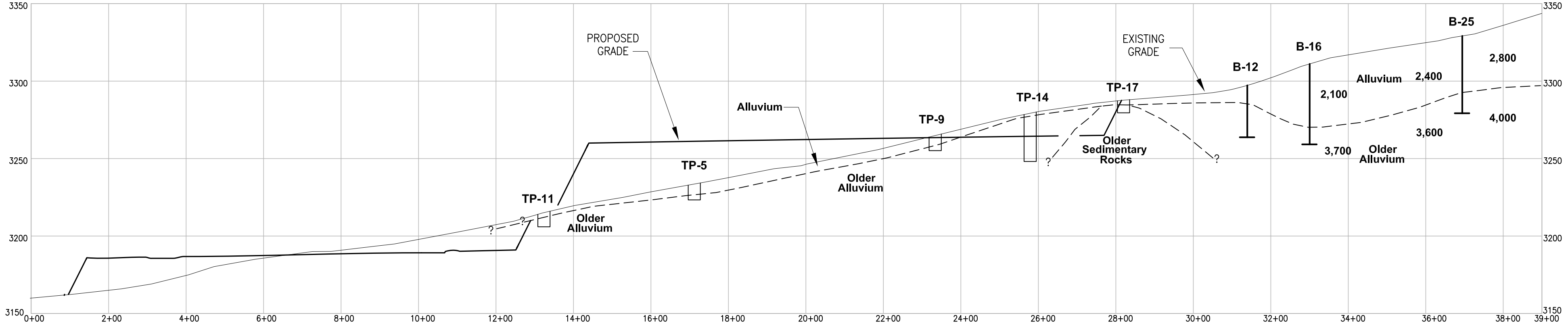
RS08-02

RS08-4

WEST

EAST



50

0 200

APPROXIMATE GRAPHIC SCALE (FEET)

VERTICAL EXAGGERATION 4X

LEGEND

GENERALIZED GEOLOGIC CONTACT

PROPOSED GRADE

RS08-01 — REFRACTION SEISMIC SURVEY APPROXIMATELY PARALLEL TO SECTION

RS08-02 — REFRACTION SEISMIC SURVEY APPROXIMATELY PERPENDICULAR TO SECTION

NOTE:
VELOCITIES SHOWN IN CROSS SECTION ARE FEET PER SECOND (f/s)

GEOLOGIC CROSS SECTION A-A'
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

CHECKED BY: DR	DATE: 06-10-08	FIG. NO: 6
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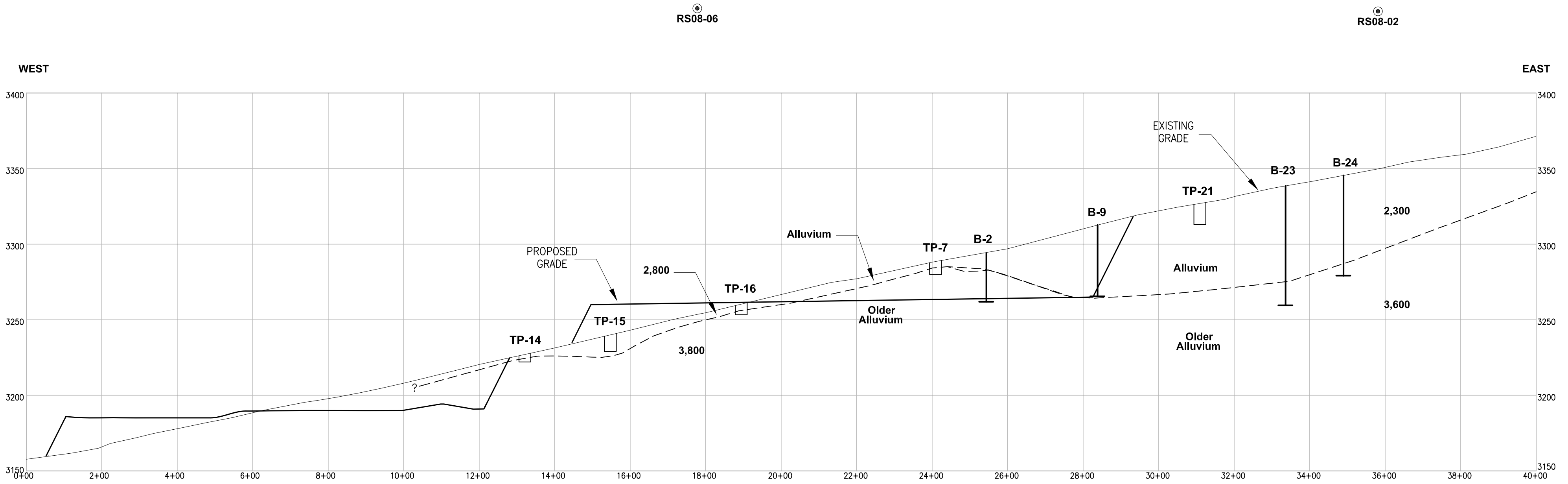

LEGEND

- GENERALIZED GEOLOGIC CONTACT
- PROPOSED GRADE
- RS08-01 — REFRACTION SEISMIC SURVEY APPROXIMATELY PARALLEL TO SECTION
- RS08-02 — REFRACTION SEISMIC SURVEY APPROXIMATELY PERPENDICULAR TO SECTION

NOTE:
VELOCITIES SHOWN IN CROSS SECTION ARE FEET PER SECOND (f/s)

50
0
200
APPROXIMATE GRAPHIC SCALE (FEET)
VERTICAL EXAGGERATION 4X

GEOLOGIC CROSS SECTION B-B'
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

CHECKED BY: DR	DATE: 06-10-08	FIG. NO: 7
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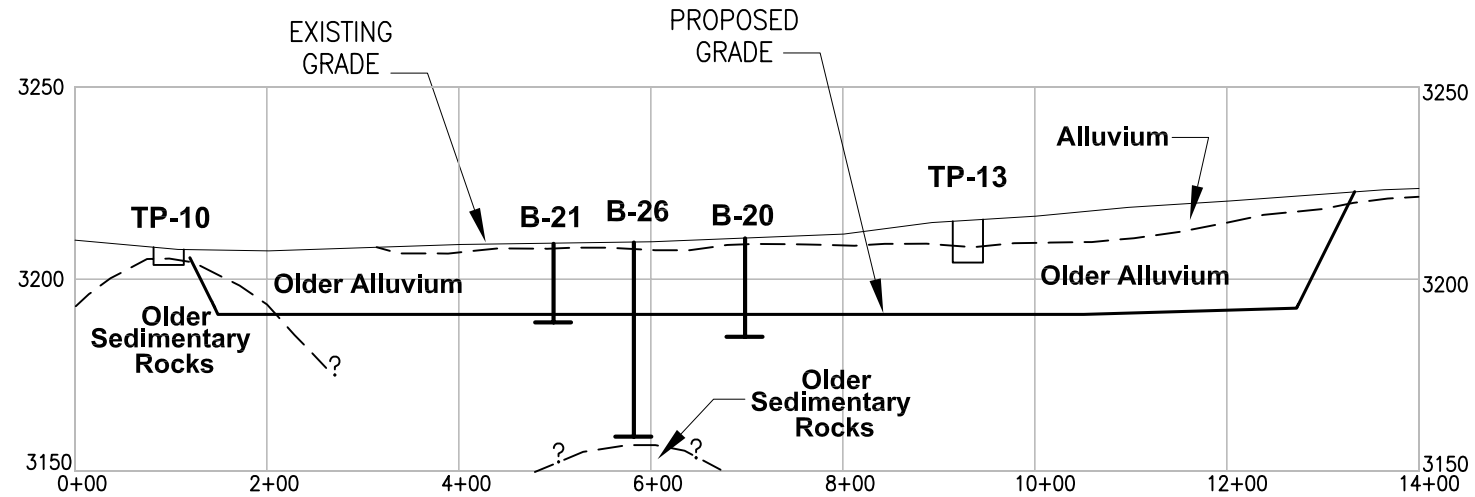
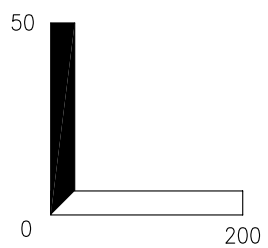


LEGEND

GENERALIZED GEOLOGIC CONTACT

PROPOSED GRADE



APPROXIMATE GRAPHIC SCALE (FEET)

VERTICAL EXAGGERATION 4X

GEOLOGIC CROSS SECTION C-C'
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

CHECKED BY: DR	DATE: 06-10-08	FIG. NO: 8
PM: MEH	PROJ. NO: 27667021.00030	

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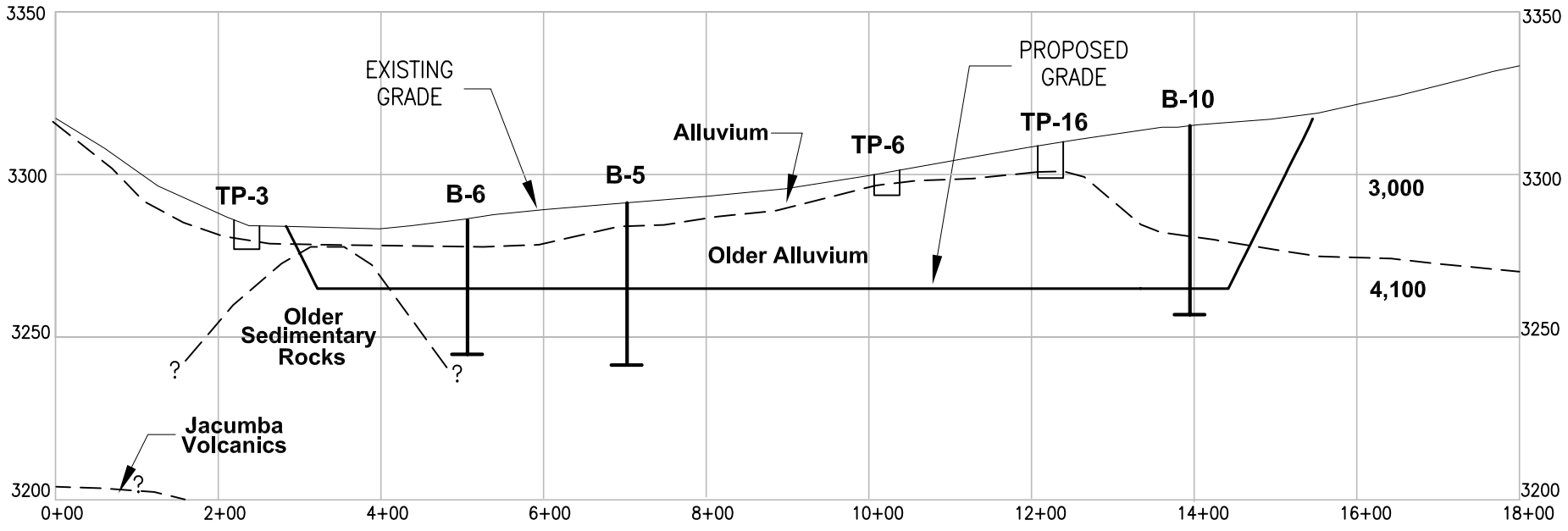
RS08-06

NORTH

SOUTH



LEGEND

GENERALIZED GEOLOGIC CONTACT

PROPOSED GRADE

50

0 200

APPROXIMATE GRAPHIC SCALE (FEET)

VERTICAL EXAGGERATION 4X

GEOLOGIC CROSS SECTION D-D'
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS

CHECKED BY: DR	DATE: 06–10–08	FIG. NO:
PM: MEH	PROJ. NO: 27667021.00030	9

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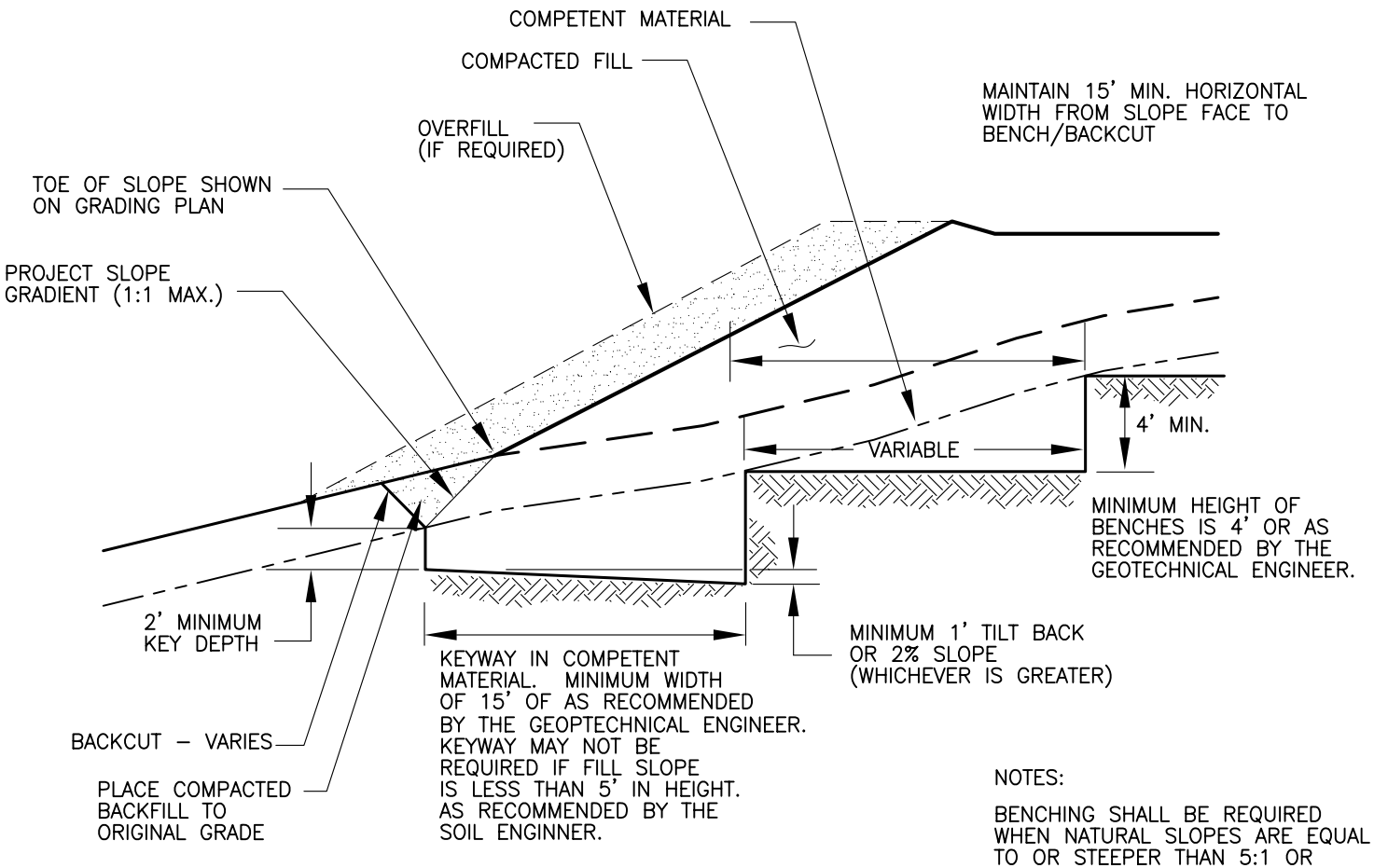

NOTES:

BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WILL BE PROVIDED BY THE GEOTECHNICAL ENGINEERS.

TYPICAL FILL ABOVE NATURAL SLOPE
EAST COUNTY SUBSTATION
SAN DIEGO GAS & ELECTRIC
JACUMBA, CALIFORNIA

URS	NOT TO SCALE	CHECKED BY: PB	DATE: 06–10–08	FIG. NO: 10
		PM: MEH	PROJ. NO: 27667021.00030	

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Twenty seven small-diameter borings (designated B-1 through B-27) were performed between March 27 and April 11, 2008 to depths ranging from about 25 to 85 feet below existing grade. The borings were advanced by Pacific Drilling of San Diego, California with a Unimog Marl M5 all terrain truck mounted drill rig that utilized 6-inch or 8-inch diameter hollow stem augers. The borings were backfilled according to County of San Diego Department of Environmental Health (DEH) requirements. URS obtained approval for alternate backfill materials consisting of a 3-foot bentonite seal at the bottom of the boring followed by native soil cuttings with 2-foot bentonite seal placed every 10 feet and a surface seal placed from 1 to 3 feet below the ground surface.

Relatively intact samples were obtained from the borings with a modified California sampler lined with four-inch-long brass tubes and driven using a 140-pound hammer dropping 30 inches. Disturbed samples were obtained from the borings using Standard Penetration Test (SPT) samplers driven with a 140-pound hammer dropping 30 inches. The number of blows shown on the logs is the field blow count for the last 12 inches of penetration (or less for blowcounts greater than 50). The reported field blowcounts have not been corrected for sampler size. Bulk samples were collected in 5-gallon buckets and sealed with lids and smaller grab samples were placed in sealed plastic bags prior to transport to our laboratory.

Twenty-three test pits (designated TP-1 through TP-23) were excavated between April 15 and 18, 2008 to depths ranging from about 4 to 10 feet below existing grade. The test pits were excavated by San Diego Concrete Cutting of San Diego, California with a rubber tired, four wheel drive Komatsu WB140 backhoe with a 24 inch bucket. The upper 1.5 to 2 feet of material was removed and placed to the side of the excavation for observation by the environmental monitors on site. This upper material was then replaced on the surface of the nominally compacted backfilled excavation. Bulk and grab samples were collected by hand from the spoils pile or from the sidewalls of the trench no deeper than 5 feet below the surface. Deeper bulk and grab samples were collected using the backhoe bucket. All samples were preserved in the same manner previously described.

The materials encountered in the borings and test pits were classified in accordance with the Unified Soil Classification System. Samples were typically collected at five-foot depth intervals or changes in stratigraphy, removed from the sampler, classified in the field, sealed to preserve the natural moisture content, and returned to our laboratory for further examination and testing.

The locations of all explorations were recorded on a hand-held Global Positioning System (GPS) unit and plotted on the site plan using the topography on the conceptual grading plan provided by SDG&E. The ground surface elevation at each exploration was obtained from the plotted locations on the electronic topographic layer.

The Key to Logs is presented on Figure A-1. Logs of the borings are presented on Figures A-2 through A-28; test pit logs are presented on Figures A-29 through A-51.

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Key to Logs

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Well Detail	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

7 **Material Description:** Description of material encountered; may include relative density / consistency, moisture, color, and grain size.

8 **Well Detail:** Graphic depiction of piezometer or well installation; materials are listed in header block; graphic symbols are explained below.

9 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

10 **Dry Unit Weight:** Dry density of soil sample measured in laboratory, in pounds per cubic foot.

11 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other field and laboratory test results, using the following abbreviations:

SA	Sieve analysis (%<#200 sieve)
WA	Wash analysis (%<#200 sieve)
LL	Liquid limit (from Atterberg limits test), %
PI	Plasticity Index (LL-PL), %; NP=nonplastic
EI	Expansion Index
CORR	Corrosivity Test
COMP	Compaction Test
R-Value	R-Value Test

TYPICAL SOIL GRAPHIC SYMBOLS

- Silty SAND (SM)
- SAND (SP)
- SAND with silt (SP-SM)
- Well graded SAND (SW)
- Clayey, silty SAND (SC-SM)
- Well graded SAND with silt (SW-SM)
- Clayey SAND (SC)
- SILT (ML)
- Lean CLAY (CL)
- GRAVEL (GM)

TYPICAL WELL GRAPHIC SYMBOLS

- Blank screen in concrete
- Blank casing in bentonite seal
- Blank screen in sand filter pack
- 0.020" dia. PVC slotted screen in sand filter pack
- End cap

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Bulk Sample (Bag)
- Bulk Sample (Bucket)
- Modified California sampler
- Standard Penetration Test sampler

OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling (ATD)
- Water level measured at specified time after completion of drilling and sampling
- Minor change in material properties within a stratum
- Inferred or gradational contact between strata

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Report: GEO_SOIL_WELL_KEY; File: 27667021.GPJ; 6/5/2008 keyhsa

URS

Figure A-1

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-1

Sheet 1 of 2

Date(s) Drilled	**03/27/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,323 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1809050 E 6603908**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, light grayish brown, well graded SAND (SW), trace silt			
3320									
	5		1-1	23		Trace gravel, mica			SA(4), CORR
3315						Very dense, moist, reddish brown, silty fine to medium SAND (SM), trace gravel			
	10		1-2	54			2		CORR
3310									
	15		1-3	39		Becomes dense, silty fine to coarse sand, trace gravel	3		LL(23), PI(NP)
3305									
	20		1-4	30		Dense, moist, grayish brown, poorly graded SAND with silt (SP-SM), trace gravel			SA(10)
3300									
	25		1-5	35		Dense, moist, grayish brown, silty SAND (SM)			
3295									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 1

URS

Figure A-2

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-1

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30					Becomes very dense			
			1-6	58			5		WA(14)
3290									
	35					Becomes dense			
			1-7	44					
3285									
	40					Becomes very dense, brown			
			1-8	55					
3280									
	45								
			1-9	50/5"			5		WA(15)
3275									
						Very dense, moist, dark brown, clayey silty SAND (SC-SM)			
	50								
			1-10	50/2"			8		LL(27), PI(6), WA(33)
						Bottom of boring at 51.5 feet			
3270									
	55								
3265									
	60								
3260									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 1

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Figure A-2

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-2

Sheet 1 of 2

Date(s) Drilled	**03/27/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**31.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,292 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807782 E 6602682**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, brown, clayey fine to coarse SAND (SC), trace gravel, roots			
3290									
	5		2-1	20		Becomes clayey medium to coarse sand	2		
3285									
						Very dense, moist, brown, well graded SAND with silt (SW-SM)			
	10		2-2	50/5"			2		SA(8)
3280									
						OLDER ALLUVIUM Very stiff, moist, brown, lean CLAY (CL), with trace sand			
	15		2-3	29			5		
3275									
						Dense, moist, brown, silty SAND (SM), trace clay			
	20		2-4	41			4		LL(22), PI(NP)
3270									
						Dense, moist, brown, clayey medium to coarse SAND (SC), trace silt			
	25		2-5	38					
3265									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 2

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Figure A-3

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-2

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		2-6	37					WA(28)
3260						Bottom of boring at 31.5 feet			
	35								
3255									
	40								
3250									
	45								
3245									
	50								
3240									
	55								
3235									
	60								
3230									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 2

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Figure A-3

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-3

Date(s) Drilled	**03/28/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**36.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,265 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807936 E 6602260**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3265	0					ALLUVIUM Dense, moist, light reddish brown, clayey fine SAND (SC), trace gravel			
3260	5		3-1	41			5		WA(29)
3255	10		3-2	50/5"		OLDER ALLUVIUM Very dense, moist, light reddish brown, clayey coarse SAND (SC)			
3250	15		3-3	46		Becomes dense	3		
3245	20		3-4	83		Becomes very dense			
3240	25		3-5	50/5"		Hard, moist, light reddish brown, lean CLAY (CL), with fine sand	6		
3235	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 3

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Figure A-4

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-3

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3235	30		3-6	50/5"			7		
						Very dense, moist, light grayish red, clayey SAND (SC)			
3230	35		3-7	50/5"					WA(33)
						Bottom of boring at 36.5 feet			
3225	40								
3220	45								
3215	50								
3210	55								
3205	60								
3200	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 3

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Figure A-4

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-4

Sheet 1 of 1

Date(s) Drilled	**03/28/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**26.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,230 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808221 E 6601799**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3230	0					ALLUVIUM Hard, moist, brown, sandy lean CLAY (CL) with gravels			
			4-1	32					WA(55)
3225	5		4-2	46		Becomes light grayish brown	8		
						OLDER ALLUVIUM Very dense, moist, brown, silty fine to coarse SAND (SM), trace gravel and clay			
3220	10		4-3	50/4"			3		
						Very dense, moist, light grayish brown, clayey fine to coarse SAND (SC)			
3215	15		4-4	60			6		LL(31), PI(10), SA(43), CORR
3210	20		4-5	50/3"					
3205	25		4-6	50/3"					
						Bottom of boring at 26.5 feet			
3200	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 4

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Figure A-5

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-5

Sheet 1 of 2

Date(s) Drilled	**03/31/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**48.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,252 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808278 E 6602157**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Very dense, Moist, light brown, silty fine to medium SAND (SM), trace gravel			
3250									
	5		5-1	50/3"		OLDER ALLUVIUM Very dense, moist, light brown, clayey fine to medium SAND (SC), with trace gravel			
3245									
	10		5-2	50/6"			3		
3240									
	15		5-3	74			6		
3235									
	20		5-4	50/3"					
3230									
	25		5-5	50/6"					
3225									
	30					Hard, moist, light brown, lean CLAY (CL), with trace fine sand			

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 5

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Figure A-6

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-5

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		5-6	50/6"			10		
3220									
	35		5-7	50/6"		Very dense, light brown, silty fine to medium SAND (SM), with trace clay	5		LL(22), PI(NP)
3215									
	40		5-8	50/4"		Hard, moist, light brown, lean CLAY (CL), with trace fine sand			
3210									
	45		5-9	50					
3205			5-10	50/3"			9		WA(51)
						Bottom of boring at 48.5 feet			
	50								
3200									
	55								
3195									
	60								
3190									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 5

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Figure A-6

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-6

Sheet 1 of 2

Date(s) Drilled	**03/31/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**41.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,249 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808511 E 6602136**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Very stiff, moist, light brown, SILT (ML), with fine sand and trace clay			
3245	5		6-1	25					LL(23), PI(3)
3240	10		6-2	50/6"		OLDER ALLUVIUM Hard, moist, light brown, lean CLAY (CL), with silt and fine sand	3		
3235	15		6-3	50/3"					
3230	20		6-4	50/6"					
3225	25		6-5	50/6"					
3220	30								

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Figure A-7

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-6

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		6-6	84			6		
3215	35		6-7	50/5"			4		
3210	40		6-8	50/2"					
						Bottom of boring at 41.5 feet			
3205	45								
3200	50								
3195	55								
3190	60								
3185	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 6

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Figure A-7

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-7

Sheet 1 of 2

Date(s) Drilled	**04/01/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,370 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807856 E 6604182**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3370	0					ALLUVIUM Dense, moist, light brown, silty fine to medium SAND (SM) with gravel			
3365	5		7-1	48			2	107	
3360	10		7-2	70		Very dense, moist, light brown, well graded SAND with silt (SW-SM), with trace gravel			
3355	15		7-3	39		Becomes dense	2	115	SA(5)
3350	20		7-4	54		Becomes very dense Very dense, light brown, poorly graded SAND (SP)			CORR
3345	25		7-5	32		Becomes dense	1		CORR
3340	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 7

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Figure A-8

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-7

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3340	30		7-6	44		With silt	2	98	
3335	35		7-7	40		With trace gravel			
3330	40		7-8	39		Very dense, moist, light grayish yellow, silty medium to coarse SAND (SM), with trace gravel			
3325	45		7-9	54		Becomes very dense	3		
3320	50		7-10	66		With gravel			
						Bottom of boring at 51.5 feet			
3315	55								
3310	60								
3305	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 7

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Figure A-8

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-8

Sheet 1 of 2

Date(s) Drilled	**04/01/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,357 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808068 E 6603977**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Dense, moist, light yellowish brown, silty fine to medium SAND (SM), with trace gravel			
3355									
	5		8-1	30		Medium dense, moist, light yellowish brown, poorly graded SAND (SP)			
3350									
	10		8-2	20					WA(3)
3345						Medium dense, moist, light yellowish brown, silty fine to coarse SAND (SM)			
	15		8-3	24			3		
3340						Medium dense, moist, light yellowish gray, well graded SAND (SW), with trace silt			
	20		8-4	38					CORR
3335									
	25		8-5	38					CORR
3330									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 8

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Figure A-9

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-8

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		8-6	48			3	101	SA(5)
3325						Medium dense, moist, light yellowish brown, silty fine to coarse SAND (SM) with gravel			
	35		8-7	30					WA(14)
3320									
	40		8-8	37					
3315									
	45		8-9	38		Trace gravel			
3310									
	50		8-10	40			3	100	
3305						Bottom of boring at 51.5 feet			
	55								
3300									
	60								
3295									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 8

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Figure A-9

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-9

Sheet 1 of 2

Date(s) Drilled	**04/01/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**46.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,313 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807888 E 6603017**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, reddish brown, poorly graded medium to coarse SAND with silt (SP-SM), with trace gravel			
3310									
	5		9-1	15					WA(7)
3305									
	10		9-2	44		Becomes dense, fine to medium sand, with trace gravel			
3300						Very dense, muist, reddish brown, clayey fine to medium SAND (SC)			
	15		9-3	58			4		WA(22)
3295									
	20		9-4	50/4"					
3290						Very dense, moist, reddish brown, silty medium to coarse SAND (SM), with trace gravel			
	25		9-5	55			2		
3285									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 9

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Figure A-10

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-9

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		9-6	50/6"					
3280									
	35		9-7	52			1		
3275									
	40		9-8	70		Very dense, moist, reddish brown, poorly graded fine to coarse SAND (SP), with trace gravel			WA(4)
3270									
	45		9-9	37		Becomes dense			
						Bottom of boring at 46.5 feet			
3265									
	50								
3260									
	55								
3255									
	60								
3250									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B- 9

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Figure A-10

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-10

Sheet 1 of 2

Date(s) Drilled	**04/02/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**56.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,274 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807650 E 6602290**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, light reddish brown, silty fine to medium SAND (SM), trace gravel			
3270	5		10-1	21			2		
3265	10		10-2	50/6"					
						Dense, moist, light brown, well graded SAND with silt (SW-SM)			
3260	15		10-3	35					SA(5)
3255	20		10-4	30		With gravel	1		
3250	25		10-5	45			2	108	
3245	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-10

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Figure A-11

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-10

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		10-6	37					
3240									
	35		10-7	54		OLDER ALLUVIUM Very dense, moist, light brown, clayey SAND (SC)			
3235									
	40		10-8	21		Becomes medium dense	7		SA(31)
3230									
	45		10-9	57		Becomes very dense			
3225									
	50		10-10	50/4"					
3220									
	55		10-11	75					
						Refusal at 56.5 feet			
3215									
	60								
3210									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-10

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Figure A-11

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-11

Sheet 1 of 2

Date(s) Drilled	**04/02/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,286 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807381 E 6602302**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3285	0					ALLUVIUM Loose, Moist, light yellowish gray, poorly graded SAND (SP), with trace gravel			
	5		11-1	9					SA(3)
3280									
	10		11-2	13		Becomes medium dense, light yellowish brown			
3275									
	15		11-3	11					
3270									
						Loose, moist, light yellowish gray, poorly graded SAND with silt (SP-SM)			
	20		11-4	11			1		WA(11)
3265									
						Medium dense, moist, brown, silty fine SAND (SM), trace coarse sand, fine gravel			
	25		11-5	10					SA(12)
3260									
	30								

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Figure A-12

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-11

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3255	30		11-6	22		Becomes silty fine to medium sand	5	100	
3250	35		11-7	20					
3245	40		11-8	79		Very dense, moist, light yellowish brown, silty fine to coarse SAND (SM)			
3240	45		11-9	42					
3235	50		11-10	63		Very dense, moist, white, clayey fine SAND (SC) with gravel	4		SA(38)
						Bottom of boring at 51.5 feet			
3230	55								
3225	60								
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-11

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Figure A-12

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-12

Sheet 1 of 2

Date(s) Drilled	**04/03/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**30.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,290 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808645 E 6603082**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3290	0					ALLUVIUM Medium dense, moist, pale brown, silty fine to medium SAND (SM), with few fine gravels			
			12-5	50/5"					
			12-1	17					
3285	5		12-2	18			1		
3280	10		12-3	53		Becomes very dense with gravel			
						OLDER ALLUVIUM Very dense, moist, pale brown, clayey fine to medium SAND (SC), with trace gravel			
3275	15		12-4	50/5"			3		
3270	20					~6" of fine gravels			
						Very dense, moist, pale brown, silty fine to medium SAND (SM), with trace gravel			
3265	25		12-6	50/3"			5		LL(33), PI(7), SA(24)
3260	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-12

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Figure A-13

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-12

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3260	30		12-7	50/3"					
						Bottom of boring at 30.5 feet			
3255	35								
3250	40								
3245	45								
3240	50								
3235	55								
3230	60								
3225	65								

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Figure A-13

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-13

Sheet 1 of 2

Date(s) Drilled	**04/03/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**30.8 feet**
Drill Rig Type	**Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,293 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808342 E 6602748**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					OLDER ALLUVIUM Medium dense, moist, pale brown, clayey fine to medium SAND (SC), with fine gravel			
3290			13-1	56			4		WA(41), EI(0), CORR
						←Cobble			
	5		13-2	45		←Becomes dense			EI(0), CORR
3285									
	10		13-3	50/5"					SA(44)
						←Becomes carbonate cemented			
3280									
	15		13-4	50/5"			5		
3275									
	20		13-5	50/4"					
3270									
	25		13-6	50/3"			4		
3265									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-13

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Figure A-14

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-13

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		13-7	50/3"					
						Bottom of boring at 30.8 feet			
3260									
	35								
3255									
	40								
3250									
	45								
3245									
	50								
3240									
	55								
3235									
	60								
3230									
	65								

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Figure A-14

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-14

Sheet 1 of 1

Date(s) Drilled	**04/03/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**28.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,278 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808626 E 6602520**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					OLDER ALLUVIUM Medium dense, moist, pale brown, clayey fine to coarse SAND (SC), with some fine gravels and trace coarse gravels			
3275			14-1	20					SA(18)
	5		14-2	50/4"		Becomes very dense			
3270									
	10		14-3	40		Dense, moist, pale brown, silty fine to coarse SAND (SM), with trace gravel	5		
3265									
	15		14-4	50/6"		Very dense, moist, pale brown, clayey fine to coarse SAND (SC), with trace gravel			WA(20)
3260									
	20		14-5	50/4"		Very dense, moist, pale brown, silty fine to coarse SAND (SM), with trace gravel	5		
3255									
	25		14-6	50/4"					
3250			14-7						
	30					Auger refusal at 28.5 feet			

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-14

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Figure A-15

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-15

Date(s) Drilled	**04/04/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**81.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,375 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807493 E 6604121**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3375	0					ALLUVIUM Dense, moist, light yellowish brown, silty fine to medium SAND (SM), with some fine gravel			
3370	5		15-1	39			2		EI(0)
3365	10		15-2	41		Dense, moist, light yellowish brown, well-graded SAND with silt (SW-SM), with some gravel			SA(11), EI(0)
						Medium dense, moist, light yellowish brown, silty SAND (SM), with some gravel			
3360	15		15-3	17			1		
3355	20		15-4	39		Becomes dense			
						Medium dense, moist, light, yellowish brown, well-graded SAND with silt (SW-SM), with trace gravel			
3350	25		15-5	17			2		SA(7), CORR
3345	30								

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Figure A-16

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-15

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3345	30		15-6	42		Becomes dense			CORR
3340	35		15-7	42		Becomes light brown, coarse to very coarse grained	3		
3335	40		15-8	32		Becomes light yellowish brown, medium to coarse grained			WA(12)
3330	45		15-9	41			4		LL(25), PI(3), WA(14)
3325	50		15-10	57		Becomes very dense			
						OLDER ALLUVIUM Medium dense, moist, light reddish brown, clayey fine SAND (SC), with gravel			
3320	55		15-11	29			5		SA(17)
3315	60		15-12	65		Becomes very dense			
3310	65								

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Figure A-16

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-15

Sheet 3 of 3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3310	65		15-13	65			4		
3305	70		15-14	50/6"		Increased fines content			WA(33)
						Very dense, moist, light yellowish brown, silty medium to coarse SAND (SM), with gravel			
3300	75		15-15	50/6"			1		
3295	80		15-16	50/6"			2		SA(12)
						Bottom of boring at 81.5 feet			
3290	85								
3285	90								
3280	95								
3275	100								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-15

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Figure A-16

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-16

Date(s) Drilled	**04/07/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,307 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808728 E 6603414**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Dense, moist, pale brown, silty medium SAND (SM), with some fine gravel			
3305									
	5		16-1	39		Becomes medium to very coarse sand			
3300									
	10		16-2	33					
3295									
						Medium dense, moist, pale brown, poorly graded SAND with silt (SP-SM)			
	15		16-3	24			3		WA(7)
3290									
	20		16-4	29					
3285									
	25		16-5	29					
3280									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-16

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Figure A-17

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-16

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30					Becomes dense			
3275			16-6	33					
						Dense, moist, pale brown, silty SAND (SM)			
	35		16-7	45			2		
3270									
	40		16-8	27		Medium dense, moist, pale brown, clayey fine SAND (SC), with some fine gravel	5		LL(29), PI(9), SA(43)
3265									
						OLDER ALLUVIUM Hard, moist, pale brown, lean CLAY (CL)			
	45		16-9	38					
3260									
	50		16-10	37			5		
3255						Bottom of boring at 51.5 feet			
	55								
3250									
	60								
3245									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-16

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Figure A-17

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-17

Sheet 1 of 2

Date(s) Drilled	**04/07/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**51.5 feet**
Drill Rig Type	**Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,317 Feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808488 E 6603494**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Dense, moist, pale brown, clayey coarse SAND (SC), with some fine gravel			
3315									
	5		17-1	40					CORR
3310									
	10		17-2	40		Becomes medium to coarse grained	3		CORR
3305									
	15		17-3	41					
3300						Dense, moist, pale brown, silty fine to medium SAND (SM)			
	20		17-4	36					WA(9)
3295									
	25		17-5	50/6"		Becomes very dense, carbonate cemented	3		
3290									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-17

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Figure A-18

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-17

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30					No carbonate			
			17-6	28					
3285									
	35						5		LL(27), PI(5), SA(37)
			17-7	62					
3280									
						OLDER ALLUVIUM Very dense, moist, pale brown, clayey medium to coarse SAND (SC), with carbonate			
	40						3		
			17-8	54					
3275									
	45		17-9	50/4"					SA(31)
3270									
	50								
			17-10	50/6"					
3265						Bottom of boring at 51.5 feet			
	55								
3260									
	60								
3255									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-17

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Figure A-18

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-18

Sheet 1 of 1

Date(s) Drilled	**04/07/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**29.3 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,271 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808535 E 6602379**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3270	0					OLDER ALLUVIUM Very dense, moist, pale brown, clayey medium to coarse SAND (SC), with some fine gravel and carbonate			
			18-1	50/6"					
3265	5		18-2	50/6"			4		
3260	10		18-3	82					
3255	15		18-4	72		Increased fines content			SA(42)
3250	20		18-5	50/6"					
3245	25		18-6	50/5"			3		
			18-7	50/4"					
	30					Auger refusal at 29.3 feet			

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-18

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Figure A-19

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-19

Sheet 1 of 1

Date(s) Drilled	**04/08/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**25.3 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,275 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808194 E 6602406**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3275	0					OLDER ALLUVIUM Very dense, moist, pale brown, clayey fine to coarse SAND (SC), with some fine gravel and carbonate			
			19-1	50/4"					
3270	5		19-2	50/5"					
3265	10		19-3	50			3		WA(21)
3260	15		19-4	50/6"					
						Hard moist, pale brown, lean CLAY (CL)			
3255	20		19-5	90					
						Very dense, moist, pale brown, clayey fine to coarse SAND (SC), with carbonate			
3250	25		19-6	50/3"					SA(33)
						Bottom of boring at 25.3 feet			
3245	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-19

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Figure A-20

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-20

Sheet 1 of 1

Date(s) Drilled	**04/08/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**27.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,215 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808030 E 6601482**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3215	0					OLDER ALLUVIUM Very stiff, moist, pale brown, sandy lean CLAY (CL)			
			20-1	16					
3210	5		20-2	63		Becomes hard			WA(58)
3205	10		20-3	50/5"					
3200	15		20-4	50/4"			4		
3195	20		20-5	69					WA(63)
3190	25		20-6	50/6"					WA(61)
			20-7	50/6"					
						Auger refusal at 27.5 feet			
3185	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-20

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Figure A-21

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-21

Sheet 1 of 1

Date(s) Drilled	**04/08/08**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**19.8 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,215 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location			

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3215	0					OLDER ALLUVIUM Hard, moist, pale brown, lean CLAY (CL), with carbonate and fine sand			
			21-1	50/6"					
3210	5		21-2	50					WA(85)
3205	10		21-3	70			6		
3200	15		21-4	50/5"					
			21-5	50/4"			6		
3195	20					Auger refusal at 19.8 feet			
3190	25								
3185	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-21

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Figure A-22

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-22

Sheet 1 of 3

Date(s) Drilled	**04/09/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**86.4 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,363 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807573 E 6603888**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, light reddish brown, silty medium to fine SAND (SM), with trace gravel			
3360									
	5		22-1	24					
3355									
	10		22-2	19					
3350									
	15		22-3	20		Becomes medium to coarse			
3345									
	20		22-4	23					
3340									
	25		22-5	22					
3335									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-22

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Figure A-23

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-22

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		22-6	35		Becomes dense			
3330									
	35		22-7	54		OLDER ALLUVIUM Very dense to dense, moist, light reddish brown, silty SAND (SM)			
3325									
	40		22-8	45					
3320									
	45		22-9	43					
3315									
	50		22-10	45					
3310									
	55		22-11	50					
3305									
	60		22-12	45					
3300									
	65								

URS

Figure A-23

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-22

Sheet 3 of 3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	65		22-13	28		Becomes medium dense			
3295									
	70		22-14	50/6"		Becomes very dense			
3290									
	75		22-15	50/6"					
3285									
	80		22-16	50/6"					
3280									
	85		22-17	50/5"		Very dense, moist, light gray, silty fine SAND (SM)			
						Bottom of boring at 86.4 feet			
3275									
	90								
3270									
	95								
3265									
	100								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-22

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Figure A-23

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-23

Date(s) Drilled	**04/09/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**80.3 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,341 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807760 E 6603489**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3340	0					ALLUVIUM Dense, moist, yellowish brown, silty fine to medium SAND (SM), with some fine gravel			
	5		23-1	36					
3335									
	10		23-2	52		Becomes very dense			
3330									
	15		23-3	50/6"					
3325									
	20		23-4	25		Becomes medium dense			
3320									
	25		23-5	27					
3315									
	30								

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Figure A-24

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-23

Sheet 2 of 3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3310	30		23-6	35		Becomes dense			
3305	35		23-7	49					
3300	40		23-8	31					
3295	45		23-9	50/6"		OLDER ALLUVIUM Very dense, moist, light reddish brown, silty medium to fine SAND (SM), with trace gravel and carbonate			
3290	50		23-10	50/4"					
3285	55		23-11	50					
3280	60		23-12	50/6"					
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-23

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Figure A-24

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-23

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3275	65		23-13	51					
3270	70		23-14	50/6"					
3265	75		23-15	50/6"					
						Becomes fine sand			
	80		23-16	50/3"		Bottom of boring at 80.3 feet			
3260									
3255	85								
3250	90								
3245	95								
	100								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-23

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Figure A-24

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-24

Date(s) Drilled	**04/10/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**66.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,351 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807843 E 6603762**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3350	0					ALLUVIUM Very dense, moist, light reddish brown, silty medium to fine SAND (SM), with trace gravel			
3345	5		24-1	50/6"					
3340	10		24-2	50/6"					
3335	15		24-3	32		Becomes dense and medium to coarse grained			
3330	20		24-4	37					
3325	25		24-5	41					SA(16), COMP, R-Value
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-24

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Figure A-25

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-24

Sheet 2 of 3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3320	30		24-6	39					
3315	35		24-7	50		OLDER ALLUVIUM Very dense, light yellowish brown, fine to medium SAND (SM) with carbonate			
3310	40		24-8	68					
3305	45		24-9	43		Becomes dense, yellowish brown, with gravel			
3300	50		24-10	50/6"		Becomes very dense			
3295	55		24-11	55		Becomes medium to fine grained			
3290	60		24-12	65					
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-24

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Figure A-25

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-24

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3285	65		24-13	50/6"					
						Bottom of boring at 66.5 feet			
3280	70								
3275	75								
3270	80								
3265	85								
3260	90								
3255	95								
	100								

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Figure A-25

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-25

Sheet 1 of 2

Date(s) Drilled	**04/10/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**50.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,320 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1808798 E 6603729**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3320	0					ALLUVIUM Medium dense, moist, light yellowish brown, silty medium to fine SAND (SM), with trace gravel			
3315	5		25-1	13					
3310	10		25-2	50/6"		Becomes very dense, light yellowish brown			
3305	15		25-3	25					
3300	20		25-4	28					
3295	25		25-5	30					
3290	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-25

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Figure A-26

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-25

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3290	30		25-6	52		Becomes very dense			
3285	35		25-7	74		OLDER ALLUVIUM Very dense, moist, light brown, clayey SAND (SC), with trace gravel			
3280	40		25-8	58					
3275	45		25-9	77					
3270	50		25-10	50/6"					
						Bottom of boring at 50.5 feet			
3265	55								
3260	60								
3255	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-25

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Figure A-26

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-26

Sheet 1 of 2

Date(s) Drilled	**04/11/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger Unimog Marl M5 All Terrain**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**50.4 feet**
Drilling Contractor	**Pacific Drilling**	Hammer Data	**140 lbs/30" drop**	Surface Elevation	**3,206 feet**
Groundwater Level	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Coordinates	**N 1,808,112.4 E 6,601,391.1**
Borehole Completion	**Soil cuttings/bentonite chips**				

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Well Detail	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3205	0					ALLUVIUM Loose, moist, light yellowish brown, silty medium to coarse SAND (SM), with fine gravel				Monitoring well constructed with above grade standpipe
						OLDER ALLUVIUM Hard, moist, pale brown, Sandy lean CLAY (CL)				
3200	5		26-1	53						CORR
3195	10		26-2	50/4"				10		
3190	15		26-3	50/5"						SA(57), CORR
3185	20		26-4	50/5"						
3180	25		26-5	50/5"				11		
	30									

Report: GEO_SOIL_WELL; File: 27667021.GPJ; 6/5/2008 B-26

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Figure A-27

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-26

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Well Detail	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
3175	30		26-6	50/6"						
3170	35		26-7	50/6"						SA(72), CORR
3165	40		26-8	50/6"				6		
3160	45		26-9	50/6"						
3155	50		26-10	50/5"		Bottom of boring at 50.4 feet				
3150	55									
3145	60									
	65									

Report: GEO_SOIL_WELL; File: 27667021.GPJ; 6/5/2008 B-26

URS

Figure A-27

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-27

Date(s) Drilled	**04/10/08**	Logged By	**A. Podwiltz**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**6 inch finger bit**	Total Depth of Borehole	**31.5 feet**
Drill Rig Type	**Unimog Marl M5 All Terrain**	Drilling Contractor	**Pacific Drilling**	Approximate Surface Elevation	**3,232 feet**
Water Level Depth (Feet)	**Not encountered**	Sampling Method(s)	**ModCal/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Soil cuttings/bentonite chips**	Location	**N 1807910 E 6601741**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Loose, moist, light yellowish brown, silty medium to coarse SAND (SM), with fine gravel			
3230			27-1	9					
	5		27-2	50/6"		OLDER ALLUVIUM Very dense, moist, light yellowish brown to pale brown, silty fine to medium SAND (SM), with fine gravel and carbonate			CORR
3225									
	10		27-3	50/6"		Very dense, moist, light yellowish brown to pale brown, clayey SAND (SC), with fine gravel and carbonate	4		
3220									
	15		27-4	50/6"					SA(39)
3215									
	20		27-5	50/6"		With trace clay			
3210									
	25		27-6	45		Becomes dense, light yellowish tan, no clay	5		CORR
3205									
	30								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-27

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Figure A-28

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Boring B-27

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		27-7	76					
3200						Bottom of boring at 31.5 feet			
	35								
3195									
	40								
3190									
	45								
3185									
	50								
3180									
	55								
3175									
	60								
3170									
	65								

Report: GEO_10_SNA; File: 27667021.GPJ; 6/5/2008 B-27

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Figure A-28

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 1

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7.8 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,230 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1809594 E 6601605**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3230	0				ALLUVIUM Loose to medium dense, moist, brown, silty medium to coarse SAND (SM), with gravel and trace cobbles		
			1				
3228							
					OLDER SEDIMENTARY ROCKS Very dense, moist, white, silty fine to coarse SAND (SM), with fine gravel		
3226							
	5						
3224							
			2				
			3				
3222					Bottom of test pit at 7.8 feet		
3220	10						
3218							
3216							
	15						
3214							
3212							
3210	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 1

URS

Figure A-29

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 2

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,235 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1809158 E 6601628**				

Elevation, feet	Depth, feet	Sample Type / Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
	0			ALLUVIUM		
3234		1		Loose to medium dense, moist, brown, silty medium to coarse SAND (SM), with gravel, trace cobbles, and carbonate beds		
3232		2				SA(25), R-Value
3230	5					
				Bottom of test pit at 6.0 feet		
3228						
3226						
	10					
3224						
3222						
3220	15					
3218						
3216						
	20					

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 2

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Figure A-30

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 3

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**8 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,245 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1808728 E 6602078**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
	0				ALLUVIUM		
3244			1		Loose to medium dense, moist, reddish brown, silty coarse to medium SAND (SM), with trace gravel		
					Loose to medium dense, moist, reddish brown with white dots (carbonate), silty coarse to medium to SAND (SM), with carbonate and trace clay		
3242			2				SA(13), R-Value
			3				
3240	5				OLDER ALLUVIUM		
			4		Dense to very dense, moist, light brown, silty fine SAND (SM), with trace gravel and carbonate		
3238							
					Bottom of test pit at 8.0 feet		
3236							
	10						
3234							
3232							
3230	15						
3228							
3226							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 3

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Figure A-31

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 4

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,228 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808566 E 6601785**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3228	0				OLDER SEDIMENTARY ROCKS Very dense, moist, light brownish white, silty fine to coarse SAND (SM), with gravel and carbonate		
3226							
		☒	1				
3224							
	5	☒	2				
3222					Bottom of test pit at 6.0 feet		
3220							
3218	10						
3216							
3214							
	15						
3212							
3210							
3208	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 4

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Figure A-32

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 5

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,230 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808300 E 6601760**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3230	0				ALLUVIUM Loose to medium dense, moist, brown, silty medium to coarse SAND (SM), with gravel and organics		
		☒	1				
3228					Loose to medium dense, moist, light brown, silty medium SAND (SM), with trace gravel, some organics, and carbonate		
		☒	2				
3226							
	5						
3224					OLDER ALLUVIUM Dense to very dense, moist, light brown to white, silty medium to fine SAND (SM), with trace coarse sand, fine gravel, and carbonate		
		☒	3				
					Bottom of test pit at 7.0 feet		
3222							
3220	10						
3218							
3216							
	15						
3214							
3212							
3210	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 5

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Figure A-33

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 6

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.2 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,251 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1807923 E 6602217**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
	0				ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium to coarse SAND (SM), with organics and trace gravel		
3250			1		OLDER ALLUVIUM Dense to very dense, moist, light brown to white, silty fine to coarse SAND (SM), with gravel, trace fine cobbles, and carbonate		
3248							
			2				SA(29), R-Value
3246	5		3				
					Bottom of test pit at 5.2 feet		
3244							
3242							
	10						
3240							
3238							
3236	15						
3234							
3232							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 6

URS

Figure A-34

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 7

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,285 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1807872 E 6602486**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3284	0				ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium to coarse SAND (SM), with gravel and trace cobbles		
3282			1				
3280	5				OLDER ALLUVIUM Dense to very dense, moist, light brown, silty fine to coarse SAND (SM), with gravel and carbonate		
3278			2				
					Bottom of test pit at 7.0 feet		
3276							
	10						
3274							
3272							
3270	15						
3268							
3266							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 7

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Figure A-35

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 8

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**4.5 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,247 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808223 E 6602022**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
	0				ALLUVIUM Loose to medium dense, moist, light brown, silty fine to medium SAND (SM)		
3246		X	1		OLDER ALLUVIUM Dense to very dense, moist, light brown to white, silty medium to fine SAND (SM), with coarse sand, fine gravel, and carbonate		
3244		X	2				
3242	5				Bottom of test pit at 4.5 feet		
3240							
3238							
	10						
3236							
3234							
3232	15						
3230							
3228							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 8

URS

Figure A-36

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP- 9

Date(s) Excavated	**04/15/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6.7 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,244 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1808557 E 6602106**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3244	0				ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium to coarse SAND (SM), with trace gravel and zone of poorly graded coarse SAND		
3242		X	1				
3240							
	5						
3238		X	2		OLDER ALLUVIUM Dense to very dense, moist, light brown, silty medium to coarse SAND (SM), with fine gravel, more cementation		SA(36) COMP, R-Value
		▩	3				
					Bottom of test pit at 6.7 feet		
3236							
3234	10						
3232							
3230							
	15						
3228							
3226							
3224	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP- 9

URS

Figure A-37

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-10

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**4 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,210 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808582 E 6601293**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3210	0				OLDER ALLUVIUM Dense to very dense, moist, light brownish white, silty medium to fine SAND (SM), with trace coarse SAND, organics, carbonate, and trace clay		
		☒	1				
3208					OLDER SEDIMENTARY ROCKS Very dense, moist, light brownish white, silty fine to coarse SAND (SM), with trace gravel and carbonate		
		☒	2				
3206					Bottom of test pit at 4.0 feet		
	5						
3204							
3202							
3200	10						
3198							
3196							
	15						
3194							
3192							
3190	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-10

URS

Figure A-38

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-11

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,215 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808372 E 6601370**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3214	0		1		ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium to coarse SAND (SM), with fine gravel		
					OLDER ALLUVIUM Dense to very dense, moist, light brownish white, silty medium to fine SAND (SM), with trace gravel and clay		
3212			2				
					Increase in carbonate		
3210	5		3				
			4				
3208					Bottom of test pit at 6.0 feet		
3206							
	10						
3204							
3202							
3200	15						
3198							
3196							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-11

URS

Figure A-39

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-12

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,231 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808076 E 6601483**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3230	0	☒	1		ALLUVIUM Loose to medium dense, moist, light brown, silty medium to fine SAND (SM), with trace gravel and organics		
3228		☒	2		OLDER ALLUVIUM Dense to very dense, moist, light brown, silty medium to coarse SAND (SM), with trace gravel and carbonate		
3226	5				OLDER SEDIMENTARY ROCKS Very dense, moist, light brownish white, silty fine to coarse SAND (SM), with trace gravel and some carbonate		
3224		☒	3		Bottom of test pit at 7.0 feet		
3222							
	10						
3220							
3218							
3216	15						
3214							
3212							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-12

URS

Figure A-40

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-13

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**10.1 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,210 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1807946 E 6601213**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3210	0				ALLUVIUM Loose to medium dense, moist, light brown, silty coarse to medium SAND (SM), with fine gravel		
3208							
3206							
	5		1				
3204					OLDER ALLUVIUM Dense to very dense, moist, light brownish red to white, silty fine SAND (SM), with trace gravel and carbonate		
			2				
3202			3				
3200	10				Dense to very dense, moist, light brownish white, silty fine SAND (SM), with trace gravel and carbonate		
			4		Bottom of test pit at 10.1 feet		
3198							
3196							
	15						
3194							
3192							
3190	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-13

URS

Figure A-41

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-14

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.2 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,226 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1807825 E 6601655**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3226	0						
		☒	1		ALLUVIUM Loose to medium dense, moist, reddish brown, silty fine to medium GRAVEL (GM), with sand and trace cobbles		
3224							
					OLDER ALLUVIUM Dense to very dense, moist, brown, silty medium to fine SAND (SM), with trace gravel		
3222		☒	2				
	5	☒	3				
					Bottom of test pit at 5.2 feet		
3220							
3218							
3216	10						
3214							
3212							
	15						
3210							
3208							
3206	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-14

URS

Figure A-42

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-15

Date(s) Excavated	**04/16/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**9.8 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,242 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1807532 E 6601807**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3242	0				ALLUVIUM Loose to medium dense, moist, brown, silty medium to coarse SAND (SM), with fine gravel		
			1				
3240					Becomes light brown		
			2				
3238							
	5						
3236							
3234							
			3				
3232	10				Bottom of test pit at 9.8 feet		
3230							
3228							
	15						
3226							
3224							
3222	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-15

URS

Figure A-43

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-16

Date(s) Excavated	04/16/08	Logged By	A. Podawiltz	Checked by	D. Rector
Length of Excavation	7 feet	Width of Excavation	2 feet	Depth of Excavation	6.5 feet
Excavation Equipment	Komatsu WB140	Excavation Contractor	SDCC	Approximate Surface Elevation	3,258 feet
Water Observations	Not encountered			Sampling Method(s)	Bulk (Bag)
Location	N 1807579 E 6602155				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3258	0				ALLUVIUM Loose to medium dense, moist, brown, silty medium to coarse SAND (SM), with gravel		
3256			1				
			2				
3254							
	5						
3252			3		OLDER ALLUVIUM Dense to very dense, moist, brown, silty medium to coarse SAND (SM), with gravel and carbonate		
					Bottom of test pit at 6.5 feet		
3250							
3248	10						
3246							
3244							
	15						
3242							
3240							
3238	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-16

URS

Figure A-44

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-17

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.9 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,287 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808657 E 6602767**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3286	0		1		ALLUVIUM Loose to medium dense, moist, brown, silty medium to coarse SAND (SM)		
			2		With trace carbonate		
3284					OLDER SEDIMENTARY ROCKS Very dense, moist, light brownish white, silty medium to coarse SAND (SM), with carbonate		
3282	5		3				
			4				
					Bottom of test pit at 5.9 feet		
3280							
3278							
	10						
3276							
3274							
3272	15						
3270							
3268							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-17

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Figure A-45

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-18

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**4.8 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,293 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808720 E 6603132**				

Elevation, feet	Depth, feet	Sample Type / Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
	0			OLDER SEDIMENTARY ROCKS		
3292		1		Very dense, moist, light brown, silty medium to fine SAND (SM), with trace gravel		
3290		2				
3288	5			Bottom of test pit at 4.8 feet		
3286						
3284						
	10					
3282						
3280						
3278	15					
3276						
3274						
	20					

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-18

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Figure A-46

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-19

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**10 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,303 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1808203 E 6603000**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3302	0				ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium to coarse SAND (SM), with trace gravel		
			1				
3300					Becomes light brown		
3298	5						
			2				
3296							
3294			3				WA(12), COMP, R-Value
			4		Loose to medium dense, moist, light reddish brown, well graded medium to coarse SAND (SW) with fine gravel		
	10				Bottom of test pit at 10.0 feet		
3292							
3290							
3288	15						
3286							
3284							
	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-19

URS

Figure A-47

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-20

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,284 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag)**
Location	**N 1808075 E 6602451**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3284	0	☒	1		ALLUVIUM Loose to medium dense, moist, brown, silty medium to fine SAND (SM), with trace gravel		
		☒	2		Loose to medium dense, moist, light reddish brown, well graded medium to coarse SAND (SW)		
3282					OLDER ALLUVIUM Dense to very dense, moist, light yellowish brown, silty medium to fine SAND (SM), with carbonate		
3280		☒	3				
	5						
3278							
					Bottom of test pit at 7.0 feet		
3276							
3274	10						
3272							
3270							
	15						
3268							
3266							
3264	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-20

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Figure A-48

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-21

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**13 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,328 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1807661 E 6603095**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3328	0				ALLUVIUM Loose to medium dense, moist, brown, silty medium SAND (SM)		
			1		With trace gravel		
3326			2				
3324			3				
	5						
3322			4				
3320							
3318	10		5		Becomes light brown		
			6				
3316							
					Bottom of test pit at 13.0 feet		
3314							
	15						
3312							
3310							
3308	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-21

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Figure A-49

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-22

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6.5 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,316 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1807986 E 6603028**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3316	0				ALLUVIUM Loose to medium dense, moist, reddish brown, silty medium SAND (SM)		
			1				
3314							
3312			2				
	5		3				
3310							
					Bottom of test pit at 6.5 feet		
3308							
3306	10						
3304							
3302							
	15						
3300							
3298							
3296	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-22

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Figure A-50

Project: East County Substation
Project Location: Jacumba, California
Project Number: 27667021.00030

Log of Test Pit TP-23

Date(s) Excavated	**04/17/08**	Logged By	**A. Podawiltz**	Checked by	**D. Rector**
Length of Excavation	**7 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**10 feet**
Excavation Equipment	**Komatsu WB140**	Excavation Contractor	**SDCC**	Approximate Surface Elevation	**3,340 feet**
Water Observations	**Not encountered**			Sampling Method(s)	**Bulk (Bag/Bucket)**
Location	**N 1808472 E 6603898**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3340	0				ALLUVIUM Loose to medium dense, moist, light brown, silty medium to coarse SAND (SM), with trace gravel		
			1				
3338			2				
					Loose to medium dense, moist, light brown, well graded coarse SAND (SW), with some coarse gravel		
3336			3				
	5		4				
3334					Becomes loose		
3332							
			5				
3330	10				Bottom of test pit at 10.0 feet		
3328							
3326							
	15						
3324							
3322							
3320	20						

Report: GEO_5D_TEST_PIT; File: 27667021.GPJ; 6/5/2008 TP-23

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Figure A-51

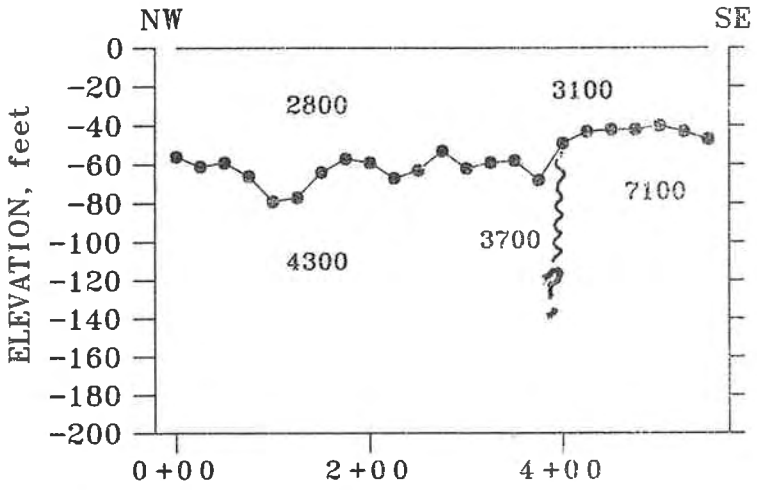
Geophysical measurements were obtained along six seismic refraction profiles (designated RS08-1 through RS08-6) during the week ending March 24, 2008, as shown on Figure 2. The seismic refraction traverses were completed by Mr. Ronald Mees, a URS California Registered geophysicist. Profiles RS08-1 and RS08-3 were run across potential bedrock irregularities. Profile RS08-6 was run near the deepest cut at the southeast corner of the original location of the west substation pad. The remaining three profiles were run near the deepest cuts on the eastern side of the original location of the east substation pad. Profile RS08-2 is 1650 feet long and the remaining profiles are 550 feet long.

The seismic refraction technique is based on the measurement of the time required for a shockwave to travel from a sourcepoint (shotpoint) to one or more co-linear sensors (geophones). Measurements were obtained using a Geometrics S24 seismograph with 24 geophones. The source consisted of multiple sledgehammer blows to a groundplate or rock. Geophones were spaced at 25 foot intervals. Shotpoints were nominally placed at the center of each line segment, at each end, and typically offset 200 feet to 500 feet beyond each end. The primary constraint on data quality was wind noise and electrical noise.

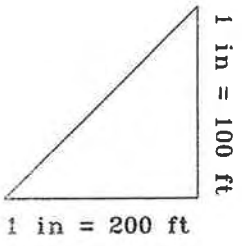
The seismic travel times were plotted on time-distance graphs and interpreted using time-term methods (the generalized reciprocal method with the XY parameter set to zero). The resulting models represent the rock and soils depths and velocities which would account for the measured travel times. The models are non-unique but appear to be the most reasonable solutions based on the known geology. Basic assumptions inherent in this geophysical method include the expectation that velocity increases downward, that layers are relatively continuous and thick enough to be individually resolved, and that significant velocity differences are present between the layers of interest. The generally accepted value for depth accuracy is 20%.

Figures B-1 through B-6 show the interpreted velocity profiles. Figures B-7 through B-22 show the data plots and interpretative process. Four seismic layers are generally evident. The surface layer typically consists of 3 feet to 15 feet of loose surficial soils with an estimated average velocity of 1,100 feet per second (fps). This first layer is not shown on the profiles, as it is poorly controlled and primarily used for internal data consistency. The second seismic layer consists of the upper younger alluvial soils, typically 30 feet to 70 feet thick, with a velocity range of 2,100 fps to 3,200 fps. The third seismic layer consists of older alluvium with a velocity range of 3,300 fps to 4,400 fps. The fourth seismic layer is bedrock, with a velocity range of 5,000 fps to 7,100 fps, which is over 100 feet deep under the proposed pad elevations, but was found to be as shallow as 40 feet under some areas outside the excavation areas.

The velocities of the two alluvial soils layers are so close, that they appear to grade into one another in some instances, both vertically and horizontally. This condition suggests that the alluvium consists of discontinuous lenses of differing materials. This condition also means that the basic seismic interpretation assumptions are being violated to some degree, and that individual calculated depths between the two alluvial units should be viewed with caution. An additional effect is that the two layers may not show up individually when directly underlain by shallow bedrock, due to one layer masking the other. These potential concerns do not, however, change the overall trends shown for the bedrock, nor the conclusion that shallow bedrock is not present along the seismic profiles obtained in the excavation areas.

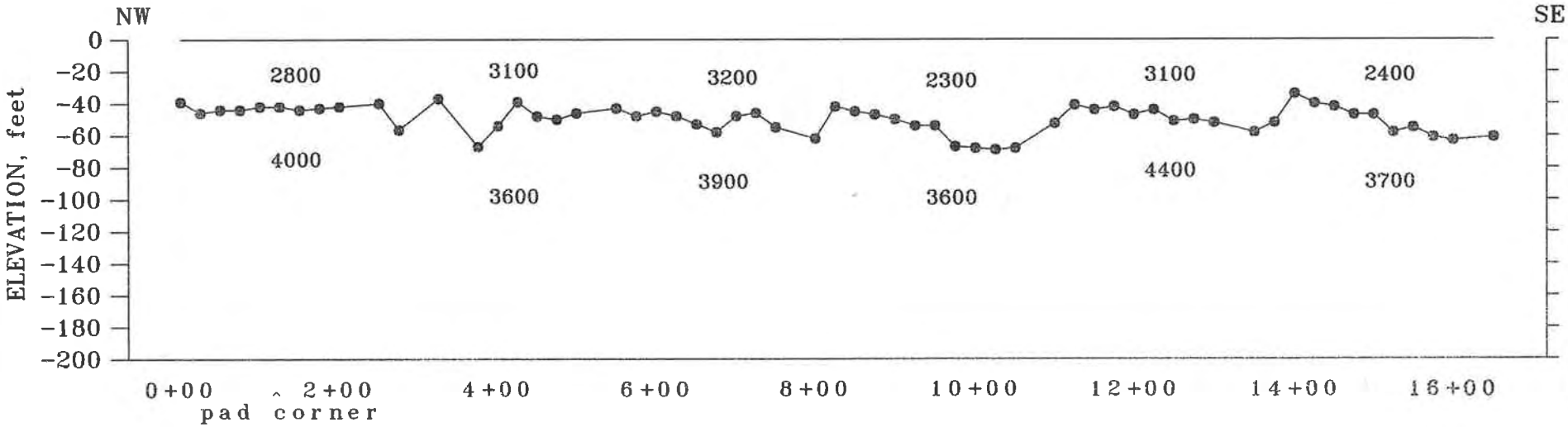


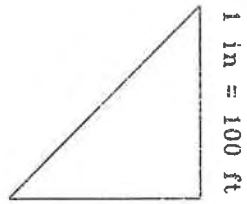
P-wave velocities in feet per second



RS08-1

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-1

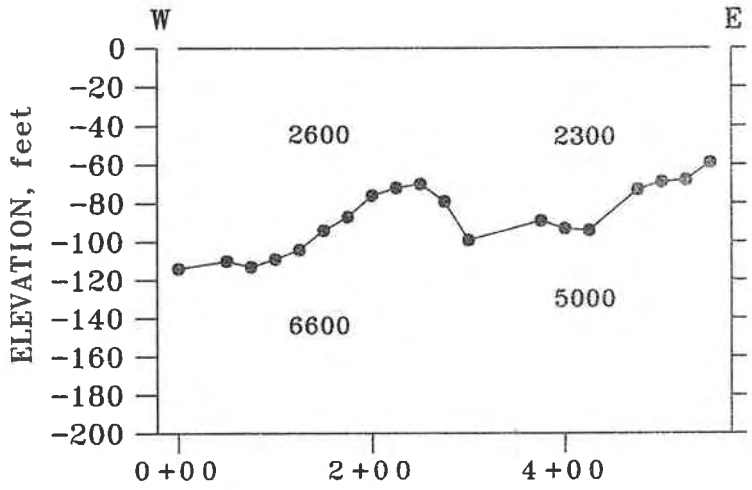


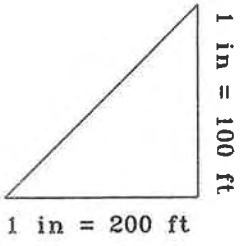


P-wave velocities in feet per second

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-2

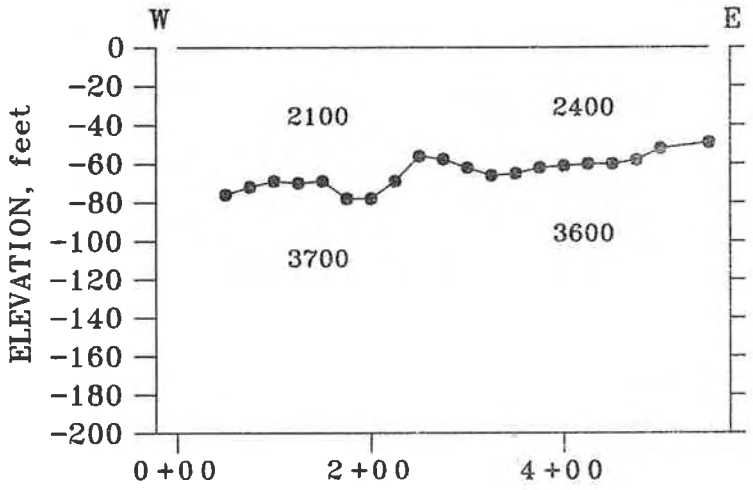


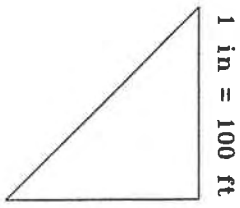


P-wave velocities in feet per second

RS08-3

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-3

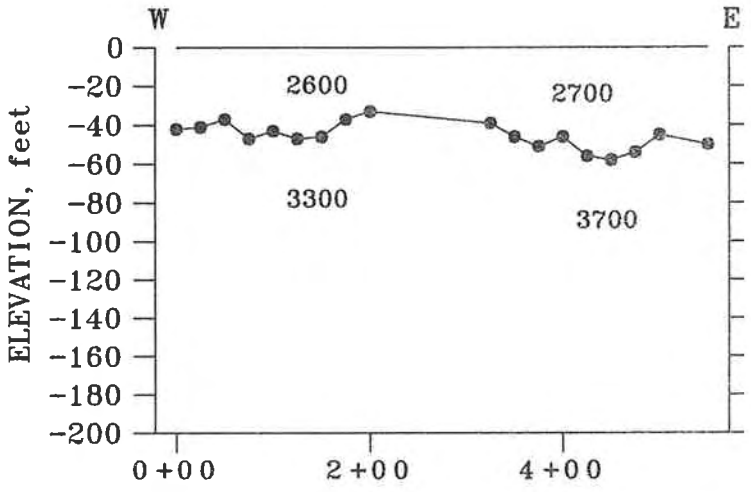




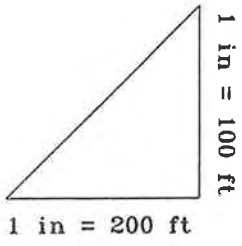
P-wave velocities in feet per second

RS08-4

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-4

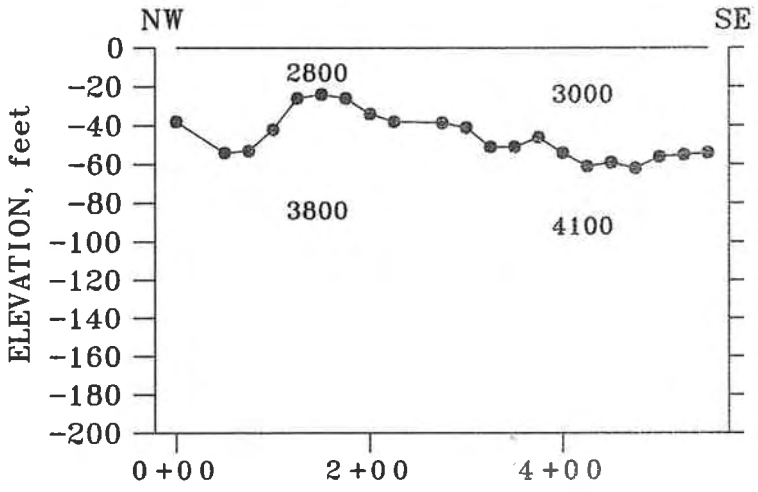


P-wave velocities in feet per second

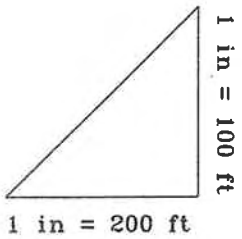


RS08-5

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-5

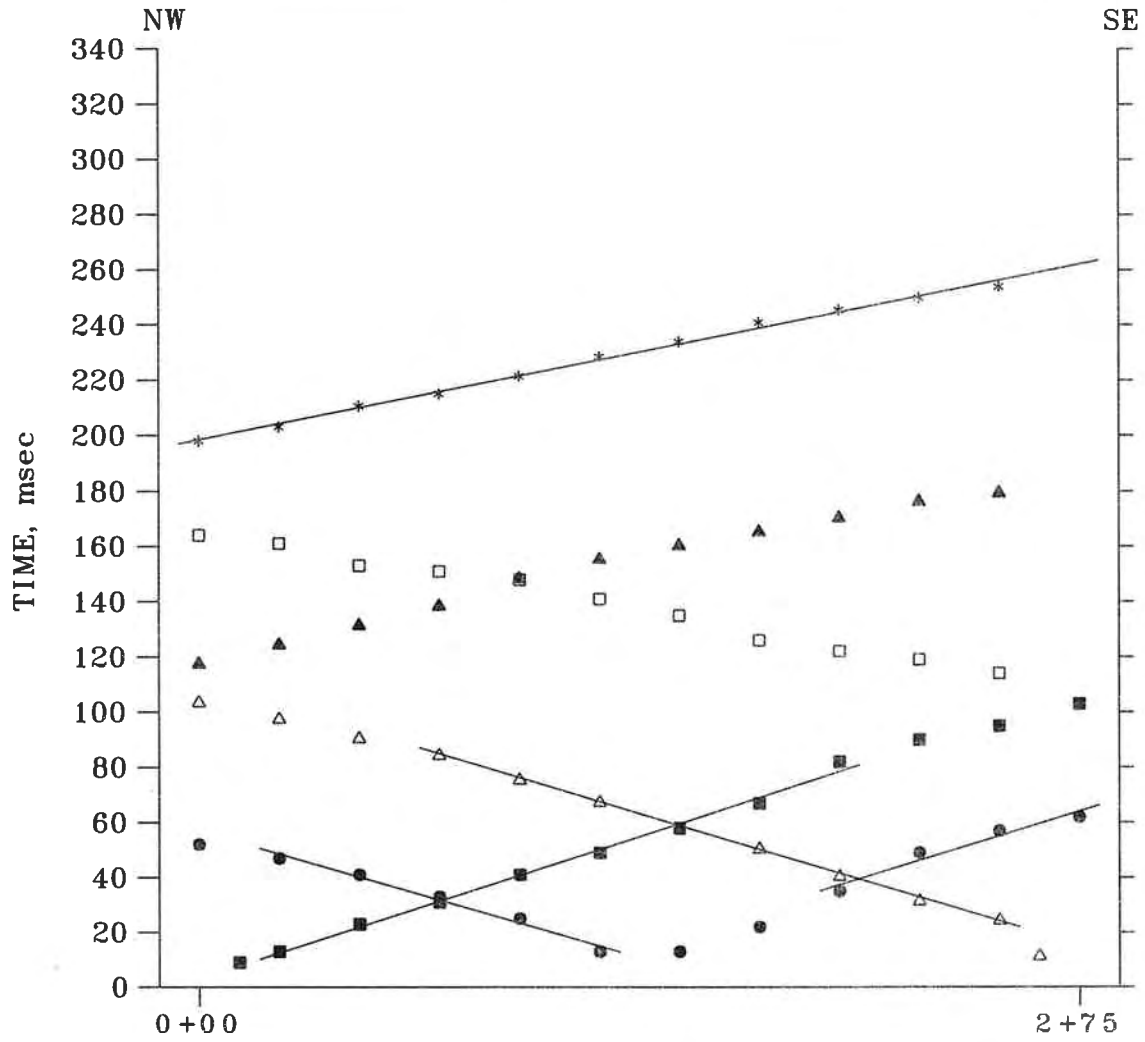


P-wave velocities in feet per second



RS08-6

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-6



Geophone spacing = 25 ft

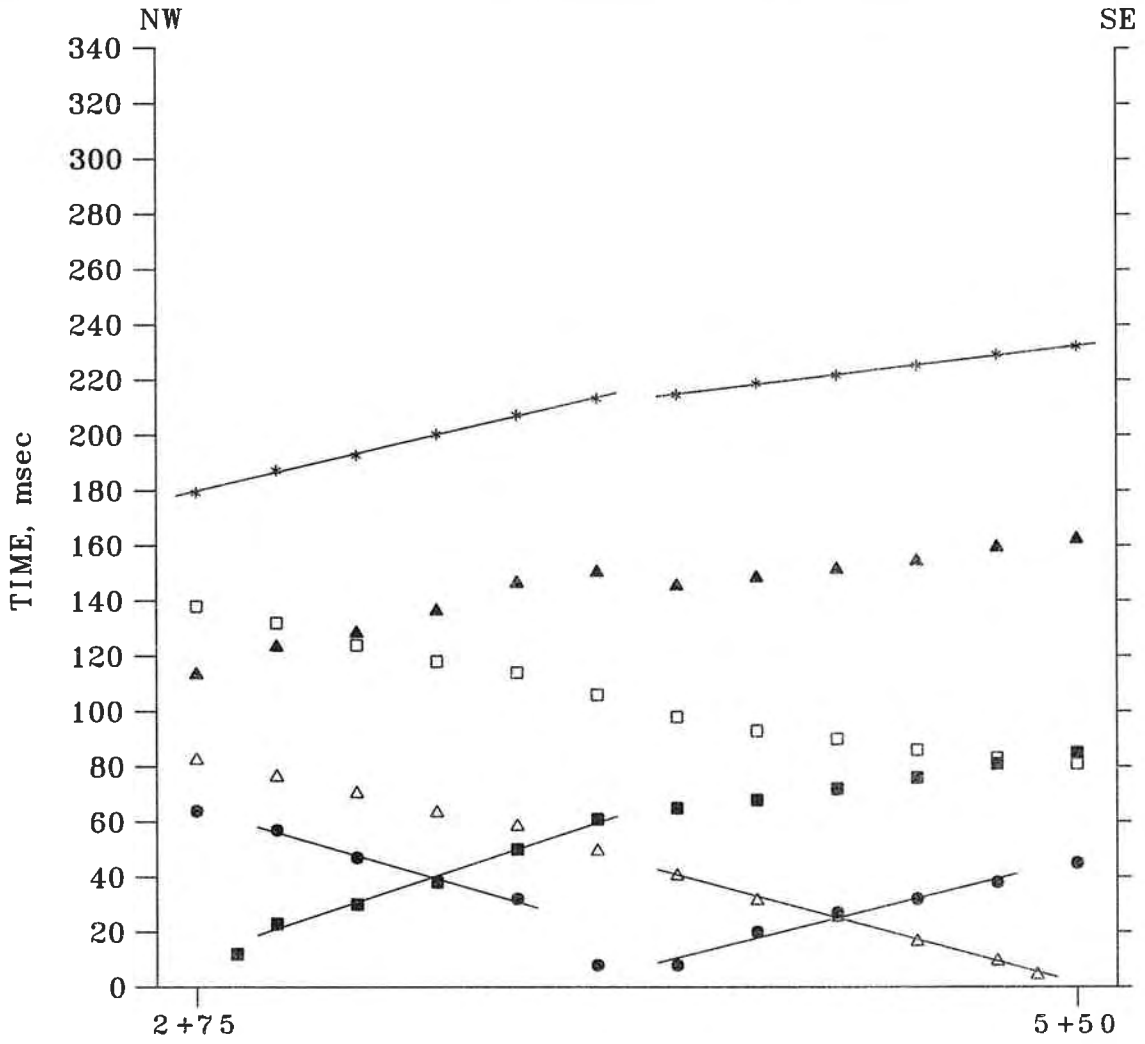
Arrival Time, msec												
▲	118	125	132	139	149	156	161	166	171	177	180	
■	9	13	23	31	41	49	58	67	82	90	95	103
●	52	47	41	33	25	13	13	22	35	49	57	62
△	104	98	91	85	76	68		51	41	32	25	12
□	164	161	153	151	148	141	135	126	122	119	114	

t_{ab} = 104 msec; XY = 0

t_a =	33	40	47	54	64	71	76	81	86	92	95	103	
t_b =	104	101	93	91	88	81	75	66	62	59	54		
* ½△t =	-35½	-30½	-23	-18½	-12	-5	0½	7½	12	16½	20½		
t_g =	16½	18½	18	20½	24	24	23½	21½	22	23½	22½		
t_c =	2	3	3	4	4	5	8	8	8	8	8	8	
z_0 =	2	3	3	4	4	5	8	8	8	8	8		ft
z_1 =	56	61	59	66	79	77	64	57	59	67	63		ft
v_0 =						1000							fps
v_1 =		2650			2980			2810			2880		fps
v_2 =						4310							fps

RS08-1

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-7



Geophone spacing = 25 ft

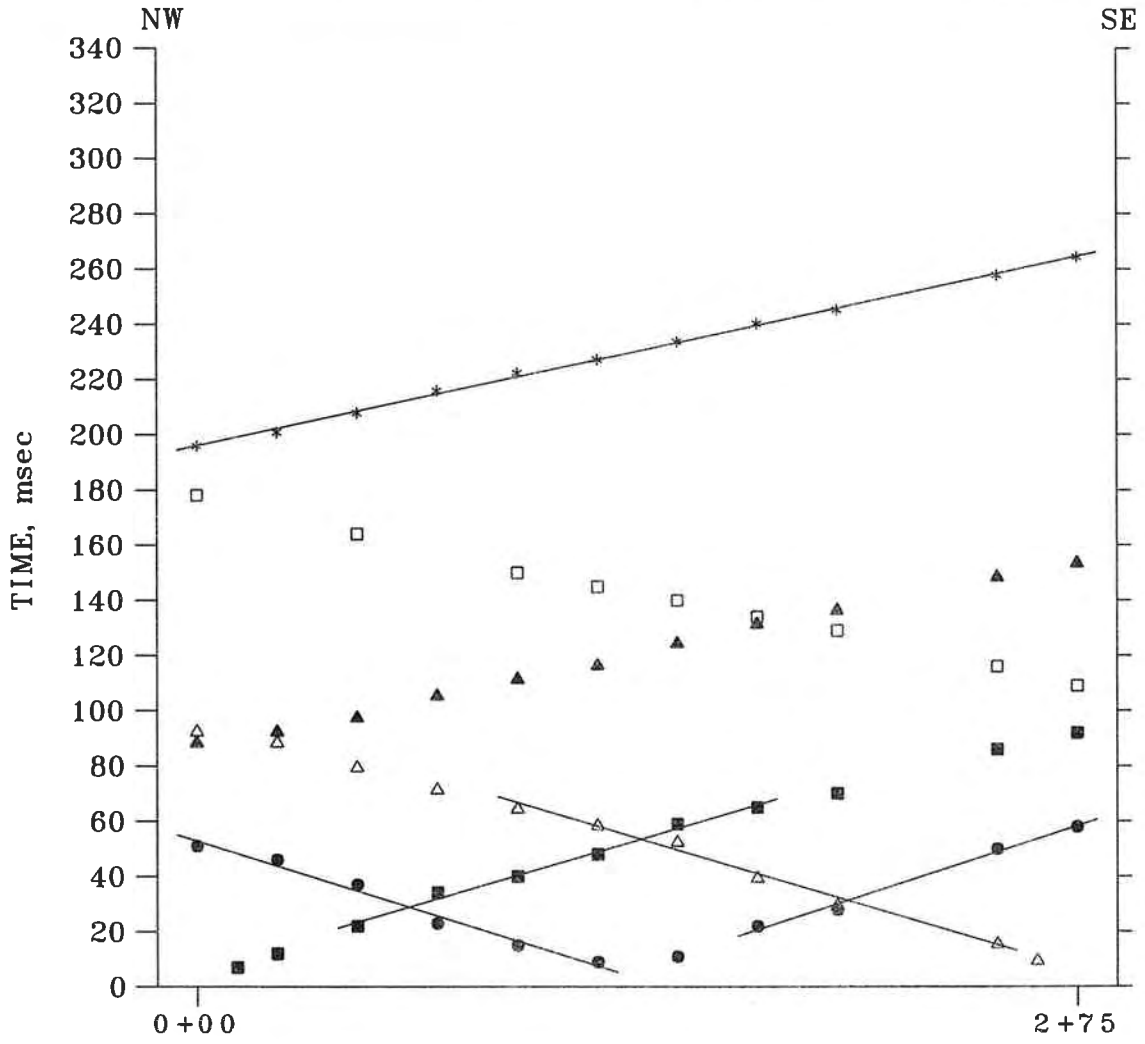
Arrival Time, msec													
▲	114	124	129	137	147	151	146	149	152	155	160	163	
■	12	23	30	38	50	61	65	68	72	76	81	85	
●	64	57	47	38	32	8	8	20	27	32	38	45	
△	83	77	71	64	59	50	41	32	26	17	10	5	
□	138	132	124	118	114	106	98	93	90	86	83	81	

t_{ab}= 84 msec; XY = 0

t_a=	35	45	50	58	68	72	67	70	73	76	81	85	
t_b=	83	77	71	64	60	52	44	39	36	32	29	27	
* ½△t=	-24	-16	-10½	-3	4	10	11½	15½	18½	22	26	29	
t_g=	17	19	18½	19	22	20	13½	12½	12½	12	13	14	
t_c=	6	6	6	7	8	9	3	2	2	2	2	1	
z_0=	6	6	6	7	8	9	3	2	2	2	2	1	ft
z_1=	53	62	59	58	68	49	43	42	42	40	43	47	ft
v_0=						1000							fps
v_1=		2600			2980			3470			3190		fps
v_2=				3680				7140					fps

RS08-1

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-8



Geophone spacing = 25 ft

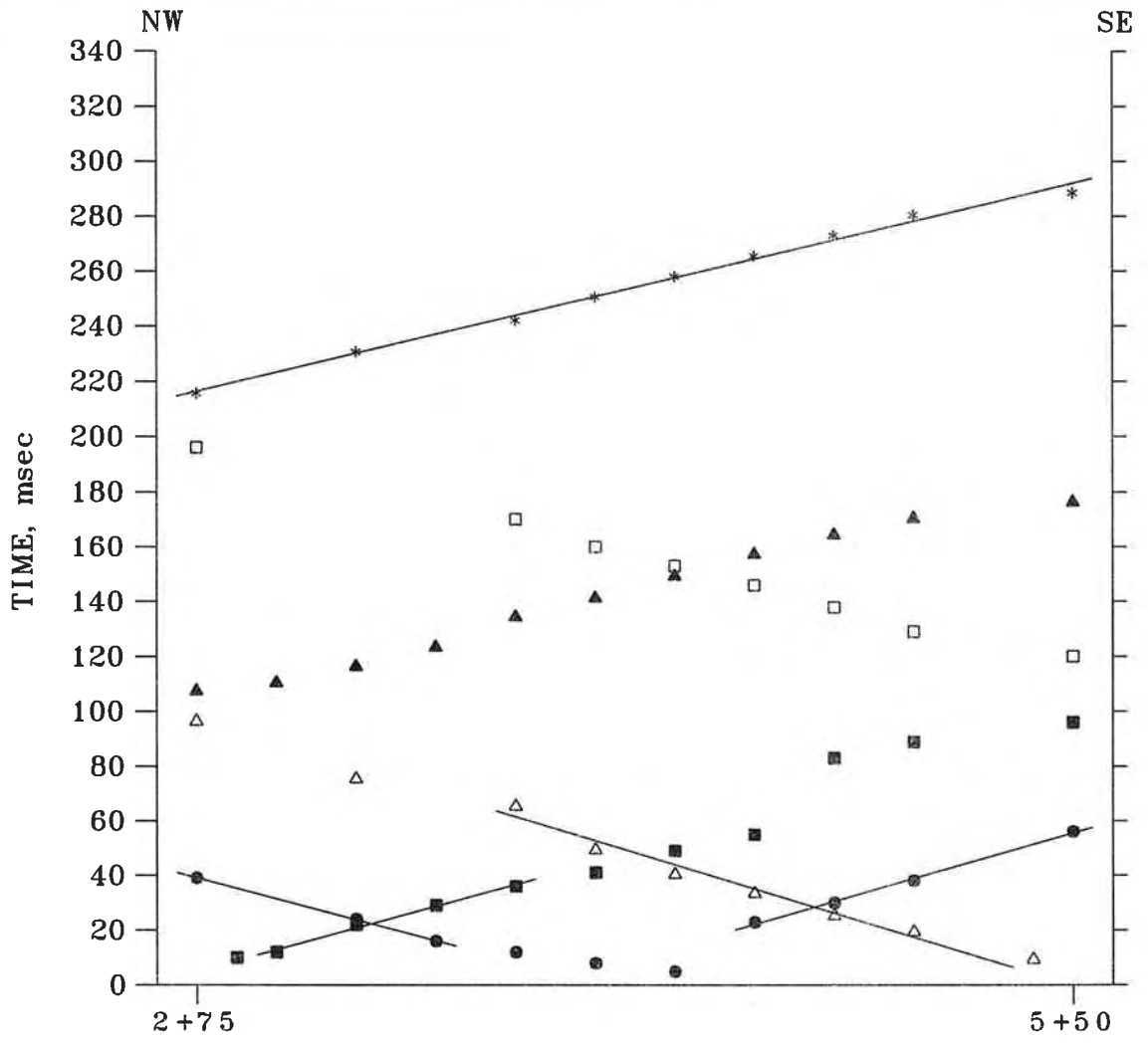
Arrival Time, msec												
▲	89	93	98	106	112	117	125	132	137	149	154	
■	7	12	22	34	40	48	59	65	70	86	92	
●	51	46	37	23	15	9	11	22	28	50	58	
△	93	89	80	72	65	59	53	40	30	16	10	
□	178		164		150	145	140	134	129	116	109	

t_{ab}= 92 msec; XY = 0

t_a=	24	30	35	43	49	54	62	69	74	86	92		
t_b=	93	89	80	72	65	60	55	49	44	31	24		
* ½Δt=	-34½	-29½	-22½	-14½	-8	-3	3½	10	15	27½	34		
t_g=	12½	13½	11½	11½	11	11	12½	13	13	12½	12		
t_c=	3	2	1	1	1	1	3	3	3	3	3	3	
z_0=	3	2	1	1	1	1	3	3	3	3	3		ft
z_1=	39	46	44	44	42	42	44	43	42	40	35		ft
v_0=						1000							fps
v_1=		2940			2760			2660		2910			fps
v_2=						4010							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-9



Geophone spacing = 25 ft

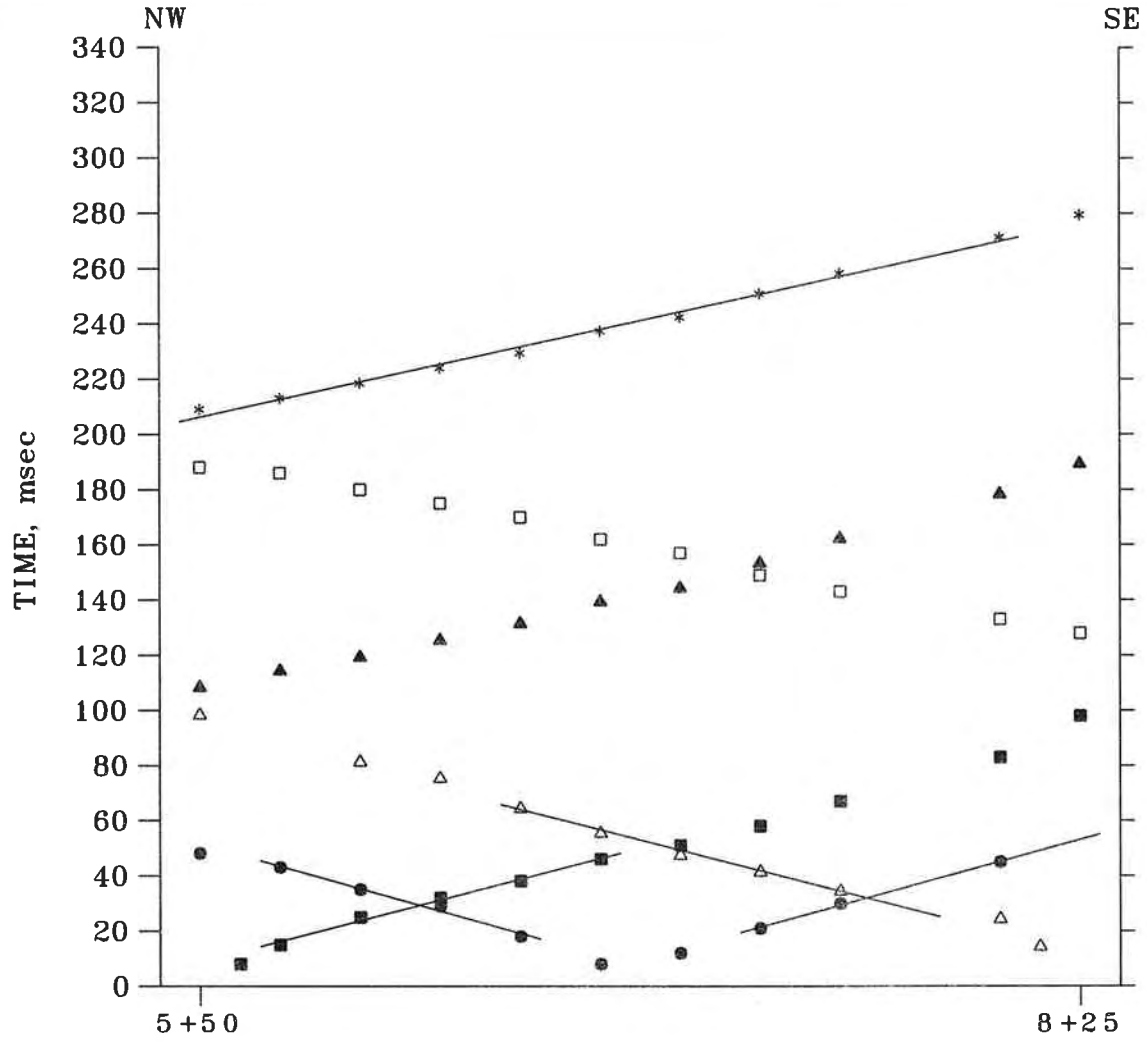
Arrival Time, msec												
▲	108	111	117	124	135	142	150	158	165	171		177
■	10	12	22	29	36	41	49	55	83	89		96
●	39		24	16	12	8	5	23	30	38		56
△	97		76		66	50	41	34	26	20		10
□	196				170	160	153	146	138	129		120

t_{ab}= 97 msec; XY = 0

t_a=	26	29	35	42	53	60	68	76	83	89		96	
t_b=	97		76		71	61	54	47	39	30		21	
* ½Δt=	−35½		−20½		−9	−0½	7	14½	22	29½		37½	
t_g=	13		7		13½	12	12½	13	12½	11		10	
t_c=	3	2	2	1	1	0	5	4	3	2	1	0	
z_0=	3		2		1	0	5	4	3	2		0	ft
z_1=	78		37		67	54	39	48	50	46		54	ft
v_0=						1000							fps
v_1=		3160			3270			3010		2830			fps
v_2=						3630							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-10



Geophone spacing = 25 ft

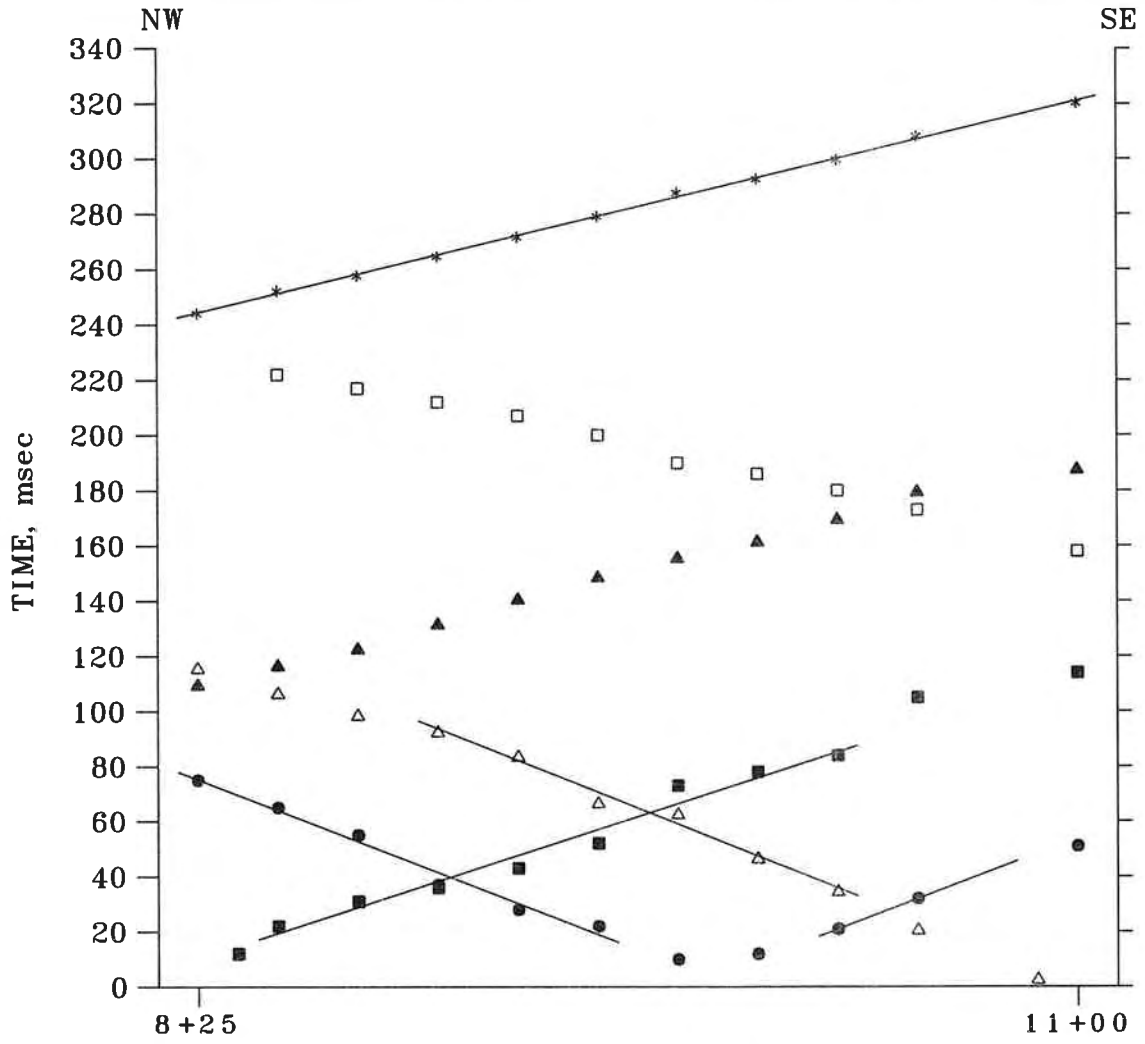
Arrival Time, msec													
▲	109	115	120	126	132	140	145	154	163		179	190	
■	8	15	25	32	38	46	51	58	67		83	98	
●	48	43	35	29	18	8	12	21	30		45		
△	99		82	76	65	56	48	42	35		25	15	
□	188	186	180	175	170	162	157	149	143		133	128	

t_{ab}= 98 msec; XY = 0

t_a=	17	23	28	34	40	48	53	62	71		87	98	
t_b=	99	97	91	86	81	73	68	60	54		44	39	
* ½△t=	-41	-37	-31½	-26	-20½	-12½	-7½	1	8½		21½	29½	
t_g=	9	11	10½	11	11½	11½	11½	12	13½		16½	19½	
t_c=	4	3	3	3	3	3	5	5	5	6	6	6	
z_0=	4	3	3	3	3	3	5	5	5		6		ft
z_1=	32	48	45	48	53	58	48	46	55		62		ft
v_0=						1000							fps
v_1=		3330			3090			3150			3380		fps
v_2=						3920							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-11



Geophone spacing = 25 ft

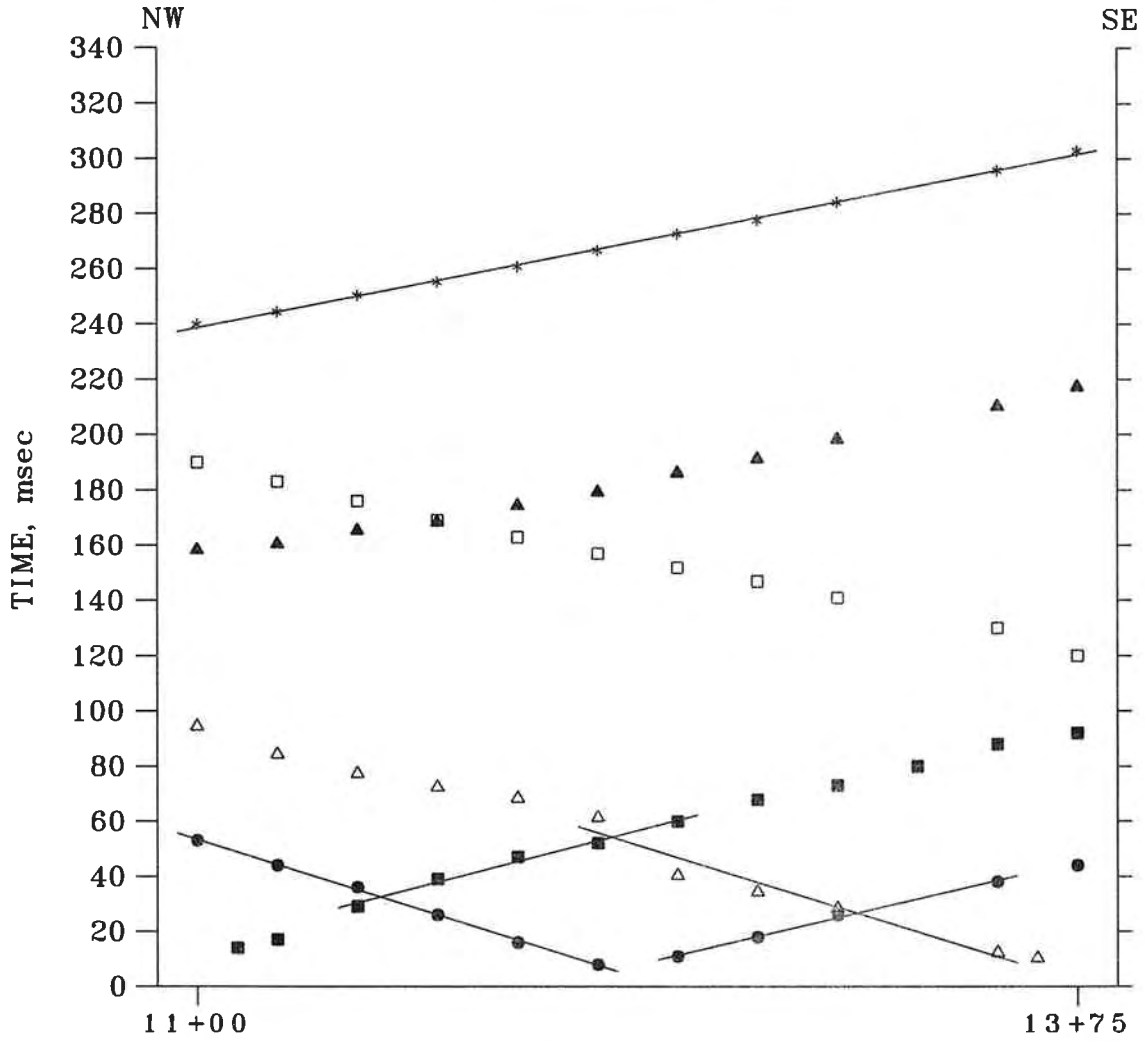
Arrival Time, msec												
▲	110	117	123	132	141	149	156	162	170	180	188	
■	12	22	31	36	43	52	73	78	84	105	114	
●	75	65	55	37	28	22	10	12	21	32	51	
△	116	107	99	93	84	67	63	47	35	21	3	
□		222	217	212	207	200	190	186	180	173	158	

t_{ab} = 115 msec; XY = 0

t_a =	35	42	48	57	66	74	81	87	95	105	114		
t_b =	116	107	102	97	92	85	75	71	65	58	43		
* ½Δt =	-40½	-32½	-27	-20	-13	-5½	3	8	15	23½	35½		
t_g =	18	17	17½	19½	21½	22	20½	21½	22½	24	21		
t_c =	5	5	5	5	6	7	0	1	1	1	1	1	
z_0 =	5	5	5	5	6	7	0	1	1	1	1		ft
z_1 =	42	45	47	50	54	54	67	68	69	68	60		ft
v_0 =						1000							fps
v_1 =		2660			2220			2270		2160			fps
v_2 =						3590							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-12



Geophone spacing = 25 ft

Arrival Time, msec												
▲	159	161	166	169	175	180	187	192	199		211	218
■	14	17	29	39	47	52	60	68	73	80	88	92
●	53	44	36	26	16	8	11	18	26		38	44
△	95	85	78	73	69	62	41	35	29		13	11
□	190	183	176	169	163	157	152	147	141		130	120

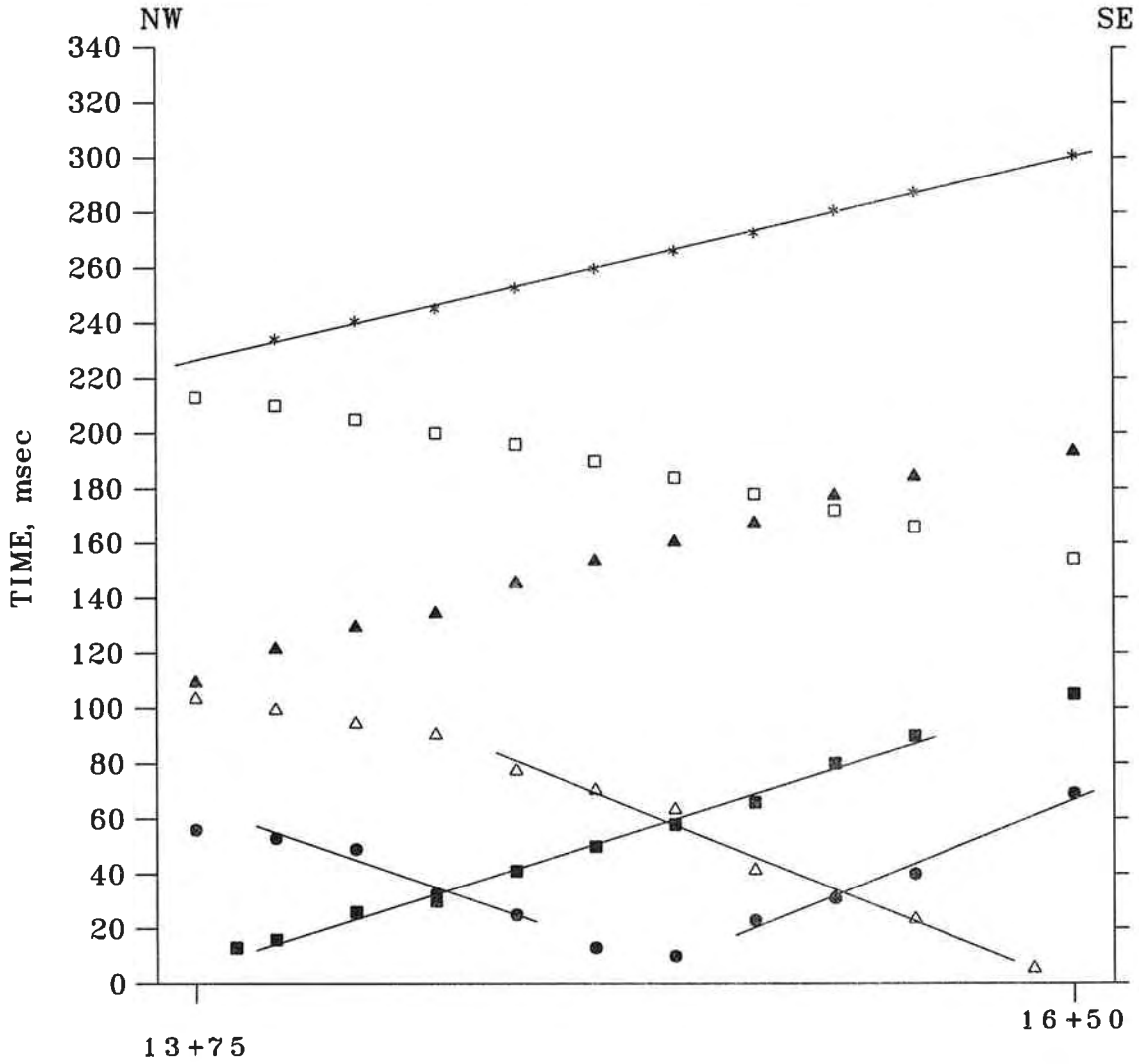
t_{ab} = 94 msec; XY = 0

t_a=	36	38	43	46	52	57	64	69	76		88	92
t_b=	95	88	81	74	69	62	57	52	46		35	25
* ½△t=	-29½	-25	-19	-14	-8½	-2½	3½	8½	15		26½	33½
t_g=	18½	16	15	13	13½	12½	13½	13½	14		14½	11½
t_c=	8	6	6	4	3	2	4	4	4	3	3	1

z_0=	8	6	6	4	3	2	4	4	4		3	1	ft
z_1=	45	41	44	42	47	44	51	50	52		58	52	ft
v_0=						1000							fps
v_1=			3330			2740			3690		2780		fps
v_2=						4370							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-13



Geophone spacing = 25 ft

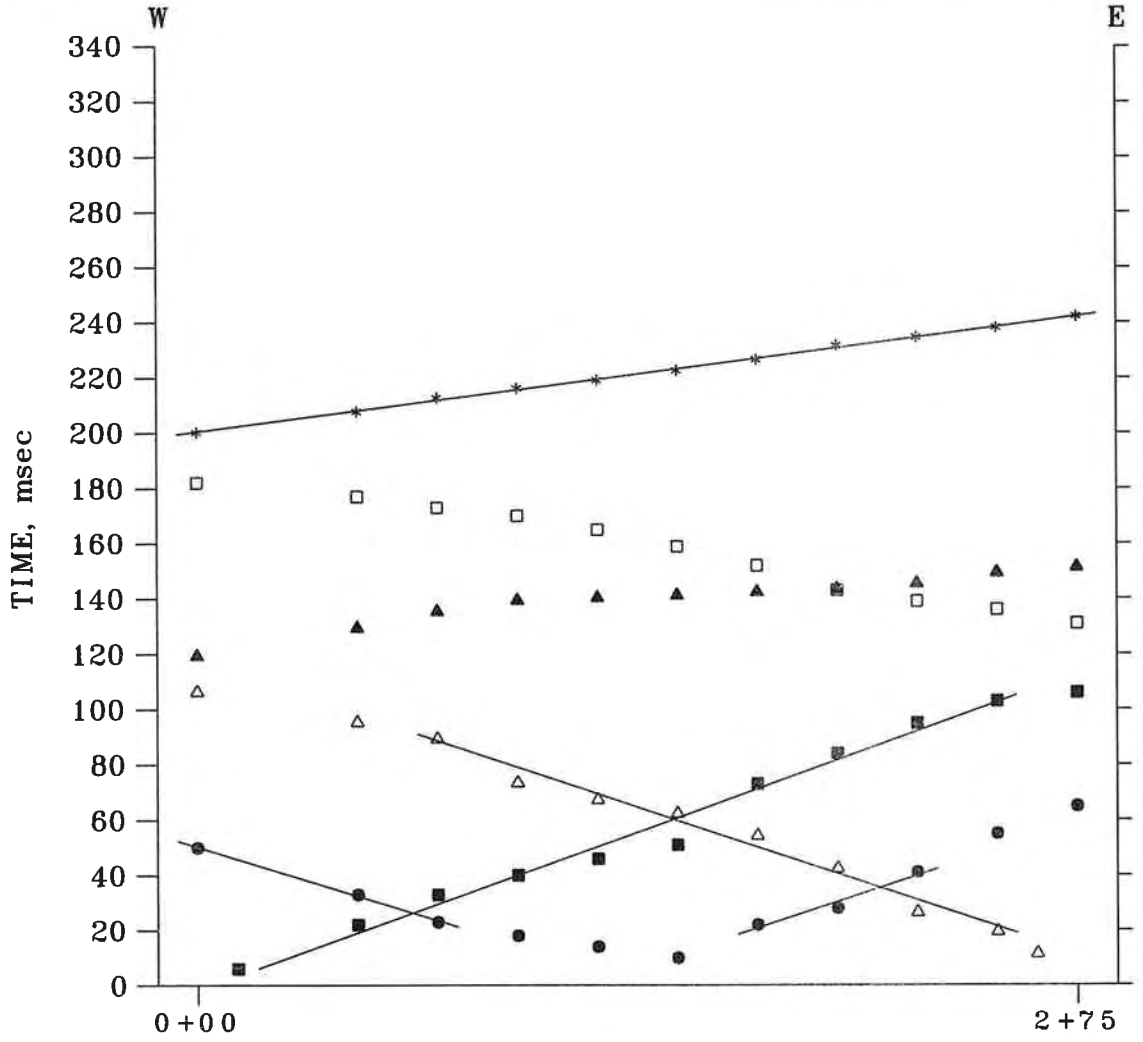
Arrival Time, msec												
▲	110	122	130	135	146	154	161	168	178	185		194
■	13	16	26	30	41	50	58	66	80	90		105
●	56	53	49	33	25	13	10	23	31	40		69
△	104	100	95	91	78	71	64	42	32	24		6
□	213	210	205	200	196	190	184	178	172	166		154

t_{ab} = 104 msec; XY = 0

t_a =		27	35	40	51	59	66	73	83	90		105	
t_b =	104	100	95	91	87	81	75	69	63	57		45	
* $\frac{1}{2}\Delta t$ =		-36½	-30	-25½	-18	-11	-4½	2	10	16½		30	
t_g =		11½	13	13½	17	18	18½	19	21	21½		23	
t_c =	3	3	3	3	4	5	1	1	1	1	1	0	
z_0 =		3	3	3	4	5	1	1	1	1		0	ft
z_1 =		34	40	42	47	47	58	55	61	63		61	ft
v_0 =						1000							fps
v_1 =		2740			2500			2150			2140		fps
v_2 =						3720							fps

RS08-2

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-14



Geophone spacing = 25 ft

Arrival Time, msec												
▲	120		130	136	140	141	142	143	144	146	150	152
■	6		22	33	40	46	51	73	84	95	103	106
●	50		33	23	18	14	10	22	28	41	55	65
△	107		96	90	74	68	63	55	43	27	20	12
□	182		177	173	170	165	159	152	143	139	136	131

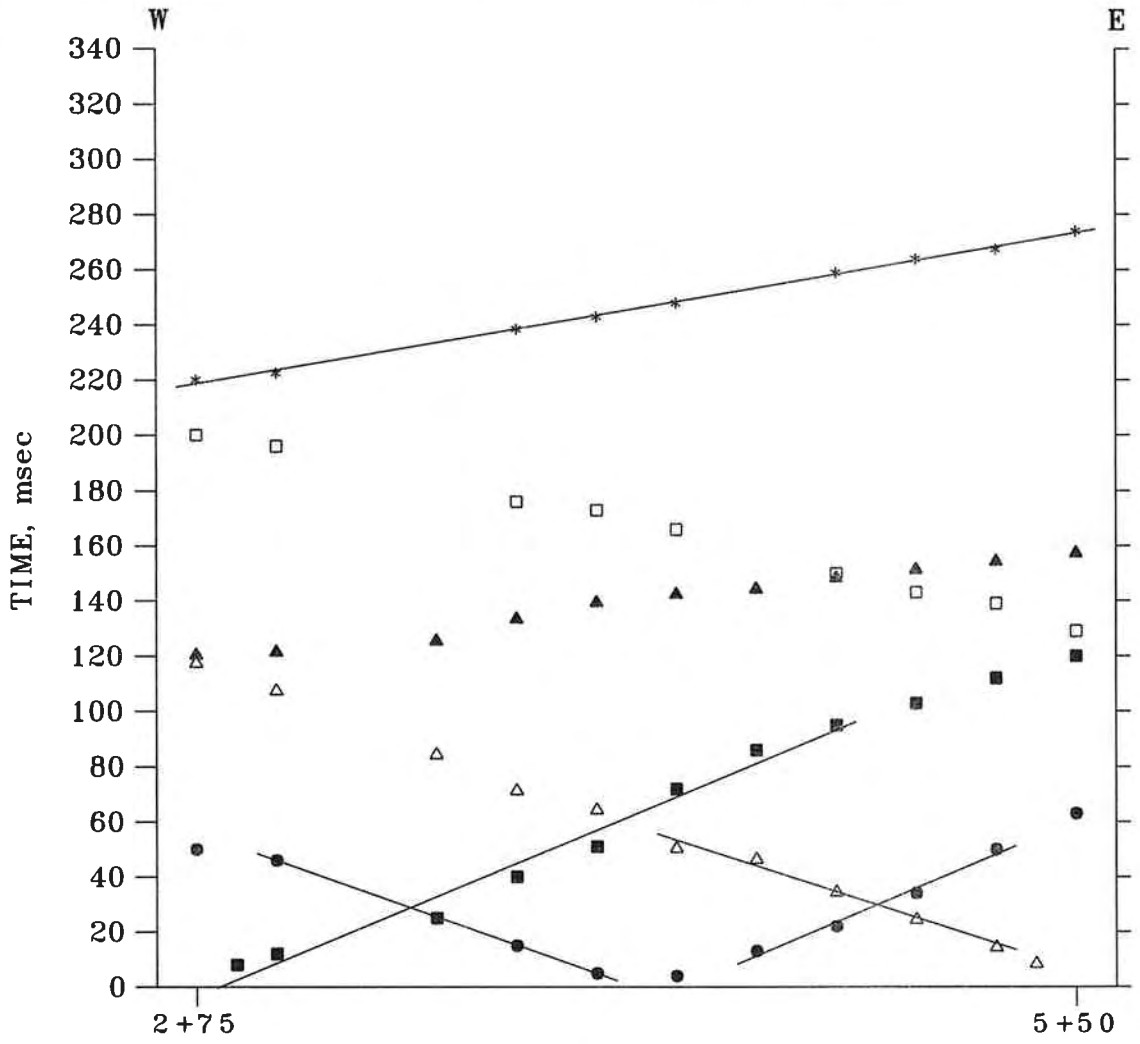
t_{ab}= 106 msec; XY = 0

t_a=	73		83	89	93	94	95	96	97	99	103	106
t_b=	107		102	98	95	90	84	77	68	64	61	56
* ½△t=	-17		-9½	-4½	-1	2	5½	9½	14½	17½	21	25
t_g=	37		39½	40½	41	39	36½	33½	29½	28½	29	28
t_c=	0	1	1	1	1	1	3	3	3	4	5	6

z_0=	0		1	1	1	1	3	3	3	4	5	6 ft
z_1=	114		110	113	109	104	94	87	76	72	70	65 ft
v_0=						1000						fps
v_1=		2400			2800			2630			2600	fps
v_2=						6580						fps

RS08-3

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-15



Geophone spacing = 25 ft

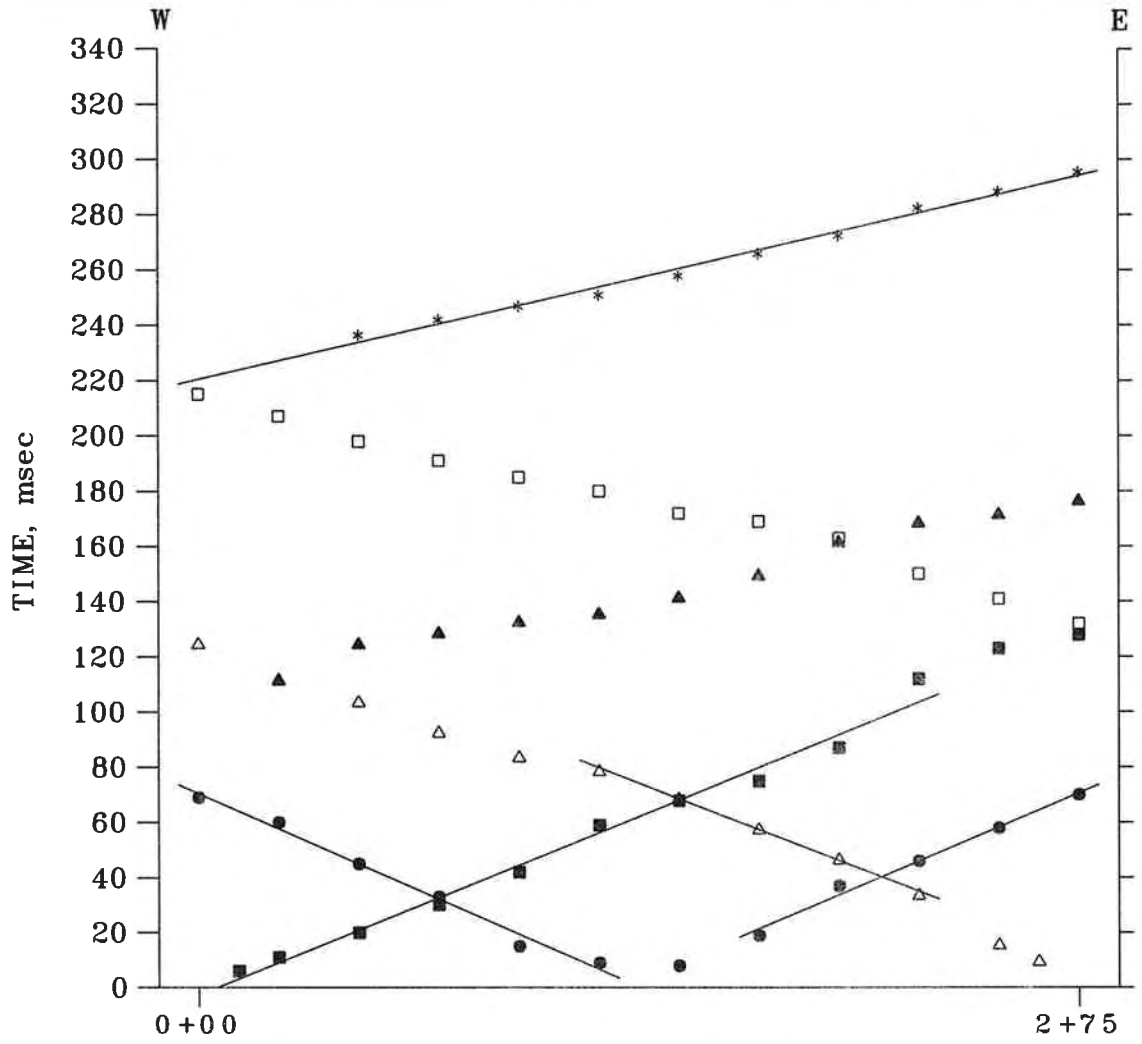
Arrival Time, msec												
▲	121	122		126	134	140	143	145	149	152	155	158
■	8	12		25	40	51	72	86	95	103	112	120
●	50	46			15	5	4	13	22	34	50	63
△	118	108		85	72	65	51	47	35	25	15	9
□	200	196			176	173	166		150	143	139	129

t_{ab}= 119 msec; XY = 0

t_a=	83	84		88	96	102	105	107	111	114	117	120	
t_b=	118	114			94	91	84		68	61	57	47	
* ½△t=	−17½	−15			1	5½	10½		21½	26½	30	36½	
t_g=	41	39½			35½	37	35		30	28	27½	24	
t_c=	0	0	0	0	0	0	0	1	2	3	3	3	
z_0=	0	0			0	0	0		2	3	3	3	ft
z_1=	93	99			89	93	94		73	69	68	59	ft
v_0=						1000							fps
v_1=		2070			2430			2030			2660		fps
v_2=						5020							fps

RS08-3

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-16



Geophone spacing = 25 ft

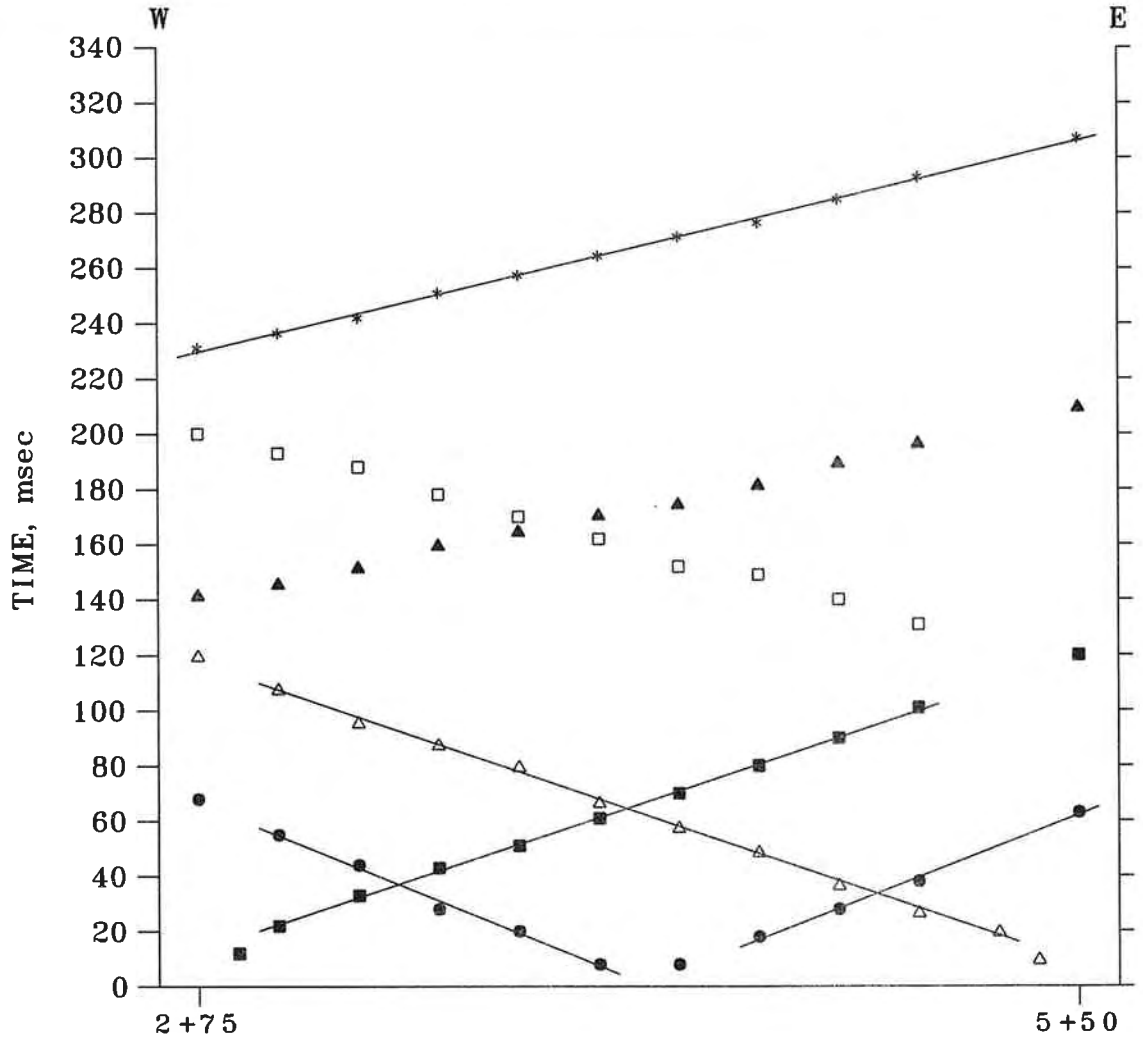
Arrival Time, msec												
▲		112	125	129	133	136	142	150	162	169	172	177
■	6	11	20	30	42	59	68	75	87	112	123	128
●	69	60	45	33	15	9	8	19	37	46	58	70
△	125		104	93	84	79	69	58	47	34	16	10
□	215	207	198	191	185	180	172	169	163	150	141	132

t_{ab} = 118 msec; XY = 0

t_a =			76	80	84	87	93	106	113	120	123	128	
t_b =	125	113	104	97	91	86	78	75	69	56	47	38	
* $\frac{1}{2}\Delta t$ =			−14	−8½	−3½	0½	7½	15½	22	32	38	45	
t_g =			31	29½	28½	27½	26½	31½	32	29	26	24	
t_c =	0	0	0	0	0	0	1	2	3	4	5	6	
z_0 =			0	0	0	0	1	2	3	4	5	6	ft
z_1 =			76	72	69	70	69	78	78	69	56	50	ft
v_0 =						1000							fps
v_1 =		2120			1960			2030			2230		fps
v_2 =						3730							fps

RS08-4

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-17



Geophone spacing = 25 ft

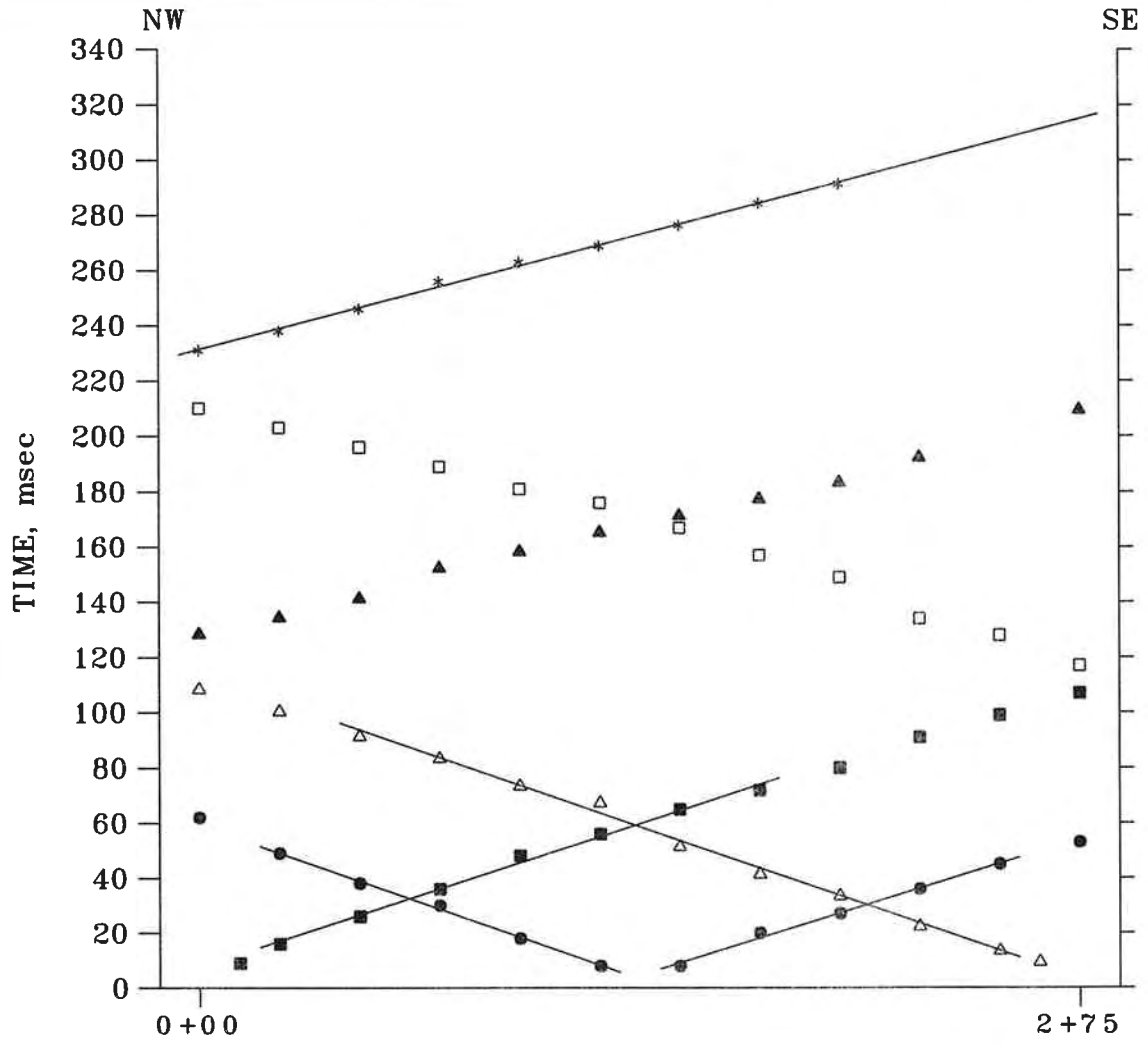
Arrival Time, msec												
▲	142	146	152	160	165	171	175	182	190	197		210
■	12	22	33	43	51	61	70	80	90	101		120
●	68	55	44	28	20	8	8	18	28	38		63
△	120	108	96	88	80	67	58	49	37	27	20	10
□	200	193	188	178	170	162	152	149	140	131		120

t_{ab}= 120 msec; XY = 0

t_a=	48	52	58	66	71	77	81	88	96	103		120	
t_b=	120	113	108	98	90	82	72	69	60	51		40	
* ½△t=	-36	-30½	-25	-16	-9½	-2½	4½	9½	18	26		40	
t_g=	24	22½	23	22	20½	19½	16½	18½	18	17		20	
t_c=	6	5	4	3	2	1	0	1	1	2	3	4	
z_0=	6	5	4	3	2	1	0	1	1	2		4	ft
z_1=	65	62	66	65	62	61	60	60	58	52		49	ft
v_0=						1000							fps
v_1=		2590			2120			2220		2530			fps
v_2=						3590							fps

RS08-4

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-18



Geophone spacing = 25 ft

Arrival Time, msec

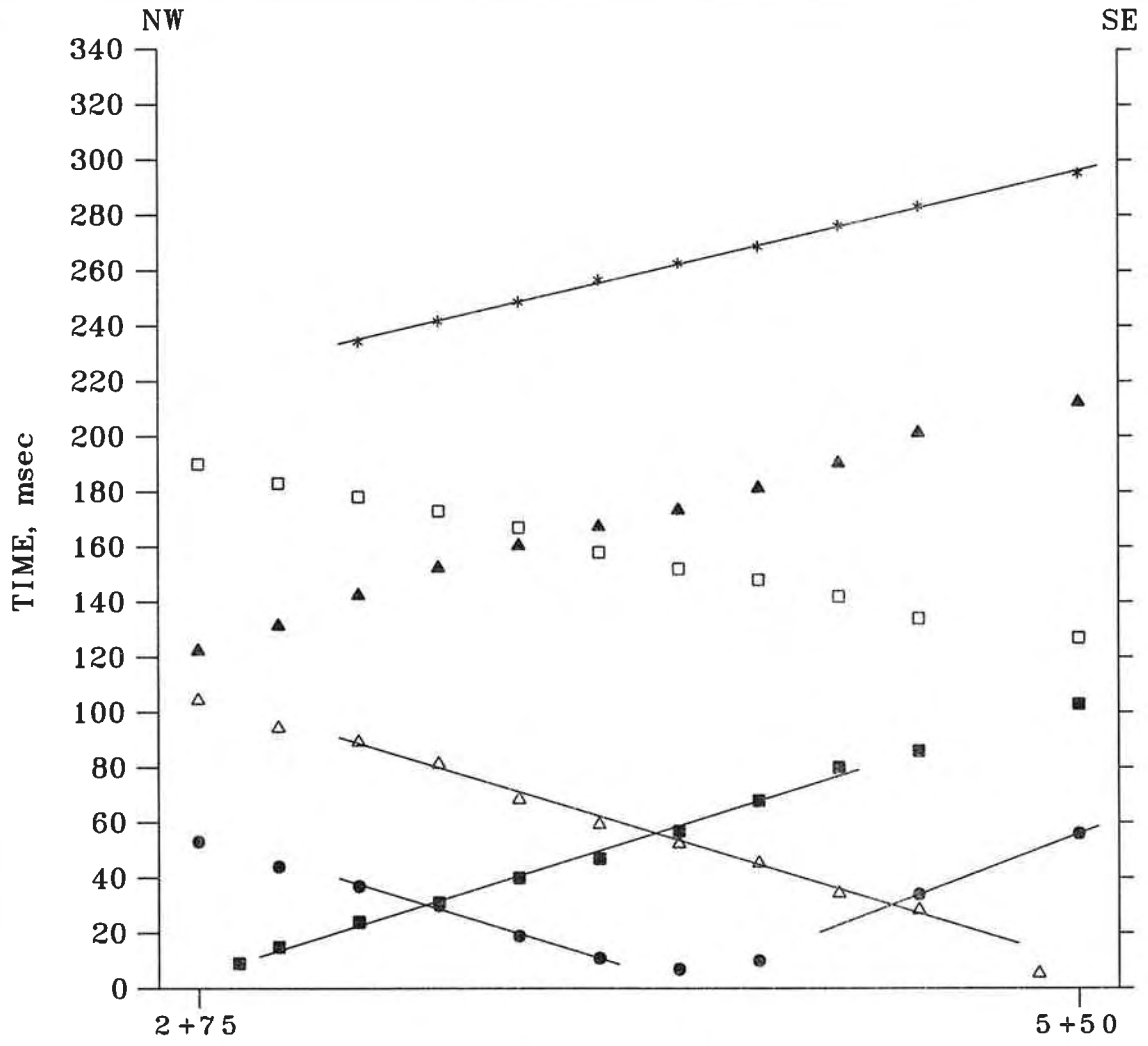
▲	129	135	142	153	159	166	172	178	184	193		210
■	9	16	26	36	48	56	65	72	80	91	99	107
●	62	49	38	30	18	8	8	20	27	36	45	53
△	109	101	92	84	74	68	52	42	34	23	14	10
□	210	203	196	189	181	176	167	157	149	134	128	117

t_{ab} = 108 msec; XY = 0

	t_a=	26	32	39	51	57	64	70	76	82	91	99	107	
	t_b=	109	101	92	84	76	71	62	52	44				
*	½△t=	-41½	-34½	-26½	-16½	-9½	-3½	4	12	19				
	t_g=	13½	12½	11½	13½	12½	13½	12	10	9				
	t_c=	4	3	3	2	2	2	2	2	2	2	2	2	
	z_0=	4	3	3	2	2	2	2	2	2				ft
	z_1=	42	41	37	47	43	47	46	37	33				ft
	v_0=						1000							fps
	v_1=		2630			2450			2780			2500		fps
	v_2=						3290							fps

RS08-5

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-19



Geophone spacing = 25 ft

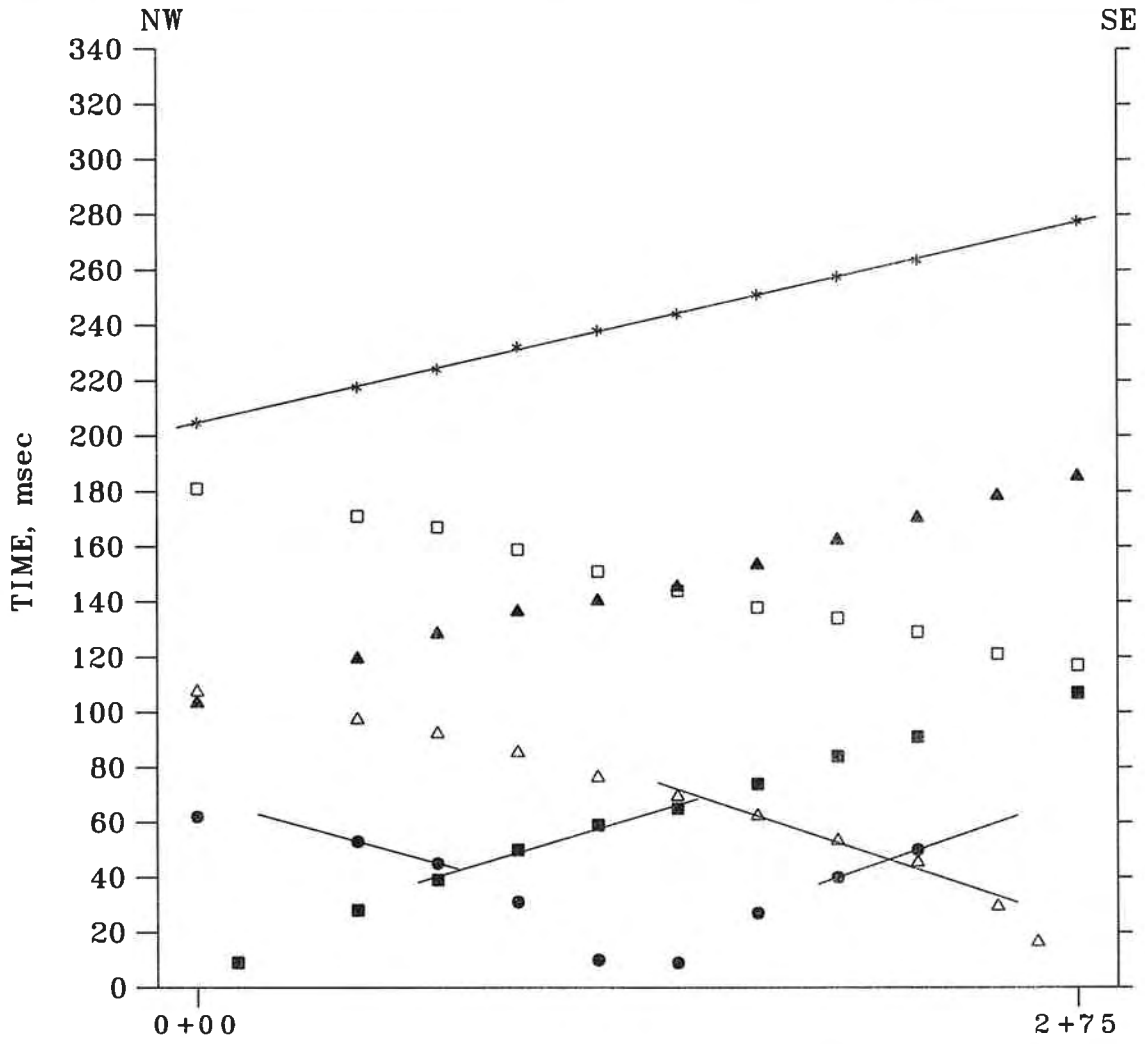
Arrival Time, msec												
▲	123	132	143	153	161	168	174	182	191	202		213
■	9	15	24	31	40	47	57	68	80	86		103
●	53	44	37	30	19	11	7	10		34		56
△	105	95	90	82	69	60	53	46	35	29		6
□	190	183	178	173	167	158	152	148	142	134		127

t_{ab}= 104 msec; XY = 0

t_a=			32	42	50	57	63	71	80	86		103	
t_b=	105	98	93	88	82	73	67	63	57	49		42	
* ½Δt=			-30½	-23	-16	-8	-2	4	11½	18½		30½	
t_g=			10½	13	14	13	13	15	16½	15½		20½	
t_c=	2	2	2	3	3	3	0	2	3	4	5	5	
z_0=			2	3	3	3	0	2	3	4		5	ft
z_1=			39	46	51	46	56	58	54	45		50	ft
v_0=						1000							fps
v_1=		2760			2810			2270			2850		fps
v_2=						3680							fps

RS08-5

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-20



Geophone spacing = 25 ft

Arrival Time, msec												
▲	104		120	129	137	141	146	154	163	171	179	186
■	9		28	39	50	59	65	74	84	91		107
●	62		53	45	31	10	9	27	40	50		
△	108		98	93	86	77	70	63	54	46	30	17
□	181		171	167	159	151	144	138	134	129	121	117

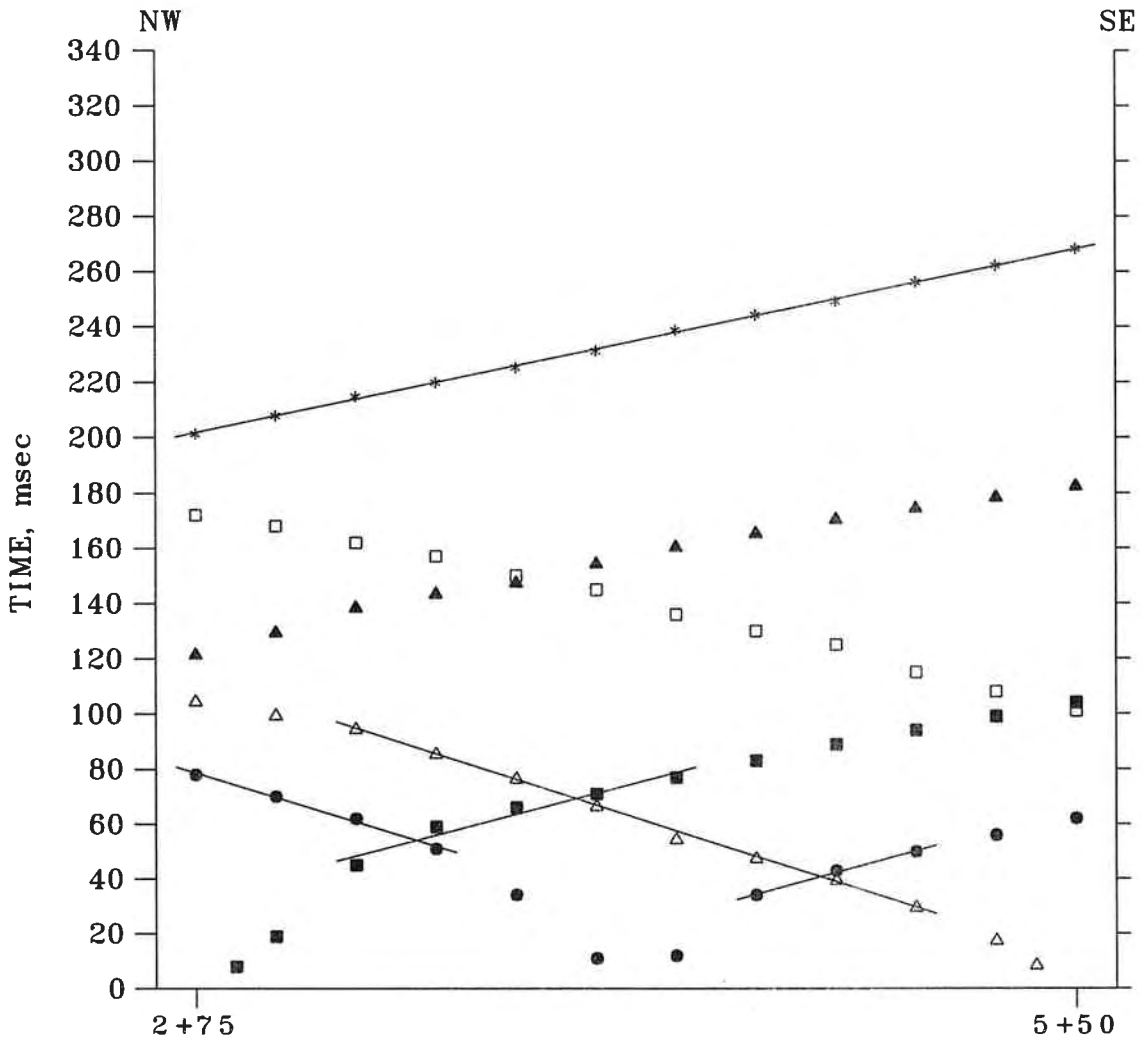
t_{ab}= 108 msec; XY = 0

t_a=	25		41	50	58	62	67	75	84	91		107
t_b=	108		98	94	86	78	71	65	61	56	48	44
* ½△t=	-41½		-28½	-22	-14	-8	-2	5	11½	17½		31½
t_g=	12½		15½	18	18	16	15	16	18½	19½		21½
t_c=	7	7	7	9	11	13	12	12	12	12	12	12

z_0=	7		7	9	11	13	12	12	12	12	12	ft
z_1=	38		54	53	42	26	24	26	34	38	45	ft
v_0=						1000						fps
v_1=		2870			3130			2500		2580		fps
v_2=						3780						fps

RS08-6

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-21



Geophone spacing = 25 ft

Arrival Time, msec												
▲	122	130	139	144	148	155	161	166	171	175	179	183
■	8	19	45	59	66	71	77	83	89	94	99	104
●	78	70	62	51	34	11	12	34	43	50	56	62
△	105	100	95	86	77	67	55	48	40	30	18	9
□	172	168	162	157	150	145	136	130	125	115	108	101

t_{ab} = 104 msec; XY = 0

t_a =	41	49	58	63	67	74	80	85	90	94	99	104	
t_b =	105	100	95	90	83	78	69	63	58	48	41	34	
* $\frac{1}{2}\Delta t$ =	−32	−25½	−18½	−13½	−8	−2	5½	11	16	23	29	35	
t_g =	21	22½	24½	24½	23	24	22½	22	22	19	18	17	
t_c =	17	16	16	16	16	15	11	10	9	7	6	5	
z_0 =	17	16	16	16	16	15	11	10	9	7	6	5	ft
z_1 =	32	41	51	51	46	54	61	59	62	56	55	54	ft
v_0 =						1000							fps
v_1 =		3290			2810			3130			2680		fps
v_2 =						4130							fps

RS08-6

Project No.: 27667021	Date: 3-24-08	Project: East County Substation	Fig. B-22

Four electrical resistivity surveys were performed at the site on March 19 and 20, 2008 by GeoVision Geophysical Services (GeoVision) of Corona, California. The surveys were performed across original configurations of the proposed substation pads, and are now to the east of the existing substation layout. The locations of the surveys are presented on Figure 2.

Soil resistivity measurements are the basis of designing grounding systems. The purpose of the geophysical surveys was to measure the soil resistivity in accordance with ASTM G57. The results of the survey are presented in a report dated April 3, 2008, prepared by GeoVision, which is included in this appendix.

GEOVision
geophysical services

April 3, 2008

Project Number 8137

Mr. Mike Hatch
URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108
(619) 683-6114

Subject: **Four Electrode Wenner Resistivity Tests**
Proposed Substations Near Jacumba, California

Dear Mr. Hatch:

A geophysical survey was conducted on March 19 and 20, 2008 near Jacumba, California. The purpose of the geophysical survey was to measure soil resistivity in accordance with ASTM Standard G57-06. Site conditions consisted of uneven terrain with moderately dense brush. The approximate locations of the center of the resistivity soundings are presented in Table 1 below.

Table 1: Resistivity Sounding Locations

Approximate Location	Resistivity Soundings	Northing (Meters)	Easting (Meters)
West Pad - Center Point C1	C1WE, C1SN	3,610,320.5	582,570.5
East Pad – Center Point C2	C2WE, C2SN	3,610,382.38	583,065.83

Note: UTM NAD 83, Zone 11. Provided by URS using a Garmin handheld GPS

METHODOLOGY

Resistivity equipment used during this investigation included an Advanced Geosciences Supersting R8/IP earth resistivity meter coupled to 1/4- inch diameter stainless steel electrode stakes with 18 gauge insulated copper wire. A test resistor, rated at 19.82 ohms, was used to verify the Supersting R8/IP was operating within manufacturer specifications. The Supersting transmitter is rated at 200W and is capable of continuous output current between 1 mA and 1 A with an output voltage of 800 V peak to peak. The operator may select a maximum output current, which the instrument will automatically reduce as needed depending on soil conditions and ground impedance. The transmitter then maintains a steady current through the measurement cycle, recording input voltage and writing V/I to internal memory.

FIELD PROCEDURES

Before conducting the geophysical survey the battery level was checked on the resistivity meter and found to be within acceptable limits. General site conditions were recorded on the field log. Electrode spacing was pre-determined based on previously conducted surveys.

A test resistor rated at 19.82 ohms was connected to the positive and negative current and potential leads on the Supersting R8/IP immediately before and after each sounding at the survey location. The resistance value across the test resistor and the time of the test measurement was recorded on the field log.

Resistivity measurements (soundings) were made at four locations (C1WE and C1SN on the west pad, C2WE and C2SN on the east pad), at the selected electrode spacings, using a surveyor's measuring tape for spatial control. A west to east and south to north sounding were approximately centered on each proposed pad midpoint (Table 1). C1WE and C2WE were oriented west to east and C1SN and C2SN were oriented south to north.

Resistivity measurements at thirteen (13) electrode spacings were made on each line. For each resistivity measurement, four stainless steel electrodes were placed at equal distances (a-spacing) in a straight line. A current was applied from the outer electrodes, and the potential difference (voltage) was measured across the inner electrodes. The Supersting R8/IP displays the resistance value equal to V/I. This value was recorded, along with the a-spacing, on a field data sheet and later transferred to a spreadsheet. Two or more measurements were recorded at each station for quality control. If there was significant variation between the first and second measurements, the control leads, electrode cable and electrode coupling were field checked to ensure proper survey conditions. After each measurement, the electrodes were moved to the next a-spacing and another set of measurements were taken.

DATA REDUCTION

Four spreadsheets were generated from the collected resistivity data. Electrode spacing (a-spacing) and resistance reading (V/I), were entered for each resistivity measurement. The generalized form of the four-electrode array is shown in Figure 1

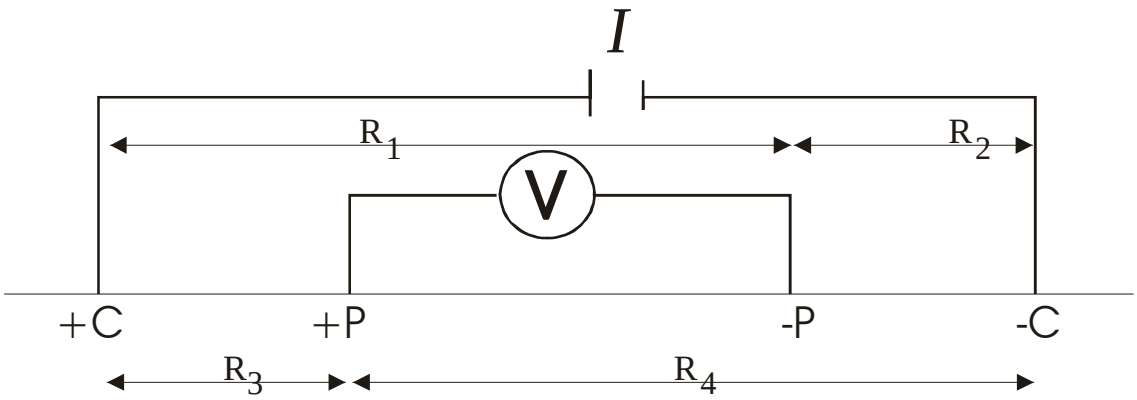


Figure 1: The generalized form of the four electrode array

When the material upon which the current is induced is uniform, the resistivity calculated will be constant independent of electrode configuration. However, in a field investigation where subsurface heterogeneities exist, the calculated resistivity values will vary with electrode array. This calculated resistivity is referred to as apparent resistivity (ρ_a), and can be calculated using the relationship:

$$\rho_a = \frac{2\pi V}{I\left\{\left(\frac{1}{R_3}-\frac{1}{R_4}\right)-\left(\frac{1}{R_1}-\frac{1}{R_2}\right)\right\}}$$

For the Wenner array, which was used during this investigation, where R1 = R4; R3 = R2 and R1 = 2R2 = 2*a*, it can be shown that the formula for calculated apparent resistivity can be reduced to the following form:

$$\rho_a = 2\pi a\left(\frac{V}{I}\right)$$

RESULTS

Data collected from the four Wenner resistivity arrays are attached as Tables 2, 3, 4 and 5. All calculations were conducted using known geometry and measured resistance (V/I) values which were recorded in the daily field logs. Apparent resistivity (magnitude) values are presented in ohm-ft, ohm-m and ohm-cm. The ASTM Standard G57-06 specifies that apparent resistivity (magnitude) is presented in the ohm-centimeter unit.

All completed data processing forms are retained in project files. All files generated during the processing sequence were archived on a back up drive.

SUMMARY

Four-electrode soil resistivity measurements were made near Jacumba, California in accordance with ASTM Standard G57-06. Apparent soil was measured at thirteen (13)

electrode spacings each sounding. Field measurements and calculated values were consistent and repeatable at all locations, as summarized in Tables 2, 3, 4 and 5.

If you have any questions concerning this investigation, please call us at 951-549-1234.

Sincerely,

GEO*Vision* Geophysical Services

Submitted by:
William Dalrymple
Project Geophysicist

Reviewed and Approved by:
Antony Martin, P. GP 989
Technical Director

Attachments:

Table 2: Resistivity Sounding C1WE
Table 3: Resistivity Sounding C1SN
Table 4: Resistivity Sounding C2WE
Table 4: Resistivity Sounding C2SN
Applied Technical Services, Incorporated Certificate of Calibration
Applied Technical Services, Incorporated Calibration Data Sheet

TABLE 2 ELECTRICAL RESISTIVITY SOUNDING RES C1WE - West Pad (West to East)

Job Number 8137 Date 19-Mar-08

19.82 ohm Test Resistor Reading

19.80 ohm at 1330 hours Repeat 19.79 ohm

A-Spacing	Resistance Reading	Geometric Multiplier	Calculated Magnitude	Converted Magnitude	Calculated to Ohm-cm	Repeat Resistance	Repeat Magnitude	Repeat Conversion	Repeat Calculation to Ohm-cm
[ft.]	[Ohm]	[2(pi)A]	[Ohm-ft.]	[Ohm-m]	[Ohm-cm]	[Ohm]	[Ohm-ft.]	[Ohm-m]	[Ohm-cm]
1.5	99.15	9.425	934.467	284.825	28482.546	99.22	935.126	285.027	28502.655
2.0	85.96	12.566	1080.205	329.247	32924.655	85.89	1079.326	328.978	32897.843
3.0	54.93	18.850	1035.406	315.592	31559.178	54.84	1033.710	315.075	31507.470
5.0	19.83	31.416	622.978	189.884	18988.364	19.83	622.978	189.884	18988.364
7.5	6.792	47.124	320.065	97.556	9755.595	6.794	320.160	97.585	9758.468
10.0	3.508	62.832	220.414	67.182	6718.223	3.506	220.288	67.144	6714.393
15.0	1.449	94.248	136.565	41.625	4162.502	1.45	136.659	41.654	4165.375
30.0	0.5204	188.496	98.093	29.899	2989.877	0.5209	98.187	29.928	2992.750
50.0	0.2474	314.159	77.723	23.690	2368.997	0.2471	77.629	23.661	2366.124
75.0	0.1452	471.239	68.424	20.856	2085.560	0.1451	68.377	20.841	2084.124
100.0	0.1066	628.319	66.979	20.415	2041.512	0.1066	66.979	20.415	2041.512
150.0	0.06253	942.478	58.933	17.963	1796.282	0.06247	58.877	17.946	1794.558
300.0	0.0357	1884.956	67.293	20.511	2051.088	0.03565	67.199	20.482	2048.215

TABLE 3 ELECTRICAL RESISTIVITY SOUNDING RES C1SN - West Pad (South to North)

Job Number 8137 Date 19-Mar-08

19.82 ohm Test Resistor Reading

19.79 ohm at 1137 hours Repeat 19.79 ohm

A-Spacing [ft.]	Resistance Reading [Ohm]	Geometric Multiplier [2(pi)A]	Calculated Magnitude [Ohm-ft.]	Converted Magnitude [Ohm-m]	Calculated to Ohm-cm [Ohm-cm]	Repeat Resistance [Ohm]	Repeat Magnitude [Ohm-ft.]	Repeat Conversion [Ohm-m]	Repeat Calculation to Ohm-cm [Ohm-cm]
1.5	92.46	9.425	871.415	265.607	26560.728	92.56	872.357	265.895	26589.455
2.0	71.14	12.566	893.972	272.483	27248.255	71.05	892.841	272.138	27213.782
3.0	38.89	18.850	733.059	223.436	22343.645	38.86	732.494	223.264	22326.409
5.0	12.58	31.416	395.212	120.461	12046.073	12.59	395.527	120.556	12055.648
7.5	5.529	47.124	260.548	79.415	7941.503	5.532	260.689	79.458	7945.812
10.0	3.234	62.832	203.198	61.935	6193.482	3.233	203.135	61.916	6191.566
15.0	1.47	94.248	138.544	42.228	4222.828	1.47	138.544	42.228	4222.828
30.0	0.2991	188.496	56.379	17.184	1718.433	0.299	56.360	17.179	1717.858
50.0	0.143	314.159	44.925	13.693	1369.307	0.1428	44.862	13.674	1367.392
75.0	0.09271	471.239	43.689	13.316	1331.627	0.09292	43.788	13.346	1334.644
100.0	0.07215	628.319	45.333	13.818	1381.755	0.07318	45.980	14.015	1401.481
150.0	0.0549	942.478	51.742	15.771	1577.097	0.05502	51.855	15.805	1580.544
300.0	0.03448	1884.956	64.993	19.810	1980.995	0.03454	65.106	19.844	1984.442

TABLE 4 ELECTRICAL RESISTIVITY SOUNDING RES C2WE - East Pad (West to East)

Job Number 8137 Date 20-Mar-08

19.82 ohm Test Resistor Reading

19.81 ohm at 0810 hours Repeat 19.81 ohm

A-Spacing [ft.]	Resistance Reading [Ohm]	Geometric Multiplier [2(pi)A]	Calculated Magnitude [Ohm-ft.]	Converted Magnitude [Ohm-m]	Calculated to Ohm-cm [Ohm-cm]	Repeat Resistance [Ohm]	Repeat Magnitude [Ohm-ft.]	Repeat Conversion [Ohm-m]	Repeat Calculation to Ohm-cm [Ohm-cm]
1.5	66.65	9.425	628.161	191.464	19146.361	67.63	637.398	194.279	19427.883
2.0	45.98	12.566	577.802	176.114	17611.396	46	578.053	176.191	17619.057
3.0	29.23	18.850	550.973	167.936	16793.642	29.2	550.407	167.764	16776.406
5.0	18.75	31.416	589.049	179.542	17954.202	18.76	589.363	179.638	17963.778
7.5	12.17	47.124	573.498	174.802	17480.211	12.18	573.969	174.946	17494.574
10.0	8.51	62.832	534.699	162.976	16297.628	8.519	535.265	163.149	16314.864
15.0	4.918	94.248	463.511	141.278	14127.802	4.915	463.228	141.192	14119.184
30.0	1.133	188.496	213.565	65.095	6509.475	1.132	213.377	65.037	6503.730
50.0	0.4615	314.159	144.985	44.191	4419.128	0.4616	145.016	44.201	4420.085
75.0	0.3204	471.239	150.985	46.020	4602.021	0.3202	150.891	45.991	4599.148
100.0	0.2406	628.319	151.173	46.078	4607.766	0.2404	151.048	46.039	4603.936
150.0	0.1416	942.478	133.455	40.677	4067.704	0.1417	133.549	40.706	4070.577
300.0	0.05481	1884.956	103.314	31.490	3149.023	0.05496	103.597	31.576	3157.641

TABLE 5 ELECTRICAL RESISTIVITY SOUNDING RES C2SN - East Pad (South to North)

Job Number 8137 Date 20-Mar-08

19.82 ohm Test Resistor Reading

19.81 ohm at 0938 hours Repeat 19.80 ohm

A-Spacing [ft.]	Resistance Reading [Ohm]	Geometric Multiplier [2(pi)A]	Calculated Magnitude [Ohm-ft.]	Converted Magnitude [Ohm-m]	Calculated to Ohm-cm [Ohm-cm]	Repeat Resistance [Ohm]	Repeat Magnitude [Ohm-ft.]	Repeat Conversion [Ohm-m]	Repeat Calculation to Ohm-cm [Ohm-cm]
1.5	63.13	9.425	594.986	181.352	18135.180	63.11	594.798	181.294	18129.435
2.0	52.62	12.566	661.242	201.547	20154.669	52.58	660.740	201.393	20139.348
3.0	32.94	18.850	620.904	189.252	18925.165	32.01	603.374	183.908	18390.848
5.0	18.64	31.416	585.593	178.489	17848.871	18.62	584.965	178.297	17829.720
7.5	10.87	47.124	512.237	156.130	15612.974	10.85	511.294	155.842	15584.247
10.0	8.002	62.832	502.780	153.247	15324.749	8.019	503.849	153.573	15357.306
15.0	4.052	94.248	381.892	116.401	11640.068	4.052	381.892	116.401	11640.068
30.0	0.9411	188.496	177.393	54.069	5406.944	0.9416	177.487	54.098	5409.817
50.0	0.4391	314.159	137.947	42.046	4204.635	0.4392	137.979	42.056	4205.592
75.0	0.275	471.239	129.591	39.499	3949.924	0.2751	129.638	39.514	3951.361
100.0	0.1988	628.319	124.910	38.072	3807.248	0.1985	124.721	38.015	3801.503
150.0	0.1412	942.478	133.078	40.562	4056.213	0.1412	133.078	40.562	4056.213
300.0	0.05375	1884.956	101.316	30.881	3088.123	0.05379	101.392	30.904	3090.421

CERTIFICATE OF CALIBRATION

ACCREDITED
CERT. # 1888-03

Accredited Calibration

Certificate Number: M505659-1

Manufacturer: **Advanced Geosciences, Inc**
Model No: **Super Sting**
Customer PO No.:

Description: **Auto Resistivity Meter**
Serial No: **SS0609199**
Customer Asset No.: **SS0609199**

Customer:
GeoVision
1151 Pomona Road
Suite P
Corona, CA 92882

Location of Calibration:
Applied Technical Services, Inc.
1049 Triad Court
Marietta, GA 30062

Calibration Procedure: **ATS-1032 Rev. 2: Calibration of Resistance Bridges / MicroOhm Meters**

Date of Calibration: **March 26, 2007**
Temperature: **70° F**
Condition Received: **In Tolerance**

*Next Calibration Due: **March 26, 2008**
Humidity: **40 %**
Condition Returned: **In Tolerance**

This instrument has been calibrated using primary or secondary standards whose calibration is traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST). Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements.

The reported expanded measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a confidence level of approximately 95%. ATS maintains, wherever possible, at least a 4:1 Test Uncertainty Ratio. Statements of compliance, where applicable, are based on test results falling within specified limits with no reduction by the uncertainty of the measurement, unless otherwise allowed by procedure.

All calibrations are performed in accordance with the ATS Quality Manual QM1, Rev. 7 dated July 7, 2006. Applied Technical Services, Inc.'s Quality System complies with the applicable requirements of ANSI/NCSL Z540-1, ISO 9001-2000, 10CFR 50 Appendix B, 10CFR Part 21 and ISO/IEC 17025. ATS is an ISO/IEC 17025 Accredited Calibration Laboratory through A2LA.

The reported data is valid only at the time of the test and related only to the item calibrated. *Calibration due dates appearing on this Certificate of Calibration and calibration label are determined by the client and do not imply continued conformance to specifications.

Notes:

Calibration Equipment Used::

Model	Desc.	ID No.	Cal Due Date
Guildline 9211A	**Master Shunt Box**	**ATS-02014**	**4/25/2007**

Calibrated by: Jeff L. Cook
Electrical Lab Supervisor

Applied Technical Services, Inc. 1049 Triad Court, Marietta, GA 30062 (770) 423-1400 www.atslab.com

APPLIED TECHNICAL SERVICES, INCORPORATED

Calibration Data Sheet

Customer : Geovision — Purchase Order No:

Item Name: Automatic Resistivity Meter — Asset No: SS0609199 — ATS Reference No: M505659-1

Manufacturer: Advanced Geosciences — Model No Super Sting — Proc. No: 1032 — Rev: 1

Serial No: SS0609199 — Calibration Date: 03-26-07 — Calibration Due Date: 3/26/2008

Reason For Service: ■ Initial Calibration ☐ Due For Calibration ☐ Repair and Calibration

Equipment Used:	Due:	
ATS-02014	04-25-07	Guidlind Resistance Standard
	Due:	
	Due:	
	Due:	
	Due:	

Calibrated By: *Jeff L Cook*

Customer Instrument Under Test

UNCERTAINTY (SEE NOTE)	Function And Range	Applied	TOLERANCE		AS FOUND READING	AS CALIBRATED READING
0.001	Restance m ohms	999.99	989.9901	1009.9899	998.1	998.1
0.001	Restance m ohms	99.99	98.9901	100.9899	99.98	99.98
0.001	Restance m ohms	10.00	9.9000	10.1000	10.01	10.01
0.001	Restance m ohms	1.00	0.9900	1.0100	1.003	1.003
0.001	Restance u ohms	333.33	329.9997	336.6663	332.9	332.9

* Indicates out of tolerance readings

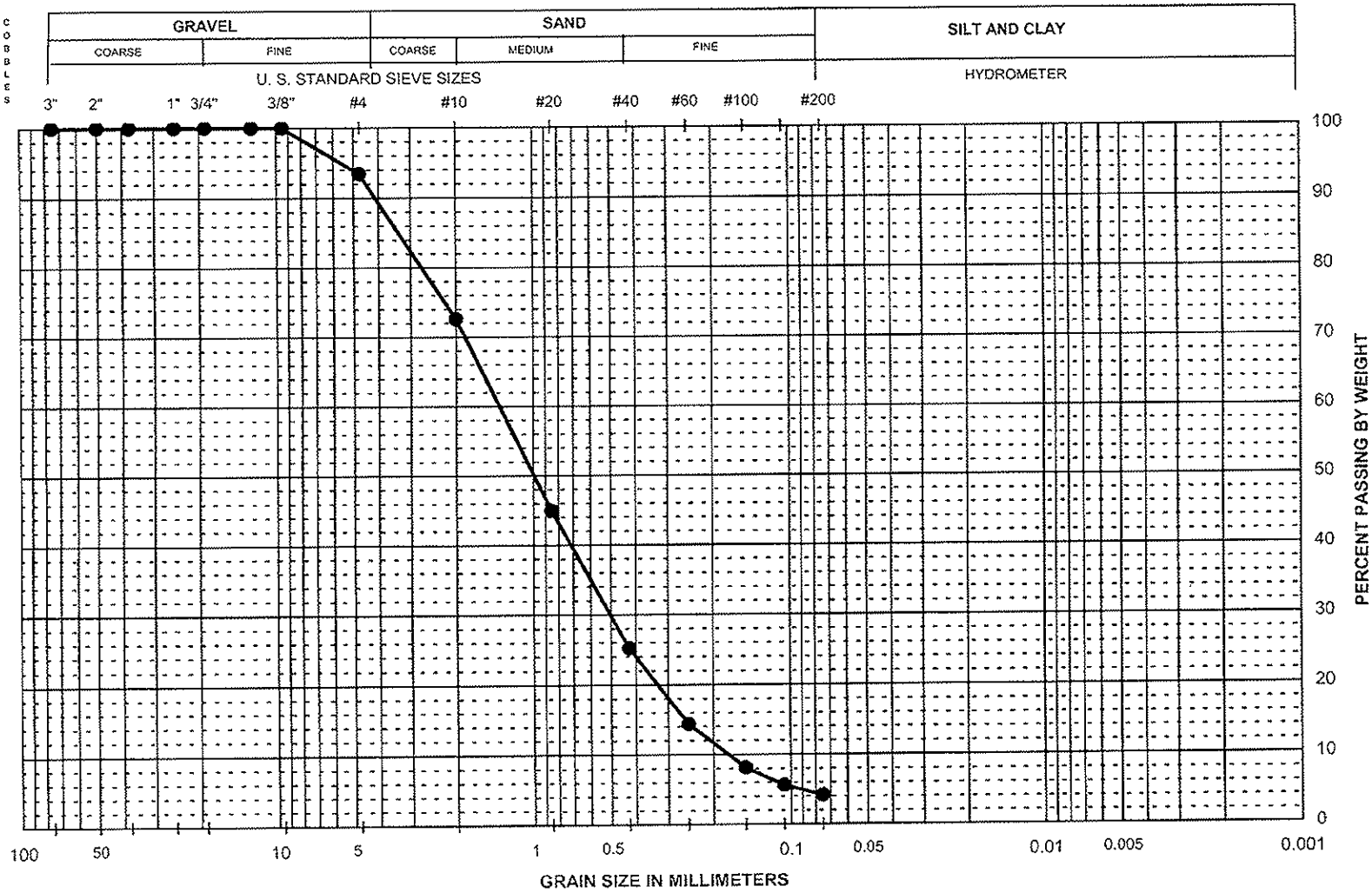
Remarks:

The materials observed in the borings and test pits were visually classified and evaluated with respect to strength, swelling, and compressibility, dry density, and moisture content. The classifications were substantiated by performing grain size analyses and Atterberg Limits tests on representative samples of the soils. The expansion potential was evaluated by performing expansion index tests. Compaction tests were performed to serve as a preliminary basis of relative compaction requirements for fill. R-value tests were also performed to provide data for pavement recommendations. The strength of the soils was preliminarily evaluated by considering the density, moisture content, and penetration resistance of the sampler. Chemical tests were performed to evaluate the potential corrosivity of the soil. The laboratory testing was performed in general accordance with ASTM standards.

The results of the testing are summarized on the boring and test pit logs at the corresponding sample depths. Results of the corrosion tests are summarized in Section 5. Detailed laboratory test results are presented as figures in this appendix, as listed below:

- Particle size distribution curves – Figures D-1 through D-32;
- Plasticity charts (Atterberg Limits) – Figures D-33 and D-34;
- Expansion index test –Figure D-35 and D-36;
- Compaction curves – Figures D-37 through D-39; and
- R-Value tests –Figures D-40 through D-44.

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	93.4
#10	2.00	72.6
#20	0.850	44.9
#40	0.425	25.2
#60	0.250	14.4
#100	0.150	8.1
#140	0.106	5.6
#200	0.075	4.1
Hydrometer Analysis		

% Cobbles	
% Gravel	6.6
% Sand	89.3
% Fines	4.1

D_{60}	1.355
D_{30}	0.503
D_{10}	0.175
C_u	7.7
C_c	1.1

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-1	1	5.0	●					Grayish Brown Well-Graded SAND (SW)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

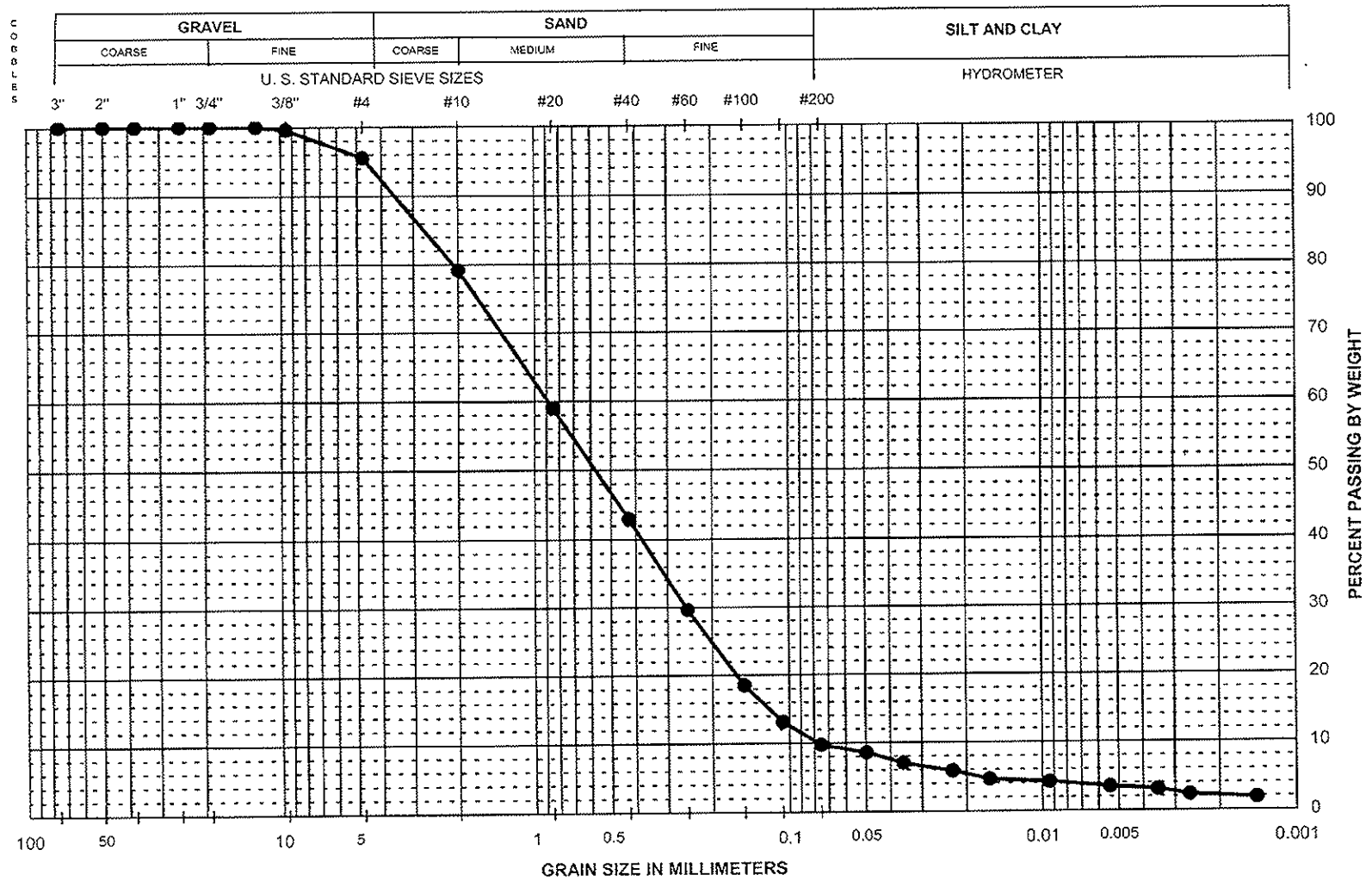
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-1

URS

Sieve ECS501005

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.6
#4	4.75	95.5
#10	2.00	79.2
#20	0.850	59.0
#40	0.425	43.0
#60	0.250	29.6
#100	0.150	18.5
#140	0.106	13.1
#200	0.075	9.7
Hydrometer Analysis	0.0497	8.6
	0.0356	7.0
	0.0227	5.9
	0.0162	4.6
	0.0094	4.2
	0.0054	3.5
	0.0035	3.1
	0.0026	2.3
	0.0014	1.8
	0.0014	1.8

% Cobbles	
% Gravel	4.5
% Sand	85.8
% Fines	9.7
D_{60}	0.886
D_{30}	0.254
D_{10}	0.077
C_u	11.5
C_c	0.9

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-1	4	20.0	•				2	Grayish Brown Poorly Graded SAND with Silt (SP-SM)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

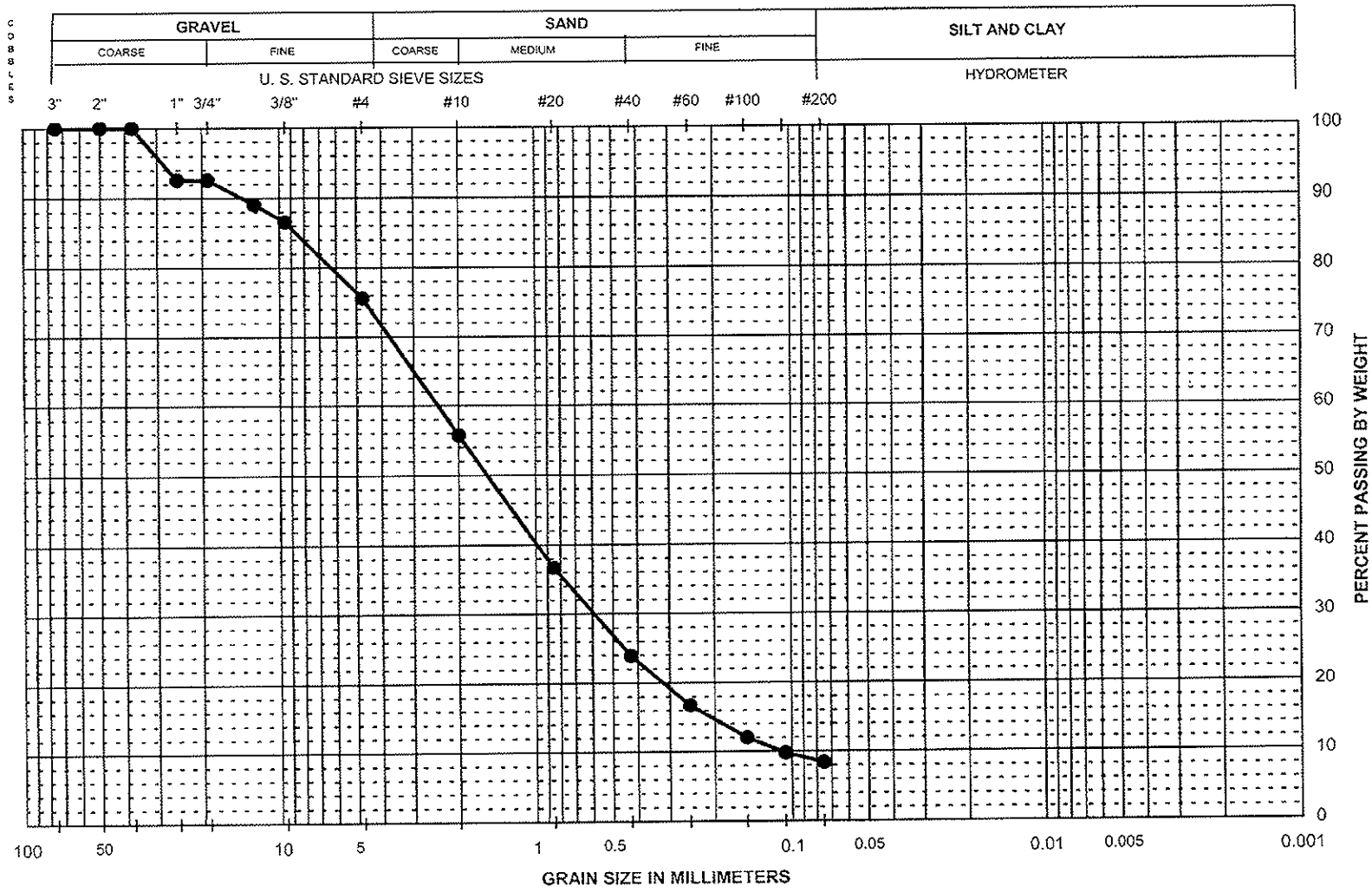
Figure: D-2

URS

(SNA) sieve only (04/2000)

Hydrometer ECSb01020

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	92.6
3/4"	19.00	92.6
1/2"	12.50	89.1
3/8"	9.50	86.6
#4	4.75	75.6
#10	2.00	55.7
#20	0.850	36.7
#40	0.425	23.9
#60	0.250	16.7
#100	0.150	12.0
#140	0.106	9.8
#200	0.075	8.4
Hydrometer Analysis		

% Cobbles	
% Gravel	24.4
% Sand	67.2
% Fines	8.4

D_{60}	2.411
D_{30}	0.591
D_{10}	0.110
C_u	21.9
C_c	1.3

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-2	2	10.0	●	2.4				**Brown Well-Graded SAND with Silt and Gravel (SW-SM)**

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

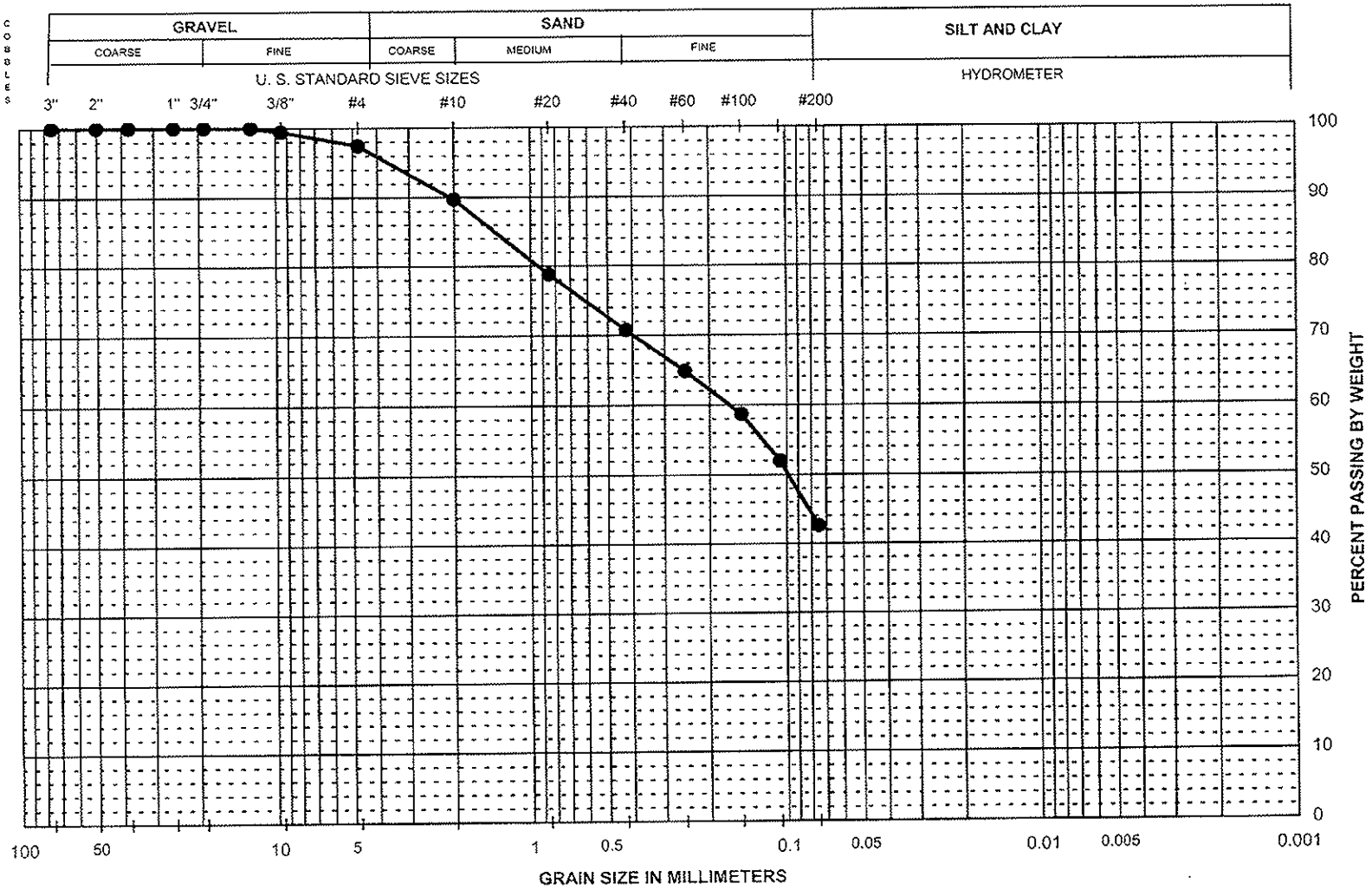
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-3

URS

Sieve ECSb02010

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.4
#4	4.75	97.5
#10	2.00	89.7
#20	0.850	78.8
#40	0.425	70.7
#60	0.250	64.9
#100	0.150	58.7
#140	0.106	52.0
#200	0.075	42.6
Hydrometer Analysis		

% Cobbles	
% Gravel	2.5
% Sand	54.9
% Fines	42.6
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-4	4	15.0	●	6.3	31	10		Reddish Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

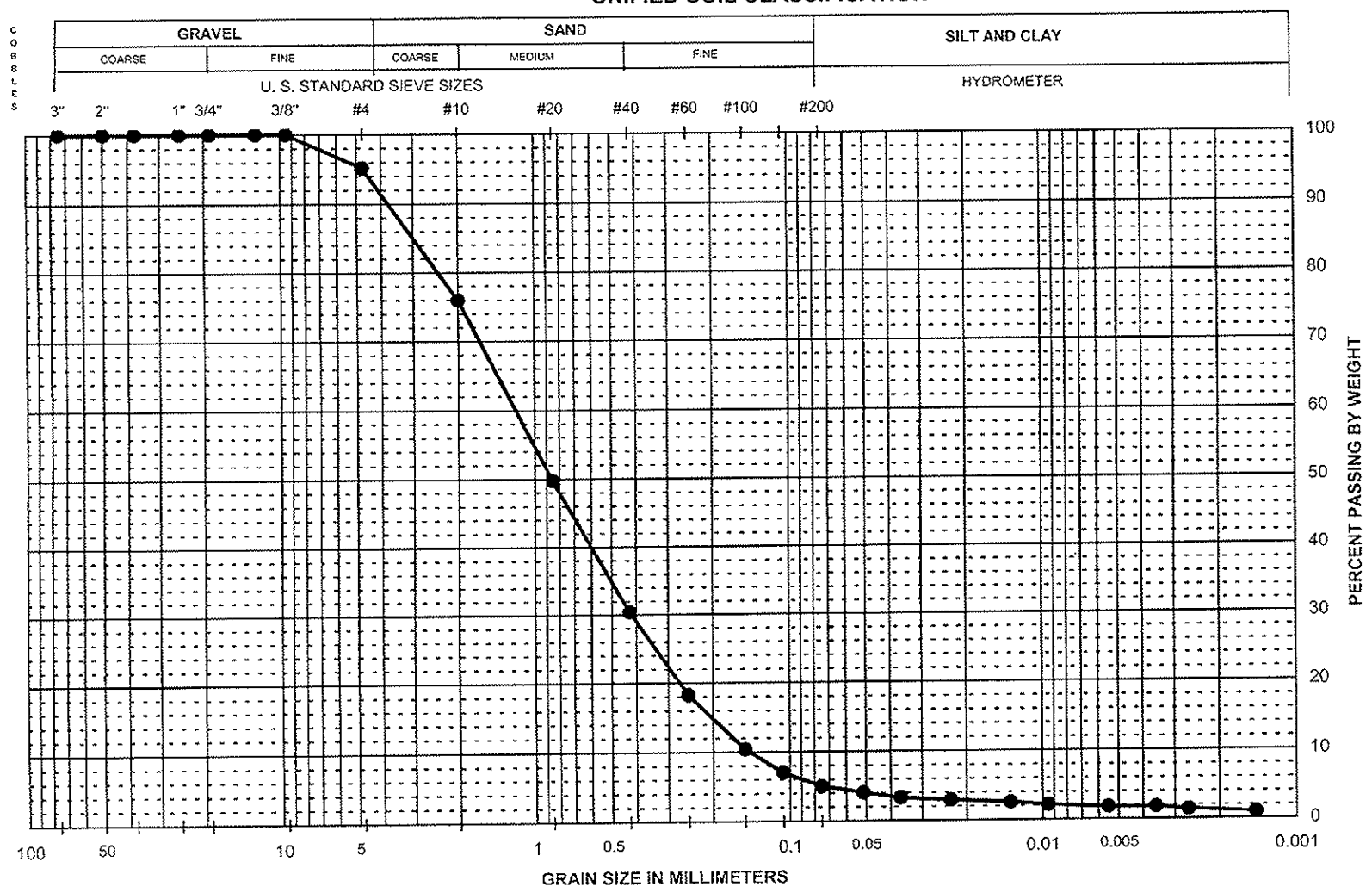
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-4

URS

Sieve ECSb04015

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	95.2
#10	2.00	76.0
#20	0.850	49.7
#40	0.425	30.4
#60	0.250	18.2
#100	0.150	10.4
#140	0.106	7.0
#200	0.075	5.0
Hydrometer Analysis	0.0512	4.0
	0.0364	3.3
	0.0231	2.9
	0.0134	2.5
	0.0095	2.1
	0.0055	1.8
	0.0036	1.8
	0.0027	1.4
	0.0014	1.0
	0.0014	1.0

% Cobbles	
% Gravel	4.8
% Sand	90.2
% Fines	5.0
D_{60}	1.189
D_{30}	0.418
D_{10}	0.144
C_u	8.3
C_c	1.0

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-7	3	15.0	•	2.3			1	Brown Well-Graded SAND with Silt (SW-SM)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

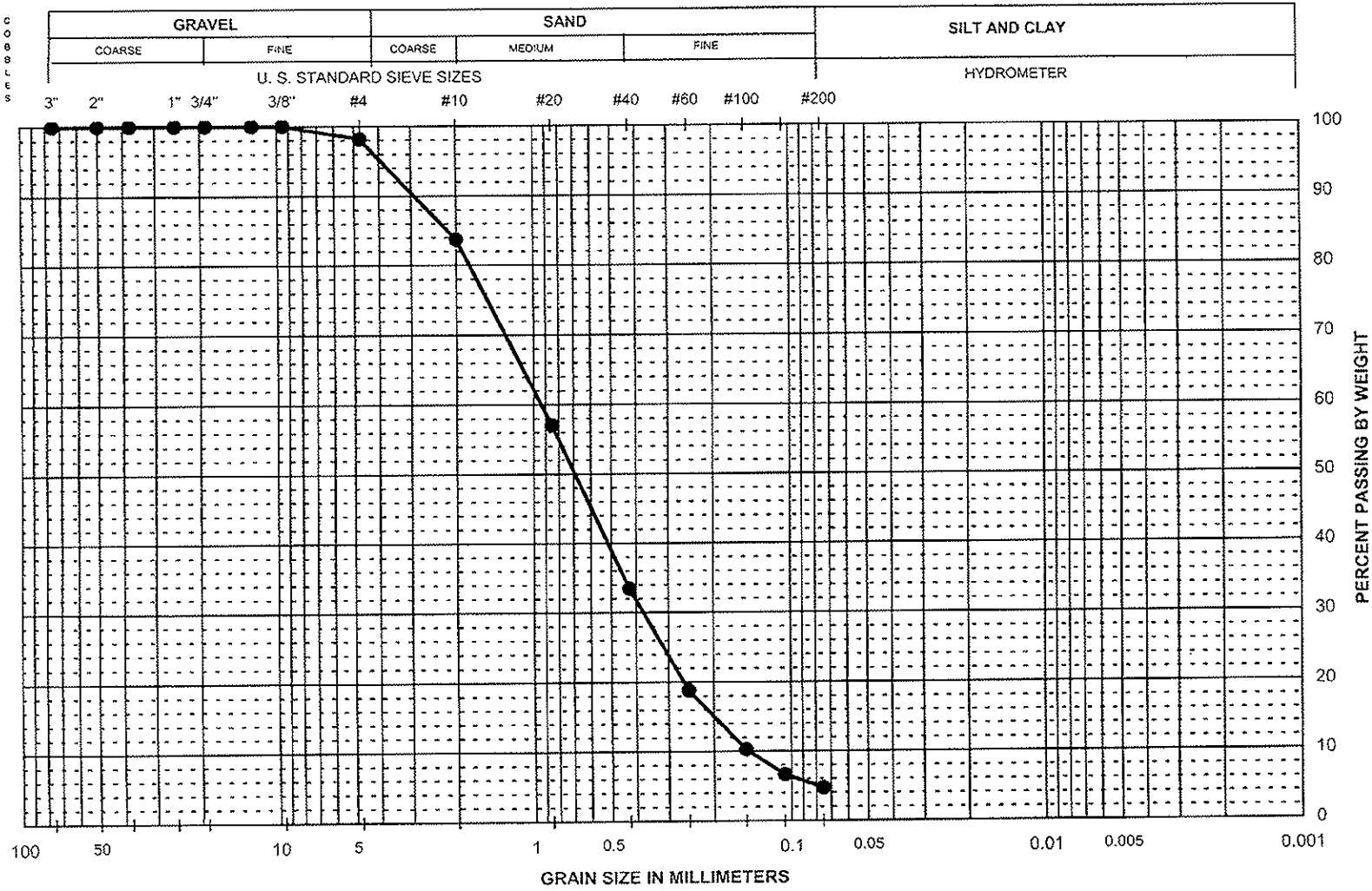
Figure: D-5

URS

(SNA) sieve only (04/2000)

Hydrometer ECSb07015

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	98.2
#10	2.00	83.7
#20	0.850	57.1
#40	0.425	33.4
#60	0.250	18.8
#100	0.150	10.3
#140	0.106	8.6
#200	0.075	4.7
Hydrometer Analysis		

% Cobbles	
% Gravel	1.8
% Sand	93.5
% Fines	4.7

D_{60}	0.934
D_{30}	0.375
D_{10}	0.146
C_u	6.4
C_c	1.0

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-8	6	30.0	●	2.5				Grayish Brown Well-Graded SAND (SW)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

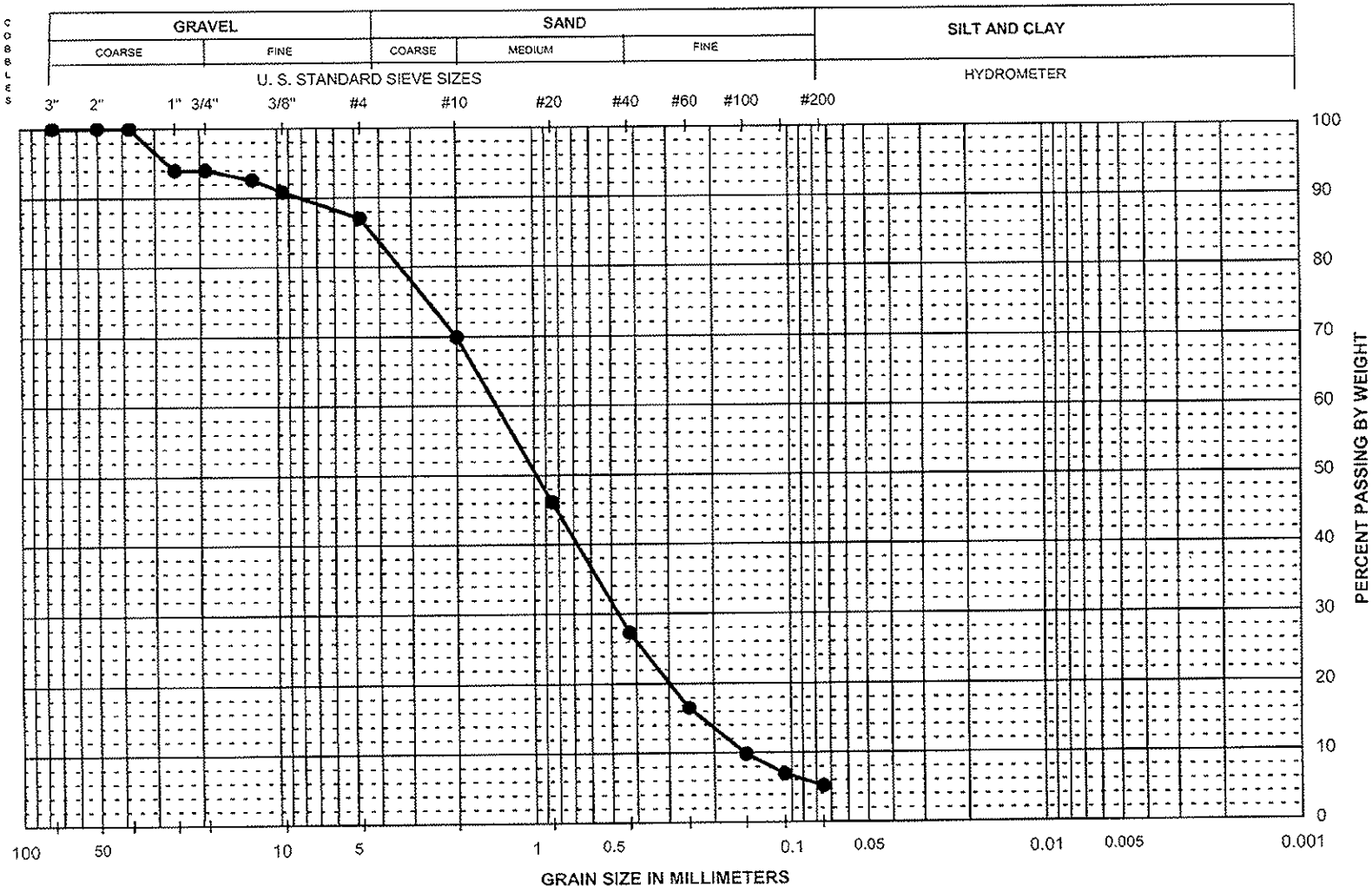
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-6

URS

Sieve ECSb08030

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	94.0
3/4"	19.00	94.0
1/2"	12.50	92.6
3/8"	9.50	90.8
#4	4.75	87.0
#10	2.00	69.9
#20	0.850	46.1
#40	0.425	27.3
#60	0.250	16.5
#100	0.150	9.8
#140	0.106	7.0
#200	0.075	5.2

Hydrometer Analysis

% Cobbles	
% Gravel	13.0
% Sand	81.8
% Fines	5.2
D_{60}	1.402
D_{30}	0.470
D_{10}	0.152
C_u	9.2
C_c	1.0

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-10	3	15.0	•					Brown Well-Graded SAND with Silt (SW-SM)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

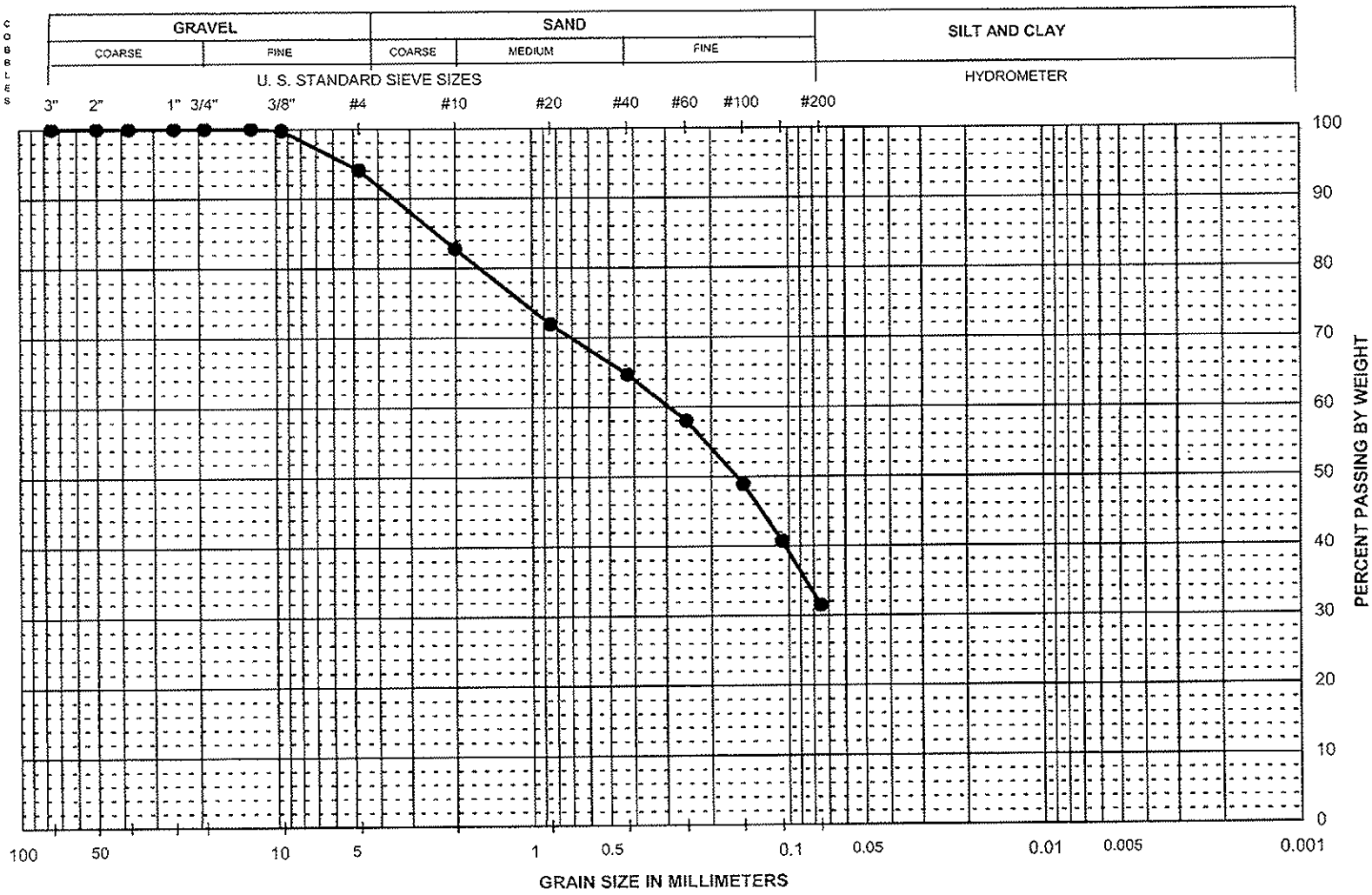
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-7

URS

Sieve ECSb10015

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.7
#4	4.75	94.1
#10	2.00	82.8
#20	0.850	71.9
#40	0.425	64.7
#60	0.250	58.0
#100	0.150	48.9
#140	0.106	40.7
#200	0.075	31.4

Hydrometer Analysis

% Cobbles	
% Gravel	5.9
% Sand	62.7
% Fines	31.4
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-10	8	40.0	●	7.1				Dark Yellowish Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

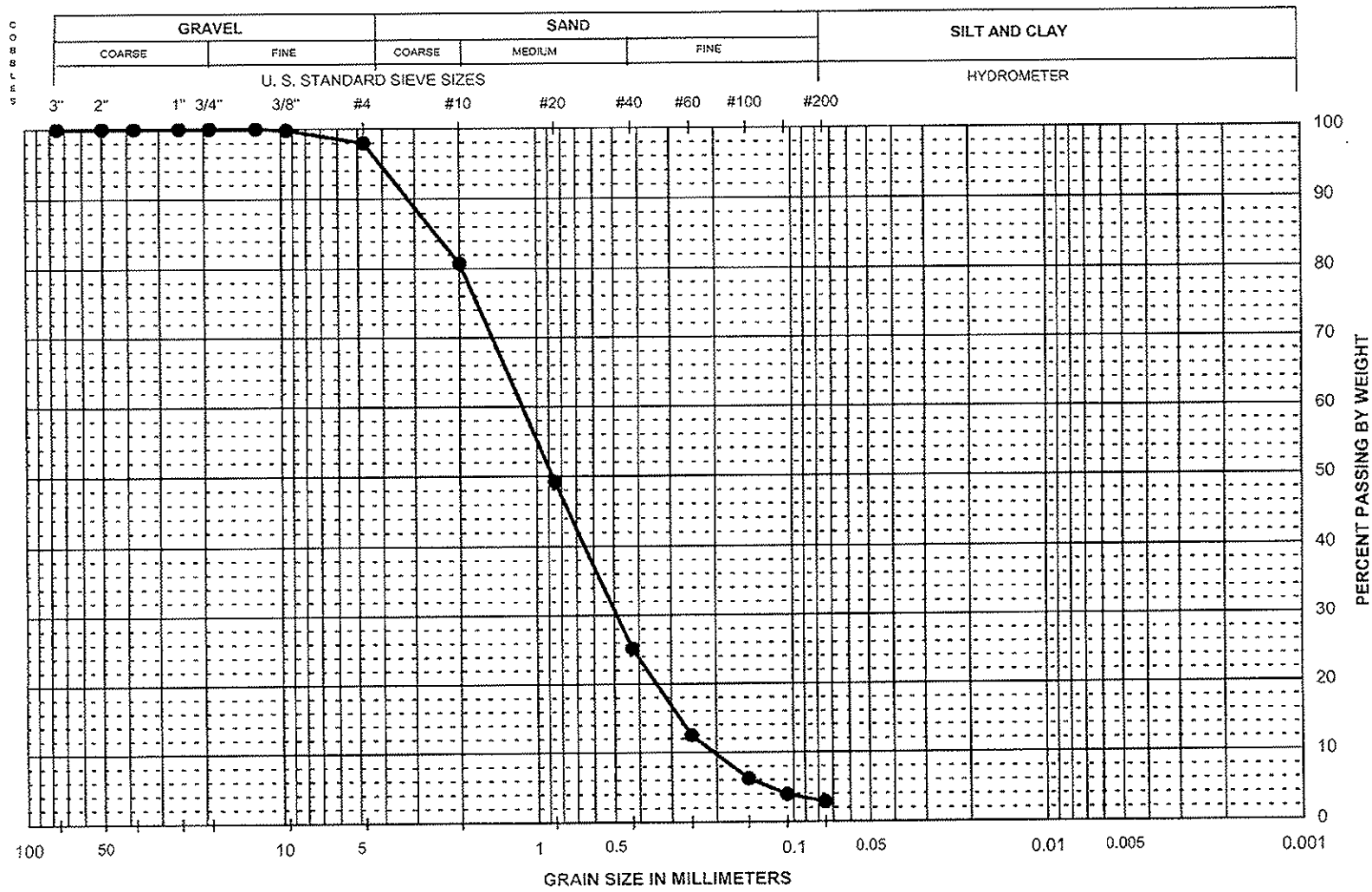
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-8

URS

Sieve ECSb10040

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.8
#4	4.75	97.9
#10	2.00	80.7
#20	0.850	49.2
#40	0.425	25.2
#60	0.250	12.4
#100	0.150	6.2
#140	0.106	3.9
#200	0.075	2.8
Hydrometer Analysis		

% Cobbles	
% Gravel	2.1
% Sand	95.1
% Fines	2.8
D_{60}	1.140
D_{30}	0.488
D_{10}	0.205
C_u	5.6
C_c	1.0

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-11	1	5.0	•					Light Gray Poorly Graded SAND (SP)

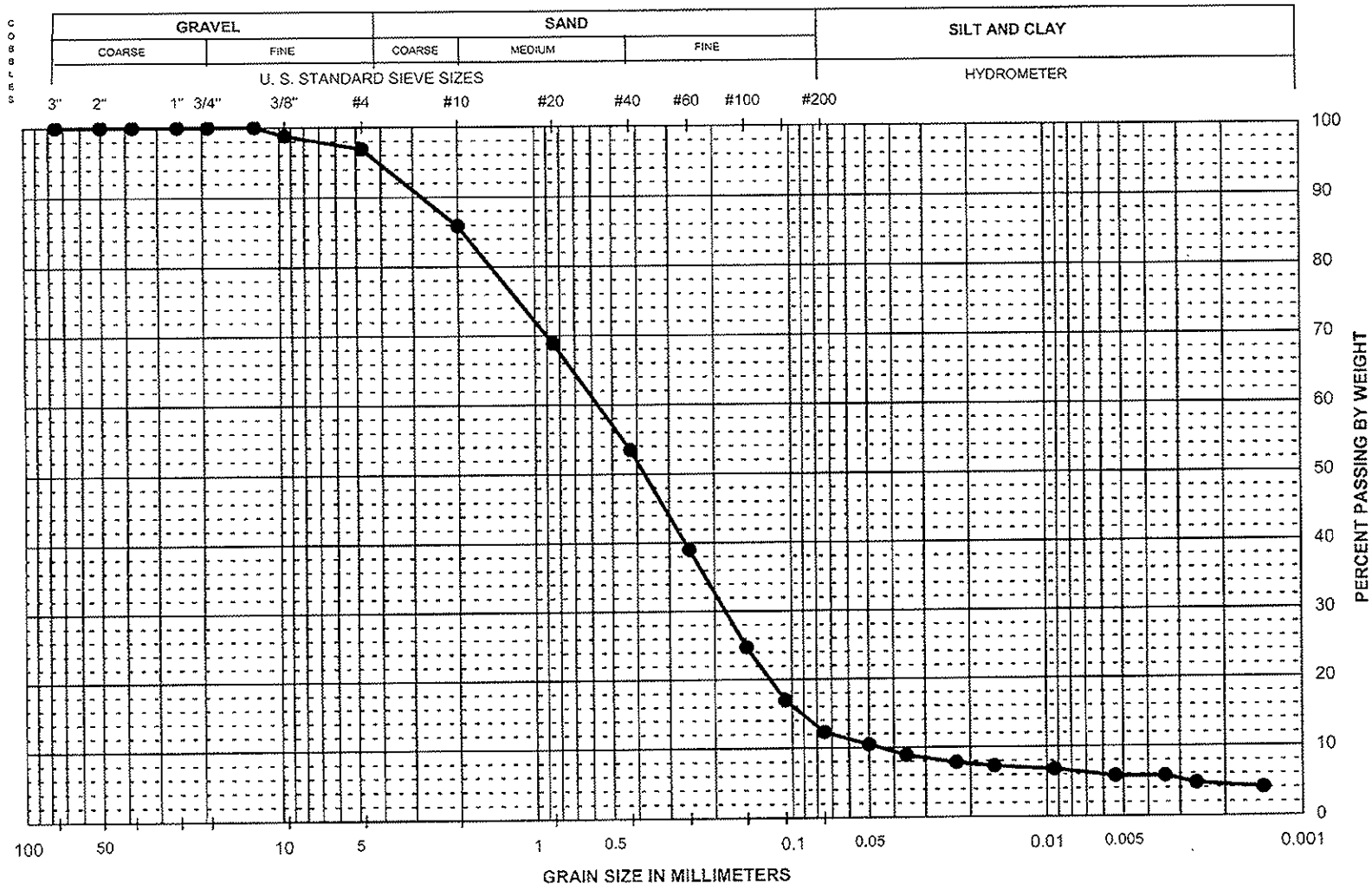
PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-9

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	98.8
#4	4.75	96.8
#10	2.00	85.8
#20	0.850	68.8
#40	0.425	53.5
#60	0.250	39.0
#100	0.150	24.7
#140	0.106	16.9
#200	0.075	12.3
Hydrometer Analysis	0.0500	10.5
	0.0357	8.9
	0.0227	7.8
	0.0161	7.3
	0.0093	6.7
	0.0064	5.7
	0.0034	5.7
	0.0026	4.7
	0.0014	4.0
	0.0014	4.0

% Cobbles	
% Gravel	3.2
% Sand	84.5
% Fines	12.3
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-11	5	25.0	●				4	**Brown Silty SAND (SM)**

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

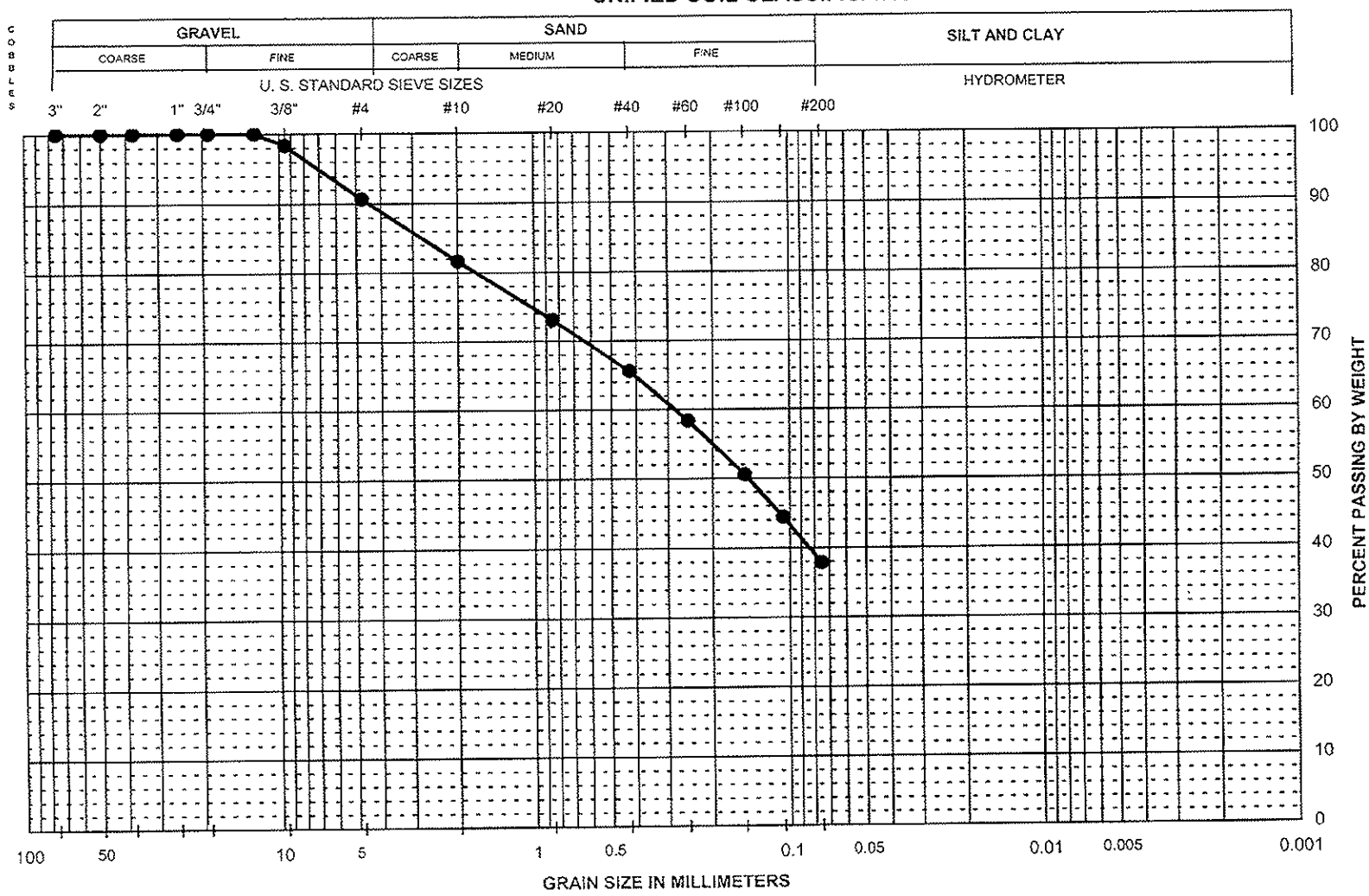
Figure: D-10

URS

(SNA) sieve only (04/2000)

Hydrometer ECSb11025

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	98.3
#4	4.75	90.6
#10	2.00	81.6
#20	0.850	73.1
#40	0.425	65.6
#60	0.250	58.4
#100	0.150	50.5
#140	0.106	44.4
#200	0.075	37.9

Hydrometer Analysis

% Cobbles	
% Gravel	9.4
% Sand	52.7
% Fines	37.9
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-11	10	50.0	●	3.5				Light Brownish Gray Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

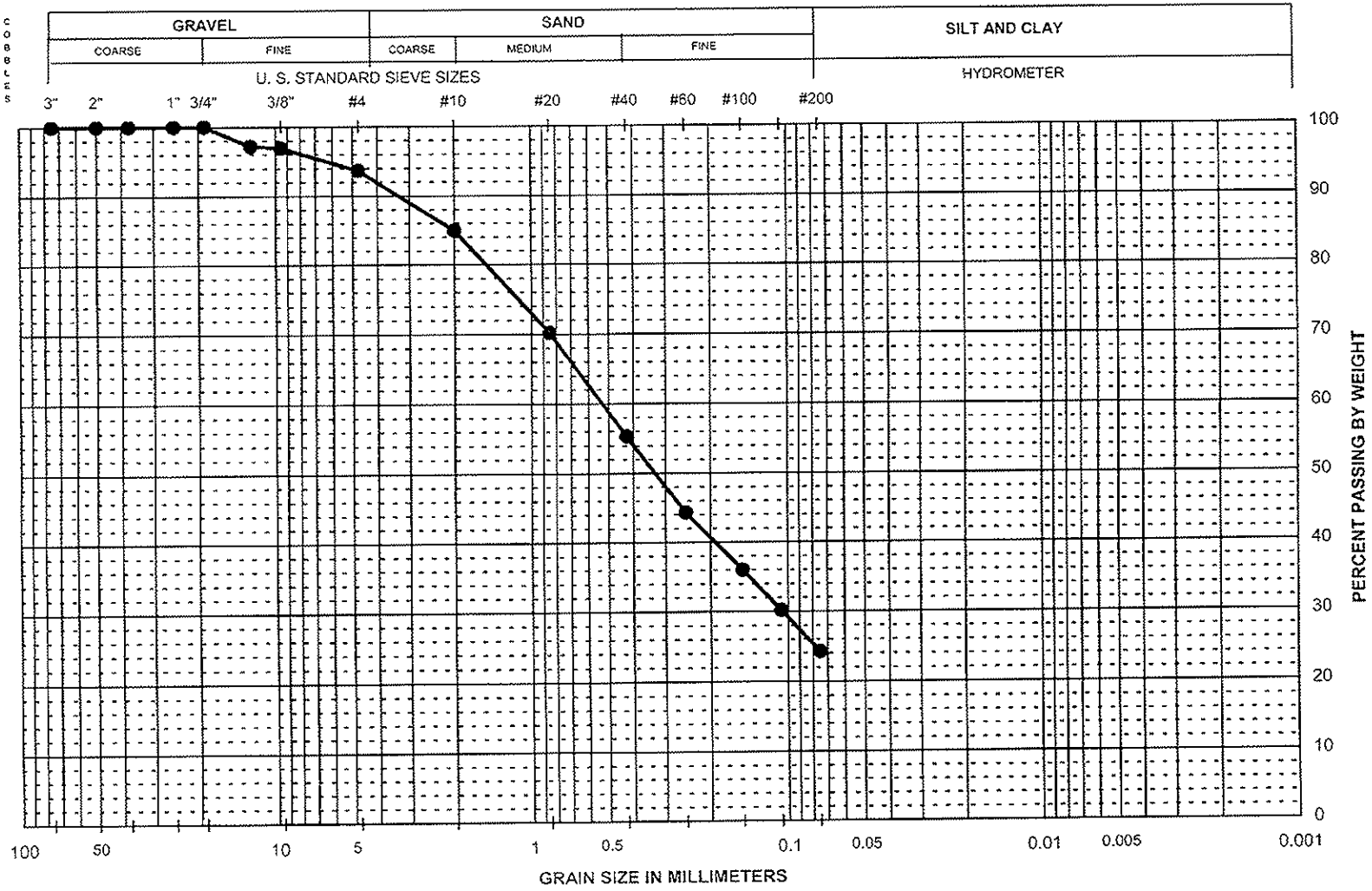
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-11

URS

Sieve ECSb11050

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	97.2
3/8"	9.50	96.9
#4	4.75	93.7
#10	2.00	84.9
#20	0.850	70.2
#40	0.425	55.3
#60	0.250	44.3
#100	0.150	36.0
#140	0.106	30.1
#200	0.075	24.2
Hydrometer Analysis		

% Cobbles	
% Gravel	6.3
% Sand	69.5
% Fines	24.2
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-12	6	25.0	●	4.6	33	7		Yellowish Brown Silty SAND (SM)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

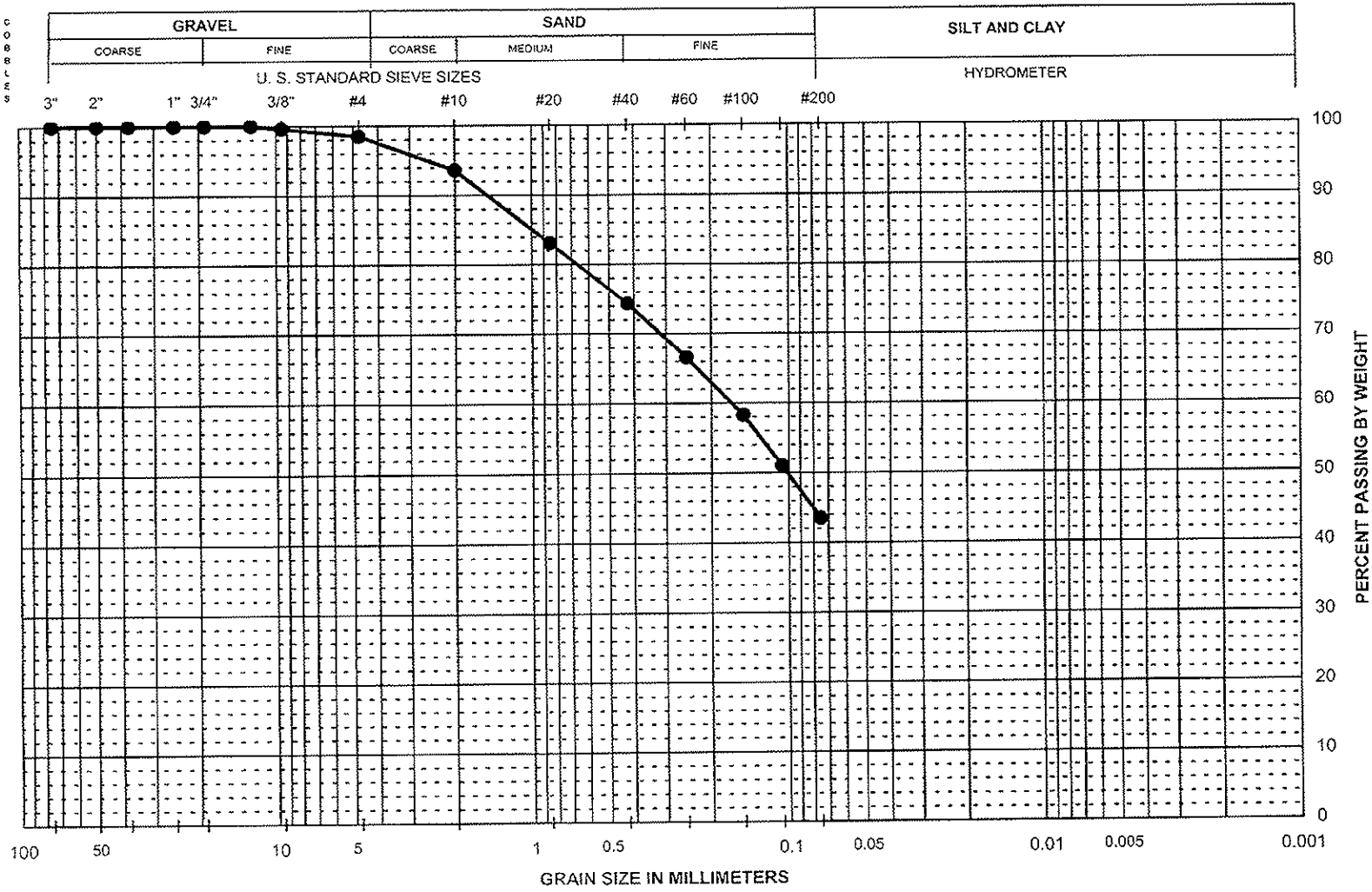
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-12

URS

Sieve ECSb12025

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.6
#4	4.75	98.5
#10	2.00	93.6
#20	0.850	83.1
#40	0.425	74.4
#60	0.250	66.6
#100	0.150	58.3
#140	0.106	51.0
#200	0.075	43.5

Hydrometer Analysis

% Cobbles	
% Gravel	1.5
% Sand	55.0
% Fines	43.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-13	3	10.0	●					Dark Yellowish Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

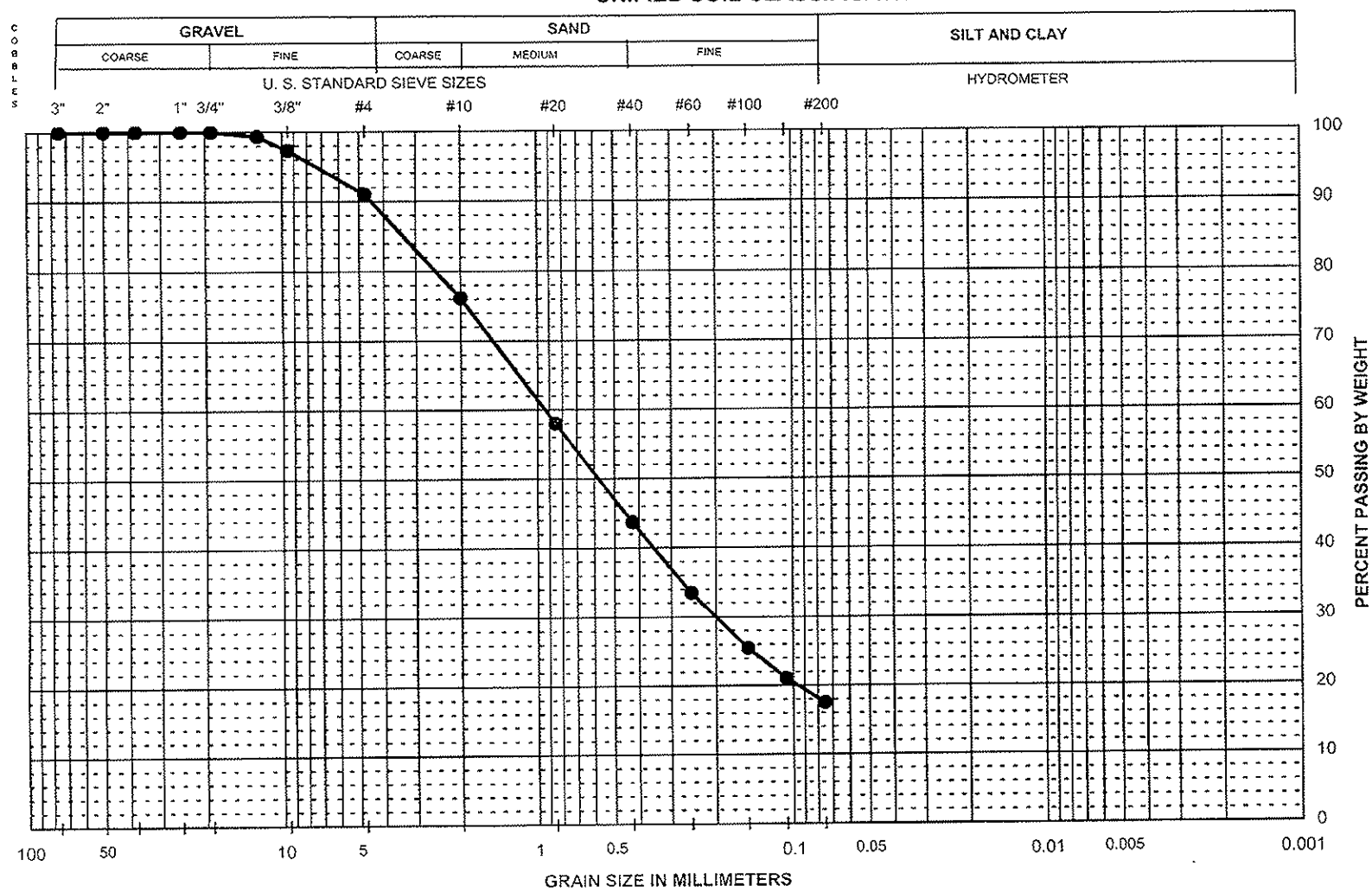
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-13

URS

Sieve ECSb13010

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	99.3
3/8"	9.50	97.3
#4	4.75	91.0
#10	2.00	76.1
#20	0.850	58.0
#40	0.425	43.7
#60	0.250	33.5
#100	0.150	25.5
#140	0.106	21.0
#200	0.075	17.5

Hydrometer Analysis

% Cobbles	
% Gravel	9.0
% Sand	73.5
% Fines	17.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-14	1	2.5	●					Dark Brown Clayey SAND (SC)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

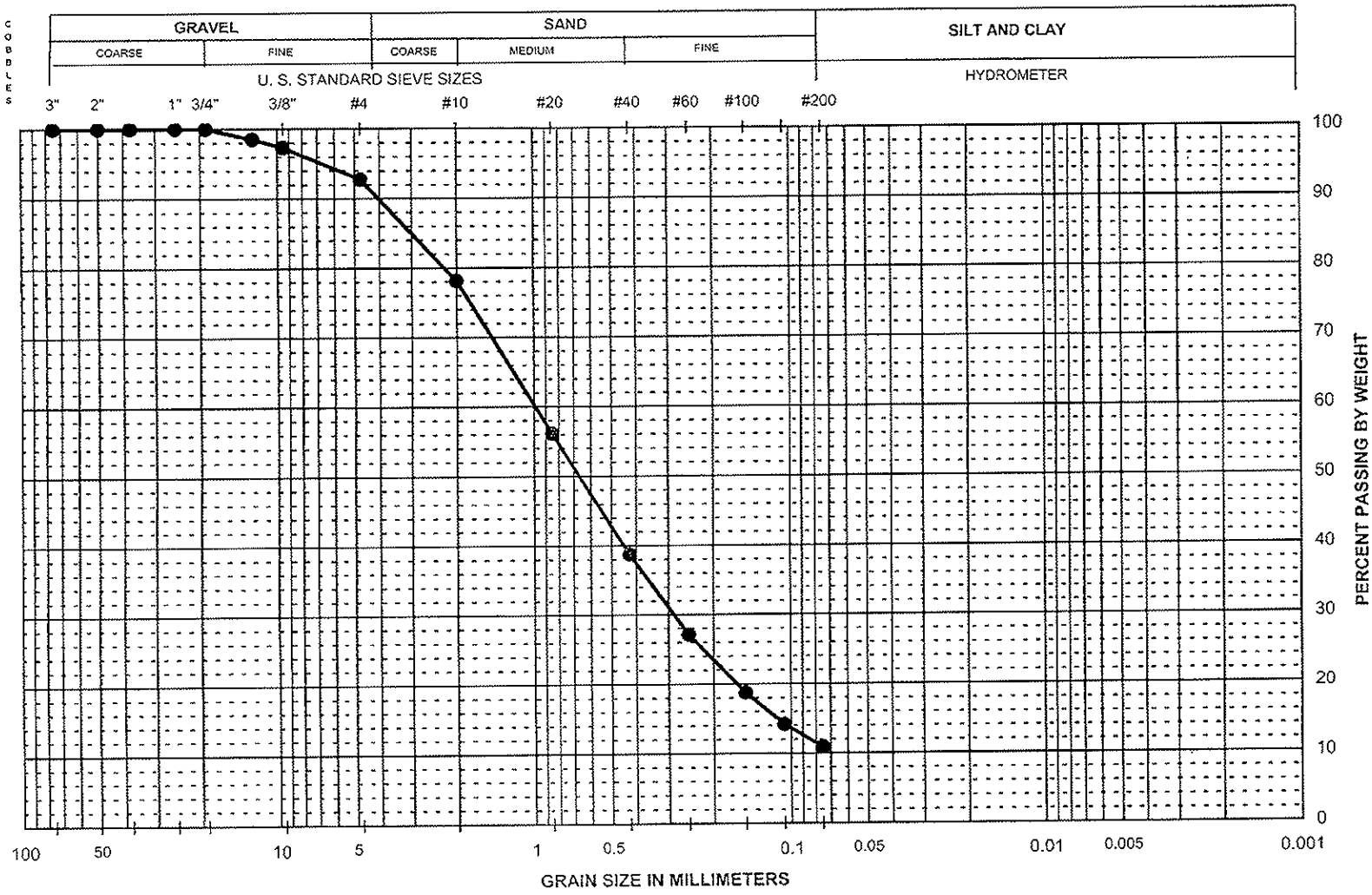
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-14

URS

Sieve ECSb14002

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	99.5
3/8"	9.50	97.3
#4	4.75	92.8
#10	2.00	78.1
#20	0.850	56.1
#40	0.425	38.7
#60	0.250	27.1
#100	0.150	18.8
#140	0.106	14.2
#200	0.075	10.9

Hydrometer Analysis

% Cobbles	
% Gravel	7.2
% Sand	81.9
% Fines	10.9

D_{60}	0.989
D_{30}	0.285
D_{10}	0.075
C_u	13.2
C_c	1.1

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-15	2	10.0	•	1.7				Dark Brown Well-Graded SAND with Silt (SW-SM)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

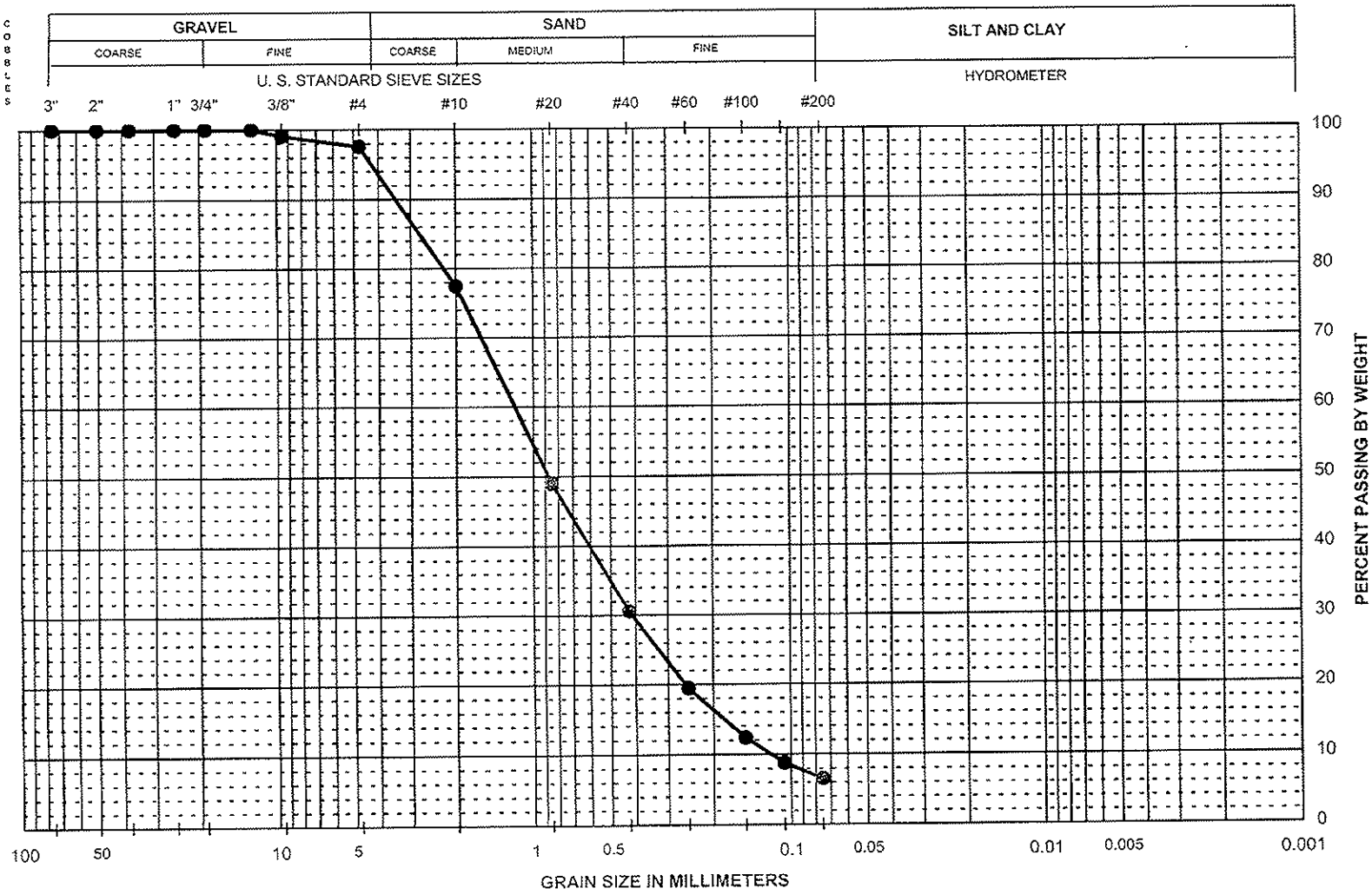
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-15

URS

Sieve ECSb15010

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.0
#4	4.75	97.6
#10	2.00	77.4
#20	0.850	49.0
#40	0.425	30.6
#60	0.250	19.4
#100	0.150	12.3
#140	0.106	8.8
#200	0.075	6.5

Hydrometer Analysis

% Cobbles	
% Gravel	2.4
% Sand	91.1
% Fines	6.5
D_{60}	1.183
D_{30}	0.414
D_{10}	0.119
C_u	9.9
C_c	1.2

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-15	5	25.0	●	2.4				Brown Well-Graded SAND with Silt (SW-SM)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

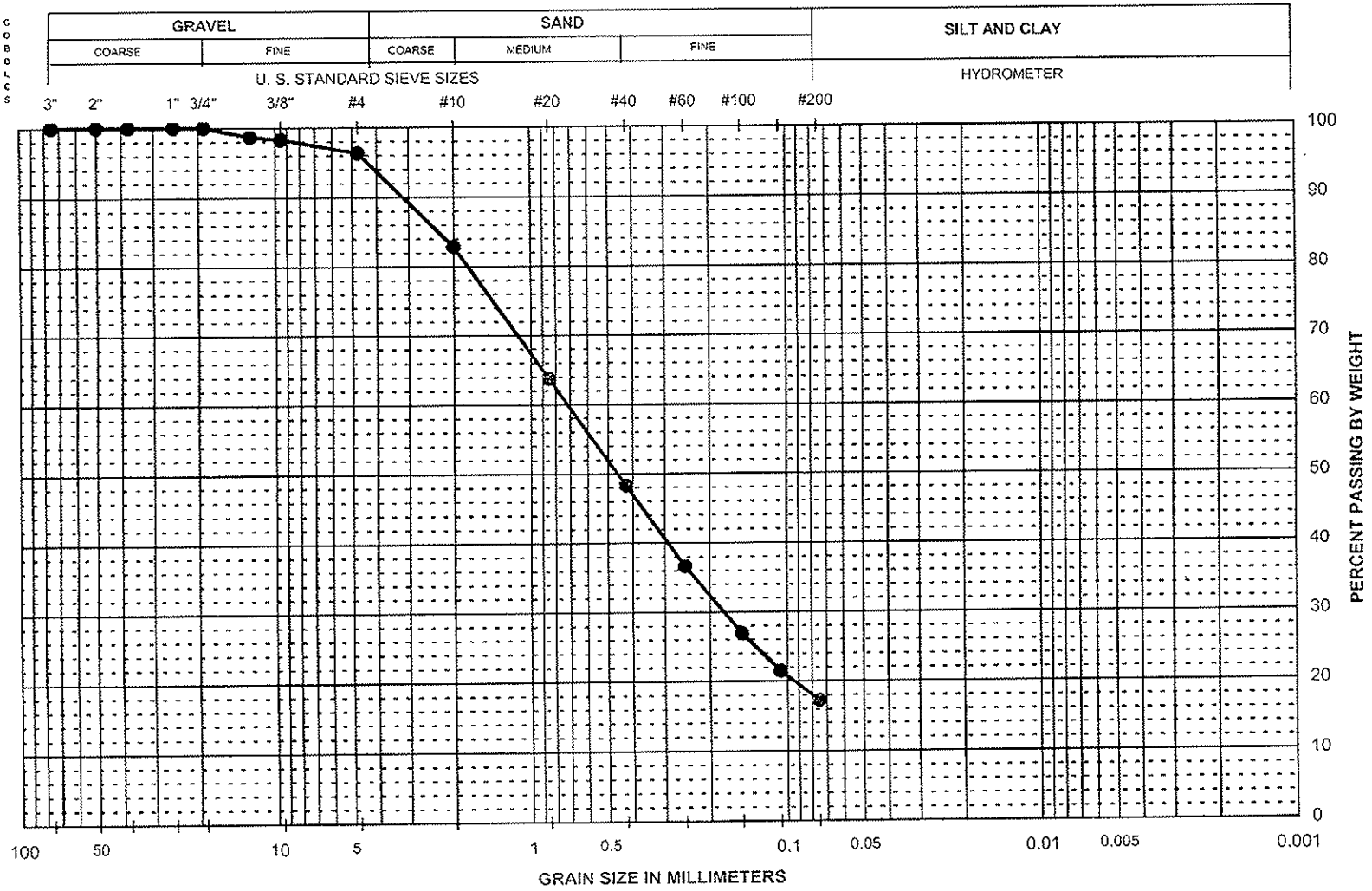
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-16

URS

Sieve ECSb15025

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	98.7
3/8"	9.50	98.3
#4	4.75	96.3
#10	2.00	82.9
#20	0.850	63.7
#40	0.425	48.3
#60	0.250	36.6
#100	0.150	26.9
#140	0.106	21.5
#200	0.075	17.3
Hydrometer Analysis		

% Cobbles	
% Gravel	3.7
% Sand	79.0
% Fines	17.3
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-15	11	55.0	●	4.6				Strong Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

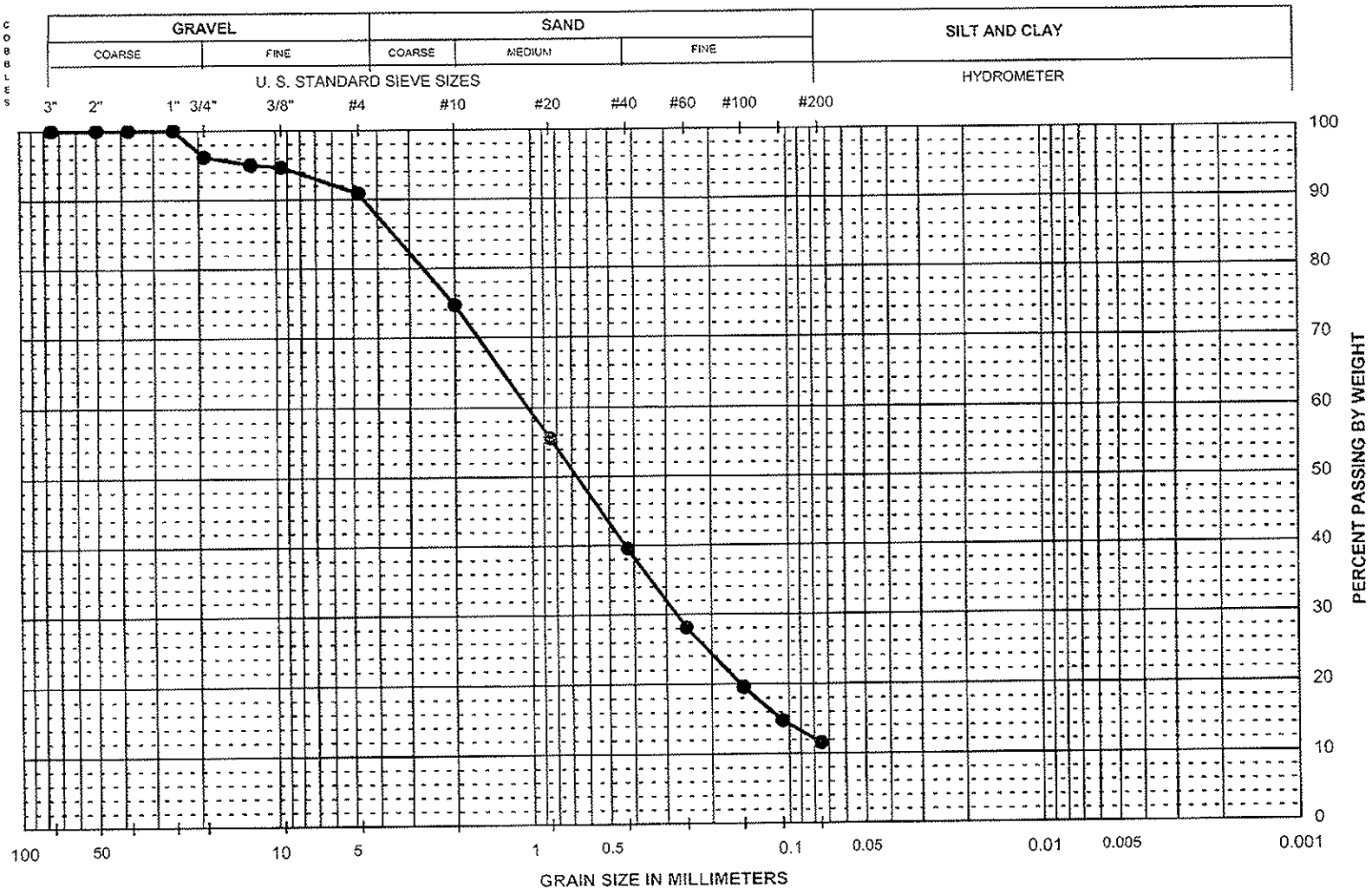
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-17

URS

Sieve ECSb15055

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	96.2
1/2"	12.50	95.0
3/8"	9.50	94.7
#4	4.75	90.9
#10	2.00	74.6
#20	0.850	55.5
#40	0.425	39.5
#60	0.250	28.1
#100	0.150	19.5
#140	0.106	14.7
#200	0.075	11.5

Hydrometer Analysis

% Cobbles	
% Gravel	9.1
% Sand	79.4
% Fines	11.5

D_{60}	1.039
D_{30}	0.274
D_{10}	0.076
C_u	13.7
C_c	1.0

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-15	16	80.0	●	2.2				Grayish Brown Well-Graded SAND with Silt (SW-SM)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

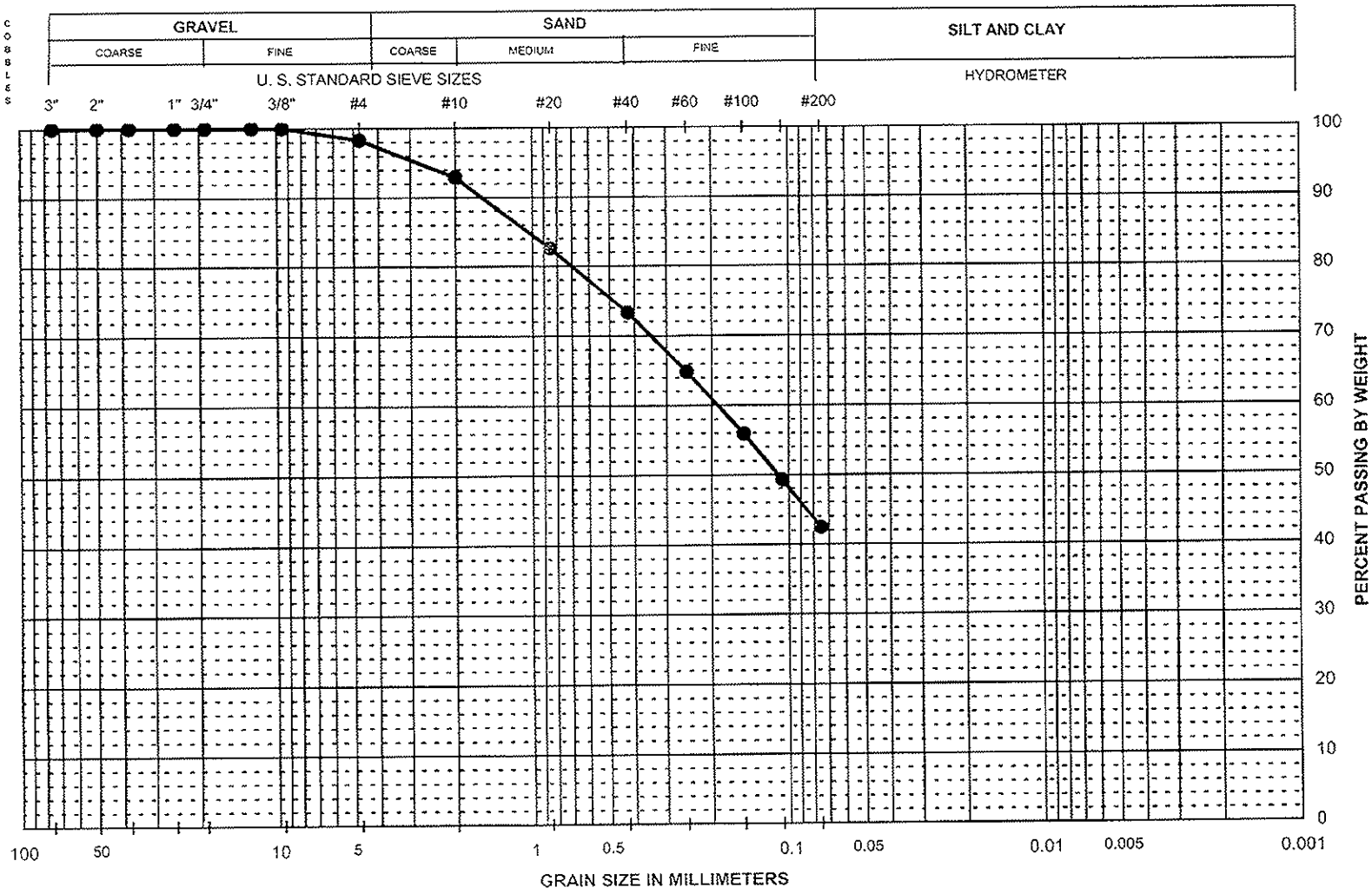
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-18

URS

Sieve ECSb15080

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	98.3
#10	2.00	92.9
#20	0.850	82.5
#40	0.425	73.3
#60	0.250	64.8
#100	0.150	55.9
#140	0.106	49.3
#200	0.075	42.5

Hydrometer Analysis

% Cobbles	
% Gravel	1.7
% Sand	55.8
% Fines	42.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-16	8	40.0	●	5.3	29	9		Grayish Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

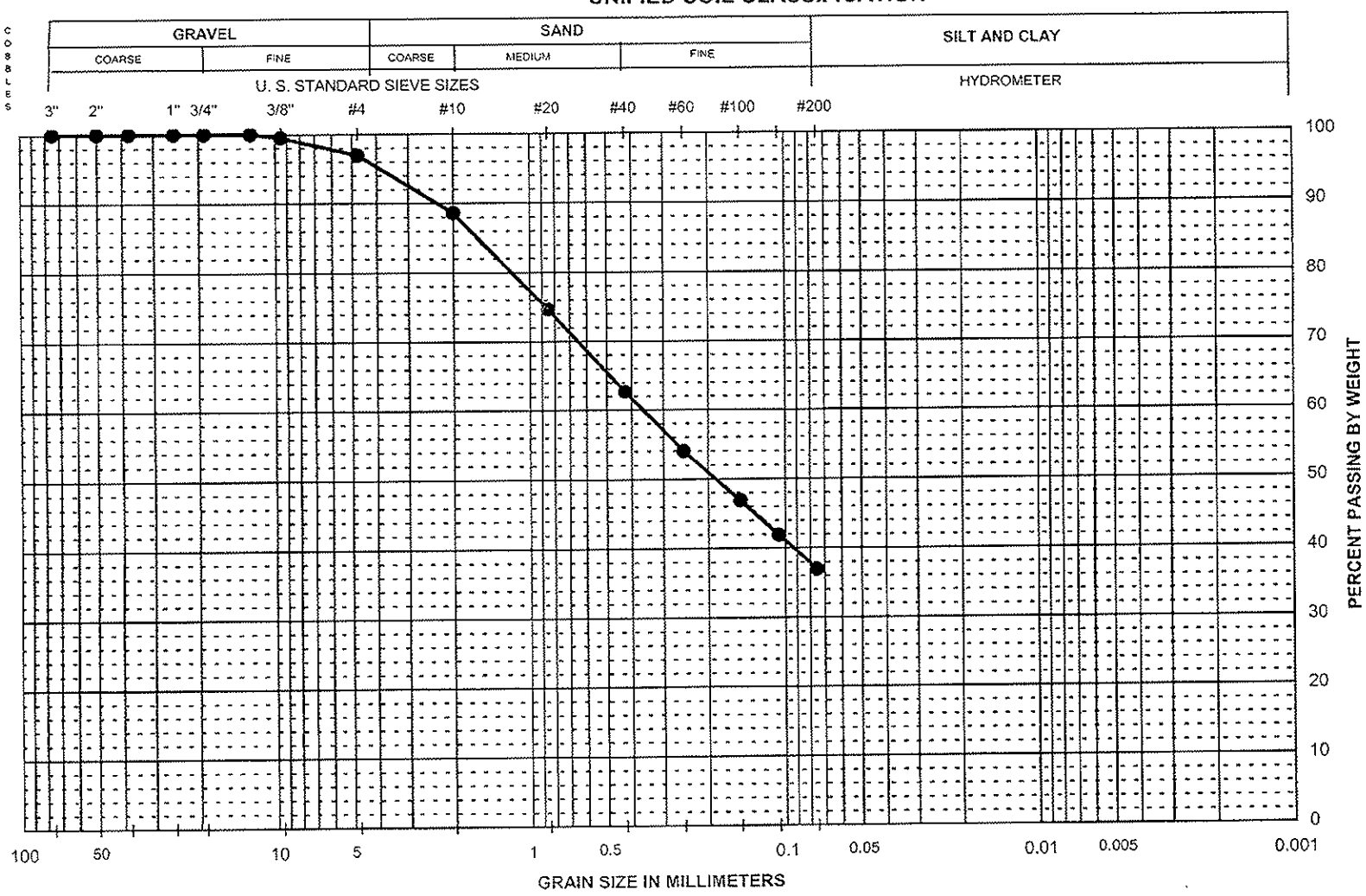
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-19

URS

Sieve ECSb16040

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.5
#4	4.75	96.9
#10	2.00	88.6
#20	0.850	74.7
#40	0.425	62.6
#60	0.250	54.0
#100	0.150	46.9
#140	0.106	41.9
#200	0.075	37.0

Hydrometer Analysis

% Cobbles	
% Gravel	3.1
% Sand	59.9
% Fines	37.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-17	7	35.0	●	5.4	27	5		Dark Yellowish Brown Silty SAND (SM)

PROJECT NAME: **East County Substation**

PROJECT NUMBER: **27667021**

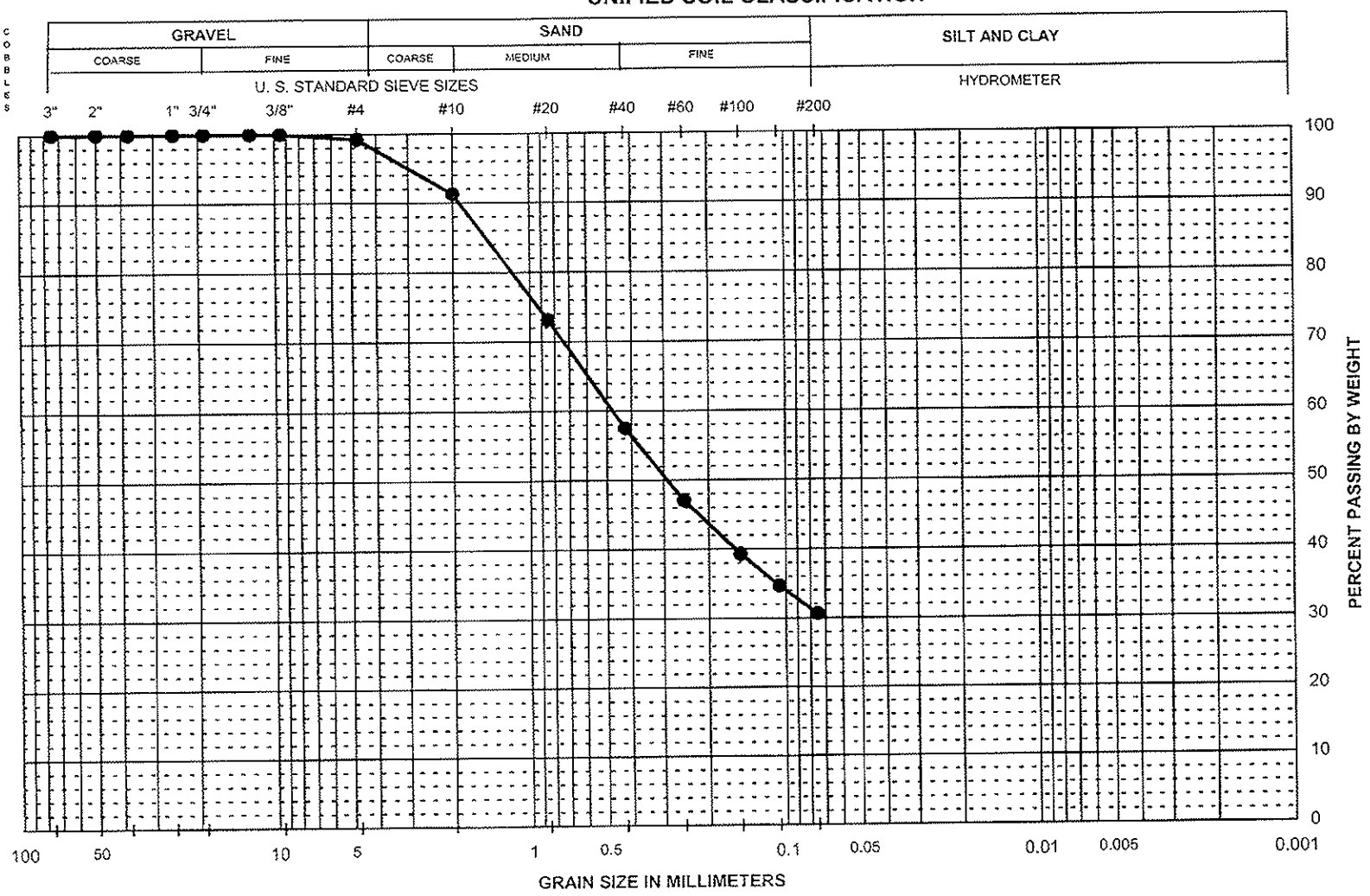
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-20

URS

Sieve ECSb17035

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.2
#10	2.00	91.2
#20	0.850	73.2
#40	0.425	57.5
#60	0.250	47.0
#100	0.150	39.3
#140	0.106	34.7
#200	0.075	30.6
Hydrometer Analysis		

% Cobbles	
% Gravel	0.8
% Sand	68.6
% Fines	30.6
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-17	9	45.0	•					Brown Clayey SAND (SC)

PROJECT NAME: East County Substation

PROJECT NUMBER: 27667021

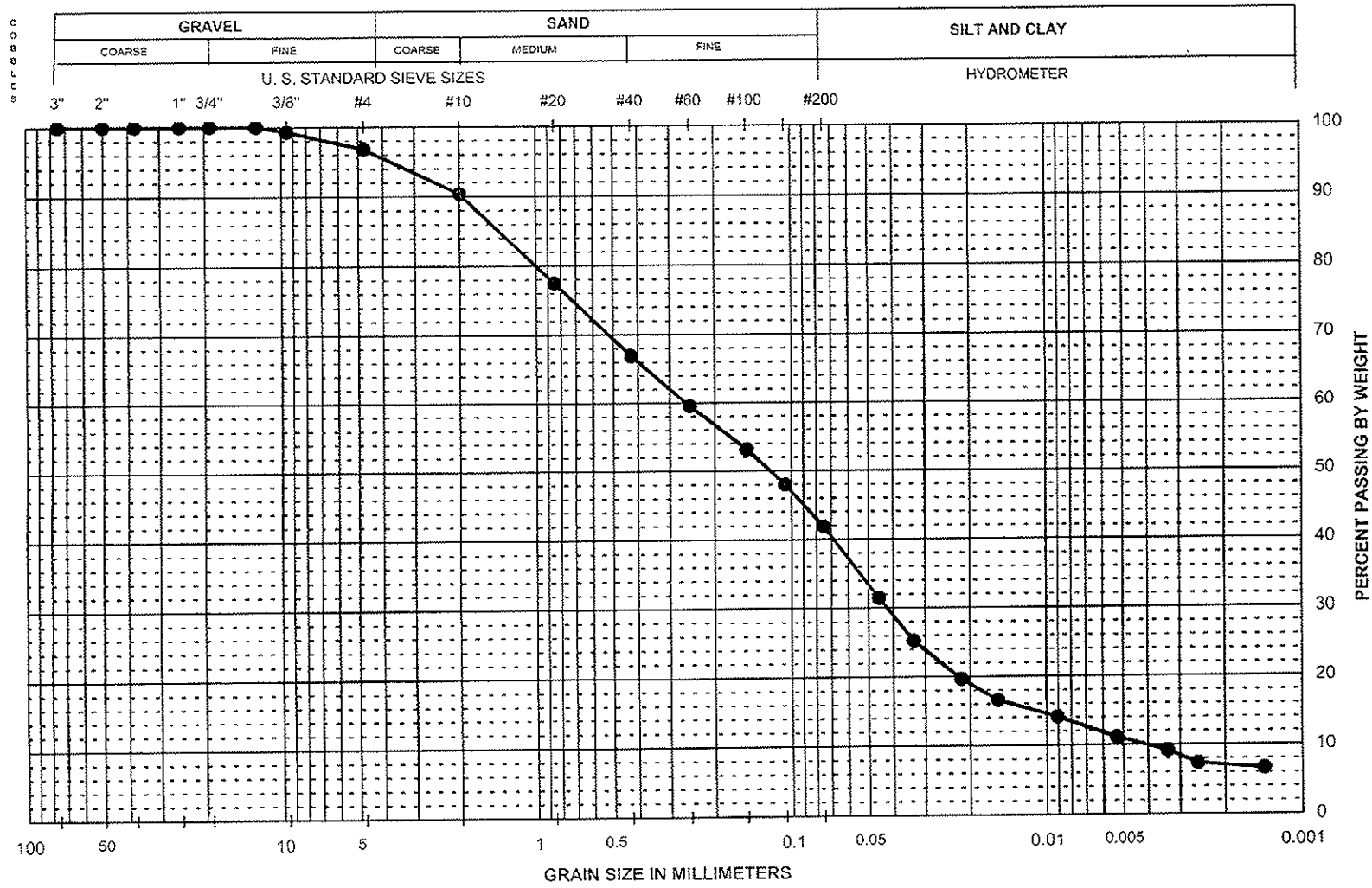
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-21

URS

Sieve ECSb17045

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.3
#4	4.75	96.8
#10	2.00	90.4
#20	0.850	77.5
#40	0.425	66.9
#60	0.250	59.5
#100	0.150	53.1
#140	0.106	48.0
#200	0.075	41.9
Hydrometer Analysis	0.0455	31.4
	0.0332	25.2
	0.0216	19.7
	0.0155	16.6
	0.0091	14.1
	0.0053	11.1
	0.0034	9.2
	0.0026	7.3
	0.0014	6.6
	0.0014	6.6

% Cobbles	
% Gravel	3.2
% Sand	54.9
% Fines	41.9
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-18	4	15.0	●				7	Pale Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

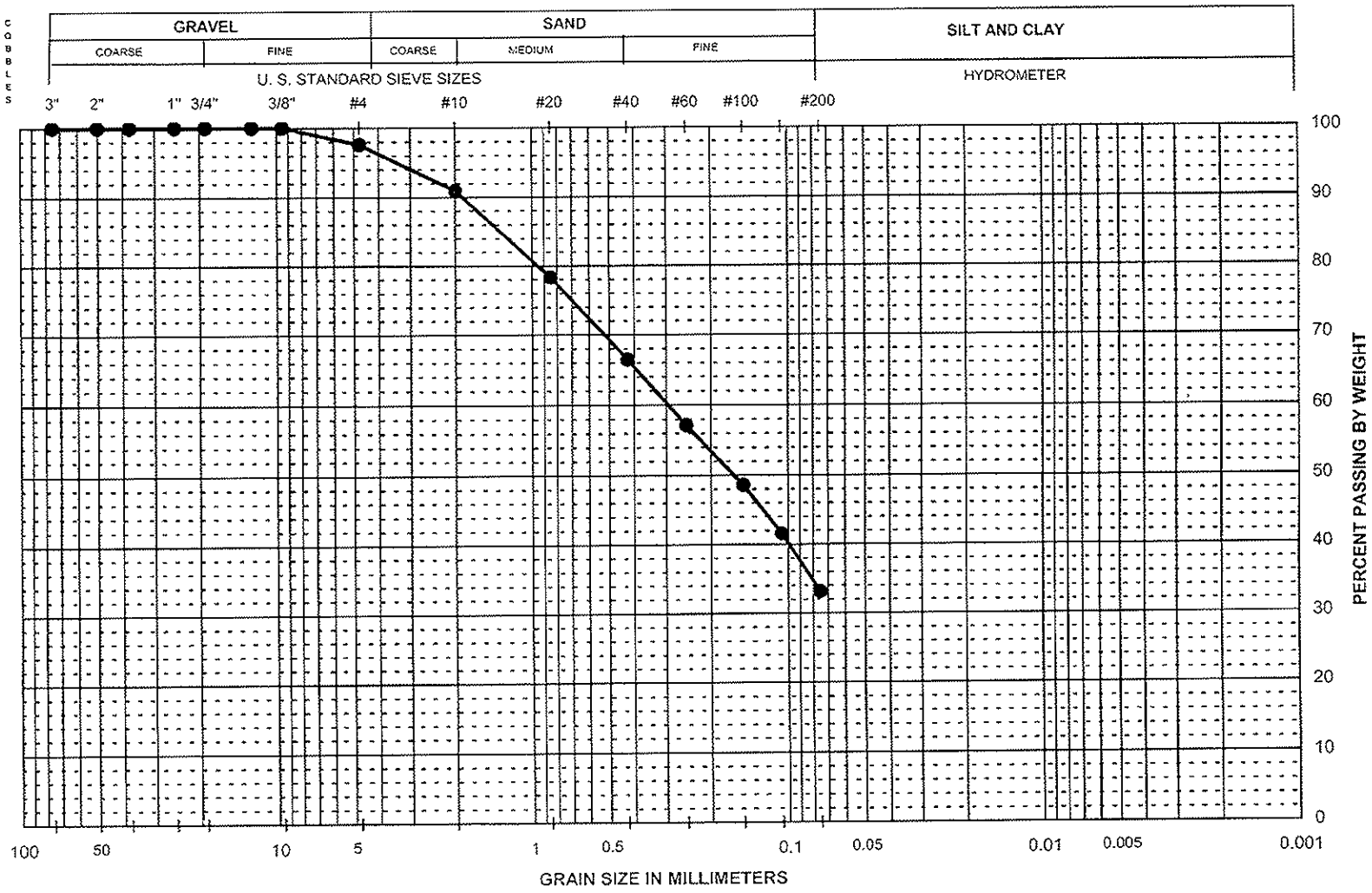
Figure: D-22

URS

(SNA) sieve only (04/2000)

Hydrometer ECSb18015

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	97.6
#10	2.00	90.9
#20	0.850	78.3
#40	0.425	66.5
#60	0.250	57.1
#100	0.150	48.6
#140	0.106	41.6
#200	0.075	33.2

Hydrometer Analysis

% Cobbles	
% Gravel	2.4
% Sand	64.4
% Fines	33.2
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-19	6	25.0	●					Yellowish Brown Clayey SAND (SC)

PROJECT NAME: **East County Substation**

PROJECT NUMBER: **27667021**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-23

URS

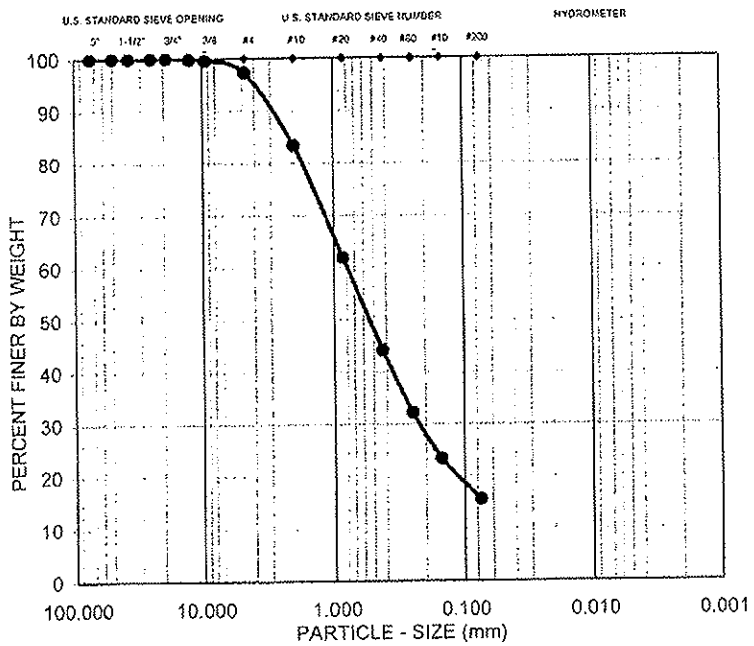
Sieve ECSb19025

Sieve Analysis

(ASTM C422)

G Force Lab No. 6205
Date Sampled: 5/14/2008 By: Client
Date Submitted: 5/14/2008 By: Client
Sample Location: B-24 @ 25' - 30'
Sample Description: Silty sand

Gravel		Sand			Fines
CRS	Fine	CR	Med	Fine	Clay and / or Silt



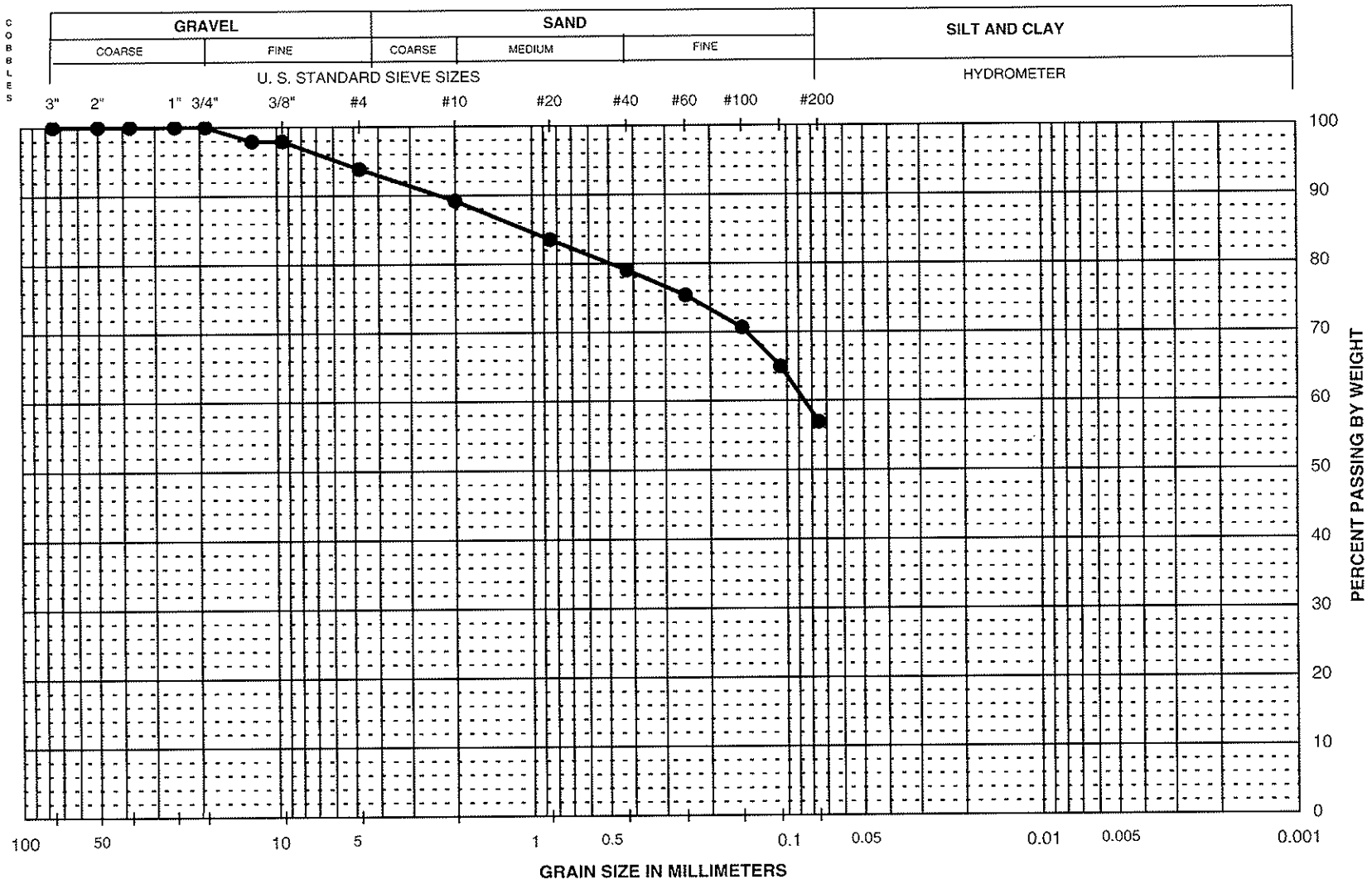
Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	100			
3/8"	100			
#4	97			
#10	83			
#20	62			
#40	44			
#60	32			
#100	23			
#200	16			

Plasticity Index	N/A		

Checked by: _____
John Inlow, Lab Manager

G FORCE
8788 Balboa Avenue ♦ San Diego, CA 92123 ♦ 619-583-6633 ♦ Fax 619-583-6654
3536 Concours Avenue, Suite 110 ♦ Ontario, CA 91764 ♦ 909-481-6833 ♦ Fax 909-481-4642
www.gforceca.com

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	97.9
3/8"	9.50	97.9
#4	4.75	93.8
#10	2.00	89.2
#20	0.850	83.5
#40	0.425	79.1
#60	0.250	75.4
#100	0.150	70.7
#140	0.106	65.0
#200	0.075	56.9
Hydrometer Analysis		

% Cobbles	
% Gravel	6.2
% Sand	36.9
% Fines	56.9
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-26	3	15.0	●					Light brown sandy Clay (CL)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

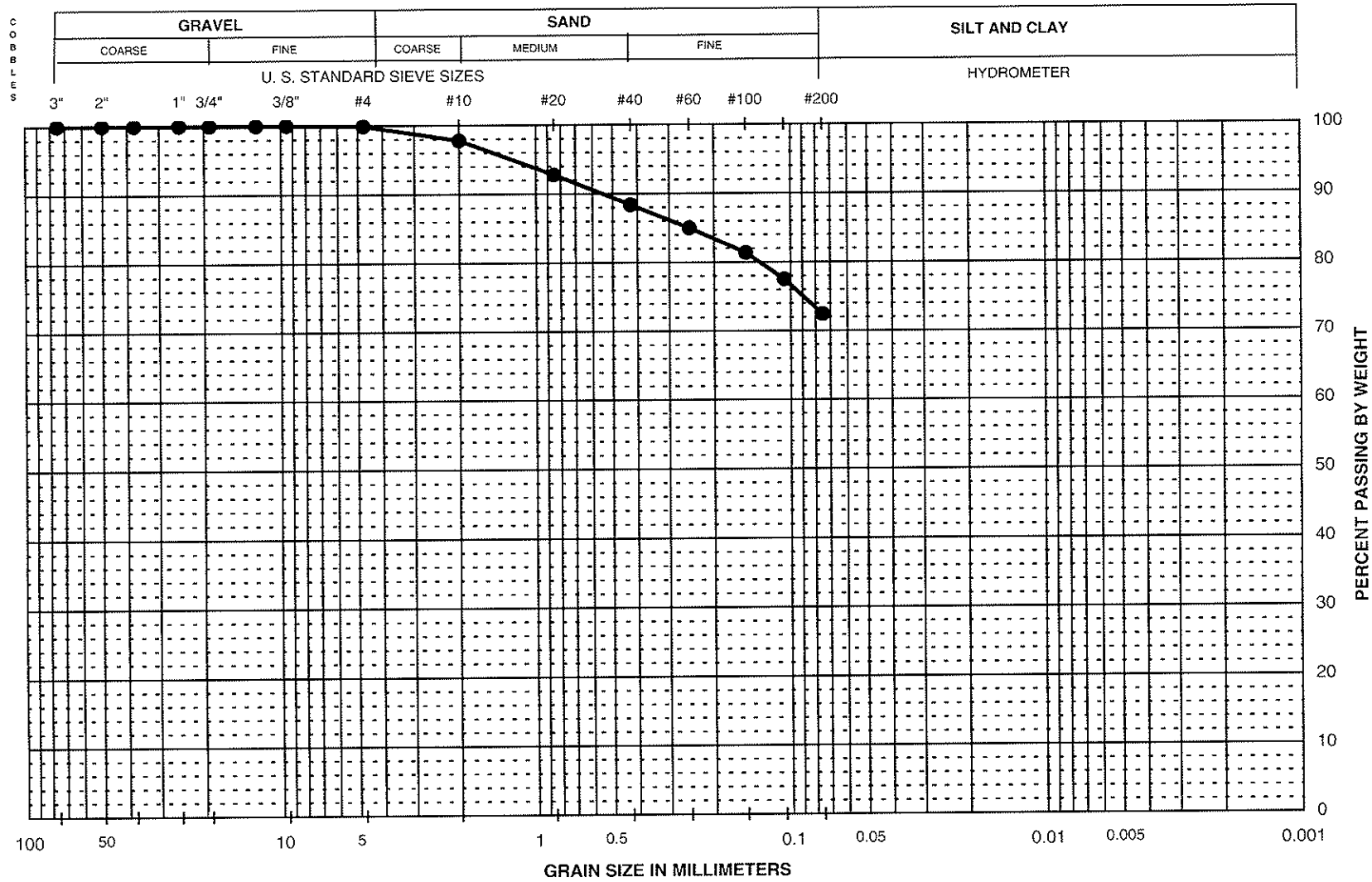
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-25

Sieve ECS B26015.xls

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.9
#10	2.00	97.8
#20	0.850	92.8
#40	0.425	88.4
#60	0.250	85.0
#100	0.150	81.4
#140	0.106	77.5
#200	0.075	72.4
Hydrometer Analysis		

% Cobbles	
% Gravel	0.1
% Sand	27.5
% Fines	72.4
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-26	7	35.0	●					**Light brown Clay with sand (CL)**

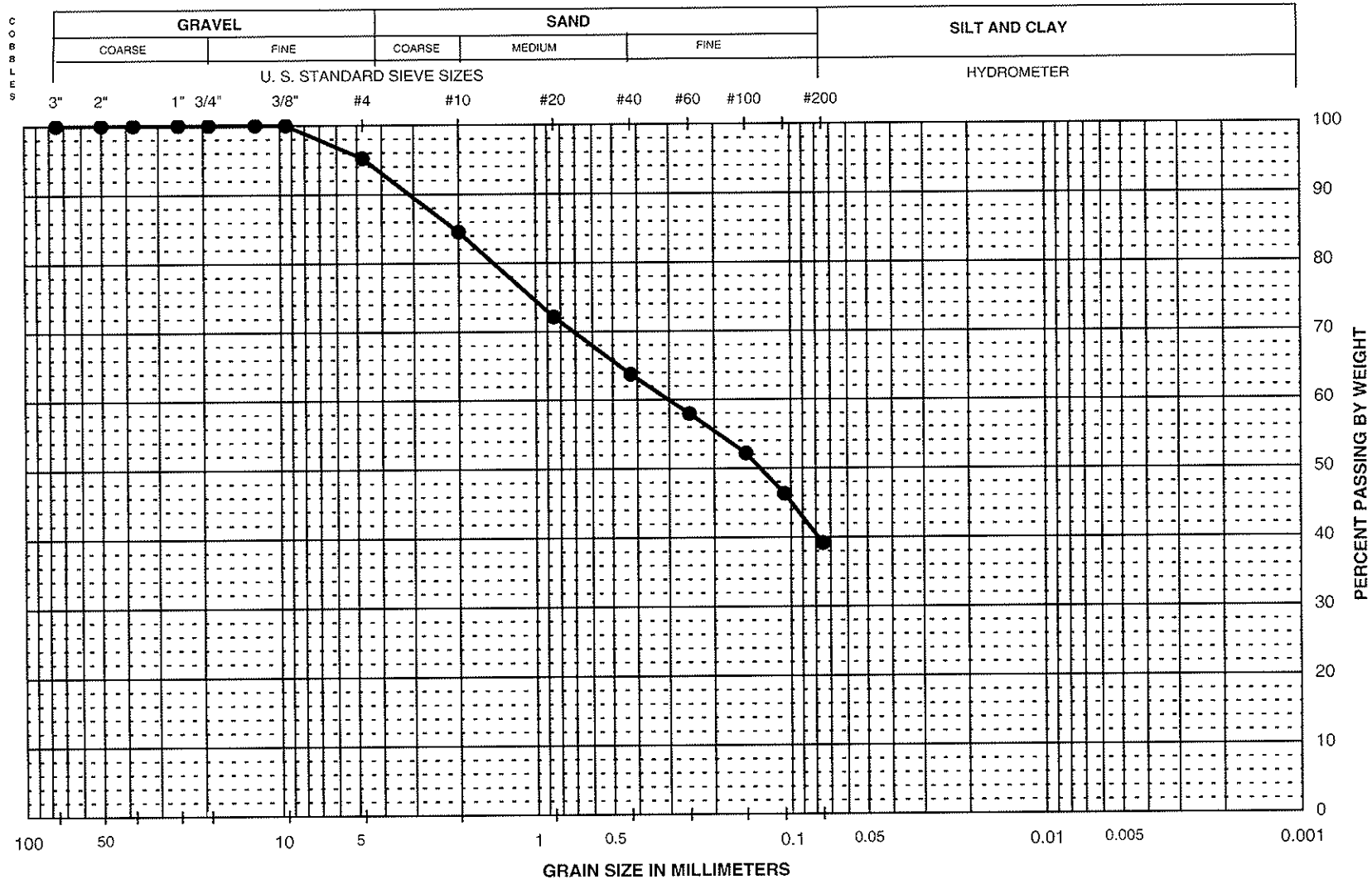
PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-26

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	95.2
#10	2.00	84.5
#20	0.850	72.2
#40	0.425	63.7
#60	0.250	57.9
#100	0.150	52.2
#140	0.106	46.3
#200	0.075	39.2
Hydrometer Analysis		

% Cobbles	
% Gravel	4.8
% Sand	56.0
% Fines	39.2
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
B-27	4	15.0	●					Tannish brown clayey Sand (SC)

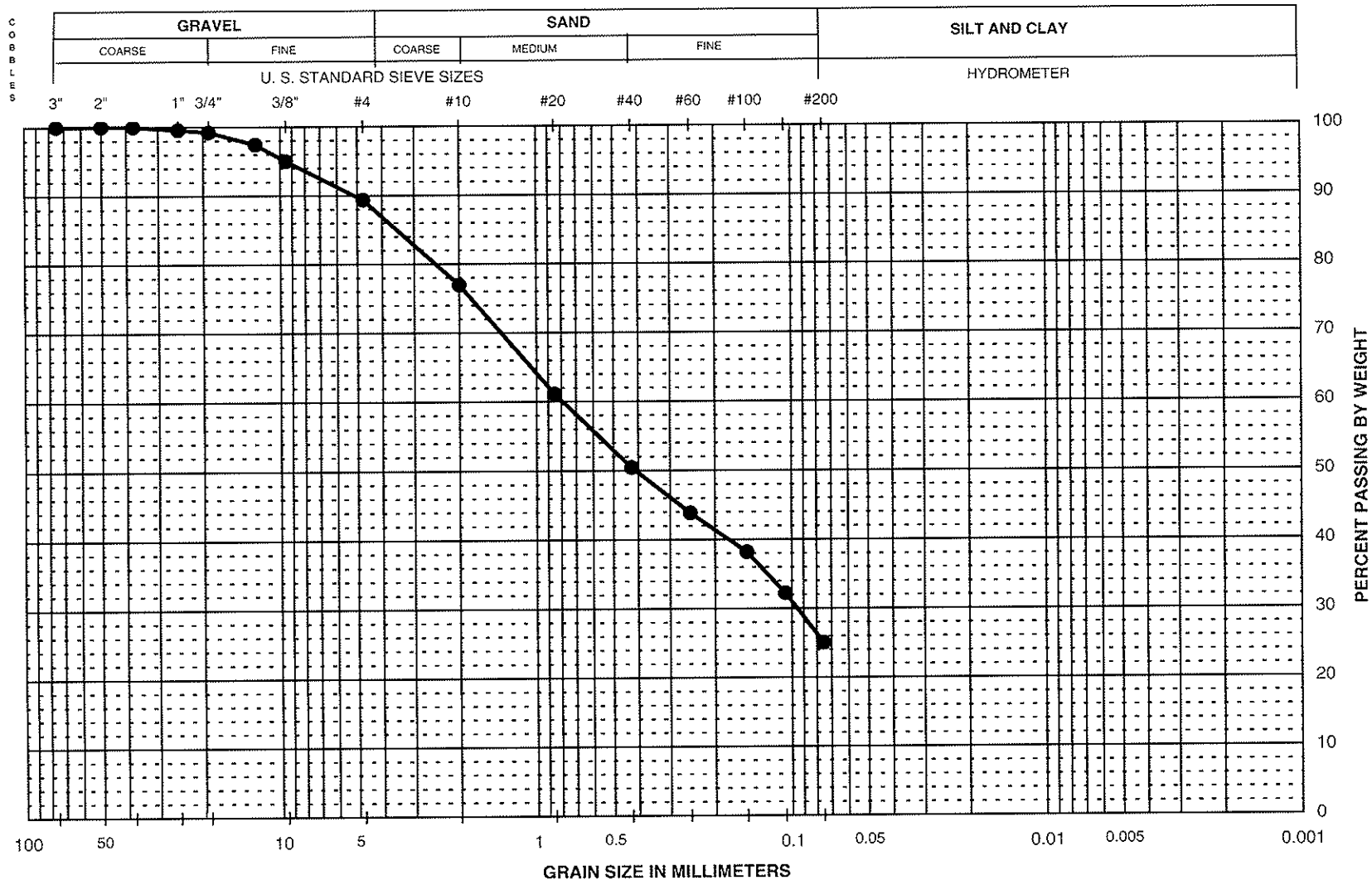
PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-27

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	99.6
3/4"	19.00	99.2
1/2"	12.50	97.4
3/8"	9.50	95.0
#4	4.75	89.4
#10	2.00	76.9
#20	0.850	61.1
#40	0.425	50.4
#60	0.250	43.9
#100	0.150	38.2
#140	0.106	32.2
#200	0.075	25.0
Hydrometer Analysis		

% Cobbles	
% Gravel	10.6
% Sand	64.3
% Fines	25.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
TP-2		3.5	●					**Grayish Brown Silty SAND (SM)**

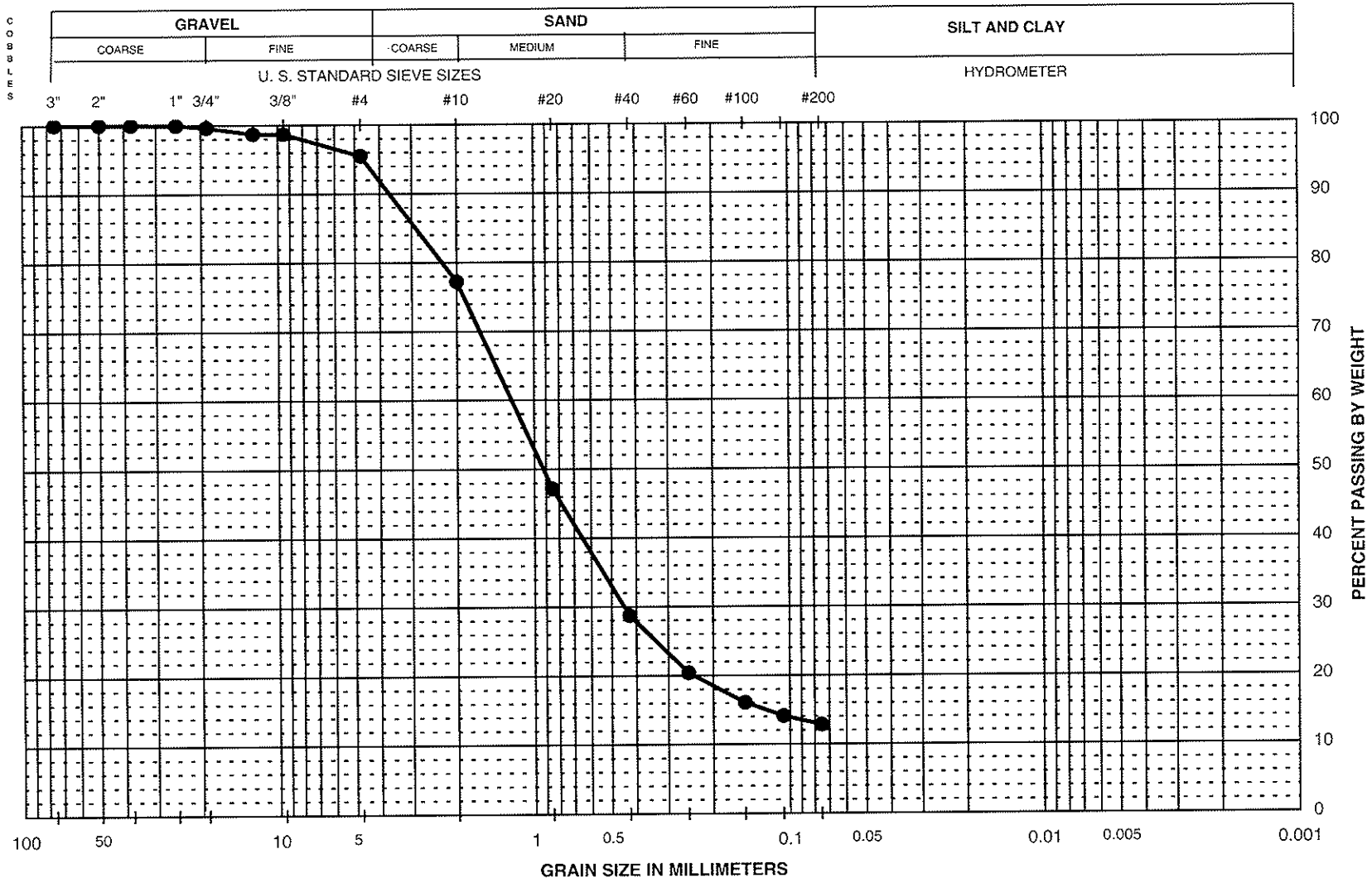
PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-28

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	99.9
3/4"	19.00	99.6
1/2"	12.50	98.7
3/8"	9.50	98.7
#4	4.75	95.5
#10	2.00	77.2
#20	0.850	47.2
#40	0.425	28.7
#60	0.250	20.4
#100	0.150	16.1
#140	0.106	14.1
#200	0.075	12.8
Hydrometer Analysis		

% Cobbles	
% Gravel	4.5
% Sand	82.6
% Fines	12.8
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
TP-3		3.0	●					**Brown Silty SAND (SM)**

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

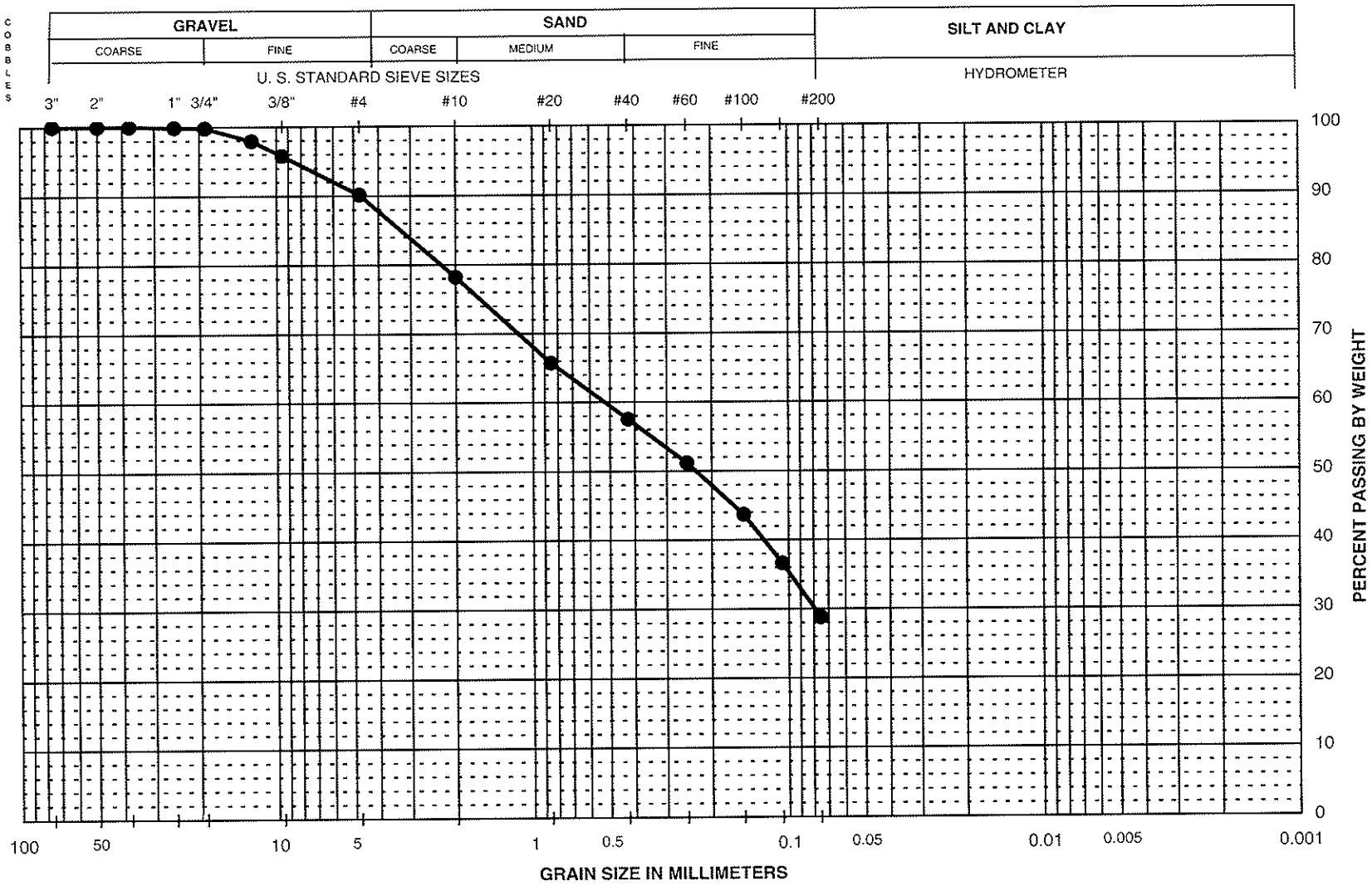
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-29

Sieve ECS TP03003.xls

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	99.9
3/4"	19.00	99.8
1/2"	12.50	97.9
3/8"	9.50	95.8
#4	4.75	90.1
#10	2.00	78.2
#20	0.850	65.7
#40	0.425	57.5
#60	0.250	51.2
#100	0.150	43.7
#140	0.106	36.6
#200	0.075	28.8
Hydrometer Analysis		

% Cobbles	
% Gravel	9.9
% Sand	61.3
% Fines	28.8
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% Clay	Description and Classification
TP-6		5.0	●					**Brown Silty SAND (SM)**

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: D-30

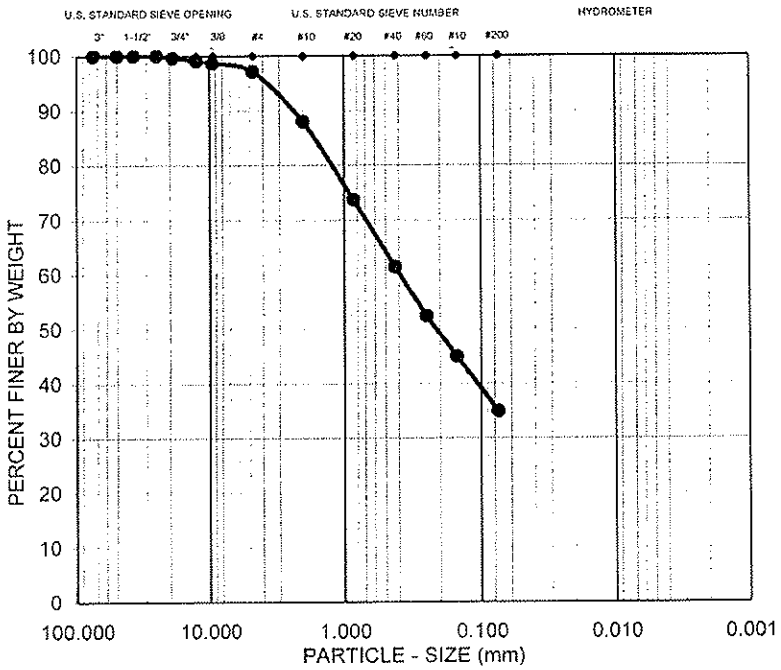
URS

Sieve Analysis

(ASTM C422)

G Force Lab No. 6206
Date Sampled: 5/14/2008 By: Client
Date Submitted: 5/14/2008 By: Client
Sample Location: TP-9 @ 6.7'
Sample Description: Clayey sand

Gravel		Sand			Fines
CRS	Fine	CR	Med	Fine	Clay and / or Silt



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	99			
3/8"	99			
#4	97			
#10	88			
#20	74			
#40	61			
#60	52			
#100	45			
#200	35			

Plasticity Index	N/A		

Checked by: _____
John Inlow, Lab Manager

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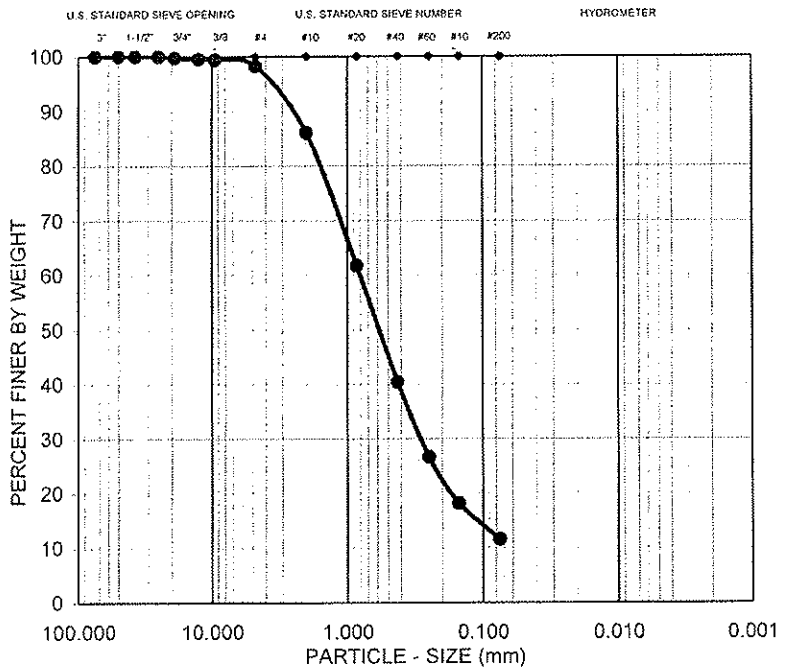
Sieve Analysis

(ASTM C422)

G Force Lab No. 6207
Date Sampled: 5/14/2008 By: Client
Date Submitted: 5/14/2008 By: Client
Sample Location: TP-19 @ 9.5'
Sample Description: Silty sand



Sieve Size	% Passing	Specification Low	Specification High	X = Out of Spec
3"	100			
2"	100			
1-1/2"	100			
1"	100			
3/4"	100			
1/2"	99			
3/8"	99			
#4	98			
#10	86			
#20	62			
#40	40			
#60	27			
#100	18			
#200	12			

Plasticity Index	N/A		

Checked by: John Inlow, Lab Manager

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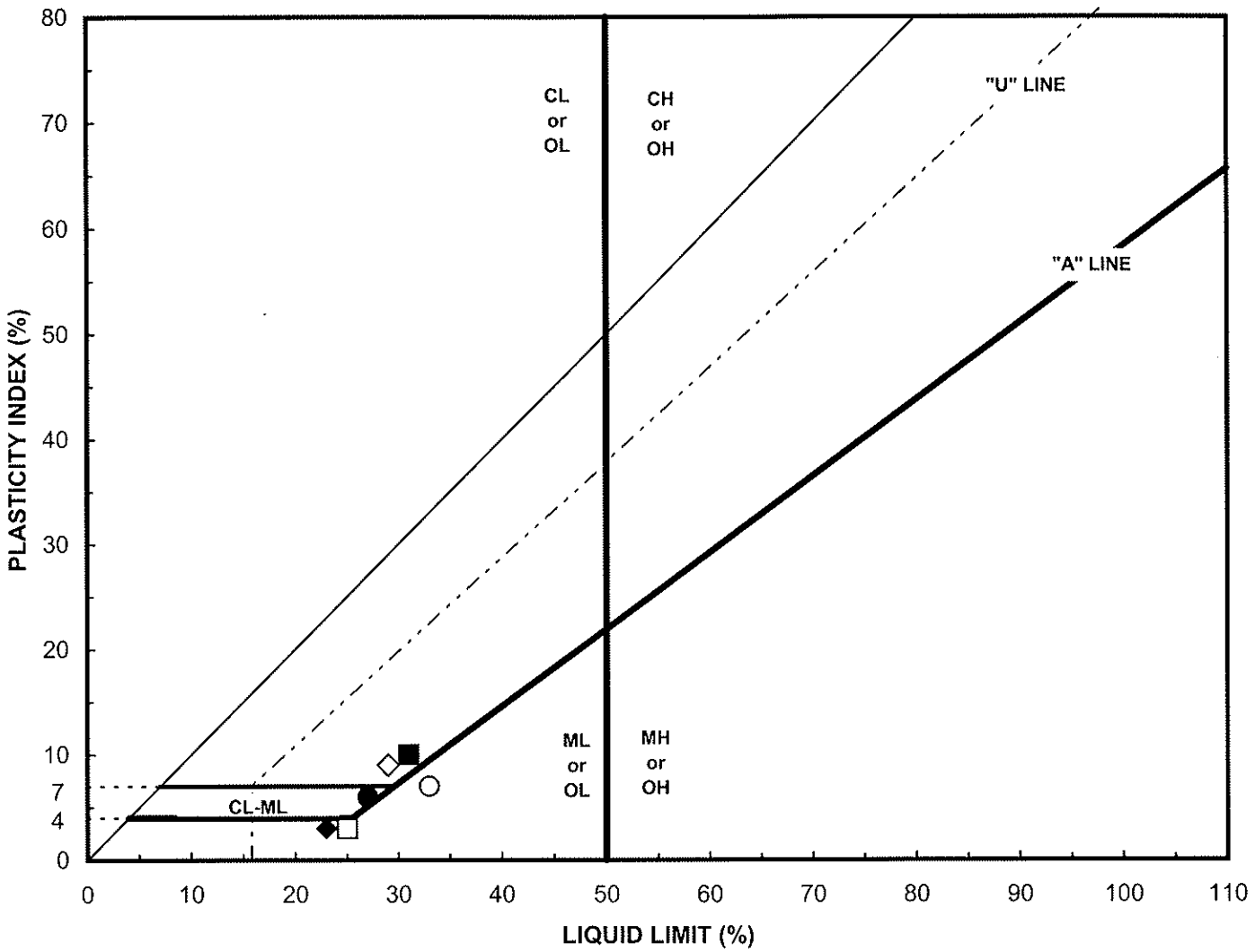
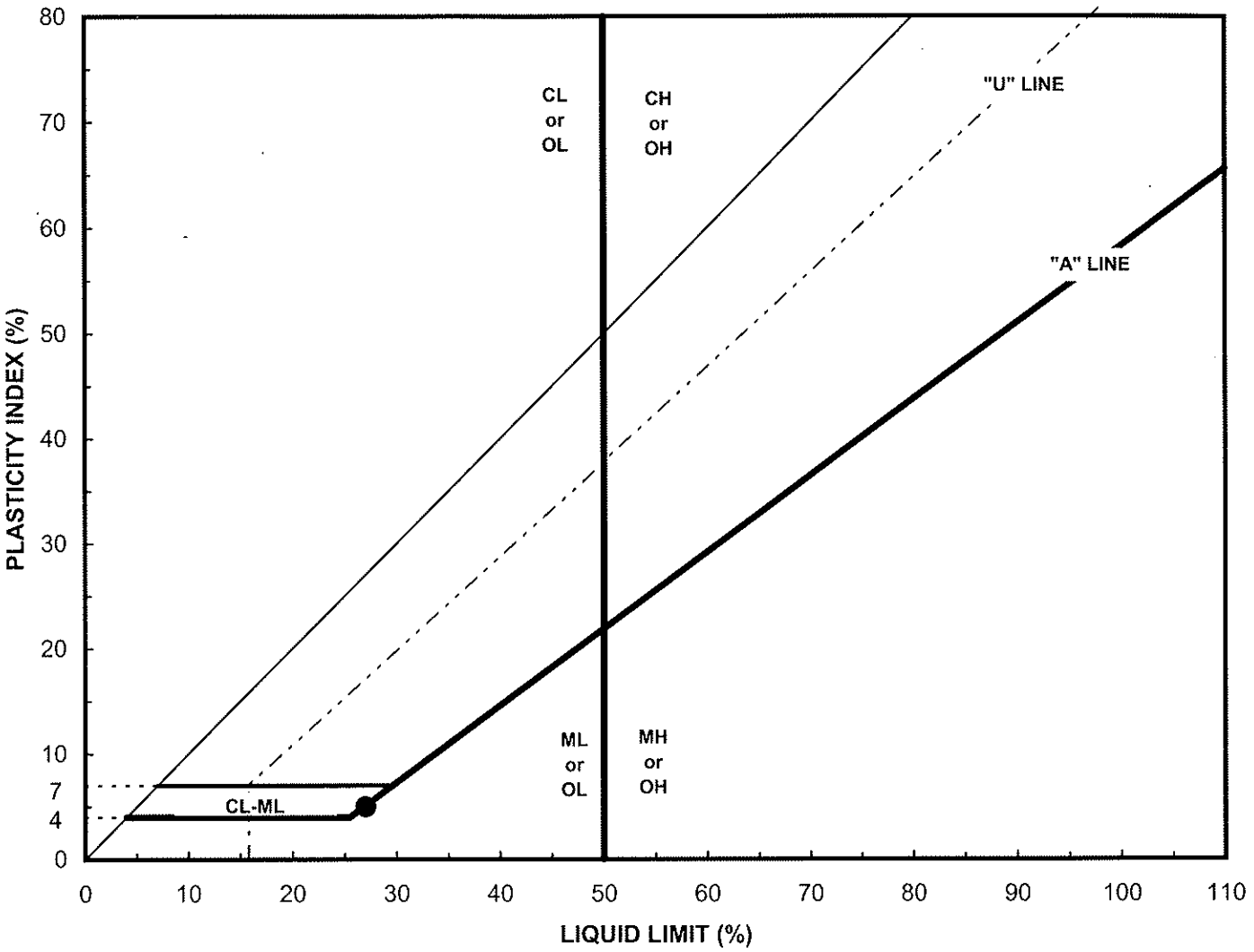


BORING / SAMPLE	DEPTH (feet)	TEST SYMBOL	WATER CONTENT (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-1	50.0	●	7.6	27	6	Gray Silty, Clayey SAND (SC-SM)
B-4	15.0	■	6.3	31	10	Reddish Brown Clayey SAND (SC)
B-6	5.0	◆		23	3	Dark Brown Silty SAND (SM)
B-12	25.0	○	4.6	33	7	Yellowish Brown Silty SAND (SM)
B-15	45.0	□	3.6	25	3	Dark Yellowish Brown Silty SAND (SM)
B-16	40.0	◇	29.0	29	9	Grayish Brown Clayey SAND (SC)

Project Name: East County Substation
Project Number: 27667021

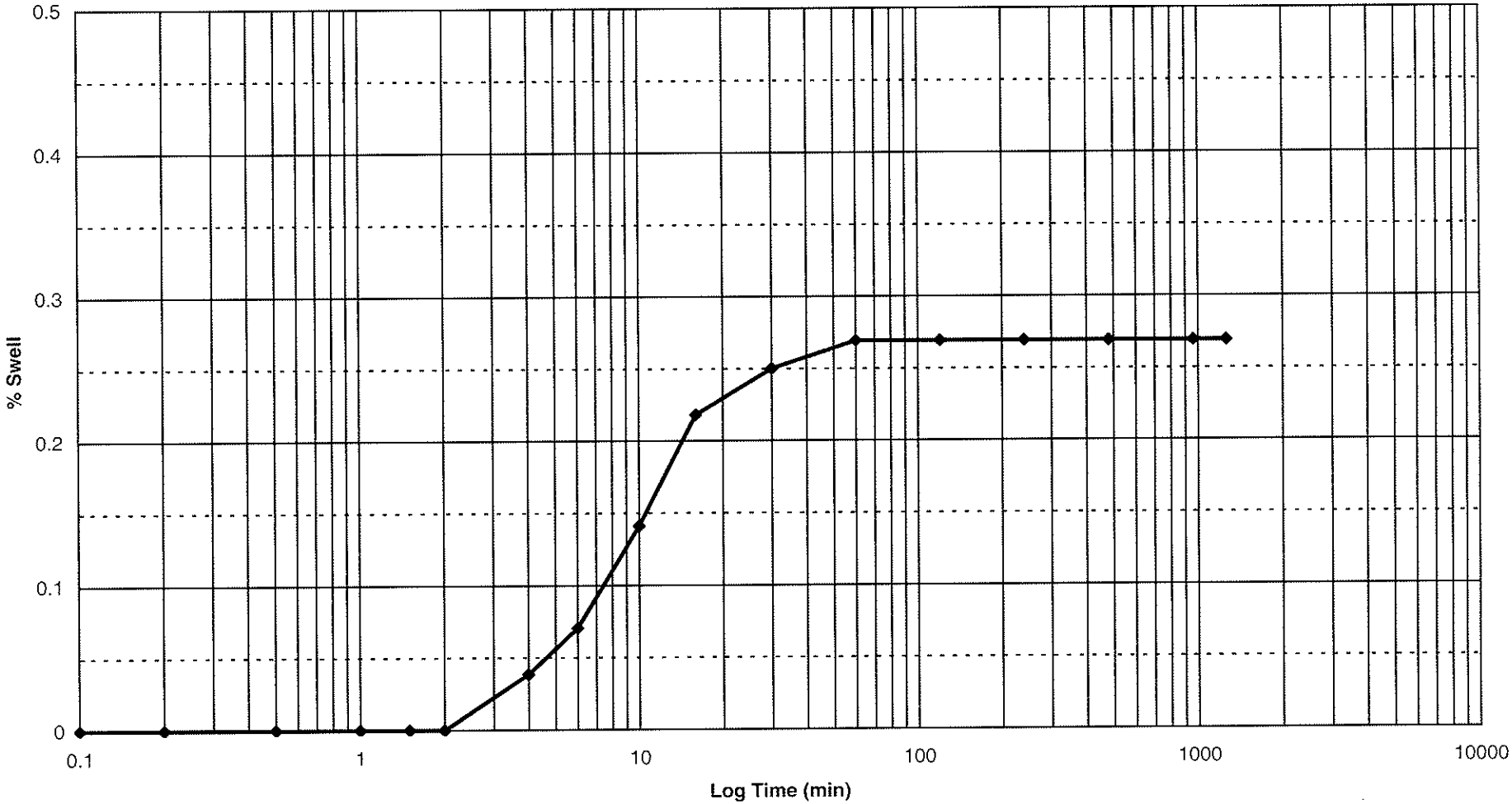
PLASTICITY CHART
Figure: D-33



BORING / SAMPLE	DEPTH (feet)	TEST SYMBOL	WATER CONTENT (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-17	35.0	●	5.4	27	5	Dark Yellowish Brown Silty SAND (SM)

Project Name: East County Substation
Project Number: 27667021

PLASTICITY CHART
Figure: D-34



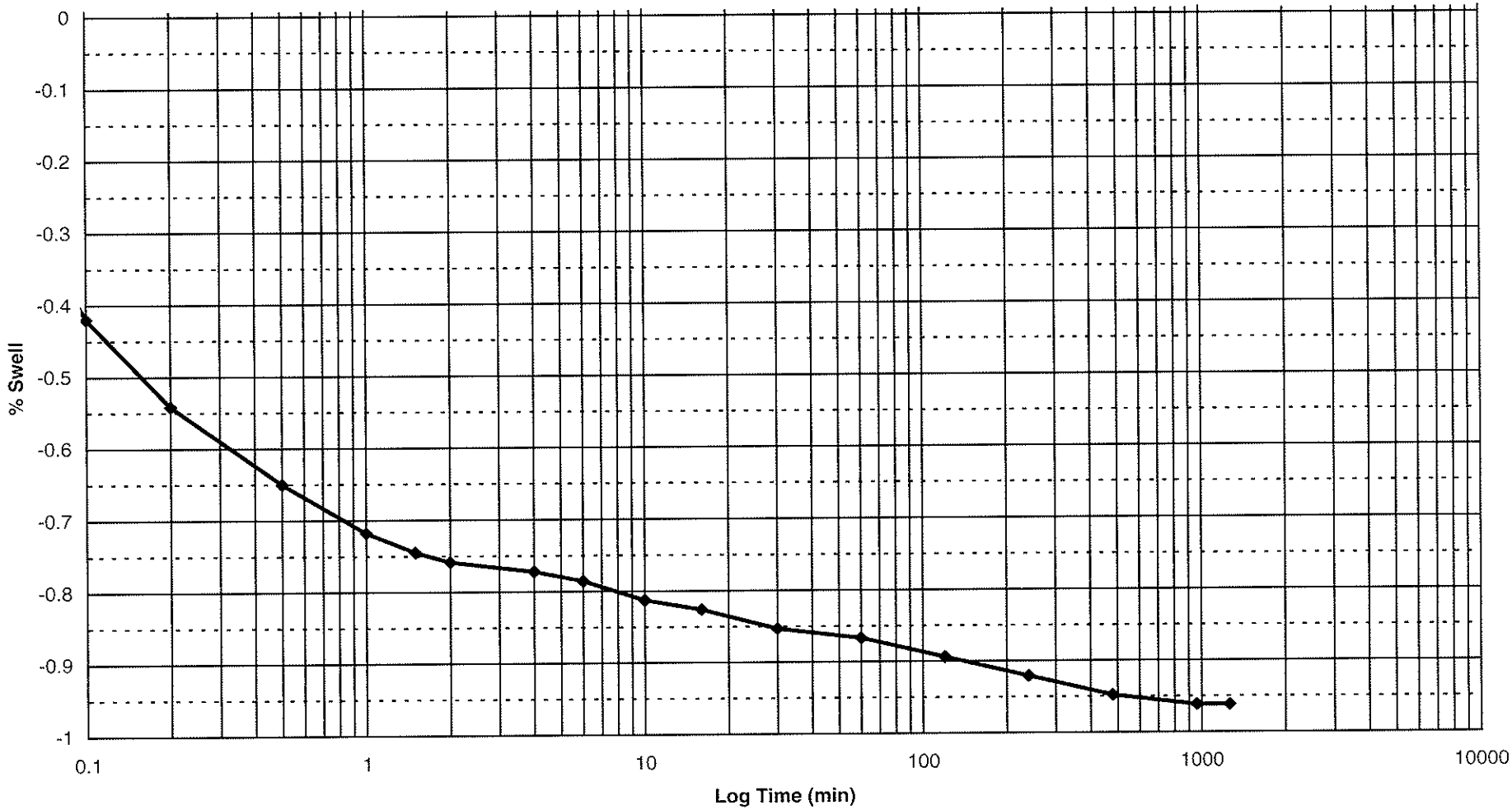
Expansion Index, EI @ S=50%:	0 to 20	21 to 50	51 to 90	91 to 130	> 130
Potential Expansion:	Very Low	Low	Medium	High	Very High

Exploration No.	Sample No.	Depth (ft)	WC (%)	DUW (pcf)	Saturation (%)	EI S meas.	EI S=50%	Description and/or Classification
B-13	1, 2	2.5	8.7	111.4	44	3	0	Brown Clayey SAND (SC)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

EXPANSION INDEX TEST
ASTM D 4829

Figure: D-35



Expansion Index, EI @ S=50%:	0 to 20	21 to 50	51 to 90	91 to 130	> 130
Potential Expansion:	Very Low	Low	Medium	High	Very High

Exploration No.	Sample No.	Depth (ft)	WC (%)	DUW (pcf)	Saturation (%)	EI S meas.	EI S=50%	Description and/or Classification
B-15	1, 2	5.0	6.6	110.6	35	0	0	Grayish Brown Silty SAND (SM)

PROJECT NAME: East County Substation
PROJECT NUMBER: 27667021

EXPANSION INDEX TEST
ASTM D 4829

Figure: D-36

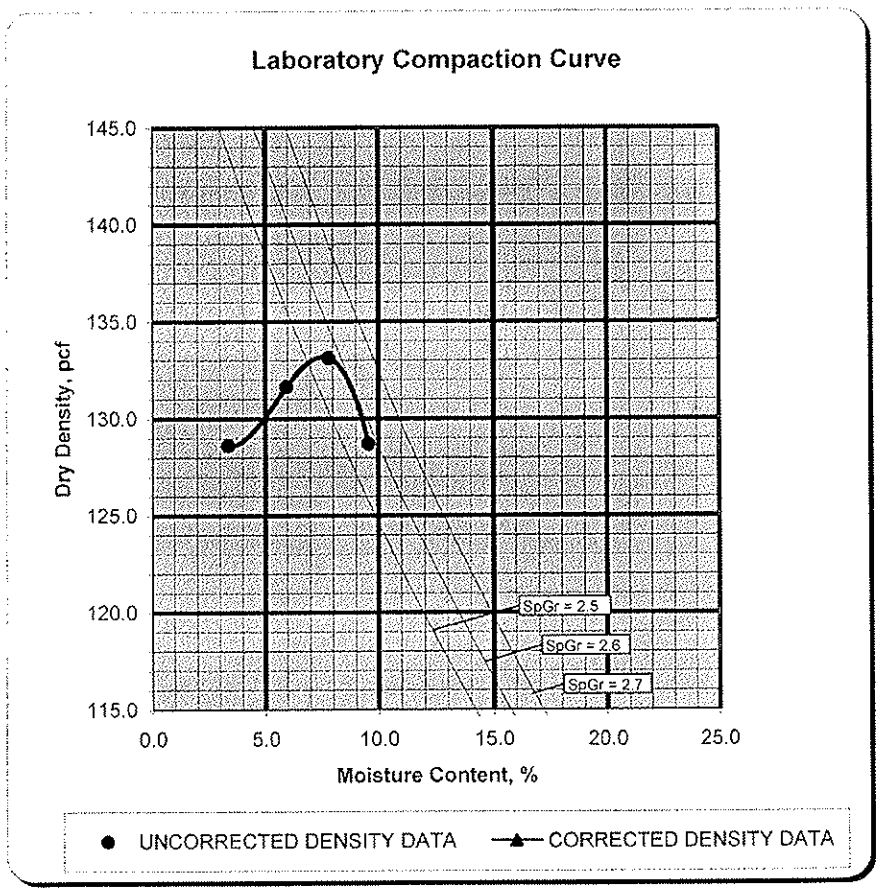
URS Corp **May 23, 2008**
East County Substation, Job No. 27667021.00020 **GF12555**

LABORATORY COMPACTION CURVE

G Force Lab No.: **6205**
Sample Location: **B-24** Depth, ft.: **25' - 30'**
Soil Description: **Light brown silty sand**
Source of Soil: **Not submitted**

Test Designation: **ASTM D1557** Method **A**
% +3/4" **0** % +3/8" **0** % +#4 **3**
Oversize Correction Applied? **No**
Method of Sample Preparation: **Wet**
Type of Rammer Used: **Manual**

M/D Curve No. 1



Test Results

Maximum Density, pcf	**133.0**
Optimum Moisture, %	**7.5**

Oversize Corrected Results

Maximum Density, pcf	
Optimum Moisture, %	

Checked by: John Inlow, Lab Manager

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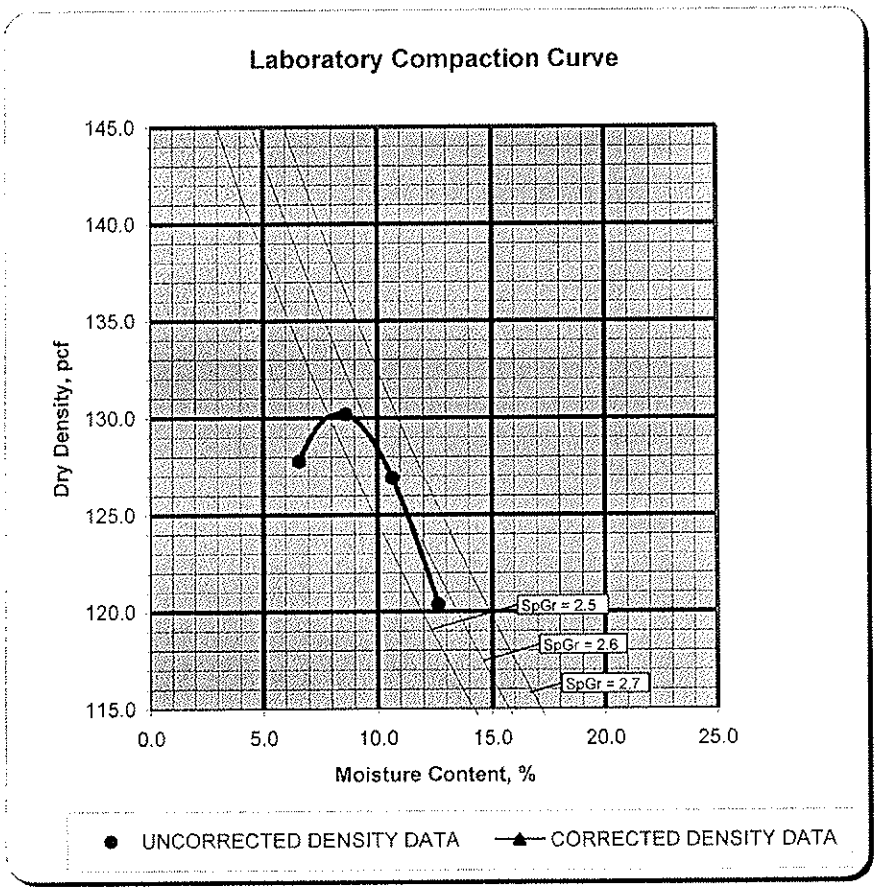
LABORATORY COMPACTION CURVE

G Force Lab No.: **6206**
Sample Location: **TP-9** Depth, ft.: **6.7'**
Soil Description: **Light brown clayey sand**
Source of Soil: **Not submitted**

Test Designation: **ASTM D1557** Method **A**
% +3/4" **0** % +3/8" **1** % +#4 **3**
Oversize Correction Applied? **No**
Method of Sample Preparation: **Wet**
Type of Rammer Used: **Manual**

M/D Curve No. 2



Test Results

Maximum Density, pcf	**130.0**
Optimum Moisture, %	**8.5**

Oversize Corrected Results

Maximum Density, pcf	
Optimum Moisture, %	

Checked by: _____
John Inlow, Lab Manager

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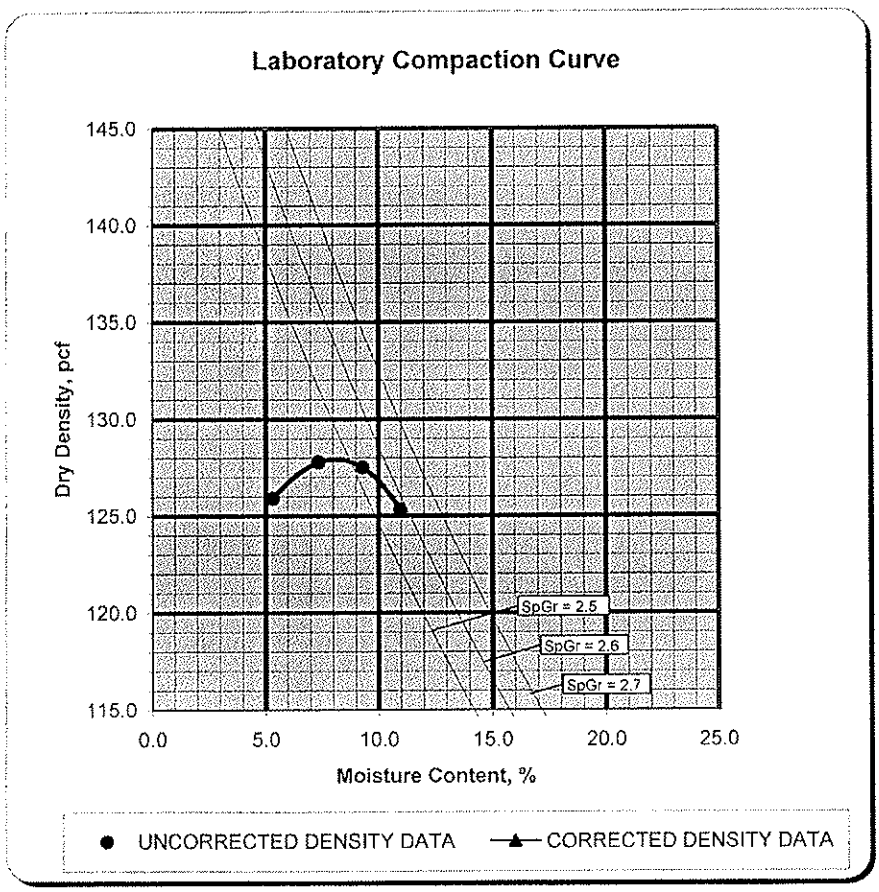
LABORATORY COMPACTION CURVE

G Force Lab No.: **6207**
Sample Location: **TP-19** Depth, ft.: **9.5'**
Soil Description: **Light brown silty sand**
Source of Soil: **Not submitted**

Test Designation: **ASTM D1557** Method **A**
% +3/4" **0** % +3/8" **1** % +#4 **2**
Oversize Correction Applied? **No**
Method of Sample Preparation: **Wet**
Type of Rammer Used: **Manual**

M/D Curve No. 3



Test Results

Maximum Density, pcf	**128.0**
Optimum Moisture, %	**8.0**

Oversize Corrected Results

Maximum Density, pcf	
Optimum Moisture, %	

Checked by: John Inlow, Lab Manager

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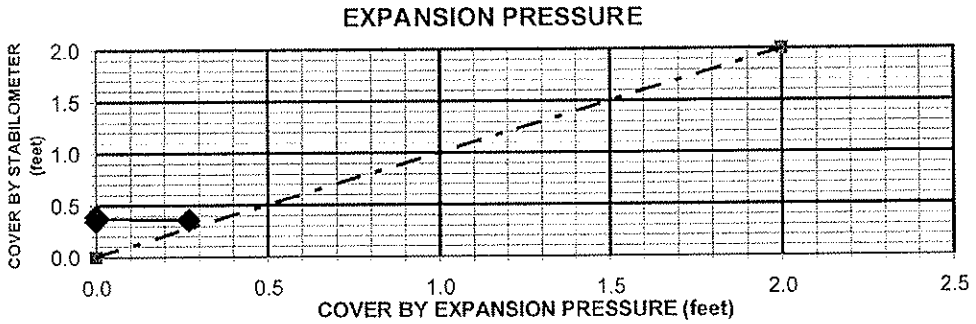
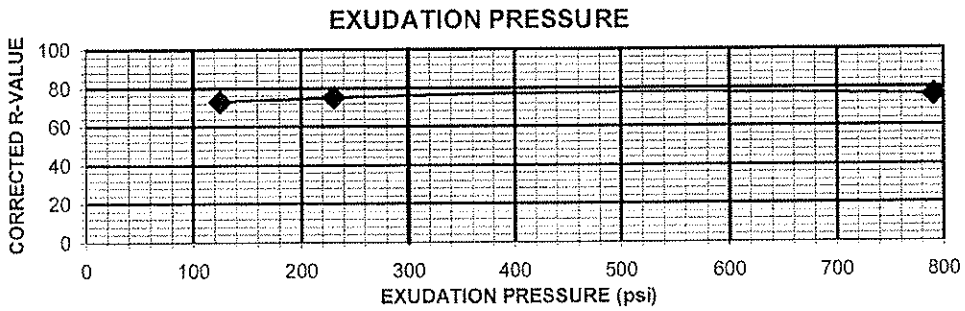
DAVIS EARTH & MATERIALS

R-VALUE TEST REPORT

DEM PROJECT NO.	13-01.01	DATE RECEIVED	5/19/2008
CLIENT	G Force	LAB NUMBER	855
CLIENT REFERENCE	GF12555, G Force Lab No. 6205	REPORT DATE	5/21/2008
CLIENT'S PROJECT OR WORK ORDER NUMBER	SDG&E East County Substation; P.O. # 2453		
SAMPLE LOCATION	B-24 @ 25-30'		
SAMPLE DESCRIPTION	Yellowish Brown Sand with Silt (SP-SM)		
SAMPLED BY	Client		

LABORATORY TEST DATA	1	2	3
Compactor Pressure (psi)	350	350	350
Moisture at Compaction (%)	8.3	9.6	10.5
Compacted Dry Density (pcf)	131.1	128.6	128.4
Cover Thickness by Expansion Pressure (feet)	0.27	0.00	0.00
Cover Thickness by Stabilometer (feet)	0.36	0.35	0.39
Exudation Pressure (psi)	791	231	125
R-Value (corrected)	76	75	73





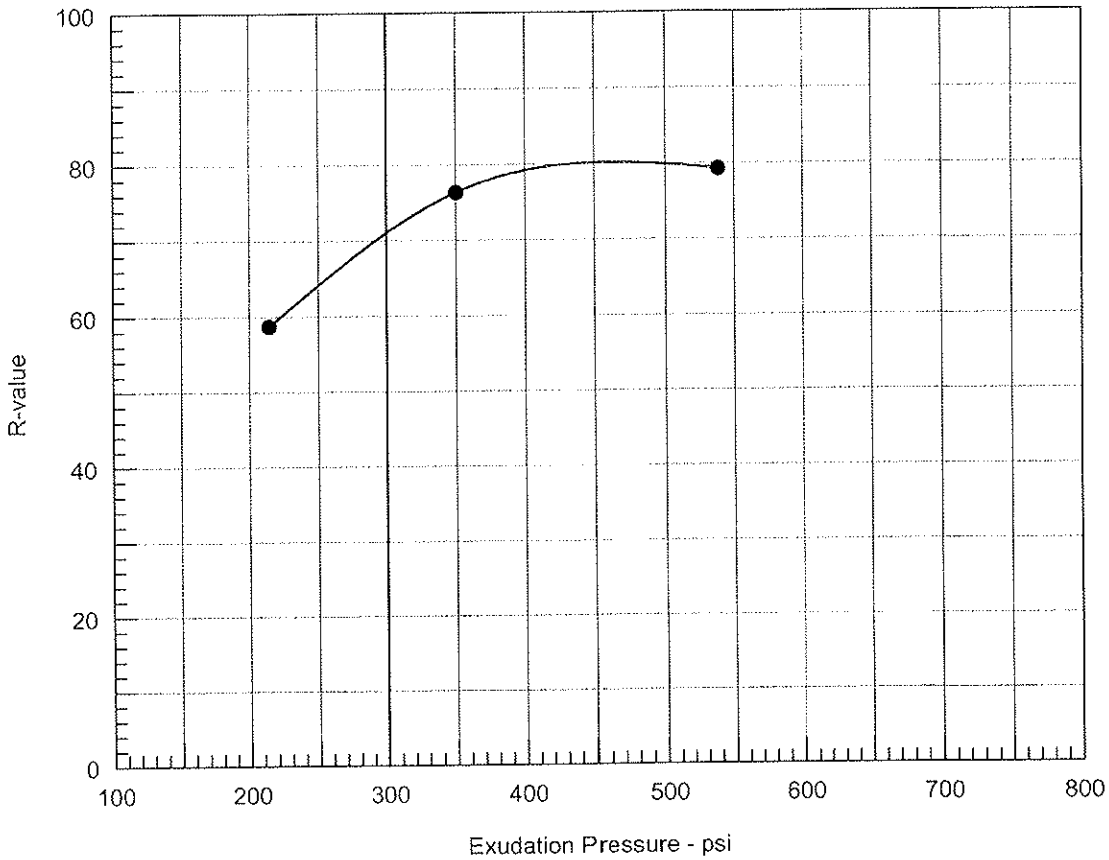
ASSUMED TRAFFIC INDEX	4.5
R-VALUE BY EXUDATION	76
R-VALUE BY EXPANSION	-
R-VALUE AT EQUILIBRIUM	76

ENGINEER: CHAD M. DAVIS, RCE

Davis Earth & Materials, Inc.
4320 Viewridge Avenue, Suite D San Diego, CA 92123 858-292-7575 fax 858-292-7570

Figure: D-40

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	117.9	11.3	0	25	2.48	350	76	76
2	350	109.0	12.4	0	53	2.68	214	54	59
3	350	112.7	10.8	0	25	2.61	539	78	79

Test Results	Material Description
R-value at 300 psi exudation pressure = 71	Tan Clayey Silty Sand with aggregate

Project No.: 15659
Project: URS Lab Testing
Location: TP-2-3.5'
Sample Number: 1 **Depth:** 2'-3.5'
Date: 5/28/2008

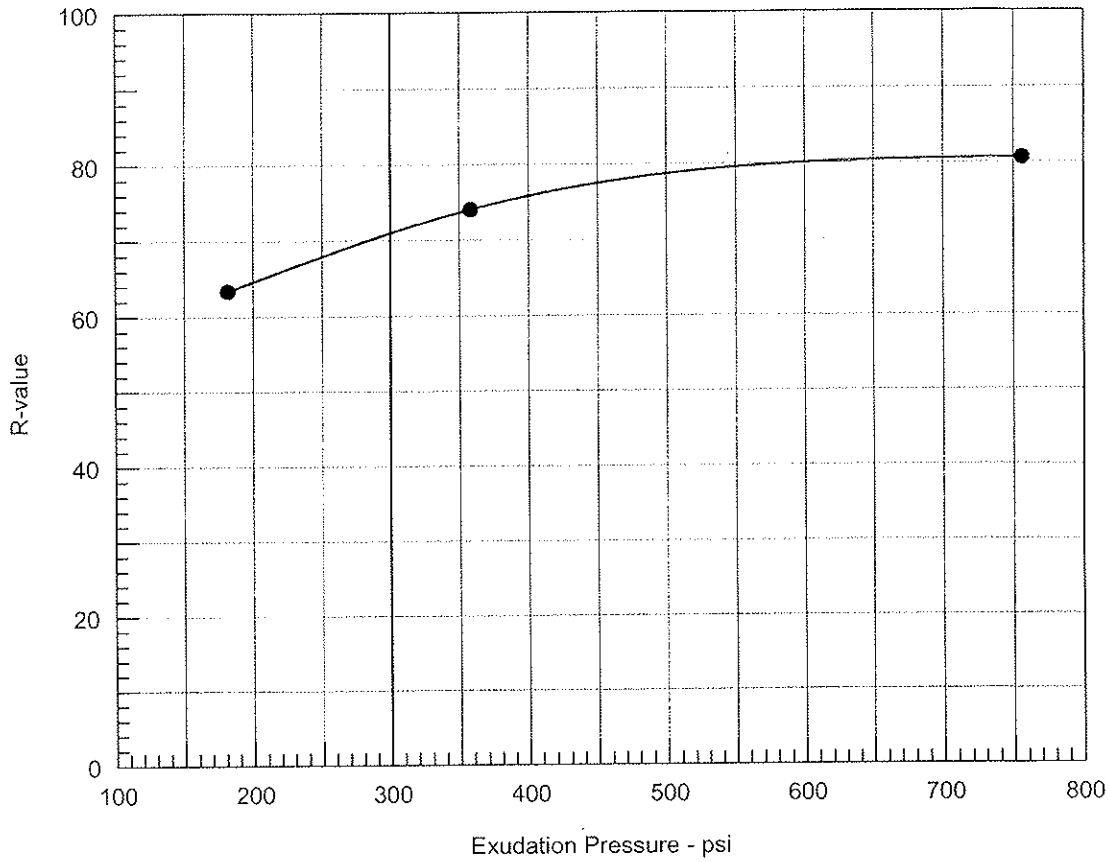
Tested by: L. Fukushima
Checked by: M. Fakharpour
Remarks:
S12503

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure D-41

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	105.0	14.6	0	23	2.70	756	78	81
2	350	99.2	16.8	0	40	2.57	181	62	63
3	350	100.3	16.3	0	28	2.60	358	72	74

Test Results	Material Description
R-value at 300 psi exudation pressure = 71	Brown Cilty Sand with aggregate

Project No.: 15659
Project: URS Lab Testing
Location: TP-3-3'
Sample Number: 3 **Depth:** 3-3'
Date: 5/28/2008

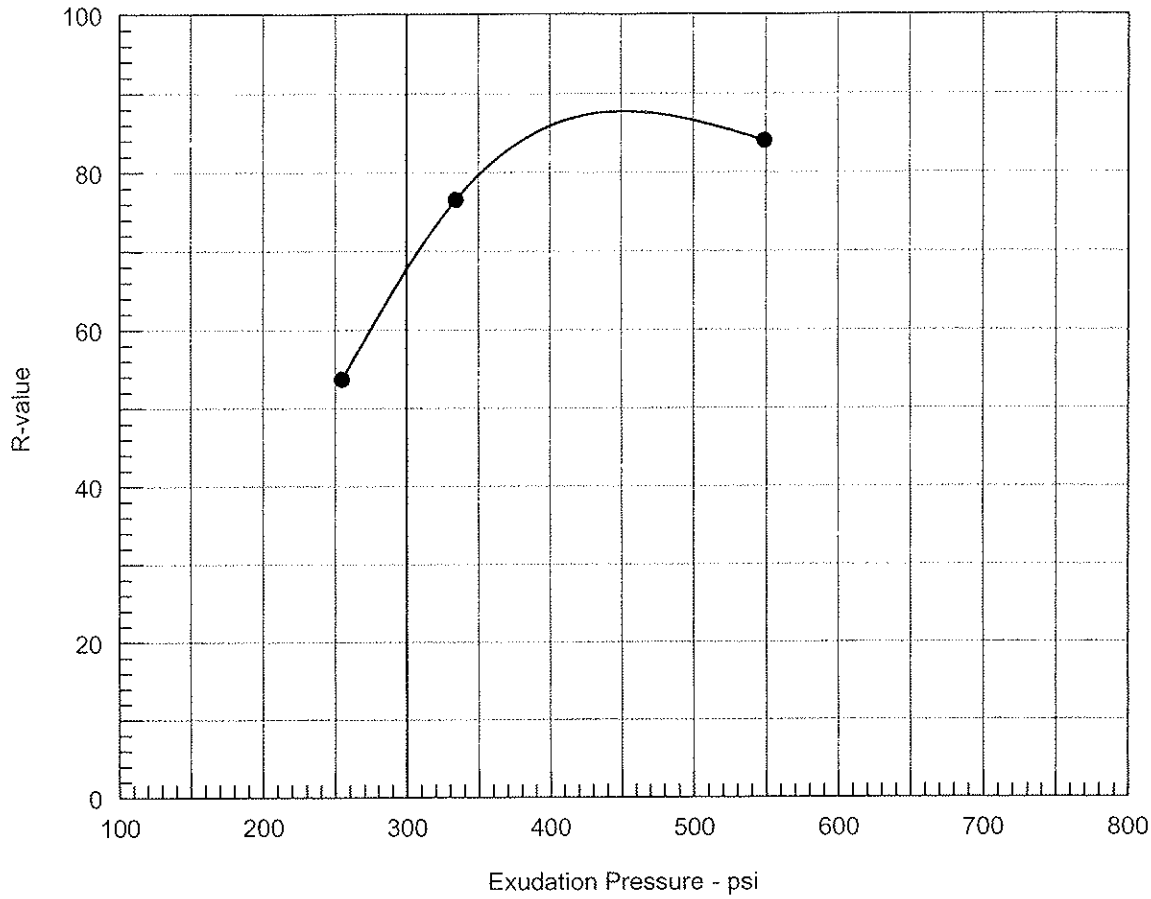
Tested by: L. Fukushima
Checked by: M. Fakharpour
Remarks:
East County Substation

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure D-42

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	128.0	9.1	0	14	2.30	549	86	84
2	350	119.1	9.9	0	28	2.70	334	73	77
3	350	120.6	11.1	0	53	2.43	255	56	54

Test Results	Material Description
R-value at 300 psi exudation pressure = 68	Brown Silty Sand with Aggregate

Project No.: 15659
Project: URS Lab Testing
Location: TP-6 @3', East county substation
Sample Number: 2 **Depth:** 3'
Date: 5/28/2008

Tested by: L. Fukushima
Checked by: M.Fakharpour
Remarks:
East County Substation

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure D-43

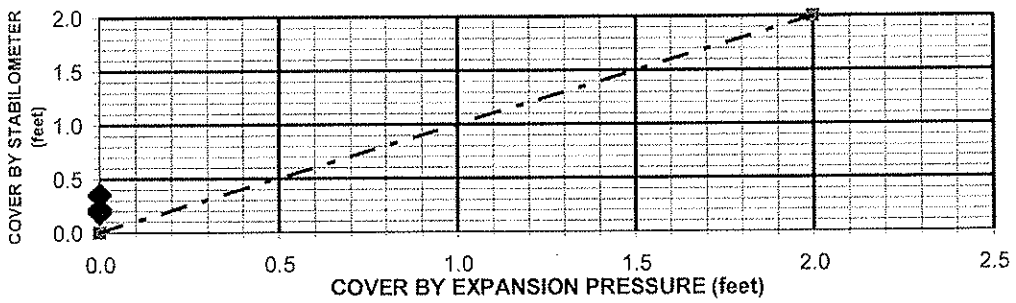
DAVIS EARTH & MATERIALS INC

R-VALUE TEST REPORT

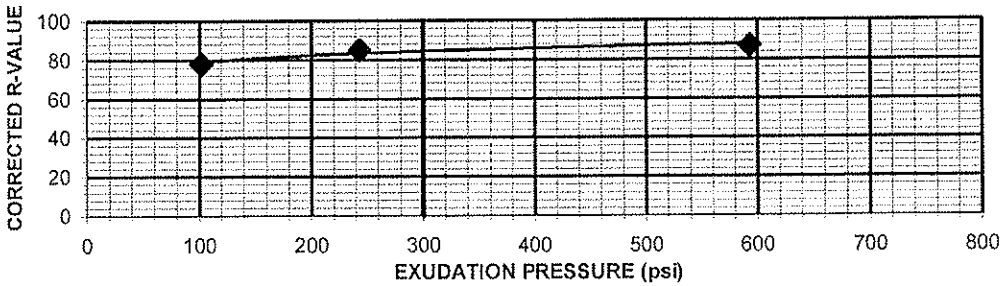
DEM PROJECT NO.	13-01.01	DATE RECEIVED	5/19/2008
CLIENT	G Force	LAB NUMBER	856
CLIENT REFERENCE	GF12555, G Force Lab No. 6207	REPORT DATE	5/21/2008
CLIENT'S PROJECT OR WORK ORDER NUMBER	SDG&E East County Substation; P.O. # 2453		
SAMPLE LOCATION	TP-19 @ 9.5'		
SAMPLE DESCRIPTION	Light Yellowish Brown Sand with Silt (SP-SM)		
SAMPLED BY	Client		

LABORATORY TEST DATA	1	2	3
Compactor Pressure (psi)	350	350	350
Moisture at Compaction (%)	9.9	10.7	11.1
Compacted Dry Density (pcf)	123.9	122.6	122.5
Cover Thickness by Expansion Pressure (feet)	0.00	0.00	0.00
Cover Thickness by Stabilometer (feet)	0.19	0.22	0.35
Exudation Pressure (psi)	593	243	102
R-Value (corrected)	87	85	78

EXPANSION PRESSURE



EXUDATION PRESSURE



ASSUMED TRAFFIC INDEX	4.5
R-VALUE BY EXUDATION	86
R-VALUE BY EXPANSION	-
R-VALUE AT EQUILIBRIUM	**86**

ENGINEER: CHAD M. DAVIS, RCE

Davis Earth & Materials, Inc.
4320 Viewridge Avenue, Suite D San Diego, CA 92123 858-292-7575 fax 858-292-7570