GEOTECHNICAL INVESTIGATION REPORT

SUNCREST SUBSTATION
SDG&E 500KV SUNRISE
POWERLINK PROJECT
SAN DIEGO COUNTY, CALIFORNIA

PREPARED FOR:

SAN DIEGO GAS & ELECTRIC COMPANY

URS PROJECT NO. 27669017.00004

DECEMBER 21, 2009

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SUNCREST SUBSTATION
SDG&E 500KV SUNRISE POWERLINK PROJECT
SAN DIEGO COUNTY, CALIFORNIA

San Diego Gas & Electric Company

Mr. Craig Riker
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URS Project No. 27669017.00004

December 21, 2009

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Subject: Geotechnical Investigation Report
Suncrest Substation
SDG&E 500kV Sunrise Powerlink Project
San Diego County, California
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Dear Mr. Riker:

URS Corporation Americas (URS) is pleased to present this geotechnical investigation report for development of the proposed Suncrest Substation in eastern San Diego County, California. Our work is intended to assist San Diego Gas & Electric Company (SDG&E) and their consultants with the site development and design of the substation and associated facilities. Our services were performed in accordance with our proposal dated August 19, 2008 and revised dated January 14, 2009.

It is our opinion that with proper design and construction, the site is geotechnically suitable for the proposed substation development. The primary geotechnical consideration associated with the project is the substantial earthwork needed to form the substation pad.

We understand that the development of the substation will use an Engineer-Procure-Construct (EPC) contract. This report provides an interpretation of the geologic conditions encountered, geotechnical recommendations for design of the substation pad and access road and geotechnical information to help EPC teams prepare a bid design. EPC teams should not view this report as a contractual statement of geotechnical conditions. 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. We look forward to continuing to work with SDG&E on this project.

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Sincerely,

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ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
ATB	Air-track borings
ATV	Acoustical Televiewer
BBTT	Bell Bluff Truck Trail
bgs	below existing ground surface
BMP	Best Management Practices
CBC	California Building Code
cc	cubic centimeters
CGS	California Geological Society
CIDH	Cast-In-Drilled Hole
CRSP	Colorado Rockfall Simulation Program
CY	Cubic Yards
EI	Expansion Index
EPC	Engineer-Procure-Construct
fps	feet per second
g	acceleration due to gravity
GeoVision	GeoVision Geophysical Services
h:v	horizontal:vertical
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
k	modulus of vertical subgrade reaction
km	kilometer
Ks	constant of horizontal subgrade reaction
ksi	kips per square inch
kV	kilovolt
MCE	Maximum Considered Earthquake
MPa	Megapascals
MSE	Mechanically Stabilized Earth
MSL	Mean Sea Level
NCMA	National Concrete Masonry Association
Nolte	Nolte Associates, Inc.
pcf	pounds per cubic foot
pci	pounds per cubic inch
psf	pounds per square foot
PSHA	Probabilistic Seismic Hazard Assessment
psi	pounds per square inch
RQD	Rock Quality Designation
SDG&E	San Diego Gas & Electric Company
TI	Traffic Indices
tsf	tons per square foot
URS	URS Corporation Americas
USCS	Unified Soil Classification System

SECTION 1 INTRODUCTION

This report presents the results of URS Corporation Americas' (URS) geotechnical investigation for the proposed Suncrest Substation, part of the San Diego Gas & Electric Company (SDG&E) 500 kilovolt (kV) Sunrise Powerlink Project. The substation site is located in eastern San Diego County, California as shown on Figure 1. URS prepared this report in accordance with our proposal dated August 19, 2008 and revised dated January 14, 2009.

1.1 PROJECT DESCRIPTION

The substation will be located west of Japatul Valley Road off of Bell Bluff Truck Trail (BBTT) in eastern San Diego County. The site layout, grading plan, and existing topography were provided by Nolte Associates, Inc. (Nolte), the project civil engineer. We have based our understanding of the project on the 90% Construction Document set of grading plans dated August 25, 2009.

The project includes a substation pad approximately 1,000 by 1,750 feet in plan dimensions. Three concrete lined stormwater basins will be located adjacent to the southeast corner and the east and west sides of the substation pad. A water tank is planned east of the site. The existing partially paved BBTT will be modified and improved, and a new access road will be constructed from BBTT to provide access to the site. The main project features are shown on the Substation Site Plan and Geologic Map, presented on Figure 2. The main features along the access road are presented on the Access Road Site Plan and Geologic Map, Figure 3.

Figure 2 shows the proposed site grading for the substation. To create the substation pad, cuts up to approximately 160 and 60 feet high are needed along the eastern and western ridges respectively, and a cut up to approximately 40 feet high is needed along the northern perimeter. Fills up to about 110 feet deep are required along the southern and western perimeter. The estimated earthwork quantities are 1,066,000 cubic yards (CY) of cut and 1,229,000 CY of fill.

The proposed grading scheme for the Suncrest Substation includes Mechanically Stabilized Earth (MSE) retaining walls along the southern side of the substation pad. MSE walls are proprietary concrete masonry units combined with geosynthetic reinforced fill to form gravity retaining structures. The MSE retaining walls extend about 1,600 lineal feet and range up to 35 feet high. Ascending slopes up to 60 feet high will exist above the walls. Descending slopes below the walls will be up to 35 feet high.

Smaller cuts and minor fills will be required for the access road along BBTT. Where the proposed road diverges from BBTT a deeper slot cut will be made to tie in the existing road grade at BBTT with the substation. For reference we have referred to this section of road between the substation and BBTT as the entrance road. Cuts along this entrance road will extend up to 60 feet in height.

Layout of the substation equipment and structures is the responsibility of the Engineer-Procure-Construct (EPC) contractor. This infrastructure is likely to include transformers, racks, "A" or "H" frames, steel cable poles and a control shelter. Foundation types typically include Cast-In-Drilled-Hole (CIDH) piles, continuous and spread footings, and mat foundations.

1.2 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of the investigation was to characterize the subsurface conditions at the site to provide geotechnical recommendations for the design of the substation pad and access road. Our scope of work included field investigation, laboratory testing, geologic and engineering evaluation and analyses, and preparation of this report. This report provides the following information:

- A description of the surface features within the site and contiguous areas.
- Generalized soil, rock and groundwater conditions at the site.
- Geologic setting and assessment of geologic and seismic hazards including expansive soils, subsidence and collapse potential, fault rupture potential, strong ground motion, and liquefaction and secondary effects.
- Summary of the exploration and laboratory testing programs.
- Preliminary geotechnical design parameters and recommendations.

We understand that this Geotechnical Investigation Report will be submitted as part of the EPC contract bid document to help EPC teams prepare bids and cost estimates. EPC teams should not view this report as a contractual statement of geotechnical conditions (baseline report). Engineers from the contracting teams should make their own interpretations and develop specific geotechnical design information using the factual information (e.g., exploration logs and laboratory test results) provided in this report. It is anticipated that further subsurface exploration, and subsequent interpretation and design development will be necessary for: 1) particular aspects of their proposed development, 2) specific design methodologies, 3) proprietary engineered systems, and 4) other factors that may require further interpretation and design development.

SECTION 2 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 FIELD INVESTIGATION

The field investigation included site reconnaissance, geologic mapping, subsurface exploration, seismic refraction traverses, and soil electrical resistivity surveys. Subsurface exploration consisted of hollow-stem auger and core borings, test pits, pavement borings, and air track borings. Downhole acoustic televiewer logging and dilatometer testing were performed at selected boring locations. The explorations were completed within the footprint of the proposed substation pad in both cut and fill areas and along the alignment of the proposed access road.

Field investigations were completed in three phases. The initial phase consisted of five seismic refraction lines completed in July 2008. The bulk of the investigations for the substation and adjacent entrance road were completed in a second phase of work completed between November 2008 and March 2009. The last phase of work consisted of borings and test pits along BBTT to help characterize conditions along the access road. This phase included six air track borings in the substation and entrance road areas. The proposed access road alignment is largely coincident with BBTT; however it does diverge from BBTT in a few areas as shown on Figure 3. Sites for access road subsurface explorations were limited to those within BBTT.

All field work was supervised by a URS engineering geologist and was monitored by a biologist and cultural representatives, which included an archeologist and a Native American representative. Erosion control Best Management Practices (BMP) were installed during and upon completion of the field work. The BMP installation was performed in consultation with a URS Certified Professional in Erosion and Sediment Control regarding BMP type, location, and quantity.

Approximate locations of the explorations are shown on the Substation Site Plan and Geologic Map, Figure 2 and on the Access Road Site Plan and Geologic Map, Figure 3. Various elements of the field investigation are discussed further in Appendices A through E. Logs of the test borings, test pits, and pavement borings and photographs of the recovered rock core are presented in Appendix A. The descriptions on the boring logs and test pit logs are based on field observations, sample inspection, and laboratory test results. A summary of the explorations is presented in Table A-1. Results of the seismic refraction surveys and electrical resistivity surveys are presented in Appendices B and C. Downhole televiewer data is presented in Appendix D. Dilatometer test results are presented in Appendix E.

2.1.1 Test Borings

The test boring program was conducted between December 22, 2008 and April 17, 2009 to depths ranging from about 6 to 120 feet below the existing ground surface (bgs). The borings were initially advanced using a hollow stem auger and then switched to core drilling when rock was encountered. Soil samples collected during augering were logged and visually classified in accordance with the Unified Soil Classification System (USCS). Samples were typically collected at five-foot depth intervals or at changes in stratigraphy, classified in the field, and were subsequently returned to our laboratory for further examination and testing. Disturbed and relatively intact samples were collected from the borings. Logging of the weathered rock during core drilling included; rock description, rate of drilling,

discontinuity descriptions, and an evaluation of Rock Quality Designation (RQD), when applicable. The core was collected in labeled wooden boxes and photographed.

2.1.2 Test Pits

Test pits were excavated using a backhoe, or by hand, between January 20 and April 16, 2009 to depths ranging from about 1 to 8 feet bgs, primarily in areas within the substation pad, fill embankments and water retention basins and along the proposed access road alignment that were inaccessible with a drill rig. Disturbed bulk soil samples, relatively undisturbed hand driven samples and disturbed grab samples were collected from the test pits. The test pits were backfilled with excavated material that was nominally compacted using the backhoe bucket or by hand for the hand excavated test pits. The upper 1.5 to 2 feet of excavated material was placed to the side of the excavation for observation by the environmental monitors on site. This material was then replaced on the surface of the nominally compacted backfilled excavation.

2.1.3 Pavement Borings

Six pavement borings were completed on April 20, 2009 to depths ranging from about 2 to 11 feet bgs along the proposed access road alignment. The asphalt was cored, and then the borings were advanced with a hollow stem auger. Soil samples collected were logged and visually classified in accordance with the USCS. Samples were subsequently returned to our laboratory and to a subcontractor laboratory for further examination and testing.

2.1.4 Air Track Borings

Six air-track borings (ATB) were advanced using percussion drilling methods on April 14 and 15, 2009 to an approximate depth of 70 feet bgs to provide information regarding the rock weathering profile near the large cut on the northwest side of the substation pad. No soil samples were collected for laboratory testing. The cuttings retrieved from the borings were reviewed and noted for moisture content and color. Figures A-117 through A-122 present graphical logs of the air-track borings.

2.1.5 Seismic Refraction Surveys

Seismic refraction surveys were completed by a crew led by a professional geophysicist from URS to help evaluate subsurface conditions. The seismic refraction surveys were performed at the site in two phases. During the week ending July 18, 2008, five traverses were completed in accessible road areas within the general area of the substation pad and adjacent access road to provide preliminary information. A second phase of work was performed the week ending November 21, 2008, and on January 7, 2009 and completed 16 additional traverses.

The seismic refraction data was used to assess the approximate depth and seismic velocity of the subsurface layers and their variability within the proposed site. Results of the seismic refraction surveys are presented in Appendix B, along with details of the seismic refraction methodology. A summary of the seismic refraction surveys is presented in Table B-1; their locations are presented on Figure 2.

2.1.6 Electrical Resistivity Survey

Three electrical resistivity surveys were performed at the site by GeoVision Geophysical Services (GeoVision) on December 18 and 19, 2008. The arrays, designated T-1 through T-3, spanned the width of the pad and the northwest-southeast and northeast-southwest diagonals as shown on Figure 2. The results of the surveys and a discussion of the methodologies are presented in Appendix C.

2.1.7 Downhole Televiewer

Downhole geophysical logging was performed by GeoVision in selected boreholes to provide additional subsurface information on rock conditions and specifically on discontinuities in the rock mass that would be exposed in the deep cuts along the eastern ridge. Acoustical TeleViewer (ATV) logs were performed for Borings B-08, B-09, B-10, and B-11. The ATV was used to create an image of the side-wall of the borehole using sound waves. An optical televiewing system was also used in boring B-10 in an attempt to image the upper, dry portion of the boring since the ATV system requires a water-filled borehole. The logs and a more detailed discussion of the methodologies involved are presented in the GeoVision report in Appendix D.

2.1.8 Dilatometer Testing

Dilatometer testing was performed in selected boreholes to provide an estimate of rock modulus. A total of 12 dilatometer tests were performed in Borings B-04, B-18, and B-20 at various depths. The cored diameter of the borehole was smaller in these borings to facilitate the dilatometer testing. The results of the dilatometer testing and a more detailed discussion of the methodologies involved are presented in Appendix E.

2.1.9 Geologic Mapping

Geologic mapping of surface exposures was performed across the substation pad and along the access road by URS engineering geologists between November 2008 and February 2009. The mapping focused on estimating the location of the contact between the various bedrock units, including the light colored Corte Madera Monzogranite, the darker gabbroic and dioritic rocks of the Cuyamaca Gabbro and the older metasedimentary rock. In some areas, a mixed rock zone has been mapped between the metamorphic rock and the granitic rock units where these materials were observed to be mixed to the extent that mapping the individual units was not possible. Mapping along the BBTT focused on the surficial geology.

The results of the mapping effort are included on Figure 2 for the substation area and on Figure 3 for the BBTT road improvements. Section 3.4 of this report, titled “Subsurface Conditions” describes the geologic units encountered.

2.2 LABORATORY TESTING

Laboratory testing was completed on representative soil and rock samples to further evaluate the field classifications and to evaluate physical and mechanical characteristics. Representative samples were selected for moisture content, dry unit weight, particle size distribution, plasticity index, direct shear,

laboratory compaction, expansion index (EI), corrosivity, unconfined compressive strength and modulus tests. R-value testing was performed to provide an evaluation of potential pavement subgrade materials. Testing was completed in general accordance with American Society for Testing and Materials (ASTM) standards.

The laboratory test results are presented in Appendix F. Results of the laboratory tests are also summarized at the corresponding sample locations on the boring and test pit logs in Appendix A.

SECTION 3 SITE CONDITIONS

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

3.1 GEOLOGIC SETTING

The Suncrest Substation site lies within the Peninsular Ranges Physiographic Province. The Peninsular Ranges are an elongated northwest trending mountain range comprised of Jurassic- to Cretaceous-age metamorphic rocks and Cretaceous-age granitic and gabbroic intrusive bodies (plutons) of plutonic rocks. This mountain range is approximately 500 miles long extending from the San Jacinto Mountains south into Baja California. The core of the Peninsular Ranges is composed of a series of these plutons collectively referred to as a batholith. During the Cretaceous age, these batholithic rocks intruded older granitic, metasedimentary, and metavolcanic rock at great depths below the earth's surface. These older rocks, which are remnants of an ancient continental shelf and volcanic arc setting, were metamorphosed by the heat and pressure created by the intruding batholithic bodies (Todd *et al.,* 2004). This formed widespread zones or "screens" of the older, metamorphosed rocks in juxtaposition to the Cretaceous plutonic rocks. These Cretaceous mountain building events were followed by millions of years of erosion resulting in the removal of kilometers (km) of material that has exposed the batholithic rocks and the older metamorphic rocks.

Continued uplift, tilting and erosion of the westernmost margin of the batholith in the Late Cretaceous formed low relief topography west of the mountains. During the Eocene age, marine and nonmarine strata were widely deposited across the erosion surface of the batholith resulting in the San Diego embayment and the terraced and hilly terrain that characterizes the coastal plain (Todd *et al.,* 2004). Late Tertiary tectonics developed a series of strike-slip faults of that are collectively referred to as the San Andreas Fault System that define the transform boundary between the Pacific Plate and the North American Plate. Uplift and westward tilting of the Peninsular Ranges continues into the Quaternary period.

A Regional Geologic Map and Legend are presented in Figures 4 and 4a.

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 45 miles east of the project site (see Figure 5, Regional Fault and Epicenter 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, along with their associated branches, are currently the most active. These structures are 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 and Rose Canyon faults, 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

In southern California, the San Andreas Fault System comprises a suite of northwest-striking, sub-parallel, right-lateral strike-slip faults that occupy a 200-km-wide swath straddling the coast of southern California. Cumulatively, these faults, which occur both on- and offshore, carry about two-thirds of the total relative plate motion. The primary onshore faults include the San Andreas, San Jacinto, Imperial, and Elsinore faults. The Newport-Inglewood and Rose Canyon fault zones are located west of the afore mentioned faults and have both onshore and offshore components. Other significant offshore faults include the San Diego Trough and San Clemente fault zones. The project site lies between the Elsinore fault to the east and the Rose Canyon fault to the west at distances of approximately 18 and 27 miles, respectively.

3.2.1.1 Elsinore Fault Zone

The Elsinore fault zone is a 250-km-long right-lateral strike-slip fault that runs along the west side of the Salton Trough from near the Mexican border northward to Corona where it branches into the Whittier and Chino faults. The central part comprises several segments, separated by step-overs, which include, from north to south, Glen Ivy, Temecula, Julian, and Coyote Mountain segments. The Laguna Salada fault extends from the southern end of the Elsinore fault into Mexico.

3.2.1.2 Rose Canyon Fault Zone

The Rose Canyon fault is a component of a fault zone that includes the Newport-Inglewood fault to the north and the Descanso fault to the south. Much of this extended fault zone is located in the offshore zone between San Diego and Orange County and between San Diego and northern Baja California. The on-shore portion of the Rose Canyon fault zone extends along the northeast flank of Mount Soledad and continues southward along the eastern margins of Mission Bay. Between Mission Bay and San Diego Bay, the zone widens and diverges.

Active faulting has been demonstrated along the Rose Canyon fault north of Mission Bay in Rose Canyon and in various locations in eastern downtown San Diego.

3.2.1.3 Local Faults

There are no known active or potentially active faults within 10 miles of the project site. The nearest active faults to the site are the Elsinore and Rose Canyon faults, as discussed above. Ancient bedrock faults are present throughout eastern San Diego County. The most significant of these ancient features in the immediate area are located to the south of the site as shown on the Regional Geologic Map, Figure 4.

3.2.2 Historical Seismicity

Figure 5 presents a Regional Fault and Epicenter Map showing the pattern of historical seismicity for the region. East of the site is the Salton Trough, which is 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.

The Elsinore fault zone, has displayed a much lower rate of seismic activity than the San Jacinto, Imperial, and San Andreas faults. There have been few historical surface-rupturing earthquakes on segments of the Elsinore fault zone. The 1910 **M** 6 Temescal Valley earthquake ruptured the surface along 15 km of the Glen Ivy segment located north of Lake Elsinore. The Laguna Salada fault, considered the southern extension of the Elsinore fault zone may have produced an **M** 7.8 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.

The Rose Canyon-Newport Inglewood fault zone to the west has also displayed a low rate of seismic activity. There have been no historical surface-rupturing events on the Rose Canyon portion of the fault zone. There was an historic event on the Newport Inglewood fault in 1933 (Long Beach earthquake) that caused considerable damage, although no surface rupture was verified for this event.

3.3 SURFACE CONDITIONS

The project site is situated in a rural area of eastern San Diego County on privately owned property, bounded by the Cleveland National Forest. The proposed site lies just south of BBTT approximately three miles west of Japatul Valley Road. The north, west and east edges of the substation site are bounded by steep ridges, with the highest one rising to an approximate elevation of 3,400 feet Mean Sea Level (MSL). The topography of the substation site area is presented on Figure 2.

The substation area is primarily steep rocky ridges with intervening swales. The ridges tend to be densely vegetated with chaparral and manzanita along with a few oak trees. The intervening swales are typically more open with grasses and scattered oak trees. Minor drainages are present in the substation area including a drainage that crosses the northern portion of the site and a small branching drainage that comes up from the west and terminates in the proposed pad area.

A dirt access road traverses portions of substation site that is locally capped with decomposed granite. This road generally follows the lower flanks of ridges along the perimeter of the swale area. Four-wheel drive vehicles are not generally necessary but heavy rains can make access difficult. A series of locked gates mark the approximate boundaries of local properties along the access road.

No utilities are present within the general site area. Two water wells are present as shown on Figure 2. One well is located in the central portion of the proposed pad and the second well is located near the top of the cut needed for the access at the entrance to the substation.

Access to the substation site is along Bell Bluff Truck Trail which extends westward from Japatul Valley Road across County of San Diego property and a series of private properties as shown on Figure 3. This rural road will be improved and locally realigned to provide adequate access for construction and operation of the substation.

The access road climbs a short hill near Japatul Valley Road and descends into the Peterson Creek drainage. This area is the most significant alluvial crossing of the road alignment. The alignment traverses moderate sloping terrain underlain by variably granitic and metamorphic rock types and crosses a series of minor drainages and swales underlain by alluvium or colluvium. Figure 3 presents a geologic strip map of the road alignment.

3.4 SUBSURFACE CONDITIONS

Weathered granitic rock (including monzogranite to granodiorite and gabbro to diorite) and metasedimentary and metavolcanic rock underlies the substation site at depth, with residual soil deposits present at the surface. Minor amounts of alluvium and colluvium are also present. The access road traverses similar rock types as those encountered at the substation as well as a series of surficial deposits associated with the various small drainages and swales. One larger alluvial crossing is near the eastern end of the alignment where Peterson Creek is crossed.

Idealized geologic cross sections are presented on Figures 6 through 9. The locations of the cross sections are shown on Figure 2.

3.4.1 Surficial Soil

Surficial soils, including; alluvium, colluvium and residual soils are present within the substation site and along the access road alignment. Deposits of residual soil are present as a relatively thin layer across the substation site. The residual soil overlies weathered granitic or metasedimentary rock and was encountered to depths generally ranging from 1 to 6 feet. The residual soil materials were observed in the borings and test pits to range from loose to medium dense silty to clayey sand. Minor amounts of sandy clay were observed locally. Thin alluvial deposits are present within the two minor drainages that cross the substation site. A remnant of older colluvium is also present along the northern margin of the drainage that traverses the northern end of the substation site.

The access road alignment crosses Peterson Creek where deeper alluvial and colluvial deposits are encountered. The road alignment also crosses a series of lesser drainages and topographic swales as shown on Figure 3. Based on Boring B-28 and B-29 the alluvial deposits in Peterson Creek extend to depths of at least 15 feet and include medium dense and dense clayey sand and silty sand. The depths of surficial soils in the lesser drainages were not all evaluated. We anticipate that the surficial soils in these areas are generally less than 10 feet thick in most areas, with some areas that may extend to depths greater than 10 feet.

3.4.2 Granitic Rock (Kcm and Kc)

The central portion of the site is underlain by variably weathered medium to coarse-grained granitic rocks represented by two granitic rock types and older metasedimentary rocks. Regional mapping depicts two

Cretaceous-age plutonic rock units in the project area: the Corte Madera Monzogranite and the Cuyamaca Gabbro. These rock units have intruded older, Cretaceous to Jurassic-age metasedimentary and metavolcanic rocks in the region. Figure 2 presents the geologic map of the site with the rock units described above as well as some areas where a mixture of rock types was encountered.

The northern and southern portions of the site are underlain by the older metamorphic rocks. The Corte Madera Monzogranite rock unit as encountered on site is generally classified as a granodiorite in hand sample evaluation although variation in rock composition is noted within the generalized rock unit and more quartz-rich rock was encountered in the hillside borings, B-8, B-9 and B-10. Very slow drill rates were noted in this very hard rock.

The Cuyamaca Gabbro is a darker granitic rock found in an elongate zone in the southern portion of the site. Rocks within this map unit can range from gabbro to diorite.

The granitic rocks, in general, exhibit a weathering profile that can grade from completely weathered to highly weathered before becoming a more competent moderately weathered or slightly weathered to fresh rock at depth. In some areas, a fairly abrupt transition from highly weathered to slightly weathered rock occurs. Weathering is a highly variable phenomenon and the weathering profile will vary laterally and vertically. In general, weathering decreases with depth; however, zones of more highly weathered rock are locally encountered below zones of less weathered rock.

The completely weathered material is soil-like, and was observed to consist primarily of reddish brown silty sand to clayey sand that ranges from loose to very dense. The thickness of the completely weathered rock zone is variable, typically ranging from 1 to 6 feet thick and grading with depth to a highly weathered rock. It may be absent in some areas and in other areas it can range to depths of 50 feet, as noted in Boring B-07.

The highly weathered rock typically exhibits more visual evidence of rock texture, but should excavate to a soil. The highly weathered rock is locally dense and generally very dense. This weathering unit was observed or is inferred to depths ranging from 15 to 50 feet. Moderately and slightly weathered rock was encountered in the test borings and air track borings and is inferred at depth throughout the site based on the seismic refraction surveys.

3.4.3 Metasedimentary Rock (KJvs)

The northern and southern portions of the site are underlain by the older metamorphic rocks that appear to be predominantly metasedimentary rocks. These metasedimentary rocks represent zones or screens of rock bounded by the plutonic granitic rock.

The metasedimentary rocks in the site area generally exhibit more discontinuities (fractures, relict bedding planes) than the granitic rocks. Based on the boring and seismic refraction surveys the weathering profile may be slightly thicker in the metasedimentary rock. In borings B-4, B-23 and B-27, the depth to moderately weathered rock ranged from about 22 to 35 feet.

3.5 GROUNDWATER CONDITIONS

Groundwater was not detected during the drilling of the geotechnical borings. However, most of these borings were cored using water that can mask the presence of groundwater. Water was measured at a depth of approximately 60 feet bgs (Elevation 3,061 feet MSL) in the existing well (Water Well W-4) located in the central portion of the site. Water was also measured in the existing well located east of the northeast corner of the substation (Water Well W-3) at depths ranging from approximately 8 to 12 feet below the ground surface (Elevation 3,139 to 3,135 feet MSL). This is an area located along the toe of a steep hillside where a steep cut for the entrance road is proposed. The occurrence of groundwater is likely attributable to shallow subsurface flow of water in fractured and weathered rock. A similar perched water situation may also be encountered along the hillside on the eastern side of the pad.

Water was also encountered during the drilling of some of the ATBs. Water was encountered in ATB 1, -3, and -4, ranging in depth from 56, 44, and 60 feet (elevations of approximately3049 feet, 3048 feet, and 3036 feet MSL), respectively.

SECTION 4 GEOLOGIC HAZARDS

4.1 SEISMIC HAZARDS

4.1.1 Fault Rupture

There are no significant active or potentially active faults in the site area as described in Section 3.2. Fault rupture is not considered a hazard at the site.

4.1.2 Seismic Shaking

The site could be subject to moderate to strong ground shaking from a local or more distant, large magnitude earthquakes occurring during the expected life of the project. The nearest seismic sources are associated with the Elsinore fault zone, as discussed in Section 3.2. Published evaluations of ground motion hazard by the California Geological Society (CGS, 2003) suggest that the site may be subject to moderate to high levels of ground shaking in the event of an earthquake on nearby active faults. The peak bedrock ground motion associated with a 10% probability of exceedance in a 50 year period is estimated at approximately 0.25g, 0.27g and 0.31g assuming firm rock, soft rock and alluvium conditions respectively (CGS, 2003). Seismic design parameters are provided in Section 5.4.

4.1.3 Liquefaction and Seismic Settlement

Liquefaction is a phenomenon where loose, saturated coarse-grained soils (with less than 50% passing the No. 200 sieve) lose their strength and acquire some mobility from strong ground motion induced by earthquakes. The secondary effects of liquefaction include sand boils, settlement, reduced soil shear strength, lateral spreading and global instability (flow slides in areas with sloping ground). Loose granular material above groundwater can also experience settlement during an earthquake (seismic compaction).

Minor, localized zones of loose granular material are present at the site within the residual soil. These are very minor occurrences and groundwater was not observed within these deposits. As a result, the potential for liquefaction to occur at the site is extremely low. Similarly, there is some minor potential for seismic settlement in the loose surficial deposits. However, these materials will be recompacted as part of remedial grading.

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.

Rockfalls are not considered a major hazard for the natural slopes in the site area. Some bolder outcrops are present on the eastern slopes. These rocks appear sufficiently embedded to not pose significant rock fall hazard in their current condition. Rock fall hazards could increase in the area during construction as a

result of heavy vibrations due to grading and blasting, or if slopes are cut below rock outcrops that reduce the embedment of boulders. Alteration of existing drainage patterns could erode the soil around boulders and decrease their embedment.

4.2.2 Expansive Soils

Potentially expansive soils were not encountered during the field exploration, and based on the geology of the area, are not expected to be present at the site in any significant quantities. Clayey residual soil was encountered in a few borings and test pits; however Expansion Index (EI) test results on two samples indicated very low potential for expansion.

SECTION 5 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that with proper design and construction, the site is geotechnically suitable for the proposed substation development. The primary geotechnical consideration associated with the project is the substantial earthwork needed to form the substation pad. Earthwork is expected to require heavy ripping and blasting that should generate large quantities of rock that will need processing for reuse as fill. The following sections provide recommendations for the design of the substation pad and access road and preliminary geotechnical parameters and recommendations to help EPC teams prepare bid designs.

5.1 GEOTECHNICAL CHARACTERISTICS AND PROPERTIES

Mass excavation should mostly expose variably weathered granitic and metamorphic rock. Excavation and processing of this material will be the predominant source of fill. The geotechnical properties of granitic and lesser metamorphic rock used for fill will depend on the degree of weathering or fracturing, method of excavation and amount of processing. The geotechnical engineering properties of insitu rock will depend on the degree of weathering and the strength of intact blocks of rock and the mechanical interaction of these blocks, which is controlled by the presence, frequency and orientation of rock mass discontinuities (joints, fractures, etc.).

In general, rock excavated and processed should possess favorable engineering properties when properly placed and compacted. Completely weathered to highly weathered rock should excavate as fine to coarse grained, silty sand to well or poorly graded sand (USCS classification SM, SW or SP) with an increasing amount of rock fragments as the degree of weathering decreases. Excavation of marginally rippable rock should produce rock fragments of varying size and varying amounts of granular soil. The amount of rock fragments depends upon the rock type, degree of weathering and fracture frequency inherent in the rock mass and on the methods used during excavation and blasting. Slightly weathered to unweathered, nonrippable rock will generate angular rock fragments of varying size depending upon the blasting and excavation methods used.

The table below presents basic geotechnical parameters for the primary materials types interpreted at the site. The parameters are given for insitu materials or materials excavated and reused as properly placed and compacted engineered fill.

Table 1
Basic Geotechnical Parameters
SDG&E Suncrest Substation

Material Type	Geotechnical Property			
	Unconfined Compressive Strength, UCS (psi) [d]	Moist Unit Weight, γ (pcf) [d]	Effective Cohesion, c' (psf) [d]	Effective Friction, ϕ' (degrees)
Soil Fill [a, b]	NA	125	0	33 - 35
Completely to Highly Weathered Rock [c]	1,500	150	100	35 - 40
Moderately Weathered Rock [c]	10,000	160	7,500	40 - 45
Slightly Weathered Rock	20,000	165	NA	NA

Notes:
a. Derived predominately from granitic material.
b. Compacted to 90 percent relative compaction (ASTM D1557).
c. Relict joints may influence properties.
d. psi = pounds per square inch, pcf = pounds per cubic foot, psf = pounds per square foot

5.2 EARTHWORK

Earthwork should be completed according to SDG&E Standard Specifications and the Green Book Standard Specifications. Earthwork should incorporate the following measures that are typical to southern California grading practices:

- Removing residual soils and other surficial deposits that do not possess sufficient strength and stability to support structures and/or embankments. Removals should extend to competent materials approved by the geotechnical engineer.
- Processing material obtained from excavation to achieve a maximum particle size and distribution that is suitable for conventional placement in engineered fills in accordance with ASTM D1557.
- Placing fill in loose lifts that range from 8 to 12 inches and compacting each lift to 90 percent relative compaction, using the latest version of ASTM D1557 as the compaction standard.
- Constructing keyways and benching into competent material for all fill slopes.
- Over-filling fill slopes and trimming them back to expose a well-compacted inner core at finished slope grade.
- Controlled blasting near cut slope faces.
- Installing subdrains in the base of fills placed in swales or ravines.
- Overexcavating cut areas where structures will be supported by a shallow foundation that will straddle a transition from cut to fill. A minimum 5-foot depth of overexcavation will also be required in all cut areas to ease footing excavation and utility installation.

Due to the presence of strong and very strong rock, excavation in many areas of the site will have the potential to generate significant quantities of oversize rock (rock greater than 8 to 12 inches). Very high seismic velocities were noted during seismic refraction studies and very slow coring rates were noted in the deeper borings performed for the eastern cut slope. In addition, high unconfined compressive strength values were measured on core samples tested in the laboratory. Unconfined compressive strength values approaching 40,000 psi were reported for some of the samples tested.

This type of material will require substantial processing to achieve a maximum particle size and distribution that is suitable for conventional placement in engineered fills in accordance with ASTM D1557. The amount of oversize rock will depend, in part, on the methods of excavation and blasting used by the contractor. Depending on the quantity of oversize material generated, it may be necessary to consider rock fill placement and/or various forms of disposing oversize material, such as placing oversize rock individually or in windrows or as cells or blankets in areas that will support parking or structures where deep foundations will not be necessary. Appendix G provides a guide Technical Specification for Rock Fill Placement.

5.3 FILL SLOPES

The maximum expected height of proposed fill slopes will be about 100 feet at 2:1 (h:v) inclinations. These slopes should be grossly stable under normal conditions and proper maintenance. Mechanically Stabilized Earth (MSE) retaining walls are planned as part of the some of the fill slopes.

5.4 CUT SLOPES

Site formation includes a large cut slope along the northern portion of the eastern side of the substation pad and lesser cut slopes along the western and northern sides. The eastern cut slope reaches a maximum height of approximately 160 feet at the apex and the western and northern cut slopes are approximately 60 feet and 40 feet in height. Several cut slopes will be needed along both sides of the entrance road. Lesser cuts are needed along the access road.

Most cut slope excavations should expose variously weathered granitic rock. The ability of insitu granitic rock to maintain the proposed cut slope inclinations depends on the degree of weathering and the presence, frequency and orientation of rock mass discontinuities (e.g., joints, fractures etc.). Discontinuities oriented out-of-slope (dip angle parallel or shallower than the slope inclination) could result in deep-seated type failures (rock glides), or surface failures such as rockfalls, spalling or exfoliation. The following sections describe the assessment of the stability of the various cut slopes at currently proposed heights and inclinations.

5.4.1 Eastern Cut Slope

Based on the findings from six borings within the eastern cut slope, excavation should expose medium to coarse-grained granitic rock (granodiorite, monzogranite, gabbro, diorite) that exhibits a weathering profile from completely weathered to highly weathered near the ground surface before becoming moderately weathered or slightly weathered rock at depth. There also appears to be a fairly abrupt transition from highly weathered to slightly weathered rock.

The northern third of slope appears to be more deeply weathered. This area does not possess enough data to confidently characterize subsurface conditions. The majority of data for the other areas of the slope suggests a somewhat consistent depth to slightly weathered material, however, B-07, which is the nearest boring to the northern portion of the eastern cut, revealed a deeper weathering profile than the surrounding borings.

The eastern cut slope is designed at inclinations from top to the toe of the slope at 1.5:1, 1:1, and 0.75:1(h:v). The hinge points were developed from interpretations of where the transitions in the weathering profile may occur, including the deeper weathering profile encountered in B-07. Fresh to slightly weathered rock should support a 0.75:1(h:v) inclination, highly to moderately weathered rock should support a 1:1(h:v) inclination and completely weathered rock should support a 1.5:1(h:v) inclination.

5.4.1.1 Cut Slope Stability

Cut slope stability was evaluated using the structural geology data from the downhole televiewer. Kinematic stereonet analyses of rock discontinuities, chiefly joints, using Markland's Test Theory were completed using the RockPack III program (Watts *et al.*, 2003). The stereonet analysis identifies the rock discontinuity attitudes that could promote slope instabilities for the specified cut slope orientations. The kinematic failure mechanisms for slope instability include plane, wedge and toppling failures. The data and the analyses are described in greater detail in Appendix D.

Rock discontinuity analyses were completed using the data for the four borings (B-08, -09, -10, and -11) that were logged with the downhole televiewer. The structural geologic data (location and orientation of discontinuities) gathered from the downhole surveys were compared to the proposed cut slope inclinations in rock of 0.75:1 and 1:1. The rock material properties used included density and joint strength (i.e., friction angle and cohesion), and the critical joints analyzed for slope stability were evaluated under dry conditions. Figures 10 and 11 present the stereonet analyses of the composite data sets using B-8, -9, -10, -11 data for each of two cases. Case 1 and Case 2 present the results of the stereonet analyses on the composite data set using friction angles of 40 and 50 degrees, respectively.

The eastern cut slope should be grossly stable as configured. Based on our analyses, there is a relatively low potential for large deep-seated type instability (rock slides and large wedge failures). However, there is a low to moderate potential for relatively small scale wedge and toppling failures. Figure 10 presents the stereonet analyses for the two slope inclinations using a joint friction angle of 50 degrees. In general the analyses show that the proposed cut slope (black great circle) trending north-south with 1:1 and 0.75:1 inclinations are favorably oriented relative to the rock discontinuities encountered in the borings. The analyses show only a few random joints (dip vector points shown as triangles and squares) planes daylighting the slope and no dip vectors fall into the critical zone (e.g., shaded area formed between the friction circle at 50 degrees and the 0.75:1(h:v) proposed cut slope great circle. Thus, the potential for plane and wedge failures is low. The potential for toppling failure is low to moderate. The potential for instability is indicated by the near vertical dipping joint planes into the proposed slope face and trending nearly parallel (typically within 30 degrees) to the strike of the slope.

An additional analysis was performed using a more conservative estimate of joint friction angle of 40 degrees as shown on Figure 11. With this friction angle, the potential for plane, wedge, and topple

failures increases slightly. The potential for instability is indicated by some dip vectors that lie inside the larger critical zone area for potential plane failures (shaded crescent shape). While some dip vectors appear in the critical zone, there are no prominent joint sets appearing in the critical zone. The potential for plane and/or wedge failures is considered low to moderate. The potential for toppling failure is moderate indicated by a greater number of dip vectors that lie inside the critical 'topple' zone (shaded triangle).

5.4.1.2 Mitigation Measures

Mitigation measures may be needed to improve areas of the slope that are more deeply weathered than desired for the planned inclination or expose adversely oriented discontinuities. During construction, adverse weathering and/or discontinuities may be mitigated by installing rock bolts and other rock slope treatment. To some degree, this type of mitigation may be necessary locally regardless of planned slope inclinations. Proper drainage of the slopes is recommended in the event of wet conditions.

In addition, there is a potential for corestones or "floaters" to be encountered within weathered portions of the granitic rock, which could dislodge if they remain buried near the face of the cut slope. Large corestones are typical and frequent in granitic rock. Further, large surface boulders exist above the crest of the cut slope that are currently supported naturally by surface friction, interlocking with other boulders and/or embedment into the underlying soil. Erosion and/or strong ground motions from an earthquake (or blasting during earthwork) could dislodge these boulders. Some of the boulders may need to be removed or stabilized in-place.

We recommended establishing a buffer zone adjacent to the substation perimeter to provide additional space for dislodged rock to accumulate without impacting the substation perimeter fence and road. The buffer zone should be a ditch with the far edge gently sloped to minimize bounce dispersion of dislodged rock. Based on highway slope engineering approaches, a rock fall analysis has been performed using the Colorado Rockfall Simulation Program (CRSP). A conceptual catchment design for this slope based on CRSP and consistent with generalized design guidelines would include a ditch on the order of 5 feet deep with a minimum width of 20 feet.

5.4.2 Western Cut Slope

The western cut slope is planned at a 1.5:1(h:v) inclination with a height of approximately 60 feet. The only subsurface information in this area is seismic refraction line SRL-18. Based on the seismic refraction data there is a weathered/less weathered rock contact along the lower portions of the slope. As shown on Figure 7, Section E-E', the location of the inferred contact is nearly coincident with the inclination of the proposed cut slope. Therefore, it is possible that the lower slope segment will encounter the transition between weathered/less weathered rock in the central portion of the cut. However, no boring information is available to assess fracture frequency or corroborate the seismic data. This slope should be stable at the 1.5:1(h:v) inclination.

5.4.3 Northern Cut Slope

The northern cut slope is planned at a 1.5:1(h:v) inclination with a height of approximately 30 feet. The top of a portion of the slope is planned to be vertical and supported with soil nails. Based on the boring B-04 and seismic refraction line SRL-11, formation of this slope should expose predominantly highly weathered rock with an upper zone of completely to highly weathered rock. As this slope extends eastward and transitions into the cuts along the northern side of the entrance road, the depth to the less weathered rock should lessen, based on seismic data. This slope should be stable at the 1.5:1(h:v) inclination.

5.4.4 Entrance and Access Road Cut Slopes

To reduce the area of impact, the proposed cut slopes approaching the entrance to the substation pad (referred to as "entrance road") have been planned at 0.75:1(h:v) in the deeper portions of the cuts, transitioning to 1.5:1(h:v) in the upper more weathered rock. Based on boring and seismic refraction data, the deeper portions of the entrance road cuts should generally encounter slightly weathered rock.

The access road area is not characterized by any downhole logging of borings and so there are no area-specific structural data available to directly address possible rock slope instability. Toppling, wedge, and sliding failures would have to be addressed by additional borings prior to construction or during construction with a closely monitored excavation and geologic slope mapping. If potentially unstable conditions are encountered then rock bolting, or other surface type rock slope treatment of potentially unstable zones would be required. Based on the three borings in this area, there does not appear to be a high frequency of moderate or high angle fractures and no faults or shears were encountered. This evidence supports the recommendation to steepen these slopes in the less weathered rock that is anticipated in the lower portions of the planned cuts.

5.4.5 Construction Recommendations

An important factor in ultimate performance of cut slopes is the integrity of the rock mass after blasting. Minimizing impact to the slope face during blasting and excavation is needed to minimize the development of new cracks and/or the expansion of existing discontinuities. Controlled blasting techniques, such as presplitting or smooth-wall blasting should be utilized.

Cut slopes should be geologically mapped as excavation proceeds downward to evaluate the character and orientation of discontinuities. Some form of stabilization is often needed following excavation of cut slopes formed in rock. It may be necessary to locally apply surface type rock stabilization measures, such as scaling, wire netting, rock dowels and rock bolts.

The slopes above all cuts should be cleared of potentially unstable boulders that represent a rockfall hazard. This scaling activity should precede any blasting or significant grading activities on the slopes. A boulder survey should be completed in the area near the planned crest of the cut slope.

5.5 RETAINING WALLS

5.5.1 Soil Nail Walls

The EPC contractor will procure the design and construction of retaining walls that will support the near vertical cuts needed to form the substation pad. This report assumes that the EPC contractor will adopt soil nailing for these retaining walls. Presently, one wall is planned along the north central portion of the perimeter of the substation pad. The wall will be about 20 feet high. Geotechnical design information for the soil nail walls is summarized in the table below.

Table 2
Geotechnical Design Information for Soil Nail Walls
SDG&E Suncrest Substation

Assumed Predominate Material	Highly Weathered Rock
Peak Effective Cohesion, c' (psf)	0
Groundwater Conditions	None
Peak Effective Internal Friction Angle, ϕ (degrees)	40
Total Unit Weight, γ (pcf)	150
Soil Aggressivity	Non Aggressive
Peak Ground Acceleration, A (g)	0.27g

Analyses should be submitted with the design that indicates the completed soil nail wall possesses factors of safety of at least 1.5 and 1.1 for static and pseudo-static overall stability, respectively.

The soil nail walls should be considered permanent structures with adequate corrosion protection for the soil nails. Drainage should be provided behind the wall with geocomposite strips leading to weep holes at the base of the wall. The surface of the wall should be protected from erosion.

As a minimum, two verification tests should be conducted in each wall. Verification tests should be performed on "sacrificial" test nails that are not part of the permanent work. Proof testing should be performed on at least 5% of the nails in each lift. Verification and proof testing should be completed in accordance with the Manual for Design and Construction of Soil Nail Walls, Report No. FHWA-SA-96/069.

5.5.2 Mechanically Stabilized Earth (MSE) Walls

MSE retaining walls should be designed according to the National Concrete Masonry Association, Design Manual for Segmental Retaining Walls (NCMA, 2002) or similar methodologies using the following design parameters and recommendations. The soils placed in the reinforced zone should be coarse-grained materials. NCMA recommends the following physical characteristic for soils placed in the reinforced zone.

Table 3
Gradation and Plasticity Recommendations for Reinforced Fill (NCMA, 2002)
SDG&E Suncrest Substation

Sieve Size	Recommended Gradation Percent Passing by Weight
100 mm (4 inch)	100 – 75
4.76 mm (No. 4)	20 – 100
0.425 mm (No. 40)	0 – 60
0.075 mm (No. 200)	0 – 35
Plasticity Index	< 20

On site materials processed to meet the above requirements should possess an internal friction angle of at least 33 degrees. Properly compacted soil should possess a moist unit weight of 125 pounds per cubic foot (pcf).

Designers of MSE retaining walls should note the following site-specific conditions:

- Installation damage reduction factors used to assess the allowable strength of the geosynthetic reinforcement should consider that the material processed for fill in the reinforced zone will possess angular gravel that is greater than a ¾-inch particle size. NCMA (2002) recommends adjusting the installation damage reduction factors since the angular particles that ¾ inch, or larger in size are more likely to damage the geosynthetic reinforcement during the placement and compaction of fill in the reinforced zone.
- There is potential for conflict between storm drains and geosynthetic reinforcement. The designer should consider additional reinforcement coverage to compensate for removal of the geosynthetic reinforcement to install the storm drain.
- The estimated peak ground acceleration for a 10% probability of exceedance in 50 years (475-year average return period, ARP) is 0.31g. We note however, that Caltrans Bridge Design Aid 3-8, Mechanically Stabilized Embankment (March 2009) indicates "Seismic design for MSE should include conventional pseudo-static loading during global stability analyses. Internal seismic loading is not utilized in MSE design".
- The overall stability of each MSE should be evaluated by a geotechnical engineer where there will be sloping ground in front of and/or behind the wall. URS has evaluated the overall stability of the MSE walls shown on the grading plans. The MSE retaining walls, as presently configured, should be stable considering static and pseudostatic conditions with a Factor of Safety of at least 1.5 and 1.1, respectively. Based on our analyses, there is a relatively low potential for large, deep-seated type, global instability.
- MSE retaining walls should be founded on properly compacted fill or relatively undisturbed weathered granitic rock materials, as approved by the geotechnical engineer. Allowable bearing pressure may be evaluated with conventional soil mechanics theory using the basic geotechnical

parameters provided in Table 1. Location-specific assessment of bearing pressure, deformation and surficial stability by the geotechnical engineer may be needed in some areas if the MSE retaining wall is founded in descending slopes and the edge of bottom level of geosynthetic reinforcement that is closest to face of the slope is located less than about 5 to 8 feet horizontally from the face of the slope.

The design of MSE retaining walls should include subsurface drainage to avoid developing hydrostatic pressure. The extent of subsurface drainage depends on the wall height, type of block open or closed face), physical characteristics of soil backfill, groundwater, existing and/or proposed infrastructure and surface conditions. Subsurface drainage may be reduced if the soils used in the reinforced and retained zones are relatively "free draining". FHWA (2001) defines free-draining materials as soils with less than five percent passing a 0.075 mm (No. 200) sieve. Figure 13 provides a detail that illustrates the recommendations provided in the following paragraphs.

MSE retaining walls that are less than five feet high should have a drain at the base of the wall, located immediately behind the facing blocks. The base drain should be a minimum four-inch diameter perforated pipe (SDR 35) leading to a suitable outlet. The pipe should be surrounded by at least three cubic feet, per foot of pipe, of free draining ¾-inch crushed rock wrapped with filter fabric, such as Mirafi 140N, or approved equivalent. For "open face" block systems, the base drain may be installed immediately behind the reinforced zone, subject to review by the geotechnical engineer.

MSE retaining walls greater than five feet high should have free draining material along the back of the wall (the area immediately behind the facing blocks) in addition to the base drain. The backfill immediately next to the MSE retaining wall (minimum horizontal distance of 12 inches measured perpendicular to the wall) should consist of ¾-inch crushed rock wrapped in filter fabric. Considering the variety of commercially available segmental units, the MSE designer should detail the width of the drainage material behind the wall using the back face or "tail" of the block. For "open face" block systems, free draining material along the back of the wall may not be necessary, subject to review by the geotechnical engineer. If it desired to avoid using filter fabric, drainage material immediately behind the wall should conform to Caltrans Class II Permeable Aggregate, which does not require enclosure with filter fabric.

Groundwater, existing or proposed water bearing utilities, or surface conditions that could promote infiltration (*e.g.,* irrigated landscaping) behind walls may require additional subsurface drainage, depending on the type of backfill. Local sources of groundwater were encountered during the fieldwork for this investigation. Groundwater could develop periodically from seasonal weather conditions or other factors. In addition, storm drains are planned near some of the MSE retaining walls; potential leakage from storm drains should be considered when planning retaining wall subsurface drainage. Therefore, the position of MSE retaining walls relative to water-bearing infrastructure and the surrounding surface conditions should be considered when assessing subsurface drainage requirements. In addition, the contract documents should include provisions that allow the geotechnical engineer to instruct the contractor to place additional subsurface drainage if geologic mapping of the MSE retaining wall backcut exposes seeps or other similar forms of groundwater that have the potential to exceed the capacity of standard wall drains. An inclined drain (chimney drain) along the wall backcut should be considered in such circumstances. An inclined drain (chimney drain) should also be considered if there are unlined stormwater basins above the MSE wall.

5.6 SEISMIC DESIGN

Various elements of the project will be designed using different seismic loading standards depending on their use and/or governing code. Parameters developed from the 2007 California Building Code (CBC) and IEEE (Institute of Electrical and Electronics Engineers) are presented in the sections below. However, given the significant cuts and fills at the site and the potential for moderate to high seismic shaking, ground motions for some structures may require specific evaluation. Structures spanning cut-to-fill transitions will require particular care. It is expected that in thick fills, the ground motions may be attenuated (decreased) for some seismic frequencies and amplified for other frequencies. As final foundation design requirements are refined, consideration should be given to performing Probabilistic Seismic Hazard Assessment (PSHA) studies to address the potential for significant variations in ground motions across the substation pad.

5.6.1 2007 California Building Code Seismic Coefficients

The following table provides seismic coefficients from the 2007 CBC. Site Class D, appropriate for the thicker fill areas of the site, was used for development of the coefficients. Additional studies should confirm that these coefficients are appropriate for the ground conditions at the specific structure, considering the location with respect to the cut-to-fill transition. Coefficients in the table below are conservative for areas where rock is present near pad level.

Table 3
2007 California Building Code Seismic Coefficients
SDG&E Suncrest Substation

Parameter	Value [a]	2007 CBC Reference
Site Class	D	Table 1613.5.2
Mapped Spectral Acceleration - Short Period, S_s (g)	1.10	Figure 1613.5
Mapped Spectral Acceleration - 1 Sec. Period, S_1 (g)	0.37	Figure 1613.5
Site Coefficient - Short Period, F_a	1.06	Table 1613.5.3(1)
Site Coefficient - 1 Sec. Period, F_v	1.66	Table 1613.5.3(2)
MCE Spectral Response Acceleration - Short Period, S_{MS} (g)	1.17	Equation 16-37, $S_{MS}=F_aS_S$
MCE Spectral Response Acceleration - 1 Sec. Period, S_{M1} (g)	0.61	Equation 16-38, $S_{M1}=F_vS_1$
Design Spectral Response Acceleration - Short Period, S_{DS} (g)	0.78	Equation 16-39, $S_{DS}=2/3*S_{MS}$
Design Spectral Response Acceleration - 1 Sec. Period, S_{D1} (g)	0.41	Equation 16-40, $S_{D1}=2/3*S_{M1}$

Note:
a. Calculated using USGS program "Earthquake Ground Motion Parameters" Version 5.0.9 for the center of the substation pad.

5.6.2 Equipment Seismic Qualification Level

The selection of the seismic qualification level for the performance evaluation of substation equipment was evaluated using the seismic exposure map methodology presented in Section 8.6.2.1 of the IEEE Standard 693-2005. For the Suncrest Substation site, the qualification level is calculated as moderate

based on a calculated peak ground acceleration for seismic qualification of 0.48g. However, we understand that SDG&E typically considers using the high qualification level where the peak ground acceleration is greater than 0.4g.

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 Earthquake (MCE) presented on regional seismic hazard maps.

Table 4
Equipment Seismic Qualification Level
SDG&E Suncrest Substation

Parameter	Value			2006 IBC Reference
Soil Profile Name	Stiff Soil	Dense Soil/ Soft Rock to Rock	Hard Rock	IBC Table 1613.5.2
Site Soil Class	D	C/B	A	IBC Table 1613.5.2
MCE Ground Motion 0.2s Spectral Response Acceleration, S_s	1.14*g*	1.14g	1.14g	IBC Figure 1613.5(3)
Site Coefficient, F_a	1.06	1.0	0.8	IBC Table 1613.5.3(1)
Adjusted MCE Spectral Response Acceleration -short period, S_{ms} ($=S_sF_a$)	1.21*g*	1.14g	0.91	IEEE 8.6.2.1 (d); IBC Equation 16-37
Peak Ground Acceleration for seismic qualification selection ($S_{ms}/2.5$)	0.48*g*	0.46g	0.37g	IEEE 8.6.2.1 (e)
Selected Seismic Qualification Level	Moderate to High[a]	Moderate to High[a]	Moderate	IEEE 8.6.2.1 (f)

Notes:
a. SDG&E typically considers using the high qualification level where the peak ground acceleration is greater than 0.4g.

5.7 SHALLOW FOUNDATIONS

Shallow spread and continuous footings and mat foundations are anticipated to support the control house, transformers, circuit breakers, capacitors and other substation equipment. A ringwall foundation will be used for the water tank. Most of the shallow foundations are likely to be embedded within properly placed and compacted fill. The following sections provide geotechnical parameters that are suitable for bid and preliminary design purposes.

5.7.1 Allowable Bearing Pressure

Strip and spread footings may be designed using the following vertical allowable bearing pressure.

Table 5
Allowable Bearing Pressure
SDG&E Suncrest Substation

Material	Allowable Bearing Pressure [a, b, c, d] (psf)	
	Embedded 12 inches	Embedded 24 inches
Engineered Soil Fill	2,000	4,000
Completed to Highly Weathered Rock	2,500	5,000
Moderately Weathered Rock	4,500	9,000

Notes:

a. Minimum footing embedment depth of 12 inches below the lowest adjacent grade.
b. Minimum footing width of 12 inches.
c. Level "infinite" ground in front of the footing.
d. May be increased by one-third increase for loads that include wind and seismic forces.

Footings should not transition between compacted fill and weathered granite unless a geotechnical engineer provides specific recommendations for such placement. The structural engineer should determine the footing embedment, size and reinforcement based on anticipated loads and estimated differential settlements.

Adjacent footings founded at different elevations should be located such that the slope from bearing level to bearing level is flatter than 1:1(h:v). Where footings are located near 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.

5.7.2 Allowable Passive Resistance

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. The following allowable lateral bearing per foot of depth below the lowest adjacent grade or slab-on-grade may be used for the design of footings poured neat against properly compacted fill or undisturbed rock.

Table 6
Allowable Passive Resistance
SDG&E Suncrest Substation

Material	Allowable Passive Resistance (psf/foot of embedment)
Engineered Soil Fill	275
Completed to Highly Weathered Rock	300
Moderately Weathered Rock	400

a. Level "infinite" ground in front of the footing.

The table below provides allowable friction coefficients that 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 as shown.

Table 7
Allowable Friction Coefficients
SDG&E Suncrest Substation

Material	Allowable Friction Coefficients	
	Base Friction Alone	Base Friction and Passive Resistance
Engineered Soil Fill	0.50	0.35
Completed to Highly Weathered Rock	0.50	0.35
Moderately Weathered Rock	0.60	0.40

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 and/or the ground in front of a footing descends.

5.7.3 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, in addition to other factors. A total settlement of less than one inch has been preliminarily estimated for the allowable bearing pressures provided in this report. This settlement 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.

Where shallow foundations are located within deep fill, some post-grading settlement is a normal occurrence and should be expected. This settlement is a function of fill type, placement conditions, underlying fill/bedrock geometry, long term moisture fluctuations and other factors. Surface monument measurements should be installed where fills are more than 50 feet deep to evaluate the completion of the short-term settlement. Local experience from long-term monitoring of compacted soil 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. Data from long-term monitoring of rock fill embankments for dams indicates that the total settlement can range from 0.2% to 0.8% of the initial fill thickness at the point under consideration. Long-term settlement monitoring of rock fill becomes more important if clean rock fill is used rather than matrix encased rock fill.

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.

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

5.7.4 Mat Foundations

Mat foundations larger than 10 feet by 10 feet in plan dimension embedded a minimum of 12 inches within properly engineered fill or undisturbed granite rock may be designed as recommended in the Allowable Bearing Pressure and Allowable Passive Resistance sections of this report. Mat foundations should not transition between compacted fill and weathered granite unless a geotechnical engineer provides specific recommendations for such placement.

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 modulus of vertical subgrade reaction (k) for engineered fill or undisturbed weathered granite rock of 200 and 300 pounds per cubic inch (pci), respectively. 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.

5.8 DEEP FOUNDATIONS

Cast-In-Drilled Hole (CIDH) piles are anticipated to support transmission line poles, “A” or “H” frames, bus supports and racks. For preliminary design purposes, CIDH piles should derive resistance from at least moderately, or less weathered rock. CIDH piles can derive support from either the shaft resistance of

a socket formed in rock or an end-bearing base in rock. End bearing and shaft resistance should not be combined without detailed analyses.

In areas where the depth of fill precludes using a rock socket, CIDH piles can derive support from the shaft resistance in the fill.

5.8.1 Axial Load Capacity

The capacity of CIDH piles that derive resistance solely from a socket formed in rock may be estimated using an allowable unit resistance along the socket length of 7.5 tons per square foot (tsf), for sockets that begin a minimum of 10 feet below the ground surface. The capacity of CIDH piles that derives resistance solely in end bearing on rock may be estimated using an allowable vertical bearing pressure of 75 tsf.

The capacity of CIDH piles that derive resistance from shaft friction in fill may be estimated using an allowable unit resistance 0.2 tsf for shafts that are embedded a minimum of 10 feet below the ground surface. This estimate considers common soil mechanics methods of assessing shaft resistance and correlations to SPT N, such as N/100 tsf for ultimate shaft resistance in sand and gravel (Xanthakos, 1995).

Allowable capacities may be increased by one-third for short-term wind and seismic loads.

5.8.2 Uplift Resistance

The uplift resistance of CIDH pile may be estimated by reducing the axial unit resistance by 30% and considering the weight of the pile. Allowable uplift capacities developed using a socket formed in rock may or shaft resistance in fill be increased by one-third for short-term wind and seismic loads. The calculation for uplift capacity for CIDH piles that derive resistance solely in end bearing may use the weight of pile only.

5.8.3 Group Effects

The axial capacity of a CIDH pile group with a socket formed in rock or with an end-bearing base in rock can be taken as the sum of the individual pile capacities, i.e. the group efficiency factor is one. The axial capacity of a CIDH pile group that derive resistance from shaft friction in fill can be taken as the sum of the individual pile capacities if the pile center to center pile spacing is less than the pile perimeter.

5.8.4 Settlement

The settlement of a singly arranged CIDH pile designed and constructed using the geotechnical recommendations in this report should be less than one inch, excluding elastic deformation of the pile shaft.

5.8.5 Lateral Load

Assessments of the lateral load capacity of CIDH pile using the Electric Power Research Institute (EPRI) computer program Moment Foundation Analysis and Design (MFAD) requires the following soil parameters:

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

Estimates of the required parameters were developed based on the results of our site observations, subsurface explorations, laboratory testing, field dilatometer 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. Dilatometer testing was performed in three representative borings as described in Appendix E. Pressuremeter testing was not performed as a part of this project due to the relatively shallow rock depth and the difficulty maintaining an undisturbed borehole diameter in the surficial soils and completely weathered rock.

Table 8
Recommended MFAD Design Parameters
SDG&E Suncrest Substation

Material	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	E_{pmt} [a] or E_D [b] (ksi)	Strength Reduction Factor, α
Soil Fill	125	33	0	1.5	1.0
Completely to Highly Weathered Rock	140	35	100	10	1.0
Moderately Weathered Rock	160	45	2,500	30	0.45
Slightly Weathered Rock	165	49	4,000	300	0.35

Notes:
a. E_{pmt} = Modulus of Deformation as would be determined from a pressuremeter test.
b. E_D = Average Modulus of Deformation determined from dilatometer 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.

5.9 CONCRETE SLABS-ON-GRADE

Slab-on-grade concrete floors should be at least five 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 membrane should not be punctured during construction. It may be prudent to specify a membrane thicker than needed for a vapor barrier. Vapor barrier requirements should be reviewed relative to desired functionality of the space and floor coverings, construction considerations and recommendations of the American Concrete Institute (ACI).

5.10 PAVEMENTS

5.10.1 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 SDG&E standard Traffic Indices (TI) of 4.5 and 5.0. These traffic indices should be confirmed by the project Civil Engineer prior to final design. TI values of 4.5 and 5.0 correlate with approximately 5 to 12 passenger vehicle trips per day, or 2 to 5 medium to heavily loaded truck trips per day (H20 loading).

Six R-Value tests performed on soil samples of subgrade materials from BBTT ranged from 14 to 20 for surficial materials (fill and alluvium/colluvium) and 69 to 74 for excavated and reconstituted samples of completely weathered rock. We assume that the pavement subgrade conditions encountered during our field investigation are representative of those along the proposed roadway subgrade. Considering the relatively high R-value of subgrade derived from weathered rock, it may be practical to consider a full depth asphalt pavement structural section rather than the typical combined asphalt and Class 2 Aggregate Base section. An evaluation should be performed to select the most cost effective pavement design. With proper removal of surficial materials, a design R-value of 70 can be used. Pavement structural sections for lower R-values are provided for informational purposes. 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 at substations where subsurface conditions are average. The following table lists preliminary pavement design sections for planning purposes only.

Table 9
Recommended Flexible Pavement Structural Sections
SDG&E Suncrest Substation

Design R-Value	Traffic Index	Composite Section		Full Depth Asphalt Thickness (inches)
		Asphalt Thickness (inches)	Class 2 Aggregate Base Thickness (inches)	
15	4.5	3.0	6.5	6.5
	5.0	3.0	8.0	7.0
70	4.5	NA	NA	2.75
	5.0	NA	NA	3.0

The sections presented in the table above 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 maximum particle size of the subgrade soils should be 3 inches to facilitate compaction. The upper 8 inches of subgrade should be scarified and recompacted to 95% relative compaction where the pavement will be constructed on cut.

5.10.2 Pavement Drainage

Adequate surface drainage should be provided to reduce ponding and possible infiltration of water into the base and subgrade materials. Paved areas should be sloped to provide adequate drainage to reduce possible future ponding and possible distress of the pavement section. As much as possible, planter areas next to pavements should be avoided; otherwise, subdrains should be used to drain the planter to appropriate outlets.

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.

5.11 CORROSION POTENTIAL

The results of pH, resistivity, and water-soluble sulfate and chloride tests from the current investigation are presented in Appendix F. The soils at the site should have a low potential for corroding steel. The soils should also have a low potential for chloride attack and sulfate attack to concrete. The type of concrete and corrosion protection for steel should be determined by the structural and/or corrosion engineer.

5.12 ADDITIONAL GEOTECHNICAL EXPLORATION

Additional geotechnical exploration may be needed to further interpret geologic conditions and/or develop more specific geotechnical design information. In addition, the EPC entities could propose different designs that may require additional geotechnical exploration. The EPC entity would also have the liberty to conduct additional geotechnical investigations to supplement this investigation.

SECTION 6 UNCERTAINTIES AND LIMITATIONS

URS has observed only a very small portion of the pertinent subsurface conditions. The conclusions made herein are based on the assumption that geologic conditions do not deviate appreciably from those found during our investigation. Specific details for the proposed project are not available at this time. The information presented in this report is intended to assist SDG&E and their subconsultants and EPC teams 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 development, 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 investigation.

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.

Southern California is an area of high seismic risk. It is generally considered economically unfeasible to build a totally earthquake-resistant project; it is therefore possible that a large or nearby earthquake could cause damage at the site.

SECTION 7 REFERENCES

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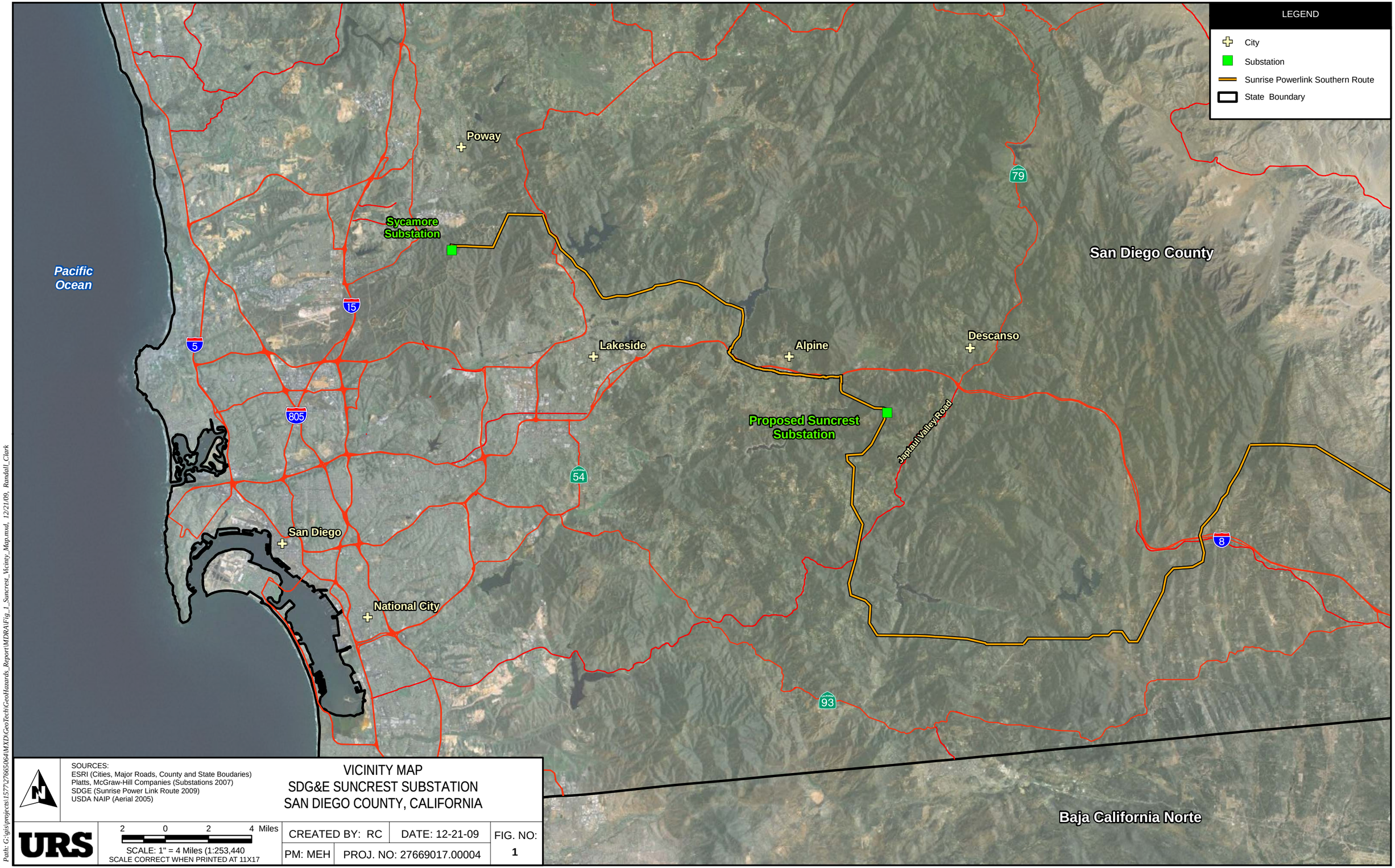
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SOURCES:
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Platts, McGraw-Hill Companies (Substations 2007)
SDGE (Sunrise Power Link Route 2009)
USDA NAIP (Aerial 2005)

VICINITY MAP
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

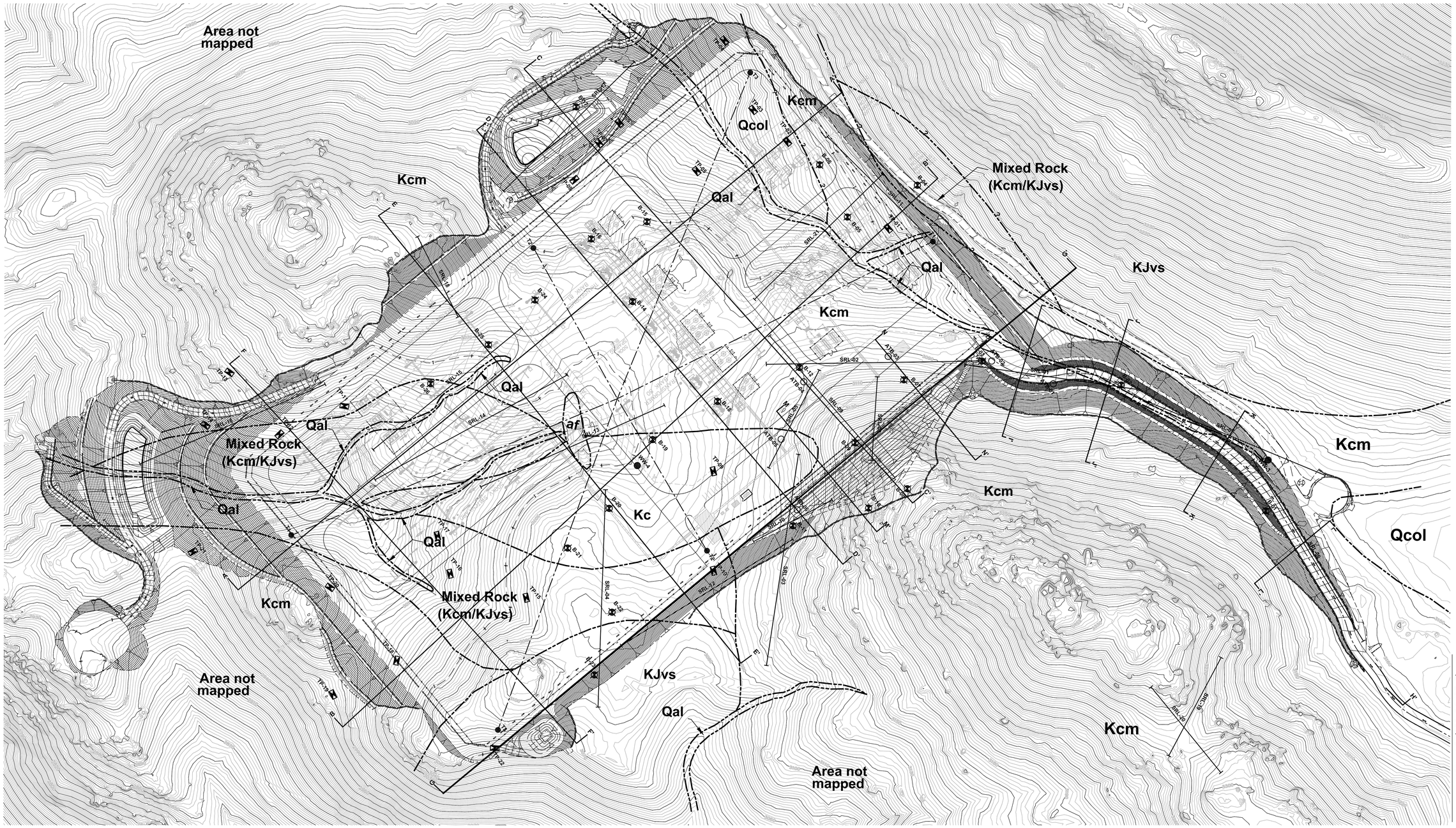
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LEGEND

B-03	APPROXIMATE LOCATION OF TEST BORING (HOLLOW STEM/CORE)
ATB-01	APPROXIMATE LOCATION OF AIR TRACK BORING
TP-07	APPROXIMATE LOCATION OF TEST PIT
WW-1	APPROXIMATE LOCATION OF WATER WELL
SRL-06	APPROXIMATE LOCATION OF SEISMIC REFRACTION LINE
T1	APPROXIMATE LOCATION OF ELECTRICAL RESISTIVITY LINES
A A'	APPROXIMATE LOCATION OF GEOLOGIC CROSS SECTION
?	GEOLOGIC CONTACT – APPROXIMATE BOUNDARY BETWEEN GEOLOGIC UNITS, QUERIED WHERE UNCERTAIN

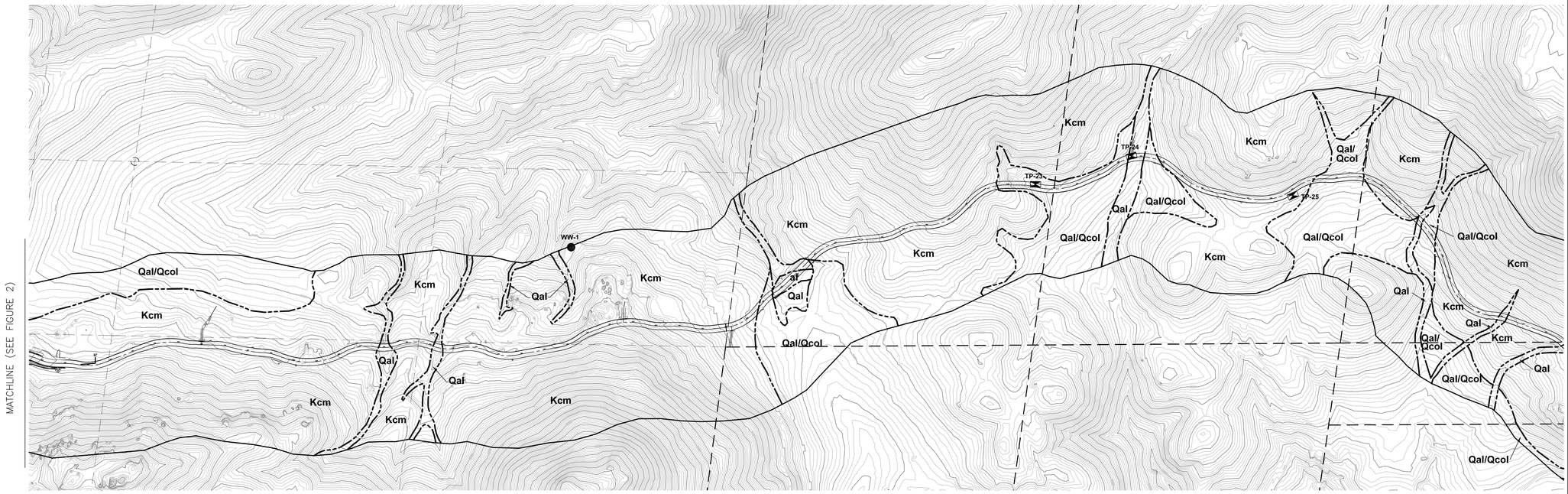
af	ARTIFICIAL FILL, SILTY AND CLAYEY SAND, MAPPED WHERE THICKNESS IS ESTIMATED TO BE GREATER THAN 5 FEET.
Qal	ALLUVIUM (QUATERNARY), SILTY AND CLAYEY SAND AND GRAVEL.
Qcol	COLLUVIUM (QUATERNARY), SANDY CLAY AND SILTY TO CLAYEY SAND. LOCALLY INCLUDES GRAVEL TO BOULDER SIZE CLASTS. MAY BE RESIDUAL SOIL IN PART. MAPPED WHERE THICKNESS IS ESTIMATED TO BE GREATER THAN 5 FEET.
Kcm	CORTE MADERA MONZOGRANITE (EARLY CRETACEOUS). GRANITIC ROCK CONSISTING OF MEDIUM TO COARSE GRAINED GRANODIORITE AND MONZOGRANITE.
Kc	CUYAMACA GABBRO (EARLY CRETACEOUS), GRANITIC ROCK CONSISTING OF FINE TO MEDIUM GRAINED QUARTZ MONZODIORITE.
KJvs	METAVOLCANIC AND METASEDIMENTARY ROCK (CRETACEOUS AND JURASSIC), INTERLAYERED METAMORPHOSED VOLCANIC AND SEDIMENTARY ROCK CONSISTING OF AMPHIBOLITE, BIOTITE SCHIST, AND QUARTZITE.
MixedRock (Kcm/KJvs)	ZONE OF MINGLING AND INTERFINGERING GRANITIC ROCK AND METAMORPHIC ROCK.

REFERENCE:
"San Diego Gas & Electric, Suncrest Substation, Grading Plan, Sheet 1", prepared by Nolte & Associates, Inc., dated 08-25-09.

SUBSTATION SITE PLAN AND GEOLOGIC MAP
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS | 50 0 50 100 Feet | SCALE: 1"= 100' | CHECKED BY: JLN | DATE: 12-21-09 | PM: MEH | PROJ. NO: 27669017.00004 | FIG. NO: 2

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LEGEND

B-03	INDICATES APPROXIMATE LOCATION OF TEST BORING (HOLLOW STEM/CORE)
P-01	INDICATES APPROXIMATE LOCATION OF TEST BORING (PAVEMENT)
TP-23	INDICATES APPROXIMATE LOCATION OF TEST PIT
WW-1	INDICATES APPROXIMATE LOCATION OF WATER WELL
	INDICATES APPROXIMATE LOCATION OF PROPERTY BOUNDARY
?	GEOLOGIC CONTACT – APPROXIMATE BOUNDARY BETWEEN GEOLOGIC UNIT, QUERIED WHERE UNCERTAIN
af	ARTIFICIAL FILL, SILTY AND CLAYEY SAND; MAPPED WHERE THICKNESS IS ESTIMATED TO BE GREATER THAN 5 FEET.
Qal	ALLUVIUM (QUATERNARY), SILTY AND CLAYEY SAND AND GRAVEL.
Qal/Qcol	ALLUVIUM AND COLLUVIUM UNDIFFERENTIATED (QUATERNARY), SANDY CLAY AND SILTY TO CLAYEY SAND. LOCALLY INCLUDES GRAVEL TO BOULDER SIZE CLASTS. MAY BE RESIDUAL SOIL IN PART. MAPPED WHERE THICKNESS IS ESTIMATED TO BE GREATER THAN 3 FEET.
Kcm	CORTE MADERA MONZOGRANITE (EARLY CRETACEOUS), GRANITIC ROCK CONSISTING OF MEDIUM TO COARSE GRAINED GRANODIORITE AND MONZOGRANITE.
KJvs	METAVOLCANIC AND METASEDIMENTARY ROCK (CRETACEOUS AND JURASSIC), INTERLAYERED METAMORPHOSED VOLCANIC AND SEDIMENTARY ROCK CONSISTING OF AMPHIBOLITE, BIOTITE SCHIST, AND QUARTZITE.

REFERENCE:
"San Diego Gas & Electric, Suncrest Substation, Grading Plan, Sheet 1", prepared by Nolte & Associates, Inc., dated 08-25-09.

ACCESS ROAD SITE PLAN AND GEOLOGIC STRIP MAP
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS | SCALE: 1"= 200' (100 0 100 200 Feet) | CHECKED BY: JLN | DATE: 12-21-09 | PM: MEH | PROJ. NO: 27669017.00004 | FIG. NO: 3

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Kc
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Kcp
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List Of Map Units

- Qya, Young alluvium
- Qc, Colluvium
- Qu, Alluvium, undivided
- Qoa, Older alluvium
- Qt/f, Older alluvial deposits, including terraces and f*

Peninsular Ranges Batholith

- Klb, Tonalite of Las Bancas
- Kc, Cuyamaca Gabbro
- Kmgp, Monzogranite of Mother Grundy Peak
- Kcm, Corte Madera Monzogranite
- Kcp, Chiquito Peak Monzogranite
- Kjv, Japatul Valley Tonalite
- Ka, Tonalite of Alpine
- Kgr, Granitoid rocks
- KJld, Leucocratic dikes

Prebatholithic and Superbatholithic Rocks

- Ksp, Santiago Peak Volcanics
- Kmv, Metavolcanic rocks
- KJvs, Metavolcanic and metasedimentary rocks
- JTRm, Metasedimentary and metavolcanic rocks
- MzPzm, Rocks of Jacumba Mountains
- Pzm, Metasedimentary rocks

Fault - Solid where accuratley located, dashed where approximately located, dotted where concealed.

Contact - Solid where accuratley located, dashed where approximately located, dotted where concealed.

LEGEND FOR REGIONAL GEOLOGIC MAP
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS

NO SCALE

CREATED BY: RC | DATE: 12-21-09 | FIG. NO: 4A

PM: MEH | PROJ. NO: 27669017.00004

Path: G:\gis\projects\1577\27665064\MXD\GeoTech\GeoHazards_Report\MDRA\Fig_4A_suncrest_gen_geo_legend.mxd, 12/17/09, Randall_Clark

LEGEND

- City
- Substation
- Sunrise Powerlink Southern Route
- State Boundary

Earthquake Epicenters

Magnitude

- 2.1 - 4.0
- 4.1 - 5.0
- 5.1 - 6.0
- 6.1- 7.0
- 7.1 - 8.0

Alquist Priolo (EFZ) Faults

- Accurately Located Fault Trace
- Approximately Located Fault Trace
- Inferred Fault Trace
- Concealed Fault Trace

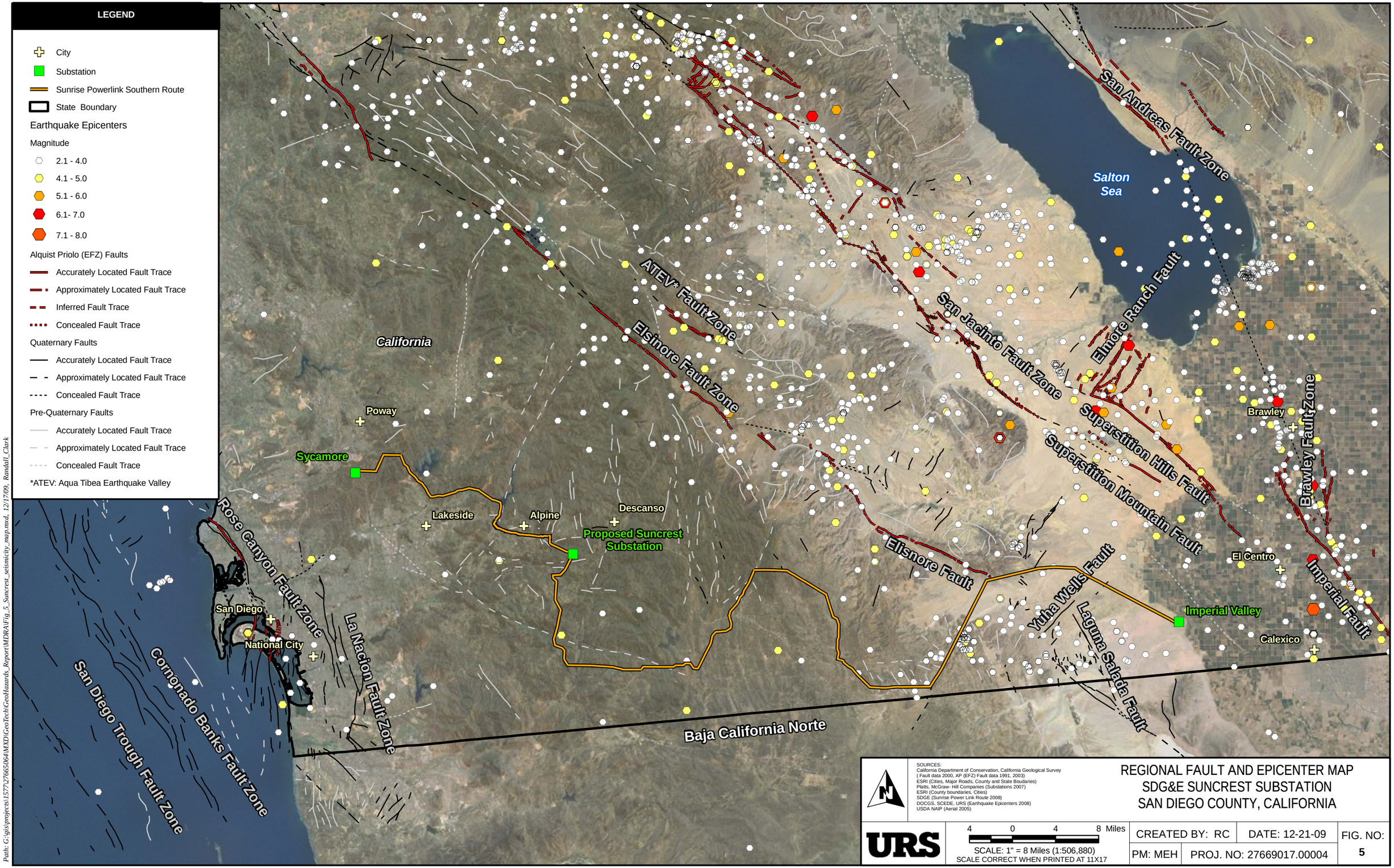
Quaternary Faults

- Accurately Located Fault Trace
- Approximately Located Fault Trace
- Concealed Fault Trace

Pre-Quaternary Faults

- Accurately Located Fault Trace
- Approximately Located Fault Trace
- Concealed Fault Trace

*ATEV: Aqua Tibea Earthquake Valley



SOURCES:
California Department of Conservation, California Geological Survey
(Fault data 2000, AP (EFZ) Fault data 1991, 2003)
ESRI (Cities, Major Roads, County and State Boudaries)
Plats, McGraw- Hill Companies (Substations 2007)
ESRI (County boundaries, Cities)
SDGE (Sunrise Power Link Route 2008)
DOCGS, SCEDE, URS (Earthquake Epicenters 2008)
USDA NAIP (Aerial 2005)

REGIONAL FAULT AND EPICENTER MAP
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

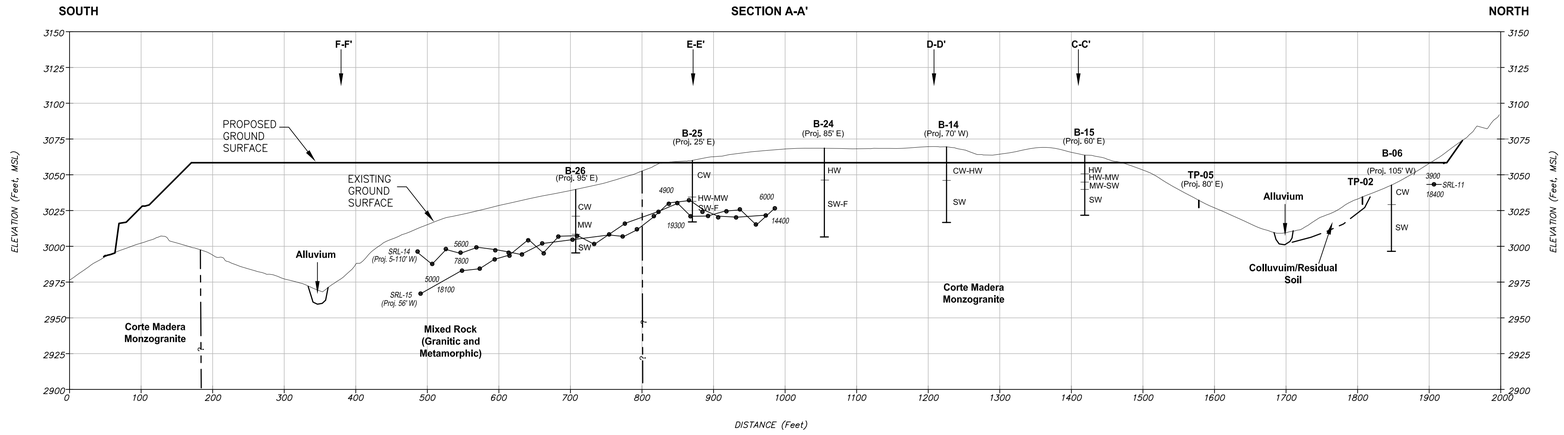
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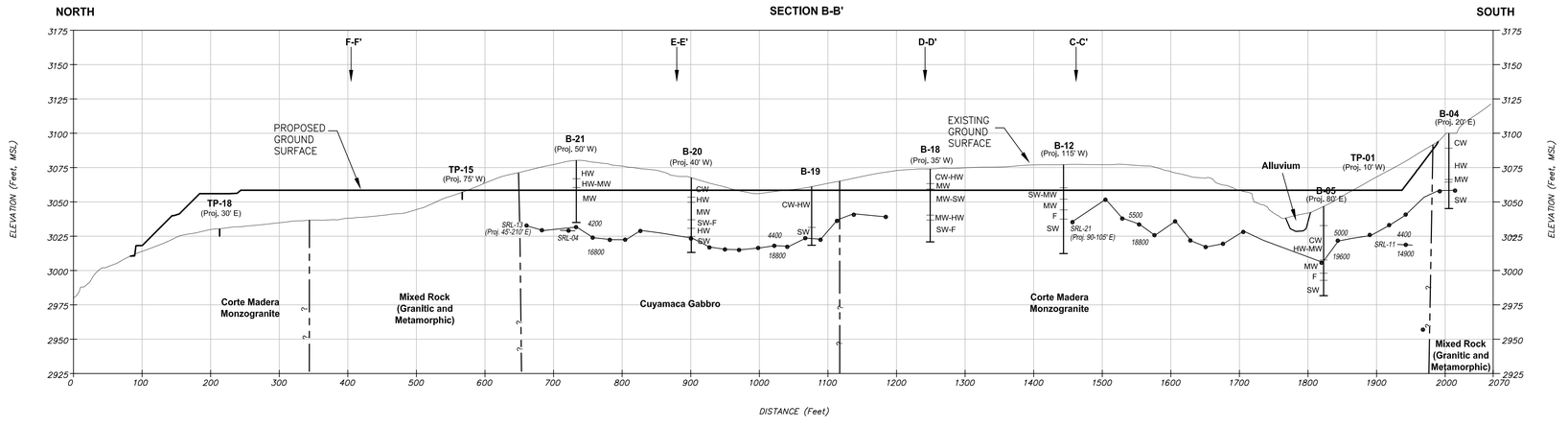
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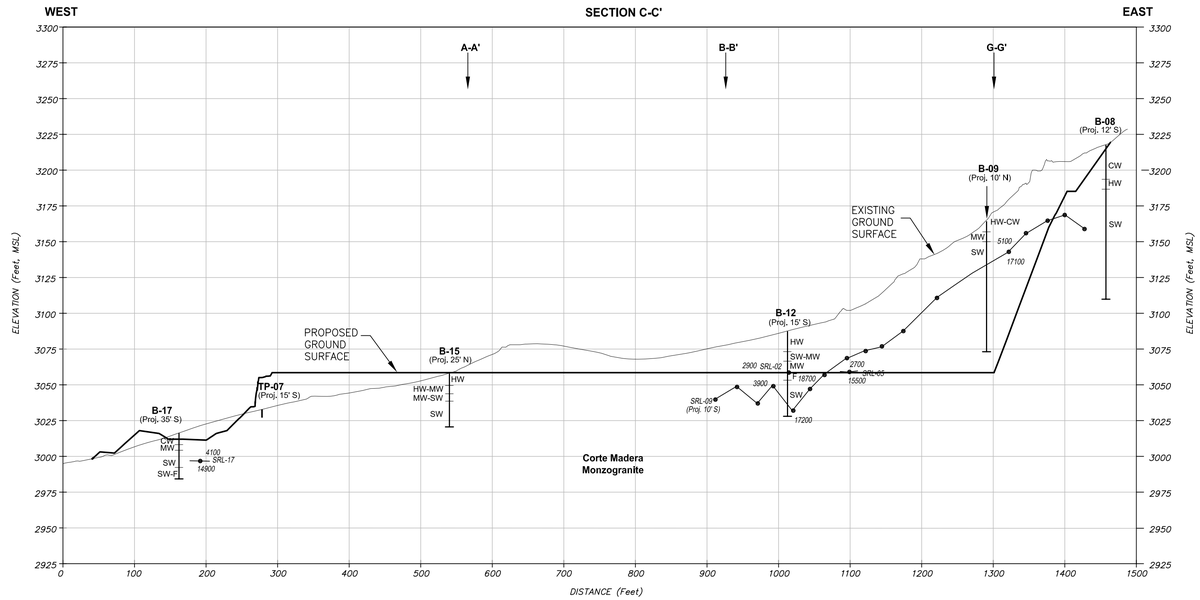
SCALE: 1" = 8 Miles (1:506,880)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: RC	DATE: 12-21-09	FIG. NO: 5
PM: MEH	PROJ. NO: 27669017.00004	

Path: G:\gis\projects\1577\27665064\MXD\GeoTechGeoHazards_Report\MDRA\Fig_5_Suncrest_seismicity_map.mxd, 12/17/09, Randall_Clark







LEGEND

TP-07 (Proj. 14' S) — TEST PIT – DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

B-04 (Proj. 21' E) — TEST BORING (HOLLOW STEM/CORE) – SHOWING DEPTH OF WEATHERING PROFILE. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

3900 SRL-11 18400 — SEISMIC REFRACTION LINE THAT INTERSECTS SECTION AT HIGH ANGLE. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND.

5000 SRL-15 18000 — SEISMIC REFRACTION LINE THAT IS SUBPARALLEL TO SECTION. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

WEATHERING PROFILE ABBREVIATIONS

- CW – COMPLETELY WEATHERED
- HW – HIGHLY WEATHERED
- MW – MODERATELY WEATHERED
- SW – SLIGHTLY WEATHERED
- F – FRESH

NOTES

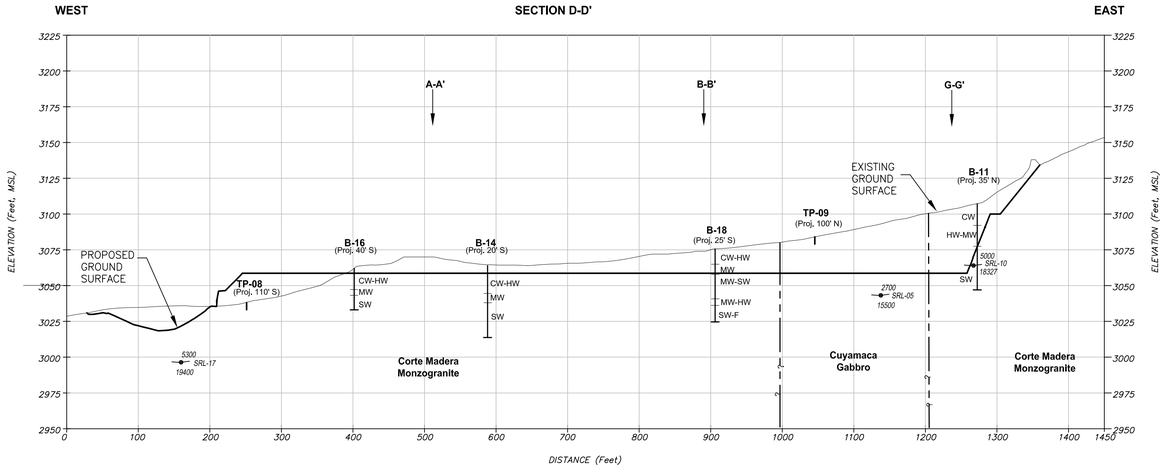
1. SEE SITE PLAN AND GEOLOGIC MAPS FOR DESCRIPTION OF ROCK UNITS IN "GEOTECHNICAL INVESTIGATION REPORT, SUNCREST SUBSTATION", DATED JUNE 8, 2009.
2. BORINGS AND TEST PITS ARE PROJECTED HORIZONTALLY TO CROSS SECTIONS AND ARE ALSO PROJECTED VERTICALLY SO THAT THE TOP OF THE TEST PIT/BORING IS SHOWN AT THE SURFACE ELEVATION ON THE SECTION.

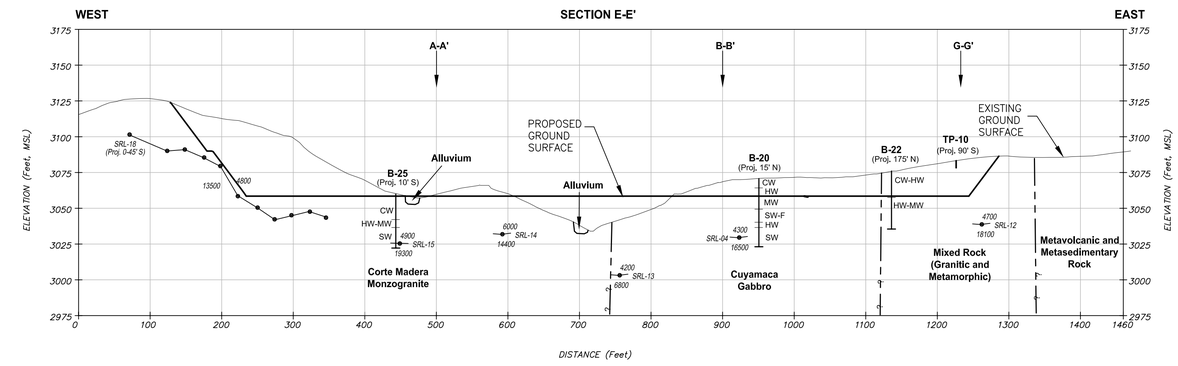
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APPROXIMATE GRAPHIC SCALE (FEET)
VERTICAL EXAGGERATION 2X

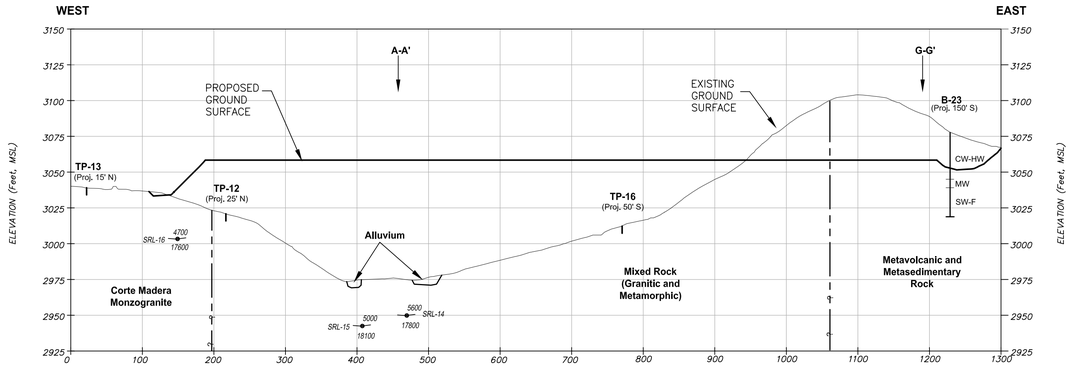
GENERALIZED GEOLOGIC CROSS SECTIONS A-A' THROUGH C-C'
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS

CHECKED BY: JLN	DATE: 12-21-09	FIG. NO:
PM: MEH	PROJ. NO: 27669017.00004	6







LEGEND

TP-07 (Proj, 14' S) — TEST PIT – DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

B-04 (Proj, 21' E) — HW / MW / SW — TEST BORING (HOLLOW STEM/CORE) – SHOWING DEPTH OF WEATHERING PROFILE. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

3900 SRL-11 18400 — SEISMIC REFRACTION LINE THAT INTERSECTS SECTION AT HIGH ANGLE. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND.

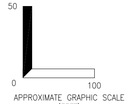
5000 SRL-15 18000 — SEISMIC REFRACTION LINE THAT IS SUBPARALLEL TO SECTION. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

WEATHERING PROFILE ABBREVIATIONS

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- SW – SLIGHTLY WEATHERED
- F – FRESH

NOTES

1. SEE SITE PLAN AND GEOLOGIC MAPS FOR DESCRIPTION OF ROCK UNITS IN "GEOTECHNICAL INVESTIGATION REPORT, SUNCREST SUBSTATION", DATED JUNE 8, 2009.
2. BORINGS AND TEST PITS ARE PROJECTED HORIZONTALLY TO CROSS SECTIONS AND ARE ALSO PROJECTED VERTICALLY SO THAT THE TOP OF THE TEST PIT/BORING IS SHOWN AT THE SURFACE ELEVATION ON THE SECTION.



APPROXIMATE GRAPHIC SCALE (FEET)
VERTICAL EXAGGERATION 2X

GENERALIZED GEOLOGIC CROSS SECTIONS D-D' THROUGH F-F'
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

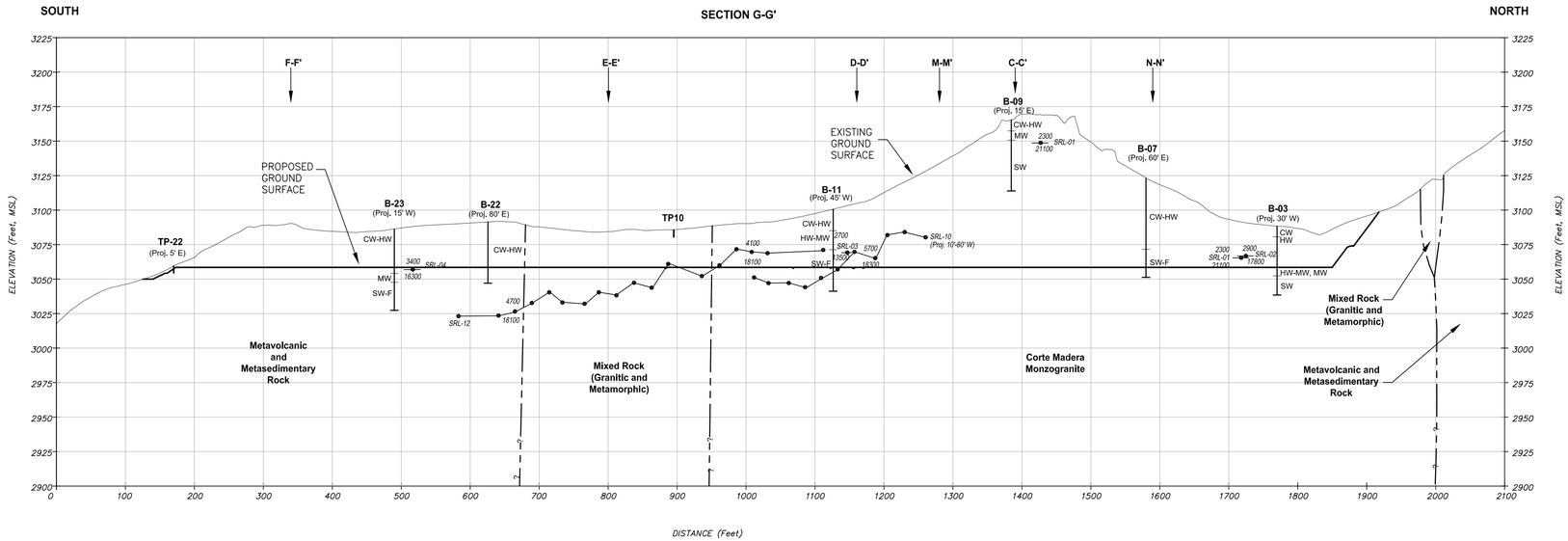
URS

CHECKED BY: JLN	DATE: 12-21-09	FIG. NO:
PM: MEH	PROJ. NO: 27669017.00004	7

SOUTH

SECTION G-G'

NORTH



LEGEND

TP-07
(Proj. 14' S)

TEST PIT – DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

B-04
(Proj. 21' E)
HW
MW
SW

TEST BORING (HOLLOW STEM/CORE) – SHOWING DEPTH OF WEATHERING PROFILE. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

3900
SRL-11
18400

SEISMIC REFRACTION LINE THAT INTERSECTS SECTION AT HIGH ANGLE. P–WAVE VELOCITIES REPORTED IN FEET PER SECOND.

5000
SRL-15
18000

SEISMIC REFRACTION LINE THAT IS SUBPARALLEL TO SECTION. P–WAVE VELOCITIES REPORTED IN FEET PER SECOND. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

WEATHERING PROFILE ABBREVIATIONS

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- SW – SLIGHTLY WEATHERED
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NOTES

1. SEE SITE PLAN AND GEOLOGIC MAPS FOR DESCRIPTION OF ROCK UNITS IN "GEOTECHNICAL INVESTIGATION REPORT, SUNCREST SUBSTATION", DATED JUNE 8, 2009.
2. BORINGS AND TEST PITS ARE PROJECTED HORIZONTALLY TO CROSS SECTIONS AND ARE ALSO PROJECTED VERTICALLY SO THAT THE TOP OF THE TEST PIT/BORING IS SHOWN AT THE SURFACE ELEVATION ON THE SECTION.

50
0
100
APPROXIMATE GRAPHIC SCALE (FEET)
VERTICAL EXAGGERATION 2X

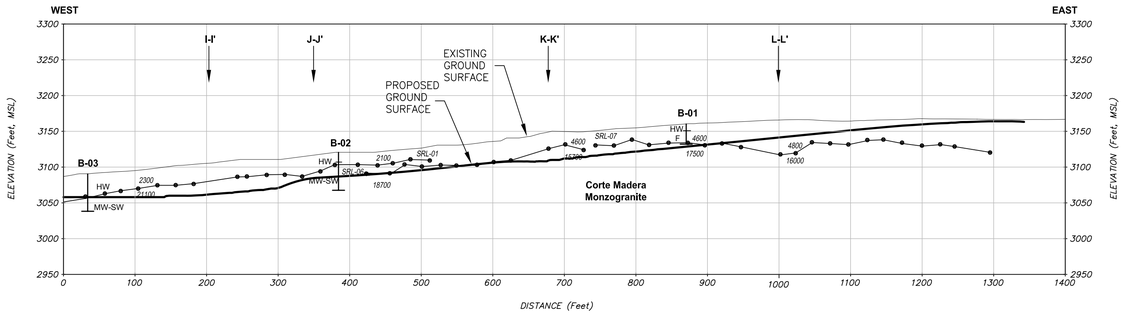
GENERALIZED GEOLOGIC CROSS SECTION G-G'
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS

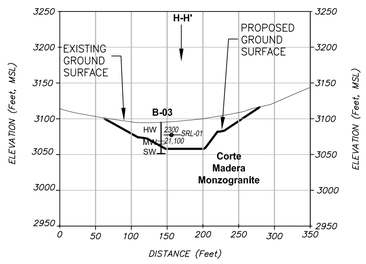
CHECKED BY: JLN	DATE: 12-21-09	FIG. NO:
PM: MEH	PROJ. NO: 27669017.00004	8

X:\27669017\Suncrest Cross Sections #1 REVISED 12-09.dwg Dec 21, 2009 – 9:56am

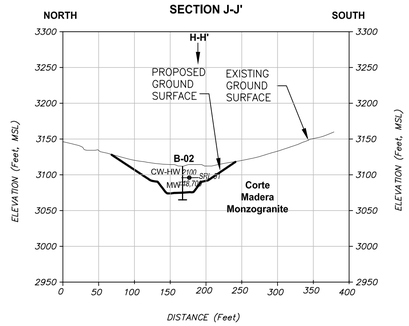
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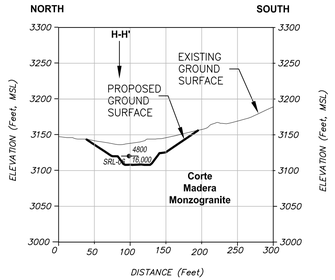
SECTION I-I'



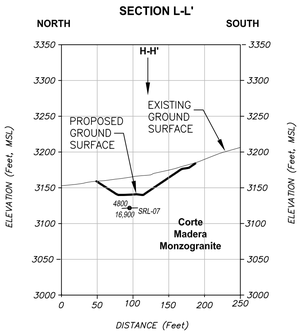
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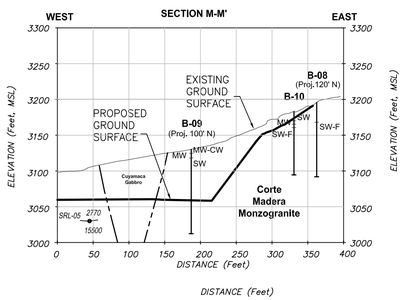
SECTION K-K'



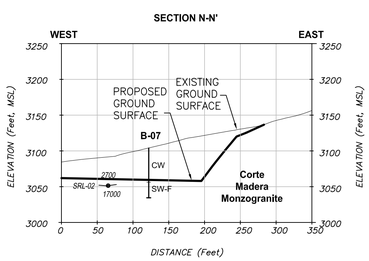
SECTION L-L'



SECTION M-M'



SECTION N-N'



LEGEND

TP-07 (Proj. 14' S) — TEST PIT – DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

B-04 (Proj. 21' E) — HW / MW / SW — TEST BORING (HOLLOW STEM/CORE) – SHOWING DEPTH OF WEATHERING PROFILE. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

3900 — SRL-11 — 16400 — SEISMIC REFRACTION LINE THAT INTERSECTS SECTION AT HIGH ANGLE. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND.

SRL-15 — 5000 / 18000 — SEISMIC REFRACTION LINE THAT IS SUBPARALLEL TO SECTION. P-WAVE VELOCITIES REPORTED IN FEET PER SECOND. DISTANCE AND DIRECTION OF PROJECTION TO SECTION SHOWN IN PARENTHESES.

WEATHERING PROFILE ABBREVIATIONS

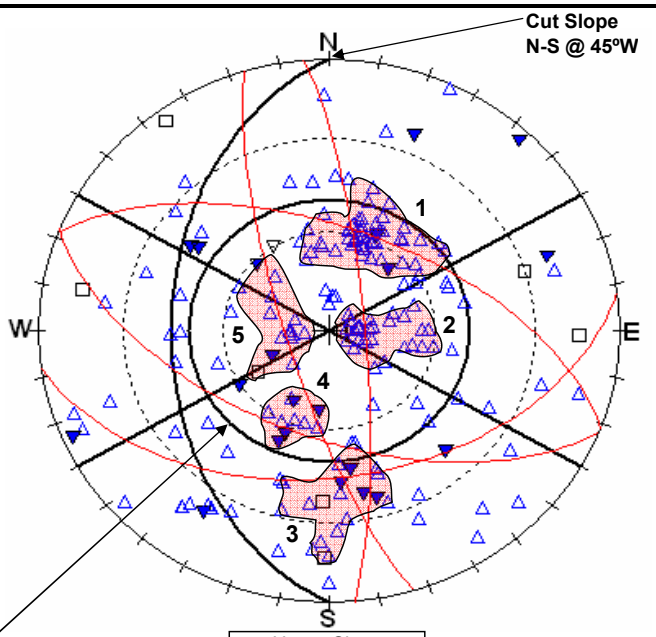
- CW – COMPLETELY WEATHERED
- HW – HIGHLY WEATHERED
- MW – MODERATELY WEATHERED
- SW – SLIGHTLY WEATHERED
- F – FRESH

NOTES

1. SEE SITE PLAN AND GEOLOGIC MAPS FOR DESCRIPTION OF ROCK UNITS IN "GEOTECHNICAL INVESTIGATION REPORT, SUNCREST SUBSTATION", DATED JUNE 1, 2009.
2. BORINGS AND TEST PITS ARE PROJECTED HORIZONTALLY TO CROSS SECTIONS AND ARE ALSO PROJECTED VERTICALLY SO THAT THE TOP OF THE TEST PIT/BORING IS SHOWN AT THE SURFACE ELEVATION ON THE SECTION.

GENERALIZED GEOLOGIC CROSS SECTIONS
H-H' THROUGH N-N'
SDG&E SUNCREST SUBSTATION
SAN DIEGO COUNTY, CALIFORNIA

URS | 50 0 50 100 Feet | SCALE: 1"= 100' | CHECKED BY: MEH | DATE: 12-21-09 | PM: MEH | PROJ. NO: 27669017.00004 | FIG. NO: 9

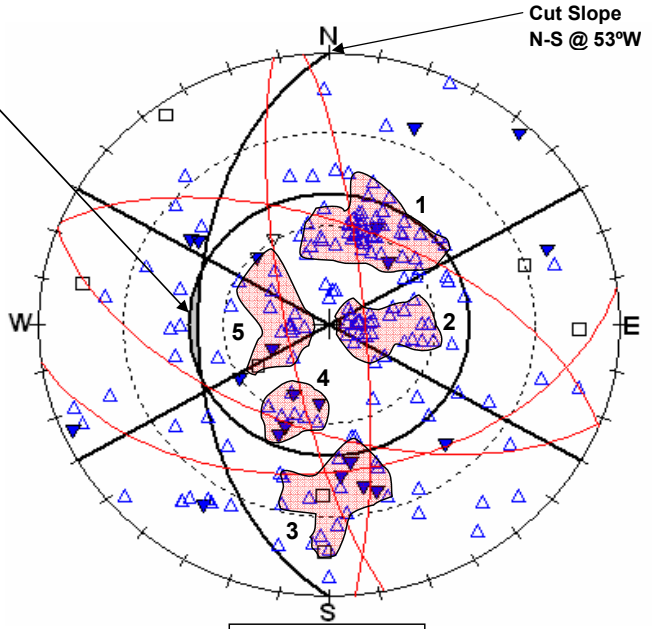


Upper Slope
1:1 cut slope

Potential Rock Failures:
Plane: low
Wedge: low
Toppling: low

Predominant Joint Sets*
(approximate mean orientation)
dip direction, dip value
1) 022, 60
2) 085, 80
3) 172, 45
4) 202, 58
5) 260, 78

Friction Circle (Φ) = 50º



Lower Slope
¾:1 cut slope

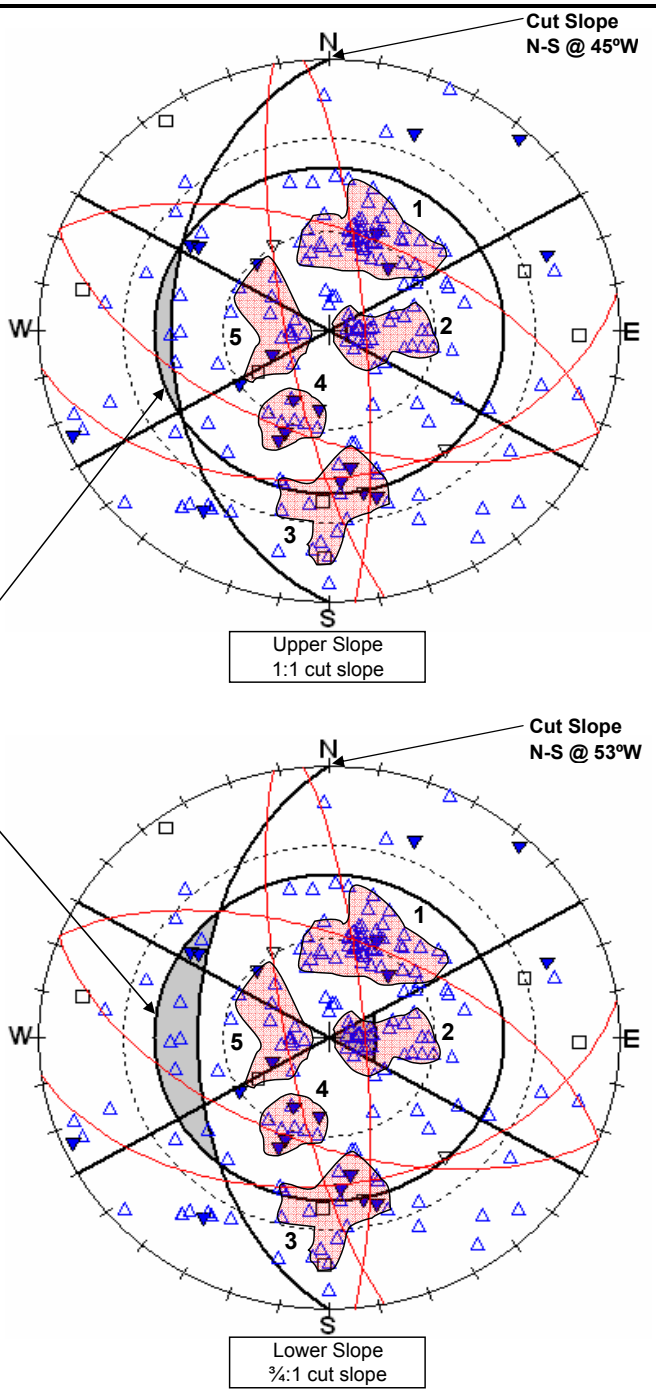
Potential Rock Failures:
Plane: low
Wedge: low
Toppling: low to moderate

NOTES:

1: Diagram is an Equal Area Lower Hemisphere Projection.
2: Discontinuity planes: Dip vector points (true dip direction and dip value) represented by triangles and squares
3: Number of data points: n = 200
4: Compiled data: downhole televiewer data (B-08, B-09, B-10 and B-11)
5: Marklands Tests: potential plane, wedge, and toppling failures [Φ = 50º]
   a) Plane Failure:(critical zone-shaded cresent moon)
   b) Toppling Failure:(critical zone-shaded triangle)
6: Great circles (red): representative for the prominent clusters of data points
7: Wedge failures*: identified by intersecting great circles in critical zone
8: Markland's Test Theory*: stereonet analyses to identify any potential plane, wedge and toppling failures

*Predominant discontinuities evaluated are represented by shaded clusters labeled by number from 1 (most) to 5 (least) prominent joint sets. A great circle (red) passes through each representative cluster of dip vectors (placement within the identified cluster based on population densisty and significance). Siginificant discontinuity represented by filled (blue) triangle (i.e. open joint).

SDG&E Suncrest Substation	URS
Case 1 (Φ = 50°)	Date: 12/21/2009
	P.N. 27669017
Rockslope Stability Analyses **B08, B09, B10, B11 compiled data**	Figure No. 10



Potential Rock Failures:
Plane: low
Wedge: low
Toppling: low to moderate

Predominant Joint Sets*
(approximate mean orientation)
dip direction, dip value
1) 022, 60
2) 085, 80
3) 172, 45
4) 202, 58
5) 260, 78

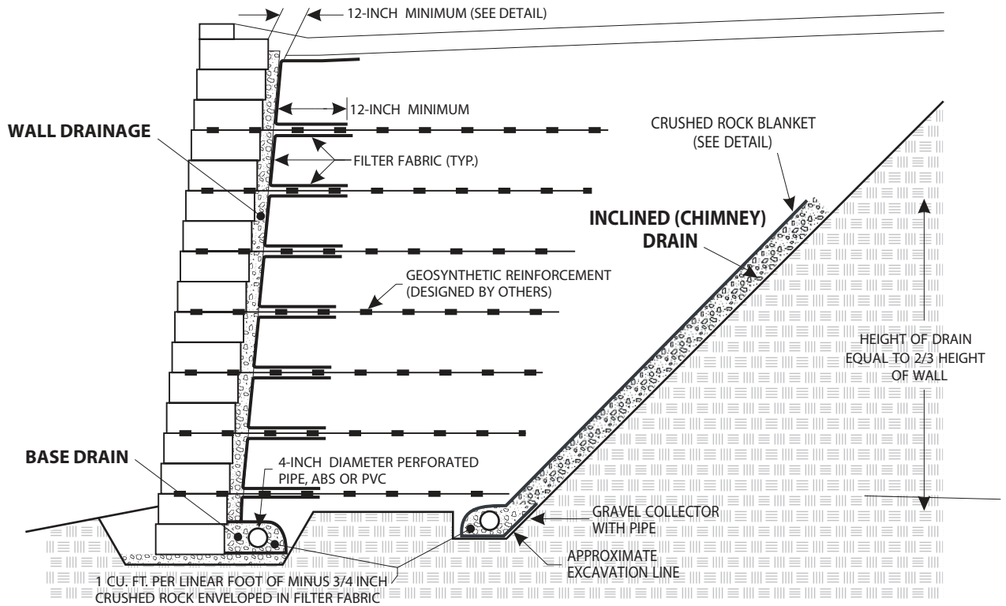
Potential Rock Failures:
Plane: low to moderate
Wedge: low to moderate
Toppling: moderate

NOTES:

1: Diagram is an Equal Area Lower Hemisphere Projection.
2: Discontinuity planes: Dip vector points (true dip direction and dip value) represented by triangles and squares
3: Number of data points: n = 200
4: Compiled data: downhole televiewer data (B-08, B-09, B-10 and B-11)
5: Marklands Tests: potential plane, wedge, and toppling failures [Φ = 40º]
a) Plane & Wedge Failure:(critical zone-shaded cresent moon)
b) Toppling Failure:(critical zone-shaded triangle, opposite of plane and wedge)
6: Great circles (red): representative for the prominent clusters of data points
7: Wedge failures*: identified by intersecting great circles in critical zone
8: Markland's Test Theory*: stereonet analyses to identify any potential plane, wedge and toppling failures

*Predominant discontinuities evaluated are represented by shaded clusters labeled by number from 1 (most) to 5 (least) prominent joint sets. A great circle (red) passes through each representative cluster of dip vectors (placement within the identified cluster based on population densisty and significance). Siginificant discontinuity represented by filled (blue) triangle (i.e. open joint).

SDG&E Suncrest Substation	URS
Case 2 (Φ = 40°)	Date: 12/21/2009
	P.N. 27669017
Rockslope Stability Analyses **B08, B09, B10, B11 compiled data**	Figure No. 11



NOTES

1) Perforated pipe should outlet through a solid pipe to a free gravity outfall. Perforated pipe and outlet pipe should have a fall of at least 1%.

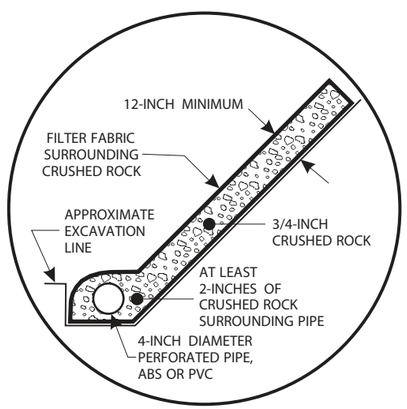
2) Filter fabric should consist of Mirafi140N, or similar approved product. Filter fabric should be overlapped per manufacturers instructions.

3) Drain installation should be observed by the geotechnical engineer prior to backfilling.

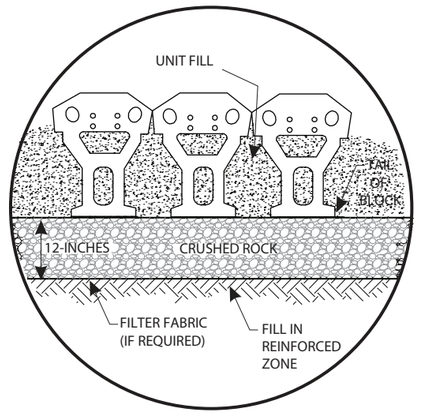
4) If it is desired to avoid using filter fabric, drainage material immediately behind the wall should conform to Caltrans Class II Permeable Aggregate, which does not require enclosure with filter fabric.

5) For "open face" block systems (e.g. Verdura), the base drain may be installed immediately behind the reinforced zone, and free draining material along the back of the wall may not be necessary, subject to review by the Geotechnical Enginneer.

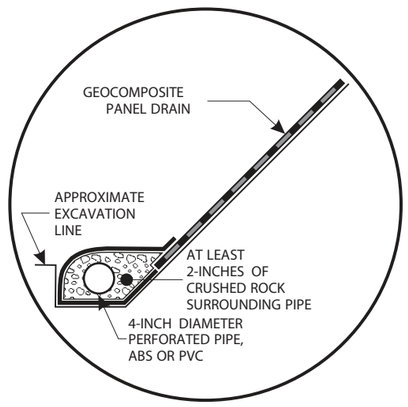
6) Subsurface drainage may be reduced if the soils used in the reinforced and retained zones are relatively "free draining" as approved by Geotechnical Engineer.



ROCK BLANKET ALTERNATIVE



PLACEMENT OF WALL DRAINAGE



GEOCOMPOSITE PANEL ALTERNATIVE

MECHANICALLY STABILIZED EARTH (MSE)
WALL DRAIN DETAILS
SDG&E SUNCREST SUBSTATION

URS

CHECKED BY: CRS	DATE: 12-21-09	FIGURE
PM: MEH	PROJ. NO: 27669017.00004	12

X:\27669017\WALL DRAIN DETAILS.ai

The field investigations for the Suncrest Substation include 28 test borings, 29 test pits, 6 pavement core borings and 6 air track borings. Boring B-13 was eliminated from the field program due to the presence of environmentally sensitive resources in the vicinity of the proposed boring location.

Table A-1 presents a summary of the explorations. The Key to Logs is presented on Figure A-1. Logs to borings are presented on Figures A-2 through A-29; test pit logs are presented on Figures A-30 through A-58; and pavement core borings are presented on Figures A-59 through A-64. Photographs of the recovered rock core are shown on Figures A-65 through A-116. Figures A-117 though A-122 present graphical logs of the air track borings.

The locations of all explorations were recorded on a hand-held GPS unit and subsequently plotted on the site plan. The ground surface elevation of each exploration was estimated from the topography provided by Nolte.

TEST BORINGS

Twenty-eight borings (designated Boring B-01 through Boring B-29 with the exception of B-13) were advanced between December 22, 2008 and April 17, 2009 to depths ranging from about 6 to 120.5 feet bgs. The upper portion of the borings in residual soil or completely weathered rock was typically advanced using hollow stem augers and the lower portion of the borings was advanced using rock coring. The majority of the borings were drilled with a either a Dietrich D120 drill rig mounted on a balloon-tired all-terrain vehicle or on a standard-tire flatbed truck. Due to access restrictions, Borings B-08, B-09, and B-10 were drilled with a portable skid-mounted drill rig that was lifted into place by helicopter.

The soil-like materials encountered during augering were classified in accordance with the Unified Soil Classification System. Samples were typically collected at five-foot depth intervals, removed from the sampler, classified, sealed to preserve the natural moisture content, and returned to our laboratory for further examination and testing. Relatively intact samples were obtained 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 using a Standard Penetration Test sampler driven with a 140-pound hammer dropping 30 inches. The number of blows shown on the logs is the field blow count, not corrected for sampler size. Larger bulk samples were collected and sealed in 5 gallon buckets, and smaller grab samples were collected and sealed in plastic bags.

The rock coring used an HQ (2.5-inch diameter core) coring system or an NQ (1.8-inch diameter core) coring system with diamond impregnated core bits. The NQ coring system was used in core borings designated for dilatometer testing (Borings B-4, B-18, and B-20). The rate of drilling, discontinuity descriptions, and Rock Quality Designation (RQD) were recorded on the boring logs. The recovered rock core was logged, photographed and placed in labeled boxes and stored on site.

The borings were backfilled with bentonite as a sealing agent in general accordance with County of San Diego Department of Environmental Health requirements.

TEST PITS

The test pits (designated Test Pit TP-01 through Test Pit TP-29) were advanced between January 20, 2009 and April 16, 2009 to depths ranging from about 1 to 8 feet bgs. The test pits were excavated with either a rubber-tracked ASV with an excavator or hand excavated with a pick and shovel. The upper 1.5 to 2 feet of material was removed and placed to the side of the excavation for observation by the environmental and cultural monitors. This upper material was then placed back on the surface of the nominally compacted backfilled excavation. Samples were collected by hand from the spoils pile or grabbed from the sidewalls of the trench no deeper than 5 feet below the surface. Deeper samples were collected using the equipment bucket. All soil samples were collected in the same manner previously described.

PAVEMENT CORE BORINGS

Six pavement borings were performed on April 20, 2009 to depths ranging from about 2 to 11 feet bgs along the proposed access road alignment. The asphalt was cored, and then the borings were advanced with hollow stem auger drilling methods. Soil samples collected were logged and classified in accordance with the USCS. Soil samples were subsequently returned to our laboratory and to our subcontractor's laboratory for further examination and testing. The pavement cores were provided to MACTEC for review.

AIR TRACK BORINGS

Six air track borings were performed in the northwest corner of the substation pad near the large cut. The air-track borings were performed on April 14 and 15, 2009 to an approximate depth of 70 feet bgs. No soil samples were collected laboratory testing. The soil cuttings retrieved from the borings were reviewed and noted for moisture content and color. Figures A-117 through A-122 present graphical logs of the air-track borings.

Table A-1
Summary of Explorations
Suncrest Substation

Exploration	Lattitude	Longitude	Date	Existing Elevation [a] (feet, MSL)	Depth of Cut/Fill [b] (feet)	Depth to Completely Weathered Rock (feet)	Depth to Moderately Weathered Rock (feet)	Maximum Exploration Depth (feet)
B-01	32 48.707	116 40.732	12/22/08	3,167	NA	1.5	12.0	31.5
B-02	32 48.694	116 40.826	12/23/08	3,116	NA	8.0	23.1	49.0
B-03	32 48.655	116 40.880	12/29/08	3,093	33.0	0.8	30.5	49.0
B-04	32 48.682	116 40.968	01/19/09	3,100	40.0	0.0	28.0	50.0
B-05	32 48.650	116 40.978	01/20/09	3,045	-15.0	2.5	35.0	60.0
B-06	32 48.655	116 41.006	01/22/09	3,047	-13.0	2.5	16.0	47.7
B-07	32 48.625	116 40.898	01/30/09	3,111	51.0	4.0	52.0	74.5
B-08	32 48.597	116 41.854	02/03/09	3,215	155.0	1.5	28.5	106.0
B-09	32 48.594	116 40.888	2/19/09	3,169	NA	4.0	8.0	120.5
B-10	32 48.578	116 40.859	3/3/09	3,206	NA	NA	4.0	90.6
B-11	32 48.545	116 40.877	01/12/09	3,106	46.0	3.0	29.0	59.0
B-12	32 48.594	116 40.936	01/08/09	3,090	30.0	1.5	13.0	59.0
B-14	32 48.558	116 40.013	12/30/08	3,064	4.0	6.6	21.0	49.0
B-15	32 48.584	116 41.040	01/08/09	3,059	-1.0	2.0	15.0	38.5
B-16	32 48.564	116 40.051	01/07/09	3,053	-7.0	2.0	16.5	30.0
B-17	32 48.591	116 41.106	01/19/09	3,018	NA	2.0	7.0	29.0
B-18	32 48.559	116 40.948	01/15/09	3,078	18.0	3.5	9.8	49.5
B-19	32 48.527	116 40.954	01/09/09	3,061	1.0	5.0	24.6	39.0
B-20	32 48.495	116 40.942	01/14/09	3,071	11.0	1.5	14.0	50.0
B-21	32 48.471	116 40.936	01/05/09	3,077	17.0	1.5	15.0	40.0
B-22	32 48.465	116 40.901	12/31/08	3,090	30.0	6.0	22.8	42.5
B-23	32 48.446	116 40.882	01/05/09	3,086	26.0	1.0	33.0	59.0
B-24	32 48.470	116 41.046	01/13/09	3,077	17.0	1.5	25.0	60.0
B-25	32 48.499	116 41.043	01/09/09	3,065	5.0	2.0	24.0	37.5
B-26	32 48.470	116 41.046	01/15/09	3,044	-16.0	2.5	15.0	40.0
B-27	32 48.593	116 39.121	04/17/09	3,064	NA	3.5	NE	5.0
B-28	32 48.572	116 39.067	04/17/09	3,053	NA	9.0	NE	9.5
B-29	32 48.571	116 39.049	04/17/09	3,074	NA	17.5	NE	17.5
TP-01	32 48.660	116 40.961	02/02/09	3,066	6.0	1.5	NE	5.5
TP-02	32 48.651	116 41.026	02/02/09	3,036	-24.0	NE	NE	5.5
TP-03	32 48.648	116 41.049	02/02/09	3,022	-38.0	NE	NE	4.5

Table A-1
Summary of Explorations
Suncrest Substation
(Continued)

Exploration	Lattitude	Longitude	Date	Existing Elevation [a] (feet, MSL)	Depth of Cut/Fill [b] (feet)	Depth to Completely Weathered Rock (feet)	Depth to Moderately Weathered Rock (feet)	Maximum Exploration Depth (feet)
TP-04	32 48.658	116 41.085	02/03/09	3,024	NA	NE	NE	1.8
TP-05	32 48.367	116 41.239	02/03/09	3,023	-37.0	2.0	NE	2.9
TP-06	32 48.601	116 41.087	02/04/09	3,020	-40.0	0.8	NE	1.2
TP-07	32 48.586	116 41.084	01/21/09	3,031	-29.0	1.8	NE	3.5
TP-08	32 48.571	116 41.079	02/02/09	3,031	-29.0	3.5	NE	7.5
TP-09	32 48.539	116 40.923	01/15/09	3,077	17.0	4.0	NE	6.5
TP-10	32 48.512	116 40.884	01/14/09	3,086	26.0	1.5	NE	6.0
TP-11	32 48.436	116 41.065	01/21/09	3,030	-30.0	1.5	NE	3.0
TP-12	32 48.408	116 41.075	01/19/09	3,015	-45.0	1.0	NE	3.0
TP-13	32 48.410	116 41.114	01/19/09	3,037	NA	1.0	NE	5.5
TP-14	32 48.386	116 41.102	01/19/09	2,990	NA	1.5	NE	3.0
TP-15	32 48.444	116 40.933	01/20/09	3,069	9.0	1.5	NE	3.0
TP-16	32 48.425	116 40.966	01/20/09	3,023	-37.0	1.0	NE	4.0
TP-17	32 48.432	116 40.985	01/20/09	3,015	-45.0	0.5	NE	3.5
TP-18	32 48.386	116 40.950	01/28/09	3,029	NA	1.1	NE	2.5
TP-19	32 48.355	116 40.957	01/28/09	2,982	NA	1.0	NE	2.0
TP-20	32 48.383	116 41.000	01/28/09	3,019	NA	0.5	NE	2.0
TP-21	32 48.348	116 41.057	01/28/09	2,955	NA	1.3	NE	2.3
TP-22	32 48.393	116 40.886	01/20/09	3,060	0.0	0.5	NE	2.0
TP-23	32 48.826	116 39.829	04/16/09	3,081	NA	5.0	NE	5.5
TP-24	32 48.848	116 39.749	04/16/09	3,069	NA	2.8	NE	4.0
TP-25	32 48.828	116 39.607	04/16/09	3,086	NA	NE	NE	4.0
TP-26	32 48.670	116 39.318	04/16/09	3,093	NA	1.8	NE	4.0
TP-27	32 48.664	116 39.274	04/16/09	3,110	NA	0.0	NE	3.5
TP-28	32 48.566	116 38.933	04/16/09	3,060	NA	NE	NE	8.0
TP-29	32 48.597	116 38.740	04/16/09	3,154	NA	0.5	NE	2.0
P-01	32 48.566	116 38.840	04/20/09	3,101	NA	5.5	NE	5.0
P-02	32 48.590	116 38.790	04/20/09	3,153	NA	5.0	NE	7.0
P-03	32 48.570	116 38.629	04/20/09	3,224	NA	NE	NE	10.0
P-04	32 48.535	116 38.538	04/20/09	3,239	NA	2.0	NE	5.0
P-05	32 48.506	116 38.472	04/20/09	3,199	NA	1.5	NE	2.0

Table A-1
Summary of Explorations
Suncrest Substation
(Continued)

Exploration	Lattitude	Longitude	Date	Existing Elevation [a] (feet, MSL)	Depth of Cut/Fill [b] (feet)	Depth to Completely Weathered Rock (feet)	Depth to Moderately Weathered Rock (feet)	Maximum Exploration Depth (feet)
P-06	32 48.489	116 38.426	04/20/09	3,177	NA	10.0	NE	10.0
ATB-01			04/14/09	3,097	NA	See Figure A-117		70.0
ATB-02			04/14/09	3,079	NA	See Figure A-118		70.0
ATB-03			04/14/09	3,080	NA	See Figure A-119		70.0
ATB-04			04/15/09	3,089	NA	See Figure A-120		70.0
ATB-05			04/15/09	3,094	NA	See Figure A-121		70.0
ATB-06			04/15/09	3,095	NA	See Figure A-122		70.0

Notes:
a. Elevation estimated using topography provided by Nolte.
b. Positive value indicates cut depth and negative value indicates fill depth to substation pad elevation of 3,060 feet MSL.
c. NA indicates Not Applicable. NE indicates Not Encountered.

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Key to Logs

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	FIELD NOTES AND LAB TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

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 **Run No.:** Number of the individual coring interval.

4 **Box No.:** Number of the core box which contains core from the corresponding run.

5 **Recovery:** Amount (in percent) of core recovered from the coring interval; calculated as the length of core recovered divided by the length of the run.

6 **Frac. Freq.:** (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks, which are considered to be induced by drilling.

7 **R Q D:** (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in each coring interval; calculated as the sum of the lengths of intact core divided by the length of the core run. NA indicates "not applicable" because core does not meet soundness criteria.

8 **Fracture Drawing:** Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. "NR" indicates no recovery.

9 **Fracture Number:** Location of each naturally occurring fracture (numbered) and mechanical break (labeled "M"). Naturally occurring fractures are described in Column 11 (keyed by number) using descriptive terms defined on the following page (Items a through g).

10 **Lithology:** A graphic log of material encountered using symbols to represent differing rock types and bedding characteristics.

11 **Description:** Lithologic description in this order: rock type, color, texture, grain size, weathering, strength, and other features; descriptive terms are defined on the following page. A detailed description of overburden material is not necessarily provided. Also, abbreviated description of fractures numbered in Column 9 using terms defined on following page.

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

13 **Sample Number:** Soil sample identification number.

14 **Blows per foot:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

15 **Drill Time (Rate):** Time in 24-hour clock marking start and finish of runs; drill rate in feet per hour.

16 **Remarks and Lab Tests:** Comments on drilling (water loss, core loss, use of drill mud, etc.). Laboratory tests indicated by following abbreviations:

SA	Sieve analysis (%<#200 sieve)
WA	Wash analysis (%<#200 sieve)
WC	Water Content (%)
DUW	Dry Unit Weight (lbs per cubic ft)
LL	Liquid limit, from Atterberg limits test (%)
PI	Plasticity Index (LL-PL), %; NP=nonplastic
UCS	Unconfined Compression Test
CORR	Corrosivity Test
COMP	Laboratory Compaction Test
DS	Direct Shear Test
EI	Expansion Index Test
MOD	Elastic Modulus

TYPICAL SAMPLER GRAPHIC SYMBOLS


Bulk or Grab sample


Standard Penetration sampler


Modified California sampler


Hand driven Modified California 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.

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Figure A-1

KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

DISCONTINUITY DESCRIPTORS

a Dip of discontinuity, measured relative to a plane normal to the core axis.

b **Discontinuity Type:**

- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

c **Aperture (inches):**

- W - Wide (0.5-2.0)
- Mw - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- Vn - Very Narrow (<0.05)
- T - Tight (0)

d **Type of Infilling:**

- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Fe - Iron Oxide
- Gy - Gypsum
- H - Healed
- Mn - Manganese Oxide
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand

e **Amount of Infilling:**

- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- N - None

f **Surface Shape of Joint:**

- Pl - Planar
- Wa - Wavy
- St - Stepped
- Ir - Irregular

g **Roughness of Surface:**

- Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- Sr - Slightly Rough [asperities on the discontinuity surfaces are distinguishable and can be felt]
- R - Rough [some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive]
- Vr - Very Rough [near-vertical steps and ridges occur on the discontinuity surface]

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh/Unweathered	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition
Extremely Weak Rock	Can be indented by thumbnail
Very Weak Rock	Can be peeled by pocket knife
Weak Rock	Can be peeled with difficulty by pocket knife
Moderately Strong Rock	Can be indented 5 mm with sharp end of pick
Strong Rock	Requires one hammer blow to fracture
Very Strong Rock	Requires many hammer blows to fracture
Extremely Strong Rock	Can only be chipped with hammer blows

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Key to Logs

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
1	2	3	4	5	6	7	8	9	10

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. Unnumbered sample indicates no sample recovery.

5 **Sampling Resistance:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch 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, particle size; texture, weathering, and strength of formation material.

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

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

10 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel.

SA	Sieve analysis (%<#200 sieve)
WA	Wash analysis (%<#200 sieve)
WC	Water Content (%)
DUW	Dry Unit Weight (lbs per cubic ft)
LL	Liquid limit, from Atterberg limits test (%)
PI	Plasticity Index (LL-PL), %; NP=nonplastic
UCS	Unconfined Compression Test
CORR	Corrosivity Test
COMP	Laboratory Compaction Test
DS	Direct Shear Test
EI	Expansion Index Test
MOD	Elastic Modulus

TYPICAL MATERIAL GRAPHIC SYMBOLS


Silty SAND (SM)


SILT (ML)


Silty SAND to sandy SILT (SM/ML)


GRAVEL (GM)


Granitic Rock-Completely Weathered


Metasedimentary Rock-Completely Weathered

TYPICAL SAMPLER GRAPHIC SYMBOLS


Grab sample


Bulk sample


Standard Penetration 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.

Figure A-1a

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-01

Sheet 1 of 3

Date(s) Drilled	**12/22/08**	Logged By	**D. Rector**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #2**	Total Depth Drilled	**31.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3167 feel MSL**
Groundwater Level	**None encountered**	Location	**N32°48.707', W116°40.732'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Medium dense, moist, brown, clayey SAND (SC)					
3166	1													
	2								GRANITIC ROCK Granodiorite, very pale brown, phaneritic, coarse grained, highly weathered, extremely weak. Fragments to very dense, moist, silty SAND to clayey SAND (SM-SC)					
3164	3													
	4													
3162	5										1	50/5"		SA(15), WC(1)
	6													
3160	7													
	8													
3158	9													
	10										2	50/5"		WA(26), WC(6)
3156	11													
	12								Becomes slightly weathered, strong				1030	
		1		40		28	NR						23	
3154	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-01

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Figure A-2

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-01

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3154	13						1						1034	
							1		1: 65°, J, N, Fe, Su, Pl, Sr				1043	
	14				0				1: 70°, J, N, Fe, Su, Pl, Sr 2: 25°, J, N, No, N, Pl, R 3: 70°, J, Cl+Fe, Su, Pl, Sr					DUW(164), UCS
3152	15		1				2							
		2		100	2	56							20	
	16						3							
					2				Becomes highly weathered, weak 4: 0°, J, Mw, No, N, Pl, R					
3150	17						4							
					10+									
	18						1		Becomes slightly weathered, strong 1: 60°, J, N, Fe, Su, Pl, Sr 2: 75°, J, N, Fe, Su, Pl, Sr 3: 30°, J, N, Fe, Su, Pl, Sr				1102	
					1								1111	
3148	19						M							
		3		98	0	90							5	
	20						2							
					2		3							
3146	21												1140	
													1151	
					10+		1							
	22						2		1: 35°, J, Mw, Fe+Cl, Su+Pa, Pl, R					
		4		99	2	72			2: 70°, J, Mw, Fe, Pl, Sr				17	
3144	23						3		3: 30°, J, N, Fe, Su, Pl, Sr					
							4							
					4		1		4: 30°, J, N, Fe+Ch, Pl, Sr				1200	
							2						1205	
	24		2						1: 20°, J, N, Fe, Su, Pl, R					
					1		3		2: 25°, J, N, Fe, Su, Pl, Sr 3: 10°, J, N, Fe, Su, Pl, Sr					
							4		4: 65°, J, N, Fe, Su, Pl, Sr					
3142	25								Becomes light gray, slightly weathered to fresh, strong to very strong					
					2		5							
		5		93		87	6		5: 20°, J, N, Fe, Su, Pl, Sr 6: 20°, J, N, No, N, Pl, Sr					
	26													
					1								8	
3140	27													
					0									
	28								Becomes very pale brown, slightly weathered, strong				1245	
			3		1		1						1253	
3138	29								1: 10°, J, N, Fe, Su, Pl, Sr					

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-01

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Figure A-2

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-01

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3138	29	6	3	100	5	77	2		2: 10°, J, N, Fe, Su, Pl, Sr					
							2		3: 10°, J, Mw, Fe, Su, St, R					
							3		4: 15°, J, Mw, Fe, Sp, Pl, R					
	30				2		4		5: 70°, J, N, Fe+Ch, Su, Pl, Sr					
							5							
3136	31													
	32								Bottom of boring at 31.5 feet					
3134	33													
	34													
3132	35													
	36													
3130	37													
	38													
3128	39													
	40													
3126	41													
	42													
3124	43													
	44													
3122	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-01

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Figure A-2

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-02

Sheet 1 of 4

Date(s) Drilled	**12/23/08**	Logged By	**D. Rector**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**49.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3116 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.694', W116°40.826'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3116	0								FILL Moist, brown, well graded sand with clay					
	1													
3114	2													
	3													
3112	4								RESIDUAL SOIL Medium dense, moist, brown, well graded SAND with clay (SW-SC)					
	5										1	11		WA(22), WC(4)
3110	6													
	7													
3108	8								GRANITIC ROCK Granodiorite, reddish brown, coarse grained, completely weathered, extremely weak. Fragments to dense, moist, reddish brown, clayey SAND (SC)					
	9													
3106	10										2	36		SA(24), WC(8)
	11								Becomes pale gray, highly weathered					
3104	12													
	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-02

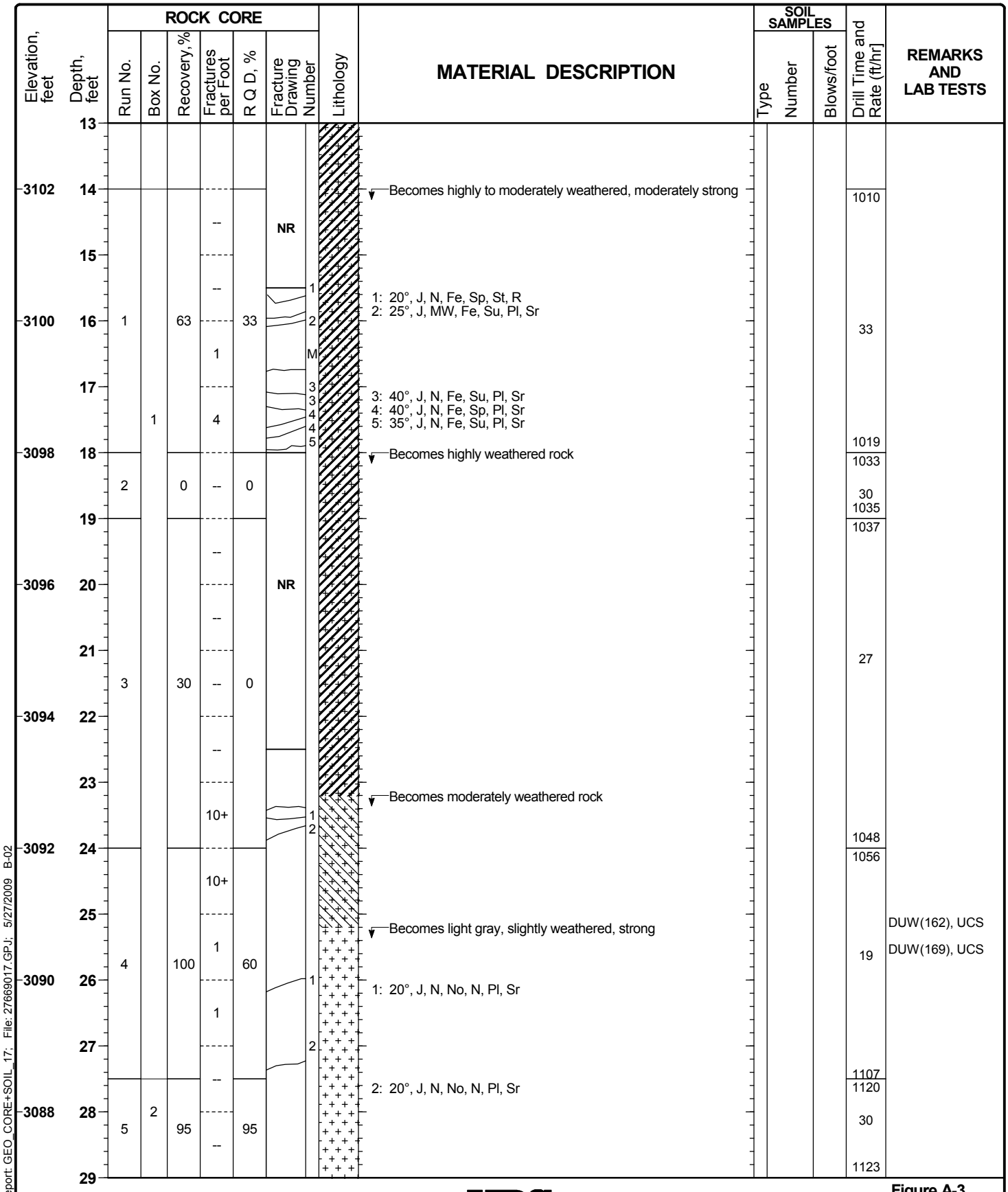
URS

Figure A-3

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-02

Sheet 2 of 4



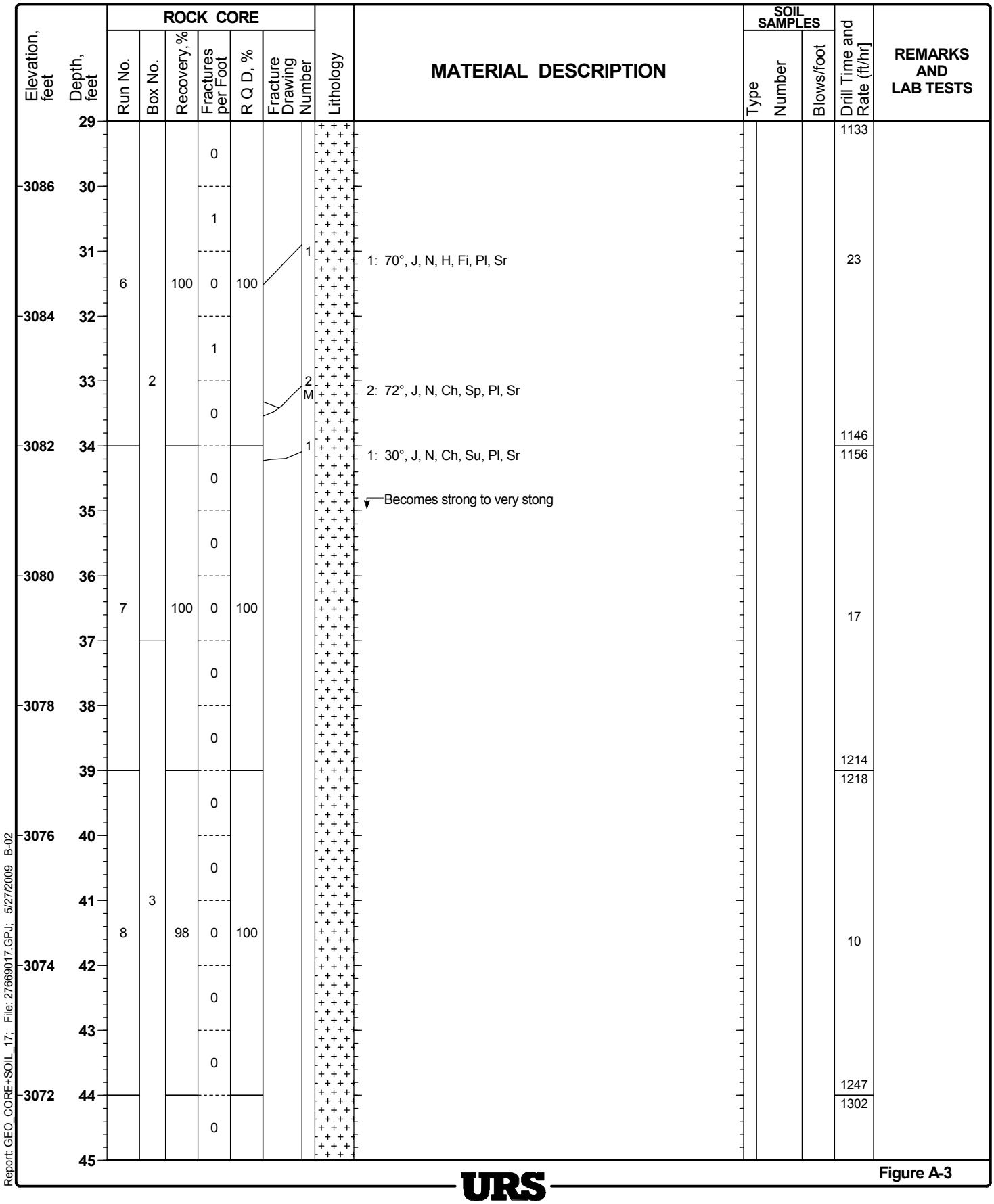
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-02

URS

Figure A-3

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-02



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-02

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Figure A-3

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-02

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3070	45				0									
	46	9		100	1	100	M-1		1: 55°, J, N, Ch, Su, Pl, Sr					
	47		3										6	
3068	48				0									
	49				0				Bottom of boring at 49 feet				1352	
3066	50													
	51													
3064	52													
	53													
3062	54													
	55													
3060	56													
	57													
3058	58													
	59													
3056	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-02

URS

Figure A-3

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-03

Date(s) Drilled	**12/29/08**	Logged By	**D. Rector**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**49.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3093 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.655', W116°40.880'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Loose, moist, reddish brown, silty SAND with clay (SM)					
3092	1								GRANITIC ROCK Granodiorite, reddish brown to brown, phaneritic, coarse grained, highly weathered, extremely weak. Fragments to medium dense, moist, silty SAND (SM)					
	2													
3090	3													
	4													
3088	5										1	12		SA(15), WC(4)
	6													
3086	7													
	8								Becomes dense					
3084	9								Becomes very dense					
	10				--						2	50/2"	0940	
3082	11		1		--								80	
	12	1		0	-----	0								
3080	13				--									

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-03

URS

Figure A-4

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-03

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3080	13				--									
													0943	
	14						M		Becomes light tannish gray, weak				1010	DUW(152), UCS
					0		M							
							1							
3078	15								1: 20°, J, MW, Fe, Su, Pl, R 2: 30°, J, N, Fe, Su, Pl, R					
					1									
	16						2							
		2		95	1	0*							9	
3076	17								3: 75°,J, N, Fe, Su, Pl, Sr					*Rock does not meet soundness requirements
					2									
	18													
					2		3							
							3							
3074	19						M						1025	
					0								1031	
							M							
		3		100		0*							18	
	20		1				1		1: 60°, J, N, Fe, Su, Pl, R					
					1								1036	
													1041	
3072	21													
					0									
	22						M						23	
		4		100	0	0*								
3070	23													
					0									
													1050	
	24												1100	
					0									
3068	25													
					1		1		1: 35°, J, N, Fe, Sp, Pl, R					
	26								2: 75°, J, N, Fe, Sp, Pl, Sr					
		5		100	1	0*			Becomes highly to moderately weathered, moderately strong				20	
3066	27						2							
			2		2		3		3: 80°, J, N, Fe, Sp, Pl, Sr					
	28													
					1									
3064	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-03

URS

Figure A-4

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-03

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3064	29				0								1120	DUW(139)
	30				0				Becomes moderately weathered, moderately strong					
3062	31	6	2	90	2	34	1		1: 30°, J, N, Fe, Sp, Pl, Sr				15	
	32				3		2 2 3 4		2: 25°, J, N, Fe, Sp, Pl, Sr 3: 30°, J, N, Fe, Sp, Pl, Sr					
3060	33				3		4 5 5		4: 40°, J, N, Fe+Ch, Su+Sp, Pl, Sr 5: 10°, J, N, No, N, Pl, Sr					
	34								Becomes light gray, slightly weathered, strong				1140	
													1147	
3058	35				0		1		1: 20°, J, N, No, N, Pl, Sr					
	36				1									DUW(167), UCS
		7		100	3	86							17	
3056	37						2 2 2 2		2: 18°, J, N, No, N, Pl, Sr					
	38				4									
					1								1205	
3054	39												1217	
	40				0									
					0									
3052	41		3				1		1: 20°, J, N, No, N, Pl, Sr					
		8		100	8	86	2 2 1 1		2: 30°, J, N, Ch, Sp, Pl, R				11	
	42				0									
3050	43				0									
													1245	
	44						1 1 1		1: 20°, J, N, F, Sp, Pl, Sr				1250	
					7									
3048	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-03

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Figure A-4

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-03

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3048	45						2							
					4		2							
	46						2							DUW(168), UCS
		9		100	2	76	2		2: 30°, J, N, Fe, Sp, Pl, R					
3046	47		3				3						6	
					4		3		3: 20°, J, N, F, Su, Pl, Sr					
	48						3							
					0		3							
3044	49												1344	
									Bottom of boring at 49 feet					
	50													
3042	51													
	52													
3040	53													
	54													
3038	55													
	56													
3036	57													
	58													
3034	59													
	60													
3032	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-03

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Figure A-4

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-04

Sheet 1 of 4

Date(s) Drilled	**01/19/09**	Logged By	**P. McDonald**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**50.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3087 feet MSL**
Groundwater Level	**None encountered**	Location	**N32° 48.682', W116° 40.968'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3087	0								METASEDIMENTARY ROCK Light brown, medium grained, completely weathered, extremely to very weak. Fragments to very dense, dry, clayey to silty SAND (SC-SM)		1	17		SA(20), WC(9), DUW(121), DS
3086	1													
	2										2	38		WA(24), WC(6)
3084	3													
	4										3	50/3"		SA(21), WC(4)
3082	5													
	6										4			SA(29), WC(5), COMP
3080	7								Becomes pale yellowish brown					
	8													
3078	9										5	50/3"		SA(29), WA(4)
	10				0		M		Becomes completely to highly weathered				1108	DUW(122), UCS
3076	11	1	1	90	0	90							20	
	12				0									
3074	13												1115	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-04

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Figure A-5

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-04

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3074	13				1		1		1: 15°, J, T, No, N, Pl, Sr				1120	
	14				0		1							
3072	15								2: 10°, J, T, No, N, Wa, Sr					
		2		68	1	0*	2							DUW(165), UCS
	16								3: 15° J, T, Cl, Sp, Wa, Sr 4: 15° J, T, Cl, Sp, Wa, Sr					*Rock does not meet soundness requirements
					1		3 4						14	
3070	17						NR							
					2								1142	
	18						1						1146	
							2							
					3		3							
3068	19						M		1: 35°, J, N, Cl, Sp, Pl, S					
			1						2: 5°, J, N, Cl, Sp, Ir, R					
					0		NR	M	3: 60-70°, J, N, Mn, Su, Wa, R					
	20						M							
		3		73	0	0*							20	
3066	21													
					0									
	22						M							
							NR							
					--									
3064	23												1201	
							1		1: 10°, Fo, Vn, Fe, Su, Pl, Sr				1210	
							2		2: 15°, J, N, Fe, Su, Ir, R					
					2		3		3: 45°, J, N, Fe+Mn, Su, Pl, S					
	24													
					1		M							
3062	25						M							
		4		50	--	0*	M						15	
	26													
					--		NR							
3060	27													
					--									
	28												1230	
							1		Becomes moderately weathered, moderately strong to strong 1: 10°, J, Py, Pa, Pl, S				1233	
			2	92	9	40	2		2: 45°, J, N, Fe+Mn, Su, Pl, S					
							3		3: 80°, J, N, Fe+Mn, Su, Pl, S					
3058	29						M		4: 75°, J, N, Mn, Su, Pl, S					

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-04

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Figure A-5

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-04

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3058	29				6		M 4 5 6		5: 5°, J, N, Cl+Py, Fi, Pl, S					
3056	30	5		92	4	40	M 7 8 9 10 11 12		Becomes slightly weathered, strong, fine grained, light gray 6: 8-10°, J, N, Cl, Fi, Pl, S 7: 10°, J, N, Cl, Fi, Pl, S 8: 10°, J, Mw, Cl+Sd, Fi, Pl, S 9: 10°, J, N, Cl+Sd, Fi, Pl, S 10: 30°, J, N, Fe, Sp, Wa, R 11: 20°, J, N, Fe, Sp, Wa, R 12: 60-70°, J, N, Fe, SP, Wa, R				6	DUW(174), UCS
	31				1									
	32													
3054	33						NR						1325	
													1330	
	34				0								5	
			2		0									
3052	35	6		100	0	73			1: 45-50°, J, Fe, Su, Pl, Sr					
	36				5									
3050	37						2							
					5				2: 10-30°, J, N, Fe, Su, Wa, R				1424	
	38												1430	
					5		1 2 3 4		1: 10°, J, N, Mn, Pl, Sr 2: 5°, J, N, Mn, Pl, Sr					
3048	39								3: 30°, J, N, Fe, Su, Wa, R 4: 30°, J, N, Fe, Su, Pl, Sr					
					3									
	40	7		100	0	90							5	
3046	41				1									
							5		5: 65-70°, J, N, Fe, Su, Wa, R					
	42				0									
3044	43												1530	
			3		0								1536	
	44			100		90	M						7	
					1									
3042	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-04

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Figure A-5

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-04

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3042	45													
		8	3	100	6	90	1		1: 5-15°, N, No, Su, Wa, R					
							3		2: 40°, J, Fe, Sp, Pl, S					
									3: 75°, J, Fe, Sp, Wa, R					
							4		4: 40-70°, J, Fe, Sp, Ir, V, R					
	46								5: 15-20°, J, Fe, Sp, St, R					
					2				←Near vertical gneiss banding up to 3/4" wide				7	
3040	47						5							
					1									
	48												1618	
													0730	
					1				1: 70°, J, Fe +H, Fi, Wa, R					
							1		2: 15°, J, Fe, Su, Wa, R					
									3: 15°, J, R, Fe, Su, Wa, R					
3038	49	9		100		92	2		4: 15°, J, No, No, Ir, Vr				4	
					3		3							
													0800	
	50								Bottom of boring at 50 feet					
3036	51													
	52													
3034	53													
	54													
3032	55													
	56													
3030	57													
	58													
3028	59													
	60													
3026	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-04

URS

Figure A-5

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-05

Sheet 1 of 4

Date(s) Drilled	**01/19/09 - 01/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**60.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3045 feet MSL**
Groundwater Level	**None encountered**	Location	**N32° 48.650', W116° 40.978'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Medium dense, moist, dark reddish brown, silty SAND (SM), with trace clay and some gravel					
3044	1										1	14		WC(9), DUW(117)
	2													
									GRANITIC ROCK Granodiorite, very light brown, phaneritic, medium to coarse grained, completely weathered, weak. Fragments to very dense, moist, orangish brown, medium to coarse clayey SAND (SC)		1A			SA(29), WC(8), COMP, CORR
3042	3										2	50/4"		WC(4)
	4													
3040	5										3	50/3"		WA(17), WC(5), DUW(124), DS
	6													
3038	7										4	50/3"		SA(35), WC(2)
	8													
3036	9													
	10								Becomes reddish brown, coarse grained, highly to moderately weathered, moderately strong to weak				1630	
					--									
3034	11						NR							DUW(152), UCS
			1										16	*Rock does not meet soundness requirements
	12	1		64	0	0*								
3032	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-05

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Figure A-6

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-05

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3032	13				2		1							
							2		1: 20°, J, N, Fe, Sp-Su, Pl, Sr 2: 0°, J, MW, Fe, Sp-Su, Wa, R					
	14				3		3		3: 45°, J, MW, Fe, Sp-Su, Pl, R-Vr 4: 50°, J, N, Fe, Sp-Su, Pl, Sr-R					
							4							
3030	15						5		5: 0°, J, N, Fe, Sp-Su, Pl-Wa, Sr-R				1640	
					--								0802	
	16						NR							
					--									
3028	17													
		2	1	50	1	46							30	
	18						1		1: 5°, J, MW, Fe, Sp-Su, Pl, R					
					1		2		2: 40°, J, N, Fe, Su, Pl-Wa, R					
3026	19		1											DUW(142), UCS
					2		3							
							4		3: 75°, J, N, H+Fe, Fi, Pl-Wa, Sr-R 4: 0°, J, MW, Fe+Sd, Su, Pl-Wa, R					
	20												0812	
					0								0822	
3024	21													
					0		NR							
	22													
		3		28	0	0							33	
3022	23													
					1									
	24						1							
							2		1: 35°, J, N, Fe, Sp-Su, Pl-Wa, R 2: 50°, J, N, Fe, Sp-Su, Pl, Sr					
					2		3		3: 30°, J, N, Fe, Sp-Su, Pl, Sr					
3020	25												0831	
													0856	
					--									
	26													
					--									
3018	27						NR						17	
		4		0	--	0								
	28													
					--									
3016	29												0914	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-05

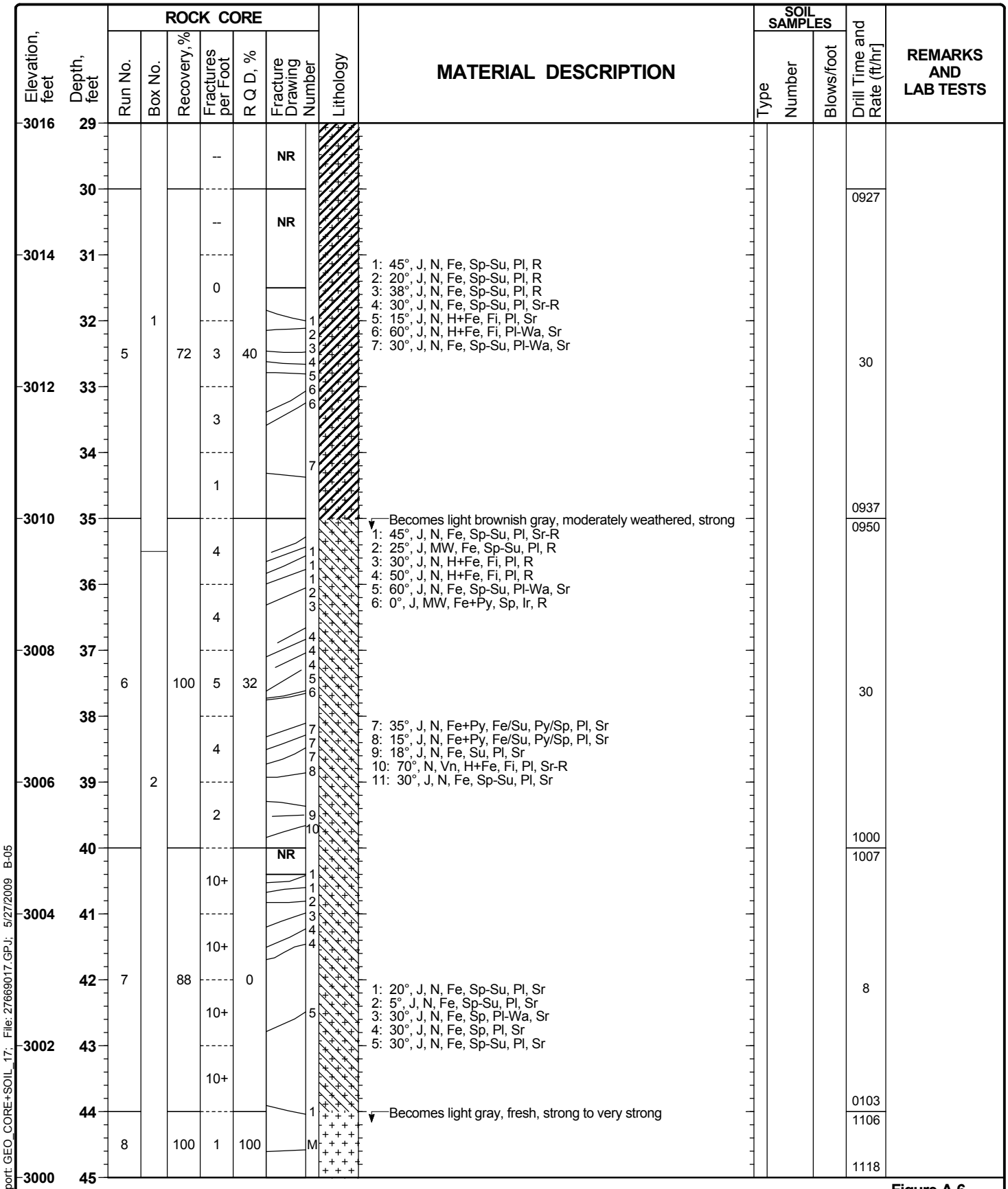
URS

Figure A-6

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-05

Sheet 3 of 4



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-05

URS

Figure A-6

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-05

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3000	45				0		NR						1126	
	46		2				1 1 1		1: 60°, J, N, H+Ch, Fi, Pl, Sr 2: 35°, J, N, Ch, Sp, Pl, Sr 3: 60°, J, N, Ch, Sp-Su, Pl, Sr					
					3				4: 40°, J, N, Fe, Su, Pl-Wa, Sr					
2998	47								5: 50°, J, N, H+Fe, Fi, Pl, Sr-R 6: 30°, J, MW, Fe, Sp-Su, Pl, Sr-R					
		9		90	1	66	2		7: 30°, J, N, Fe, SP, Pl, Sr-R				12	
	48													
					1		3							
2996	49						4		Becomes light brownish gray, slightly weathered, strong					
							5 6							
					4		7							
	50						7						1152	
					--								1216	
2994	51		3											
					--									
	52						NR							
		10		36	--	36							15	
2992	53													
					--									
	54						1		1: 70°, J, N, Fe, Sp-Su, Pl, Sr					
							2 M		2: 35°, J, N, Fe, Sp-Su, Pl, Sr					
					1		3		3: 40°, J, N, Fe, Sp, Pl, Sr-R					
2990	55												1236	
					--								1304	
	56						NR							
					--									
2988	57						1		1: 55°, J, N, Fe, Sp, Pl, Sr					
		11		60	1	18	M M		2: 50°, J, N, No-Fe, N-Sp, Pl, Sr					
							2		3: 55°, J, N, No, N, Pl, Sr				6	
	58						3 M		4: 70°, J, N, Ch, Sp, Pl, Sr 5: 60°, J, N, Fe, Sp, Pl, Sr					
					2		4 M							
2986	59						5							
					1									
	60												1354	
									Bottom of boring at 60 feet					
2984	61													

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Figure A-6

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-06

Sheet 1 of 4

Date(s) Drilled	**01/21/09 and 01/22/09**	Logged By	**P. McDonald**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/NQ Core**	Drill Bit Size/Type	**8" HSA/NQ #2**	Total Depth Drilled	**47.7 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3047 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.655', W116°41.066'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Loose to soft, moist, dark brown, silty fine to medium SAND to sandy SILT (SM/ML)		1	10		WC(8), DUW(105), DS
3046	1													
	2													
3044	3								GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, medium grained, completely weathered. Fragments to very dense, silty SAND (SM)		2	12		
	4													
3042	5				--									
	6				--									
3040	7	1	1	0	--	0								
	8				--									
3038	9				--									
	10				--									
3036	11				--									
	12	2		0	--	0								
3034	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-06

URS

Figure A-7

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-06

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3034	13				--									
	14	2		0	--	0								
3032	15				1								0143	
	16						1		Becomes light gray, slightly weathered, strong					
3030	17				1								8	
	18	3		92	0	70			1: 20°, J, N, No, N, Pl, Sr					DUW(167), UCS
3028	19				0									
	20				0		NR						1023	
													1035	
3026	21		1		0									
	22				2		1							
							2							
		4		100	2	96	3		1: 10°, J, N, No, N, Wa, R 2: 20°, J, N, No, N, Ir, R 3: 30°, J, N, No, N, Wa, R				5	
							4		4: 10°, J, N, No, N, Pl, S 5: 10°, J, N, No, N, Pl, S					
3024	23				2		5		6: 75°, J, N, No, N, Wa, R					DUW(166), UCS
							6							
	24				0									
3022	25												1130	
					1								1135	
	26	5		100		95			1: 70°, J, N, No, N, Pl, Sr				4	
					1		2		2: 45°, J, N, No, N, Pl, R					
3020	27		1										1205	
					0								1230	
	28												9	
		6		100	0	100								
3018	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-06

URS

Figure A-7

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-06

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3018	29				0								1250	
	30						M							
		7		100	0	100							1305	
3016	31													
					0		M						1330	
	32													
					0									DUW(170), UCS
3014	33	8		100		100							11	
			2		0									
	34													
					0									
3012	35												1350	
					0								1358	
	36													
					0		M							
3010	37												7	
		9		92	0	88								
	38													
					4		1		1: 20°, J, N, No ,N Fe, Su					
							2		2: 0°, T, Fe, No, N Su, Pl, Sr					
3008	39						3		3: 15°, J, T, No, N, Wa, Sr					
							4		4: 85°, J, T, No, N, Wa, Sr					
					--		N							
							NR						1436	
	40												1445	
					0									
3006	41													
					0									
	42													DUW(167), UCS
		10		100	0	100							1	
3004	43													
					0									
	44													
			3		0									
3002	45												1618	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-06

URS

Figure A-7

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-06

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3002	45				0								0935	
	46	11	3	100	0	100							4	
3000	47				0								1101	
	48								Bottom of boring at 47.7 feet					
2998	49													
	50													
2996	51													
	52													
2994	53													
	54													
2992	55													
	56													
2990	57													
	58													
2988	59													
	60													
2986	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-06

URS

Figure A-7

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-07

Sheet 1 of 5

Date(s) Drilled	**01/29/09 - 01/30/09**	Logged By	**P. McDonald**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ3**	Total Depth Drilled	**74.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3111 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.625', W116°40.898'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Loose, moist, light brown, clayey SAND (SC)					
3110	1										1	5		
	2													
3108	3										1A			SA(44), WC(10), COMP, CORR
	4								GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, medium to coarse grained, completely weathered, extremely weak					
3106	5				--						2	50/6"	1105	WA(27), WC(5), DUW(122), DS
	6				--									
3104	7	1		0	--	0	NR						30	
	8				--									
3102	9				--									
	10		1		--								1115	
													1130	
3100	11				--									
	12	2		20	--	0	NR						17	
3098	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 6/1/2009 B-07

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Figure A-8

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-07

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3098	13				--		NR							
	14			20	-----	0								
													1148	
3096	15				-----			M					1153	*Rock does not meet soundness requirements
	16				--									

3094	17	3		0	--	0	NR						27	
	18				-----									
					--									
3092	19				-----									
			1		--								1203	
		4		100		0							1214	
	20												1217	
													1240	
3090	21				--									

	22				--									
		5		0	-----	0	NR						60	
3088	23				--									

	24				--									
													1245	
3086	25												1248	
					--									
	26				-----									
					--									
3084	27				-----								43	
		6		0	--	0	NR							
	28				-----									
					--									
3082	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-07

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Figure A-8

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-07

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3082	29			0	--	0	NR						1255	
	30												1300	
3080	31				--									
	32	7		0	--	0	NR						38	
3078	33				--									
	34				--									
3076	35												1308	
													1312	
	36				--									
3074	37				--									
	38	8	1	0	--	0	NR						38	
3072	39				--									
	40												1320	
													1345	
3070	41				--									
	42				--									
		9		0	--	0	NR						60	
3068	43				--									
	44				--									
3066	45												1350	

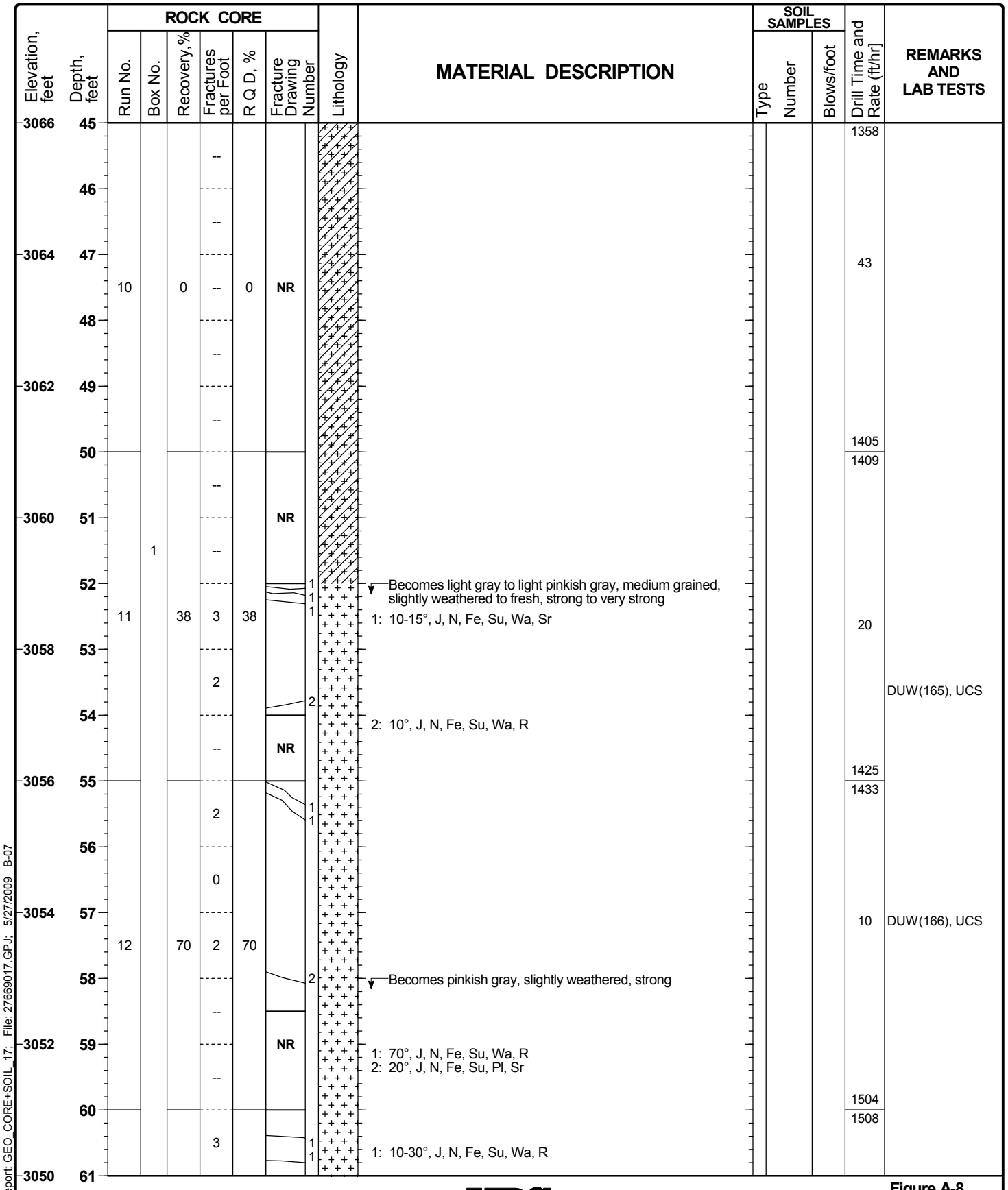
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-07

URS

Figure A-8

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-07



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-07

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Figure A-8

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-07

Sheet 5 of 5

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3050	61						1							
					4		2							
	62		1				1		Becomes fresh, strong to very strong					
		13		100	4	80	3		2: 20°, J, N, Fe, Su, Wa, S					
							4		3: 30°, J, N, Fe, Su, Pl, S					
3048	63								4: 70°, J, N, Fe, Su, Wa, S 5: 80°, J, N, Fe, Su, Pl, S				12	
					2				6: 10°, J, N, Fe, Su, Pl, S					
	64						5							
					2		6							
													1534	DUW(164), UCS
3046	65						M						0845	
					0									
	66	14		100		100			1: 90°, J, N, Fe, Su, Pl, Sr-R				8	
					1				2: 70°, J, N, No, N, Pl, Sr					
							2						0800	
3044	67						M						0915	
					0									
	68													
		15		100	2	92			Becomes pinkish gray, slightly weathered, strong				4	
							1		1: 30-50°, J, N, Qz, Wa, R					
3042	69						2		2: 15°, J, N, Fe, Su, Pl, R					
							3		3: 10°, J, N, Fe, Su, W, R					
					5		4		4: 15°, J, N, No, Pl, R 5: 70-80°, J, N, Fe, Su, Wa, Sr					
							M						1000	
	70		2										1016	
					0				Becomes medium gray, medium grained, very strong, with few mafic minerals					
3040	71													
					0									
	72													
		16		100		100							4	
					1									
3038	73						1		1: 15°, J, N, No, Pl, Sr					
					0									
	74													
					0									
													1123	DUW(166), UCS
									Bottom of boring at 74.5 feet					
3036	75													
	76													
3034	77													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-07

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Figure A-8

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

Date(s) Drilled	**01/20/09 - 01/21/09**	Logged By	**A. Avakian/D. Orris**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**106.0 feet**
Drill Rig Type	**Helicopter Rig**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3115 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.597', W116°41.854'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3115	0								RESIDUAL SOIL Soft, moist, dark brown SILT (ML) with trace fine sand					
3114	1													
	2								GRANITIC ROCK Granodiorite, light orangish brown, phaneritic, coarse grained, completely weathered, extremely weak rock. Fragments to very dense, moist, fine to coarse SAND (SP) with some silt		1	50/4"		
3112	3													
	4													
3110	5				--		NR		Becomes completely to highly weathered, weak to moderately strong		2	50/3"	1545	
	6	1		60	2	0		1 2						
3108	7				3			3 4 5	1: 10°, J, N, Fe, Sp-Su, Pl, R-Vr 2: 5°, J, N, Fe, Sp-Su, Pl, R-Vr 3: 0°, J, N, Fe, Sp-Su, Pl, R-Vr 4: 40°, J, N, Fe, Sp-Su, Pl, R-Vr 5: 40°, J, N, Fe, Sp-Su, Pl, R-Vr				12 1601	
	8				--								0857	
3106	9				--									
	10				--								17	
3104	11	2	1	0	--	0	NR							
	12				--									
3102	13				--								0915	

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

Sheet 2 of 7

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3102	13				--								0930	
	14				--									
3100	15				--		NR						30	
	16	3		0	--	0								
3098	17				--									
	18				--								0940	
													0956	
3096	19				--									
	20				--								27	
3094	21	4	1	0	--	0	NR							
	22				--									
3092	23				--				Becomes highly weathered, weak to moderately strong				1007	
							NR						1015	DUW(153), UCS, MOD
	24				0									
3090	25						1		1: 17°, J, N, Fe, Su, Pl, S-Sr				23	*Rock does not meet soundness requirements
		5		80	2	0*			2: 80°, J, N, Fe, Fi, Wa, Sr					
	26						2		3: 15°, J, N, Sd, Fi, Pl-Wa, Sr 4: 15°, J, N, Fe, Sp-Su, Pl, Sr 5: 10°, J, N, Fe, Si, Pl, Sr-R					
					2		3							
3088	27						4							
					2		5							
	28						6						1028	
													1040	
		6		20	--	0	1		Becomes slightly weathered to fresh, strong to very strong				3	
3086	29						2						1102	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-08

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

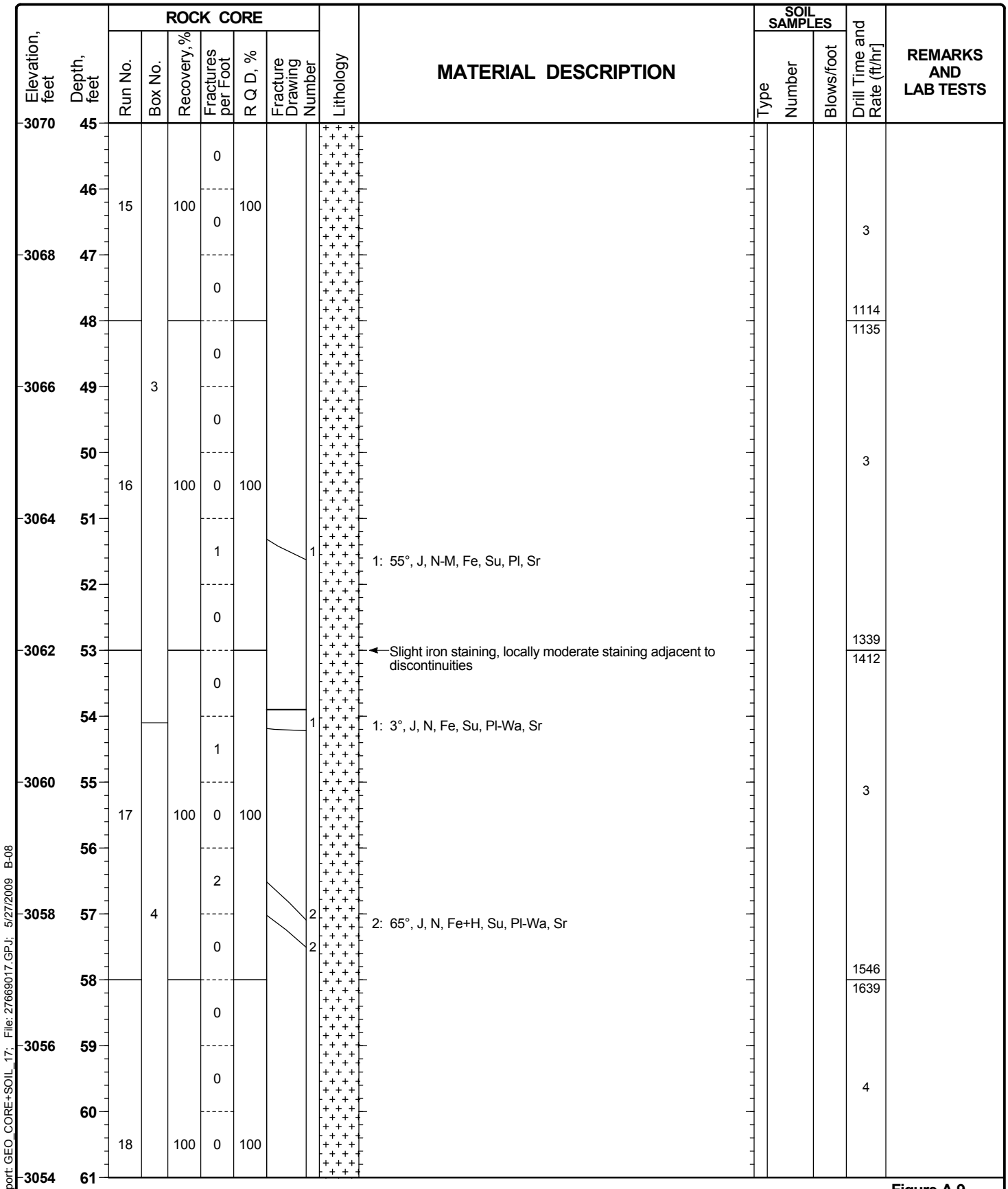
Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3086	29						1						1110	
		7		100	2	100	2		1: 45°, J, N, Fe, Sp, Pl, Sr 2: 60°, J, T, H+Fe, Fi, Pl, Sr				1	
	30								Becomes grayish brown with darker gray splotches and black spots, coarse grained, moderately to slightly weathered, strong to very strong				1210 1246	
					0									
3084	31	8	1	100		100							2	
					0									
	32												1358	
		9		100	1	80	1		Becomes light pinkish gray, slightly weathered, strong 1: 0°, J, N, Fe, Su, Pl, Sr				1145 2	
3082	33												1510	
					2		1		Becomes light gray, slightly weathered to fresh, strong to very strong				0920	
	34						2							
					4		3							
							4		1: 30°, J, Mw, No, N, Pl, Sr					
3080	35		2				5		2: 18°, J, Vn, No, N, Pl-Wa, Sr					
							6		3: 55°, J, Vn, Fe, Su, Pl, Sr					
		10		68	4	68	6		4: 65°, J, N, Fe, Su, Pl-Wa, Sr				8	
							7		5: 10°, J, Vn, No+Fe, Pa, Pl, Sr					
	36						8		6: 55°, J, Vn, H, Fi, Pl, Sr					
									7: 60°, J, N-Vn, Cl-Fe, Su, Pl, S-Sr					
							9		8: 62°, J, Vn, Fe, Su-Fi, Pl, S-Sr					
					1		10		9: 70°, J, Vn, H, N, Wa, Sr					
3078	37								10: 65°, J, N, Fe, Su, Pl-Wa, Sr					
							NR							
					--									
	38		2										0956	
					0								1033	
3076	39	11		100		100							2	
					0									
	40												1124	
		12		100		100							1212	
					0									
3074	41												1305	
					1		1		1: 20-25°, J, N-Mw, Fe-No, Su-Sp, Pl-Wa, Sr				0137	
	42	13		100		100							1	
					0									
3072	43												1522	
					0								1612	
		14		100		100							3	
	44												1649	
			3		0								0956	
3070	45													

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-08

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3054	61				0									
	62		4		0									DUW(165), UCS
3052	63												0930	
					0								0959	
	64				0									
3050	65	19		100	0	100							3	
	66				0									
3048	67		5		0									
	68												1201	
					0								1326	
3046	69	20		100	0	100							3	
	70				0									
3044	71												1424	
					1								1505	
	72	21		100	0	100	1		1: 2°, J, N-Mw, Fe, Su, Pl-Wa, Sr				9	
3042	73				0									
	74												1557	
					0								1605	
3040	75	22		100		100							2	
			6		0								1644	
	76	23		100		100							0852	
					0								2	
3038	77												0950	

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3038	77												1012	
		24		100	0	100							1	
	78												1054	
					0								1107	
3036	79	25		100		100							4	
					0									
	80		6										1139	
		26		100	0	100							1157	
3034	81												2	
					0								1236	
													1246	
	82	27		100		100							2	
					0									
3032	83												1345	
					0								1418	
	84	28		100		100							3	
					0									
													1456	
3030	85												1518	
					0								5	
	86	29		100		100								
					0								1538	
													0837	
3028	87	30		100		100							2	
					0									
													0919	
	88		7										0939	DUW(165), UCS, MOD
					0									
3026	89	31		100		84			1: 80°, J, N, Fe, Su, Pl-Wa, Sr 2: 80°, J, N-Vn, Su,Pl-Wa, Sr				4	
					1									
	90													
					3								1018	
									1: 30°, J, N, Fe, Su, Pl-Wa, Sr 2: 80°, J, N, Fe, Su, Pl, Sr 3: 20°, J, N, Fe, Su, Wa-Ir, Sr 4: 20°, J, N-Mw, Fe-No, Su-Sp, St-Pl, Sr 5: 10°, J, N-Vn, Fe, Su, Pl, Sr 6: 30°, J, N, Fe, Su, Pl, Sr				1032	
3024	91						1							
					0		2						3	
		32		100		73								
	92						3							
					4		4							
							5							
3022	93						6						1117	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-08

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-08

Sheet 7 of 7

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3022	93				1								1131	
	94						1							
					6		2							
							3		1: 65°, J, Mw-N, Cl, Su-Pa, Pl, S-Sr 2: 30°, J, N, Fe, Su, Pl-St, Sr					
3020	95		8						3: 60°, J, N, Fe, Su, Pl-Wa, Sr				7	
		33		98	2	78	4							
	96				2									
3018	97						5							
					0									
	98												1214	
					--								1235	
3016	99						1		1: 2°, J, N, Fe, Su, Pl-Wa, Sr					
							2		2: 10°, J, N, Fe, Su, Ir, Sr					
		34		93	--	81	3						2	
	100								3: 60°, N-Mw, Fe, Su, Pl-St, Sr-S					
					--		4		4: 60°, J, N-Mw, Fe, Su, Pl-St, Sr-S					
							5		5: 50-60°, J, Vn, Fe+H, Fi, Pl, Sr-S					
3014	101												1349	
													1411	
					1		1						2	
		35		100		100			1: 2-5°, J, N-Mw-Fe, Su, Wa-Ir, Sr					
	102													
													1506	
		36		20	0	0							1523	
3012	103												1539	
													0840	
					0									
	104						1							
		37	9	93	2	83	1						1	
3010	105								1: 20°, J, N, Fe, Su, Pl, S-Sr					
					1		1							
	106												1158	
									Bottom of boring at 106 feet					
3008	107													
	108													
3006	109													

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Figure A-9

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Sheet 1 of 8

Date(s) Drilled	**02/04/09 - 02/19/09**	Logged By	**D. Orris**	Checked By	**M. Hatch/J. Nevius**
Drilling Method	**Rotary Wash/HQ3 Core**	Drill Bit Size/Type	**Tri-cone/HQ diamond impregnated**	Total Depth Drilled	**120.5 feet**
Drill Rig Type	**Helicopter Rig**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3169 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.594', W116°40.888'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**NA**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Loose to medium dense, moist, dark brown, silty SAND (SM) graded to clayey SAND (SC)					
3168	1													
	2													
3166	3													
	4												1523	DUW(161), UCS, MOD
3164	5				1		1		GRANITIC ROCK Granodiorite, yellow to light yellowish brown, phaneritic, medium to coarse grained, highly to completely weathered, extremely weak to strong					
	6	1		38	0	NA	NR		1: 20°, J, Mw, Fe, Su-Sp, Wa-Ir, Sr-R				22	
3162	7				--									
	8		1		--								1534	
							1		Becomes light yellowish brown, moderately weathered, strong				1546	
3160	9				1									
	10				0				1: 20°, J, Mw-N, Fe, Su, Pl-Wa, Sr					
3158	11	2		40	--	40	NR						5.8	
	12				--									
3156	13				--								1638	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-09

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Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3156	13				0				Becomes slightly weathered, strong, slight iron oxide staining				0846	
	14				0									
3154	15	3	1	94	0	94							3.8	
	16				0									
3152	17				0		NR							
	18												1004	
		4		100	0	100							1034	
													2.0	DUW(165), UCS
3150	19								Becomes strong to very strong, decrease in iron oxide staining				1115	
					0								1131	
	20													
					0									
3148	21	5		100		100							2.7	
					0									
	22													
					0									
3146	23												1259	
					1		1						1352	
	24								1: 25°, J, N, Fe, Su-Sp, Pl, S-Sr					
					0									
3144	25	6		100	0	100							4.6	
	26		2											
					0									
3142	27													
					0									
	28												1457	
													1518	
		7		100	0	100								
3140	29													

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Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3140	29													
		7		100	0	100							2.1	
	30		2										1610	
					0								0918	DUW(165), UCS, MOD
3138	31													
		8		100	0	100							6.7	
	32													
					0									
3136	33												0945	
					0								1007	
	34	9		100		100							2.7	
					0									
3134	35												1052	
					0								1110	
		10		100		100							2.1	
	36													
					0								1152	
													1210	
3132	37	11	3	100		100			← Increase in iron oxide staining/weathering, preferential staining along joints/fractures				2	
					0								1240	
					0								1302	
	38						1							
					2		2		1: 50°, J, Mw-W, Fe-Cl, Sp-Su, Pl, Sr					
									2: 50°, J, Mw-N, Fe, Su, Pl-Wa, Sr					
3130	39													
					0									
	40	12		100		97							3.8	
					2		3		3: 40°, J, N, Fe, Su, Pl-Wa, Sr					
3128	41						4		4: 70°, J, N, Fe, Sp, Pl, Sr					
					1									
	42						5		5: 40°, J, N, Fe, Su, Pl, Sr					
					0								1420	
					0								1449	
3126	43								1: 53°, J, N, Fe, Su, Pl-Wa, Sr					
			4		1		1						5.4	
	44													
					0									
3124	45													

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Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3124	45	13		100	1	100	2		2: 85°, J, N, Fe, Su,-Sp, Pl, Sr					
	46				1		3		3: 60°, J, N-Mw, Fe, Su, Pl, Sr					
3122	47		4		1									
					1		4		4: 60°, J, N-Mw, Fe, Su, Pl, Sr				1545	
					1		1		← Slight iron oxide staining				0952	
	48								1: 45°, J, N, Fe-No, Sp, Pl, Sr					
					0									
3120	49	14		100		77							3.4	
					0									
	50													
					1		2		2: 65°, J, N, Fe, Su, Pl, Sr				1045	
					0				← Very slight iron oxide staining				1114	DUW(164), UCS
3118	51													
					0									
	52													
					1		1		← Becomes pale olive, medium grained (slight decrease in grain size)				2.5	
3116	53	15		100		100			1: 20°, J, N, Fe, Su, Pl, Sr					
					0									
	54													
					1		2		2: 65°, J, N, Ch, Su-Sp, Pl, S-Sr				1302	
3114	55												1345	
					0									
	56		5						← Becomes medium to coarse grained				2.0	
		16		100	0	100								
3112	57						1		1: 55°, J, N, No, N, Pl-Wa, Sr					
					1		1		← Becomes light yellowish brown, slight iron oxide staining				1500	
	58								1: 30°, J, N, Fe, Su, Pl, Sr				1525	
					0									
3110	59						2		2: 50°, J, N, Fe, Su, Pl, Sr				3.5	
					0									
	60	17		100		96								DUW(165), UCS, MOD
					0									
3108	61													

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Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3108	61		5		0									
	62				1		3						1650	
		18		100	0	100			3: 30°, J, N, Fe-No, Su-N, Pl, Sr				0913 0923	Drill Rate 3.0
3106	63												0932	
					0									
	64	19		100		100							2.4	
					0									
3104	65								Strong iron oxide staining				1023 1047	
					0									
	66	20		100		100							1.8	
					0									
3102	67				0									
					0								1212	
	68	21	6	100		100							1231 1.9	
					0								1302	
					0								1351	
3100	69													
					0									
	70	22		100		100							2.6	
					0									
3098	71													
					0									
	72												1513	
		23		100	0	100							1532 1614	Drill Rate 0.7
					0								1628	
3096	73	24		100		100	1		1: 80°, J, N-Vn, No-H, N, Pl-Wa, Sr				2.7	
					2									
	74						2 1		2: 30°, J, N, No, N, Pl, Sr 1: 30°, J, N, No, N, Pl, Sr				1702 0851	
					1									
3094	75	25	7	100		100							2.6	
					0									
	76													
					0								0948	
3092	77				0								1010	DUW(165), UCS

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-09

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Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3092	77	26		100	0	100							1.6 1047	
	78	27		100	0	100							1106 1.5 1146	
3090	79				0 1				1: 80°, J, N-Mw, Fe-Cl, Su, Pl, Sr				1213	
	80	28	7	89	0	64	1						2.6	
3088	81				0		NR						1322	
	82	29		100	1 2	66	1 2 2		1: 85°, J, N, No-Fe-Cl, Su-N, Pl-Wa, Sr				1352 2.4	
3086	83				0				2: 40°, J, N, Fe, Su, Pl, Sr				1442	
	84	30		100	0 0	100							1503 1.4 1545	
3084	85	31		100	0 0	100							1614 1.3 1700	
	86	32		100	0	100							0917 1.1 1013	
3082	87	33		100	1	77	1		1: 75-80°, J, N, Fe, Su, Pl-Wa, Sr				1030 4.1	
	88				0		1						1052	
3080	89		8		1		1		1: 30°, J, N, No-Fe, N-Sp, Pl, Sr 2: 75°, J, N-Vn, Fe-No-H, Sp-Fi, Pl-Wa, Sr				1115	
	90	34		100	1 0	95	2						3.4	
3078	91				0								1217	
	92	35		100	0	100							1251 1.7 1326	DUW(165), UCS, MOD
3076	93													

URS

Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3076	93				0								1401	
	94	36	8	100	0	100							2.4	
3074	95												1450	
		37		100	0	100							1540	
	96												2.1	
					1				1: 52°, J, N, Fe-Mn, Su-Pa, Pl, S				1609	
3072	97	38		100	0	100	1						0952	
	98												2.4	
		39		100	0	100							1043	
3070	99		9										1120	
					0								4.0	
	100	40		100	0	100							1135	
													1232	
3068	101												1.6	
		41		100	0	100							1349	
	102												1402	
					0								1.2	DUW(165), UCS
3066	103	42		100	0	100							1457	
	104												1533	
					0								2.2	
3064	105	43		100	0	100							1600	
													0920	
	106		10		0								2.2	
		44		100		100							1014	
3062	107				0								1031	
					0								1.4	
	108												1134	
		45		100	0	100							1150	
3060	109												2.5	

URS

Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-09

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3060	109				0								1250	
	110		10										1329	
3058	111	46		100	0	100								
					1		1		1: 35°, J, N, No, N, Pl, Sr				2.5	
	112				0									
3056	113												1442	
					0								1542	
	114								← Encountered a 9" thick sill of fine to medium grained granitic rock					
					3		1							
		47		100		100			1: 30°, J, N-Mw, No, N, Pl, Sr (joint forms the lower sill contact)				3.1	
3054	115						2		2: 65°, J, N, No-H, N-Fi, Pl, Sr					
					1		2		3: 50°, J, N, No-H, N-Fi, Pl, S-Sr					
							3		4: 30°, J, N, No-Fe, Sp-N, Pl, S					
	116		11											
					1		4							
							1						1619	
					1								0857	
3052	117								1: 30°, J, N, Fe, Su, Pl, S					DUW(171), UCS, MOD
							2		2: 60°, J, N, Ch, Su, Pl, Sr					
					1				↓ Becomes dark gray, slightly weathered to fresh, transitions to slightly more mafic in composition					
	118												2.5	
		48		100	0	100								
3050	119													
					0									
	120												1034	
					0									
									Bottom of boring at 120.5 feet					
3048	121													
	122													
3046	123													
	124													
3044	125													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-09

URS

Figure A-10

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10

Sheet 1 of 6

Date(s) Drilled	**02/20/09 - 03/03/09**	Logged By	**A. Avakian**	Checked By	**M. Hatch/J. Nevius**
Drilling Method	**Rotary Wash/HQ3 Core**	Drill Bit Size/Type	**Tri-cone/HQ diamond impregnated**	Total Depth Drilled	**90.6 feet**
Drill Rig Type	**Helicopter Rig**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3206 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.578', W116°40.859'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**NA**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3206	0								RESIDUAL SOIL Medium stiff to stiff, moist, dark brown SILT (ML), some fine to medium sand and trace coarse sand and organics					
	1													
									Stiff, moist, orangish red, fine to coarse, sandy lean CLAY (CL)					
3204	2													
	3													
3202	4												1019	
		1		100	2	100	1		GRANITIC ROCK Granodiorite, reddish brown orange, phaneritic, coarse grained, moderately weathered, strong 1: 80°, J, Vn, H+Fe, Fi, Pl, Sr				0.9 1124	DUW(165), UCS, MOD
	5						2		2: 68°, J, Vn, H+Fe, Fi, Pl, Sr				1130	
		2		100	1	100	1						1.4 1212	
									1: 55°, J, Mw, Fe, Su, Pl, R					
3200	6						M		Becomes light reddish gray, slightly to moderately weathered				1229	
					0									
	7	3		100		100							3.3	
					0									
3198	8		1				M						1305	
		4		100		100							1313 1.2	DUW(165), UCS
					0		M		Becomes bluish gray, slightly weathered, strong to very strong				1403	
	9												1412	
					0									
3196	10													
					0									
	11	5		100		100							3.8	
					0		M							
3194	12													
					0									
	13						M						1516	

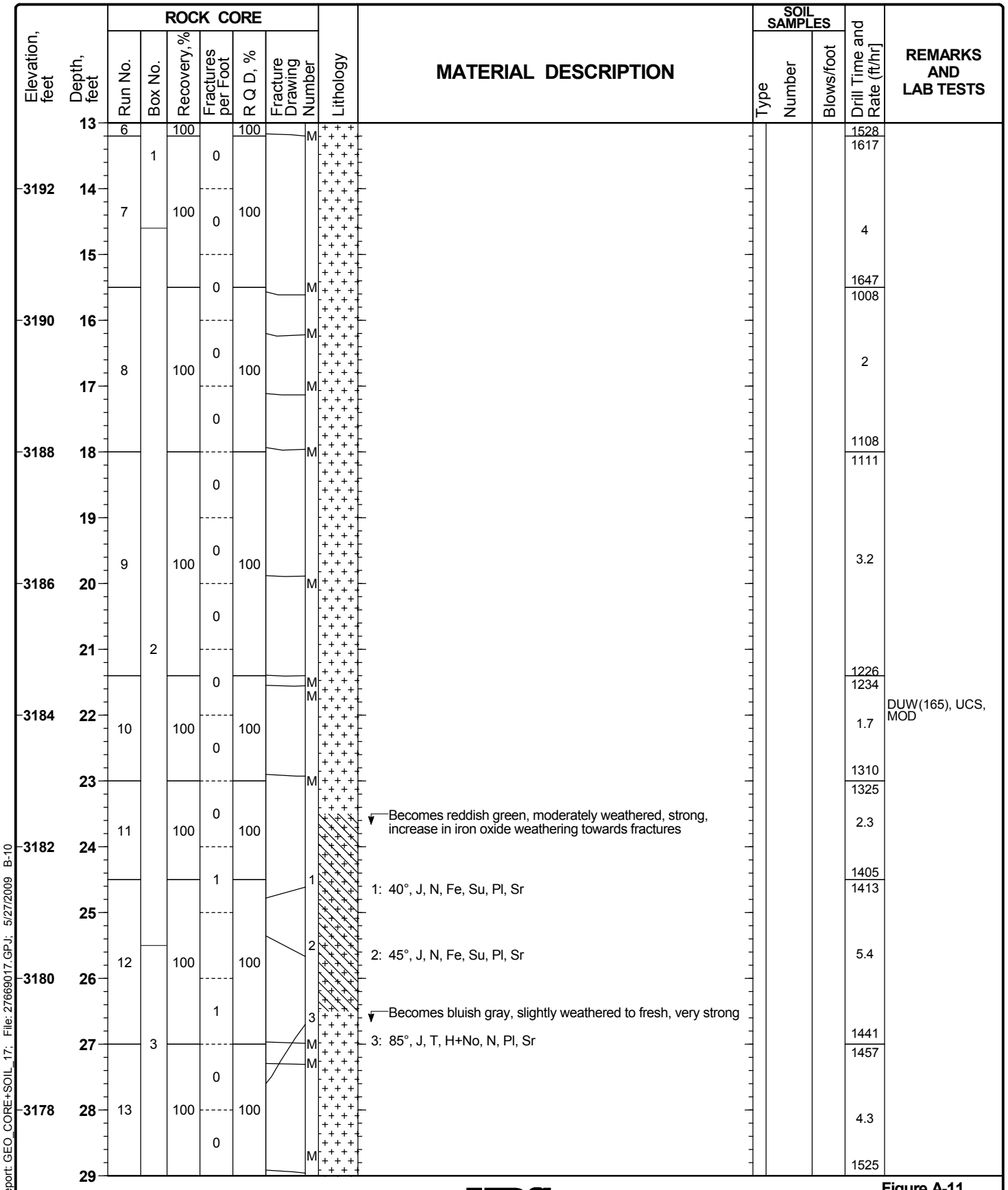
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-10

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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10



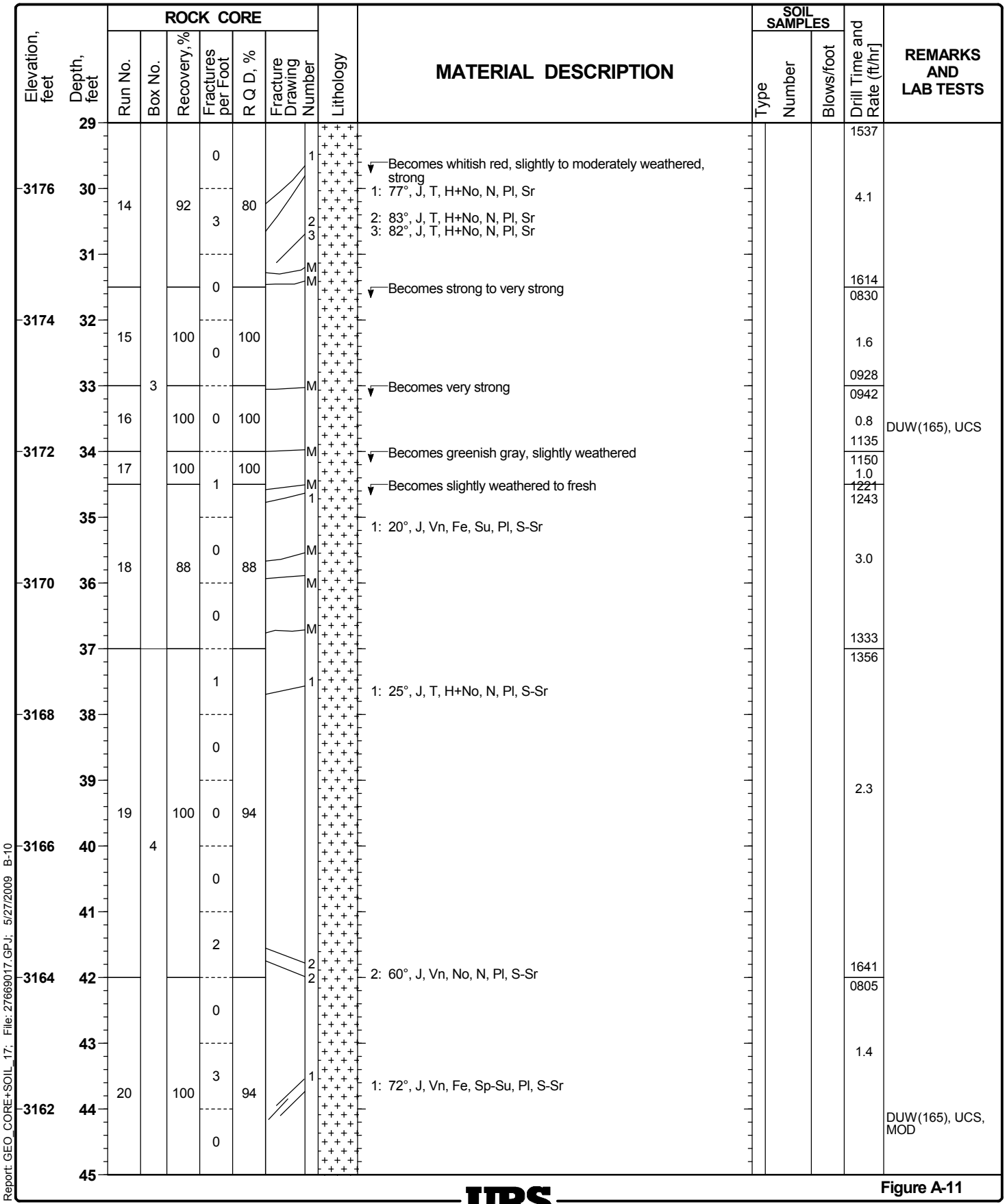
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-10

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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10



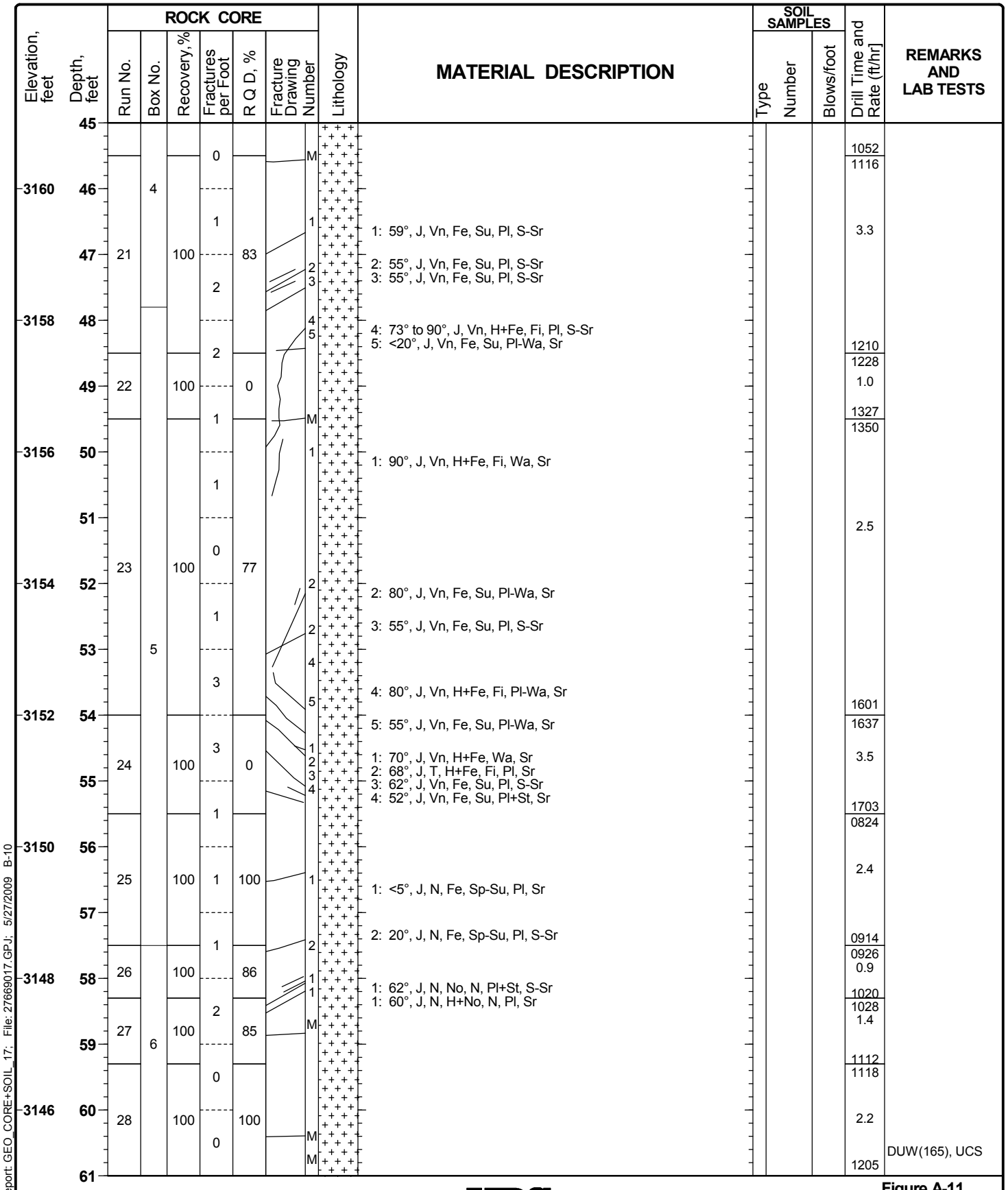
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-10

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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10



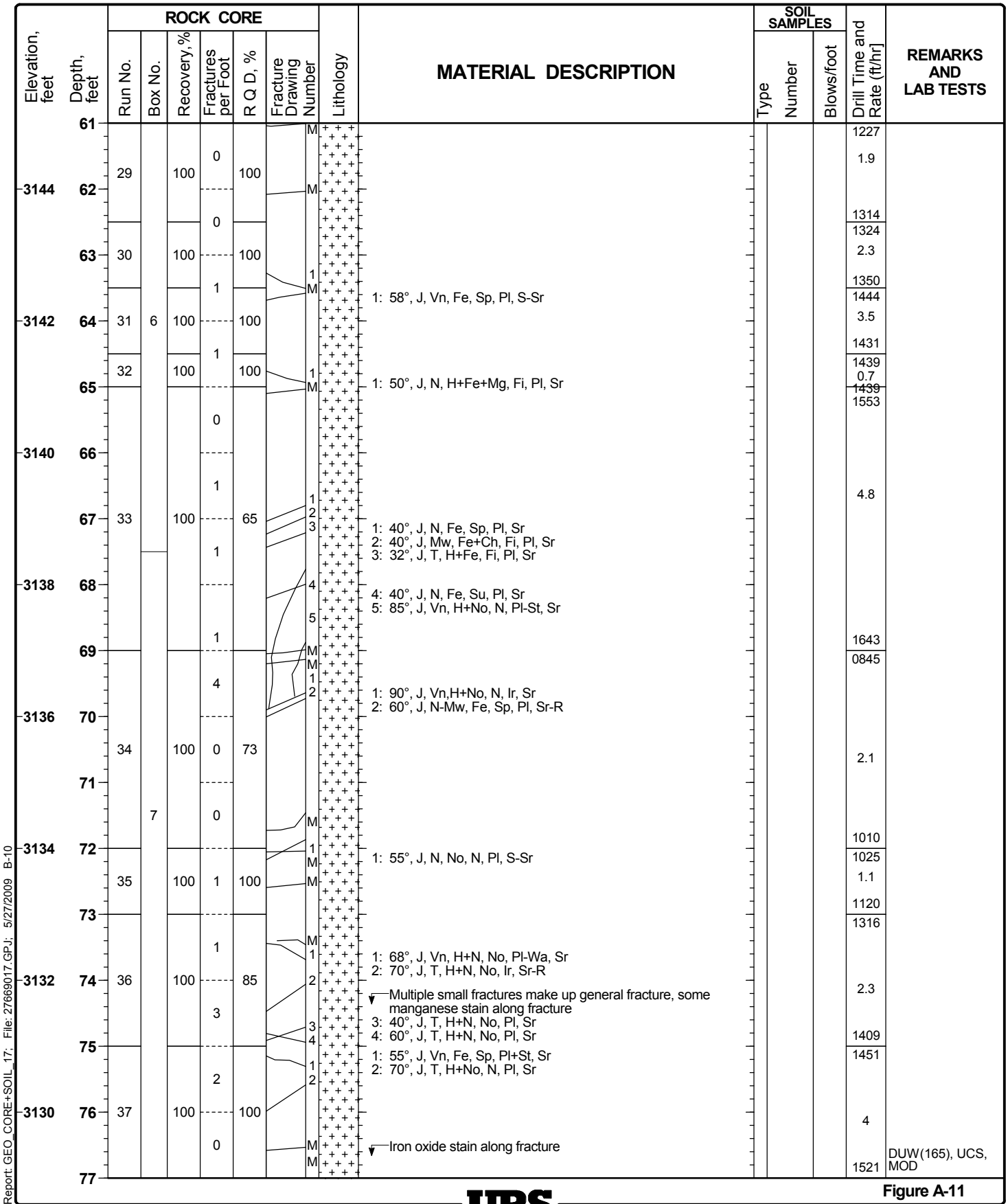
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-10

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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10



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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-10

Sheet 6 of 6

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	77												0835	
		38	7	100	2	100	1 2 M		1: 25°, J, Vn, H+Fe+Ch, Fi, Pl, Sr 2: 80°, J, Vn, Fe+Ch, Sp-Su, Pl, S-Sr				0.8 0946	
3128	78						1							
					2		2		1: 85-90°, J, N, Fe+Ch, Sp-Su, Pl-Wa, S-Sr 2: 85°, J, T, H+N, No, Pl-St, Sr				1019	
	79	39		100		85	3		3: 72°, J, Vn, H+Fe, Fi, Pl, Sr 4: 40°, J, Vn, H+N, No, Pl, Sr				2.5	
					4		4 5		5: 25°, J, N, Fe+Ch, Sp, Pl, Sr				1107	
3126	80												1118	
					1		1		1: 82°, J, T, H+N, No, Pl, Sr					
	81	40		100		95	2		2: 45°, J, T, H+Fe/Ch, Fi, Pl, Sr				2.1	
					2		3 M		3: 45°, J, Vn, Fe+Ch, Sp, Pl, S, Sr					
3124	82												1215	
					2		1		1: 50°, J, N, Fe, Fe+Ch, Sp, Pl, Sr				1226	
		41		100		87			2: 62°, J, T, H+N, No, Pl, S 3: 0°, V, Mw, Qz, Fi, Ir, Sr				4.7	
	83						2							
					1		3						1245	
			8				M						1306	
3122	84						1		1: 25°, J, T, H+Fe, Fi, Pl, Sr 2: 80°, J, T, H+Fe+Ch, Fi, Pl-Wa, Sr					
		42		100		93							2.2	
					2		2 M						1347	
	85												1358	
					1		1		1: 45°, J, T, H+N, No, Pl, Sr					
3120	86	43		100		100							2.4	
					0		M						1449	
	87						M						1456	
		44		100		100	M						1544	Drill Rate 0.8
					0								1628	
3118	88													
					1									
	89	45		90		90	1		1: 0-10°, V, Mw, Q, Fi, PL-Wa, Sr				4.2	
					0									
3116	90		9				2		2: 60°, J, N, Ch, Sp, Pl, Sr					
					1								1711	
	91								Bottom of boring at 90.6 feet					
3114	92													
	93													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-10

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Figure A-11

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-11

Sheet 1 of 4

Date(s) Drilled	**01/09/09 - 01/12/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**59.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3180 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.545', W116°40.877'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3180	0								RESIDUAL SOIL Loose, moist, dark brown, sandy SILT (ML), with some very coarse sand					
	1													
3178	2													
	3								GRANITIC ROCK Granodiorite, light orangish brown, phaneritic, medium grained, completely weathered, extremely weak. Fragments to dense, moist, reddish orange, clayey SAND (SC)					
3176	4										1	35		SA(39), WC(9), CORR
	5													
3174	6													
	7													
3172	8													
	9						NR						1227	
3170	10				0				Becomes gray, coarse grained, highly to moderately weathered, weak to moderately strong		2	50/3"		
	11		1											
		1		84	2	0*							38	DUW(166), UCS
3168	12						1 2 3 4		1: 75°, J, Vn, F+Fe, Fi, Pl+St, Sr 2: 20°, J, N, Fe, Su, Pl-St, Sr-R 3: 15°, J, N, Fe, Sp-Su, Pl, Sr 4: 35°, J, N, Fe, Su, Pl+Wa, Sr					
	13				2									

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-11

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Figure A-12

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-11

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	13				2		5 6 1		5: 10°, J, Mw, Fe, Su, Pl, Sr 6: 35°, J, Mw, Fe, Sp-Su, Pl+Wa, Sr-R				1235	
3166	14								1: 40°, J, N, Fe, Sp-Su, Pl-Wa, Sr Becomes highly weathered, weak				1240	*Rock does not meet soundness requirements
	15				2		2		2: 65°, J, Vn, H+Fe, Fi, Pl, Sr					
					0									
3164	16	2		100	0	0*			Becomes highly to moderately weathered, weak to moderately strong				27	
	17		1				3 4 5 6 7 8		3: 20°, J, N, Fe, Sp-Su, Pl-Wa, Sr 4: 40°, J, N, Fe, Su, P, Sr 5: 40°, J, N, Fe, Su, Pl, Sr 6: 45°, J, N, Fe, Su, Pl, Sr 7: 70°, J, N, Fe, Su, Pl, Sr 8: 30°, J, N, Fe, Su, Pl, Sr					
3162	18				3									
					3									
	19												1251	
					1								1256	
3160	20						1		1: 60°, J, N, H+Fe, Fi, Pl, Sr					
					1									
	21						2		2: 70°, J, N, H+Fe, Fi, Pl-Wa, Sr				33	
		3		100	1	0*								
3158	22						3 4 5		3: 65°, J, N, H+Fe, Fi, Pl-Wa, Sr 4: 65°, J, N, H+Fe, Fi, Pl, Sr 5: 85°, J, N, H+Fe, Fi, Wa, Sr					
					1									
	23													
					1									
3156	24												1305	
					0								1316	
	25		2				1 1							
					2									
3154	26								1: 60°, J, N, H+Fe, Fi, Pl, Sr 2: 45°, J, N, H+Fe, Fi, Pl, Sr 3: 45°, J, N, H+Fe, Fi, Pl, Sr 4: 35°, J, N, H+Fe, Fi, Pl-Wa, Sr				20	
		4		100	1	0*	2							
	27						2 3 4							
					3									
3152	28													
					0									
	29												1331	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-11

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Figure A-12

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-11

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				0				Becomes slightly weathered, strong				1338	
3150	30				0		NR							
	31		2										8	
		5		50	1	32								
3148	32				0		1		1: 70°, J, N, Fe, Su, Pl, Sr					DUW(182), UCS, MOD
	33						2		2: 50°, J, N, Fe, Sp, Pl, Sr					
					4		3		3: 15°, J, N, Fe, Sp, Pl, Sr					
							4		4: 50°, J, MW, Fe, Sp, Pl, Sr					
							5		5: 25°, J, N, H+Fe, Fi, Pl, Sr					
3146	34						1		Becomes slightly weathered to fresh, strong to very strong				1414	
													1422	
					1				1: 30°, J, N, Fe, Sp, Pl, Sr					
	35				0									
3144	36												19	
		6		100	0	100								DUW(181), UCS
	37						M							
					1		2		2: 55°, J, N, Fe, Sp-Su, Pl, Sr					
3142	38				0		M							
	39		3										1438	
													1446	
					0									
3140	40				2		1		1: 20°, J, N, Fe, Sp-Su, Pl, Sr					DUW(181), UCS, MOD
	41						2		2: 20°, J, N, Fe, Sp-Su, Pl, Sr				9	
		7		100	0	96								
3138	42				0									
	43				0									
3136	44												1518	
													0845	
			4		0									
	45													

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Figure A-12

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-11

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	45				0									
3134	46												10	
		8		100	1	100	M 1		1: 40°, J, N, No, N, Pl, Sr					
	47				0									
3132	48				0									
	49						NR						0922	
					2		1		1: 0°, J, Mw, Fe, Sp-Su, Pl-Wa, Sr					DUW(180), UCS
							2		2: 40°, J,/V, W, Pl+Fe, Fe/Su, Pl, Pa-Fi, P+Wa, Sr					
3130	50		4				3		3: 0°, J,/V, W, Pl+Fe, Fe/Su, Pl/Pa-Fi, Pl, Sr					
					0									
	51						4		4: 0°, J, Mw, Fe, Sp, Pl-Wa, Sr				12	
		9		90	1	80								
3128	52				0									
	53													
					0									
3126	54						NR						0948	
													1000	
	55				0									
														DUW(182), UCS, MOD
3124	56				0								6	
		10		96		90								
	57		5				1		1: 70°, J, Vn, H+Fe, Fi, Pl-Wa, Sr					
							2		2: 70°, J, Vn, H+Fe, Fi, Pl-Wa, Sr					
					2				3: 82°, J, Vn, H+Fe, Fi, Pl-Wa, Sr					
3122	58						3		4: 0°, J, Mw, Fe, Sp, Wa, Sr					
							4							
					2									
	59												1047	
									Bottom of boring at 59 feet					
3120	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-11

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Figure A-12

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-12

Sheet 1 of 4

Date(s) Drilled	**01/07/09 - 01/08/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**59.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3090 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.594', W116°40.936'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3090	0								RESIDUAL SOIL Loose, moist, dark brown, silty SAND (SM), some organics					
	1													
3088	2								GRANITIC ROCK Granodiorite, reddish brown, phaneritic, coarse grained, highly weathered, extremely weak . Fragments to very dense, moist, clayey SAND (SC)					
	3													
3086	4													
	5										1	53		WC(6), CORR
3084	6													
	7													
3082	8													
	9													
3080	10								Becomes light reddish brown, very dense		2	50/4"		WC(1)
	11													
3078	12													
	13													

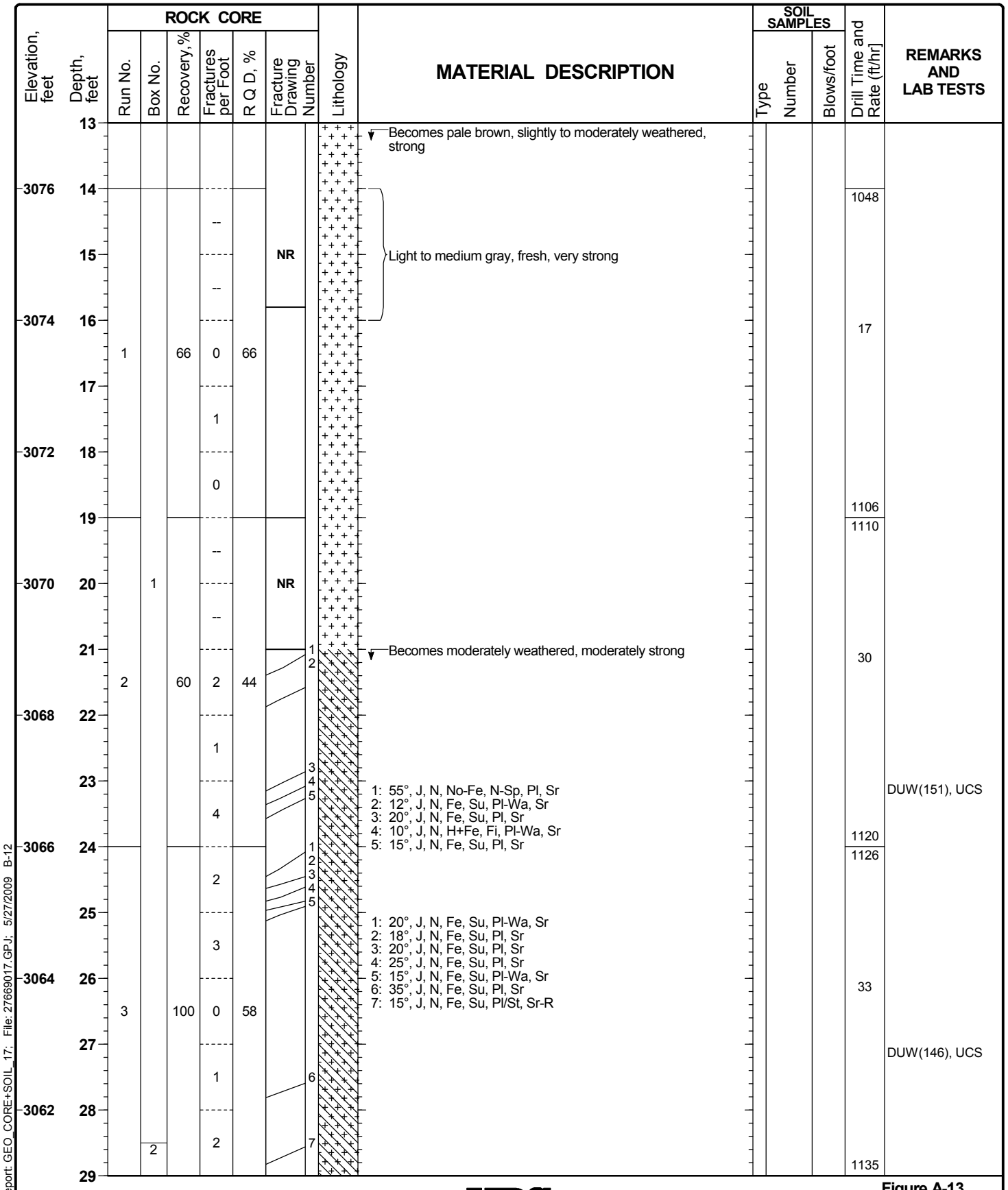
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-12

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Figure A-13

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-12



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Figure A-13

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-12

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				3		1		Becomes light to medium gray, fresh, strong to very strong				1138	
3060	30				2		2		1: 29°, J, N, Fe, Su, Pl, Sr 2: 10°, J, N, Fe, Su, Pl, Sr 3: 80°, J, N, H+Fe, Pl-Wa, Sr 4: 20°, J, N, Fe, Sp-Su, Pl, Sr 5: 15°, J, Vn, Fe, Sp-Su, Pl, Sr 6: 25°, J, Vn, Fe, Sp-Su, Pl, Sr 7: 55°, J, Vn, Fe, Su, Pl, Sr					
	31	4		100	1	93	3 4 5						7	
3058	32				1		6							
	33				1		7							
3056	34		2		1				Becomes pale brown to light gray, slightly weathered, strong				1209 1225	DUW(170), UCS
	35				5		1 2 3 4 5 5		1: 30°, J, N, Fe, Sp, Pl-Wa, Sr 2: 30°, J, N, Fe, Sp, Pl-Wa, Sr 3: 15°, J, N, Fe, Sp, Wa-St, R 4: 15°, J, N, Fe, Sp, Wa-St, R					
3054	36	5		100	3	64	6 7 8 9 10		5: 20°, J, N, Fe, Sp, Wa-St, R 6: 55°, J, N, Fe, Sp-Su, Pl-Wa, Sr 7: 10°, J, N, Fe, Sp-Su, Pl-Wa, Sr 8: 30°, J, N, Fe, Sp-Su, Pl-Wa, Sr 9: 30°, J, N, Fe, N-Sp, Pl, Sr-R				11	
	37				3		11		10: 45°, J, N, Fe, Sp, Pl, Sr-R 11: 65°, J, N, Fe, Sp, Wa-St, Sr 12: 85°, J, N, Fe, Sp, Pl, Sr-R					
3052	38				1		12							
	39				--								1252 1308	
3050	40				4		1 2 3 4		1: 85°, J, N, Fe, Sp+Su, Pl, Sr 2: 0°, J, N, Fe, Sp, Pl+St, Sr 3: 70°, J, N, Fe, Su, Pl, Sr 4: 0°, J, N, Fe, Sp, Pl+St, St-R					
	41	6		100	1	81	5		5: 25°, J, N, Fe, Sp, Pl-Wa, Sr 6: 30°, J, N, Fe, Sp, Pl, Sr 7: 28°, J, N, Fe, N-Sp, Pl, Sr 8: 17°, J, N, Fe, Sp, Pl-Wa, Sr				8	
3048	42		3		3		6 7 8							
	43				0									
3046	44				--		1 1 1						1348 1412	
	45													

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Figure A-13

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-12

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Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	45				11		2							
3044	46													
		7		100	--	78								
	47		3						1: 30°, J, N, Fe, Sp-Su, Pl, Sr 2: 30°, J, N, Fe, Sp-Su, Pl, Sr				5	
					1		M 3		3: 38°, J, N, Fe, Sp-Su, Pl, Sr 4: 65°, J, N, No-Fe, N-Sp, Pl, Sr					
3042	48								5: 60°, J, N, No-Fe, N-Sp, Pl, Sr					
					2		M 4							
	49						5						1509	
							1						1525	
					3		2 3							
3040	50													
					2		4 5							
	51								Becomes slightly weathered to fresh, strong to very strong				6	
		8		100	--	94								
3038	52								1: 20°, J, N, Fe, Sp, Pl, Sr 2: 55°, J, N, Fe, Sp, Pl, Sr					
					1				3: 30°, J, N, Fe, Sp-Su, Pl, Sr 4: 10°, J, N, Fe, Sp, Pl, Sr					
	53						6		5: 20°, J, N, H+Fe, Fi, Pl, Sr 6: 82°, J, N, Fe, Sp-Su, Pl, Sr					
					1				7: 70°, J, N, Fe, Sp-Su, Pl, Sr					
													1614	
3036	54		4				7						0853	
					1		1 M							
	55								1: 80°, Mw, Fe, Fi, Pl, Sr 2: 30°, J, Fe, Su, N, Pl, Sr					
					1				3: 30°, J, N, No, N, Pl, Sr-R 4: 25°, J, N, Ch, Su, Pl, Sr					
3034	56						2		5: 25°, J, N, No, N, Pl, Sr				4	
		9		100	2	85	3							
							4							
	57						5							
					1									
3032	58													
					0									
	59												1000	
									Bottom of boring at 59 feet					
3030	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-12

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Figure A-13

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-14

Date(s) Drilled	**12/30/08**	Logged By	**M. Higgins**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #2**	Total Depth Drilled	**49.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3064 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.558', W116°40.013'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3064	0								RESIDUAL SOIL Loose to medium dense, moist, brown, to reddish brown, sandy SILT (ML) to silty SAND (SM), with some clay					
	1													
3062	2													
	3								RESIDUAL SOIL TO COMPLETELY WEATHERED GRANITIC ROCK Medium dense, moist, reddish yellow to strong brown, silty SAND (SM)					
3060	4													
	5										1	14		
3058	6													
	7								GRANITIC ROCK Granodiorite, yellowish brown to strong brown, coarse grained, completely to highly weathered, extremely to very weak. Fragments to very dense, moist, silty SAND (SM)					
3056	8													
	9				--								0923	
3054	10				--		NR				2	50/3"		
	11	1	1	56	--	0			1: 70°, J, N, Sd+Cl, Fi, R				30	
3052	12				4		1							
	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-14

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Figure A-14

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-14

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	13				3		2		Becomes pale brown, highly weathered, weak to moderately strong 2: 30°, J, Na, Sd+Cd, Fi, R				0931	
3050	14						1		1: 60°, J, N, Sd+Cl, Fi, St, R 2: 20°, J, Mw, Cl+Fe, Pa, Wa, Sr 3: 65°, J, N-Mw, Cl+Fe, Pa, Wa, Sr 4: 75°, J, T-Wa, Fe, Su, Pl, Sr				0935	
	15				3									
					2									*Rock does not meet soundness requirements
3048	16	2		99	1	0*	M						25	
	17		1		1		M 4							
3046	18				1		4		Becomes light gray with orange hue, highly to moderately weathered, moderately strong to strong				0947	
	19								1: 60°, J, N-Mw, Fe+Cl, Pa-Su, Pl, R 2: 25°, J, N-Mw, Cl, Pa, Pl, Sr 3: 75-80°, J, N, Fe+Mn, Su, Pl, Sr				0954	
					3		1 1							DUW(155), UCS
3044	20				2		2							
					2		3							
	21	3		100	2	66	2 M		Becomes moderately weathered, strong				5	
3042	22				2		3		4: 60°, J, N-Mw, Fe, Su, Pl-Ir, R					
	23				1		4 M							
3040	24												1023	
			2		1		1						1028	
	25				1		2 3		Becomes light gray, slightly weathered, strong to very strong					
3038	26	4		100	0	90	M		1: 60°, J, N, Fe+Mn, Su, Pl, Sr 2: 60-70°, J, T, Fe+H, Su, Ir, R 3: 80°, J, Na, Fe, Su-Pa, Pl-Wa, Sr-R 4: 20°, J, N-Mw, Fe, Su, Pl-Wa, Sr-R 5: 20-30°, J, T, Fe+H, Su, Wa, R 6: 30°, Sh, Vn, Mn+Py, Su, Pl, S-Slk				18	
	27				1		4 5							DUW(165), UCS
3036	28				1		6							
	29												1045	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-14

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Figure A-14

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-14

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				1		1		1: 35°, J, Vn, Mn+Py, Su, Pl, Sr-S				1052	
3034	30		2		2		2 3		2: 30°, J, Vn-N, Fe+Py, Su, Pl, Sr-S 3: 75-80°, J, N-Mw, Fe, Su-Pa, Sr-R					
	31	5		100	1	92			Moderately to slighty weathered				15	
3032	32				0		M		Becomes bluish gray, fresh, very strong					DUW(165), UCS
	33				0									
3030	34												1112	
					1		1		1: 25-30°, J, Vn-N, Fe, Su, Pl, Sr-S				1120	
	35				0				2: 50°, J, N, Cl+Mn, Su, Pl, Sr					
3028	36	6		100	1	92	5 1		3: 30°, Sh, N, Cl+mica, Su-Pa, Pl, Sr-Slk				5	
	37				0				4: 60-70°, J, Vn, Se+Cl, Wa, R					
3026	38		3		2		2 4 M 3		5: 30°, J, T, Cl+H, Su, Pl, S Becomes pale brownish gray, slightly weathered, strong					
	39												1218	
					1								1228	
3024	40				2		1		1: 60°, J, N, Fe, Su, Pl, Sr					
	41	7		100	1	97	2		2: 30°, J, Vn, Cl, Sp, Pl, Sr				5	
3022	42				1		3 M 4 5		3: 20°, J, Vn, Cl, Sp, Pl,Sr-R 4: 75°, J, T, Cl, Pa, Pl, Sr, healed					
	43				0		6 M		5: 40°, J, Vn-N, Cl, Sp, Wa, Sr-R 6: 10°, J, Vn-T, Cl+Mn, Su-Pa, Wa, Sr					
3020	44		4		0		7 1		7: 60°, J, T, No, N, Pl, Sr-R				1325 1333	
	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-14

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Figure A-14

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-14

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	45													
3018	46	8		100	1	97			1: 65°, J, T, Cl, Su-Fi, Pl-Wa, Sr-R, healed 2: 30°, J-V, Vn-N, Cl+Blk, Su-Pa, Pl, Sr 3: 60°, J, N, Cl+Blk, Su-Pa, Pl, Sr 4: 30°, J-Sh, Vn-N, Cl, Su-Pa, Pl, S-Slk 5: 75-80°, J, N, Cl, Su-Pa, Pl-Wa, Sr-R					
	47		4										6	
3016	48				2								1420	
	49								Bottom of boring at 49 feet					
3014	50													
	51													
3012	52													
	53													
3010	54													
	55													
3008	56													
	57													
3006	58													
	59													
3004	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-14

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Figure A-14

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-15

Sheet 1 of 3

Date(s) Drilled	**01/08/09**	Logged By	**S. Clay**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/NQ Core**	Drill Bit Size/Type	**7.5" HSA/NQ #2**	Total Depth Drilled	**38.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3059 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.584', W116°41.040'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Loose, moist, reddish brown silty SAND (SM), with abundant organics					
3058	1													
	2								GRANITIC ROCK Granodiorite, reddish brown, phaneritic, coarse grained, highly weathered, very weak. Fragments to very dense, moist, silty SAND (SM) with clay					
3056	3													
	4													
3054	5				--						1	50/4"	1000	
	6				--									
3052	7	1		0	--	0	NR							
	8		1		--									
3050	9				--									
	10				--		NR		Becomes light brownish gray, highly to moderately weathered, weak to moderately strong				1010 1025	
3048	11				1			1	1: 25°, J, Vn, No, N, Pl, Sr					
	12	2		80	0	0								
3046	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-15

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Figure A-15

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-15

Sheet 2 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3046	13				1		2		2: 70°, J, N, Fe, Su, Pl, Sr					
	14				1		3		3: 10°, J, W, No, N, Pl, Sr					
3044	15				0				Becomes moderately to slightly weathered, strong				1040 1045	
	16				2		1 2							
3042	17	3		100	2	90	3 4						9	DUW(152), UCS
	18				2									
3040	19		1		0		5 6		4: 50°, J, N, Fe, Su, Pl, Sr 5: 20°, J, N, Fe, Su, Pl, Sr					
	20				1		1						1120 1124	DUW(161), UCS
3038	21				0				Becomes slightly weathered, strong 1: 60°, J, N, Fe, Sp, Pl, R 2: 10°, J, T, No, N, Pl, R					
	22	4		100	1	100	2						10	
3036	23				1		3		3: 60°, J, N, Mn, Su, Pl, Sr					
	24				1		M							DUW(161), UCS
3034	25				--								1155 1305	DUW(157), UCS
	26				1		1		1: 10°, J, Vn, Sa+Fe, Sp, W, R				12	
3032	27	5	2	98	3	68	2 3 2		2: 30°, J, Mw, Sa, Pa, W, R 3: 30°, J, Vn, Fe, Su, Pl, S					
	28				0									
3030	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-15

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Figure A-15

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-15

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3030	29				1		4		4: 80°, J, Vn, Fe, Su, Pl, S 5: 10°, J, Vn, No, No, Pl, S					
							5						1330	
3030	30						1						1340	
					1				1: 30°, J, W, No, No, Pl, Sr 2: 70°, J, W, No, No, Pl, Sr 3: 0°, J, W, Fe, Pa, Pl, Sr 4: 40°, J, T, H, No, Pl, Sr					
3028	31						2							
							3		5: 20°, J, W, Fe, Su, Pl,Sr					
					4		4							
3028	32						M							
		6		100		88							11	
					1		5							
3026	33													
					0									
3026	34		2											
					--				Becomes slightly weathered to fresh, very strong				1403	
							NR						1500	
3024	35						1		1: 30°, J, T, Fe, Su, Pl, Sr					
					2									
3024	36						2						6	
		7		88	0	75								
3022	37													
					0									
	38						2							
					2+		2		2: 10°, J, T, Fe, Su, Pl, Sr				1610	
									Bottom of boring at 38.5 feet					
3020	39													
	40													
3018	41													
	42													
3016	43													
	44													
3014	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-15

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Figure A-15

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-16

Sheet 1 of 3

Date(s) Drilled	**01/07/09**	Logged By	**S. Clay**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/NQ Core**	Drill Bit Size/Type	**8" finger bit/NQ #2**	Total Depth Drilled	**30.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3053 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.564', W116°40.051'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Medium dense, moist, reddish brown, clayey SAND (SC)				0930	
3052	1													
	2								GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, coarse grained, completely to highly weathered, extremely weak. Fragments to very dense, moist, silty SAND with gravel (SM)					
3050	3													
	4													
3048	5				--		NR						1000	
	6				--								1100	WC(4)
3046	7	1		66	0	0*					1	85	20	
	8				0									
3044	9		1		0									
	10				0				Becomes highly weathered, weak				1115	
3042	11				1								1125	*Rock does not meet soundness requirements
	12	2		100	1	0*	1		1: 70°, J, T, H, N, Pl, R				15	
3040	13													

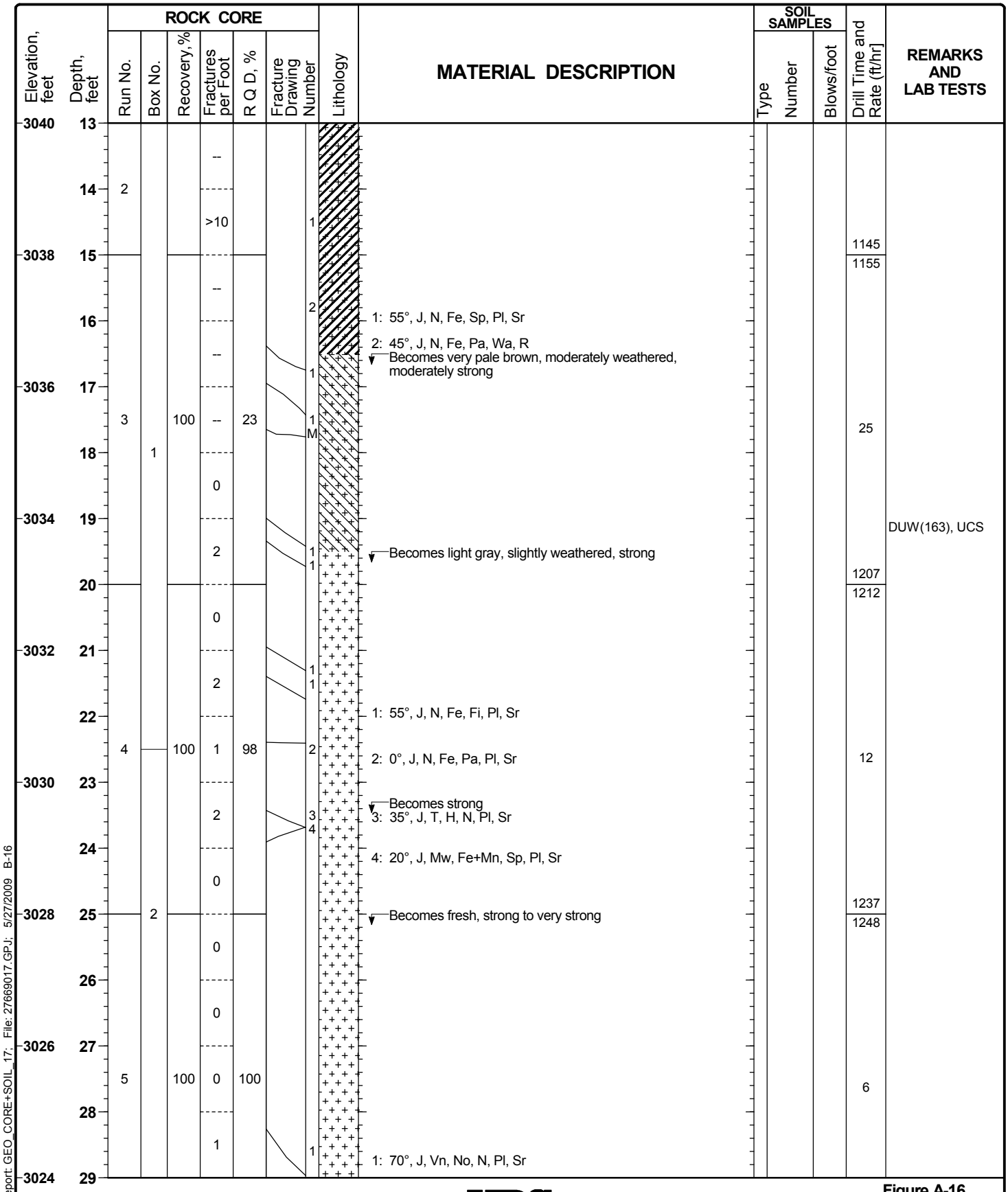
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-16

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Figure A-16

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-16



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Figure A-16

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-16

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3024	29	5	2	100	--	100							1335	
	30								Bottom of boring at 30 feet					
3022	31													
	32													
3020	33													
	34													
3018	35													
	36													
3016	37													
	38													
3014	39													
	40													
3012	41													
	42													
3010	43													
	44													
3008	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-16

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Figure A-16

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-17

Sheet 1 of 2

Date(s) Drilled	**01/16/09 - 01/19/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**29.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3018 feet MSL**
Groundwater Level	**None encountered**	Location	**N32° 48.591', W116° 41.106'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3018	0								RESIDUAL SOIL Soft, moist, dark brown, sandy, fine to medium SILT (ML), trace coarse sand and organic material		1A			
	1													WC(7), CORR, COMP
3016	2								GRANITIC ROCK Granodiorite, light orangish brown, phaneritic, coarse grained, completely weathered, extremely weak. Fragments to very dense, moist, poorly graded fine SAND with silt (SP-SM)		1	54		WC(5)
	3										1A			SA(34), WC(7)
3014	4													
	5								Fragments to very light orangish yellow, fine to coarse SAND (SP), some silt		2	50/3"		
3012	6													
	7								Becomes brownish gray, moderately weathered, strong				1220	
3010	8				0		NR							
		1		47	1	23							23	
	9						1		1: 70°, J, Mw, Fe, Sp-Su, Wa-St, R-Vr					
					1		2		2: 0°, J, N, Fe, Sp, Pl, Sr					
3008	10		1				3		3: 45°, J, N, Fe, Sp-Su, Pl, Sr Becomes slightly weathered				1228	
							1						1240	
					5		2							
	11						3							
							4							
					2		5		1: 40°, J, N, Fe+Py, Sp, Pl-Wa, Sr-R 2: 20°, J, N, H+Cl, Fi, Wa, Sr-R 3: 0°, J, Mw, Cl, Su, Wa, Sr-R 4: 30°, J, N, H+Cl, Fi, Pl-Wa, Sr-R 5: 70°, J, N, H+Fe, Fi, Pl, Sr					
3006	12						6		6: 20°, J, N, Fe, Sp, Pl-Wa, R-Vr				12	
		2		100	0	78								DUW(161), UCS
	13													

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Figure A-17

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-17

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	13				0									
3004	14			100	1	78	7		7: 80°, J, N, Fe, Su, Pl, Sr-R				1306	
	15				--		NR						1324	
							1		1: 12°, J, N, Fe, Su, Pl, Sr					
							2		2: 25°, J, N, Fe, Su, Pl, Sr					
									3: 90°, J, N, Fe, Su, Pl-Wa, Sr					
3002	16		1				3		4: 65d, J, N, Fe, Sp-Su, Pl, Sr					
									5: 10°, J, N, Fe, Sp, Pl, R					
					3		4		6: 30°, J, N, Fe, Sp-Su, Pl, Sr					
							5		7: 60°, J, N, H+Cl/Fe, Fi, Pl, Sr					
	17						6		8: 70°, J, N, Fe, Sp-Su, Pl, Sr					
							7		9: 45°, J, N, Fe, Sp-Su, Pl-Wa, Sr-R					
							8		10: 0°, J, N, Fe, Sp, Pl, Sr-R					
		3		96	5	48	9		11: 80°, J, N, Fe, Su, Pl, Sr				8	
							10		12: 40°, J, N, Fe, Sp, Pl-Wa, Sr					
3000	18						11		13: 10°, J, N, Fe, Sp-Su, Pl, Sr					
					3		12							
	19						13							
					1									
2998	20						1						1400	
					1				Becomes slightly weathered to fresh				1408	
	21						2							
					1									
2996	22						3							
		4		100	1	100							5	
	23													
					1		4							
2994	24		2											
					1		5							
	25						1						1504	
									1: 10°, J, N, Fe, Sp-Su, Pl-Wa, Sr				0856	
					1				2: 8°, J, Mw, Fe, Sp-Su, Pl+St, R					
2992	26						2		3: 20°, J, N, H+Fe, Fi, Pl-Wa, Sr					
							3							
		5		100	2	97							6	
	27													
					0								0921	
2990	28												1000	
		6		25	0	0							3	
									Bottom of boring at 29 feet				1020	
	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-17

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Figure A-17

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-18

Sheet 1 of 4

Date(s) Drilled	**01/15/09**	Logged By	**D. Rector/P. McDonald**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**49.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3078 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.559', W116°40.948'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3078	0								RESIDUAL SOIL Medium stiff, moist, brown, sandy lean to fat CLAY (CL-CH)					
	1													
3076	2										1	7		WA(73), WC(18)
	3													
3074	4								GRANITIC ROCK Granodiorite, light gray, phaneritic, fine grained, highly to completely weathered, extremely weak. Fragments to a hard, fine sandy lean CLAY (CL) with <0.75 inches of carbonate					
	5										2	31		WC(8)
3072	6										3			SA(53), WC(4), COMP, CORR
	7								Becomes light yellowish brown, coarse grained, highly weathered. Fragments to very dense, moist, clayey coarse SAND (SC)		4	140		WC(2)
3070	8													
	9										5	50/2"	1042	WC(3)
3068	10				1		1		Becomes light gray, medium grained, moderately weathered, strong 1: 36°, J, N, Fe, Sp, Pl, R					
	11	1	1	38	1	33	NR						6	
3066	12				--									
	13				--								1122	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-18

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Figure A-18

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-18

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	13				2		1		Becomes medium gray, medium grained, moderately to slightly weathered, moderately strong to strong				1126	
3064	14				2		2							
	15	2		100	2	67	3 4 5		1: 30°, J, Mw, Cl+Sd, Fi, Pl, R 2: 70°, J, N, Fi, Sp, Pl, S 3: 25°, J, Mw, Cl, Fi, Pl, S 4: 10°, J, N, Fi, Sp, Ir, Vr 5: 10°, J, N, Fi, Sp, Wa, Vr 6: 40°, J, N, Fi, Sp, Pl, S 7: 30° J, N, Fi, Sp, Wa, R 8: 70°, J, N, Fe, Fi, Wa, Sr 9: 50°, J, N, Fe, Sp, Wa, Sr 10: 50°, J, N, Fe, Sp, Wa, Sr 11: 70°, J, N, Fe, Sp, Wa, Sr				10	
3062	16				3		6 7 8							
	17				3		9 10 11							DUW(159), UCS
3060	18												1128	
	19	3	1	100	1 1	92	1 2 3		1: 60°, J, N, Fe, Su, Wa, S 2: 45°, J, N, Fe, Su, Pl, S 3: 5-10°, J, M, Fe, Sp, Ir, R 4: 40-50°, J, Vn, healed, Wa 5: 35-40°, J, N, Fe, Sp, Ir, Vr 6: 0-5°, J, T, No, No, Pl, Sr				1212 5	
3058	20													
	21				3		4 5 6							
3056	22				0									
	23												1312	DUW(160), UCS
3054	24	4		90	2 2	70	1 2 3 4 5 6		1: 45°, J, N, Fe, Sp to Fi, Pl, S 2: 10°, J, N, Fe, Sp, Ir, R 3: 30°, J, N, Fe, Fi, healed 4: 10-15°, J, N, Fe, Fi, Ir, R 5: 10-15°, J, N, Fe+Cl, Fi, W, R 6: 45°, J, N, Fe, Fi, S 7: 10-15°, J, N, Fe, Fi, Ir, R 8: 70°, J, Fe, Su, Pl, S 9: 10-15°, J, N, Fe, Fi, Ir, R				1319 16	
	25													
3052	26		2		0		6 7 8 9							
	27				--		NR						1338	
3050	28				4		1 1 1						1345	
	29													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-18

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Figure A-18

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-18

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				10+		1		Becomes weak to moderately strong					
3048	30	5		100	5	50	1 1 1 2						15	
	31				2				1: 10-30°, J, N to Vn, Fe, Sp, Wa, R 2: 45°, J, N, Fe, Fi, Wa, S 3: 30°, V, W, Qz, Fi, Pl, S-Sr					
3046	32				0		3 1						1404	
	33				1		1						1407	DUW(162), UCS
3044	34				1		2		Becomes medium gray with orange gray staining, moderately to highly weathered, weak					
	35	6	2	100	3	60	3 4		1: 40°, J, N, Fe, Sr, Pl, R 2: 30°, J, N, F, Su, Wa, R 3: 20°, J, N, Fe, Sp, Wa, R 4: 40°, J, N, Fe, Sp, Wa, R				19	
3042	36				20		5		5: Fracture zone, N to T, Fe, Sp, Wa					
	37				10		6 7 8 9		Becomes light gray, slightly weathered, strong 6: 45°, J, T, H, N, Wa, R 7: 45-50°, J, N, Fe, Su, Wa, R 8: 76°, J, N, Fe, Su, Pl, S 9: 10-20°, N, Fe, Sp, Wa, R				1423	
3040	38				4		1		Becomes slightly weathered, strong				1489	
	39				10		2 3 2							
3038	40	7		100	10	33	2 2 2 2		1: 65°, J, Fe, Su, Pl-Wa, Sr 2: 10°, J, Fe, Su, Pl-Wa, Sr 3: 45°, J, Fe, Su, Pl-Wa, Sr				10	
	41				3		2 2 2 2 2							
3036	42		3		3		2						1501	
	43				1		1		Becomes light gray, moderately weathered				1508	DUW(162), UCS
3034	44			97	4	87	2 3 4		1: 30°, J, N, Fe, Pa, Pl, S 2: 80°, J, Fe, Su, Wa, R 3: 0°, J, Fe, Su, Wa, R 4: 70°, J, Fe, Su, Wa, R 5: 55°, J, Fe, Sp, Pl, S 6: 90° to 70°, J, Fe, Sp, Ir, R 7: 45°, J, Fe, Sp, Pl, S				10	
	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-18

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Figure A-18

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-18

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	45						5							
		8		97	2	87	6		Becomes fresh, very strong					
3032	46												10	
					1		7							
	47		3											
					0									
3030	48												1540	
									Becomes very light gray, very coarse grained to pegmatic				1545	
		9		66	2	66	1		1: 70°, J, N, No, N, Pl to Wa, R				3	
	49						2		2: 10°, J, N, No, N, It, R					
					--								1610	
									Bottom of boring at 49.5 feet					
3028	50													
	51													
3026	52													
	53													
3024	54													
	55													
3022	56													
	57													
3020	58													
	59													
3018	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-18

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Figure A-18

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-19

Date(s) Drilled	**01/08/09 - 01/09/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**39.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3061 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.527', W116°40.954'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Dense, moist, dark brown, silty CLAY (CL), with sand, some organics					
3060	1													
	2								Dense, moist, greenish brown, sandy CLAY (CL), coarse grained sand					
3058	3								Loose, moist, brown, silty SAND (SM)					
	4													
3056	5								GRANITIC ROCK Quartz Monzodiorite, greenish gray, phaneritic, coarse grained, highly to completely weathered, extremely weak. Fragments to medium dense, moist, clayey SAND (SC)		1	20		SA(41), WC(11)
	6													
3054	7													
	8													
3052	9				--				Fragments to dense, moist, lightish green gray, clayey SAND (SC)		2	37	1520	WC(4)
	10				--									
3050	11	1	1	30	--	0	NR						33	
	12				--									
3048	13						1		Becomes greenish gray, highly weathered, very weak to weak					

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-19

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Figure A-19

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-19

Sheet 2 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3048	13				2		NR	M	1: 0°, J, Mw, Fe, Sp, Wa+St, R					
	14							2	2: 0°, J, Mw, Fe, Sp, Wa to St, R				1529	
					--								1533	
3046	15				--									
	16						NR							
		2		4	--	0							25	
3044	17													
	18				--									
3042	19				--								1545	
													1550	
	20				0									
					1									
3040	21		1				1		1: 8°, J, N, H+Fe, Fi, Pl, Sr					
		3		96	4	0*			2: 65°, J, Mw, H+Fe, Fi, Pl, Sr 3: 0°, J, Mw, Fe, Sp-Su, Wa+St, R-Vr				23	*Rock does not meet soundness requirements
	22						2		4: 0°, J, Wa, Fe, Su, Wa+St, R-Vr					
					1		3							
3038	23						4							
					1									
	24						NR						1603	
					1			1					1608	
3036	25								Becomes medium gray, slightly weathered, strong to very strong					DUW(180), UCS, MOD
					0									
	26													
		4		80	0	56							9	
3034	27								1: 12°, J, Mw, No-Fe, N-Sp, Pl, Sr					
					2		2		2: 50°, J, N, Fe, Sp-Su, Wa, Sr					
	28						3		3: 75°, J, N, Fe, Su, Pl, Sr					Driller report; soft drilling at 28-29'
					0		NR							
3032	29												1642	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-19

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Figure A-19

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-19

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3032	29				2		1 2 3		Becomes light brownish gray, moderately weathered, moderately strong				0839	
3030	31	5		100	2 3	46	4 5 6 7 8 9 10 11 12 13 14 15		1: 20°, J, N, Fe, Su, Pl-Wa, Sr 2: 0°, J, N, Fe, Su, Pl-Wa, Sr 3: 45°, J, Vn, H+Fe, Fi, Pl, Sr 4: 85°, J, N, Fe, Su, Pl, Sr 5: 60°, J, Mw, Fe, Su, Pl, Sr 6: 5°, J, Mw, Fe, Sp-Su, Pl-Wa, Sr 7: 77°, J, Mw, Fe, Su, Pl, Sr 8: 30°, J, N, Fe, Sp-Su, Pl-Wa, Sr 9: 15°, J, N, Fe, Sp-Su, Pl-Wa, Sr 10: 63°, J, Vn, H+Fe, Fi, Pl, Sr 11: 90°, J, Vn, H+Fe, Fi, Pl-Wa, Sr 12: 20°, J, Vn, H+Fe, Fi, Wa, Sr 13: 10°, J, Mw, Fe, Su, Pl, Sr-R 14: 25°, J, N, Fe, Su, Pl, Sr 15: 23°, J, N, Fe-No, N-Sp, Pl, Sr				15	
3028	33		2		5 3								0859	
3026	34				0	NR			Becomes slightly weathered to fresh, strong to very strong				0910	
3024	36	6		82	2 2 1 1	66	1 2 3 4 5 6		1: 18°, J, N, Fe, Sp-Su, Pl, Sr 2: 15°, J, N, Fe, Sp-Su, Pl, Sr 3: 18°, J, N, Fe, Sp-Su, Pl, Sr 4: 5°, J, N, Fe, Sp-Su, Pl, S 5: 26°, J, N, Fe, Sp-Su, Pl-Wa, Sr 6: 53°, J, N, Fe, Sp-Su, Pl, Sr				12	
3022	39								Bottom of boring at 39 feet				0935	
3020	41													
3018	43													
3016	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-19

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Figure A-19

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-20

Sheet 1 of 4

Date(s) Drilled	**01/12/09 - 01/14/09**	Logged By	**D. Rector**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #6**	Total Depth Drilled	**50.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3071 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.495', W116°40.942'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	0								RESIDUAL SOIL Very dense, dry, dark yellow orange, silty fine to medium SAND (SM)					
3070	1													
	2								GRANITIC ROCK Quartz Monzodiorite, dark yellowish orange, completely weathered. Fragments to very dense, moist, fine to medium SAND (SP)					
3068	3													
	4													
3066	5										1	50/3"		
	6													
3064	7													
	8													
3062	9								Becomes highly weathered, weak to very weak		2	50/3"	1350	
	10				--									
3060	11				--								17	
	12	1	1	0	--	0	NR							
3058	13				--									

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-20

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Figure A-20

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-20

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3058	13				--									
	14				0				Becomes medium dark gray, moderately weathered, strong				1608 1511	
3056	15		1		--									
	16	2		20	--	0	NR						18	
3054	17				--									
	18				--									
3052	19												1628 0830	
	20				10+		1 2		1: 0-45°, J, N, Fe, Su, Ir, R 2: 70°, J, N, Fe, Su, Wa, Sr					
3050	21	3		32	--	18	NR						5	
	22		1		--									
3048	23								Becomes slightly weathered to fresh, strong to very strong				1910	
		4		100	0	100							-- 0925	DUW(177), UCS
	24				1								0928	
3046	25						1 2		1: 45°, J, N, Fe, Su, W, R 2: 20°, J, N, Fe, Su, W, R					
	26				1									
		5		100		100	3		3: 20°, J, N, Fe, Su, W, R				6	
3044	27				0									
	28													
					0									
3042	29												1020	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-20

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Figure A-20

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-20

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3042	29				2									DUW(172), UCS
	30				1		1 2		1: 20°, J, T, No, Wa, Sr 2: 20°, J, T, No, Wa, Sr 3: 70°, J, T, Fe, Su, Wa, R 4: 70°, J, , T, Fe, Su, Wa, R					
3040	31						3 4							
		6		100	10+	40			Becomes highly weathered, weak					
3038	32				10+									
	33						M							
					0									
	34						1						1115	
							2 3		1: 45°, J, N, Fe, Su, Wa, R 2: 35°, J, N, Fe, Su, Wa, R 3: 0°, J, N, Fe, Su, Wa, R				1120	
3036	35				4		4		4: 0-10°, J, N, Fe+Cl, Sp, R					
							4							
					2									
	36													
		7		100	2	40	4 5 6		Becomes slightly weathered, strong 5: 90°, J, N, Fe, Su, Pl-Wa, Sr 6: 190°, J, N, Fe, Su, Wa, R 7: 20°, J, N, Fe, Su, Wa, Sr				5	
3034	37													
					5		6 M							
	38		2				6 6 7							
					5									
3032	39												1240	
													1244	
					0									
	40													
					1		1							
3030	41													
		8		100	3	93	2		1: 0-5°, J, N, Fe, Su, St, R 2: 0-5°, J, N, Fe, Su, Wa, Sr					
	42						3							
					4		4		Granodiorite, light gray, medium grained					
3028	43						5							
					1				3: 30-40°, J, N. Fe. Pa, Wa, Sr 4: 45°, J, Fe, Su, Wa, Sr 5: 0-5°, J, N, No, Wa, R				1500	
	44						1						1505	
					4		2 3 4		Becomes granodiorite, light gray, slightly weathered to fresh, strong 1: 15°, J, N, Fe, Su, Wa, R 2: 20°, J, N, Fe, Su, Wa, R					
3026	45													

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Figure A-20

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-20

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3026	45													
		9	2	98	2		M 5 6 M M M M M M M M M		3: 0°, J, N, No, Wa, R 4: 25°, J, Fo, N, No, Pl, S 5: 45°, J, N, Fe, Su, Pl, S 6: 45°, J, N, Fe, Su, Pl, S				5	
	46				0									
3024	47												1545	
					--								0815	
	48	10		80	0	80	M						4	
3022	49				--									
							NR						0900	
	50								Bottom of boring at 50 feet					
3020	51													
	52													
3018	53													
	54													
3016	55													
	56													
3014	57													
	58													
3012	59													
	60													
3010	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-20

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Figure A-20

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-21

Sheet 1 of 3

Date(s) Drilled	**01/05/09**	Logged By	**S. Clay**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/NQ Core**	Drill Bit Size/Type	**7.5" finger bitA/NQ #2**	Total Depth Drilled	**40.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3077 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.471', W116°40.936'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3076	0								RESIDUAL SOIL Medium dense, moist, reddish brown, silty SAND with clay (SM)					
	1													
	2								GRANITIC ROCK Quartz Monzodiorite, gray, phaneritic, medium grained, highly weathered, extremely weak. Fragments to very dense, moist, gravelly clayey SAND (SC)					
3074	3													
	4													
3072	5										1	65		SA(29), WC(6), CORR
	6													
3070	7													
	8													
3068	9													
	10				--				Becomes highly to moderately weathered				1136	
3066	11		1		--		NR							
	12	1		4	--	0								
3064	13													

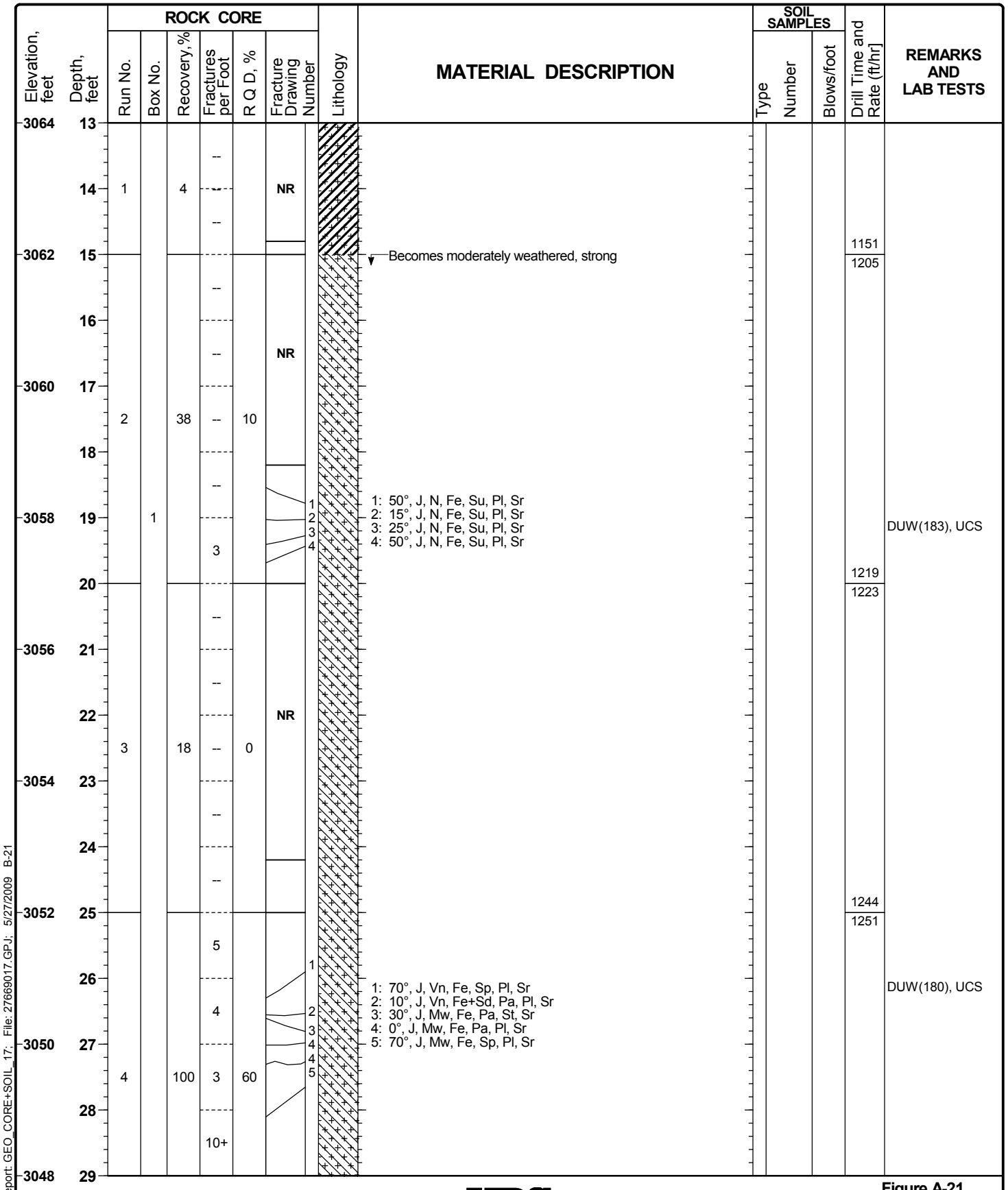
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-21

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Figure A-21

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-21



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-21

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Figure A-21

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-21

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3048	29	4		100	7	0							0105	
	30				--								0230	
3046	31				--									
	32				-----		NR							
		5	1	6	--	0								
3044	33				-----									
	34				--									
	35				-----								0248	
3042					--								0258	
	36	6		0	-----	0	NR							
3040	37				--								0330	
					-----		1						0335	
	38						2		1: 30°, J, Vn, No, N, Pl, Sr					
		7		100	3	20	2		2: 30°, J, N, No, N, Pl, Sr					DUW(168), UCS
3038	39				-----		2							
					10+								0345	
	40								Bottom of boring at 40 feet					
3036	41													
	42				-----									
3034	43													
	44				-----									
3032	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-21

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Figure A-21

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-22

Sheet 1 of 3

Date(s) Drilled	**12/31/08**	Logged By	**M. Higgins**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #4**	Total Depth Drilled	**42.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3090 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.465', W116°40.901'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3090	0								RESIDUAL SOIL Medium stiff, moist, reddish brown, fat CLAY (CH) with sand and some gravels, contains some organics					
	1													
3088	2										1			
	3								Stiff to very stiff, moist, brown to strong brown, fine sandy lean CLAY (CL)					
3086	4													
	5										2	95/8"		WC(7)
3084	6								GRANITIC ROCK Granodiorite, light brown, medium to coarse grained, completely weathered, extremely to very weak. Fragments to very dense, moist, sandy lean CLAY (CL) to clayey SAND (SC)					
	7													
3082	8													
	9				--								0920	
3080	10				--		M				3	50/5.5"		
	11		1				M							*Rock does not meet soundness requirements
		1		70	1	0*	1		1: 30°, J, N-Mw, Fe, Su-Pa, Pl, Sr-R 2: 60°, J, N-Mw, Fe, Su-Pa, Pl, Sr-R					
3078	12				2		2		Becomes weak					
	13						2							

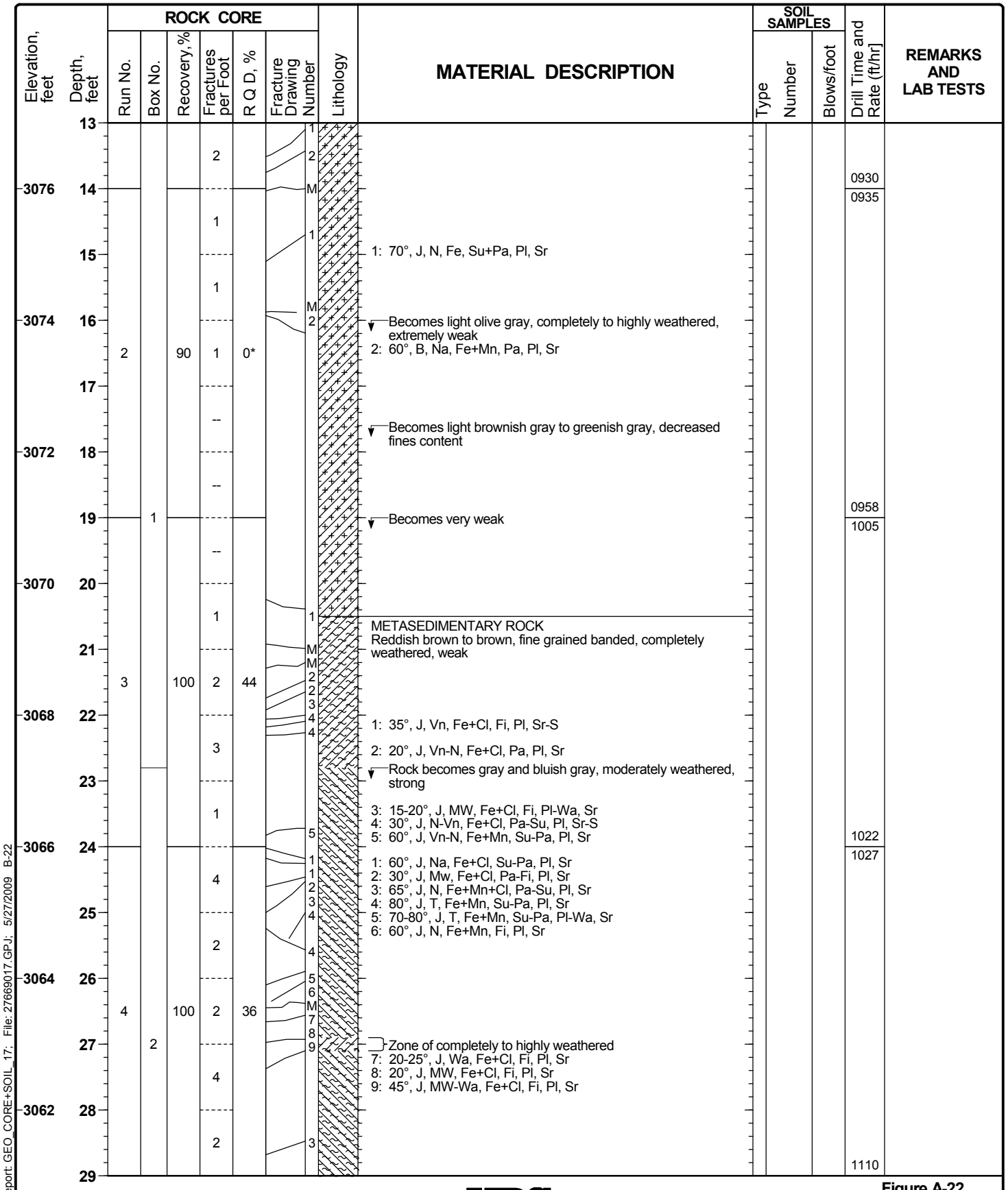
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-22

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Figure A-22

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-22



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-22

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Figure A-22

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-22

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				2								1115	DUW(171), UCS
3060	30				1		1 2		1: 10°, J, N, Fe, Su, Pl, Sr 2: 15-20°, J, N, Fe, Su, Pl, Sr 3: 75-80°, J, N, Fe,+Mn,+Cl, Su-Pa, Pl-Wa, Sr-R 4: 75-80°, J, N-Vn, Fe+Cl, Su, Wa, Sr-R					
	31	5		100	2	62	M 3 4							
3058	32				5		2 5 1 1 5		5: 60°, J, Vn, Fe+Mn, Su, Pl-Wa, Sr 6: 75°, J, N, Fe+Cl, Fi, Pl, Sr					
	33		2		1		M 6 M M							
3056	34								Becomes moderately strong				1131 1136	
	35	6			10+ 5	0	1		1: 75-80°, J, Fe+Sd, Su-Sp, Wa, R					
3054	36						1						1210	
	37				4		1		1: 10°, J, N, Mn+Fe, Su-Sp, Pl, Sr 2: 50°, J, N, Mn+Cl, Su, Wa, Sr-R 3: 10-15°, J, N-Mw, Fe+Cl, Fi, Wa, Sr-R				1215	
3052	38	7	3	100	2 10+	20	2 3							
	39						M						1220 1230	
3050	40				1		M 1		1: 60°, J, Vn, Fe+Mn, Sp, Pl, Sr-R 2: 25°, J, Vn, Fe, Sp, Pl, Sr 3: 65-70°, J, Na, Fe, Su, Wa, R 4: 10°, J, Vn, Fe, Su, Pl, Sr 5: 80°, J, N, Fe+Mn, Pl, Sr-S 6: 60°, J, Na, Fe+Mn, Su-Sp, Pl, Sr-S					
	41	8		100	3	31	2 M 3							
3048	42				4 --		2 4 5 6						1242	
	43								Bottom of boring at 42.5 feet					
3046	44													
	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-22

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Figure A-22

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-23

Sheet 1 of 4

Date(s) Drilled	**01/05/09**	Logged By	**D. Rector**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" finger bit/HQ3 #4**	Total Depth Drilled	**59.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3086 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.446', W116°40.882'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3086	0								RESIDUAL SOIL Medium dense, moist, reddish brown, clayey SAND (SC)					
	1								METASEDIMENTARY ROCK Light brown to brown, fine grained, completely to highly weathered, extremely weak. Fragments to very dense, moist, clayey SAND (SC)					
3084	2													
	3													
3082	4													
	5										1	50/5"		SA(32), WC(6)
3080	6													
	7													
3078	8													
	9								Becomes highly weathered, weak to very weak		2	50/4"	1010	
3076	10				--									
	11	1	1	0	--	0	NR						20	
3074	12				--									
	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-23

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Figure A-23

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-23

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	13				--									
3072	14						NR		Becomes weak				1025	
													1036	
	15				--									
					--									
3070	16						M							
		2		66	0	0	M							
	17						M		1: 25°, J, N, Fe, Su, Pl, Sr 2: 80°, J, N, Fe, Su, Pl, Sr				21	
					0									
3068	18						M							
					1		M							
							1							
	19						M						1050	
													1104	
					--									
3066	20		1											
					--									
	21						NR							
		3		12	--	0							27	
3064	22													
					--									
	23													
					--									
							M							
							M							
3062							M						1115	
	24						M						1120	
					--		NR							
	25								1: 15°, J, N, Cl, Pa, Pl, S 2: 70°, J, N, Cl, Pa, Pl, S					
					3		1							
3060	26						2							
		4		80	1	0							6	
	27						2							
					1									
							2							
3058	28						M							
					--		M							
							M							
							M							
	29												1207	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-23

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Figure A-23

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-23

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				--								1212	
3056	30		1						1: 70°, N, Fe, Su, Pl, S					
					1				2: 50°, N, Fe, Su, Pl, S					
	31						1		3: 40°, N, Fe, Su, Pl, S					
		5		100	3	0			4: 10°, N, Fe, Su, Pl, S				11	
3054	32						2							
					3		2 3							
	33						4		Becomes moderately weathered, moderately strong					
					--									
							M						1240	
3052	34						M 1		Becomes strong				1245	
					2		2 3							
	35						4		1: 10°, J, N, Fe, Sp, Pl, Sr					
					2		5 1		2: 0°, J, N, Fe, Sp, Pl, Sr					
3050	36								3: 20°, J, N, Fe, Fi, Pl, Sr 4: 45°, J, Mw, H, No, Pl, Sr					
		6		100	2	54	4		5: 70°, J, Mw, Fe, Fi, Pl, Sr				7	
	37						8 6							
					3				6: 0°, J, MW, Fe, Sp, Pl, Sr					
									7: 10°, J, N, Fe, Sp, Pl, Sr					
3048	38		2				7		8: 25°, J, N, Fe, Sp, Pl, Sr					
					3									
							8						1330	
	39						1 2		Becomes light gray, slightly weathered, strong				1351	
					2									
3046	40								1: 0°, J, N, No, N, Pl, Sr					
					0				2: 60°, J, N, Fe, SU, Pl, Sr					
	41								3: 30°, J, Mw, Fe, Fi, Pl, Sr					
		7		100	0	98							15	
3044	42													
					0									
	43		3											
					1									
3042	44												1410	
					1		1						1425	
		8		100		98							7	
	45													

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Figure A-23

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-23

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	45				0		M		1: 35°, J, N, No, N, Pl, Sr				1439	
3040	46						1						1445	
					3		2		1: 15°, J, N, Fe, Sp, Pl, Sr					
	47						M							
		9		97	2	63	3		2: 20°, J, N, Fe, Sp, Pl, Sr					
									3: 20°, J, N, Fe, Sp, Pl, Sr				10	
3038	48						4		4: 42°, J, N, Fe, Sp, Pl, Sr					
			3		1		M							
							M							
							M						1506	
	49								Becomes slightly weathered to fresh, strong to very strong				1545	
					0									
3036	50								1: 50°, J, Mw, No, N, Pl, R					
					1		1		2: 30°, J, N, Fe, Sp, Pl, Sr					
									3: 40°, J, N, Fe, Sp, Pl, Sr					
	51						2							
		10		100	2	98	3		4: 60°, J, Wa, Fe, Fi, Pl, Sr				9	
3034	52								5: 25°, J, N, Fe, Sp, Pl, Sr					
					3		3							
							4		6: 40°, J, N, Fe, Su, Pl, Sr					
	53													
					4		5							
							6							
3032	54												1620	
													0843	
					1									
	55						1							
					1				1: 18°, J, Mw, Fe, Su, Pl, Sr					
							2		2: 40°, J, Mw, Fe, Su, Pl, Sr					
3030	56		4						3: 70°, J, Mw, Fe, Su, Pl, Sr					
		11		100	0	100			4: 60°, J, Mw, Fe, Su, Wa, Sr					
	57													
					1		M							
3028	58						3							
					1									
							4							
	59								Bottom of boring at 59 feet					
3026	60													
	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-23

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Figure A-23

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-24

Date(s) Drilled	**01/12/09 - 01/13/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**60.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3077 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.470', W116°41.046'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3076	0								RESIDUAL SOIL Loose, moist, brown, sandy SILT (ML), with some coarse sand and organics					
	1													
	2								GRANITIC ROCK Granodiorite, light orangish brown, phaneritic, medium to coarse grained, highly to completely weathered, extremely weak. Fragments to very dense, moist, light yellowish brown, silty SAND (SM), fine to medium grained					
3074	3													
	4													
3072	5				--						1	50/5"	1312	SA(30), WC(7)
	6				--									
3070	7	1	1	0	--	0	NR						43	
	8				--									
3068	9				--									
	10				--				Becomes reddish orange, coarse grained, highly weathered, weak				1319 1343	
3066	11				--		NR						75	
	12	2		8	--	0								
3064	13													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-24

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Figure A-24

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-24

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3064	13				--		NR							
	14				--									
3062	15						M						1347	
													1357	
	16				0									
					0									
3060	17													
		3		100	1	0							14	
	18						1		1: 40°, J, N, Fe, Su, Pl, Sr					
					1									
3058	19						2		2: 0°, J, N, Fe, Su, Wa, Sr					DUW(147)
					1				3: 10°, J, N, Fe, Su, Pl-Wa, Sr					
	20						3						1418	
													1430	
					0									
3056	21		1											
					2		1							
	22						1		1: 18°, J, N, H+Fe, Fi, Pl, Sr					
		4		100	3	20	2		2: 5°, J, Mw, Fe, Sp-Su, Pl-Wa, Sr					
							3		3: 75°, J, N, H+Fe, Fi, Pl, Sr					
							4		4: 50°, J, N, H+Fe, Fi, Pl, Sr				14	
3054	23								5: J, N, H+Fe, Fi, Pl-Wa, Sr					
					2		5		6: 20°, J, N, H+Fe, Fi, Wa-St, Sr					
							6		7: 35°, J, N, H+Fe. Fi, Pl, Sr					
	24													
					1		7							
3052	25												1451	
									Becomes light gray, slightly weathered to fresh, strong to very strong				1500	
					2		1							DUW(164), UCS
	26						2							
							3		1: 30°, J, Mw, Fe, Su, Pl, Sr					
					1				2: 15°, J, Mw, Fe, Sp-Su, Pl-Wa, Sr					
									3: 75°, J, N, H+Fe, Fi, Pl-Wa, Sr				4	
3050	27		2						4: 45°, J, N, Fe, Sp-Su, Pl, Sr					
		5		100	1	94	4		5: 18°, J, N, Fe, Sp-Su, Pl-Wa, Sr					
	28													
					1		5							
3048	29													

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Figure A-24

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-24

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3048	29				1								1610	
	30						6		6: 60°, J, N, Fe, Sp-Su, Pl-Wa, Sr				0841	
					1		1							
3046	31													
					0				1: 80°, J, N, H+Fe, Fi, Pl-Wa, Sr 2: 0°, J, N, No-Fe, Sp-N, Pl, Sr 3: 80-90°, J, N, H+Fe, Fi, Wa, Sr 4: 25°, J, N, Fe, Sp-Su, Pl, Sr 5: 35°, J, N, Fe, Sp-Su, Pl, Sr				4	
	32		2											
		6		100	1	96								
3044	33						2 3							
					3									
	34						4 5							
					0		M						0957	
3042	35						NR						1040	
					2		1							
							1							
	36						1		1: 80°, J, N, H+Fe, Fi, Pl-Wa, Sr 2: 18°, J, Mw, Fe, Sp-Su, Pl-St, Sr 3: 18°, J, Mw, Fe, Sp-Su, Pl, Sr					DUW(162), UCS
					1									
3040	37													
		7		90	2	86							3	
	38						2 3							
					0									
3038	39						M							
					0									
	40												1230	
					0								1313	
3036	41		3						1: 8°, J, Vn, Fe, Fi, Wa, Sr 2: 30°, J, N, Fe, Sp-Su, Pl+St, Sr 3: 0°, J, N, Fe, Sp, Pl-Wa, R 4: 30°, J, N, H+Fe, Fi, Pl-Wa, Sr-R 5: 63°, J, N, Fe, Su, Pl-Wa, Sr 6: 0°, J, N, Fe, Su, Wa, R 7: 18°, J, N, Fe, Su, Pl, Sr 8: 50°, J, N, H+Fe, Fi, Pl-Wa, Sr					DUW(162), UCS
					0									
	42						1							
		8		100	3	88	2 3 4						4	
3034	43						5 6							
					5		7 8							
	44													
					--									
3032	45												1420	

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-24

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Figure A-24

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-24

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3032	45	9		100	0	100	M						1535 1 1635	
	46						NR						0833	
			3		0									
3030	47				1		1		1: 62°, J, N, Fe, Su, Pl+St, Sr				1635	
	48	10		93		93							4	
					1									
3028	49						2		2: 20°, J, N, Fe, Su, Pl, Sr-R					
					0									
	50												0929	
													0946	
					1		1		1: 65°, J, N, Ch+Fe, Sp, Pl, Sr-R					
3026	51		4											
					0								3	
	52													
		11		100	0	90								
3024	53													
					0		M		2: 65°, J, N, Fe, Sp-Su, Pl, Sr					
	54						2		3: 60°, J, N, Fe, Sp, Pl, Sr					
					4		3							
							3							
3022	55						1						1132	
													1142	
					1								1	
	56	12		100		100			1: 65°, J, N, Fe, Sp-Su, Pl, Sr					
					0									
3020	57													
					0								1340	
	58						M						1422	
					2				1: 65°, J, Vn, Fe, Su, Pl, Sr 2: 65°, J, Vn, Fe, Sp-Su, Pl, Sr 3: 90°, J, Vn, H+Fe, Fi, Pl, Sr 4: 65°, J, Vn, H+Fe, Fi, Pl, Sr					
		13		100		72							10	
3018	59						1		5: 30°, J, Mw, Fe, Sp-Su, Pl, Sr					
					3		2 3 4 5							
	60												1437	
									Bottom of boring at 60 feet					
3016	61													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-24

URS

Figure A-24

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-25

Sheet 1 of 3

Date(s) Drilled	**01/09/09**	Logged By	**S. Clay**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/NQ Core**	Drill Bit Size/Type	**7.5" HSA/NQ #2**	Total Depth Drilled	**37.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3065 feet MSL**
Groundwater Level	**None encountered**	Location	**N32°48.499', W116°41.043'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3064	0								RESIDUAL SOIL Loose, moist, reddish brown, fine to coarse GRAVEL (GM) with some organics					
	1													
	2								GRANITIC ROCK Granodiorite, pinkish gray, phaneritic, coarse grained, completely weathered, extremely weak. Fragments to a very dense, moist, silty coarse SAND (SM)					
3062	3													
	4													
3060	5												1000	
					--		NR				1	50/5"	1050	SA(27), WC(3)
	6													
					--			1	1: 40°, J, Mw, Fe, Su, Wa, Sr					
3058	7							2	2: 15°, J, Mw, Fe, Su, Ir, Sr					
		1		66	1	0*							20	*Rock does not meet soundness requirements
	8				1			3	3: 40°, J, Mw, Fe+Su, Fi, Pl, Sr					
3056	9		1					4	4: 20°, J, Mw, Fe, Pa, Pl, Sr					
					10+								1105	
	10												1120	
					1			1	25°, J, W, Fe, Su, Pl, Sr					
3054	11													
				100	0	0*							20	
	12								Becomes highly weathered, moderately strong					
		2			0									
3052	13													

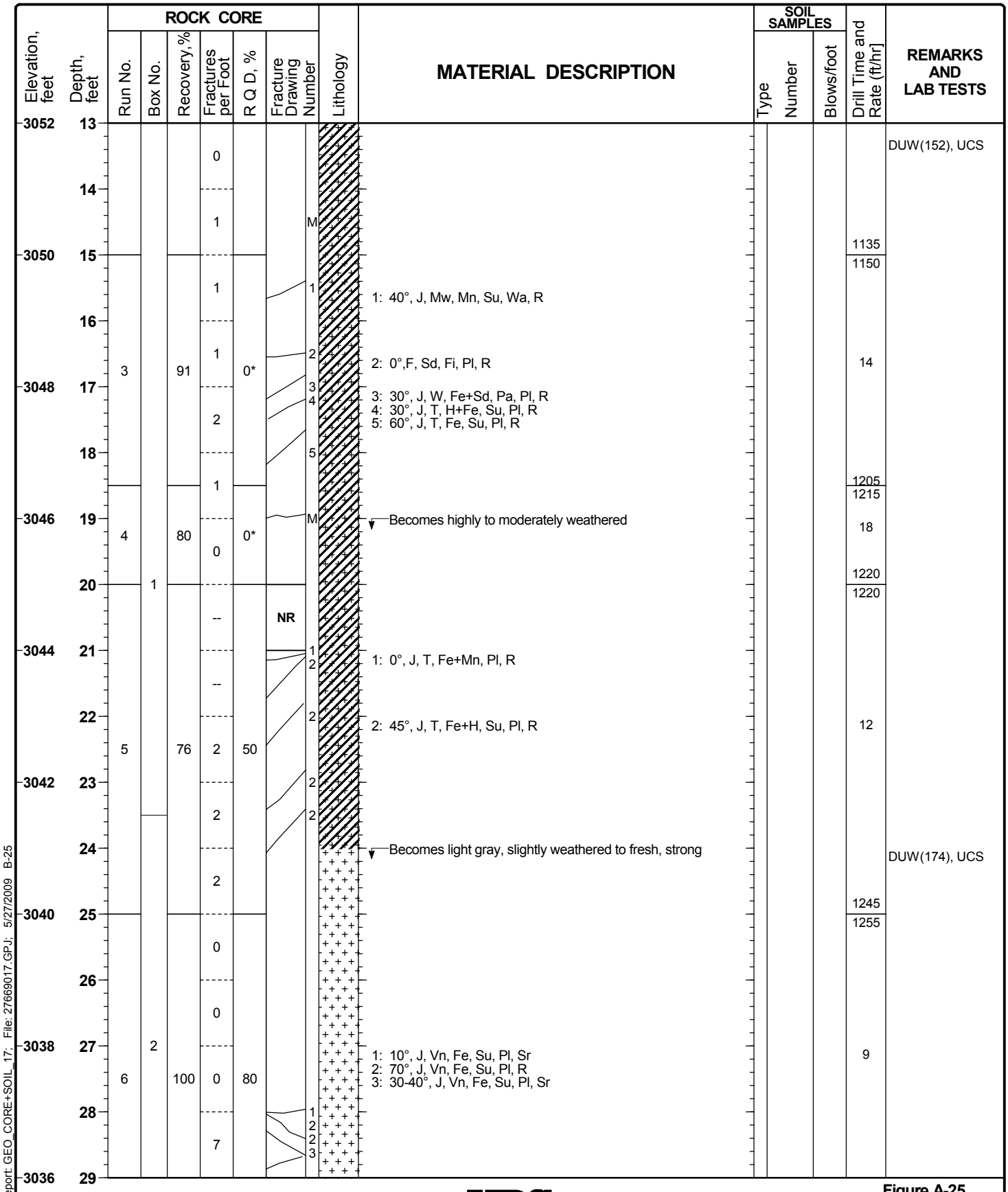
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-25

URS

Figure A-25

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-25



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-25

URS

Figure A-25

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-25

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3036	29		2		0								1330	
	30												1335	
3034	31				0									
					1		1							
3032	32	7		100	5		2 2 2 2 2		1: 25°, J, Mw, Fe, Sp, Pl, Sr 2: 20°, J, Mw, Fe, Su, Pl, Sr 3: 48°, J, N, Fe, Sp, Pl, Sr 4: 20°, J, Mw, Fe, Sp, Pl, Sr				4	
	33						3							
					1									
3030	34						4 M							
	35				1								1423	
													1441	
	36	8		100	0	100								
3028	37				0									
					0				Bottom of boring at 37,5 feet					
	38													
3026	39													
	40													
3024	41													
	42													
3022	43													
	44													
3020	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-25

URS

Figure A-25

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-26

Sheet 1 of 3

Date(s) Drilled	**01/15/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius/C. Goetz**
Drilling Method	**Hollow Stem Auger/HQ3 Core**	Drill Bit Size/Type	**8" HSA/HQ diamond impregnated bit**	Total Depth Drilled	**40.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approx. Surface Elevation	**3044 feet MSL**
Groundwater Level	**None encountered**	Location	**N 32° 48.470', W116° 41.046'**	Inclination from Horizontal/Bearing	**90°**
Borehole Completion	**Bentonite grout**			Hammer Data	**140 lbs/30" drop**

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
3044	0								RESIDUAL SOIL Loose, moist, dark brown, sandy SILT (ML), with cobbles and organics					
	1								Stiff, moist, dark brown, silty CLAY (CL), with trace sand					
3042	2										1	19		WA(36), WC(8)
	3								METASEDIMENTARY ROCK Light orangish brown, fine to medium grained, completely weathered, extremely weak. Fragments to loose, moist, orangish brown, clayey SAND (SC)					
3040	4													
	5								Fragments to medium dense, moist, orangish brown		2	30		SA(24), WC(5)
3038	6													
	7								Fragments to very dense moist, very light grayish brown		3	50/5"		SA(36), WC(5)
3036	8													
	9													
3034	10								Fragments to loose, moist, orangish greenish brown		4	21		WA(45), WC(14)
	11													
3032	12													
	13													

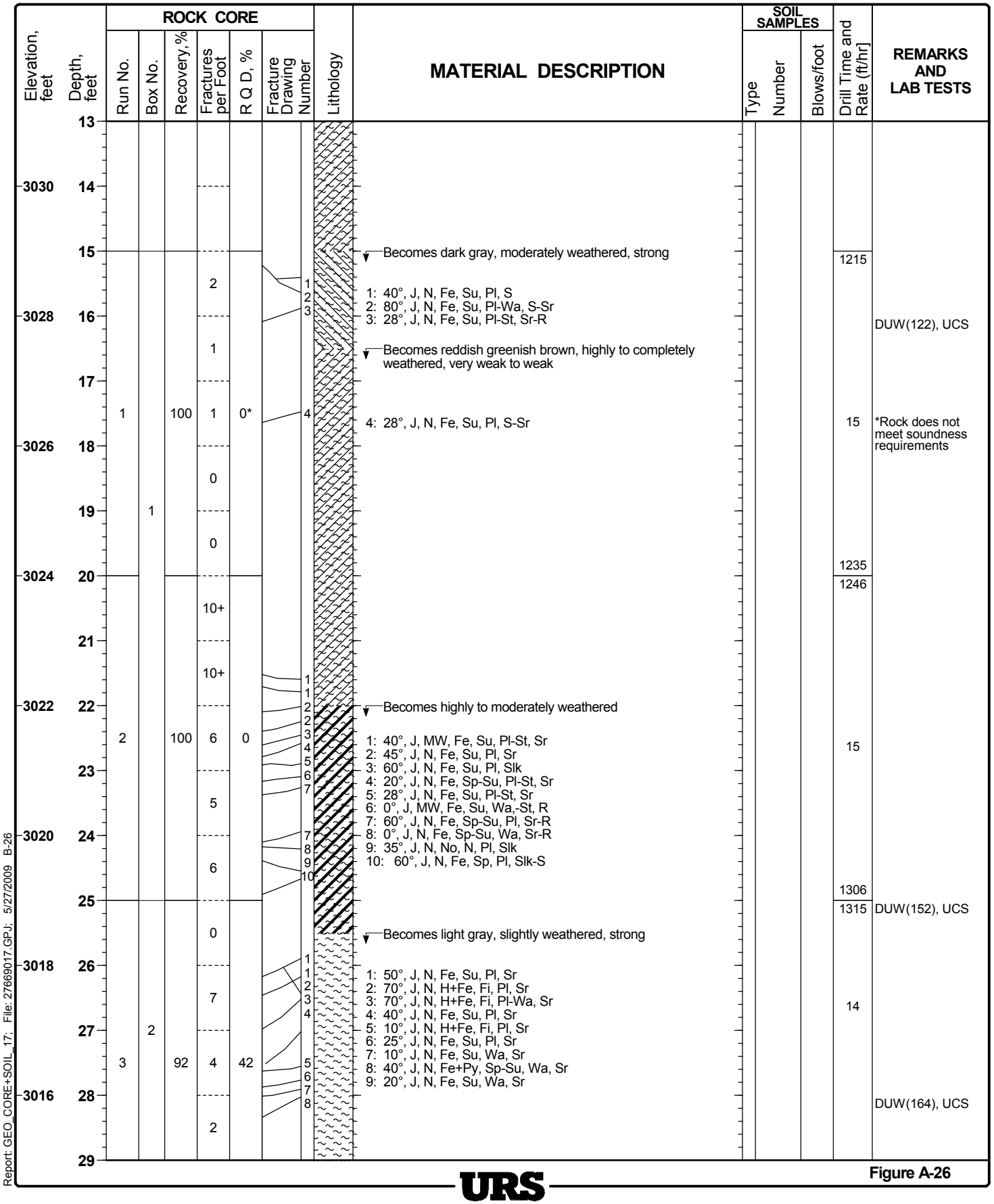
Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-26

URS

Figure A-26

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-26



Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-26

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Figure A-26

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-26

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows/foot	Drill Time and Rate (ft/hr)	REMARKS AND LAB TESTS
	29				5		9 10 11 12		10: 60°, J, N, H+Fe, Fi, Pl-Wa, Sr 11: 10°, J, N, Fe, Su, Pl-St, Sr 12: 60°, J, N, Fe, Su, Pl, Sr				1337	
3014	30								Slightly to moderately weathered, strong very strong				1350	
					2		1 1		1: 60°, J, N, Fe, Su, Pl, S-Sr 2: 60°, J, N, No-Fe, Sp, Pl, S-Sr					
	31								3: 60°, J, N, Fe, Su, Pl, S-Sr 4: 65°, J, N, Py, Sp, Pl, S-Sr					
					4		2 3 4		5: 25°, J, N, Py, Sp, Pl+St, Sr 6: 67°, J, N, Fe+Py, Sp, Wa, Sr					
3012	32		2				5		7: 60°, J, N, Fe+Py, Sp-Su, Pl, S 8: 25°, J, N, No-Py, Sp, Pl, S				11	
		4		100	1	34			9: 90°, J, N, Py, Sp-Su, Pl, S-Sr 10: 20°, J, N, Ch, Sp-Su, Pl, S-Sr					
	33						6		11: 0°, J, N, No, N, St, Sr-R 12: 65°, J, N, Py, Sp, Pl, S-Sr					
					3		7							
							8 9							
3010	34						10 11							
					4		12 1							
	35												1417	
													1432	
					2		2		1: 45°, J, N, Py+Ch, Sp-Su, Pl, Sr 2: 20°, J, N, Ch, Sp, Wa, Sr					
3008	36								3: 60°, J, N, Ch, Fi, Pl, S-Sr 4: 40°, J, N, Py, Sp, Wa, Sr-R					
					3		3		5: 32°, J, N, Py, Sp, Pl, Sr 6: 32°, J, N, Py+Ch, Sp, Pl, Sr					
	37		3				3 8		7: 0°, J, N, Py, Sp, Pl-Wa, Sr-R 8: 90°, J, N, Py+Ch, Fi, Wa, Sr-R				9	
		5		100	3	64	4 5							
							6							
3006	38													
					1		7							
	39													
					0									
3004	40								Bottom of boring at 40 feet				1506	
	41													
3002	42													
	43													
3000	44													
	45													

Report: GEO_CORE+SOIL_17; File: 27669017.GPJ; 5/27/2009 B-26

URS

Figure A-26

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-27

Sheet 1 of 1

Date(s) Drilled	**04/17/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**6.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3064 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.989', W116° 65.202'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0								
			1	25		ALLUVIUM Medium dense, moist, brown, clayey to silty fine SAND (SC-SM) with some coarse gravels of metasedimentary granitic rock, trace coarse sand	4		SA(27), LL(22), PI(4)
	2								
3060	4		2	75		METASEDIMENTARY ROCK Metasedimentary rock, reddish brown, fine to medium grained, completely weathered, extremely weak. Fragments to very dense, moist, silty fine SAND (SM) with trace medium to coarse sand			
			3	50/6"					
	6					Bottom of boring at 6 feet			
	8								
3055									
	10								
	12								
3050	14								
	16								
	18								
3045									
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 B-27

URS

Figure A-27

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-28

Sheet 1 of 1

Date(s) Drilled	**04/17/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**9.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3053 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.954', W116° 65.111'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL			
			1	14		ALLUVIUM Medium dense, moist, dark brown, clayey fine SAND (SC) with some lean clay			
	2								
3050									
	4		2	25					WA(32)
						Very dense, moist, reddish brown, silty fine to medium SAND (SM) with fine gravels of metasedimentary rock, trace coarse sand			
	6		3	50/6"					
3045	8		4			Very dense, moist, brown, silty fine to coarse GRAVEL (GM) derived from metasedimentary rock			
			5	50/6"		METASEDIMENTARY ROCK Metasedimentary rock, dark gray, fine to medium grained, highly weathered, weak			
	10					Bottom of boring at 9.5 feet			
	12								
3040									
	14								
	16								
3035	18								
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 B-28

URS

Figure A-28

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring B-29

Sheet 1 of 1

Date(s) Drilled	**04/17/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**20.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3074 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.952', W116° 65.082'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					ALLUVIUM Medium dense, moist, dark brown, clayey fine SAND (SC), trace organic fragments, trace medium sand			
			1	24					
	2					Becomes dense, greenish gray			
3070	4		2	34			7		WA(38)
						No clay			
	6		3	38					
						Dense, moist, greenish gray, silty fine to medium SAND (SM) with trace coarse sand, boulder or cobbles and gravel			
	8								
3065									
						Medium dense, moist, reddish brown, clayey fine SAND (SC) with trace medium sand			
	10		4	20					WA(26)
	12								
3060	14								
			5	50/5"		METASEDIMENTARY ROCK Very dense, moist, reddish brown, SILT (ML) with some fine sand			
	16								
			6	50/2"					
						Metasedimentary rock, dark gray, fine to medium grained, highly weathered, weak			
	18								
3055									
						Bottom of boring at 20 feet			
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 B-29

URS

Figure A-29

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-01

Date(s) Excavated	**02/02/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**8 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3066 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.660', W116° 40.961'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3066	0				RESIDUAL SOIL/COLLUVIUM		
			1		Loose, moist, reddish brown, clayey SAND (SC)		
3065	1						
					GRANITIC ROCK		
					Granitic rock, reddish brown, phaneritic, coarse grained, completely to highly weathered, extremely weak. Fragments to dense, moist, clayey SAND (SC)		
3064	2						
3063	3						
			2				
3062	4						
					Increase in density, becomes light reddish brown		
3061	5						
			3				
					Bottom of test pit at 5.5 feet due to refusal		
3060	6						
3059	7						
3058	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-01

URS

Figure A-30

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-02

Date(s) Excavated	**02/02/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**6 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3036 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.651', W116° 41.026'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3036	0				COLLUVIUM Loose, moist, brown, clayey fine to medium SAND (SC)		
			1				
3035	1				RESIDUAL SOIL Hard, moist, dark brown to brown, sandy CLAY (CH)		
3034	2						
			2				
3033	3						
3032	4				With fine carbonate and decrease in sand		
			3				
3031	5				Bottom of test pit at 5.5 feet due to refusal		
3030	6						
3029	7						
3028	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-02

URS

Figure A-31

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-03

Date(s) Excavated	**02/02/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**6 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**4.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3022 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.648', W116° 41.049'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3022	0				COLLUVIUM Loose, moist, brown, clayey fine to medium SAND (SC)		
		☒	1				
3021	1						
		☒	2		RESIDUAL SOIL Hard, moist, dark brown to brown, sandy CLAY (CH)		
3020	2						
3019	3				Decrease in sand with some carbonate flakes		
3018	4	☒	3				
					Bottom of test pit at 4.5 feet		
3017	5						
3016	6						
3015	7						
3014	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-03

URS

Figure A-32

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-04

Date(s) Excavated	**02/03/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**2.9 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**1.8 feet**
Excavation Equipment	**Shovel, pick**	Excavation Contractor	**URS (hand dug)**	Approximate Surface Elevation	**3024 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.658', W116° 41.085'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3024	0				RESIDUAL SOIL Medium dense, moist, brown, fine to medium sandy SILT (ML), trace coarse sand and fine gravels, few metasedimentary cobbles		
			1				
3023	1		2		Stiff, moist, dark brown, fine to medium sandy CLAY (CL), trace coarse sand, few metasedimentary cobbles, trace organics		
			3		Becomes greenish gray brown		
3022	2				Bottom of test pit at 1.8 feet		
3021	3						
3020	4						
3019	5						
3018	6						
3017	7						
3016	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-04

URS

Figure A-33

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-05

Date(s) Excavated	**02/03/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**2.3 feet**	Width of Excavation	**2.3 feet**	Depth of Excavation	**2.9 feet**
Excavation Equipment	**Shovel, pick**	Excavation Contractor	**URS (hand dug)**	Approximate Surface Elevation	**3023 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.367', W116°41.239'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3023	0				RESIDUAL SOIL Loose, moist, dark brown, fine sandy SILT (ML), trace coarse sand		
			1				
3022	1				Loose to medium dense, moist, dark brown with red inter fingering, silty fine to coarse SAND (SM), trace fine gravel		
			2				
3021	2				GRANITIC ROCK Granodiorite, brownish red, phaneritic, coarse grained, completely weathered, extremely weak. Fragments to medium dense, moist, silty fine to coarse SAND (SM), trace fine gravel		
			3				
3020	3				Bottom of test pit at 2.9 feet		
3019	4						
3018	5						
3017	6						
3016	7						
3015	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-05

URS

Figure A-34

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-06

Date(s) Excavated	**02/04/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**2.5 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**1.2 feet**
Excavation Equipment	**Shovel**	Excavation Contractor	**URS (hand dug)**	Approximate Surface Elevation	**3020 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.601', W116° 41.087'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3020	0				RESIDUAL SOIL Loose, moist, dark brown, fine to medium sandy SILT (ML), trace coarse sand and fine gravel, organics present and granite cobbles		
					Loose to medium dense, moist, brick red, silty fine to coarse SAND (SM), some fine gravel and organics		
		☒	1				
3019	1	☒	2		GRANITIC ROCK Granodiorite, brick red, phaneritic, coarse grained, completely weathered, extremely weak. Fragments to loose to medium dense, moist, fine to coarse SAND (SP), trace fine gravel		
					Bottom of test pit at 1.2 feet		
3018	2						
3017	3						
3016	4						
3015	5						
3014	6						
3013	7						
3012	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-06

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Figure A-35

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-07

Date(s) Excavated	**01/21/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**3 feet**	Depth of Excavation	**3.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3031 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.586', W116°41.084'**				

Elevation, feet	Depth, feet	Sample Type / Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3031	0					
		1		COLLUVIUM Loose, moist, brown to dark yellowish brown, poorly graded fine SAND with silt (SP-SM), few organics, slight porosity, trace gravel, cobbles and boulders		
3030	1					
		2		GRANITIC ROCK Granodiorite, brownish yellow, medium to coarse grained, highly to completely weathered, very weak, trace organics, friable. Fragments to dense, moist, poorly graded medium to coarse SAND (SP)		
3029	2					
3028	3			Bottom of test pit at 3.5 feet		
3027	4					
3026	5					
3025	6					
3024	7					
3023	8					

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-07

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Figure A-36

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-08

Date(s) Excavated	**02/02/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**5 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**7.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3031 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.571', W116°41.079'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3031	0				COLLUVIUM/RESIDUAL SOIL Loose, moist, dark reddish brown, clayey medium grained SAND (SC)		
3030	1						
			1				
3029	2						
3028	3						
					GRANITIC ROCK Granodiorite, reddish brown, phaneritic, medium to coarse grained, completely to highly weathered, extremely weak. Fragment to medium dense, moist, clayey medium to coarse SAND (SC)		
3027	4						
			2				
3026	5						
3025	6				Becomes highly weathered and light reddish brown		
			3				
			4				
3024	7						
					Bottom of test pit at 7.5 feet		
3023	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-08

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Figure A-37

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-09

Date(s) Excavated	**01/15/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**8 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3077 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.539', W116° 40.923'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3077	0				COLLUVIUM Loose, moist, dark brown, fine silty SAND (SM)		
			1			8	WA(37), LL(19), PI(3)
3076	1						
			2		RESIDUAL SOIL Medium dense, moist, dark reddish brown, clayey SAND (SC) with some fine gravels	15	WA(42), LL(46), PI(29), EI(17)
3075	2						
3074	3						
3073	4				GRANITIC ROCK Quartz Monzodiorite, reddish brown, phaneritic, medium grained, completely weathered. Fragments to dense, moist, clayey SAND to sandy CLAY (SC-CL)		
3072	5		3			4	SA(13), CORR
3071	6		4			11	SA(23), COMP, DS
					Bottom of test pit at 6.5 feet due to near refusal		
3070	7						
3069	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-09

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Figure A-38

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-10

Date(s) Excavated	**01/14/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**8 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**6 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3086 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.512', W116° 40.884'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3086	0				RESIDUAL SOIL Loose, moist, brown, clayey SAND (SC), grades laterally to a fine sandy CLAY (CL) with many metasedimentary boulders		
3085	1		1			14	WA(25), LL(23), PI(6), EI(4)
					GRANITIC ROCK Granodiorite, reddish brown, phaneritic, coarse grained, highly weathered, extremely weak rock. Fragments to medium dense to dense, moist, well graded SAND with clay (SW-SC)		
3084	2						
3083	3		2			10	
3082	4						
3081	5		3		Reddish brown to white with black, very dense	8	SA(16), COMP, CORR, DS
3080	6				Bottom of test pit at 6 feet		
3079	7						
3078	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-10

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Figure A-39

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-11

Date(s) Excavated	**01/21/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**3 feet**	Depth of Excavation	**3 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3030 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.436', W116°41.065'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3030	0				COLLUVIUM Loose, moist, brown, poorly graded fine SAND with silt (SP-SM), few gravel and cobbles, trace bolder, few organics, slightly to moderate porosity		
			1		Becomes dark yellow brown to reddish brown		
3029	1		2				
					GRANITIC ROCK Granodiorite, reddish brown, medium to coarse grained, completely weathered, extremely weak, highly fractured, trace organics. Fragments to dense, moist, clayey fine to medium SAND (SC)		
3028	2				Becomes highly to moderately weathered, weak. Fragments to poorly graded SAND (SP) medium grained		
3027	3				Bottom of test pit at 3 feet due to refusal		
3026	4						
3025	5						
3024	6						
3023	7						
3022	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-11

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Figure A-40

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-12

Date(s) Excavated	**01/19/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**3 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3015 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.408', W116° 41.075'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3015	0				COLLUVIUM Loose, moist, brown to dark yellowish brown, silty fine SAND (SM), trace fine gravel, abundant organics, slight porosity		
3014	1				GRANITIC ROCK Granodiorite, yellowish brown, coarse grained, highly weathered, extremely weak. Fragments to well graded SAND with silt (SW-SM), dense, moist, trace organics		
3013	2		1			6	SA(8)
3012	3				Bottom of test pit at 3 feet due to refusal		
3011	4						
3010	5						
3009	6						
3008	7						
3007	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-12

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Figure A-41

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-13

Date(s) Excavated	**01/19/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**8 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**5.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3037 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Hand driven ModCal**
Location	**N32° 48.410', W116° 41.114'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3037	0				COLLUVIUM Loose, slightly moist, dark yellowish brown, silty fine grained SAND (SM), slight to moderate porosity, few roots/organics		
			1			9	WA(24)
3036	1				GRANITIC ROCK Granodiorite, reddish brown, coarse grained, completely to highly weathered, extremely weak. Fragments to a medium dense, clayey SAND (SC) with fine gravels		
3035	2		2			9	WA(17)
3034	3		3			11	SA(30), COMP, CORR
3033	4		4			9	DUW(111), DS
3032	5						
					Bottom of test pit at 5.5 feet due to refusal on hard rock		
3031	6						
3030	7						
3029	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-13

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Figure A-42

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-14

Date(s) Excavated	**01/19/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**3 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**2990 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.386', W116° 41.102'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
2990	0				COLLUVIUM Loose, moist, dark yellowish brown, silty fine SAND (SM), trace fine and coarse gravel, slight porosity, few organics		
			1			9	WA(27)
2989	1				Becomes yellowish brown, fine and medium grained sand, moderate porosity		
			2		GRANITIC ROCK Granodiorite, yellowish brown, coarse grained, completely weathered, extremely weak. Fragments to medium dense, moist, clayey SAND (SC), fine to medium grained sand, micaceous	13	SA(33)
2988	2				Becomes highly weathered. Fragments to dense, poorly graded fine to medium grained SAND (SP)		
2987	3				Bottom of test pit at 3 feet due to refusal		
2986	4						
2985	5						
2984	6						
2983	7						
2982	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-14

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Figure A-43

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-15

Date(s) Excavated	**01/20/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**3 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3069 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Bulk**
Location	**N32° 48.444', W116° 40.933'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3069	0				COLLUVIUM Loose, moist, dark brown, silty fine to medium SAND (SM), few gravel, abundant organics		
					Medium dense, moist, reddish brown, clayey fine to medium SAND (SC), trace gravel, slightly to medium porosity, micaceous, trace organics		
3068	1		1			14	SA(41), COMP, CORR, DS
					GRANITIC ROCK Granodiorite, light yellow brown to olive yellow, medium to coarse grained, highly weathered, extremely to very weak. Fragments to dense, moist, clayey SAND (SC)		
3067	2						
3066	3				Bottom of test pit at 3 feet due to refusal		
3065	4						
3064	5						
3063	6						
3062	7						
3061	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-15

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Figure A-44

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-16

Date(s) Excavated	**01/20/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**4 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3023 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Hand driven ModCal**
Location	**N32° 48.425', W116° 40.966'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3023	0				COLLUVIUM Loose, moist, brown, silty fine SAND (SM), few organics, trace fine gravel		
			1			6	SA(28)
3022	1				GRANITIC ROCK Granodiorite, reddish brown, medium to coarse grained, completely weathered, extremely weak, trace organic material. Fragments to dense, moist, clayey fine to medium SAND (SC), trace organics		
			2			11	SA(18), DUW(113)
3021	2				Becomes completely to highly weathered. Fragments to dense, moist, poorly graded fine to medium SAND (SP)		
3020	3						
3019	4				Bottom of test pit at 4 feet		
3018	5						
3017	6						
3016	7						
3015	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-16

URS

Figure A-45

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-17

Date(s) Excavated	**01/20/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**10 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**3.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3015 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.432', W116° 40.985'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3015	0				COLLUVIUM Loose, moist, brown, silty fine SAND (SM), few organics, moderate porosity		
3014	1		1		GRANITIC ROCK Granodiorite, reddish brown, fine grained, completely weathered, extremely weak, few roots (up to 1/4"), slight to moderate porosity. Fragments to medium dense, moist, clayey fine to medium SAND (SC)	15	CORR
					Becomes completely to highly weathered, extremely weak. Fragments to dense, moist, poorly graded medium to coarse graded SAND (SM)		
3013	2		2			12	SA(24), COMP, CORR, DS
3012	3						
					Bottom of test pit at 3.5 feet due to refusal		
3011	4						
3010	5						
3009	6						
3008	7						
3007	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-17

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Figure A-46

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-18

Date(s) Excavated	**01/28/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**4 feet**	Width of Excavation	**1 foot**	Depth of Excavation	**2.5 feet**
Excavation Equipment	**Pick and shovel**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3029 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Hand driven ModCal**
Location	**N32°48.386', W116°40.950'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3029	0				RESIDUAL SOIL/COLLUVIUM Loose, moist, reddish brown, clayey SAND (SC)		
			1			7	WA(29), CORR
3028	1		2		GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, coarse grained, highly weathered, very weak. Fragments to dense, moist, clayey SAND (SC) with mica		
3027	2		3			10	SA(26)
					Bottom of test pit at 2.5 feet due to very difficult digging		
3026	3						
3025	4						
3024	5						
3023	6						
3022	7						
3021	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-18

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Figure A-47

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-19

Date(s) Excavated	**01/28/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**3 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**2 feet**
Excavation Equipment	**Pick and shovel**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**2982 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32°48.355', W116°40.957'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
2982	0				RESIDUAL SOIL/COLLUVIUM Loose, moist, brown, clayey fine to medium SAND (SC)		
		X	1			3	WA(28), CORR
2981	1				GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, coarse grained, highly weathered, very weak. Fragments to dense, moist, clayey coarse SAND (SC)		
		X	2			2	
2980	2				Bottom of test pit at 2 feet due to very hard digging		
2979	3						
2978	4						
2977	5						
2976	6						
2975	7						
2974	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-19

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Figure A-48

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-20

Date(s) Excavated	**01/28/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**3 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**2 feet**
Excavation Equipment	**Pick and shovel**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3019 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Hand driven ModCal**
Location	**N32°48.383', W116°41.000'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3019	0		1		RESIDUAL SOIL/COLLUVIUM Loose, moist, brown, clayey fine to medium SAND (SC)		
3018	1		2		GRANITIC ROCK Granodiorite, light reddish brown, phaneritic, coarse grained, highly weathered, very weak. Fragments to dense, moist, clayey coarse SAND (SC)		
			3			8	CORR
3017	2				Bottom of test pit at 2 feet due to very hard digging		
3016	3						
3015	4						
3014	5						
3013	6						
3012	7						
3011	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-20

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Figure A-49

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-21

Date(s) Excavated	**01/28/09**	Logged By	**D. Rector**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**2.5 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**2.25 feet**
Excavation Equipment	**Pick and shovel**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**2955 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Hand driven ModCal**
Location	**N32°48.348', W116°41.057'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
2955	0		1		RESIDUAL SOIL/COLLUVIUM Loose, moist, brown, clayey fine to medium SAND (SC)	4	WA(27), CORR
2954	1				GRANITIC ROCK Granodiorite, light reddish brown to reddish brown, phaneritic, coarse grained, highly weathered, very weak. Fragments to dense, moist, clayey coarse SAND (SC)		
2953	2		2			7	SA(15)
					Bottom of test pit at 2.25 feet due to very hard digging		
2952	3						
2951	4						
2950	5						
2949	6						
2948	7						
2947	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-21

URS

Figure A-50

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-22

Date(s) Excavated	**01/20/09**	Logged By	**D. Orris**	Checked by	**J. Nevius/C. Goetz**
Length of Excavation	**3 feet**	Width of Excavation	**2 feet**	Depth of Excavation	**2 feet**
Excavation Equipment	**ASV RC-100 trackboe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3060 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.393', W116° 40.886'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3060	0		1		COLLUVIUM Loose, moist, yellowish brown, silty fine to medium SAND (SM), numerous gravel and cobbles, abundant organics	4	SA(14)
3059	1				METASEDIMENTARY ROCK Metasedimentary rock, light yellowish brown to light olive brown, medium grained, highly weathered, moderately to intensely fracture (soil formation within fractures). Fragments to dense, moist, poorly graded fine to medium SAND (SP)		
3058	2				Bottom of test pit at 2 feet		
3057	3						
3056	4						
3055	5						
3054	6						
3053	7						
3052	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-22

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Figure A-51

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-23

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**3 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**5.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3081 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab**
Location	**N32° 48.826', W116° 39.829'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3081	0				ALLUVIUM 4" of decomposed granite fill over medium dense, moist, dark brown, clayey fine to medium SAND (SC), trace fine gravels and trace coarse and		
			1				
3080	1						
3079	2		2			10	WA(28)
3078	3						
3077	4						
3076	5		3		GRANITIC ROCK Granitic rock, reddish brown, coarse grained, completely weathered, extremely weak. Fragments to very dense, greenish brown, fine to medium SAND with trace coarse sand (SP)		R-Value
					Bottom of test pit at 5.5 feet		
3075	6						
3074	7						
3073	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-23

URS

Figure A-52

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-24

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**3 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**4 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3069 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.848', W116° 39.749'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3069	0				ALLUVIUM 4" of decomposed granite fill over medium dense, moist, dark brown, clayey fine SAND (SC), trace medium to coarse sand, trace fine gravels		
			1				
3068	1						
			2			7	SA(20)
3067	2						
			3				
3066	3				GRANITIC ROCK Monzogranite, light reddish brown, coarse grained, completely weathered, extremely weak. Fragments to dense, moist, light brown, fine to medium SAND (SP) with with trace to coarse gravels, some coarse sand		
3065	4				Bottom of test pit at 4 feet		
3064	5						
3063	6						
3062	7						
3061	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-24

URS

Figure A-53

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-25

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**5 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**4 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3086 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.828', W116° 39.607'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3086	0				COLLUVIUM 2" decomposed granitic fill over medium dense, moist, brown, silty fine SAND (SM) with trace medium to coarse sand		
			1		Very dense, moist, reddish brown, clayey fine to medium SAND (SC) with some fine gravels to cobbles of granitic rock, trace organic fragments		
3085	1						
			2			7	SA(47)
3084	2						
					← Lean clay content, dark brick red color, no granitic clasts		
3083	3						
			3 4			15	LL(49), PI(28)
3082	4				Bottom of test pit at 4 feet		
3081	5						
3080	6						
3079	7						
3078	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-25

URS

Figure A-54

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-26

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**5 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**4 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3093 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.670', W116° 39.318'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3093	0				COLLUVIUM 4" decomposed granite over medium dense, moist, reddish brown, fine to medium SAND (SP) with trace coarse sand, trace fine gravels of granitic rock		
3092	1		1				
3091	2						
3090	3				GRANITIC ROCK Monzogranite, light reddish brown, coarse grained, completely weathered, extremely weak, Fragments to dense, moist, brownish orange, silty fine to medium SAND (SM) with trace coarse sand, trace fine gravels		
3089	4		2 3		Bottom of test pit at 4 feet		WA(13)
3088	5						
3087	6						
3086	7						
3085	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-26

URS

Figure A-55

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-27

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**5 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**3.5 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3110 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.664', W116° 39.274'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3110	0				GRANITIC ROCK Monzogranite, light reddish brown, coarse grained, completely weathered, extremely weak. Fragments to dense, moist, light reddish brown, clayey fine to medium SAND (SC) with some coarse sand		
			1			7	SA(17)
3109	1						
3108	2				Less weathered, light in color, very dense with 3" thick mafic dike running from bottom east of pit to central part of pit		
3107	3		2 3			6	SA(15)
					Bottom of test pit at 3.5 feet		
3106	4						
3105	5						
3104	6						
3103	7						
3102	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-27

URS

Figure A-56

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-28

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**7 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**8 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3060 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.566', W116° 38.933'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3060	0				FILL Moist, light brown, silty fine to medium sand with trace gravel, trace organics		
			1				
3059	1				ALLUVIUM Medium dense, moist, brown, clayey fine to medium SAND (SC) with some coarse gravels to cobbles of granite and pure quartz, with trace red clay layers		
			2				WA(37)
3058	2						
					Becomes dark brown with olive gray, fat clay layers (1"-2" thick) and discontinuous		
3057	3		3				
3056	4						
			4				WA(29)
3055	5						
			6				
3054	6						
3053	7						
			5				
3052	8				Bottom of test pit at 8 feet		

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-28

URS

Figure A-57

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Test Pit TP-29

Date(s) Excavated	**04/16/09**	Logged By	**A. Avakian**	Checked by	**J. Nevius**
Length of Excavation	**5 feet**	Width of Excavation	**1.5 feet**	Depth of Excavation	**2 feet**
Excavation Equipment	**ASV RC-100 trackhoe**	Excavation Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3154 feet MSL**
Water Observations	**None encountered**			Sampling Method(s)	**Grab/Bulk**
Location	**N32° 48.597', W116° 38.740'**				

Elevation, feet	Depth, feet	Sample Type	Sample Number	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND LAB TESTS
3154	0				FILL 2" asphalt over 2" of gravelly, silty fine sand		
					METASEDIMENTARY ROCK Metasedimentary rock, light reddish brown, fine to coarse grained, completely weathered, extremely weak. Fragments to very dense, moist, olive brown, silty fine to coarse SAND (SM) with trace fine gravels		
3153	1		1 2			6	SA(14)
3152	2				Bottom of test pit at 2 feet Excavated adjacent to pavement		
3151	3						
3150	4						
3149	5						
3148	6						
3147	7						
3146	8						

Report: GEO_5D_TEST_PIT; File: 27669017.GPJ; 5/27/2009 TP-29

URS

Figure A-58

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-01

Sheet 1 of 1

Date(s) Drilled	**04/17/09, 04/20-09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**7.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3101 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.943', W116° 64.734'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0								
3100			1	19		FILL 2.5" asphalt over moist, brown with black and white spots, clayey fine to medium sand with trace coarse sand			WA(40)
	2								
	4		2	13		RESIDUAL SOIL Medium dense, moist, reddish brown, silty fine SAND (SM) with trace medium to coarse sand			
3095	6		3	31		METASEDIMENTARY ROCK Metasedimentary rock with granitic inclusions, light reddish brown, fine to coarse grained, completely weathered, extremely weak. Fragments to medium dense, red, silty fine SAND (SM) with trace medium sand			
						Bottom of boring at 7 feet			
	8								
	10								
3090									
	12								
	14								
3085	16								
	18								
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-01

URS

Figure A-59

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-02

Sheet 1 of 1

Date(s) Drilled	**04/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**9.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3153 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab/Bulk**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.982', W116° 64.650'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0		1			FILL 2.5" asphalt, 7" gravel base over moist, brown, clayey fine sand with some medium to coarse sand			WA(20)
	2		2	8					
3150									
	4		3	32					
	6		4	28		METASEDIMENTARY ROCK Metasedimentary rock and granitic mix, light reddish brown, fine to coarse grained, completely weathered, extremely weak. Fragments to medium dense, moist, reddish brown, silty fine SAND (SM) with trace medium sand			
3145	8		5	28					
						Bottom of boring at 9 feet			
	10								
	12								
3140									
	14								
	16								
3135	18								
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-02

URS

Figure A-60

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-03

Sheet 1 of 1

Date(s) Drilled	**04/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**11.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3224 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.850', W116° 64.381'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					COLLUVIUM 3.5" asphalt, no gravel base, over dense, most, brown, clayey fine SAND (SC) with trace medium to coarse sand, with some lean clay, trace fine gravels and metasedimentary rock			
			1	50/5"					WA(36)
	2					Increase in metasediment clasts, fine to coarse gravels with some cobbles, trace lean clay			
3220	4		2	42					
						METASEDIMENTARY ROCK Metasedimentary rock, brown, fine grained, completely weathered, extremely weak. Fragments to medium dense, moist, brown, silty fine SAND (SM)			
	6		3	19					
	8		5	63					
3215						Fragments to very dense, moist, olive brown, fine sandy SILT (ML) with trace lean clay			
	10		6	50/2"					
						Bottom of boring at 11 feet			
	12								
3210	14								
	16								
	18								
3205									
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-03

URS

Figure A-61

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-04

Sheet 1 of 1

Date(s) Drilled	**04/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**6.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3239 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.892', W116° 64.230'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 2" asphalt, no gravel base over moist, brown, silty fine sand with trace medium sand			
	2					METASEDIMENTARY ROCK Metasedimentary rock mixed with granite, light reddish brown, fine to coarse grained, completely weathered, extremely weak. Fragments to dense, brown, silty fine SAND (SM) with trace medium to coarse sand			
3235	4		1	43					
			2	50/4"					
	6		3	50/5"		Bottom of boring at 6.5 feet			
	8								
3230									
	10								
	12								
3225	14								
	16								
	18								
3220									
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-04

URS

Figure A-62

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-05

Sheet 1 of 1

Date(s) Drilled	**04/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**2.0 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3199 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.844', W116° 64.120'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 2" asphalt with no gravel base over moist, brown, silty fine sand with trace medium to coarse sand	6		SA(27)
			1	50/2"		GRANITIC ROCK Granitic rock, light reddish brown, medium to coarse grained, completely weathered, extremely weak. Fragments to dense, moist, reddish brown, silty fine SAND (SM) with trace medium sand			
	2					Bottom of boring at 2 feet			
3195	4								
	6								
	8								
3190									
	10								
	12								
3185	14								
	16								
	18								
3180									
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-05

URS

Figure A-63

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Log of Boring P-06

Sheet 1 of 1

Date(s) Drilled	**04/20/09**	Logged By	**A. Avakian**	Checked By	**J. Nevius**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**10.5 feet**
Drill Rig Type	**Deitrich D120**	Drilling Contractor	**Tri County Drilling**	Approximate Surface Elevation	**3177 feet MSL**
Water Level Depth (Feet)	**None encountered**	Sampling Method(s)	**SPT/Grab**	Hammer Data	**140 lbs/30" drop**
Borehole Backfill	**Bentonite chips and soil cuttings**	Location	**N32° 80.815', W116° 64.044'**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blow per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 2" asphalt over moist, dark brown, fine gravelly silty sand, trace coarse gravel, trace medium sand	2		LL(22), PI(2)
			1						
3175	2		2	11		ALLUVIUM Medium dense, moist, reddish brown, silty fine SAND (SM) with trace medium to coarse sand			
	4		3	10					
	6								
3170						Medium dense, moist, very light brown, fine sandy SILT (ML), with trace medium to coarse sand			
	8		5	16					
	10		6	50/4"		METASEDIMENTARY ROCK Metasedimentary rock, light gray, fine grained, highly weathered, weak Bottom of boring at 10.5 feet			
3165	12								
	14								
	16								
3160									
	18								
	20								

Report: GEO_10_SNA; File: 27669017.GPJ; 5/27/2009 P-06

URS

Figure A-64



Boring B-01, Depth Interval 0.0 to 20.5 feet



Boring B-01, Depth Interval 20.5 to 28.0 feet

CORE PHOTOGRAPHS BORING B-01	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-65

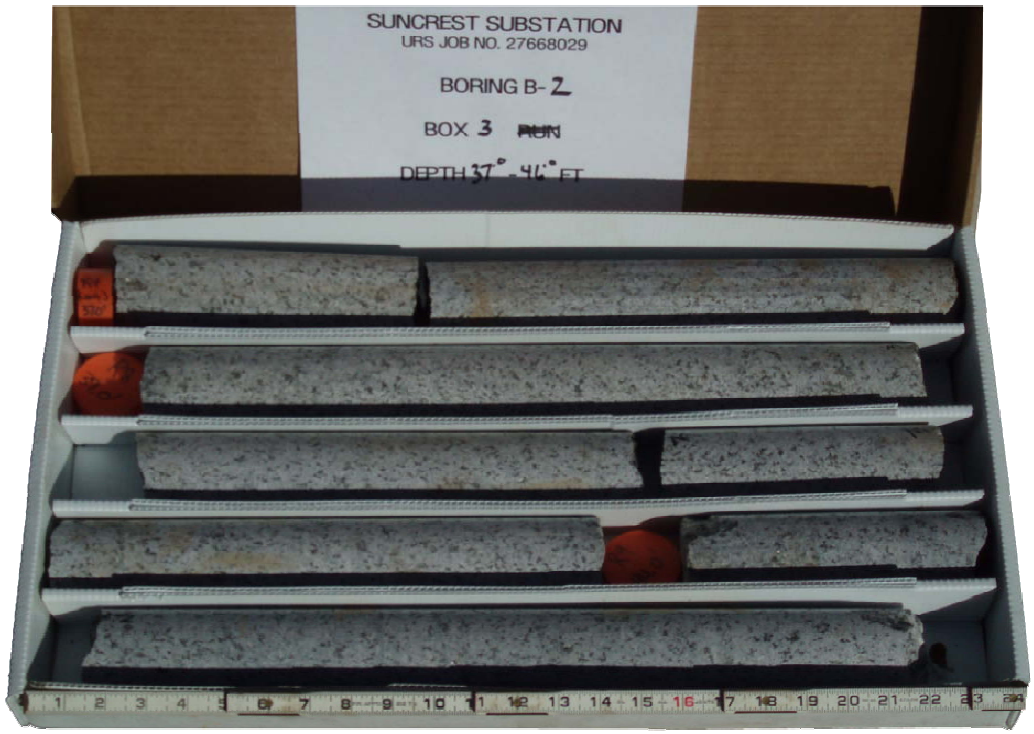


Boring B-02, Depth Interval 0.0 to 27.5 feet



Boring B-02, Depth Interval 27.5 to 37.0 feet

CORE PHOTOGRAPHS BORING B-02	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-66



Boring B-02, Depth Interval 37.0 to 46.0 feet



Boring B-02, Depth Interval 46.0 to 49.0 feet

CORE PHOTOGRAPHS BORING B-02	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-67



Boring B-03, Depth Interval 10.0 to 26.5 feet



Boring B-03, Depth Interval 26.5 to 36.8 feet

CORE PHOTOGRAPHS BORING B-03	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-68



Boring B-03, Depth Interval 36.8 to 46.7 feet



Boring B-03, Depth Interval 46.7 to 49.0 feet

CORE PHOTOGRAPHS BORING B-03	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-69



Boring B-04, Depth Interval 9.6 to 28.0 feet



Boring B-04, Depth Interval 28.0 to 42.3 feet

CORE PHOTOGRAPHS BORING B-04	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-70



Boring B-04, Depth Interval 42.3 to 50.0 feet

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CORE PHOTOGRAPHS BORING B-04	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-71



Boring B-05, Depth Interval 10.0 to 35.5 feet



Boring B-05, Depth Interval 35.5 to 47.5 feet

CORE PHOTOGRAPHS BORING B-05	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-72



Boring B-05, Depth Interval 47.5 to 60.0 feet

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CORE PHOTOGRAPHS BORING B-05	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-73

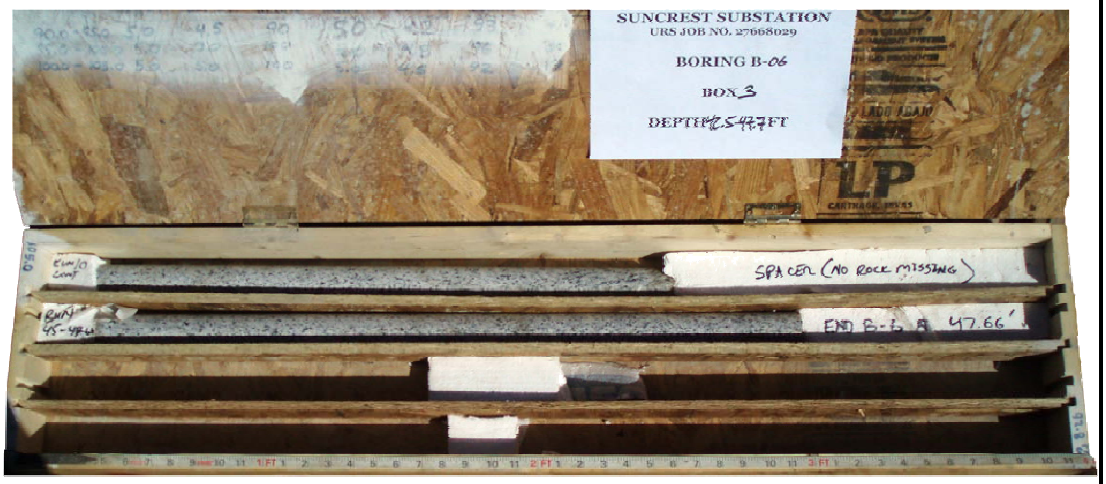


Boring B-06, Depth Interval 15.0 to 28.5 feet



Boring B-06, Depth Interval 28.5 to 42.5 feet

CORE PHOTOGRAPHS BORING B-06	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-74



Boring B-06, Depth Interval 42.5 to 47.7 feet

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CORE PHOTOGRAPHS BORING B-06	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-75



Boring B-07, Depth Interval 10.0 to 65.0 feet



Boring B-07, Depth Interval 65.0 to 74.5 feet

CORE PHOTOGRAPHS BORING B-07	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-76



Boring B-08, Depth Interval 5.0 to 33.0 feet



Boring B-08, Depth Interval 33.0 to 44.2 feet

CORE PHOTOGRAPHS BORING B-08	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-77



Boring B-08, Depth Interval 44.2 to 53.9 feet



Boring B-08, Depth Interval 53.9 to 63.0 feet

CORE PHOTOGRAPHS BORING B-08	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-78



Boring B-08, Depth Interval 63.0 to 73.3 feet



Boring B-08, Depth Interval 73.3 to 84.4 feet

CORE PHOTOGRAPHS BORING B-08	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-79



Boring B-08, Depth Interval 84.4 to 93.0 feet



Boring B-08, Depth Interval 93.0 to 103.0 feet

CORE PHOTOGRAPHS BORING B-08	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-80



Boring B-08, Depth Interval 103.0 to 106.0 feet

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CORE PHOTOGRAPHS BORING B-08	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-81



Boring B-9, Depth Interval 4.0 to 20.75 feet

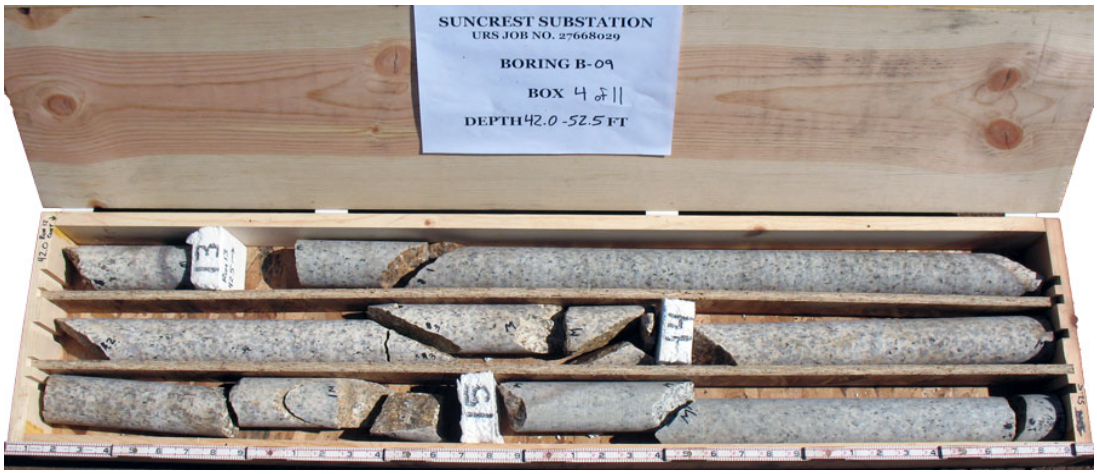


Boring B-9, Depth Interval 20.75 to 31.2 feet

CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-82



Boring B-9, Depth Interval 31.2 to 42.0 feet



Boring B-9, Depth Interval 42.0 to 52.5 feet

CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-83



Boring B-9, Depth Interval 52.5 to 63.0 feet



Boring B-9, Depth Interval 63.0 to 74.0 feet

CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-84



Boring B-9, Depth Interval 74.0 to 84.5 feet



Boring B-9, Depth Interval 84.5 to 95.0 feet

CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-85



Boring B-9, Depth Interval 95.0 to 104.0 feet



Boring B-9, Depth Interval 104.0 to 114.8 feet

CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-86



Boring B-9, Depth Interval 114.8 to 120.5 feet

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CORE PHOTOGRAPHS BORING B-9	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-87

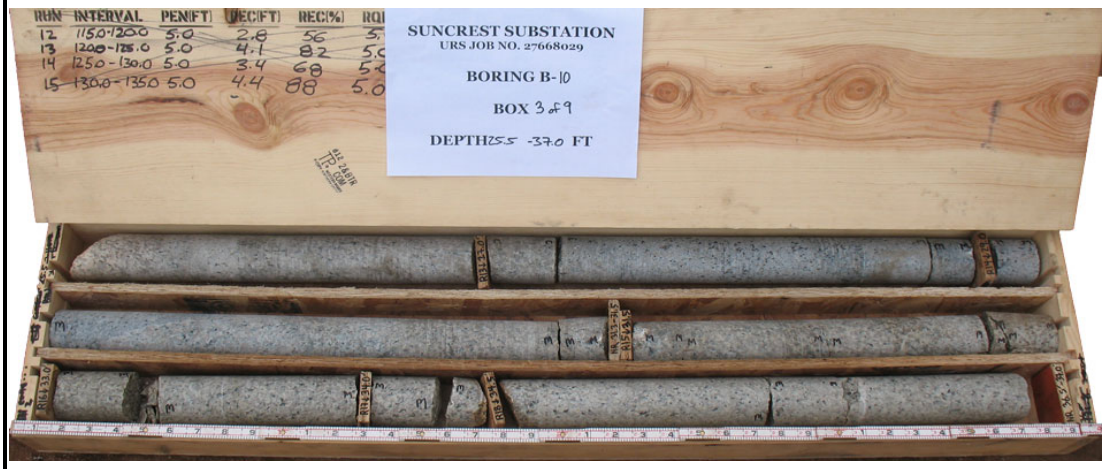


Boring B-10, Depth Interval 4.0 to 14.7 feet



Boring B-10, Depth Interval 14.7 to 25.5 feet

CORE PHOTOGRAPHS BORING B-10	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-88



Boring B-10, Depth Interval 25.5 to 37.0 feet



Boring B-10, Depth Interval 37.0 to 47.9 feet

CORE PHOTOGRAPHS BORING B-10	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-89



Boring B-10, Depth Interval 47.9 to 57.5 feet



Boring B-10, Depth Interval 57.5 to 67.8 feet

CORE PHOTOGRAPHS BORING B-10	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-90



Boring B-10, Depth Interval 67.8 to 79.1 feet



Boring B-10, Depth Interval 79.1 to 89.8 feet

CORE PHOTOGRAPHS BORING B-10	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-91



Boring B-10, Depth Interval 89.8 to 90.6 feet

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CORE PHOTOGRAPHS BORING B-10	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-92



Boring B-11, Depth Interval 9.0 to 21.5 feet



Boring B-11, Depth Interval 21.5 to 34.25 feet

CORE PHOTOGRAPHS BORING B-11	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-93



Boring B-11, Depth Interval 34.25 to 44.5 feet



Boring B-11, Depth Interval 44.5 to 55.5 feet

CORE PHOTOGRAPHS BORING B-11	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-94



Boring B-11, Depth Interval 55.5 to 59.0 feet

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CORE PHOTOGRAPHS BORING B-11	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-95



Boring B-12, Depth Interval 14.0 to 28.5 feet



Boring B-12, Depth Interval 28.5 to 39.75 feet

CORE PHOTOGRAPHS BORING B-12	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-96



Boring B-12, Depth Interval 39.75 to 50.5 feet

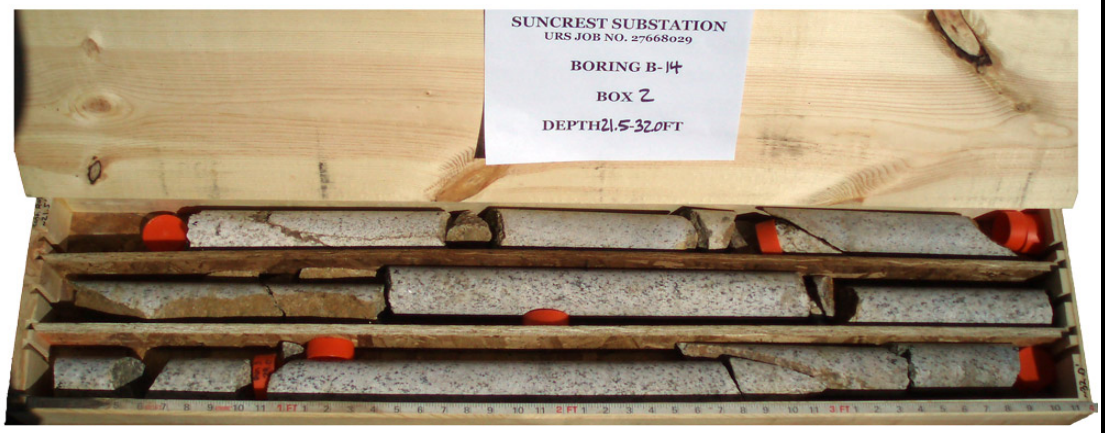


Boring B-12, Depth Interval 50.5 to 59.0 feet

CORE PHOTOGRAPHS BORING B-12	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-97



Boring B-14, Depth Interval 9.0 to 21.5 feet



Boring B-14, Depth Interval 21.5 to 32.0 feet

CORE PHOTOGRAPHS BORING B-14	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-98



Boring B-14, Depth Interval 32.0 to 43.25 feet



Boring B-14, Depth Interval 43.25 to 49.0 feet

CORE PHOTOGRAPHS BORING B-14	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-99



Boring B-15, Depth Interval 0.0 to 25.0 feet



Boring B-15, Depth Interval 25.0 to 38.5 feet

CORE PHOTOGRAPHS BORING B-15	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-100



Boring B-16, Depth Interval 0.0 to 22.5 feet

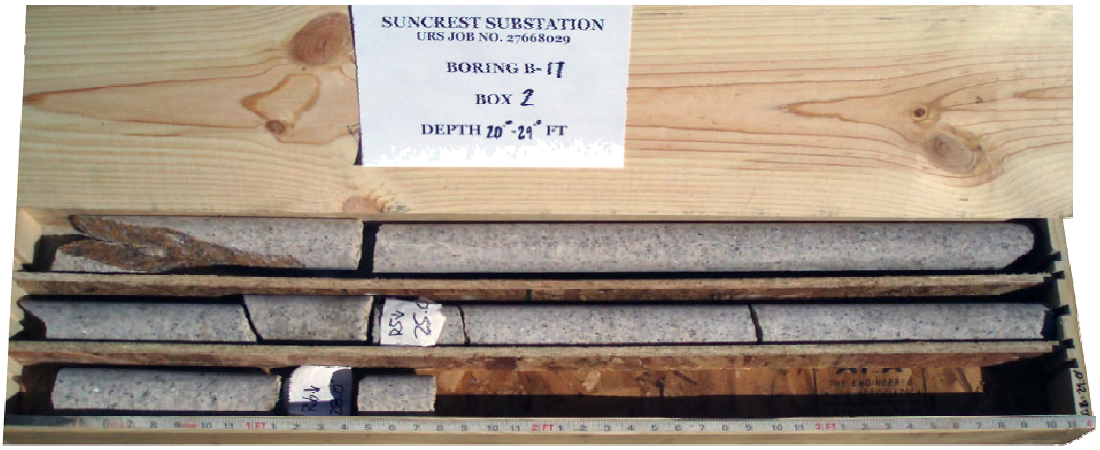


Boring B-16, Depth Interval 22.5 to 30.0 feet

CORE PHOTOGRAPHS BORING B-16	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-101

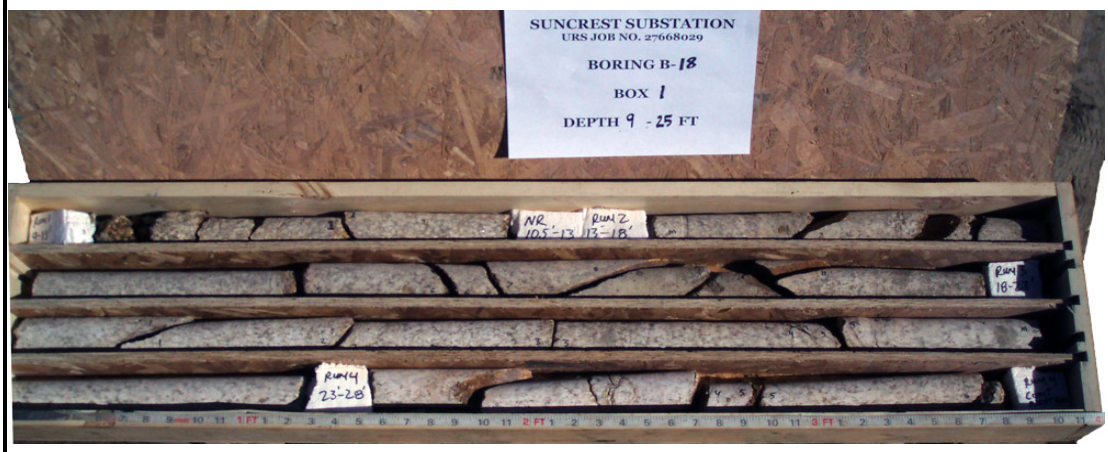


Boring B-17, Depth Interval 7.0 to 20.0 feet



Boring B-17, Depth Interval 20.0 to 29.0 feet

CORE PHOTOGRAPHS BORING B-17	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-102



Boring B-18, Depth Interval 9.0 to 25.0 feet



Boring B-18, Depth Interval 25.0 to 40.0 feet

CORE PHOTOGRAPHS BORING B-18	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-103



Boring B-18, Depth Interval 40.0 to 49.5 feet

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CORE PHOTOGRAPHS BORING B-18	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-104



Boring B-19, Depth Interval 9.0 to 29.5 feet



Boring B-19, Depth Interval 29.5 to 39.0 feet

CORE PHOTOGRAPHS BORING B-19	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-105



Boring B-20, Depth Interval 9.0 to 34.0 feet



Boring B-20, Depth Interval 34.0 to 50.0 feet

CORE PHOTOGRAPHS BORING B-20	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-106



Boring B-21, Depth Interval 0.0 to 40.0 feet

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CORE PHOTOGRAPHS BORING B-21	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-107



Boring B-22, Depth Interval 9.0 to 22.8 feet



Boring B-22, Depth Interval 22.8 to 34.0 feet

CORE PHOTOGRAPHS BORING B-22	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-108



Boring B-22, Depth Interval 34.0 to 42.5 feet

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CORE PHOTOGRAPHS BORING B-22	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-109



Boring B-23, Depth Interval 15.5 to 31.5 feet



Boring B-23, Depth Interval 31.5 to 41.3 feet

CORE PHOTOGRAPHS BORING B-23	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-110



Boring B-23, Depth Interval 41.3 to 53.5 feet



Boring B-23, Depth Interval 53.5 to 59.0 feet

CORE PHOTOGRAPHS BORING B-23	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-111



Boring B-24, Depth Interval 5.0 to 25.25 feet



Boring B-24, Depth Interval 25.25 to 36.5 feet

CORE PHOTOGRAPHS BORING B-24	URS
Suncrest Substation 27669017.00002	Date: 2-19-09 Figure: A-112



Boring B-24, Depth Interval 36.5 to 48.0 feet



Boring B-24, Depth Interval 48.0 to 60.0 feet

CORE PHOTOGRAPHS BORING B-24	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-113



Boring B-25, Depth Interval 5.0 to 23.0 feet



Boring B-25, Depth Interval 23.5 to 37.1 feet

CORE PHOTOGRAPHS BORING B-25	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-114



Boring B-26, Depth Interval 15.0 to 25.0 feet



Boring B-26, Depth Interval 25.0 to 35.5 feet

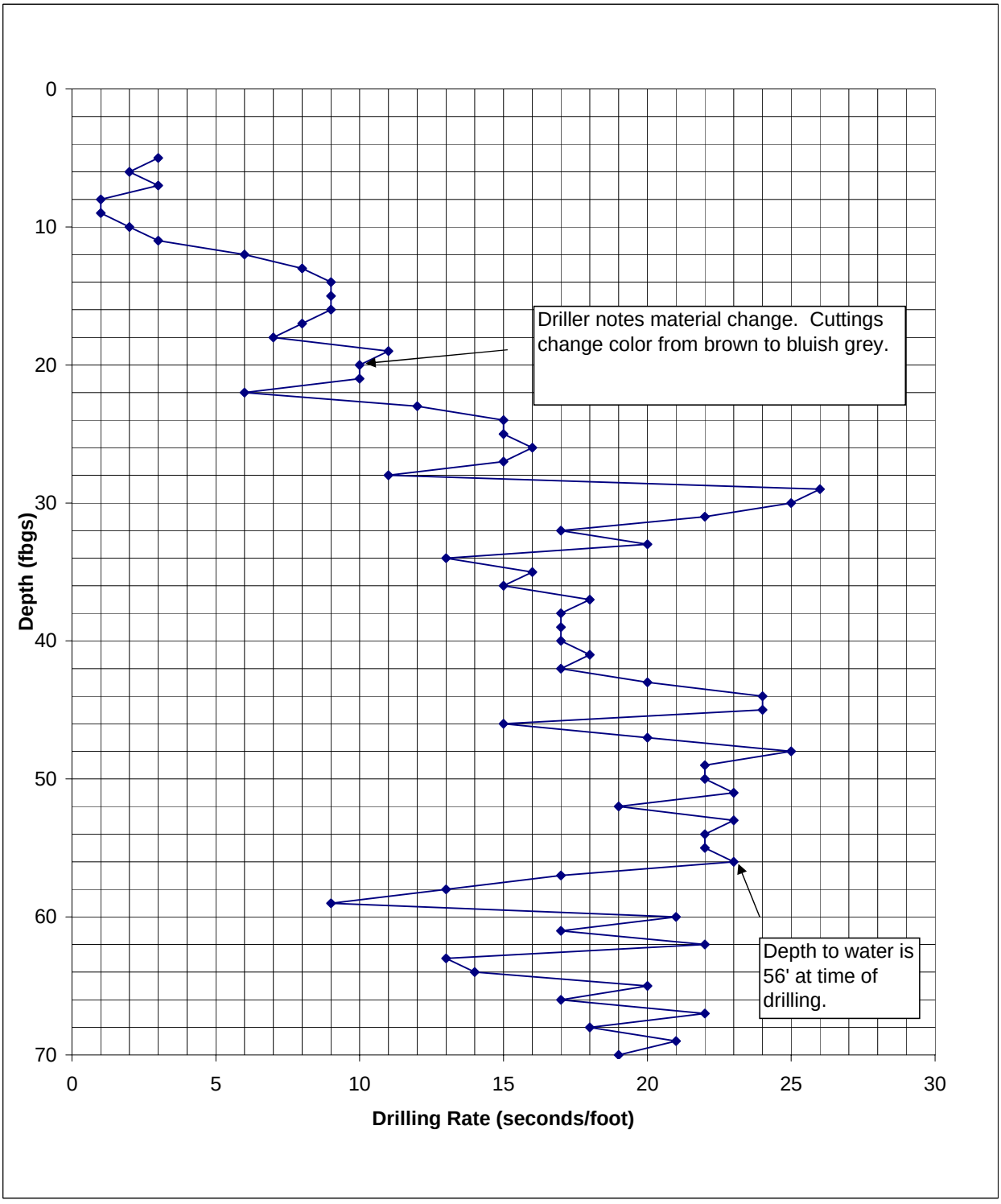
CORE PHOTOGRAPHS BORING B-26	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-115



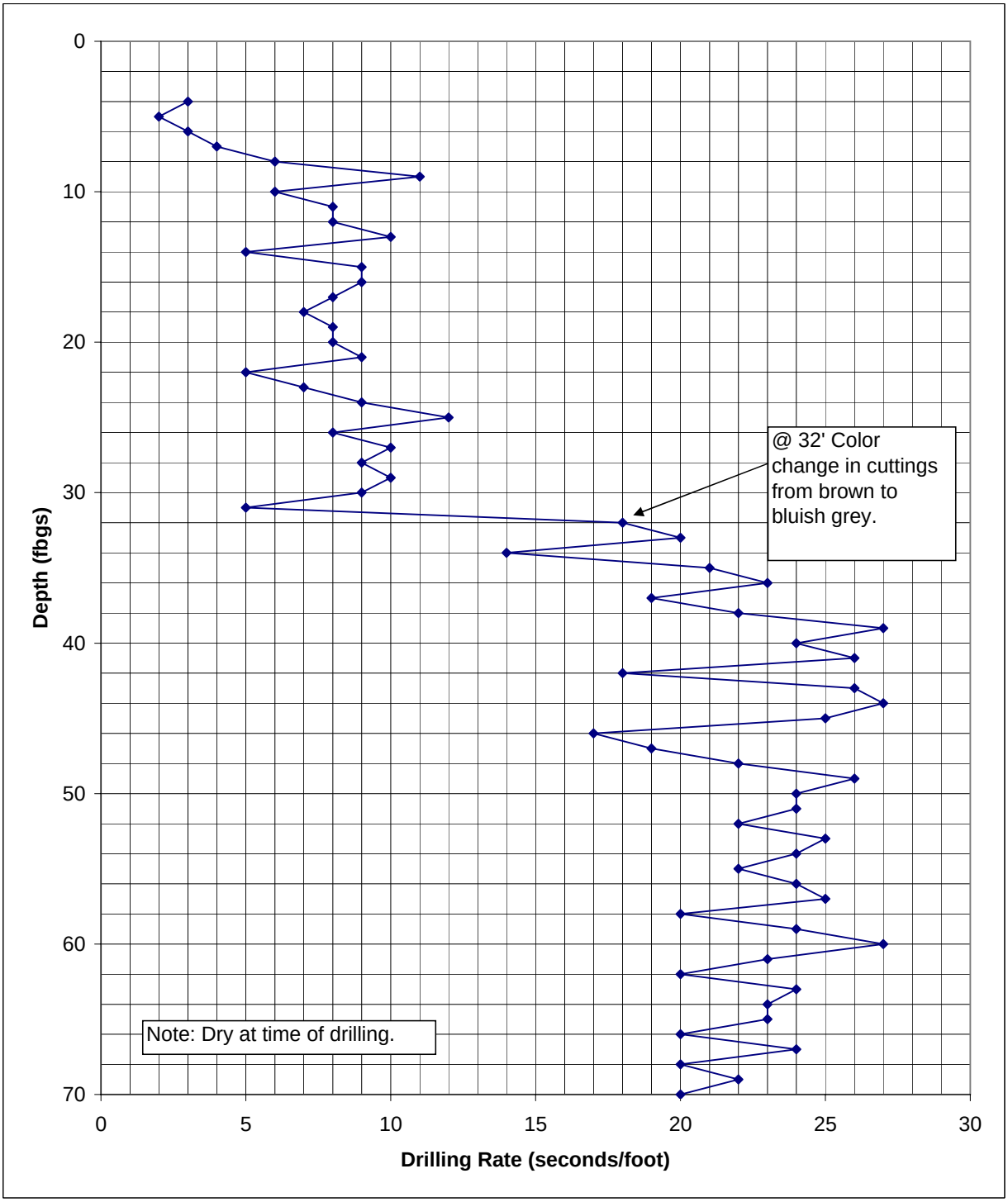
Boring B-26, Depth Interval 35.5 to 40.0 feet

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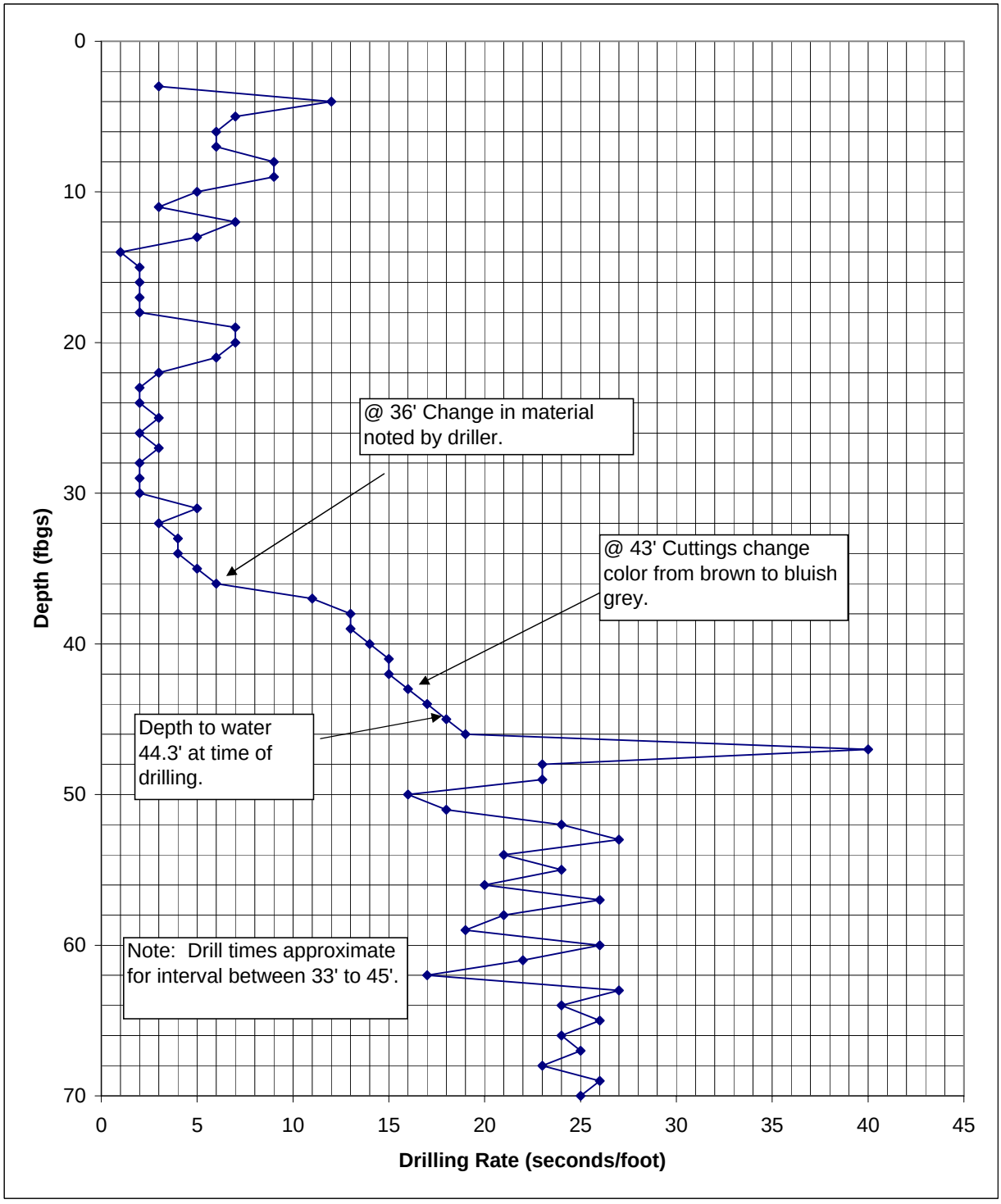
CORE PHOTOGRAPHS BORING B-26	URS
Suncrest Substation 27669017.00002	Date: 2-19-09
	Figure: A-116



URS	**Air-Track Boring - 01 (Elevation 3,097 ft)**	Date: 6/4/2009
	Project: SDG&E - Suncrest Substation **Project Location:** Bell Bluff, San Diego County, California **Project Number:** 27669017.00002	Figure: A-117



URS	**Air-Track Boring - 02 (Elevation 3,079 ft)**	Date: 6/4/2009
	Project: SDG&E - Suncrest Substation **Project Location:** Bell Bluff, San Diego County, California **Project Number:** 27669017.00002	Figure: A-118



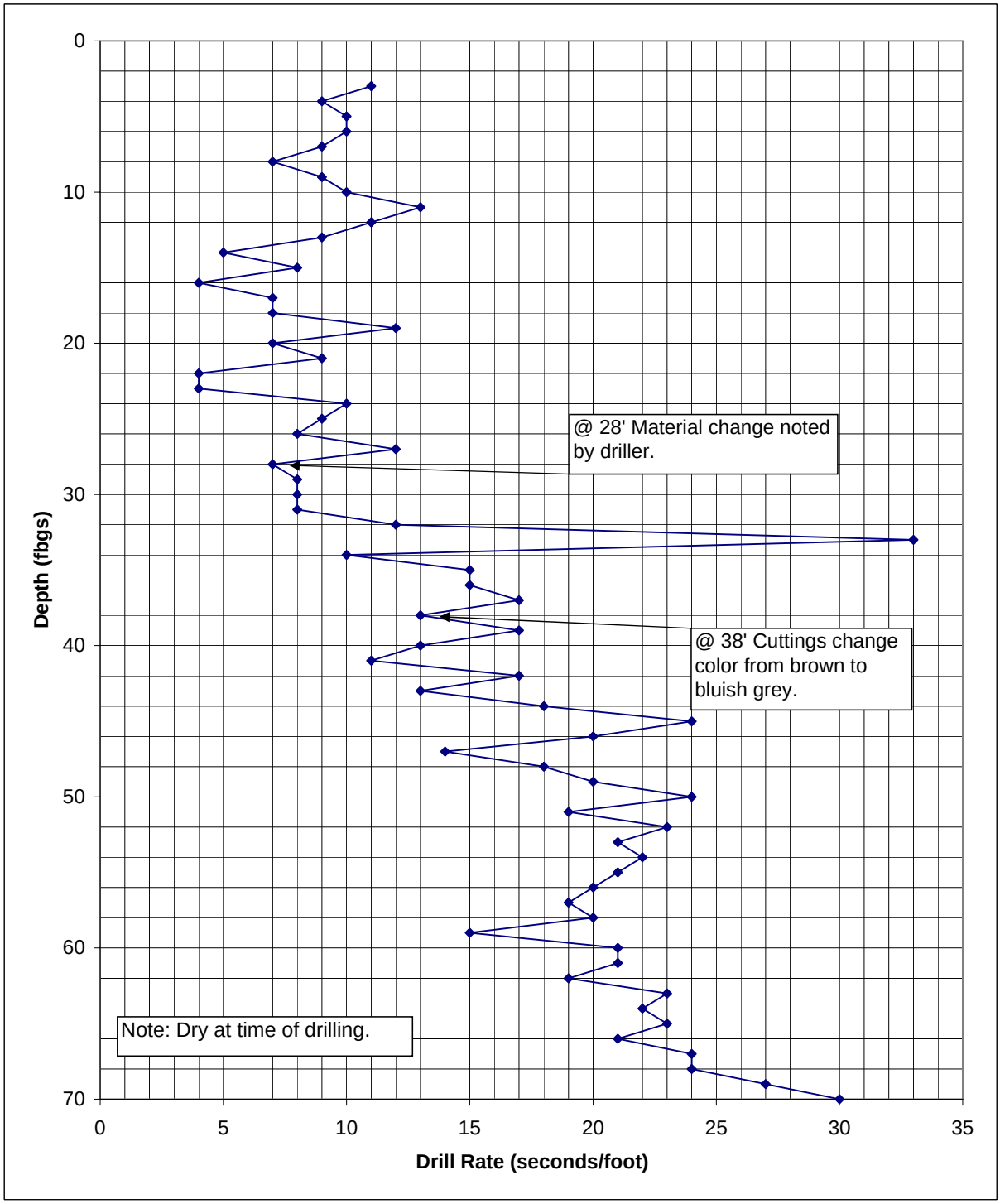
URS

Air-Track Boring - 03 (Elevation 3,080 ft)

Date: 6/4/2009

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Figure: A-119



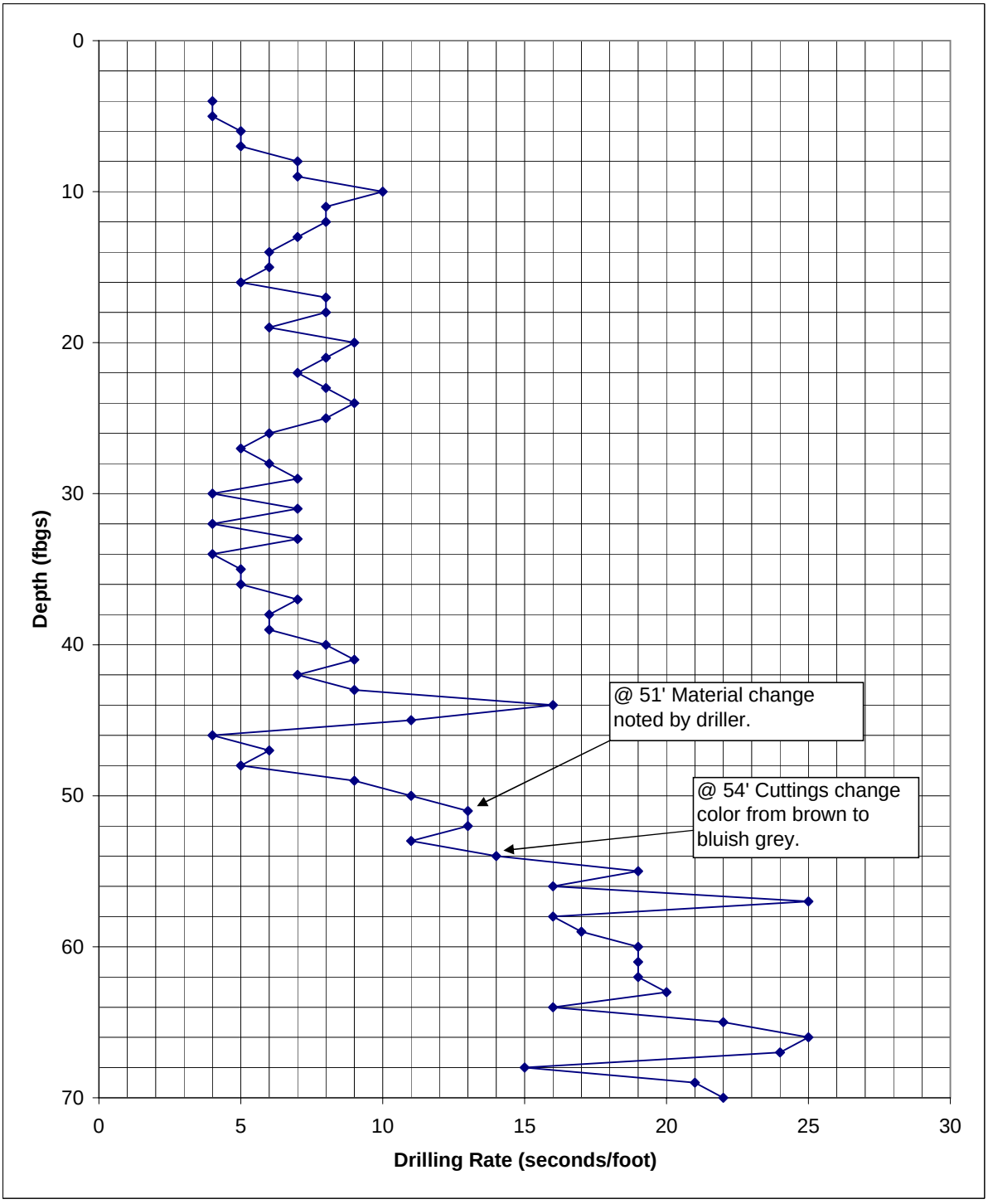
URS

Air-Track Boring - 04 (Elevation 3,089 ft)

Date: 6/4/2009

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Figure: A-120



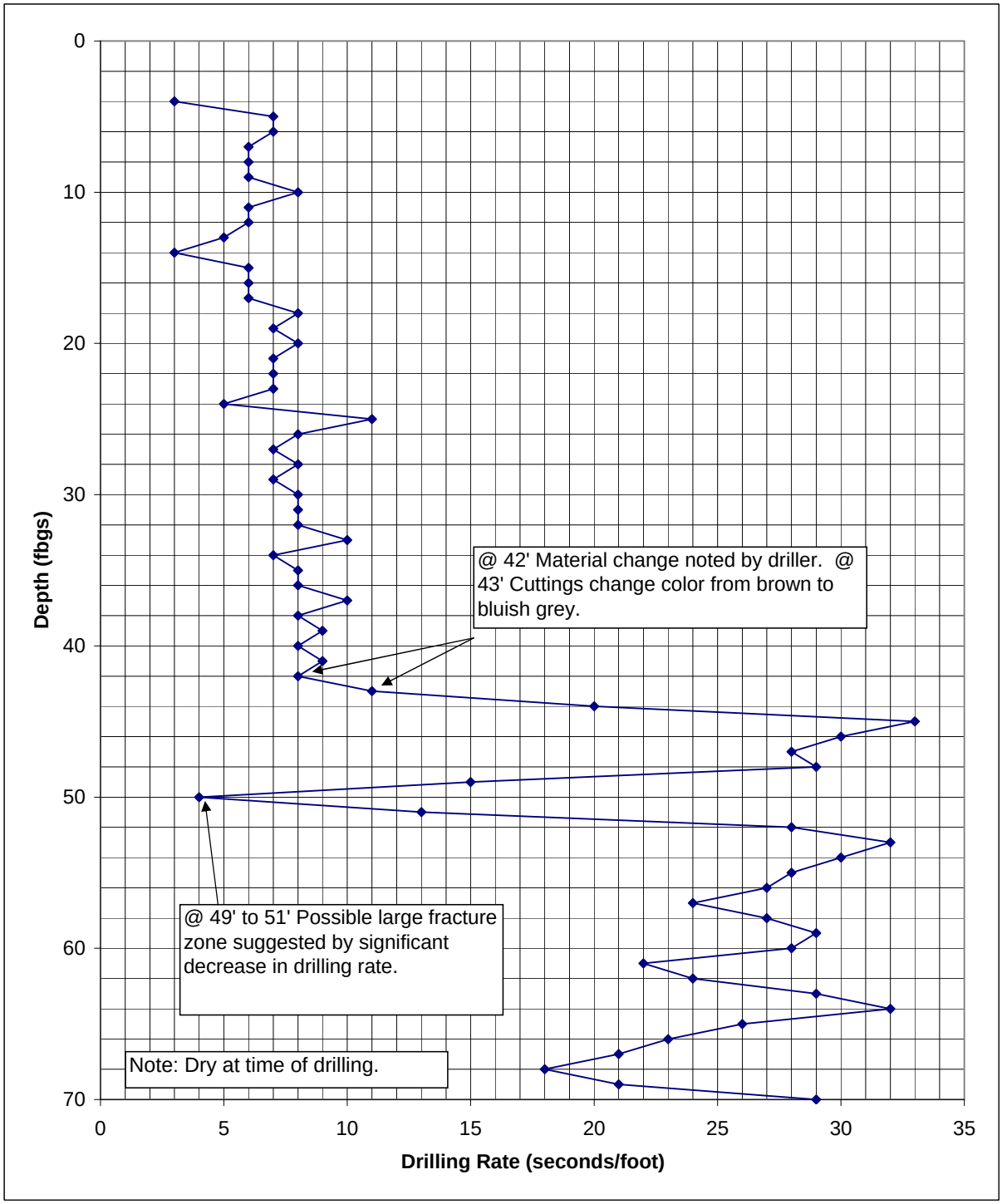
URS

Air-Track Boring - 05 (Elevation 3,094 ft)

Date: 6/4/2009

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Figure: A-121



URS

Air-Track Boring - 06 (Elevation 3,095 ft)

Date: 6/4/2009

Project: SDG&E - Suncrest Substation
Project Location: Bell Bluff, San Diego County, California
Project Number: 27669017.00002

Figure: A-122

Seismic refraction surveys were performed at the site in two phases by engineering geologists and a professional geophysicist from URS. During the week ending July 18, 2008, five traverses were completed in accessible road areas within the substation pad to provide preliminary information. A second phase of work performed the week ending November 21, 2008, and on January 7, 2009 completed 16 additional traverses across the substation pad and in the area of a proposed water tank. A summary of the seismic refraction surveys is presented in Table B-1; their locations are presented on Figure 2.

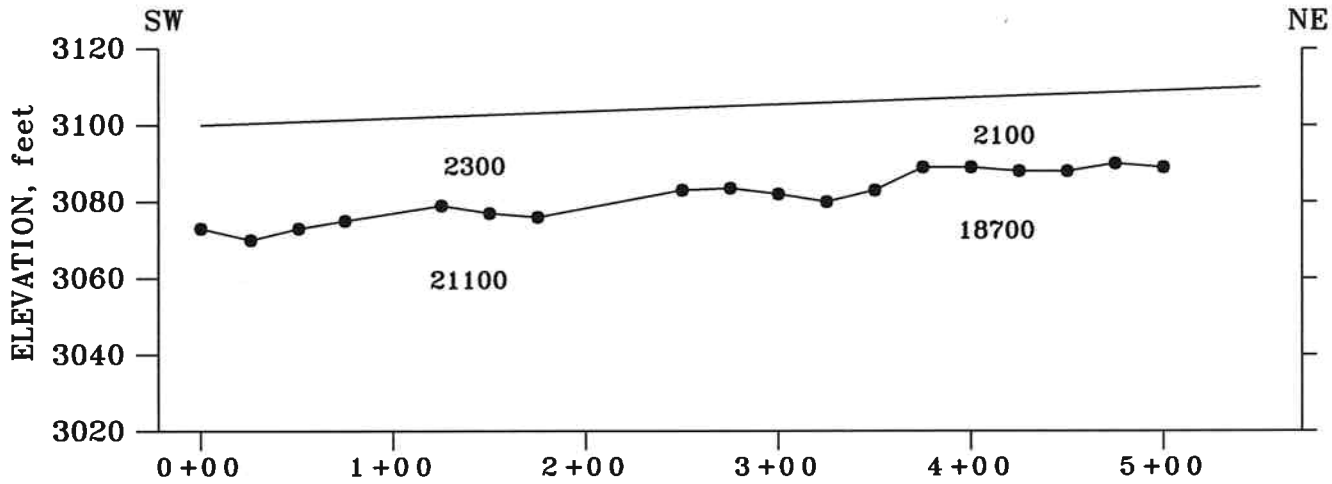
The seismic refraction technique is based on the measurement of the time required for a shockwave to travel from a sourcepoint (shotpoint) to one or more co-linear sensors (geophones). Measurements were obtained using a Geometrics S24 seismograph with 24 geophones. The source consisted of multiple sledgehammer blows to a groundplate or rock. Geophones were normally spaced at 25-foot intervals. Two profiles (Profiles RS08-19 and RS08-20) also included 10-foot geophone spacings to provide greater near surface detail. Shotpoints were nominally placed at the center of each line segment, at each end, and typically offset 110 feet to 220 feet beyond each end. The primary constraint on data quality was wind noise.

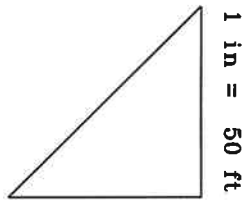
The seismic traveltimes were plotted on time-distance graphs and interpreted using time-term methods (the generalized reciprocal method with the XY parameter set to zero). The resulting models represent the rock and soils depths and velocities which would account for the measured traveltimes. The models 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-21 present the interpreted profiles. Figures B-22 through B-59 present the data plots and interpretative process. Three seismic layers are generally evident. The surface layer typically consists of 2 feet to 6 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 soils and highly weathered bedrock, typically 20 feet to 60 feet thick, with a normal velocity range of 3,100 fps to 6,200 fps. The third seismic layer is less weathered bedrock, with a usual velocity range of 14,000 fps to 20,000 fps. The plotted profiles show averaged velocities. Profiles RS08-19 and RS08-20 show somewhat lower velocity values due, partially, to reduced penetration depths compared to most of the profiles.

Table B-1
Summary of Seismic Refraction Surveys
Suncrest Substation

Seismic Refraction ID	Actual Traverse Length (feet.)	Date Performed	General Orientation	General Site Location
RS08-1	550	7/2008	SW-NE	Access Road
RS08-2	550	7/2008	SW-NE	Base of Granitic Knob
RS08-3	550	7/2008	NW-SE	Base of Granitic Knob
RS08-4	550	7/2008	NW-SE	Storage Area
RS08-5	275	7/2008	NW-SE	Base of Granitic Knob
RS08-6	550	11/2008	W-E	Access Road
RS08-7	550	11/2008	W-E	Access Road
RS08-8	275	11/2008	NW-SE	Granitic Knob
RS08-9	550	11/2008	W-E	Granitic Knob
RS08-10	275	11/2008	SW-NE	Granitic Knob
RS08-11	550	11/2008	W-E	Cut North Side of Pad
RS08-12	550	11/2008	S-N	Cut South of Granitic Knob
RS08-13	550	11/2008	SW-NE	500 kV Switchyard
RS08-14	550	11/2008	S-N	500 kV Switchyard
RS08-15	550	11/2008	S-N	Compensation Yard
RS08-16	550	11/2008	SW-NE	Fill Area SW Corner of Pad
RS08-17	550	11/2008	S-N	Water Storage Basin
RS08-18	275	11/2008	W-E	Cut on West Side of Pad
RS08-19	410	11/2008	S-N	Water Tank
RS08-20	410	11/2008	W-E	Water Tank
RS08-21	550	11/2008	S-N	230 kV Switchyard

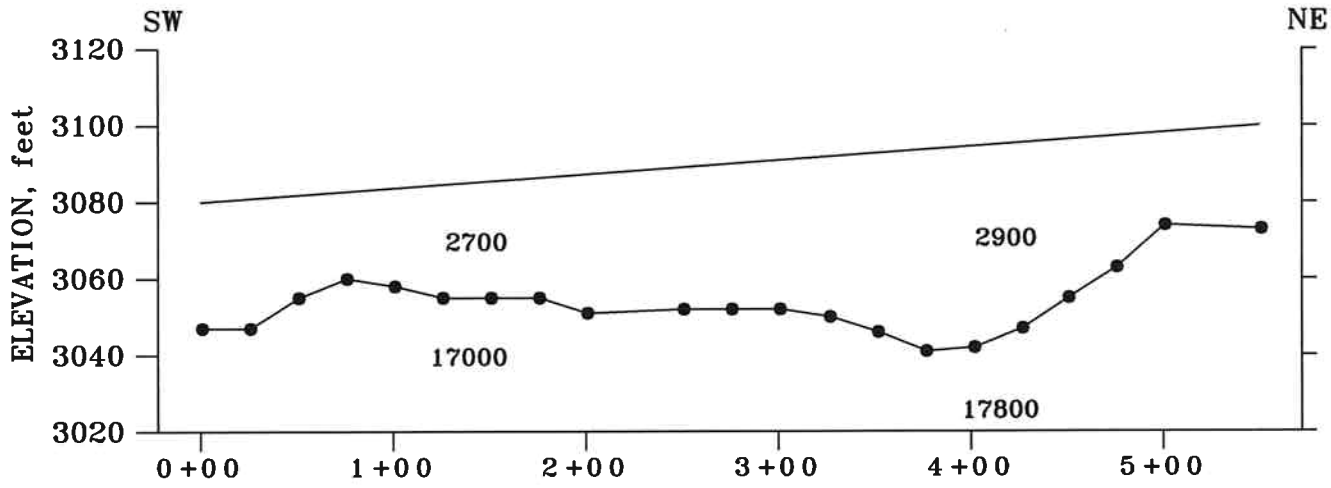


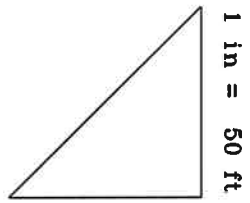


P-wave velocities in feet per second

RS08-1

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-1

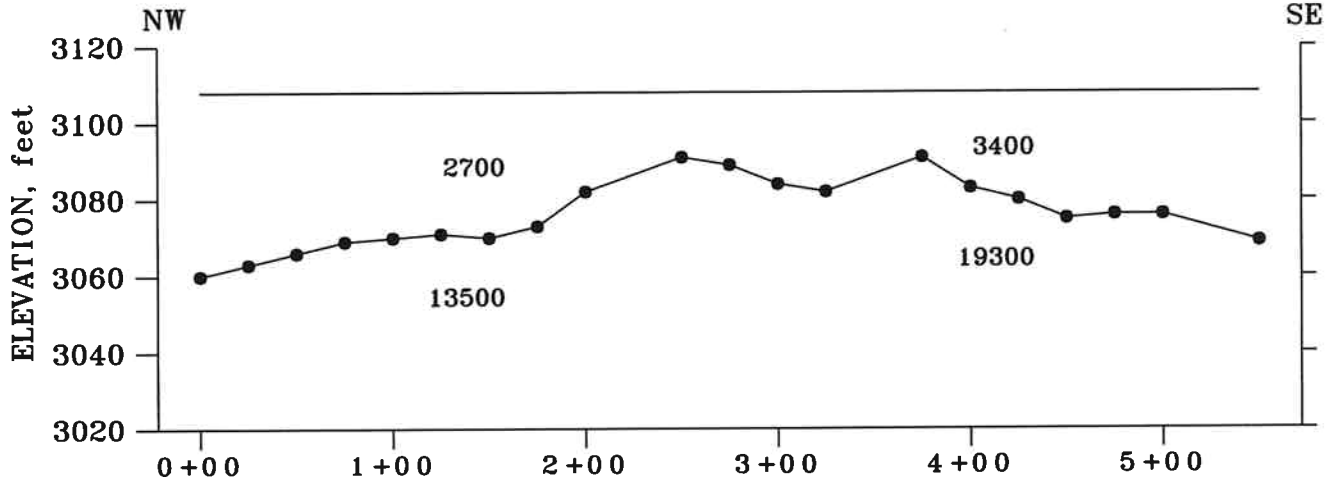


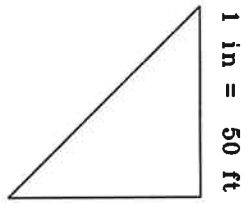


P-wave velocities in feet per second

RS08-2

Project No. 27669017	Date: **7-18-08**	Project: Suncrest Substation	Fig. B-2

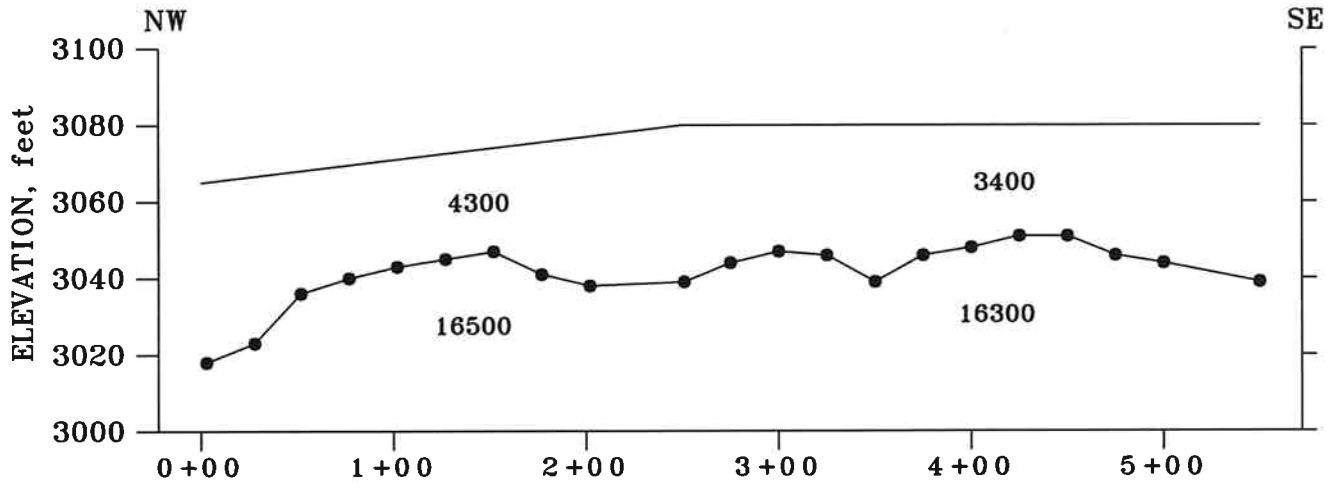


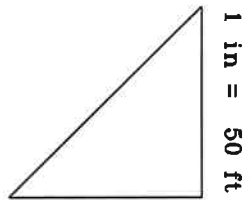


P-wave velocities in feet per second

RS08-3

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-3



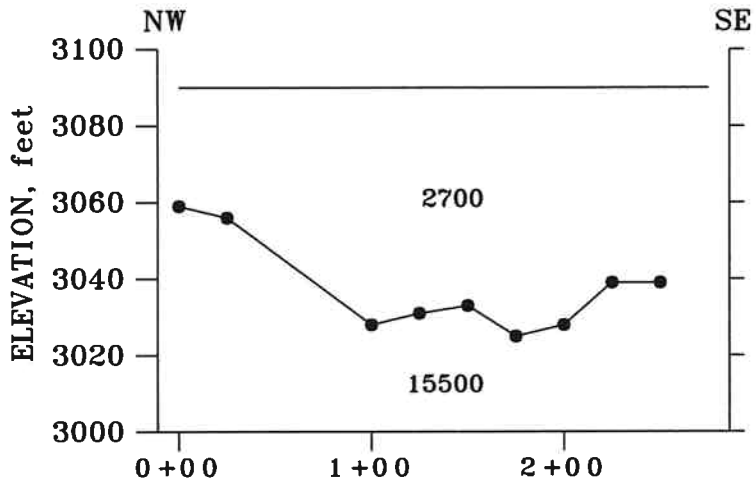


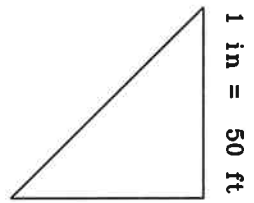
1 in = 100 ft

P-wave velocities in feet per second

RS08-4

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-4

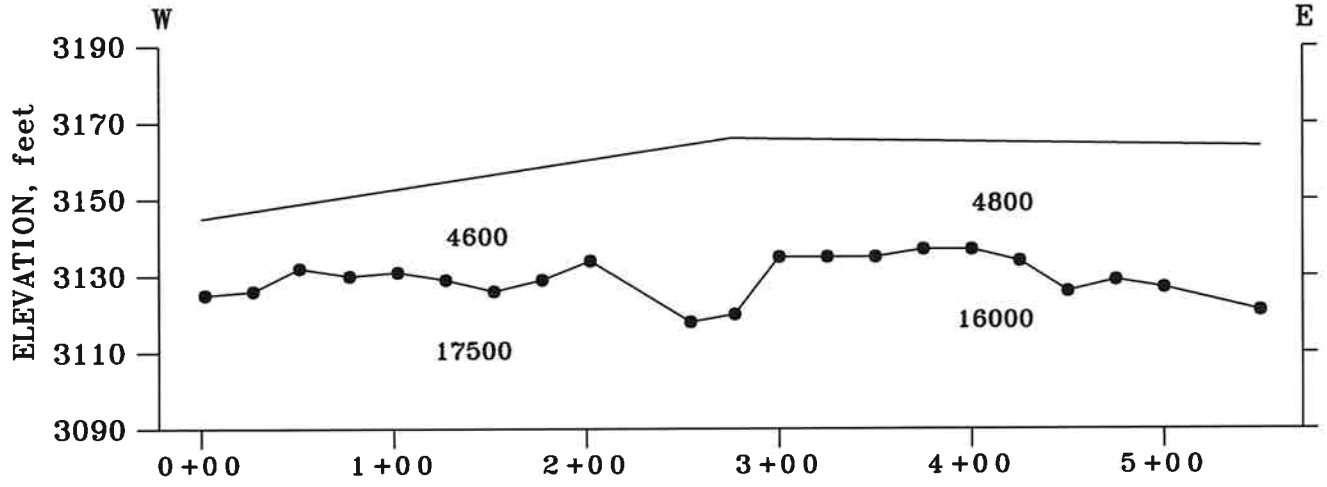


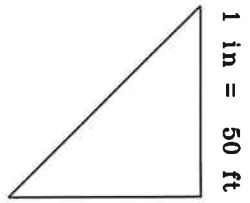


P-wave velocities in feet per second

RS08-5

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-5



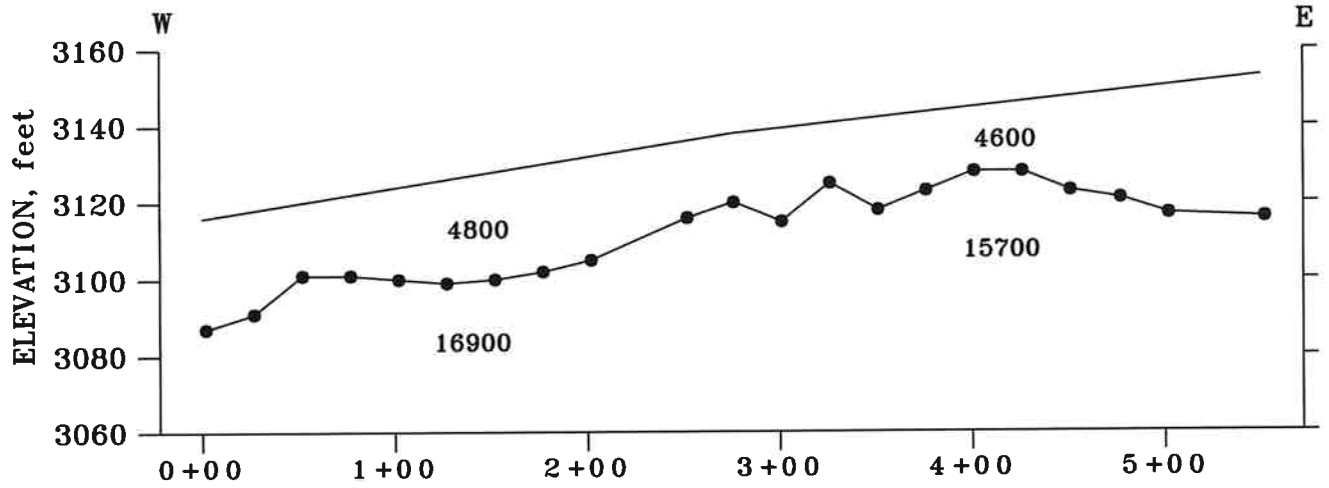


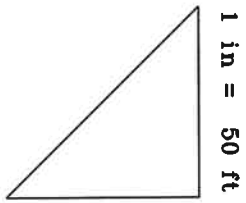
1 in = 100 ft

P-wave velocities in feet per second

RS08-6

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-6

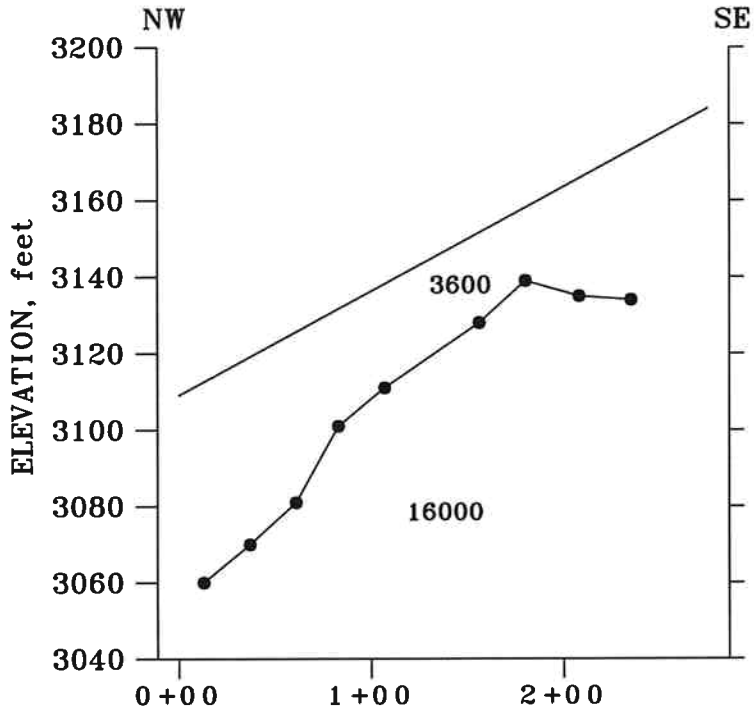


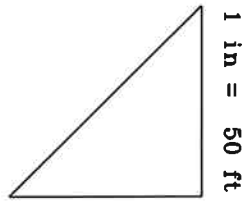


P-wave velocities in feet per second

RS08-7

Project No. 27669017	Date: **11-24-08**	Project: Suncrest Substation	Fig. B-7

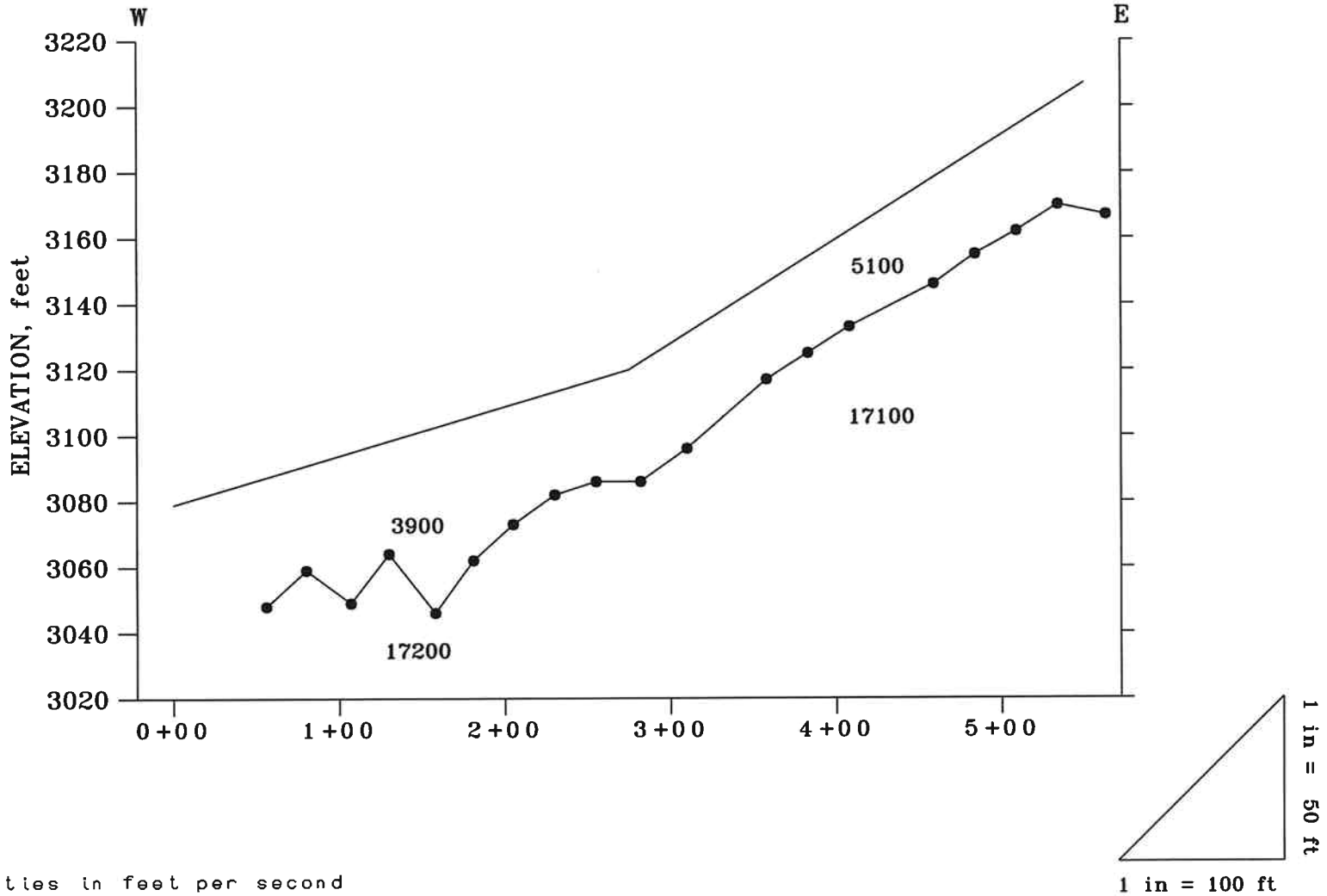




P-wave velocities in feet per second

RS08-8

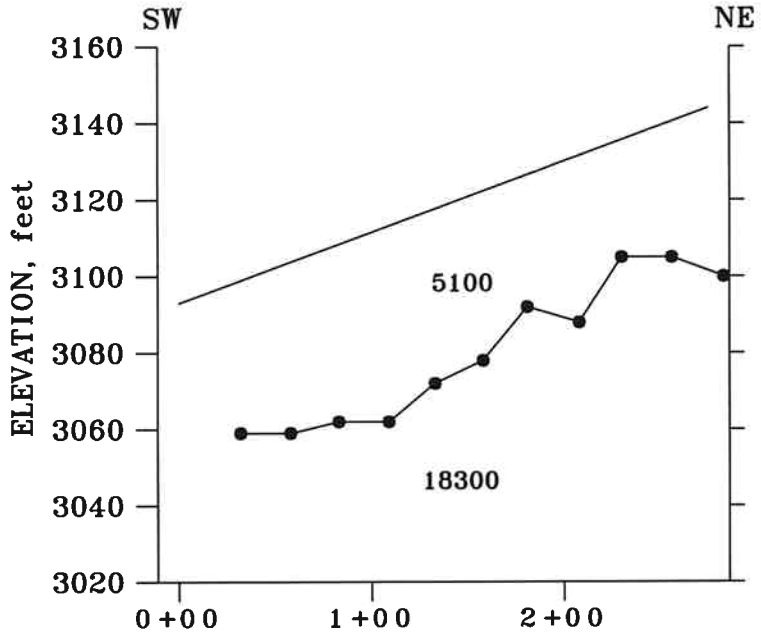
Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-8

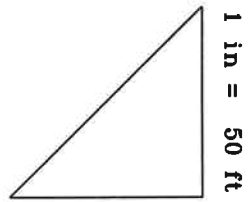


P-wave velocities in feet per second

RS08-9

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-9

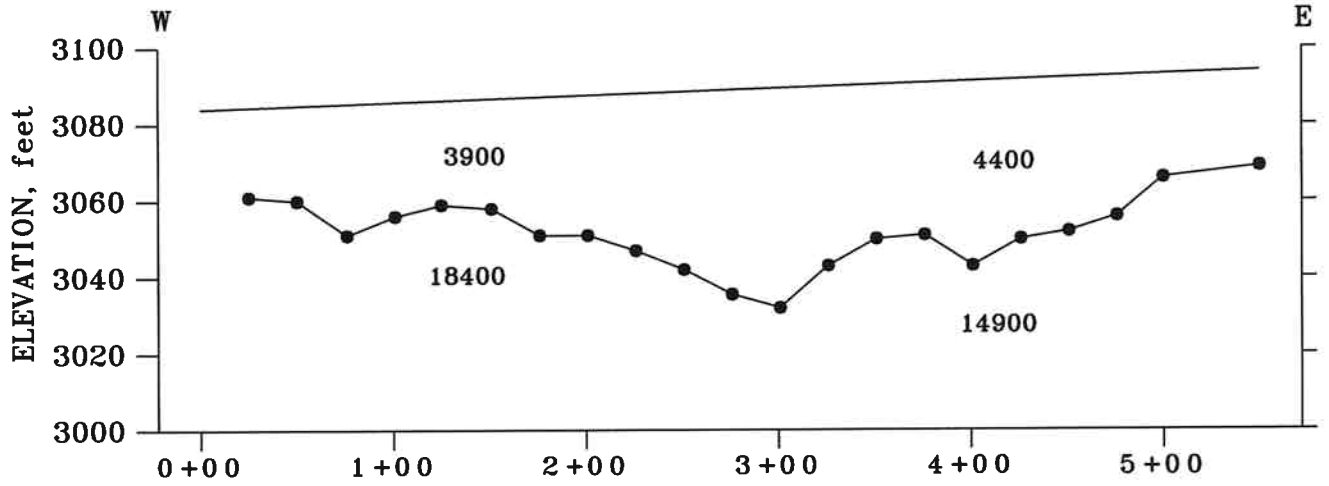


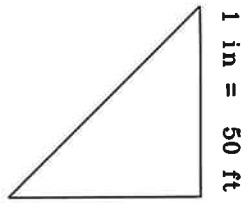


P-wave velocities in feet per second

RS08-10

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-10



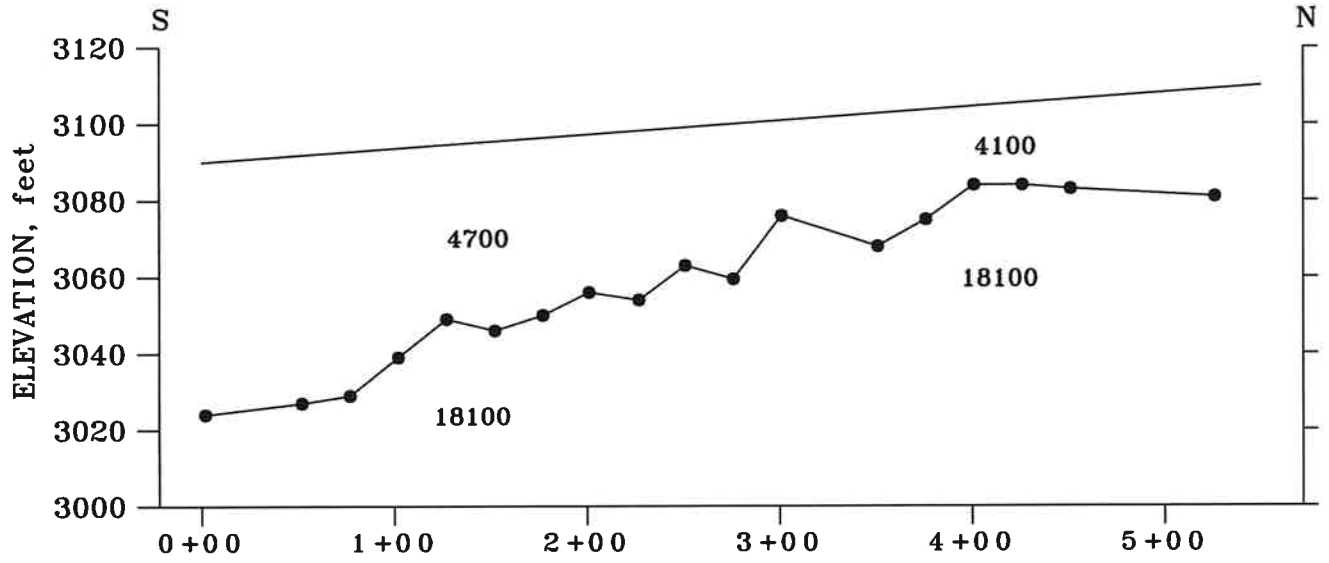


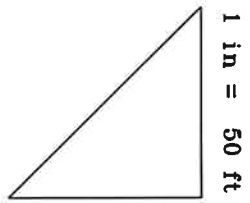
1 in = 100 ft

P-wave velocities in feet per second

RS08-11

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-11

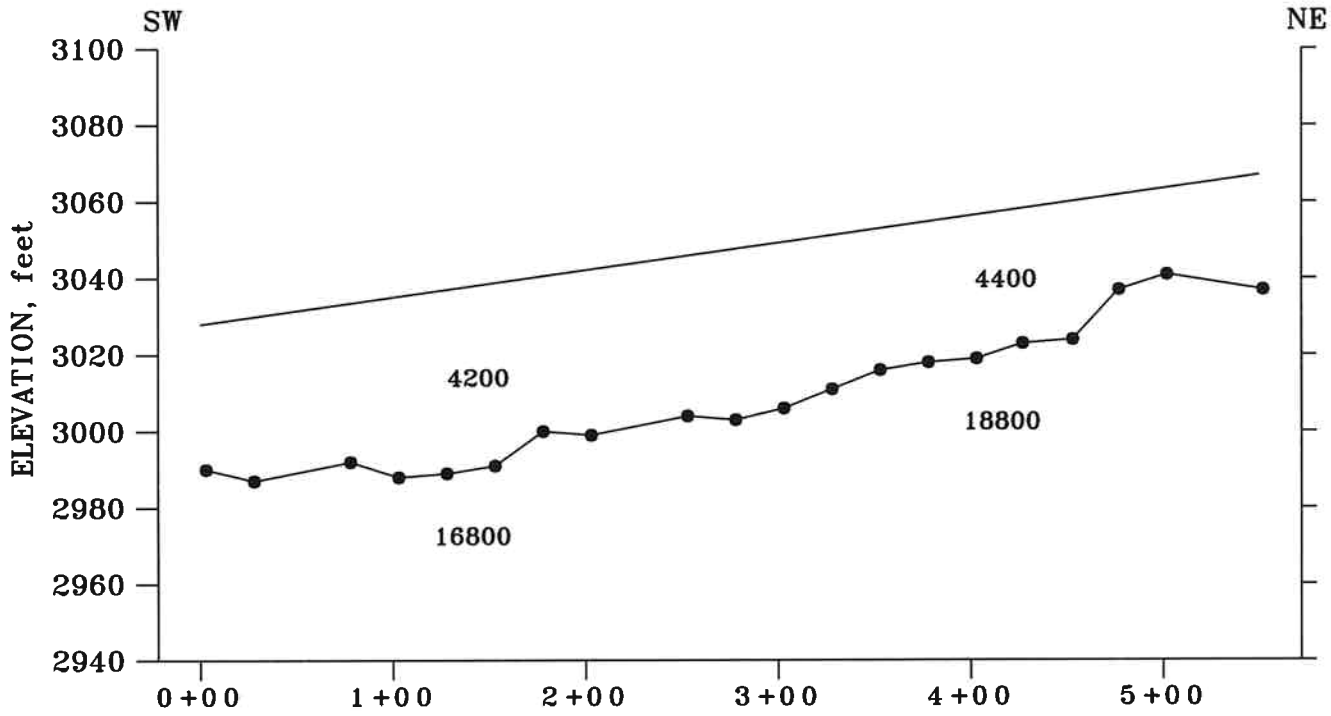


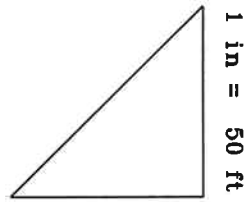


P-wave velocities in feet per second

RS08-12

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-12



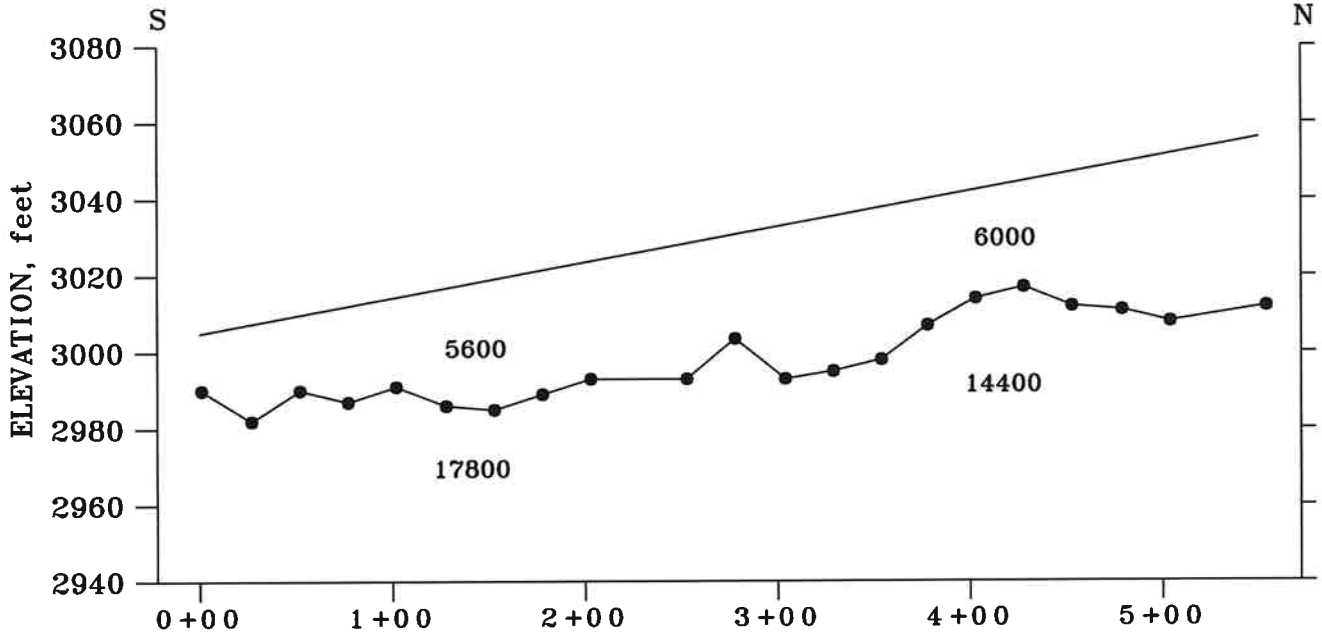


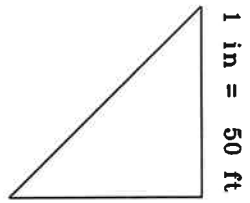
1 in = 100 ft

P-wave velocities in feet per second

RS08-13

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-13



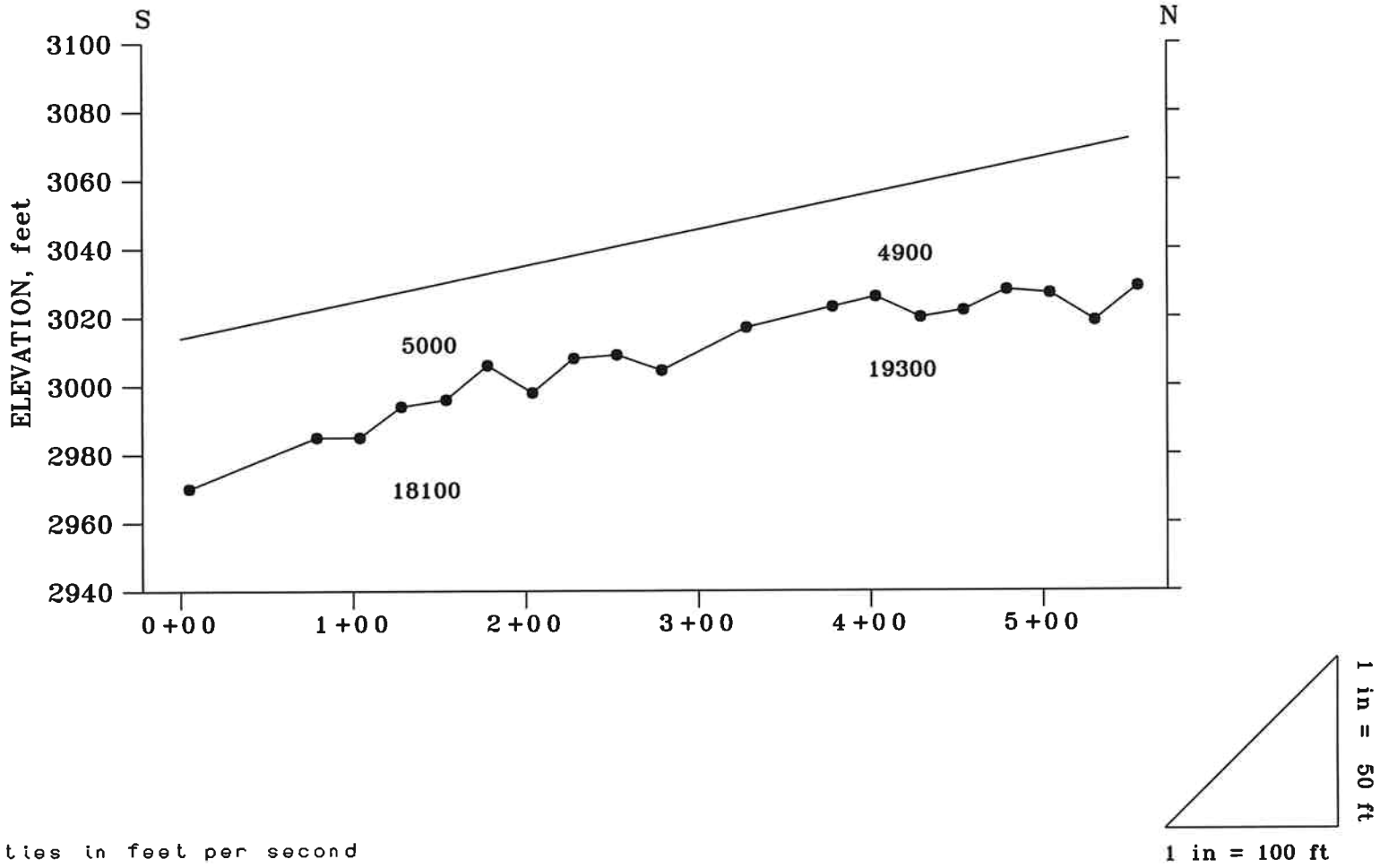


1 in = 100 ft

P-wave velocities in feet per second

RS08-14

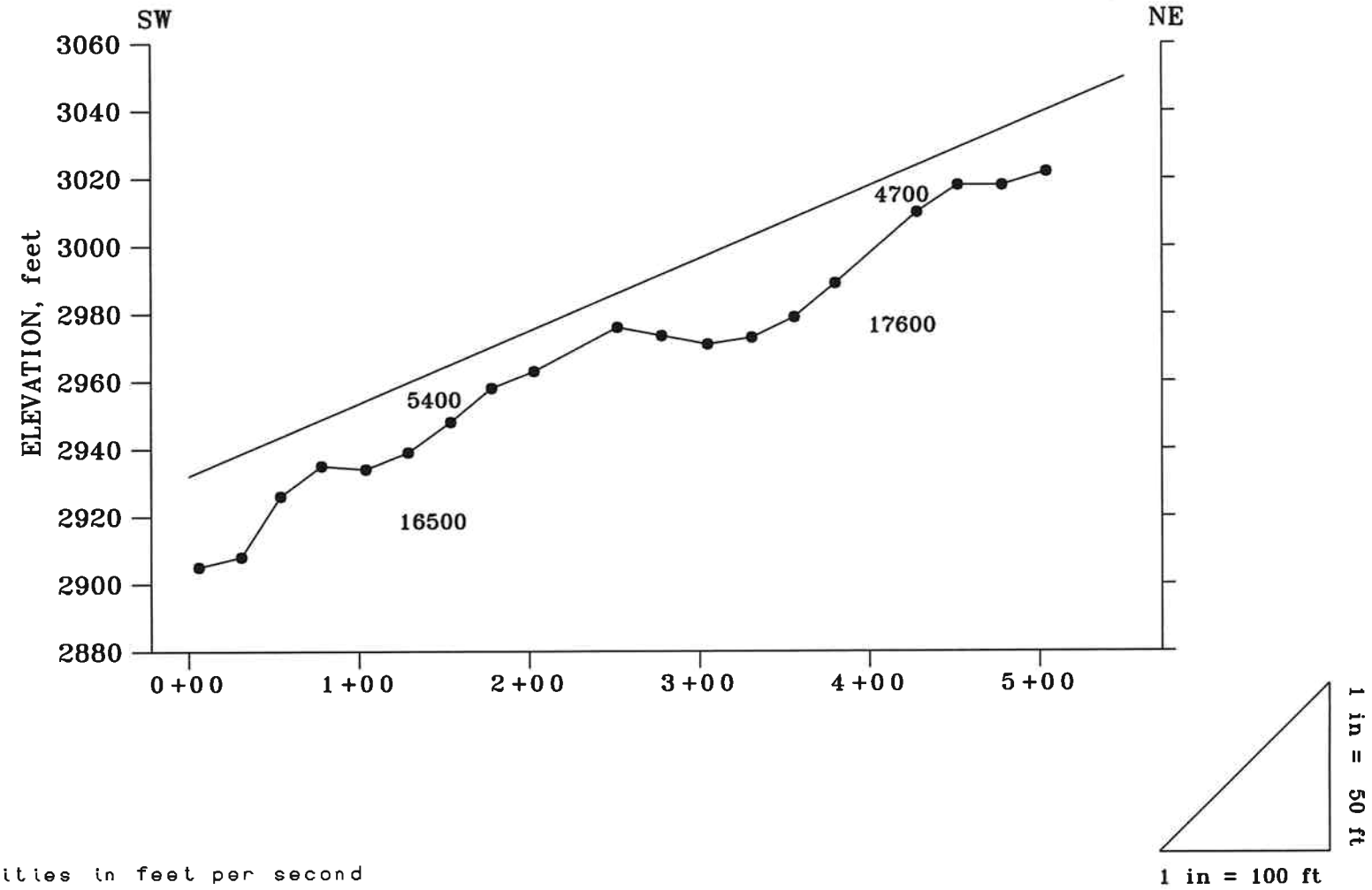
Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-14



P-wave velocities in feet per second

RS08-15

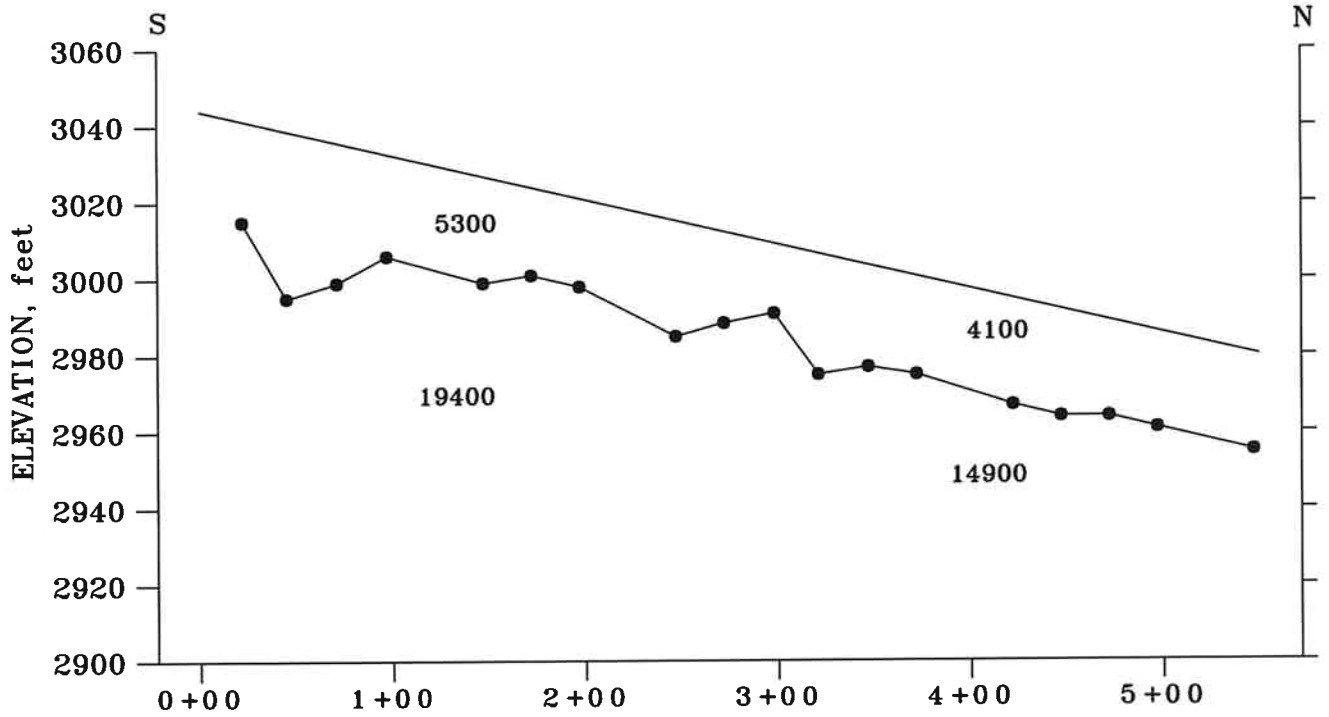
Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-15

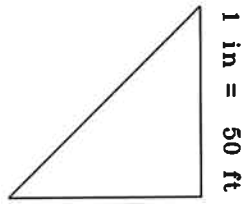


P-wave velocities in feet per second

RS08-16

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-16



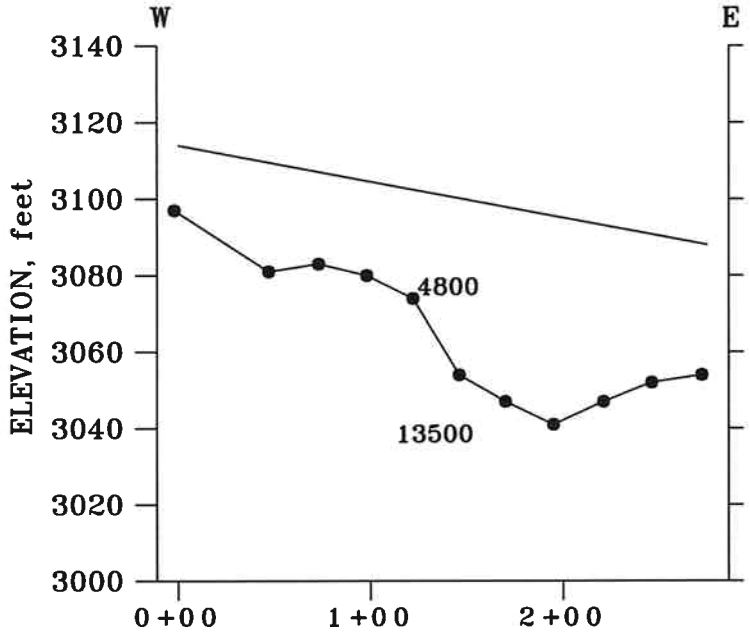


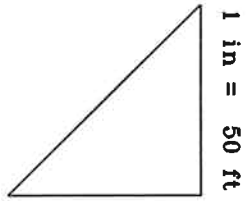
1 in = 100 ft

P-wave velocities in feet per second

RS08-17

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-17

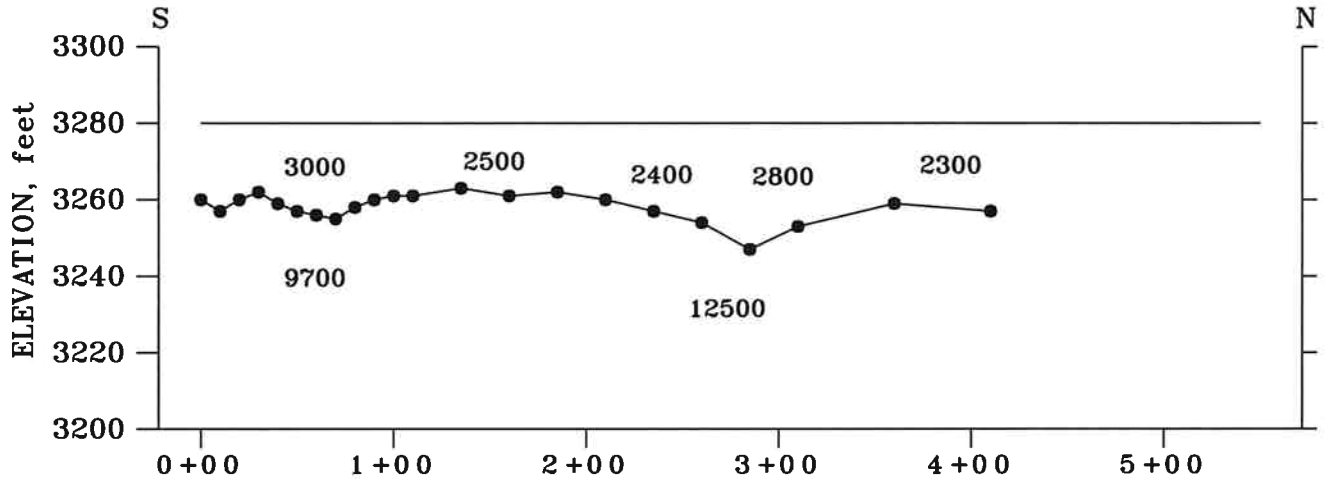


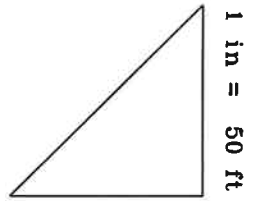


P-wave velocities in feet per second

RS08-18

Project No. 27669017	Date: **11-24-08**	Project: Suncrest Substation	Fig. B-18



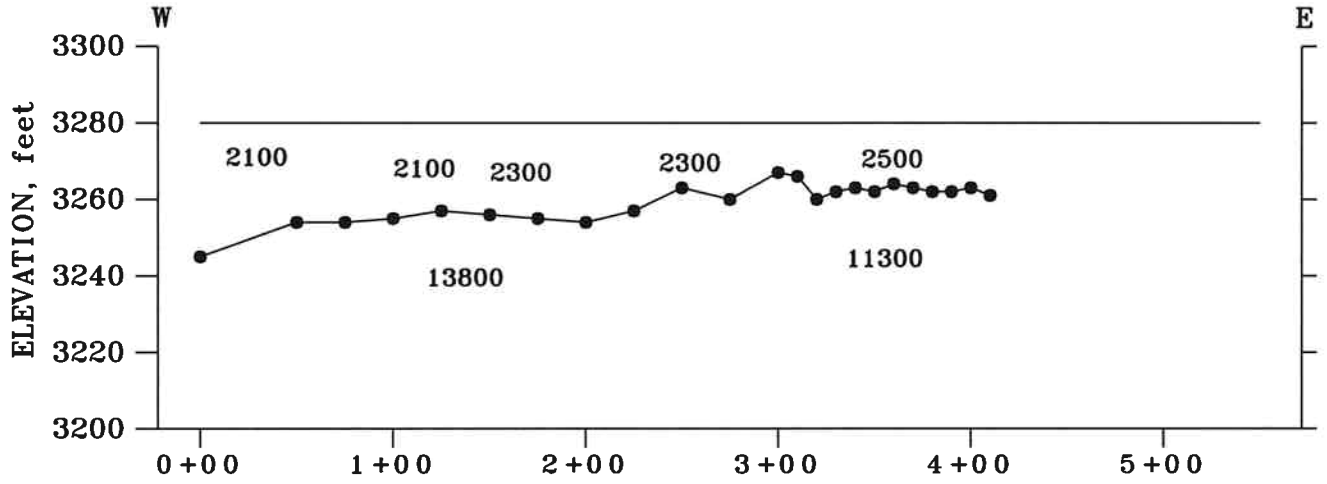


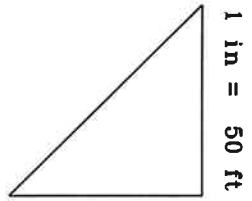
1 in = 100 ft

P-wave velocities in feet per second

RS08-19

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig. B-19

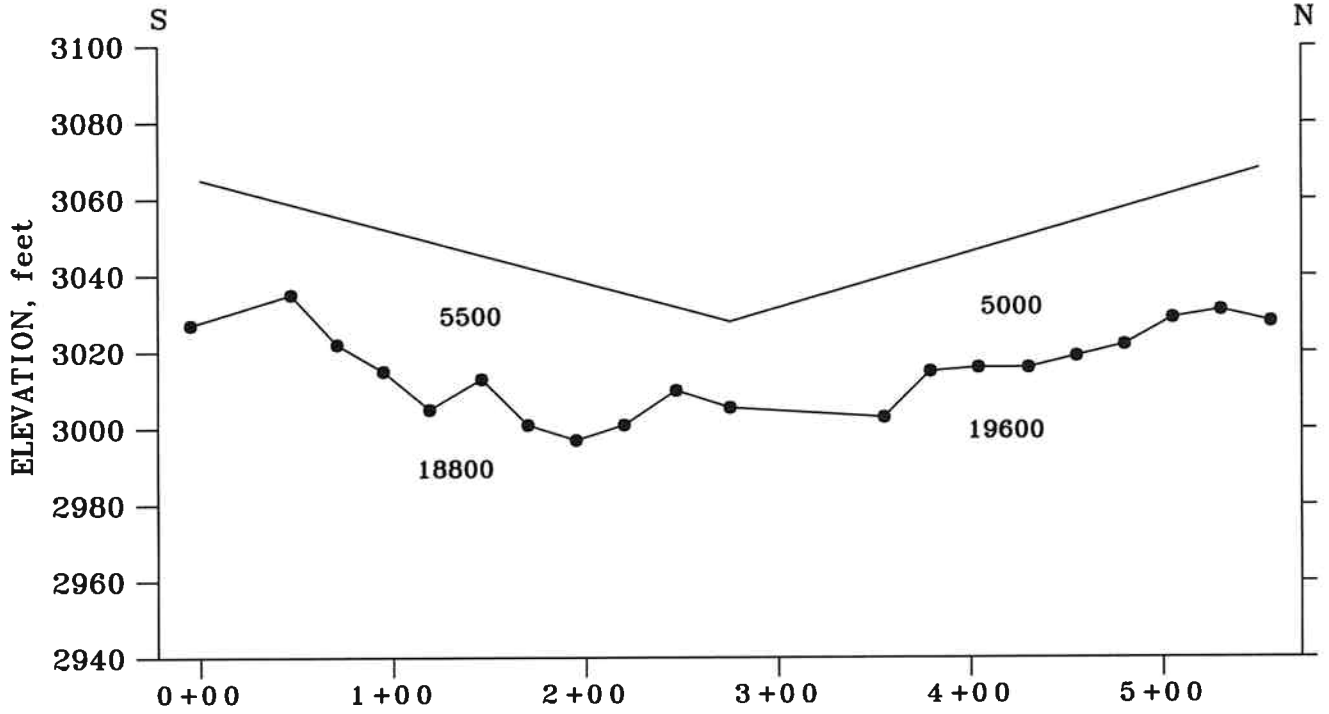


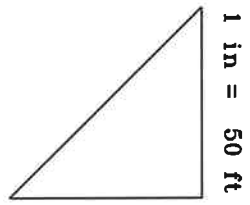


P-wave velocities in feet per second

RS08-20

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig. B-20



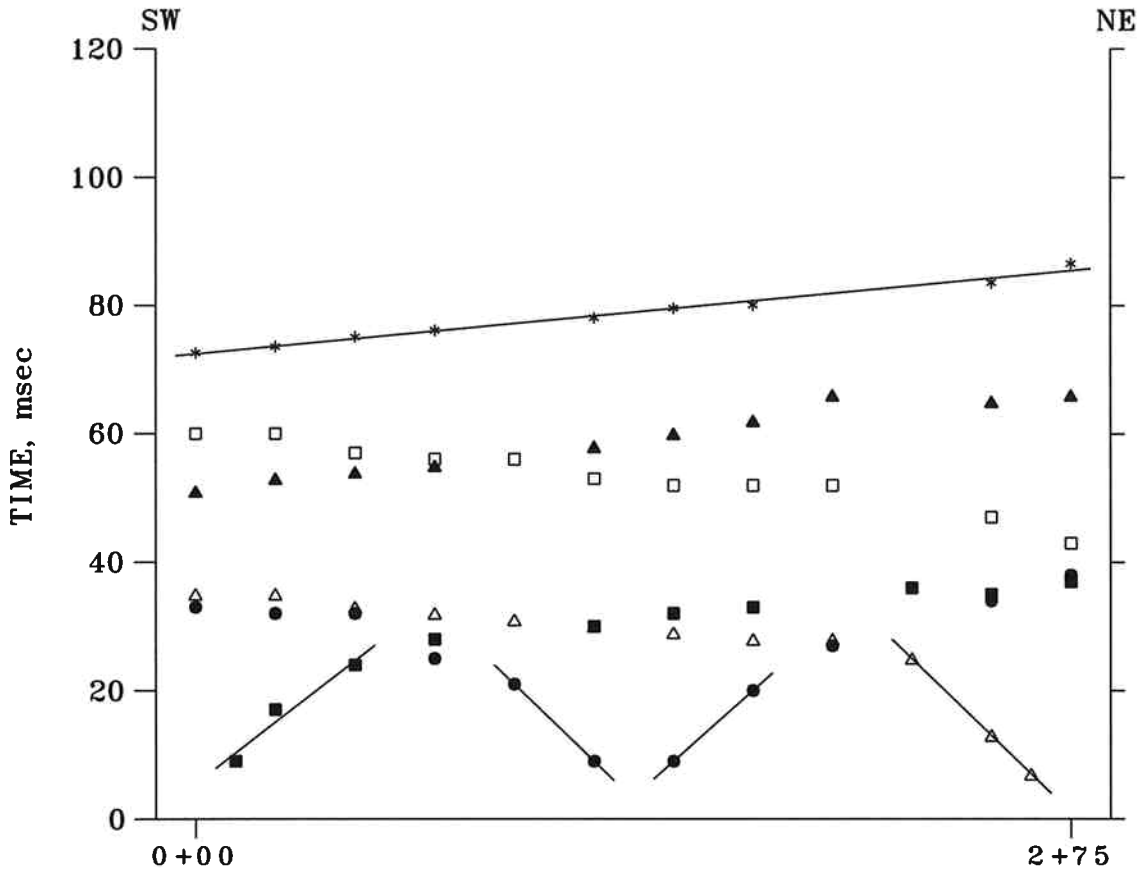


1 in = 100 ft

P-wave velocities in feet per second

RS08-21

Project No. 27669017	Date: 11-24-08	Project: Suncrest Substation	Fig. B-21



Geophone spacing = 25 ft

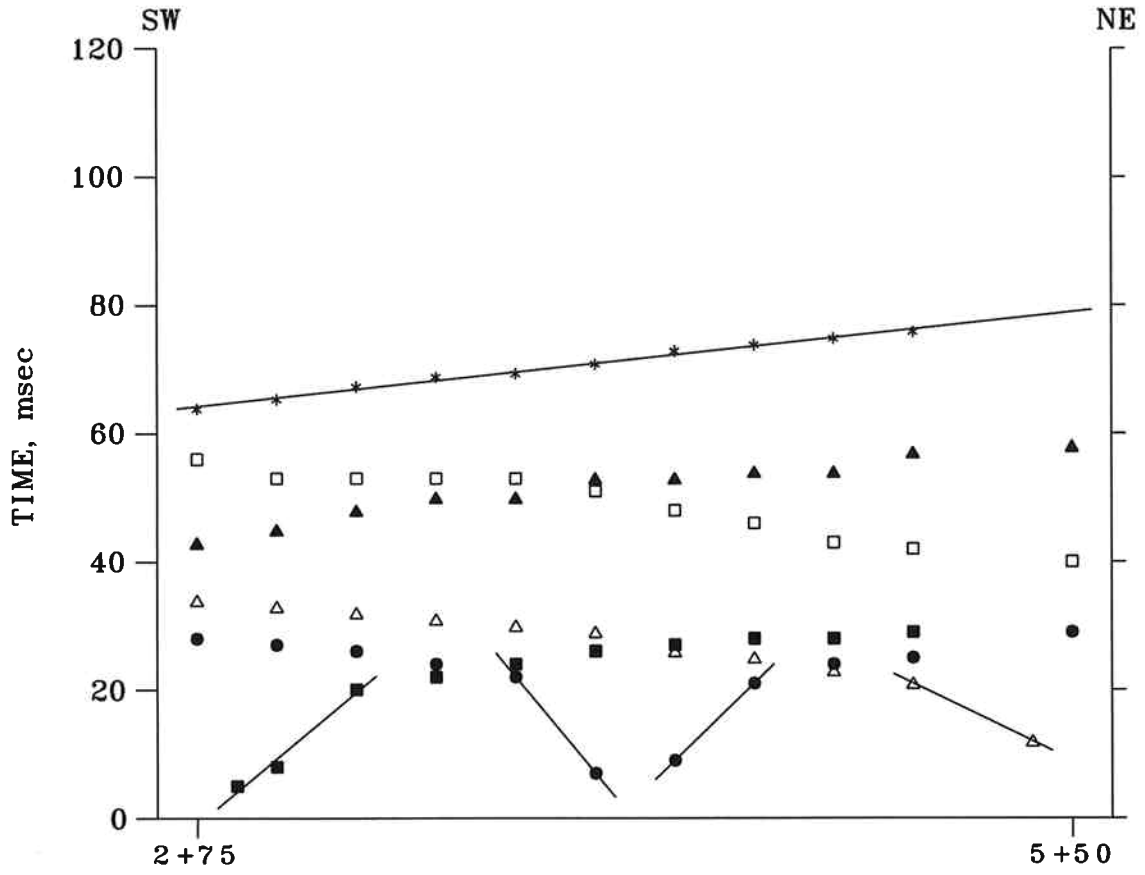
Arrival Time, msec												
▲	51	53	54	55		58	60	62	66		65	66
■	9	17	24	28		30	32	33		36	35	37
●	33	32	32	25	21	9	9	20	27		34	38
△	35	35	33	32	31	30	29	28	28	25	13	7
□	60	60	57	56	56	53	52	52	52		47	43

t_{ab} = 36 msec; XY = 0

t_a =	24	26	27	28		30	32	33		36	35	37	
t_b =	35	35	33	32	31	30	29	29	29		24	20	
* $\frac{1}{2}\Delta t$ =	-5½	-4½	-3	-2		0	1½	2			5½	8½	
t_g =	11½	12½	12	12		12	12½	13			11½	10½	
t_c =	2	2	2	2	2	2	2	2	2	2	2	1	
z_0 =	2	2	2	2		2	2	2			2	1	ft
z_1 =	27	30	29	26		23	26	27			22	21	ft
v_0 =						1100							fps
v_1 =		2610			2080			2270		2080			fps
v_2 =						21050							fps

RS08-1

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-22



Geophone spacing = 25 ft

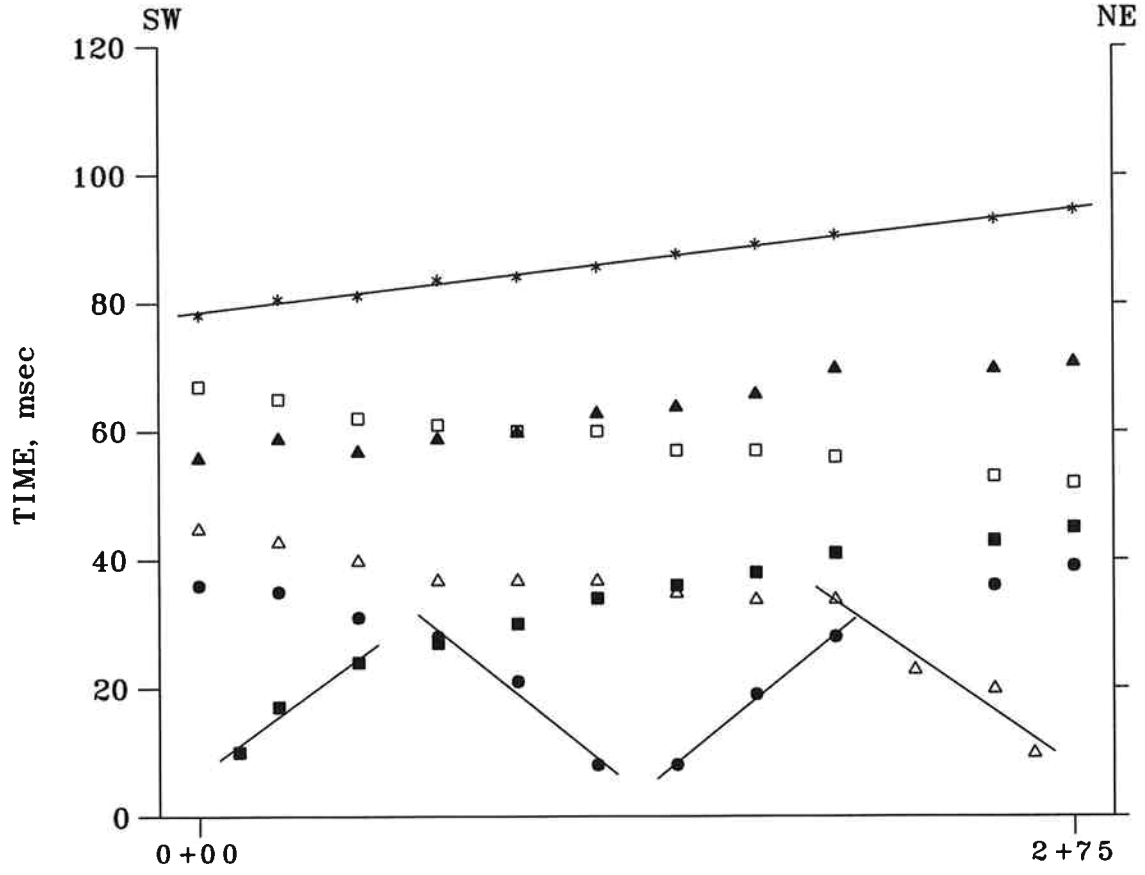
Arrival Time, msec												
▲	43	45	48	50	50	53	53	54	54	57		58
■	5	8	20	22	24	26	27	28	28	29		
●	28	27	26	24	22	7	9	21	24	25		29
△	34	33	32	31	30	29	26	25	23	21		12
□	56	53	53	53	53	51	48	46	43	42		40

t_{ab}= 33 msec; XY = 0

t_a=	17	19	22	24	24	26	27	28	28	29			
t_b=	34	33	32	31	30	29	26	25	23	22		20	
* ½△t=	-8½	-7	-5	-3½	-3	-1½	0½	1½	2½	3½			
t_g=	9	9½	10½	11	10½	11	10	10	9	9			
t_c=	0	0	0	0	0	0	1	1	1	1	1	2	
z_0=	0	0	0	0	0	0	1	1	1	1			ft
z_1=	22	23	26	23	18	18	20	20	26	35			ft
v_0=						1100							fps
v_1=		2430			1670			2080		4170			fps
v_2=						18710							fps

RS08-1

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-23



Geophone spacing = 25 ft

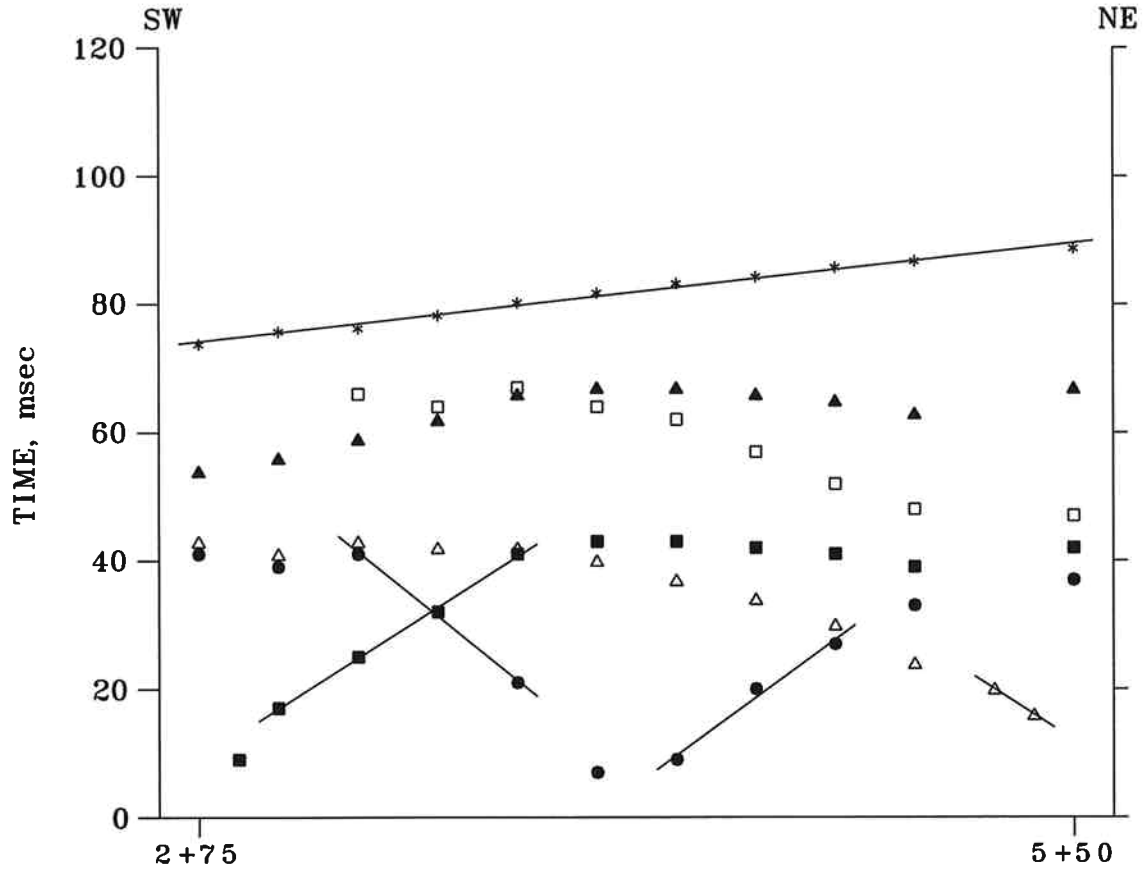
Arrival Time, msec													
▲	56	59	57	59	60	63	64	66	70		70	71	
■	10	17	24	27	30	34	36	38	41		43	45	
●	36	35	31	28	21	8	8	19	28		36	39	
△	45	43	40	37	37	37	35	34	34	23	20	10	
□	67	65	62	61	60	60	57	57	56		53	52	

t_{ab} = 45 msec; XY = 0

t_a =	27	30	28	30	31	34	36	38	41		43	45	
t_b =	45	43	40	37	37	37	35	34	34		31	30	
* $\frac{1}{2}\Delta t$ =	−9	−6½	−6	−3½	−3	−1½	0½	2	3½		6	7½	
t_g =	13½	14	11½	11	11½	13	13	13½	15		14½	15	
t_c =	3	3	3	3	2	2	2	2	3	3	3	4	
z_0 =	3	3	3	3	2	2	2	2	3		3	4	ft
z_1 =	33	34	27	24	26	30	30	31	36		37	37	ft
v_0 =						1100							fps
v_1 =		2780			2500			2500		2920			fps
v_2 =						16980							fps

RS08-2

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-24



Geophone spacing = 25 ft

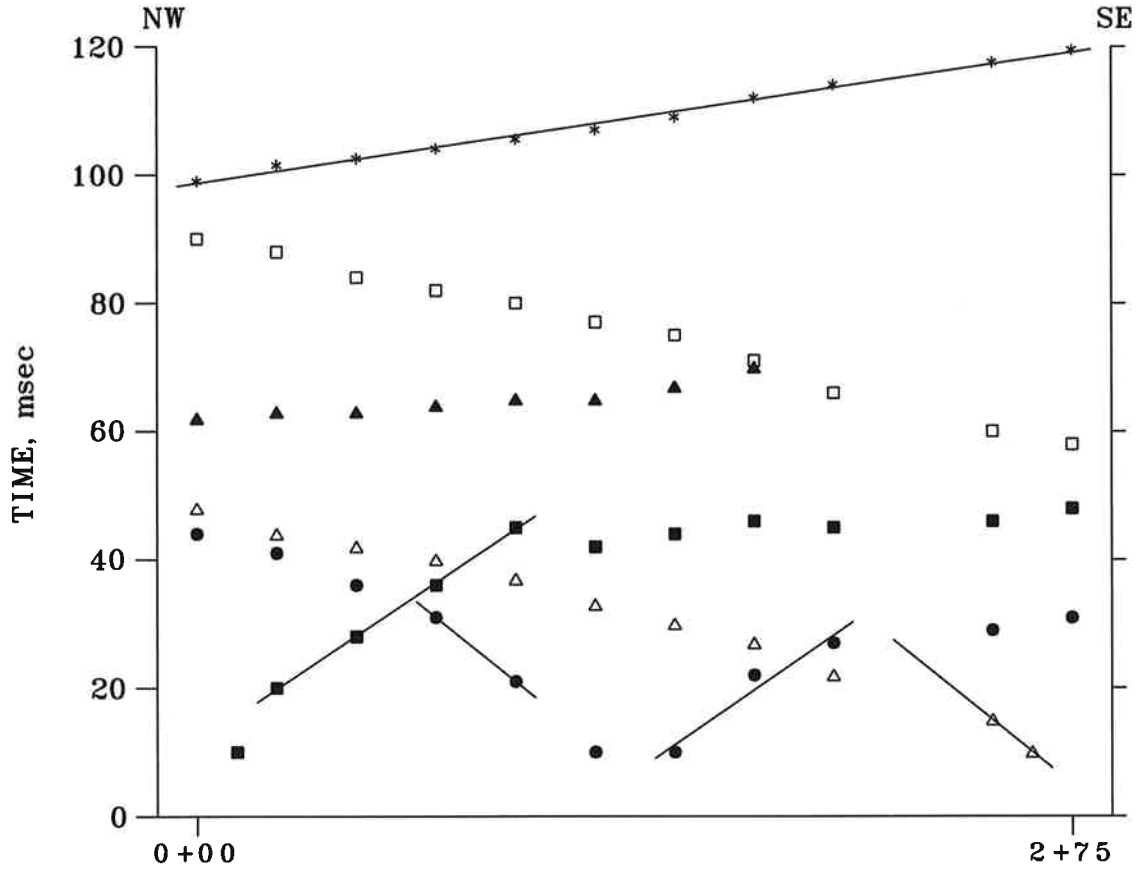
Arrival Time, msec												
▲	54	56	59	62	66	67	67	66	65	63		67
■	9	17	25	32	41	43	43	42	41	39		42
●	41	39	41	32	21	7	9	20	27	33		37
△	43	41	43	42	42	40	37	34	30	24	20	16
□			66	64	67	64	62	57	52	48		47

t_{ab} = 42 msec; XY = 0

	t_a =	30	32	35	38	42	43	43	42	41	39		42	
	t_b =	43	41	43	42	42	40½	37	34	30	26		25	
*	½△t =	−6½	−4½	−4	−2	0	1½	3	4	5½	6½		8½	
	t_g =	15½	15½	18	19	21	20½	19	17	14½	11½		12½	
	t_c =	5	5	5	4	4	3	3	4	4	5	5	6	
	z_0 =	6	6	6	4	4	3	3	4	4	6		7	ft
	z_1 =	39	39	43	47	53	53	48	41	34	25		27	ft
	v_0 =						1100							fps
	v_1 =			3160			2500			2780				fps
	v_2 =						17790							fps

RS08-2

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig B-25



Geophone spacing = 25 ft

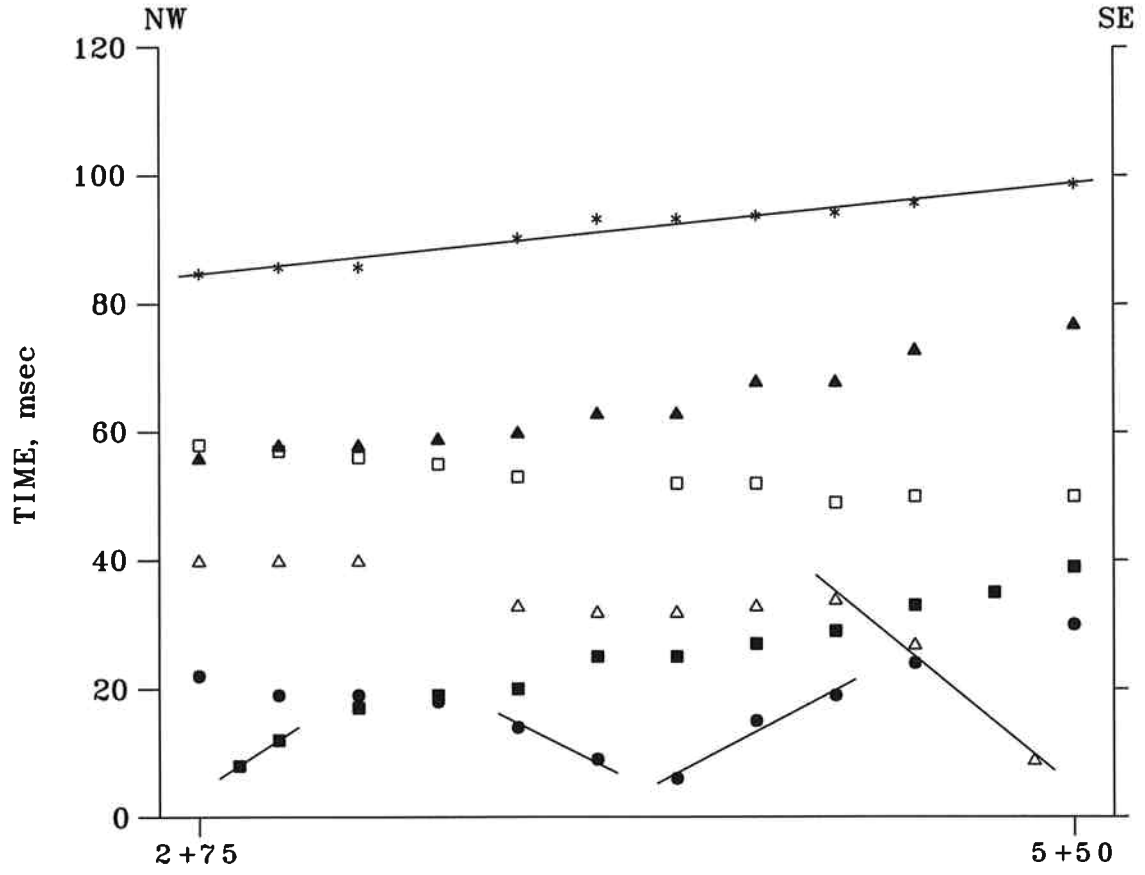
Arrival Time, msec												
▲	62	63	63	64	65	65	67	70				
■	10	20	28	36	45	42	44	46	45		46	48
●	44	41	36	31	21	10	10	22	27		29	31
△	48	44	42	40	37	33	30	27	22		15	10
□	90	88	84	82	80	77	75	71	66		60	58

t_{ab}= 48 msec; XY = 0

	t_a=	39	40	40	41	42	42	44	46	45		46	48	
	t_b=	48	44	42	40	38	35	33	29	24		18	16	
*	½△t=	−4½	−2	−1	0½	2	3½	5½	8½	10½		14	16	
	t_g=	19½	18	17	16½	16	14½	14½	13½	10½		8	8	
	t_c=	6	5	5	4	4	3	3	3	3	3	2	2	
	z_0=	7	6	6	4	4	3	3	3	3		2	2	ft
	z_1=	48	46	43	40	38	37	38	35	26		17	17	ft
	v_0=						1100							fps
	v_1=		3010			2500			2940		2500			fps
	v_2=						13460							fps

RS08-3

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-26



Geophone spacing = 25 ft

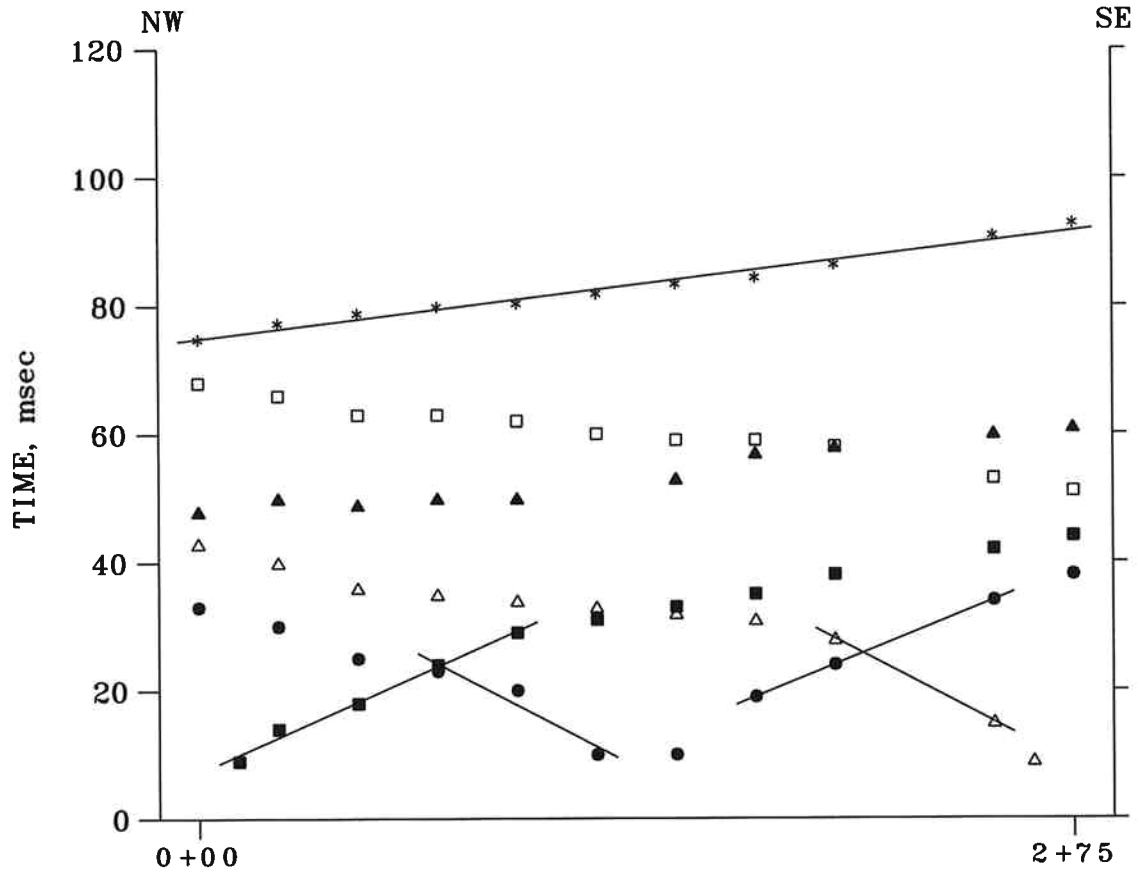
Arrival Time, msec												
▲	56	58	58	59	60	63	63	68	68	73		77
■	8	12	17	19	20	25	25	27	29	33	35	39
●	22	19	19	18	14	9	6	15	19	24		30
△	40	40	40		33	32	32	33	34	27		9
□	58	57	56	55	53		52	52	49	50		50

t_{ab}= 40 msec; XY = 0

	t_a=	16	18	18	19	20	25	25	27	29	33	35	39	
	t_b=	40	40	40		33	32	32	33	34	35		35	
*	$\frac{1}{2}\Delta t$=	-12	-11	-11		-6½	-3½	-3½	-3	-2½	-1		2	
	t_g=	8	9	9		6½	8½	8½	10	11½	14		17	
	t_c=	2	2	2	2	3	3	2	2	2	2	2	2	
	z_0=	2	2	2		3	3	2	2	2	2		2	ft
	z_1=	21	24	27		18	26	28	34	33	32		39	ft
	v_0=						1100							fps
	v_1=		3130			4000			3850		2460			fps
	v_2=						19340							fps

RS08-3

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-27



Geophone spacing = 25 ft

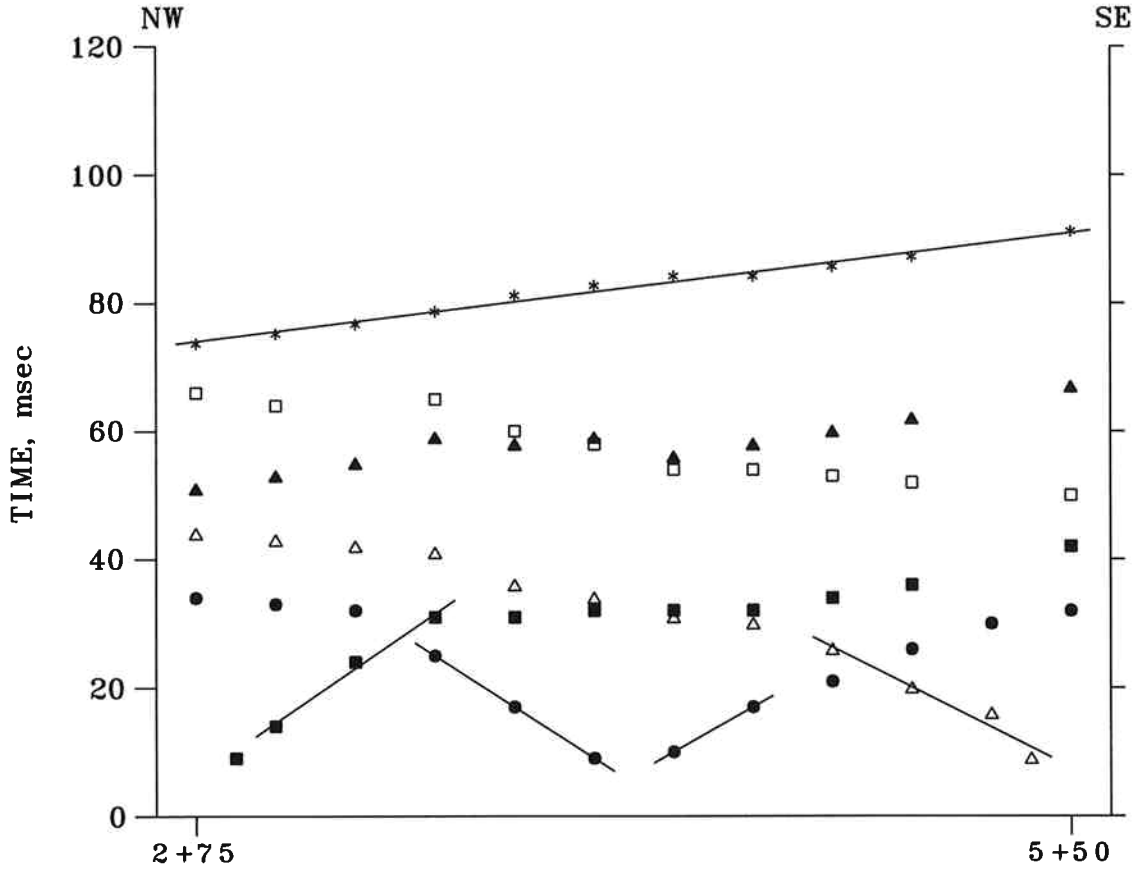
Arrival Time, msec													
▲	48	50	49	50	50		53	57	58		60	61	
■	9	14	18	24	29	31	33	35	38		42	44	
●	33	30	25	23	20	10	10	19	24		34	38	
△	43	40	36	35	34	33	32	31	28		15	9	
□	68	66	63	63	62	60	59	59	58		53	51	

t_{ab} = 44 msec; XY = 0

t_a=	27	29	28	29	29	31	33	35	38		42	44	
t_b=	43	40	36	35	34	33	32	32	31		26	24	
* ½△t=	-8	-5½	-4	-3	-2½	-1	0½	1½	3½		8	10	
t_g=	13	12½	10	10	9½	10	10½	11½	12½		12	12	
t_c=	4	4	4	4	4	4	6	6	5	5	4	4	
z_0=	4	4	4	4	4	4	7	7	6		4	4	ft
z_1=	47	45	33	30	28	28	27	35	40		41	41	ft
v_0=						1100							fps
v_1=		4550			3850			5000			3850		fps
v_2=						16490							fps

RS08-4

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-28



Geophone spacing = 25 ft

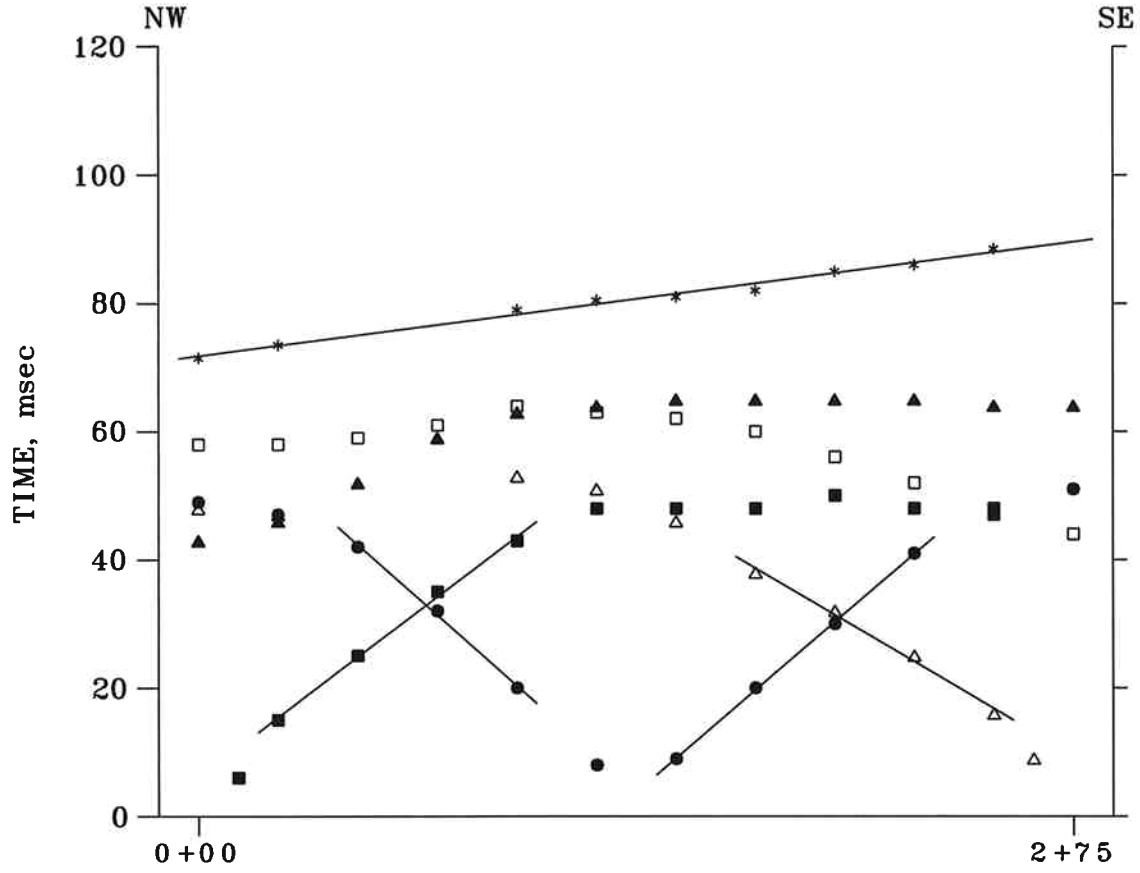
Arrival Time, msec												
▲	51	53	55	59	58	59	56	58	60	62		67
■	9	14	24	31	31	32	32	32	34	36		42
●	34	33	32	25	17	9	10	17	21	26	30	32
△	44	43	42	41	36	34	31	30	26	20	16	9
□	66	64		65	60	58	54	54	53	52		50

t_{ab} = 43 msec; XY = 0

t_a =	24	26	28	31	31	32	32	32	34	36		42	
t_b =	44	43	42	41	36	34	31	31	30	29		27	
* $\frac{1}{2}\Delta t$ =	−10	−8½	−7	−5	−2½	−1	0½	0½	2	3½		7½	
t_g =	12½	13	13½	14½	12	11½	10	10	10½	11		13	
t_c =	3	3	3	2	2	2	3	3	3	3	4	4	
z_0 =	3	3	3	2	2	2	3	3	3	3		4	ft
z_1 =	32	33	35	41	34	33	29	29	34	36		41	ft
v_0 =						1100							fps
v_1 =		2940			3130			3570		3990			fps
v_2 =						16270							fps

RS08-4

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig. B-29 of 5



Geophone spacing = 25 ft

Arrival Time, msec ▲	43	46	52	59	63	64	65	65	65	65	64	64
■	6	15	25	35	43	48	48	48	50	48	48	
●	49	47	42	32	20	8	9	20	30	41	47	51
△	48	47			53	51	46	38	32	25	16	9
□	58	58	59	61	64	63	62	60	56	52	47	44

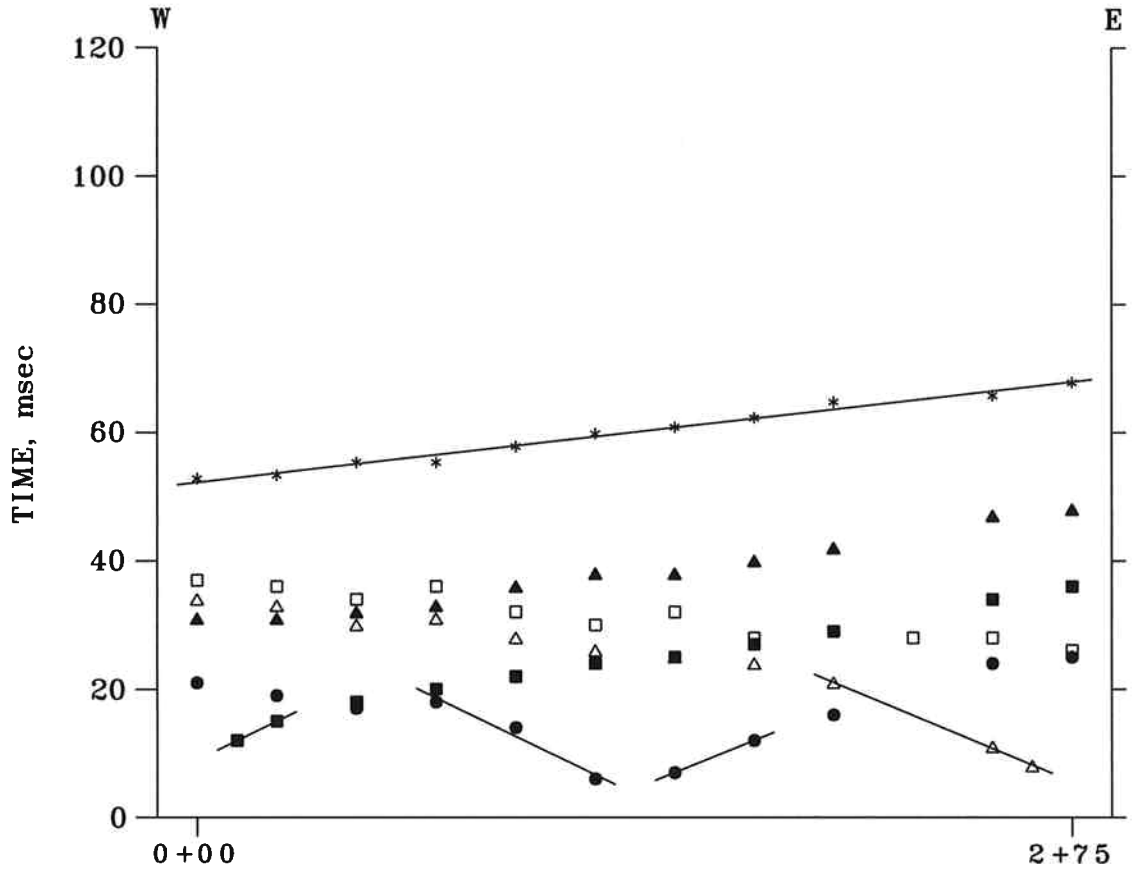
t_{ab}= 48 msec; XY = 0

t_a=	27	30	36	43	47	48	48	48	50	48	48	
t_b=	48	47			53	51	50	48	44	40	35	32
* ½△t=	−10½	−8½			−3	−1½	−1	0	3	4	6½	
t_g=	13½	14½			26	25½	25	24	23	20	17½	
t_c=	3	3	3	3	2	2	2	3	3	4	4	5

z_0=	3	3			2	2	2	3	3	4	4	ft
z_1=	32	34			62	60	57	65	62	51	52	ft
v_0=						1100						fps
v_1=		2660			2270			2360			3420	fps
v_2=						15490						fps

RS08-5

Project No. 27669017	Date: 7-18-08	Project: Suncrest Substation	Fig B-30



Geophone spacing = 25 ft

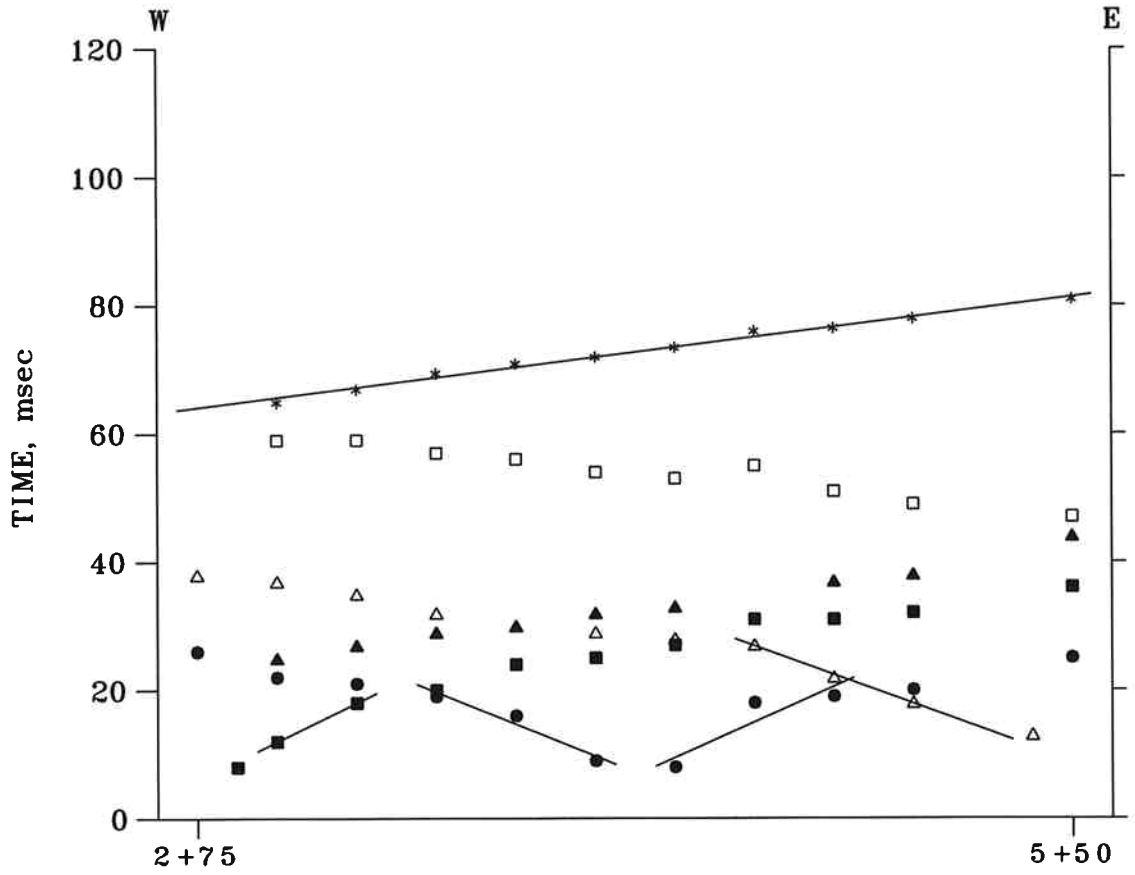
Arrival Time, msec													
▲	31	31	32	33	36	38	38	40	42		47	48	
■	12	15	18	20	22	24	25	27	29		34	36	
●	21	19	17	18	14	6	7	12	16		24	25	
△	34	33	30	31	28	26	25	24	21		11	8	
□	37	36	34	36	32	30	32	28		28	28	26	

t_{ab}= 35 msec; XY = 0

t_a=	18	18	19	20	22	24	25	27	29		34	36	
t_b=	34	33	30	31	28	26	25	24	21	24	24	22	
* ½△t=	−8	−7½	−5½	−5½	−3	−1	0	1½	4		5	7	
t_g=	8½	8	7	8	7½	7½	7½	8	7½		11½	11½	
t_c=	5	4	4	4	3	2	2	3	3	3	3	3	
z_0=	6	4	4	4	3	2	2	3	3		3	3	ft
z_1=	21	22	17	22	23	26	31	29	26		46	46	ft
v_0=						1100							fps
v_1=		4170			4170			5000			4860		fps
v_2=						17530							fps

RS08-6

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-31



Geophone spacing = 25 ft

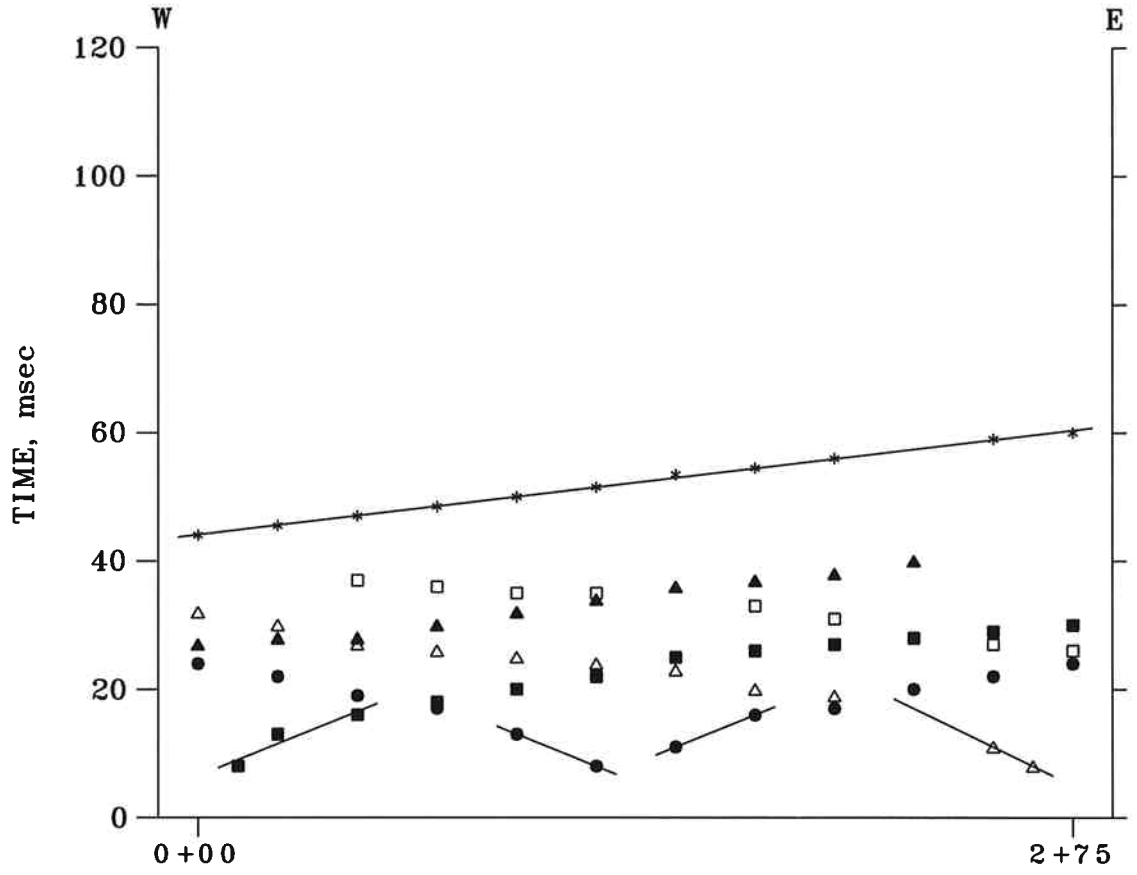
Arrival Time, msec												
▲		25	27	29	30	32	33		37	38		44
■	8	12	18	20	24	25	27	31	31	32		36
●	26	22	21	19	16	9	8	18	19	20		25
△	38	37	35	32	30	29	28	27	22	18		13
□		59	59	57	56	54	53	55	51	49		47

t_{ab}= 37 msec; XY = 0

t_a=		19	21	23	24	25	27	31	31	32		36	
t_b=	38	37	35	32	30	29	28	27	26	24		22	
* $\frac{1}{2}\Delta t$=		-9	-7	-4½	-3	-2	-0½	2	2½	4		7	
t_g=		9½	9½	9	8½	8½	9	10½	10	9½		10½	
t_c=	3	3	3	4	4	4	3	4	4	4	4	4	
z_0=		3	3	4	4	4	3	4	4	4		4	ft
z_1=		31	31	31	28	28	32	39	36	37		43	ft
v_0=						1100							fps
v_1=		4170			5000			4550			5560		fps
v_2=						16010							fps

RS08-6

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-32



Geophone spacing = 25 ft

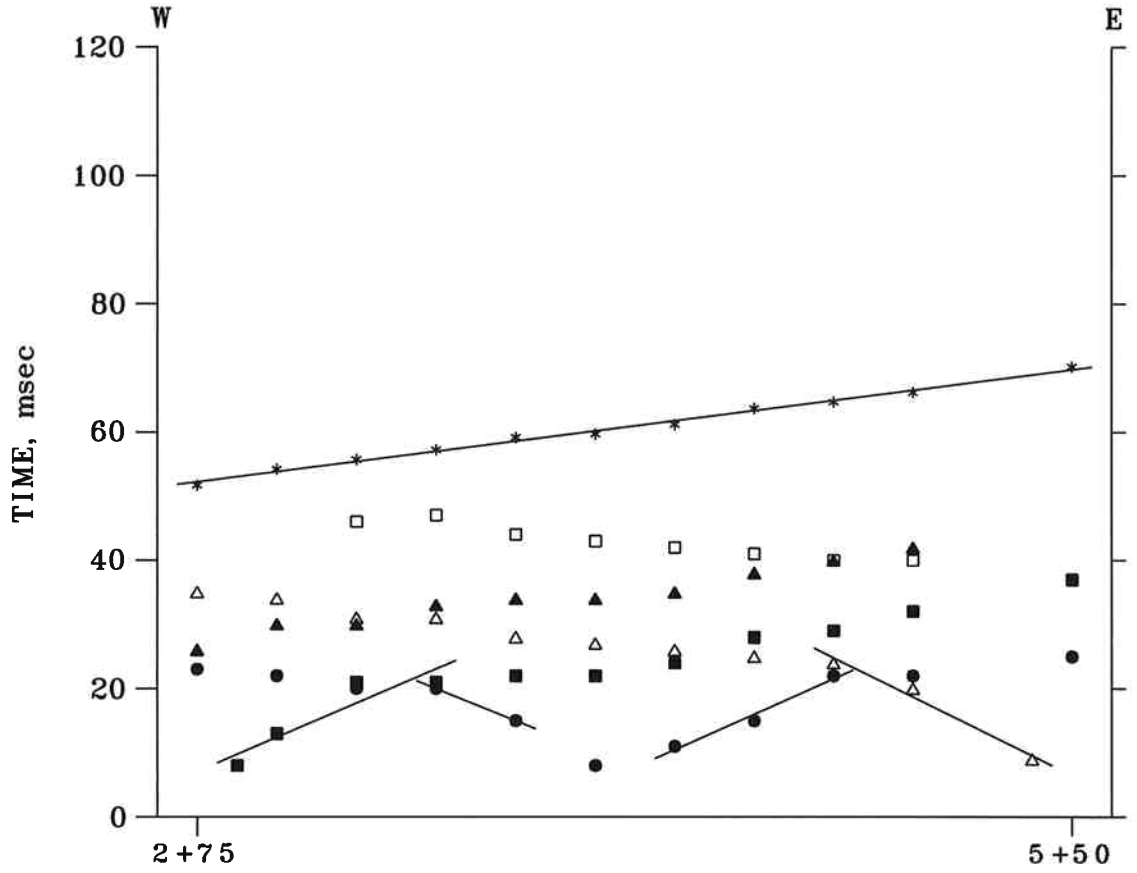
Arrival Time, msec													
▲	27	28	28	30	32	34	36	37	38	40			
■	8	13	16	18	20	22	25	26	27	28	29	30	
●	24	22	19	17	13	8	11	16	17	20	22	24	
△	32	30	27	26	25	24	23	20	19		11	8	
□			37	36	35	35		33	31		27	26	

t_{ab} = 31 msec; XY = 0

	t_a =	15	16	16	18	20	22	25	26	27	28	29	30	
	t_b =	32	30	27	26	25	24	23	22	20		16	15	
*	$\frac{1}{2}\Delta t$ =	−8½	−7	−5½	−4	−2½	−1	1	2	3½		6½	7½	
	t_g =	8	7½	6	6½	7	7½	8½	8½	8		7	7	
	t_c =	3	3	3	3	3	3	4	4	3	3	3	3	
	z_0 =	3	3	3	3	3	3	4	4	3		3	3	ft
	z_1 =	29	27	19	22	24	27	28	28	27		21	21	ft
	v_0 =						1100							fps
	v_1 =			5000			5000			5000		4170		fps
	v_2 =						16880							fps

RS08-7

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig. B-33



Geophone spacing = 25 ft

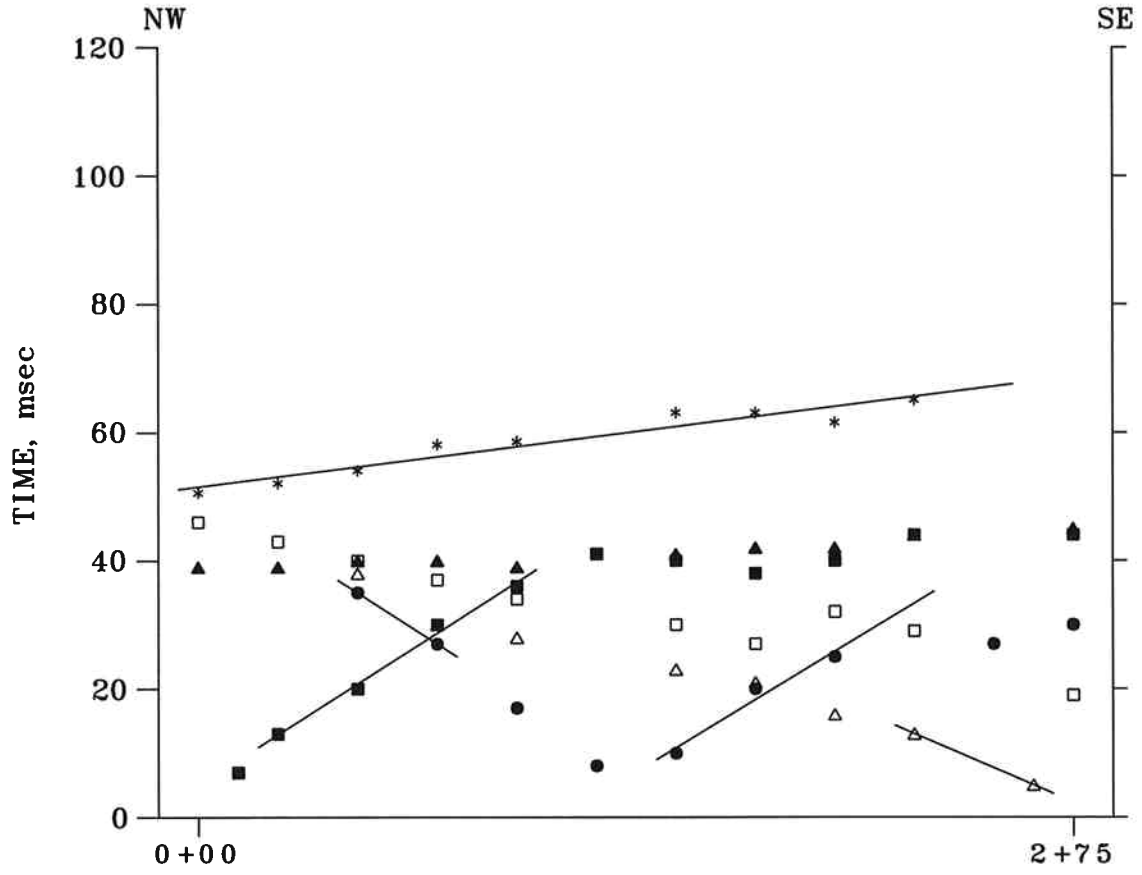
Arrival Time, msec													
▲	26	30	30	33	34	34	35	38	40	42			
■	8	13	21	21	22	22	24	28	29	32		37	
●	23	22	20	20	15	8	11	15	22	22		25	
△	35	34	31	31	28	27	26	25	24	20		9	
□			46	47	44	43	42	41	40	40		37	

t_{ab} = 36 msec; XY = 0

t_a =	14	18	18	21	22	22	24	28	29	32		37	
t_b =	35	34	31	31	28	27	26	25	24	24		21	
* $\frac{1}{2}\Delta t$ =	−10½	−8	−6½	−5	−3	−2½	−1	1½	2½	4		8	
t_g =	6½	8	6½	8	7	6½	7	8½	8½	10		11	
t_c =	4	4	4	4	4	4	4	4	3	3	3	3	
z_0 =	4	4	4	4	4	4	4	4	3	3		3	ft
z_1 =	17	24	17	25	20	17	19	26	28	33		37	ft
v_0 =						1100							fps
v_1 =		4700			5000			4550		4090			fps
v_2 =						15710							fps

RS08-7

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-34



Geophone spacing = 25 ft

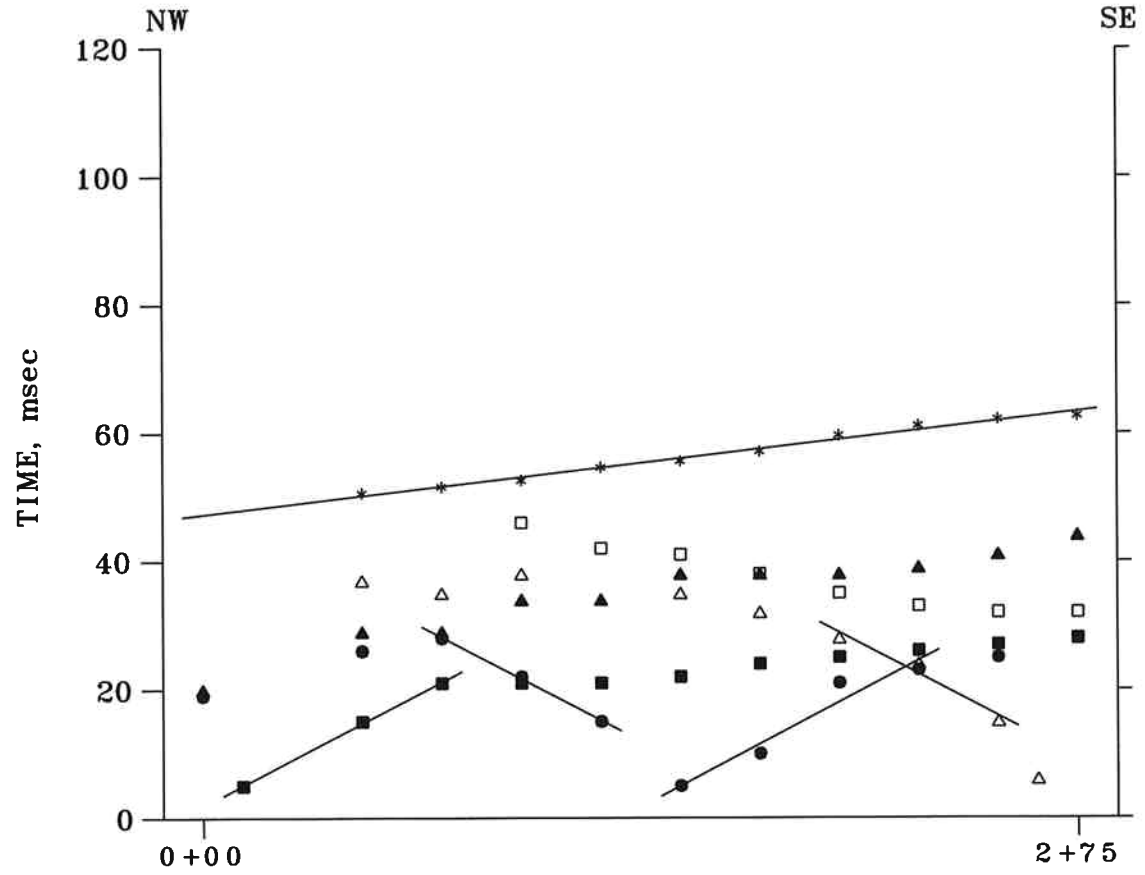
Arrival Time, msec												
▲	39	39	40	40	39		41	42	42	44		45
■	7	13	20	30	36	41	40	38	40	44		44
●			35	27	17	8	10	20	25		27	30
△			38	30	28		23	21	16	13		5
□	46	43	40	37	34		30	27	32	29		19

t_{ab} = 44 msec; XY = 0

	t_a=	36	36	37	37	36	41	40	38	40	44		44	
	t_b=	44	41	38	30	28		23	21	26	23			
*	½Δt=	-4	-2½	-0½	3½	4		8½	8½	7	10½			
	t_g=	18	16½	15½	11½	10		9½	7½	11	11½			
	t_c=	3	3	3	3	3	3	4	3	3	3	2	1	
	z_0=	3	3	3	3	3		4	3	3	3			ft
	z_1=	52	47	43	31	26		23	19	31	39			ft
	v_0=						1100							fps
	v_1=		3160			3130			3330			4690		fps
	v_2=						16000							fps

RS08-8

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-35



Geophone spacing = 25 ft

Arrival Time, msec												
▲	20		29	29	34	34	38	38	38	39	41	44
■	5		15	21	21	21	22	24	25	26	27	28
●	19		26	28	22	15	5	10	21	23	25	28
△			37	35	38	34	35	32	28	24	15	6
□					46	42	41	38	35	33	32	32

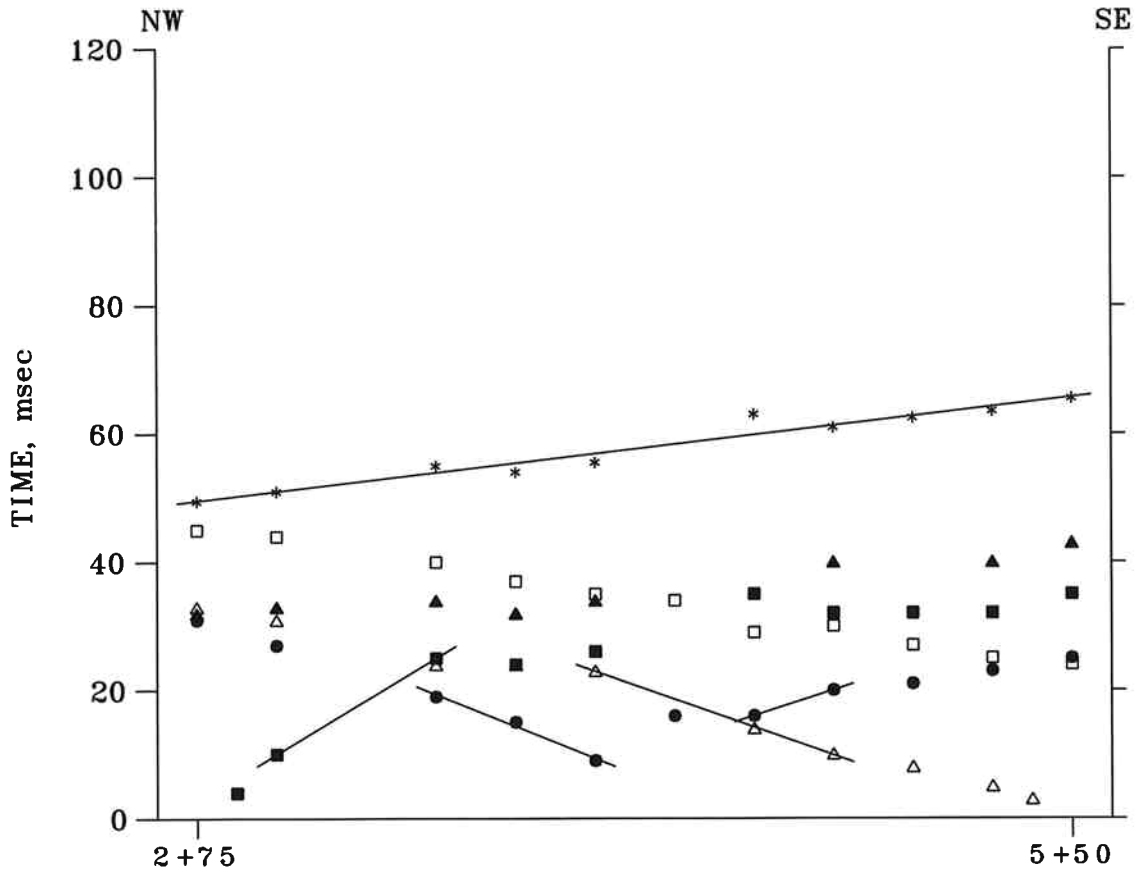
t_{ab}= 29 msec; XY = 0

t_a=			16	16	21	21	24	24	25	26	27	28
t_b=	30		37	35	38	34	35	32	28	26	25	25
* $\frac{1}{2}\Delta t$=			−10½	−9½	−8½	−6½	−5½	−4	−1½	0	1	1½
t_g=			12	11	15	13	15	13½	12	11½	11½	12
t_c=	1	2	3	4	5	6	1	3	4	5	5	5

z_0=			3	4	6	7	1	3	4	6	6	6 ft
z_1=			39	32	45	34	56	45	36	31	31	33 ft
v_0=						1100						fps
v_1=		3890			3850			3850			3850	fps
v_2=						17150						fps

RS08-9

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig. B-36



Geophone spacing = 25 ft

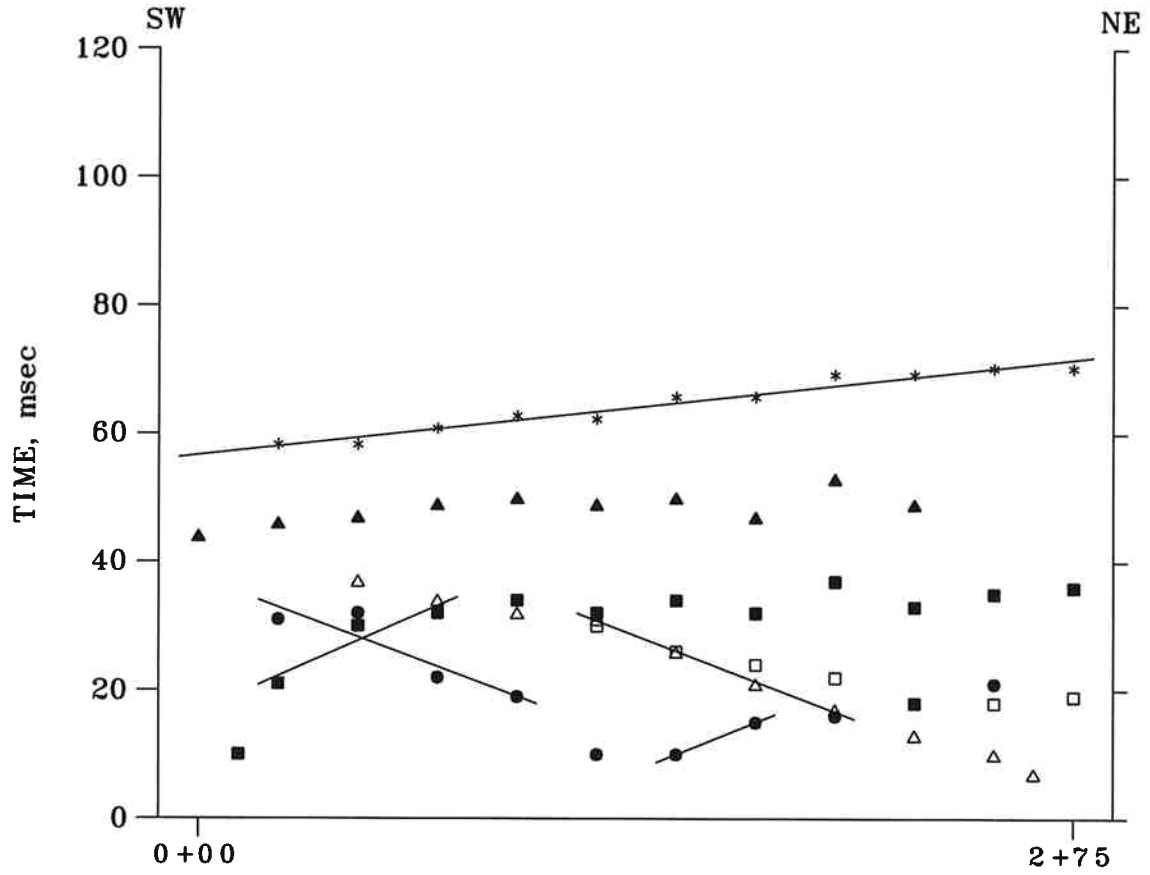
Arrival Time, msec													
▲	32	33		34	32	34		40		40	43		
■	4	10		25	24	26		35	32	32	32	35	
●	31	27		19	15	9	16	16	20	21	23	25	
△	33	31		24	24	23		14	10	8	5	3	
□	45	44		40	37	35	34	29	30	27	25	24	

t_{ab} = 34 msec; XY = 0

t_a =	24	25		26	24	26		35	32	32	32	35	
t_b =	33	31		24	24	23	22	17	18	15	13	12	
* $\frac{1}{2}\Delta t$ =	-4½	-3		1	0	1½		9	7	8½	9½	11½	
t_g =	11½	11		8	7	7½		9	8	6½	5½	6½	
t_c =	1	2	2	2	2	3	5	5	4	2	1	0	
z_0 =	1	2		2	2	3		6	4	2	1	0	ft
z_1 =	37	33		28	28	29		31	30	31	30	42	ft
v_0 =						1100							fps
v_1 =		3330			5000			6250			5740		fps
v_2 =						17090							fps

RS08-9

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig. B-37



Geophone spacing = 25 ft

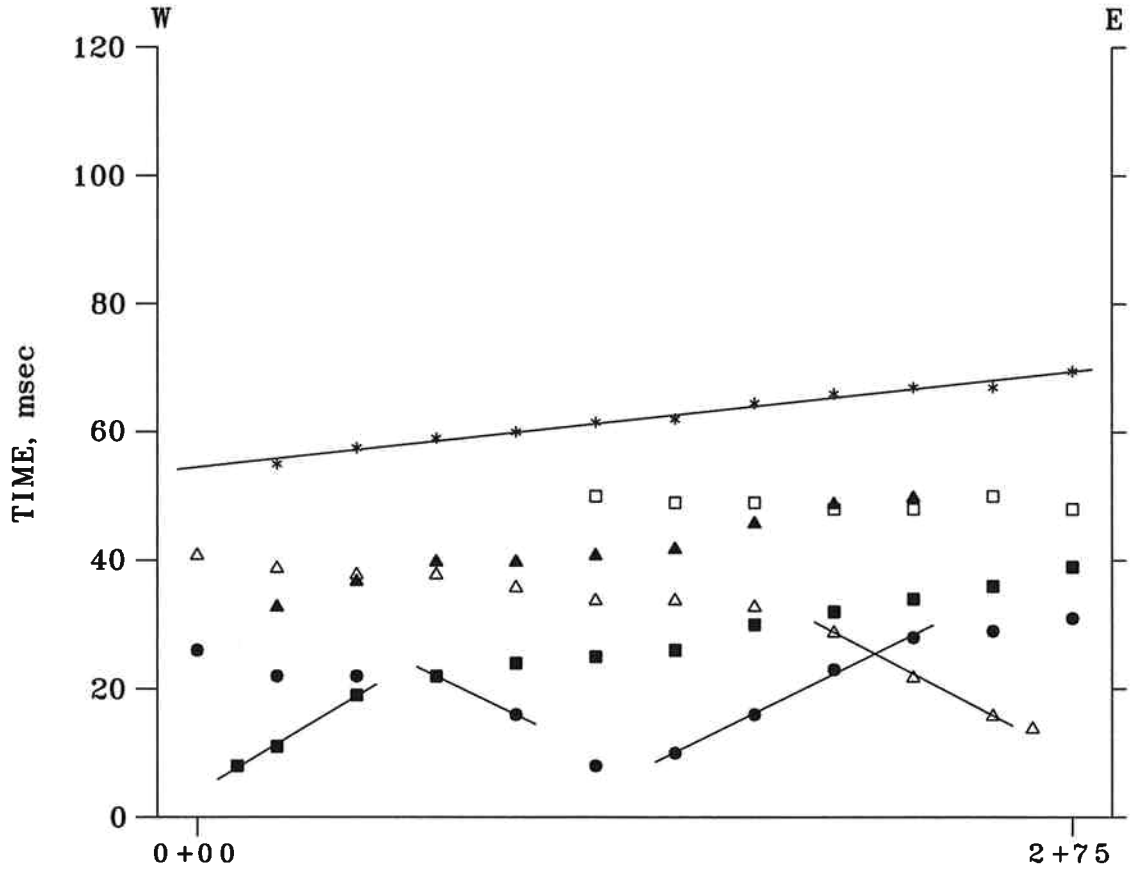
Arrival Time, msec												
▲	44	46	47	49	50	49	50	47	53	49		
■	10	21	30	32	34	32	34	32	37	33	35	36
●		31	32	22	19	10	10	15	16	18	21	
△			37	34	32	31	26	21	17	13	10	7
□						30	26	24	22	18	18	19

t_{ab}= 37 msec; XY = 0

t_a=	27	29	30	32	34	32	34	32	37	33	35	36	
t_b=		36	37	34	32	31	26	24	22	18	18	19	
* $\frac{1}{2}\Delta t$=		$-3\frac{1}{2}$	$-3\frac{1}{2}$	-1	1	$0\frac{1}{2}$	4	4	$7\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	
t_g=		14	15	$14\frac{1}{2}$	$14\frac{1}{2}$	13	$11\frac{1}{2}$	$9\frac{1}{2}$	11	7	8	9	
t_c=	8	8	8	7	7	6	4	4	4	2	2	1	
z_0=		9	9	8	8	7	4	4	4	2	2	1	ft
z_1=		40	45	47	50	46	45	34	43	30	36	46	ft
v_0=						1100							fps
v_1=		4550			5430			5000			5320		fps
v_2=						18330							fps

RS08-10

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-38



Geophone spacing = 25 ft

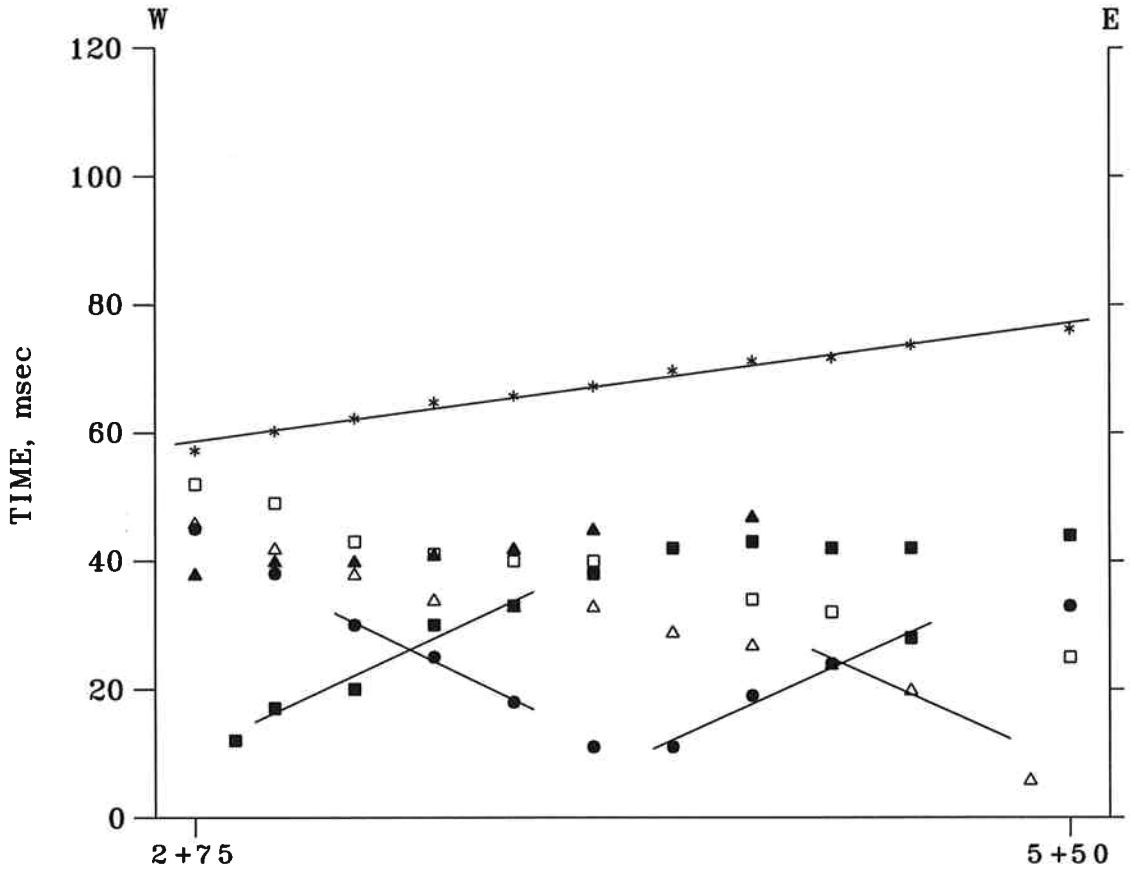
Arrival Time, msec												
▲		33	37	40	40	41	42	46	49	50		
■	8	11	19	22	24	25	26	30	32	34	36	39
●	26	22	22	22	16	8	10	16	23	28	29	31
△	41	39	38	38	36	34	34	33	29	22	16	14
□						50	49	49	48	48	50	48

t_{ab}= 40 msec; XY = 0

t_a=		17	21	24	24	25	26	30	32	34	36	39	
t_b=	41	39	38	38	36	34	34	33	32	32	34	32	
* $\frac{1}{2}\Delta t$=		-11	-8½	-7	-6	-4½	-4	-1½	0	1	1	3½	
t_g=		8	9½	11	10	9½	10	11½	12	13	15	15½	
t_c=	2	2	3	4	4	4	4	4	4	4	4	5	
z_0=		2	3	4	4	4	4	4	4	4	4	6	ft
z_1=		23	26	34	30	28	30	36	37	41	48	47	ft
v_0=						1100							fps
v_1=		3370			4170			4100			3850		fps
v_2=						18390							fps

RS08-11

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig. B-39



Geophone spacing = 25 ft

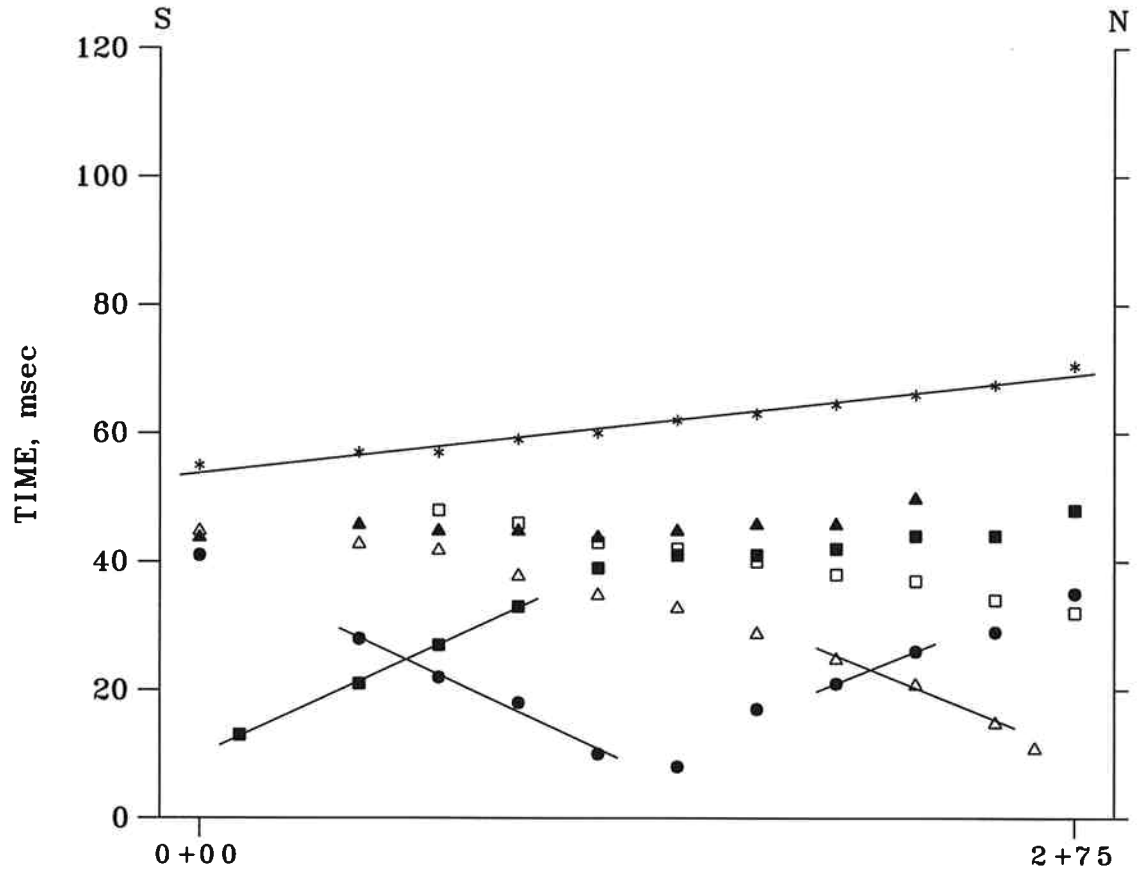
Arrival Time, msec												
▲	38	40	40	41	42	45		47				
■	12	17	20	30	33	38	42	43	42	42		44
●	45	38	30	25	18	11	11	19	24	28		33
△	46	42	38	34	33	33	29	27	24	20		6
□	52	49	43	41	40	40		34	32	28		25

t_{ab}= 45 msec; XY = 0

	t_a=	34	36	36	37	38	41	42	43	42	42		44	
	t_b=	46	42	38	34	33	33	29	27	25	21		18	
*	½△t=	-6	-3	-1	1½	2½	4	6½	8	8½	10½		13	
	t_g=	17½	16½	14½	13	13	14½	13	12½	11	9		8½	
	t_c=	5	5	5	5	5	5	5	5	4	4	4	4	
	z_0=	6	6	6	6	6	6	6	6	4	4		4	ft
	z_1=	62	57	48	41	41	49	43	41	37	28		26	ft
	v_0=						1100							fps
	v_1=		4310			4170			4460		4500			fps
	v_2=						14860							fps

RS08-11

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-40



Geophone spacing = 25 ft

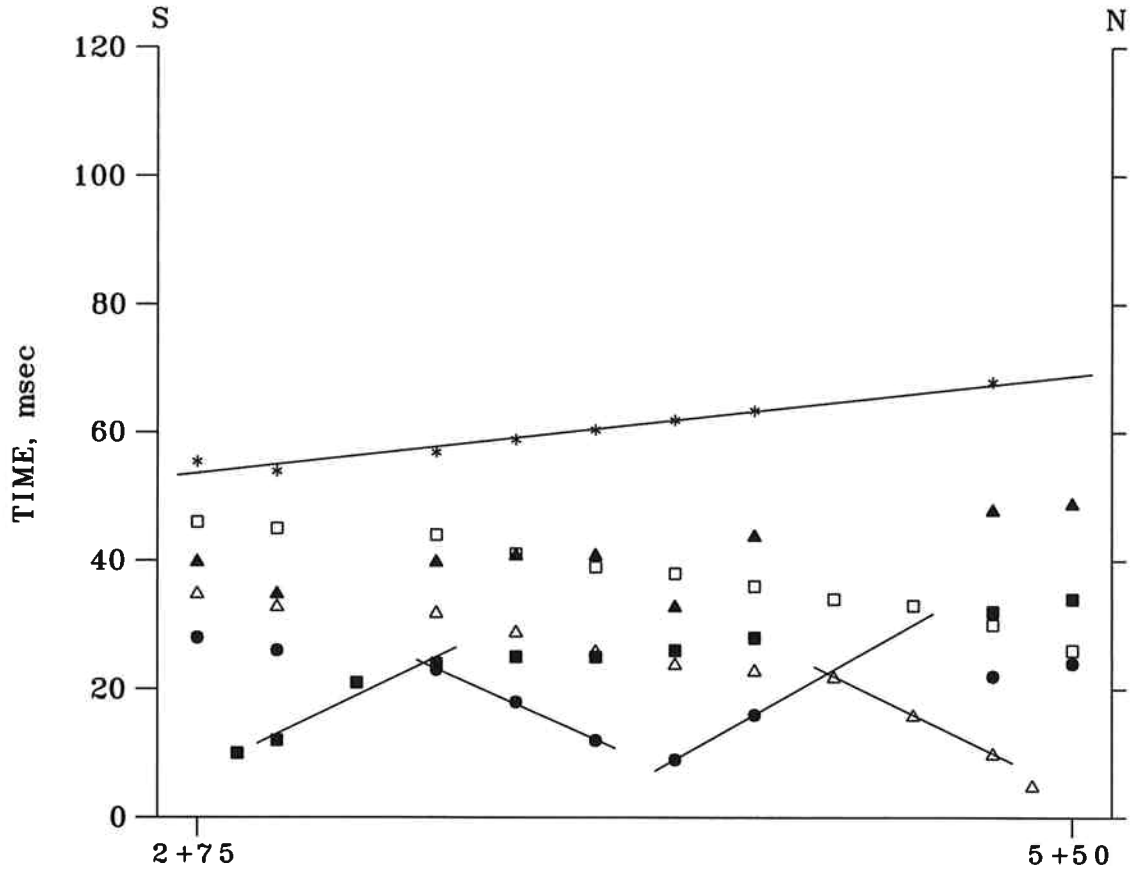
Arrival Time, msec												
▲	44		46	45	45	44	45	46	46	50		
■	13		21	27	33	39	41	41	42	44	44	48
●	41		28	22	18	10	8	17	21	26	29	35
△	45		43	42	38	35	33	29	25	21	15	11
□				48	46	43	42	40	38	37	34	32

t_{ab}= 47 msec; XY = 0

	t_a=	39		41	40	40	39	41	41	42	44	44	48	
	t_b=	45		43	42	38	35	33	31	29	28	25	23	
*	$\frac{1}{2}\Delta t$=	−3		−1	−1	1	2	4	5	6½	8	9½	12½	
	t_g=	18½		18½	17½	15½	13½	13½	12½	12	12½	11	12	
	t_c=	5	5	5	4	4	4	4	4	5	5	5	5	
	z_0=	6		6	4	4	4	4	4	6	6	6	6	ft
	z_1=	66		66	65	56	47	49	46	42	45	37	42	ft
	v_0=						1100							fps
	v_1=		4370			4310			5000			5000		fps
	v_2=						18050							fps

RS08-12

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-41



Geophone spacing = 25 ft

Arrival Time, msec												
▲	40	35		40	41	41	33	44			48	49
■	10	12	21	24	25	25	26	28			32	34
●	28	26		23	18	12	9	16			22	24
△	35	33		32	29	26	24	23	22	16	10	5
□	46	45		44	41	39	38	36	34	33	30	26

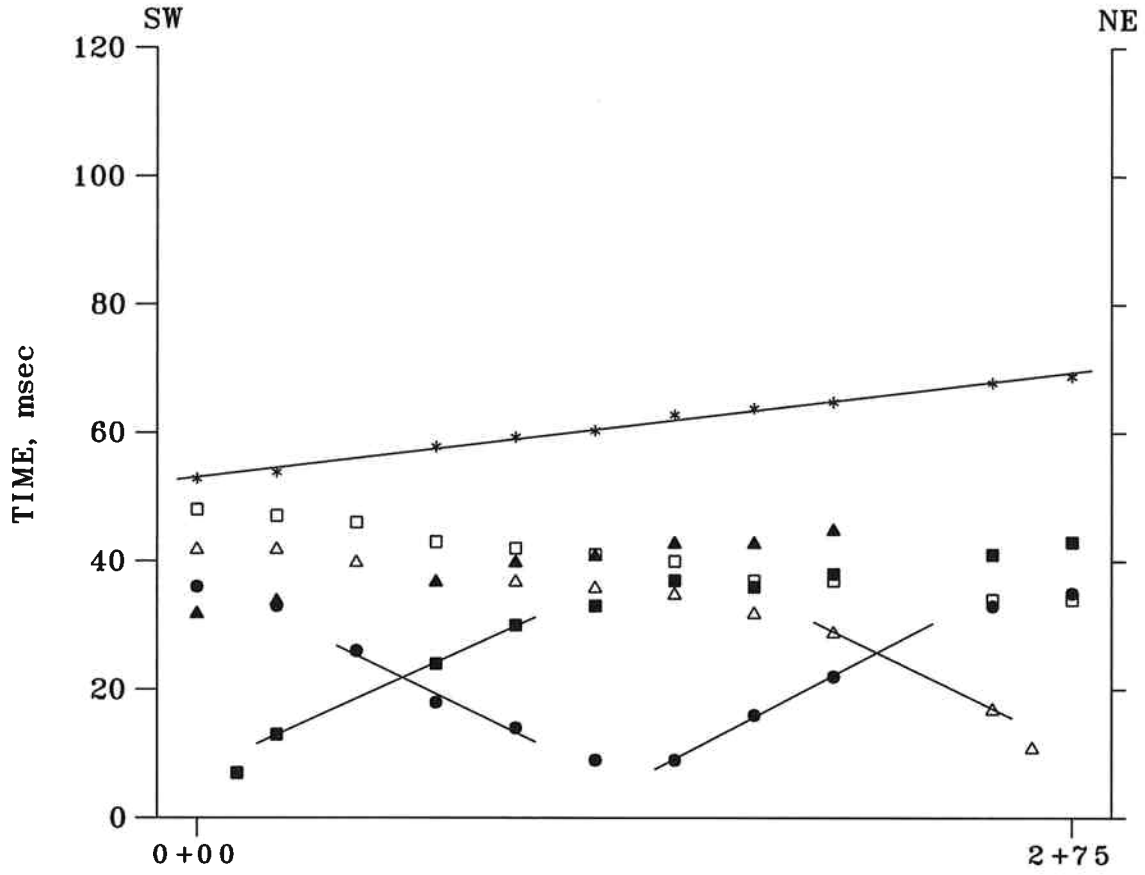
t_{ab}= 34 msec; XY = 0

t_a=	24	19	21	24	25	25	26	28			32	34
t_b=	35	33		32	29	26	24	23	22	21	18	
* ½△t=	-5½	-7		-4	-2	-0½	1	2½			7	
t_g=	12½	9		11	10	8½	8	8½			8	
t_c=	4	4	4	4	5	5	3	3	3	3	2	2

z_0=	4	4		4	6	6	3	3			2	ft
z_1=	41	26		36	29	22	22	23			28	ft
v_0=						1100						fps
v_1=		4170			4550			3570		4170		fps
v_2=						18090						fps

RS08-12

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-42



Geophone spacing = 25 ft

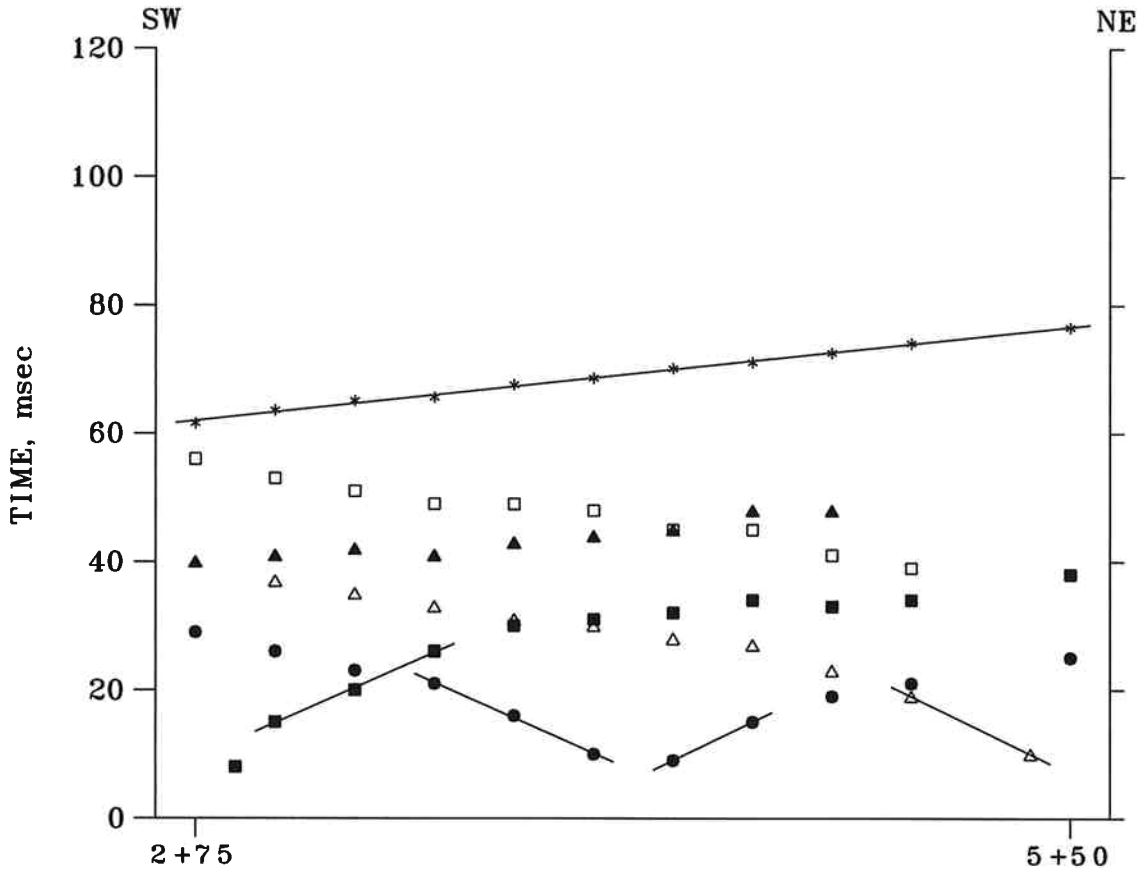
Arrival Time, msec	▲	32	34		37	40	41	43	43	45			
	■	7	13		24	30	33	37	36	38		41	43
	●	36	33	26	18	14	9	9	16	22		33	35
	△	42	42	40	37	37	36	35	32	29		17	11
	□	48	47	46	43	42	41	40	37	37		34	34

t_{ab}= 43 msec; XY = 0

	t_a=	24	26		29	32	33	37	36	38		41	43	
	t_b=	42	42	40	37	37	36	35	32	32		29	29	
*	½△t=	-9	-8		-4	-2½	-1½	1	2	3		6	7	
	t_g=	11½	12½		11½	13	13	14½	12½	13½		13½	14½	
	t_c=	4	4	3	3	3	2	3	3	4	4	5	6	
	z_0=	4	4		3	3	2	3	3	4		6	7	ft
	z_1=	39	43		41	48	48	49	41	44		42	43	ft
	v_0=						1100							fps
	v_1=		4430			4170			3850			4170		fps
	v_2=						16780							fps

RS08-13

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-43



Geophone spacing = 25 ft

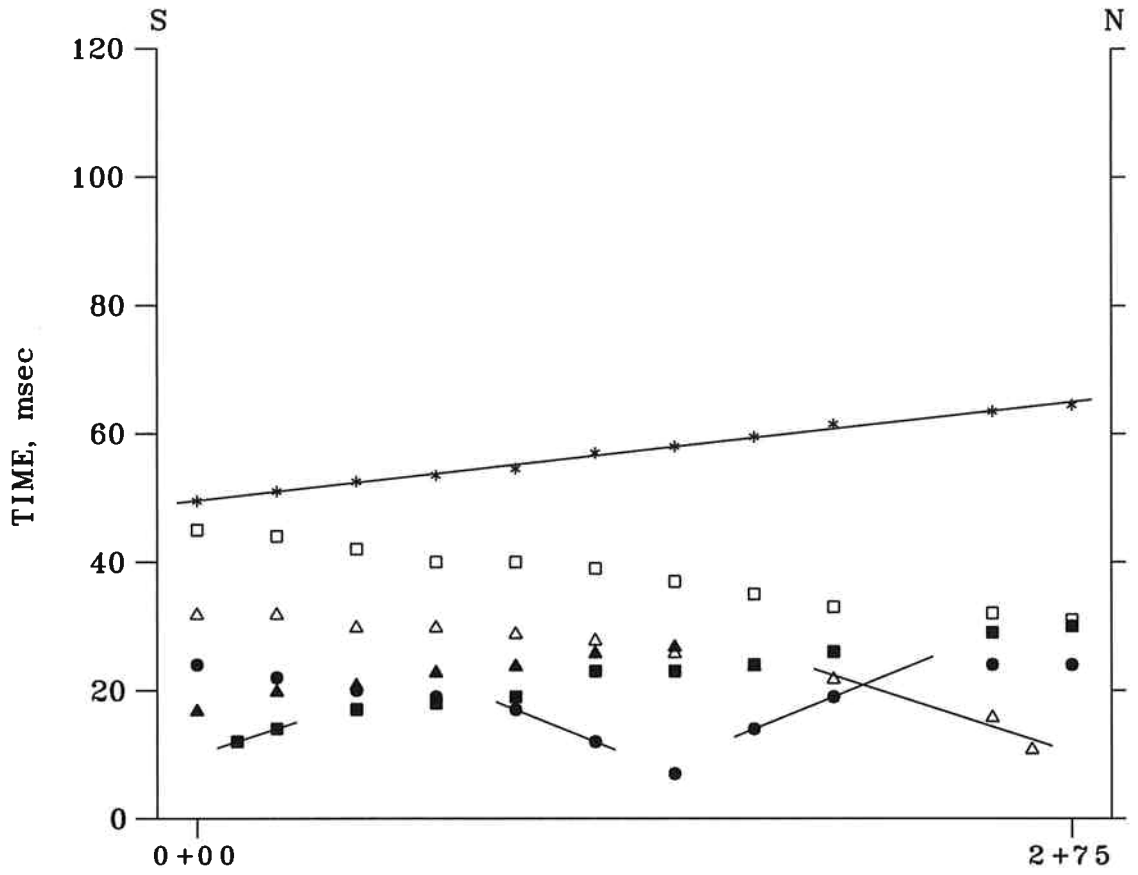
Arrival Time, msec												
▲	40	41	42	41	43	44	45	48	48			
■	8	15	20	26	30	31	32	34	33	34		38
●	29	26	23	21	16	10	9	15	19	21		25
△	40	37	35	33	31	30	28	27	23	19		10
□	56	53	51	49	49	48	45	45	41	39		38

t_{ab}= 39 msec; XY = 0

t_a=	27	28	29	28	30	31	32	34	33	34		38	
t_b=	40	37	35	33	31	30	28	28	24	22		21	
* $\frac{1}{2}\Delta t$=	-6½	-4½	-3	-2½	-0½	0½	2	3	4½	6		8½	
t_g=	14	13	12½	11	11	11	10½	11½	9	8½		10	
t_c=	5	5	5	4	4	4	3	4	4	4	4	4	
z_0=	6	6	6	4	4	4	3	4	4	4		4	ft
z_1=	48	43	41	37	37	37	35	36	26	24		30	ft
v_0=						1100							fps
v_1=			4550			4550			4170			4170	fps
v_2=							18800						fps

RS08-13

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig. B-44



Geophone spacing = 25 ft

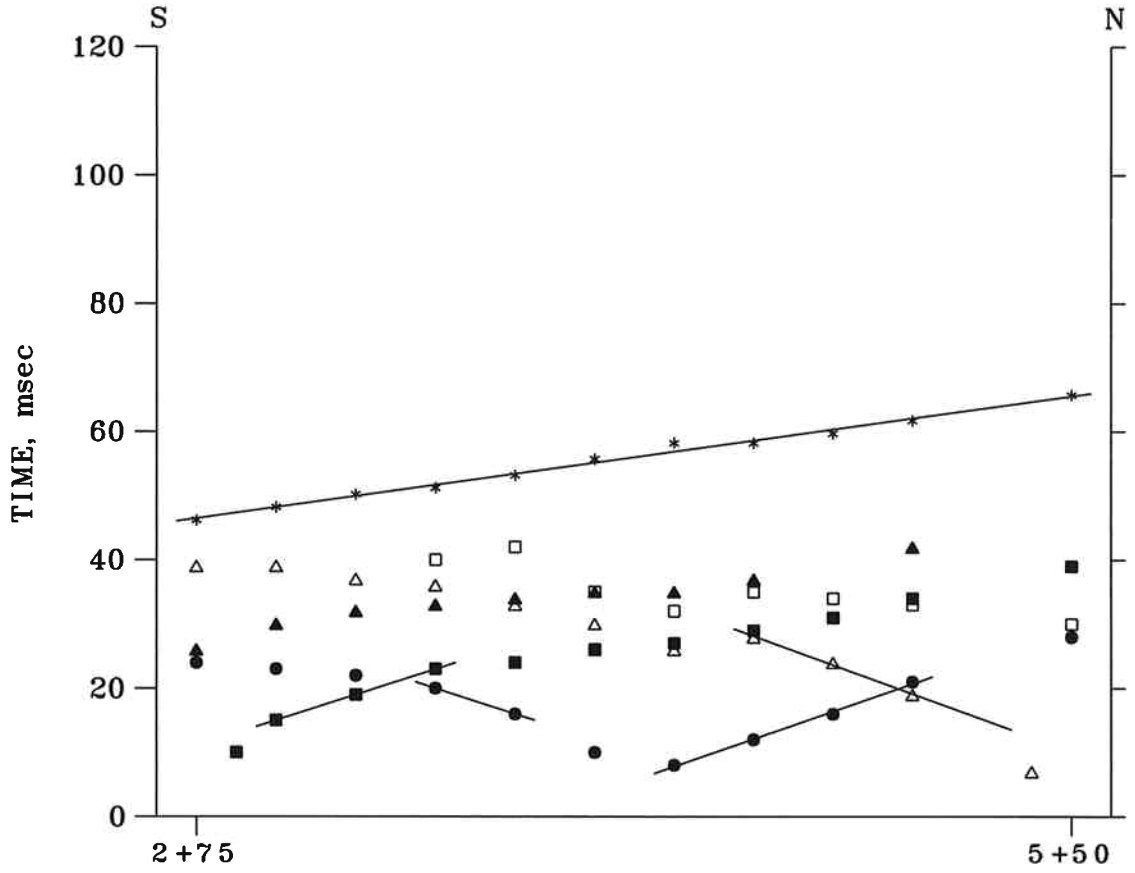
Arrival Time, msec													
▲	17	20	21	23	24	26	27						
■	12	14	17	18	19	23	23	24	26		29	30	
●	24	22	20	19	17	12	7	14	19		24	24	
△	32	32	30	30	29	28	26	24	22		16	11	
□	45	44	42	40	40	39	37	35	33		32	31	

t_{ab} = 31 msec; XY = 0

t_a =	12	15	16	18	19	23	23	24	26		29	30	
t_b =	32	32	30	30	29	28	26	24	22		21	20	
* $\frac{1}{2}\Delta t$ =	−10	−8½	−7	−6	−5	−2½	−1½	0	2		4	5	
t_g =	6½	8	7½	8½	8½	10	9	8½	8½		9½	9½	
t_c =	5	5	5	5	5	5	3	3	4	5	5	5	
z_0 =	6	6	6	6	6	6	3	3	4		6	6	ft
z_1 =	16	26	21	25	24	32	35	32	31		36	36	ft
v_0 =						1100							fps
v_1 =		6250			5000			5000		6250			fps
v_2 =						17820							fps

RS08-14

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-45



Geophone spacing = 25 ft

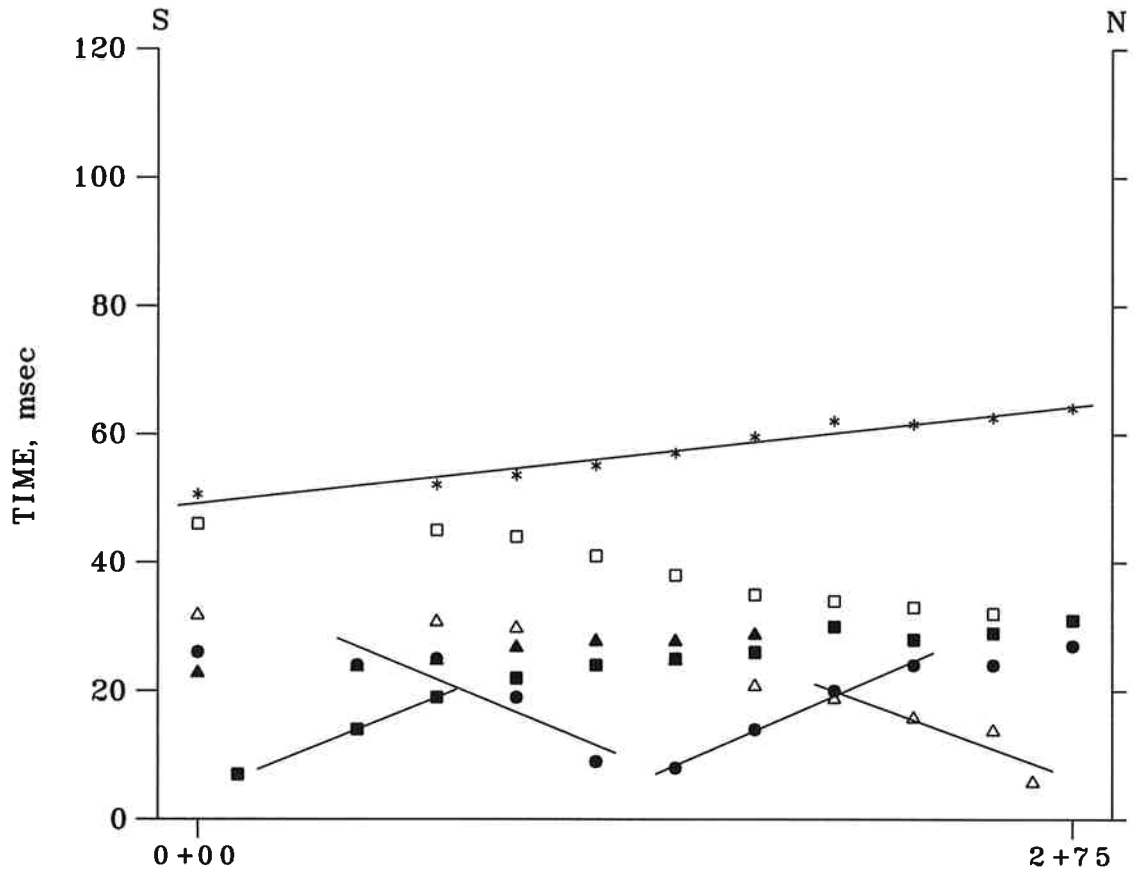
Arrival Time, msec												
▲	26	30	32	33	34	35	35	37		42		
■	10	15	19	23	24	26	27	29	31	34		39
●	24	23	22	20	16	10	8	12	16	21		28
△	39	39	37	36	33	30	26	28	24	19		7
□				40	42	35	32	35	34	33		30

t_{ab}= 39 msec; XY = 0

t_a=	16	20	22	23	24	26	27	29	31	34		39	
t_b=	39	39	37	36	33	30	26	28	27	26		23	
* $\frac{1}{2}\Delta t$=	−11½	−9½	−7½	−6½	−4½	−2	0½	0½	2	4		8	
t_g=	8	10	10	10	9	8½	7	9	9½	10½		11½	
t_c=	6	5	5	5	5	5	3	4	4	4	4	5	
z_0=	7	6	6	6	6	6	3	4	4	4		6	ft
z_1=	20	40	40	40	33	29	29	35	38	45		45	ft
v_0=						1100							fps
v_1=		6250			6250			5810		5560			fps
v_2=						14430							fps

RS08-14

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-46



Geophone spacing = 25 ft

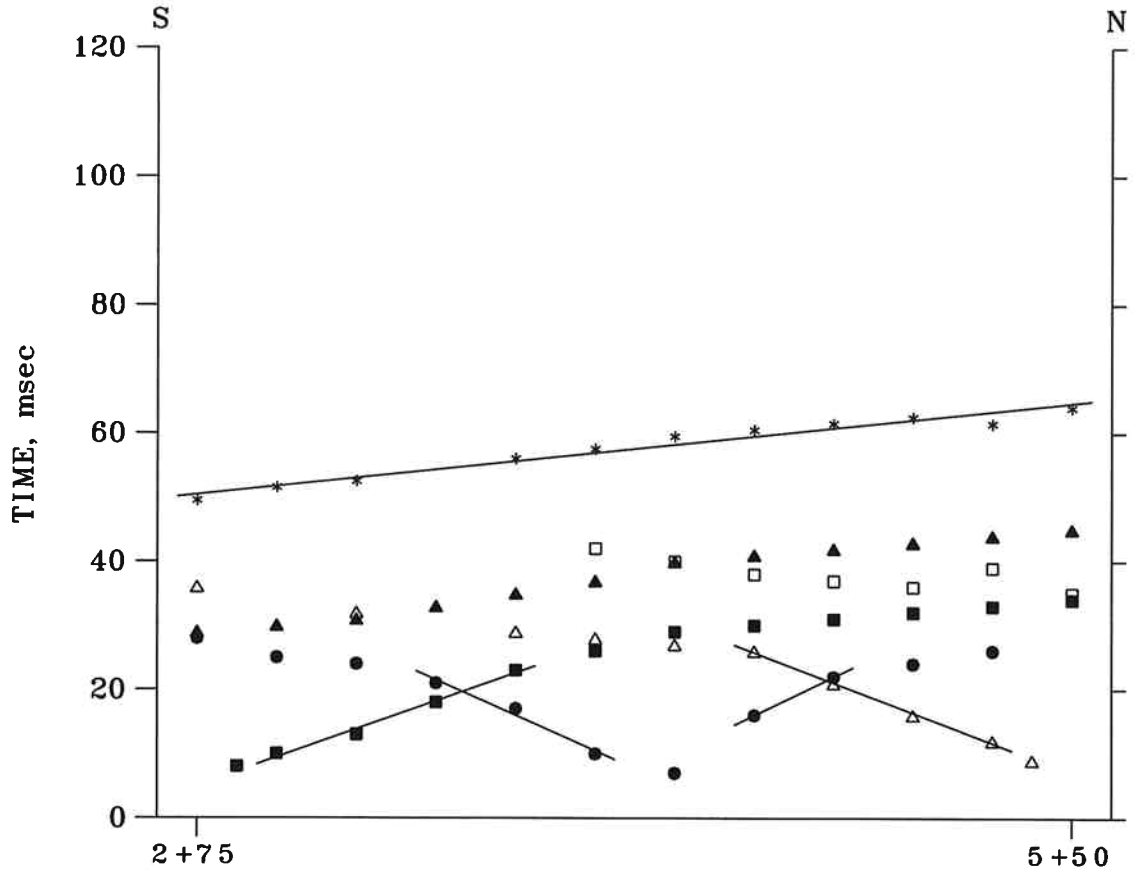
Arrival Time, msec												
▲	23		24	25	27	28	28	29				
■	7		14	19	22	24	25	26	30	28	29	31
●	26		24	25	19	9	8	14	20	24	24	27
△	32			31	30	28	25	21	19	16	14	6
□	46			45	44	41	38	35	34	33	32	31

t_{ab}= 31 msec; XY = 0

	t_a=	19		20	21	23	24	25	26	30	28	29	31
	t_b=	32			31	30	28	25	21	20	19	18	17
*	$\frac{1}{2}\Delta t$=	-6½			-5	-3½	-2	0	2½	5	4½	5½	7
	t_g=	10			10½	11	10½	9½	8	9½	8	8	8½
	t_c=	2	3	3	4	4	5	3	3	3	3	3	3
	z_0=	2			4	4	6	3	3	3	3	3	3 ft
	z_1=	44			38	40	33	34	27	38	30	32	35 ft
	v_0=						1100						fps
	v_1=		5000			4900			4630		5550		fps
	v_2=						18100						fps

RS08-15

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-47



Geophone spacing = 25 ft

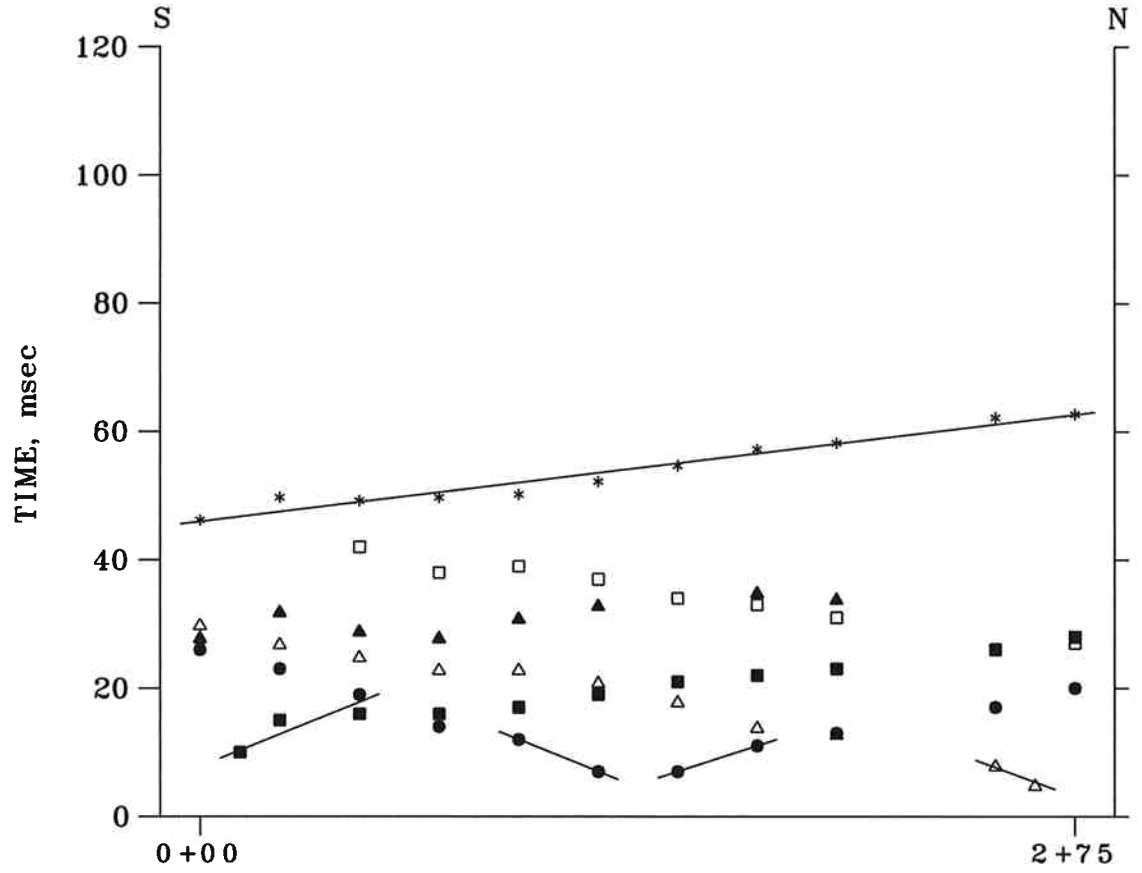
Arrival Time, msec												
▲	29	30	31	33	35	37	40	41	42	43	44	45
■	8	10	13	18	23	26	29	30	31	32	33	34
●	28	25	24	21	17	10	7	16	22	24	26	
△	36		32		29	28	27	26	21	16	12	9
□						42	40	38	37	36	39	35

t_{ab}= 35 msec; XY = 0

	t_a=	18	19	20	22	24	26	29	30	31	32	33	34	
	t_b=	36	33	32		29	28	27	26	25	24	27	23	
*	$\frac{1}{2}\Delta t$=	-9	-7	-6		-2½	-1	1	2	3	4	3	5½	
	t_g=	9½	8½	8½		9	9½	10½	10½	10½	10½	12½	11	
	t_c=	3	4	4	4	4	4	3	3	4	4	4	4	
	z_0=	3	4	4		4	4	3	3	4	4	4	4	ft
	z_1=	42	31	31		31	30	39	40	36	40	51	43	ft
	v_0=						1100							fps
	v_1=			5680			4550			4170			5320	fps
	v_2=							19280						fps

RS08-15

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-48



Geophone spacing = 25 ft

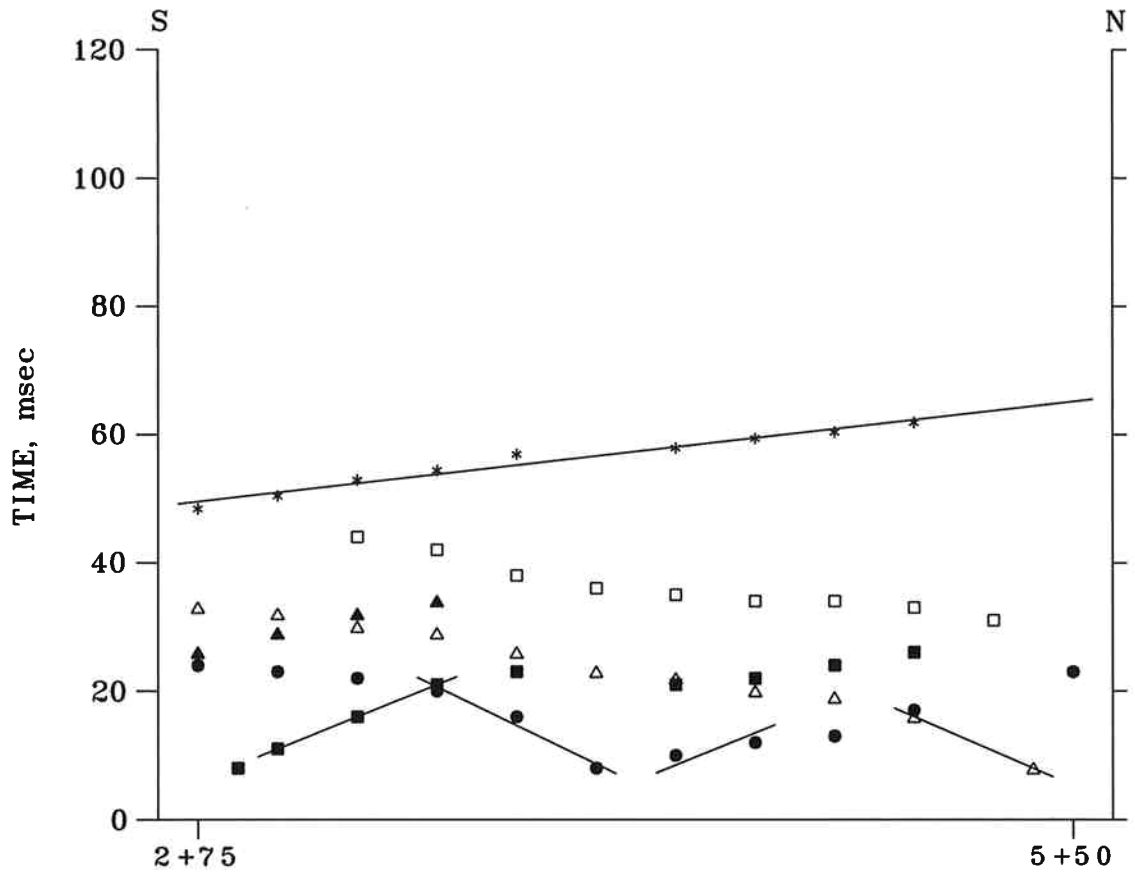
Arrival Time, msec												
▲	28	32	29	28	31	33		35	34			
■	10	15	16	16	17	19	21	22	23		26	28
●	26	23	19	14	12	7	7	11	13		17	20
△	30	27	25	23	23	21	18	14	13		8	5
□			42	38	39	37	34	33	31			27

t_{ab} = 29 msec; XY = 0

	t_a=	16	20	17	16	17	19	21	22	23		26	28	
	t_b=	30	27	25	23	23	21	18	14	13		8	9	
*	$\frac{1}{2}\Delta t$=	−7	−3½	−4	−3½	−3	−1	1½	4	5		9	9½	
	t_g=	8½	9	6½	5	5½	5½	5	3½	3½		2½	4	
	t_c=	4	4	4	3	2	2	3	2	2	2	1	2	
	z_0=	4	4	4	3	2	2	3	2	2		1	2	ft
	z_1=	28	31	18	14	21	21	17	12	12		10	14	ft
	v_0=						1100							fps
	v_1=		5000			5000			6250		5500			fps
	v_2=						16520							fps

RS08-16

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-49



Geophone spacing = 25 ft

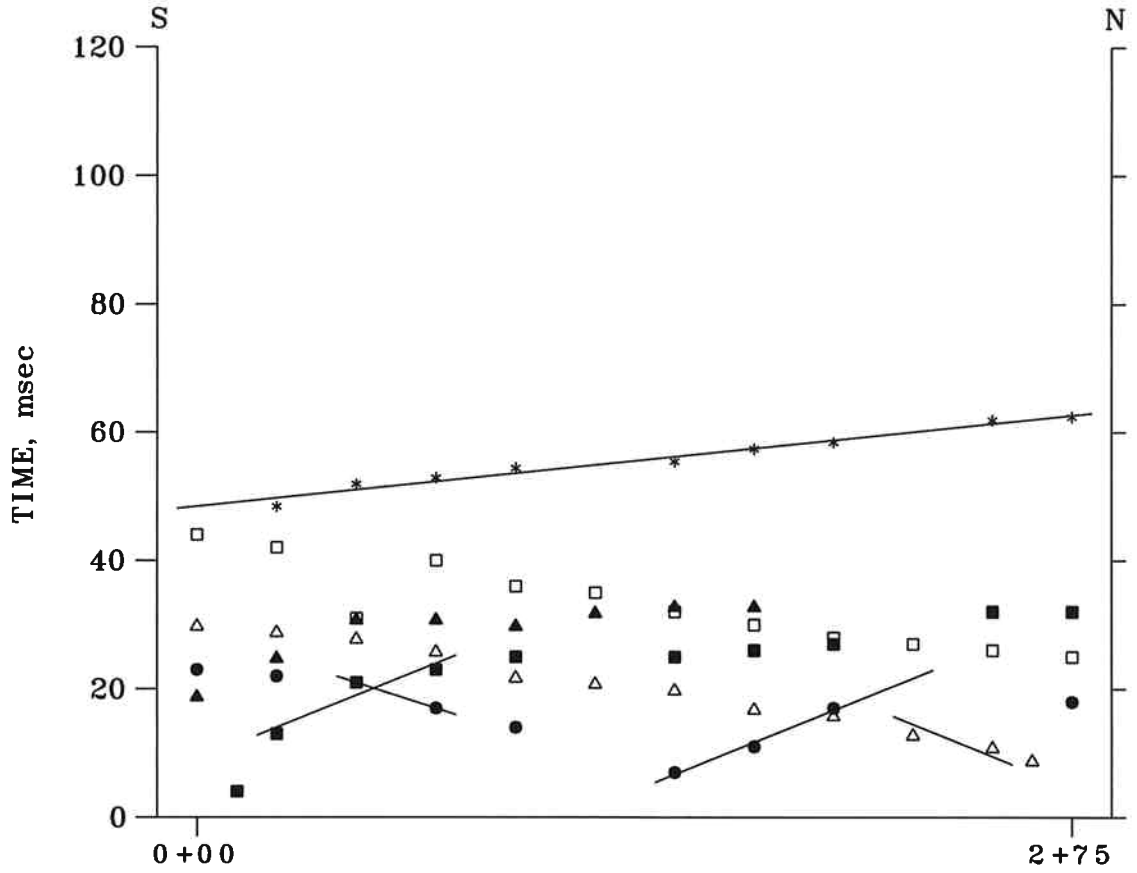
Arrival Time, msec													
▲	26	29	32	34									
■	8	11	16	21	23		21	22	24	26			
●	24	23	22	20	16	8	10	12	13	17		23	
△	33	32	30	29	26	23	22	20	19	16		8	
□			44	42	38	36	35	34	34	33	31		

t_{ab}= 33 msec; XY = 0

t_a=	13	16	19	21	23		21	22	24	26			
t_b=	33	32	30	29	26	23	22	20	20	19	17		
* $\frac{1}{2}\Delta t$=	-10	-8	-5½	-4	-1½		-0½	1	2	3½			
t_g=	6½	7½	8	8½	8		5	4½	5½	6			
t_c=	3	3	3	3	3	3	3	3	3	3	3	3	
z_0=	3	3	3	3	3		3	3	3	3			ft
z_1=	22	27	29	29	25		14	11	16	18			ft
v_0=						1100							fps
v_1=		5000			4170			5000			4690		fps
v_2=						17610							fps

RS08-16

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-50



Geophone spacing = 25 ft

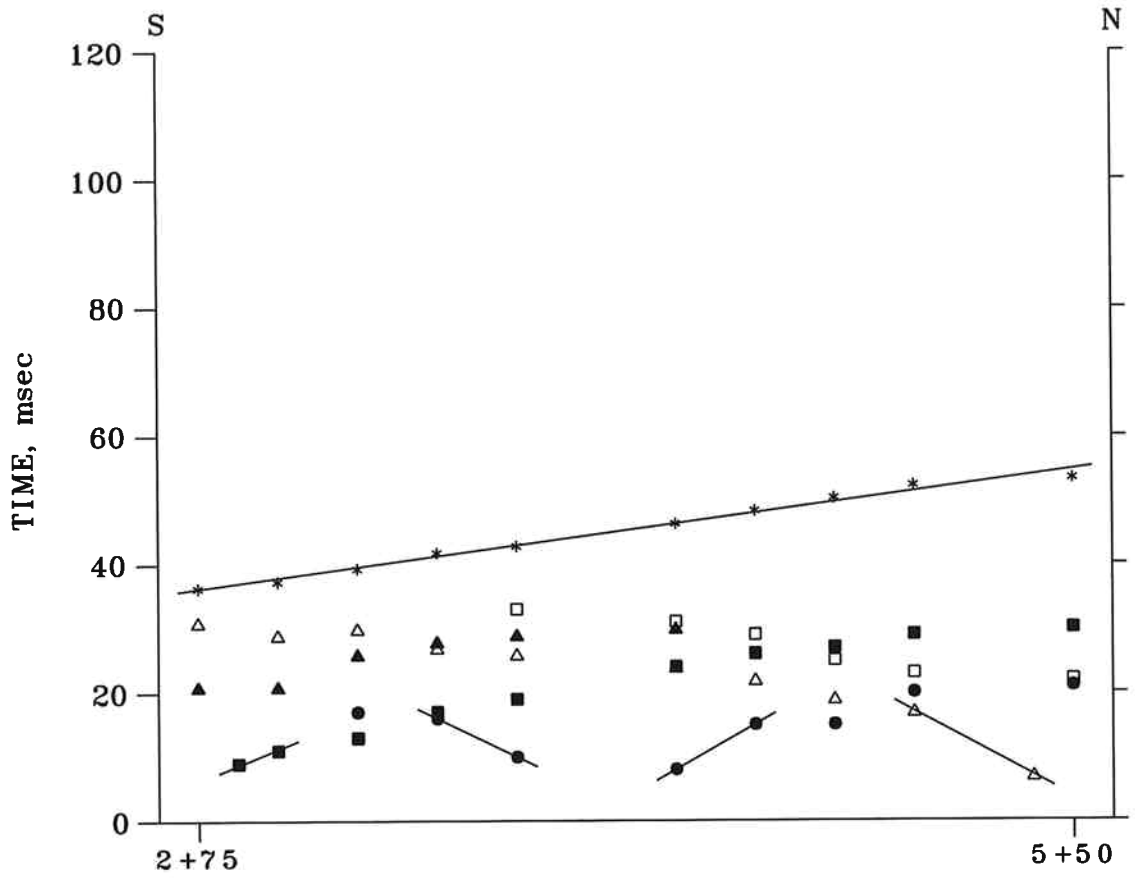
Arrival Time, msec												
▲	19	25	31	31	30	32	33	33				
■	4	13	21	23	25		25	26	27		32	32
●	23	22	21	17	14		7	11	17			18
△	30	29	28	26	22	21	20	17	16	13	11	9
□	44	42	31	40	36	35	32	30	28	27	26	25

t_{ab}= 31 msec; XY = 0

	t_a=		20	26	26	25		25	26	27		32	32	
	t_b=	30	29	28	26	22	21	20	17	16	15	14	13	
*	½△t=		−4½	−1	0	1½		2½	4½	5½		9	9½	
	t_g=		9	11½	10½	8		7	6	6		7½	7	
	t_c=	5	5	5	5	4	3	2	2	2	2	2	2	
	z_0=		6	6	6	4		2	2	2		2	2	ft
	z_1=		26	44	38	27		28	23	23		31	28	ft
	v_0=						1100							fps
	v_1=		5000			6250			5000		5000			fps
	v_2=						19370							fps

RS08-17

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-51



Geophone spacing = 25 ft

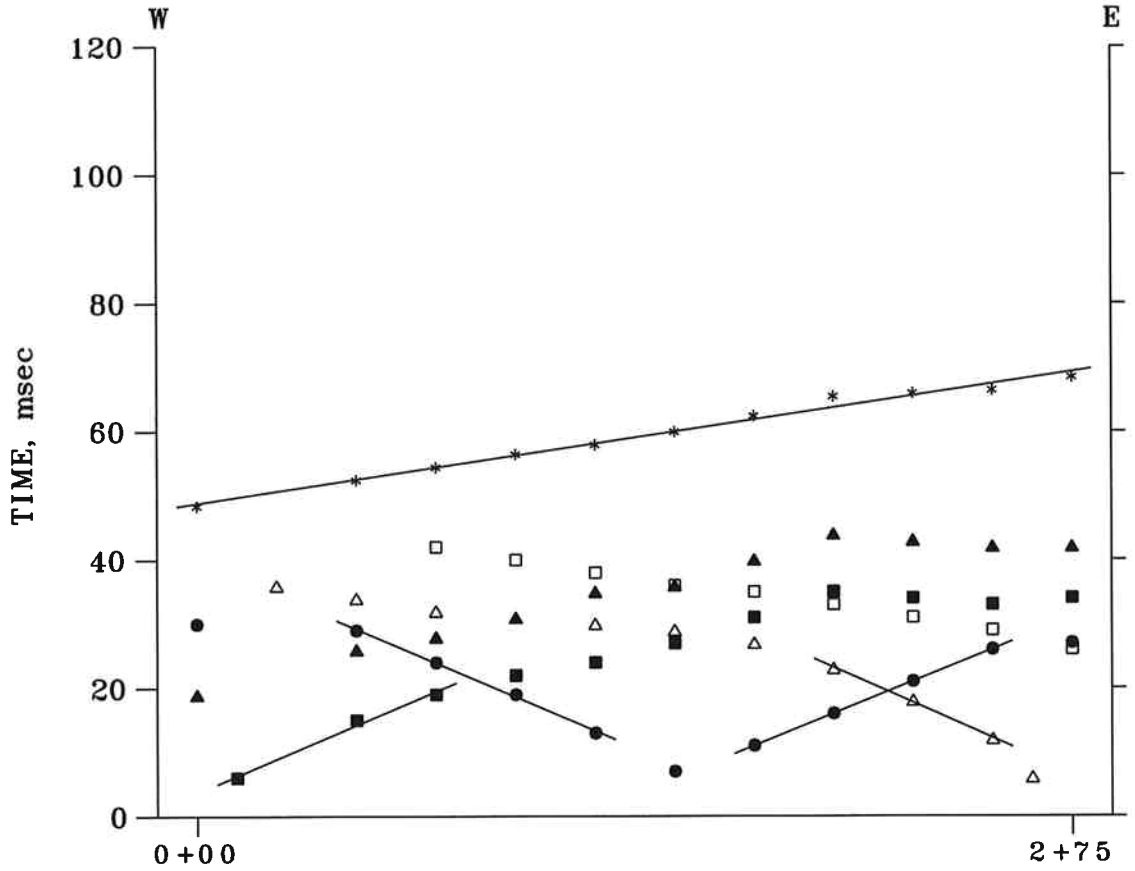
Arrival Time, msec												
▲	21	21	26	28	29		30					
■	9	11	13	17	19		24	26	27	29		30
●			17	16	10		8	15	15	20		21
△	31	29	30	27	26		24	22	19	17		7
□					33		31	29	25	23		22

t_{ab}= 30 msec; XY = 0

t_a=	11	11	16	18	19		24	26	27	29		30	
t_b=	31	29	30	27	26		24	22	19	17		16	
* ½△t=	-10	-9	-7	-4½	-3½		0	2	4	6		7	
t_g=	6	5	8	7½	7½		9	9	8	8		8	
t_c=	3	2	2	2	2	1	2	2	2	2	2	2	
z_0=	3	2	2	2	2		2	2	2	2		2	ft
z_1=	19	18	31	26	26		28	28	25	25		25	ft
v_0=						1100							fps
v_1=		5000			4170			3570		3750			fps
v_2=						14890							fps

RS08-17

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-52



Geophone spacing = 25 ft

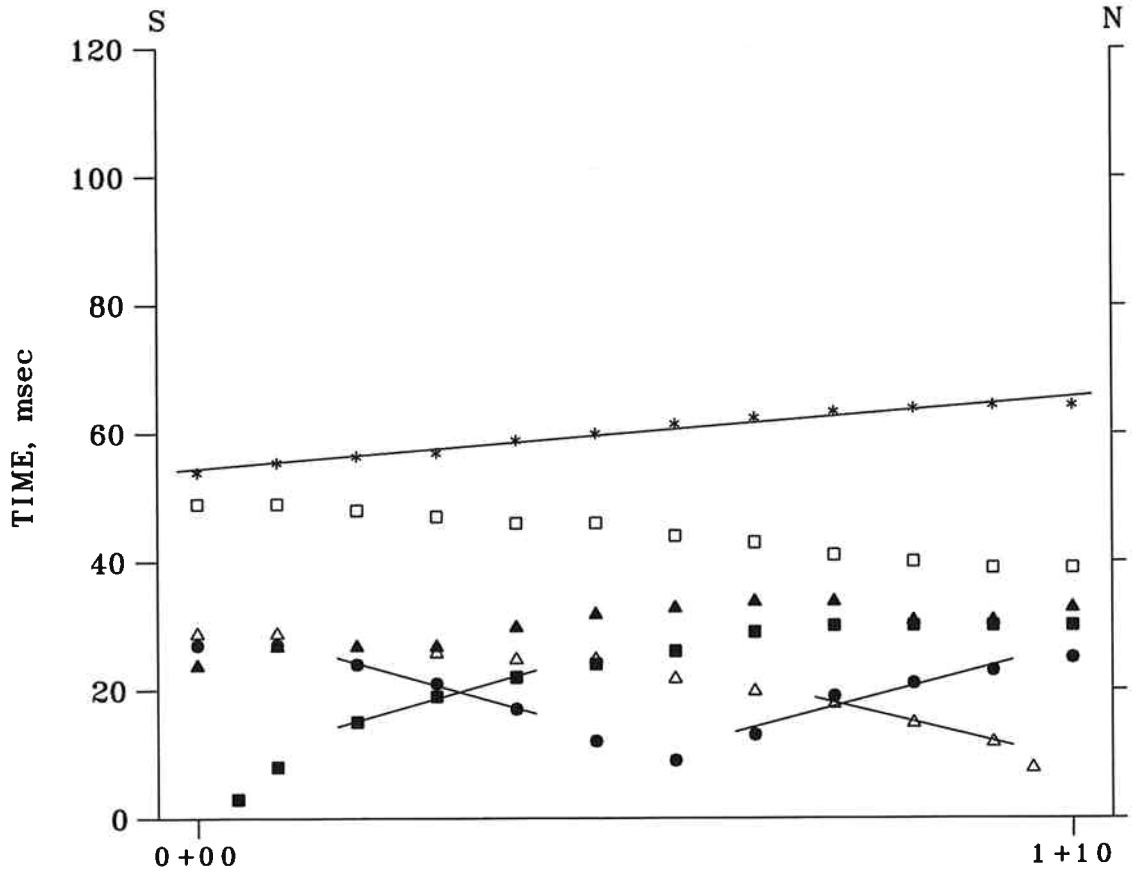
Arrival Time, msec												
▲	19		26	28	31	35	36	40	44	43	42	42
■	6		15	19	22	24	27	31	35	34	33	34
●	30		29	24	19	13	7	11	16	21	26	27
△		36	34	32	31	30	29	27	23	18	12	6
□				42	40	38	36	35	33	31	29	26

t_{ab} = 35 msec; XY = 0

	t_a =	10		17	19	22	24	27	31	35	34	33	34	
	t_b =	35	36	34	32	31	30	29	28	26	24	22	19	
*	$\frac{1}{2}\Delta t$ =	-12½		-8½	-6½	-4½	-3	-1	1½	4½	5	5½	7½	
	t_g =	5		8	8	9	9½	10½	12	13	11½	10	9	
	t_c =	2	2	3	4	5	5	2	3	3	3	3	3	
	z_0 =	2		3	4	6	6	2	3	3	3	3	3	ft
	z_1 =	17		29	25	26	28	46	52	54	47	39	34	ft
	v_0 =						1100							fps
	v_1 =		4750			4720			5000			4550		fps
	v_2 =						13470							fps

RS08-18

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-53



Geophone spacing = 10 ft

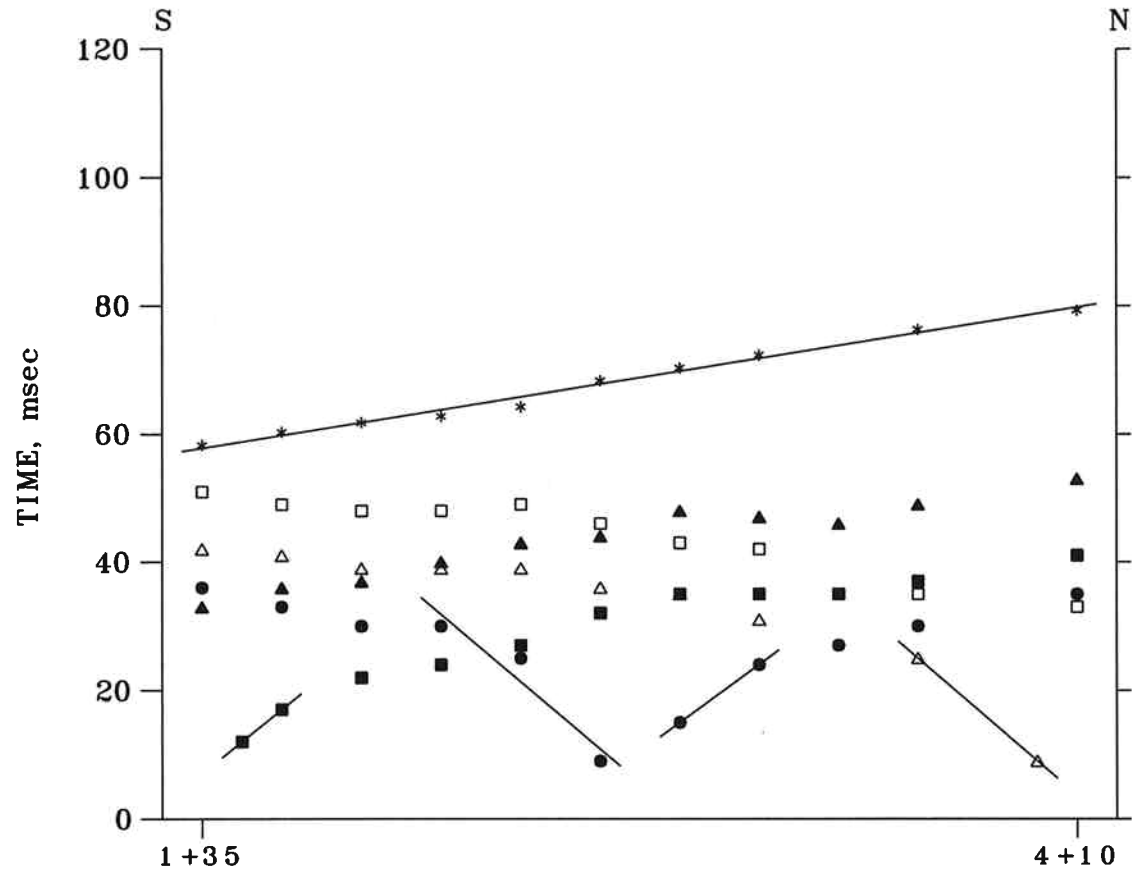
Arrival Time, msec												
▲	24	27	27	27	30	32	33	34	34	31	31	33
■	3	8	15	19	22	24	26	29	30	30	30	30
●	27	27	24	21	17	12	9	13	19	21	23	25
△	29	29	27	26	25	25	22	20	18	15	12	8
□	49	49	48	47	46	46	44	43	41	40	39	39

t_{ab} = 30 msec; XY = 0

t_a =	20	23	23	23	26	28	29	30	30	30	30	30	
t_b =	29	29	27	26	25	25	23	22	20	19	18	18	
* $\frac{1}{2}\Delta t$ =	−4½	−3	−2	−1½	0½	1½	3	4	5	5½	6	6	
t_g =	9½	11	10	9½	10½	11½	11	11	10	9½	9	9	
t_c =	4	5	5	5	5	6	5	5	5	5	5	5	
z_0 =	4	6	6	6	6	7	6	6	6	6	6	6	ft
z_1 =	21	23	20	19	22	24	25	25	23	21	19	19	ft
v_0 =						1100							fps
v_1 =		2860			2860			3130			3330		fps
v_2 =						9740							fps

RS08-19

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig B-54



Geophone spacing = 25 ft

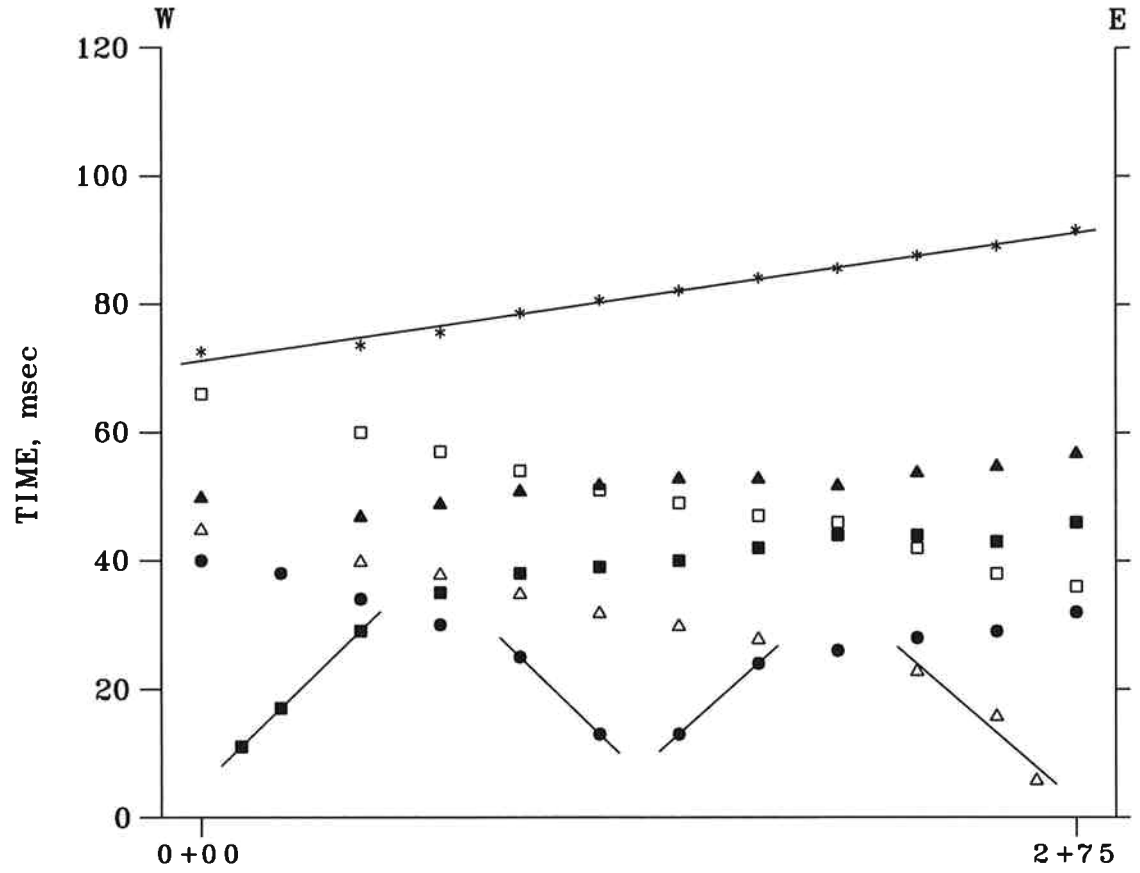
Arrival Time, msec												
▲	33	36	37	40	43	44	48	47	46	49		53
■	12	17	22	24	27	32	35	35	35	37		41
●	36	33	30	30	25	9	15	24	27	30		35
△	42	41	39	39	39	36	35	31		25		9
□	51	49	48	48	49	46	43	42		35		33

t_{ab}= 42 msec; XY = 0

	t_a=	18	21	22	24	27	32	35	35	35	37		41	
	t_b=	42	41	39	39	39	36	35	31		25		23	
*	½△t=	-12	-10	-8½	-7½	-6	-2	0	2		6		9	
	t_g=	9	10	9½	10½	12	13	14	12		10		11	
	t_c=	4	4	4	4	4	4	4	4	3	2	2	2	
	z_0=	4	4	4	4	4	4	4	4		2		2	ft
	z_1=	17	20	18	20	24	26	33	27		21		24	ft
	v_0=						1100							fps
	v_1=		2500			2380			2780		2340			fps
	v_2=						12530							fps

RS08-19

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig B-55

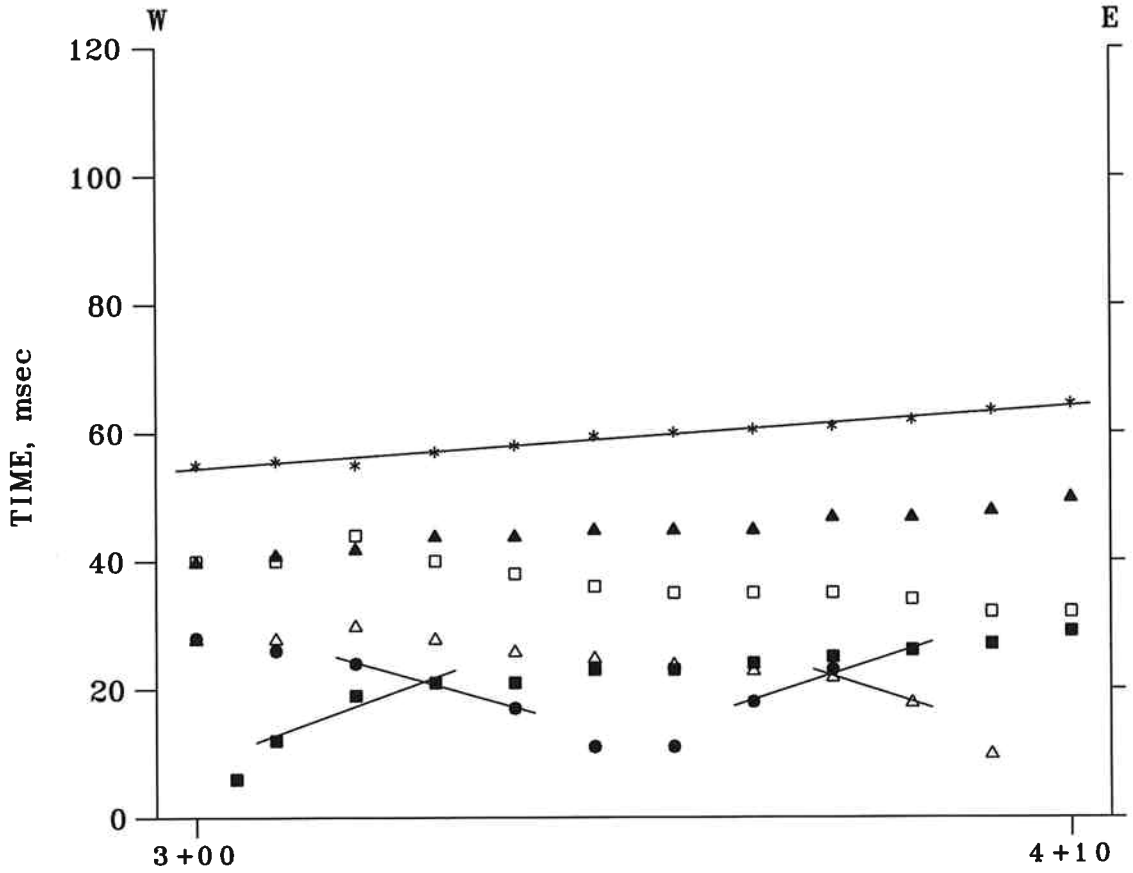


Geophone spacing = 25 ft

Arrival Time, msec	▲	50		47	49	51	52	53	53	52	54	55	57	
	■	11	17	29	35	38	39	40	42	44	44	43	46	
	●	40	38	34	30	25	13	13	24	26	28	29	32	
	△	45		40	38	35	32	30	28		23	16	6	
	□	66		60	57	54	51	49	47	46	42	38	36	
					t_{ab}= 45 msec;				XY = 0					
	t_a=	36		33	35	38	39	40	42	44	44	43	46	
	t_b=	45		40	38	35	32	30	28	27	23	19	17	
*	$\frac{1}{2}\Delta t$=	-4½		-3½	-1½	1½	3½	5	7	8½	10½	12	14½	
	t_g=	18		14	14	14	13	12½	12½	13	11	8½	9	
	t_c=	3	3	3	3	4	4	4	3	3	2	2	1	
	z_0=	3		3	3	4	4	4	3	3	2	2	1	ft
	z_1=	35		26	26	25	23	24	25	27	23	18	20	ft
	v_0=						1100							fps
	v_1=		2080			2080			2270			2330		fps
	v_2=						13750							fps

RS08-20

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig B-56



Geophone spacing = 10 ft

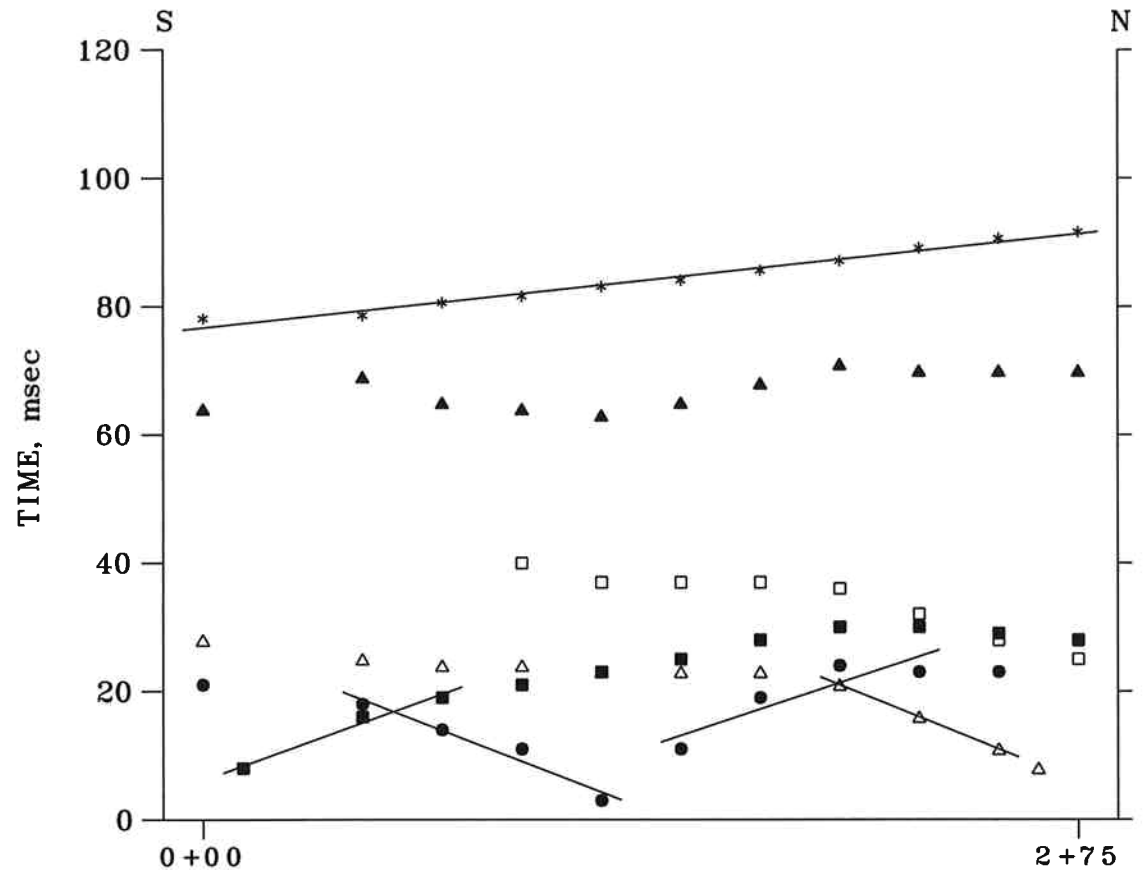
Arrival Time, msec												
▲	40	41	42	44	44	45	45	45	47	47	48	50
■	6	12	19	21	21	23	23	24	25	26	27	29
●	28	26	24	21	17	11	11	18	23	26	27	29
△	28	28	30	28	26	25	24	23	22	18	10	
□	40	40	44	40	38	36	35	35	35	34	32	32

t_{ab}= 29 msec; XY = 0

t_a=	17	18	19	21	21	23	23	24	25	26	27	29	
t_b=	28	28	30	28	26	25	24	24	24	23	21	21	
* $\frac{1}{2}\Delta t$=	−5½	−5	−5½	−3½	−2½	−1	−0½	0	0½	1½	3	4	
t_g=	8	8½	10	10	9	9½	9	9½	10	10	9½	10½	
t_c=	4	4	4	5	5	5	5	5	5	5	5	5	
z_0=	4	4	4	6	6	6	6	6	6	6	6	6	ft
z_1=	13	15	20	19	17	18	16	17	18	18	17	20	ft
v_0=						1100							fps
v_1=		2220			2860			2500			2500		fps
v_2=						11280							fps

RS08-20

Project No. 27669017	Date: 1-7-09	Project: Suncrest Substation	Fig B-57



Geophone spacing = 25 ft

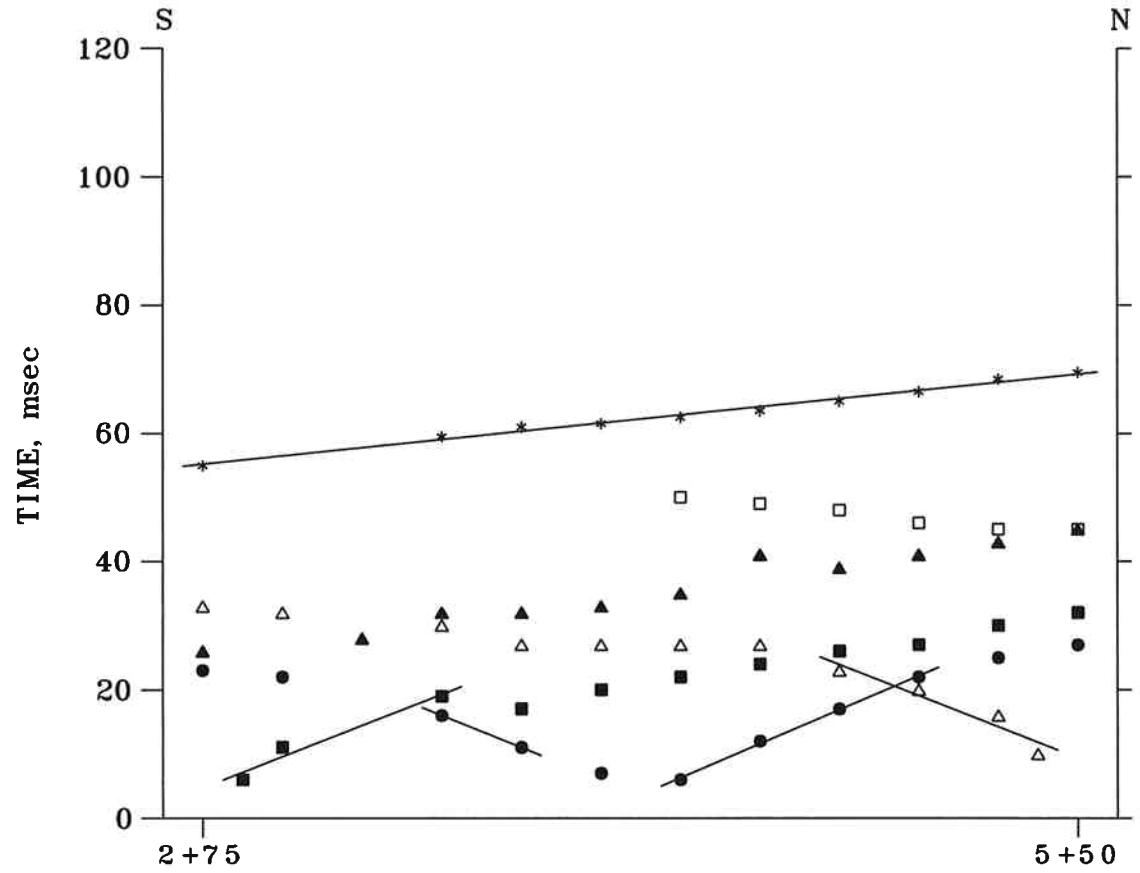
Arrival Time, msec												
▲	64		69	65	64	63	65	68	71	70	70	70
■	8		16	19	21	23	25	28	30	30	29	28
●	21		18	14	11	3	11	19	24	23	23	
△	28		25	24	24	23	23	23	21	16	11	8
□					40	37	37	37	36	32	28	25

t_{ab}= 28 msec; XY = 0

	t_a=	18		16	19	21	23	25	28	30	30	29	28	
	t_b=	28		25	24	24	23	23	23½	22	18	14	11	
*	½△t=	-5		-4½	-2½	-1½	0	1	2½	4	6	7½	8½	
	t_g=	9		6½	7½	8½	9	10	11½	12	10	7½	5½	
	t_c=	3	3	3	2	2	1	6	6	6	5	4	3	
	z_0=	3		3	2	2	1	7	7	7	6	4	3	ft
	z_1=	38		23	33	37	44	32	42	41	35	23	16	ft
	v_0=						1100							fps
	v_1=		5590			5210			6100			5000		fps
	v_2=						18780							fps

RS08-21

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-58



Geophone spacing = 25 ft

Arrival Time, msec													
▲	26		28	32	32	33	35	41	39	41	43	45	
■	6	11		19	17	20	22	24	26	27	30	32	
●	23	22		16	11	7	6	12	17	22	25	27	
△	33	32		30	27	27	27	27	23	20	16	10	
□							50	49	48	46	45	45	

t_{ab}= 32 msec; XY = 0

t_a=	13		15	19	19	20	22	24	26	27	30	32	
t_b=	33	32		30	27	27	27	27	26	24	23	23	
* $\frac{1}{2}\Delta t$ =	−10			−5½	−4	−3½	−2½	−1½	0	1½	3½	4½	
t_g=	7			8½	7	7½	8½	9½	10	9½	10½	11½	
t_c=	2	2	2	2	2	2	2	3	4	4	5	5	
z_0=	2			2	2	2	2	3	4	4	6	6	ft
z_1=	29			36	28	30	34	35	35	32	35	40	ft
v_0=						1100							fps
v_1=		5150			5000			4720			5160		fps
v_2=						19600							fps

RS08-21

Project No. 27669017	Date: 11-23-08	Project: Suncrest Substation	Fig B-59

Three electrical resistivity surveys were performed at the site by GeoVision Geophysical Services on December 18 and 19, 2008. The arrays, designated T-1 through T-3, spanned the width, northeast-southeast, and northeast-southwest diagonals of the proposed substation pad. All three arrays crossed at a common center point. Arrays T-1, T-2, and T-3 were 1,795, 890, and 1,795 feet in length, respectively.

Soil resistivity measurements are the basis of designing grounding systems. The purpose of the electrical resistivity surveys was to measure the soil resistivity in accordance with ASTM Test Standard G57. The results of the surveys are presented in this appendix in a report dated December 23, 2008, prepared by GeoVision.

GEOVision
geophysical services

December 23, 2008

Project Number 8538

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

Subject: **Three Wenner Resistivity Tests, MRDA Site**

Dear Mr. Hatch:

A geophysical survey was conducted on December 18 and 19, 2008 at the MRDA site located east of Alpine, California. The purpose of the geophysical survey was to measure soil resistivity in accordance with ASTM Standard G 57. Site conditions consisted of areas of heavy vegetation and undulating topography. Resistivity data was collected along three (3) arrays numbered T1, T2 and T3. The approximate locations of the center and the endpoints of the resistivity soundings are presented in Table 1.

Table 1: Resistivity Sounding Locations

Approximate Location	Northing (US Ft)	Easting (US Feet)
Center Point	1,874,328	6,428,617
T1 North	1,875,204	6,428,823
T1 South	1,873,465	6,428,353
T2 West	1,874,409	6,428,184
T2 East	1,874,256	6,429,062
T3 Southeast	1,873,553	6,429,073
T3 Northwest	1,875,121	6,428,193

Note: Collected using a Trimble ProXRS GPS system with OmniSTAR differential corrections. California State Plane, NAD83 (Conus), Zone VI (0406).

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 200 watts and is capable of continuous output current between 1 mA and 1 A with an output voltage of 800 volts 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 (I) throughout the measurement cycle, recording input voltage (V) and writing resistance (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 specifications provided previously by SDG&E. Resistivity measurements were made using the Wenner array (Figure 1). The Wenner array uses a constant spacing between consecutive electrodes (a-spacing). A-spacings of 1.5, 3, 5, 7, 10, 20, 30, 50, 75, 100, 150, 200, 300 and 600 were used where possible. The a-spacing of 600 ft was not able to be completed on T2WE due to limited accessibility.

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 three locations (T1SN, T2WE and T3SENW), for a total of 3 soundings. Resistivity measurements were made at the selected electrode spacings, mentioned above, using a surveyor's measuring tape for spatial control. Each sounding was approximately centered over a common center point.

Resistivity measurements at up to fourteen (14) 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

Three 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.

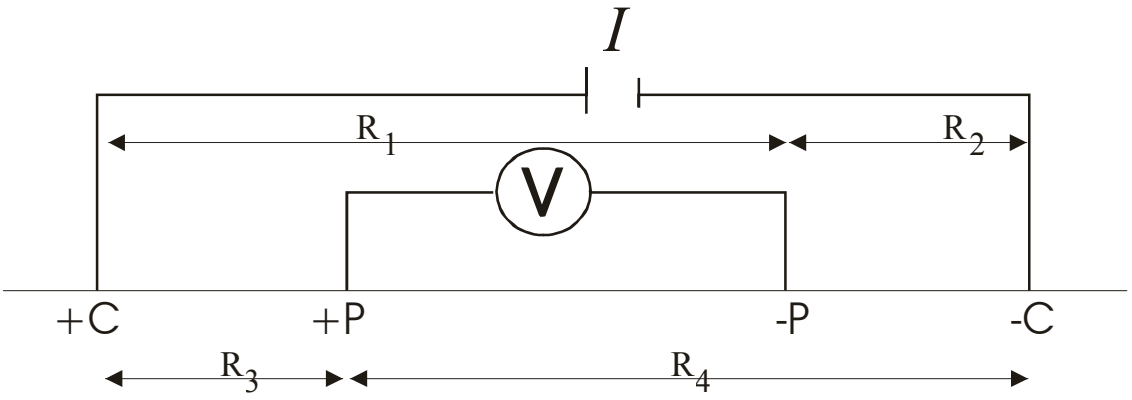


Figure 1: The generalized form of the four electrode array (Wenner Array – R2=R3. R1=2R3, R4=2R2).

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 three Wenner resistivity arrays are attached as Tables 2 through 4. 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.

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

Three electrode soil resistivity measurements were made at the MRDA site located east of Alpine, California in accordance with ASTM Standard G 57. Apparent soil resistivity was measured at up to fourteen (14) electrode spacings for each sounding. Field measurements and calculated values were consistent and repeatable at all locations, as summarized in Tables 2 through 4.

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 T1SN
Table 3: Resistivity Sounding T2WE
Table 4: Resistivity Sounding T3SENW
Micro Precision Calibration, Inc. - Certificate of Calibration

TABLE 2: ELECTRICAL RESISTIVITY SOUNDING RES - T1SN (South to North)

Job Number 8538 Date 18-Dec-08

19.82 ohm @ 25 deg Celsius - Test Resistor Reading

19.82 ohm at 1258 hours Repeat 19.82 ohm

19.82 ohm at 1437 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	99.370	9.425	936.540	285.457	28545.7	99.380	936.634	285.486	28548.6
3.0	44.950	18.850	847.288	258.253	25825.3	43.920	827.872	252.336	25233.6
5.0	18.610	31.416	584.650	178.201	17820.1	18.600	584.336	178.106	17810.6
7.0	9.701	43.982	426.672	130.050	13005.0	9.686	426.013	129.849	12984.9
10.0	5.754	62.832	361.534	110.196	11019.6	5.748	361.157	110.081	11008.1
20.0	4.600	125.664	578.053	176.191	17619.1	4.597	577.676	176.076	17607.6
30.0	4.216	188.496	794.697	242.224	24222.4	4.213	794.132	242.051	24205.1
50.0	4.484	314.159	1408.690	429.369	42936.9	4.484	1408.690	429.369	42936.9
75.0	3.794	471.239	1787.880	544.946	54494.6	3.792	1786.938	544.659	54465.9
100.0	2.470	628.319	1551.947	473.033	47303.3	2.470	1551.947	473.033	47303.3
150.0	2.016	942.478	1900.035	579.131	57913.1	2.016	1900.035	579.131	57913.1
200.0	2.510	1256.637	3154.159	961.388	96138.8	2.510	3154.159	961.388	96138.8
300.0	2.632	1884.956	4961.203	1512.175	151217.5	2.633	4963.088	1512.749	151274.9
600.0	1.296	3769.911	4885.805	1489.193	148919.3	1.296	4885.805	1489.193	148919.3

Testing Started: 1257 hrs Testing Ended: 1438 hrs

Temperature: ~60 deg Fahrenheit

Comments: Last rain night of 12/17/08

Heavy, dense vegetation. Unable to clear due to biological concerns.

TABLE 3: ELECTRICAL RESISTIVITY SOUNDING RES - T2WE (West to East)

Job Number 8538 Date 19-Dec-08

19.82 ohm @ 25 deg Celsius - Test Resistor Reading

19.82 ohm at 0940 hours Repeat 19.82 ohm

19.82 ohm at 1034 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	126.000	9.425	1187.522	361.957	36195.7	126.100	1188.465	362.244	36224.4
3.0	35.120	18.850	661.996	201.777	20177.7	35.120	661.996	201.777	20177.7
5.0	10.920	31.416	343.062	104.565	10456.5	10.930	343.376	104.661	10466.1
7.0	6.651	43.982	292.526	89.162	8916.2	6.651	292.526	89.162	8916.2
10.0	5.050	62.832	317.301	96.713	9671.3	5.042	316.798	96.560	9656.0
20.0	4.649	125.664	584.211	178.067	17806.7	4.636	582.577	177.569	17756.9
30.0	3.845	188.496	724.765	220.909	22090.9	3.843	724.388	220.794	22079.4
50.0	3.290	314.159	1033.584	315.036	31503.6	3.296	1035.469	315.611	31561.1
75.0	3.490	471.239	1644.624	501.281	50128.1	3.482	1640.854	500.132	50013.2
100.0	3.656	628.319	2297.133	700.166	70016.6	3.661	2300.274	701.124	70112.4
150.0	3.745	942.478	3529.579	1075.816	107581.6	3.747	3531.464	1076.390	107639.0
200.0	3.405	1256.637	4278.849	1304.193	130419.3	3.400	4272.566	1302.278	130227.8
300.0	2.020	1884.956	3807.610	1160.560	116056.0	2.020	3807.610	1160.560	116056.0

Testing Started: 0936 hrs Testing Ended: 1036 hrs

Temperature: ~50 deg Fahrenheit

Comments: Last rain night of 12/17/08. Frost on the ground the morning of 12/19/08
Heavy, dense vegetation. Unable to clear due to biological concerns.
Far western end of line inaccessible without clearing vegetation. Unable to complete a-spacing of 600 ft as a result.

TABLE 4: ELECTRICAL RESISTIVITY SOUNDING RES - T3SENW (Southeast to Northwest)

Job Number 8538 Date 19-Dec-08

19.82 ohm @ 25 deg Celsius - Test Resistor Reading

19.82 ohm at 1312 hours Repeat 19.80 ohm

19.81 ohm at 1516 hours Repeat 19.82 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	134.900	9.425	1271.403	387.523	38752.3	134.900	1271.403	387.523	38752.3
3.0	48.280	18.850	910.057	277.385	27738.5	48.290	910.245	277.443	27744.3
5.0	14.430	31.416	453.332	138.176	13817.6	14.420	453.018	138.080	13808.0
7.0	6.662	43.982	293.010	89.309	8930.9	6.659	292.878	89.269	8926.9
10.0	4.691	62.832	294.744	89.838	8983.8	4.688	294.556	89.781	8978.1
20.0	4.509	125.664	566.618	172.705	17270.5	4.516	567.497	172.973	17297.3
30.0	4.978	188.496	938.331	286.003	28600.3	4.979	938.519	286.061	28606.1
50.0	3.810	314.159	1196.947	364.829	36482.9	3.803	1194.748	364.159	36415.9
75.0	3.793	471.239	1787.409	544.802	54480.2	3.780	1781.283	542.935	54293.5
100.0	3.638	628.319	2285.823	696.719	69671.9	3.637	2285.194	696.527	69652.7
150.0	3.036	942.478	2861.363	872.143	87214.3	3.037	2862.305	872.431	87243.1
200.0	2.818	1256.637	3541.203	1079.359	107935.9	2.774	3485.911	1062.506	106250.6
300.0	2.232	1884.956	4207.221	1282.361	128236.1	2.235	4212.876	1284.085	128408.5
600.0	1.340	3769.911	5051.681	1539.752	153975.2	1.340	5051.681	1539.752	153975.2

Testing Started: 1311 hrs Testing Ended: 1517 hrs

Temperature: ~70 deg Fahrenheit

Comments: Last rain night of 12/17/08. Frost on the ground the morning of 12/19/08
Heavy, dense vegetation. Unable to clear due to biological concerns.

MICRO PRECISION CALIBRATION, INC.
12686 HOOVER STREET
GARDEN GROVE CA. 92841-1823
714.901.5659

Certificate of Calibration

Date: 8/14/2008 **Lab #** AC-1274 **Certificate #:** 389581

Customer:
GEOVISION
1124 OLYMPIC DRIVE
CORONA, CA, 92881

Purchase Order: 8200-080721-01
Work Order: N/A

MPC Control #:	BM9313
Asset ID:	SS0609199
Gage Type:	RESISTIVITY METER
Manufacturer:	SUPER STING
Model Number:	R8/P
Size:	N/A
Temp./RH:	71 °F / 50 %

Serial Number:	SS0609199
Department:	N/A
Performed By:	KYU HAN
Received Condition:	IN TOLERANCE
Returned Condition:	IN TOLERANCE
Cal Date:	August 14, 2008
Cal. Interval:	12 MONTHS
Cal. Due Date:	August 14, 2009

Found conditions meet or exceed manufacturer specifications.

***Calibration Notes:**
The UUT (unit under test) was calibrated using the manufacturers procedures in our mobile lab from GV.

Test Points

Description	Standard	Tolerance -	Tolerance +	As Found	As Left	UOM	Result
Resistance	1.000	0.960	1.040	1.035	1.035	Ohms	Pass
Resistance	5.000	4.800	5.200	5.045	5.045	Ohms	Pass
Resistance	10.00	9.60	10.40	10.07	10.07	Ohms	Pass
Resistance	15.00	14.40	15.60	15.07	15.07	Ohms	Pass
Resistance	20.00	19.20	20.80	20.09	20.09	Ohms	Pass
Resistance	25.00	24.00	26.00	25.10	25.10	Ohms	Pass
Resistance	30.00	28.80	31.20	30.03	30.03	Ohms	Pass
Cal Resistor	19.832	19.832	19.832	19.832	19.832	Ohms	Pass

Standards Used To Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
BC9000	RESISTOR	1432-M	17235	GENERAL RADIO	12/13/2008	2955672
L1600	MULTIMETER	34401A	US35012966	HEWLETT PACKARD	3/4/2009	2299150

Calibrating Technician: KYU HAN

QC Approval: Tammy Webster

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2000, ANSI/NCSL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacture's service instructions and are warranted for no less than (30) days. This report may not be reproduced in part or in whole without the prior written approval of the issuing MPC lab.

MICRO PRECISION CALIBRATION, INC.
12686 HOOVER STREET
GARDEN GROVE CA. 92841-1823
714.901.5659

Certificate of Calibration

Date: 8/14/2008 **Lab #** AC-1274 **Certificate #:** 389581

Procedures Used In This Event:

Procedure Name	Description
MANUFACTURER	MANUAL REV CONTROL

Calibrating Technician: KYU HAN

QC Approval: Tammy Webster

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2000, ANSI/NCSL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacture's service instructions and are warranted for no less than (30) days. This report may not be reproduced in part or in whole without the prior written approval of the issuing MPC lab.

Downhole televiewer logging was performed in selected boreholes to provide additional subsurface information on the deep cuts. The televiewer logging was performed by GeoVision using acoustical equipment in the borings presented in the table below.

Table D-1
Summary of Borings with Downhole Televiewer
Suncrest Substation

Exploration	Date Drilling Completed	Date Televiewed	Boring Depth (feet)	Depth Televiewed (feet)
B-08	1/21/09	2/4/09	106.0	102.6
B-09	2/19/09	2/20/09	120.5	119.4
B-10	3/3/09	3/9/09	90.6	88.8
B-11	1/12/09	1/17/09	59.0	56.4

The acoustical televiewer (ATV) uses the returns from reflected soundwaves to produce a simulated image of the borehole wall. The ATV tool must be submerged in order to produce these images. The ATV probes were lowered into the borehole with a cable pulled on a calibrated wench. The cable acts as the data conduit between the probe and the data collector at the ground surface while the wench keeps track of the depth of the probe. The data collector coordinates the image and orientation sampling of the televiewer with depth information from the wench. Well-CAD software was used for data analysis and presentation.

Subsequent interpretation analysis of the acoustical surveys by GeoVision provided information on dip angle and dip magnitude for the identified planar features. The planar features intercepted by the core borings typically consisted of planar bedding and hairline fractures, with a few open fractures identified.

The televiewer images and other geophysical information from the televiewer are presented in the Geovision report presented in this appendix. The structural data provided by the televiewer is used to evaluation potential slope conditions using the Rock Pack computer program and the methodologies described below.

Rock Slope Analyses

The Markland's test was used as an initial screening tool to identify potentially significant discontinuities along the proposed cut slopes. For a plane failure or block sliding to occur, two conditions must be met. First, the discontinuity must have a dip angle that is steeper than its friction angle. Second, the discontinuity must daylight, less steeply, from the slope face in a down-dip direction or same direction as the slope face. Sliding can only rarely occur if the discontinuity dips in the same direction but more steeply than the slope face (Watts *et al.,* 2003). In the Markland's test, these conditions are projected along a cut slope's great circle in the form of a crescent-shaped critical zone (shaded, where the friction angle is less than the cut slope) on the RockPack stereonet (Schmidt net) plot. The discontinuity data are evaluated using dip vectors (i.e. points that show the true dip and dip-direction of the joints). Thus, the dip vector data points that lie within the critical 'shaded' zone dip more steeply than the friction angle of

the rock, and the discontinuities are considered "critical". The most vulnerable discontinuities would be blocks dipping within ±20° directly out of the slope face (Watts *et al.*, 2003). The Markland's test gives a range of ±30° bounded as a triangle or wedge projected from the center of the stereonet plot toward the perimeter.

The potential for wedge failure can be identified using the Markland's test on a stereonet plot in the same manner as a plane failure. As stated in Watts *et al.* (2003), for a wedge failure to occur, "the line made by the intersection of the planes creating the wedge must plunge more steeply than the friction angle and less steeply than the dip of the slope face and in direction such that it daylights from the slope face". In the stereonet plot, the discontinuity data points that represent the higher population densities are grouped into clusters. Each cluster has a single, range of, or bounding great circle. The great circles that intersect within the shaded critical zone on the stereonet plot meet the conditions required for wedge failure to occur.

Toppling failure can also be identified using Markland's method. This approach is based primarily on Goodman's 1980 procedures (Watts *et al.*, 2003) for kinematically identifying potential toppling failures. For toppling deformations to develop, interlayer slip must first occur between blocks that dip into the cut slope face. In addition, toppling can only occur if the layers strike nearly parallel to the strike of the slope to within about 30° (Watts *et al*, 2003). The Markland's test provides a boundary that meets these ±30° conditions and is presented as a triangle or wedge projected from the center of the stereonet plot toward the perimeter.

Where critical joints may provide a pathway for potential wedge or plane failures identified using Markland's test, additional analyses were performed using RockPack to estimate a factor of safety against failure. Input parameters to the wedge and plane/sliding block analyses include joint orientations, slope orientation and height, and rock properties (friction angle, cohesion and density). Typically, a range of joint orientations were checked to account for variation in the rock structure. Safety factor calculations are then evaluated based on the significance of failure potential. The resulting factors of safety were used to provide additional interpretation of the stability for cut slopes with a higher potential for failure.

GEOVision
geophysical services

MRDA SUBSTATION

TELEVIEWER SURVEYS

BORINGS B-08, B-09, B-10 AND B-11

April 30, 2009

Report 8538-01 rev A

MRDA SUBSTATION

TELEVIEWER SURVEYS

BORINGS B-08, B-09, B-10 AND B-11

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April 30, 2009

Report 8538-01 rev A

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APPENDIX B **TELEVIEWER FRACTURE DISTRIBUTION HISTOGRAMS**

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APPENDIX D **ACOUSTIC TELEVIEWER BASED CALIPER LOGS**

INTRODUCTION

Acoustic and optical televiewer logging was performed in four uncased rock borings at the MRDA Substation site near Alpine, California. Data acquisition was performed between January 12 and March 4, 2009 by Robert Steller and Nathan Baldwin of Geovision. The work was performed under subcontract with URS Corporation, with Mike Hatch serving as the point of contact for URS.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of acoustic and optical televiewer logs collected in four uncased nominal 3.86 inch diameter borings, as detailed in Table 1. The purpose of these studies was to supplement lithologic information obtained during URS's rock coring program and to acquire fracture and bedding depths, azimuths and dips.

INSTRUMENTATION

Acoustic Televiewer Instrumentation

Acoustic televiewer data were collected using a Robertson high resolution acoustic televiewer probe (HiRAT), serial number 5174, controlled by Robertson's HiRAT program, version 11. The total length of the probe as used in this survey is 5.2 feet, with the sensor head located 0.5 feet above the bottom end of the probe, as illustrated in Figure 2. The probe receives control signals from, and sends data to, instrumentation on the surface via a 4-conductor armored cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk. The probe is centered in the boring by two sets of flat spring centralizers.

In this application, this probe is useful in the following studies:

- Measurement of boring inclination and deviation from vertical
- Determination of need to correct soil and geophysical log depths to true vertical depths
- Acoustic imaging of the boring wall to identify fractures, dikes, and weathered zones, and determine dip and azimuth of these features

This system produces images of the boring wall based upon the amplitude and travel time of an ultrasonic beam reflected from the formation wall. The ultrasonic energy is generated by a piezoelectric transducer at a frequency of 1.4 MHz. A periodic acoustic energy wave is emitted by the transducer and travels through the acoustic head and boring fluid until it reaches the interface between the boring fluid and the boring wall. Here a portion of the energy is reflected back to the transducer, the remainder continuing on into the formation. By careful time sequencing, the piezoelectric transducer acts as both the transmitter of the ultrasonic pulse and receiver of the reflected wave. The travel time of the energy wave is the period between transmission of the source energy pulse and the return of the reflected wave measured at the point of maximum wave amplitude. The magnitude of the wave energy is measured in dB, a unit-less ratio of the detected echo wave amplitude divided by the amplitude of the transmitted

wave. The strength of the reflected signal depends primarily upon the impedance contrast of the boring fluid and the boring wall formation. In these rock borings, the contrast between the water filling the boring and the rock formation generally provides high contrast. The changes in reflectance between rock types provide imaging of healed fractures in the parent rock.

The acoustic wave propagates along the axis of the probe and then is reflected perpendicular to this axis by a reflector that focuses the beam to a 0.1-inch diameter spot about 2 inches from the central axis of the probe. This reflector is mounted on the shaft of a stepper motor enabling the position of the measurement to be rotated through 360°. Sampling rates of 90, 180 and 360 measured points per revolution are available. During these surveys, data were collected at 360 samples per revolution, providing an equivalent horizontal pixel size of approximately 0.033 inches on the boring wall. It should be noted that during logging the probe is moving vertically in the boring, so that the measured points describe a very fine pitch spiral.

The probe contains a fluxgate magnetometer to monitor magnetic north, and all raw televiewer data is referenced to magnetic north. The processed data is referenced to true north, using a declination of 12.6 degrees east for this site and dates, obtained from the NOAA declination web site (http://www.ngdc.noaa.gov/seg/geomag/jsp/struts/calcDeclination). Also, a three axis accelerometer is enclosed in the probe, and boring deviation data is recorded during the logging runs, to permit correction of structure dip angle from apparent dip, (referenced to boring axis), to true dip (referenced to a vertical axis) in non-vertical borings. The probe is centered in the boring by two sets of flat spring centralizers.

The data are presented on a computer screen for operator review during the logging run, and stored on hard disk for later processing.

Optical Televiewer Instrumentation

A Robertson Geophysics Micrologger II and a Robertson digital optical televiewer (DOPTV) probe, S/N 5117, were used to obtain the optical televiewer logs, controlled by Robertson's DOPTV program, version 13. The total length of the probe as used in this survey is 6.7 feet, with the sensor head located 0.5 feet above the bottom end of the probe. The probe receives control signals from, and sends data to, instrumentation on the surface via a four conductor armored cable. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk. The probe is centered in the boring by two sets of flat spring centralizers.

In this application, this probe is useful in the following studies:

- Measurement of boring inclination and deviation from vertical
- Determination of need to correct soil and geophysical log depths to true vertical depths
- Optical imaging of the boring wall to identify fractures, dikes, and weathered zones, and determine dip and azimuth of these features

This system produces images of the boring based upon periodic annular scans of the boring wall. A video camera is mounted looking down the axis of the probe at a hyperbolic mirror, which produces an annular image of the boring wall on the camera. A constant "ring" of pixels on the camera face are output at each subsequent measurement depth, allowing a cylindrical image of the boring wall to be constructed. This image is referenced to magnetic north, allowing the cylinder to be "unwrapped" with north as the edge of the unwrapped image. Sampling rates of 720 or 360 points per annulus are available. During these logs, data was collected at 720 points per annulus, providing an equivalent horizontal pixel size of approximately 0.016 inches on the boring wall.

The probe contains a fluxgate magnetometer to monitor magnetic north, and all raw televiewer data is referenced to magnetic north. The processed data is referenced to true north, using a declination of 12.6 degrees east for this site and date, obtained from the NOAA declination web site (http://www.ngdc.noaa.gov/seg/geomag/jsp/struts/calcDeclination). Also, a three axis accelerometer is enclosed in the probe, and boring deviation data is recorded during the logging runs, to permit correction of structure dip angle from apparent dip, (referenced to boring axis), to true dip (referenced to a vertical axis) in non-vertical borings.

The data is presented on a computer screen for operator review during the logging run, and stored on hard disk for later processing.

MEASUREMENT PROCEDURES

Acoustic Televiewer Measurement Procedures

All four borings were logged with the acoustic televiewer below standing fluid level. In accordance with the manufacturer's recommended procedures, the probe was inspected and tested prior to entering the boring. The probe was then positioned with the collar of the probe positioned at grade, and the electronic depth counter was set to 4.72 feet, corresponding to the offset between collar and imaging unit. The probe was lowered to the bottom of the boring, where data acquisition was started on the laptop computer. The rotational scan resolution was set to 360 samples per revolution, giving a horizontal pixel size of 0.033 inches. The probe was then raised at a nominal rate of 3 feet per minute to static water level with an acquisition rate of 125 samples/foot, giving an equivalent vertical pixel size of 0.008 feet (approximately 0.1 inches). This file was then closed and reviewed on the computer screen. Upon completion of the measurements, the probe zero depth indication at grade was verified prior to removal from the boring.

Optical Televiewer Measurement Procedures

B-10 was logged with the optical televiewer above and below standing fluid level. In accordance with the manufacturer's recommended procedures, the probe was inspected and tested prior to entering the boring. The probe was then positioned with the collar of the probe positioned at grade, and the electronic depth counter was set to 6.2 feet, corresponding to the offset between collar and imaging unit. The rotational scan resolution was set to 720 samples per revolution, giving a horizontal pixel size of 0.016 inches. Acquisition was started on the laptop computer and the probe was lowered at a nominal rate of 3 feet per minute to the bottom of the boring, with an acquisition rate of 125 samples/foot, giving an equivalent vertical pixel size of 0.008 feet (approximately 0.1 inches). This file was then closed and reviewed on the computer screen. Upon completion of the measurements, the probe zero depth indication at grade was verified prior to removal from the boring.

DATA ANALYSIS

Acoustic Televiewer Analysis

The acoustic televiewer data were processed using Robertson's RGLDIP software, version 6.2. Sinusoidal projections of fractures in the boring walls were interactively picked on the un-wrapped televiewer image, and are presented on the logs as red sinusoids superimposed over the televiewer image. Bedding features, where identifiable, were picked on the same images, and are presented on the logs as green sinusoids. The sinusoidal projections were processed using the standard boring gauge of 3.86 inches to calculate apparent dip angle. True dip was calculated, correcting for the plunge of the borings using the recorded data from the accelerometers located in the probes, and presented in arrow format, with true dip indicated by the arrow position across the plot. Azimuth of dip (not strike), is indicated by the direction of the arrow tail, with true north being "up". These values are presented with the comments to the right of the arrow plots, as dip azimuth followed by dip angle.

The televiewer images were also processed to create a simulated core image of the borings. It must be noted that the simulated core image represents a core that would have the full 3.86 inch diameter of the boring, not the 2.5 inch diameter of the cores removed during drilling, so that direct comparison between the two is not possible. Also, the unwrapped image is viewed from the perspective of an observer in the center of the boring looking outward. The simulated core image is viewed form the "outside" of the boring looking inward, so there is a reversal of the position of east and west relative to north between the two images.

The televiewer data were also processed to extract the deviation data and produce an ASCII file and plots of boring deviation, as well as a 4-arm caliper log, derived from the acoustic travel time data. Stereonet analysis of the identified features was performed with Robertson's RGLDIP software, version 6.2 to assist in identifying dominant joining in the borings. High concentrations of similarly oriented features were enclosed in three to five small circles on the stereonet image, and the vector mean dip and azimuth for each small circle was calculated.

Optical Televiewer Analysis

The optical televiewer data was processed using Robertson's RGLDIP software, version 6.2. Sinusoidal projections of both open and hairline fractures in the boring walls were interactively picked on the un-wrapped televiewer image, and are presented on the logs as red sinusoids superimposed over the televiewer image. Bedding projections, where visible, were picked on the same images, and are presented on the logs as green sinusoids. The sinusoidal projections were processed using the standard boring gauge of 3.86 inches to calculate apparent dip angle. True dip was calculated, correcting for the plunge of the borings using the recorded data from the accelerometers located in the probes, and presented in arrow format, with true dip indicated by the arrow position across the plot. Azimuth of dip (not strike), is indicated by the direction of the arrow tail, with true north being "up". These values are presented with the comments to the right of the arrow plots, as dip azimuth followed by dip angle.

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Stereonet analysis of the identified features was performed with Robertson's RGLDIP software, version 6.2 to assist in identifying dominant joining in the borings. High concentrations of similarly oriented features were enclosed in three to five small circles on the stereonet image, and the vector mean dip and azimuth for each small circle was calculated.

RESULTS

Acoustic Televiewer Results

Acoustic televiewer images and dip data are presented in Appendix A. Acoustic Televiewer based caliper logs are presented in Appendix D. Both are provided in PDF format as well. Fracture and bedding depth, dip and azimuth of dip data are provided on the multi-page log sheets in Appendix A, and in Tables 4, 5, 6 and 8 as well as in .txt and EXCEL format.

Stereonet plots are presented in Figures 2, 4, 6 and 9, as well as in PDF format. These borings did not exhibit different zones of feature orientation; the feature orientations appeared to be fairly evenly distributed over the boring depths, so they were processed as single zone models.

The mean dips for each of the stereonet small circles are presented in Figures 2, 4, 6 and 9, and in ASCII format. Fracture distribution histograms are presented in Appendix B, Rose diagrams are presented in Appendix C and Acoustic Televiewer based Caliper logs are presented in Appendix D. All are provided in .PDF format as well.

Boring deviation data are presented graphically in Figures 3, 5, 8 and 10, and summarized in Table 3. Deviation data plots in Acrobat format and deviation data at 1.0-foot stations are presented in ASCII format.

Optical Televiewer Results

Optical televiewer images and dip data for B-10 are presented in Appendix A, as well as in PDF format. Fracture and bedding depth, dip and azimuth of dip data for B-10 are provided on the multi-page log sheets in Appendix A, and in Table 7, as well as in .txt and EXCEL format. All optical televiewer files include "optical" in the file name to distinguish them from the acoustic televiewer files.

The optical stereonet plot for B-10 is presented in Figure 7, as well as in PDF format. The mean dip for each of the stereonet small circles is presented in Figure 7, and in ASCII format. Fracture distribution histograms are presented in Appendix B and the Rose diagrams are presented in Appendix C. All are provided in .PDF format.

SUMMARY

Discussion of Televiewer Results

These borings were clean, hard rock borings, and produced very good acoustic televiewer images, though televiewer logs in B-11 show some distortion of the image near the surface due to disturbance of the magnetic field by the hollow stem auger that was used as a surface casing. This causes the orientation of the image to north to be degraded, resulting in degraded image quality.

A majority of the footage in these surveys was collected in very hard, monolithic granitic rock, with few open fractures. Many hairline and healed fractures are present, and oxide staining can be seen around these features in the optical televiewer images from B-10.

B-10 produced good optical images, though the optical televiewer logs collected above standing water do not exhibit the rich colors seen in the images collected below standing water. Some clouding of the optical image is visible toward the bottom of B-10, due to suspended silt in the water.

Deviation in all these borings is 1.5 degrees or less, as summarized in Table 3. This corresponds to a maximum depth error of less than 0.1 percent, which does not warrant adjustment of depth values on the logs.

Quality Assurance

These televiewer measurements were performed using industry-standard or better methods for both measurements and analyses. All work was performed under GEOVision quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation;
- Use of standard field data logs;
- Use of independent verification of orientation and plunge by comparison of measured values to as built information and reference structures, such as casing shoe or water surface, when available.

Televiewer Data Reliability

Depth indications are very reliable with estimated precision of +/- 0.2 feet. Estimated precision of dip and azimuth of dip is +/- 5 degrees. Standardized field procedures and quality assurance checks add to the reliability of these data.

BORING DESIGNATION	DATES LOGGED	COORDINATES [1]		ELEVATION [1] (FEET, MSL)
		LATTITUDE	LONGITUDE	
B-08	2/4/2009	32 48.597	116 41.854	3,215
B-09	2/20/2009	32 48.594	116 40.888	3,169
B-10	3/4/2009	32 48.578	116 40.859	3,206
B-11	1/12/2009	32 48.545	116 40.877	3,106

[1] Coordinates and elevation provided by URS

Table 1. Boring locations and logging dates

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	OPEN HOLE (FEET)	DEPTH TO BOTTOM OF CASING (FEET)	SAMPLE INTERVAL (FEET)	DATE LOGGED
B-08	ACOUSTIC TELEVIEWER UP01	102.6 – 4.2	102.6	9.9 PVC	.008	2/4/2009
B-09	ACOUSTIC TELEVIEWER UP01	119.5 – 5.0	119.5	5.0 PVC	.008	2/20/2009
B-10	ACOUSTIC TELEVIEWER UP01	89.0 – 5.6	-	5.0 PVC	.008	3/4/2009
B-10	OPTICAL TELEVIEWER DOWN01	6.1 – 89.1	89.1	5.0 PVC	.008	3/4/2009
B-11	ACOUSTIC TELEVIEWER UP01	56.5 – 34.5	56.5	8.9 AUGER	.008	1/12/2009
B-11	ACOUSTIC TELEVIEWER UP02	56.5 – 8.5	56.5	8.9 AUGER	.008	1/12/2009
B-11	ACOUSTIC TELEVIEWER UP03	13.0 - 8.5	-	8.9 AUGER	.008	1/12/2009

- PROBE DID NOT TOUCH BOTTOM OF BORING

Table 2. Logging dates and depth ranges

BORING NUMBER	MEAN DEVIATION AND AZIMUTH (DEGREES TN)	SURVEY DEPTH (FEET)	VERTICAL DEPTH (FEET)	DEPTH ERROR (FEET)	HORIZONTAL OFFSET (FEET)
B-08	1.5 – N359	102.6	102.5	0.1	2.7
B-09	1.1 – N305	119.5	199.5	0.0	2.4
B-10	0.6 – N357	88.9	88.9	0.0	0.9
B-11	0.1 – N278	56.4	56.4	0.0	0.1

Table 3. Televiewer Deviation Data Summary

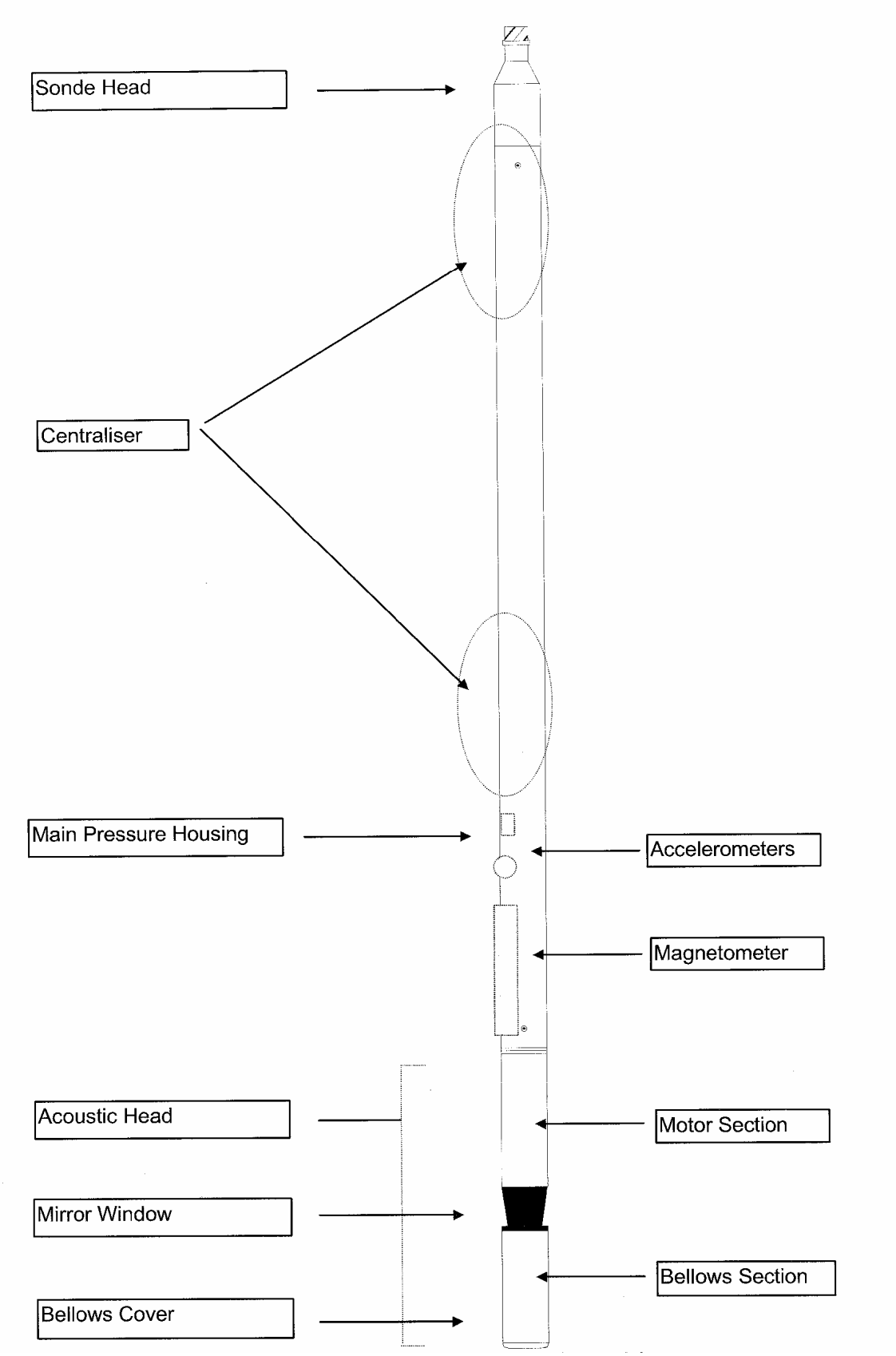


Figure 1: Concept illustration of televiewer probe

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS STEREOGRAMS

URS

Borehole: B-08

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

North ref: true
Depth units are feet

Zone from 102.592 to 9.841ft
Mean dip format: dip-azimuth and dip

Interpretation 1

Dip data sets .....
BHTV dips

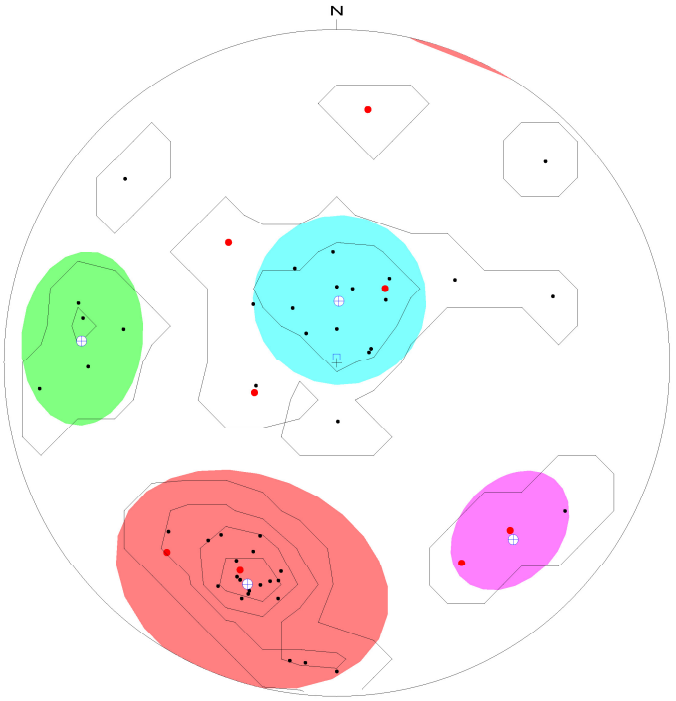
B-08
Zone 0. 9.841 - 102.592ft
Deviation 1.50 N358.00

dipdata sets.....
BHTV dips
● Highlighted dips: Fracture Planar Open-fracture

	mean dip	n	f
N182 15	N182 15	13	0.14
N022 61	N022 61	23	0.54
N095 66	N095 66	5	(0.13)
N315 64	N315 64	3	(0.08)

intersections

	N182 15	N022 61	N095 66	N315 64
N182 15		05 N109	15 N178	10 N230
N022 61	05 N109		58 N050	58 N354
N095 66	15 N178	58 N050		36 N024
N315 64	10 N230	58 N354	36 N024	



equal-area lower-hemisphere 0-90
contour-levels 1,3,6,10,

B-08, Interpretation 1 102.592 to 9.841ft 1

Figure 2. Boring B-08, Stereonet Plot

Depth (feet)	Dip azimuth	Dip	Structure description
10.3	N314	61.6	Fracture Planar Open-fracture
15.2	N328	60.1	Fracture Planar Open-fracture
16.9	N138	40.2	Fracture Planar Open-fracture
19.2	N187	65.6	Fracture Planar Open-fracture
19.7	N131	73.2	Fracture Planar Hairline-fracture
20.9	N070	21.5	Fracture Planar Open-fracture
22.7	N213	21.7	Fracture Planar Open-fracture
24.1	N192	18.5	Fracture Planar Hairline-fracture
25.4	N303	70.7	Fracture Planar Hairline-fracture
25.7	N253	57.4	Fracture Planar Hairline-fracture
27.0	N024	47.3	Fracture Planar Hairline-fracture
27.5	N091	15.3	Primary-structure Planar Bedding
31.6	N324	5.2	Primary-structure Planar Bedding
32.4	N280	14.8	Primary-structure Planar Bedding
34.0	N182	37.1	Primary-structure Planar Bedding
35.4	N024	51.9	Fracture Planar Hairline-fracture
35.7	N017	58.1	Fracture Planar Hairline-fracture
35.9	N014	62.1	Fracture Planar Hairline-fracture
36.5	N089	63.8	Fracture Planar Hairline-fracture
38.5	N178	27.3	Fracture Planar Hairline-fracture
40.5	N218	19.5	Fracture Planar Hairline-fracture
50.4	N099	54.7	Fracture Planar Hairline-fracture
53.0	N247	9.1	Fracture Planar Hairline-fracture
55.5	N103	68.6	Fracture Planar Hairline-fracture
55.9	N100	66.4	Fracture Planar Hairline-fracture
71.1	N251	8.3	Fracture Planar Hairline-fracture
89.1	N226	76.1	Fracture Planar Hairline-fracture
89.6	N085	78.7	Fracture Planar Hairline-fracture
90.8	N359	14.2	Fracture Planar Hairline-fracture
91.2	N074	20.6	Fracture Planar Hairline-fracture
92.7	N021	63.5	Fracture Planar Hairline-fracture
92.7	N024	60.7	Fracture Planar Hairline-fracture
93.3	N028	65.1	Fracture Planar Hairline-fracture
93.5	N024	60.8	Fracture Planar Hairline-fracture
93.6	N021	62.5	Fracture Planar Hairline-fracture
93.7	N235	35.7	Fracture Planar Hairline-fracture
93.8	N025	60.3	Fracture Planar Hairline-fracture
94.0	N042	65.4	Fracture Planar Open-fracture
94.2	N036	55.4	Fracture Planar Hairline-fracture
94.2	N045	60.8	Fracture Planar Hairline-fracture
95.4	N006	79.6	Fracture Planar Hairline-fracture
95.6	N025	58.3	Fracture Planar Open-fracture
95.8	N022	65.3	Fracture Planar Hairline-fracture
95.9	N015	54.7	Fracture Planar Hairline-fracture
95.9	N009	79.6	Fracture Planar Hairline-fracture
96.0	N000	81.9	Fracture Planar Hairline-fracture
96.6	N156	25.4	Fracture Planar Hairline-fracture
96.7	N125	25.1	Fracture Planar Hairline-fracture
96.9	N141	17.2	Fracture Planar Hairline-fracture
97.1	N027	56.1	Fracture Planar Hairline-fracture
97.4	N015	57.3	Fracture Planar Hairline-fracture

Table 4. Boring B-08, Structure depth, dip azimuth, dip and description

Depth (feet)	Dip azimuth	Dip	Structure description
97.4	N034	52.2	Fracture Planar Hairline-fracture
97.6	N019	59.9	Fracture Planar Hairline-fracture
98.9	N180	18.6	Fracture Planar Hairline-fracture
99.1	N180	8.3	Fracture Planar Hairline-fracture
100.1	N134	10.4	Fracture Planar Hairline-fracture
102.6	N212	24.3	Fracture Planar Hairline-fracture

Table 4, continued. Boring B-08, Structure depth, dip azimuth, dip and description

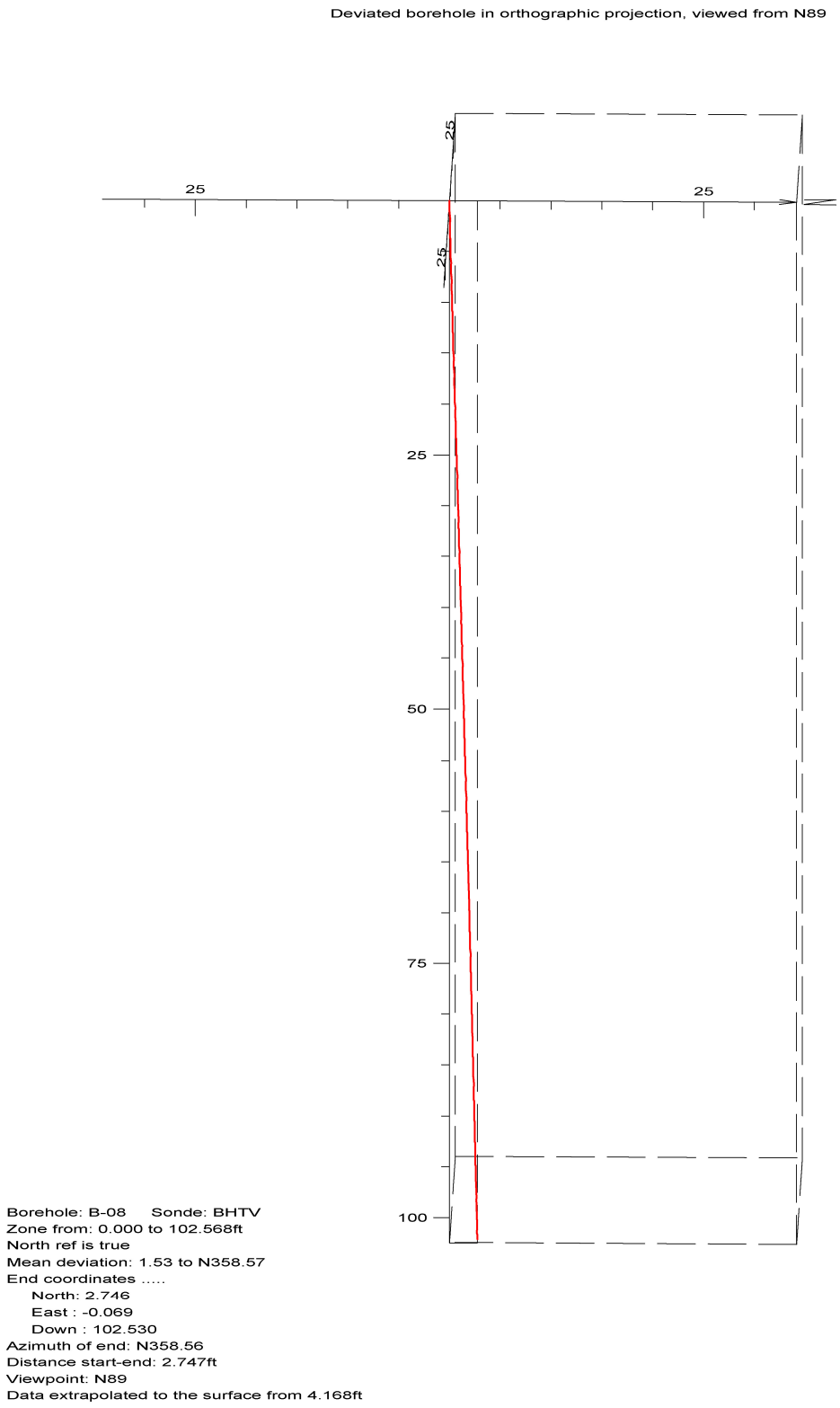


Figure 3. Boring B-08, Deviation Projection (dimensions in feet)

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS STEREOGRAMS

URS

Borehole: B-09

top of borehole.....
East:_
North:_
Elev:_

North ref: true
Depth units are feet

Zone from 117.087 to 9.741ft
Mean dip format: dip-azimuth and dip

Interpretation 1

Dip data sets .....
BHTV dips

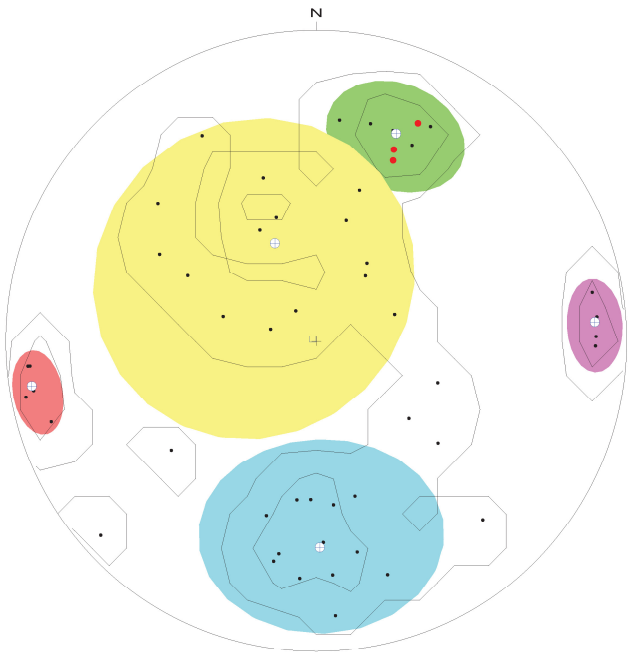
B09
Zone 0. 9.741 - 117.077ft
Deviation 1.10 N301.40

dipdata sets.....
BHTV dips
Highlighted dips: Fracture Planar Open-fracture

	mean dip	n	f
N359 56	N359 56	13	0.22
N081 82	N081 82	6	(0.35)
N201 61	N201 61	8	(0.15)
N266 79	N266 79	4	(0.22)
N157 28	N157 28	15	0.16

intersections

	N359 56	N081 82	N201 61	N266 79	N157 28
N359 56		56 N003	17 N281	55 N340	08 N083
N081 82	56 N003		54 N160	15 N353	28 N167
N201 61	17 N281	54 N160		61 N196	24 N126
N266 79	55 N340	15 N353	61 N196		26 N181
N157 28	08 N083	28 N167	24 N126	26 N181	



mean dip
well axis

equal-area lower-hemisphere 0-90
contour-levels 1,3,

B09, Interpretation 1 117.077 to 9.741ft 1

Figure 4. Boring B-09, Stereonet Plot

Depth (feet)	Dip azimuth	Dip	Structure description
10.2	N217	21.4	Primary-structure Planar Bedding
22.5	N213	24.5	Fracture Planar Hairline-fracture
37.3	N203	53.2	Fracture Planar Open-fracture
37.4	N202	56.3	Fracture Planar Open-fracture
38.0	N346	42.7	Fracture Planar Hairline-fracture
39.7	N002	42.3	Fracture Planar Hairline-fracture
40.0	N208	67.3	Fracture Planar Hairline-fracture
41.2	N162	46.0	Fracture Planar Hairline-fracture
42.2	N016	48.8	Fracture Planar Hairline-fracture
45.8	N200	61.6	Fracture Planar Hairline-fracture
45.9	N186	60.9	Fracture Planar Hairline-fracture
46.7	N194	61.5	Fracture Planar Hairline-fracture
46.8	N358	54.6	Fracture Planar Hairline-fracture
49.3	N205	66.5	Fracture Planar Open-fracture
50.3	N151	64.9	Fracture Planar Hairline-fracture
51.4	N251	21.8	Fracture Planar Hairline-fracture
54.0	N004	65.5	Fracture Planar Hairline-fracture
54.1	N349	58.5	Fracture Planar Hairline-fracture
55.1	N343	67.5	Fracture Planar Hairline-fracture
56.7	N131	57.1	Fracture Planar Hairline-fracture
57.2	N119	48.2	Fracture Planar Hairline-fracture
57.3	N310	32.0	Fracture Planar Hairline-fracture
57.4	N289	34.0	Fracture Planar Hairline-fracture
58.4	N310	42.5	Fracture Planar Hairline-fracture
61.2	N105	12.4	Fracture Planar Hairline-fracture
61.7	N105	25.4	Fracture Planar Hairline-fracture
68.2	N048	82.7	Fracture Planar Hairline-fracture
69.4	N085	81.8	Fracture Planar Hairline-fracture
69.8	N080	81.7	Fracture Planar Hairline-fracture
70.7	N081	81.3	Fracture Planar Hairline-fracture
71.4	N269	79.2	Fracture Planar Hairline-fracture
72.0	N271	79.0	Fracture Planar Hairline-fracture
72.5	N260	79.3	Fracture Planar Hairline-fracture
73.2	N162	34.4	Fracture Planar Hairline-fracture
79.3	N073	78.3	Fracture Planar Hairline-fracture
81.7	N079	84.7	Fracture Planar Hairline-fracture
82.8	N265	79.8	Fracture Planar Hairline-fracture
86.9	N085	82.5	Fracture Planar Hairline-fracture
88.0	N153	32.9	Fracture Planar Hairline-fracture
89.0	N356	77.6	Fracture Planar Hairline-fracture
95.7	N206	59.7	Fracture Planar Hairline-fracture
98.9	N146	9.6	Fracture Planar Hairline-fracture
111.0	N117	38.4	Fracture Planar Hairline-fracture
113.6	N354	44.0	Fracture Planar Hairline-fracture
114.3	N317	67.6	Fracture Planar Hairline-fracture
114.6	N356	64.4	Fracture Planar Hairline-fracture
114.9	N011	61.3	Fracture Planar Hairline-fracture
115.2	N053	48.8	Fracture Planar Hairline-fracture
115.3	N007	42.7	Fracture Planar Hairline-fracture
115.9	N194	32.8	Fracture Planar Hairline-fracture
116.3	N196	41.9	Fracture Planar Hairline-fracture
116.6	N010	58.8	Fracture Planar Hairline-fracture

Table 5. Boring B-09, Structure depth, dip azimuth, dip and description

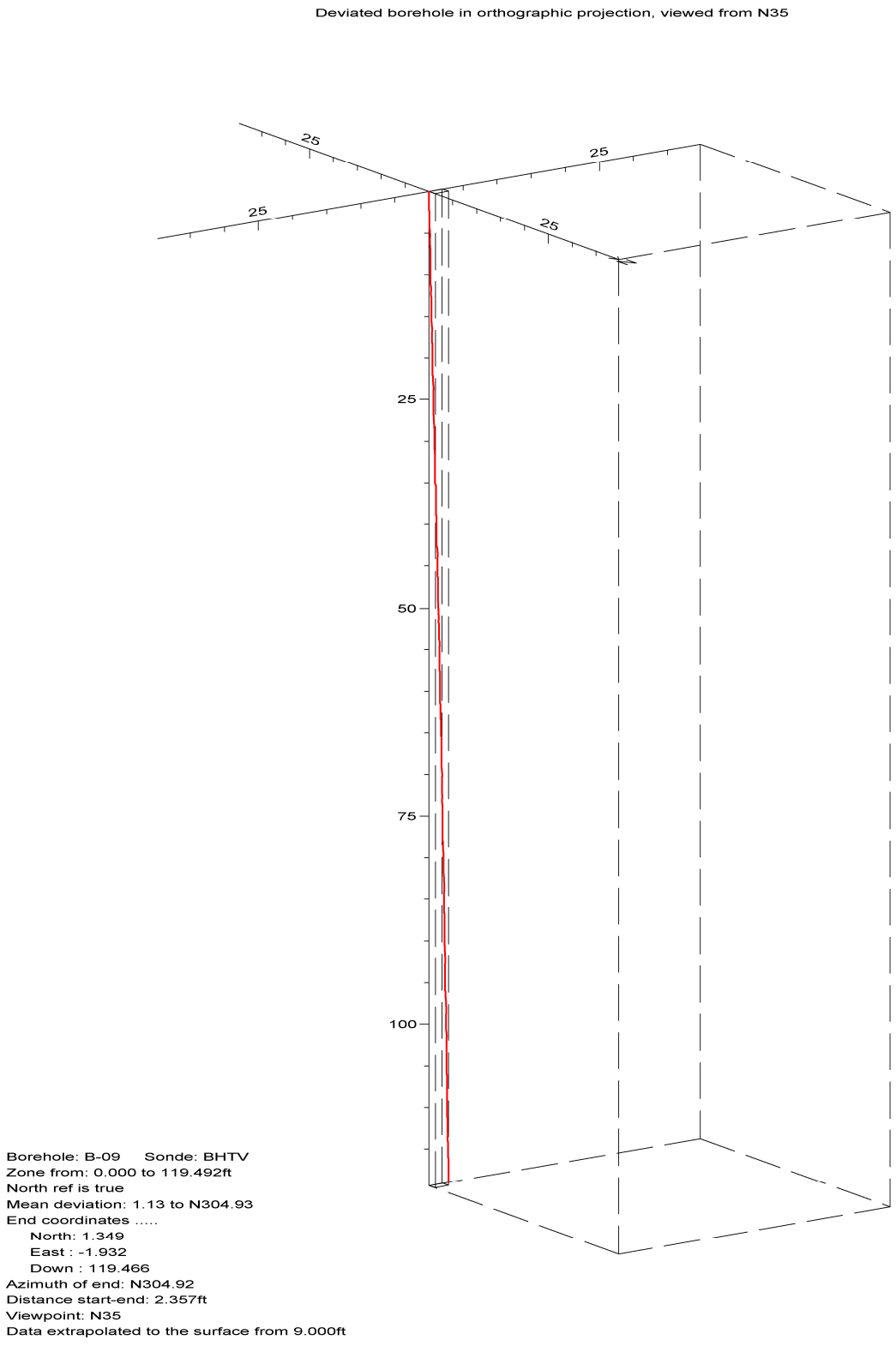


Figure 5. Boring B-09, Deviation Projection (dimensions in feet)

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS STEREOGRAMS

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

North ref: true
Depth units are feet

Zone from 83.593 to 23.300ft
Mean dip format: dip-azimuth and dip

Interpretation 1

Dip data sets .....
BHTV dips

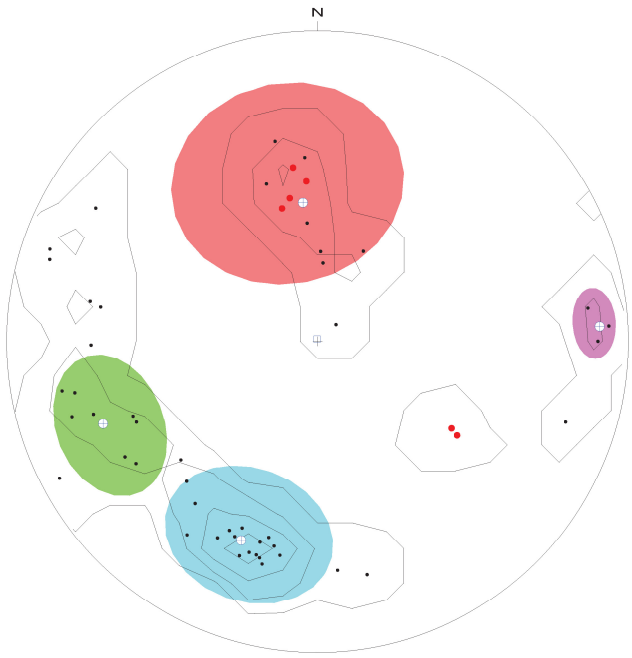
B-10
Zone 0. 23.300 - 83.593ft
Deviation 0.60 N342.60

dipdata sets.....
BHTV dips
• Highlighted dips: Fracture Planar Open-fracture

	mean dip	n	f
N021 58	N021 58	16	0.51
N174 37	N174 37	11	0.23
N069 63	N069 63	8	0.29
N267 80	N267 80	3	(0.28)

intersections

	N021 58	N174 37	N069 63	N267 80
N021 58		13 N102	58 N032	52 N344
N174 37	13 N102		32 N140	37 N185
N069 63	58 N032	32 N140		24 N352
N267 80	52 N344	37 N185	24 N352	



mean dip
well axis

equal-area lower-hemisphere 0-90
contour-levels 1,3,6,10,

B-10, Interpretation 1 83.593 to 23.300ft 1

Figure 6. Boring B-10, Acoustic Stereonet Plot

Depth (feet)	Dip azimuth	Dip	Structure description
23.8	N304	45.0	Fracture Planar Open-fracture
23.9	N303	42.6	Fracture Planar Open-fracture
25.0	N176	42.9	Fracture Planar Open-fracture
25.2	N172	47.2	Fracture Planar Open-fracture
33.9	N182	23.6	Fracture Planar Hairline-fracture
40.6	N014	63.0	Fracture Planar Hairline-fracture
40.7	N014	54.7	Fracture Planar Hairline-fracture
40.8	N012	56.8	Fracture Planar Hairline-fracture
42.6	N079	72.6	Fracture Planar Hairline-fracture
42.7	N073	71.5	Fracture Planar Hairline-fracture
42.8	N078	68.7	Fracture Planar Hairline-fracture
45.9	N023	57.7	Fracture Planar Hairline-fracture
46.3	N016	56.7	Fracture Planar Hairline-fracture
46.4	N022	54.5	Fracture Planar Hairline-fracture
46.5	N025	56.6	Fracture Planar Hairline-fracture
51.9	N270	79.3	Fracture Planar Hairline-fracture
52.2	N034	64.1	Fracture Planar Hairline-fracture
52.2	N015	61.3	Fracture Planar Hairline-fracture
52.2	N109	80.1	Fracture Planar Hairline-fracture
53.0	N107	79.1	Fracture Planar Hairline-fracture
53.1	N099	60.0	Fracture Planar Hairline-fracture
53.3	N121	72.1	Fracture Planar Hairline-fracture
53.7	N100	63.3	Fracture Planar Hairline-fracture
53.9	N089	62.0	Fracture Planar Hairline-fracture
54.1	N056	59.7	Fracture Planar Hairline-fracture
55.6	N228	6.5	Fracture Planar Hairline-fracture
56.6	N184	20.6	Fracture Planar Hairline-fracture
57.3	N016	60.7	Fracture Planar Hairline-fracture
57.3	N027	60.2	Fracture Planar Hairline-fracture
57.5	N010	59.3	Fracture Planar Hairline-fracture
57.6	N020	62.6	Fracture Planar Hairline-fracture
62.8	N018	60.6	Fracture Planar Hairline-fracture
66.5	N175	31.3	Fracture Planar Hairline-fracture
66.7	N165	36.5	Fracture Planar Open-fracture
66.8	N169	38.8	Fracture Planar Open-fracture
67.5	N176	49.6	Fracture Planar Hairline-fracture
67.7	N263	76.6	Fracture Planar Hairline-fracture
69.3	N049	48.6	Fracture Planar Hairline-fracture
69.3	N037	55.1	Fracture Planar Hairline-fracture
72.7	N162	44.3	Fracture Planar Hairline-fracture
72.8	N168	55.4	Fracture Planar Hairline-fracture
75.0	N043	51.8	Fracture Planar Hairline-fracture
77.6	N267	83.1	Fracture Planar Hairline-fracture
78.9	N288	72.8	Fracture Planar Hairline-fracture
79.2	N207	26.5	Fracture Planar Hairline-fracture
80.8	N062	83.3	Fracture Planar Hairline-fracture
81.1	N068	53.8	Fracture Planar Hairline-fracture
81.2	N059	61.5	Fracture Planar Hairline-fracture
81.2	N355	63.1	Fracture Planar Hairline-fracture
81.5	N066	53.6	Fracture Planar Hairline-fracture
82.3	N348	65.8	Fracture Planar Hairline-fracture
83.1	N072	64.8	Fracture Planar Hairline-fracture

Table 6. Boring B-10, Televiewer Structure depth, dip azimuth, dip and description

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS STEREOGRAMS

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:
North:
Elev:

North ref: true
Depth units are feet

Zone from 85.182 to 23.273ft
Mean dip format: dip-azimuth and dip

Interpretation 1

Dip data sets .....
OPTV dips

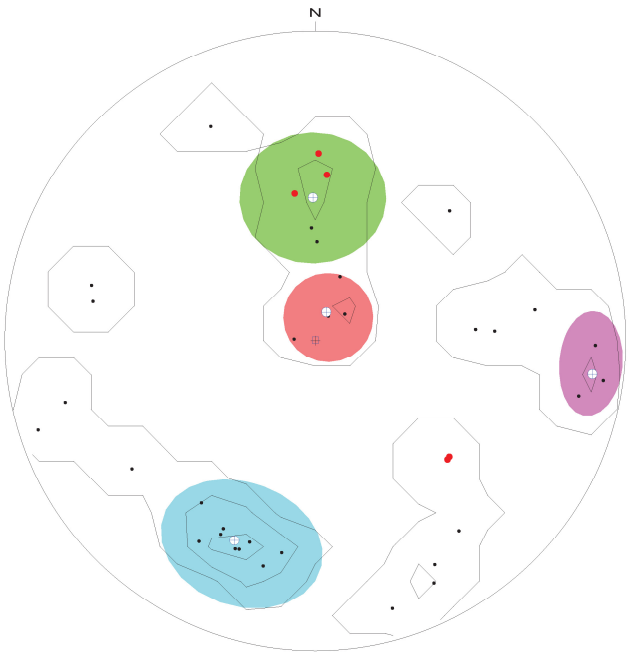
B-10
Zone 0. 23.273 - 85.172ft
Deviation 0.20 N 7.20

dipdata sets.....
OPTV dips
• Highlighted dips: Fracture Planar Open-fracture

	mean dip	n	f
N022 59	N022 59	9	0.29
N201 8	N201 8	4	(0.06)
N179 38	N179 38	5	(0.10)
N277 79	N277 79	3	(0.26)

intersections

	N022 59	N201 8	N179 38	N277 79
N022 59		00 N112	12 N105	55 N351
N201 8	00 N112		04 N264	08 N189
N179 38	12 N105	04 N264		37 N195
N277 79	55 N351	08 N189	37 N195	



mean dip
well axis

equal-area lower-hemisphere 0-90
contour-levels 1,3,6,

B-10, Interpretation 1 85.172 to 23.273ft 1

Figure 7. Boring B-10, Optical Stereonet Plot

Depth (feet)	Dip azimuth	Dip	Structure description
23.8	N311	47.7	Fracture Planar Open-fracture
23.9	N312	47.8	Fracture Planar Open-fracture
25.0	N184	44.6	Fracture Planar Open-fracture
25.1	N181	50.5	Fracture Planar Open-fracture
26.7	N344	79.1	Primary-structure Planar Bedding
29.3	N332	70.9	Primary-structure Planar Bedding
33.9	N181	26.1	Fracture Planar Hairline-fracture
40.8	N009	58.8	Fracture Planar Hairline-fracture
42.7	N076	71.9	Fracture Planar Hairline-fracture
45.9	N026	59.0	Fracture Planar Hairline-fracture
46.3	N018	57.9	Fracture Planar Hairline-fracture
46.5	N026	57.1	Fracture Planar Hairline-fracture
51.9	N271	79.3	Fracture Planar Hairline-fracture
52.1	N020	61.0	Fracture Planar Hairline-fracture
53.1	N100	61.9	Fracture Planar Hairline-fracture
53.7	N104	63.4	Fracture Planar Hairline-fracture
54.0	N055	61.3	Fracture Planar Hairline-fracture
55.6	N208	7.2	Fracture Planar Hairline-fracture
56.6	N201	18.1	Fracture Planar Hairline-fracture
57.4	N013	63.8	Fracture Planar Hairline-fracture
57.6	N030	64.0	Fracture Planar Hairline-fracture
60.6	N154	65.9	Fracture Planar Hairline-fracture
62.8	N021	61.3	Fracture Planar Hairline-fracture
64.3	N226	50.4	Fracture Planar Hairline-fracture
66.5	N178	29.8	Fracture Planar Hairline-fracture
66.7	N172	39.5	Fracture Planar Open-fracture
69.3	N035	53.8	Fracture Planar Hairline-fracture
74.0	N323	65.9	Fracture Planar Hairline-fracture
74.9	N334	76.1	Primary-structure Planar Bedding
75.4	N262	60.7	Fracture Planar Hairline-fracture
77.5	N278	83.0	Fracture Planar Hairline-fracture
80.6	N266	42.9	Fracture Planar Hairline-fracture
80.8	N072	83.2	Fracture Planar Hairline-fracture
82.6	N094	5.6	Primary-structure Planar Bedding
82.8	N228	10.4	Primary-structure Planar Bedding
83.6	N282	75.7	Fracture Planar Hairline-fracture
84.7	N267	48.3	Fracture Planar Hairline-fracture

Table 7. Boring B-10, Optical Televiewer Structure depth, dip azimuth, dip and description

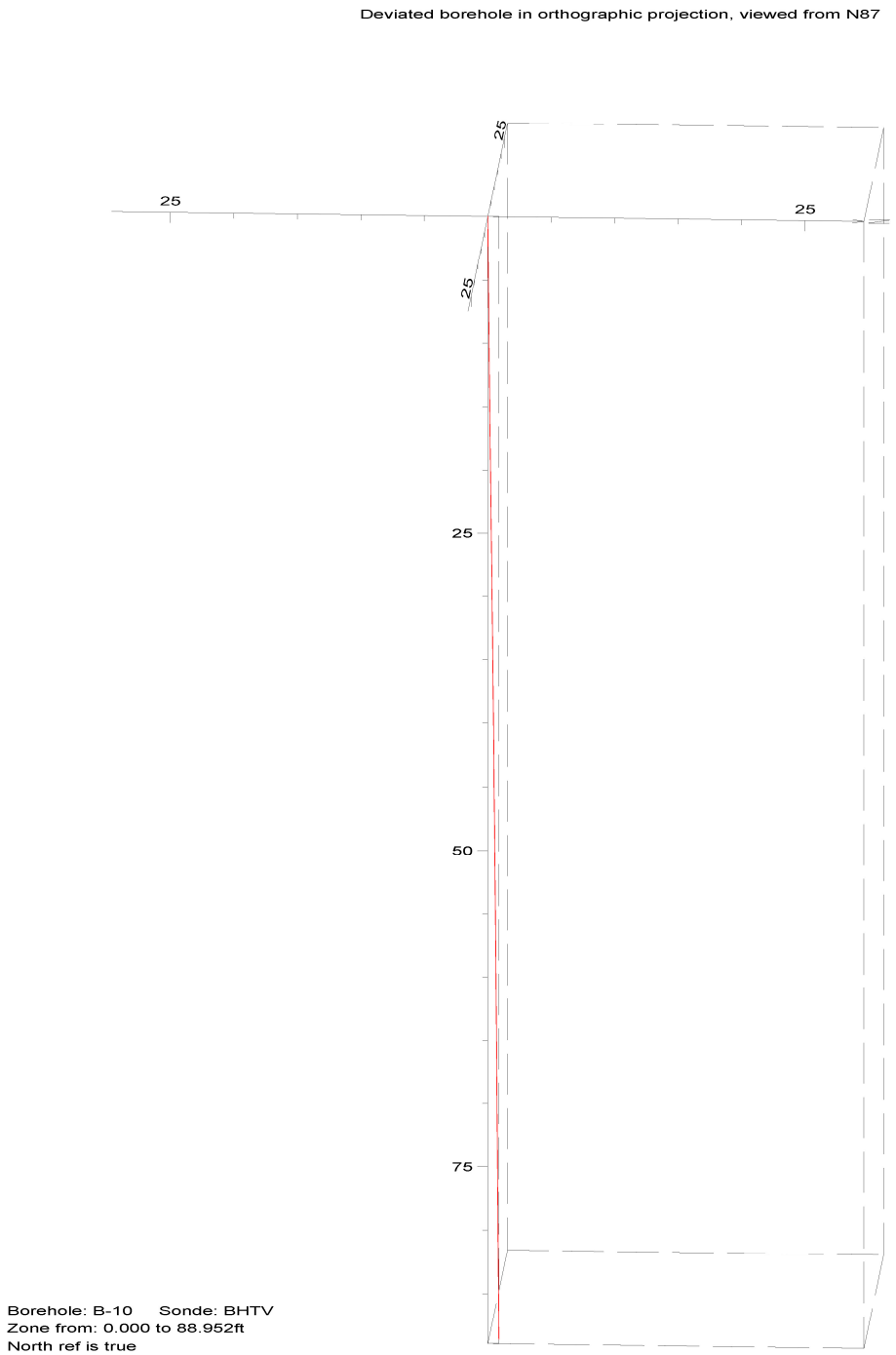


Figure 8. Boring B-10, Deviation Projection (dimensions in feet)

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS STEREOGRAMS

18 Jan 2009

URS

Borehole: B-11

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

North ref: true
Depth units are feet

Zone from 56.436 to 10.040ft
Mean dip format: dip-azimuth and dip

Interpretation 1

Dip data sets .....
BHTV dips

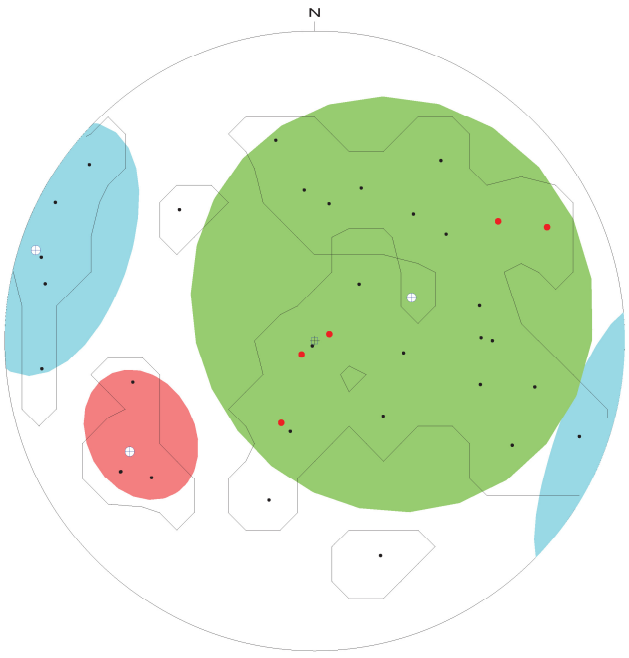
B-11
Zone 0. 10.040 - 56.436ft
Deviation 0.10 N279.50

dipdata sets.....
BHTV dips
• Highlighted dips: Fracture Planar Open-fracture

	mean dip	n	f
N108 84	N108 84	6	1.13
N059 59	N059 59	4	(0.17)
N246 28	N246 28	23	0.56

intersections

	N108 84	N059 59	N246 28
N108 84		55 N026	19 N196
N059 59	55 N026		03 N331
N246 28	19 N196	03 N331	



mean dip
well axis

equal-area lower-hemisphere 0-90
contour-levels 1,

B-11, Interpretation 1 56.436 to 10.040ft 1

Figure 9. Boring B-11, Stereonet Plot

Depth (feet)	Dip azimuth	Dip	Structure description
10.5	N238	66.5	Primary-structure Planar Bedding
10.5	N077	50.4	Fracture Planar Hairline-fracture
11.2	N318	27.0	Fracture Planar Hairline-fracture
11.3	N084	77.5	Fracture Planar Hairline-fracture
11.7	N278	23.6	Fracture Planar Hairline-fracture
11.9	N072	30.2	Primary-structure Planar Bedding
14.5	N016	44.5	Fracture Planar Hairline-fracture
16.6	N134	50.8	Fracture Planar Hairline-fracture
17.9	N056	64.5	Fracture Planar Hairline-fracture
23.7	N056	64.7	Fracture Planar Hairline-fracture
24.6	N050	58.2	Fracture Planar Hairline-fracture
27.2	N128	81.5	Fracture Planar Hairline-fracture
28.5	N218	18.9	Fracture Planar Hairline-fracture
29.8	N118	84.2	Fracture Planar Hairline-fracture
29.9	N181	17.7	Primary-structure Planar Bedding
30.1	N218	42.9	Fracture Planar Hairline-fracture
30.2	N282	61.8	Fracture Planar Hairline-fracture
30.6	N197	42.6	Fracture Planar Hairline-fracture
32.0	N270	47.8	Fracture Planar Hairline-fracture
32.0	N269	44.6	Fracture Planar Hairline-fracture
32.2	N231	45.4	Fracture Planar Hairline-fracture
34.8	N258	45.2	Fracture Planar Hairline-fracture
35.8	N169	55.5	Fracture Planar Hairline-fracture
37.3	N102	77.9	Fracture Planar Hairline-fracture
38.8	N022	23.5	Fracture Planar Open-fracture
39.0	N015	24.9	Fracture Planar Hairline-fracture
42.2	N215	60.3	Fracture Planar Hairline-fracture
42.3	N186	36.5	Fracture Planar Hairline-fracture
42.4	N025	1.5	Fracture Planar Hairline-fracture
42.5	N298	61.4	Fracture Planar Hairline-fracture
45.1	N285	46.1	Fracture Planar Hairline-fracture
47.4	N246	4.2	Fracture Planar Open-fracture
47.9	N244	72.3	Fracture Planar Open-fracture
48.2	N237	59.9	Fracture Planar Open-fracture
49.5	N043	5.0	Fracture Planar Open-fracture
51.1	N343	61.9	Fracture Planar Hairline-fracture
53.0	N176	40.2	Fracture Planar Hairline-fracture
56.1	N290	80.0	Fracture Planar Hairline-fracture
56.2	N107	81.4	Fracture Planar Hairline-fracture

Table 8. Boring B-11, Acoustic Televiewer Structure depth, dip azimuth, dip and description

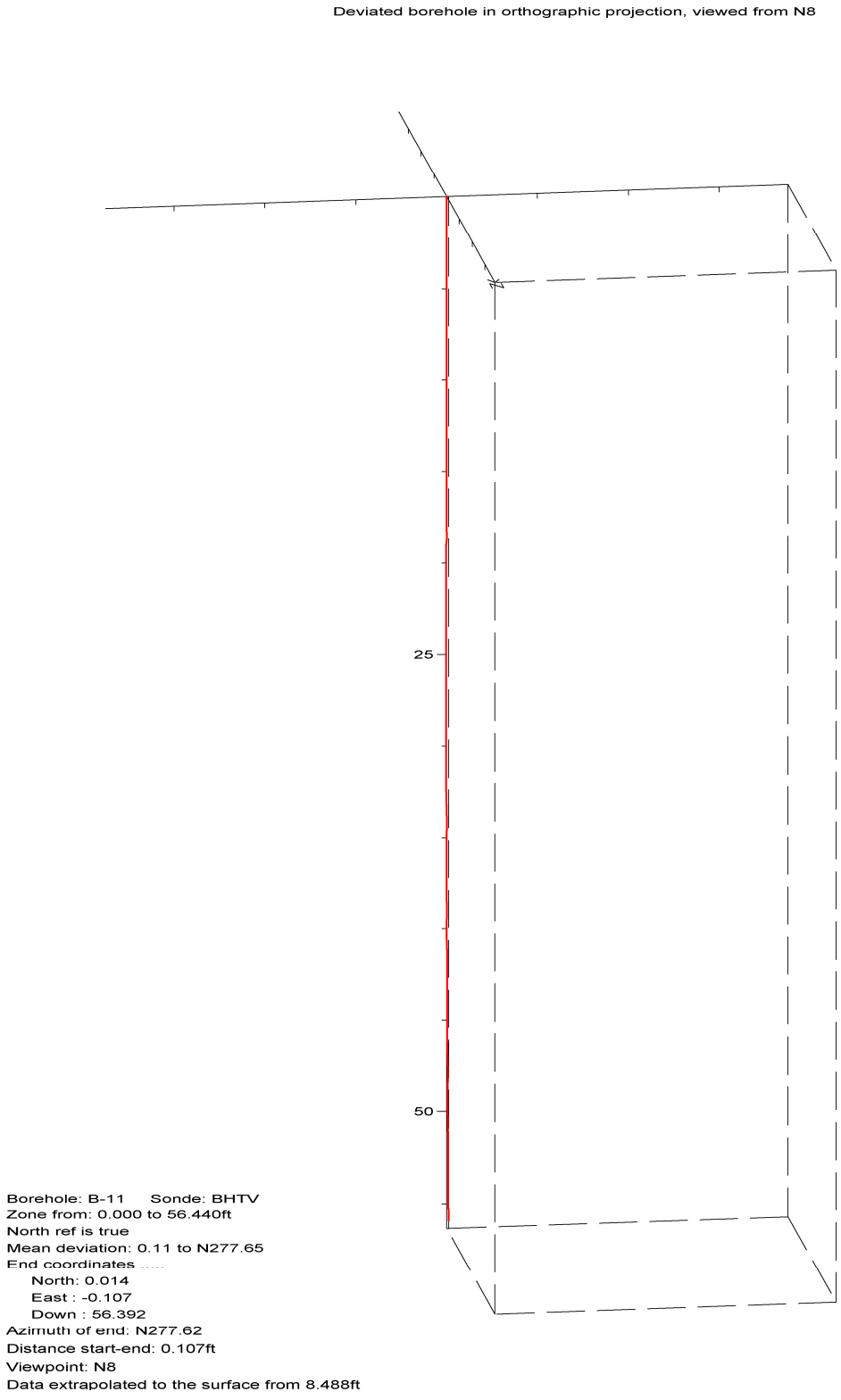


Figure 10. Boring B-11, Deviation Projection (dimensions in feet)

APPENDIX A

PROCESSED TELEVIEWER LOGS WITH FRACTURE AND BEDDING DEPTHS, DIPS, AND DIP AZIMUTHS

BHTV DATA PROCESSING
RGLDIP vsn 6.2
INTERPRETED BHTV DIPS LOG

URS

Borehole: B-08

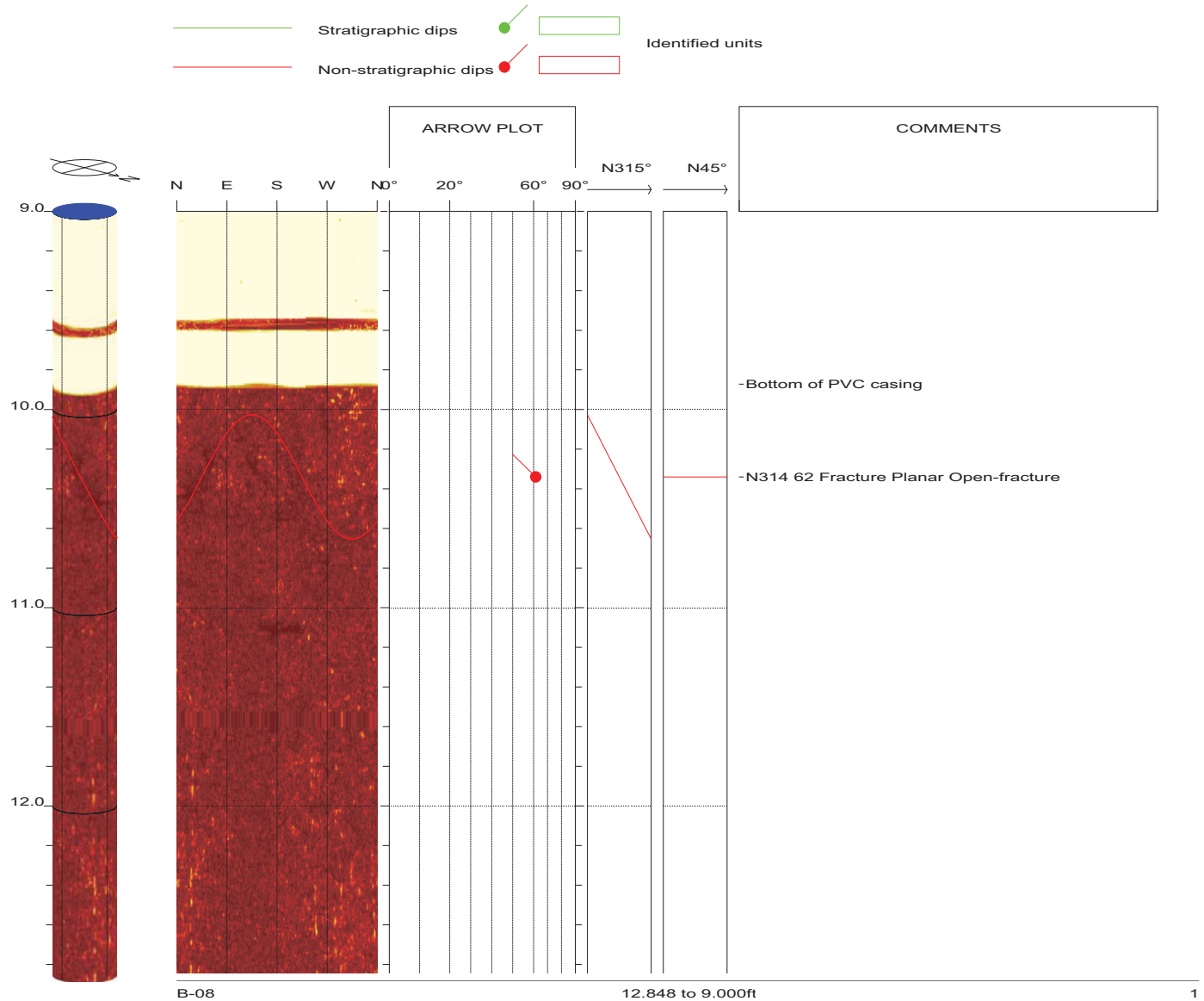
MRDA SUBSTATION

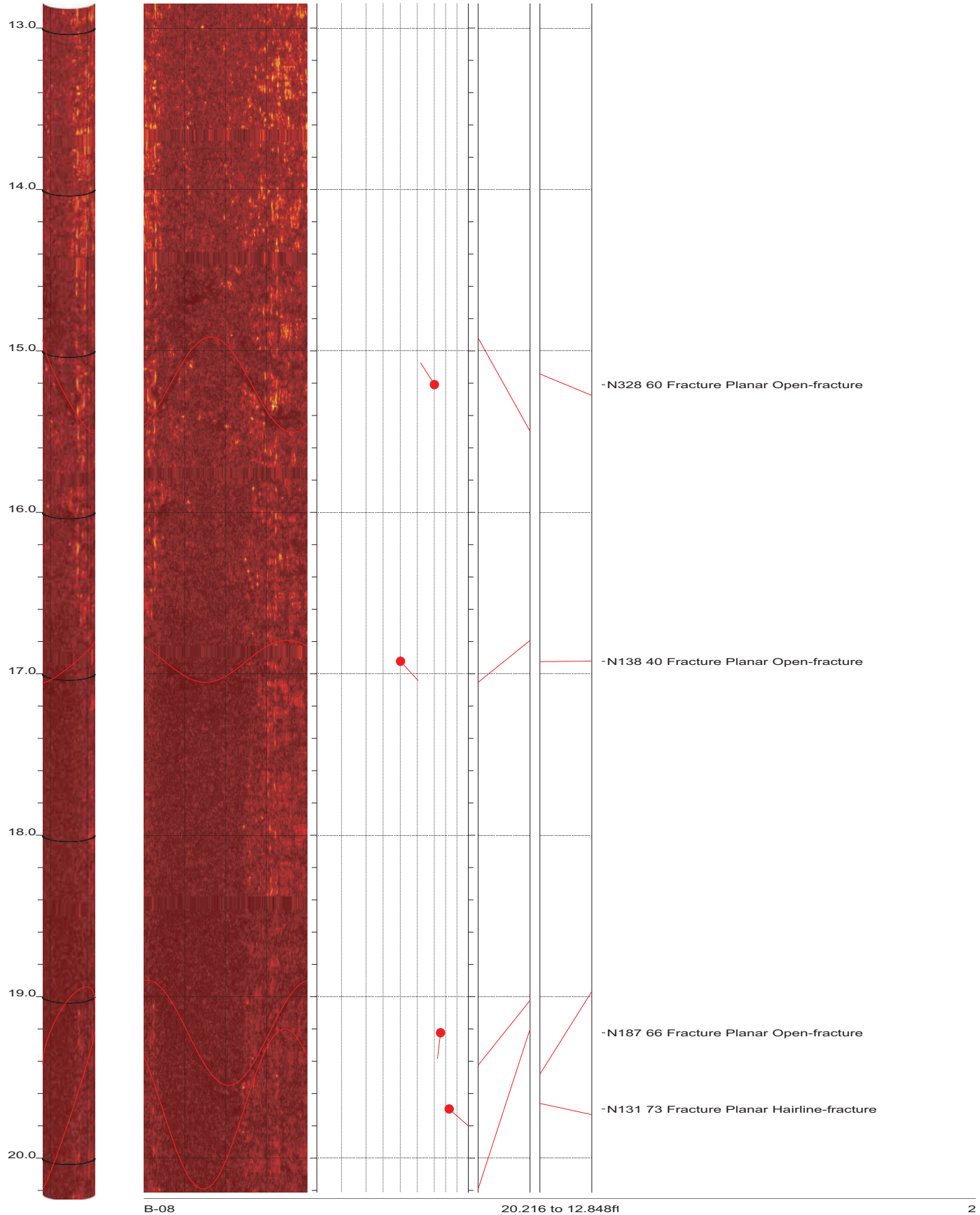
top of borehole.....
East: _
North: _
Elev: _

North ref. is true
Depth units are feet
Vertical scale: 1/10
Horiz scale = 1.00x Vert scale

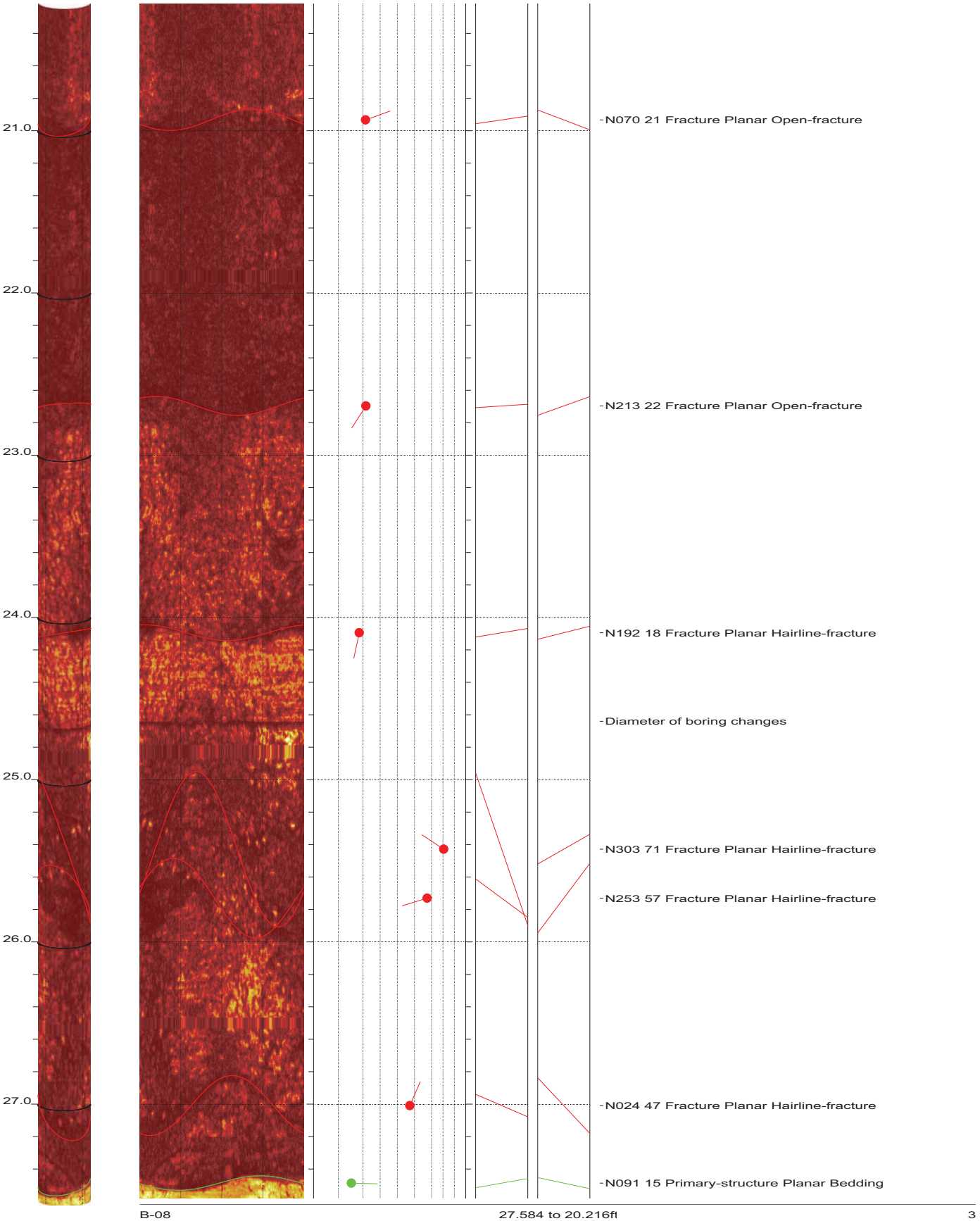
Zone from 102.592 to 9.000ft
Format: BHTV-NESWN

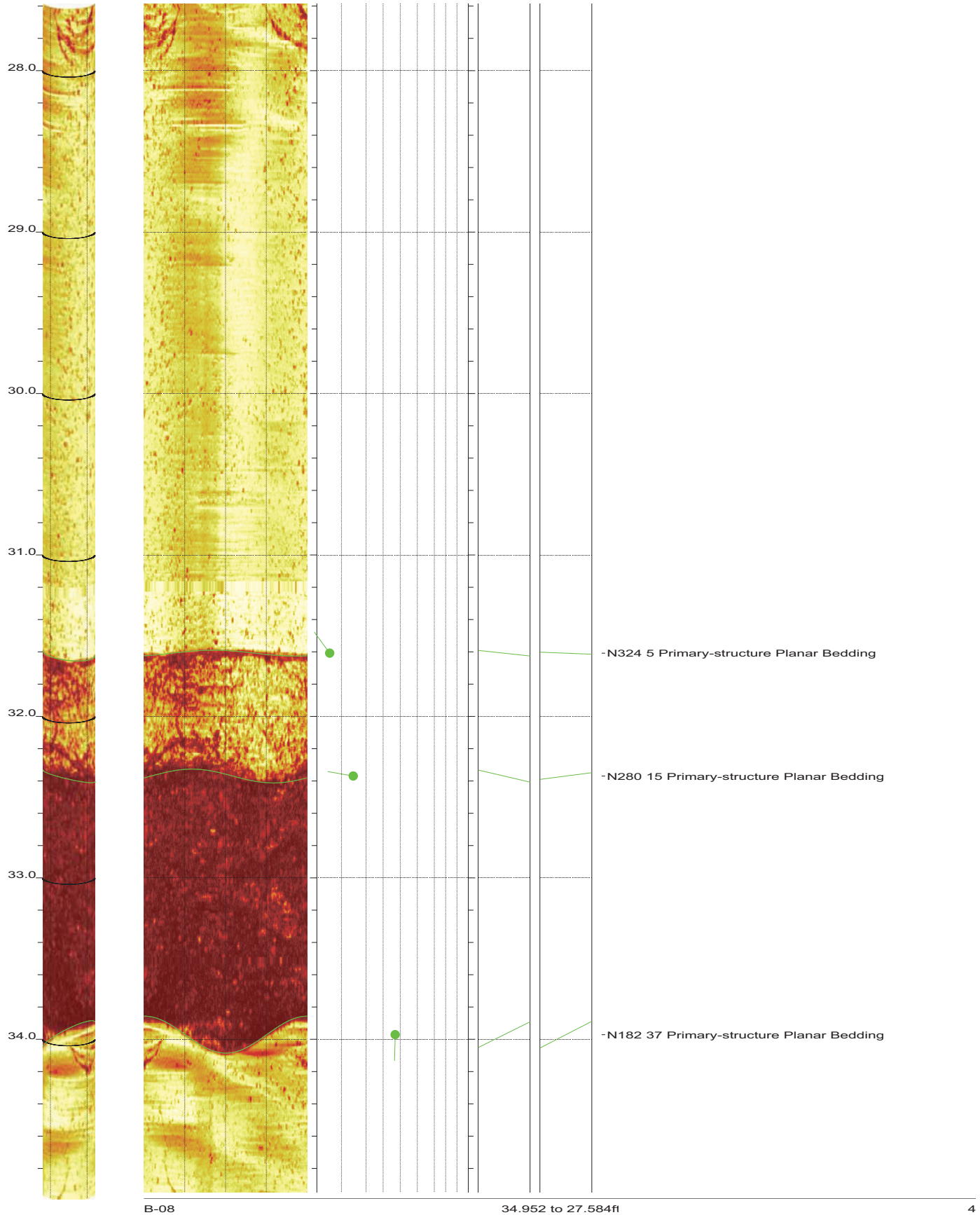
Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude



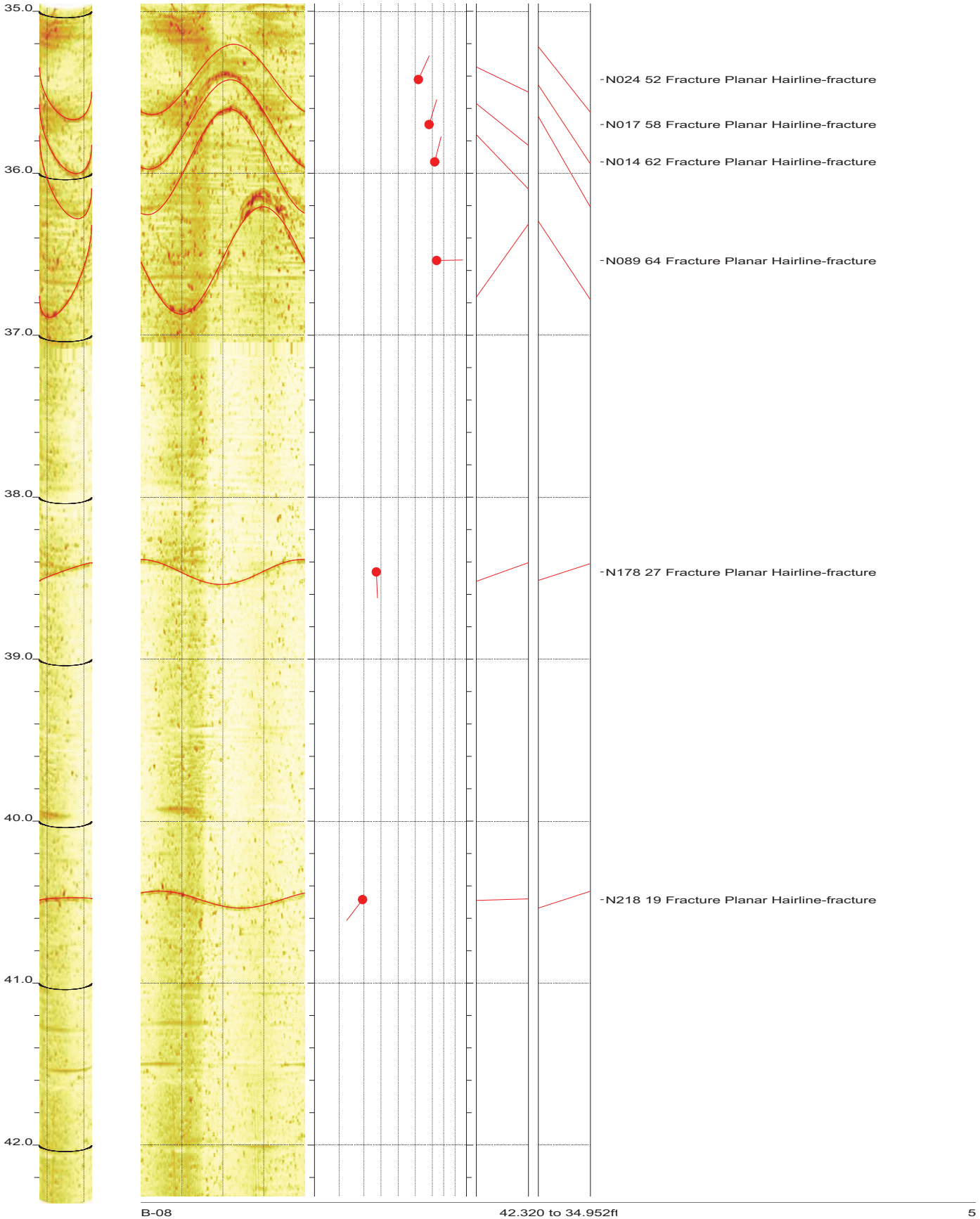


MRDA Substation Boring B-08 Acoustic Televiewer Dips rev 1 Sheet 2 of 14

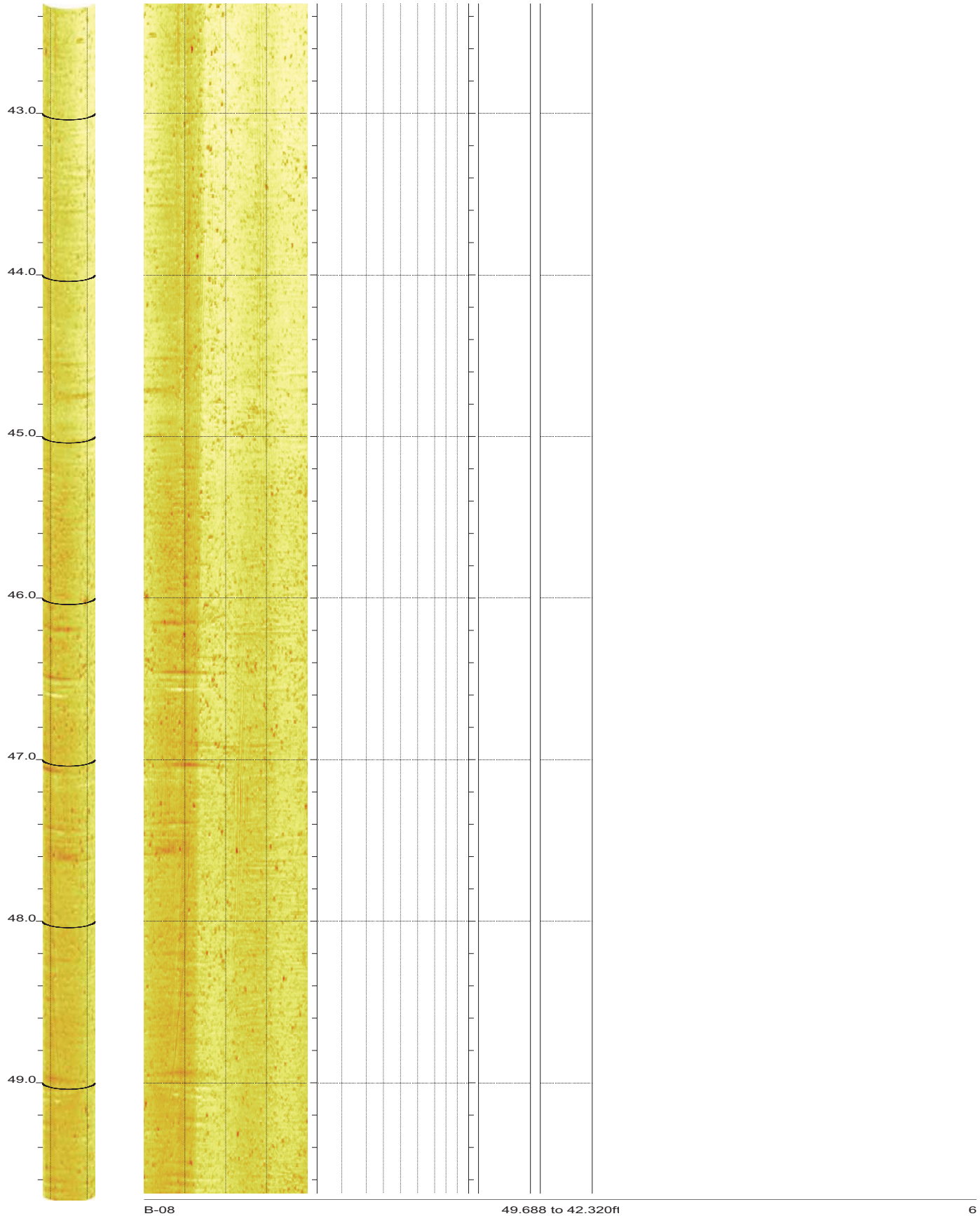

21.0
22.0
23.0
24.0
25.0
26.0
27.0
N070 21 Fracture Planar Open-fracture
N213 22 Fracture Planar Open-fracture
N192 18 Fracture Planar Hairline-fracture
Diameter of boring changes
N303 71 Fracture Planar Hairline-fracture
N253 57 Fracture Planar Hairline-fracture
N024 47 Fracture Planar Hairline-fracture
N091 15 Primary-structure Planar Bedding
B-08
27.584 to 20.216fl
3

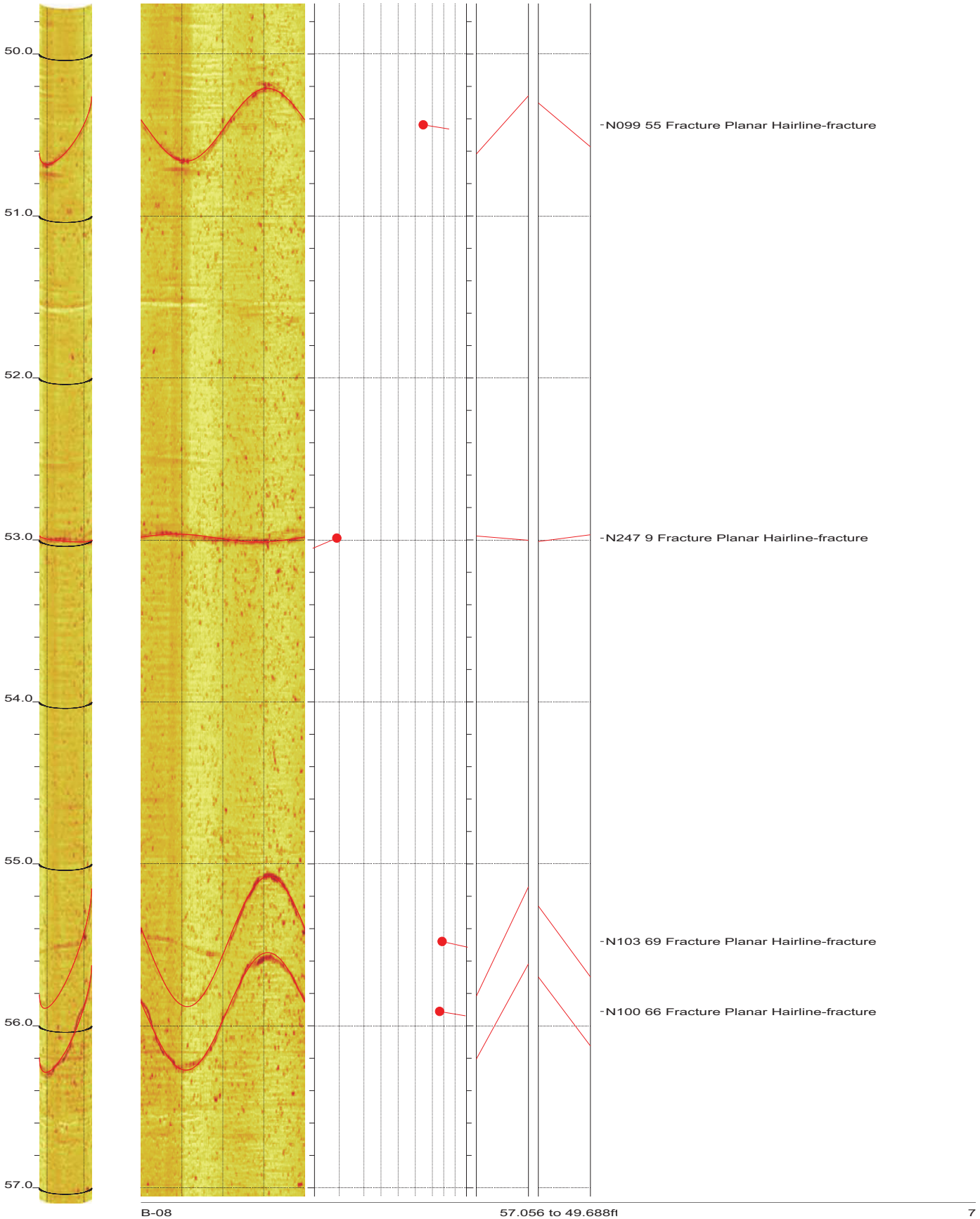


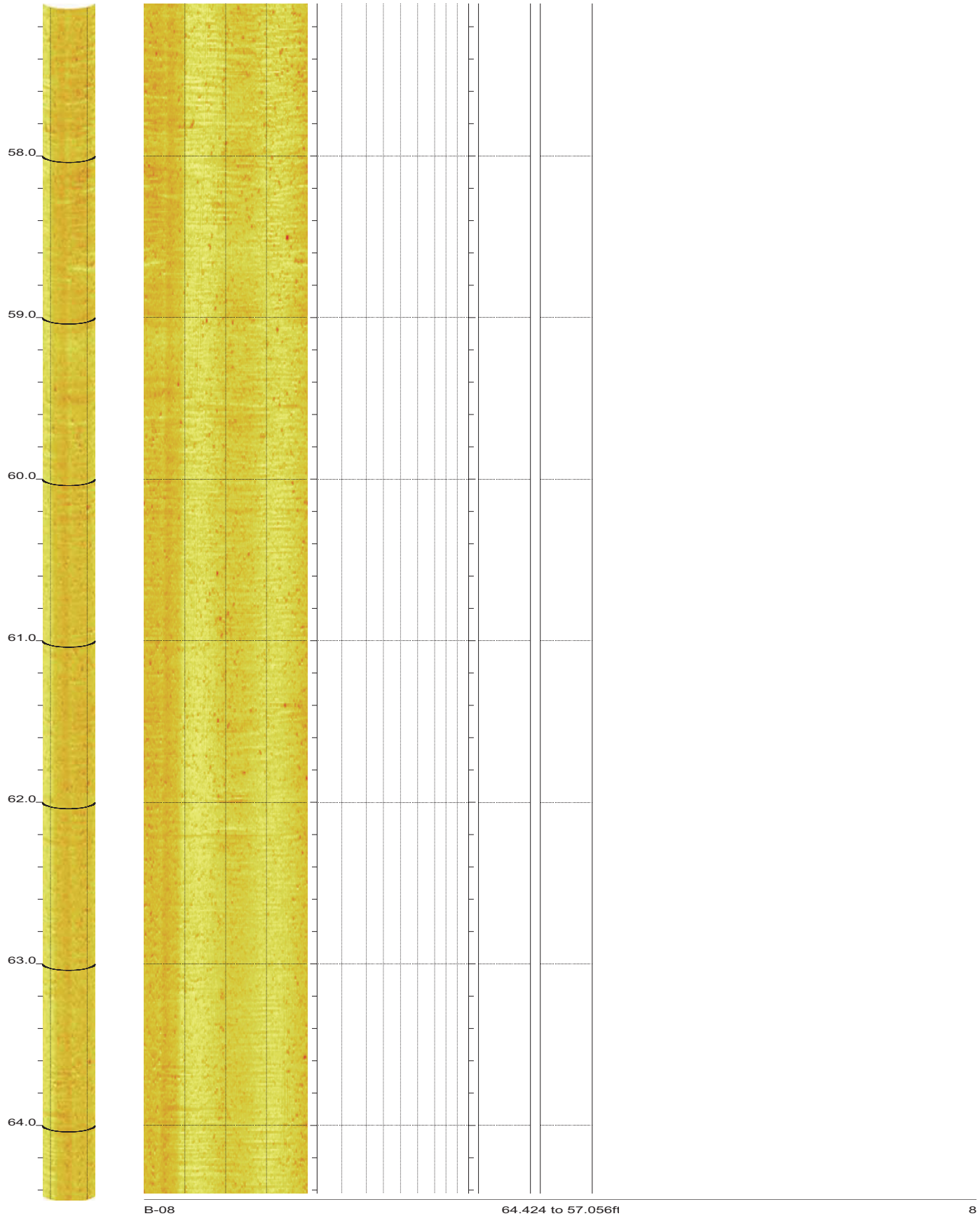
MRDA Substation Boring B-08 Acoustic Televiewer Dips rev 1 Sheet 4 of 14

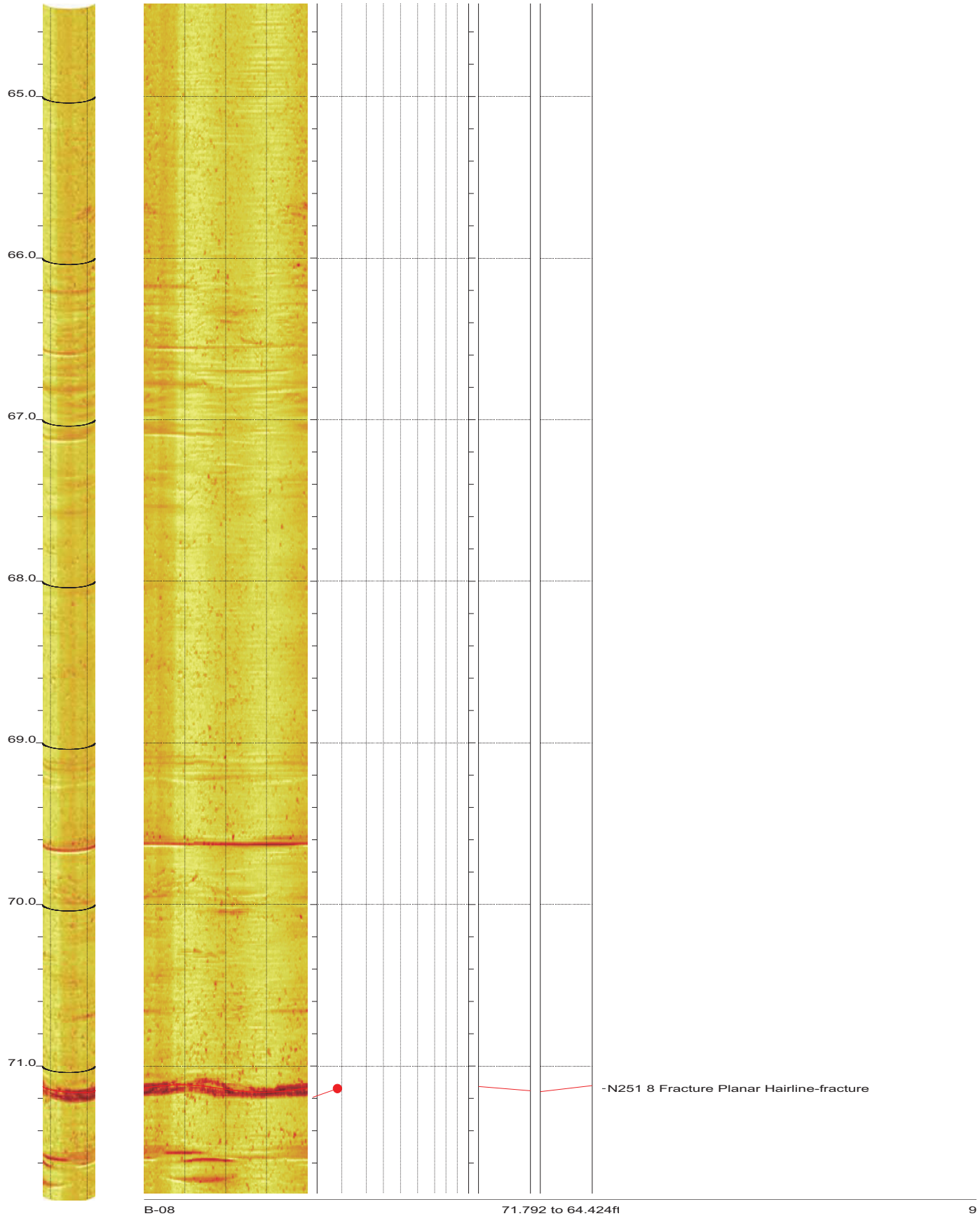


MRDA Substation Boring B-08 Acoustic Televiewer Dips rev 1 Sheet 5 of 14

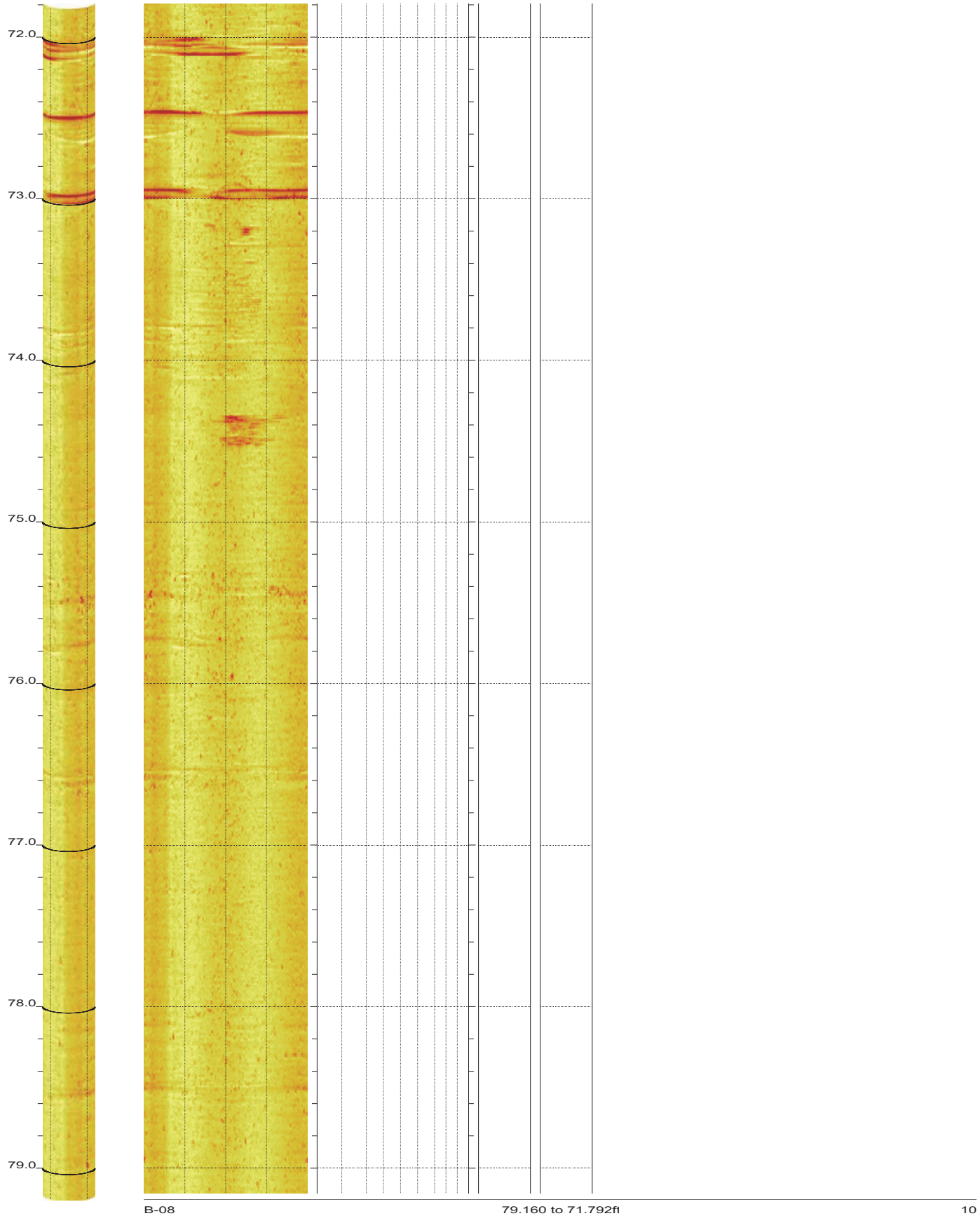

43.0
44.0
45.0
46.0
47.0
48.0
49.0
B-08
49.688 to 42.320ft
6

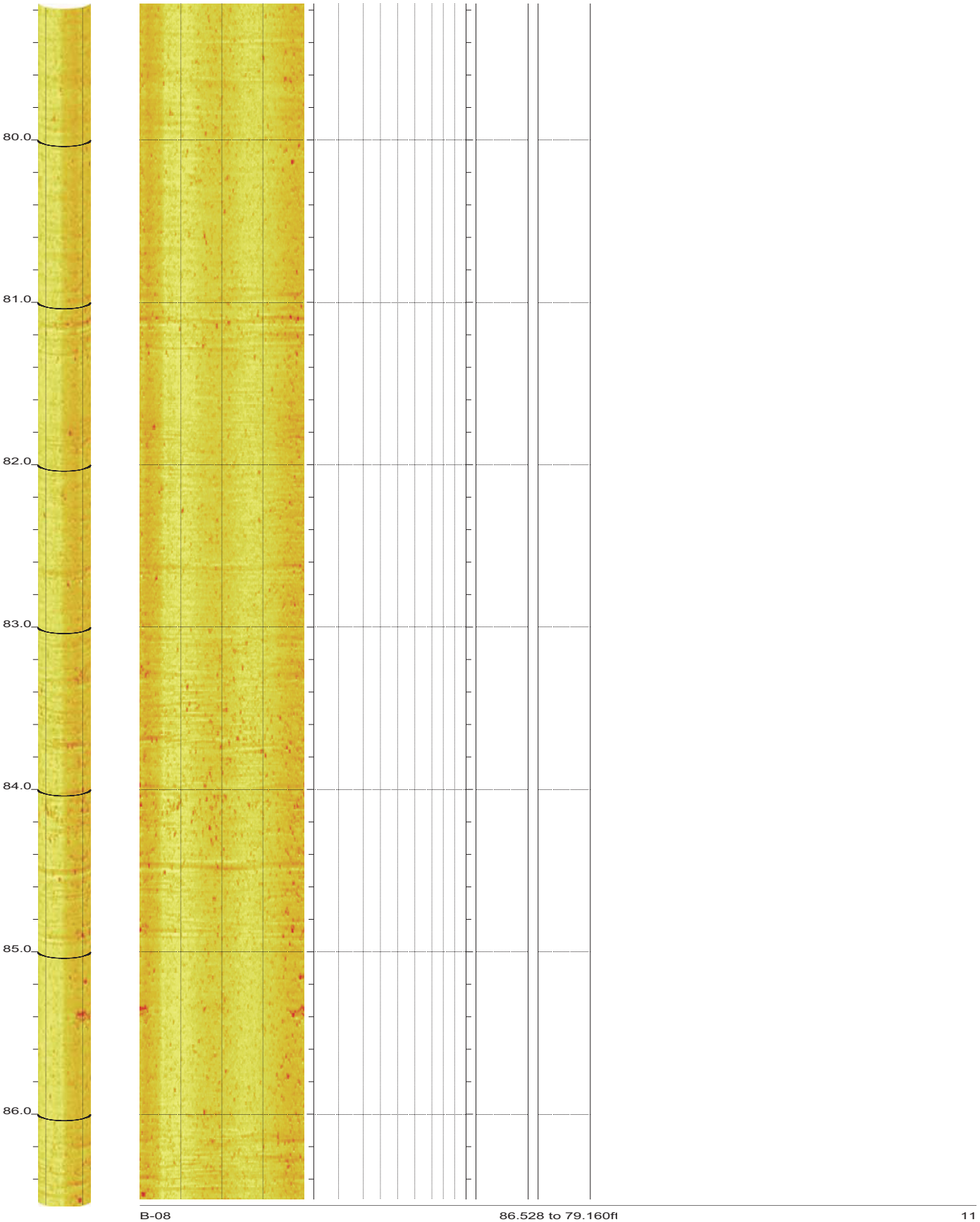

50.0
51.0
52.0
53.0
54.0
55.0
56.0
57.0
N099 55 Fracture Planar Hairline-fracture
N247 9 Fracture Planar Hairline-fracture
N103 69 Fracture Planar Hairline-fracture
N100 66 Fracture Planar Hairline-fracture
B-08
57.056 to 49.688ft
7

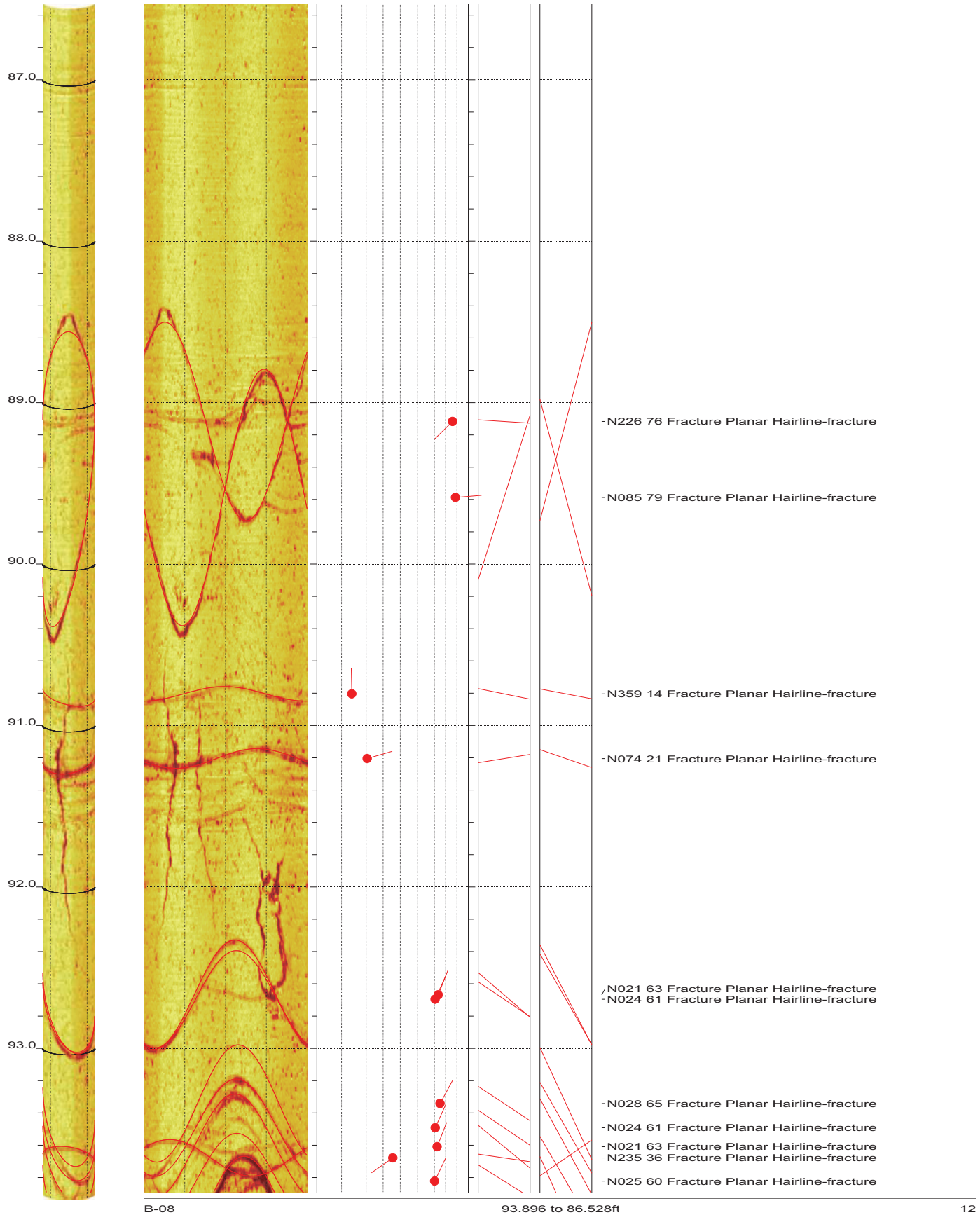

58.0
59.0
60.0
61.0
62.0
63.0
64.0
B-08
64.424 to 57.056fl
8



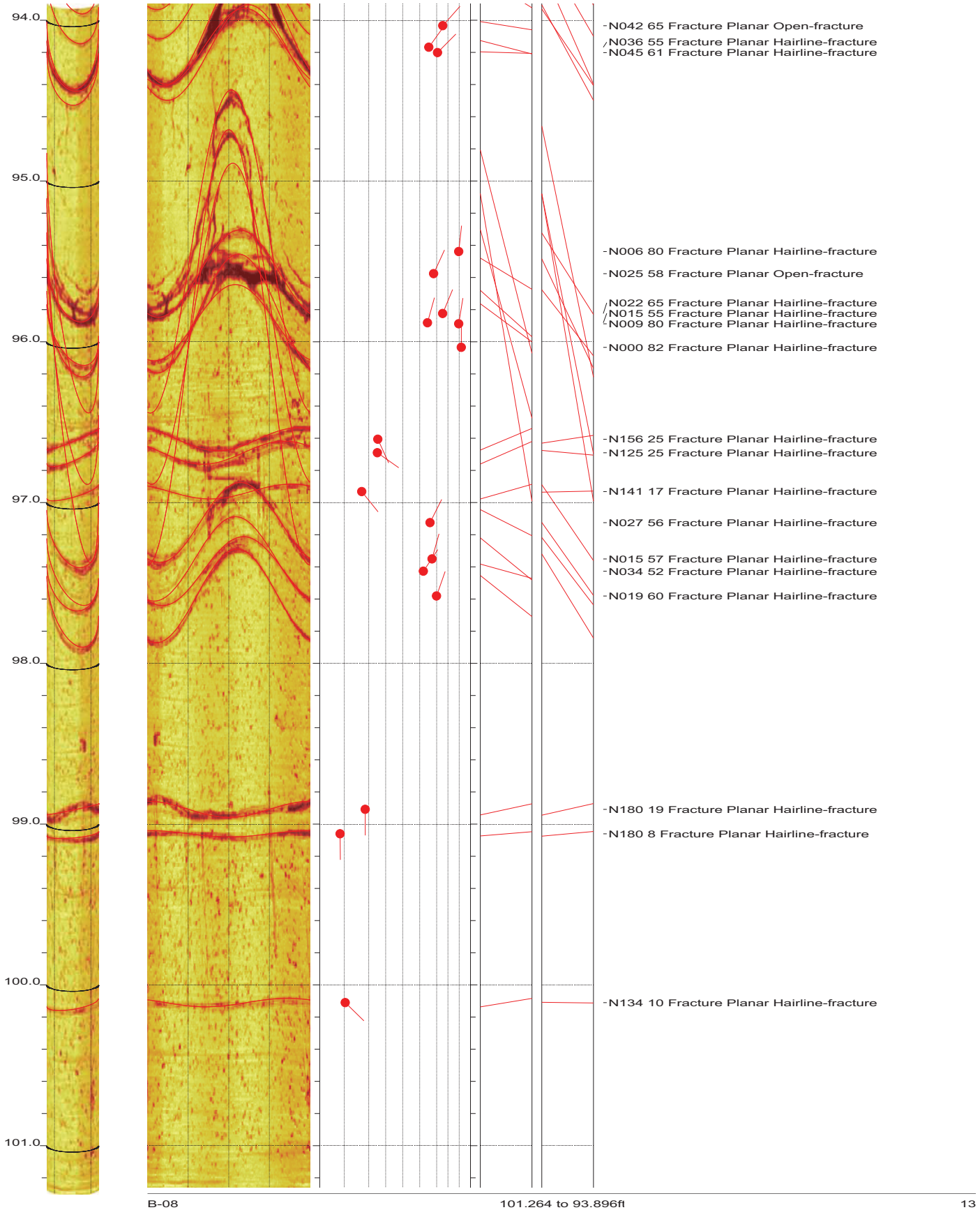
MRDA Substation Boring B-08 Acoustic Televiewer Dips rev 1 Sheet 9 of 14

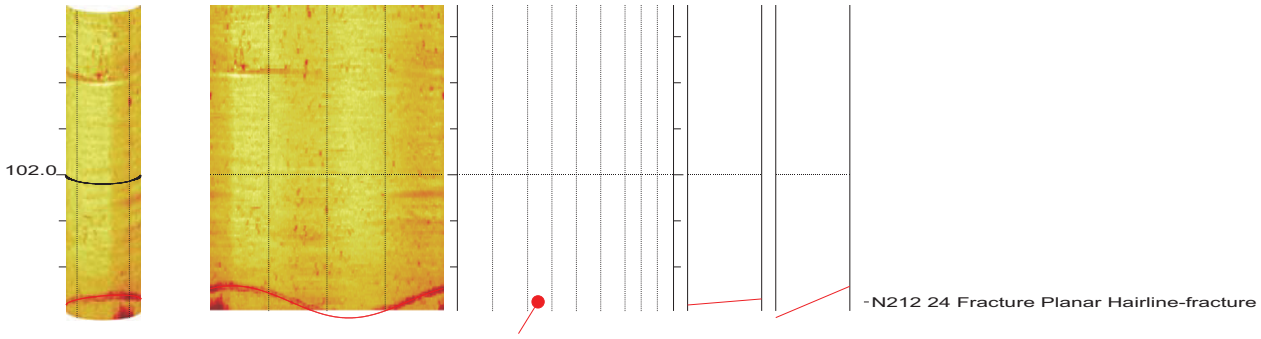

72.0
73.0
74.0
75.0
76.0
77.0
78.0
79.0
B-08
79.160 to 71.792fl
10


80.0
81.0
82.0
83.0
84.0
85.0
86.0
B-08
86.528 to 79.160ft
11



MRDA Substation Boring B-08 Acoustic Televiewer Dips rev 1 Sheet 12 of 14


94.0
95.0
96.0
97.0
98.0
99.0
100.0
101.0
N042 65 Fracture Planar Open-fracture
N036 55 Fracture Planar Hairline-fracture
N045 61 Fracture Planar Hairline-fracture
N006 80 Fracture Planar Hairline-fracture
N025 58 Fracture Planar Open-fracture
N022 65 Fracture Planar Hairline-fracture
N015 55 Fracture Planar Hairline-fracture
N009 80 Fracture Planar Hairline-fracture
N000 82 Fracture Planar Hairline-fracture
N156 25 Fracture Planar Hairline-fracture
N125 25 Fracture Planar Hairline-fracture
N141 17 Fracture Planar Hairline-fracture
N027 56 Fracture Planar Hairline-fracture
N015 57 Fracture Planar Hairline-fracture
N034 52 Fracture Planar Hairline-fracture
N019 60 Fracture Planar Hairline-fracture
N180 19 Fracture Planar Hairline-fracture
N180 8 Fracture Planar Hairline-fracture
N134 10 Fracture Planar Hairline-fracture
B-08
101.264 to 93.896ft
13


102.0
N212 24 Fracture Planar Hairline-fracture

BHTV DATA PROCESSING
RGLDIP vsn 6.2
INTERPRETED BHTV DIPS LOG

URS

Borehole: B-09

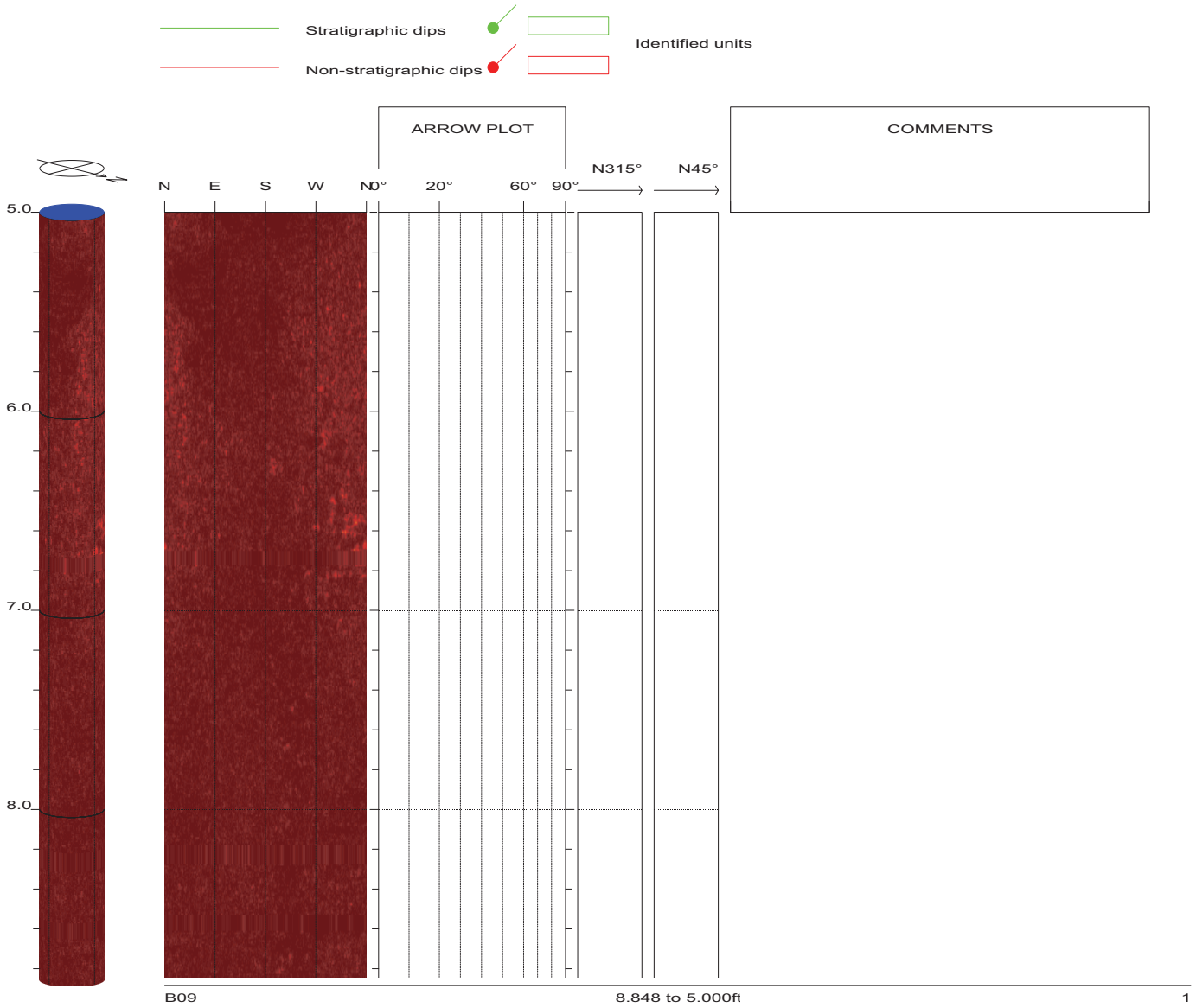
_

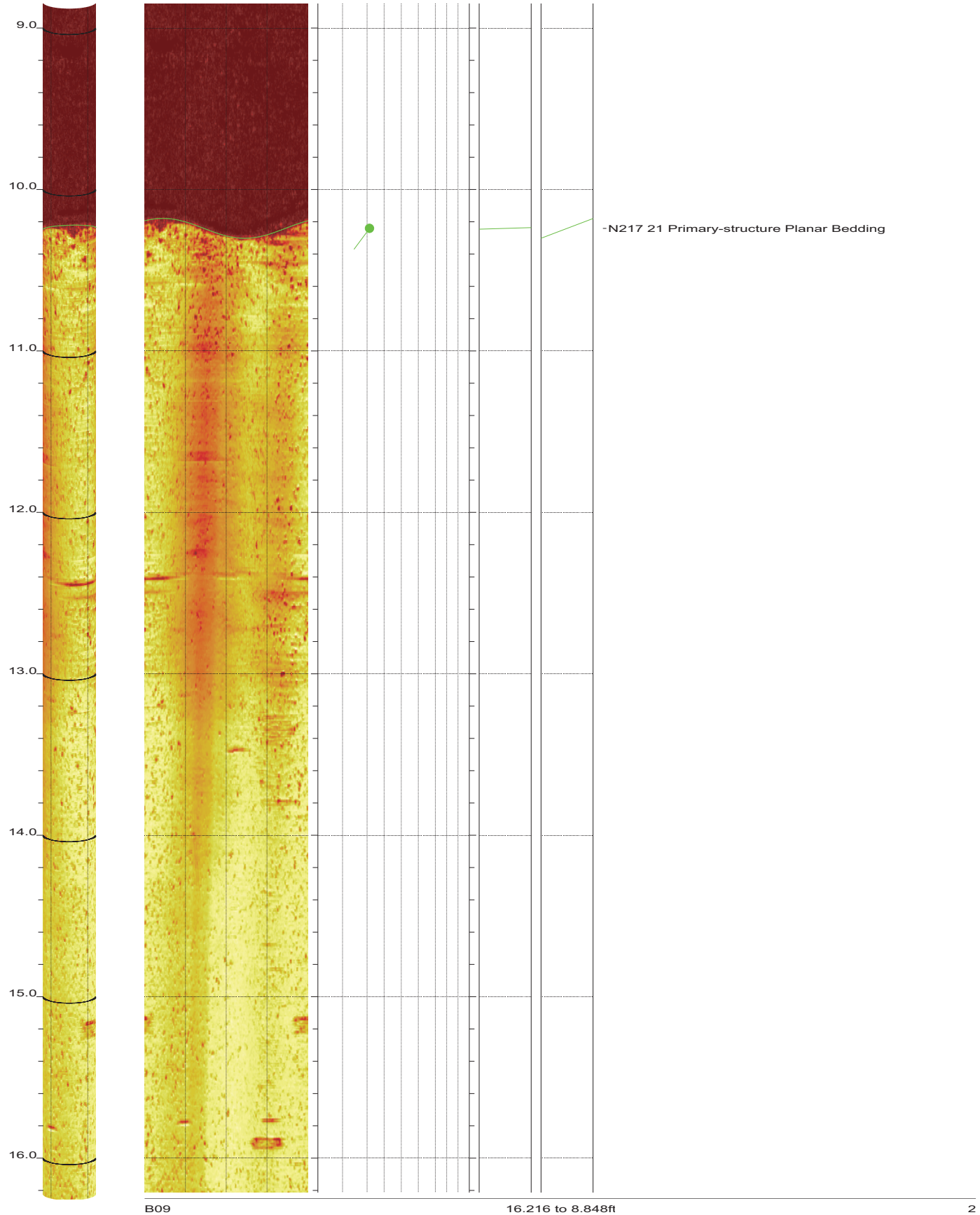
top of borehole.....
East: _
North: _
Elev: _

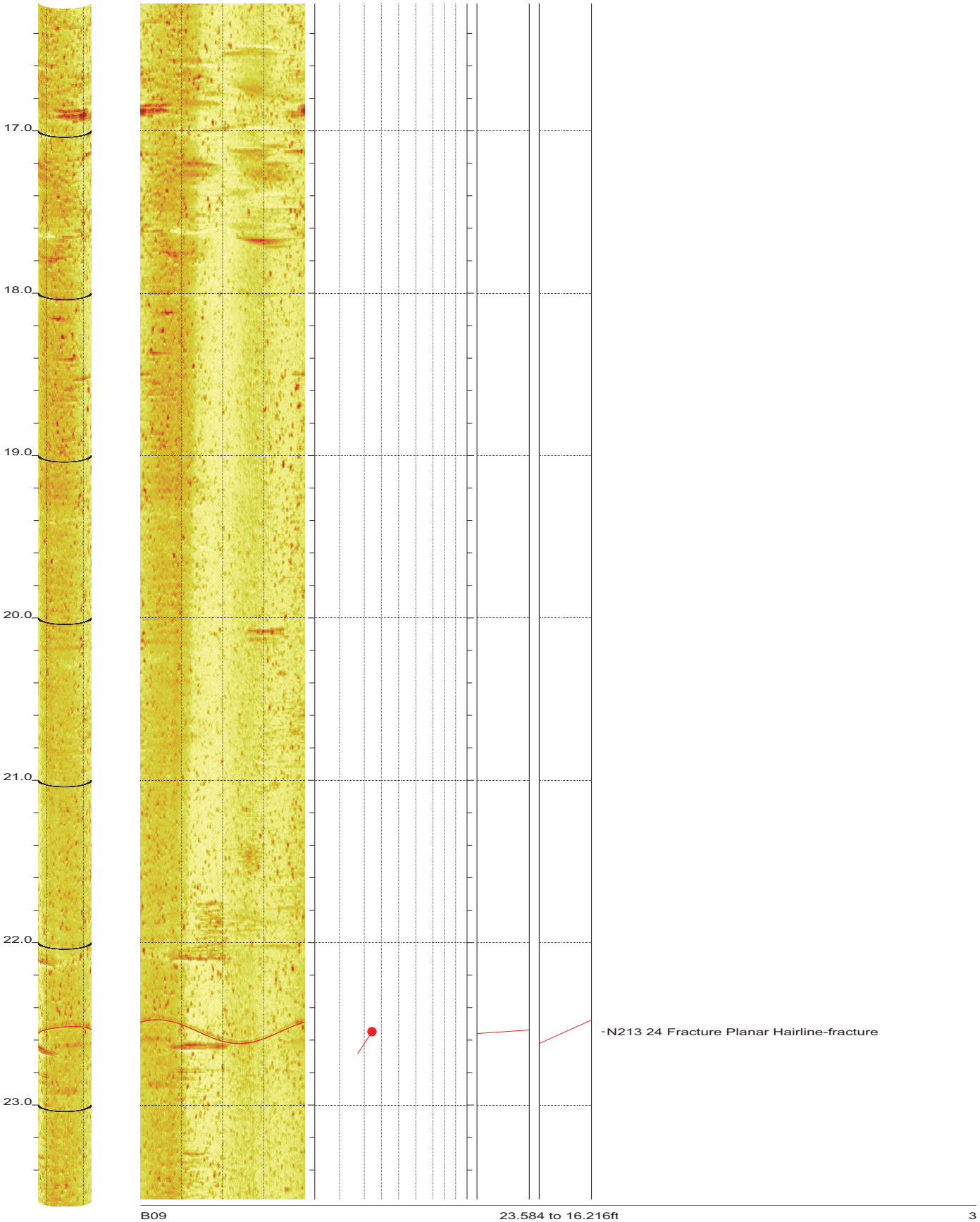
North ref. is true
Depth units are feet
Vertical scale: 1/10
Horiz scale = 1.00x Vert scale

Zone from 119.400 to 5.000ft
Format: BHTV-NESWN

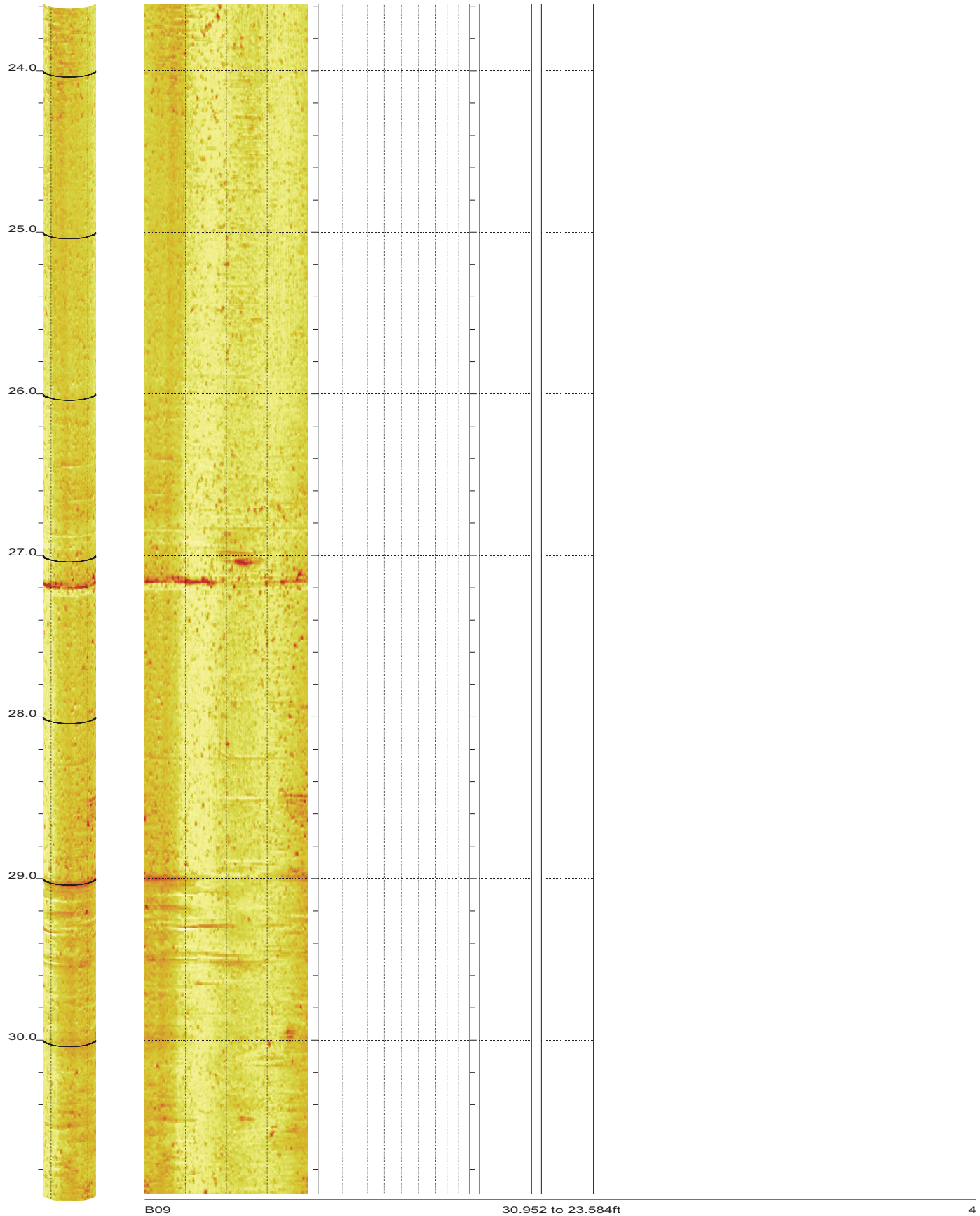
Borehole diam: 3.864inch
Vertical = borehole-axis
Image: Amplitude

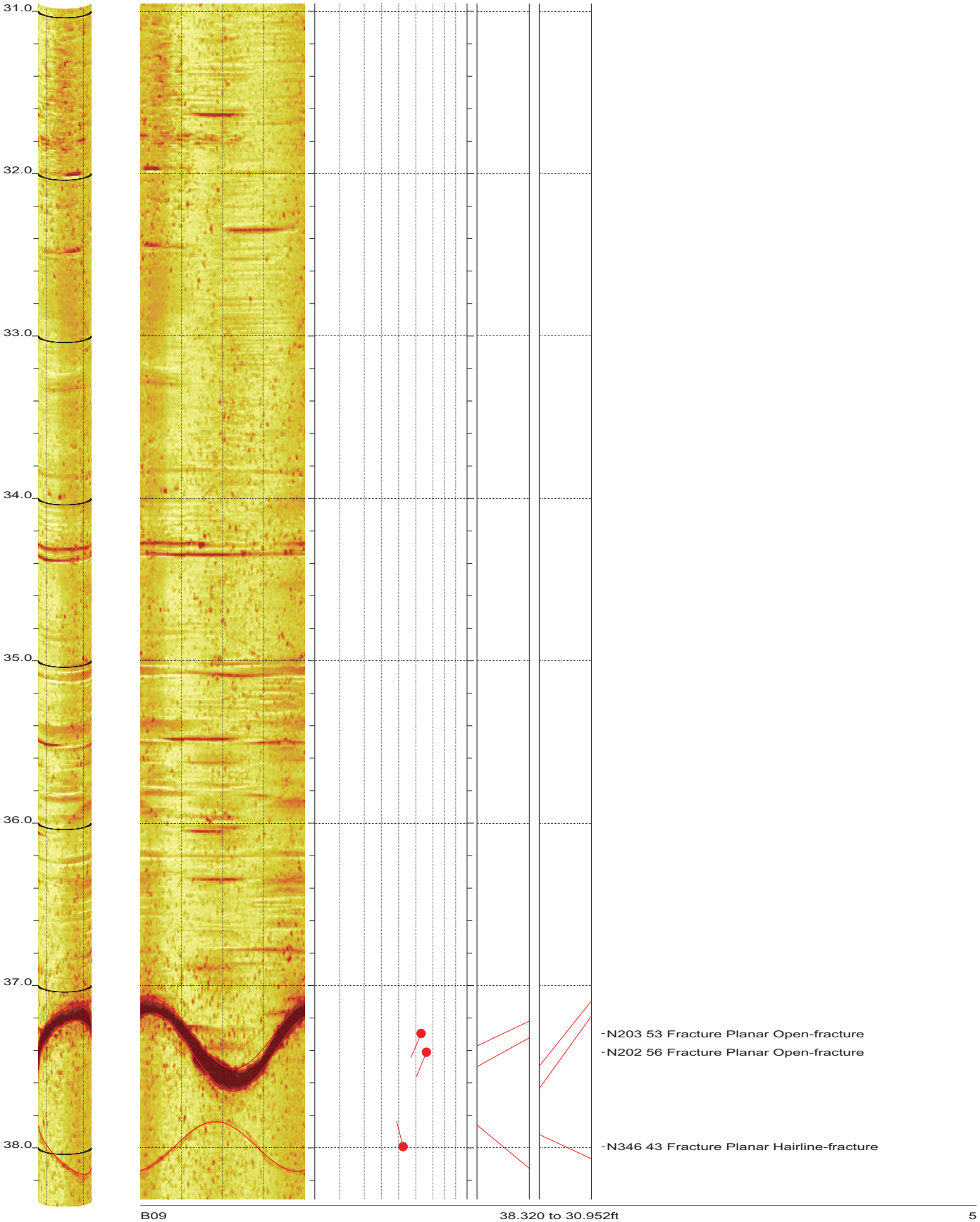



9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
N217 21 Primary-structure Planar Bedding
B09
16.216 to 8.848ft
2

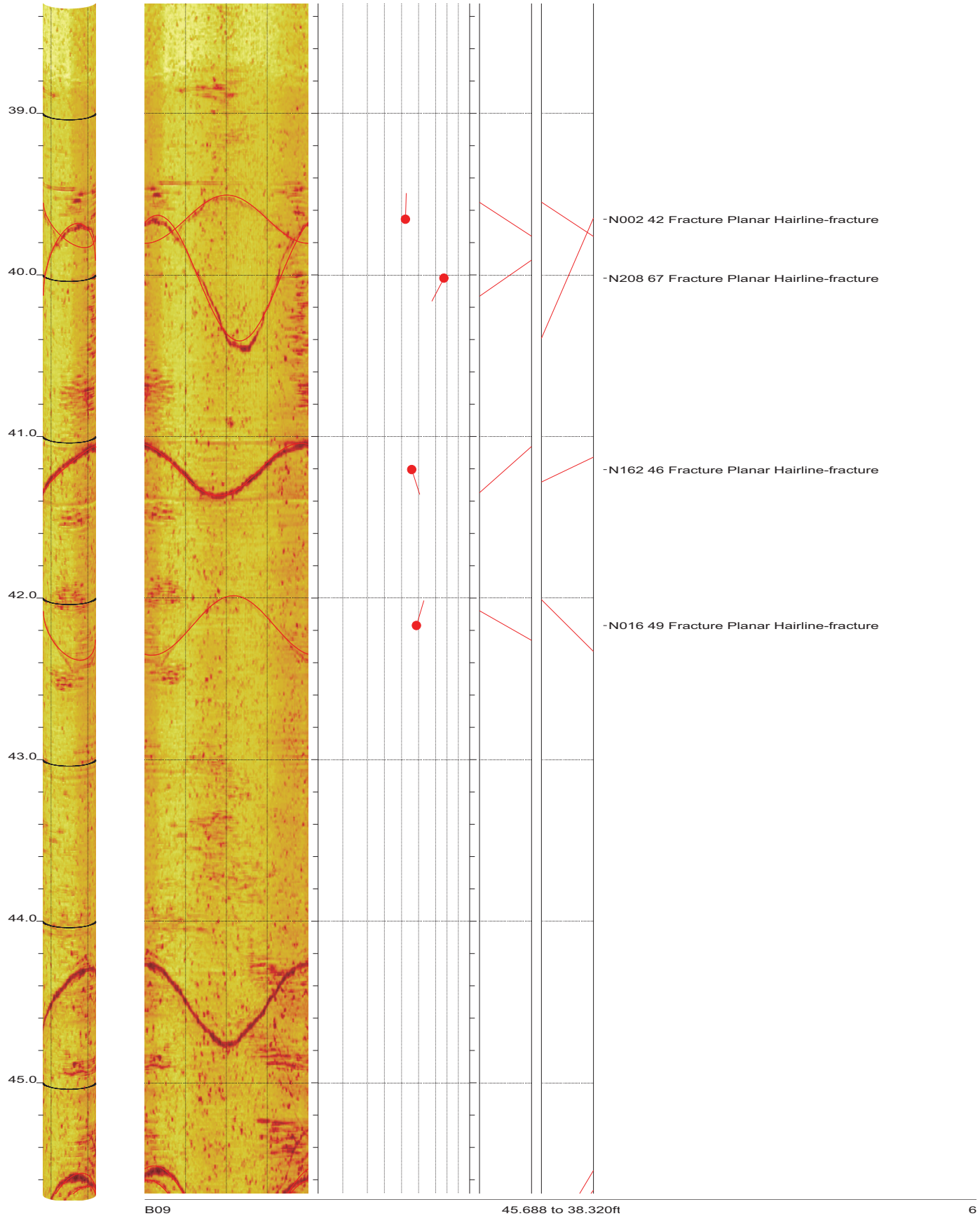


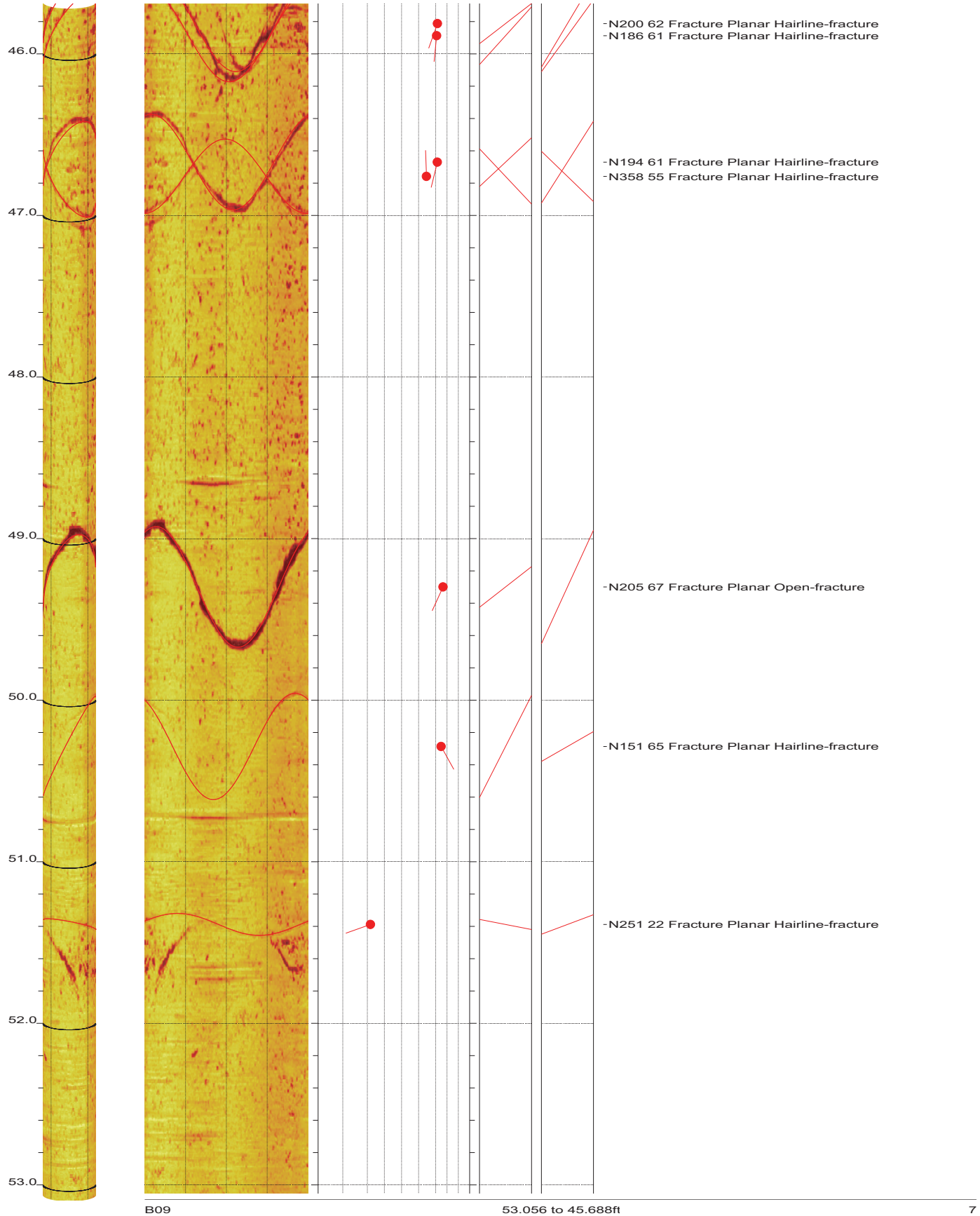
MRDA Substation Boring B-09 Acoustic Televiewer Dips rev 1 Sheet 3 of 17

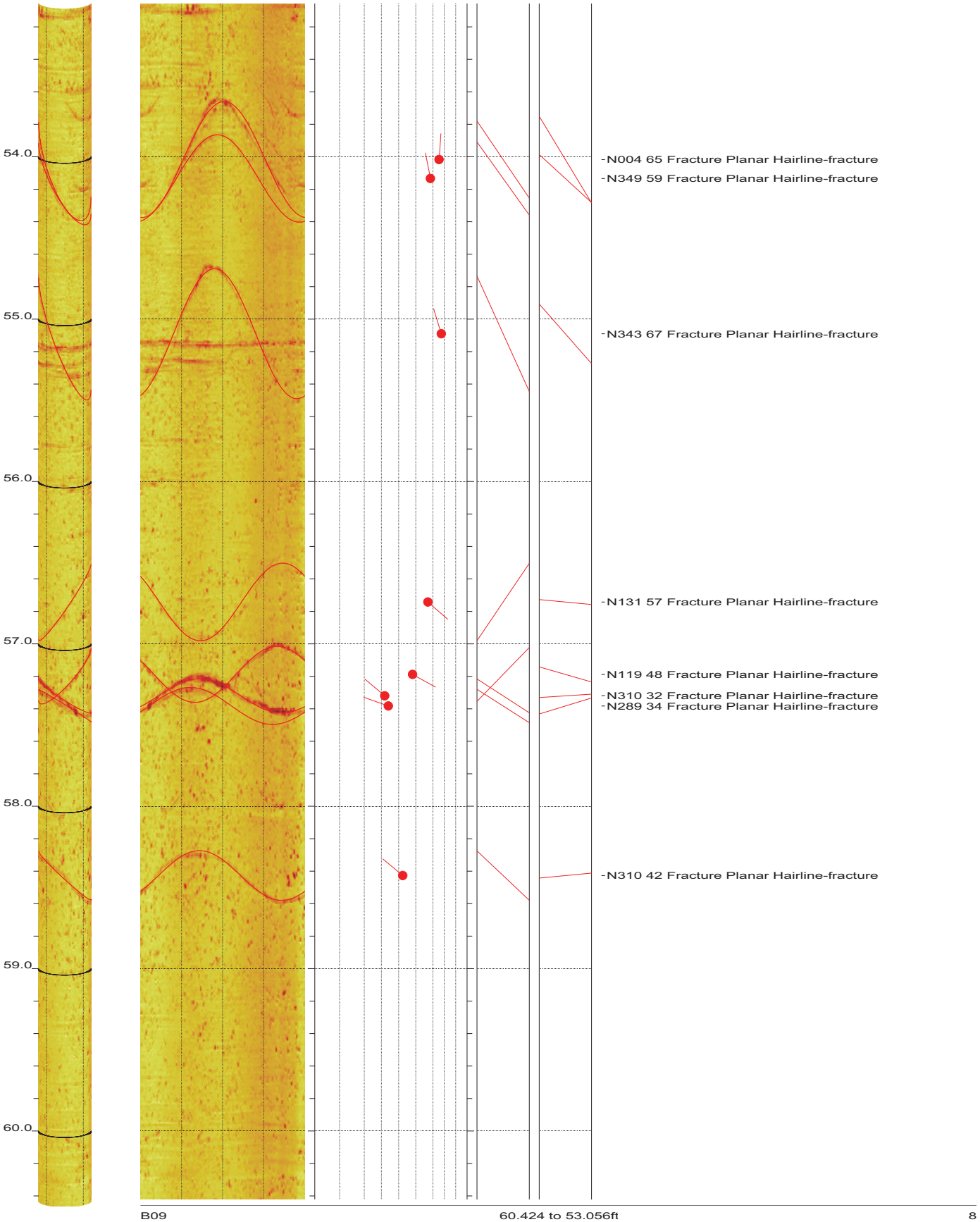

24.0
25.0
26.0
27.0
28.0
29.0
30.0
B09
30.952 to 23.584ft
4



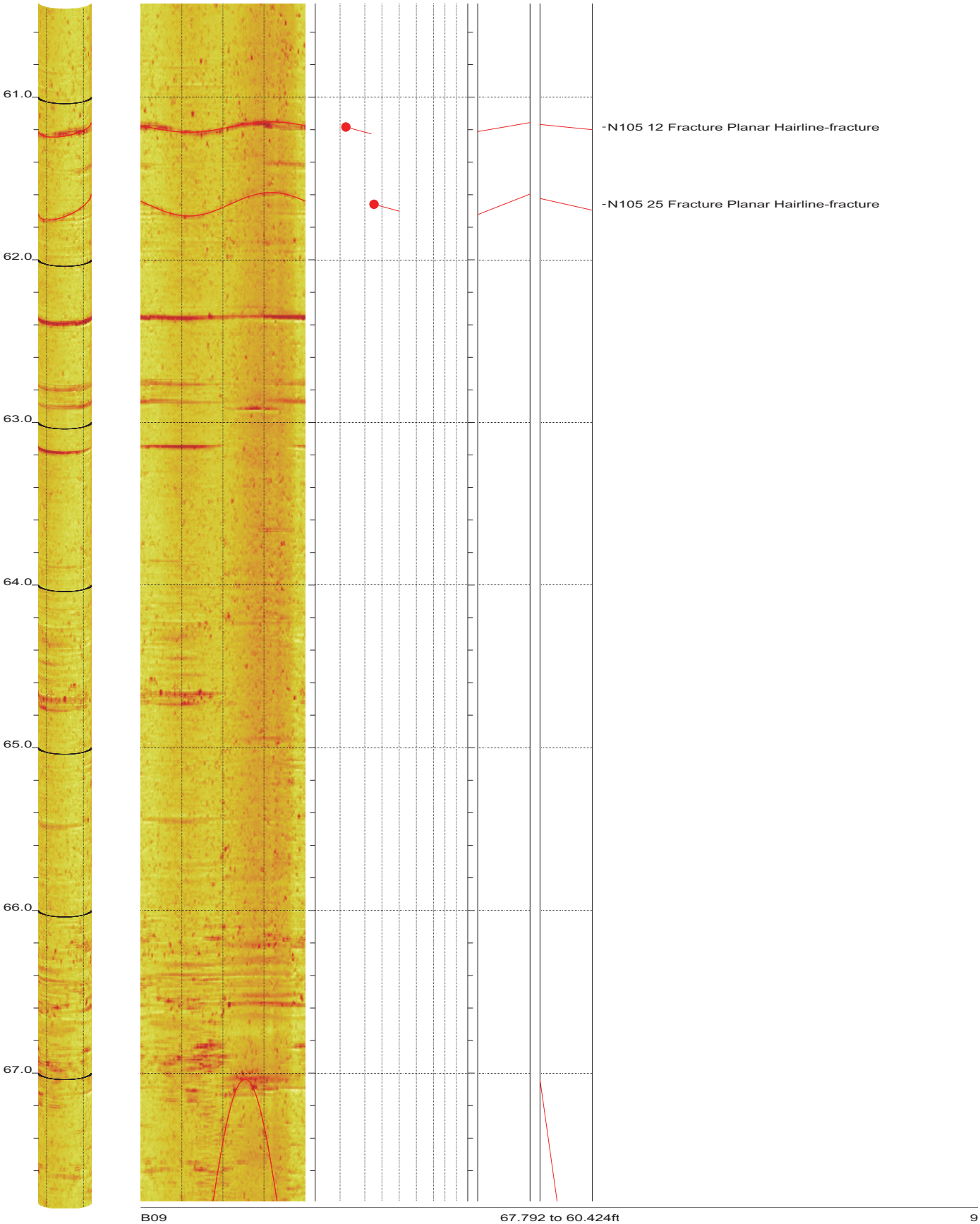
MRDA Substation Boring B-09 Acoustic Televiewer Dips rev 1 Sheet 5 of 17

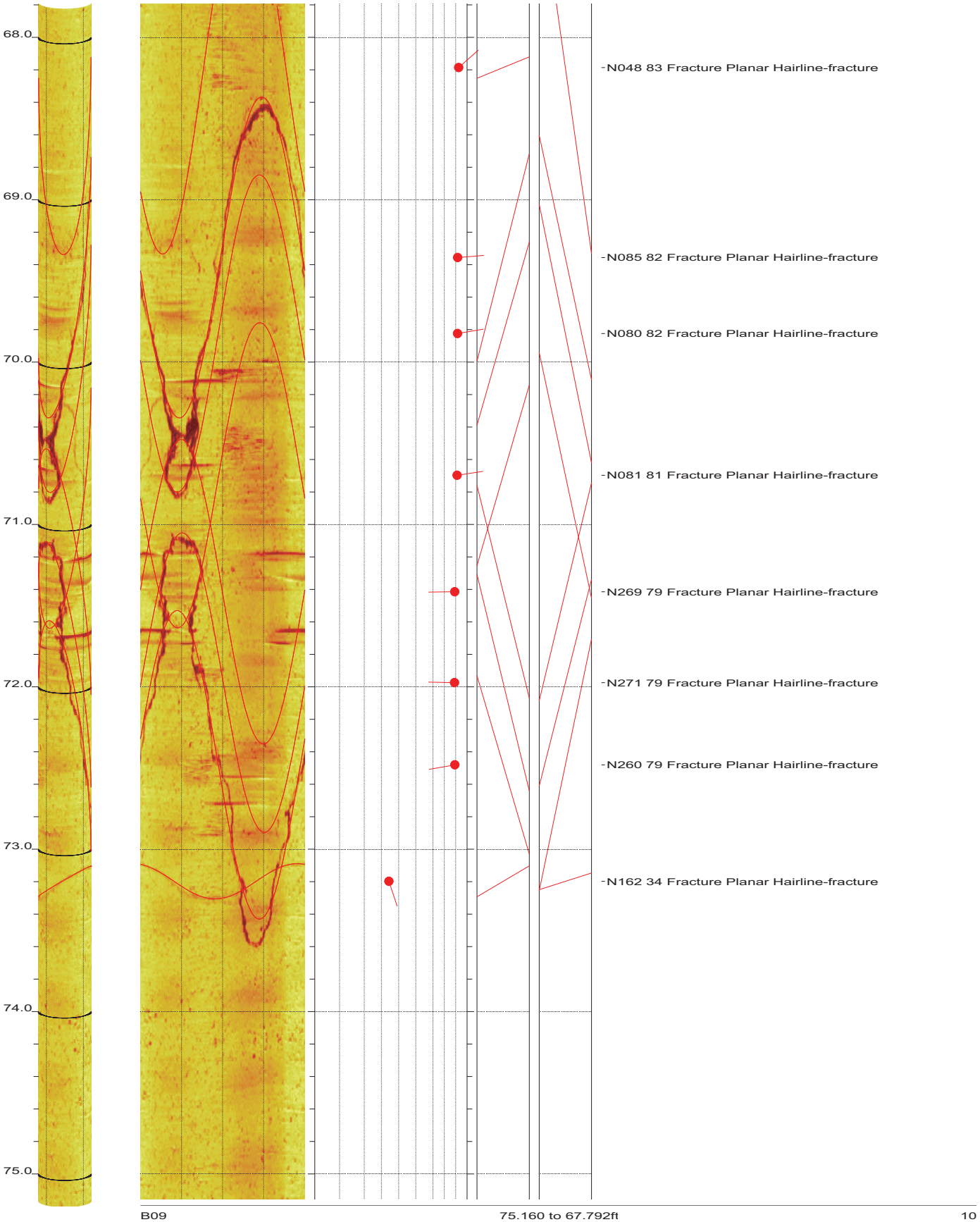

39.0
40.0
41.0
42.0
43.0
44.0
45.0
N002 42 Fracture Planar Hairline-fracture
N208 67 Fracture Planar Hairline-fracture
N162 46 Fracture Planar Hairline-fracture
N016 49 Fracture Planar Hairline-fracture
B09
45.688 to 38.320ft
6

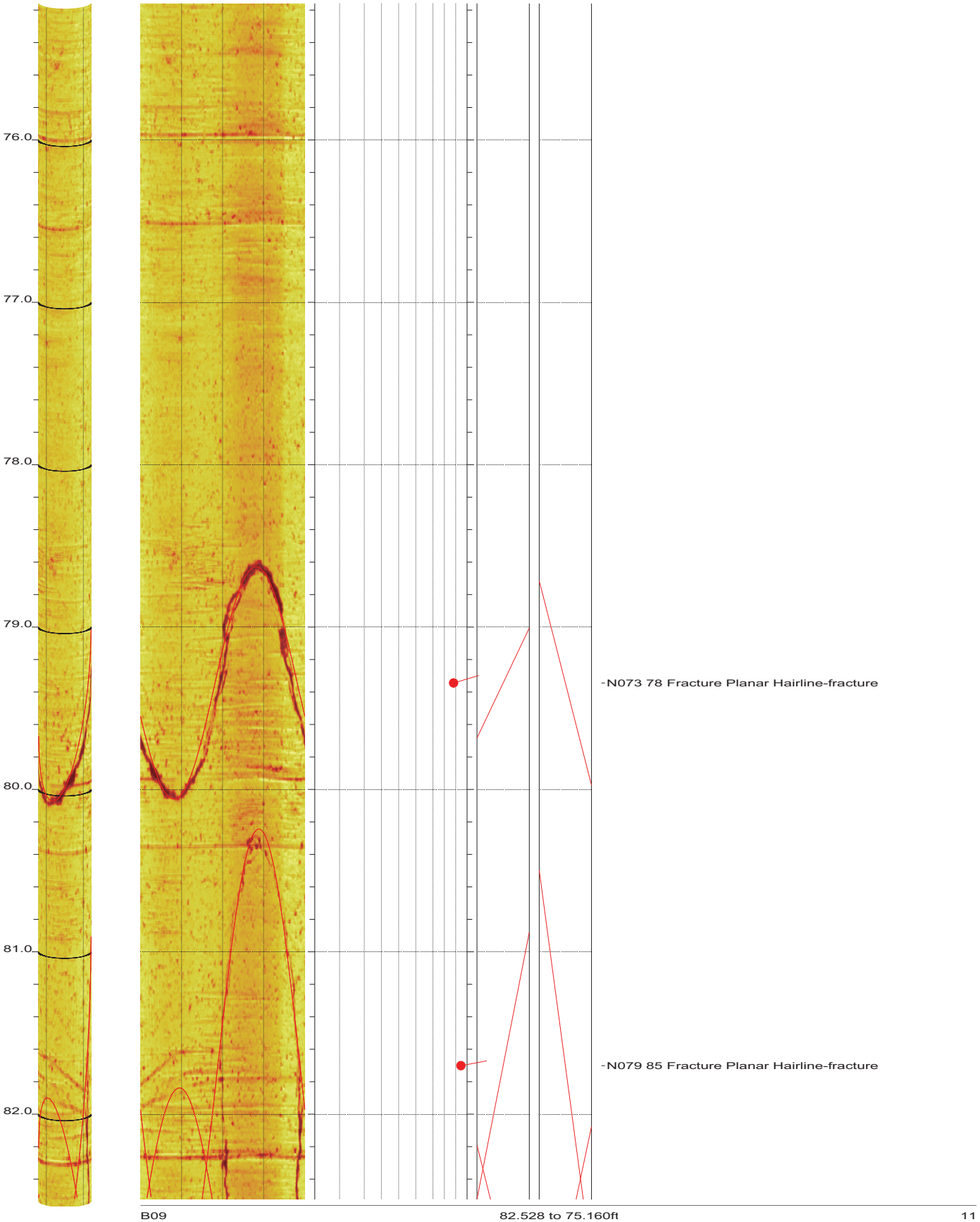

46.0
47.0
48.0
49.0
50.0
51.0
52.0
53.0
-N200 62 Fracture Planar Hairline-fracture
-N186 61 Fracture Planar Hairline-fracture
-N194 61 Fracture Planar Hairline-fracture
-N358 55 Fracture Planar Hairline-fracture
-N205 67 Fracture Planar Open-fracture
-N151 65 Fracture Planar Hairline-fracture
-N251 22 Fracture Planar Hairline-fracture
B09
53.056 to 45.688ft
7

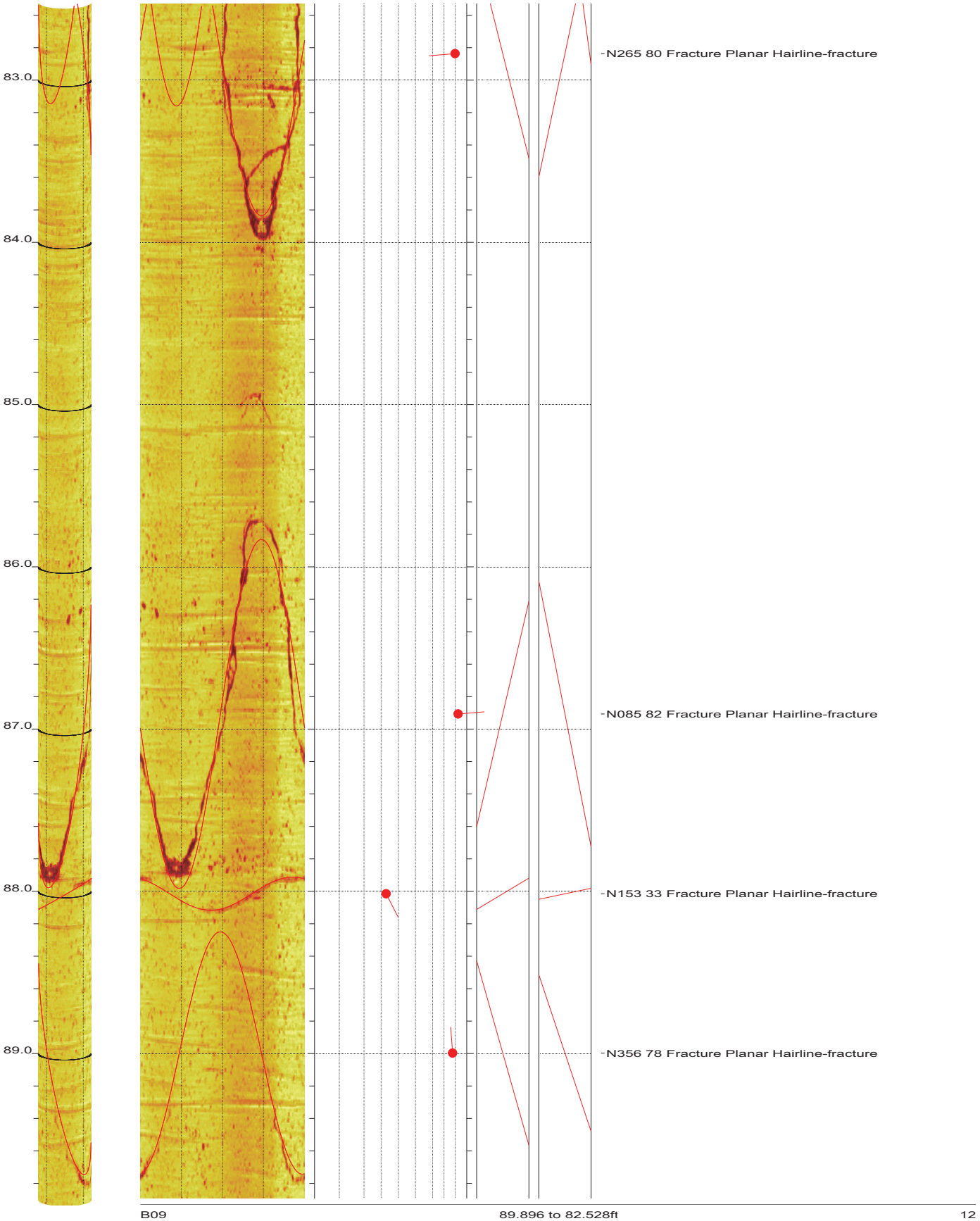


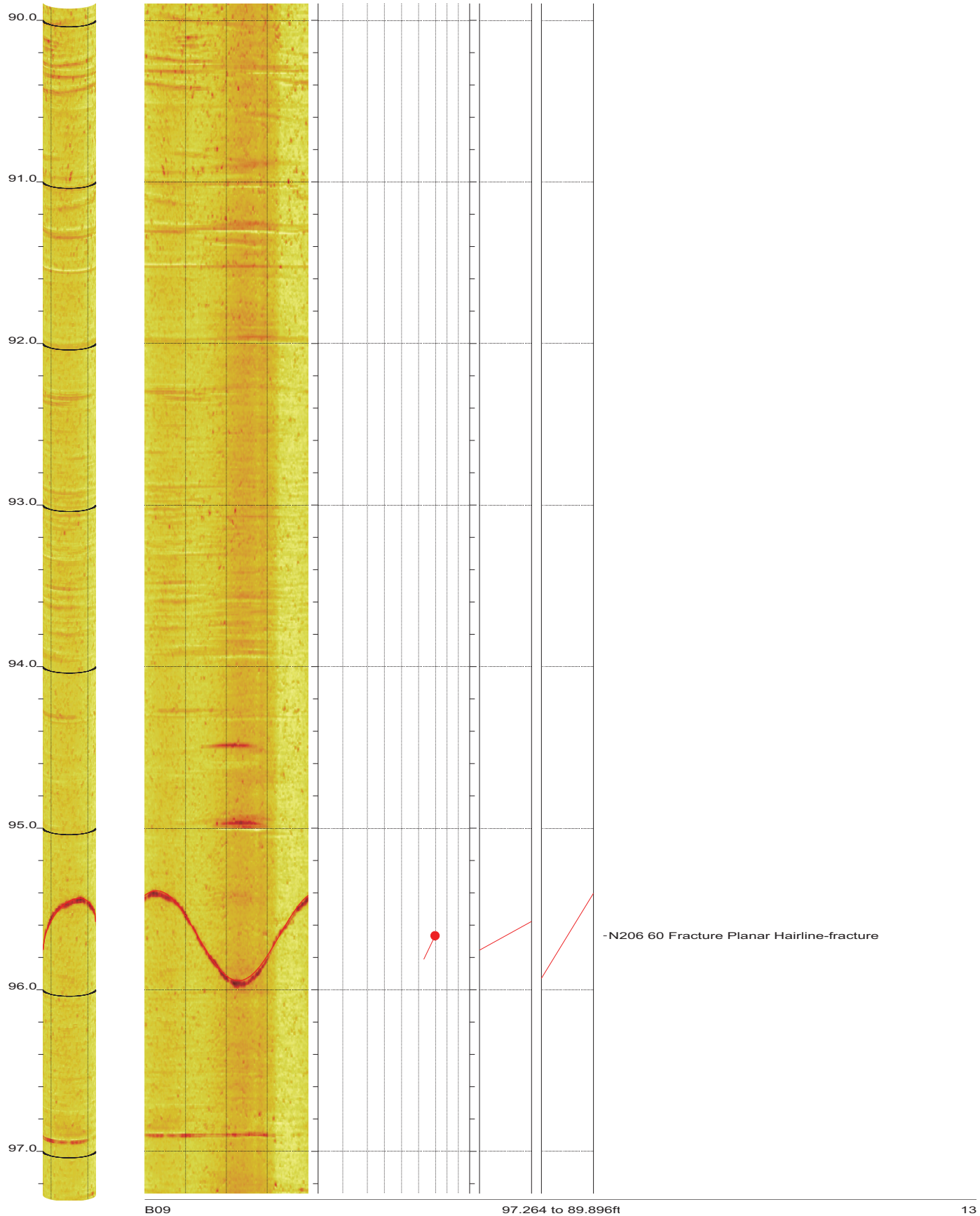
MRDA Substation Boring B-09 Acoustic Televiewer Dips rev 1 Sheet 8 of 17

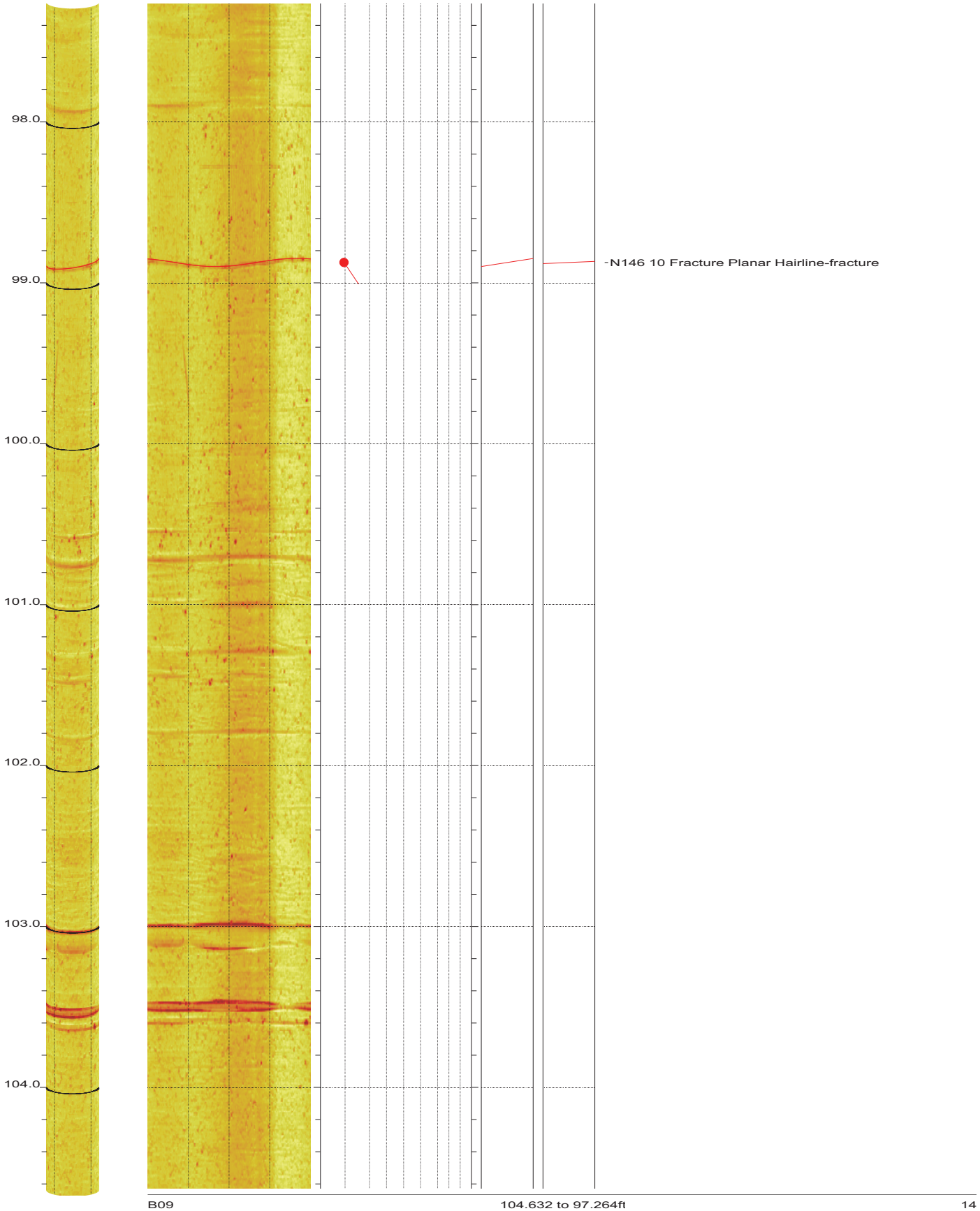

61.0
62.0
63.0
64.0
65.0
66.0
67.0
-N105 12 Fracture Planar Hairline-fracture
-N105 25 Fracture Planar Hairline-fracture
B09
67.792 to 60.424ft
9


68.0
69.0
70.0
71.0
72.0
73.0
74.0
75.0
-N048 83 Fracture Planar Hairline-fracture
-N085 82 Fracture Planar Hairline-fracture
-N080 82 Fracture Planar Hairline-fracture
-N081 81 Fracture Planar Hairline-fracture
-N269 79 Fracture Planar Hairline-fracture
-N271 79 Fracture Planar Hairline-fracture
-N260 79 Fracture Planar Hairline-fracture
-N162 34 Fracture Planar Hairline-fracture
B09
75.160 to 67.792ft
10

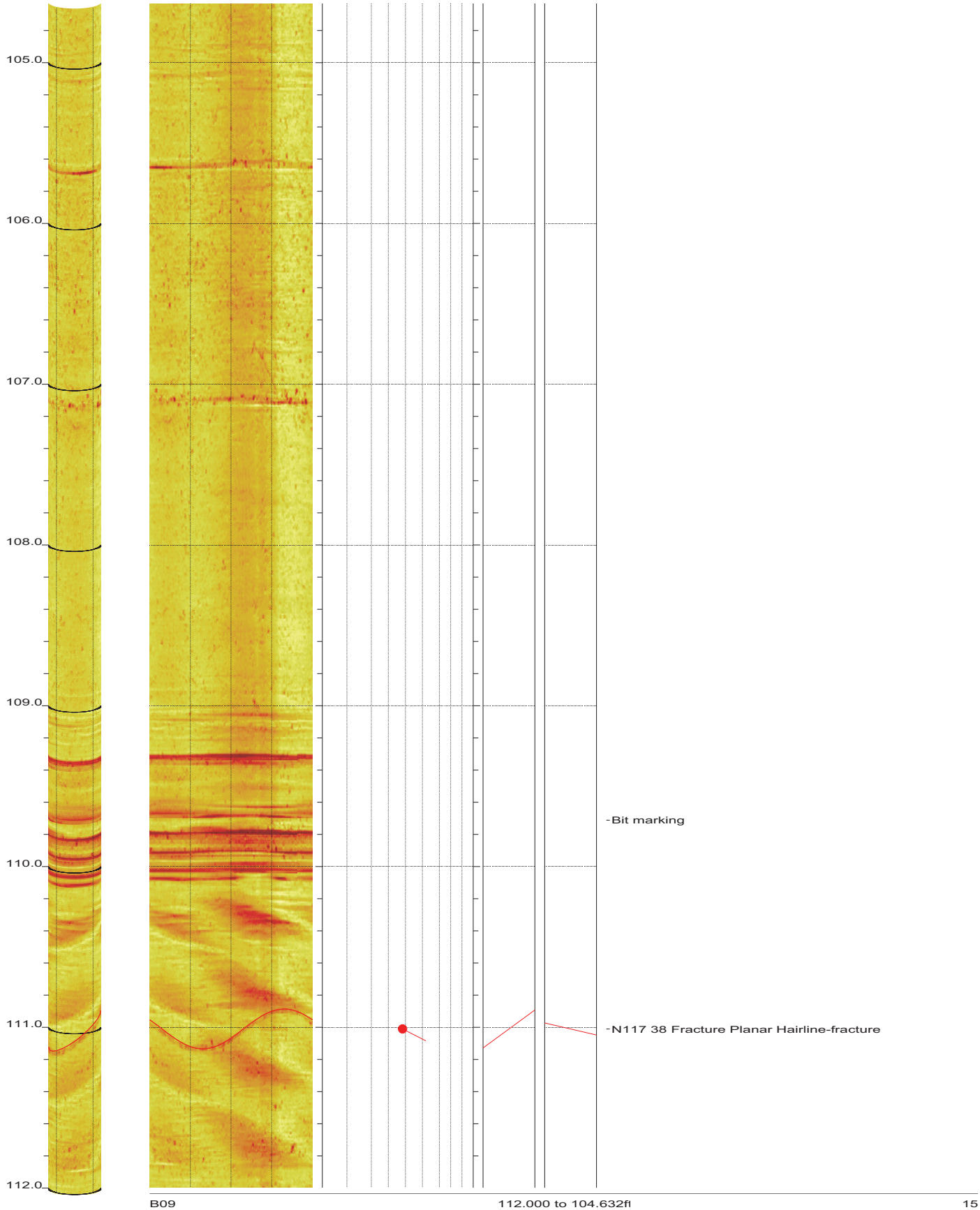

76.0
77.0
78.0
79.0
80.0
81.0
82.0
N073 78 Fracture Planar Hairline-fracture
N079 85 Fracture Planar Hairline-fracture
B09
82.528 to 75.160ft
11

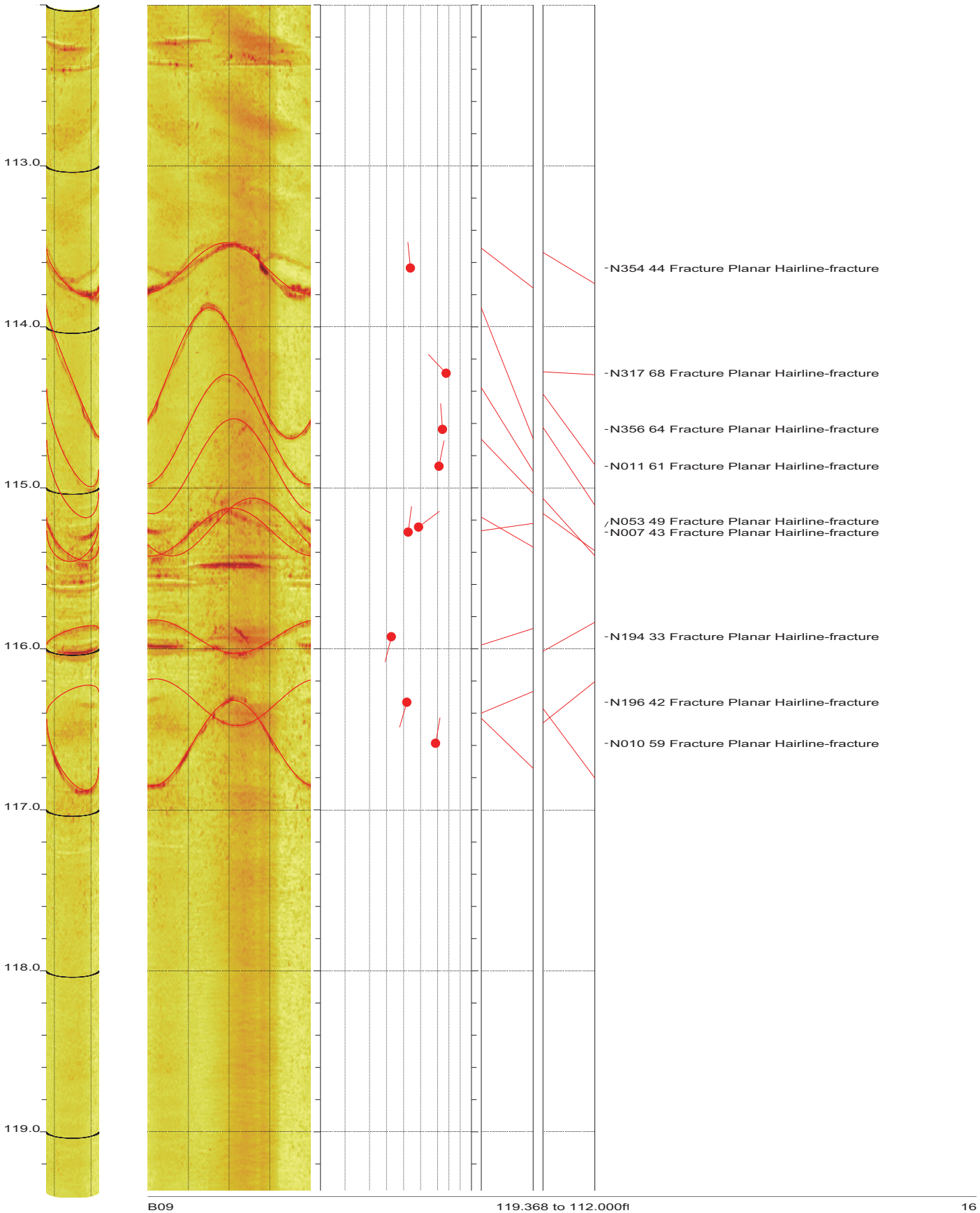

83.0
84.0
85.0
86.0
87.0
88.0
89.0
N265 80 Fracture Planar Hairline-fracture
N085 82 Fracture Planar Hairline-fracture
N153 33 Fracture Planar Hairline-fracture
N356 78 Fracture Planar Hairline-fracture
B09
89.896 to 82.528ft
12


90.0
91.0
92.0
93.0
94.0
95.0
96.0
97.0
N206 60 Fracture Planar Hairline-fracture
B09
97.264 to 89.896ft
13



MRDA Substation Boring B-09 Acoustic Televiewer Dips rev 1 Sheet 14 of 17


105.0
106.0
107.0
108.0
109.0
110.0
111.0
112.0
-Bit marking
-N117 38 Fracture Planar Hairline-fracture
B09
112.000 to 104.632fl
15



MRDA Substation Boring B-09 Acoustic Televiewer Dips rev 1 Sheet 16 of 17



B09 119.400 to 119.368fl 17

BHTV DATA PROCESSING
RGLDIP vsn 6.2
INTERPRETED BHTV DIPS LOG

URS

Borehole: B-10

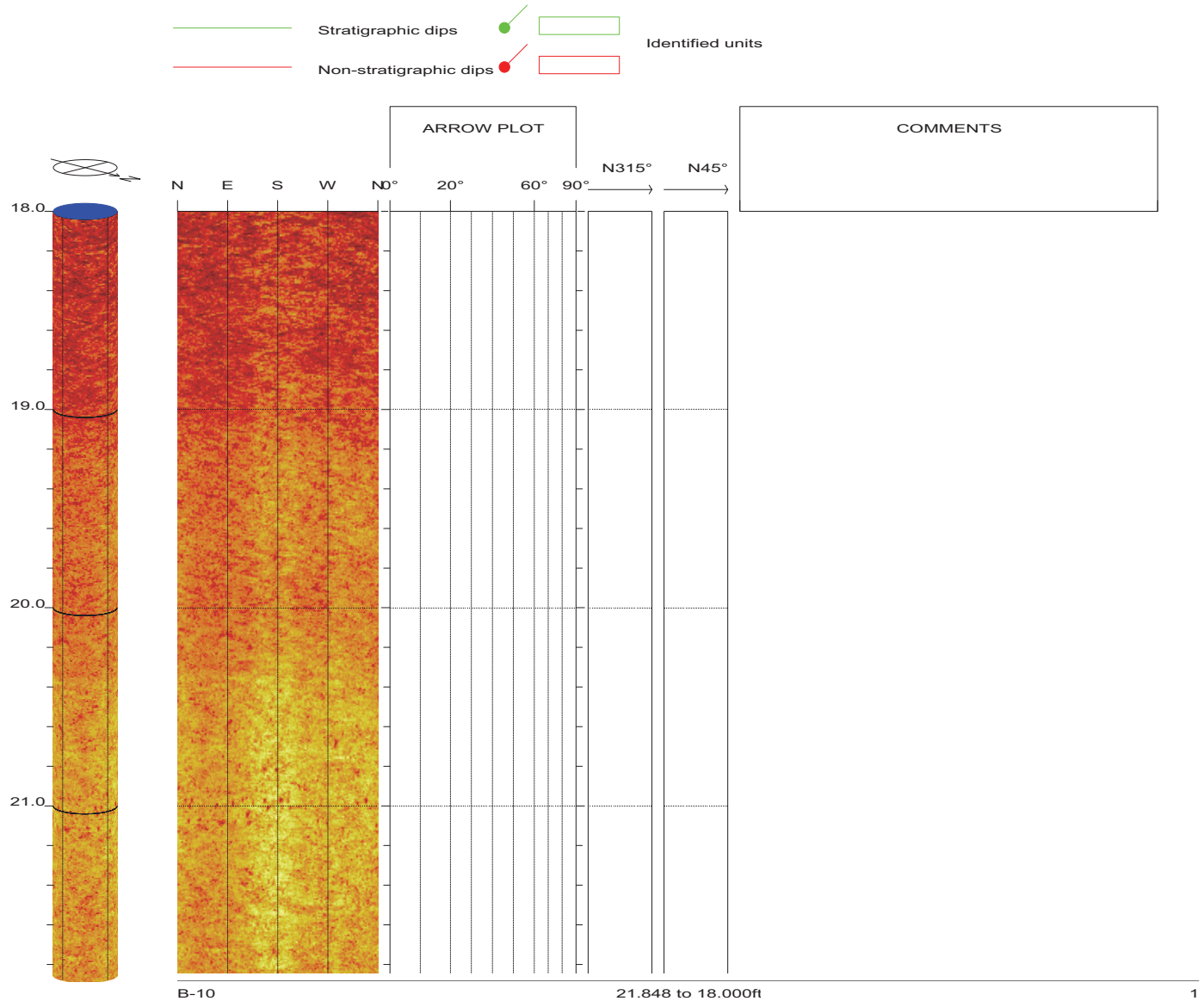
MRDA SUBSTATION

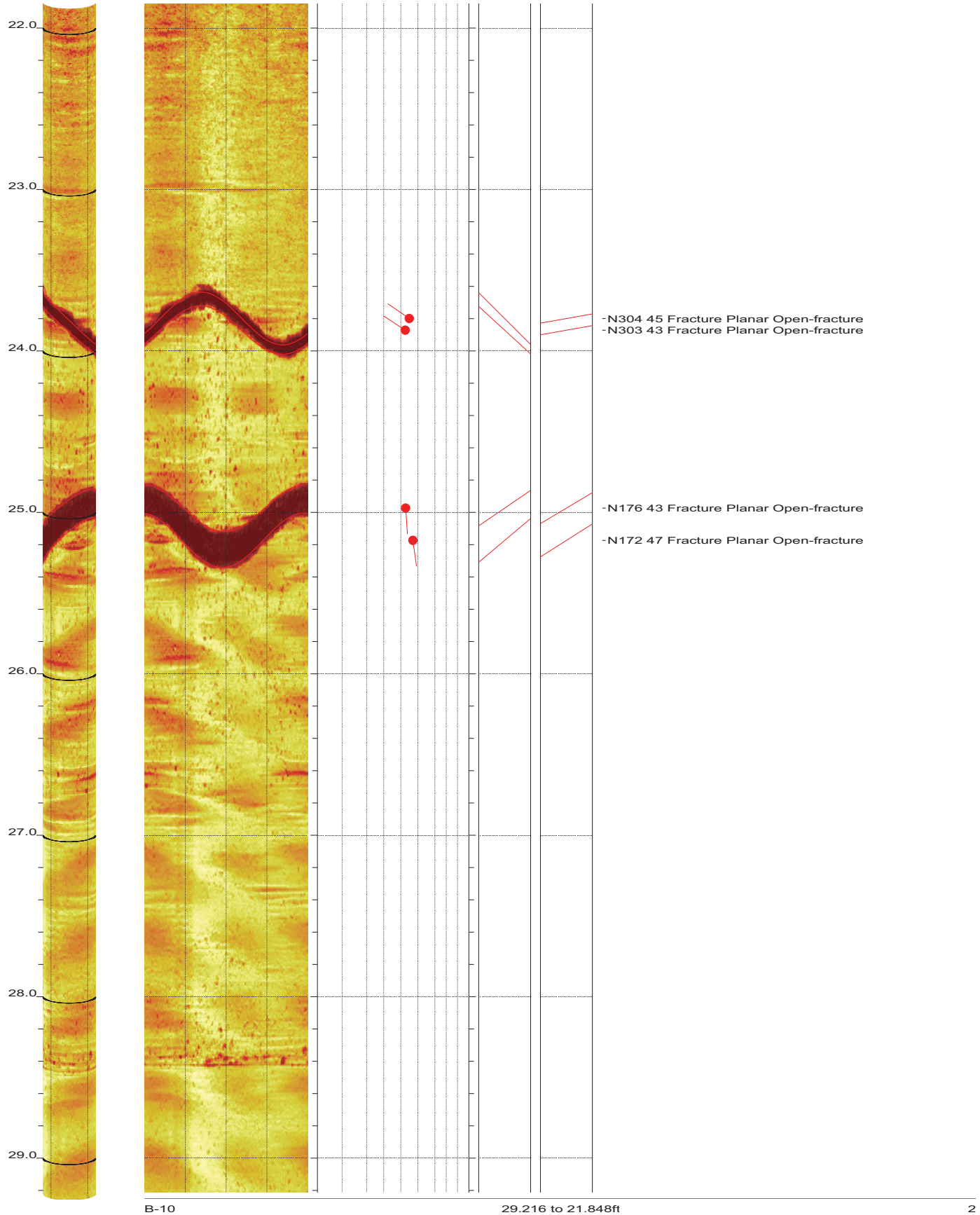
top of borehole.....
East: _
North: _
Elev: _

North ref. is true
Depth units are feet
Vertical scale: 1/10
Horiz scale = 1.00x Vert scale

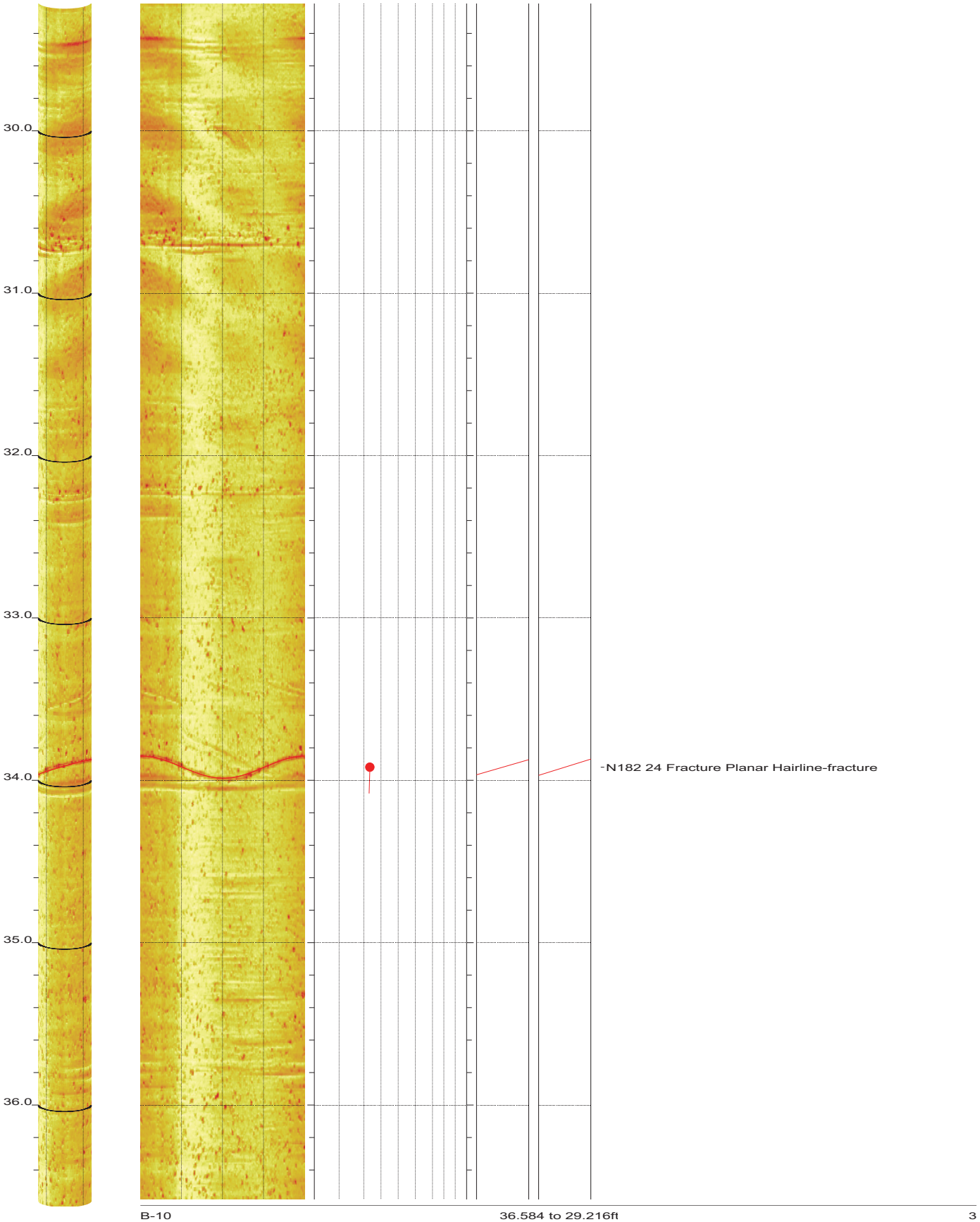
Zone from 88.800 to 18.000ft
Format: BHTV-NESWN

Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude

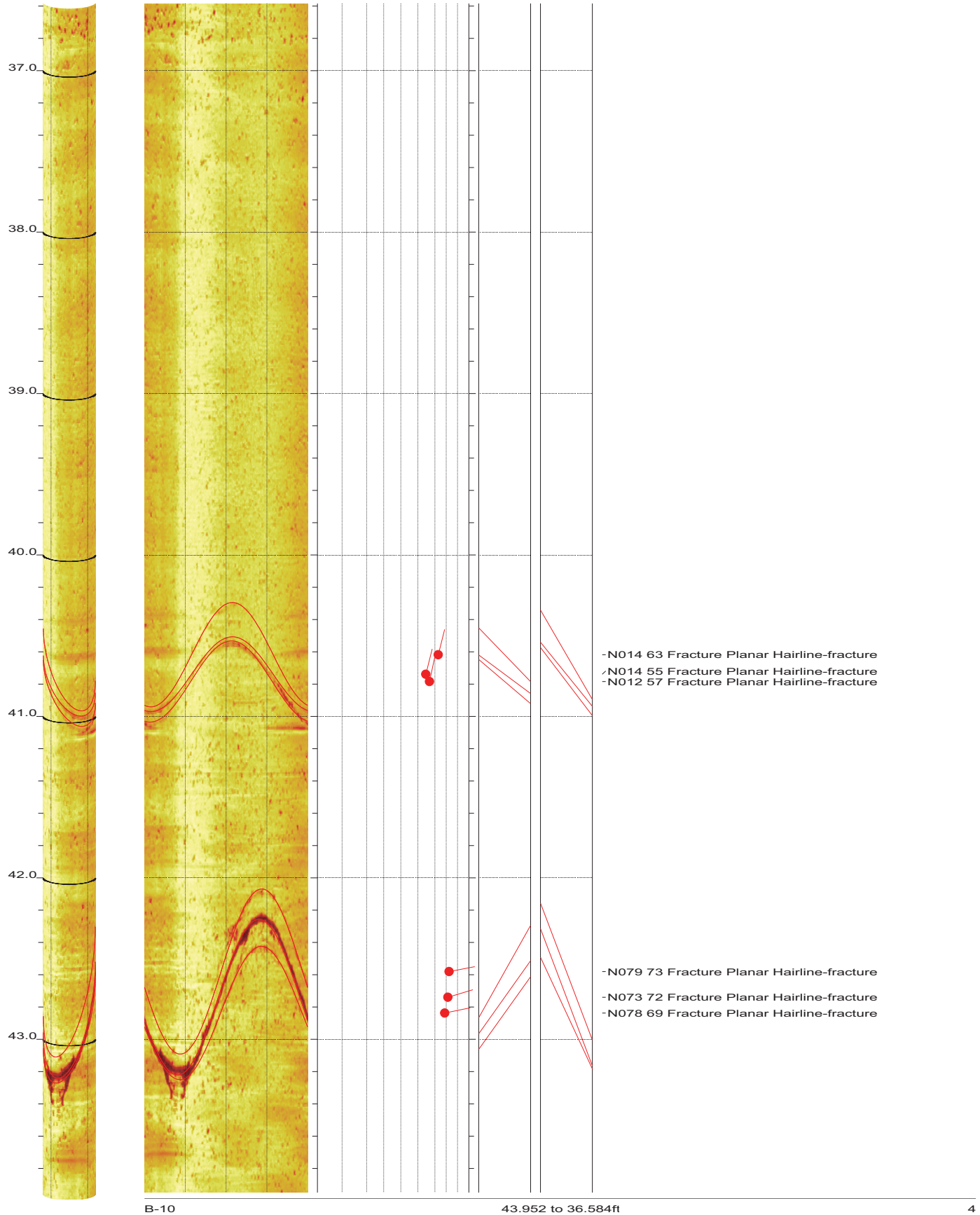


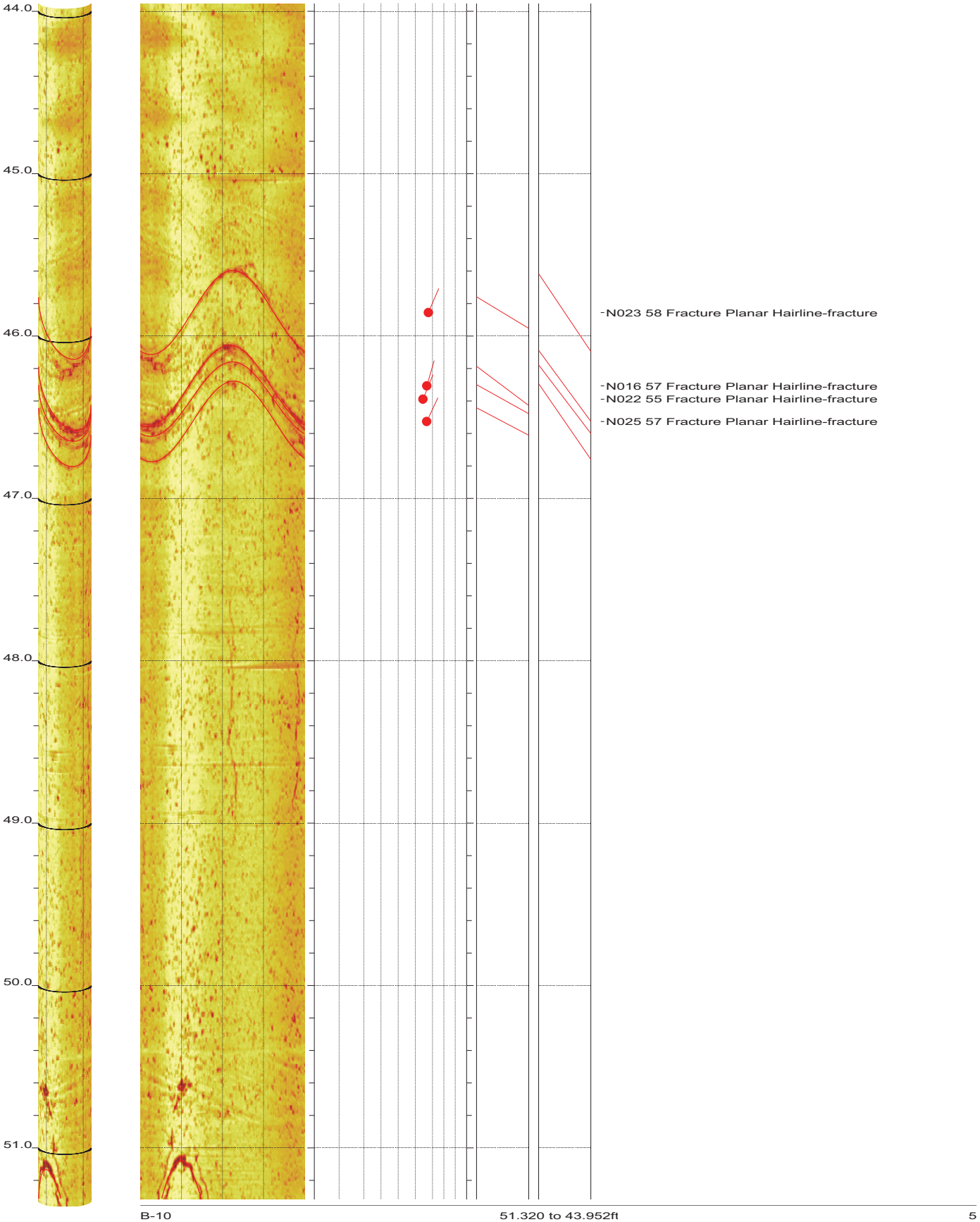


MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 2 of 11

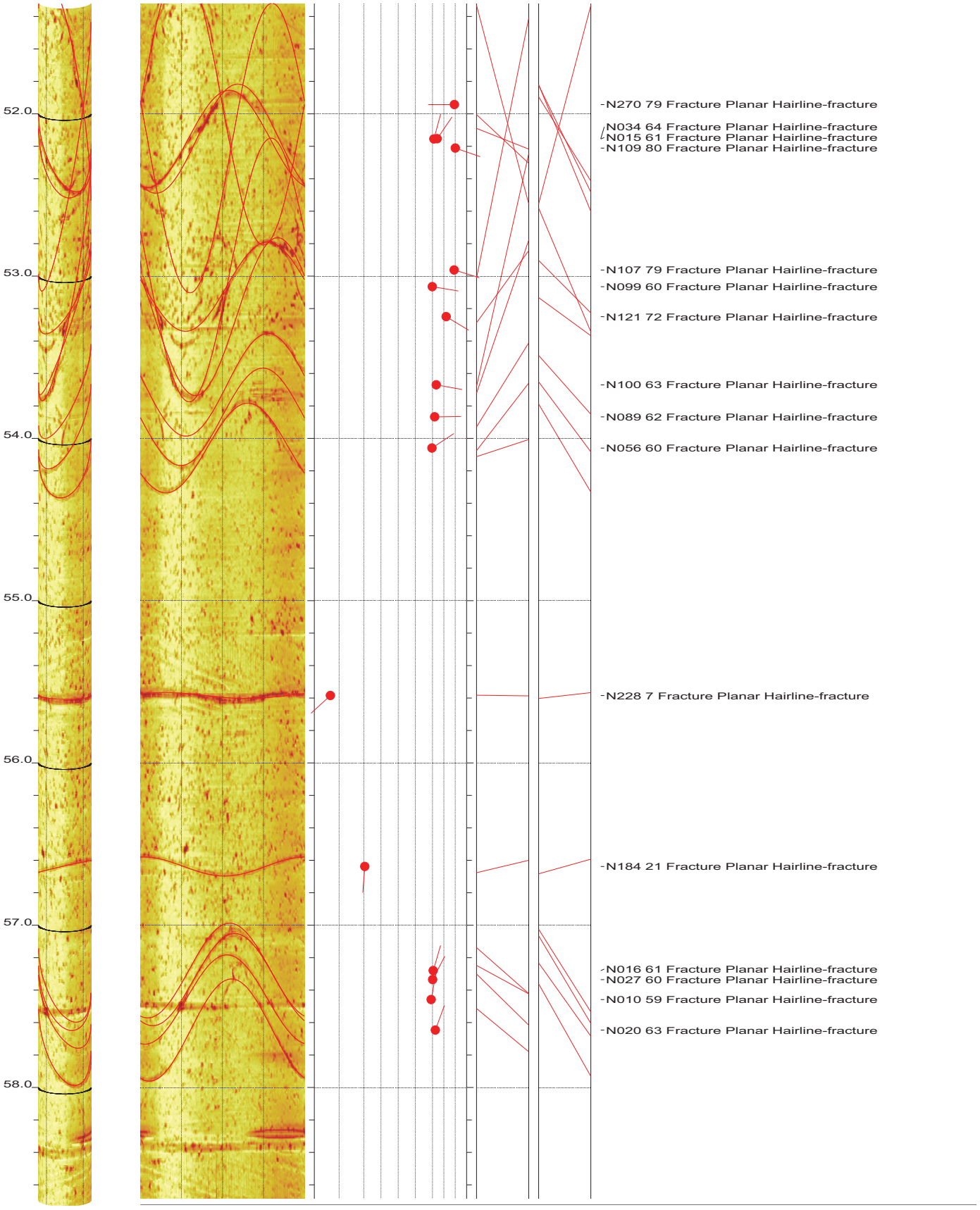


MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 3 of 11

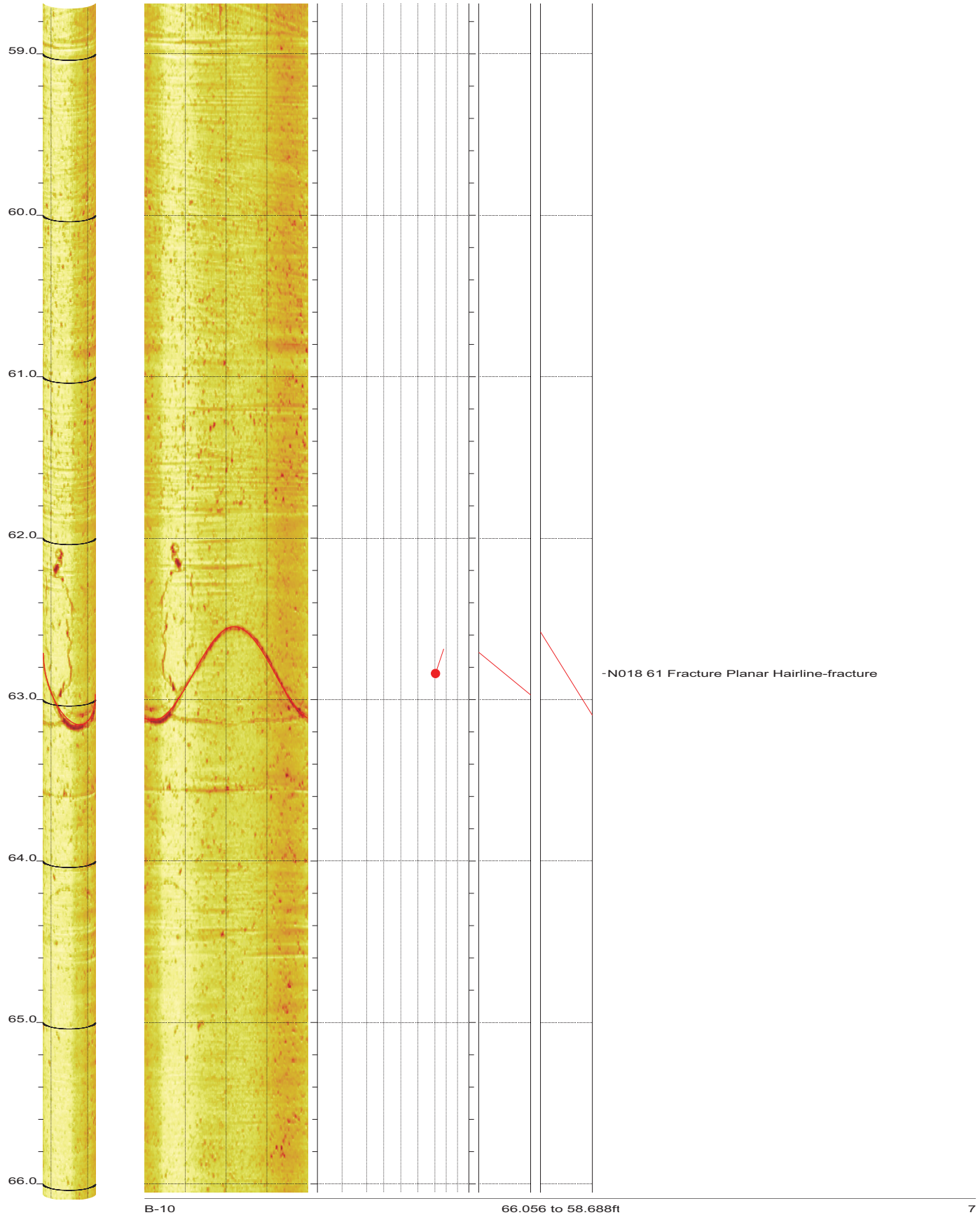

37.0
38.0
39.0
40.0
41.0
42.0
43.0
N014 63 Fracture Planar Hairline-fracture
N014 55 Fracture Planar Hairline-fracture
N012 57 Fracture Planar Hairline-fracture
N079 73 Fracture Planar Hairline-fracture
N073 72 Fracture Planar Hairline-fracture
N078 69 Fracture Planar Hairline-fracture
B-10
43.952 to 36.584ft
4

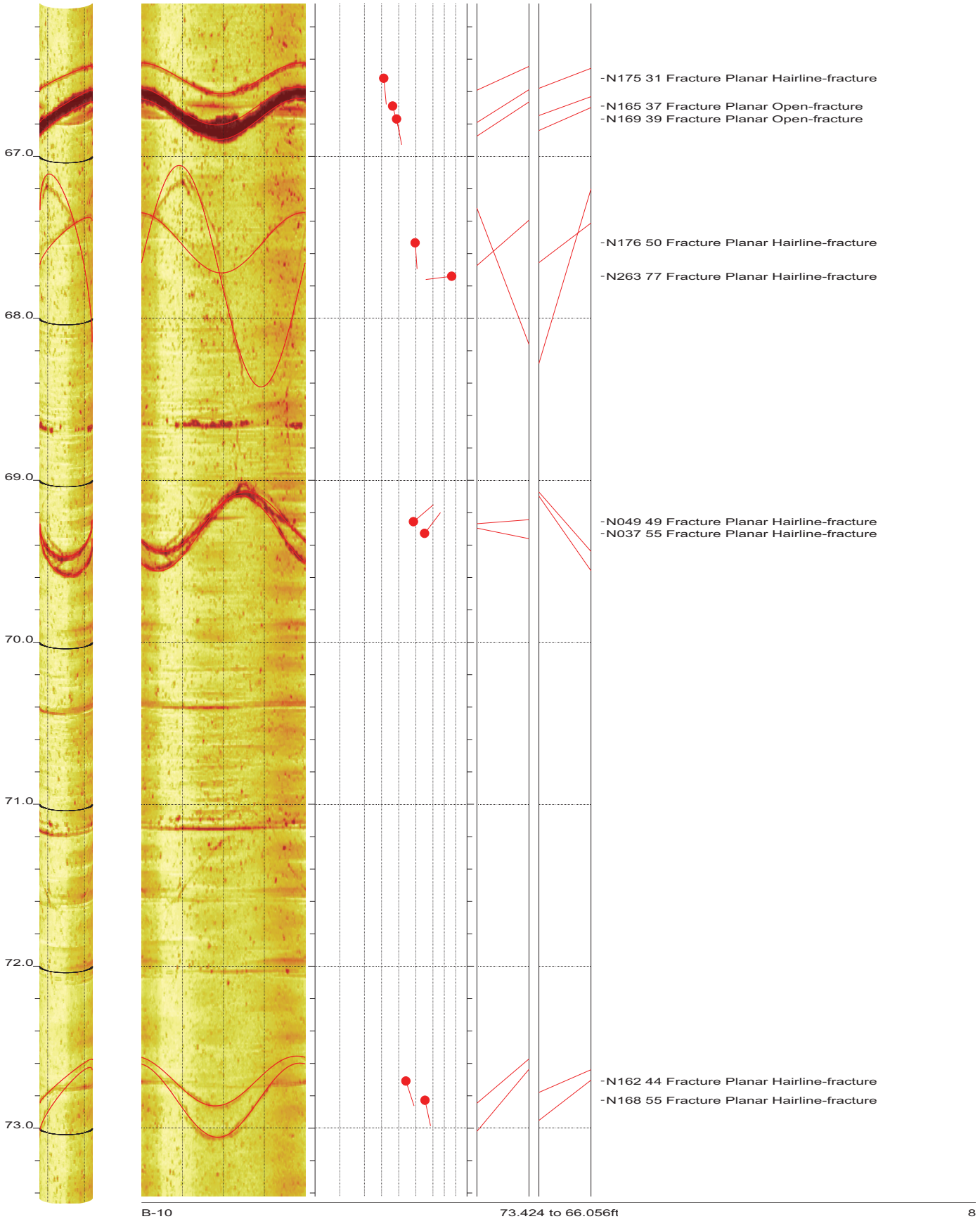


MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 5 of 11

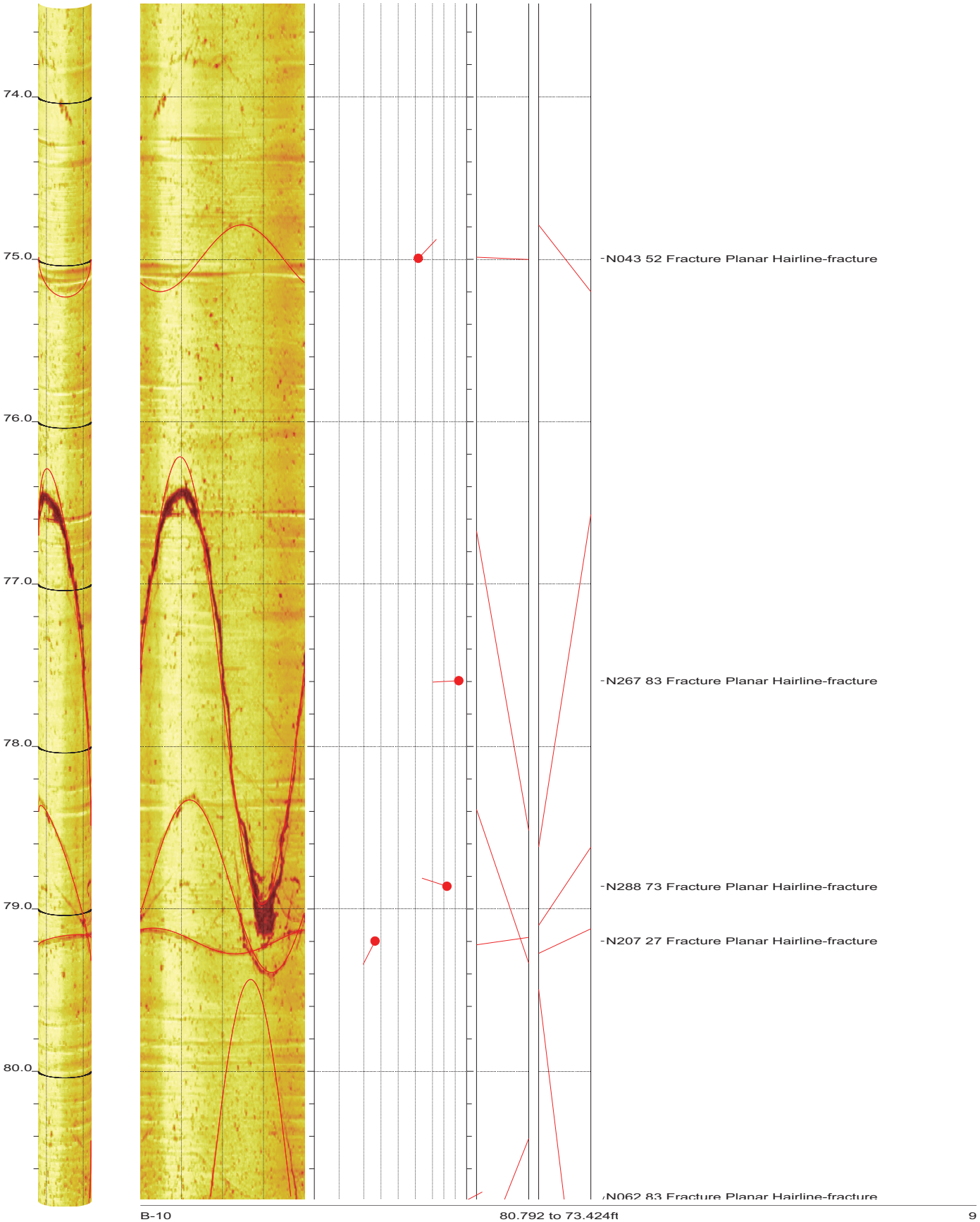


MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 6 of 11

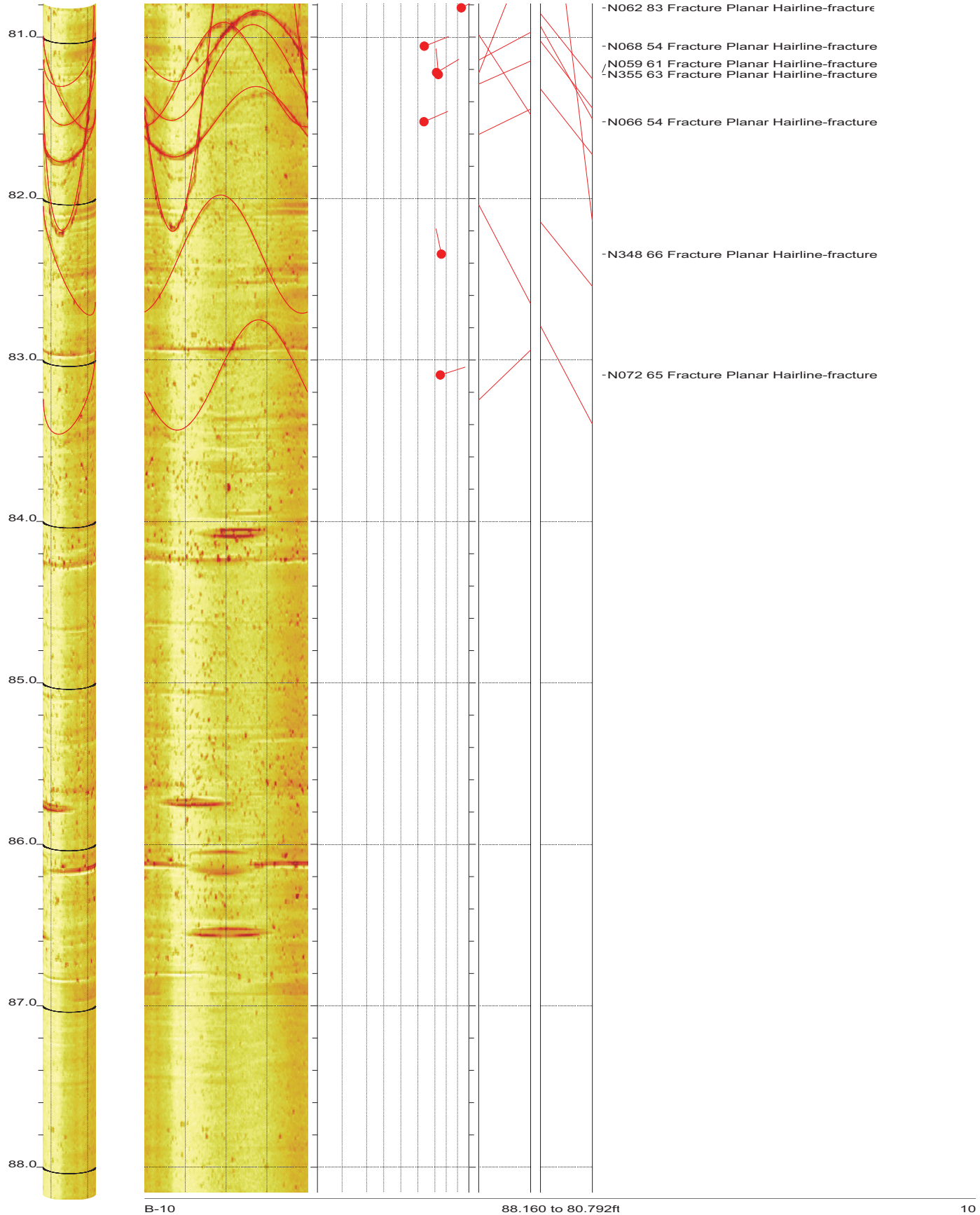

59.0
60.0
61.0
62.0
63.0
64.0
65.0
66.0
-N018 61 Fracture Planar Hairline-fracture
B-10
66.056 to 58.688ft
7

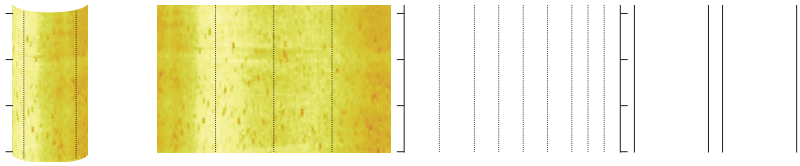


MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 8 of 11



MRDA Substation Boring B-10 Acoustic Televiewer Dips rev 1 Sheet 9 of 11


81.0
82.0
83.0
84.0
85.0
86.0
87.0
88.0
N062 83 Fracture Planar Hairline-fracture
N068 54 Fracture Planar Hairline-fracture
N059 61 Fracture Planar Hairline-fracture
N355 63 Fracture Planar Hairline-fracture
N066 54 Fracture Planar Hairline-fracture
N348 66 Fracture Planar Hairline-fracture
N072 65 Fracture Planar Hairline-fracture
B-10
88.160 to 80.792ft
10



OPTV DATA PROCESSING
RGLDIP vsn 6.2
INTERPRETED OPTV DIPS LOG

URS

Borehole: B-10

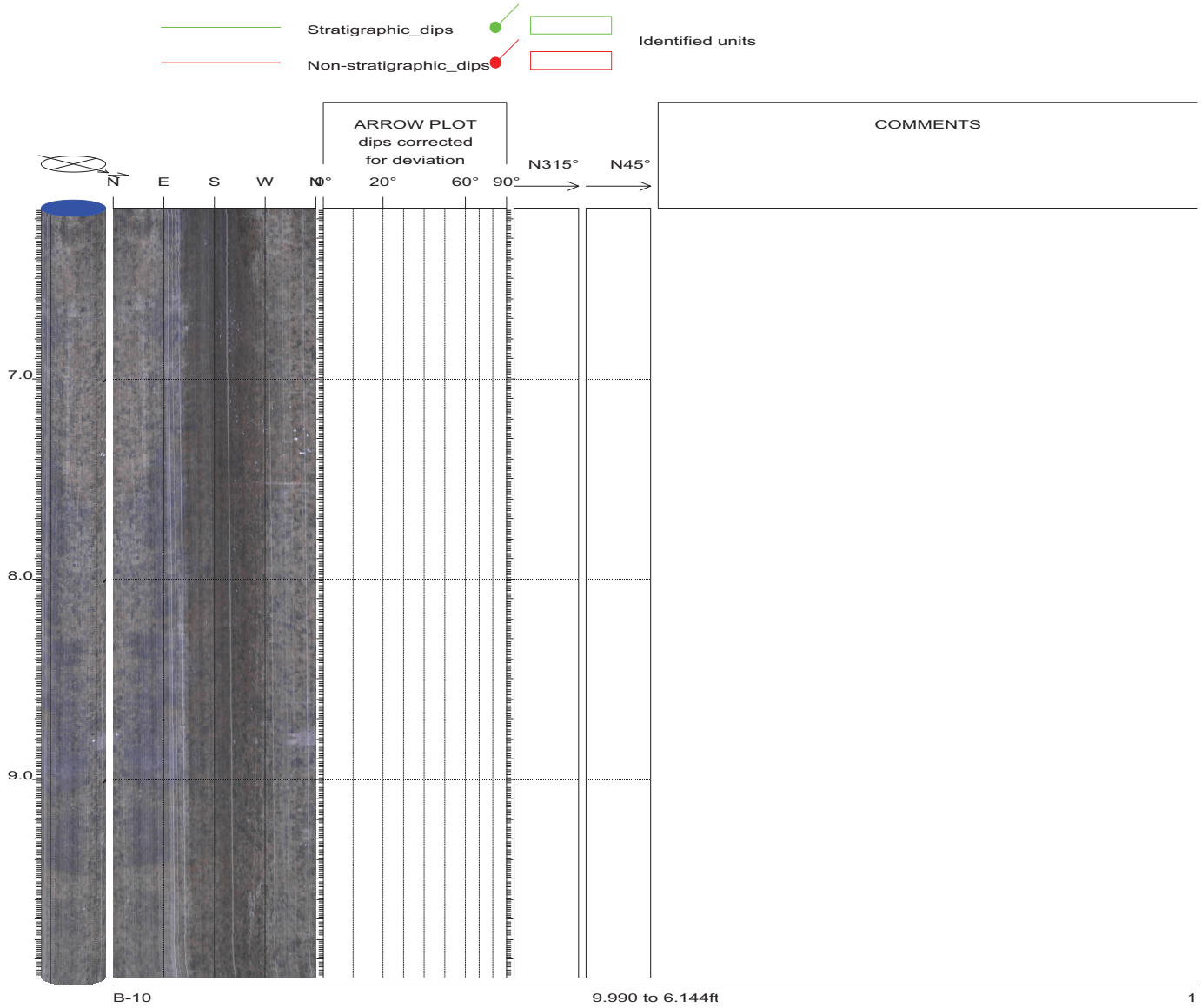
MRDA SUBSTATION

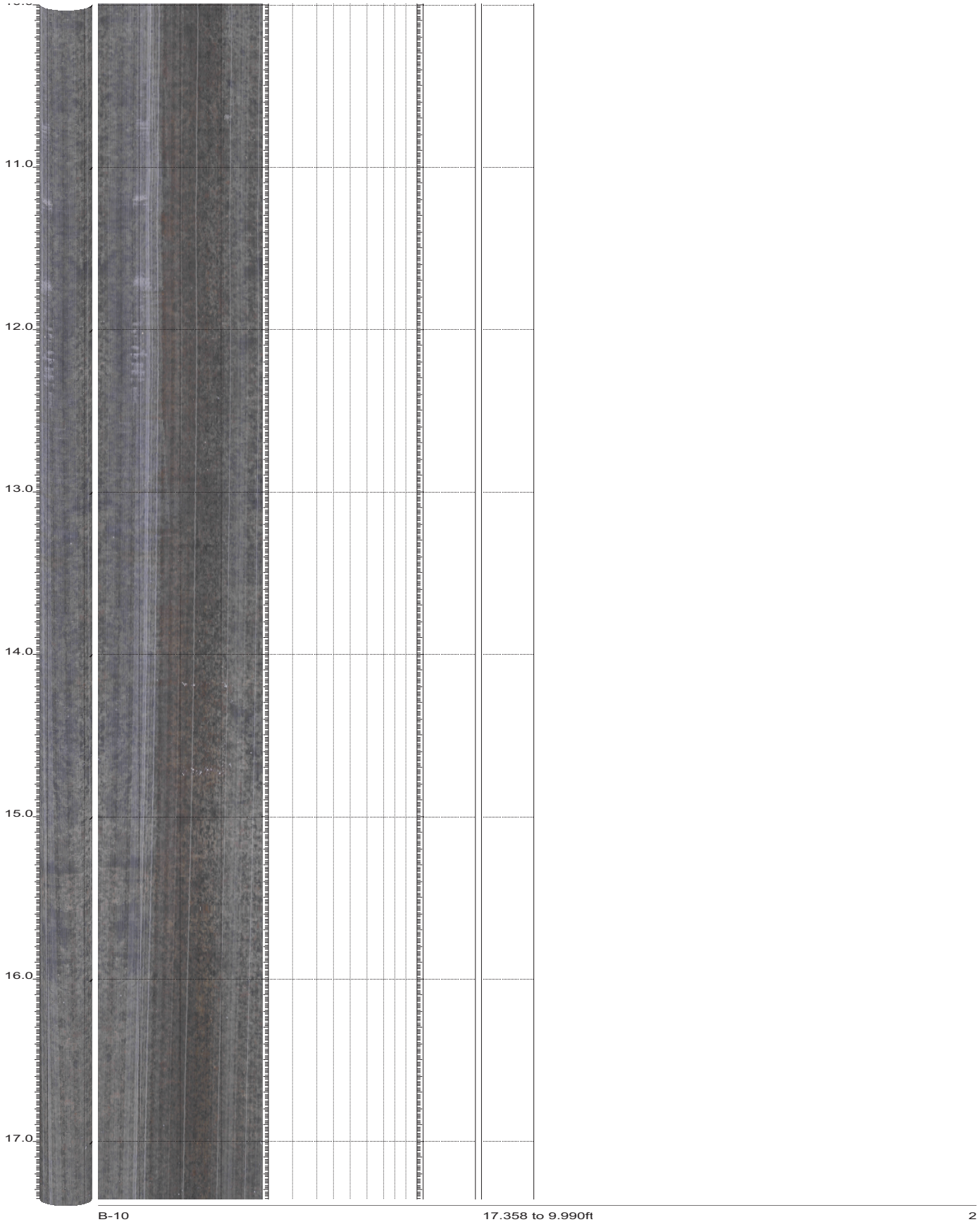
top of borehole.....
East:
North:
Elev:

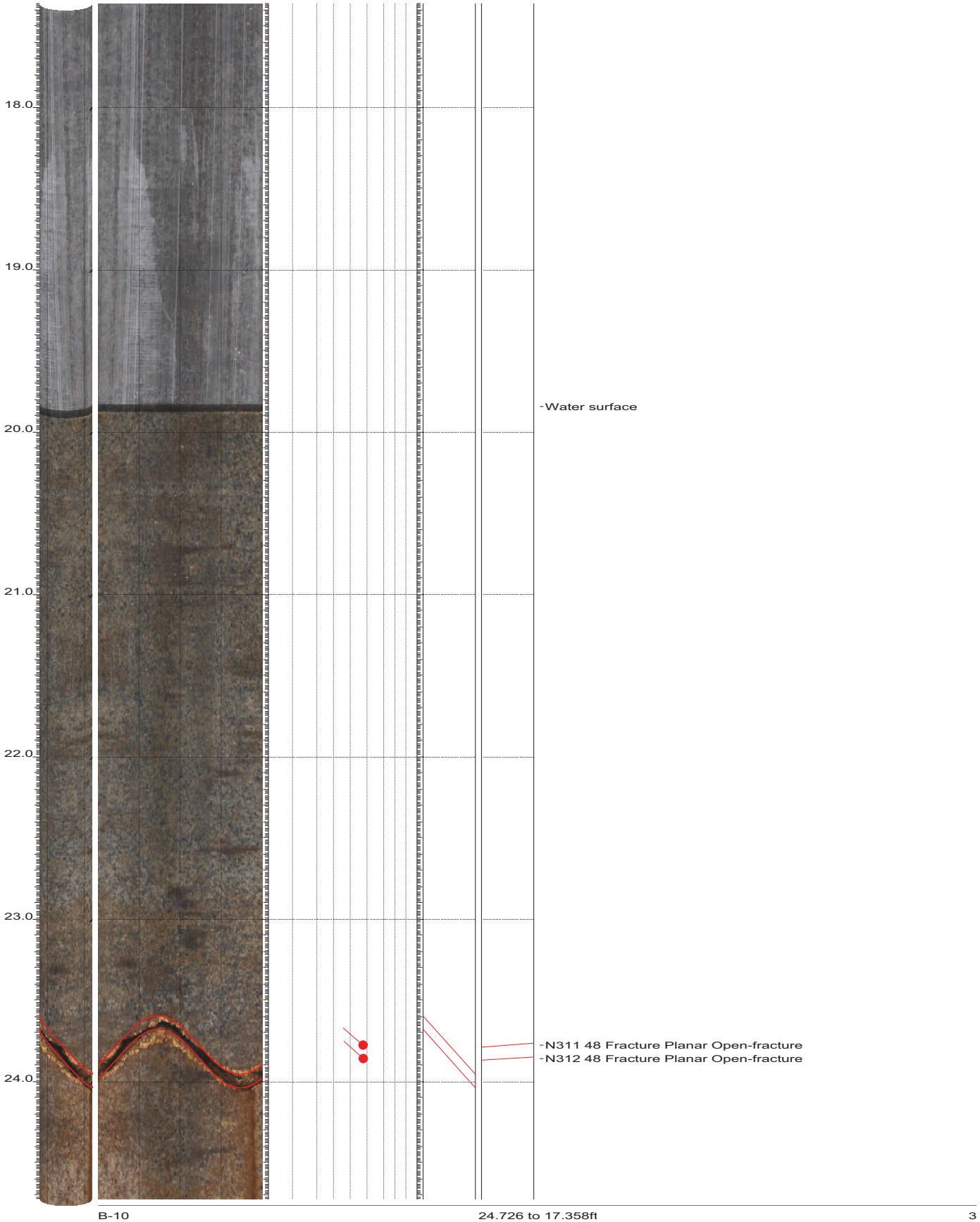
North ref. is true
Depth units are feet
Vertical scale: 1/10
Horiz scale = vert scale

Zone from 89.136 to 6.144ft
Format: BHTV-NESWN

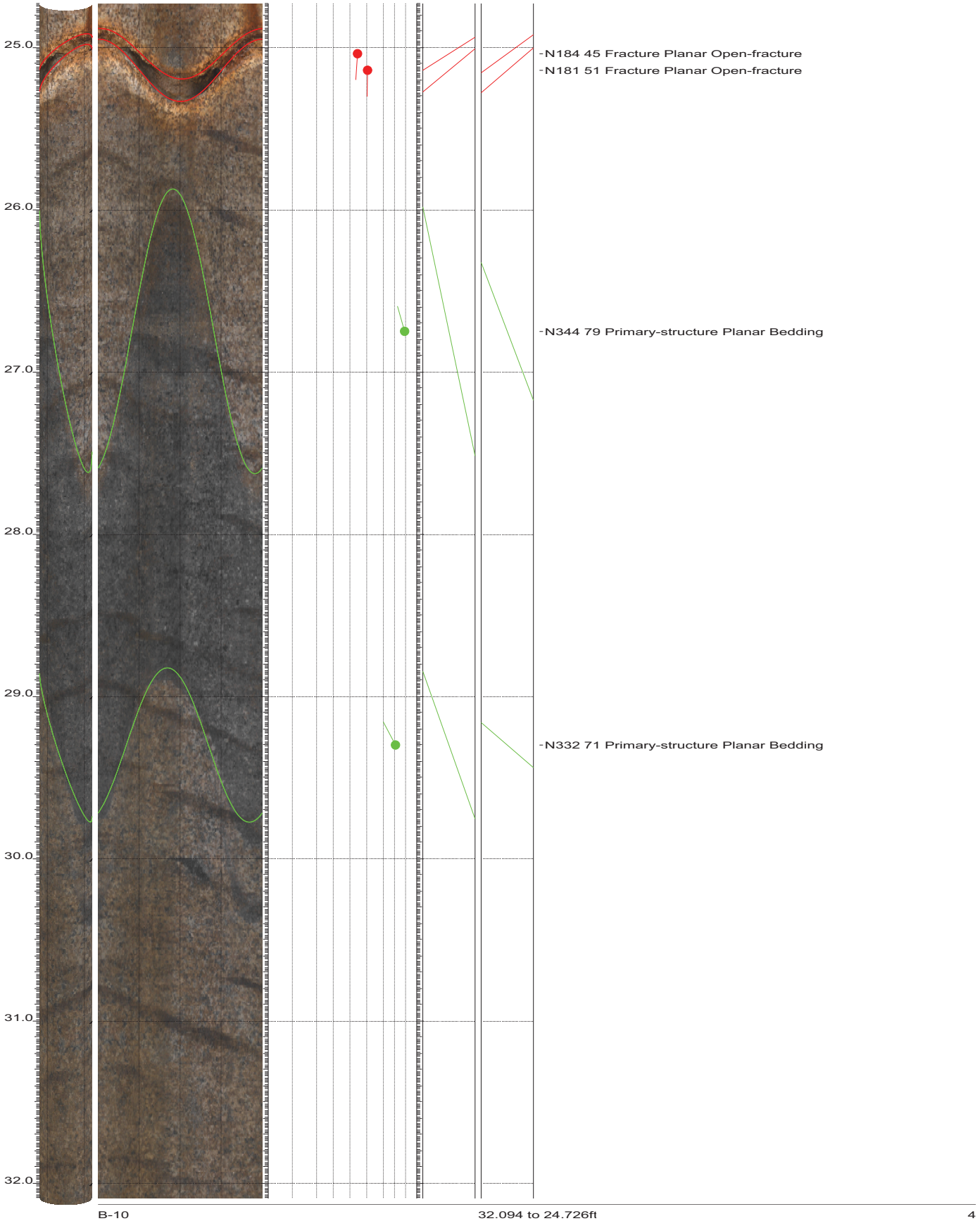
Borehole diam: 3.864inch
Vertical = borehole-axis

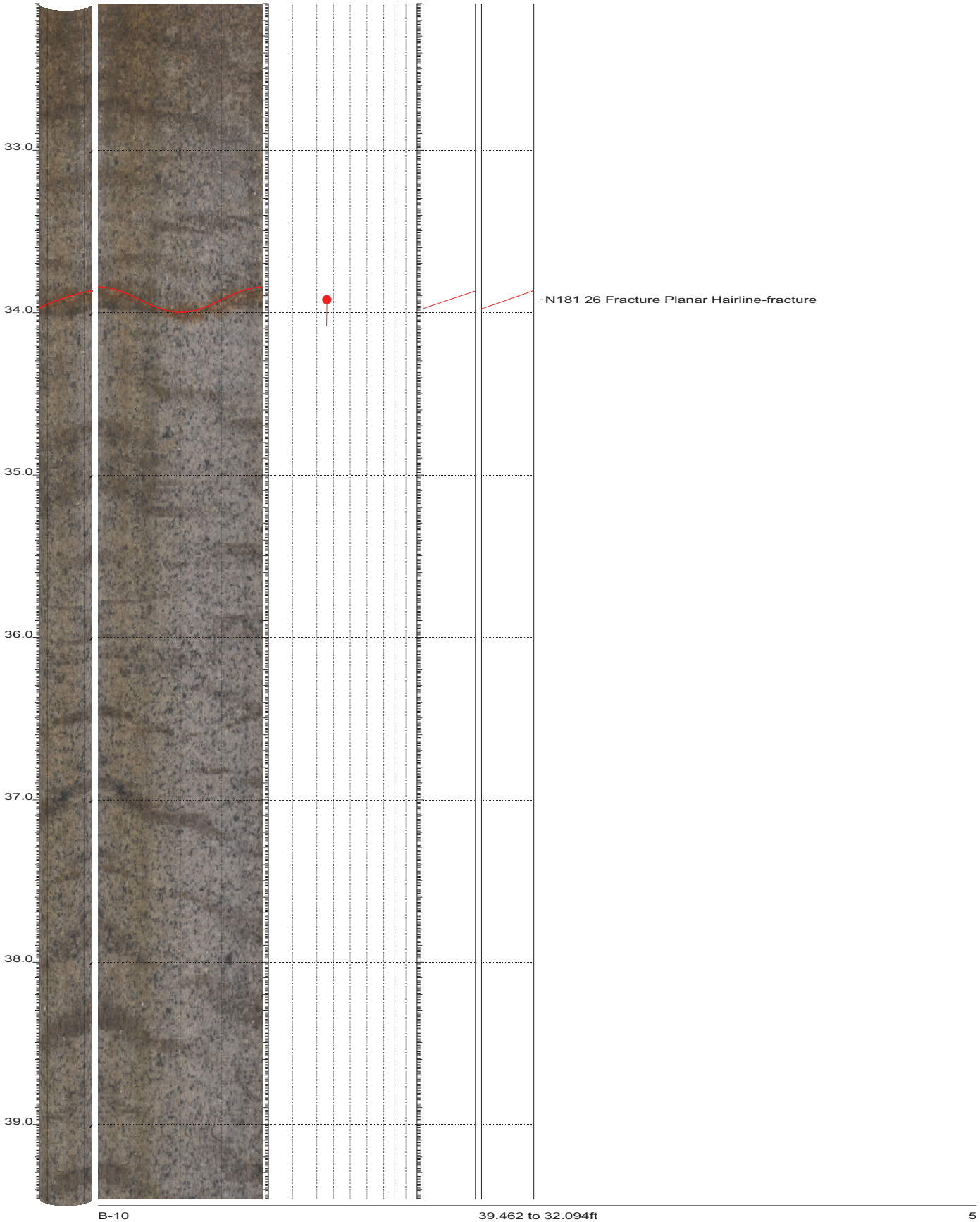


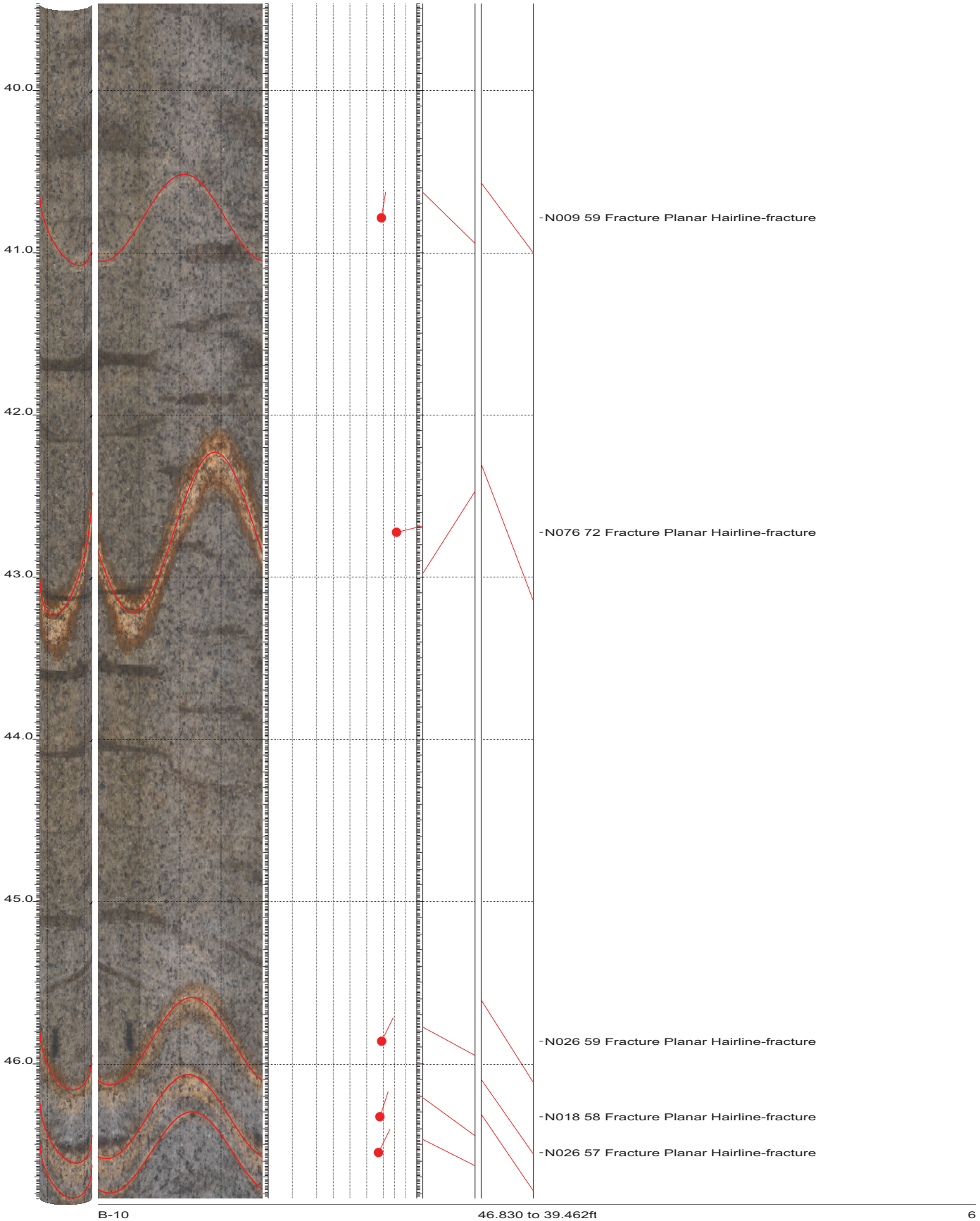

11.0
12.0
13.0
14.0
15.0
16.0
17.0
B-10
17.358 to 9.990ft
2



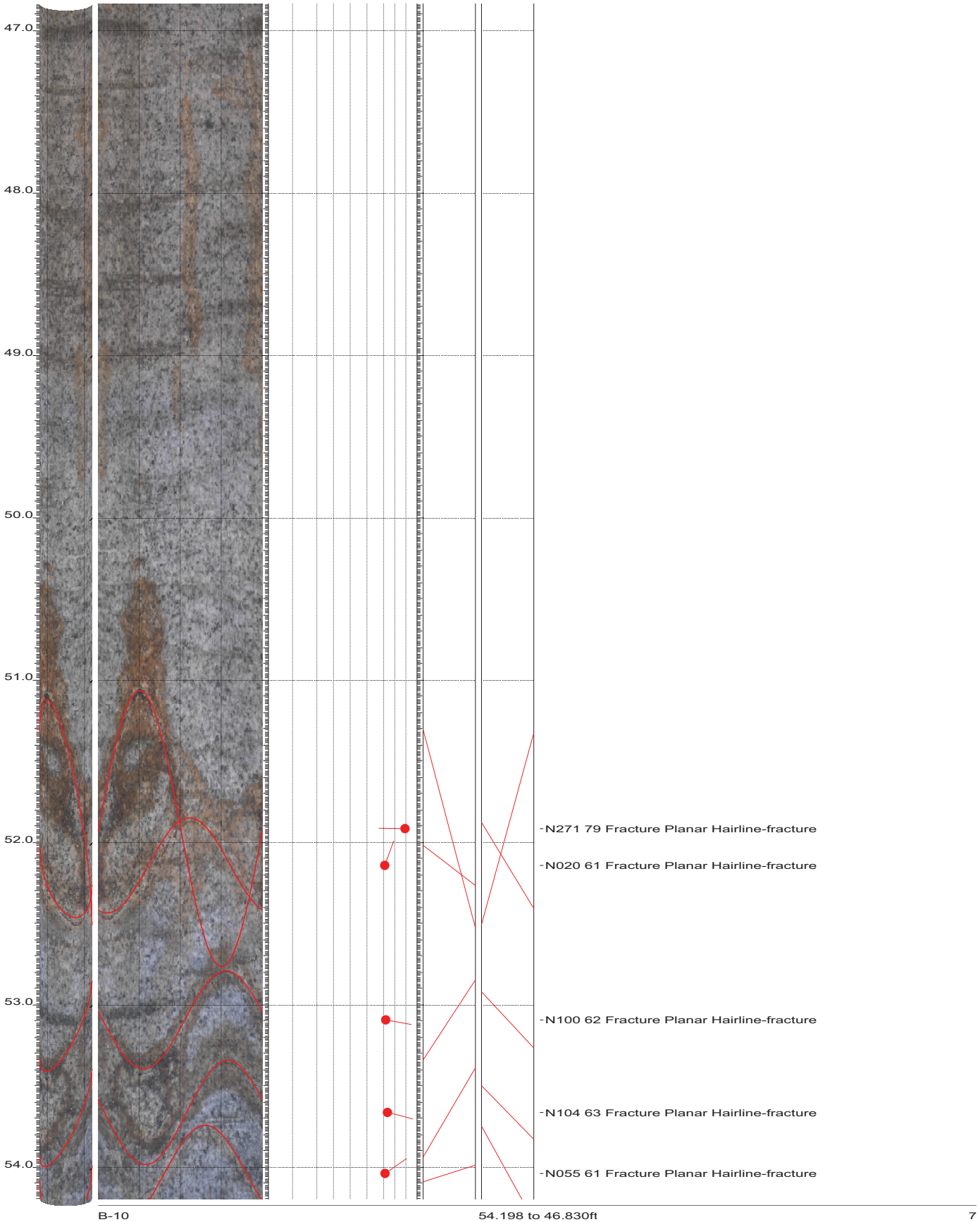
MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 3 of 12


25.0
26.0
27.0
28.0
29.0
30.0
31.0
32.0
-N184 45 Fracture Planar Open-fracture
-N181 51 Fracture Planar Open-fracture
-N344 79 Primary-structure Planar Bedding
-N332 71 Primary-structure Planar Bedding
B-10
32.094 to 24.726ft
4

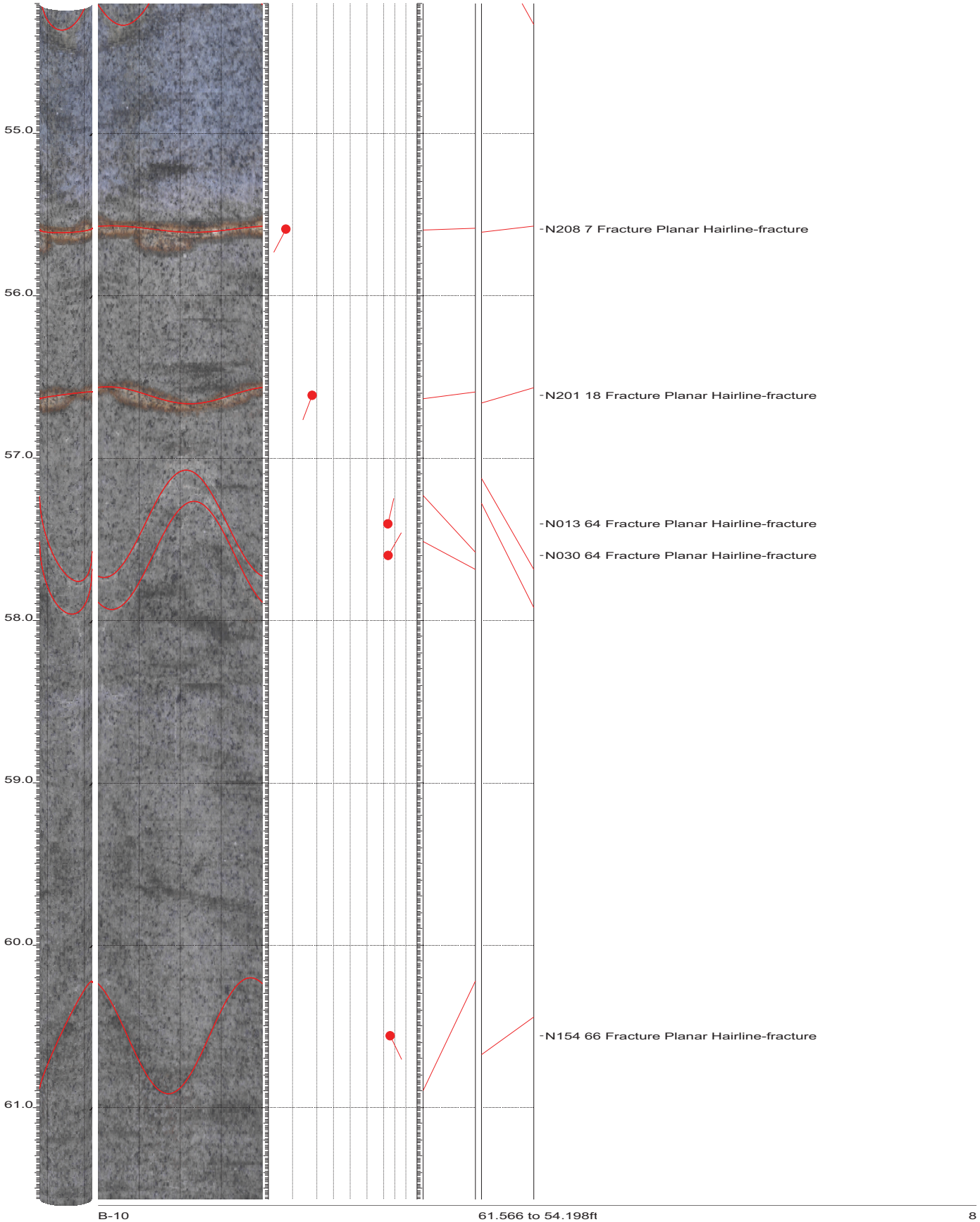

33.0
34.0
35.0
36.0
37.0
38.0
39.0
-N181 26 Fracture Planar Hairline-fracture
B-10
39.462 to 32.094ft
5



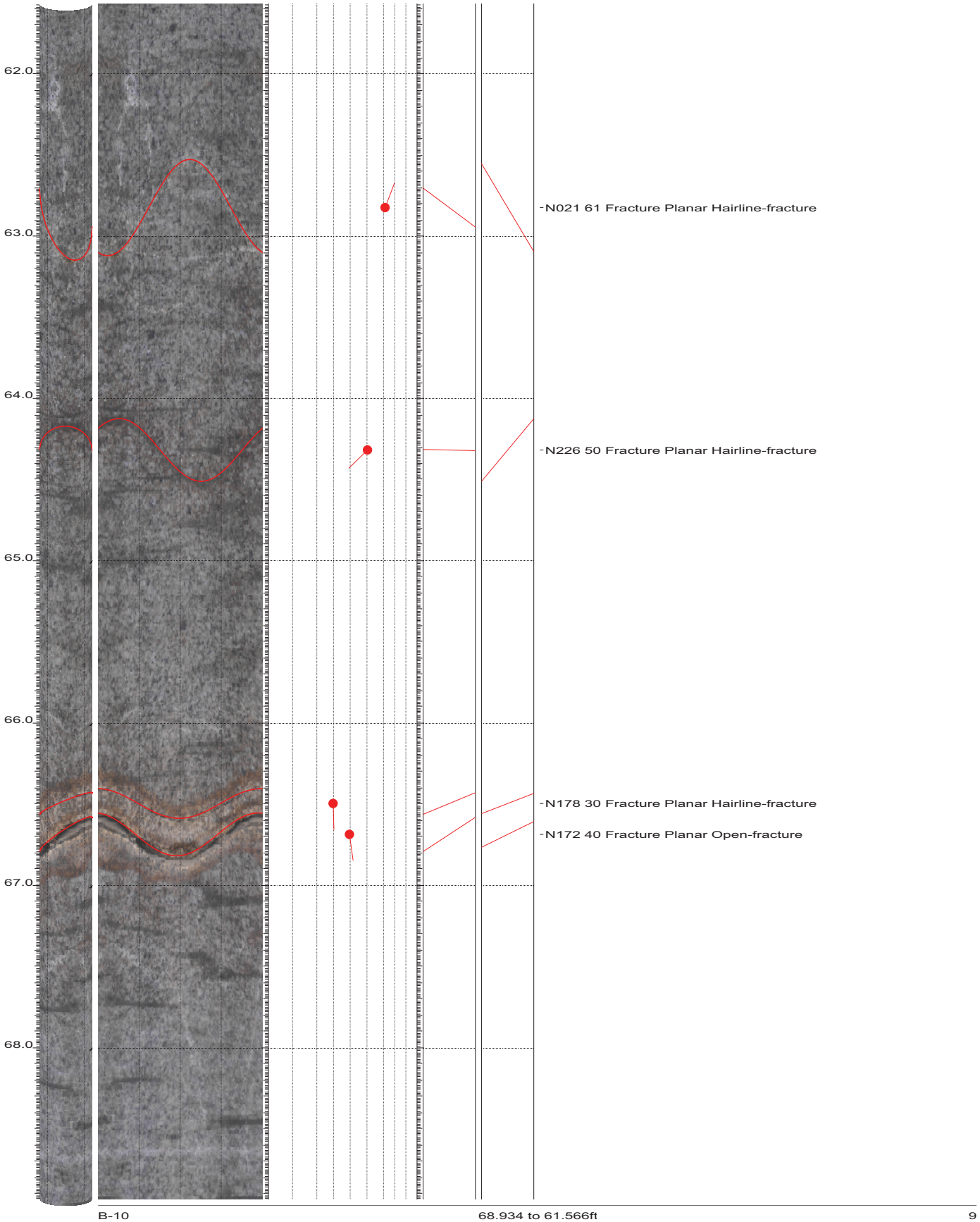
MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 6 of 12



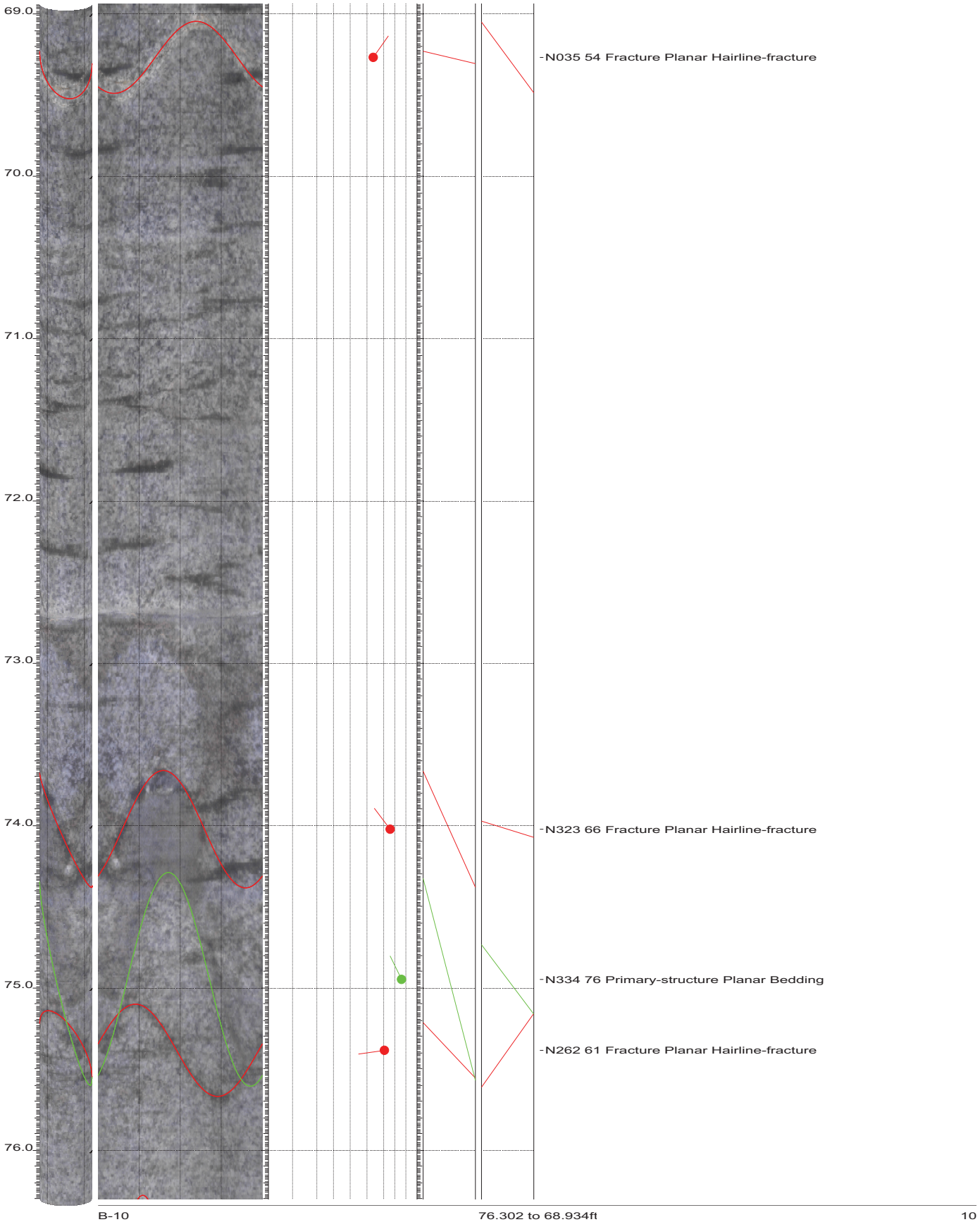
MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 7 of 12

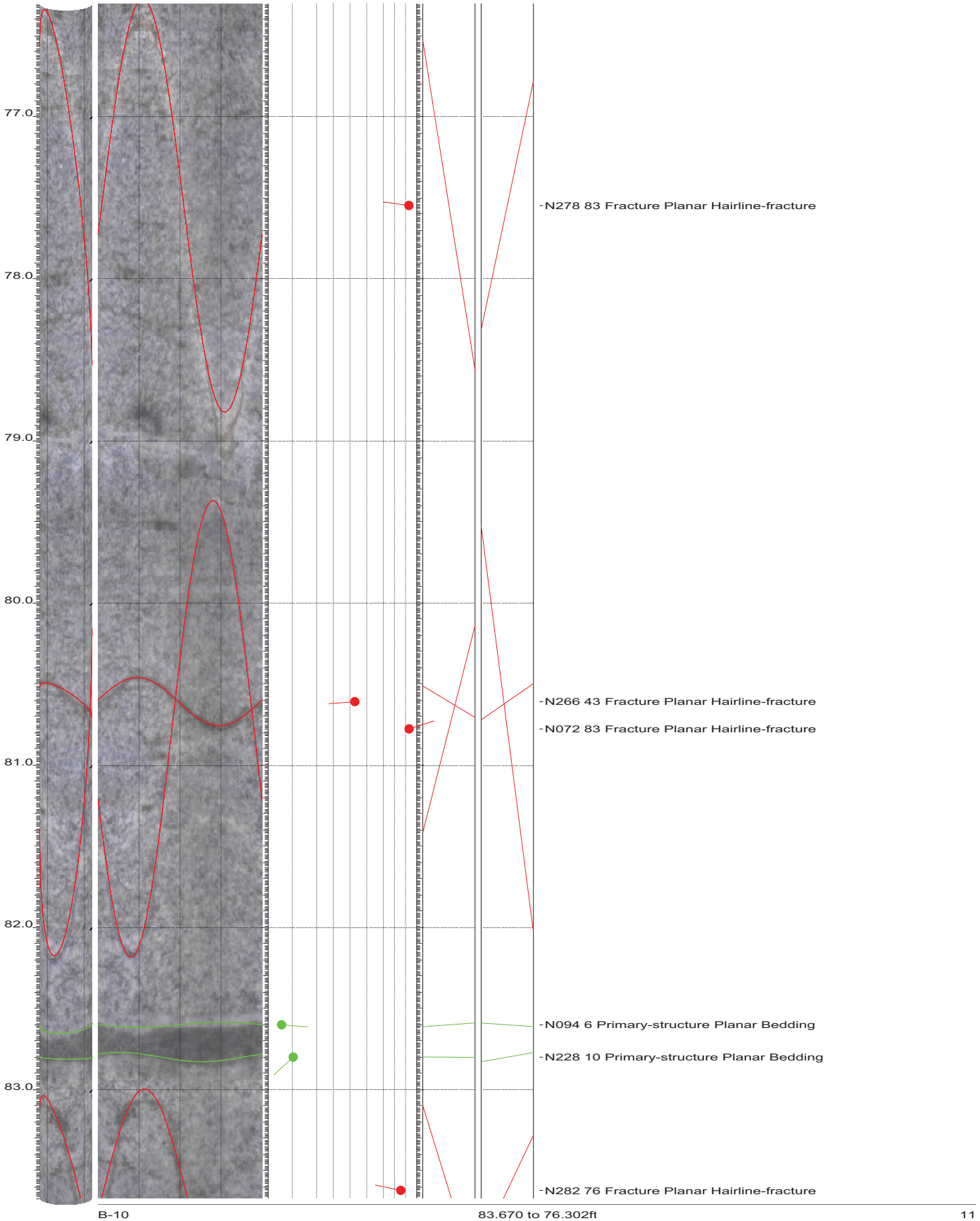


MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 8 of 12

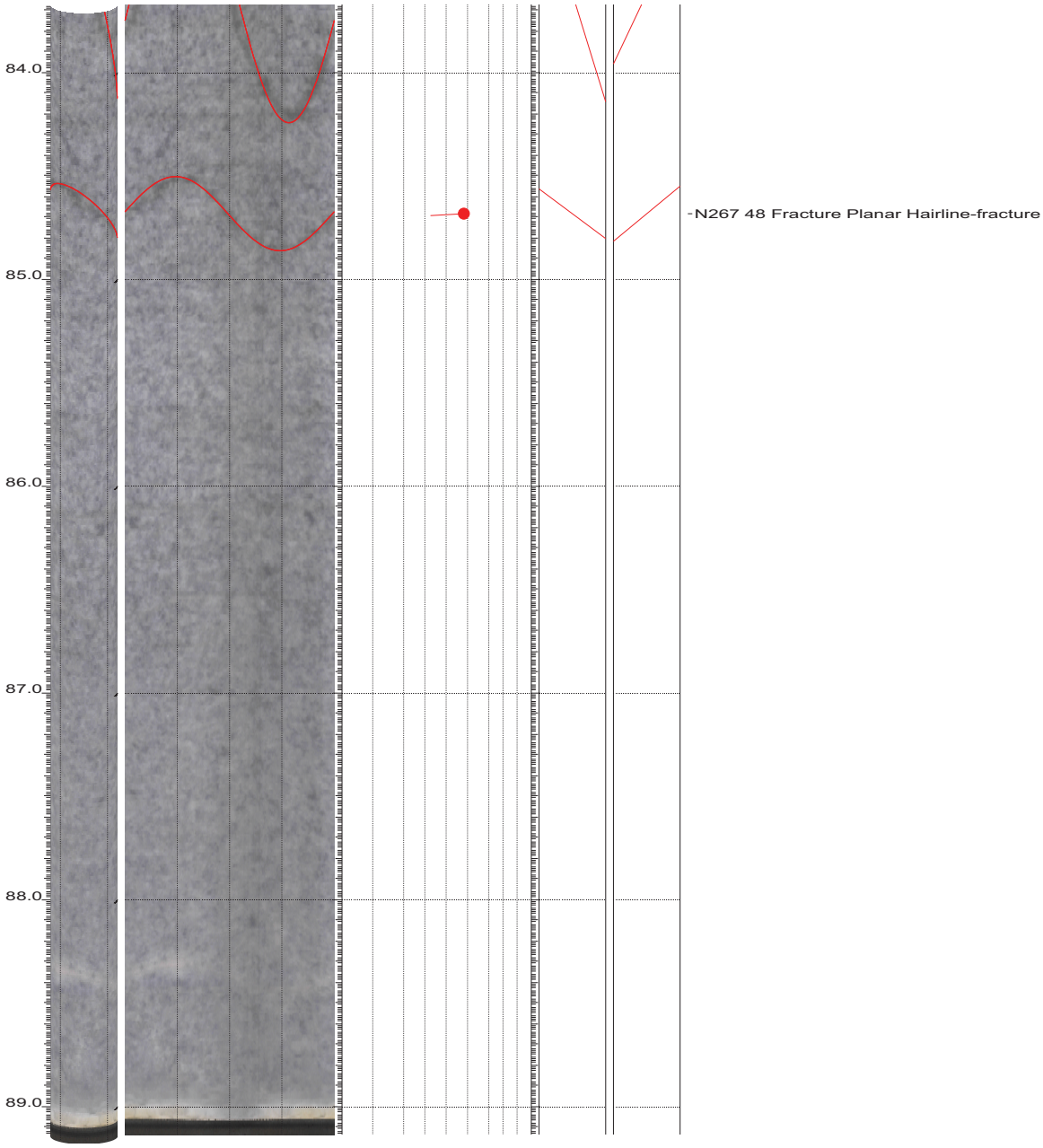


MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 9 of 12


69.0
70.0
71.0
72.0
73.0
74.0
75.0
76.0
N035 54 Fracture Planar Hairline-fracture
N323 66 Fracture Planar Hairline-fracture
N334 76 Primary-structure Planar Bedding
N262 61 Fracture Planar Hairline-fracture
B-10
76.302 to 68.934ft
10



MRDA Substation Boring B-10 Optical Televiewer Dips rev 1 Sheet 11 of 12


84.0
85.0
86.0
87.0
88.0
89.0
N267 48 Fracture Planar Hairline-fracture

BHTV DATA PROCESSING
RGLDIP vsn 6.2
INTERPRETED BHTV DIPS LOG

URS

Borehole: B-11

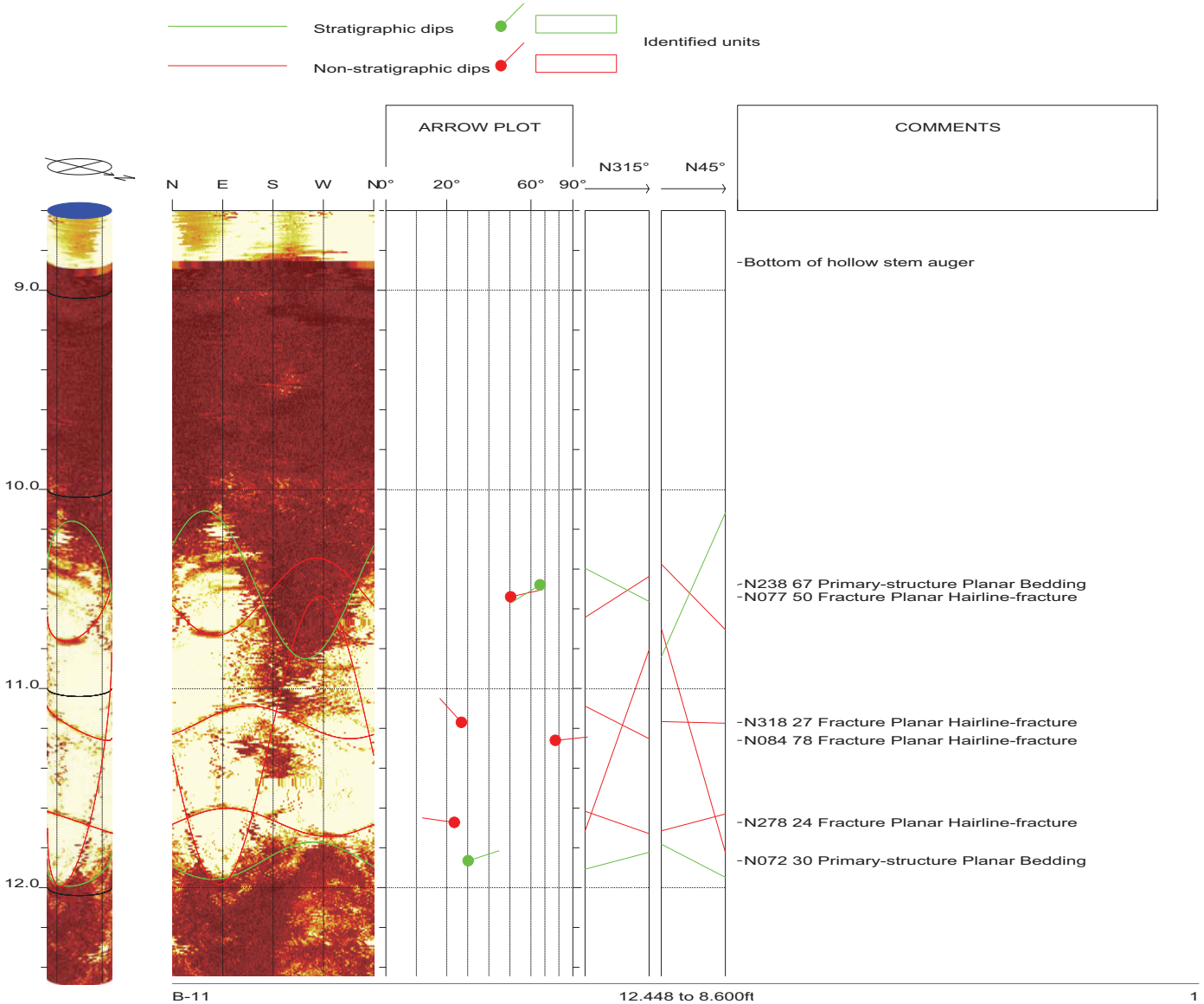
MRDA SUBSTATION

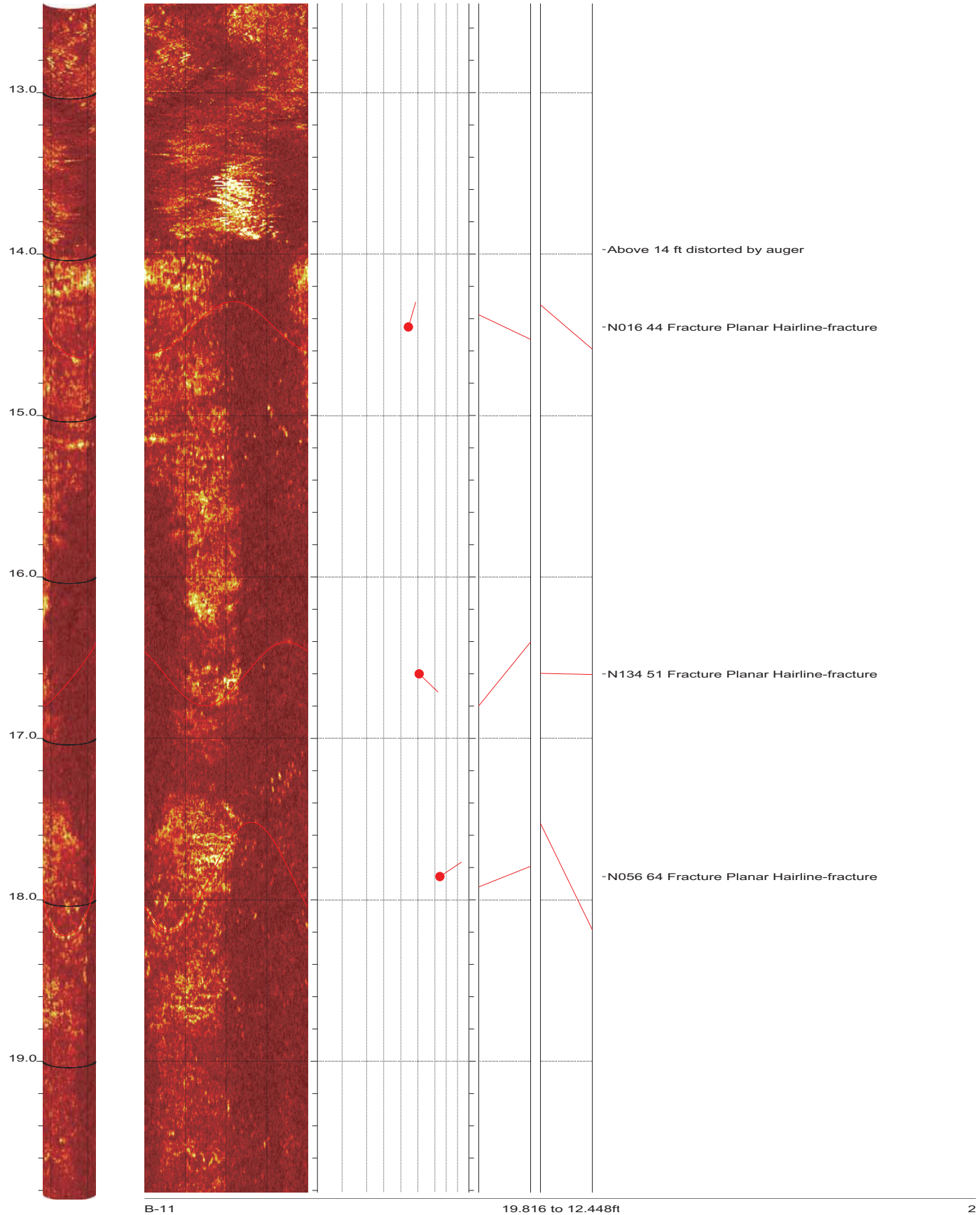
top of borehole.....
East: _
North: _
Elev: _

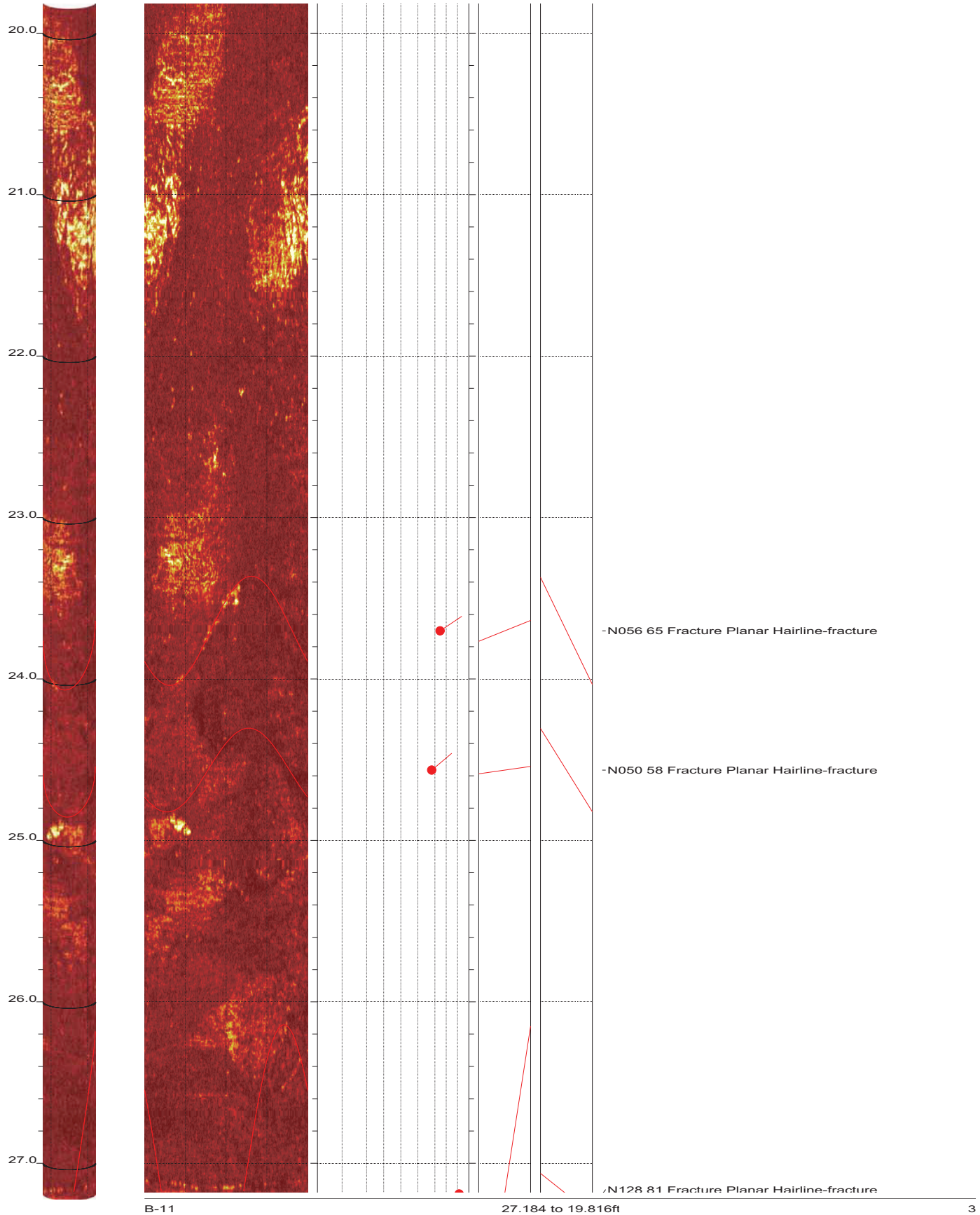
North ref. is true
Depth units are feet
Vertical scale: 1/10
Horiz scale = 1.00x Vert scale

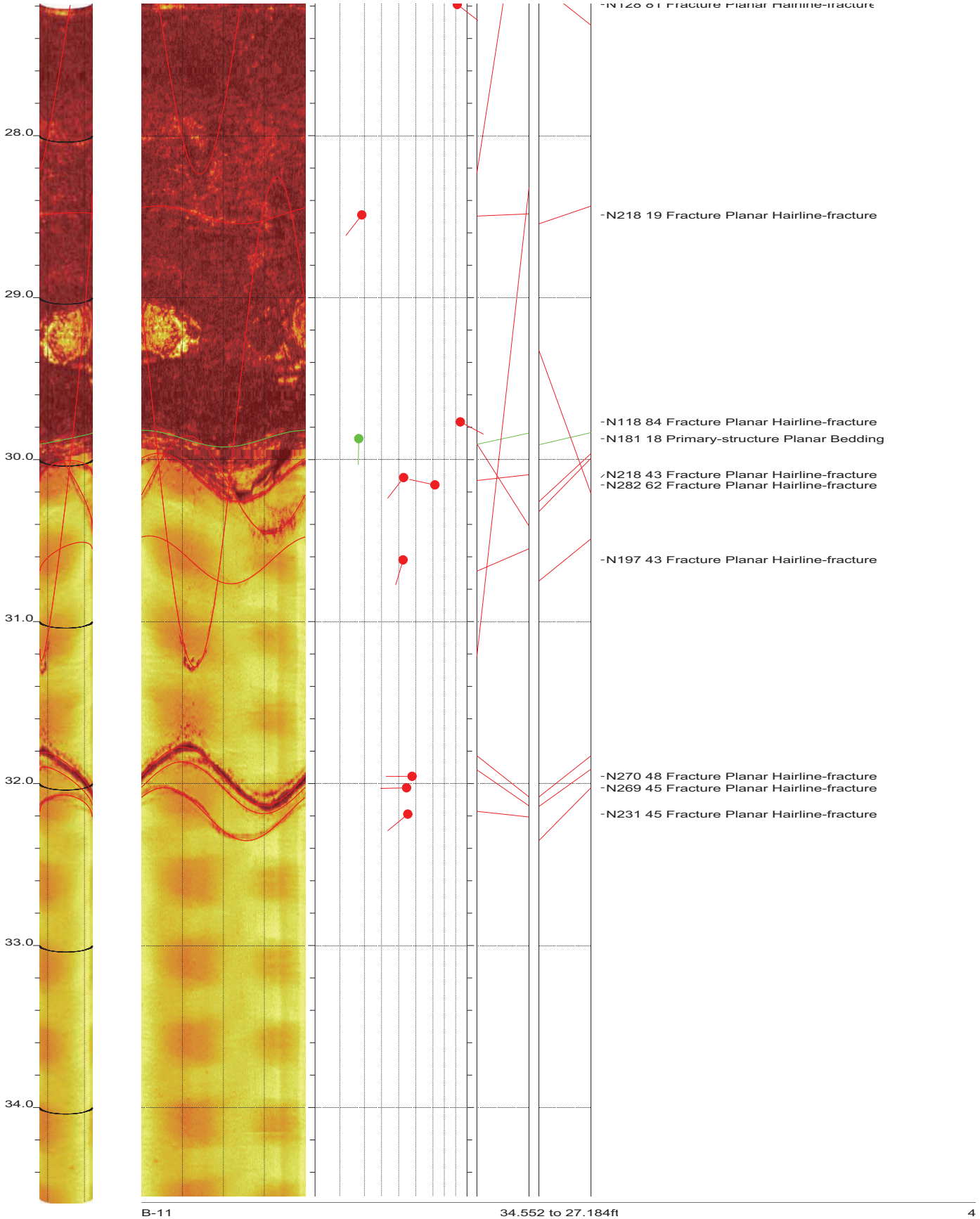
Zone from 56.400 to 8.600ft
Format: BHTV-NESWN

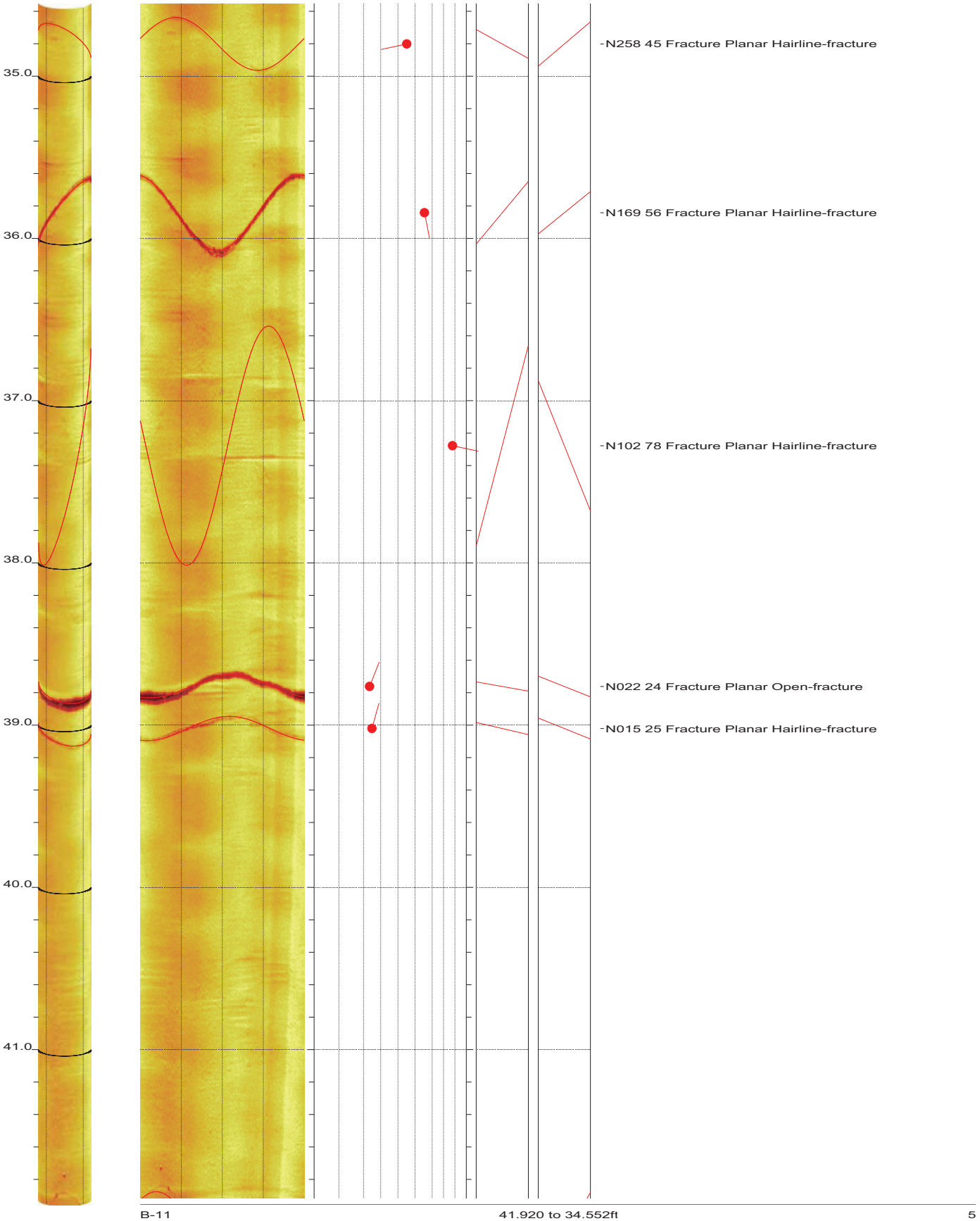
Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude

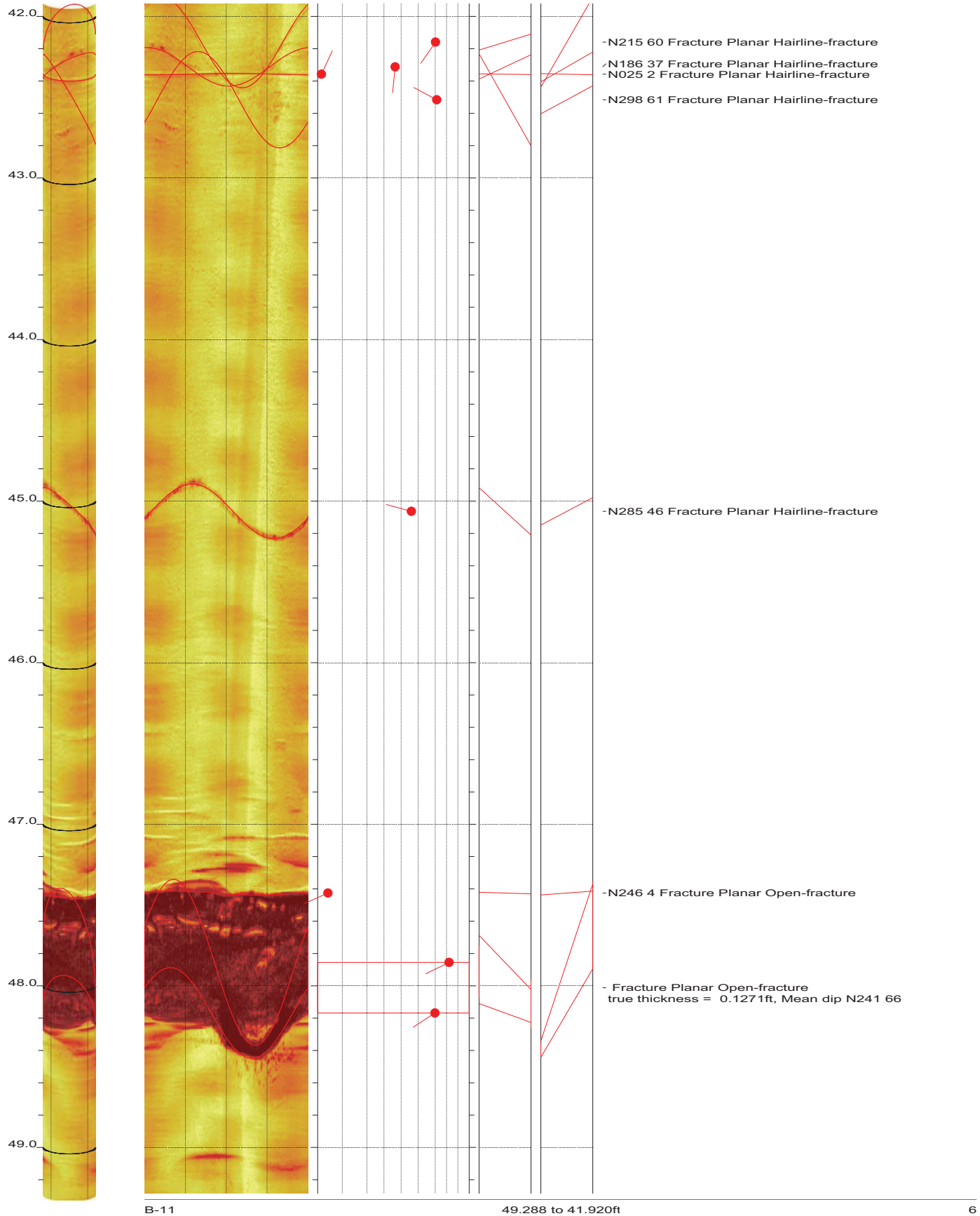


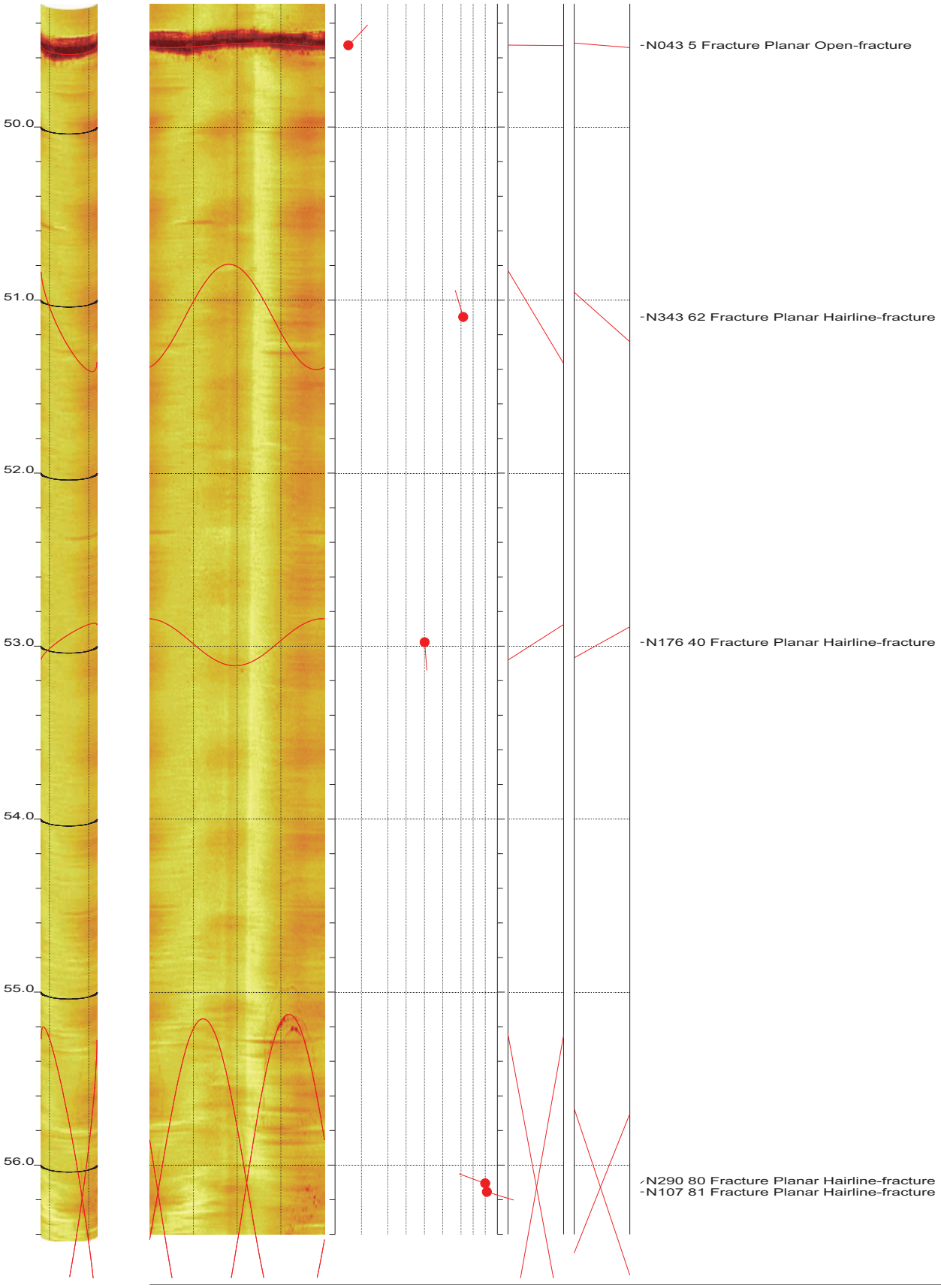

13.0
14.0
15.0
16.0
17.0
18.0
19.0
-Above 14 ft distorted by auger
-N016 44 Fracture Planar Hairline-fracture
-N134 51 Fracture Planar Hairline-fracture
-N056 64 Fracture Planar Hairline-fracture
B-11
19.816 to 12.448ft
2


20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
N056 65 Fracture Planar Hairline-fracture
N050 58 Fracture Planar Hairline-fracture
N128 81 Fracture Planar Hairline-fracture
B-11
27.184 to 19.816ft
3


-N128 81 Fracture Planar Hairline-fracture
28.0
-N218 19 Fracture Planar Hairline-fracture
29.0
-N118 84 Fracture Planar Hairline-fracture
-N181 18 Primary-structure Planar Bedding
30.0
-N218 43 Fracture Planar Hairline-fracture
-N282 62 Fracture Planar Hairline-fracture
-N197 43 Fracture Planar Hairline-fracture
31.0
-N270 48 Fracture Planar Hairline-fracture
-N269 45 Fracture Planar Hairline-fracture
32.0
-N231 45 Fracture Planar Hairline-fracture
33.0
34.0
B-11
34.552 to 27.184ft
4


35.0
36.0
37.0
38.0
39.0
40.0
41.0
N258 45 Fracture Planar Hairline-fracture
N169 56 Fracture Planar Hairline-fracture
N102 78 Fracture Planar Hairline-fracture
N022 24 Fracture Planar Open-fracture
N015 25 Fracture Planar Hairline-fracture
B-11
41.920 to 34.552ft
5


42.0
43.0
44.0
45.0
46.0
47.0
48.0
49.0
-N215 60 Fracture Planar Hairline-fracture
-N186 37 Fracture Planar Hairline-fracture
-N025 2 Fracture Planar Hairline-fracture
-N298 61 Fracture Planar Hairline-fracture
-N285 46 Fracture Planar Hairline-fracture
-N246 4 Fracture Planar Open-fracture
- Fracture Planar Open-fracture
true thickness = 0.1271ft, Mean dip N241 66
B-11
49.288 to 41.920ft
6


50.0
51.0
52.0
53.0
54.0
55.0
56.0
N043 5 Fracture Planar Open-fracture
N343 62 Fracture Planar Hairline-fracture
N176 40 Fracture Planar Hairline-fracture
N290 80 Fracture Planar Hairline-fracture
N107 81 Fracture Planar Hairline-fracture
B-11
56.400 to 49.288ft
7

APPENDIX B

TELEVIEWER FRACTURE DISTRIBUTION HISTOGRAMS

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS LOG

URS

Borehole: B-08

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

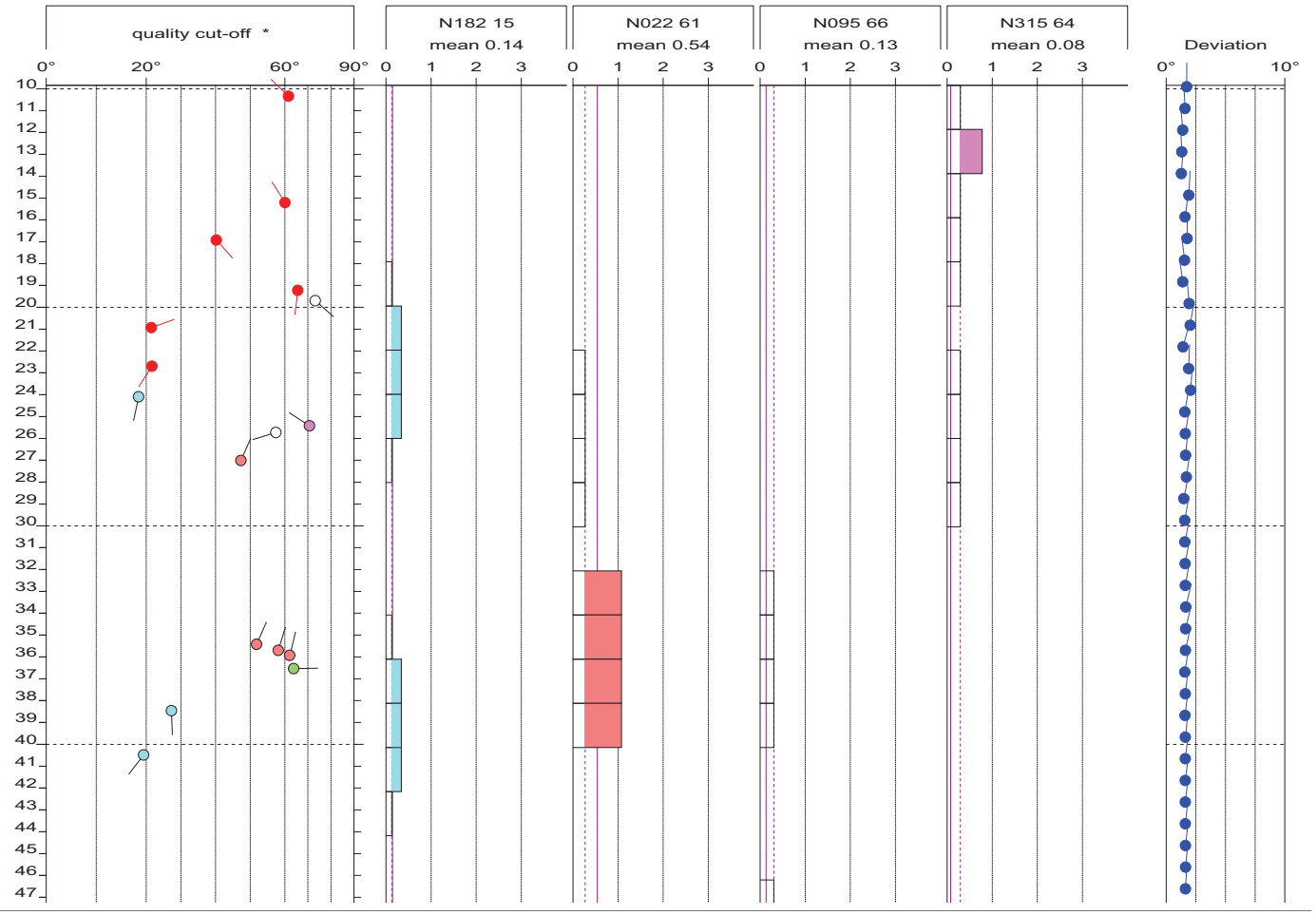
North ref: true
Depth units are feet
Vertical scale: 1/100

Zone from 102.592 to 9.841ft
Mean dip format: dip-azimuth and dip
Frequency histogram parameters:

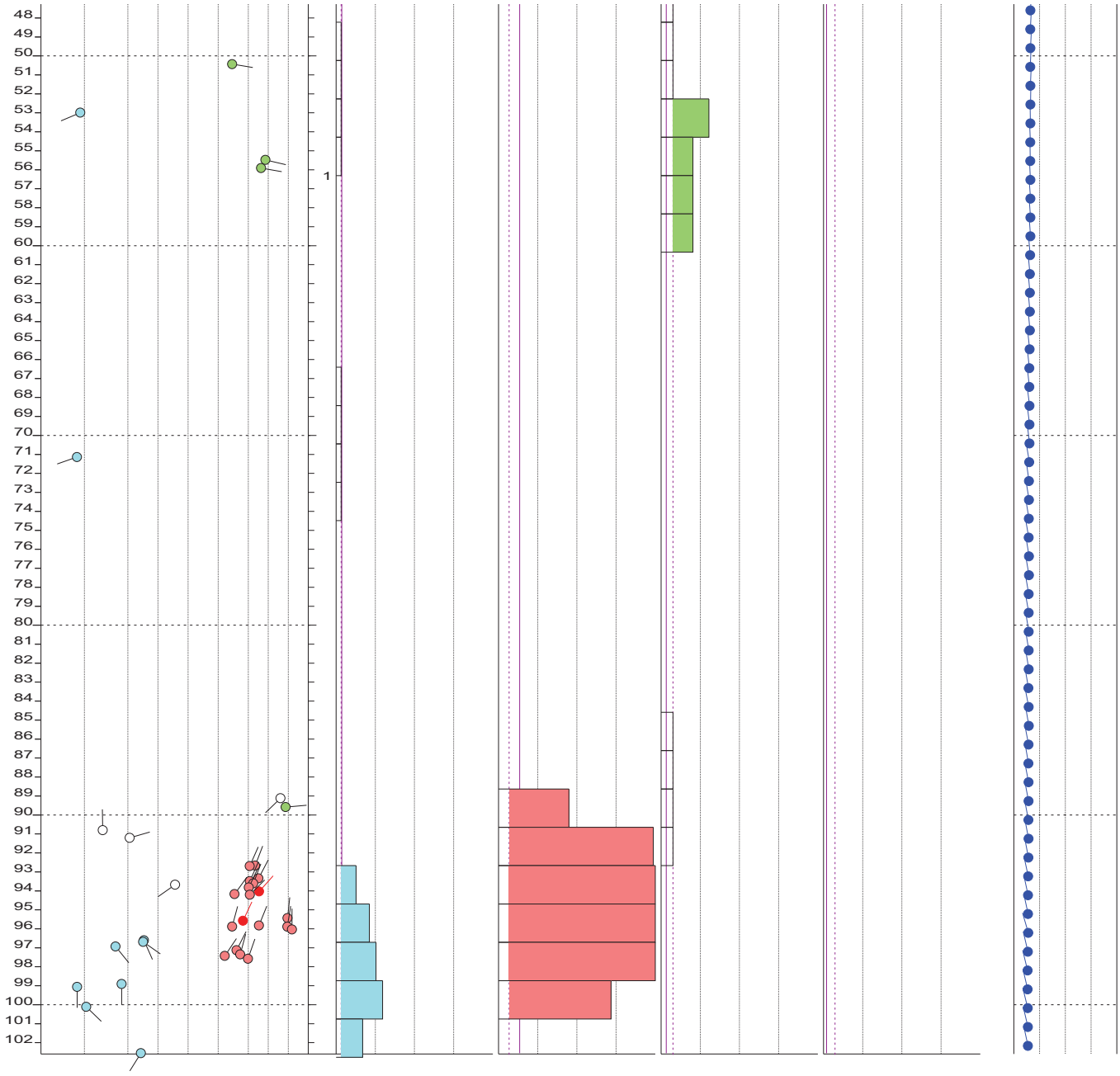
measurement distance 0.000ft
step distance 0.000ft

Interpretation 1

Dip data sets .....
BHTV dips
Highlighted dips: Fracture Planar Open-fracture
open symbols not used in mean-dip/zone-axis calculation



B-08, Interpretation 1 47.271 to 9.841fl 1


48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
1

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS LOG

URS

Borehole: B-09

_

top of borehole.....
East:_
North:_
Elev:_

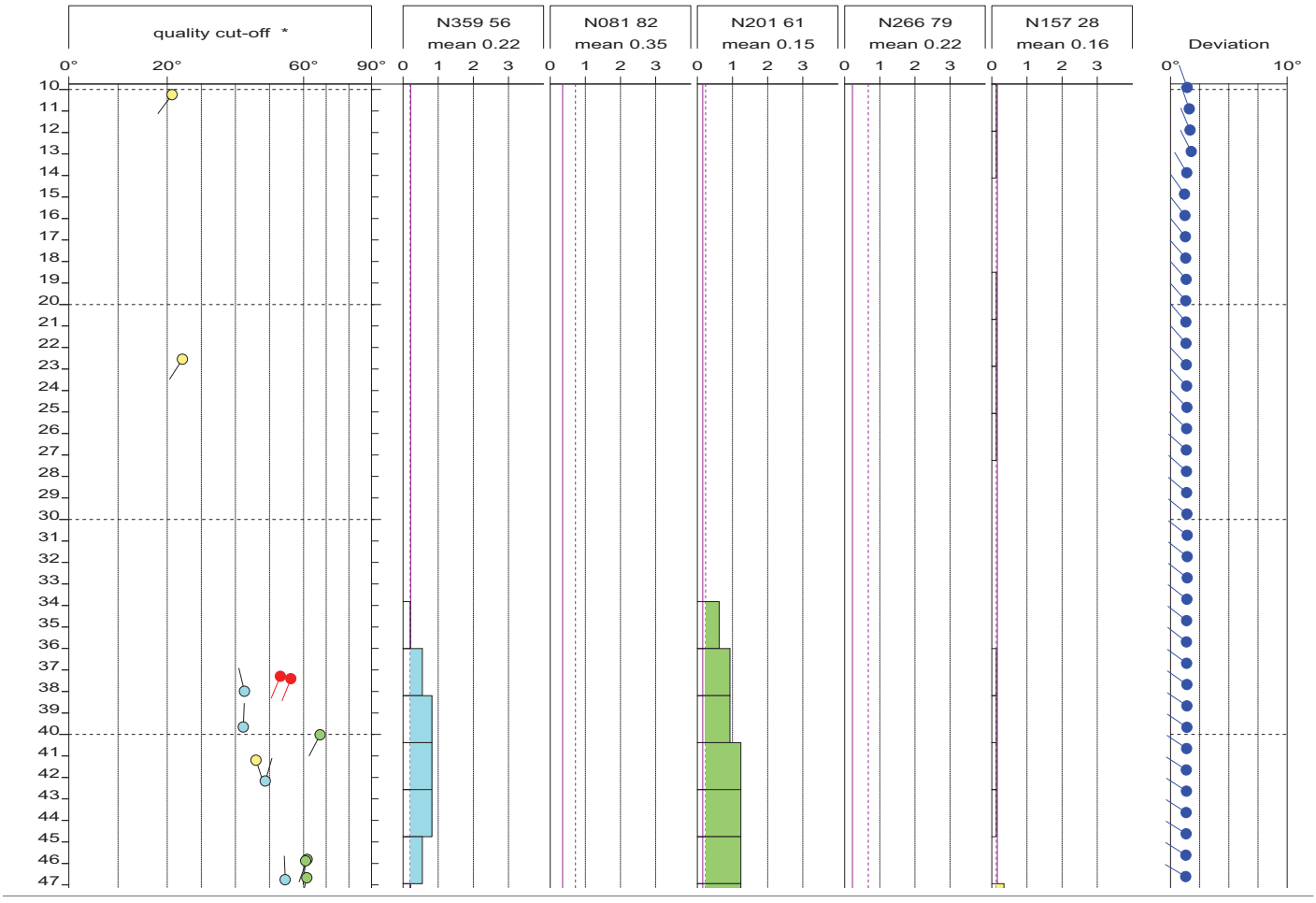
North ref: true
Depth units are feet
Vertical scale: 1/100

Zone from 117.087 to 9.741ft
Mean dip format: dip-azimuth and dip
Frequency histogram parameters:

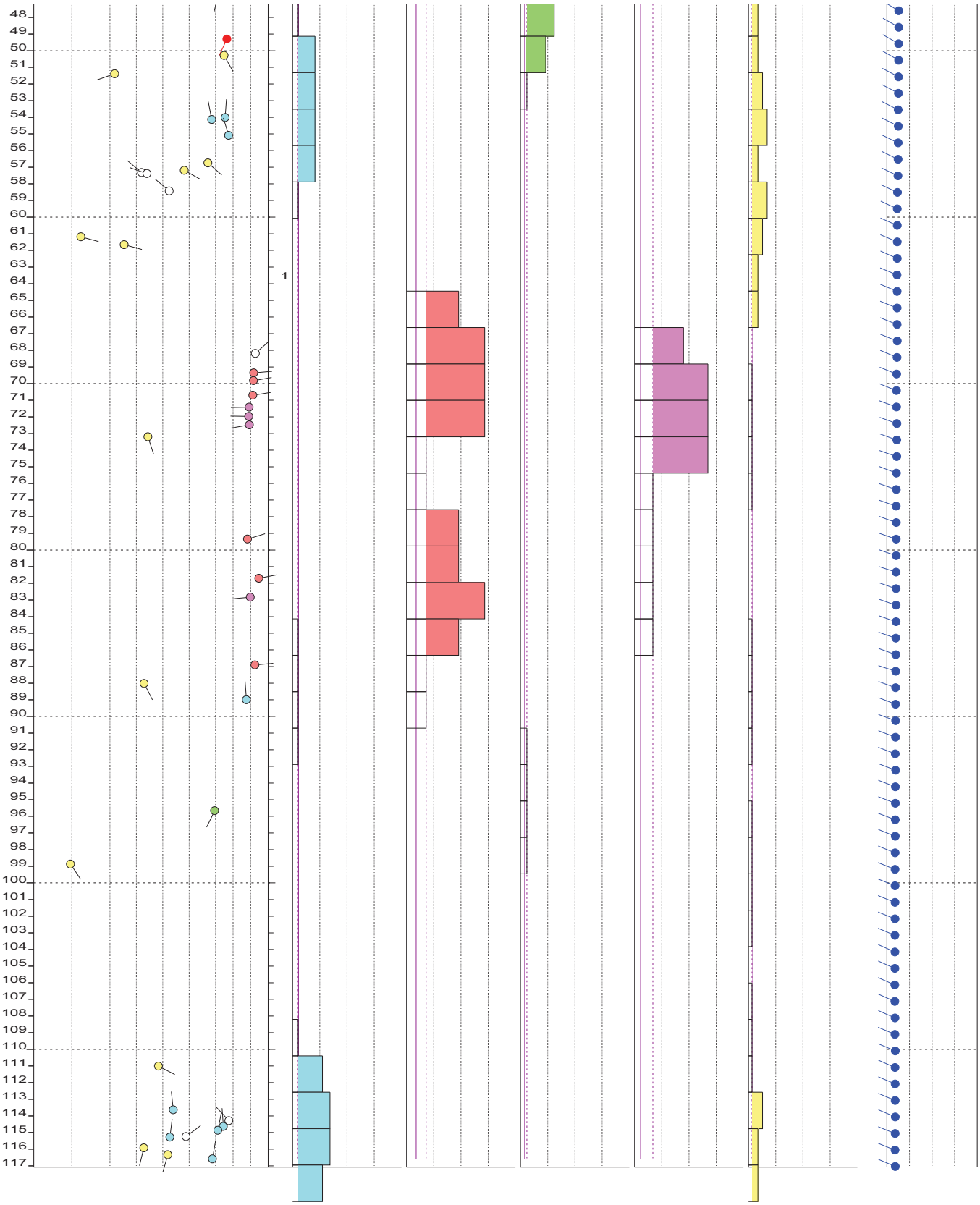
measurement distance 0.000ft
step distance 0.000ft

Interpretation 1

Dip data sets .....
BHTV dips
Highlighted dips: Fracture Planar Open-fracture
open symbols not used in mean-dip/zone-axis calculation



B09, Interpretation 1 47.171 to 9.741fl 1



B09, Interpretation 1 117.087 to 47.171ft 2

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS LOG

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

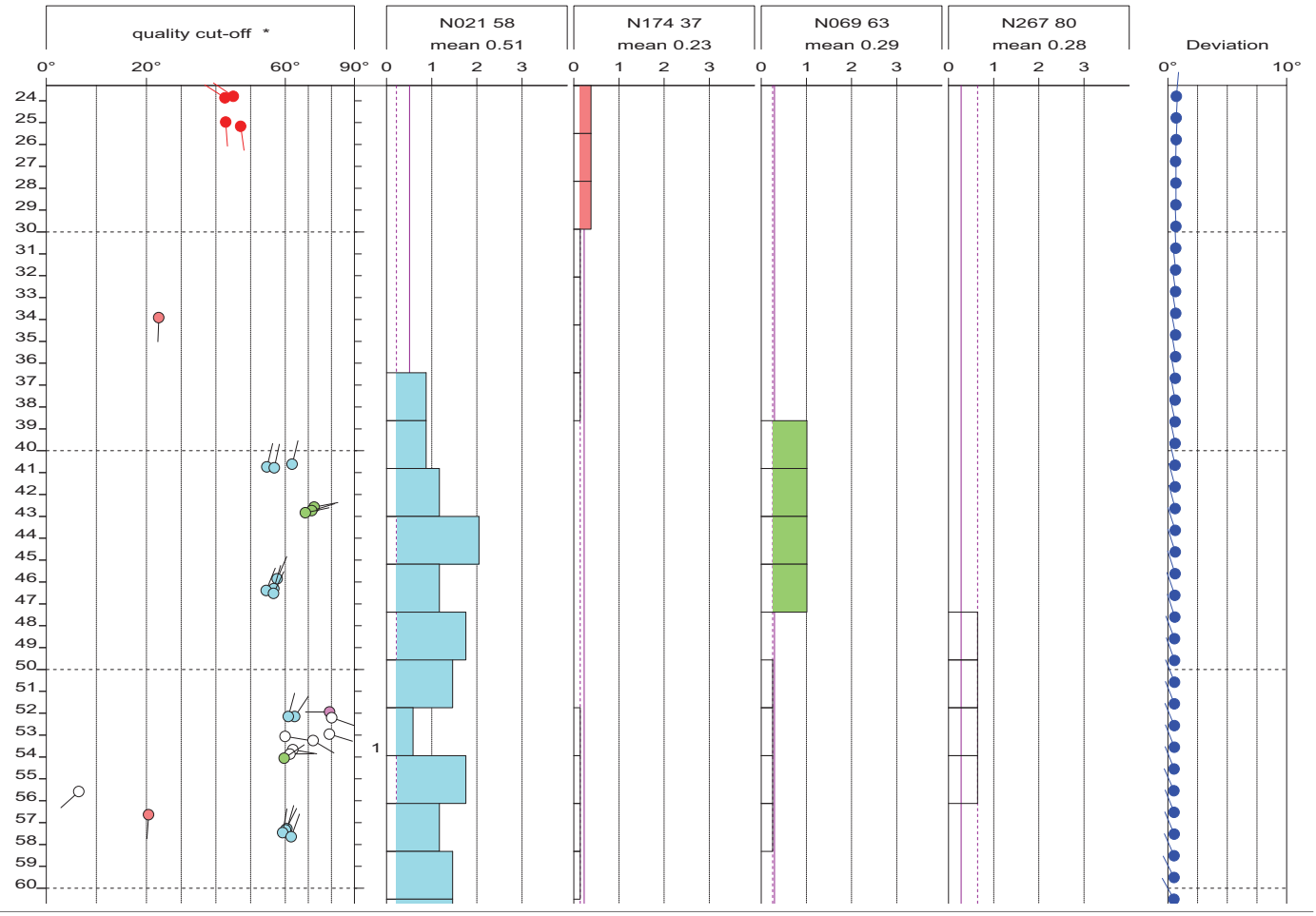
North ref: true
Depth units are feet
Vertical scale: 1/100

Zone from 83.593 to 23.300ft
Mean dip format: dip-azimuth and dip
Frequency histogram parameters:

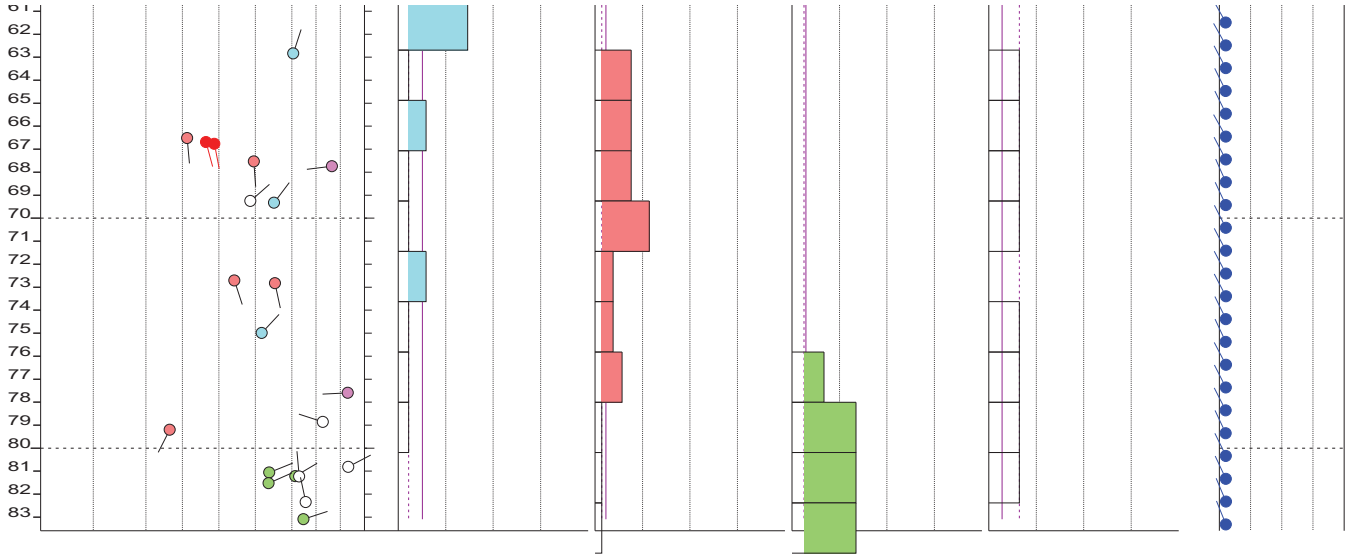
measurement distance 0.000ft
step distance 0.000ft

Interpretation 1

Dip data sets .....
BHTV dips
Highlighted dips: Fracture Planar Open-fracture
open symbols not used in mean-dip/zone-axis calculation



B-10, Interpretation 1 60.730 to 23.300ft 1


61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS LOG

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:
North:
Elev:

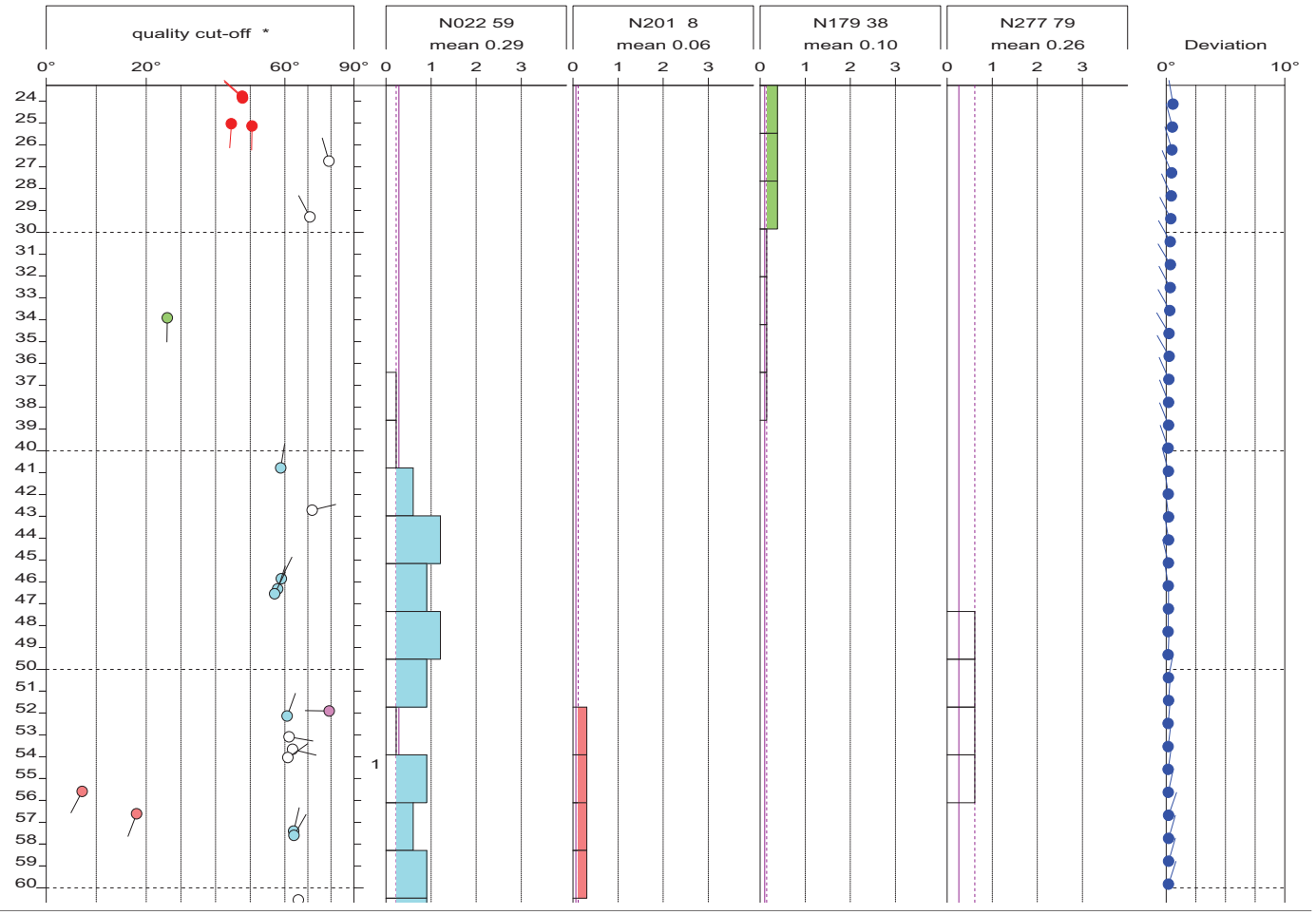
North ref: true
Depth units are feet
Vertical scale: 1/100

Zone from 85.182 to 23.273ft
Mean dip format: dip-azimuth and dip
Frequency histogram parameters:

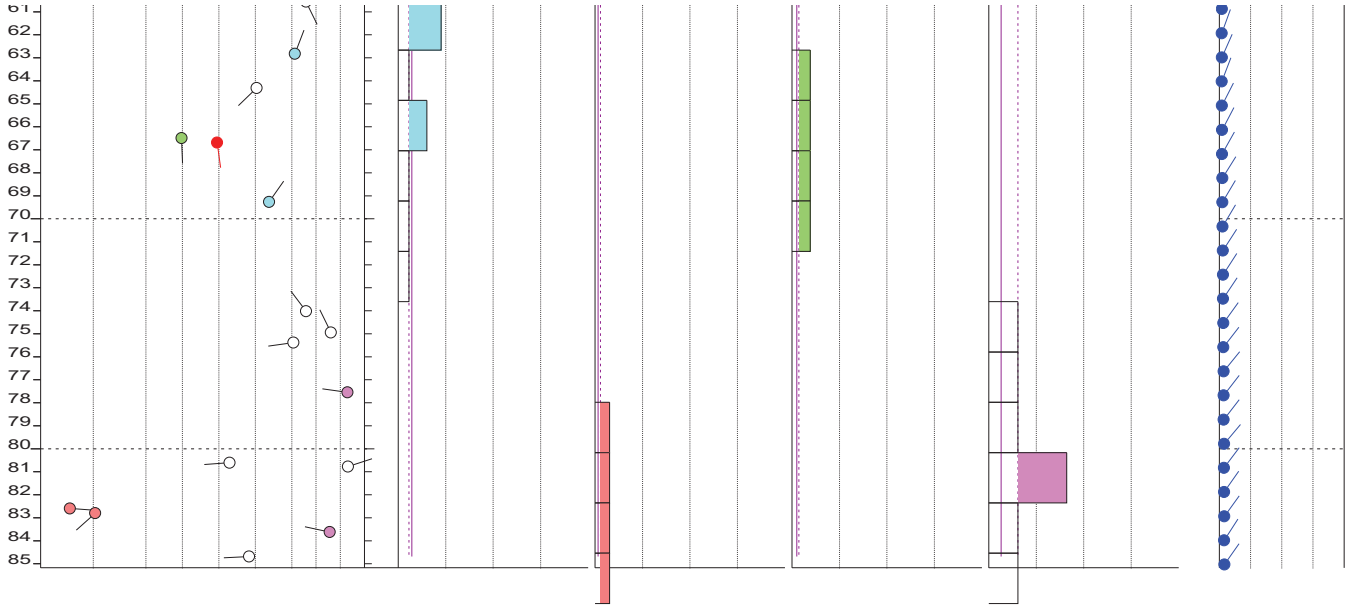
measurement distance 0.000ft
step distance 0.000ft

Interpretation 1

Dip data sets .....
OPTV dips
Highlighted dips: Fracture Planar Open-fracture
open symbols not used in mean-dip/zone-axis calculation



B-10, Interpretation 1 60.703 to 23.273fl 1


61
62
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DIP DATA INTERPRETATION
RGLDIP vsn 6.2
FRACTURE ANALYSIS LOG

18 Jan 2009

URS

Borehole: B-11

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Elev:_

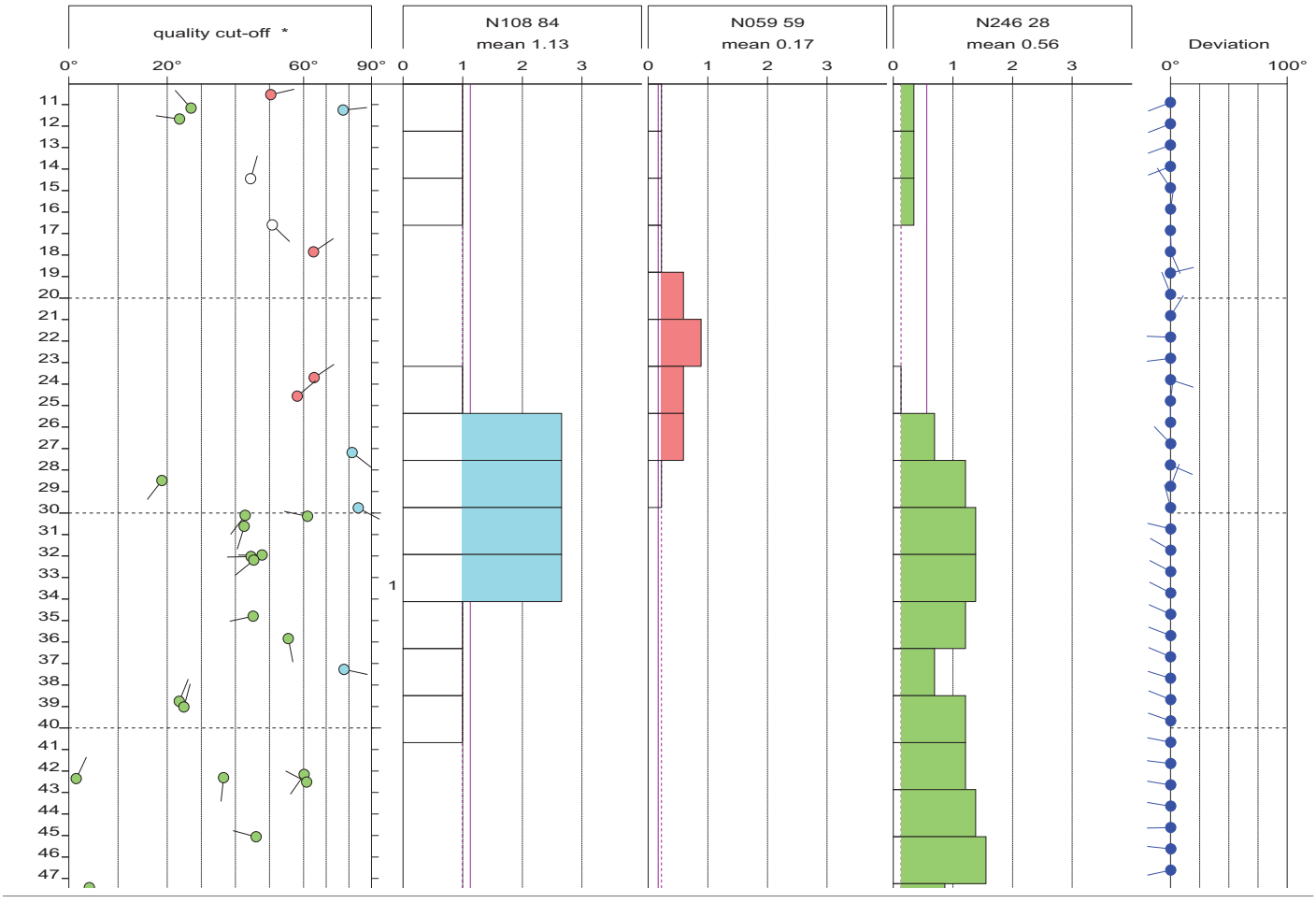
North ref: true
Depth units are feet
Vertical scale: 1/100

Zone from 56.436 to 10.040ft
Mean dip format: dip-azimuth and dip
Frequency histogram parameters:

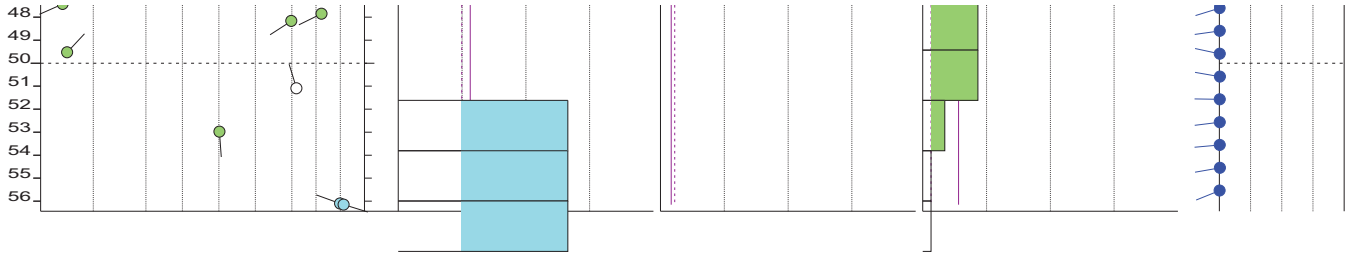
measurement distance 0.000ft
step distance 0.000ft

Interpretation 1

Dip data sets .....
BHTV dips
Highlighted dips: Fracture Planar Fresh Open-fracture
open symbols not used in mean-dip/zone-axis calculation



B-11, Interpretation 1 47.470 to 10.040ft 1


48
49
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APPENDIX C

TELEVIEWER ROSE DIAGRAMS

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
DIP-AZIMUTH, FRACTURE ROSE-DIAGRAM

URS

Borehole: B-08

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Alt: _

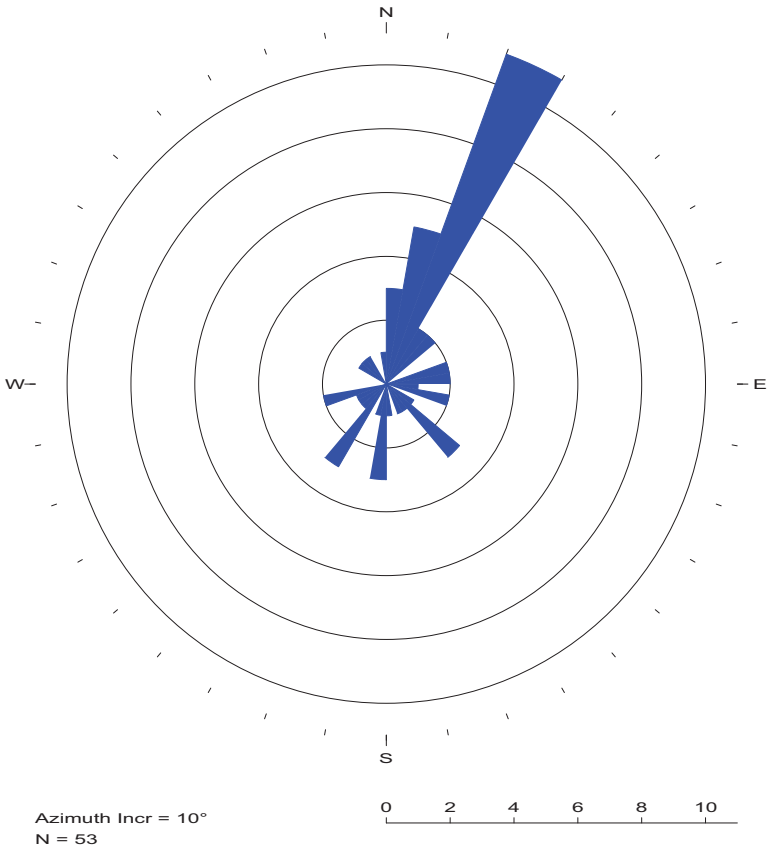
North ref. is true
Depth units are feet

Zone from 102.592 to 9.841ft

Interpretation 1

Dip data sets .....
BHTV dips

B-08
9.841 - 102.592ft
Dip-azimuth, fracture rose-diagram



Azimuth Incr = 10°
N = 53

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
DIP-AZIMUTH, FRACTURE ROSE-DIAGRAM

URS

Borehole: B-09

_

top of borehole.....
East:_
North:_
Alt: _

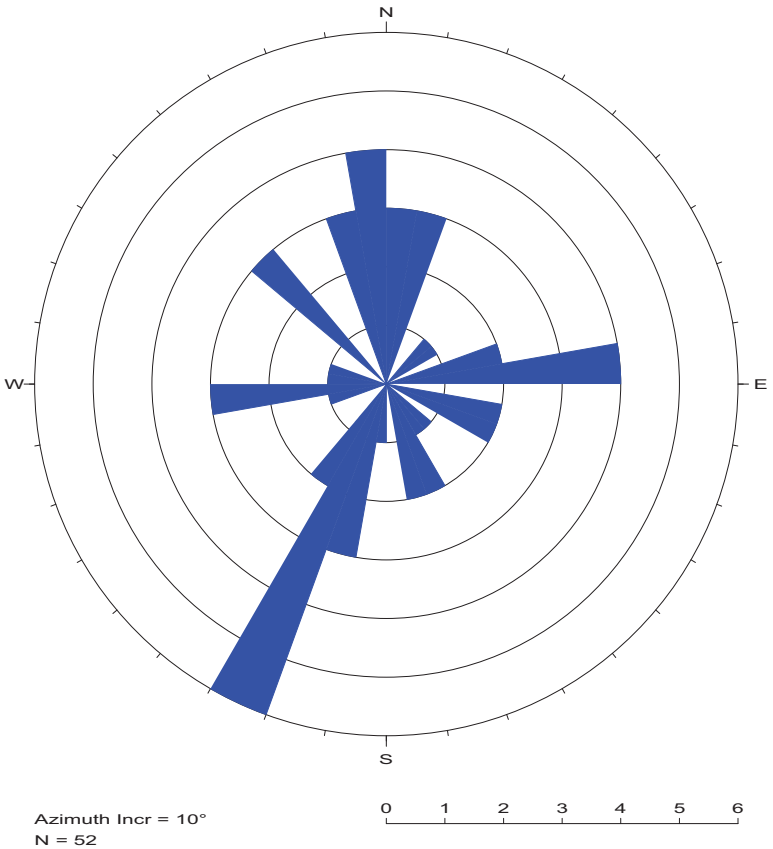
North ref. is true
Depth units are feet

Zone from 117.087 to 9.741ft

Interpretation 1

Dip data sets .....
BHTV dips

B09
9.741 - 117.087ft
Dip-azimuth, fracture rose-diagram



Azimuth Incr = 10°
N = 52

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
DIP-AZIMUTH, FRACTURE ROSE-DIAGRAM

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Alt: _

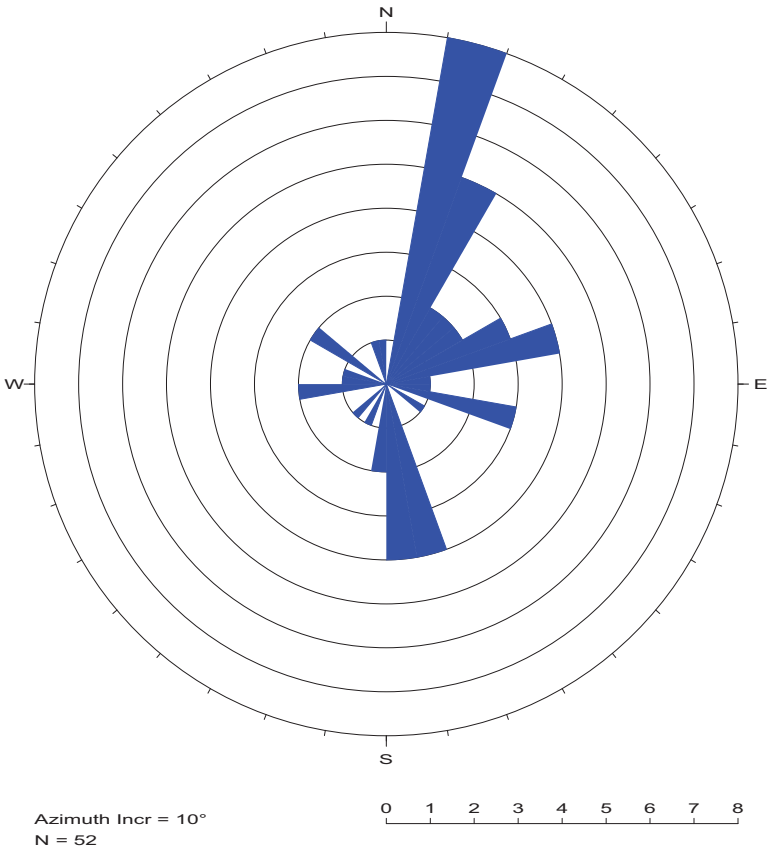
North ref. is true
Depth units are feet

Zone from 83.593 to 23.300ft

Interpretation 1

Dip data sets .....
BHTV dips

B-10
23.300 - 83.593ft
Dip-azimuth, fracture rose-diagram



Azimuth Incr = 10°
N = 52

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
DIP-AZIMUTH, FRACTURE ROSE-DIAGRAM

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East:
North:
Alt:

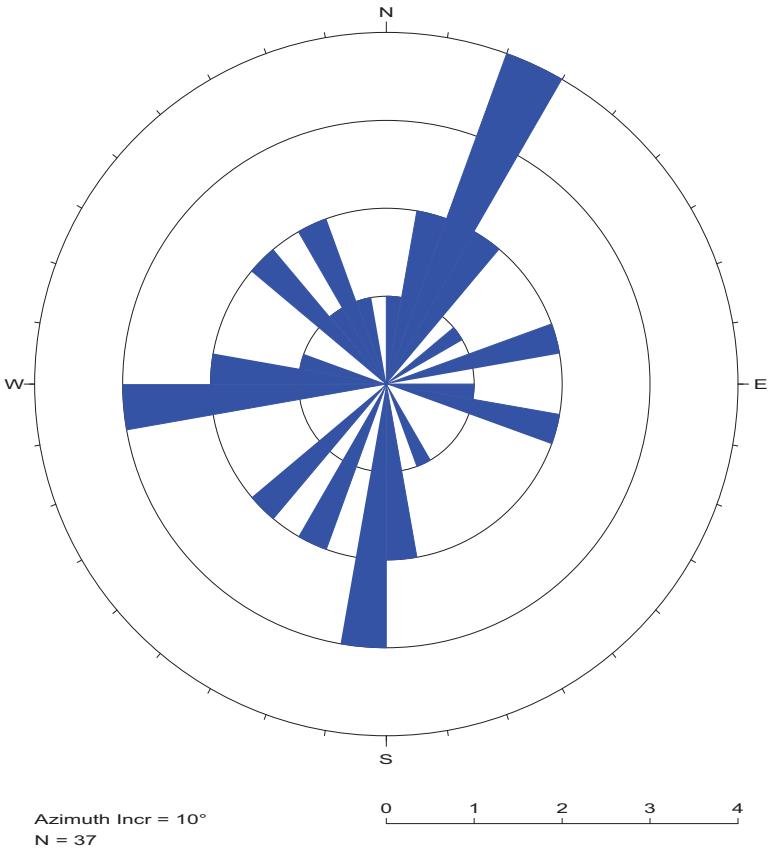
North ref. is true
Depth units are feet

Zone from 85.182 to 23.273ft

Interpretation 1

Dip data sets .....
OPTV dips

B-10
23.273 - 85.182ft
Dip-azimuth, fracture rose-diagram



Azimuth Incr = 10°
N = 37

DIP DATA INTERPRETATION
RGLDIP vsn 6.2
DIP-AZIMUTH, FRACTURE ROSE-DIAGRAM

18 Jan 2009

URS

Borehole: B-11

MRDA SUBSTATION

top of borehole.....
East:_
North:_
Alt: _

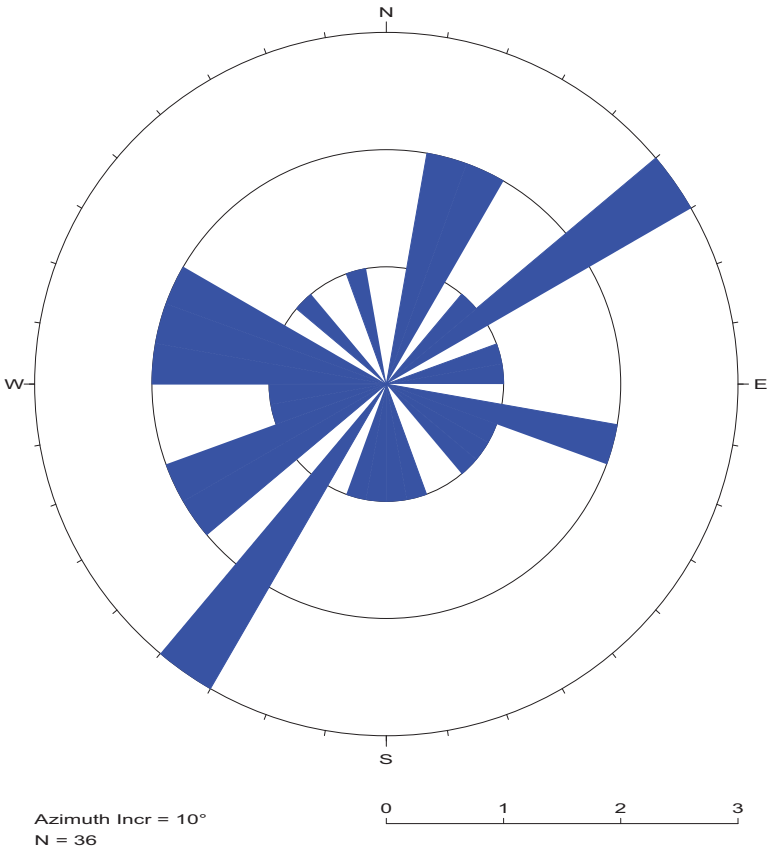
North ref. is true
Depth units are feet

Zone from 56.436 to 10.040ft

Interpretation 1

Dip data sets .....
BHTV dips

B-11
10.040 - 56.436ft
Dip-azimuth, fracture rose-diagram



Azimuth Incr = 10°
N = 36

APPENDIX D

ACOUSTIC TELEVIEWER BASED CALIPER LOGS

BHTV DATA PROCESSING
RGLDIP vsn 6.2
ACOUSTIC CALIPER LOG

URS

Borehole: B-08

MRDA SUBSTATION

top of borehole.....
East: _
North: _
Elev: _

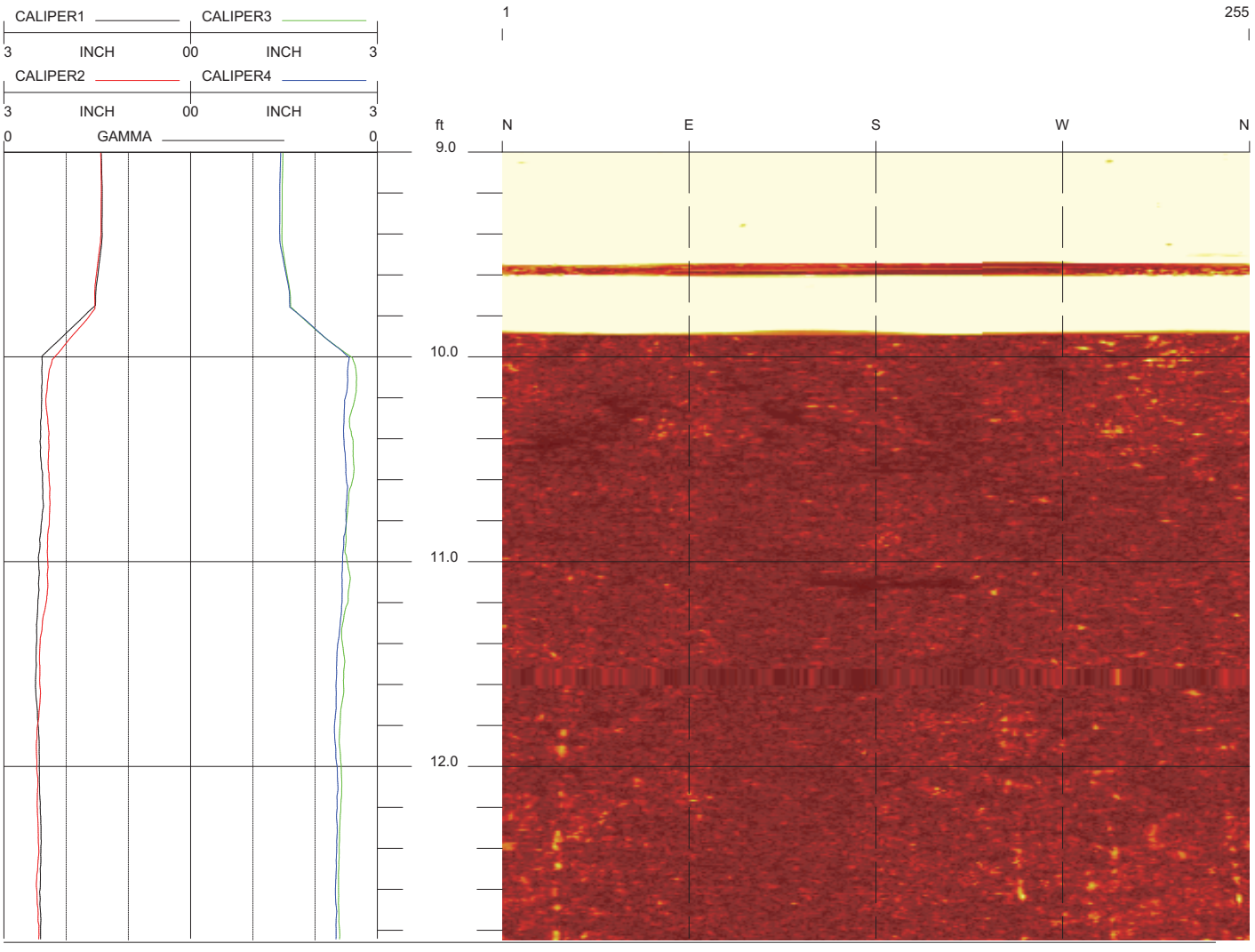
North ref. is true
Depth units are feet
Vertical scale: 1/10

Zone from 102.592 to 9.000ft

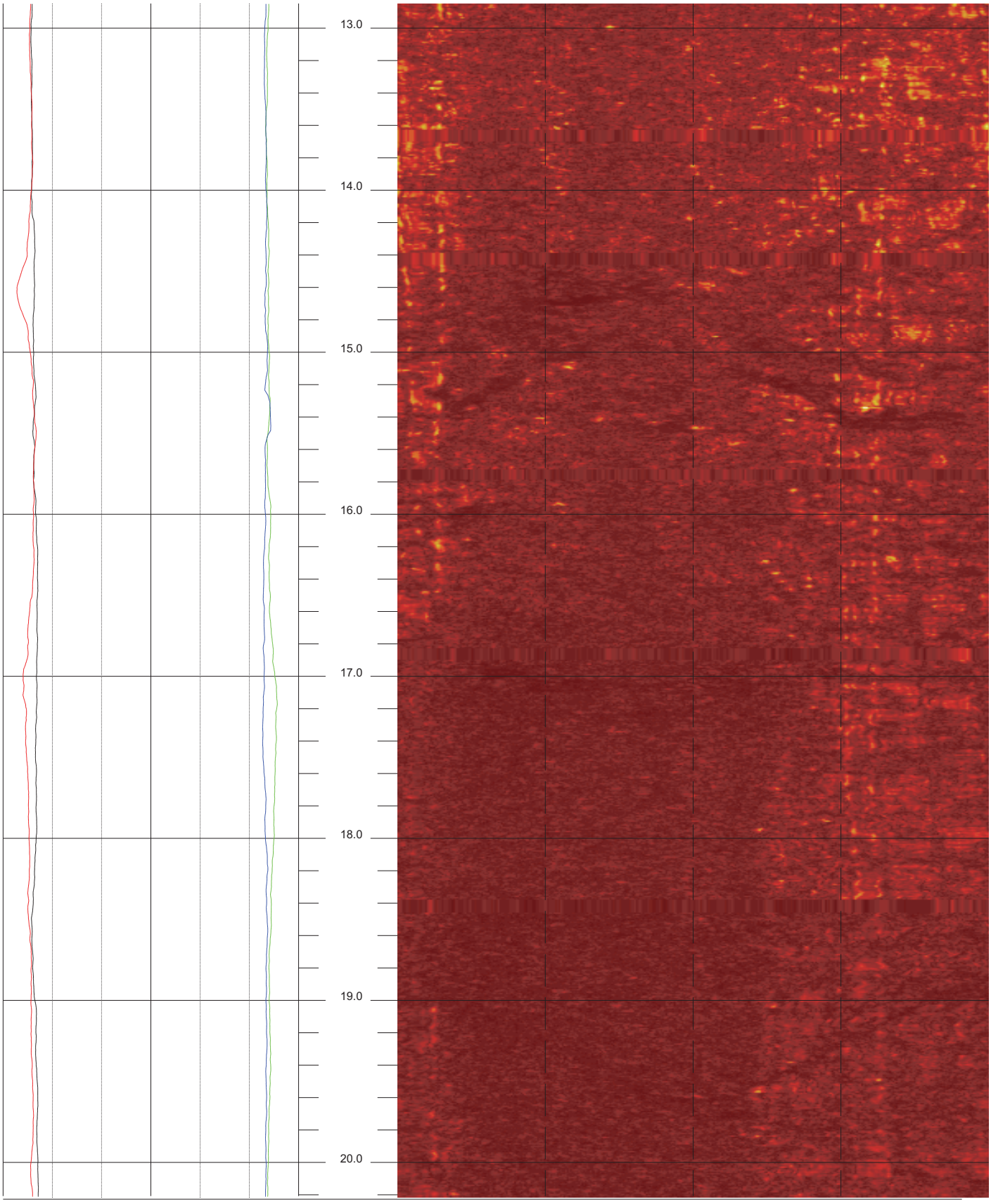
Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude

Depth interval 0.008ft, Filter length 0.248ft

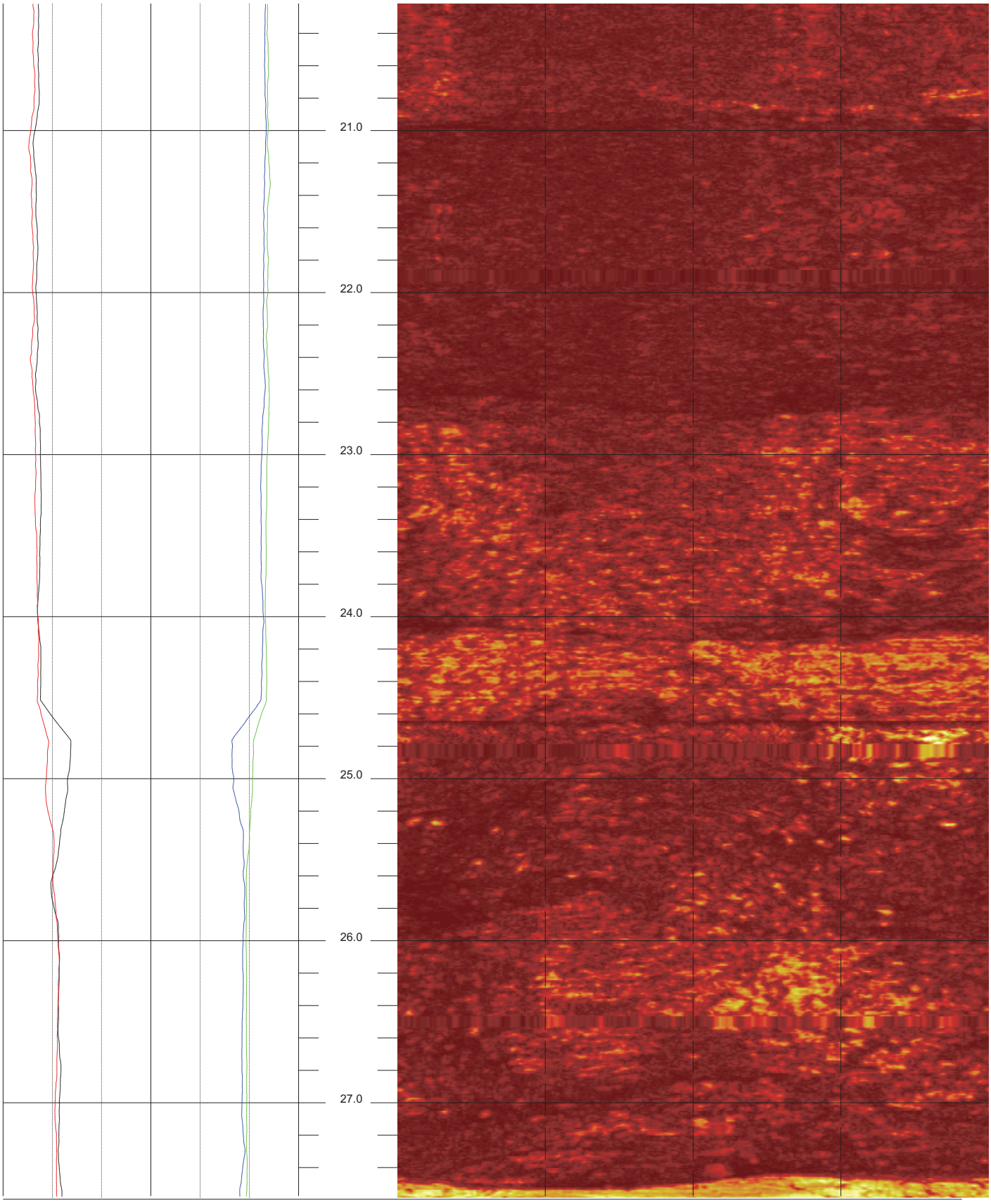
REFLECTANCE



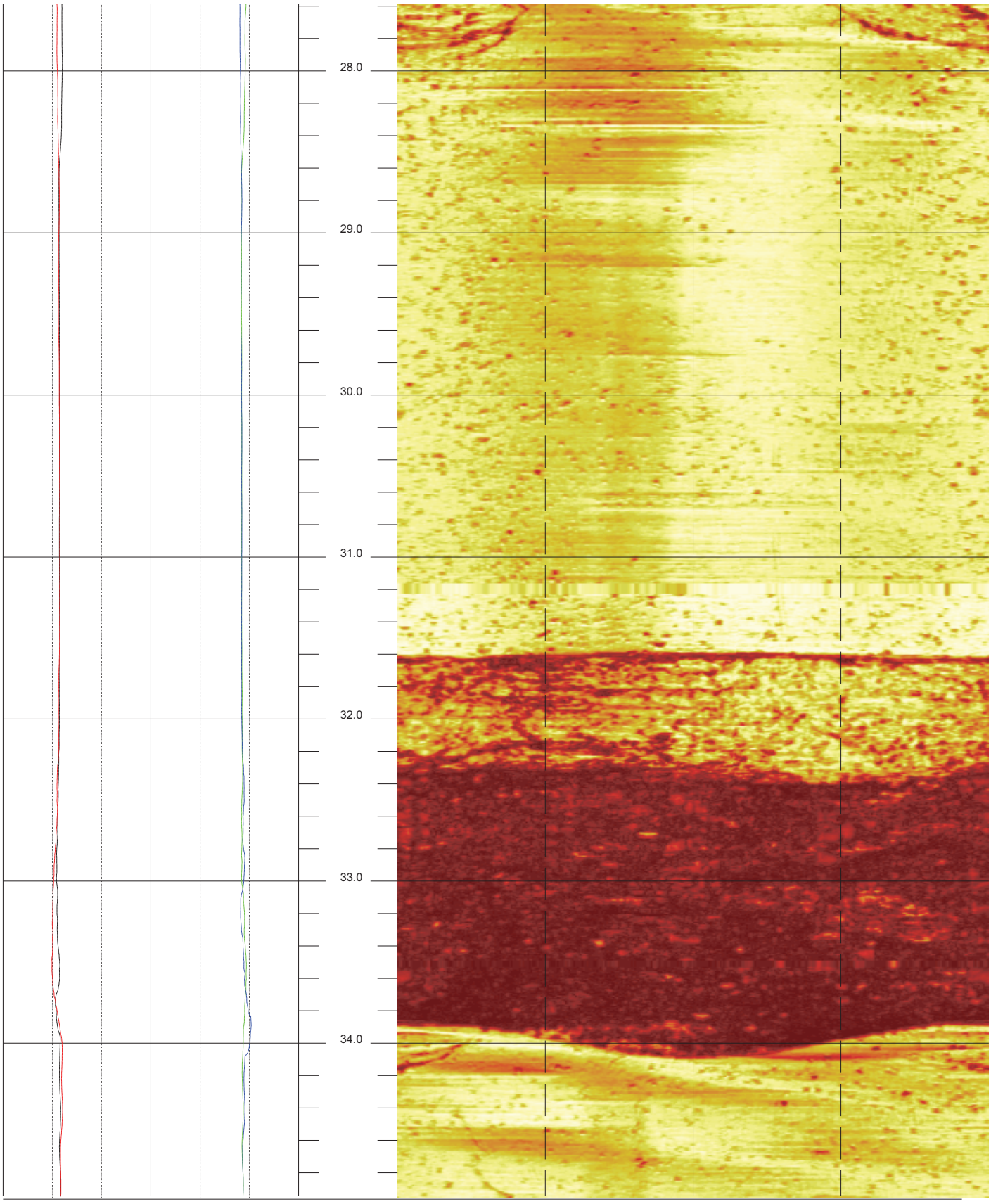
B-08 12.848 to 9.000ft 1



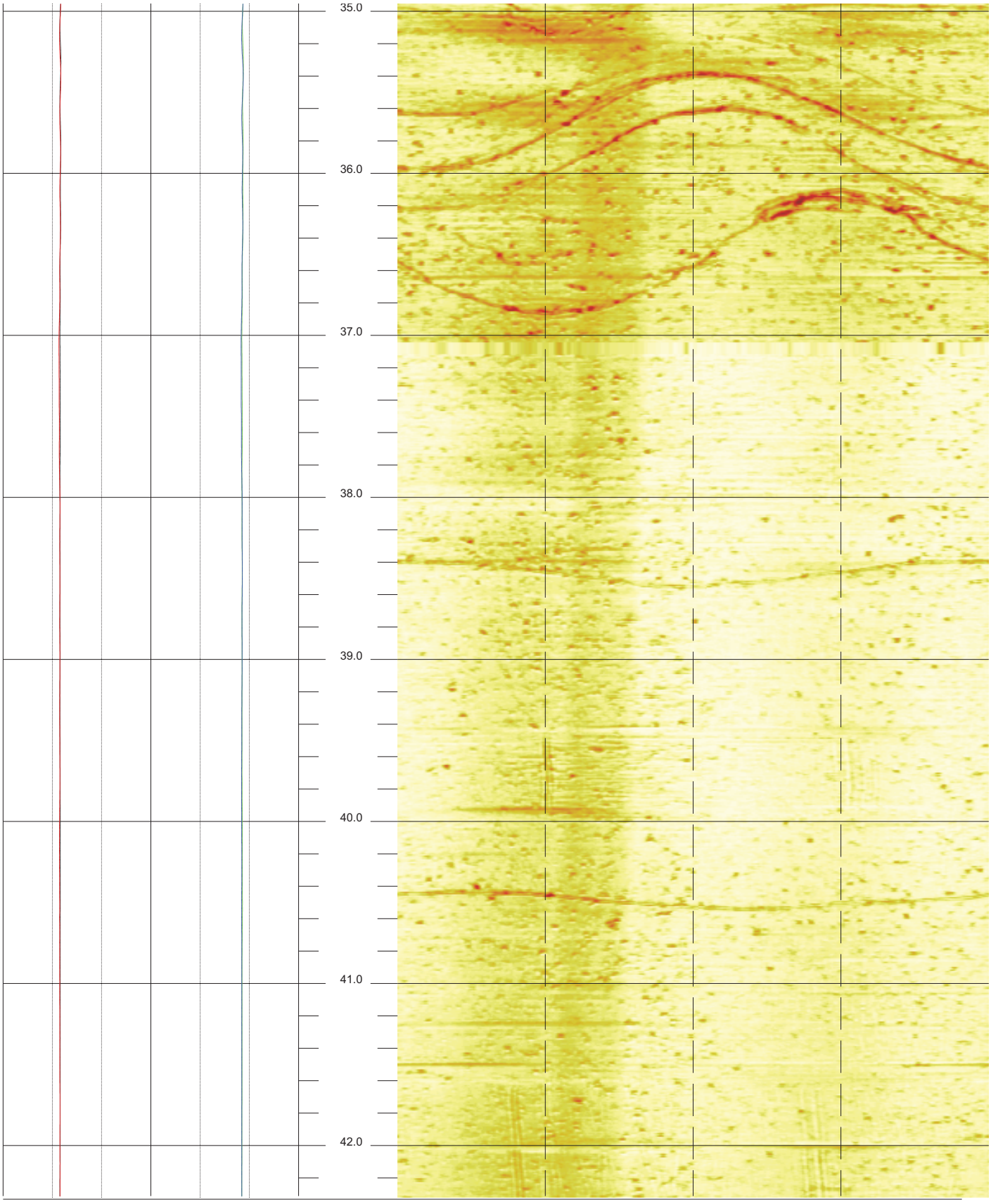
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 2 of 14



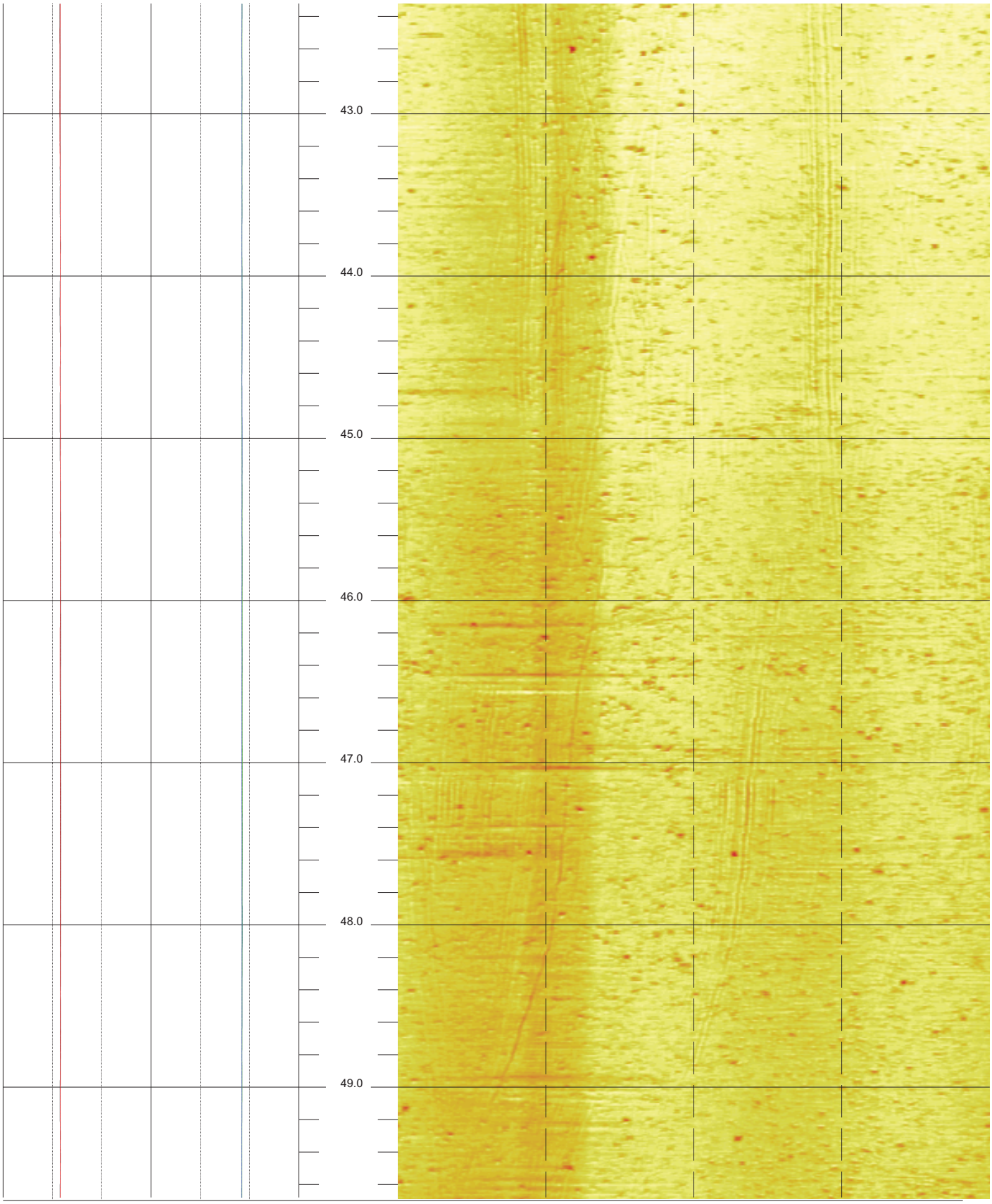
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 3 of 14



MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 4 of 14

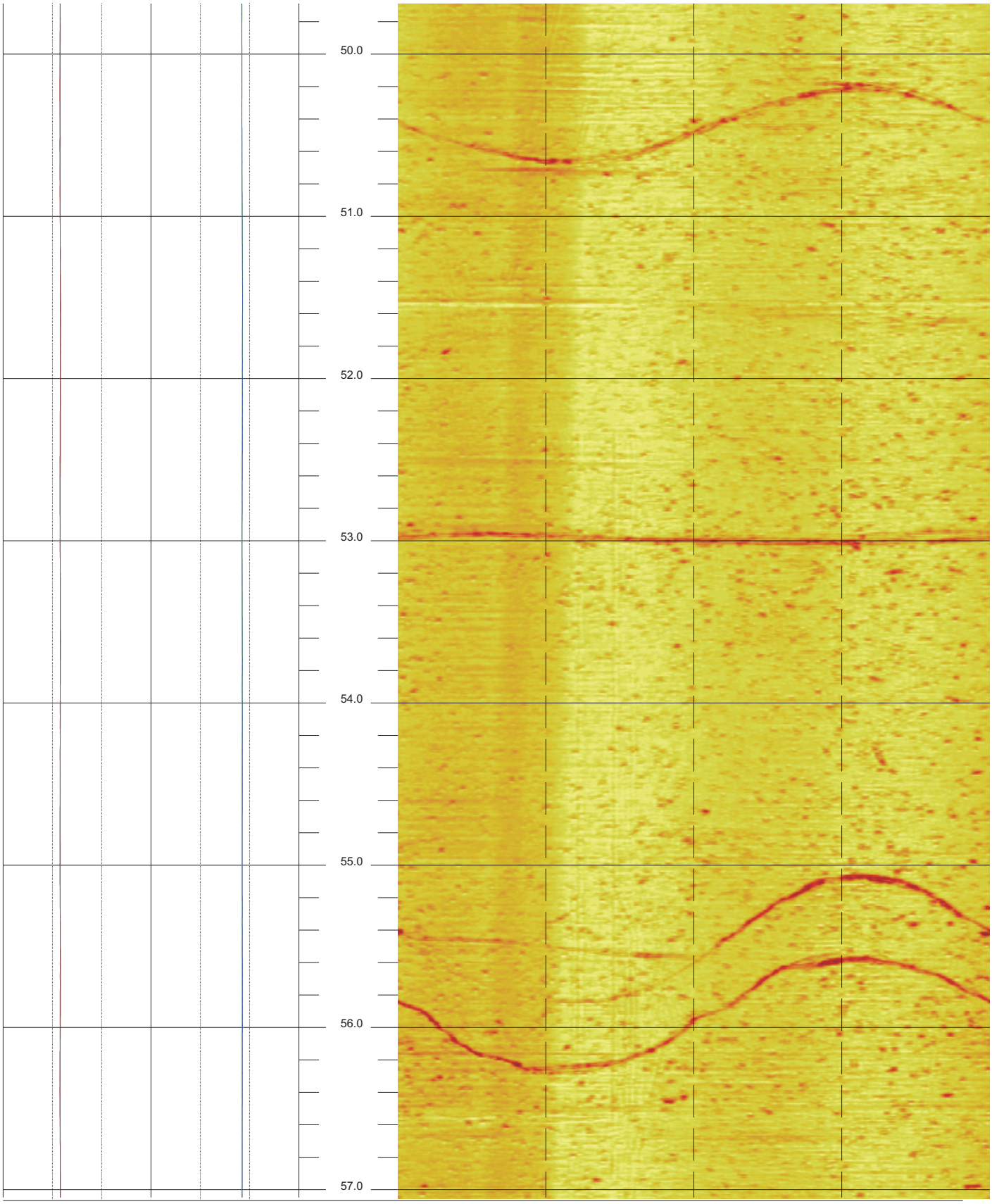


MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 5 of 14

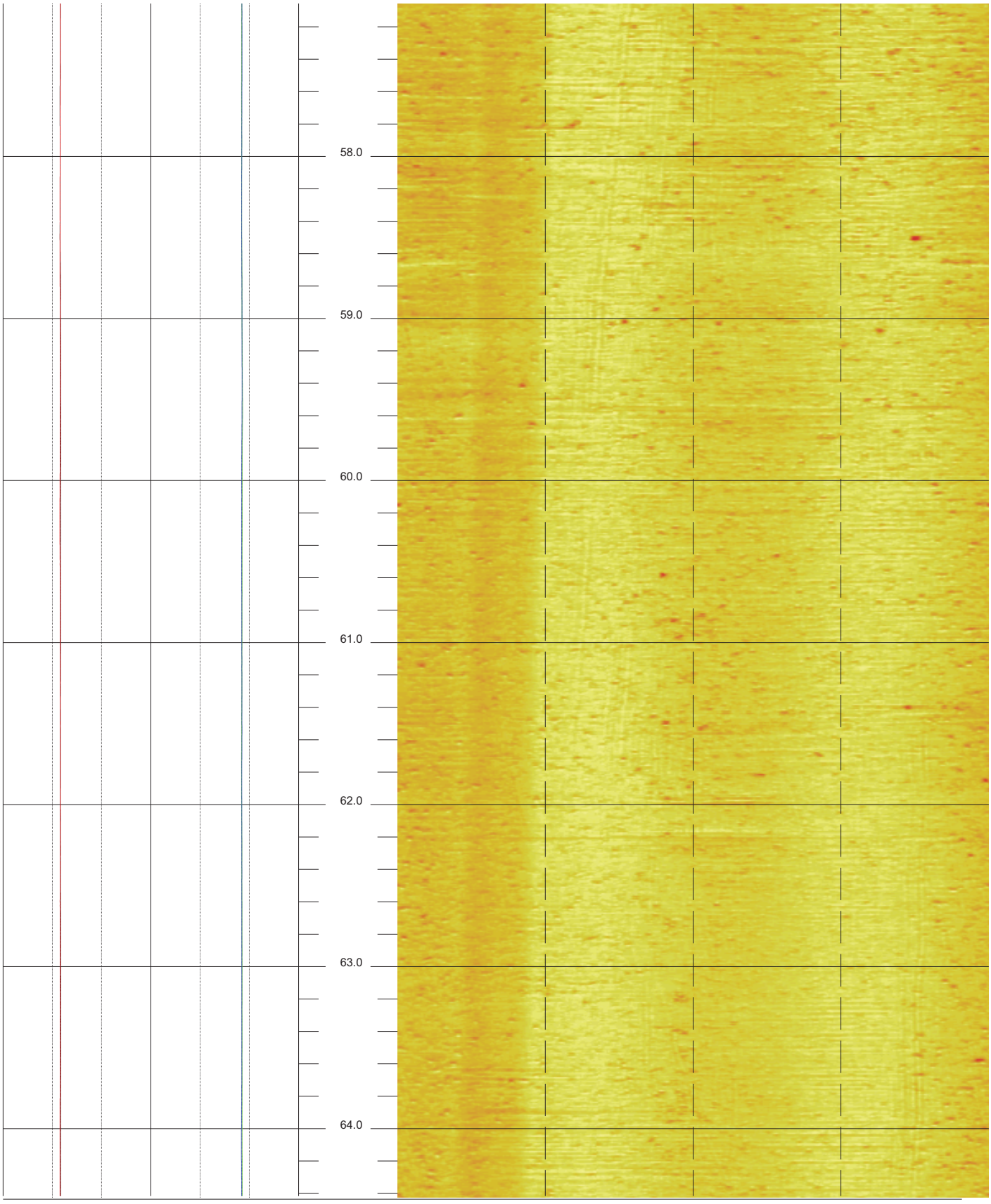


B-08 49.688 to 42.320ft 6

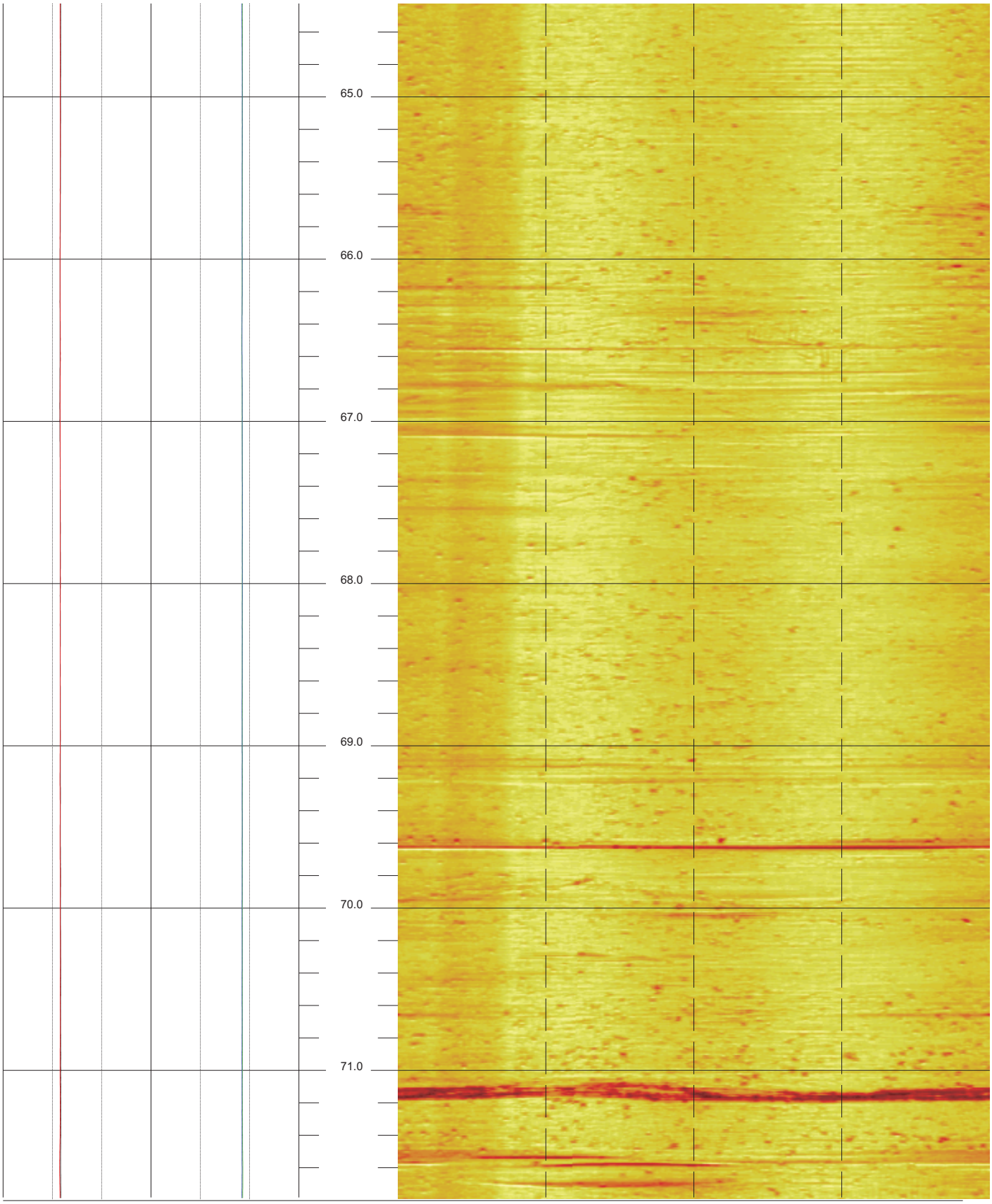
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 6 of 14



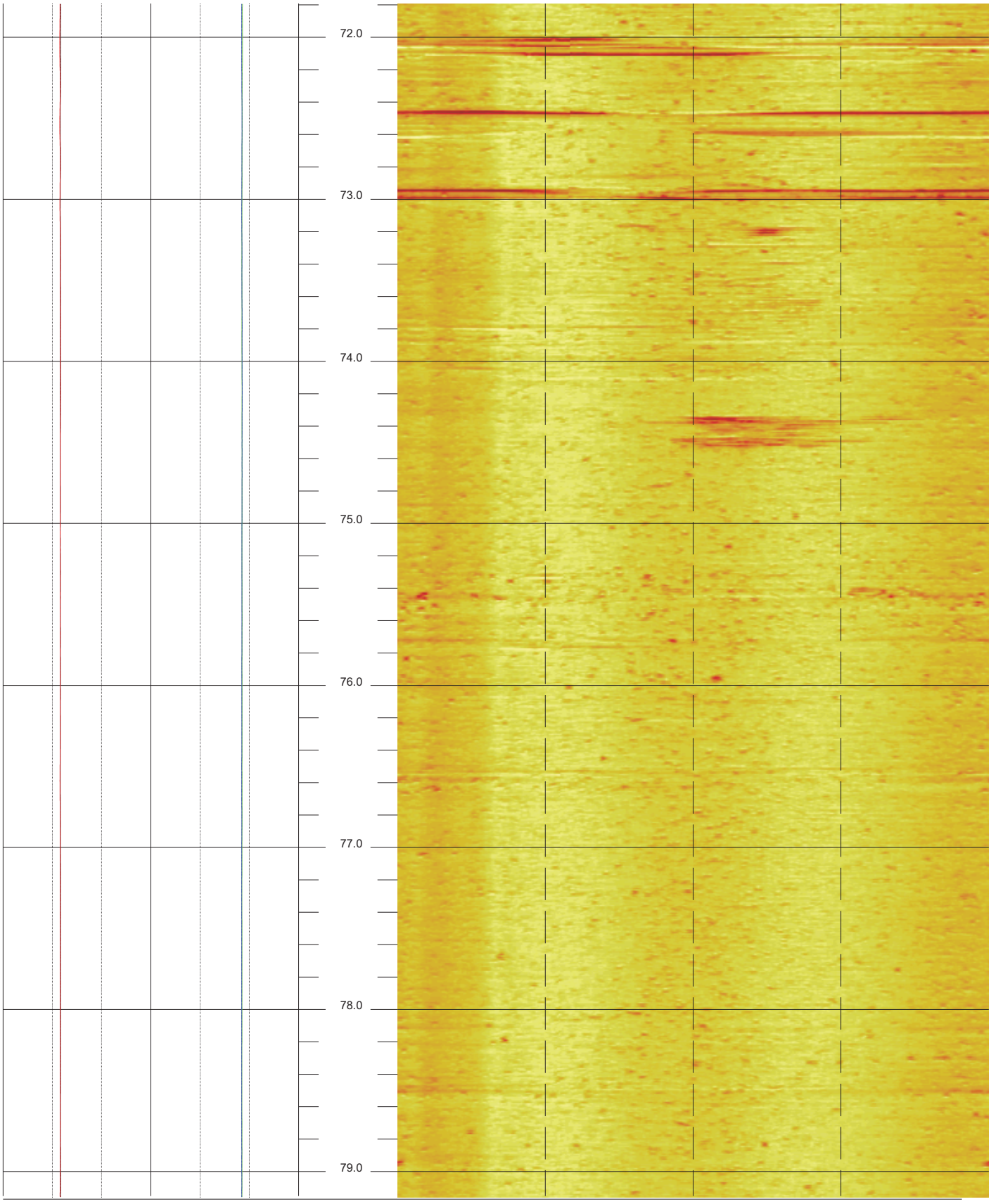
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 7 of 14



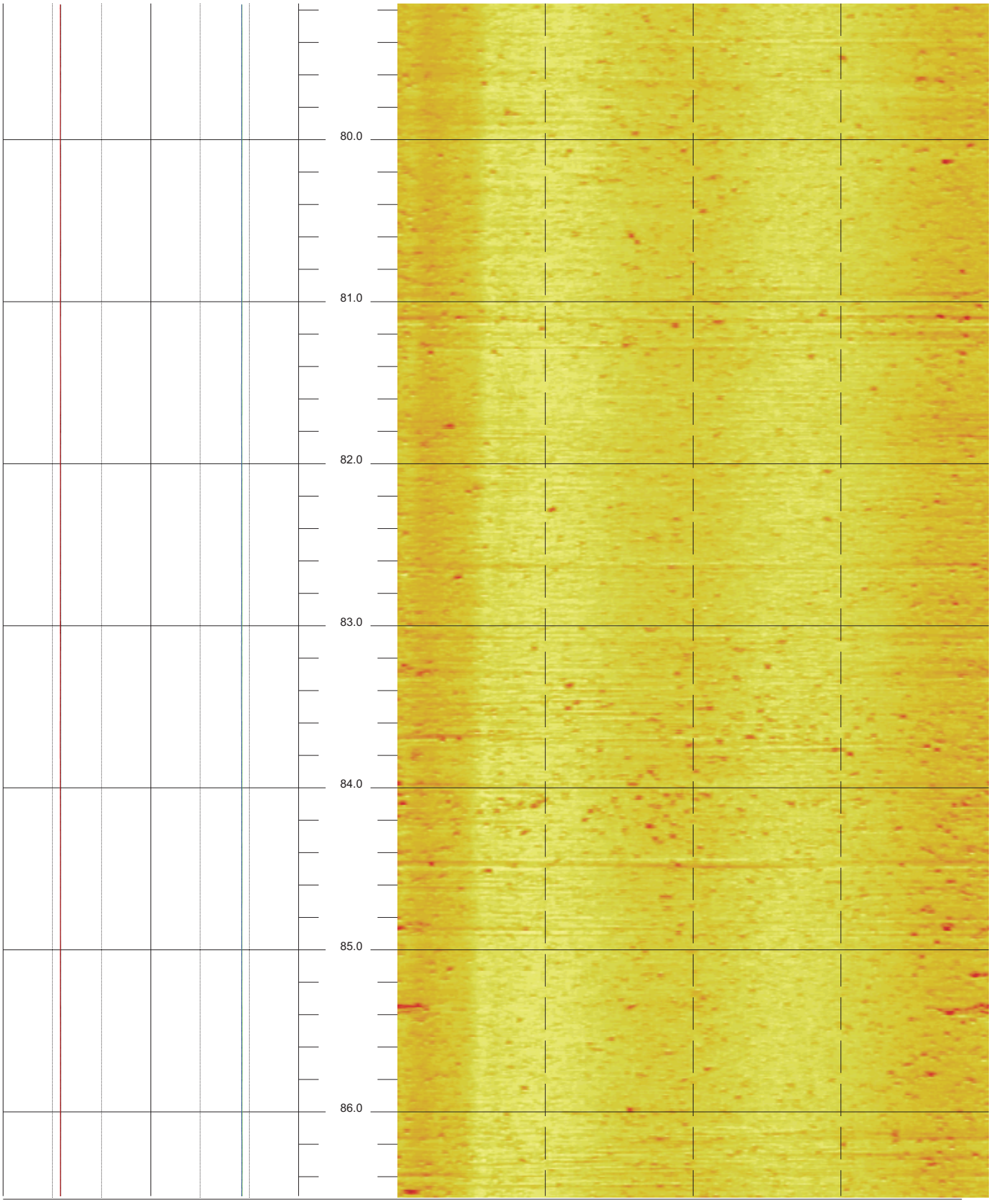
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 8 of 14



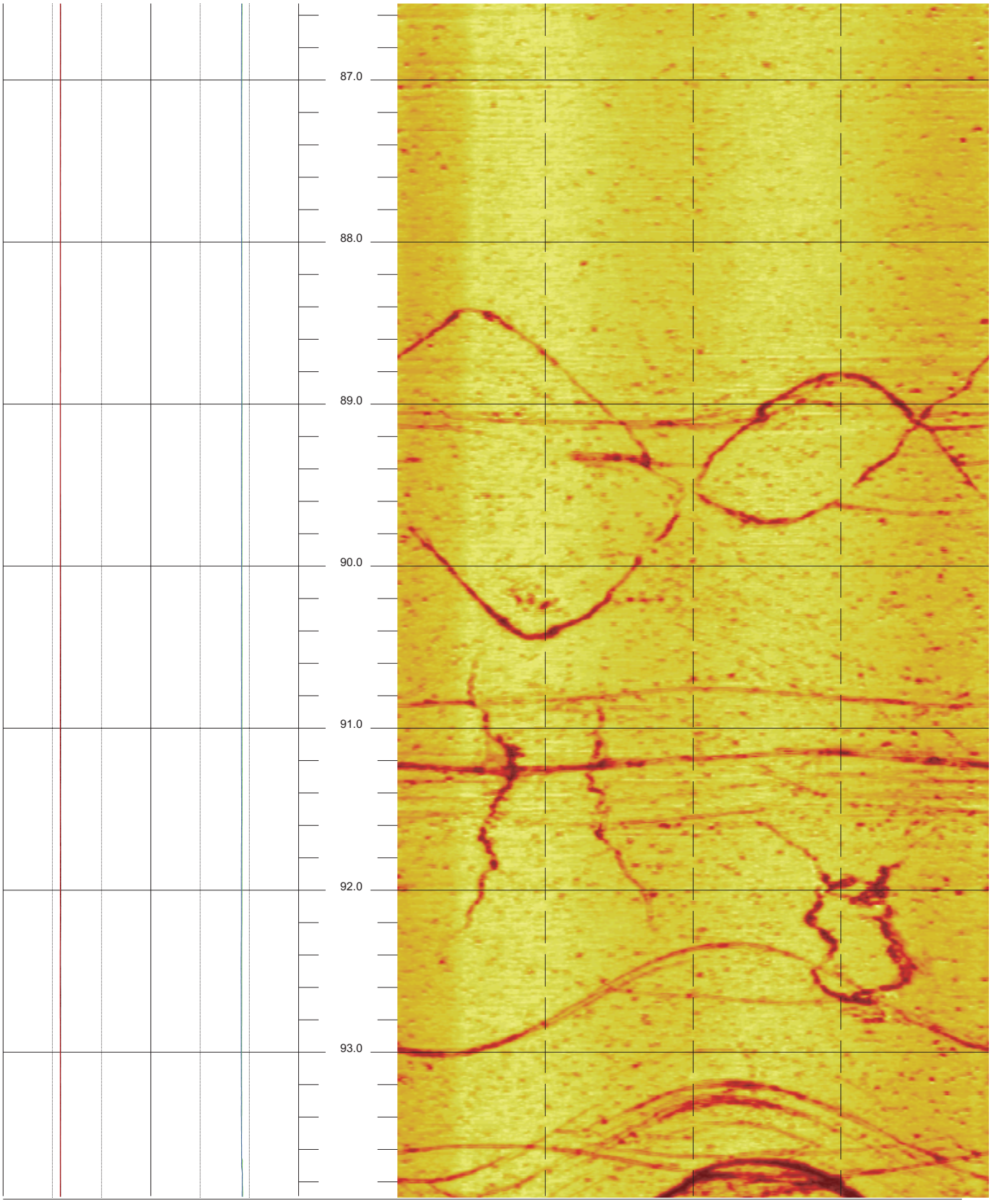
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 9 of 14



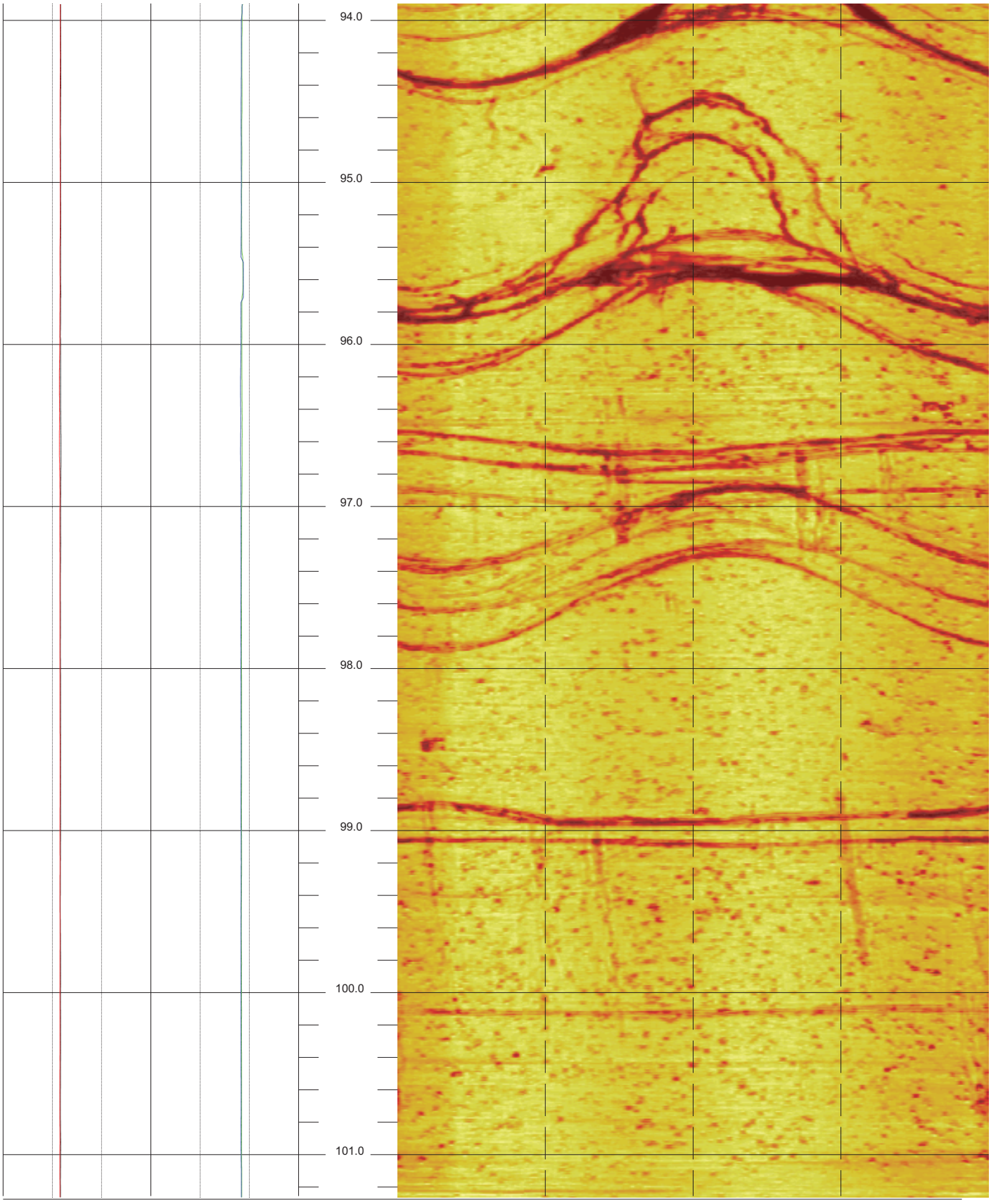
MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 10 of 14



MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 11 of 14

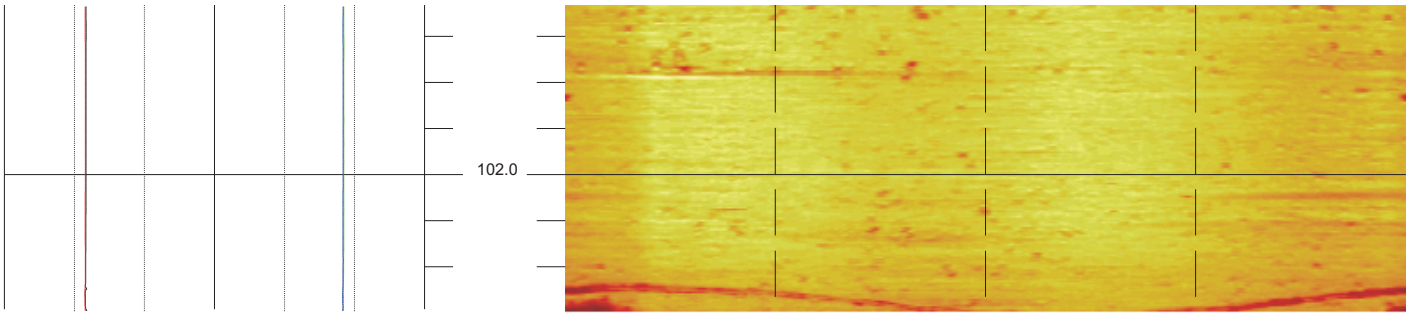


MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 12 of 14



B-08 101.264 to 93.896fl 13

MRDA Substation Boring B-08 Acoustic Televiewer Derived Caliper rev 1 Sheet 13 of 14


102.0

BHTV DATA PROCESSING
RGLDIP vsn 6.2
ACOUSTIC CALIPER LOG

URS

Borehole: B-09

_

top of borehole.....
East: _
North: _
Elev: _

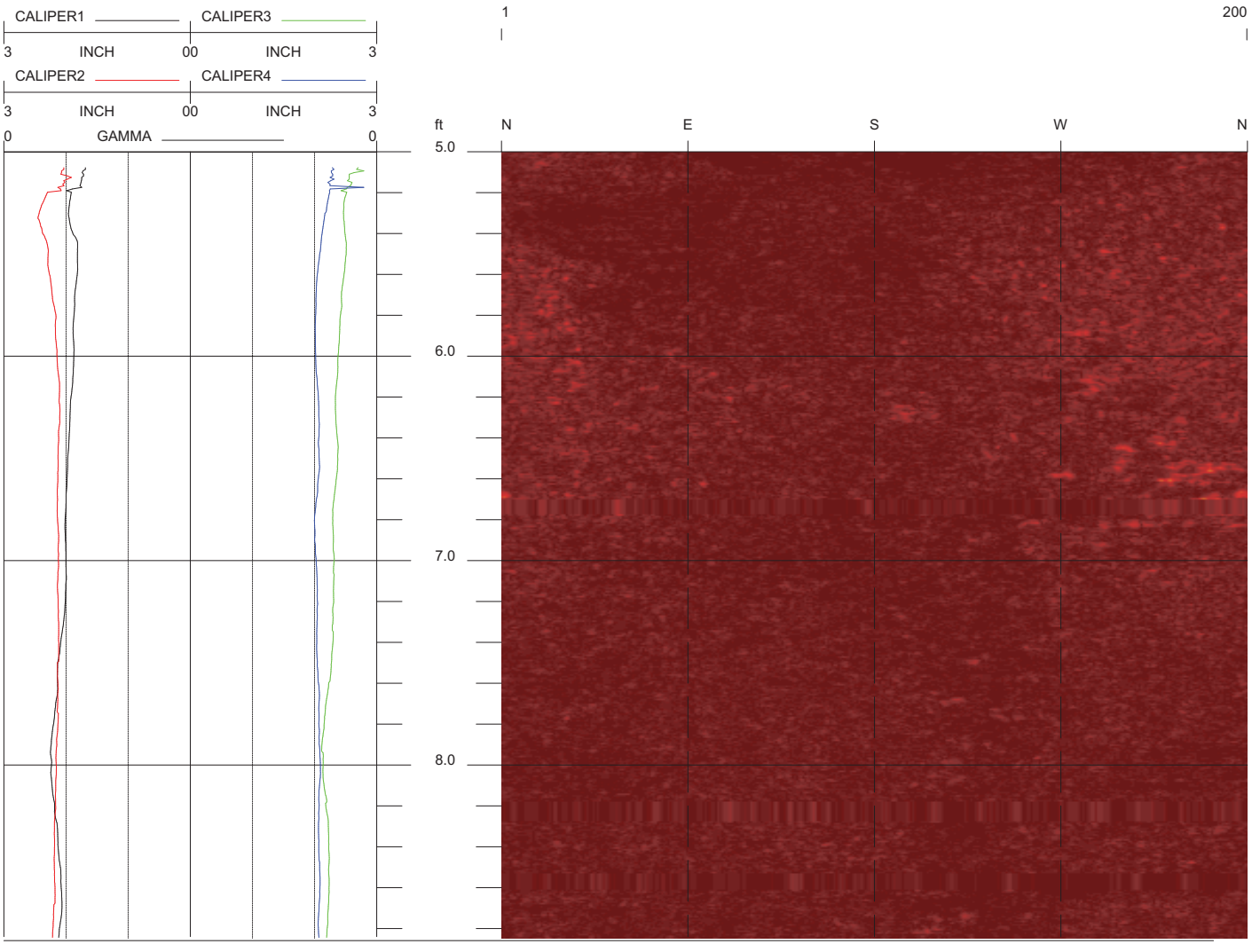
North ref. is true
Depth units are feet
Vertical scale: 1/10

Zone from 119.400 to 5.000ft

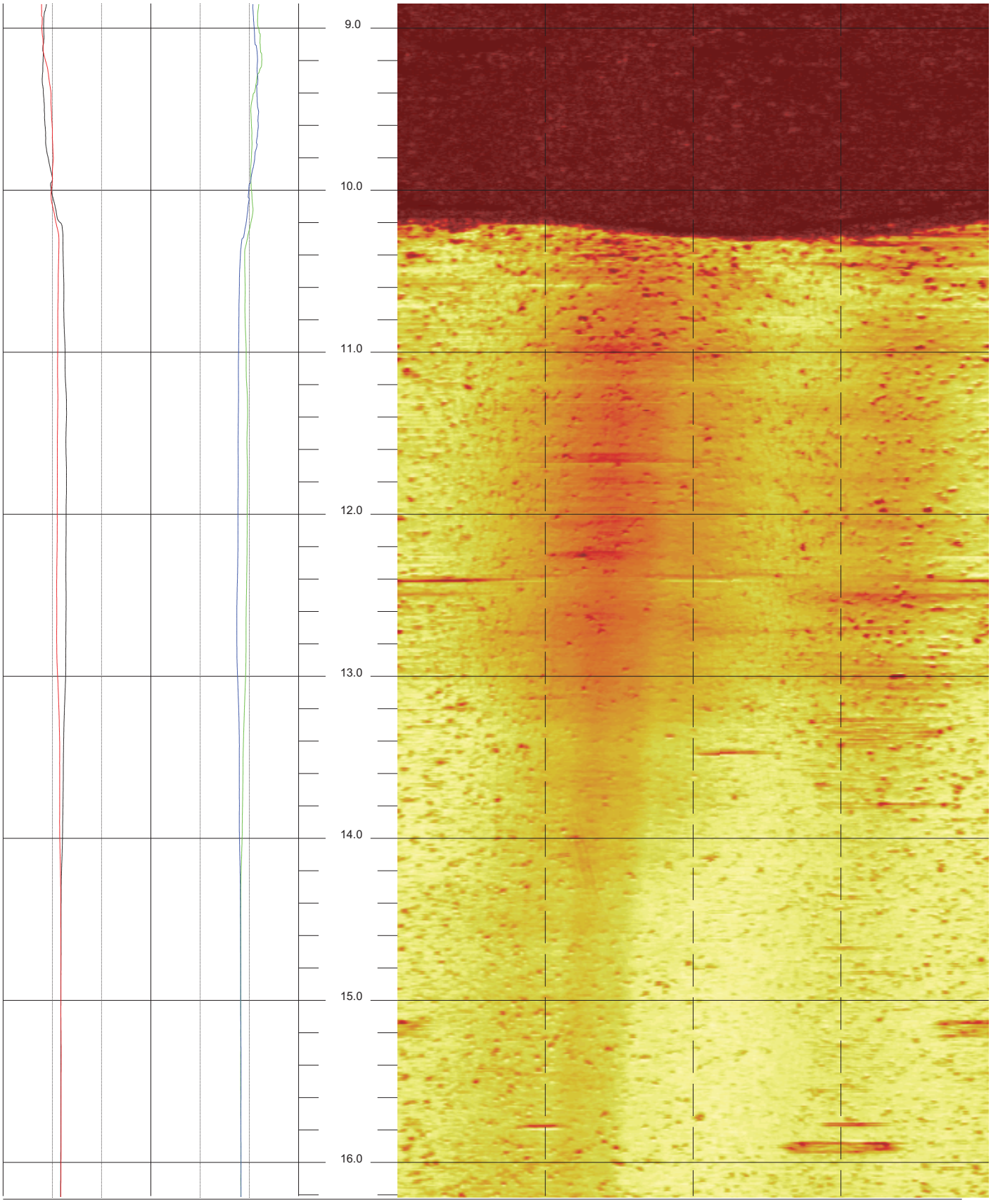
Borehole diam: 3.864inch
Vertical = borehole-axis
Image: Amplitude

Depth interval 0.008ft, Filter length 0.248ft

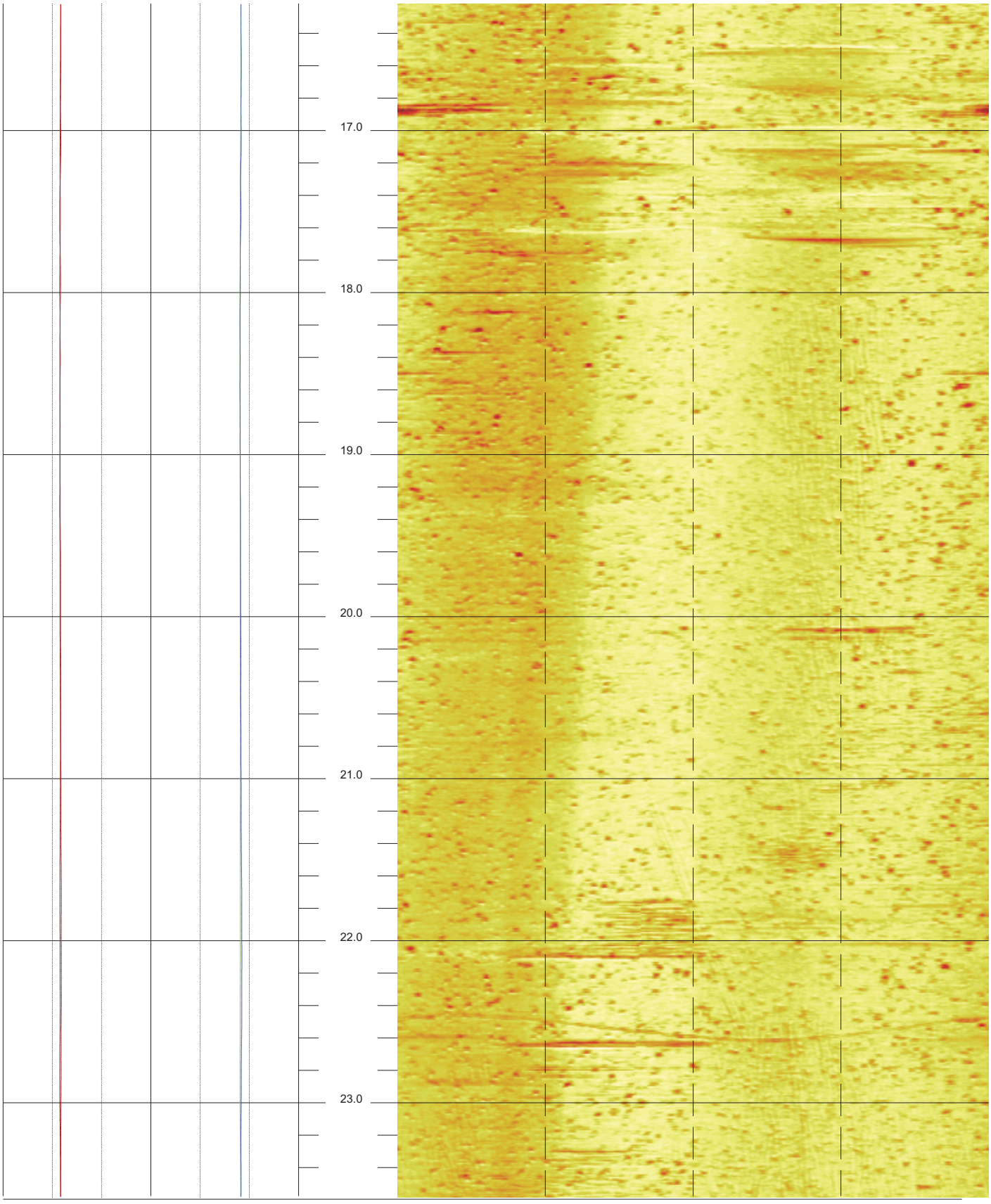
REFLECTANCE



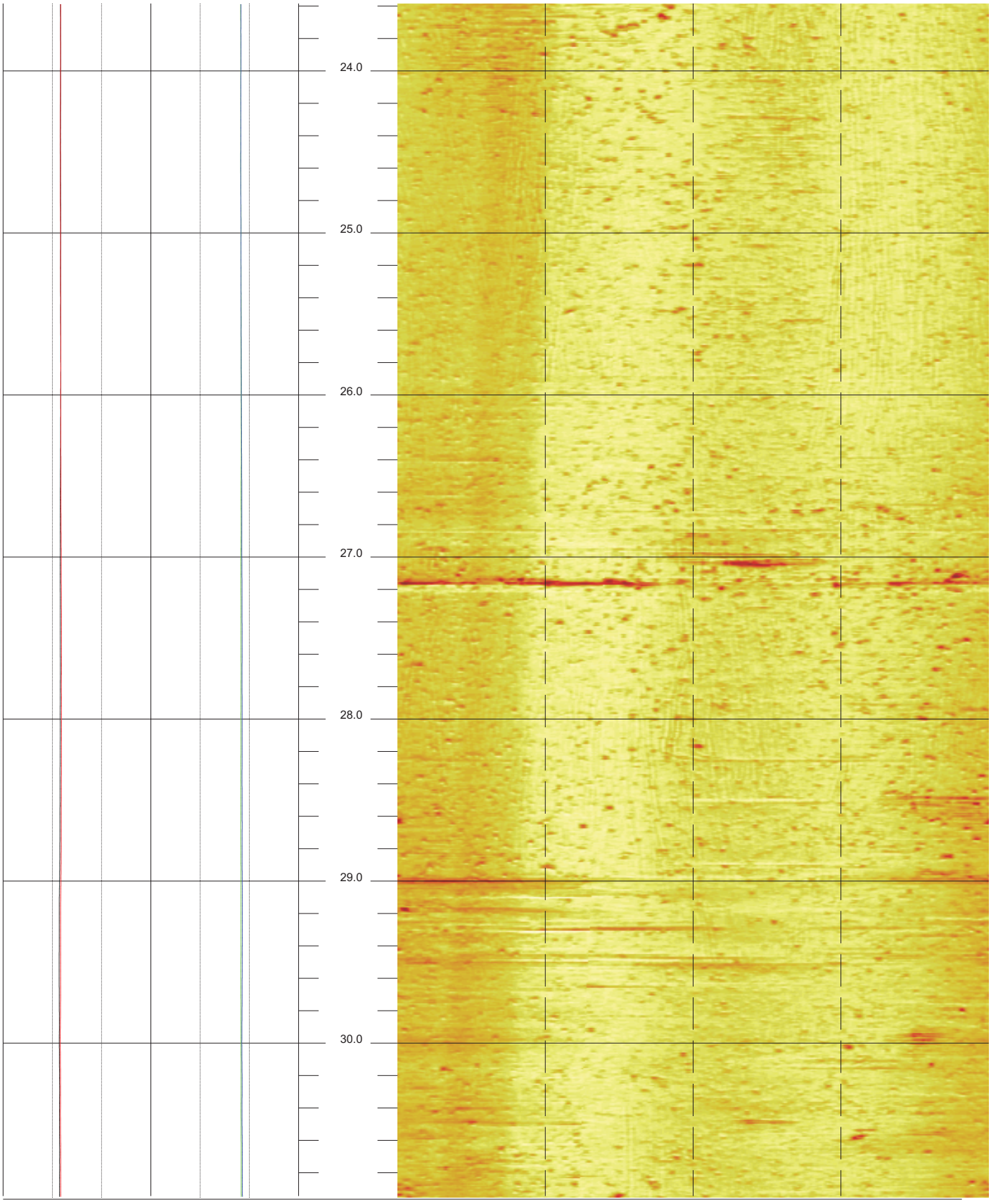
B09 8.848 to 5.000fl 1



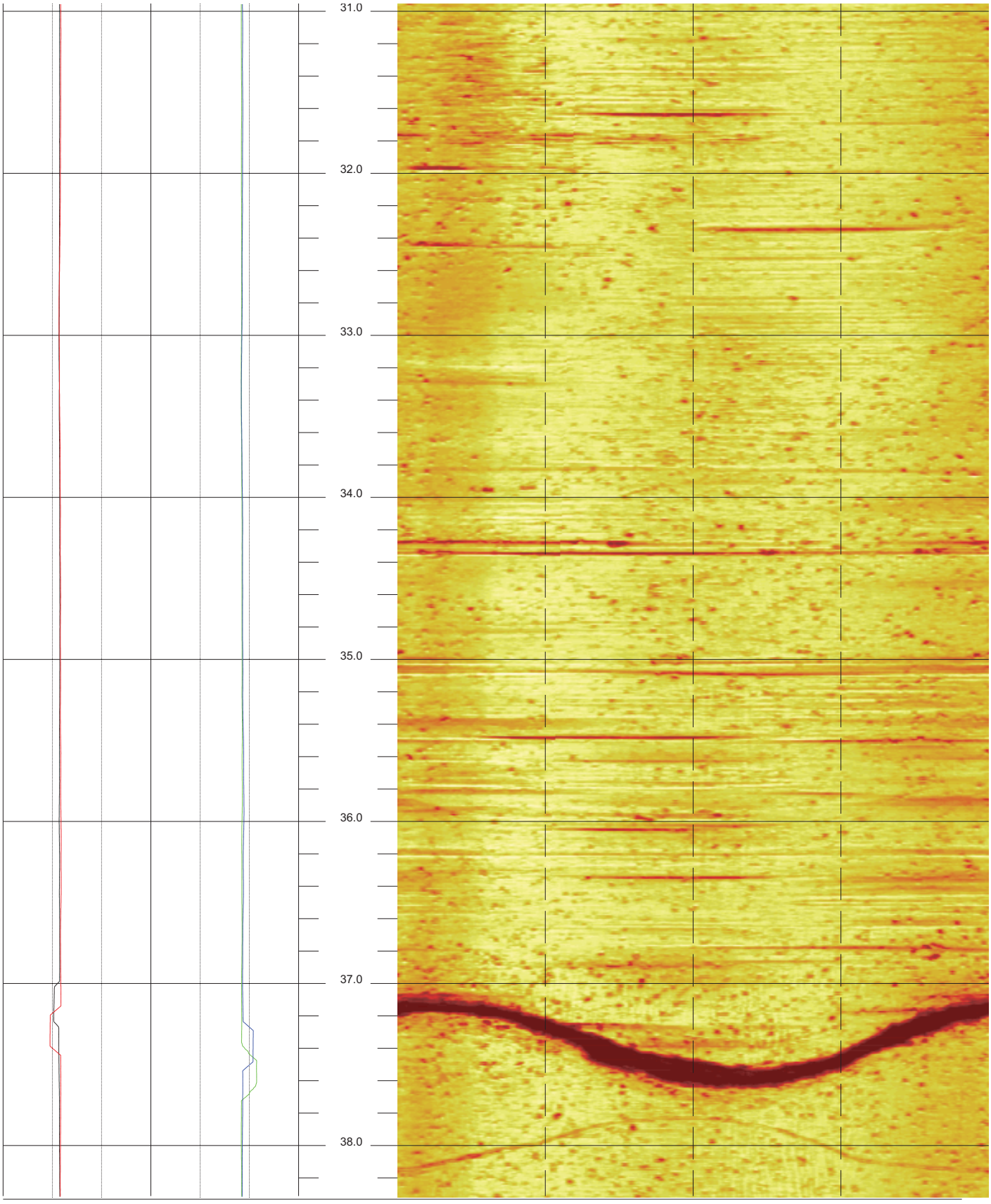
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 2 of 17



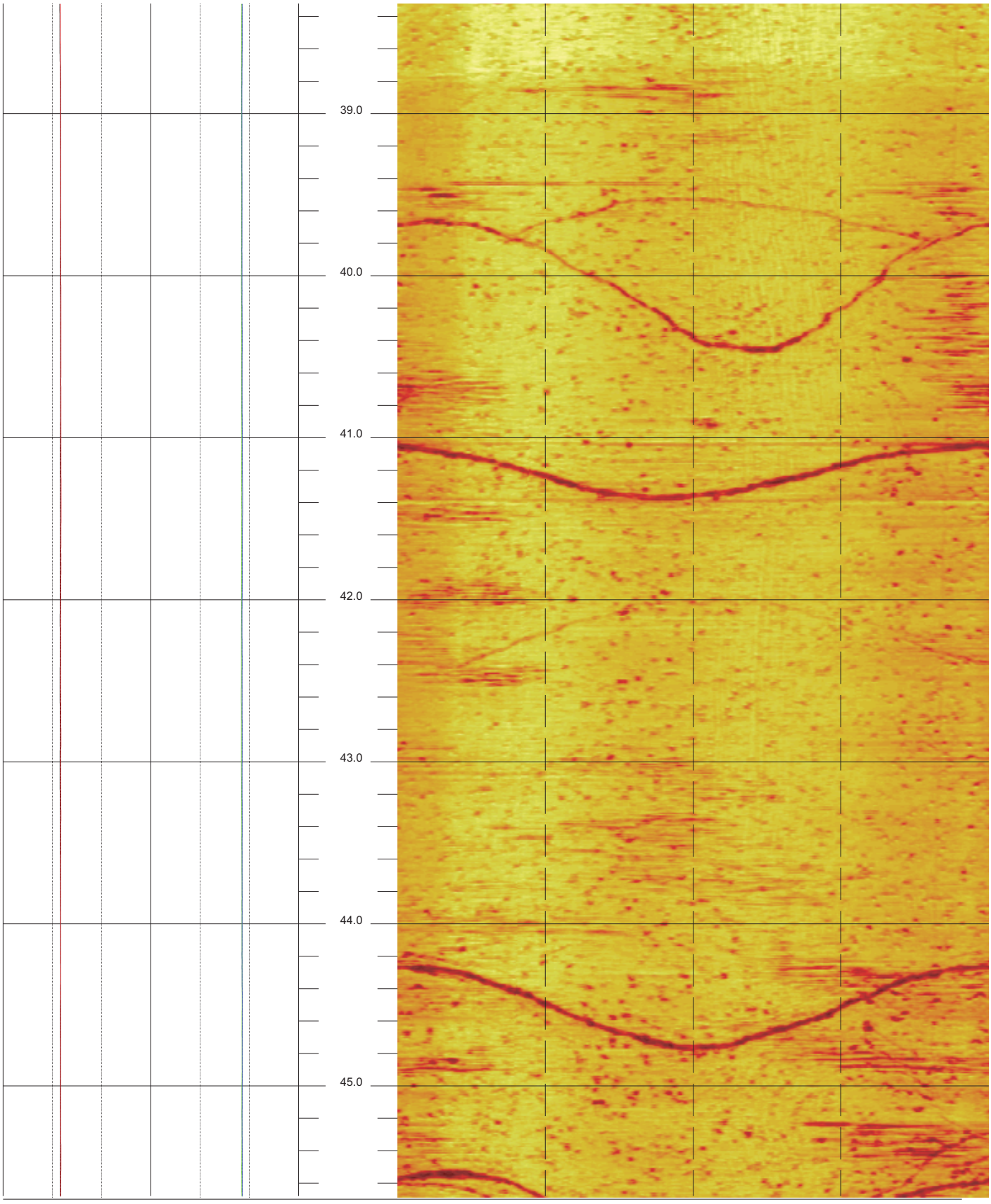
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 3 of 17



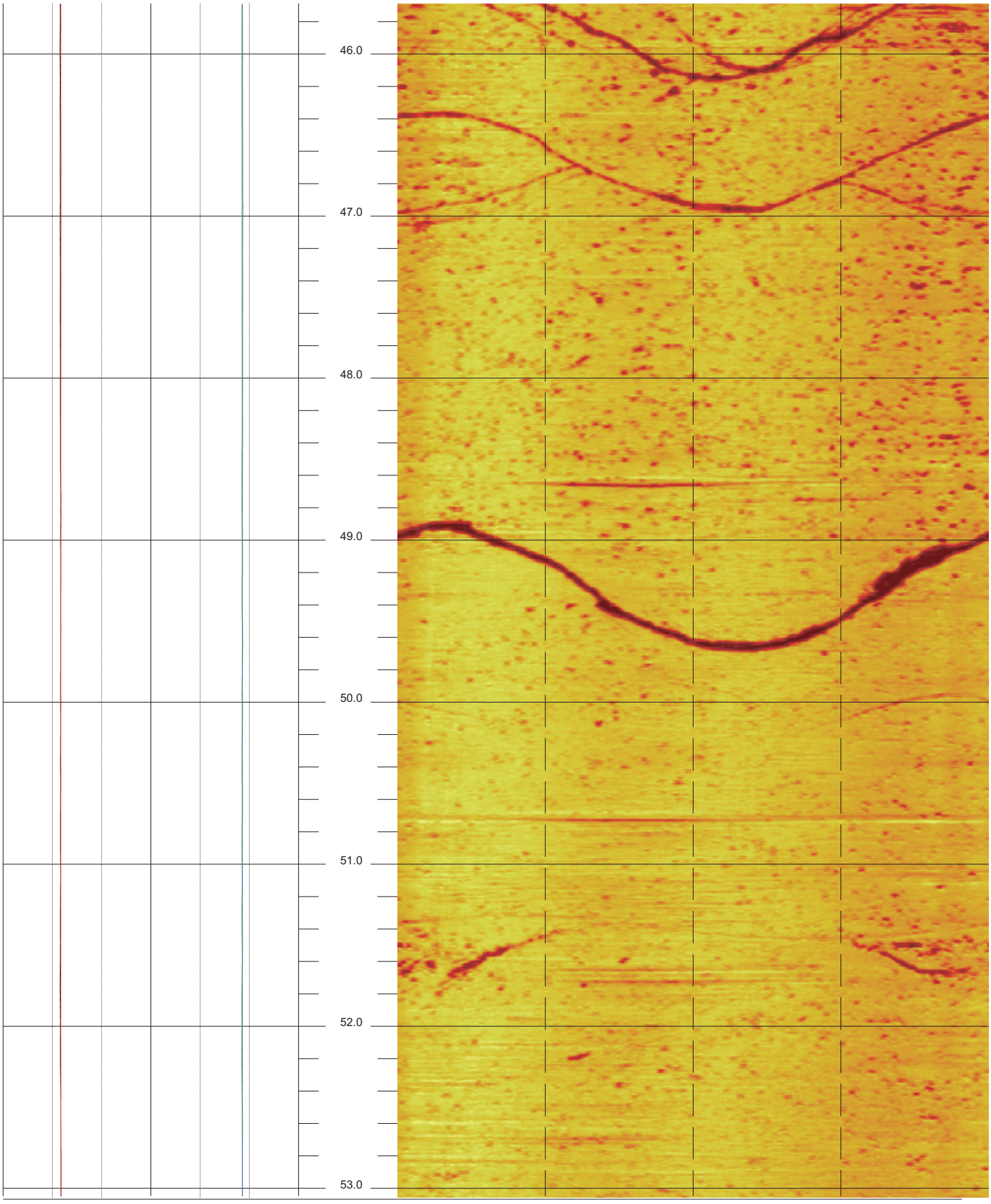
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 4 of 17



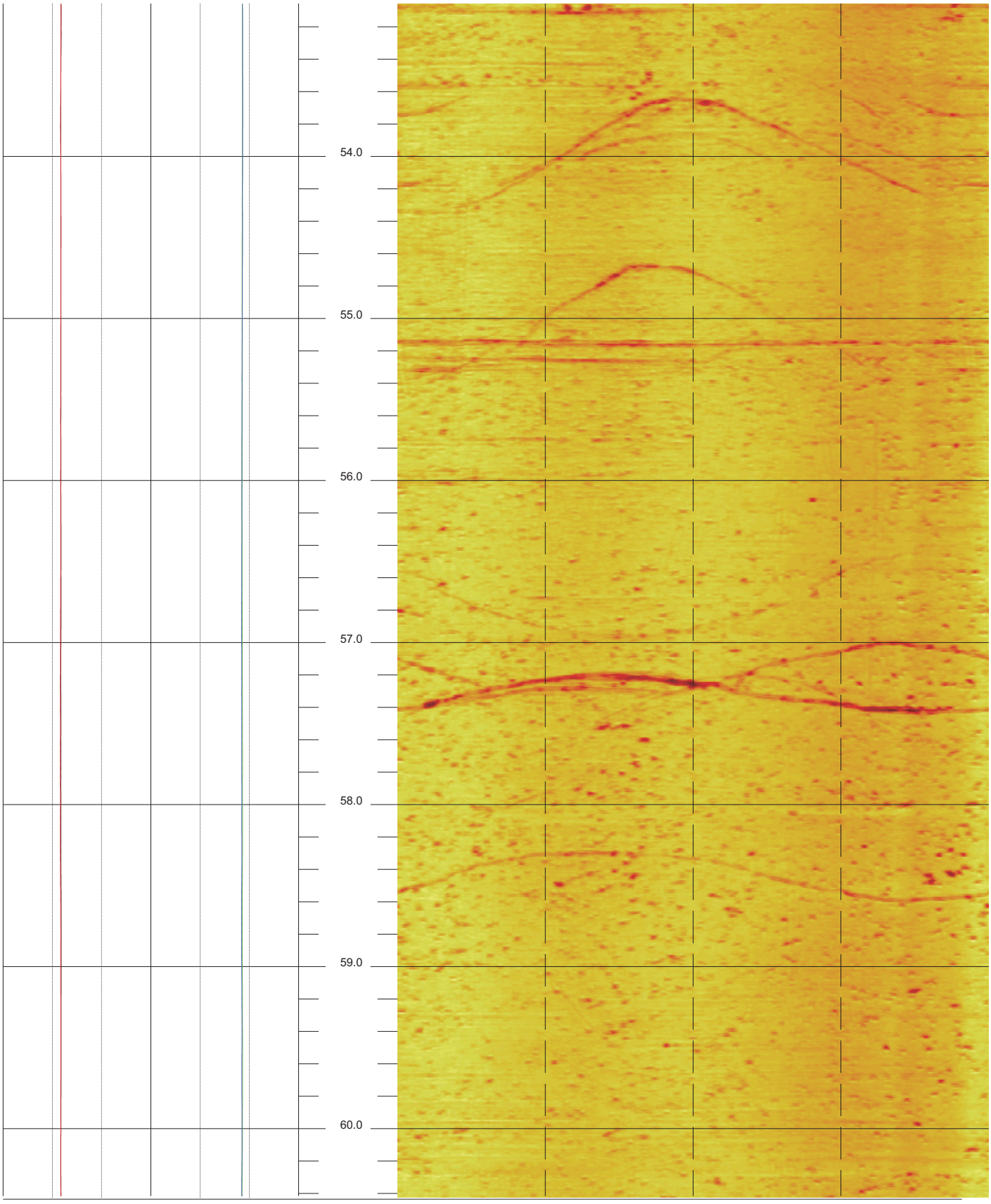
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 5 of 17



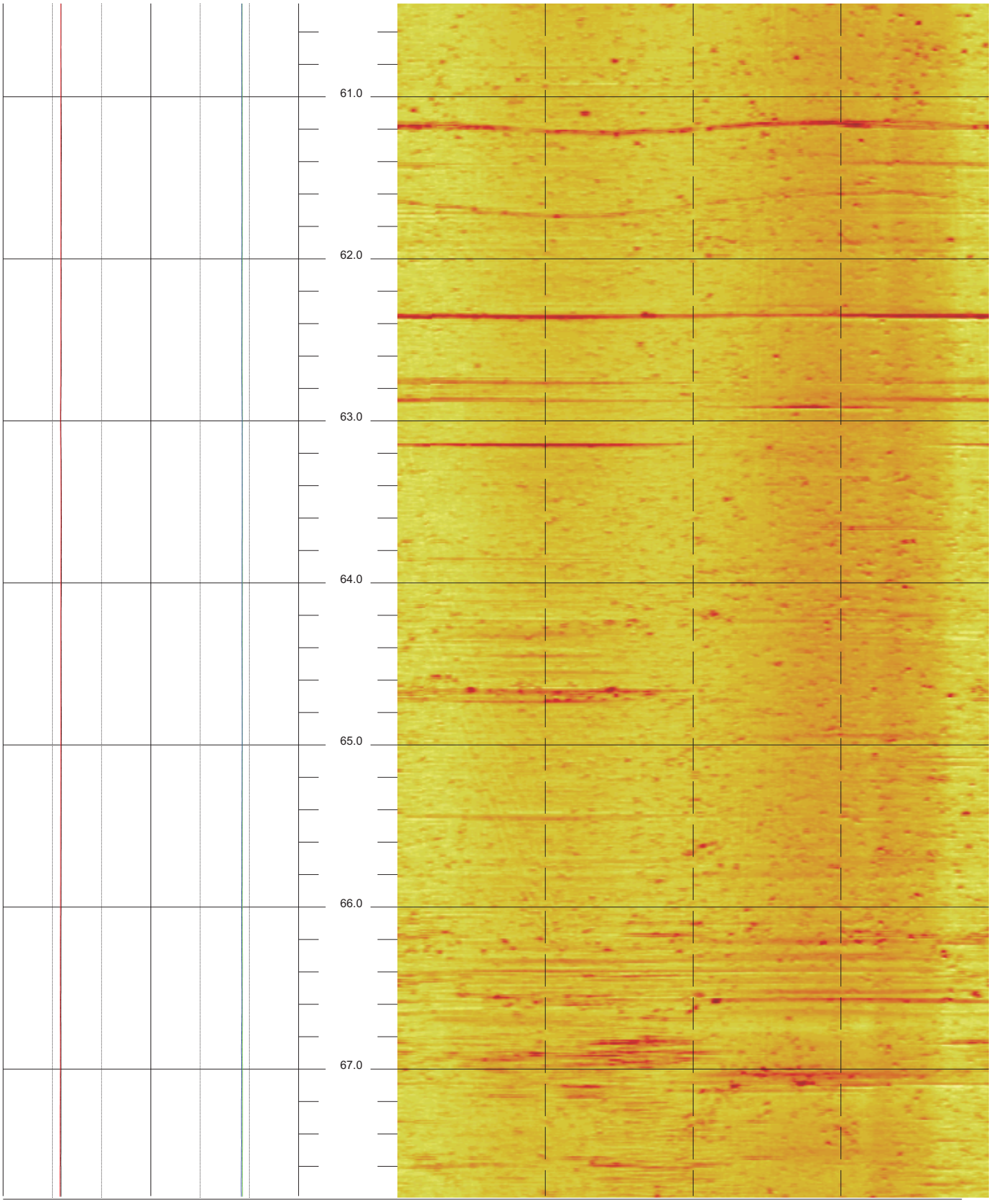
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 6 of 17



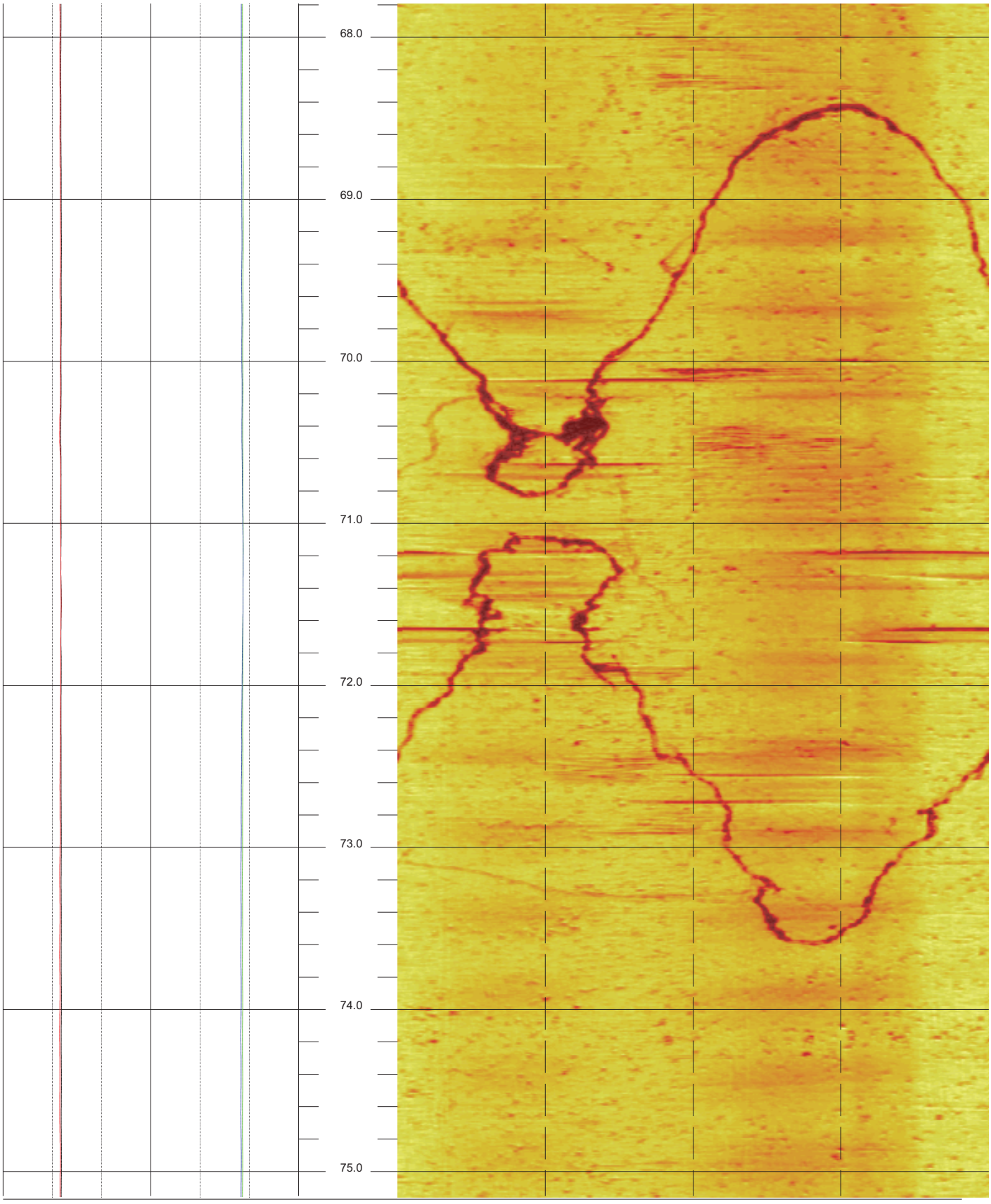
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 7 of 17



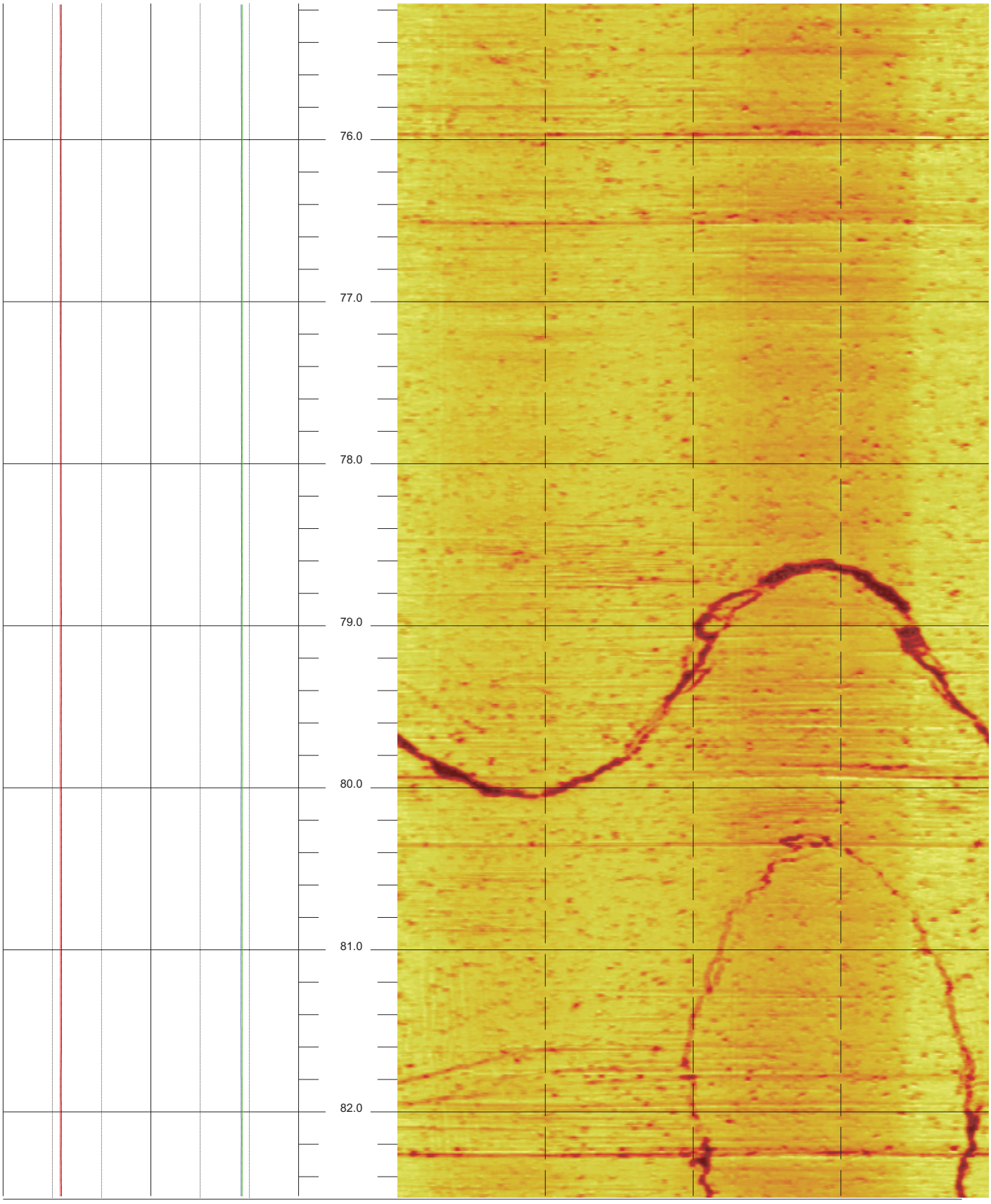
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 8 of 17



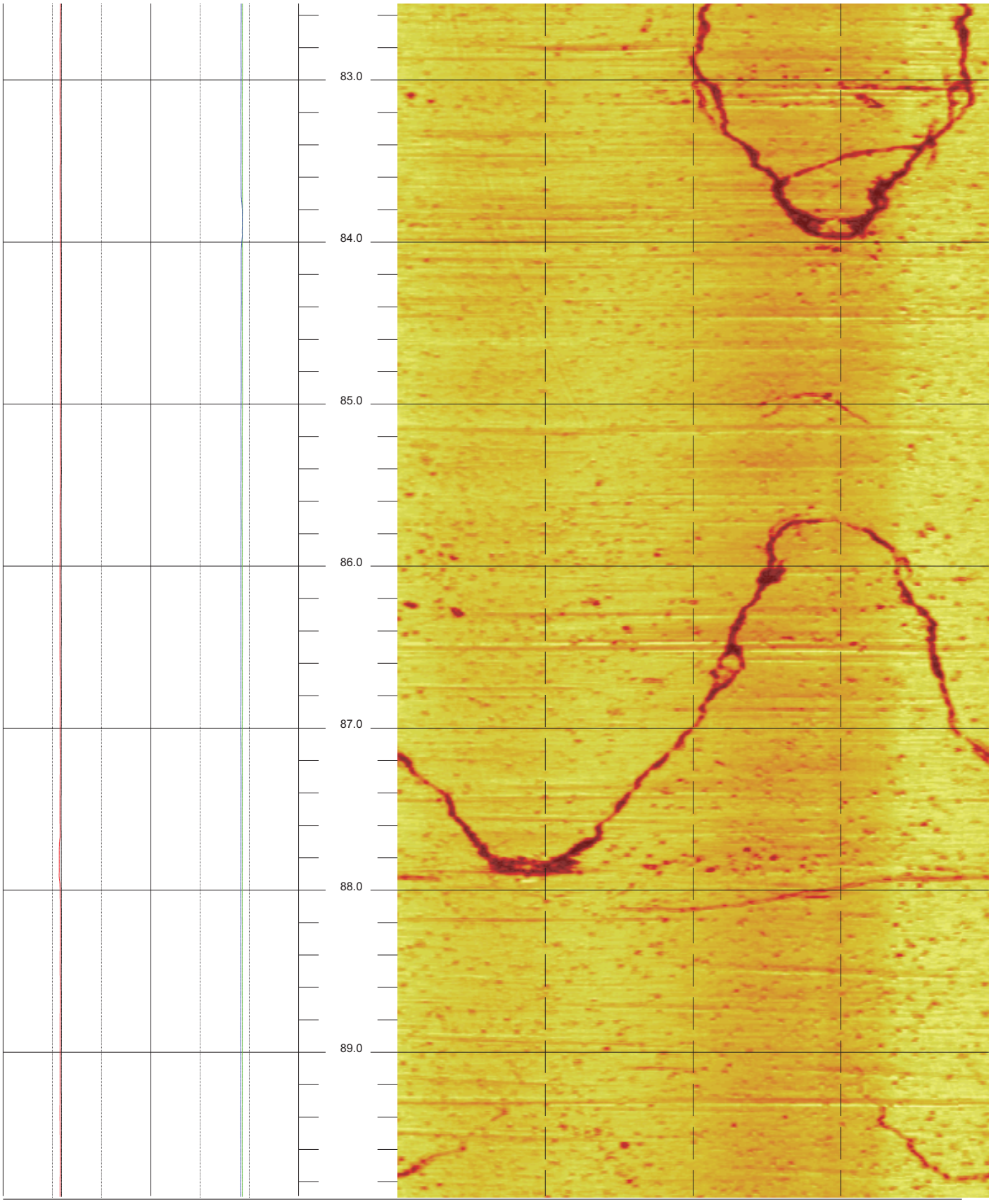
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 9 of 17



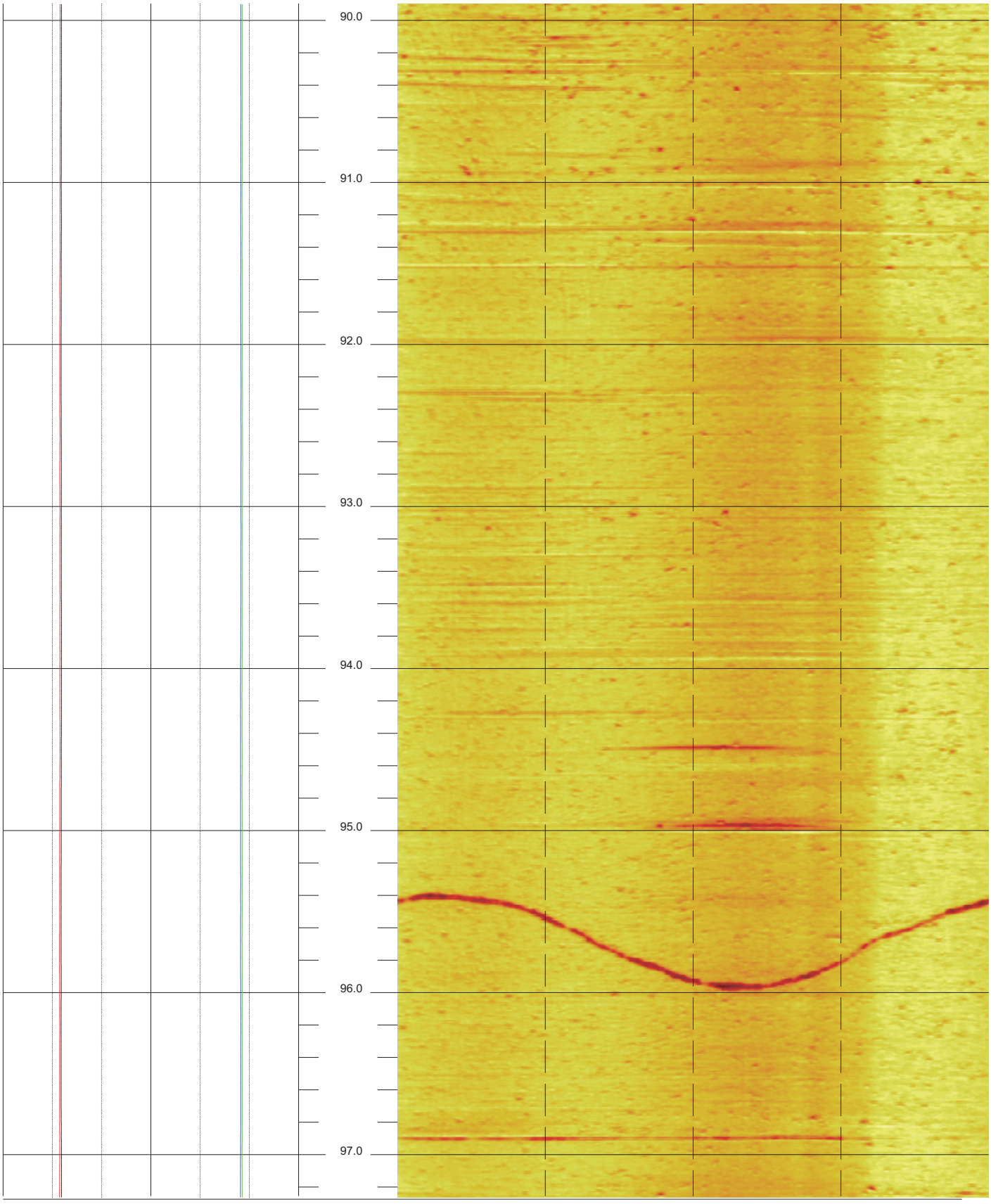
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 10 of 17



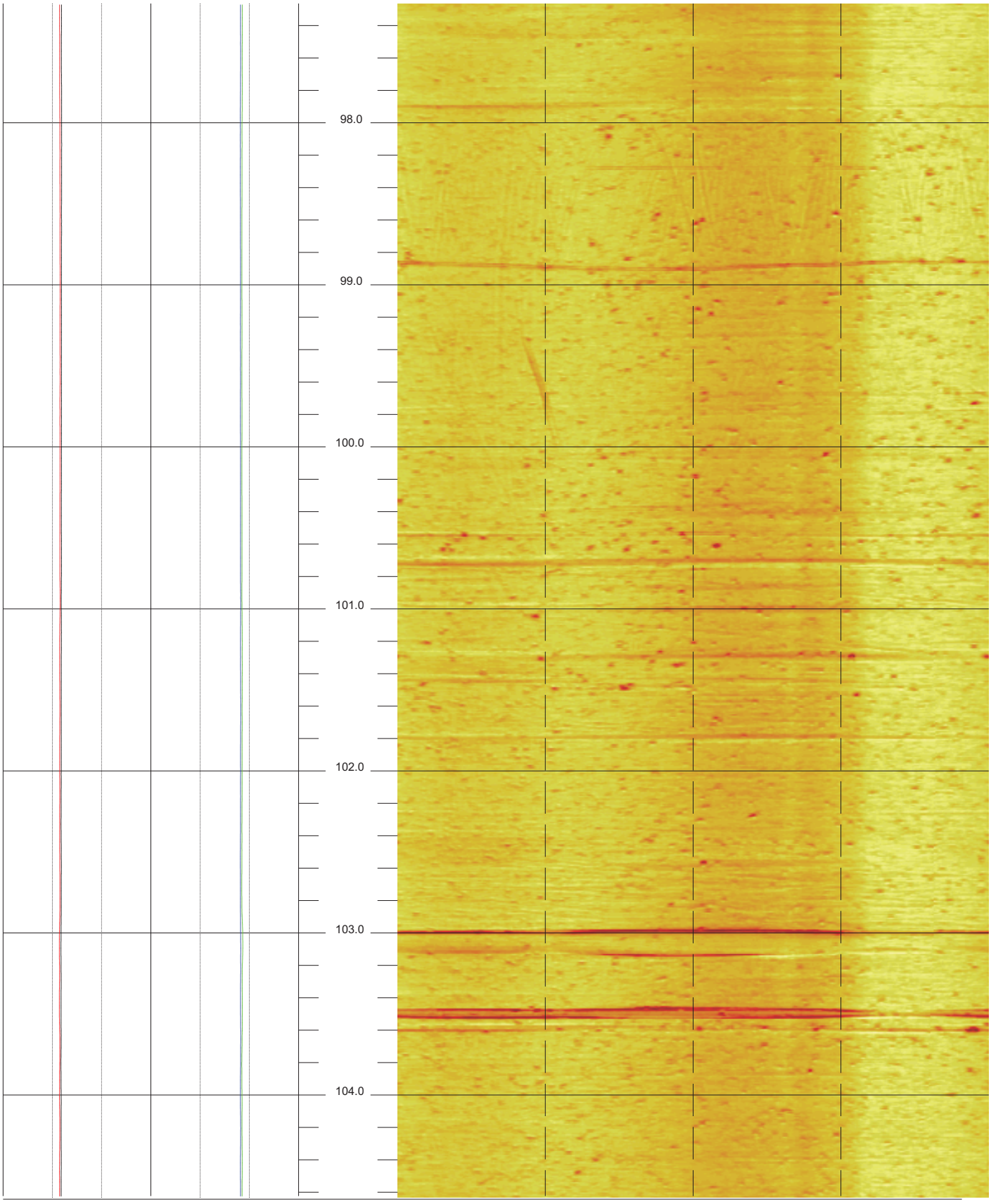
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 11 of 17



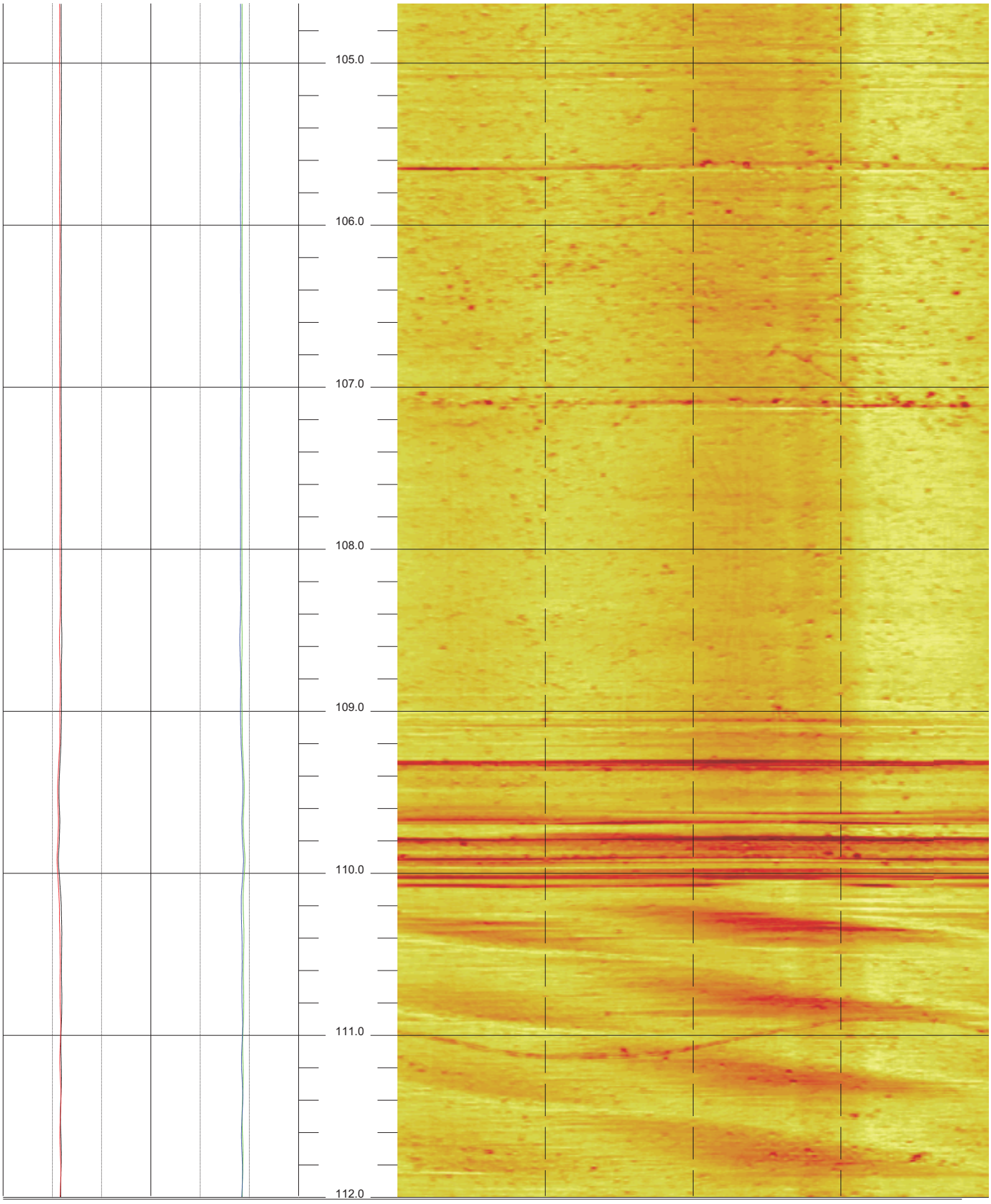
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 12 of 17



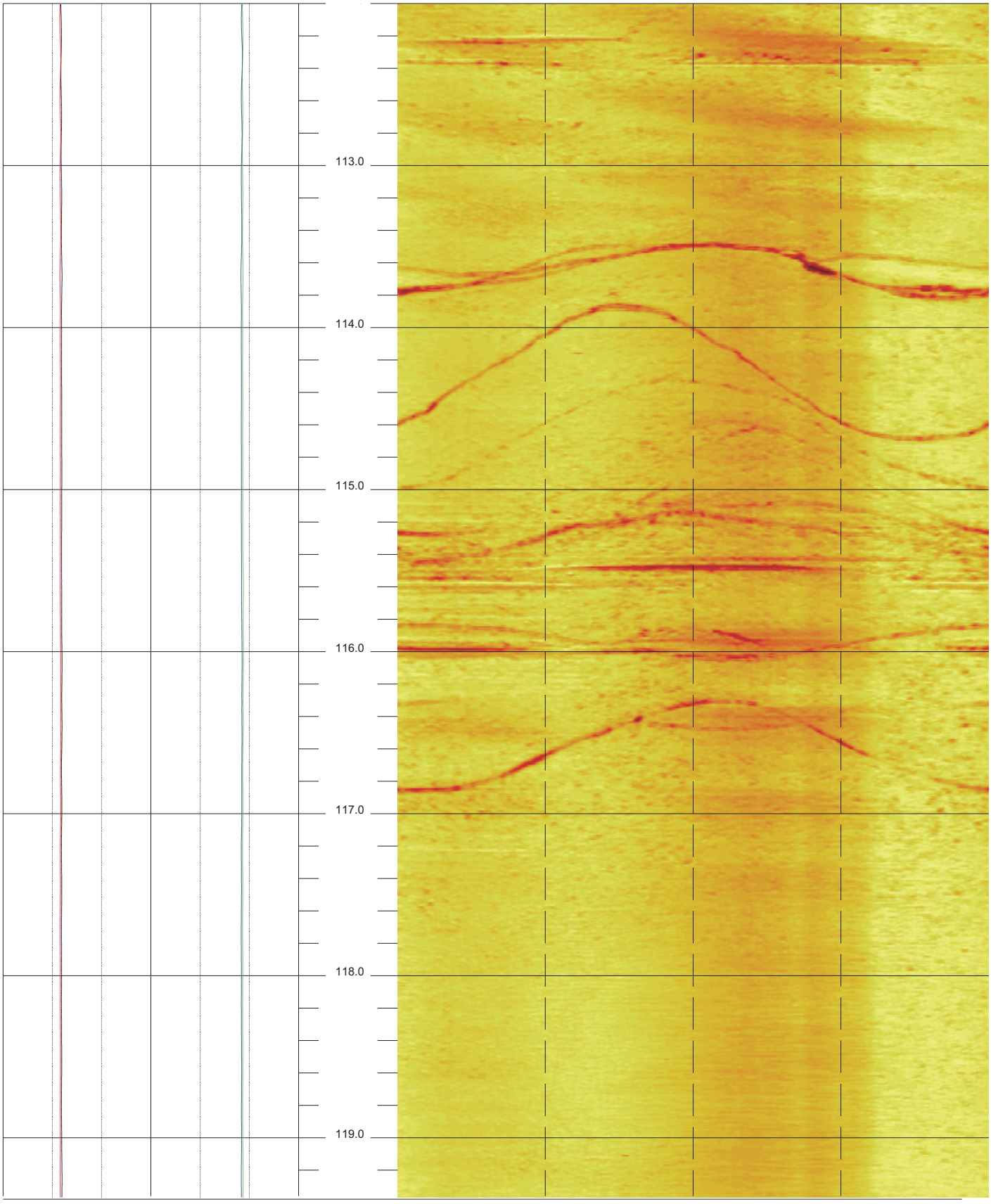
MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 13 of 17



MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 14 of 17



MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 15 of 17



MRDA Substation Boring B-09 Acoustic Televiewer Derived Caliper rev 1 Sheet 16 of 17

BHTV DATA PROCESSING
RGLDIP vsn 6.2
ACOUSTIC CALIPER LOG

URS

Borehole: B-10

MRDA SUBSTATION

top of borehole.....
East: _
North: _
Elev: _

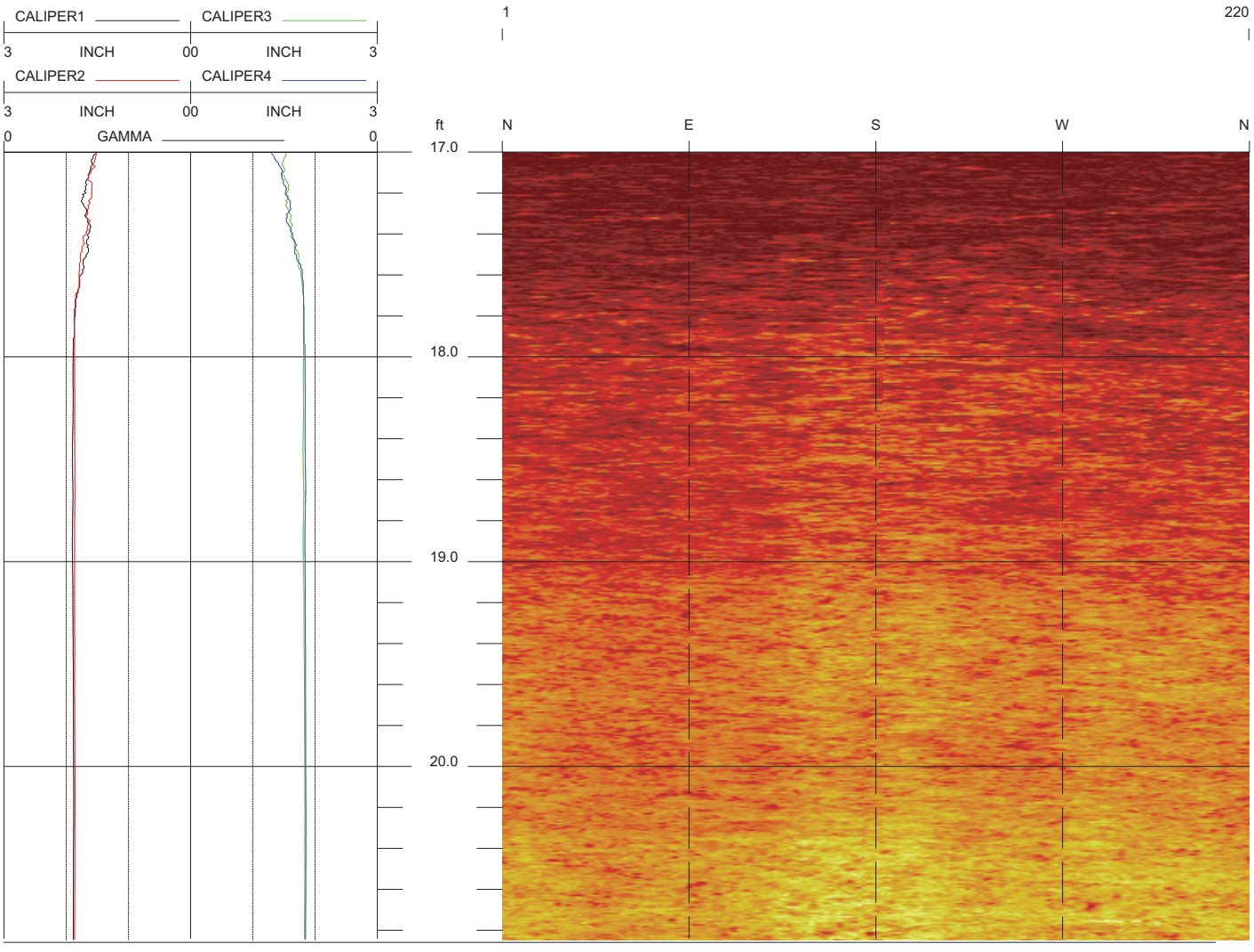
North ref. is true
Depth units are feet
Vertical scale: 1/10

Zone from 88.800 to 17.000ft

Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude

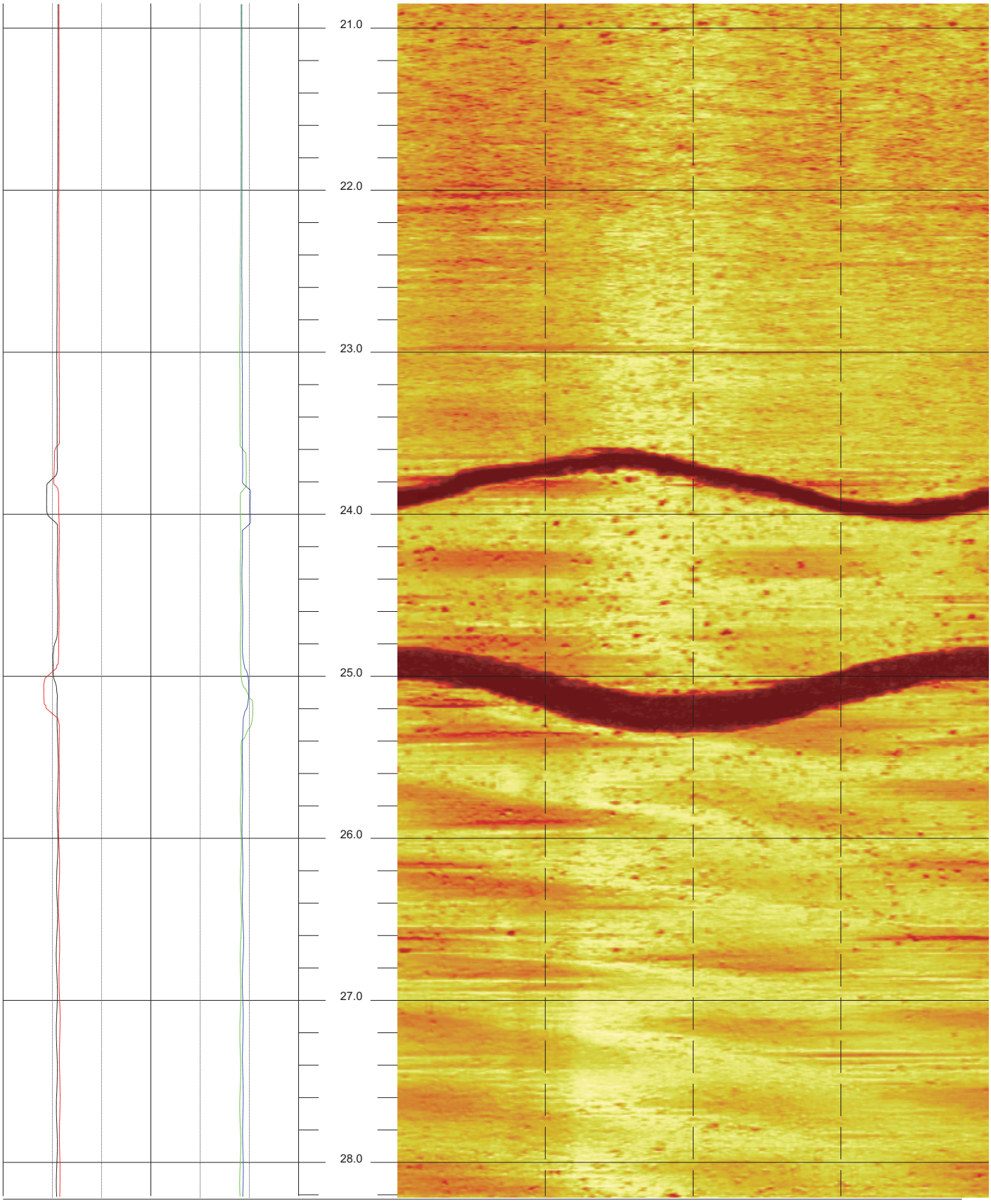
Depth interval 0.008ft, Filter length 0.248ft

REFLECTANCE

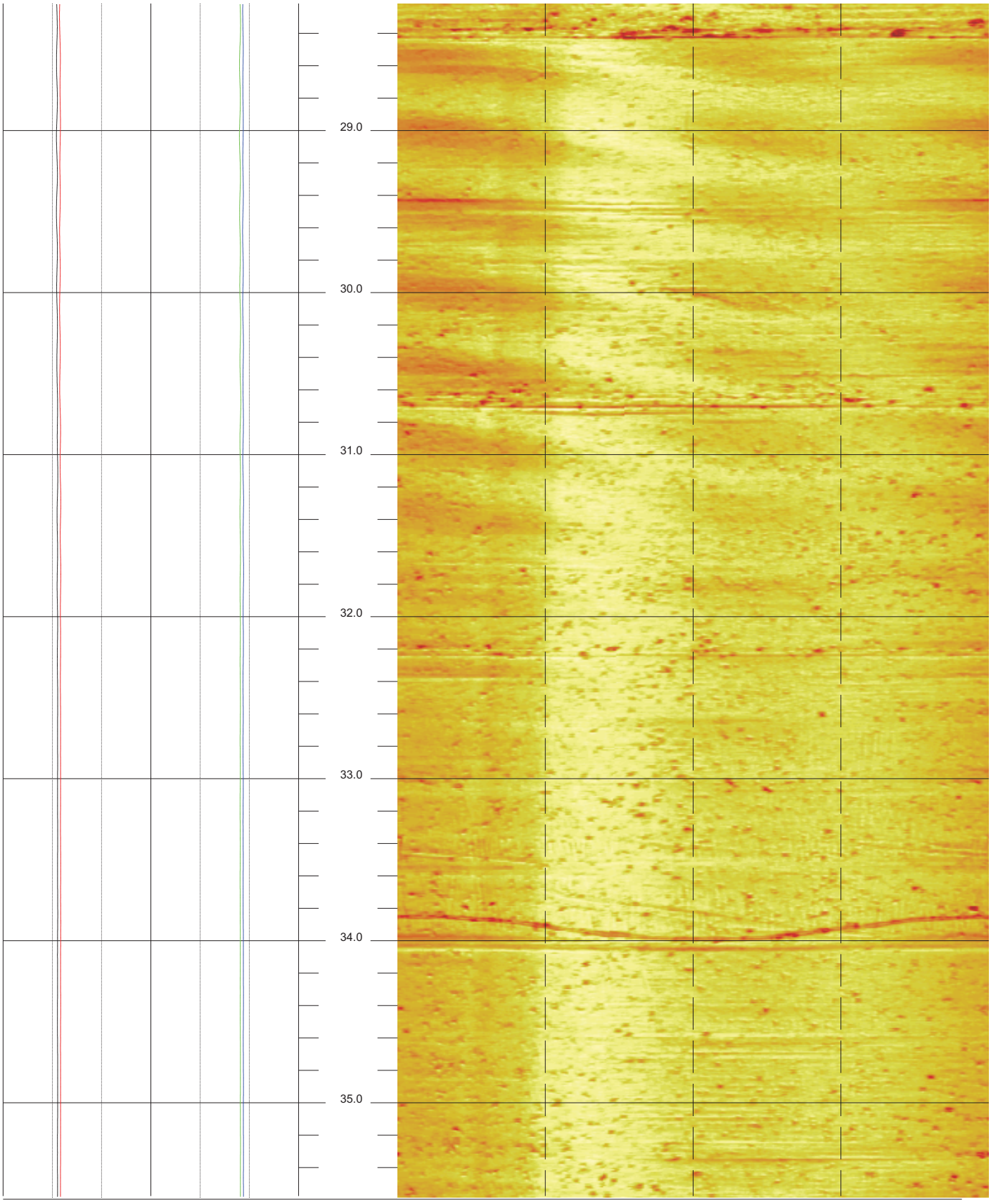


B-10 20.848 to 17.000ft 1

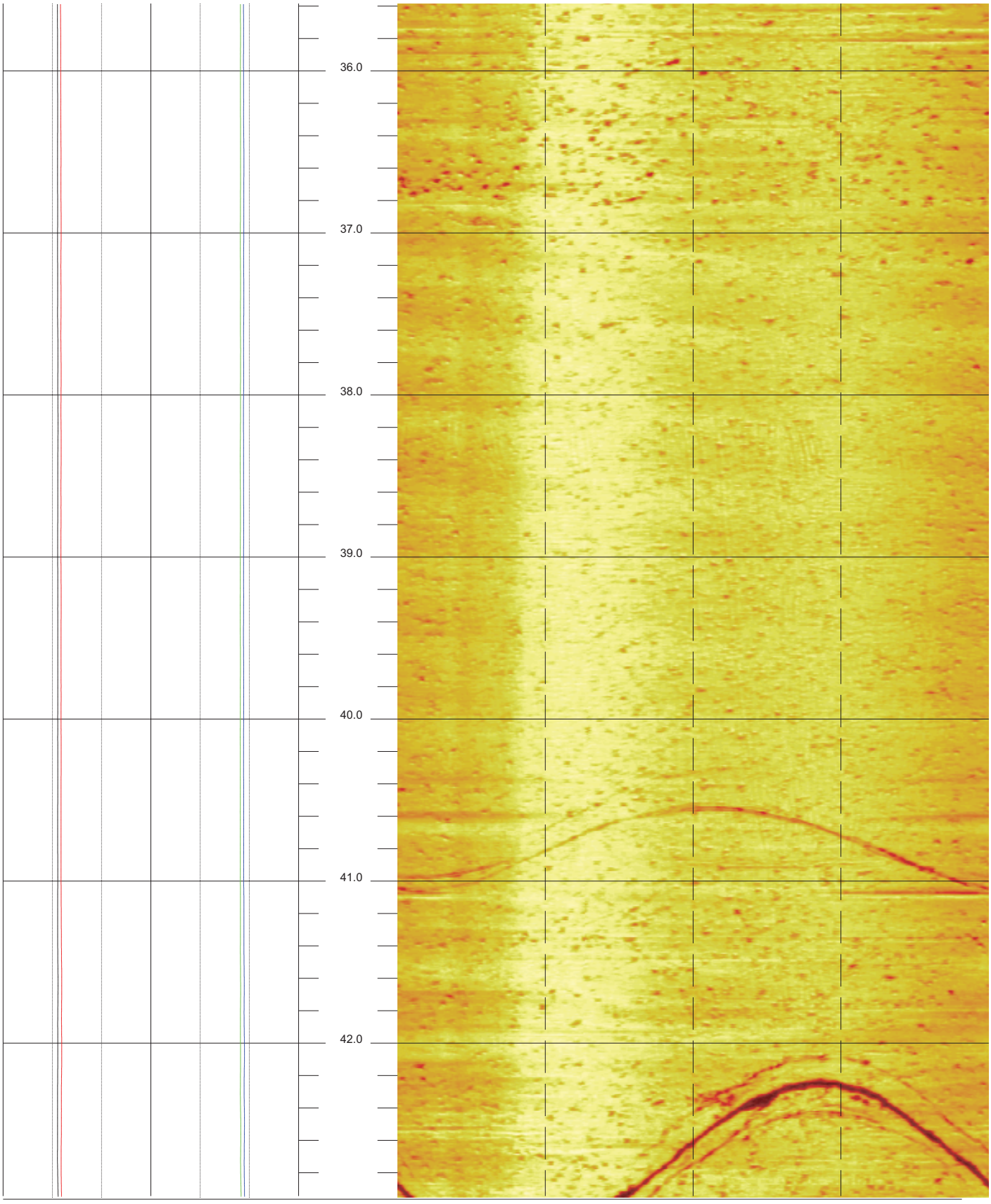
MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 1 of 11



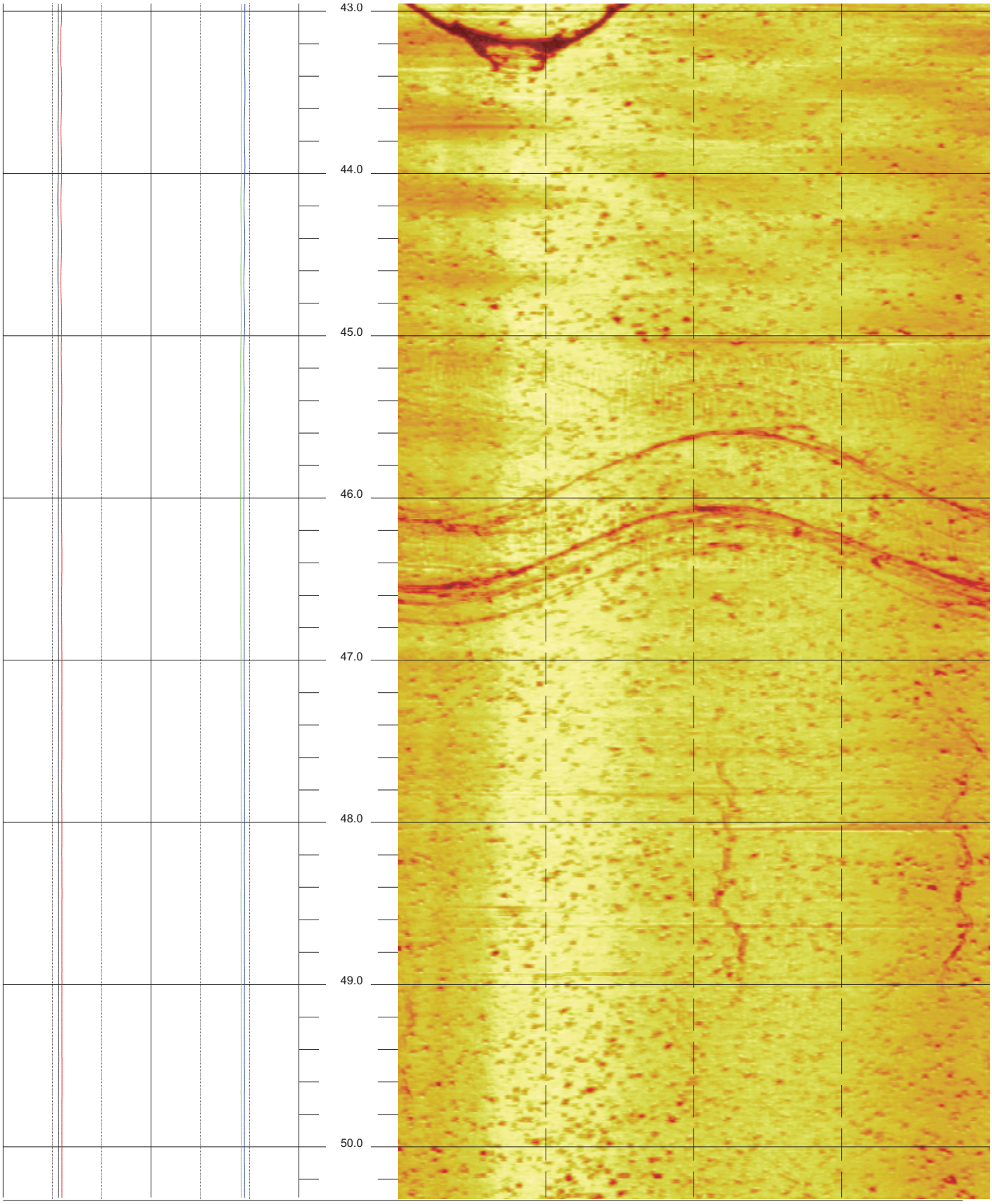
MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 2 of 11



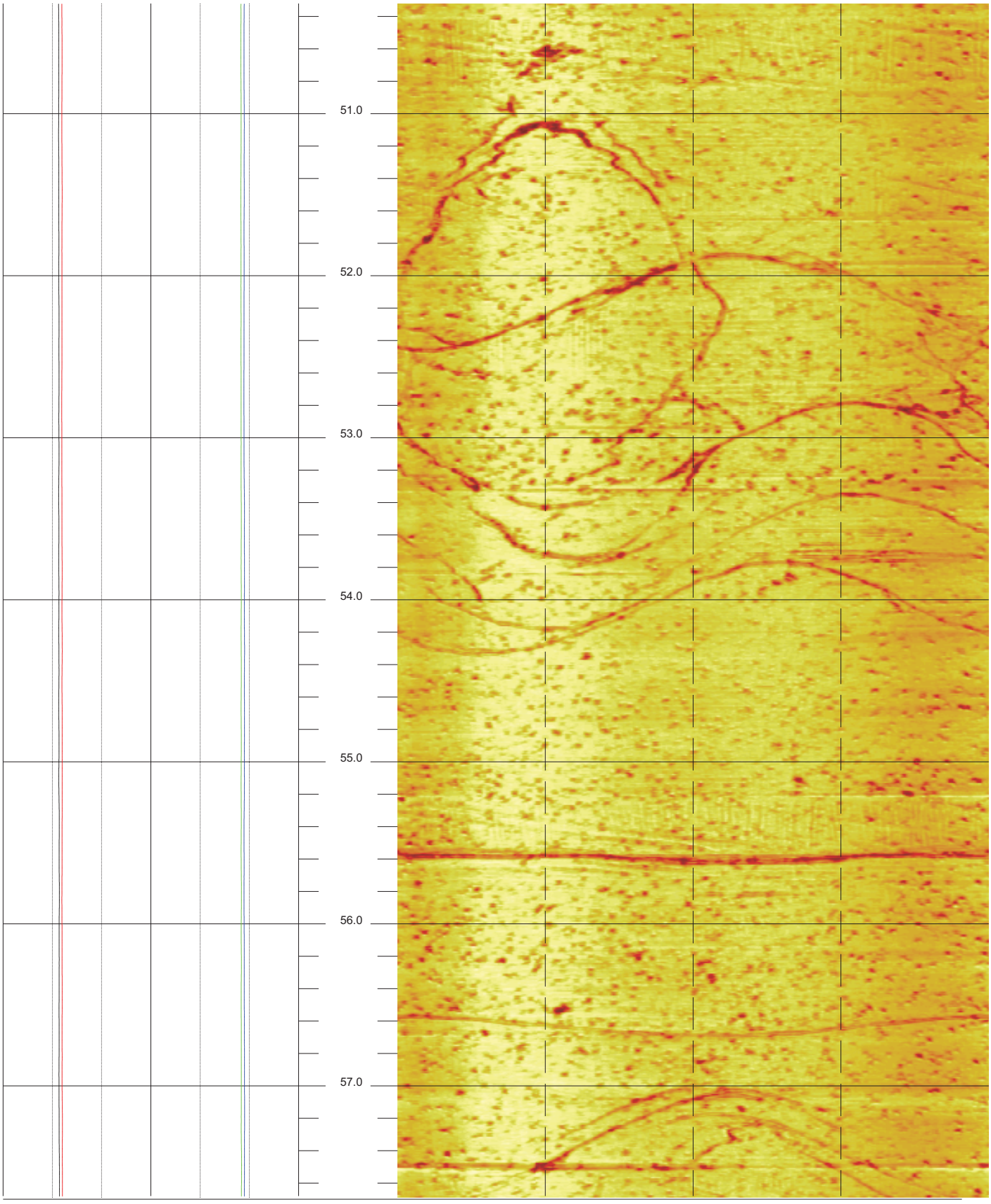
MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 3 of 11



MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 4 of 11

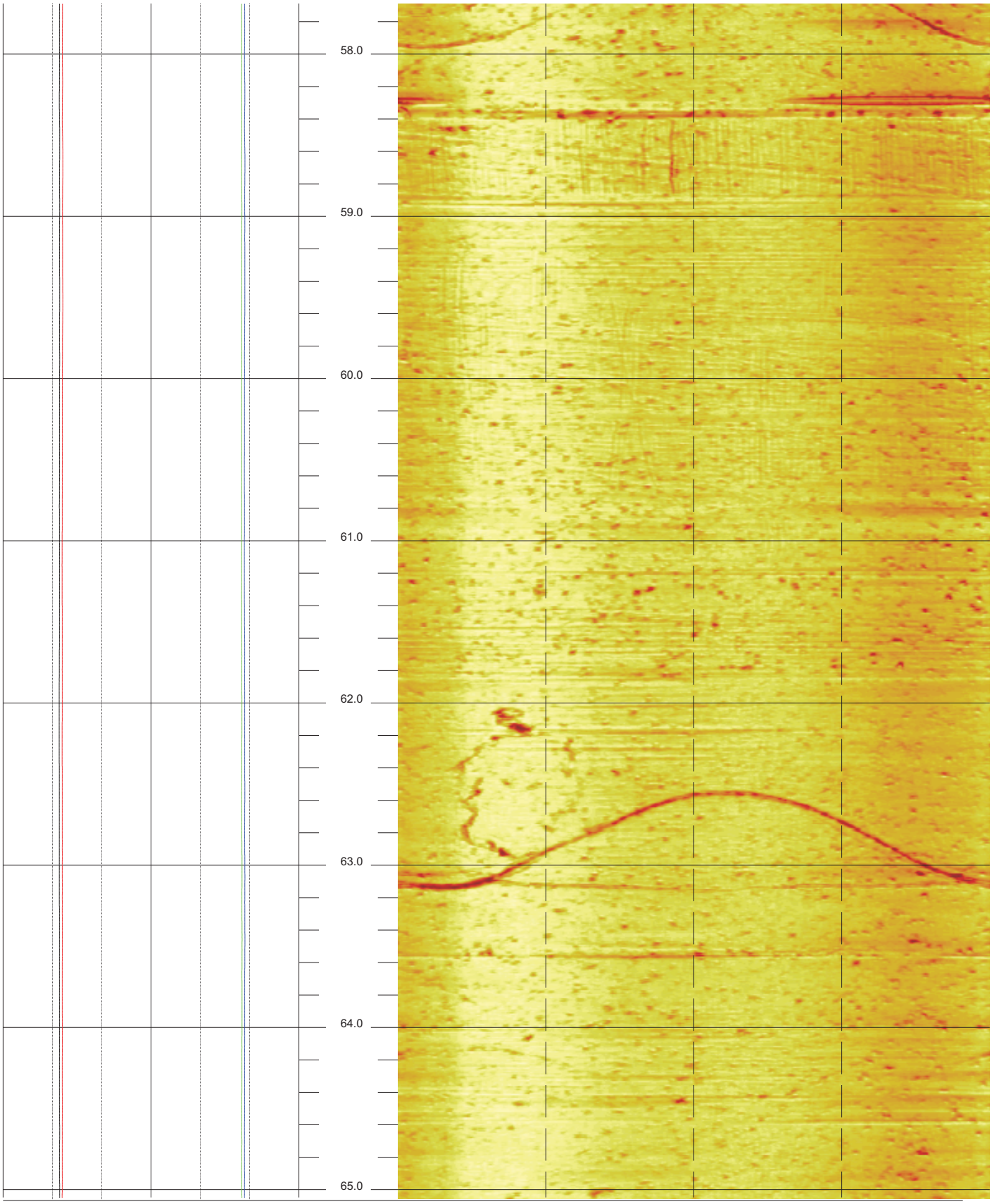


MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 5 of 11

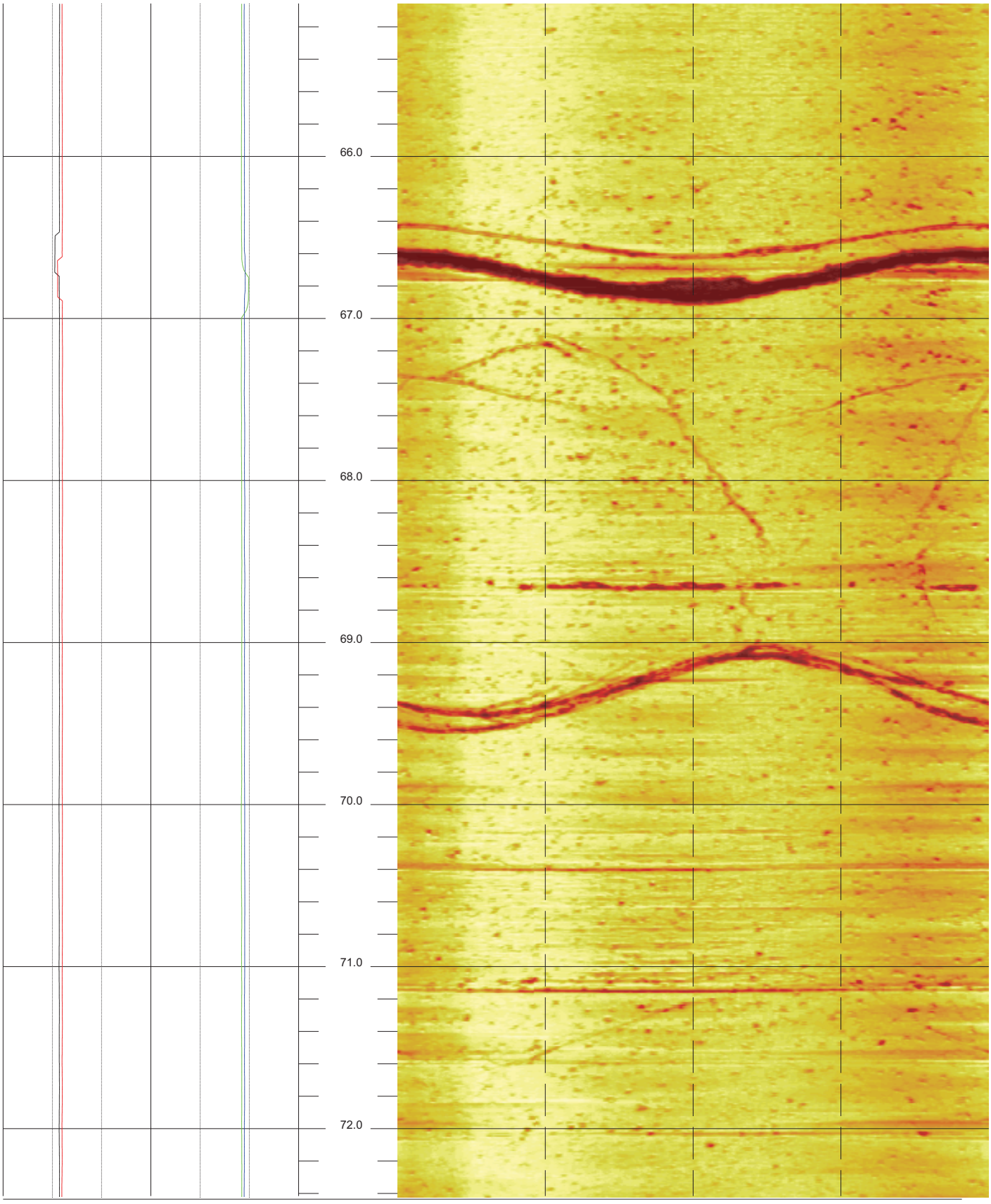


B-10 57.688 to 50.320ft 6

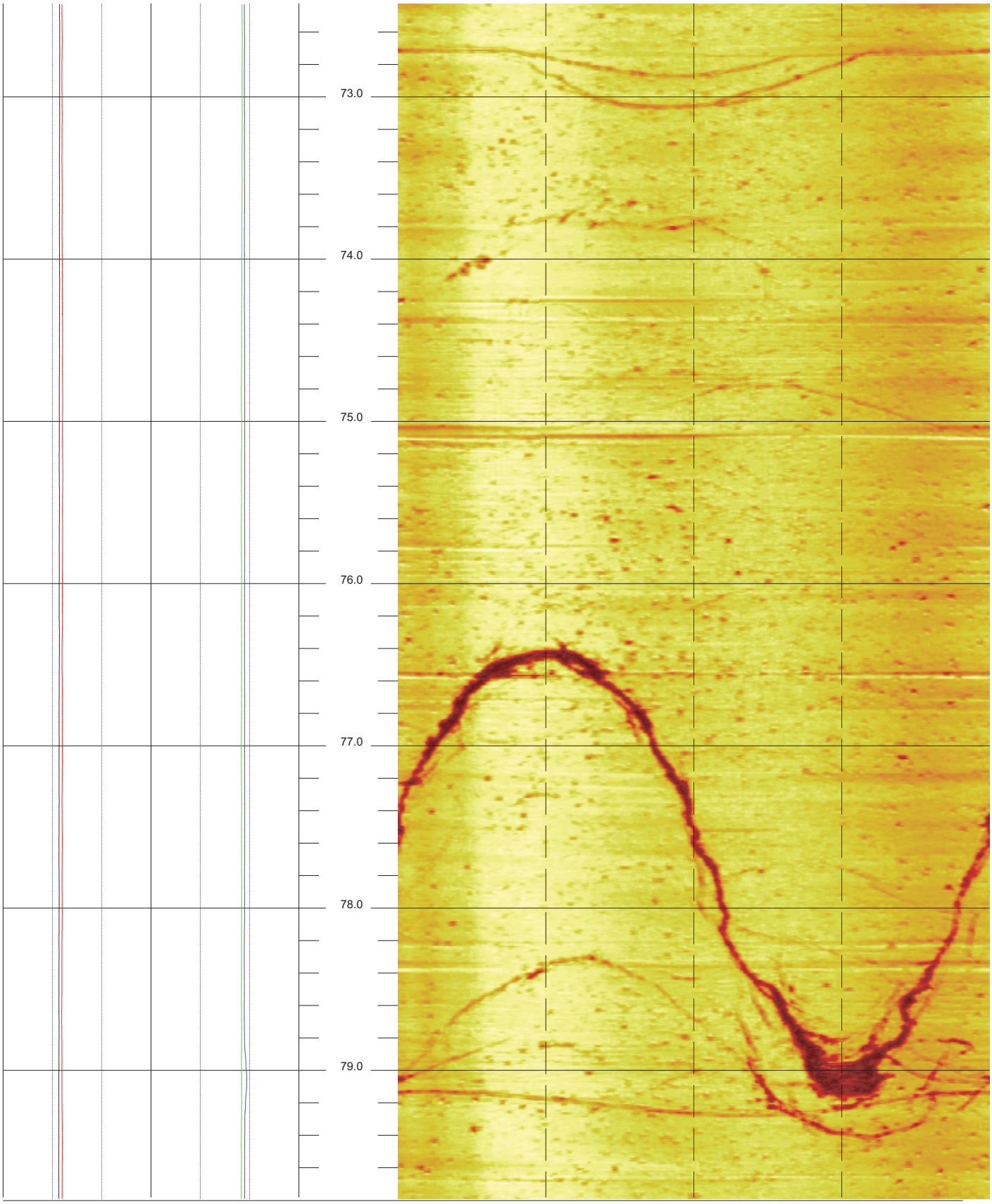
MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 6 of 11



MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 7 of 11

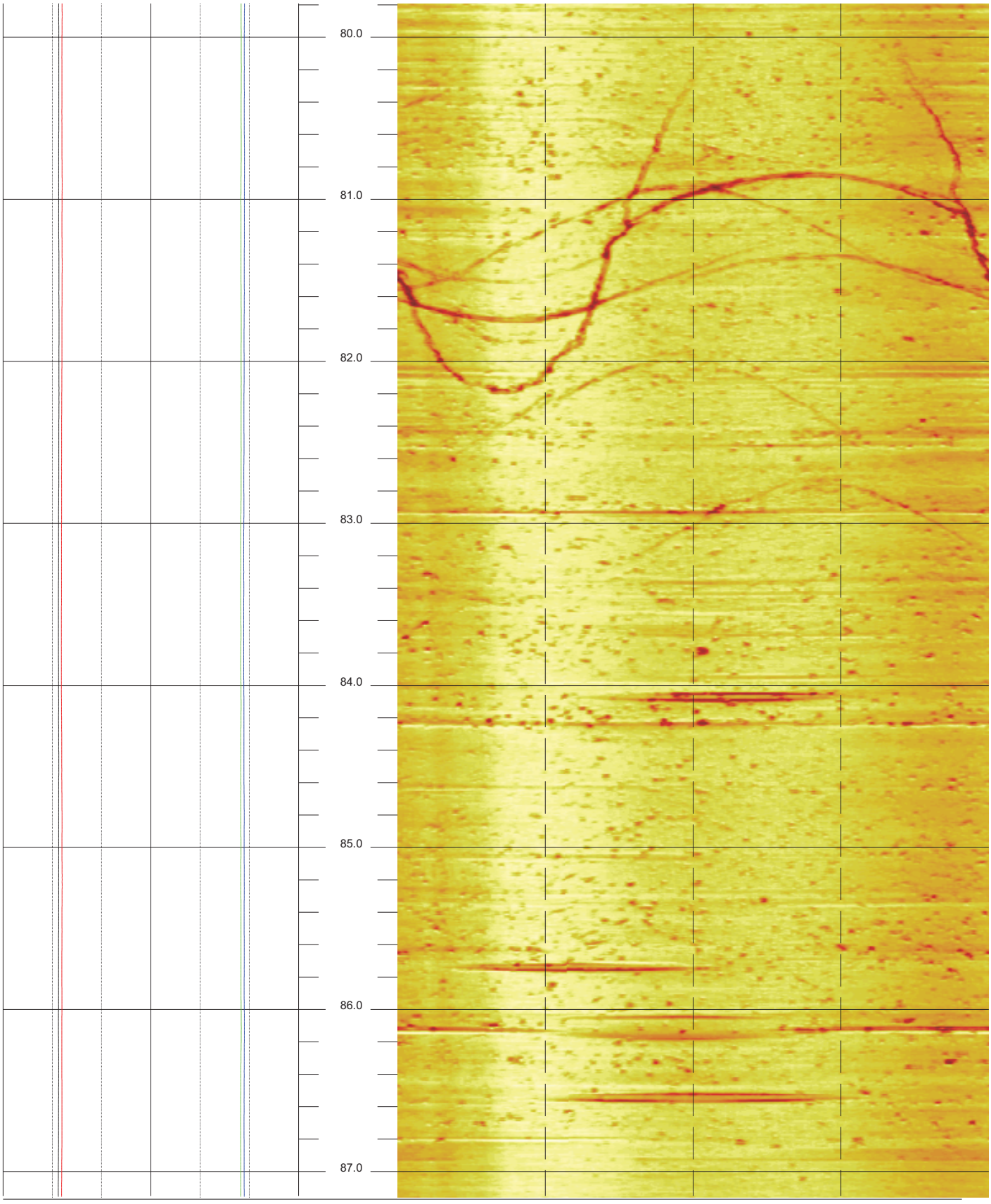


MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 8 of 11

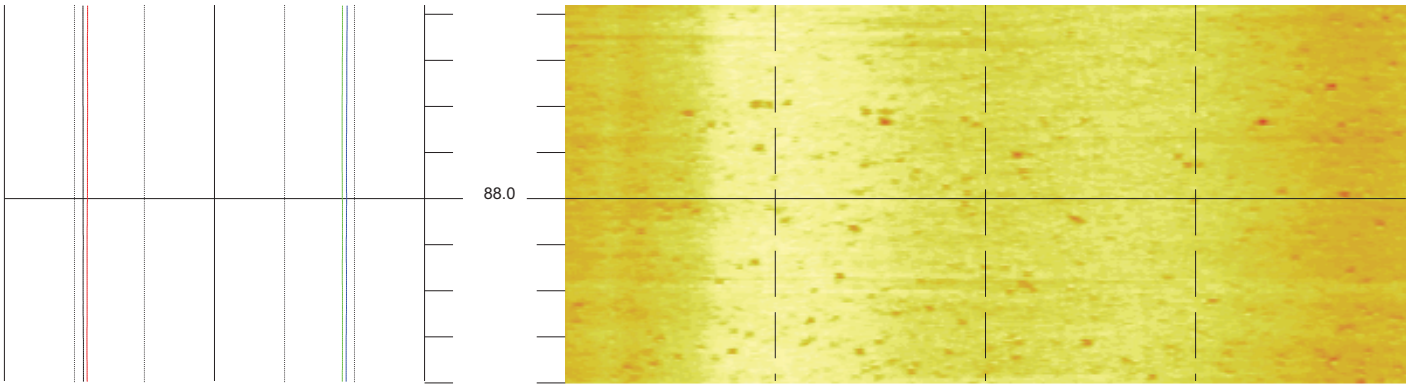


B-10 79.792 to 72.424ft 9

MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 9 of 11



MRDA Substation Boring B-10 Acoustic Televiewer Derived Caliper rev 1 Sheet 10 of 11


88.0

BHTV DATA PROCESSING
RGLDIP vsn 6.2
ACOUSTIC CALIPER LOG

URS

Borehole: B-11

MRDA SUBSTATION

top of borehole.....
East: _
North: _
Elev: _

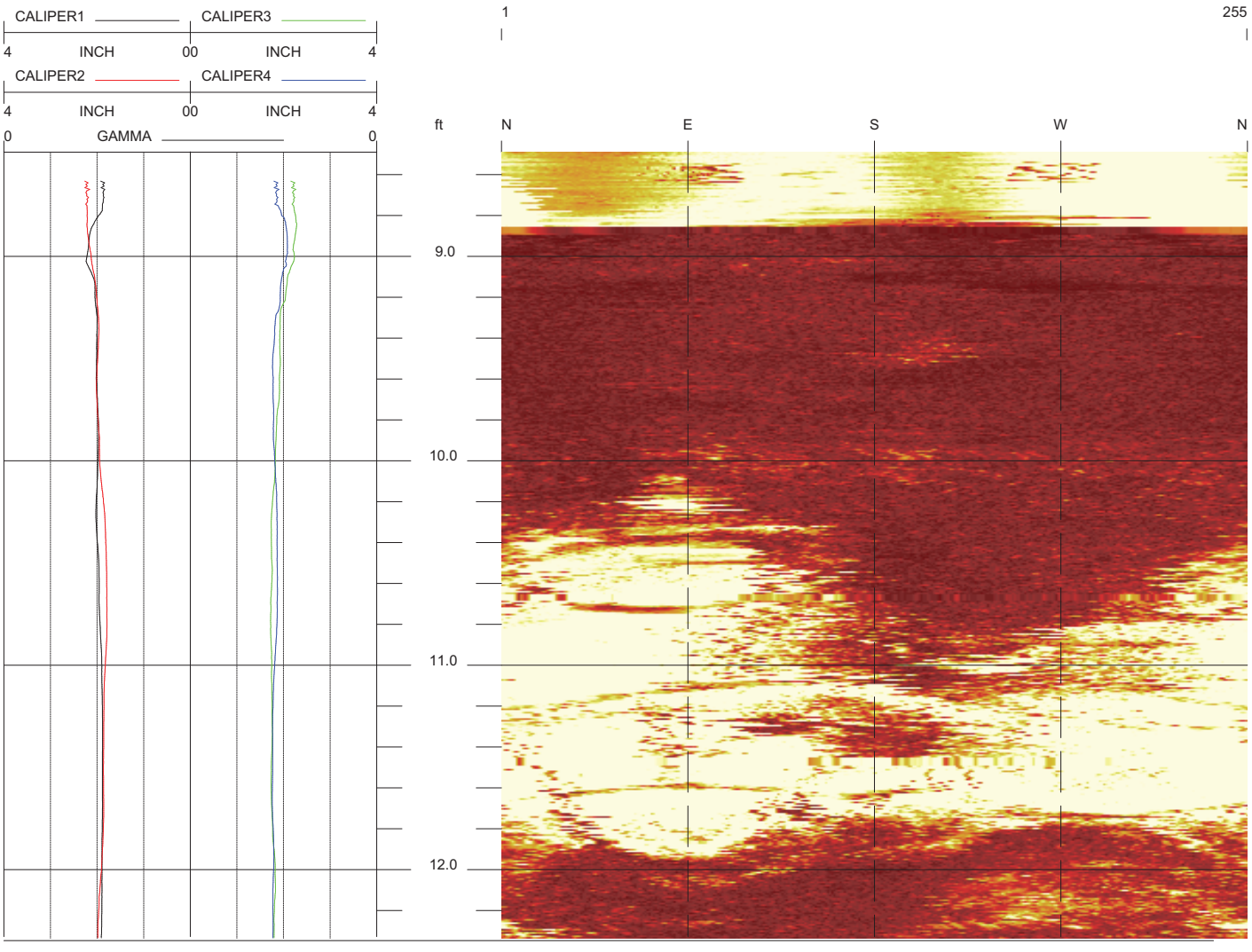
North ref. is true
Depth units are feet
Vertical scale: 1/10

Zone from 56.400 to 8.488ft

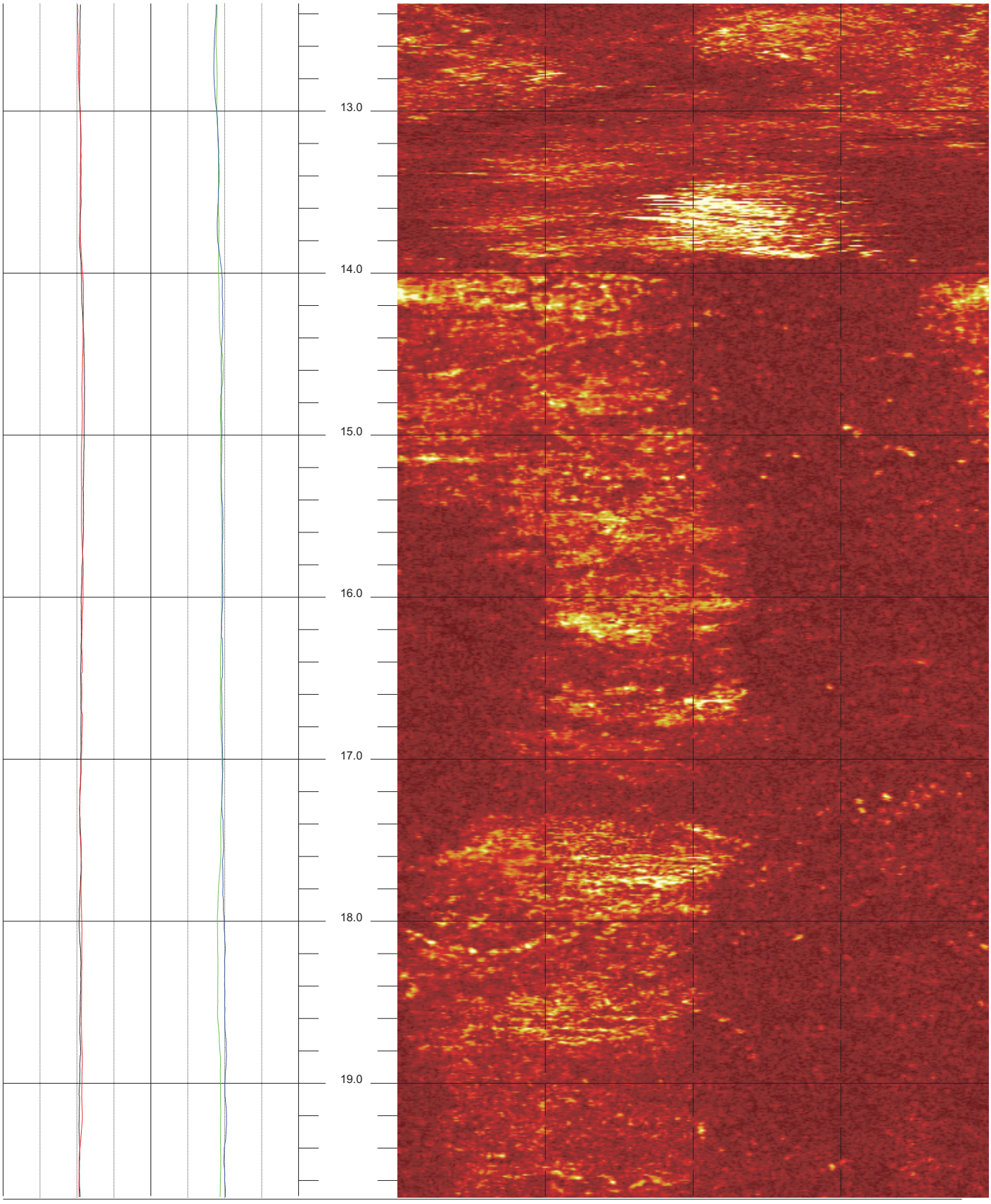
Borehole diam: 3.860inch
Vertical = borehole-axis
Image: Amplitude

Depth interval 0.008ft, Filter length 0.248ft

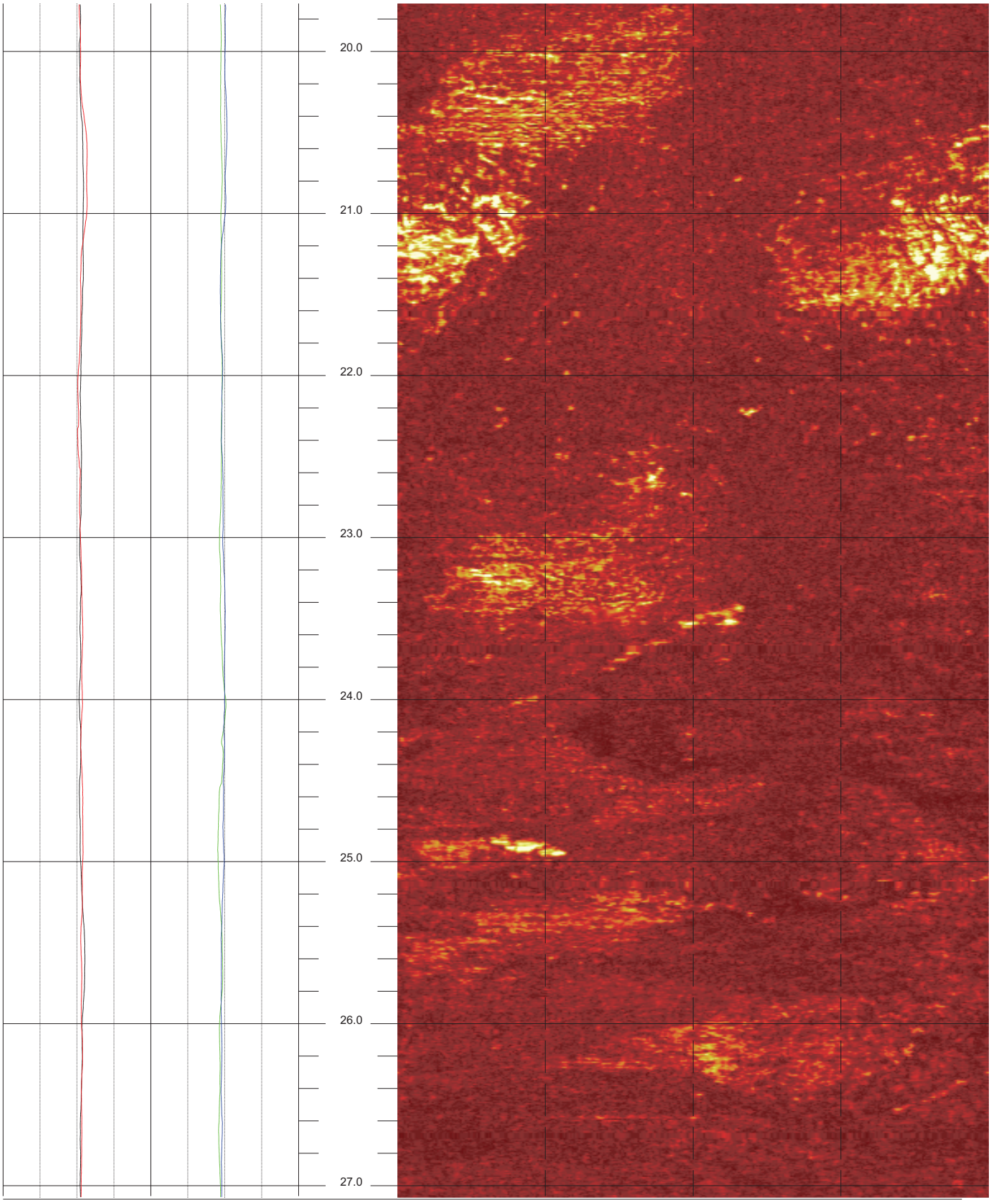
REFLECTANCE



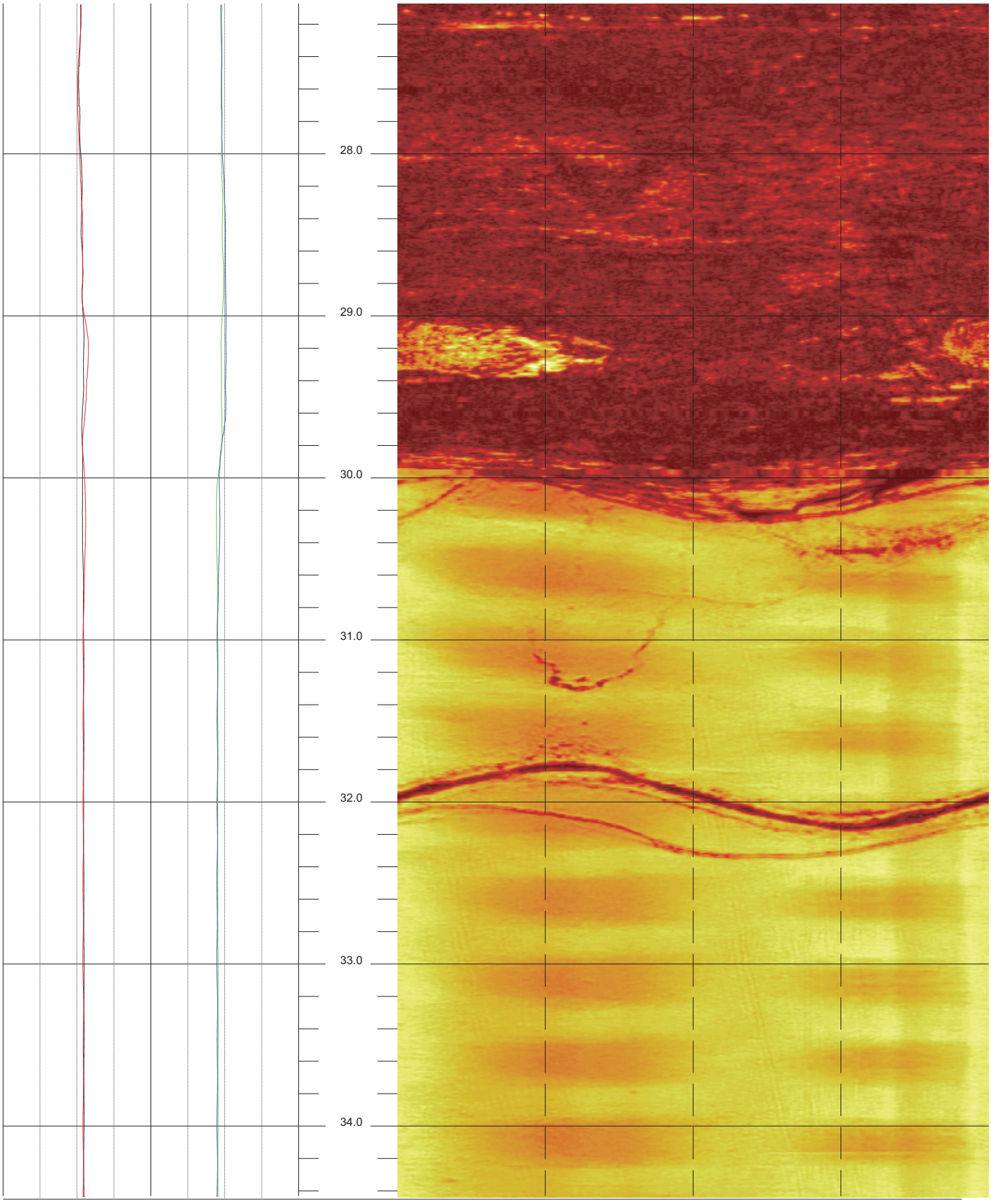
B-11 12.336 to 8.488ft 1



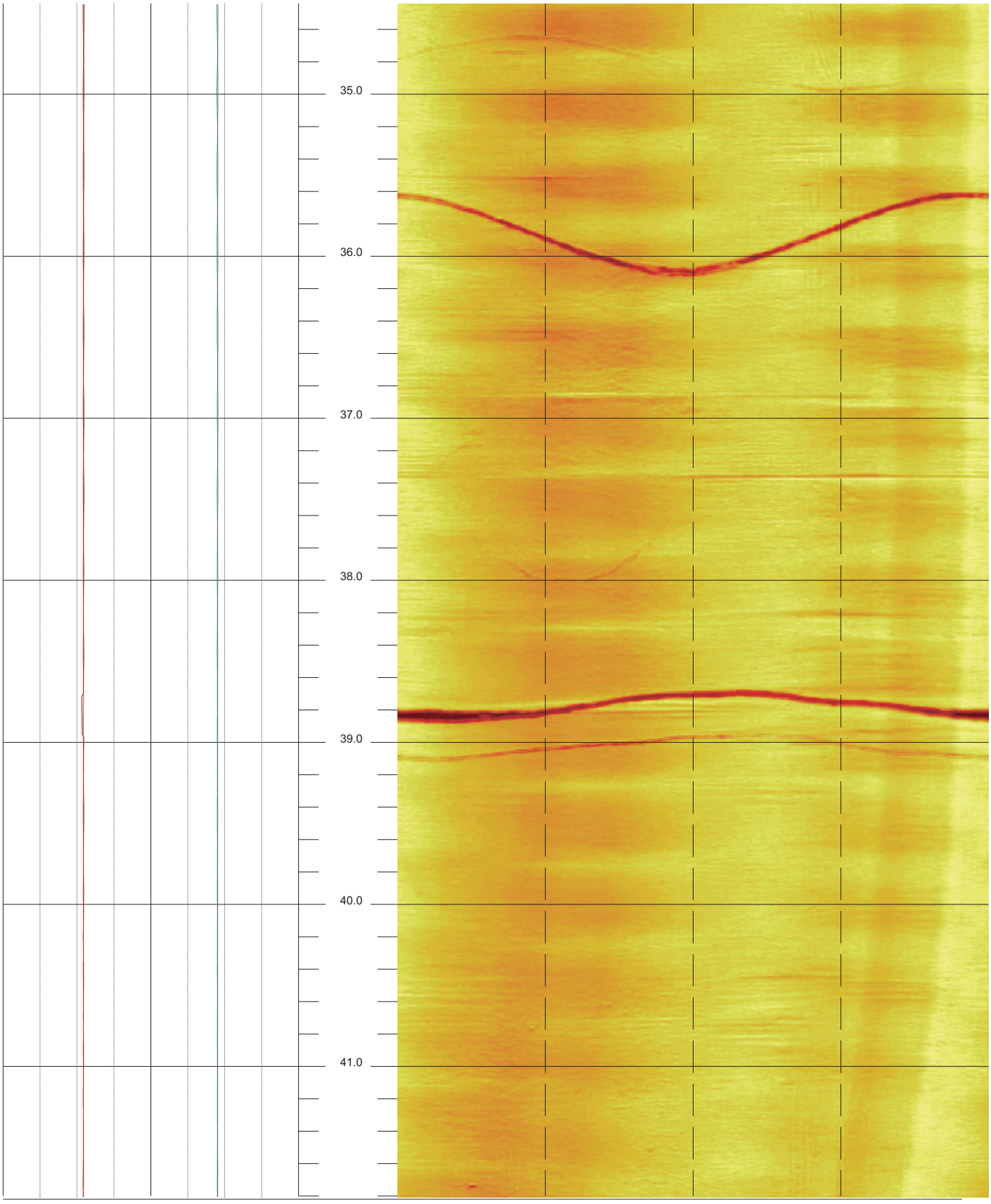
MRDA Substation Boring B-11 Acoustic Televiewer Derived Caliper rev 1 Sheet 2 of 7



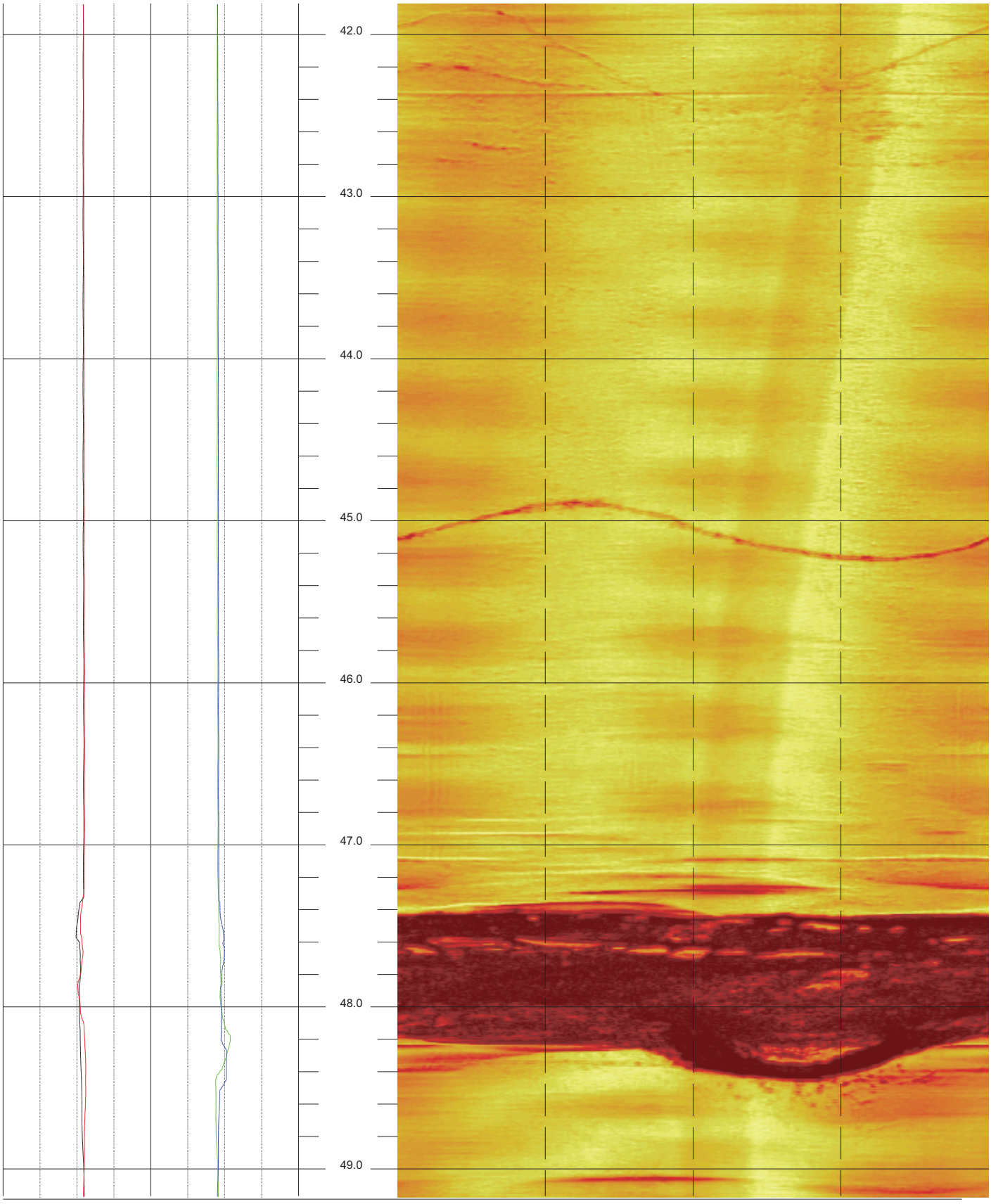
MRDA Substation Boring B-11 Acoustic Televiewer Derived Caliper rev 1 Sheet 3 of 7



MRDA Substation Boring B-11 Acoustic Televiewer Derived Caliper rev 1 Sheet 4 of 7

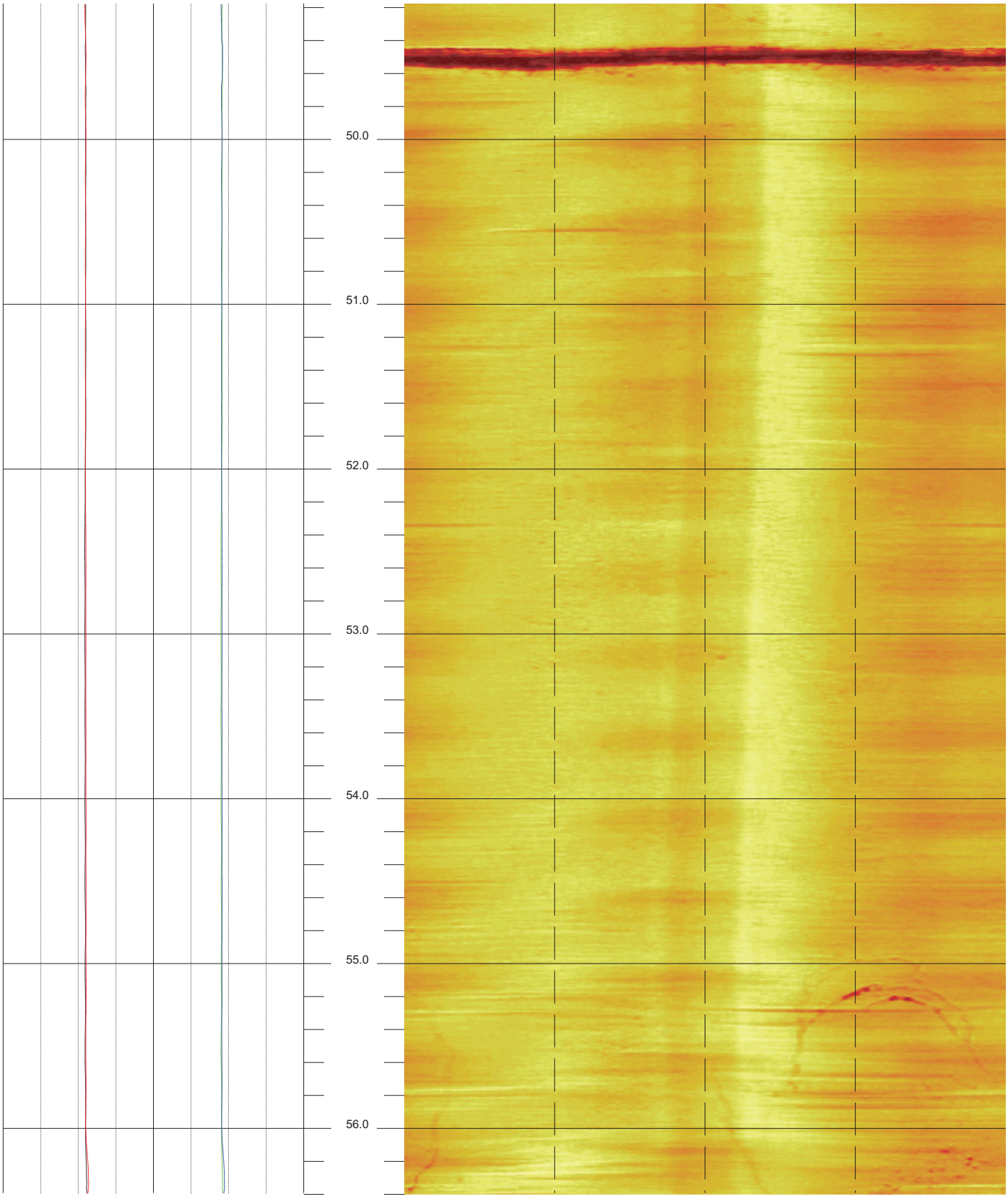


MRDA Substation Boring B-11 Acoustic Televiewer Derived Caliper rev 1 Sheet 5 of 7



B-11 49.176 to 41.808ft 6

MRDA Substation Boring B-11 Acoustic Televiewer Derived Caliper rev 1 Sheet 6 of 7


50.0
51.0
52.0
53.0
54.0
55.0
56.0

INTRODUCTION

URS personnel performed dilatometer tests in three core borings (Boring B-4, Boring B-18 and Boring B-20) at the proposed Suncrest Substation. The tests were performed at depths ranging from 14.7 feet to 47.2 feet bgs. The rock types tested included granitic rock and metasedimentary rock. The condition of the rock ranged from moderately weathered to fresh rock.

At present, no specific ASTM standard exists for dilatometer testing. The dilatometer tests were performed in general accordance with ASTM D4719 (Standard Test Method for Prebored Pressuremeter Testing in Soils) with adaptations to reflect differences in the two types of equipment. URS personnel recorded the change in volume vs. set pressure increases as recommended by Roctest, the manufacturer of the Probex-1 dilatometer.

Dilatometer Equipment

The RocTest Probex-1 dilatometer system was used to perform the dilatometer tests. The dilatometer system consists of an expandable probe, which is connected to a hydraulic pump by two hydraulic lines, and a readout unit, which is connected to the probe by an electric cable. The hydraulic pump is also connected to the readout unit by a transducer. The cylindrical probe has an expandable steel-reinforced plastic measuring cell membrane, which is inflated by injection of water from an isolated reservoir. Water is forced into the measuring cell membrane chamber by a piston, which is advanced by the flow of hydraulic fluid through an inflation line attached to the manual hydraulic pump located at the ground surface. The movement of the piston is measured by a linear variable differential transformer mounted in the probe and is displayed as a volume change in cubic centimeters (cc). Both pressure and volume are recorded by the battery-powered readout unit. The probe is deflated by pumping hydraulic fluid through the deflation line against a smaller deflation piston. This system has a maximum working pressure capacity of 30 Megapascals (MPa) (4.35 kips per square inch [ksi]) and a maximum working volume of 350 cc.

Test Procedure

To prepare a borehole for dilatometer testing, an NQ wire line core barrel (approx 2.875 inches outside diameter) was used to advance the borings to depths of approximately 50 feet bgs. Test intervals were then selected by a URS engineering geologist to investigate a range of testable conditions. After the probe was lowered into position, tests were performed by expanding the probe in equal pressure increments of 3 MPa (0.435 ksi), and measuring the change in volume of the measuring cell for each increment. For a given pressure, volume readings were taken 60 seconds after application of the pressure increment. The pressure was increased in equal increments until the pressure or volume capacity of the system was reached. Unloading and reloading cycles were performed at selected locations, but yielded little useful information due to the high strength of the rock.

Equipment Calibration

The pressure and volume change measurements obtained during the dilatometer tests were corrected for inertia of the probe, expansion of the measurement system, and the hydrostatic pressure of the column of fluid between the surface transducer and the probe membrane. The system expansion was calibrated by systematically testing pressures throughout the working range of the probe in a rigid steel casing. An appropriate volume change due to system expansion was then calculated and deducted from the actual test volume measurements. The inertia of the measuring system was calibrated in open air by determining the pressure required to expand the measuring cell membrane to specific volumes without any external resistance. The inertia-correction pressure corresponding to each volume reading was subtracted from each test pressure. To account for the column of fluid between the transducer and the probe, the hydrostatic pressure from the column of fluid was added to the recorded pressure.

INTERPRETATION OF RESULTS

Interpretation of the dilatometer test data yields information on the deformability of the tested rock mass, from which a qualitative inference to the rock properties can be made.

Elastic Modulus

The dilatometer data can be interpreted to yield the shear modulus, and hence Young's elastic modulus, E, using Lamé's (1852) solution for a radial expansion of an internally pressurized cylindrical cavity made in an infinitely elastic medium using the following equation:

$$E = 2(1+\nu)(V_0 + V_m)\frac{\Delta P}{\Delta V}$$

where: ν = Poisson's ratio

V_0 = nominal initial or "at-rest" volume of the deflated probe

V_m = mean additional volume injected from the "at-rest" condition up to the midpoint of the selected pressure range where E is calculated

ΔP = change in pressure over the interval the selected pressure range where E is calculated

ΔV = change in volume over the interval the selected pressure range where E is calculated

The values of ΔP and ΔV correspond to the initial linear loading part of the curve after the membrane has made contact with the borehole wall. The value of Poisson's ratio (ν) was assumed to be 0.35.

Dilatometer Modulus

Kulhawy and Mayne (1990) note a correlation between Elastic Modulus (E) and Dilatometer Modulus (E_D as:

$$E_D = E/(1-\nu^2)$$

RESULTS

The dilatometer test data were reduced using Probex Companion (version 2.0.4), a program supplied by the dilatometer manufacturer. This appendix presents plots of the reduced data, showing the corrected volume versus pressure plot and the interpreted values of the elastic modulus and the dilatometer modulus. The dilatometer test results are summarized in the table below.

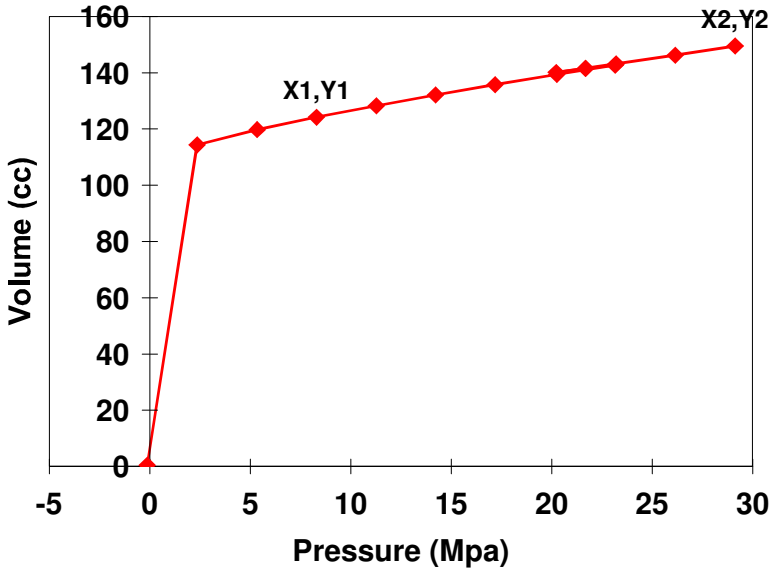
Table E-1
Summary of Dilatometer Test Results
Suncrest Substation

Boring ID	Depth (feet)	Rock Description	Elastic Modulus, E (MPa)	Elastic Modulus, E (ksi)	Dilatometer Modulus, E_D (MPa)	Dilatometer Modulus, E_D (ksi)
B-04	34.0	Slightly Weathered Rock	19,283	2,797	21,975	3,187
B-04	38.0	Slightly Weathered Rock	4,487	651	5,113	742
B-04	43.0	Slightly Weathered Rock	20,481	2,971	23,340	3,386
B-04	47.2	Slightly Weathered Rock	5,869	851	6,688	970
B-18	14.7	Moderately to Slightly Weathered Rock	734	106	836	121
B-18	19.5	Moderately to Slightly Weathered Rock	709	103	808	117
B-18	22.5	Moderately to Slightly Weathered Rock	523	76	596	87
B-18	32.5	Moderately to Slightly Weathered Rock	4,132	599	4,709	683
B-18	46.2	Slightly Weathered Rock	12,045	1,747	13,726	1,991
B-20	27.0	Slightly Weathered to Fresh Rock	8,694	1,261	9,908	1,437
B-20	38.5	Slightly Weathered Rock	6,584	955	7,503	1,088
B-20	46.7	Slightly Weathered Rock	8,024	1,164	9,144	1,326

Probex Companion Dataset information

Borehole Name:	B-4-MRDA/004
Date:	16:53 01-20-2009
Probe:	PROBEX-1
Depth:	34.00 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B-4(C = 0.954123 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.024	.404
2.998	114.339
6.023	119.786
9.012	124.237
12.014	128.254
14.994	132.142
17.982	135.806
21.073	139.405
24.002	142.731
22.523	141.565
21.048	140.158
22.519	141.629
24.053	143.197
27.015	146.296
30.018	149.535

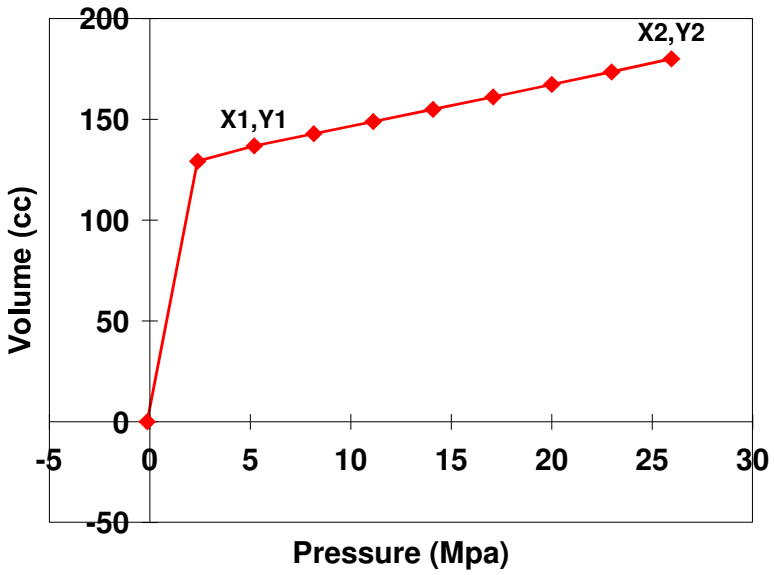
X1 = 8.28985 X2 = 29.1309
Y1 = 124.237 Y2 = 149.535

E = 19283.44 MPa

Probex Companion Dataset information

Borehole Name:	B-4-MRDA/003
Date:	16:22 01-20-2009
Probe:	PROBEX-1
Depth:	38.00 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B-4(C = 0.954123 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.022	-.016
3.124	129.248
5.996	136.836
8.996	142.912
11.993	148.897
15.007	154.991
18.028	161.17
20.989	167.297
23.996	173.577
27.009	180.08

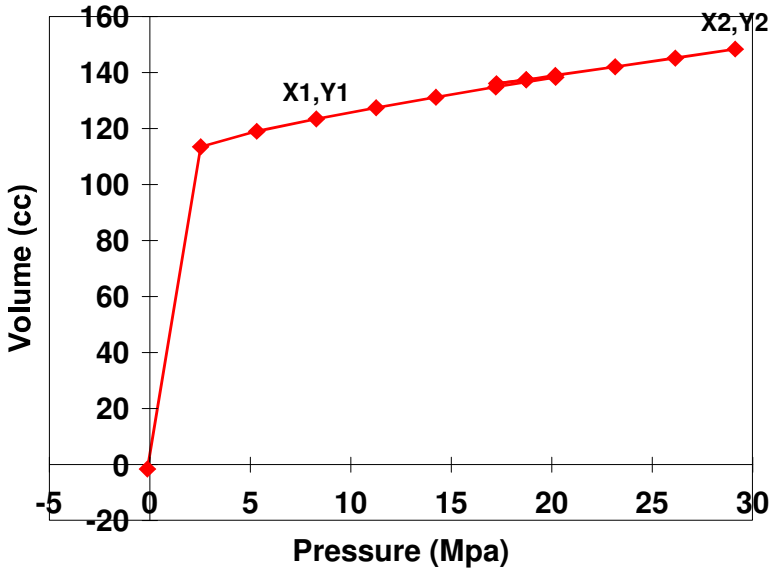
X1 = 5.19172 X2 = 25.9628
Y1 = 136.836 Y2 = 180.08

E = 4486.834 MPa

Probex Companion Dataset information

Borehole Name:	B-4-MRDA/002
Date:	15:46 01-20-2009
Probe:	PROBEX-1
Depth:	43.00 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B-4(C = 0.954123 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.03	-1.589
3.172	113.494
5.998	119.056
8.998	123.401
12	127.448
15.003	131.194
17.997	134.848
21.011	138.365
19.538	137.511
18.054	136.056
19.549	137.417
21.004	139.022
23.996	142.042
27.012	145.206
30.017	148.398

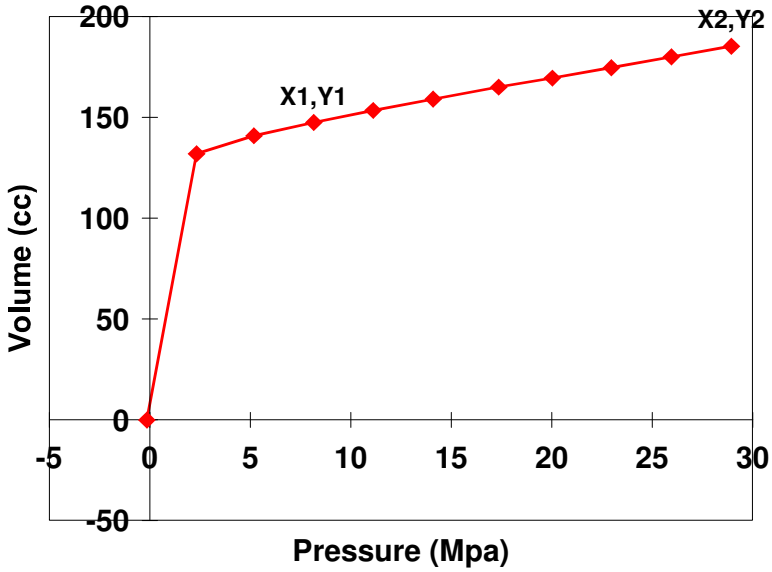
X1 = 8.2813 X2 = 29.1373
Y1 = 123.401 Y2 = 148.398

E = 20481.03 MPa

Probex Companion Dataset information

Borehole Name:	B-4-MRDA/001
Date:	15:17 01-20-2009
Probe:	PROBEX-1
Depth:	47.17 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B-4(C = 0.954123 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.008	-.186
3.09	132
6.003	140.888
9.027	147.499
12.014	153.451
15.04	159.042
18.33	165.054
21.024	169.507
23.984	174.686
27.002	180.027
30.021	185.335

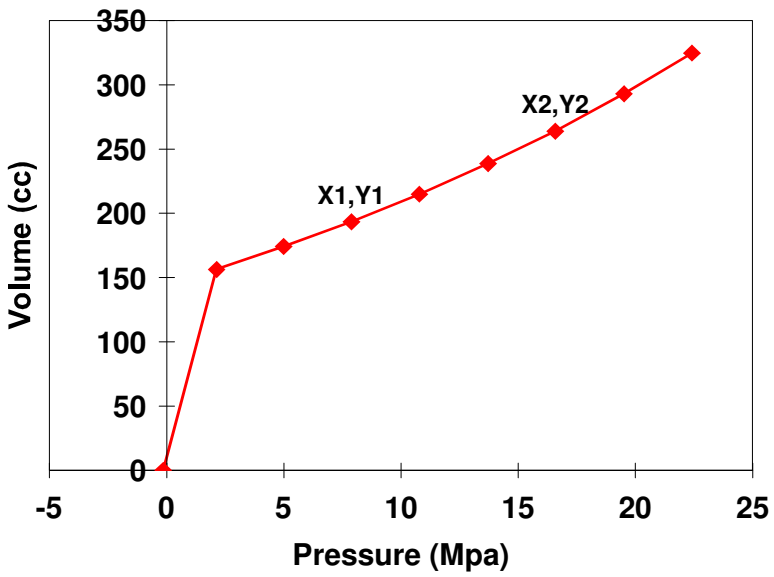
X1 = 8.1532 X2 = 28.9477
Y1 = 147.499 Y2 = 185.335

E = 5869.442 MPa

Probex Companion Dataset information

Borehole Name:	B-18-MRDA/007
Date:	17:27 01-16-2009
Probe:	PROBEX-1
Depth:	14.66 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B18(C = 0.968548 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.01	.083
3.047	156.504
6.001	174.218
8.996	193.527
11.998	214.985
15.014	238.8
17.973	263.972
20.997	293.053
23.995	324.746

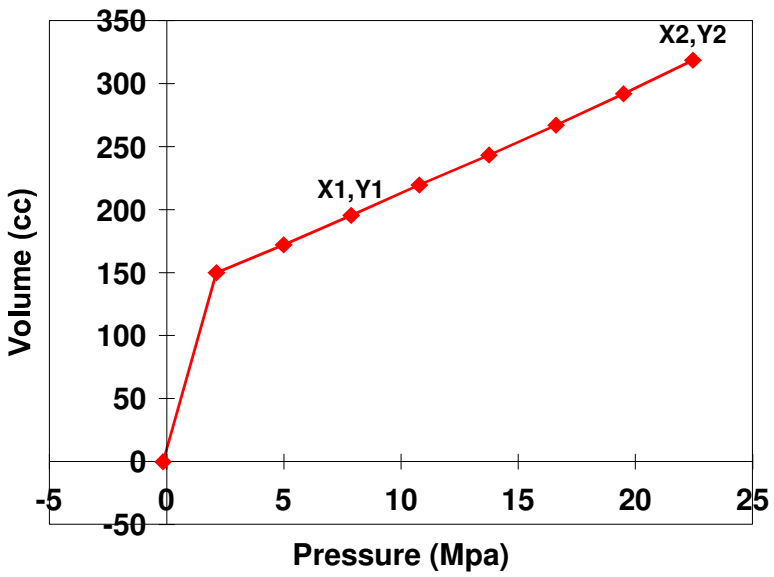
X1 = 7.88047 X2 = 16.5825
Y1 = 193.527 Y2 = 263.972

E = 733.7207 MPa

Probex Companion Dataset information

Borehole Name:	B-18-MRDA/005
Date:	16:54 01-16-2009
Probe:	PROBEX-1
Depth:	19.45 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B18(C = 0.968548 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.004	-.239
3.009	149.856
5.993	172.09
8.997	195.377
12.008	219.631
15.071	243.265
18.017	267.076
20.975	291.951
24.016	318.48

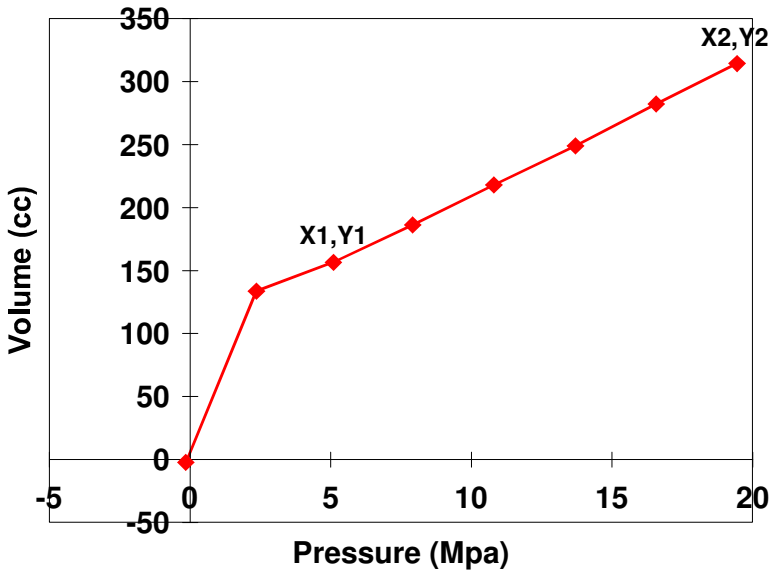
X1 = 7.87193 X2 = 22.4528
Y1 = 195.377 Y2 = 318.48

E = 708.6523 MPa

Probex Companion Dataset information

Borehole Name:	B-18-MRDA/004
Date:	16:30 01-16-2009
Probe:	PROBEX-1
Depth:	22.45 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B18(C = 0.968548 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.001	-2.27
3.138	133.806
6.019	156.653
8.991	186.25
12.029	218.141
15.046	249.01
18.02	282.221
20.997	314.403

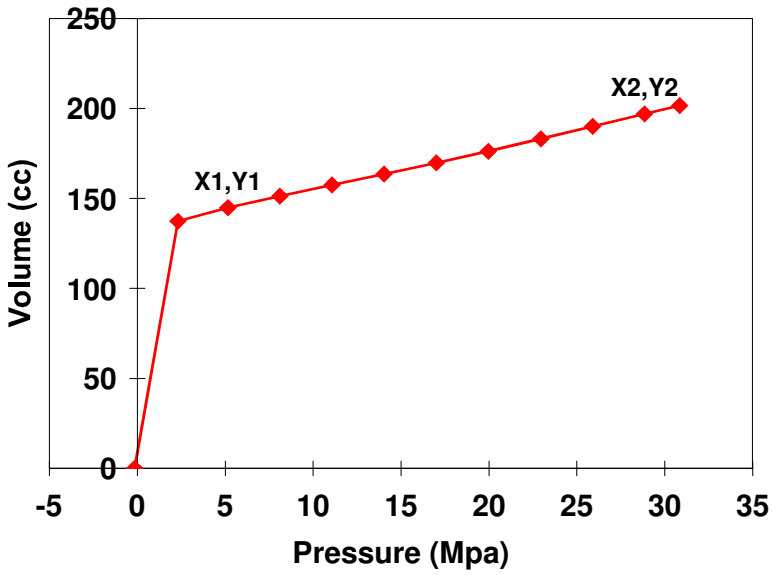
X1 = 5.09357 X2 = 19.4457
Y1 = 156.653 Y2 = 314.403

E = 523.3307 MPa

Probex Companion Dataset information

Borehole Name:	B-18-MRDA/002
Date:	15:44 01-16-2009
Probe:	PROBEX-1
Depth:	32.45 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B18(C = 0.968548 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.004	.089
3.11	137.431
6.007	144.873
9	151.309
11.998	157.514
14.992	163.638
18.004	169.872
20.994	176.307
24.019	183.232
27	190.125
29.987	197.032
32.007	201.644

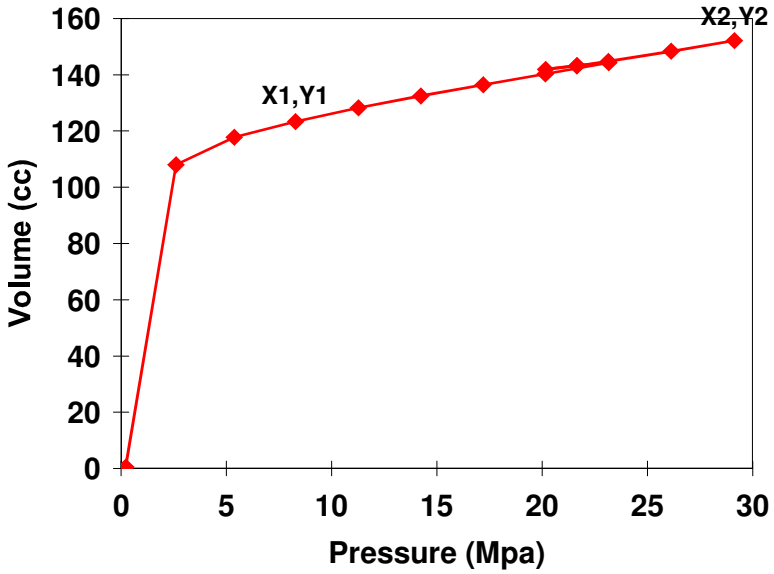
X1 = 5.15032 X2 = 28.8534
Y1 = 144.873 Y2 = 197.032

E = 4131.834 MPa

Probex Companion Dataset information

Borehole Name:	B-18-MRDA/001
Date:	15:07 01-16-2009
Probe:	PROBEX-1
Depth:	46.20 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B18(C = 0.968548 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



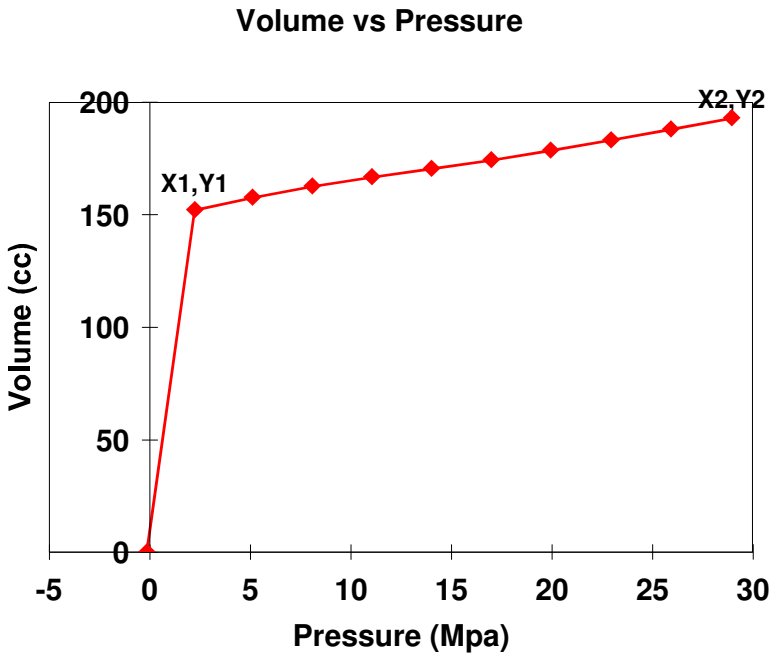
Pressure (Mpa)	Volume (cc)
.378	.48
3.218	108.054
6.045	117.807
8.996	123.33
12.015	128.249
15.017	132.498
18.006	136.453
20.985	140.341
24.02	144.278
22.506	143.321
21.009	141.939
22.5	143.183
24.003	144.806
27.011	148.371
30.034	152.2

X1 = 8.27977 X2 = 29.1315
Y1 = 123.33 Y2 = 152.2

E = 12045.11 MPa

Probex Companion Dataset information

Borehole Name:	B-20-MRDA/004
Date:	18:44 01-14-2009
Probe:	PROBEX-1
Depth:	27.00 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B20-C□□□(C = 0.941192 cc/Mpa)
Membrane Inertia:	MRDAB-20/001



Pressure (Mpa)	Volume (cc)
.001	.016
3.127	152.126
6.02	157.603
9.012	162.582
12.008	166.725
15.002	170.49
17.986	174.259
20.97	178.611
23.996	183.163
26.997	187.965
30.045	192.912

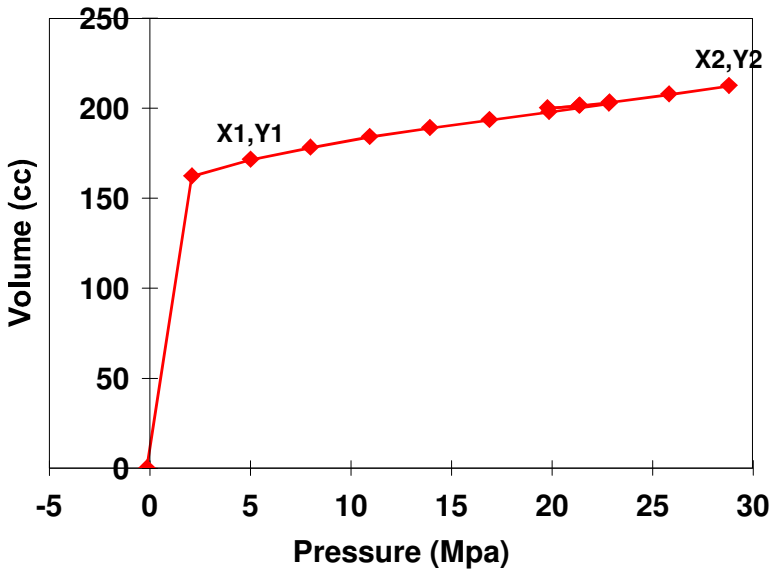
X1 = 2.22491 X2 = 28.9326
Y1 = 152.126 Y2 = 192.912

E = 8693.896 MPa

Probex Companion Dataset information

Borehole Name:	B-20-MRDA/003
Date:	18:05 01-14-2009
Probe:	PROBEX-1
Depth:	38.50 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B20-C□□□(C = 0.941192 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
0	.007
3.03	162.217
5.994	171.397
9.004	178.074
11.989	184.162
15.012	189.003
18.002	193.477
20.991	197.921
23.988	202.505
22.496	201.38
20.92	200.03
22.527	201.451
24.01	203.212
26.995	207.63
30	212.391

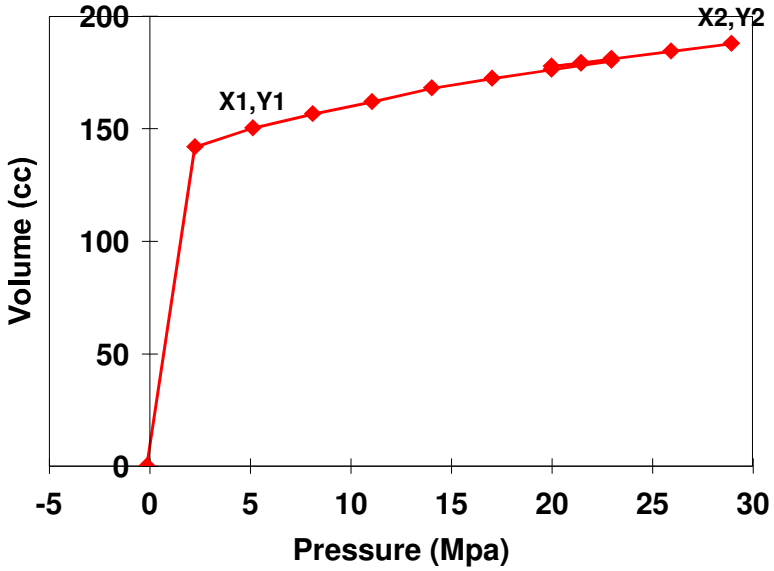
X1 = 4.99256 X2 = 28.7992
Y1 = 171.397 Y2 = 212.391

E = 6583.989 MPa

Probex Companion Dataset information

Borehole Name:	B-20-MRDA/001
Date:	17:06 01-14-2009
Probe:	PROBEX-1
Depth:	46.70 ft
Units:	Metric
Delay:	60 s
Volume Correction:	MRDA-B20-C□□□(C = 0.941192 cc/Mpa)
Membrane Inertia:	MRDAB-20/001

Volume vs Pressure



Pressure (Mpa)	Volume (cc)
.001	.025
3.065	141.891
5.998	150.313
9.011	156.554
11.989	161.974
14.994	168.006
18.025	172.351
20.993	176.254
23.996	180.197
22.473	179.024
21.001	177.732
22.487	179.307
23.999	181.072
26.986	184.421
30.005	187.818

X1 = 5.10586 X2 = 28.9189
Y1 = 150.313 Y2 = 187.818

E = 8024.42 MPa

SOIL TESTING

The soil-like materials observed in the borings and test pits were visually classified and evaluated with respect to strength, swelling, and compressibility, dry density, and water content. The classifications were substantiated by performing particle size analyses and Atterberg Limits tests on representative samples of the soils. Compaction tests were performed to serve as a preliminary basis of relative compaction requirements for fill and to provide an estimate of in-place unit weight for soil fill. The strength of the soils was evaluated by considering the density, water content, penetration resistance of the sampler and the results of direct shear tests. Expansion index tests were performed to evaluate the potential for shrink/swell of clayey soils. Chemical tests including pH, sulfate content, and chloride content were performed to evaluate the potential corrosivity of the soils. The testing was performed in general accordance with ASTM standards.

The results of the unit weight, water content, grain size distribution tests and Atterberg Limits testing are summarized on the boring and test pit logs at the corresponding sample depth. A summary of the geotechnical laboratory testing is presented in Table F-1. A summary of the corrosion testing is presented in Table F-2. Detailed graphical laboratory test results are presented as figures in this appendix.

ROCK TESTING

The rock materials were visually described in terms of weathering, fracturing, and strength. Rock tests including unconfined compressive strength, modulus, and unit weight were performed on samples of intact rock. The results of these tests are summarized in Table F-3. The photos presenting the before and after testing conditions of the rock samples are in our files and available for review upon request.

Table F-1
Summary of Soil Laboratory Test Results
Suncrest Substation

Exploration Number	Sample/ Specimen Number	Depth (ft)	USCS Symbol	Water Content (%)	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Gravel (%)	Sand (%)	Fines (%)	Max. Dry Unit Weight (pcf)	Opt. Water Content (%)	Direct Shear Peak Friction (deg)	Direct Shear Cohesion (ksf)
B-01	1	5.0	SM	0.7						3.9	81.1	15.0				
B-01	2	10	SC	6.3								25.9				
B-02	1	5.0	SC	4.4								21.5				
B-02	2	10	SC	8.2						4.2	71.5	24.3				
B-03	1	5.0	SM	4.4						9.4	76.1	14.5				
B-04	1	0-1.5	SC	8.6	131.0	120.6				0.5	79.7	19.8			43	0.23
B-04	2	2.0	SC	5.9								24.0				
B-04	3	4.0	SC	4.0						0.0	79.3	20.7				
B-04	4	7.0	SC	5.4								29.4				
B-04	5	9.0	SM	4.1						0.1	70.9	29.0				
B-04	6	5-8	SC	3.2						0.1	61.4	38.5	134.0	7.0		
B-05	1A	0-5	SC	8.1						15.8	55.0	29.2	134.0	8.0		
B-05	1	1.0	SC	9.0	127.8	117.3										
B-05	2	3.0	SP-SM	4.2												
B-05	3	5.0	SM	5.0	130.6	124.3						17.3			60	0.20
B-05	4	7.0	SC	1.8						2.7	62.7	34.6				
B-06	1	0.5	CL	8.2	114.0	105.3									30	0.28
B-07	1A	2.5	SC	9.9						1.5	55.0	43.5	129.0	9.0		
B-07	1	5.0	SC	5.1	128.4	122.2						27.3			40	0.26
B-11	1	4.0	SC	9.1						1.9	59.4	38.7				
B-12	1	5.0	SC	5.7												
B-12	2	10	SP-SC	1.1												
B-16	1	5.0	SP-SM	3.8												
B-17	1A	0-5	SC	6.9						3.3	63.3	33.5	131.5	7.5		

Table F-1
Summary of Soil Laboratory Test Results
Suncrest Substation
(Continued)

Exploration Number	Sample/ Specimen Number	Depth (ft)	USCS Symbol	Water Content (%)	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Gravel (%)	Sand (%)	Fines (%)	Max. Dry Unit Weight (pcf)	Opt. Water Content (%)	Direct Shear Peak Friction (deg)	Direct Shear Cohesion (ksf)
B-17	1	2.0	SP-SM	5.1												
B-18	1	2.0	CL	18.1								73.4				
B-18	2	5.0	CL	7.7												
B-18	3	5.0	CL	3.8						0.9	46.0	53.2	128.0	8.5		
B-18	4	7.0	SP-SM	1.7												
B-18	5	9.0	SP-SM	3.0												
B-19	1	5.0	SC	11.0						0.0	58.6	41.4				
B-19	2	9.0	SC	3.6												
B-21	1	5.0	SC	6.0						3.8	67.7	28.5				
B-22	2	5.0	SC	6.7												
B-23	1	5.0	SC	6.2						0.0	67.8	32.2				
B-24	1	5.0	SC	6.5						1.9	68.2	29.9				
B-25	1	5.0	SC	2.8						2.5	70.9	26.6				
B-26	1	2.0	SC	8.3								35.9				
B-26	2	5.0	SC	4.6						0.1	76.0	23.9				
B-26	3	7.0	SC	5.3						0.4	64.1	35.5				
B-26	4	10.0	SC	13.6								44.6				
TP-9	1	0.5	SM	8.4			19	3	-2.52			37.3				
TP-9	2	1.0	SC	15.1			46	29	-0.07			41.7				
TP-9	3	5.0	SM	4.1						7.3	80.0	12.7				
TP-9	4	5.5	SC	11.3						6.4	71.0	22.5	129.5	10.0	35	0.01
TP-10	1	1.0	SC	10.0								25.2				
TP-10	2	3.0	SM	10.3												

Table F-1
Summary of Soil Laboratory Test Results
Suncrest Substation
(Continued)

Exploration Number	Sample/ Specimen Number	Depth (ft)	USCS Symbol	Water Content (%)	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Gravel (%)	Sand (%)	Fines (%)	Max. Dry Unit Weight (pcf)	Opt. Water Content (%)	Direct Shear Peak Friction (deg)	Direct Shear Cohesion (ksf)
TP-10	3	5.0	SC	7.8						6.8	77.3	15.9	126.5	9.0	30	0.54
TP-10	1A	1.5	CL-ML	13.6			23	6	-0.56							
TP-12	1	1.5	SW-SM	5.8						11.3	80.3	8.4				
TP-13	1	0.5	SC	8.5								24.3				
TP-13	2	2.0	SM	8.6								17.0				
TP-13	3	2.5	SC	10.6						4.8	65.2	30.0	129	8.5		
TP-13	4	4.0	SC	8.9	121.1	111.2									35	0.25
TP-14	1	0.0	SC	8.9								26.8				
TP-14	2	1.5	SC	12.6						0.0	67.0	33.0				
TP-15	1	0.5	SC	14.3						6.0	52.8	41.2	124	11.5	25	0.25
TP-16	1	0.0	SC	5.6						9.4	62.4	28.2				
TP-16	2	1.0	SC	11.2	125.1	112.5				5.1	76.5	18.4				
TP-17	1	0.5	CL	14.7												
TP-17	2	2.0	SC	11.7						5.1	71.2	23.7	135	8.0	30	0.27
TP-18	1	0.5	SC	7.4								29.2				
TP-18	3	2.0	SM	9.7						2.9	71.6	25.5				
TP-19	1	0.3	SC	3.4								27.6				
TP-19	2	1.5	SP-SM	1.9												
TP-20	3	1.0	SC	7.7												
TP-21	1	0	SC	3.9								26.9				
TP-21	2	2.0	SM	7.2						12.0	73.2	14.8				
TP-22	1	0.0	GC	4.1						47.1	39.4	13.5				

Table F-2
Summary of Corrosion Testing
Suncrest Substation

Exploration Number	Sample/ Specimen Number	Depth (ft)	USCS Symbol	Water Content (%)	pH	Minimum Resistivity (ohm - cm)	Sulfate Content (ppm)	Chloride Content (ppm)
B-04	4	5.0	SC	3.2	7.0	7,200	54	75
B-05	1A	0.0	SC	8.1	7.2	8,150	9	90
B-07	1A	0.0	CL	9.8	7.2	6,400	ND	120
B-11	1	4.0	SC	9.1	5.6	5,100	240	75
B-12	1	5.0	SC	5.7	6.3	7,100	3	60
B-17	1A	0.0	SC	6.9	6.9	13,000	9	225
B-18	3	5.0	CL	3.8	7.0	2,200	9	105
B-21	1	5.0	SC	6.0	5.6	19,500	45	45
TP-09	3	5.0	SM	8.4	5.7	9,500	42	60
TP-09	3	5.0	SM	4.1	7.0	13,500	78	90
TP-13	3	2.5	SC	10.6	6.9	12,500	ND	60
TP-15	1	0.5	SC	14.3	7.0	4,250	15	30
TP-17	1	0.5	CL	14.7	5.8	2,550	ND	15
TP-17	2	2.0	SC	11.7	7.1	7,200	ND	30
TP-18	1	0.5	SC	7.4	7.0	24,000	ND	45
TP-19	1	0.3	SC	3.4	6.9	6,750	ND	45
TP-20	3	1.0	SC	7.7	6.7	21,500	240	45
TP-21	1	0.0	SC	3.9	6.9	33,500	108	45

Table F-3
Summary of Rock Laboratory Test Results
Suncrest Substation

Boring	Depth (feet)	Rock Type	Degree of Weathering	Total Density, γ (pcf)	Unconfined Compressive Strength (psi)
B-01	14.0	Granitic Rock	Slightly	164.4	7,297
B-02	25.0	Granitic Rock	Moderately to Slightly	168.3	7,658
B-02	25.5	Granitic Rock	Slightly	168.8	3,685
B-03	14.0	Granitic Rock	Highly	152.0	190
B-03	35.9	Granitic Rock	Slightly	167.8	10,031
B-03	46.2	Granitic Rock	Slightly	168.2	10,636
B-04	10.4	Metasedimentary Rock	Completely to Highly	130.0	26
B-04	15.6	Metasedimentary Rock	Completely to Highly	166.6	1,949
B-04	30.0	Metasedimentary Rock	Slightly	173.9	12,871
B-05	10.7	Granitic Rock	Highly to Moderately	154.6	205
B-05	19.0	Granitic Rock	Highly to Moderately	146.7	19
B-06	17.9	Granitic Rock	Slightly	167.5	13,766
B-06	23.2	Granitic Rock	Slightly	166.2	7,620
B-06	32.1	Granitic Rock	Slightly	170.3	12,432
B-06	42.0	Granitic Rock	Slightly	167.3	11,666
B-07	53.4	Granitic Rock	Slightly to Fresh	165.0	14,778
B-07	56.5	Granitic Rock	Slightly to Fresh	166.6	16,533
B-07	64.5	Granitic Rock	Fresh	164.7	8,997
B-07	74.0	Granitic Rock	Slightly	166.0	13,340
B-08	23.0	Granitic Rock	Highly	152.7	941
B-08	62.3	Granitic Rock	Slightly to Fresh	165.1	31,743
B-08	88.0	Granitic Rock	Slightly to Fresh	165.0	29,613
B-09	4.0	Granitic Rock	Completely to Highly	160.9	10,388
B-09	18.0	Granitic Rock	Slightly	164.6	30,474
B-09	30.5	Granitic Rock	Slightly	164.6	27,280
B-09	50.5	Granitic Rock	Slightly	164.1	28,804
B-09	59.3	Granitic Rock	Slightly	164.8	28,606
B-09	76.5	Granitic Rock	Slightly	164.7	29,408
B-09	92.0	Granitic Rock	Slightly	164.7	32,245
B-09	101.0	Granitic Rock	Slightly	164.6	28,413

Table F-3
Summary of Rock Laboratory Test Results
Suncrest Substation
(Continued)

Boring	Depth (feet)	Rock Type	Degree of Weathering	Total Density, γ (pcf)	Unconfined Compressive Strength (psi)
B-09	117.8	Granitic Rock	Slightly to Fresh	171.1	31,220
B-10	4.0	Granitic Rock	Moderately	164.5	28,982
B-10	8.0	Granitic Rock	Slightly	164.8	33,275
B-10	21.6	Granitic Rock	Slightly	164.5	30,741
B-10	33.3	Granitic Rock	Moderately to Slightly	164.7	30,571
B-10	44.7	Granitic Rock	Slightly to Fresh	164.6	31,056
B-10	60.0	Granitic Rock	Slightly to Fresh	165.1	34,201
B-10	76.5	Granitic Rock	Slightly to Fresh	165.0	30,468
B-11	10.7	Granitic Rock	Completely	166.9	1,290
B-11	32.1	Granitic Rock	Slightly	181.7	39,357
B-11	36.6	Granitic Rock	Slightly to Fresh	180.7	37,044
B-11	39.9	Granitic Rock	Slightly to Fresh	180.4	39,354
B-11	50.1	Granitic Rock	Slightly to Fresh	179.9	35,525
B-11	55.5	Granitic Rock	Slightly to Fresh	181.9	38,094
B-12	23.4	Granitic Rock	Moderately	153.0	369
B-12	26.8	Granitic Rock	Moderately	147.6	163
B-12	34.3	Granitic Rock	Slightly	169.5	31,177
B-14	19.5	Granitic Rock	Highly to Moderately	156.0	954
B-14	26.9	Granitic Rock	Slightly	165.1	7,870
B-14	32.0	Granitic Rock	Fresh	165.2	11,414
B-15	16.8	Granitic Rock	Moderately to Slightly	153.5	1,376
B-15	20.0	Granitic Rock	Moderately to Slightly	161.6	13,004
B-15	24.2	Granitic Rock	Slightly	161.0	7,844
B-15	25.2	Granitic Rock	Slightly	157.9	3,655
B-16	19.1	Granitic Rock	Moderately	163.7	9,890
B-17	12.5	Granitic Rock	Slightly	160.9	7,197
B-18	17.5	Granitic Rock	Moderately to Slightly	159.2	2,475
B-18	22.5	Granitic Rock	Moderately to Slightly	160.3	6,919
B-18	33.0	Granitic Rock	Moderately to Slightly	162.1	9,851

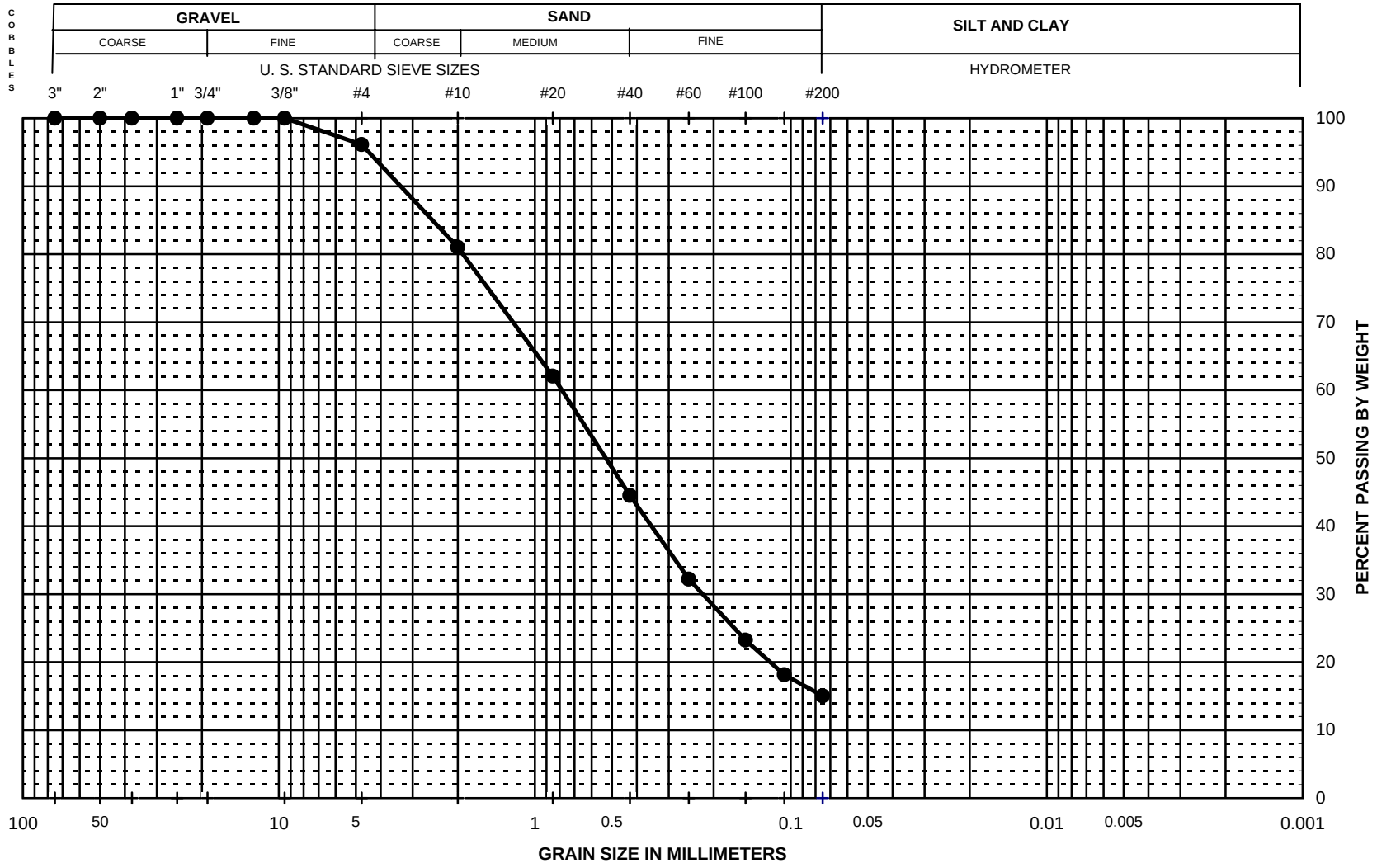
Table F-3
Summary of Rock Laboratory Test Results
Suncrest Substation
(Continued)

Boring	Depth (feet)	Rock Type	Degree of Weathering	Total Density, γ (pcf)	Unconfined Compressive Strength (psi)
B-18	43.2	Granitic Rock	Moderately	162.2	12,118
B-19	24.5	Granitic Rock	Slightly	179.9	39,183
B-20	23.4	Granitic Rock	Slightly to Fresh	177.1	22,178
B-20	29.0	Granitic Rock	Slightly to Fresh	172.7	26,437
B-21	19.5	Granitic Rock	Moderately	183.0	22,293
B-21	26.0	Granitic Rock	Moderately	179.9	18,941
B-21	38.5	Granitic Rock	Moderately	168.4	953
B-22	29.1	Metasedimentary Rock	Moderately	170.7	11,764
B-24	25.7	Granitic Rock	Slightly to Fresh	163.9	9,632
B-24	35.9	Granitic Rock	Slightly to Fresh	162.2	9,771
B-24	41.6	Granitic Rock	Slightly to Fresh	162.3	10,967
B-25	13.2	Granitic Rock	Highly	153.3	291
B-25	24.0	Granitic Rock	Slightly to Fresh	174.3	18,788
B-26	16.1	Metasedimentary Rock	Moderately	133.7	165
B-26	25.3	Metasedimentary Rock	Highly to Moderately	154.3	820
B-26	28.1	Metasedimentary Rock	Slightly	165.2	1,852

Note:

a. Some reported values appear low for the density and degree of weathering and may reflect failures along discontinuities.

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	96.1
#10	2.00	81.0
#20	0.850	62.0
#40	0.425	44.5
#60	0.250	32.2
#100	0.150	23.2
#140	0.106	18.1
#200	0.075	15.0

Hydrometer Analysis

% Cobbles	
% Gravel	3.9
% Sand	81.1
% Fines	15.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-1	1	5.0	●	0.7				**Pale brown silty Sand (SM)**

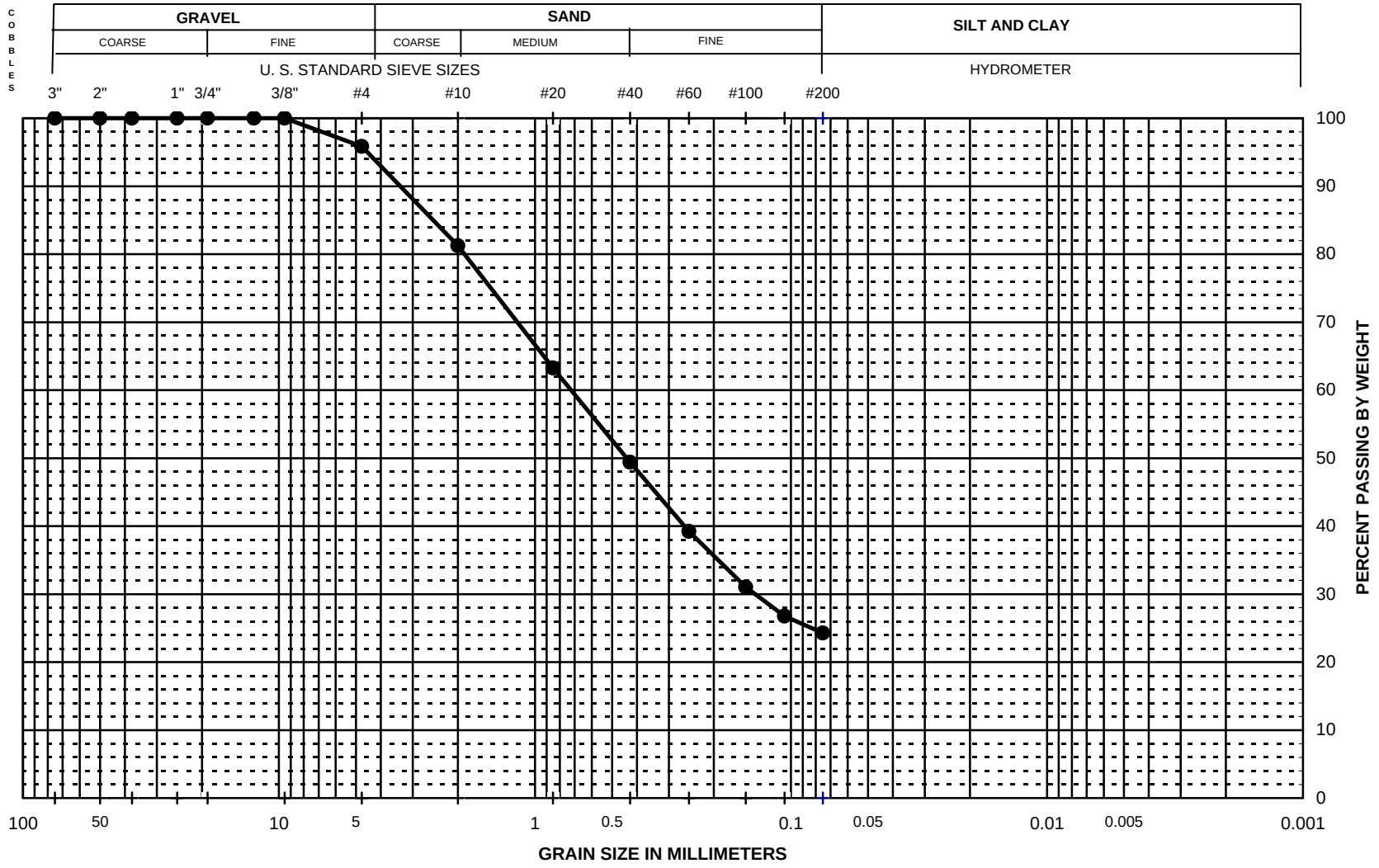
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-1

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	95.8
#10	2.00	81.2
#20	0.850	63.3
#40	0.425	49.4
#60	0.250	39.2
#100	0.150	31.0
#140	0.106	26.8
#200	0.075	24.3

Hydrometer Analysis

% Cobbles	
% Gravel	4.2
% Sand	71.5
% Fines	24.3
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-2	2	10.0	●	8.2				**Reddish brown clayey Sand (SC)**

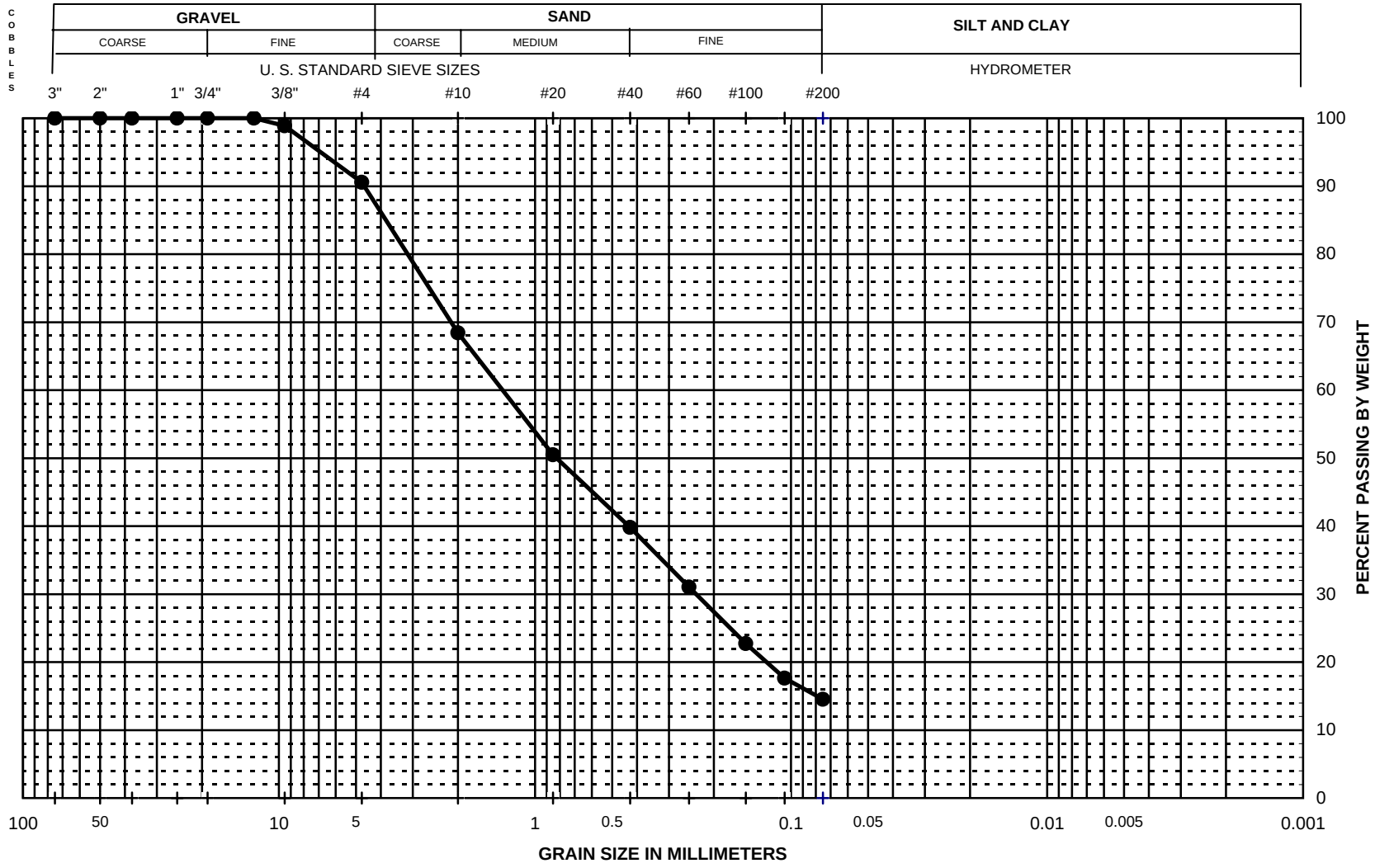
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-2

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	98.9
#4	4.75	90.6
#10	2.00	68.4
#20	0.850	50.5
#40	0.425	39.8
#60	0.250	31.0
#100	0.150	22.7
#140	0.106	17.6
#200	0.075	14.5

Hydrometer Analysis

% Cobbles	
% Gravel	9.4
% Sand	76.1
% Fines	14.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

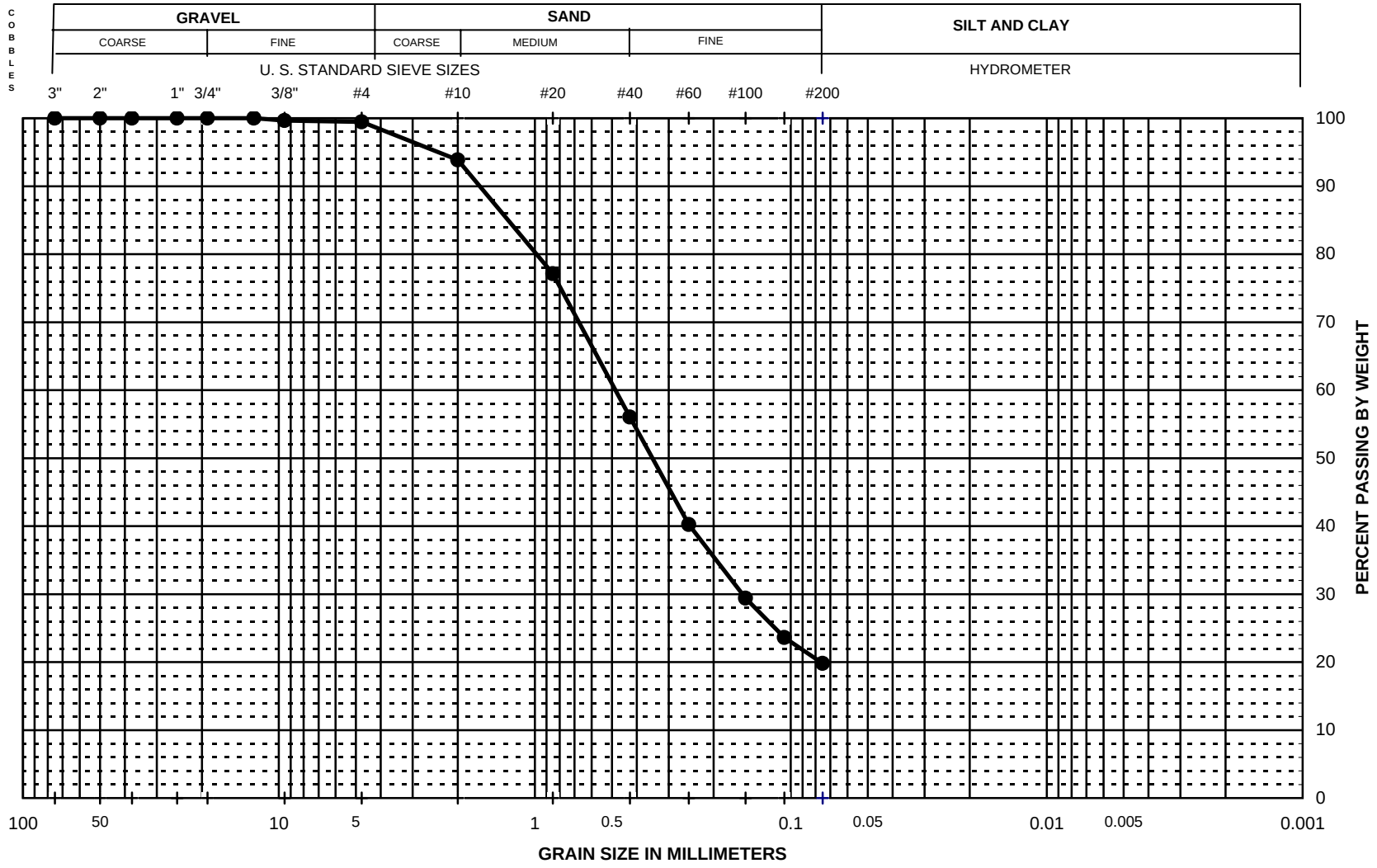
Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-3	1	5.0	●	4.4				**Reddish brown to brown silty Sand (SM)**

PROJECT NAME: **Suncrest Substation**
PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-3

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	99.5
#10	2.00	93.9
#20	0.850	77.1
#40	0.425	56.0
#60	0.250	40.2
#100	0.150	29.4
#140	0.106	23.6
#200	0.075	19.8
Hydrometer Analysis		

% Cobbles	
% Gravel	0.5
% Sand	79.7
% Fines	19.8
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-4	1	0.0	●	8.6				**Yellowish red clayey Sand (SC)**

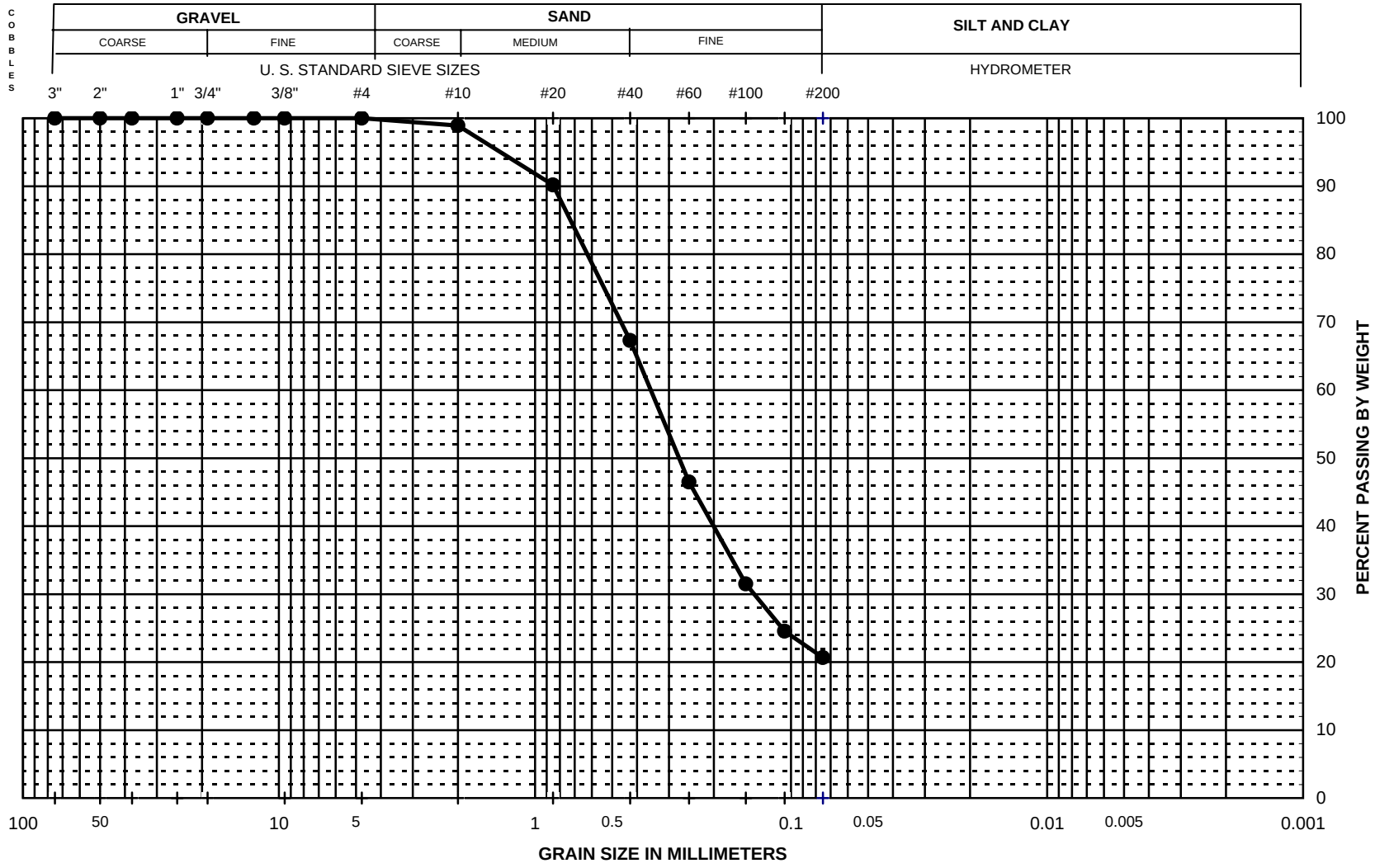
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-4

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	100.0
#10	2.00	98.9
#20	0.850	90.2
#40	0.425	67.3
#60	0.250	46.5
#100	0.150	31.5
#140	0.106	24.5
#200	0.075	20.7
Hydrometer Analysis		

% Cobbles	
% Gravel	0.0
% Sand	79.3
% Fines	20.7
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-4	3	4.0	●	4.0				**Light brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

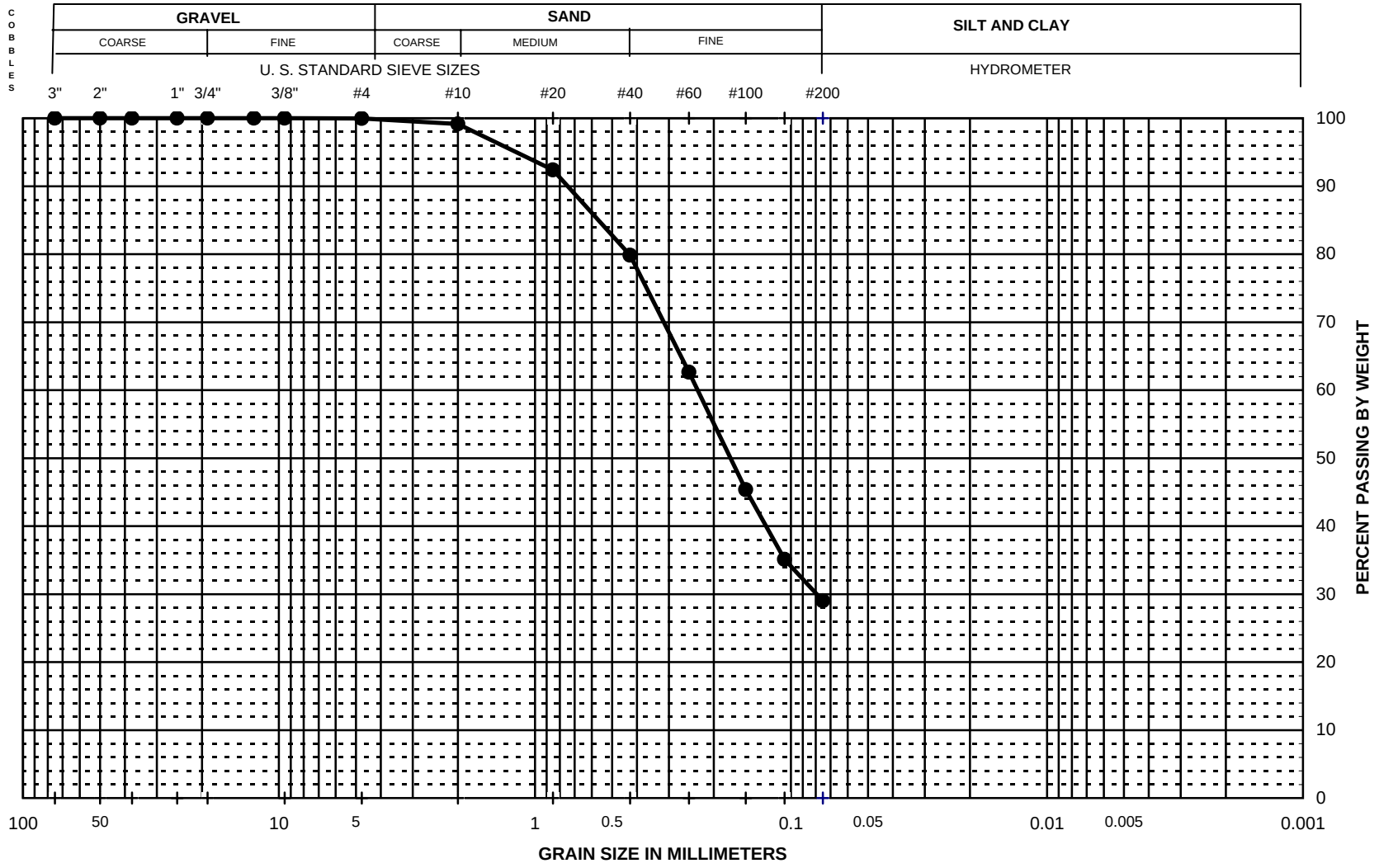
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-5

Sieve SS B04004

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	99.1
#20	0.850	92.4
#40	0.425	79.8
#60	0.250	62.6
#100	0.150	45.3
#140	0.106	35.1
#200	0.075	29.0

Hydrometer Analysis

% Cobbles	
% Gravel	0.1
% Sand	70.9
% Fines	29.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-4	5	9.0	●	4.1				**Light yellowish brown silty Sand (SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

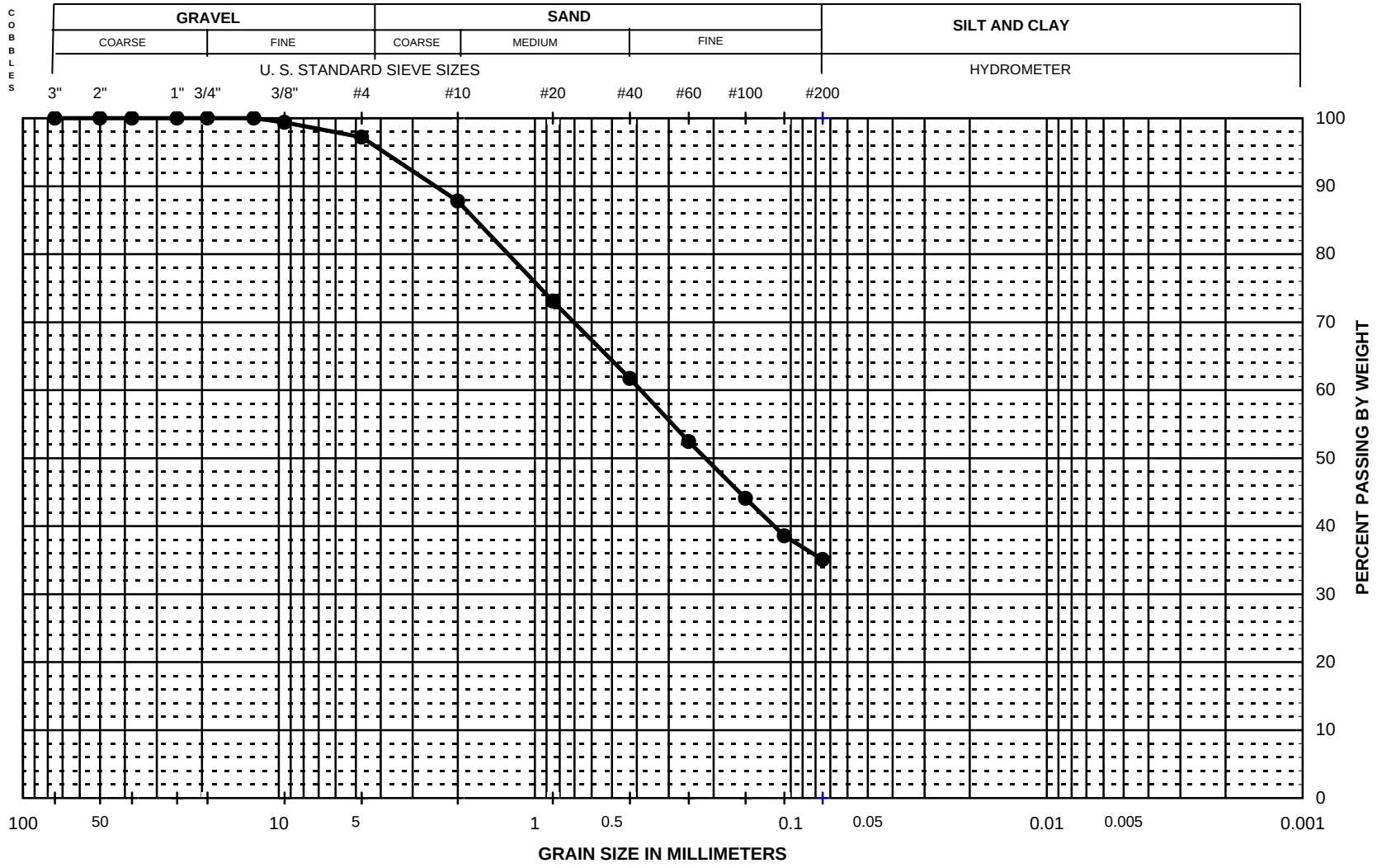
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-6

Sieve SS B04009

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	99.4
#4	4.75	97.2
#10	2.00	87.8
#20	0.850	73.1
#40	0.425	61.7
#60	0.250	52.4
#100	0.150	44.1
#140	0.106	38.6
#200	0.075	35.1
Hydrometer Analysis		

% Cobbles	
% Gravel	2.8
% Sand	62.1
% Fines	35.1
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-5	1A	0.0	●	7.1				**Dark brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

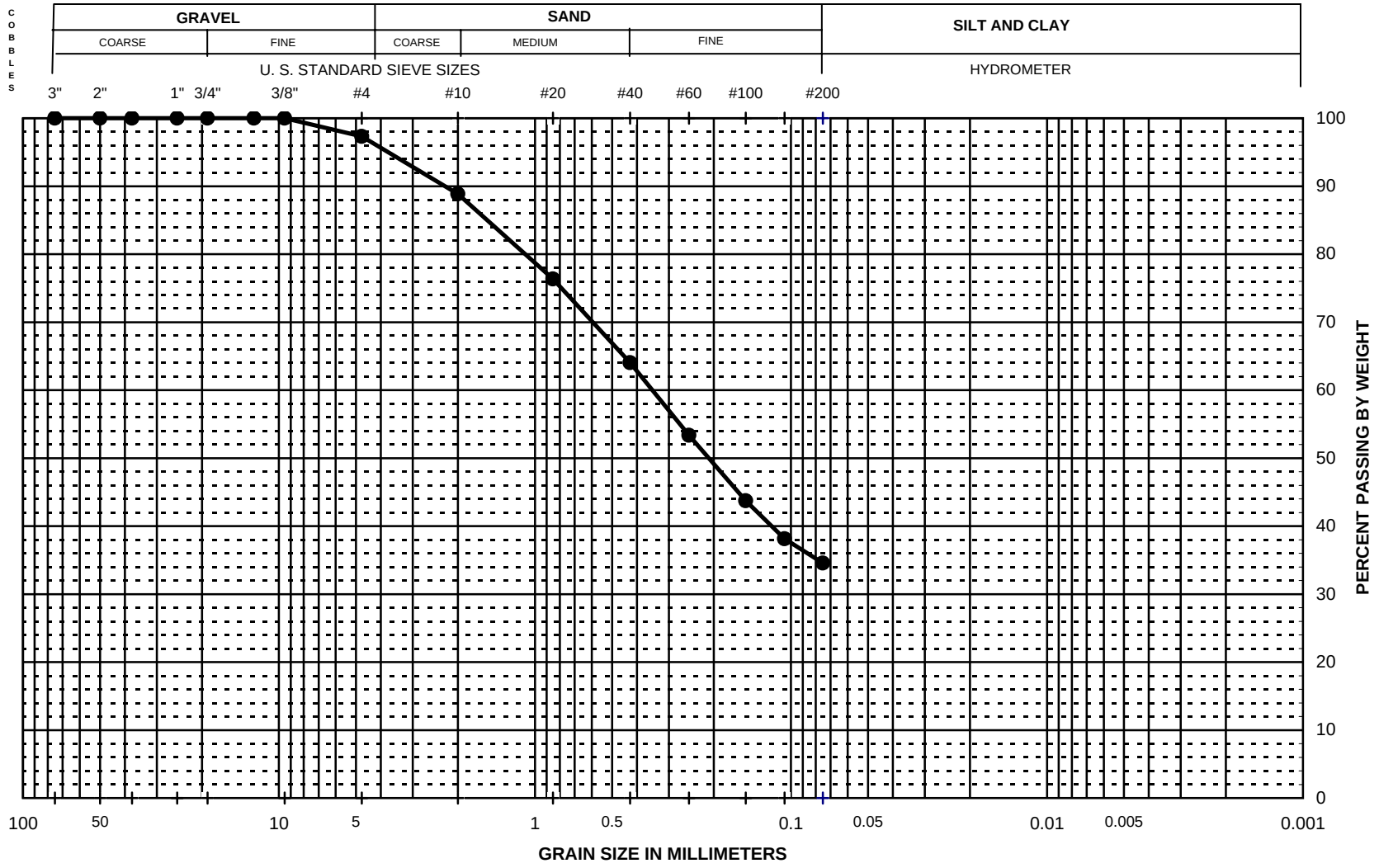
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-7

Sieve SS B05000

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	97.3
#10	2.00	88.9
#20	0.850	76.4
#40	0.425	64.0
#60	0.250	53.4
#100	0.150	43.7
#140	0.106	38.1
#200	0.075	34.6
Hydrometer Analysis		

% Cobbles	
% Gravel	2.7
% Sand	62.7
% Fines	34.6
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-5	4	7.0	●	1.8				**Light brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

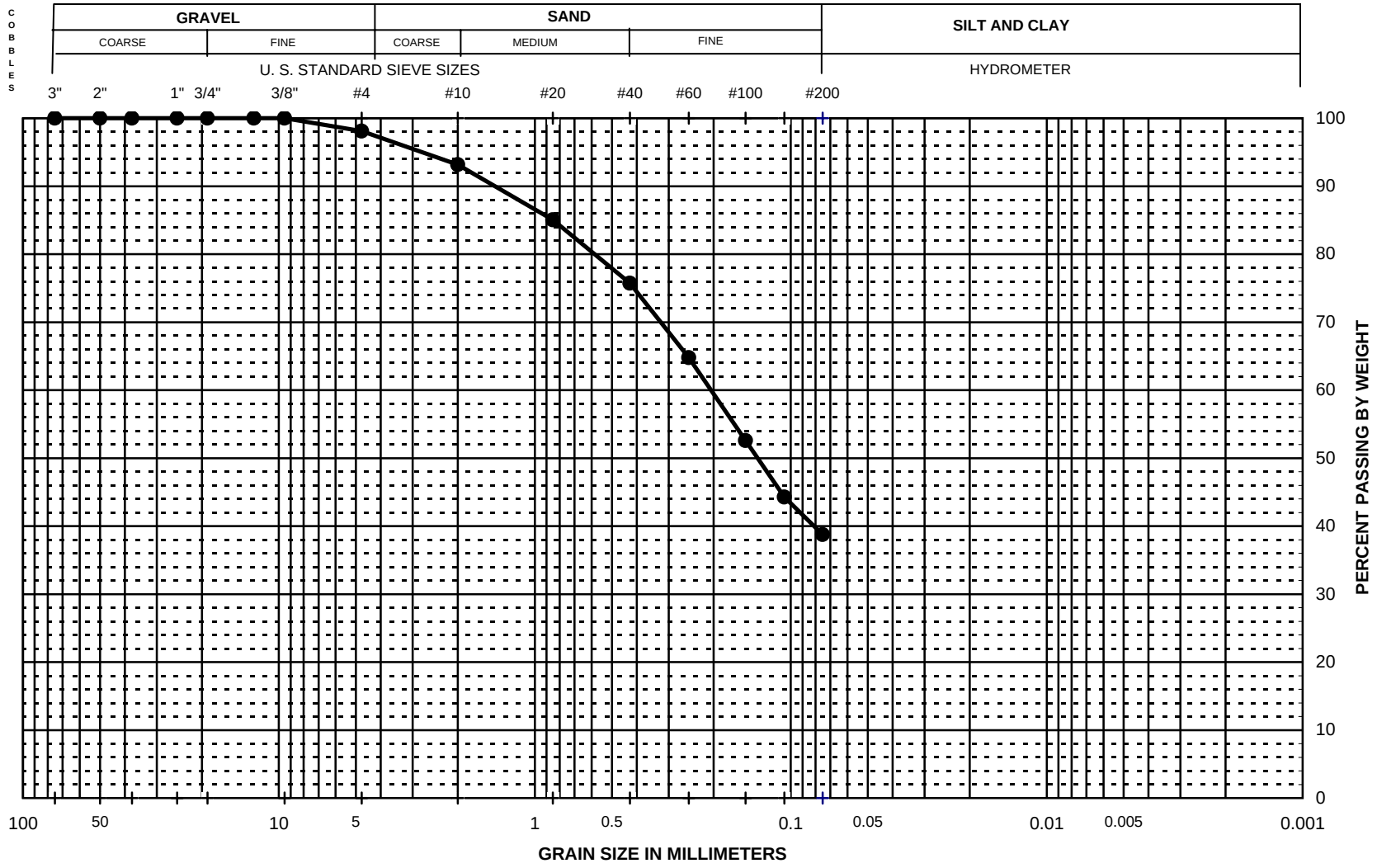
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-8

Sieve SS B05007

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	98.1
#10	2.00	93.2
#20	0.850	85.1
#40	0.425	75.7
#60	0.250	64.8
#100	0.150	52.6
#140	0.106	44.3
#200	0.075	38.7
Hydrometer Analysis		

% Cobbles	
% Gravel	1.9
% Sand	59.4
% Fines	38.7
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-11	1	4.0	●	9.1				**Light orangish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

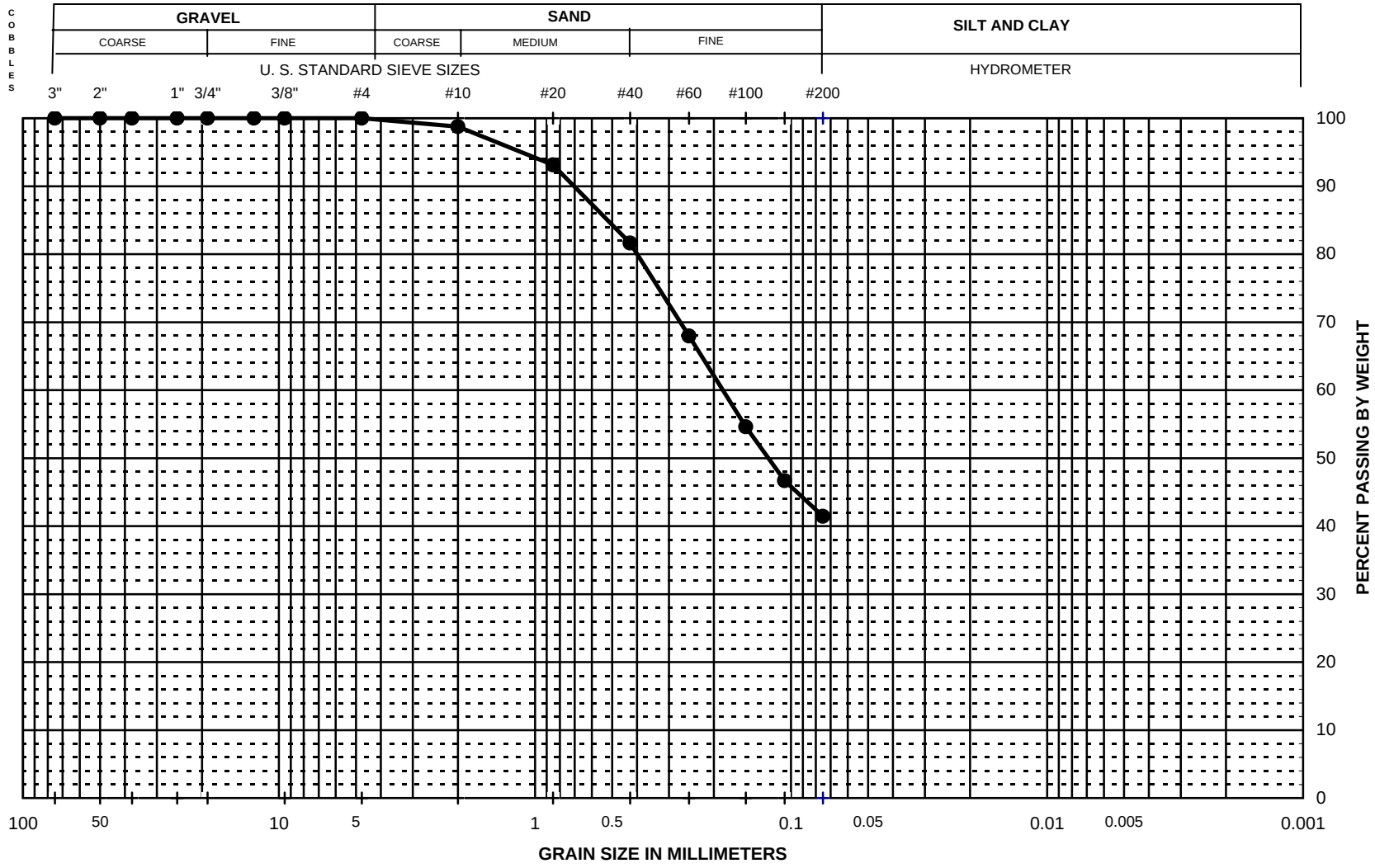
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-9

Sieve SS B11004

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	100.0
#10	2.00	98.8
#20	0.850	93.1
#40	0.425	81.6
#60	0.250	68.0
#100	0.150	54.6
#140	0.106	46.7
#200	0.075	41.4
Hydrometer Analysis		

% Cobbles	
% Gravel	0.0
% Sand	58.6
% Fines	41.4
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-19	1	5.0	●	11.0				**Greenish gray clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

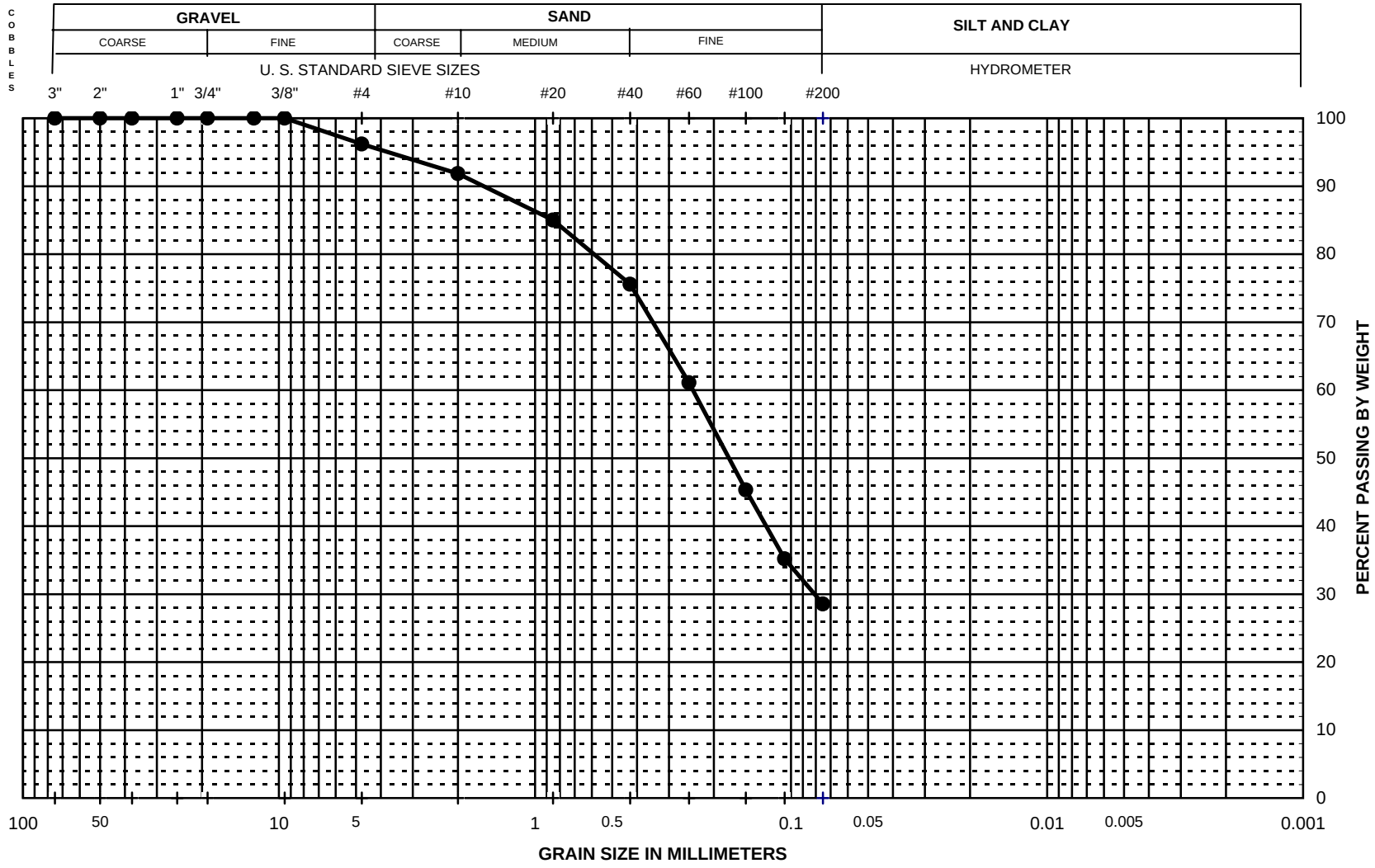
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-10

Sieve SS B19005

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	96.2
#10	2.00	91.8
#20	0.850	85.0
#40	0.425	75.6
#60	0.250	61.1
#100	0.150	45.3
#140	0.106	35.2
#200	0.075	28.5

Hydrometer Analysis

% Cobbles	
% Gravel	3.8
% Sand	67.7
% Fines	28.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-21	1	5.0	●	6.0				**Dark gray clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

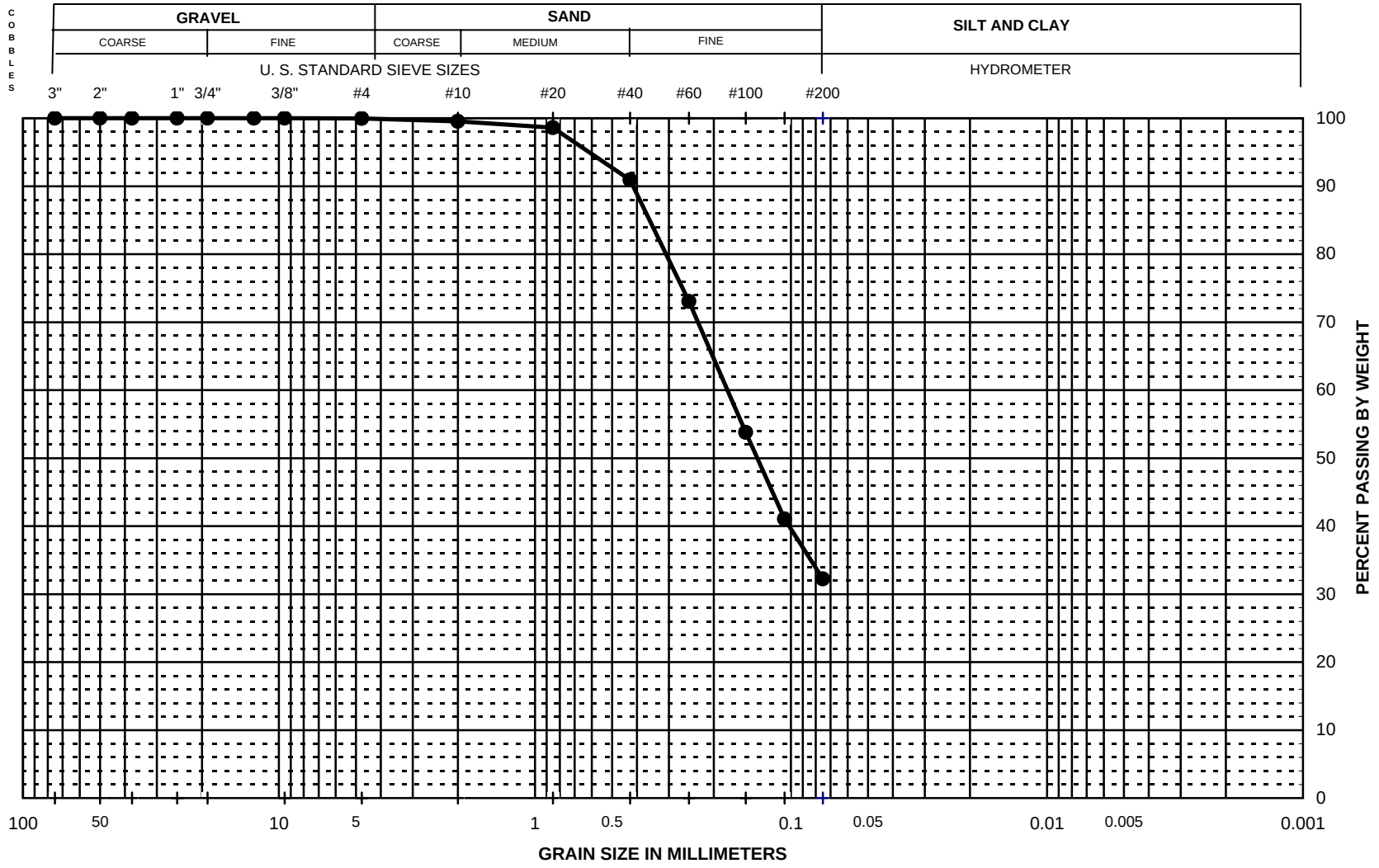
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-11

Sieve SS B21005

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	100.0
#10	2.00	99.5
#20	0.850	98.6
#40	0.425	90.9
#60	0.250	73.0
#100	0.150	53.8
#140	0.106	41.1
#200	0.075	32.2

Hydrometer Analysis

% Cobbles	
% Gravel	0.0
% Sand	67.8
% Fines	32.2
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-23	1	5.0	●	6.2				**Light brown to brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

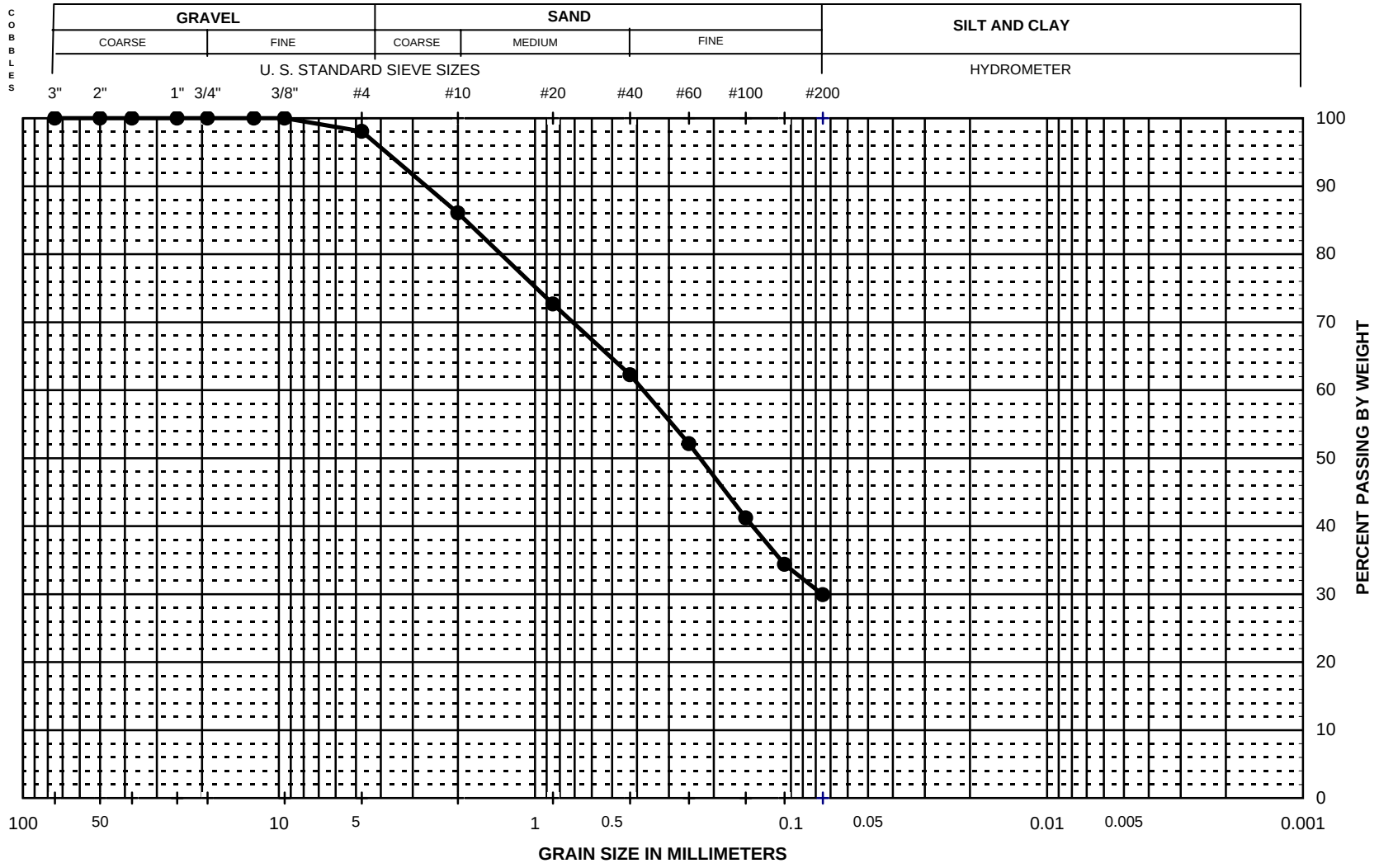
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-12

Sieve SS B23005

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	98.1
#10	2.00	86.1
#20	0.850	72.7
#40	0.425	62.3
#60	0.250	52.1
#100	0.150	41.2
#140	0.106	34.4
#200	0.075	29.9

Hydrometer Analysis

% Cobbles	
% Gravel	1.9
% Sand	68.2
% Fines	29.9
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-24	1	5.0	●	6.5				**Light orangish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

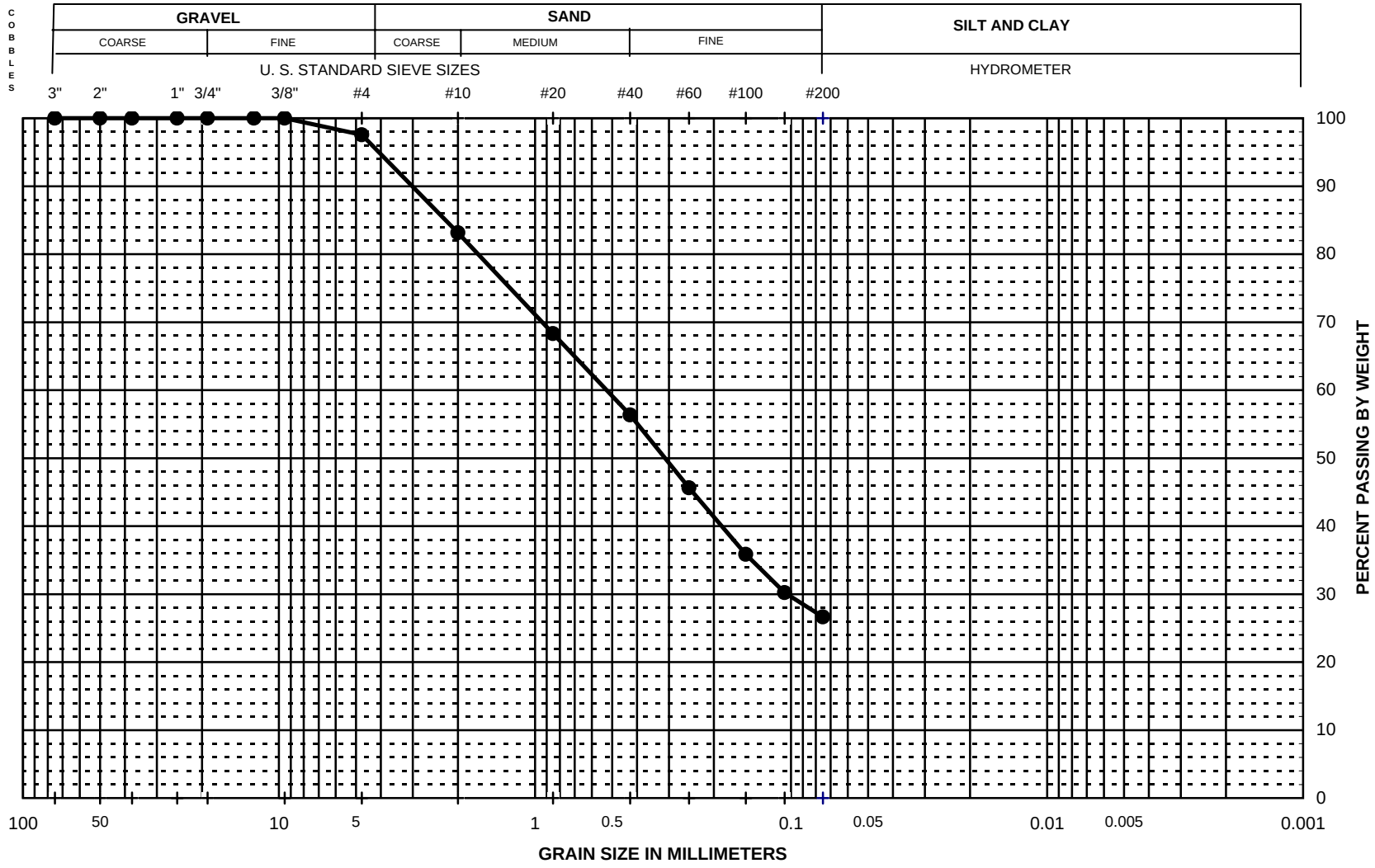
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-13

Sieve SS B24005

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	97.5
#10	2.00	83.1
#20	0.850	68.3
#40	0.425	56.4
#60	0.250	45.6
#100	0.150	35.8
#140	0.106	30.2
#200	0.075	26.6

Hydrometer Analysis

% Cobbles	
% Gravel	2.5
% Sand	70.9
% Fines	26.6
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-25	1	5.0	●	2.8				**Pinkish gray clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

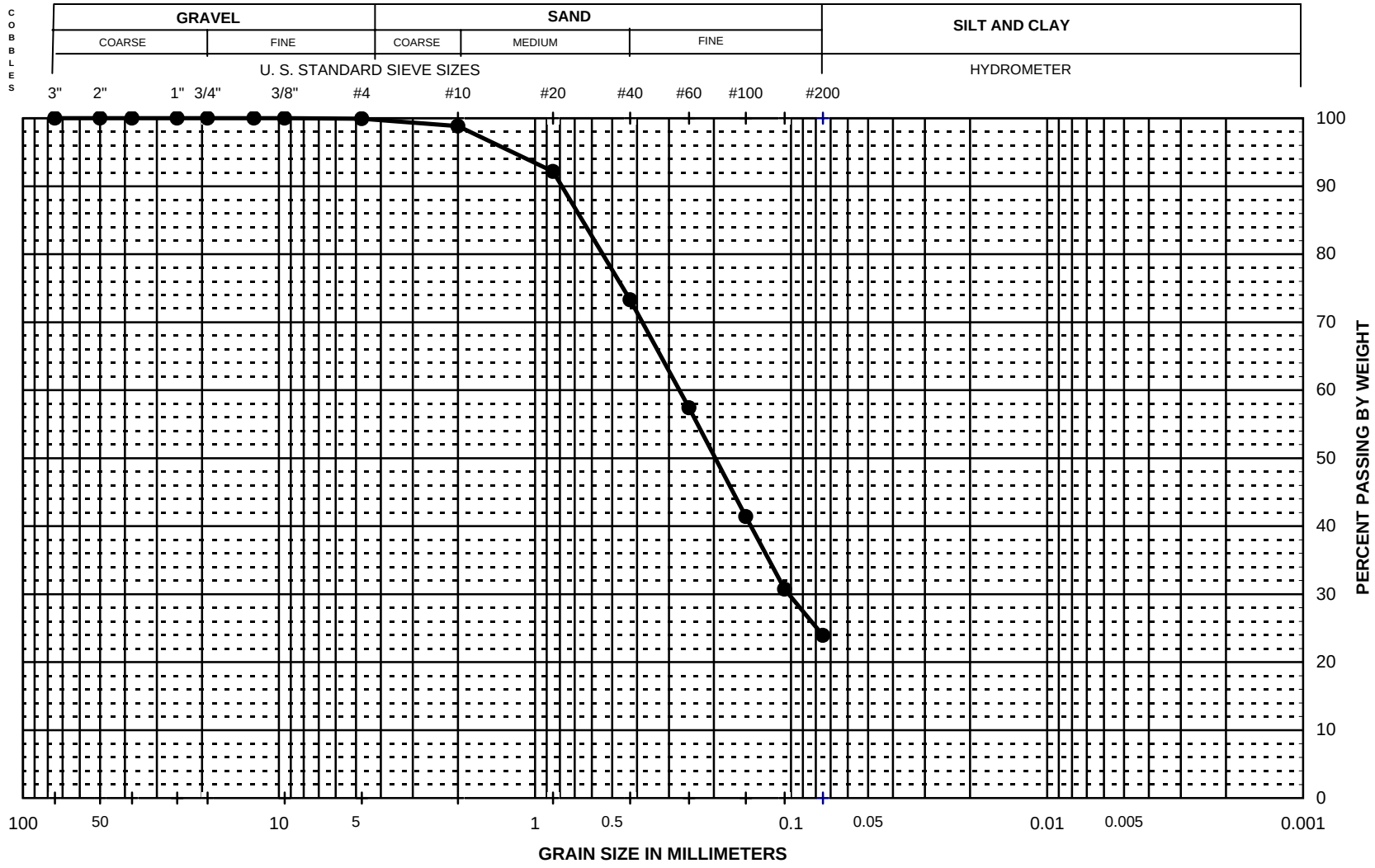
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-14

Sieve SS B25005

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	98.8
#20	0.850	92.1
#40	0.425	73.3
#60	0.250	57.4
#100	0.150	41.4
#140	0.106	30.7
#200	0.075	23.9
Hydrometer Analysis		

% Cobbles	
% Gravel	0.1
% Sand	76.0
% Fines	23.9
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-26	2	5.0	●	4.6				**Orangish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

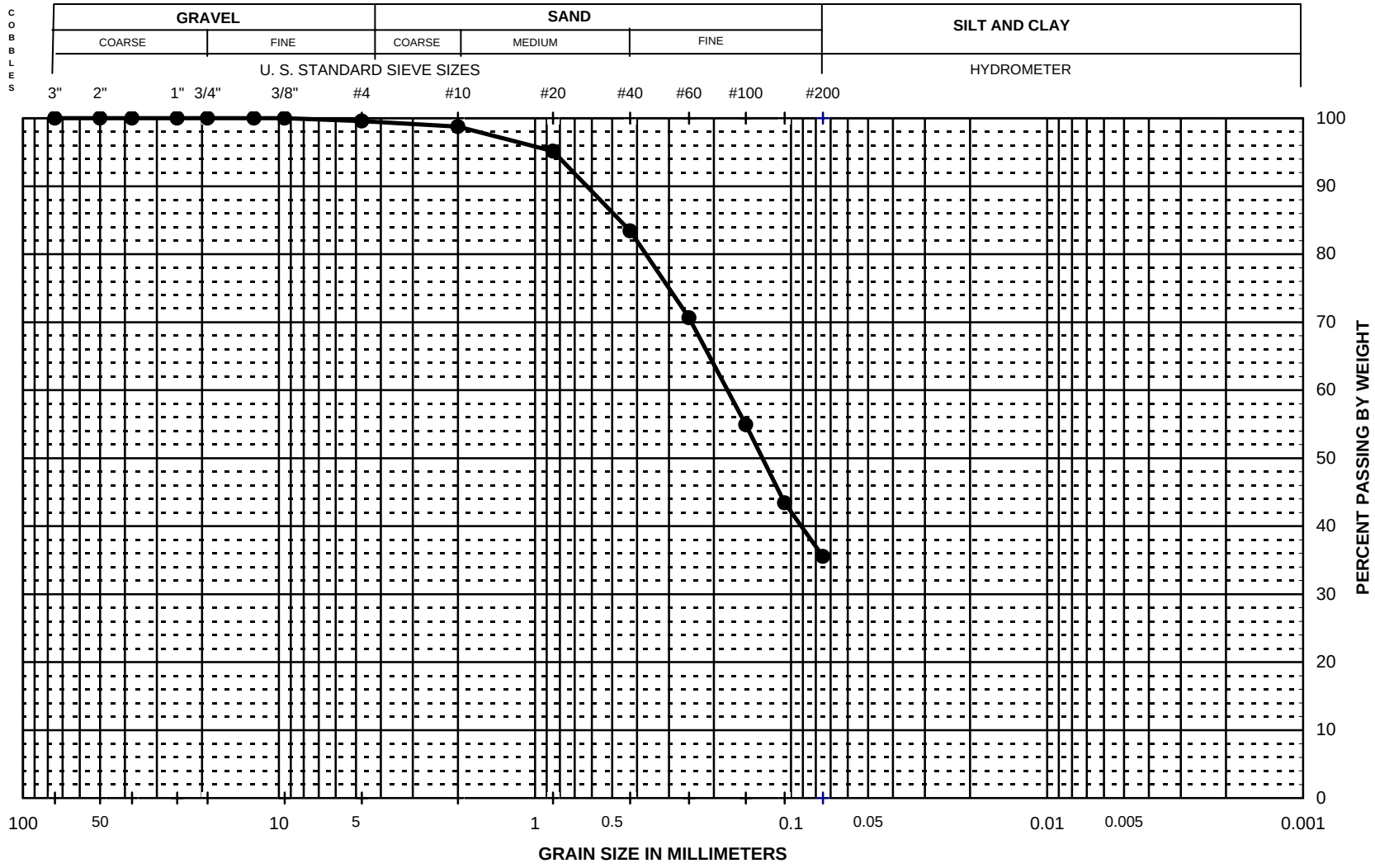
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-15

Sieve SS B26005

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	99.6
#10	2.00	98.7
#20	0.850	95.2
#40	0.425	83.4
#60	0.250	70.6
#100	0.150	54.9
#140	0.106	43.4
#200	0.075	35.5
Hydrometer Analysis		

% Cobbles	
% Gravel	0.4
% Sand	64.1
% Fines	35.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-26	3	7.0	●	5.3				**Light grayish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

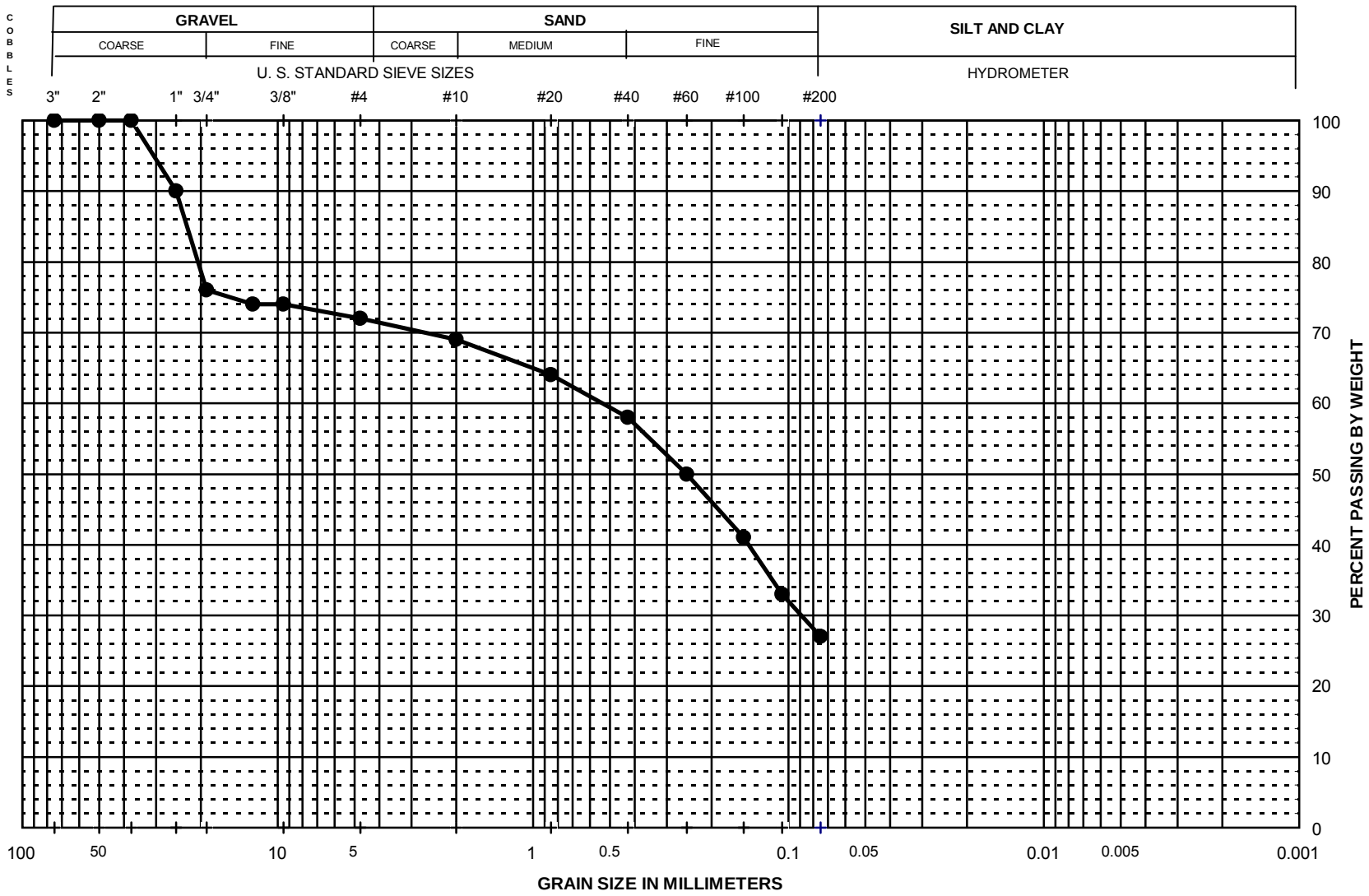
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-16

Sieve SS B26007

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	90.0
3/4"	19.00	76.0
1/2"	12.50	74.0
3/8"	9.50	74.0
#4	4.75	72.0
#10	2.00	69.0
#20	0.850	64.0
#40	0.425	58.0
#60	0.250	50.0
#100	0.150	41.0
#140	0.106	33.0
#200	0.075	27.0

Hydrometer Analysis

% Cobbles	
% Gravel	28.0
% Sand	45.0
% Fines	27.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
B-27	1	0.0	●	3.5	22	4		**Brown silty, clayey Sand with gravel (SC-SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

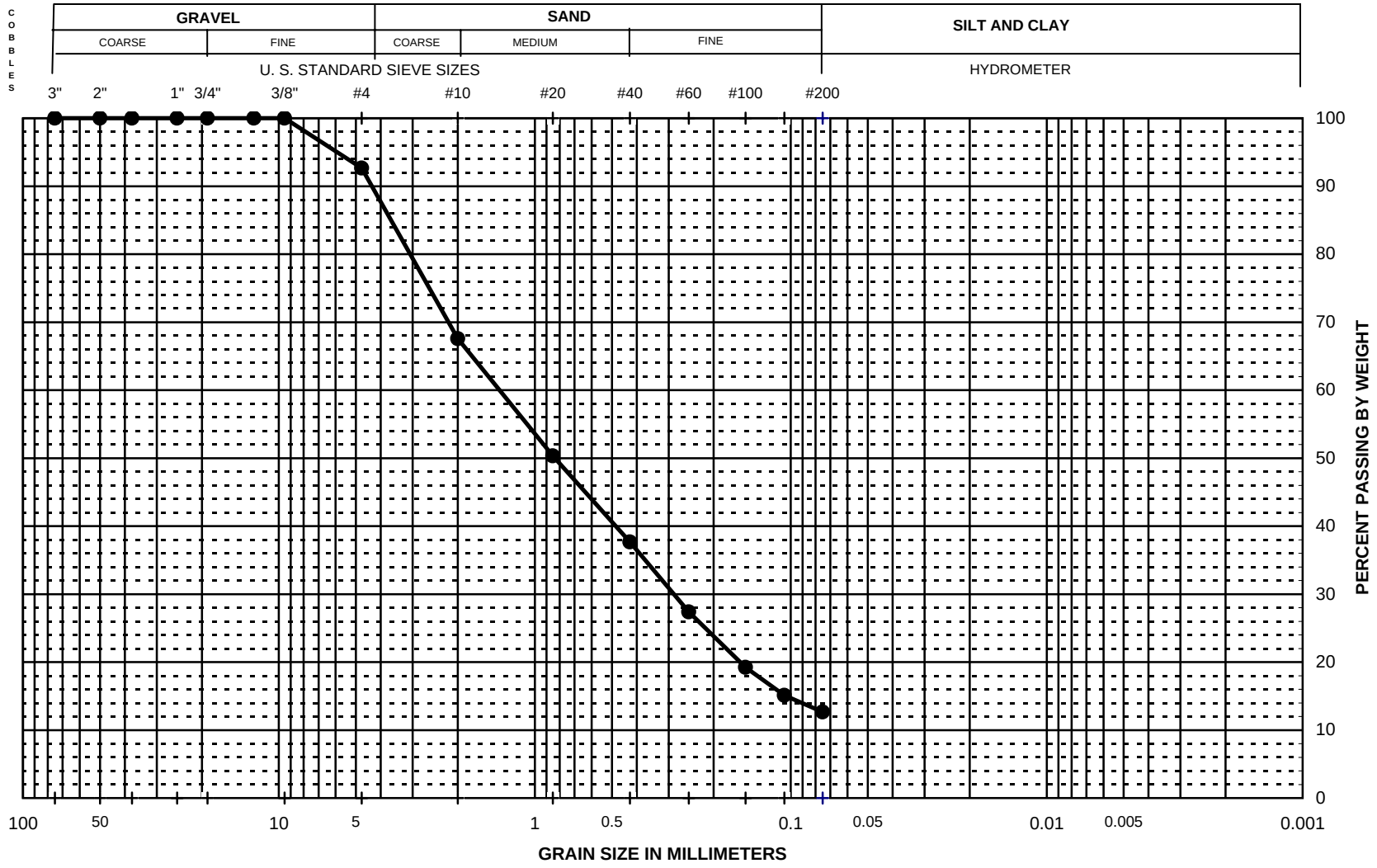
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-17

URS

Sieve Suncrest Access B27000

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	92.7
#10	2.00	67.6
#20	0.850	50.3
#40	0.425	37.7
#60	0.250	27.4
#100	0.150	19.2
#140	0.106	15.1
#200	0.075	12.7
Hydrometer Analysis		

% Cobbles	
% Gravel	7.3
% Sand	80.0
% Fines	12.7
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-9	3	5.0	●	4.1				**Reddish brown silty Sand (SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

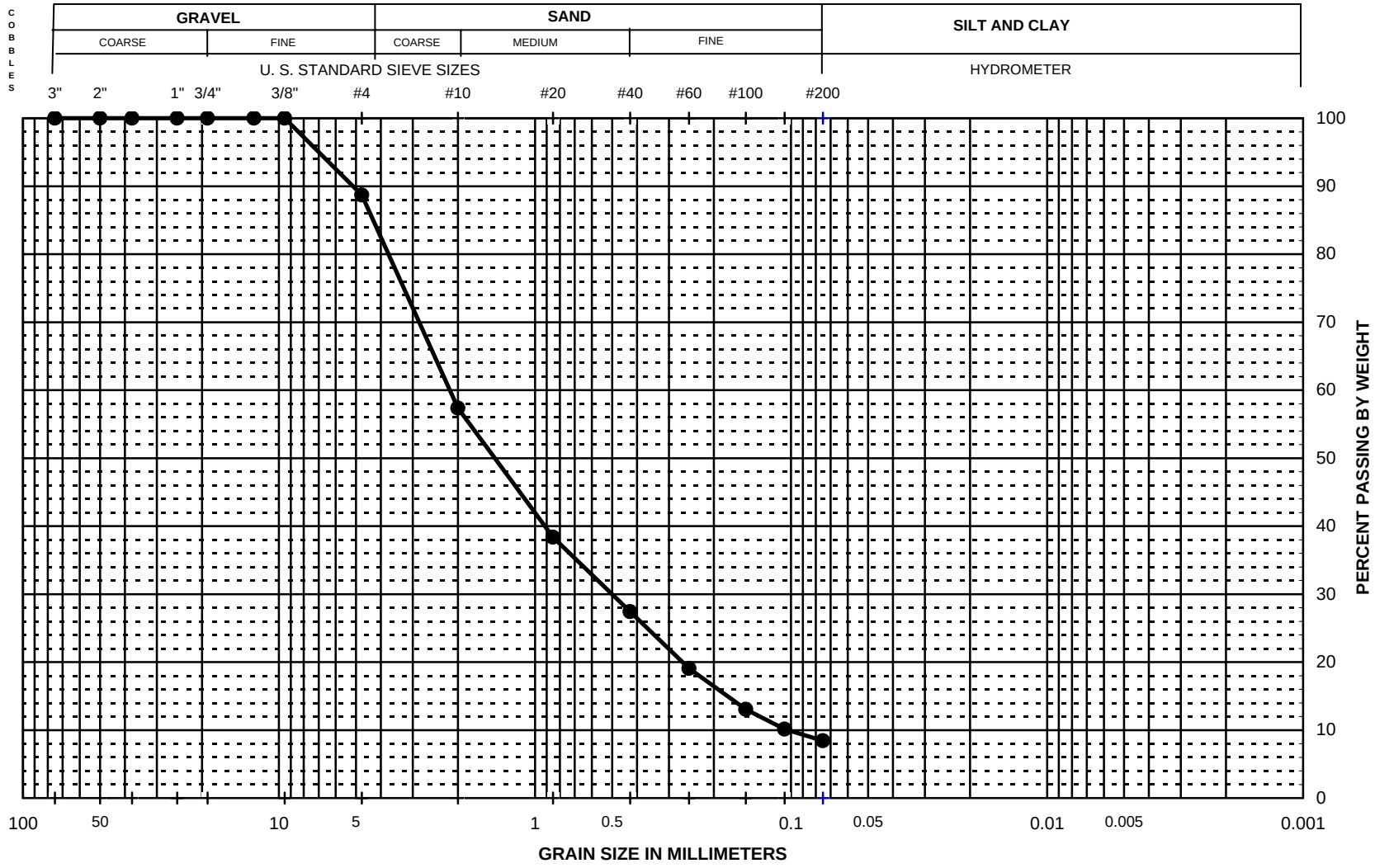
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-18

Sieve SS TP09005

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	88.7
#10	2.00	57.4
#20	0.850	38.4
#40	0.425	27.4
#60	0.250	19.1
#100	0.150	13.1
#140	0.106	10.1
#200	0.075	8.4
Hydrometer Analysis		

% Cobbles	
% Gravel	11.3
% Sand	80.3
% Fines	8.4
D_{60}	2.151
D_{30}	0.501
D_{10}	0.103
C_u	20.8
C_c	1.1

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-12	1	1.5	●	5.8				**Yellowish brown well-graded Sand with silt (SW-SM)**

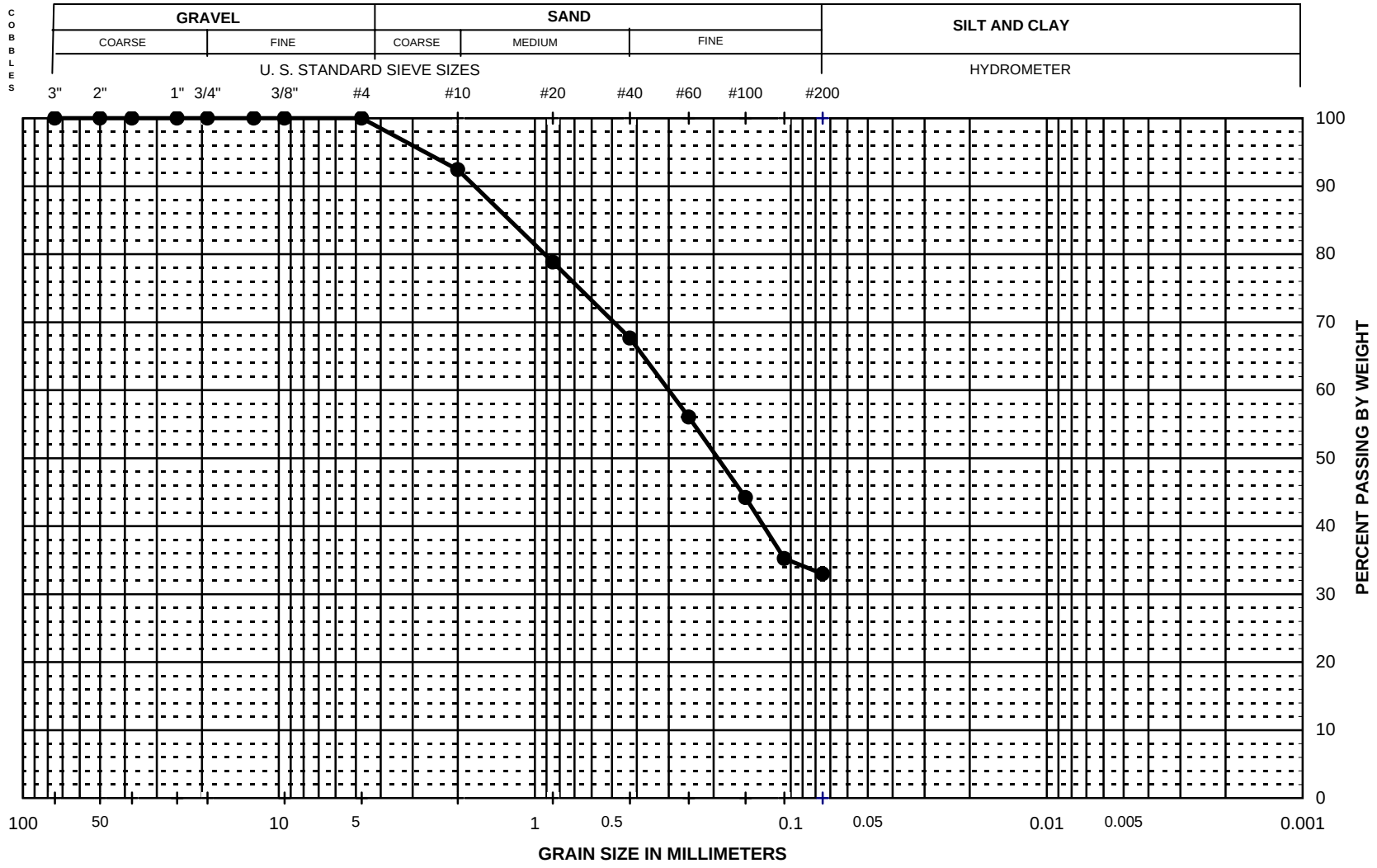
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-19

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	100.0
#10	2.00	92.4
#20	0.850	78.8
#40	0.425	67.7
#60	0.250	56.0
#100	0.150	44.2
#140	0.106	35.2
#200	0.075	33.0
Hydrometer Analysis		

% Cobbles	
% Gravel	0.0
% Sand	67.0
% Fines	33.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-14	2	1.5	●	12.6				**Yellowish brown clayey Sand (SC)**

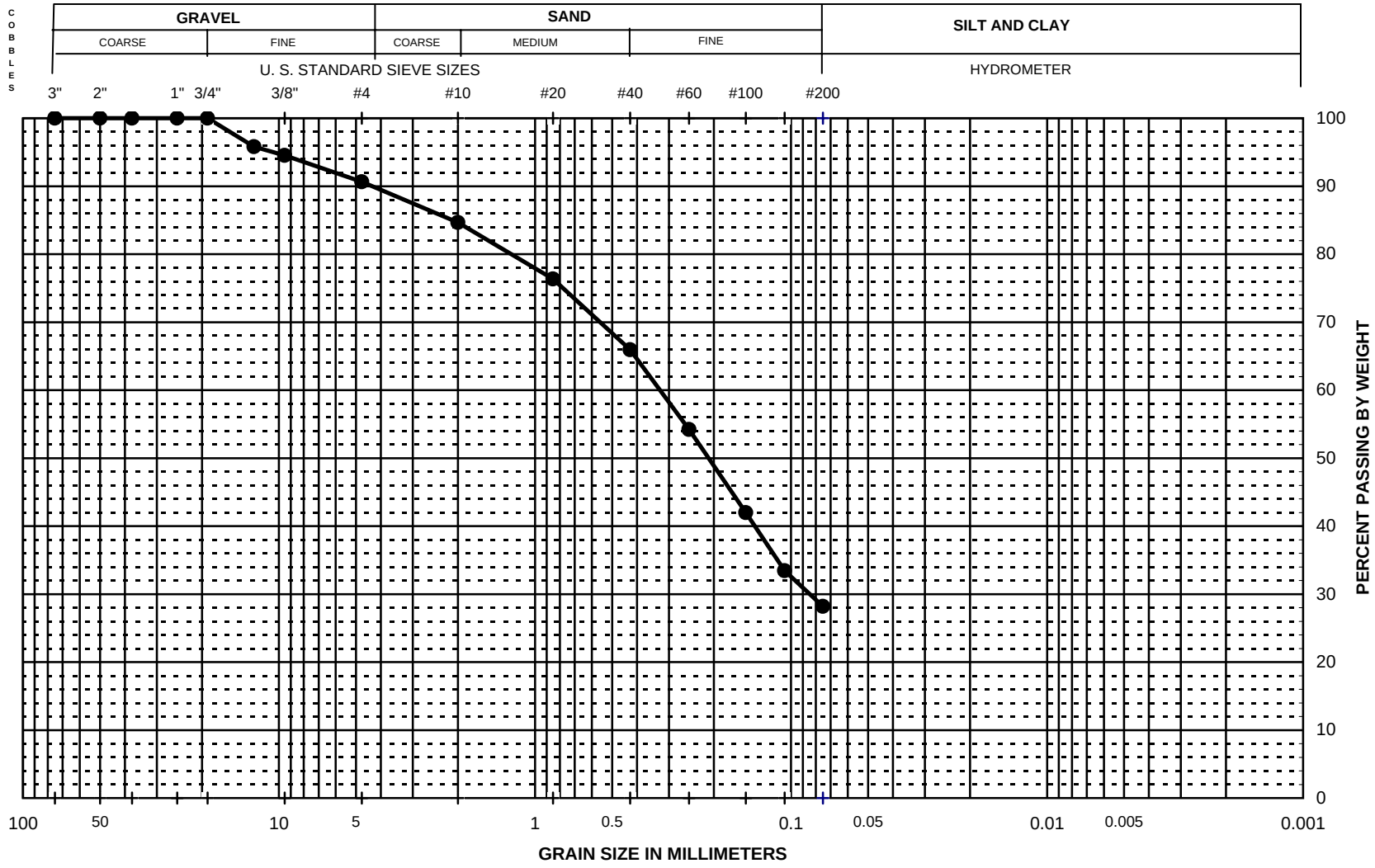
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-20

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	95.8
3/8"	9.50	94.5
#4	4.75	90.6
#10	2.00	84.7
#20	0.850	76.3
#40	0.425	65.9
#60	0.250	54.2
#100	0.150	42.0
#140	0.106	33.4
#200	0.075	28.2
Hydrometer Analysis		

% Cobbles	
% Gravel	9.4
% Sand	62.4
% Fines	28.2
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-16	1	0.0	●	5.6				**Brown clayey Sand (SC)**

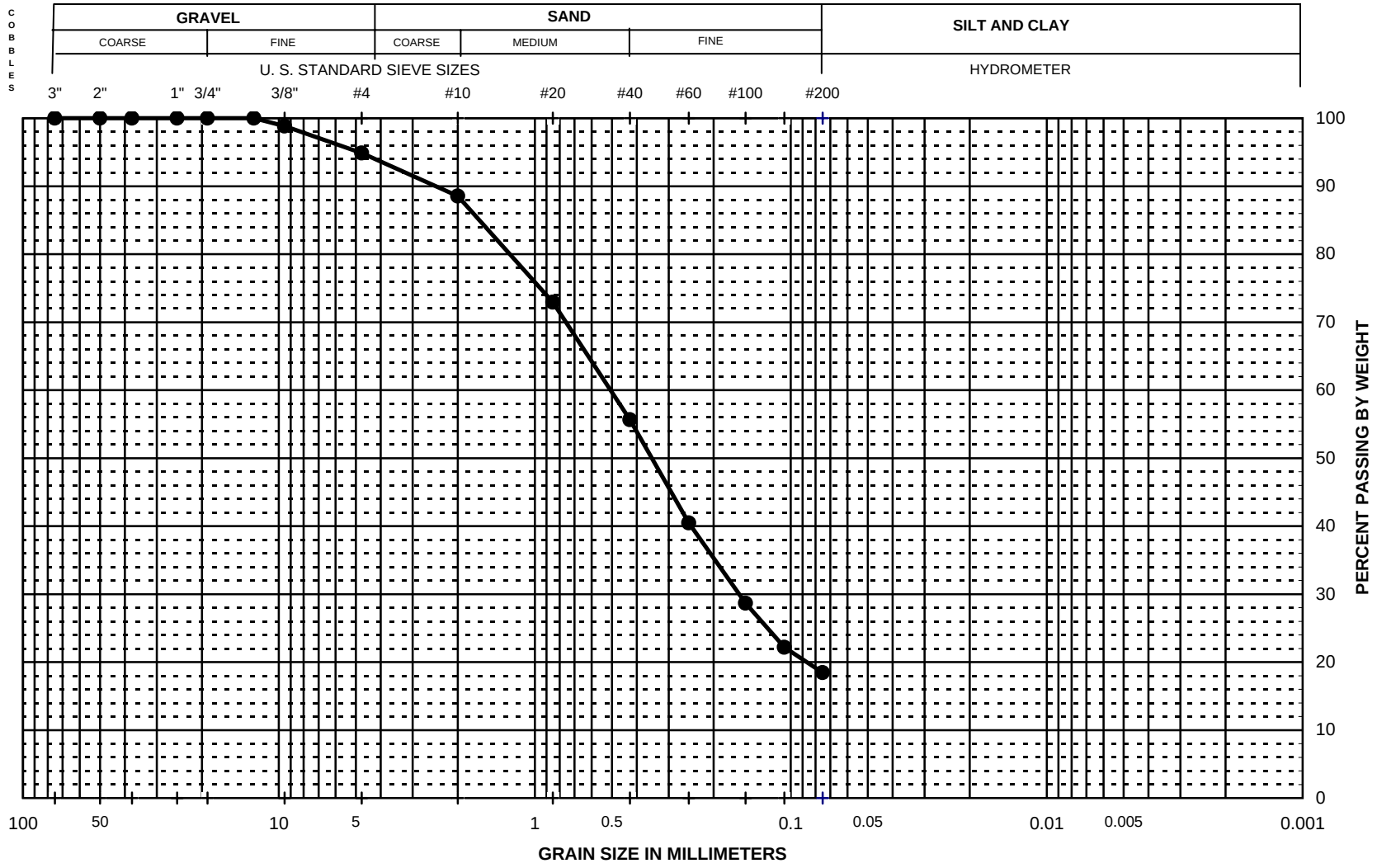
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-21

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	94.9
#10	2.00	88.5
#20	0.850	72.9
#40	0.425	55.6
#60	0.250	40.5
#100	0.150	28.6
#140	0.106	22.2
#200	0.075	18.4
Hydrometer Analysis		

% Cobbles	
% Gravel	5.1
% Sand	76.5
% Fines	18.4
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-16	2	1.0	●	11.2				**Reddish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

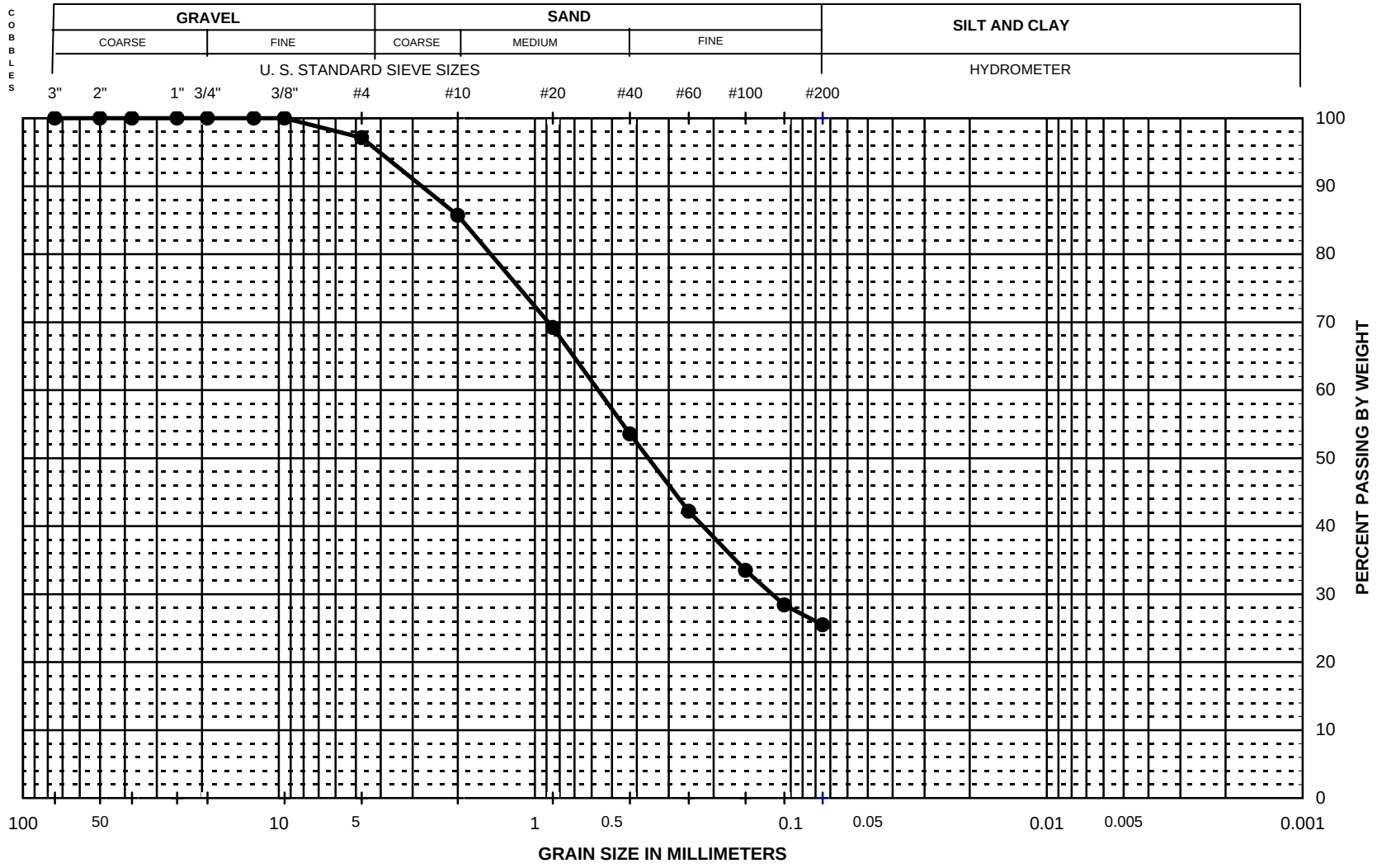
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-22

Sieve SS TP16001

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	97.1
#10	2.00	85.7
#20	0.850	69.2
#40	0.425	53.6
#60	0.250	42.2
#100	0.150	33.5
#140	0.106	28.4
#200	0.075	25.5
Hydrometer Analysis		

% Cobbles	
% Gravel	2.9
% Sand	71.6
% Fines	25.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-18	3	2.0	●	9.7				**Reddish brown silty Sand (SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

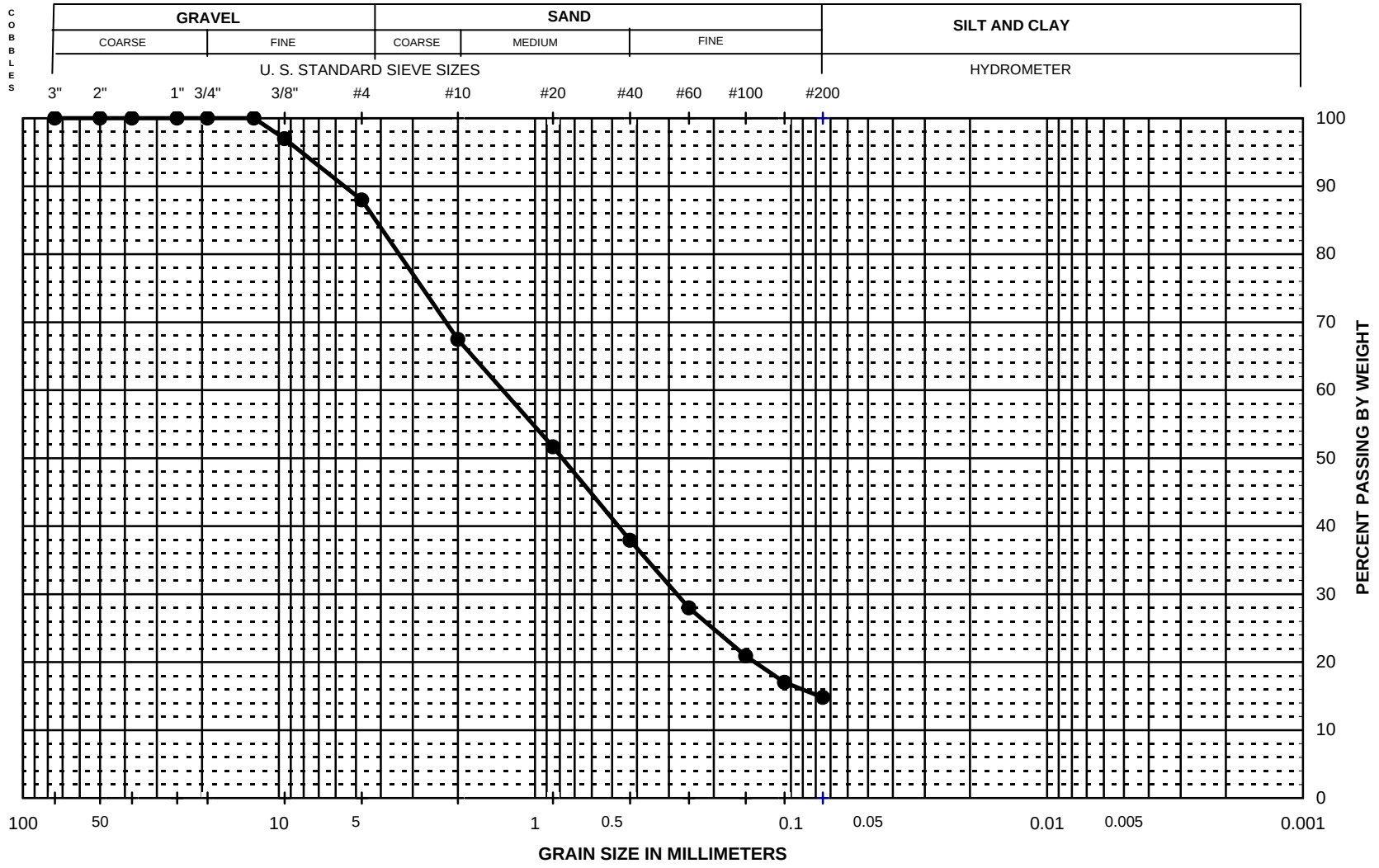
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-23

Sieve SS TP18002

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	97.0
#4	4.75	88.0
#10	2.00	67.4
#20	0.850	51.6
#40	0.425	37.9
#60	0.250	28.0
#100	0.150	20.9
#140	0.106	17.0
#200	0.075	14.8
Hydrometer Analysis		

% Cobbles	
% Gravel	12.0
% Sand	73.2
% Fines	14.8
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-21	2	20.0	●	7.2				**Reddish brown silty Sand (SM)**

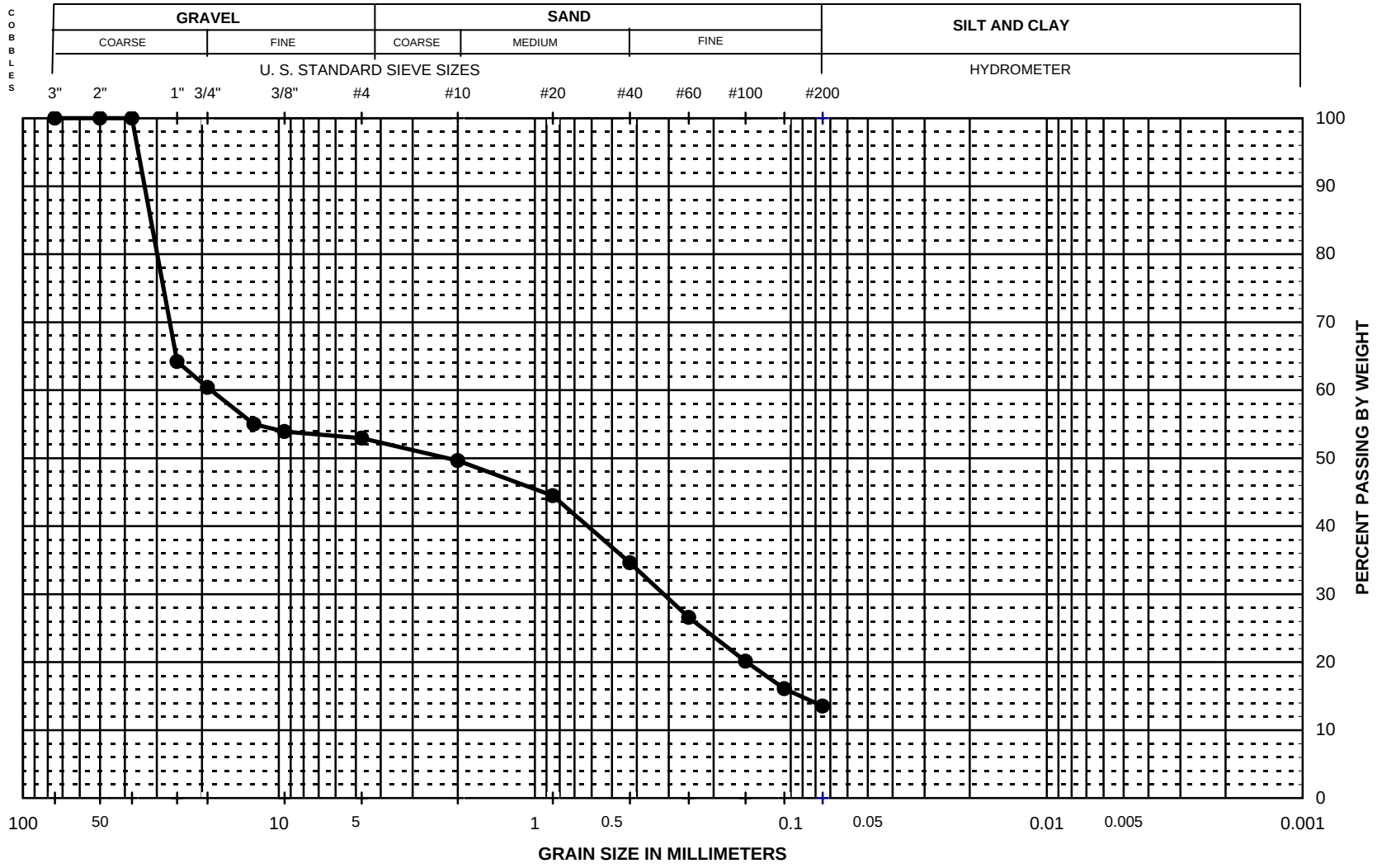
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-24

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	64.2
3/4"	19.00	60.4
1/2"	12.50	55.0
3/8"	9.50	53.9
#4	4.75	52.9
#10	2.00	49.6
#20	0.850	44.5
#40	0.425	34.6
#60	0.250	26.6
#100	0.150	20.1
#140	0.106	16.1
#200	0.075	13.5
Hydrometer Analysis		

% Cobbles	
% Gravel	47.1
% Sand	39.4
% Fines	13.5
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-22	1	0.0	●	4.1				**Yellowish brown clayey Gravel with sand (GC)**

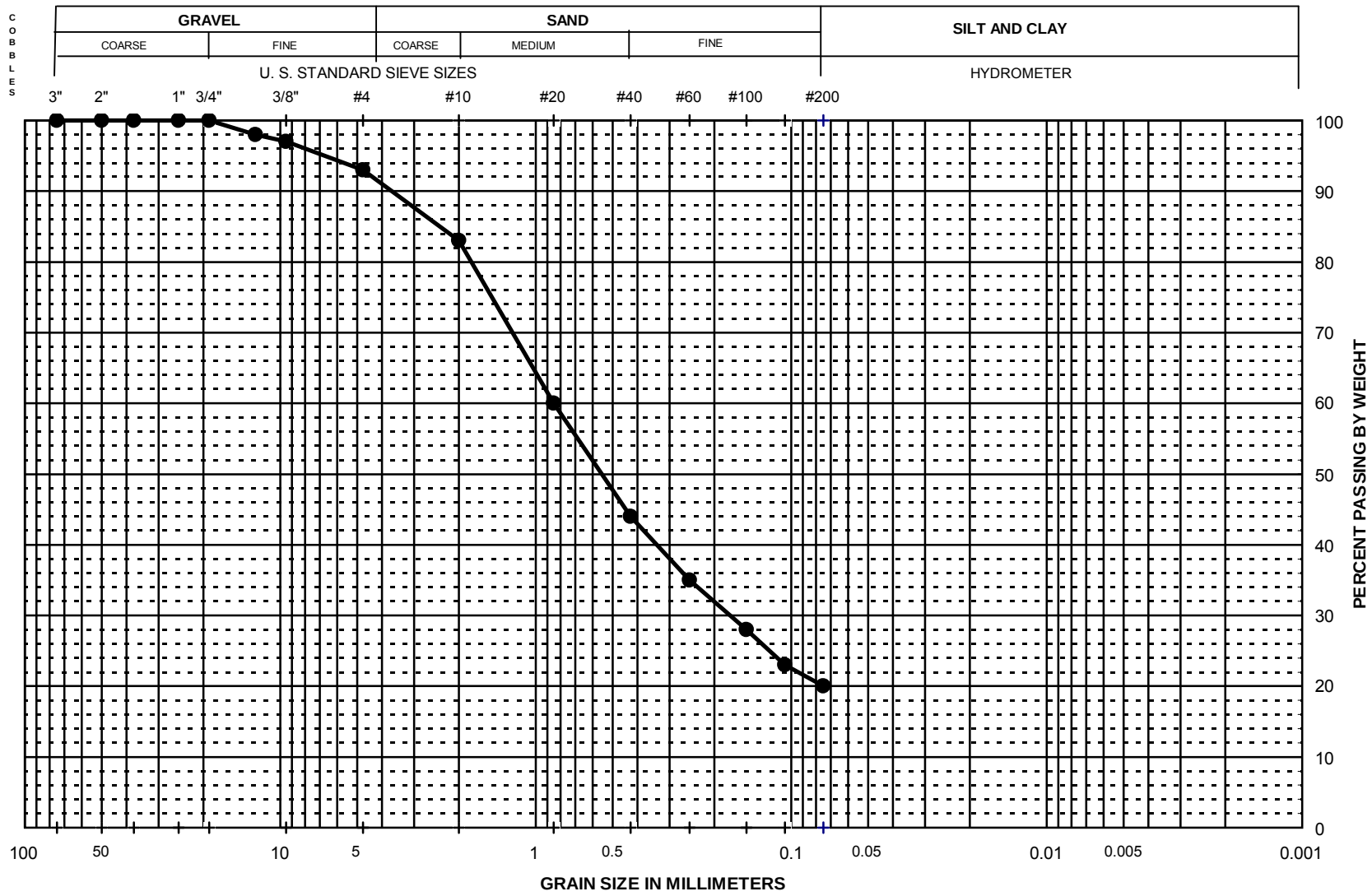
PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-25

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	98.0
3/8"	9.50	97.0
#4	4.75	93.0
#10	2.00	83.0
#20	0.850	60.0
#40	0.425	44.0
#60	0.250	35.0
#100	0.150	28.0
#140	0.106	23.0
#200	0.075	20.0

Hydrometer Analysis

% Cobbles	
% Gravel	7.0
% Sand	73.0
% Fines	20.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-24	2	2.0	●	7.1				**Olive brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

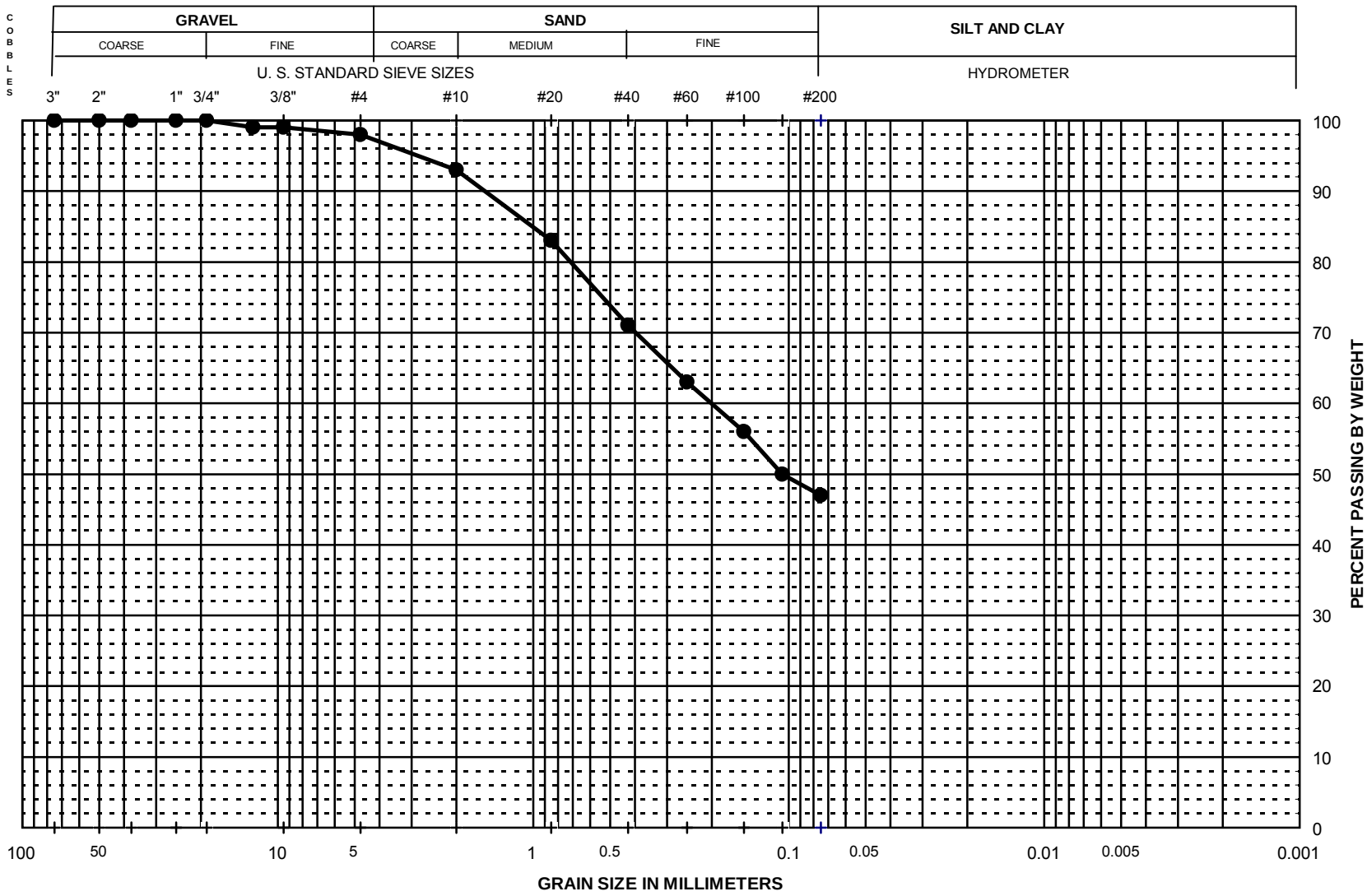
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-26

URS

Sieve Suncrest Access TP24002

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	99.0
3/8"	9.50	99.0
#4	4.75	98.0
#10	2.00	93.0
#20	0.850	83.0
#40	0.425	71.0
#60	0.250	63.0
#100	0.150	56.0
#140	0.106	50.0
#200	0.075	47.0

Hydrometer Analysis

% Cobbles	
% Gravel	2.0
% Sand	51.0
% Fines	47.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-25	2	1.0	●	7.0				**Yellowish brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

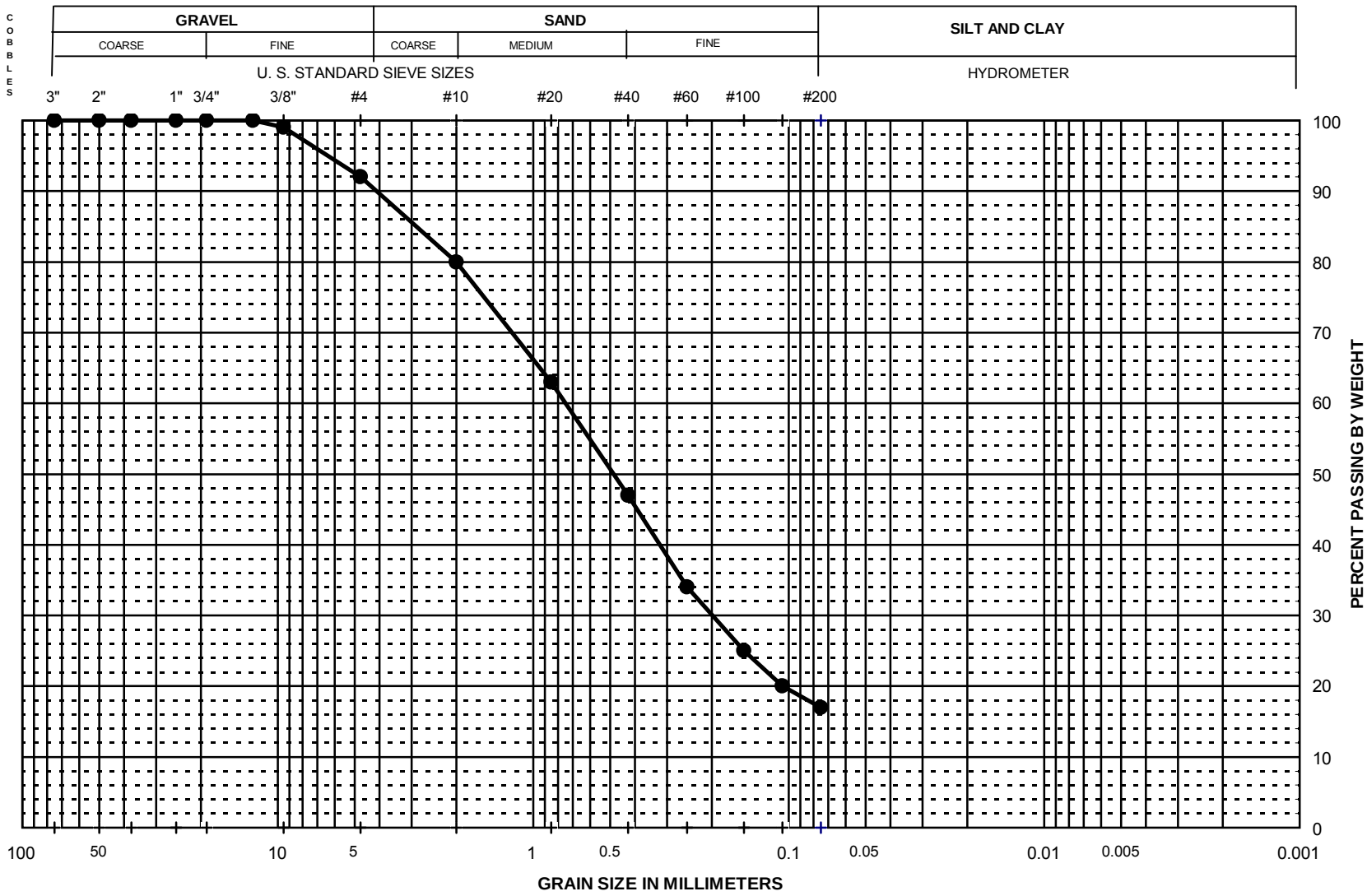
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-27

URS

Sieve Suncrest Access TP25001

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	92.0
#10	2.00	80.0
#20	0.850	63.0
#40	0.425	47.0
#60	0.250	34.0
#100	0.150	25.0
#140	0.106	20.0
#200	0.075	17.0

Hydrometer Analysis

% Cobbles	
% Gravel	8.0
% Sand	75.0
% Fines	17.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-27	1	0.5	●	6.8				**Yellowish red clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

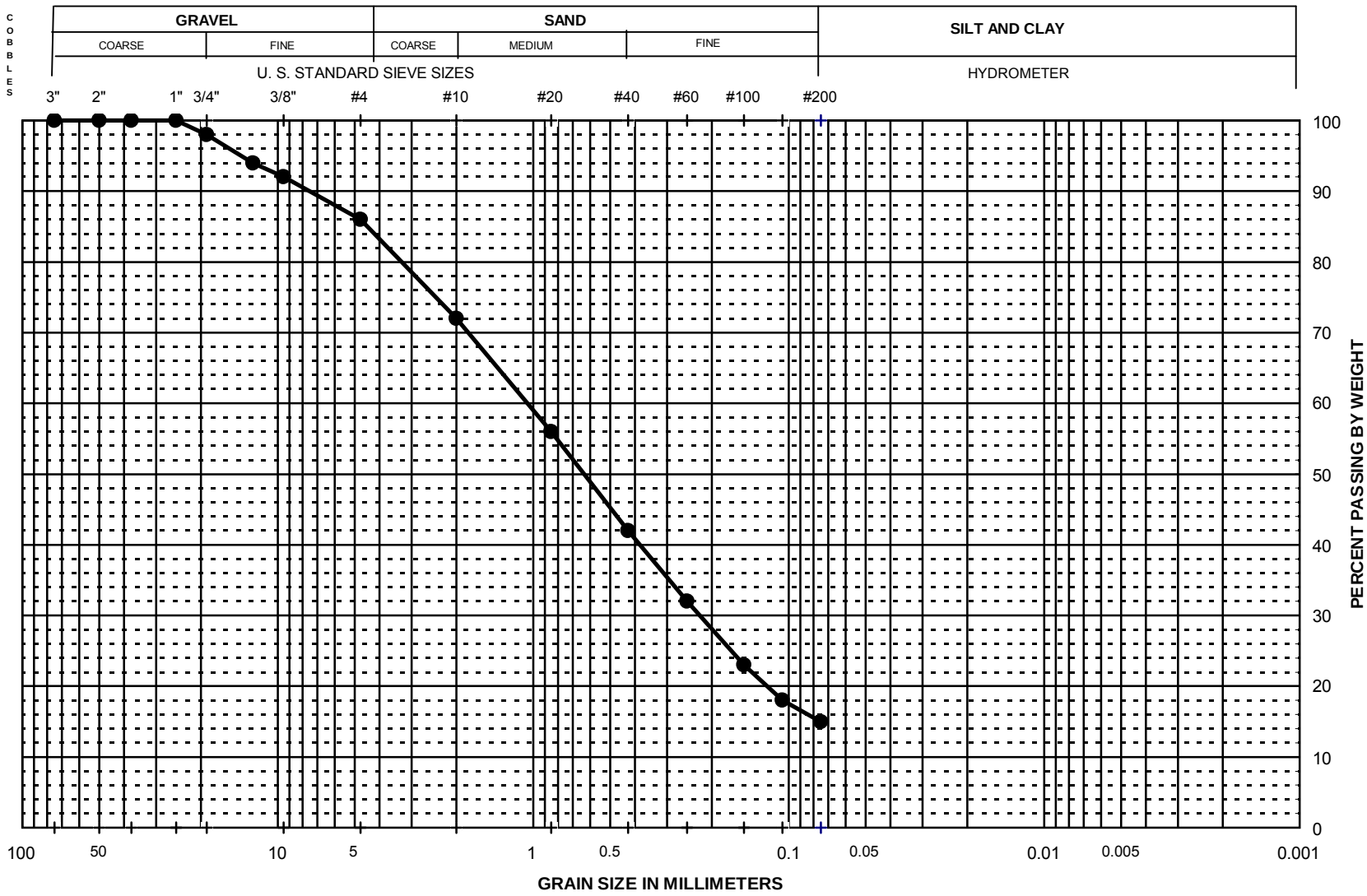
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-28

URS

Sieve Suncrest Access TP27001

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	98.0
1/2"	12.50	94.0
3/8"	9.50	92.0
#4	4.75	86.0
#10	2.00	72.0
#20	0.850	56.0
#40	0.425	42.0
#60	0.250	32.0
#100	0.150	23.0
#140	0.106	18.0
#200	0.075	15.0
Hydrometer Analysis		

% Cobbles	
% Gravel	14.0
% Sand	71.0
% Fines	15.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-27	2	3.5	●	5.9				**Yellowish brown silty Sand (SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

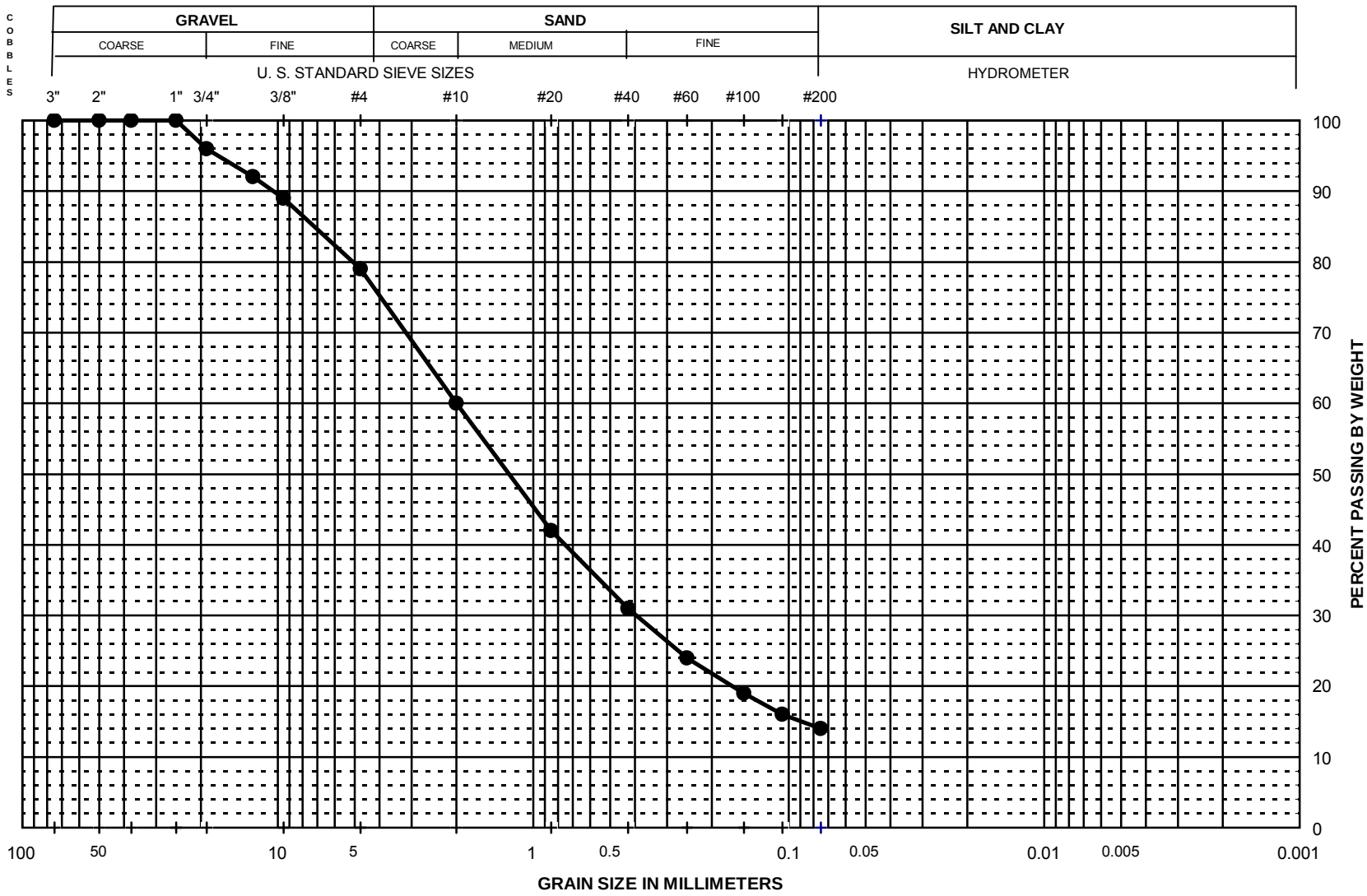
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-29

URS

Sieve Suncrest Access TP27003

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	96.0
1/2"	12.50	92.0
3/8"	9.50	89.0
#4	4.75	79.0
#10	2.00	60.0
#20	0.850	42.0
#40	0.425	31.0
#60	0.250	24.0
#100	0.150	19.0
#140	0.106	16.0
#200	0.075	14.0
Hydrometer Analysis		

% Cobbles	
% Gravel	21.0
% Sand	65.0
% Fines	14.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
TP-29	1	1.0	●	6.2				**Olive brown silty Sand with gravel (SM)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

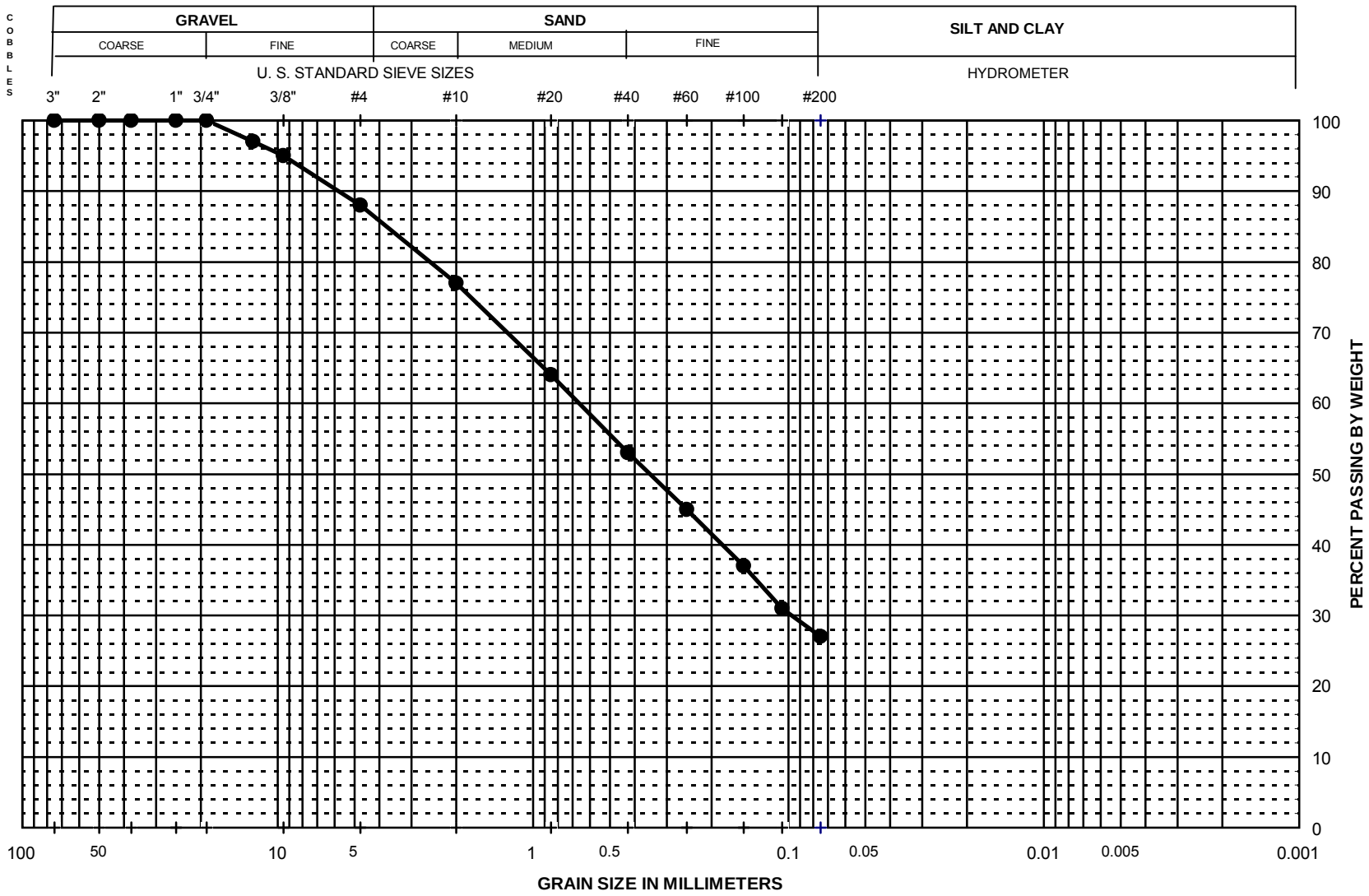
PARTICLE-SIZE DISTRIBUTION CURVES

Figure: F-30

URS

Sieve Suncrest Access TP29001

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	97.0
3/8"	9.50	95.0
#4	4.75	88.0
#10	2.00	77.0
#20	0.850	64.0
#40	0.425	53.0
#60	0.250	45.0
#100	0.150	37.0
#140	0.106	31.0
#200	0.075	27.0

Hydrometer Analysis

% Cobbles	
% Gravel	12.0
% Sand	61.0
% Fines	27.0
D_{60}	
D_{30}	
D_{10}	
C_u	
C_c	

Exploration	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 5 μm	Description and Classification
P-05	1	1.5	●	5.7				**Olive brown clayey Sand (SC)**

PROJECT NAME: **Suncrest Substation**

PROJECT NUMBER: **27669017**

PARTICLE-SIZE DISTRIBUTION CURVES

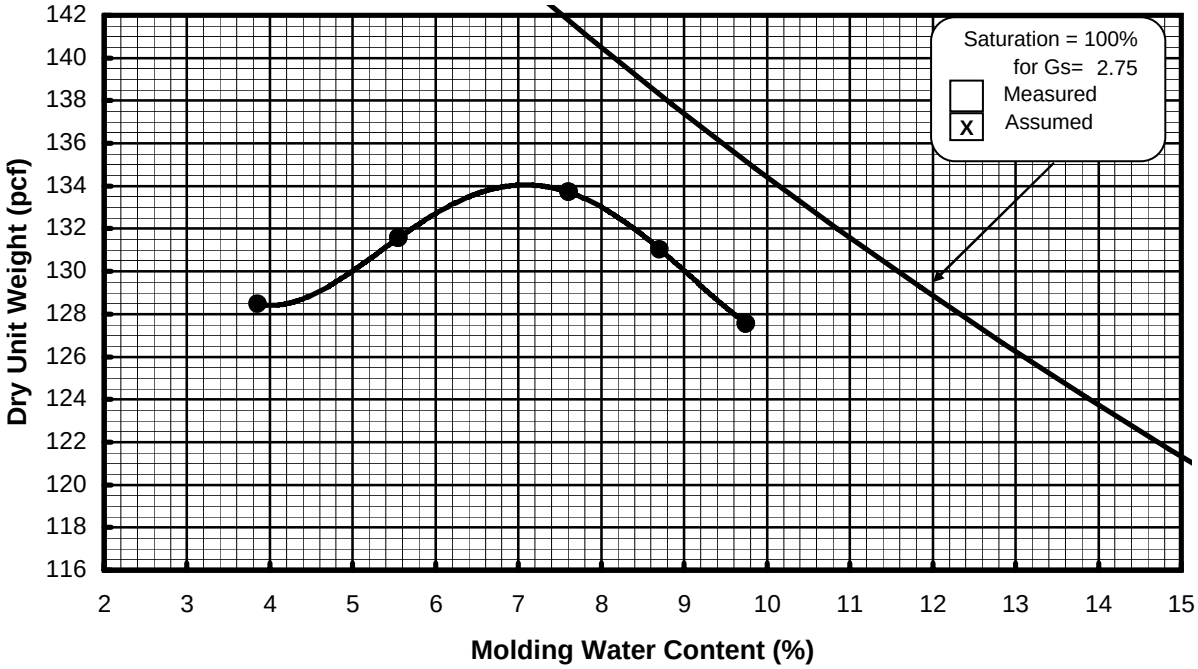
Figure: F-31

URS

Sieve Suncrest Access P05001

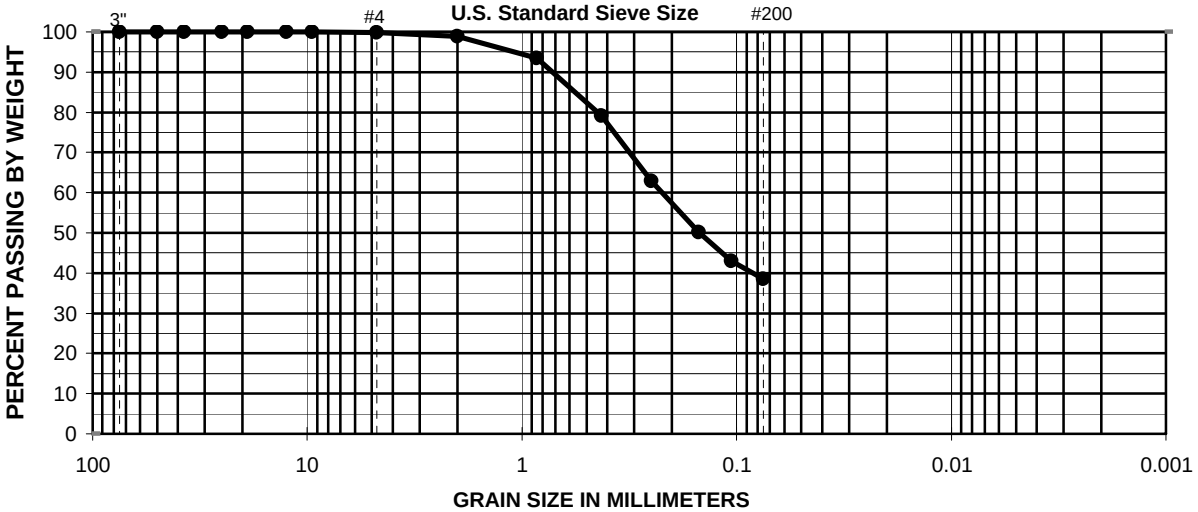
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-4	4	5 - 8	7.0	134.0	Olive yellow clayey Sand (SC)

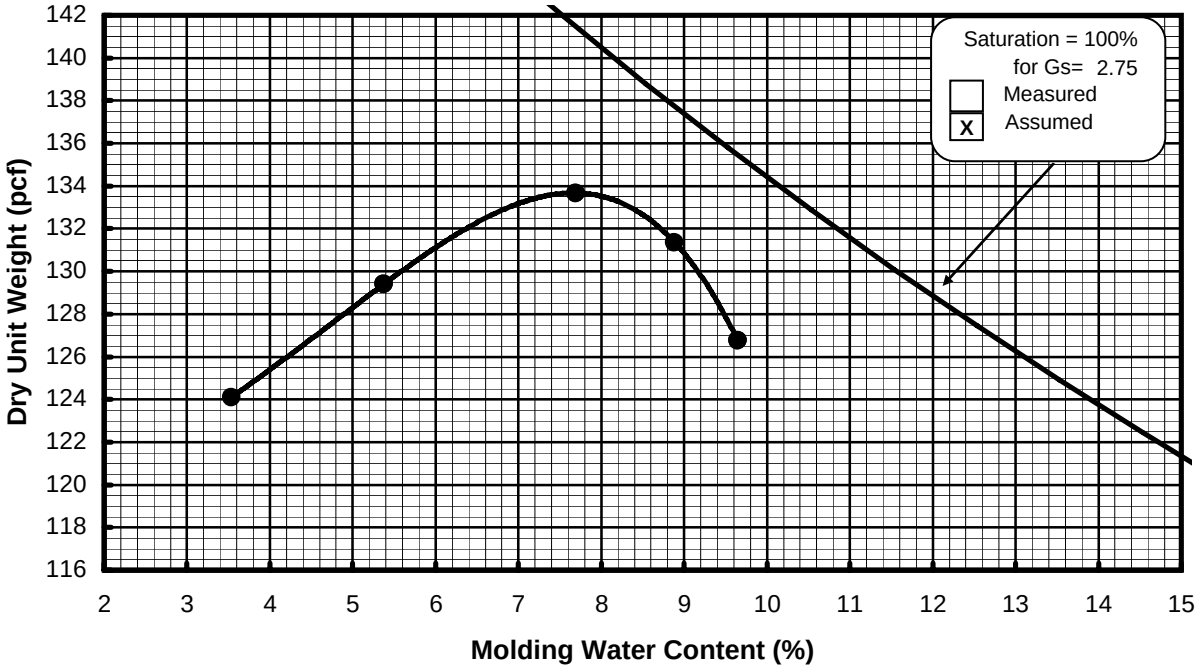
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig. F-32

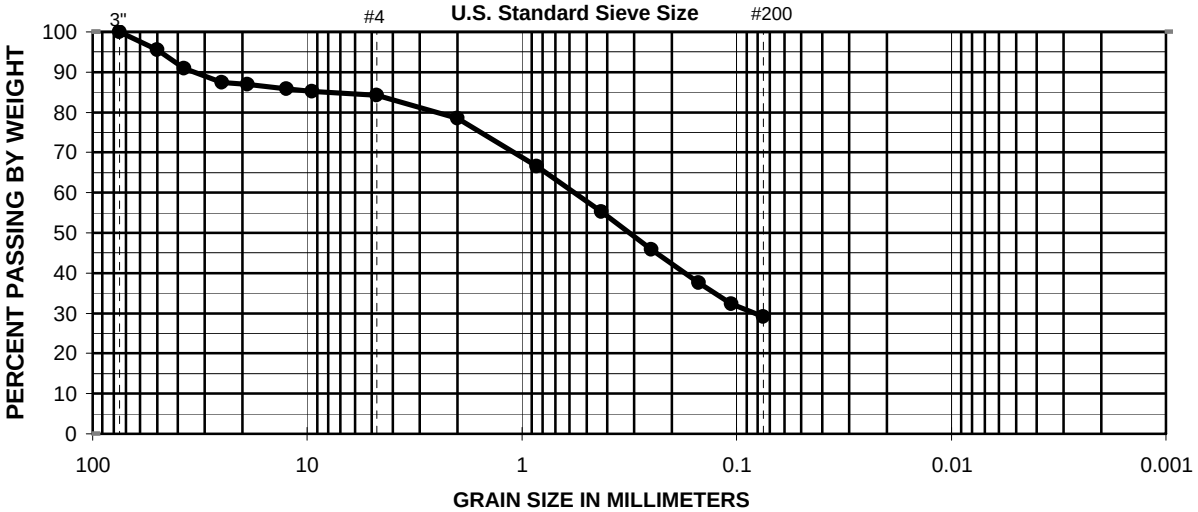
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

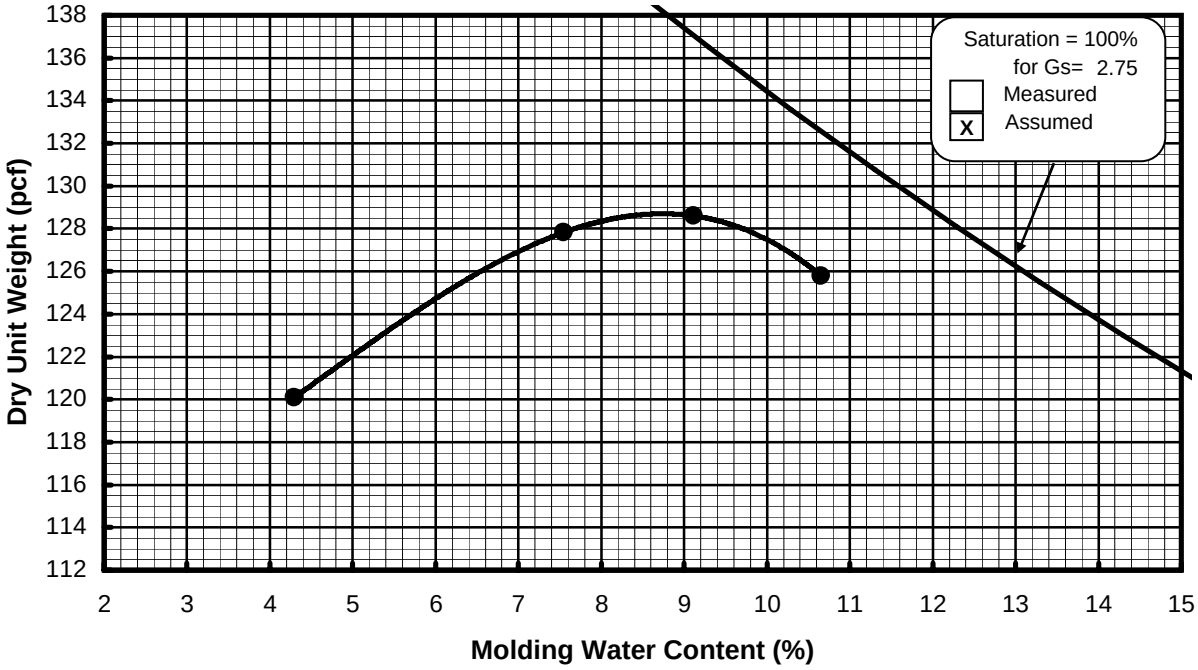
Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-5	1A	0 ~ 5	8.0	134.0	Dark yellowish brown clayey Sand with gravel (SC)

PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA | **Fig. F-33**

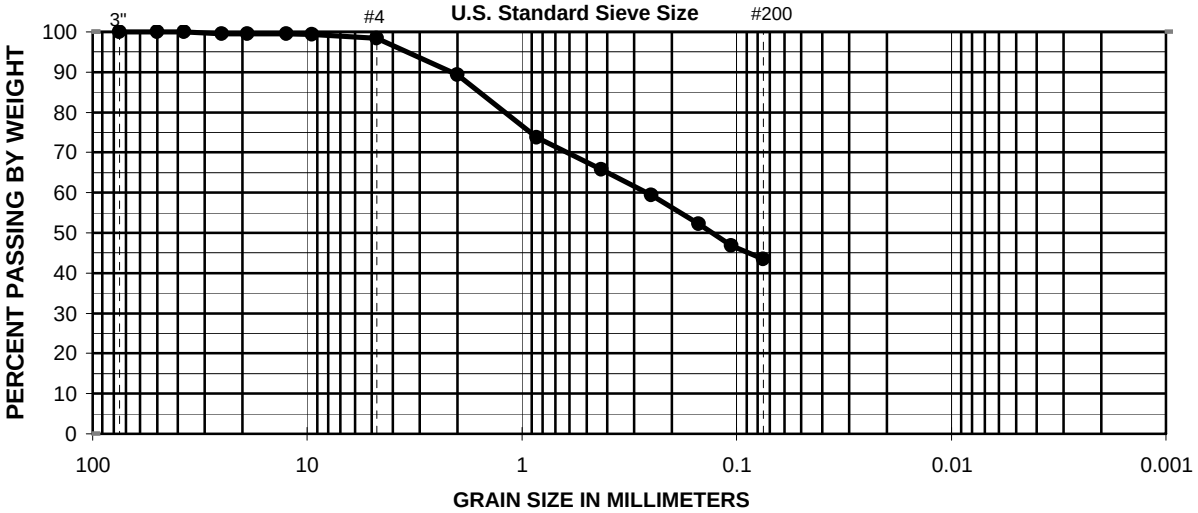
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-7	1A	1 - 5	9.0	129.0	Dark red clayey Sand (SC)

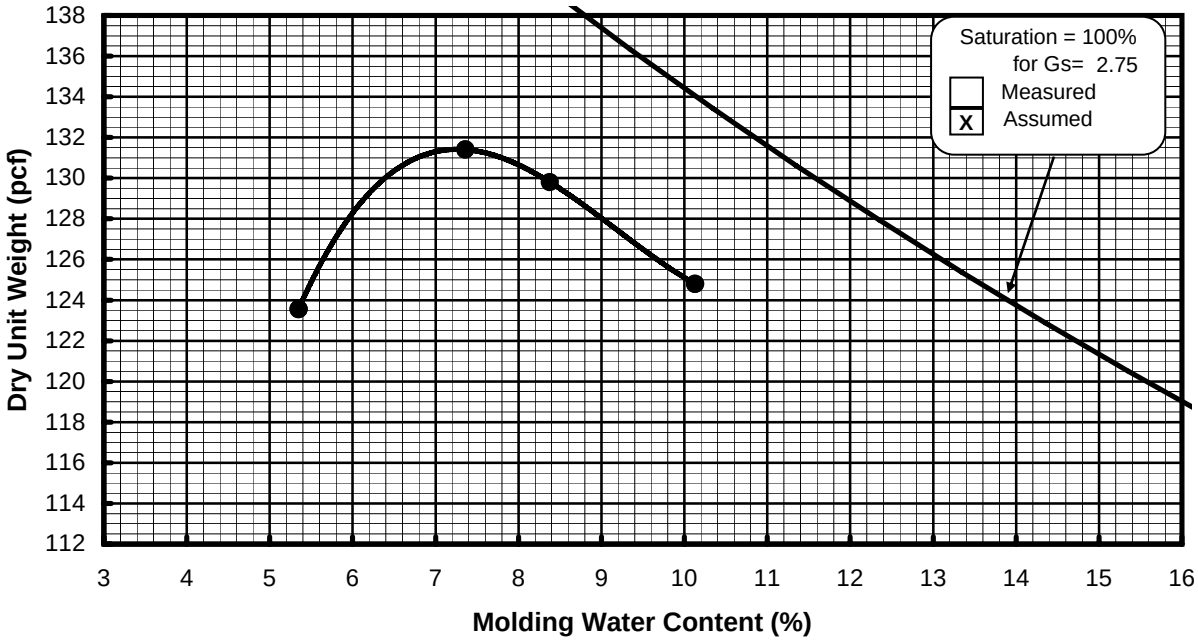
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig. F-34

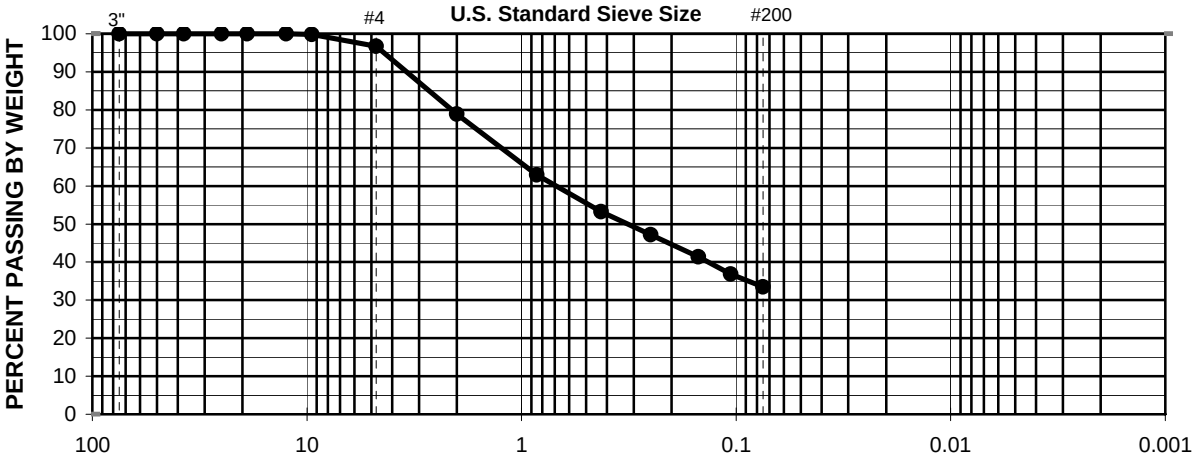
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-17	1A	0 - 5	7.5	131.5	Dark brown to orangish brown clayey Sand (SC)

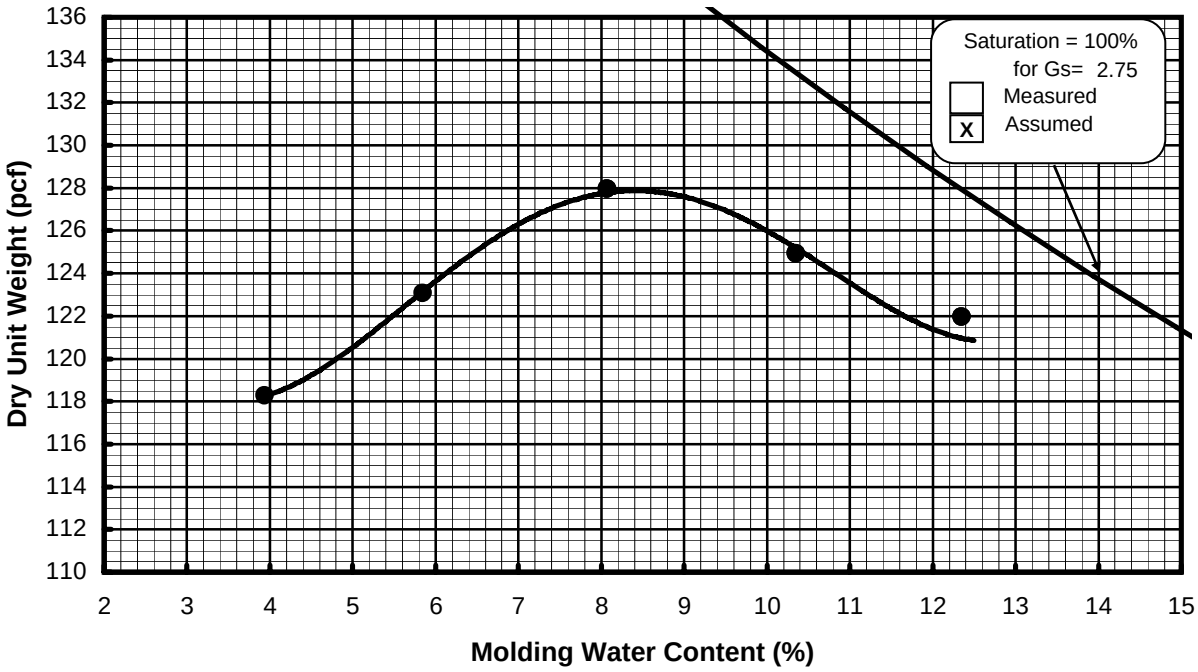
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig: F-35

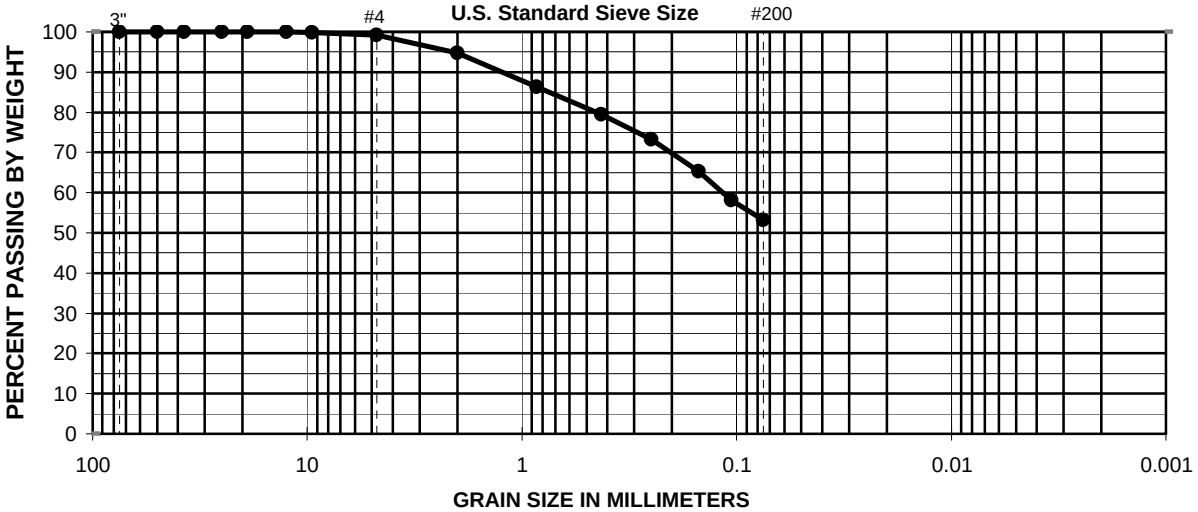
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-18	3	5 -10	8.5	128.0	Yellow sandy Clay (CL)

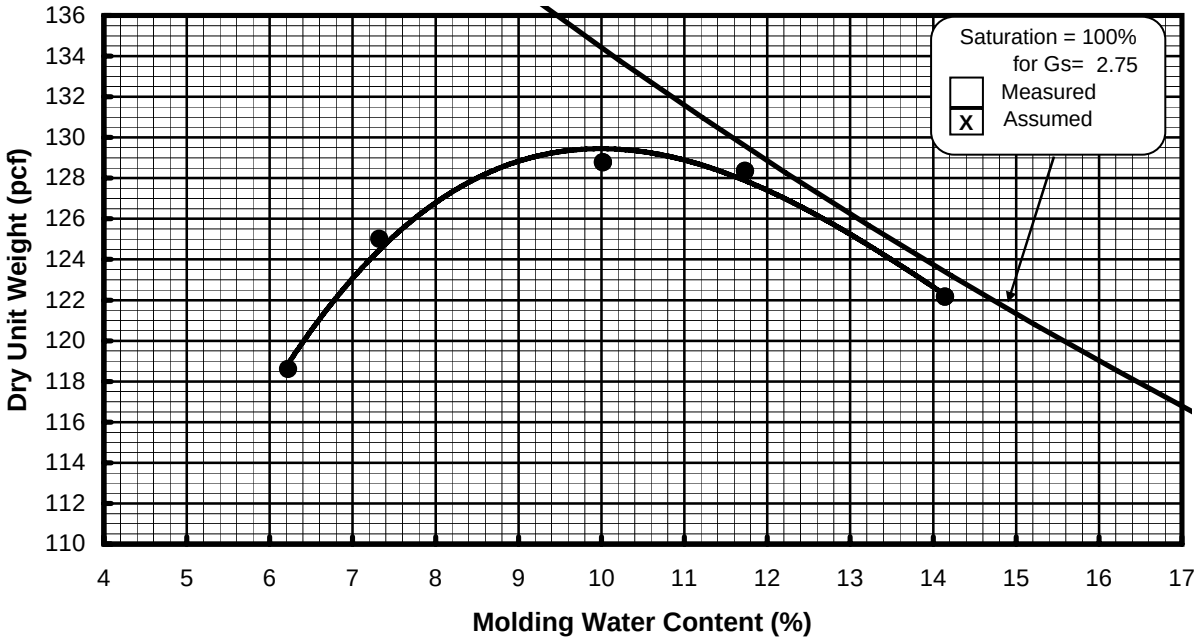
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig. F-36

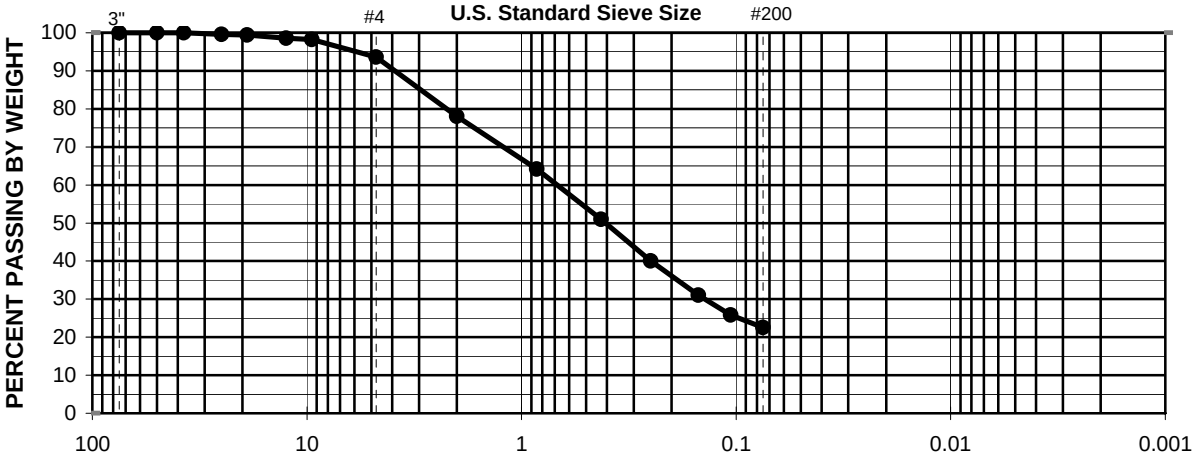
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
TP-9	4	5.5	10.0	129.5	Reddish brown clayey Sand (SC)

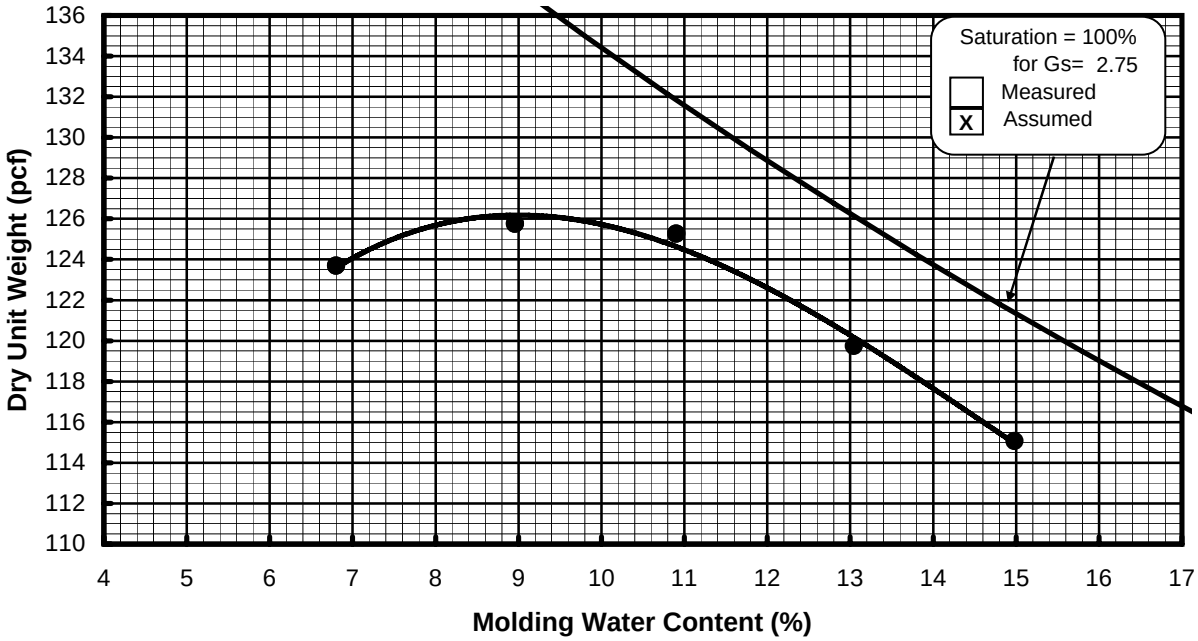
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig: F-37

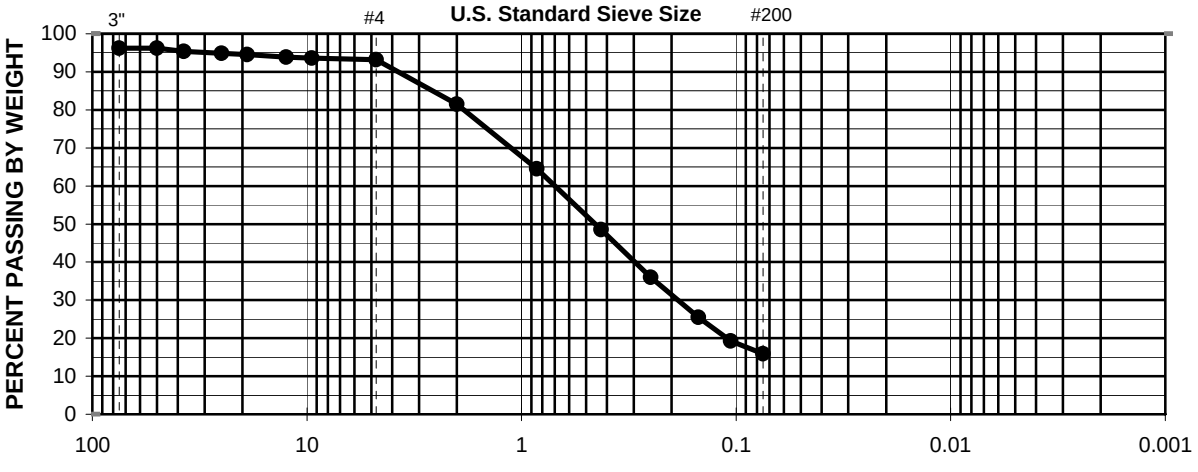
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
TP-10	3	5.0	9.0	126.5	Reddish brown clayey Sand (SC)

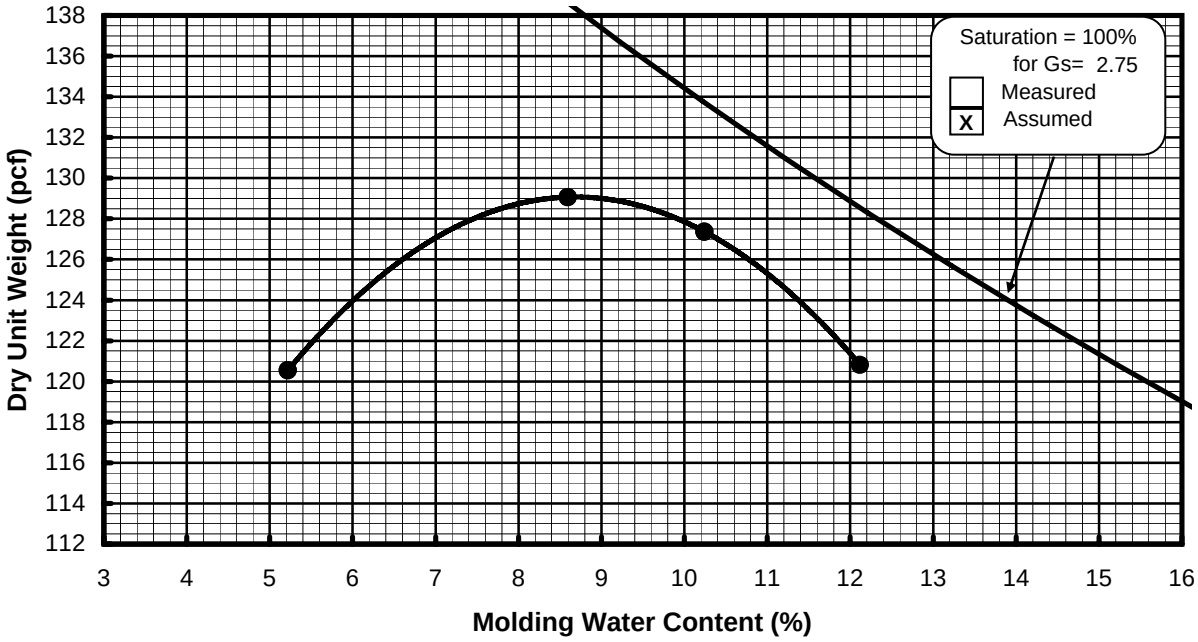
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig: F-38

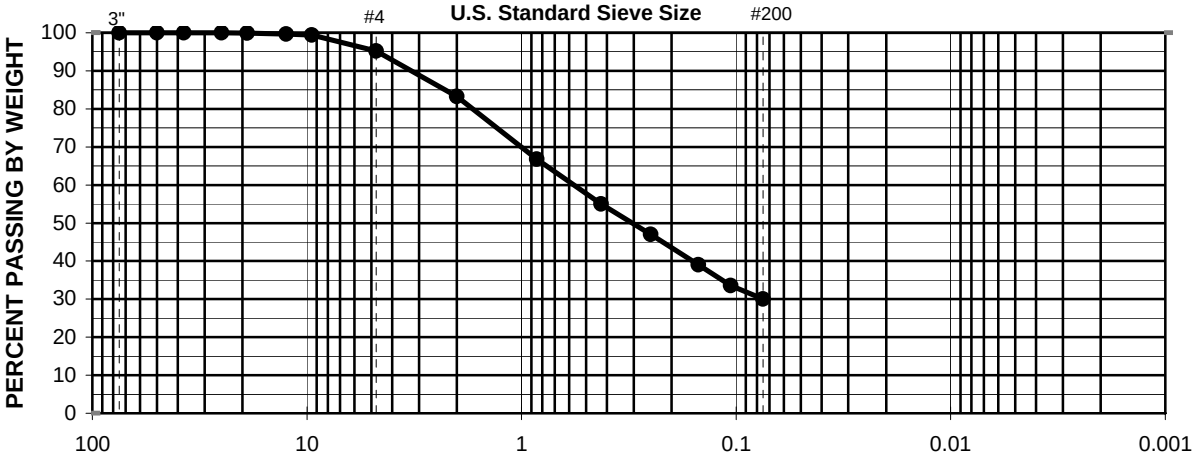
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
TP-13	3	2.5	8.5	129.0	Reddish brown clayey Sand (SC)

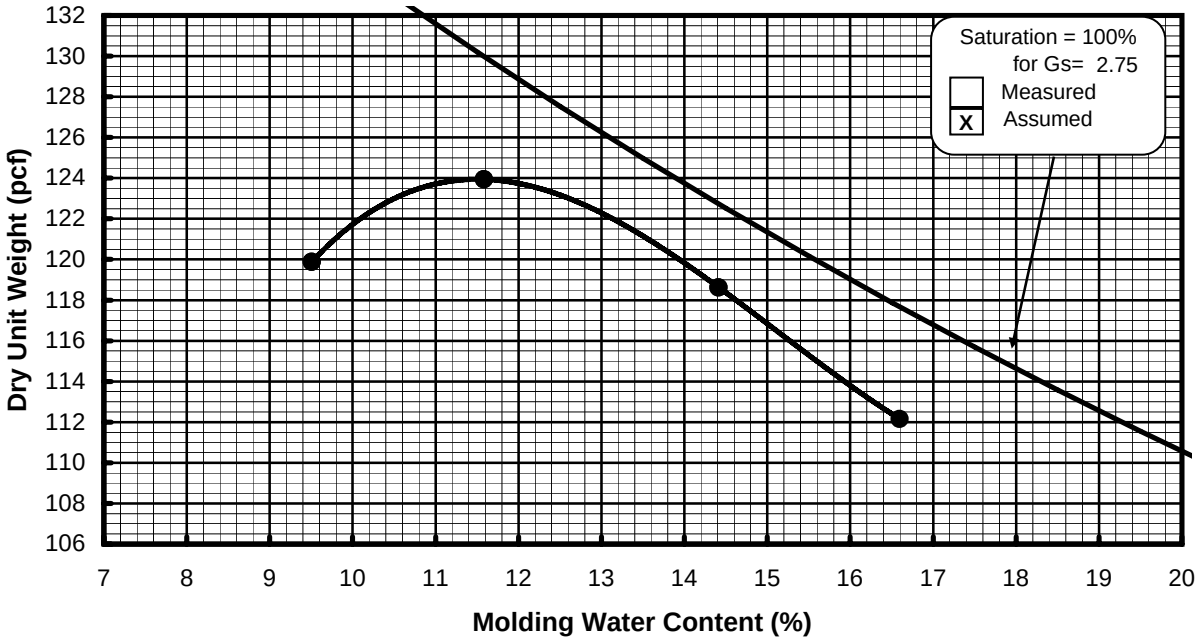
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig: F-39

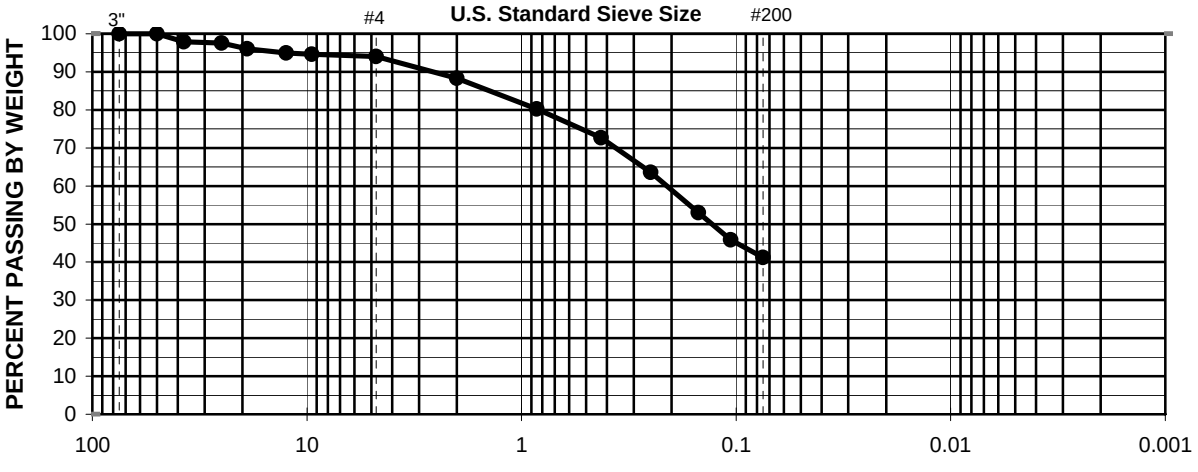
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
TP-15	1	0.5	11.5	124.0	Reddish brown clayey Sand (SC)

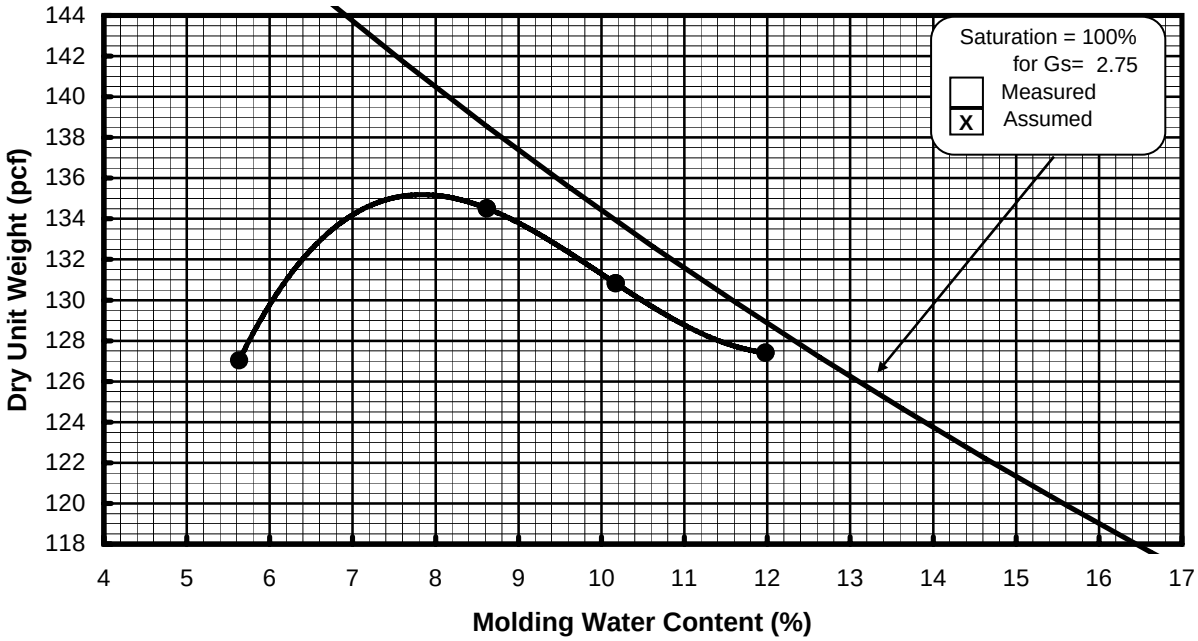
PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

Fig: F-40

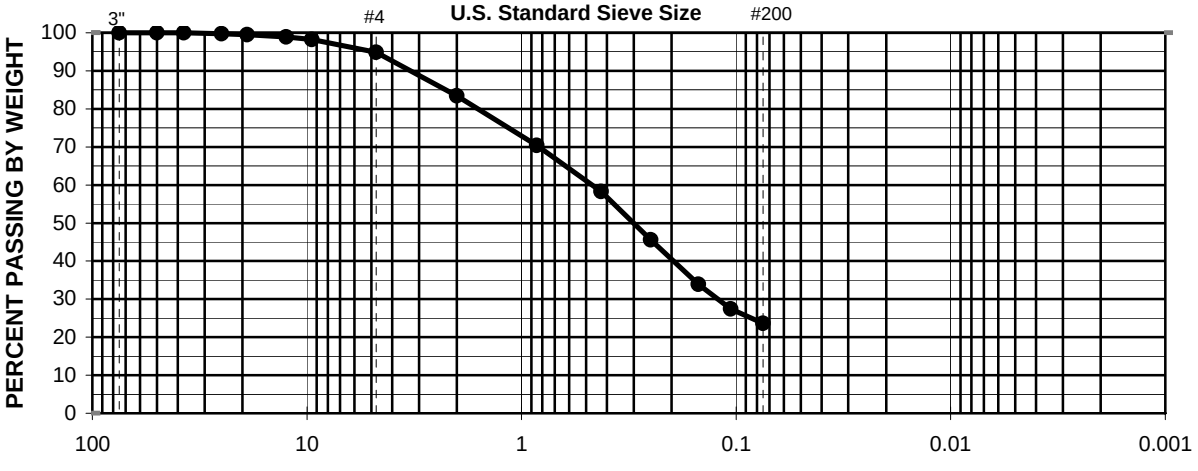
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



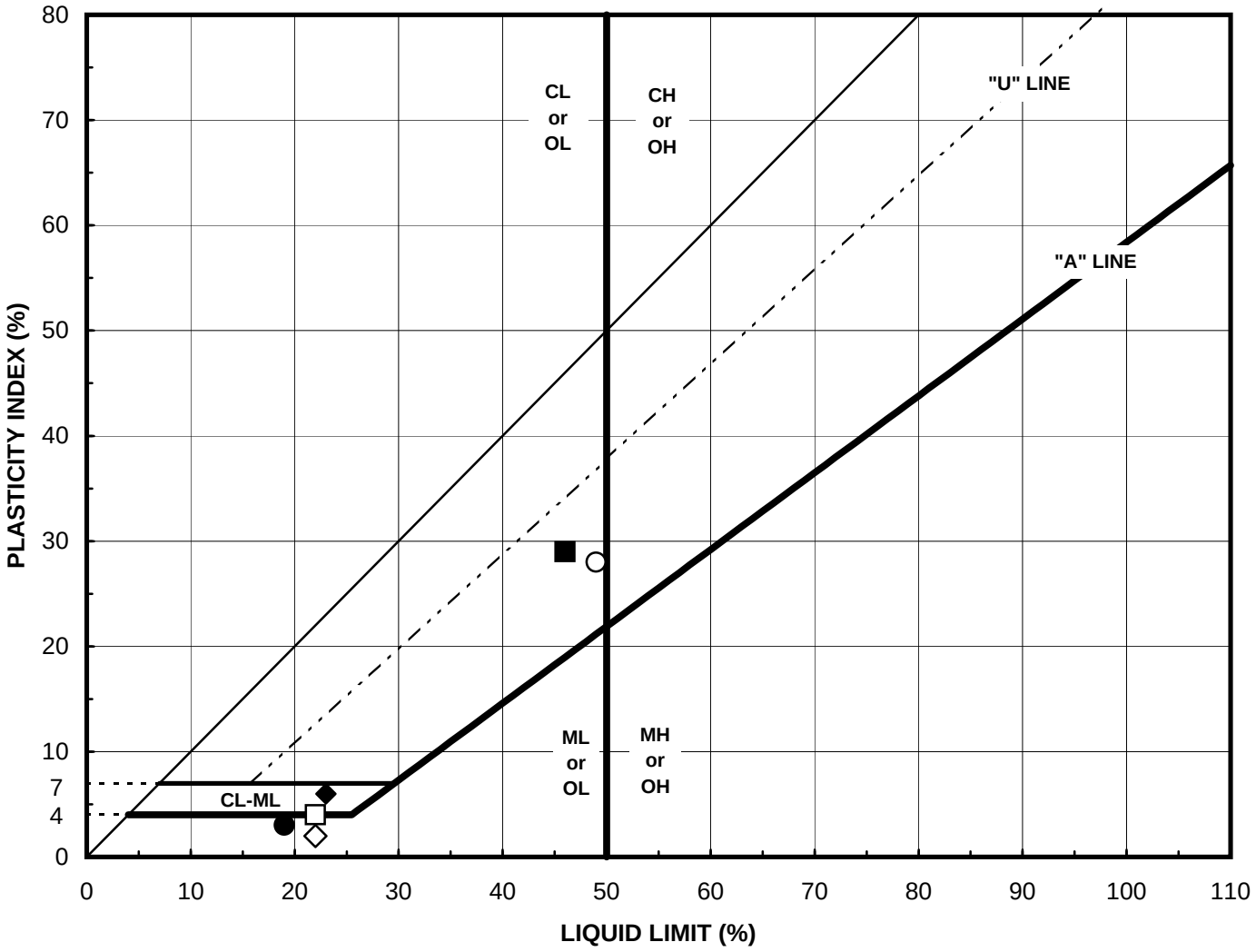
NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Exploration Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
TP-17	2	2.0	8.0	135.0	Reddish brown clayey Sand (SC)

PROJECT NAME: Suncrest Substation
PROJECT NUMBER: 27669017

COMPACTION AND INDEX PROPERTY DATA

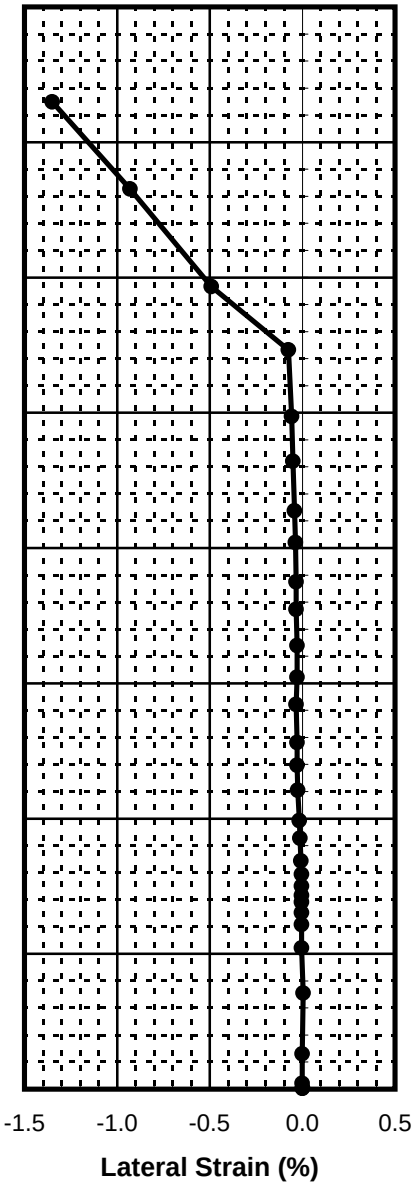
Fig: F-41

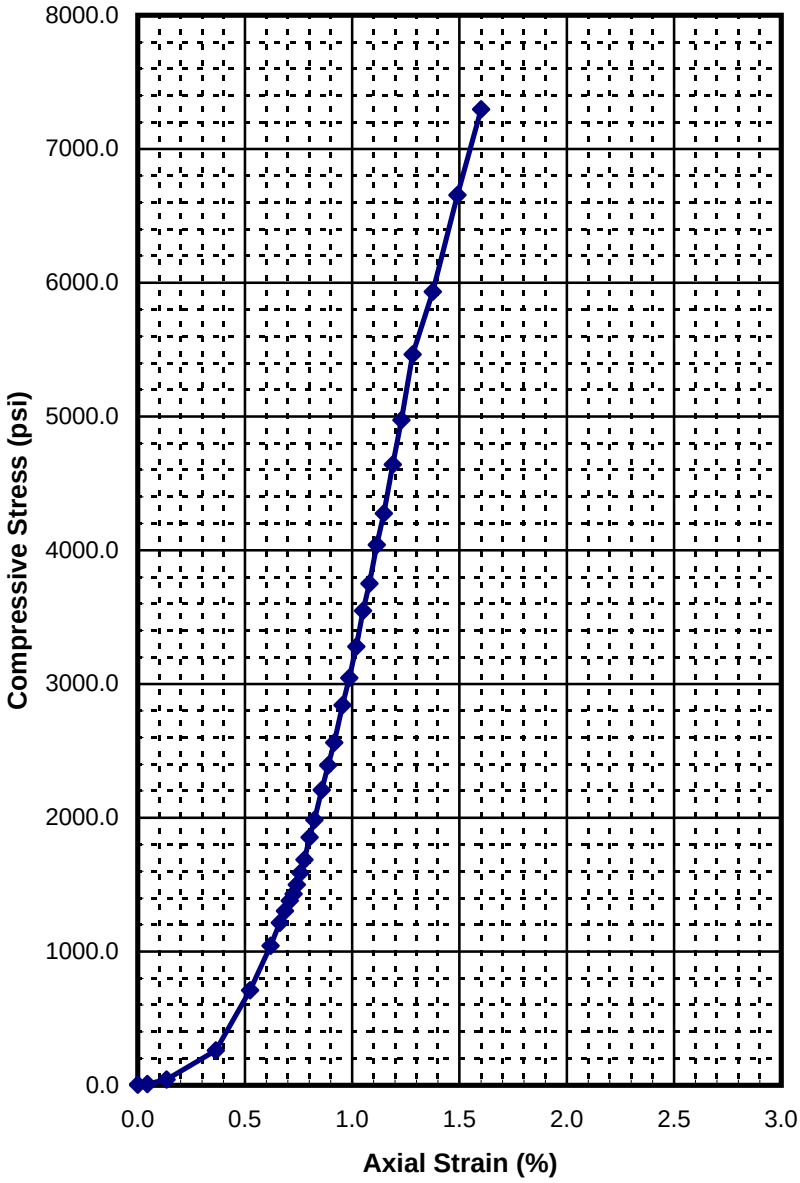


BORING / SAMPLE	DEPTH (feet)	TEST SYMBOL	WATER CONTENT (%)	LL	PI	DESCRIPTION / CLASSIFICATION
TP-9	0.5	●	8.4	19	3	Dark brown silty Sand (SM)
TP-9	1.0	■	15.1	46	29	Dark reddish brown clayey Sand (SC)
TP-10	1.5	◆	13.6	23	6	Brown silty Clay (CL-ML)
TP-25	4.0	○	14.5	49	28	Brown Clay (CL)
B-27	0.0	□	3.5	22	4	Brown silty, clayey Sand with gravel (SC-SM)
P-06	0.0	◇	2.2	22	2	Very dark gray silty Sand (SM)

Project Name: **Suncrest Substation**
Project Number: **27669017**

PLASTICITY CHART
Figure: F-42



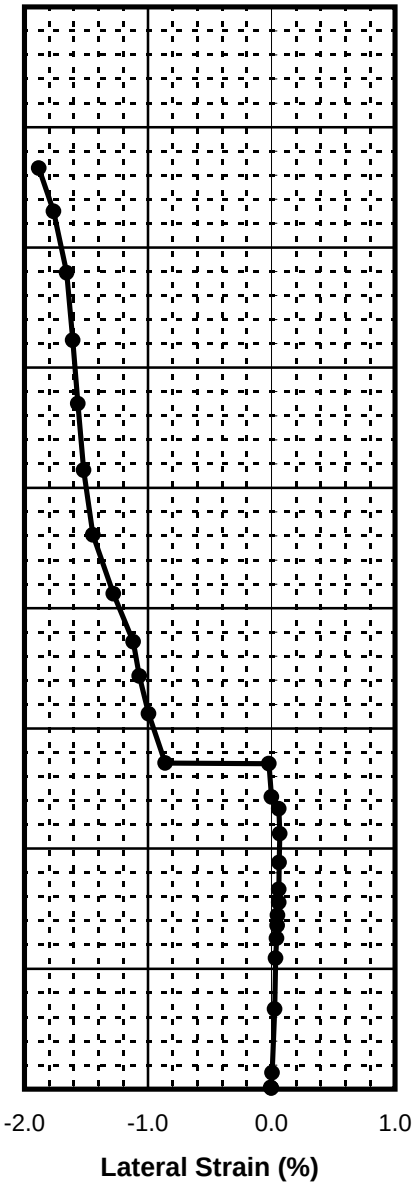


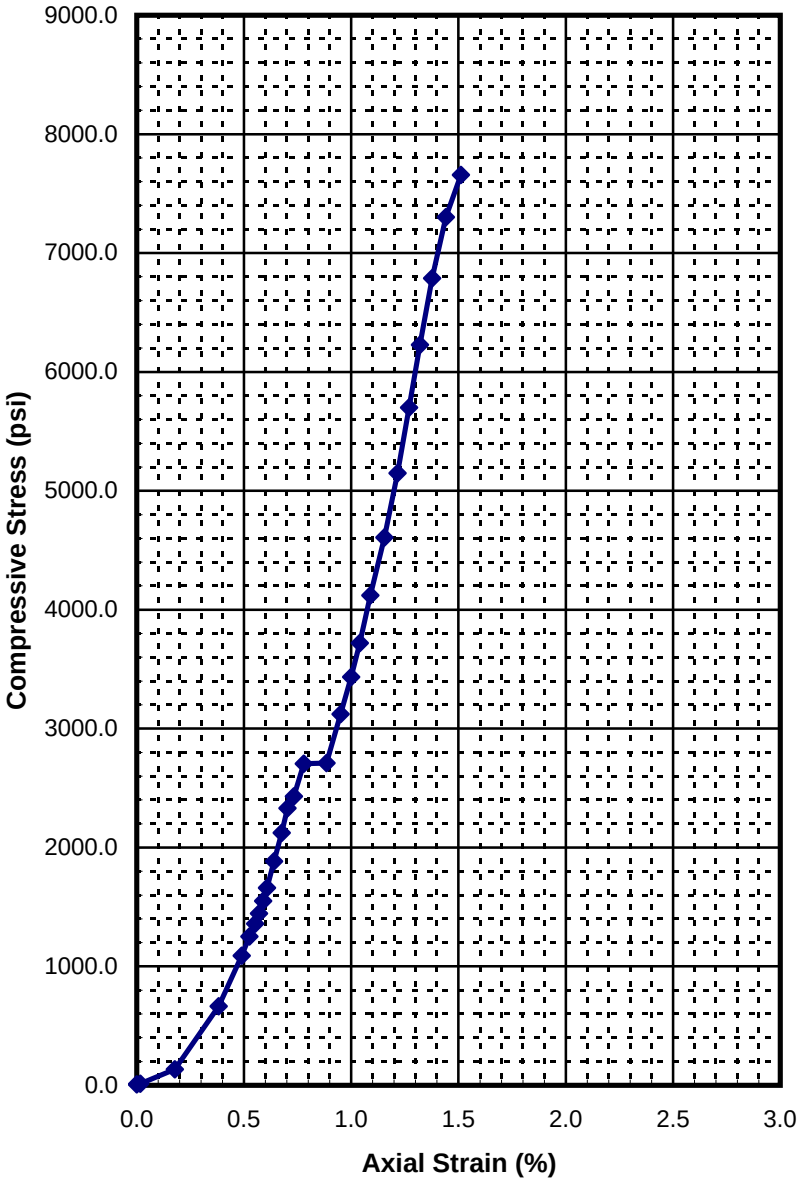
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.3	4.979	2.385	164.4	7,297

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-1** **Depth (ft): 14.0**
Description and/or Classification:	**Granodiorite, very pale brown with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

Figure: F- 43



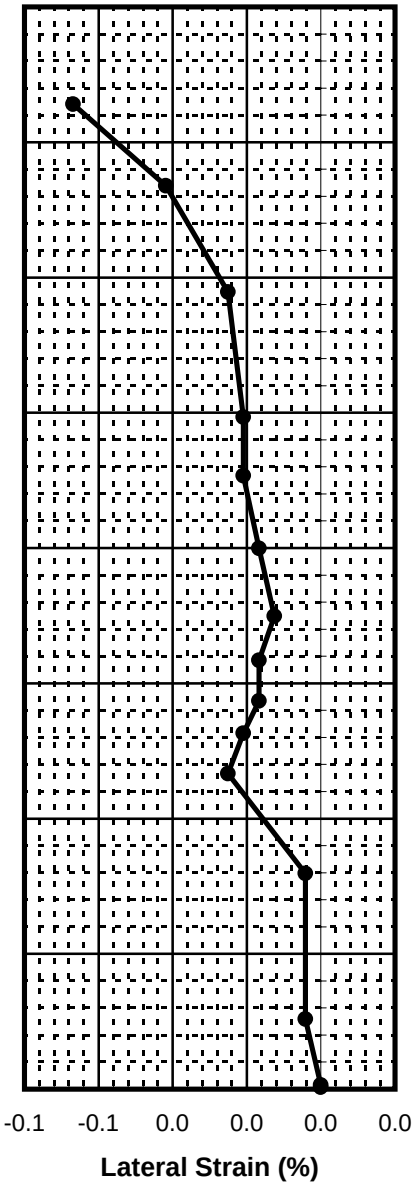


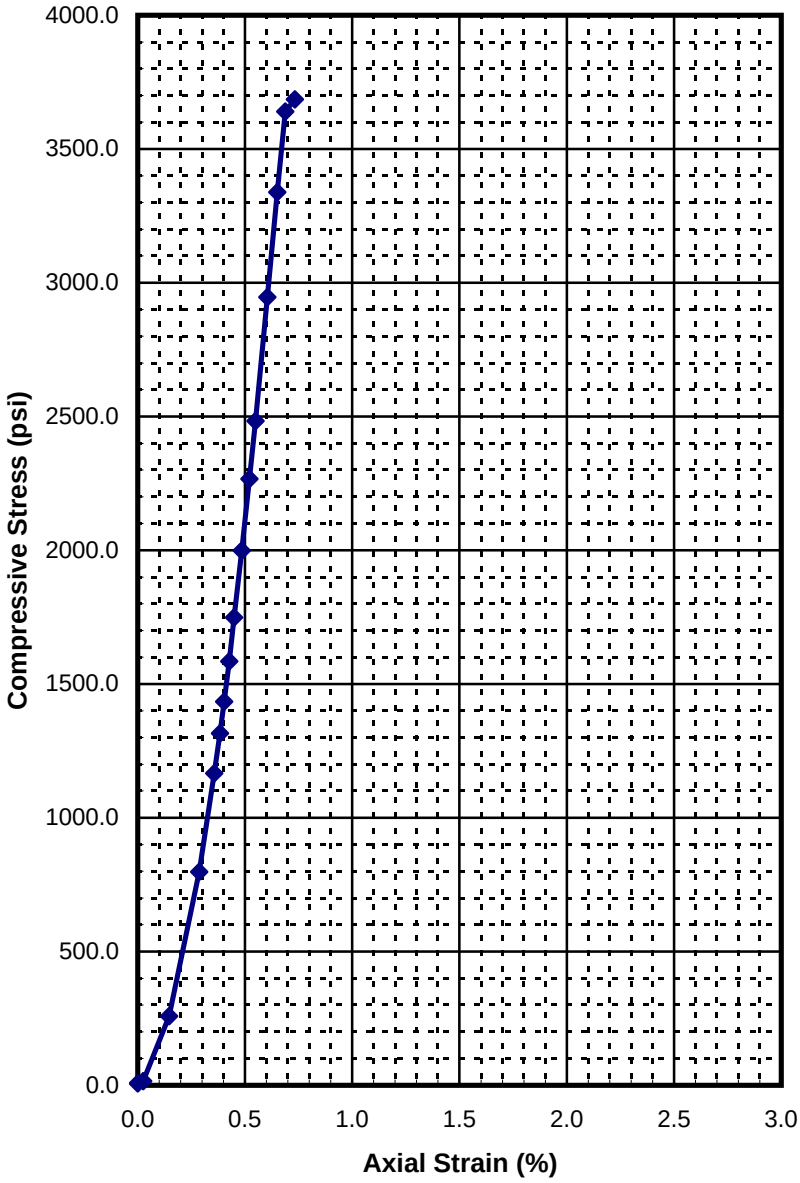
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.3	4.970	2.393	168.3	7,658

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-2** **Depth (ft): 25.0**
Description and/or Classification:	**Granodiorite, light gray, coarse grained**

UNCONFINED COMPRESSION TEST

Figure: F- 44



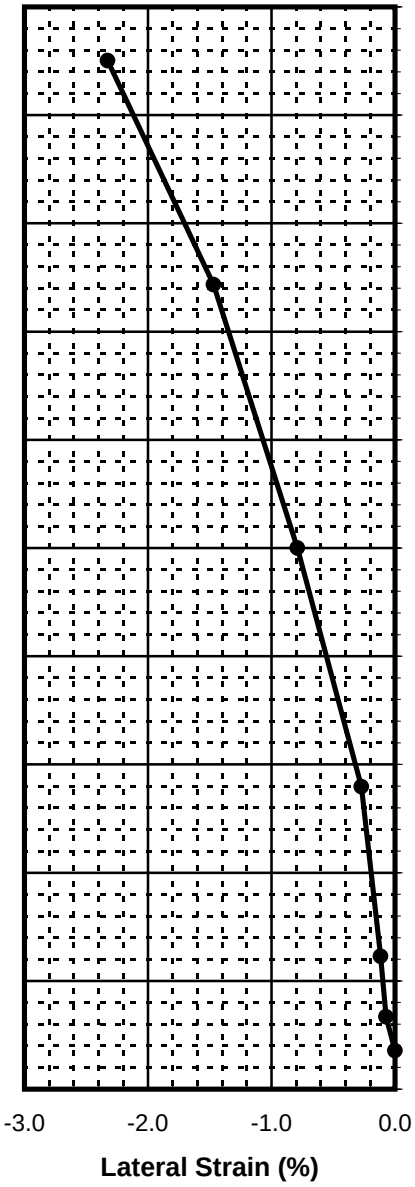


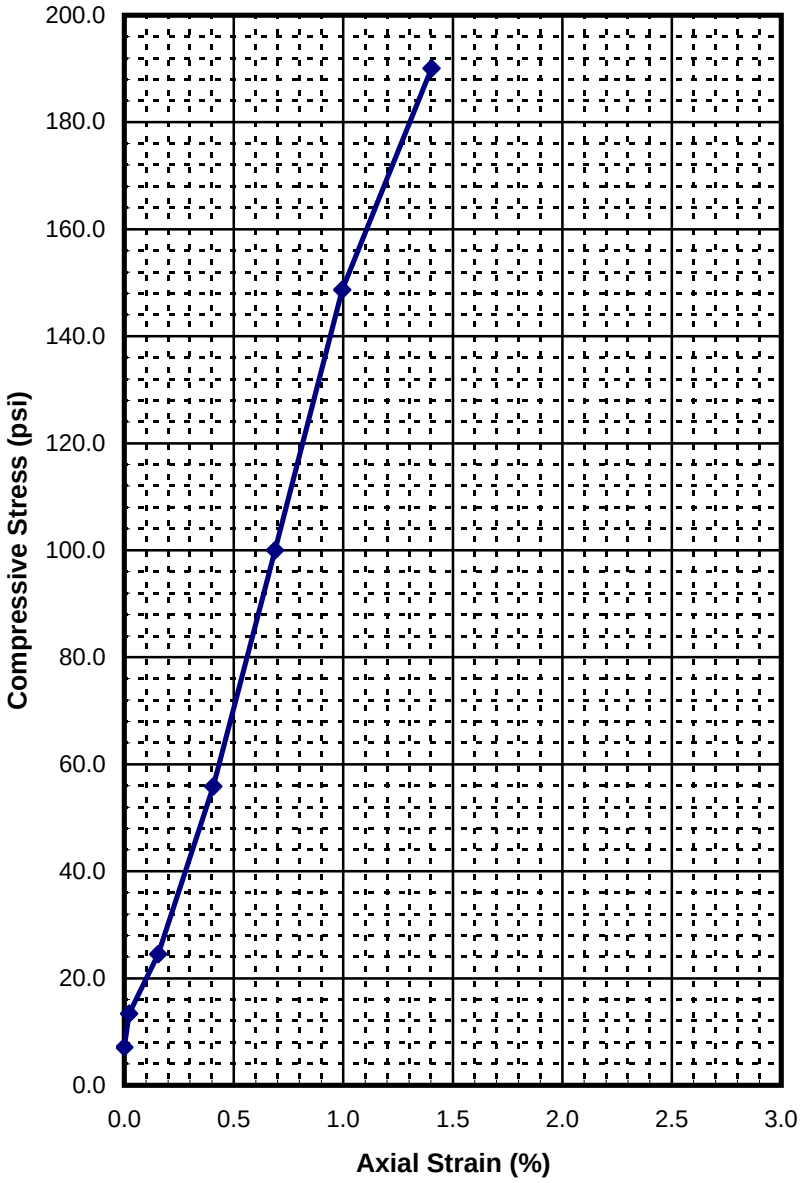
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.739	2.393	168.8	3,685

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-2** **Depth (ft): 25.5**
Description and/or Classification:	**Granodiorite, light gray with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

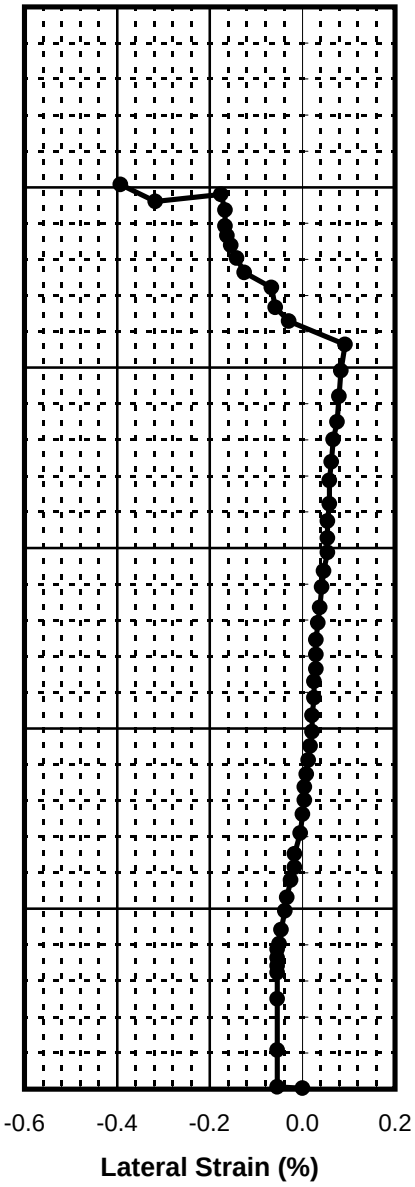
Figure: F- 45

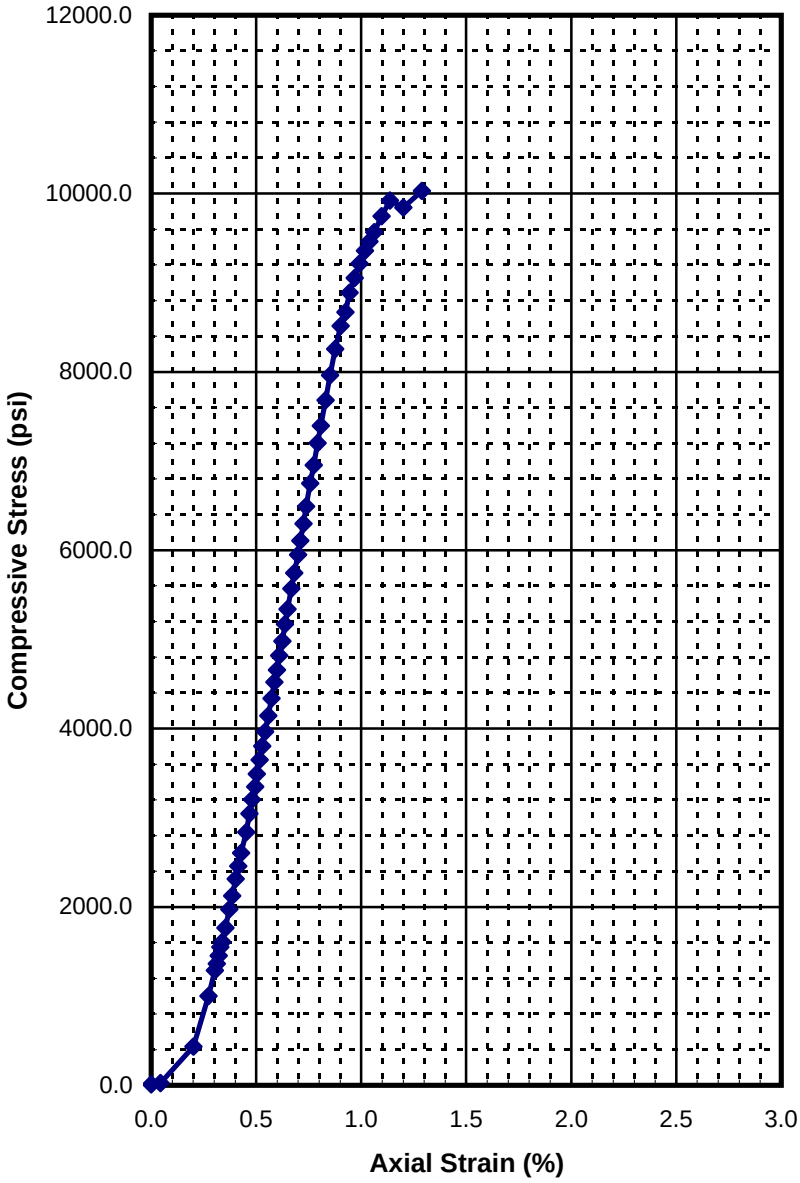




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.2	4.964	2.381	152.0	190

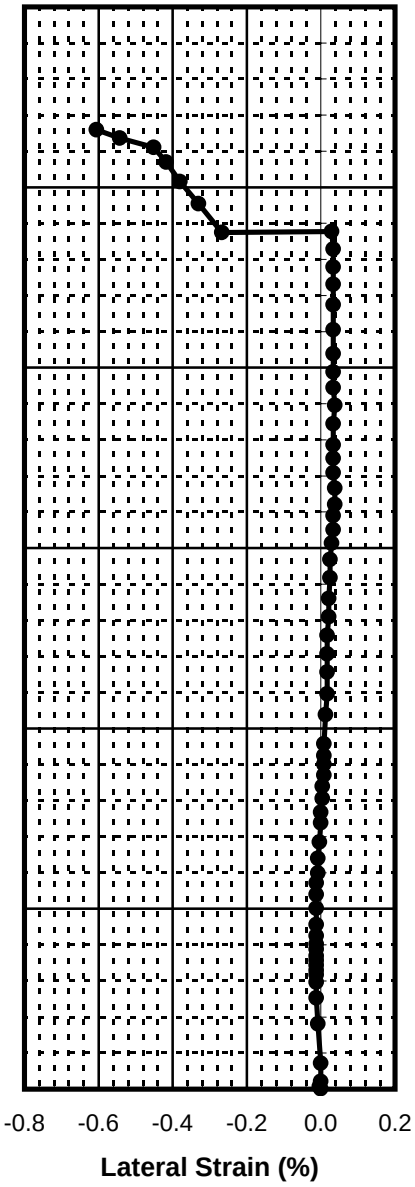
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-3** **Depth (ft): 14.0**	
Description and/or Classification:	**Granodiorite, light tannish gray, coarse grained**	**Figure: F- 46**

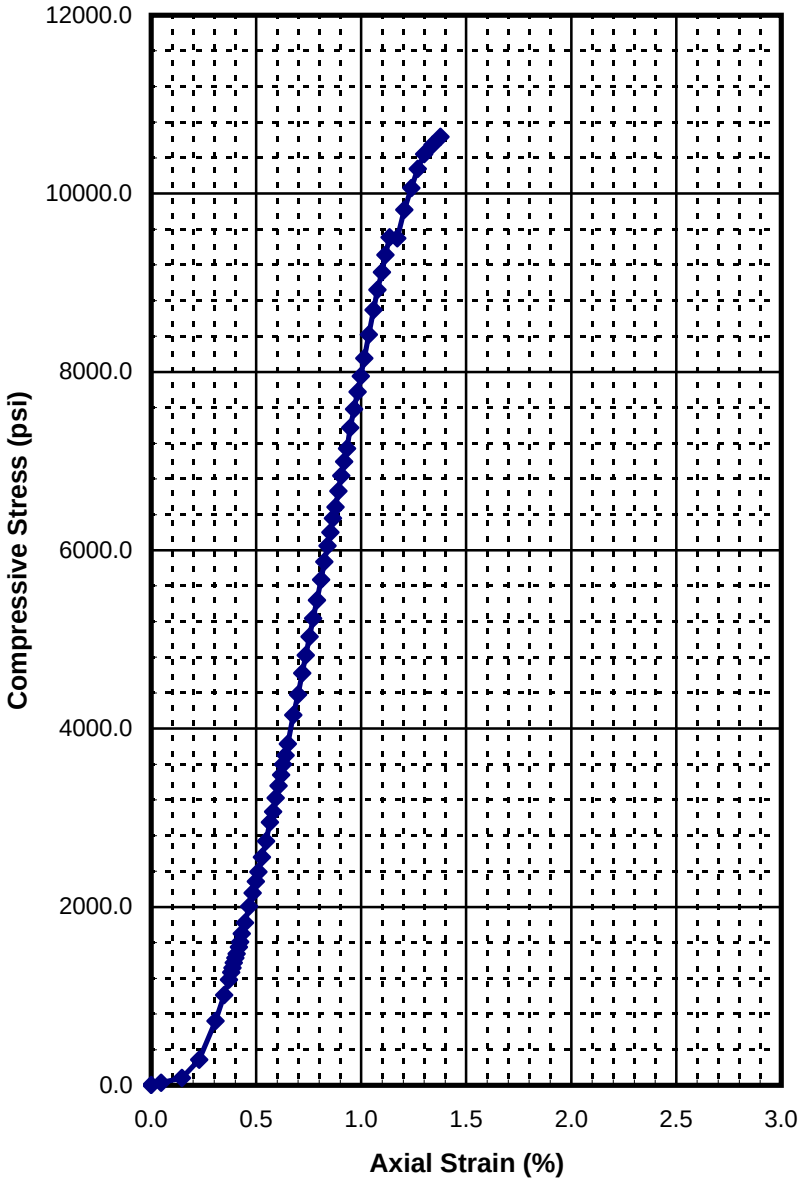




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.974	2.393	167.8	10,031

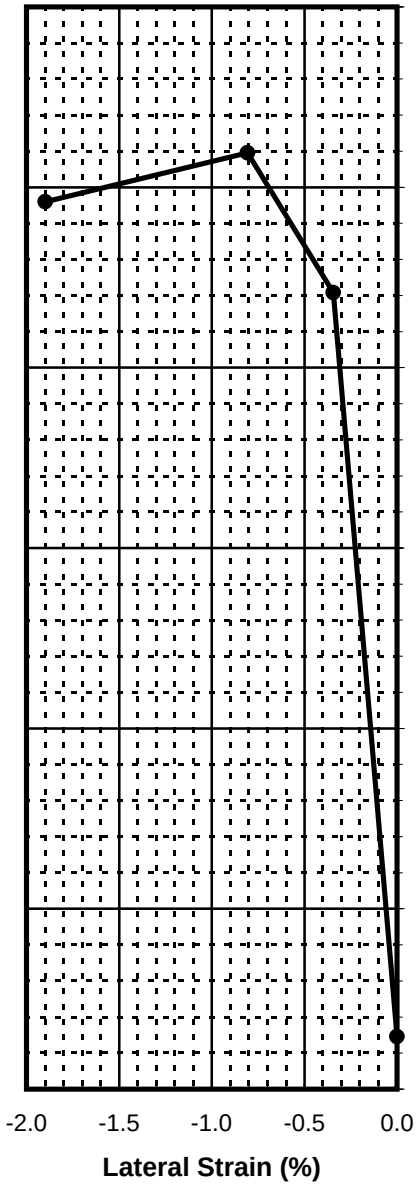
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-3** **Depth (ft): 35.9**	
Description and/or Classification:	**Granodiorite, light gray with black specks, coarse grained**	**Figure: F- 47**

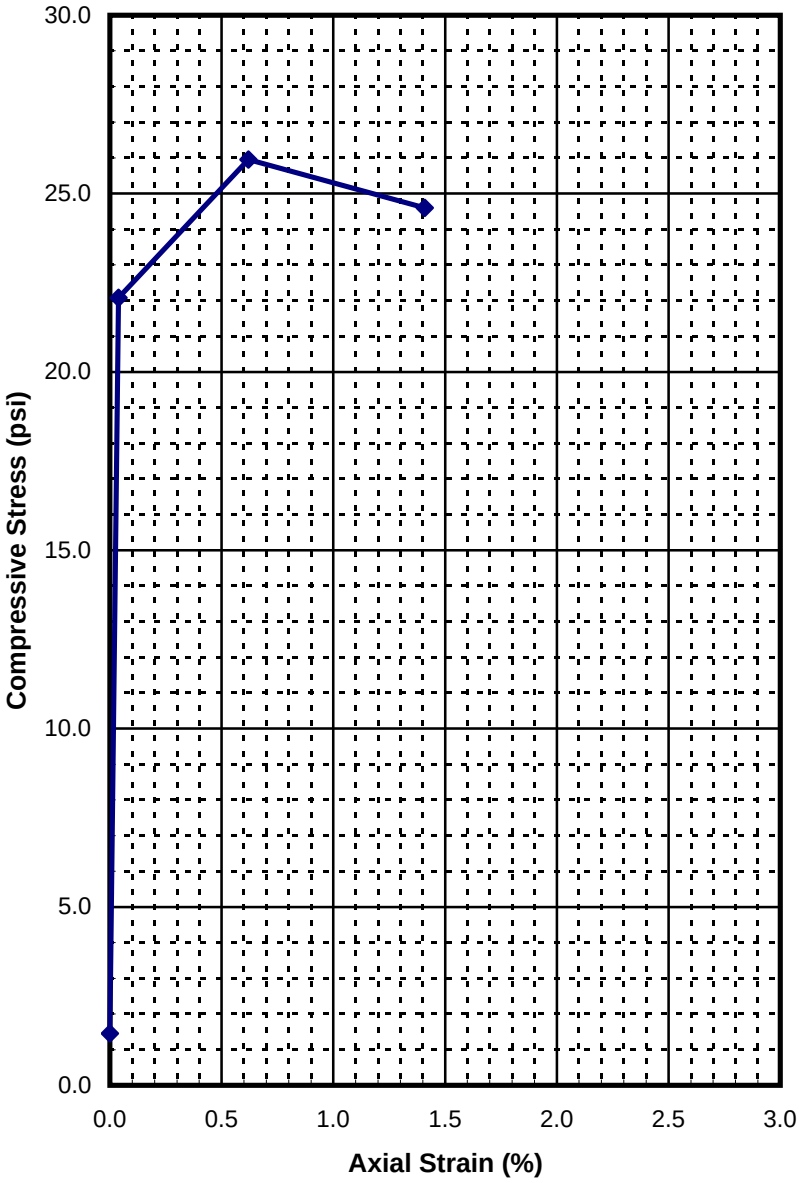




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.862	2.395	168.2	10,636

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-3** **Depth (ft): 46.2**	
Description and/or Classification:	**Granodiorite, light gray with black specks, coarse grained**	**Figure: F- 48**



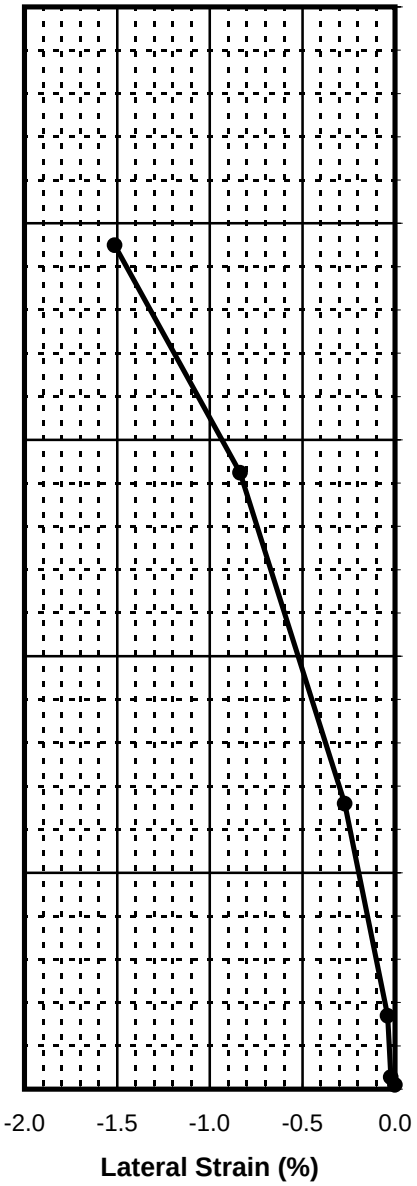


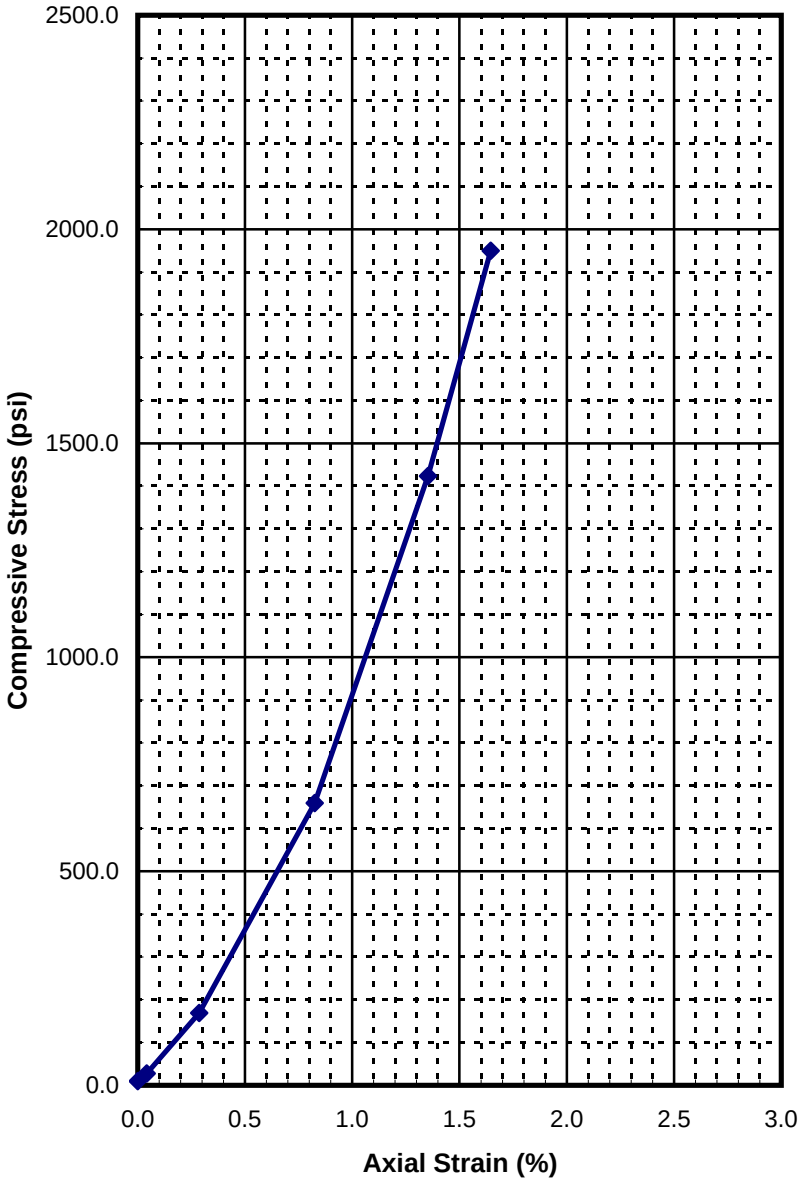
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
6.9	4.124	1.749	130.0	26

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-4** **Depth (ft): 10.4**
Description and/or Classification:	**Metasedimentary Rock, pale yellowish brown silty Sand (SM), medium grained**

UNCONFINED COMPRESSION TEST

Figure: F- 49



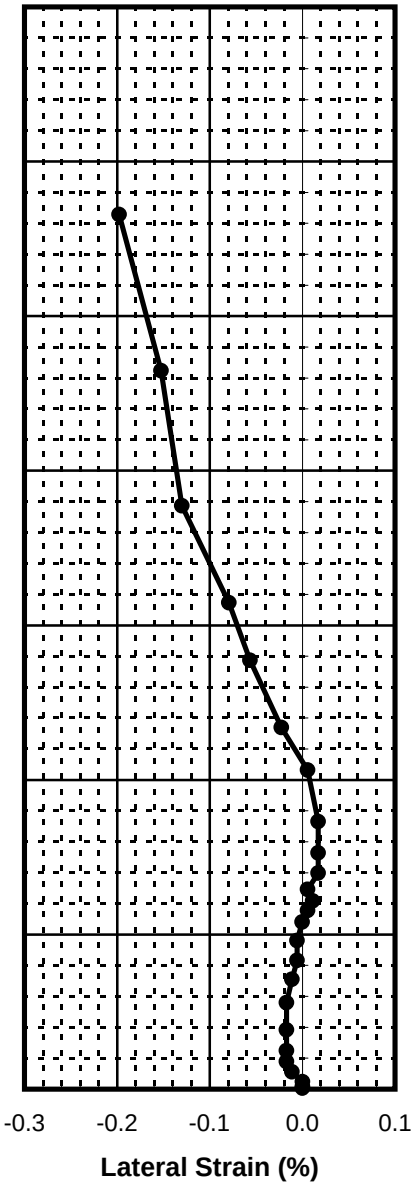


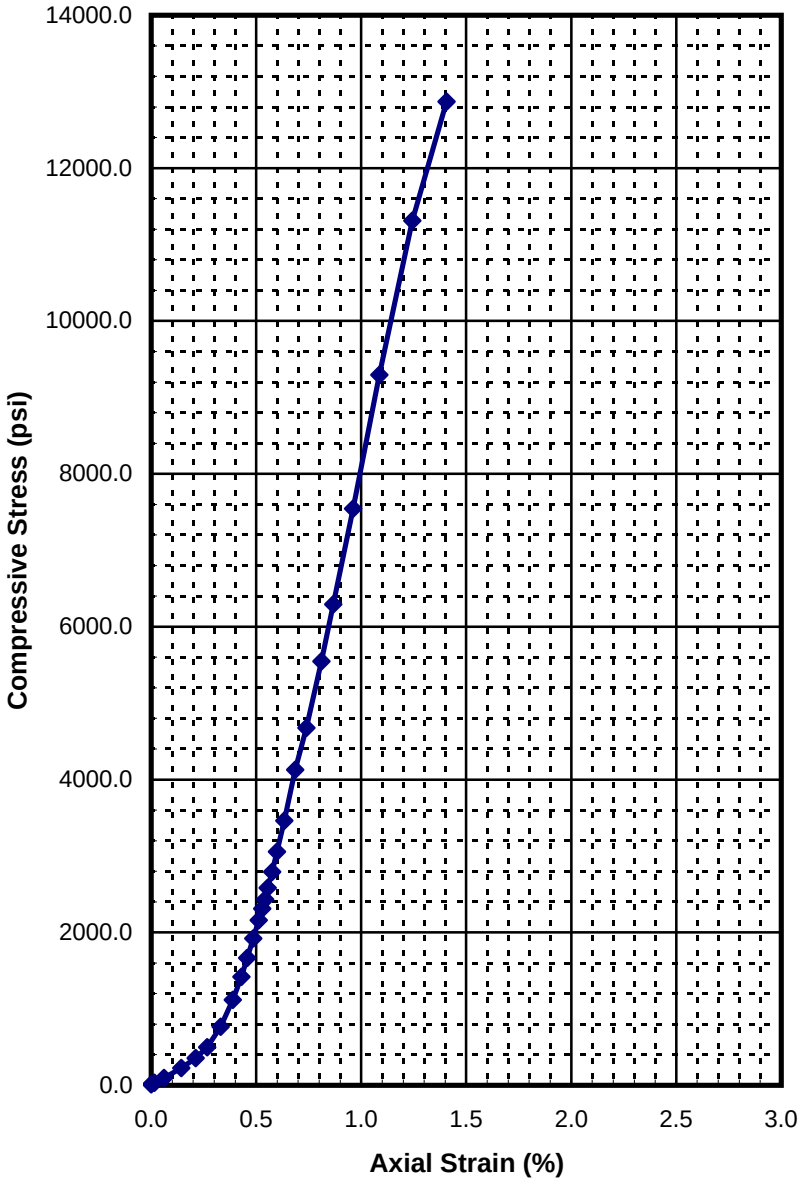
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.1	4.085	1.772	166.6	1,949

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-4** **Depth (ft): 15.6**
Description and/or Classification:	**Metasedimentary Rock, pale yellowish brown with brown specks, silty Sand (SM), medium grained**

UNCONFINED COMPRESSION TEST

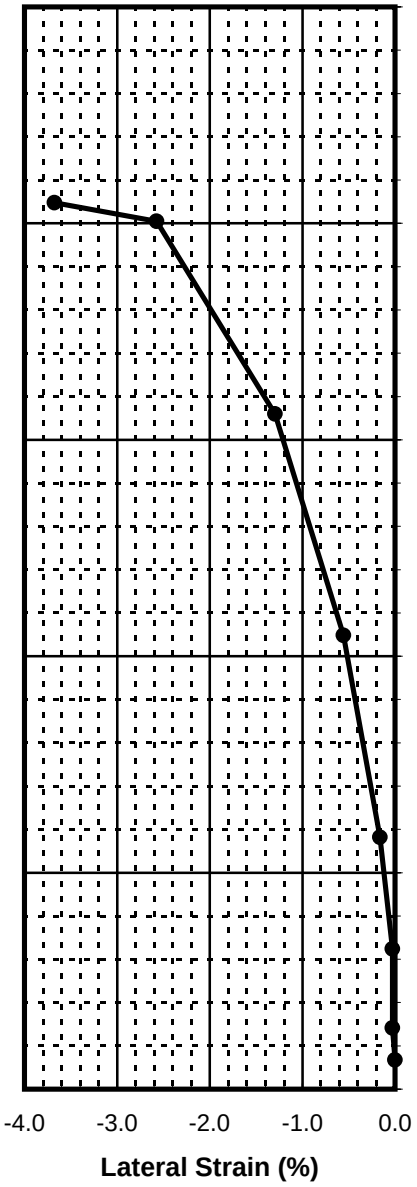
Figure: F- 50

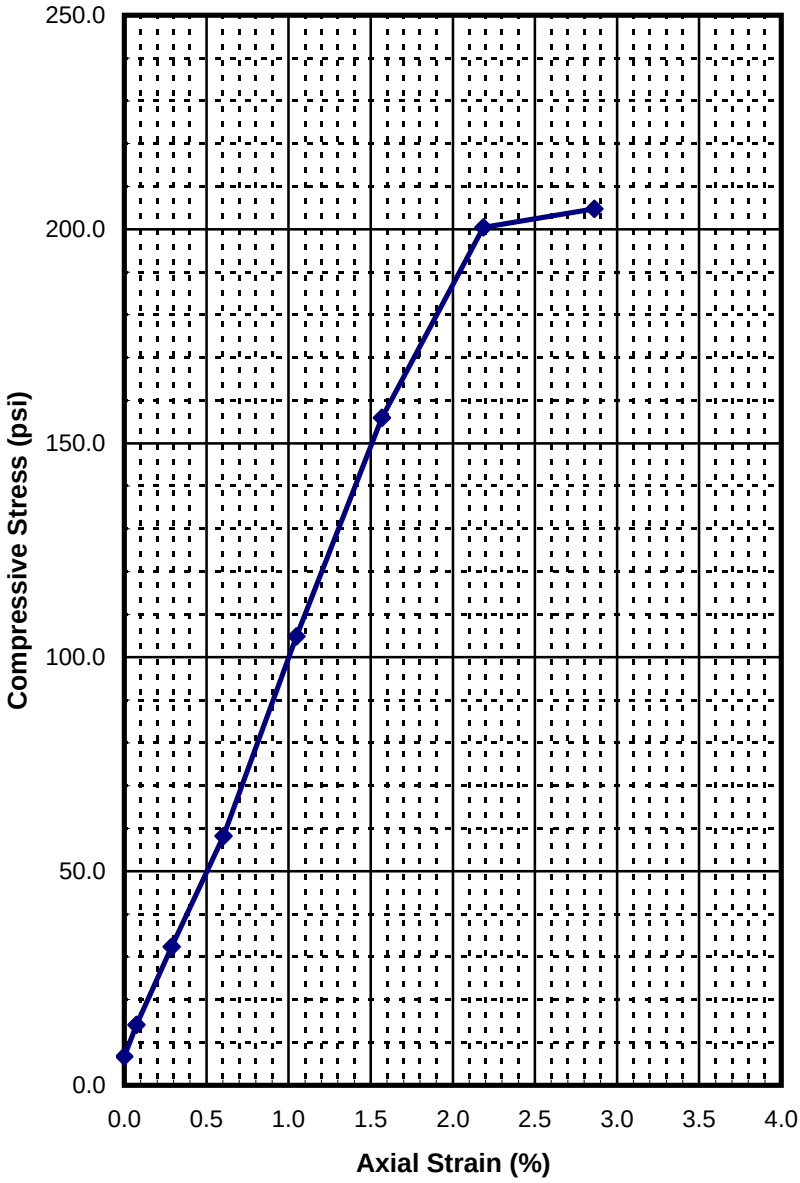




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.910	1.769	173.9	12,871

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-4** **Depth (ft): 30.0**	
Description and/or Classification:	**Metasedimentary Rock, light gray, fine grained**	**Figure: F-51**



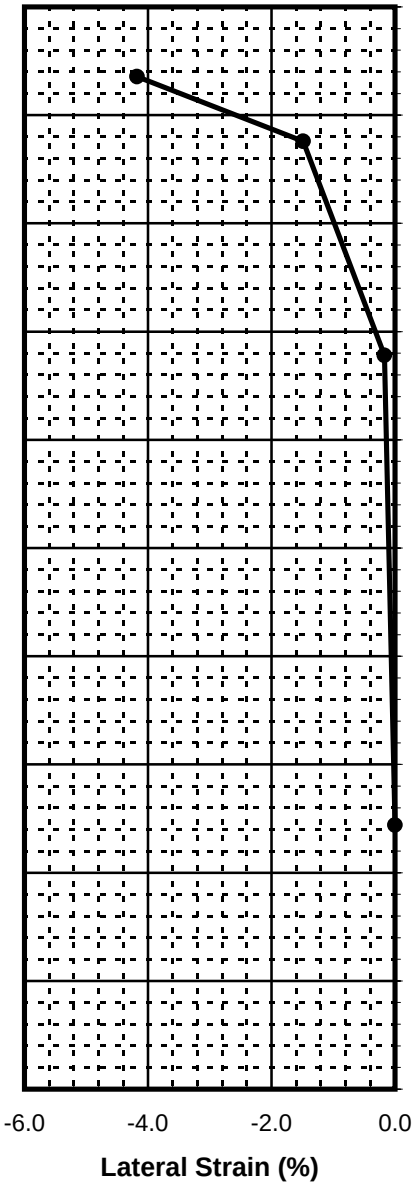


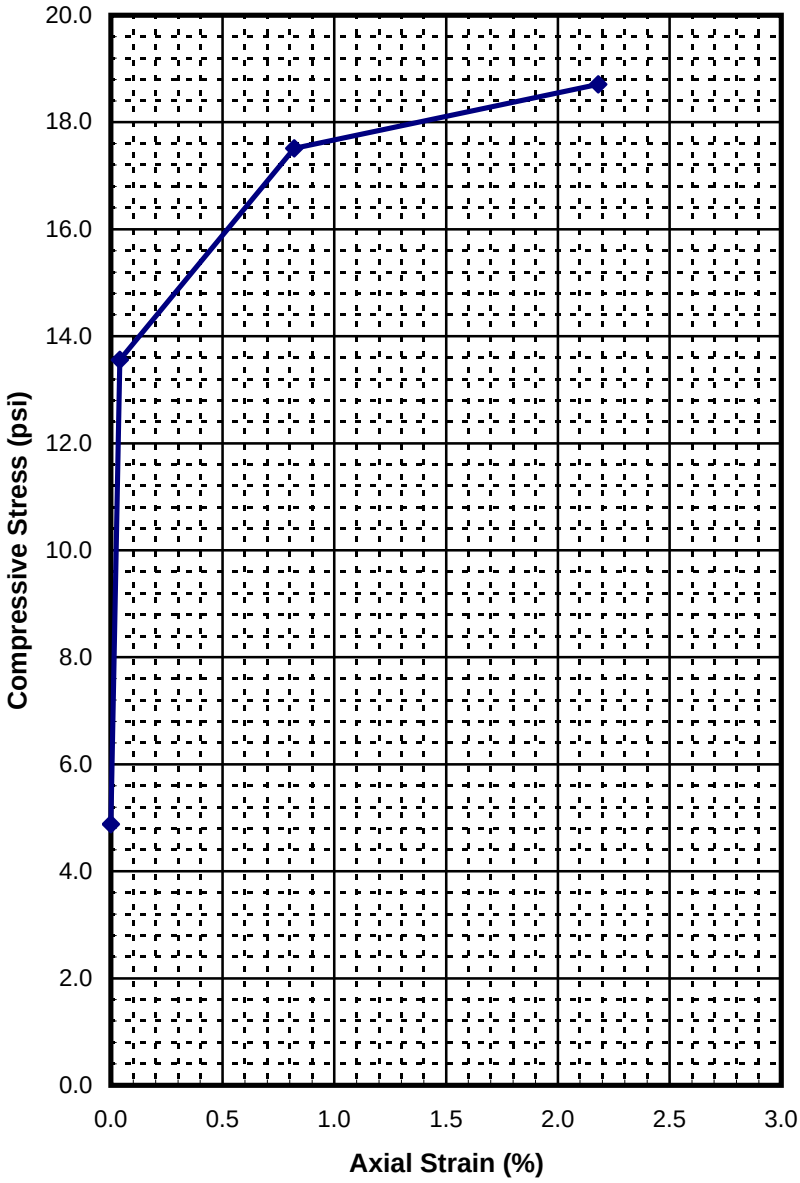
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.9	4.189	2.396	154.6	205

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-5** **Depth (ft): 10.7**
Description and/or Classification:	**Granodiorite, reddish brown with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

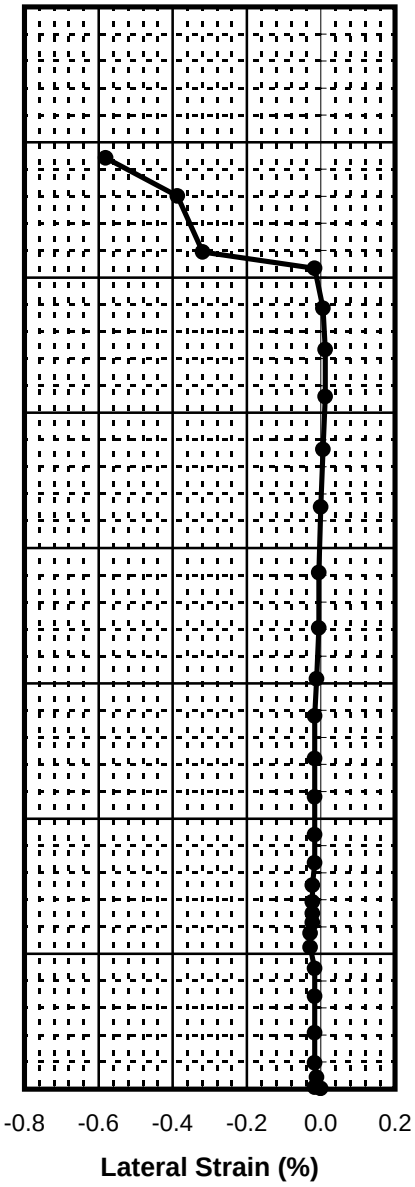
Figure: F-52

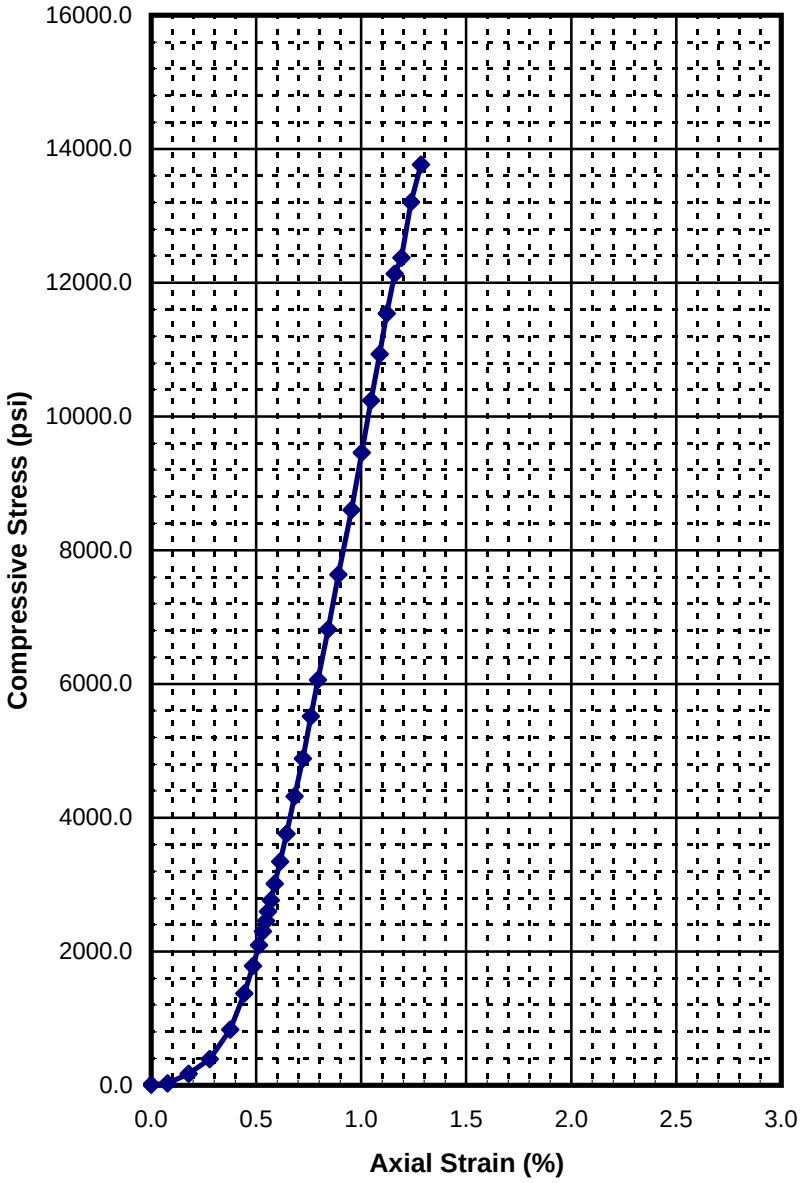




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
3.1	5.013	2.393	146.7	19

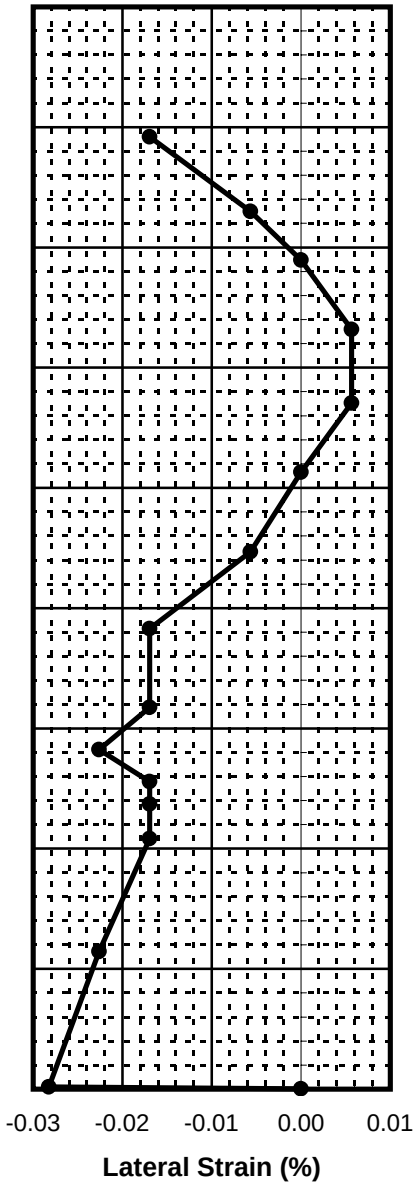
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-5** **Depth (ft): 19.0**	
Description and/or Classification:	**Granodiorite, reddish brown, coarse grained**	**Figure: F-53**

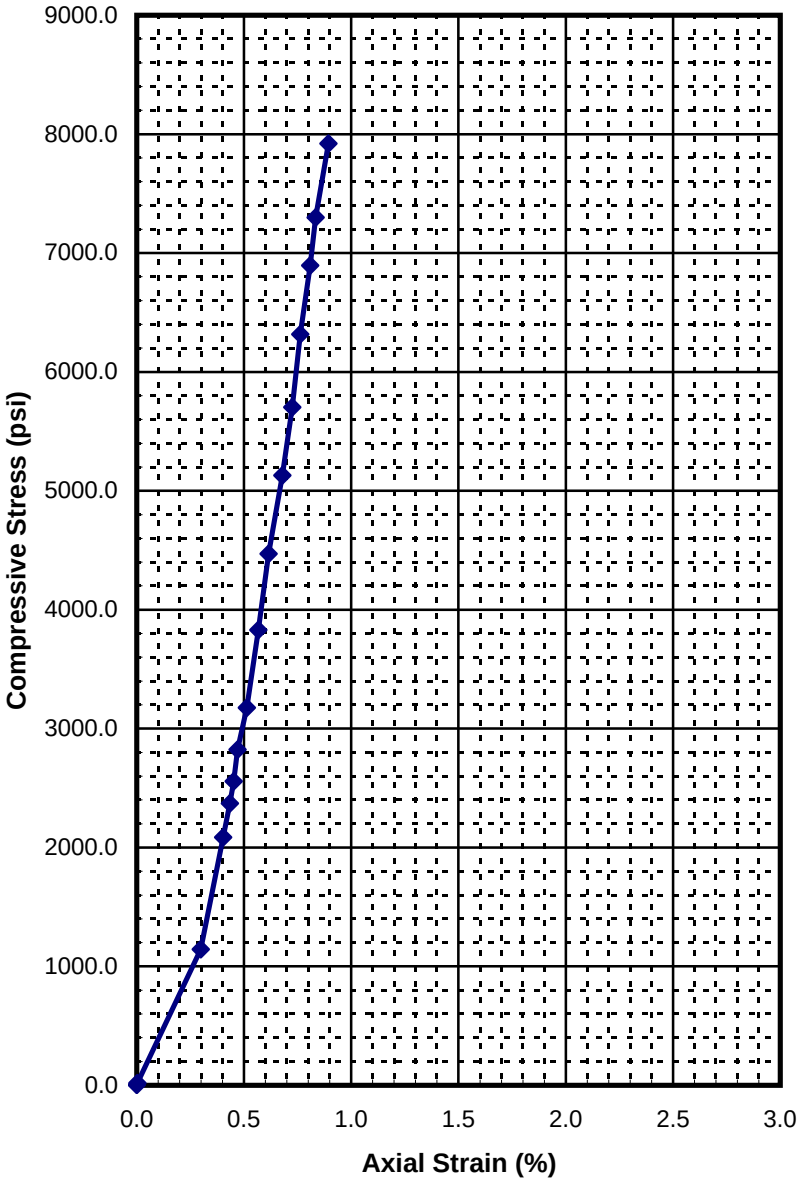




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.879	1.757	167.5	13,766

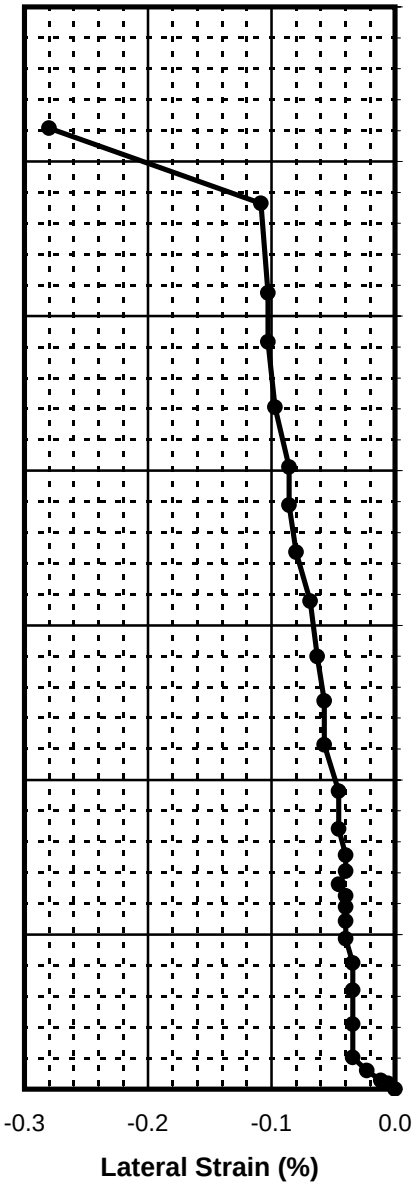
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-6** **Depth (ft): 17.9**	
Description and/or Classification:	**Granodiorite, light gray with black specks, medium grained**	**Figure: F-54**

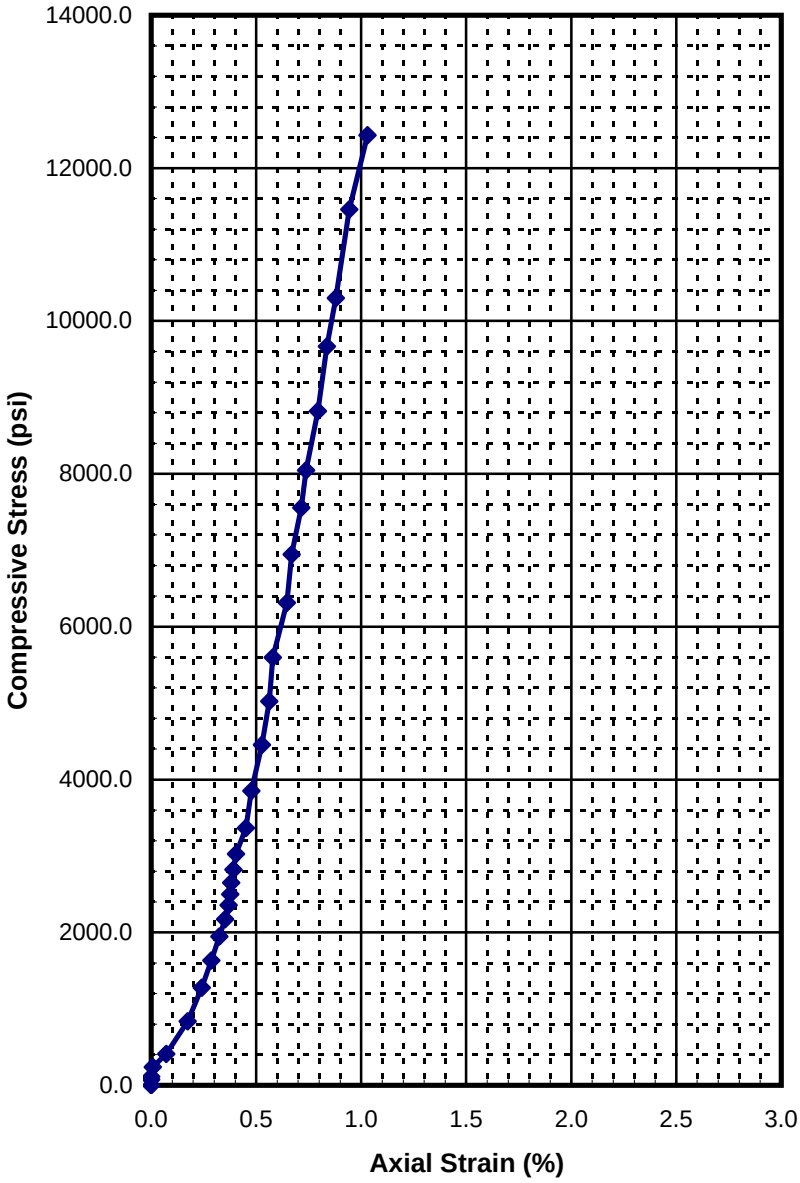




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.919	1.770	166.2	7,920

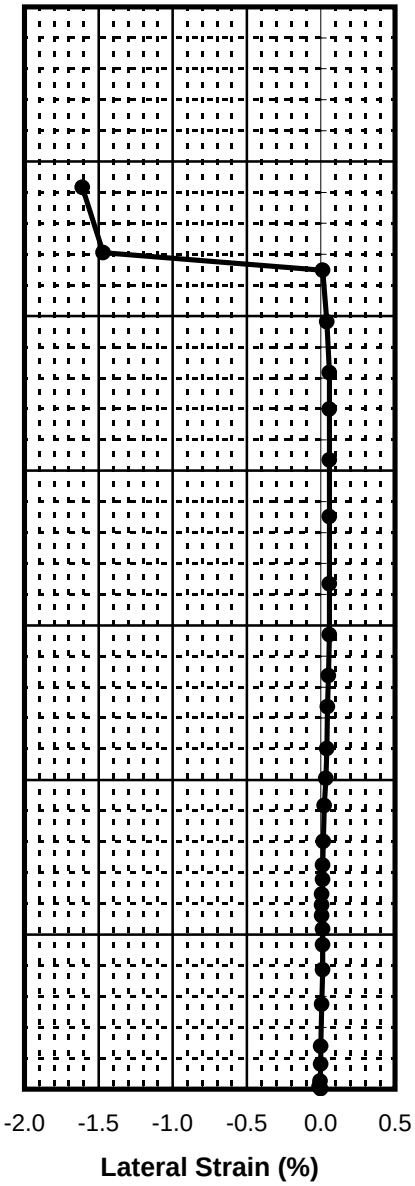
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-6** **Depth (ft): 23.2**	
Description and/or Classification:	**Granodiorite, light gray with black specks, medium grained**	**Figure: F-55**

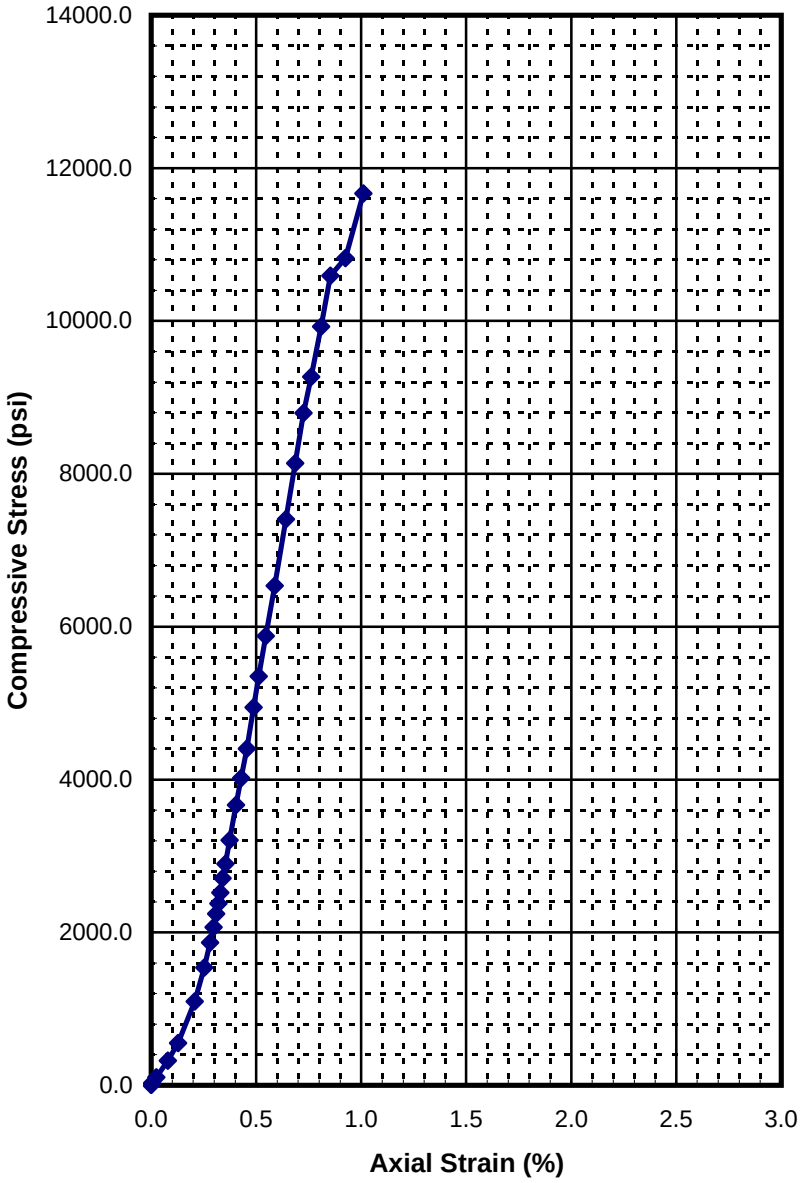




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.041	1.750	170.3	12,432

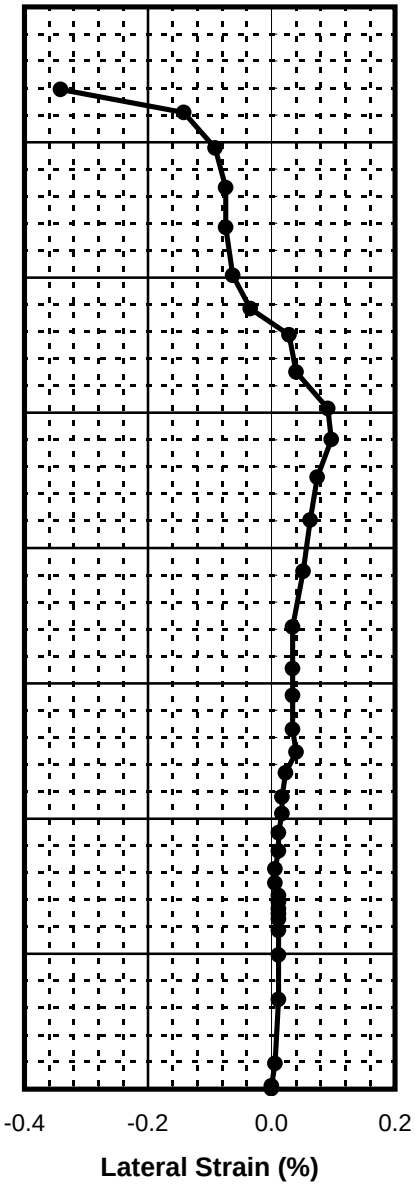
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-6** **Depth (ft): 32.1**	
Description and/or Classification:	**Granodiorite, light gray with black specks, medium grained**	**Figure: F-56**

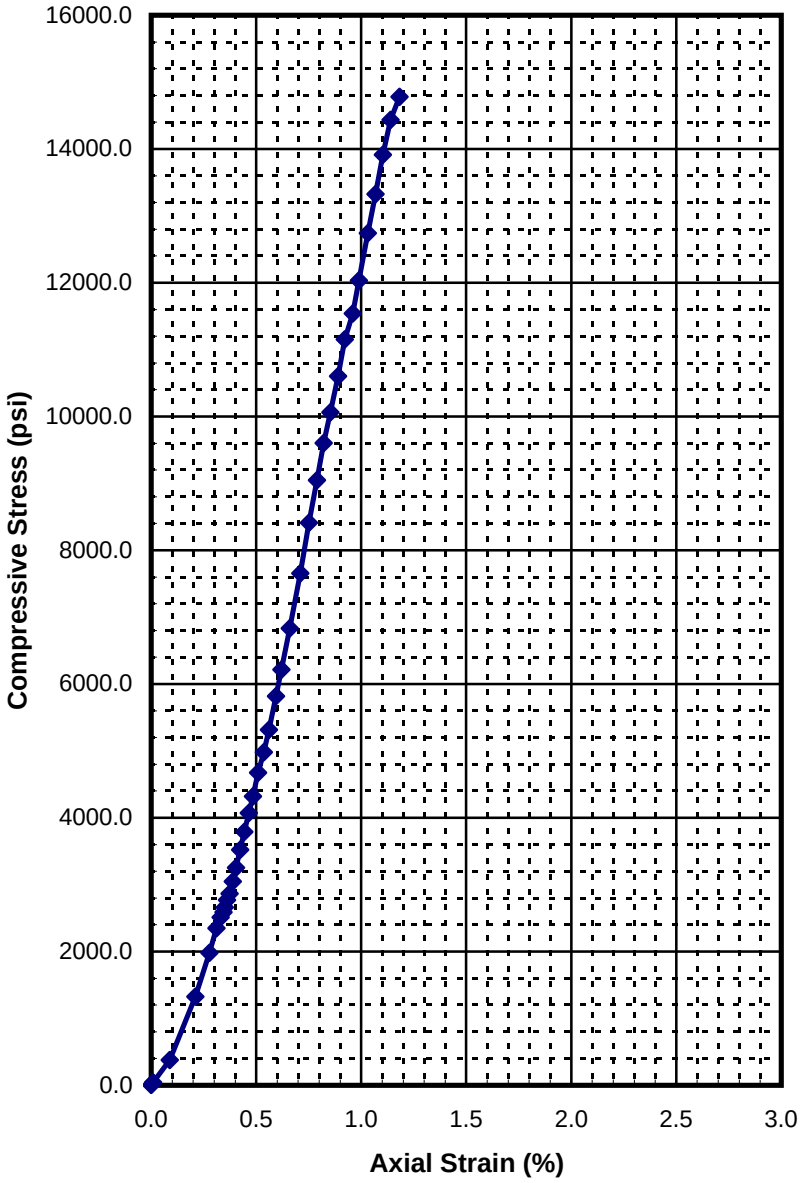




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.066	1.764	167.3	11,666

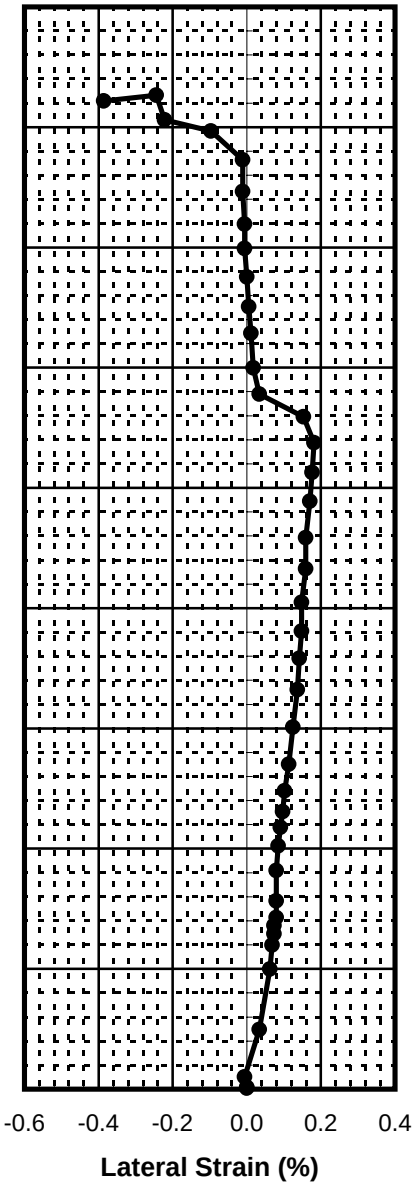
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-6** **Depth (ft): 42.0**	
Description and/or Classification:	**Granodiorite, light gray with black specks, medium grained**	**Figure: F-57**

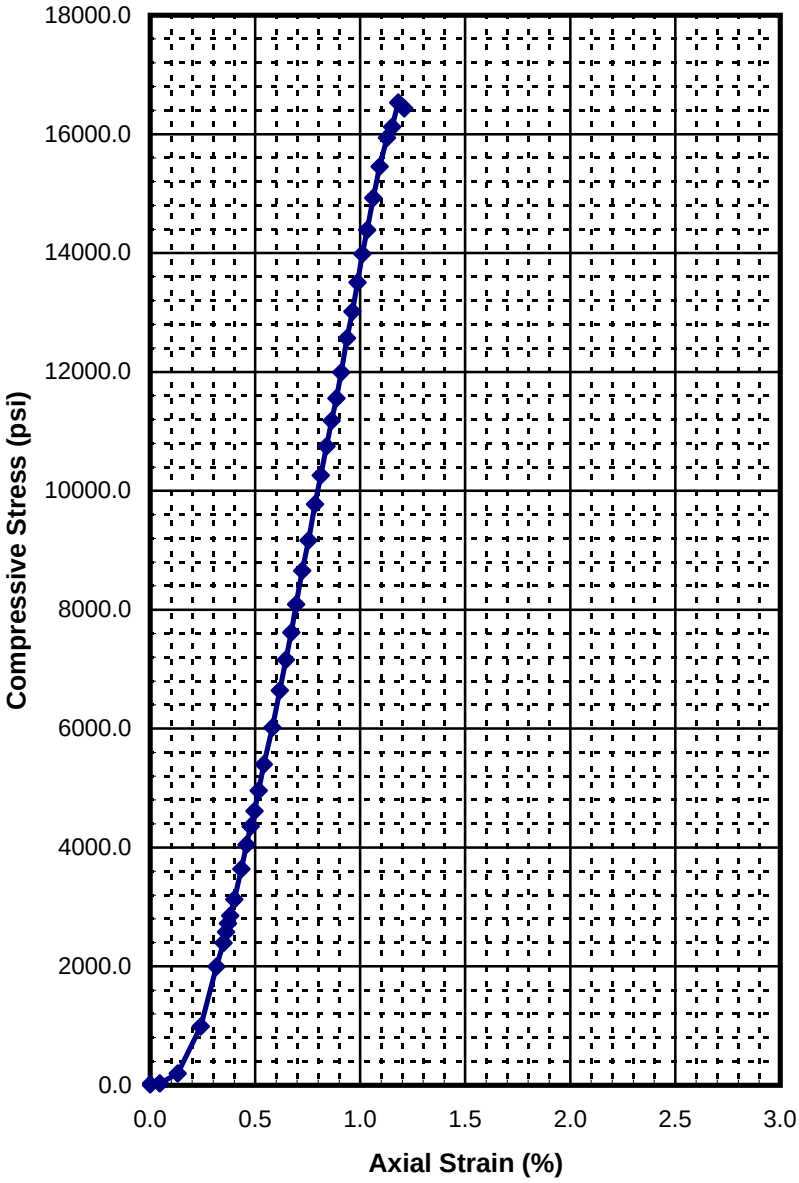




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.044	1.758	165.0	14,778

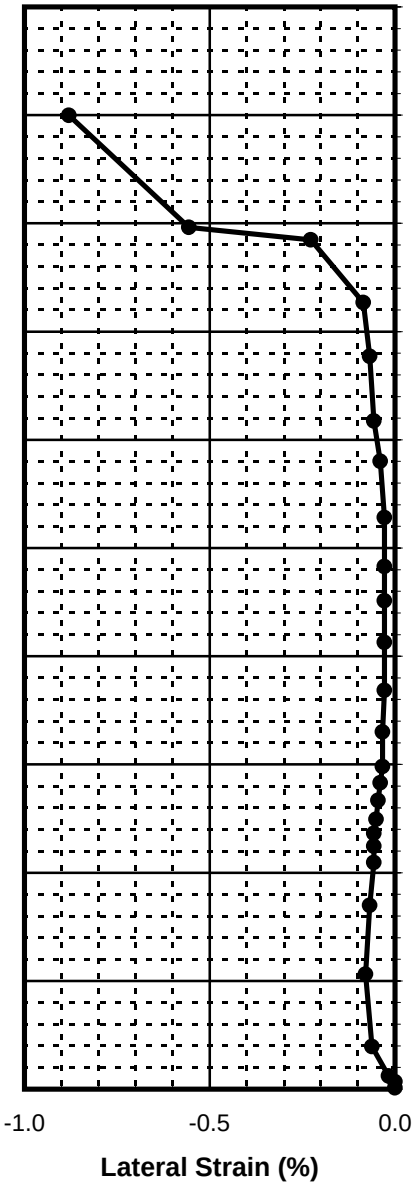
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-7** **Depth (ft): 53.4**	
Description and/or Classification:	**Granodiorite, light gray to light pinkish gray, medium grained**	**Figure: F-58**

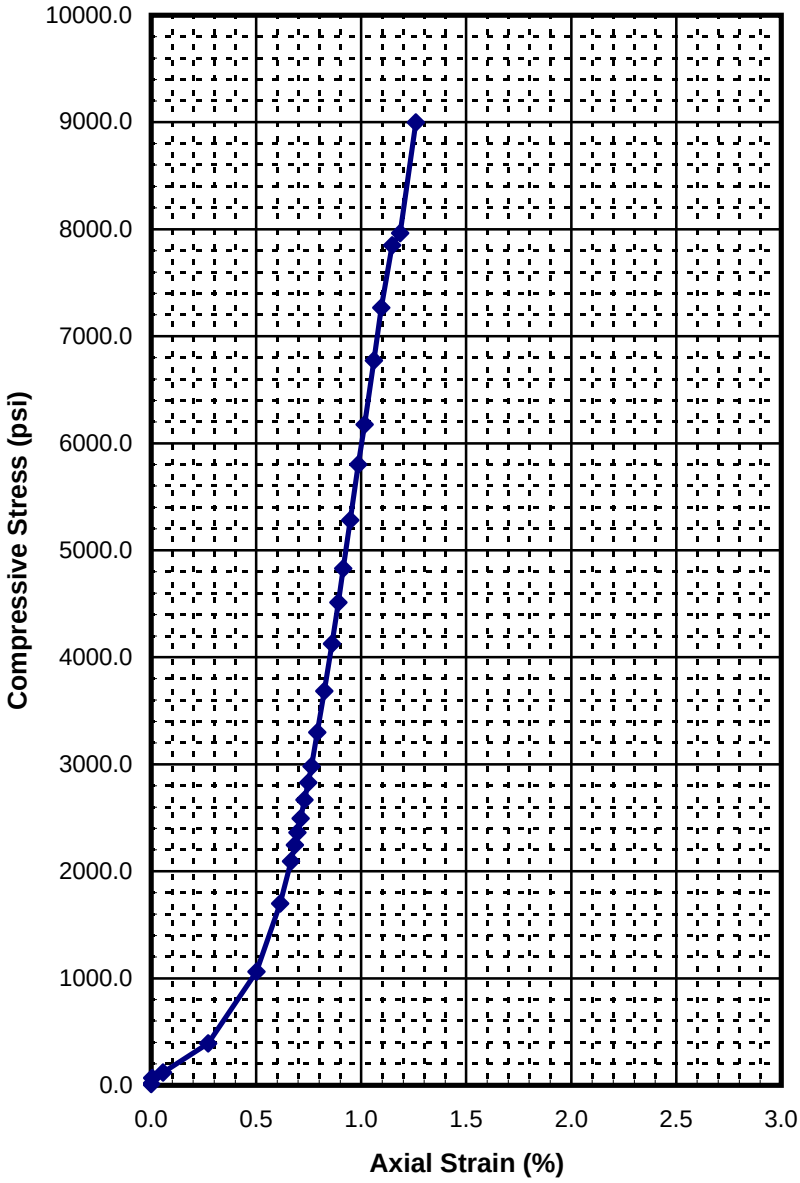




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.991	1.762	166.6	16,533

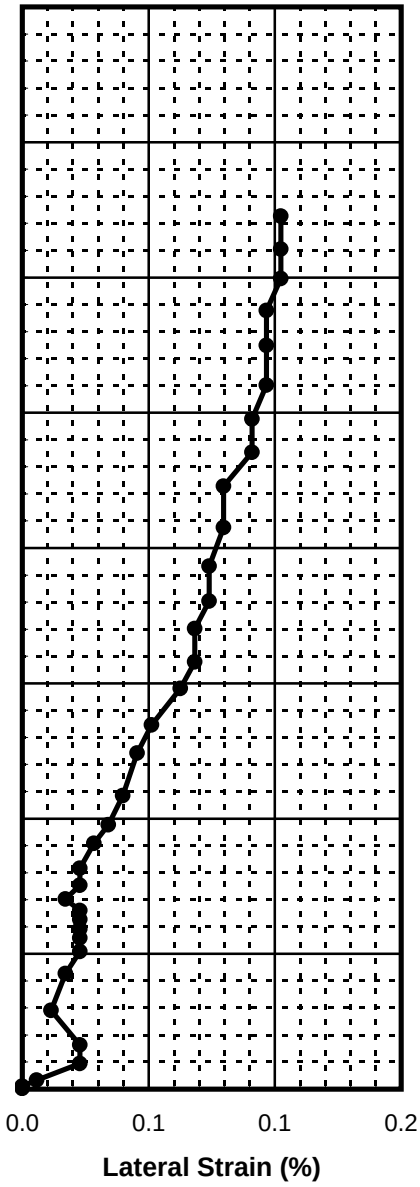
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-7** **Depth (ft): 56.5**	
Description and/or Classification:	**Granodiorite, light gray to light pinkish gray, medium grained**	**Figure: F-59**

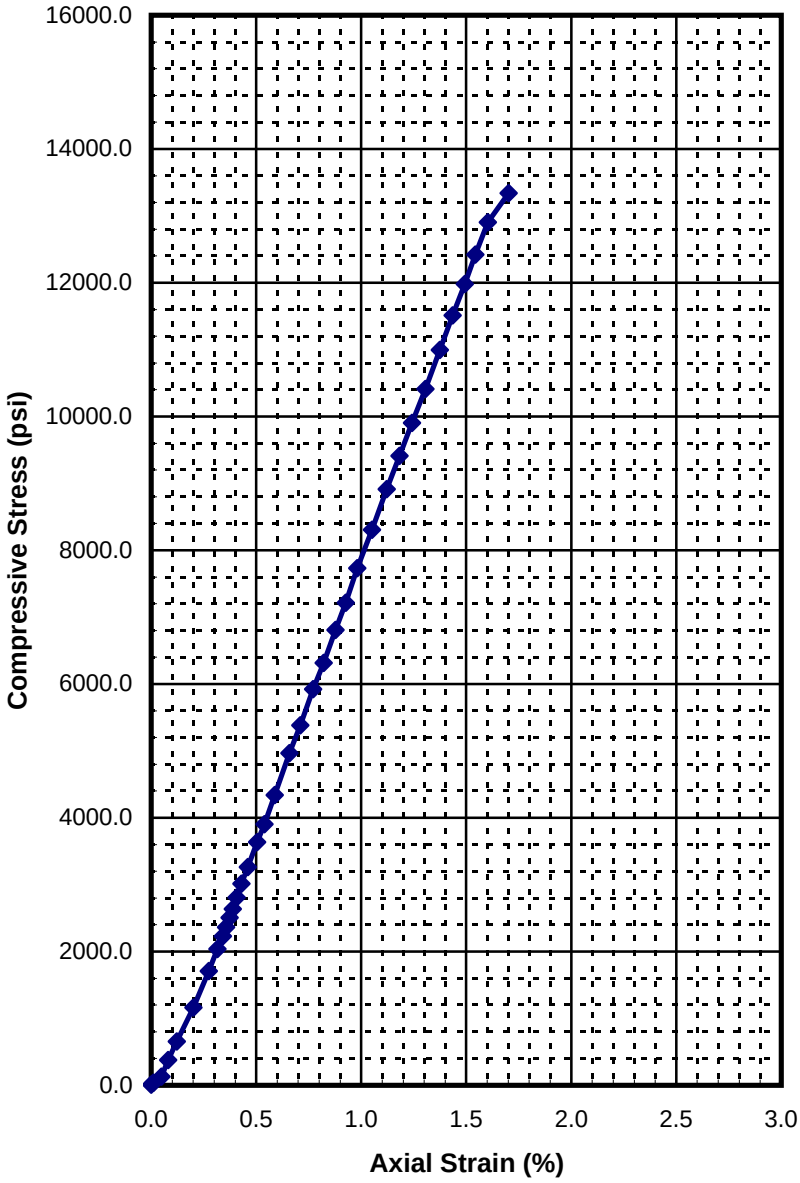




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	3.906	1.761	164.7	8,997

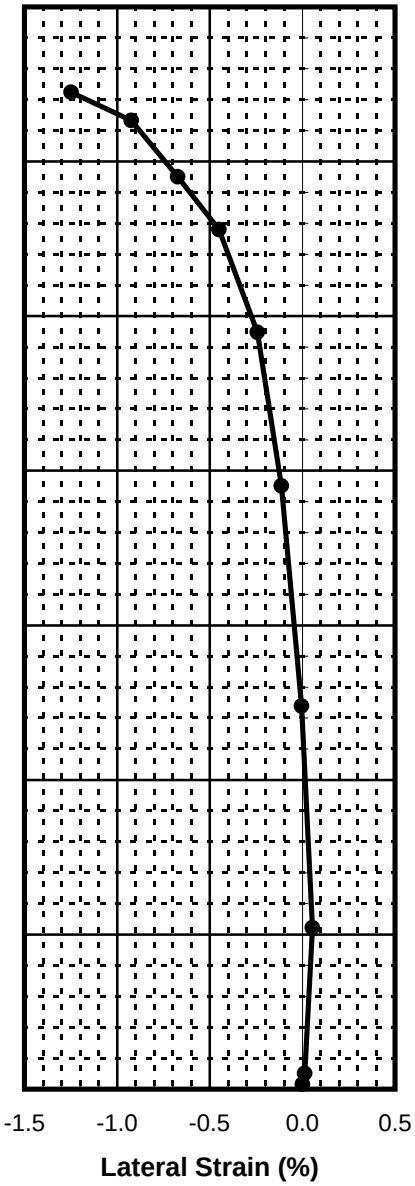
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-7** **Depth (ft): 64.5**	
Description and/or Classification:	**Granodiorite, light gray with black specks, medium grained**	**Figure: F-60**

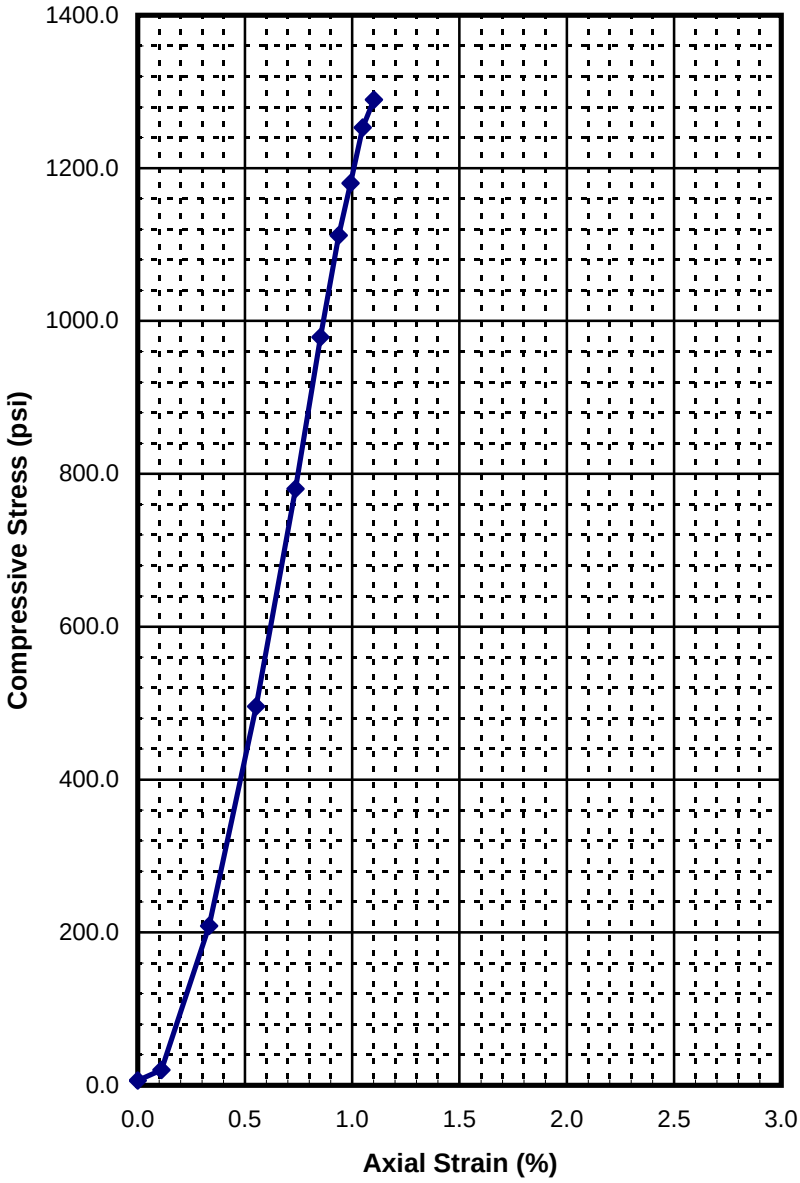




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	3.931	1.758	166.0	13,340

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-7** **Depth (ft): 74.0**	
Description and/or Classification:	**Granodiorite, medium gray, medium grained**	**Figure: F-61**



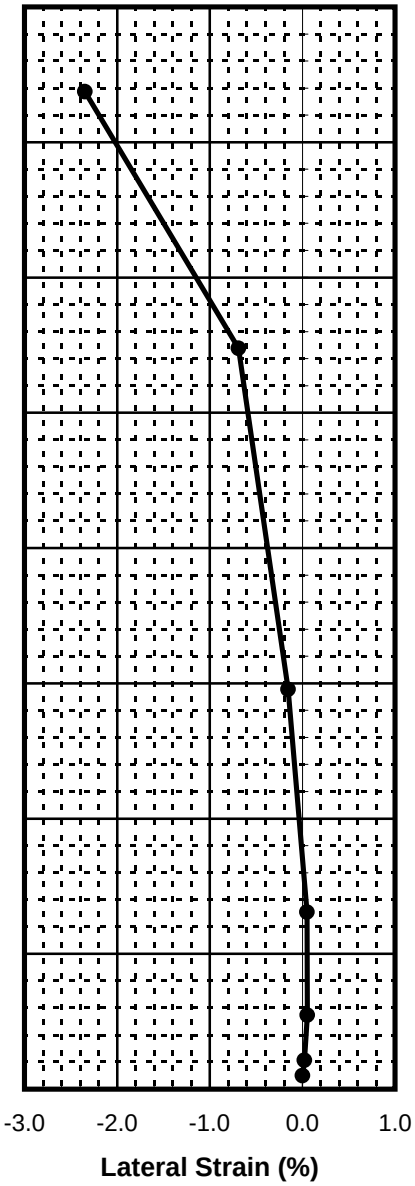


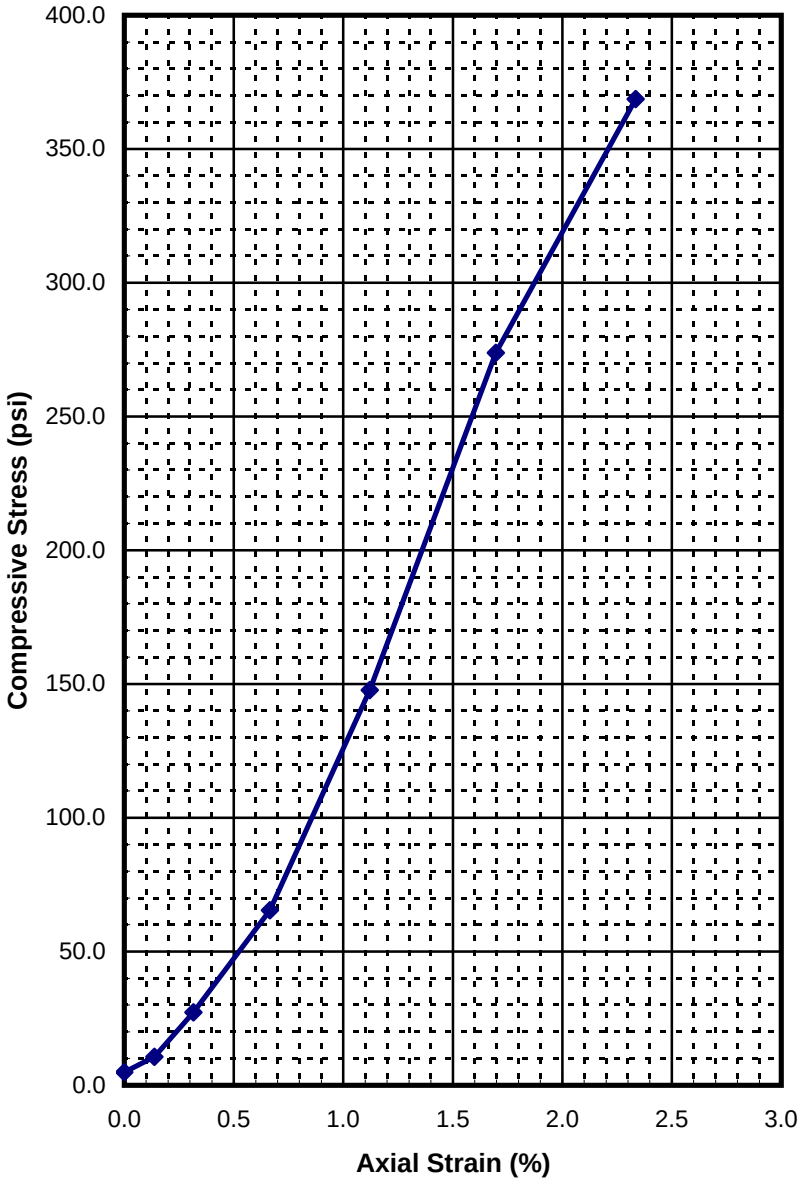
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.8	5.179	2.396	166.9	1,290

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-11** **Depth (ft): 10.7**
Description and/or Classification:	**Granodiorite, gray, coarse grained**

UNCONFINED COMPRESSION TEST

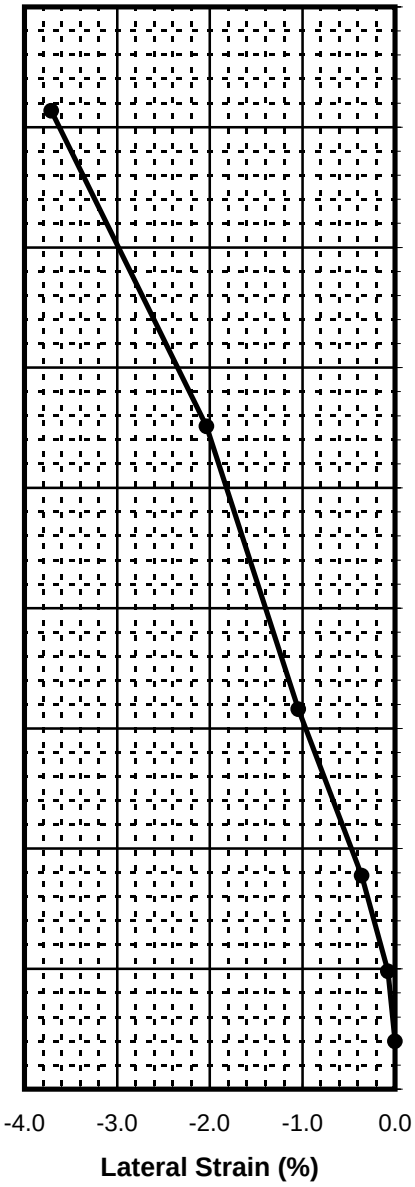
Figure: F-62

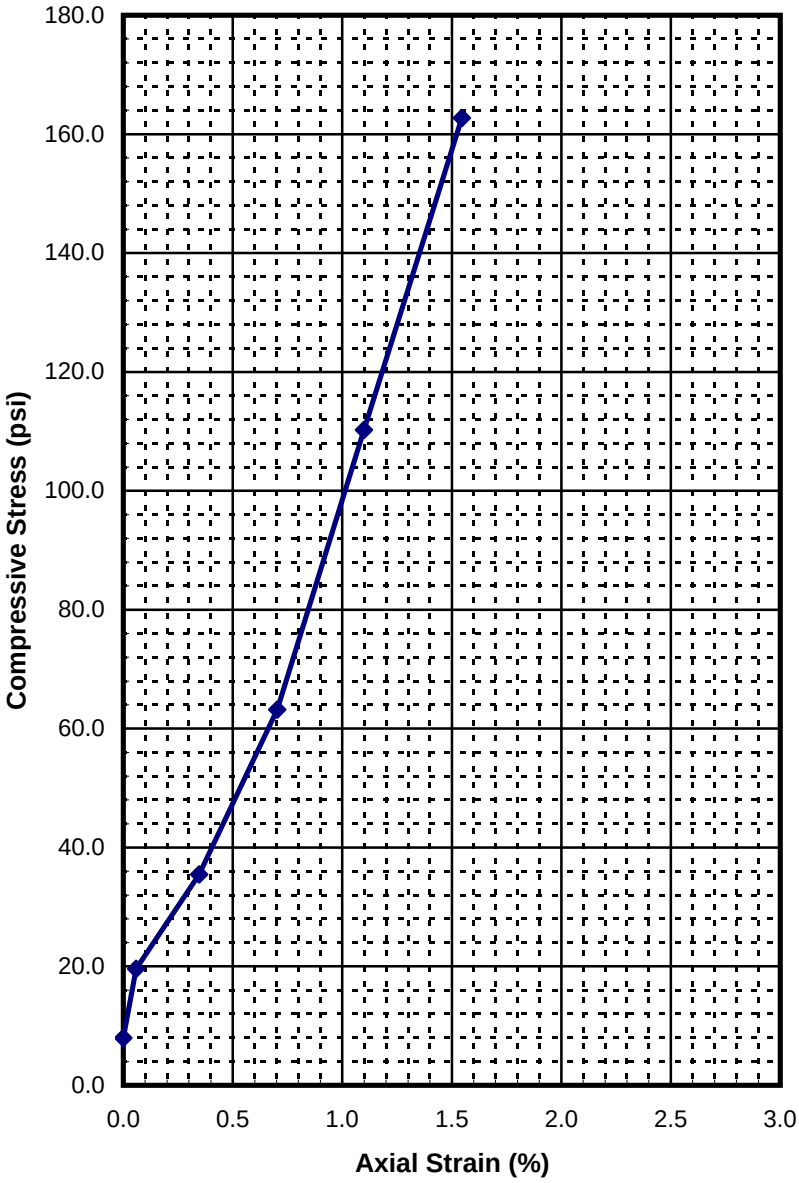




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.6	4.998	2.406	153.0	369

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-12** **Depth (ft): 23.4**	
Description and/or Classification:	**Granodiorite, pale brown with black specks, coarse grained**	**Figure: F-63**



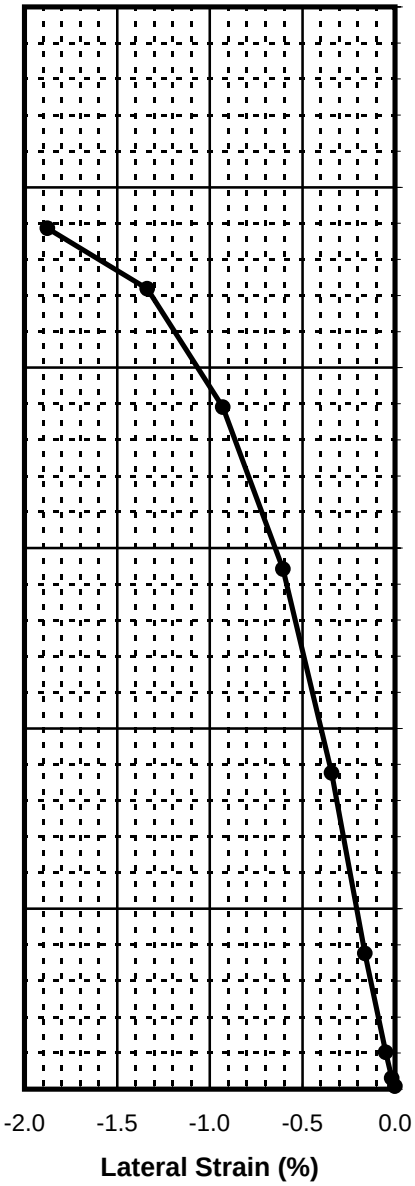


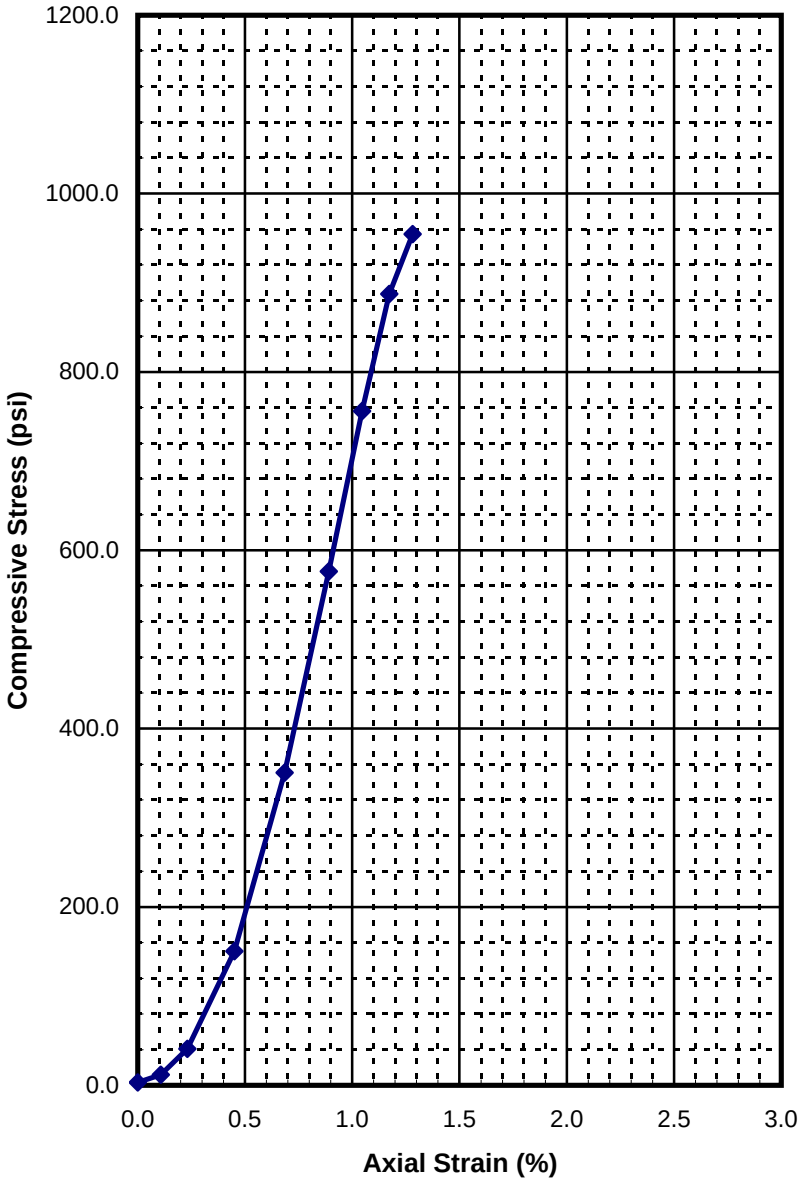
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.0	5.005	2.415	147.6	163

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-12** **Depth (ft): 26.8**
Description and/or Classification:	**Granodiorite, pale brown with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

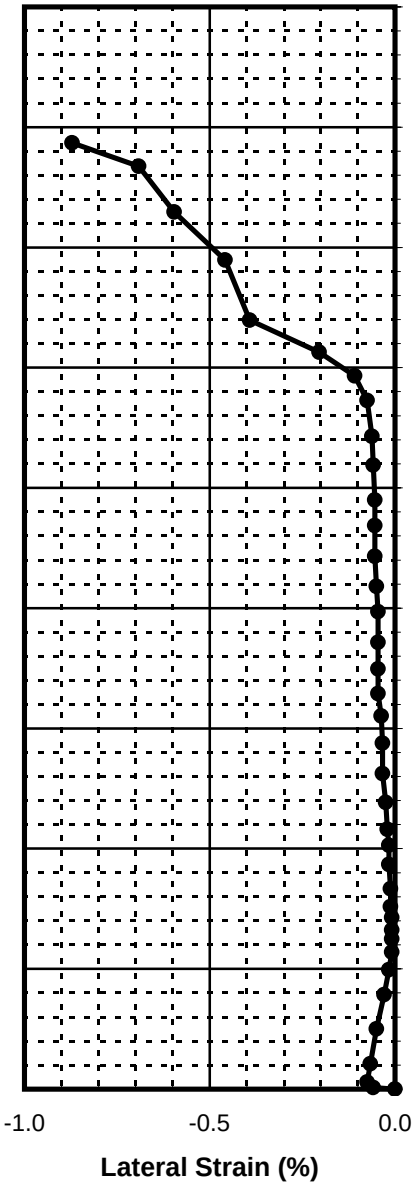
Figure: F-64

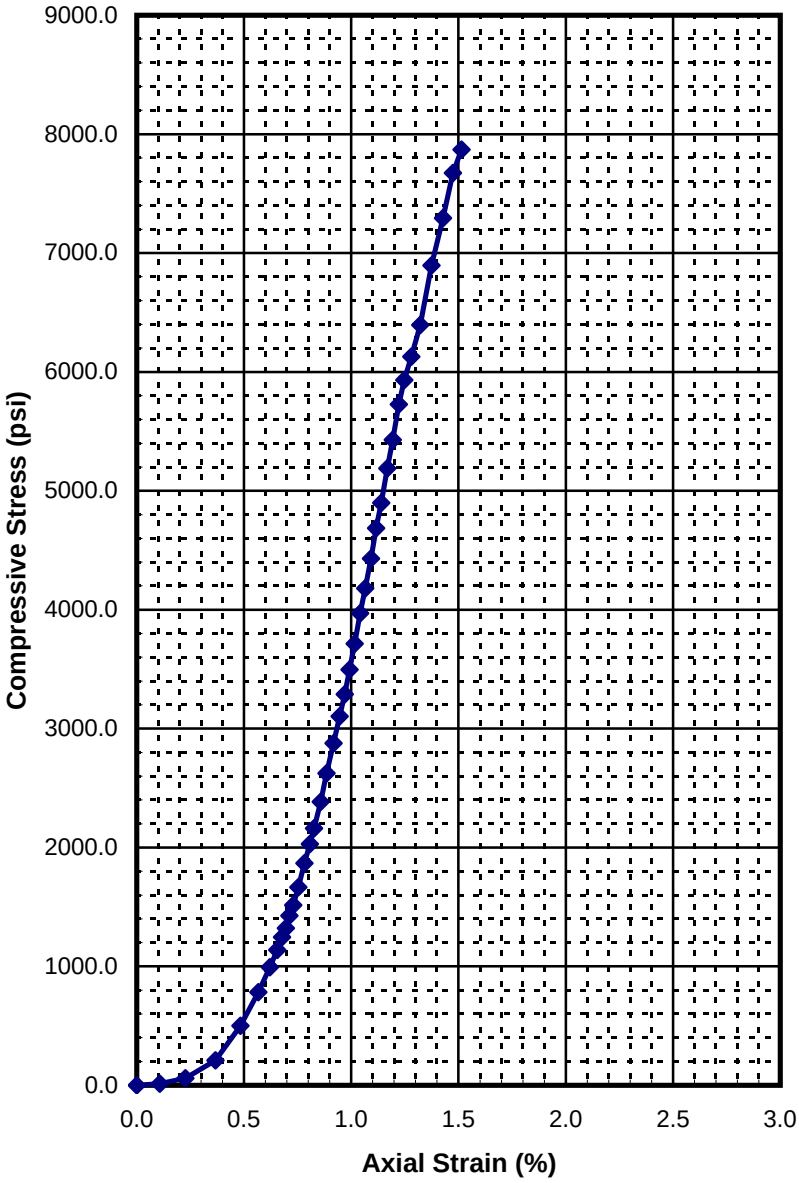




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.7	5.012	2.400	156.0	954

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-14** **Depth (ft): 19.5**	
Description and/or Classification:	**Granodiorite, light gray with orange staining, coarse grained**	**Figure: F-65**



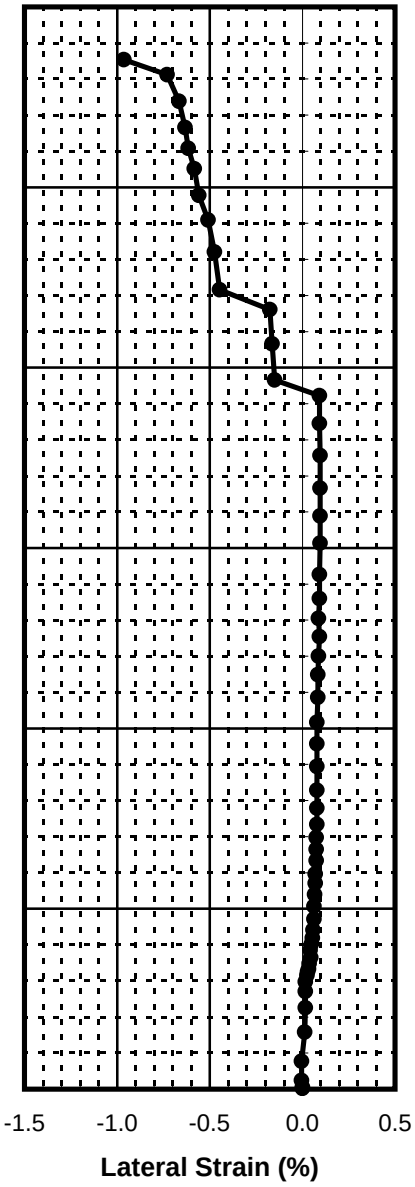


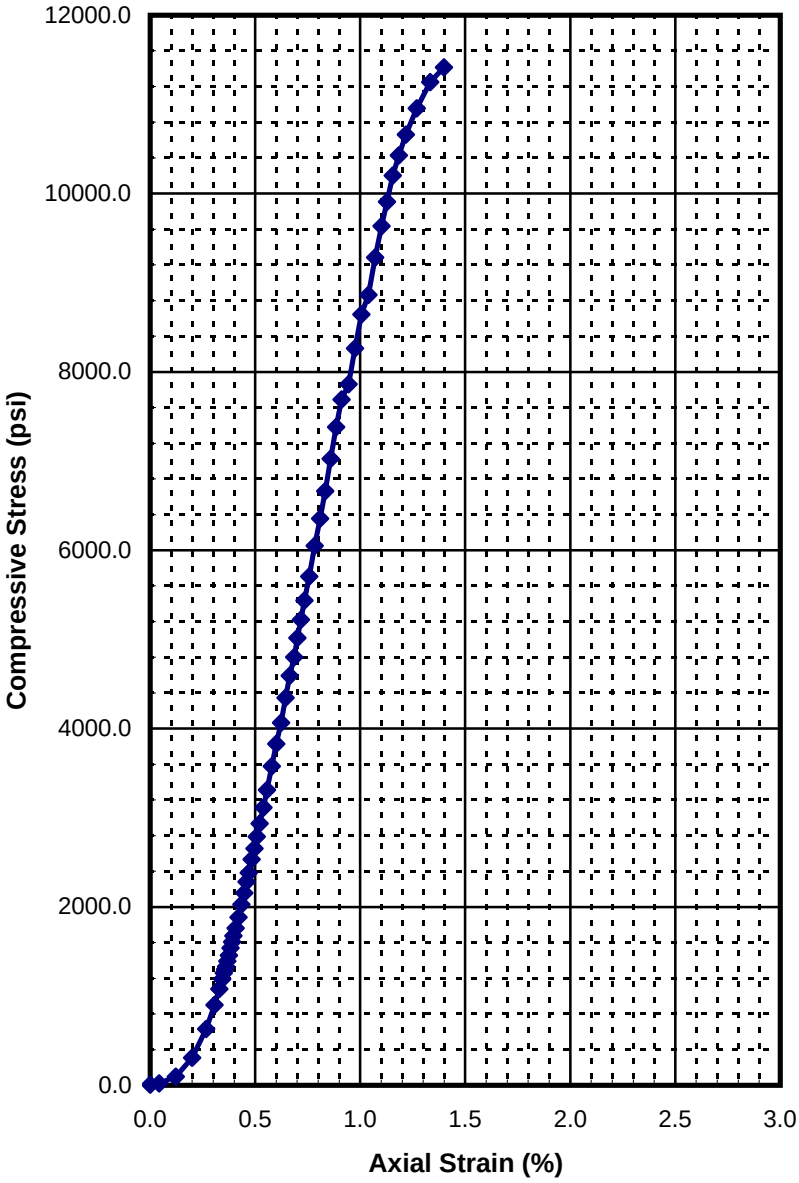
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.993	2.399	165.1	7,870

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-14** **Depth (ft): 26.9**
Description and/or Classification:	**Granodiorite, light gray with dark green specks, coarse grained**

UNCONFINED COMPRESSION TEST

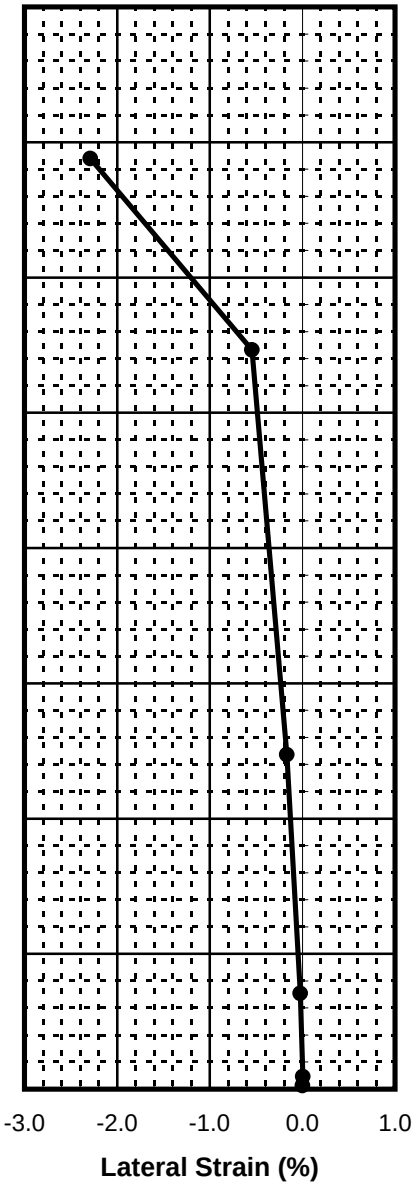
Figure: F-66

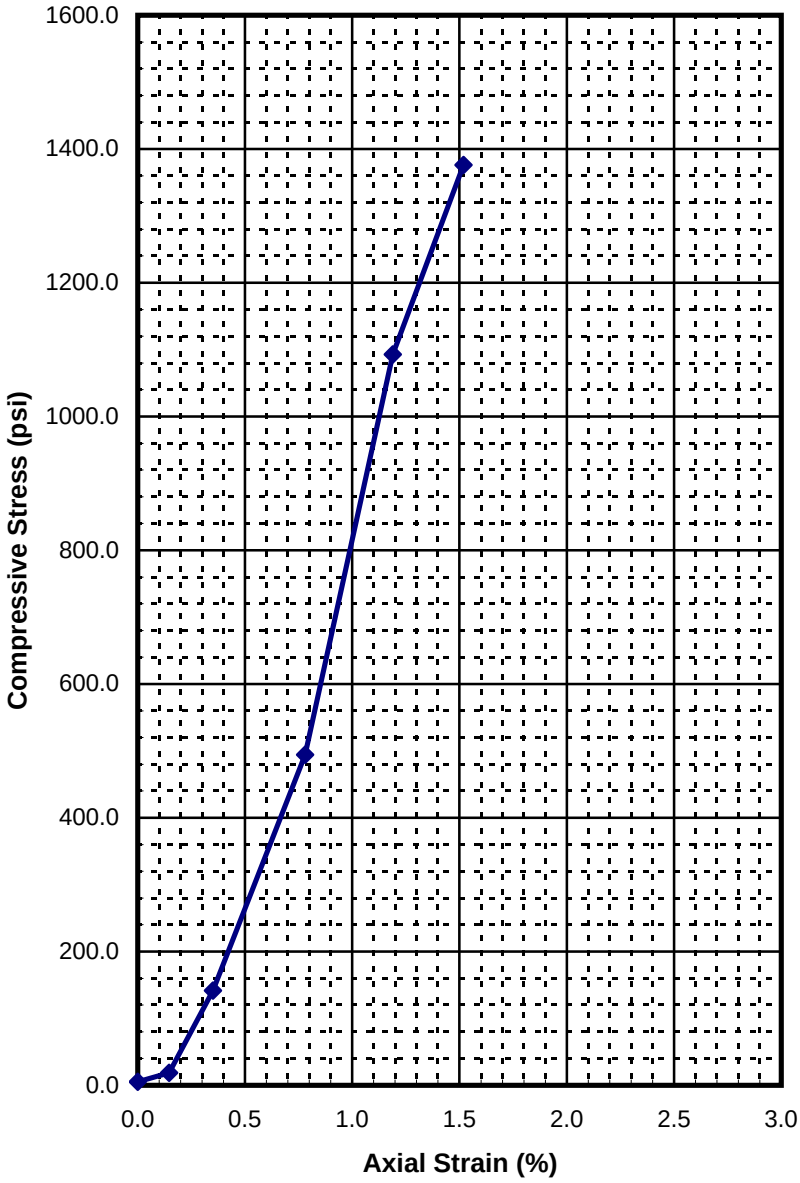




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.993	2.401	165.2	11,414

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-14** **Depth (ft): 32.0**	
Description and/or Classification:	**Granodiorite, blueish gray with green specks, medium grained**	**Figure: F-67**



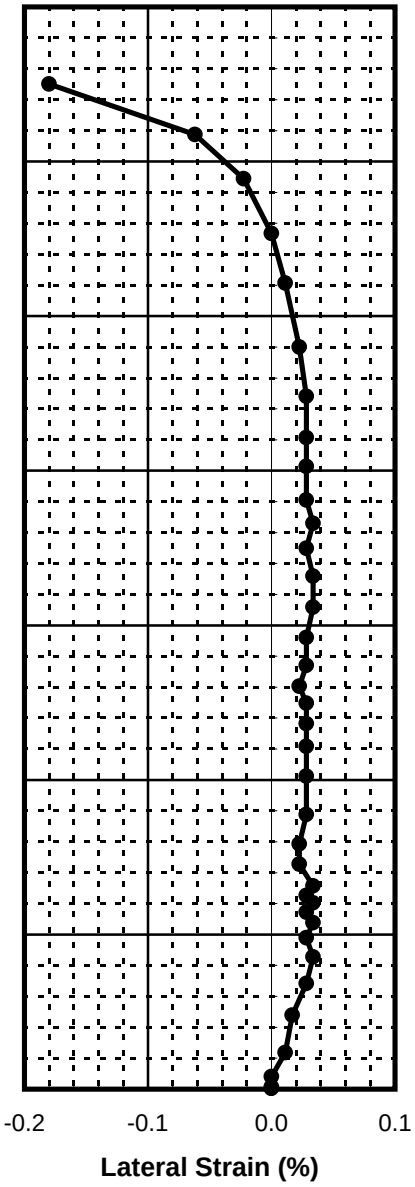


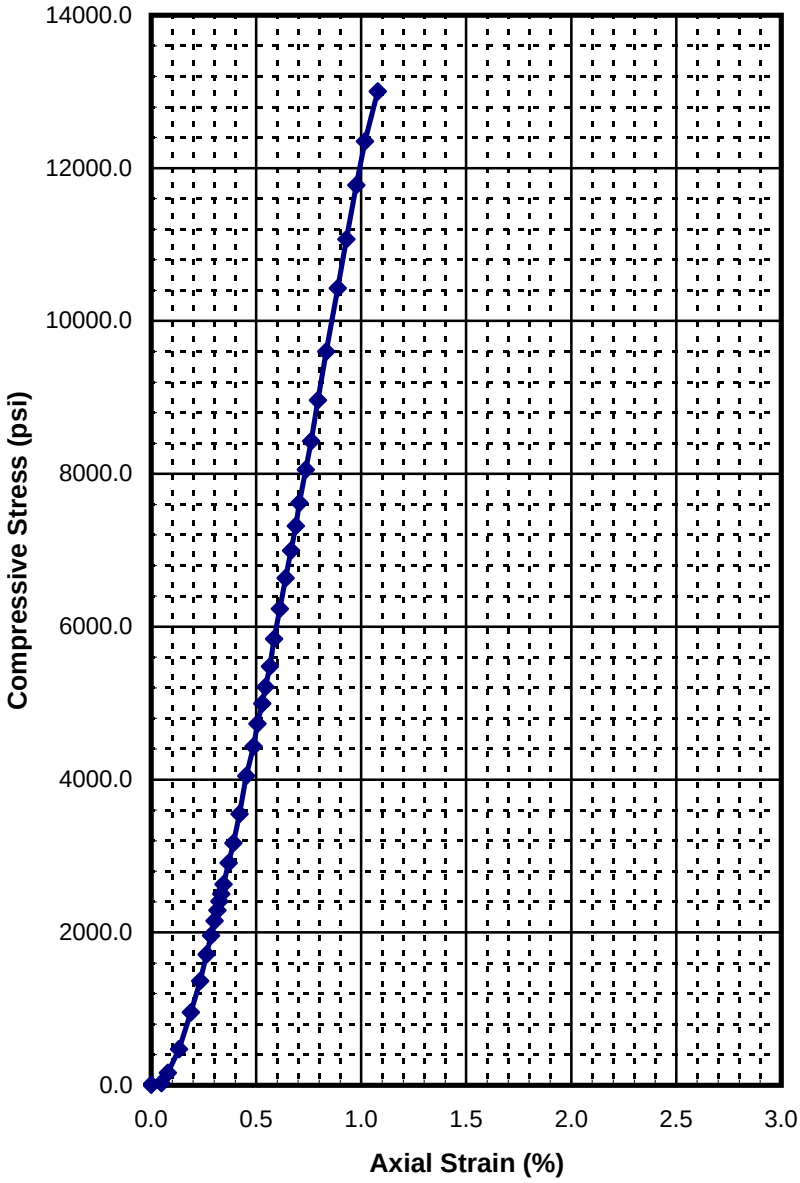
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.0	3.963	1.779	153.5	1,376

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-15** **Depth (ft): 16.8**
Description and/or Classification:	**Granodiorite, light brownish gray, coarse grained**

UNCONFINED COMPRESSION TEST

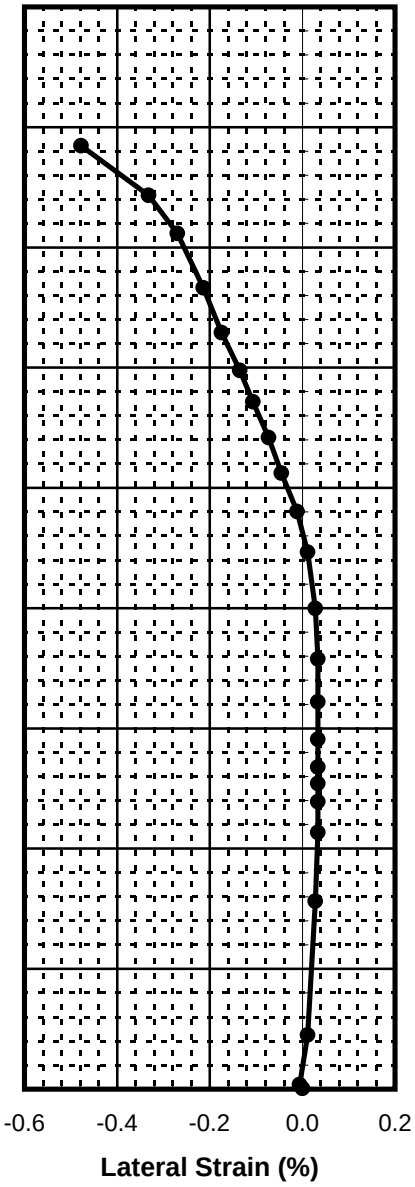
Figure: F-68

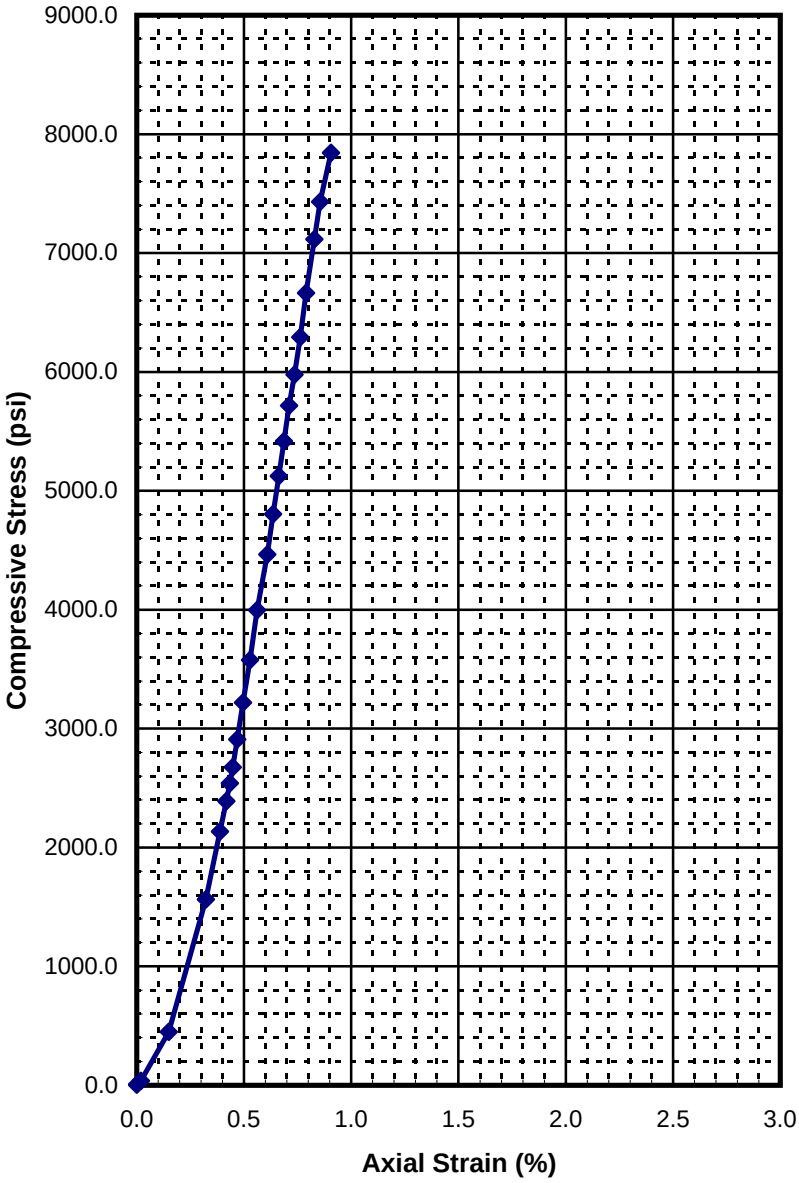




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.067	1.778	161.6	13,004

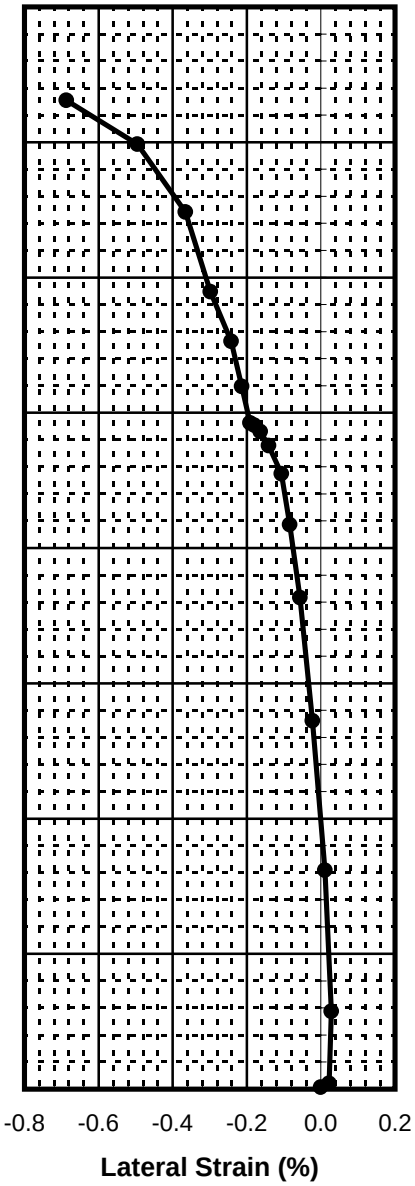
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-15** **Depth (ft): 20.0**	
Description and/or Classification:	**Granodiorite, light brownish gray, medium grained**	**Figure: F-69**

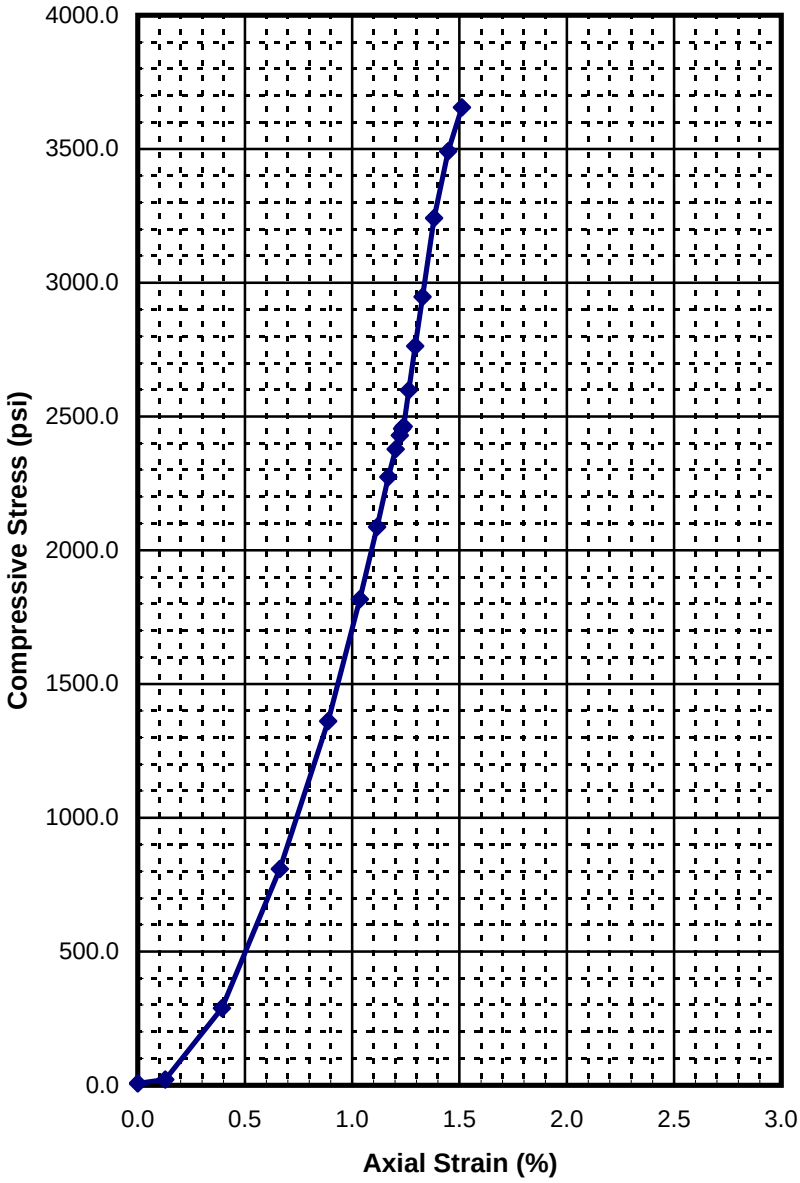




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.095	1.778	161.0	7,844

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-15** **Depth (ft): 24.2**	
Description and/or Classification:	**Granodiorite, light brownish gray with black specks, medium grained**	**Figure: F-70**



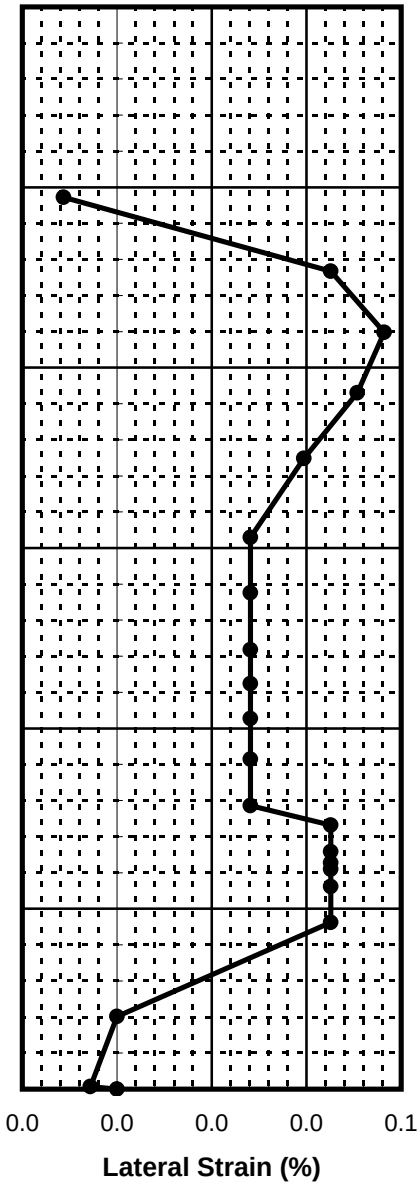


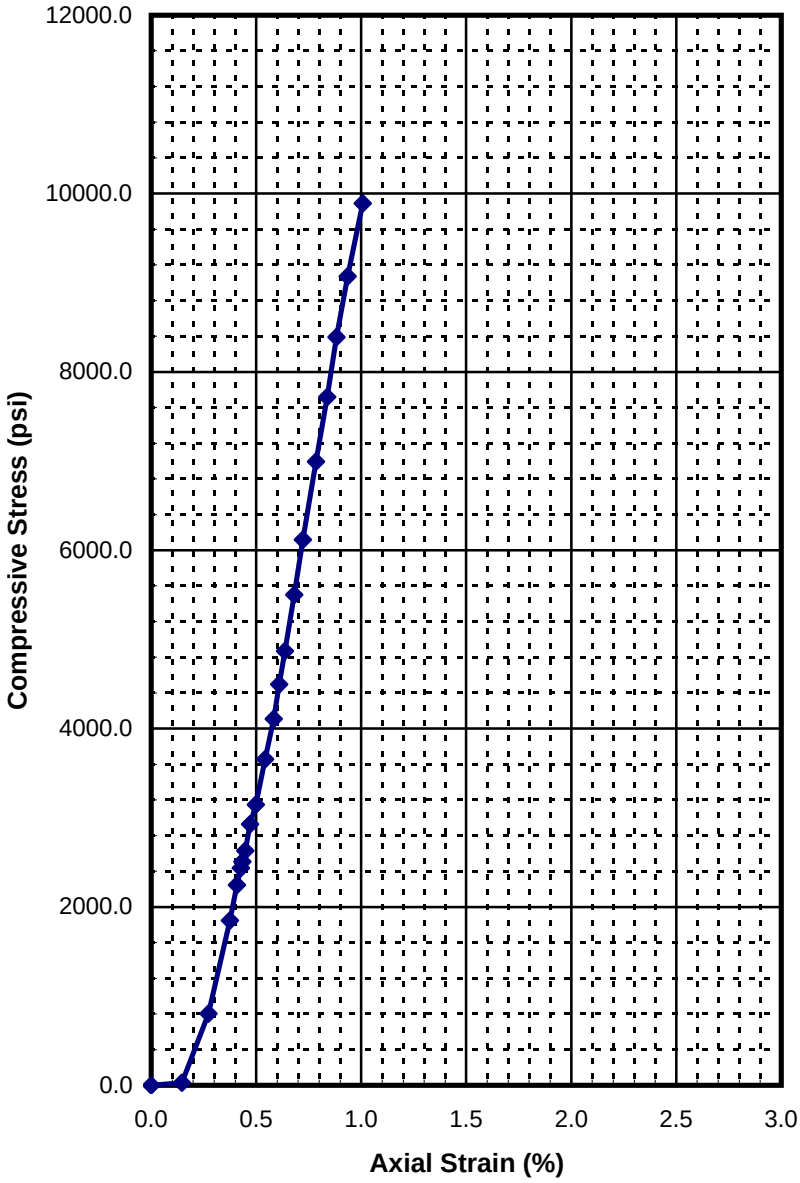
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.5	4.076	1.777	157.9	3,655

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-15** **Depth (ft): 25.2**
Description and/or Classification:	**Granodiorite, light brownish gray with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

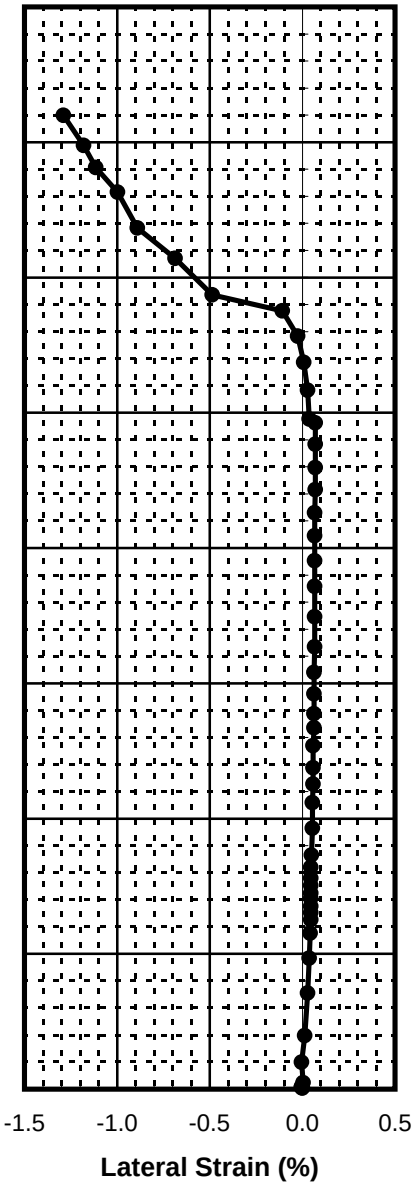
Figure: F-71

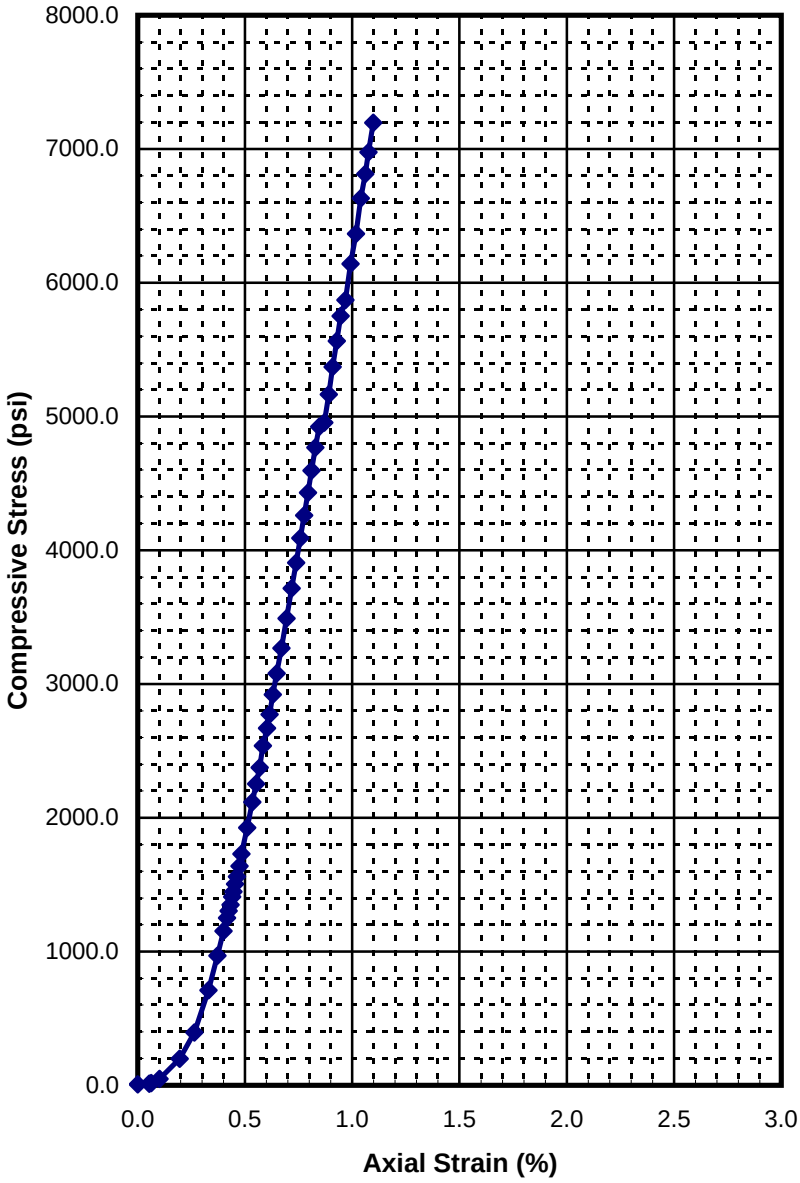




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.3	3.890	1.773	163.7	9,890

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-16** **Depth (ft): 19.1**	
Description and/or Classification:	**Granodiorite, very pale brown with black specks, coarse grained**	**Figure: F-72**



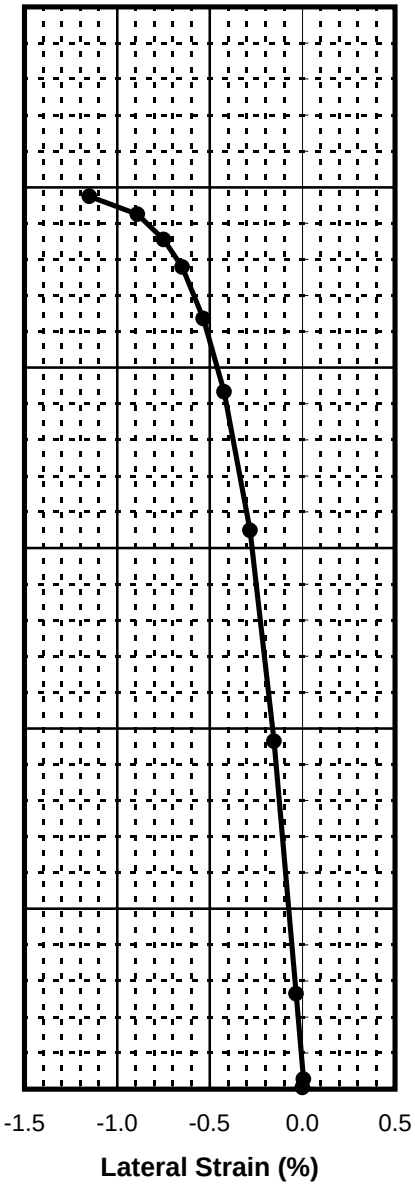


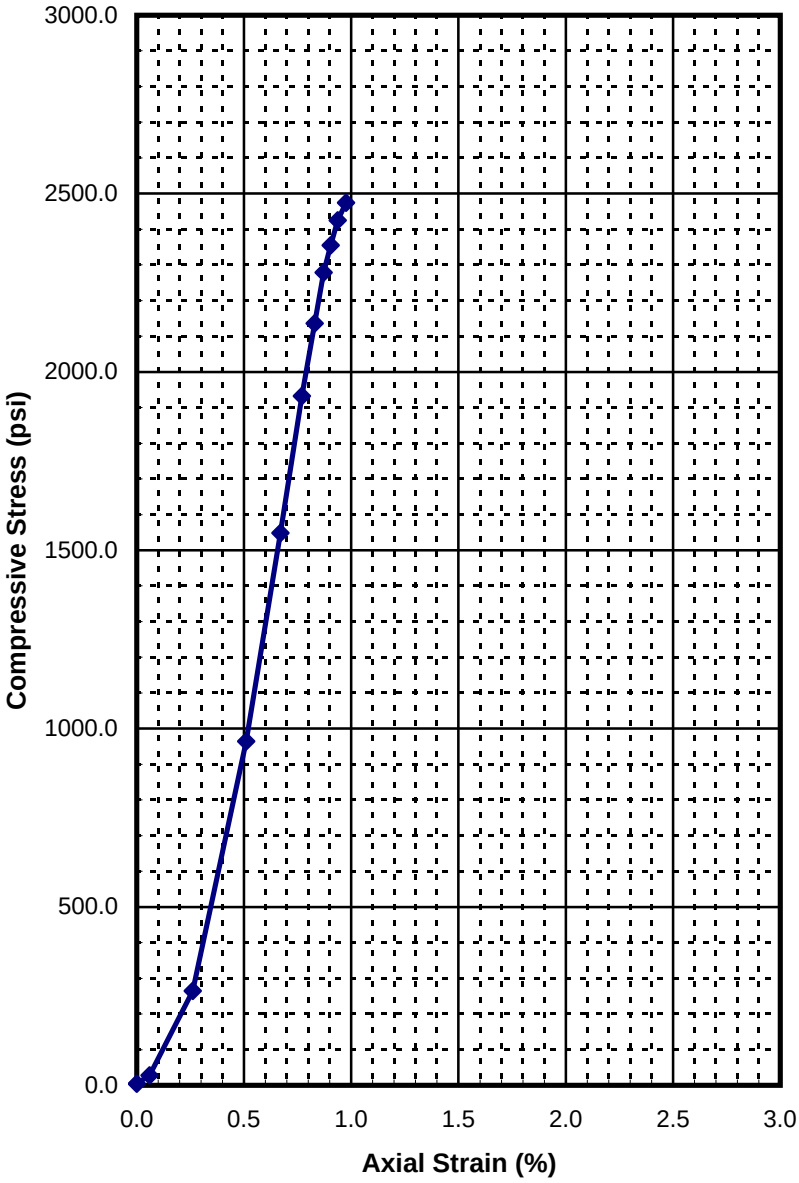
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	5.000	2.405	160.9	7,197

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-17** **Depth (ft): 12.5**
Description and/or Classification:	**Granodiorite, brownish gray with black and brown specks, coarse grained**

UNCONFINED COMPRESSION TEST

Figure: F-73



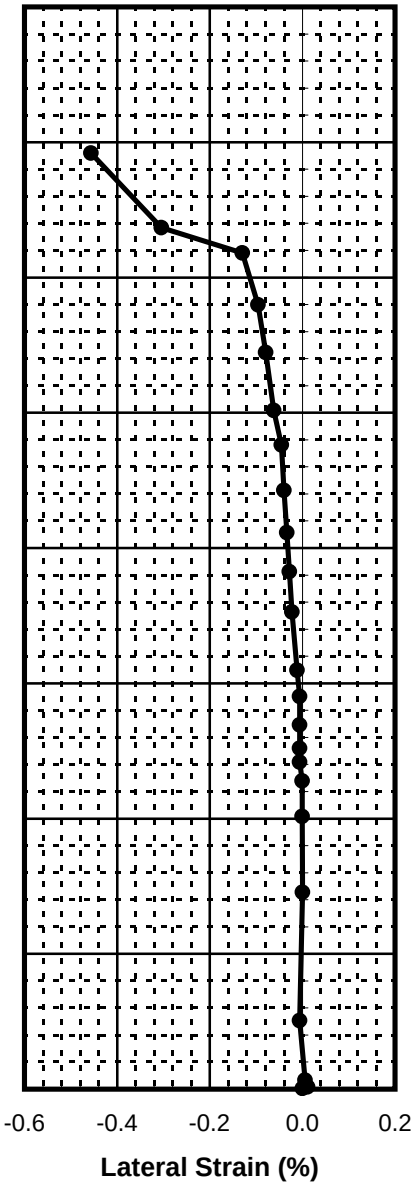


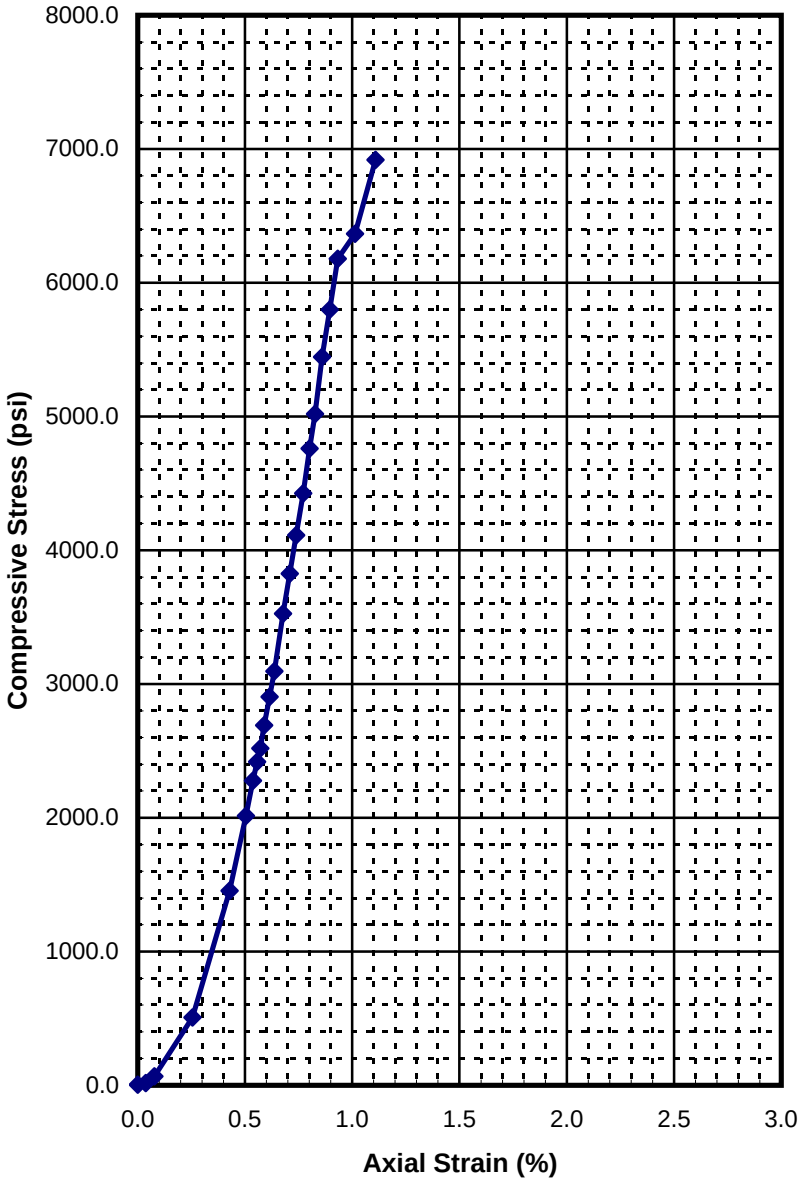
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.4	4.015	1.775	159.2	2,475

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-18** **Depth (ft): 17.5**
Description and/or Classification:	**Granodiorite, medium gray with black specks, medium grained**

UNCONFINED COMPRESSION TEST

Figure: F-74



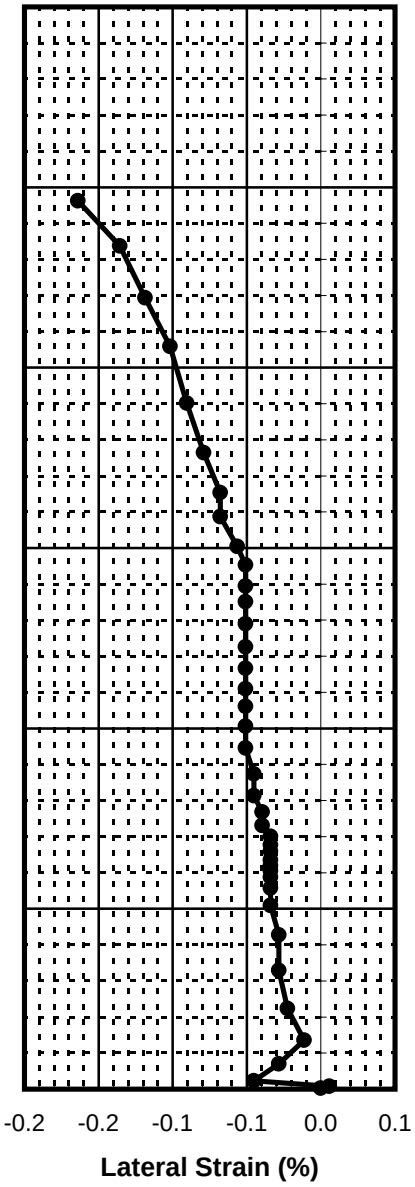


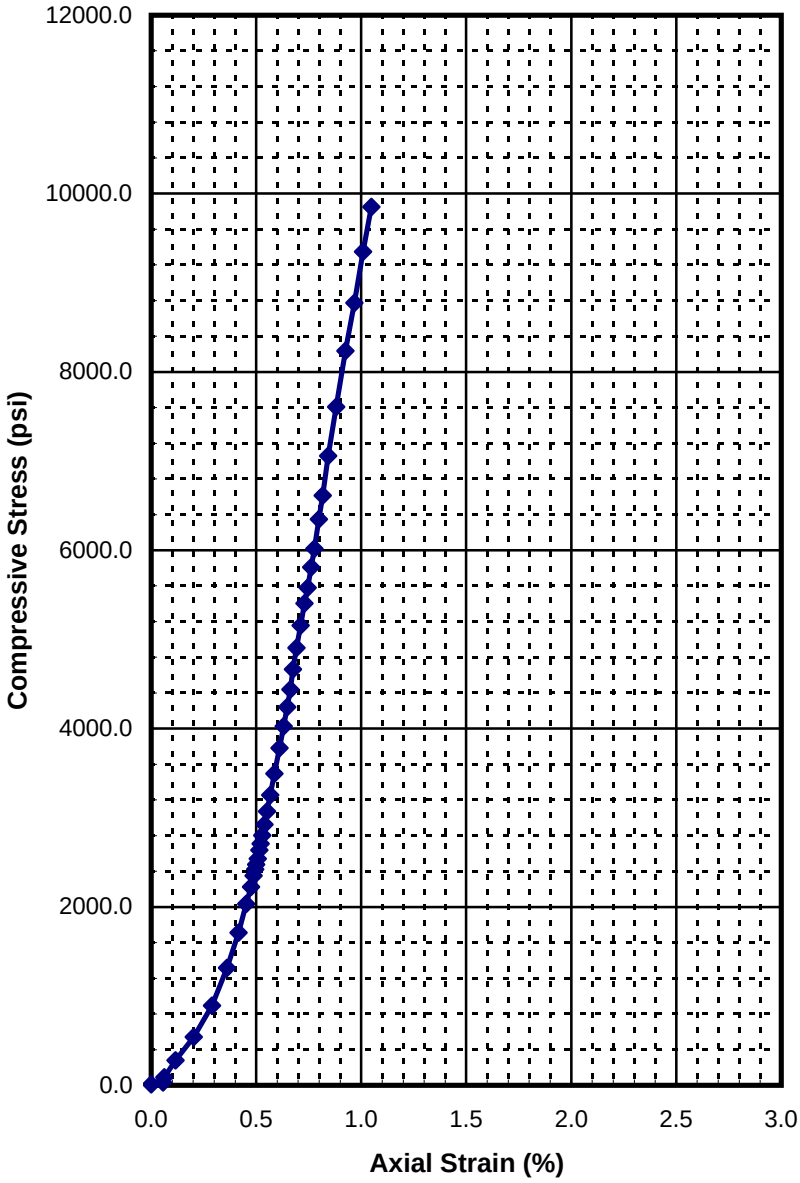
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	3.969	1.774	160.3	6,919

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-18** **Depth (ft): 22.5**
Description and/or Classification:	**Granodiorite, medium gray with black specks, medium grained**

UNCONFINED COMPRESSION TEST

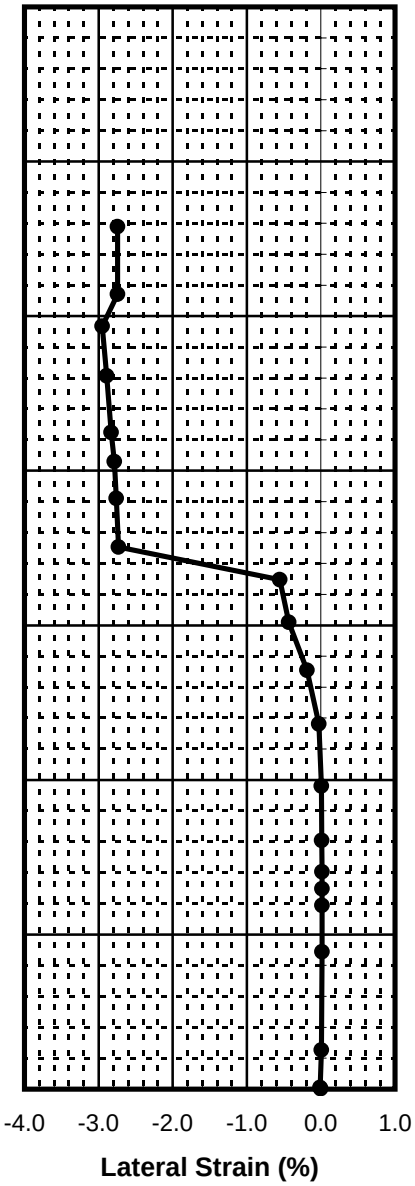
Figure: F-75

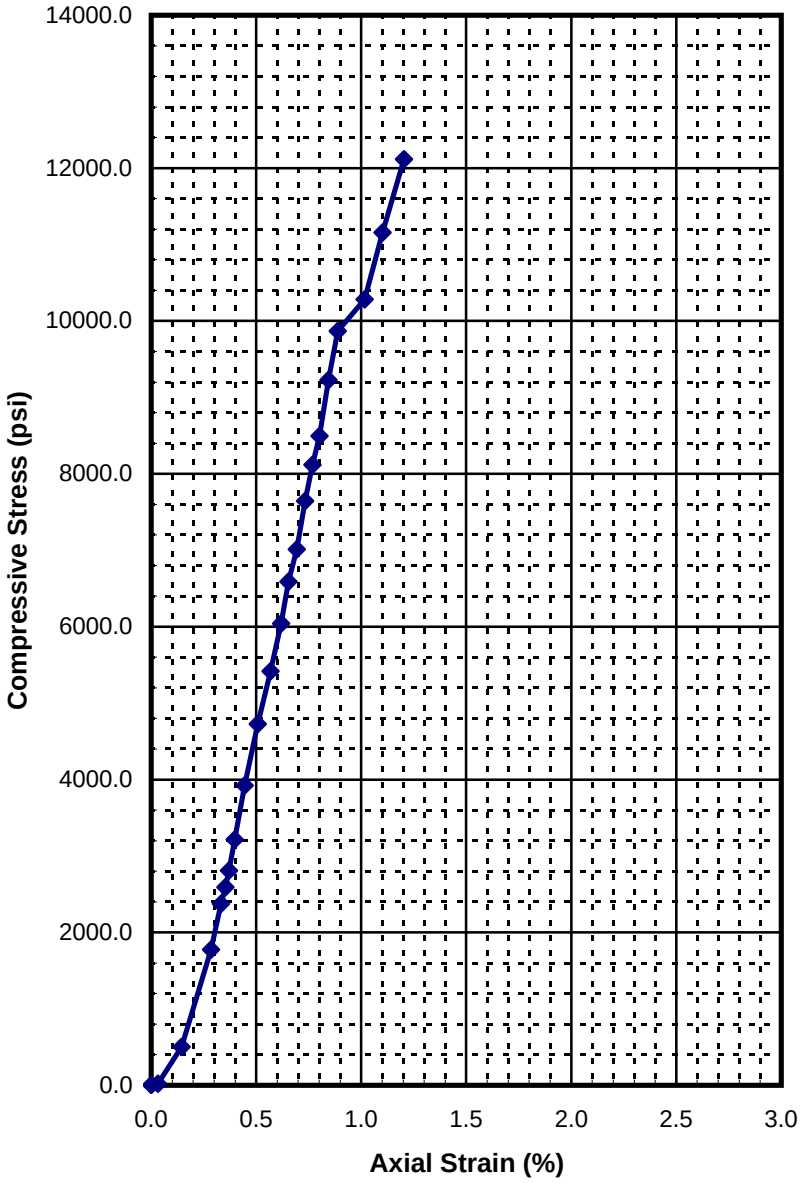




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.044	1.769	162.1	9,851

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-18** **Depth (ft): 33.0**	
Description and/or Classification:	**Granodiorite, medium gray with green specks, coarse grained**	**Figure: F-76**



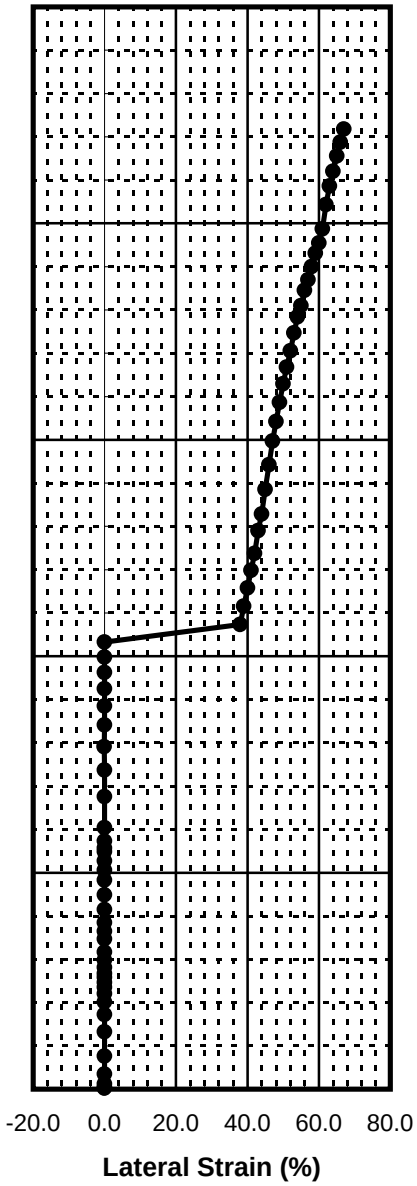


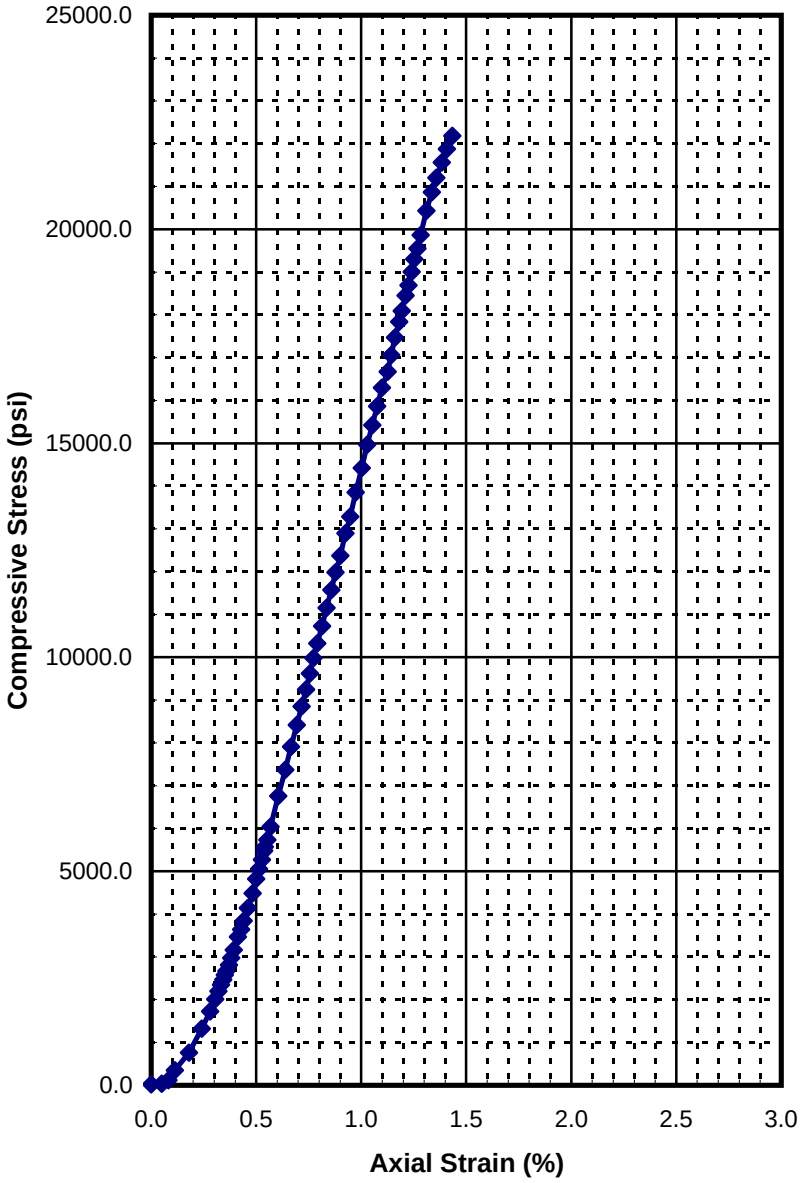
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	3.996	1.768	162.2	12,118

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-18** **Depth (ft): 43.2**
Description and/or Classification:	**Granodiorite, light gray with black specks and orange staining, coarse grained**

UNCONFINED COMPRESSION TEST

Figure: F-77



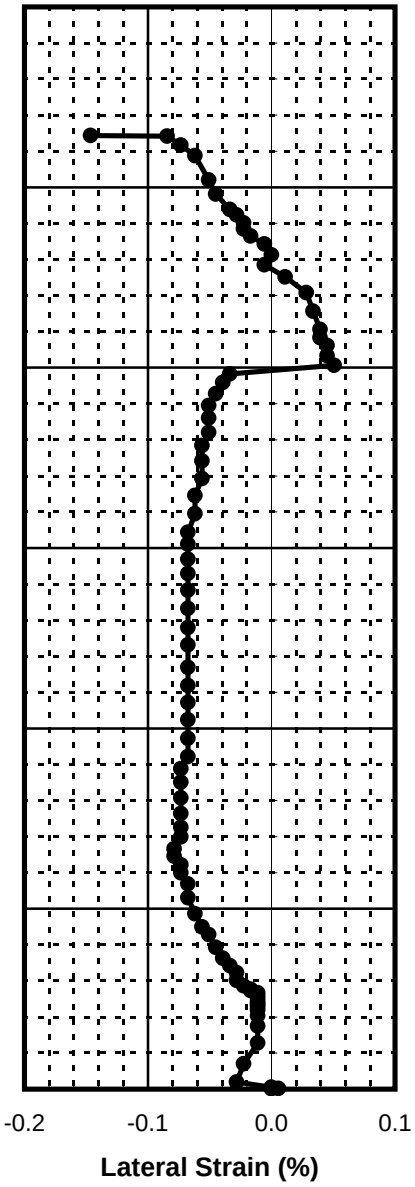


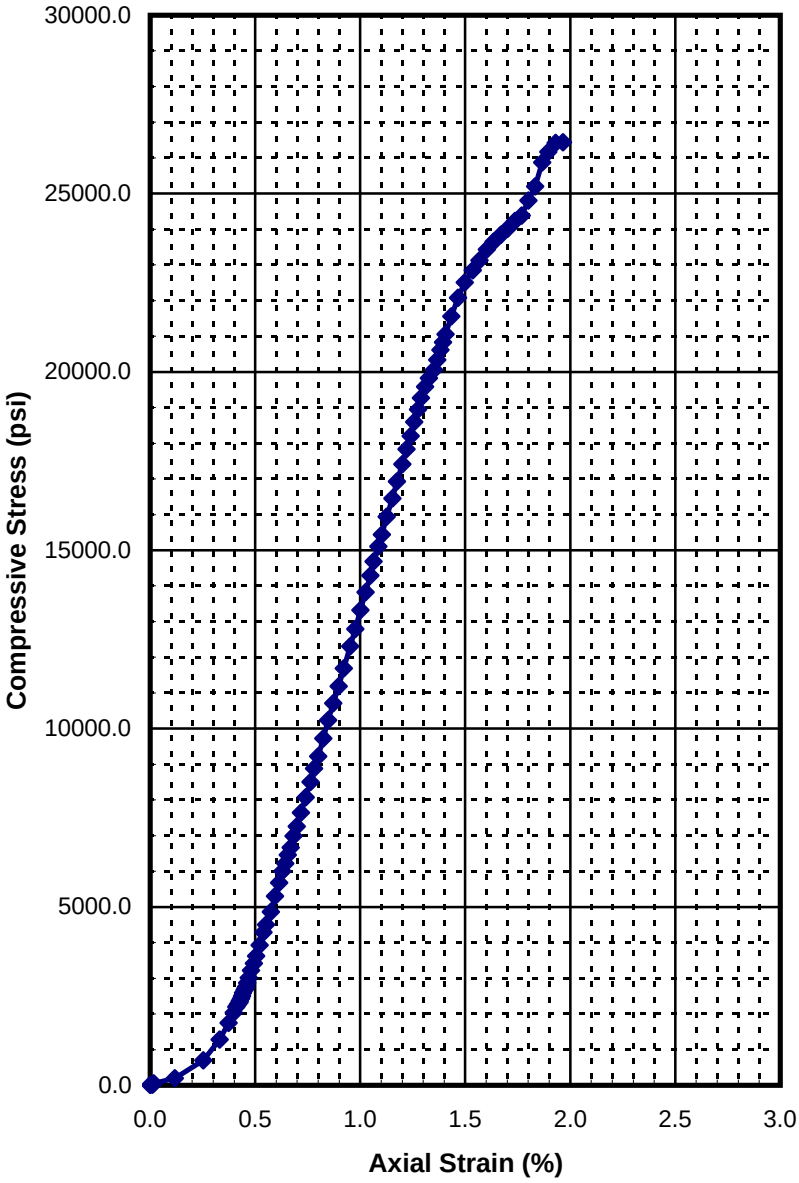
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.998	1.777	177.1	22,178

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-20** **Depth (ft): 23.4**
Description and/or Classification:	**Quartz Monzodiorite, medium dark gray, fine grained**

UNCONFINED COMPRESSION TEST

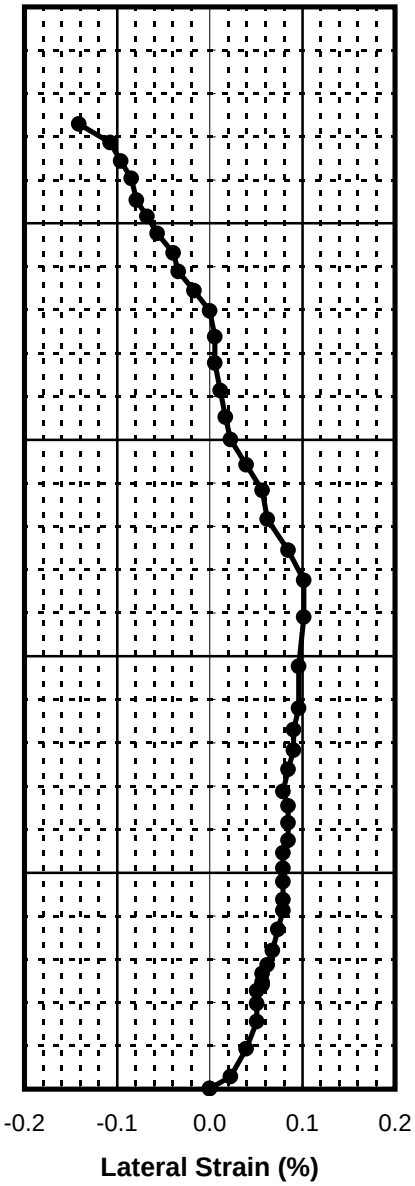
Figure: F-78

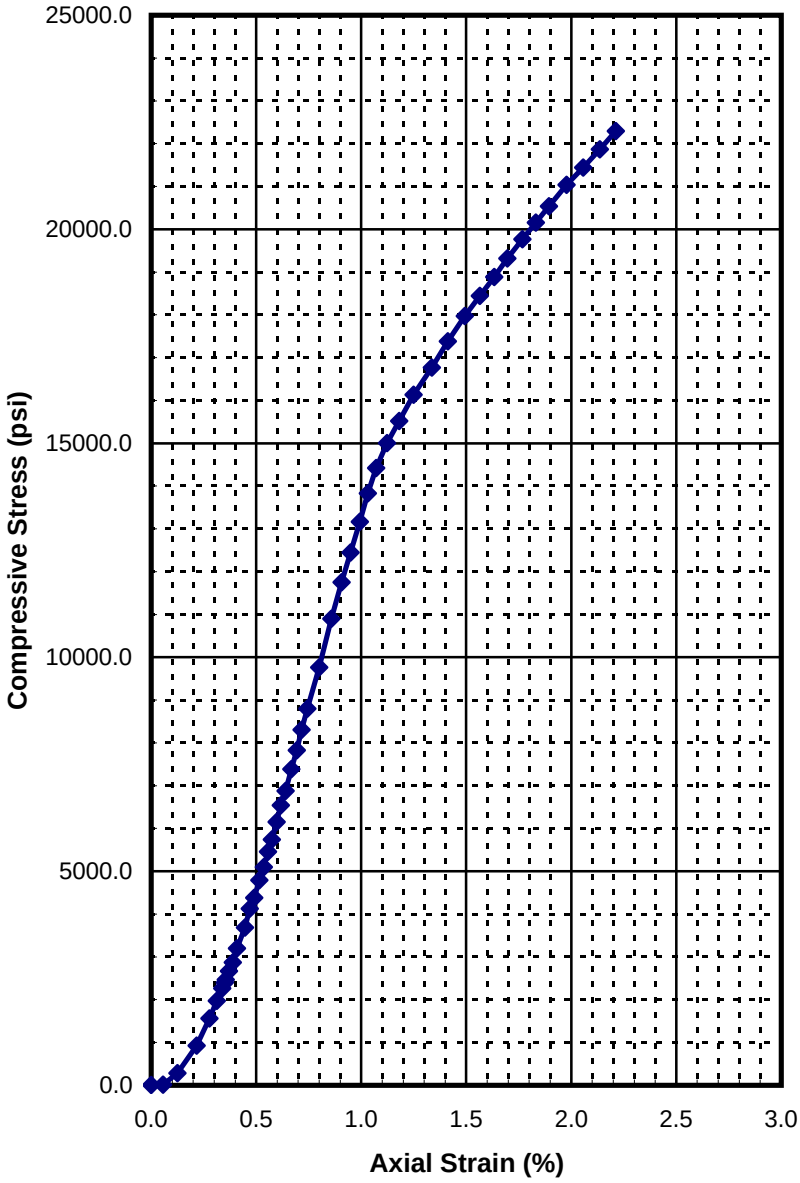




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	4.025	1.775	172.7	26,437

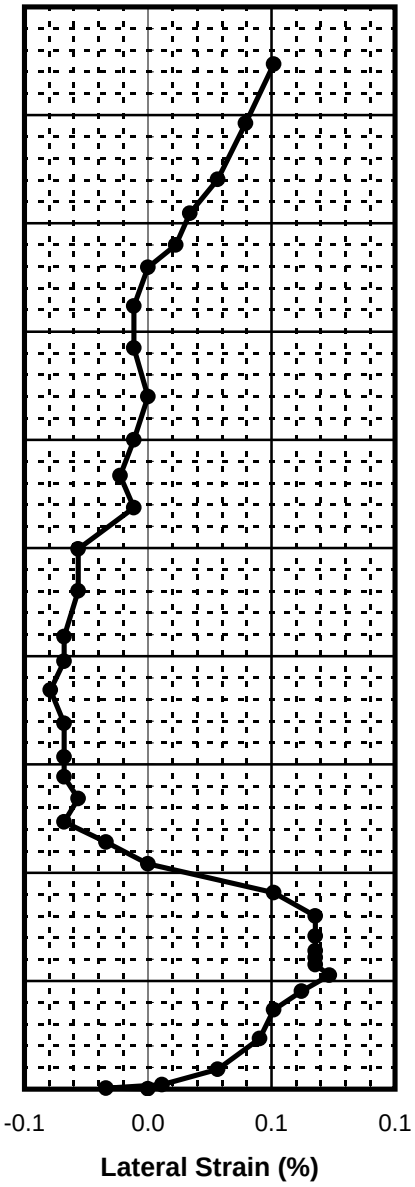
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-20** **Depth (ft): 29.0**	
Description and/or Classification:	**Quartz Monzodiorite, medium dark gray, fine grained**	**Figure: F-79**

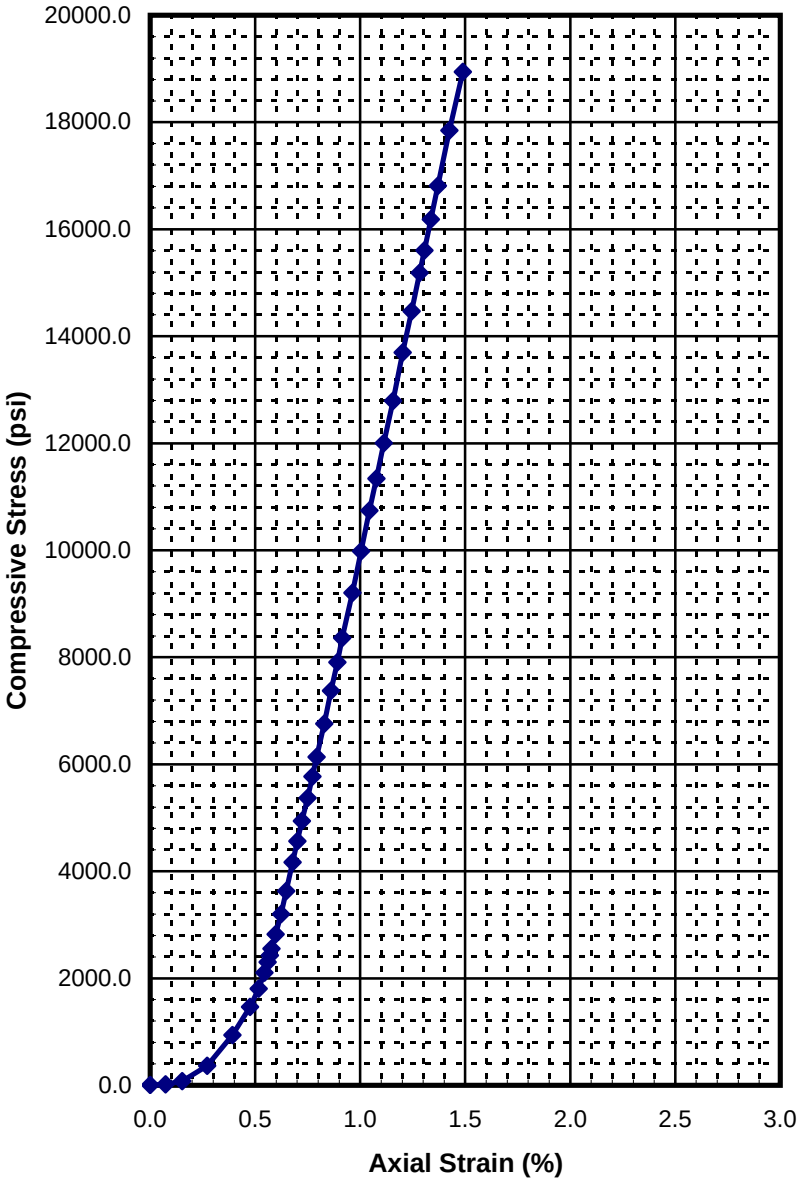




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.2	3.938	1.770	183.0	22,293

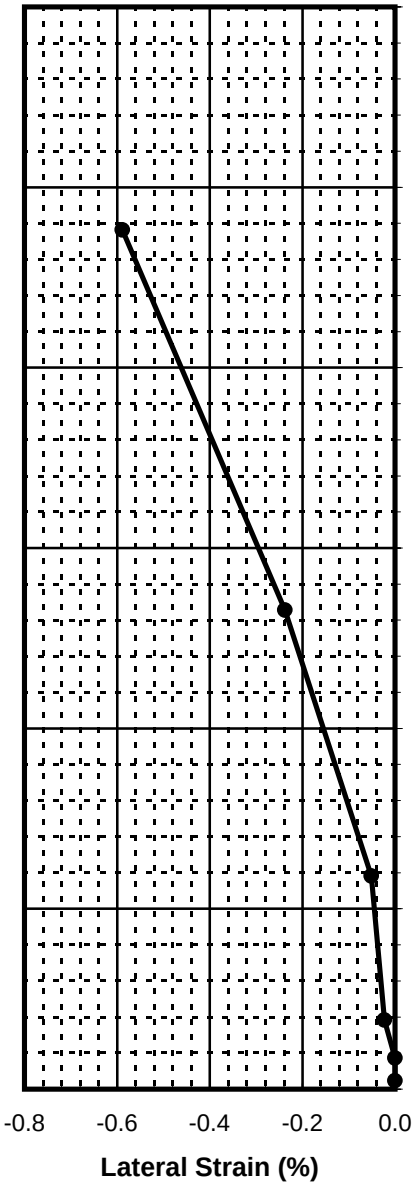
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-21** **Depth (ft): 19.5**	
Description and/or Classification:	**Quartz Monzodiorite, gray, medium grained**	**Figure: F-80**

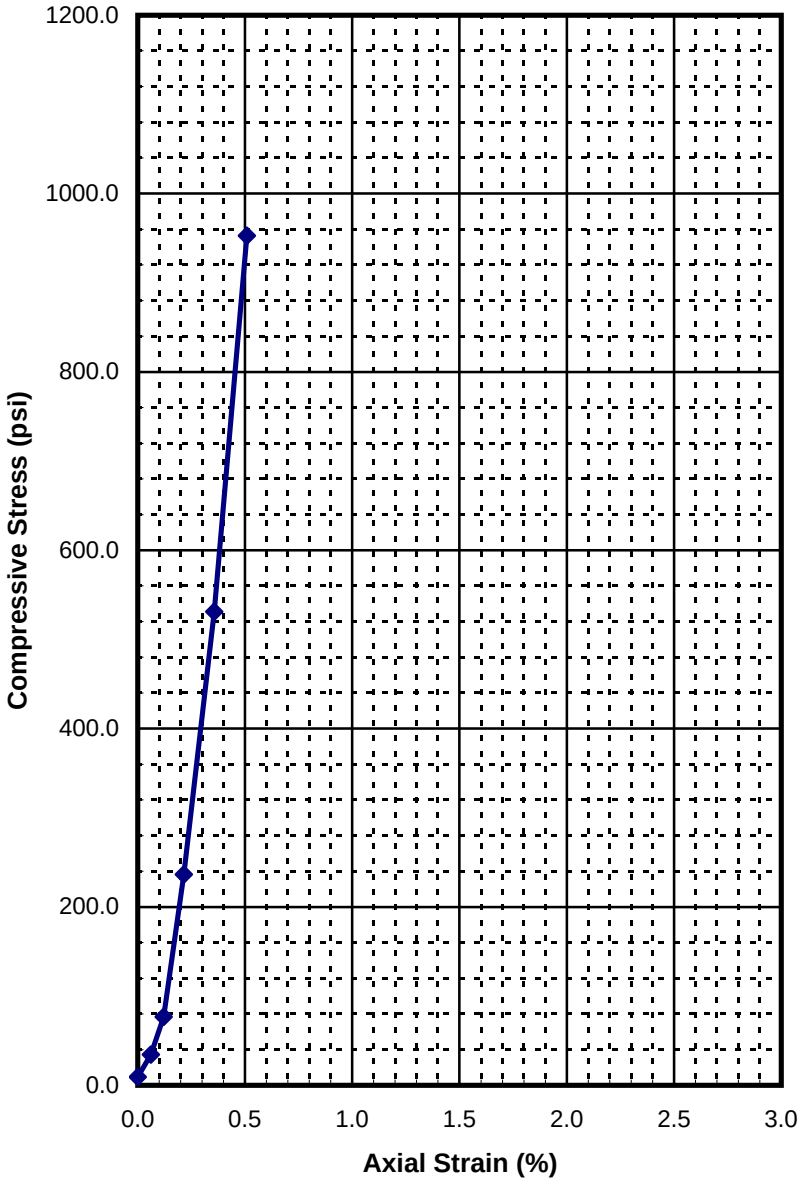




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	3.936	1.770	179.9	18,941

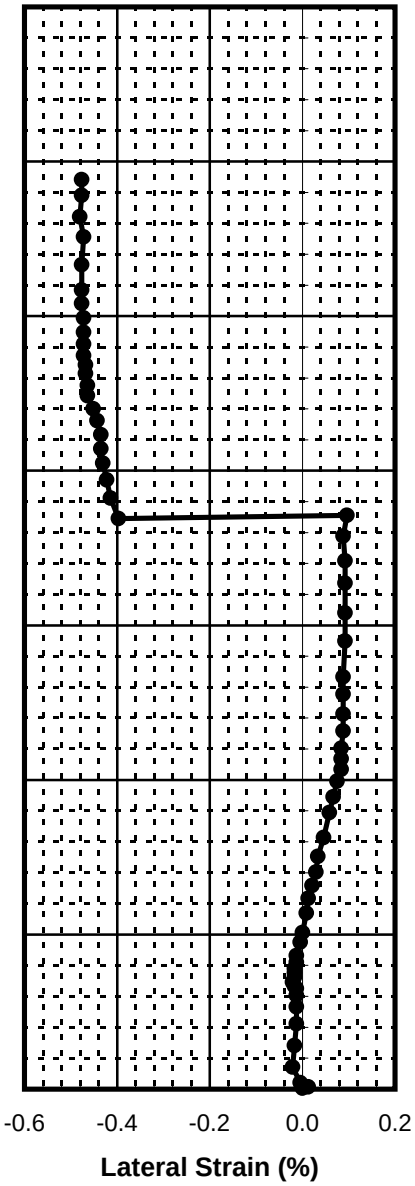
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-21** **Depth (ft): 26.0**	
Description and/or Classification:	**Quartz Monzodiorite, gray, medium grained**	**Figure: F-81**

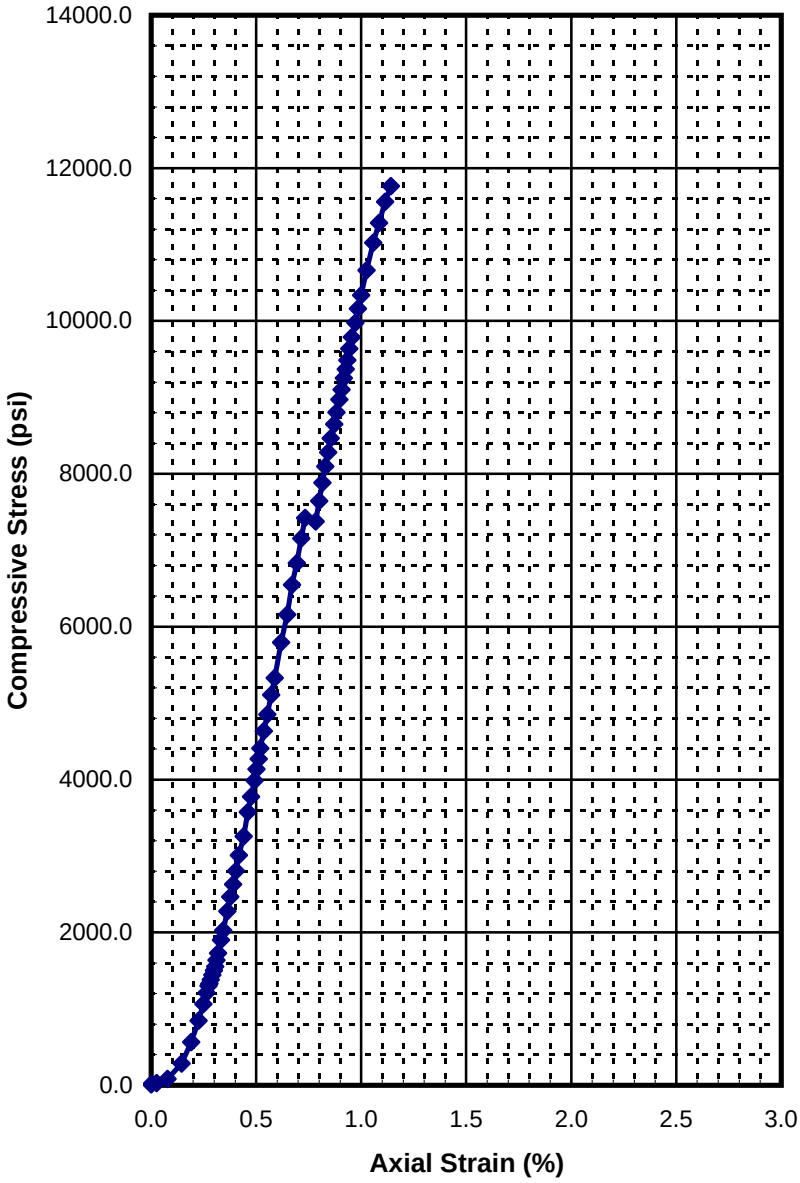




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.6	3.952	1.766	168.4	953

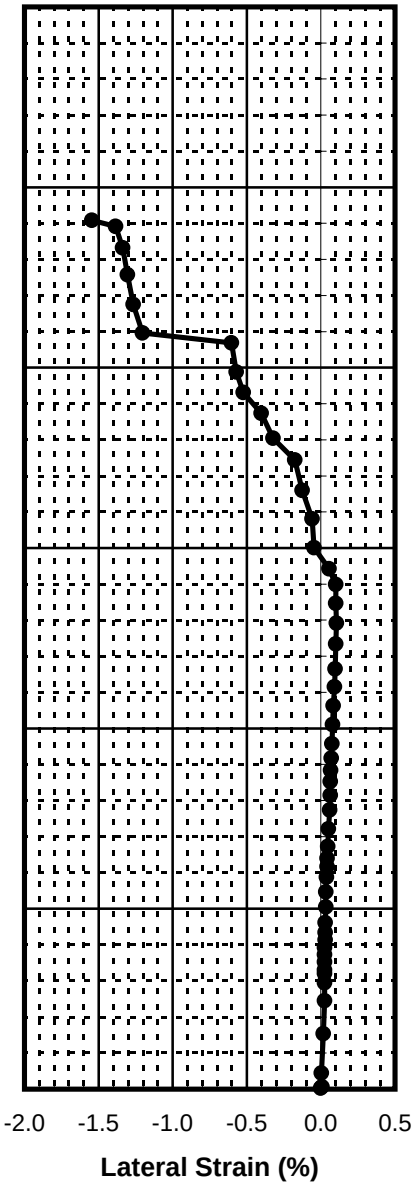
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-21** **Depth (ft): 38.5**	
Description and/or Classification:	**Quartz Monzodiorite, gray with black specks, medium grained**	**Figure: F-82**

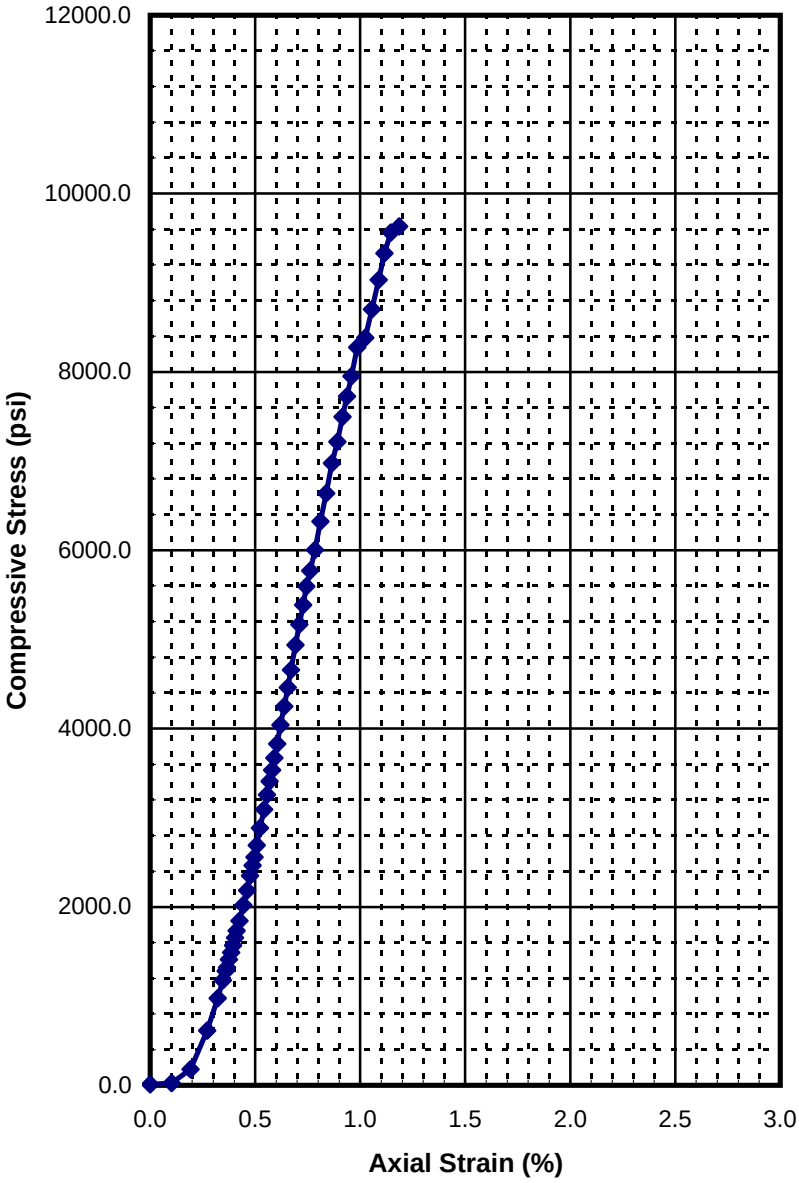




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	5.022	2.392	170.7	11,764

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-22** **Depth (ft): 29.1**	
Description and/or Classification:	**Metasedimentary Rock, gray, fine grained**	**Figure: F-83**



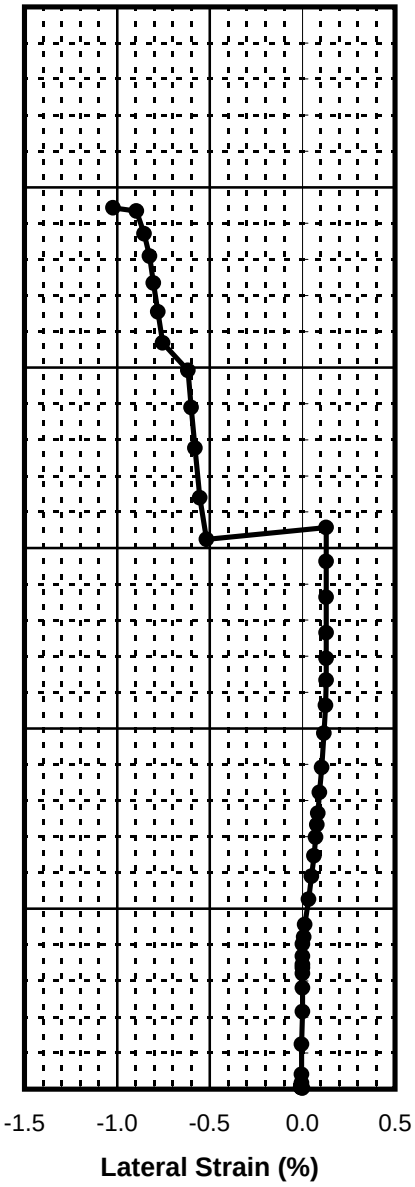


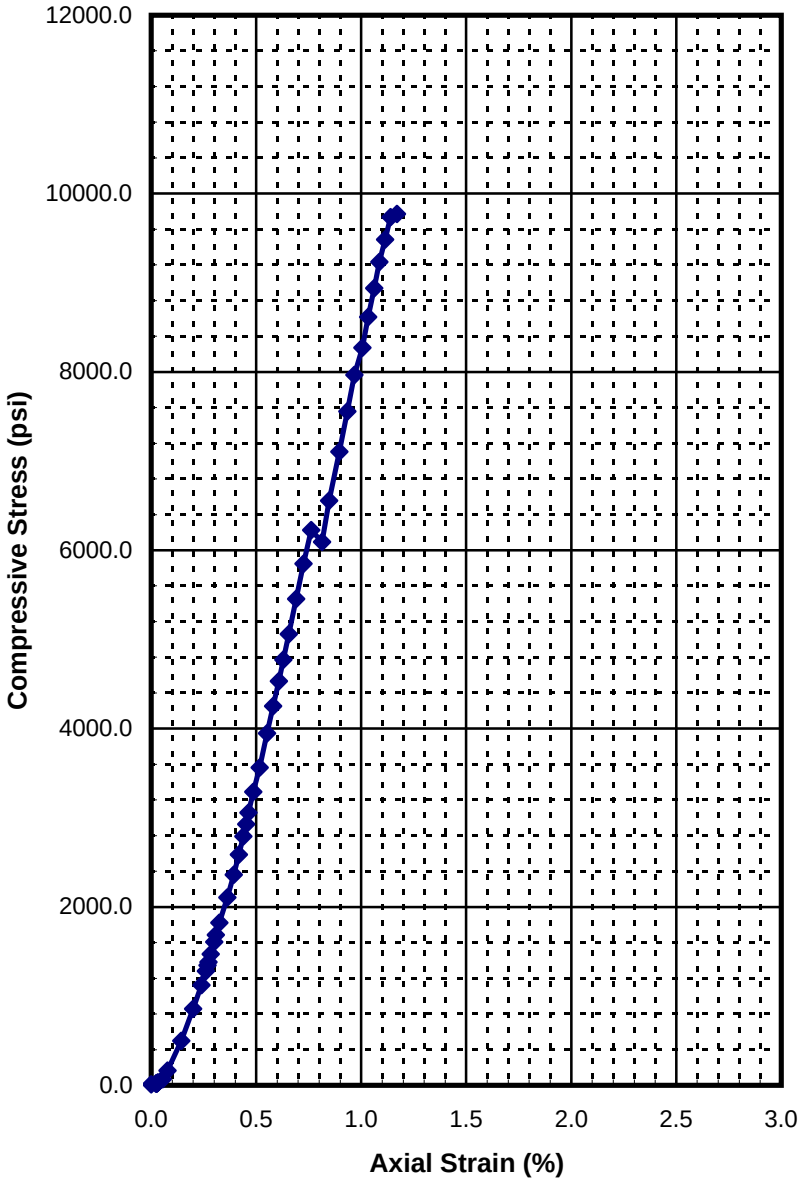
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	5.012	2.384	163.9	9,632

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-24** **Depth (ft): 25.7**
Description and/or Classification:	**Granodiorite, light gray with some orange staining, medium grained**

UNCONFINED COMPRESSION TEST

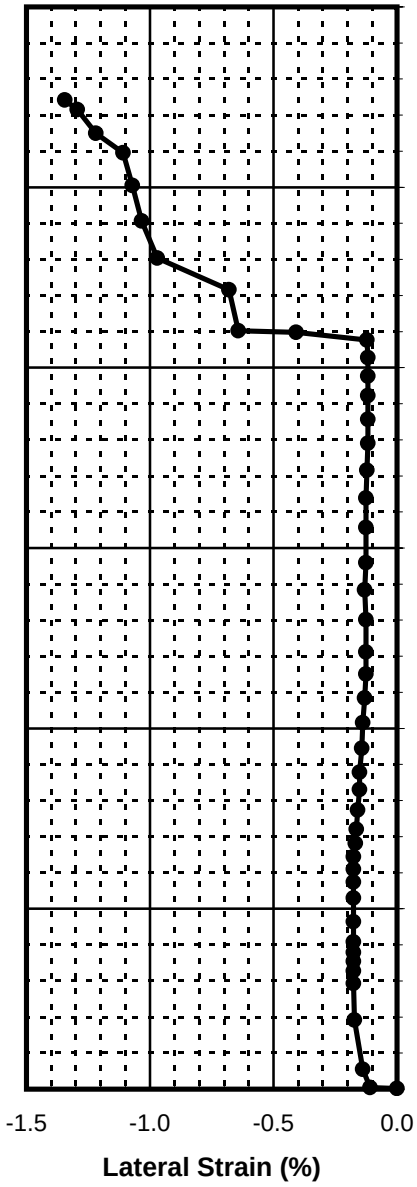
Figure: F-84

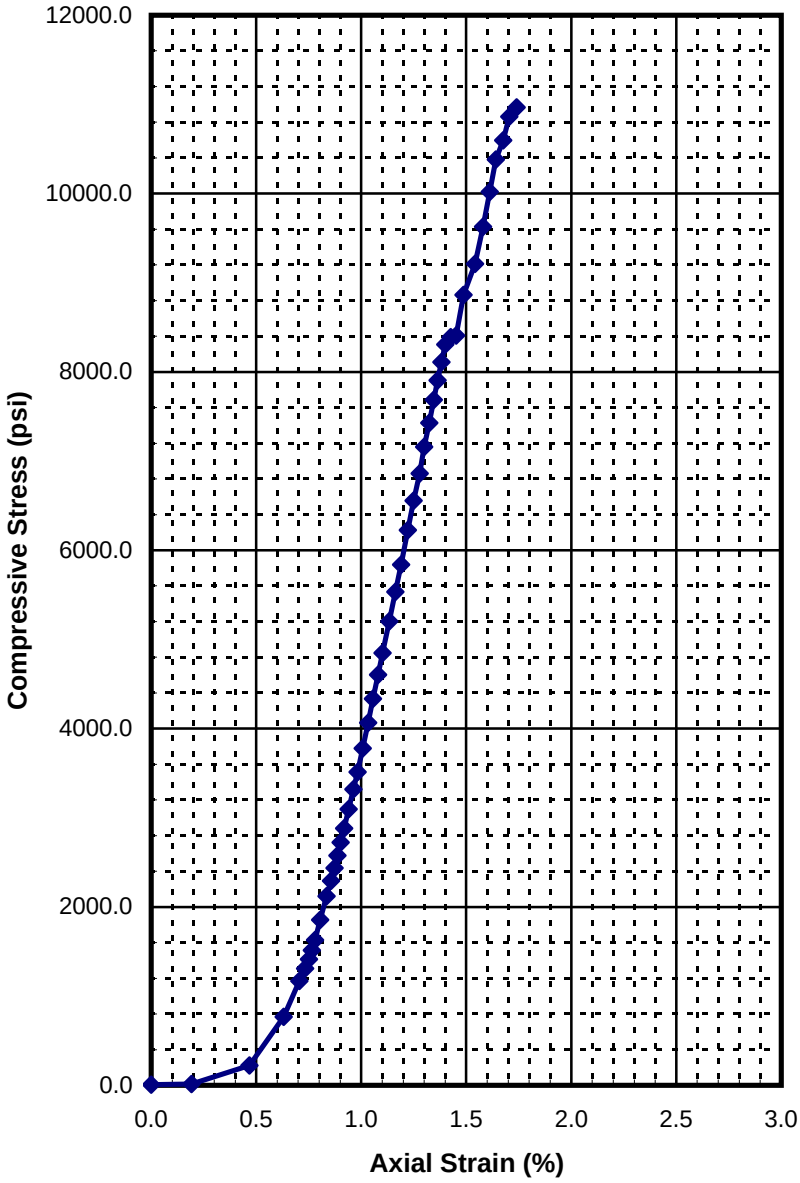




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.766	2.400	162.2	9,771

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-24** **Depth (ft): 35.9**	
Description and/or Classification:	**Granodiorite, light gray with black specks, coarse grained**	**Figure: F-85**



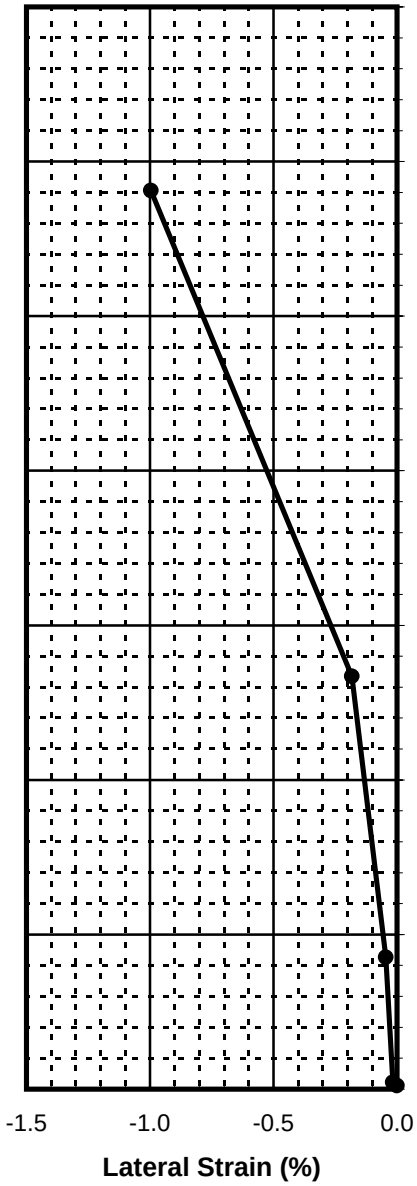


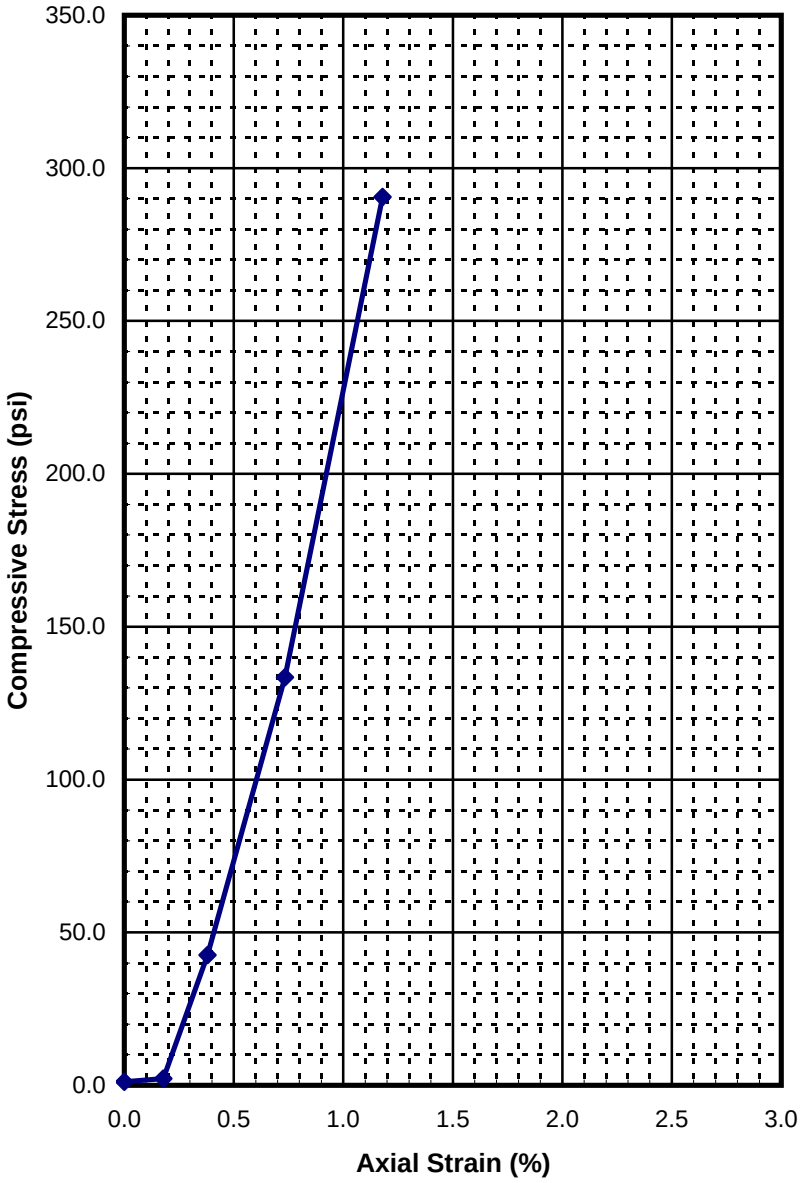
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	5.008	2.380	162.3	10,967

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-24** **Depth (ft): 41.6**
Description and/or Classification:	**Granodiorite, light gray with green specks, coarse grained**

UNCONFINED COMPRESSION TEST

Figure: F-86



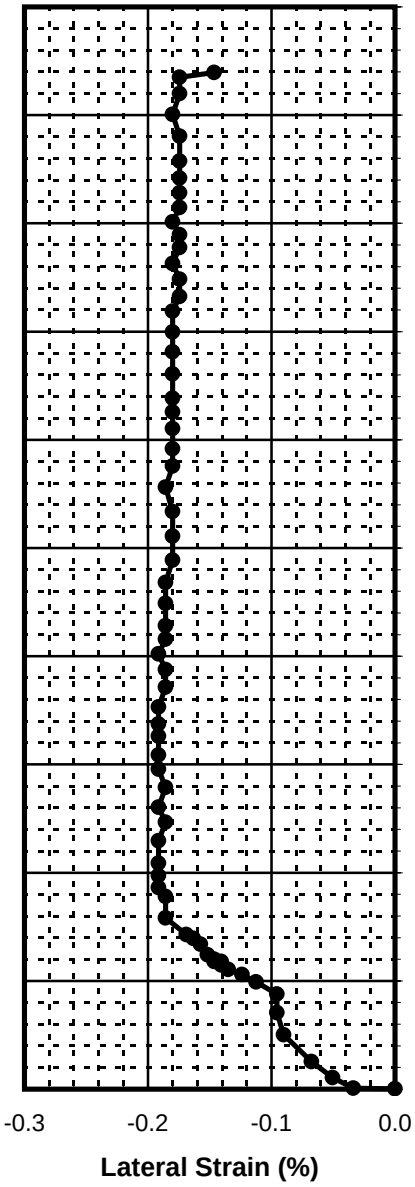


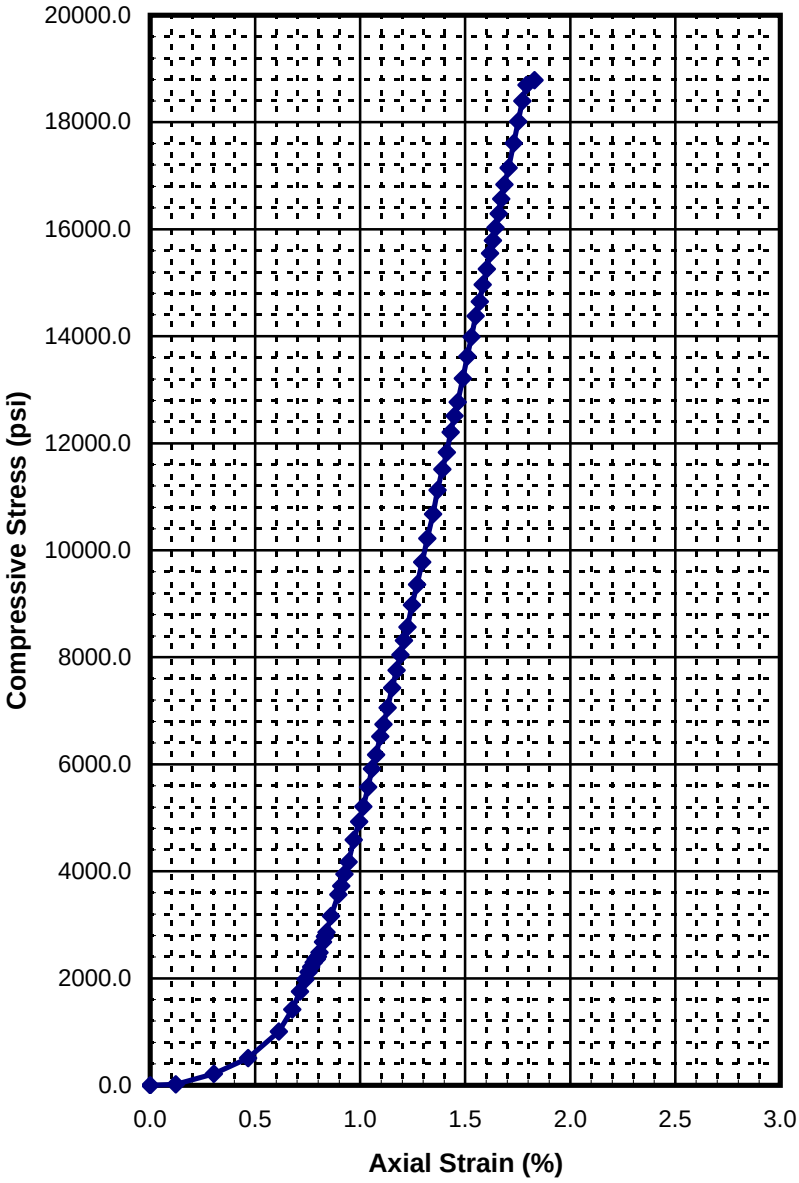
Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.9	4.309	1.757	153.3	291

Project Name:	**Suncrest Substation**
Project Number:	**27669017**
Exploration No:	**B-25** **Depth (ft): 13.2**
Description and/or Classification:	**Granodiorite, pinkish gray with black specks, coarse grained**

UNCONFINED COMPRESSION TEST

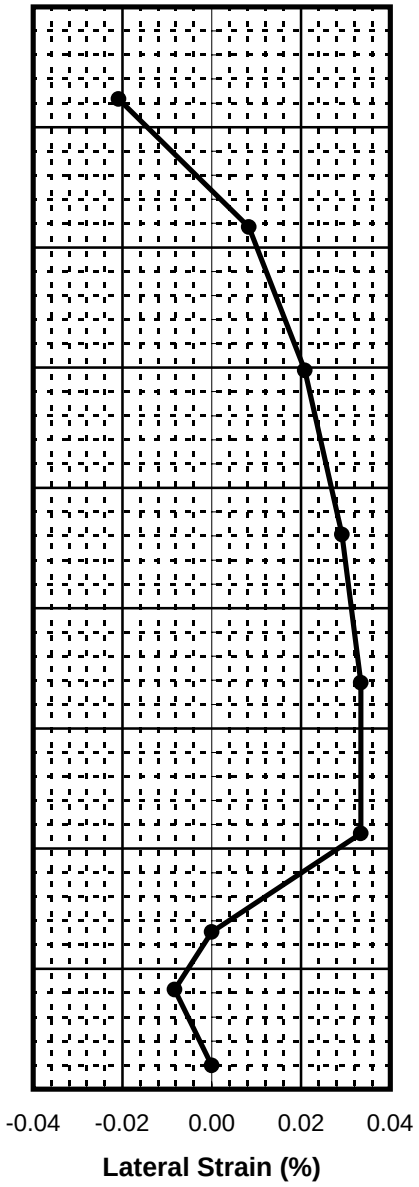
Figure: F-87

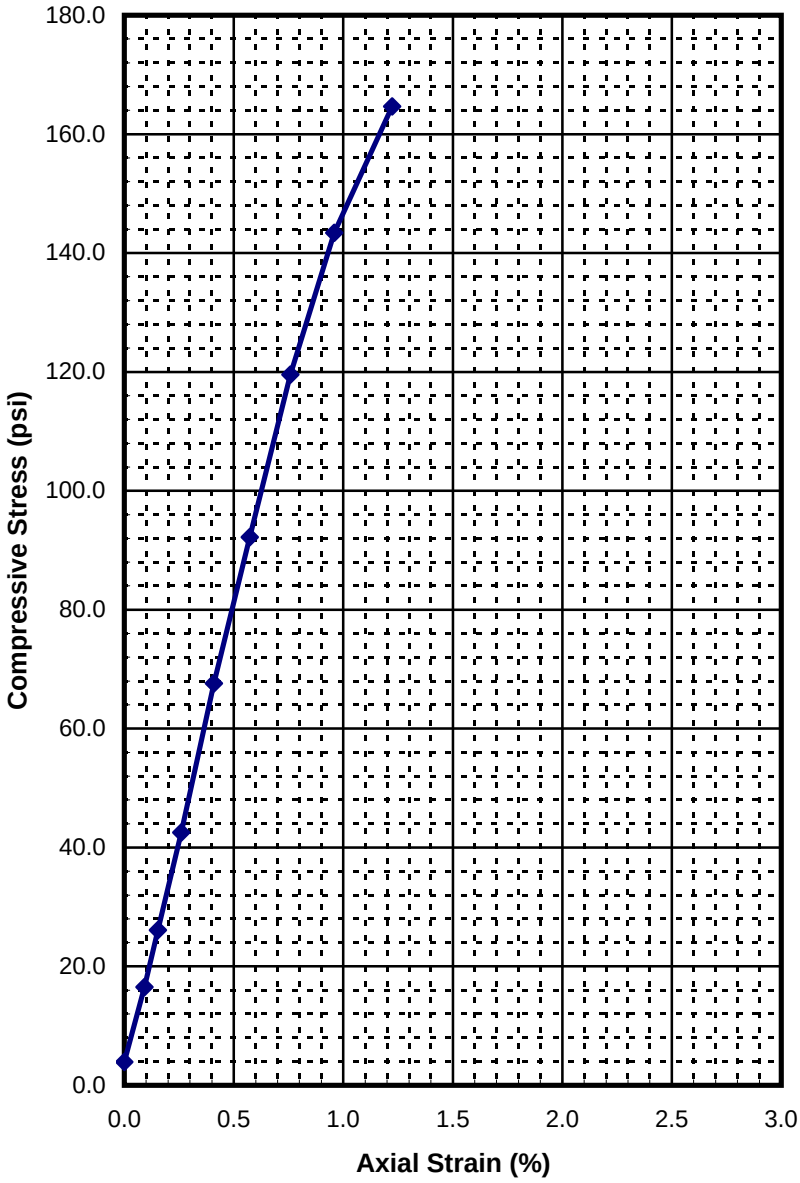




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.1	4.098	1.777	174.3	18,788

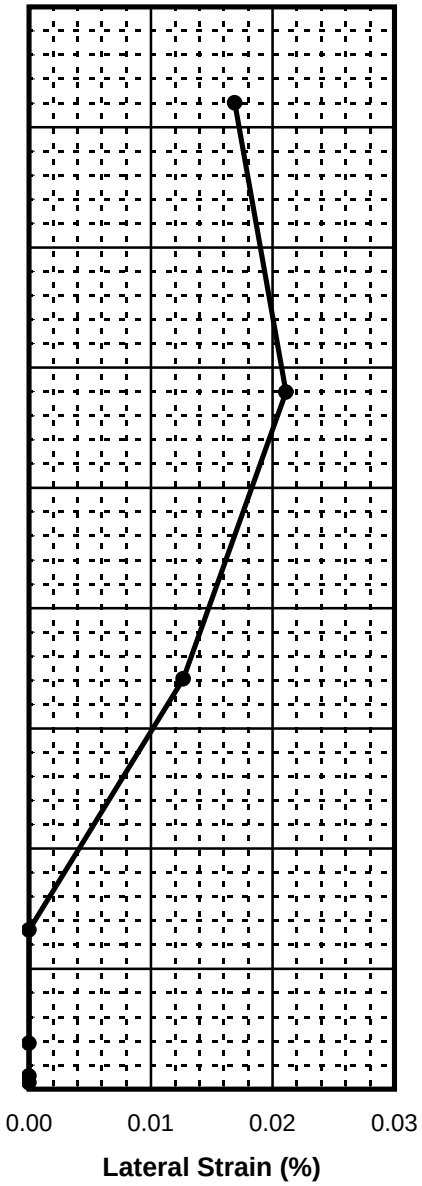
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-25** **Depth (ft): 24.0**	
Description and/or Classification:	**Granodiorite, light gray, fine grained**	**Figure: F-88**

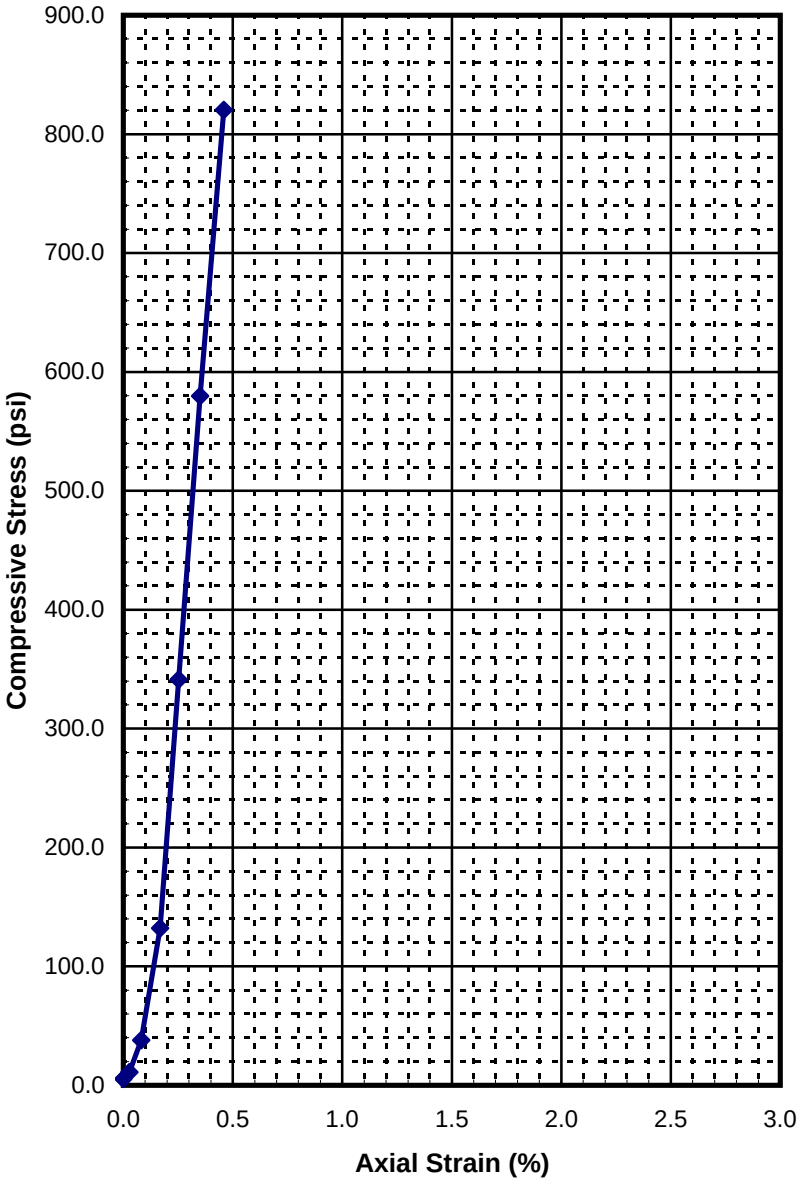




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
9.3	5.006	2.397	133.7	165

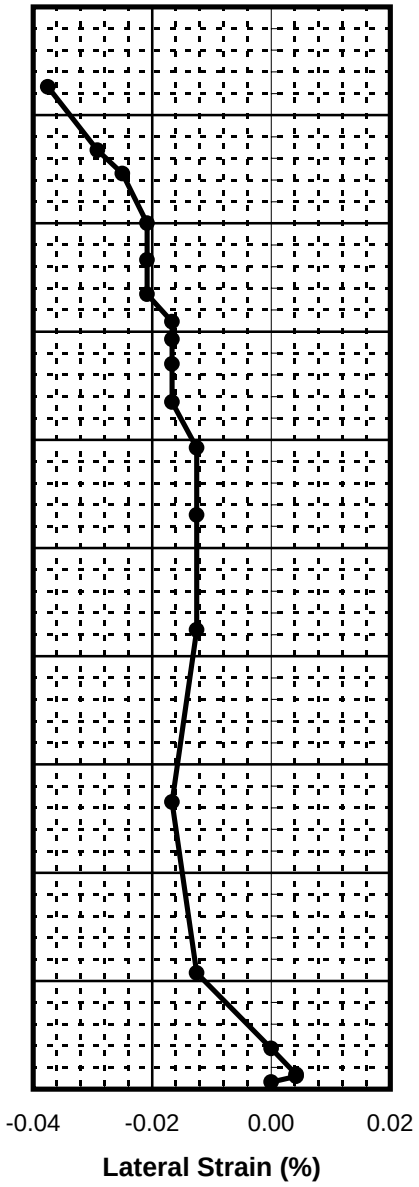
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-26** **Depth (ft): 16.1**	
Description and/or Classification:	**Metasedimentary Rock, dark gray, fine grained**	**Figure: F-89**

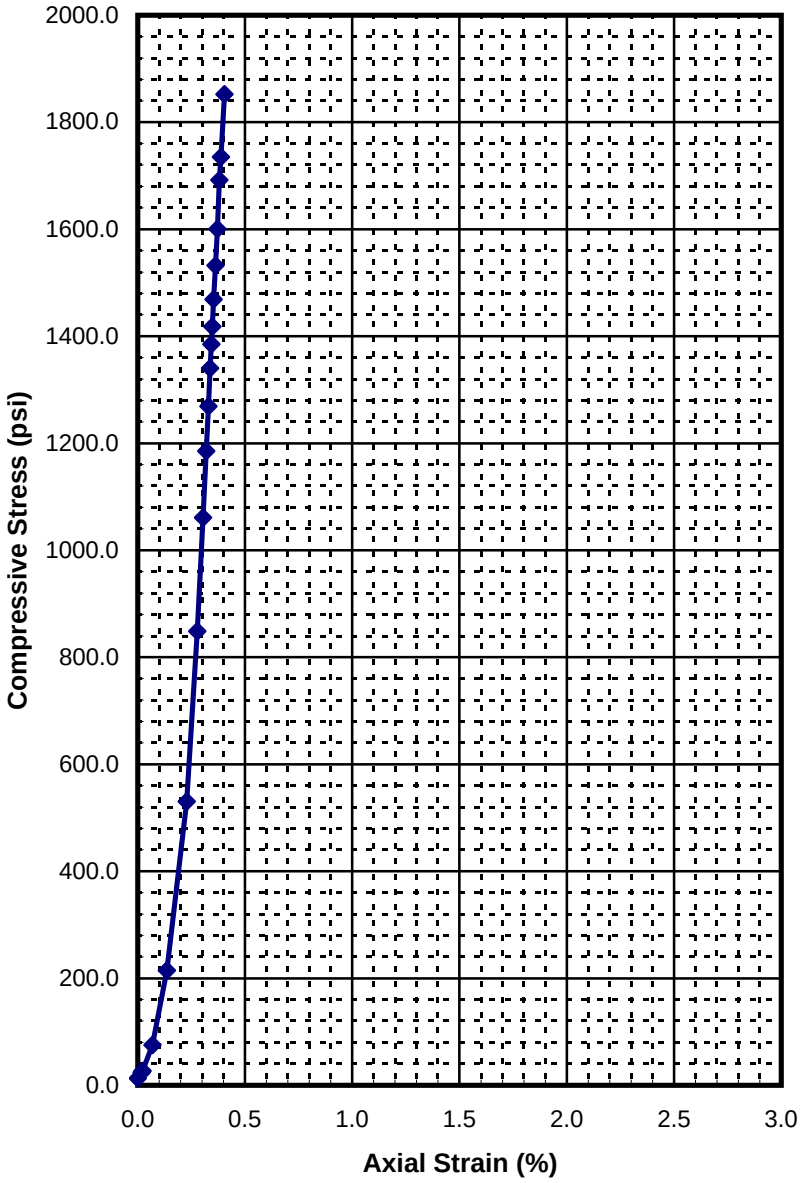




Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
1.9	5.011	2.369	154.3	820

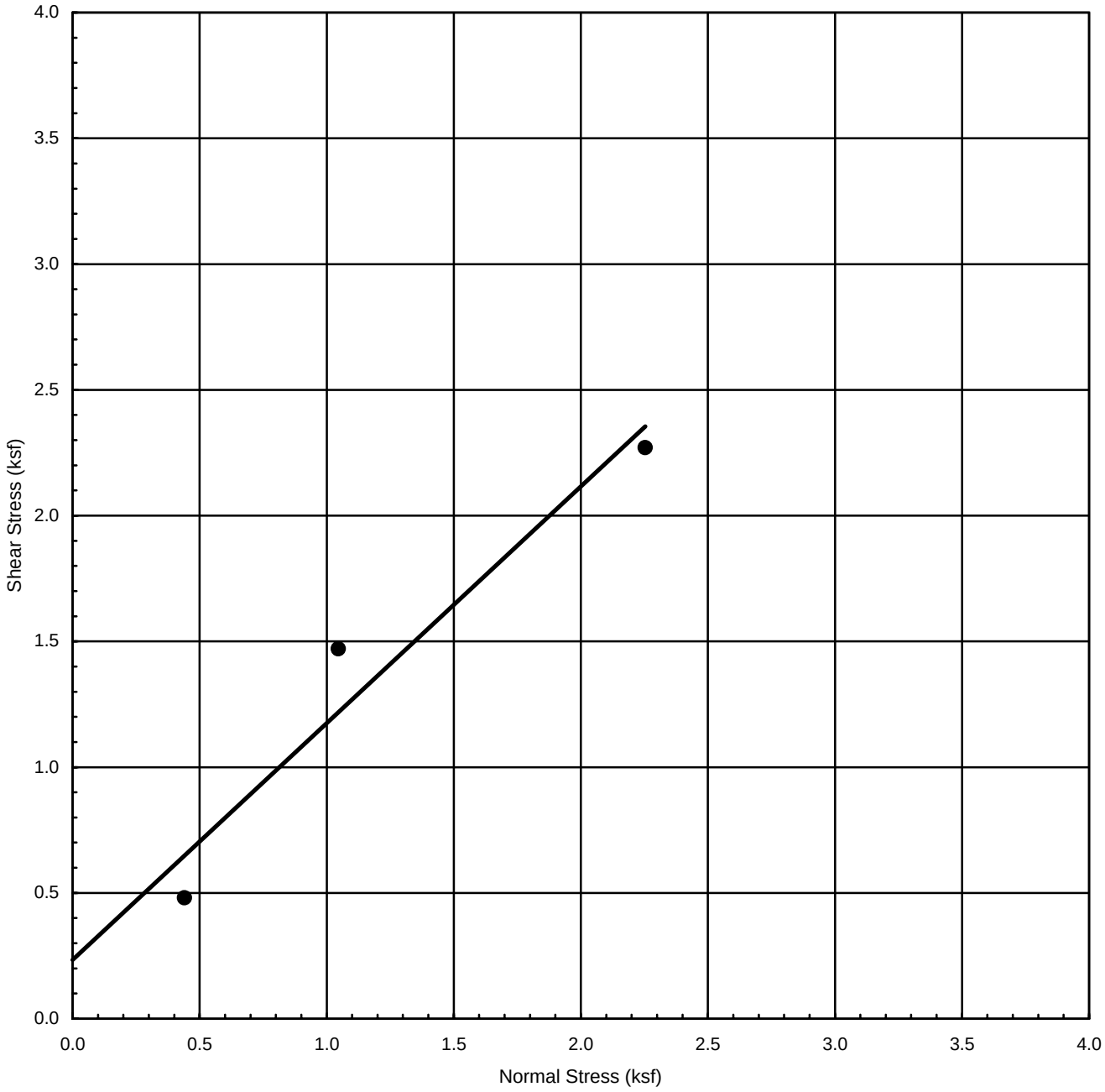
Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-26** **Depth (ft): 25.3**	
Description and/or Classification:	**Metasedimentary Rock, reddish, greenish brown, fine grained**	**Figure: F-90**





Water Content (%)	Length (in)	Diameter (in)	Wet Unit Weight (pcf)	Peak Stress (psi)
0.7	5.003	2.399	165.2	1,852

Project Name:	**Suncrest Substation**	**UNCONFINED COMPRESSION TEST**
Project Number:	**27669017**	
Exploration No:	**B-26** **Depth (ft): 28.1**	
Description and/or Classification:	**Metasedimentary Rock, light gray with white streaks, fine grained**	**Figure: F-91**



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-4	Strength Intercept (C) :	0.23	ksf	Peak	XXXXX	ksf	Ultimate	
Sample No.:	1		11.2	kPa		XXXXX	kPa		
Depth (ft | m)	0-1.5	Friction Angle (ϕ) :	43	degree		XXXXX	degree		

Description: **Yellowish red clayey Sand (SC) - Intact Sample** Shear rate : 0.008 (in/min) , 0.0203 (cm/min)

	SYMBOL	% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
	Initial / Set up	8.6	131.0	20.6	120.6	19.0	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	21.3	139.1	21.9	114.6	18.0	0.4	21.1	0.5	23.0	XXXXX	XXXXX
pre-shear	spec. 2	19.1	136.2	21.4	114.4	18.0	1.0	50.1	1.5	70.4	XXXXX	XXXXX
pre-shear	spec. 3	18.2	134.6	21.2	113.9	17.9	2.3	107.9	2.3	108.7	XXXXX	XXXXX

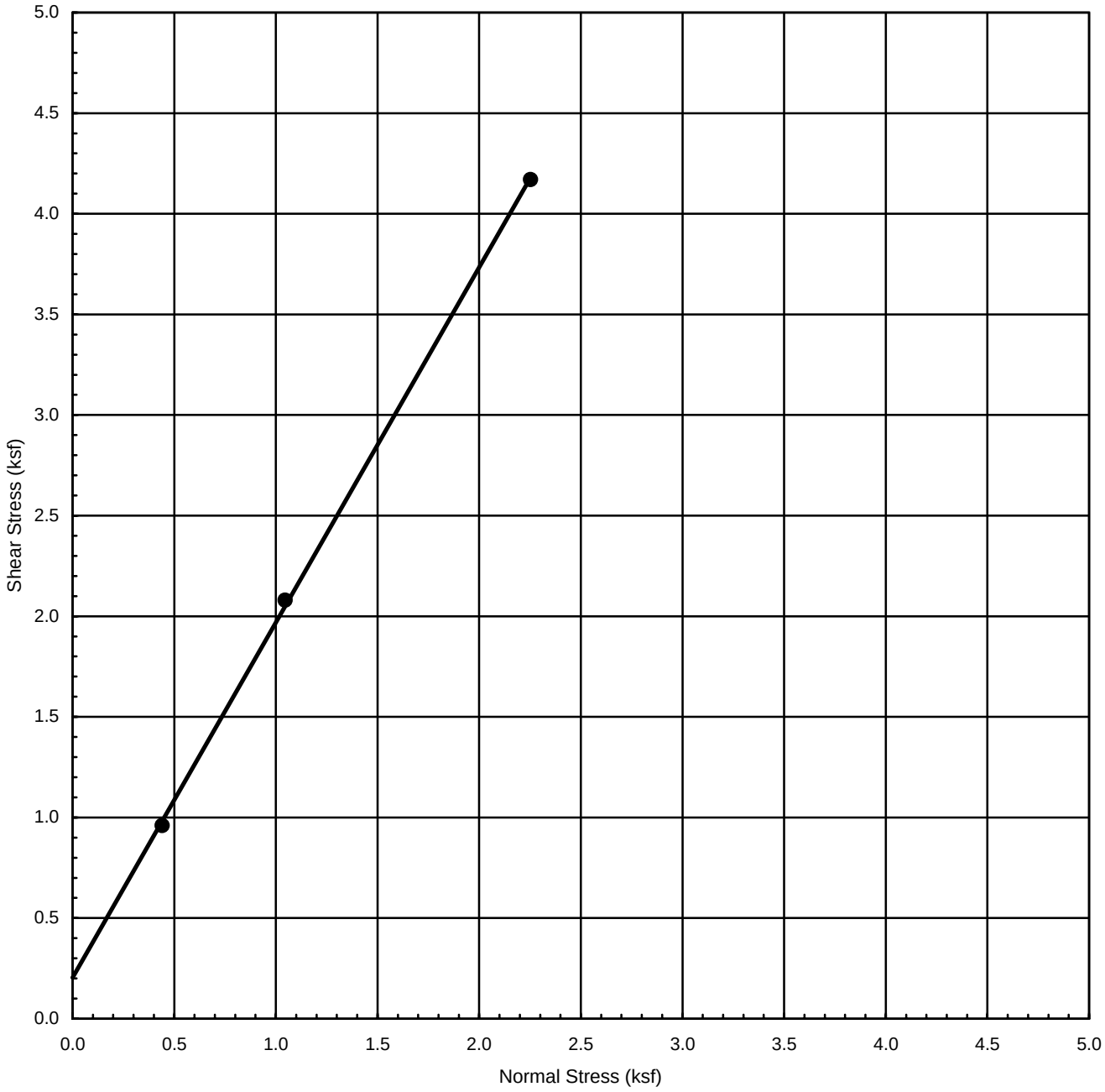
URS

Suncrest Substation

Project Number: 27669017 Date: 2/27/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-92

ds_shear plot SS B04000



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-5		Strength Intercept (C) :	0.20	ksf	Peak	XXXXX	ksf	Ultimate		
Sample No.:	3			9.8	kPa		XXXXX	kPa			
Depth (ft | m)	5.0	1.5	Friction Angle (ϕ) :	60	degree		XXXXX	degree			
Description:	**Light olive brown silty Sand (SM) - Intact Sample**					Shear rate :	0.008	(in/min) ,	0.0203	(cm/min)	

SYMBOL		% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress	
			(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(ksf)	(kPa)	(ksf)	(kPa)	(ksf)	(kPa)
Initial / Set up		5.0	130.6	20.5	124.3	19.5	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	15.2	135.2	21.2	117.4	18.4	0.4	21.1	1.0	46.0	XXXXX	XXXXX
	spec. 2	15.3	139.4	21.9	120.9	19.0	1.0	50.1	2.1	99.6	XXXXX	XXXXX
	spec. 3	16.4	152.0	23.9	130.6	20.5	2.3	107.9	4.2	199.7	XXXXX	XXXXX

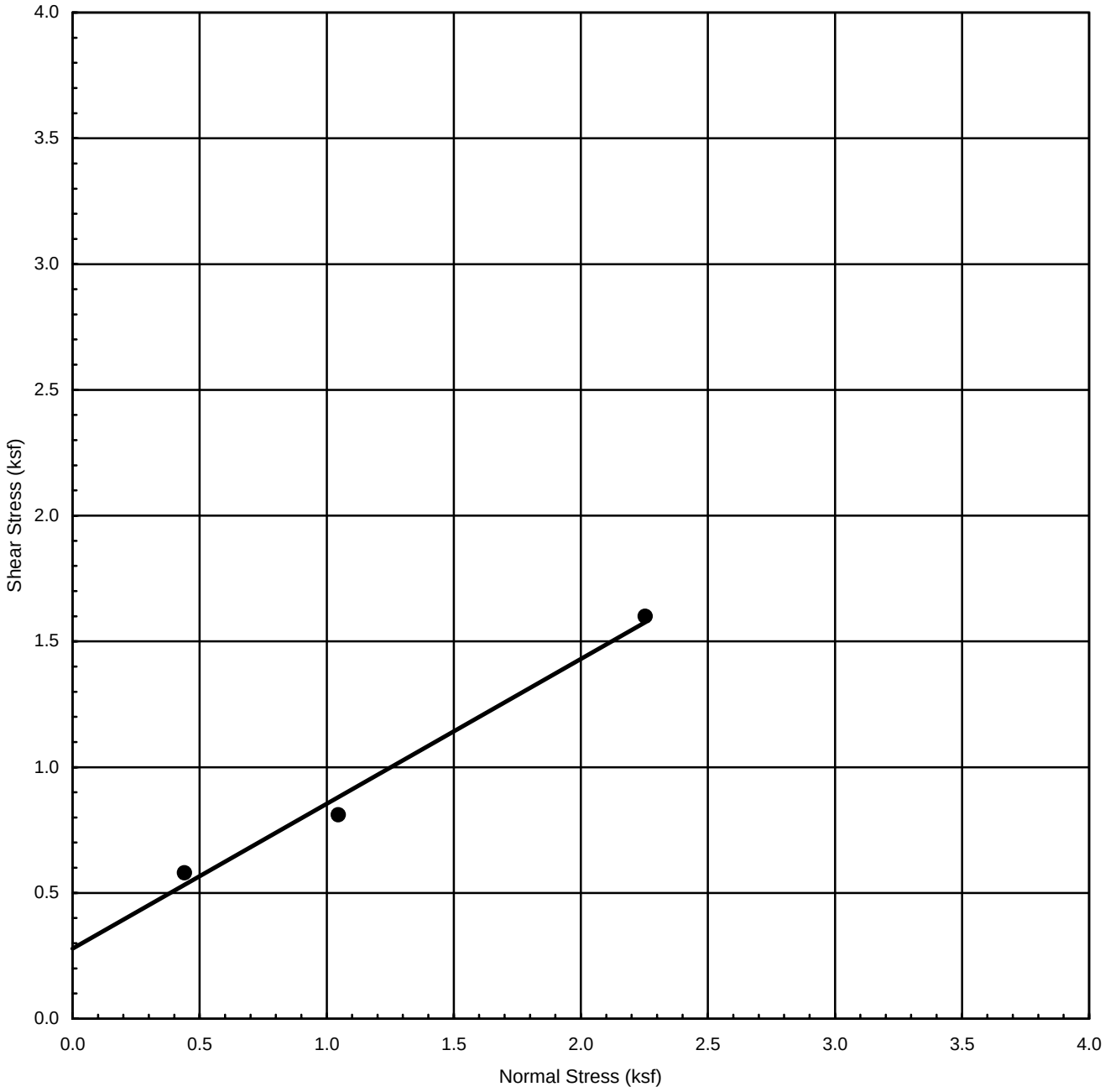
URS

Suncrest Substation

Project Number: 27669017 Date: 3/3/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-93

ds_shear plot SS B05005



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-6		Strength Intercept (C) :	0.28	ksf	Peak	XXXXX	ksf	Ultimate
Sample No.:	1			13.4	kPa		XXXXX	kPa	
Depth (ft | m)	0.5	0.2	Friction Angle (ϕ) :	30	degree		XXXXX	degree	

Description: **Dark brown sandy Clay (CL) - Intact Sample** Shear rate : 0.005 (in/min) , 0.0127 (cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		8.2	114.0	17.9	105.3	16.6	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	16.0	132.6	20.8	114.3	18.0	0.4	21.1	0.6	27.8	XXXXX	XXXXX
	spec. 2	14.5	133.4	21.0	116.5	18.3	1.0	50.1	0.8	38.8	XXXXX	XXXXX
	spec. 3	17.5	129.0	20.3	109.8	17.3	2.3	107.9	1.6	76.6	XXXXX	XXXXX

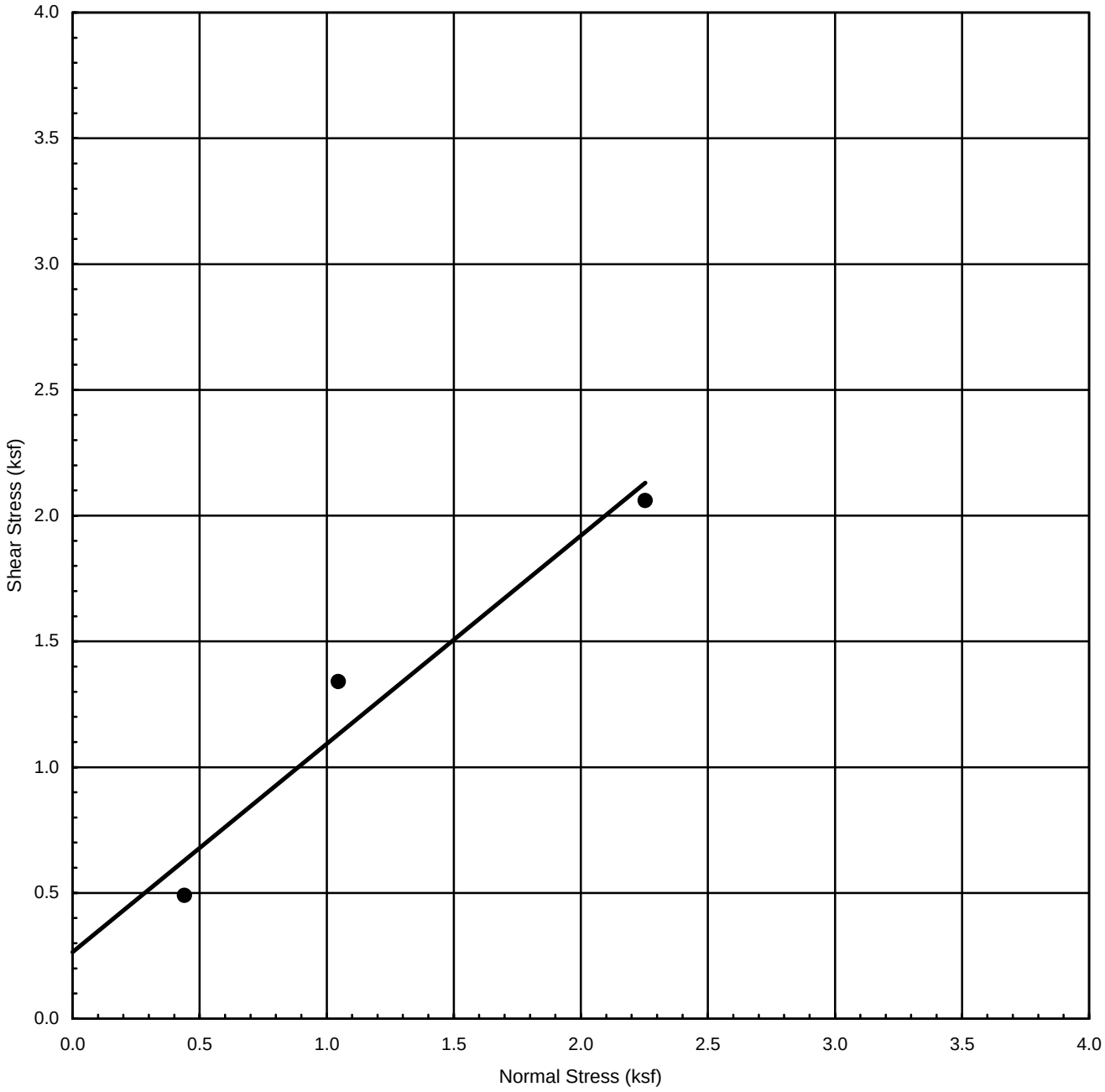
URS

Suncrest Substation

Project Number: 27669017 Date: 3/5/20009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-94

ds_shear plot SS B06001



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-7		Strength Intercept (C) :	0.26	ksf	Peak	XXXXX	ksf	Ultimate
Sample No.:	1			12.7	kPa		XXXXX	kPa	
Depth (ft | m)	5	1.5	Friction Angle (ϕ) :	40	degree		XXXXX	degree	

Description: **Brownish yellow clayey Sand (SC) - Intact Sample** Shear rate : 0.008 (in/min) , 0.0203 (cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		5.1	128.4	20.2	122.2	19.2	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	18.1	140.8	22.1	119.2	18.7	0.4	21.1	0.5	23.5	XXXXX	XXXXX
	spec. 2	16.8	141.5	22.2	121.2	19.0	1.0	50.1	1.3	64.2	XXXXX	XXXXX
	spec. 3	18.1	144.0	22.6	122.0	19.2	2.3	107.9	2.1	98.6	XXXXX	XXXXX

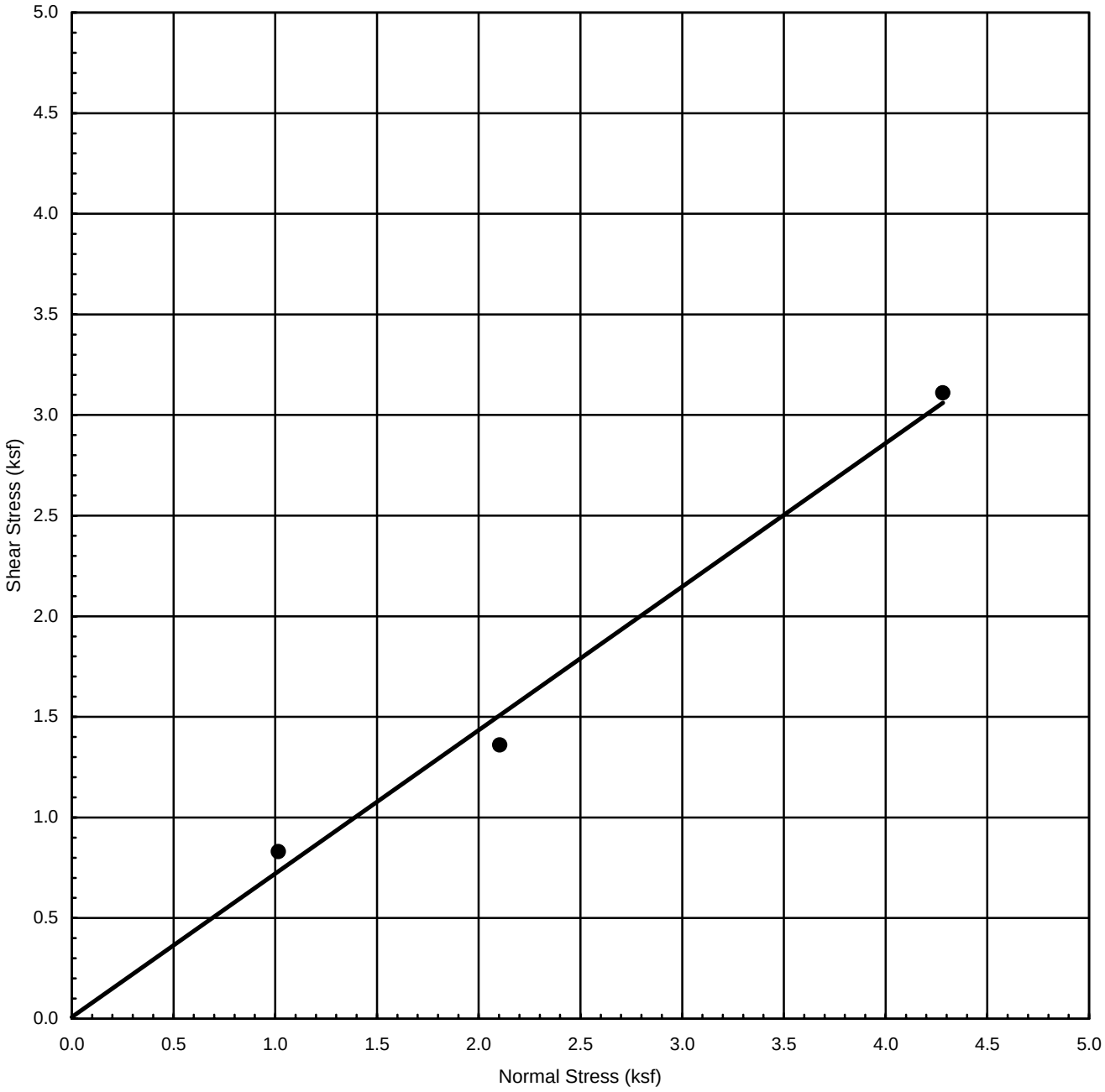
URS

Suncrest Substation

Project Number: 27669017 Date: 3/6/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-95

ds_shear plot SS B07005



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	TP-9		Strength Intercept (C) :	0.01	ksf	Peak	XXXXX	ksf	Ultimate		
Sample No.:	4			0.4	kPa		XXXXX	kPa			
Depth (ft | m)	5.5	1.7	Friction Angle (ϕ) :	35	degree		XXXXX	degree			
Description:	**Yellowish brown clayey Sand (SC) - Remolded to 90% RC**				Shear rate :	0.008	(in/min) ,	0.0203	(cm/min)		

SYMBOL		% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress	
			(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(ksf)	(kPa)	(ksf)	(kPa)	(ksf)	(kPa)
Initial / Set up		9.1	127.9	20.1	117.3	18.4	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	19.9	132.5	20.8	110.5	17.4	1.0	48.6	0.8	39.7	XXXXX	XXXXX
	spec. 2	19.3	138.2	21.7	115.8	18.2	2.1	100.7	1.4	65.1	XXXXX	XXXXX
	spec. 3	18.3	139.9	22.0	118.3	18.6	4.3	205.0	3.1	148.9	XXXXX	XXXXX

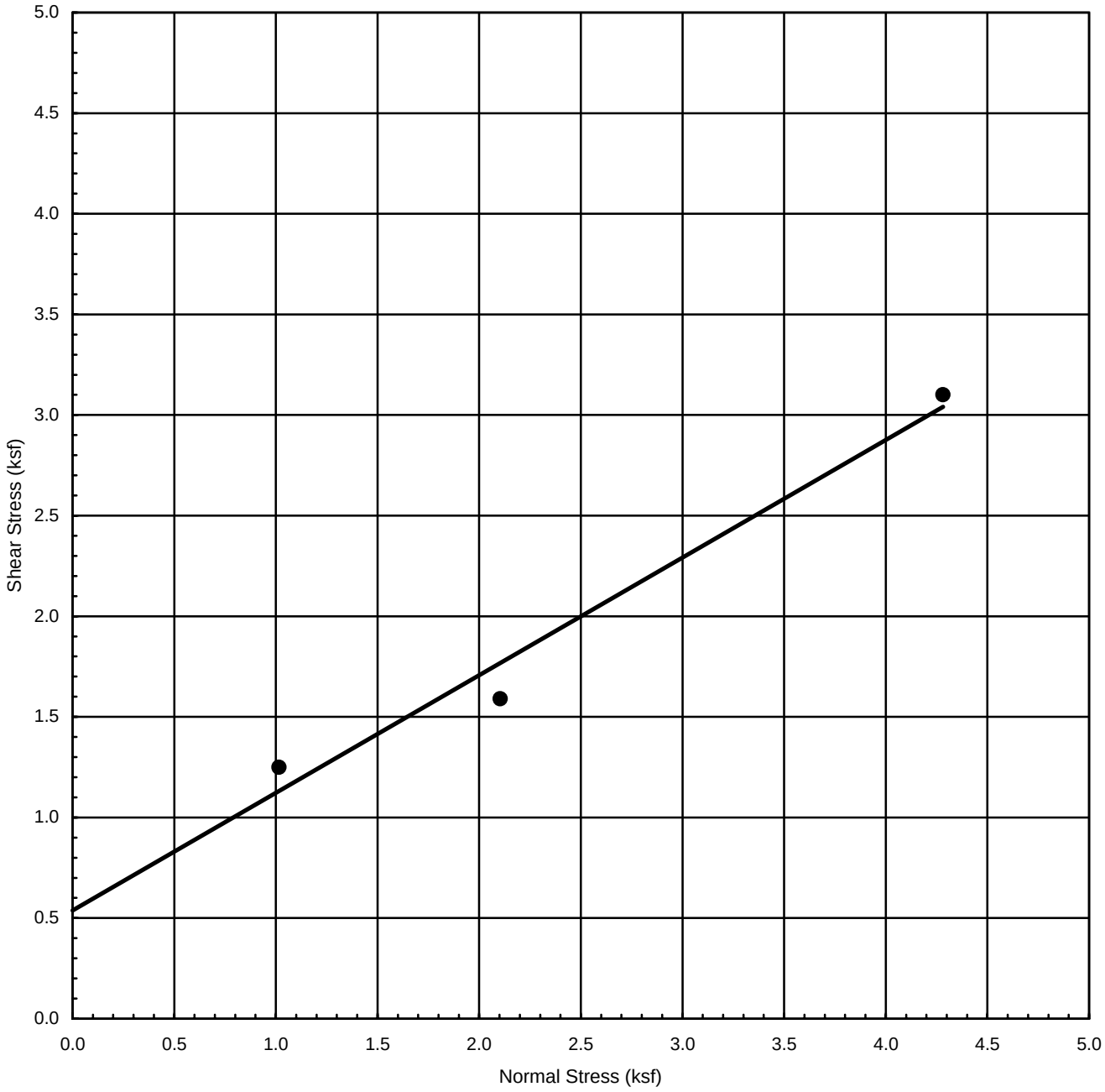
URS

Suncrest Substation

Project Number: 27669017 Date: 3/9/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-96

ds_shear plot SS TP09005



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	TP-10		Strength Intercept (C) :	0.54	ksf	Peak	XXXXX	ksf	Ultimate		
Sample No.:	3			25.8	kPa		XXXXX	kPa			
Depth (ft | m)	5.0	1.5	Friction Angle (ϕ) :	30	degree		XXXXX	degree			
Description:	**Yellowish brown clayey Sand (SC) - Remolded to 90% RC**				Shear rate :	0.008	(in/min) ,	0.0203	(cm/min)		

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		10.5	129.2	20.3	117.0	18.4	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	18.6	135.5	21.3	114.2	18.0	1.0	48.6	1.3	59.9	XXXXX	XXXXX
	spec. 2	18.8	129.2	20.3	108.7	17.1	2.1	100.7	1.6	76.1	XXXXX	XXXXX
	spec. 3	18.8	130.1	20.4	109.5	17.2	4.3	205.0	3.1	148.4	XXXXX	XXXXX

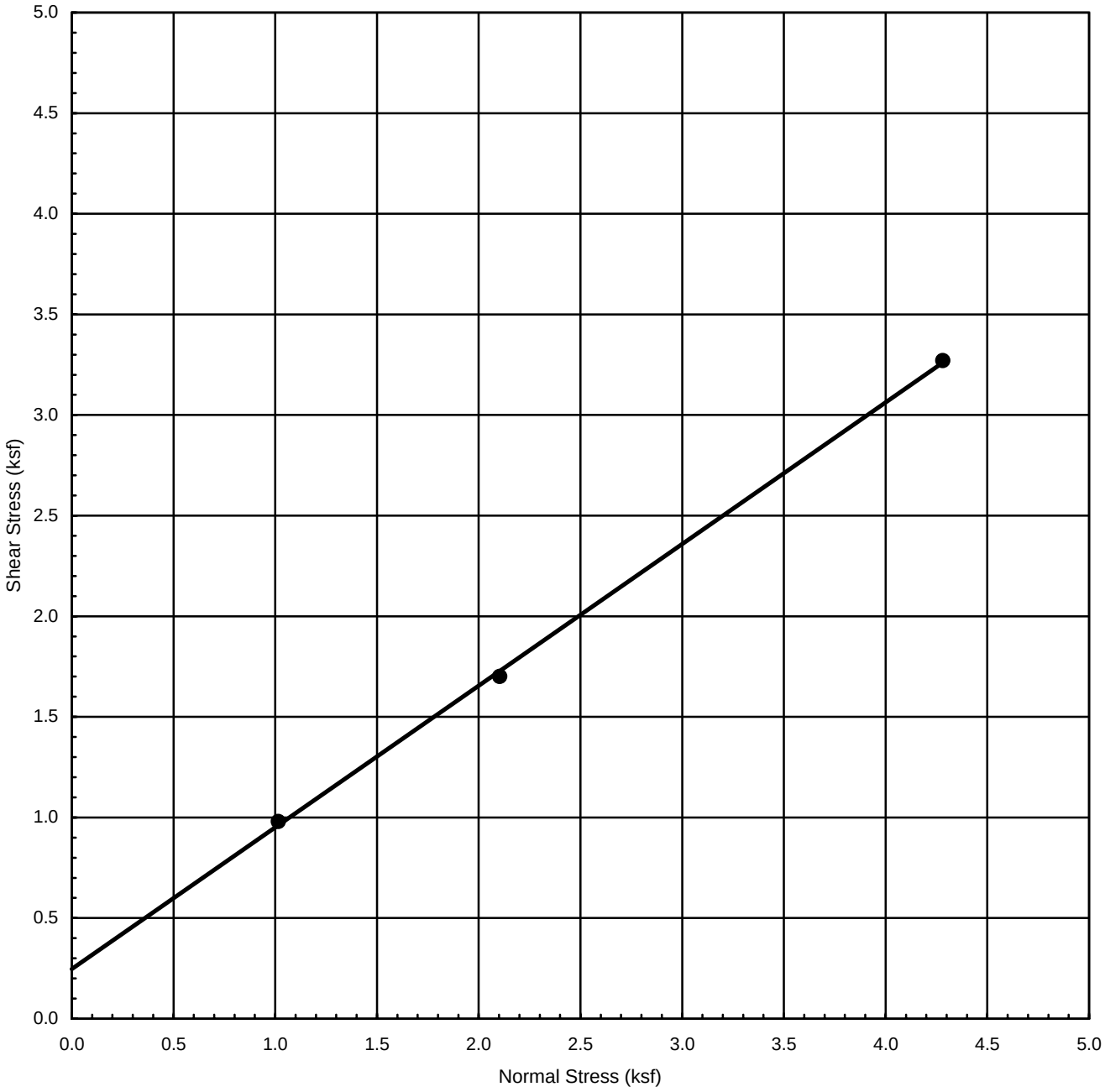
URS

Suncrest Substation

Project Number: 27669017 Date: 3/10/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-97

ds_shear plot SS TP10005



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	TP-13		Strength Intercept (C) :	0.25	ksf	Peak	XXXXX	ksf	Ultimate
Sample No.:	4			11.8	kPa		XXXXX	kPa	
Depth (ft | m)	4.0	1.2	Friction Angle (ϕ) :	35	degree		XXXXX	degree	

Description: **Yellowish brown clayey Sand (SC) - Remolded to 90% RC** Shear rate : 0.008 (in/min) , 0.0203 (cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		8.4	125.3	19.7	115.5	18.2	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	14.6	135.5	21.3	118.2	18.6	1.0	48.6	1.0	46.9	XXXXX	XXXXX
	spec. 2	14.9	134.9	21.2	117.4	18.4	2.1	100.7	1.7	81.4	XXXXX	XXXXX
	spec. 3	14.5	136.2	21.4	119.0	18.7	4.3	205.0	3.3	156.6	XXXXX	XXXXX

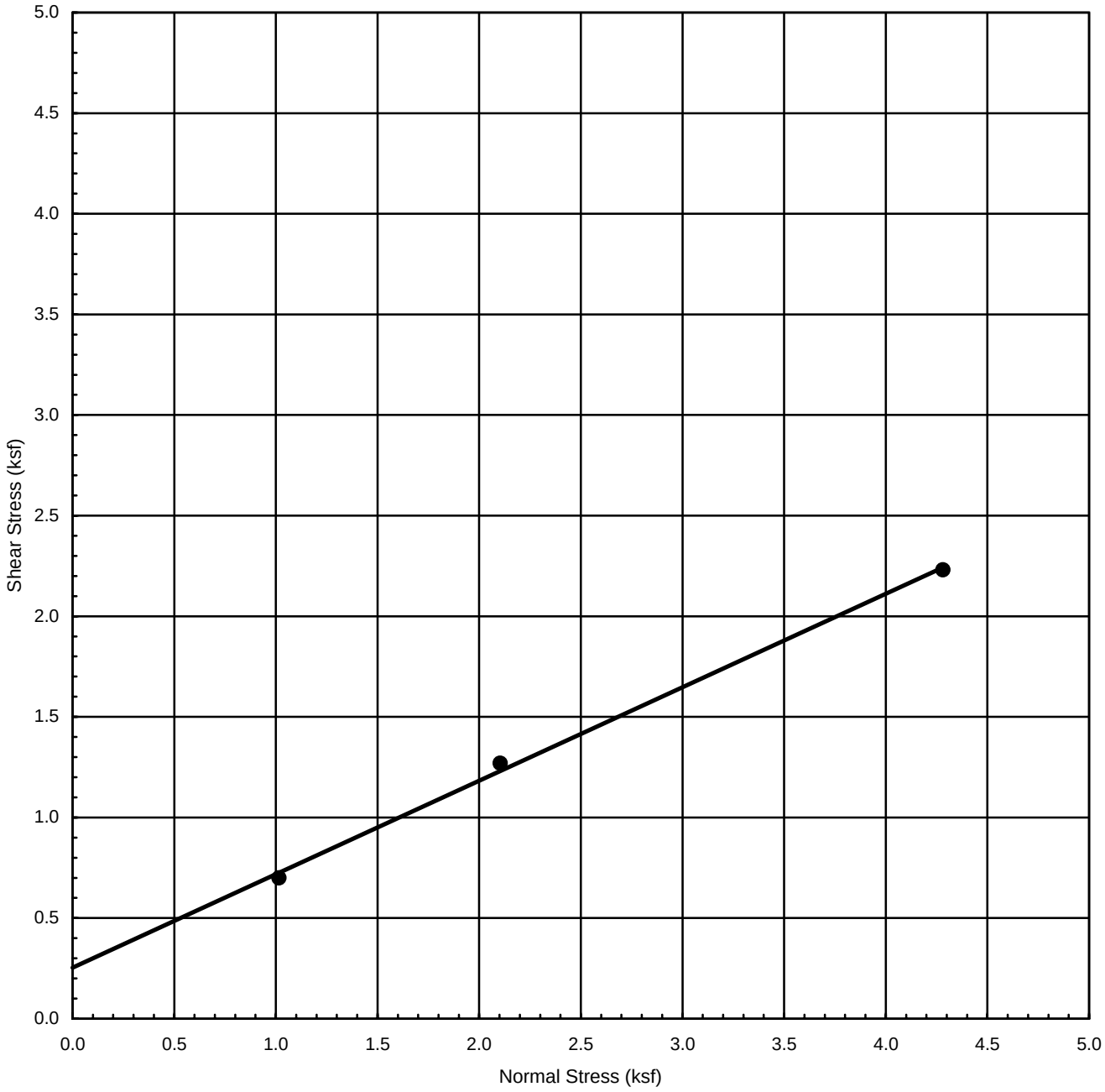
URS

Suncrest Substation

Project Number: 27669017 Date: 3/12/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-98

ds_shear plot SS TP13004



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	TP-15		Strength Intercept (C) :	0.25	ksf	Peak	XXXXX	ksf	Ultimate
Sample No.:	1			12.2	kPa		XXXXX	kPa	
Depth (ft | m)	0.5	0.2	Friction Angle (ϕ) :	25	degree		XXXXX	degree	

Description: **Dark reddish brown clayey Sand (SC) - Remolded to 90% RC** Shear rate : 0.008 (in/min) , 0.0203 (cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		10.3	121.6	19.1	110.2	17.3	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	20.7	134.8	21.2	111.7	17.6	1.0	48.6	0.7	33.5	XXXXX	XXXXX
	spec. 2	19.4	132.7	20.9	111.2	17.5	2.1	100.7	1.3	60.8	XXXXX	XXXXX
	spec. 3	18.6	136.9	21.5	115.4	18.1	4.3	205.0	2.2	106.8	XXXXX	XXXXX

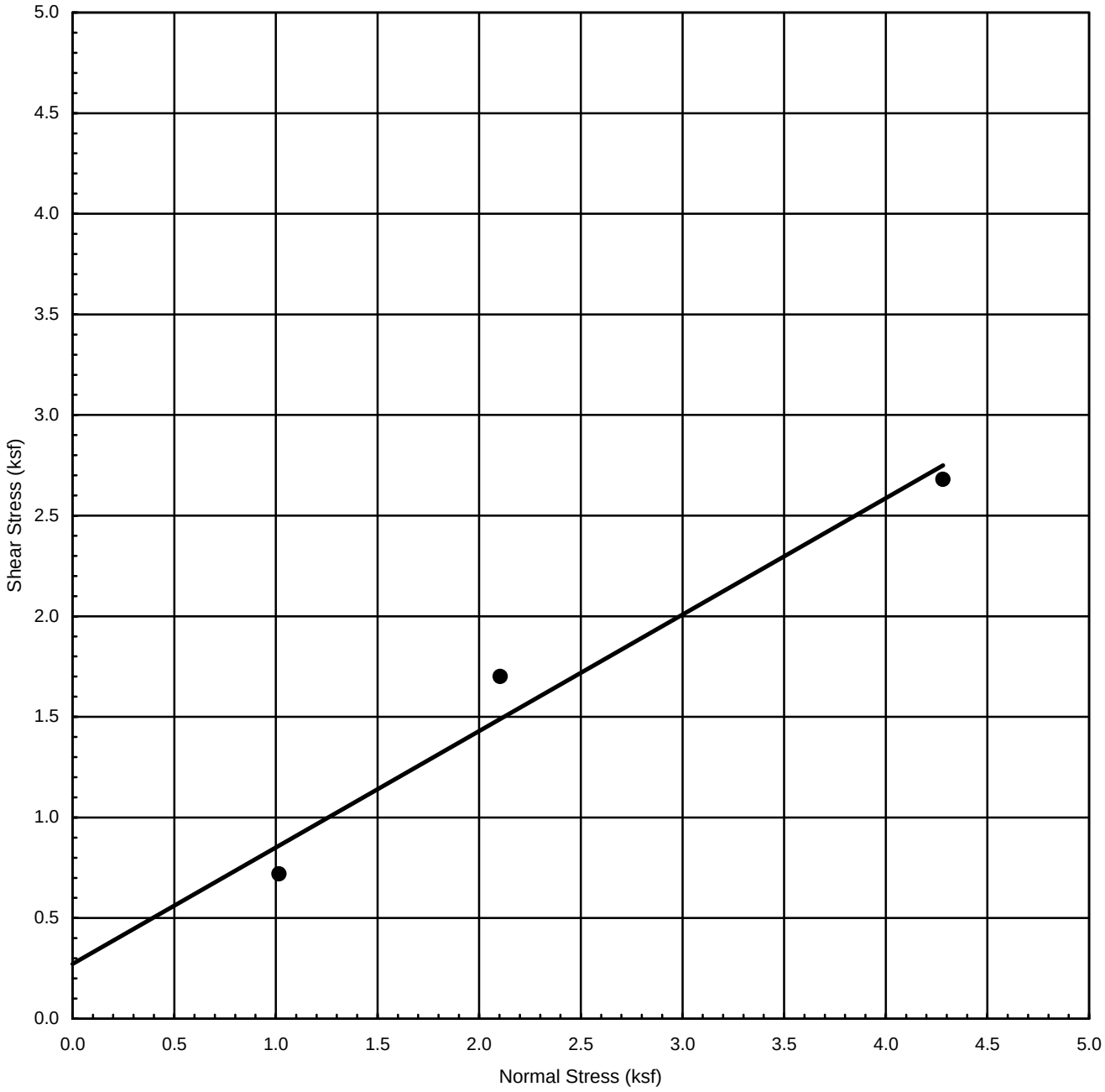
URS

Suncrest Substation

Project Number: 27669017 Date: 3/11/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-99

ds_shear plot SS TP15001



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	TP-17		Strength Intercept (C) :	0.27	ksf	Peak	XXXXX	ksf	Ultimate		
Sample No.:	2			13.1	kPa		XXXXX	kPa			
Depth (ft | m)	2.0	0.6	Friction Angle (ϕ) :	30	degree		XXXXX	degree			
Description:	**Dark brown clayey Sand (SC) - Remolded to 90% RC**					Shear rate :	0.008	(in/min) ,	0.0203	(cm/min)	

SYMBOL		% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress	
			(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(ksf)	(kPa)	(ksf)	(kPa)	(ksf)	(kPa)
Initial / Set up		7.8	130.3	20.5	120.9	19.0	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	16.7	135.0	21.2	115.7	18.2	1.0	48.6	0.7	34.5	XXXXX	XXXXX
	spec. 2	15.4	137.4	21.6	119.1	18.7	2.1	100.7	1.7	81.4	XXXXX	XXXXX
	spec. 3	14.3	144.9	22.8	126.7	19.9	4.3	205.0	2.7	128.3	XXXXX	XXXXX

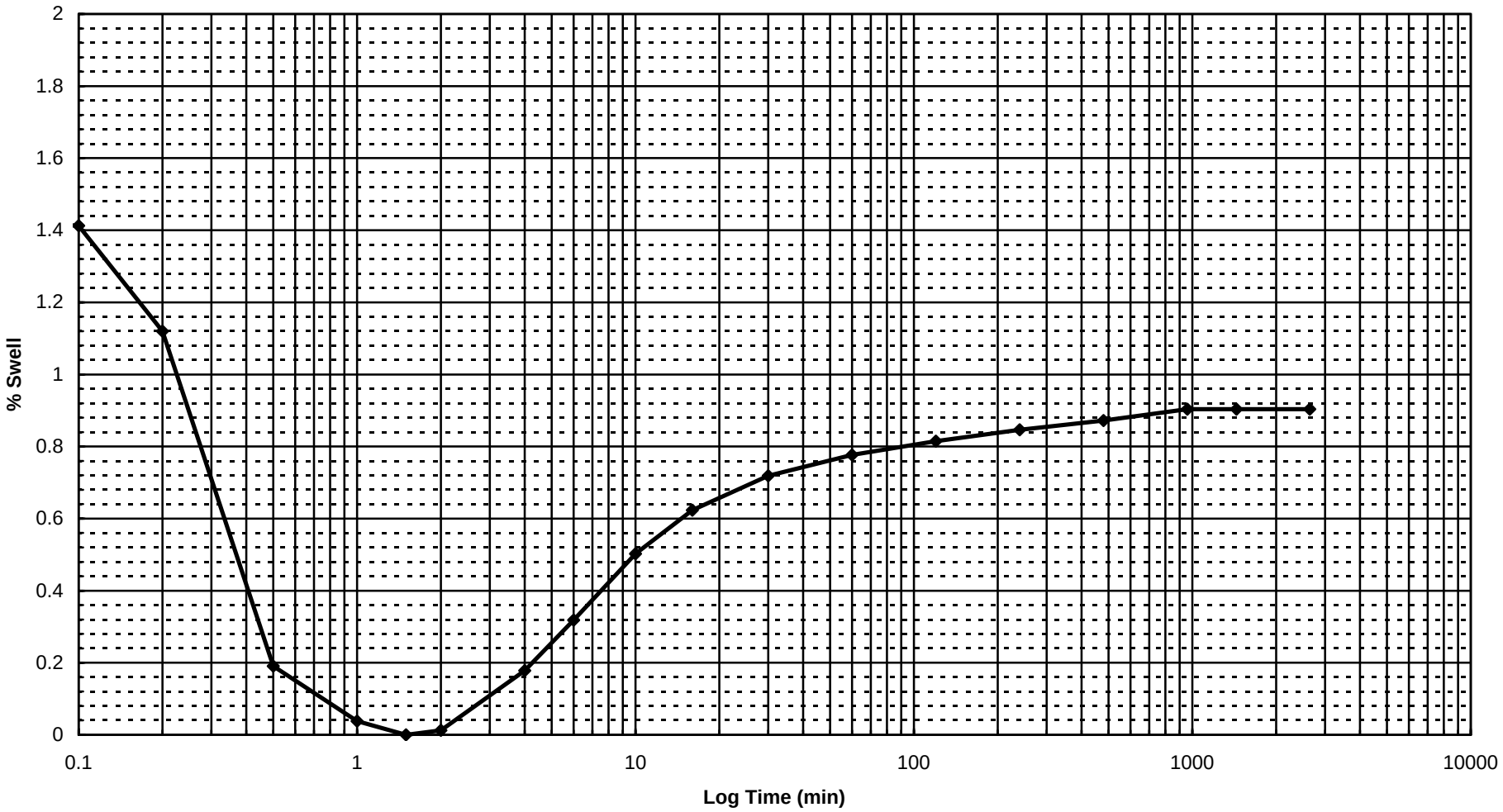
URS

Suncrest Substation

Project Number: 27669017 Date: 3/13/2009

DIRECT SHEAR TEST
ASTM D 3080
Figure: F-100

ds_shear plot SS TP17002



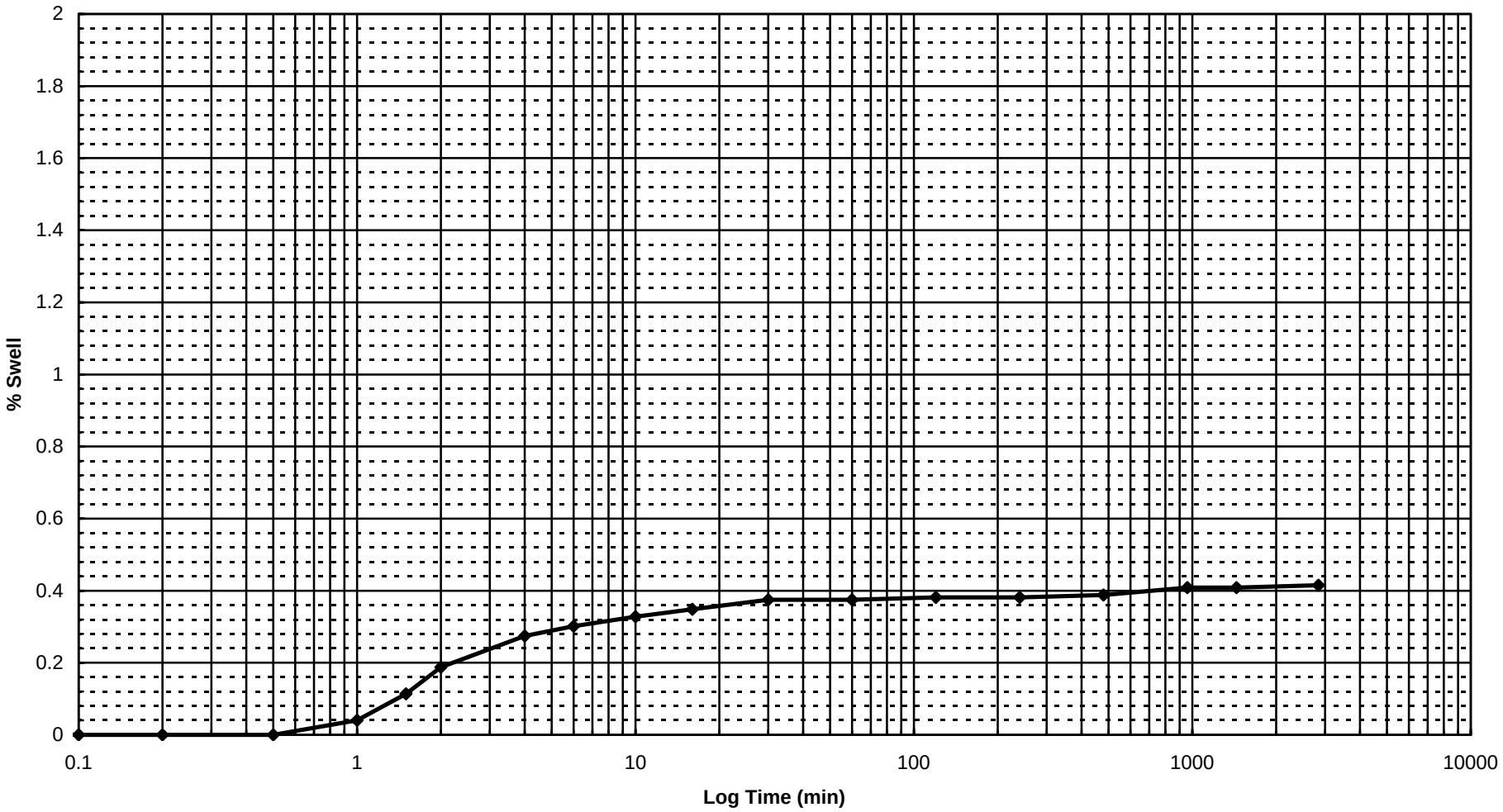
Expansion Index, EI @ S=50%:	0 to 20	21 to 50	51 to 90	91 to 130	> 130
Potential Expansion:	Very Low	Low	Medium	High	Very High

Exploration No.	Sample No.	Depth (ft)	WC (%)	DUW (pcf)	Saturation (%)	EI S meas.	EI S=50%	Description and/or Classification
TP-09	2	1.5	12.0	106.4	54	15	17	Dark reddish brown clayey Sand (SC)

PROJECT NAME: **Suncrest Substation**
PROJECT NUMBER: **27669017**

EXPANSION INDEX TEST
ASTM D 4829

Figure: F-101



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
TP-10	1	1.5	9.2	114.8	50	4	4	Brown silty Clay (CL-ML)

PROJECT NAME: **Suncrest Substation**
PROJECT NUMBER: **27669017**

EXPANSION INDEX TEST
ASTM D 4829

Figure: F-102

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-4
Project Name: Suncrest Substation | Sample No.: 4
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	c8
Mass Container + Wet Soil (g), M1	203.24
Mass Container + Dry Soil (g), M2	199.56
Mass Container (g), M3	71.65
Water Content, w (%)	2.88

Resistivity Test: California Test Method 643

Mininum Resistence value: 7,200 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	582.1	599.62	617.96	641.23	659.4
Weight of mixing bowl (g):	152.76	152.76	152.76	152.76	152.76
Wet weight of Soil (g):	429.34	446.86	465.2	488.47	506.64
Amount of water added (ml):	0	20	20	25	20
Soil Box + Wet Soil (g), M5	250.20	248.63	266.60	277.73	275.55
Weight of Soil Box (g), M6	126.97	126.97	126.97	126.97	126.97
Wt. of Wet Soil for test (g), M7	123.23	121.66	139.63	150.76	148.58
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	9.9	33.3	56.5	83.8	87.0
Resistivity Reading (ohm)	38,500	14,000	7,700	7,200	7,550
Resistence (ohm-cm)	38,500	14,000	7,700	7,200	7,550

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.00

Temperature : 21.8 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 54

recorded mg of SO_4 in sample, x, = 18 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 75

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 5

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure F-103

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-5
Project Name: Suncrest Substation | Sample No.: 1A
Project Engineer: JN | Depth (ft): 0.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	S47
Mass Container + Wet Soil (g), M1	180.92
Mass Container + Dry Soil (g), M2	174.61
Mass Container (g), M3	82.64
Water Content, w (%)	6.86

Resistivity Test: California Test Method 643

Mininum Resistence value: 8,150 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	515.24	533.98	557.07		
Weight of mixing bowl (g):	135.83	135.83	135.83		
Wet weight of Soil (g):	379.41	398.15	421.24		
Amount of water added (ml):	0	20	25		
Soil Box + Wet Soil (g), M5	242.77	268.87	277.47		
Weight of Soil Box (g), M6	124.66	124.66	124.66		
Wt. of Wet Soil for test (g), M7	118.11	144.21	152.81		
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	19.9	64.6	91.8		
Resistivity Reading (ohm)	16,500	8,150	8,200		
Resistence (ohm-cm)	16,500	8,150	8,200		

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.15

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 9

recorded mg of SO_4 in sample, x, = 3 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80)* (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 90

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 6

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure F-104

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 Exploration No.: B-7
Project Name: Suncrest Substation Sample No.: 1A
Project Engineer: JN Depth (ft): 0 - 5.0

Initial Visual Classification Symbol: CL

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up Water Content	Minus No. 8 or ( )
Container No.	s11
Mass Container + Wet Soil (g), M1	218.69
Mass Container + Dry Soil (g), M2	207.73
Mass Container (g), M3	95.8
Water Content, w (%)	9.79

Resistivity Test: California Test Method 643

Mininum Resistence value: 6,400 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	479.33	496.7	519.62	531.09	
Weight of mixing bowl (g):	140.87	140.87	140.87	140.87	
Wet weight of Soil (g):	338.46	355.83	378.75	390.22	
Amount of water added (ml):	0	20	25	15	
Soil Box + Wet Soil (g), M5	230.17	263.29	271.31	266.75	
Weight of Soil Box (g), M6	127.19	127.19	127.19	127.19	
Wt. of Wet Soil for test (g), M7	102.98	136.1	144.12	139.56	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	20.7	64.9	89.0	84.0	
Resistivity Reading (ohm)	25,000	6,450	6,400	7,100	
Resistence (ohm-cm)	25,000	6,450	6,400	7,100	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.16

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80)* (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 120

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 8

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure F-105

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-11
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 4.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s20
Mass Container + Wet Soil (g), M1	104.26
Mass Container + Dry Soil (g), M2	102.95
Mass Container (g), M3	76.34
Water Content, w (%)	4.92

Resistivity Test: California Test Method 643

Mininum Resistence value: 5,100 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	514.31	532.63	556.5	579.76	
Weight of mixing bowl (g):	189.56	189.56	189.56	189.56	
Wet weight of Soil (g):	324.75	343.07	366.94	390.2	
Amount of water added (ml):	0	20	25	25	
Soil Box + Wet Soil (g), M5	231.22	234.06	265.03	266.71	
Weight of Soil Box (g), M6	126.96	126.96	126.96	126.96	
Wt. of Wet Soil for test (g), M7	104.26	107.1	138.07	139.75	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	11.6	34.9	75.1	87.9	
Resistivity Reading (ohm)	92,500	13,000	5,100	5,300	
Resistence (ohm-cm)	92,500	13,000	5,100	5,300	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 5.58

Temperature : 21.4 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 240

recorded mg of SO_4 in sample, x, = 80 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 75

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 5

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/5/2009 Checked By: TJO

Figure: F-106

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-12
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s25
Mass Container + Wet Soil (g), M1	114.71
Mass Container + Dry Soil (g), M2	114.02
Mass Container (g), M3	99.03
Water Content, w (%)	4.60

Resistivity Test: California Test Method 643

Mininum Resistence value: 7,100 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	580.84	603.35	626.81	654.36	
Weight of mixing bowl (g):	189.69	189.69	189.69	189.69	
Wet weight of Soil (g):	391.15	413.66	437.12	464.67	
Amount of water added (ml):	0	25	25	30	
Soil Box + Wet Soil (g), M5	248.43	254.85	281.32	285.33	
Weight of Soil Box (g), M6	130.61	130.61	130.61	130.61	
Wt. of Wet Soil for test (g), M7	117.82	124.24	150.71	154.72	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	13.9	46.0	84.8	105.6	
Resistivity Reading (ohm)	265,000	14,000	7,100	7,200	
Resistence (ohm-cm)	265,000	14,000	7,100	7,200	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.30

Temperature : 21.2 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 3

recorded mg of SO_4 in sample, x, = 1 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 60

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 4

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/5/2009 Checked By: TJO

Figure: F-107

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-17
Project Name: Suncrest Substation | Sample No.: 1A
Project Engineer: JN | Depth (ft): 0 ~ 5.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s34
Mass Container + Wet Soil (g), M1	242.83
Mass Container + Dry Soil (g), M2	237.5
Mass Container (g), M3	118.03
Water Content, w (%)	4.46

Resistivity Test: California Test Method 643

Mininum Resistence value: 13,000 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	593.33	611.87	630.54	653.21	663.85
Weight of mixing bowl (g):	147.46	147.46	147.46	147.46	147.46
Wet weight of Soil (g):	445.87	464.41	483.08	505.75	516.39
Amount of water added (ml):	0	20	20	25	15
Soil Box + Wet Soil (g), M5	250.39	264.33	290.84	294.87	288.59
Weight of Soil Box (g), M6	130.63	130.63	130.63	130.63	130.63
Wt. of Wet Soil for test (g), M7	119.76	133.7	160.21	164.24	157.96
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	14.0	44.9	84.6	106.7	96.9
Resistivity Reading (ohm)	165,000	27,000	13,000	13,000	13,500
Resistence (ohm-cm)	165,000	27,000	13,000	13,000	13,500

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.86

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 9

recorded mg of SO_4 in sample, x, = 3 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = 0 = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 225

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 15

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/16/2009 Checked By: TJO

Figure: F-108

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-18
Project Name: Suncrest Substation | Sample No.: 3
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: CL

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s44
Mass Container + Wet Soil (g), M1	270.29
Mass Container + Dry Soil (g), M2	264.39
Mass Container (g), M3	116.92
Water Content, w (%)	4.00

Resistivity Test: California Test Method 643

Mininum Resistence value: 2,200 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	581.89	605.25	623.53	646.41	664.01
Weight of mixing bowl (g):	155.82	155.82	155.82	155.82	155.82
Wet weight of Soil (g):	426.07	449.43	467.71	490.59	508.19
Amount of water added (ml):	0	25	20	25	15
Soil Box + Wet Soil (g), M5	260.66	278.15	293.19	286.21	292.25
Weight of Soil Box (g), M6	130.67	130.67	130.67	130.67	130.67
Wt. of Wet Soil for test (g), M7	129.99	147.48	162.52	155.54	161.58
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	15.3	63.1	91.2	96.0	108.9
Resistivity Reading (ohm)	19,000	3,700	2,250	2,200	2,200
Resistence (ohm-cm)	19,000	3,700	2,250	2,200	2,200

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.03

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 9

recorded mg of SO_4 in sample, x, = 3 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 105

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 7

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-109

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: B-21
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s23
Mass Container + Wet Soil (g), M1	124
Mass Container + Dry Soil (g), M2	121.71
Mass Container (g), M3	83.49
Water Content, w (%)	5.99

Resistivity Test: California Test Method 643

Mininum Resistence value: 19,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	408.8	422.09	440.2	453.55	
Weight of mixing bowl (g):	205.25	205.25	205.25	205.25	
Wet weight of Soil (g):	203.55	216.84	234.95	248.3	
Amount of water added (ml):	0	15	20	15	
Soil Box + Wet Soil (g), M5	248.39	258.15	274.82	271.03	
Weight of Soil Box (g), M6	127.10	127.10	127.10	127.10	
Wt. of Wet Soil for test (g), M7	121.29	131.05	147.72	143.93	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	18.7	57.9	96.3	96.9	
Resistivity Reading (ohm)	41,500	23,000	19,500	22,500	
Resistence (ohm-cm)	41,500	23,000	19,500	22,500	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 5.62

Temperature : 21.2 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 45

recorded mg of SO_4 in sample, x, = 15 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 45

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 3

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/5/2009 Checked By: TJO

Figure: F-110

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-9
Project Name: Suncrest Substation | Sample No.: 3
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: SM

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s34
Mass Container + Wet Soil (g), M1	189.33
Mass Container + Dry Soil (g), M2	186.53
Mass Container (g), M3	118.04
Water Content, w (%)	4.09

Resistivity Test: California Test Method 643

Mininum Resistence value: 9,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	564.44	582.97	600.95	624.21	
Weight of mixing bowl (g):	201.51	201.51	201.51	201.51	
Wet weight of Soil (g):	362.93	381.46	399.44	422.7	
Amount of water added (ml):	0	20	20	25	
Soil Box + Wet Soil (g), M5	250.14	259.64	281.91	292.70	
Weight of Soil Box (g), M6	130.66	130.66	130.66	130.66	
Wt. of Wet Soil for test (g), M7	119.48	128.98	151.25	162.04	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	12.8	45.1	78.5	110.9	
Resistivity Reading (ohm)	62,000	13,000	9,500	11,000	
Resistence (ohm-cm)	62,000	13,000	9,500	11,000	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 5.69

Temperature : 21.2 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 42

recorded mg of SO_4 in sample, x, = 14 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 60

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 4

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/5/2009 Checked By: TJO

Figure: F-111

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-10
Project Name: Suncrest Substation | Sample No.: 3
Project Engineer: JN | Depth (ft): 5.0

Initial Visual Classification Symbol: SM

	State of Specimen before Processing
X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up Water Content	Minus No. 8 or ( )
Container No.	s21
Mass Container + Wet Soil (g), M1	164.68
Mass Container + Dry Soil (g), M2	159.14
Mass Container (g), M3	104.87
Water Content, w (%)	10.21

Resistivity Test: California Test Method 643

Mininum Resistence value: 13,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	456.53	474.21	492.29	509.46	
Weight of mixing bowl (g):	152.81	152.81	152.81	152.81	
Wet weight of Soil (g):	303.72	321.4	339.48	356.65	
Amount of water added (ml):	0	20	20	20	
Soil Box + Wet Soil (g), M5	239.48	254.10	265.39	265.17	
Weight of Soil Box (g), M6	127.03	127.03	127.03	127.03	
Wt. of Wet Soil for test (g), M7	112.45	127.07	138.36	138.14	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	25.2	59.6	81.2	89.0	
Resistivity Reading (ohm)	27,500	16,500	13,500	14,500	
Resistence (ohm-cm)	27,500	16,500	13,500	14,500	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.98

Temperature : 22.1 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 78

recorded mg of SO_4 in sample, x, = 26 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 90

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 6

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-112

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-13
Project Name: Suncrest Substation | Sample No.: 3
Project Engineer: JN | Depth (ft): 2.5

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	S9
Mass Container + Wet Soil (g), M1	202.41
Mass Container + Dry Soil (g), M2	198.53
Mass Container (g), M3	87.95
Water Content, w (%)	3.51

Resistivity Test: California Test Method 643

Mininum Resistence value: 12,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	535.44	554.48	572.92	596.77	619.32
Weight of mixing bowl (g):	130.13	130.13	130.13	130.13	130.13
Wet weight of Soil (g):	405.31	424.35	442.79	466.64	489.19
Amount of water added (ml):	0	20	20	25	25
Soil Box + Wet Soil (g), M5	237.37	241.25	263.29	271.92	268.99
Weight of Soil Box (g), M6	126.98	126.98	126.98	126.98	126.98
Wt. of Wet Soil for test (g), M7	110.39	114.27	136.31	144.94	142.01
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	9.5	32.5	57.7	81.3	86.8
Resistivity Reading (ohm)	365,000	29,500	14,500	12,500	14,000
Resistence (ohm-cm)	365,000	29,500	14,500	12,500	14,000

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.88

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = 120 mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 60

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 4

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/16/2009 Checked By: TJO

Figure: F-113

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017
Project Name: Suncrest Substation
Project Engineer: JN

Exploration No.: TP-15
Sample No.: 1
Depth (ft): 0.5

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s38
Mass Container + Wet Soil (g), M1	200.26
Mass Container + Dry Soil (g), M2	193
Mass Container (g), M3	123.87
Water Content, w (%)	10.50

Resistivity Test: California Test Method 643

Mininum Resistence value: 4,250 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	499.7	517.8	536.24	558.46	
Weight of mixing bowl (g):	151.1	151.1	151.1	151.1	
Wet weight of Soil (g):	348.6	366.7	385.14	407.36	
Amount of water added (ml):	0	20	20	25	
Soil Box + Wet Soil (g), M5	241.34	267.43	282.02	282.27	
Weight of Soil Box (g), M6	130.62	130.62	130.62	130.62	
Wt. of Wet Soil for test (g), M7	110.72	136.81	151.4	151.65	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	25.1	66.8	94.7	107.7	
Resistivity Reading (ohm)	17,000	6,050	4,250	4,650	
Resistence (ohm-cm)	17,000	6,050	4,250	4,650	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.01

Temperature : 22.1 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 15

recorded mg of SO_4 in sample, x, = 5 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 30

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 2

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-114

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-17
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 0.5

Initial Visual Classification Symbol: CL

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s31
Mass Container + Wet Soil (g), M1	127.42
Mass Container + Dry Soil (g), M2	123.94
Mass Container (g), M3	98.28
Water Content, w (%)	13.56

Resistivity Test: California Test Method 643

Mininum Resistence value: 2,550 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	487.55	505.87	528.7		
Weight of mixing bowl (g):	188.41	188.41	188.41		
Wet weight of Soil (g):	299.14	317.46	340.29		
Amount of water added (ml):	0	20	25		
Soil Box + Wet Soil (g), M5	235.59	263.34	268.82		
Weight of Soil Box (g), M6	126.98	126.98	126.98		
Wt. of Wet Soil for test (g), M7	108.61	136.36	141.84		
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	29.7	75.5	96.1		
Resistivity Reading (ohm)	5,250	2,550	3,000		
Resistence (ohm-cm)	5,250	2,550	3,000		

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 5.77

Temperature : 21.2 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 15

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 1

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/5/2009 Checked By: TJO

Figure: F-115

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-17
Project Name: Suncrest Substation | Sample No.: 2
Project Engineer: JN | Depth (ft): 2.0

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s33
Mass Container + Wet Soil (g), M1	238.76
Mass Container + Dry Soil (g), M2	230.64
Mass Container (g), M3	110.19
Water Content, w (%)	6.74

Resistivity Test: California Test Method 643

Mininum Resistence value: 7,200 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	517.41	540.82	563.81	587.23	
Weight of mixing bowl (g):	140.85	140.85	140.85	140.85	
Wet weight of Soil (g):	376.56	399.97	422.96	446.38	
Amount of water added (ml):	0	25	25	25	
Soil Box + Wet Soil (g), M5	235.03	260.18	282.00	273.38	
Weight of Soil Box (g), M6	127.27	127.27	127.27	127.27	
Wt. of Wet Soil for test (g), M7	107.76	132.91	154.73	146.11	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	16.3	59.1	96.9	95.3	
Resistivity Reading (ohm)	24,000	8,600	7,200	9,300	
Resistence (ohm-cm)	24,000	8,600	7,200	9,300	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 7.05

Temperature : 22.0 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 30

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 2

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-116

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-18
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 0.5

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s20
Mass Container + Wet Soil (g), M1	146.75
Mass Container + Dry Soil (g), M2	141.47
Mass Container (g), M3	76.33
Water Content, w (%)	8.11

Resistivity Test: California Test Method 643

Mininum Resistence value: 24,000 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	451.56	469.61	493.38	510.3	
Weight of mixing bowl (g):	151.09	151.09	151.09	151.09	
Wet weight of Soil (g):	300.47	318.52	342.29	359.21	
Amount of water added (ml):	0	20	25	20	
Soil Box + Wet Soil (g), M5	242.00	257.11	269.43	266.69	
Weight of Soil Box (g), M6	126.98	126.98	126.98	126.98	
Wt. of Wet Soil for test (g), M7	115.02	130.13	142.45	139.71	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	21.7	59.0	88.5	90.7	
Resistivity Reading (ohm)	49,500	27,500	24,000	26,500	
Resistence (ohm-cm)	49,500	27,500	24,000	26,500	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.98

Temperature : 21.8 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 45

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 3

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-117

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-19
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 0.3

Initial Visual Classification Symbol: SC

State of Specimen before Processing

X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up **Water Content**	Minus No. 8 or ( )
Container No.	s12
Mass Container + Wet Soil (g), M1	106.45
Mass Container + Dry Soil (g), M2	106.39
Mass Container (g), M3	83.61
Water Content, w (%)	0.26

Resistivity Test: California Test Method 643

Mininum Resistence value: 6,750 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	368.13	404.74	417.33	430.04	440.95
Weight of mixing bowl (g):	135.84	135.84	135.84	135.84	135.84
Wet weight of Soil (g):	232.29	268.9	281.49	294.2	305.11
Amount of water added (ml):	0	35	15	15	15
Soil Box + Wet Soil (g), M5	245.53	274.51	287.36	284.88	282.24
Weight of Soil Box (g), M6	130.63	130.63	130.63	130.63	130.63
Wt. of Wet Soil for test (g), M7	114.9	143.88	156.73	154.25	151.61
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	0.8	89.0	101.7	106.7	109.0
Resistivity Reading (ohm)	100,000	9,350	7,150	6,750	6,850
Resistence (ohm-cm)	100,000	9,350	7,150	6,750	6,850

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.90

Temperature : 21.0 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : not detected

recorded mg of SO_4 in sample, x, = 0 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 45

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 3

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/18/2009 Checked By: TJO

Figure: F-118

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-20
Project Name: Suncrest Substation | Sample No.: 3
Project Engineer: JN | Depth (ft): 1.0

Initial Visual Classification Symbol: SC

	State of Specimen before Processing
X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up / Water Content	Minus No. 8 or ( )
Container No.	s27
Mass Container + Wet Soil (g), M1	150.61
Mass Container + Dry Soil (g), M2	145.31
Mass Container (g), M3	79.04
Water Content, w (%)	8.00

Resistivity Test: California Test Method 643

Mininum Resistence value: 21,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	500	519.04	542.55	560.51	
Weight of mixing bowl (g):	139.3	139.3	139.3	139.3	
Wet weight of Soil (g):	360.7	379.74	403.25	421.21	
Amount of water added (ml):	0	20	25	20	
Soil Box + Wet Soil (g), M5	250.59	259.14	282.52	276.73	
Weight of Soil Box (g), M6	130.77	130.77	130.77	130.77	
Wt. of Wet Soil for test (g), M7	119.82	128.37	151.75	145.96	
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	23.4	53.7	94.8	93.0	
Resistivity Reading (ohm)	59,500	32,500	21,500	23,000	
Resistence (ohm-cm)	59,500	32,500	21,500	23,000	

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.73

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 240

recorded mg of SO_4 in sample, x, = 80 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 45

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 3

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/16/2009 Checked By: TJO

Figure: F-119

URS

CORROSIVITY TEST ANALYSIS

Project Number: 27669017 | Exploration No.: TP-21
Project Name: Suncrest Substation | Sample No.: 1
Project Engineer: JN | Depth (ft): 0.0

Initial Visual Classification Symbol: SC

	State of Specimen before Processing
X	Passing soil through #8 sieve
X	Moist State
	Air Dried
	Oven Dried at 60 C

Set-Up / Water Content	Minus No. 8 or ( )
Container No.	s28
Mass Container + Wet Soil (g), M1	139.48
Mass Container + Dry Soil (g), M2	137.34
Mass Container (g), M3	84.65
Water Content, w (%)	4.06

Resistivity Test: California Test Method 643

Mininum Resistence value: 33,500 ohm-cm

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Weight of Soil in bowl (g):	567.16	608.23	631.28	648.71	661.07
Weight of mixing bowl (g):	147.75	147.75	147.75	147.75	147.75
Wet weight of Soil (g):	419.41	460.48	483.53	500.96	513.32
Amount of water added (ml):	0	45	25	20	15
Soil Box + Wet Soil (g), M5	234.97	258.41	270.18	271.83	267.02
Weight of Soil Box (g), M6	127.13	127.13	127.13	127.13	127.13
Wt. of Wet Soil for test (g), M7	107.84	131.28	143.05	144.7	139.89
Volume of Soil Box (cm^3)	79.2	79.2	79.2	79.2	79.2
Est. Saturation (%)	10.3	66.0	80.0	87.1	83.9
Resistivity Reading (ohm)	200,000	43,000	35,500	33,500	38,000
Resistence (ohm-cm)	200,000	43,000	35,500	33,500	38,000

Resistence = Soil Box Constant x Reading

pH Test : California Test Method 532

50g wet weight of soil mixed with 50 mL of de-ionized water.

pH of slurry: 6.89

Temperature : 21.9 Celsius

Sulfate Content: California Test Method 417

100g of soil mixed with 300 mL of de-ionized water.

SO_4 (ppm) : 108

recorded mg of SO_4 in sample, x, = 36 mg

soil / water ratio, r, = 3

number of dilutions to obtain above value, d, = _____ = _____ mg/ L = ppm

Dilution Equation, d > 0; $SO_4 = ((x / 80) * (r\ 80 * 2^{d} - r\ 80 * 2^{(d-1)})) + r\ 80 * 2^{(d-1)}$

Chloride Content: California Test Method 422

100g of soil mixed with 300 mL of de-ionized water.

Cl^- (ppm) : 45

mg/L of Cl^- = ((A-B) x N x 35453) x 3

A = mL of $AgNO_3$ A= 3

B = 23 mL of the blank

N = 0.0493 N, normality of the titrant

Cl^- (mg/L) = A * 5 * 3

Tested By: YS Date: 2/16/2009 Checked By: TJO

Figure: F-120

URS

GUIDE TECHNICAL SPECIFICATION
ROCKFILL PLACMENT AND COMPACTION

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1.0 GENERAL

1.1 Scope of Work:

The Work includes all labor, materials, equipment, transportation and services necessary for the processing, placement, compaction, testing, and observation of Rock Fill that may be used to form the substation pad.

1.2 Governing Documents:

1.2.1 URS Geotechnical Investigation Report dated November 20, 2009.

1.2.2 SDG&E Suncrest Substation Site Development Plans and Specifications.

1.2.6 American Society for Testing and Materials – Specification and Test Standards, latest edition.

2.0 PRODUCTS

2.1 Rock Fill:

2.1.1 Rock Fill shall be well-graded and shall meet the gradation requirements summarized below. The Contractor shall design blasting or crushing programs to produce the specified gradation.

.

Rock Fill Gradation

Screen/Sieve Size	Percent Passing by Weight
24 inch	95
¾ inch	20 – 50

2.1.2 Gradation specified herein applies to the material after placing, spreading, moisture conditioning, and compacting. The Contractor shall determine the gradation that the material must have before transportation to the embankment to ensure that the specified gradation is obtained in place after placing, spreading, moisture conditioning and compacting. Materials represented by samples that do not meet the specified requirements will be rejected. The Contractor shall remove all rejected materials and replace with material meeting the specified requirements at no cost to SDG&E.

2.1.3 Rock Fills may be placed within all substation pad fill areas except within the upper five feet of the substation pad and where the ultimate arrangement structure foundations, drainage structures, and conduit packages will be located, subject to approval by SDG&E.

2.2 Individual Large Rock Fragments: Rocks or rock fragments up to 4 feet in maximum dimension may be occasionally placed within the Rock Fill provided there is sufficient space between the individual large rock fragments to allow for compaction equipment and there is sufficient matrix of material less than ¾-inch maximum size to properly fill the void spaces around the individual rock fragment. Rock fragments with a maximum dimension between 2 to 4 feet should not protrude above the fill surface of the fill lift or possess overhangs that could hinder compaction or create void spaces. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Engineer prior to placement.

2.2 Graded Filter Material: A graded filter may be required at the interface between other fill and the Rock Fill to reduce the potential for piping of fines from soil fill, or soil-rock fill into the rock fill. This will generally be required for the coarsest rock fill if the adjacent fill consist of materials with 100 percent passing the No. 4 sieve. The need for the graded filter, and the gradation and thickness of the graded filter will be determined by the Geotechnical Engineer during earthwork.

3.0 EXECUTION

3.1 Test Fill: Prior to production earthwork, the Contractor shall construct a Test Fill to determine the number of compaction equipment passes, lift thickness and other aspects of processing, placement and compaction of Rock Fill. The Test Fill shall determine the minimum number of equipment passes from a survey of settlement of the Rock Fill lift versus the number of compaction equipment passes. At least 10 control points on the surface of the Test Fill shall be surveyed for every 2 passes of the compaction equipment. The method of production compaction would generally be acceptable if it produces 80 percent of the settlement surveyed after 8 passes in the Test Fill. After acceptance of the Test Fill Plan, changes shall not be made during production without the prior written acceptance of the Engineer. The Engineer may specify additional Test Fills during construction.

3.2 Compaction Equipment: Compaction equipment shall be equipment providing suitable energy to compact the Rock Fill until there is no visible yielding of the material being compacted. Compaction of Rock Fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple wheel pneumatic tired rollers, loaded rock trucks, or other types of acceptable compaction equipment.

3.3 Placement and Compaction:

3.3.1 Spreading: Rock Fill shall be dumped and spread in level, continuous, approximately horizontal lifts that do not exceed 30 inches in thickness before compaction. Spreading of the Rock Fill shall be by dozer to facilitate seating of the rock. Spreading shall be such that the larger materials are routed toward the outside limits of

the zone. Materials shall be dumped on the end of the advancing lift and spread by bulldozer over the surface of the underlying compacted lift, unless otherwise specified or directed by the Engineer.

3.3.2 Watering: Watering shall consist of water trucks traversing in front of the current Rock Fill lift face and spraying water continuously during placement and compaction to sluice finer materials into the rock voids.

3.3.3 Compaction: Each lift shall be compacted until there is no visible evidence of further settlement according to methods set forth in the Test Fill. Coverage is the process of operating compaction equipment over the fill surface such that the primary compaction element(s) comes in contact with the entire lift surface. Coverage of the compaction equipment shall be carried out so that the compactive effort is uniformly distributed in a systematic manner over the entire lift. Compaction of individual lanes of a lift shall be completed before beginning compaction of adjacent portions of the lift. Individual lanes shall be overlapped by at least 18 inches.

3.3.4 Contamination and Segregation: The Contractor shall control and conduct all operations including, but not limited to, loading, transporting, dumping, spreading, moisture conditioning and compacting materials to prevent contamination and segregation. All contaminated or segregated materials shall be removed and replaced to the satisfaction of the Engineer. The distribution of materials throughout the embankment shall be such that each lift is free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from the surrounding material.

4.0 TESTING AND INSPECTION

4.1. The Engineer shall observe, sample, and perform field and laboratory tests on a regular basis. The Engineer may verify that the coverage specified in the Test Fill has been obtained. The Engineer may also elect to observe random test pits excavations and/or perform random large volume Gradation Tests, Large Volume In-Place Density Tests or Plate Bearing Tests. The Contractor shall assist the Engineer in taking samples and performing field tests.

4.2 The Engineer will inform the Contractor when their observations, sampling or test results indicate that the compaction does not appear to be in conformance with the project requirements. The Contractor shall make immediate adjustments in procedures as necessary to conform to the specified requirements. Re-working to attain the specified requirements may include removal, rehandling, reprocessing, reconditioning, recompaction, or combinations of these procedures. The Contractor shall perform all re-work required at no additional cost to SDG&E.

4.3. The Contractor shall provide access for the Engineer to areas where inspection, sampling and testing is to be performed and schedule construction operations to avoid interference with the sampling and testing operations.

4.4 Observation, sampling and testing by the Engineer shall not relieve the Contractor of its responsibility to construct the rock fills in conformance with the provisions of this section.

5.0 SCHEDULE OF DRAWINGS/DATA TO BE SUBMITTED BY CONTRACTOR

5.1 A detailed Test Fill Plan describing the equipment and methods for loading, hauling, spreading, moisture conditioning, and disking, scarifying, compacting and measuring compaction.

5.2 Work plan detailing the methods, equipment and schedule for processing, placing and compacting the rock fills.

5.3 Laboratory test data on material used.

5.4 Daily report detailing the earthwork activities performed.

**** END OF SECTION ****