APPENDIX D-5:
EARTH CONSULTANTS INTERNATIONAL INC. (ECI), GEOLOGIC STUDY TO EVALUATE THE POTENTIAL FOR ACTIVE FAULTING NEAR THE INTERSECTION OF LINCOLN AND JEFFERSON BOULEVARDS, AT THE PLAYA VISTA SITE, IN THE CITY OF LOS ANGELES, CA, MARCH 30, 2001

Earth Consultants International

Project No. 800130-0001 (1813.01)
March 30, 2001

To: **Playa Capital Company, LLC**
12555 Jefferson Boulevard, Suite 300
Los Angeles, California 90066

Attention: **Mr. David Nelson, Sr. Vice-President**

Subject: **Geologic Study to Evaluate the Potential for Active Faulting Near the Intersection of Lincoln and Jefferson Boulevards, at the Playa Vista Site, in the City of Los Angeles, California**

At the request of Playa Vista, LLC, Earth Consultants International, Inc. (ECI) have conducted a geologic study of that portion of the Playa Vista property to the southeast of the intersection of Lincoln and Jefferson Boulevards to evaluate whether or not the near-surface sediments in this area are offset by a northwest-trending fault. This study was prompted by a report by Exploration Technologies, Inc. (ETI, 2000) which conducted a subsurface assessment of methane gas at the site, and suggested that methane is migrating to the shallow subsurface along a previously unrecognized, potentially active fault east of and parallel to Lincoln Boulevard.

As part of our investigation we reviewed previously published geologic maps and reports covering this area, and unpublished geologic and geotechnical reports prepared by other investigators for the Playa Vista site. We also conducted a subsurface study consisting of drilling borings and CPTs across the area where this fault is proposed. The data obtained from our literature review and our field investigation have been reviewed and analyzed. The data indicate that there are no north to northwest-trending faults in this area that offset the Pleistocene-age sediments that form the bluffs to the south of the site, nor the Pleistocene-age sediments underlying the Ballona Creek floodplain. Lateral continuity of shallower, Holocene-age sediments underlying the site also indicates that the younger strata are not offset by faulting.

From all our data, we cannot find evidence to support the existence of a supposed "Lincoln Boulevard fault" across the property. Our study found no reason to interpret a fault through any of the alluvial units we correlated from CPTs and borings in four transects of the Playa Vista site, nor in the older sediments forming the bluffs south of the site. While a fault might lie deeper than our investigation was designed to explore, it has not had a displacement-producing earthquake in tens to hundreds of thousands of years (as evidenced by the unfaulted Pleistocene sediments forming the bluffs), and likely does not exist at all. Therefore, in accordance with the California definitions of active faulting, there are no faults that meet the criteria of sufficiently active and well-defined to preclude development of this area.

2522 North Santiago Boulevard, Suite B Orange California 92867
Telephone: (714) 282-6123 Facsimile: (714) 998-0971
tgonzalez@ earthconsultants.com www.earthconsultants.com

We hope that this report provides you with the information you need at this time. Should you have any questions regarding our report, please do not hesitate to contact us.

Respectfully submitted,

EARTH CONSULTANTS INTERNATIONAL, INC.

Tania Gonzalez, CEG 1859
Project Consultant

Eldon Gath, CEG 1292
Principal Consultant

Kerry Sieh, PhD., RG 5067
Sr. Project Consultant

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Geologic Study to Evaluate the Potential for Active Faulting Near the Intersection of Lincoln and Jefferson Boulevards, at the Playa Vista Site, in the City of Los Angeles, California

1.0 Introduction

1.1 Purpose of the Study

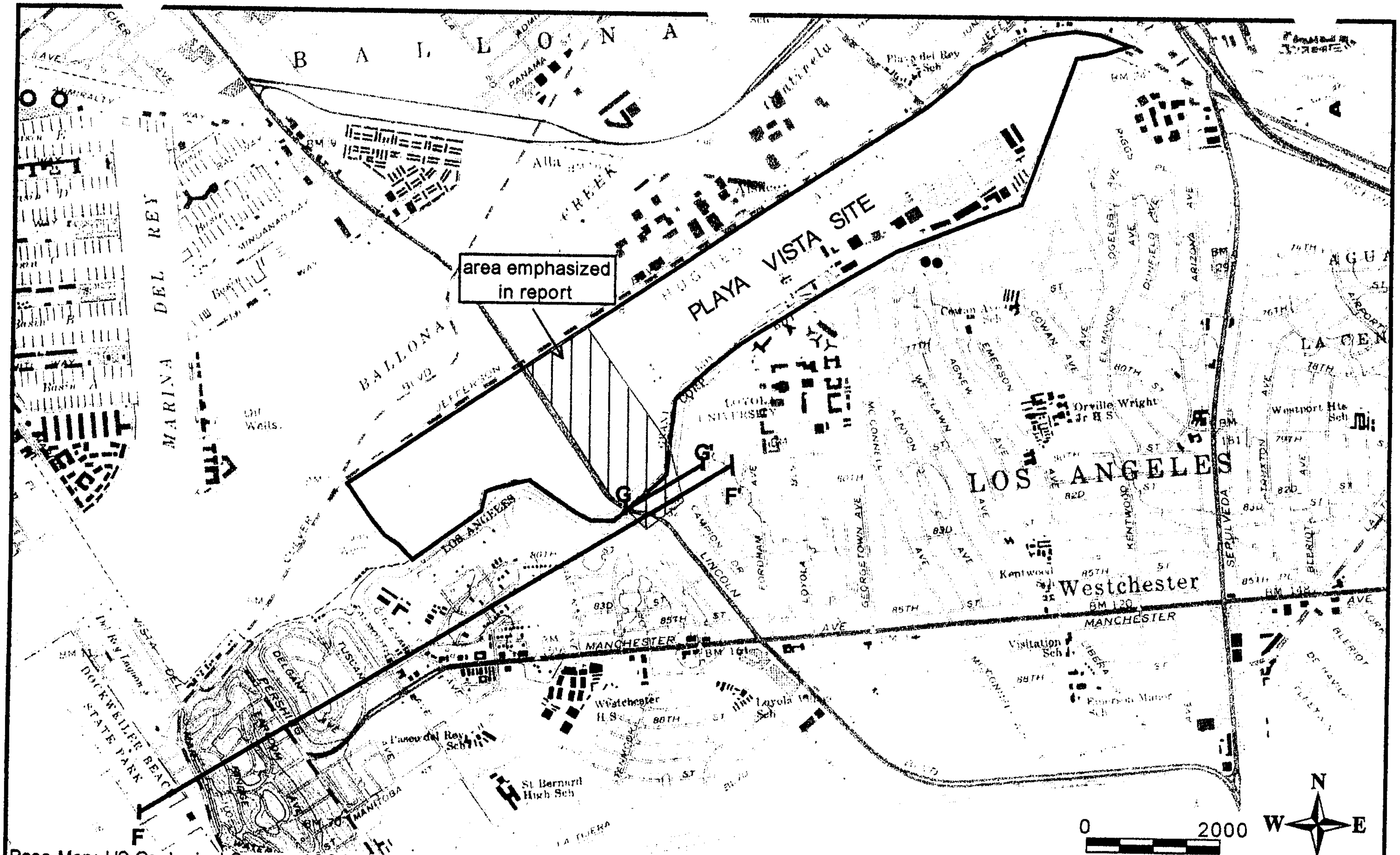
This report presents the results of a fault rupture hazard investigation conducted for the west-central portion of the Playa Vista site, southeast of the intersection of Lincoln and Jefferson Boulevards, in the City of Los Angeles (see Figure 1). The purpose of our study was to evaluate whether or not a fault underlies that area of the Playa Vista site where the Lincoln Boulevard fault has been proposed by Exploration Technologies Inc. (ETI, 2000). If the data suggest that indeed there is a fault in this area, we would further assess whether or not the fault is an active structure, using the California definitions of fault activity for residential projects.

1.2 Site Description

The Playa Vista site consists of approximately 1,000 acres of developed and undeveloped land in the city of Los Angeles. The site is approximately 1,500 to 2,500 feet wide (in a north-south direction), and nearly 4 miles long (in an east-west direction). The property is accessed off of Centinela Avenue by Teale Street, a road that extends westward through the property, providing access to several of the former Hughes facility buildings still present on the east side of the site. The site is bounded to the north by West Jefferson Boulevard, to the east by Centinela Avenue, to the south by steep bluffs, and to the west by the Ballona wetlands and the community of Playa del Rey (see Site Location Map, Figure 1). The area discussed in this report is primarily (but not limited to) that portion of the site southeast of the intersection of Jefferson and Lincoln Boulevards.

It is our understanding that the eastern and central portions of the property, east of Lincoln Boulevard, will be developed into a residential, industrial, entertainment and technology district. Some of the former Hughes facility buildings are considered of historical value and will remain onsite. Other buildings will be demolished as part of the re-development and development process. The designated wetlands on the western portion of the site will remain undeveloped as protected wildlife habitat.

Geomorphically, the Playa Vista site is located on the south side of the Ballona Creek floodplain, in the western portion of the Los Angeles Basin (see Figure 2). Prior to grading, the site was nearly level, with a regional gentle slope to the west-southwest, toward the Pacific Ocean. Pre-development elevations at the site varied from approximately 15 feet above mean sea level along its eastern end, near Centinela Avenue, to approximately 5 feet above mean sea level along its western end. Recently, however, as a result of extensive grading that has been conducted in the area that is the focus of this study, the original topography has been modified locally. For example, the project's geotechnical engineers recommended that the soils in the area proposed for development be surcharged (buried under a thick section of artificial fill) to increase their in-situ densities and decrease their potential to liquefy. In addition, large cuts below design street level that will be the parking sub-levels to various buildings have already been excavated in this area. These excavations are reflected in the topographic map of the site that we used as a base map (see Plate 1, and the cross-sections in Plates 4 through 8).



Base Map: US Geological Survey, 1964, Venice, California 71/2 minute Quadrangle, photorevised 1981

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Site Location Map
Playa Vista Property

showing location of cross-sections
F-F' and G-G'

Figure
1

The site is underlain in the near surface by alluvial (stream-lain) sediments associated with Ballona Creek and other drainages, including an ancestral Los Angeles River, that have flowed out to sea through this area for hundreds to thousands of years. Locally, the alluvium has been buried with as much as 20 feet of artificial fill associated with the surcharge and grading operations described above. Based on extensive subsurface exploration of the site, we know that the alluvial sequence is underlain by Holocene-age, fine-grained lagoonal and alluvial sediments that are in turn underlain by a gravel-sand sequence of possibly late Pleistocene age. The top of the gravel-sand sequence is approximately 45 to 50 feet below the original ground surface. Additional information regarding these geologic units and stratigraphy at the site is provided in Sections 2 and 3 below.

1.3 Scope of Work

Specific tasks that we completed as part of this study are listed below.

- We reviewed older topographic maps of the Playa Vista area to observe pre-development landforms in this part of the Los Angeles basin that would be analogues to the landforms interpreted from the subsurface data, and to look for landforms at the surface that could be indicative of active faulting.

- We reviewed other published and unpublished reports and maps to obtain data on the geologic units, faults, ground-water barriers and geomorphic characteristics of the site, with emphasis on site-specific geological reports prepared by previous investigators for the study area. We specifically looked for geological data on the bluffs to the south of the Playa Vista site that would show whether or not faulting has been previously observed in this area. Refer to Appendix A for a list of references.

- We ran historical earthquake and deterministic seismic analyses for the site using Blake's (1990, 1995) EQSEARCH and EQFAULT software to locate historical earthquakes of magnitude greater than 4 reported within 20 miles of the site, and to estimate the peak ground accelerations that could be expected at the site from the closest known seismic sources. Refer to Appendices B and C for the computer outputs.

- We reviewed borehole and cone penetrometer test (CPT) data available for the site provided to us by Playa Vista and its consultants (primarily Group Delta Consultants and CDM). Other data reviewed and incorporated into this report include more than one hundred archeological cores collected and described by Statistical Research, Inc., and the recently emplaced soundings used by CDM to find the top of gravel surface. The borings that encountered the gravelly layer were located on the maps provided to us, and their locations were plotted on a GIS-based map of the Playa Vista site. Then, the elevation of the gravelly layer (relative to mean sea level) was calculated for each point by subtracting the depth of the gravel (as reported in the boring or CPT) from the elevation of that boring. The elevations of the top of the gravel layer were then plotted and the top of the gravel layer was contoured using these data points. A similar contour map was prepared for a distinctive silty sand layer that occurs at an elevation of about 30 feet below mean sea level.

- We prepared cross-sections using borehole data collected by previous investigators for the bluffs south of the site. In the borehole data we looked for discrete units, such as geologic contacts between discernible units, that can be used to determine whether or not these deposits have been faulted.

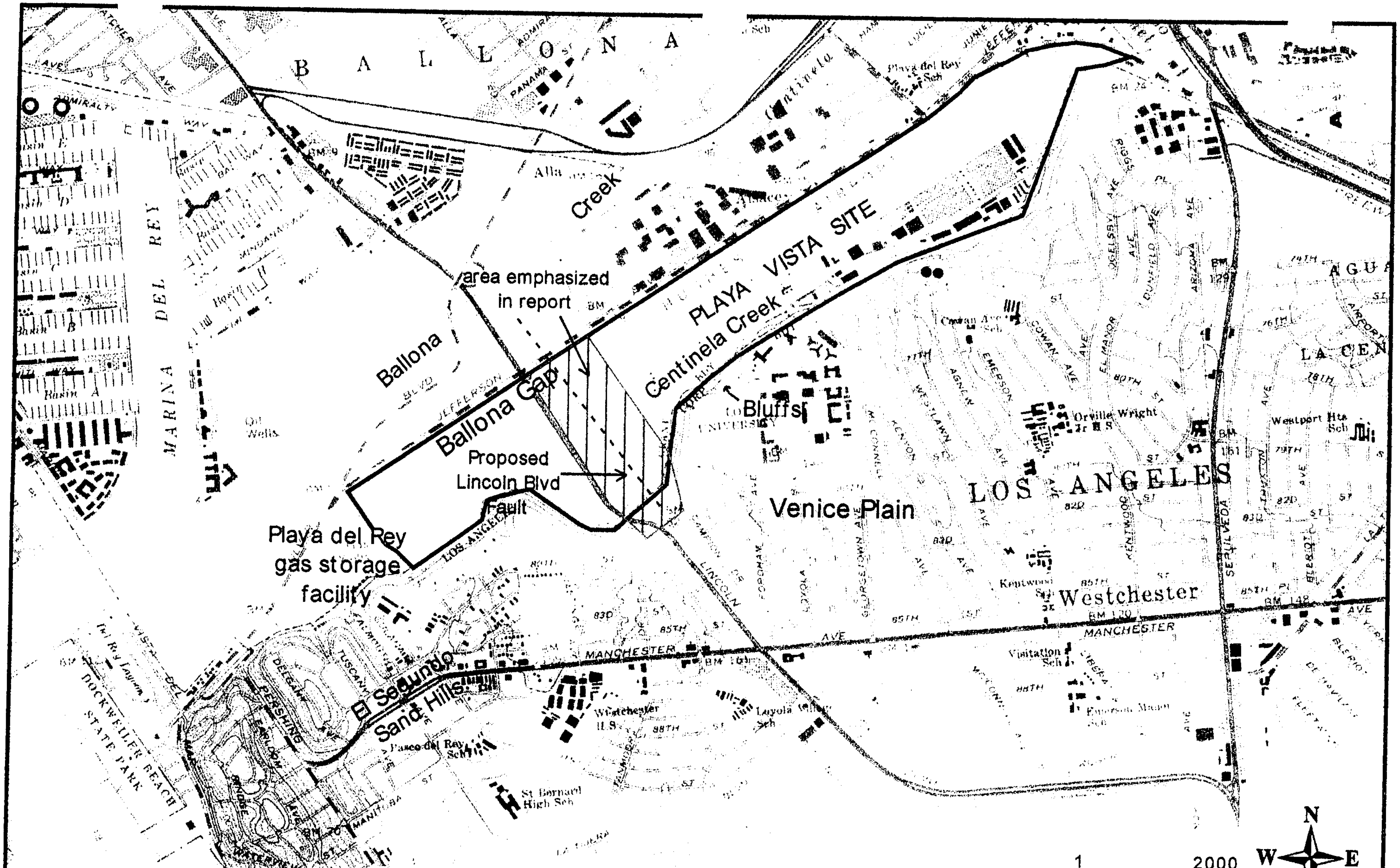
- We reviewed vintage aerial photographs of the site and vicinity from our in-house library and at Playa Vista to look for landforms that could be indicative of faulting in this area. Vertical pairs of photographs from our in-house library were reviewed with a stereoscope to look for fault-related topography, vegetation and soil contrasts, or other lineaments of possible fault origin. The in-house library photos reviewed are listed in Appendix A.

- We conducted a subsurface investigation that consisted of drilling 57 CPT soundings and 5 hollow stem auger borings (their logs are included in Appendices D and E, respectively). The CPTs and borings were drilled roughly perpendicular to the trend of the proposed Lincoln Boulevard fault, along three 800-feet long lines and one 300-feet long line trending east-west, east of Lincoln Boulevard and south of Jefferson Boulevard, within the area of concern. The CPTs were drilled to refusal in the gravelly sand layer that underlies the site. The hollow stem borings were drilled and sampled continuously to confirm and correlate the subsurface data obtained with the CPTs. The borings were generally drilled at least 5 feet into the gravelly sand layer. All of the borings and CPTs were backfilled with a grout slurry to the surface. Their locations were surveyed by GPS Landworks, Inc. who provided us with the survey data in digital format. The subsurface data obtained from our field study were used to image in more detail the top of the gravelly sand layer and other, more shallow soil layers in the area where the Lincoln Boulevard fault has been proposed.

  The CPT and borehole program described above was conducted in lieu of trenching, because, even though trenching is the most common and preferred method to assess the presence or absence of faulting, this investigative method was not feasible at this site. At the Playa Vista site, ground water generally occurs within 5 feet of the original ground surface, and the Holocene (less than 10,000 years old) section of sediments is relatively thick (approximately 40 to 50 feet thick), making trenching extremely expensive, if not impossible, at this site.

- We compiled the data obtained from our literature review and subsurface investigation, analyzed it, and prepared this report summarizing our findings and conclusions. As part of this task we prepared cross-sections perpendicular to and parallel to the proposed Lincoln Boulevard fault on which we projected the CPT and borehole data available for the area. These cross-sections are critical to our analysis of whether or not the sediments in the area of this study are vertically offset by a fault.

Geophysical survey studies to image the older sediments at depth, from approximately 1,000 feet below the ground surface down to the basement rock, were conducted by Davis & Namson at about the same time as this report was being prepared. Davis & Namson's report was submitted in November, 2000, and their findings are summarized herein. Please refer to their report for a complete description of their methodology, findings and conclusions.



Base Map: US Geological Survey, 1964, Venice, California 71/2 minute Quadrangle, photorevised 1981

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Geomorphic Map Showing Features Discussed in the Text

Figure 2

2.0 Background Information and Review of the Literature

2.1 Tectonic Setting

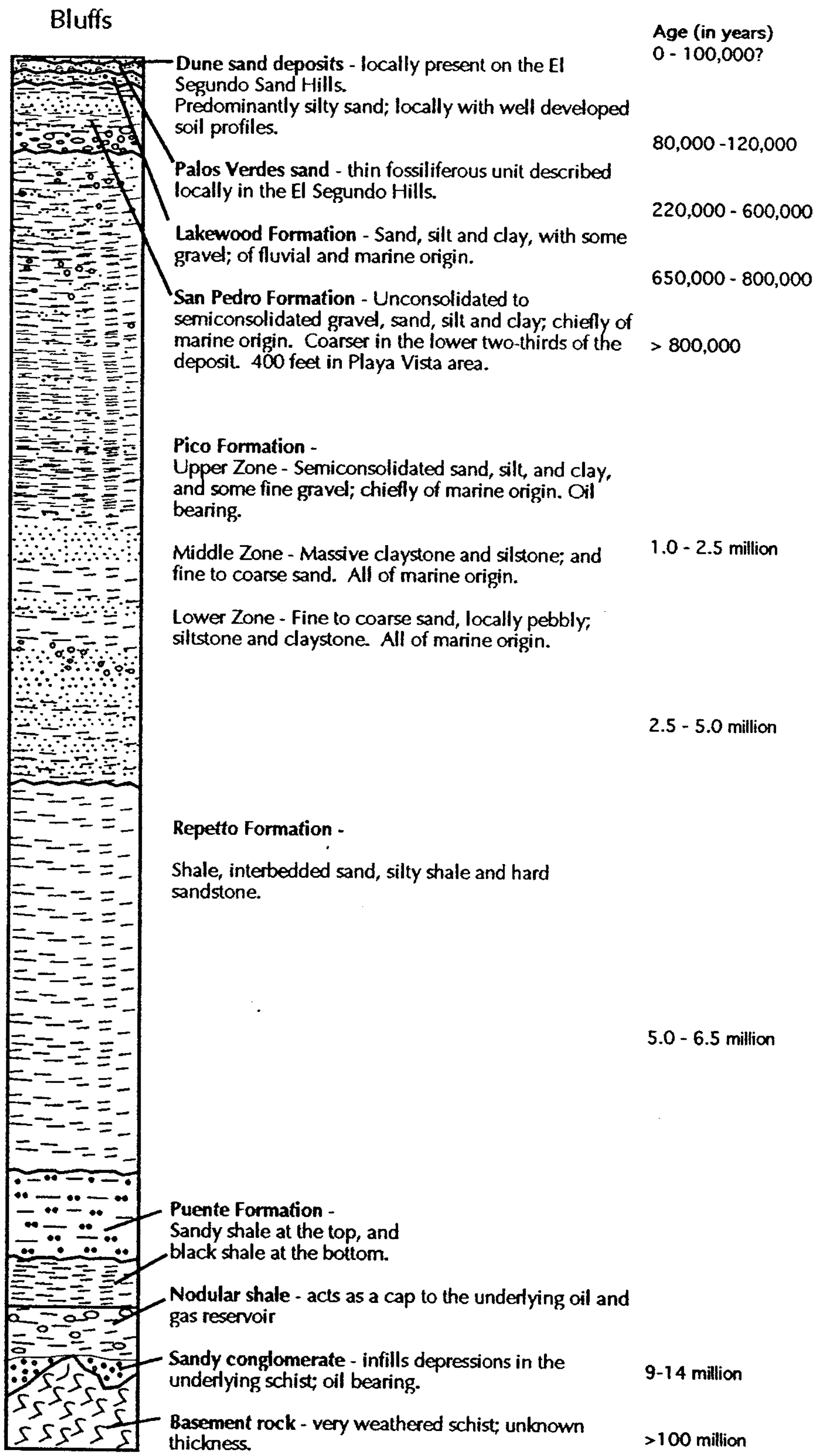
The Playa Vista site is located near the northwestern end of the Peninsular Ranges province of southern California, just south of its intersection with the Transverse Ranges province. The Peninsular Ranges province is characterized by a northwest-southeast grain that is reflected in the orientation of its major faults and folds. The Transverse Ranges is characterized by an east-west grain that is "transverse" to the predominant grain of the Peninsular Ranges. Three major fault systems are located about 5 miles from the site: 1) the Newport-Inglewood fault zone, 2) the Palos Verdes fault, and 3) the Santa Monica fault. The first two fault zones are located within the Peninsular Ranges province, and consist of predominantly right-lateral strike-slip faults that trend northwesterly. The Santa Monica fault forms the southern boundary to the Transverse Ranges province, trends east-west, and is considered responsible for uplift of the Santa Monica mountains. This fault is believed to have a left-lateral, north-side-up dip-slip component of movement.

Historical seismicity in the vicinity correlates with the mapped traces of the Newport-Inglewood fault to the east, the Santa Monica fault to the north, and to a lesser extent with the schist ridge underlying the Playa del Rey oil field, but there is no recognizable pattern in the microseismicity immediately below the site that would suggest there is a seismically active fault in this area (Hauksson, 1987; 1992a; 1992b; 2000; Richards-Denger and Shearer, 2000). A review of past earthquake history for this area shows that in the last 200 years, approximately 74 earthquakes of magnitude 4 and above have occurred within 20 miles of the site (see Appendix B). Of these, 14 earthquakes have occurred within 5 miles of the site, with the closest occurring about 2 miles to the north, in Santa Monica. The largest of these earthquakes is a magnitude 5 event that occurred on November 19, 1918 just off the coast of Santa Monica, 5 miles to the northwest of the Playa Vista site. This earthquake is estimated to have caused peak ground accelerations at the site of about 0.14g.

All three of the faults within 5 miles of the site have the potential to generate significant earthquakes that would have an impact at the site. Other active faults farther away can also generate earthquakes that would be felt at the site. Peak ground accelerations at the site as a result of the worst-case scenario, a magnitude 7.1 on the Palos Verdes fault are estimated at about 0.42g, where g is the acceleration of gravity (see Appendix C), although stronger ground motions could be expected if the soft sediments underlying the site amplify the seismic waves.

2.2 Geologic Setting

This area of the Los Angeles Basin has been studied geologically in quite some detail since the earlier part of the 20th century, when oil exploration in this area began in earnest. Wildcat wells (boreholes drilled for the intent of discovering an oil field) were drilled throughout the area, including in the Playa Vista site, eventually leading to the discovery of the Playa del Rey Oil Field in 1929. Once the oil field was discovered, development was very rapid, so that by the end of 1930, more than 140 wells had been drilled in the area (Riegle, 1953). The drillers' notes, oil well cuttings and cores, and geophysical logs of these wells have been used by oil field geologists to interpret the subsurface geology. (For a diagram showing the stratigraphic units in this portion of the Los Angeles Basin, refer to Figure 3).



Earth Consultants International Project No. 800130-001 March 30, 2001	**Stratigraphic Column for the West Portion of the Los Angeles Basin**	**Figure 3**

The first to describe the subsurface geology in the Playa del Rey area was Metzner (1935). His work was later superseded by Hodges (1944). Basement rock, the igneous and/or metamorphic hard rock that is exposed in the Santa Monica Mountains to the north (Hoots, 1931), was reached in the oil wells at depths of between 6,000 and 6,500 feet. The basement rock, a schist, is extensively weathered and forms a very irregular upper surface that consists of a topographic high from which several depressions (or valleys) descend both to the northeast and southwest. These depressions were eroded into the bedrock surface when it was exposed at the surface hundreds of millions of years ago. The valleys were filled with a detrital deposit of sandy conglomerate that in turn is overlain by a layer of nodular shale that formed an effective cap, trapping large concentrations of oil and gas at depth. This conglomerate was the principal oil-bearing unit in the Playa del Rey area, producing approximately two-thirds of the oil from this field (Wright, 1991). The gas currently stored in the Playa del Rey field is stored in this sand-conglomerate unit (Riegle, 1953).

The nodular shale is overlain by sediments assigned to the Upper Miocene Puente Formation that include approximately 250 feet of a black shale and 425 feet of sandy shale. The Puente Formation is overlain by 2,500 feet of sediments assigned to the Lower Pliocene Repetto Formation, and approximately 2,000 feet of sediments assigned to the Pico Formation. Oil sands within the Repetto Formation produced the remaining one-third of the oil produced from this field. The Puente, Repetto and Pico sediments are thought to be of marine origin.

These marine sediments are overlain by 400 to 1,000 feet of sediments of Pleistocene age (1.6 million to 10,000 year old). These Pleistocene sediments have been studied extensively because they contain nearly all of the fresh ground water tapped by wells in this portion of the Los Angeles Basin. The principal source of water is the San Pedro Formation, the oldest Pleistocene unit, which consists primarily of unconsolidated gravel and sand, locally capped with silt and clay. The coarse, bottom two-thirds of the San Pedro sediments are thought to be more than 800,000 years old in the Torrance Plain (Ponti and Lajoie, 1992). The upper, fine-grained section was probably deposited between 650,000 and 800,000 years ago.

The San Pedro Formation is overlain by the Lakewood Formation, which was previously referred to as Unnamed Pleistocene Terrace Deposits (Poland and others, 1959; California Department of Water Resources, 1961). Ponti and Lajoie (1992) estimate that this unit was deposited between 220,000 and 600,000 years ago. The Palos Verdes sand described by Hoots (1931), Poland and others (1959), and Cooper (1967), among others, is a fossiliferous layer that locally occurs near the top of the Lakewood Formation. In the Palos Verdes Hills area, this deposit is estimated to be between 80,000 and 120,000 years old (Ponti and Lajoie, 1992). This fossiliferous layer is covered by reddish brown sand of primarily non-marine origin that typically has a well-developed soil profile.

The geologic history of the area in the last 18,000 to 20,000 years is fairly well understood. During the last glacial maximum, large amounts of water were locked in glaciers and ice-sheets that covered extensive areas of the continents. Sea level was approximately 130 meters (400 feet) lower than its present level, and therefore, the coastline was many miles offshore from its present position. Rivers draining the mountains to the east carved deep trenches on their way to sea, probably removing all of the Lakewood sediments within the Ballona Gap area, and cutting into the San Pedro Formation. Then, as world-wide temperatures rose and the glaciers melted, sea level began to rise very quickly, at a rate of about 1 meter (3 feet) in 100 years. The deep trenches began to infill with sediment as the rivers tried to establish a new base level with the rising coastline. The sediments infilling these trenches consisted primarily of gravel, sand and silt. Sea level continued to rise rapidly until about 7,000 to 6,000 years ago. At some point, the Ballona Gap was flooded by the rising sea water, and was cut off from the sea, probably by longshore sediment drift. The alluvial sediments were replaced with finer-grained marsh and lagoonal sediments. As the fine-grained sediments infilled the basin, sea water retreated. More recently, the lagoonal deposits were overlain by a thin veneer of alluvial sediments deposited by an ancestral Los Angeles River, and Ballona and Centinela creeks.

Radiocarbon dating of sediments collected by the project archaeologists from cores drilled at various locations on the Playa Vista site provide age control on this process of sedimentation (Brevik and others, undated). Two samples collected near the bottom of the fine-grained alluvial sediments overlying the gravelly sand, at depths of 39 and 46 feet, were dated at 15,640 ± 50 years before present (BP) and 14,770 ± 120 years BP, respectively. The first sample was from a peat deposit, and the second was wood. It seems that infilling by fine-grained alluvial sediments continued until approximately 6,000 years ago, when Brevik and others suggest that a spit of sand formed across the mouth of the coastal inlet, creating the Ballona lagoon.

2.3 Geomorphic Setting

The Playa Vista site is located in the southern half of the Ballona Creek floodplain. The floodplain itself is a nearly level to very gently sloping surface that drains to the west. "Original", pre-development elevations at the site range from about 15 feet above mean sea-level near the eastern boundary of the site, to about 5 feet above mean sea level in the area of this study. The channelized Ballona Creek is located north of the site, while Centinela Creek flows along the southern portion of the site, near the bluffs that rise about 150 feet to the Venice Plain and the El Segundo sand hills (Figure 2).

The bluffs form a rather straight east-west profile in the area of Playa Vista, except for the big "bite" formed by the valley along which Lincoln Boulevard rises toward Manchester Avenue (see Figure 2). The bluffs on both sides of this "bite" however, are fairly straight and continuous, and neither side extends out onto the Ballona floodplain more than the other does. This suggests that the bluffs are not laterally offset in this area, as would be expected if a fault extended in a northerly direction through the area.

Several early investigators studied the El Segundo sand hills before they were extensively disturbed by development. Hoots (1931) briefly mentions that the bluffs overlooking the Ballona Plain are underlain by a sand unit that contains fossils of upper San Pedro age, and probably correlative with the Palos Verdes sand. Cooper (1967), in part based on Merriam's (1949) work, describes the sand dunes as underlain by a terrace cover that includes the marine Palos Verdes sand, and a non-marine section. According to Cooper, the dune section itself includes three, and possibly four dune sand layers, each layer followed by a stabilization period during which a distinct soil profile developed.

In 1935 Metzner described the hills southeast of the Playa del Rey Oil Field, and divided them into four separate "provinces" on the basis of their topography. Metzner argued that the two provinces closer to the coastline are controlled by faulting, as evidenced by the abrupt escarpments at their margins. The eastern margin of Metzner's third province coincides with Lincoln Boulevard. Metzner noted that this third province is characterized by features nearly perpendicular (rather than parallel) to the coastline, and by closed drainages, and suggested that these features could be the result of faulting, tilting or wind action. Metzner did not offer evidence from which to discriminate a cause, and he did not give preference to one cause over another.

Poland and others (1959) and Cooper (1967) describe two main zones, rather than four, within the sand dune complex, but disagree about the origin of the inland section. Both Poland and others (1959) and Cooper (1967) describe the zone adjacent to the coast as a dune field of Holocene age. However Poland and others interpret the inland zone as a series of ancient offshore bars modified by wind and stream action, while Cooper considers this section a field of subdued dunes of much greater age. Within these zones, Cooper describes several ridges and depressions parallel to the coastline and explains them as superposed dune surfaces (Figure 4a). Unlike Metzner, neither Poland and others (1959) nor Cooper (1967) identify a topographic lineament coincident with Lincoln Boulevard.

Lajoie and others (1992) also identify two zones and explain them as strandline terraces cut onto the Venice Plain, that were then overlain by sand dunes. Based on fossils, they assign an age of 124,000 years before present (BP) to the top of the Venice Plain, below the dune sediments, and a tentative age of 320,000 years BP for older sediments exposed lower in the bluffs. According to Lajoie and others (1992), the terrace closest to the present shoreline is approximately 80,000 years old, and the other is about 102,000 years old, although it could be even older (Figure 4b).

The bluffs facing the Playa Vista site have also been mapped previously by at least two consultants (Converse Ward Davis Dixon, 1979; LeRoy Crandall and Associates, 1991). The geologic maps prepared by both consultants were done with sufficient care to note geologic contacts, bedding attitudes, shallow landslides and erosional gullies. Neither map shows any faulting anywhere on the bluffs (Figures 5a and 5b).

2.4 Local Faulting

Metzner (1935) identified and mapped several faults in the subsurface in the Playa del Rey oil field, to the southwest of the Playa Vista site. The faults were identified approximately 6,000 feet below the ground surface, within the basement bedrock, and oriented primarily east-west. According to Hodges (1944), "these faults cut the oil sand-conglomerate zone and the Nodular shale of the Miocene but are not known to be reflected [i.e., present] in the Upper Zone". The "Upper Zone" is more than 2,000 feet below the ground surface. A map accompanying Hodges (1944) report also shows a bentonite (clay) layer approximately 3,300 to 4,000 feet below the ground surface that is not faulted.

More recently, Yeats and Beall (1991) prepared an east-west cross-section from the Inglewood field to the Playa del Rey oil field that extends from the Pleistocene-age

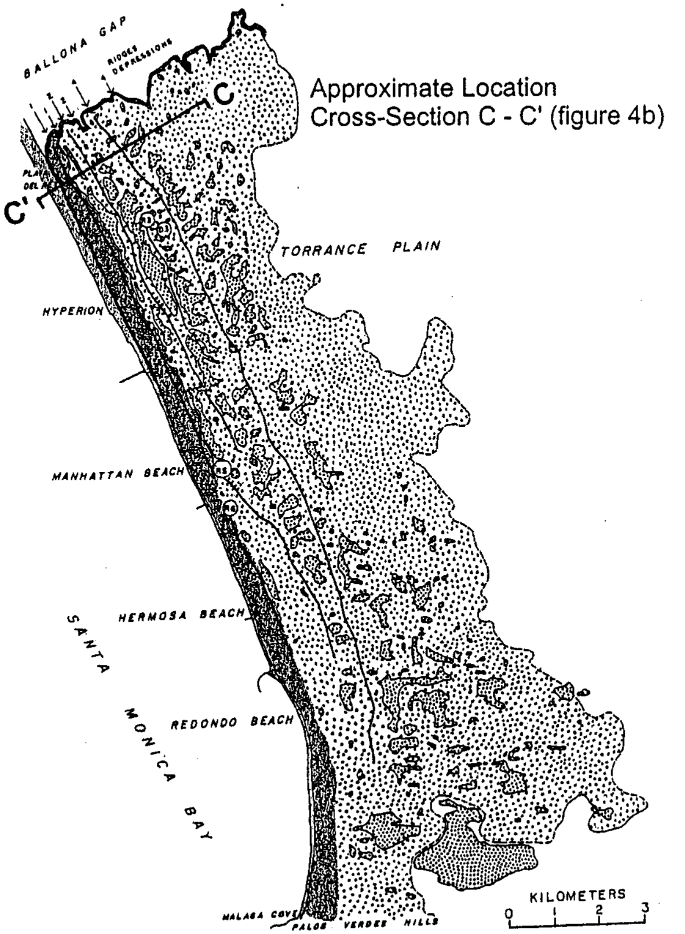
San Pedro Formation at the top down to the basement schist. Yeats and Beall interpret no faulting west of the Inglewood field within the sedimentary section (Figure 6a). Similarly, Jack West, a petroleum geologist working with Davis & Namson on this project, used subsurface well data to prepare two regional cross-sections through the Playa Vista site. His cross-sections show faulting cutting the schist basement, the sand-conglomerate zone, the Nodular shale and portions of the Puente Formation. The faults do not cut the lower Repetto section, and have therefore not moved in the last about 5 million years (Davis & Namson, 2000). The faults identified have a normal sense of displacement, consistent with the extensional tectonic regime that characterized the Los Angeles Basin about 5 million years ago [the basin is now undergoing compression].

Hummon and others (1992) mapped the base of the Pleistocene marine gravels (the bottom of the San Pedro Formation) and found that this surface forms a syncline (a bowl-shaped fold) that extends southwesterly from the Newport-Inglewood fault zone on the east toward the coastline (Figure 6b). The data from which Hummon and others (1992) prepared this structural contour map do not support the presence of a northwest-trending fault in the area of the "Lincoln Boulevard fault" west of the Newport-Inglewood fault zone.

None of the published geologic maps, cross-sections and geologic reports that cover this portion of the Los Angeles Basin show any faults or reasons to suspect a fault underlying the area southwest of Lincoln and Jefferson Boulevards, in the area of the proposed "Lincoln Boulevard fault" (Poland et al., 1967; Yeats and Beall, 1991; Wright, 1991). The site is also not located within an Alquist-Priolo Earthquake Fault Zone (Hart and Bryant, 1997). The Newport-Inglewood fault is the closest fault to the site that has been zoned by the State as active (CDMG, 1986; Byrant, 1988; Hart and Bryant, 1997). The Charnock fault, a fault inferred from groundwater level anomalies (Poland and others, 1959; California Department of Water Resources, 1961), has been mapped as underlying the eastern portion of the Playa Vista site, but has not been found near the surface at or near the site (Kovacs-Byer and Associates, 1987; LeRoy Crandall and Associates, 1987a; 1987b).

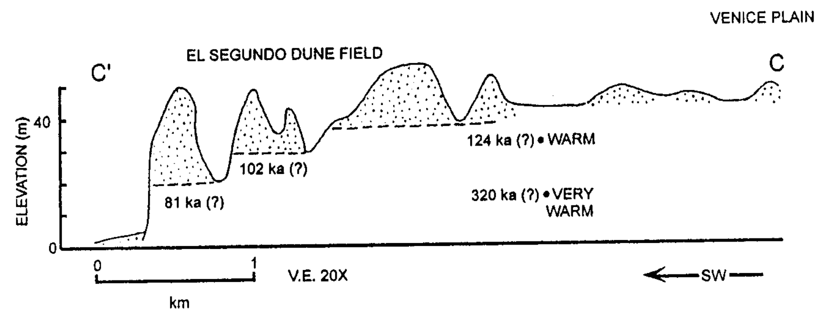
Figure 4a

Lines connect the high points on ridge crests; they are not faults.



From Cooper, 1967

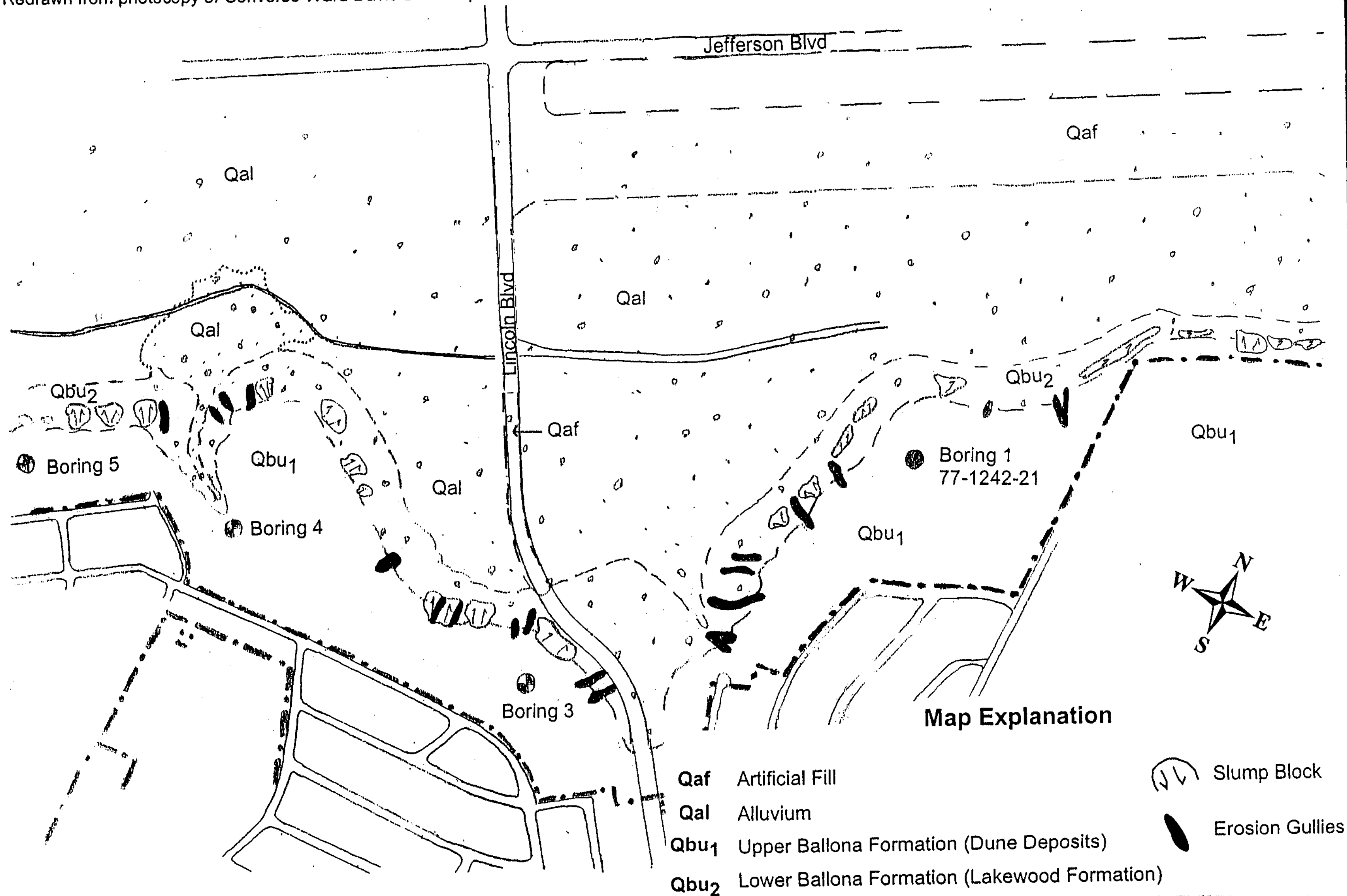
Figure 4b



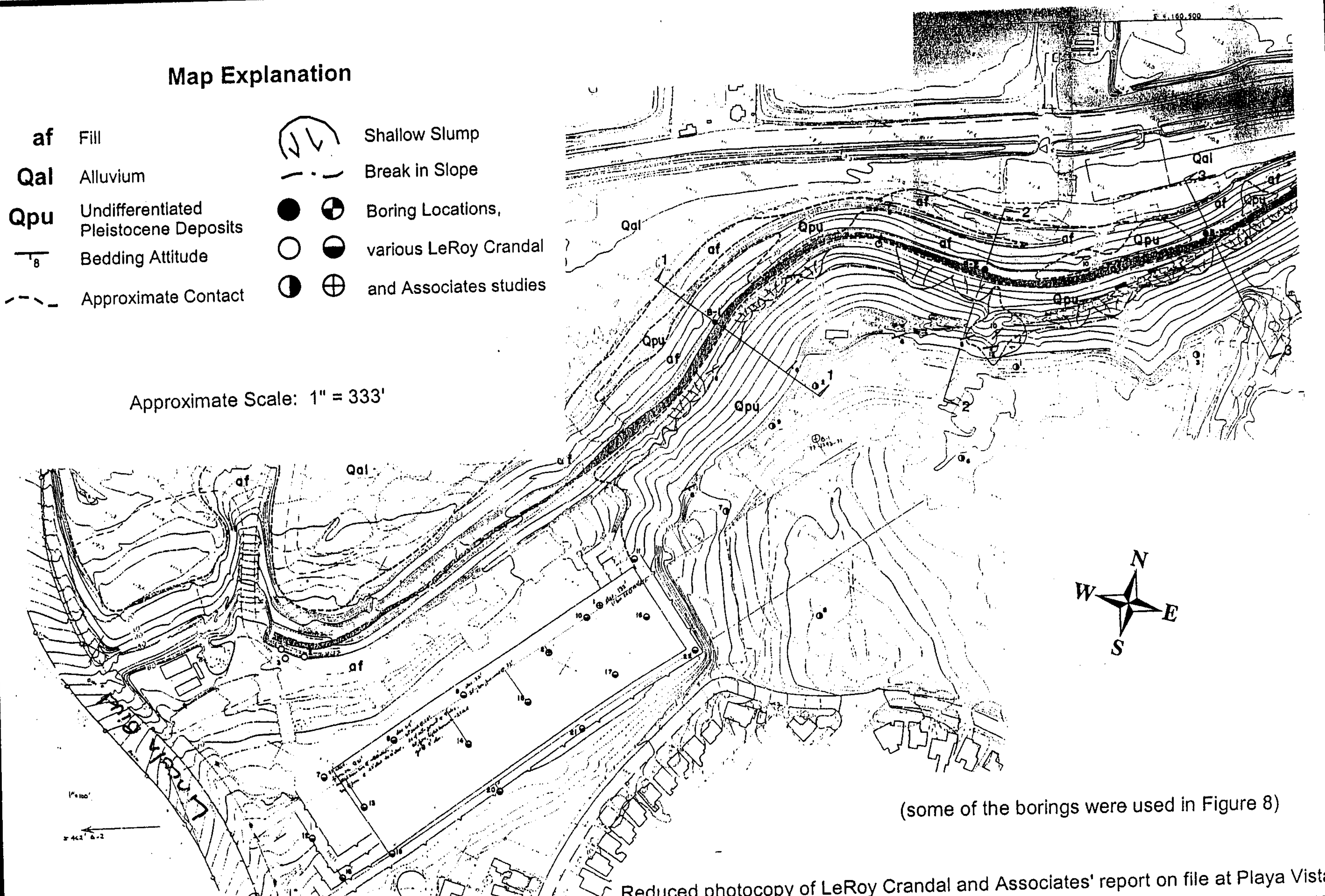
From Lajoie and others, 1992

Earth Consultants International	Project No.: 1813.01 Date: March 30, 2001	Coastal Dunes Mapped by Cooper (4a) and East-West Cross-Section Through the El Segundo Dune Hill (4b)	**Figure 4**

Redrawn from photocopy of Converse Ward Davis Dixon report 1979 on file at Playa Vista



Earth Consultants International	Project No.: 1813.01 Date: March 30, 2001	Geologic Map of the Bluffs Adjacent to Lincoln Boulevard (by Converse Ward Davis Dixon, 1979)	Figure 5a



Earth Consultants International

Project No.: 1813.01
Date: March 30, 2001

Geologic Map of the Bluffs Adjacent to Lincoln Boulevard (by LeRoy Crandall and Associates, 1991)

Figure 5b

Figure 6a (from Yeats and Beall, 1991)

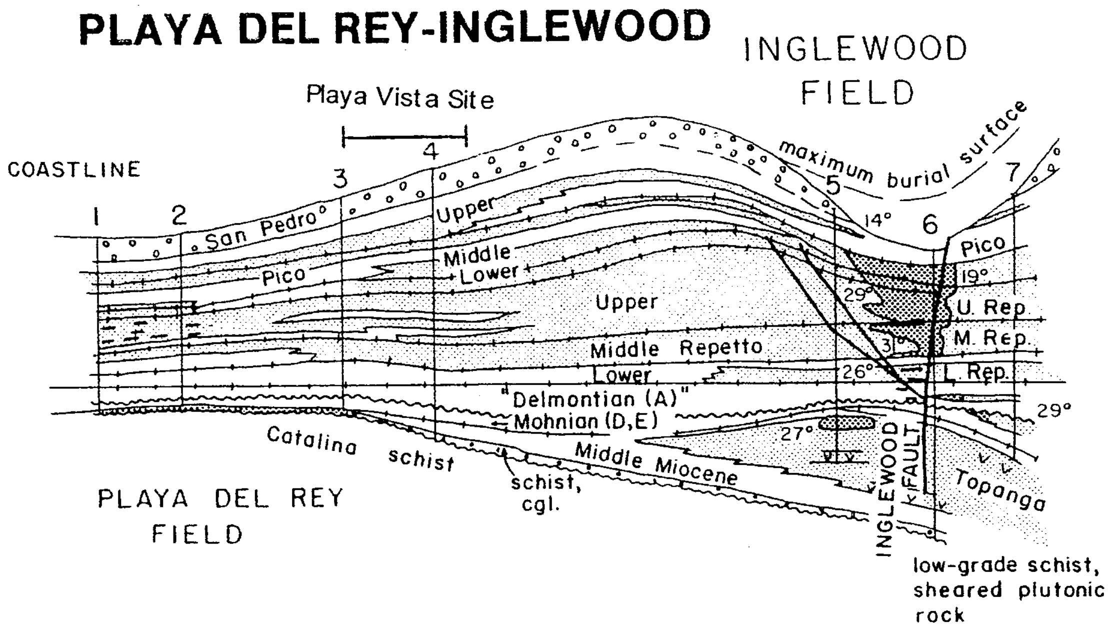
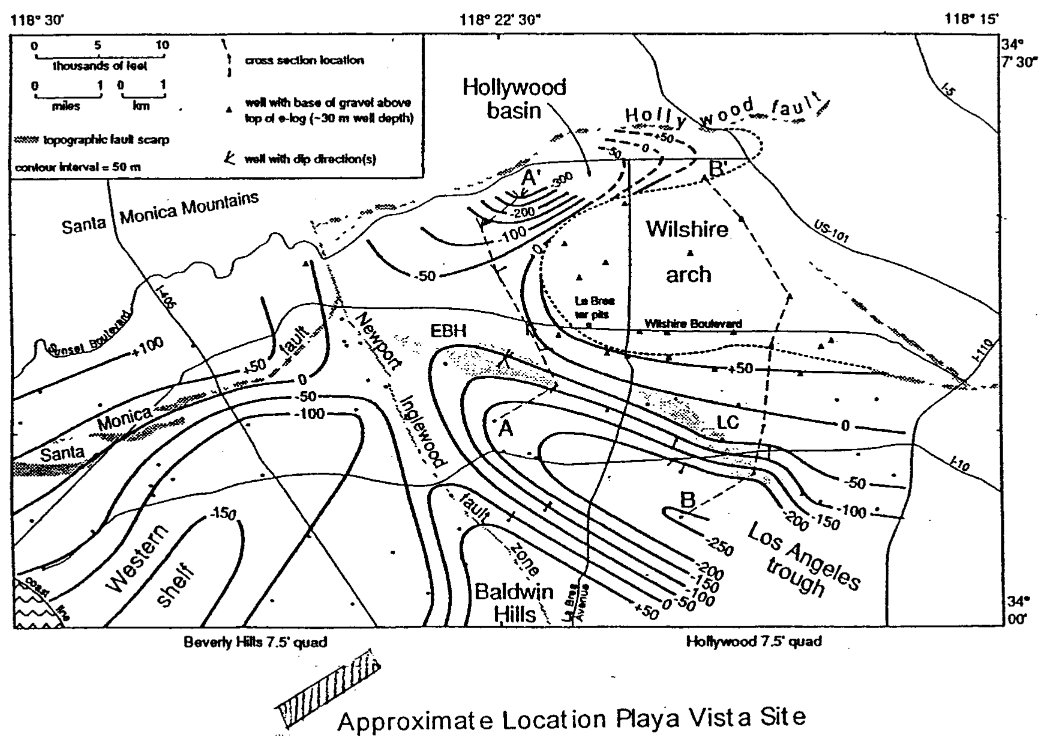


Figure 6b (from Hummon and others, 1992)



Earth Consultants International

Project No.: 1813.01
Date: March 30, 2001

Cross-Section from the Inglewood Field to the Playa del Rey Field (6a) and Structural Contour Map at the Base of the Pleistocene Gravel (6b)

Figure 6

3.0 Site-Specific Geologic Studies

3.1 Borehole and CPT Data by Other Investigators

Subsurface exploration of the Playa Vista site has been extensive; hundreds of borings and CPT soundings have been drilled onsite in the last 20 to 25 years. As part of this study we attempted to utilize this extensive data set to correlate stratigraphic units across the area and evaluate whether or not the stratigraphy has been offset by faulting. To do this, we concentrated on the gravelly sand layer that underlies the site, as this layer seems to represent the contact between Pleistocene (greater than 10,000 years old) and Holocene (less than 10,000 years old) sediments. This sandy gravel layer is referred to by Poland and others (1959) as the "50-foot" gravel, named so because on average, this unit occurs about 50 feet below the ground surface. Poland and others (1959) suggest that this unit was laid down by an ancestral Los Angeles River that extended in a westerly direction across the central portion of the study area. Poland and others (1959) recognized from water well data that although the top of the gravel layer slopes to the west, its surface is very irregular.

We plotted the borings that encountered the gravelly layer on a GIS-based map of the Playa Vista site (see Plate 1). Then, for each point, we calculated the elevation of the gravelly layer (relative to mean sea level) by subtracting the depth of the gravel (as reported in the boring or CPT) from the elevation of that boring (Plate 2). Unfortunately, some of the earlier borings were not surveyed, so their elevations were either missing or were unreliable. For example, we ultimately dropped from the analysis most of the borings and CPTs conducted by Pacific Soils in the 1980s, either because they were not deep enough to intercept the gravelly sand layer, or because their elevation was unknown. We also dropped many of the "MWW" borings by ETI (2000) and "R" borings by Group Delta Consultants (1998) because these borings were reportedly drilled very quickly, and we could not verify the reported depth to the sandy gravel layer.

3.2 Recent Subsurface Studies by Earth Consultants International and Others

After careful review of the data available to us in the summer of 2000, it became clear that we had insufficient points at the top of the sandy gravel layer to image the top of this deposit in the area where the "Lincoln Boulevard fault" was proposed. Therefore, to obtain more closely spaced data in this area we conducted a detailed CPT and boring program in the area east of Lincoln Boulevard and south of Jefferson Boulevard. Three 800-foot long lines of CPTs and borings were drilled perpendicular to Lincoln Boulevard (lines A, C and D in Plate 1). Another line of CPTs approximately 300 feet long was drilled between lines A and C (line B in Plate 1). On each line, the CPTs and borings are spaced on average between20 and 40 feet apart, although some are less than 10 feet apart. The CPTs were driven until refusal in the dense gravelly sand layer. The borings were drilled adjacent to some of the CPTs to confirm the stratigraphy interpreted from the CPTs.

Between December 2000 and March 2001, dozens of additional non-instrumented CPT soundings have been emplaced at the site under the supervision of CDM. The soundings have been drilled using a CPT-rig, but the tip of the cones used have not been instrumented. Therefore, data on the soil behavior type are not available. Nevertheless, from the pressure necessary to push the cone into the ground, CDM personnel have estimated the location of the top of the gravel layer at each sounding location. We have been provided with these "geoprobe" data, including the location and elevation of the soundings, and the depth to the high-pressure zone, and have incorporated these values into the overall top-of-gravel database. As mentioned before, extensive archaeological surveys have also been conducted at the site. These studies included the drilling and collection of over 150 cores. Most of these were drilled to about 25 feet below the ground surface, but some were as much as 100 feet deep. We have also used these core descriptions in our top-of-gravel assessment.

The geologic units encountered in our borings and CPTs are described below, from youngest to oldest (top to bottom).

3.2.1 Modern Artificial Fill

Artificial fill locally covers the site by as much as 15 to 20 feet. These materials were placed by mechanical means in the last few years, typically for the purpose of surcharging the underlying loose sediments thereby increasing their in-situ densities. The artificial fill typically consists of layered gravelly sand, fine to coarse sand, and silty sand. Scattered pieces of glass and wood were observed locally in the borings and basement excavations, within the artificial fill section.

3.2.2 Modern Alluvial Sediments

A thin (2- to 4-foot thick) section of alluvium typically covers the site in those areas where the ground has not been covered with artificial fill. The alluvium generally consists of sand and silty sand with no soil development.

3.2.3 Holocene Marsh and Lagoonal and Alluvial Sediments

The Holocene section is usually about 40 feet thick and typically consists of two distinct sediment packages separated by a silty sand to sand layer at an elevation of between 25 and 30 feet below current sea level. The upper package consists primarily of silt with thin silty clay interbeds. The unit gets finer-grained up-section (fining upward), so that at the top it is capped with a layer of clay 2 to 4 feet thick. This clay layer is referred in other publications and reports as an "adobe" layer. This fining-upward sequence was probably deposited when the area was a closed-in marsh or lagoon, in the last about 6,000 years.

The bottom of the Holocene sediment package consists primarily of silty and silty clay, with thin sandy and even gravelly layers locally. The coarser beds indicate a fluvial origin, consistent with the environment of deposition expected in the area between about 14,000 and 7,000 years ago, when sea level was rising. In the southern portion of the area investigated, there is a series of layers consisting of gravelly sand, sand and silty sand that appear to have emanated from the bluffs to the south, possibly as slump debris or sediment eroded during high energy storms (see Cross-Sections C-C', D-D' and E-E').

3.2.4 Late Pleistocene Alluvial Sediments

Dense sand and gravel deposits were encountered at the bottom of the CPTs and in our borings. These sediments are considerably denser than the overlying deposits, with equivalent SPT blow counts of more than 50 for 6 inches of core. The top of this layer is shown in all of our cross-sections (see Plates 4 through 8), and in the structural contour map (Plate 3). As observed by Poland and others (1959), this layer has a regional dip to the west, but is vertically variable. Undulations in the top of this layer, typically in the order of 2 to 4 feet, are reflective of the natural bar and pool riffle morphology of active streams.

Using most non-questionable borings by previous investigators, the borehole and CPT data that we collected in the summer of 2000, and the geoprobe data recently collected by CDM, we contoured the sandy gravel (or gravelly sand) layer elevations using two-foot contour spacing (Plate 3). The contours show that the top of the gravelly sand deposits forms an irregular surface that has received sediment input from two sources, one to the south, and one to the north-northeast. To the south, the source of this sediment appears to be the escarpment south of the site, with gravelly sand deposited at the base of the slope and out to the north, away from but parallel to the slope. The sediments to the north appear to emanate from the large fan that cuts a gap through the elevated surface south of Santa Monica. This fan can be seen in the older topographic maps of the area. The depressions suggested by the closed contours (produced by the automatic contouring program) are oriented in a westerly direction, rather than in a north-south direction, as would be expected if the postulated Lincoln Boulevard fault or other similar fault was present below the site. The lack of a north-trending linear scarp through the site argues against an active fault with the orientation and sense of movement suggested by ETI (2000) for the postulated Lincoln Boulevard fault.

From the cross-sections prepared with the CPT and borehole data available next to lines A-A′ through D-D′ (Plates 4 through 7), we can identify those areas where the gravelly sand layer is irregular. Specific portions of each cross-section are described below.

In Section A-A′, there are changes in the elevation of the top of the gravel layer between ECI-44 and ECI-1, between ECI-53 and ECI-10, between ECI-33 and ECI-13 (based on TVW-009), and between ECI-12 and ECI-16 (based on TVW-80). The entire section is overlain by a silty sand layer at an elevation of –25 feet that extends unbroken across the area. This sand layer is about 6,000 years old.

In Section B-B′, the gravelly sand layer is level across the eastern portion of the cross-section, and makes a vertical step only between ECI-50 and ECI-30, and possibly between ECI-50 and ECI-48 (based on TVW-030). It is possible that the top of the gravelly sand layer in this area is best represented by the top of the silty sand layer in ECI-48 and ECI-50. If this is the case, then the layer would be level across the entire area. Similar to cross-section A-A′, the silty sand layer at –25 feet elevation is laterally extensive across the entire section.

The top of the gravelly sand layer has been investigated extensively in the area of Section C-C′, and the extensive geoprobe data recently added to the database indicate that the gravelly sand layer extends almost smoothly across the entire area. Variations in the elevation of the layer are small, generally amounting to a difference of about 1 foot. The only vertical change of significance is in the area of MMW-207. Since this well was drilled very quickly, the geologic contacts identified during the drilling operations are suspect, and could well be off by 5 feet or more. Therefore, the 2-foot change in elevation in this area could well be an artifice of the sampling. The geoprobe data available in the immediate vicinity of this well suggest that the top of gravel is off by about 1 foot, well within the tolerances of the methodology used for this study. Note that the silty sand layer at about –21, as recognized in the CPTs, extends unbroken across the area.

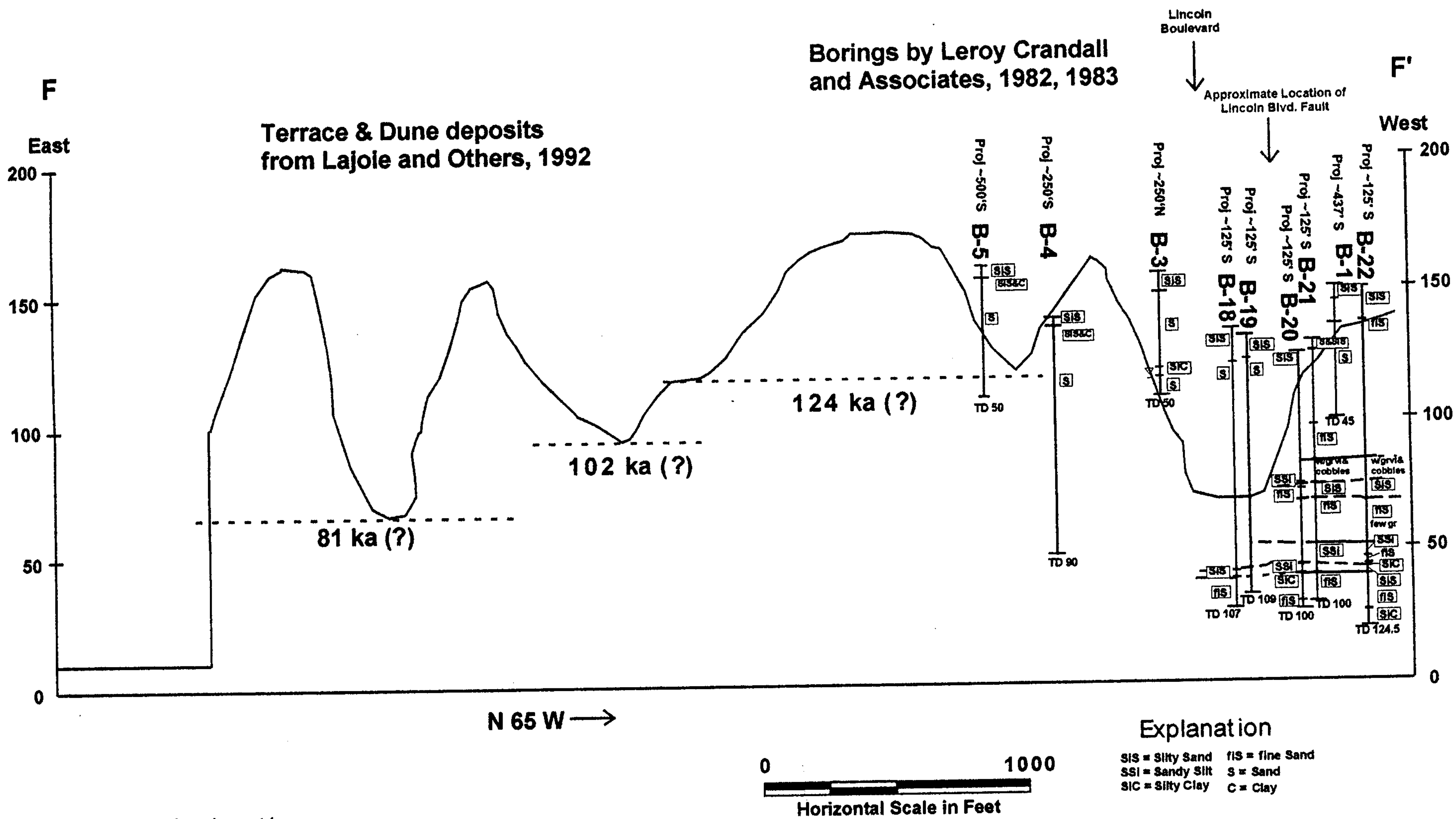
Section D-D′ is significant because it shows that in the southern portion of the study area, the alluvial sediments are interlayered with sand beds 5 to 20 feet thick. These sand beds are interpreted as slump debris or colluvium that originated from the escarpment to the south. The gravel layer extends fairly smoothly across the section, except in the area where TVW-076 was emplaced. There the pressure difference that signals the contact between the fine-grained alluvial sediments and the gravelly sand layer was felt approximately 2 feet below where the rest of the CPTs would have predicted the contact. It is possible that this datum is incorrect, as the geoprobe-picked contacts are only approximate, based on pressure readings, and the pressure is dependent on the rig used (at least one of the rigs used at the site has twice the push-capability of the other rigs, and that would have an effect on the pressure readings used to recognize the gravelly sand layer). The smooth, laterally continuous character of the gravelly sand layer is mimicked in the overlying sediments in the eastern portion of the cross-section. However, in the western portion of the area covered by the cross-section, the slump sediments that have been recognized in this section have impacted the lateral continuity of the overlying layers. Therefore, in this area, we cannot conclusively demonstrate the absence of faulting in the deeper alluvial section.

3.3 Cross-Sections of the Bluffs South of the Site

Since the near-surface sediments in the area where the "Lincoln Boulevard fault" is proposed are young geologically, we looked for evidence of faulting in the bluffs south of the site. The sediments that form these bluffs are Pleistocene in age, and therefore, if a fault is present in this area, and the fault has moved in the last approximately 100 thousand years, it should offset these older sediments.

To evaluate whether or not the bluff sediments have been impacted by faulting, we constructed two cross-sections, F-F' and G-G' parallel to the bluffs (see Figures 7 and 8, and Figure 1 for the location of the cross-sections). The subsurface geology shown on these cross-sections is based on borehole data obtained by Converse Ward Davis Dixon (CWDD, 1979) and LeRoy Crandall and Associates (1982 and 1983, 1991) for the former Hughes facility off of Lincoln Boulevard, and geologic data provided by Lajoie and others (1992), and Poland and others (1959) (see Sections F-F' and G-G', Figures 7 and 8, respectively).

A gravel-cobble bed at an approximate elevation of 80 feet above mean sea level is recognized in several of the borings (see Section G-G', Figures 8). This layer can be correlated from one boring to the next in the eastern portion of the section. The borings on the west-end of the section were located on a bench in the bluffs that is generally below the elevation of the gravel-cobble bed. Therefore, we could not correlate that layer across the entire section. However, other deeper beds extend between borings in the western portion of the section. Ground water was measured in some of the borings by CWDD, and the water surface is fairly constant across the western portion of the site. Since faulting often impacts the groundwater surface, its continuity in this area argues against a fault impacting these sediments. The water surface could not be correlated across the borings on the east side of the section because most of these borings were drilled with a mud rotary rig, which does not allow for measurements of the groundwater level. Although none of the layers extends laterally along the entire width of the cross-section, by using several of these layers we can show that there is no offset in the Pleistocene sediments underlying the bluffs to suggest a fault in this area.



See Figure 1 for location

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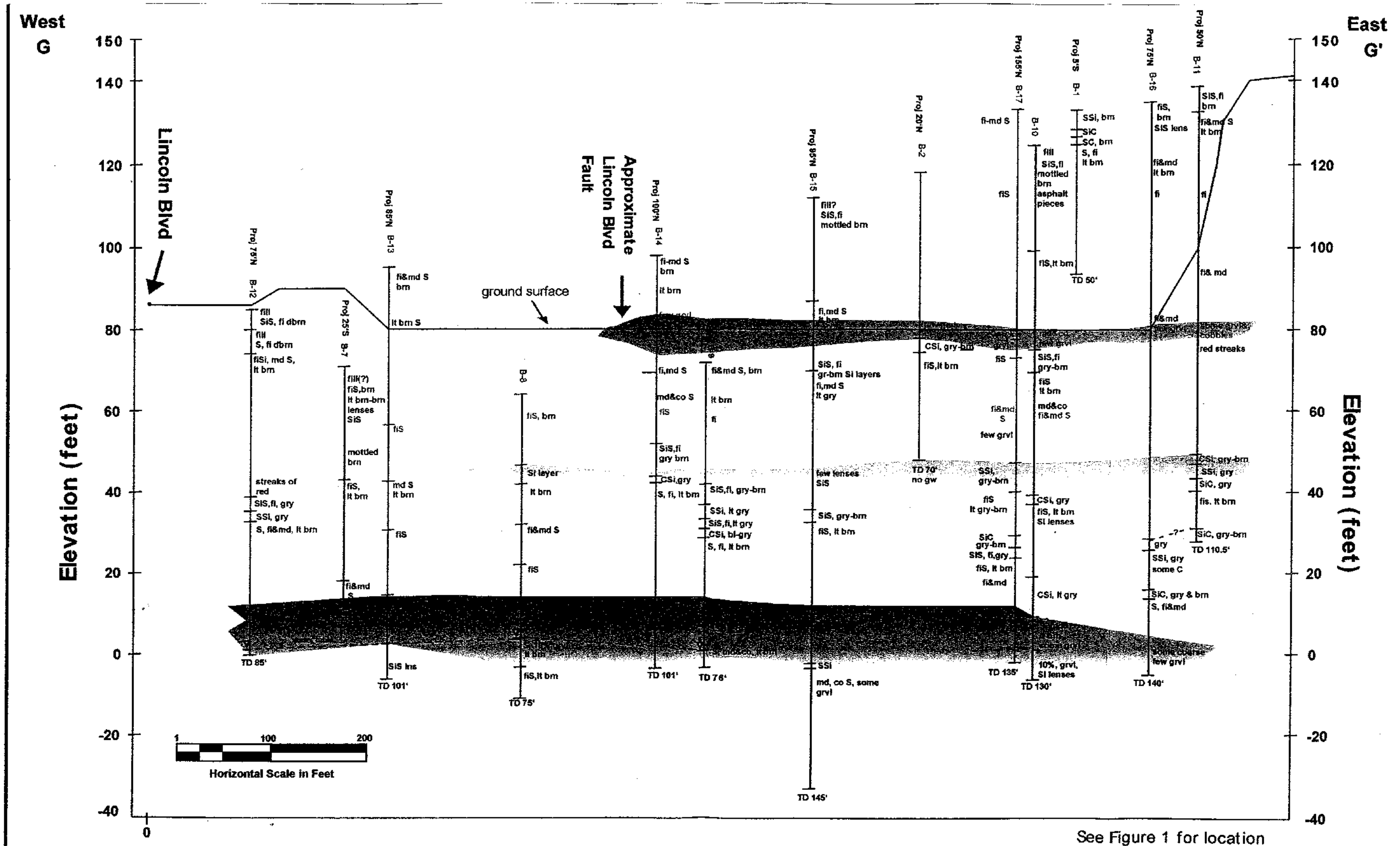
Date March 30, 2001

Cross-Section F-F'

Figure 7



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Project No. 800130-001

Date March 30, 2001

Cross-Section G-G'

Figure 8

4.0 Summary and Conclusions

Geochemical data were used by ETI (2000) to propose that the area of the Playa Vista site immediately east of Lincoln Boulevard is underlain by a fault. The proposed fault reportedly trends north-northwesterly, and dips to the west with a normal sense of slip (the west side of the structure has moved down relative to the east side of the structure). According to ETI (2000), this fault acts as a pathway for thermogenic methane gas to reach the surface. The gas presumably originates at depths of between approximately 500 and 3,400 feet.

To evaluate whether or not this fault does underlie the area, we undertook a multi-phased geological study. As with much of the Los Angeles Basin, this area has been the subject of several oil and ground water studies. Wildcat oil exploration wells drilled across the area eventually led to the discovery of the Playa del Rey oil field to the west-southwest. Ground water has been produced from several shallow aquifers, including the 50-foot gravel that was the subject of our field studies. A review of these published data shows that no faults have been mapped in the subsurface in this area. Historical seismicity in the vicinity corresponds with the mapped traces of the Newport-Inglewood fault to the east and the Santa Monica fault to the north, and there is no recognizable pattern in the microseismicity immediately below the site that would suggest there is a seismically active fault in this area.

Although the extensive subsurface data from oil well and groundwater well records do not show a fault in this area, we undertook a site-specific study that looked at the extensive near-surface data that has been obtained from the various geotechnical studies conducted at the site. Realizing that the data available were insufficient to image the top of the 50-foot gravel layer, we drilled 57 new CPTs and 5 borings in the area. Additional subsurface data that have become available since we conducted our field study in the summer of 2000 have also been incorporated in this report.

Using these data we refined the structural contour map of the top of the Pleistocene gravel surface, and prepared several cross-sections. These graphics show that the top of the sandy gravel layer is locally irregular. The amplitude of these irregularities is typically less than 2 feet, and generally no more than 4 feet. Although these irregularities could conceivably obscure a fault offset of small magnitude, we believe that this is unlikely, since the irregularities in a north-south direction are predominantly equidimensional rather than elongate (elongate irregularities in a north-south direction would be expected for a fault trending northerly). The elongate features that are present typically trend westerly, consistent with the channeling and point-bar morphology that would be expected in a west-flowing stream environment like that of Ballona Creek.

We also used the geometry of the overlying, fine-grained sediments, which were deposited in a low-energy environment, to show lateral continuity across the site. Those areas above where the gravelly sand layer made small vertical changes were in most cases overlain by laterally extensive, unbroken fine-grained sediments. This indicates that although we cannot preclude the possibility of a small vertical offset of the top of the gravel, the overlying Holocene sediments are not faulted. The sandy gravel is thought to be approximately 15,000 years old, whereas the overlying fine-grained sediments were probably deposited about 6,000 years ago.

Furthermore, we also looked for geologic reports that had mapped the Pleistocene-age bluffs south of the site. Two of the geotechnical studies that we reviewed include detailed geologic maps of the bluffs which do not show any faults. Cross-sections parallel to the bluffs show that layers in the underlying terrace sediments (assigned to the Lakewood Formation, which is more than 100,000 years old) are laterally continuous across the area where the "Lincoln Boulevard fault" would project through.

Taken together, the data reviewed for this study indicate that there is no north-trending fault in the area of the postulated "Lincoln Boulevard fault", that has ruptured the ground surface in at least the past several tens to hundred thousand years. Therefore, there is no need to mitigate for potential surface fault rupture there.

Appendix A
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In-House Aerial Photographs Reviewed

Date	Flight No.	Frame No.	Scale	Source
11/4/1952	AXJ-4K	71-74	1:20,000	USDA
11/19/1953	AXJ-14K	67-70	1:20,000	USDA
11/22/1974	389	14, 16, 17, 22, 24, 25	1:6,000	Metrex Aerial Surveys, Inc.

Appendix B
Earthquake History Analysis

Appendix B
Search for Past Earthquakes in the Site Vicinity

Software Used: EQSEARCH Version 2.01
(Estimation of Peak Horizontal Acceleration From California Earthquake Catalogs)

SITE COORDINATES: LATITUDE: 33.9715 N LONGITUDE: 118.4281 W
SEARCH RADIUS: 20 mi
SEARCH MAGNITUDES: 4.0 TO 9.0
SEARCH DATES: 1800 TO 2000
ATTENUATION RELATION: 1) Campbell (1993) Horiz. - 0=Soil 1=Rock
FAULT TYPE ASSUMED (DS=Reverse, SS=Strike-Slip): DS
EARTHQUAKE-DATA FILE USED: ALLQUAKE.DAT
TIME PERIOD OF EXPOSURE FOR STATISTICAL COMPARISON: 25 years
SOURCE OF DEPTH VALUES (A=Attenuation File, E=Earthquake Catalog): A

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (GMT) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
T-A	34.000	118.250	9/23/1827	0 0 0.0	7.3	5.00	0.077	VII	10 [17]
T-A	34.000	118.250	1/10/1856	0 0 0.0	7.3	5.00	0.077	VII	10 [17]
T-A	34.000	118.250	5/ 2/1856	810 0.0	7.3	4.30	0.048	VI	10 [17]
T-A	34.000	118.250	1/17/1857	1 0 0.0	7.3	4.30	0.048	VI	10 [17]
T-A	34.000	118.250	5/ 4/1857	6 0 0.0	7.3	4.30	0.048	VI	10 [17]
MGI	34.100	118.200	1/27/1860	830 0.0	7.3	4.30	0.048	VI	10 [17]
T-A	34.000	118.250	3/26/1860	0 0 0.0	7.3	4.30	0.030	V	16 [25]
T-A	34.000	118.250	3/21/1880	1425 0.0	7.3	5.00	0.077	VII	10 [17]
MGI	34.000	118.300	9/ 3/1905	540 0.0	7.3	4.30	0.048	VI	10 [17]
DMG	34.000	118.500	11/ 8/1914	1140 0.0	6.5	5.30	0.130	VIII	8 [12]
MGI	33.800	118.500	6/18/1915	15 5 0.0	7.3	4.50	0.104	VII	5 [7]
MGI	34.100	118.200	5/ 2/1916	1432 0.0	7.3	4.00	0.032	V	13 [20]
MGI	34.000	118.200	2/13/1917	13 5 0.0	7.3	4.00	0.024	V	16 [25]
MGI	34.000	118.200	6/26/1917	424 0.0	7.3	4.60	0.046	VI	13 [21]
MGI	34.000	118.200	6/26/1917	2115 0.0	7.3	4.00	0.030	V	13 [21]
MGI	34.000	118.200	6/26/1917	2120 0.0	7.3	4.60	0.046	VI	13 [21]
MGI	34.000	118.200	6/26/1917	2130 0.0	7.3	4.60	0.046	VI	13 [21]
DMG	34.000	118.500	3/ 6/1918	1820 0.0	7.3	4.60	0.046	VI	13 [21]
MGI	34.000	118.500	3/ 8/1918	1230 0.0	7.3	4.00	0.074	VII	5 [7]
MGI	34.000	118.500	11/19/1918	2018 0.0	7.3	4.00	0.074	VII	5 [7]
MGI	34.000	118.400	2/22/1920	1610 0.0	7.3	5.00	0.146	VIII	5 [7]
DMG	34.000	118.500	6/22/1920	248 0.0	7.3	4.60	0.140	VIII	3 [4]
MGI	34.000	118.300	6/22/1920	2035 0.0	7.3	4.90	0.137	VIII	5 [7]
MGI	34.000	118.500	6/23/1920	1220 0.0	7.3	4.00	0.052	VI	8 [12]
MGI	34.000	118.300	6/30/1920	350 0.0	7.3	4.00	0.074	VII	5 [7]
MGI	34.080	118.260	7/16/1920	18 8 0.0	7.3	4.00	0.052	VI	8 [12]
MGI	34.100	118.300	7/16/1920	2022 0.0	7.3	5.00	0.066	VI	12 [20]
MGI	34.100	118.300	7/16/1920	2127 0.0	7.3	4.60	0.053	VI	12 [19]
MGI	34.100	118.300	7/16/1920	2130 0.0	7.3	4.60	0.053	VI	12 [19]
MGI	34.100	118.300	7/26/1920	1215 0.0	7.3	4.60	0.053	VI	12 [19]
MGI	34.100	118.200	4/21/1921	1538 0.0	7.3	4.00	0.035	V	12 [19]
MGI	34.000	118.400	1/29/1927	2324 0.0	7.3	4.00	0.024	V	16 [25]
MGI	34.000	118.400	2/ 7/1927	429 0.0	7.3	4.00	0.093	VII	3 [4]
DMG	34.000	118.500	8/ 4/1927	1224 0.0	7.3	4.60	0.140	VIII	3 [4]
MGI	33.900	118.200	10/ 8/1927	1914 0.0	7.3	5.00	0.146	VIII	5 [7]
MGI	33.800	118.300	12/31/1928	1045 0.0	7.3	4.60	0.043	VI	14 [22]
DMG	33.900	118.100	7/ 8/1929	1646 6.7	7.3	4.00	0.028	V	14 [22]
DMG	33.950	118.632	8/31/1930	04036.0	6.8	5.20	0.031	V	19 [31]
MGI	34.000	118.400	10/ 1/1930	040 0.0	7.3	4.60	0.079	VII	12 [19]
DMG	33.770	118.480	4/24/1931	182754.8	7.3	4.40	0.140	VIII	3 [4]

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (GMT) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.800	118.300	11/ 3/1931	16 5 0.0	7.3	4.00	0.028	V	14 [22]
DMG	33.850	118.267	3/11/1933	629 0.0	7.3	4.40	0.042	VI	12 [20]
DMG	33.850	118.267	3/11/1933	1425 0.0	7.3	5.00	0.064	VI	12 [20]
DMG	33.883	118.317	3/11/1933	1457 0.0	7.3	4.90	0.084	VII	9 [14]
DMG	33.950	118.133	10/25/1933	7 046.0	7.3	4.30	0.028	V	17 [27]
DMG	33.867	118.200	11/13/1933	2128 0.0	7.3	4.00	0.026	V	15 [24]
DMG	33.759	118.253	8/31/1938	31814.2	7.3	4.50	0.030	V	18 [29]
DMG	33.903	118.431	11/29/1938	192115.8	7.3	4.00	0.072	VII	5 [8]
DMG	34.000	118.417	12/ 7/1938	338 0.0	7.3	4.00	0.097	VII	2 [3]
DMG	33.783	118.200	12/27/1939	192849.0	7.3	4.70	0.033	V	18 [30]
DMG	33.983	118.300	2/11/1940	192410.0	7.3	4.00	0.053	VI	7 [12]
DMG	33.767	118.450	10/11/1940	55712.3	7.3	4.70	0.045	VI	14 [23]
DMG	33.783	118.417	10/12/1940	024 0.0	7.3	4.00	0.030	V	13 [21]
DMG	33.783	118.417	10/14/1940	205111.0	7.3	4.00	0.030	V	13 [21]
DMG	33.783	118.417	11/ 1/1940	725 3.0	7.3	4.00	0.030	V	13 [21]
DMG	33.783	118.417	11/ 2/1940	25826.0	7.3	4.00	0.030	V	13 [21]
DMG	33.817	118.217	10/22/1941	65718.5	7.3	4.90	0.045	VI	16 [26]
DMG	33.783	118.250	11/14/1941	84136.3	6.2	5.40	0.063	VI	17 [27]
DMG	33.867	118.217	6/19/1944	0 333.0	7.3	4.50	0.039	V	14 [23]
DMG	33.867	118.217	6/19/1944	3 6 7.0	7.3	4.40	0.037	V	14 [23]
DMG	33.939	118.205	1/11/1950	214135.0	7.3	4.10	0.033	V	13 [21]
PAS	33.944	118.681	1/ 1/1979	231438.9	7.3	5.00	0.054	VI	15 [24]
PAS	33.933	118.669	10/17/1979	205237.3	7.3	4.20	0.032	V	14 [23]
PAS	34.049	118.101	10/ 1/1987	144541.5	7.3	4.70	0.031	V	19 [31]
PAS	34.060	118.100	10/ 1/1987	1449 5.9	7.3	4.70	0.030	V	20 [32]
PAS	33.919	118.627	1/19/1989	65328.8	7.3	5.00	0.067	VI	12 [19]
GSP	34.030	118.180	6/12/1989	165718.4	7.3	4.40	0.035	V	15 [24]
GSP	34.020	118.180	6/12/1989	172225.5	7.3	4.10	0.029	V	15 [23]
GSP	34.213	118.537	1/17/1994	123055.4	3.0	6.70	0.146	VIII	18 [29]
GSP	34.228	118.573	1/17/1994	175608.2	7.3	4.60	0.029	V	20 [31]
GSP	34.218	118.607	1/18/1994	113509.9	7.3	4.20	0.021	IV	20 [32]
GSP	34.245	118.471	1/18/1994	155144.9	7.3	4.00	0.019	IV	19 [31]
GSP	34.215	118.510	1/19/1994	140914.8	7.3	4.50	0.031	V	17 [28]
GSP	34.231	118.475	3/20/1994	212012.3	6.5	5.30	0.052	VI	18 [29]

****

-END OF SEARCH- 74 RECORDS FOUND

MAXIMUM SITE ACCELERATION DURING TIME PERIOD 1800 TO 2000: 0.146g
MAXIMUM SITE INTENSITY (MM) DURING TIME PERIOD 1800 TO 2000: VIII
MAXIMUM MAGNITUDE ENCOUNTERED IN SEARCH: 6.70
NEAREST HISTORICAL EARTHQUAKE WAS ABOUT 2 MILES AWAY FROM SITE.
NUMBER OF YEARS REPRESENTED BY SEARCH: 201 years

RESULTS OF PROBABILITY ANALYSES

TIME PERIOD OF SEARCH: 1800 TO 2000
LENGTH OF SEARCH TIME: 201 years
ATTENUATION RELATION: 1) Campbell (1993) Horiz. - 0=Soil 1=Rock
*** TIME PERIOD OF EXPOSURE FOR PROBABILITY: 25 years

PROBABILITY OF EXCEEDANCE FOR ACCELERATION

ACC. g	NO.OF TIMES EXCED	AVE. OCCUR. #/yr	RECURR. INTERV. years	COMPUTED PROBABILITY OF EXCEEDANCE in 0.5 yr	in 1 yr	in 10 yr	in 50 yr	in 75 yr	in 100 yr	in *** yr
0.01	74	0.368	2.716	0.1681	0.3080	0.9748	1.0000	1.0000	1.0000	0.9999
0.02	73	0.363	2.753	0.1661	0.3045	0.9735	1.0000	1.0000	1.0000	0.9999
0.03	63	0.313	3.190	0.1451	0.2691	0.9565	1.0000	1.0000	1.0000	0.9996
0.04	44	0.219	4.568	0.1037	0.1966	0.8880	1.0000	1.0000	1.0000	0.9958
0.05	32	0.159	6.281	0.0765	0.1472	0.7965	0.9997	1.0000	1.0000	0.9813
0.06	24	0.119	8.375	0.0580	0.1125	0.6970	0.9974	0.9999	1.0000	0.9495
0.07	20	0.100	10.050	0.0485	0.0947	0.6303	0.9931	0.9994	1.0000	0.9169
0.08	12	0.060	16.750	0.0294	0.0580	0.4495	0.9495	0.9886	0.9974	0.7752
0.09	11	0.055	18.273	0.0270	0.0533	0.4215	0.9352	0.9835	0.9958	0.7454
0.10	9	0.045	22.333	0.0221	0.0438	0.3609	0.8934	0.9652	0.9886	0.6735
0.11	8	0.040	25.125	0.0197	0.0390	0.3283	0.8633	0.9495	0.9813	0.6303
0.12	8	0.040	25.125	0.0197	0.0390	0.3283	0.8633	0.9495	0.9813	0.6303
0.13	8	0.040	25.125	0.0197	0.0390	0.3283	0.8633	0.9495	0.9813	0.6303
0.14	6	0.030	33.500	0.0148	0.0294	0.2581	0.7752	0.8934	0.9495	0.5259

PROBABILITY OF EXCEEDANCE FOR MAGNITUDE

MAG.	NO.OF TIMES EXCED	AVE. OCCUR. #/yr	RECURR. INTERV. years	COMPUTED PROBABILITY OF EXCEEDANCE in 0.5 yr	in 1 yr	in 10 yr	in 50 yr	in 75 yr	in 100 yr	in *** yr
4.00	74	0.368	2.716	0.1681	0.3080	0.9748	1.0000	1.0000	1.0000	0.9999
4.50	38	0.189	5.289	0.0902	0.1723	0.8490	0.9999	1.0000	1.0000	0.9911
5.00	14	0.070	14.357	0.0342	0.0673	0.5017	0.9693	0.9946	0.9991	0.8247
5.50	1	0.005	201.000	0.0025	0.0050	0.0485	0.2202	0.3114	0.3920	0.1170
6.00	1	0.005	201.000	0.0025	0.0050	0.0485	0.2202	0.3114	0.3920	0.1170
6.50	1	0.005	201.000	0.0025	0.0050	0.0485	0.2202	0.3114	0.3920	0.1170

GUTENBERG & RICHTER RECURRENCE RELATIONSHIP:

a-value= 3.934
b-value= 1.064

beta-value= 2.449

Earth
Consultants
International

Appendix C
Deterministic Seismic Analysis

Appendix C
Deterministic Seismic Analysis

Run with EQFAULT Version 2.20
Estimation of Peak Horizontal Acceleration from digitized California faults

SITE COORDINATES: LATITUDE: 33.9715 N LONGITUDE: 118.4281 W
SEARCH RADIUS: 100 km (62 mi)
ATTENUATION RELATION: 1) Campbell & Bozorgnia (1994) Horiz. - Alluvium
FAULT-DATA FILE USED: CDMGSCE.DAT

ABBREVIATED FAULT NAME	APPROX. DISTANCE mi (km)	MAX. CREDIBLE EVENT			MAX. PROBABLE EVENT		
		MAX. CRED. MAG.	PEAK SITE ACC. g	SITE INTENS MM	MAX. PROB. MAG.	PEAK SITE ACC. g	SITE INTENS MM
SAN ANDREAS - San Bernardi	56 (91)	7.30	0.054	VI	7.30	0.054	VI
SAN ANDREAS - Southern	56 (91)	7.40	0.059	VI	7.30	0.054	VI
SAN ANDREAS - Mojave	44 (70)	7.10	0.062	VI	7.10	0.062	VI
SAN ANDREAS - Carrizo	50 (81)	7.20	0.057	VI	7.20	0.057	VI
SAN ANDREAS - 1857 Rupture	44 (70)	7.80	0.113	VII	7.50	0.088	VII
SAN JACINTO-SAN BERNARDINO	56 (90)	6.70	0.032	V	6.70	0.032	V
ELSINORE-GLEN IVY	46 (74)	6.80	0.045	VI	6.30	0.029	V
WHITTIER	24 (38)	6.80	0.104	VII	5.90	0.048	VI
CHINO-CENTRAL AVE. (Elsino	39 (63)	6.70	0.051	VI	5.50	0.020	IV
CORONADO BANK	56 (91)	7.40	0.059	VI	6.30	0.022	IV
NEWPORT-INGLEWOOD (Offshor	39 (64)	6.90	0.060	VI	5.80	0.023	IV
CLAMSHELL-SAWPIT	28 (46)	6.50	0.069	VI	5.00	0.021	IV
CUCAMONGA	41 (67)	7.00	0.060	VI	6.10	0.030	V
HOLLYWOOD	8 (12)	6.40	0.310	IX	5.30	0.138	VIII
HOLSER	31 (51)	6.50	0.060	VI	4.90	0.017	IV
MALIBU COAST	7 (12)	6.70	0.376	IX	4.90	0.106	VII
M.RIDGE-ARROYO PARIDA-SANT	54 (87)	6.70	0.033	V	5.40	0.011	III
NEWPORT-INGLEWOOD (L.A.Bas	5 (8)	6.90	0.398	X	5.60	0.189	VIII
OAK RIDGE (Onshore)	34 (54)	6.90	0.074	VII	6.20	0.043	VI
PALOS VERDES	5 (8)	7.10	0.424	X	6.20	0.304	IX
RAYMOND	16 (25)	6.50	0.152	VIII	5.00	0.047	VI
RED MOUNTAIN	57 (92)	6.80	0.033	V	5.90	0.016	IV
SAN CAYETANO	37 (60)	6.80	0.060	VI	6.40	0.044	VI
SAN GABRIEL	25 (41)	7.00	0.113	VII	5.60	0.034	V
SAN JOSE	32 (51)	6.50	0.059	VI	5.00	0.018	IV

Page 2

ABBREVIATED FAULT NAME	APPROX. DISTANCE mi (km)	MAX. CREDIBLE EVENT			MAX. PROBABLE EVENT		
		MAX. CRED. MAG.	PEAK SITE ACC. g	SITE INTENS MM	MAX. PROB. MAG.	PEAK SITE ACC. g	SITE INTENS MM
SANTA MONICA	6 (10)	6.60	0.414	X	5.50	0.210	VIII
SANTA YNEZ (East)	50 (81)	7.00	0.048	VI	5.90	0.018	IV
SANTA SUSANA	24 (38)	6.60	0.096	VII	6.30	0.076	VII
SIERRA MADRE (San Fernando	22 (35)	6.70	0.115	VII	5.60	0.049	VI
SIERRA MADRE	20 (33)	7.00	0.153	VIII	6.20	0.086	VII
SIMI-SANTA ROSA	30 (49)	6.70	0.073	VII	5.50	0.028	V
VENTURA - PITAS POINT	48 (78)	6.80	0.042	VI	5.50	0.015	IV
VERDUGO	17 (27)	6.70	0.157	VIII	5.20	0.049	VI
ELYSIAN PARK THRUST	12 (19)	6.70	0.356	IX	5.80	0.192	VIII
NORTHRIDGE (E. Oak Ridge)	21 (34)	6.90	0.207	VIII	5.80	0.090	VII
ANACAPA-DUME	15 (25)	7.30	0.257	IX	6.30	0.136	VIII
CHANNEL IS. THRUST (Easter	48 (77)	7.40	0.101	VII	6.00	0.033	V
MONTALVO-OAK RIDGE TREND	52 (84)	6.60	0.048	VI	5.50	0.020	IV
OAK RIDGE(Blind Thrust Off	50 (80)	6.90	0.065	VI	6.10	0.035	V
CLEGHORN	60 (96)	6.50	0.024	V	6.00	0.016	IV

-END OF SEARCH- 41 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE PALOS VERDES and the NEWPORT-INGLEWOOD FAULTS ARE CLOSEST TO THE SITE.
BOTH FAULTS ARE LOCATED ABOUT 5.0 MILES AWAY.

LARGEST MAXIMUM-CREDIBLE SITE ACCELERATION: 0.42 g

LARGEST MAXIMUM-PROBABLE SITE ACCELERATION: 0.30 g

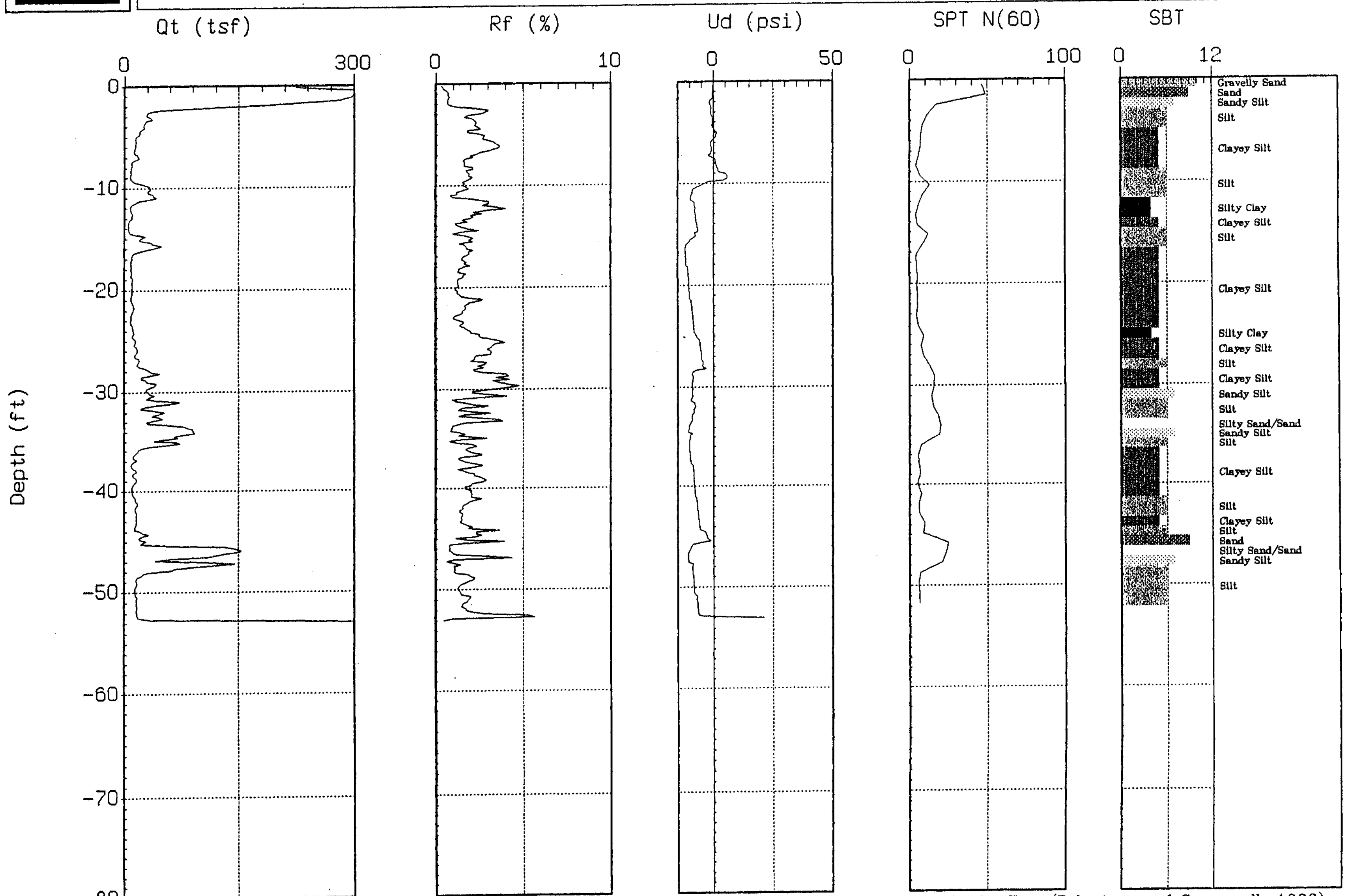
Appendix D: CPT Logs, This Study

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-1

Engineer : S. KOLTHOFF
Date : 05:25:00 09:44



Max. Depth: 52.98 (ft)
Depth Inc.: 0.164 (ft)

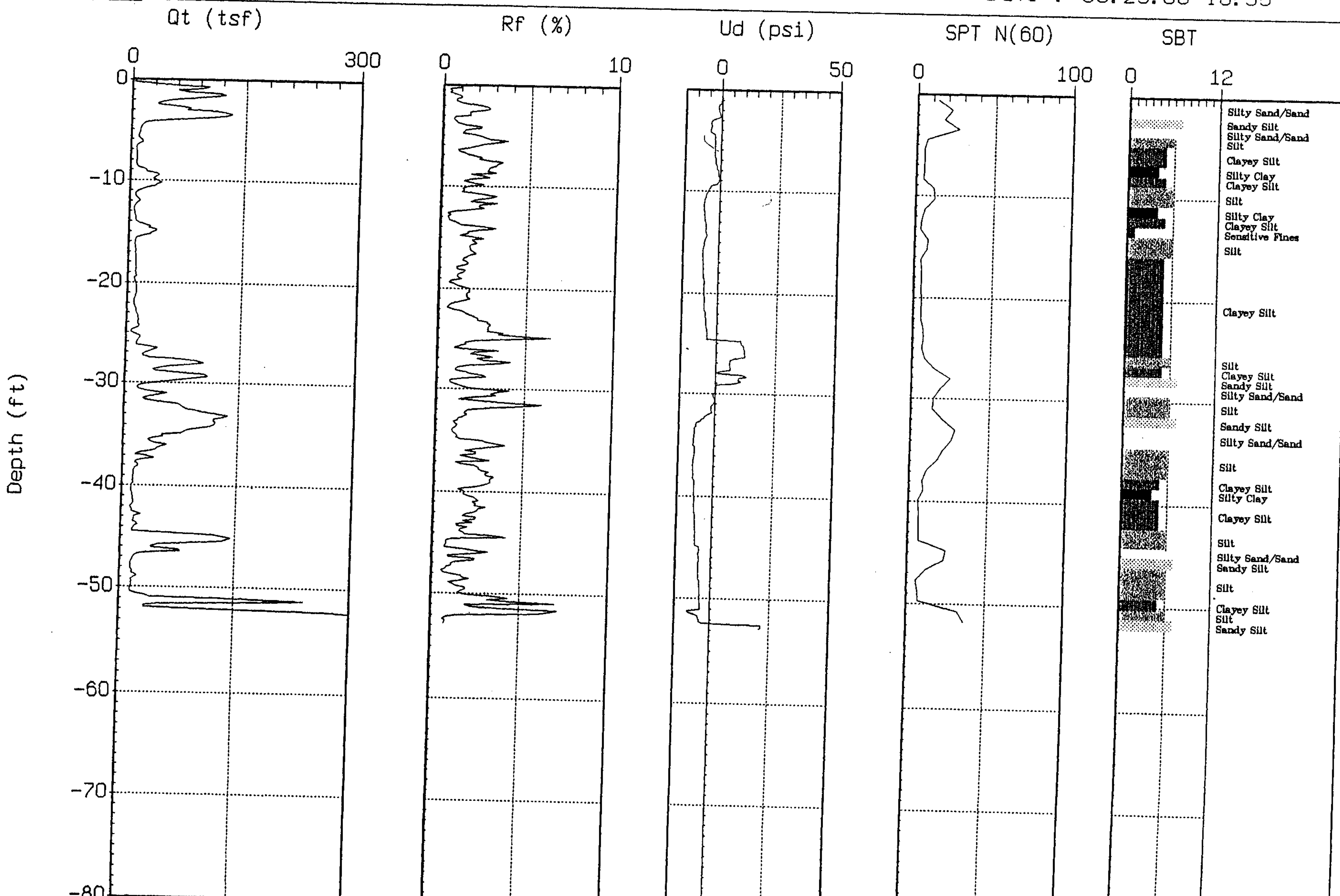
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI2

Engineer : S. KOLTHOFF
Date : 05:25:00 10:55



Max. Depth: 52.82 (ft)

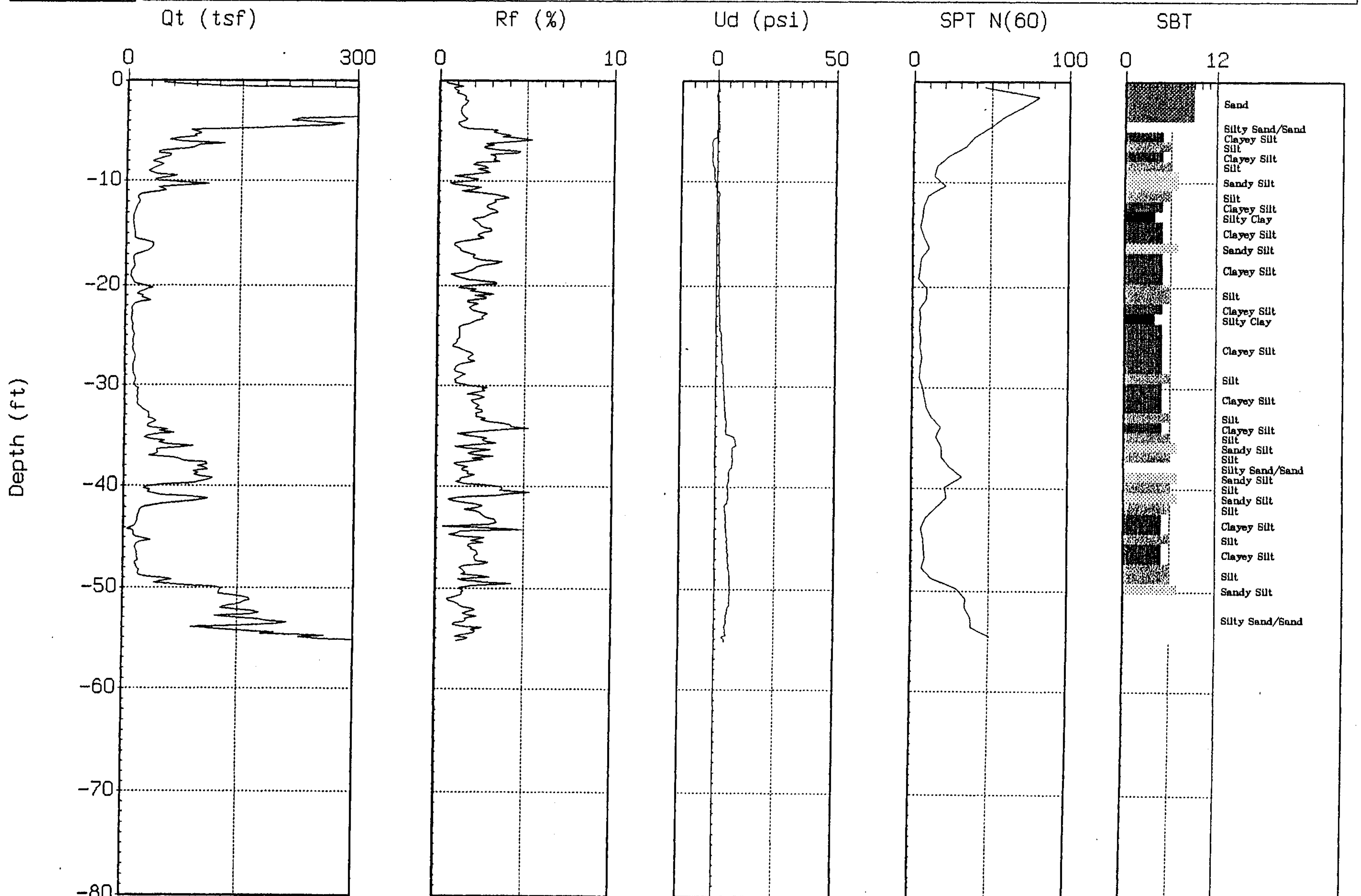
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-3

Engineer : S. KOLTHOFF
Date : 05:25:00 12:00



Max. Depth: 55.28 (ft)

Depth Inc.: 0.164 (ft)

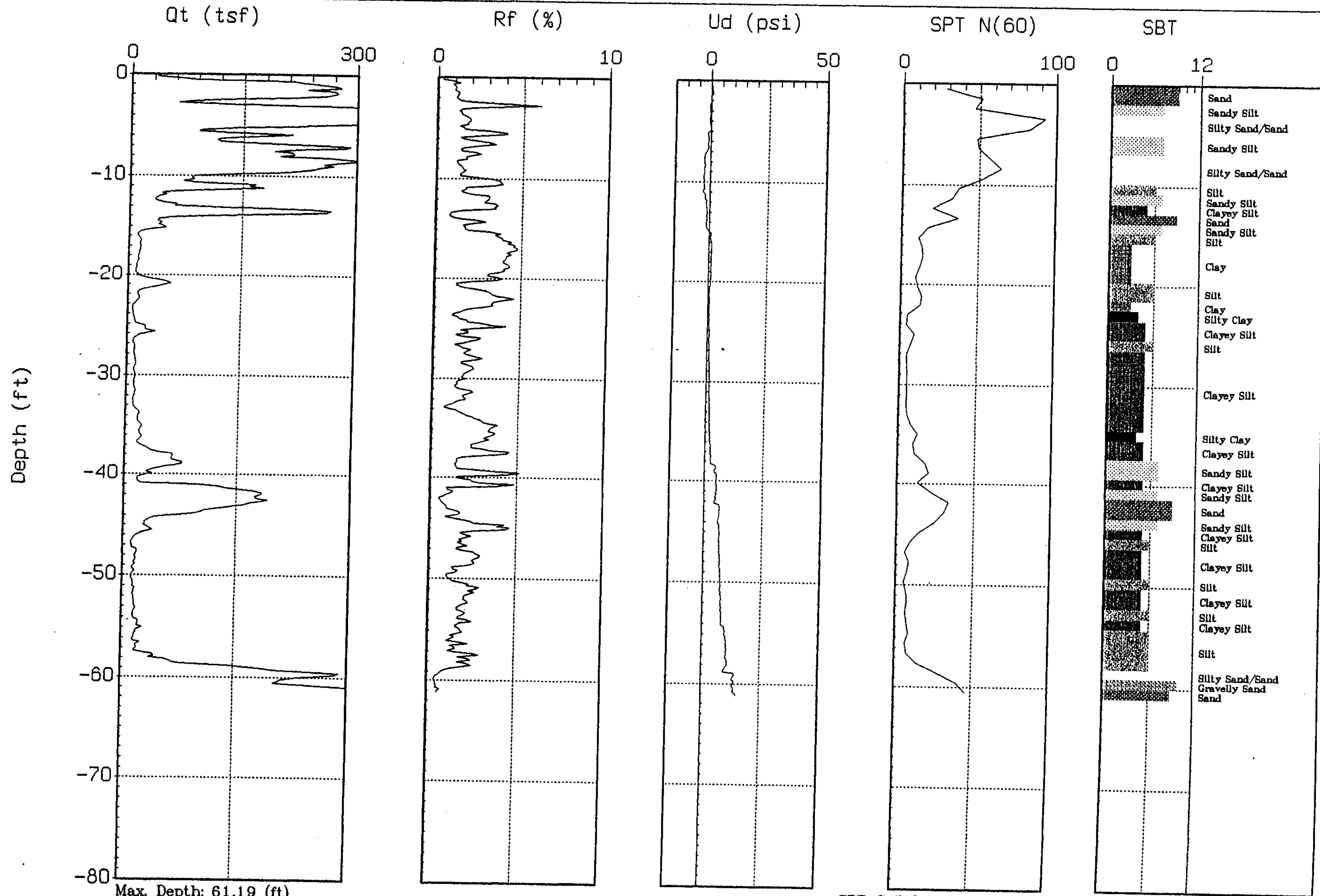
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-4

Engineer : S. KOLTHOFF
Date : 05:25:00 13:02



Max. Depth: 61.19 (ft)
Depth Inc.: 0.164 (ft)

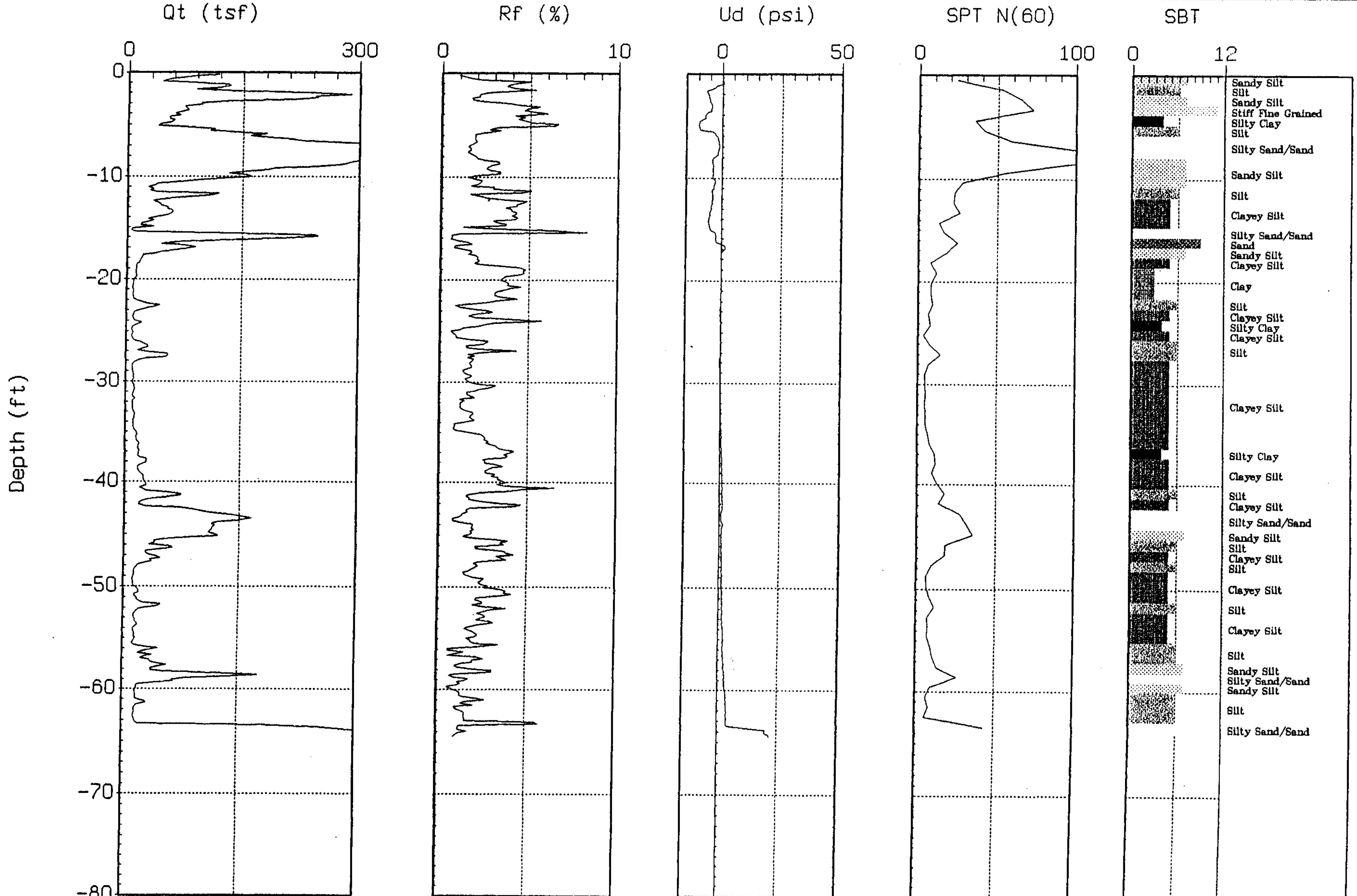
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-5

Engineer : S. KOLTHOFF
Date : 05:25:00 14:11



Max. Depth: 64.47 (ft)

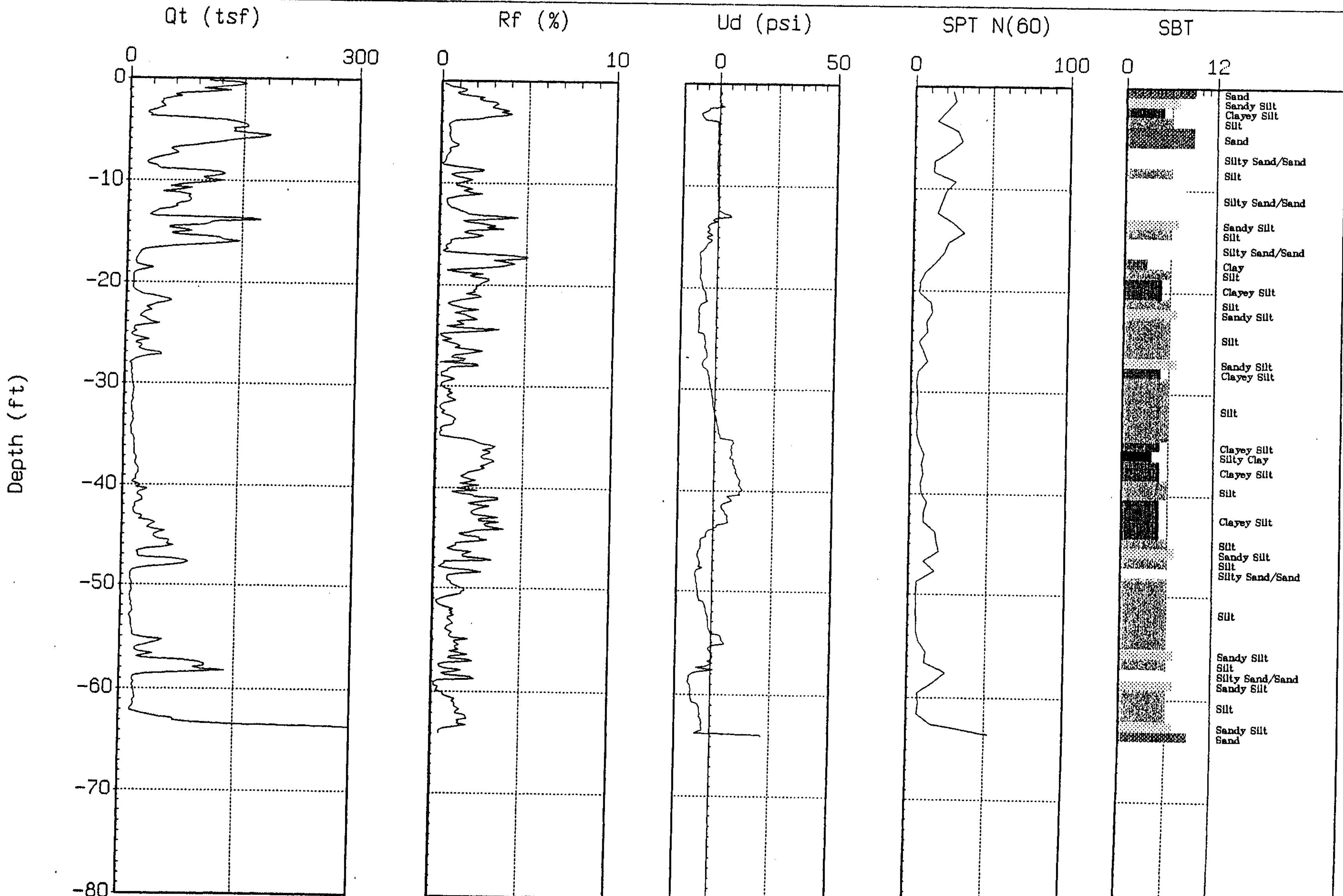
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-6

Engineer : S. KOLTHOFF
Date : 05:25:00 15:25



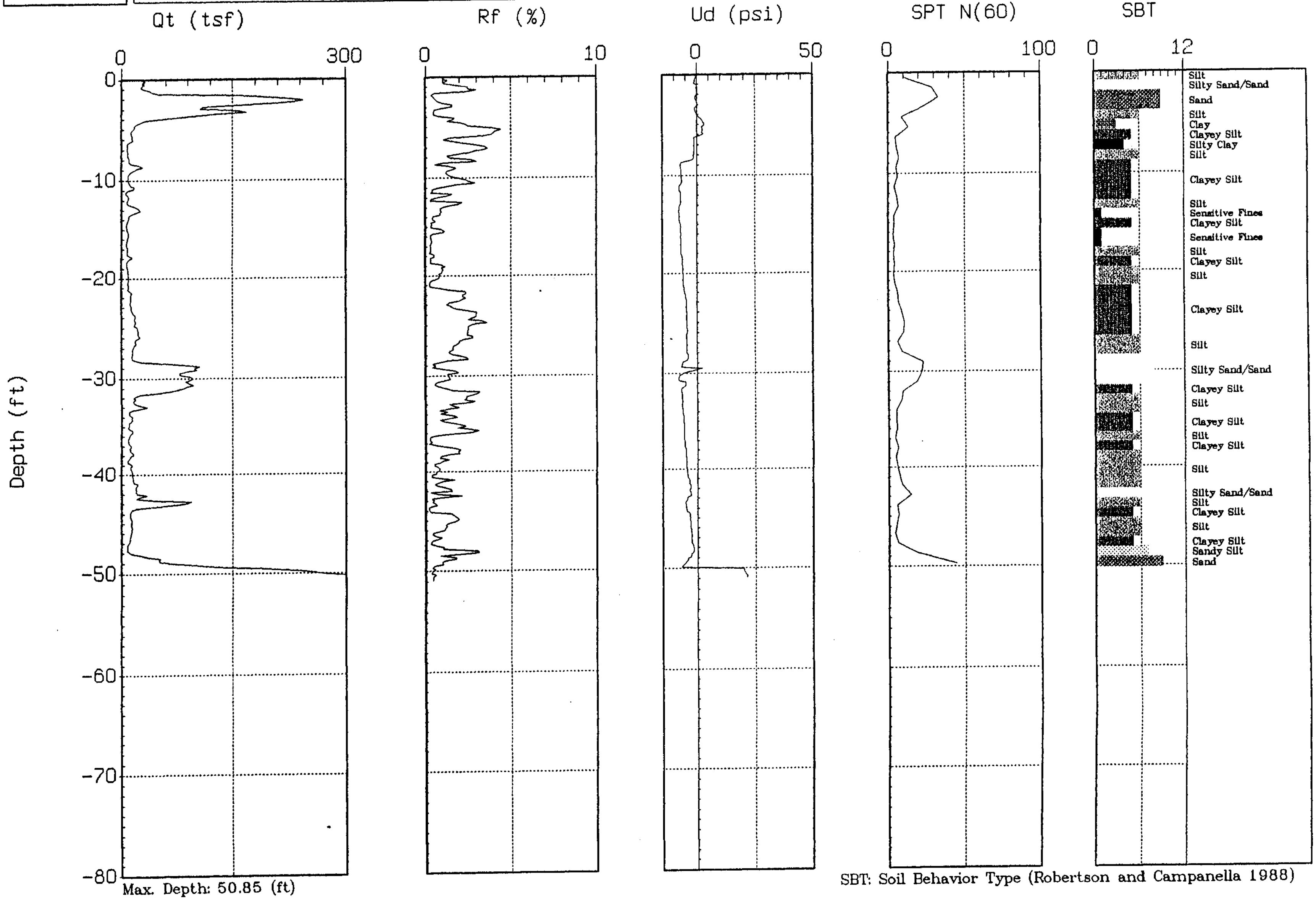
Max. Depth: 63.98 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-7

Engineer : S. KOLTHOFF
Date : 05:25:00 16:33



Max. Depth: 50.85 (ft)

Depth Inc.: 0.164 (ft)

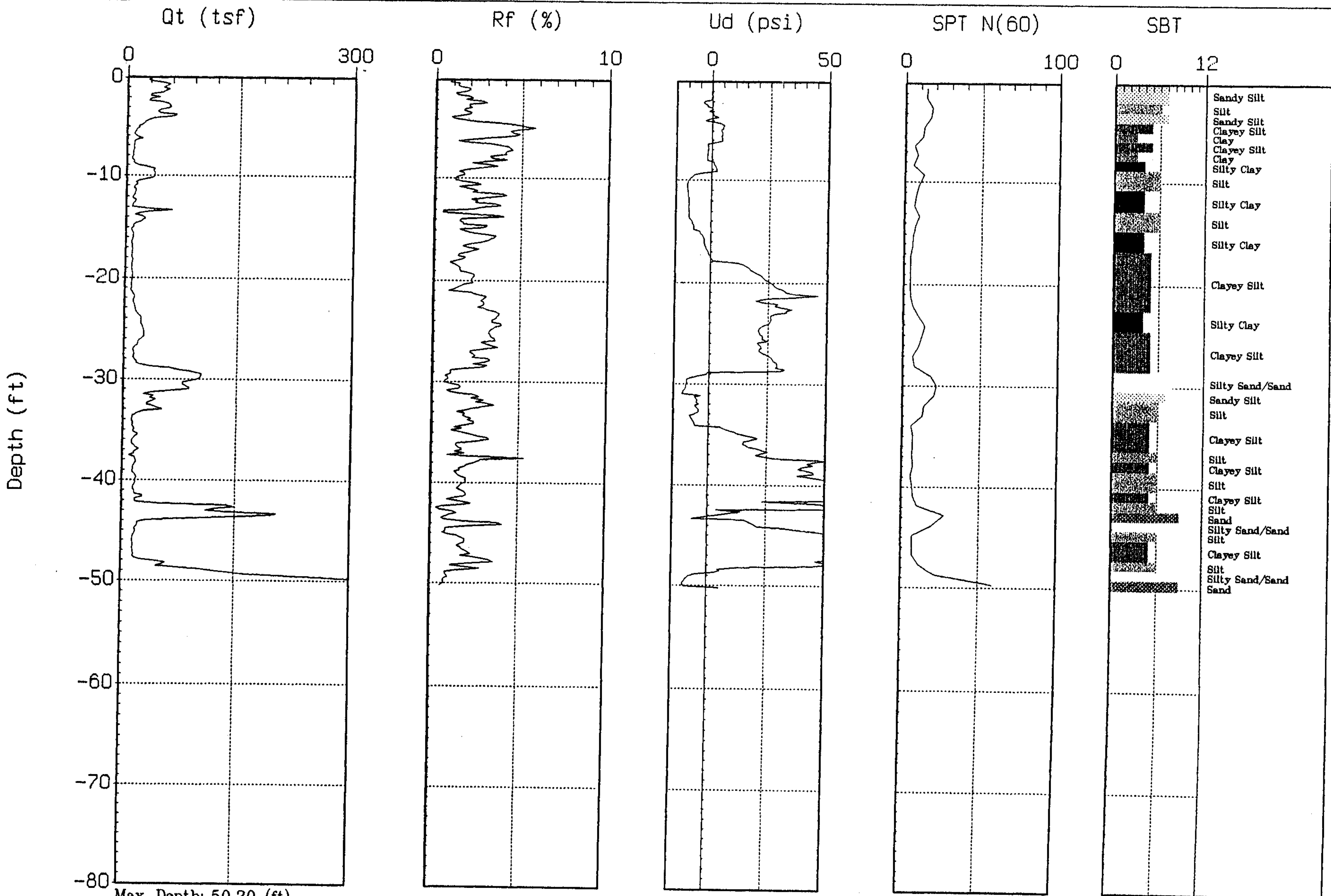
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-8

Engineer : S. KOLTHOFF
Date : 05:26:00 07:32



Max. Depth: 50.20 (ft)
Depth Inc: 0.164 (ft)

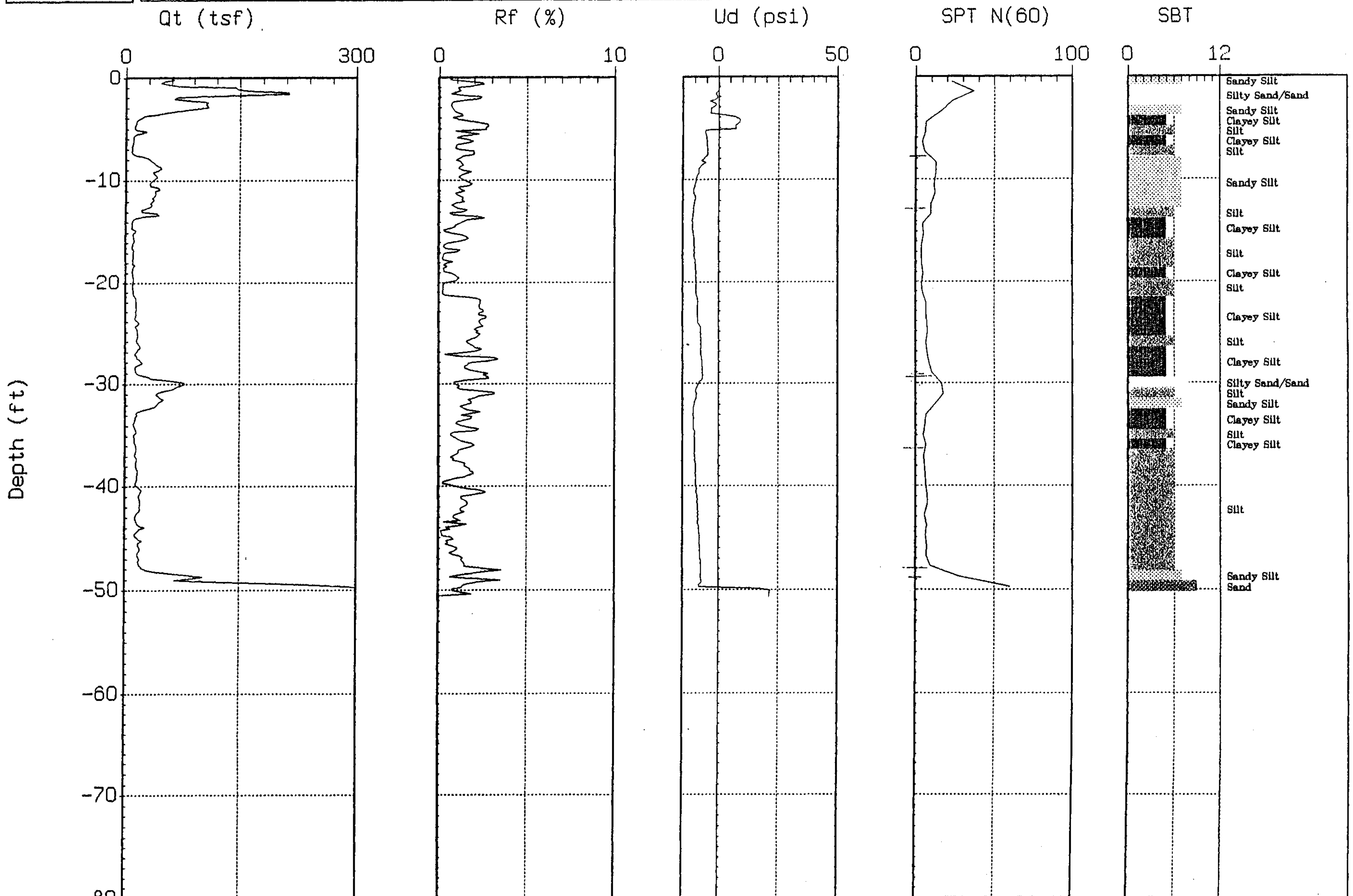
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-9

Engineer : S. KOLTHOFF
Date : 05:26:00 06:21



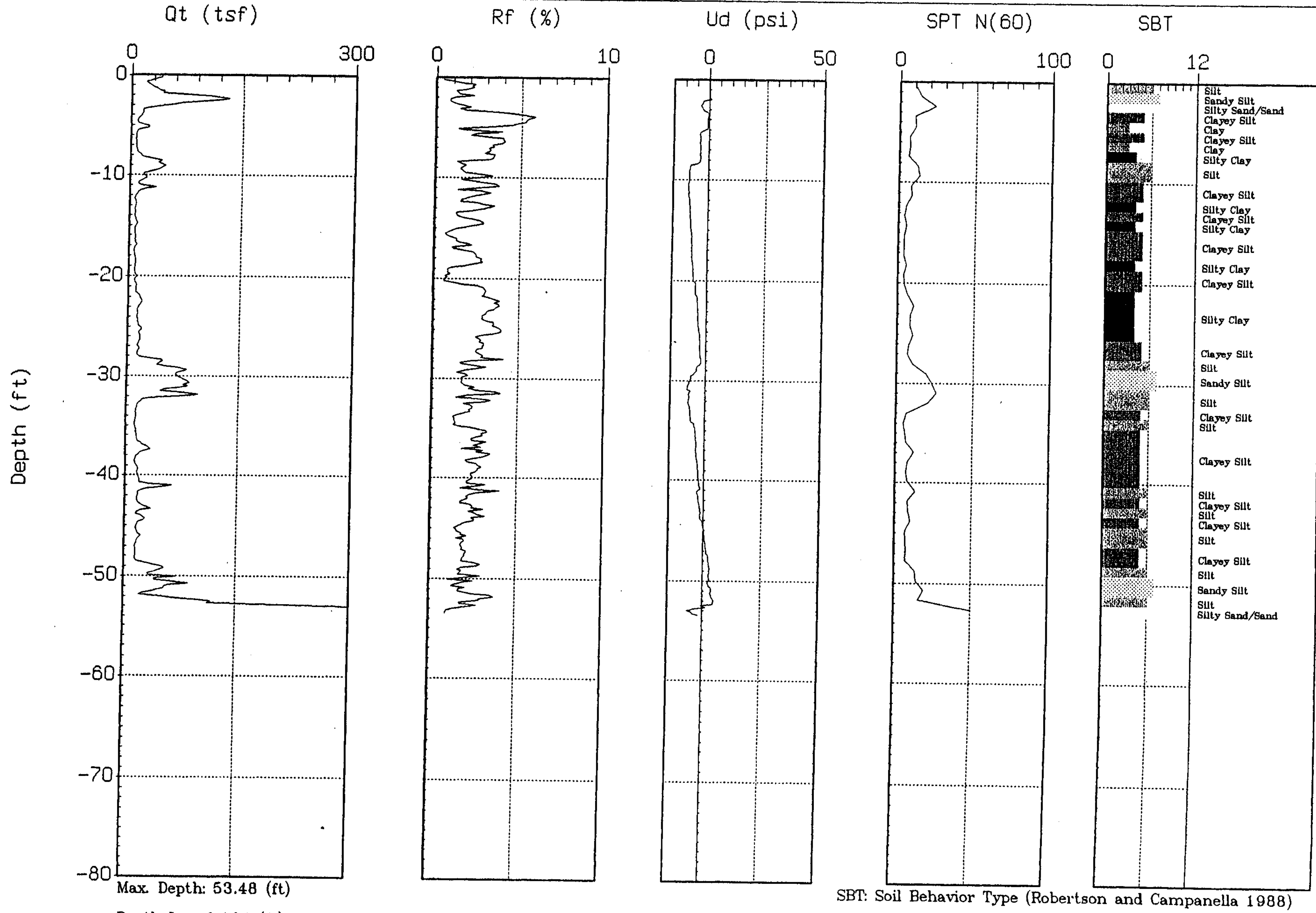
Max. Depth: 50.69 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-10

Engineer : S. KOLTHOFF
Date : 05:26:00 06:48



Max. Depth: 53.48 (ft)

Depth Inc.: 0.164 (ft)

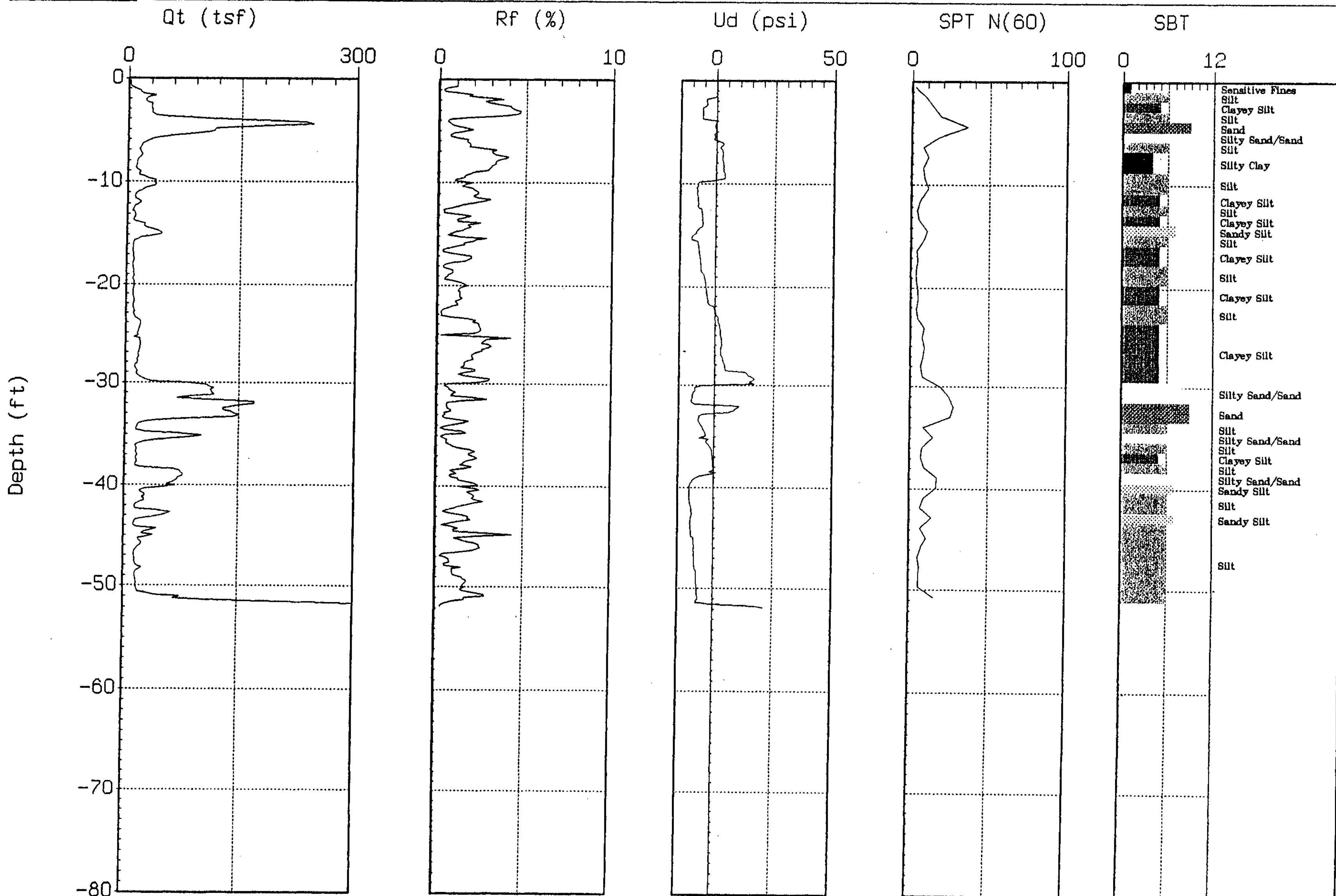
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-11

Engineer : S. KOLTHOFF
Date : 05:26:00 08:09



Max. Depth: 51.84 (ft)

Depth Inc.: 0.164 (ft)

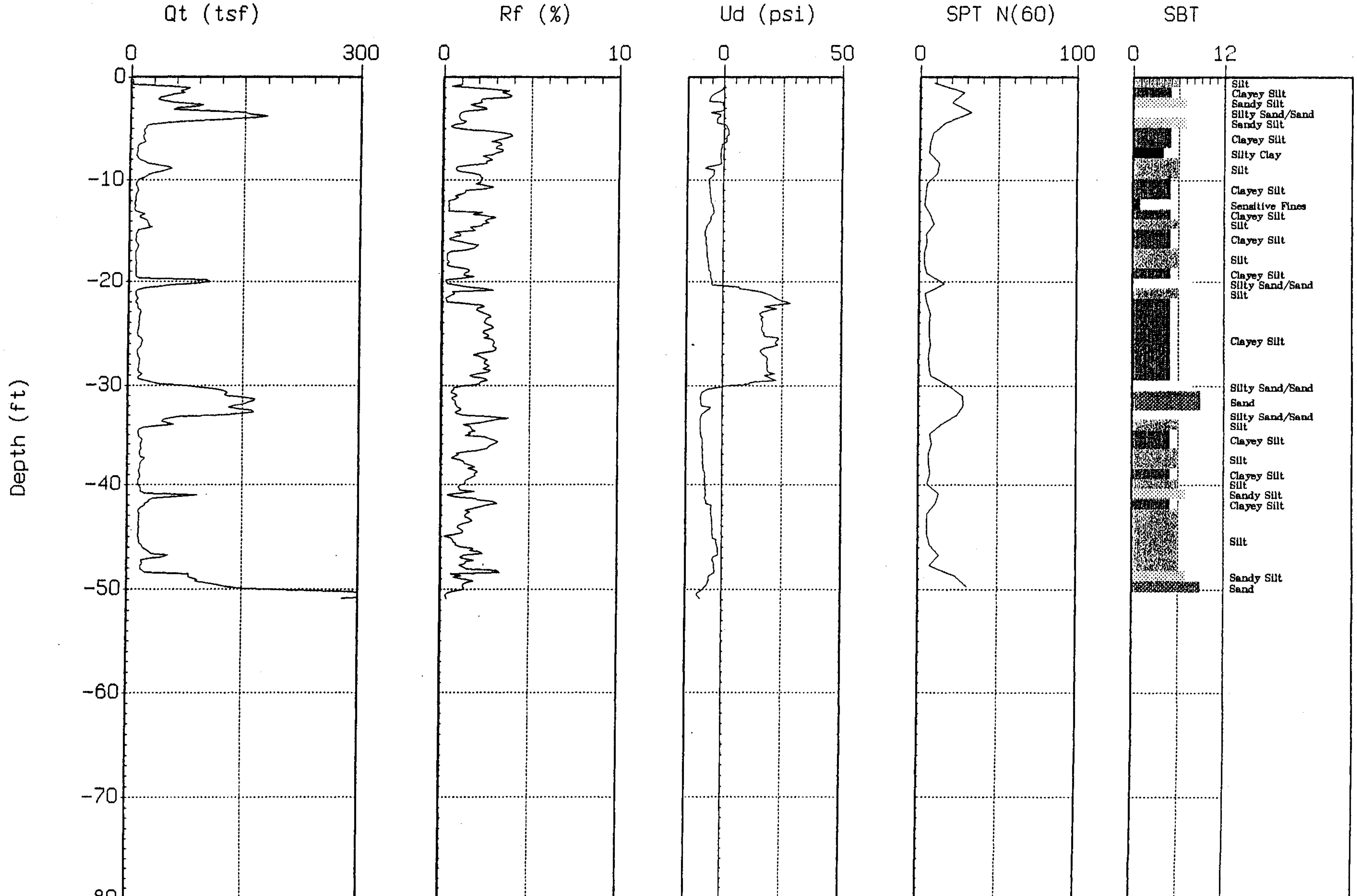
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-12

Engineer : S. KOLTHOFF
Date : 05:26:00 08:43



Max. Depth: 50.85 (ft)

Depth Inc.: 0.164 (ft)

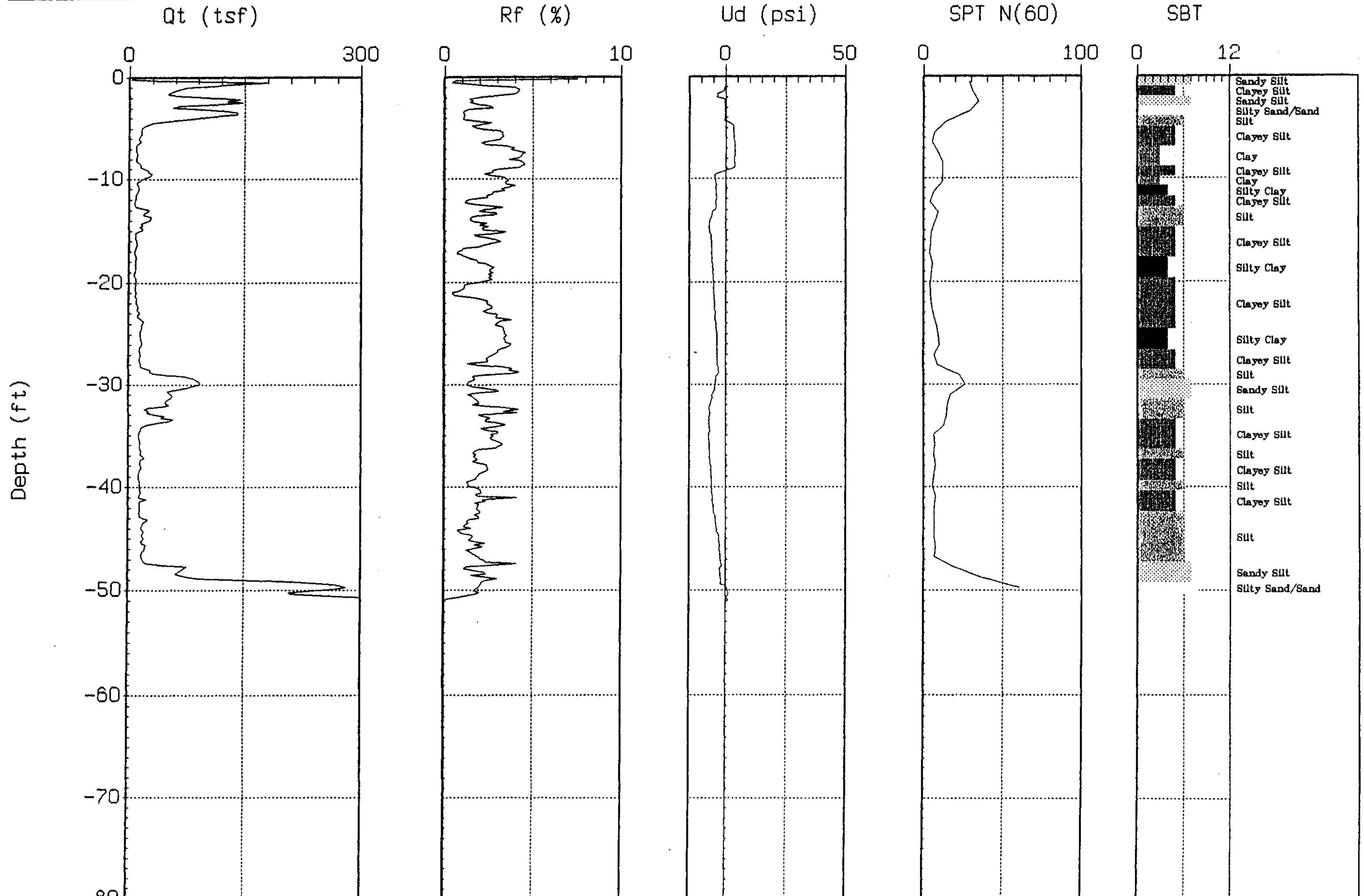
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

GREGG

Site : PLAYA VISTA
Location : CPT-ECI-13

Engineer : S. KOLTHOFF
Date : 05:26:00 07:16



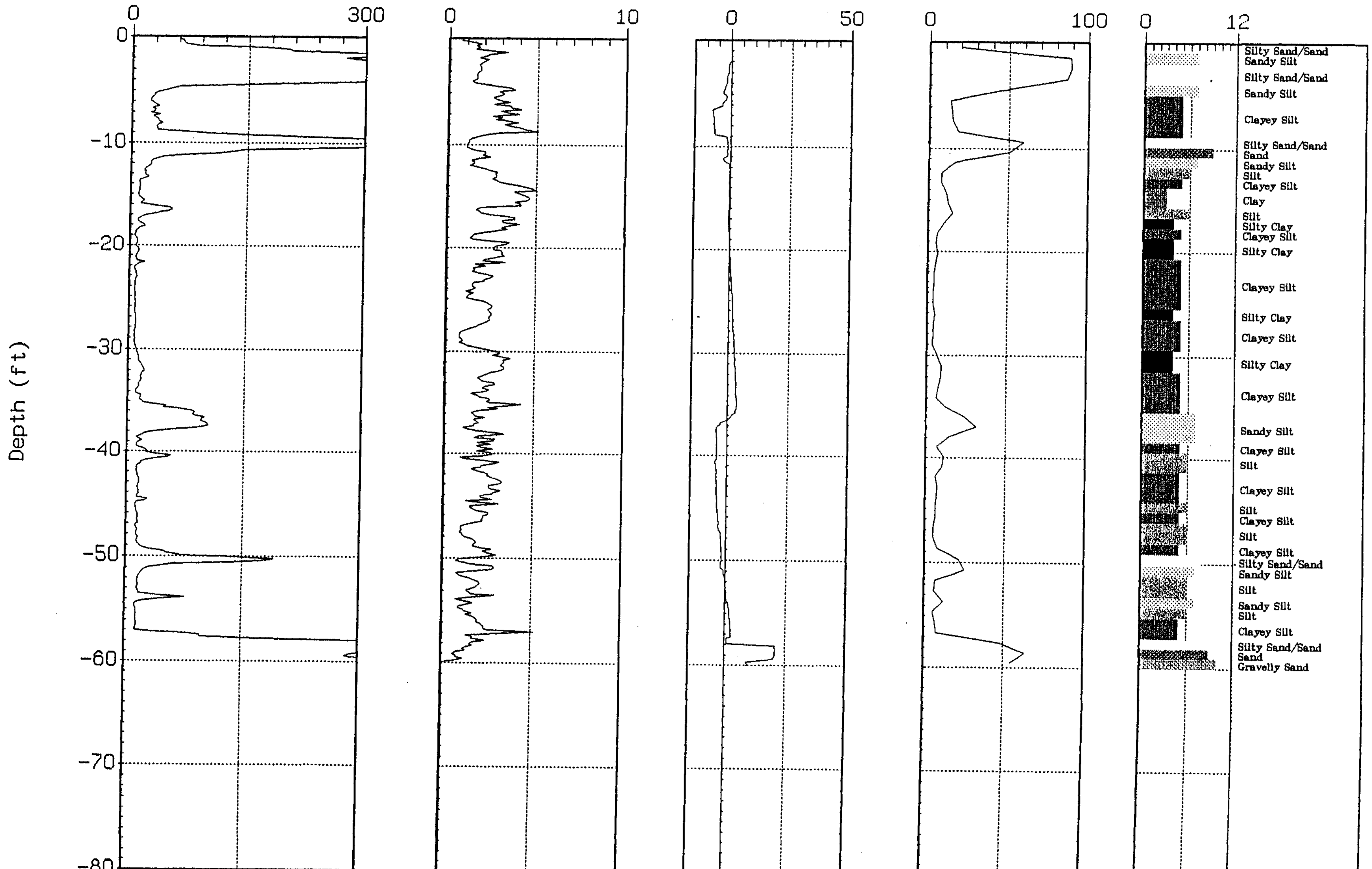
Max. Depth: 51.02 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-14

Engineer : S. KOLTHOFF
Date : 05:26:00 07:58



Max. Depth: 60.04 (ft)
Depth Inc.: 0.164 (ft)

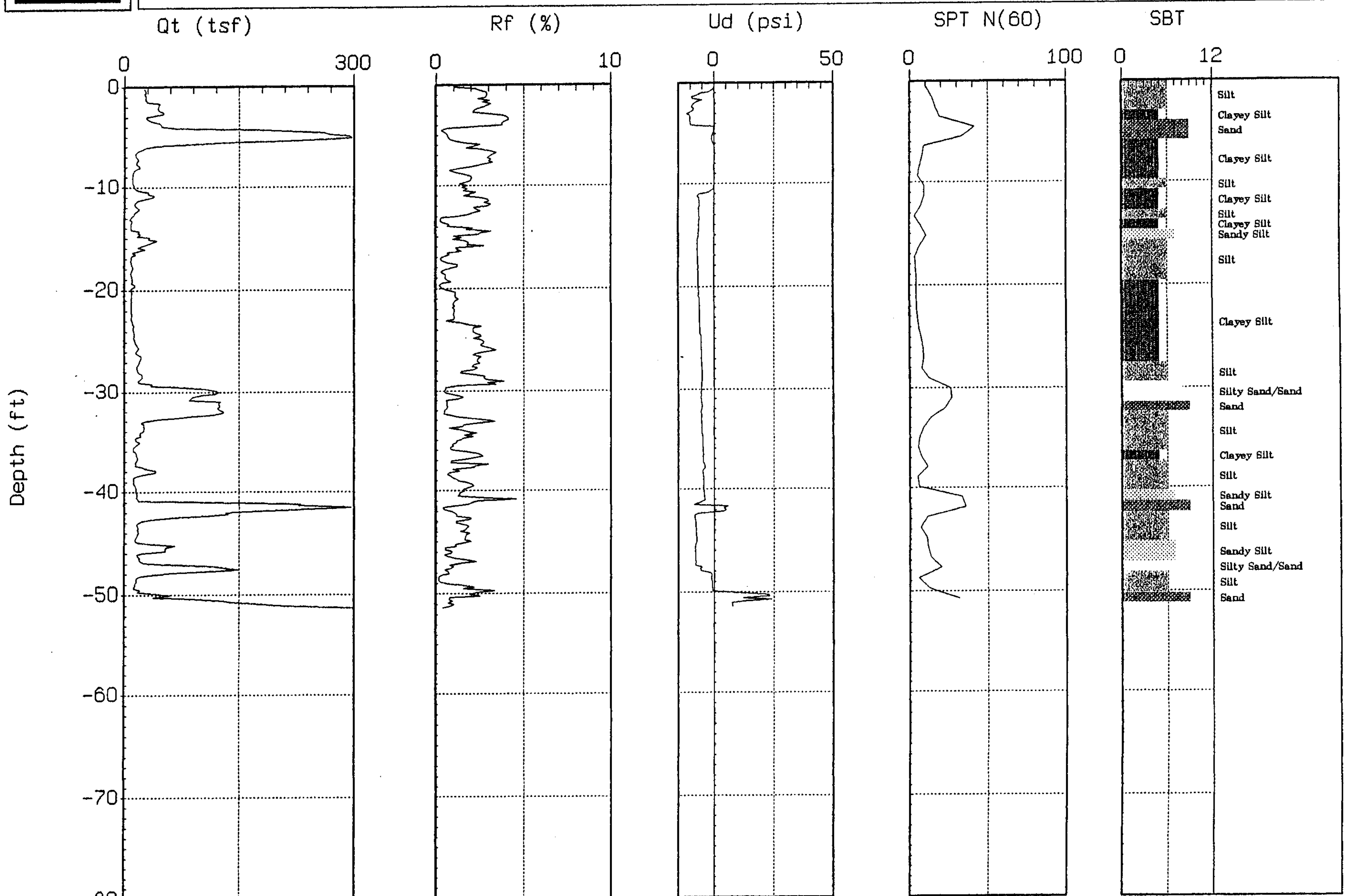
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-15

Engineer : S. KOLTHOFF
Date : 05:26:00 09:22



Max. Depth: 51.34 (ft)

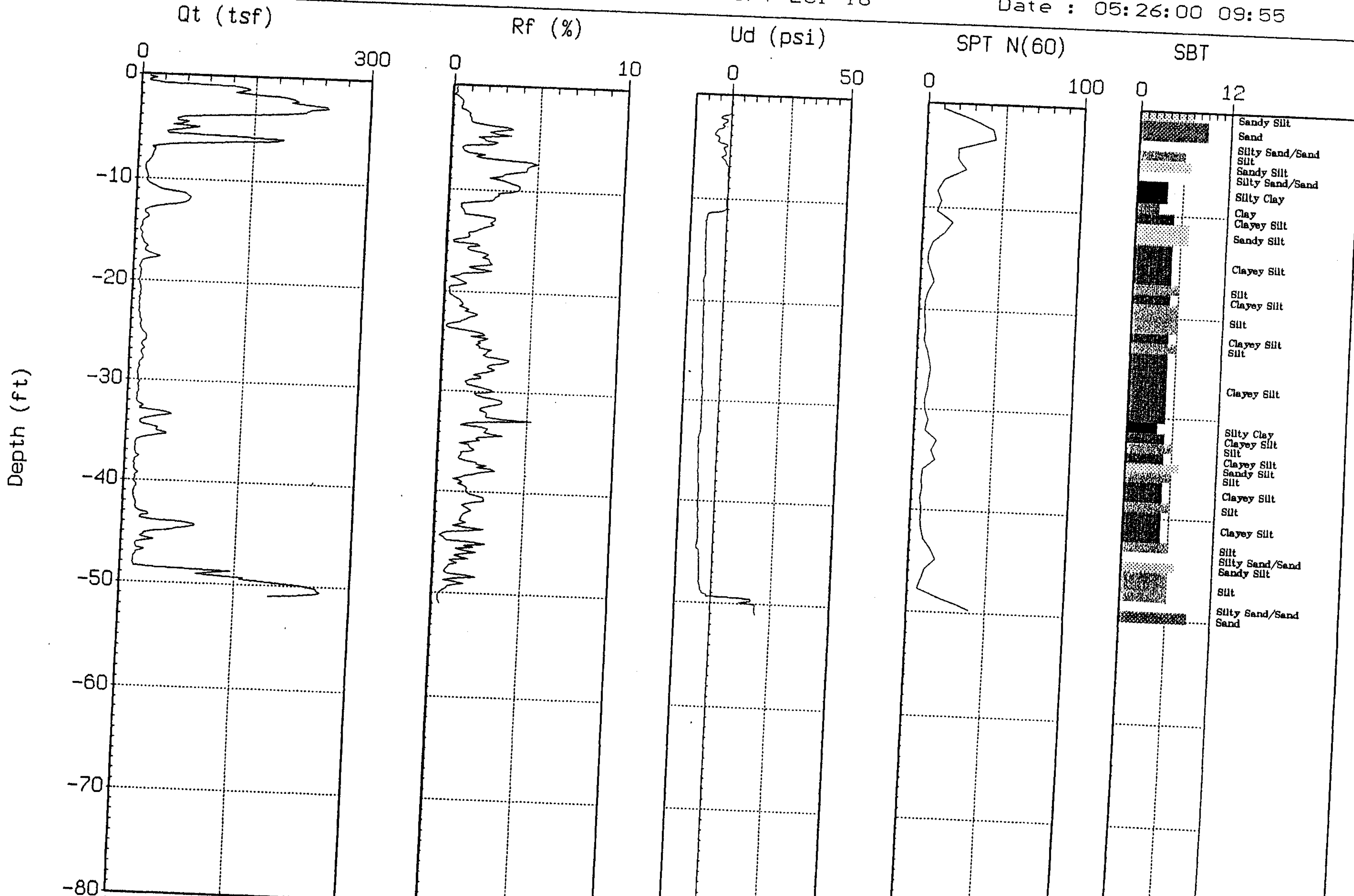
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-16

Engineer : S. KOLTHOFF
Date : 05:26:00 09:55



Max. Depth: 51.02 (ft)

Depth Inc.: 0.164 (ft)

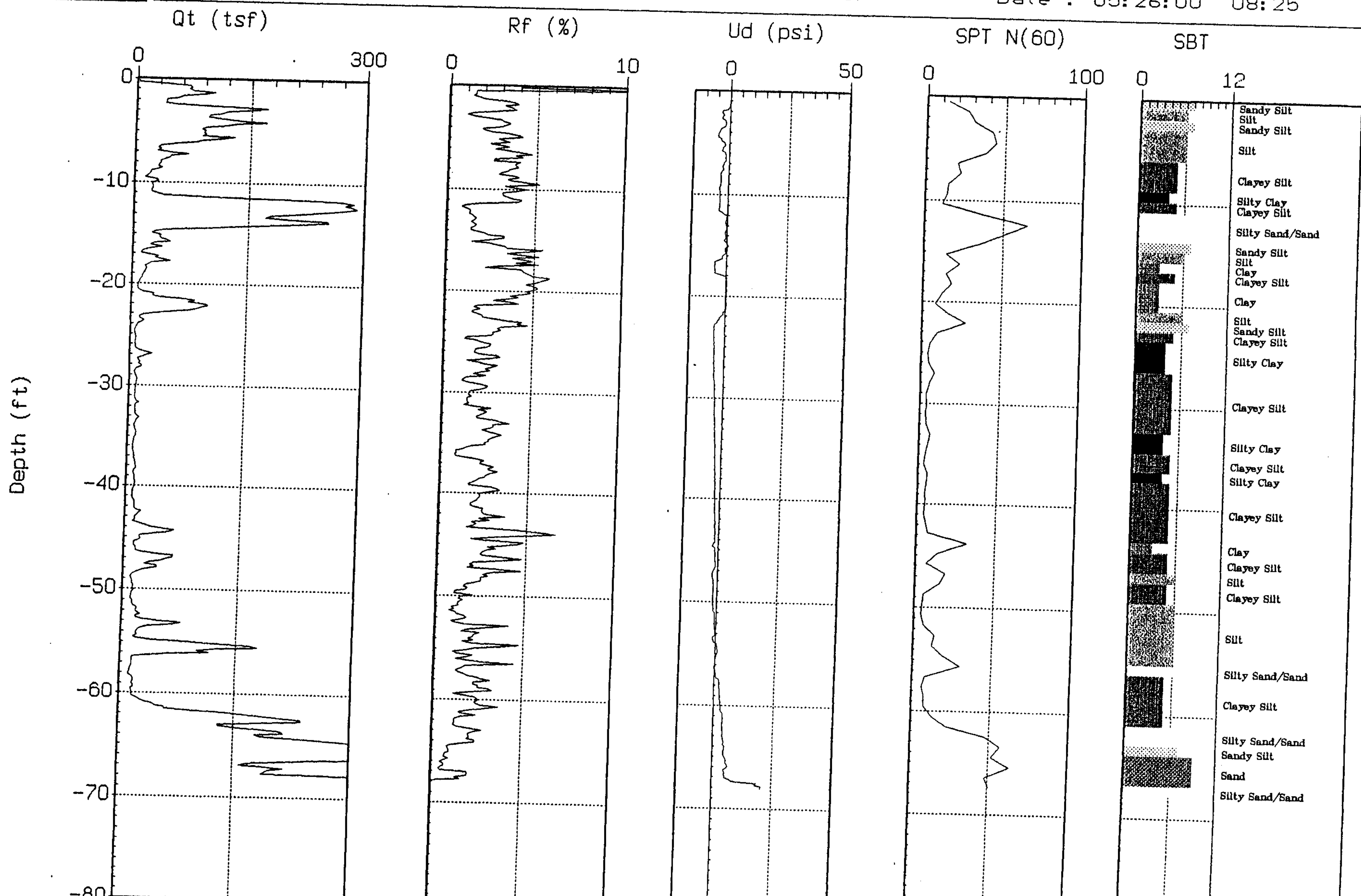
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-17

Engineer : S. KOLTHOFF
Date : 05:26:00 08:25



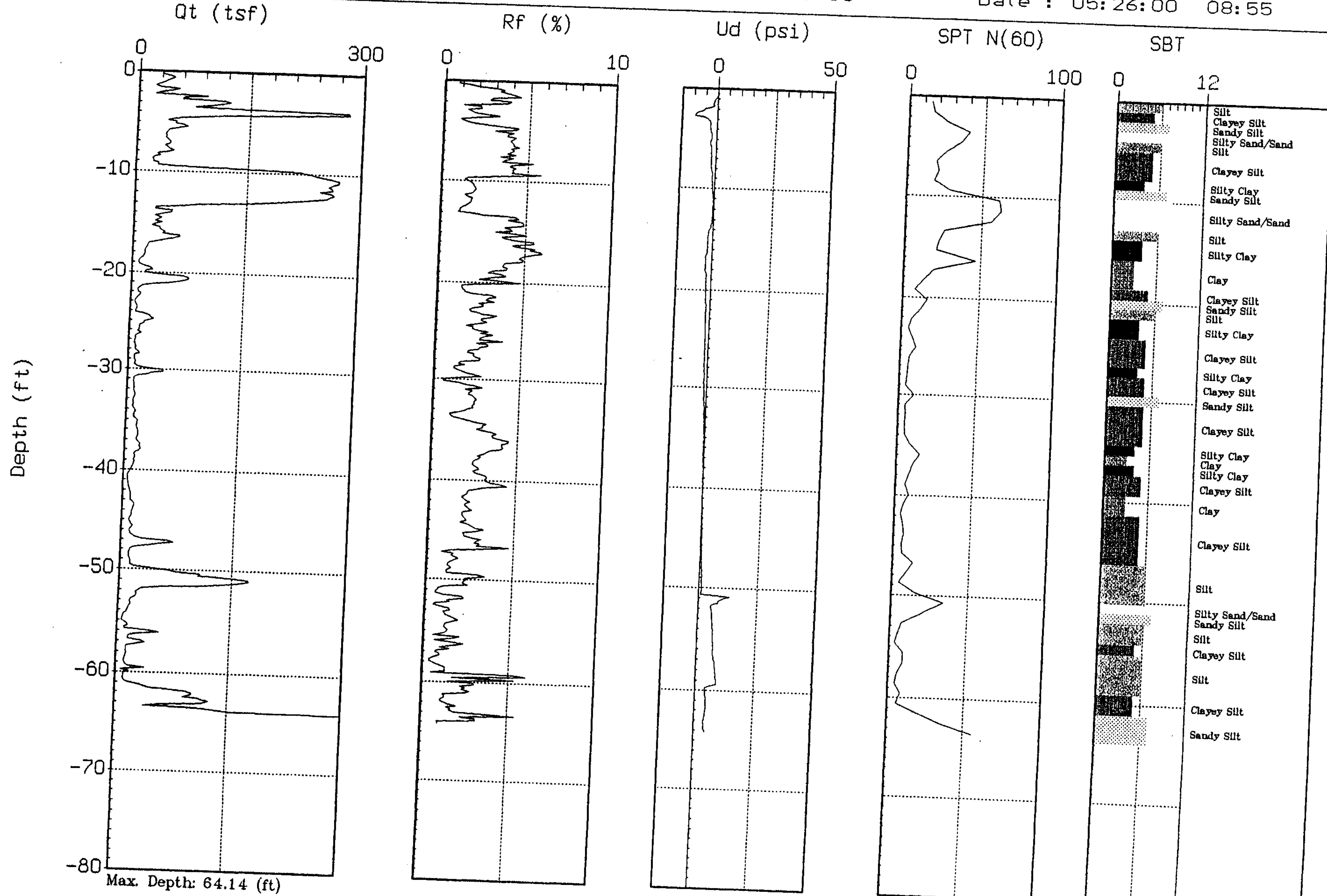
Max. Depth: 68.08 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-18

Engineer : S. KOLTHOFF
Date : 05:26:00 08:55



Max. Depth: 64.14 (ft)

Depth Inc.: 0.164 (ft)

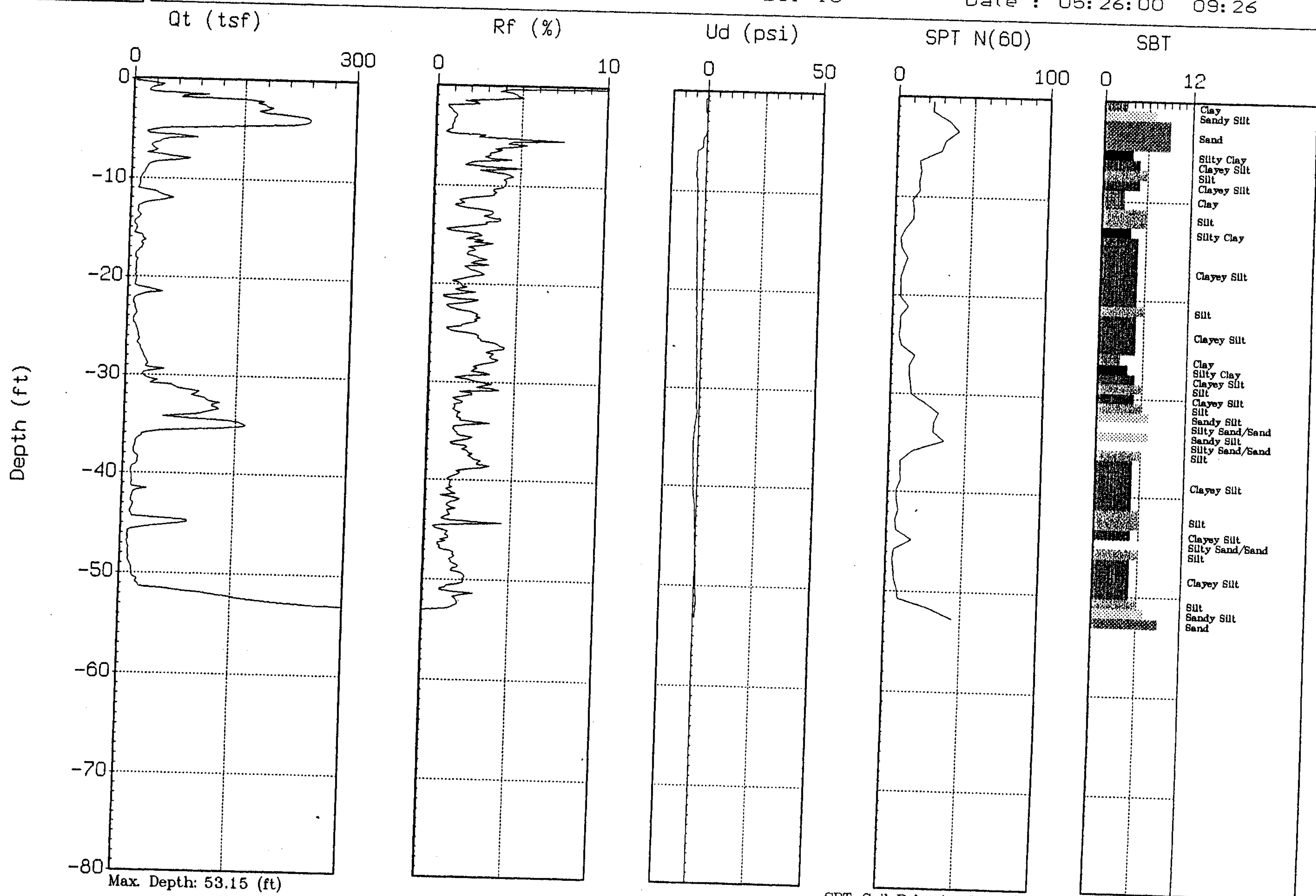
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-19

Engineer : S. KOLTHOFF
Date : 05:26:00 09:26



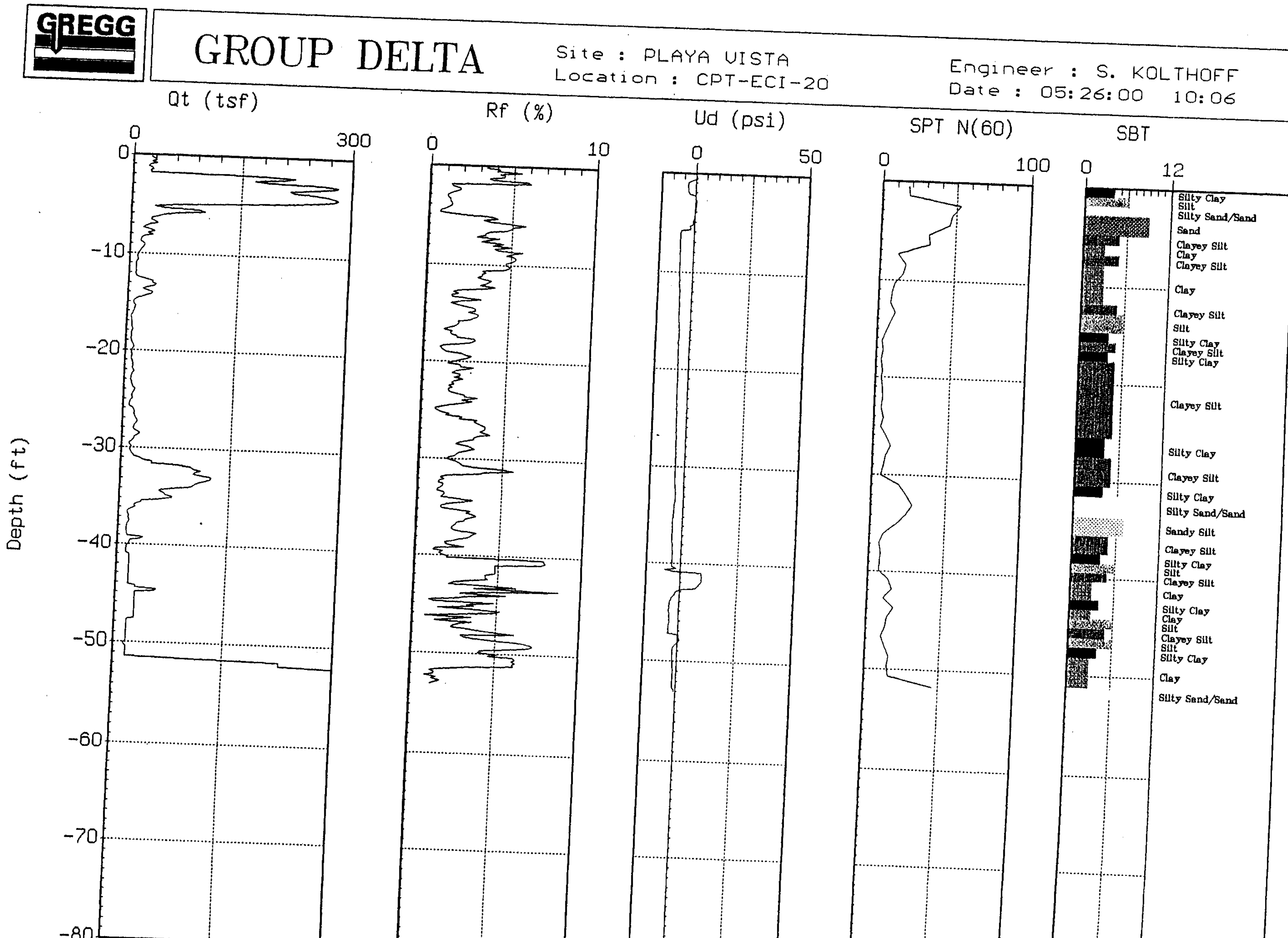
Max. Depth: 53.15 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-20

Engineer : S. KOLTHOFF
Date : 05:26:00 10:06



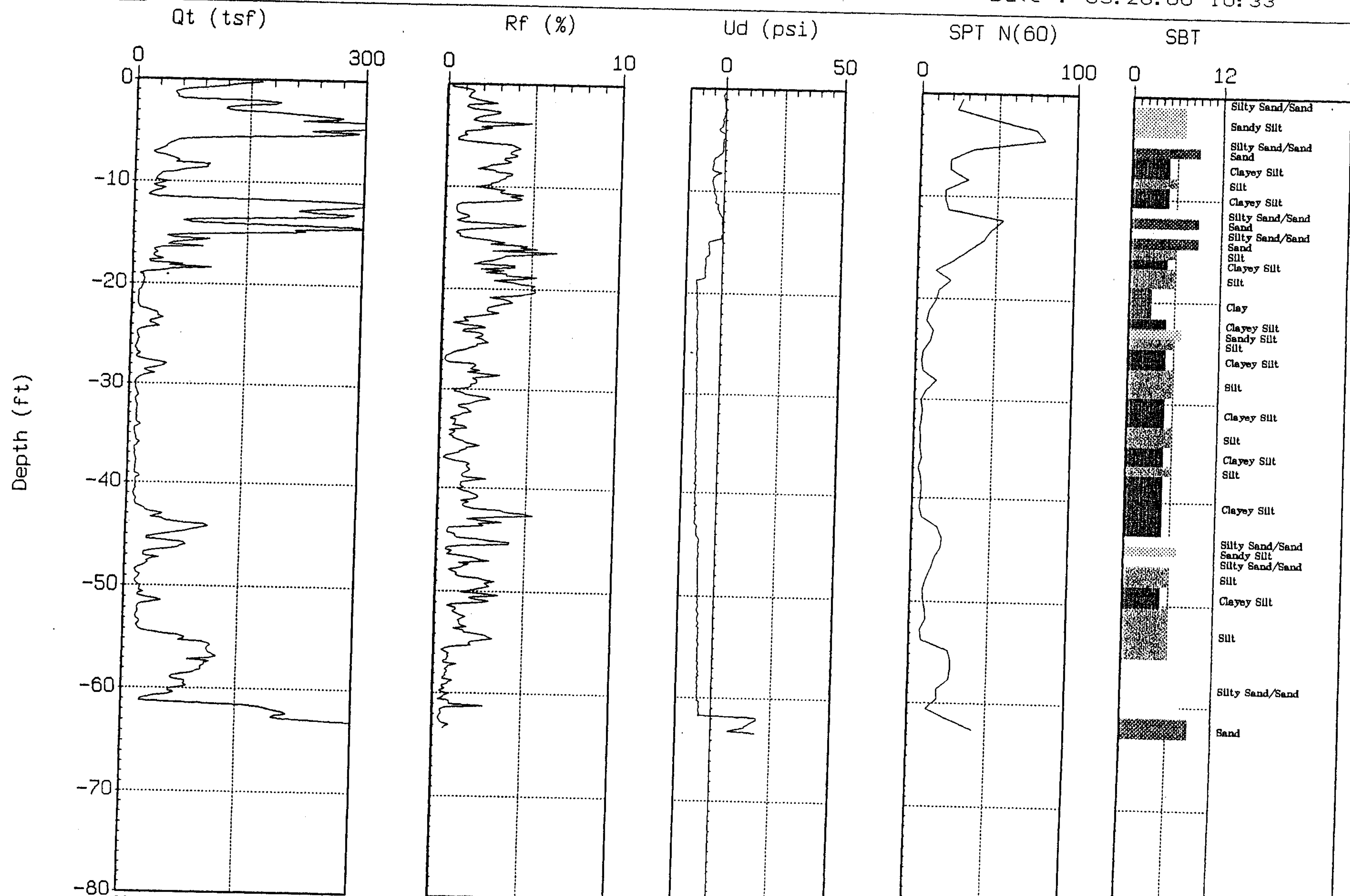
Max. Depth: 52.98 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-21

Engineer : S. KOLTHOFF
Date : 05:26:00 10:33



Max. Depth: 63.32 (ft)

Depth Inc.: 0.164 (ft)

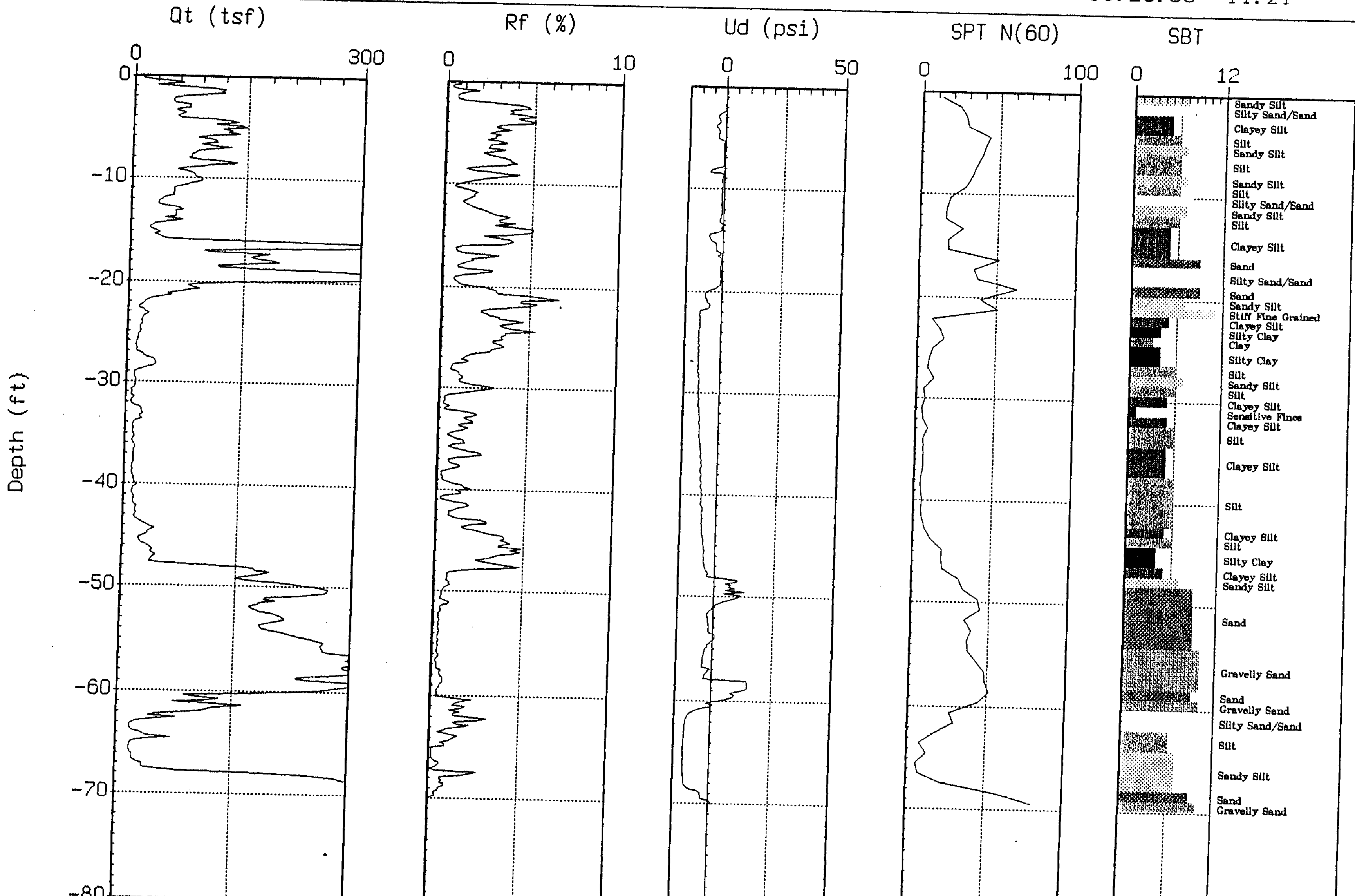
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-22

Engineer : S. KOLTHOFF
Date : 05:26:00 11:21



Max. Depth: 70.05 (ft)
Depth Inc.: 0.164 (ft)

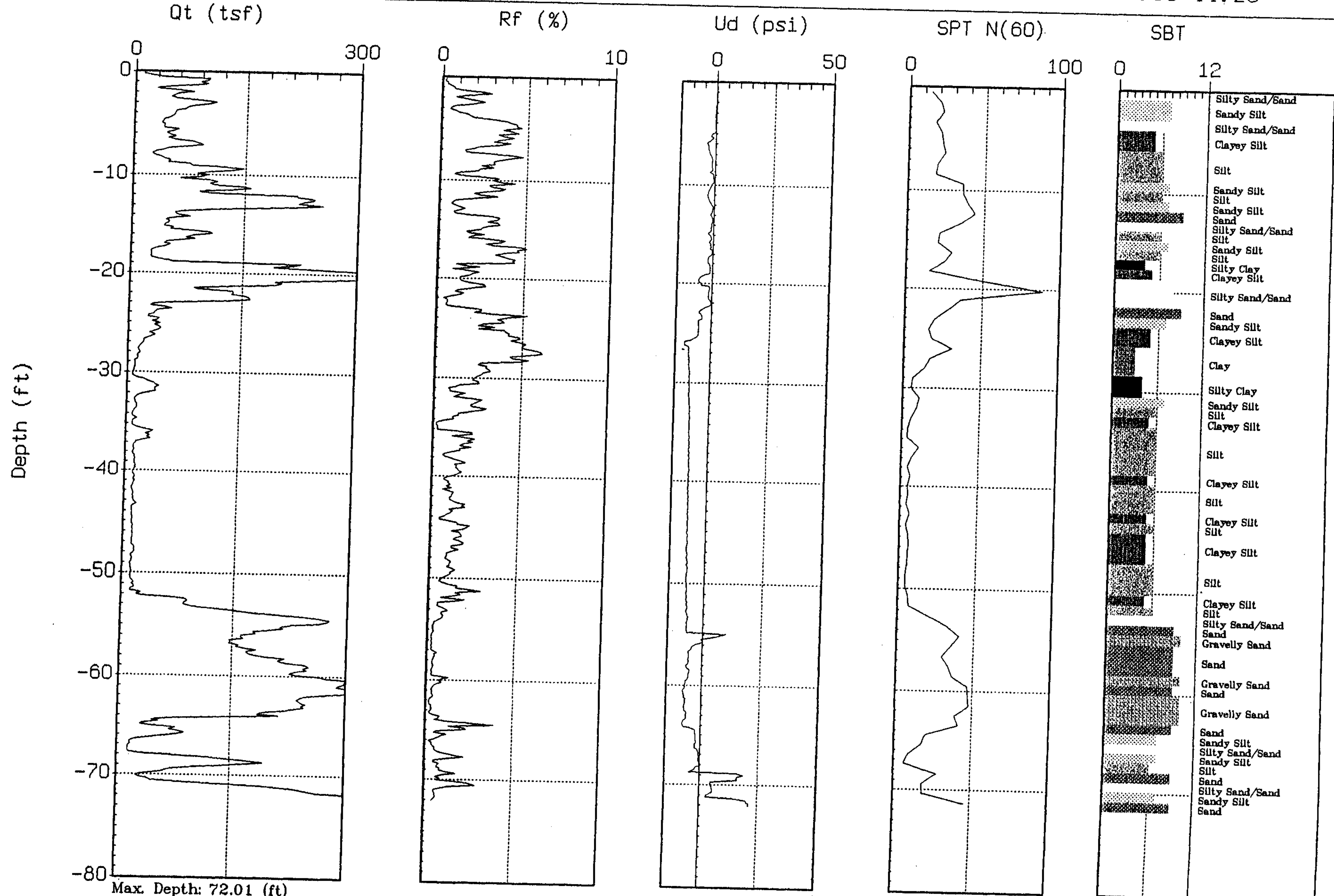
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-23

Engineer : S. KOLTHOFF
Date : 05:26:00 11:23



Max. Depth: 72.01 (ft)
Depth Inc.: 0.164 (ft)

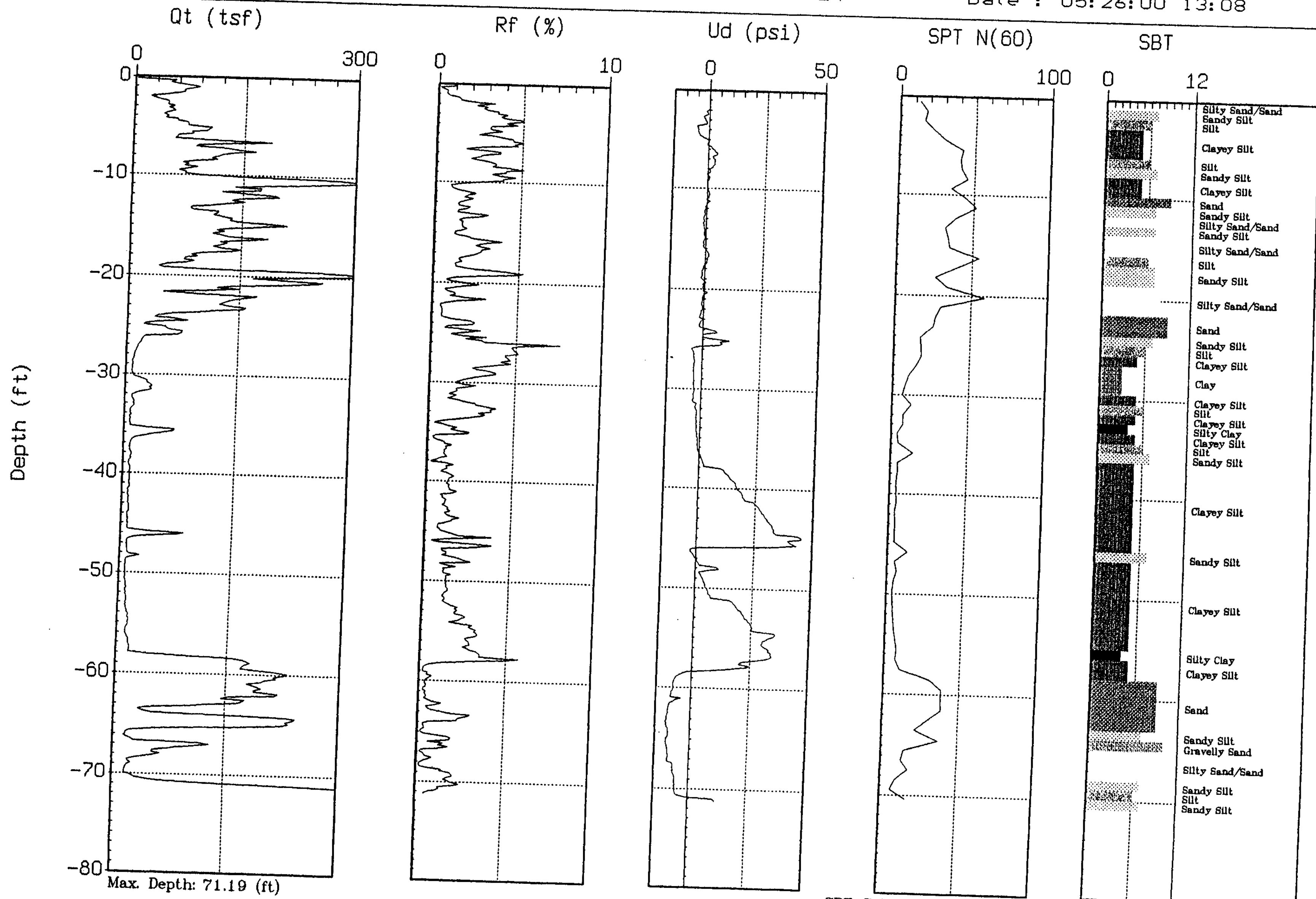
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-24

Engineer : S. KOLTHOFF
Date : 05:26:00 13:08



Max. Depth: 71.19 (ft)
Depth Inc.: 0.164 (ft)

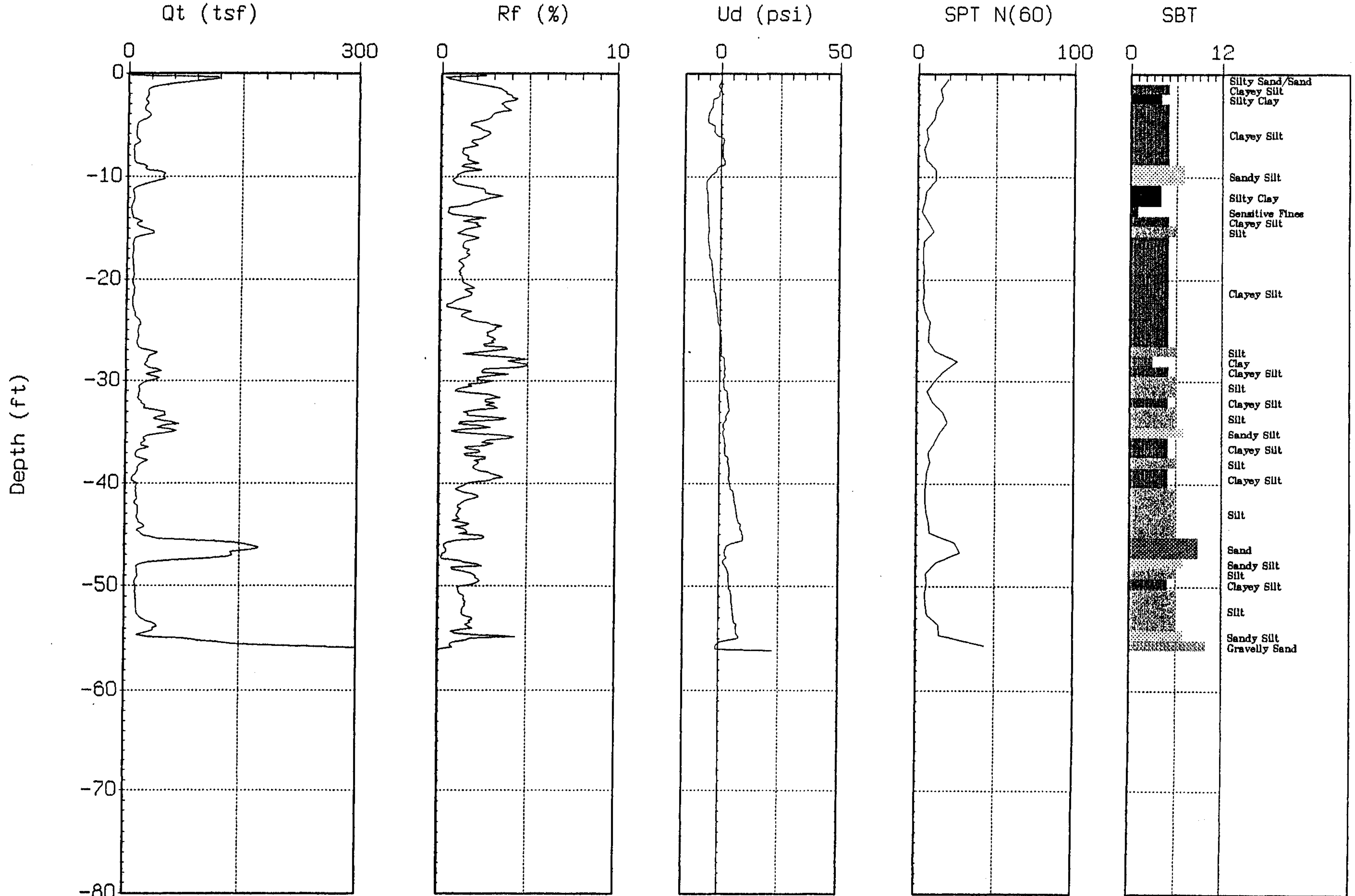
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-25

Engineer : S. KOLTHOFF
Date : 05:26:00 12:25



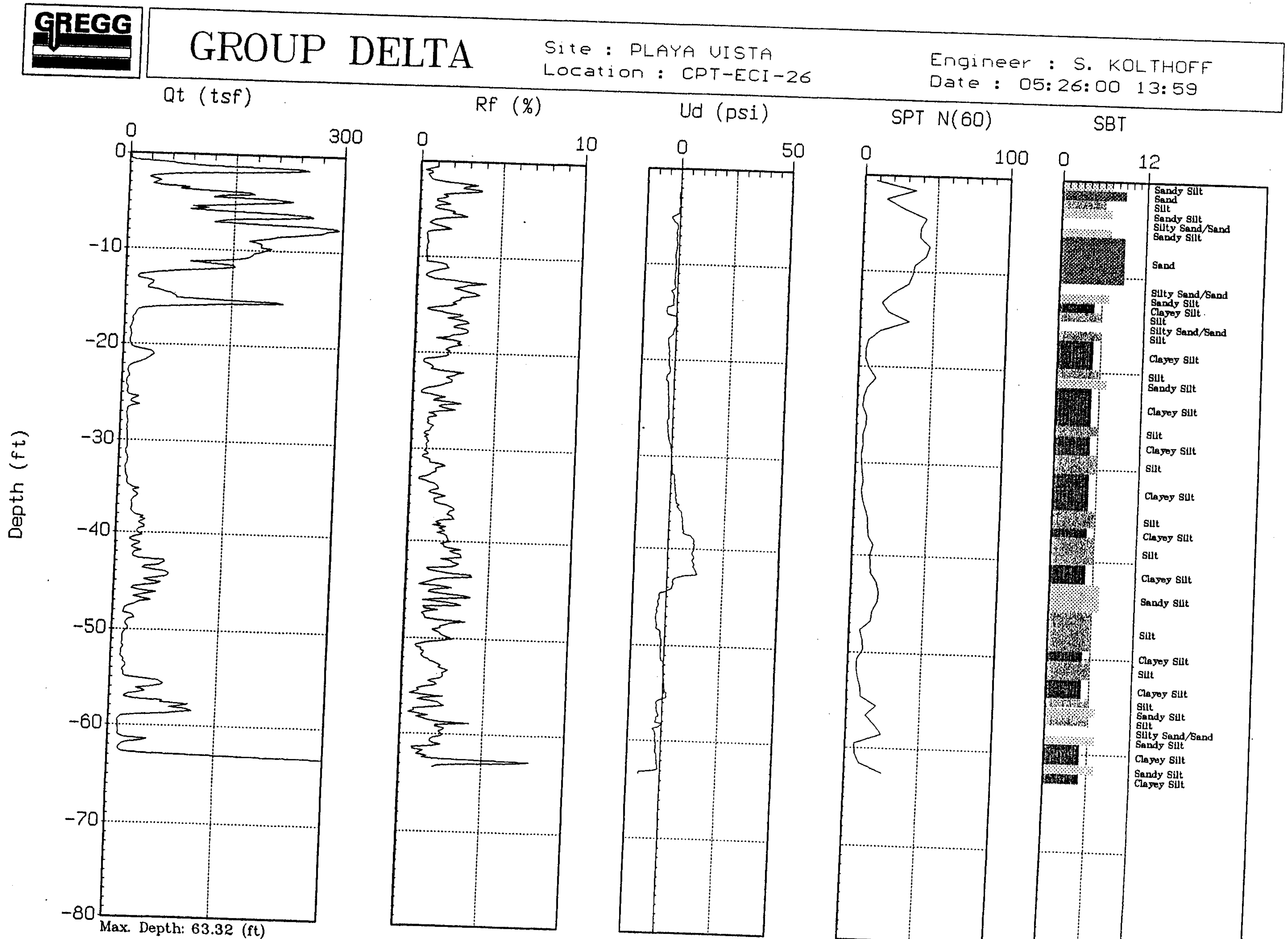
Max. Depth: 56.10 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-26

Engineer : S. KOLTHOFF
Date : 05:26:00 13:59



Max. Depth: 63.32 (ft)

Depth Inc.: 0.164 (ft)

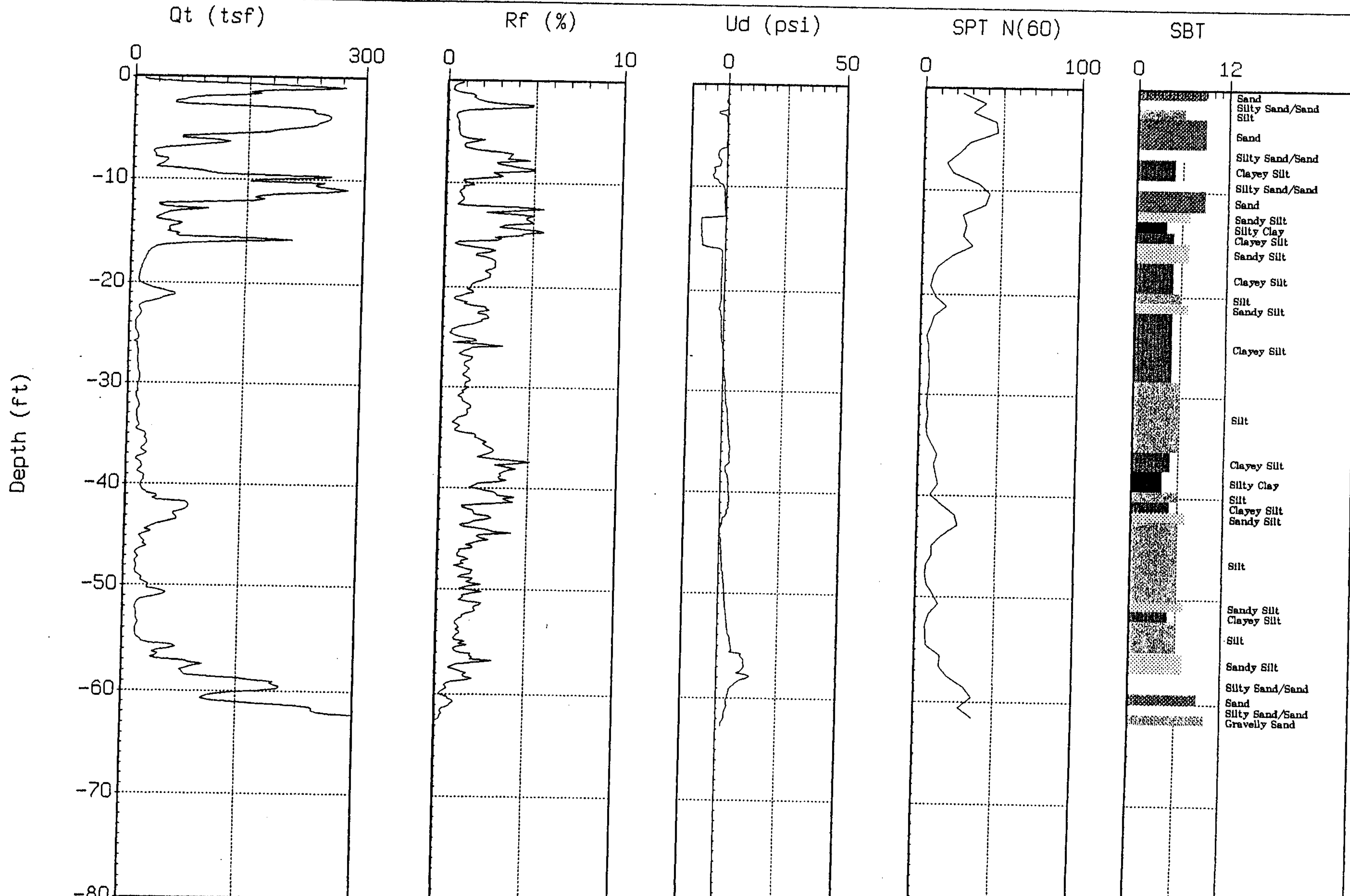
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-27

Engineer : S. KOLTHOFF
Date : 05:26:00 12:48



Max. Depth: 62.66 (ft)

Depth Inc.: 0.164 (ft)

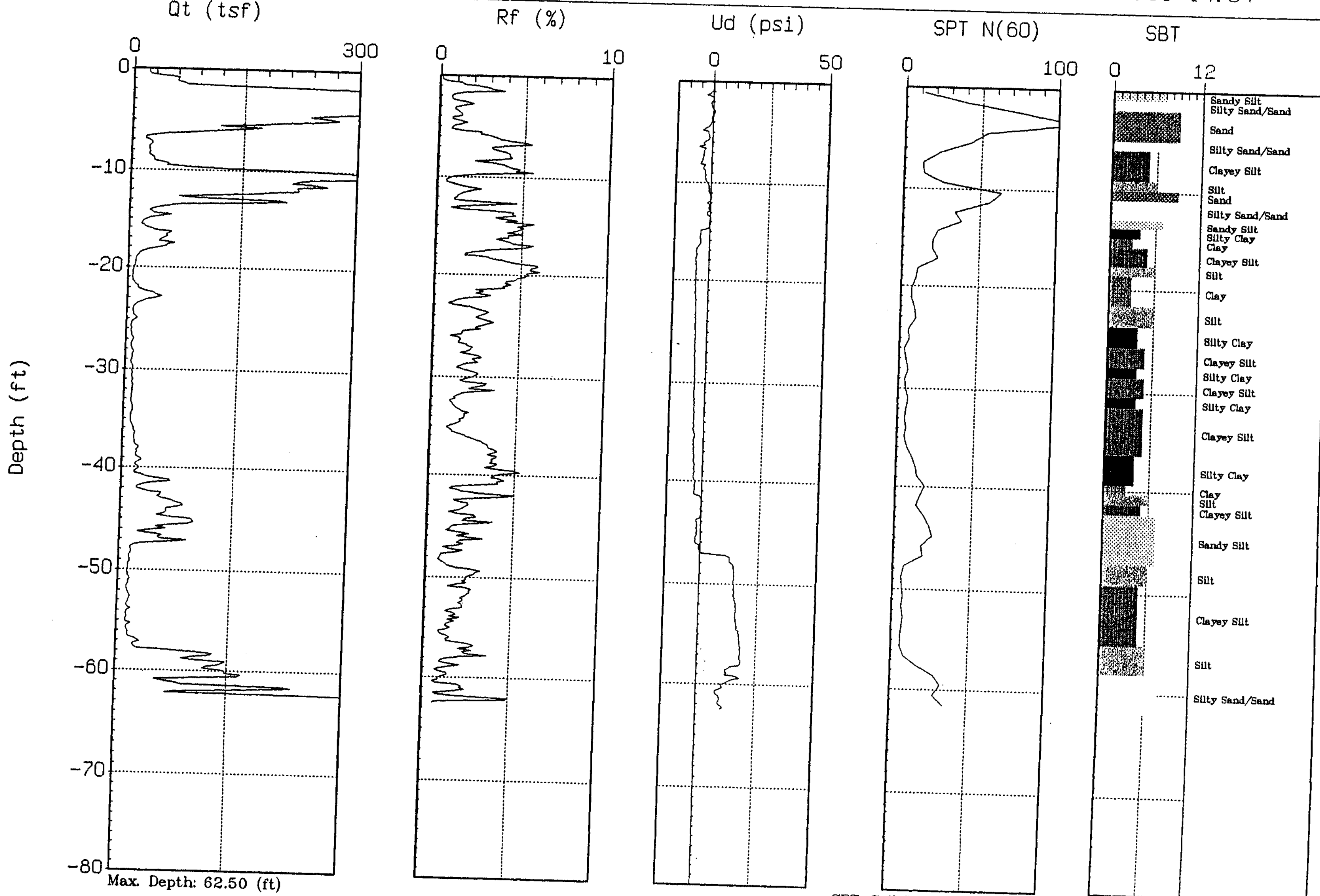
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-28

Engineer : S. KOLTHOFF
Date : 05:26:00 14:34



Max. Depth: 62.50 (ft)
Depth Inc.: 0.164 (ft)

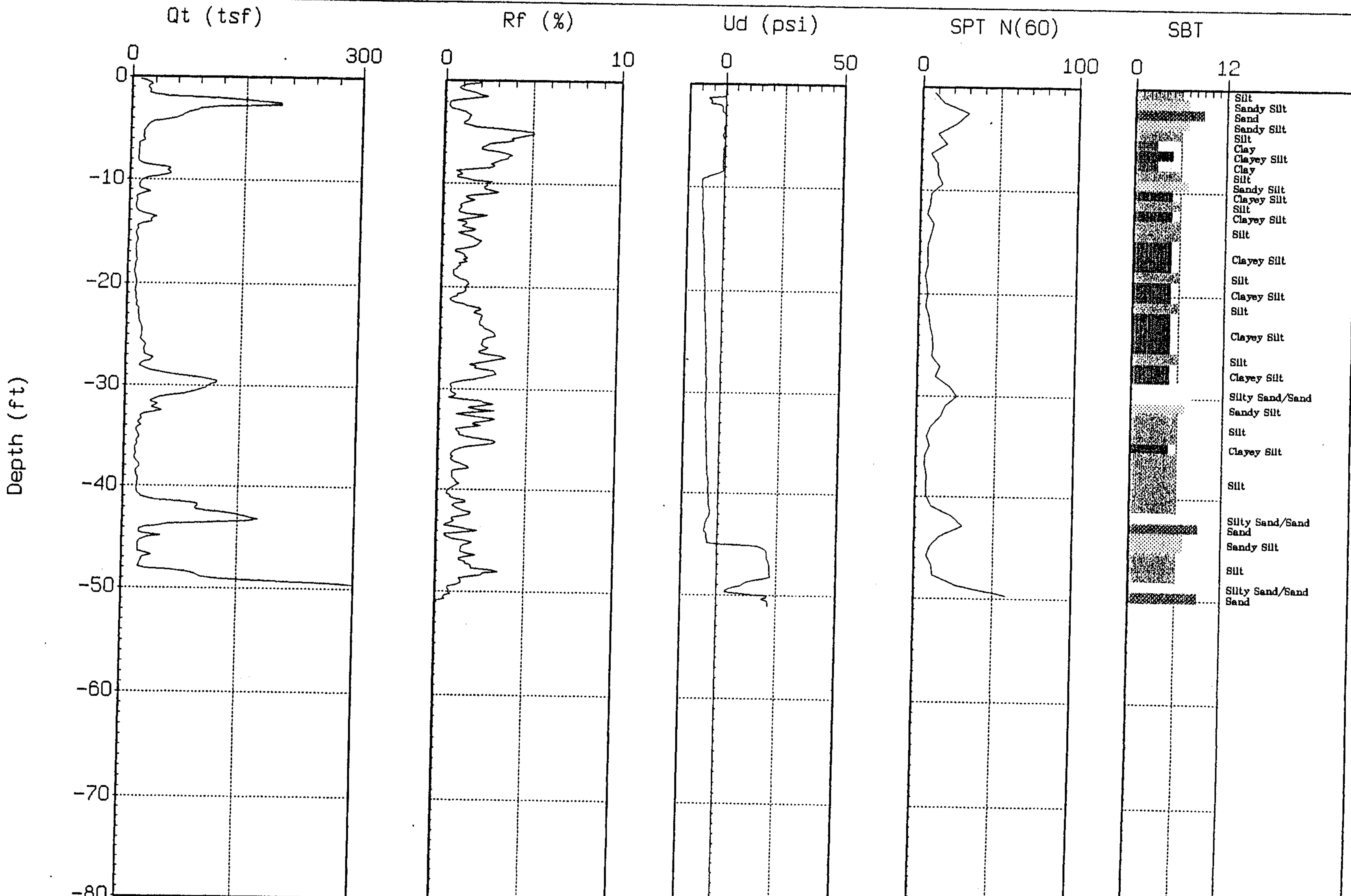
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-29

Engineer : S. KOLTHOFF
Date : 05:26:00 13:24



Max. Depth: 51.02 (ft)
Depth Inc.: 0.164 (ft)

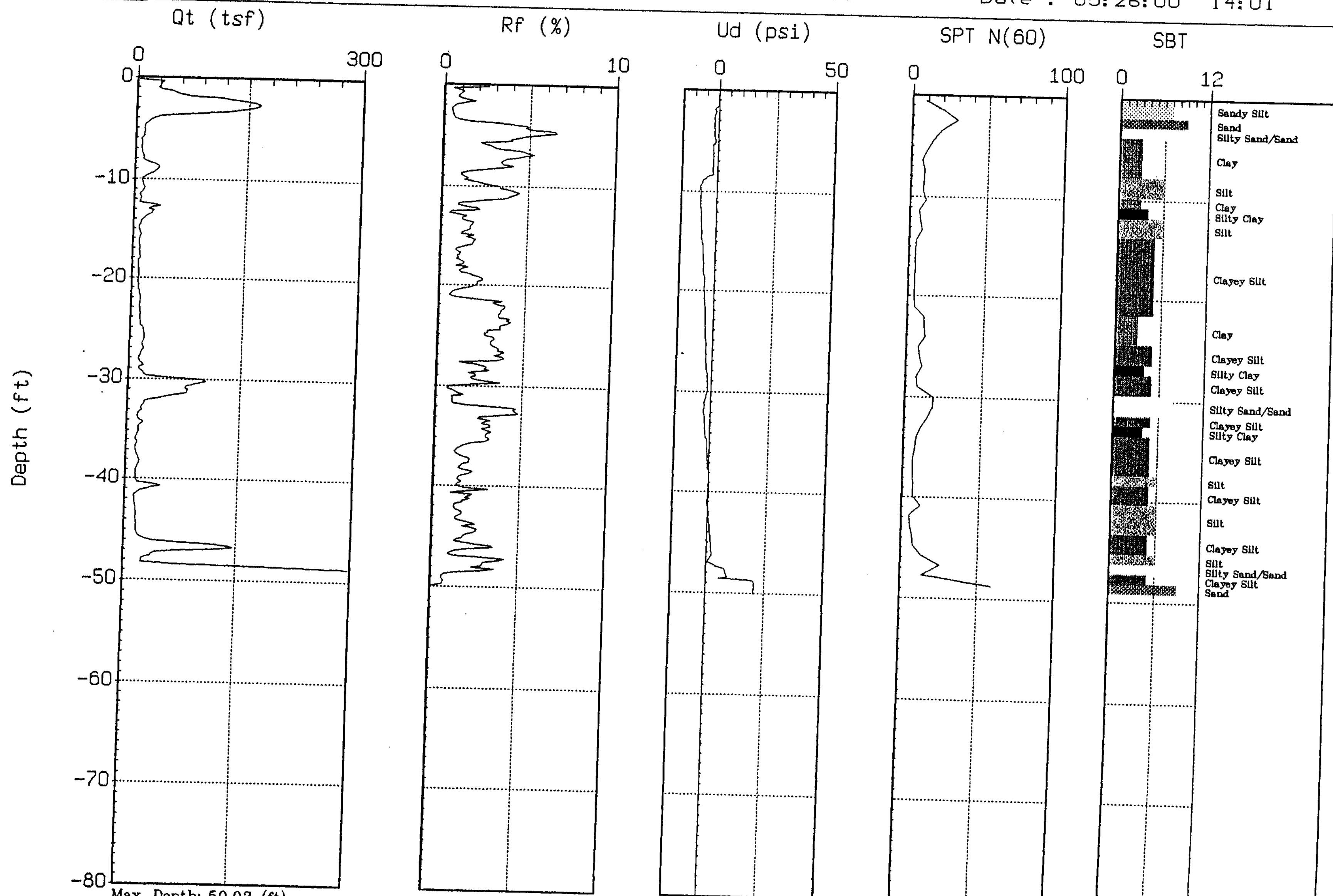
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

GREGG

Site : PLAYA VISTA
Location : CPT-ECI-30

Engineer : S. KOLTHOFF
Date : 05:26:00 14:01



Max. Depth: 50.03 (ft)
Depth Inc.: 0.164 (ft)

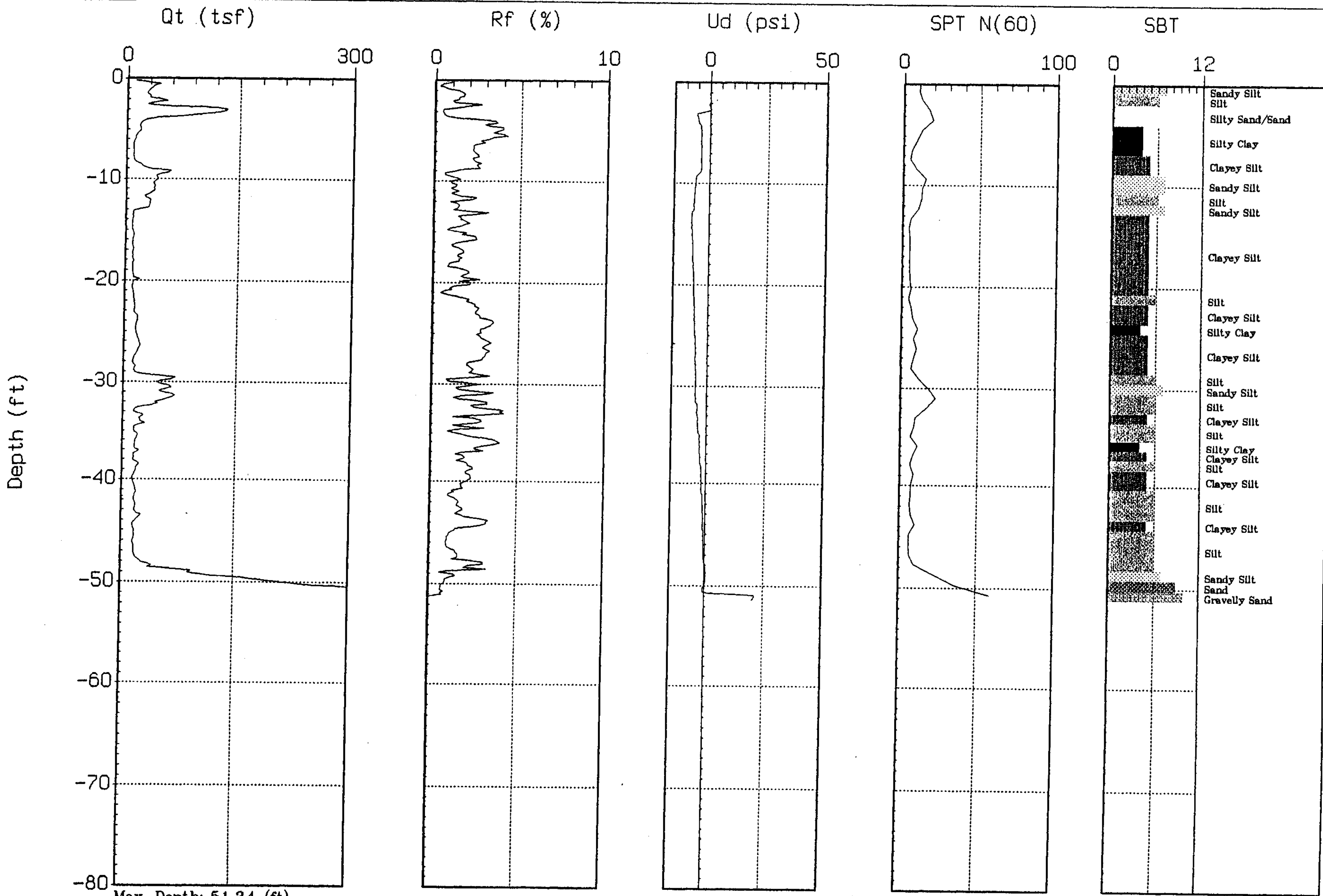
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-31

Engineer : S. KOLTHOFF
Date : 05:26:00 14:30



Max. Depth: 51.34 (ft)
Depth Inc.: 0.164 (ft)

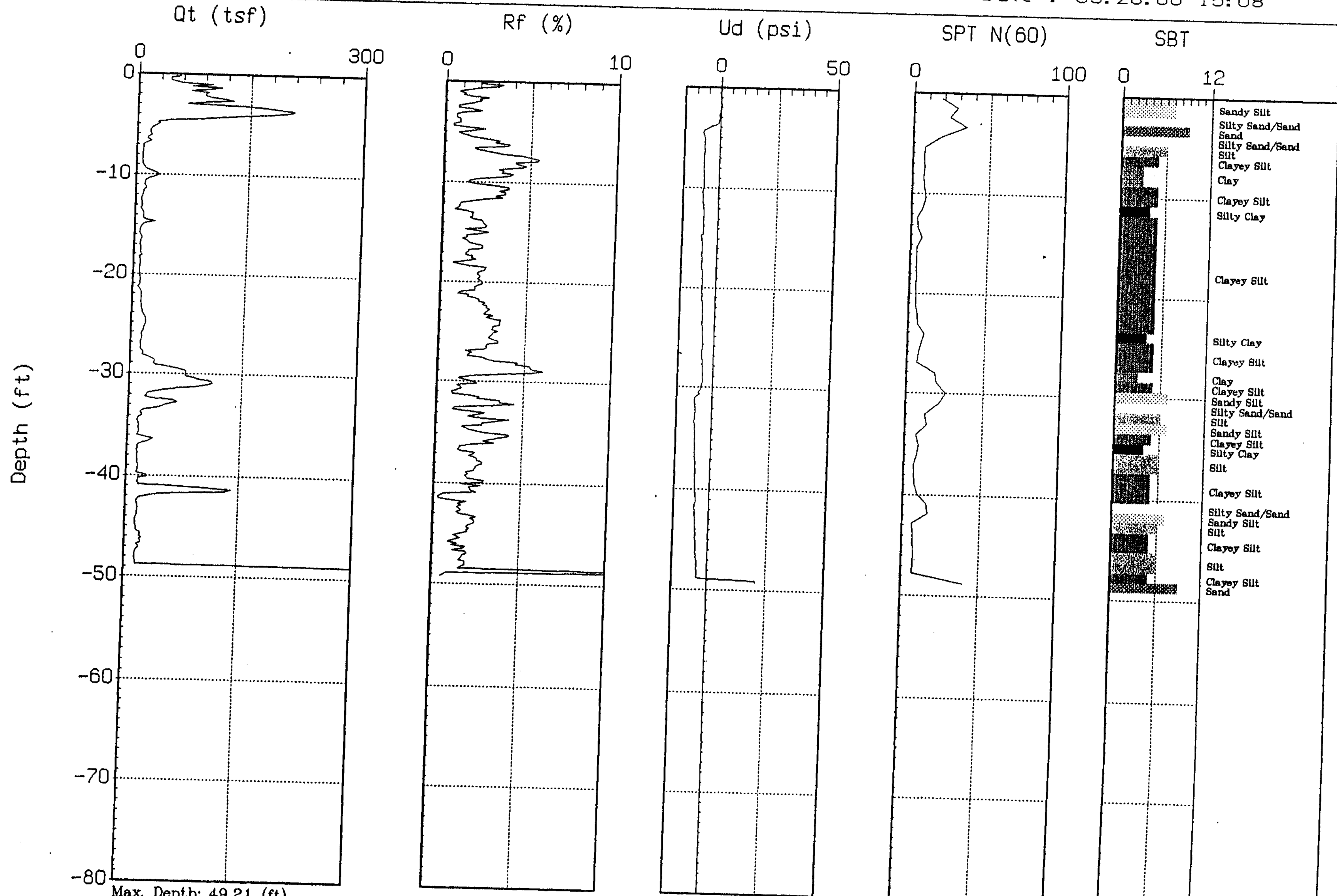
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-32

Engineer : S. KOLTHOFF
Date : 05:26:00 15:08



Max. Depth: 49.21 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

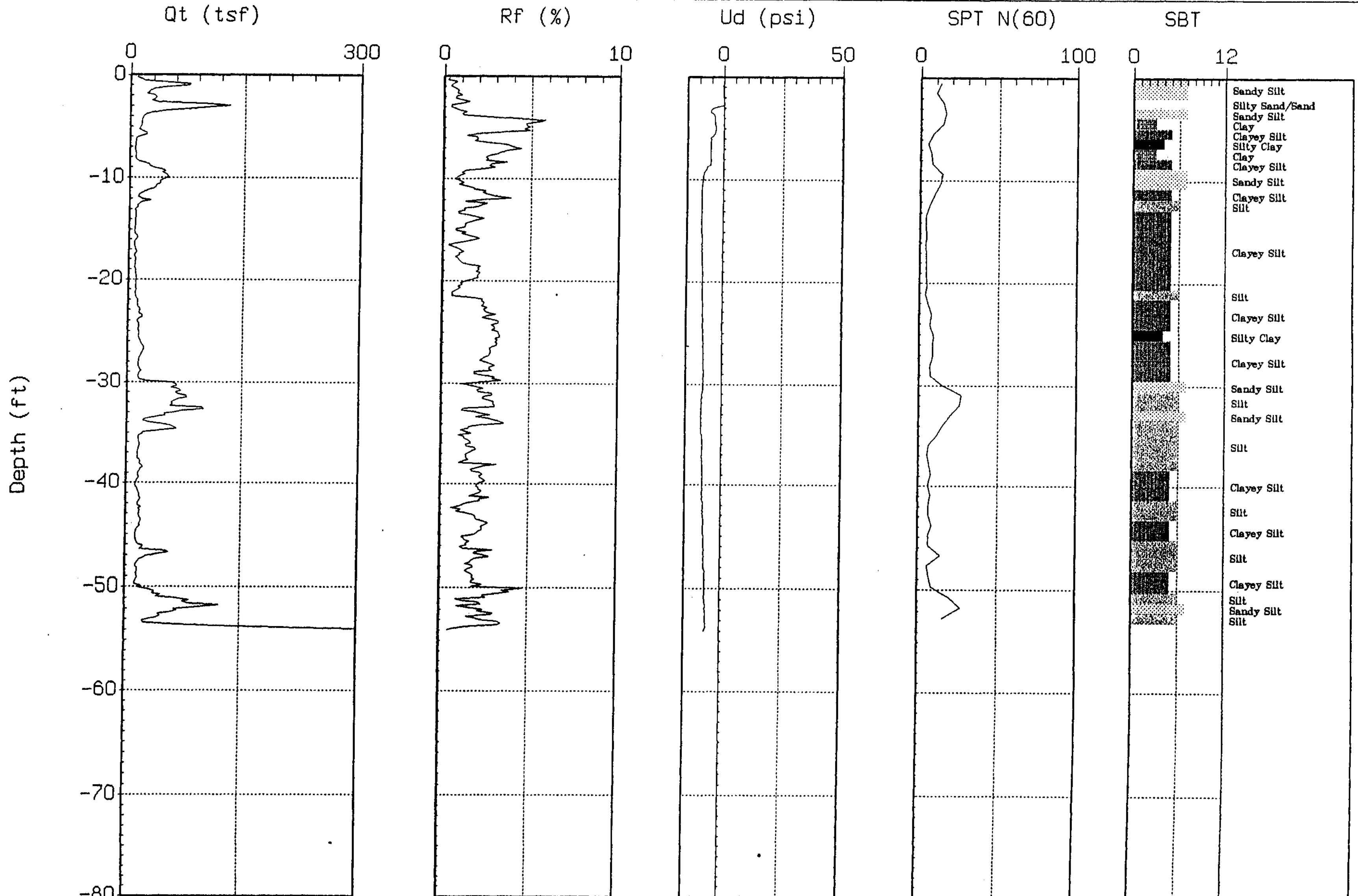
~141

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-33

Engineer : S. KOLTHOFF
Date : 05:26:00 15:50



Max. Depth: 53.97 (ft)

Depth Inc.: 0.164 (ft)

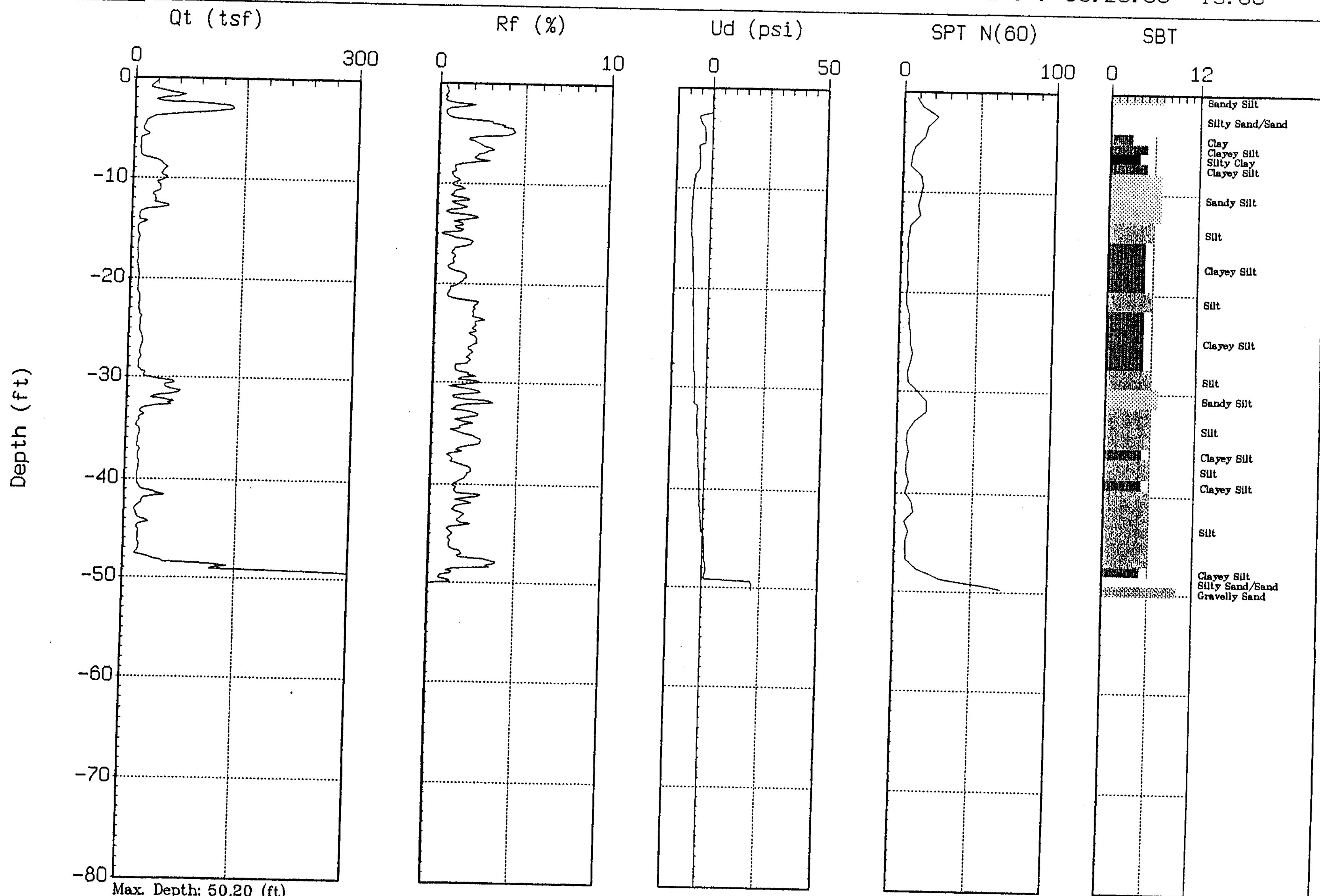
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : CPT-ECI-34

Engineer : S. KOLTHOFF
Date : 05:26:00 15:00



Max. Depth: 50.20 (ft)
Depth Inc.: 0.164 (ft)

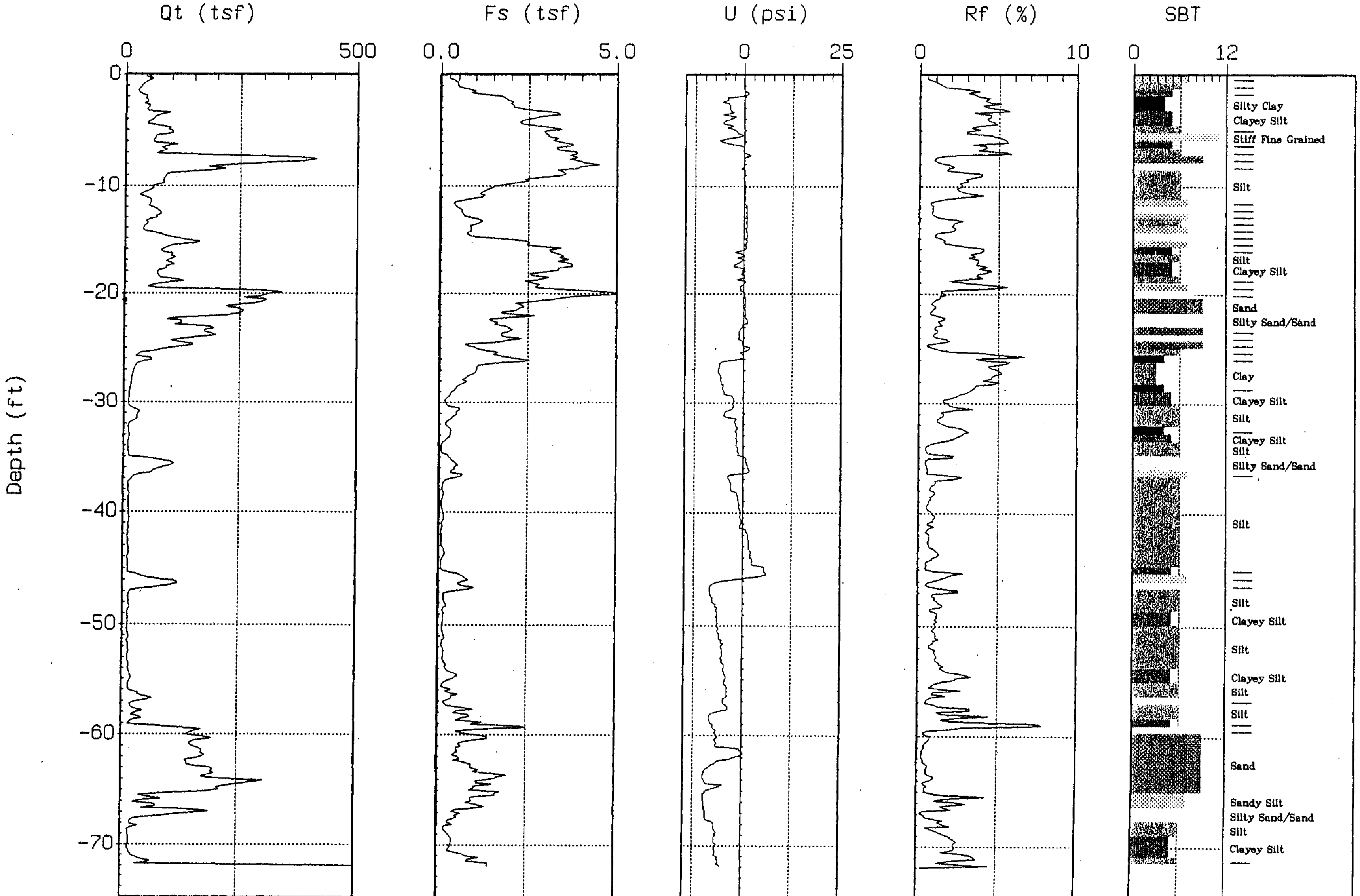
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-35

Geologist : S. KOLTHOFF
Date : 06:16:00 07:55

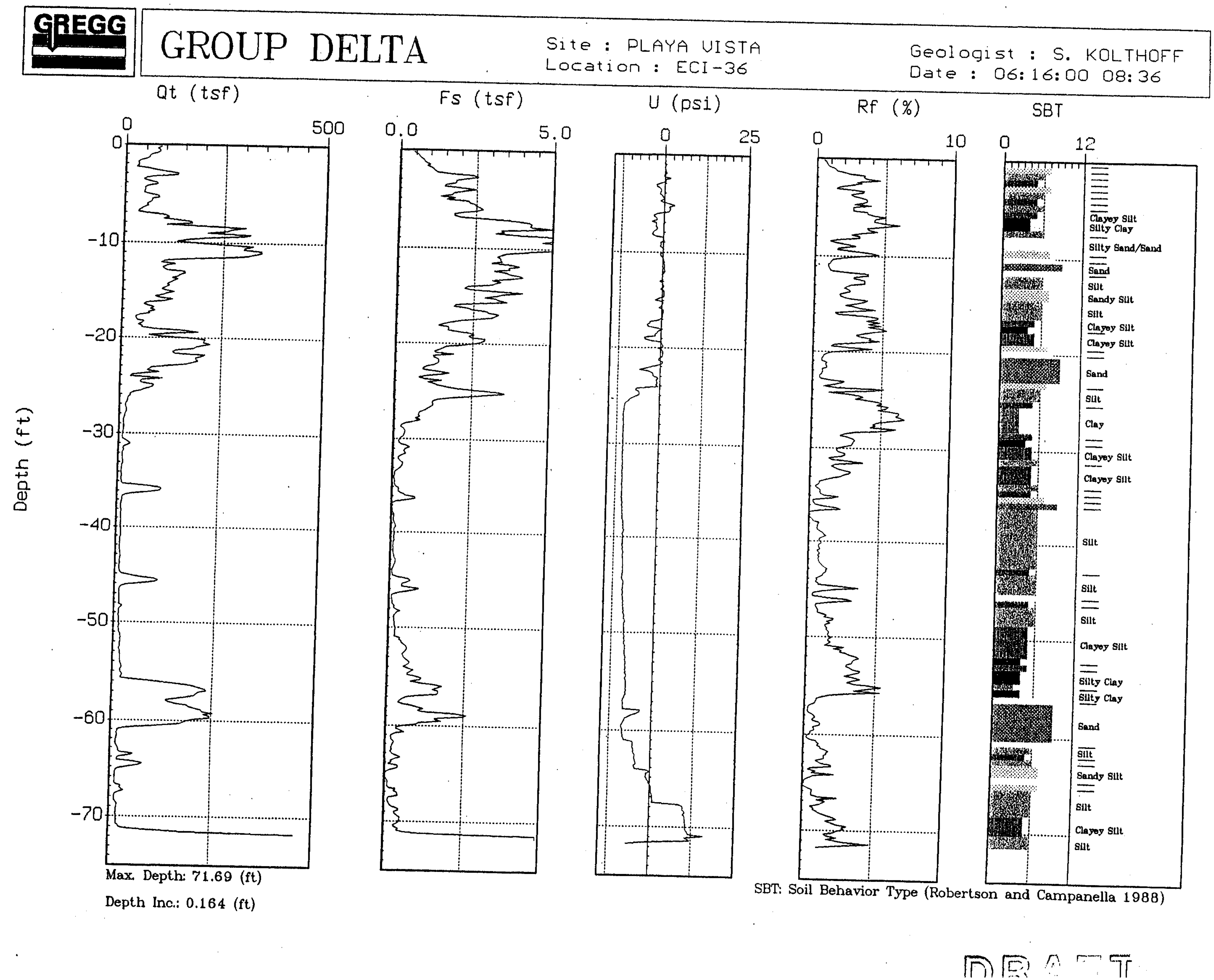


Max. Depth: 72.01 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

DRAFT

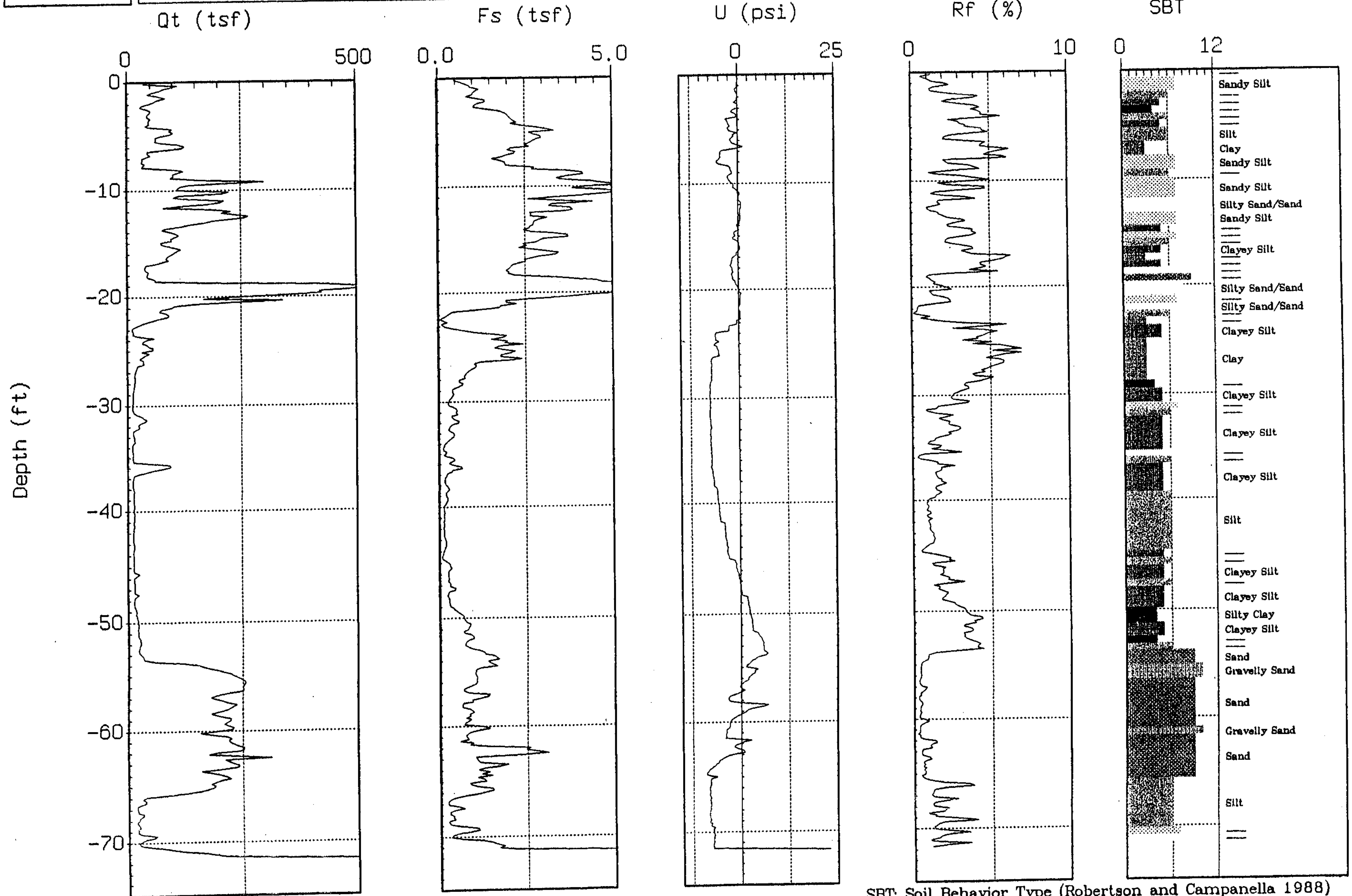

GREGG
GROUP DELTA
Site : PLAYA VISTA
Location : ECI-36
Geologist : S. KOLTHOFF
Date : 06:16:00 08:36
Qt (tsf)
Fs (tsf)
U (psi)
Rf (%)
SBT
Depth (ft)
Clayey Silt
Silty Clay
Silty Sand/Sand
Sand
Silt
Sandy Silt
Clay
Max. Depth: 71.69 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson and Campanella 1988)
DRAFT

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-37

Geologist : S. KOLTHOFF
Date : 06:16:00 09:23



Max. Depth: 71.69 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

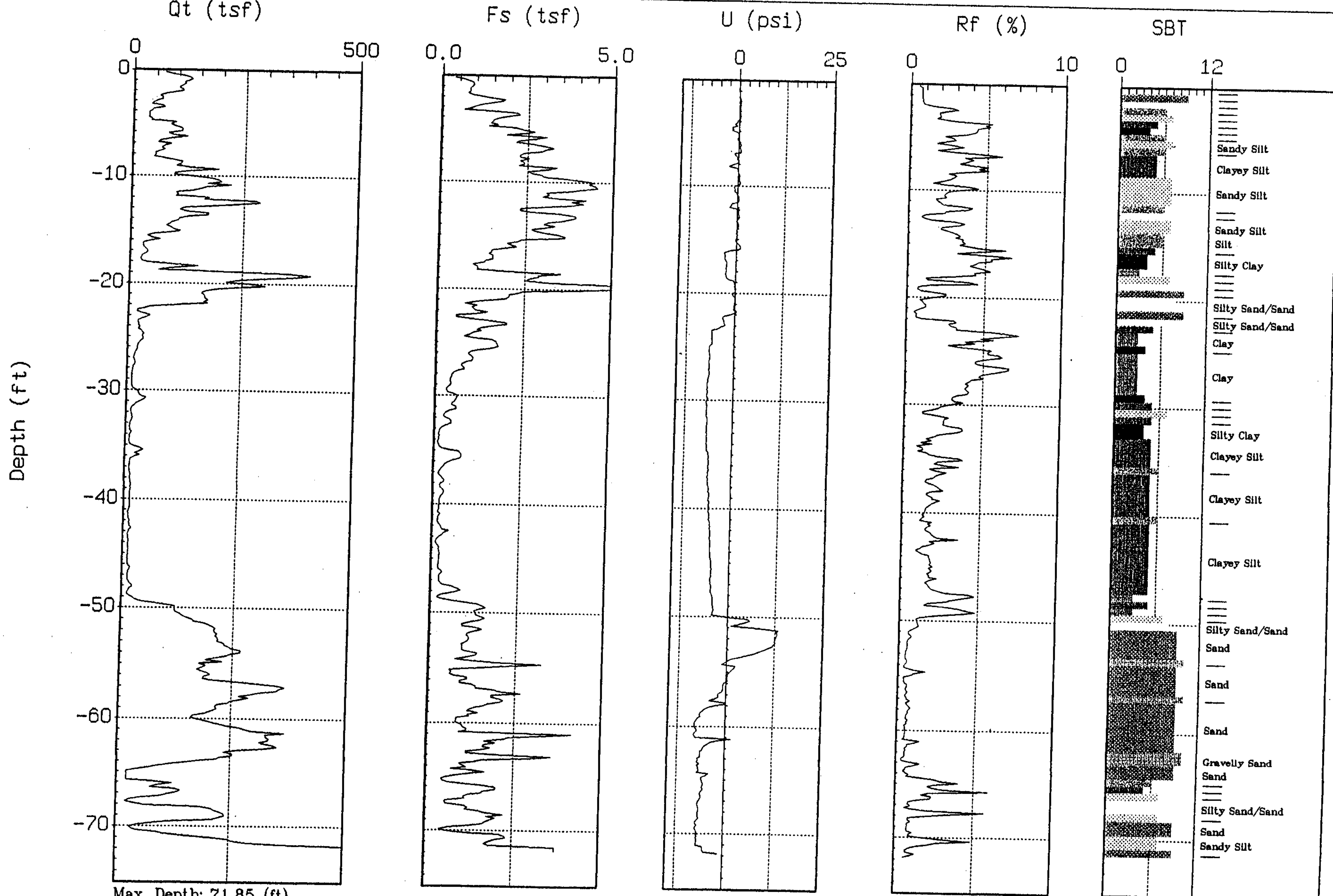
DRAFT

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-38

Geologist : S. KOLTHOFF
Date : 06:16:00 10:01



Max. Depth: 71.85 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

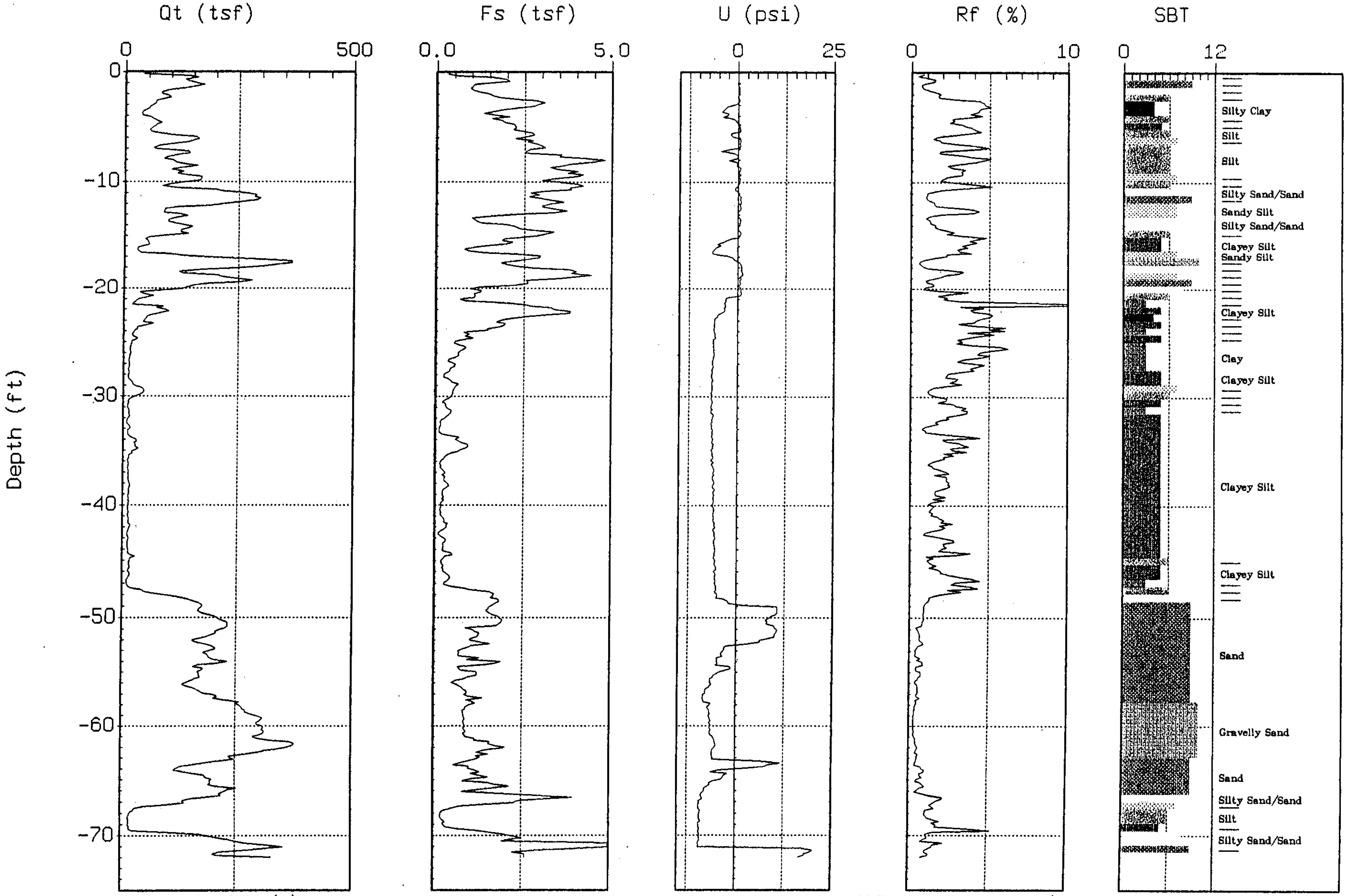
DRA_T

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-39

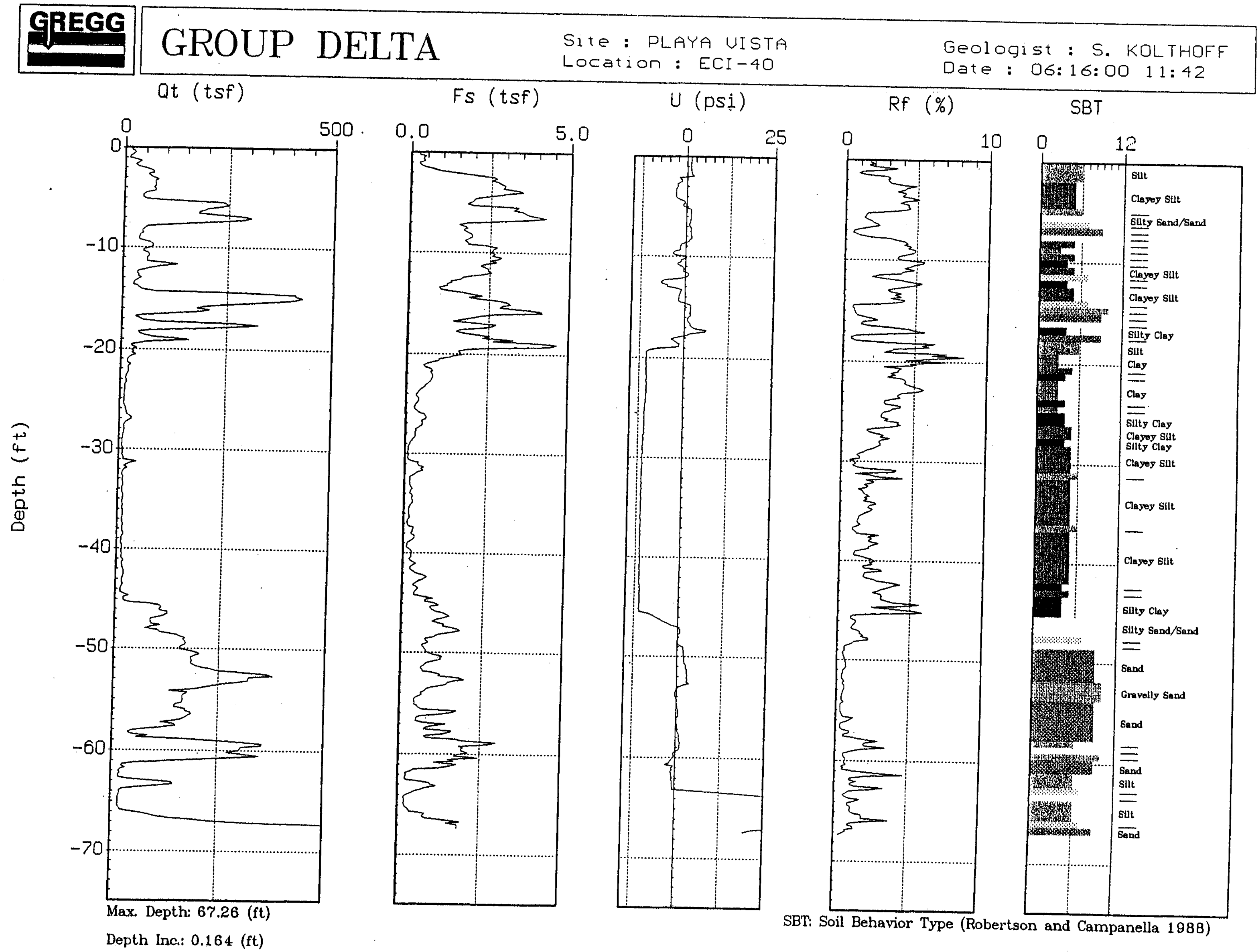
Geologist : S. KOLTHOFF
Date : 06:16:00 10:55



Max. Depth: 72.01 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

DRAFT

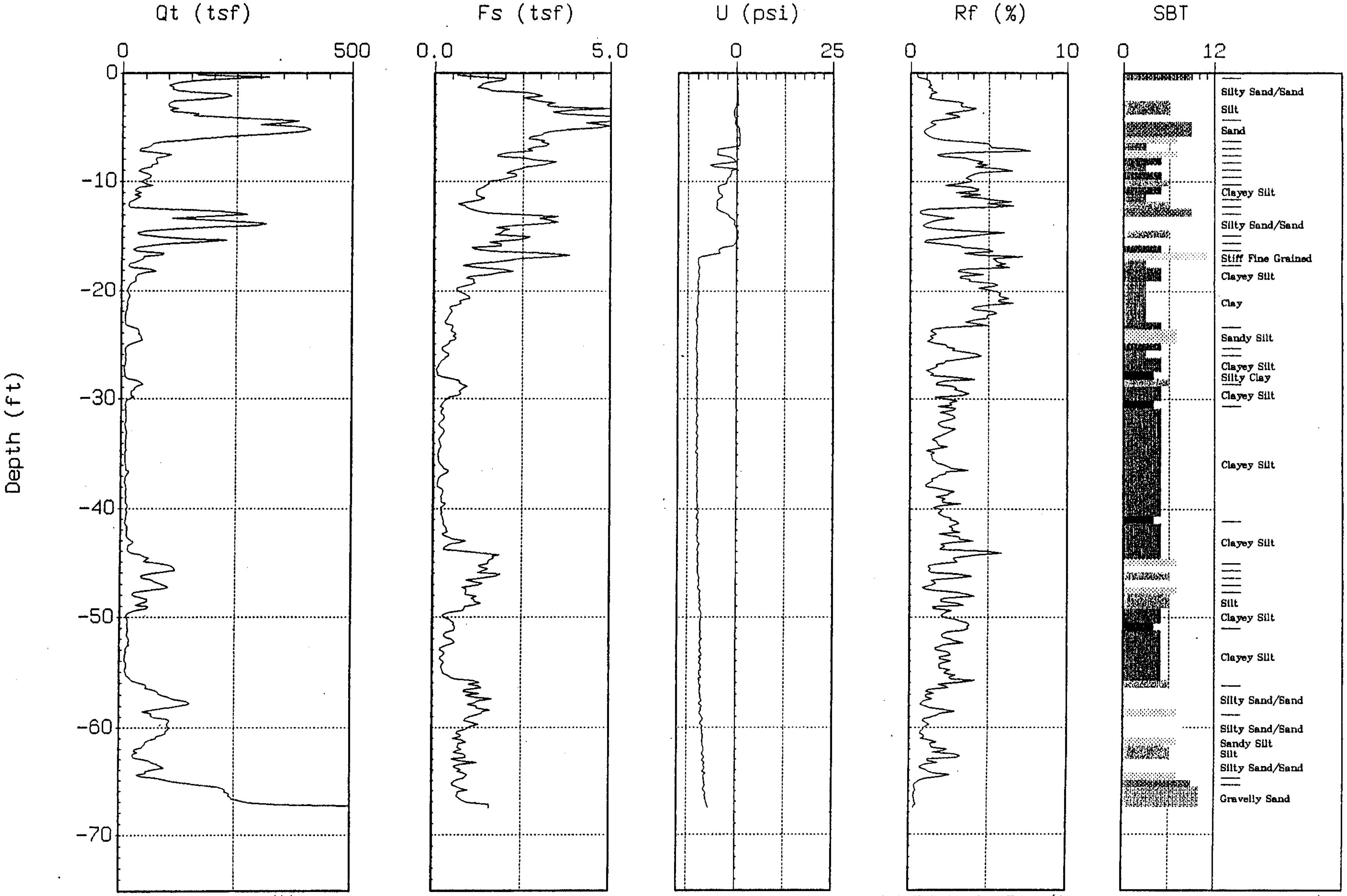

GREGG
GROUP DELTA
Site : PLAYA VISTA
Location : ECI-40
Geologist : S. KOLTHOFF
Date : 06:16:00 11:42
Qt (tsf)
Fs (tsf)
U (psi)
Rf (%)
SBT
0
500
0.0
5.0
25
10
12
Depth (ft)
-10
-20
-30
-40
-50
-60
-70
Silt
Clayey Silt
Silty Sand/Sand
Clayey Silt
Clayey Silt
Silty Clay
Silt
Clay
Clay
Silty Clay
Clayey Silt
Silty Clay
Clayey Silt
Clayey Silt
Clayey Silt
Silty Clay
Silty Sand/Sand
Sand
Gravelly Sand
Sand
Sand
Silt
Silt
Sand
Max. Depth: 67.26 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-41

Geologist : S. KOLTHOFF
Date : 06:16:00 12:21



Max. Depth: 67.58 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

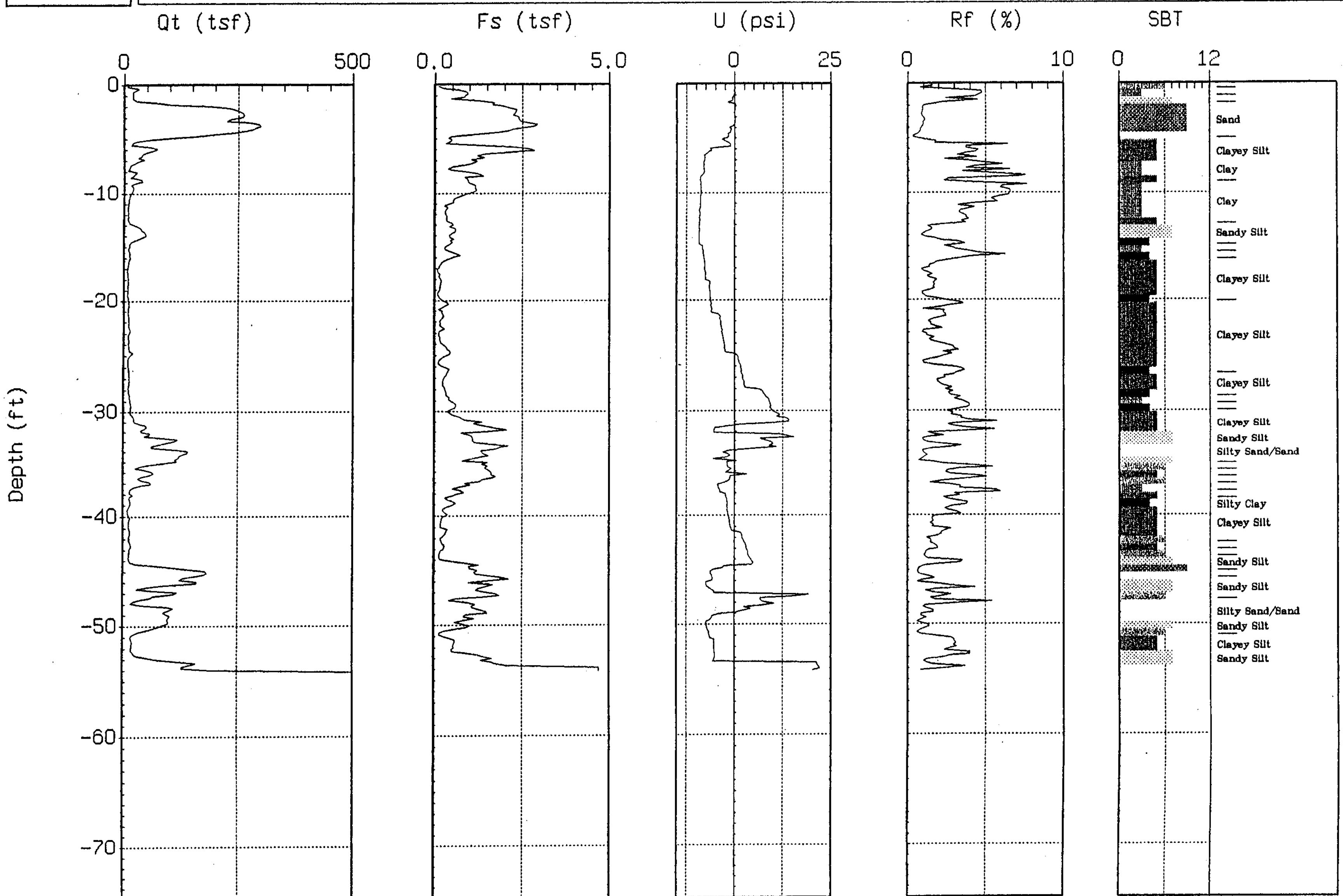
DRAFT

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-42

Geologist : S. KOLTHOFF
Date : 06:16:00 13:33



Max. Depth: 54.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

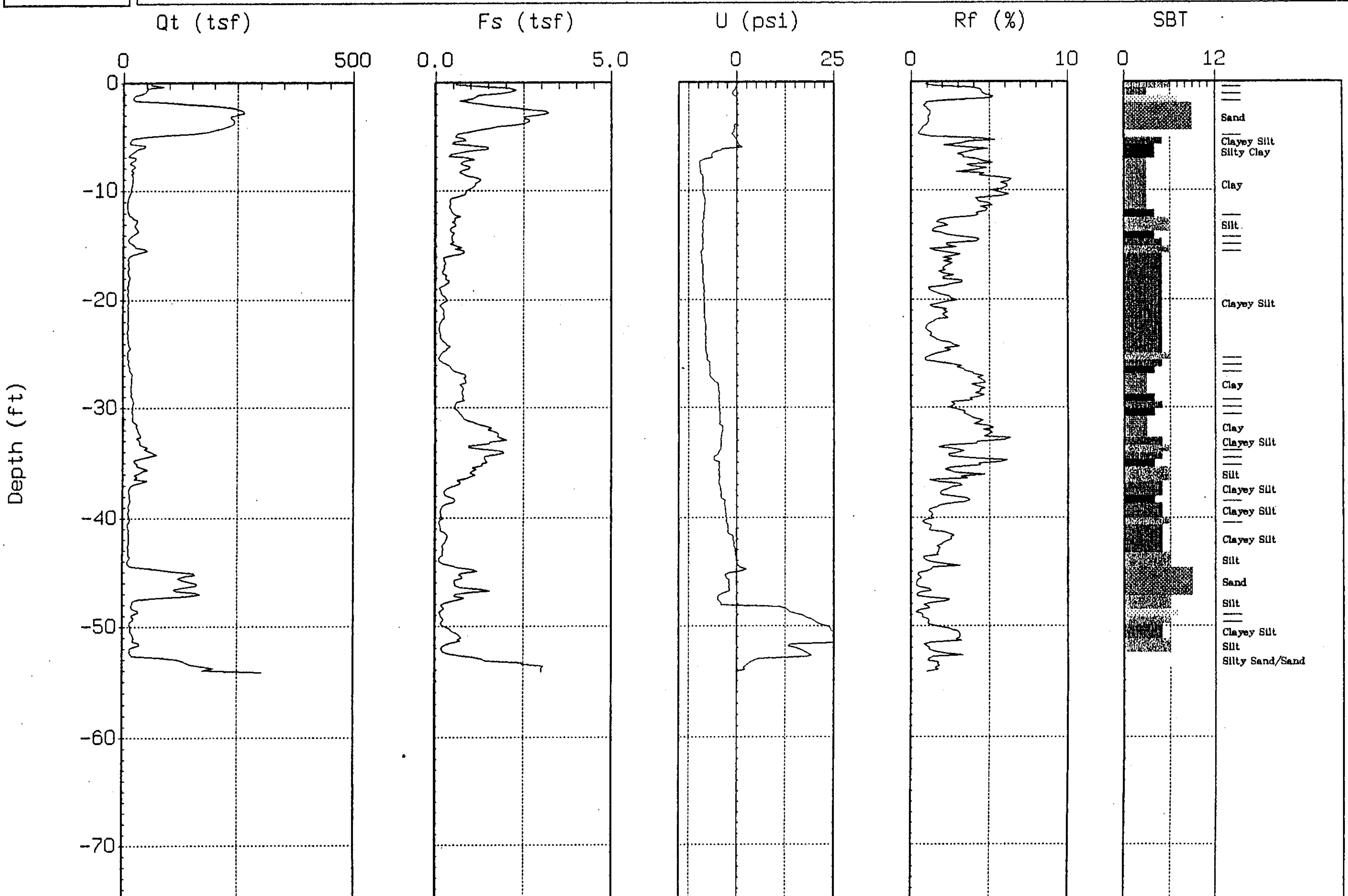
DRAFT

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-43

Geologist : S. KOLTHOFF
Date : 06:16:00 14:08



Max. Depth: 54.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

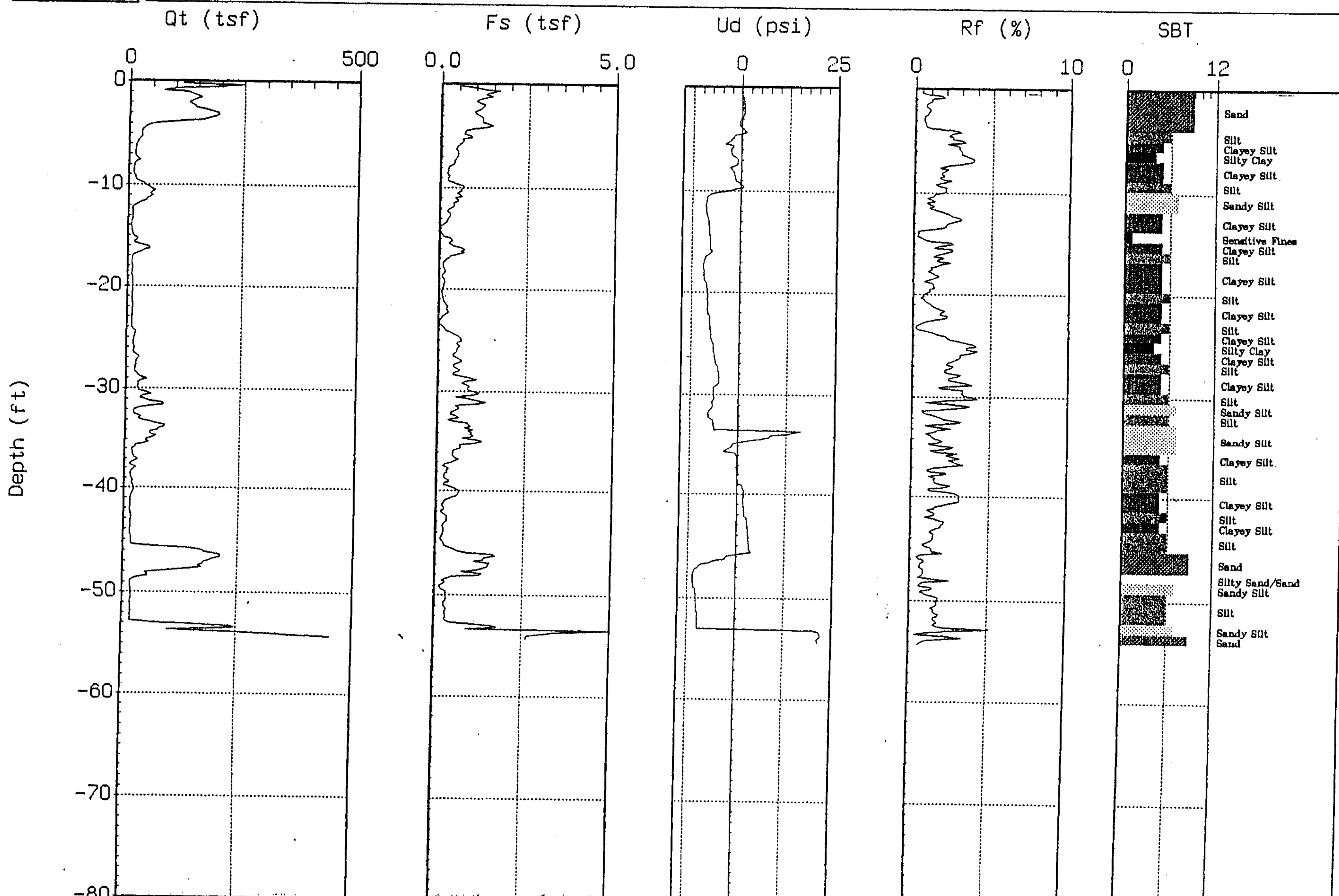
DRAFT

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-44

Engineer : S. KOLTHOFF
Date : 06:21:00 07:26



Max. Depth: 54.30 (ft)
Depth Inc.: 0.164 (ft)

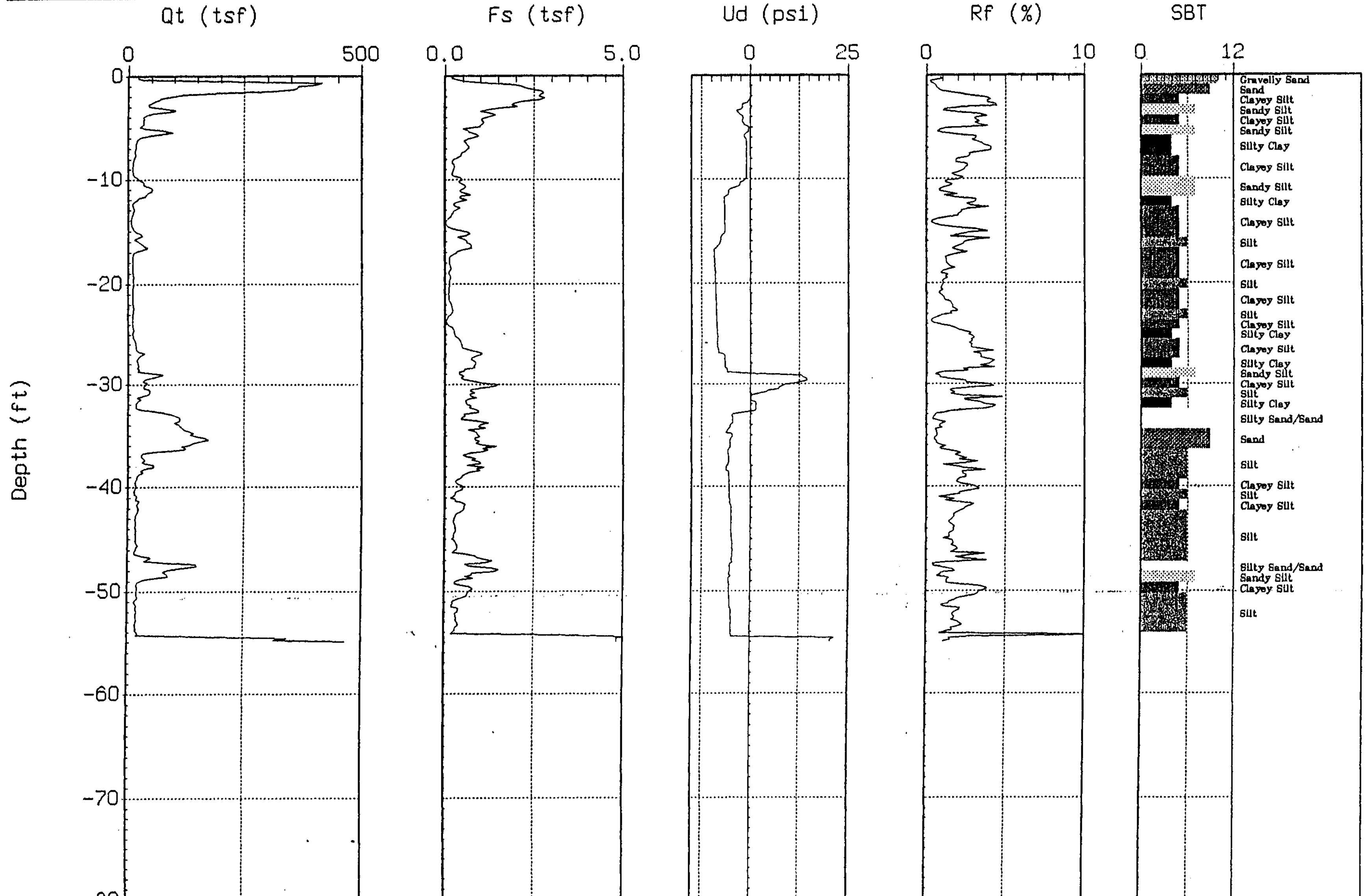
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-45

Engineer : S. KOLTHOFF
Date : 06:21:00 08:10



Max. Depth: 54.95 (ft)

Depth Inc.: 0.164 (ft)

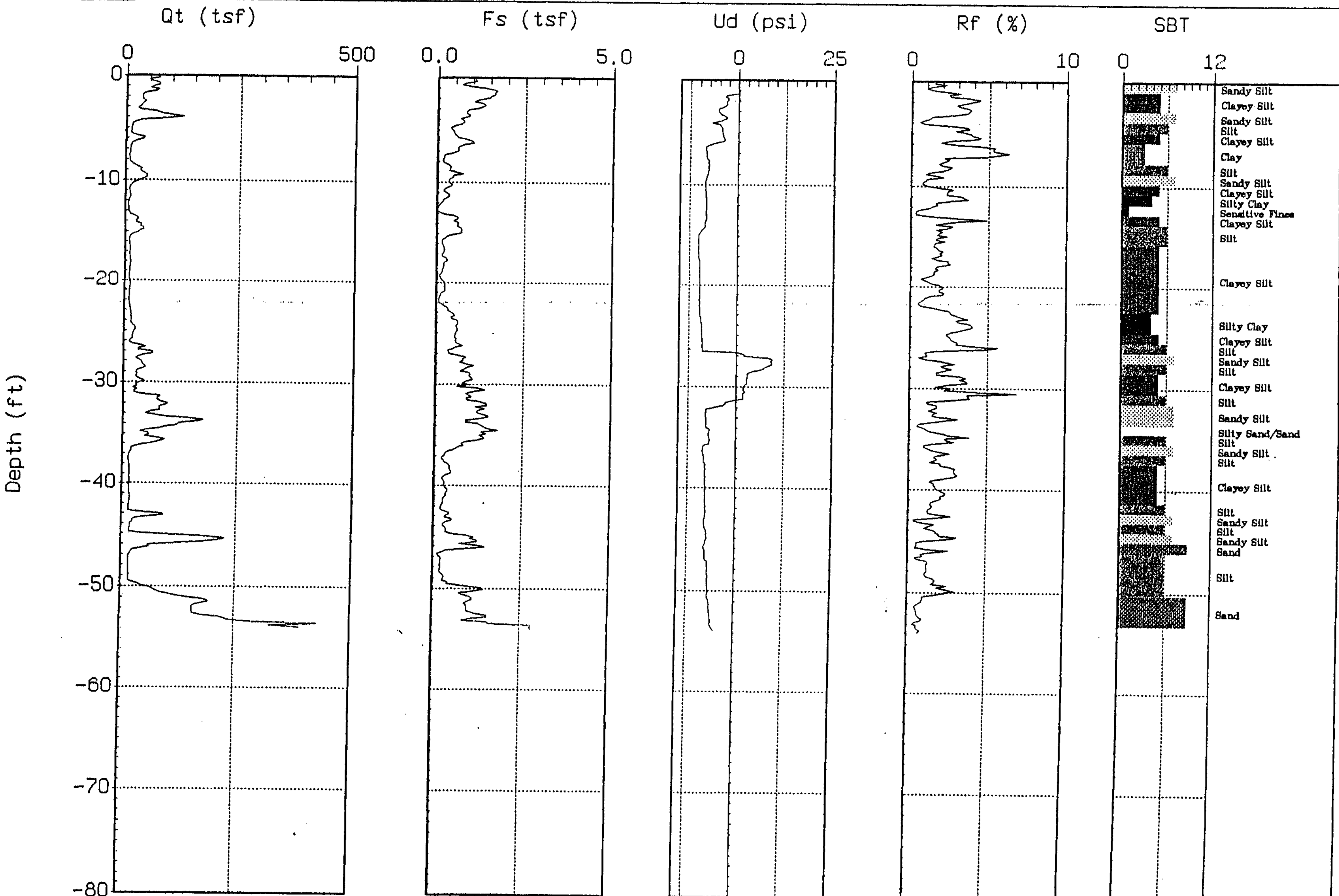
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-46

Engineer : S. KOLTHOFF
Date : 06:21:00 08:38



Max. Depth: 53.81 (ft)

Depth Inc.: 0.164 (ft)

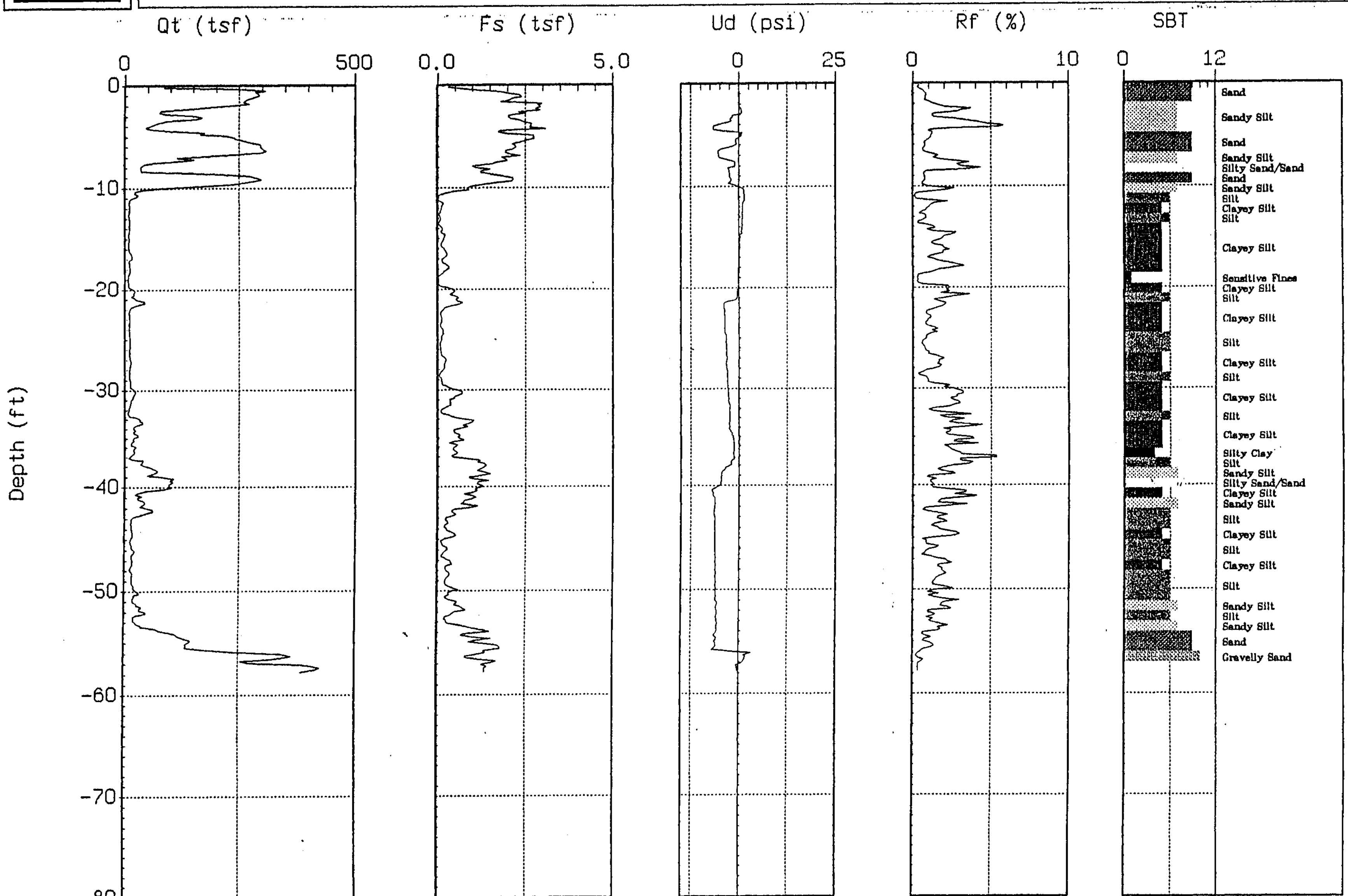
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-47

Engineer : S. KOLTHOFF
Date : 06:21:00 09:11



Max. Depth: 57.74 (ft)
Depth Inc.: 0.164 (ft)

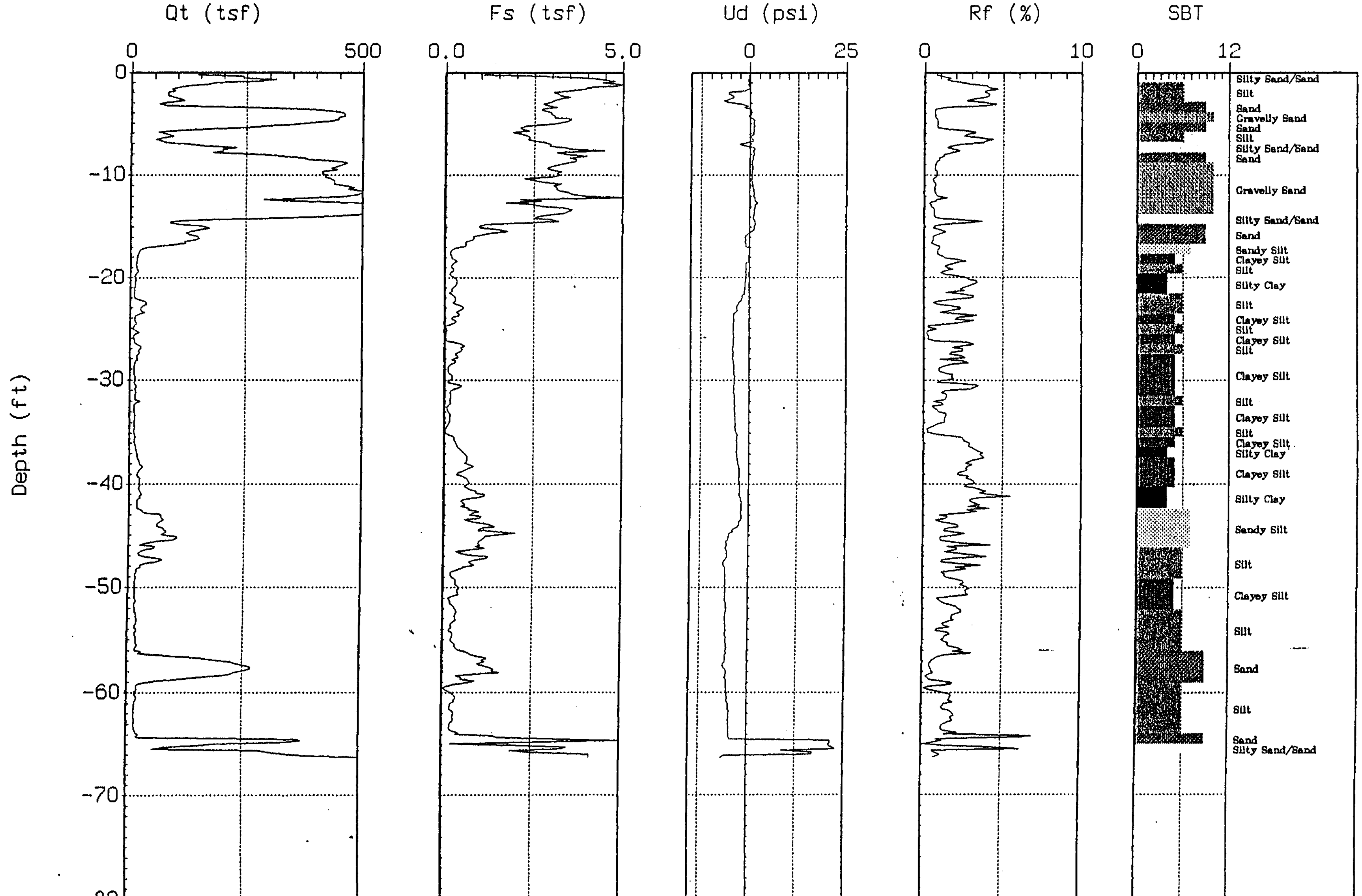
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-48

Engineer : S. KOLTHOFF
Date : 06:21:00 09:42



Max. Depth: 66.27 (ft)
pth Inc.: 0.164 (ft)

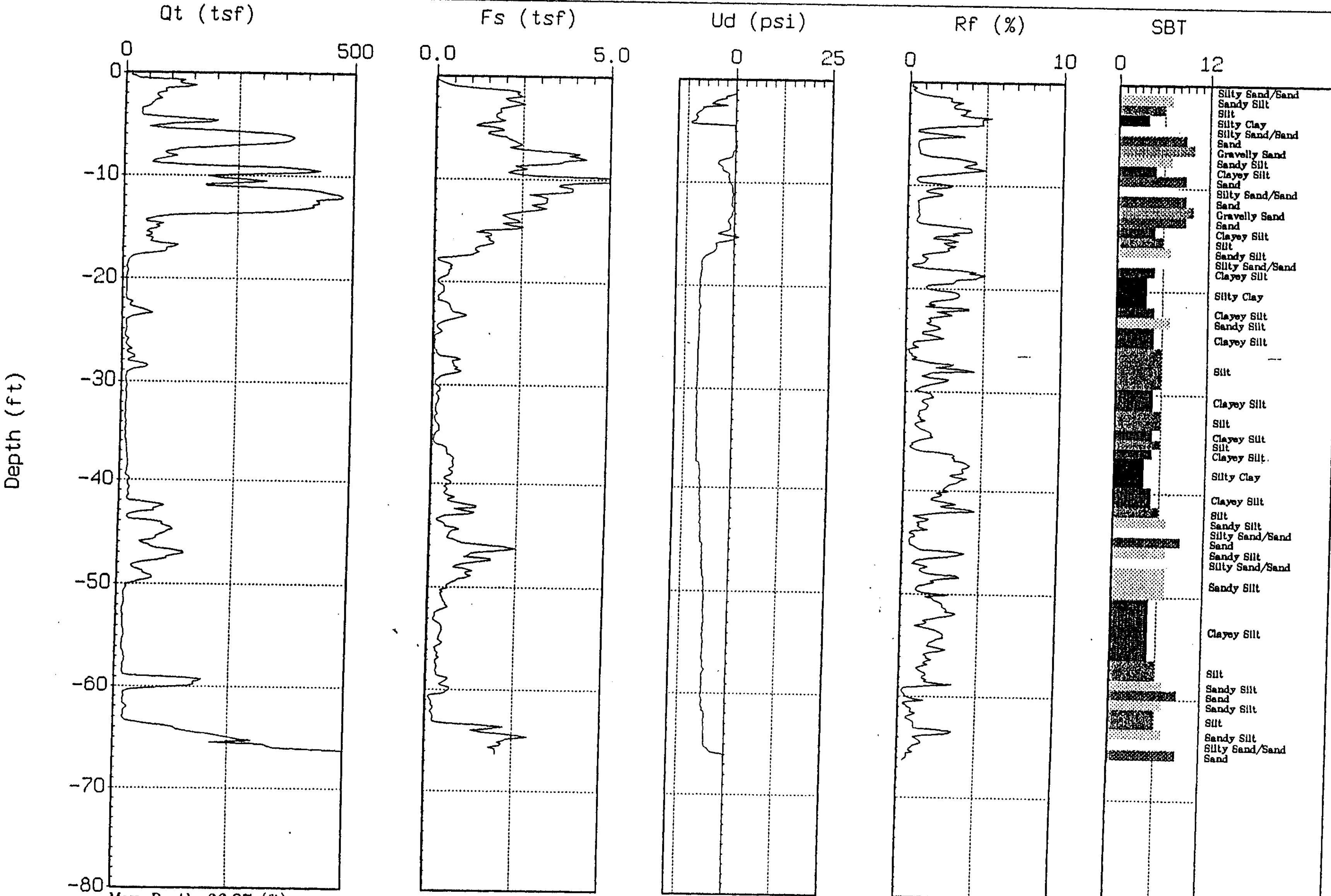
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-49

Engineer : S. KOLTHOFF
Date : 06:21:00 10:19



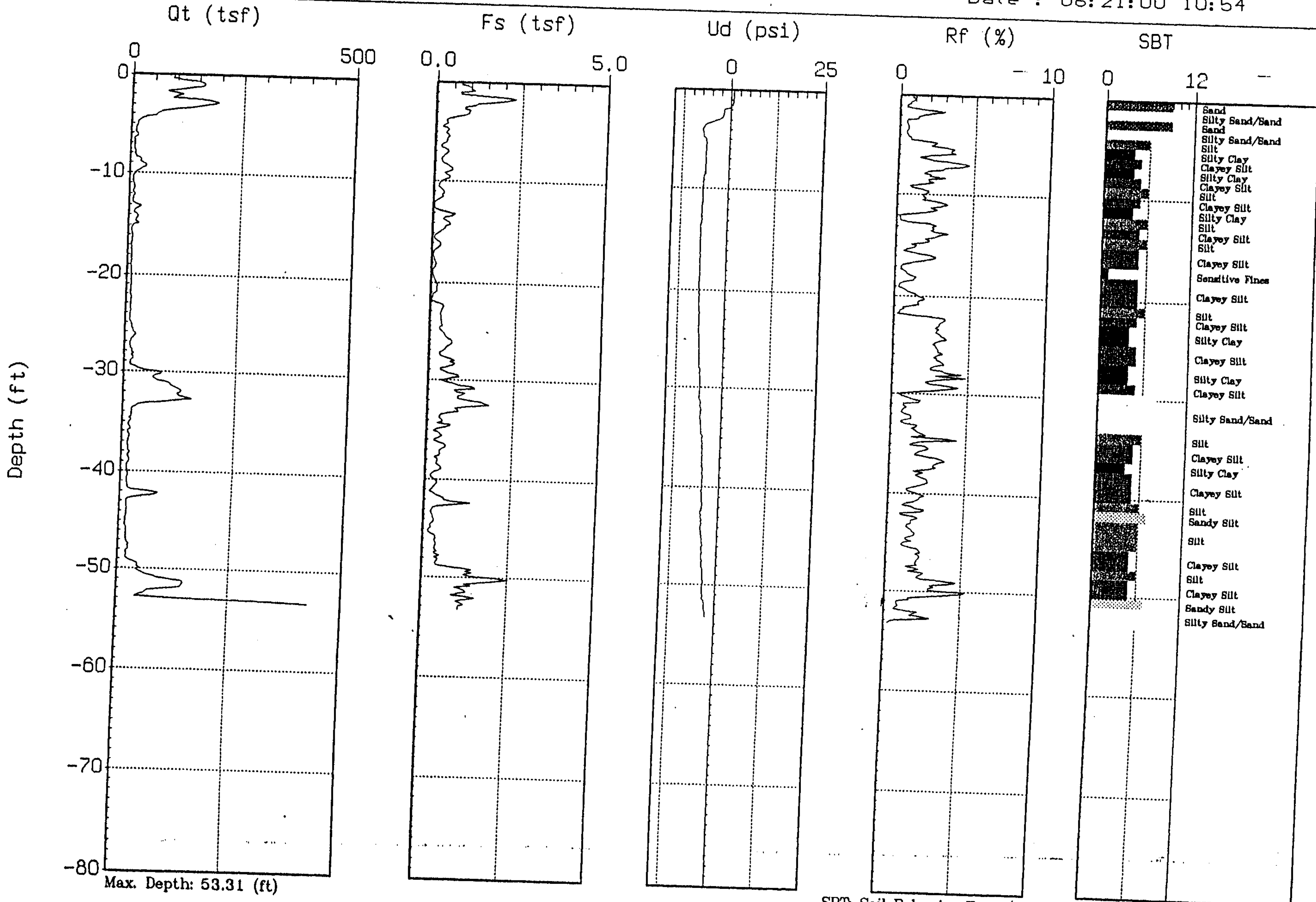
Max. Depth: 66.27 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-50

Engineer : S. KOLTHOFF
Date : 06:21:00 10:54



Max. Depth: 53.31 (ft)
ɔth Inc.: 0.164 (ft)

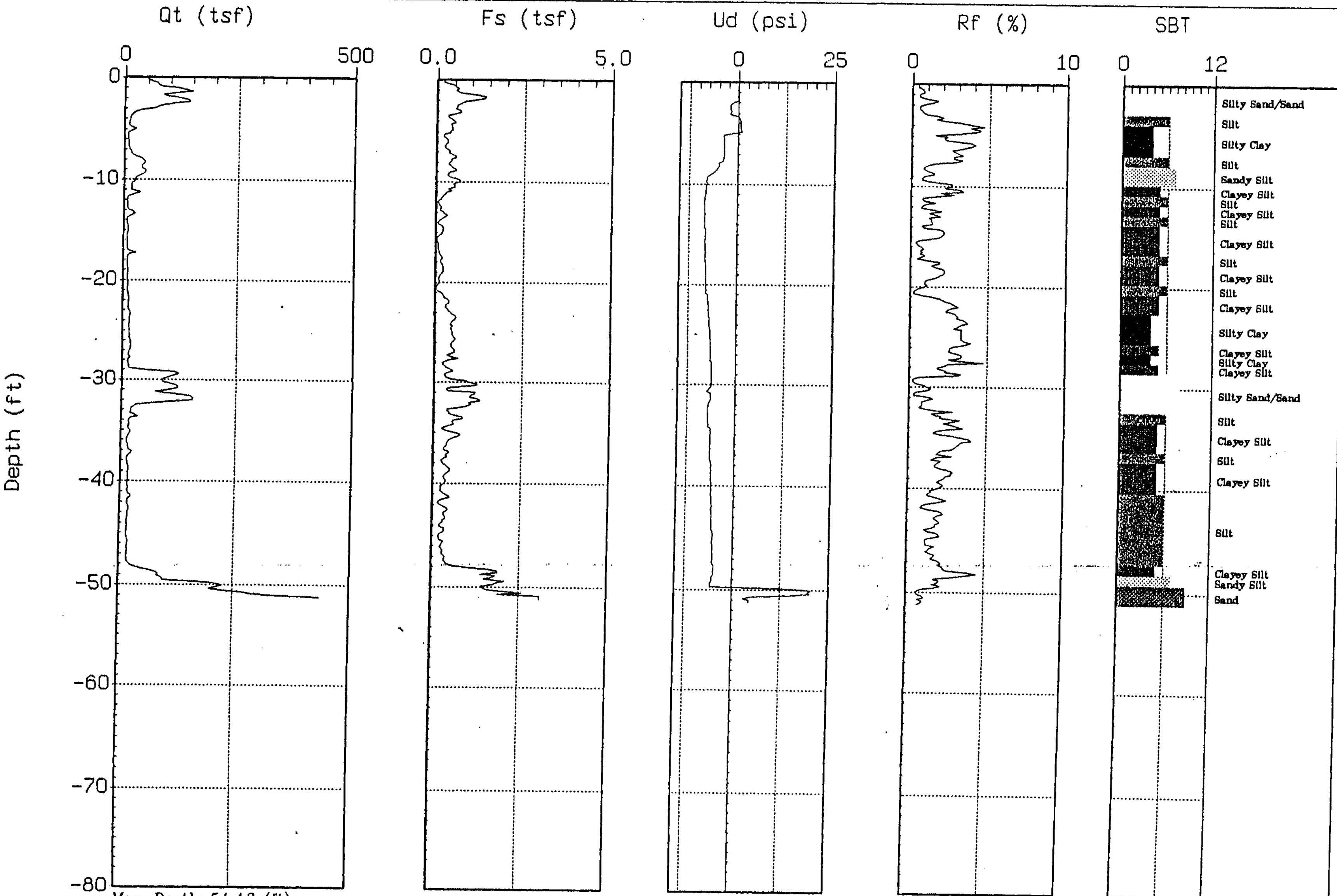
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-51

Engineer : S. KOLTHOFF
Date : 06:21:00 11:18



Max. Depth: 51.18 (ft)
Depth Inc.: 0.164 (ft)

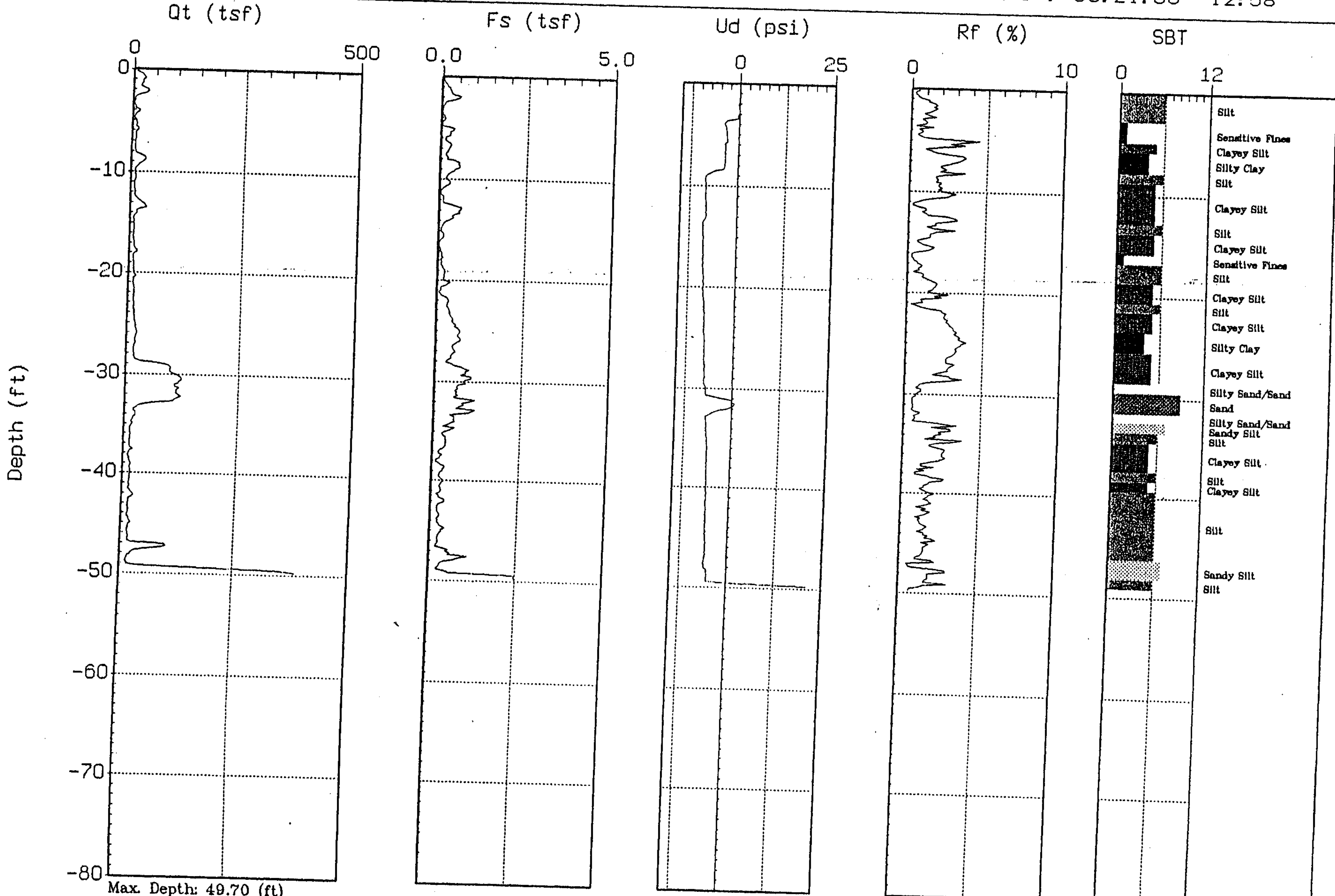
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-52

Engineer : S. KOLTHOFF
Date : 06:21:00 12:58



Max. Depth: 49.70 (ft)
pth Inc.: 0.164 (ft)

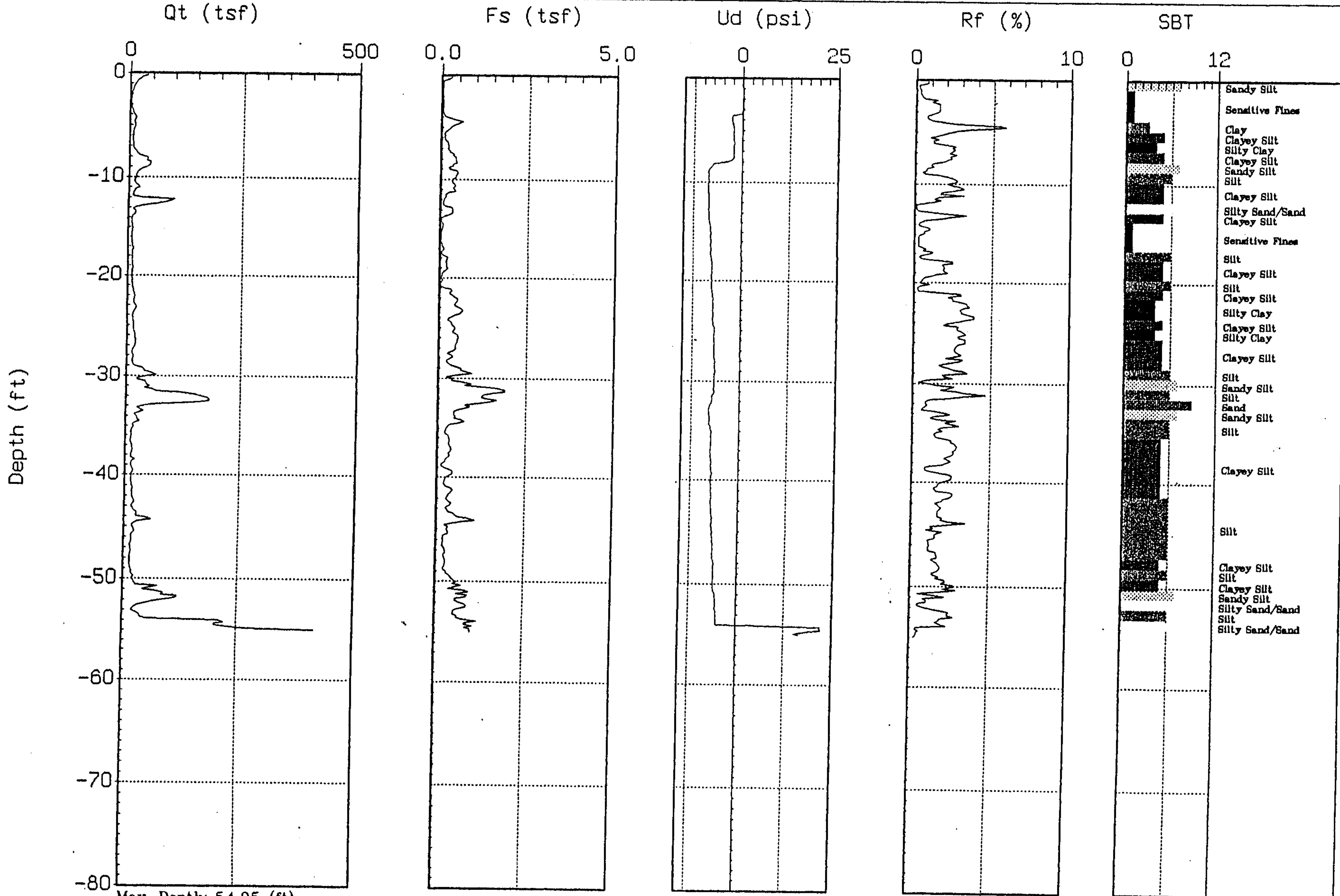
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-53

Engineer : S. KOLTHOFF
Date : 06:21:00 13:28



Max. Depth: 54.95 (ft)
Depth Inc.: 0.164 (ft)

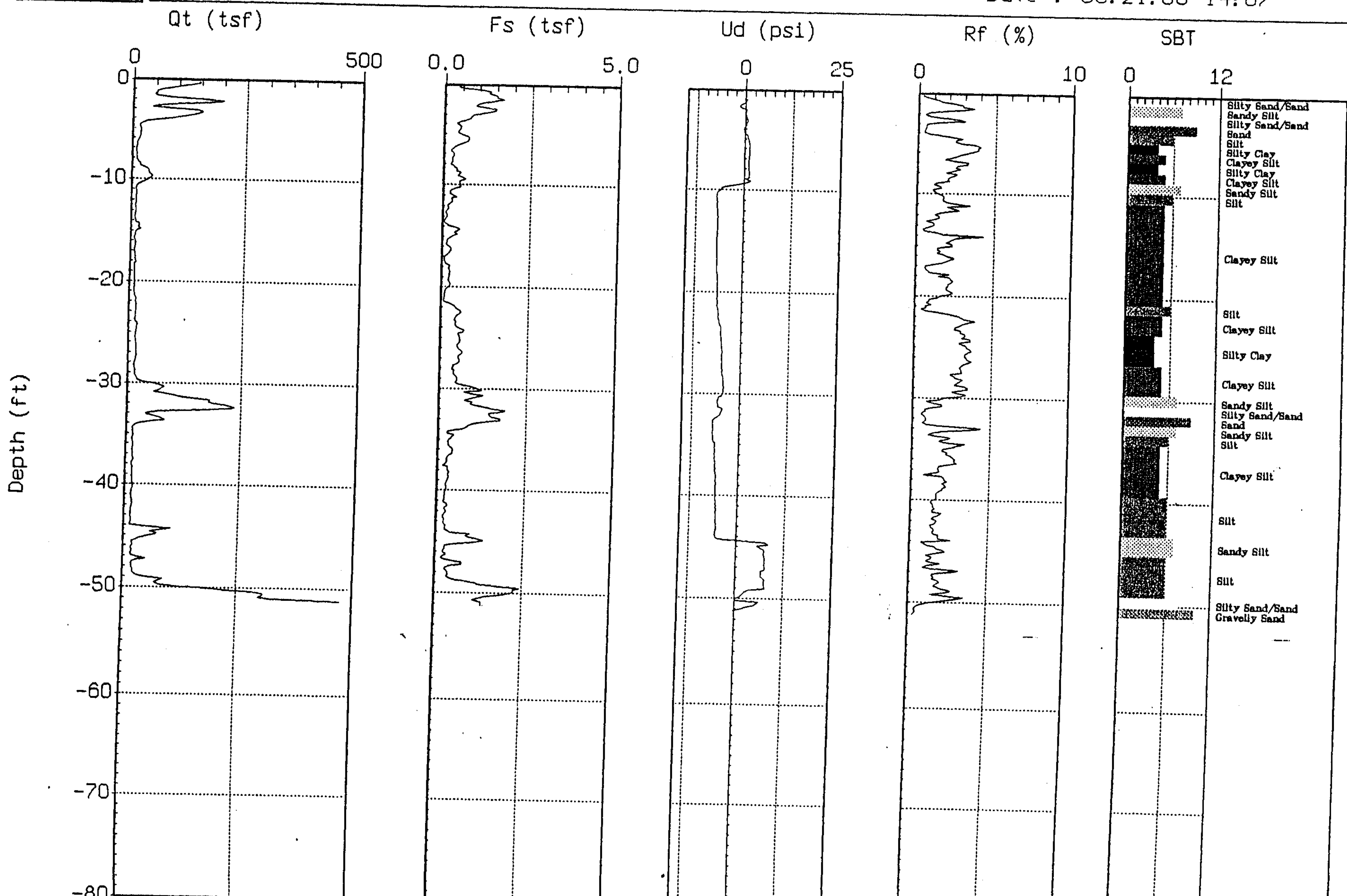
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-54

Engineer : S. KOLTHOFF
Date : 06:21:00 14:07



Max. Depth: 51.18 (ft)
pth Inc.: 0.164 (ft)

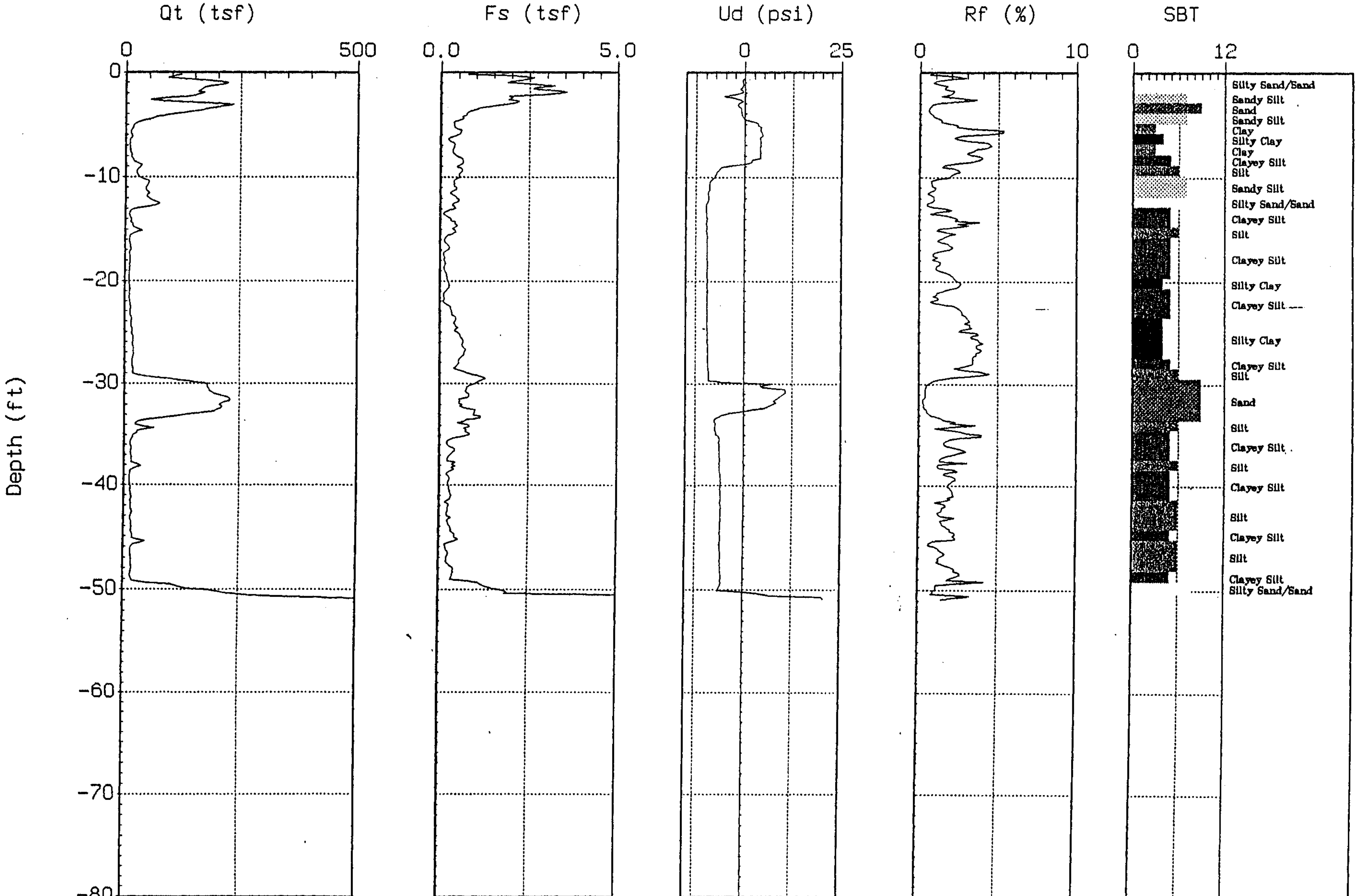
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-55

Engineer : S. KOLTHOFF
Date : 06:21:00 14:34



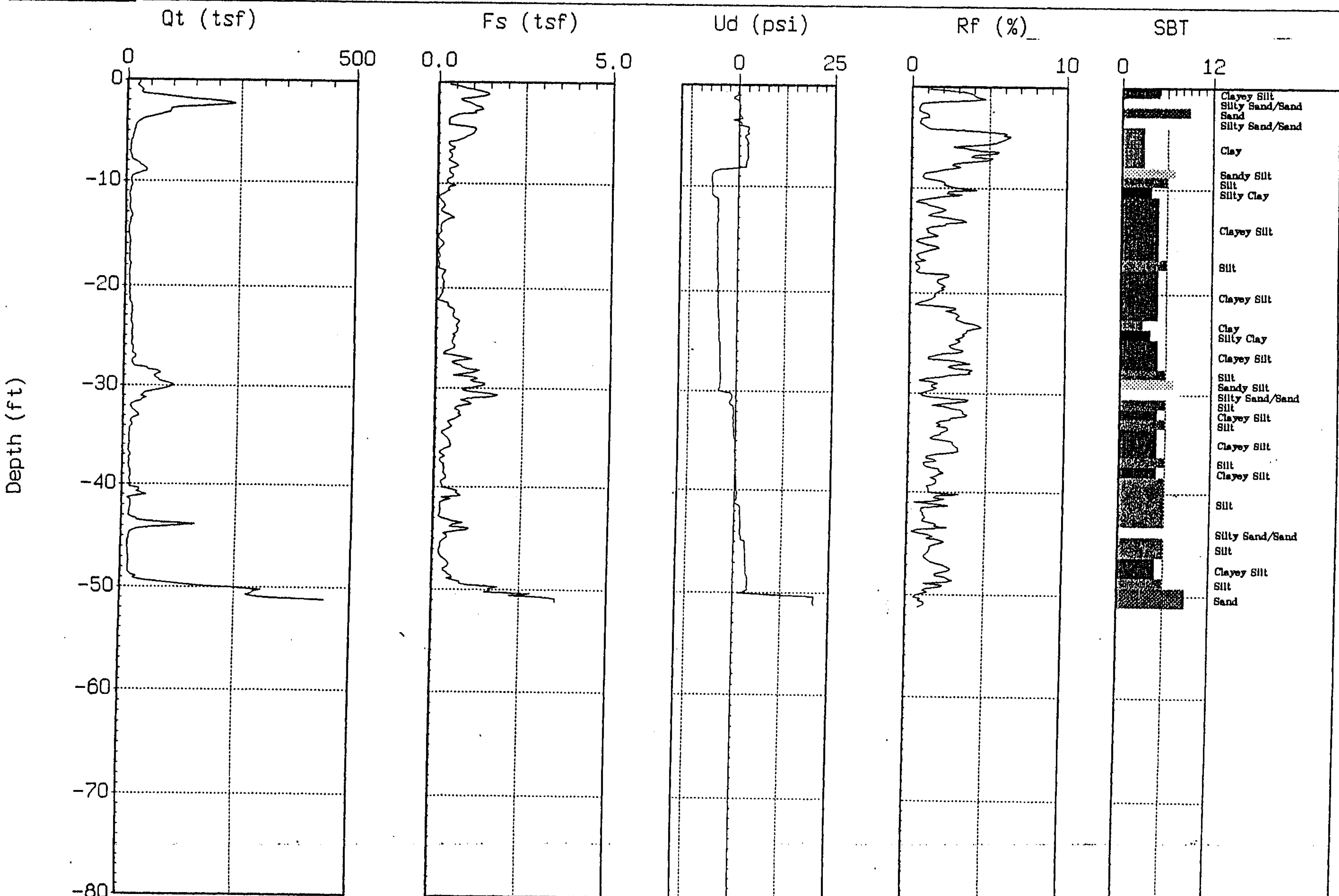
Max. Depth: 50.85 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-56

Engineer : S. KOLTHOFF
Date : 06:21:00 14:57



Max. Depth: 51.18 (ft)
Depth Inc.: 0.164 (ft)

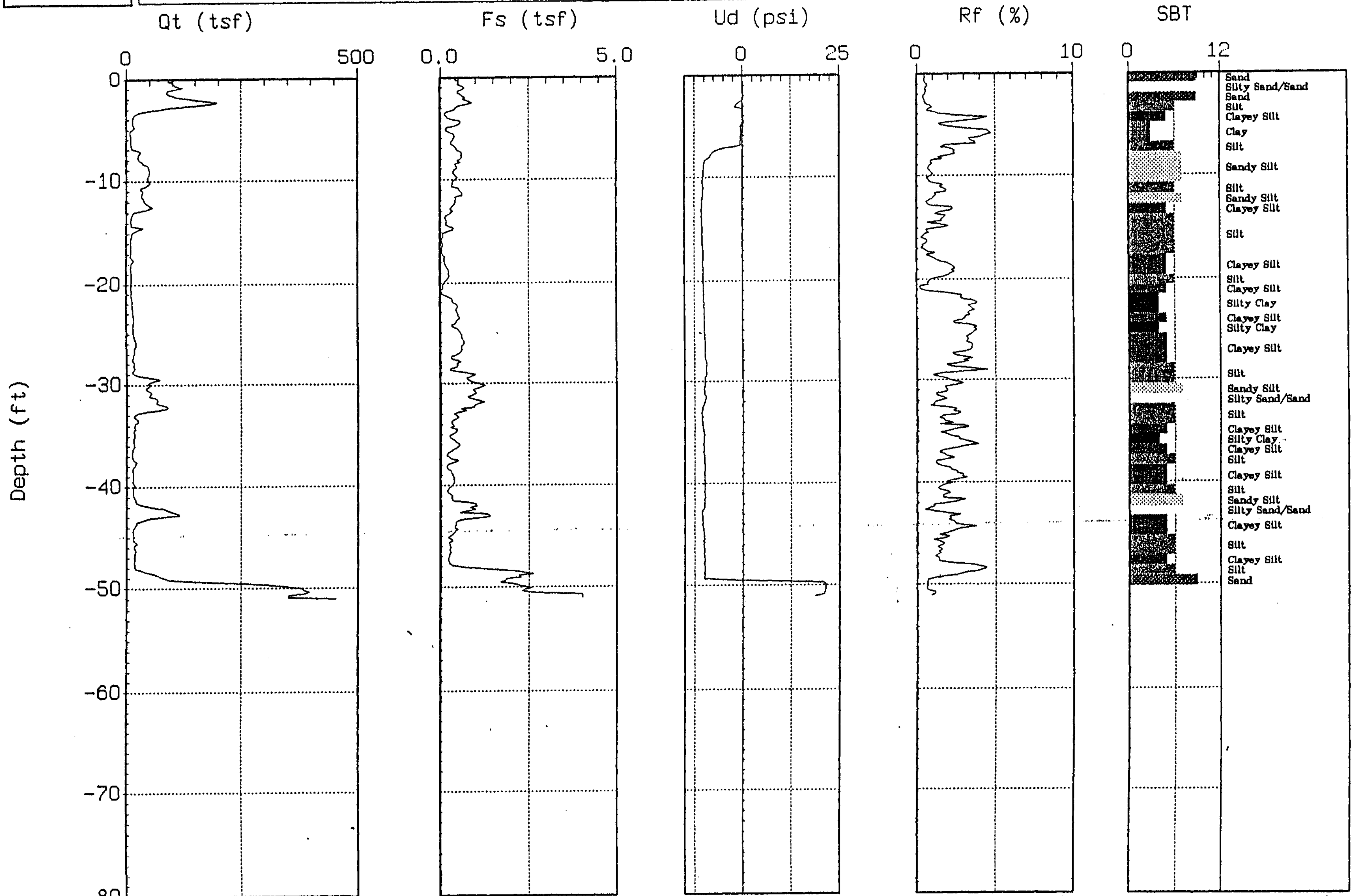
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

GROUP DELTA

Site : PLAYA VISTA
Location : ECI-57

Engineer : S. KOLTHOFF
Date : 06:21:00 15:26



Max. Depth: 51.02 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

Appendix E: Boring Logs, This Study

DRILLERS SHANNON, CHAD, & CHRIS

GEOTECHNICAL BORING LOG

Date 5-31-00 **Drill Hole No.** B-1 **Sheet** 1 **of** 2

Project Playa Vista **Job No.** 800130-001

Drilling Co. Cascade **Type of Rig** CME Hollow stem

Hole Diameter ____ **Drive Weight** ____ **Drop** ____ **in.** Pushed: no blow cts

Elevation Top of Hole ____ **Ref. or Datum** Between ECI 1&2

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION (Sampler is continuous pushed.) Logged by KS, MDZ Sampled by
0		80%						@0-2' missing
								@2-3.3' f-m Sa, m.brn, (10YR5/4) moist.
	f-m S						Fill	@3.3' 4.4' f-m Sa, drk brn (10YR4.5/6) moist.
								@4.4' 5.5' f-m Sa, m. brn (5Y2.5/1 10YR2/1)
5		95%						@5'-7.5' Si Clay/cl Si, m. gry (2.5Y5/2), moist
	C/CSi							@7.5' Grades to v.f. Sa clay/cl Sa silt, m. gry brn
	SCL/SSi							@7.5-9.5' Si cl, m-drk gry (10YR4/1-2.5Y2/0) moist.
	Si C							@9.5-10' F-m Sa, m-drk gry-brn (10YR4/3.5) moist
10	f-m Si	100% ±					Alluvium	@10' v.f. Sa silt w/ clay, m. gry 10YR3/1 moist, micaceous.
	vfSSi w/C							@13' cl Si, m gry (2.5Y4/2) moist
	Si							@14'-15' Silt, lt gry (5Y6/2-2.5Y6/2) v. moist-sl. wet
15	vfSSi	100% ±						@16'-18' v.f. Sa silt, m. drk gry (5Y 4/1) sl. wet.
	SSi Si f S							@18' Si f-m Sa, m. drk gry (5Y3/1.5) wet.
	vfS							@19' Grades to v.f. Sa silt w/cl v. moist.
20		95%						@19-20' v.f. Sa silt, vaguely laminated lt gry, med gry, drk gry. moist.
								@20-20.5' Lost
	CSi							@20.5'-25' Sl cl Si, m-drk gry (5Y 5/1) v. moist
25	CSi	95%						@24' Grades to drk gry (5y 2.5/1)
	vfS							@25' ClSi/Si Cl w/ minor v.f. Sa, drk gry-blk (2.5y 2/0) moist.
	vfS Si							@27' Grades to v.f. Sa cl. Si, drk gry-blk
30	f-m S							@28' Grades to sl. cl. Si f-m Sa, drk gry v. moist

500A (2/77) Backfilled w/ bentonite slurry. @29-30' f-m Sa, drk gry (2.5y 3/0) Sl. wet. v. moist

GEOTECHNICAL BORING LOG

Date 5-31-00 Drill Hole No. B-1 Sheet 2 of 2

Project Playa Vista Job No.

Drilling Co. Cascade Type of Rig CME Hollow stem

Hole Diameter Drive Weight Drop in.

Elevation Top of Hole Ref. or Datum

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MDZ Sampled by
30	m-gs	From 30-35 Sample disaggregated 70%?						@ 30-35' m. gr Sa, m. drk gry, (2.5y 5/0) v. moist - sl. wet, v friable
35		30% (3.4' missing)						@ 38.6'± Interbedded f.-m gr Sa and m. gr. Sa, m. drk gry (2.5y 3/0) v. moist sl. wet v. friable
f-mgs / fgs								
40		2.3' missing; 50%±						@ 42.5' m. gr. Sa, drk. gry (2.5y 4/0) wet - Sat.
45	clayey	~15%						@45-50' most of Sample lost. Driller reports more resistance @ 45-48 (prob. clayey zone by his estimate, then back into sand ≈ 48'. methane starts bubbling @48'. prob. imperm. layer @ 45-48'. [This was only minor gas encounter - mud not used]
50		2.5' missing						Driller reports gravel layer @ 53' as noted by "chatter" in drilling @ 52.5' Sa as above.
55 / gs								@ 54' f. Sa, drk gry, (2.5y 4/0), moist f. gravel in tip of Sampler.
f-cs / fg								@ 58.5' f.-c Sa w/ minor f. gravel, 1 sm. cobble. drk gray.
60								

500A (2/77)

TD 60' Backfilled w/ slurry

GEOTECHNICAL BORING LOG

Date 5-31-00 **Drill Hole No.** B-2 **Sheet** 1 **of** 2

Project Playa Vista **Job No.** 800130-001

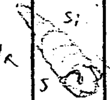
Drilling Co. Cascade **Type of Rig** CME Hollow stem

Hole Diameter ______ **Drive Weight** ______ **Drop** ______ **in.**

Elevation Top of Hole **Ref. or Datum**

Logged by KS MDZ

Sampled by ______

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0		90%					si s	@ 1'-5' sl. silty f.-m Sa, drk yellowish brn, (10yr 4/6) - damp - sl moist
5		80%					s.si+cl	@ 6'-8' mixed si cl + Sa (Fill)
							s	@ 8'-10' f-m Sa, yellowish brn, (10yr 5/8), damp - moist.
							s	@ 11.5' - 12' si f. Sa, brn, sl. moist.
10		80%					si s	@ 12.5'-14' sl. cl. si f. Sa, drk brn - blk sl. moist, wood fragments (prob. fill)
							s	@ 14' f-m Sa, drk gry-brn, (10YR 4/2) 15' Prob. native.
15		95%						@ 15' Si Cl / Cl Si, drk grayish brown (10yr 3/2), moist.
							ssi	@ 17' v.f. Sa Si, drk gry (10yr 4/1) micaceous, moist.
							si-s	@ 19'-20' v. si f. v. - f. Sa, (5yr 4/2) moist, v. micaceous.
20		95%					ssi	@ 20'-20.5' v.f. Sa Si, drk brn, (10yr 3/3) moist
					turritella		si	@ 20.5' Silt w/ minor v.f. Sa, olive brn (2.5y 4/2) moist.
							s	@ 22'-23' f. Sa w/ shells, lt brnish - gray (2.5y 6/2), v. moist.
25		100%					ssi	@ 23' sl. micaceous v.f. Sa silt, gray-brn (2.5y 5/2), moist
								@ 24' Same - v. drk gry (2.5y 3/0) moist.
30							si s	@ 25-27' Si f-m Sa (possibly f. small shell frag.), drk gry brn (2.5y 4/2) moist

Located between ECI 3 + 27

GEOTECHNICAL BORING LOG

Date 5-31-00 **Drill Hole No.** B-2 **Sheet** 2 of 2

Project Playa Vista **Job No.** 800130-001

Drilling Co. Cascade **Type of Rig** CME Hollow stem

Hole Diameter 9" **Drive Weight** ____ **Drop** ____ **in.**

Elevation Top of Hole ____ **Ref. or Datum** ____

GEOTECHNICAL DESCRIPTION

Logged by KS, MOZ

Sampled by ____

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Geotechnical Description
30		95%					S	@28-29' silt, lt brn-gry (2.5y 4/0), moist
							SSi	@29-30' v.f. Sa silt, v. drk gry brn (2.5y 3/2) moist
								@30 - same
							S	@32' sl. cl. Si, black, (5y 2.5/1) moist micaceous
35		70%						@32-35' cl. Si, dark olive (5y 3/2) moist
							S	@35-40' f. Sa, black (5y 2.5/2) moist.
40		Lost 3.5' 25%					S	@43.5-45' f. Sa, black (5yr. 2.5/1) moist
45		80% Lost 12"±					Si	@45-50' cl. si, black (2.5y 2/0), v. moist micaceous.
50		75% Lost 18"±					CSi	@51.5-55 Cl Si, black, v. moist, micaceous.
								[Driller reports hit gravel @60'] [No gas was evident until removing drill augers - then active bubbling could be heard in hole]
55		Lost					SSi	@57.5-58.5' Sa Si, dark olive (5y 3/2) v. moist - wet
	SSi / S							@58.5 Abrupt change to f.-c Sa w/ scattered gravel (minor), black (2.5y 2/0) wet.
60 / 65							S	@63'-64' m gr Sa, blk, wet

500A (3/77) 60-65' (not recovered?) S @64-65' m-c Sa w/ gravel, blk, wet

GEOTECHNICAL BORING LOG

Date 6-5-08 Drill Hole No. B-3 Sheet 1 of 2

Project Playa Vista Job No. 800130-001

Drilling Co. Cascade Type of Rig CME Hollow Stem

Hole Diameter 9" Drive Weight ______ Drop ______ in.

Elevation Top of Hole ______ Ref. or Datum ______

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MGZ Sampled by
0	recovery							@0-2' no recovery
2							SSi	@2 fi-m S w/some gravel fill dry-m (10YR 4/2)
							SC	@3.1 glass pieces (fill) m SC dry-m (10YR 3/1)
							Si S/S	@3.7 fi-m S w/clay (Sandy Clay) w/gravel, moist, (10YR 3/1)
5	100%							@3.9-5' fine S/Si moist (10YR 3.5/2)
								@5-5.5' clay, moist (2.5Y 3/0)
								@5.5'-6.5' C w/f-vfi S (2.5Y 4/0) moist
								@6.5-9.0 C (2.5Y 5/0) moist
10	75%							@9.0-10 CS w/fi-vfi S, moist (2.5Y 5/2)
								10-11.5 no recovery
							fi S	@11.5-12.5 fi S/Si sheen, damp, w/few minor gravel to clasts (5Y 5/1)
							SC	@12.5-13.5 SC w/fi S, moist (5Y 4/1)
							CS	@13.5-14' CS w/some minor gravel moist — fine S
15	100%							@14-15 CS moist
								@15-15.8 CS damp (5Y 4/1)
								@15.8-17.8 CS some gravel ~2% moist (5Y 4/1)
								@17.8-19' CS w/mS (5Y 5/1) moist
							C	@19-20.4 C (5Y 3.5/1), moist
20	100%							@20.4-20.8 CS w/fi S (5Y 3.5/1) moist
							CS	@20.8-21.4 C (5Y 3/1) moist
								@21.4-22' trace shell fragments, CS w/fi S (5Y 2.5-3/1) moist
25	100%						C	@22-29.3' C (2.5Y 3.5/0) moist
								@29.3-30' CS w/fi S, moist (2.5Y 4/0)
30							CS	@30' S w/m S, wet-damp, (2.5Y 3/0) 35' (MINUS 30-32.5)

GEOTECHNICAL BORING LOG

Date 10-5-06 Drill Hole No. B-3 Sheet 2 of 2

Project Playa Vista Job No.

Drilling Co. Cascade Type of Rig CME Hallow stem

Hole Diameter 9" Drive Weight Drop in.

Elevation Top of Hole Ref. or Datum

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS MDZ Sampled by
30	~50%							@30-32.5 no recovery @32-35' S w/ mS, wet-dmp, (2.5Y 3/6)
32.5						S		
35	100%					SC		@ 35'-35.8 CS w/ fS, moist, (2.5Y 3.5/6)
								@35.8-39.2' C, moist, (2.5Y 3/6) 39.2-40 C w/ vfi-f. S (2.5 3/6), moist
40	~80%					S		@40-41 no recovery @41-41.5 mS, dmp, (2.5 4/6) @ 41-44.8 C, moist, (2.5 3/6)
								@44.8-45 C, v. firm, (2.5 3/6)
45	~50%						S	@45-46' no recovery @46'-46.8 dmp, mS (2.5Y 4/6)
						C/CS SC		@46.8-47.3', C (w/ fi S) (2.5Y 3/6) moist @47.3'-47.4 C w/ gravels (2.5Y 3/6) moist @47.4-48.9' CS w/ fiS, moist ~~@48.9-49.9' C, moist, (2.5 2.5/6)~~ (2.5Y 2/6) | @ 49.9-50' SC moist, (2.5Y 3/6)
50	~60%							@ 50-52' no recovery @52-54' mS w/ few gravel, (2.5Y 3.5/6) GRAVEL @ 54'
							S	@54-55' Gravel max up to 2in, large range in gravel size most ~1-2cm diam (2.5Y 5/6) granitic
55							GS	T.D. 55' Backfilled w/ slurry
60								

500A (2/77)

GEOTECHNICAL BORING LOG

Date 6-5-00 **Drill Hole No.** B-4 **Sheet** 1 **of** 2

Project Playa Vista **Job No.** 850130-001

Drilling Co. Cascade **Type of Rig** CME Hollow Stem

Hole Diameter 9" **Drive Weight** ____ **Drop** ____ **in.**

Elevation Top of Hole ____ **Ref. or Datum** ____

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MOZ Sampled by
0	~75%						X	0-1.3 no recovery ~0-10' FILL
							SC	@1.3-2.1 SC, gravels friable, slightly mottled (2.5Y6/2 - 2.5Y6/4, 2.5Y5/2) Fill
							SiC	@2.1-3.0' CS w/ fiS, dry-moist (5Y3/1) Fill
							SiS	@3.0-5.0' fiS not well compacted (loose) mottled (2.5Y5/6, 5Y6/6, 5Y5/3)
5	~70%						X	@5-6.5 no recovery
								@6.5-6.8 mS, damp, (5Y4.5/2)
							SiS	@6.8-7.2 fiS, moist (5Y5/2)
								@7.2-10.0' C w/ charcoal gravels more mixed up stuff (5Y3.5/2), (5Y4/2)
10	100%							@10-11.3' (native) C, moist, (10Y3.5/0)
								@11.3-13.2 C, moist (2.5Y4/0)
								@13.2-13.5 CS, moist (2.5Y4/0)
								@13.5-15.5 S, dmp, few minor gravels, slightly mottled (5Y5/1) (5Y4/2)
15	~90%						X	@15-15.5' no recovery
							C	@15.5-16.5 C, some gravel (5Y4/1) soft,
							SiC	@16.5-18' C with Shells [turitella, clams etc), some vfi-fi S, some mottling (2.5Y5/4, 5Y5/2), moist
								@18-19 CS w/vfi+fiS, moist, (5Y3.5/2)
							C / CS	@19'-19.3 C (5Y3/1) moist
20	100%						CS	@19.3-19.4 co. S + gravel, moist, (5Y5/1)
							SC	@19.4-20.5 CS w/fi + vfiS, moist (5Y4/1)
							CS / (c:s) C / CS	@20.5-21.2 SC w/ m-co. S + gravel some shells, moist (5Y4/1)
							CS	@21.2-21.5 CS 5Y4/1 moist
							C	@21.5-22.1 C w/some fiS (5Y5.5/1) moist
25	100%							@22.1-22.5 CS w/fiS (5Y5/1) moist
							CS	@22.5-23.9 co S some gravel + shell frag. (2.5Y5/0)
								@23.9-25.1 C, moist (5Y3.5/1)
								@25.1-26.4 CS, w/fiS, moist (5Y3/1) shell frag
							C	@26.4-30' C, hd (2.5Y2/0)
30								

GEOTECHNICAL BORING LOG

Date 6-5-00 Drill Hole No. B-4 Sheet 2 of 2

Project Plana Vista Job No. 800130-001

Drilling Co. Cascade Type of Rig CME Hollow stem

Hole Diameter 9" Drive Weight ______ Drop ______ in.

56' gravel

Elevation Top of Hole ______ Ref. or Datum ______

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MOZ Sampled by
30	~90%						X	@30-31' no recovery
								@31-33.5 CS w/ fi very fi S, damp, sticky (2.5Y 3/0)
						CS		@33.5-35' S w/ fi S, moist (2.5Y 4/0)
							Si/S	@35-36 no recovery
35	~90%							@36-38.3' S w/ fi S, moist (2.5Y 3.5/0)
							X	@38.3-39.5 C, moist, (5Y 3/1)
							Si/S	
						CS		@39.5-40' CS w/ fi S (2.5-5Y 3/0 3/1)
40	~90%						X	@40-41 no recovery
								@41-41.5, damp-wet, fi S (2.5Y 3/0)
							fi S/Si	@41.5-43.6 CS w/ fi S (2.5Y 3/0) moist
						CS	w/ fi S	@43.6-45 CS w/ < fi S than above, moist (2.5Y 3/0)
						CS		@45-48' no recovery
45	~90%						X	@48-48.5 fi S, v. moist-wet (2.5Y 3/0)
								@48.5-50 fi-m S, damp-wet (2.5Y 4/0)
							fi-m S	
50	20%						X	@50-54% no recovery
								@54-55 mS, damp, (2.5Y 4/0)
55							S	@55-56 same as 54-55'
							GS	@56-57' gravel round-subround max. to 2.5 in diam, damp-wet 2.5Y 4.5/0
60								T.D. 57'

500A (2/77)

Backfilled w/ slurry

GEOTECHNICAL BORING LOG

Date 6-5-00 **Drill Hole No.** B-5 **Sheet** 1 of 2

Project Plaza Vista **Job No.** 800130-001

Drilling Co. Cascade **Type of Rig** CME Hollow Stem Auger

Hole Diameter 9" **Drive Weight** ____ **Drop** ____ **in.**

Elevation Top of Hole ____ **Ref. or Datum** ____

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MOZ Sampled by
0	~50%							@0-2.5 no recovery
							FILL	@2.5'-5.0', f-mS, moist (10YR 4/6) few larger gravels
2.5	S							
5	90%							@5-5.5 no recovery
	CS							@5.5-6.8' CS, mst, (2.5Y 4/4) small gravels, f-mS
	SC							@6.8-8.5 SC, mst, f-mS, (10YR 3/2.5)
	CS (gravels + sands)							@8.5-9.9' CS w/ gravels, moist (10YR 3/2) (pocket of gravel & sand @ 9.0-9.1)
								@9.9'-11.9' SC f-mS gravels up to 2in diam md-suban + wood chips, moist (10YR 3/3)
10	100%							
	SiS/S							@11.9-12.3' CS, moist gravels (10YR 3/3)
	CS							@12.3-14 fiS w/ gravels (10YR 5/4)
	SG							@14-17 CS, dry-moist, mottled, hd, w/ gravel "junk", 2.5Y 3/2 (crushed)
								@17-18.8 CS (2.5Y 6/2) mst-dry some gravel
								@18.8-19.5 C
15	95-100%							@19.5-20' fiS (10YR 4/4) moist-dr
	CS							
	CS few gr							@20-23 no recovery
	C							
	S/Si							@23-24.2 fiS some clay (2.5Y 4/3), moist
20	~40%							@24.2-24.9 m-fS, dmp, (2.5Y 3.5/2)
23	fiS							
	S							
25	0%							
30								

GEOTECHNICAL BORING LOG

Date 6-5-06 Drill Hole No. B-5 Sheet 2 of 3

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Drilling Co. Cascade Type of Rig CME Hollow Stem Auger

Hole Diameter 9" Drive Weight ______ Drop ______ in.

Elevation Top of Hole ______ Ref. or Datum ______

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KS, MDZ Sampled by
30	0%							@30-50' no recovery
35								
40								
45								
50	100% S							@50-53.5 wet, mS, (2.5Y 3.5/)
								@53-60' sat. mS (2.5Y 3.5/)
55	100% S							
60								

GEOTECHNICAL BORING LOG

Date 6-5-00 Drill Hole No. B-5 Sheet 3 of 3

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Drilling Co. Cascade Type of Rig CME Hollow Stem Auger

Hole Diameter 9" Drive Weight ______ Drop ______ in.

Elevation Top of Hole ______ Ref. or Datum ______

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by ______ Sampled by ______
60	X							@60-63 no recovery
63	fiS							@63-64.9 Sat, mS (2.5Y 3/0) @64.9-65 fiS
65	X							@65-68 no recovery
68	G							@68-70.5 mS, Sat, (2.5Y 3/0)
70	fiS							@70.5-71 fiS, dense (2.5Y 3/0)
	G							@71-71.5 Gravel layer, moist (2.5Y 4.5/1) max up to 1 in diam. rnd-subrnd
75								T.D 71.5