

**GEOTECHNICAL FEASIBILITY EVALUATION
PUENTE HILLS LANDFILL PARK MASTER PLAN PROJECT
PUENTE HILLS LANDFILL
2800 WORKMAN MILL ROAD
WHITTIER, CALIFORNIA**

PREPARED FOR:

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April 29, 2016
Project No. 209393001

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Ms. Lacy Withers
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Subject: Geotechnical Feasibility Evaluation
Puente Hills Landfill Park Master Plan Project
Puente Hills Landfill
2800 Workman Mill Road
Whittier, California

Dear Ms. Withers:

In accordance with your request and authorization, Ninyo & Moore has performed a geotechnical feasibility evaluation for the Puente Hills Landfill Park Master Plan Project located at the Puente Hills Landfill located at 2800 Workman Mill Road in Whittier, California. This report presents our preliminary findings and conclusions regarding the subject property.

We appreciate the opportunity to provide geotechnical consulting services.

Respectfully submitted,
NINYO & MOORE



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1. INTRODUCTION

In accordance with your request and authorization, we have performed a geotechnical feasibility evaluation for the Puente Hills Landfill Park Master Plan Project located at the Puente Hills Landfill property in Whittier, California (Figure 1). We understand that the Department of Parks and Recreation will develop portions of the Puente Hills Landfill “fill” areas and other suitable non-fill areas into a recreational facility for park use. The planned improvements include a visitor center, trail lift (gondola), scenic overlook and café, multi-use trails, open space areas, interpretive features, and other amenities that can provide benefits to local and regional communities. Settlement-sensitive structures are generally planned beyond the landfill waste limits due to the relatively high anticipated settlements of the approximately 500-foot-thick landfill waste of up to approximately 120 feet (County Sanitation Districts of Los Angeles County (LACSD, 2011). Therefore, our evaluation was primarily focused on the proposed improvements that are planned beyond the landfill waste limits. Additionally, our study included preliminary slope stability analyses to evaluate the effect of the proposed loop road grading, scenic overlook, and trail lift tower on the buttress stabilization currently being constructed on the Nike Hill western slopes.

Our evaluation is intended to provide a preliminary assessment of potential geologic and seismic hazards at the sites and develop preliminary conclusions regarding the geotechnical feasibility of the park improvements. Our evaluation was based on review of readily available published geotechnical literature pertinent to the subject property provided by Sanitation Districts of Los Angeles County and a property reconnaissance. We did not perform our own subsurface evaluation.

2. SCOPE OF SERVICES

Our scope of services has included the following:

- Project coordination, management and technical support including review of existing geotechnical reports and geotechnical-related plans regarding the project and other projects at the landfill site, including Nike Hill slopes.
- Review of readily available geologic maps, published literature, stereoscopic and aerial photographs.

- Geotechnical site reconnaissance to document the existing surficial conditions at the project site, including geologic mapping of adjacent natural slopes along the gondola alignment and the slope below the proposed visitor center.
- Assessment of the general geologic conditions and seismic hazards affecting the site, and evaluation of their potential impacts on the proposed project.
- Compilation and analysis of existing geotechnical data pertaining to the subsurface conditions in the areas of the proposed structural improvements.
- Preliminary slope stability analysis for proposed roadway grading and structural improvements on the Nike Hill slope that is currently being stabilized.
- Preparation of this report presenting our findings and conclusions regarding the various geologic constraints for the project, as well as our conclusions and recommendations relative to the geotechnical aspects of the project's conceptual design.

3. PROJECT DESCRIPTION

The Puente Hills Landfill Park Master Plan will convert the landfill to a regional park for the greater Los Angeles Area. The Puente Hills Landfill property is approximately 1,365 acres and includes natural areas and areas where landfill waste was placed. Approximately 142 acres of the property will be improved over time for the proposed park (Figure 2).

Based on our review of the draft Puente Hills Landfill Park Master Plan (Withers & Sandgren, 2016), the master plan envisions three major phases of development over the next 30 years plus two more phases in 2043. The majority of the planned park improvements will be constructed in the former waste areas. Due to anticipated settlement of up to approximately 120 feet in the landfill waste areas (County Sanitation Districts of Los Angeles County, 2011), planned improvements in these areas are generally limited to a one-way park loop road, hiking trails, picnic areas, open play areas, a zip line, bike skills areas, interpretive overlooks, stair climbs, parking lots, a dog park, and native planting areas. It is our understanding that park spaces, landscape and programming will transition and adapt as necessary as the landfill continues to settle. The proposed pedestrian bridge and overlook on the west side of the site and the land bridge (planted pedestrian overcrossing) that will connect the eastern and southern decks will be some of the last park elements to be constructed due to landfill settlement. However, there are

new improvements planned in the initial phases of the project that would be sensitive to future settlements. Therefore, these improvements are planned beyond the boundary of the landfill waste in areas that are in a natural condition or had some grading modification to construct adjacent improvements.

The proposed park improvements located beyond the landfill waste include an Entry Plaza in the northern portion of the site near the landfill entrance, which will include a visitor center, restrooms, shared agency offices, shuttle pick-up, and a parking lot. A scenic overlook and café are proposed at the top of Nike Hill. The scenic overlook will include two cantilevered decks for views to the northeast and northwest. A trail lift (gondola) is proposed that will begin at the Entry Plaza and end at the Nike Hill scenic overlook and café. The trail lift structure at Nike Hill will incorporate an approximately 2,000-square-foot building that includes the café, restrooms, and a park staff office. In addition, a trail and staircase are proposed along the face of the Nike Hill slope. The proposed trail lift alignment has two intermediate towers where the alignment changes directions. These tower locations are anticipated to be located outside the landfill waste limits, but the alignment will span across the landfill waste. Later park phasing may also include new improvements at the decommissioned Flare Site, including canopy structures, café, interpretive center, and a parking lot. The park improvements are shown on Figure 2.

4. SITE DESCRIPTION AND OBSERVATIONS

Representatives of Ninyo & Moore performed a site reconnaissance and geologic mapping on March 16 and 17, 2016, to observe the current site conditions and to map erosion, landslides, and geologic exposures of bedrock in the vicinity of the proposed Entry Plaza, Nike Hill overlook and café, Flare Site, and trail lift alignment, as well as near the boundary of the landfill waste in the eastern and southern portions of the landfill property. The Puente Hills Landfill is bordered by commercial properties, Rio Hondo College, and Rose Hills Memorial Park to the west, the Pomona Freeway, commercial and residential properties to the north, residential properties to the east, and the Rose Hills Memorial Park and hiking trails to the south.

The majority of the park improvements will be constructed within the landfill waste areas and are designated as the Western Deck, Eastern Deck, and Southern Deck (Figure 2). The decks are relatively flat pads that expose the landfill waste cap and have little vegetation. The western deck and eastern deck are separated by a slope that is up to approximately 125 feet in height. Landfill waste slopes descend to the north from the Western and Eastern Decks on the order of 700 feet. A landfill waste slope up to approximately 400 feet in height descends from the east sides of the Southern Deck and Eastern Deck. The landfill waste slopes generally have approximately 20-foot-wide, level benches spaced at approximately 30-foot vertical intervals that provide access to the methane gas collection system pipelines. The landfill waste slopes are generally covered with a moderate to dense growth of landscape vegetation.

The existing primary landfill access road that will be used as the One Way Loop Road has experienced significant settlement in some areas and pavement cracking and repairs were observed. Our observations along the access road and “Deck” areas included areas of hummocky/undulatory ground indicative of differential settlement related to the landfill deposits.

A relatively shallow landslide was observed on a cut slope that was constructed during landfill operations south of the Southern Deck. Based on our aerial photograph review, the slope failure has been a recurring maintenance issue involving re-grading and covering the area with visqueen and sandbags. Another shallow landslide was observed west of this area above the debris basin along the perimeter road. The approximate limits of the landslides are shown on Figure 2. The general site conditions near the proposed structural improvements are provided below.

4.1. Entry Plaza Area

The area of the entry plaza is currently occupied by a single-story office building, parking lot, scales, and a fenced materials storage area. The area is generally paved with asphalt concrete. An approximately 20 to 50-foot-high slope descends to the north from the existing office building to the existing landfill entrance road. Beyond the entrance road, the slope further descends up to approximately 90 feet to Crossroads Parkway South. The slopes are inclined at approximately 2:1 (horizontal to vertical) and have a relatively dense growth of

trees, shrubs, and grasses. Some of the trees have fallen and some trees show evidence of slope creep.

4.2. Nike Hill Area

Nike Hill is located near the southwest boundary of the landfill property adjacent to Rose Hills Memorial Park. Microwave towers, a water tank, Southern California Edison electrical transmission towers, and the Schabarum-Skyline Trail are located at the top of the slope. At the time of our site reconnaissance, the western portion of the northwest-facing Nike Hill slope was undergoing rough grading to stabilize the slope. The slope stabilization is discussed in more detail below. When finished, the stabilization fill slope will be at slope ratio ranging from 2.8:1 to 3.2:1 (horizontal to vertical) and will be up to approximately 110 feet high. The portions of the slope that have not been graded have a moderate growth of natural vegetation and some relatively small surficial slope failures were observed. An approximately 200 to 300-foot-high natural slope descends to the south to Rose Hills Memorial Park.

4.3. Proposed Trail Lift Tower Adjacent to Gas-To-Energy Facility I Area

A tower for the trail lift is proposed near the northeast side of the Gas-To-Energy Facility I, between the gas facility and the landfill waste limits. The general area of the proposed tower is relatively level and paved with asphalt concrete. An approximately 400-foot-high northerly descending natural slope is located to the north and northwest of the proposed tower and a landfill waste slope that ascends approximately 100 feet to the one-way loop road is located east of the proposed tower. The natural and landfill waste slopes are covered with a relatively thick growth of vegetation. Retaining structures are present along the north and west sides of the gas facility.

4.4. Proposed Trail Lift Tower Northwest of Shared Maintenance Yard Area

A tower for the trail lift is proposed about 500 feet northwest of the proposed Shared Maintenance Yard. The general area of the proposed tower is relatively level and is currently being used for materials storage. A Southern California Edison (SCE) Transmission Line easement is located to the south and southwest of the proposed tower. An approximately 20

to 40-foot-high slope ascends to a north-trending ridgeline west of the proposed tower. From the top of the ridgeline, there are graded slopes and a graded access road that leads to an electrical transmission tower. Beyond the ridgeline and SCE easement, natural slopes descend toward the northwest and west. Landfill waste slopes ascend to the Western Deck from the proposed tower location. The natural slopes and landfill waste slopes have a moderate growth of vegetation; however, the graded slopes associated with the SCE access road have a lesser amount of landscape vegetation. Straw waddles were present on the slope face. A landfill gas collection pipeline is also present near the tower location.

4.5. Flare Site

The Flare Site, which was decommissioned when less methane gas was escaping from an older part of the landfill, is located near the eastern boundary of the proposed park improvements on a relatively level pad at the top of a ridgeline. The flare tower and equipment remains and the surrounding area is paved with asphalt concrete and is used for materials storage. A paved road provides access to the site. An approximately 1:1 (horizontal to vertical) cut slope up to approximately 40 feet high descends to the west from the Flare Site and access road and an approximately 40-foot-high 1:1 (horizontal to vertical) cut slope ascends to the southeast from the east side of the site. The cut slopes were covered with a moderate growth of vegetation. Densely vegetated natural slopes up to about 150 feet high descend from the northeast side of the site.

5. BACKGROUND

The San Jose Development Company began landfill operations at the Puente Hills Landfill in 1957. The LACSD acquired the Puente Hills Landfill as part of the purchase of Pellissier Ranch in 1970. In May 1981, an additional 151 acres of land was purchased on the northern portion of the property. The Puente Hills Landfill operated as a Class III municipal solid waste disposal facility and ceased accepting waste from the public on October 31, 2013. Closure activities involving final cover construction, drainage facilities, landscape and irrigation systems, environmental systems, and structure removal were subsequently initiated.

We reviewed several geotechnical reports provided by the Sanitation Districts of Los Angeles County for various projects within the landfill site. In addition, we reviewed the geotechnical report that was prepared for Segment 8 of the Tehachapi Renewable Transmission Project that included borings along the SCE easement adjacent to the southwestern boundary of the site. The reports that we reviewed are listed in the References section of this report. The reports were reviewed to evaluate the general geologic conditions near the proposed Entry Plaza, trail lift towers, and the improvements in the vicinity of the Nike Hill that are located beyond the landfill waste limits. A summary of the geologic conditions based on our review of the reports, and on our site reconnaissance and geologic mapping, are presented in the following sections.

6. GEOLOGIC CONDITIONS

6.1. Regional Geology

The Puente Hills, together with the San Jose Hills, are a topographic extension of the Santa Ana Mountains in the northern end of the Peninsular Ranges Geomorphic Province. The Puente Hills are underlain by a sequence of upper Cenozoic sedimentary and volcanic rocks, which in turn overlie a basement of Mesozoic plutonic and metamorphic rocks. Marine sedimentary rocks of the Miocene-age Puente and Fernando Formations are exposed in the Puente Hills.

Where not buried by landfill waste, the proposed park site is generally underlain by a thick sequence of north-northwest dipping marine sedimentary bedrock of the Fernando Formation, which includes sandstone facies (Tfs) and claystones of the Pico (Tfp) and Repetto (Tfr) members. Unconsolidated surficial deposits at the site include landfill waste, artificial fill, alluvium, colluvium, and landslides. Regional geologic conditions are shown on Figure 3.

Bedrock structure in the Puente Hills Landfill area is dominated by the north-dipping, northwest-trending Whittier-Elsinore Fault Zone located approximately two miles south of the Puente Hills Landfill. In general, bedrock generally strikes to the northeast and dips at approximately 15 to 35 degrees north to northwest.

6.2. Site Geology and Geotechnical Conditions

The following sections provide a general description of the geologic conditions in the areas of the proposed Entry Plaza, Nike Hill, trail lift towers, and Flare Site. The descriptions are based on our site reconnaissance and geologic mapping, regional geologic publications, and on our review of relevant geotechnical reports that were provided for our review.

6.2.1. Entry Plaza

Regional geologic mapping indicates that the area of the Entry Plaza is underlain by the Pico Claystone member of the Fernando Formation, which is described as vaguely bedded siltstone and silty claystone with some silty sandstone (Dibblee, 1999). Regionally, bedding dips approximately 25 to 35 degrees north to northwest.

Soils International (1989a) performed two hollow-stem-auger exploratory borings for a geotechnical study for the scale house building. The borings were drilled to depths of approximately 21 feet. Based on the boring logs, bedrock materials of the Puente Formation were encountered that consisted of massive siltstone. A thin, hard, cemented layer was encountered at approximately 16 feet. The approximate locations of the borings are shown on Figure 2 and copies of the logs are included in Appendix A. The geotechnical report concluded that the northerly descending slope was considered stable based on the approximate 21-degree angle of the slope and the strength of the underlying siltstone bedrock; however, a slope stability analysis was not performed.

During our site reconnaissance and geologic mapping, several trees were observed to have fallen on the slope that descends from the existing office building to the landfill entrance road and some trees exhibited signs of slope creep.

6.2.2. Nike Hill

Regional geologic mapping indicates that the Nike Hill area is underlain by landslide deposits and the Repetto Claystone member of the Fernando Formation (Dibblee, 1999). The landslide deposits are derived from the Repetto Claystone. Beyond the

mapped boundary of the landslide, regional bedding in this area dips approximately 16 to 35 degrees north to northwest.

The Nike Hill slopes have experienced ancient and historic landslides, as well as grading-induced landslides that occurred during landfill operations. The Nike Hill slopes have been the subject of numerous geotechnical studies performed between 1976 and 2014. Two geotechnical reports pertaining to the Nike Hill slopes were provided for our review (Geomatrix Consultants, Inc., 2005, and AMEC, 2014). In addition, we reviewed the geotechnical study performed for Segment 8 of the Tehachapi Renewable Transmission Project that included a 24-inch-diameter bucket auger boring (Boring B-9) drilled to a depth of 51 feet (Kleinfelder, 2010).

The purpose of the geotechnical study performed by Geomatrix Consultants, Inc. (2005) was to design a stable subgrade for the Nike Hill slopes where landfill operations were expanding. In addition to reviewing earlier subsurface data from other consultants, several additional bucket-auger borings and continuous core borings, as well as geologic mapping, were performed as a part of this study. The locations of the bucket-auger borings that are considered relevant to the park improvement at the top of Nike Hill are shown on Figure 2 and copies of the logs are included in Appendix B; copies of the core logs are not included in the appendix due to poor image quality in the report we were provided. An equal area stereonet analysis was performed by Geomatrix to evaluate the average bedding conditions of over 1,600 bedding orientations, which yielded an average orientation of N75°E, 29°N. This bedding orientation has resulted in the natural and grading-induced slope failures on Nike Hill. Similar stereonet analyses were performed for joint and shear surfaces. Several slope stability analyses were performed by Geomatrix to evaluate the stability of the eastern Nike Hill slopes. Slope stability analyses for the western slope are addressed in a separate report discussed below.

Based on the geotechnical report for the western Nike Hill slopes (AMEC, 2014), the eastern portion of the Nike Hill slopes was stabilized, lined, and backfilled with refuse.

The western portion of the slopes was planned to be stabilized; however, due to a reduction in the amount of refuse received at the landfill, the area of the western slopes was not to be filled to capacity before the landfill closed in 2013. In general, findings in the geotechnical report indicated that the western Nike Hill slopes did not have an adequate factor of safety and would involve stabilization measures in order to achieve a factor of safety of 1.5 or more in accordance with County of Los Angeles, Department of Public Works guidelines and industry standards. Several alternatives for slope stabilization were considered and constructing a soil buttress was ultimately decided as the more cost-effective approach. The slope stability analyses indicate that adequate factors of safety would be achieved for static and pseudo-static (seismic) conditions.

At the time of our site reconnaissance and geologic mapping, the western portion of the Nike Hill slope was undergoing rough grading to construct the buttress stabilization fill described above. Based on the construction drawings, the finish slope face will have a slope ratio ranging from 2.8:1 to 3.2:1 (horizontal to vertical) with intermediate access road benches and drainage benches (County Sanitation District No. 2 of Los Angeles County, California, 2014). Internal buttress backdrains are planned.

6.2.3. Proposed Trail Lift Tower Adjacent to Gas-To-Energy Facility I

Regional geologic mapping indicates that the area of the proposed trail lift tower adjacent to the Gas-To-Energy Facility I is also underlain by the Pico Claystone member of the Fernando Formation (Dibblee, 1999). Regionally, bedding in this area dips approximately 30 degrees north to northwest.

Woodward Clyde Consultants (1984a) performed a geotechnical study for the expansion of the Gas-To-Energy Facility I (then referred to as the Puente Hills Flaring and Turbine Facility). The study included two rotary wash borings that were drilled to depths ranging from 42 to 47 feet deep (including downhole geophysical surveys in each boring), one approximately 60-foot-long exploratory trench, and geologic mapping. The borings and test pit encountered massive siltstone and some thin interbedded sandstone of the Pico member of the Fernando Formation. Bedding was described to dip

approximately 35 to 40 degrees to the north. The geotechnical report also described several small landslides near the toe of the northerly descending natural slope adjacent to the Gas-To-Energy I facility that were visible in the 1935 aerial photographs they reviewed. The landslides were interpreted to be shallow, surficial failures. The geotechnical report concluded that due to the thick-bedded to massive nature of the bedrock, and bedding dips that are steeper than the natural slope, the bedding is generally favorably oriented with respect to stability of the north-facing natural slope. In addition, in their opinion, the shallow landslides near the toe of the slope did not represent a gross stability problem for the facility due to the distance from the site and the fact that the San Gabriel River no longer undercuts the slope now that it has been diverted.

Soils International (1989b) prepared a geotechnical report for the proposed maintenance buildings at the Gas-To-Energy Facility I (at that time referred to as the Puente Hills Energy Recovery from Gas (PERG) facility) that included two 18-inch-diameter, bucket-auger borings that were drilled to depths of 30 and 45 feet, and three hollow-stem-auger borings that were drilled to depths of 30 to 40 feet. The borings encountered bedrock materials that were described as massive siltstone with indistinct bedding. A hand-calculated slope stability analysis was included in the report that indicated that the factor of safety for a 100-foot-high slope was more than 1.5.

The approximate locations of the borings are shown on Figure 2 and copies of the logs are included in Appendix C.

6.2.4. Proposed Trail Lift Tower Northwest of Shared Maintenance Yard

Regional geologic mapping indicates that the area of the proposed trail lift tower adjacent to the shared maintenance yard is underlain by the Repetto Claystone member of the Fernando Formation (Dibblee, 1999). Regionally, bedding in this area dips approximately 16 to 35 degrees north to northwest. A landslide was mapped to the east of this area that was presumably buried beneath landfill waste.

Kleinfelder (2010) performed a geotechnical study for Segment 8 of the Tehachapi Renewable Transmission Project that included a 24-inch-diameter bucket auger boring (Boring B-8) drilled to a depth of 51 feet. The boring was drilled near the electrical transmission tower about 250 feet south of the proposed trail lift tower. The approximate location of the boring is shown on Figure 2 and a copy of the log is included in Appendix D.

The boring encountered siltstone with some sandstone of the Fernando Formation. Bedrock materials were described as moderately weathered and weak and included several continuous and discontinuous shears. Bedding was described to dip approximately 22 to 37 degrees to the northwest. Shears generally dipped at moderate to steep angles to the northeast and southwest and some of the shears had relatively short offset beds. Additionally, numerous joints were encountered that were observed to be moderately to steeply dipping in varying directions. A slope stability analysis was not performed for this tower location.

Signs of surficial slope failures and erosion were observed in the aerial photographs of the natural slope west of the site in 2011 photographs (Google Earth, 2016).

6.2.5. Flare Site

Regional geologic mapping indicates that the area of the Flare Site is underlain by the sandstone facies and Repetto Claystone members of the Fernando Formation (Dibblee, 1999). Regionally, bedding in this area dips approximately 12 to 32 degrees north to northwest. At the time of our site reconnaissance and geologic mapping, the approximately 1:1 (horizontal to vertical) cut slope on the west side of the Flare Site did not exhibit significant signs of instability; however, some eroded material has accumulated near the toe of the slope. The densely vegetated natural slopes that descend from the east side of the site did not exhibit significant signs of instability. Previous geotechnical reports were not available for this area.

6.3. Groundwater

Ninyo & Moore reviewed groundwater information for the site on the State Water Resources Control Board GeoTracker database (GeoTracker, www.geotracker.swrcb.ca.gov). According to a Water Quality Monitoring and Corrective Action Program Progress Report (County Sanitation Districts of Los Angeles, 2015), groundwater was measured in September 2014 at depths ranging from 15.7 to 82.4 feet below the ground surface at the site. Groundwater is expected to flow in the general direction of the site topography.

7. FAULTING AND SEISMICITY

The proposed park improvements are located in a seismically active area, as is the majority of Southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structures. The numerous faults in southern California include active, potentially active, and inactive faults. As defined by the California Geological Survey, active faults are faults that have ruptured within Holocene time, or within approximately the last 11,000 years. Potentially active faults are those that show evidence of movement during Quaternary time (approximately the last 1.6 million years) but for which evidence of Holocene movement has not been established. Inactive faults have not ruptured in the last approximately 1.6 million years.

The approximate locations of major active faults in the vicinity of the site and their geographic relationship to the site are shown on Figure 4. The project site is not located within an area mapped in a State of California Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone).

Table 1 lists selected principal known active faults that may affect the site and the maximum moment magnitude (M_{max}) as published by the USGS (2008).

Table 1 – Principal Active Faults

Fault	Approximate Fault-to-Site Distance ¹ miles (kilometers)	Maximum Moment Magnitude ¹ (M_{max})
Elsinore (Whittier)	2.4 (3.9)	6.8
Puente Hills (Santa Fe Springs)	6.1 (9.8)	6.7
Elysian Park (Upper)	6.2 (9.9)	6.7
San Jose	7.7 (12.4)	6.7
Raymond	8.6 (13.9)	6.8
Puente Hills (Coyote Hills)	8.9 (14.3)	6.9
Sierra Madre	9.8 (15.8)	7.2
Clamshell-Sawpit	11.0 (17.6)	6.7
Verdugo	11.3 (18.1)	6.9
Hollywood	14.3 (23.1)	6.7
Chino	15.3 (24.5)	6.8
Newport Inglewood	16.6 (26.7)	7.5
Cucamonga	17.7 (28.5)	6.7
San Joaquin Hills	22.8 (36.6)	7.1
San Andreas	30.3 (48.7)	8.0
Notes: ¹ USGS, 2008		

The principal seismic hazards evaluated at the subject site are surface fault rupture, ground motion, liquefaction, and landsliding. A brief description of these hazards and the potential for their occurrences on site are discussed in the following sections.

7.1. Surface Fault Rupture

Based on our review of the referenced literature and our site reconnaissance, no active faults are known to cross the project site. However, surface fault rupture, such as lurching and cracking of the ground surface as a result of nearby seismic events, is a possibility.

7.2. Ground Motion

The 2013 California Building Code (CBC) specifies that the Risk-Targeted, Maximum Considered Earthquake (MCE_R) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCE_R ground motion

response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal peak ground acceleration that corresponds to the MCE_R for the site was calculated as 0.92g using the USGS (2016) seismic design tool (web-based).

7.3. Liquefaction Potential

Liquefaction is the phenomenon in which loosely deposited granular soils with silt and clay contents of less than approximately 35 percent and non-plastic silts located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure, and causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

As shown on Figure 5, the project site is not located in an area mapped as potentially susceptible to liquefaction (California Department of Conservation, Division of Mines and Geology [CDMG], 1999a,b). We anticipate that the proposed improvements located beyond the landfill waste limits will be underlain by bedrock. Accordingly, it is our opinion that liquefaction and liquefaction-related seismic hazards (e.g., dynamic settlement, ground subsidence, and/or lateral spreading) are not design considerations at this site.

7.4. Seismically Induced Landsliding

The State of California Seismic Hazard Evaluations of the El Monte and Baldwin Park Quadrangles (CDMG, 1999a,b), indicate that steep and/or north to northwest-facing hillsides of the site and vicinity may be susceptible to earthquake-induced landsliding (Figure 5). Landslides have been mapped within the site or adjacent hillside terrain and evidence of landslides were observed during our site reconnaissance. Some of the mapped landslides

have been buried by landfill waste. The western Nike Hill slopes were being stabilized at the time of this report.

The bedrock materials that comprise the hillside terrain are composed of siltstone, claystone, and sandstone of the Fernando Formation. Bedrock structure in the Puente Hills Landfill area is dominated by the north-dipping, northwest-trending Whittier-Elsinore fault zone located approximately two miles south of the Puente Hills Landfill. In general, bedrock generally strikes to the northeast and dips at approximately 15 to 35 degrees north to northwest which is considered adverse for north and west-facing slopes.

Based on the general bedding conditions documented in regional geologic maps as well as the bedding conditions described in the various referenced geotechnical studies performed at the Puente Hills Landfill property, seismically-induced landsliding is a geotechnical design consideration. During the future detailed design phase of the proposed structural park improvements, additional subsurface exploration and geologic mapping, laboratory testing, and slope stability analyses will be appropriate to evaluate the stability of slopes adjacent to the Entry Plaza, trail lift tower locations, and Flare Site.

8. SLOPE STABILITY

Slope stability analyses were performed to evaluate the effect of the proposed access road grading and structural improvements to the stability of the buttress currently being constructed to stabilize the western Nike Hill slopes. Selected slope stability analyses prepared by AMEC (2014) were updated to reflect the conceptual grading for the One-Way Loop Road (cross-section P-P') and construction of the trail lift tower structure and scenic overlook structure (cross-sections C-C' and D-D'). Graphic representations of the stability model conditions are presented in Appendix E.

Slope stability analyses were performed using the Morgenstern and Price (1965) limit equilibrium method as implemented in the computer program, Slope/W (Geo-Slope International Ltd., 2012). Our stability analysis included evaluation of circular rotational and block-type failures for static and pseudo-static conditions. Iterations using these subroutines yielded what we

consider to be critical failure surfaces. Our stability analyses were performed to evaluate the following design criteria: 1) a factor of safety of 1.5 or higher for planned slopes under static loading, and 2) a factor of safety of 1.1 or higher for pseudo-static conditions using a horizontal seismic coefficient of 0.15.

The proposed stair climb and switchback trail are considered relatively minor grading/structural modifications to the slope and are not anticipated to have a significant impact to the stability of the slope. At this early stage of the project, structural loading information was not available for the proposed trail lift tower structure or the scenic overlook structure. Therefore, preliminary foundation loads of 500 pounds per square foot (psf) were assumed in our slope stability analyses for these structures. The average bedding orientation of N75°E, 29°N included in the Geomatrix (2005) report was used in our slope stability analyses. The shear strength parameters developed by AMEC (2014) were also used in our analyses. A summary of the shear strength parameters is presented in Table 2.

Table 2 – Shear Strength Parameters Used in Slope Stability Analyses

Soil Description	Soil Type Number	Unit Weight (psf)	Friction Angle (degrees)	Cohesion (psf)
Moderately Weathered Siltstone (cross-bedded)	1	120	35	530
Fresh Siltstone (cross bedded)	2	120	35	1,400
Bedding Plane/Clay Seam	3	110	13	0
Landslide Deposits	4	120	16	1,430
Existing Soil Stockpile	5	120	27	100
Buttress Fill	6	110	28	50
Final Cover, Depth 0 to 7 feet	7	115	28	150
Municipal Solid Waste	8	Varies with Depth	33	0
Note: Strength parameters per AMEC, 2014.				

The results of our stability analyses are presented in Appendix E and summarized in Table 3. Based on our analyses, adequate slope stability will be maintained for the design slopes under static and pseudo-static conditions.

Table 3 – Summary of Slope Stability Analyses

Geologic Cross Section	Static Condition Factor of Safety	Pseudo-Static Factor of Safety
C-C'	2.25	1.40
D-D'	1.86	1.12
P-P'	1.97	1.26

9. DISCUSSION AND CONCLUSIONS

The purpose of our evaluation was to review geotechnical background materials and property conditions in order to assess the potential geologic and seismic hazards in the areas of the major structural improvements for the Puente Hills Landfill Park Master Plan and develop preliminary conclusions regarding the geotechnical feasibility of the proposed park improvements. Our evaluation was based on review of readily available regional geologic publications, review of previous geotechnical reports and other plans and documents for various projects at the landfill site, and a property reconnaissance.

Based on our evaluation, construction of the proposed park improvements is feasible from a geotechnical perspective. However, there are geotechnical conditions that should be considered during the detailed design phase of the project. The primary geotechnical conditions that could affect the feasibility of the proposed major structural improvements include: 1) the presence of the landfill waste materials at the property and 2) the stability of graded and natural slopes that are adjacent to the major structural improvements.

9.1. Presence of Landfill Waste

As previously discussed, future landfill waste settlements of up to approximately 120 feet are anticipated within the Eastern and Southern Deck areas and settlement on the order of 20 feet is anticipated in the Western Deck area. Our observations at the property included areas of hummocky/undulatory ground that, in our opinion, are indicative of differential settlement related to the landfill deposits. Settlement-sensitive improvements within these areas, such as parking lots, the One Way Loop Road, stair climbs, hiking trails, etc., will involve long-term maintenance. In addition, these improvements may also be affected by the

expansive clayey soil materials that were used for the final landfill cover. Maintenance activities may include routine crack repair to the asphalt concrete paved loop road and parking lots. Periodic re-grading may also be needed where larger differential settlements are occurring. Repairs to concrete stairs and routine trail maintenance should also be anticipated. It is our understanding that park spaces, landscaping and programming will transition and adapt as necessary as the landfill continues to settle.

Due to the long-term settlement of the landfill waste, the major structural improvements for the Entry Plaza, trail lift alignment, and the improvements at the top of Nike Hill are planned beyond the waste limits. The approximate limits of the landfill waste are shown on Figure 2. These limits were based on the limit of fill shown on the Iso-Settlement Contour Map included in the Postclosure Maintenance Plan (County Sanitation Districts of Los Angeles County, 2011) and our geologic mapping. When the future locations of the improvements are more certain, subsurface exploration will be appropriate to evaluate the presence of landfill waste in these areas. If landfill waste materials are encountered within the areas of future structural improvements, mitigation of the landfill deposits at the sites would generally involve one of two typical alternatives commonly employed to allow construction where such conditions exist: 1) excavation and offsite disposal of the landfill materials and replacement with engineered, compacted fill, or 2) support of new structures on deep pile foundations that extend through the landfill materials and bear on competent bedrock materials beneath the landfill deposits.

There are relatively long spans between the trail lift tower supports of up to approximately 2,500 feet. The alignment will span across landfill waste deposits between each major tower structure shown on Figure 2. If intermediate tower supports are proposed in the trail lift design, they may be located in areas of landfill waste. Site-specific subsurface exploration should be performed to evaluate the site conditions at each tower location in order to provide geotechnical design parameters for the tower foundations. The geotechnical conditions may vary significantly between various tower locations. Individual tower designs will need to accommodate future down-drag forces on the pile foundations from the landfill waste

settlement if they will penetrate landfill waste materials. Geotechnical subsurface exploration as well as the construction of the tower supports within waste areas should be coordinated with the County Sanitation District landfill closure guidelines.

9.2. Slope Stability

In general, the stability of the graded and natural slopes adjacent to the Entry Plaza, trail lift towers, Nike Hill, and Flare Site should be evaluated in the detailed design phase of the project. As described in Section 7.4, portions of the site are located within State of California earthquake-induced landslide hazard zones (CDMG, 1999a,b) and landslides are present within the property. Therefore, these slopes, particularly the north to west-facing slopes, should be evaluated in accordance with State of California guidelines (California Department of Conservation, Division of Mines and Geology, 1997) due to northwest-dipping bedding conditions that are considered adverse for these slopes.

The north-facing slope that descends from the area of the proposed Entry Plaza exhibited signs of slope creep and the stability of the slope should be evaluated due to the regional northwest-dipping bedding conditions. If future evaluation indicates unstable slope conditions, construction of a buttress to stabilize the slope, building setbacks from the slope, and/or supporting the building on deepened foundations may be appropriate to improve the stability of the slopes and to meet County of Los Angeles and 2013 CBC setback requirements. We did not observe signs of significant slope instability at the time of our site reconnaissance.

Similar evaluations will be appropriate along the trail lift alignment to evaluate the stability of the slopes that could affect the proposed towers, as well as to evaluate the geotechnical properties of the soil and bedrock for design of the tower foundations. Previous geotechnical studies at the Gas-To-Energy I facility indicated that the adjacent slopes were considered stable and we are not aware of slope instability issues impacting these existing structures. We did not observe evidence of significant slope instability in the vicinity of the tower that is proposed near the Gas-to-Energy I facility; however, the west-facing natural slope of the canyon west of the tower location may have adverse bedding conditions that could have an

impact on the stability of the tower. Similar northwest-dipping bedding conditions are anticipated at the trail lift tower northwest of the proposed Shared Maintenance Yard. The tower is proposed near the top of a west-facing slope that is anticipated to have adverse bedding conditions and, as previously described, the slope has experienced some surficial failures and erosion. If the slopes are found to be unstable, a stronger and deeper foundation for the tower may be needed.

The proposed One Way Loop Road grading and structures at the top of the Nike Hill slopes were analyzed to provide a preliminary assessment of the impacts to the buttress that is currently being constructed to stabilize the western Nike Hill slopes. Based on our preliminary slope stability analyses for cross-section P-P', the proposed grading for the Loop Road is not anticipated to have a significant impact on the stability of the slope. However, the possible impacts should be re-evaluated based on the as-graded configuration of the buttress and detailed grading plans for the Loop Road. Our slope stability analyses for cross-sections C-C' and D-D' indicate that the proposed structures at the top of the Nike Hill slope do not have a significant impact to the stability of the slope provided that the buttress is constructed as planned. However, our analyses were based on assumed structural foundation loads and the average bedding conditions documented by Geomatrix (2005). Additionally, future slope stability analyses should consider the as-graded geologic conditions, in particular, the bedding orientations collected during grading of the buttress. During the detailed design phase, close coordination between the geotechnical consultant and the trail lift designer will be needed to further evaluate the feasibility of the trail lift.

If structural improvements are planned at the Flare Site, the stability of the north-facing natural slope should also be evaluated due to the regional adverse bedding conditions. The slope has a thick growth of native vegetation and evidence of slope instability was not observed during our site reconnaissance. Routine maintenance should be anticipated on the relatively steep, 1:1 (horizontal to vertical) graded slopes where eroded debris was observed during our site reconnaissance.

The following additional conclusions were made:

- The areas of the major structures at the sites are predominantly underlain by bedrock materials of the Fernando Formation generally comprised of siltstone, claystone and some sandstone. These materials may require light to moderate ripping during site grading. However, cemented layers may be encountered that will involve greater ripping efforts and possible difficult drilling conditions for tower foundations or other deep foundations for structures, if utilized.
- Remedial grading should be anticipated to provide suitable subgrades in the areas of new building structures (i.e., visitors center, mini café, office buildings, restrooms, and pavement areas).
- Based on the elevations of the major structural improvements at the site, groundwater is not anticipated to be encountered in relatively shallow grading operations. However, seepage could be encountered, particularly in drilled shaft excavations for tower foundations or other caisson foundations.
- The relatively shallow landslides located south of the Southern Deck are a significant distance away from the proposed improvements and are not anticipated to be a hazard to the proposed improvements. However, this may be a continued maintenance issue if the landslide is not stabilized.
- Utilization of geogrids in paved parking lots and roadways may help to reduce the frequency of pavement crack repairs; however, due to the excessive settlements at the site, differential settlement and cracking cannot be eliminated and routine repairs should be planned for.
- The soils comprising the landfill cap materials are anticipated to be expansive.
- The site includes an extensive landfill gas collection system. Evaluation of methane conditions, methane mitigation and monitoring would be involved for property development.
- The property is not located within a State of California Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone). Based on our review of the referenced literature and our property reconnaissance, no active faults are known to cross the subject property.
- The property is located in a seismically active area and may experience moderately high ground accelerations during a seismic event on the order of 0.92g.
- The areas of the major structural improvements are not located within a mapped Seismic Hazard Zone area considered susceptible to liquefaction.

10. RECOMMENDATIONS

This feasibility evaluation was performed for preliminary planning purposes. Our scope of services did not include subsurface exploration, laboratory testing or detailed geotechnical engineering for design purposes. Prior to design and construction of new improvements, a detailed geotechnical evaluation, including subsurface exploration and laboratory testing, should be performed to address the potential geologic hazards at the site and geotechnical design and construction considerations. The purpose of the geotechnical evaluation would be to: 1) further evaluate the subsurface conditions at the property, 2) provide site-specific data regarding potential geologic hazards and geotechnical constraints, and 3) provide information pertaining to the engineering characteristics of earth materials with regard to project improvements and building and tower foundation design. Recommendations for earthwork, foundations, pavements, and other pertinent geotechnical design considerations could then be formulated from the detailed geotechnical evaluation. The detailed geotechnical evaluation should be performed in accordance with current State and County guidelines, and applicable codes. The detailed geotechnical evaluation may include the following:

- Large-diameter bucket-auger borings to evaluate geologic conditions for slope stability at the Entry Plaza, trail lift towers, and Flare Site, and to evaluate geotechnical engineering properties for tower foundation design.
- Backhoe test pits to evaluate the presence of landfill waste materials in the area of the new structures where they are near the boundary of the waste limits.
- Slope stability analyses to evaluate the stability of adjacent graded and natural slopes near proposed structural improvements, including evaluation of the possible impacts to the western Nike Hill slope buttress.
- Geotechnical engineering analyses to develop pile foundation parameters for building and trail lift towers.

11. LIMITATIONS

The limited geologic hazard evaluation presented in this report has been conducted in general accordance with current geologic and engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No warranty, implied or

expressed, is made regarding the conclusions and professional opinions expressed in this letter. Our preliminary conclusions are based on a review of the referenced geologic literature, property observations, and an analysis of the data collected. Subsurface exploration was not performed as part of our limited evaluation. Geologic variations may exist on the property, and conditions not described in this report may be encountered.

The purpose of this study was to evaluate geologic conditions within the property limits using readily available data and to provide a geotechnical feasibility report which can be utilized for evaluation of the proposed project. A more detailed geotechnical evaluation, including detailed property reconnaissance, subsurface exploration, and laboratory testing, should be performed prior to design and construction of the proposed project.

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Quadrangle Map, Scale 1:24,000, Photorevised 1981.

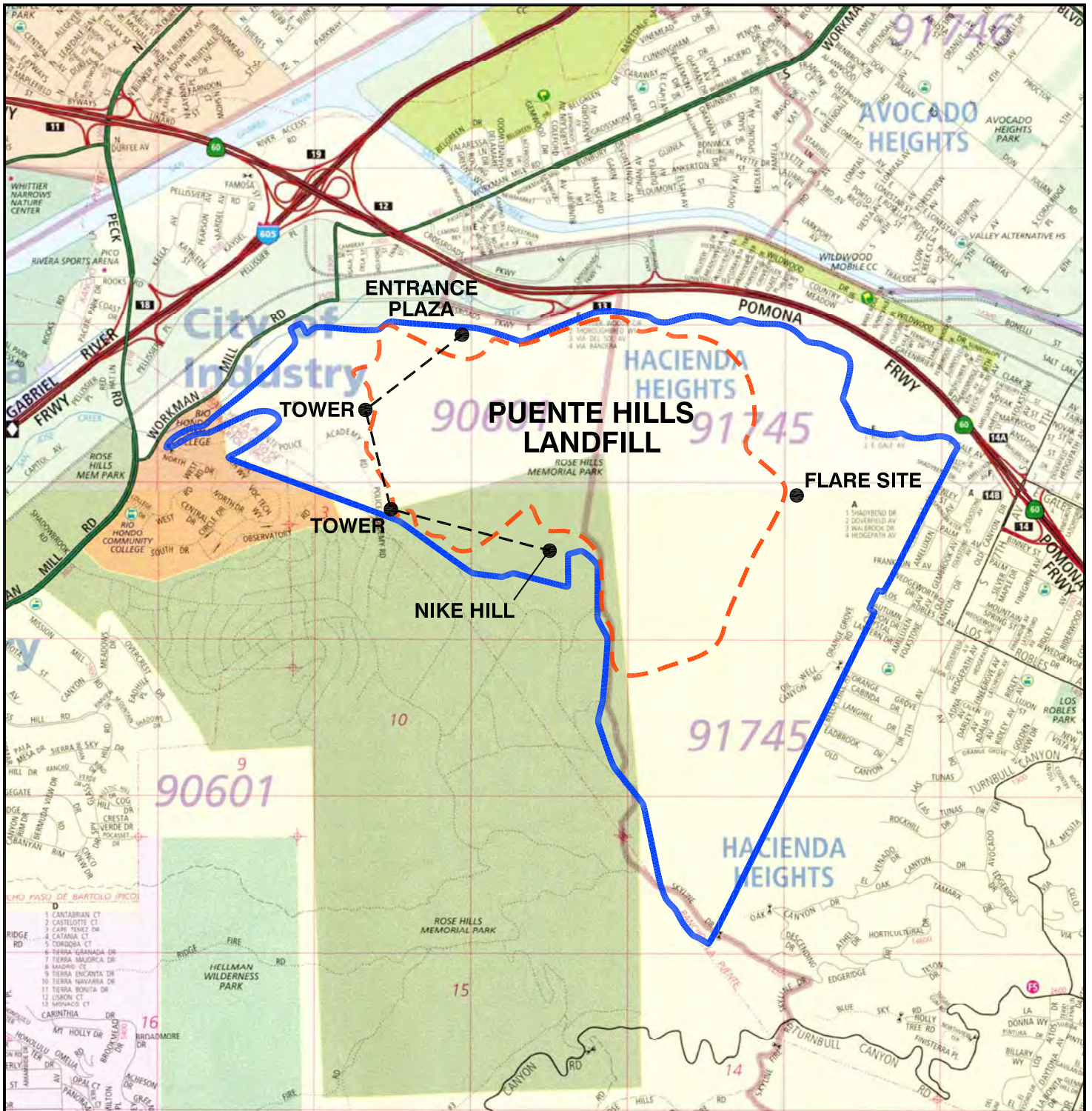
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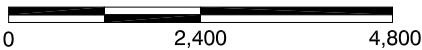
Yerkes, R.F., and Campbell, R.H., 2005, Preliminary Geologic Map of the Los Angeles 30' x 60'
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AERIAL PHOTOGRAPHS				
Source	Date	Flight	Numbers	Scale
USDA	8-31-54	AXJ-19K	58 and 59	1:20,000
USDA	11-10-52	AXJ-5K	44 and 45	1:20,000



REFERENCE: 52ND EDITION, THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY.

SCALE IN FEET



LEGEND

- SITE BOUNDARY
- - - - LIMITS OF LANDFILL WASTE

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.
Map © Rand McNally, R.L.07-S-129



SITE LOCATION

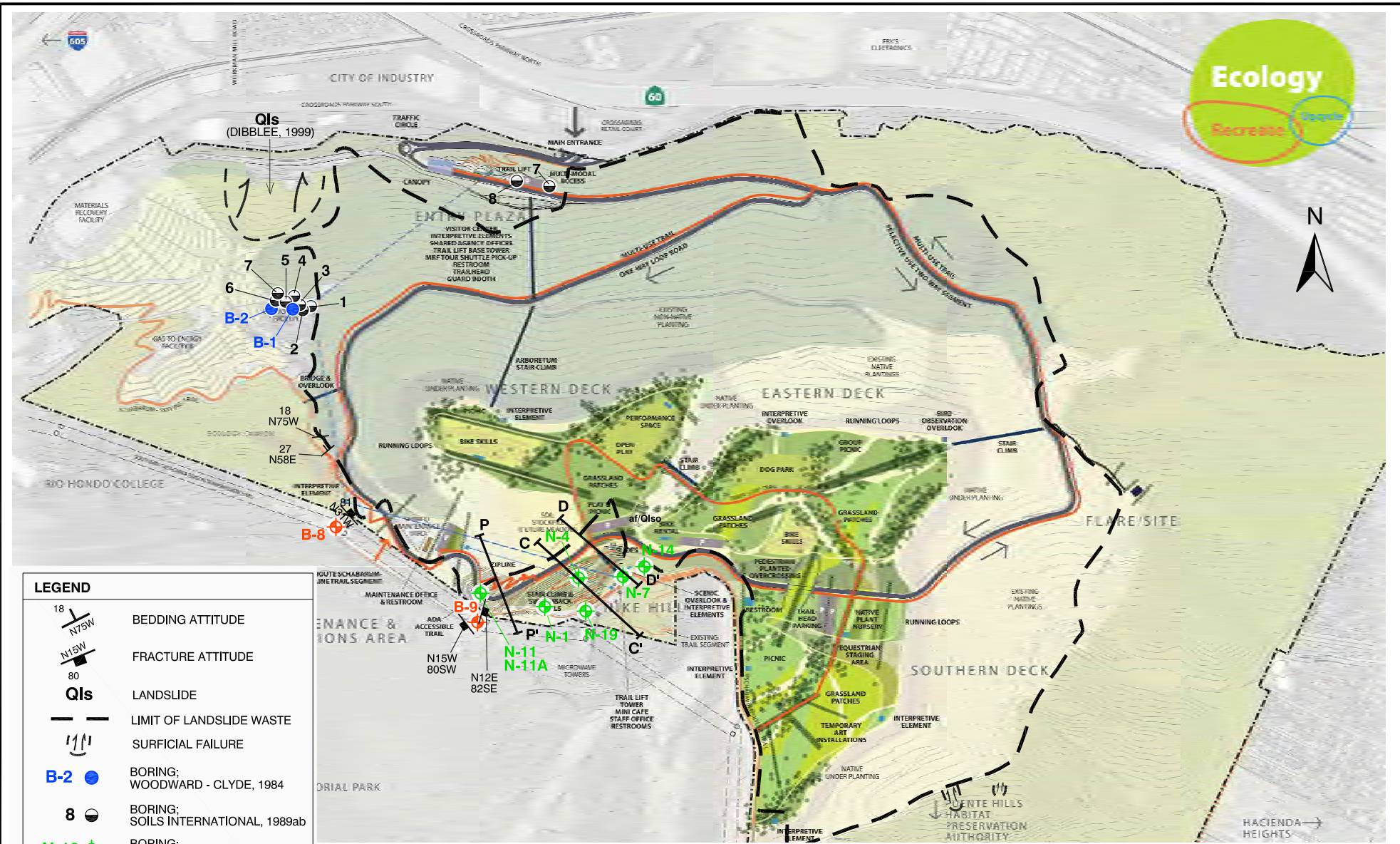
PUENTE HILLS LANDFILL PARK MASTER PLAN PROJECT
2800 WORKMAN MILL ROAD
WHITTIER, CALIFORNIA

FIGURE

1

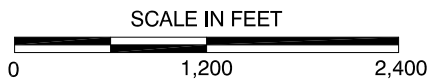
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LEGEND

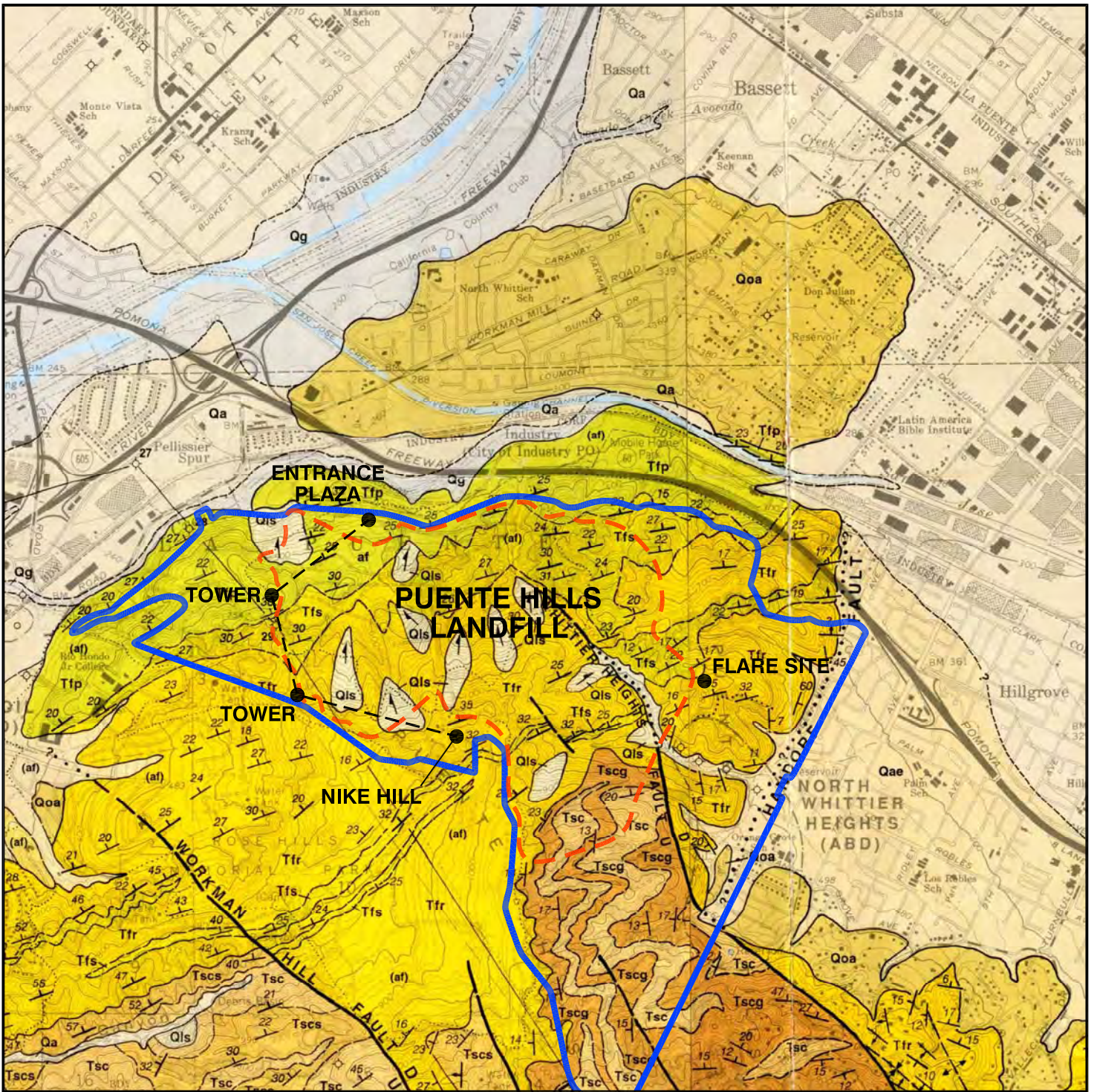
- BEDDING ATTITUDE
- FRACTURE ATTITUDE
- LANDSLIDE
- LIMIT OF LANDSLIDE WASTE
- SURFICIAL FAILURE
- BORING; WOODWARD - CLYDE, 1984
- BORING; SOILS INTERNATIONAL, 1989ab
- BORING; GEOMATRIX, 2005
- BORING; KLEINFELDER, 2010
- SLOPE STABILITY, CROSS SECTION



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

REFERENCE: WITHERS & SANDGREN, 2016, DRAFT PUENTE HILLS LANDFILL PARK MASTER PLAN, DATED MARCH 18.

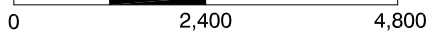
		SITE PLAN AND PREVIOUS BORING LOCATIONS	FIGURE 2



REFERENCE: DIBBLEE, T.W., JR., 1999, GEOLOGIC MAP OF THE EL MONTE AND BALDWIN PARK QUADRANGLES, LOS ANGELES COUNTY, CALIFORNIA: DIBBLEE FOUNDATION, DF-69.



SCALE IN FEET



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

Qa	ALLUVIUM	Tfr	FERNANDO FORMATION "REPETTO" CLAYSTONE
Qls	LANDSLIDE DEBRIS		GEOLOGIC CONTACT
Qoa	OLDER ALLUVIUM		FAULT; DOTTED WHERE CONCEALED
Tfp	FERNANDO FORMATION "PICO" CLAYSTONE		SITE BOUNDARY
Tfs	FERNANDO FORMATION SANDSTONE FACIES		LIMITS OF LANDFILL WASTE



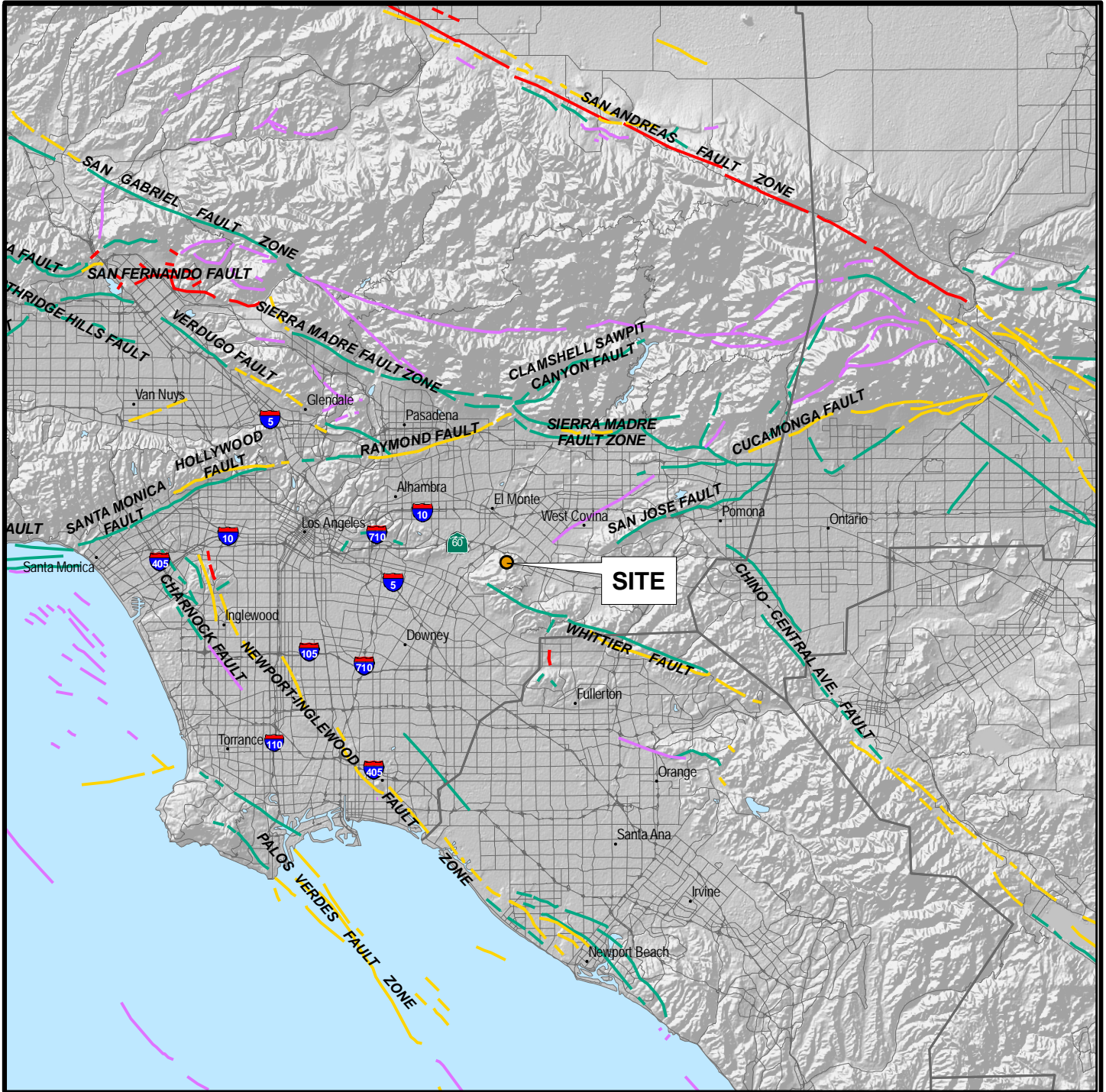
REGIONAL GEOLOGY

FIGURE






PROJECT NO.	DATE
209393001	4/16

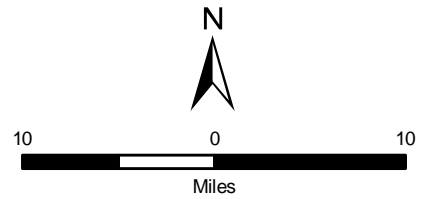
PUENTE HILLS LANDFILL PARK MASTER PLAN PROJECT
2800 WORKMAN MILL ROAD
WHITTIER, CALIFORNIA

3



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
 REFERENCE: JENNINGS, C.W. AND BRYANT, W.A., 2010, FAULT ACTIVITY MAP OF CALIFORNIA.

LEGEND	
FAULT ACTIVITY:	
 HISTORICALLY ACTIVE	 LATE QUATERNARY
 HOLOCENE ACTIVE	 QUATERNARY
 COUNTY BOUNDARIES	



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore

FAULT LOCATIONS

FIGURE

PROJECT NO.

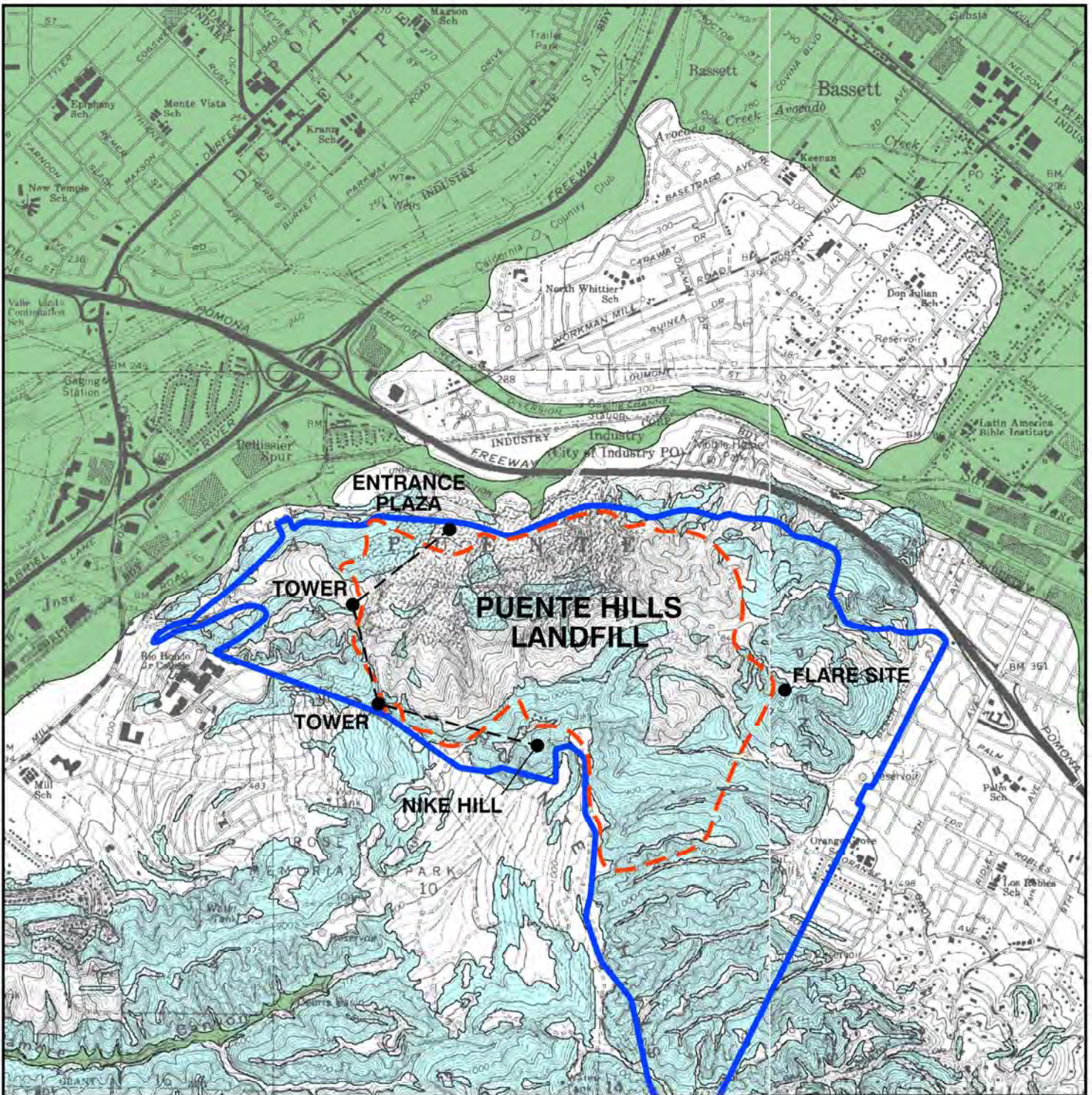
DATE

PUENTE HILLS LANDFILL PARK MASTER PLAN PROJECT
 2800 WORKMAN MILL ROAD
 WHITTIER, CALIFORNIA

209393001

4/16

4



REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY, STATE OF CALIFORNIA, 1999, SEISMIC HAZARD ZONES MAP OFFICIAL REVISED MAP EL MONTE AND BALDWIN PARK QUADRANGLES, 7.5-MINUTE SERIES: SCALE 1:24,000.





SCALE IN FEET

0 2,400 4,800

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

-  EARTHQUAKE-INDUCED LANDSLIDES
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.
-  LIQUEFACTION:
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.



SEISMIC HAZARD ZONES

FIGURE

PROJECT NO.	DATE
209393001	4/16

PUENTE HILLS LANDFILL PARK MASTER PLAN PROJECT
2800 WORKMAN MILL ROAD
WHITTIER, CALIFORNIA

5

APPENDIX A

BORING LOGS NEAR ENTRY PLAZA

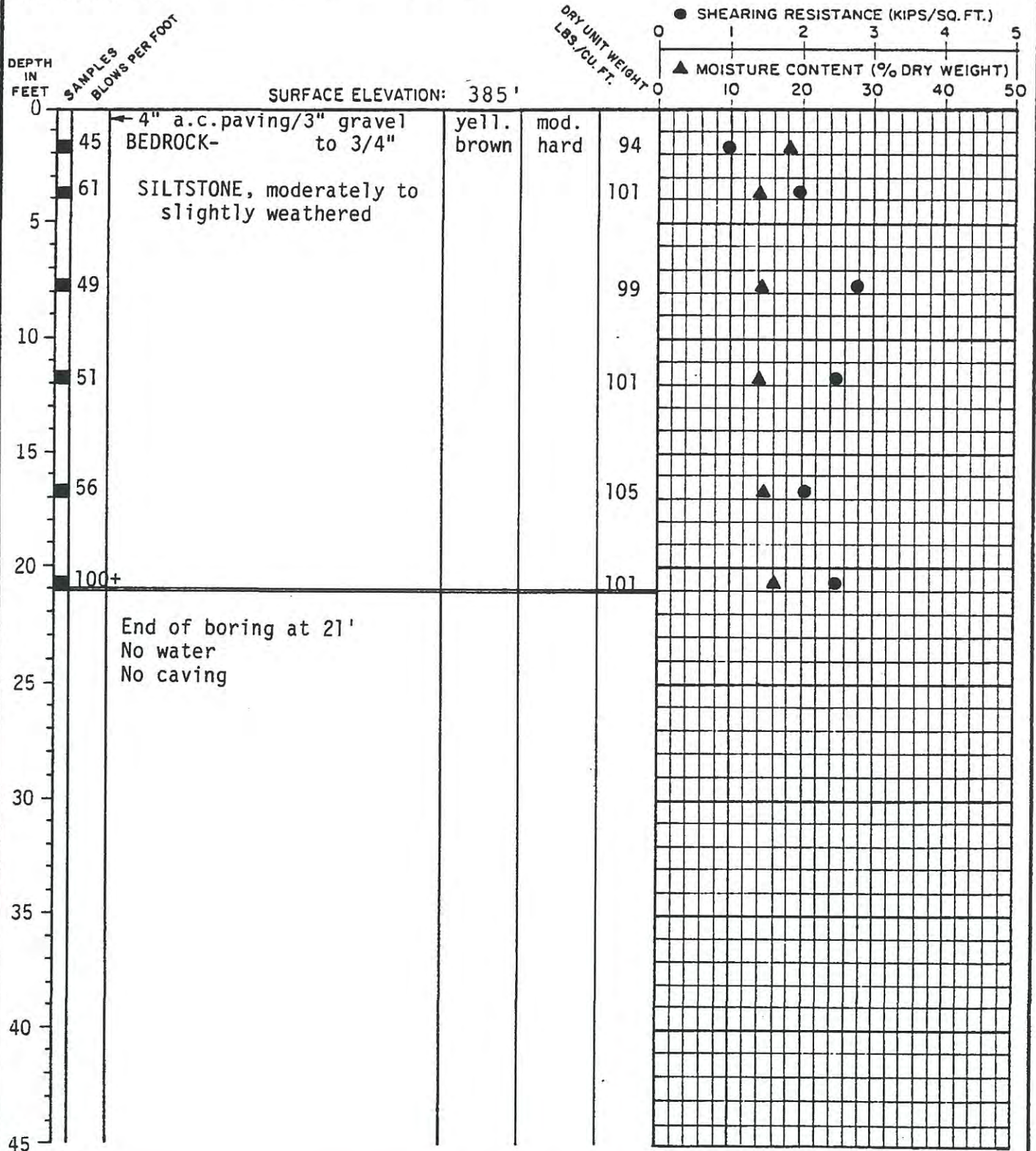
BY

SOILS INTERNATIONAL (1989)

LOG OF BORING NO. 7

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/9/89



Puente Hills Landfill Scale House Building
 Los Angeles County,
 California

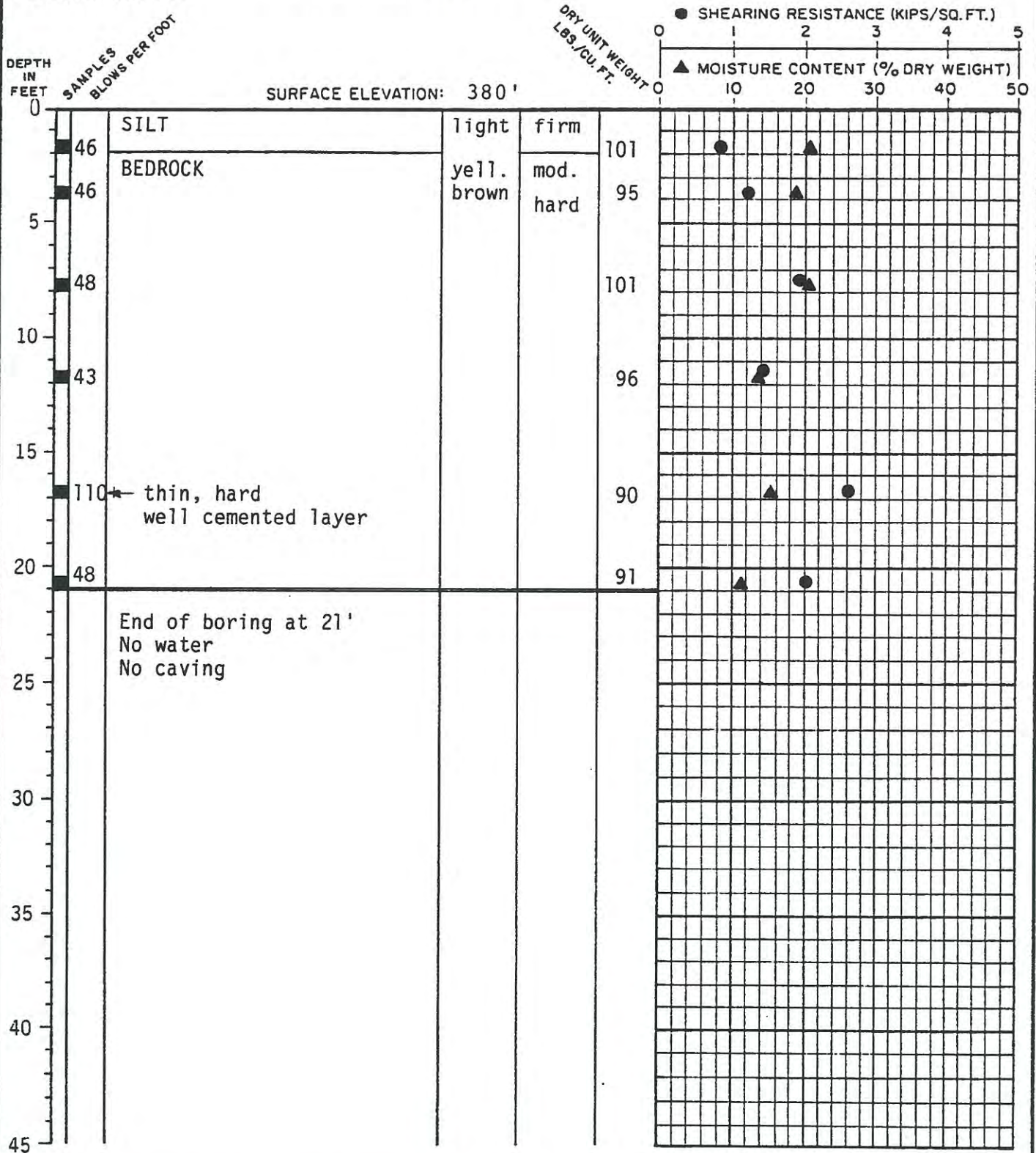
PROJECT NO. 273-101-89

PLATE B-2

LOG OF BORING NO. 8

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/10/89



Puente Hills Landfill Scale House Building
 Los Angeles County,
 California

PROJECT NO. 273-101-89
 PLATE C-2

APPENDIX B

BORING LOGS NEAR NIKE HILL|

BY

GEOMATRIX (2005)

AND

KLEINFELDER (2010)

PROJECT: NIKE SLOPES AREA GEOTECHNICAL INVESTIGATION Puente Hills Landfill		Downhole Log of Boring No. N-1	
BORING LOCATION: N: 1828495.54; E: 6556582.12		ELEVATION AND DATUM: 1112.86 FMSL	
DRILLING CONTRACTOR: Al-Roy Drilling		DATE STARTED: 9/21/03	DATE FINISHED: 9/22/03
DRILLING METHOD: Bucket auger		TOTAL DEPTH (ft.): 100.0	MEASURING POINT: ground surface
DRILLING EQUIPMENT: E-Z Bore, 24 in. bucket		DEPTH TO WATER	NA
SAMPLING METHOD: Bulk from spoil		LOGGED BY: N. T. Hall	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: N. T. Hall C.E.G.	REG. NO. 1422

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
				Surface Elevation: 1112.86 FMSL		
1				SILTSTONE: light yellowish brown (2.5Y 6/3), damp, trace very fine sand, soft, limonite mottles common, scattered limonite filled plant fossil molds, micaceous, no obvious bedding, moderately weathered REPETTO MEMBER OF FERNANDO FORMATION	casing	
2						
3						
4						
5				grades clayey and grayish brown (2.5Y 5/2), discontinuous sand laminae present		J: N25W, 78NE closed, clean, slightly irregular
6				little limonite staining below joints		B(?): apparent dip 22N Js: N25W, 65SW; N60E, 80SE open 1/2mm, irregular
7						
8				carbonate concretion 10" long, 1" thick		J: N30W, 84NE slightly open and irregular, root hairs common
9				carbonate concretion 1' long, 2" thick faint limonite stained laminations		
10						B(?): apparent dip 41N questionable
11				burrows filled with oxidized sand		
12						
13				sand lamina		B(?): apparent dip 20N
14						
15						

DE (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
16				SILTSTONE: continued		
17				discontinuous sand lamina		B(?): apparent dip 27N
18						
19				grades to CLAYEY SILTSTONE limonite staining common, pervades beds to 26 ft bgs		
20						
21						
22				6" zone of interbedded laminated fine sand and clayey silt limonite stains parallel to bedding up to 1" thick		B: N80E, 23NW sand bed J: N23W, 72SW closed, slightly irregular, partially limonite stained
24						
25						
26				rare fossils		
27				sand laminae noted in spoil		
28						
29						
30						
31						
32						
33						J: N60W, 48SW closed, irregular, manganese coated



DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
34				CLAYEY SILTSTONE: continued manganese oxide staining becomes common, rare fossils		<p>J: N10W, 87NE curved, slightly irregular, manganese coated, open to 1/4", extends to 38.6'</p> <p>J: N15W, 90 open 1/8-1/4", irregular, extends to 42'</p> <p>B(?): apparent dip 16N</p> <p>J: N20W, 90 J: N23W, 52SW closed, slightly irregular, limonite stained</p> <p>G: N70W, 80SW-90</p>
35				siltstone matrix grades to olive gray (5Y 5/2), limonite stained mottles and laminae common		
36						
37						
38				rare sand filled burrows		
39						
40				limonite stained sandy siltstone horizon (probably not reliable bedding indicator)		
41						
42				vertical joints appear to sole out into bedding		
43						
44						
45	1			bulk sample from spoil, 45-50'		
46						
47				top of gypsum veins; veins vary in thickness from 1/8" to 1", are curved, intersect, and appear randomly oriented (shown diagrammatically); veins typically have a medial silt parting		
48						
49						
50						
51						

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
52				CLAYEY SILTSTONE: continued		G: apparent dips 15-52N
53				gradual color change of clayey siltstone to greenish gray (10Y 5/1), limonite staining common, moderately weathered		
54						
55						
56				color change from olive gray to olive brown		
57						
58						
59						
60						
61						
62						
63				typical color of siltstone is greenish gray (10Y 5/1), limonite staining common, typically follows gypsum veins, moderately to slightly weathered		
64						
65						
66						
67						
68						
69						

GRPH3



DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
70				CLAYEY SILTSTONE: continued grades less gypsiferous		
71				grades sandy, more oxidized to olive yellow (2.5Y 6/6); no gypsum, moderately weathered, base of discontinuous fine sand laminae		B(?): apparent dip 15N
72						
73				interbedded clayey siltstone and sandy siltstone		B(?): apparent dip 20N
74				1/2" fine sand bed		B: N80E, 25NW
75						
76				1" fine to medium sand bed, cemented, overlying 6" thick dolomitic siltstone concretion; limonite stained, contains biotite; base of sandy horizon, clayey siltstone below		B: E-W, 22N sand bed 1" thick
77						
79						
80						
81				olive brown clayey siltstone with gypsum veins; no obvious bedding		
82						
83						
84						
85						
86				grades sandy, no gypsum 2" diameter dolomitic siltstone concretion, east wall		
				grades clayey, 3/4" gypsum vein		G: N15W, 78SW

DEP. (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
88				CLAYEY SILTSTONE: continued well rounded gravel clast 1/2" diameter, east wall		B: N82E, 23NW F: N65W, 55NE
89						
90				grades sandy		
91				3" diameter dolomitic siltstone concretion, east wall		
92				1/4" thick, discontinuous very fine sand bed		
93						
94				discontinuous 1" thick sand bed with 3/8" diameter clay filled burrows that plunge 77° south		
95	2			bulk sample from spoil, 95-100'		
96				grades to silty fine sandstone		
97				base of downhole logging		
98						
99						
100				Bottom of boring at 100 ft bgs. Downhole logged by a geologist to 97 ft bgs. No free groundwater encountered. Boring backfilled with cuttings and tamped to surface; site protected by fence. Began drilling 7:30 am on 9/22/03; completed hole at 11:00 am 9/22/03.		B(?): apparent dip 22N on sand bed

PROJECT: NIKE SLOPES AREA GEOTECHNICAL INVESTIGATION Puente Hills Landfill		Downhole Log of Boring No. N-4	
BORING LOCATION: N: 1828774.55; E: 6556845.02		ELEVATION AND DATUM: 1039.21 FMSL	
DRILLING CONTRACTOR: Al-Roy Drilling		DATE STARTED: 8/26/03	DATE FINISHED: 8/27/03
DRILLING METHOD: Bucket auger		TOTAL DEPTH (ft.): 115.0	MEASURING POINT: ground surface
DRILLING EQUIPMENT: E-Z Bore, 24 in. bucket		DEPTH TO WATER 66	74.5 77
SAMPLING METHOD: NA		LOGGED BY: N. T. Hall	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: N. T. Hall C.E.G.	REG. NO. 1422

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
				Surface Elevation: 1039.21 FMSL		
1					casing	
2				SANDY SILT (ML): very pale brown (10YR 7/4), dry, low plasticity, rare cobbles, firm to soft [FILL]		C: apparent dip 35N
3						
4						
5						
6						
7				CLAYEY SILT (ML): brown (10YR 4/3) to dark brown (10YR 3/3), damp, low to moderate plasticity, firm to stiff, rare oxidized siltstone clasts to 0.5", caliche coated root hair holes and fractures common, contains irregular zones of brown silty clay (CL) 1-3" thick, cumulic soil profile [COLLUVIUM]		
8						
9						
10				VOCs: average - 0.2 ppm; peak = 0.3 ppm on spoil		
11						
12						
13						
14						
15						

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
16				CLAYEY SILT (ML): continued		
17						
18						
19				grades light olive brown (2.5Y 5/4), damp, soft		
20						
21						
22				CLAYEY SILTSTONE: light olive brown (2.5Y 5/4), damp, low plasticity, very soft, moderately weathered, hint of lamination, trace carbonate, micaceous REPETTO MEMBER OF FERNANDO FORMATION		C: apparent dip 22N slightly irregular
23				VOCs: average = 0.3 ppm; peak = 0.4 ppm on spoil		
24						
25						J: N80W, 56SW, closed, lined with soft carbonate to 3/4"
26						
27				fault lined with 1/4" tan clay and angular fragments of hard siltstone	F: N35W, 48NE no obvious slicks	
28						
29				no obvious bedding		J: N30E, 72NW 1/8" open, roots
30				VOCs: average = 0.3 ppm; peak = 0.6 ppm on spoil trace soil carbonate		J: N5W, 90; N85W, 90 closed, clean, slightly rough
31						
32						
33						B(?): apparent dip 25N on 0.5mm thick carbonate seams

Downhole Log of Boring No. N-4

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
34				CLAYEY SILTSTONE: <i>continued</i>		F: N30W, 74SW slicks plunge 15N
35				grades light yellowish brown (2.5Y 6/4), damp, soft, trace manganese staining on fractures, rare limonite filled fossil molds		
36				siltstone concretion, highly fractured, moderately hard, stained with iron and manganese oxides		
37						
38						
39						
40						B: N80E, 31N carbonate lined lamina 1mm thick
41						
42				rare scattered carbonate nodules to 1"		J: N22W, 80SE closed, limonite coated, slightly irregular
43				VOCs: average = 0.3 ppm; peak = 0.7 ppm on spoil		J: N35E, 75NW
44						
45						
46						
47						
48						
49				siltstone concretion, clayey, limonite stained, soft, crumbly		J: N60W, 50SW closed, undulatory, clay coated, no slicks F: N18W, 79NE open 1mm, carbonate lined; slicks plunge 26NE
50				grades slightly weathered, color change to gray (5Y 6/1), in siltstone matrix, limonite stringers, spots and fracture coatings common		
51				VOCs: average = 0.5 ppm; peak = 0.8 ppm on spoil		J: N30W, 70NE




DEPTH (ft)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
52				CLAYEY SILTSTONE: continued		closed, smooth, clay coated, shiny
53				limonite stained lamina		B: N65E, 25NW J: N15W, 55NE
54						closed, shiny, clay coated
55						S: N55W, 80SW
56						undulatory, slicks plunge 43N
57						J: N-S, 55E
58						closed, limonite and clay coatings
59						S: N79E, 65NW
60				VOCs: average = 0.7 ppm; peak = 1.2 ppm on spoil		slicks plunge 59NE F: N45W, 25NE on probable bedding plane
61						
62				grades unweathered, abrupt color change to very dark gray (5Y 3/1) in hanging wall, chocolate brown in foot wall, grades greenish gray (10Y 5/1)		J: N30W, 55NE
63				CLAYEY SILTSTONE: moist, hard to pick, no obvious bedding, massive		closed, clay lined
64				hard drilling, siltstone concretion, gray (10Y 6/1), calcareous (?)		F: N46W, 45SW F: N10W, 40SW
65				siltstone concretion, gray		F: N15W, 44SW
66				base of oxidation, unweathered below		
67				sea urchin fossil		J: N30W, 90
68				grades more clayey, no obvious bedding		clay lined, trace free water
69						

DEP. (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
70				CLAYEY SILTSTONE: continued 1/8" clayey zone VOCs: average = 0.5 ppm; peak = 0.6 ppm on spoil		B(?): apparent dip of 25 toward N50W on clayey zone	
71				grades to silty claystone			
72							
73				foram tests noted			
74							F: N10E, 20NW polished, no slicks F: N10W, 27NE smooth, clay lined, wet @ 74.5'
75				1/4mm angular quartz grains scattered throughout (homogenized by bioturbation?)			
76							
77				grades to clayey siltstone, dark greenish gray (5GY 4/1), damp to wet, soft to moderately soft, 1/8-1/4" diameter fossil burrows filled with light gray very fine sand, sand may be of aeolian origin			J: N-S, 55E minor seep @ 72'
78							
79							J: N25W, 65SW slightly rough, clay lined
80				VOCs: average = 1.3 ppm; peak = 1.7 ppm on spoil			
81							
82							
83							
84				no obvious bedding			
85							
86							
87				1/8-1/4" carbonate lines joint or shear, seep on hanging wall		J/S: N28W, 51NE seep @ 87.5'	

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
88				CLAYEY SILTSTONE: continued		
89						
90				VOCs: average = 1.6 ppm; peak = 1.9 ppm on spoil		
91						
92				no obvious bedding		
93						
94						
95						
97						
98						J/S: N25W, 24S smooth, clay lined
99						
100					J: apparent dip 23S	
101					J: apparent dip 15S	
102				VOCs: average = 1.8 ppm; peak = 2.3 ppm on spoil	J: apparent dip 25S	
103						
104					F: N40W, 64SW 1/4" clay lined braided shear zone	
106				no obvious bedding		

GRPH3



DEPTH (ft.)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
107				CLAYEY SILTSTONE: continued no obvious bedding		
108						
109						
110				VOCs: average = 1.3 ppm; peak = 4.2 ppm on spoil		
111						
112						
113						
115				VOCs: average = 0.1 ppm; peak = 0.6 ppm on spoil Bottom of boring at 115 ft bgs. Logged by geologist to 110 ft bgs. Wet conditions at 66 ft bgs, seepage at 74.5, 77 and 87 ft bgs. Boring backfilled with cuttings and tamped to 5.5 ft bgs. Upper 5.5' backfilled with sand cement slurry. Began drilling 11:30 am 8/26/03, drilled to 76 ft bgs by 3:00 pm. Resumed drilling 8/27/03 at 7:00 am and completed hole to 115 ft bgs by 8:30 am.		

PROJECT: NIKE SLOPES AREA GEOTECHNICAL INVESTIGATION
Puente Hills Landfill

Downhole Log of Boring No. N-7

BORING LOCATION: N: 1828783.00; E: 6557215.41

ELEVATION AND DATUM:
1154.51 FMSL

DRILLING CONTRACTOR: Al-Roy Drilling

DATE STARTED:
9/24/03

DATE FINISHED:
9/25/03

DRILLING METHOD: Bucket auger

TOTAL DEPTH (ft.):
100.0

MEASURING POINT:
ground surface

DRILLING EQUIPMENT: E-Z Bore, 24 in. bucket

DEPTH TO WATER: 33.7

54

SAMPLING METHOD: Bulk from spoil

LOGGED BY:
N. T. Hall

HAMMER WEIGHT: NA

DROP: NA

RESPONSIBLE PROFESSIONAL:
N. T. Hall C.E.G.

REG. NO.
1422

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
				Surface Elevation: - 1154.51 FMSL		
1				SILTSTONE: light olive brown (2.5Y 5/3), damp, trace clay, soft, micaceous, no obvious bedding, moderately weathered, limonite mottles common REPETTO MEMBER OF FERNANDO FORMATION	Casing	
2						
3						
4						J: N2E, 85SE closed, slightly irregular, clay coated
5						J: N18E, 48NW closed, irregular, clay coated
6						
7						
8						S: N30W, 73NE closed, slightly irregular, minor limonite stains, rake on slicks 35SE
9						J/S: N10E, 44NW closed, irregular, hard, limonite stains, subhorizontal slicks(?)
10				3" long, 1" thick concretion, east wall		B(?): apparent dip 18N top of concretion
11						
12				open joint may be result of gypsum dissolution		J: N60W, 78NE open 1/4", irregular, discontinuous
13				randomly oriented gypsum veins below fault		F: N23W, 68NE 1mm clay gouge, local gypsum vein 1/4" thick
14						
15				grades more clayey to CLAYEY SILTSTONE		



DEP. (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
16				CLAYEY SILTSTONE: continued greenish gray (10Y 6/3)			
17				vertical joints may be open from dissolution of gypsum		J: N40W, 90 open 1mm, irregular, scattered gypsum crystals	
18				grades to olive gray and slightly weathered		J: N50W, 90 open 1-2mm, slightly irregular, scattered gypsum, manganese oxide	
19							
20				grades light gray			
21							
22							J: N32W, 85NE curved, slightly irregular, coated with gypsum and limonite
23							
24							J: N50W, 79SW slightly open and irregular, coated with gypsum and limonite
25	1			bulk sample from spoil			J: N60W, 70SW slightly irregular, limonite coated, rare gypsum
26							J: N49W, 68SW open 1/2mm, irregular, limonite coated
27							J: N45W, 60SW closed, clean, irregular
28							
29							
30				limonite stained lamina, discontinuous			B(?): apparent dip 31N
31							
32							J: N53W, 70NE closed, irregular, limonite coated
33							J: N33W, 70NE same as above

DEP. (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
34				CLAYEY SILTSTONE: <i>continued</i> highly fractured, soft, prone to caving, seepage from south wall @ 33.7'		G: N33W, 70NE vein 1/2" thick	
35							
36							
37							F(?): N68W, 40NE 1/4mm clay gouge with down dip slicks
38							F: N5W, 64NE 3" thick clayey gouge beneath fault, slicks plunge SE
39	4			grab sample of clayey fault gouge			
40				6" thick dolomitic siltstone concretion in north wall, siltstone tight, moderately soft and hard to pick			
41							
42							
43							
44				fossil pelecypod			
45							
46						J: E-W, 60S closed, curved, smooth, clay coated	
47						J: N25W, 70NE closed, undulatory	
48						J: N20W, 76NE closed, irregular, limonite stained	
49				hard drilling, siliceous, slightly dolomitic, siltstone concretion, up to 2.2' thick, generally not fractured with minor limonite staining			
50							
51						J: N10E, 69NW	

GRPH3



DE (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
52				CLAYEY SILTSTONE: continued scattered randomly oriented gypsum veins		closed, slightly irregular, coated with clay and limonite	
53							
54				crushed zone, below are randomly oriented, curved, slickensided fractures, seepage			S: N44W, 60NE
55	2			bulk sample from spoil			F: N-S, 52NE polished, 1/2mm clay gouge, slicks plunge NE
56							
57							
58				color grades light olive brown (2.5Y 5/4)			G: subhorizontal, 1" thick
59							
60							
61							
62							
63							
64				hard drilling, dolomitic siltstone concretion, cut by fault		B(?): apparent dip 26N top of concretion F: N24W, 85SW changes to N12W, 82SE @ 64'	
65							
66							
67							
68							
69							

D (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
70				CLAYEY SILTSTONE: continued		J/S: N87W, 58NE closed, smooth, clay coated, parallel feature @ 70'
71						J: N20W, 70NE slightly irregular, coated with gypsum and manganese oxide
72						
73				gypsum partially dissolved		
74						J: N45W, 63NE slightly irregular, some gypsum, manganese oxide coated
75						J: similar to joint above
76						
77						
79						J: N30W, 80NE coated with gypsum and manganese oxide
80	3			bulk sample from spoil		
81						
82						
83						
84						J: N42W, 40NE closed, slightly irregular, curved, manganese oxide coated
85						J: N46W, 90 curved, irregular, coated with limonite and gypsum
86						



DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS); color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
88				CLAYEY SILTSTONE: continued sand filled burrows noted in spoil		J/S: N35W, 50SW open 1/2mm, irregular, limonite coated
89						
90				intersecting gypsum veins		
91						
92						
93						G: 1" thick gypsum vein plus smaller veins
94						
95						G: 1/2" thick gypsum vein
96						
97						
98						
99						
100				Bottom of boring at 100 ft bgs. Logged by geologist to 97 ft bgs. Seepage at 33.7 and 54 ft bgs. Boring backfilled with cuttings and tamped to 5.6 ft bgs. Upper 5.6' backfilled with sand cement slurry. Began drilling at 8:00 am on 9/24/03 and reached 85 ft bgs by 1:00 pm. Resumed drilling at 6:40 am on 9/25/03 and completed hole to 100 ft bgs by 7:30 am.		

PROJECT: NIKE SLOPES AREA GEOTECHNICAL INVESTIGATION Puente Hills Landfill		Downhole Log of Boring No. N-11A	
BORING LOCATION: N: 1828645.13; E: 6555904.41		ELEVATION AND DATUM: 919.61 FMSL	
DRILLING CONTRACTOR: Al-Roy Drilling		DATE STARTED: 9/26/03	DATE FINISHED: 9/26/03
DRILLING METHOD: Bucket auger		TOTAL DEPTH (ft.): 30.0	MEASURING POINT: ground surface
DRILLING EQUIPMENT: E-Z Bore, 24 in. bucket		DEPTH TO WATER	23.5 26.5 27
SAMPLING METHOD: Grab from boring wall		LOGGED BY: N. T. Hall	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: N. T. Hall C.E.G.	REG. NO. 1422

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
				Surface Elevation: 919.61 FMSL		
1				mixed debris consisting of fine gravel, recycled pavement, and bedrock materials derived from the Fernando Formation [ARTIFICIAL FILL]	Casing	
2					X + B X X X	
3					X + X X X X	
4					X + X X X	
5				CLAYEY SILT (ML): light yellowish brown (2.5Y 6/3), damp, moderately plastic, soft, contains light gray (2.5Y 7/2) siltstone, fragments to 6" thick near base, joints open to 1/2mm near base, structureless and massive at top, grading fragmental toward base.	/	
6					/	
7					/	
8				LANDSLIDE DEPOSIT (derived from Repetto Member of Fernando Formation)	/	
9					/	
10				deposit grades fragmental in appearance, joints/fractures commonly open 1/2mm	/	
11					/	
12				zone of siltstone fragments up to 6" across	/	
13					/	
14				grab sample of clay from landslide slip plane	/	
15	1				/	SP: N80E, 35NW irregular, covered with 1/2" clay



DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
16				CLAYEY SILTSTONE: light olive brown (2.5Y 5/3), damp, soft, locally micaceous, moderately weathered REPETTO MEMBER OF FERNANDO FORMATION [possible translational block]			
17							
18							
19				fine sand bed, well sorted, 2" thick			J/S: N25W, 54NE smooth, manganese oxide coated
20							B: N60E, 29NW F: N30W, 55NE curved, limonite coated, offsets sand bed, slicks plunge down dip
21							J: N20E, 45SE smooth, open 1/4mm, manganese oxide coated
22							
23				grades unweathered, discontinuous sand laminae, transition from oxidized siltstone above to unoxidized below, seepage from fractures at 23.5'			J: N17W, 65NE closed, slightly irregular, clay coated
24							B(?): apparent dip 28N on sand lamina
25							
26				6" thick dolomitic siltstone concretion in south wall, seepage from fractures at 26.5' and 27'			
27							
28				QUARTZ SANDSTONE bed, very light gray (N 8/) to medium light gray (N 6/), wet, ~100% fine to medium sand, ~80% subangular to subrounded quartz, ~20% feldspar and lithics including biotite, 2" thick, discontinuous, undulatory base indicates possible channel origin			B: N78NW, 33NW sand bed 1-2" thick
29							
30				Bottom of boring at 30 ft bgs. Logged by geologist to 28.5 ft bgs. Seepage at 23.5, 26.5, and 27 ft bgs. Boring backfilled with cuttings and tamped to 5.5 ft bgs. Upper 5.5' backfilled with sand cement slurry. Began drilling at 11:45 am on 9/26/03; completed hole to 30 ft bgs at 12:30 pm.			

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
16				CLAYEY SILT (ML): continued			
17							
18				highest occurrence of gypsum veins; veins lack continuity			
19							
20				open fracture 1' long 1/4" wide			
21							
22							
23							F: N25W, 72NE overlain by 1/4" clay seam, underlain by 1/2" gypsum vein, groves on fault plunge 25N
24							
25				base of landslide			
26				CLAYEY SILTSTONE: light yellowish brown (2.5Y 6/3), damp, soft, micaceous, moderately weathered REPETTO MEMBER OF FERNANDO FORMATION			
27							B(?): apparent dip 29N on sand lamina
28				scattered gypsum veins to 1/2" thick common			
29							
30							
31							
32							
33							

D (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
34				CLAYEY SILTSTONE: continued			
35							
36							
37							
38				possible fault, subparallel to base of landslide, 7 subparallel fractures all open 1mm, extend 8" into footwall, prone to caving			J/F: N30W, 76NE open 1/4", undulatory, gypsum lined
39							
40							
41				1.25" diameter round metavolcanic pebble noted in spoil (dark gray microporphyry)			
42				scattered gypsum veins to 1/2"			J: N80W, 67NE slightly open, slightly irregular, clean
43				gradual color change to olive gray (5Y 5/2)			
44							
45							
46							
47							G: N40W, 60NE 1/2" thick
48							
49	1			bulk sample of spoil, 49-55'			
50				dolomitic siltstone concretion up to 1' thick on north wall, fractures in concretion stained with limonite and manganese oxide, covers ~50% of boring circumference			J: E-W, 65N closed, slightly irregular, limonite coated
51							

D (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
52				CLAYEY SILTSTONE: continued		
53						
54						
55				<p>Bottom of boring at 55 ft bgs. Downhole logged by a geologist to 52 ft bgs. No groundwater encountered. Boring backfilled with cuttings and tamped to surface. Began drilling at 10:30 am on 9/23/03; completed hole to 55' by 11:40 am.</p>		



PROJECT: NIKE SLOPES AREA GEOTECHNICAL INVESTIGATION Puente Hills Landfill		Downhole Log of Boring No. N-19	
BORING LOCATION: N: 1828478.48; E: 6556942.91		ELEVATION AND DATUM: 1158.91 FMSL	
DRILLING CONTRACTOR: Al-Roy Drilling		DATE STARTED: 9/15/03	DATE FINISHED: 9/16/03
DRILLING METHOD: Bucket auger		TOTAL DEPTH (ft.): 115.0	MEASURING POINT: ground surface
DRILLING EQUIPMENT: E-Z Bore, 24 in. bucket		DEPTH TO WATER 38 to 67 (no water below)	
SAMPLING METHOD: Grab sample from spoil		LOGGED BY: N. T. Hall	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: N. T. Hall C.E.G.	REG. NO. 1422

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
				Surface Elevation: 1158.91 FMSL		
1				CLAYEY SILT (ML): pale brown (10YR 6/3), damp, with fragments of concrete, macadam, plywood, and siltstone [FILL]	casing	
2				CLAYEY SILTSTONE: light yellowish brown (2.5Y 6/3) with olive yellow (2.5Y 6/8) limonitic mottles, damp, low plasticity, highly weathered, micaceous, scattered soft carbonate nodules to 1/8", no obvious bedding REPETTO MEMBER OF FERNANDO FORMATION		
3						J: N10W, 76NE closed, slightly irregular, limonite coated
4						
5						
6						
7						
8						
9						
10						J: N10W, 76NE same as above
11						
12				top of highly fractured zone, fractures irregular, randomly oriented, some open 1/2mm, zone contains soil carbonate 2-3" thick, possible fault zone		
13				2" calcareous concretion		
14				grades to SANDY SILTSTONE		J: N28W, 50SW slightly open and rough, clay coated
15						



Downhole Log of Boring No. N-19

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
16				SANDY SILTSTONE: continued		F: N70E, 28NW clay gouge 1mm thick
17						J: N28W, 68SW slightly open, curved, slightly irregular, clean, roots common
18						J: N50W, 46NE closed, slightly irregular, clay coated
19						
20				grades to CLAYEY SILTSTONE		
21						
22						
23						
24				zone of intersecting joints		J: N25W, 85SW J: N60W, 68SW closed, slightly rough, clay coated
25	1			bulk sample of spoil zone of intersecting joints		J: N50W, 75SW J: N24W, 65NE closed, curved, clay coated
26				concretion in east wall, 14" long, 2" thick		B: apparent dip 25N on concretion
27				highly fractured zone, fractures randomly oriented, many open to 1mm, loose siltstone matrix grades olive gray (5Y 5/2), moderately weathered		
28						
29				2" carbonate concretion		
30						J: N30W, 77NE
31						
32						
33				concretion, east wall		J: N80E, 70SE open 1mm




DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
34				CLAYEY SILTSTONE: continued		J: N20W, 60SW closed, curved, clay coated B(?): apparent dip 30N on concretion J: N20W, 60SW
35						J: N32W, 85NE closed, slightly irregular, clay coated
36						
37						
38				intersecting joints, slight seepage		J: N85E, 82N J: N40W, 33NE
39						
40				small joints are wet		
41						
42						
43				clayey siltstone, olive gray (5Y 5/2)		S: N70E, 72SE undulatory, open 1/8" B(?): apparent dip 25N on limonite lamina
44						J: N60E, 55SE open 0.5mm, slightly irregular, clean
45						F: N20W, 82SW slightly open and irregular, limonite coated
46				concretion, east wall, 6" long, 1.5" thick		
47						
48						F: N30W, 67SW clay gouge, small carbonate concretions, limonite coated
49				minor seepage from joint		J: N24W, 42SW
50	2			bulk sample of spoil		
51						

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
52				CLAYEY SILTSTONE: continued		J: N20W, 40SW closed, slightly irregular, clean
53						
54				limonite stained seam, possible bedding		B(?): apparent dip 26N on limonite seam
55				highly fractured zone, wet, loose		
56						
57						
58						J: N30W, 63SW slightly irregular and open, wet, partially limonite and clay coated Js: same as above
59				limonite mottling common		F: N80W, 29N 1/4" clay gouge, carbonate 1/2-1-1/2" thick, limonite stained
60						
61						
62						
63				slight color change to light olive gray (5Y 6/2)	J: N10W, 60SW slightly open and irregular, limonite coated, wet	
64						
65					J: N30W, 18SW closed, irregular, limonite coated J: N-S, 40W	
66						
67					J: N22W, 60SW closed, slightly irregular, clay coated J: N80E, 83NW open 1-2mm, discontinuous F: N50W, 75SW	
68				color change to light olive brown (2.5Y 5/3) approximate base of seepage		
69				concretion in foot wall, 1.5' long, 1.5" thick		

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
70	3			CLAYEY SILTSTONE: continued bulk sample of spoil			
71							
72				1" thick sand bed, micaceous			B: E-W, 30N sand bed 1' thick J: N20W, 50SW closed, curved, slightly irregular, clean J: same as above
73							
74							
75							
76							
77							J: N10W, 46SW closed, clean, slightly irregular
78							same as above, slight manganese coating
79							
80							J: N30W, 46SW closed, curved, slightly irregular, coated with olive gray clay
81							
82				concretion, upside down "U", 1-3" thick			J: N22W, 72SW closed, slightly irregular, clay coated
83							
84							
85							S: N25W, 56SW closed, curved, clay coated, down dip slickenlines
86							
87							

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA	
	Sample No.	Sample	Blows/ Foot				
88				CLAYEY SILTSTONE: continued			
89							
90							S: N40W, 72SW closed, slightly irregular, curved, manganese oxide stained, down dip slickenlines
91							
92				1mm sand lamina			B(?): apparent dip 22N on sand lamina
93							
94				limonite stained horizon			J: N25W, 72SW closed, slightly irregular, manganese coated B(?): apparent dip 40N on sand lamina
95							
96							
97							
98				1" diameter sand filled burrow noted in spoil			J: N10W, 76SW closed, slightly irregular, manganese oxide coated
99							
100							J: N33W, 43SW slightly open, slightly irregular, manganese oxide coated
101				contains clayey siltstone base of downhole logging			
102				grades to SANDY SILTSTONE, sandy horizons wet			B(?): apparent dip 20N on sand lamina
103							
104							J: N25W, 60SW closed, irregular, partial limonite coating
105							F: N5E, 63N down dip slickenlines on fractured concretions within clayey gouge zone
106				grades to CLAYEY SILTSTONE			

Depth (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	GRAPHIC LOG	GEOLOGIC DATA
	Sample No.	Sample	Blows/ Foot			
107				CLAYEY SILTSTONE: continued fault separates clayey siltstone in hanging wall from 2-3" thick zone of silty clay (CH) below, silty clay is olive (5Y 5/3), damp, very stiff, sticky, contains carbonate nodules and limonite mottles, probable fault gouge, clayey siltstone below gouge, moderately to slightly weathered		
108						
109						
110				base of downhole logging		
111	4			bulk sample of spoil		
112						
113						
114						
115				Bottom of boring at 115 ft bgs. Logged by geologist to 110 ft bgs. Seepage between 38 and 68 ft bgs. Boring backfilled with cuttings and tamped to 6.2 ft bgs. Upper 6.2' backfilled with sand cement slurry. Began drilling at 11:00 am on 9/15/03; completed drilling to 110' at 3:00 pm. Continued drilling at 6:35 am on 9/16/03 and completed hole to 115' by 6:50 am.		

Date Drilled: 9/3/09 Water Depth: Not Encountered
 Drilled By: AIRoy Drilling Date Measured: 9/3/2009
 Drilling Method: 24 inch Bucket Auger Elevation: 1032 feet (approx.)
 Logged By: DGH Datum: MSL

Elevation (feet) Depth	Sample Type	Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION	Dry Density (pcf)	Moisture Content (%)	Additional Tests
1030		1			Bedrock: Fernando Formation: Lower Member (Tfl): Siltstone: Pale brown, dry, highly weathered, weak			COR
		3	3		2 ft, yellowish brown mottled with iron oxide	111	15.1	DS
5		4	5		Sandy Siltstone: Pale brown, dry, slightly weathered, structureless, mottled iron oxide 5 ft, thin irregular sand lenses, locally cemented with gypsum	113	12.4	
1025		5	6		7 ft, J: N10E, 68NW, manganese oxide coated	112	7.1	
10		6	4		Sandstone: Pale grayish brown, dry, fine grained sand, with clay filled paleo worm borrows	108	8.8	DS
1020								
15		7	3		Silty Sandstone: Pale grayish brown, dry, with some fine grained sand, with clay filled worm borrows, increase fines content downwards 13 ft, S:N6W, 64SW, polished, undulatory 14 ft, increase in moisture content	108	19.8	
1015					Siltstone: Mottled olive gray with iron oxide, dry, slightly weathered, weak, J:N5E, 73NW			
20		8	4		21 ft, J: N10E, 60NW, iron oxide staining persistent	107	20.1	DS
1010					23 ft, zone of three parallel shears, S: N13E, 61NW			
25		9	4			107	20.1	
1005								
30		10	4			108	19.3	
1000					32 ft, general bedding B: N75E, 24NW, J: N9E, 39NW, iron oxide stained 33 ft, shear zone 3 inches thick, softer above shear, not traceable around boring			

GEOTECH DB-SCE.DH LOG 102950.DH I & 2010 (MERGED DATA).GPI KA_RDLND.GDT 1/25/10



PROJECT NO. 102950

TRTP - Segment 8
 San Bernardino and
 Los Angeles Counties, California

LOG OF BORING B-9

PLATE
 A-11a

Drafted By: Reviewed By: Legend To Logs On Plate A-1
 Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

GEOTECH DB-SCE.DH LOG 102950.DH I 8 2010 (MERGED DATA).GPI KA_RDLND.GDT 1/25/10

Elevation (feet) Depth	Sample Type Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION <i>(Continued From Previous Page)</i>	Dry Density (pcf)	Moisture Content (%)	Additional Tests	
995	11	4		33 ft, shears in shear zone - S1: N59E, 60NW/ S2: N29E, 52NW/ S3: N10E, 57NW 34 ft, J:N32E, 81NW, manganese coating 35 ft, J:N18E, 75NW 36 ft, J:N15E, 49NW 37 ft, J:N32E, 73NW and J:N39E, 90	105	20.3		
40 990	12	5		42 ft, J: N41W, 55SW 43 ft, joint set, gypsum infilled, up to 1/4 inch wide, one set is sub-horizontal, may represent bedding, other joint set is vertical	108	18.7		
45 985	13	6		46 ft, J:N50W, 53SW, infilled with gypsum, 1/2 inch wide, joint width increase downward up to 1/2 inch of gypsum	110	18.0		
50	14	6		Borehole terminated at approximately 51 feet Groundwater was not encountered Borehole backfilled with soil cuttings and tamped with kelly bar Boring down-hole logged up to 46 feet by D. Hasham on 9/3/2009 Truck mounted EZ Bore bucket auger Kelly Bar Weights: 0 - 29 ft = 4800 lbs 29 - 58 ft = 3350 lbs	109	18.1		
				TRTP - Segment 8 San Bernardino and Los Angeles Counties, California			PLATE A-11b	
PROJECT NO. 102950				LOG OF BORING B-9				

Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

APPENDIX C

BORING LOGS NEAR GAS-TO-ENERGY FACILITY I

BY

WOODWARD-CLYDE CONSULTANTS (1984)

AND

SOILS INTERNATIONAL (1989)

DATE OF BORING 26 September 1983 WATER DEPTH _____ DATE MEASURED _____
 TYPE OF DRILL RIG Mobile B-61 Drill Rig HOLE DIAMETER 4 3/4 inches
 WEIGHT OF HAMMER _____ FALLING _____ SAMPLES Pitcher Samples

DEPTH, FT.	SAMPLES	BLOWS/FOOT	DESCRIPTION	UNC. COMP. STRENGTH, k_{sf}	MOISTURE CONTENT, %	DRY DENSITY ρ_{cf}	OTHER TESTS
SURFACE ELEVATION: Approximately 664 feet							
5	1		Subgrade gravels (aggregate base)				
			SANDSTONE – Light greenish tan, very fine grained, damp	8.9 1.0*	17.8 14.6	109.3 111.6	TX
10	2		SILTSTONE – Light greenish tan, with some gravels Some sandy intervals, damp				
15	3			5.4 3.75*	18.9 19.0 20.3	110.1 108.7 104.7	TX CONS
20	4			5.7 8.0*	21.0 22.0	105.0 104.1	TX
25	5						
35	6						
45	7						
	8		← Concretion				
50			Bottom of Boring at 47 feet NOTE: * indicates undrained shear strength				

Project: **PUENTE HILLS TURBINE FACILITY**
 Project No. **41714A**

LOG OF BORING B-1

Fig. **7**

DATE OF BORING 28 September 1983 WATER DEPTH _____ DATE MEASURED _____
 TYPE OF DRILL RIG Mobile B-50 Drill Rig HOLE DIAMETER 4 3/4 inches
 WEIGHT OF HAMMER _____ FALLING _____ SAMPLES Pitcher Samples

DEPTH, FT.	SAMPLES	BLOWS/FOOT	DESCRIPTION	UNC. COMP. STRENGTH, ksf	MOISTURE CONTENT, %	DRY DENSITY pcf	OTHER TESTS
SURFACE ELEVATION: Approximately 664 feet							
5	1		SILTSTONE -- Light yellowish tan, clayey, indistinctly bedded, slightly damp	3.3	23.2 21.3	102.6 106.0	CONS
15	2		Light yellowish tan to greenish tan, damp, with very fine sand and some clay				
20	3						
30	4		Light yellowish tan, clayey, indistinctly bedded, damp				
35	5		Very fine sand and some clay, damp				
40	6						
45			Bottom of Boring at 42 1/2 feet				
50							

Project: **PUENTE HILLS TURBINE FACILITY**
 Project No. **41714A**

LOG OF BORING B-2

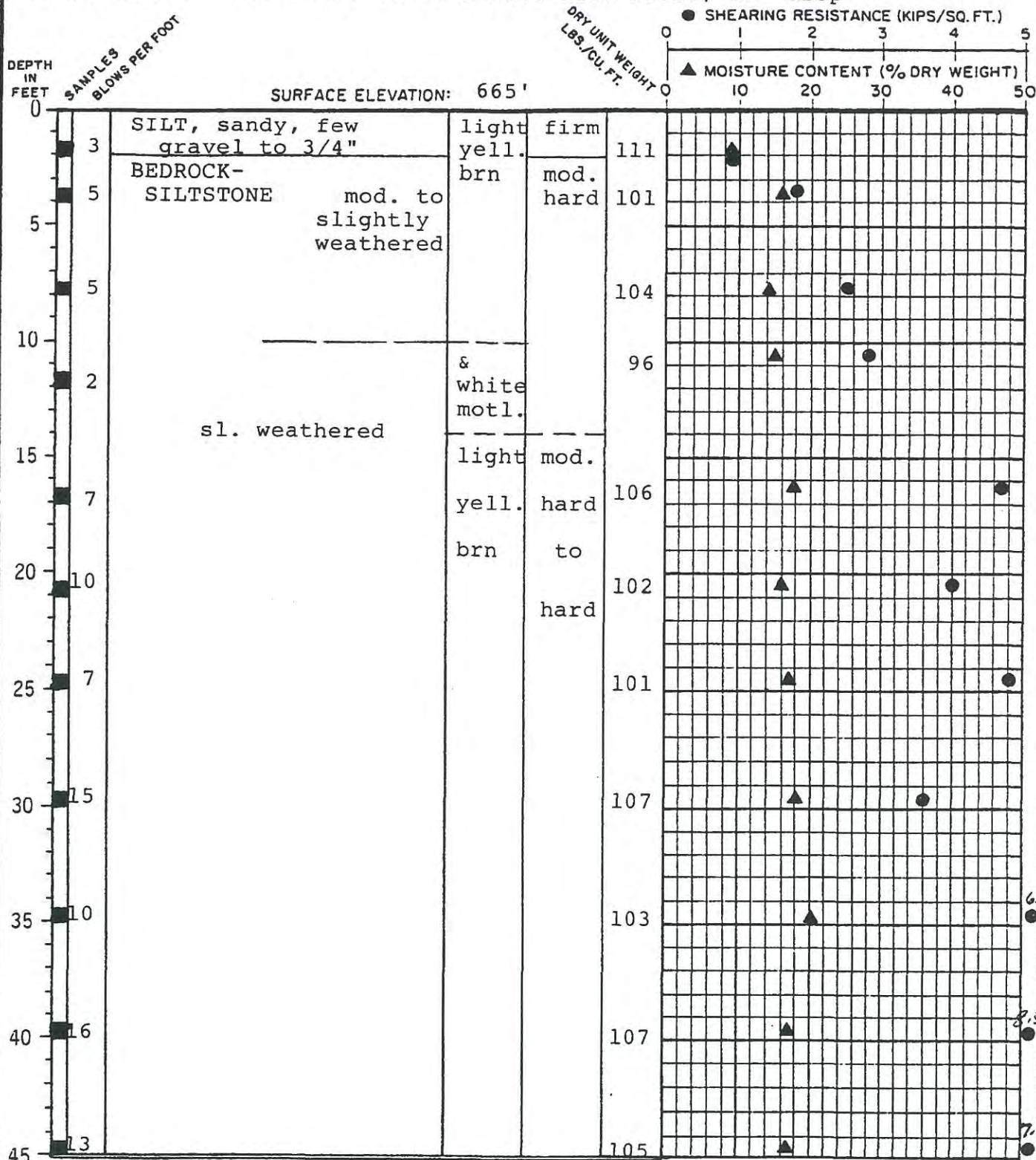
Fig. **8**

LOG OF BORING NO. 1

DRILLING EQUIPMENT: 18" bucket auger

DATE DRILLED: 3/7/89

DRIVING WEIGHT: 2800 lbs. to 25'; 2000 lbs. below, 12" drop



End of boring at 45'
No water: no caving

Puente Hills Landfill PERG Maintenance Building
Los Angeles County,
California

PROJECT NO. 273-101-89

PLATE B-1

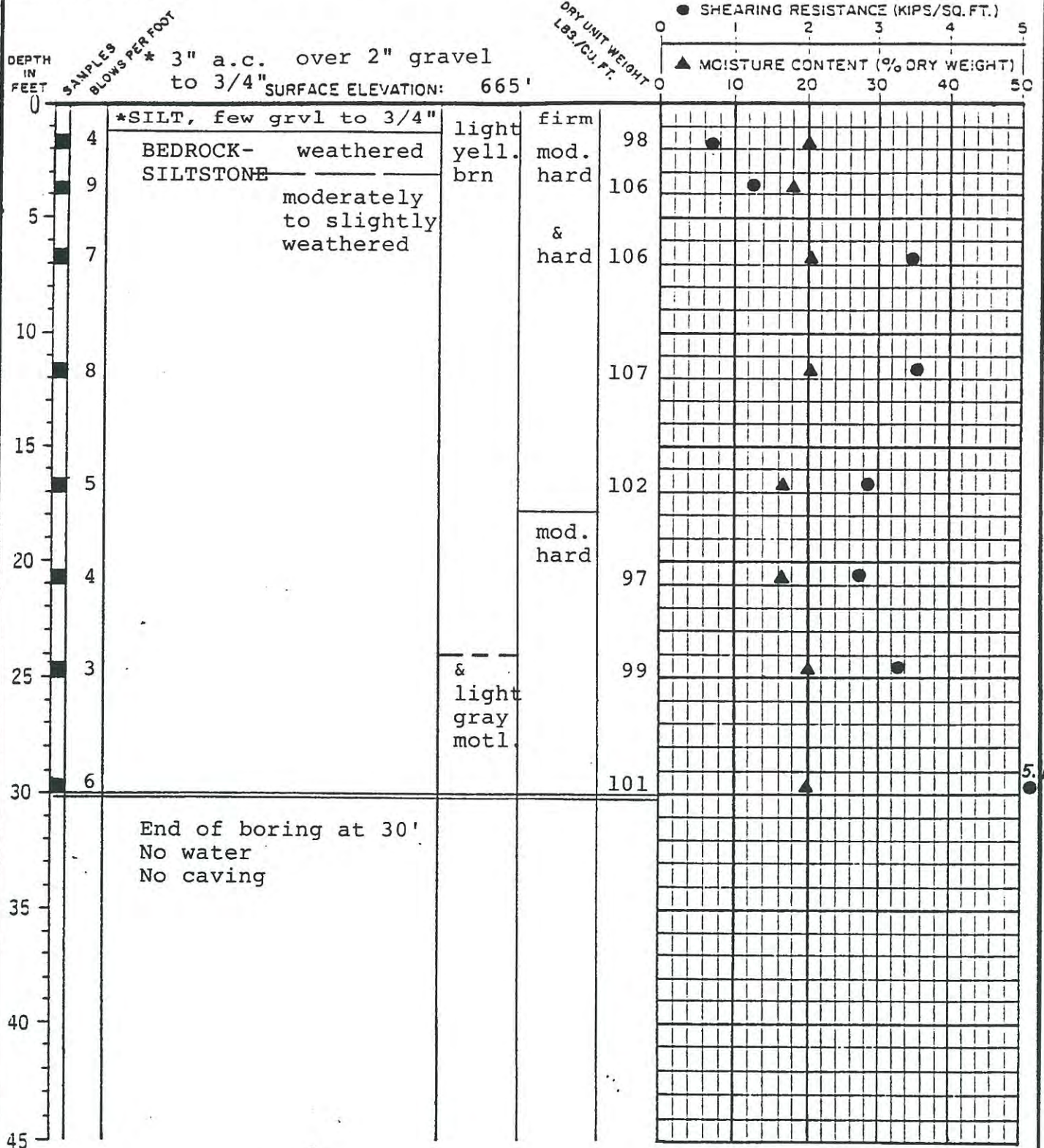
SOILS INTERNATIONAL
CONSULTING FOUNDATION ENGINEERS & ENGINEERING GEOLOGISTS.

LOG OF BORING NO. 2

DRILLING EQUIPMENT: 18" bucket auger

DATE DRILLED: 3/6/89

DRIVING WEIGHT: 2800 lbs. to 25'; 2000 lbs. below, 12" drop



Puente Hills Landfill PERG Maintenance Building
Los Angeles County,
California

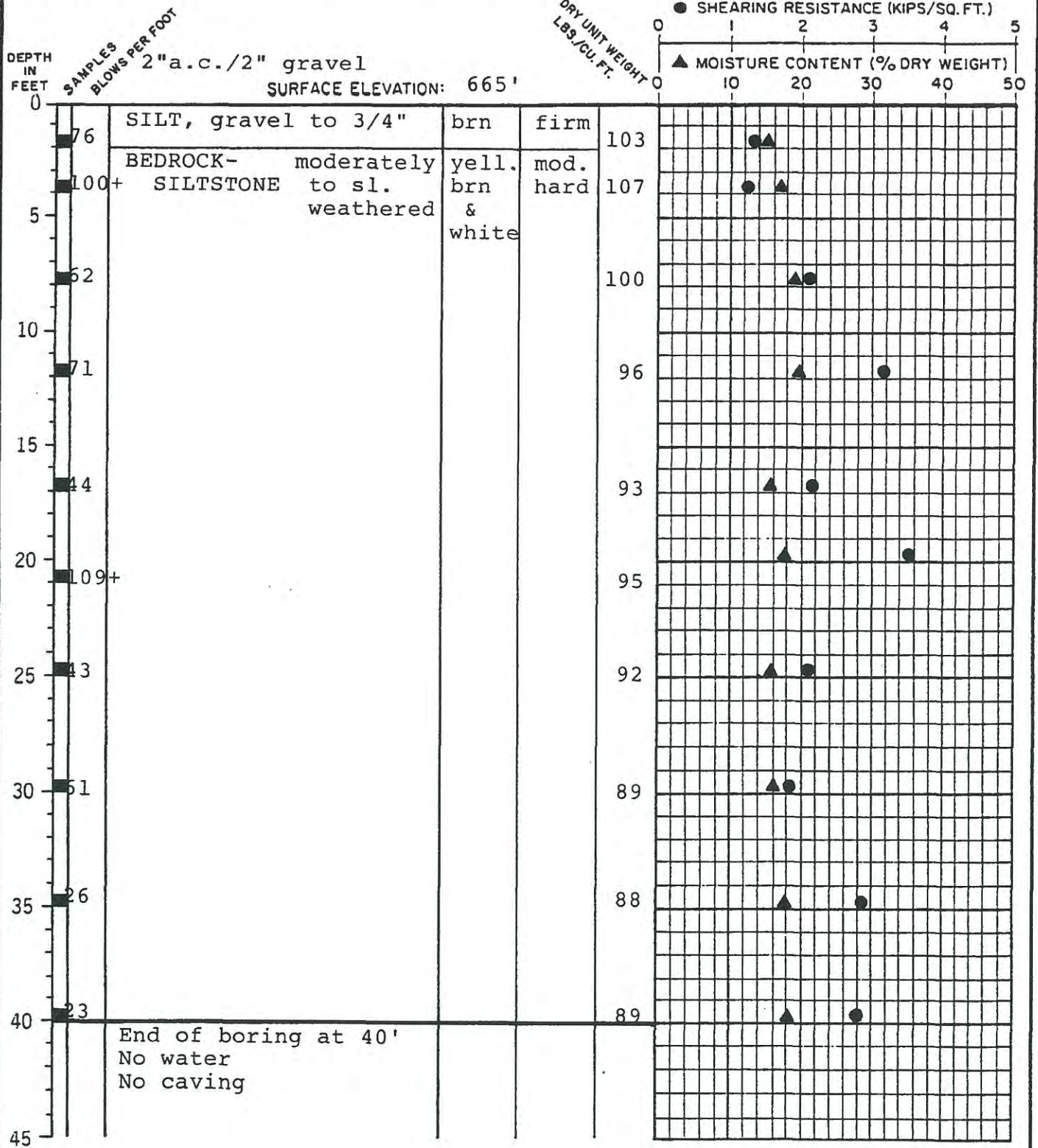
PROJECT NO.	273-101-89
PLATE	C-1

SOILS INTERNATIONAL
CONSULTING FOUNDATION ENGINEERS & ENGINEERING GEOLOGISTS.

LOG OF BORING NO. 3

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/6/89



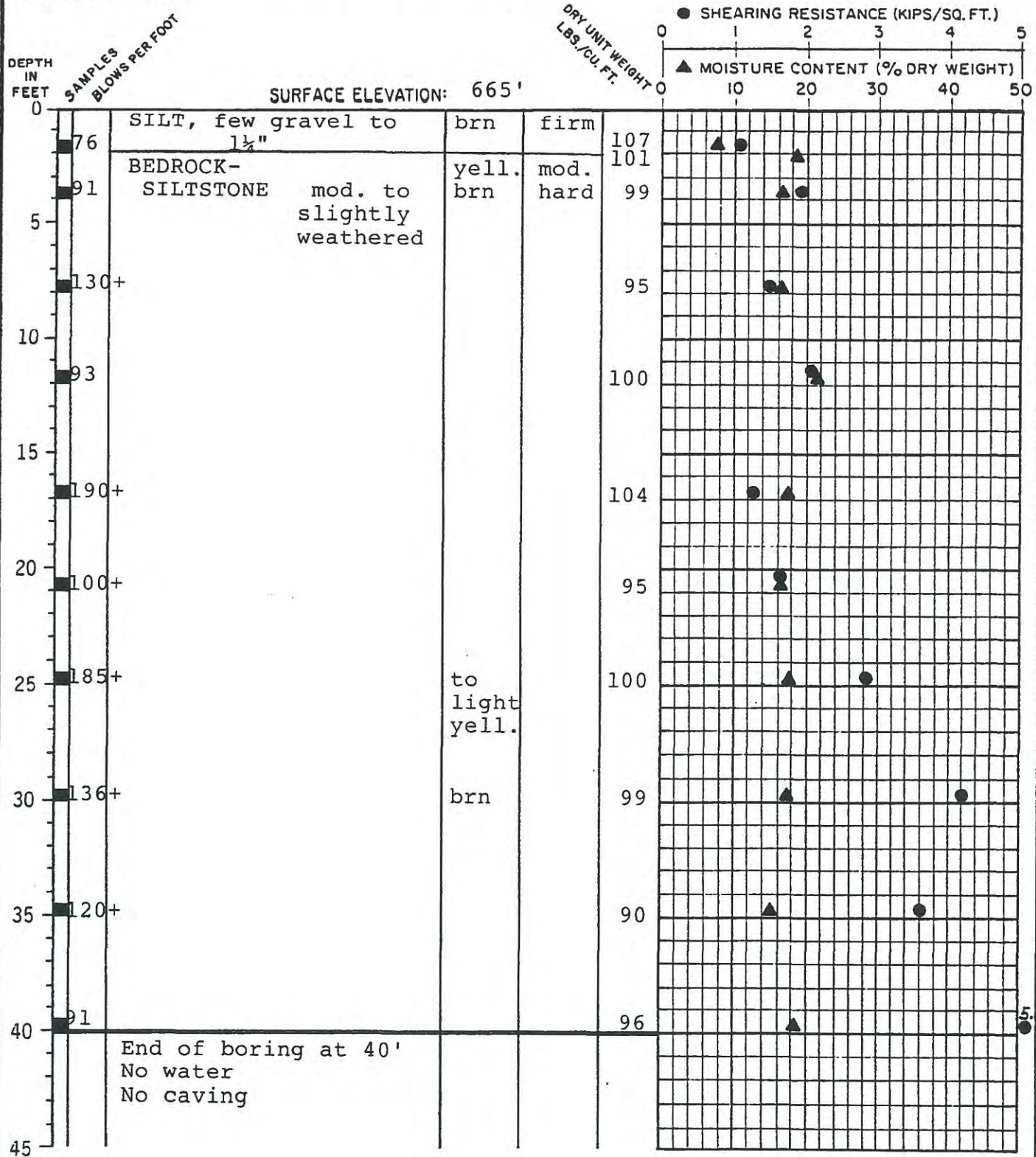
Puente Hills Landfill PERG Maintenance Building
 Los Angeles County,
 California

PROJECT NO. 273-101-89
 PLATE D-1

LOG OF BORING NO. 4

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/9/89

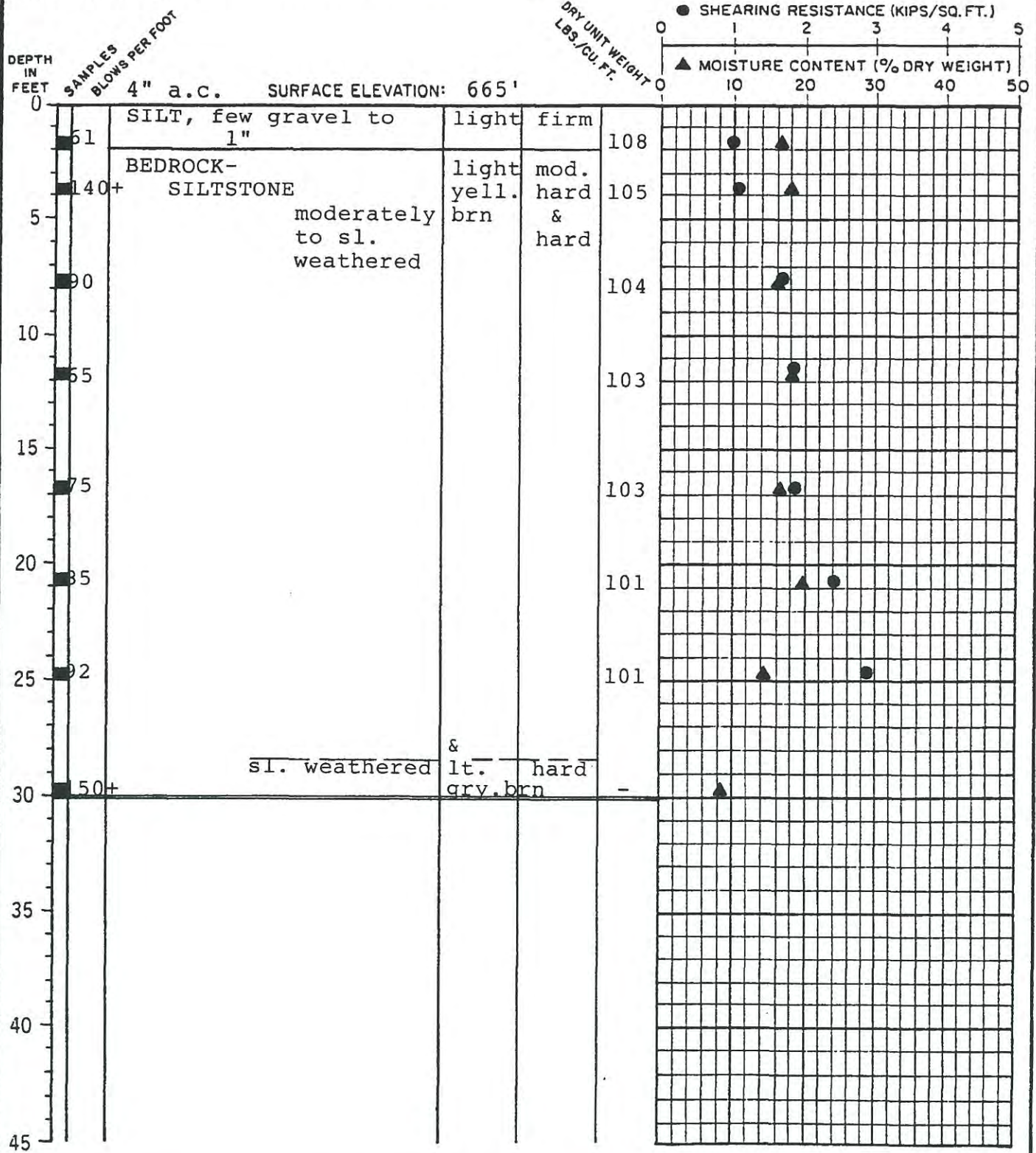


Puente Hills Landfill PERG Maintenance Building Los Angeles County, California	PROJECT NO.	273-101-89
	PLATE	E-1

LOG OF BORING NO. 5

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/9/89



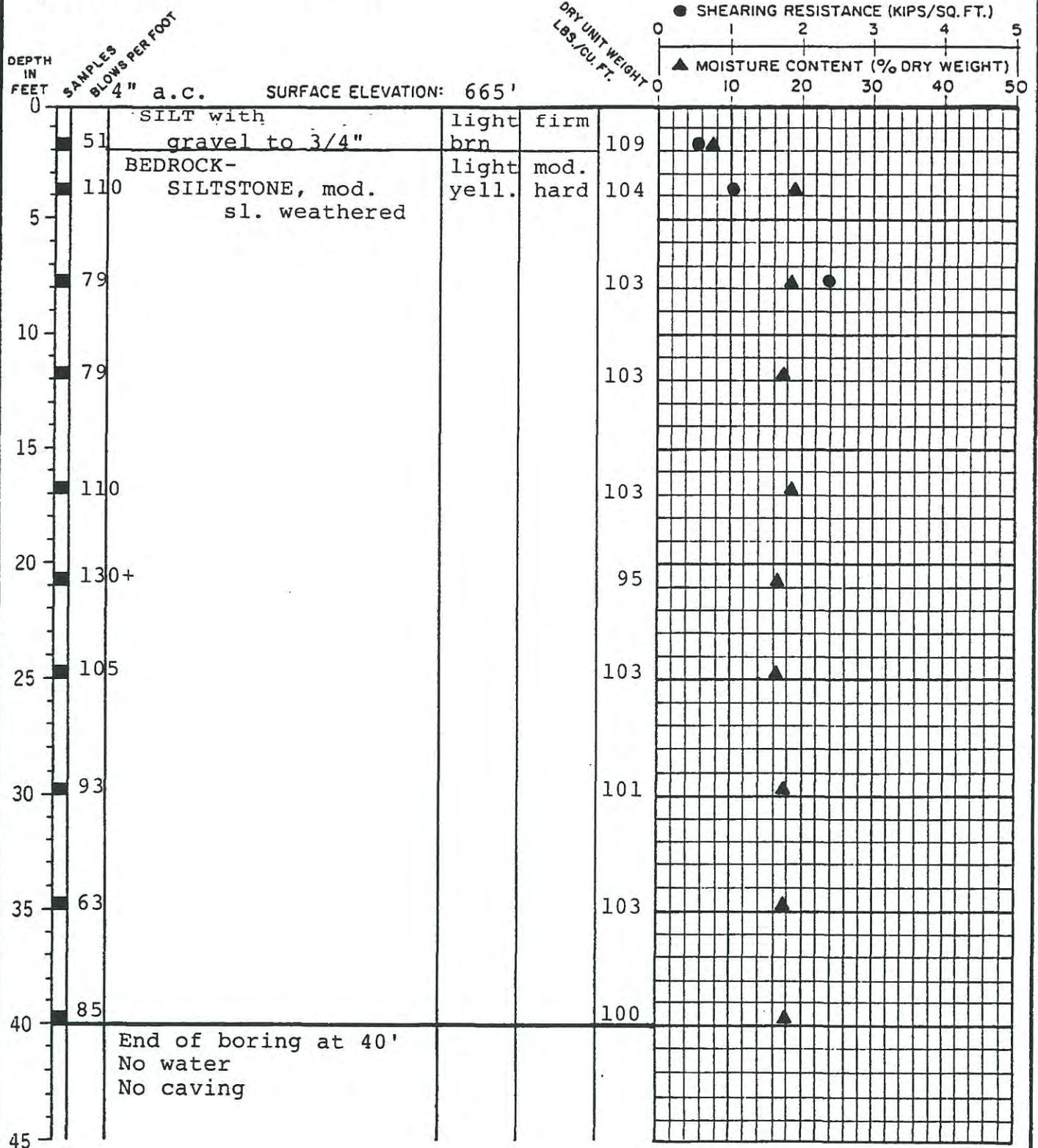
Puente Hills Landfill PERG Maintenance Building
 Los Angeles County,
 California

PROJECT NO. 273-101-89
 PLATE F-1

LOG OF BORING NO. 6

DRILLING EQUIPMENT: 10" hollowstem auger
 DRIVING WEIGHT: 140 lbs., 30" drop

DATE DRILLED: 3/9/89



Puente Hills Landfill PERG Maintenance Building
 Los Angeles County,
 California

PROJECT NO.	273-101-89
PLATE	G-1

LOG OF BORING NO. 7 (?)

DRILLING EQUIPMENT: 8" hollowstem auger

DATE DRILLED: 11/9/90

DRIVING WEIGHT: 36 lbs., 42" drop

DEPTH IN FEET	SAMPLES BLOWN PER FOOT	SURFACE ELEVATION: 665'	DRY UNIT WEIGHT LBS./CU. FT.	● SHEARING RESISTANCE (KIPS/SQ. FT.)	▲ MOISTURE CONTENT (% DRY WEIGHT)
0		FILL SAND, f-c, gravelly, rounded to 1½"			
		mod. comp.			
		light brown			
5		SILTSTONE BEDROCK sl. sandy, mod. to sl. weathered, bedding attitude near vertical			
		mod. hard			
10		End of boring at 10.0 feet No groundwater No caving			
15					

County Sanitation PERG Building
La Puente Hills Landfill

PROJECT NO. 273-101-89

PLATE B

SOILS INTERNATIONAL

CONSULTING FOUNDATION ENGINEERS & ENGINEERING GEOLOGISTS

APPENDIX D

BORING LOG NORTHWEST OF SHARED MAINTENANCE YARD

BY

KLEINFELDER (2010)

Date Drilled: 9/4/09 Water Depth: Not Encountered
 Drilled By: AI Roy Drilling Date Measured: 9/4/2009
 Drilling Method: 24 inch Bucket Auger Elevation: 898 feet (approx.)
 Logged By: DGH Datum: MSL

Elevation (feet) Depth	Sample Type Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION			Dry Density (pcf)	Moisture Content (%)	Additional Tests
	1			Colluvium/ Residual soil: Silty Clay with Sand (CL): Dark brown, dry, hard, with fine grained sand, trace coarse gravel					COR
895	3	3		Bedrock: Fernando Formation: Lower Member (Tfl): Siltstone: Pale brown, dry, weak, moderately weathered			91	13.7	DS
	4	5		Sandstone: Pale brown, fine grained sand, moderately weathered, weak 2.5 ft, GB: N10E, 30NW 3 ft, 4 inch diameter krotovia			102	7.3	
890	5	3		4 ft, S: N35W, 30 NE, shear traceable around boring, offsets siltstone against sandstone, discordant across shear below shear: sandstone/ silty sandstone, mottled pale reddish brown and light brown, iron oxide staining, very fine grained sand, moderately weathered, weak, J: N65W, 62NE			86	20.7	DS
	6	3		6 ft, B:N5E, 37 NW 7 ft, J:N25W, 46NE 8.5 ft, J: N56W, 53NE, manganese oxide coated			82	22.5	
885				Siltstone: Pale yellowish brown, dry, with fine grained sandstone, moderately weathered, weak					
	7	2		11 ft, J: N11W, 80SW 12 ft, J: N14W, 74NE 13 ft, J: EW, 51N 14.5 ft, 3 inch thick sand bed, multiple offsets on minor shears less than 1 inch, max 2 inches, shears are dendritic, B: N44E, 34NW 17 ft to 20 ft, S: N88W, 76NE, 6 inch wide kotovina, white chalky in filling, offset 2 inch by shear, strike slip striations			101	9.5	DS
880									
	8	4		20 ft, 2 krotovina with chalky infilling 20 ft, J: N25E, 33NW			91	17.2	
875				21.5 ft, shear zone 6 inches thick, several parallel shears, basal S: N66W, 52NE					
	9	5		21.5 ft, bedding shear, continuous, open 1/16 inch: N15E, 29NW, sandy siltstone, pale olive brown, structureless, weak 24 ft, B: N17E, 22NW			95	21.3	
870				27 ft, B: N6W, 32SW, continuous bedding around boring 28 ft, J: N68W, 72SW					
	10	5		30 ft, S: N50W, 50SW, shear can not be traced around boring 30.5 ft, S: N66W, 62SW 31 ft, intersecting joints- J1: N38W, 59SW, manganese oxide coated, J2: N47W, 51NE, iron oxide coated 33 ft, six closely spaced joints open 1/16 inch to hair line J: N55W, 51NE			95	23.2	
865									

GEO TECH DB-SCE.DH.1 & 2010 (MERGED DATA).GPI_KA_RDL.ND.GDT 1/25/10



PROJECT NO. 102950

TRTP - Segment 8
 San Bernardino and
 Los Angeles Counties, California


LOG OF BORING B-8

PLATE

A-10a

Drafted By: Reviewed By: Legend To Logs On Plate A-1
 Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

GEOTECH DB-SCE.DH.1 & 2010 (MERGED DATA).GPI KA_RDLND.GDT 1/25/10

Elevation (feet) Depth	Sample Type Sample Number	Blows per Foot	Graphic Log	SOIL DESCRIPTION AND CLASSIFICATION <i>(Continued From Previous Page)</i>		Dry Density (pcf)	Moisture Content (%)	Additional Tests	
860	11	4				101	21.8		
40	12	4		40 ft, J: N29W, 84NE		104	21.8		
855				42 ft, J: N39W, 87NE, tight, evidence of water					
				43 ft, J: N19W, 83SW					
45	13	5		43 ft, J: N59E, 42NE		103	22.6		
850									
50	14	3				106	19.9		
				<p>Borehole terminated at approximately 51 feet Groundwater was not encountered Borehole backfilled with soil cuttings and tamped with kelly bar Boring down-hole logged to 43 feet by D. Hasham on 9/4/2009</p> <p>Truck mounted EZ Bore bucket auger Kelly Bar Weights:</p> <p>0 - 29 ft = 4800 lbs 29 - 58 ft = 3350 lbs</p>					
				<p>TRTP - Segment 8 San Bernardino and Los Angeles Counties, California</p>				<p>PLATE A-10b</p>	
PROJECT NO. 102950				<p>LOG OF BORING B-8</p>					

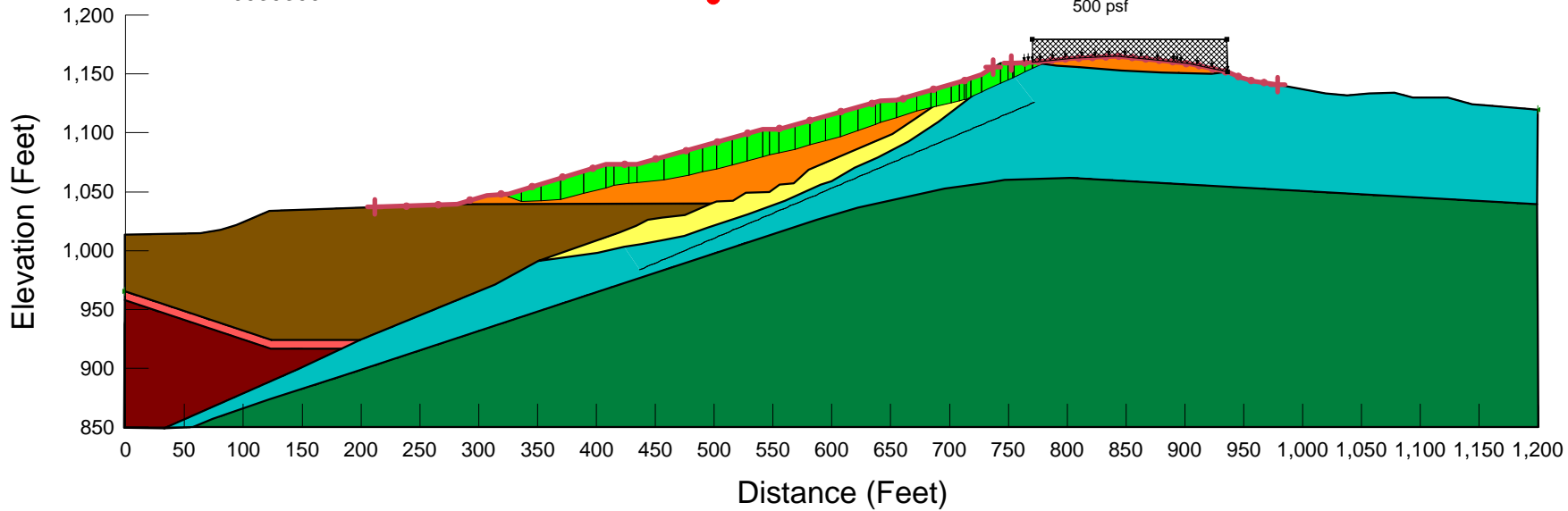
Legend To Logs On Plate A-1

Note: The boundaries between soil types shown on the logs are approximate as the transition between different soil layers may be gradual.

APPENDIX E
PRELIMINARY SLOPE STABILITY ANALYSIS

Section C-C' Slope Stability - Static
 Puente Hills Landfill
 209393001

2.25



- Name: Fill
 Model: Mohr-Coulomb
 Unit Weight: 110 pcf
 Cohesion: 50 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: Soil Stockpile
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 100 psf
 Phi: 27 °
 Phi-B: 0 °
- Name: Cover
 Model: Mohr-Coulomb
 Unit Weight: 115 pcf
 Cohesion: 150 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: MSW
 Model: Mohr-Coulomb
 Unit Weight: 85 pcf
 Cohesion: 0 psf
 Phi: 33 °
 Phi-B: 0 °
- Name: Ols
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,430 psf
 Phi: 16 °
 Phi-B: 0 °
- Name: Siltstone
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,400 psf
 Phi: 35 °
 Phi-B: 0 °
- Name: Weathered Siltstone Clay
 Model: Anisotropic Fn.
 Unit Weight: 120 pcf
 Cohesion: 530 psf
 Phi: 35 °
 Phi-Anisotropic Strength Fn.: phi
 C-Anisotropic Strength Fn.: c
 Phi-B: 0 °

Section C-C' Slope Stability - Pseudostatic

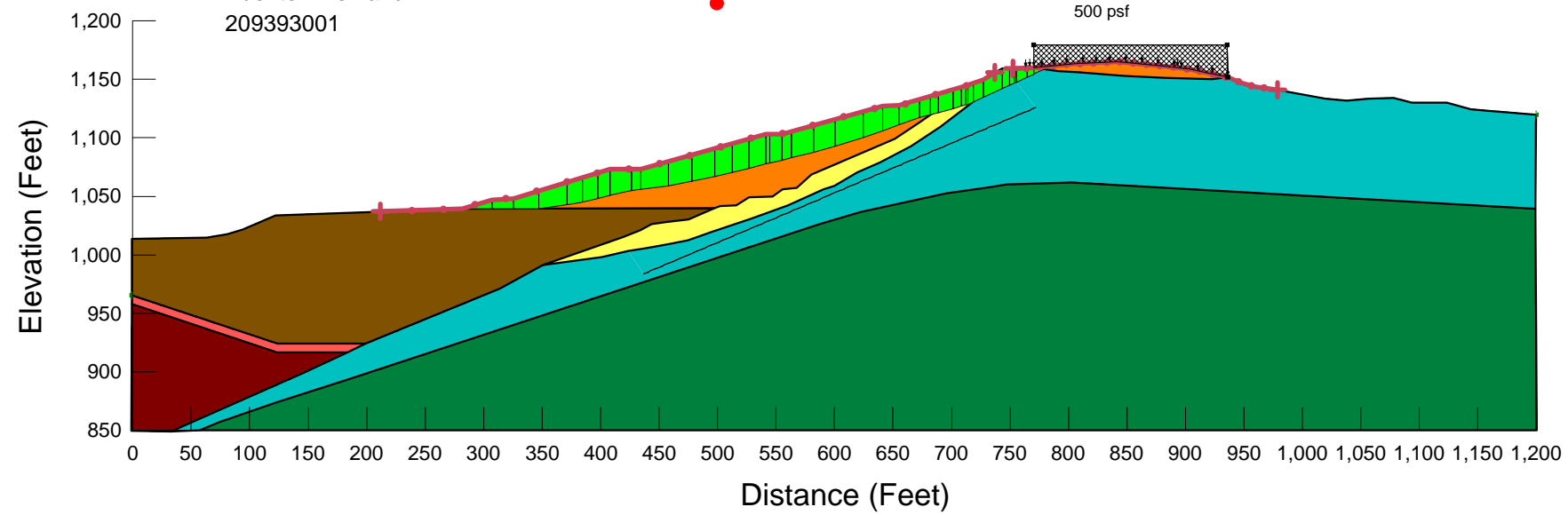
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Puente Hills Landfill

209393001

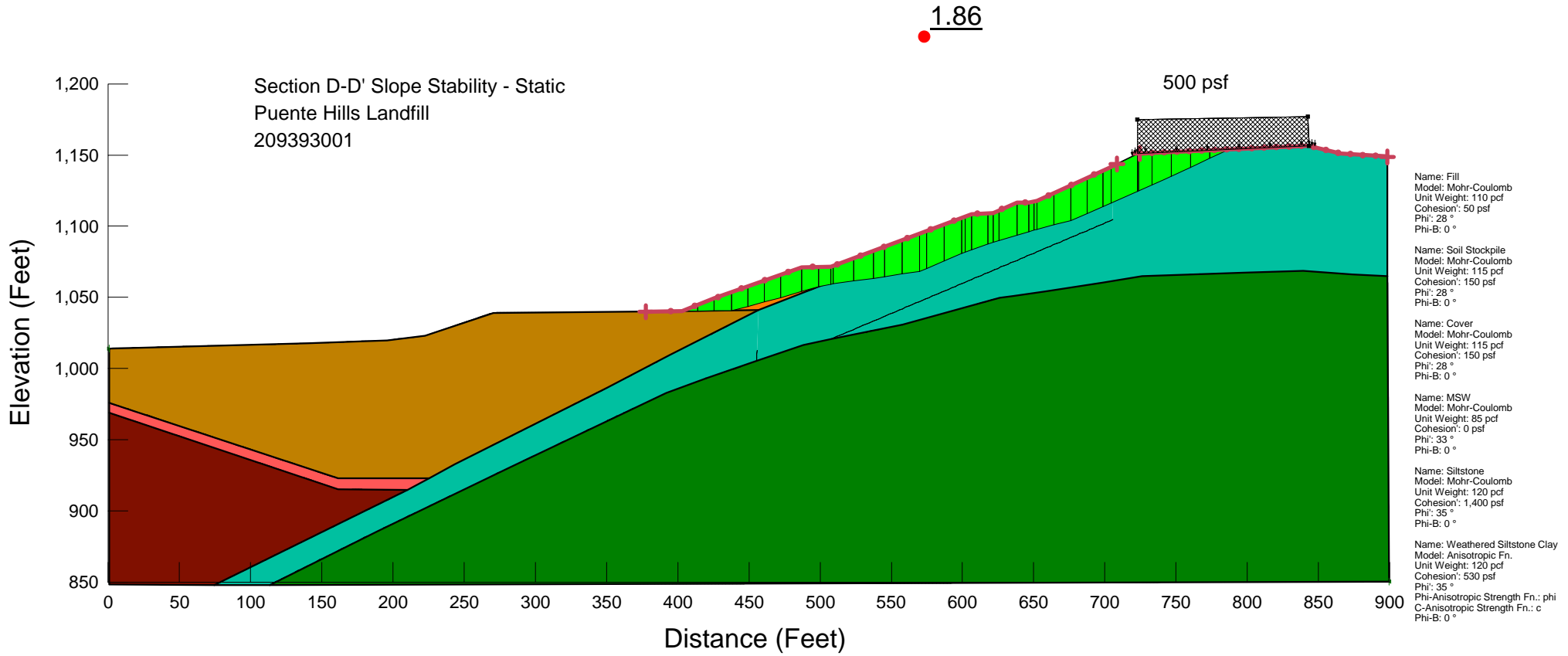
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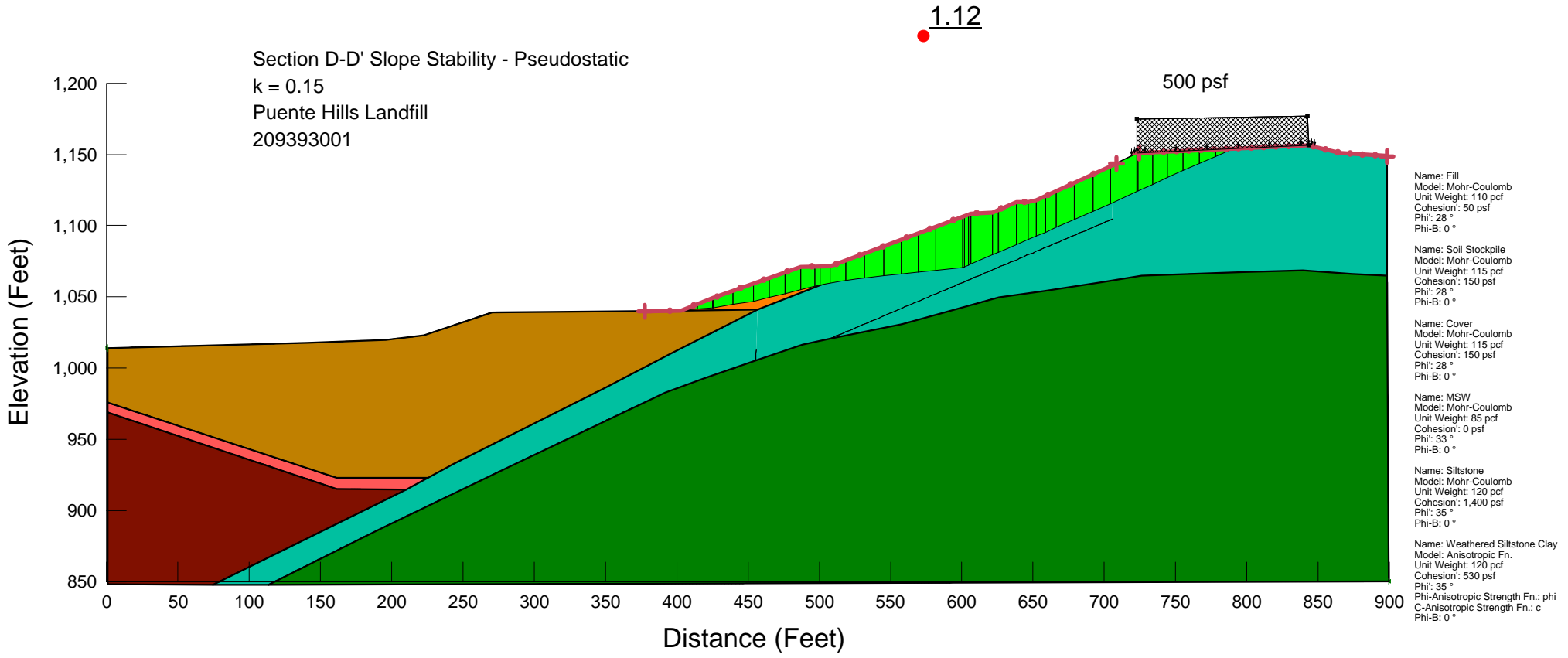
500 psf



- Name: Fill
Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion: 50 psf
Phi: 28 °
Phi-B: 0 °
- Name: Soil Stockpile
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 100 psf
Phi: 27 °
Phi-B: 0 °
- Name: Cover
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 150 psf
Phi: 28 °
Phi-B: 0 °
- Name: MSW
Model: Mohr-Coulomb
Unit Weight: 85 pcf
Cohesion: 0 psf
Phi: 33 °
Phi-B: 0 °
- Name: Qls
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 1,430 psf
Phi: 16 °
Phi-B: 0 °
- Name: Siltstone
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 1,400 psf
Phi: 35 °
Phi-B: 0 °
- Name: Weathered Siltstone Clay
Model: Anisotropic Fn.
Unit Weight: 120 pcf
Cohesion: 530 psf
Phi: 35 °
Phi-Anisotropic Strength Fn.: phi
C-Anisotropic Strength Fn.: c
Phi-B: 0 °

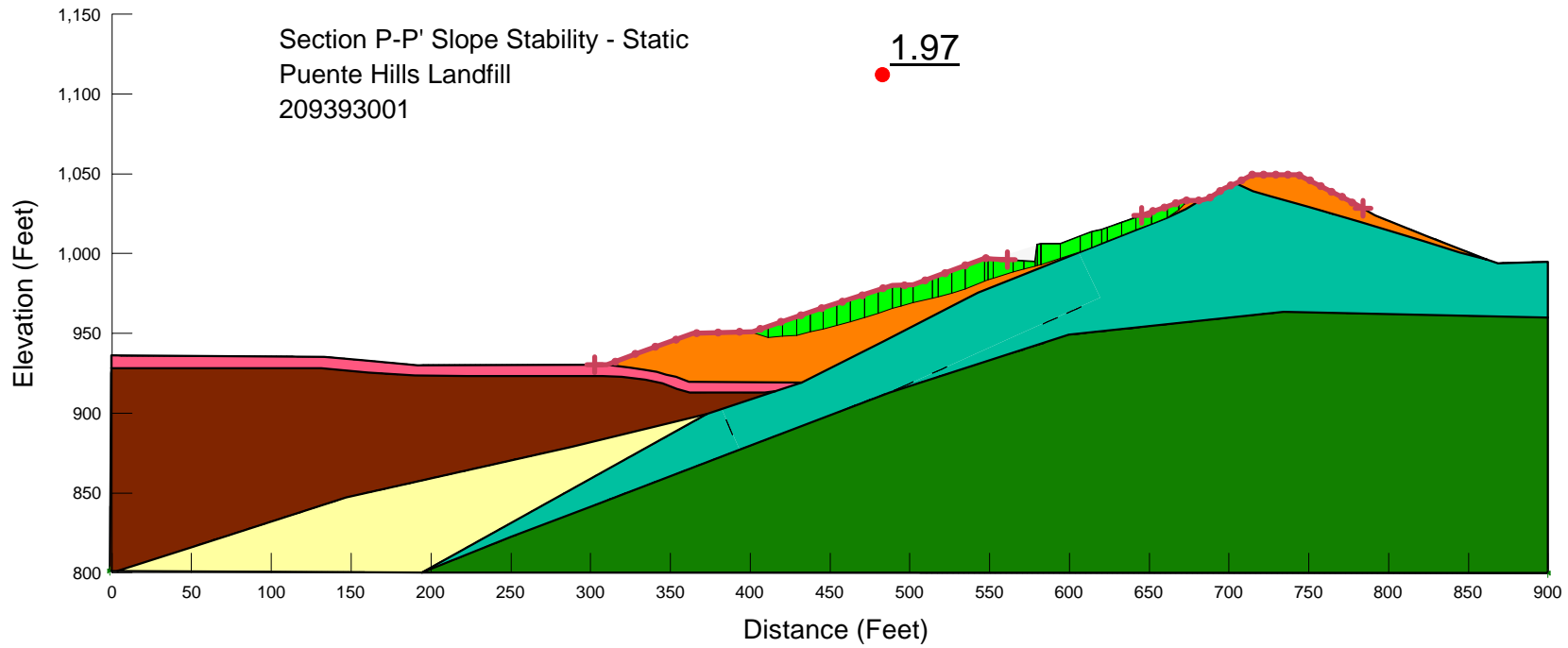
Section D-D' Slope Stability - Static
 Puente Hills Landfill
 209393001



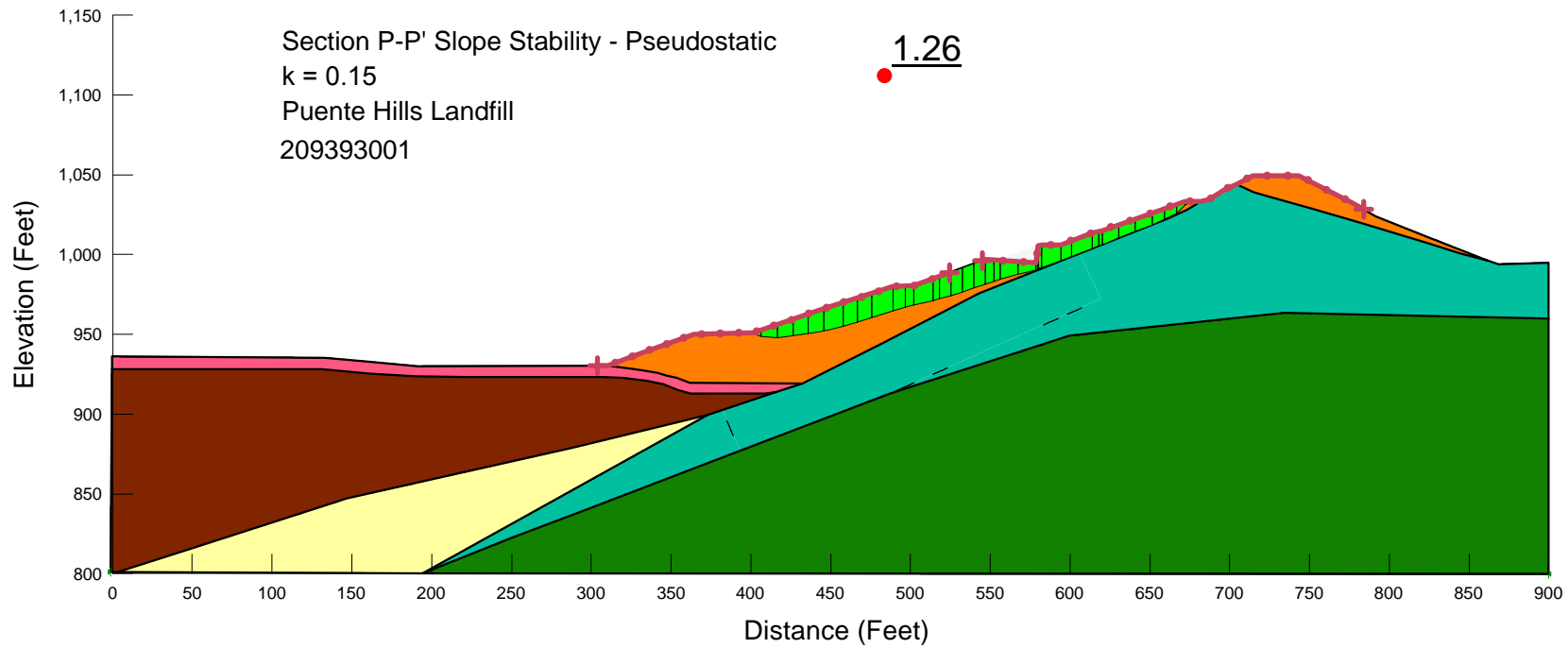


Section P-P' Slope Stability - Static
 Puente Hills Landfill
 209393001

1.97



- Name: Fill
 Model: Mohr-Coulomb
 Unit Weight: 110 pcf
 Cohesion: 50 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: Cover
 Model: Mohr-Coulomb
 Unit Weight: 115 pcf
 Cohesion: 150 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: MSW
 Model: Mohr-Coulomb
 Unit Weight: 85 pcf
 Cohesion: 0 psf
 Phi: 33 °
 Phi-B: 0 °
- Name: Ols
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,430 psf
 Phi: 16 °
 Phi-B: 0 °
- Name: Siltstone
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,400 psf
 Phi: 35 °
 Phi-B: 0 °
- Name: Weathered Siltstone Clay
 Model: Anisotropic Fr.
 Unit Weight: 120 pcf
 Cohesion: 530 psf
 Phi: 35 °
 Phi-Anisotropic Strength Fr.: phi
 C-Anisotropic Strength Fr.: c
 Phi-B: 0 °



- Name: Fill
 Model: Mohr-Coulomb
 Unit Weight: 110 pcf
 Cohesion: 50 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: Cover
 Model: Mohr-Coulomb
 Unit Weight: 115 pcf
 Cohesion: 150 psf
 Phi: 28 °
 Phi-B: 0 °
- Name: MSW
 Model: Mohr-Coulomb
 Unit Weight: 85 pcf
 Cohesion: 0 psf
 Phi: 33 °
 Phi-B: 0 °
- Name: Qls
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,430 psf
 Phi: 16 °
 Phi-B: 0 °
- Name: Siltstone
 Model: Mohr-Coulomb
 Unit Weight: 120 pcf
 Cohesion: 1,400 psf
 Phi: 35 °
 Phi-B: 0 °
- Name: Weathered Siltstone Clay
 Model: Anisotropic Fn.
 Unit Weight: 120 pcf
 Cohesion: 530 psf
 Phi: 35 °
 Phi-Anisotropic Strength Fn.: phi
 C-Anisotropic Strength Fn.: c
 Phi-B: 0 °